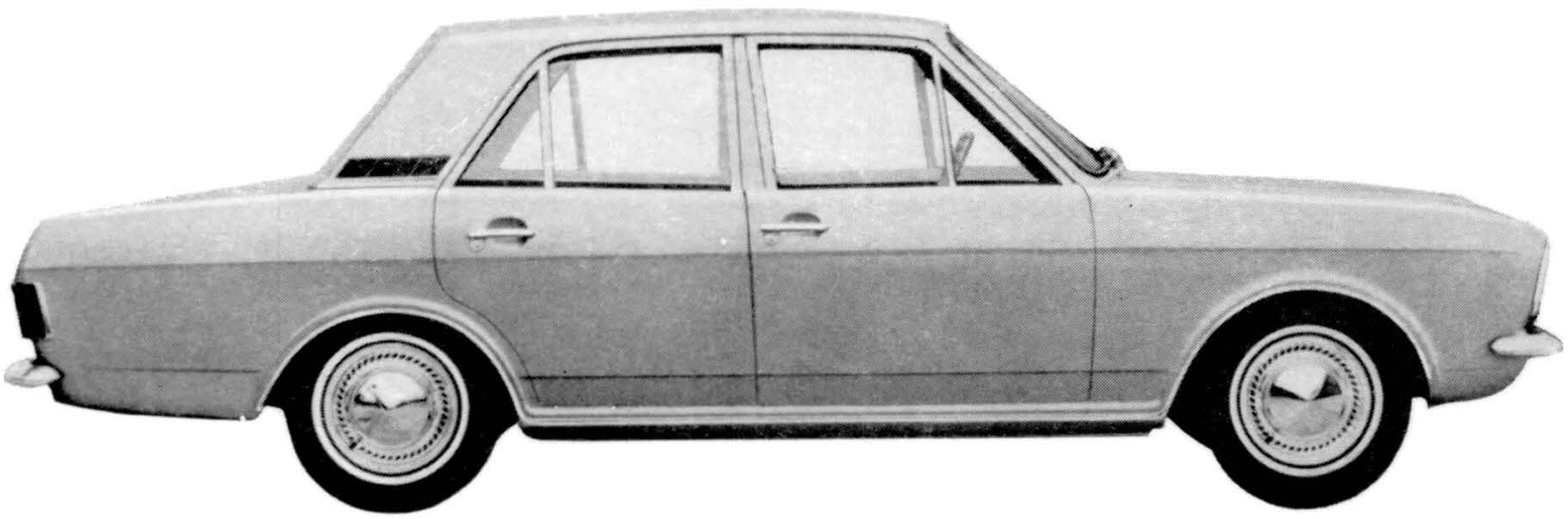
Cortina
Workshop Manual



Ford of Britain

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Ford policy is one of continuous improvement, and the right to change prices, specifications and equipment at any time without notice is reserved.

FOREWORD

This Workshop Manual gives repair and adjustment procedures applicable to all the Cortina range, and includes component illustrations wherever possible, technical specifications and details of any tools or equipment that may be required.

The Manual has been prepared primarily for use by Ford Dealerships and hence it has been assumed that a comprehensive range of special tools is available. Ford owners not possessing these tools may find it necessary to change the dismantling and reassembling sequences, depending on the tools and equipment available. For operations such as the overhaul of the gearbox or differential assemblies the use of special tools is essential, if a satisfactory repair is to be made. In these cases we strongly advise owners and operators to allow Ford Dealerships to carry out the repairs.

Included in this manual is all the technical information normally required for the maintenance and repair of the vehicle. However, it does not necessarily follow that comprehensive information will be found on all aspects of vehicle repair. Similarly, we do not intend issuing periodic amendment sheets. Thus should a specific query arise, you should contact your local Ford Main Dealer.

Repair and Adjustment Procedures

Repair operations tabulated in this manual are of three types:—

(i) *Basic Operation* – This can be complete by itself or the prelude to additional work. Generally a basic operation describes the removal and installation of a component or assembly.

(ii) *Subsidiary Operation* – This is additional work related to a basic operation. For example, overhauling an assembly that has already been removed.

(iii) *Group Operation* – This is a more extensive operation which combines one basic and one or more subsidiary operations. Because the basic and subsidiary operations are themselves already given in detail, the group operation merely lists which of the basic and subsidiary operations are required to successfully perform the group operation.

Examples:—

Basic Operation

OPERATION 3498-A STEERING GEAR – REMOVE AND INSTALL

Subsidiary Operation

OPERATION 3498-A1 Extra: steering gear – adjust

Group Operation

OPERATION 3498-B **STEERING GEAR – ADJUST**
(Includes OPS 3498-A and A1)

In most cases, the basic operation number corresponds to the part number of the component being serviced, i.e. 1107 is the part number of a wheel stud and OP 1107-A refers to wheel studs.

It is not, however, practical to use part numbers for body operations. Therefore, bodywork operations commence at 1000 and are prefixed by the letter M.

Following the completion of any service work normal test procedures should be used to ensure that a satisfactory repair has been performed. In addition, as a precautionary measure:—

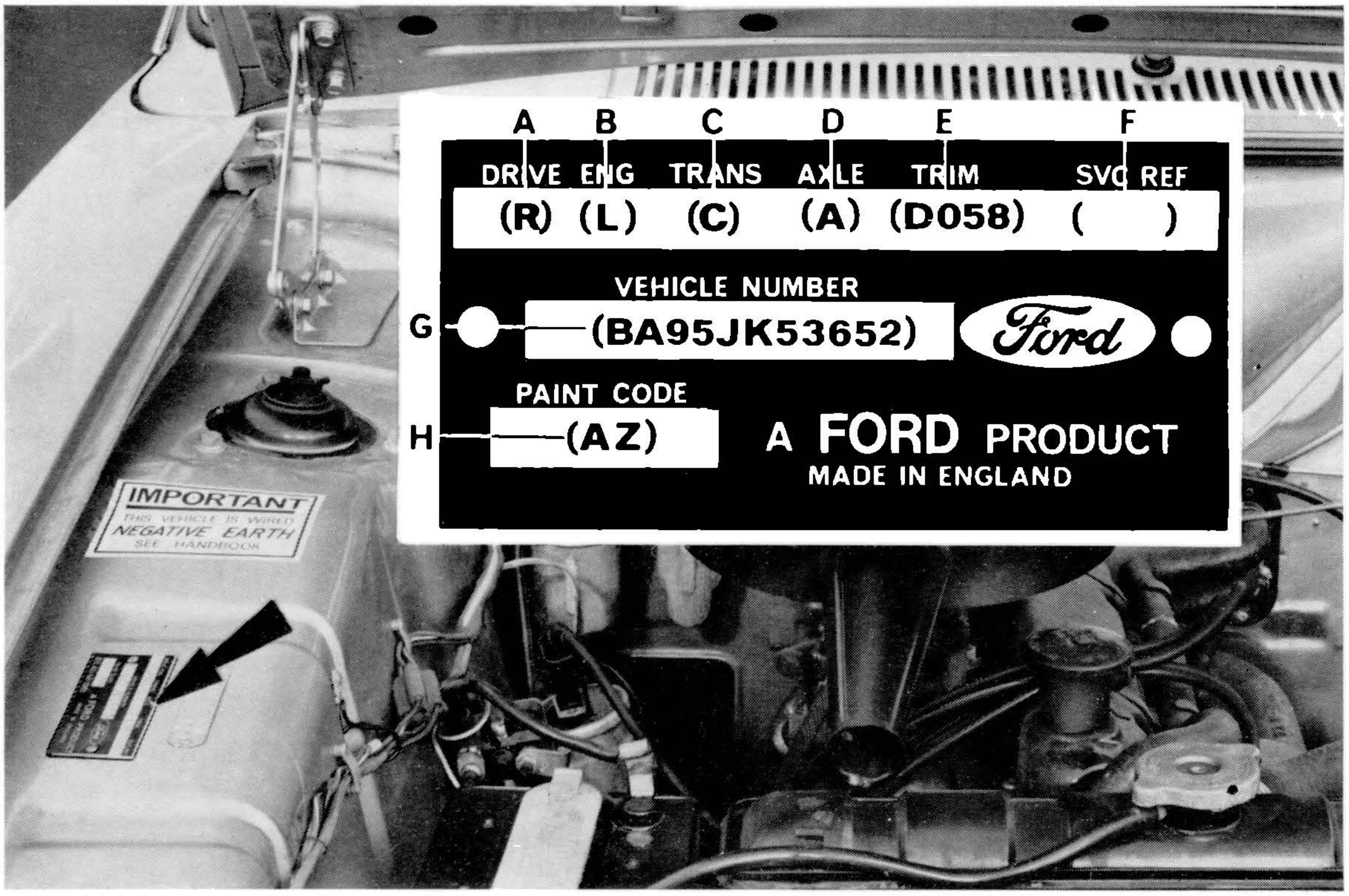
1. Check the Dual Brake warning light where fitted by depressing the test switch with the ignition "ON".

On cars with automatic transmission

2. Drive the vehicle at 30 m.p.h. in 'D', release the accelerator pedal and as the road speed falls to about 25 m.p.h. select 'L'. Ensure that second gear is engaged with resultant increase in braking effect.

3. With the selector linkage correctly adjusted, check that the starter operates ONLY when 'N' or 'P' is selected and that the back-up lamps operate ONLY when 'R' is selected. (See OP 7007-A sub-operation 38.)

Vehicle Identification



A vehicle identification plate is riveted to the top of the engine side apron panel and gives details of the type of engine, transmission, axle and body. The useful codes can be broken down as follows:

A: *Drive Code*:

R or 1 — Right Hand Drive

L or 2 — Left Hand Drive

B: *Engine Code* — Cortina:

J — 1,300 c.c. High Compression

K — 1,300 c.c. Low Compression

L — 1,600 c.c. High Compression

M — 1,600 c.c. Low Compression

N — 1,600 c.c. G.T.

C: *Transmission Code:*

A — Floor and Remote Change
B — Column Change
C — Automatic

D: *Rear Axle Code:*

A — 3.900 : 1 Ratio
B — 4.125 : 1 Ratio
C — 4.444 : 1 Ratio

E: *Trim Combination Number*

This code, which consists of an alphabetical prefix and three digits (e.g. D058) indicates the colour and type of material used within the vehicle. Refer to the Soft Trim Parts List for details.

F: *S.V.C. Reference*

This signifies the date of manufacture when a vehicle is shipped unassembled from the source company for assembly in another factory.

G: *Vehicle Number*

The vehicle number consists of eleven symbols, both numerical and alphabetical, arranged in five sections.

1. Product Source	2. Assembly Plant	3. Body Type	4. Assembly Code	5. Sequence No.
B	A	95	JK	12212

1. Product Source

"B" signifies that the vehicle was assembled in Britain. When a vehicle is shipped unassembled the letter "C" or "D" is shown to denote the territory in which it is assembled.

2. Assembly Plant

"A" denotes Dagenham
"B" denotes Halewood
"C" denotes Langley
"D" denotes Southampton

3. Body Type

This is a numerical two-figure reference

90 — 2 door saloon
92 — 2 door de luxe saloon
93 — 4 door de luxe saloon
94 — 2 door super
95 — 4 door super
96 — 2 door G.T.
97 — 4 door G.T.
98 — De luxe estate car
99 — Super estate car

4. Assembly Code

This is a two-figure alphabetical date code for factory use only.

5. Sequence Number

This will be a five-figure number within the range 00001 to 99999 and upon reaching the end of a particular range, the sequence number will revert to the original number for that respective model.

H: *Paint Code:*

This code consists of either one or two groups of letters, for single and two tone body colours respectively. The colour, or combination of colours, may be determined from the following table:

Ermine White	—	AB	Anchor Blue	—	BJ
Aubergine	—	AQ	Red II	—	BN
Silver Fox	—	A2	Beige	—	BV
Blue Mink	—	A3	Amber Gold	—	B4
Aquatic Jade	—	A5	Fern Green	—	B5
Saluki Bronze	—	A6	Light Blue	—	CG
Light Orchid	—	A9	Light Green	—	CR

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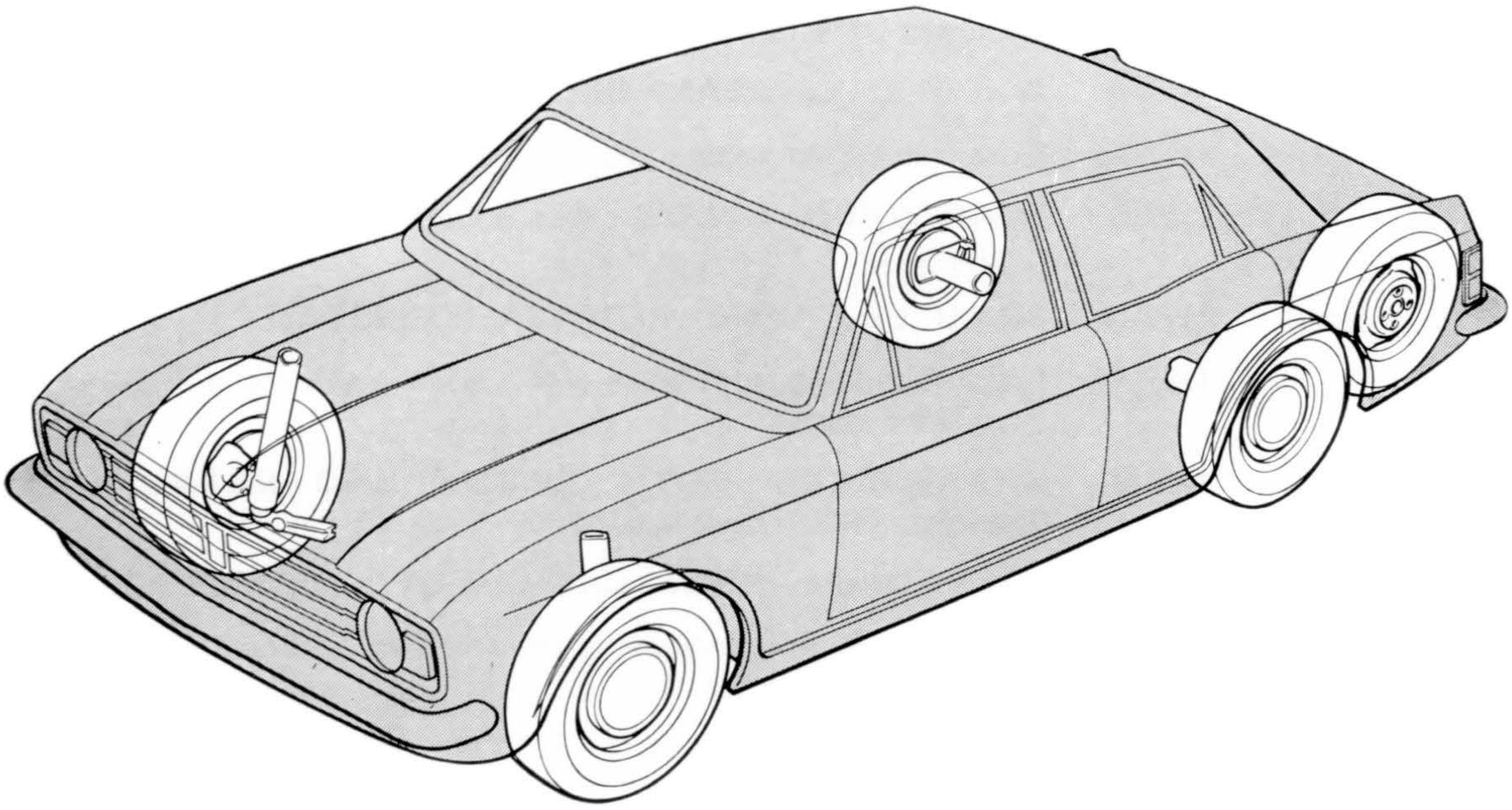
WHEELS, HUBS AND TYRES



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GENERAL DESCRIPTION

Pressed steel disc type wheels are fitted to all models in this range. They have a four-stud fixing to the wheel hub. The spare wheel is located in a well in the luggage compartment behind the left rear wheel, on saloons, and under the rear floor on estate cars.

Wheel sizes vary depending on what type of tyre is fitted and tyre sizes vary depending on model application. As standard equipment:—

1. De luxe saloons have 5.60×13 tubeless cross-ply tyres on 4J×13 rims.
2. Super saloons have 5.60×13 tubeless cross-ply tyres on 4.5J×13 rims.
3. De luxe Estate cars have 6.00×13 tubeless cross-ply tyres on 4J×13 rims.
4. Super Estate cars have 6.00×13 tubeless cross-ply tyres on 4.5J×13 rims.
5. G.T. models have 165×13 tubeless radial-ply tyres on 4.5J×13 flat ledge rims.
6. 1600E models have 165×13 tubeless radial-ply tyres on 5.5J×13 flat ledge rims.

In addition, the 165×13 tubeless radial-ply tyres with the 4.5J flat ledge wheels can be fitted as an option on all models.

NOTE – Because of the special characteristics of radial-ply tyres a special "flat ledge" wheel has been developed so that these tyres can be fitted without tubes. Therefore, if it is wished to fit radial-ply tyres to the conventional wheels, they **must** be fitted with tubes.

Tyre pressures, with the cross-ply tyres should normally be maintained at 24 p.s.i. (1.7 kg./sq. cm.) front and rear, and with the radial-ply tyres 24 p.s.i. (1.7 kg./sq. cm.) front and 28 p.s.i. (2.0 kg./sq. cm.) rear except for 1600E, which should be 24 p.s.i. (1.7 kg./sq. cm.) rear. (Estate car with radial-ply tyres—30 p.s.i. [2.1 kg./sq. cm.] rear.)

Cross-ply tyre pressures should be increased when operating fully laden or at high speeds.

When tyres are being fitted to any flat ledge or hump ledge wheels, in order to avoid damage to the tyre bead they should be applied from the side of the wheel which has the narrowest ledge (i.e. distance from rim flange to edge of well).

It is suggested that when fitting a new tubeless tyre, a new snap-in valve is also fitted. The valve is made to last the life of the tyre but beyond that time, fatigue of the valve rubber body is likely to impair the air seal at the rim hole.

The front hubs are each mounted on two taper roller bearings which run in cups pressed into the hub. Never replace the bearing without replacing the corresponding cup.

The rear hub bearings consist of ball races pressed onto the outer ends of the axle shafts. These bearings incorporate built-in oil seals.

TYRES AND TYRE CARE

Original equipment tyres

The original equipment tyres for the Cortina have undergone extensive testing by Ford and the tyre manufacturers who produce them.

It is essential for safety that the recommended inflation pressures are always maintained. When tyre tread depth is less than 1 mm, the tyre must (by legal requirement) be renewed. (U.K. only, other territories may have different regulations.)

Radial ply tyres will visually appear under-inflated at the correct recommended pressures shown over-page. This is normal and they should never be inflated beyond the recommended pressures. Under no circumstances fit radial-ply tyres on the front with conventional cross-ply tyres on the rear, nor should both types be fitted to one axle.

Tyre Care

Tyre tread life varies from car to car because of driving conditions. Aside from good driving practices, the most important factor in obtaining maximum tread life is maintaining proper tyre pressure. Pressure lower than recommended may affect vehicle handling. Over-inflated tyres reduce ride comfort by magnifying rather than absorbing road shocks and are more vulnerable to damage from road surface impacts.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

Weekly
- Check tyre pressures

6,000 miles (10,000 km.)
- Check and adjust the front wheel bearings
- Reposition road wheels if required

21,000 miles (35,000 km.)
- Repack and adjust front wheel bearings

DATA

With Cross-ply Tyres

Wheel size—1,300 c.c. and 1,600 c.c. De luxe Saloons and Estate Cars	4J × 13
—1,300 c.c. and 1,600 c.c. Super Saloons and Estate Cars	4.5J × 13
Tyre sizes—1,300 c.c. and 1,600 c.c. De luxe and Super	Tubeless 5.60 × 13
—Estate Cars	Tubeless 6.00 × 13
Ply rating (saloons)	4
(estate cars)	6
Tyre pressures—All models, normal operating conditions ...	24 p.s.i. (1.7 kg./sq. cm.)
—All models, high speed operation	28 p.s.i. (2.0 kg./sq. cm.)
—Saloons, fully laden, rear tyres only, all conditions	28 p.s.i. (2.0 kg./sq. cm.)
—Estates, fully laden, rear tyres only, all conditions	33 p.s.i. (2.3 kg./sq. cm.)

N.B.—For high speed fully laden operation, use the highest applicable pressure, e.g. for a vehicle on 6.00 × 13 tyres the front tyres will be at 28 p.s.i. (2.0. kg./sq. cm.) the rear tyres at 33 p.s.i. (2.3 kg./sq. cm.)

With Radial-ply Tyres

Wheel size—All models except 1600E	4.5J × 13
—1600E	5.5J × 13
Tyre size	165 × 13
Tyre pressures—Front	24 p.s.i. (1.7 kg./sq. cm.)
—Rear—Saloon (Except 1600E) ...	28 p.s.i. (2.0 kg./sq. cm.)
—Estate	30 p.s.i. (2.1 kg./sq. cm.)
—1600E	24 p.s.i. (1.7 kg./sq. cm.)

Tightening Torques

	lb. ft.	(*kg.m.*)
Wheel nuts	50 to 55	(6.91 to 7.60)
Brake calliper to front suspension unit ...	45 to 50	(6.22 to 6.91)
Front brake disc to hub	30 to 34	(4.15 to 4.70)
Front wheel bearing adjusting nut	See text	
Axle shaft bearing retainer bolts	15 to 18	(2.08 to 2.48)

SERVICE AND REPAIR OPERATIONS

OP 1015-A WHEEL ASSEMBLIES - BOTH FRONT OR BOTH REAR - BALANCE (INCLUDES STATIC AND DYNAMIC BALANCE)

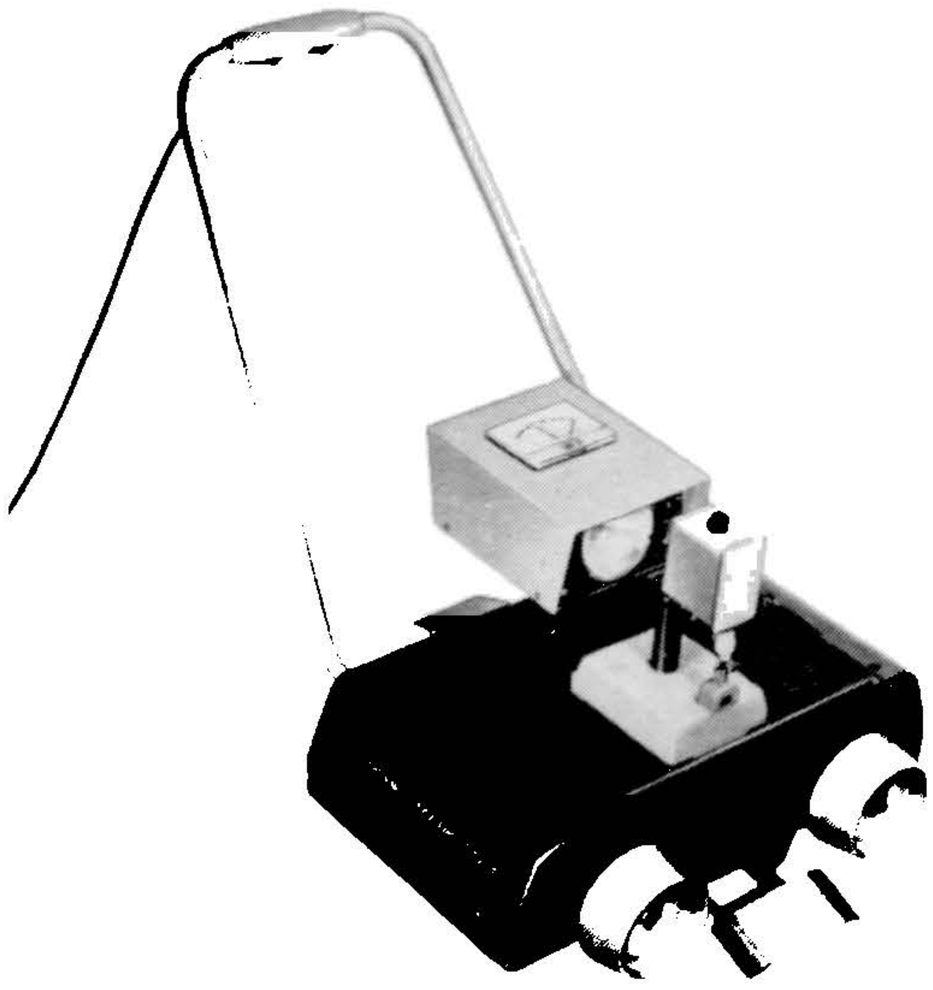
The following instructions indicate the general principles to be followed for wheel balancing. The method of balancing, however, will vary for machines of different manufacture. For specific details refer to the equipment manufacturer's instructions.

A - ON THE CAR

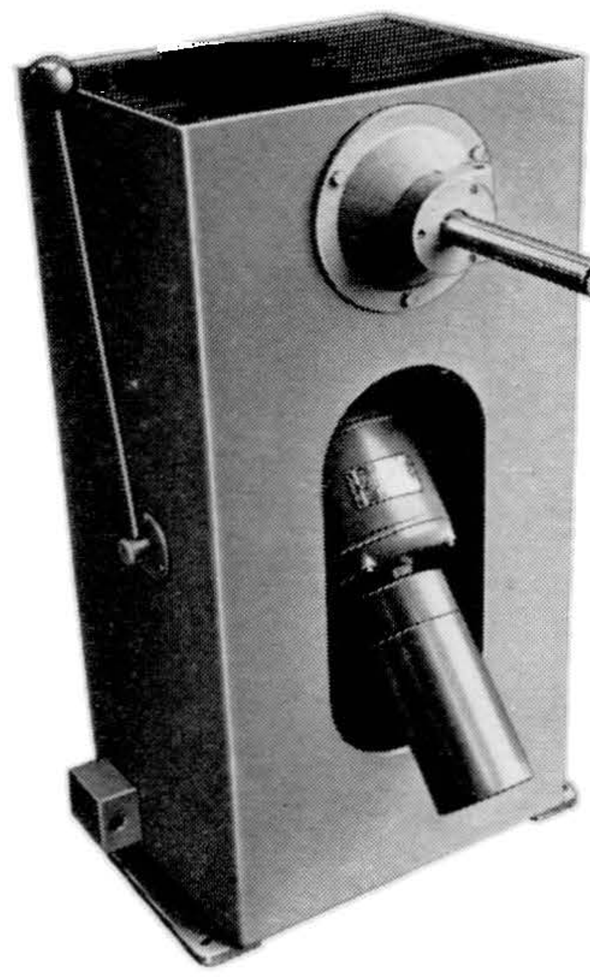
1. Jack up the front or rear of the car as required and fit chassis stands.
2. Check that wheel bearings, suspension ball joints, etc. are in correct order, and that no excess play is present, and that the tyres are correctly inflated.
3. Position the spin-up motor in correct relation to the wheel to be balanced.
4. Remove any wheel weights present.
5. Fit the wheel adaptor, or fit the pick-up onto the suspension, as close to the wheel centre as possible.
6. Spin up the wheel, and balance according to the manufacturer's instructions.
7. If applicable, move the pick-up to the brake back plate or calliper.
8. Again spin up and balance the wheel.
9. Repeat for other wheel.

B - OFF THE CAR

1. Jack up the front or rear of the car as required, fit chassis stands and remove the wheels.
2. Remove any wheel weights present, and check that the tyres are correctly inflated.



On the Car



Off the Car

Wheel Balancing Equipment

3. Mount the wheel on the balancer.
4. Statically balance the wheel by allowing it to spin so that the heaviest sector rests at the bottom, and applying suitable weights.
5. Spin up, and dynamically balance according to the manufacturer's instructions.
6. If necessary, repeat static balance.
7. Remove the wheel, mount the other wheel and balance.

OP 1015-A1 EXTRA: REMAINING ROAD WHEELS – BALANCE (INCLUDES STATIC AND DYNAMIC BALANCE)

Repeat the above operations for the remaining two wheels.

OP 1015-B WHEEL ASSEMBLIES – FOUR ROAD WHEELS – BALANCE (INCLUDES STATIC AND DYNAMIC BALANCE) – (Includes OPS 1015-A and A1)

OP 1015-C WHEEL ASSEMBLIES – ALL FIVE – BALANCE (INCLUDES STATIC AND DYNAMIC BALANCE)

1. Jack up the car and fit chassis stands all round.
2. Remove the road wheels and spare wheel.
3. Remove any wheel weights present, and check that the tyres are correctly inflated.
4. Mount one wheel on the balancer.
5. Statically balance the wheel by allowing it to spin so that the heaviest sector rests at the bottom, and applying suitable weights.
6. Spin up and dynamically balance according to the manufacturer's instructions.
7. If necessary, repeat static balance.
8. Remove the wheel and repeat for the other four wheels.

OP 1107-A FRONT WHEEL STUD – ONE – RENEW

To Remove

1. Remove the hub cap, slacken the wheel nuts, jack up the front of the car and fit stands.
2. Detach the road wheel.
3. Drive out the wheel stud.

To Install

4. Locate the new stud in its splined hole and draw it into position using a spacer and the wheel nut reversed i.e. tapered face outwards.
5. Replace the wheel.
6. Jack up, remove the stands and lower the car to the ground.
7. Tighten the wheel nuts and fit the hub cap.

OP 1107-A1 EXTRA: REMAINING STUDS – RENEW

1. Drive out the other three studs.
2. Replace the studs in their splined holes and draw them into position using a spacer and the wheel nut reversed.

OP 1107-B FRONT WHEEL STUDS – ALL – ONE WHEEL – RENEW
(Includes OPS 1107-A and A1)

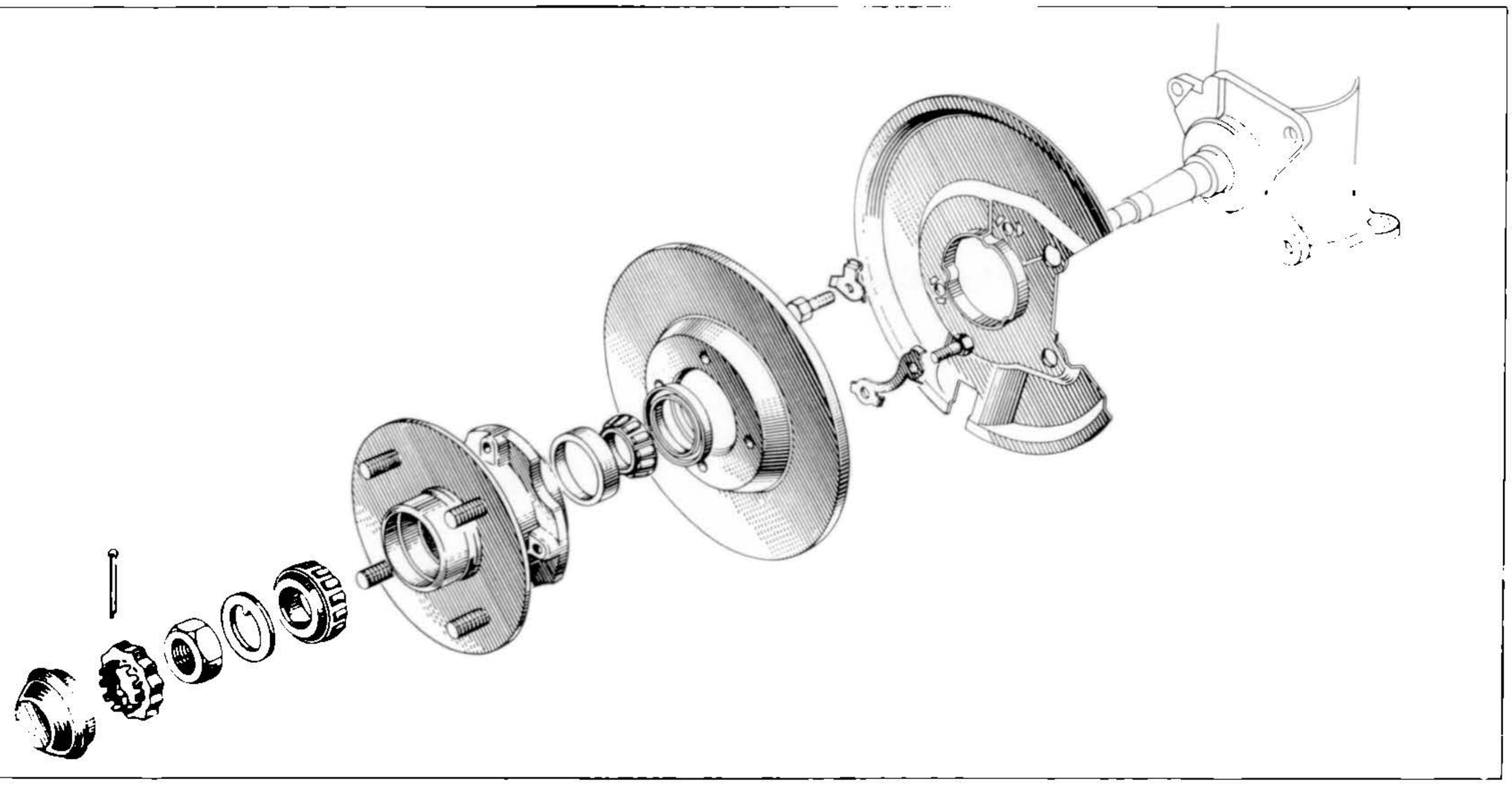
OP 1110-A FRONT WHEEL HUB ASSEMBLY – ONE – REMOVE AND INSTALL

Tools Required

550	Universal Handle
P.1029	Front hub grease seal replacer
P.2012	Brake line plugs
	Dial gauge

To Remove

1. Remove the hub cap and slacken the wheel nuts.
2. Jack up the front of the car and fit chassis stands.
3. Remove the road wheel.
4. Break the fluid supply to the front brake calliper at the pipe bracket on the suspension unit. Fit a brake line plug, P.2012, to each of the opened pipe ends.
5. Detach the brake calliper from its mounting lugs on the base of the suspension unit after bending back the lock tabs and unscrewing the securing bolts.
6. Remove the dust cap from the centre of the hub. Withdraw the split pin, remove the nut retainer, adjusting nut, thrust washer and outer bearing cone.



Front Hub Assembly—Exploded

7. Remove the hub and disc assembly from the wheel spindle.
8. Bend back the lock tabs, unscrew the bolts and separate the disc from the hub assembly.
9. Discard the hub assembly.

To Replace

NOTE – A new hub assembly is supplied complete with cups and cones. The cups are in position in the hub and the cones are separate. It should be noted that the cups and cone must be of the same manufacture. This should be checked, the manufacturer's name can be read off the cone and the initial letter of the name is stamped on the hub (i.e. T = Timken, S = Skefco).

10. Clean the mating faces of the hub and disc, these must be scrupulously clean if disc run-out is to be avoided.
11. Align the run-out marks and assemble the disc to the hub using new locking plates under the bolts. Tighten the bolts to a torque of 30 to 34 lb. ft. (4.15 to 4.70 kg.m.) and bend up the tabs on the locking plates.
12. Fully pack the bearing cage and rollers with a lithium based grease. Work the grease well into the bearing. Smear grease around both wheel bearing caps but **leave the hub and grease cap empty to allow for expansion.**
13. Using Tool No. P.1029 and the 550 handle, fit the grease seal with the lip towards the bearing.
14. Fit the hub and disc assembly to the wheel spindle and assemble the outer bearing, thrust washer and bearing adjusting nut. Tighten the adjusting nut to a torque of 27 lb. ft. (3.73 kg.m.) whilst rotating the hub and disc assembly. Slacken the nut back 90° and then fit the nut retainer so as to align a slot in the retainer with the hole in the spindle. Fit a new split pin but do not bend up at this stage.
15. Check the disc run-out using a dial gauge. The maximum permissible run-out, measured near the periphery of the disc, is 0.004 in. (0.10 mm.) total indicated run-out. If this is excessive, examine the mating faces of the hub and disc for dirt or distortion and check the bearings and cups for damage.
16. Bend up the split pin and fit the dust cap to the wheel spindle.
17. Fit the calliper to its mounting lugs using new lock tabs and tighten the securing bolts to a torque of 45 to 50 lb. ft. (6.22 to 6.94 kg.m.).
18. Reconnect the hydraulic fluid pipe to the calliper assembly and tighten the union securely.
19. Replace the road wheel.
20. Jack up the car, remove the stands and lower the car to the ground.
21. Tighten the wheel nuts and fit the hub cap.
22. Bleed the brakes as described in OP 2000-A.

OP 1110-A1 EXTRA: REMAINING FRONT WHEEL HUB ASSEMBLY – REMOVE AND INSTALL (Front of vehicle on stands)

Repeat sub-operations 3 to 19 above.

OP 1110-B FRONT WHEEL HUB ASSEMBLY – BOTH – REMOVE AND INSTALL (Includes OPS 1110-A and A1)

OP 1117-A REAR WHEEL STUD – REPLACE

To Remove

1. Remove the hub cap, slacken the wheel nuts, chock the front wheels, jack up the rear of the car and fit stands.
2. Detach the road wheel.
3. Remove the brake drum after unscrewing the countersunk head screw and releasing the handbrake.
4. Drive out the wheel stud.

To Install

5. Locate the new stud in its splined hole and draw it into position using a spacer and the wheel nut reversed, i.e. tapered face outwards.
6. Replace the wheel.
7. Jack up, remove the stands and lower the car to the ground.
8. Tighten the wheel nuts and fit the hub cap.
9. Apply the handbrake and remove the chocks from the front wheels.

OP 1117-A1 EXTRA: REMAINING STUDS – RENEW (BRAKE DRUM REMOVED)

1. Drive out the other three studs.
2. Replace the studs in their splined holes and draw them into position using a spacer and the wheel nut reversed.

OP 1117-B REAR WHEEL STUDS – ALL – ONE WHEEL – RENEW
(Includes OPS 1117-A and A1)

OP 1125-A FRONT BRAKE DISC – ONE – REMOVE AND INSTALL

Tools Required

550	Universal Handle
P.1029	Front hub grease seal replacer
P.2012	Brake line plugs
	Dial gauge

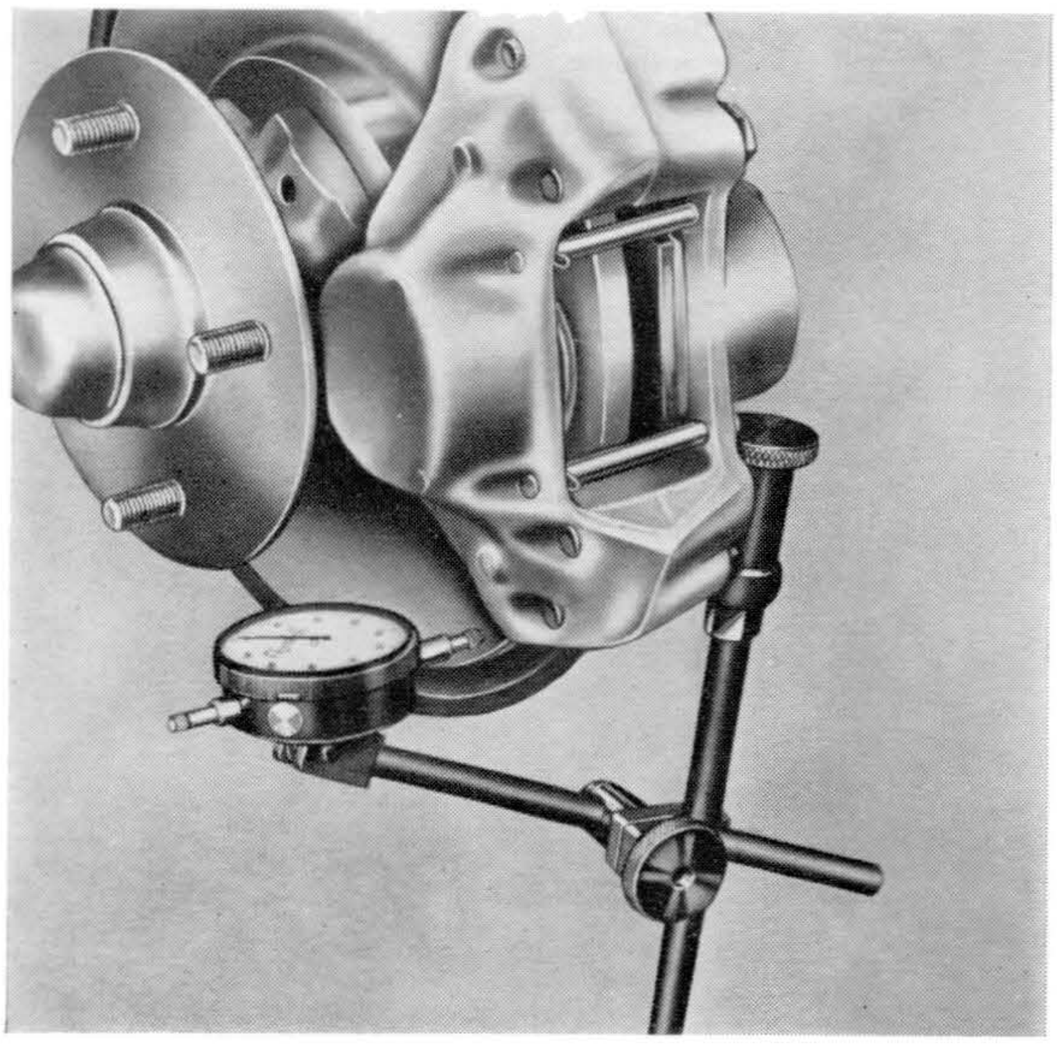
To Remove

1. Remove the hub cap and slacken the wheel nuts.
2. Jack up the front of the car and fit chassis stands.
3. Remove the road wheel.
4. Break the fluid supply to the front brake calliper at the pipe bracket on the suspension unit. Fit a brake line plug, P.2012, to each of the opened pipe ends.
5. Detach the brake calliper from the mounting lugs on the base of the suspension unit after bending back the lock tabs and unscrewing the securing bolts.
6. Remove the dust cap from the centre of the hub. Withdraw the split pin, remove the nut retainer, adjusting nut, thrust washer and outer bearing cone.

7. Remove the hub and disc assembly from the wheel spindle.
8. Bend back the lock tabs, unscrew the bolts and separate the disc from the hub assembly.
9. Discard the disc, locking plates and bolts.

To Install

10. Clean the mating faces of the hub and disc, these must be scrupulously clean if disc run-out is to be avoided.
11. Align the run-out marks and assemble the disc to the hub using new locking plates under the bolts. Tighten the bolts to a torque of 30 to 34 lb. ft. (4.15 to 4.70 kg.m.) and bend up the tabs on the locking plates.
12. Pack the hub with lithium base grease and, if removed previously, refit the inner bearing cone.
13. Using Tool No. P.1029 and the 550 handle, fit the grease sealer with the lip towards the bearing.
14. Fit the hub and disc assembly to the wheel spindle and assemble the outer bearing, thrust washer and bearing adjusting nut. Tighten the adjusting nut to a torque of 27 lb. ft. (3.73 kg.m.) whilst rotating the hub and disc assembly. Slacken the nut back 90° and then fit the nut retainer so as to align a slot in the retainer with the hole in the spindle. Fit a new split pin but do not bend up at this stage.
15. Check the disc run-out using a dial gauge. The maximum permissible run-out, measured near the periphery of the disc, is 0.004 in. (0.10 mm.) total indicated run-out. If this is excessive, examine the mating faces of the hub and disc for dirt or distortion and check the bearings and cups for damage.



Checking Brake Disc Run-Out

16. Bend up the split pin and fit the dust cap to the wheel spindle.
17. Fit the calliper to its mounting lugs using new lock tabs and tighten the securing bolts to a torque of 45 to 50 lb. ft. (6.22 to 6.94 kg.m.).
18. Reconnect the hydraulic fluid pipe to the calliper assembly and tighten the union securely.
19. Replace the road wheel.
20. Jack up the car, remove the stands and lower the car to the ground.
21. Tighten the wheel nuts and fit the hub cap.
22. Bleed the brakes as described in OP 2000-A.

OP 1125-A1 EXTRA: REMAINING FRONT DISC - REMOVE AND INSTALL (Front of vehicle on stands)

Repeat sub-operations 3 to 19 above.

OP 1125-B BRAKE DISCS - BOTH - REMOVE AND INSTALL
(Includes OPS 1125-A and A1)

OP 1126-A BRAKE DRUM - REAR - ONE - REMOVE AND INSTALL

To Remove

1. Remove the hub cap, slacken the wheel nuts, chock the front wheels, jack up the rear of the car and fit chassis stands.
2. Remove the road wheel.
3. Remove the brake drum after unscrewing the countersunk head screw and releasing the handbrake.
4. Back off the brake adjustment mechanism by turning the serrated ratchet wheel against the pawl. To do this it is necessary to lift the pawl out of engagement with the ratchet.

Brake Drum Securing Screw

To Install

5. Install the new brake drum and secure with the countersunk head screw.
6. Replace the road wheel.
7. Jack up, remove the stands and lower the car to the ground.
8. Tighten the wheel nuts and fit the hub cap.
9. Operate the handbrake several times to bring the brake shoes into their correct adjustment relative to the brake drum.
10. Apply the handbrake and remove chocks from the front wheels.

OP 1126-A1 EXTRA: REMAINING REAR BRAKE DRUM – REMOVE AND INSTALL
(Rear of vehicle on stands)

Repeat sub-operations 2 to 7 above.

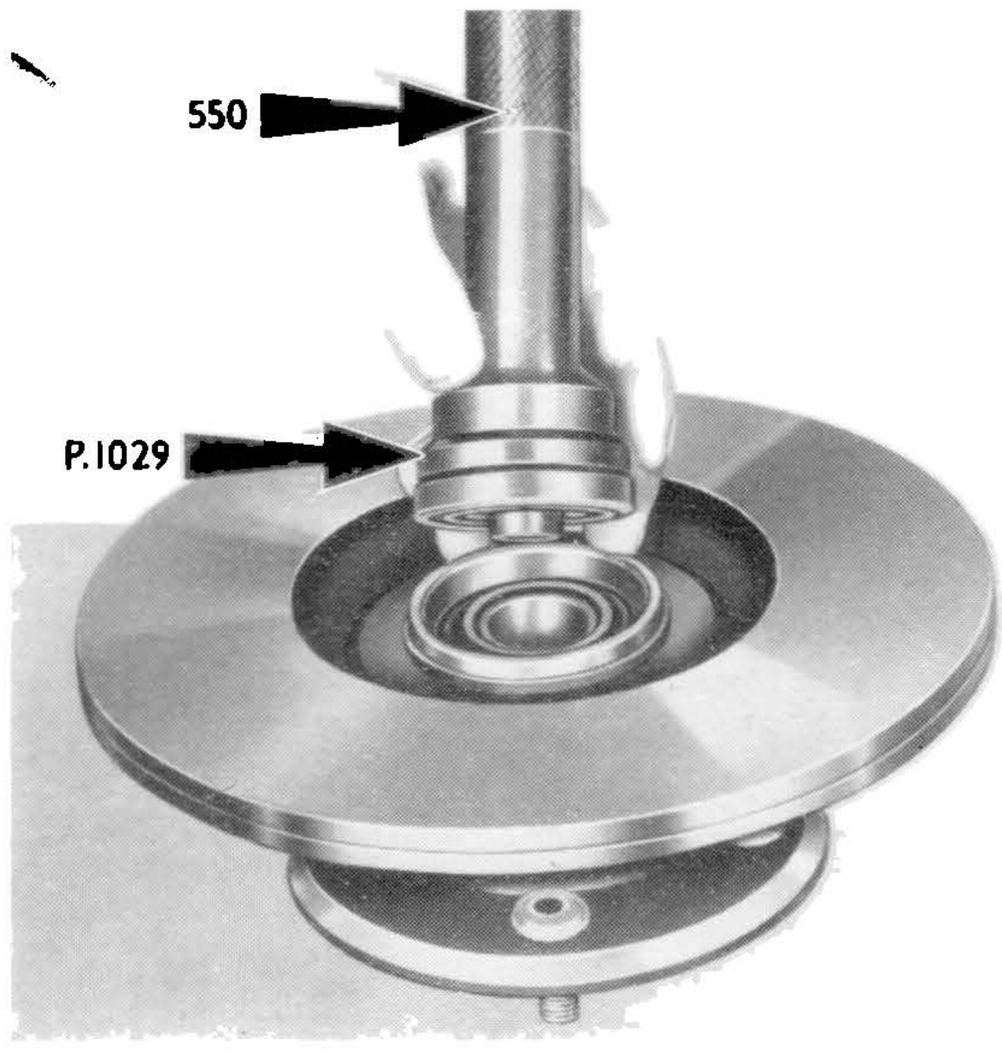
OP 1126-B BRAKE DRUMS – REAR – BOTH – REMOVE AND INSTALL
(Includes OPS 1126-A and A1)

OP 1202-A WHEEL BEARING – ONE FRONT WHEEL – ADJUST

To Adjust

1. With the handbrake applied, jack up the front of the car and fit chassis stands.
2. Remove the hub cap and prise out the dust cap from the end of the wheel spindle.
3. Remove the split pin and detach the adjusting nut retainer.
4. Adjust the bearing by tightening the adjusting nut to a torque of 27 lb. ft. (3.73 kg.m.) whilst rotating the road wheel.

Adjusting the Front Wheel Bearings



Fitting a Front Hub Grease Seal

5. Slacken back the nut 90° and then fit the nut retainer so that a slot in the retainer lines up with the hole in the spindle.
6. Fit a new split pin and bend back the legs. Tap the dust cap into place and replace the hub cap.
7. Jack up, remove the stands and lower the car to the ground.

OP 1202-A1 EXTRA: REMAINING FRONT WHEEL BEARING – ADJUST (Front of vehicle on stands)

Repeat sub-operations 2 to 6 above.

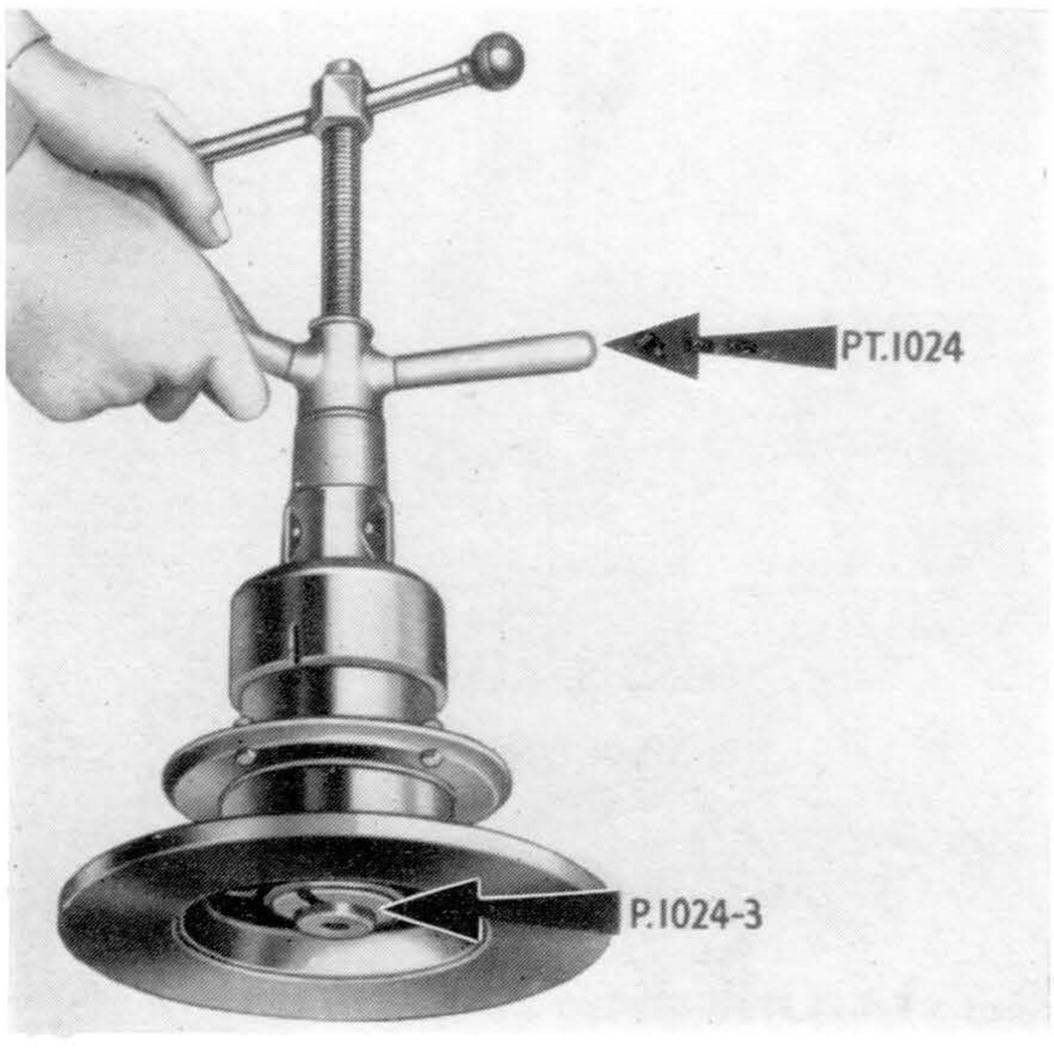
OP 1202-A2 EXTRA: BEARING – ONE FRONT WHEEL – LUBRICATE (Front of vehicle on stands)

Tools Required

550	Universal handle
P.1029	Front hub grease seal replacer
P.2012	Brake line plugs
	Dial gauge

To Dismantle

1. Break the fluid supply to the front brake calliper at the pipe bracket on the suspension unit. Fit a brake line plug, Tool No. P.2012, to each of the opened pipe ends.
2. Detach the brake calliper from the mounting lugs on the base of the suspension unit after bending back the lock tabs and unscrewing the securing bolts.
3. Remove the dust cap from the centre of the hub. Withdraw the split pin, remove the nut retainer, adjusting nut, thrust washer and outer bearing cone.
4. Remove the hub and disc assembly from the wheel spindle.
5. Prise out the grease seal and remove the inner bearing cone.



Refitting the Bearing Cups

6. Wash out the hub and the bearing cones. During this operation take care not to get any grease, etc., on the surface of the disc.

To Reassemble

7. Fully pack the bearing cages and rollers with a lithium-based grease. Work the grease well into the bearing. Smear grease around both wheel bearing cups but **leave the hub and grease cap empty to allow for expansion.** Fit the inner bearing cone.

8. Using Tool No. P.1029 and the 550 handle, fit the grease seal with the lip towards the bearing.

9. Fit the hub and disc assembly to the wheel spindle and assemble the outer bearing, thrust washer and bearing adjusting nut. Tighten the adjusting nut to a torque of 27 lb. ft. (3.73 kg.m.) whilst rotating the hub and disc assembly. Slacken the nut back 90° and then fit the nut retainer so as to align a slot in the retainer with the hole in the spindle. Fit a new split pin but do not bend up at this stage.

10. Check the disc run-out using a dial gauge. The maximum permissible run-out, measured near the periphery of the disc is 0.004 in. (0.10 mm.) total indicated run-out. If this is excessive examine the mating faces of the hub and disc for dirt or distortion and check the bearings and cups for damage.

11. Bend up the split pin and fit the dust cap to the wheel spindle.

12. Fit the calliper to its mounting lugs using new lock tabs and tighten the securing bolts to a torque of 45 to 50 lb. ft. (6.22 to 6.94 kg.m.).

13. Reconnect the hydraulic fluid pipe to the calliper assembly and tighten the union securely.

14. Bleed the brakes as described in OP 2000-A.

OP 1202-A3 EXTRA: FRONT WHEEL BEARING CUPS – EACH FRONT WHEEL – RENEW (FRONT HUB REMOVED)

Tools Required

PT.1024	Front hub bearing cups remover and replacer (Main Tool)
P.1024-3	Adaptors for PT.1024

1. Remove the inner and outer bearing cups, using PT.1024 and the adaptors.

2. Replace new cups using the same tools.

NOTE – When replacing cones **always** fit new bearing cups as well. Also, make sure that the cups and bearing cones are of the same manufacture.

OP 1202-B WHEEL BEARINGS – BOTH FRONT WHEELS – ADJUST
(Includes OPS 1202-A and A1)

OP 1202-C WHEEL BEARINGS – ONE FRONT WHEEL – LUBRICATE AND ADJUST
(Includes OPS 1202-A and A2)

OP 1202-D WHEEL BEARINGS – BOTH FRONT WHEELS – LUBRICATE AND ADJUST
(Includes OPS 1202-A, A1 and A2 × 2)

OP 1202-E WHEEL BEARING CUPS – ONE FRONT WHEEL – RENEW
(Includes OPS 1202-A, A2 and A3)

OP 1202-F WHEEL BEARING CUPS – FRONT WHEELS – RENEW
(Includes OPS 1202-A, A1, A2 × 2 and A3 × 2)

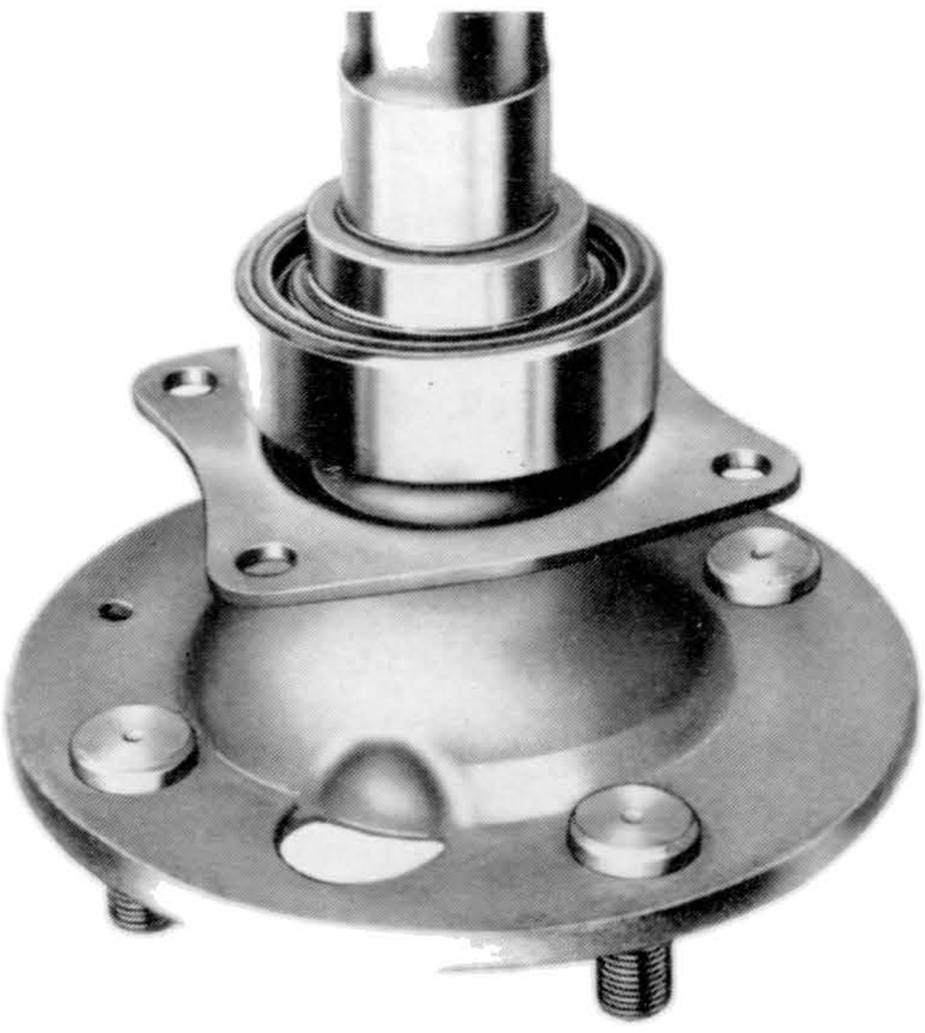
OP 1225-A WHEEL BEARING – ONE – REAR – REMOVE AND INSTALL

Tools Required

CPT.3072	Slide hammer
P.4090-2 & 6	Axle shaft bearing remover
370	Universal taper base for press
P.4084	Spring indicator

To Remove

1. Remove the hub cap, slacken the wheel nuts, chock the front wheels, jack up the rear of the car, fit stands and remove the road wheel.
2. Release the handbrake inside the car.
3. Remove the brake drum securing screw and pull off the drum. (Ensure handbrake is released.)
4. Remove the four bolts and spring washers securing the bearing retainer plate to the axle casing. These bolts are accessible through holes in the axle shaft flange.
5. Secure the base of Tool No. P.3072 to the axle shaft flange with the wheel nuts. Use the slide hammer of the tool to draw out the axle shaft.
6. Locate the adaptors (Tool No. P.4090-6) and a slave ring between the bearing and axle shaft flange. Support the assembly in the base plate (Tool No. 370) of a hydraulic press and push the axle shaft out of the bearing.



Axle Shaft and Bearing Assembly

To Install

7. Locate the bearing retainer plate and the bearing on the axle shaft with the oil seal side towards the splined end.
8. Support the assembly in the bed of a hydraulic press on a spacer ring, adaptors (Tool No. P.4090-2) and slave ring.
9. Fit a spring indicator (Tool No. P.4084) to the ram and press the bearing onto the axle shaft shoulder. A minimum pressure of 1,200 lb. (544 kg.) should be required. A lower pressure indicates an incorrect fit.
10. Use the same tools as in sub-operations 6 and 7 and fit the bearing collar to abut the bearing. A minimum pressure of 2,400 lb. (1,088 kg.) should be required.
11. Insert the axle shaft into the casing and engage the splines in the differential side gear. Tap the shaft fully home.
12. Fit the four bolts and spring washers to secure the bearing retainer plate; torque to 15 to 18 lb. ft. (2.08 to 2.48 kg.m.).
13. Replace the brake drum and refit the securing screw.
14. Replace the road wheel and apply the handbrake.
15. Jack up, remove the stands and lower the car to the ground. Remove the chocks from the front wheels.
16. Tighten the wheel nuts and fit the hub cap.

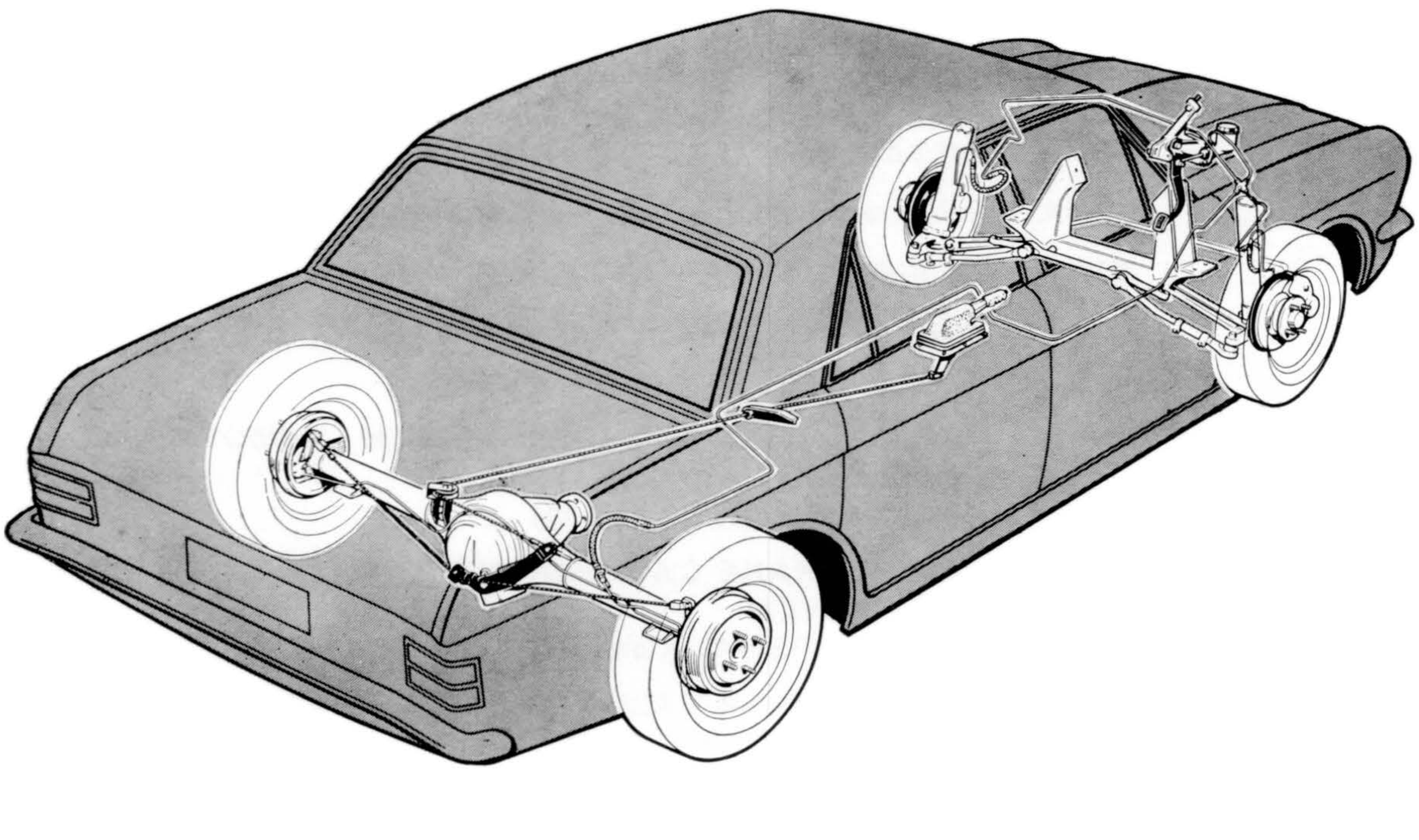
OP 1225-A1 EXTRA: REMAINING REAR WHEEL BEARING – REMOVE AND INSTALL
(Rear of vehicle on stands)

Repeat sub-operations 3 to 14 above.

OP 1225-B WHEEL BEARINGS – BOTH REAR – REMOVE AND INSTALL
(Includes OPS 1225-A and A1)

2

BRAKING SYSTEM



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,,	2000-E	BRAKE HYDRAULIC FLUID – RENEW
,,	2000-F	BRAKE HYDRAULIC SEALS AND FLEXIBLE HOSES – RENEW
,,	2004-A	BRAKE SERVO UNIT – REMOVE AND INSTALL
,,	2004-A2	Extra: brake servo unit – overhaul
,,	2004-C	**BRAKE SERVO UNIT – OVERHAUL** (Includes OPS 2004-A and A2)
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,,	2220-B1	Extra: brake shoes and/or retracting springs – second side – renew
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,,	2220-B5	Extra: rear brake carrier plate – remove and install
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GENERAL DESCRIPTION

Hydraulically operated brakes, discs on the front, drums on the rear, are fitted to all four wheels. They are operated by means of a pendant pedal suspended from a bracket attached to the rear face of the engine compartment rear bulkhead.

The hydraulic system may be either dual line or conventional single line. The dual line system provides separate hydraulic circuits for the front and rear brakes. Should one circuit fail the other circuit is unaffected and the car can still be stopped.

The front disc brakes may be the leading calliper or trailing calliper type depending on the model to which they are fitted. Similarly, the rear drum brakes may be 8 in. (20.3 cm.) or 9 in. (22.9 cm.) diameter and the wheel cylinder and master cylinder sizes may also vary. Because of this, when renewing or overhauling braking components, check with the specification (or quick reference data, see below) to ensure that only correct parts are fitted.

All models in the latest Cortina range incorporate a floor mounted parking brake located between the front seats. The parking brake has been modified to reduce application effort and improve efficiency, and incorporates a re-designed brake relay lever which is mounted on the rear axle casing. The handbrake operates through a two-cable linkage and its operation causes the "self-adjust" mechanism in the rear brakes to function as and when necessary, as on the previous Cortina range.

A mechanical servo of new design is fitted as standard on all G.T., 1600E and estate car models fitted with a dual line braking system.

The mechanical servo is of the suspended vacuum type and is fitted to a bracket attached to the engine compartment rear bulkhead. The mechanical servo incorporates a rod and clevis assembly which is attached to the brake pedal at one end, and the brake master cylinder at the other.

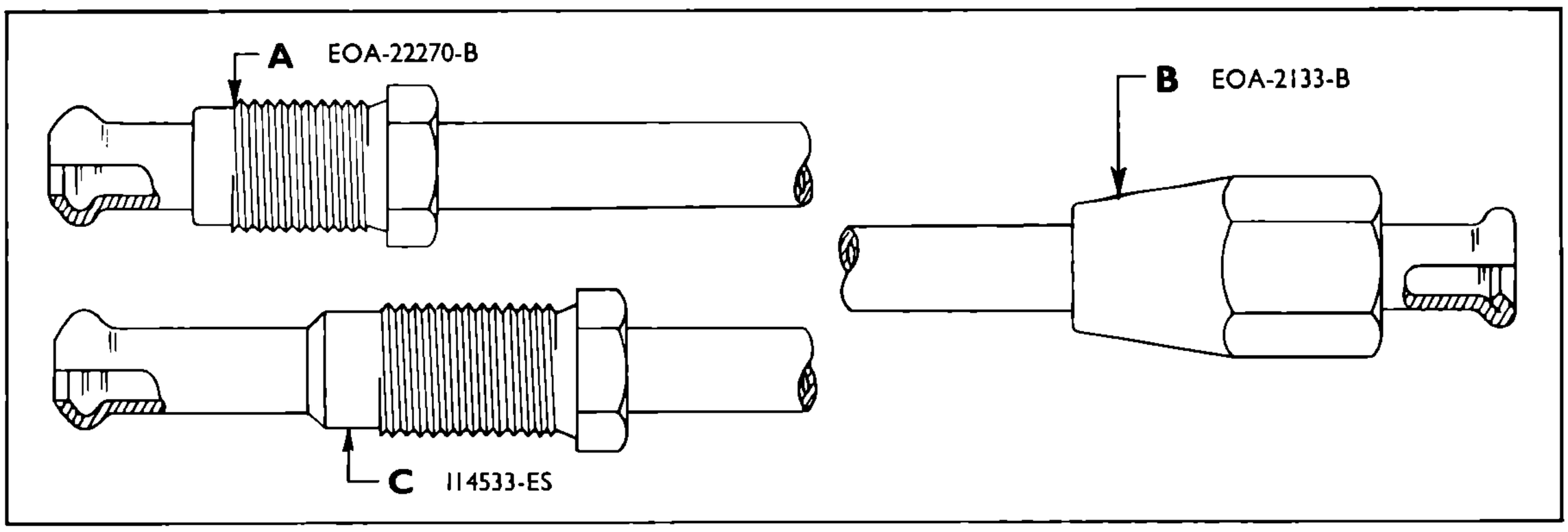
With the engine running, vacuum is supplied to the servo unit through a non-return valve, and both sides of the chamber diaphragm are subjected to equal vacuum. Initial movement of the brake pedal admits atmospheric pressure to the rear of the diaphragm resulting in a pressure difference which causes the diaphragm to move forward. The brake pedal effort is therefore supplemented by the movement of the diaphragm, therefore increasing fluid pressure to the brake lines.

Because there are varying types of braking systems, when renewing or overhauling components take care that only correct parts are fitted. If an incorrect master cylinder is fitted the pedal effort will be affected. If an incorrect wheel cylinder is fitted, brake balance will be upset.

Brake Pipe Chart

Part Number	LENGTH Inches	cms.	END FITTINGS A	B	C
3050E-2A040-A	22.0	56	2	–	–
3050E-2A040-B	24.5	62	1	–	1
3050E-2A040-C	48.75	124	1	–	1
3051E-2A040-A	24.0	61	1	–	1
3051E-2A040-B	30.0	76	1	–	1
3050E-2B097-A	42.5	108	1	1	–
3050E-2B097-B	19.0	48.5	1	1	–
3051E-2B097-A	45.5	115.5	1	1	–
3051E-2B097-B	39.0	99	1	1	–
3050E-2263-A	38.25	97.5	1	1	–
3050E-2264-A	29.75	75.5	1	1	–
3050E-2265-A	89.5	227	1	1	–
3050E-2265-B	18.5	47	–	2	–
3051E-2K470-A	39.5	100.5	–	1	1
3051E-2K471-A	29.75	75.5	–	1	1
3050E-2K472-A	24.5	62	–	–	2
3050E-2K472-B	48.75	124	–	–	2
3051E-2K472-A	24.0	61	...	–	–	2
3051E-2K472-B	30.0	76	–	–	2
3050E-2K473-A	23.25	59	2	–	–
3050E-2K473-B	46.75	119	2	–	–
3051E-2K473-A	28.5	72.5	2	–	–
3051E-2K473-B	34.5	87.5	2	–	–
3051E-2K475-A	15.0	38	1	1	–

Brake Pipe End Fittings



BRAKE PIPES

To eliminate impractical and expensive stock holding, brake pipes are not serviced individually. They should be fabricated in line with the information in the chart opposite.

All brake pipes must be manufactured from bundy tubing having a wall thickness of 0.028 in., (0.7 mm.) (EM-900D-1 is a suitable material). **On no account must fuel pipe be used as it is designed to operate at a much lower pressure and will fail if used as brake pipe.**

FORMING PIPES

Two types of flare are used on piping:

(1) Single Flare

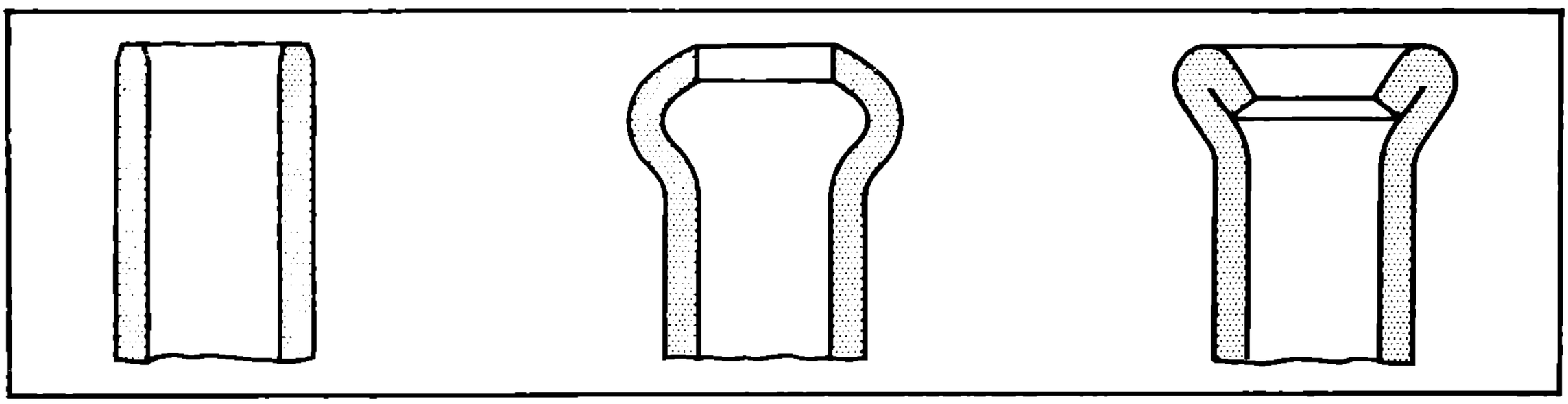
(2) Double Flare

Either of these flares can be formed, using the same tool, and this process is described below.

Flaring a Pipe (Split-Die Type)

Single Flare	Ops. 1 to 5, 7 and 8
Double Flare	Ops. 1 to 8

1. Cut off and straighten the required length of pipe. (A pipe cutting tool will simplify obtaining a clean and square cut.)
2. Square off the ends of the pipe with a file and chamfer the end of the pipe to be flared.
3. Select the split die for the pipe being used and insert the die into the tapered hole in the body.
4. Push the bundy tube through the die until the pipe is flush with the face of the die. Lock the pipe in this position by tightening the wing nut securely.
5. The punches are marked Op. 1 and Op. 2. Slide the first operation punch into the hole in the centre of the body and tighten the screw well home to form the single flare.
6. Release the screw and replace the first operation punch with the second operation punch and tighten the screw to form the double flare.
7. Release the screw, wing nut, punch and dies.

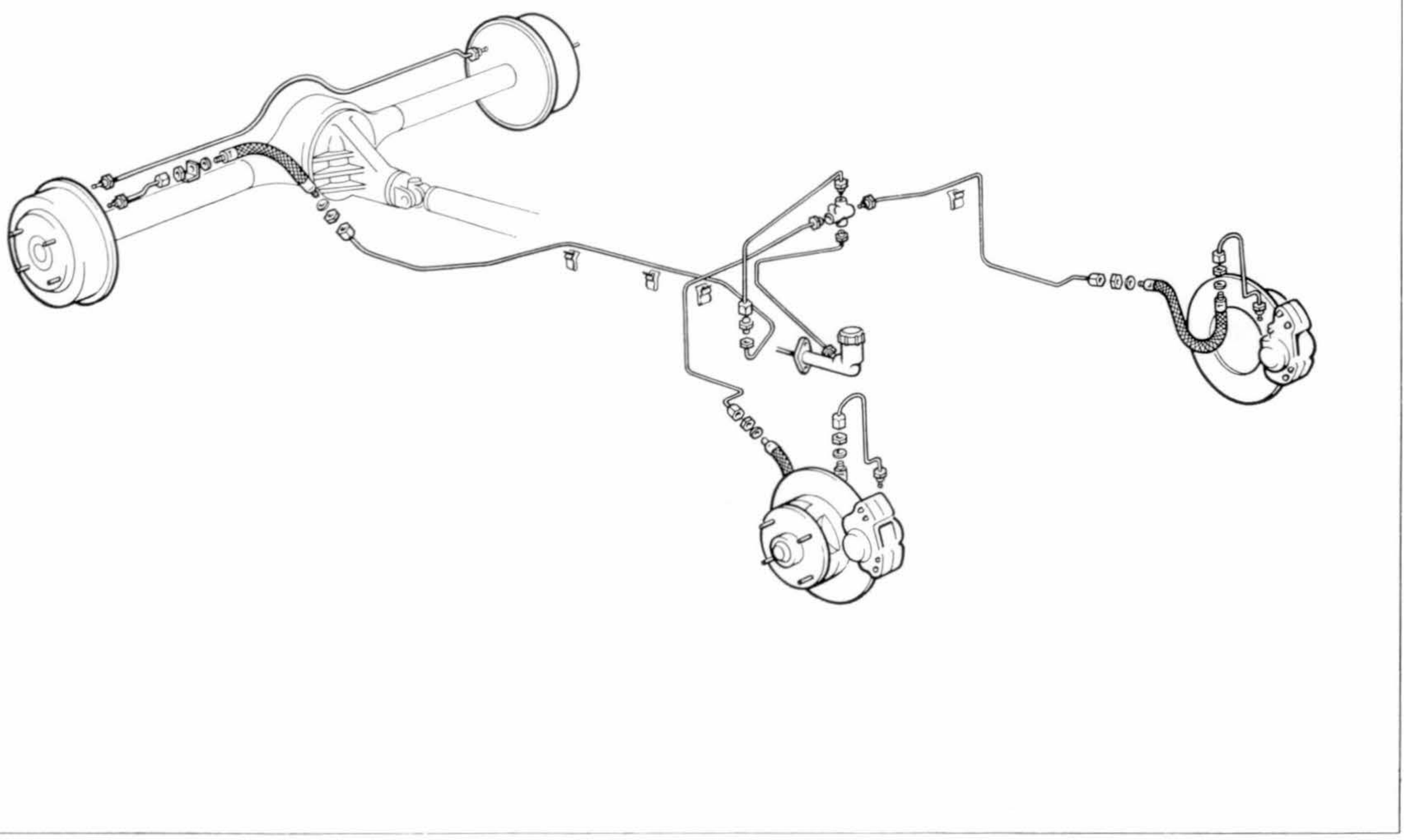


1
Before Flaring
Chamfer Edges

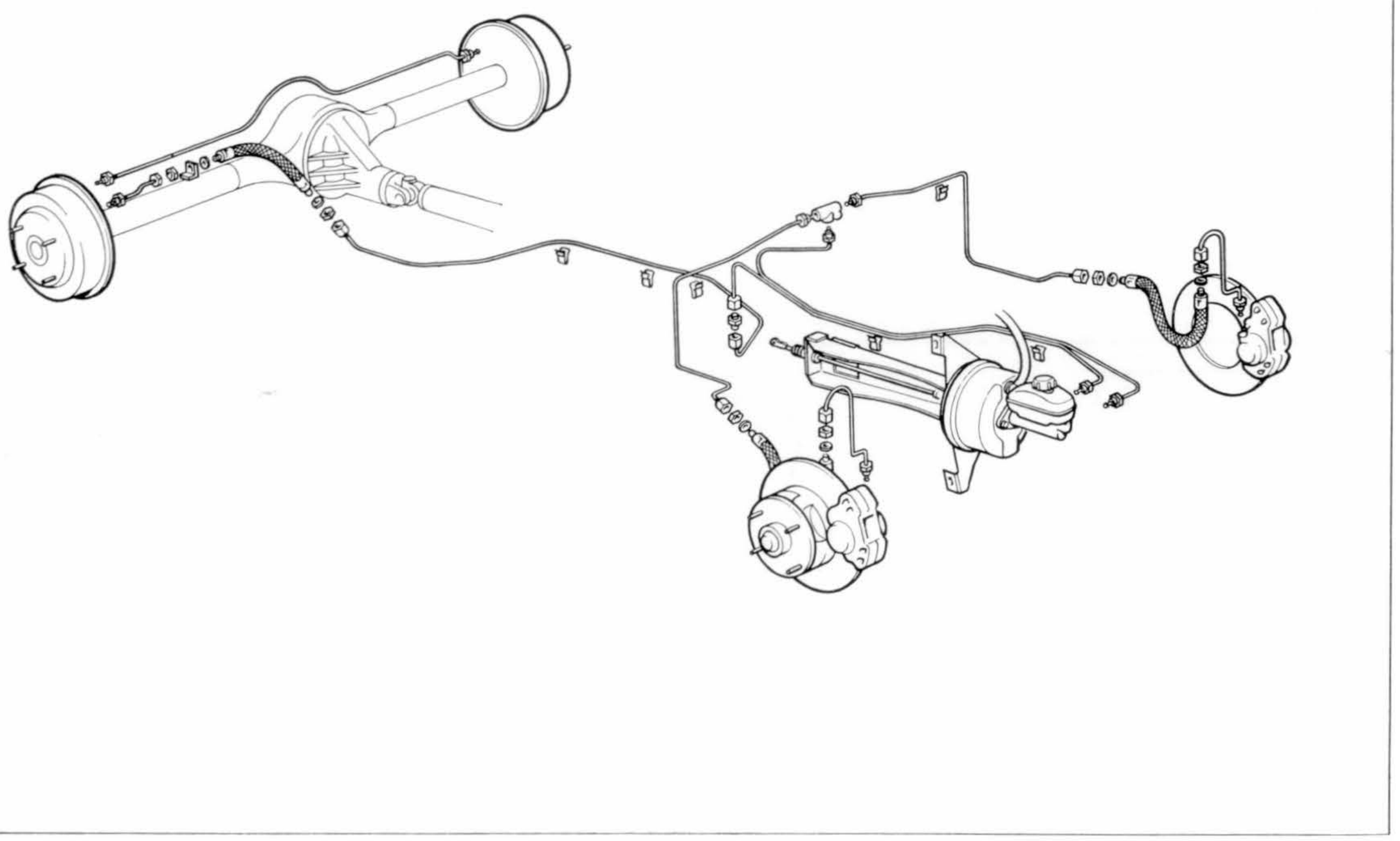
2
First Operation
Single Flare

3
Second Operation
Double Flare

Flaring Sequence



Brake Pipe Layout — Single Line



Brake Pipe Layout — Dual Line with Servo — R.H.D.

8. Remove the pipe and inspect the flare for cracks or poor flare form. If any doubt exists about the flare it should be cut off and the process repeated.

   The finished flare must be square with the pipe, free from any cracks and have a smooth mating surface to ensure a leakproof connection.

Flaring a Pipe (Flaring-Bar Type)

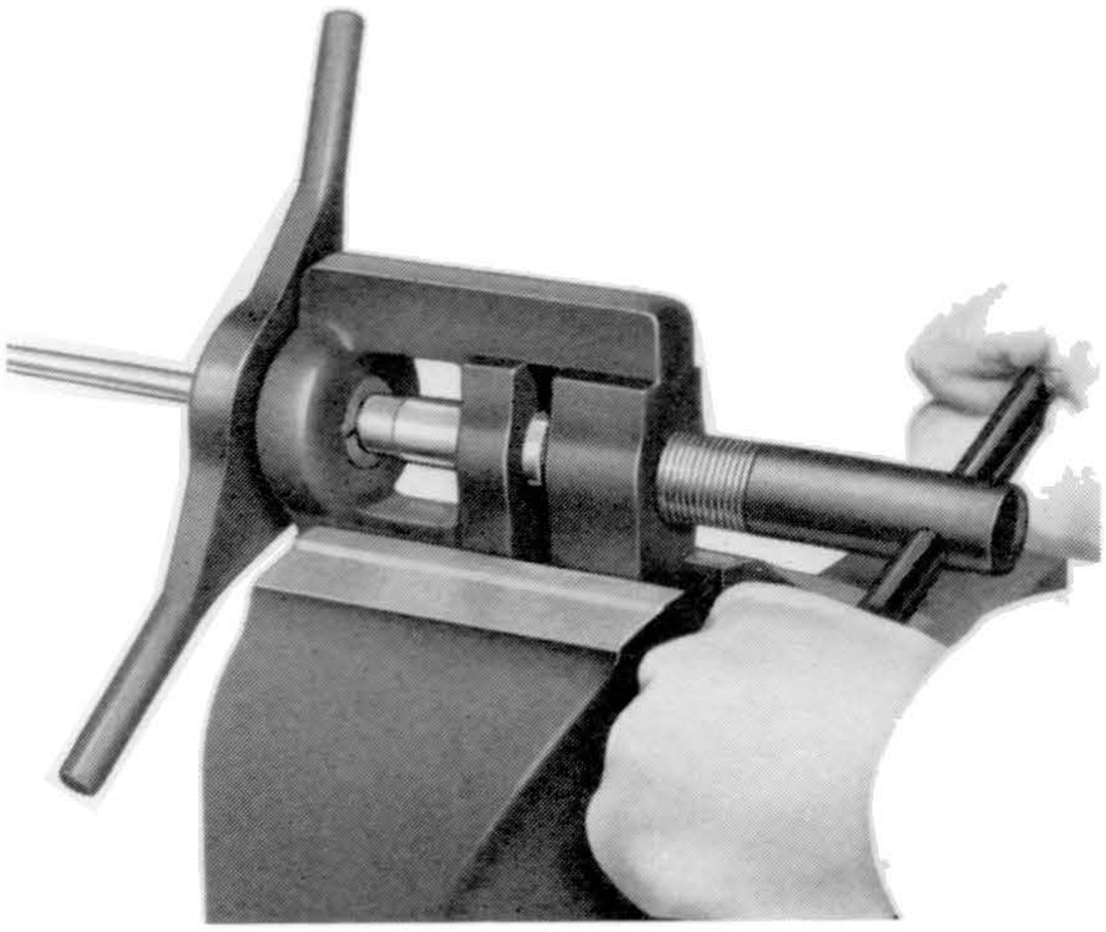
Single Flare ... Ops. 1 to 6 and 8

Double Flare ... ... Ops. 1 to 8

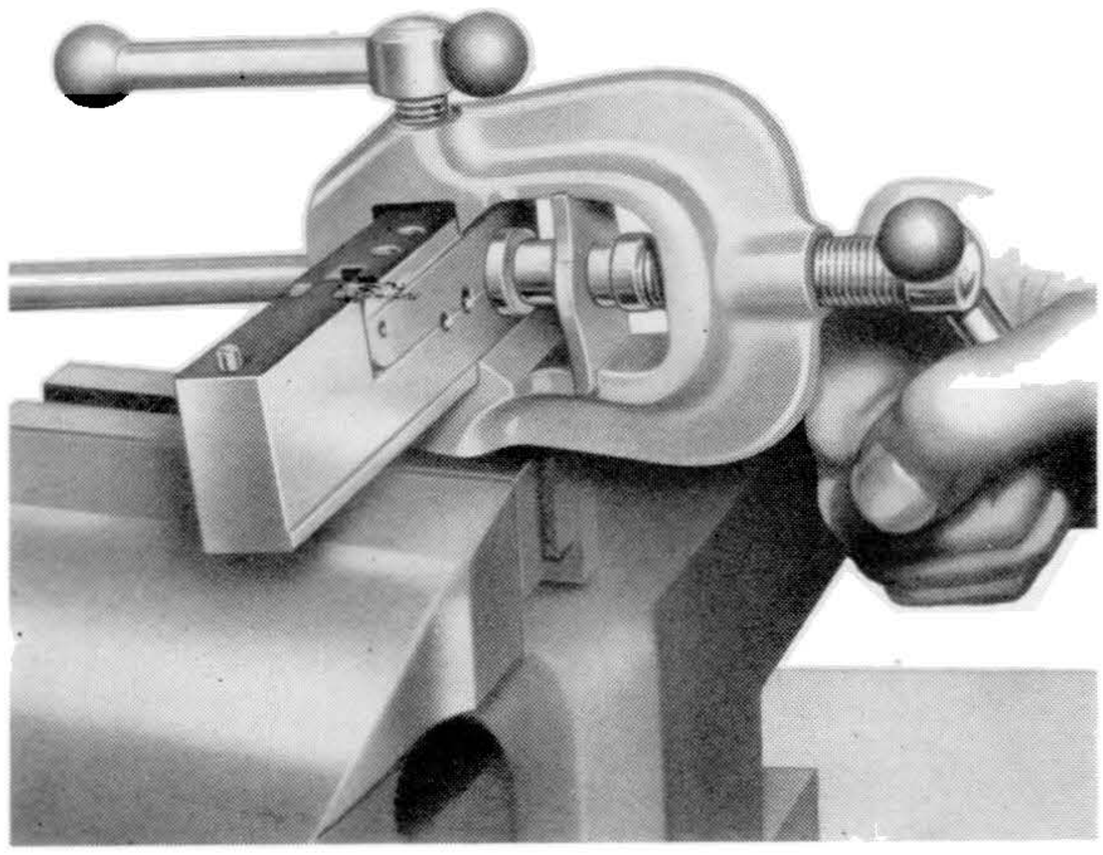
1. Cut off and straighten the required length of pipe. (A pipe cutting tool will simplify obtaining a clean and square cut.)
2. Square off the ends of pipe with a file and chamfer the end of the pipe to be flared.
3. Insert the pipe through its appropriate ribbed hole in the bar assembly until the end of the pipe protrudes approximately the thickness of the respective adaptor above the bar, or flush with the bar, depending on the tool used.
4. Fit the adaptor on to the pipe and slide the bar into the yoke. Lock the bar in position with the pipe beneath the yoke screw.
5. Form the single flare by screwing the yoke screw well home.
6. Release the screw and remove the adaptor.
7. Form the double flare by screwing down the yoke screw again, with second adaptor fitted, depending on the tool used.
8. Release the screw, bar and flared pipe. Inspect the flare for cracks or poor flare form and if any doubt exists about the flare, it should be cut off and the process repeated.

Bending the Pipe

Any suitable bundy tube bending tool should be used in the manner prescribed by the tool manufacturer. It is also possible to hand form bends around a suitable former, which can be



Split Die Type



Flaring-Bar Type

Pipe Flaring

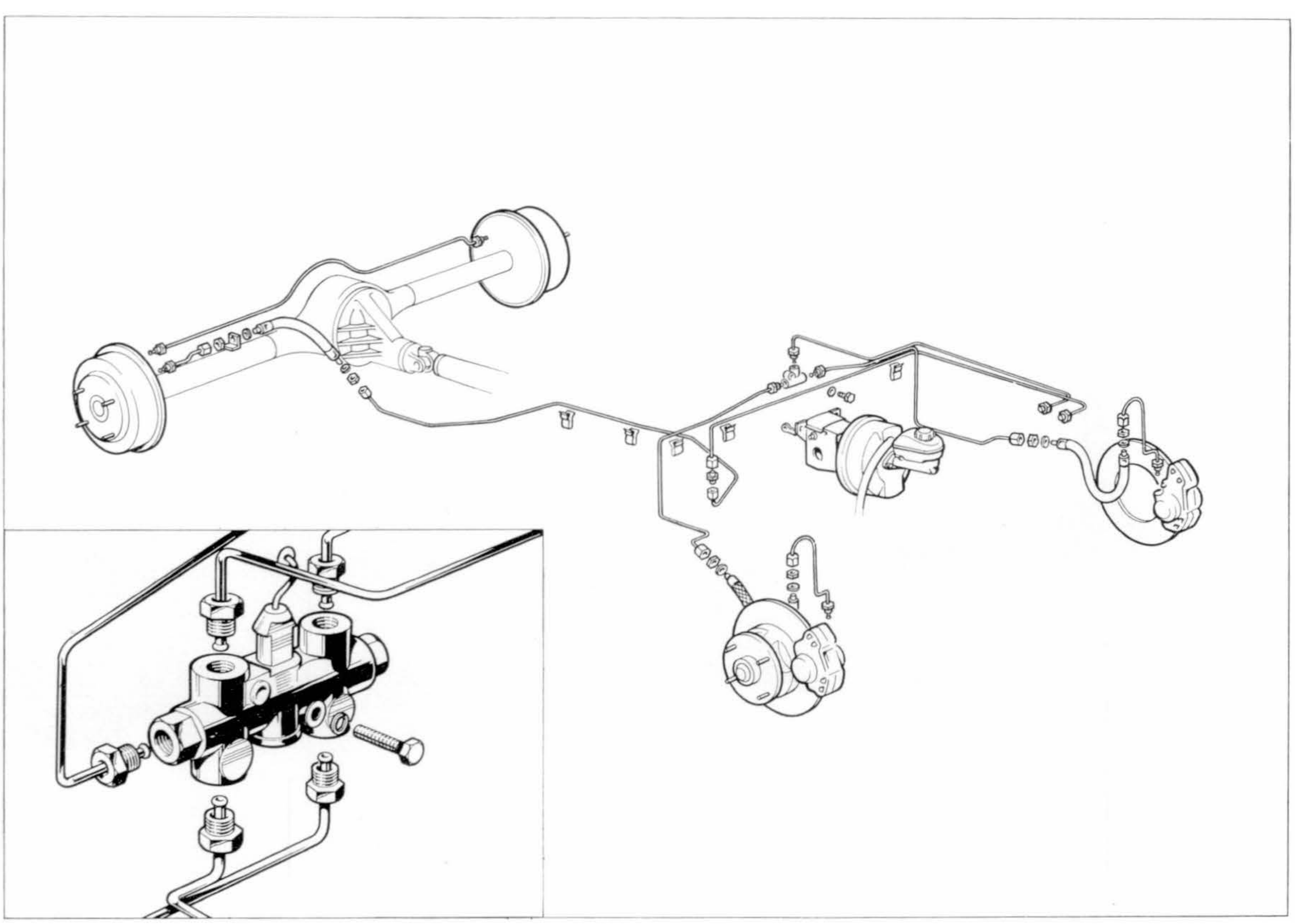
manufactured to suit the different size pipes. When forming a pipe by hand it is essential that the pipe is not kinked as it will then be weakened, and may fracture when fitted to the car.

When special formers are made for specific applications, always keep the surfaces smooth and the shapes free from edges which could damage the tube.

If it is necessary to form a sharp bend very close to the end of the pipe, the difficulty arises of bending the pipe after forming the flare or *vice versa*. This can be overcome by extending the length of tube with the use of a male and female connection, alternatively, screw several Brake Pipe Plugs, Tool No. P.2012 together and screw into the pipe connection. It is then possible to grip the extension and form the bend.

MINIMUM PERMISSIBLE BENDING RADII

UP TO 45°				46° TO 90°				91° TO 180°				181° TO 360°			
HAND BEND		DIE BEND		HAND BEND		DIE BEND		HAND BEND		DIE BEND		HAND BEND		DIE BEND	
in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
$\frac{3}{8}$	9.5	$\frac{3}{16}$	4.8	$\frac{3}{4}$	19.1	$\frac{3}{8}$	9.5	$\frac{7}{8}$	22.2	$\frac{7}{16}$	11.1	$\frac{7}{8}$	22.2	$\frac{7}{16}$	11.1



Brake Pipe Layout — Dual Line with Servo — L.H.D.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

Weekly

(*a*) Check brake fluid reservoir.

At first 3,000 miles (5,000 km.) or three months and every subsequent 6,000 miles (10,000 km.) or six months

(*b*) Check brake pads and shoes for wear, examine self-adjusting mechanism and blow the drums clean.

(*c*) Lubricate handbrake cable at dash panel grommet and adjust cable if necessary.

(*d*) Check brake hoses for signs of leaks or chafing.

At first 39,000 miles (65,000 km.) or three years, and every subsequent 36,000 miles (60,000 km.) or three years

(*e*) Renew all brake seals, hydraulic fluid, and flexible brake hoses. However, bear in mind any previous work recently carried out on the braking system.

It should be noted, when cleaning any hydraulic components which come into contact with brake fluid, that the only fluids that may be used are commercial alcohol, methylated spirit or approved brake fluid. Never use mineral oils for this purpose, i.e. oils or liquids such as petrol, paraffin, carbon tetrachloride, etc.

When dismantling any part of the hydraulic system it is always advisable to inspect the piston seals and piston bores for any imperfections. Should there be any damage the faulty components should be discarded. Prior to assembly, dip the hydraulic components in clean approved brake fluid.

DATA

Rearward Facing Calliper	
Disc diameter	... 9.625 in. (24.13 cm.)
Disc run-out (maximum) ...	0.002 in. (0.05 mm.) T.I.R.
Pad swept area (total) ...	171.9 sq. in. (1,109 sq. cm.)
Pad colour coding ...	Yellow, Red, Red, Yellow
Forward Facing Calliper	
Disc diameter	... 9.625 in. (24.45 cm.)
Disc run-out maximum ...	0.002 in. (0.05 mm.) T.I.R.
Pad swept area (total) ...	189.5 sq. in. (1,220 sq. cm.)
Pad colour coding ...	... Green, Red, Red, Red
8 in. (20.3 cm.) Rear Brake	
Drum diameter and width	8 × 1.5 in. (20.3 × 3.81 cm.)
Shoe swept area (total) ...	75.5 sq. in. (487 sq. cm.)
9 in. (22.9 cm.) Rear Brake	
Drum diameter and width	9 × 1.75 in. (22.9 × 4.45 cm.)
Shoe swept area total ...	99.0 sq. in. (639 sq. cm.)

SINGLE LINE BRAKES

All cars except G.T. and 1600E	
Front brakes	... Rearward facing
Rear brakes	... 8 in. (20.3 cm.)
Master cylinder diameter ...	0.625 in. (1.59 cm.)
Rear wheel cylinder diameter ...	0.70 in. (1.77 cm.)

G.T. and 1600E cars

Front brakes	Forward facing
Rear brakes	9 in. (22.9 cm.)
Master cylinder diameter	0.70 in. (1.77 cm.)
Rear wheel cylinder diameter	0.87 in. (2.22 cm.)

DUAL LINE BRAKES

1300 saloon (except l.h.d. automatic)

Front brakes ...	Rearward facing
Rear brakes	8 in. (20.3 cm.)
Master cylinder diameter	0.7 in. (1.77 cm.)
Rear wheel cylinder diameter	0.7 in. (1.77 cm.)

1300 saloon (l.h.d. automatic only)

Front brakes ...	Rearward facing
Rear brakes	8 in. (20.3 cm.)
Master cylinder diameter	0.75 in. (1.87 cm.)
Rear wheel cylinder diameter	0.7 in. (1.77 cm.)

1300 estate, 1600 saloon and estate (except l.h.d. automatic)

Front brakes	Rearward facing
Rear brakes	8 in. (20.3 cm.)
Master cylinder diameter—Except Estate cars	... 0.70 in. (1.77 cm.)
—Estate cars	... 0.813 in. (2.06 cm.)
Rear wheel cylinder diameter ...	... 0.70 in. (1.77 cm.)

1300 estate, 1600 saloon and estate (l.h.d. automatic only)

Front brakes ...	Rearward facing
Rear brakes	8 in. (20.3 cm.)
Master cylinder diameter—Except Estate cars	... 0.75 in. (1.87 cm.)
—Estate cars ...	0.813 in. (2.06 cm.)
Rear wheel cylinder diameter	... 0.87 in. (2.22 cm.)

G.T. and 1600E cars

Front brakes	... Forward facing
Rear brakes	... 9 in. (22.9 cm.)
Master cylinder diameter	0.813 in. (2.06 cm.)
Rear wheel cylinder diameter	... 0.87 in. (2.22 cm.)

Mechanical Servo

Boost ratio ...	2.2 : 1
Diaphragm area	38 sq. in.

Tightening Torques, lb. ft. (kg.m.)

Brake calliper to front suspension unit	45 to 50 (6.22 to 6.91)
Brake disc to hub	30 to 34 (4.15 to 4.70)
Rear brake plate to axle housing	15 to 18 (2.07 to 2.49)
Hydraulic unions	5 to 7 (0.7 to 1.0)
Bleed valves ...	5 to 7 (0.7 to 1.0)

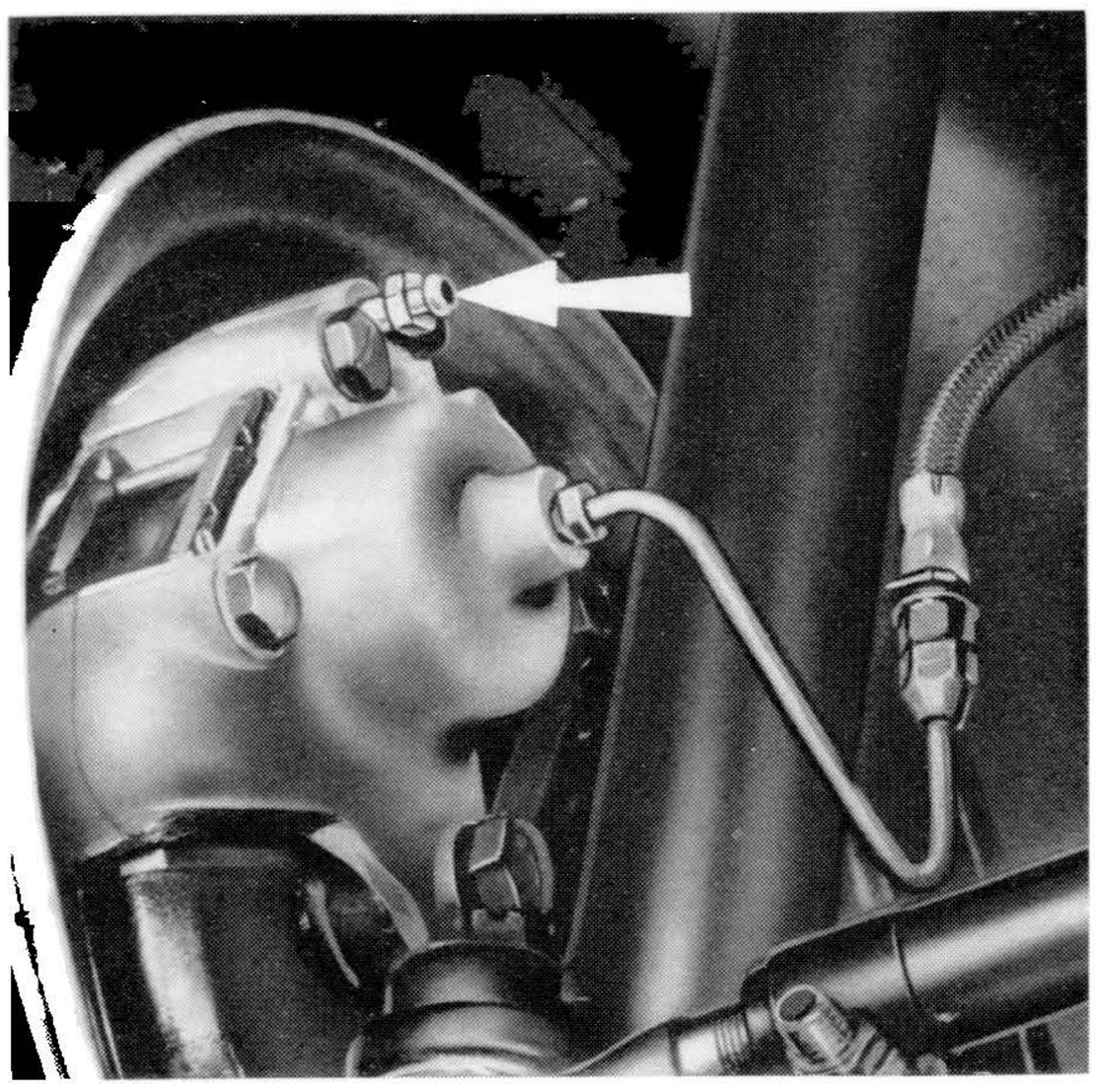
SERVICE AND REPAIR OPERATIONS

OP 2000-A BRAKING SYSTEM – BLEED (SINGLE LINE)

Tools Required

P.2006 Brake bleeding tubes

1. Remove the reservoir filler cap and top-up the reservoir.
2. Remove the rubber dust cap from the right-hand front bleed nipple and fit a bleed tube Tool No. P.2006.
3. Place the other end of the tube in a glass jar containing a small quantity of approved brake fluid. During the bleeding operation the end of the pipe must be kept immersed in the fluid.
4. Unscrew the bleed valve about half-a-turn, depress the brake pedal fully and then allow it to return to its "off" position. Brake fluid and/or air should have been pumped into the jar; if not, unscrew the bleed valve further.
5. Pause for an instant (about three seconds) to allow full recuperation of the master cylinder.
6. Continue depressing the brake pedal, pausing after each return stroke, until the fluid entering the jar is clean and free from air bubbles.
7. Press the pedal down to the floor and hold it there whilst the bleed valve is tightened. The correct tightening torque is 5 to 7 lb. ft. (0.7 to 1.0 kg.m.), **do not overtighten.**
8. During the bleeding operation keep the master cylinder topped-up with approved fluid. If the master cylinder is not kept up to the required level during bleeding operations, the entire system will have to be bled again.
9. Remove the tube and replace the rubber dust cap.
10. Bleed the left-hand front brake in the same way.
11. Bleed the left-hand rear brake in the same way.



Bleed Valve

12. Re-bleed the front right-hand brake to check that air has not been drawn in through the master cylinder.
13. Top-up the master cylinder and replace the filler cap after checking that the vent hole is clear.

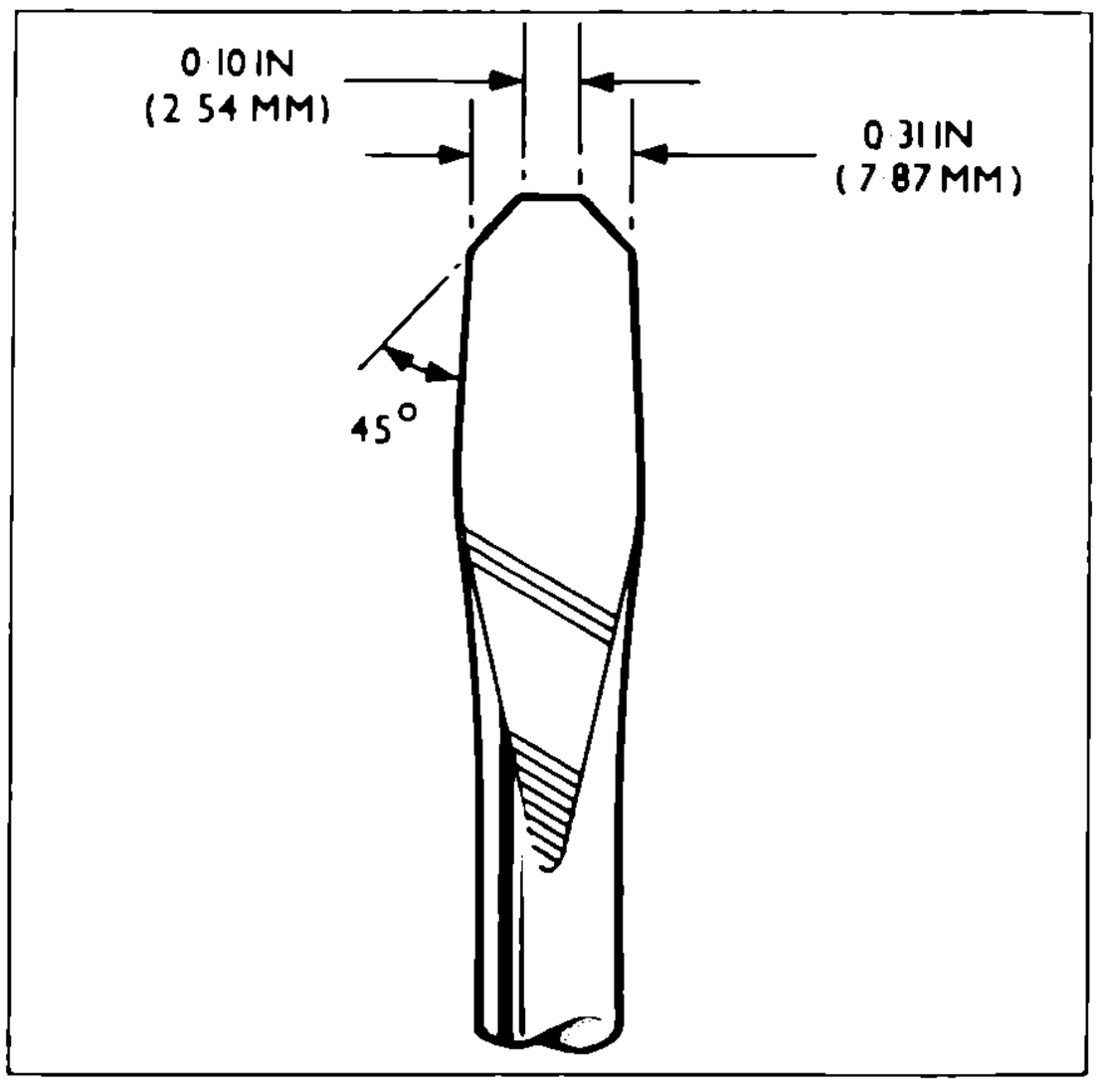
OP 2000-A BRAKING SYSTEM – BLEED (DUAL LINE)

Tools Required

P.2006 Brake bleeding tubes
Valve and Switch Assembly piston centralising tool (see text)

NOTE – The procedure for bleeding the brakes is similar to that used with standard brakes. The only difference is that the piston in the Valve and Switch Assembly (where fitted) has to be held in the central position. If this is not done, it will be very difficult to get the warning light to go out and stay out.

1. Centralise the piston in the valve and switch assembly (where fitted) using a screwdriver with the blade modified in line with dimensions given. The tool should be inserted through the aperture in the base of the assembly after the rubber has been removed.
2. Remove the reservoir cap and top-up the reservoir ensuring that both halves are filled.
3. Remove the rubber dust cap from the right-hand front bleed nipple and fit a bleed tube P.2006.
4. Place the other end of the tube in a glass jar containing a small quantity of approved brake fluid. During the bleeding operation the end of the pipe must be kept immersed in brake fluid.
5. Unscrew the bleed valve about half-a-turn, depress the brake pedal fully and then allow it to return to its "off" position. Brake fluid and/or air should have been pumped into the jar, if not, unscrew the bleed valve further.



Valve and Switch Assembly Piston Centralising Tool

6. Pause for a moment (about three seconds) to allow full recuperation of the master cylinder.
7. Continue depressing the brake pedal, pausing after each return stroke, until the fluid entering the jar is clean and free from air bubbles.
8. Press the pedal down to the floor and hold it there whilst the bleed valve is tightened. The correct tightening torque is 5 to 7 lb. ft. (0.7 to 1.0 kg.m.). DO NOT OVERTIGHTEN.
9. During the bleeding operation keep the master cylinder topped-up with approved fluid.
10. Remove the tube and replace the rubber dust cap.
11. Bleed the left-hand front brake in the same way.
12. Bleed the left-hand rear brake in the same way.
13. Top-up the master cylinder reservoir and replace the cap after checking that the vent hole is free.
14. Remove the tool from the valve and switch assembly (where fitted) and, with the ignition switched on, depress the brake pedal several times. The brake warning light should not illuminate.
15. With the ignition still switched on, operate the test switch, the warning light should illuminate.

OP 2000-D BRAKE SHOES AND PADS - ALL - RENEW

This is equivalent to OPS 2018-A and 2220-C.

OP 2000-E BRAKE HYDRAULIC FLUID - RENEW

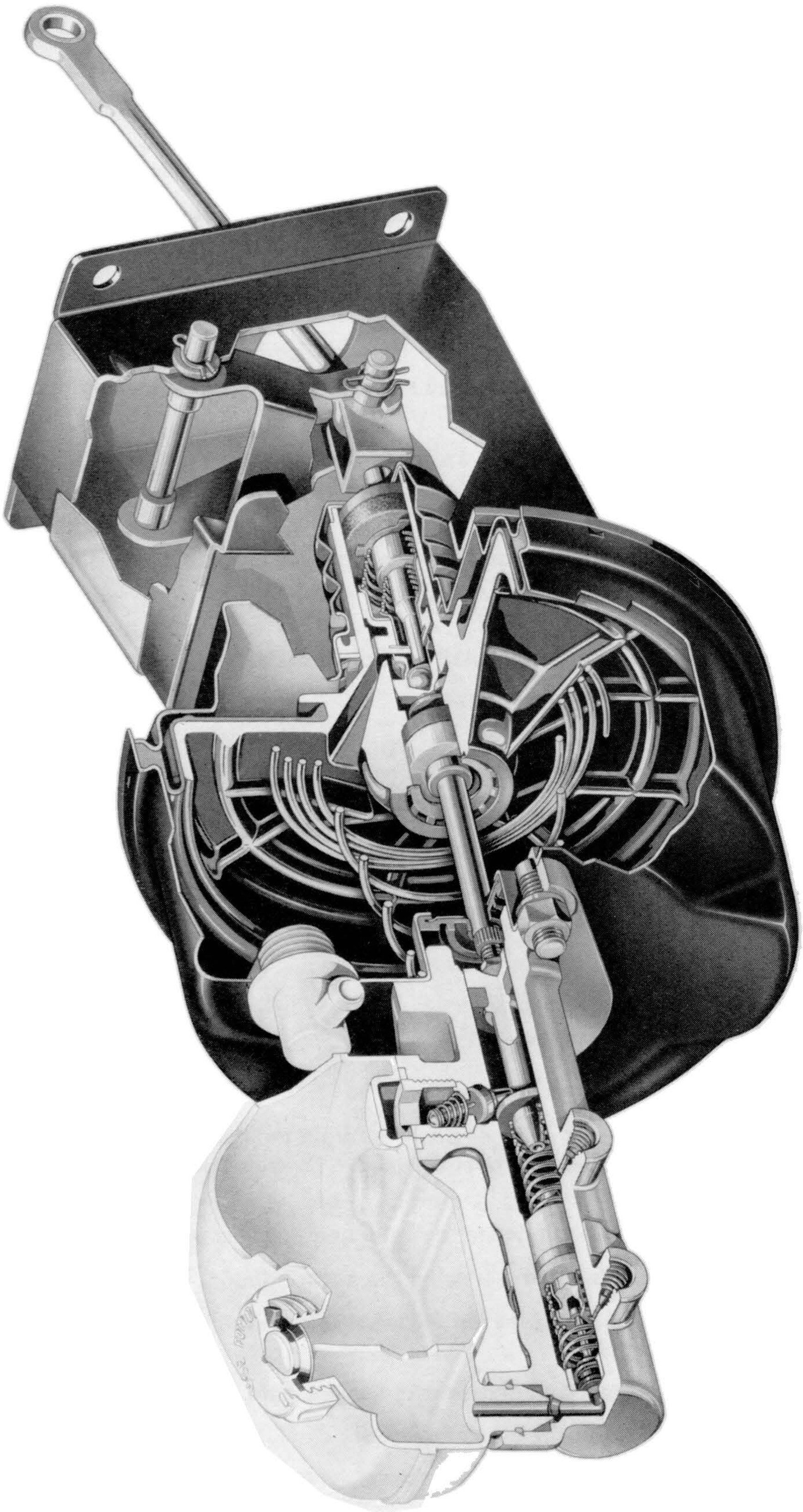
This is the same as Operation 2000-A, except that the system must be bled at each point until clean new fluid is expelled through each bleed valve.

OP 2000-F BRAKE HYDRAULIC SEALS AND FLEXIBLE HOSES - RENEW

Tools Required

P.2012	Brake line plugs (small)
P.2031	Brake line plugs (large)

1. Open the bonnet and fit wing covers.
2. Disconnect the brake master cylinder push rod from the pedal by removing the spring clip and withdrawing the clevis pin and bushes. (N.B. – On cars fitted with servo assisted brakes, this operation is not necessary.)
3. Detach the fluid pipes from the master cylinder and plug the pipes.
4. Remove the master cylinder by unscrewing the securing nuts.
5. Dismantle the master cylinder (see Op 2140-A1). Clean the cylinder and inspect the bore, reassemble using new seals.
6. Replace the master cylinder and secure with the two nuts and spring washers.
7. Reconnect the fluid pipes to the master cylinder.
8. Fit the push rod to the brake pedal and secure.



The Servo Unit — L.H.D.

9. Jack up the car front and rear and fit chassis stands. Remove the road wheels.
10. Remove the two callipers and the two rear drums.
11. Remove the brake shoes and retracting springs. Detach the wheel cylinders and dismantle. Discard the seals, inspect all other components. Reassemble using new seals. Dismantle the callipers and overhaul, see OP 2010-A2, fitting new piston seals.
12. Replace the wheel cylinders on the brake back plates. Refit the brake shoes and retracting springs.
13. Replace the callipers and rear brake drums.
14. Detach, in turn, the two front flexible hoses and the rear flexible hose. Discard the hoses.
15. Fit new hoses at each of the three locations.
16. On dual line braking systems, remove the pressure differential valve assembly, where fitted, and overhaul (refer to OP 2493-A1) fitting new hydraulic seals.
17. Bleed the braking system until clean, new fluid is expelled through each bleed valve, see OP 2000-A.
18. Replace the road wheels.
19. Jack up, remove the chassis stands and lower the car to the ground.
20. Remove the wing covers and close the bonnet.

OP 2004-A BRAKE SERVO UNIT – REMOVE AND INSTALL

Tools Required

P.2012	Brake line plugs (small)
P.2031	Brake line plugs (large)

To Remove

1. Open the bonnet and fit wing covers.
2. Disconnect the vacuum supply pipe from the servo unit.
3. Detach the brake fluid pipes from the master cylinder, plug the master cylinder ports and the pipe ends.
4. Remove the two nuts and spring washers securing the master cylinder to the front of the servo unit. Remove the master cylinder.
5. Disconnect the push rod from the pedal by removing the spring clip, clevis pin and clevis pin bushes.
6. From within the front wheel arch remove the two nuts and one bolt securing the servo unit mounting bracket to the side apron panel. (R.H.D. only.)
7. Unscrew the nuts securing the rear end of the servo mounting bracket to the engine compartment rear bulkhead. Remove the servo complete with its mounting bracket.
8. Remove the spring clip, clevis pin and bush securing the servo push rod and the pedal push rod to the relay lever pivoted inside the servo mounting bracket.
9. Unscrew the four nuts and spring washers securing the servo to the mounting bracket. Detach the servo.

To Install

10. Locate the servo unit on the mounting bracket and fit the four spring washers and nuts.
11. Assemble the servo push rod to the relay lever and the pedal push rod. When correctly assembled the push rod clevis that is attached to the pedal must be fitted so that the yellow paint daub will be towards the centre-line of the car when the unit is installed. Measure the distance between the rear face of the bracket and the centre-line of the holes in the clevis yoke. Adjust the push rod length if necessary so that this dimension is 5.94 to 5.97 in. (15.10 to 15.16 cm.) on R.H.D. cars or 5.88 to 5.91 in. (14.9 to 15.0 cm.) on L.H.D. cars. It is **most important** that this dimension is correctly set and that the yellow paint daub on the clevis yoke is towards the centre-line of the car. Tighten the locknut.
12. Place the servo unit and bracket assembly in position in the car and fit the two bolts to secure it to the side apron panel (R.H.D. only).
13. Fit the spring washers and nuts securing the rear end of the bracket to the engine compartment rear bulkhead.
14. Attach the push rod to the brake pedal using the clevis pin, clevis pin bushes and the spring clip.
15. Replace the master cylinder on its mounting studs on the front face of the servo and fit the retaining washers and nuts.
16. Connect the brake fluid pipes to the master cylinder.
17. Refit the vacuum supply pipe to the servo unit.
18. Bleed the braking system as detailed in OP 2000-A.
19. Remove the wing covers and close the bonnet.

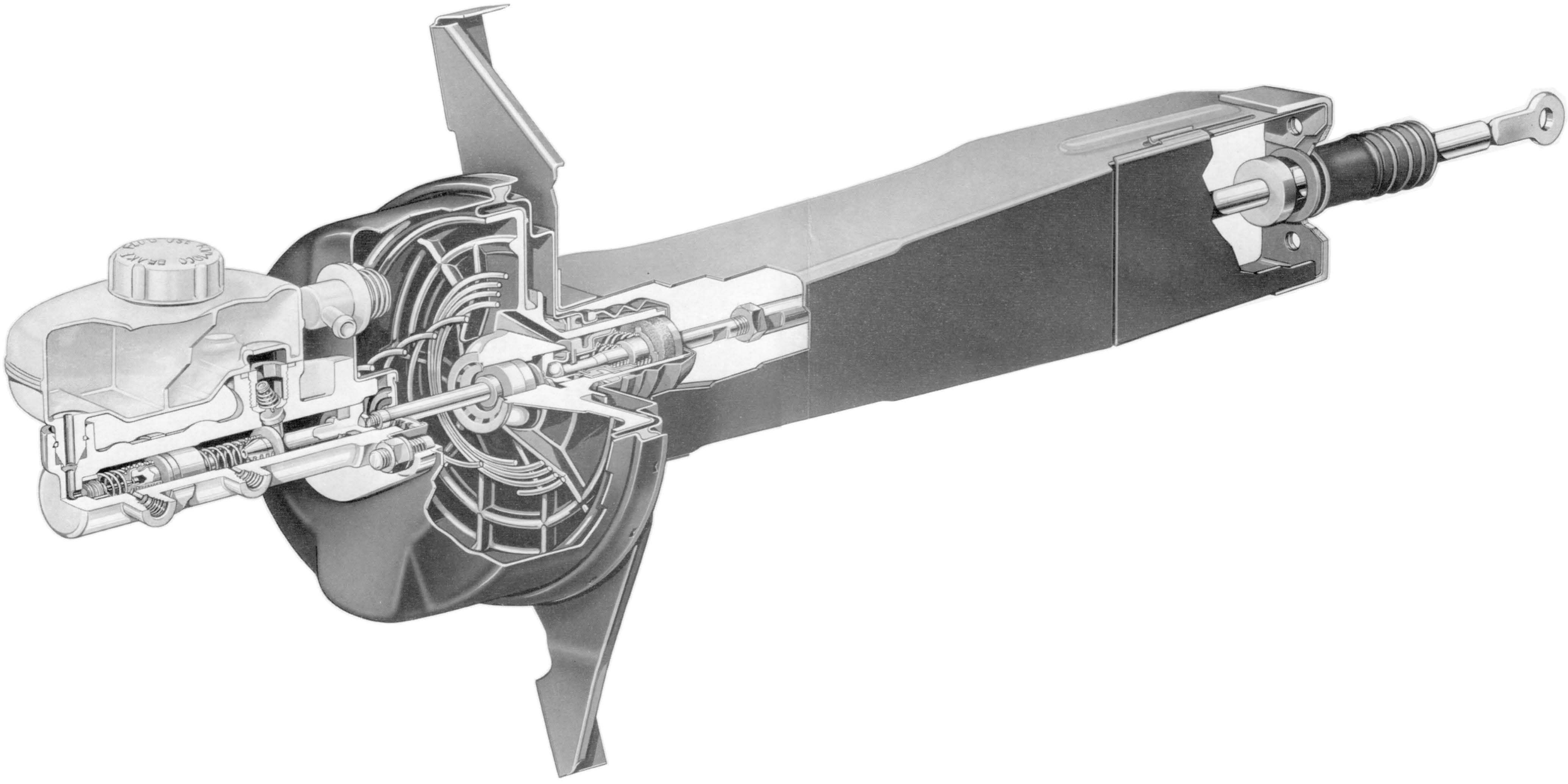
OP 2004-A2 EXTRA: BRAKE SERVO UNIT – OVERHAUL

To dismantle the servo unit it is necessary to separate the two halves of the shell. This must be done with the diaphragm spring extended and this necessitates creating a vacuum behind the diaphragm.

Two pieces of angle iron about 3 ft. (1 metre) long and one piece about 1 ft. (33 cm.) long should be made up and drilled with clearance holes to fit over the mounting studs on the front and rear shells.

To Dismantle

1. Mark both shells so that they can be refitted in the original positions.
2. Fit the angle iron to the studs and tighten them securely with suitable nuts. If they are not secured it is possible that the studs will be pulled out of the shell when attempting to separate them.
3. Clamp one piece of angle iron in a vice directly under the servo unit with the non-return valve downwards.
4. Connect a suitable length of vacuum hose to the servo unit non-return valve and the engine manifold.
5. Start the engine to release the spring pressure on the diaphragm.

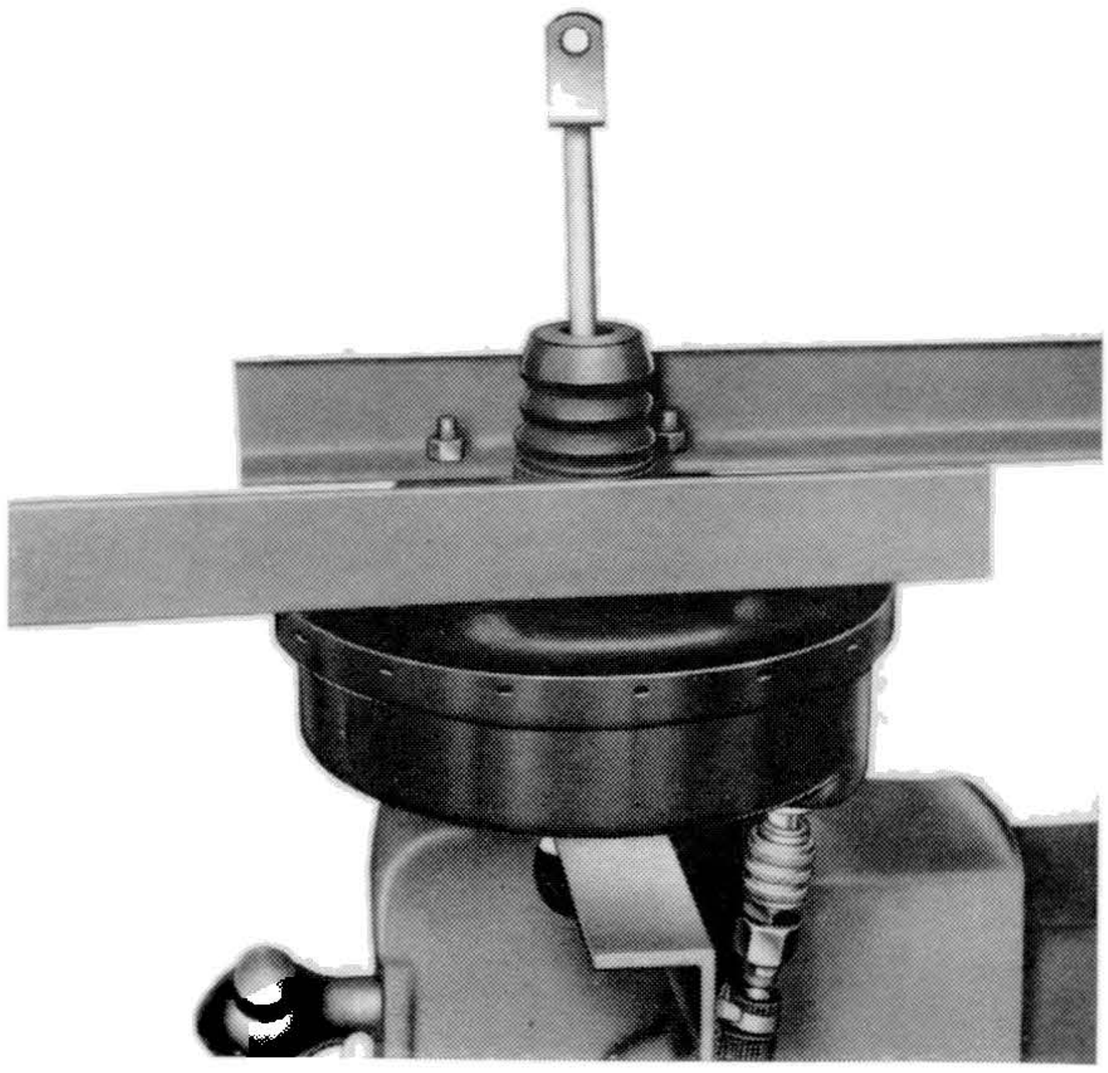


The Servo Unit — R.H.D.

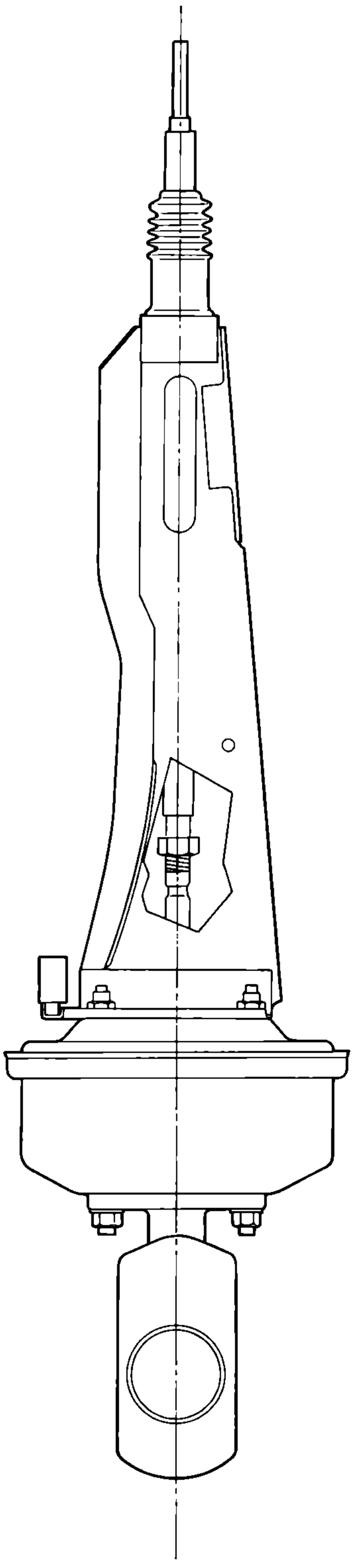
6. Using the angle iron, turn the top shell in an anti-clockwise direction until an indentation in the top shell aligns with a cut-away in the lower. It will be necessary for two or three mechanics to carry out this operation, one of them steadying the lower piece of angle iron. If the shells do not separate immediately, they should be tapped with a soft hammer. During the whole of this operation take great care to prevent the two shells flying apart under the action of the diaphragm spring. It is essential that the vacuum connection to the engine is maintained throughout.
7. Withdraw the diaphragm and the diaphragm plate assembly, which at this stage includes the control rod and valve assembly.
8. Separate the control rod and valve assembly from the diaphragm plate. Detach the diaphragm from the diaphragm plate by carefully pulling the centre of the diaphragm from the groove in the diaphragm plate. Withdraw the stop key, then the control rod and valve assembly can be withdrawn from the diaphragm plate.

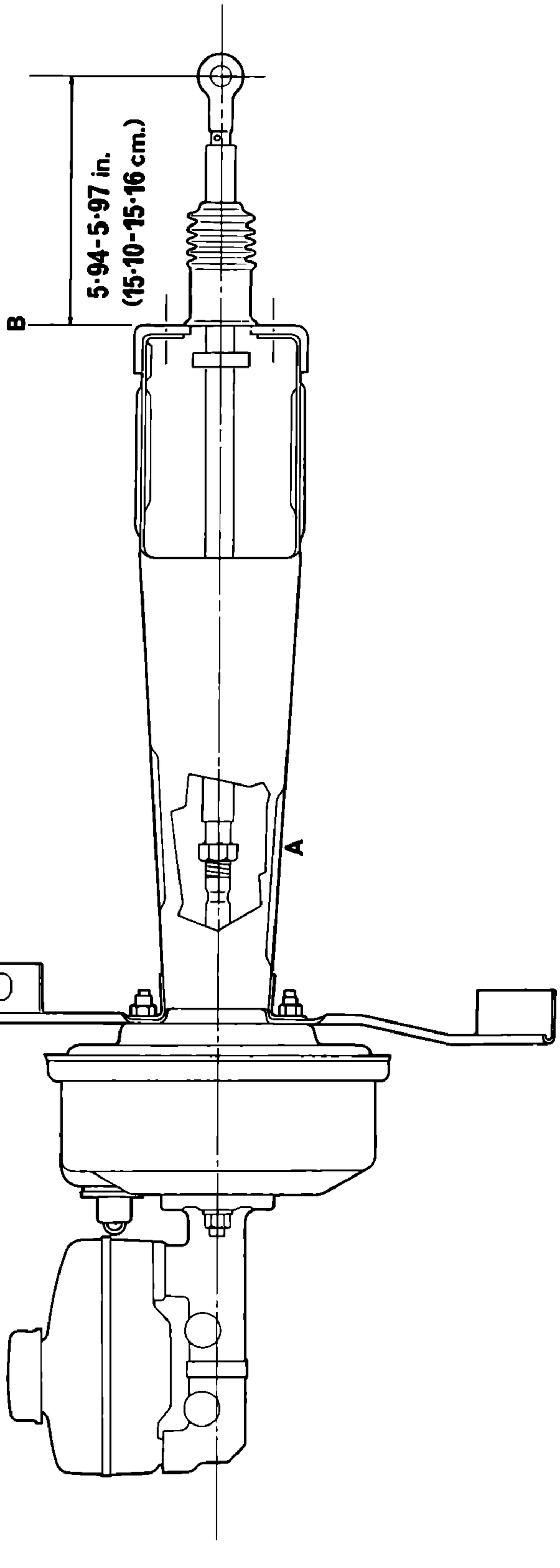
   NOTE – The control rod and valve assembly which includes the control rod, control valve, and the control piston is serviced as a complete assembly.
9. Remove and discard the air filter which is located in the extension flange on the rear of the diaphragm plate.
10. Withdraw the front shell seal and the push rod.
11. Remove the reaction disc from the diaphragm plate.
12. Withdraw the servo valve body seal retainer from the rear shell using a suitable tool, such as a screwdriver. Pull out the seal.
13. Remove the non-return valve from the servo unit front shell. Using a suitable spanner, turn the valve in an anti-clockwise direction. Lift away the valve and detach the rubber "O" ring seal.

Before reassembly thoroughly clean and examine all the parts of the servo unit, paying particular attention to the control rod and valve assembly. All rubber parts, including the diaphragm (but not including the control valve) should be renewed from the service kit regardless of their apparent condition.



Separating the Front and Rear Shells





Servo Installation R.H.D. — Pedal push rod to be adjusted at location A to give dimension shown at B. Yellow paint mark on clevis to be towards car centre line

To Reassemble

14. Refit the non-return valve into the front shell. Carefully examine the non-return valve to ensure that the "securing lugs" are not damaged in any way. Position the "O" type sealing ring, which should not be greased in any way, onto the non-return valve and locate this assembly onto the front shell. Using a suitable spanner, turn the valve in an anti-clockwise direction until the securing lugs contact their stops.

15. Fit a new servo valve body seal into the rear shell and fit the retainer. A suitable socket will assist in correctly locating the retainer.

16. Position a new air filter in the recess in the flange on the rear of the diaphragm plate.

17. Insert the control rod and valve assembly into the hub of the diaphragm plate. Apply a suitable lubricant such as Part No. EM-1C-14 to the bearing surfaces of the control rod and valve assembly. Insert this assembly into the diaphragm plate and secure in position with the stop key.

18. Fit the diaphragm to the diaphragm plate, ensuring that it is correctly located in the groove of the diaphragm plate, applying to the diaphragm outer beads, which contact the front and rear shells, a suitable grease such as Part No. EM-1C-15 to assist in reassembly and any subsequent dismantling.

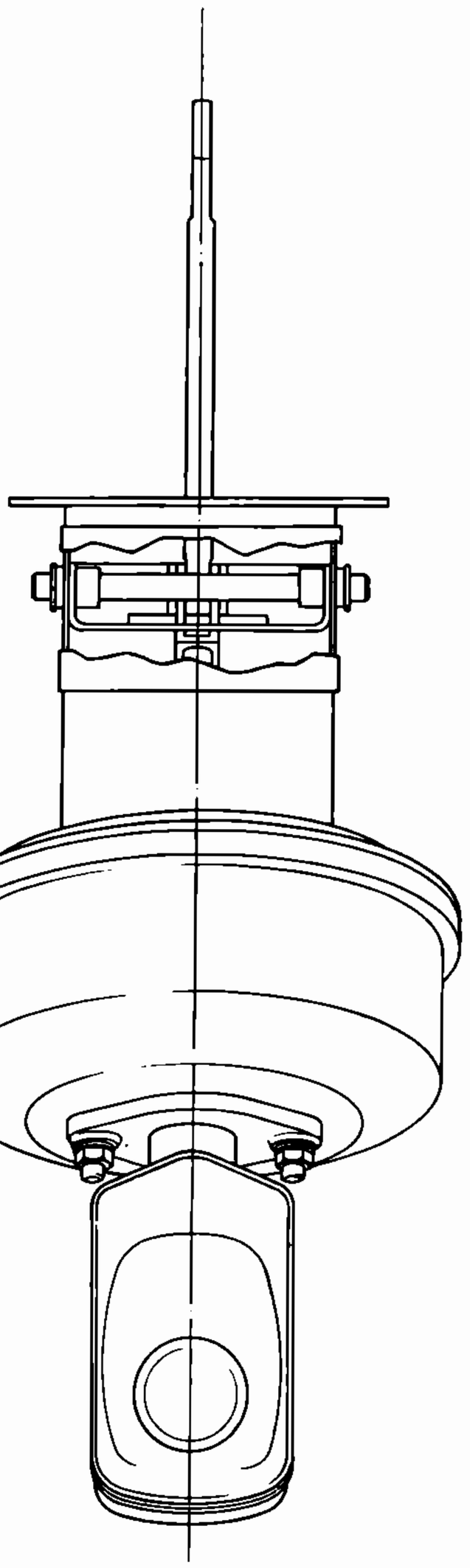
    NOTE – This grease must not be allowed to contact the master cylinder seals, otherwise damage will result.

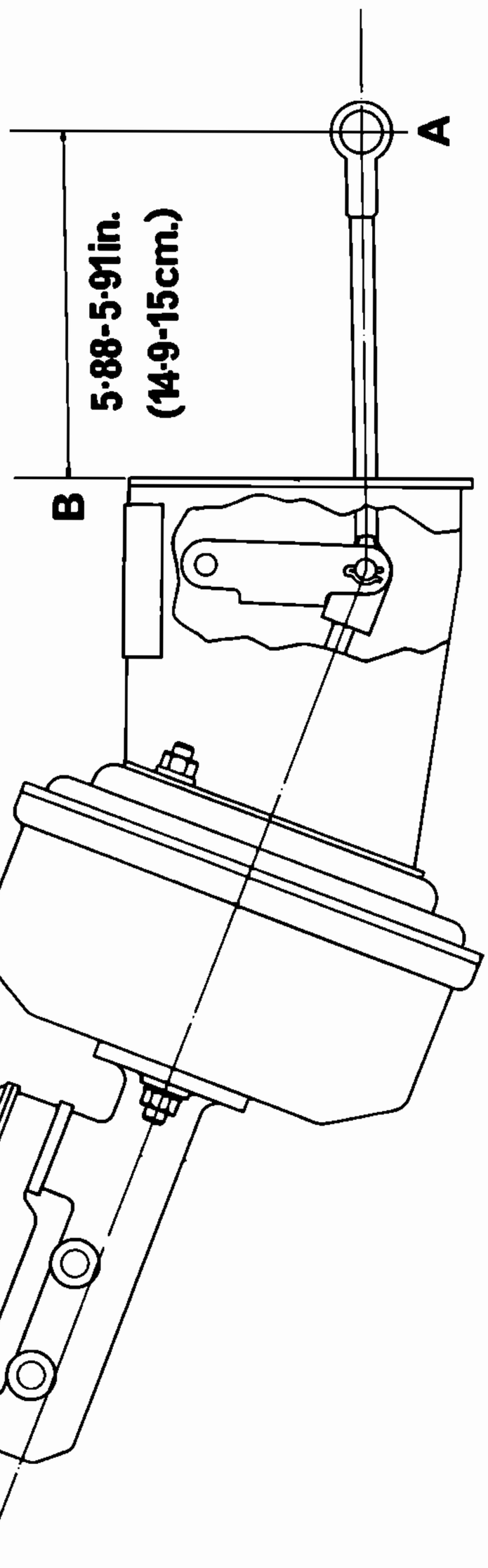
    (*a*) Ensure that the alignment marks made prior to dismantling are in line, also that the diaphragm is evenly located between the front and rear shells.

    (*b*) Connect a suitable length of vacuum hose to the servo unit non-return valve and the engine manifold.

    (*c*) Fit the lengths of angle iron used for dismantling the servo unit in their respective positions and apply pressure so that the front and rear shells rigidly hold the diaphragm in position.

Control Rod and Valve Assembly





Servo Installation L.H.D. — Pedal push rod to be adjusted at location A to give dimension shown at B. Yellow paint mark on clevis to be towards car centre line

(*d*) Start the engine so that a vacuum will be created between the front shell and the diaphragm plate and apply further pressure on the lengths of angle iron to completely engage the front shell with the rear shell. Using the angle iron, turn the rear shell in a clockwise direction until the alignment marks made prior to dismantling are in line.

19. Before setting the push rod, vacuum must be introduced into the unit. Connect a suitable length of hose from the inlet manifold to the non-return valve, start the engine and allow it to run for a few minutes. Check the distance that the push rod is below the front shell. To do this, place a straight edge across the front shell above the push rod and measure the gap using feeler gauges. This must be 0.011 to 0.016 in. (0.28 to 0.40 mm.).
After setting, apply two drops of a suitable sealer (such as Loctite B) to the threads of the domed adjusting bolt to lock it in position.

OP 2004-C BRAKE SERVO UNIT – OVERHAUL
(Includes OPS 2004-A and A2)

OP 2010-A FRONT BRAKE CALLIPER – ONE SIDE – REMOVE AND INSTALL

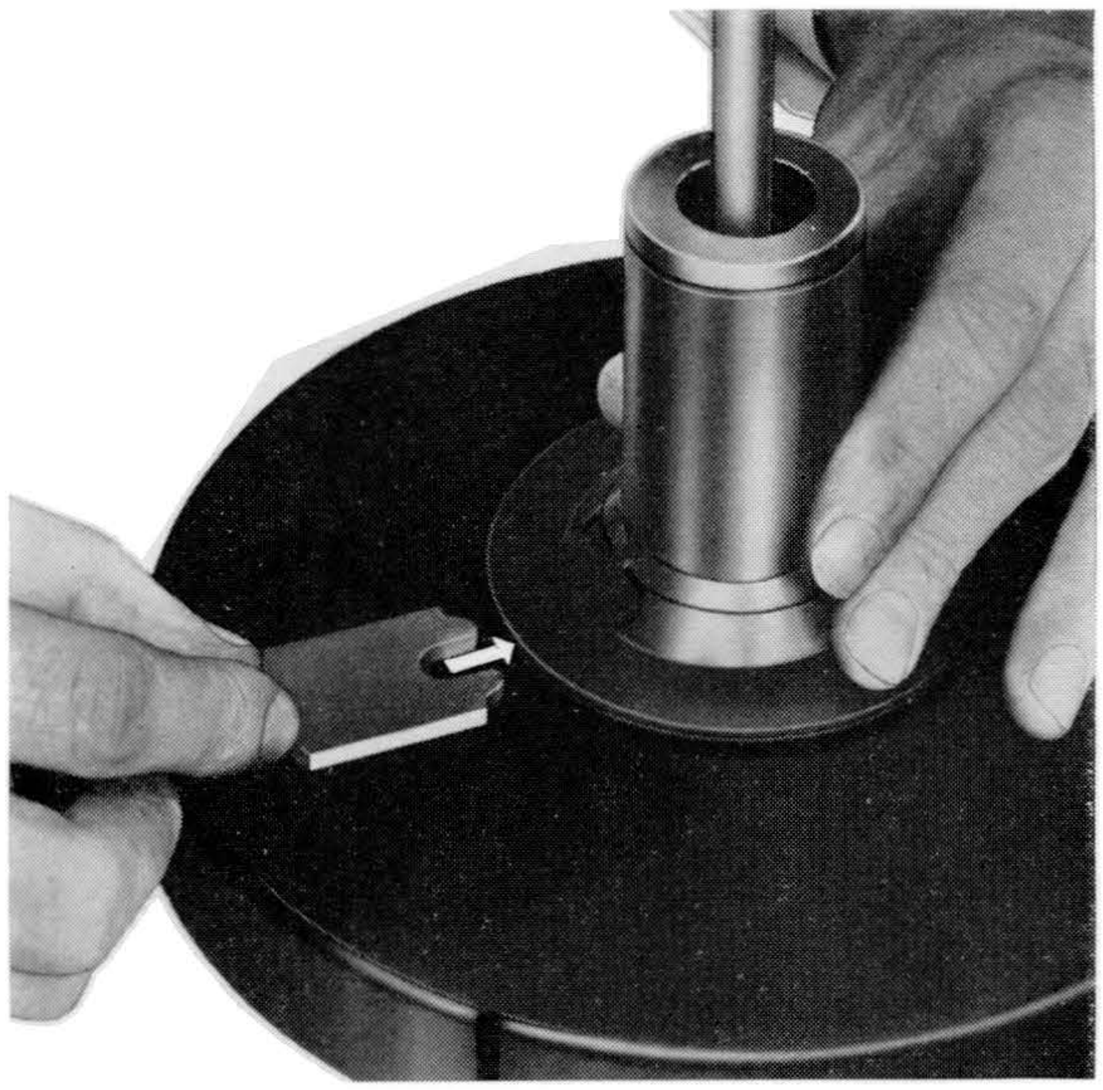
Tools Required

P.2012 Brake line plugs

To Remove

1. Remove the hub cap and slacken the wheel nuts.
2. With the handbrake applied, jack up the front of the car and fit stands.
3. Remove the road wheel.
4. Remove the brake pads after withdrawing the retaining pins and clips. If it is intended to overhaul the calliper unit, depress the brake pedal to bring the pistons into contact with the disc and thus facilitate removal of the pistons.

Fitting the Stop Key



5. Detach the hydraulic pipe from the union on the rear of the calliper and fit a brake line plug, Tool No. P.2012, to each opened end.
6. Bend up the lock tabs and remove the two calliper retaining bolts and detach the calliper assembly.

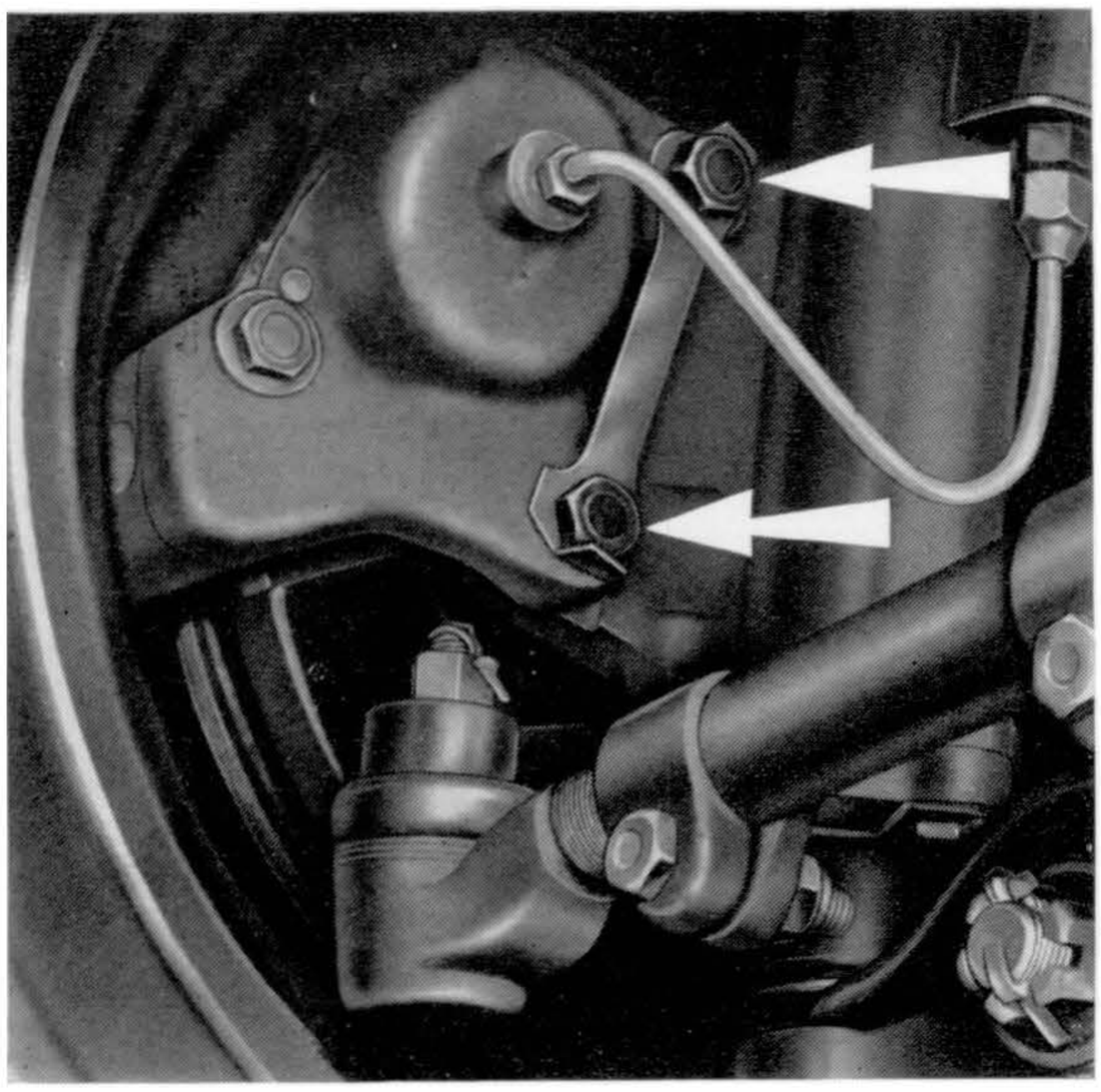
To Replace

7. Replace the calliper assembly, using a new locking plate and tighten the bolts to a torque of 45 to 50 lb. ft. (6.22 to 6.91 kg.m.). Bend up the lock tabs.
8. Recouple the hydraulic pipe to the union on the rear of the calliper.
9. Push the pistons sufficiently into their bores to accommodate the pads and fit the pads and shims. Ensure that piston seals are properly fitted to pistons.
10. Secure the pads in position with the retaining pins and clips. Ensure that clips are on side of retaining pin, away from piston seal, to prevent damage to seal.
11. Replace the road wheel.
12. Remove the stands and lower the car to the ground.
13. Tighten the wheel nuts and replace the hub caps.
14. Bleed the brakes, see OP 2000-A.

OP 2010-A1 EXTRA: REMAINING FRONT CALLIPER - REMOVE AND INSTALL
Repeat sub-operations 3 to 11, OP 2010-A.

OP 2010-A2 EXTRA: CALLIPER PISTONS AND/OR SEALS - RENEW

NOTE – The calliper is made in two paired halves, which are bolted together. Under no circumstances should the two halves be separated.



Calliper Mounting Bolts

(a) *All cars except G.T. and 1600E models*

To Dismantle

1. Remove the circlip securing the dust cover to the calliper and pull off the dust cover.
2. Remove the piston. Piston removal can be facilitated by using air or low hydraulic pressure.
3. Withdraw the piston sealing ring from the cylinder bore.
4. Repeat these operations for the other cylinder.
5. Wash the pistons and piston bores in commercial alcohol, methylated spirit or approved brake fluid. Do **not** use a mineral base fluid such as petrol, paraffin, carbon tetrachloride, etc.
6. Ensure that the pistons and their bores are free from score marks and are fit for further service.

To Reassemble

7. Rebuild the wheel cylinders. Assemble a piston seal to the annular groove provided in the cylinder.
8. Lubricate piston with clean hydraulic fluid. Place the piston, crown first, into the cylinder and push the piston into the cylinder as far as possible.
9. Fit the dust cover over the piston, ensuring correct fit to piston and secure it to the calliper with the circlip.
10. Repeat the operations for the other cylinder.

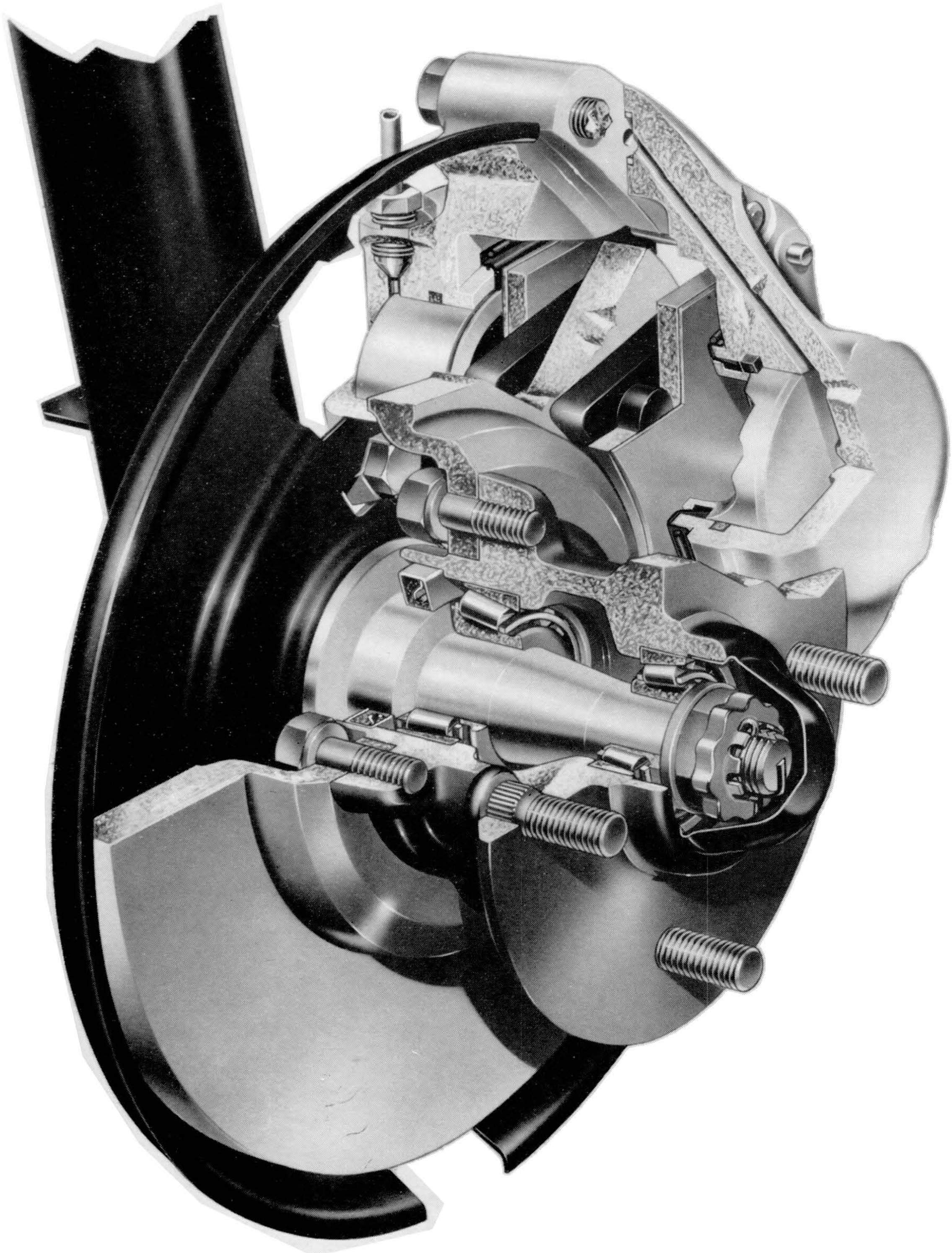
(b) *G.T. and 1600E models only*

To Dismantle

1. Partially remove the piston from one cylinder bore and remove the sealing bellows from its location in the lower part of the piston skirt. Piston removal can be facilitated by using air pressure or low hydraulic pressure. Withdraw the piston.
2. Pull the sealing bellows from its location in the annular ring machined in the cylinder bore.
3. Withdraw the piston sealing ring from the cylinder bore.
4. Repeat these operations for the other cylinder.
5. Wash the pistons and piston bores in commercial alcohol, methylated spirit or approved brake fluid. Do **not** use a mineral base fluid such as petrol, paraffin, carbon tetrachloride, etc.
6. Ensure that the pistons and their bores are free from score marks and are fit for further service.

To Reassemble

7. Rebuild the wheel cylinders. Assemble a piston seal to the annular groove provided in the cylinder.
8. Refit the rubber bellows to the cylinder with the lip that is turned outwards fitting in the groove provided in the cylinder.



Front Brake — Forward Facing Calliper

9. Lubricate piston with clean hydraulic fluid. Place the piston, crown first, through the rubber sealing bellows and into the cylinder. Care should be exercised when carrying out this operation as the piston may tend to damage the rubber bellows.
10. When the piston is located in the cylinder fit the inner edge of the bellows in the annular groove provided in the piston skirt.
11. Push the piston as far down the cylinder bore as possible.
12. Repeat the operations for the other cylinder.

OP 2010-A3 EXTRA: SPLASH SHIELD – REMOVE AND INSTALL

To Remove

1. Lever the dust cap from its aperture in the end of the hub.
2. Remove the split pin and adjusting nut retainer, then unscrew the adjusting nut and remove the thrust washer and the outer bearing cone.
3. Detach the hub and disc assembly from the wheel spindle.
4. Remove the splash shield after bending back the integral lock tabs and removing the securing screws.

To Install

5. Bolt the splash shield to the base of the front suspension unit and bend up the locking tabs.
6. Replace the hub and disc assembly on the wheel spindle and fit the outer bearing cone, the thrust washer and the adjusting nut.
7. Tighten the nut to a torque of 27 lb. ft. (3.73 kg.m.) whilst rotating the disc to ensure proper seating of the bearings.
8. Slacken back the nut 90° and fit the nut retainer so that one of the retainer castellations lines up with the split pin hole in the wheel spindle. Fit a new split pin.
9. Tap the dust cap back into place in the end of the hub.

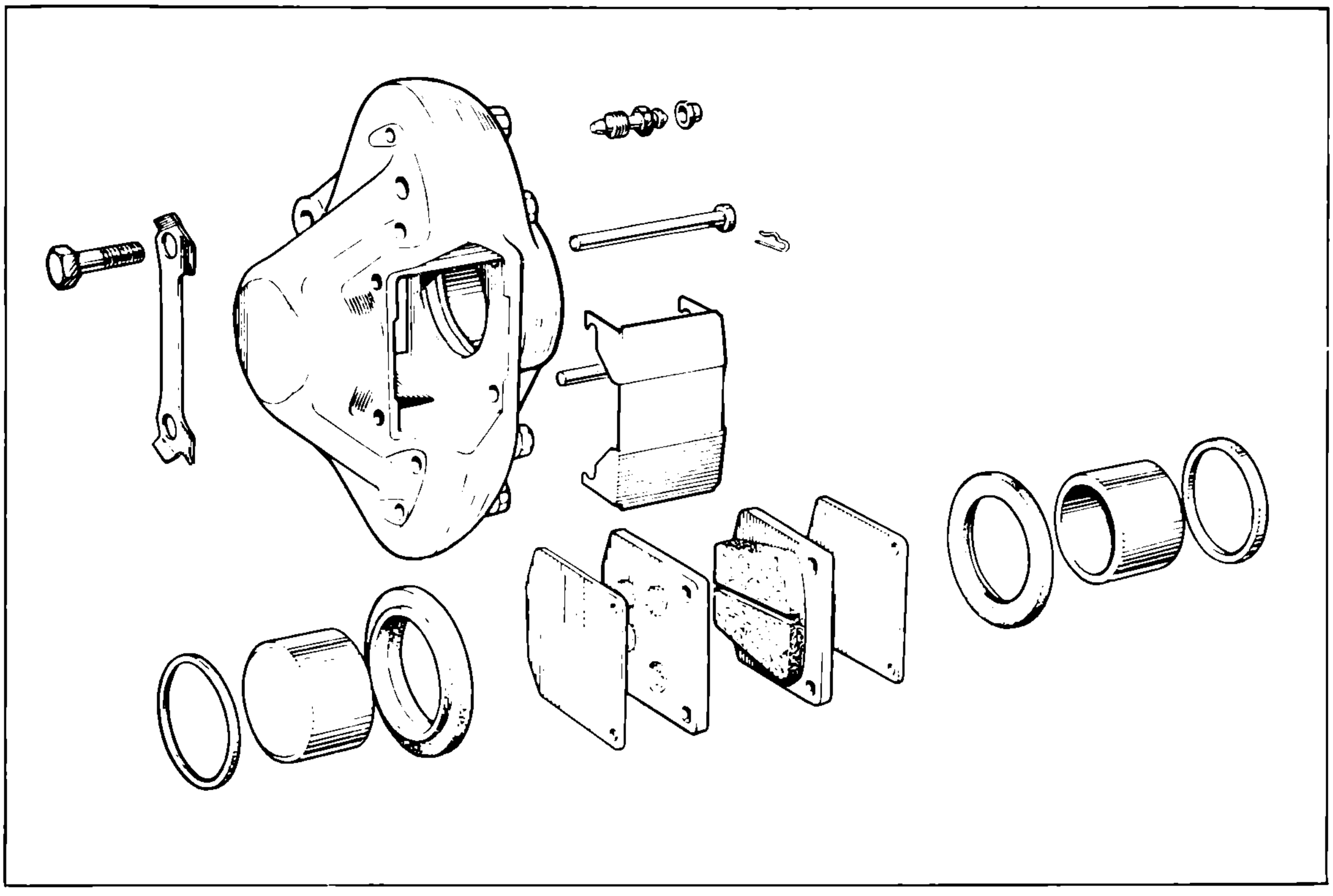
OP 2010-A4 EXTRA: BRAKE DISC – REMOVE AND INSTALL

Tools Required

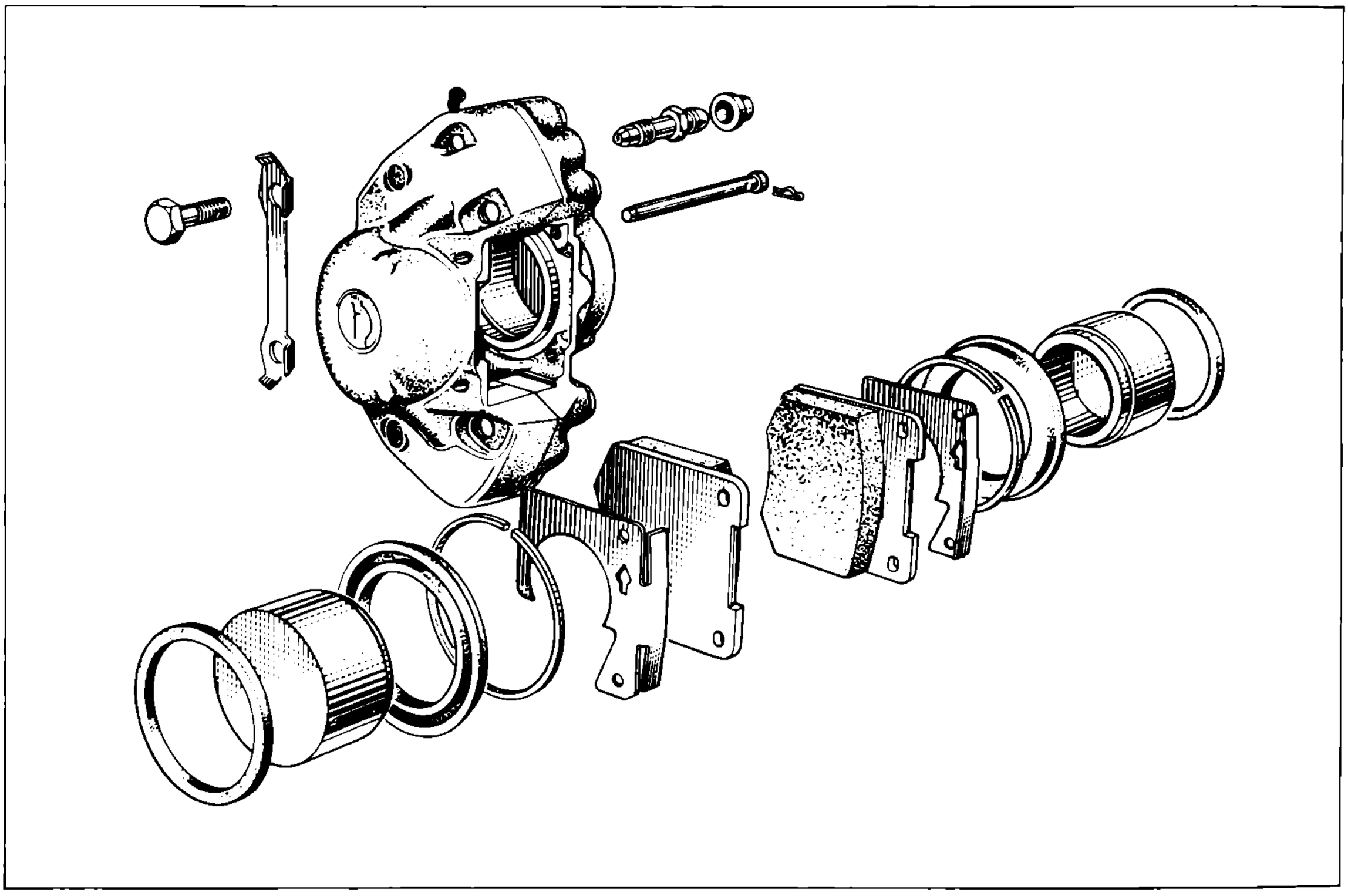
P.4008 Dial gauge

To Remove

1. Lever the dust cap from its aperture in the end of the hub.
2. Remove the split pin and adjusting nut retainer, then unscrew the adjusting nut and remove the thrust washer and the outer bearing cone.
3. Detach the hub and disc assembly from the wheel spindle.
4. Separate the brake disc from the hub after bending back the bolt lock tabs and unscrewing the bolts. Discard the locking plates and the bolts.



Forward Facing Calliper Assembly — Exploded



Rearward Facing Calliper Assembly — Exploded

To Replace

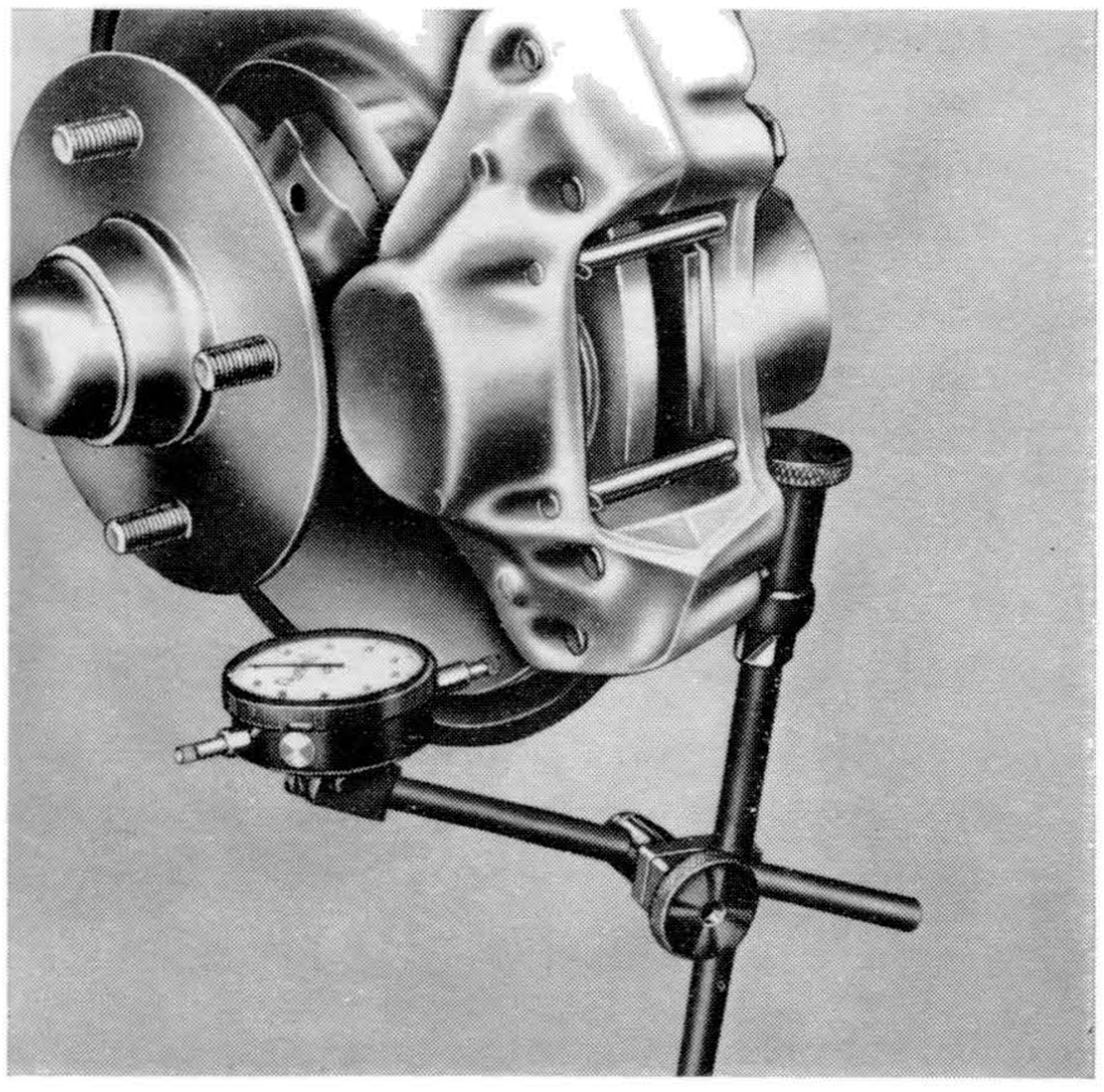
5. Thoroughly clean the mating faces of the hub and disc – this is most important.
6. Align the mating marks, place the disc on the hub and fit two new locking plates and four new bolts.
7. Tighten the bolts to a torque of 30 to 34 lb. ft. (4.15 to 4.70 kg.m.) and bend up the locking tabs to secure.
8. Replace the hub and disc assembly on the wheel spindle and fit the outer bearing cone, the thrust washer and the adjusting nut.
9. Tighten the nut to a torque of 27 lb. ft. (3.73 kg.m.) whilst rotating the disc to ensure proper seating of the bearings.
10. Slacken back the nut 90° and fit the nut retainer so that one of the retainer castellations lines up with the split pin hole in the wheel spindle. Fit a new split pin.
11. Check the disc run-out (relative to the axis of the spindle body) as follows:—

    (*a*) Disconnect the track rod from the steering arm at its outer end, after removing the split pin and castellated nut and separating the ball joint.

    (*b*) Using a dial gauge (Tool No. P.4008) attached to the steering arm, check the run-out of the disc.

    This figure must be within 0.004 in. (0.102 mm.), total indicator reading. Should a reading in excess of this be recorded, the cause of this excessive run-out, i.e. a worn or distorted disc, dirt between the disc and hub faces, or mal-alignment of the hub bearings, etc., must be eliminated.

    (*c*) Remove the backlash gauge and refit the track rod end, tightening the castellated nut to 18 to 22 lb. ft. (2.48 to 3.04 kg.m.) securing with a new split pin.
12. Tap the dust cap back into place in the end of the hub.



Checking Brake Disc Run-out

OP 2010–B FRONT BRAKE CALLIPERS – BOTH – REMOVE AND INSTALL
(Includes OPS 2010-A and A1)

OP 2010-C FRONT BRAKE CALLIPER PISTONS AND/OR SEALS – ONE CALLIPER – RENEW
(Includes OPS 2010-A and A2)

OP 2010-D FRONT BRAKE CALLIPER PISTONS AND/OR SEALS – BOTH – RENEW
(Includes OPS 2010-A, A1 and A2×2)

OP 2010-E FRONT BRAKE CALLIPER SPLASH SHIELD – ONE – REMOVE AND INSTALL
(Includes OPS 2010-A and A2)

OP 2010-F FRONT BRAKE CALLIPER SPLASH SHIELD – BOTH – REMOVE AND INSTALL
(Includes OPS 2010-A, A1 and A3×2)

OP 2010-G FRONT BRAKE DISC – ONE – REMOVE AND INSTALL
(Includes OPS 2010-A and A4)

OP 2010-H FRONT BRAKE DISCS – BOTH – REMOVE AND INSTALL
(Includes OPS 2010-A, A1 and A4×2)

OP 2018-A FRONT BRAKE PADS – ALL – INSPECT AND/OR RENEW

To Remove

1. With the handbrake applied, jack up the front of the car and fit stands. Remove the front road wheels.
2. Pull out the retaining pin clips, withdraw the retaining pins and remove the brake pads and shims using, if necessary, a pair of thin-nosed pliers.

   NOTE – Prior to fitting new pads, check that they are the correct type for the particular car being worked on. Also, ensure that the pads and the disc are free from grease, oil or dirt.

To Replace

3. To enable the new pads to be fitted, push the pistons into their bores. This action will cause fluid to be returned to the master cylinder which, if it has recently been topped-up, may overflow. To avoid this, examine the fluid level and, if necessary, remove a quantity of fluid.
4. Fit new brake pads and shims ensuring that both are correctly fitted. The shims fitted to rearward facing callipers incorporate an arrow which must point in the direction of forward rotation of the wheel. The shims fitted to forward facing callipers may be fitted either way up.
5. Refit the retaining pins and secure with the retaining pin clips. Ensure that clips are on side of retaining pins away from piston seal to prevent damage to seal.
6. Operate the brake pedal several times to bring the pads into the correct adjustment. Check that the pads are free to move slightly, this indicates that the retaining pins are not fouling the pad.
7. Replace the road wheels and lower the car to the ground.
8. Tighten the wheel nuts and replace the hub cap.

OP 2075-A FOUR-WAY UNION – RENEW (Includes bleeding)

Tools Required

P.2012 Brake line plugs

1. Disconnect the brake pipes from the union and plug the end of the pipe from the master cylinder.
2. Remove the bolt securing the union to the side of the engine compartment.
3. Reconnect the hydraulic pipes. Be careful not to overtighten the unions.
4. Replace the union and secure with the retaining bolt.
5. Bleed the braking system as described in OP 2000-A.

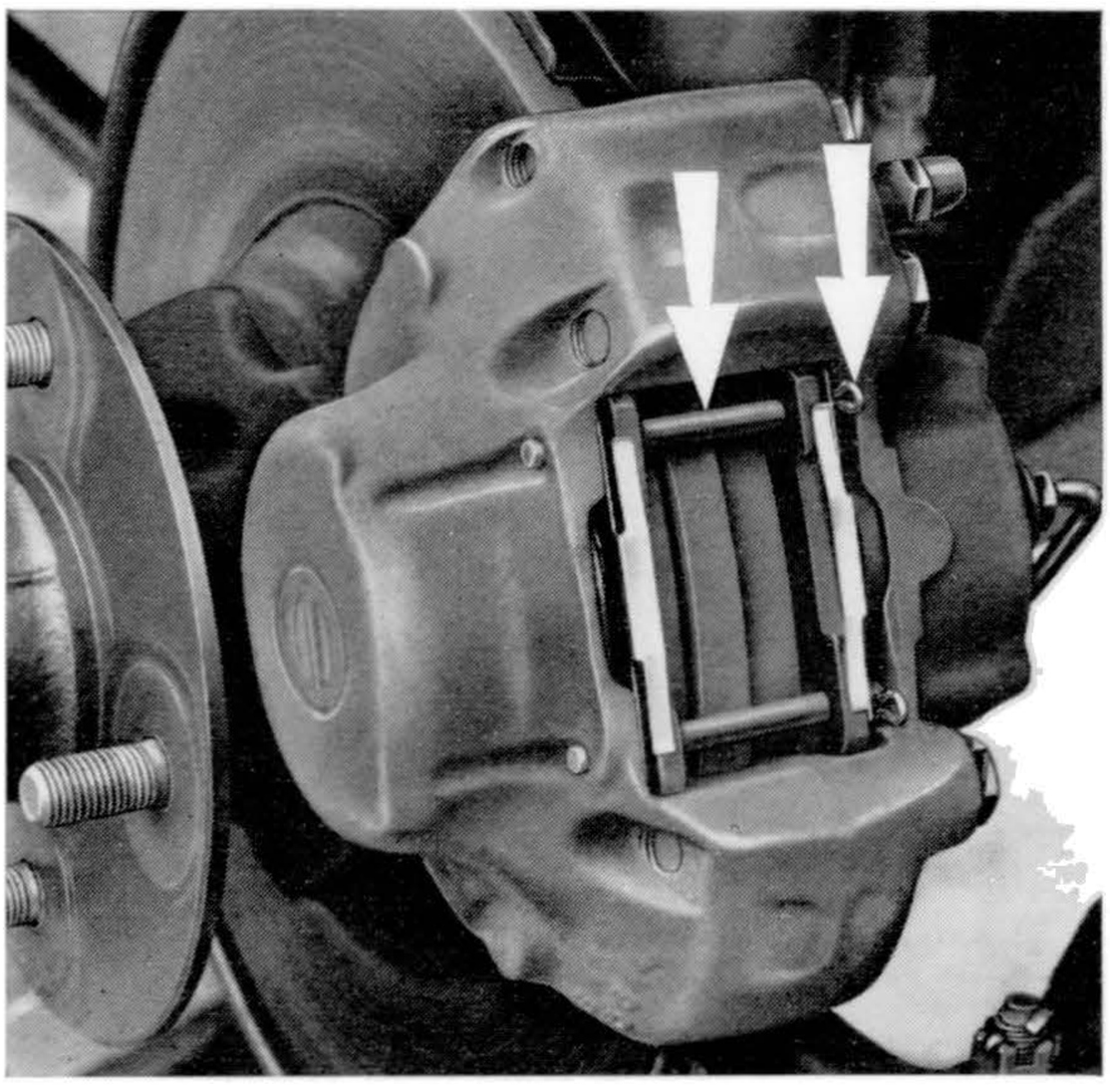
OP 2078-A HYDRAULIC FLEXIBLE HOSE – ANY ONE – RENEW (Includes bleeding)

Tools Required

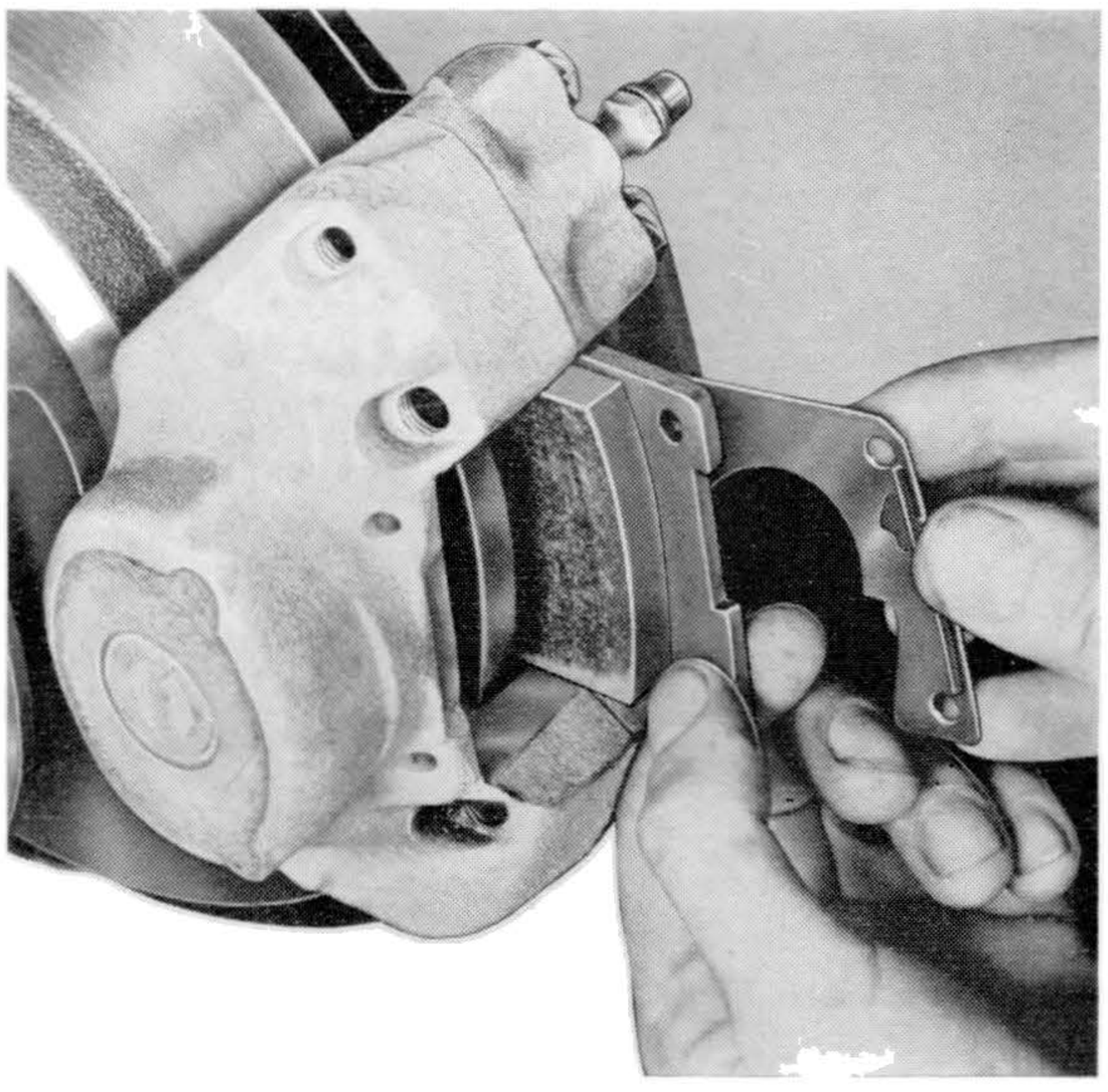
P.2012 Brake line plugs (if required)

Front

1. With the handbrake applied jack up the front of the car and fit stands.
2. Disconnect one end of the flexible hose from the bracket on the suspension unit and the other end from underneath the wheel arch.
3. Connect the new flexible hose, ensuring that the locknuts and both securing brackets are tight.
4. Jack up, remove the stands and lower the car to the ground.
5. Bleed the braking system as described in OP 2000-A.



Calliper Retaining Pins and Clips—Rearward Facing



Fitting Brake Pads and Shims — Rearward Facing

Rear

1. Jack up the rear of the car and fit stands.
2. Detach the flexible hose from the bracket on the underbody and the bracket on the right-hand side of the axle casing.
3. Connect the new flexible hose, ensuring that the locknuts and both securing brackets are tight.
4. Jack up, remove the stands and lower the car to the ground.
5. Bleed the braking system as described in OP 2000-A.

OP 2078-A1 EXTRA: REPLACE OTHER SIDE
Repeat operations 2 to 5, OP 2078-A

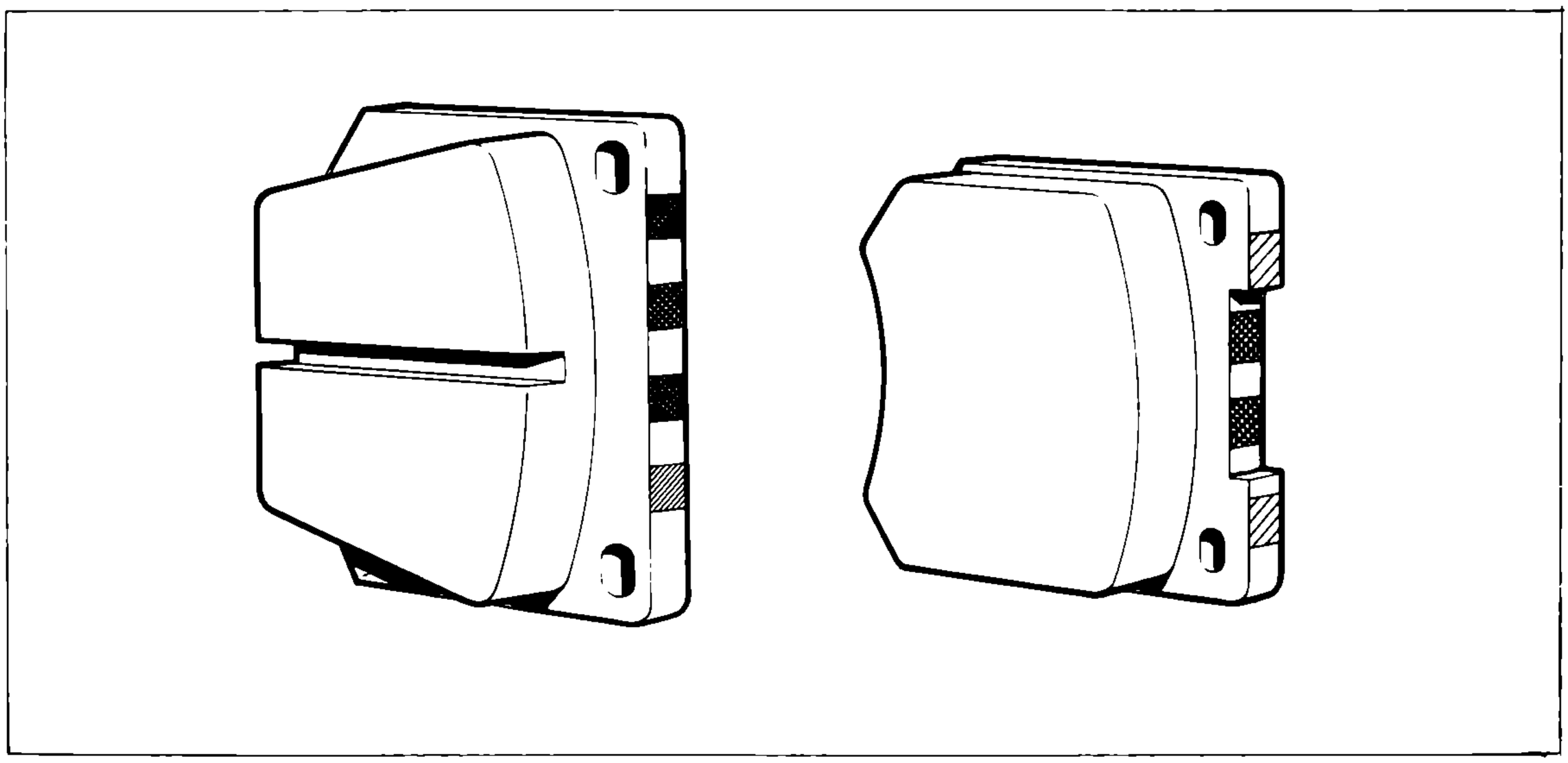
OP 2140-A BRAKE MASTER CYLINDER – REPLACE (SINGLE LINE)

Tools Required

P.2012 Brake line plugs

To Remove

1. Disconnect the brake master cylinder push rod from the pedal by unscrewing the locknut and withdrawing the shouldered bolt.
2. Detach the fluid line by unscrewing the union nut, using a blanking plug to prevent dirt entering the line.
3. Withdraw the master cylinder after unscrewing the two nuts and spring washers securing the master cylinder to the bulkhead.



Forward Facing Calliper — 1600E & GT Green, Red, Red, Red

Rearward Facing Calliper 1,600 c.c. and 1,300 c.c. — Yellow, Red, Red, Yellow

BRAKE PAD COLOUR CODING

4. Empty the contents of the fluid reservoir into a waste container.

To Replace

5. Refit the master cylinder to the engine bulkhead, replace the two spring washers and nuts and tighten securely.
6. Reconnect the fluid pipe, tighten the union nut securely, but do not overtighten.
7. Reconnect the brake master cylinder push rod to the pedal by passing the shouldered bolt through the push rod and then the pedal. Fit the locknut.
8. Fill the master cylinder reservoir with clean approved fluid, Part No. ME-3833-F, and then bleed the system as described in OP 2000-A.

   Check the action of the brakes on road test.

OP 2140-A BRAKE MASTER CYLINDER – REPLACE (DUAL LINE)

Tools Required

P.2012 Brake line plugs

To Remove

1. Disconnect the brake master cylinder push rod from the pedal by unscrewing the locknut and withdrawing the shouldered bolt.
2. Detach the two fluid lines by unscrewing the union nuts, using blanking plugs to prevent dirt entering the lines.
3. Withdraw the master cylinder after unscrewing the two nuts and spring washers securing the master cylinder to the bulkhead.
4. Empty the contents of the fluid reservoir into a waste container.

To Replace

5. Refit the master cylinder to the engine bulkhead, replace the two spring washers and nuts and tighten securely.
6. Reconnect the two fluid pipes, tighten the union nuts securely, but do not overtighten.
7. Reconnect the brake master cylinder push rod to the pedal by passing the shouldered bolt through the push rod and then the pedal. Fit the locknut.
8. Fill the master cylinder reservoir with clean approved fluid, Part No. ME-3833-F, and then bleed the system as described in OP 2000-A.

   Check the action of the brakes on road test.

OP 2140-A BRAKE MASTER CYLINDER – REPLACE (DUAL LINE WITH SERVO)

Tools Required

P.2012 Brake line plugs

To Remove

1. Detach the two fluid lines by unscrewing the union nuts, using blanking plugs to prevent dirt entering the lines.

Brake Pedal and Master Cylinder — Single Line

2. Remove the two nuts and spring washers securing the master cylinder to the front of the servo unit. Remove the master cylinder.
3. Empty the contents of the fluid reservoir into a waste container.

To Replace

4. Refit the master cylinder to its mounting studs on the front face of the servo and fit the retaining washers and nuts.
5. Reconnect the fluid pipe, tighten the union nut securely but do not overtighten.
6. Fill the master cylinder reservoir with clean approved fluid, Part No. ME-3833-F, and then bleed the system as described in OP 2000-A.

   Check the action of the brakes on road test.

OP 2140-A1 EXTRA: MASTER CYLINDER (SINGLE LINE) – OVERHAUL

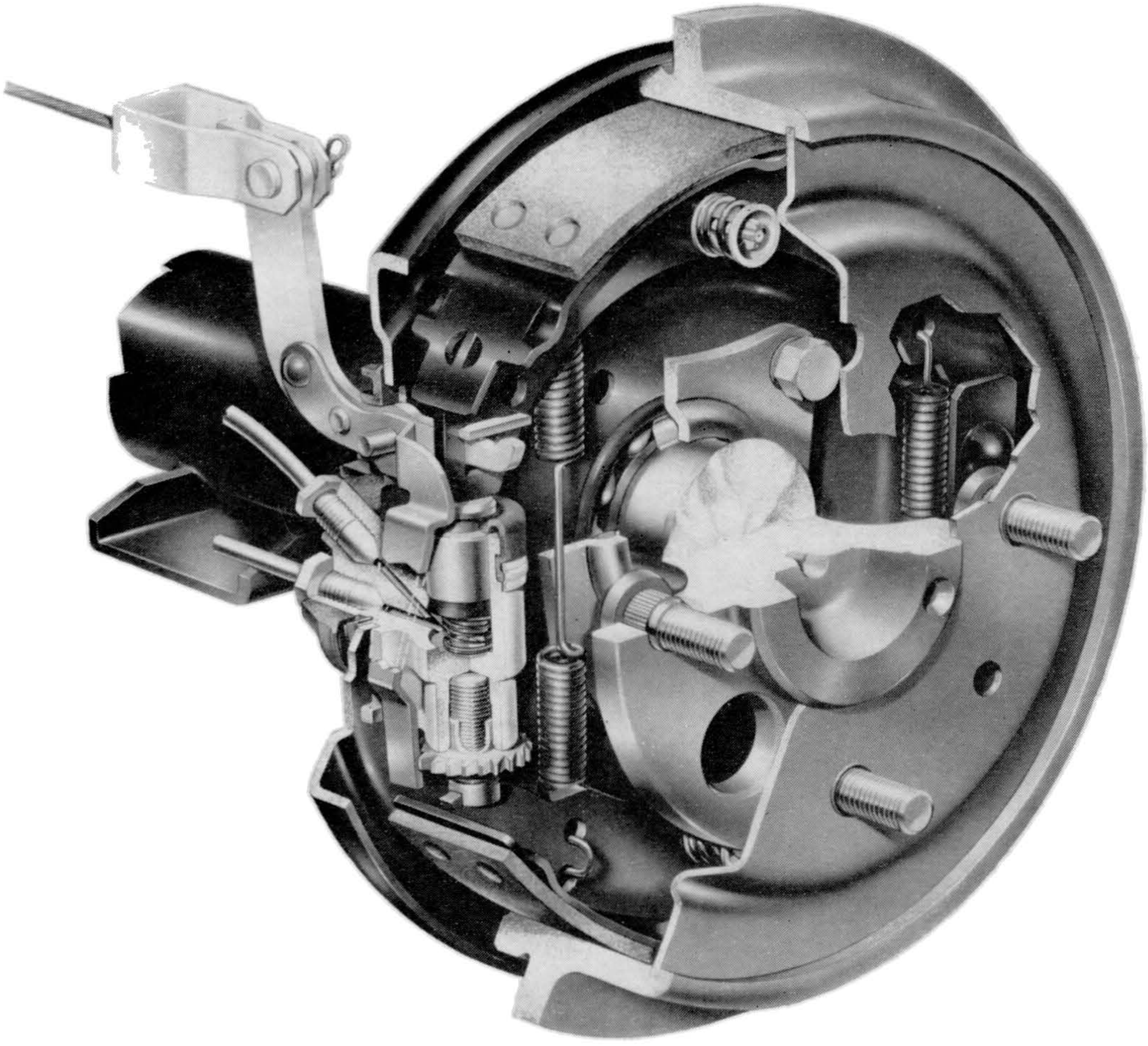
To Dismantle

1. Remove the rubber boot. Withdraw the circlip and remove the push rod.
2. Pull the piston and valve assembly from the cylinder.
3. The piston is held in the spring retainer by a tab which engages under a shoulder on the front of the piston. Carefully lift this tab, and remove the piston.
4. Compress the spring and move the retainer to one side which will release the end of the valve stem from the retainer.
5. Slide the valve spacer and shim off the valve stem.
6. Remove the rubber valve seal and the piston seal, if necessary.
7. Wash all parts in methylated spirit, commercial alcohol or approved brake fluid. Do not use mineral base oils such as petrol, paraffin or carbon tetrachloride.

   Inspect the piston and cylinder bore for score marks and the rubber seals for damage to the sealing lips. Renew any parts that appear unsuitable for further service.

To Reassemble

8. Fit the piston seal to the piston with the sealing lips towards the spigot end and the valve seal to the valve stem with the lip towards the front of the valve.
9. Replace the shim washer on the valve stem together with the seal spacer so that the legs of the spacer are towards the valve seal. Ensure that the shim is fitted concentrically on the rear shoulder of the valve stem so that its convex face abuts the shoulder flange.
10. Fit the return spring over the valve stem and insert the spring retainer into the end of the return spring. Compress the spring and engage the boss on the valve stem in its recess in the spring retainer.
11. Insert the spigot end of the piston into the spring retainer and secure by pressing down the tab so that it locates against the shoulder of the piston.
12. Dip the assembly in brake fluid and enter it into the cylinder, with the valve leading. Care should be taken to avoid damaging the piston seal as they enter the cylinder.
13. Install the push rod in the master cylinder. Locate the washer and install the retaining circlip.
14. Replace the dust cap.



Rear Brake Assembly (8 in.)

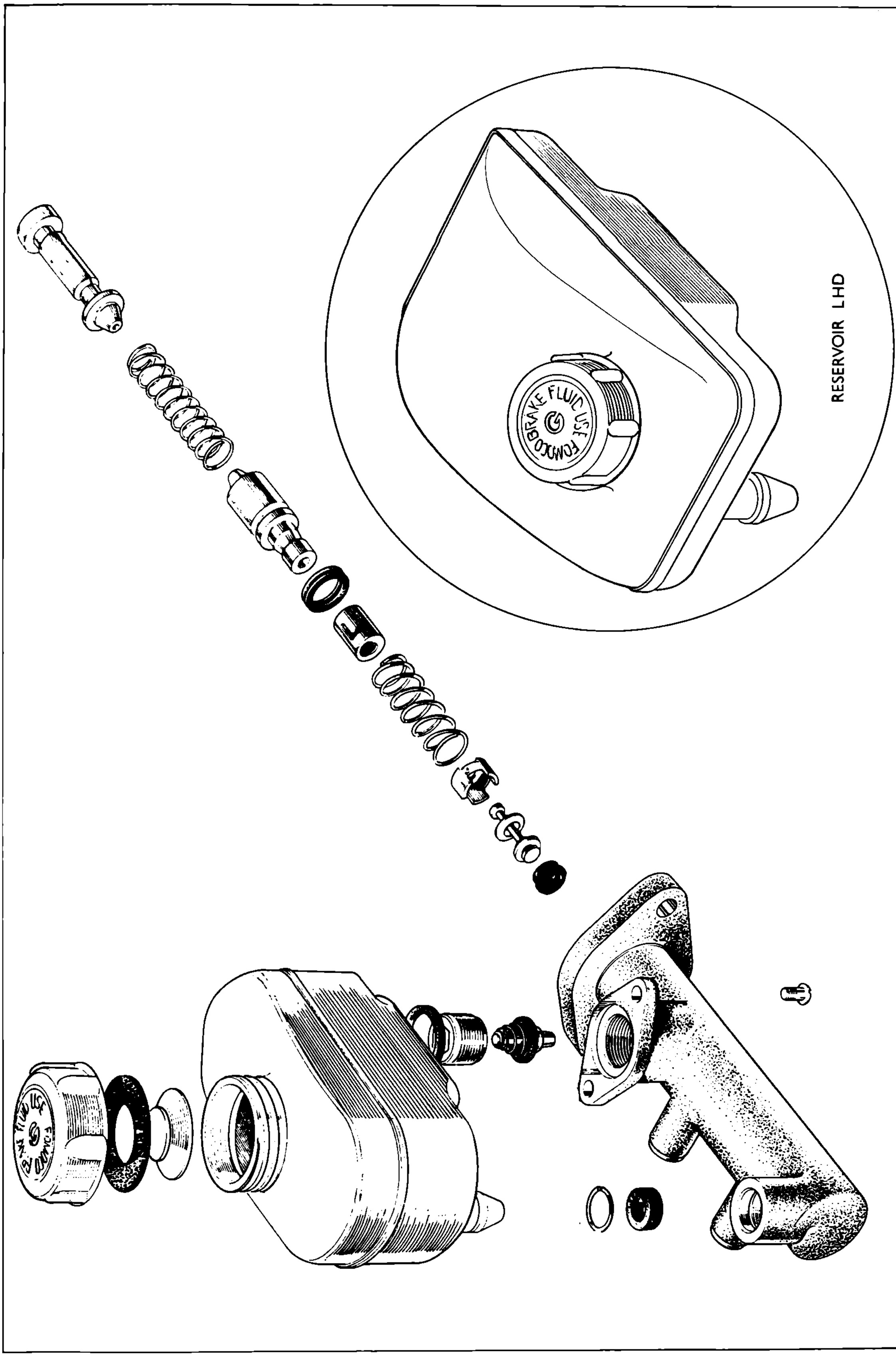
OP 2140-A1 EXTRA: BRAKE MASTER CYLINDER – OVERHAUL (DUAL LINE)

To Dismantle

1. Pull off the rubber boot, remove the circlip and detach the push rod.
2. Remove the two crosshead screws securing the reservoir to the body. Turn the reservoir.
3. Remove and discard the sealing washer adjacent to the primary recuperating valve.
4. Using a suitable hexagon key unscrew the plug which retains the primary recuperating valve.
5. Lift out and discard the primary recuperating valve assembly.
6. Fit plastic (or other suitable) plugs to the two outlet ports and block off the primary recuperating valve aperture.
7. Using an air line, blow air into the secondary recuperating valve aperture and expel the primary piston, the primary piston spring and the secondary piston and recuperating valve assembly from the cylinder bore.
8. Remove the primary piston seal from the primary piston.
9. The secondary piston is held in the spring retainer by a tab which engages under a shoulder on the front of the piston. Carefully lift this tab and remove the piston.
10. Compress the spring and move the retainer to one side to release the end of the secondary recuperating valve stem from the retainer.
11. Slide the valve spacer and shim off the valve stem.
12. Remove the rubber valve seal and the secondary piston seal and discard.
13. Wash all parts in methylated spirit, commercial alcohol or approved brake fluid. Do not use mineral base oils such as petrol, paraffin or carbon tetrachloride.
14. Inspect the pistons and cylinder bore for score marks and other parts for damage. Renew any parts that appear unsuitable for further service. If either of the pistons or the cylinder bore are defective in any way, a new master cylinder assembly must be fitted.

To Reassemble

15. Fit a new seal to the secondary piston.
16. Replace the shim washer on the valve stem together with the seal spacer so that the legs of the spacer are towards the valve seal. Ensure that the shim is fitted concentrically on the rear shoulder of the valve stem so that its convex face abuts the shoulder flange.
17. Fit the return spring over the valve stem and insert the spring retainer into the end of the return spring. Compress the spring and engage the boss on the valve stem in its recess in the spring retainer.
18. Insert the spigot end of the secondary piston into the spring retainer and secure by pressing down the tab so that it locates against the shoulder of the piston.
19. Dip the secondary piston and recuperating valve assembly in approved brake fluid and enter it into the cylinder with the valve leading.



Master Cylinder — Exploded — Dual Line

20. Fit a new seal to the primary piston.
21. Enter the primary piston spring into the cylinder.
22. Dip the primary piston in approved brake fluid and enter it into the cylinder with the drilled end leading.
23. Fit the push rod so that it fits into the recess in the end of the primary piston, press the guide washer into position and secure the complete assembly with the circlip. Check that the push rod moves freely.
24. Fit the primary recuperating valve into its aperture, moving the push rod as necessary to gain access.
25. Screw the retaining plug into position using a suitable hexagon key. Tighten to a torque of 35 to 45 lb. ft. (4.9 to 6.2 kg.m.).
26. Cycle the push rod and ensure that the primary recuperating valve "tips" open when the push rod is fully withdrawn and that the valve closes when the push rod is pushed in.
27. Fit a new rubber sealing washer in the recuperating valve entry port.
28. Fit the reservoir and secure with the two crosshead screws.
29. After installation in the car and bleeding the brakes, depress the brake pedal for about ten seconds and then examine the master cylinder to ensure that there are no signs of fluid leakage.

GROUP OPERATIONS

OP 2140-B BRAKE MASTER CYLINDER - OVERHAUL (SINGLE LINE)
(Includes OPS 2140-A and A1)

OP 2140-B BRAKE MASTER CYLINDER - OVERHAUL (DUAL LINE)
(Includes OPS 2140-A and A1)

OP 2140-B BRAKE MASTER CYLINDER - OVERHAUL (DUAL LINE WITH SERVO)
(Includes OPS 2140-A and A1)

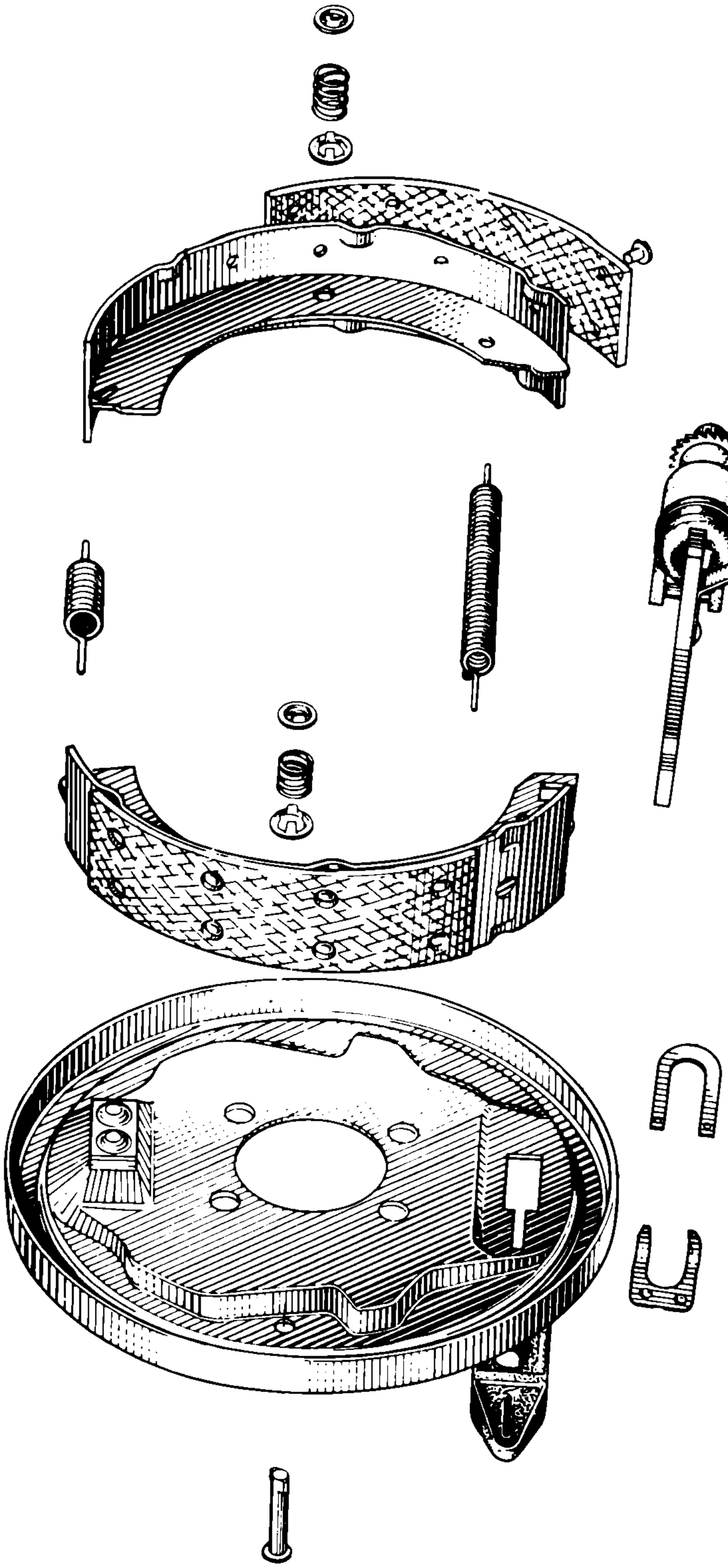
OP 2145-A BRAKE SERVO FLEXIBLE VACUUM PIPE - RENEW

To Remove

1. Open the bonnet and fit wing covers.
2. Slacken the pipe clips securing the ends of the pipe to the adaptors on the servo unit and the inlet manifold.
3. Remove the vacuum pipe and pull off the clips.

To Install

4. Fit the clips to the new pipe and push onto the adaptors on the servo and inlet manifold.
5. Tighten the clips.
6. Remove the wing covers and close the bonnet.



Rear Brake (9 in.) — Exploded

OP 2220-B REAR BRAKE SHOES AND/OR RETRACTING SPRINGS – ONE SIDE – RENEW

NOTE – The rear brake shoes should be inspected for wear at 6,000 mile (10,000 km.) intervals. There should always be at least $\frac{1}{32}$ in. (0.793 mm.) of lining material above the rivet heads. If the linings are worn so that there is less than $\frac{1}{32}$ in. they should be renewed. Also, if the linings are contaminated by oil or grease, it is preferable to renew them rather than attempt to clean them.

To Remove

1. Remove the hub cap, slacken off the wheel nuts, jack up the rear end, fit stands and remove the wheel.
2. Ensure that the handbrake is fully released then remove the pan head screw securing the brake drum to the half-shaft and remove the drum.
3. Remove the shoe holding down springs, one on each shoe, by turning the top washer through 90° and pulling off the washer and spring.
4. Disengage each shoe from its location slot in the fixed pivot and the wheel cylinder and remove the shoes. To prevent the piston falling out of the wheel cylinder it should be held in with a clip or a rubber band round the cylinder.
5. Remove the retracting springs from the brake shoes.
6. Withdraw the ratchet wheel assembly from the wheel cylinder and rotate the wheel until it abuts the slot head bolt shoulder. This moves the brake shoes (when refitting) to the fully off adjustment. If this is not done difficulty may be encountered when refitting the brake drum.

To Replace

7. Assemble the retracting springs between the two shoes. On the 9 in. (22.9 cm.) diameter brake and the 8 in. (20.3 cm.) brake they are fitted on the backplate side.
8. Smear grease (EM-1C-18) to the brake shoe support pads, brake shoe pivots and to the ratchet wheel threads and the recess in the wheel cylinder.
9. Fit the shoes assembly to the backplate by positioning the rear shoe in its location on the fixed pivot and over the handbrake link.
10. Secure the shoes to the backplate with the holding down spindles and retain the spindles with a washer, spring and another washer. Turn the top washer through 90°.
11. Check to ensure that the shoes are firmly seated and that the springs are not binding on the backplate or the slave cylinder.
12. Replace the brake drum and secure with the pan head screw.
13. Operate handbrake lever at backplate for as long as necessary to adjust the brakes (i.e., until clicking at backplate stops).

    Important – With the ratchet wheel in the fully off adjustment position, it is possible for the indexing lever on handbrake link to over-ride ratchet wheel and stay in this position. When operating the link lever, therefore, it is necessary to ensure that it always returns to the fully "off" position each time.

14. Refit the wheel, remove the stands and lower the car to the ground. Tighten the wheel nuts and replace the hub cap.
15. Operate the handbrake several times to bring the brakes into correct adjustment.
16. Check the operation of the brakes on road test.

OP 2220-B1 EXTRA: BRAKE SHOES AND/OR RETRACTING SPRINGS – SECOND SIDE – RENEW

Repeat operations 2 to 12, OP 2220-B.

OP 2220-B3 EXTRA: REAR BRAKE WHEEL CYLINDER – ONE SIDE – REMOVE AND INSTALL

Tools Required

P.2012 Brake line plugs

To Remove

1. Disconnect the brake fluid pipe (two on right-hand brake plate) and fit brake line plugs.
2. Remove the spring clip and clevis pin from the handbrake link on the inside of the brake plate.
3. Prise the rubber boot on the rear of the wheel cylinder away from the brake plate and remove. Pull off the two 'U' shaped retainers securing the cylinder to the brake plate.
4. Remove the wheel cylinder and handbrake link.

To Replace

5. Rotate the ratchet wheel on its shaft so that when the shoes are assembled they will be on the "fully off" limit of their adjustment. Replace the ratchet wheel assembly in its recess in the end of the wheel cylinder body, after applying a smear of grease to the threads and the recess.
6. Smear the brake plate with grease (EM-1C-18) in the area where the wheel cylinder slides.
7. Replace the handbrake link and wheel cylinder in the aperture in the brake plate. Ensure that the pivot on the handbrake link is correctly located in the slot in the wheel cylinder body.
8. Secure the wheel cylinder to the brake plate, using the 'U' shaped spring retainer and the 'U' shaped flat retainer. Note that the spring retainer is fitted from the handbrake link end of the wheel cylinder and the flat retainer from the other.
9. Fit the rubber boot over the wheel cylinder and the handbrake link. Ensure that the wheel cylinder can slide in the carrier plate. Check that the handbrake link operates the self-adjusting mechanism.

   NOTE – Make sure that the correct ratchet wheel and screw assembly is fitted to the wheel cylinder. There is a right-handed threaded screw on the right-hand wheel cylinder and a left-handed threaded screw on the left-hand wheel cylinder.
10. Grease the brake shoe support pads, using zinc oxide grease.

11. Reconnect the handbrake linkage to the handbrake link, using a clevis pin and retain in position with spring clip.
12. Remove the brake line blanking plug from the brake line and fit the pipe to the wheel cylinder.
13. After refitting the brake shoes, the brake drum and the road wheel (part of OP 2220-A), bleed the braking system as described in OP 2000-A.

OP 2220-B4 EXTRA: WHEEL CYLINDER – OVERHAUL

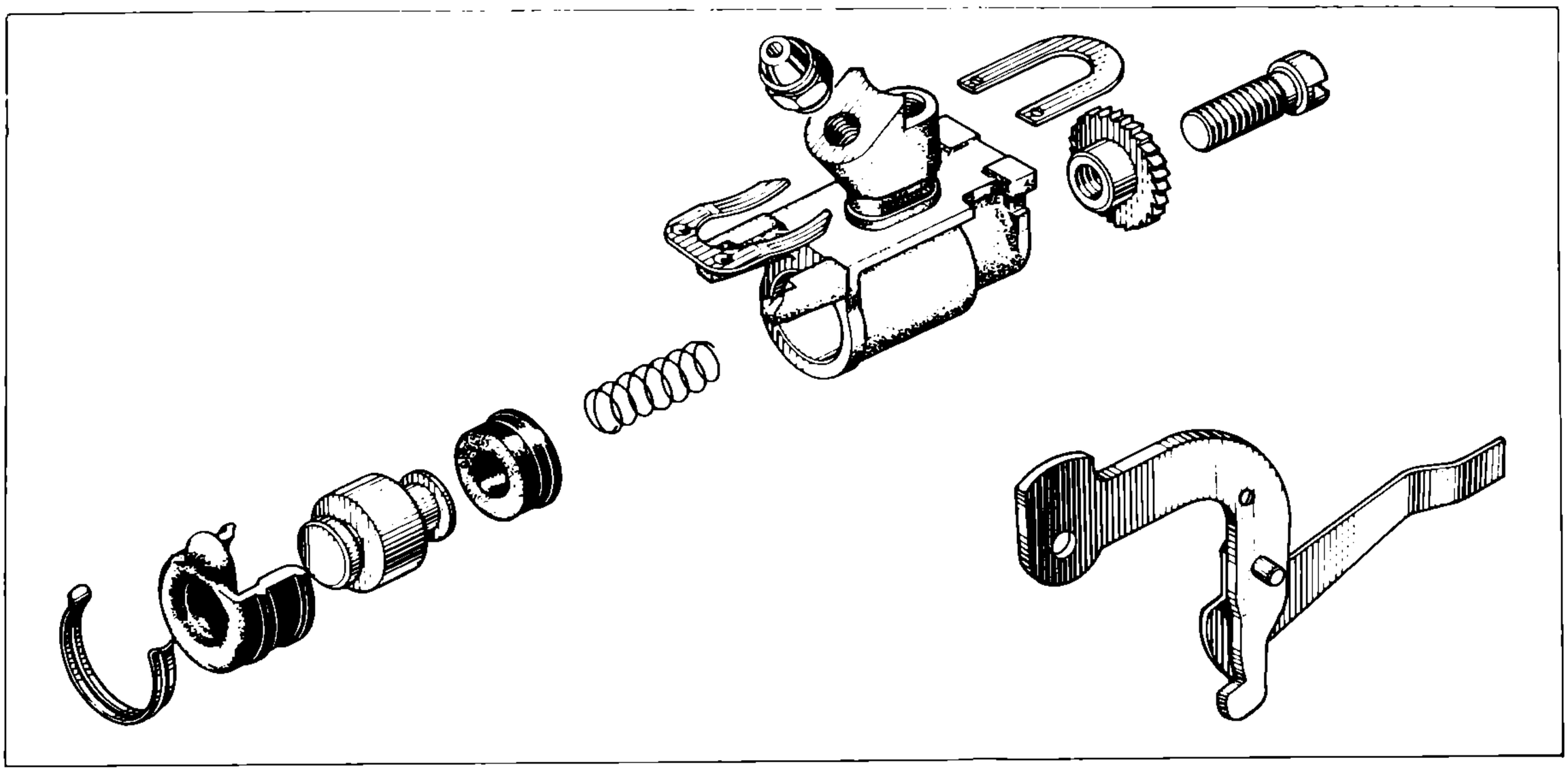
To Dismantle

1. Remove the boot retainer, prise off the boot and withdraw the piston, complete with seal, from the wheel cylinder bore.
2. Detach the seal from the piston.
3. Remove the return spring from the cylinder bore.
4. Remove the ratchet wheel and screw assembly from the other end of the wheel cylinder.

To Reassemble

All parts should be washed and inspected for wear or damage, any components that are not considered fit for further service should be discarded.

5. Dip the piston and seal in approved brake fluid and reassemble them. Fit the seal to the piston with the flat face of the seal adjacent to the piston rear shoulder.
6. Fit the return spring in the wheel cylinder bore.
7. Dip the piston and seal assembly in approved brake fluid and insert into the cylinder bore seal end first.



Rear Wheel Cylinder — Exploded

8. Locate the rubber boot on the wheel cylinder and fit the retainer.
9. Replace the ratchet wheel and screw assembly in the wheel cylinder. Rotate the ratchet wheel until it abuts the shoulder of the slot head bolt. This ensures that the brakes are in the fully "off" position.

OP 2220-B5 EXTRA: REAR BRAKE CARRIER PLATE – ONE – REMOVE AND INSTALL

Tools Required

PT.3072	Slide hammer (main tool)
P.3072-4	Rear axle shaft assembly remover and replacer (adaptor)

To Remove

1. Rotate the axle shaft flange to gain access to two of the retaining bolts securing the axle shaft retaining plate and back plate to the axle casing. Rotate the axle shaft through 90° and remove the other two bolts and spring washers.
2. Withdraw the axle shaft, using the slide hammer and adaptor, Tool Nos. PT.3072 and P.3072-4. Remove the brake plate.

To Replace

3. Position the brake plate on the axle casing and replace the axle shaft and retainer.
4. Secure the axle shaft retainer and the back plate to the rear axle housing, using four bolts and spring washers.

GROUP OPERATIONS

OP 2220-C REAR BRAKE SHOES AND/OR RETRACTING SPRINGS – ALL – RENEW
(Includes OPS 2220-B and B1)

Fitting the Wheel Cylinder Retainers

OP 2220-F REAR WHEEL CYLINDER ASSEMBLY – ONE SIDE – REMOVE AND INSTALL
(Includes OPS 2220-B and B3)

OP 2220-G REAR WHEEL CYLINDER ASSEMBLY – BOTH – REMOVE AND INSTALL
(Includes OPS 2220-B, B1 and B3 × 2)

OP 2220-H REAR WHEEL CYLINDER ASSEMBLY – ONE SIDE – OVERHAUL
(Includes OPS 2220-B, B3 and B4)

OP 2220-J REAR WHEEL CYLINDER ASSEMBLY – BOTH – OVERHAUL
(Includes OPS 2220-B, B1, B3 × 2 and B4 × 2)

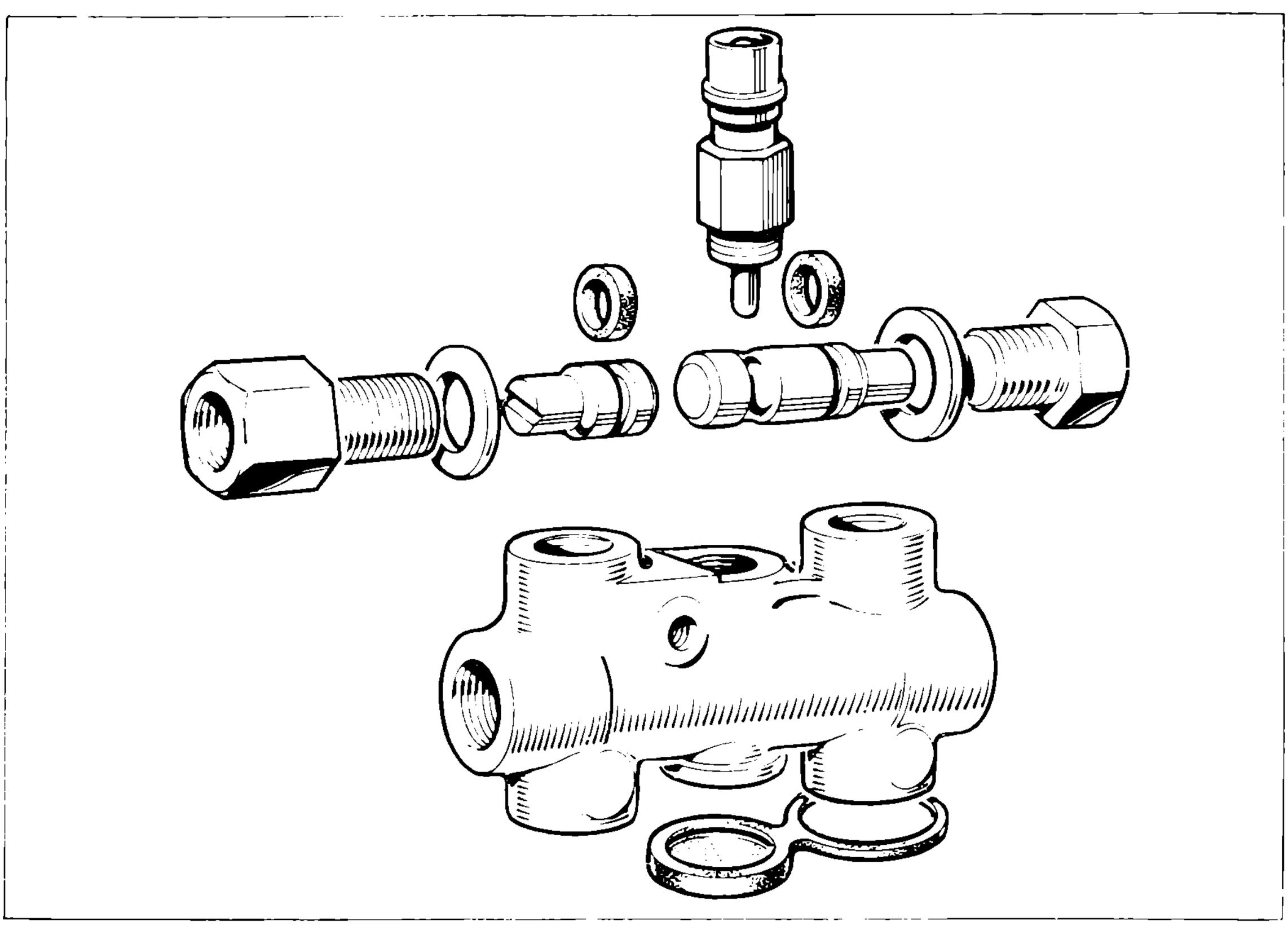
OP 2220-K REAR BRAKE CARRIER PLATE – ONE SIDE – REMOVE AND INSTALL
(Includes OPS 2220-B, B3 and B5)

OP 2220-L REAR BRAKE CARRIER PLATE – BOTH – REMOVE AND INSTALL
(Includes OPS 2220-B, B1, B3 × 2 and B5 × 2)

OP 2493-A VALVE AND SWITCH ASSEMBLY (WHERE FITTED) – REMOVE AND INSTALL

Tools Required

P.2012 Brake line plugs



Valve and Switch Assembly

To Remove

1. Disconnect the five brake pipes from the ports on the valve and switch assembly. Plug the ends of the two pipes from the master cylinder.
2. Disconnect the wiring from the switch.
3. Unscrew the bolt securing the assembly to the rear of the engine compartment. Remove the assembly.

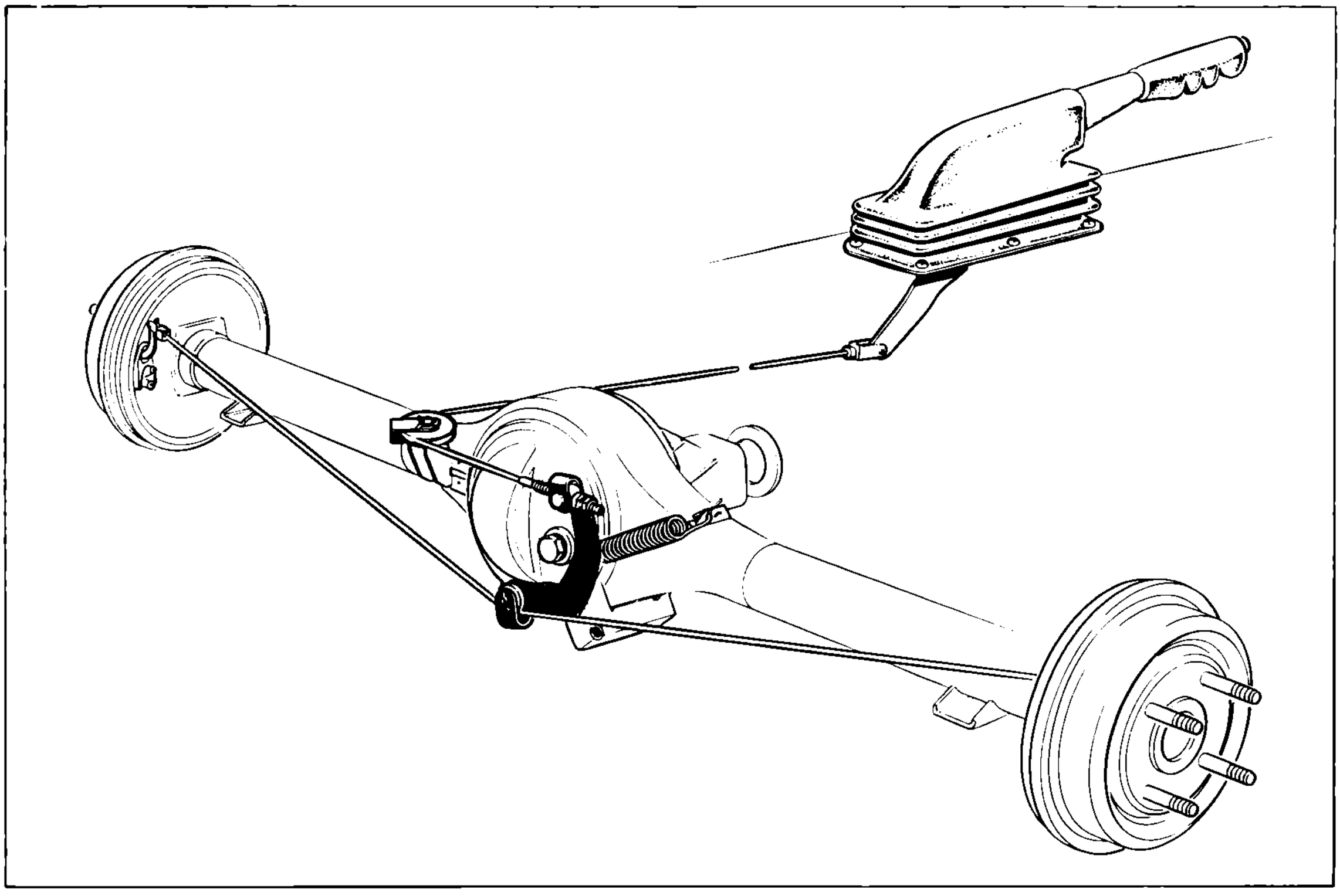
To Replace

4. Position the valve and switch assembly in place on the engine compartment rear bulkhead and loosely fit the securing bolt.
5. Reconnect the hydraulic pipes. Be careful not to overtighten the unions.
6. Tighten the bolt securing the assembly to the bulkhead.
7. Reconnect the electrical wiring to the switch.

OP 2493-A1 EXTRA: VALVE AND SWITCH ASSEMBLY (WHERE FITTED) – OVERHAUL

To Dismantle

1. Unscrew the end plug, discard the copper gasket.



Handbrake Layout

2. Unscrew the adaptor, discard the copper gasket.
3. Unscrew the switch assembly.
4. Push the pistons out of the bore, taking extreme care to avoid damaging the bore surface finish.
5. Remove the seals from the pistons and discard.
6. Pull off the dust cover and discard.
7. Wash all parts in methylated spirit, commercial alcohol or approved brake fluid. Do not use mineral base oils such as petrol, paraffin or carbon tetrachloride.

To Reassemble

8. Fit new seals to the piston so that the larger diameter of each seal is adjacent to the slotted end of the piston, see illustration.
9. Dip the pistons in clean brake fluid.
10. Insert the longer piston into the bore (slotted end outermost) until the groove is opposite the switch plunger aperture.
11. Screw the switch plunger into position and tighten to a torque of 2 to 2.5 lb. ft. (0.28 to 0.34 kg.m.).
12. Insert the shorter piston into the bore (slotted end outermost).
13. Fit a new copper gasket to the adaptor and screw the adaptor into the end of the assembly adjacent to the mounting bolt hole.
14. Fit a new copper gasket to the end plug and screw it into the other end of the assembly.
15. Tighten plug and adaptor to a torque of 16 to 20 lb ft. (2.22 to 2.80 kg.m.).
16. Fit a new dust cover.

OP 2493-B VALVE AND SWITCH ASSEMBLY (WHERE FITTED) – OVERHAUL
(Includes OPS 2493-A and A1)

OP 2800-A HANDBRAKE LINKAGE – ADJUST

To Adjust

1. Jack up the rear of the car, fit stands under the body jacking points and release the handbrake.

   NOTE – Prior to commencing the adjustment, check that the primary cable follows its correct run and is properly located in the guides. Also ensure that all cable guides are well greased.

2. Adjust the effective length of the primary cable. Slacken the locknut on the end of the cable adjacent to the relay lever on the rear axle. Adjust the nut until the primary cable has no slack in it and the relay lever is just clear of the stop on the banjo casing.
3. Adjust the effective length of the transverse cable. Slacken the locknut on the end of the cable adjacent to the right-hand rear brake. Check that the handbrake operating levers are in the fully "off" position, (i.e. back on their stops) and adjust the cable so that there is no slack. Check that the operating levers are still on their stops and then tighten the locknut.

4. Jack up, remove the stands and lower the car to the ground.

NOTE – Once correctly set it should only be necessary to adjust the handbrake system in the event of replacing parts, or in the event of lost motion due to wear on handbrake linkage components.

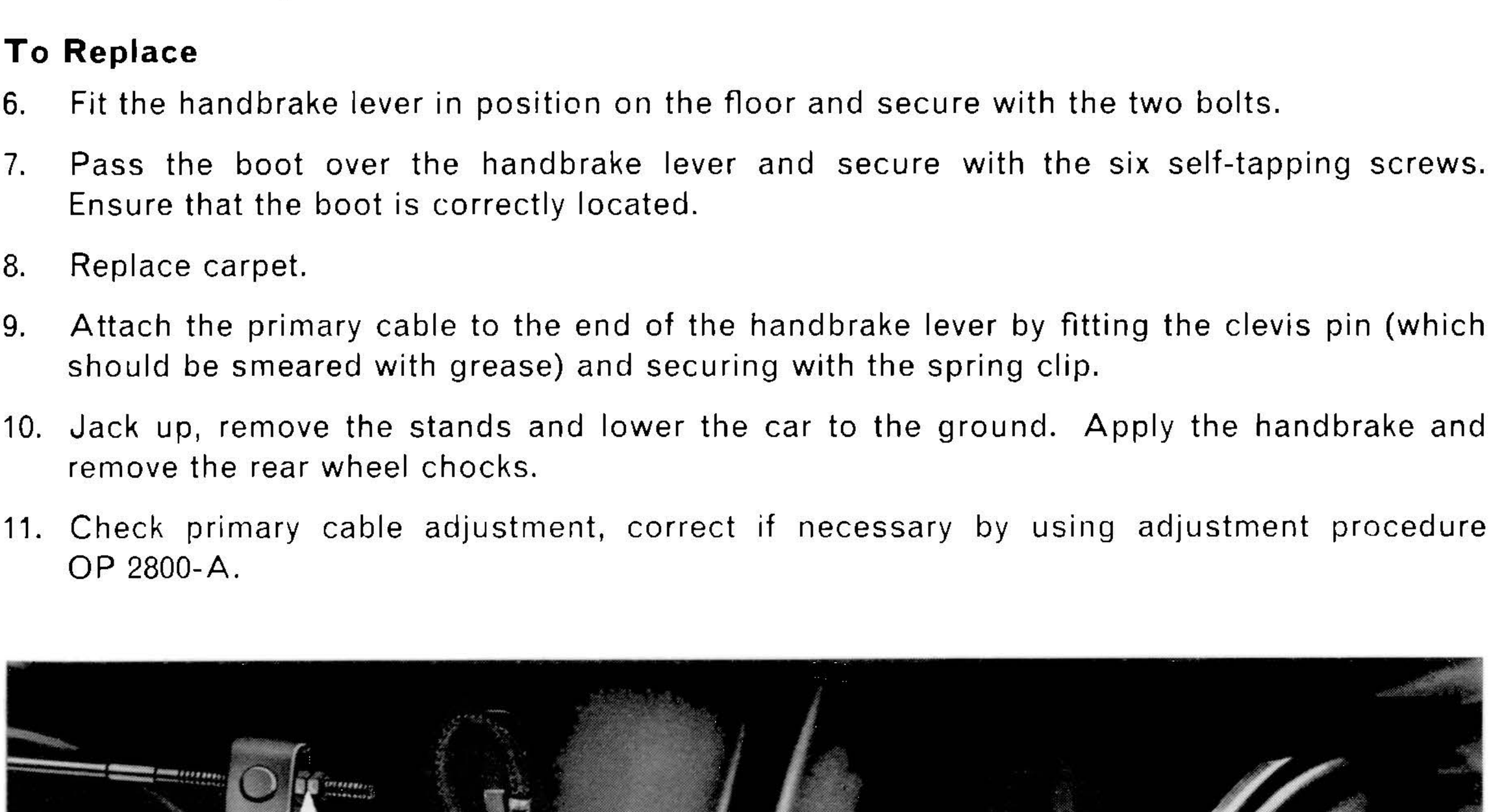
OP 2811-A HANDBRAKE LEVER ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Jack up the front of the car and fit stands. Chock the rear wheels and release the handbrake.
2. Remove carpet around handbrake area.
3. Disconnect the primary cable from the end of the handbrake lever protruding beneath the car by removing the spring clip and clevis pin.
4. Remove the handbrake lever boot after unscrewing the six self-tapping screws.
5. Remove the two bolts securing the handbrake lever to the floor and lift out the handbrake lever assembly.

To Replace

6. Fit the handbrake lever in position on the floor and secure with the two bolts.
7. Pass the boot over the handbrake lever and secure with the six self-tapping screws. Ensure that the boot is correctly located.
8. Replace carpet.
9. Attach the primary cable to the end of the handbrake lever by fitting the clevis pin (which should be smeared with grease) and securing with the spring clip.
10. Jack up, remove the stands and lower the car to the ground. Apply the handbrake and remove the rear wheel chocks.
11. Check primary cable adjustment, correct if necessary by using adjustment procedure OP 2800-A.



Handbrake Linkage Adjustment Points

OP 2811-B HANDBRAKE LEVER AND PRIMARY CABLE ASSEMBLY – FACIA MOUNTED – REMOVE AND INSTALL

To Remove

1. Chock the front wheels, jack up the rear of the car, fit stands, and release the handbrake.

OP 2841-A HANDBRAKE TRANSVERSE CABLE – RENEW

To Remove

1. Chock the front wheels, release the handbrake, jack up the rear of the car and fit stands.
2. Remove the spring clip and clevis pin securing the cable to the left-hand rear brake.
3. Detach the cable from the right-hand rear brake by releasing the locknut and unscrewing the cable from the clevis.
4. Remove the relay lever pulley by withdrawing the spring clip and pivot pin.

To Replace

5. Grease the sides of the pulley and the pulley pivot pin.
6. Lay the cable in the relay lever flange so that the threaded end of the cable is adjacent to the right-hand rear brake. Fit the relay lever pulley and secure with the pivot pin and spring clip.
7. Screw the threaded portion of the cable into the clevis on the right-hand rear brake but do not tighten.
8. Secure the other end of the cable to the left-hand rear brake and fit the clevis pin (which should be smeared with grease) and the spring clip.
9. Adjust the effective length of the cable by screwing it into the clevis and then tightening the locknut. When correctly adjusted, the cable should be taut but not so tight that the handbrake operating levers on the brake carrier plates are pulled off their stops.
10. Jack up, remove the stands and lower the car to the ground. Apply the handbrake and remove the front wheel chocks.

OP 2853-A HANDBRAKE PRIMARY CABLE – REPLACE

To Remove

1. Chock the front wheels, jack up the rear of the car, fit stands and release the handbrake.
2. From underneath the car, unscrew the nuts securing the end of the primary cable to the relay lever on the rear of the axle casing.
3. Detach the primary cable from the end of the handbrake lever protruding beneath the car by removing the spring clip and clevis pin.
4. Free the cable from its guides on the underbody and remove it from beneath the car.

To Replace

5. Attach the primary cable to the end of the handbrake lever by fitting the clevis pin (which should be smeared with grease) and securing with the spring clip.

6. Apply grease to the cable guides mounted on the underbody and thread the cable through the guides.
7. Reconnect the primary cable to the relay lever by threading it through the pivot pin (which should be smeared with grease), fitting the spacer and securing with the two nuts. Adjust the primary cable, see OP 2800-A (adjustment procedure).
8. Jack up, remove the stands and lower the car to the ground. Apply the handbrake and remove the front wheel chocks.

Important

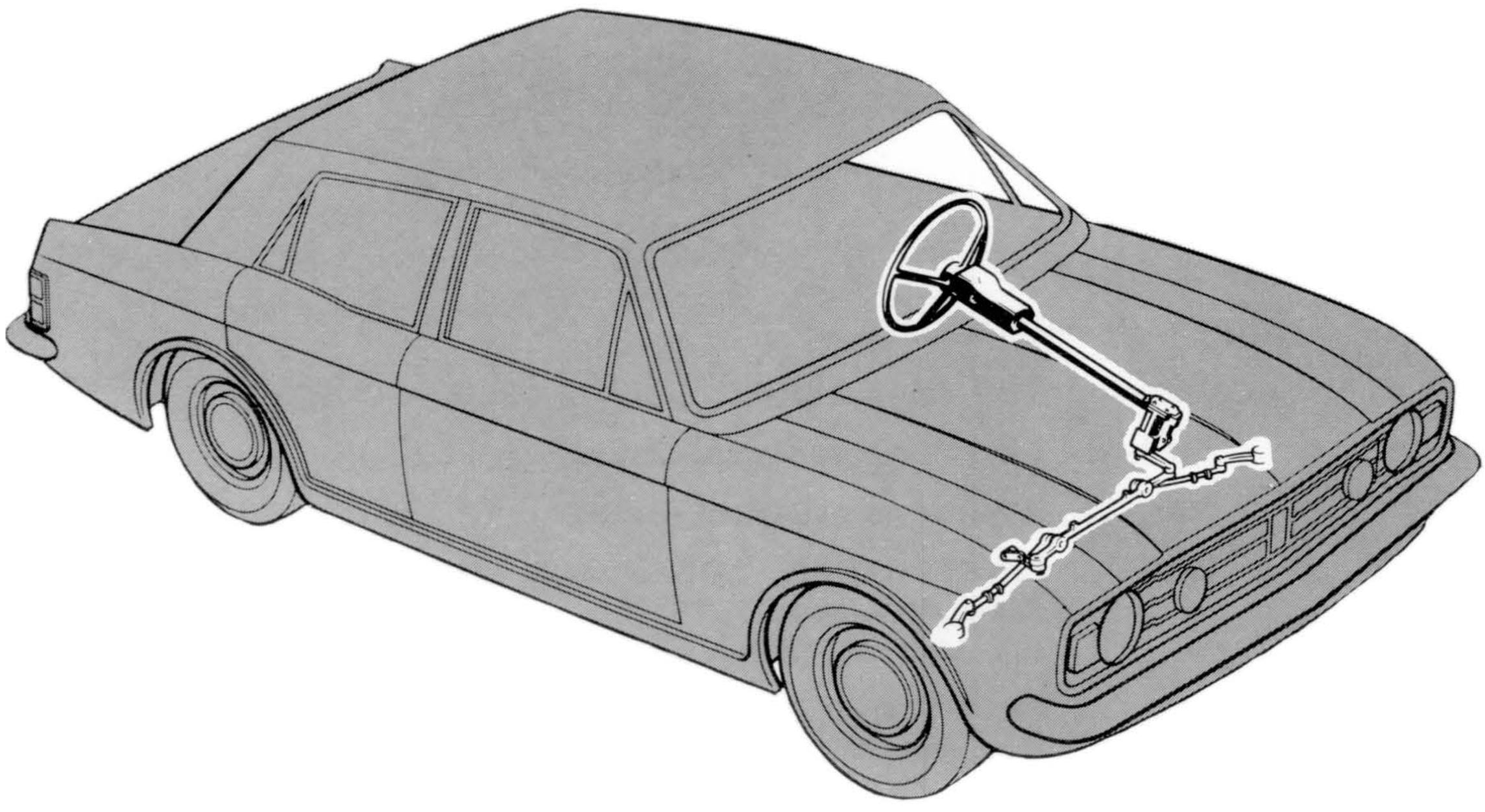
After carrying out any repair work on the dual line braking system (or any other work that involves disturbing part of the braking system) perform a road or roller test to ensure that the brakes function satisfactorily.

In addition to the normal checks made to ensure satisfactory performance after any service attention to the brakes, the dual brake warning light system, where fitted, must be checked for correct operation in line with the following procedure:—

1. Switch on the ignition.
2. Depress the test switch momentarily, the warning light should illuminate. If it does not, there is an electrical fault (blown bulb, broken connection, etc.).
3. Depress the brake pedal several times, the warning light should not illuminate. If it does, there is a fault in the hydraulic system of the brakes.
4. Switch off the ignition.

3

STEERING GEAR AND LINKAGE



SECTION INDEX

STEERING GEAR

GENERAL DESCRIPTION

QUICK REFERENCE DATA

SERVICE AND REPAIR PROCEDURES

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,,	3498-A1	Extra: steering gear — adjust
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,,	3498-B	**STEERING GEAR — ADJUST** (Includes OPS 3498-A and A1)
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,,	3575-A	ROCKER SHAFT - PRE-LOAD — ADJUST
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,,	3600-A	STEERING WHEEL AND/OR INDICATOR CAM — REMOVE AND INSTALL

STEERING LINKAGE

GENERAL DESCRIPTION

QUICK REFERENCE DATA

SERVICE AND REPAIR PROCEDURES

OPERATION	3000-A	TOE-IN AND WHEEL LOCK ANGLES — CHECK
,,	3000-A1	Extra: toe-in and wheel lock angles — adjust
,,	3000-A2	Extra: wheel alignment — check
,,	3000-B	**FRONT WHEEL TOE-IN AND WHEEL LOCK ANGLES — ADJUST** (Includes OPS 3000-A and A1)
,,	3000-C	**FRONT WHEEL ALIGNMENT — CHECK** (Includes OPS 3000-A and A2)
,,	3000-D	**FRONT WHEEL ALIGNMENT — CHECK AND ADJUST** (Includes OPS 3000-A, A1 and A2)
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,,	3301-A	DROP ARM TO IDLER ARM — RENEW
,,	3351-A	IDLER ARM — RENEW
,,	3535-A	STEERING LOCK STOPS — ADJUST

STEERING GEAR

GENERAL DESCRIPTION

Movement of the steering wheel is transmitted by a solid shaft to a worm and nut steering gear which is mounted in the engine compartment attached to the reinforced sidemember. The nut is of the recirculatory ball type incorporating thirteen balls.

The steering ratio in the straight-ahead position is 16.4 : 1, however, the ratio varies between the straight-ahead and extreme lock positions.

The construction of the steering gear provides for two adjustments:—

(*a*) Rocker shaft adjustment, this is by means of a stud and locknut on the steering box top cover plate.

(*b*) Steering shaft adjustment, this is by means of shims between the rear face of the steering box and the steering column flange.

The rocker shaft may be adjusted with the steering gear installed in the car, but the gear must be removed to adjust the steering shaft.

Some vehicles, built for certain export territories, are fitted with a new type steering wheel. It consists of a small flat wheel with heavily padded spokes mounted on a collapsible convoluted steel canister which in turn is mounted to the steering column. The convoluted canister is so designed that if the driver were thrown against the steering wheel in an accident, the canister would gradually collapse, thus absorbing most of the impact.

To remove the steering wheel the centre emblem should be prised out of crash padding and a suitable socket and extension or box spanner used to release the securing nut which is recessed at the bottom of the convoluted canister. The steering wheel and canister can then be drawn off the taper splines.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

(*a*) The oil level in the steering box should be checked at the first 1,000 miles (2,000 km.) and at every 6,000 miles (10,000 km.) and, if necessary, topped-up with an approved S.A.E. 90 E.P. oil to the bottom of the combined filler and level plug hole.

DATA

Steering shaft adjustment is by means of shims. Shim details are as follows:—

105E-3592-B ...	...	Paper	0.010 in. (0.254 mm.)
105E-3595-A	...	Steel	0.004 in. (0.102 mm.)
105E-3595-B		Steel	0.010 in. (0.254 mm.)
3014E-3595-A		Steel ...	0.002 in. (0.051 mm.)

TIGHTENING TORQUES

Drop arm nut ...	60 to 80 lb. ft. (8.3 to 11.1 kg.m.)
Steering wheel nut ...	20 to 25 lb. ft. (2.8 to 3.4 kg.m.)
Steering gear to sidemember ...	20 to 25 lb. ft. (2.8 to 3.4 kg.m.)
Steering gear top cover ...	18 to 20 lb. ft. (2.5 to 2.7 kg.m.)
Steering linkage to drop arm	25 to 30 lb. ft. (3.4 to 4.1 kg.m.)

IMPORTANT

Following the completion of any service work normal test procedures should be used to ensure that a satisfactory repair has been performed. In addition, as a precautionary measure:—

Where Fitted

1. Check the Dual Brake warning light by depressing the test switch with the ignition "ON".

On cars fitted with automatic transmission

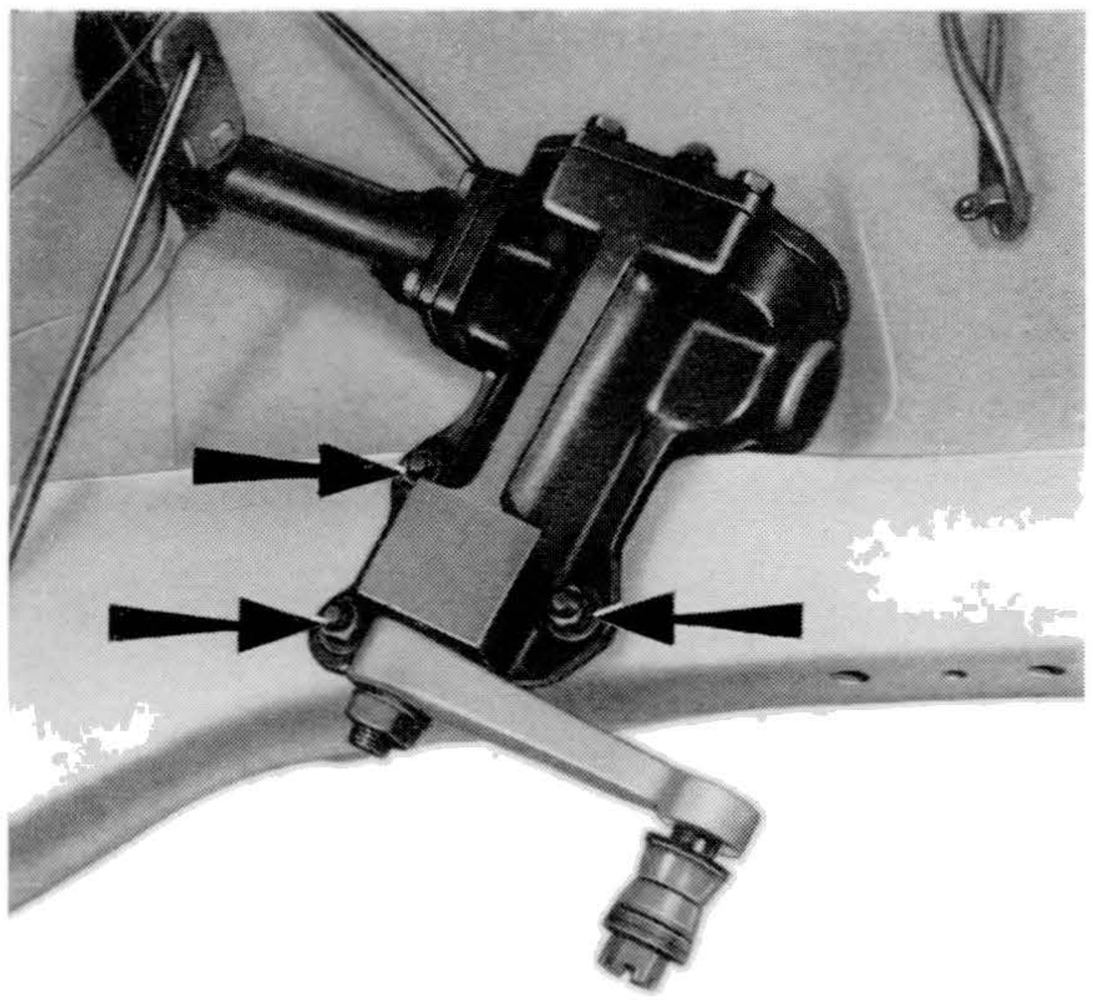
2. Drive the vehicle at 30 m.p.h. in 'D', release the accelerator pedal and as the road speed falls to about 25 m.p.h. select 'L'. Ensure that second gear is engaged with resultant increase in braking effect.
3. With the selector linkage correctly adjusted, check that the starter operates ONLY when 'N' or 'P' is selected and that the back-up lamps operate ONLY when 'R' is selected. (See OP 7007-A sub-operation 38.)

SERVICE AND REPAIR OPERATIONS

OP 3498-A STEERING GEAR ASSEMBLY — REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Prise off the steering wheel centre emblem.
3. Remove the steering wheel retaining nut and lift off the steering wheel.
4. Remove the screws securing the column shrouds together. Separate the shrouds and remove.
5. Disconnect the wires supplying the indicator switch, etc. at the multi-point connector.
6. Remove the indicator switch by undoing the two cross-head screws securing it to the bracket on the column.
7. Roll back the carpet and unscrew the two screws securing the floor plate.
8. Detach the brake pedal return spring from the bracket on the column.
9. Remove the bolt securing the steering column to the pedal bracket and the two bolts securing the top of the column to the underside of the facia and remove the 'U' brackets.
10. Jack up the front of the car and fit chassis stands to the front jacking point.
11. Release the lower end of the drop arm from the drop arm idler arm rod.
12. Undo the three self-locking nuts securing the steering gear assembly to the sidemember. Push out the bolts. Note that there is a flat washer under each nut and under each bolt head.
13. Remove the floor plate and rubber draught excluder by lifting it over the top of the steering column.

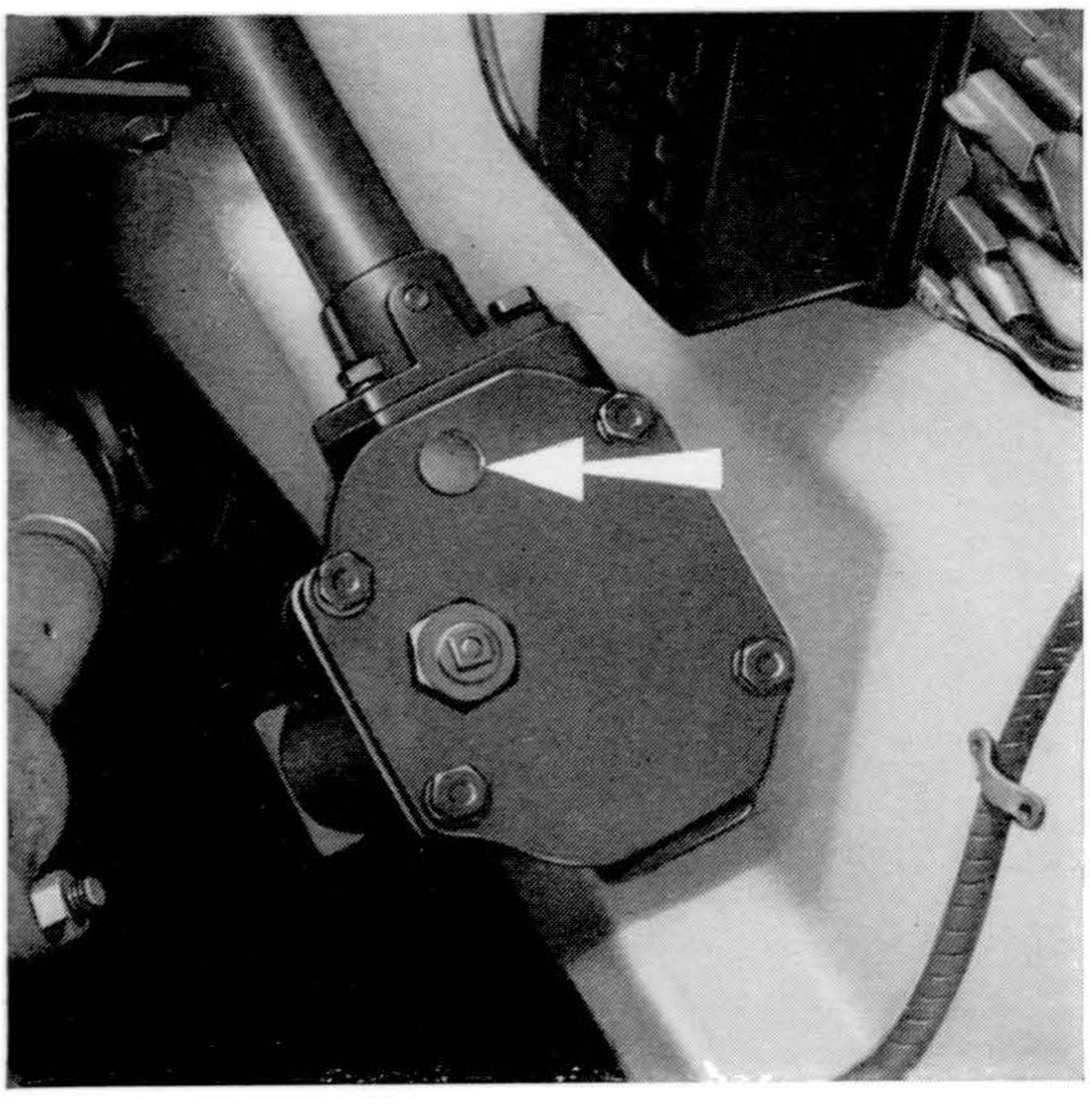


Steering Gear Mounting Bolts

14. On right-hand drive cars remove the steering gear assembly by withdrawing it from beneath the car. On left-hand drive G.T. cars it is necessary to remove the clutch slave cylinder and the air cleaner prior to removing the steering gear, which has to be removed through the top of the engine compartment. During this operation avoid having the steering box above the steering wheel end of the column for long as this allows oil to run down the column and out through the end.
15. Rotate the drop arm so that the steering gear is in the straight-ahead position, note the position of the indicator cancelling cam and then remove it from its spline on the column.

To Install

16. Check that the drop arm is in the straight-ahead position and then tap the indicator cam into place on its spline on the top of the steering shaft. It should be fitted in the same position as that from which it was removed, i.e. with the cam pointing towards the indicator switch.
17. Place the steering gear in position and slide the draught excluder and floor plate over the top of the column.
18. Fit the bolts and locknuts securing the steering gear assembly to the sidemember. Ensure that a flat washer is fitted under each nut and each bolt head. Tighten the bolts to a torque of 20 to 25 lb. ft. (2.8 to 3.4 kg.m.).
19. Assemble the drop arm to the drop arm to idler arm rod. The conical rubber bushes should be lubricated (bore only) prior to assembly. Fit the washer and castellated nut, tighten the nut to a torque of 25 to 30 lb. ft. (3.4 to 4.1 kg.m.). Fit a new split pin.
20. Jack up, remove the stands and lower the car to the ground.
21. Fit the bolt securing the column to the pedal bracket.
22. Locate the 'U' brackets around the column and secure them to the underside of the facia panel.
23. Fit the brake pedal return spring to the bracket on the steering column.



Filler Plug

24. Locate the draught excluder and floor plate in position at the base of the steering column and secure with two screws.
25. Assemble the indicator switch to the bracket on the steering column upper end. Check that the indicator cam is correctly positioned, if necessary, temporarily fit the steering wheel to check that the cam operates the switch properly.
26. Plug the wires supplying the indicator switch into the multi-point connector.
27. Fit the column shrouds, check that they are correctly located and do not foul the steering wheel.
28. Locate the steering wheel on its spline, check that the drop arm is in the straight-ahead position and fit a new nut. Tighten the nut to a torque of 20 to 25 lb. ft. (2.8 to 3.4 kg.m.).
29. Tap the steering wheel motif into place in the steering wheel centre.
30. Reconnect the battery and check the operation of the indicators, horn, etc.
31. Check the steering box oil level and top-up if necessary.

OP 3498-A1 EXTRA: STEERING GEAR — ADJUST
(Includes removing the Steering Gear from the car)

Tools Required

Dial gauge

Pull scale

1. Remove the steering gear from the car, as in OP 3498-A.
2. Remove the four bolts securing the steering column flange to the steering box, drain the lubricant and detach the column. Remove the old shim pack and discard the gaskets.

   NOTE — Be careful not to disturb the steering shaft or bearings.
3. Position a new gasket and two 0.010 in. (0.254 mm.) shims on the rear face of the steering box and fit the steering column, securing it with the four bolts.
4. Using a dial gauge mounted on the top of the steering column, measure the steering shaft end-float.
5. Remove the steering column and withdraw the shim pack.
6. Assemble a new shim pack so that the overall end-float is 0.001 in, (0.025 mm.) and fit it to the steering box and check that the end-float is 0.001 in. (0.025 mm.).
7. Remove the column again and withdraw a 0.004 in. (0.102 mm.) thick shim to give a preload of between 0.002 in. (0.051 mm.) and 0.004 in. (0.102 mm.).
8. Coat the four bolts with a suitable sealer and finally assemble the column to the box.
9. Remove the oil filler plug and pour the correct quantity (420 c.c.) of oil into the box.
10. Fit the steering wheel to the top of the steering shaft and fit the pull scale to the periphery of the steering wheel at its junction with a spoke.
11. Remove the adjusting stud and locknut from the steering box top cover and clean all traces of old sealer from the stud threads.

12. Coat the stud with sealer and assemble it to the steering box. Fit the locknut loosely.
13. Adjust the stud so that an effort of 1¾ to 2 lb. (0.79 to 0.91 kg.) is required on the pull scale to turn the steering wheel from the straight-ahead position.
14. Tighten the locknut and check the adjustment.
15. Replace the steering gear in the car, as in OP 3498-B.

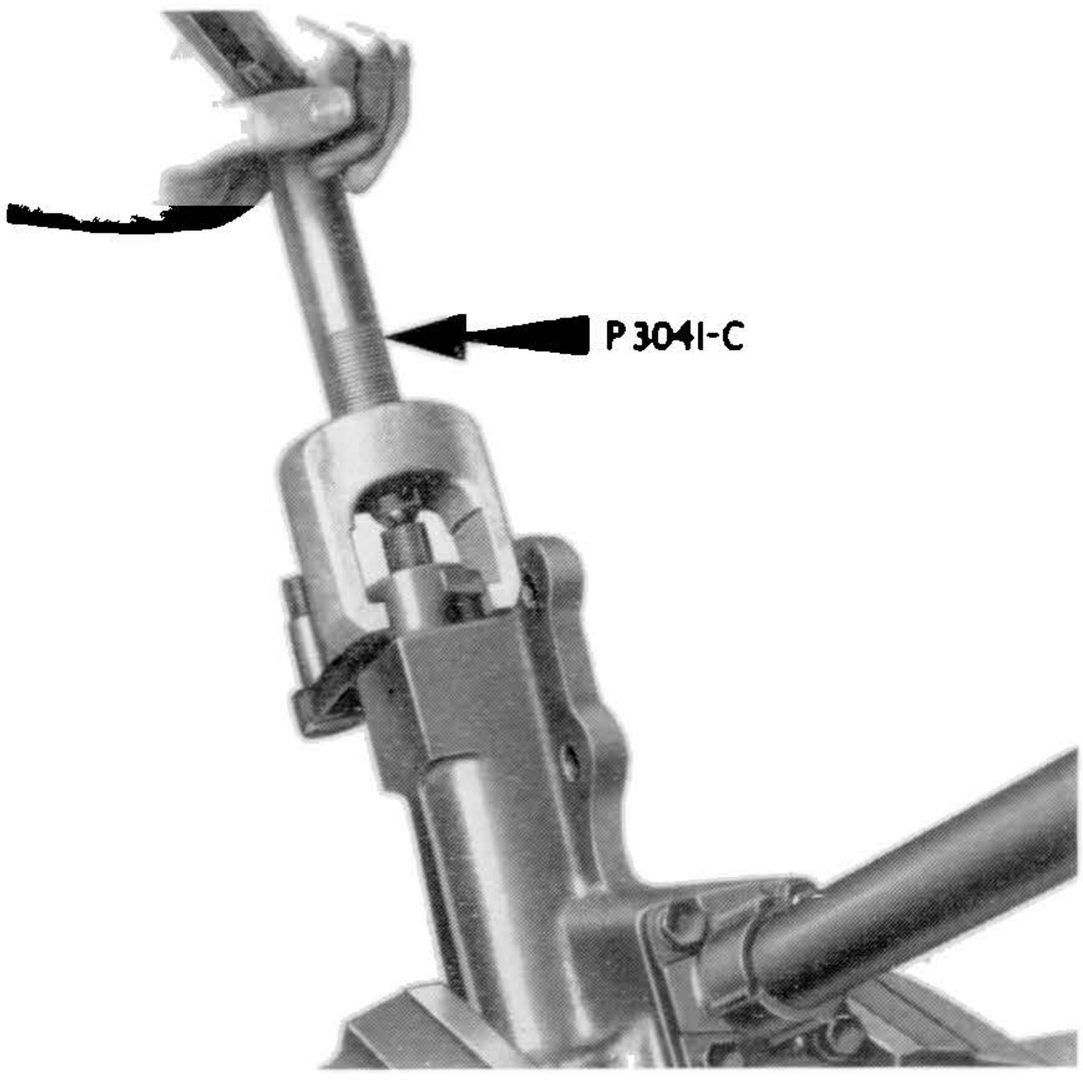
OP 3498-A5 EXTRA: STEERING GEAR — OVERHAUL

Tools Required

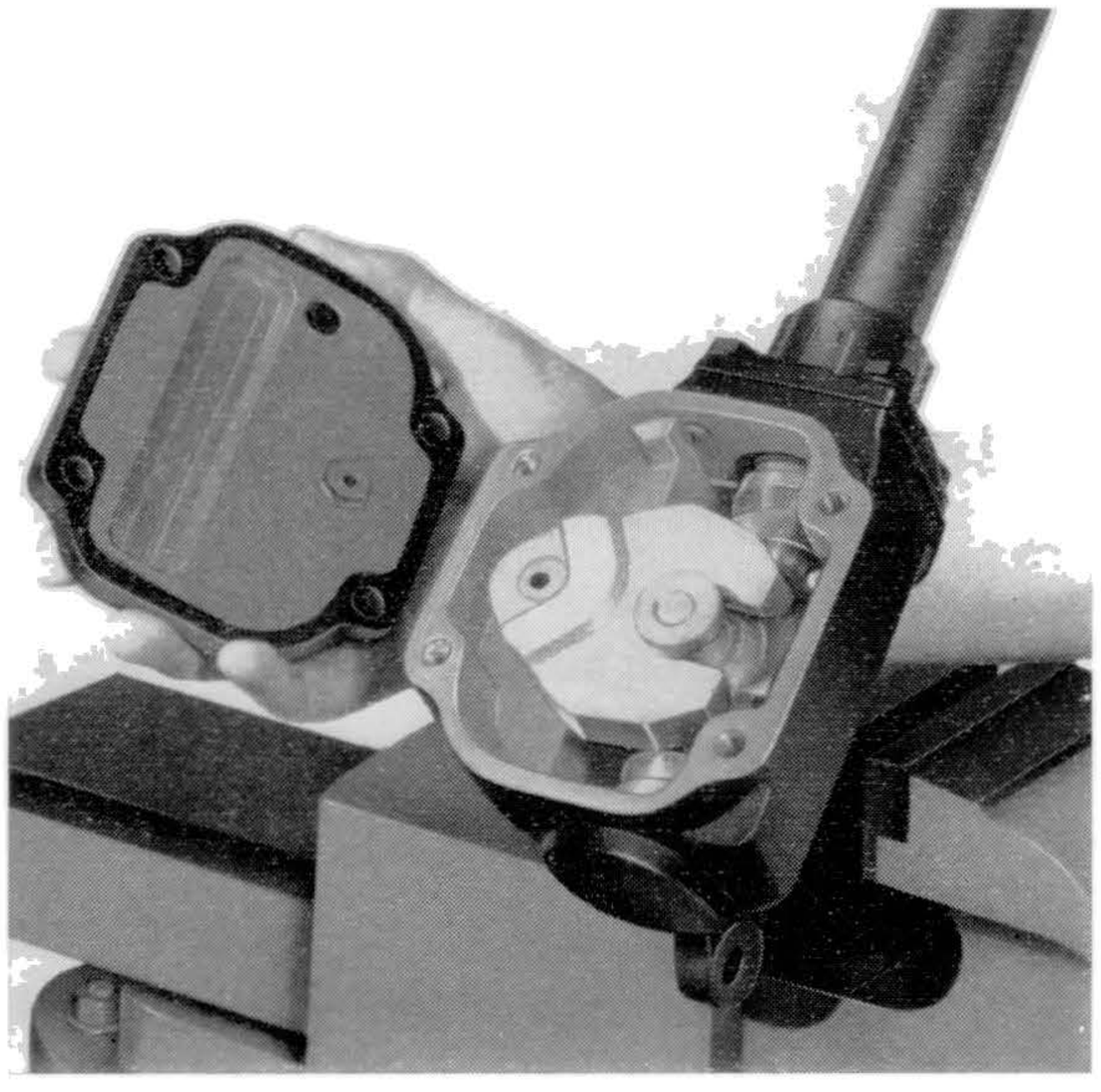
P 3041-C Drop arm remover
P 3087 Steering rocker shaft bush and oil seal replacer
(details 'a' & 'b')
P 3089 Steering rocker shaft bush broaching kit
(details 'a' & 'b')
Pull scale
Dial gauge

To Dismantle

1. If the lubricant has not been drained, remove the rubber filler plug and empty the oil into a suitable waste container.
2. Mark the drop arm and rocker shaft for reference on reassembly, unscrew the retaining nut and remove the washer. Using Tool No. P 3041-C, pull the drop arm off the rocker shaft. If necessary use a hammer on the domed nut to jar the drop arm off. NEVER hammer the drop arm.
3. Remove the four bolts and spring washers and lift off the top cover plate.
4. Detach the roller from the peg on the steering nut and pull out the rocker shaft.



Removing the Drop Arm



Removing the Top Cover

5. Unscrew the four bolts and spring washers securing the steering column flange to the rear face of the steering box. Pull the steering column and flange off the steering shaft and remove the gaskets and shim pack.
6. Withdraw the spacer from the rear of the steering box.
7. Carefully pull the steering shaft rearwards, this will dislodge the upper bearing track and the twelve ball bearings, take care not to lose any. Remove the bearing track and retrieve the balls from both upper and lower bearings.
8. Unscrew the steering nut from the steering shaft and collect the balls contained inside the nut.
9. Remove the steering shaft.
10. Remove the lower bearing track by tapping the rear face of the steering box on a block of wood.
11. Remove and discard the rocker shaft oil seal.
12. Inspect the rocker shaft bush and if it is unserviceable remove it by using a $\frac{3}{8}$ in. B.S.P. tap screwed into the bush and then forcing the tap and bush out of the bore.
13. If necessary, remove the plastic bush from the top of the steering column.
14. Clean all the components and examine all parts for wear, replacing those which appear unserviceable.

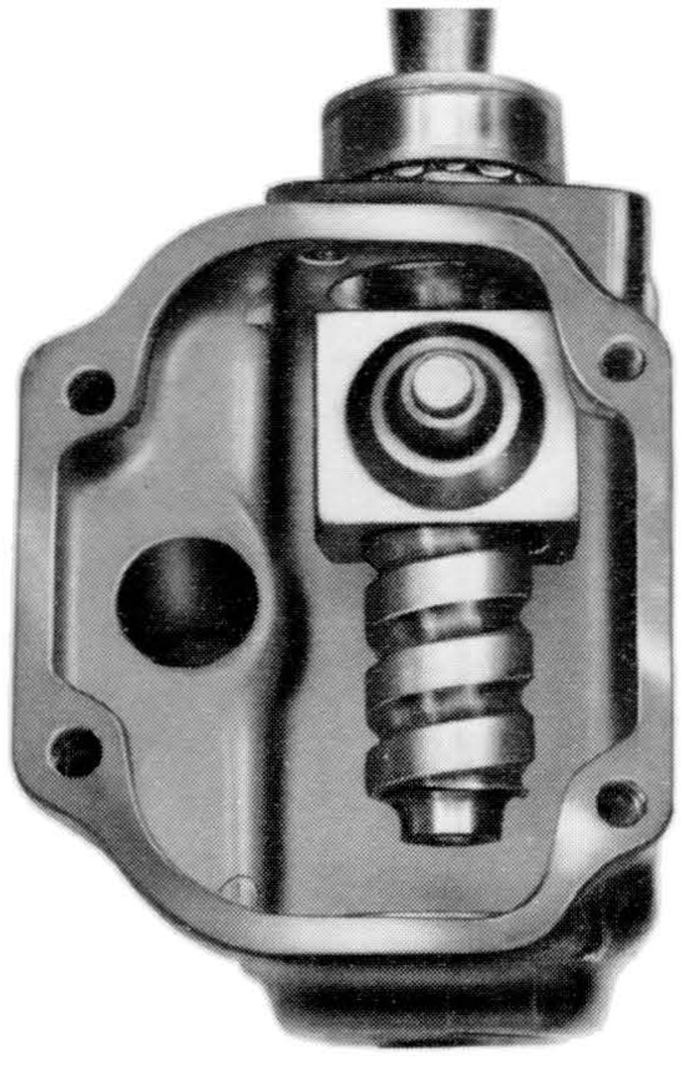
    NOTE — The ball bearings fitted in this gear assembly are not all the same size. Those fitted in the upper and lower steering shaft bearings are $\frac{7}{32}$ in. (5.56 mm.) diameter, while those fitted in the steering nut are $\frac{5}{16}$ in. (7.94 mm.) diameter.

To Reassemble

15. If the rocker shaft bush has been removed, install a new one with the open end of the oil groove facing towards the steering shaft. Tool No. P 3087 should be used to fit the bush using detail 'd' to support the box and detail 'a' to drive the bush into position.

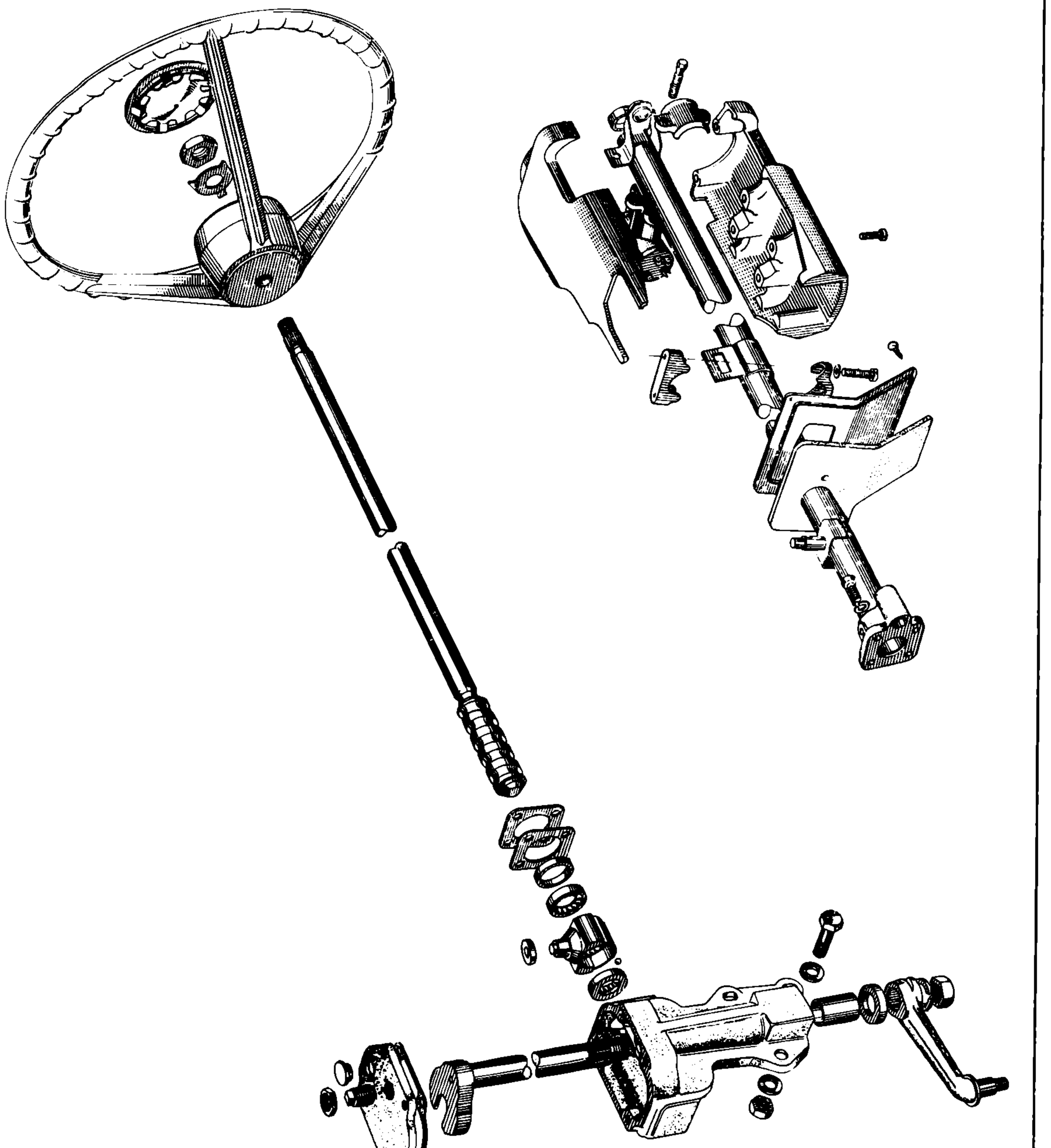
P/9/191/C

The Steering Nut



P/9/193/C

Assembling the Upper Bearing

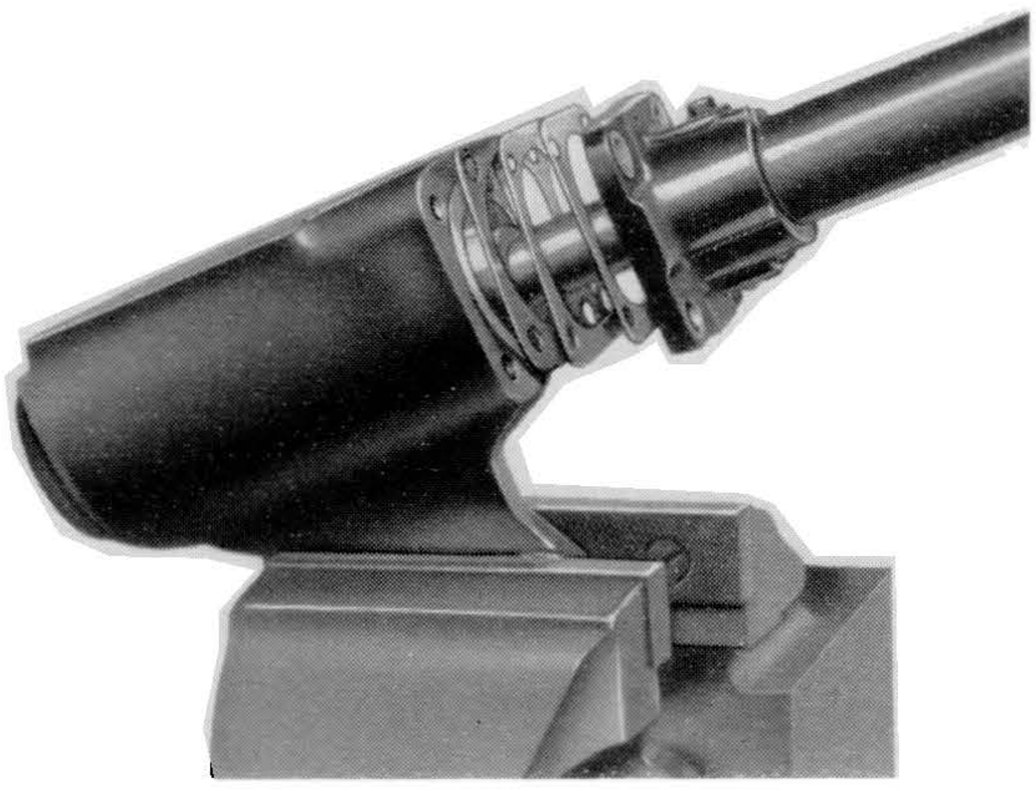


Steering Gear Assembly—Exploded

16. Broach the rocker shaft bush to size using Tool No. P 3089 and details 'a' and 'b'.
17. When the bush is fitted and reamed to size clean the box thoroughly to remove any traces of swarf.
18. Install a new oil seal in the housing using Tool No. P 3087. The sharp inner edge of the seal should be towards the interior of the steering box.
19. Replace the lower bearing track in the housing and retain the $\frac{7}{32}$ in. (5.56 mm.) diameter balls in the track using grease.
20. Assemble the balls into the steering nut using grease to retain them in position.
21. Fit the upper bearing track over the steering shaft and assemble the bearings to it, retaining them with grease.
22. With the housing clamped in a vice, pass the steering shaft into the housing and carefully screw the nut onto the worm.
23. Locate the steering shaft in the lower bearing and carefully push the upper bearing into position behind the worm.
24. If the bearing has been removed from the top of the steering column, replace it in its position after lightly smearing the inside diameter with grease.
25. Fit the spacer behind the upper bearing track and then fit the steering column using new gaskets either side of the original shim pack.
26. Secure the steering column with the four bolts and lockwashers, tighten them gradually whilst rotating the shaft. Any binding indicates that the shim thickness is insufficient.
27. Fit a dial gauge to the top of the column and check the end-float. Obtain an end-float reading of 0.001 in. (0.025 mm.) by adding or removing shims as required.
28. Remove the column again and withdraw a 0.004 in. (0.102 mm.) thick shim to give a preload of between 0.002 in. (0.051 mm.) and 0.004 in. (0.102 mm.).

P 9192 C

Steering Column Plastic Bush



Steering Shaft Shims

29. Coat the four bolts with a suitable sealer and finally assemble the column to the box, tighten the four bolts to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.).

30. Slide the rocker shaft into its bore in the housing and fit the roller so that it engages with the peg on the nut.

31. Fit a gasket to the top face of the steering box and position the cover plate on top. Coat the four bolts with a suitable sealer and secure the cover plate to the housing tightening the bolts to a torque of 18 to 20 lb. ft. (2.5 to 2.7 kg.m.).

32. Fill the steering box with the correct quantity (420 c.c.) of S.A.E. 90 E.P. lubricant.

33. Temporarily fit the steering wheel to the top of the steering shaft and fit a pull scale to the periphery of wheel at its junction with a spoke.

34. Remove the adjusting stud and locknut from the steering box top cover and clean all traces of old sealer from the stud threads. Coat the stud with sealer, assemble it to the cover plate and loosely fit the locknut.

35. Adjust the stud so that an effort of 1¾ to 2 lbs. (0.79 to 0.91 kg.) is required to turn the steering wheel from the straight-ahead position.

36. Tighten the locknut, recheck the adjustment and then remove the steering wheel.

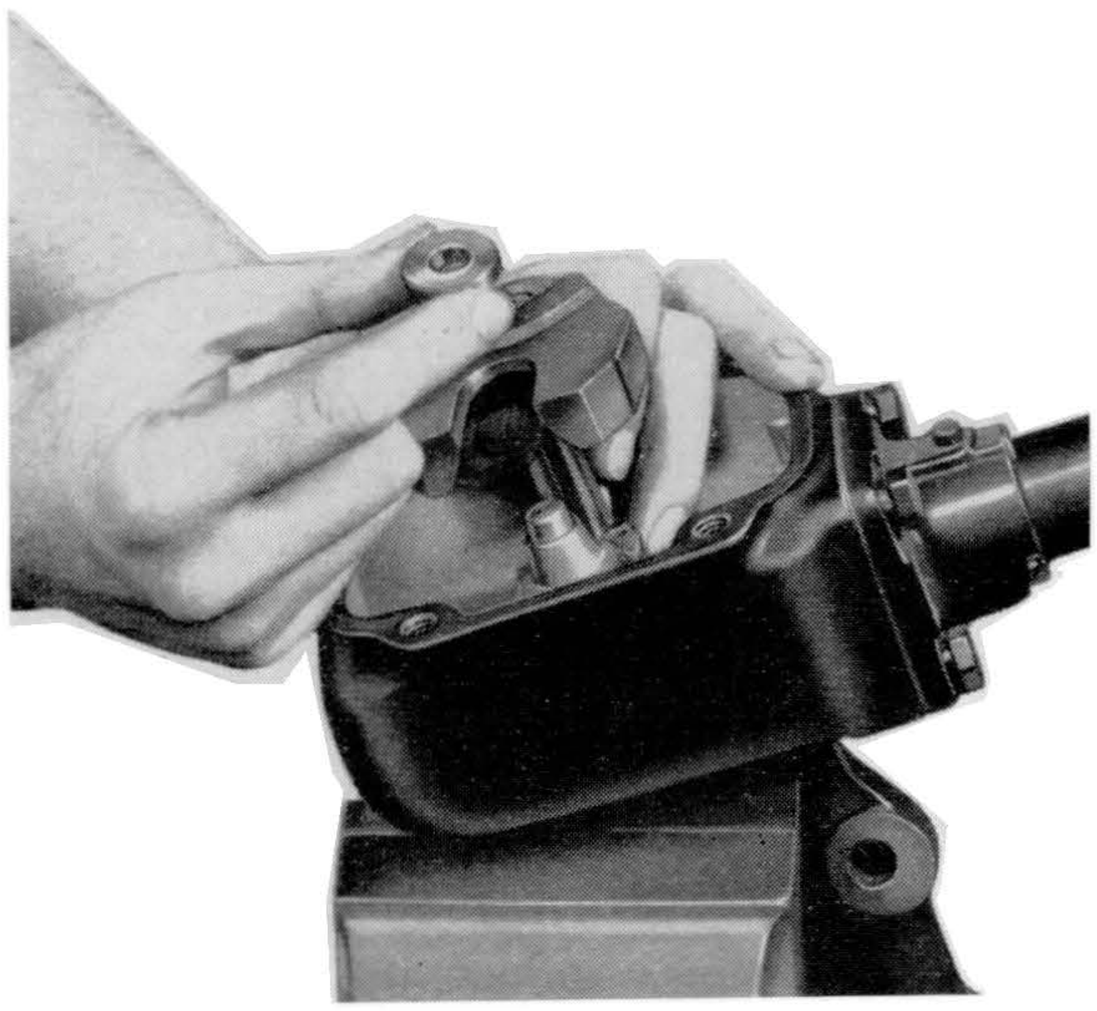
37. Refit the drop arm to the rocker shaft, checking that the mating marks align correctly.

38. Fit the washer and retaining nut. Tighten the nut to a torque of 60 to 80 lb. ft. (8.3 to 11.1 kg.m.).

OP 3498-B STEERING GEAR — ADJUST
(Includes OPS 3498-A and A1)

OP 3498-E STEERING GEAR — OVERHAUL
(Includes OPS 3498-A, A1 and A5)

Measuring the Steering Shaft End-Float



Fitting the Rocker Shaft and Roller

OP 3575-A ROCKER SHAFT PRE-LOAD — ADJUST
(Steering gear in situ)

Tools Required

Pull scale

1. Disconnect the steering linkage from the drop arm by removing the split pin and nut.

2. Centralise the steering gear in the straight-ahead position. The drop arm should point straight ahead, i.e. parallel to the steering shaft.

3. Attach a pull scale to the periphery of the steering wheel at its junction with a spoke.

4. Remove the adjusting stud and locknut from the steering box top cover and clean all traces of old sealer from the stud threads.

5. Coat the stud with sealer and refit it to the steering box. Loosely fit the locknut.

6. Adjust the stud so that an effort of 1¾ to 2 lb. (0.79 to 0.91 kg.) is required on the pull scale to turn the steering wheel from the straight-ahead position.

7. Tighten the locknut and check the adjustment.

8. Reconnect the steering linkage to the drop arm, securing it with a castellated nut. Tighten the nut to a torque of 25 to 30 lb. ft. (3.4 to 4.1 kg.m.) and fit a new split pin.

OP 3590-A DROP ARM — REMOVE AND INSTALL

Tools Required

P 3041-C Drop arm remover

To Remove

1. With the handbrake applied, jack up the car and fit stands.

2. Remove the split pin and castellated nut and detach the drop arm from the drop arm to idler arm rod.

3. Mark the drop arm and rocker shaft for reference on reassembly and remove the retaining nut and washer. Using Tool No. P 3041-C, pull the drop arm off the rocker shaft. If necessary a hammer can be used on the domed part of the tool to jar the drop arm off. NEVER hammer the drop arm.

To Install

4. Refit the drop arm to the rocker shaft spline checking that the mating marks align correctly.

5. Fit the washer and retaining nut. Tighten the nut to a torque of 60 to 80 lb. ft. (8.3 to 11.1 kg.m.).

6. Reconnect the steering linkage to the drop arm securing it with a castellated nut. Tighten the nut to a torque of 25 to 30 lb. ft. (3.4 to 4.1 kg.m.) and fit a new split pin.

OP 3591-A ROCKER SHAFT OIL SEAL — REMOVE AND INSTALL
(Steering gear in situ)

Tools Required

P 3041-C Drop arm remover

P 3085 Rocker shaft oil seal replacer (in situ)

To Remove

1. Disconnect the steering linkage from the drop arm by removing the split pin and nut and detaching the drop arm from the drop arm to idler arm rod.
2. Centralise the steering gear in the straight-ahead position and mark the drop arm and the rocker shaft for reference on reassembly.
3. Remove the retaining nut and washer and, using Tool No. P 3041-C, pull the drop arm off the rocker shaft. If necessary, a hammer can be used on the domed part of the tool to jar the drop arm off. NEVER hammer the drop arm.
4. Using a suitable pointed instrument, lever the existing oil seal out of the recess in the steering gear housing.

To Install

5. Install a new oil seal in the housing, using Tool No. P 3085. The sharp inner edge of the seal should be towards the interior of the steering box.
6. Refit the drop arm to the rocker shaft, checking that the mating marks align correctly.
7. Fit the washer and retaining nut. Tighten the nut to a torque of 60 to 80 lb. ft. (8.3 to 11.1 kg.m.).
8. Reconnect the steering linkage to the drop arm securing it with a castellated nut. Tighten the nut to a torque of 25 to 30 lb. ft. (3.4 to 4.1 kg.m.) and fit a new split pin.
9. Check the steering box oil level and top-up if necessary.

OP 3600-A STEERING WHEEL AND/OR INDICATOR CAM — REMOVE AND INSTALL

To Remove

1. Set the road wheels in the straight-ahead position.
2. Prise off the steering wheel centre emblem.
3. Remove the steering wheel retaining nut.
4. Remove the steering wheel.
5. Note the position of the lobe on the indicator cancelling cam and pull the cam off its spline.

To Install

6. Replace the cancelling cam ensuring that the cam lobe is midway between the cancelling "fingers" with the road wheels in the straight-ahead position. The cam should be pushed onto its spline until a clearance of $\frac{1}{10}$ in. (2.5 mm.) exists between the lower face of the cam and the top of the steering column.

7. Replace the steering wheel in the straight-ahead position.
8. Fit a new retaining nut onto the steering shaft.
9. Tighten the steering wheel nut to a torque of 20 to 25 lb. ft. (2.8 to 3.4 kg.m.).
10. Tap the steering wheel centre emblem into position.

Wheel alignment figures quoted relate only to cars with standard suspension. If Heavy Duty suspension is fitted, refer to the appropriate figures in the Quick Reference Data.

1. Position the car with the front wheels on locked turntables and the rear wheels on wooden blocks so that the car is level.

2. Unlock the turntables.

3. Attach the alignment gauge to the left-hand front wheel. Level the gauge until the bubble aligns with the zero on the camber gauge.

4. Turn the gauge through 90° and read off the camber (1° 00′ to 2° 30′).

5. Turn the road wheel onto 20° back lock, turn the gauge through 90° (i.e. normal to the wheel) and align the zero on the castor scale with the bubble. Turn the road wheel onto 20° front lock and read the castor off the scale (—0° 59′ to +0° 36′).

6. Fit the pedal depressor to lock the brakes. Turn the road wheel onto 20° back lock and, with the gauge parallel to the wheel, align the zero on the k.p.i. scale with the bubble. Turn the road wheel onto 20° front lock and read off the king pin inclination (6° 23′ to 7° 53′).

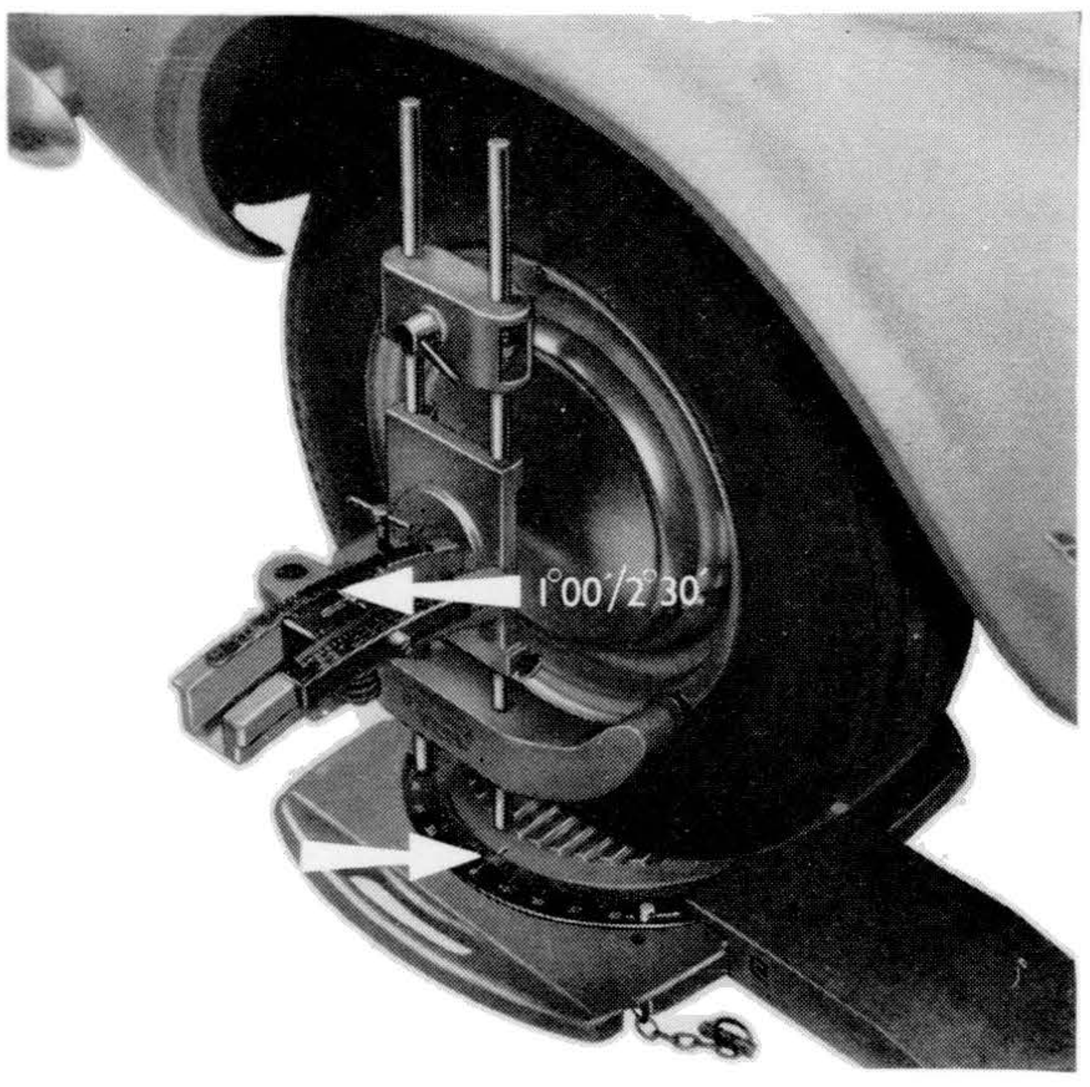
7. Fit the gauge to the right front wheel and repeat operations 3, 4, 5 and 6. Remove the pedal depressor.

The castor, camber and king pin inclination angles are not adjustable, but the following points should be checked in cases where the actual reading differs from that specified.

Incorrect Castor Angle

Check that the stabiliser bar "U" clamps are secure and that the "U" clamp retaining bolts are tight.

Zeroing the Gauges



Checking the Camber Angle

Incorrect Camber or King Pin Inclination Angles

If the king pin inclination angle is correct, but the camber angle is wrong the wheel spindle should be checked for distortion.

If the king pin inclination and the camber angles are both wrong, check the track control arm for distortion and the track control arm ball joint for looseness and excess wear. The track control arm to crossmember mounting should also be checked for wear and distortion.

Group Operations

OP 3000-B FRONT WHEEL TOE-IN AND WHEEL LOCK ANGLES — ADJUST
(Includes OPS 3000-A and A1)

OP 3000-C FRONT WHEEL ALIGNMENT — CHECK
(Includes OPS 3000-A and A2)

OP 3000-D FRONT WHEEL ALIGNMENT — CHECK AND ADJUST
(Includes OPS 3000-A, A1 and A2)

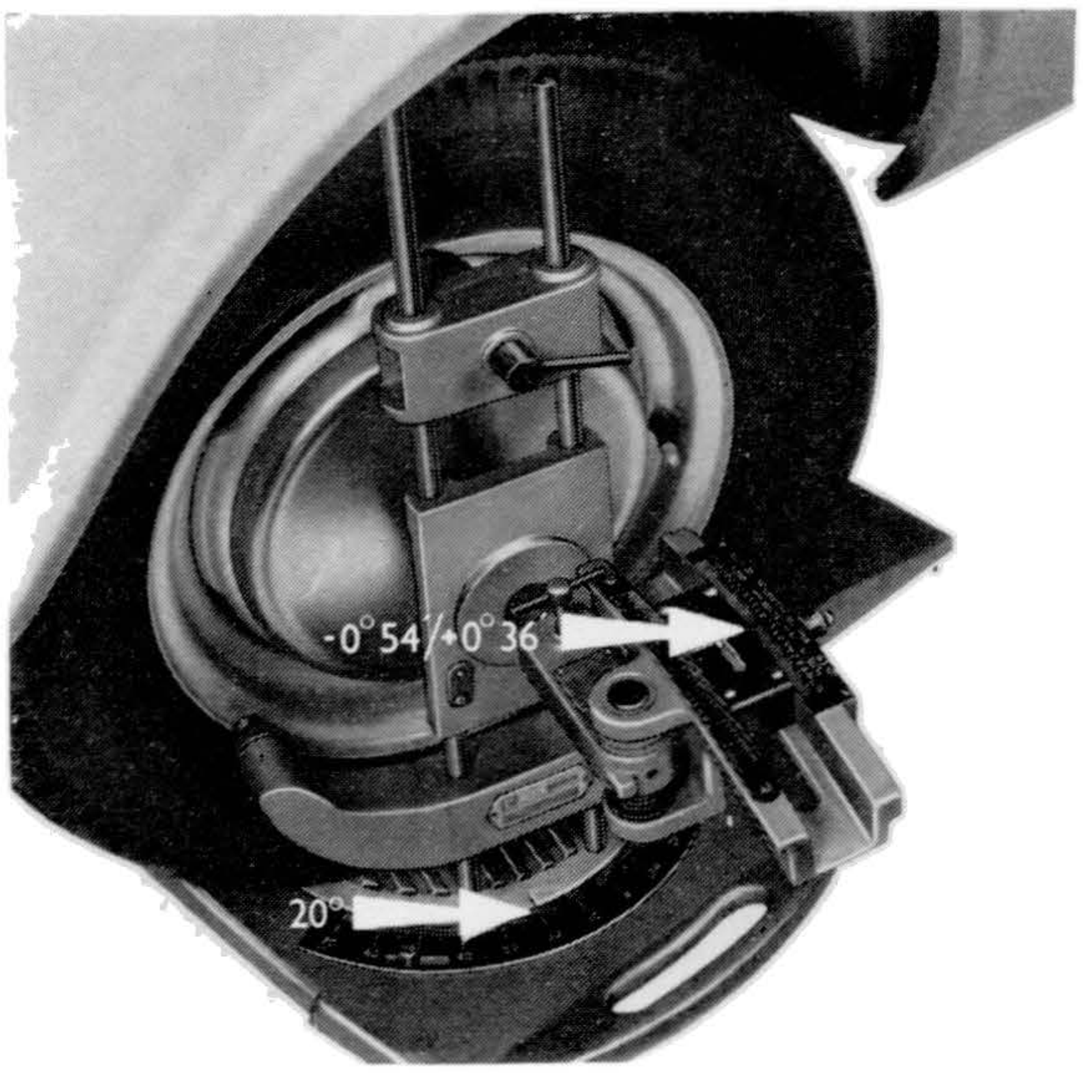
OP 3289-A TRACK ROD END — ONE — RENEW
(Includes setting toe-in)

Tools Required

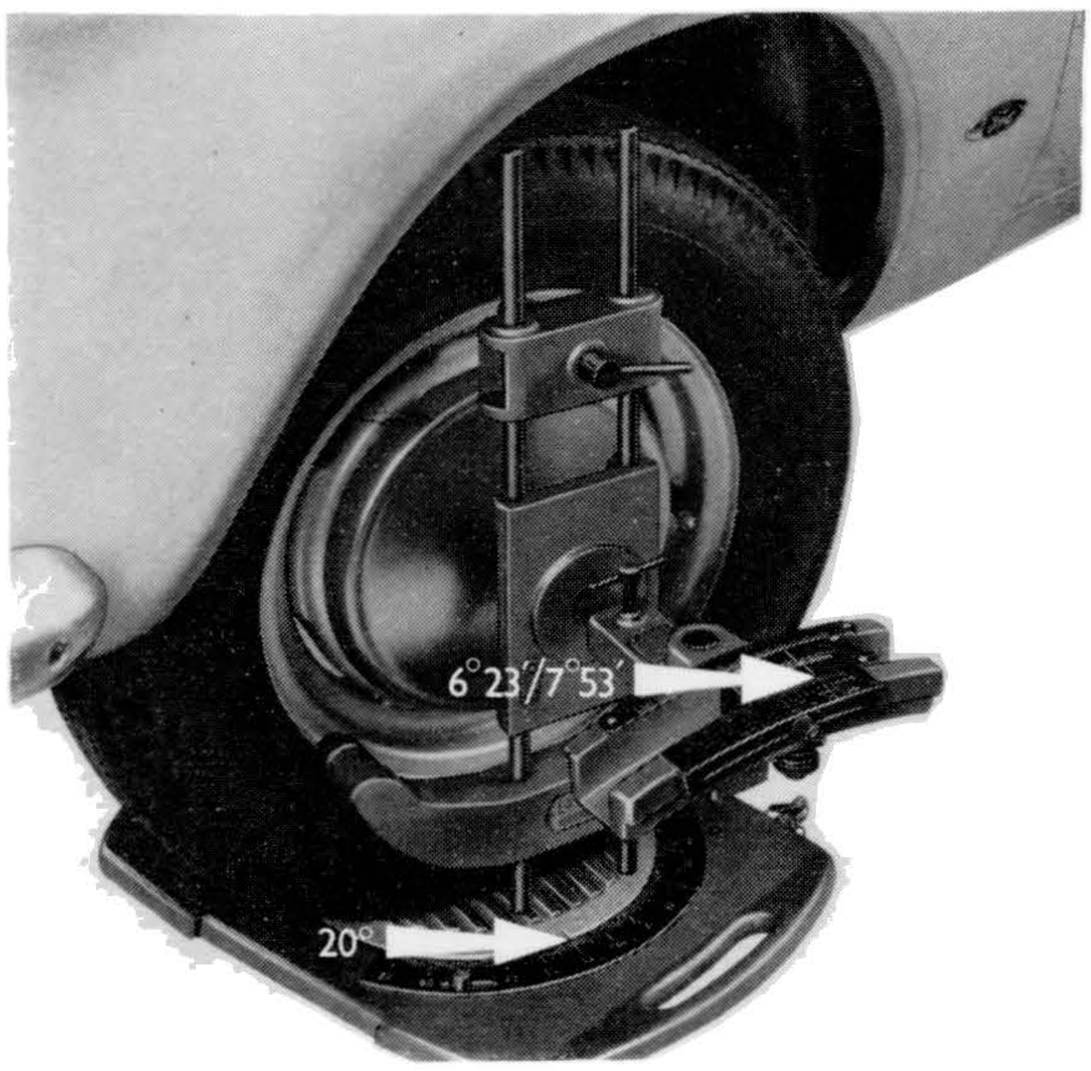
P 3073-9 Steering joint taper separator
Track gauge

To Remove

1. With the handbrake applied, jack up the front of the car and fit stands under the body jacking points.
2. Remove the split pin and nut securing the track rod end to either the steering arm or the drop arm to idler arm rod.



Checking the Castor Angle



Checking the King Pin Inclination

3. Break the taper joint using the separator Tool No. P 3073-9.

4. Slacken the track rod clamp and unscrew the end, noting the number of turns required to free it from the sleeve.

To Install

5. Screw the new end into the sleeve, using the same number of turns as was required to remove the old track rod end.

6. Position the clamp against the indentation on the connecting sleeve, align the clamp slots with the slots in the sleeve and nip the clamp bolts, do not fully tighten at this stage.

7. Assemble the track rod to either the steering arm or the drop arm to idler arm rod. Tighten the castellated nut to a torque of 18 to 22 lb. ft. (2.5 to 3.0 kg.m.) and fit a new split pin.

8. Remove the stands and lower the car to the ground.

9. Check the toe-in and adjust if necessary.

10. Tighten the track rod clamp bolt to a torque of 15 to 18 lb. ft. (2.1 to 2.4 kg.m.).

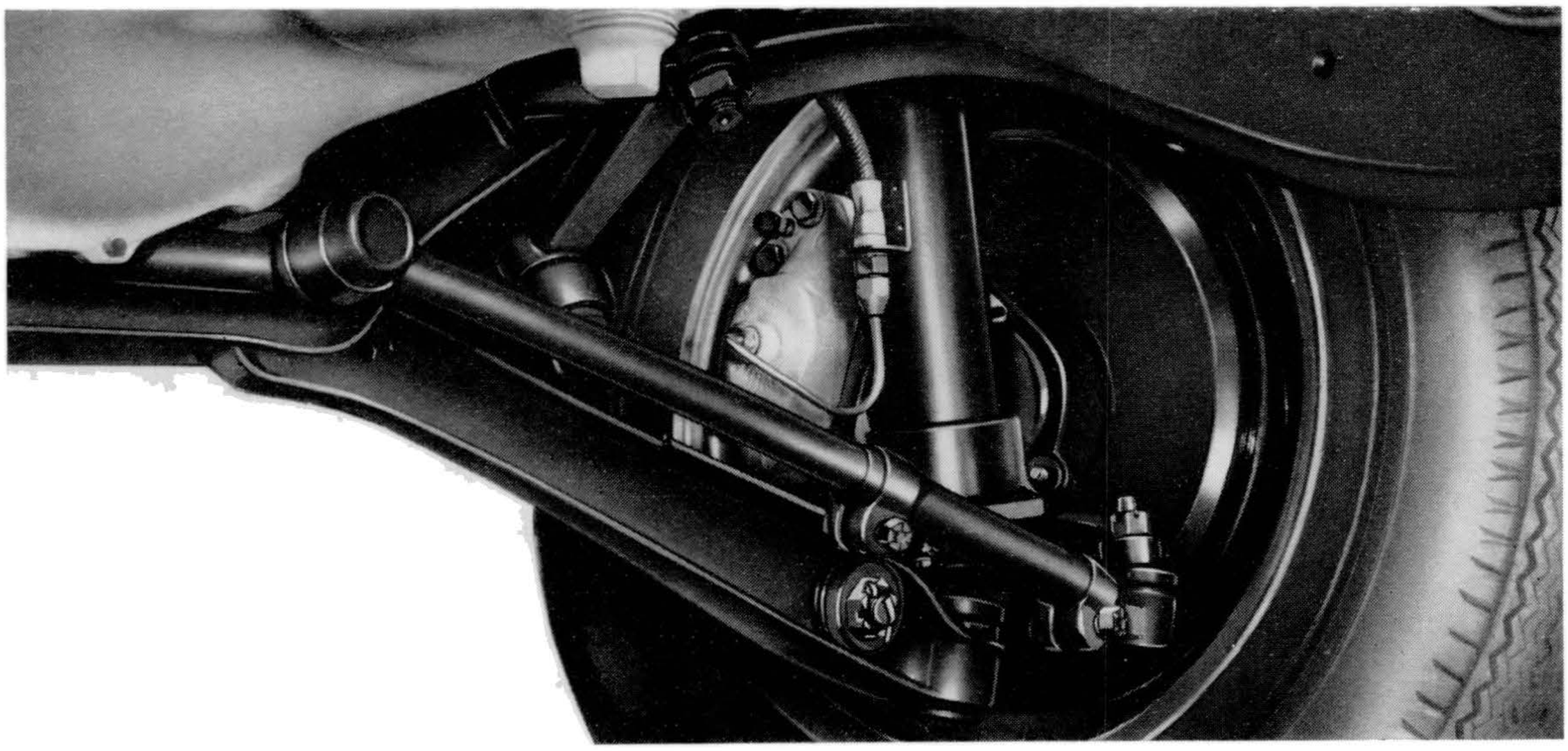
OP 3289-A1 EXTRA: SECOND TRACK ROD END (Same side) — RENEW

To Remove

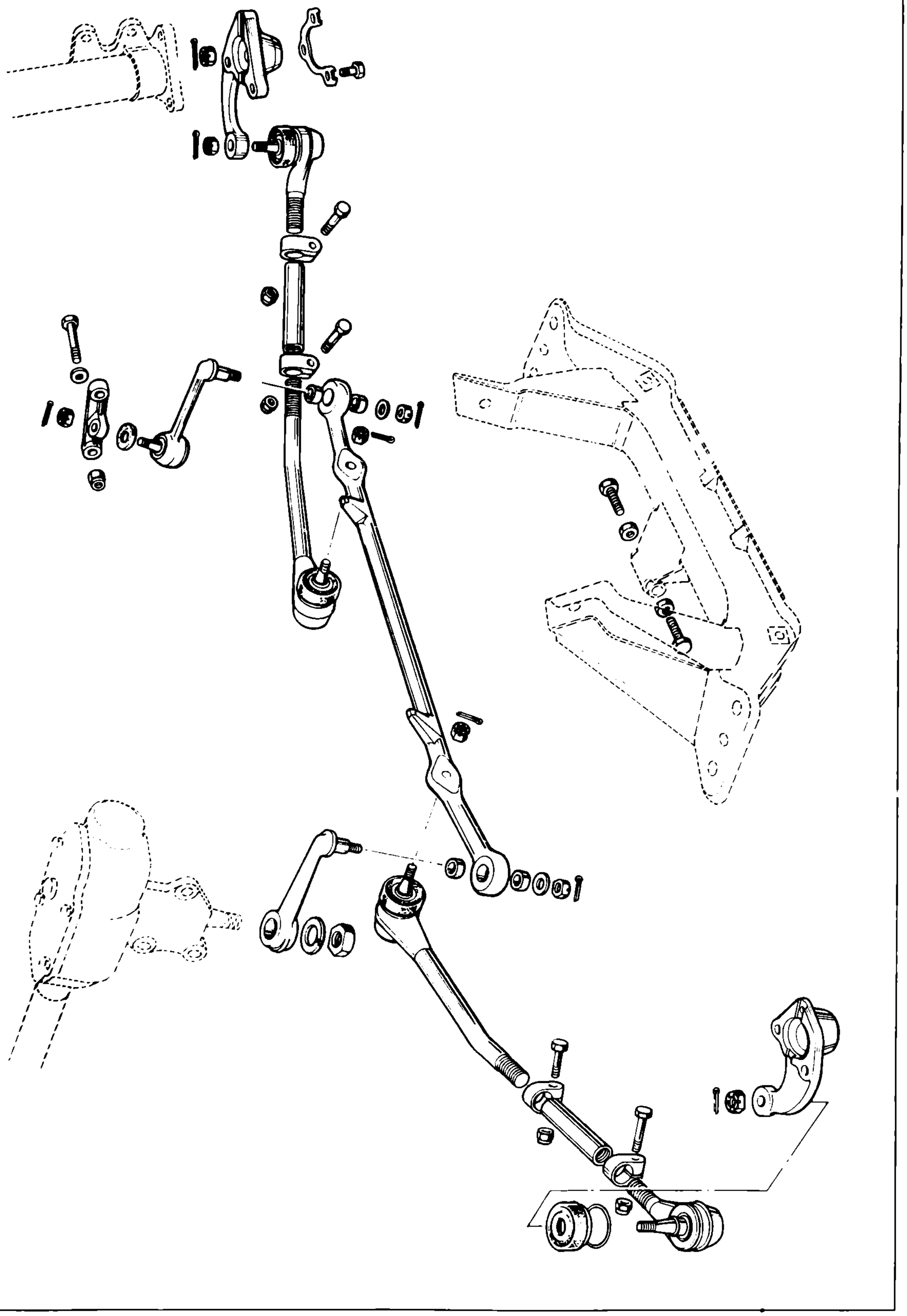
1. Remove the split pin and nut and detach the other track rod end.

To Install

2. Reconnect the track rod end and fit the retaining nut tightening it to a torque of 18 to 22 lb. ft. (2.5 to 3.0 kg.m.). Fit a new split pin.



Steering Linkage (one side)



The Steering Linkage—Exploded

OP 3289-B TRACK ROD ENDS — ALL — RENEW
(Includes adjusting toe-in and back lock angles)

Tools Required

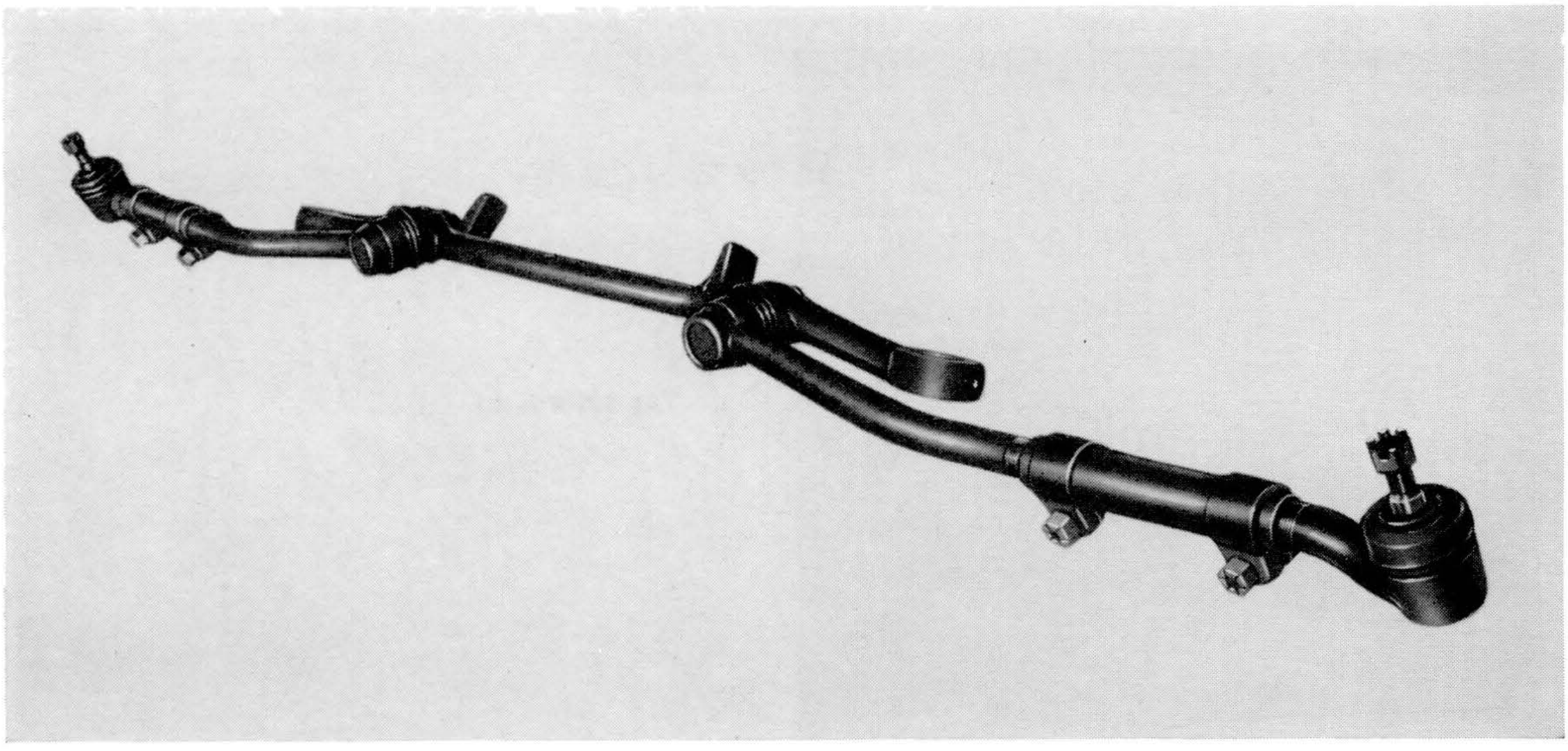
P 3073-9 Steering joint taper separator
Tracking gauge
Turntables

To Remove

1. With the handbrake applied, jack up the front of the car and fit chassis stands.
2. Remove the split pins and nuts and detach the track rod assemblies from the steering arms and the drop arm to idler arm rod.
3. Slacken the connecting sleeve clamps and unscrew the track rod ends, noting the number of turns required to release them.

To Install

4. Screw new track rod ends into the connecting sleeve using the same number of turns as was required to remove the old ends. Position the clamps against the indentations and nip the bolts.
5. Reconnect the track rods to the steering arms and to the drop arm to idler arm rod. Secure with new castellated nuts, tighten the nuts to a torque of 18 to 22 lb. ft. (2.5 to 3.0 kg.m.) and fit new split pins.
6. Jack up the car, remove the chassis stands and lower the car to the ground.
7. Using the tracking gauge check and if necessary adjust the toe-in to within 0.10 to 0.20 in. (2.5 to 5.1 mm.).



Drop Arm to Idler Arm Rod and Track Rods

8. Position the car on turntables and set the calibration scales.
9. Turn the front wheels so that a 35° back lock angle is obtained on one wheel and then read off the front lock angle on the other wheel. This should be within 32° 15′ to 33° 15′.
10. Repeat this operation for the other steering lock.
11. If these are incorrect or unequal, alter the track rod lengths by releasing the clamps and turning the connecting sleeves. Each track rod sleeve must be turned the same amount.
12. Drive the car off the turntables and recheck the toe-in adjustment.
13. Reposition the car on turntables and recheck the wheel lock angles.

    NOTE — If either the wheel lock angles or the toe-in is adjusted, then both the toe-in and the wheel lock angles must be rechecked when the adjustment is completed.
14. Tighten the track rod clamp bolts.

OP 3301-A DROP ARM TO IDLER ARM ROD — RENEW

Tools Required

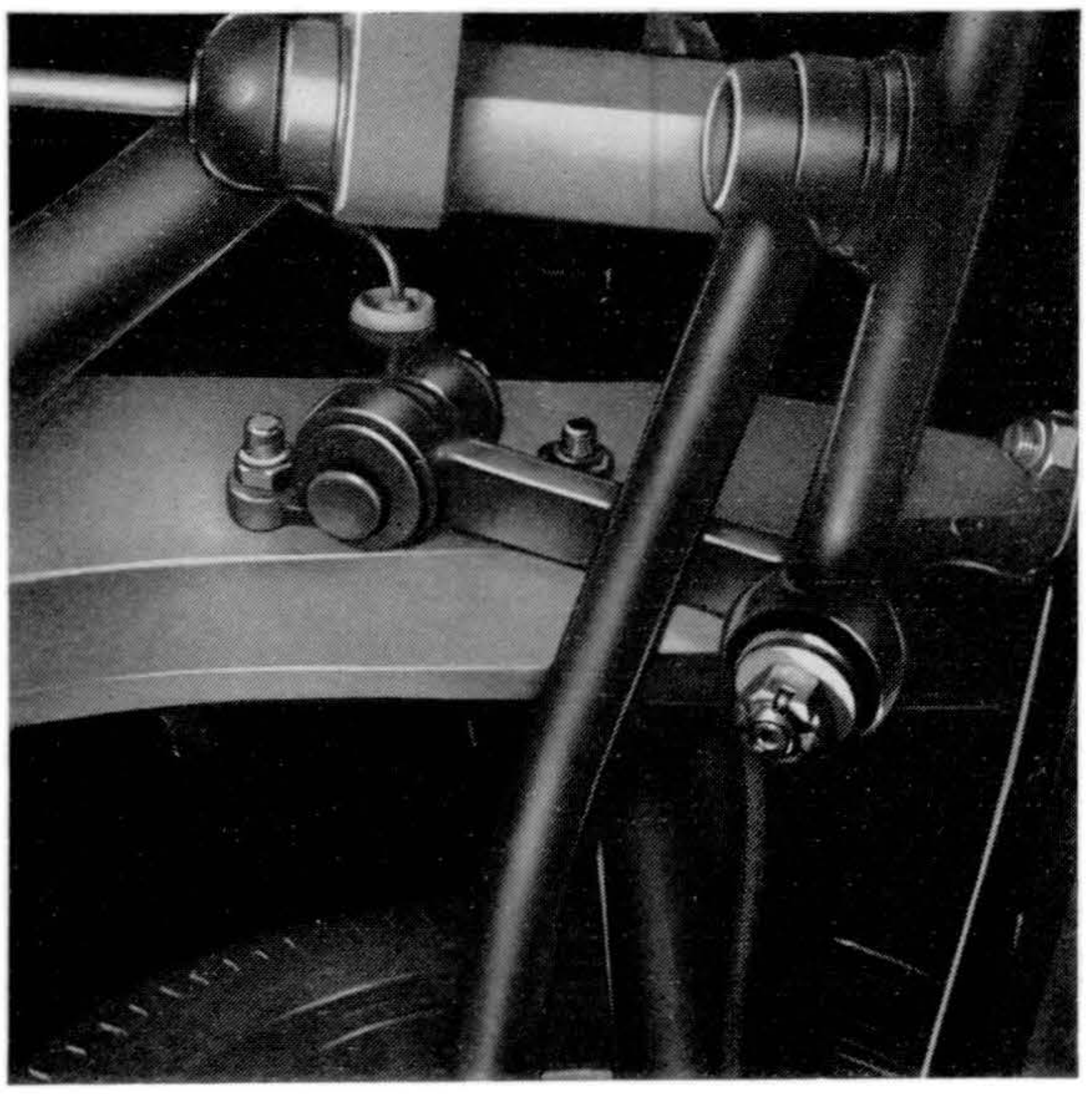
P 3073-9 Steering joint taper separator
Tracking gauge

To Remove

1. With the handbrake applied, jack up the front of the car and fit chassis stands.
2. Disconnect both track rods from the drop arm to idler arm rod, using Tool No. P 3073-9 after removing the split pins and nuts.
3. Remove the split pins, nuts and washers and detach the drop arm and idler arm, remove the drop arm to idler arm rod.

To Install

4. Replace the drop arm to idler arm rod using new bushes lubricated with lithium based grease and reconnect it to the idler arm and the drop arm. Replace the nuts, tighten them to a torque of 25 to 30 lb. ft. (3.5 to 4.1 kg.m.) and fit new split pins.



The Idler Arm

5. Reconnect the track rods to the drop arm to idler arm rod securing them with the castellated nuts, tighten them to a torque of 18 to 22 lb. ft. (2.5 to 3.0 kg.m.) and fit new split pins.
6. Remove the stands and lower the car to the ground.
7. Using the track gauge, check that the toe-in is 0.10 to 0.20 in. (2.5 to 5.1 mm.).

OP 3351-A IDLER ARM — RENEW

To Remove

1. With the handbrake applied, jack up the front of the car and fit stands.
2. Remove the split pin, nut and washer and detach the idler arm from its bracket on the sidemember.
3. Remove the split pin, nut and washer and detach the idler arm from the drop arm to idler arm rod. Retrieve the polyurethane bushes.

To Install

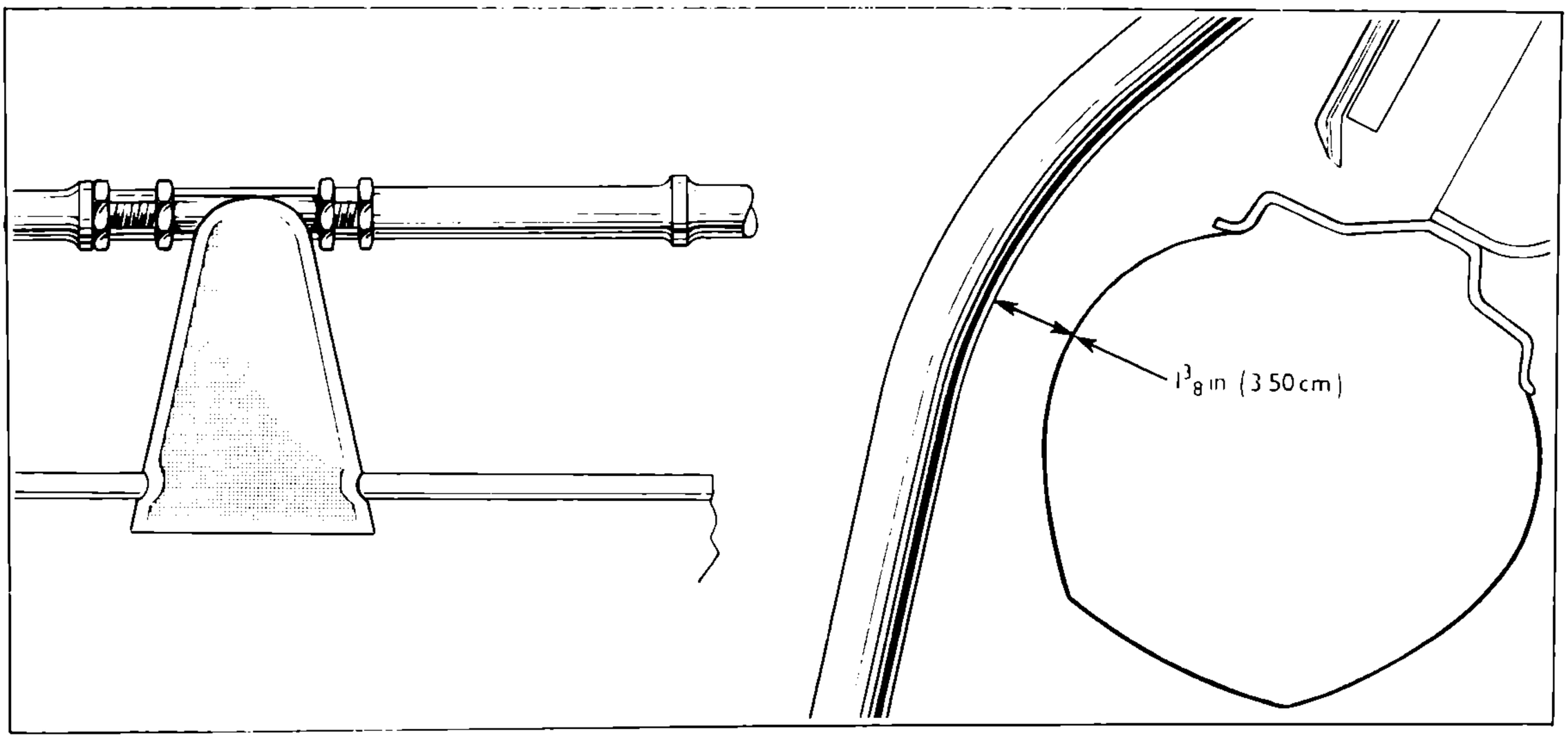
4. Lubricate the bores of the polyurethane bushes with a lithium base grease and assemble the idler arm to the drop arm to idler arm rod. Fit the washer and nut, tighten the nut to a torque of 25 to 30 lb. ft. (3.5 to 4.1 kg.m.) and fit a new split pin.
5. Reconnect the idler arm to its bracket on the sidemember. Retain with a castellated nut, tighten the nut to a torque of 25 to 30 lb. ft. (3.5 to 4.1 kg.m.) and fit a new split pin.
6. Jack up, remove the stands and lower the car to the ground.

OP 3535-A STEERING LOCK STOPS —ADJUST

Tools Required

Turntables

1. Drive the car onto turntables, slacken the locknuts on both steering stop bolts and screw the bolts inwards towards the centre-line of the car.



Steering Lock Stop Adjustment

2. Turn one road wheel until the minimum clearance between the tyre sidewall and the stabiliser bar is 1½ in. (3.81 cm.) with 5.20 tyres or 1⅜ in. (3.5 cm.) with 5.60 tyres.

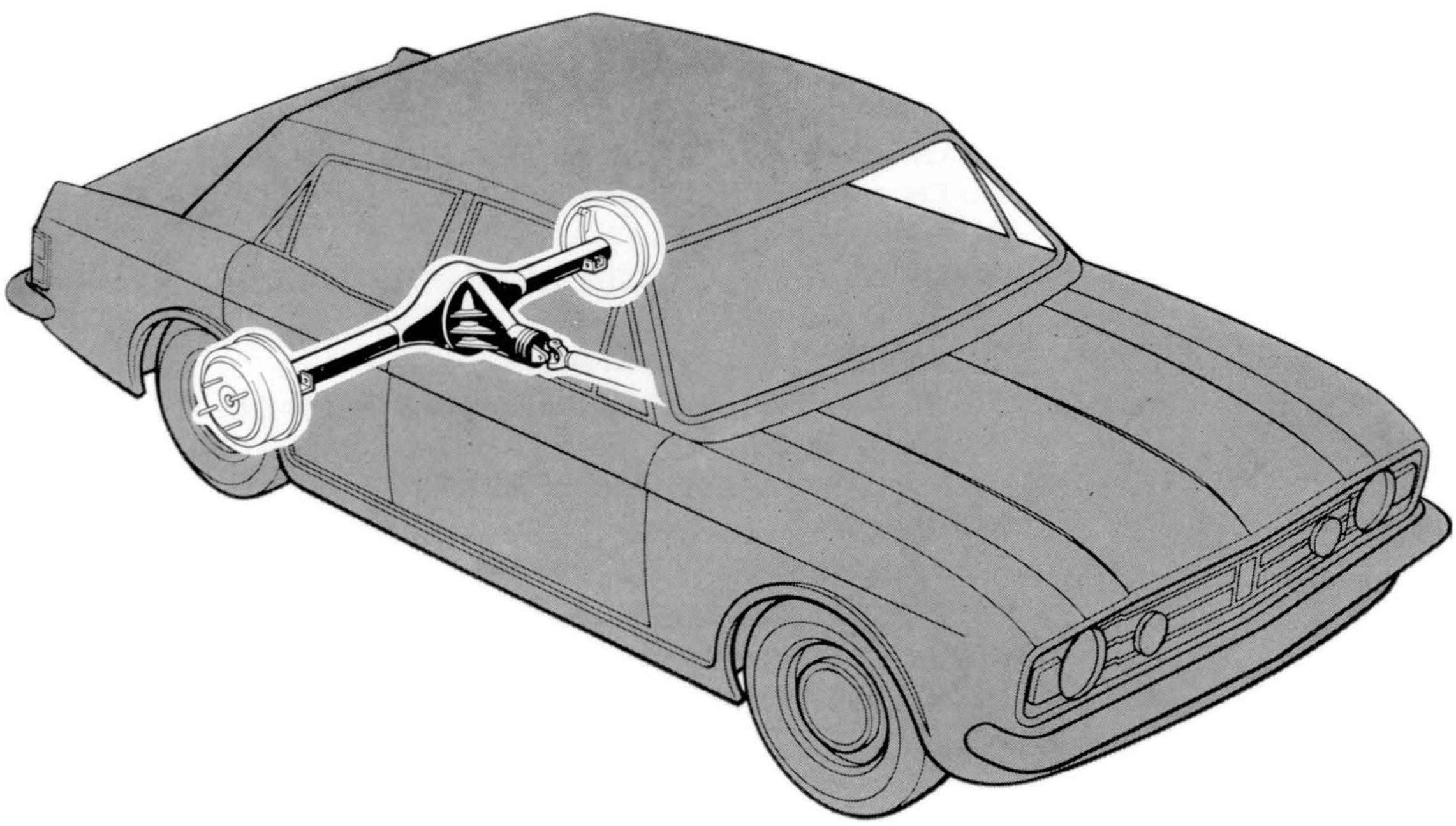
3. Adjust the appropriate steering stop bolt so that it contacts the lug on the drop arm to idler arm rod and tighten the locknut.

4 & 5. Repeat operations 2 and 3 for the other road wheel.

6. Recheck the adjustments.

4

REAR AXLE



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,,	4676-A	DRIVE PINION OIL SEAL – RENEW (Includes remove and adjust differential assembly)
,,	4676-B	**DRIVE PINION OIL SEAL – RENEW (DIFFERENTIAL ASSEMBLY IN SITU)** (Comprises OPS 4602-A and A2)

GENERAL DESCRIPTION

The rear axle is of the conventional semi-floating type with a hypoid crownwheel and pinion, and a two-pinion differential.

A one-piece tubular driveshaft is splined to the gearbox output shaft, and transmits drive through two universal joints to the differential pinion flange.

The differential pinion runs in two taper roller bearings which are pre-loaded by collapsing a tubular spacer set between them. The pinion depth of mesh with the crownwheel is controlled by selective spacers between the pinion head and the rear bearing.

The crownwheel is bolted to the differential case and runs on two taper roller bearings.These bearings are pre-loaded by spreading the differential carrier.

The drive is taken by way of a two-pinion differential to the axle shafts. The assembly is bolted to the front face of the axle casing.

The axle shafts are splined to the differential pinion gears, and supported at the outer ends by ball races with built-in oil seals fitted in the axle casing.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

At first 600 miles (1,000 km.)

Check and top-up oil level

At first 3,000 miles (5,000 km.) and every subsequent 6,000 miles (10,000 km.)

Check and top-up oil level

If a new crownwheel and pinion are fitted, special running-in oil must be used to fill the axle, which must be run-in for at least 600 miles (1,000 km.).

DATA

Model	*Axle Ratio*	*Number of Teeth*	
		Crownwheel	*Pinion*
1,300 c.c.—standard	4.125 : 1	33	8
—optional	4.444 : 1	40	9
1,600 c.c.—standard	3.889 : 1	35	9
—optional	4.125 : 1	33	8
G.T. ...	3.889 : 1	35	9

Oil capacity	2.0 Imp. pints (2.4 U.S. pints, 1.1 litres)
Grade of lubricant ...	... S.A.E. 90 Hypoid
Initial fill lubricant	... ... EM-2C-29
Crownwheel and pinion backlash	0.005 to 0.007 in. (0.13 to 0.18 mm.)
*Pinion bearing pre-load ...	... 20 to 26 lb. in. (0.23 to 0.30 kg.m.) including oil seal drag
	13 to 19 lb. in. (0.15 to 0.22 kg.m.) excluding oil seal drag
Pinion bearing shims (selective) ...	0.1304 to 0.1453 in. (3.312 to 3.691 mm.)
*Differential bearing pre-load (cap spread)	0.008 to 0.010 in. (0.20 to 0.25 mm.)
Differential pinion thrust washer thickness ...	0.030 to 0.032 in. (0.76 to 0.81 mm.)

Tightening Torques, lb. ft. (kg.m.)

Crownwheel to differential case bolts	50 to 55 (6.913 to 7.604)
Differential carrier to axle housing nuts	15 to 18 (2.074 to 2.489)
Differential bearing locking plate bolts	12 to 15 (1.659 to 2.074)
Differential bearing cap bolts ...	45 to 50 (6.221 to 6.931)
Axle shaft bearing retainer bolts ...	15 to 18 (2.074 to 2.489)
Universal joint flange to pinion flange	15 to 18 (2.074 to 2.489)

SERVICE AND REPAIR OPERATIONS

OP 4003-A REAR AXLE ASSEMBLY - REMOVE AND INSTALL

Tools Required

P.2012 Brake line plugs

To Remove

1. Jack up the rear of the car, fit stands and remove the wheels.
2. Release the handbrake inside the car and disconnect the cable at the lever on the rear of the axle casing.
3. Disconnect the brake pipe at the junction on the axle and fit brake line plugs (Tool No. P.2012).
4. Mark the driveshaft and pinion flanges for correct re-alignment on reassembly, and then remove the four nuts and bolts.
5. Jack up under the centre of the axle and disconnect the shock absorber lower mounting bolts. Lower the jack.
6. **1600E only**

   Detach the rear ends of the radius arms from the rear axle, where fitted, by unscrewing the nut and withdrawing the through bolt.
7. Remove the rear spring "U" bolt nuts and detach bolts and plates.
8. Lift the axle and remove it from the car through a wheel arch.

To Install

9. Lift the axle and slide it through a wheel arch into position on the springs. Ensure that the spigot on the springs fits in the hole in the axle mounting pads.
10. Fit the "U" bolts over the axle, slide on the lower plates and fit the locknuts; torque to 25 lb. ft. (3.5 kg.m.).
11. Jack up under the centre of the axle and fit the shock absorber into the lower mounting bracket. Fit securing bolts and locknuts. Lower jack.
12. **1600E only**

    Attach the rear ends of the radius arms, where fitted, to the mounting brackets on the axle casing, but do not tighten the bolts.
13. Reconnect the driveshaft to the pinion flange, aligning the mating marks.
14. Remove the brake line plugs and reconnect the pipes THROUGH the bracket on the axle casing.
15. Reconnect the handbrake cable to the lever on the axle and adjust the cable as required. Adjust the brakes as necessary by moving the handbrake levers on the backplate in and out.
16. Bleed the braking system.
17. Refit the road wheels, lower car to ground.
18. Torque the radius arm securing bolts, where fitted, to the following torque figures; forward end (body mounting) - 45 to 50 lb. ft. (6.22 to 6.91 kg.m.), rear end (axle mounting) - 22 to 27 lb. ft. (3.04 to 3.73 kg.m.). **These bolts MUST be tightened with the weight of the car on its wheels.**

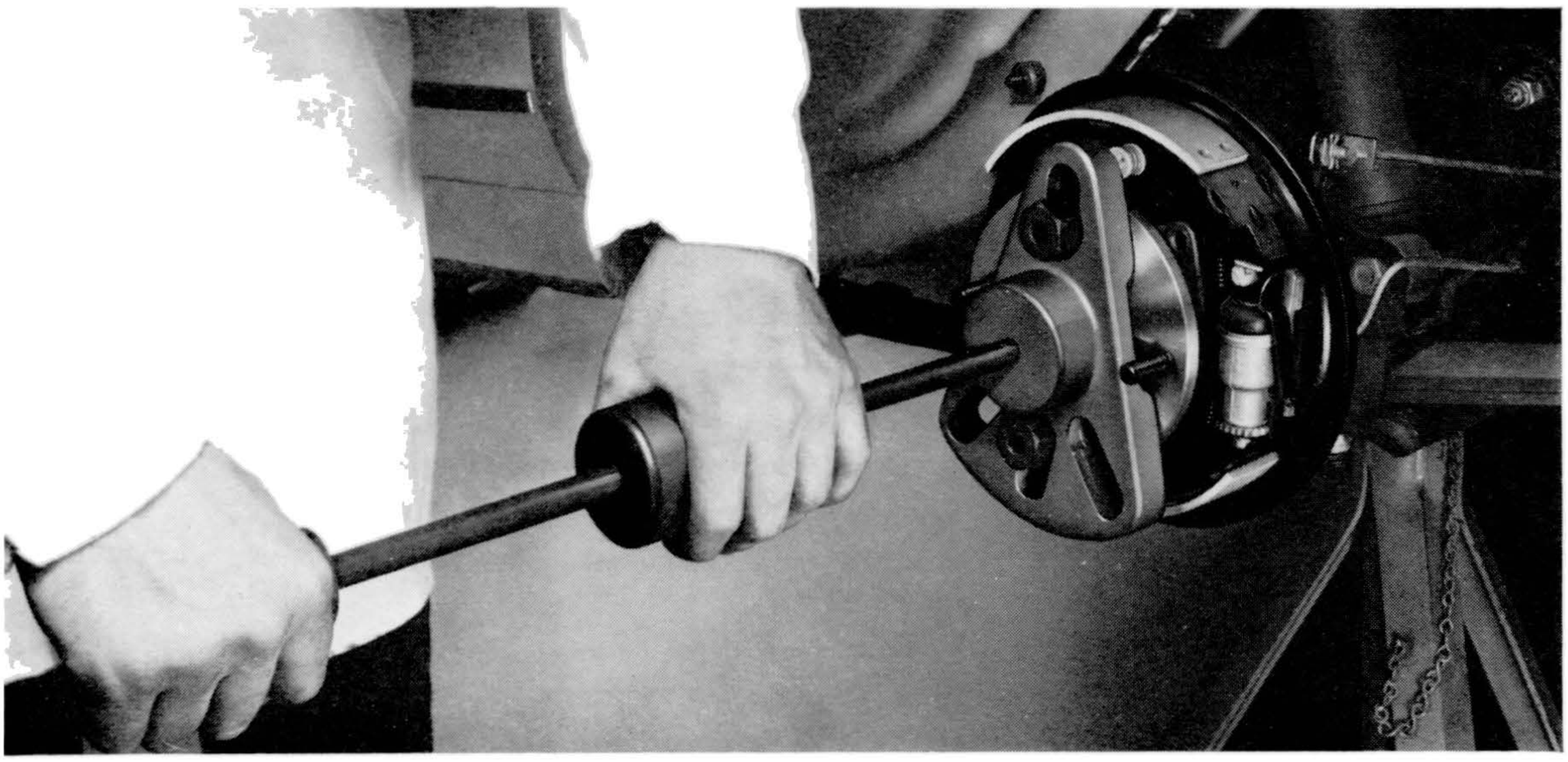
OP 4003-A1 EXTRA: REAR AXLE HOUSING – RENEW (REAR AXLE ASSEMBLY REMOVED)

Tools Required

P.2012	Brake line plugs
P.3072	Axle shaft remover

To Dismantle

1. Disconnect the hydraulic pipes at the brake expanders and fit brake line plugs (Tool No. P.2012).
2. Remove the transverse hydraulic pipe from the clips on the axle housing, and remove the pipe.
3. Mount the axle assembly in a suitable vice.
4. Remove the slave cylinder protection plate from the axle casing.
5. Remove the brake drum securing screw and pull off the brake drum.
6. Remove the four bolts and spring washers securing the bearing retainer plate to the axle casing. These bolts are accessible through holes in the axle shaft flange.
7. Secure the base of Tool No. P.3072 to the axle shaft flange with the wheel nuts. Use the slide hammer of the tool to knock out the axle shaft.
8. Repeat operations 4 to 7 for the other side.
9. Unscrew the eight nuts holding the differential carrier assembly to the axle casing, and allow the oil to drain.
10. Withdraw the carrier assembly from the casing, and remove the bolts.
11. Remove the eight brake plate bolts, four each side, and remove the brake plates.
12 Remove the rear axle filler and level plug, and the breather.



Withdrawing an Axle Shaft

To Reassemble

13. Refit the rear axle breather, brake plates and eight brake plate bolts.
14. Replace the eight differential carrier bolts and fit a new gasket.
15. Replace the carrier assembly, and tighten the nuts to a torque of 50 to 55 lb. ft. (6.91 to 7.60 kg.m.).
16. Insert the axle shaft into the housing and engage the splines in the differential side gear. Tap the shaft fully home.
17. Fit the four bolts and spring washers to secure the bearing retainer plate; torque to 15 to 18 lb. ft. (2.07 to 2.49 kg.m.).
18. Replace the brake drum and fit the securing screw.
19. Refit the slave cylinder protection plate on the axle casing.
20. Repeat operations 16 to 19 for the other side.
21. Remove the brake line plugs and reconnect the hydraulic pipes at the brake expanders.
22. Replace the transverse brake pipe behind the clips on the axle casing.

OP 4003-A2 EXTRA: REAR SPRING ASSEMBLY – ONE – REMOVE AND INSTALL (REAR AXLE ASSEMBLY REMOVED)

Tools Required

P.5029	Spring shackle bush remover and replacer
CP.5029-A	Adaptor

To Remove

1. Remove the rear shackle nuts and detach the combined shackle bolt and plate assemblies. Remove the four rubber bushes.
2. Unscrew the nut from the front mounting, and withdraw the through bolt.
3. Remove the spring assembly.
4. Using Tool No. P.5029 and CP.5029-A, pull the bush out of the front eye.

To Install

5. Replace the front mounting bush using Tool No. P.5029 and CP.5029-A to ensure that the bush is fitted squarely in its aperture.
6. Locate the front of the spring in its body mounting bracket. Fit the through bolt and lightly assemble the nut. Do not tighten at this stage.
7. Fit new rubber bushes to the rear spring "eye" and the apertures in the body for the rear shackle.
8. Locate the spring in position and assemble the rear shackle bolt and plate assemblies. Fit the nuts, but again do not tighten.
9. Lower the car so that the weight is resting on its rear wheels.
10. Tighten the front hanger bolt to 25 to 30 lb. ft. (3.46 to 4.15 kg.m.) and the rear shackle nuts to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.).

OP 4003-A3 EXTRA: REAR SHOCK ABSORBER – ONE – REMOVE AND INSTALL (REAR AXLE ASSEMBLY REMOVED)

To Remove

1. Unscrew the self-locking nut at the top of the shock absorber
2. Remove the shock absorber.

To Install

3. Replace the shock absorber and secure with the flat washer and self-locking nut.
4. Lower the car so that the weight is resting on its rear wheels, and tighten the nut to 15 to 20 lb. ft. (2.07 to 2.76 kg.m.).

OP 4003-B REAR AXLE HOUSING – RENEW
(Includes OPS 4003-A and A1)

OP 4235-A AXLE SHAFT AND BEARING ASSEMBLY – ONE – REMOVE AND INSTALL

Tools Required

P.3072 Axle shaft remover

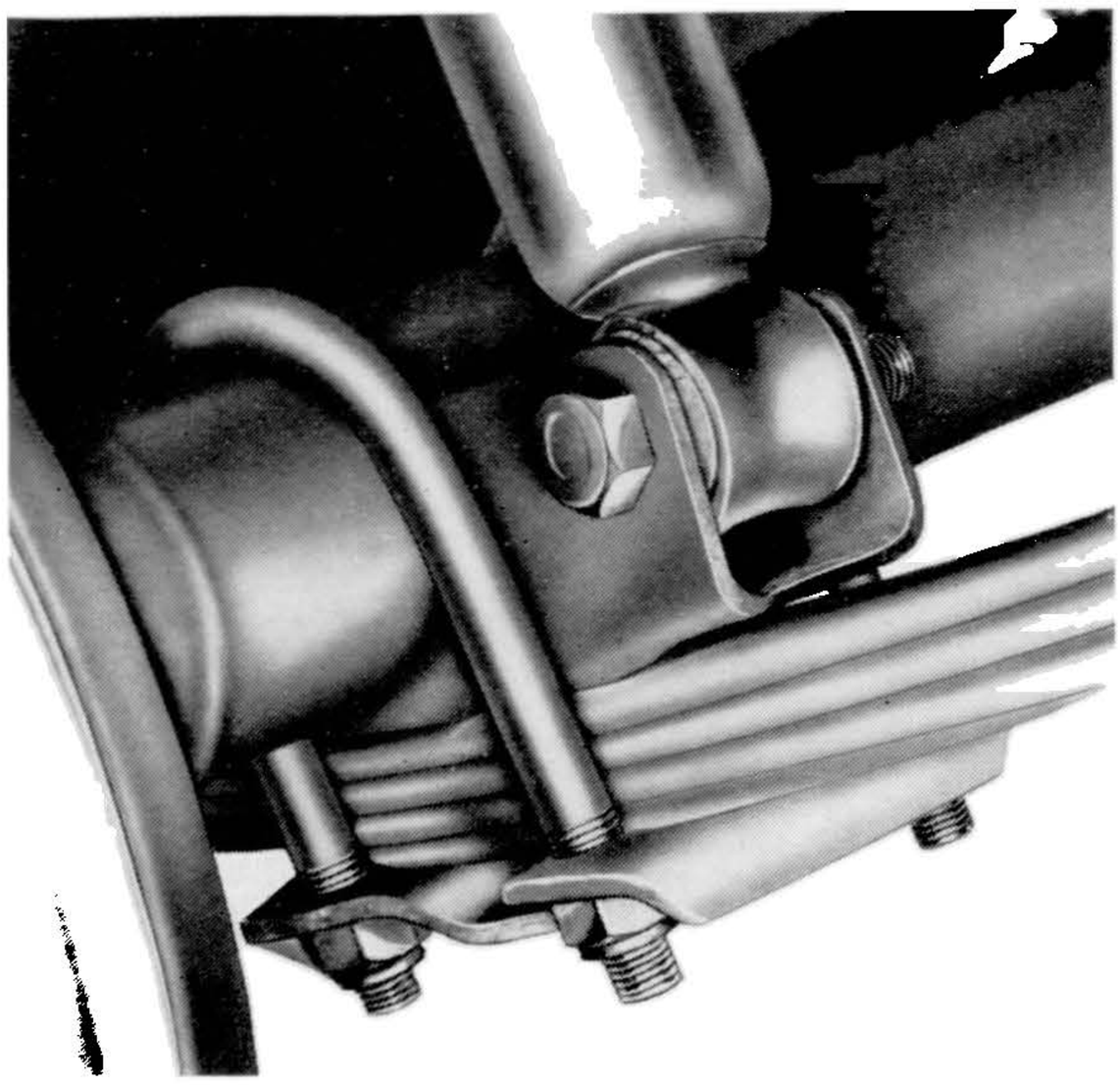
These operations may be carried out with the axle either in or out of the car.

To Remove

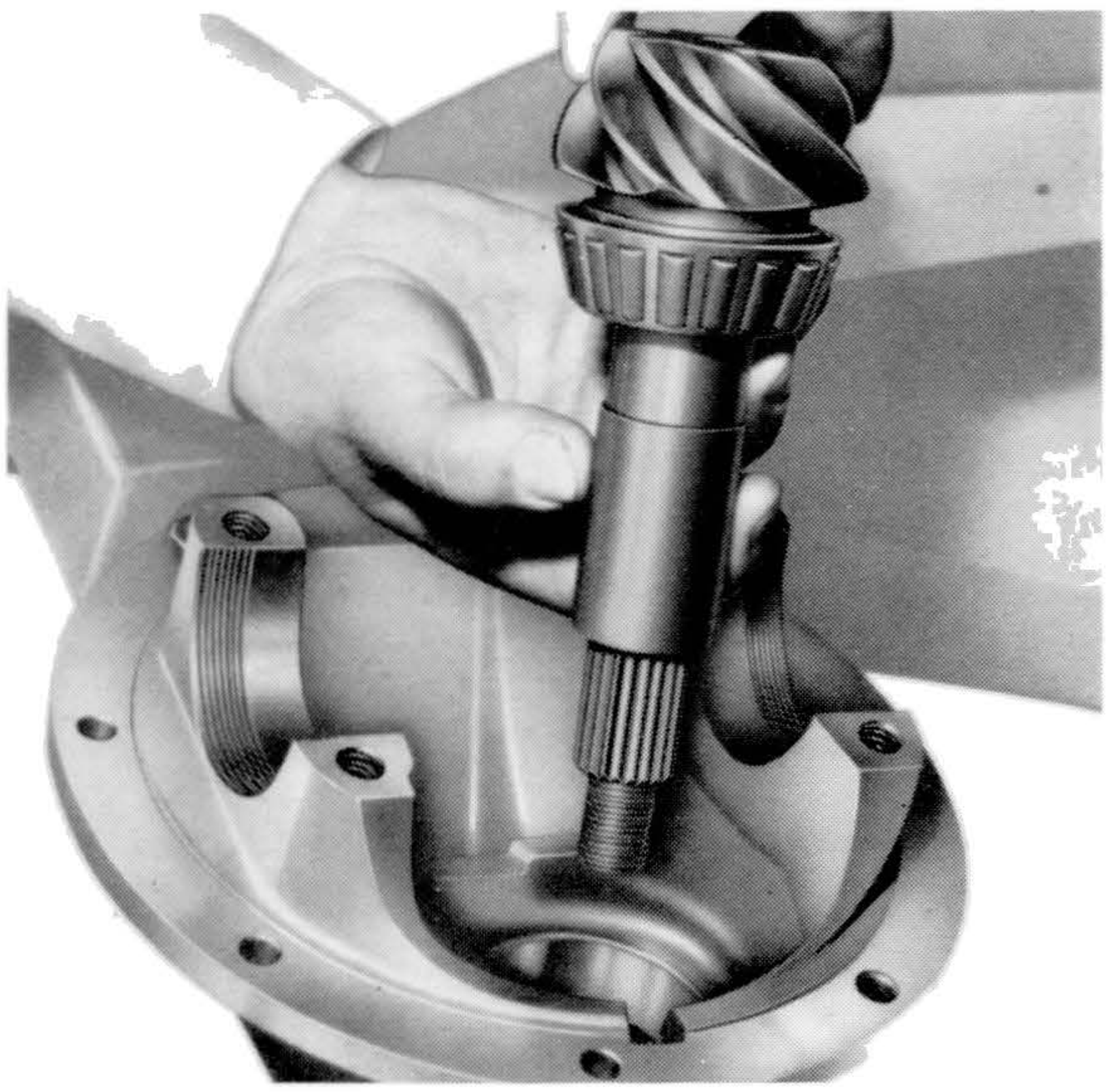
1. Remove the brake drum securing screw and pull off the drum. (Ensure handbrake is released.)
2. Remove the four bolts and spring washers securing the bearing retainer plate to the axle casing. These bolts are accessible through holes in the axle shaft flange.
3. Secure the base of Tool No. P.3072 to the axle shaft flange with the wheel nuts. Use the slide hammer of the tool to knock out the axle shaft.

To Install

4. Insert the axle shaft into the casing and engage the splines in the differential side gear. Tap the shaft fully home.



Rear Spring "U" Bolts



Fitting the Pinion

5. Fit the four bolts and spring washers to secure the bearing retainer plate: torque to 15 to 18 lb. ft. (2 to 2.5 kg.m.).

6. Replace the brake drum and refit the securing screw.

OP 4235-A1 EXTRA: REMAINING REAR AXLE SHAFT AND BEARING ASSEMBLY – REMOVE AND INSTALL (REAR OF VEHICLE ON STANDS)

Repeat sub-operations 1 – 6 above

OP 4235-A2 EXTRA: AXLE SHAFT OR BEARING AND OIL SEAL – ONE – RENEW (AXLE SHAFT AND BEARING ASSEMBLY REMOVED)

Tools Required

P.4090-2 & 6	Axle shaft bearing remover
370	Universal taper base
P.4084	Spring indicator

To Remove

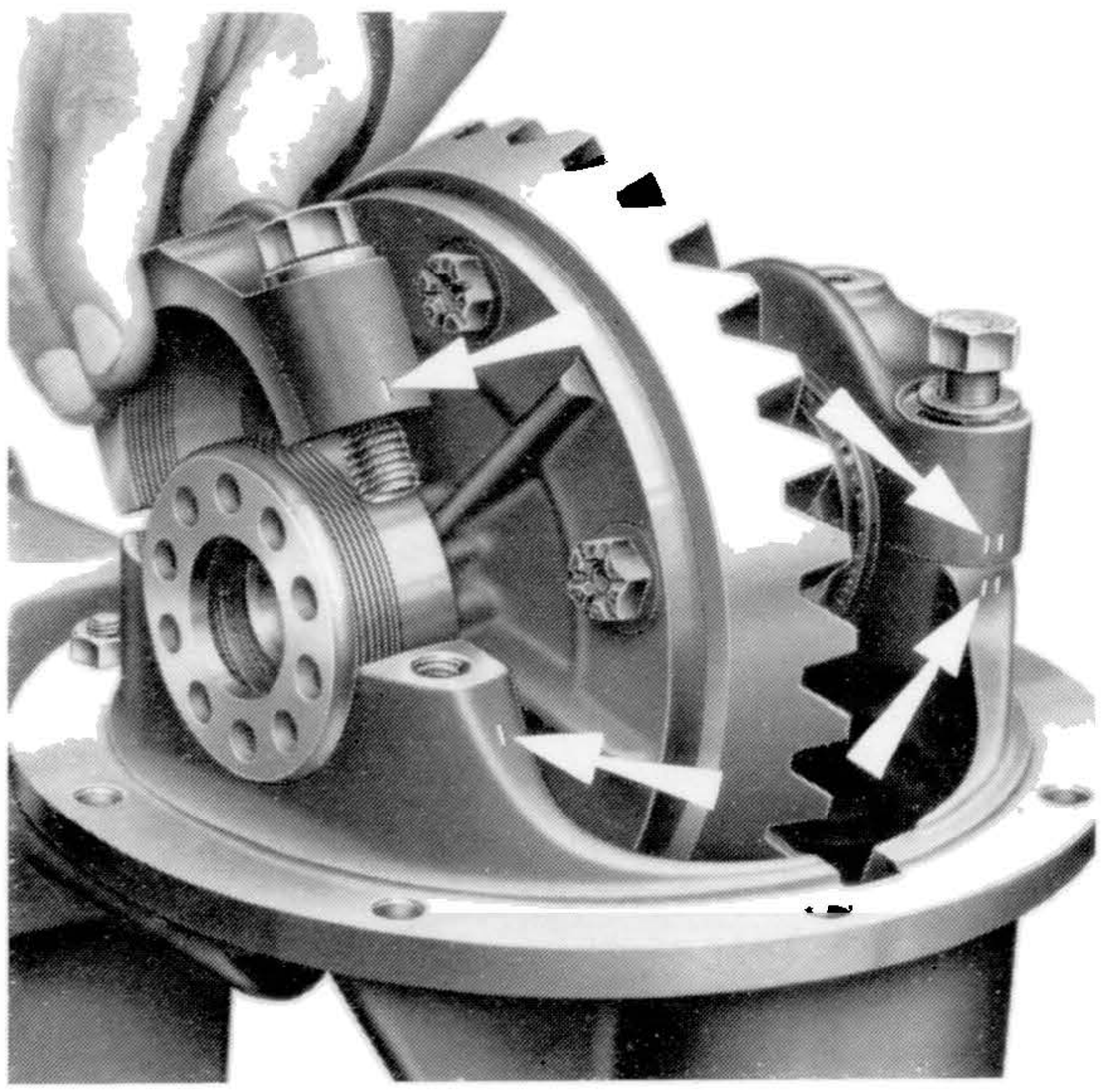
1. Locate the adaptors (Tool No. P.4090-6) and a slave ring between the bearing and axle shaft flange. Support the assembly in the base plate (Tool No. 370) of a hydraulic press and push the axle shaft out.

To Install

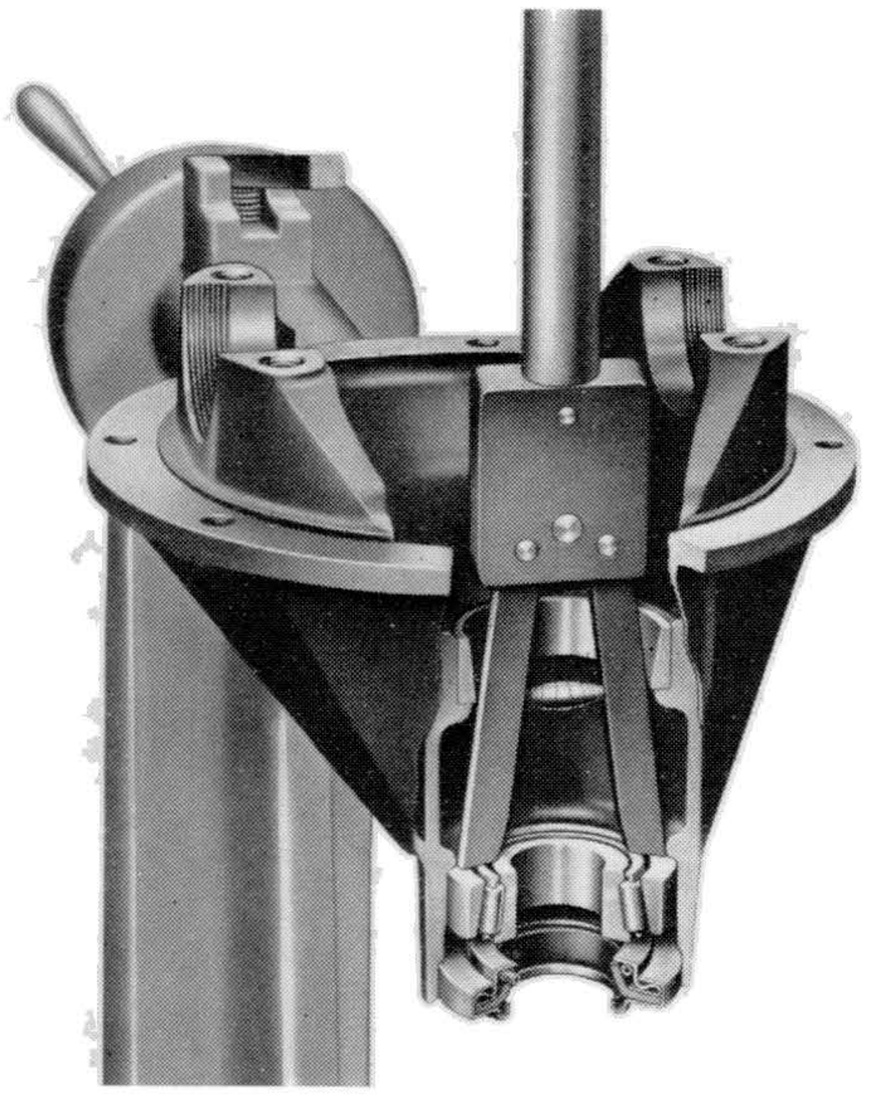
2. Locate the bearing retainer plate and the bearing on the axle shaft with the oil seal side towards the splined end.

3. Support the assembly in the bed of a hydraulic press on a spacer ring, adaptors (Tool No. P.4090-2) and slave ring.

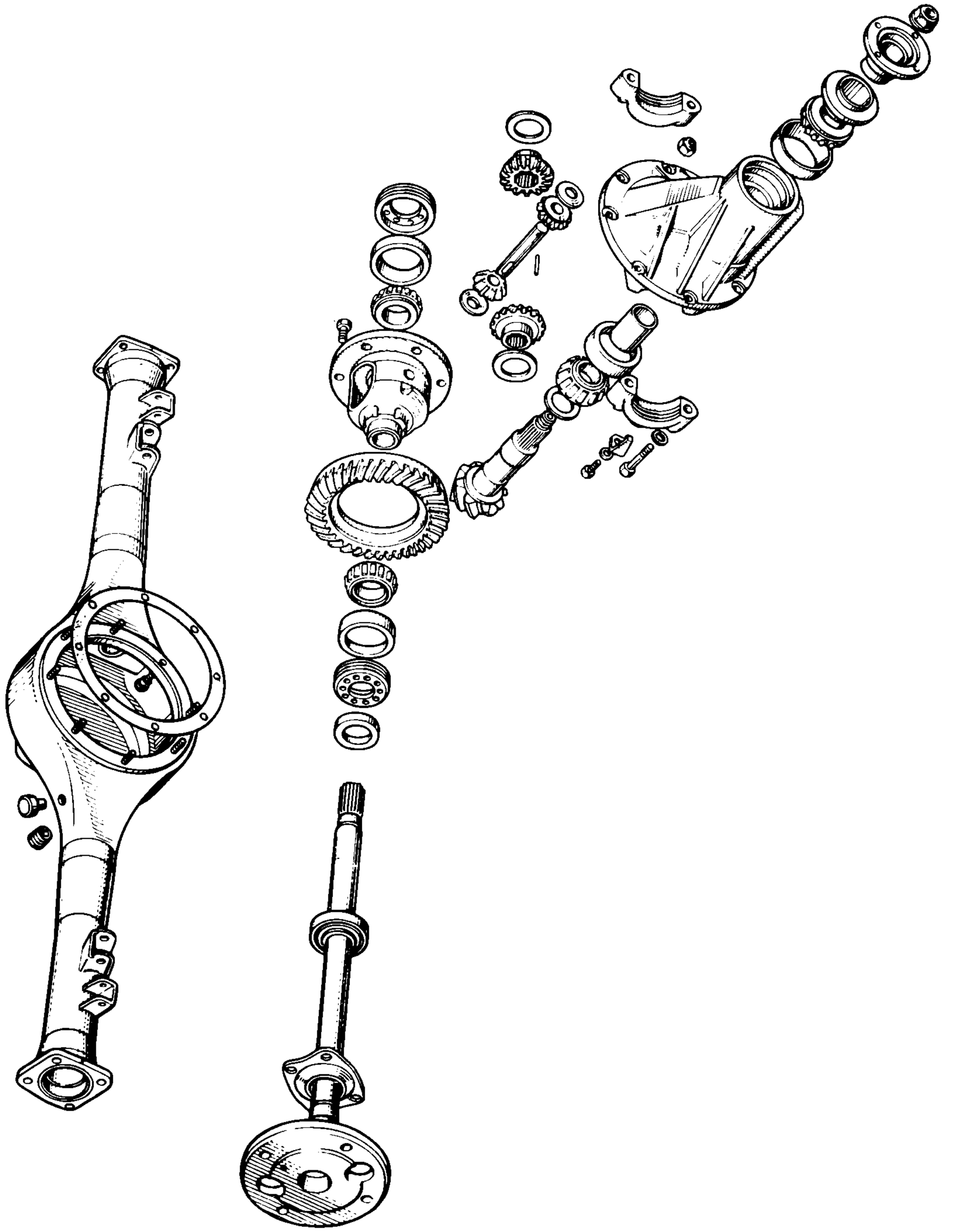
4. Fit a spring indicator (Tool No. P.4084) to the ram and press the bearing onto the axle shaft shoulder. A minimum pressure of 1,200 lb. (544 kg.) should be required. A lower pressure indicates an incorrect fit.



Differential Bearing Cap Mating Marks



Removing the Pinion Bearing Cups



Rear Axle Assembly – Exploded View

5. Use the same tools as in operations 3 and 4 and fit the bearing collar to abut the bearing. A minimum pressure of 2,400 lb. (1090 kg.) should be required.

OP 4235-A3 EXTRA: DIFFERENTIAL ASSEMBLY – REMOVE AND INSTALL (AXLE SHAFTS REMOVED)

To Remove

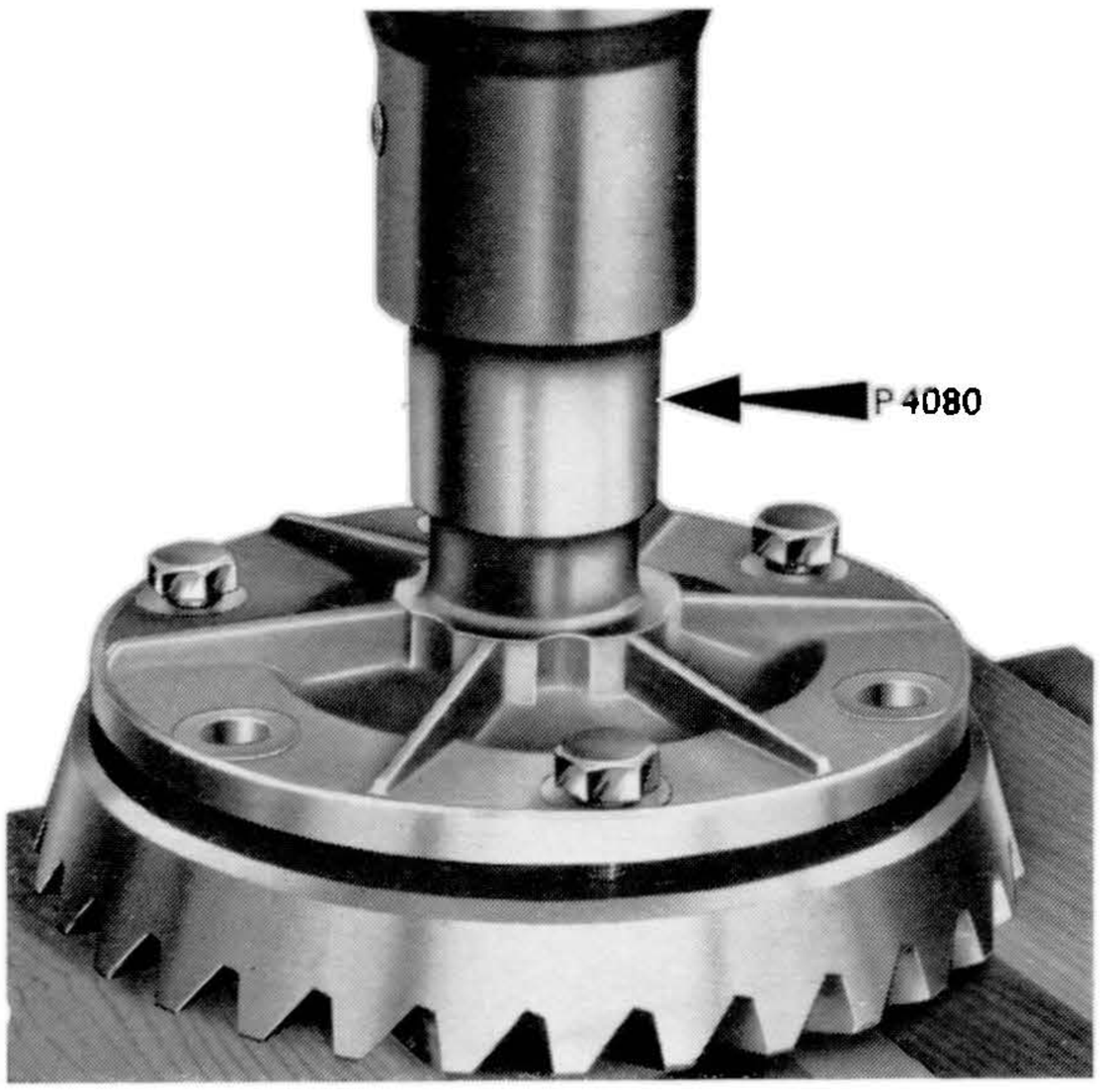
1. If the axle is in the car, disconnect the driveshaft from the pinion flange, after marking the flanges for correct reassembly.
2. Unscrew the eight nuts holding the differential carrier assembly to the axle casing. Allow the oil to drain.
3. Withdraw the carrier assembly from the casing.

To Replace

4. Clean the mating faces of the carrier assembly and axle casing. Fit a new gasket over the studs.
5. Refit the differential carrier assembly to the casing and replace the nuts; torque to 20 lb. ft. (2.8 kg.m.).
6. Fill the axle with S.A.E. 90 hypoid gear oil or if a new crownwheel and pinion have been fitted fill with the special running-in oil, EM-2C-29.
7. Reconnect driveshaft to the pinion flange, aligning the mating marks.

OP 4235-A4 EXTRA: DIFFERENTIAL ASSEMBLY – OVERHAUL (DIFFERENTIAL ASSEMBLY REMOVED)

NOTE – If a new pinion or differential taper roller bearing is fitted, then a new cone **and** a new cup should be used. Mating cones and cups should be of the same manufacture (i.e. Timken, Skefco, etc.).



Refitting the Crownwheel

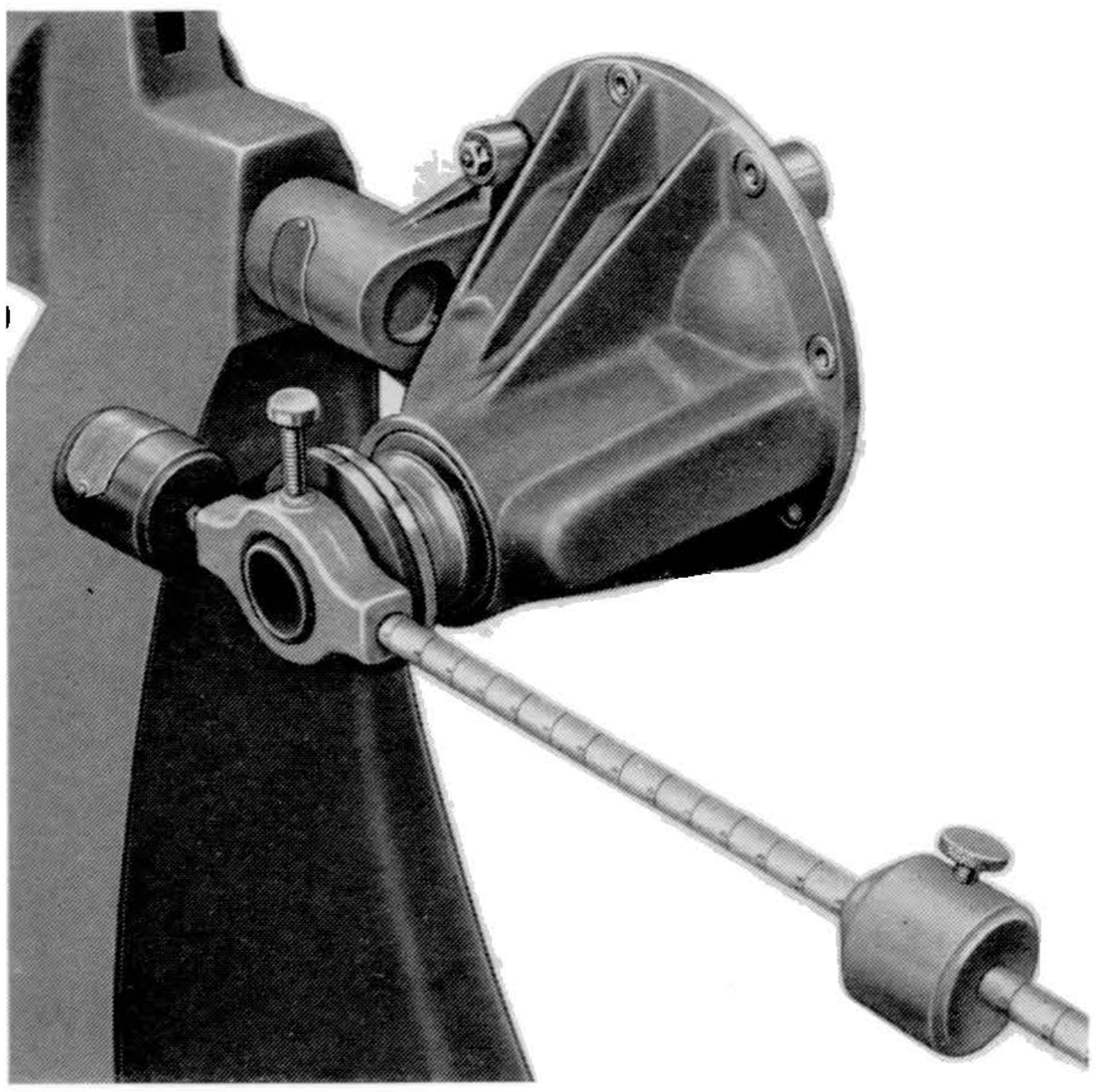
Replacing or Removing the Pinion Gear Shaft

Tools Required

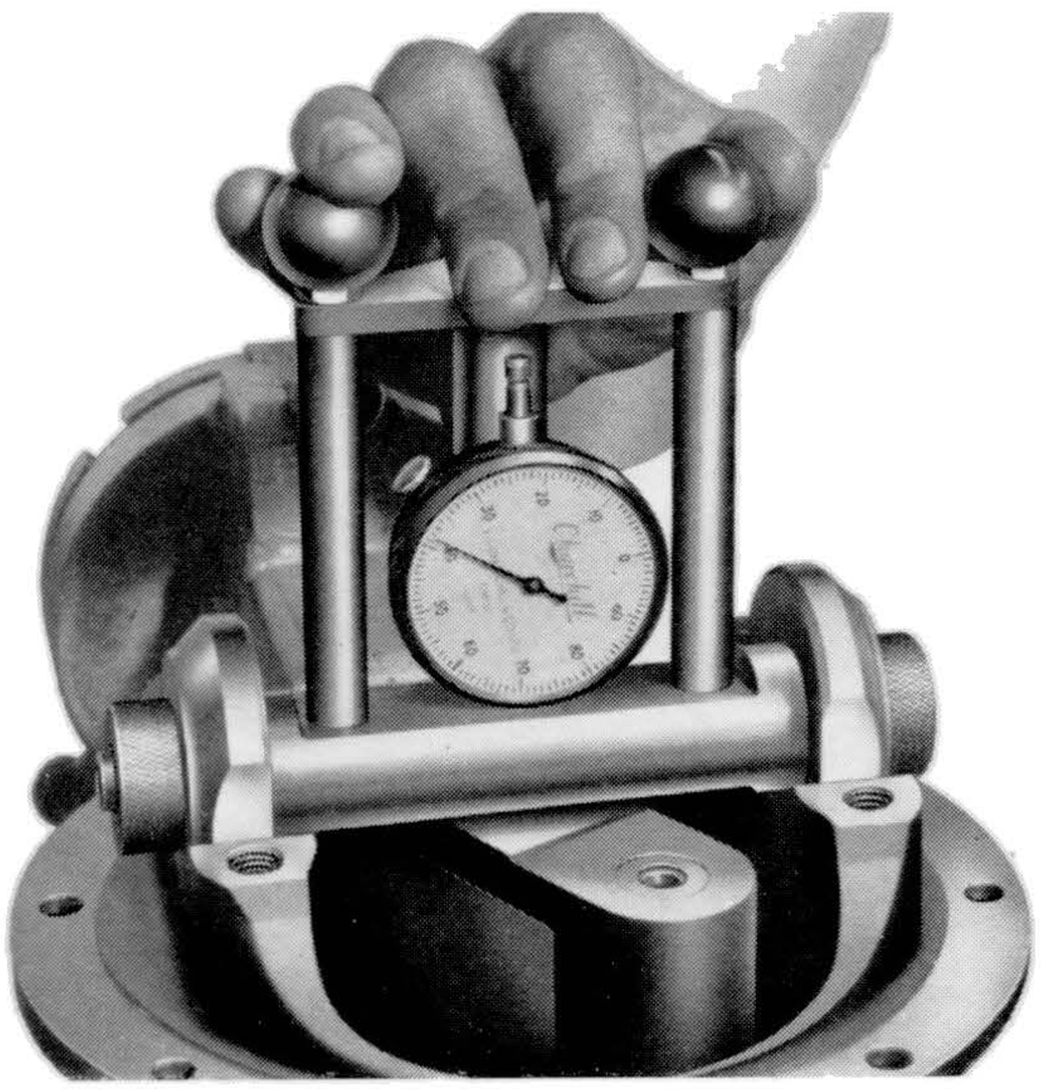
P.4077-A	Mounting adaptor
P.4079	Differential bearing adjuster
P.4097	Pinion flange wrench
P.4015	Pinion bearing cup remover
CP.4000	Hand press
P.4000-28	Split ring
P.4000-27A	Split ring
P.4080	Thrust button
P.4013-3	Pinion bearing cup replacer
P.4075-4	Dummy pinion
CP.4030	Pre-load gauge
P.4030-1	Adaptor
P.4075	Depth of mesh gauge
P.4009	Cap spread gauge
P.4008	Backlash gauge

To Dismantle

1. Mount the assembly on a dismantling stand with an adaptor (Tool No. P.4077-A).
2. Check for mating marks on the differential adjusting nut caps and if necessary mark them for correct reassembly. Remove the lock tabs and slacken the cap bolts. Back-off the adjusting nuts with the special spanner (Tool No. P.4079) and then remove the cap bolts and detach the caps.
3. Lift out the crownwheel and differential case assembly, keeping the bearing cones and cups together as a pair.
4. Holding the pinion flange (use Tool No. P.4097 for G.T. and Tool No. P.4028 for other models) unscrew the self-locking pinion nut. Pull the flange from the pinion. Remove the with the pinion, tubular spacer and rear bearing cone, from the carrier.



Pinion Bearing Pre-Load Gauge



Pinion Depth Gauge

5. Prise the pinion oil seal from the carrier or if required the pinion front bearing cup and oil seal can be driven out by locating the legs of the driver (Tool No. P.4015) through the carrier and up against the bearing in the notches provided.

   The rear bearing cup can be removed by inserting the driver from the other end of the carrier.

6. Locate the pinion in the split ring (Tool No. P.4000-28) with the lips behind the bearing cone. Mount the assembly in a hand press (Tool No. CP.4000) and after checking that the bearing cage is not trapped, press out the pinion. Remove the spacer from behind the pinion head.

7. Remove the six bolts securing the crownwheel to the differential case. Suitably support the crownwheel in the bed of a press and press out the differential case (use thrust button P.4080).

8. Drive out the differential pinion gear shaft lock-pin from the crownwheel side of the differential case. Push out the shaft.

9. Rotate the pinion gears around the side gears and extract them from the case. Remove the side gears and the two spherical and two flat thrust washers from the case.

10. Locate the differential bearing cones in the adaptors (Tool No. P.4000-27A) and in a support ring in the bed of a press. Press off the cones, one at a time.

To Reassemble

11. Lubricate the flat thrust washers and position them on the flanges of the side gears. Fit the side gears in the differential case.

    Lubricate the spherical thrust washers and position them on the rear of the pinion gears. Position the pinions in the cut-outs and rotate the side gears to draw them into place.

    Check that the thrust washers are not misplaced.

12. Push the pinion gear shaft through the case and gears so that the lock-pin holes line up. Fit the tapered end of the lock-pin from the differential side of the case and tap it right home. Lightly peen the case to retain the pin.

13. Examine the mating faces of the crownwheel and the differential case, removing any burrs by lightly stoning. Locate the crownwheel on the case and enter three suitable long bolts through the case into the crownwheel to ensure correct alignment.

14. Place the crownwheel, teeth downwards, on wood blocks in the bed of a press. Place a thrust button (Tool No. P.4080) on the case and bring down the ram to press on the crown-wheel.

15. Whilst the assembly is in the press, replace the bearing cones using the thrust button (Tool No. P.4080).

16. Remove the three pilot bolts and fit the six self-locking bolts: torque to 50 to 55 lb. ft. (6.9 to 7.6 kg.m.).

17. Place the pinion rear bearing cup on Tool No. P.4013-3 and pass it through the differential carrier from the rear. Assemble the front bearing cup to the tool and fit the front adaptor and wing nut. Tighten the wing nut to pull the bearings fully home.

18. Select the pinion bearing shim.

    (*a*) Slide the rear bearing cone onto the dummy pinion (Tool No. P.4075-4) and fit it in the carrier.

    (*b*) Fit the front bearing cone to the dummy pinion, slide on the pinion flange and screw on the nut. Lightly lubricate both bearings with a thin oil.

(*c*) Hold the pinion flange (use Tool No. P.4097 for G.T. and Tool No. P.4028 for other models) and tighten the nut whilst rocking the pinion to ensure correct seating of the bearings. When there is slight bearing drag, fit the pre-load gauge (Tool Nos. CP.4030 and P.4030-4 for G.T. and Tool No. P.4030-1 for other models) to the flange and measure the running torque by allowing the gauge weight to drop through the horizontal position.

Tighten the nut until a running torque of 13 to 19 lb. in. (0.150 to 0.219 kg.m.) is obtained. If the figures specified are exceeded, slacken the nut to remove all pre-load and recommence tightening.

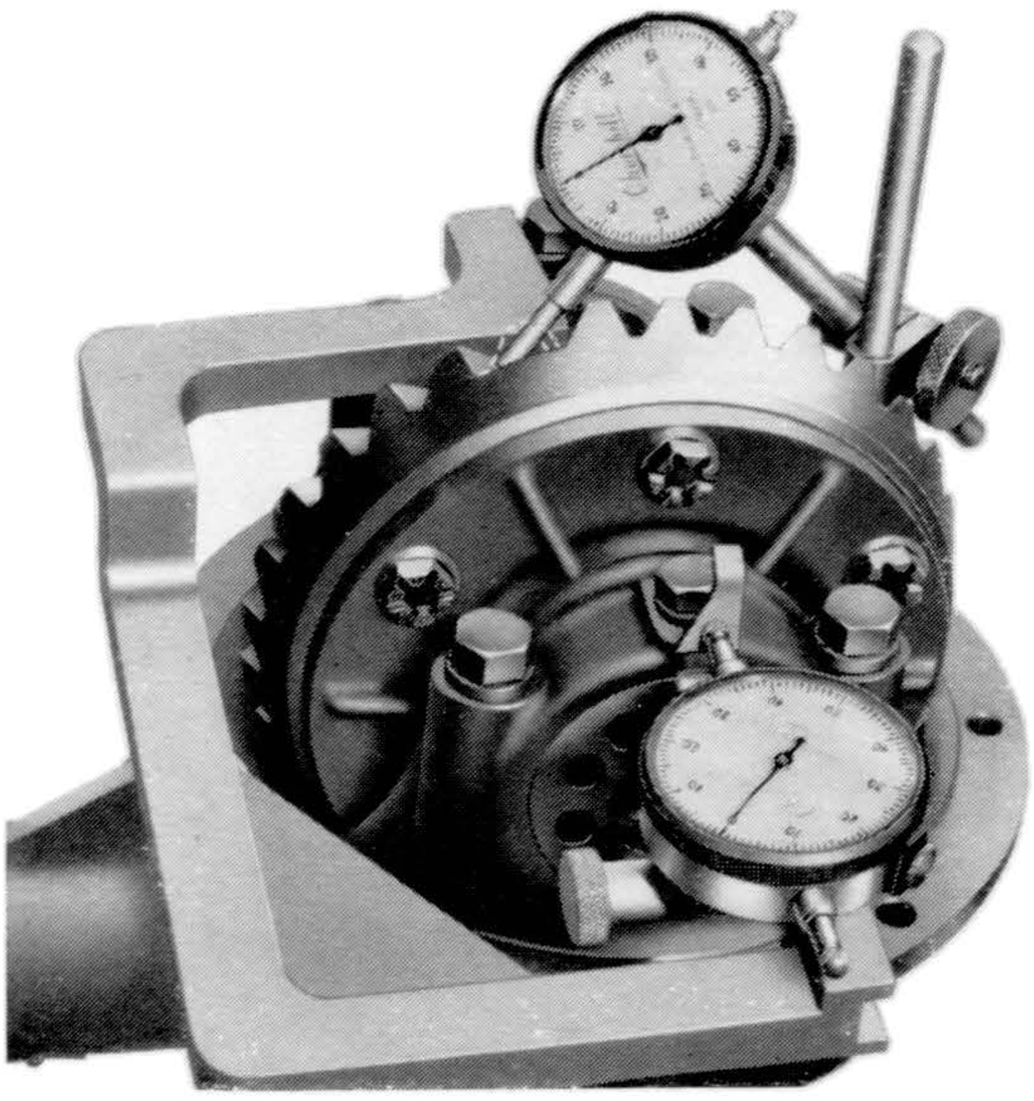
When re-using the part-used original bearings, a running torque of 6.5 to 9.5 lb. in. (0.075 to 0.109 kg.m.) should be used.

(*d*) Set the dial gauge of Tool No. P.4075 to zero by sliding the setting button across the under face.

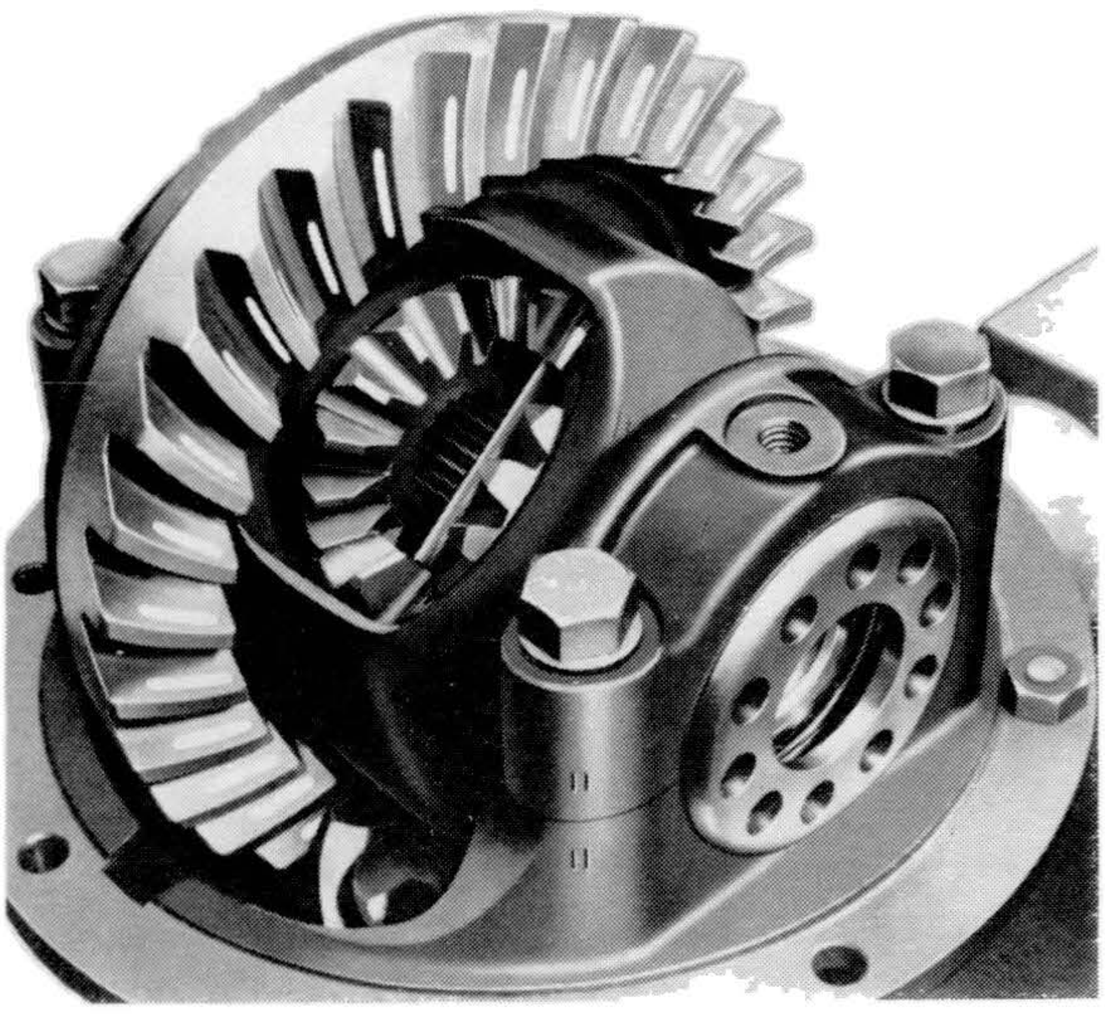
(*e*) Clean the differential bearing location in the carrier and fit the gauge (with adaptors P.4075-4) so that the plunger rests on the dummy pinion. Rock the gauge backwards and forwards slightly to obtain a minimum reading.

NOTE – It is essential to use the same bearing for assembly as was used for obtaining the shim reading.

(*f*) To the reading obtained add the amount 0.100 in. (2.54 mm.) which is the gauge compensation figure and, to allow for bearing expansion when it is pressed onto the pinion, subtract the amount 0.001 in. (0.025 mm.). Examine the end face of the actual pinion to be fitted, any variance from standard size will be indicated. If a "+" figure, it should be subtracted and if "—" it should be added.



Crownwheel Backlash and Cap Spread Gauges



Correct Tooth Marking

Incorrect Tooth Marking and Method of Correction

Heavy Flank Contact *(left)*
In this case the area of contact is below the centre line of the tooth, and the condition should be rectified by moving the pinion away from the crownwheel, using a thinner shim behind the pinion. Reset the backlash and differential bearing pre-load.

Heavy Face Contact (*right*)
In this case the area of contact is above the centre line of the tooth, due to the pinion being too far away from the crownwheel. Use a thicker pinion bearing shim to lower the contact area and reset the backlash and differential bearing pre-load.

Contact on Toe *(left)*
When the area of contact is running off the toe of the pinion, move the crownwheel away from the pinion. Slacken the crownwheel adjusting nut and screw in the differential side nut an equal amount. It may also be necessary to use a thicker shim behind the pinion in order to keep the backlash within the correct limits.

Contact on Heel (*right*)
In this case the crownwheel is too far out from the pinion. Slacken the differential side adjusting nut and tighten the crownwheel side nut, re-check the backlash and differential bearing pre-load readings. If the backlash is reduced below the minimum specified, use a thinner shim behind the pinion and, using a new collapsible spacer, readjust pinion bearing pre-load.

For example:—

Gauge reading	0.039 in.	(0.991 mm.)
plus gauge compensation	0.100 in.	(2.540 mm.)
	0.139 in.	(3.531 mm.)
minus allowance for bearing expansion	0.001 in.	(0.025 mm.)
	0.138 in.	(3.506 mm.)
add or subtract pinion marking (say "+2")	0.002 in.	(0.051 mm.)
	0.136 in.	(3.455 mm.)

The shim required may now be selected from the following list:—

Pinion Bearing Shims

105E-4672-A	0.1304 to 0.1308 in. (3.312 to 3.322 mm.)
2925E-4672-AA	0.1309 to 0.1313 in. (3.325 to 3.335 mm.)
105E-4672-B	0.1314 to 0.1318 in. (3.338 to 3.348 mm.)
2925E-4672-AB	0.1319 to 0.1323 in. (3.350 to 3.360 mm.)
105E-4672-C	0.1324 to 0.1328 in. (3.363 to 3.373 mm.)
2925E-4672-AC	0.1329 to 0.1333 in. (3.376 to 3.386 mm.)
105E-4672-D	0.1334 to 0.1338 in. (3.388 to 3.399 mm.)
2925E-4672-AD	0.1339 to 0.1343 in. (3.401 to 3.411 mm.)
105E-4672-E	0.1344 to 0.1348 in. (3.414 to 3.424 mm.)
2925E-4672-AE	0.1349 to 0.1353 in. (3.426 to 3.437 mm.)
105E-4672-F	0.1354 to 0.1358 in. (3.439 to 3.449 mm.)
2925E-4672-AF	0.1359 to 0.1363 in. (3.452 to 3.462 mm.)
105E-4672-G	0.1364 to 0.1368 in. (3.465 to 3.475 mm.)
2925E-4672-AG	0.1369 to 0.1373 in. (3.477 to 3.487 mm.)
105E-4672-H	0.1374 to 0.1378 in. (3.490 to 3.506 mm.)
2925E-4672-AH	0.1379 to 0.1383 in. (3.503 to 3.513 mm.)
105E-4672-J	0.1384 to 0.1388 in. (3.515 to 3.526 mm.)
2925E-4672-AJ	0.1389 to 0.1393 in. (3.528 to 3.538 mm.)
105E-4672-K	0.1394 to 0.1398 in. (3.541 to 3.551 mm.)
2925E-4672-AK	0.1399 to 0.1403 in. (3.553 to 3.564 mm.)
105E-4672-L	0.1404 to 0.1408 in. (3.566 to 3.576 mm.)
2925E-4672-AL	0.1409 to 0.1413 in. (3.579 to 3.589 mm.)
105E-4672-M	0.1414 to 0.1418 in. (3.592 to 3.602 mm.)
2925E-4672-AM	0.1419 to 0.1423 in. (3.604 to 3.614 mm.)
105E-4672-N	0.1424 to 0.1428 in. (3.617 to 3.627 mm.)
2925E-4672-AN	0.1429 to 0.1433 in. (3.630 to 3.640 mm.)
105E-4672-R	0.1434 to 0.1438 in. (3.642 to 3.653 mm.)
2925E-4672-AR	0.1439 to 0.1443 in. (3.655 to 3.665 mm.)
105E-4672-T	0.1444 to 0.1448 in. (3.668 to 3.678 mm.)
2925E-4672-AT	0.1449 to 0.1453 in. (3.680 to 3.691 mm.)

(*g*) Remove the dummy pinion and gauge.

19. Fit the selected shim to the pinion with the internal chamfer towards the gear teeth. Fit the rear bearing cone and support the assembly in the split rings (Tool No. P.4000-28). Press the bearing fully home, taking care not to damage the bearing cage.

20. Fit the front bearing cone to its cup in the carrier and locate a new oil seal in the carrier throat with the lip towards the bearing after lightly smearing the outer diameter with EM-4G-14 sealer. Pass Tool No. P.4013 through the carrier and fit adaptor No. P.4013-3 with its flat face against the seal. Tighten the wing nut to pull the seal fully home. Lightly oil the seal.

21. Fit the pinion in the carrier with a new collapsible spacer. Fit the drive flange and a new retaining nut. Tighten the nut until a slight end-float can be felt on the pinion.

22. Fit the pre-load gauge (Tools CP.3040 and P.4030-4 for G.T. and Tool No. P.4030-1 for other models) to the drive flange and measure the oil seal drag (usually around 5 lb. in. (0.06 kg.m.)). To the figure obtained add the specified bearing running torque of 13 to 19 lb. in. (0.150 to 0.219 kg.m.) which will give the correct figure required.

    When re-using the part-used original bearings, a running torque of 6.5 to 9.5 lb. in. (0.075 to 0.109 kg.m.) should be used.

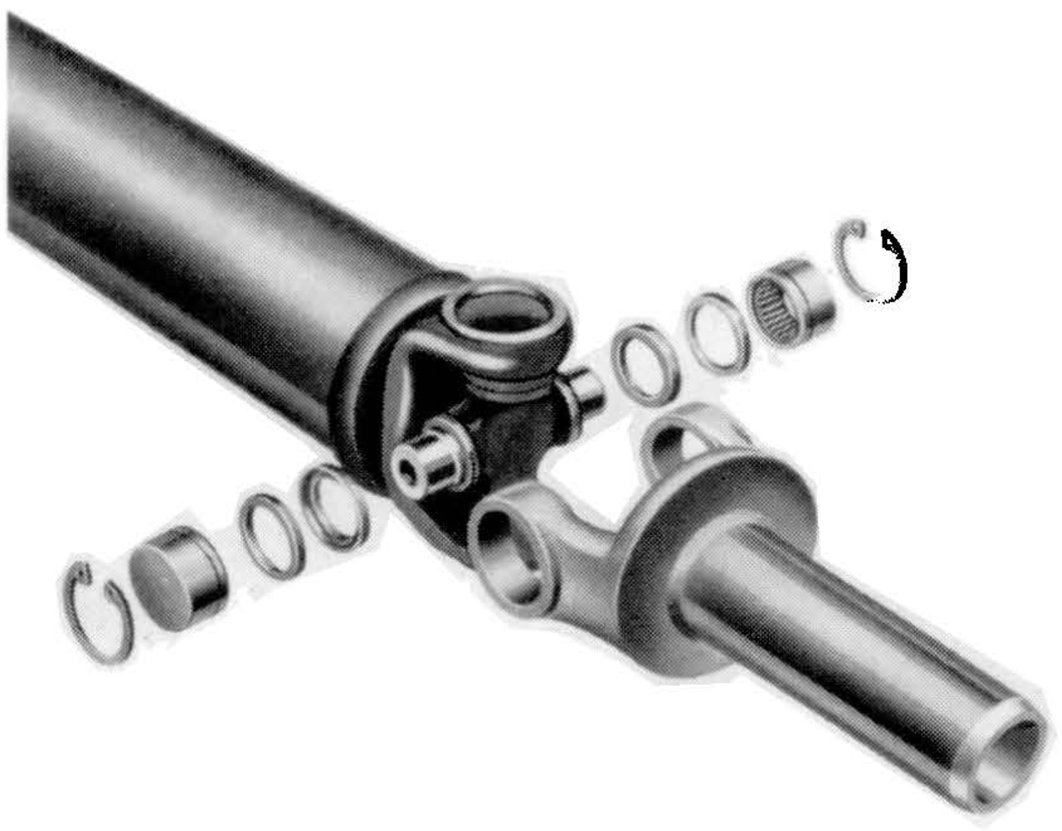
23. Gradually and carefully tighten the drive flange nut, rocking the pinion to seat the bearings, until the required pre-load is obtained. Frequent checks must be taken with the pre-load gauge and if the maximum pre-load is exceeded the collapsible spacer must be renewed and the operation recommenced.

    NOTE – Although self-locking nuts of this kind can be used for up to say, six applications, **if there is any doubt** as to the condition or locking properties of a particular nut then a new nut should be fitted.

24. Locate the differential bearing cups on their cones and position the differential assembly in the carrier housing.

25. Refit the bearing caps with the mating marks aligned and replace the bolts so that they just nip the caps in position. Screw in the adjusting nuts (use Tool No. P.4079), whilst rotating the crownwheel, until there is just a slight backlash.

26. Bolt a spread gauge (Tool No. P.4009) to the centre bolt hole of a bearing cap and fit an inverted bearing cap lock-tab to the other cap. Ensure that the dial plunger rests against the lock-tab and set the gauge to zero.



Universal Joint — Exploded View

27. Mount a backlash gauge (Tool No. P.4008) to a suitable hole in the carrier flange so that the dial plunger rests against a tooth and at right angles to it. Zero the gauge.

28. Screw in the adjusting nuts (use Tool No. P.4079) until a backlash of 0.001 to 0.002 in. (0.025 to 0.050 mm.) is indicated when rocking the crownwheel. Swing the backlash gauge out of position.

29. Screw in the adjusting nut on the differential side, whilst rotating the crownwheel, until a constant cap spread of 0.008 to 0.010 in. (0.200 to 0.250 mm.) is indicated.

    When re-using the part-used original bearings, a cap spread of 0.004 to 0.005 in. (0.100 to 0.125 mm.) should be used.

30. Swing the backlash gauge back in position and zero the dial. Hold the pinion and rock the crownwheel. The backlash should now be 0.008 to 0.010 in. (0.200 to 0.250 mm.) [0.004 to 0.005 in. (0.100 to 0.125 mm.) with original bearings]. If it is outside these limits, adjust the position of the crownwheel relative to the pinion by slackening the adjusting nut on one side and tightening the nut on the other side so that the cap spread remains unaltered. The final tightening must always be made to the nut on the crownwheel side.

31. Refit the lock-tabs (left- and right-hand offsets are available) and torque to 15 lb. ft. (2.1 kg.m.). Torque the cap bolts to 45 to 50 lb. ft. (6.2 to 6.9 kg.m.).

32. Apply a thin coating of red or yellow ochre to the crownwheel teeth. Fit the axle shafts and hold them to apply a load, and rotate the pinion in both directions.

    Check the tooth patterns on both sides of the gears and rectify if incorrect. (Four methods of correction are illustrated.)

33. Place a new gasket on the axle housing and refit the differential assembly. Replace the locknuts.

OP 4235-B REAR AXLE SHAFT AND BEARING ASSEMBLY – BOTH – REMOVE AND INSTALL
(Includes OPS 4235-A and A1)

OP 4235-C REAR AXLE SHAFT OR BEARING AND OIL SEAL – ONE – RENEW
(Includes OPS 4235-A and A2)

OP 4235-D REAR AXLE SHAFT OR BEARING AND OIL SEAL – BOTH – RENEW
(Includes OPS 4235-A, A1 and A2×2)

OP 4235-E DIFFERENTIAL ASSEMBLY – REMOVE AND INSTALL
(Includes OPS 4235-A, A1 and A3)

OP 4235-F DIFFERENTIAL ASSEMBLY – OVERHAUL
(Includes OPS 4235-A, A1, A3 and A4)

OP 4602-A DRIVESHAFT ASSEMBLY – REMOVE AND INSTALL

For One-piece Driveshaft

To Remove

1. Mark the driveshaft and pinion flanges for correct re-alignment on reassembly and then remove the four nuts and bolts.

2. Lower the rear of the driveshaft and withdraw it from the gearbox. A slight amount of oil may leak from the gearbox. This may be overcome by use of a locally manufactured dummy propshaft.

To Install

3. Slide the front yoke into the gearbox, engaging the mainshaft splines, taking care not to damage the oil seal or bearing in the extension housing.
4. Lift the rear of the driveshaft, align the marks and fit the four bolts and locknuts.
5. Check gearbox oil level.

For Two-piece Driveshaft (where fitted)

To Remove

1. Mark the driveshaft and pinion flanges for correct re-alignment on reassembly and then remove the four bolts and spring washers.
2. Remove the two bolts and spring washers securing the centre bearing to the body.
3. Lower the driveshaft assembly and withdraw it from the gearbox. A slight amount of oil may leak from the gearbox.

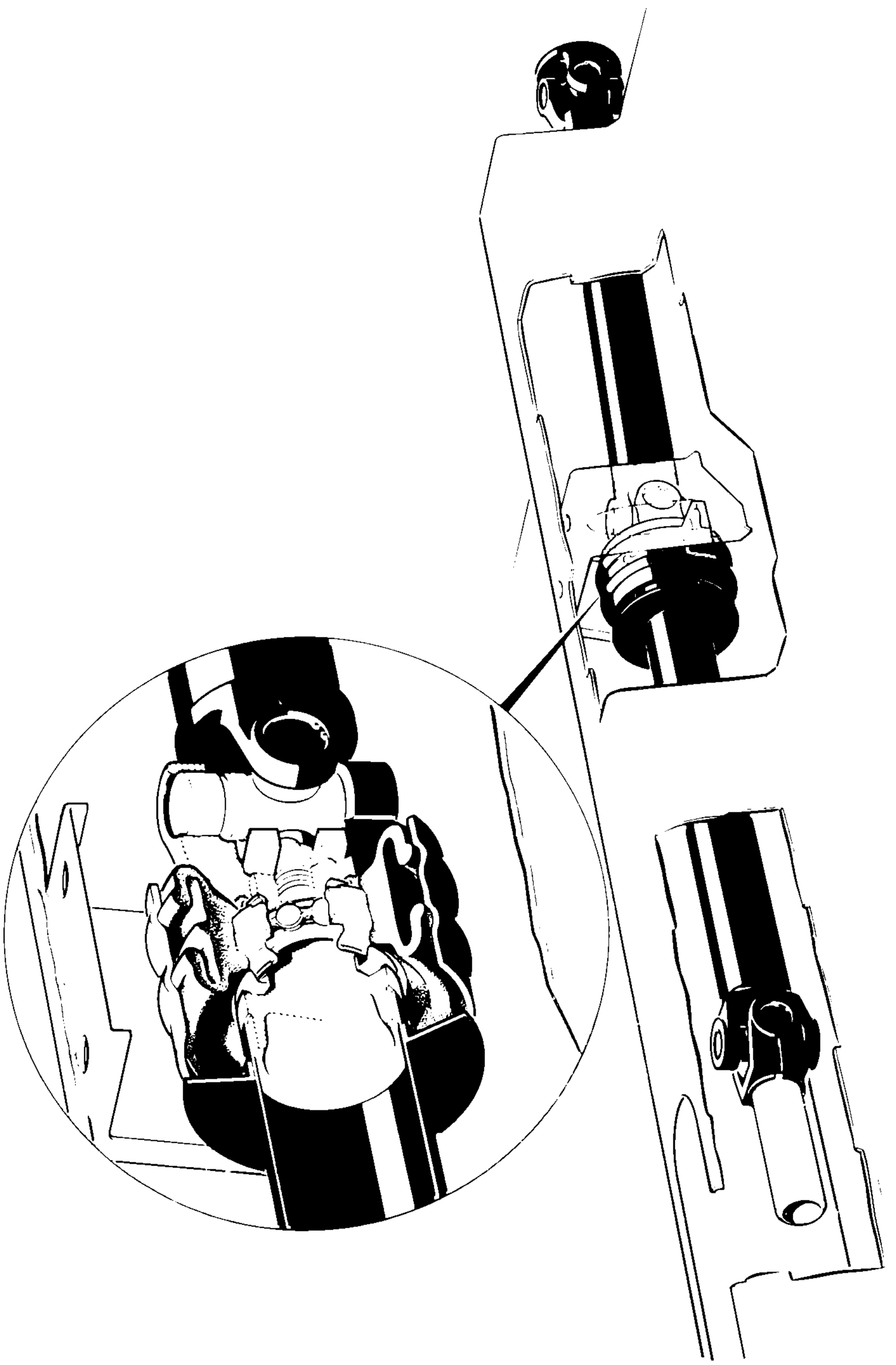
To Install

4. Slide the front yoke into the gearbox, engaging the mainshaft splines, taking care not to damage the oil seal or bearing in the extension housing.
5. Secure the centre bearing carrier to its bracket and tighten to a torque of 13 to 17 lb. ft. (1.8 to 2.3 kg.m.).
6. Lift the rear of the driveshaft assembly, align the mating marks on the driveshaft and pinion flanges, fit the four bolts and spring washers and tighten to a torque of 43 to 47 lb. ft. (6.0 to 6.5 kg.m.).
7. Check the gearbox oil level.

OP 4602-A1 EXTRA: UNIVERSAL JOINT – ONE – OVERHAUL (DRIVESHAFT REMOVED)

When applicable the universal joint spider, bearings, oil seals and retainers are serviced as a kit.

1. Extract each spider bearing circlip and remove the bearing cups and rollers by gently tapping the yoke at each bearing.
2. Remove the spider and detach the oil seal and seal retainer from each spider journal.
3. To reassemble, fit new oil seals to the retainers and locate them on the shoulders of the spider journals with the oil seals outwards. Position the spider in the driveshaft yoke and assemble the needle rollers in each bearing cup. Pack the bearings with a multi-purpose lithium base grease, leaving an air space to allow for expansion of the grease when warm. Refit the bearings, tapping them squarely into place. Take care not to dislodge the needle rollers.
4. Similarly, refit the other half of the joint.
5. Refit the circlips to each bearing.



Two-piece Driveshaft Assembly

OP 4602-A2 EXTRA: DRIVE PINION OIL SEAL – RENEW (DRIVESHAFT REMOVED)

Tools Required

P.4028	Flange holding wrench (all except G.T.)
P.4097	Flange holding wrench (G.T. only)
CP.4030	Drive pinion bearing pre-load gauge
P.4030-1	Drive pinion pre-load gauge adaptor (all except G.T.)
P.4030-4	Drive pinion pre-load gauge adaptor (G.T. only)

To Remove

1. Hold the pinion flange (using Tool No. P.4028 for all except G.T. and P.4097 for G.T. only) and unscrew the pinion bearing nut.
2. Remove the pinion drive flange and oil seal.

To Install

3. Fit a new pinion drive flange oil seal, after applying sealer EM-4G-14 to the outside diameter of the seal.
4. Inspect the pinion drive flange for damage on oil seal journal, renew if necessary.
5. Fit the drive flange and a new retaining nut. Tighten the nut until an end-float of 0.002 to 0.005 in. (0.05 to 0.13 mm.) is obtained.
6. Fit the pre-load gauge (Tool Nos. CP.4030 and P.4030-1 for all except G.T. and P.4030-4 for G.T. only) to the drive flange and measure the oil seal running torque.
7. Gradually and carefully tighten the drive flange nut to give 4 to 8 lb. in. (0.052 to 0.092 kg.m.) torque, plus the torque found in sub-operation 6.

   Frequent checks must be made with the pre-load gauge, since if the maximum pre-load is exceeded, this will necessitate the replacement of the collapsible spacer in the differential assembly.

OP 4602-A3 EXTRA: CENTRE BEARING (WHERE FITTED) – REMOVE AND INSTALL (DRIVESHAFT ASSEMBLY REMOVED)

To Remove

1. Mark the centre universal yoke and front universal yoke for correct re-alignment on re-assembly. Bend back the lock tab in the centre of the universal joint yoke and slacken the restraining bolt. Remove the "U" shaped plate and separate the two halves of the driveshaft.
2. Remove the driveshaft and bearing assembly from the rubber insulator.
3. Bend back the six tabs securing the rubber insulator into its carrier, and remove.
4. With a suitable two-legged puller remove the bearing and protective caps from the driveshaft.

To Install

5. Drive the ball bearing and protective caps onto the driveshaft, using a tube of suitable diameter.
6. Insert the rubber insulator into its carrier with the boss upwards. Bend the six tabs on the carrier back over the beaded edge of the rubber insulator.

7. Slide the carrier and the rubber insulator over the bearing assembly.

8. Screw the securing bolt with a new lock tab onto the end of the front driveshaft, leaving enough space to allow for the "U"-shaped plate.

9. Line up the mating marks on the two universal joint yokes and assemble the driveshaft. Insert the "U"-shaped plate, with the smooth surface facing the fork, under the securing bolt head and tighten the bolt to a torque of 25 to 30 lb. ft. (3.5 to 4.0 kg.m.). Bend up the lock tab.

OP 4602-B DRIVESHAFT UNIVERSAL JOINT – ONE – OVERHAUL
(Includes OPS 4602-A and A1)

OP 4602-C DRIVESHAFT UNIVERSAL JOINT – BOTH – OVERHAUL
(Includes OPS 4602-A and A1 ×2)

OP 4602-D DRIVESHAFT UNIVERSAL JOINTS – THREE – OVERHAUL
(Includes OPS 4602-A and A1 × 3)

OP 4676-A DRIVE PINION OIL SEAL – RENEW
(Includes remove and adjust differential assembly)

OP 4676-B DRIVE PINION OIL SEAL – RENEW (DIFFERENTIAL ASSEMBLY IN SITU)
(Comprises OPS 4602-A and A2)

OP 4817-D CENTRE BEARING – REMOVE AND INSTALL
(Comprises OPS 4602-A and A3)

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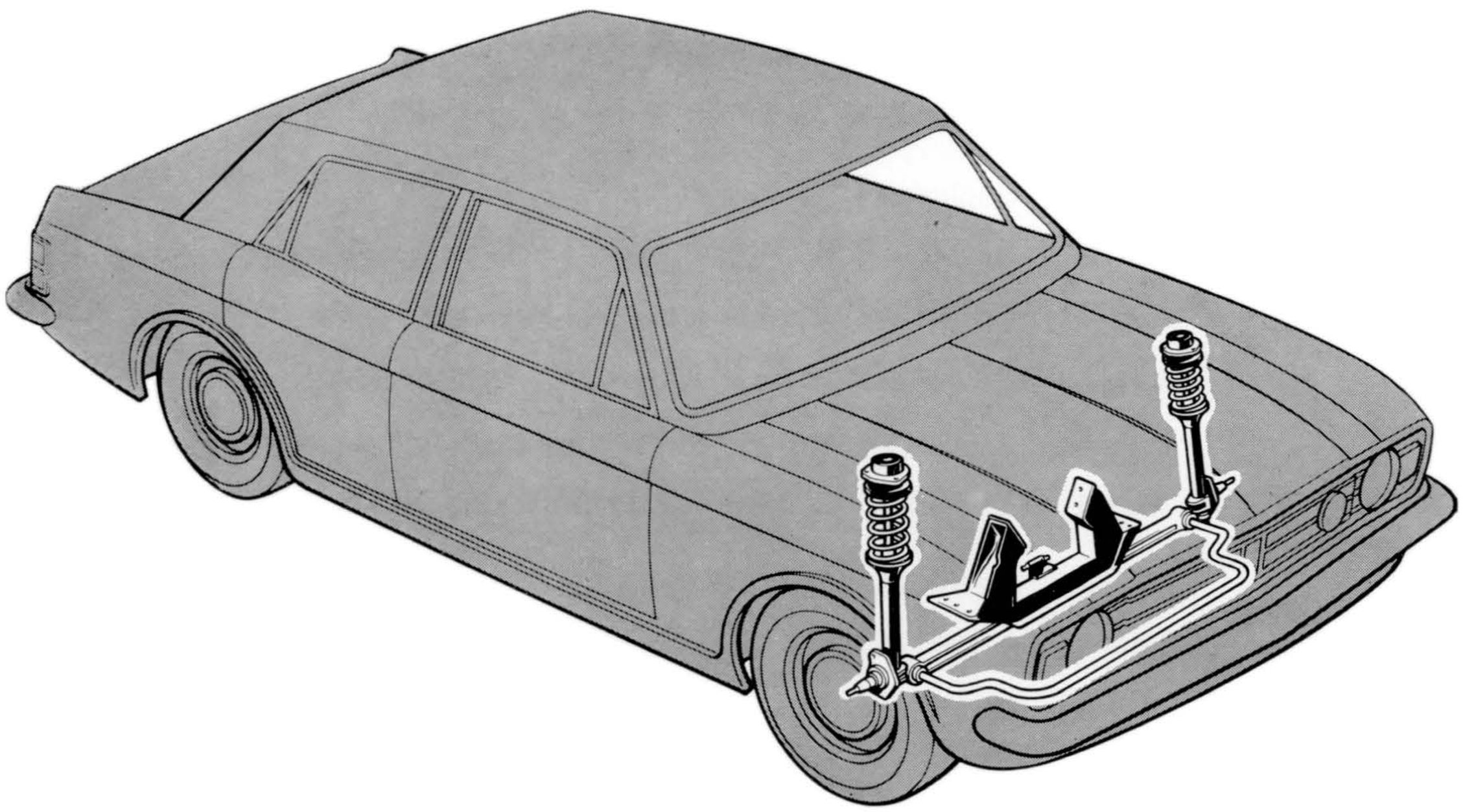
FRONT SUSPENSION



SECTION INDEX

GENERAL DESCRIPTION

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,,	3063-B	**TRACK CONTROL ARM INNER BUSHES – ALL – RENEW** (Includes OPS 3063-A and A1)
,,	3078-A	TRACK CONTROL ARM ASSEMBLY – ONE – REMOVE AND INSTALL
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,,	3078-B	**TRACK CONTROL ARM ASSEMBLIES – BOTH –** REMOVE AND INSTALL (Includes OPS 3078-A and A1)
,,	3482-A	STABILISER BAR CLAMPS – REMOVE AND INSTALL
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,,	5431-B	**FRONT SUSPENSION UNIT ASSEMBLIES – BOTH – REMOVE AND INSTALL** (Includes OPS 5431-A and A1)
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,,	5431-F	**FRONT SUSPENSION UNITS – BOTH – OVERHAUL** (Includes OPS 5431-A, A1 and A3 × 2)

GENERAL DESCRIPTION

The front suspension utilises vertical shock absorbers surrounded by large coil springs. Lateral movement of each front wheel is controlled by the track control arm and fore and aft movement is controlled by the stabiliser bar. Vertical movement of the wheel is limited by a rebound stop inside the suspension unit (or shock absorber) and by the suspension spring reaching the limit of its compression. Rebound movement of the wheel is limited by indentations in the cylinder bore. On all cars, except G.T. models, a rubber bump stop is fitted around the suspension unit piston rod. This comes into operation before the spring is fully compressed. As G.T. models have "harder" springs the bump stop is not required except for heavy duty applications.

Piston rod protection is provided on all models by the skirt on the bump stop. This shields the piston rod from road dirt, water, etc. and minimises damage to the accurately machined surfaces.

The top mount utilises a mounting plate with a rubber bush into which is bonded a steel insert. This rubber bonded top mount is designed to give increased service life, it also dampens any wheel wobble, shimmy, etc., and gives a smoother, more silent ride. It is important that the top mounts are installed with the road wheels in the straight-ahead position or the steering will tend to pull to one side. In addition, as a safety precaution a cranked retainer is fitted to the piston rod above the top mount. In the unlikely event of bond or rubber failure, the cranked end of the retainer will prevent the piston rod pulling out of the top mount. It should be noted that the cranked retainers, when only one is fitted, must face inboard towards the centre-line of the vehicle.

The track control arm ball joint is designed to give increased Service life. The ball diameter has been increased giving a greater bearing surface.

The suspension mounting points are all rubber insulated to minimise the transmission of road noise and vibration to the body and interior. A "compliance device" is incorporated in the stabiliser bar to track control arm mounting. Its function is to permit the wheel a small amount of fore and aft movement and thus reduce the shock loading on the steering linkage when the wheel hits a sudden irregularity in the road surface.

A service tool is required to facilitate operations which entail compressing the front suspension spring. This tool, Coil Spring Adjustable Restrainers (P.5045) should be used in place of the spring clips (P.5030). The tool consists of a central post with a fixed solid contoured jaw, over this post slides a tube carrying the second jaw. The jaws can be opened or closed by means of a hexagonal headed bolt passing through a thrust race in the outer tube and threaded into the central post.

The restrainers are placed diametrically opposite each other around the coil spring, the jaws fitting snugly around the spring coils. To compress the spring a standard socket and ratchet or speed brace are used, taking up each restrainer a little alternately ($\frac{1}{2}$ in. (13 mm.) maximum) to avoid bowing the spring.

This new coil spring restrainer has been designed to offer the maximum degree of convenience coupled with complete safety.

The toe-in and toe-out on turns (wheel-lock angles) are adjustable but the camber, castor and king-pin inclination angles are set in manufacture and are not adjustable.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

At the first 600 miles (1,000 km.), at the first 3,000 miles (5,000 km.) or three months, at the first 9,000 miles (15,000 km.) or nine months, and at each subsequent 6,000 miles (10,000 km.) or six months. Also at the first 21,000 miles (35,000 km.) and every subsequent 18,000 miles (30,000 km.) and every subsequent 18,000 miles (30,000 km.). At the first 39,000 miles (65,000 km.) and every subsequent 36,000 miles (60,000 km.):

(a) Check torque of front suspension crossmember retaining bolts.

(b) Check boot type gaiters on steering and front suspension joints and renew if suspect.

It should be noted that the front suspension units/shock absorbers are sealed and therefore do not require periodic topping-up.

DATA

Front Suspension Springs

Part Number	*Identification*	*Model Application*
3014E-5310-B	Green	Standard
3016E-5310-A	Brown	GT. and H.D. G.T.
3014E-5310-A	Yellow	H.D. only

Front Suspension Units

Part Number	*Position*	*Identification*	*Model Application*
68BB-3K033-HA ...	R.H.	Green & White ...	G.T.
68BB-3K034-HA ...	L.H.	Green & White ...	G.T.
3036E-3K033-F ...	R.H.	Yellow & White ...	H.D. G.T.
3036E-3K034-F ...	L.H.	Yellow & White ...	H.D. G.T.
68BB-3K033-FA ...	R.H.	Red & White ...	Standard
68BB-3K034-FA ...	L.H.	Red & White ...	Standard
3034E-3K033-G ...	R.H.	Blue & White ...	H.D.
3034E-3K034-G ...	L.H.	Blue & White ...	H.D.

Bump Rubbers

Part Number	*Model Application*
69AB-3025-AA	Standard except G.T.

NOTE — The G.T. is only fitted with Bump Rubbers for Heavy Duty applications.

Tightening Torques, lb. ft. (kg.m.)

Suspension unit upper mounting bolts	15 to 18 (2.07 to 2.49)
Spindle to top mount assembly	28 to 32 (3.90 to 4.40)
Track control arm ball stud nut	30 to 35 (4.15 to 4.85)
*Stabiliser bar attachment clamps	15 to 18 (2.07 to 2.49)
*Stabiliser bar to track control arm nut	25 to 30 (3.46 to 4.15)
*Track control arm inner bushing	22 to 27 (3.04 to 3.73)
Front suspension crossmember to body sidemember	25 to 30 (3.46 to 4.15)

*These to be tightened with the weight of the car resting on its wheels.

SERVICE AND REPAIR OPERATIONS

OP 3063-A TRACK CONTROL ARM INNER BUSH — ONE SIDE — RENEW

Tools Required

P.5045 Coil spring adjustable restrainers

To Remove

1. Fit spring restrainers, Tool No. P.5045, to the front suspension spring.
2. Jack up the front of the car and fit chassis stands.
3. Remove the self-locking nut and flat washer from the rear of the track control arm pivot bolt and push out the bolt.
4. Pull the inner end of the track control arm downwards and remove the two conical rubber bushes.

To Install

5. Assemble new bushes to the recesses in the track control arm.
6. Position the track control arm so that the pivot bolt can be fitted. Slide the pivot bolt into position from the front and fit the flat washer and self-locking nut from the rear. Do not tighten the nut at this stage.
7. Jack up, remove the chassis stands and lower the car to the ground, and tighten the nut to a torque of 22 to 27 lb. ft. (3.04 to 3.73 kg.m.).
8. Remove the spring restrainers.

OP 3063-A1 EXTRA: REMAINING TRACK CONTROL ARM INNER BUSH – RENEW
Repeat sub-operations 3 to 7 of OP 3063-A.

OP 3063-B TRACK CONTROL ARM INNER BUSHES – ALL – RENEW
(Includes OPS 3063-A and A1)

OP 3078-A TRACK CONTROL ARM ASSEMBLY — ONE — REMOVE AND INSTALL

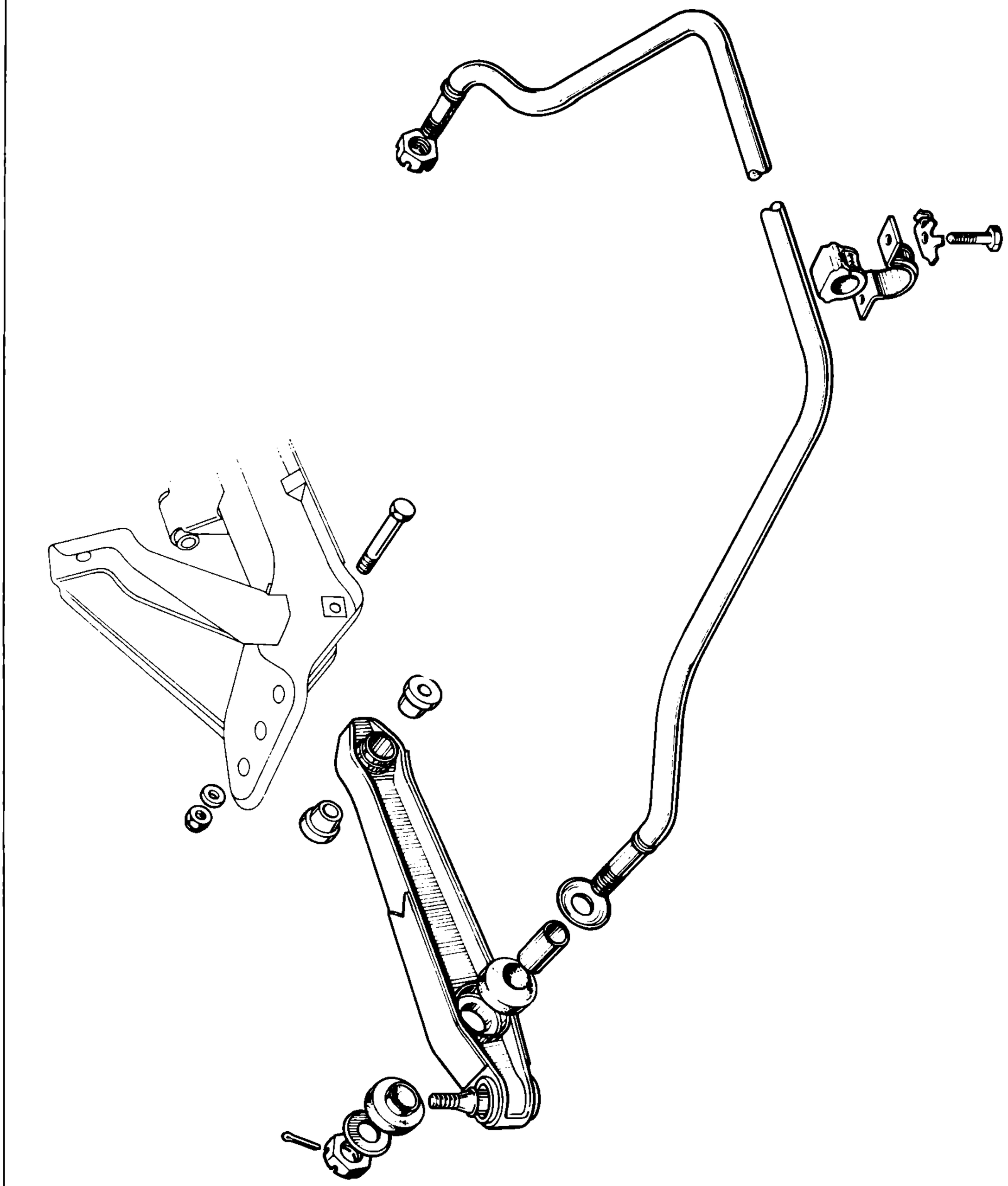
Tools Required

P.3073-9 Steering joint taper separator

P.5045 Coil spring adjustable restrainers

To Remove

1. Fit spring restrainers, Tool No. P.5045, to the front suspension spring.
2. Jack up the front of the car, fit chassis stands and remove the road wheel.
3. Remove the split pin and unscrew the castellated nut securing the track control arm to the stabiliser bar. Pull off the large dished washer and the plastic bush.
4. Bend back the lock tabs and remove the three bolts securing the steering arm to the base of the suspension unit.
5. Remove the split pin and unscrew the nut securing the track control arm ball joint to the steering arm. Separate the joint, using Tool No. P.3073-9.


Stabiliser Bar and Track Control Arm

6. Remove the self-locking nut and flat washer from the rear of the track control arm pivot bolt and release the inner end of the track control arm.

To Install

7. Assemble new conical rubber bushes to the recesses in the track control arm. Position the track control arm so that it locates correctly over the stabiliser bar and then secure the inner end. Slide the pivot bolt into position from the front and fit the flat washer and self-locking nut from the rear. Tighten the nut to a torque of 22 to 27 lb. ft. (3.04 to 3.73 kg.m.) when the car is resting on the ground.
8. Assemble the track control arm ball stud to the steering arm, tighten to a torque of 30 to 35 lb. ft. (4.15 to 4.84 kg.m.) and fit a new split pin.
9. Fit the steering arm to the base of the suspension unit and secure with three bolts. Bend up the lock tabs to prevent the bolts loosening.
10. Assemble the large rubber bush and the dished washer to the end of the stabiliser bar. Ensure that the bush and washer are fitted the correct way round. Fit the castellated nut and, when the car is resting on the ground, tighten to a torque of 25 to 30 lb. ft. (3.46 to 4.15 kg.m.). Fit a new split pin.
11. Fit the road wheel, jack up the car and remove the chassis stands.
12. Remove the spring restrainers, tighten the road wheel nuts.

OP 3078-A1 EXTRA: REMAINING TRACK CONTROL ARM ASSEMBLY – REMOVE AND INSTALL

Repeat sub-operations 3 to 10, OP 3078-A.

OP 3078-B TRACK CONTROL ARM ASSEMBLY – BOTH – REMOVE AND INSTALL (Includes OPS 3078-A and A1)

OP 3482-A STABILISER BAR TO BODY MOUNTING CLAMPS — REMOVE AND INSTALL

Tools Required

P.5045 Coil spring adjustable restrainers

1. With the handbrake applied, jack up the front of the car and fit stands.
2. Bend back the lock tab and remove two bolts securing one clamp to the body member.
3. Replace the clamp and refit the bolts, using a new lock tab. Do not tighten the bolts at this stage.
4. Repeat sub-operations 2 and 3 for the second clamp.
5. Jack up the car, remove the stands and lower the car to the ground. Tighten the clamp bolts to a torque of 15 to 18 lb. ft. (2.07 to 2.47 kg.m.) and turn up the lock tabs.

OP 3482-A1 EXTRA: STABILISER BAR MOUNTING BUSHES – RENEW

To Remove

1. Remove one front road wheel.
2. Withdraw the split pin and unscrew the stabiliser bar nut which secures the end of the stabiliser bar to the track control arm. Remove the large washer and plastic bush.
3. Pull the end of the stabiliser bar forward and remove from the track control arm.

4. Withdraw the second plastic bush, the sleeve and large washer from the end of the stabiliser bar.

5. Remove the two mounting bushes by sliding them along the stabiliser bar and off the end.

To Install

6. Replace the bushes on the stabiliser bar, and slide them along until they are beneath the clamp bolt holes in the body members.

7. Replace the large washer, sleeve and front plastic bush onto the end of the stabiliser bar, ensuring that they are the right way round.

8. Position the end of the stabiliser bar in the track control arm, and fit the rear plastic bush, ensuring it is correctly located.

9. Assemble the large washer to the end of the stabiliser bar and secure with the castellated nut. When the car has been lowered on to its wheels, tighten the nut to a torque of 25 to 30 lb. ft. (3.46 to 4.15 kg.m.) and secure with a split pin.

10. Replace the front road wheel.

OP 3530-A STABILISER BAR – REMOVE AND INSTALL

OP 3530-A1 EXTRA: STABILISER BAR TO TRACK CONTROL ARM BUSHES – RENEW

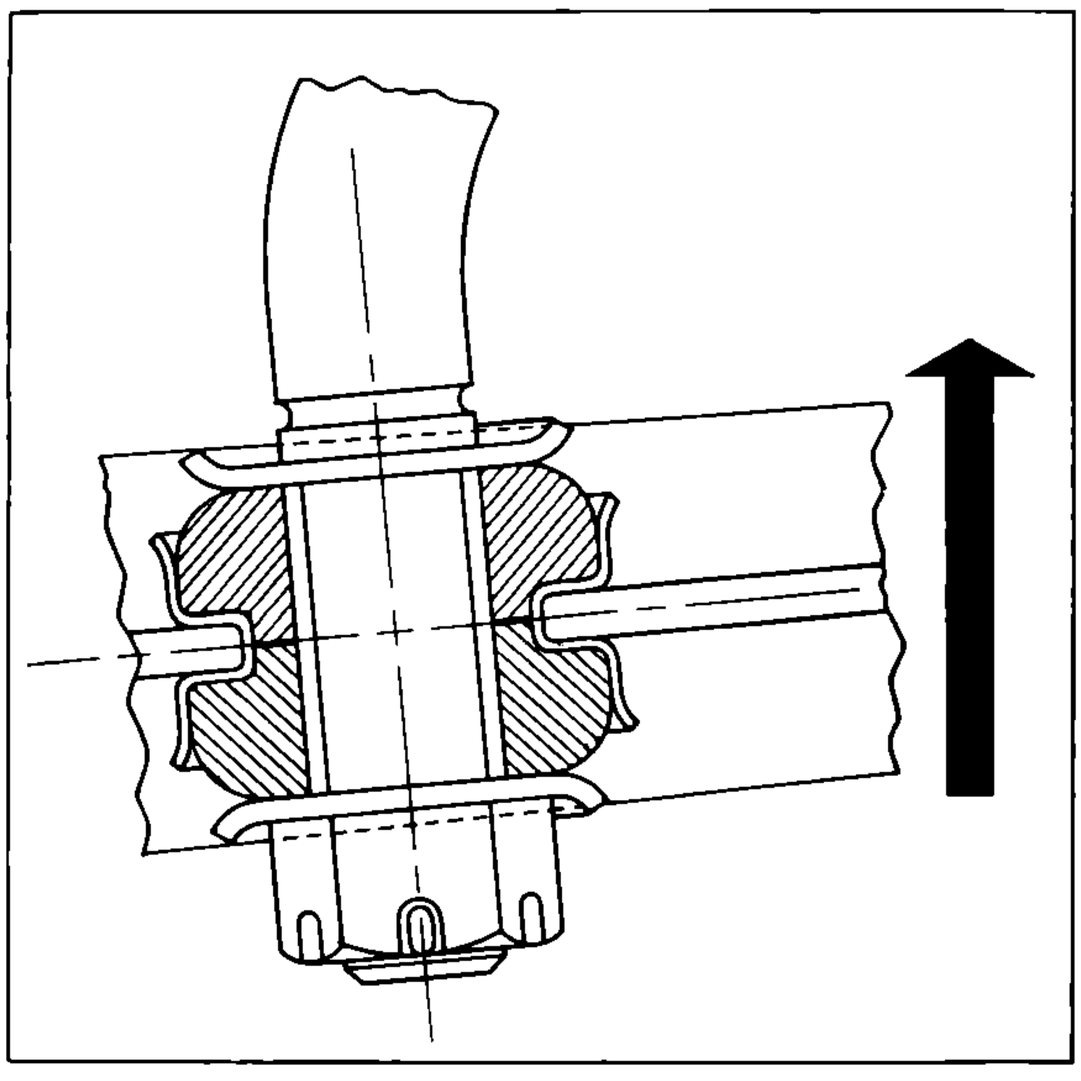
OP 3530-B STABILISER BAR TO TRACK CONTROL ARM BUSHES – RENEW (Includes OPS 3530-A and A1)

Tools Required

P.5045 Coil spring adjustable restrainers

To Remove

1. Fit spring restrainers, Tool No. P.5045, to the front spring. Slacken the front wheel nuts.



Stabiliser Bar Bushes

2. Jack up the front of the car and fit chassis stands under the front jacking points.
3. Remove the front road wheels.
4. Remove the two attachment clamps from the front of the stabiliser bar after bending back the lock tabs and removing the four bolts.
5. Withdraw the split pins and unscrew the stabiliser bar nuts which secure the ends of the stabiliser bar to the track control arms. Remove the nuts and pull off the large washers and plastic bushes.
6. Pull the stabiliser bar forward and remove.
7. Withdraw the second plastic bush, the sleeve and large washer from each end of the stabiliser bar.

To Install

8. Assemble a large washer to each end of the stabiliser bar and slide the sleeves and front plastic bushes into position. Ensure that the washers and bushes are fitted the correct way round.
9. Insert the stabiliser bar through the apertures in the track control arms and fit the rear plastic bushes, ensuring that they are the correct way round.
10. Assemble the large washers to the ends of the stabiliser bar and secure with the castellated nuts. When the car has been lowered onto its wheels tighten the nuts to a torque of 25 to 30 lb. ft. (3.46 to 4.15 kg.m.) and secure with new split pins.
11. Position new rubber insulators on the front of the stabiliser bar with the slits facing forwards and locate the attachment clamps.
12. Secure the bar to the mounting points, using two new locking plates, if necessary, and two bolts on each clamp. When the car is resting on the ground, tighten the bolts to a torque of 15 to 18 lb. ft. (2.07 to 2.47 kg.m.). Turn up the tabs of the locking plates.
13. Fit the road wheels, jack up the car, remove the stands and lower the car to the ground.
14. Remove the spring restrainers and tighten the wheel nuts.

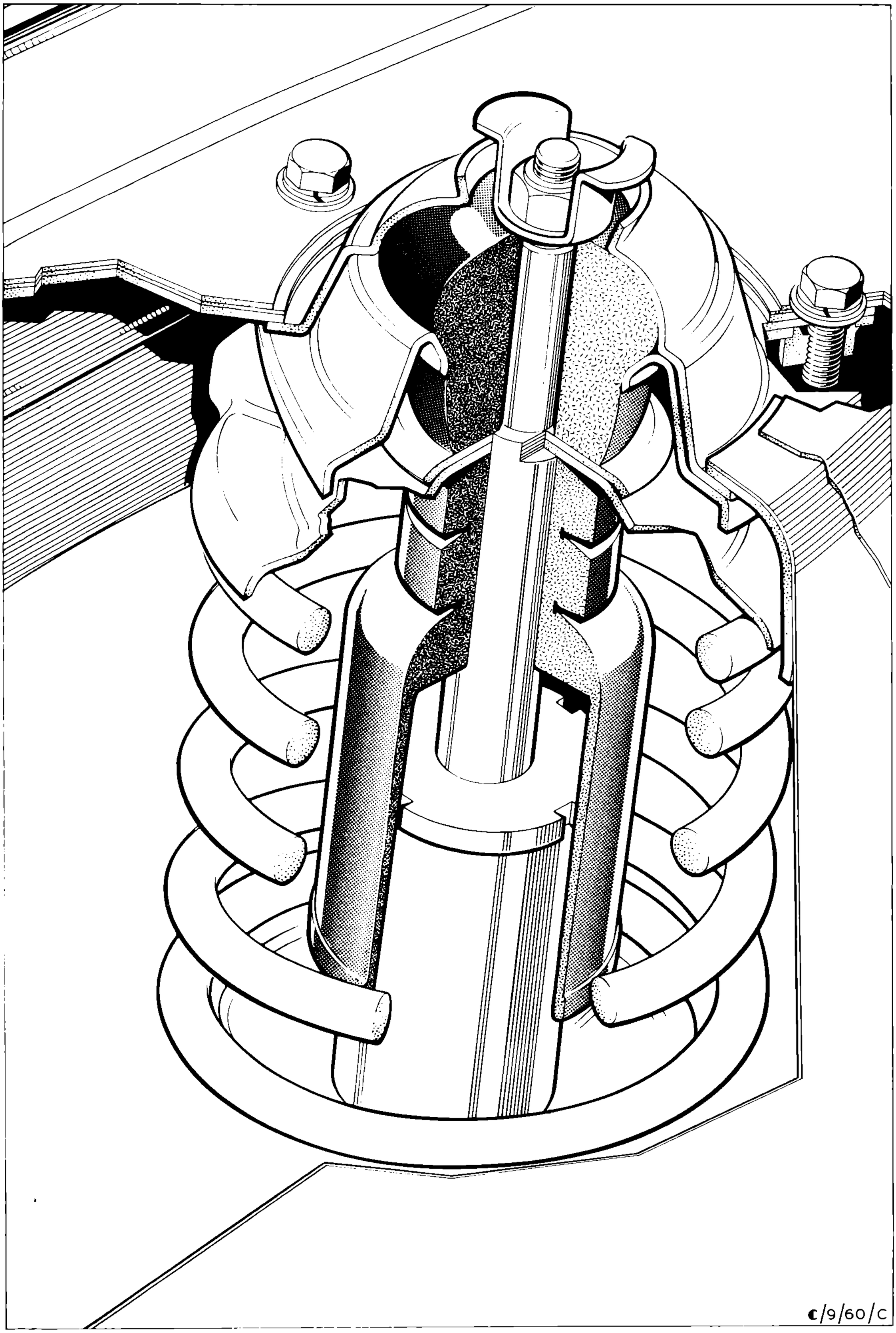
OP 5310-A SUSPENSION COIL SPRING — REMOVE AND INSTALL

Tools Required

P.5045 Coil spring adjustable restrainers

To Remove

1. Open the bonnet and fit wing covers.
2. Jack up the front of the car, fit chassis stands and remove the road wheel.
3. Fit the adjustable spring restrainers, Tool No. P.5045, and **fully** compress the front suspension spring.
4. Measure the distance the threaded end of the piston rod protrudes above the piston rod nut. Slacken the piston rod nut.
5. Using a "bottle" jack under the outer end of the track control arm, support the suspension unit.
6. Remove the piston rod nut and the cranked retainer. (Some vehicles may have a double retainer.)



Suspension Spring and Top Mount

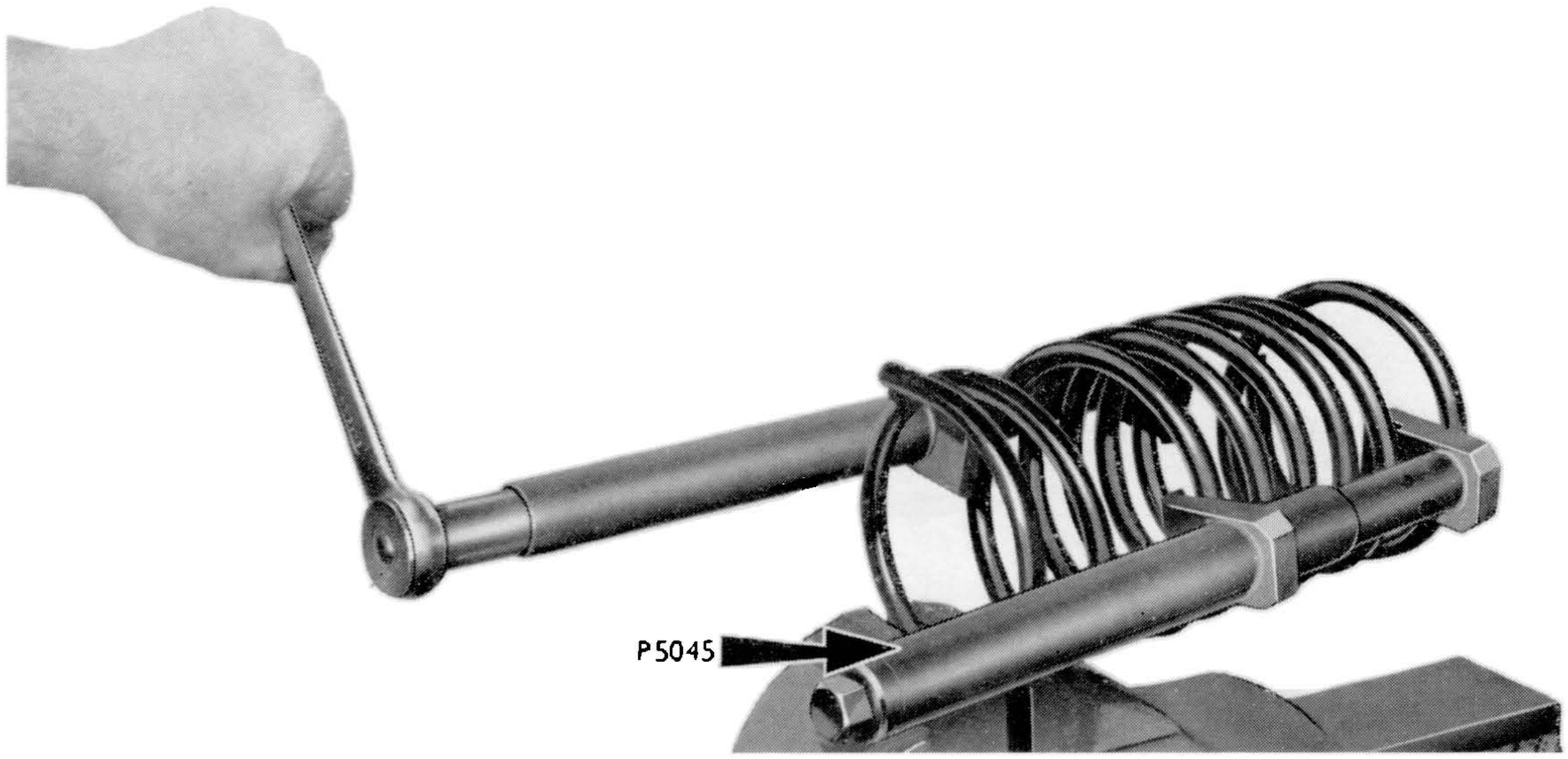
7. Remove the three bolts securing the top mount assembly to the side apron panel.
8. Push the piston rod downwards as far as it will go.
9. Lift off the top mount assembly, the dished washer and the spring upper seat assembly from the top of the spring and manoeuvre the spring out of its location.
10. Mount the spring in a vice and note the position of the spring restrainer jaws relative to the ends of the spring. Remove the adjustable spring restrainers.

To Install

11. Fit the new spring into a vice and compress with the adjustable spring restrainers. Ensure that the jaws of the spring restrainers are correctly located relative to the ends of the spring.

    NOTE — Check the colour coding of the replacement spring against the chart in the Quick Reference Data at the beginning of this section. Also check that the other spring is the same. Never mix springs, this will give unequal ride heights each side of the car and upset the handling characteristics.

12. Manoeuvre the spring into position and locate it on the lower spring seat. Push the piston rod upwards and fit the upper spring seat so that it locates on the flats on the piston rod.
13. Fit the dished washer, convex side upwards, on to the piston rod.
14. Push the piston rod further upwards if necessary and fit the top mount assembly.
15. With the steering in the straight-ahead position fit the cranked retainer so that the upper tang faces inwards, i.e. towards the engine when a single one is fitted, and assemble the securing nut. Do not tighten the nut at this stage.
16. Locate the top mount assembly and secure it to the side apron panel with the three bolts. Tighten the bolts to a torque of 15 to 18 lb. ft. (2.1 to 2.5 kg.m.).
17. Replace the road wheel after removing the spring restrainers.
18. Jack up, remove the chassis stands and the "bottle" jack from under the track control arm. Lower the car to the ground.



Compressing a Spring with the Adjustable Spring Restrainers

19. Tighten the piston rod nut to a torque of 28 to 32 lb. ft. (3.9 to 4.4 kg.m.) whilst holding the spring upper seat to prevent it rotating. Check that the cranked retainer still faces inwards when a single one is fitted, and that the piston rod thread protrusion is the same as that measured in sub-operation 2.

    NOTE — It is essential that the road wheels are kept in the straight-ahead position when the top nut is tightened. If the wheels are turned onto lock, this will cause the top mount rubber to be twisted when the wheels are subsequently turned into the straight-ahead position. This puts a bias into the steering so that the car continually pulls to one side.

20. Remove the wing covers and close the bonnet.

OP 5310-A1 EXTRA: REMAINING SUSPENSION COIL SPRING - REMOVE AND INSTALL

Repeat sub-operations 2 to 19 of OP 5310-A

OP 5310-B SUSPENSION COIL SPRINGS - BOTH - REMOVE AND INSTALL (Includes OPS 5310-A and A1)

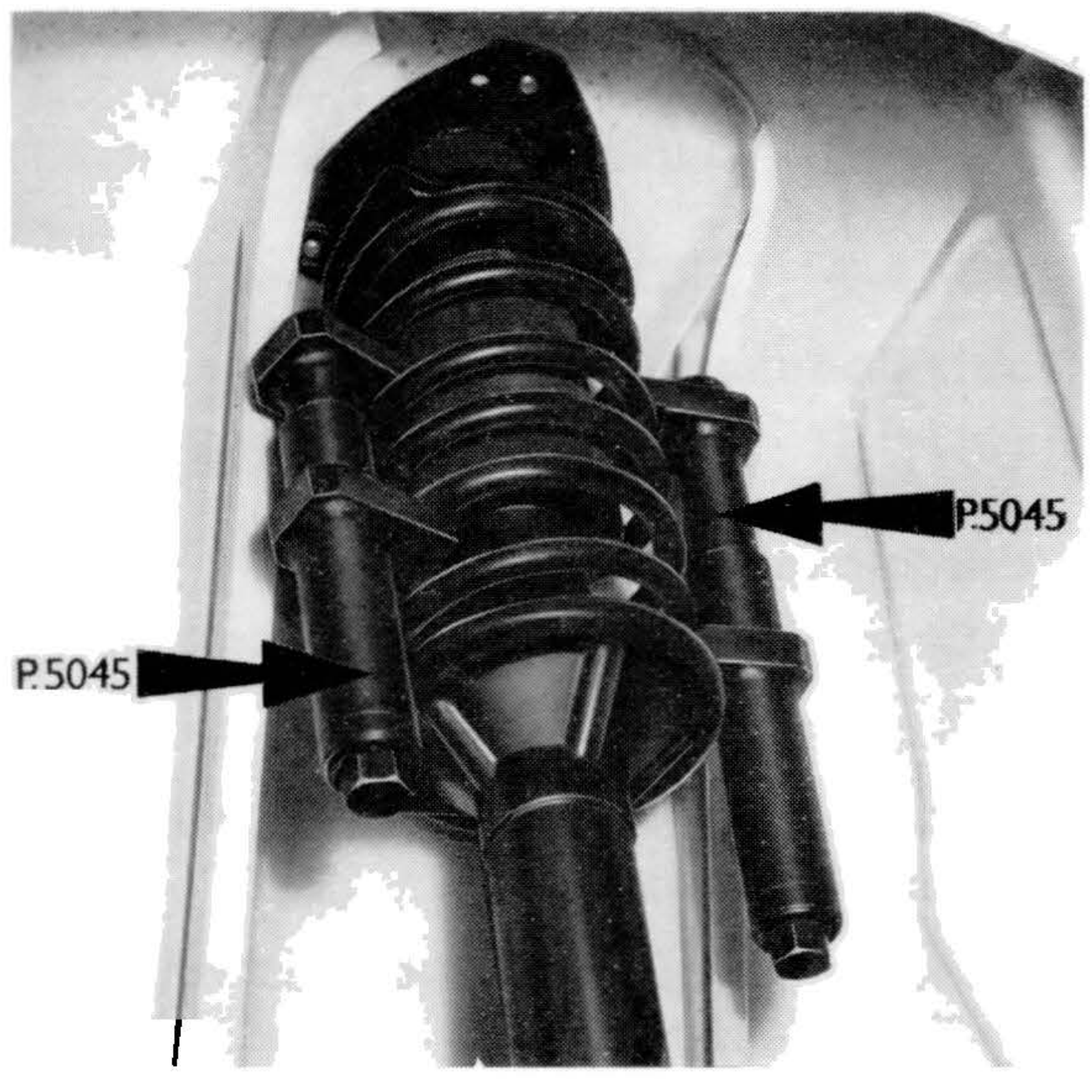
OP 5325-A BUMP RUBBER (where fitted) — RENEW

Tools Required

P.5045 Coil spring adjustable restrainers

To Remove

1. Open the bonnet and fit wing covers.
2. Jack up the front of the car, remove the road wheel and fit chassis stands.
3. Fit the adjustable spring restrainers, Tool No. P.5045, and **fully** compress the front suspension spring.
4. Measure the distance the threaded end of the piston rod protrudes above the piston rod nut. Slacken the piston rod nut.
5. Position a "bottle" jack under the outer end of the track control arm to support the suspension unit.



Adjustable Spring Restrainers

6. Remove the piston rod nut and the cranked retainer.
7. Remove the three bolts securing the top mount assembly to the side apron panel.
8. Push the piston rod downwards as far as it will go.
9. Lift off the top mount assembly, the dished washer and the spring upper seat assembly from the top of the spring and pull the bump rubber off the piston rod.

To Install

10. Fit the bump rubber to the piston rod and push it down as far as it will go.
11. Fit the spring upper seat on the spring and pass the piston rod upwards so that it locates in the upper seat. Fit the dished washer, convex side uppermost, onto the piston rod.
12. Pull the piston rod upwards and fit the top mount assembly.
13. With the road wheels in the straight-ahead position, fit the cranked retainer so that the upper tang faces inwards, i.e. towards the engine where a single one is fitted, and assemble the securing nut. Do not tighten the nut at this stage.
14. Locate the top mount assembly and secure it to the side apron panel with the three bolts. Tighten the bolts to a torque of 15 to 18 lb. ft. (2.1 to 2.5 kg.m.).
15. Remove the spring restrainers and refit the road wheel.
16. Jack up, remove the chassis stands, and the "bottle" jack from under the track control arm. Lower the car to the ground.
17. Tighten the piston rod nut to a torque of 28 to 32 lb. ft. (3.9 to 4.4 kg.m.) whilst holding the spring upper seat to prevent it rotating. Check that the cranked retainer still faces inwards where a single one is fitted, and that the piston rod protrusion is the same as that measured in sub-operation 2.

    NOTE — It is essential that the front wheels are kept in the straight-ahead position while the top nut is tightened.
18. Remove the wing covers and close the bonnet.

OP 5325-A1 EXTRA: REMAINING BUMP RUBBER – RENEW

Repeat sub-operations 2 to 17 of OP 5325-A.

OP 5325-B BUMP RUBBER – BOTH SIDES – RENEW
(Includes OPS 5325-A and A1)

OP 5425-A FRONT SUSPENSION TOP MOUNT ASSEMBLY — RENEW

Tools Required

P.5045 Coil spring adjustable restrainers

To Remove

1. Open the bonnet and fit wing covers.
2. Jack up the front of the car, remove the road wheel and fit chassis stands.
3. Fit the adjustable spring restrainers, Tool No. P.5045, and **fully** compress the front suspension spring.
4. Measure the distance the threaded end of the piston rod protrudes above the piston rod nut. Slacken the piston rod nut.

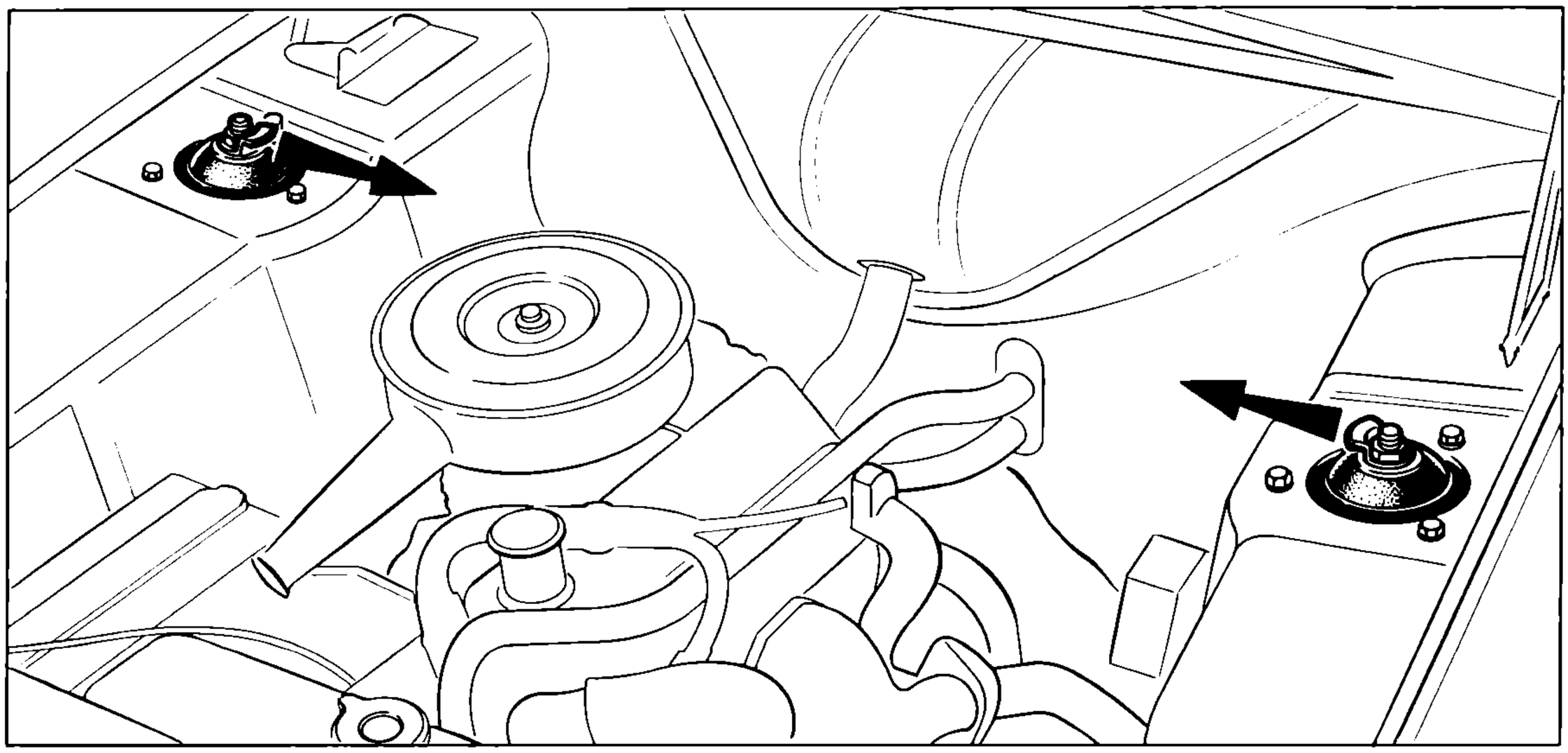
5. Position a "bottle" jack under the outer end of the track control arm to support the suspension unit.
6. Remove the piston rod nut and the cranked retainer.
7. Push the piston rod downwards as far as it will go.
8. Remove the three bolts securing the top mount assembly to the reinforced side apron panel. Detach the upper mount assembly.

To Install

9. Check that the spring upper seat and the dished washer are correctly located on the piston rod.
10. Push the piston rod upwards and fit the top mount assembly to the piston rod.
11. With the road wheels in the straight-ahead position, fit the cranked retainer so that the upper tang faces inwards. i.e. towards the engine where a single one is fitted, and assemble the securing nut. Do not tighten the nut at this stage.
12. Locate the mount assembly and secure it to the side apron with the three bolts. Tighten the bolts to a torque of 15 to 18 lb. ft. (2.1 to 2.5 kg.m.).
13. Remove the spring restrainers and refit the road wheel.
14. Jack up, remove the chassis stands and the "bottle" jack from under the track control arm. Lower the car to the ground.
15. Tighten the piston rod nut to a torque of 28 to 32 lb. ft. (3.9 to 4.4 kg.m.) whilst holding the spring upper seat to prevent it rotating. Check that the cranked retainer still faces inwards when a single one is fitted, and that the piston rod protrusion is the same as that measured in sub-operation 2.

    NOTE — It is essential that the front wheels are kept in the straight-ahead position while the top nut is tightened.

16. Remove the wing covers and close the bonnet.



Position of Cranked Retainers (they must point inwards when a single one is fitted each side)

OP 5425-A1 EXTRA: REMAINING TOP MOUNT ASSEMBLY – RENEW
Repeat sub-operations 2 to 15 of OP 5425-A

OP 5425-B FRONT SUSPENSION TOP MOUNT ASSEMBLY – BOTH – RENEW
(Includes OPS 5425-A and A1)

OP 5431-A FRONT SUSPENSION ASSEMBLY — ONE SIDE — REMOVE AND INSTALL

Tools Required

P.5045 Coil spring adjustable restrainers
P.2012 Brake line plugs

To Remove

1. Open the bonnet and fit wing covers.
2. Jack up the front of the car and fit chassis stands.
3. Remove the road wheel.
4. Detach the hydraulic flexible brake pipe from the bracket on the suspension unit. Fit brake line plugs (Tool No. P.2012) to each of the opened unions.
5. Fit the adjustable spring restrainers (Tool No. P.5045), and **fully** compress the front suspension spring.
6. Disconnect the track rod from the steering arm after removing the split pin and nut.
7. Detach the track control arm from the base of the suspension unit after removing the split pin and nut.
8. Remove the three bolts securing the top mount assembly to the side apron panel and remove the suspension assembly complete with the brake calliper.

To Install

9. Reposition the suspension assembly and secure with the three bolts through the side apron panel, to the top mount assembly. Tighten the bolts to a torque of 15 to 18 lb. ft. (2.1 to 2.5 kg.m.).
10. Assemble the track control arm ball stud to the base of the suspension unit, tighten the securing nut to a torque of 30 to 35 lb. ft. (4.2 to 4.8 kg.m.) and fit a new split pin.
11. Fit the track rod end into the locating hole in the steering arm. Fit the castellated nut, tighten to a torque of 18 to 22 lb. ft. (2.5 to 3.0 kg.m.) and lock with a new split pin.
12. Remove the brake line plugs and reconnect the flexible brake pipe to the bracket on the suspension unit.
13. Remove the spring restrainers and check visually to ensure correct location of the spring.
14. Bleed the brakes, see Operation 2000-A.
15. Replace the road wheel.
16. Jack up and remove the chassis stands.
17. Remove the wing covers and close the bonnet.

OP 5431-A1 EXTRA: REMAINING FRONT SUSPENSION ASSEMBLY – REMOVE AND INSTALL
Repeat sub-operations 3 to 13 inclusive and sub-operation 15 of OP 5431-A.

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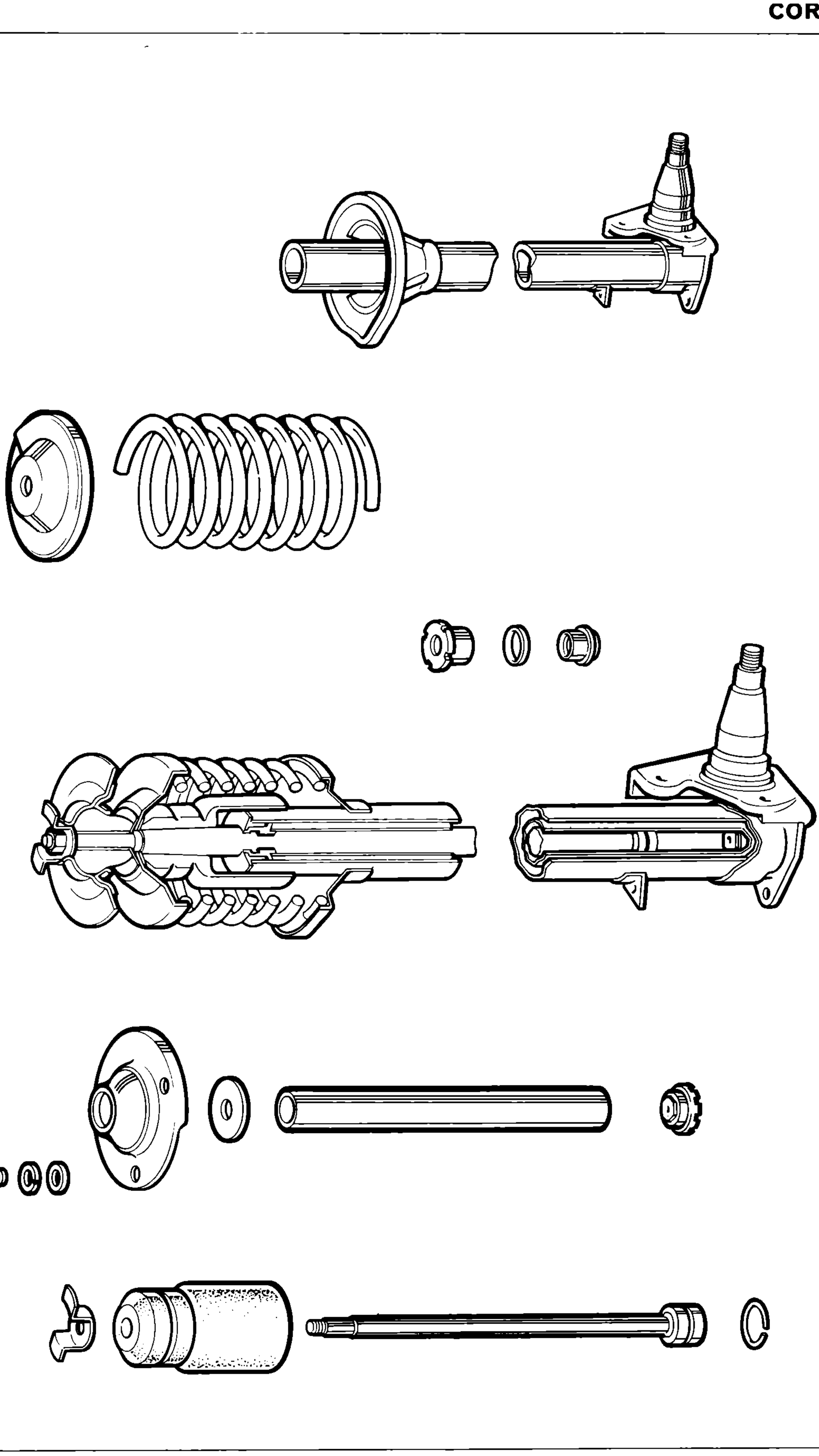
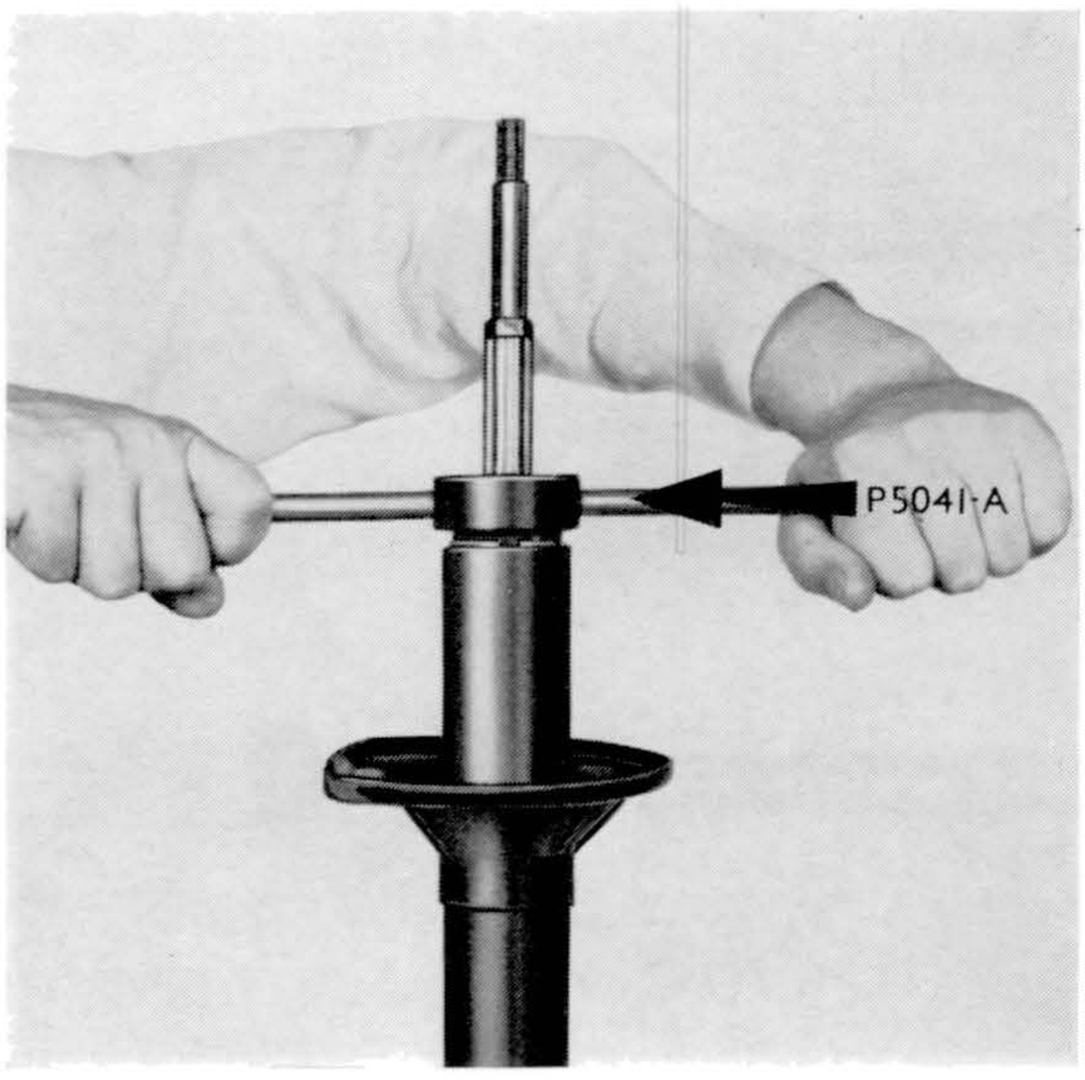


Front Suspension Unit — Exploded

OP 5431-A2 EXTRA: FRONT SUSPENSION UNIT ASSEMBLY – RENEW

To Renew

1. Unscrew the piston rod nut and remove the cranked retainer.
2. Detach the top mount and lift off the dished washer, spring upper seat, suspension spring and the bump rubber, if fitted.
3. Remove the brake pads after removing the clips, retaining pins and shims.
4. Bend back the lock tabs on the calliper securing bolts, remove the bolts and detach the calliper.
5. Remove the hub and disc assembly after detaching the dust cap, adjusting nut, etc.
6. Remove the disc splash shield.
7. Detach the steering arm.
8. Replace the steering arm, tighten the securing nuts to a torque of 30 to 34 lb. ft. (4.2 to 4.7 kg.m.).
9. Fit the hub and disc assembly onto the wheel spindle. Assemble the outer bearing, the thrust washer and fit the adjusting nut. Tighten the nut to a torque of 27 lb. ft. (3.73 kg.m.) whilst rotating the hub to seat the bearings. Slacken the nut back 90° then fit the retainer and secure with a new split pin. Tap the dust cap into place.
10. Fit the calliper assembly to its mounting lugs on the suspension unit using a new locking plate under the bolts. Tighten the bolts to a torque of 45 to 50 lb. ft. (6.3 to 6.9 kg.m.) bend up the lock tabs.
11. Replace the brake pads and shims, secure with the retaining pins and clips.
12. Reassemble the spring, etc., to the suspension unit; pull the piston rod fully upwards and fit the bump rubber, suspension spring, spring upper seat and dished washer, convex side upwards, to the piston rod.
13. Assemble the top mount and the cranked retainer. Fit the securing nut loosely.



Removing the Bump Stop Platform

14. Tighten the securing nut to a torque of 28 to 32 lb. ft. (3.9 to 4.4 kg.m.) when the suspension unit is assembled into the car and the car is on the ground. When tightening the piston rod nut, the road wheels must be in the straight-ahead position and the cranked retainer must face inwards, i.e. towards the engine, where a single one is fitted.

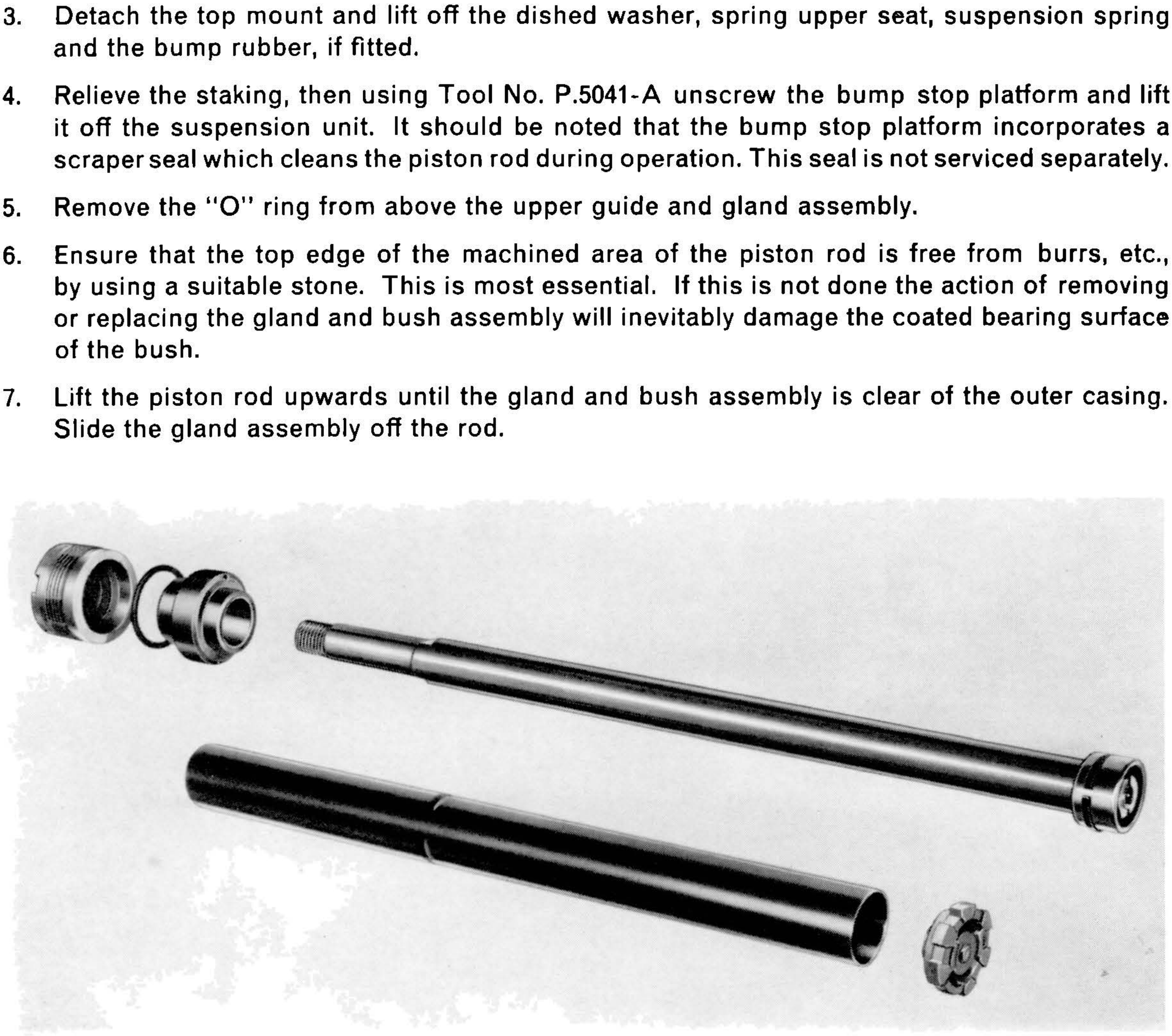
OP 5431-A3 EXTRA: FRONT SUSPENSION UNIT — OVERHAUL

Tools Required

P.5041-A Front suspension unit bump stop platform wrench
P.5042 Gland and bush guide
P.5045 Adjustable spring restrainers

To Dismantle

1. Fit the adjustable spring restrainers, Tool No. P.5045, and **fully** compress the front spring.
2. Unscrew the piston rod nut and remove the cranked retainer.
3. Detach the top mount and lift off the dished washer, spring upper seat, suspension spring and the bump rubber, if fitted.
4. Relieve the staking, then using Tool No. P.5041-A unscrew the bump stop platform and lift it off the suspension unit. It should be noted that the bump stop platform incorporates a scraper seal which cleans the piston rod during operation. This seal is not serviced separately.
5. Remove the "O" ring from above the upper guide and gland assembly.
6. Ensure that the top edge of the machined area of the piston rod is free from burrs, etc., by using a suitable stone. This is most essential. If this is not done the action of removing or replacing the gland and bush assembly will inevitably damage the coated bearing surface of the bush.
7. Lift the piston rod upwards until the gland and bush assembly is clear of the outer casing. Slide the gland assembly off the rod.



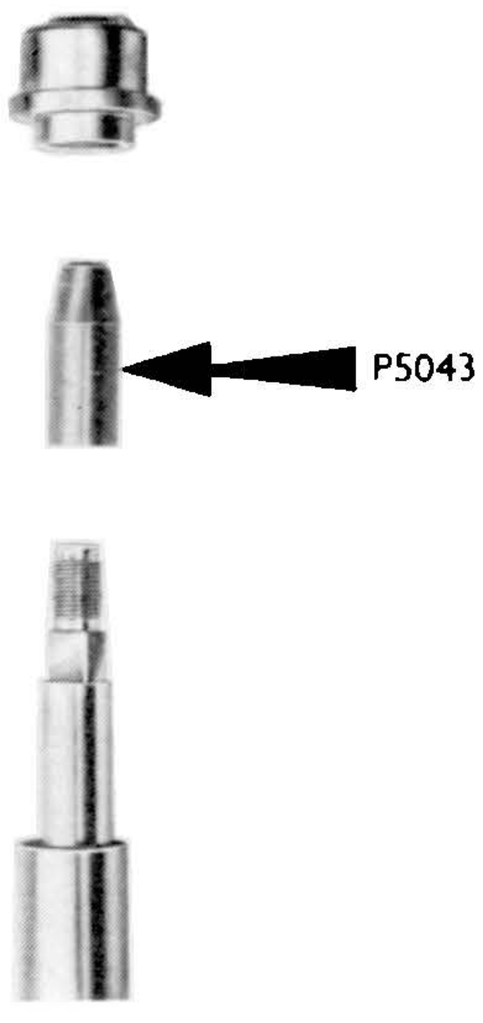
Front Suspension Unit — Internal Components

8. Empty the fluid into a suitable waste container.
9. Pull the piston rod complete with piston, cylinder and compression valve out of the outer casing.
10. Remove the piston rod from the cylinder by pushing the compression valve out of the base and then pushing the rod downwards and withdrawing it from the cylinder.
11. If necessary remove the piston ring from the piston.
12. Wash all components in a suitable bath and then examine them for wear or damage.

    N.B. Do not remove the piston from the piston rod, these components are serviced as an assembly, they are not available separately. This is because the piston incorporates a valve and the assembly procedure is critical if the valve is to function correctly.

To Reassemble

13. If the piston ring has been removed, fit a new one to the piston.
14. Insert the piston rod into the cylinder and push the compression valve into the base of the cylinder.
15. Carefully pass the cylinder and piston rod assembly into the outer casing. Fill the unit with the correct quantity of fluid, 260 c.c. Ensure that the correct fluid is used, M-100502-E.
16. Fit the gland and bush guide P.5043 onto the end of the piston rod and slide the gland and bush over the guide. Push it down until it contacts the end of the cylinder and the complete internal assembly is below the top of the outer casing.
17. Place the rubber "O" ring on the top of the gland and bush assembly and locate it correctly round the bore of the outer casing.
18. Screw the bump stop platform into the top of the outer casing. Using Tool No. P.5041-A, tighten it securely.
19. Reassemble the spring, etc., to the suspension unit; pull the piston rod fully upwards and fit the bump rubber, suspension spring, spring upper seat and dished washer, convex side upwards to the piston rod.
20. Assemble the top mount and the cranked retainer. Fit the securing nut loosely.



Replacing Gland and Bush Assembly

21. Remove the adjustable spring restrainers, Tool No. P.5045, from the front spring.
22. Tighten the securing nut to a torque of 28 to 32 lb. ft. (3.9 to 4.4 kg.m.) when the suspension unit is assembled into the car and the car is on the ground. When tightening the piston rod nut the road wheels must be in the straight-ahead position and the cranked retainer must face inwards, i.e. towards the engine where a single one is fitted.

OP 5431-A4 EXTRA: TOP MOUNT AND/OR BUMP RUBBER AND/OR PISTON ROD GAITER – RENEW (FRONT SUSPENSION UNIT REMOVED)

Tools Required

P.5045 Adjustable spring restrainers

To Renew

1. Fit the adjustable spring restrainers, Tool No. P.5045, and **fully** compress the front suspension spring.
2. Remove the piston rod nut and cranked retainer.
3. Lift off the top mount assembly and the upper spring seat and pull the bump rubber off the piston rod.
4. Pull the piston rod gaiter off the upper spring seat.
5. Push the bump rubber onto the piston rod.
6. Fit the piston rod gaiter to the upper spring seat and locate the upper spring seat on the flats of the piston rod.
7. Assemble the top mount assembly and the cranked retainer. Apply Loctite to the thread, fit the piston rod nut and tighten to 5 to 10 lb. ft. (0.7 to 1.4 kg.m.).
8. Remove the adjustable spring retainers, Tool No. P.5045, from the front suspension spring.
9. Slacken the piston rod nut and retighten to a torque of 28 to 32 lb. ft. (3.9 to 4.4 kg.m.) when the suspension unit is assembled into the car and the car is on the ground. When tightening the piston rod nut, the road wheels must be in the straight-ahead position and the cranked retainer must face inwards, i.e. towards the engine where a single one is fitted.

OP 5431-A5 EXTRA: FRONT SUSPENSION COIL SPRING – REMOVE AND INSTALL (TOP MOUNT REMOVED)

To Remove

1. Remove the spring.
2. Mount the spring in a vice and remove the adjustable spring restrainers.

To Install

3. Fit the new spring in a vice and **fully** compress with the adjustable spring restrainers.

   NOTE – Check the colour coding of the replacement spring against the chart in the Quick Reference Data at the beginning of this section. Also, check that the other spring is the same. Never mix springs, this will give unequal ride heights each side of the car and upset the handling characteristics.
4. Replace the spring.

OP 5431-B FRONT SUSPENSION UNIT ASSEMBLIES – BOTH – REMOVE AND INSTALL
(Includes OPS 5431-A and A1)

OP 5431-C FRONT SUSPENSION UNIT – ONE – RENEW
(Includes OPS 5431-A and A2)

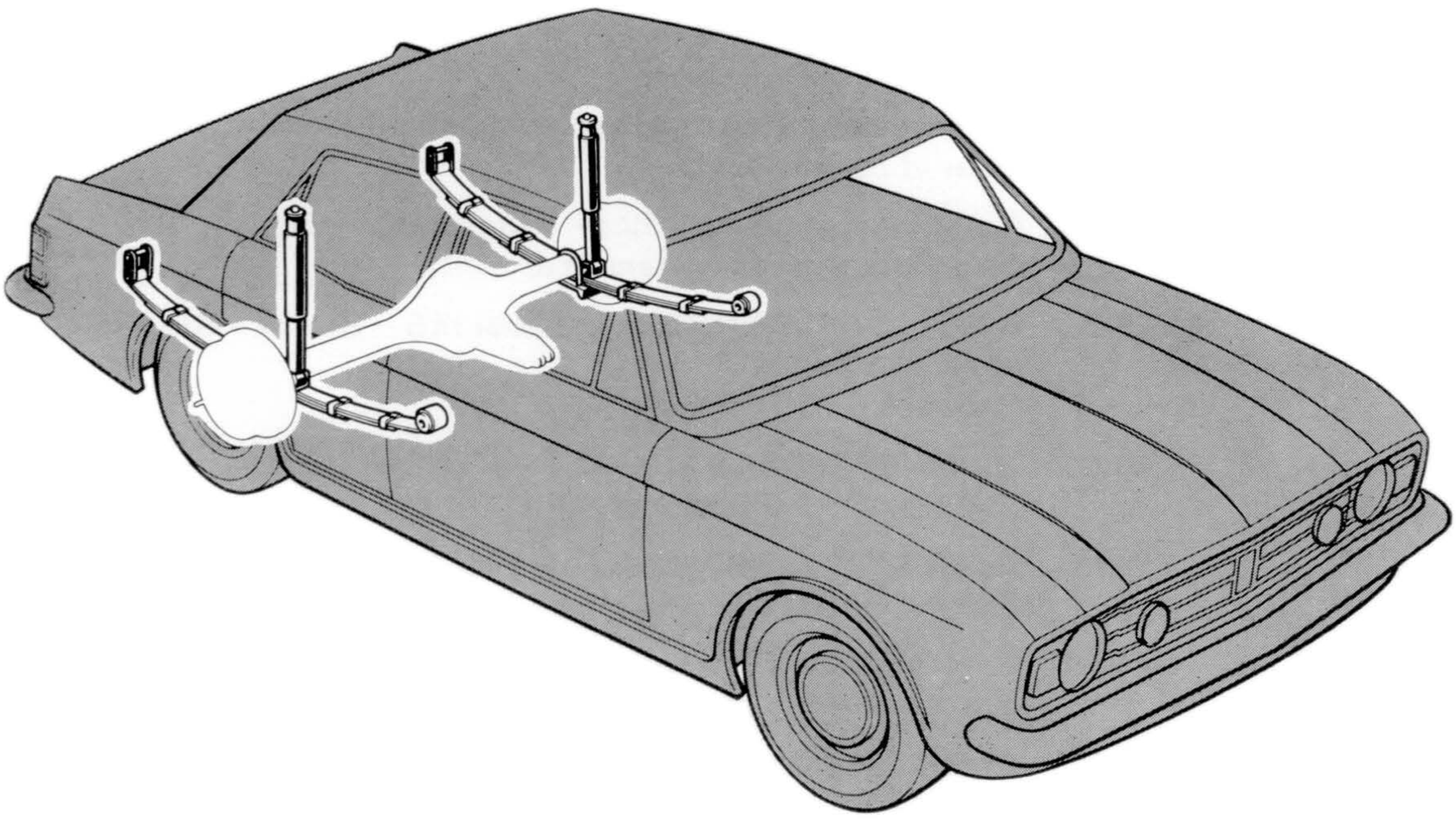
OP 5431-D FRONT SUSPENSION UNITS – BOTH – RENEW
(Includes OPS 5431-A, A1 and A2 × 2)

OP 5431-E FRONT SUSPENSION UNIT – ONE – OVERHAUL
(Includes OPS 5431-A and A3)

OP 5431-F FRONT SUSPENSION UNITS – BOTH – OVERHAUL
(Includes OPS 5431-A, A1 and A3 × 2)

5/2

REAR SUSPENSION



SECTION INDEX

QUICK REFERENCE DATA

SERVICE AND REPAIR OPERATIONS

OPERATION	5500-A	REAR SHOCK ABSORBER – ONE – REMOVE AND INSTALL
,,	5500-A1	Extra: remaining rear shock absorber – Remove and install (Rear of car on stands)
,,	5500-B	**REAR SHOCK ABSORBERS – BOTH – REMOVE AND INSTALL** (Includes OPS 5500-A and A1)
,,	5545-A	RADIUS ARM – REMOVE AND INSTALL
,,	5545-A1	Extra: remaining radius arm – remove and install
,,	5545-A2	Extra: radius arm bush – one – renew
,,	5545-B	**RADIUS ARMS – BOTH – REMOVE AND INSTALL** (Includes OPS 5545-A and A1)
,,	5560-A	REAR LEAF SPRING ASSEMBLY – ONE – REMOVE AND INSTALL
,,	5560-A1	Extra: remaining rear leaf spring assembly – remove and install (Rear of car on stands)
,,	5560-A2	Extra: rear spring leaf – one – remove and install (Rear spring assembly removed)
,,	5560-B	**REAR LEAF SPRING ASSEMBLIES – BOTH – REMOVE AND INSTALL** (Includes OPS 5560-A and A1)
,,	5560-C	**REAR SPRING LEAF – ONE – RENEW** (Includes OPS 5560-A and A2)
,,	5560-M	REAR SPRING SHACKLE PLATES AND/OR BUSHES – ONE SPRING – REMOVE AND INSTALL
,,	5560-M1	Extra: remaining rear spring shackle plates and/or bushes – remove and install (Rear of car on stands)
,,	5560-N	**REAR SPRING SHACKLE PLATES AND/OR BUSHES – BOTH SPRINGS – REMOVE AND INSTALL** (Includes OPS 5560-M and M1)
,,	5560-P	REAR SPRING FRONT BUSH – ONE SIDE – RENEW
,,	5560-P1	Extra: remaining rear spring front bush – renew (Rear of car on stands)
,,	5560-R	**REAR SPRING FRONT BUSH – BOTH SIDES – RENEW** (Includes OPS 5560-P and P1)
,,	5560-S	**REAR SPRING FRONT AND REAR BUSHES – ALL – RENEW** (Includes OPS 5560-M, M1, P and P1)

OPERATION	5707-A	REAR SPRING 'U' BOLT – ONE SPRING – REMOVE AND INSTALL
,,	5707-A1	Extra: remaining rear spring 'U' bolts – remove and install (Rear of car on stands)
,,	5707-A2	Extra: spring insulator – one spring – renew (1600E only)
,,	5707-B	**REAR SPRING 'U' BOLTS – BOTH SPRINGS – REMOVE AND INSTALL** (Includes OPS 5707-A and A1)
,,	5707-C	**SPRING INSULATOR – ONE – RENEW (1600E ONLY)** (Includes OPS 5707-A and A2)
,,	5707-D	**SPRING INSULATORS – BOTH – RENEW (1600E ONLY)** (Includes OPS 5707-A, A1 and A2 × 2)

GENERAL DESCRIPTION

The rear suspension is of the conventional longitudinal semi-elliptic leaf spring type. The rear axle is mounted asymmetrically on the rear springs, i.e. it is closer to the front of the spring than it is to the rear. Large diameter rubber bushes are used in both front and rear spring eyes to minimise the transmission of road noise and vibration.

Shock absorbers are of the double-acting hydraulic type. On all Saloon variants the shock absorbers are telescopic and sealed for life whilst those fitted to the Estate car are lever arm and may be topped up using fluid M-100502-E.

Twin radius arms are fitted to the 1600E only to reduce the effects of acceleration and braking on the rear springs. Also insulation between the spring and rear axle is provided on the 1600E to further reduce the transmission of noise and vibration.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

At the first 600 miles (1,000 km.)

Check torque of rear spring 'U' bolts.

At the first 3,000 miles (5,000 km.) and every subsequent 6,000 miles (10,000 km.)

Check torque of rear spring 'U' bolts.

Check condition of rear spring inserts.

DATA

Rear Springs

Model	*Part Number*	*Colour Code*	*No. of Leaves*
Saloon (not H.D.)	69BB-5560-HA	Blue/Red	3
Saloon (H.D.) ...	69BB-5560-JA	White	4
G.T. (not H.D.)	69BB-5560-KA	Green	4
G.T. (H.D.) ...	69BB-5560-LA	Red	5
1600E (not H.D.) ...	69BB-5560-EA	Yellow	5
Estate Car (not H.D.)	69BB-5560-MA	Green/Yellow	5
Estate Car (H.D.)	69BB-5560-NA	Yellow/Blue	6

Rear Shock Absorbers

Model	*Part Number*	*Colour Code*
Saloon (not H.D.)	68BB-18080-A1A	Pink
Saloon (H.D.)	68BB-18080-B1A	Blue
G.T. (not H.D.) ...	68BB-18080-A1A	Pink
G.T. (H.D.) ...	68BB-18080-B1A	Blue
1600E (not H.D.)	68BB-18080-C-A	Green/Red
1600E (H.D.) ...	68BB-18080-B1A	Blue
Estate Car — L.H.	3014E-18K004-A	(Lever Arm)
Estate Car — R.H.	3014E-18080-C	(Lever Arm)

Length between spring eye centres	47 in. (1194 mm.)
Length from front spring eye to centre-line of axle	19.5 in. (495.6 mm.)
Width of leaves ...	... 2 in. (50.8 mm.)
Shock absorbers – Saloon	... Double-acting telescopic
– Estate Car ...	Double-acting lever-arm
Length between radius arm eye centres ...	11.7 in. (297.2 mm.)

Tightening Torques lb. ft. (kg.m.)

*Radius arm to axle (1600E only)	22 to 27 (3.04 to 3.73)
*Radius arm to body (1600E only)	45 to 50 (6.22 to 6.91)
*Shock absorber to body ...	15 to 20 (2.07 to 2.76)
Shock absorber to axle	40 to 45 (5.54 to 6.22)
*Rear spring plate 'U' bolts	20 to 25 (2.76 to 3.46)
*Rear spring front hanger ...	25 to 30 (3.46 to 4.15)
*Rear spring axle shackle nuts	8 to 10 (1.11 to 1.38)

*These items to be tightened with the vehicle resting on its wheels.

OP 5500-A REAR SHOCK ABSORBER – ONE – REMOVE AND INSTALL – TELESCOPIC

To Remove

1. Chock the front wheels, jack up the rear of the car and fit chassis stands under the body jacking points.
2. From inside the luggage compartment remove the two nuts from the top of the shock absorber, using a second spanner on the flats on the piston rod to prevent it turning.
3. Lift off the top steel washer, the rubber bush and the lower steel washer, where fitted.
4. Detach the lower end of the shock absorber from the bracket on the axle by removing the nut, lockwasher and bolt. Remove the shock absorber from the car.
5. Remove the rubber bush and steel washer from the top of the shock absorber.

To Install

6. Assemble the large steel washer (lipped edge upwards) and the rubber bush to the top of the shock absorber.
7. Fit the lower end of the shock absorber into the bracket on the axle and line up the holes in the bracket with the hole in the shock absorber. Fit the bolt, lockwasher and nut, but do not tighten at this stage.
8. Extend the shock absorber upwards and pass it through the mounting aperture in the body. Position the cupped washer (large opening upwards) followed by the rubber bush, or the rubber bush with the spigot to fit the mounting aperture in the body, and dished washer over the piston rod. Fit the first nut to retain the shock absorber in position.
9. Jack up the rear of the car, remove the chassis stands and lower the car to the ground. Remove the chocks from the front wheels, after tightening the lower mounting locknut to 40 to 45 lb. ft. (5.54 to 6.22 kg.m.).
10. Tighten the first top nut to a torque of 20 to 25 lb. ft. (2.76 to 3.46 kg.m.), remembering to prevent the piston rod rotating. If the torque wrench permits, this can be done by holding the top of the piston rod, using a $\frac{1}{4}$ in. A/F open-ended spanner across the flats or, alternatively, if the torque wrench prevents access, grip the upper part of the shock absorber body (this requires the assistance of a second mechanic).
11. Fit the locknut and tighten it securely.

OP 5500-A REAR SHOCK ABSORBER – ONE – REMOVE AND INSTALL – LEVER ARM TYPE

To Remove

1. Chock the front wheels, jack up the rear of the car and fit chassis stands under the body jacking points.
2. Remove the two self-locking nuts and spring washer securing the shock absorber to the body sidemember.
3. Remove the nut and spring washer securing the link arm to the axle casing, and remove the shock absorber assembly.
4. Remove the nut and spring washer securing the link to the shock absorber arm.

To Install

5. Replace the end of the connecting link through the shock absorber arm, fit the spring washer and bolt, and nip the bolt.
6. Replace the other end of the connecting link in the bracket in the axle casing and fit the spring washer and bolt, nip the bolt.
7. Replace the mounting bolts and flat washer, and tighten the mounting nuts.
8. Jack up the car, remove the stands and lower the car to the ground.
9. From underneath the car, tighten the nuts on each end of the shock absorber connecting link.

OP 5500-A1 EXTRA: REMAINING REAR SHOCK ABSORBER – REMOVE AND INSTALL

Repeat sub-operations 2 to 10 above.

OP 5500-B REAR SHOCK ABSORBERS – REMOVE AND INSTALL
(Includes OPS 5500-A and A1)

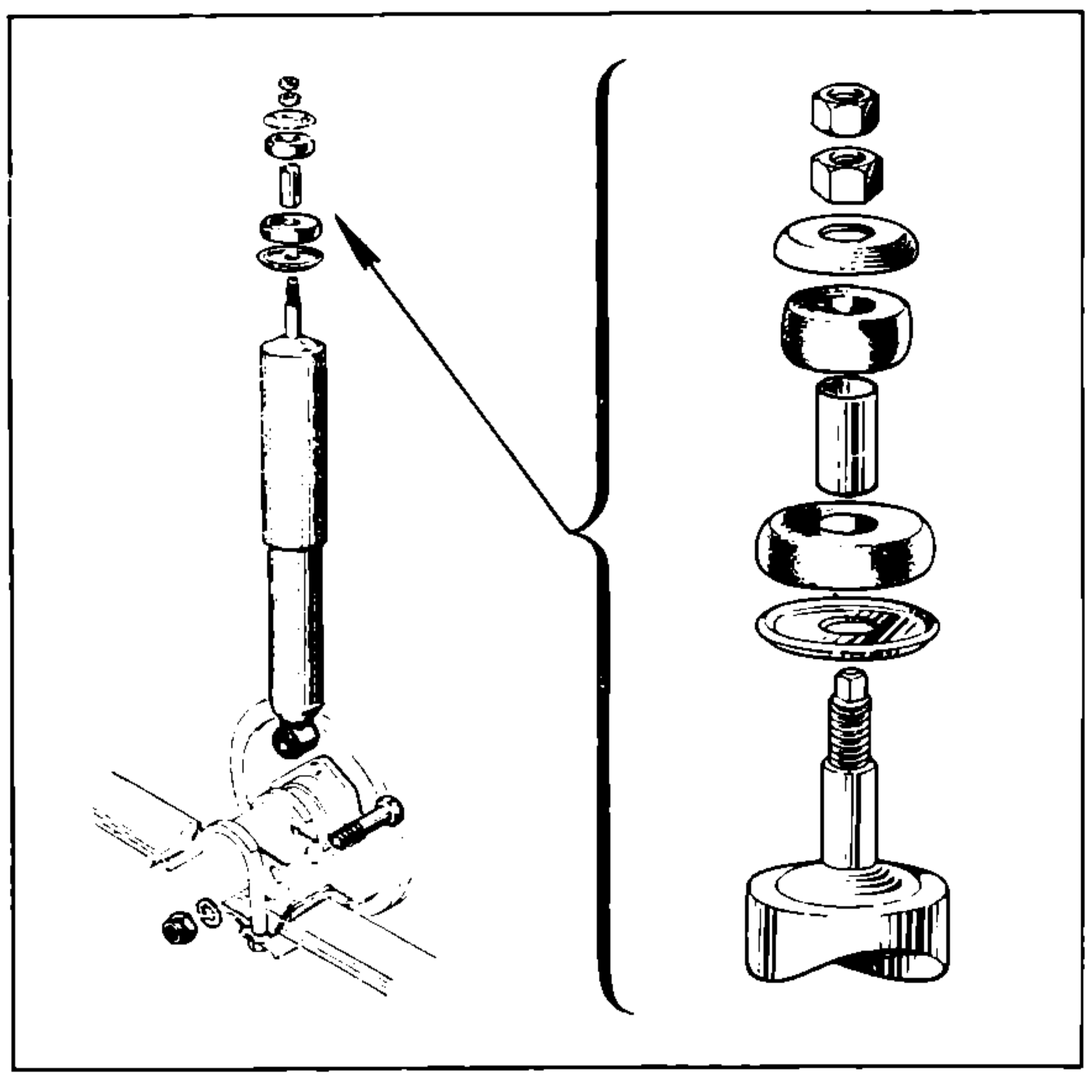
OP 5545-A RADIUS ARM – REMOVE AND INSTALL (1600E only)

To Remove

1. Chock the front wheels, jack up the rear of the car and fit chassis stands.
2. Detach the rear end of the radius arm from the rear axle by unscrewing the nut and withdrawing the through bolt.
3. Detach the forward end of the radius arm from the body mounting.

To Install

4. Attach the forward end of the radius arm to the body mounting.
5. Attach the rear end of the radius arm to the mounting bracket on the axle casing.
6. Remove the chassis stands and lower the car so that the rear wheels are either on the ground or on blocks. Torque the radius arm securing bolts to the following torque figures:



Shock Absorber Mounting

forward end (body mounting) – 45 to 50 lb. ft. (6.22 to 6.91 kg.m.), rear end (axle mounting) – 22 to 27 lb. ft. (3.04 to 3.73 kg.m.). **These bolts MUST be tightened with the weight of the car on its wheels.**

7. If the rear wheels are on blocks, jack up the car and remove them.

OP 5545-A1 EXTRA: REMAINING RADIUS ARM – REMOVE AND INSTALL (1600E ONLY)
Repeat sub-paragraphs 2 to 7 above, except removal of the chassis stands.

OP 5545-A2 EXTRA: RADIUS ARM BUSH – RENEW (1600E only)

1. Press the bush out of the end of the rod using a suitable adaptor.
2. Press the new bush into the rod, ensuring that it is square in the aperture.

OP 5545-B RADIUS ARMS – BOTH – REMOVE AND INSTALL (1600E only)
(Includes OPS 5545-A and A1)

OP 5560-A REAR LEAF SPRING ASSEMBLY – ONE – REMOVE AND INSTALL

Tools Required

P 5029 Rear spring bush remover and replacer

To Remove

1. Chock the front wheels, jack up the rear of the car and fit chassis stands under the body jacking points.
2. Position a trolley jack under the rear axle and extend it sufficiently to support the axle.
3. Remove the rear shackle nuts and detach the combined shackle bolt and plate assemblies. Remove the two rubber bushes from the body.

   When replacing the left rear spring, remove the spare wheel and the rubber plug in the wheel well adjacent to the upper shackle nut.
4. Unscrew the nut from the front mounting bracket and withdraw the through bolt.
5. Remove the 'U' bolts and the attachment plate.
6. Remove the spring assembly.
7. Using Tool No. P 5029, pull the bush out of the spring front eye.
8. Cut the flange from the spring rear eye bush and remove the bush from the spring eye.

To Install

9. Replace the spring front mounting bush using Tool No. P 5029 to ensure that the bush is fitted squarely in its aperture.
10. Replace the spring rear eye bush using Tool No. P.5029 to ensure the correct alignment of the bush. The bush must be positioned such that one apex of the triangle points downwards when the spring is installed in the vehicle.

11. Locate the front of the spring in its body mounting bracket. Fit the through bolt and loosely assemble the nut. Do not tighten it at this stage.

12. Fit the spring to the axle using the 'U' bolts, the plate and the lockwashers and nuts. Do not tighten the nuts. On the 1600E take care to position the insulator correctly.

13 Fit new loose rubber bushes to the apertures in the body for the rear shackle.

14. Locate the spring in position and assemble the rear shackle bolt and plate assemblies. Fit the nuts, but again do not tighten.

15. Remove the trolley jack supporting the rear axle.

16. Lower the car so that the rear wheels are on the ground or on blocks.

17. Tighten the spring front and rear attachment points and the 'U' bolts to the following torques:

'U' bolts	20 to 25 lb. ft. (2.76 to 3.46 kg.m.)
Spring front hanger	25 to 30 lb. ft. (3.46 to 4.15 kg.m.)
Spring rear shackles	8 to 10 lb. ft. (1.11 to 1.38 kg.m.)

NOTE – These nuts must be tightened with the car on its wheels.

OP 5560-A1 EXTRA: REMAINING REAR LEAF SPRING ASSEMBLY – REMOVE AND INSTALL

Repeat sub-operations 3 to 16 above, except lowering of the car to the ground.

OP 5560-A2 EXTRA: REAR SPRING LEAF – ONE – REMOVE AND INSTALL

To Dismantle

1. Remove the spring centre bolt and nut.

2. Drill out the rivets securing the spring clips and slide the clips along to the ends of the spring.

3. Remove the appropriate leaf.

To Reassemble

4. Check that the rubber pads are correctly located between the ends of the spring leaves and rebuild the spring.

5. Fit the centre bolt and nut.

6. Reposition the spring clips and rubbers and rivet the clips to the spring.

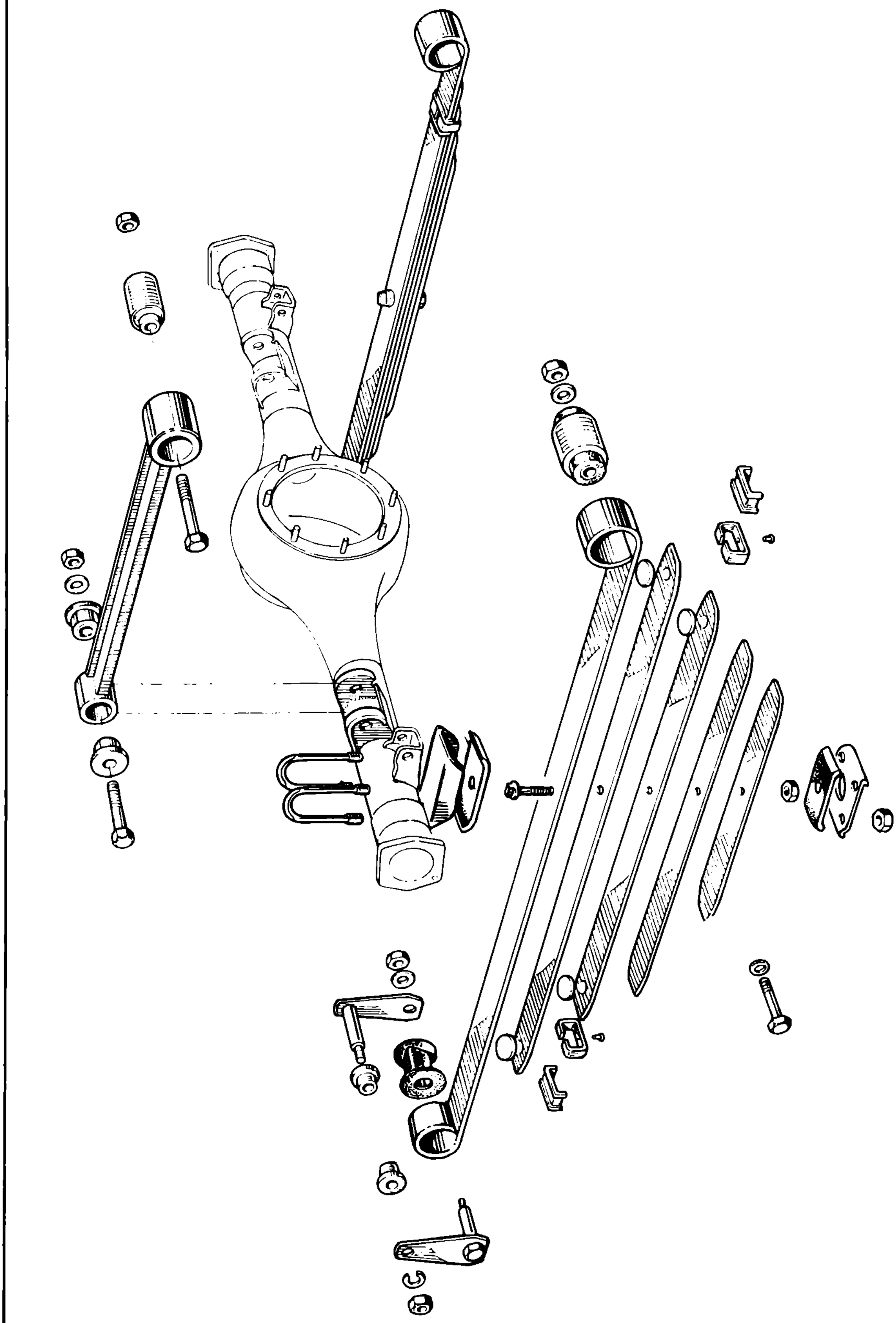
OP 5560-B REAR LEAF SPRING ASSEMBLIES – BOTH – REMOVE AND INSTALL
(Includes OPS 5560-A and A1).

OP 5560-C REAR SPRING LEAF – ONE – RENEW
(Includes OPS 5560-A and A2)

OP 5560-M REAR SPRING SHACKLE PLATES AND/OR BUSHES – ONE SPRING – REMOVE AND INSTALL

Tools Required

P.5029 Spring rear eye bush replacer.



Rear Suspension—Exploded

To Remove

1. Chock the front wheels, jack up the rear of the car and fit chassis stands under the body jacking points.
2. Position a trolley jack under the rear axle and extend it sufficiently to support the axle.
3. Remove the rear shackle nuts and detach the combined shackle bolt and plate assemblies. Remove the two rubber bushes from the body aperture and the single bush from the spring eye.

To Install

4. Fit new rubber bushes to the apertures in the body for the rear shackle.
5. Fit the bush into the rear spring eye using Tool No. P.5029. Position the bush such that one apex of the triangular bush points downwards when the spring is installed in the vehicle.
6. Locate the rear end of the spring in position and assemble the rear shackle bolt and plate assemblies. Fit the nuts but do not tighten at this stage.
7. Remove the trolley jack supporting the axle.
8. Jack up, remove the stands and lower the car to the ground. Remove the chocks from the front wheels.
9. Tighten the spring rear attachment nuts to the following torques:

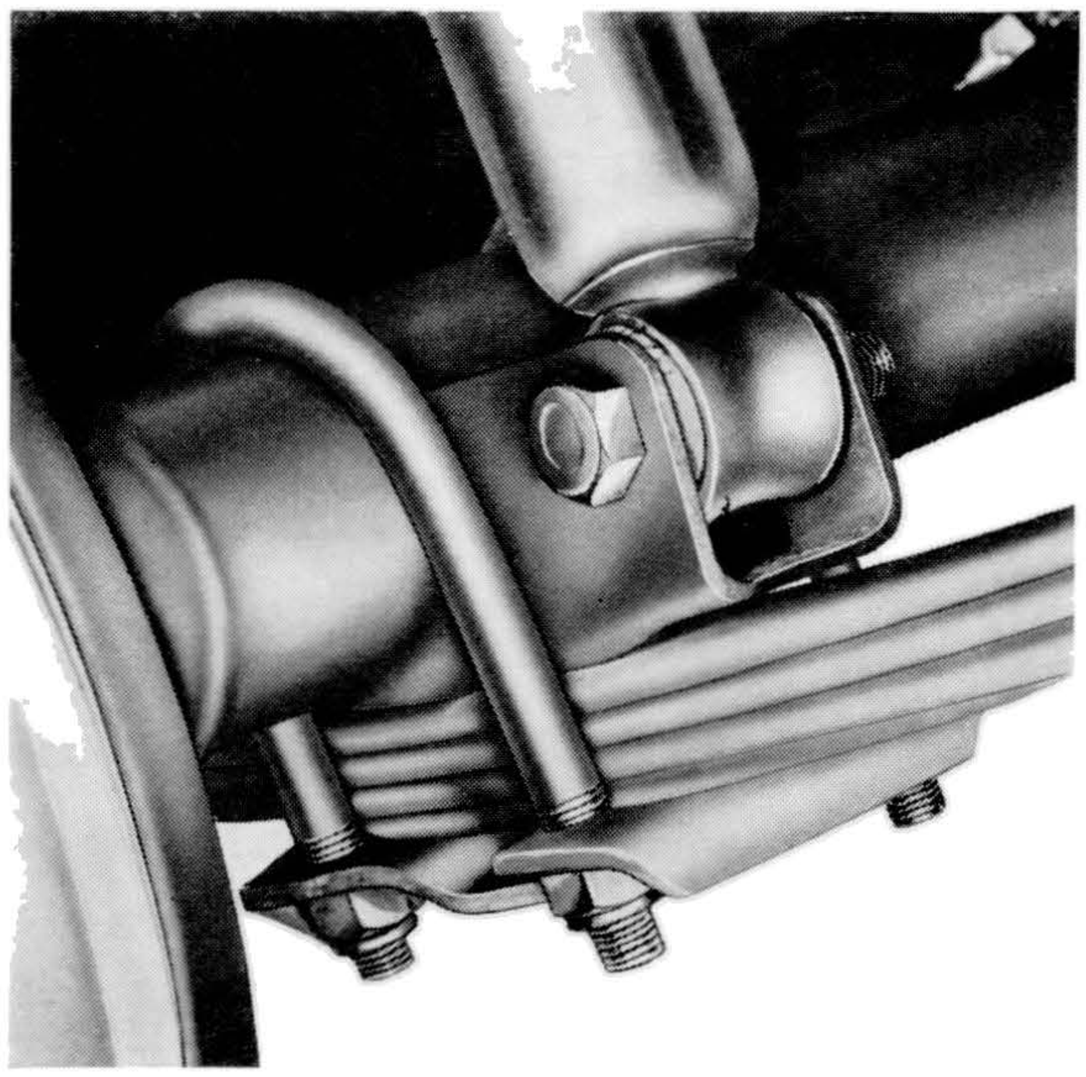
   Spring rear shackles ... ... 8 to 10 lb. ft. (1.11 to 1.38 kg.m.)

   NOTE – These nuts must be tightened with the car on its wheels.

OP 5560-M1 EXTRA: REMAINING REAR SPRING SHACKLE PLATES AND/OR BUSHES – REMOVE AND INSTALL

Repeat sub-operations 3 to 9 above, except removal of the chassis stands.

OP 5560-N REAR SPRING SHACKLE PLATES AND/OR BUSHES – BOTH SPRINGS – REMOVE AND INSTALL
(Includes OPS 5560-M and M1)



Rear Spring "U" Bolts

OP 5560-P REAR SPRING FRONT BUSH – ONE SPRING – RENEW

Tools Required

P 5029 Spring shackle bush remover and replacer

To Remove

1. Chock the front wheels, jack up the rear of the car and fit chassis stands under the body jacking points.
2. Unscrew the nut from the front mounting bracket and withdraw the through bolt.
3. Pull the front end of the spring downwards and, using Tool No. P 5029, remove the bush from the front 'eye'.

To Install

4. Using Tool No. P 5029, fit a new bush into the front spring 'eye'.
5. Position the front of the spring in its body mounting bracket. Fit the through bolt and assemble the nut, but do not tighten at this stage.
6. Jack up, remove the stands and lower the car to the ground. Remove the chocks from the front wheels.
7. Tighten the spring front shackle securing nut to a torque of 25 to 30 lb. ft. (3.46 to 4.15 kg.m.). This nut must be tightened with the car on the ground.

OP 5560-P1 EXTRA: REMAINING REAR SPRING FRONT BUSH – RENEW
Repeat sub-operations 2 to 7 above, except removal of the chassis stands.

OP 5560-R REAR SPRING FRONT BUSHES – BOTH SIDES – RENEW
(Includes OPS 5560 P and P1)

OP 5560-S REAR SPRING FRONT AND REAR BUSHES – ALL – RENEW
(Includes OPS 5560-M, M1, P and P1)

OP 5707-A REAR SPRING 'U' BOLTS – ONE SPRING – REMOVE AND INSTALL

To Remove

1. Chock the front wheels, jack up the rear of the car and fit chassis stands under the body jacking points.
2. Unscrew the 'U' bolt nuts and detach the 'U' bolts.

To Install

3. Locate the 'U' bolts in position and loosely fit the securing nuts.
4. Jack up, remove the stands and lower the car to the ground. Remove the chocks from the front wheels.
5. Tighten the 'U' bolt nuts to a torque of 20 to 25 lb. ft. (2.76 to 3.46 kg.m.). These nuts must be tightened with the car on the ground.

OP 5707-A1 EXTRA: REMAINING REAR SPRING 'U' BOLTS – REMOVE AND INSTALL

Repeat sub-operations 2, 3 and 4.

OP 5707-A2 EXTRA: SPRING INSULATOR – ONE SPRING – RENEW (1600E only)

1. Jack the axle up clear of the springs and remove the insulator and retainer from the spring.
2. Position the insulator and retainer on the spring, lower the axle on to the spring aligning the spigot on the retainer with the hole in the axle pad.

OP 5707-B REAR SPRING 'U' BOLTS – BOTH SPRINGS – REMOVE AND INSTALL
(Includes OPS 5707-A and A1)

OP 5707-C SPRING INSULATOR – ONE – RENEW (1600E only)
(Includes OPS 5707-A and A2)

OP 5707-D SPRING INSULATORS – BOTH – RENEW (1600E only)
(Includes OPS 5707-A, A1 and A2×2)

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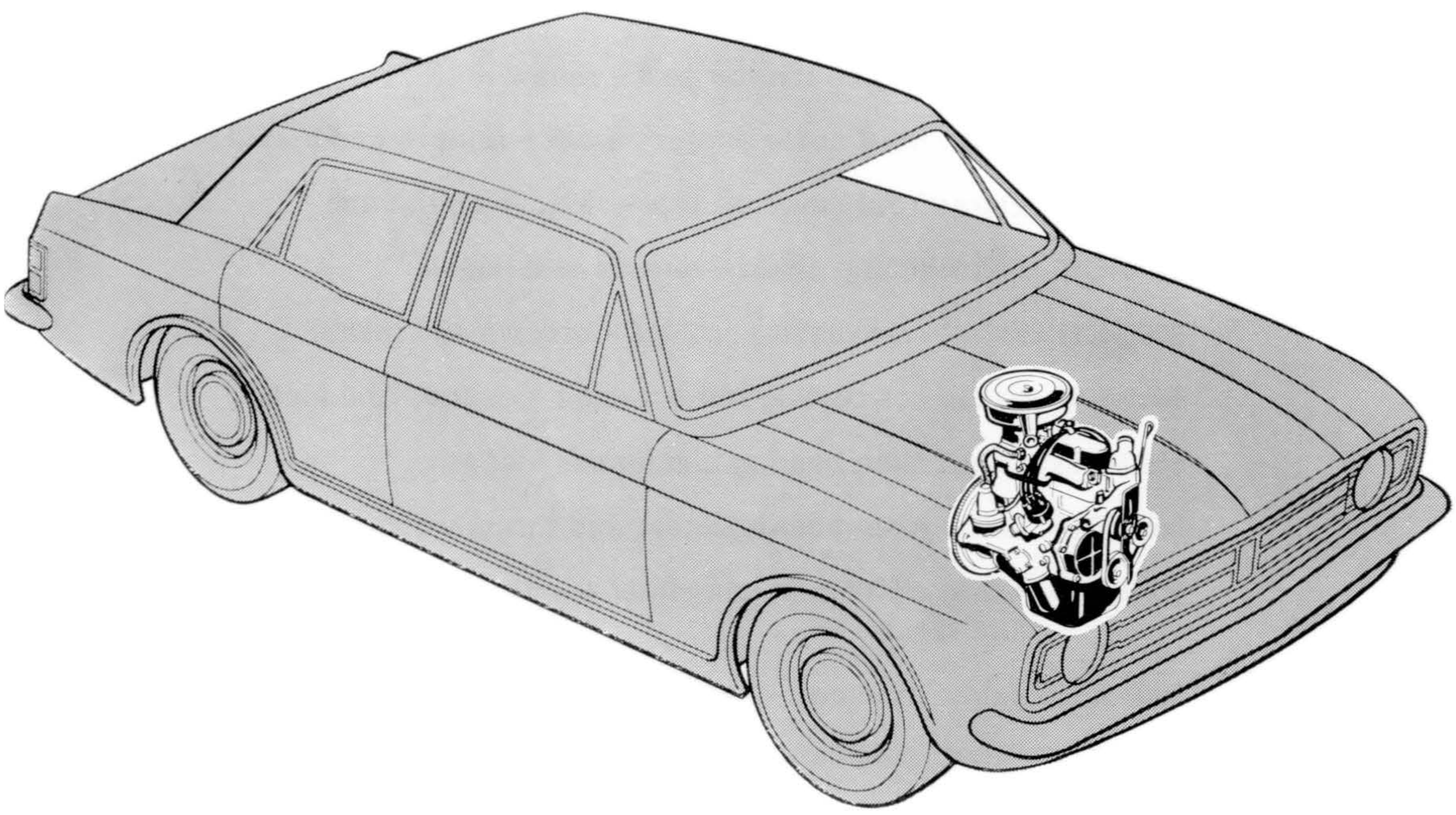
ENGINE



SECTION INDEX

GENERAL DESCRIPTION

QUICK REFERENCE DATA

SERVICE AND REPAIR OPERATIONS

OPERATION	6000-A	ENGINE – TUNE
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,,	6000-C	ENGINE ASSEMBLY – REMOVE AND INSTALL
,,	6000-C1	Extra: ancillaries – remove and install
,,	6000-C2	Extra: clutch disc and/or pressure plate – remove and install
,,	6000-C3	Extra: clutch pilot spigot bearing – remove and install
,,	6000-C4	Extra: flywheel or drive plate – remove and install
,,	6000-C5	Extra: sump and/or gaskets – remove and refit
,,	6000-C6	Extra: engine rear oil seal carrier – remove and install
,,	6000-C7	Extra: engine rear oil seal – renew
,,	6000-C8	Extra: front cover and/or gasket – remove and install
,,	6000-C9	Extra: front cover oil seal – remove and install
,,	6000-C10	Extra: timing chain – remove and install
,,	6000-C11	Extra: crankshaft sprocket – remove and install
,,	6000-C12	Extra: connecting rod bearings – remove and install
,,	6000-C13	Extra: main bearing clearances – check
,,	6000-C14	Extra: main bearing liners and thrust washers – remove and install
,,	6000-C15	Extra: all main bearing liner and thrust washers – check clearances and renew
,,	6000-C16	Extra: camshaft – remove and install
,,	6000-C17	Extra: camshaft bearings – renew
,,	6000-C18	Extra: crankshaft – remove and install
,,	6000-C19	Extra: cylinder head and pistons – decarbonise
,,	6000-C20	Extra: valves – all – reface, reseat and grind-in
,,	6000-C21	Extra: cylinder assembly – remove and install
,,	6000-C22	Extra: cylinder block – remove and install
,,	6000-C23	Extra: cylinder block – rebore
,,	6000-C24	Extra: cylinder block – rebore and fit liners

OPERATION	6010-A	**CYLINDER ASSEMBLY – REPLACE** (Includes 6000-C, C1 and C21)
,,	6010-B	**CYLINDER BLOCK – REPLACE** (Includes 6000-C, C1, C21 and C22)
,,	6010-C	**CYLINDER BLOCK – REBORE** (Includes 6000-C1, C21, C22 and C23)
,,	6010-D	**CYLINDER BLOCK – SLEEVE** (Includes 6000-C, C1, C21, C22, C23 and C24)
,,	6015-A	ENGINE ASSEMBLY – FIT NEW, SERVICE, OR RECONDITIONED UNIT
,,	6015-A1	Extra: engine compartment – clean
,,	6015-A2	Extra: clutch disc and/or pressure plate – remove and install
,,	6015-A3	Extra: clutch release bearing – renew
,,	6015-A4	Extra: clutch fork – remove and install
,,	6015-A5	Extra: main drive gear bearing retainer gasket and/or main drive gear oil seal – renew
,,	6015-B	ENGINE AND GEARBOX ASSEMBLY – REMOVE AND INSTALL
,,	6015-B1	Extra: engine and gearbox – separate and reconnect
,,	6019-A	CYLINDER FRONT COVER GASKET – RENEW
,,	6019-A1	Extra: front cover and/or seal – renew
,,	6019-A2	Extra: timing chain and/or camshaft sprocket – remove and install
,,	6019-B	**FRONT COVER AND/OR OIL SEAL – REMOVE AND INSTALL** (Includes 6019-A and A1)
,,	6019-C	**TIMING CHAIN – REMOVE AND INSTALL** (Includes 6019-A, A1 and A2)
,,	6038-A	ENGINE FRONT MOUNTING – ONE – RENEW
,,	6038-A1	Extra: remaining front engine mounting – renew
,,	6038-B	**ENGINE FRONT MOUNTINGS – BOTH – RENEW** (Includes 6038-A and A1)
,,	6038-C	ENGINE FRONT MOUNTINGS – BOTH – CHECK TORQUE OF BOLTS
,,	6051-A	CYLINDER HEAD GASKET – RENEW
,,	6051-A1	Extra: cylinder head – decarbonise
,,	6051-A2	Extra: pistons – decarbonise

OPERATION	6051-A3	Extra: one valve – remove and install
,,	6051-A4	Extra: each additional valve – remove and install
,,	6051-A5	Extra: each valve seat – re-cut
,,	6051-A6	Extra: each valve – grind-in
,,	6051-A7	Extra: each valve guide – ream
,,	6051-A8	Extra: each valve guide – renew
,,	6051-A9	Extra: cylinder head – renew
,,	6051-B	**CYLINDER HEAD AND PISTONS – DECARBONISE** (Includes 6051-A, A1 and A2)
,,	6051-C	**VALVE – ONE – REMOVE AND INSTALL** (Includes 6051-A, A1, and A3)
,,	6051-D	**VALVE – ONE – REMOVE AND INSTALL** (Includes 6051-A, A1, A3, A5 and A6)
,,	6051-E	**VALVES – ALL – REMOVE AND INSTALL** (Includes 6051-A, A1, A3, A4, A5 and A6)
,,	6051-F	**DECARBONISE CYLINDER HEAD AND PISTONS AND RESET AND GRIND-IN ALL VALVES** (Includes 6051-A, A1, A2, A3, A4, A5 and A6)
,,	6051-G	**VALVE GUIDE – ONE – REAM** (Includes 6051-A, A1, A3, A5 and A7)
,,	6051-H	**VALVE GUIDES – ALL – REAM** (Includes 6051-A, A1, A3, A4, A5 and A7)
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,,	6051-J	**VALVE GUIDES – ALL – RENEW** (Includes 6051-A, A1, A3, A4, A5 and A8)
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,,	6051-P	CYLINDER HEAD CORE PLUG – RENEW
,,	6068-A	ENGINE REAR MOUNTING – RENEW
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,,	6250-B1	Extra: camshaft bearings – replace and check oilways
,,	6250-C	**CAMSHAFT BEARINGS – RENEW** (Includes 6250-B and B1)

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,,	6303-A	CRANKSHAFT – REMOVE AND INSTALL
,,	6312-A	CRANKSHAFT PULLEY – REMOVE AND INSTALL
,,	6335-A	CRANKSHAFT REAR OIL SEAL CARRIER – REMOVE AND INSTALL
,,	6335-A1	Extra: rear oil seal and/or carrier – renew
,	6335-B	**CRANKSHAFT REAR OIL SEAL AND/OR CARRIER – RENEW** (Includes 6335-A and A1)
,	6374-A	DRIVE PLATE – REMOVE AND INSTALL
,,	6375-A	FLYWHEEL ASSEMBLY – REMOVE AND INSTALL
,,	6375-A1	Extra: flywheel ring gear – renew
,,	6375-B	**FLYWHEEL RING GEAR – RENEW** (Includes 6375-A and A1)
,,	6450-A	ROCKER COVER AND/OR GASKET – REMOVE AND INSTALL
,,	6450-A1	Extra: all valve clearances – adjust
,,	6450-A2	Extra: rocker shaft assembly and/or push rods – remove and install
,,	6450-A3	Extra: any or all rocker shaft parts – renew
,,	6450-B	**VALVE CLEARANCES – ADJUST** (Includes 6450-A and A1)
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,,	6513-A	VALVE SPRING AND/OR STEM SEAL – ONE – RENEW
,,	6513-A1	Extra: each additional valve spring and/or stem seal – renew
,,	6513-B	**VALVE SPRINGS AND/OR STEM SEALS – ALL – RENEW** (Includes 6513-A and A1)
,,	6600-A	OIL PUMP ASSEMBLY – REMOVE AND INSTALL

OPERATION	6600-A1	Extra: oil pump – overhaul
,,	6600-B	**OIL PUMP – OVERHAUL** (Includes 6600-A and A1)
,,	6675-A	SUMP AND/OR GASKETS – REMOVE AND INSTALL
,,	6675-A1	Extra: timing chain tensioner – remove and install
,,	6675-A3	Extra: all main bearing clearances – check
,,	6675-A4	Extra: all main bearing liners and/or thrust washers – remove and install
,,	6675-A5	Extra: all main bearing liners and thrust washers – check clearances and renew
,,	6675-A6	Extra: all connecting rod liners – remove and install
,,	6675-A7	Extra: one piston, connecting rod and rings assembly – remove and install
,,	6675-A8	Extra: each additional piston, connecting rod and rings assembly – remove and install
,,	6675-A9	Extra: each set of piston rings – renew
,,	6675-A10	Extra: each connecting rod and/or piston pin – renew
,,	6675-A11	Extra: each piston, pin and rings assembly – renew
,,	6675-B	**TIMING CHAIN TENSIONER – REMOVE AND INSTALL** (Includes 6675-A and A1)
,,	6675-C	**MAIN BEARING CLEARANCES – ALL – CHECK** (Includes 6675-A, A1 and A3)
,,	6675-D	**MAIN BEARING LINERS – ALL – RENEW** (Includes 6675-A, A1 and A4)
,,	6675-E	**MAIN BEARING LINERS – ALL – CHECK CLEARANCES AND RENEW** (Includes 6675-A, A1 and A5)
,,	6675-F	**CONNECTING ROD LINERS – ALL – RENEW** (Includes 6675-A and A6)
,,	6675-G	**PISTON RINGS – ONE PISTON – REMOVE AND INSTALL** (Includes 6675-A, A7 and A9)
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,,	6675-I	**PISTON – ONE – REMOVE AND INSTALL** (Includes 6675-A, A7 and A10)

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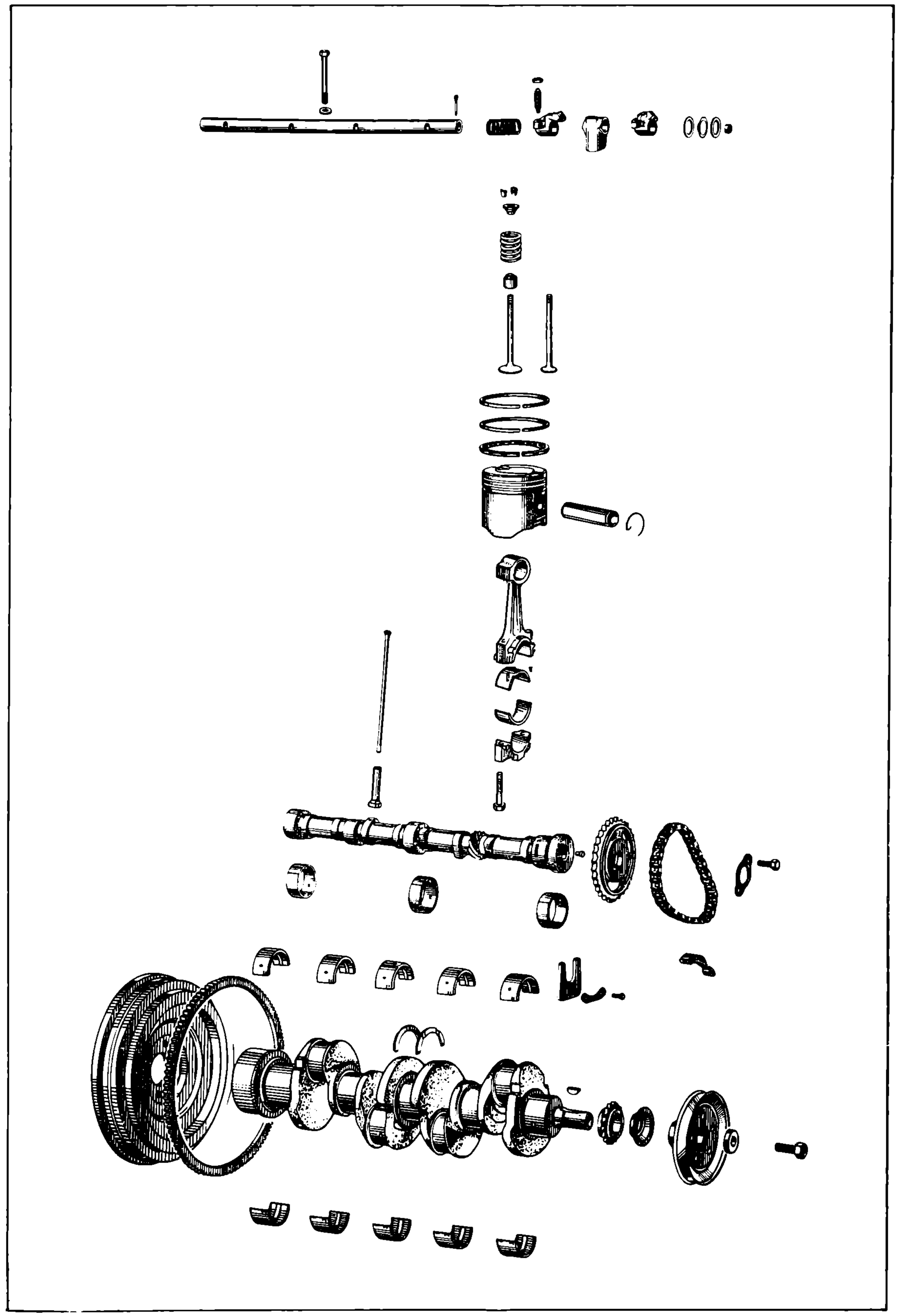
,,	6675-M	SUMP BOLTS – TORQUE
,,	6731-A	OIL FILTER ELEMENT – RENEW
,,	6731-B	OIL FILTER ELEMENT AND ENGINE OIL – RENEW
,,	6900-A	OIL PRESSURE GAUGE OR WARNING LIGHT SENDER UNIT – REMOVE AND INSTALL
,,	6900-A1	Extra: oil pressure – check
,,	6900-B	TEMPERATURE GAUGE SENDER UNIT – REMOVE AND INSTALL



The Engine – Exploded – Interior

GENERAL DESCRIPTION

The engine is a four cylinder, "in line", overhead valve unit operating on the four stroke cycle with direct flow cylinder head and bowl-in-piston combustion chambers. Three engines are available; a 1,300 c.c., a 1,600 c.c. and a 1,600 c.c. G.T. unit. The 1,300 and 1,600 c.c. units are also available in high and low compression ratio versions. The increased capacity is obtained by lengthening the stroke, the bore remaining constant for all engines.

The cylinder bores are machined directly in the cast iron cylinder block, which is cast integral with the upper half of the crankcase, and are provided with full length water jacketing.

The cast iron crankshaft runs in five large diameter main bearings fitted with steel-backed copper/lead or white metal liners in the 1,300 c.c. engine and, because of the increased power output, only steel-backed copper/lead bearing liners in the 1,600 c.c.

End-float and thrust are controlled by half-thrust washers located in the cylinder block on either side of the centre main bearing.

Seals pressed in the front cover and the rear oil seal carrier prevent oil leaks from the front and rear of the crankshaft. The front seal runs on the pulley hub whilst the rear seal runs on the crankshaft flange itself. Where a manual gearbox is fitted, a sintered bronze spigot bearing is pressed into the end of the crankshaft.

The connecting rods are 'H' section forgings having separate big end caps retained by two bolts and located by hollow dowel pins. Big end bearing liners are, again, steel-backed copper/lead, lead/bronze or aluminium/tin. The small ends have steel-backed bronze bushes.

Solid skirt aluminium alloy pistons with two compression and one oil control ring situated above the piston pin bore are used. The combustion chamber is machined in the piston crown and a different piston is used for each engine capacity and compression ratio. The piston pins are fully floating and are retained in position by circlips installed in grooves at each end of the piston bore.

The camshaft is driven at half engine speed by a single row chain and sprockets from the crankshaft. This timing chain is automatically tensioned by a snail cam bearing against a pivoted tensioner arm. A skew gear and an eccentric, machined integral with the camshaft, drive the distributor, oil pump and the fuel lift pump. A thrust plate bolted to the cylinder block front face and located between the front bearing journal and the sprocket flange retains the camshaft.

Overhead valves are mounted 'normal' to the cast iron cylinder head in integral valve guides and are operated by rockers, push rods and tappets from the camshaft. The inlet valves are larger than the exhausts to improve efficiency. The rockers are mounted on a shaft supported by four mounting posts bolted to the cylinder head. Valve clearances are adjusted by screws in the rocker arms.

With manual transmission a cast iron flywheel is mounted on the crankshaft flange and ensures a smooth-running engine. When an automatic transmission is used a drive plate is fitted to the crankshaft flange to couple the engine to the torque converter, which incorporates an inertia ring for flywheel effect. The drive for the starter motor is provided by a steel ring gear shrunk onto the flywheel periphery, or onto the torque converter.

The sump is a steel pressing and has a front well for the lubricating oil. The engine lubrication system is the force feed type incorporating a full flow oil filter. The oil pump, which is mounted externally on the engine, may be of the eccentric bi-rotor type or the sliding vane type. Both types of pump incorporate a non-adjustable plunger type relief valve.

An oil filler cap is located in the rocker cover and also incorporates a filter gauze for crankcase ventilation. Crankcase ventilation is by semi-closed positive systems.

Three-point mounting for the engine and gearbox assembly, on sandwich type rubber insulators, is provided.

CYLINDER BLOCK

The cylinder block is cast iron and is cast integral with the upper half of the crankcase. A separate cylinder block is used for each capacity engine, that for the 1,600 c.c. being taller, all other dimensions being common. The two cylinder blocks can be identified by the number cast on the left-hand side.

	1,300 c.c.	1,600 c.c.
Identification number	2733E-6015	2737E-6015
Height—from sump to cylinder head faces ...	7.224 to 7.229 in. (183.49 to 183.62 mm.)	8.326 to 8.331 in. (211.48 to 211.61 mm.)

Internally the crankcase incorporates five main bearings with removable caps retained by bolts fitted without lockwashers. The intermediate and rear caps are identical, but their positions must not be interchanged. When dismantling these caps ensure that their positions are marked, this is normally done, in production, by a number 2 stamped on the front intermediate cap and 4 on the rear intermediate cap. The rear cap is not marked. All caps must be fitted with the cast arrows pointing forwards.

The crankshaft bearing liner parent bore in the cylinder block may be either standard or 0.015 in. (0.38 mm.) oversize. Where the bore is oversize the bearing caps and inside the crankcase are marked with WHITE paint spots. The camshaft bearing parent bore may be 0.020 in. (0.51 mm.) oversize but in this case the block is unmarked. Tappet bores may also be 0.004 in. (0.10 mm.) oversize and the cylinder block in this case is marked with WHITE paint adjacent to the tappet bores. A letter "T" stamped on the engine build code number pad provides additional identification.

The cylinder bores are machined directly into the cylinder block and, in production, are graded for size, the grade number, of each bore, being stamped on the push rod side of the cylinder block adjacent to the top face. Cast iron dry type cylinder liners, however, may be fitted and two sizes of liner are available, a standard size and one 0.020 in. (0.508 mm.) oversize on the outside diameter.

To remove and replace the cylinder liners, a cylinder liner remover and replacer ring should be made to the dimensions shown. Locate the remover in the bottom of the cylinder liner, with the cylinder block inverted, and press the liner out on a suitable press. When replacing or fitting a liner, ensure that the cylinder bore is machined to the correct size (see Service Data section). Place the remover adaptor in the replacer ring and locate in the cylinder liner, which should be lubricated on the outside with tallow (no other lubricant should be used). Press the liner into the bore from the top on a suitable press. Cut the connecting rod clearance slots in the base of the liner and machine the bore to give the correct clearance for the piston being fitted.

CYLINDER HEAD

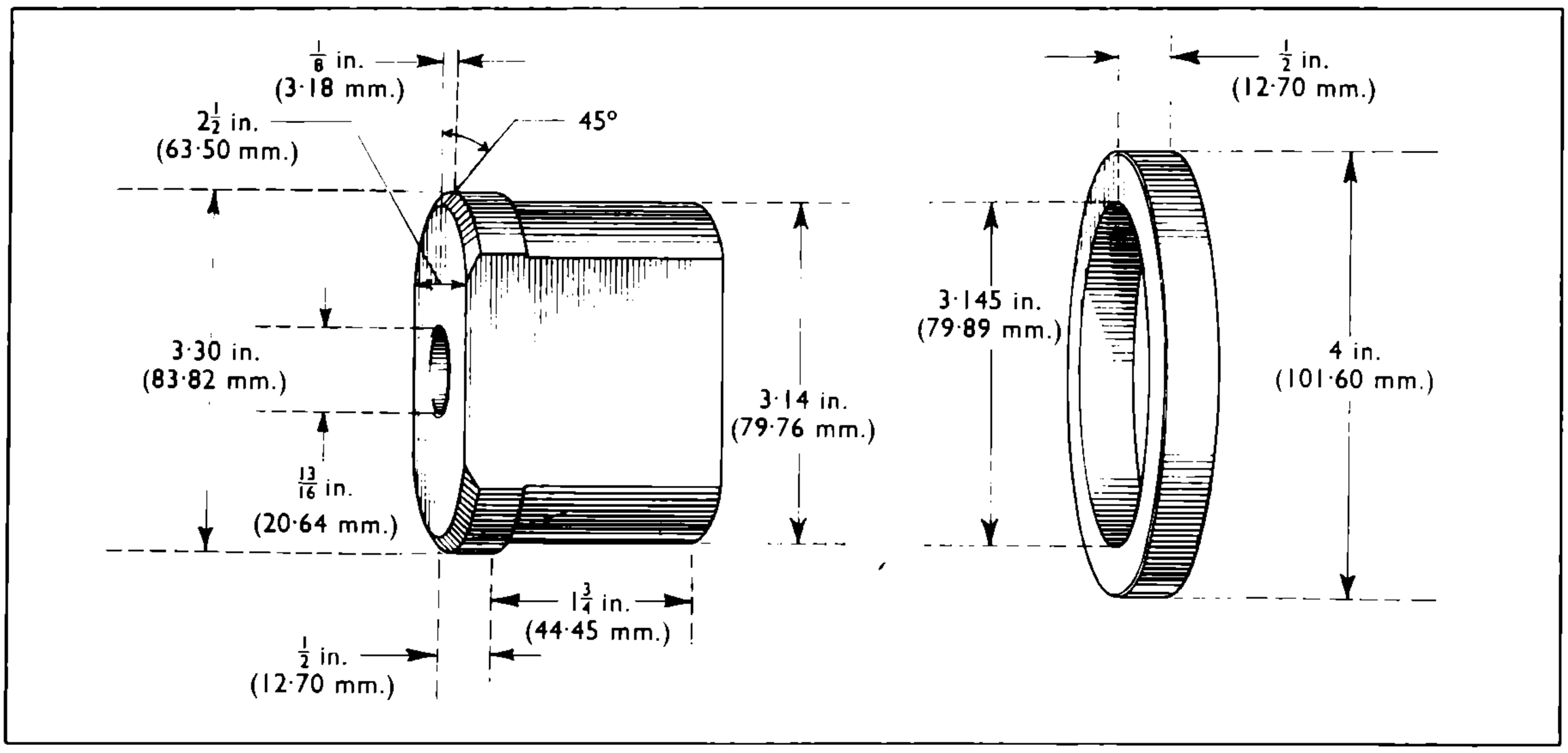
The cylinder head is made of cast iron and a separate casting is used for the 1,300 c.c. and the 1,600 c.c. cylinder heads. All the 1,600 c.c. H.C., L.C. and G.T. versions use the same cylinder head. These cylinder heads can be identified by the number cast under the inlet manifold mounting face, between number 1 and 2 and between number 3 and 4 ports and by the recessed valves in the 1,600 c.c. engines.

Engine Capacity	*Cylinder Head Number*
1,300 c.c.	2733E-6090-A
1,600 c.c.	2737E-6090-A

Ten bolts are used to retain the cylinder head, eight 3.79 in. (96.3 mm.) long and two 2.51 in. (63.8 mm.) long. The cylinder head gasket is of a composition type, reinforced with copper on the 1,300 c.c. and an asbestos/steel gasket on the 1,600 c.c. engines. Gasket kits available in service only include the asbestos/steel gasket as this can be used on all engines. The composition type gasket must not be used on the 1,600 c.c. engines.

The valves operate in guides machined directly in the cylinder head, although in some instances valve guides may be fitted and are available in service. It should be noted that the exhaust valve guide is longer than the inlet. When fitting valve guides, press each new guide into the cylinder head until the plain end is flush with the spot faced boss in the valve port, when the upper end will be level with the rocker cover mounting face.

Valve Guide	*Length*
Inlet	1.82 to 1.84 in. (46.2 to 46.7 mm.)
Exhaust	2.07 to 2.09 in. (52.6 to 53.1 mm.)



Cylinder Liner Remover **Replacer Ring**

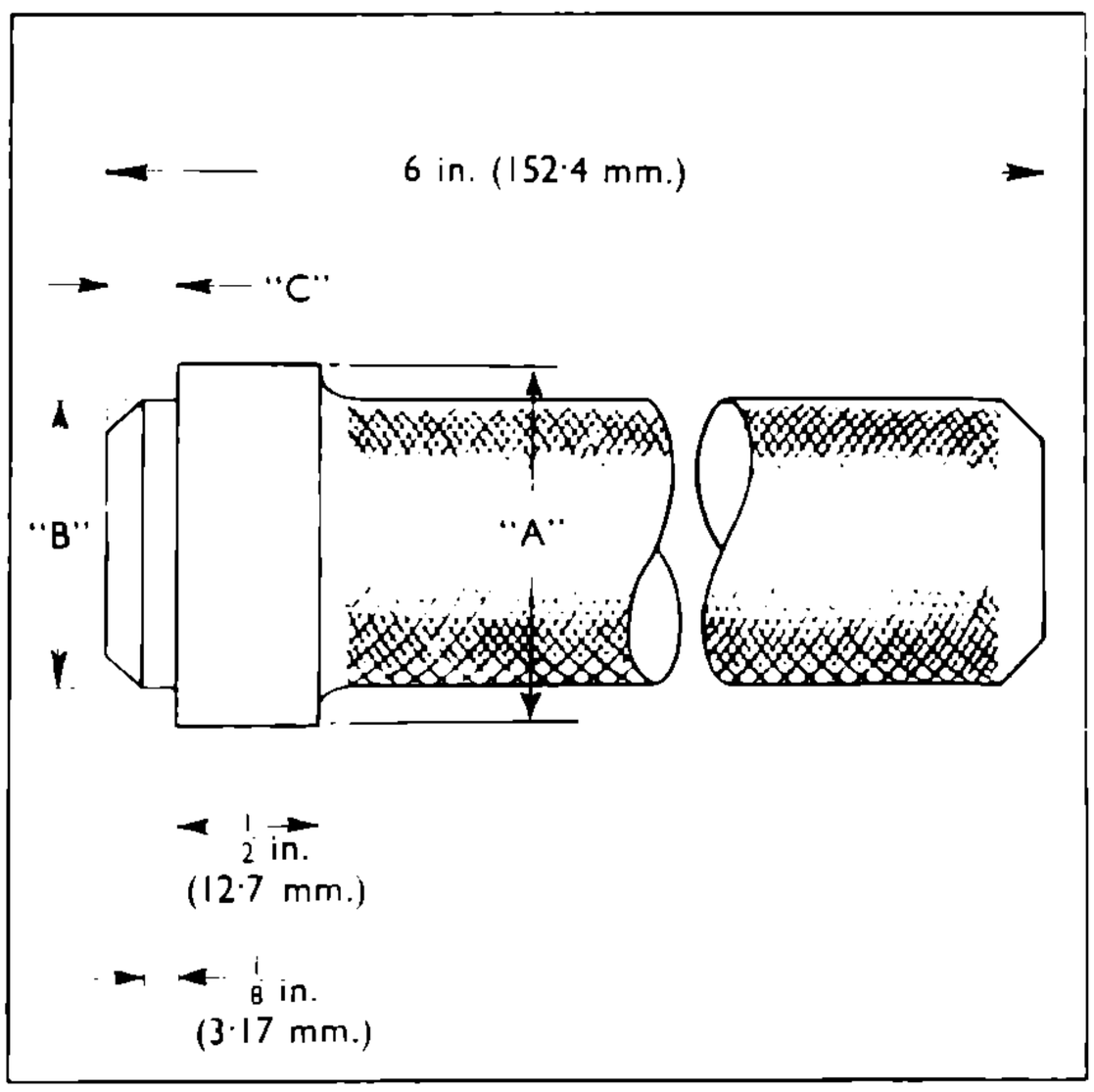
Where the guides are machined directly in the cylinder head the bores may be reamed 0.015 in. (0.381 mm.) oversize with reamer Tool No. P.6056-015 and valves with 0.015 in. (0.38 mm.) oversize stems fitted. This, of course, may also be done where the guides are replaceable. After fitting new valve guides or reaming the valve stem bore the valve seats must be recut to ensure that the seat is concentric with the valve stem bore.

Recut the seats with the appropriate cutters fitted to pilot Tool No. 316-10 in handle Tool No. 316X. Where necessary the seats may be narrowed with top face and port cutters. If there is a hard glazed carbon deposit on the seat this may be removed with a glaze breaker. The valve seats should also be recut when they show signs of pitting or burning and when fitting new inlet valves.

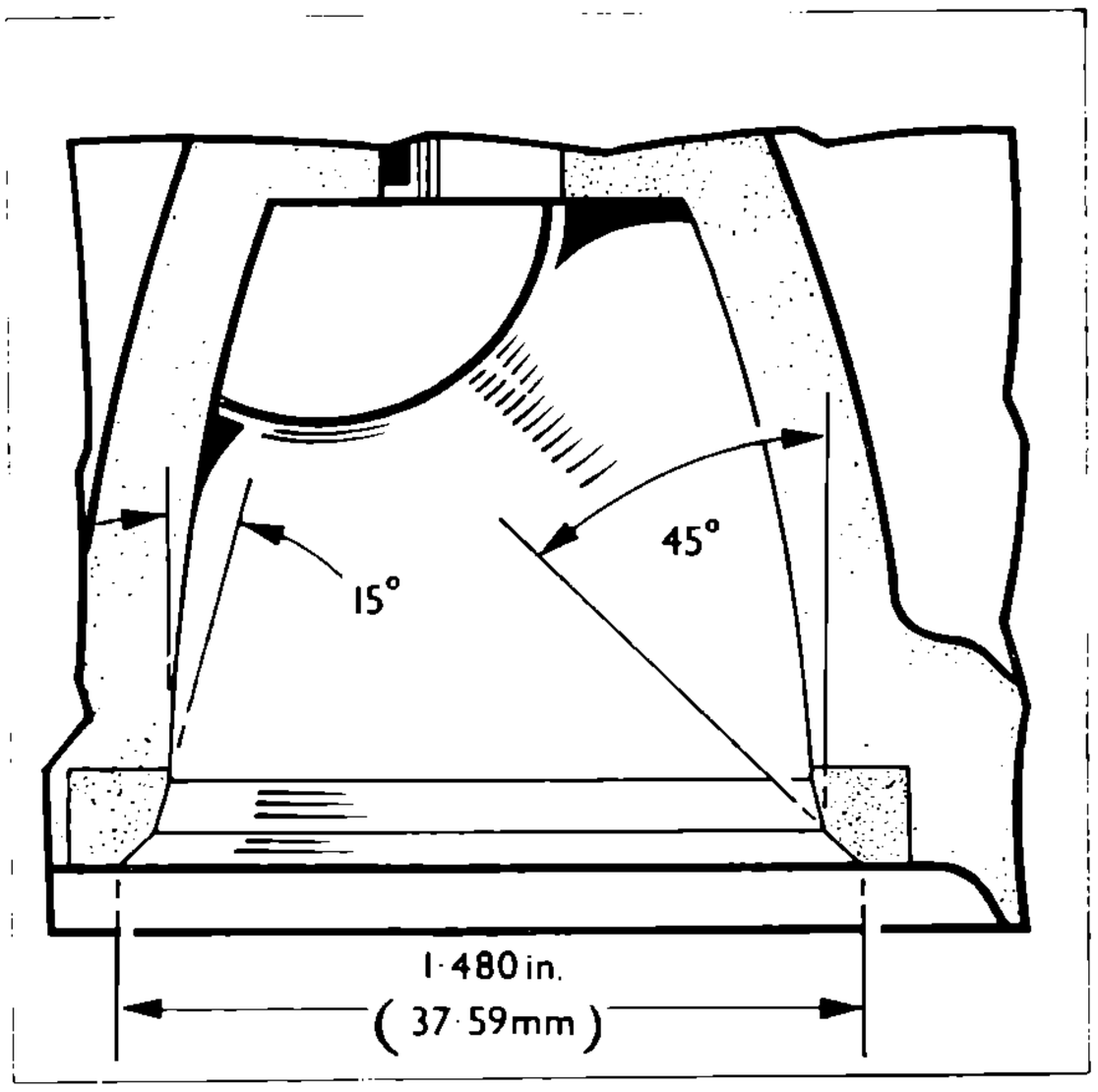
	Cutter Tool Number			
Valve	*Seat-45°*	*Top Face-15°*	*Port-75°*	*Glaze Breaker-45°*
Inlet	317-25	317T-25	317P-22	317G-25
Exhaust	317-20	317T-20	317P-20	317G-20

Replaceable valve seat inserts are available and should be fitted where necessary. Where inserts have not been fitted previously it will be necessary to machine a recess in the cylinder head for the appropriate valve seat insert. If, for any reason, an existing insert has become loose or damaged, oversize inserts can be fitted. The sizes for machining the recesses for standard and oversize valve seat inserts are tabulated in the Service Data section.

Valve seat inserts may be removed by inserting a suitable chisel under the insert and striking smartly when the insert will be forced out of its location. Care should be taken in this operation to avoid damage to the cylinder head.



Valve Seat Insert Replacer



1600 Inlet Valve Seat Insert Machining Dimensions

To fit a new insert, select the correct size and enter the insert with the chamfered edge away from the combustion chamber and press into place using insert replacer tools made to the dimensions shown.

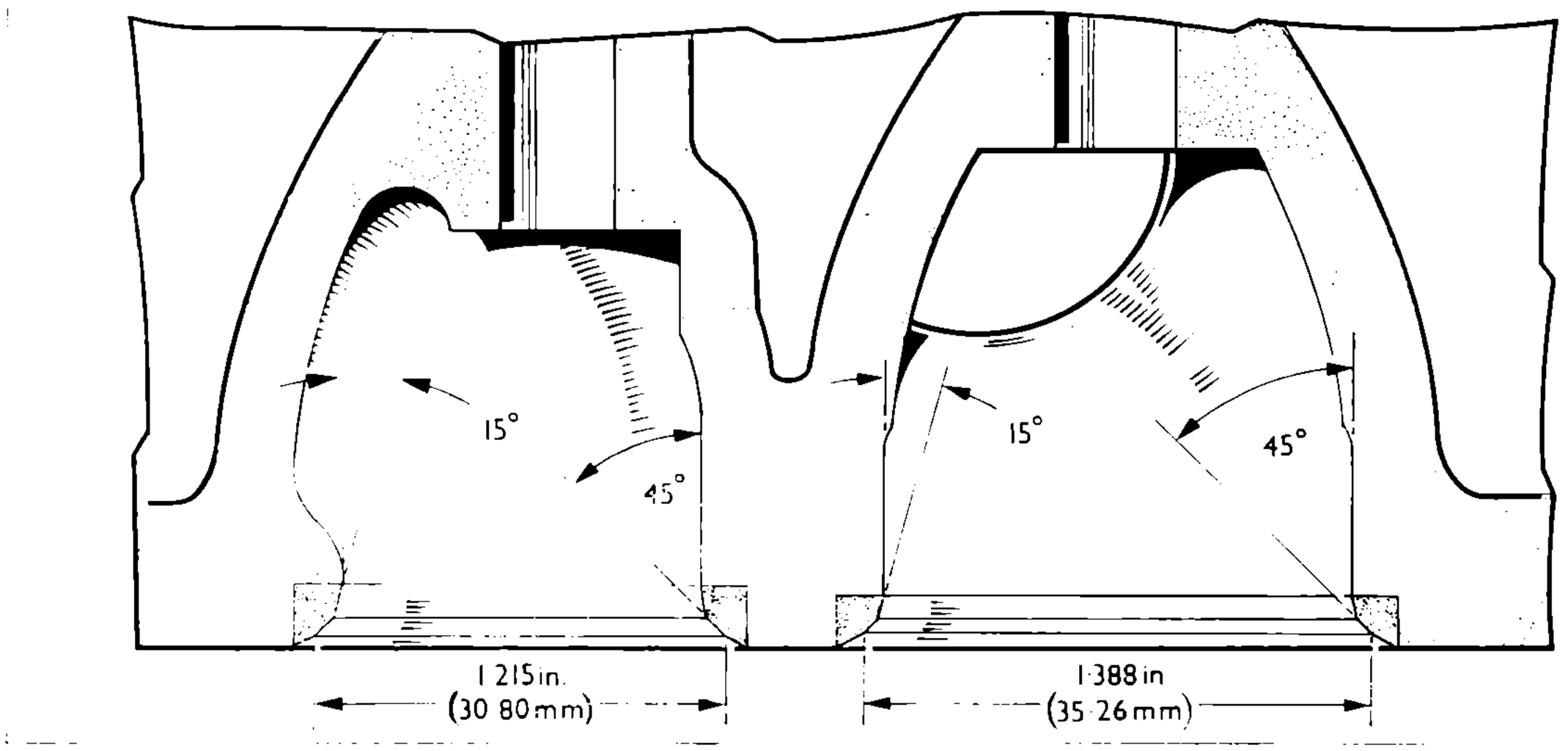
	Valve Seat Insert Replacer Tool Dimensions		
	Diameter 'A'	Diameter 'B'	'C'
Inlet Valve—1,300 c.c.	1.56 in. (39.6 mm.)	1.22 in. (31.0 mm.)	0.17 in. (4.3 mm.)
—1,600 c.c.	1.66 in. (42.2 mm.)	1.29 in. (32.8 mm.)	0.21 in. (5.3 mm.)
Exhaust Valve	1.26 in. (32.0 mm.)	1.03 in. (26.2 mm.)	0.21 in. (5.3 mm.)

After fitting the inserts, the seats must be cut with the appropriate cutter tools to the correct dimensions.

INLET MANIFOLDS

The inlet manifolds are of cast aluminium and have separate ports for each cylinder, on the G.T. manifold each port having a separate tract from the carburettor riser. The carburettor riser for the G.T. incorporates a four-stud mounting flange for the dual-barrel carburettor, whereas that for the 1,300 and 1,600 c.c. engines has a two-stud flange for the single barrel carburettor used on these models.

Water passages in the manifold provide heating around the carburettor riser and a tapped hole into this water jacket is used for the car interior heater connection. A tapped hole is incorporated in the carburettor mounting flange for the engine ventilation system vacuum connection. The manifold gasket is of a composition type material.



Valve Seat Insert Machining Dimensions (Except 1600 Inlet)

EXHAUST MANIFOLDS

The 1,300 and 1,600 c.c. engines have a cast iron exhaust manifold with separate ports for number 1 and 4 cylinders and siamesed ports for number 2 and 3 cylinders. The single outlet from the manifold incorporates a cast flange with a two-stud fixing for the exhaust pipe.

A free flow multi-branch exhaust manifold fabricated from welded steel tubes and with separate pipes for each cylinder is used on the G.T. engine. These pipes are paired together, Nos. 1 and 4 forming one pair and Nos. 2 and 3, which pass outside of Nos. 1 and 4, the other, the pipes of each pair being joined at junction boxes. The outlet pipes from each pair are joined together by another junction box to form a common outlet. The exhaust manifold assembly is secured to the cylinder head by flanges welded to the pipe ends. A flared end at the outlet provides a connection for the exhaust pipe.

The manifold gasket is made of asbestos reinforced on either side with perforated steel. Ensure that the centre manifold gasket is fitted the correct way up, as the centre flange is not symmetrical.

FRONT COVER AND DIPSTICK

The front cover is an aluminium pressure die casting bolted to the front face of the cylinder block. A single composition gasket ensures efficient sealing of both the front cover and water pump to cylinder block joints. The gasket is perforated so that if only one of these components is removed the gasket can be parted and a new gasket fitted on reassembly of the component removed. In service separate gaskets only are used for these applications. To prevent oil leaks around the crankshaft pulley boss, an oil seal is pressed into the front cover.

The oil seal can be removed, after first removing the front cover, by supporting the cover around the seal and driving the seal out from the rear with remover Tool No. P.6161 fitted to a 550 handle. Invert the tool and drive a new seal into the housing, again from the rear, and supporting the cover around the seal. The use of Tool No. P.6161 ensures that the seal protrudes $\frac{3}{64}$ in. (1.19 mm.) inside the cover.

When fitting the cover it is important that the oil seal is aligned concentrically with the crankshaft and pulley boss. To facilitate this a centraliser Tool No. P.6150 is inserted into the seal while fitting the cover.

The oil level dipstick tube is pressed into the front cover and its upper end must be 4.90 in. (124.5 mm.) vertically above the front cover bottom face if the correct oil level is to be attained.

A longer dipstick is used on the 1,600 c.c. engine. To provide identification between the two dipsticks the handles are of different shapes and an identification number is stamped on the blade. The 1,600 c.c. dipstick has a circular handle and the number stamped on the blade is 2737E-6752-A; the handle on the 1,300 c.c. is elongated and the number is 2735E-6752-A.

A timing pointer is also incorporated on the front cover to facilitate ignition timing and has two marks 4° apart. When one of the marks on the crankshaft pulley aligns with the appropriate mark on the timing pointer, the ignition timing is correct.

REAR OIL SEAL CARRIER

The crankshaft rear oil seal is pressed into an aluminium carrier which is bolted to the cylinder block rear face, and fitted with a composition type gasket. The oil seal runs on the periphery of

the flywheel mounting flange. After removing the carrier, the oil seal can be easily replaced. Support the carrier, close to the seal, and drive the seal out, using a remover/replacer Tool No. P.6165 fitted to a 550 handle. Reverse the carrier, the remover/replacer tool and fit a new seal. When fitting the carrier the seal must be aligned concentrically with the crankshaft if oil leaks are to be avoided. Locate a centraliser Tool No. CP.6173 in the seal and over the crankshaft while tightening the seal carrier retaining bolts.

SUMP

The pressed steel sump has a front well, incorporating a longitudinal baffle, for the lubricating oil and is bolted to the base of the cylinder block. A larger capacity sump is used on the 1,600 c.c. and G.T. engines. A drain plug is located in the left-hand side on the 1,300 c.c. engine and the right-hand side on 1,600's. The gaskets are made of aluminium foil faced with cork.

To gain access to the two rear sump bolts, position the flywheel so that the recesses in the flywheel are adjacent to each bolt in turn and use a $\frac{3}{8}$ in. square drive socket.

When fitting the sump apply ESEE-M4G-1008A jointing compound to the front cover and rear oil seal carrier joints to prevent oil leaks.

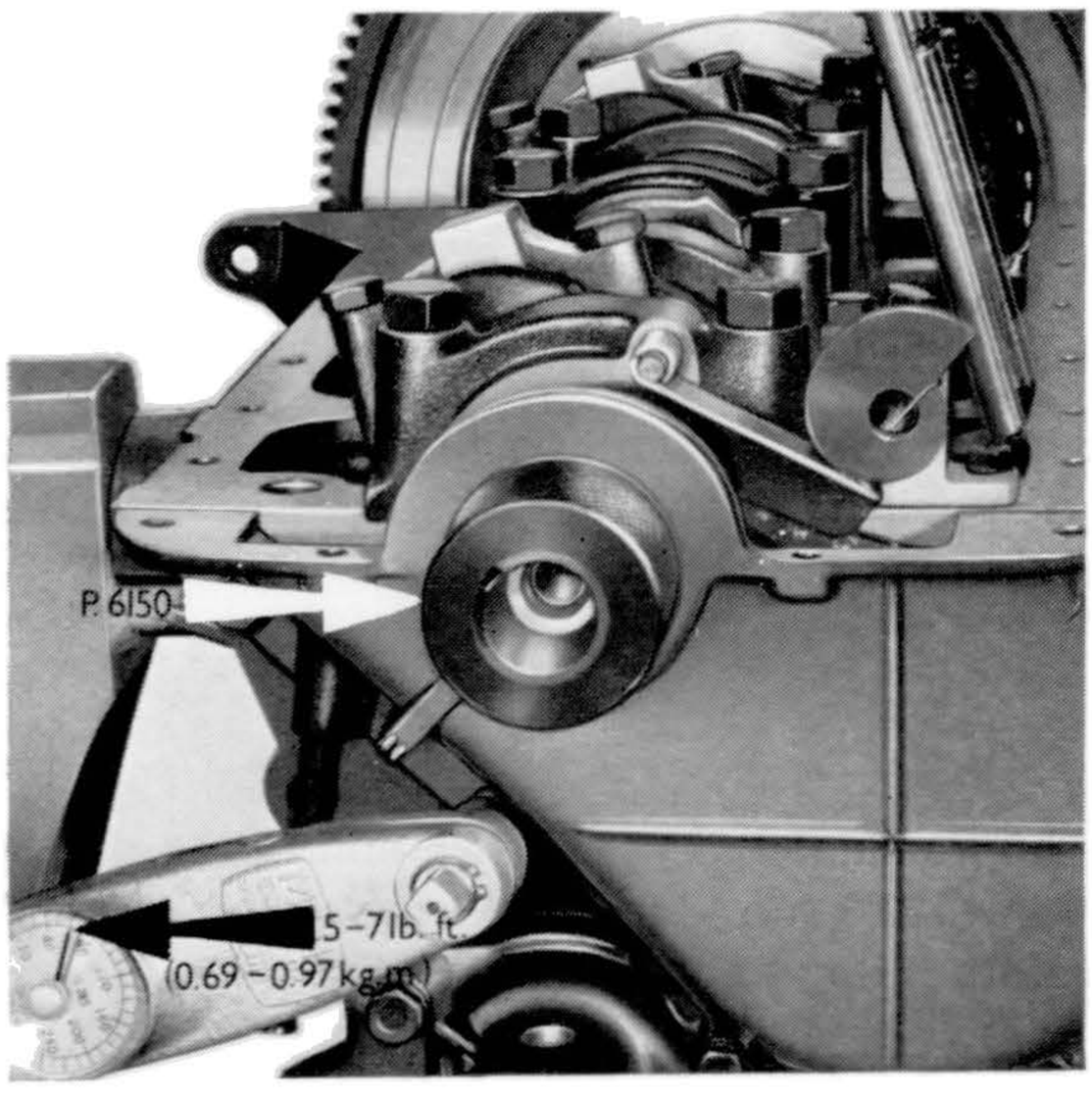
ROCKER COVER

The rocker cover is a steel pressing retained by screws and plain washers around the flanged edges. A cork and rubber gasket is dove-tailed to the rocker cover flange to prevent oil leaks.

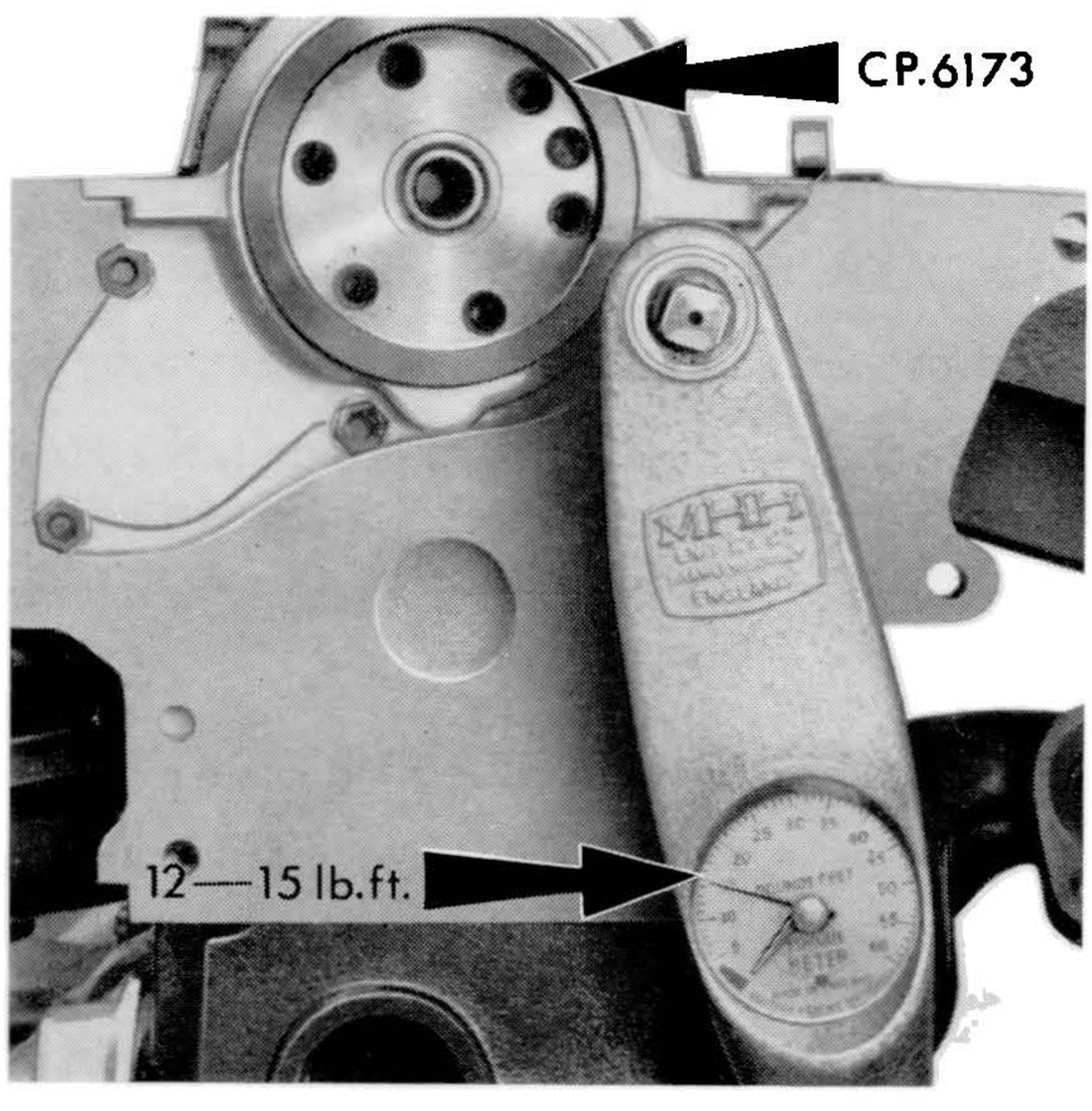
This gasket should give satisfactory service for up to ten removals of the rocker cover. Replace the gasket when it no longer provides an effective seal.

VALVES AND SPRINGS

The valves, which have 45 seats, are mounted vertically in the cylinder head, the inlet valve head diameter being larger than the exhaust. The 1,300 c.c. inlet valves have a concave face,



Front Cover Oil Seal Alignment



Crankshaft Rear Oil Seal Alignment

all the other valves being plain. It should be noted that the valves used on the 1,600 c.c. engines are shorter than those used on the 1,300 c.c. because of the recessed valve heads on the larger capacity engines. To facilitate identification the 1,600 c.c. exhaust valve has the number "37" stamped on its face.

Model	*Valve Diameter*		*Valve Length*	
	Inlet	*Exhaust*	*Inlet*	*Exhaust*
1,300 c.c.	1.405 to 1.415 in. (35.69 to 35.94 mm.)	1.234 to 1.244 in. (31.34 to 31.60 mm.)	4.377 in. (111.18 mm.)	4.355 in. (110.74 mm.)
1,600 c.c.	1.497 to 1.507 in. (38.02 to 38.28 mm.)	1.234 to 1.244 in. (31.34 to 31.60 mm.)	4.277 in. (108.64 mm.)	4.265 in. (108.458 mm.)

The valve positions are: Inlets 2, 3, 6 and 7 and Exhausts 1, 4, 5 and 8.

The inlet valve head has a diffused aluminium coating to increase the valves' resistance to high temperature oxidisation and to form a hard wear-resistant surface on the seating area. In no circumstances should the faces of "aluminised" inlet valves be ground or the valves lapped in as this will remove the diffused aluminium coating and reduce the valves' wear and heat resistant properties. If the valve faces are worn or pitted it will be necessary to fit new valves and to recut the valve seats or, alternatively, lap the seats using dummy valves. The exhaust valves may be lapped in or the faces ground if required.

Valve stems are phosphate coated to improve durability and prevent scuffing during "running-in". Inlet and exhaust valves can be obtained with standard 0.003 in. (0.08 mm.) oversize or 0.015 in. (0.38 mm.) oversize valve stems.

An umbrella type oil seal is fitted to each valve stem immediately below the valve spring retainer. The valve springs are of a symmetrical design and can be fitted either way round. Valve spring retention is by a steel retainer and tapered collets, which have three ribs locating in corresponding grooves in the valve stem. The collets do not grip the valve stem, but allow the valve to rotate during engine operation, thus reducing wear and promoting longer life.

ROCKER SHAFT ASSEMBLY

The rocker shaft assembly is retained by four bolts fitted with plain washers.

The rocker arms, which are handed, are arranged in pairs with rockers on either side of a rocker shaft support. A compression spring between each pair holds them against the supports, the end rockers being retained by the washers and split pins at the ends.

PUSH RODS AND TAPPETS

The push rods are $\frac{7}{32}$ in. (5.6 mm.) diameter by approximately $6\frac{1}{2}$ in. (165.1 mm.) long on the 1,300 c.c. engine and $\frac{1}{4}$ in. (6.4 mm.) diameter by $7\frac{3}{4}$ in. (196.9 mm.) long on the 1,600 c.c. and G.T. engines. Check the push rods for straightness before fitting to an engine.

The chilled cast iron tappets can only be removed from the crankcase after removing the camshaft.

CAMSHAFT AND TIMING CHAIN

The camshaft used on the 1,300 c.c. and 1,600 c.c. (except G.T.) engines can be identified by the number 109E cast on the shaft at the rear end and by a band of white paint. A high lift camshaft is used on the G.T. engine and can be identified by the number 116E cast on the shaft at the rear end.

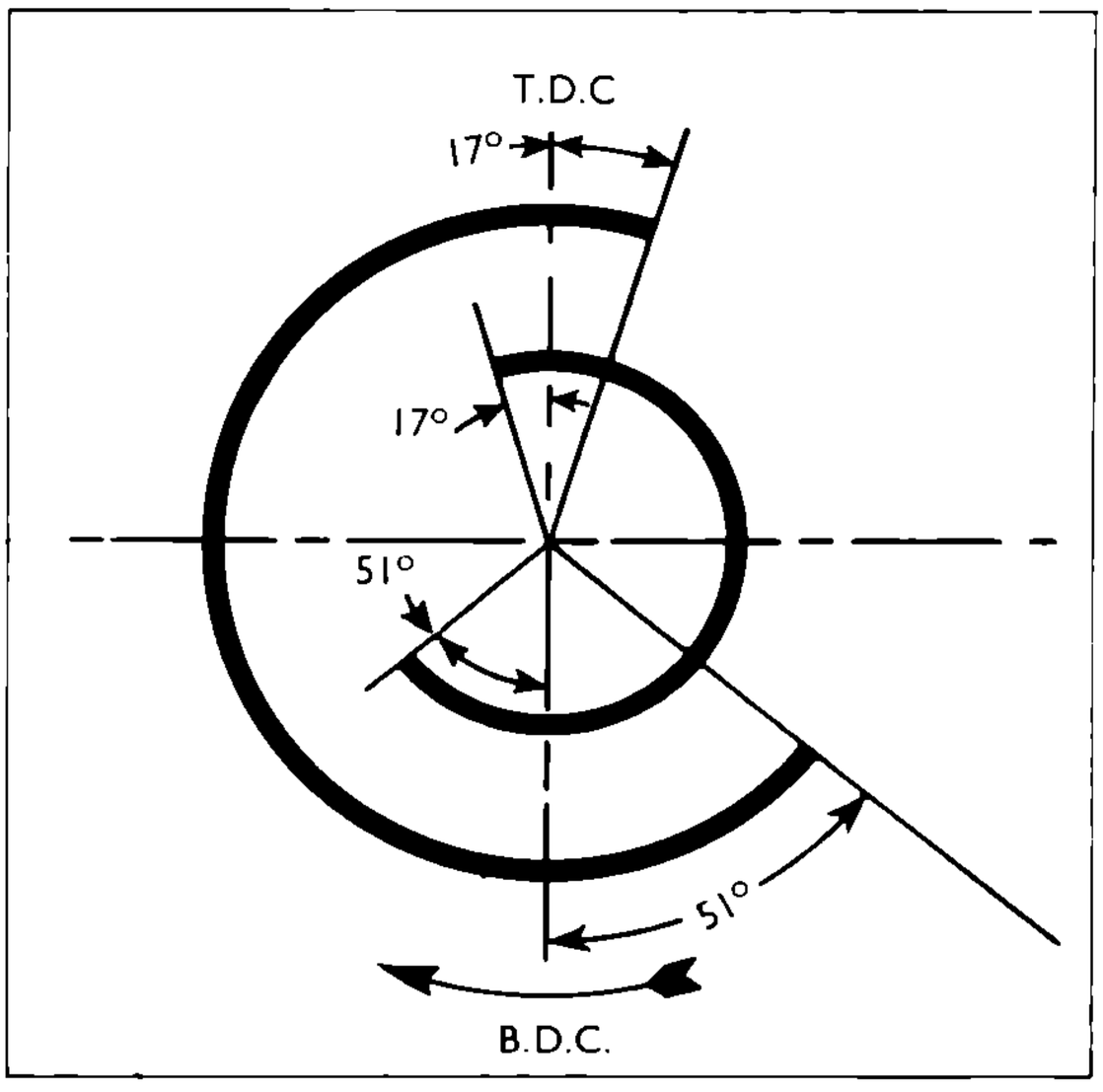
The camshaft runs in three steel-backed white metal bushes, which may have a standard size or a 0.020 in. (0.51 mm.) oversize outside diameter. The bushes available in service are pre-sized and require no machining after fitting. When one bush requires replacement it is advisable to replace all three bushes as camshaft alignment may be affected if only one bush is changed.

Remove the bushes using camshaft bearing remover Tool No. P.6031 with adaptor set P.6031-3. Locate the remover and guide detail "–3a" adjacent to the collar and with the spigot in the bearing. If the centre liner is being removed also use the centraliser detail "–3d". Remove the bush by screwing down the wing nut.

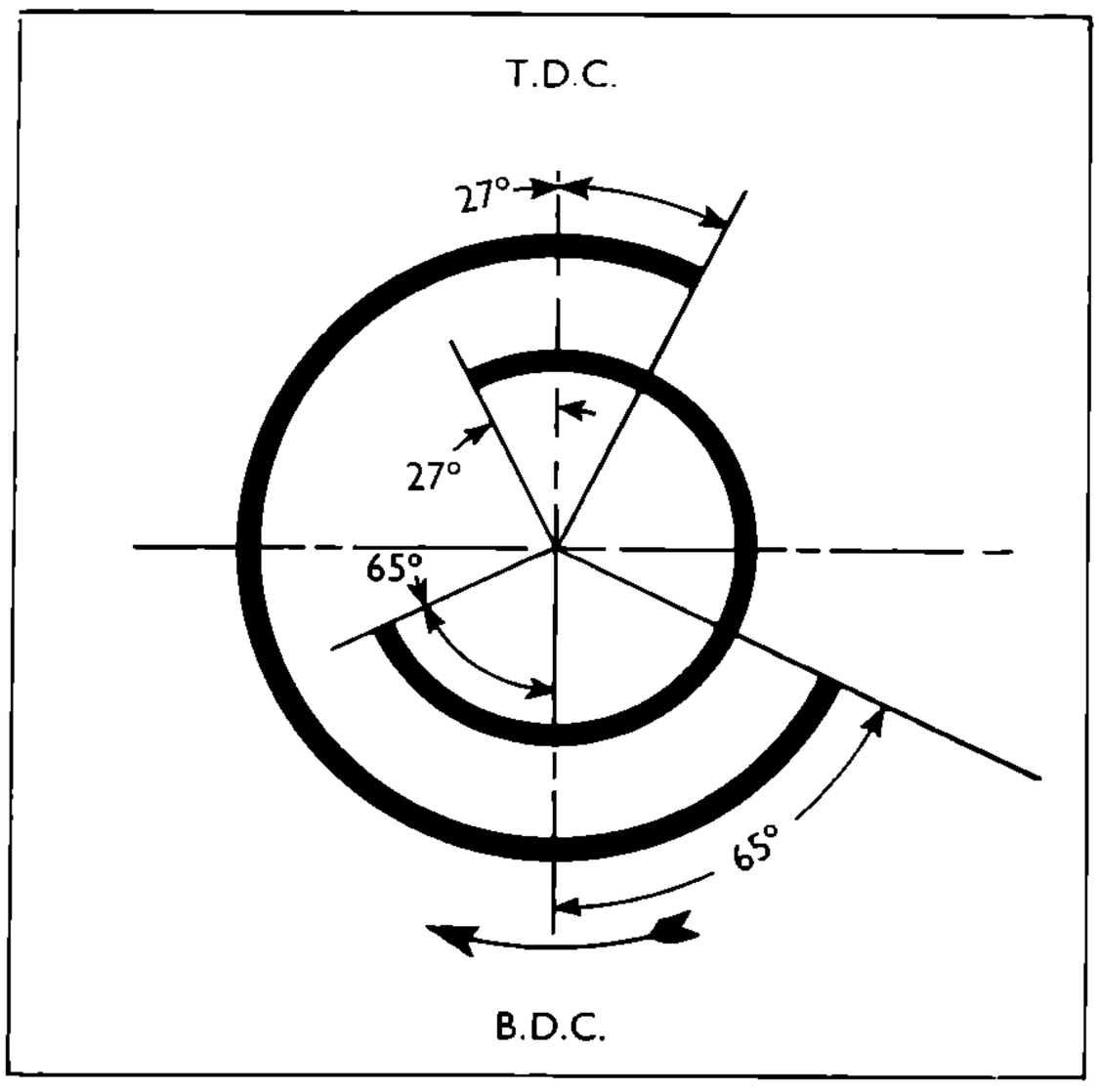
The camshaft front and rear bushes are both approximately $\frac{3}{4}$ in. (19.1 mm.) wide, the front one having an additional oil hole for the rocker shaft oil feed, and the centre bush approximately $\frac{5}{8}$ in. (15.9 mm.) wide. Fit the bushes using a replacer detail "–3b" in addition to the adaptors previously used.

Ensure that the oil holes in the bushes and cylinder block are correctly aligned before fitting and that the splits in the bushes are upwards and outwards at 45° to the vertical. A line scribed on the remover and guide detail "–3a" can be used as a guide to facilitate oil hole alignment.

The camshaft is retained by a sintered iron thrust plate bolted to the cylinder block front face and located in a groove behind the camshaft flange.



Nominal Valve Timing Diagram (Except G.T.)



G.T. only

A single row timing chain, with an automatic mechanical tensioner, is used. This tensioner consists of spring-loaded snail cam bearing against a pivoted tensioner arm. The timing chain runs across a synthetic rubber pad on the tensioner arm and in use the links wear two grooves in the pad so that the chain runs directly on the rollers. **Do not** dress the surface of the pad to remove the grooves.

The sprockets incorporate timing marks to facilitate correct valve timing. Note the identification groove on the crankshaft sprocket. A similar sprocket for previous three-bearing crankshaft engines must not be used. The crankshaft sprocket can be removed with remover Tool No. P.6116 and replaced with replacer Tool No. P.6032A or B.

CRANKSHAFT AND BEARINGS

Both cast iron dynamically balanced crankshafts run in five main bearings. Steel-backed copper/lead or white metal liners are used on the 1,300 c.c. engines and only steel-backed copper/lead liners on the 1,600 c.c. The respective crankshafts can be identified by the number cast on the number 6 web.

	1,300 c.c.	1,600 c.c.
Crank throw ...	1.238 to 1.242 in. (31.45 to 31.55 mm.)	1.526 to 1.530 in. (38.76 to 38.86 mm.)
Identification number	2730E	2737E

In new engines the crankshaft may be either standard or 0.010 in. (0.25 mm.) undersize on the main bearing journals and crankpins. The crankshaft main bearing journals are graded, the standard crankshaft webs being marked, adjacent to the journal, with a paint spot, BLUE for the smallest grade and RED for the largest. Where the crankshaft is 0.010 in. (0.25 mm.) undersize the grades are GREEN and YELLOW respectively.

The crankshaft main bearing journals may be ground 0.010 in. (0.25 mm.) 0.020 in. (0.51 mm.), or 0.030 in. (0.76 mm.) undersize and the crankpins to 0.040 in. (1.02 mm.) undersize. When grinding crankshafts undersize it is important to maintain the correct fillet radii at all times. The centre main bearing journal has a double radius of 0.070 in. (1.78 mm.) and 0.080 in. (2.03 mm.) and the rear main bearing has a double fillet radius, the inner radius of which must be maintained at 0.100 to 0.110 in. (2.54 to 2.79 mm.) when regrinding. The remaining main journal fillet radii are 0.110 to 0.096 in. (2.79 to 2.44 mm.). The crankpin journal fillet radii are 0.080 to 0.094 in. (2.03 to 2.39 mm.). Grind the bearing journals with the crankshaft and grinding wheel revolving in an anti-clockwise direction as viewed from the front of the shaft. Ensure that the fillet radii are smooth and free from visual chatter marks. The centre main bearing journal length between the thrust faces can be increased by up to 0.020 in. (0.51 mm.) providing an equal amount is machined from each face and the corresponding oversize thrust washers fitted. When grinding the rear main journal, ensure that the width of the machining wheel is 1.30 to 1.33 in. (33.02 to 33.78 mm.), that it has a fillet radii of 0.100 to 0.110 in. (2.54 to 2.79 mm.), and that the wheel is positioned 0.074 in. (1.879 mm.) from the rear face. The crankpin length must not exceed 0.010 in. (0.25 mm.) oversize.

Main bearing journal and crankpin ovality should not exceed 0.0004 in. (0.010 mm.) T.I.R. and taper 0.0005 in. (0.013 mm.). The centre main bearing run-out relative to the front and rear journals should not exceed 0.002 in. (0.05 mm.) T.I.R. The crankpins should be parallel to the main journals within 0.001 in. (0.025 mm.) and be within 0.005 in. (0.13 mm.) on either side of the centre line through No. 1 crankpin and main journal. The thrust faces should be smooth and square to the bearing journal within 0.0005 in. (0.013 mm.) T.I.R. After grinding, crankpins and

journals should be polished, with a fine lapping paper and the crankshaft revolving clockwise to produce a good surface finish.

Crankshaft thrust is taken by steel-backed white metal half thrust washers located in the cylinder block at the centre main bearing. Standard size washers and 0.0025 in. (0.064 mm.), 0.005 in. (0.127 mm.), 0.0075 in. (0.191 mm.) and 0.010 in. (0.254 mm.) oversize washers are available.

The clutch pilot spigot bearing is located in a bore machined in the centre of the crankshaft flange. The spigot bearing can be removed with adaptor Tool No. CP.7600-7 fitted to remover Tool No. CP.7600A or B and replaced with Tool No. P.7137.

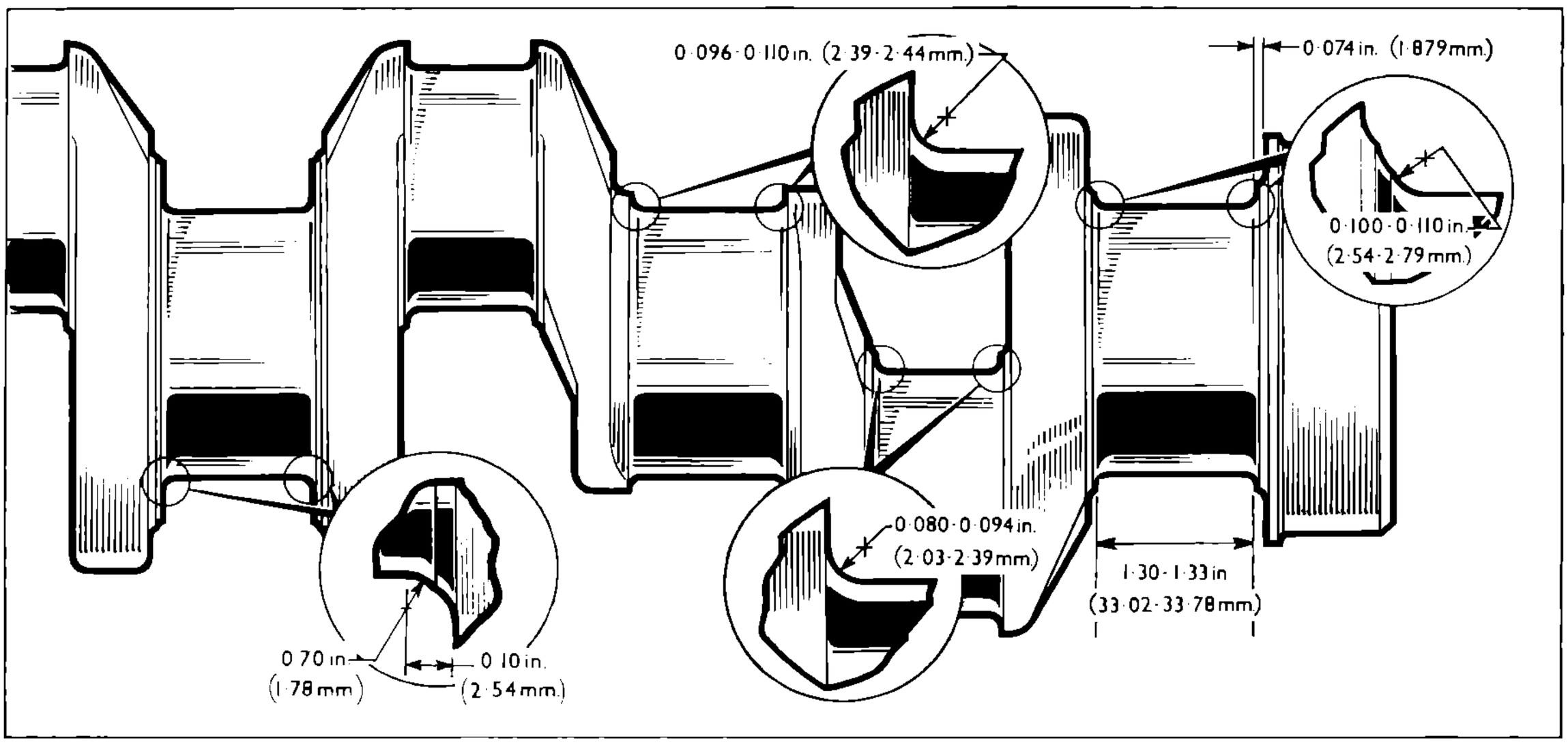
NOTE – Where an automatic transmission is fitted a spigot bearing **must not be fitted.**

CONNECTING RODS

Both connecting rods are H section steel forgings with detachable big end caps. The caps are located by two hollow dowel pins pressed into the connecting rod and retained by two bolts fitted without lockwashers. The connecting rod can be identified by the number forged on the web. An oil squirt hole machined in the connecting rod feeds oil from the crankpin to the non-thrust side of the cylinder bore.

	1,300 c.c.	1,600 c.c.
Length between centres	4.1325 to 4.1355 in. (104.965 to 105.042 mm.)	4.9265 to 4.9295 in. (125.133 to 125.209 mm.)
Identification number	2735E-B	2737E-B

The steel-backed big end bearing liners may have either copper/lead, lead/bronze or aluminium/tin bearing surfaces. The upper liner which locates in the connecting rod incorporates an oil hole, the lower liner being plain. Each pair of bearing liners must consist of two liners made of the same material, they should not be mixed. Undersize liners are available in 0.002 in. (0.05 mm.), 0.010 in. (0.25 mm.), 0.020 in. (0.51 mm.), 0.030 in. (0.76 mm.) and 0.040 in. (1.02 mm.) sizes.



Crankshaft Fillet Radii

The connecting rod small end bearing is a steel-backed bronze bush, which is not available in service, the connecting rod being serviced with the bush already fitted.

When dismantling an engine examine the piston markings to check the connecting rods for straightness. A heavy marking on the piston skirt above the pin on one side together with a correspondingly heavy marking below the pin on the other side indicates a bent connecting rod which should either be straightened or a replacement fitted. The connecting rod small and big ends should be parallel and square to the longitudinal centre line within 0.0005 in. per inch (0.0005 cm. per cm.) length.

When assembling a connecting rod to the piston ensure that it is fitted the correct way round. The marking "FRONT" is embossed on the web to facilitate this.

Connecting Rod Numbering

Connecting rods are numbered when installed in the engine during manufacture, to facilitate correct reassembly should they be dismantled.

The number is stamped on the camshaft side of the big end so that a cap replaced with the numbers together must be in its original position. Never reassemble a bearing cap to another connecting rod.

It is advisable when removing connecting rods from an engine to check that the connecting rods have been numbered correctly. Where the connecting rods are unmarked they should be suitably stamped unless the connecting rods are being scrapped.

PISTONS, PISTON PINS AND RINGS

The pistons are made of an aluminium alloy and are of the cut-away solid skirt type with thermal slots in the oil control ring groove and the upper part of the piston skirt. The combustion chamber bowl and, on 1,300 c.c. engines, valve recesses are machined in the piston crown. Different pistons are used for each capacity engine and for each compression ratio. These can be identified by the combustion chamber bowl depth, by the cast number inside the piston skirt and by the number stamped on the piston crown. This last number consists of the last digit of the part number prefix and the part number suffix, e.g. 2735E-6110-D, identification number 5/D.

Model	*Bowl Depth*	*Identification Number*			
		*Standard**	0.0025 in. o/s* (0.064 mm.)	0.015 in. o/s* (0.38 mm.)	0.030 in. o/s† (0.76 mm.)
1,300 c.c. H.C. ...	0.540 to 0.548 in. (13.72 to 13.92 mm.)	5/D‡‡ 5/R	5/G	5/J	5/K
1,300 c.c. L.C. ...	0.640 to 0.648 in. (16.25 to 16.46 mm.)	5/E‡‡ 5/AE	5/V	5/Z	5/AA
1,600 c.c. H.C. and G.T.	0.469 to 0.504 in. (12.60 to 12.80 mm.)	7/D‡‡ 7/R	7/G	7/J	7/K
1,600 c.c. L.C. ...	0.599 to 0.607 in. (15.22 to 15.42 mm.)	7/E‡‡ 7/AE	7/V	7/Z	7/AA

Casting Number * 2733E-6110-D
† 2733E-6110-K
‡‡ Production pistons

The piston pin is offset in the piston 0.04 in. (1.0 mm.) towards the thrust side of the engine. To facilitate correct assembly an arrow head is cast in the piston crown and must point forwards when the piston is fitted to the engine.

The tubular steel piston pins are fully floating and are retained in position by circlips installed in grooves at each end of the piston pin bore. The piston pin bores are graded during manufacture and paint spots corresponding to the grade are placed on the piston crown. The piston pins are selected to give the correct fit in the piston pin bore and small end bush in the connecting rod. Pistons are only supplied in service complete with the piston pin, to ensure the correct fit. The piston pins should not be interchanged.

On assembling the piston, pin and connecting rods, the assemblies are weighed. The maximum variation of weight between the piston and connecting rod assemblies fitted in an engine is 8 grams. When changing pistons or connecting rods in service, it is good practice to check the weights of the piston, pin and connecting rod assemblies and, if necessary, select parts to ensure that the weight variation between the respective assemblies does not exceed 8 grams.

Three piston rings are fitted, two compression and one oil control ring. The lower compression ring is stepped externally on the bottom face and the upper ring is chrome plated and tapered on the periphery. Both rings are marked "TOP" and must be fitted this way round. The upper ring, when new, has a reddish brown "running in" compound on the outer edge. On no account must this compound be removed. The oil control rings have narrow ring lands and may be fitted either way round.

Oversize pistons and rings are available in 0.0025 in. (0.064 mm.), 0.015 in. (0.38 mm.) and 0.030 in. (0.76 mm.) sizes.

Piston Selection

During engine manufacture the cylinder bores and pistons are graded. The piston grade number is marked on the piston crown and, in production, each cylinder bore grade number is stamped on the push rod side of the cylinder block, adjacent to the top face, during engine

Connecting Rod and Piston Assembly

assembly. Pistons selected and fitted to correspond to the cylinder bore grading thus have the correct working clearance of 0.0007 to 0.0013 in. (0.018 to 0.033 mm.).

When selecting standard size pistons, measure each cylinder bore at a point 2.338 in. (59.39 mm.) from the cylinder block top face, across the axis of the crankshaft, and refer to the Specification, to determine the grade of piston required. Select a standard SMALL or standard LARGE piston according to the grade number found for the cylinder bore, if necessary hone the bore to obtain the correct fit.

Note — When selecting pistons always carry out the procedure mentioned below with the connecting rod and piston pin removed. At room temperature the piston pin is an interference fit with the piston and consequently distortion takes place thus giving an incorrect piston pull reading.

An alternative method of selecting pistons or checking their fit is to use a piston pull scale Tool No. 512 fitted with either a 0.0025 in. or a 0.0020 in. (0.064 mm., 0.051 mm.) by $\frac{1}{2}$ in. (12.7 mm.) wide steel feeler blade.

Insert the piston pull scale feeler blade into the cylinder bore for its full length and then slide the corresponding piston, crown first, into the bore after it to trap the feeler blade between the piston skirt at its largest diameter and the cylinder wall. Hold the piston stationary in the cylinder bore without applying any side thrust and withdraw the feeler blade with a steady pull on the piston pull scale, observing the pounds pull required to remove the feeler blade. At the correct working clearance the pull required will be 7 to 11 lb. (3.18 to 5 kg.).

When reboring cylinders in service, to suit oversize pistons or standard size pistons after fitting cylinder liners, it is essential that each cylinder bore is machined to give the correct fit for the individual piston. The piston skirt diameter must be measured accurately at right angles to the piston pin at a point 2.314 in. (58.78 mm.) from the piston crown, the maximum measurement being taken as the piston skirt is oval. By adding the piston clearance to this figure the correct size for machining the cylinder bore can be obtained.

FLYWHEEL AND RING GEAR

The cast iron flywheel is located concentrically on the crankshaft flange and retained by six bolts fitted without lockwashers. A drive for the engine starter motor is provided by a ring gear shrunk onto the flywheel. The number of teeth on this ring gear varies with the type of starter motor used; 110 teeth with an inertia type starter or 132 teeth with pre-engaged types. The 110 tooth ring gear has chamfered teeth and this provides an easy method of identification as the 132 tooth gear has no chamfers on the teeth. A lighter flywheel is used on the G.T. engine. The respective flywheels can be identified by the weight, 26 lb. (11.8 kg.) for the 1,300 and 1,600 c.c. H.C. and L.C. engines and 18.5 lb. (8.39 kg.) for the G.T.

The flywheel ring gear locates in a retention groove and can be removed by cutting between two teeth with a hack saw and splitting the gear with a chisel. In no circumstances should pressure be applied in an attempt to dismantle the ring gear for repositioning on the flywheel.

When replacing the ring gear it must be heated evenly to a temperature not exceeding 600°F (316°C) or the ring gear wear resistant properties will be destroyed. If the ring gear is heated by a naked flame place the ring gear on a bed of fire bricks and then play the flame in a circular motion onto the bricks about $1\frac{1}{2}$ in. (38.1 mm.) from the inside of the gear until it reaches the required temperature. The correct temperature can be detected by using a special type of temperature sensitive crayon, or alternatively by polishing a section of the ring gear and heating

until it turns dark blue. Fit the ring gear with the chamfers on the leading faces of the gear teeth relative to the direction of rotation. Allow the ring gear to cool naturally in air, **Do not quench.**

The flywheel and ring gear assembly are dynamically balanced to close limits. The clutch is located on the flywheel by three dowels and is retained by six bolts with spring washers.

Where an automatic transmission is used a drive plate is fitted to the crankshaft flange. This plate is located on the crankshaft by a spacer, which provides spigot location for the torque converter, and is retained by a reinforcing plate and six bolts. These bolts, however, are shorter than the flywheel bolts, the respective lengths being 0.75 in. (19.1 mm.) and 0.9 in. (22.9 mm.). The ring gear is fitted to the torque converter.

THE OIL PUMP

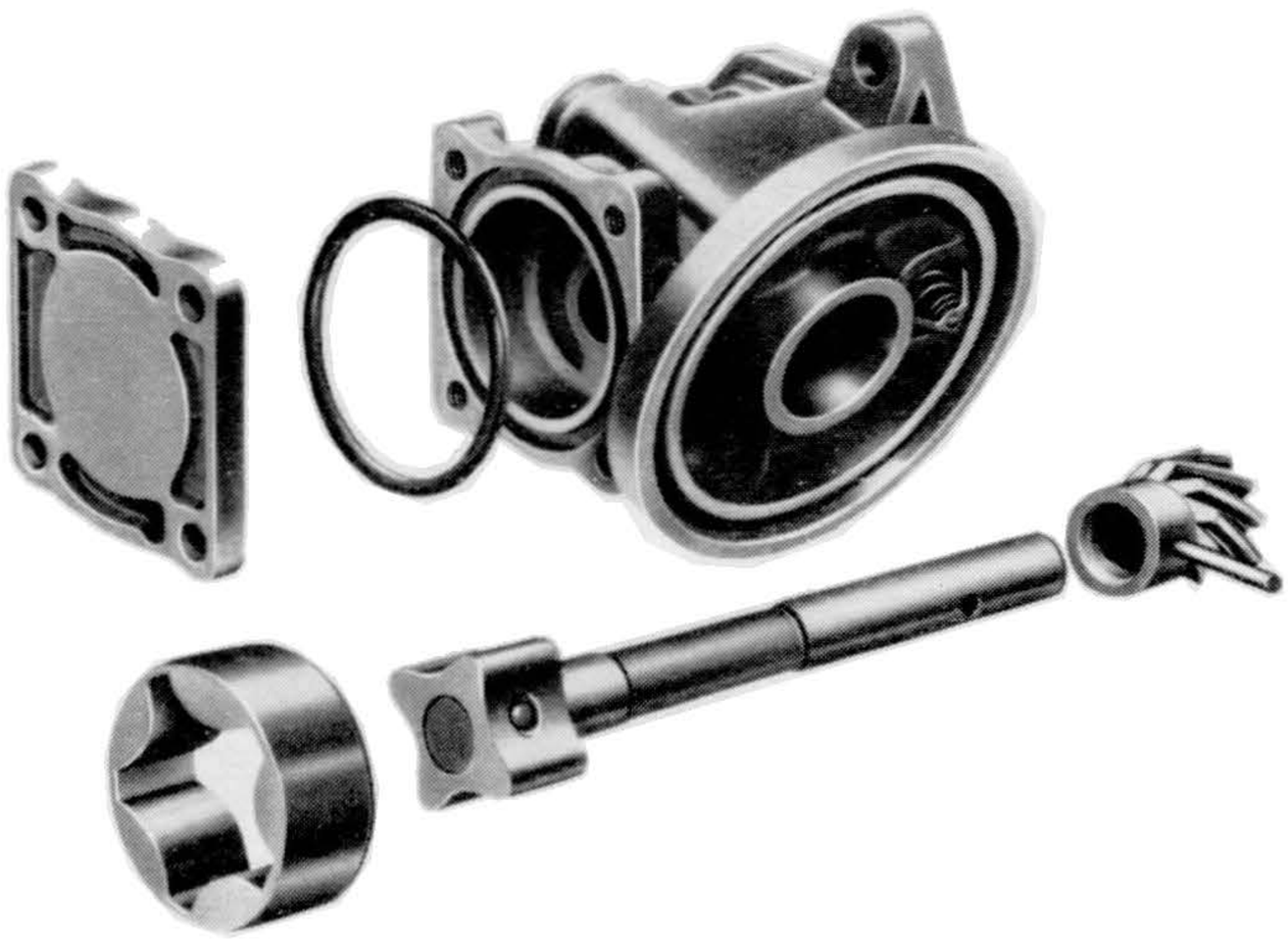
The oil pump and filter assembly is bolted to the right-hand side of the cylinder block and can be removed with the engine in place. The oil pump, which is driven by a skew gear on the engine camshaft, has the full flow element type filter bolted to a mounting flange integral with the oil pump body.

One of two types of oil pump is fitted in production. The eccentric bi-rotor type or the sliding vane type. The pumps are directly interchangeable, differing only in internal design and may be readily identified on the car by the different appearance of their end covers. The eccentric bi-rotor type has four recesses cast in the cover, the vane-type being flat.

Oil enters the pump through a tube pressed into the cylinder block sump face. A spring-loaded filter gauze located on the end of this tube provides primary filtration. The gauze can be removed by bending back the retaining lug and sliding the gauze out sideways. A pressure relief valve oil return pipe is also pressed into the cylinder block sump face parallel to the inlet tube.

THE OIL FILTER

The full flow type oil filter is bolted to a mounting flange integral with the oil pump body. To remove the filter unscrew the securing bolt and withdraw the filter body and element. Remove the sealing ring from the groove in the filter body mounting flange, then locate the new



Eccentric Bi-rotor Type Oil Pump

ring (supplied with the replacement element) in the groove at four diametrically opposite points. Do not fit the ring at one point and then work it round the groove as the rubber may stretch, thus leaving a surplus which may cause an oil leak. Thoroughly clean the filter body and insert the new element. Locate a new washer on the securing bolt and refit the filter assembly to the oil pump body.

VENTILATION SYSTEM

A semi-closed positive ventilation system is fitted as standard and consists of a breather, incorporated in the oil filler cap, an oil separator located on the fuel pump mounting pad, an emission valve, which fits into a grommet on top of the oil separator, and a connecting tube to the inlet manifold.

ENGINE MOUNTINGS

The engine and gearbox assembly has a three-point mounting on bonded rubber insulators. The two front insulators consist of a rubber block bonded between the engine mounting bracket and a mounting plate, incorporating a weld nut on the inner face. A single bolt is thus used to secure the insulator to the mounting bracket on the front crossmember. Two insulators are available, one for the 1,300 c.c. engine and another for 1,600 c.c. engines. These insulators can be identified by their respective sizes and by the number marked on them.

Model	*Length of Mounting Face*	*Number*
1,300 c.c. ...	3 in. (76.2 mm.)	3034E-6038-A
1,600 c.c.	$3\frac{1}{2}$ in. (88.9 mm.)	3036E-6038-A

The single rear insulator is secured to a pad on the gearbox extension housing and consists of rubber blocks bonded between steel channel section plates. Three insulators are available, one for the 1,300 c.c. engine with manual transmission, one for the 1,600 c.c. engine with manual

Sliding Vane Type Oil Pump

transmission, but not the G.T. version, and a larger softer insulator for the G.T. and with automatic transmission. With the manual transmission a retainer is located beneath and in front of the insulator when fitted to the crossmember, on automatic transmission vehicles the retainer takes the form of a strap bolted directly to the crossmember.

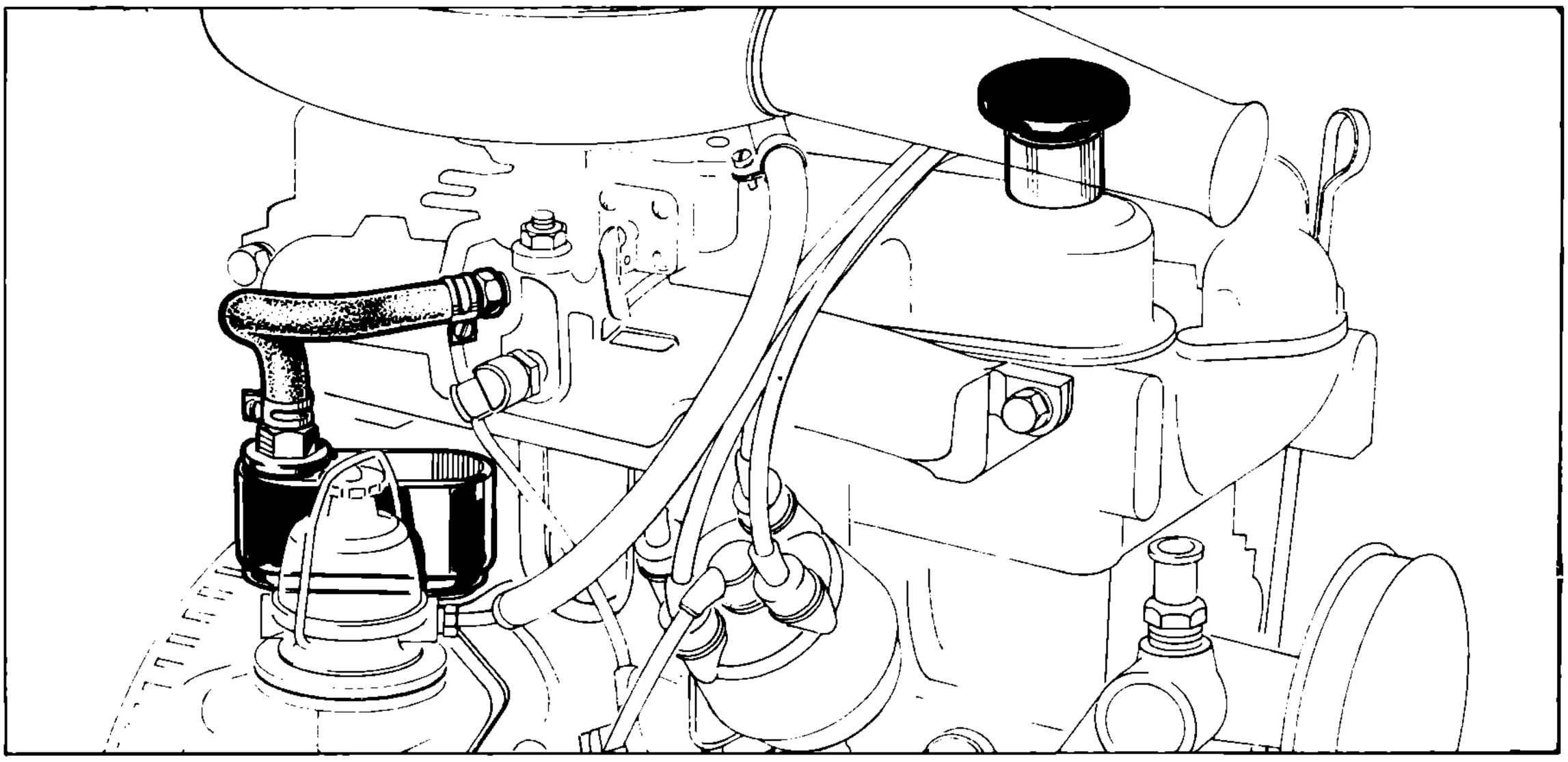
Model	*Distance Between Bolt Centres*	*Insulator Number*	*Retainer Number*
1,300 c.c.—Manual ...	3.32 in. (84.3 mm.)	3014E-6068-A	3014E-6053-A
1,300 and 1,600 c.c.—Auto ...	3.74 in. (95.0 mm.)	3036E-6068-A	3034E-6053-A
1,600 c.c.—Except G.T. and Auto ...	3.74 in. (95.0 mm.)	3016E-6068-A	3014E-6053-A
—G.T. ...	3.74 in. (95.0 mm.)	3036E-6068-A	3036E-6053-A

The crossmember is bolted to the car underbody, spacers being used between the crossmember and the body when an automatic transmission is fitted. The automatic transmission crossmember is longer than that used with the manual transmission and has additional bolt holes for the retainer strap.

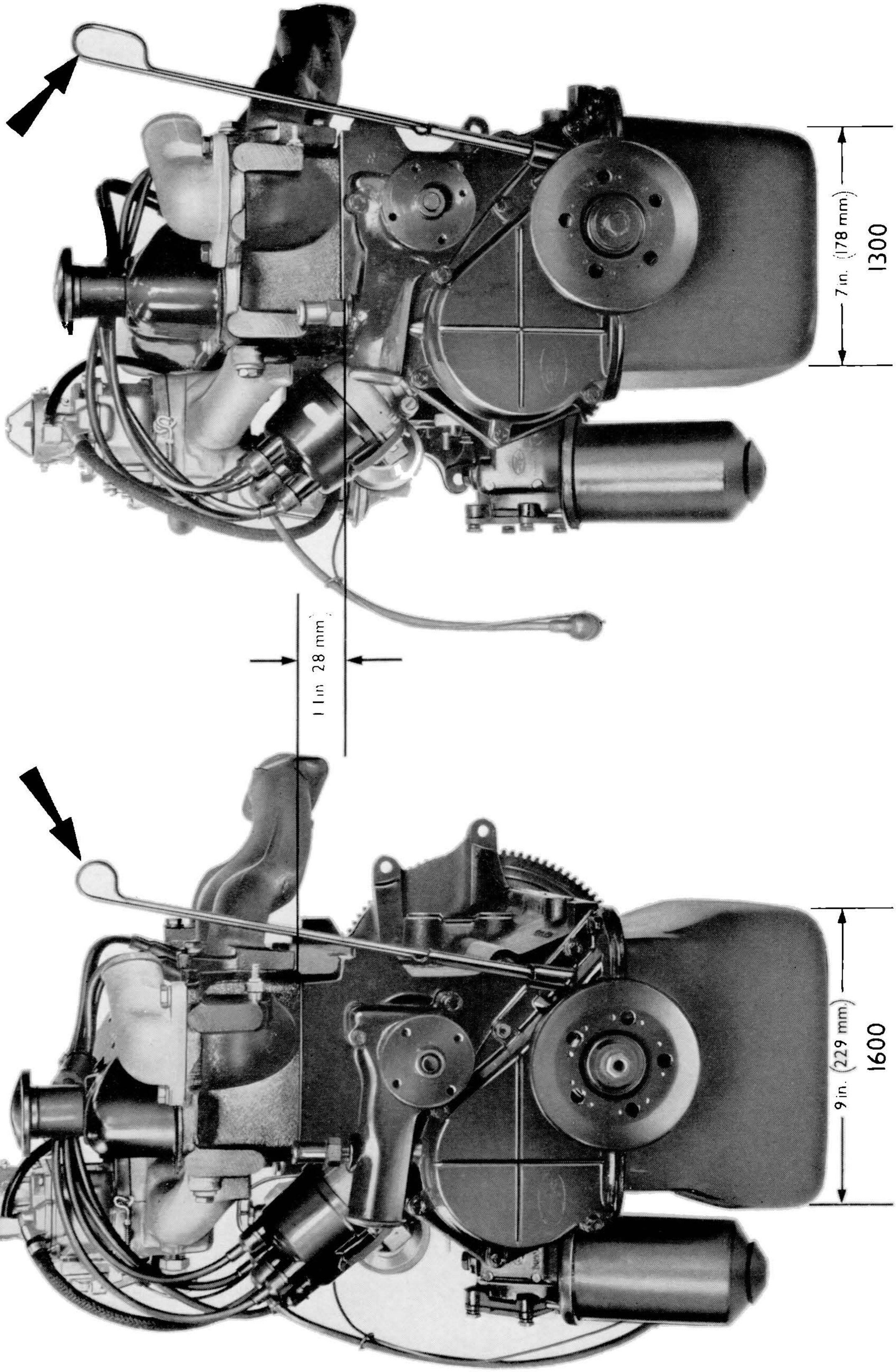
The G.T. crossmember has insulator bolt holes which are circular, slotted holes being used on the other manual transmission version.

Further identification is provided by the number stamped on the crossmember.

Gearbox	*Insulator Bolt Holes*	*Number*
Manual—Except G.T.	Slotted	3014E-6A092-B
—G.T. ...	Round	3036E-6A092-A
Automatic ...	Round	3034E-6A092-A



Positive Ventilation System



Engine Identification

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

Daily

Check the engine oil level and top-up if necessary.

At first 600 miles (1000 km.)

Check the engine oil level and top-up if necessary.

Tighten the cylinder head manifold and sump bolts.

Check the valve clearances and adjust if necessary.

At first 3,000 miles (5,000 km.) and every subsequent 6,000 miles (10,000 km.)

Change the engine oil and filter.

Check the valve clearances and adjust if necessary.

Clean the oil filler cap gauze.

DATA

Compression pressures—1,300—H.C.	168 lb./sq. in. (11.81 kg./sq. cm.) at 360 rev./min.
—L.C.	157 lb./sq. in. (11.04 kg./sq. cm.) at 360 rev./min.
—1,600—H.C. and G.T.	188 lb./sq. in. (13.22 kg./sq. cm.) at 300 rev./min.
—L.C. ...	170 lb./sq. in. (11.95 kg./sq. cm.) at 300 rev./min.
Idling speed—except G.T.	580 to 620 rev./min.
—G.T.	680 to 720 rev./min.
Minimum stable vacuum at idling speed—except G.T.	18 in. (45.7 cm.) Hg.
—G.T. only	16 in. (40.6 cm.) Hg.
Maximum vacuum variation at idling speed ...	... 2 in. (5.1 cm.) Hg.
Firing order	... 1, 2, 4, 3
Location of No. 1 cylinder	Next to radiator
Camshaft end-float	0.0025 to 0.0075 in. (0.064 to 0.191 mm.)
Connecting rod end-float on crankpin	0.004 to 0.010 in. (0.10 to 0.25 mm.)
Crankshaft end-float	0.003 to 0.011 in. (0.08 to 0.28 mm.)
Valve seat angle ...	... 44° 30′ to 45° inlet and exhaust
Valve seat width—Inlet ...	$\frac{1}{16}$ in. (1.59 mm.)
—Exhaust	... ... $\frac{5}{64}$ in. (1.98 mm.)
Flywheel run-out	0.005 in. (0.13 mm.) maximum
Inner and outer rotor clearance	... 0.006 in. (0.15 mm.) maximum

Outer rotor and housing clearance	0.010 in. (0.25 mm.) maximum
Inner and outer rotor end-float ...	... 0.005 in. (0.13 mm.) maximum
Vane clearance in rotor ...	0.005 in. (0.13 mm.) maximum
Rotor and vane end-float	... 0.005 in. (0.13 mm.) maximum
Vane to housing clearance at centre of cam form ...	... 0.010 in. (0.25 mm.) maximum
Rotor to housing clearance	... ... 0.005 in. (0.13 mm.) maximum
Oil pressure	... 35 to 40 lb./sq. in. (2.46 to 2.81 kg./sq. cm.)
Sump capacity (including oil filter)—1,300	5.5 Imp. pints (7.0 U.S. pints, 3.25 litres)
—1,600	6.0 Imp. pints (7.5 U.S. pints, 3.50 litres)
Oil filter capacity ...	$\frac{2}{3}$ Imp. pint (0.8 U.S. pint, 0.38 litre)

SAE Grade	Use Below	Use Above	Max. High	Min. Low
5W-20 and 5W-30	—10 F		32°F	
10W-30		General Use	90°F	—10°F
10W-40		General Use		—10°F
10W-50		General Use		—10°F
20W-40 and 20W-50		90 F		32°F*
10W	10 F	—10 F		
20W-20	—32°F	10 F		
30	90 F	32 F		
40		90 F		

*"All Season" oils 25 F

Piston clearance in cylinder bore—1,300	0.0019 to 0.0025 in. (0.048 to 0.064 mm.)
—1,600	0.0013 to 0.0019 in. (0.033 to 0.048 mm.)
Piston pull—1,300 ...	7 to 11 lb. (3.18 to 5 kg.) with 0.0025 in. (0.064 mm.) feeler blade, 0.5 in. (12.7 mm.) wide
—1,600 ...	7 to 11 lb. (3.18 to 5 kg.) with 0.0020 in. (0.051 mm.) feeler blade, 0.5 in. (12.7 mm.) wide
Clearance between block face and piston crown at T.D.C.:	
—1,300	0.005 to 0.023 in. (0.13 to 0.58 mm.)
—1,600	0.025 to 0.043 in. (0.64 to 1.09 mm.)
Compression ring to groove clearance	0.0016 to 0.0036 in. (0.041 to 0.091 mm.)
Oil control ring to groove clearance ...	0.0018 to 0.0038 in. (0.046 to 0.097 mm.)
Ring gap ...	0.009 to 0.014 in. (0.23 to 0.36 mm.)
Valve face angle	... ... 45° to 45° 15'
Valve clearance—Except G.T.—(hot) —Inlet ...	... ... 0.010 in. (0.25 mm.)
—Exhaust	... ... 0.017 in. (0.43 mm.)
—(cold)—Inlet ...	0.008 to 0.010 in. (0.20 to 0.25 mm.)
—Exhaust	0.018 to 0.020 in. (0.48 to 0.51 mm.)
—G.T.—(hot) —Inlet ...	... 0.012 in. (0.30 mm.)
—Exhaust	... ... 0.022 in. (0.56 mm.)
—(cold)—Inlet ...	0.011 to 0.013 in. (0.28 to 0.33 mm.)
—Exhaust	0.021 to 0.023 in. (0.53 to 0.58 mm.)

Tightening Torques

Cylinder head	$\frac{7}{16}$ in. – 14 UNC	65 to 70 lb. ft. (8.98 to 9.67 kg.m.)
Main bearing cap ...	$\frac{7}{16}$ in. – 14 UNC	65 to 70 lb. ft. (8.98 to 9.67 kg.m.)
Connecting rod big end ...	$\frac{3}{8}$ in. – 24 UNF	30 to 35 lb. ft. (4.15 to 4.84 kg.m.)
Flywheel—Hexagonal bolts	$\frac{3}{8}$ in. – 24 UNF	45 to 50 lb. ft. (6.22 to 6.91 kg.m.)
—Bi-hexagonal bolts ...	$\frac{3}{8}$ in. – 24 UNF	50 to 55 lb. ft. (6.92 to 7.61 kg.m.)
Oil filter centre bolt	$\frac{3}{8}$ in. – 24 UNF	12 to 15 lb. ft. (1.66 to 2.07 kg.m.)
Rocker shaft	$\frac{3}{8}$ in. – 16 UNC	17 to 22 lb. ft. (2.35 to 3.04 kg.m.)
Manifolds—bolts ...	$\frac{5}{16}$ in. – 18 UNC	15 to 18 lb. ft. (2.07 to 2.49 kg.m.)
—nuts	$\frac{5}{16}$ in. – 24 UNC	15 to 18 lb. ft. (2.07 to 2.49 kg.m.)
Front cover ...	$\frac{1}{4}$ in. – 20 UNC	5 to 7 lb. ft. (0.69 to 0.97 kg.m.)
Sump	$\frac{1}{4}$ in. – 20 UNC	6 to 8 lb. ft. (0.83 to 1.11 kg.m.)
Rear oil seal retainer	$\frac{5}{16}$ in. – 18 UNC ...	12 to 15 lb. ft. (1.66 to 2.07 kg.m.)
Crankshaft pulley ...	$\frac{7}{16}$ in. – 20 UNF	24 to 28 lb. ft. (3.32 to 3.87 kg.m.)
Oil pump	$\frac{5}{16}$ in. – 18 UNC	12 to 15 lb. ft. (1.66 to 2.07 kg.m.)
Camshaft thrust plate	$\frac{1}{4}$ in. – 20 UNC	2.5 to 3.5 lb. ft. (0.35 to 0.48 kg.m.)
Camshaft sprocket	$\frac{5}{16}$ in. – 18 UNC	12 to 15 lb. ft. (1.66 to 2.07 kg.m.)
Rocker cover	$\frac{1}{4}$ in. – 20 UNC	2.5 to 3.5 lb. ft. (0.35 to 0.48 kg.m.)
Sump drain plug	$\frac{1}{2}$ in. – 20 UNF	20 to 25 lb. ft. (2.76 to 3.46 kg.m.)
Tappet adjusting screw locknut ...	$\frac{5}{16}$ in. – 24 UNF	10 to 14 lb. ft. (1.38 to 1.93 kg.m.)
Chain tensioner to cylinder block	$\frac{1}{4}$ in. – 20 UNF	5 to 7 lb. ft. (0.69 to 0.97 kg.m.)
Engine rear insulator to extension housing—Manual transmission		40 to 45 lb. ft. (5.53 to 6.22 kg.m.)

SERVICE AND REPAIR OPERATIONS

When working around the engine compartment care must be taken to prevent damage to the paintwork. Immediately after opening the bonnet, wing covers must be fitted. This is assumed in all operations where required.

Before reassembling, during any operation, all components should be thoroughly cleaned, paying particular attention to joint faces and bearing surfaces. Any local high spots or burrs on the joint faces should be carefully removed with a fine oil stone. Ensure that any piece of gasket material or dirt which enters a blind tapped hole, during cleaning, is removed as the bolt may bottom on the resulting plug of dirt before the bolt head clamps the mating part. When tightening a bolt which bottoms, a characteristic springiness may be felt through the spanner or torque wrench. If this occurs, the bolt should be removed and the hole cleaned out.

Inspect all moving parts and bearing surfaces for wear. Check the dimensions of worn parts against the "Specification" and select new parts where necessary.

In the following repair operations it is assumed that all normal precautions regarding cleanliness and lubrication are observed and that all gaskets, oil seals and lockplates, etc. are renewed.

OP 6000-A TUNE ENGINE

(Includes the use of diagnosis equipment, Cleaning and Adjusting Spark Plugs, Cleaning or Replacing Air Cleaner Element, Replacing and/or Adjusting Contact Breaker Points, Checking and/or Adjusting Timing, Cleaning and Adjusting Carburettor and Fuel Pump and Adjusting Valves)

Tools Required

Spark plug cleaner
Tach dwell meter
Timing light
500 X Gang gauge set (Vacuum Gauge)
Exhaust gas analyser

1. Pull off the spark plug leads and remove the spark plugs. Clean the spark plugs and reset the gap to 0.023 to 0.027 in. (0.58 to 0.64 mm.).
2. Replace the spark plugs and reconnect the spark plug leads.
3. Remove the distributor cap and examine the contact breaker points. Replace the points if badly burnt or excessive metal transfer has occurred i.e., more than 0.025 in. (0.64 mm.).
4. Adjust the dwell angle to 38° to 40° at 1,000 rev./min. with the vacuum tube disconnected. Alternatively adjust the point gap to 0.025 in. (0.64 mm.) and refit the distributor cap.
5. Unscrew the fuel pump sediment bowl retainer clamp and lift off the bowl and filter screen.
6. Carefully wash the screen in petrol and flush all traces of sediment from the sediment chamber and bowl.
7. Refit the screen to the fuel pump body, ensure that the gasket is in good condition, refit the sediment bowl and tighten the clamp.
8. Unscrew the bolt and lift off the carburettor air cleaner cover.
9. Remove the paper element from the air cleaner. Shake the element clean or blow out with compressed air. Renew if unserviceable.

10. Remove the air cleaner body and wash in petrol.

11. Disconnect the fuel feed pipe at the carburettor.

12. NOT G.T.–Disconnect the choke control inner cable (manual choke only). Where the automatic choke is fitted remove the thermostatic spring and water housing.

13. Remove the carburettor upper body. Carefully lift off the body and gasket disconnecting the choke link at the same time.

    NOTE – On the Ford carburettor the accelerator pump discharge valve will be exposed in its bore when the upper body is removed. Exercise care when operating the throttle linkage in this condition as the valve and weight may be ejected. Serious damage will occur if the valve enters the engine.

14. Withdraw the float arm pivot pin and remove the float and gasket.

15. Unscrew the main jet and blow it clear with an air line. On the G.T. carburettor remove and blow through all jets.

16. Remove the needle valve and the needle valve body and blow it clear with an air line. Clean the gauze filter.

17. Replace the main jet (all jets G.T.), the gauze filter, the needle valve body and needle valve.

18. Clean the float and float chamber using clean petrol.

19. Locate the gasket on the upper body and fit the float assembly, sliding the pivot pin into position. Check the float setting.

20. Refit the upper body and check the throttle operation and the accelerator pump stroke (except G.T.).

21. Reconnect the fuel feed pipe.

22. NOT G.T. – Where an automatic choke is used, fit the thermostatic spring and water housing. Check the choke operation and setting.

23. Refit the air cleaner.

24. Adjust the valve clearances see Operations No. 6450-A and A1.

25. Connect the leads of a timing light using the clips provided in accordance with the manufacturer's instructions.

26. Check that the timing marks are visible and mark with chalk or paint if necessary.

27. Disconnect the distributor vacuum pipe and start the engine, allowing it to idle.

28. Point the timing light at the timing pointer. Check that the appropriate marks on the crankshaft pulley and front cover timing pointer align. Adjust the timing if necessary by turning the distributor body.

29. Securely tighten the distributor body clamp bolt and reconnect the vacuum pipe.

30. Connect a vacuum gauge with a suitable Tee connector, into the crankcase ventilation tube.

31. Run the engine and adjust the throttle stop screw until the correct idling speed is obtained. Adjust the volume control screw to obtain the maximum vacuum, readjusting the idling speed as necessary.

    NOTE – The crankcase emission valve must be connected to the manifold while carrying out these adjustments.

32. Remove the vacuum gauge and reconnect the crankcase ventilation tube.

    NOTE – An exhaust gas analyser can be used instead of a vacuum gauge to adjust the slow-running. Connect it in accordance with the manufacturer's instructions and adjust the volume control screw to give the optimum mixture strength.

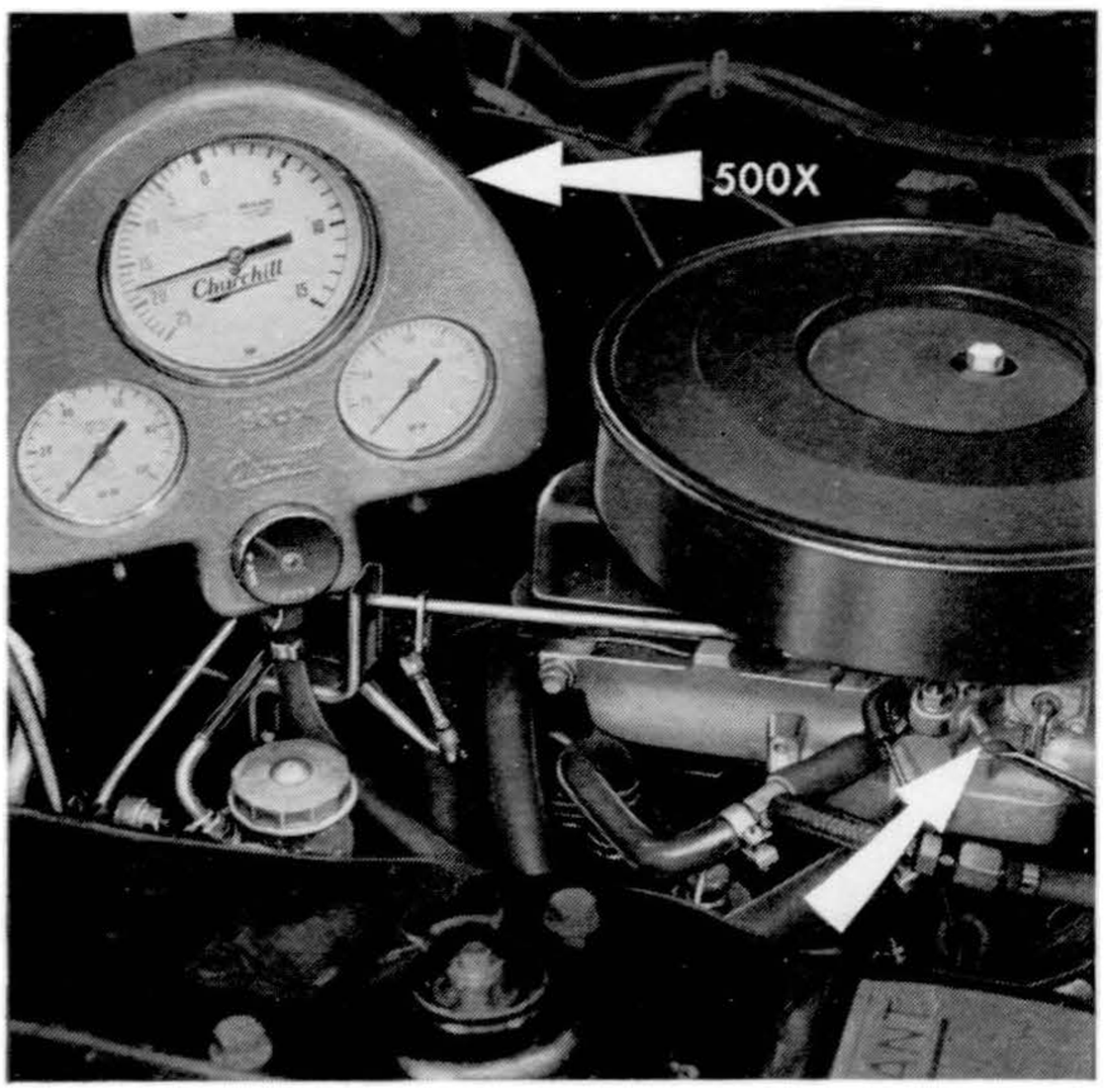
OP 6000-B ENGINE ASSEMBLY – CHECK COMPRESSION

Tools Required

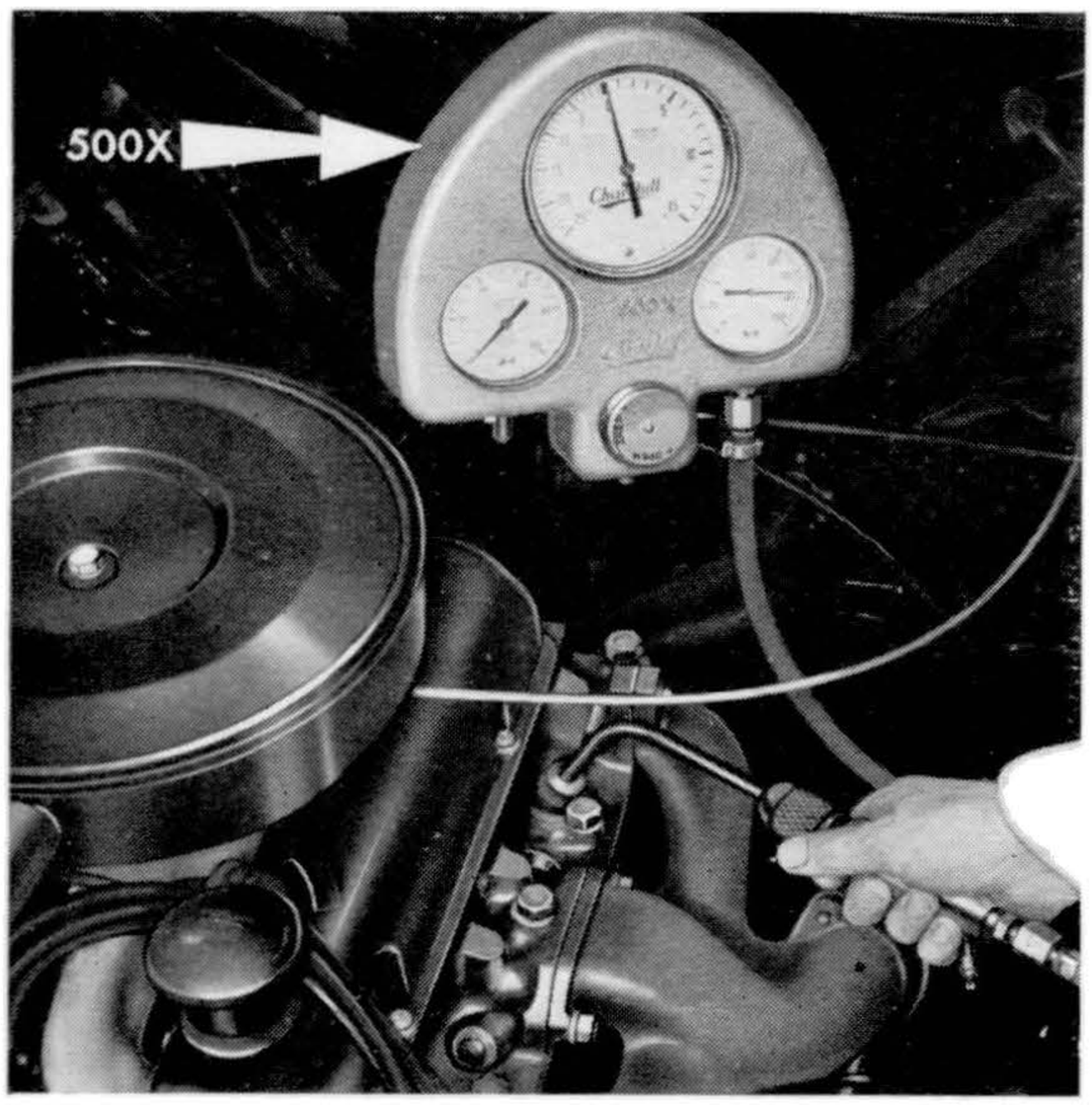
500X Gang Gauge Set

1. Warm up the engine to the normal operating temperature.
2. Remove all the spark plugs.
3. Set the throttle to the wide open position.
4. Place the gang gauge in a convenient position, insert the expanding rubber plug into the No. 1 spark plug orifice and expand the plug by turning the knurled nut.
5. Crank the engine with the starter motor until full pressure is recorded on the gauge.
6. Test the remaining cylinders in a similar manner.
7. Replace the spark plugs.

    NOTE – If the above check is made at an altitude appreciably above sea level proportionally lower pressures will be obtained.



Adjusting the Idling Speed with a Vacuum Gauge



Checking the Compression

OP 6000-C ENGINE ASSEMBLY – REMOVE AND INSTALL

Tools Required

P.6171 Engine lifting brackets

To Remove

1. Remove the bonnet.
2. Disconnect the battery lead and earth strap at the engine.
3. Drain the cooling system by opening the drain plugs on the radiator and engine cylinder block. Store the coolant if it is to be used again.
4. Disconnect the radiator hoses at the engine and then remove the radiator assembly.
5. Remove the air cleaner.
6. Disconnect both heater hoses at the bulkhead.
7. Disconnect the accelerator linkage and downshift cable (automatic transmission) from the carburettor.
8. Disconnect the choke control from carburettor (except where an automatic choke is used).
9. Disconnect the temperature gauge sender unit lead and two generator leads.
10. Unscrew the exhaust pipe clamp bolts and disconnect the exhaust pipe from the manifold. (On G.T. cars complete this operation after jacking up the car.)
11. Disconnect the fuel inlet pipe from the fuel pump.
12. Disconnect the fuel pipe from the carburettor and unclip the vent pipe (not G.T.).
13. Disconnect the distributor high and low tension leads from the coil and the high tension leads from the spark plugs. Remove distributor cap.
14. Disconnect the distributor vacuum pipe at manifold.
15. Disconnect the engine ventilation system vacuum pipe at the manifold.
16. Remove the inlet manifold complete with heater water control where fitted.
17. Remove the exhaust manifold.
18. Jack up the front of the car and fit stands. Remove the sump shield where fitted.
19. Disconnect the starter motor lead and remove the starter motor.
20. Unscrew the lower clutch housing bolts, disconnect the reinforcing bracket and remove the cover.
21. On automatic transmission cars turn the engine as necessary and remove the drive plate to torque converter bolts.
22. Remove the stands and jack from beneath the car.
23. Unscrew the clutch housing to engine bolts.
24. On automatic transmission cars slacken the filler tube at the gearbox.
25. Fit lifting brackets Tool No. P.6171. Support the engine on suitable tackle.
26. Disconnect the engine mountings from the front crossmember.

27. Suitably support the gearbox (automatic transmission).
28. Pull the engine unit forward off the main drive gear (or torque converter) and lift the assembly from the engine compartment
29. Drain the engine oil.

To Install

30. Transfer the lifting brackets to the new engine.
31. Position the engine assembly in the engine compartment and engage the unit on the main drive gear (or with the torque converter). Ensure that the upper flywheel cover is located on the dowels.
32. Secure the engine front mountings to the front crossmember.
33. Fit the engine to clutch housing bolts. Note that the engine earth strap is secured by the top left-hand bolt. On automatic transmission cars turn the engine as necessary and fit the drive plate to torque converter bolts.
34. Remove the engine lifting tackle and brackets.
35. On automatic transmission cars retighten the filler tube at the gearbox.
36. Fit the exhaust manifold, coat the gaskets on both sides with EM-4G-14 jointing compound.
37. Reconnect the fuel pipe to the fuel pump.
38. Fit the inlet manifold.
39. Reconnect the engine ventilation system vacuum pipe.
40. Replace the distributor cap and reconnect the high and low tension leads to the coil and the high tension leads to the spark plugs.
41. Reconnect the distributor vacuum pipe.
42. Replace the two generator leads and the temperature gauge sender unit lead.
43. Reconnect the carburettor fuel pipe and locate the ventilation tube in the rocker cover clip. (Not G.T.)
44. Reconnect the exhaust pipe and tighten the clamp bolts. (On G.T. cars complete this operation after jacking up the car.)
45. Reconnect the choke control to the carburettor. (Except where an automatic choke is used.)
46. Reconnect the throttle linkage and downshift cable (automatic transmission) to the carburettor.
47. Reconnect the heater hoses. Where fitted, connect the automatic choke hoses.
48. Replace the radiator assembly and reconnect the radiator hoses.
49. Make sure the two coolant drain plugs are closed. Refill the cooling system with long life anti-freeze.
50. Fit the air cleaner to the carburettor.
51. Jack up the front of the car and fit stands.
52. Replace the starter motor and reconnect the starter motor lead.

53. Replace the sump shield if fitted. Fit the lower clutch housing cover and all the lower clutch housing bolts. On automatic transmission cars reconnect the reinforcing bracket.
54. Jack up the car, remove the stands, lower car to the ground and remove the jack.
55. Reconnect the battery lead and earth strap.
56. Refill the engine sump with approved engine oil.
57. Run up and check engine for leaks.
58. Refit the bonnet.

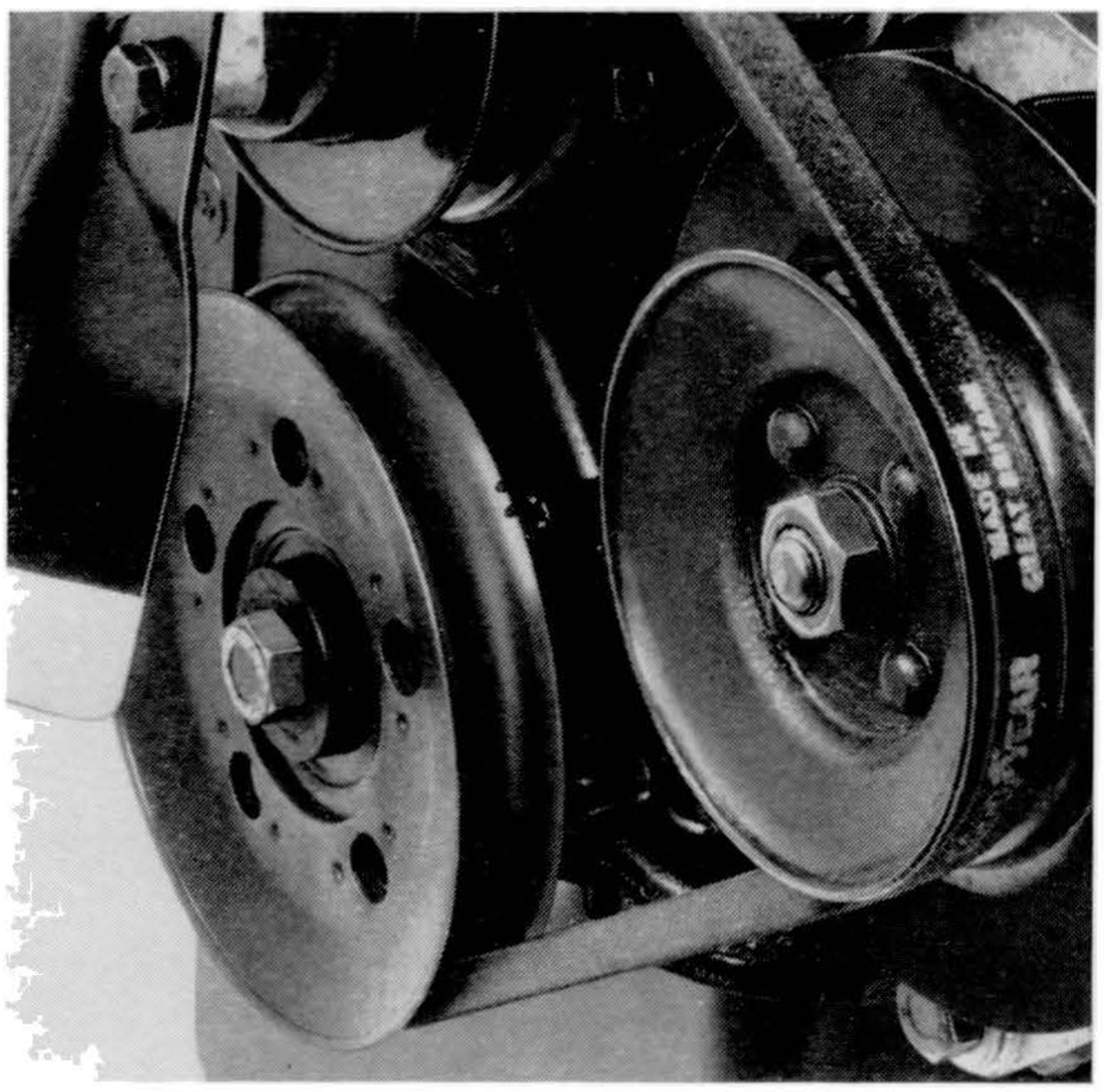
OP 6000-C1 EXTRA: ANCILLARIES – REMOVE AND INSTALL
(Includes Distributor, Fuel Pump, Generator, Engine Mountings and Sender Units)

To Remove

1. Remove the engine ancillaries. Slacken the generator mounting and remove the fan belt. Remove the fan, water pump pulley, generator and the left-hand front engine mounting. Remove the fuel pump, distributor, oil pressure sender unit (pressure gauge adaptor on the G.T.), right-hand front engine mounting, water pump, thermostat housing and thermostat.

To Replace

2. Fit the thermostat housing, right-hand front engine mounting, oil pressure sender unit (pressure gauge adaptor on the G.T.) and fuel pump. Fit the left-hand front engine mounting, generator, water pump, water pump pulley and fan.
3. Fit the fan belt, note that a shorter belt, identified by a green spot, is used, together with a smaller generator pulley, when an automatic transmission is fitted. Adjust the fan belt tension to give $\frac{1}{2}$ in. (12.7 mm.) total free play.
4. Fit and time the distributor. Turn the engine crankshaft until the appropriate timing marks on the pulley and the front cover are in line with number 1 cylinder on compression (see section 10 Ignition System). With the vacuum unit to the rear and approximately 35° out from



Ignition Timing Marks

Fitting the Distributor

the engine, turn the rotor until the electrode is immediately over the condenser retaining screw for the 1,600 c.c. or over the end of the condenser canister for the 1,300 c.c. Insert the distributor into its bore in this position and secure the clamp bracket to the cylinder block. Slacken the clamp and turn the distributor body until the points just open while holding the rotor against the direction of rotation to take up lost motion. Tighten the clamp in this position but DO NOT OVER-TIGHTEN.

OP 6000-C2 EXTRA: CLUTCH DISC AND/OR PRESSURE PLATE – REMOVE AND INSTALL

See Operation No. 7000-A2 of Section 7/1

OP 6000-C3 EXTRA: CLUTCH PILOT SPIGOT BEARING – REMOVE AND INSTALL

See Operation No. 7000-A3 of Section 7/1

OP 6000-C4 EXTRA: FLYWHEEL OR DRIVE PLATE – REMOVE AND INSTALL FLYWHEEL

Tools Required

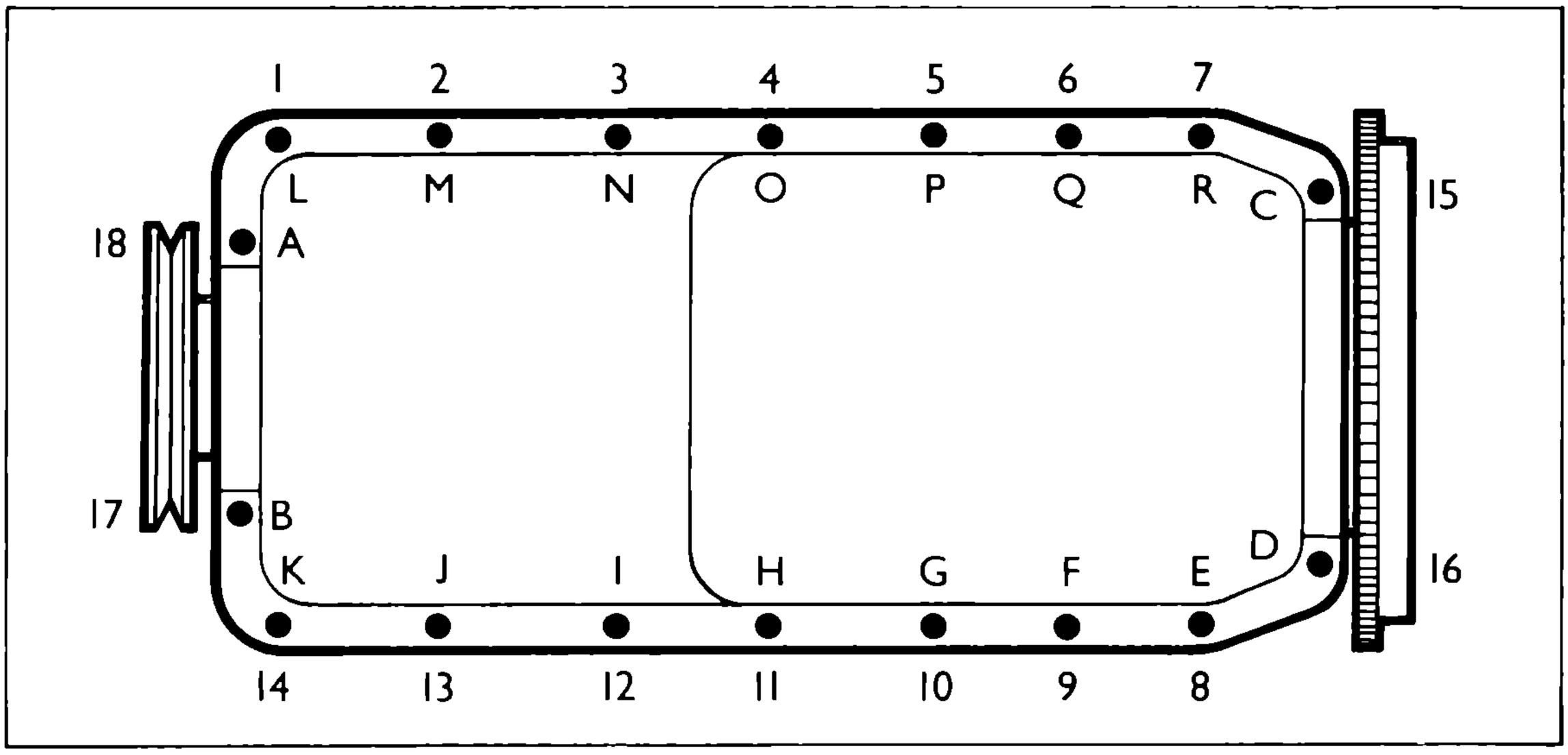
P.4008 Crown wheel and pinion backlash gauge

To Remove

1. Remove the flywheel.

To Replace

2. Locate the flywheel squarely upon crankshaft flange and tighten the retaining bolts evenly to a torque of 50 to 55 lb. ft. (6.92 to 7.60 kg.m.) for the bi-hexagonal type only.
3. Check the flywheel run-out using the gauge Tool No. P.4008 at the rim. The flywheel run-out should not exceed 0.005 in. (0.13 mm.) total indicator reading.



Sump Bolt Tightening Sequence

DRIVE PLATE

To Remove

1. Remove the reinforcing and drive plate and spacer.

To Replace

2. Locate the spacer on the crankshaft flange and fit the drive and reinforcing plates. Tighten the retaining bolts evenly to a torque of 50 to 54 lb. ft. (6.92 to 7.46 kg.m.).

OP 6000-C5 EXTRA: SUMP AND/OR GASKETS – REMOVE AND REFIT

Tools Required

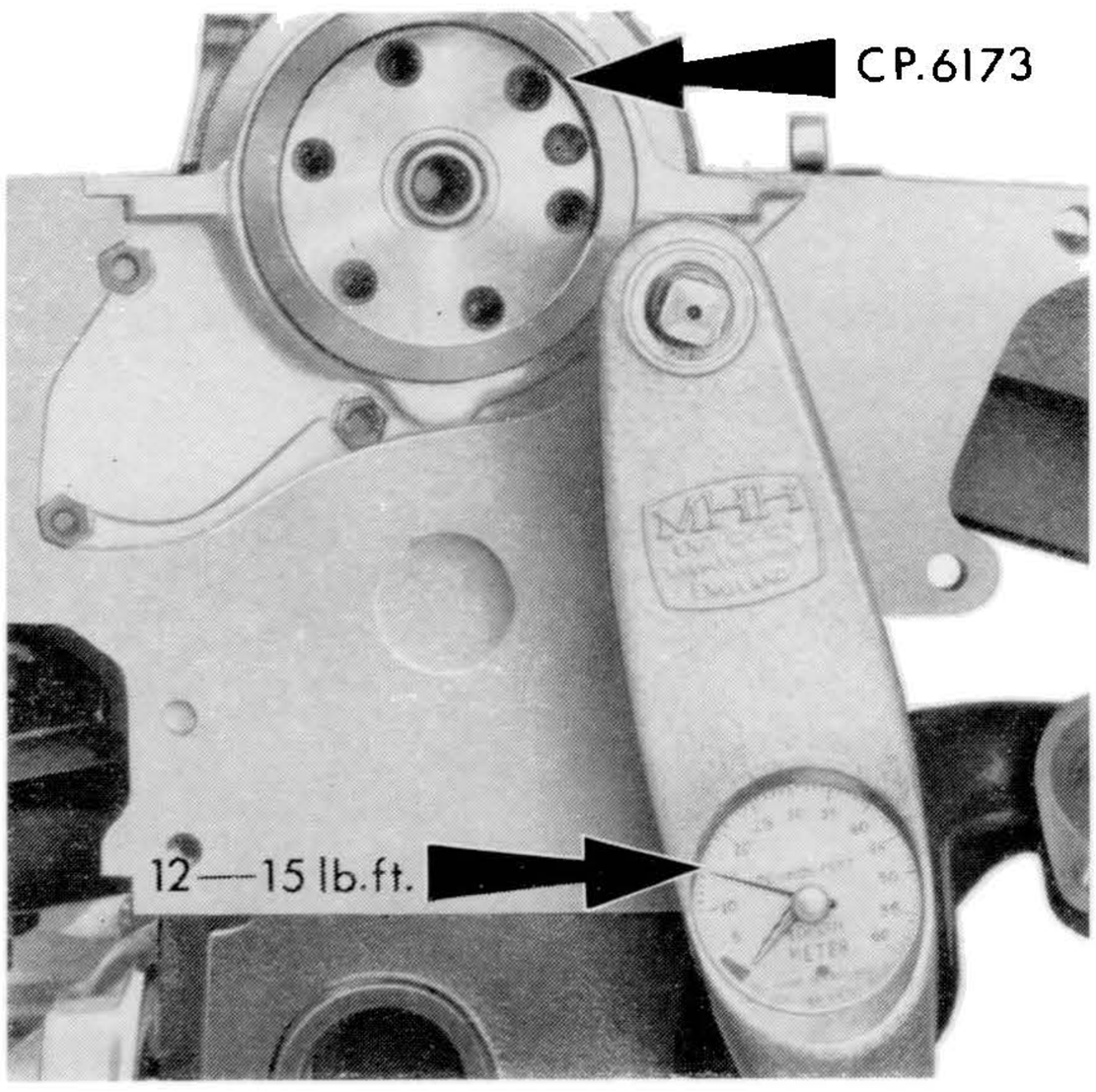
200A or B	Engine stand
P.6107	Universal stand adaptor
P.6171	Engine lifting brackets

To Remove

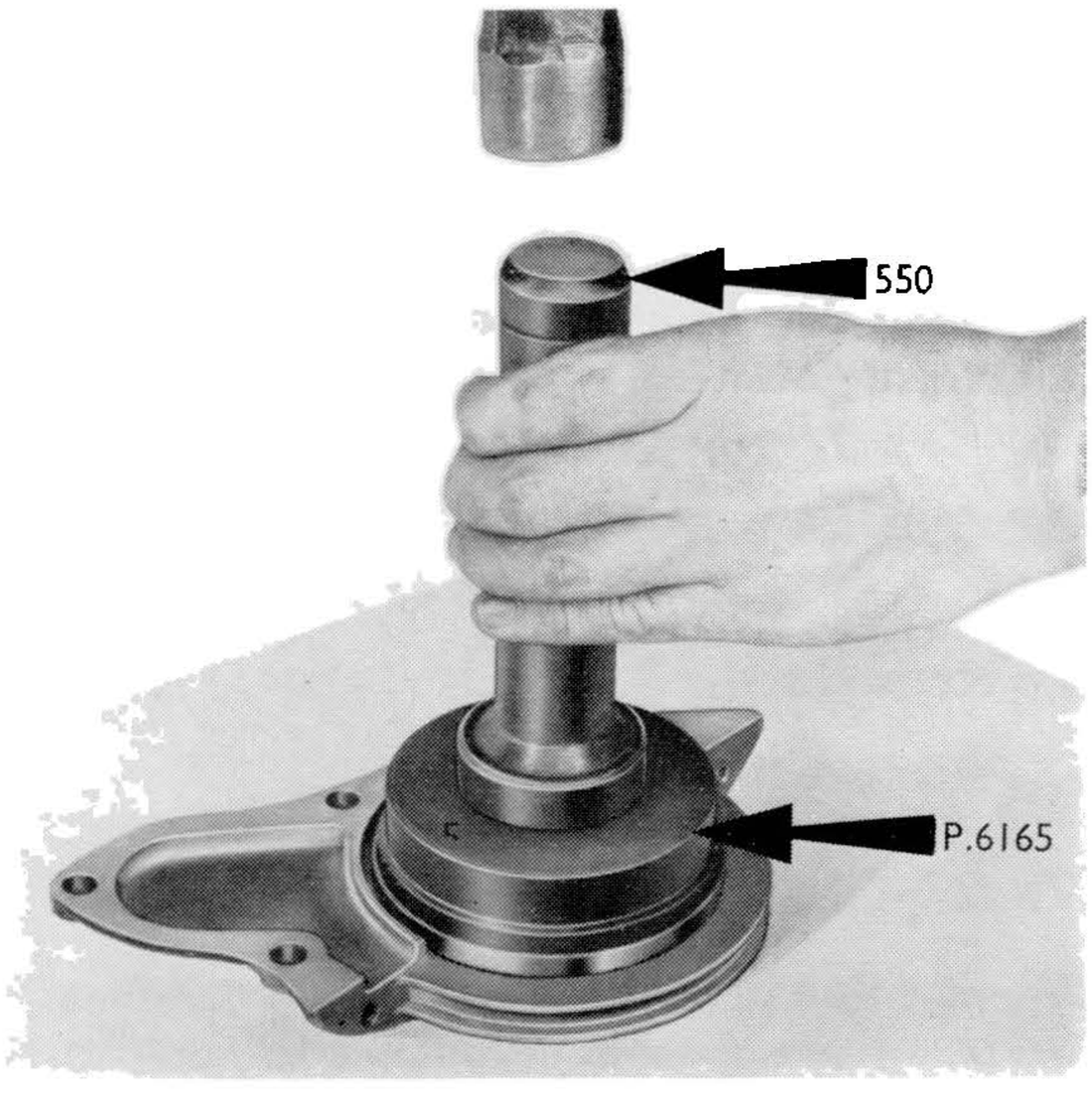
1. Fit a universal stand adaptor Tool No. P.6107 and mount the engine on a stand Tool No. 200A or B. Remove the lifting bracket Tool No. P.6171.
2. Remove the sump and gasket.
3. Clean the sump and cylinder block faces and remove the cork packing strips.

To Replace

4. Apply sealer ESEE-M4G-1008A to the front cover and rear oil seal carrier to cylinder block joints, and also to the ends of the grooves in the front cover and rear oil seal carrier. Then refit the new sump gaskets, followed by the cork packing strips.
5. Refit the sump and engage the corner bolts and tighten sufficiently to allow engagement of the remainder.



Crankshaft Rear Oil Seal Alignment



Fitting the Crankshaft Rear Oil Seal

6. Engage remaining bolts and tighten all bolts sufficiently to clamp gasket.
7. Tighten all bolts to 7 to 9 lb. ft. (0.97 to 1.24 kg.m.) following the sequence given in alphabetical order.
8. Retighten all bolts to 7 to 9 lb. ft. (0.97 to 1.24 kg.m.) following the sequence given in numerical order.
9. Fit lifting brackets Tool No. P.6171 and remove from stand and adaptor.

OP 6000-C6 EXTRA: ENGINE REAR OIL SEAL CARRIER AND/OR GASKET – REMOVE AND INSTALL (with flywheel or drive plate and sump removed)

Tools Required

CP.6173	Crankshaft rear oil seal aligner

To Remove

1. Remove the rear oil seal carrier.

To Replace

2. Locate a new gasket on the rear oil seal carrier, using ESEE-M4G-1008A jointing compound at the ends, and fit the carrier to the block rear face using an aligner Tool No. CP.6173. Tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) and remove the aligner.

OP 6000-C7 EXTRA: ENGINE REAR OIL SEAL – RENEW (with rear oil seal carrier removed)

Tools Required

550	Driver handle
P.6165	Crankshaft rear oil seal remover/replacer

To Remove

1. Suitably support the rear oil seal carrier and remove the oil seal using a remover/replacer Tool No. P.6165 fitted to a 550 handle.

To Replace

2. Invert the remover/replacer Tool No. P.6165 on the 550 handle and with the rear oil seal carrier suitably supported, drive a new seal into the housing.

OP 6000-C8 EXTRA: FRONT COVER AND/OR GASKET – REMOVE AND INSTALL (with sump removed)

To Remove

1. Remove the front cover.

To Replace

2. Position the gasket on the front cover with ESEE-M4G-1008A jointing compound at the ends. Align the cover in position with Tool No. P.6150. Tighten the retaining bolts evenly to a torque of 5 to 7 lb. ft. (0.69 to 0.97 kg.m.) and remove the aligner tool.

OP 6000-C9 EXTRA: FRONT COVER OIL SEAL - REMOVE AND INSTALL
(with front cover removed)

Tools Required

550	Driver handle
P.6161	Crankshaft front oil seal remover/replacer

To Remove

1. Suitably support the front cover and remove the oil seal from the rear, using remover/replacer Tool No. P.6161 fitted to a 550 handle.

To Replace

2. Insert the remover/replacer Tool No. P.6161 on the 550 handle and with the front cover suitably supported drive a new seal into the housing.

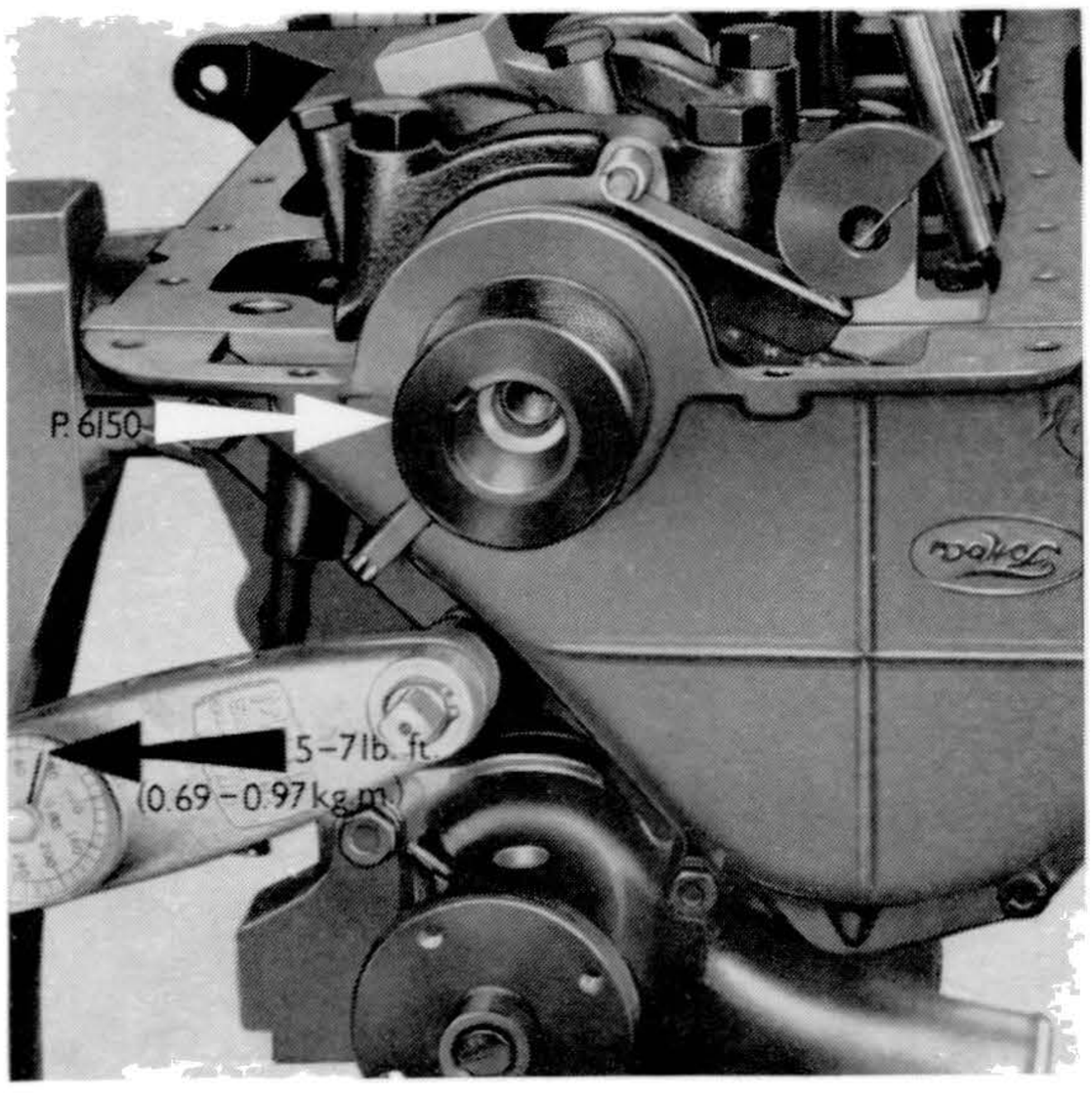
OP 6000-C10 EXTRA: TIMING CHAIN - REMOVE AND INSTALL
(with front cover removed)

To Remove

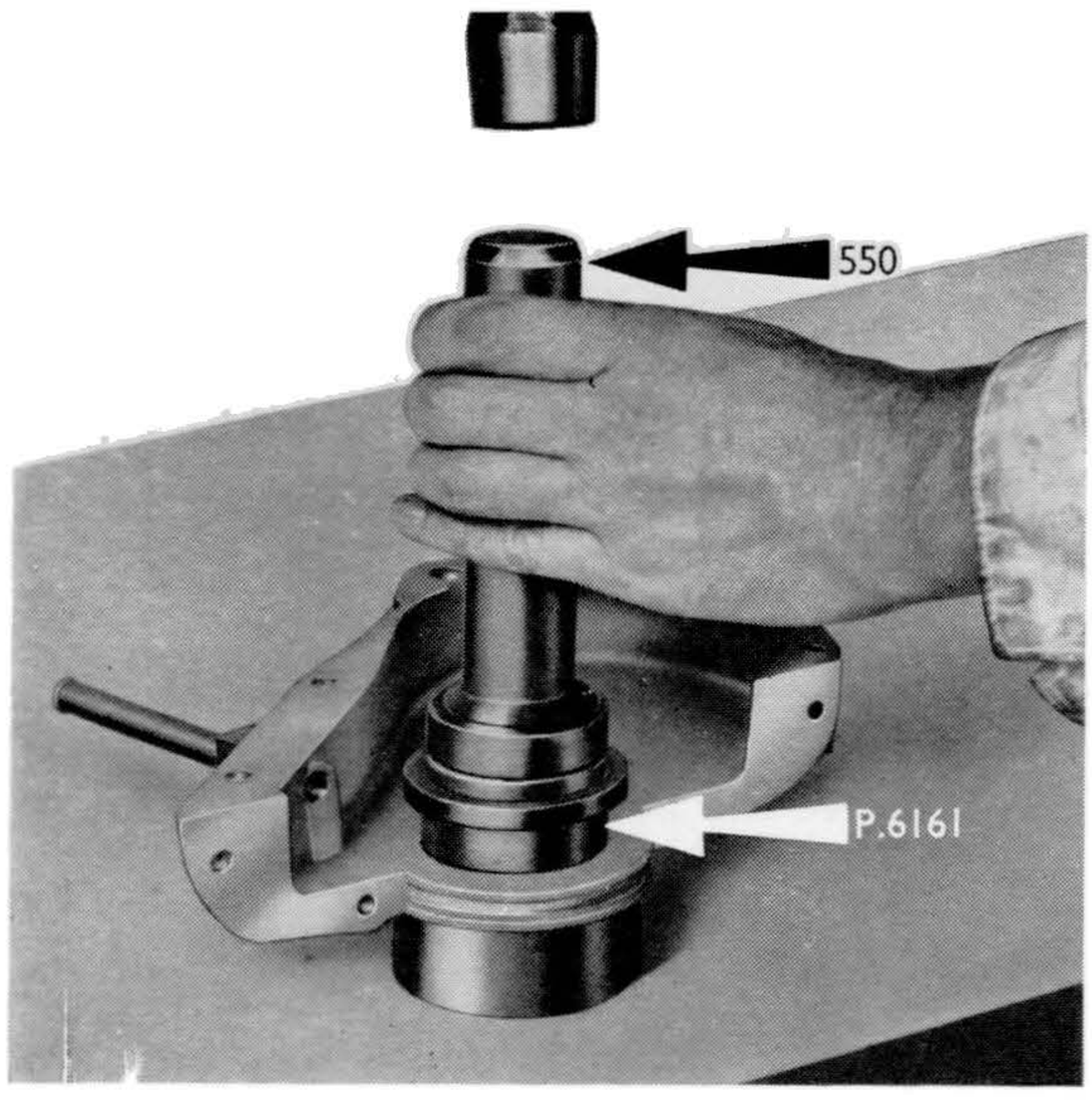
1. Remove the crankshaft oil slinger.
2. Remove the timing chain tensioner and the tensioner arm.
3. Remove the camshaft sprocket and timing chain.

To Replace

4. Locate the timing chain on the camshaft sprocket, and fit the camshaft sprocket with the timing mark adjacent to the one on the crankshaft sprocket. Tighten the retaining bolts to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) torque and bend up the locking tabs.



Front Cover Oil Seal Alignment



Removing the Front Cover Oil Seal

5. Locate the tensioner arm on the pivot and fit the timing chain tensioner.
6. Fit the oil slinger on the crankshaft.

OP 6000-C11 EXTRA: CRANKSHAFT SPROCKET – REMOVE AND INSTALL
(with front cover and timing chain removed)

Tools Required

P.6032-B Crankshaft sprocket replacer
P.6116 Crankshaft sprocket remover

To Remove

1. Remove the crankshaft sprocket using Tool No. P.6116.

To Replace

2. Replace the crankshaft sprocket using replacer Tool No. P.6032-B.

OP 6000-C12 EXTRA: CONNECTING ROD BEARINGS – REMOVE AND INSTALL
(with sump removed)

To Remove

1. Turn the crankshaft to facilitate removal of number one big end cap. Unscrew the big end bolts two or three turns and tap them to release the cap. Completely unscrew the bolts and remove the cap.
2. Remove the upper connecting rod liner from the connecting rod and the lower from the connecting rod cap.

To Replace

3. Replace the upper and lower bearing liners in their appropriate locations.
4. Locate the big end caps on the connecting rod and tighten the bolts to a torque of 30 to 35 lb. ft. (4.15 to 4.84 kg.m.).
5. Repeat sub-operations 1 to 4 for the other three connecting rods.

OP 6000-C13 EXTRA: MAIN BEARING CLEARANCES – CHECK
(with sump removed)

Tools Required

Micrometer, or means such as "Plastigage" to measure bearing clearance.

1. Remove the bearing cap and wipe the bearing and journal clean.
2. Place a piece of "Plastigage" on the bearing surface the full width of the bearing cap and about $\frac{1}{4}$ in. (6.4 mm.) off centre.
3. Install the cap and tighten the bolts to a torque of 65 to 70 lb. ft. (8.98 to 9.67 kg.m.). **Do not turn the crankshaft while the "plastigage" is in place.**

4. Remove the cap and using the "Plastigage" scale check the width of the now compressed "Plastigage" strip.

   Check at the widest point to get the minimum clearance.
   Check at the narrowest point to get the maximum clearance.
   The difference between the two readings is the taper.

5. Clean the bearing liner and refit the cap.

6. Check the remaining bearing clearances using the same procedure.

OP 6000-C14 EXTRA: MAIN BEARING LINERS AND THRUST WASHERS – REMOVE AND INSTALL
(with sump removed)

Tools Required

P.6110 Main bearing liner remover/replacer

To Remove

1. Remove number one main bearing cap.

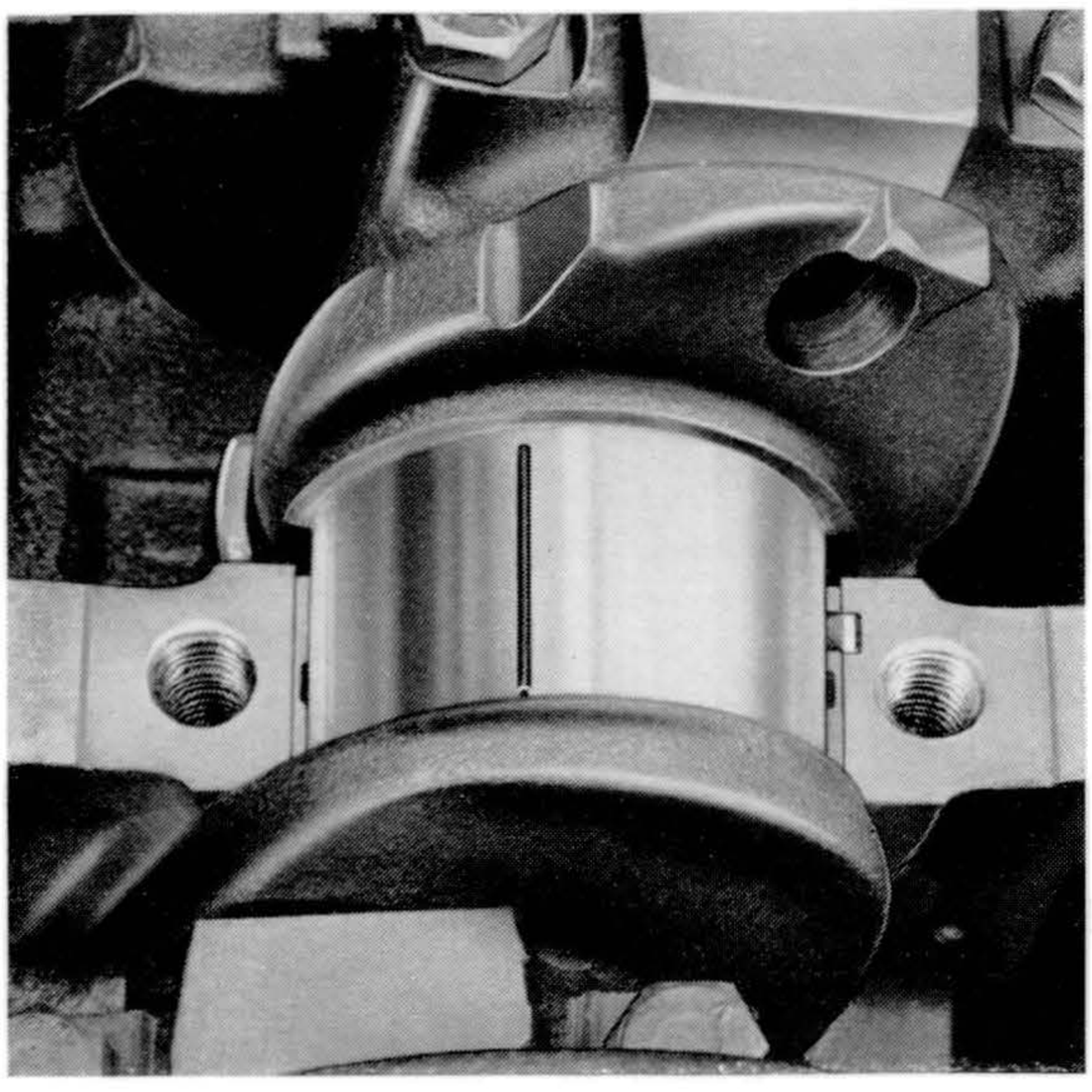
2. Remove the upper bearing liner from the cylinder block using Tool No. P.6110 and the lower bearing liner from the cap.

To Replace

3. Fit the new upper bearing liner in the cylinder block using Tool No. P.6110 and the new lower bearing liner in the cap.

4. Refit the main bearing cap and tighten the bolts to a torque of 65 to 70 lb. ft. (8.98 to 9.67 kg.m.).

Change the remaining main bearing liners in sequence



Measuring Bearing Clearance with Plastigage

Intermediate and Rear Main Bearing

5. Complete sub-operations 1, 2, 3 and 4.

Centre Main Bearing

6. Complete sub-operation 1.
7. Remove the thrust washers.
8. Complete sub-operations 2 and 3.
9. Fit new thrust washers.
10. Complete sub-operation 4.

OP 6000-C15 EXTRA: ALL MAIN BEARING LINER AND THRUST WASHERS – CHECK CLEARANCES AND RENEW (with sump removed)

1. Check the clearances, see Operation No. 6000-C13.
2. Remove the bearing liner, see Operation No. 6000-C14 sub-operations 1 and 2.
3. Select bearing liners to give the correct clearance.
4. Fit the bearing liners, see Operation No. 6000-C14 sub-operation 3.
5. Recheck the bearing clearance, see Operation No. 6000-C13 sub-operations 2 to 7.
6. Repeat the procedure for the remaining bearings.

OP 6000-C16 EXTRA: CAMSHAFT – REMOVE AND INSTALL
(with timing chain and sprocket removed)

To Remove

1. Remove the camshaft thrust plate.
2. Rotate the camshaft to fully lift the tappets and then remove the camshaft. Remove the tappets from the cylinder block and keep them in their correct order.

To Replace

3. Insert the tappets into the bores from which they were removed and slide the camshaft into position. Fit the camshaft thrust plate in the camshaft groove. Tighten the retaining bolts to 2.5 to 3.5 lb. ft. (0.35 to 0.48 kg.m.) and bend up the locking tabs.
4. Check the camshaft end-float with feeler blades between the thrust plate and camshaft flange. This should be between 0.0025 and 0.0075 in. (0.064 and 0.191 mm.).

OP 6000-C17 EXTRA: CAMSHAFT BEARINGS – RENEW
(with camshaft and crankshaft removed)

1. Remove the camshaft bearing bushes using tool No. P.6031 wiTh adaptors Tool No. P.6031-3.
2. Check all the oilways to ensure that they are clear, apply EM-4G-52 sealing compound to the oil gallery plugs prior to refitting.

To Replace

3. Fit new camshaft bearing bushes again using Tool No. P.6031 and P.6031-3. Ensure that the oil holes in the bushes and cylinder block are aligned. The splits in the bushes should be upwards and outwards at 45 to the vertical.

OP 6000-C18 EXTRA: CRANKSHAFT – REMOVE AND INSTALL
(with sump, front cover, rear oil seal carrier, connecting rods and main bearings removed)

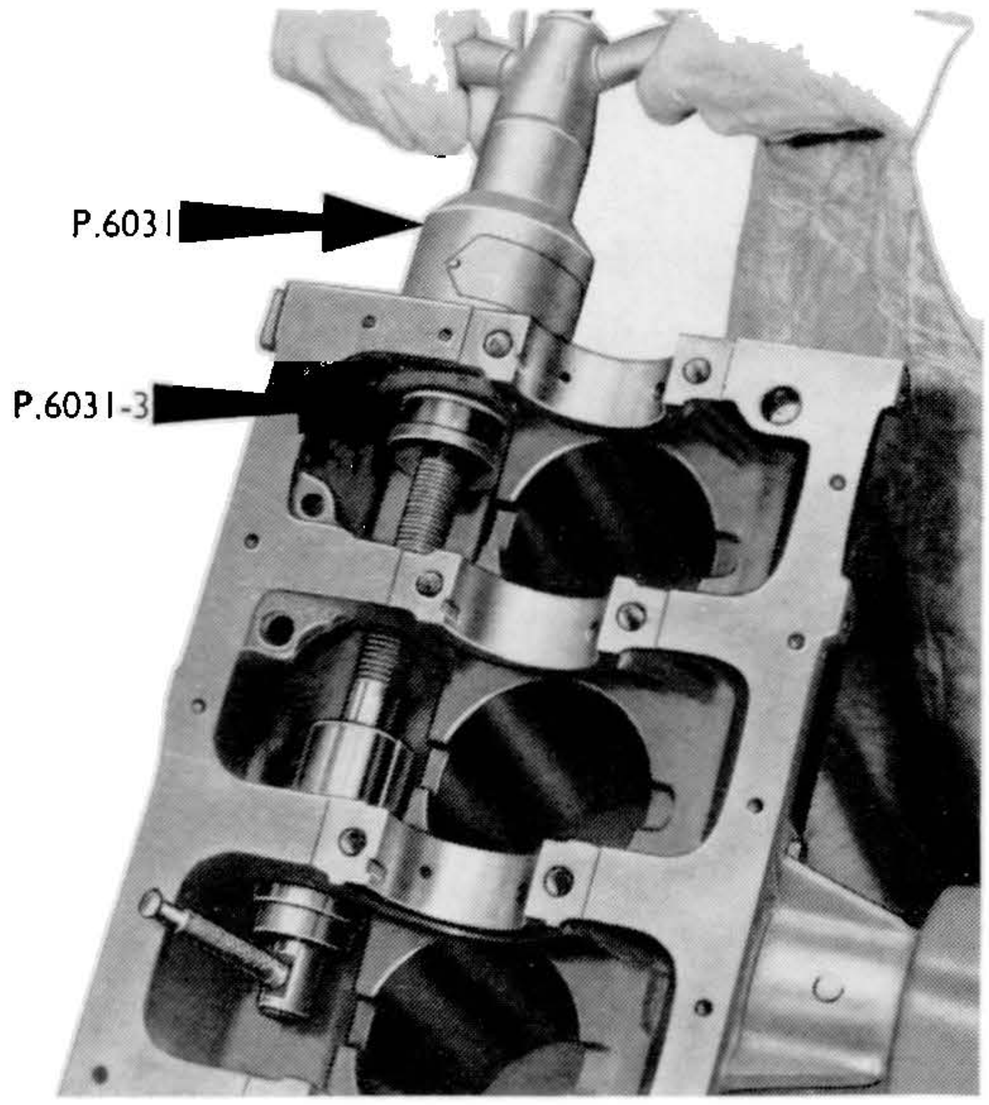
To Remove

1. Remove the rear oil seal housing.
2. Unscrew the big end bolts two or three turns and tap them to release the caps. Completely unscrew the bolts and remove the caps. Push the pistons up into the cylinder bores.
3. Unscrew the main bearing cap bolts evenly and lift off each cap. Lift out the crankshaft and remove the bearing liners and thrust washers.

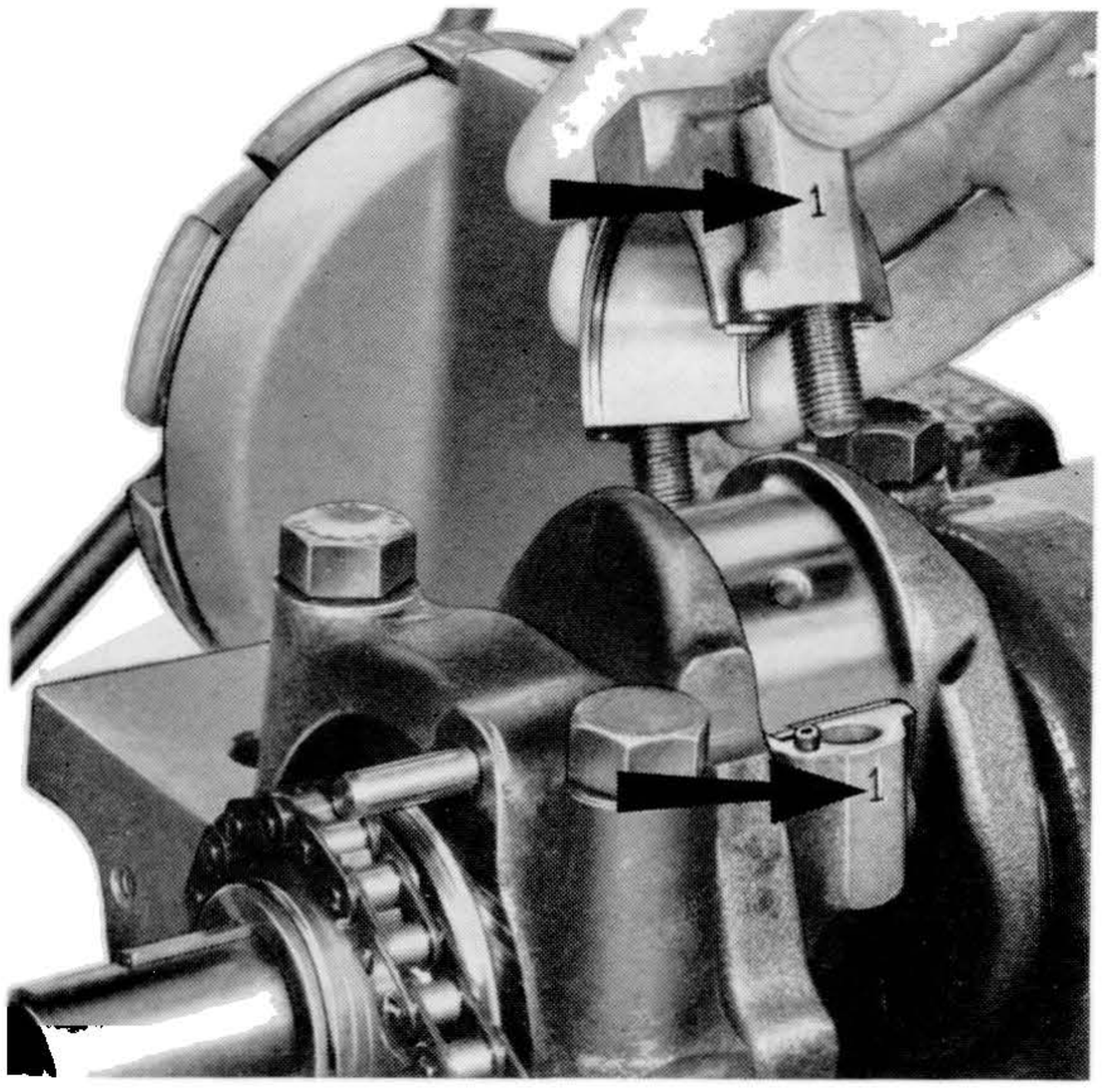
To Replace

4. Fit a new spigot bearing into the crankshaft using Tool No. P.7137.
5. Fit the main bearing liners and replace the crankshaft. Fit the crankshaft thrust washers with the oil grooves facing the crankshaft flange. Refit the main bearing caps and tighten the bolts to 65 to 70 lb. ft. (8.89 to 9.67 kg.m.) torque.
6. Check the crankshaft end-float with feeler blades between the crankshaft and the thrust washers. This should be between 0.003 and 0.011 in. (0.08 and 0.28 mm.).

OP 6000-C19 EXTRA: CYLINDER HEAD AND PISTONS – DECARBONISE
(with engine removed)
See Operation No. 6051-A, sub-operations 10 to 19 and Operations No. A1 and A2.



Fitting the Camshaft Bushes



Fitting a Big End Cap

OP 6000-C20 EXTRA: VALVES – ALL – REFACE, RESEAT AND GRIND-IN
(with engine removed)
(Includes initial setting of valves, running-up engine and final setting of valve clearances)
See Operation No. 6051-A, sub-operations 10 to 19 and Operations No. A3, A4, A5 and A6

OP 6000-C21 EXTRA: CYLINDER ASSEMBLY – REMOVE AND INSTALL
(with engine and ancillaries removed)

Tools Required

200 A or B	Engine stand
P.4008	Crown wheel and pinion backlash gauge
PT.4063	Cylinder head gasket locating studs
P.6041	Crankshaft pulley remover
P.6107	Universal stand adaptor
P.6171	Engine lifting brackets
P.7137	Spigot bearing replacer and clutch disc locator

To Remove

1. Fit a universal stand adaptor Tool No. P.6107 and mount the engine on a stand Tool No. 200 A or B. Remove the engine lifting brackets Tool No. P.6171.
2. Unscrew the pressure plate bolts evenly and detach the pressure plate and clutch disc. (Manual transmission only.)
3. Remove the flywheel or, with automatic transmission, the drive plate.
4. Remove the crankshaft pulley, using remover Tool No. P.6041.
5. Remove the oil pump and filter assembly.
6. Remove the rocker cover and gasket.
7. Slacken the rocker shaft support bolts evenly and lift off the rocker shaft assembly.
8. Withdraw the push rods from their locations in the cylinder block, taking care to keep them in their correct order.
9. Unscrew the cylinder head bolts evenly and lift off the cylinder head and gasket.
   NOTE - DO NOT lay the cylinder head flat on its face as damage to the spark plugs can occur.
10. Invert the engine on the stand and remove the sump and gaskets.
11. Remove the oil pump inlet tube and oil return pipe.
12. Remove the cylinder assembly from the stand and remove the adaptor.

To Replace

13. Bolt the adaptor Tool No. P.6107 to the new cylinder assembly and mount on the universal stand.
14. Replace the oil pump inlet tube and oil return pipe. Press the pipe fully home to the full depth of the counterbored hole.

15. Apply sealer ESEE-M4G-1008A to the front cover and rear oil seal carrier to cylinder block joints, and also to the ends of the grooves in the front cover and rear oil seal carrier. Then fit new sump gasket, followed by the cork packing strips. Refit the sump and tighten the bolts following the procedure described on page 37.

16. Fit the crankshaft pulley.

17. Fit a new clutch pilot spigot bearing using replacer Tool No. P.7137.

    NOTE – Where an automatic transmission is fitted a spigot bearing **must not be fitted.**

18. Locate the flywheel, or, with automatic transmission, the spacer, the drive and reinforcing plates squarely on the crankshaft flange. Tighten the retaining bolts evenly to a torque of 50 to 55 lb. ft. (6.92 to 7.60 kg.m.) for the bi-hexagonal type only.

19. Check the flywheel run-out using gauge Tool No. P.4008. This should not exceed 0.005 in. (0.13 mm.) total indicator reading.

20. Centralise the clutch disc (manual transmission only) with the hub assembly away from the flywheel using the locator Tool No. P.7137. Tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) then remove the clutch disc locator.

21. Locate the cylinder head gasket on the cylinder block using the locating studs Tool No. PT.4063 screwed into diagonally opposite bolt holes in the block face.

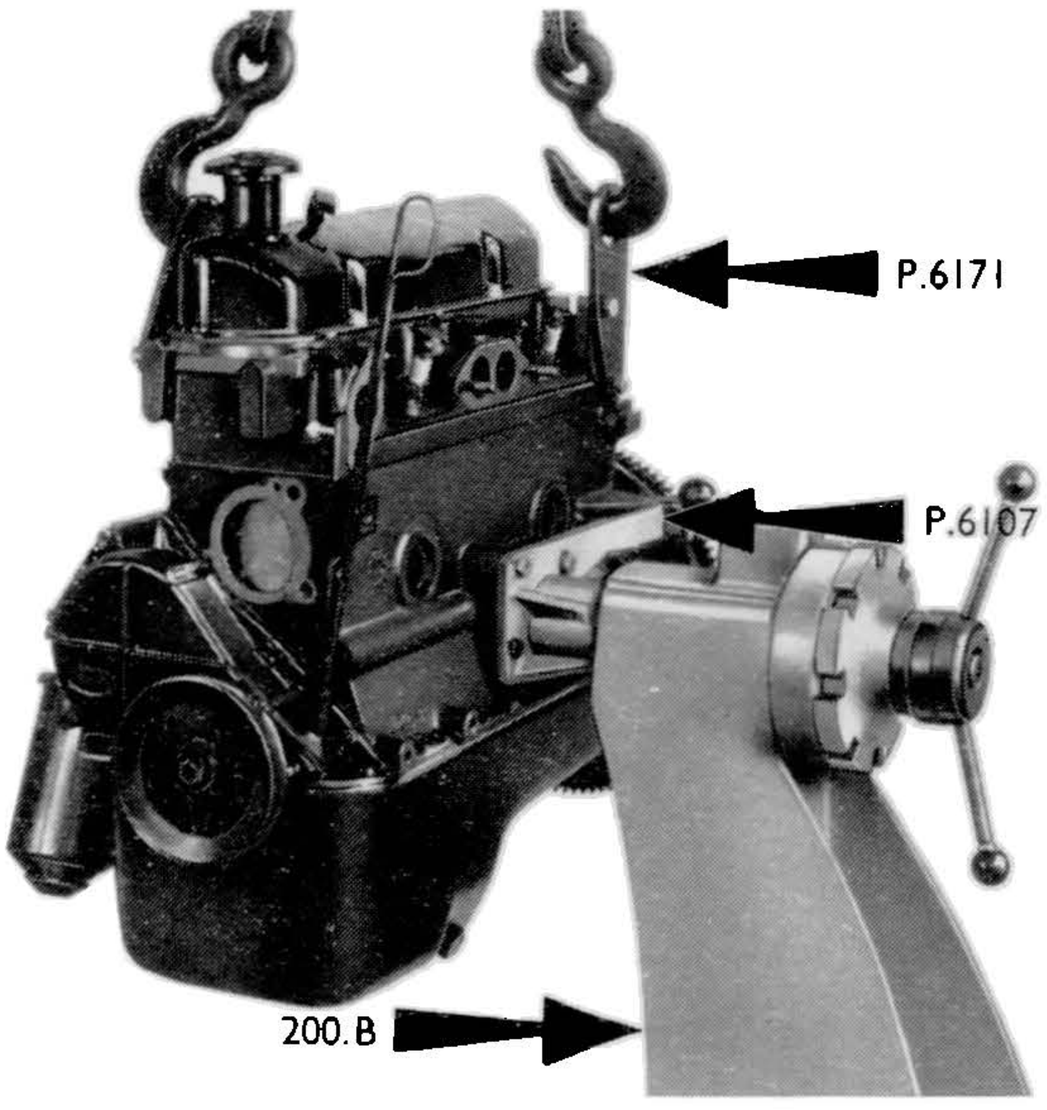
22. Install the cylinder head assembly and refit the cylinder head bolts before removing the locating studs. Tighten the bolts in sequence to 65 to 70 lb. ft. (8.98 to 9.67 kg.m.) torque.

23. Locate the push rods in the push rod bores in the same order in which they were extracted.

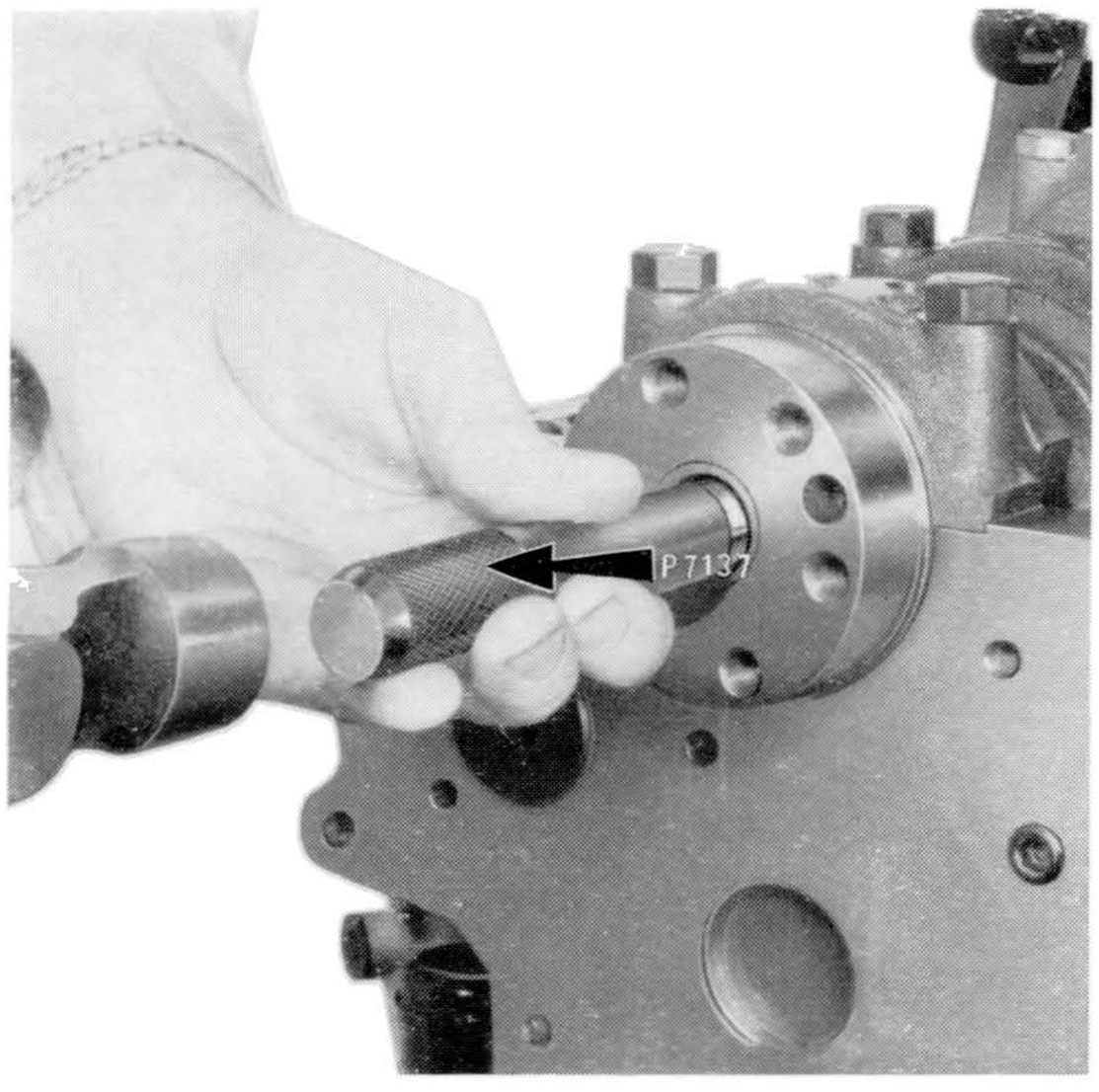
24. Fit the rocker shaft assembly to the cylinder head engaging the push rod with the adjusting screws. Tighten the retaining bolts evenly to a torque of 17 to 22 lb. ft. (2.35 to 3.04 kg.m.).

25. Adjust the valve clearances, see Operation No. 6450-A1.

26. Inspect the rocker cover gasket and if necessary renew. Replace the rocker cover and tighten the retaining screws evenly to a torque of 2.5 to 3.5 lb. ft. (0.35 to 0.48 kg.m.).



Mounting the Engine on a Stand



Fitting the Clutch Pilot Spigot Bearing

27. Fit the oil pump and filter assembly.
28. Fit lifting brackets Tool No. P.6171 and remove from the stand and adaptor.

OP 6000-C22 EXTRA: CYLINDER BLOCK – REMOVE AND INSTALL
(with cylinder assembly removed)

Tools Required

550	Drive handle
38 U 3	Piston ring squeezer
CP.6147	Crankshaft rear oil seal aligner
P.6150	Front oil seal aligner
P.6161	Front oil seal remover and replacer
P.6165	Crankshaft rear oil seal remover and replacer.

To Remove

1. Remove the front cover and crankshaft oil slinger.
2. Remove the timing chain tensioner.
3. Remove the rear oil seal carrier.
4. Unscrew the bolts several turns and tap them to release the big end caps. Unscrew the bolts completely and remove the caps. Push the pistons out of the bores and withdraw the assemblies.
5. Remove the camshaft sprocket and timing chain.
6. Remove the camshaft thrust plate and withdraw the camshaft. Extract the cam followers, keeping them in their correct order.
7. Unscrew the main bearing cap bolts evenly and lift off each cap. Lift out the crankshaft and remove the main bearing liners and thrust washers.
8. Dismantle the piston and connecting rod assemblies. Remove the piston rings and remove the two piston pin circlips. Push the piston pin out of each piston.

To Replace

9. Fit the tappets into their appropriate bores and slide the camshaft into position.
10. Locate the camshaft thrust plate in the camshaft groove and tighten the retaining bolts to 2.5 to 3.5 lb. ft. (0.35 to 0.48 kg.m.) torque. Check the camshaft end-float which should be between 0.0025 and 0.0075 in. (0.064 and 0.191 kg.m.). Turn over the locking tabs.
11. Fit the camshaft sprocket and timing chain aligning the timing marks on the camshaft and crankshaft sprockets. Tighten the retaining bolts to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) and turn up the locking plate tabs.
12. Fit the crankshaft main bearing liners and thrust washers. Install crankshaft in cylinder block and refit main bearing caps. Tighten main bearing cap bolts evenly to 65 to 70 lb. ft. (8.98 to 9.67 kg.m.) torque and check crankshaft rotation.

13. Check the crankshaft end-float. Take up the end-float in one direction and insert a feeler blade between the crankshaft and the thrust washer to measure the clearance. The end-float should be between 0.003 and 0.011 in. (0.08 and 0.28 mm.).

14. Select new piston pin and ring assemblies, and check the piston fit with a piston pull scale. Re-select pistons as necessary until the correct fit is obtained.

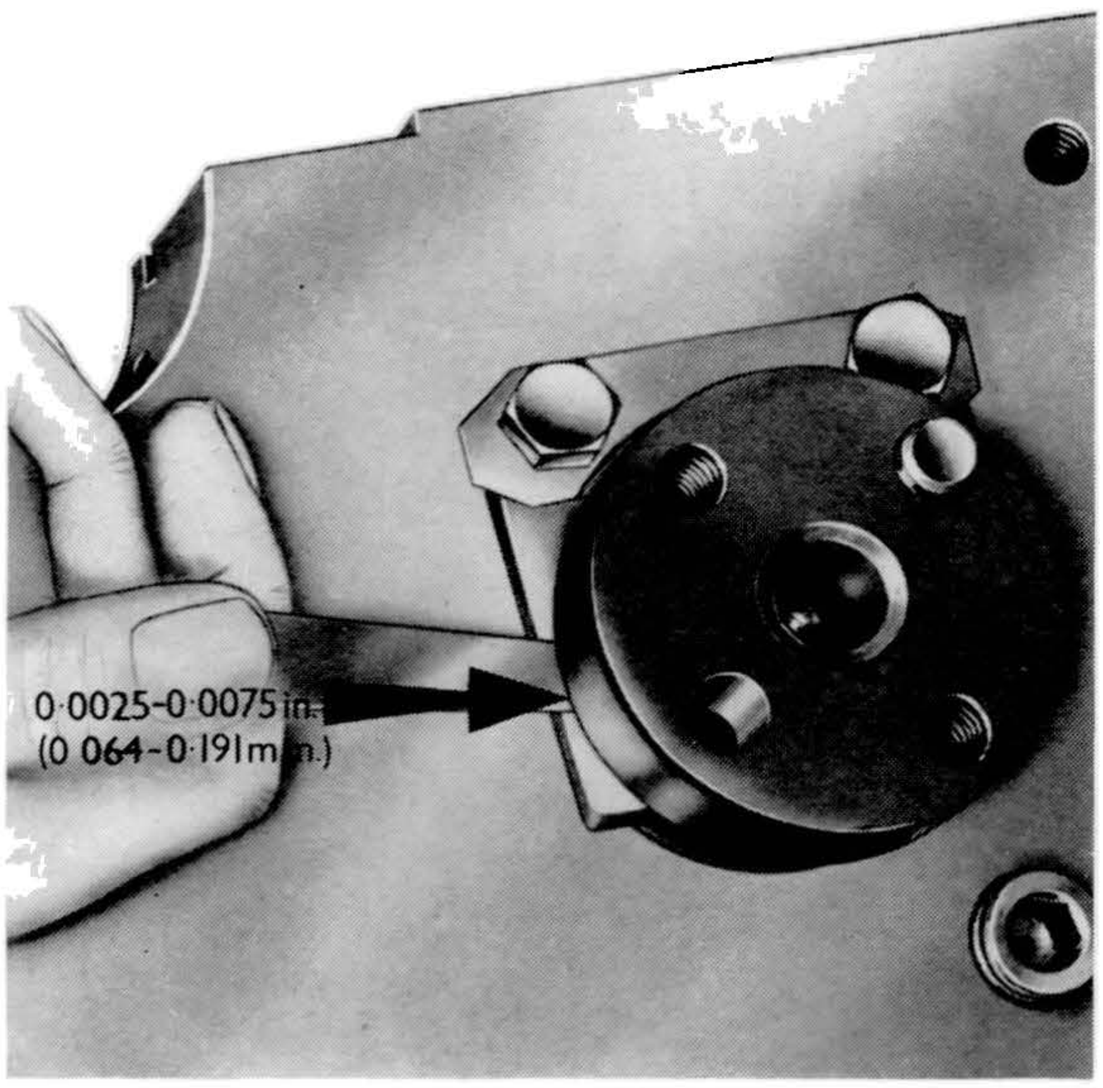
Model	*Blade Thickness*	*Piston Pull*	*Clearance*
1,300 c.c.	0.0025 in. (0.064 mm.)	7 to 11 lb. (3.18 to 4.54 kg.)	0.0019 to 0.0025 in. (0.048 to 0.064 mm.)
1,600 c.c.	0.0020 in. (0.050 mm.)		0.0013 to 0.0019 in. (0.033 to 0.048 mm.)

15. Locate the piston rings in the cylinder bore and check the ring gaps which should be between 0.009 and 0.014 in. (0.23 and 0.36 mm.).

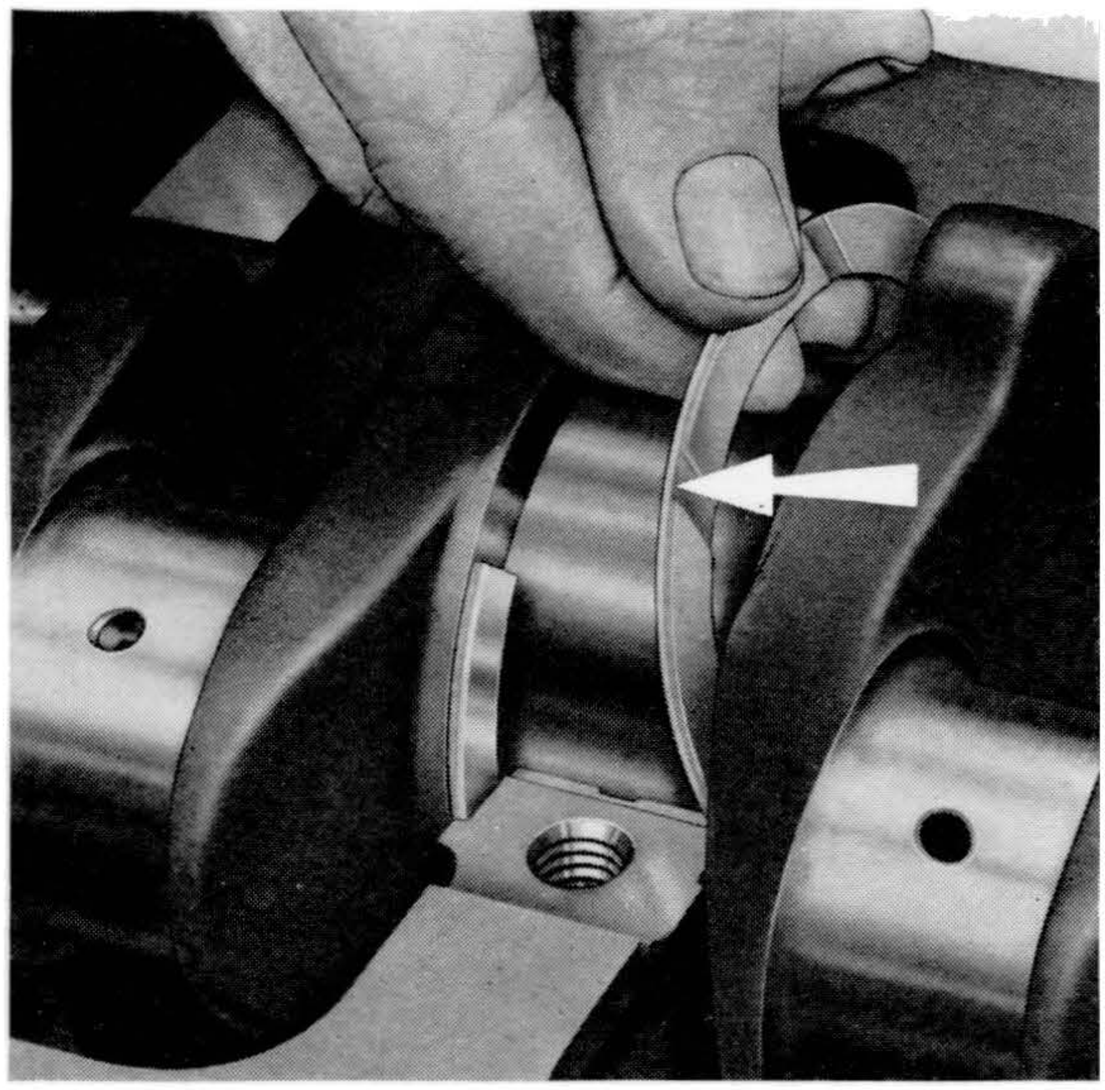
16. Check piston ring to groove clearances which should be as follows:—
Upper compression ring, Lower compression ring ... 0.0016 to 0.0036 in. (0.041 to 0.091 mm.)
Oil control ring ... ... 0.0018 to 0.0038 in. (0.046 to 0.097 mm.)

17. Fit the piston rings, fitting the oil control ring first, followed by the lower and then the upper compression rings. Ensure that the compression rings are fitted the correct way up.

18. Assemble the piston to the connecting rod. Ensure that the "FRONT" marking on the connecting rod is on the same side of the assembly as the arrow in the piston crown. Heat the piston in water or oil prior to inserting the piston pin. Retain the piston pin with the circlips.



Checking the Camshaft End-float



Fitting the Crankshaft Thrust Washers

19. Fit the piston and connecting rod assemblies into the appropriate bores. Position the oil control ring gap to the rear and the top and second compression ring gaps at 180° and 90° to this. Compress the rings using Tool No. 38 U 3. Turn the crankshaft as necessary to fit the connecting rod big end caps to the crankpins. Tighten the bolts to 30 to 35 lb. ft. (4.15 to 4.84 kg.m.) torque. Check the big end float on the crankpin, this should be 0.004 to 0.010 in. (0.10 to 0.25 mm.).

20. Fit a new oil seal to the rear oil seal carrier using Tool No. P.6165 and a 550 handle.

21. Fit a new gasket to the rear oil seal carrier using ESEE-M4G-1008A jointing compound at the ends. Secure the carrier to the cylinder block, aligning it with Tool No. CP.6147. Tighten the bolts evenly to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) torque and remove the aligner.

22. Position the timing chain tensioner arm on the pivot pin and fit the tensioner.

23. Fit the oil slinger on the crankshaft.

24. Fit a new oil seal to the front cover using Tool No. P.6161 and a 550 handle.

25. Position the front cover gasket in place with ESEE-M4G-1008A jointing compound at the ends and fit the front cover, aligning the seal with Tool No. P.6150. Tighten the bolts evenly to 5 to 7 lb. ft. (0.69 to 0.97 kg.m.) torque and remove the aligner.

OP 6000-C23 EXTRA: CYLINDER BLOCK – REBORE
(with cylinder block removed)

Tools Required

Boring bar

1. Rebore cylinder block using proprietary boring equipment and adhering to the manufacturer's instructions.

OP 6000-C24 EXTRA: CYLINDER BLOCK – REBORE AND FIT LINERS
(with cylinder block removed)

Tools Required

Boring bar

Locally manufactured remover and replacer ring

1. Bore the cylinder block to the specified size for the cylinder liner using a proprietary boring bar.

2. Place the remover adaptor in the replacer ring and locate in the cylinder liner which should be lubricated on the outside with tallow. Press the liner into the bore from the top on a suitable press.

3. Cut the connecting rod clearance slots in the base of the liner and machine the bore to give the correct clearance for the piston being fitted.

OP 6010-A CYLINDER ASSEMBLY – REMOVE AND INSTALL
(Includes 6000-C, C1 and C21)

OP 6010-B CYLINDER BLOCK – REMOVE AND INSTALL
(Includes 6000-C, C21 and C22)

OP 6010-C CYLINDER BLOCK – REBORE
(Includes 6000-C, C1, C21, C22 and C23)

OP 6010-D CYLINDER BLOCK – SLEEVE
(Includes 6000-C, C1, C21, C22, C23 and C24)

OP 6015-A ENGINE ASSEMBLY – FIT NEW, SERVICE, OR RECONDITIONED UNIT
(Includes transferring, but not overhauling, ancillaries, adjusting carburettor and ignition timing, cleaning exterior of ancillaries and checking for water, oil or fuel leaks. Does not include valve adjustment)

1. Remove and install the engine assembly, see OP 6000-C and C1.

OP 6015-A1 EXTRA: ENGINE COMPARTMENT – CLEAN
(with steam cleaner with engine removed)

Tools Required

Steam cleaner

Clean engine compartment using proprietary steam cleaner, following manufacturer's instructions.

OP 6015-A2 EXTRA: CLUTCH DISC AND/OR PRESSURE PLATE – REMOVE AND INSTALL
(with engine removed)

To Remove

1. Unscrew the pressure plate bolts evenly and remove the pressure plate and disc.

To Replace

2. Centralise the clutch disc, with the hub assembly away from the flywheel, using Tool No. P.7137. Fit the pressure plate and cover assembly and tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) and remove the clutch disc locator.

OP 6015-A3 EXTRA: CLUTCH RELEASE BEARING – RENEW
(with engine removed)

To Remove

1. Withdraw the release arm and bearing assembly from the clutch housing.

2. Remove the release arm from the hub and bearing assembly.

To Replace

3. Apply a smear of molybdenum based grease to the hub and release arm then engage the arm in the slots in the hub and release bearing assembly.

4. Pass the release arm through the aperture in the clutch housing and slide the release bearing onto the main drive gear bearing retainer.

OP 6015-A4 EXTRA: CLUTCH FORK – REMOVE AND INSTALL
(with clutch release bearing removed)

To Remove

1. Disconnect the clutch fork boot and clutch cable.

2. Remove the clutch fork.

To Replace

3. Locate the clutch in the bell housing with the end under the pivot pin.

4. Connect the clutch cable and refit the boot.

OP 6015-A5 EXTRA: MAIN DRIVE GEAR BEARING RETAINER GASKET AND/OR MAIN DRIVE GEAR OIL SEAL – REMOVE AND INSTALL
(with engine and clutch release bearing removed)

See Operation No. 7000-A6 of Section 7A.

OP 6015-B ENGINE AND GEARBOX ASSEMBLY – REMOVE AND INSTALL
(Includes remove assembly, position on blocks on floor and refit assembly)

To Remove

1. Disconnect the engine components prior to removal, see Operation No. 6000-C sub-operations 1 to 29, but do not disconnect the gearbox or remove the starter motor.

2. Remove the driveshaft (see Section 4, Operation No. 4602-A sub-operations 1 and 2) and fit a dummy sliding spline.

3. Disconnect the engine rear insulator crossmember from the floorpan.
4. Remove the insulator from the gearbox extension housing.
5. Disconnect the clutch cable.
6. Disconnect the speedometer cable.
7. Remove the gear lever.
8. Remove the engine and gearbox assembly and place on blocks on the floor.

To Replace

9. Install the engine and gearbox assembly in the engine compartment.
10. Fit the engine rear insulator to the gearbox extension housing.
11. Fit the rear insulator crossmember to the floorpan.
12. Connect the clutch cable and adjust if necessary.
13. Connect the speedometer cable.
14. Refit the driveshaft, see Section 4, Operation No. 4602-A sub-operations 3 to 5.
15. Fit the gear lever.
16. Reconnect the engine components, see Operation No. 6000-C sub-operations 34 to 64.

OP 6015-B1 EXTRA: ENGINE AND GEARBOX – SEPARATE AND RECONNECT

To Separate

1. Remove the starter motor.
2. Remove the clutch housing to sump support bracket and the dust cover.
3. Unscrew the engine to clutch housing bolts and clutch housing to engine bolts.
4. Separate the gearbox and the engine.
5. Remove the upper flywheel cover from the engine.

To Reconnect

6. Locate the upper flywheel cover in position on the dowels in the cylinder block rear face.
7. Offer the gearbox up to the engine so that the main drive gear spigot enters the crankshaft bearing and the splines engage with the clutch disc splines. Turn the mainshaft with the box in gear, if necessary, to engage the splines. Push the gearbox fully home.
8. Refit the clutch housing to engine bolts and engine to clutch housing bolts.
9. Fit the dust cover and the clutch housing to sump support bracket.
10. Refit the starter motor.

OP 6019-A CYLINDER FRONT COVER GASKET – RENEW
(Includes cutting front of sump gasket and splicing in a new section)

Tools Required

P.6150 Cranskhaft front cover oil seal aligner

To Remove

1. Raise the bonnet and fit wing covers.
2. Drain the engine coolant by opening the drain plugs on the radiator and cylinder block.
3. Disconnect the radiator hoses at the engine.
4. Remove the radiator assembly.
5. Remove the fan belt and then remove the fan and the water pump pulley.
6. Remove the water pump.
7. Remove the crankshaft pulley, using suitable levers.
8. Remove the front cover, note that it is also retained by four sump bolts.

To Replace

9. Position new portions of sump gasket, and a new cork packing strip on the front cover with ESEE-M4G-1008A jointing compound. Align the cover in position with Tool No. P.6150. Tighten the retaining bolts evenly to a torque of 5 to 7 lb. ft. (0.69 to 0.97 kg.m.). Tighten the sump bolts to 6 to 8 lb. ft. (0.83 to 1.11 kg.m.) torque and remove the aligner tool.
10. Fit the crankshaft pulley aligning the pulley slot with the crankshaft key. Tighten the retaining bolt to 24 to 28 lb. ft. (3.32 to 3.87 kg.m.).
11. Replace the water pump.
12. Replace the water pump pulley and the fan. Fit the fan belt and adjust the tension so that there is $\frac{1}{2}$ in. (12.7 mm.) total movement.
13. Replace the radiator assembly.
14. Refit the radiator top and bottom hoses and tighten the clips.
15. Refill the radiator with long life anti-freeze.
16. Remove the wing covers and close the bonnet.

OP 6019-A1 EXTRA: FRONT COVER AND/OR SEAL – RENEW
(with front cover removed)

See Operation No. 6000-C9

OP 6019-A2 EXTRA: TIMING CHAIN AND/OR CAMSHAFT SPROCKET – REMOVE
(with front cover removed)

To Remove

1. Remove the crankshaft oil slinger.
2. Remove the camshaft sprocket, and disconnect the timing chain.

To Replace

3. Locate the timing chain over the camshaft and crankshaft sprockets so that the timing marks are aligned when the sprocket is fitted. Tighten the bolts to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) torque and bend up the locking tabs.
4. Fit the oil slinger on the crankshaft.

OP 6019-B FRONT COVER AND/OR OIL SEAL – REMOVE AND INSTALL
(Includes 6019-A and A1)

OP 6019-C TIMING CHAIN – REMOVE AND INSTALL
(Includes 6019-A, A1 and A2)

OP 6038-A ENGINE FRONT MOUNTING – ONE – RENEW

To Remove

1. With handbrake applied, jack up the front of car and fit stands.
2. Support the engine on a jack. (Remove the engine sump shield if fitted.)
3. Remove one of the engine mountings.

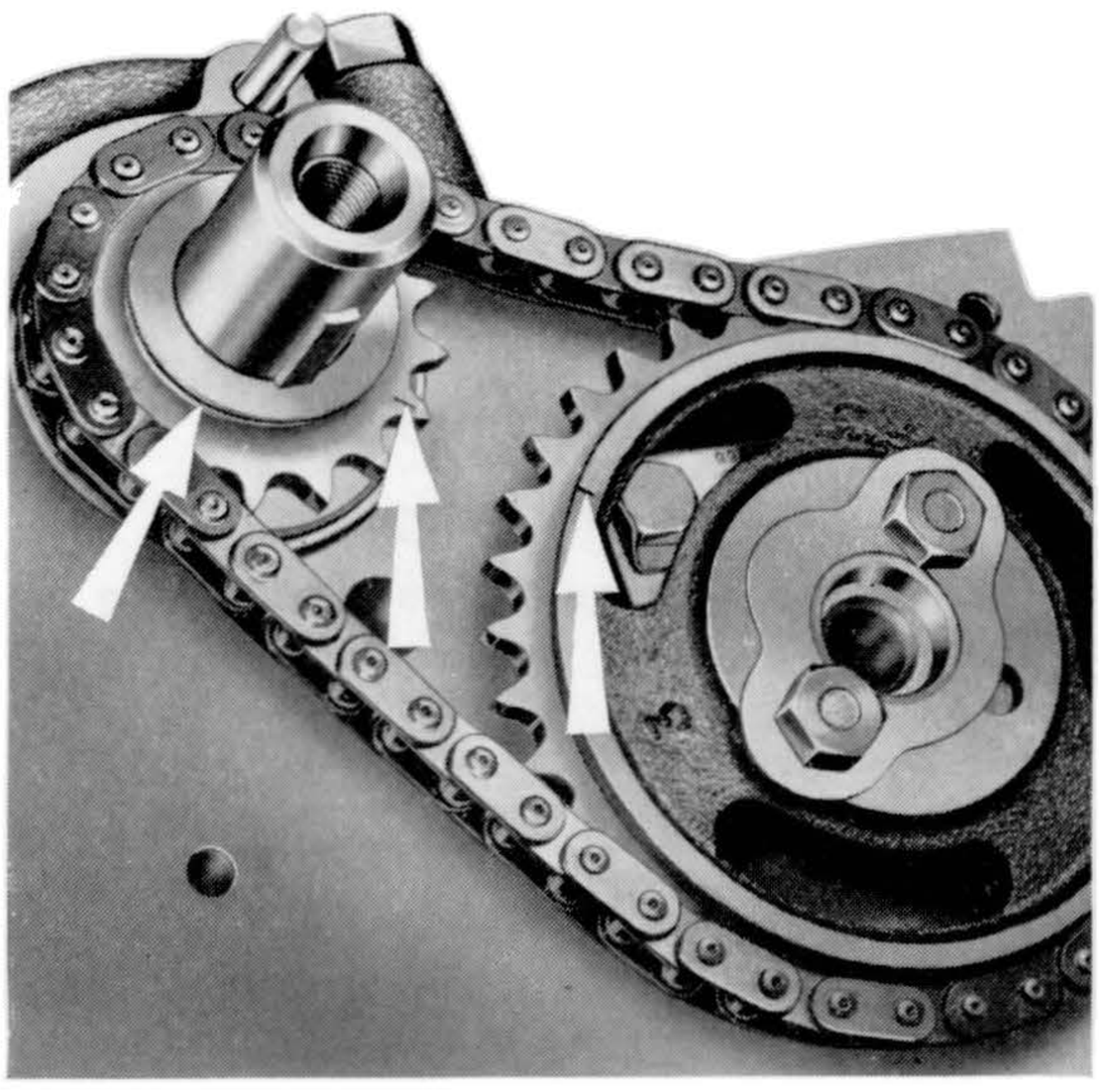
To Replace

4. Replace the engine mounting.
5. Remove the jack from under the engine. (Replace the sump shield if fitted.)
6. Remove the stands and lower the car to ground.

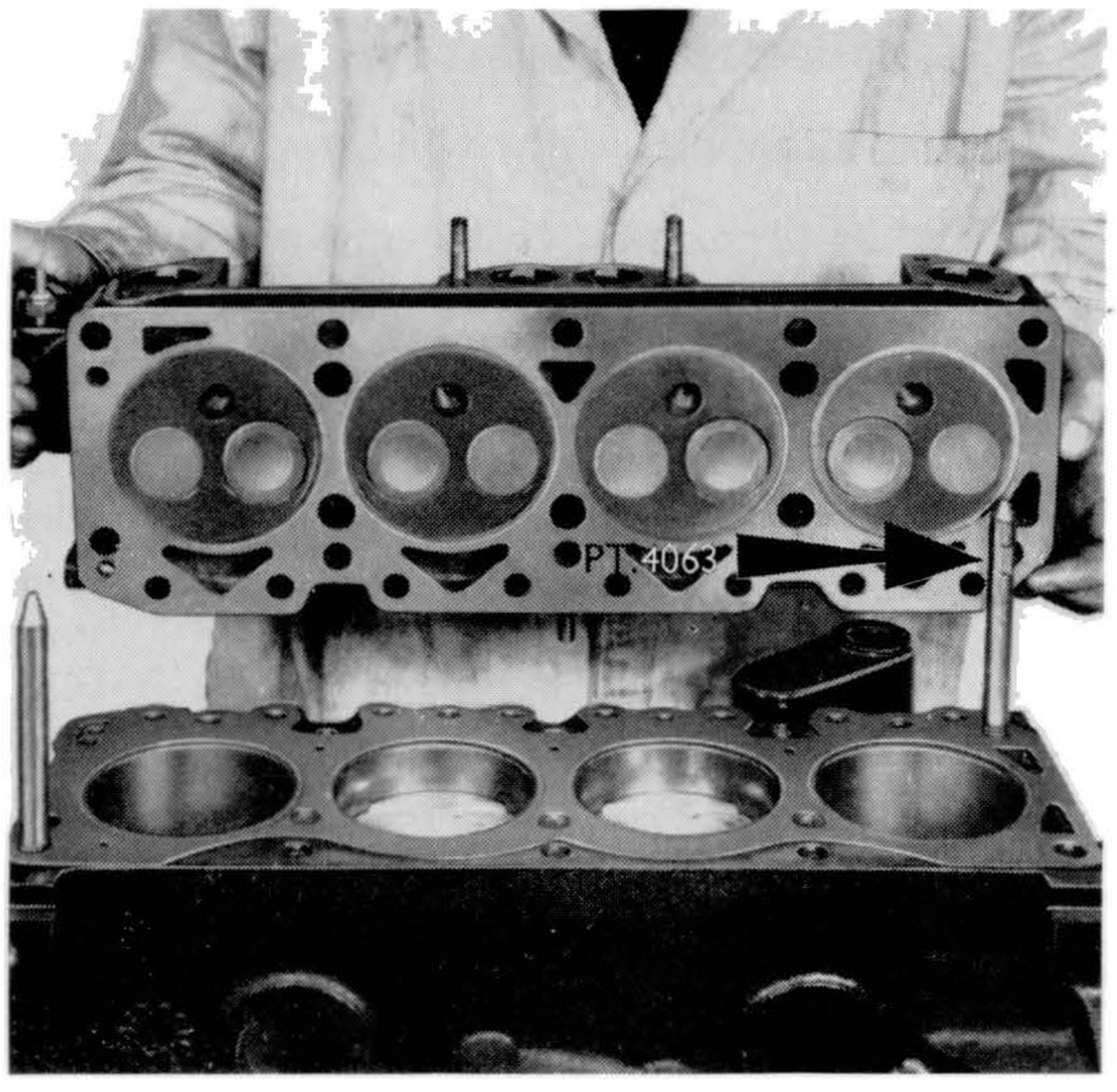
OP 6038-A1 EXTRA: REMAINING FRONT ENGINE MOUNTING – RENEW

To Remove

1. Remove other engine mounting.



The Valve Timing Marks



Replacing the Cylinder Head

To Replace

2. Replace other engine mounting.

OP 6038-B ENGINE FRONT MOUNTINGS - BOTH - RENEW
(Includes 6038-A and A1)

OP 6038-C ENGINE FRONT MOUNTINGS - BOTH - CHECK TORQUE OF BOLTS

OP 6051-A CYLINDER HEAD GASKET - RENEW
(Includes remove and install cylinder head assembly, clean cylinder head and block mating faces and adjust valves. Does not include decarbonise cylinder head or pistons)

Tools Required

PT.4063 Cylinder head gasket locating studs.

To Remove

1. Raise the bonnet and fit wing covers.
2. Drain the engine coolant.
3. Remove the carburettor air cleaner.
4. Remove the thermostat housing, pull to one side and remove the thermostat.
5. Disconnect the heater hoses and the vacuum hose from the inlet manifold. Where applicable, disconnect the automatic choke hoses.
6. Disconnect the temperature gauge sender unit.
7. Detach the exhaust pipe and move clear of the cylinder head. On the G.T. engine detach exhaust manifold.
8. Disconnect the downshift cable (automatic transmission where fitted), the throttle cable and linkage, the choke cable (where fitted), the fuel pipe and the distributor vacuum pipe from the carburettor.
9. Disconnect the leads from the spark plugs and remove the distributor cap.
10. Unclip the carburettor ventilation pipe from the rocker cover (not G.T.).
11. Remove the rocker cover and gasket.
12. Unscrew the rocker shaft bolts evenly and lift off the rocker shaft assembly.
13. Lift out the push rods from their locations and keep them in their correct order.
14. Unscrew the cylinder head bolts evenly and lift off the cylinder head and gasket.

    NOTE - **Do not** lay the cylinder head flat on its face as damage to the spark plugs can occur.

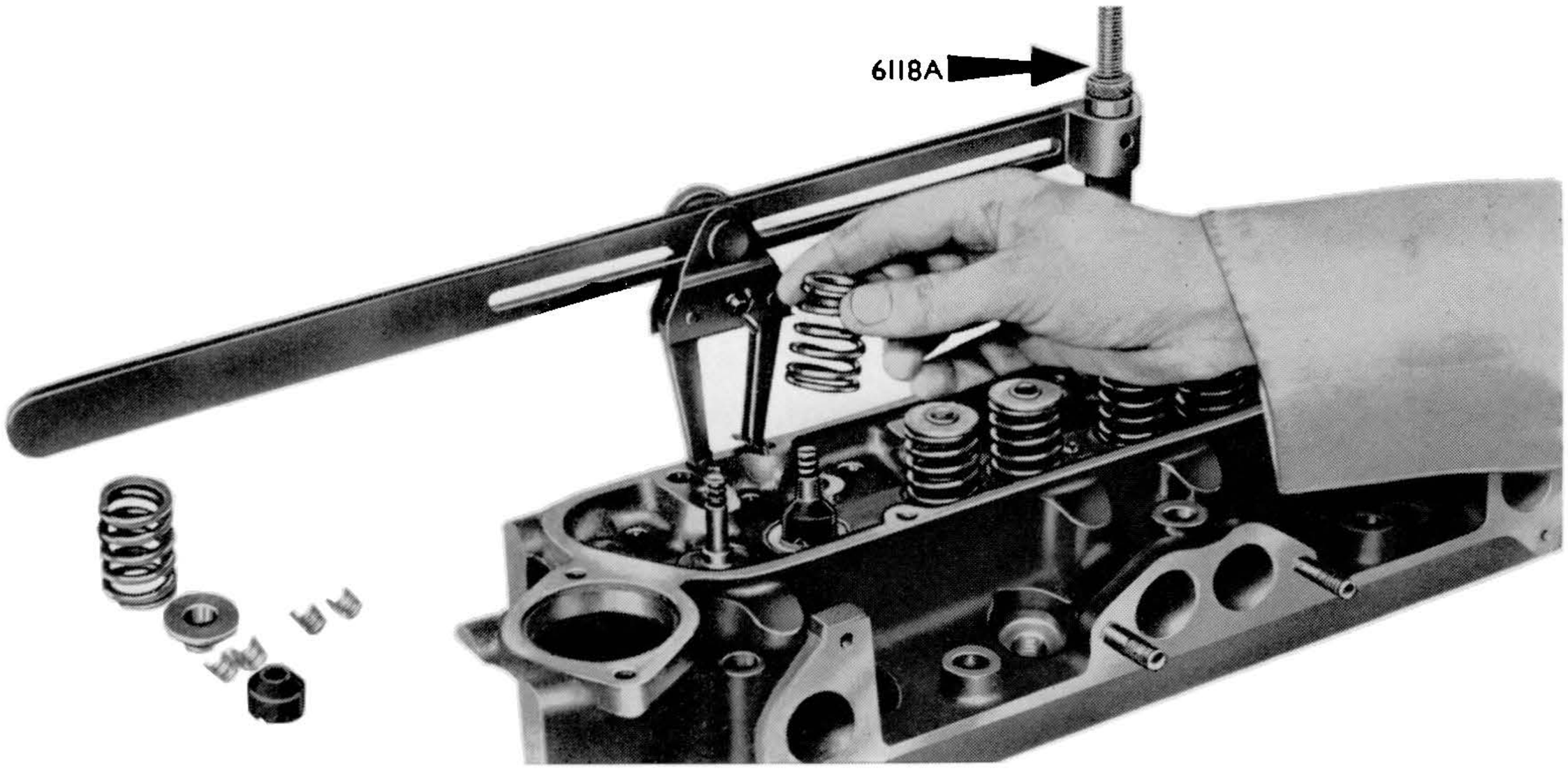
To Replace

15. Locate the cylinder head gasket on the cylinder block. Screw the studs Tool No. PT.4063 into diagonally opposite bolt holes on the block face to locate the gasket.
16. Install the cylinder head assembly and refit the cylinder head bolts before removing the locating studs. Tighten the bolts down evenly in sequence to 65 to 70 lb. ft. (8.98 to 9.67 kg.m.) torque.

17. Replace the push rods in the push rod bores in the correct order.
18. Fit the rocker shaft assembly to the cylinder head locating the push rods on the adjusting screws. Tighten the bolts evenly to a torque of 17 to 22 lb. ft. (2.35 to 3.04 kg.m.).
19. Adjust the valve clearances, see Operation No. 6450-A1.
20. Fit the rocker cover and gasket.
21. Reconnect the exhaust pipe. On the G.T. engine fit the exhaust manifold assembly. Tighten the retaining nuts and bolts to 15 to 20 lb. ft. (2.07 to 2.76 kg.m.) torque.
22. Clip the carburettor ventilation pipe to the rocker cover (not G.T.)
23. Reconnect the vacuum pipe, the fuel pipe, the choke cable (where fitted), and the throttle linkage to the carburettor. Reconnect the throttle cable and the automatic transmission downshift cable (where fitted).
24. Reconnect the temperature gauge sender unit.
25. Reconnect the heater hoses and the vacuum hose to the inlet manifold. Where applicable, reconnect the automatic choke hoses.
26. Locate the thermostat in its bore in the cylinder head and refit the thermostat housing.
27. Fit the distributor cap and reconnect the spark plug leads.
28. Fit the carburettor air cleaner.
29. Refill the cooling system with long life anti-freeze.
30. Remove the wing covers and close the bonnet.

OP 6051-A1 EXTRA: CYLINDER HEAD – DECARBONISE
(with cylinder head removed)

1. Remove the sparking plugs.
2. Remove the inlet manifold and carburettor assembly.



Assembling the Valves and Springs

3. Remove the exhaust manifold (not G.T.).
4. Using a suitable implement, remove all carbon deposits from cylinder head faces, cylinder head ports and valve heads. Care must be taken to ensure that carbon scraped off is prevented from contaminating any part of the engine.
5. Fit the exhaust manifold (not G.T.) and tighten the retaining nuts and bolts to 15 to 20 lb. ft. (2.07 to 2.76 kg.m.) torque.
6. Fit the inlet manifold using EM-4G-14 jointing compound around the water port.
7. Refit the sparking plugs.

OP 6051-A2 PISTONS – DECARBONISE (with cylinder head removed)

Using a suitable implement, remove all carbon deposits from the combustion bowl and piston crown. Care must be taken to ensure that carbon scraped off is prevented from contaminating any part of the engine, and that no damage is done to the piston by the scraping tool.

OP 6051-A3 EXTRA: ONE VALVE – REMOVE AND INSTALL
(does not include refacing seat or grind-in valve)

Tools Required

6118A	Valve spring compressor
P.6118-3A	Valve spring compressor (adaptor)

To Remove

1. Place the cylinder head on its face.
2. Compress the valve spring, using Tool No. 6118A and adaptor Tool No. P.6118-3A located in a rocker support bolt hole. Remove the split tapered collets. Release the spring and remove the valve spring and retainer.
3. Remove the rubber seal fitted to the valve stem and withdraw the valve.

To Replace

4. Insert the valve into the valve guide. Fit the rubber seal to the stem with the open end to the head.
5. Place the cylinder head on its face and position the valve spring and retainer over the valve stem.
6. Compress the valve spring using Tool No. 6118A and Tool No. P.6118-3A as before. Locate the split collets in the valve stem collet grooves and slowly release the spring compressor to engage the collets in the retainer tapers.

OP 6051-A4 EXTRA: EACH ADDITIONAL VALVE – REMOVE AND INSTALL

Using the procedure in Operation No. 6051-A3 remove and install each additional valve.

OP 6051-A5 EXTRA: EACH VALVE SEAT – RECUT (with valve removed)

Tools Required

316X	Valve seat cutter
316-10	Valve seat cutter pilot
317-20 or 25	Valve seat cutter

1. Recut the valve seat to ensure that the seat is concentric with the valve stem bore. Use cutter tool No. 317-20 (exhaust) and 317-25 (inlet) fitted to pilot Tool No. 316-10 in handle Tool No. 316X.
2. If necessary, reduce the seat width using cutters Tool No. 317P-20 and 317T-20 (exhaust) or 317P-22 and 317T-25 (inlet).

OP 6051-A6 EXTRA: EACH VALVE – GRIND-IN (with valve removed)

Tools Required

Valve lapping dolly

1. Grind or lap in the exhaust valve using a suitable grade of grinding paste.

NOTE – The inlet valve is aluminised and must, under no circumstances, be ground or lapped in as this will remove the aluminum coating. If necessary lap the valve seat using a dummy valve.

OP 6051-A7 EXTRA: EACH VALVE GUIDE – REAM
(with valve removed)

Tools Required

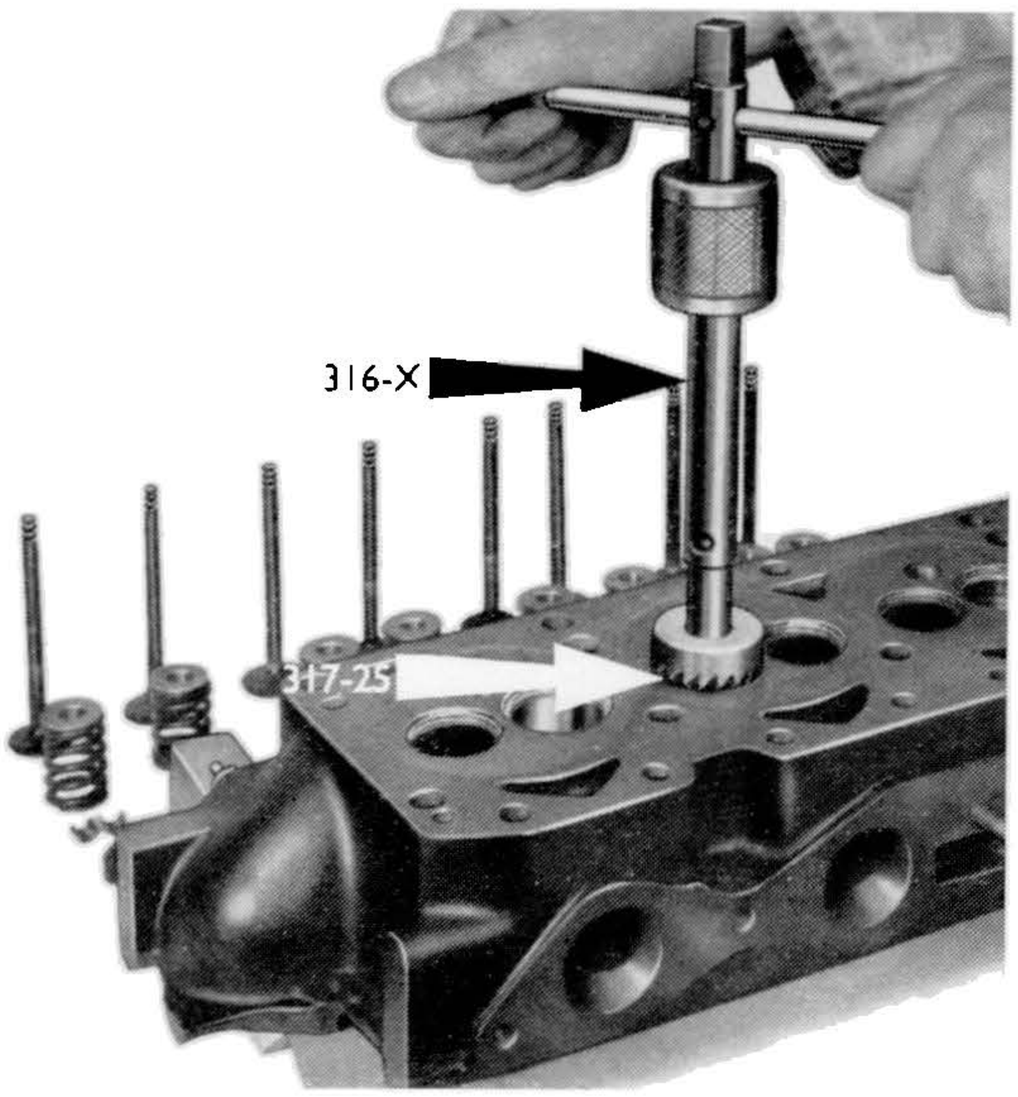
Tap wrench
P.6056-015 Valve guide reamer

1. Ream the guide bore using Tool No. P.6056-015 and a suitable tap wrench.

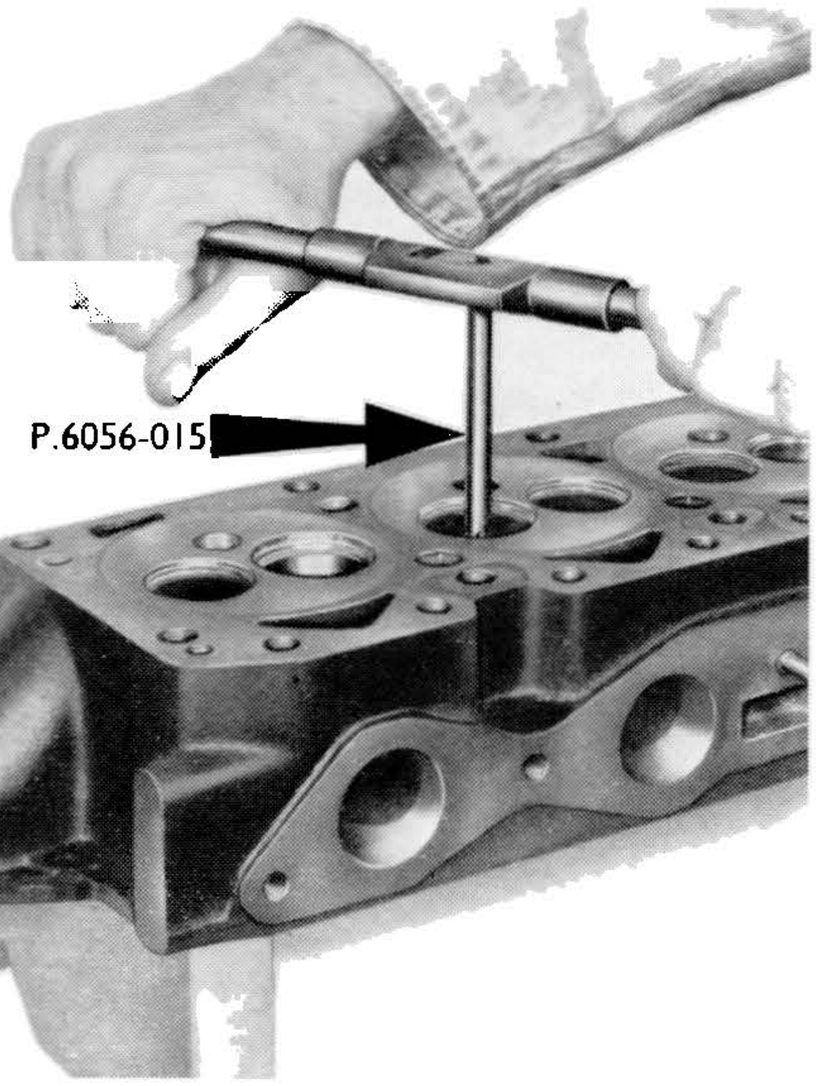
OP 6051-A8 EXTRA: EACH VALVE GUIDE – RENEW
(with valve removed)

Tools Required

P.6054 Valve guide remover/replacer



Recutting the Valve Seats



Reaming the Valve Guides

To Remove

1. Remove the valve guide using Tool No. P.6054.

To Replace

2. Press a new guide into the cylinder head until the plain end is flush with the spot faced boss in the valve port.

OP 6051-A9 EXTRA: CYLINDER HEAD – RENEW (with valves removed)

1. Remove the temperature gauge sender unit.
2. Replace the temperature gauge sender unit on the new cylinder head.
3. Remove the three manifold studs from the head being replaced and fit them to the new cylinder head. Alternatively fit three new studs in the new cylinder head.

OP 6051-B CYLINDER HEAD AND PISTONS – DECARBONISE
(Includes 6051-A, A1 and A2)

OP 6051-C VALVE – ONE – REMOVE AND INSTALL
(Includes 6051-A, A1 and A3)
(Does not include reface valve seat or grind-in valve)

OP 6051-D VALVE – ONE – REMOVE AND INSTALL
(Includes 6051-A, A1, A3, A5 and A6)
(Includes reface valve seat and grind-in valve)

OP 6051-E VALVES – ALL – REMOVE AND INSTALL
(Includes 6051-A, A1, A3, A4, A5 and A6)

OP 6051-F DECARBONISE CYLINDER HEAD AND PISTONS AND RESEAT AND GRIND-IN ALL VALVES
(Includes 6051-A, A1, A2, A3, A4, A5 and A6)

OP 6051-G VALVE GUIDE – ONE – REAM
(Includes 6051-A, A1, A3, A5 and A7)
(Includes recut valve seat)

OP 6051-H VALVE GUIDES – ALL – REAM
(Includes 6051-A, A1, A3, A4, A5 and A7)
(Includes recut valve seats)

OP 6051-I VALVE GUIDE – ONE – RENEW
(Includes 6051-A, A1, A3, A5 and A8)

OP 6051-J VALVE GUIDES – ALL – RENEW
(Includes 6051-A, A1, A3, A4, A5 and A8)

OP 6051-K CYLINDER HEAD – REMOVE AND INSTALL
(Includes 6051-A, A2, A3, A4 and A9)

OP 6051-M CYLINDER HEAD BOLTS – TORQUE
(Includes adjust valve clearances)

Tools Required

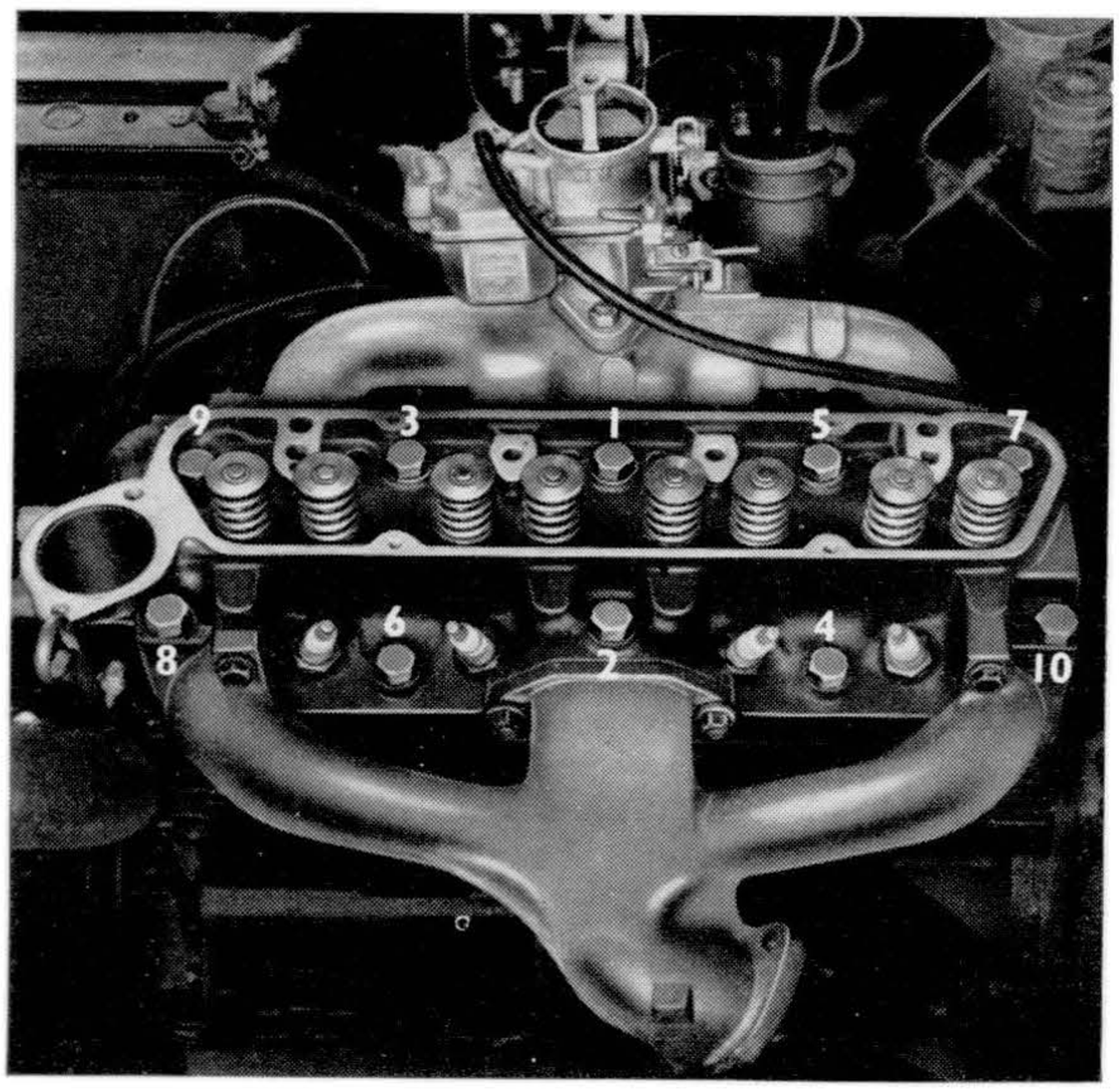
P.6129 Cylinder head bolt socket

1. Raise the bonnet and fit wing covers.
2. Remove the rocker cover, see Operation No. 6450-A, sub-sections 1 to 6.
3. Partially drain the cooling system, store the coolant if it is to used again.
4. Remove the thermostat housing.
5. Tighten the bolts evenly in sequence to a torque of 65 to 70 lb. ft. (8.98 to 9.67 kg.m.).
6. Adjust the valve clearances, see Operation No. 6450-A1.
7. Refit the thermostat housing.
8. Refill the cooling system with long life anti-freeze.
9. Install the rocker cover, see Operation No. 6450-A sub-sections 7 to 12.
10. Remove the wing covers and close the bonnet.

OP 6051-P CYLINDER HEAD CORE PLUG – RENEW
(Includes remove and install cylinder head and adjust valves)

Tools Required

PT.4063 Cylinder head gasket locating studs.



Cylinder Head Bolt Tightening Sequence

To Remove

1. Remove the cylinder head, see Operation No. 6051-A sub-sections 1 to 14.
2. Remove the core plug and clean its bore.

To Replace

3. Fit the new core plug using ESE-M4G-116A sealer to ensure a watertight joint.
4. Refit the cylinder head, see Operation No. 6051-A sub-sections 15 to 30.

OP 6068-A ENGINE REAR MOUNTING INSULATOR – RENEW

To Remove

1. With the handbrake applied, jack up the car front end and fit stands.
2. Suitably support the gearbox or automatic transmission with a jack.
3. Disconnect the crossmember from the body floor pan.
4. Unscrew the engine rear mounting centre bolt and remove the crossmember.
5. With automatic transmission, remove the insulator and retainer from the crossmember.

To Replace

6. For the automatic transmission, fit the retainer and insulator from the crossmember.
7. Locate the crossmember on the gearbox extension housing and fit the centre bolt and tighten to a torque of 40 to 45 lb. ft. (5.53 to 6.22 kg.m.).
8. Fit the crossmember to the body.
9. Remove the jack from under the gearbox.
10. Jack up the car, remove the stands, and lower the car to the ground.

OP 6250-B CAMSHAFT AND/OR TAPPETS – REMOVE AND INSTALL
(Includes remove and install engine)

Tools Required

200 A or B	Engine stand
550	Driver handle
CP.6041	Crankshaft pulley remover
P.6107	Engine bracket
P.6171	Engine lifting brackets
P.6150	Front cover oil seal aligner
P.6161	Camshaft front cover oil seal remover/replacer

To Remove

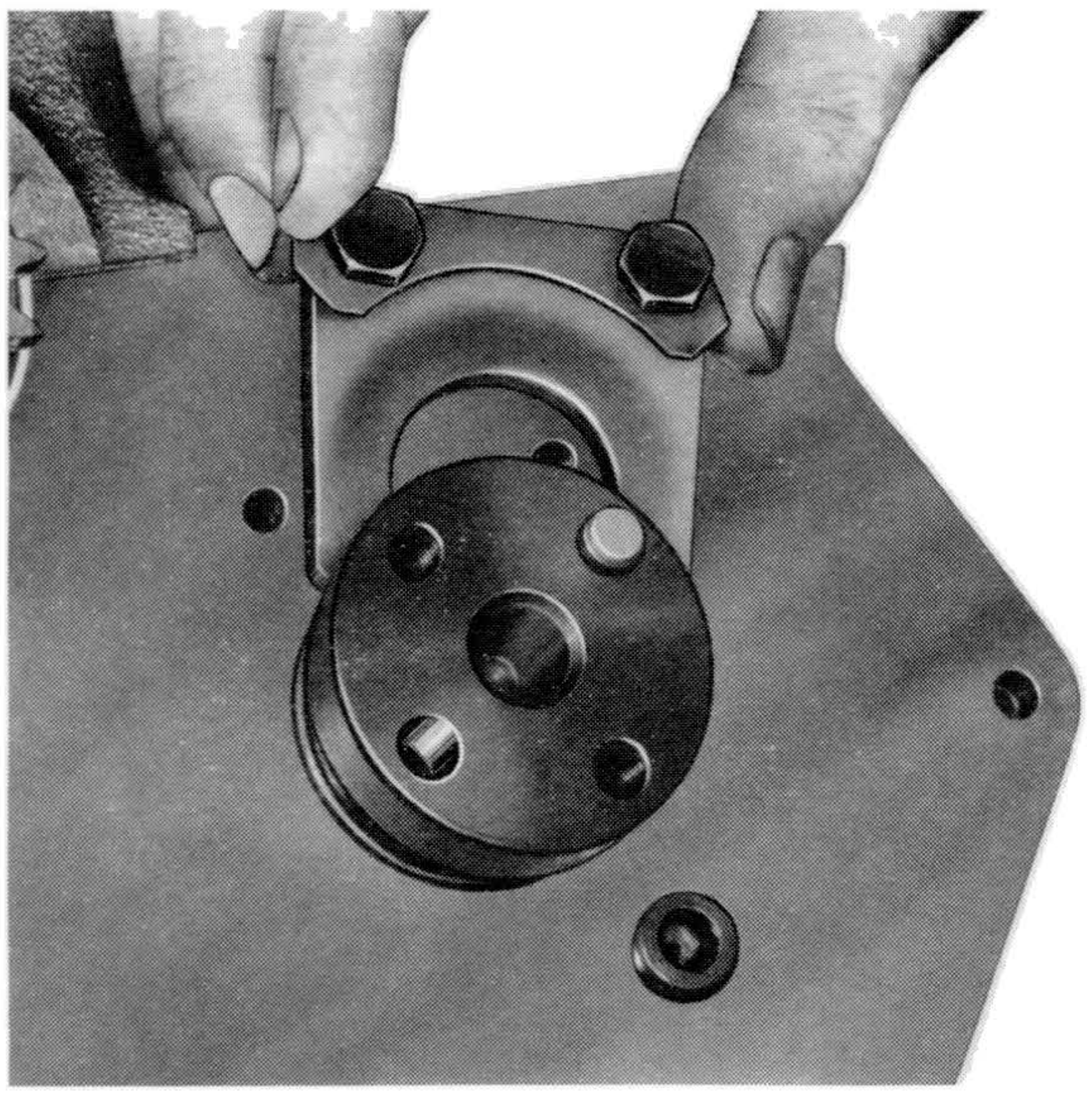
1. Remove the engine assembly as described in OP 6000-C.
2. Fit the bracket Tool No. P.6107 and mount the engine on a stand Tool No. 200 A. Remove the lifting brackets Tool No. P.6171.
3. Remove the rocker cover.

4. Remove the rocker shaft support bolts evenly and lift off the rocker shaft assembly.
5. Lift out the push rods from their locations and keep them in their correct order.
6. Remove the crankshaft pulley using Tool No. CP.6041.
7. Remove the oil pump and filter assembly.
8. Invert the engine and remove the sump, gaskets and cork packing strips.
9. Remove the front cover and gasket.
10. Remove the timing chain and sprocket, see Operation No. 6000-C10 sub-operations 1 to 3.
11. Remove the camshaft and tappets, see Operation No. 6000-C16 sub-operations 1 and 2.

To Replace

12. Install the tappets and camshaft, see Operation No. 6000-C16 sub-operations 3 and 4.
13. Refit the timing chain and sprocket, see Operation No. 6000-C10 sub-operations 4 to 6.
14. Fit a new oil seal to the front cover using Tool No. P.6161 and a 550 handle.
15. Position the gasket on the front cover with ESEE-M4G-1008A jointing compound at the ends, align the front cover with Tool No. P.6150 and tighten the bolts evenly to 5 to 7 lb. ft. (0.69 to 0.97 kg.m.) torque before removing the aligner.
16. Locate a new gasket on the oil pump mounting flange and fit the oil pump and filter assembly. Tighten the retaining bolts to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.).
17. Apply sealer ESEE-M4G-1008A to the front cover and rear oil seal carrier to cylinder block joints, and also to the ends of the grooves in the front cover and rear oil seal carrier. Then fit new sump gasket, followed by the cork packing strips. Refit the sump and tighten the bolts following the procedure described on page 37.

Remove the Oil Pump



Fitting the Camshaft Thrust Plate

18. Fit the crankshaft pulley aligning the pulley slot with the crankshaft key. Tighten the pulley retaining bolt to 24 to 28 lb. ft. (3.32 to 3.87 kg.m.) torque.
19. Locate the push rods in their respective bores and fit the rocker shaft assembly, ensuring that the cupped ends of the push rods engage with the adjusting screws. Tighten the rocker shaft retaining bolts evenly to 17 to 22 lb. ft. (2.35 to 3.04 kg.m.) torque.
20. Adjust the valve clearances as in Operation No. 6450-A1.
21. Replace the rocker cover and gasket, tighten the screws to 2.5 to 3.5 lb. ft. (0.35 to 0.48 kg.m.) torque.
22. Fit lifting brackets Tool No. P.6171 and remove the engine from the work stand and remove the bracket Tool No. P.6107.
23. Refit the engine assembly in the car as in Operation No. 6000-C.

OP 6250-B1 EXTRA: CAMSHAFT BEARINGS – REPLACE AND CHECK OILWAYS

Tools Required

550	Driver handle
P.4008	Crown wheel and pinion backlash gauge
P.6031	Camshaft bearing bush remover/replacer
P.6031-3	Camshaft bearing bush remover/replacer adaptors
CP.6147	Crankshaft rear oil seal aligner
P.6165	Crankshaft rear oil seal remover/replacer
P.7137	Spigot bearing replacer and clutch disc locator or P.7091-A clutch disc locator

To Remove

1. Unscrew the pressure plate bolts evenly and detach the pressure plate and disc (manual transmission only).
2. Remove the flywheel, or with automatic transmission, the drive plate.
3. Remove the crankshaft rear oil seal carrier.
4. Unscrew the bolts several turns and tap them to release the big end caps. Completely unscrew the bolts and remove the caps. Push the pistons up into the cylinder bores.
5. Unscrew the main bearing cap bolts evenly and lift off each cap. Lift out the crankshaft. Remove the thrust washers and bearing liners.

To Replace

6. Remove and install the camshaft bearing bushes, see Operation No. 6000-C17.
7. Fit the main bearing liners and replace the crankshaft. Locate the crankshaft, thrust washers with the oil grooves facing the crankshaft flange. Refit the main bearing caps and tighten the retaining bolts to 65 to 70 lb. ft. (8.98 to 9.67 kg.m.) torque.
8. Check the crankshaft end-float with feeler blades between the crankshaft and the thrust washers. This should be between 0.003 and 0.011 in. (0.08 and 0.28 mm.).

9. Turn the crankshaft as necessary to fit the connecting rod big ends to the crank pins. Tighten the bolts to a torque of 30 to 35 lb. ft. (4.15 to 4.84 kg.m.).

10. Fit a new crankshaft rear oil seal using remover/replacer Tool No. P.6165 and a 550 handle.

11. Fit a new gasket to the rear oil seal carrier using ESEE-M4G-1008A jointing compound at the ends. Secure the carrier to the cylinder block, aligning it with Tool No. CP.6147. Tighten the bolts evenly to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) torque and remove the aligner.

12. Locate the flywheel, or, with automatic transmission, the spacer, the drive and reinforcing plates squarely on the crankshaft flange. Tighten the retaining bolts to 50 to 54 lb. ft. (6.91 to 7.46 kg.m.) torque for the hexagonal type and 50 to 55 lb. ft. (6.92 to 7.60 kg.m.) for the bi-hexagonal type.

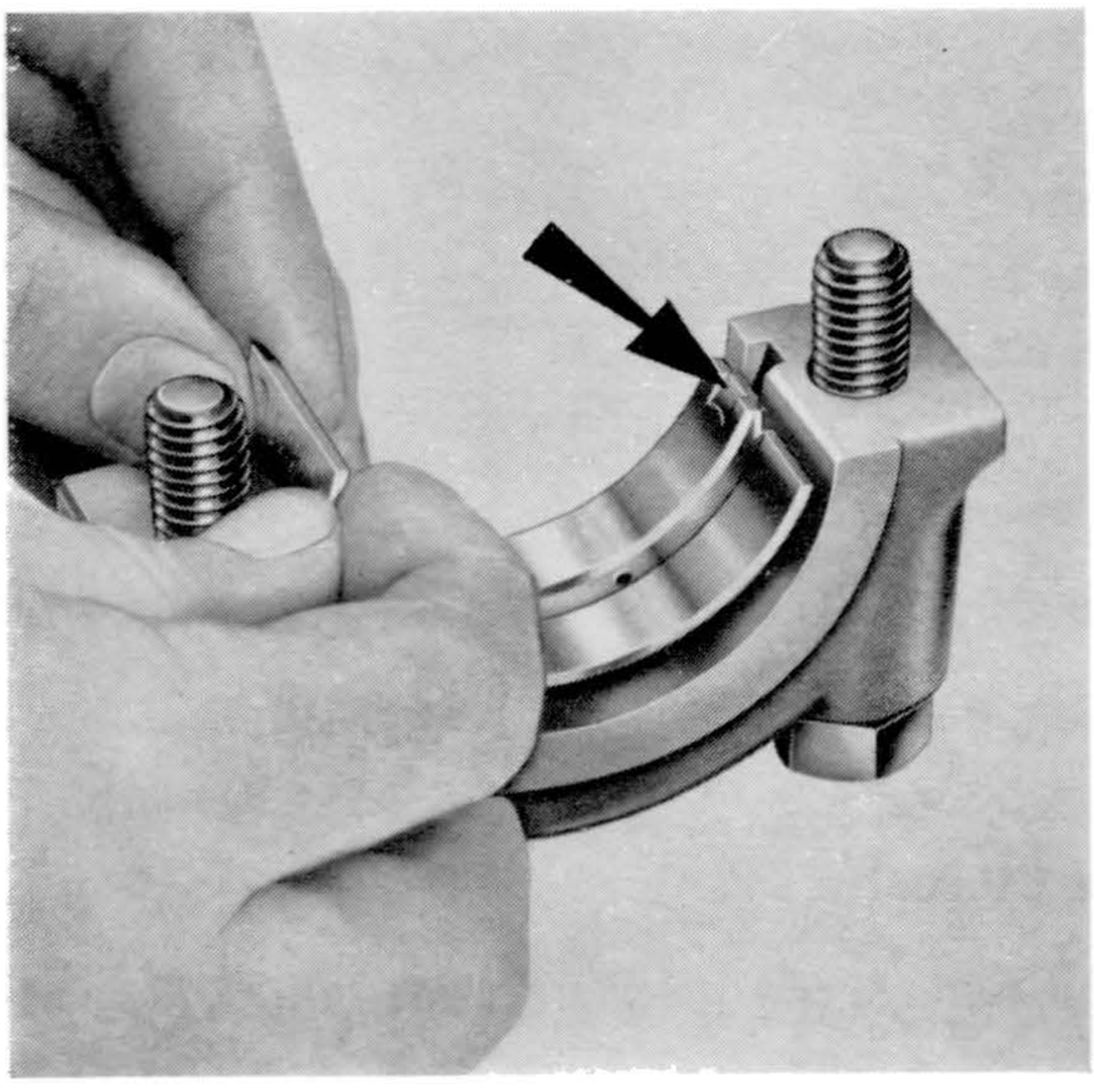
13. Check the flywheel run-out using gauge Tool No. P.4008. This should not exceed 0.005 in. (0.13 mm.) total indicator reading.

14. Centralise the clutch disc (manual transmission only) with the hub assembly away from the flywheel using Tool No. P.7137 or P.7091-A. Tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) and remove the clutch disc locator.

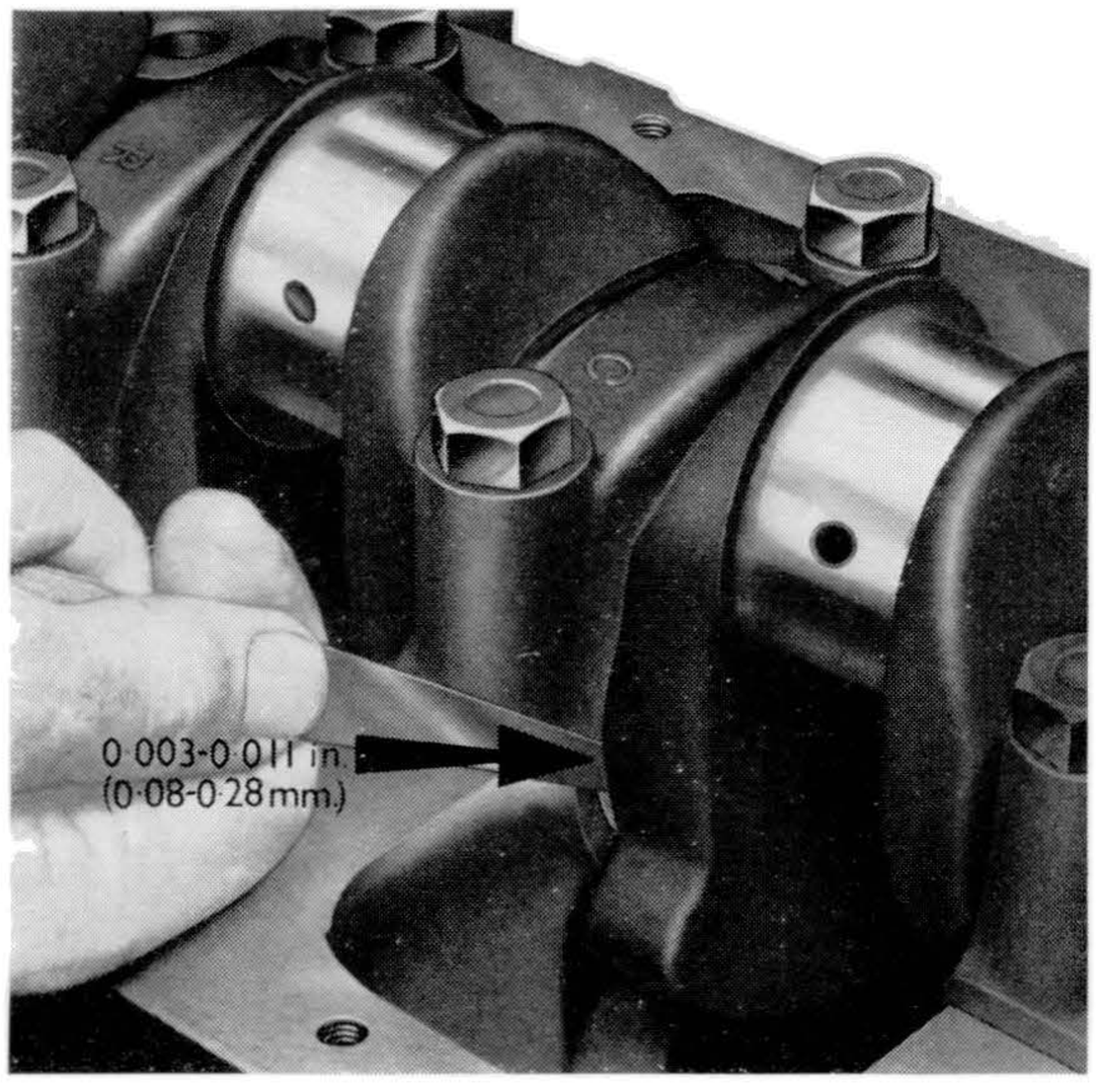
OP 6250-C CAMSHAFT BEARINGS – RENEW
(Includes 6350-B and B1)

OP 6250-D CAMSHAFT LOBES – CHECK LIFT
(Includes remove and install rocker cover, rocker shaft and check lift of lobes at push rod with dial gauge and adjust valves)

1. Remove the rocker cover, see Operation No. 6450-A sub-sections 1 to 6.



Fitting a Main Bearing Liner



Checking the Crankshaft End-float

2. Unscrew the rocker shaft bolts evenly and lift off the rocker shaft assembly.
3. Mount the dial gauge Tool No. P.4008 at a suitable location and position the gauge anvil in the push rod socket. Zero the gauge with the tappet on the heel of the cam.
4. Turn the engine until the tappet is on the toe of the cam and measure the lift.
5. Repeat for the other cam lobes.
6. Fit the rocker shaft assembly to the cylinder head, engaging the push rods with the adjusting screws. Tighten the bolts evenly to a torque of 17 to 22 lb. ft. (2.35 to 3.04 kg.m.).
7. Adjust the valve clearances, see Operation No. 6450-A1.
8. Install the rocker cover, see Operation No. 6450-A sub-sections 7 to 12.

OP 6303-A CRANKSHAFT – REMOVE AND INSTALL

(Includes remove and install engine, connecting rod and main bearing liners and transferring crankshaft sprocket)

Tools Required

200A or B	Engine stand
550	Driver handle
P.4008	Crown wheel and pinion backlash gauge
CP.6041	Crankshaft pulley remover
P.6032A or B	Crankshaft sprocket replacer
P.6107	Engine bracket
P.6171	Engine lifting brackets
P.6116	Crankshaft sprocket remover
CP.6173	Crankshaft rear oil seal aligner
P.6150	Crankshaft front cover oil seal aligner
P.6161	Front cover oil seal remover/replacer
P.6165	Crankshaft rear oil seal remover/replacer
P.7137	Spigot bearing replacer and clutch disc locator

To Remove

1. Remove the engine assembly as described in OP 6000-C.
2. Fit a bracket Tool No. P.6107 and mount the engine on a stand Tool No. 200A or B. Remove the lifting brackets Tool No. P.6171.
3. Remove the crankshaft pulley using Tool No. CP.6041.
4. Unscrew the pressure plate bolts evenly and remove the pressure plate and clutch disc. (Manual Transmission only.)
5. Remove the flywheel, or, with automatic transmission, the drive plate.

6. Remove the sump and gaskets.

7. Remove the front cover, gasket and crankshaft oil slinger.

8. Remove the timing chain tensioner and tensioner arm.

9. Remove the camshaft sprocket and timing chain.

10. Remove the crankshaft sprocket using Tool No. P.6116.

11. Remove the crankshaft, see Operation No. 6000-C18 sub-sections 1 to 3.

To Replace

12. Install the crankshaft, see Operation No. 6000-C18 sub-sections 4 to 6.

13. Replace the crankshaft sprocket using replacer Tool No. P.6032A or B.

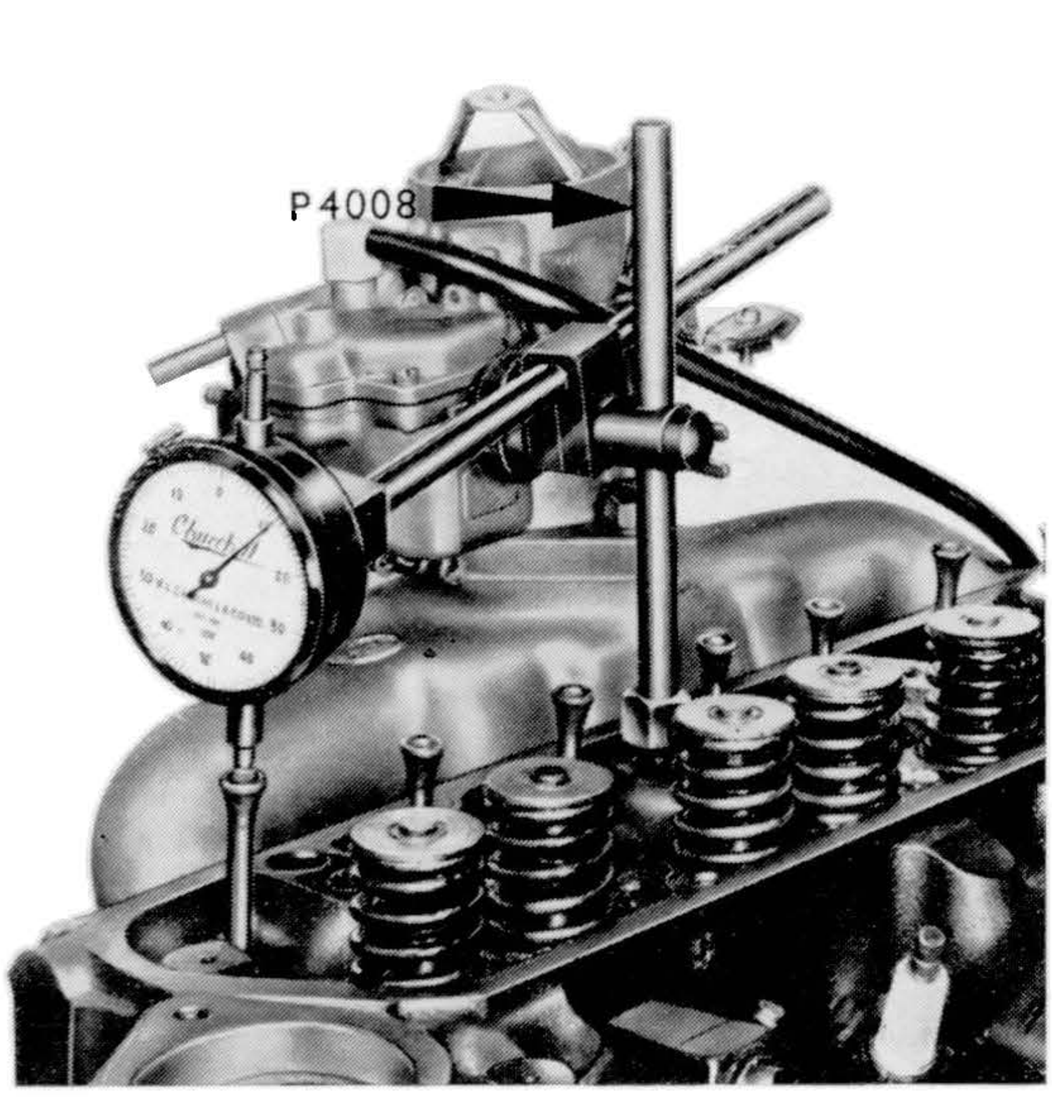
14. Locate the timing chain around the camshaft sprocket and fit the camshaft sprocket with the timing mark adjacent to and in line with the corresponding mark on the crankshaft sprocket.

15. Turn the crankshaft as necessary to fit the connecting rod big ends to the crank pins. Tighten the connecting rod bolts to 30 to 35 lb. ft. (4.15 to 4.84 kg.m.) torque. Check the end-float on the crankpin, this should be 0.004 to 0.010 in. (0.10 to 0.25 mm.).

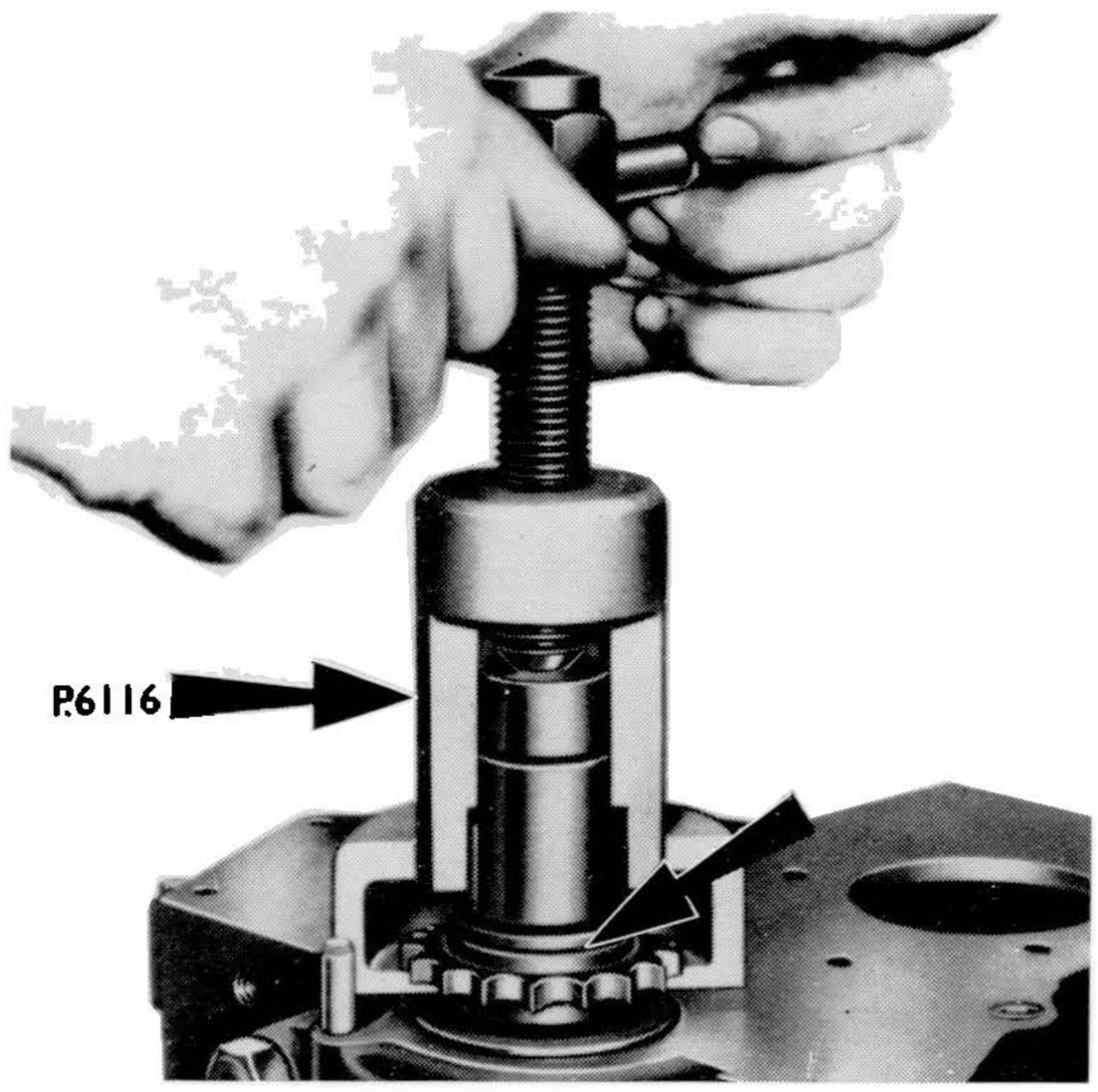
16. Fit a new crankshaft rear oil seal using remover/replacer Tool No. P.6165 and a 550 handle.

17. Locate a new gasket on the rear oil seal carrier using ESEE-M4G-1008A jointing compound at the ends and fit the carrier to the block rear face using an aligner Tool No. CP.6173. Tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) and remove the aligner.

18. Position the tensioner arm on the pivot pin and fit the timing chain tensioner.



Checking the Camshaft Lift



Removing the Crankshaft Sprocket

19. Fit the oil slinger on the crankshaft.

20. Fit a new oil seal to the front cover using Tool No. P.6161 and a 550 handle.

21. Position a gasket on the front cover using ESEE-M4G-1008A jointing compound at the ends. Secure the cover in place using an aligner Tool No. P.6150. Tighten the bolts evenly to a torque of 5 to 7 lb. ft. (0.69 to 0.97 kg.m.) and remove the aligner.

22. Locate the flywheel, or, with automatic transmission, the spacer, the drive and reinforcing plates squarely upon the crankshaft flange. Tighten the bolts evenly to 50 to 54 lb. ft. (6.91 to 7.46 kg.m.) torque for the hexagonal type and 50 to 55 lb. ft. (6.92 to 7.60 kg.m.) for the bi-hexagonal type.

23. Check the flywheel run-out using the gauge Tool No. P.4008 at the rim. The flywheel run-out should not exceed 0.005 in. (0.13 mm.) total indicator reading.

24. Centralise the clutch disc (manual transmission only) with the hub assembly away from the flywheel using Tool No. P.7137. Fit the pressure plate and cover assembly and tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.68 to 2.07 kg.m.) then remove the disc locator.

25. Fit the crankshaft pulley aligning the pulley slot with the crankshaft key. Tighten the retaining bolt to 24 to 28 lb. ft. (3.32 to 3.87 kg.m.).

26. Apply sealer ESEE-M4G-1008A to the front cover and rear oil seal carrier to cylinder block joints, and also to the ends of the grooves in the front cover and rear oil seal carrier. Then fit new sump gasket, followed by the cork packing strips. Refit the sump and tighten the bolts following the procedure described on page 37.

27. Remove the engine from the stand using the lifting brackets Tool No. P.6171. Remove the bracket Tool No. P.6107.

28. Refit the engine assembly in the car as described in OP 6000-C.

OP 6312-A CRANKSHAFT PULLEY - REMOVE AND INSTALL

To Remove

1. Raise the bonnet and fit wing covers.

2. Slacken the generator mounting bolts and remove the fan belt.

3. Remove crankshaft pulley using suitable levers.

To Replace

4. Replace crankshaft pulley aligning the pulley slot with the crankshaft key. Tighten the retaining bolt to 24 to 28 lb. ft. (3.32 to 3.87 kg.m.).

5. Replace the fan belt and adjust the tension to give $\frac{1}{2}$ in. (12.7 mm.) total movement.

6. Remove the wing covers and close the bonnet.

OP 6335-A CRANKSHAFT REAR OIL SEAL CARRIER – REMOVE AND INSTALL
(Includes remove and install engine)

Tools Required

200A or B	Engine stand
P.4008	Crown wheel and pinion backlash gauge
P.6107	Engine bracket
P.6171	Engine lifting brackets
CP.6173	Crankshaft rear oil seal aligner
P.7137	Spigot bearing replacer and clutch disc locator

To Remove

1. Remove the engine assembly as described in OP 6000-C.
2. Fit a bracket Tool No. P.6107 and mount the engine on a stand Tool No. 200A or B. Remove the lifting brackets Tool No. P.6171.
3. Unscrew the pressure plate bolts evenly and remove the pressure plate and clutch disc. (Manual transmission only.)
4. Remove the flywheel, or, with automatic transmission, the drive plate.
5. Remove the sump and gaskets.
6. Remove the rear oil seal carrier.

To Replace

7. Locate a new gasket on the rear oil seal carrier, using ESEE-M4G-1008A jointing compound at the ends, and fit the carrier to the block rear face using an aligner Tool No. CP.6173. Tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) and remove the aligner.

Fitting the Clutch

8. Locate the flywheel or, with automatic transmission, the spacer, the drive and reinforcing plates squarely upon the crankshaft flange. Tighten the bolts evenly to a torque of 50 to 55 lb. ft. (6.91 to 7.60 kg.m.) for the bi-hexagonal type only.
9. Check the flywheel run-out using the gauge Tool No. P.4008 at the rim. The flywheel run-out should not exceed 0.005 in. (0.13 mm.) total indicator reading.
10. Centralise the clutch disc (manual transmission only), with the hub assembly away from the flywheel using Tool No. P.7137. Fit the pressure plate and cover assembly and tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.68 to 2.07 kg.m.) then remove the disc locator.
11. Apply sealer ESEE-M4G-1008A to the front cover and rear oil seal carrier to cylinder block joints, and also to the ends of the grooves in the front cover and rear oil seal carrier. Then fit new sump gasket, followed by the cork packing strips. Refit the sump and tighten the bolts following the procedure described on page 37.
12. Remove the engine from the stand using the lifting brackets Tool No. P.6171. Remove the bracket Tool No. P.6107.
13. Refit the engine assembly in the car as described in OP 6000-C.

OP 6335-A1 EXTRA: REAR OIL SEAL CARRIER AND/OR SEAL – RENEW
(with rear oil seal carrier removed)

See Operation No. 6000-C7.

OP 6335-B CRANKSHAFT REAR OIL SEAL AND/OR CARRIER – RENEW
(Includes 6335-A and A1)

OP 6374-A DRIVE PLATE – REMOVE AND INSTALL

To Remove

1. Remove the automatic transmission and converter assembly as described in OP 7007-A of Section 7/2.
2. Remove the reinforcing and drive plates and spacer.

To Replace

3. Locate the spacer on the crankshaft and fit the drive and reinforcing plates. Tighten the hexagonal retaining bolts evenly to a torque of 50 to 54 lb. ft. (6.91 to 7.46 kg.m.).
4. Refit the automatic transmission and converter assembly as described in OP 7007-A of Section 7/2.

OP 6375-A FLYWHEEL ASSEMBLY – REMOVE AND INSTALL
(Includes remove and install gearbox assembly, clutch disc and pressure plate)

Tools Required

P.4008	Crown wheel and pinion backlash gauge
P.7137	Spigot bearing replacer and clutch disc locator

To Remove

1. Remove the gearbox as described in OP 7003-A of Section 7/1.
2. Unscrew the pressure plate bolts evenly and remove the pressure plate and disc.
3. Remove the flywheel.

To Replace

4. Locate the flywheel squarely on the crankshaft flange. Fit and tighten the bolts evenly to a torque of 50 to 55 lb. ft. (6.91 to 7.10 kg.m.) for the bi-hexagonal type.
5. Check the flywheel run-out using the gauge Tool No. P.4008 at the rim. The flywheel run-out should not exceed 0.005 in. (0.13 mm.) total indicator reading.
6. Centralise the clutch disc with the hub assembly away from the flywheel using Tool No. P.7137. Fit the pressure plate and cover assembly and tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) and remove the clutch disc locator.
7. Replace the gearbox in the car as described in OP 7003-A of Section 7/1.

OP 6375-A1 EXTRA: FLYWHEEL RING GEAR – RENEW (with flywheel removed)

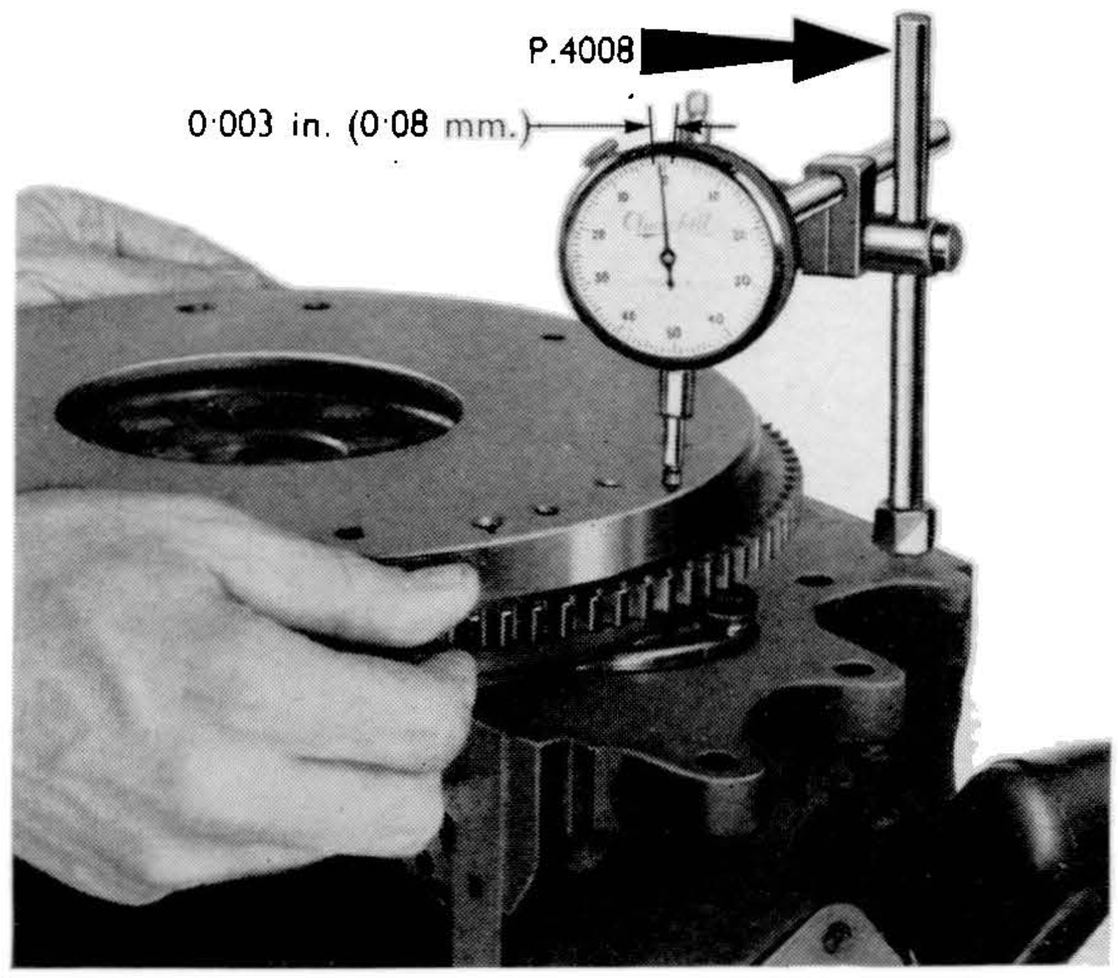
To Remove

1. Cut between two teeth with a hacksaw and split the flywheel ring gear with a chisel.

To Replace

2. Heat the new ring gear evenly to a temperature not exceeding 600°F (316°C) and fit the ring gear. Allow the ring to cool naturally in air. **Do not quench.**

   NOTE – If the ring gear has 100 teeth fit it to the flywheel with the chamfer on the leading faces of the gear teeth relative to the direction of rotation. The 132 teeth ring gear can be fitted either way round.



Checking the Flywheel Run-Out

OP 6375-B FLYWHEEL RING GEAR - RENEW
(Includes OPS 6375-A and A1)

OP 6450-A ROCKER COVER AND/OR GASKET - REMOVE AND INSTALL

To Remove

1. Raise the bonnet and fit wing covers.
2. Disconnect the ignition high tension leads from the spark plugs and unclip from the rocker cover.
3. Disconnect the throttle cable from the carburettor throttle shaft and the rocker cover.
   On automatic transmission cars, disconnect the downshift cable.
4. Disconnect the carburettor throttle shaft from the carburettor and remove from the rocker cover.
5. Unclip the heater and ventilation hoses from the rocker cover.
6. Remove the rocker cover and gasket.

To Replace

7. Inspect the gasket and if necessary replace it. Locate the gasket on the rocker cover flange and fit the rocker cover. Tighten the screws evenly to a torque of 2.5 to 3.5 lb. ft. (0.35 to 0.48 kg.m.).
8. Refit the carburettor throttle shaft to the rocker cover and reconnect to the carburettor.
9. Reconnect the throttle cable to the rocker cover and the carburettor throttle shaft. Adjust if necessary. On automatic transmission cars, reconnect the downshift cable.
10. Clip the heater and ventilation hoses to the rocker cover.
11. Clip the ignition high tension leads to the rocker cover and connect to the spark plugs.
12. Remove the wing covers and lower the bonnet.

OP 6450-A1 EXTRA: ALL VALVE CLEARANCES - ADJUST

To check valve clearances turn the crankshaft until the valves in the first column are fully open, when the valves shown in the second column may be checked and adjusted as required:—

Valves Open	*Valves to Adjust*
1 and 6	3 In. and 8 Ex.
2 and 4	5 Ex. and 7 In.
3 and 8	1 Ex. and 6 In.
5 and 7	2 In. and 4 Ex.

To adjust a valve clearance, slacken off the adjusting screw locknut and insert a feeler blade between the rocker pad and the valve end. Turn the adjusting screw until the correct clearance has been obtained and tighten the locknut to 10 to 14 lb. ft. (1.38 to 1.93 kg.m.). Recheck the gap after tightening the locknut.

	Inlet	*Exhaust*
1,300 c.c. and 1,600 c.c. (Except G.T.)—Cold ...	0.008 to 0.010 in. (0.20 to 0.25 mm.)	0.018 to 0.020 in. (0.46 to 0.51 mm.)
—Hot ...	0.010 in. (0.25 mm.)	0.017 in. (0.43 mm.)
1,600 c.c. G.T.—Cold ...	0.011 to 0.013 in. (0.28 to 0.33 mm.)	0.021 to 0.023 in. (0.53 to 0.58 mm.)
—Hot	0.012 in. (0.30 mm.)	0.022 in. (0.56 mm.)

OP 6450-A2 EXTRA: ROCKER SHAFT ASSEMBLY OR ALL ROCKERS AND/OR PUSH RODS - REMOVE AND INSTALL

To Remove

1. Unscrew the rocker shaft bolts evenly and lift off the rocker shaft assembly.
2. Withdraw the push rods from their locations and keep them in their correct order.

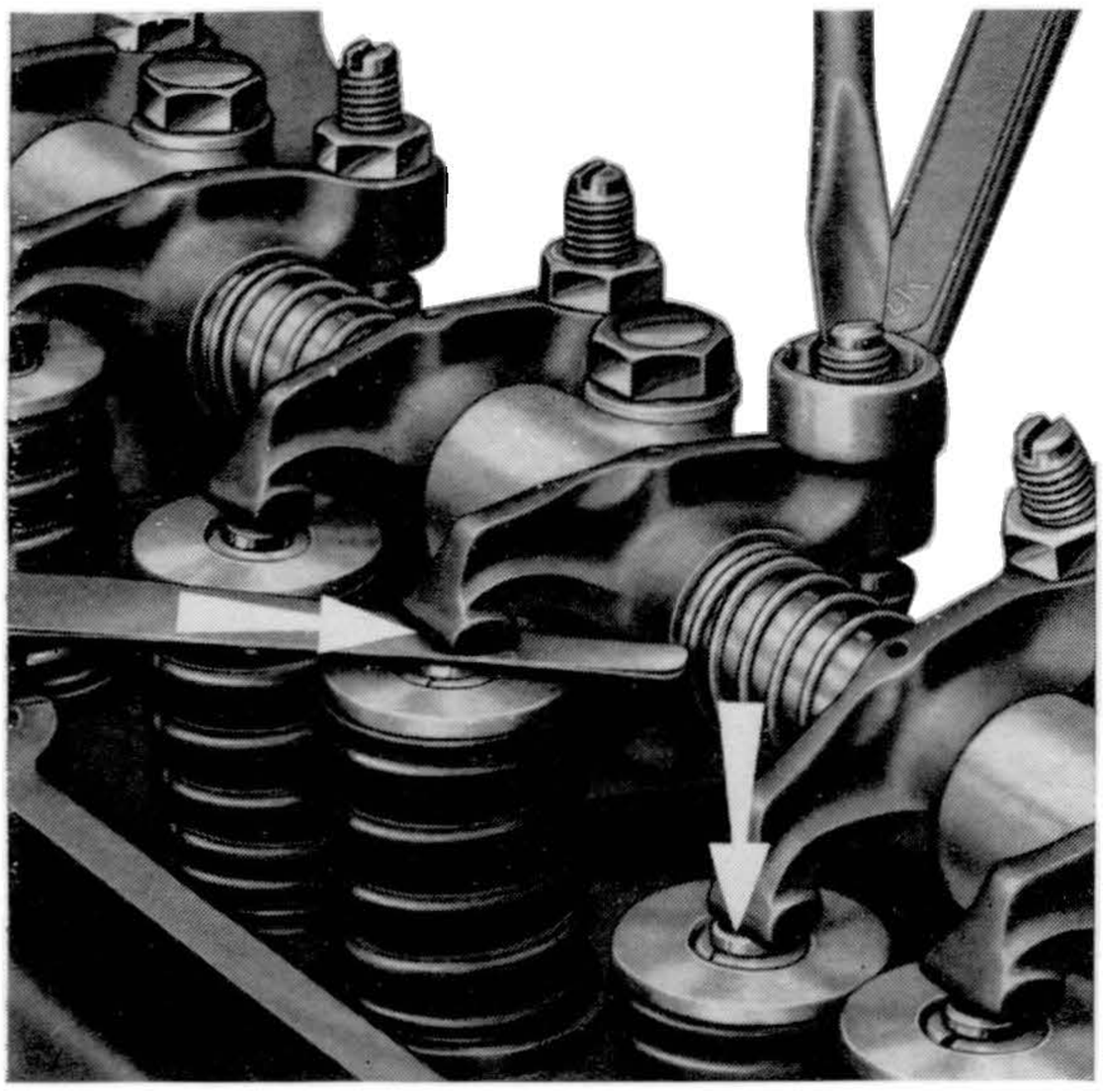
To Replace

3. Locate the push rods in their respective push rod bores.
4. Fit the rocker shaft assembly to the cylinder head, engaging the push rods with the adjusting screws. Tighten the bolts evenly to a torque of 17 to 22 lb. ft. (2.35 to 3.04 kg.m.).

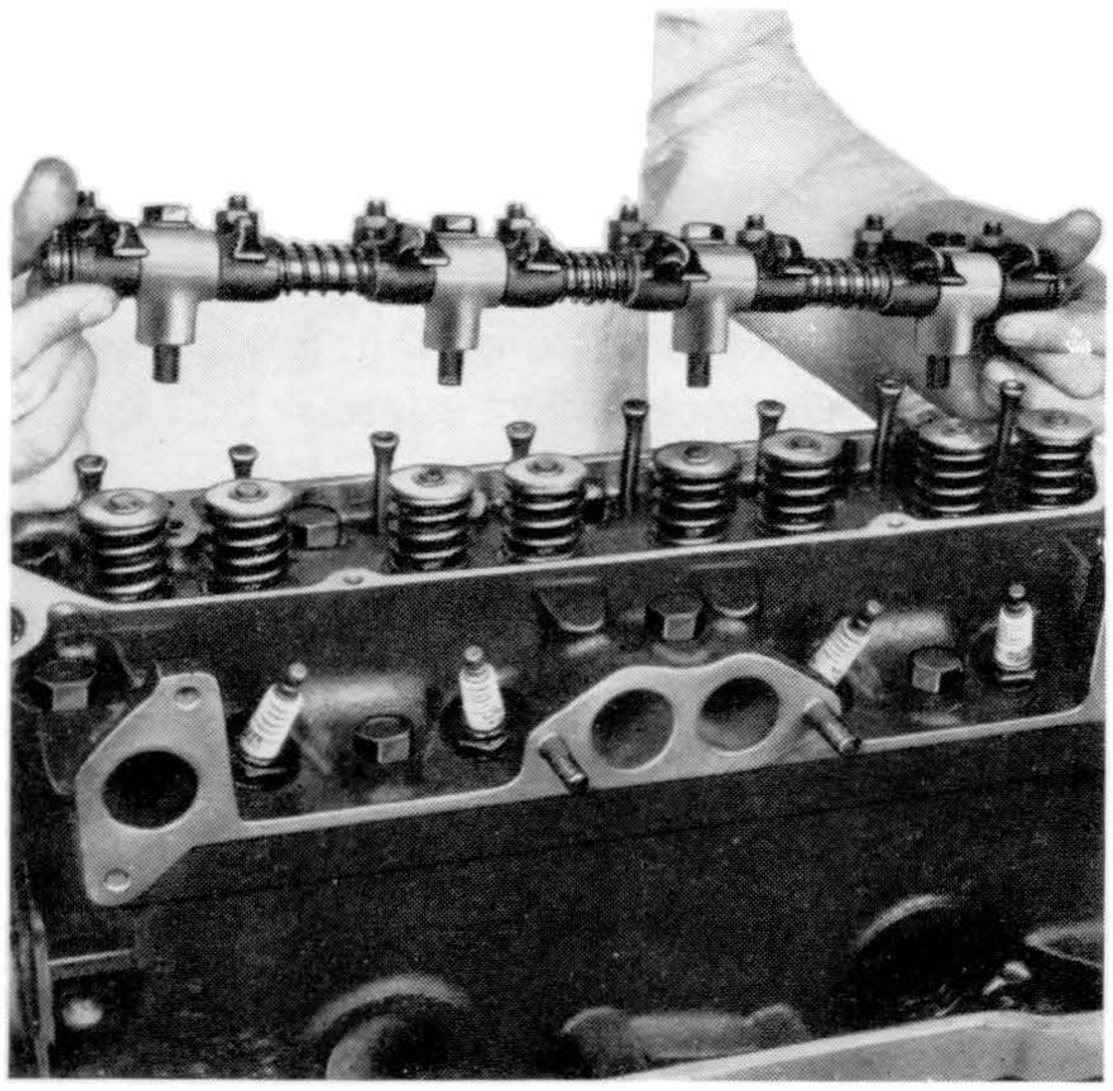
OP 6450-A3 EXTRA: ANY OR ALL ROCKER SHAFT PARTS - RENEW

To Remove

1. Remove the split pin from one end of the shaft and detach the flat washer, crimped spring washer and second flat washer, which bear against the end rocker arm. The rocker shaft supports, rocker arms and springs can now be removed from the shaft.



Adjusting the Valve Clearances



Fitting the Rocker Shaft Assembly

To Replace

2. Build up the rocker shaft assembly in the reverse order to removal.

   Note that the bolt hole in the rocker shaft support must be on the same side as the adjusting screw in the rocker arm and that the rocker arms are handed, the rocker pads being inclined towards the support. Fit the split pins with the heads upwards and bend over the legs to secure.

OP 6450-B VALVE CLEARANCES – ADJUST
(Includes 6450-A and A1)

OP 6450-C ROCKER SHAFT OR ALL ROCKERS AND/OR PUSH RODS – REMOVE AND INSTALL
(Includes 6450-A, A1 and A2)

OP 6450-D ROCKER SHAFT – OVERHAUL
(Includes 6450-A, A1, A2 and A3)

OP 6513-A VALVE SPRING AND/OR STEM SEAL – ONE – RENEW
(Includes remove and install rocker cover, rocker shaft, spark plugs and supporting valve through spark plug hole)

Tools Required

6118A	Valve spring compressor
P.6118-3A	Valve spring compressor (adaptor)

To Remove

1. Remove the rocker cover, see Operation No. 6450-A, sub-sections 1 to 6.
2. Remove the rocker shaft and push rods, see Operation No. 6450-A2 sub-sections 1 and 2.
3. Remove the spark plug from the cylinder corresponding to the valve.
4. Turn the engine until the piston in this cylinder is at T.D.C., or alternatively support the valve with a suitable lever through the spark plug hole.
5. Compress the valve spring, using Tool No. 6118A and adaptor Tool No. P.6118-3A located in an adjacent rocker support bolt hole. Remove the split tapered collets and release the spring.
6. Remove the valve spring retainer, valve spring and seal.

To Replace

7. Fit the seal to the valve stem, with the open end to the cylinder head, followed by the valve spring and retainer.
8. Compress the valve spring using Tool No. 6118A and adaptor Tool No. P.6118-3A as before. Locate the split collets in the valve stem collet grooves and slowly release the spring compressor to engage the collets in the retainer tapers. Remove the lever, if used, from the spark plug hole.

9. Refit the push rods and rocker shaft, see Operation No. 6450-A2 sub-operations 3 and 4.
10. Adjust the valve clearances, see Operation No. 6450-A1.
11. Refit the sparking plug.
12. Refit the rocker cover, see Operation No. 6450-A sub-operations 7 to 12.

OP 6513-A1 EXTRA: EACH ADDITIONAL VALVE SPRING AND/OR STEM SEAL – RENEW

1. Remove the spark plug and turn the engine as necessary and renew each additional valve spring and/or seal, see Operation No. 6513-A sub-operations 5 to 8.

OP 6513-B VALVE SPRING AND/OR STEM SEALS – ALL – RENEW
(Includes 6513-A and A1)

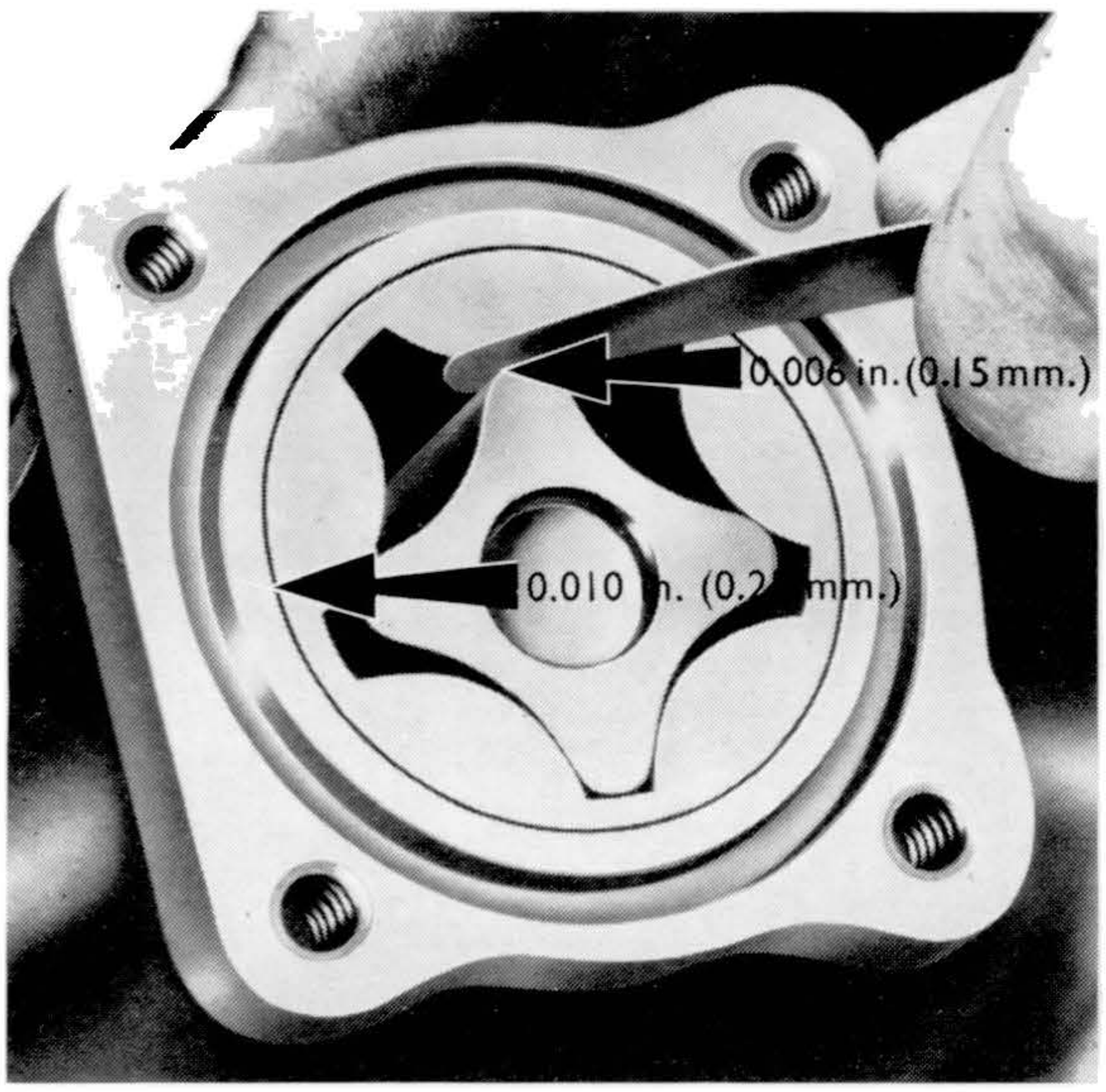
OP 6600-A OIL PUMP ASSEMBLY – REMOVE AND INSTALL

To Remove

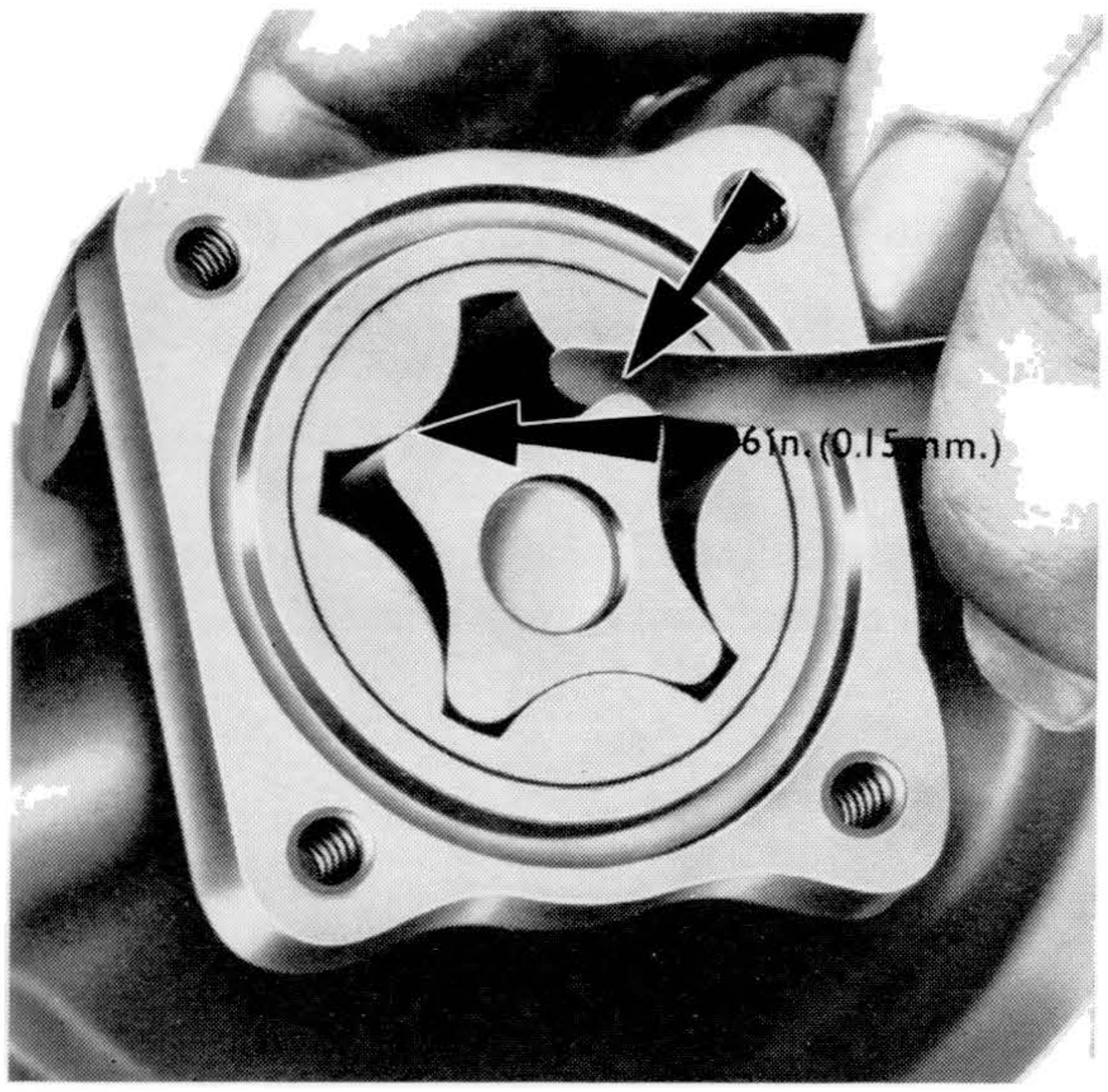
1. With the handbrake applied, jack up the front of the car and fit stands.
2. Remove the oil pump and filter assembly.

To Replace

3. Locate a new gasket on the oil pump mounting flange and fit the oil pump and filter assembly to the cylinder block. Tighten the bolts to 12 to 15 lb. ft. (1.66 to 2.04 kg.m.) torque.
4. Jack up the car, remove the stands and lower the car to the ground.



Checking the Eccentric Bi-Rotor Clearances



Checking the Eccentric Bi-Rotor Clearances

OP 6600-A1 EXTRA: OIL PUMP ASSEMBLY - OVERHAUL

(*a*) *Bi-Rotor Type*

To Dismantle

1. Remove the filter body and element and extract the sealing ring from the groove.

2. Remove the end plate and withdraw the rubber 'O' ring from the groove in the pump body.

3. Check the clearance between the lobes of the inner and outer rotors. This should not exceed 0.006 in. (0.15 mm.). The rotors are supplied as a matched pair only so that if clearance is excessive a new rotor must be fitted.

4. Check the clearance between the outer rotor and the housing, this should not exceed 0.010 in. (0.25 mm.). If clearance between the outer rotor and pump body is excessive a new rotor assembly and/or pump body should be fitted.

5. Place a straight edge across the face of the pump body and check the clearance between the face of the rotors and the straight edge. This should not exceed 0.005 in. (0.13 mm.). If this clearance is excessive the face of the pump body can be carefully lapped on a flat surface.

6. If it is necessary to renew the rotor or drive shaft, remove the outer rotor, then drive out the retaining pin securing the skew gear to the drive shaft and pull off the gear.

7. Withdraw the inner rotor and drive shaft.

To Reassemble

8. If the pump has been completely dismantled, fit the inner rotor and drive shaft assembly to the pump body. Press the skew gear onto the drive shaft, supporting the shaft at the rotor end on a suitable spacer, until the far end of the gear teeth are 2.24 in. (56.9 mm.) from the mounting flange. Drill a 0.12 in. (3.0 mm.) hole at right angles to the shaft through the gear shoulder 1.3 in. (33.6 mm.) from the mounting flange. Replace the gear retaining pin and peen over the ends securely.

9. Install the outer rotor with its chamfered face inwards, towards the pump body.

10. Place the rubber 'O' ring in the groove in the pump body.

11. Fit the end plate with the machined face towards the rotors.

12. Locate a new filter body sealing ring in the groove and fit the filter assembly to the oil pump. Fit a new aluminium washer to the centre bolt and tighten to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.).

(*b*) *Vane Type*

To Dismantle

1. Remove the filter body and element and extract the sealing ring from the groove.

2. Remove the end plate, keeping the pump shaft vertical. Withdraw the 'O' ring from the groove in the pump body.

3. Place a straight edge across the face of the pump body and check the clearance between the face of the vanes and rotor assembly and the straight edge. This should not exceed 0.005 in. (0.13 mm.). Should the clearance be greater than this the face of the pump body can be carefully lapped on a flat surface.

4. Turn the oil pump until one of the vanes is in the centre of the cam form. Check the clearance between the rotor and the oil pump body at the closest point. If this exceeds 0.005 in. (0.13 mm.) a worn body is indicated and a new oil pump assembly should be fitted.

5. With the rotor in the same position centralise the locating ring and check the clearance between the diametrically opposite vane and the pump body. If the clearance exceeds 0.010 in. (0.25 mm.) the vanes are worn and should be renewed.

6. Check the vane clearance in the locating grooves, if this exceeds 0.005 in. (0.13 mm.) the vanes and/or a rotor are worn. Substitute new vanes and recheck the clearance to see if the rotor grooves are worn. If the rotor is worn fit a new rotor and shaft assembly.

7. If it is necessary to renew the rotor or drive shaft, lift out the vanes and the outer locating ring. Drive out the retaining pin securing the skew gear to the drive shaft and pull off the gear.

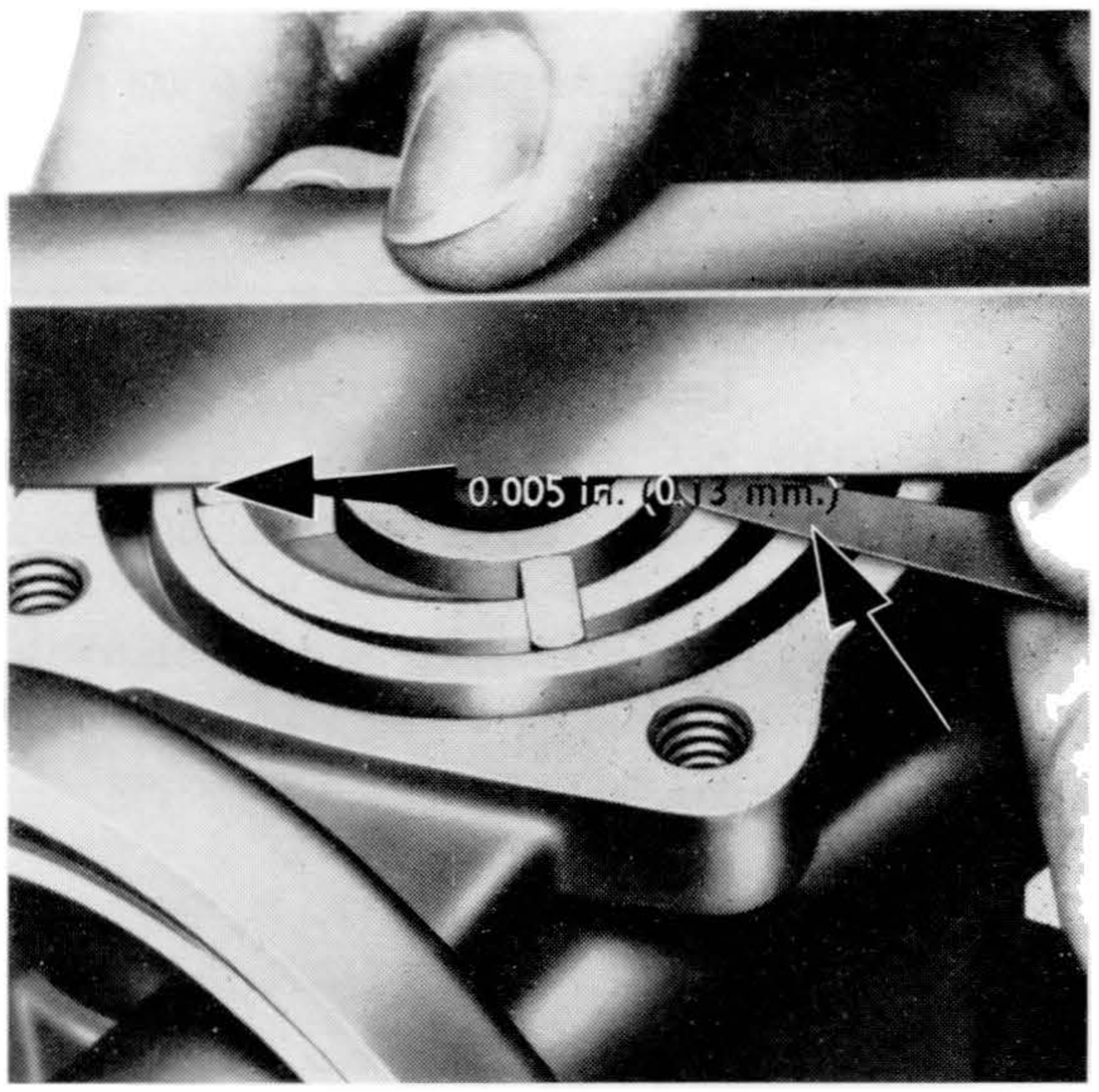
8. Remove the drive shaft and rotor assembly together with the vane locating inner ring from the pump housing.

To Reassemble

9. If the pump has been completely dismantled, place the vane locating inner ring in the pump housing and fit the drive shaft and rotor assembly to the pump body. Press the skew gear onto the drive shaft, supporting the shaft at the rotor end on a suitable spacer, until the far end of the gear teeth are 2.24 in. (56.9 mm.) from the mounting flange. Drill a 0.12 in. (3.0 mm.) hole at right angles to the shaft through the gear shoulder 1.3 in. (33.0 mm.) from the mounting flange. Replace the gear retaining pin and peen the ends over securely.

10. Replace the vane locating outer ring and locate the sliding vanes in the rotor grooves with the curved edges outwards.

Checking the Eccentric Bi-Rotor End-Float



Checking the Vane and Rotor End-Float

11. Place the rubber 'O' ring in the groove in the pump body and fit the end plate with the machined face towards the rotor.

12. Locate a new filter body sealing ring in the groove and fit the filter assembly to the oil pump. Fit a new aluminium washer to the centre bolt and tighten to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.).

OP 6600-B OIL PUMP OVERHAUL
(Includes 6600-A and A1)

OP 6675-A SUMP AND/OR GASKET – REPLACE

To Remove

1. Remove engine as described in OP 6000-C.

2. Remove the sump gasket.

3. Clean the sump and cylinder block faces and remove the cork packing strips.

To Replace

Apply sealer ESEE-M4G-1008A to the front cover and rear oil seal carrier to cylinder block joints, and also to the ends of the grooves in the front cover and rear oil seal carrier. Then fit new sump gasket, followed by the cork packing strips. Refit the sump and tighten the bolts following the procedure described on page 37.

5. Refit the engine assembly in the car as described in OP 6000-C.

OP 6675-A1 EXTRA: TIMING CHAIN TENSIONER – REMOVE AND INSTALL

To Remove

1. Remove the timing chain tensioner and tensioner arm.

To Replace

2. Locate the tensioner arm on the pivot pin and fit the tensioner. Tighten the bolts to a torque of 5 to 7 lb. ft. (0.69 to 0.97 kg.m.).

OP 6675-A3 EXTRA: ALL MAIN BEARING CLEARANCES – CHECK
(with sump removed)

See Operation No. 6000-C13, but support the crankshaft, with a jack adjacent to the bearing being measured, to transfer the clearance to the bottom of the journal.

OP 6675-A4 EXTRA: ALL MAIN BEARING LINERS AND/OR THRUST WASHERS – REMOVE AND INSTALL (with sump removed)

See Operation No. 6000-C14

OP 6675-A5 EXTRA: ALL MAIN BEARING LINERS AND THRUST WASHERS – CHECK CLEARANCES AND RENEW (with sump removed)

See Operation No. 6000-C15, but support the crankshaft, with a jack adjacent to the bearing being measured, to transfer the clearance to the bottom of the journal.

OP 6675-A6 EXTRA: ALL CONNECTING ROD LINERS – REMOVE AND INSTALL
(with sump removed)

See Operation No. 6000-C12

OP 6675-A7 EXTRA: ONE PISTON, CONNECTING ROD AND RINGS ASSEMBLY – REMOVE AND INSTALL
(Includes remove and install cylinder head. Does not include any dismantling of piston, connecting rod and rings assembly)

Tools Required

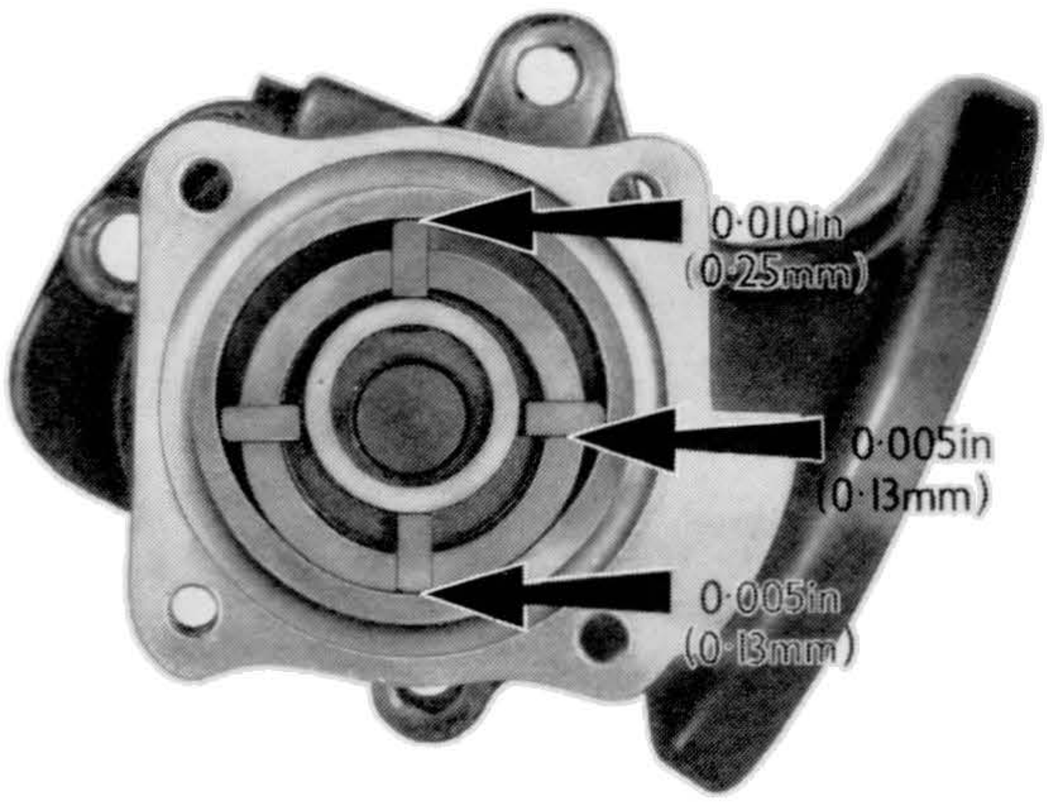
38 U 3	Piston ring squeezer
PT.4063	Cylinder head gasket locating studs

To Remove

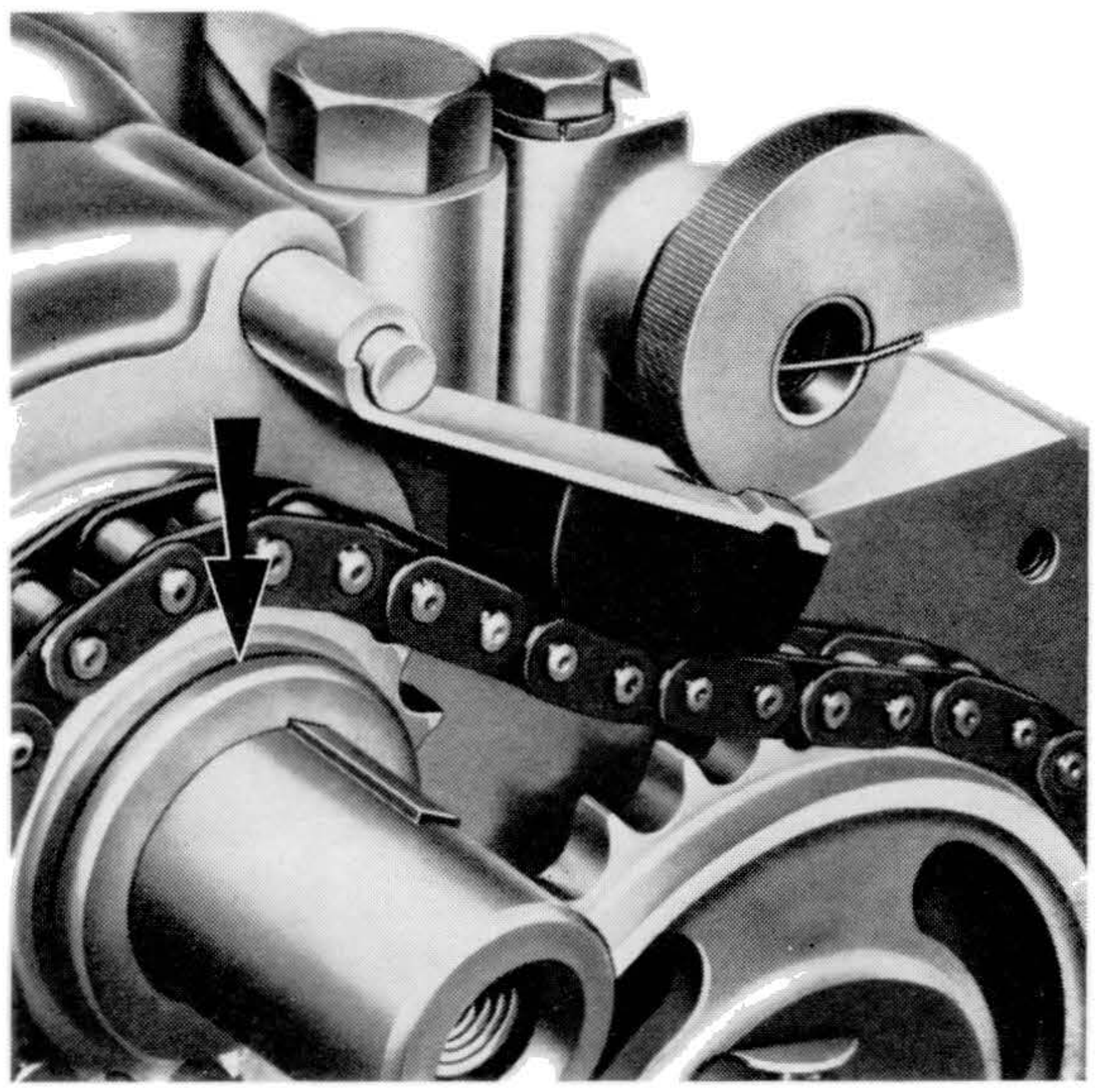
1. Remove the cylinder head, see Operation No. 6051-A sub-sections 1 to 14.
2. Unscrew the big end bolts several turns and tap them to release the cap. Completely unscrew the bolts and remove the big end cap. Push the piston out of the bore and withdraw the assembly.

To Replace

3. Position the oil control ring gap to the rear and the top and second compression ring gaps at 180° and 90° to this. Compress the rings using Tool No. 38 U 3 and push the piston into its cylinder bore with the arrow on the crown pointing towards the front of the engine.
4. Turn the crankshaft as necessary to fit the connecting rod big end to the crank pin. Tighten the connecting rod bolts to a torque of 30 to 35 lb. ft. (4.15 to 4.84 kg.m.).
5. Refit the cylinder head, see Operation No. 6051-A sub-sections 15 to 30.



Checking the Vane and Rotor Clearances



The Timing Chain Tensioner

OP 6675-A8 EXTRA: EACH ADDITIONAL PISTON, CONNECTING ROD AND RINGS ASSEMBLY - REMOVE AND INSTALL
(with cylinder head removed)

1. Remove and install each additional piston, connecting rod and rings assembly, see Operation No. 6675-A7 sub-sections 2 to 4.

OP 6675-A9 EXTRA: EACH SET OF PISTON RINGS - RENEW
(with piston, connecting rod and rings assembly removed)
(Includes checking ring gaps and cleaning ring grooves)

Tools Required

Piston ring groove cleaner

1. Remove the piston rings.
2. Clean the ring grooves in the piston with a proprietary ring groove cleaner.
3. Locate the piston rings in the unworn portion of the cylinder bore and check the ring gaps, which should be between 0.009 to 0.014 in. (0.23 to 0.36 mm.).
4. Fit the piston rings, fitting the oil control ring first, followed by the lower and then the upper compression rings. Ensure that the compression rings are fitted the correct way up.
5. Check piston ring to groove clearances which should be as follows:—

Upper compression ring Lower compression ring ...	0.0016 to 0.0036 in. (0.041 to 0.091 mm.)
Oil control ring	0.0018 to 0.0038 in. (0.046 to 0.097 mm.)

OP 6675-A10 EXTRA: EACH PISTON, PIN AND RINGS ASSEMBLY - RENEW
(with piston, connecting rod and rings assembly removed)
(Includes check piston fit with pull gauge, checking ring gaps and fitting rings to piston)

Checking the Piston Ring Gap

Checking the Piston Ring to Groove Clearance

Tools Required

512 Piston pull scale

1. Extract the two piston pin circlips and, after heating the assembly in hot oil or water to approximately 80°C, push the pin out of the piston. Separate the piston and connecting rod.

2. Select a new piston pin and ring assembly, and check the piston fit with a piston pull scale. Re-select pistons as necessary until the correct fit is obtained.

Model	*Blade Thickness*	*Piston Pull*	*Clearance*
1,300 c.c. ...	0.0025 in. (0.064 mm.)	7 to 11 lb. (3.18 to 4.54 kg.)	0.0019 to 0.0025 in. (0.048 to 0.064 mm.)
1,600 c.c. ...	0.0020 in. (0.050 mm.)	7 to 11 lb. (3.18 to 4.54 kg.)	0.0013 to 0.0019 in. (0.033 to 0.048 mm.)

NOTE – The pistons and piston pins are matched assemblies and must not be interchanged.

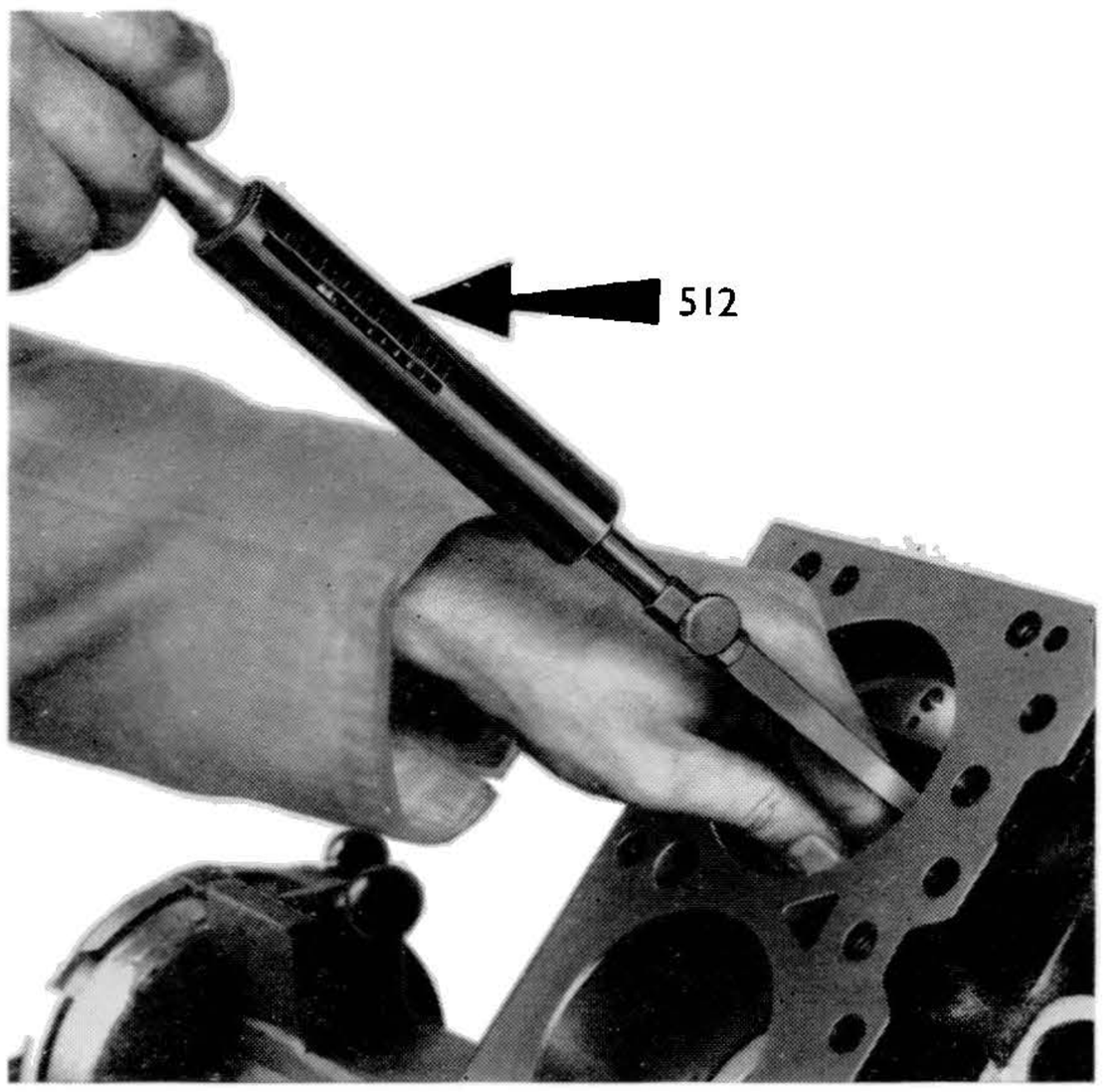
3. Assemble the piston to the connecting rod. Ensure that the "FRONT" marking on the connecting rod is on the same side of the assembly as the direction of the arrow in the piston crown. Heat the piston in water or oil prior to inserting the piston pin. Retain the piston pin with the circlips.

4. Locate the piston rings in the unworn portion of the cylinder bore and check the ring gaps, which should be between 0.009 to 0.014 in. (0.23 to 0.36 mm.).

5. Fit the piston rings, fitting the oil control ring first, followed by the lower and then the upper compression rings. Ensure that the compression rings are fitted the correct way up.

OP 6675-A11 EXTRA: EACH CONNECTING ROD AND/OR PISTON PIN – RENEW
(with piston connecting rod and rings assembly removed)
(Includes measuring size of piston pin)

1. Extract the two piston pin circlips and push the pin out of the piston. Separate the piston and connecting rod.



Selecting a Piston with a Pull Scale

2. Select a new connecting rod to maintain the correct assembly weight, or alternatively select a new piston pin to give the correct fit in the piston and small end.

3. Assemble the piston to the connecting rod. Ensure that the "FRONT" marking on the connecting rod is on the same side of the assembly as the direction of the arrow in the piston crown. Heat the piston in water or oil prior to inserting the piston pin. Retain the piston pin with the circlips.

OP 6675-B TIMING CHAIN TENSIONER – REMOVE AND INSTALL
(Includes 6675-A and A1)

OP 6675-C MAIN BEARING CLEARANCES – ALL – CHECK
(Includes 6675-A, A1 and A3)

OP 6675-D MAIN BEARING LINERS – ALL – RENEW
(Includes 6675-A, A1 and A4)

OP 6675-E MAIN BEARING LINERS – ALL – CHECK AND RENEW
(Includes 6675-A, A1 and A5)

OP 6675-F CONNECTING ROD LINERS – ALL – RENEW
(Includes 6675-A, A1 and A6)

OP 6675-G PISTON RINGS – ONE PISTON – REMOVE AND INSTALL
(Includes 6675-A and A9)

OP 6675-H PISTON RINGS – ALL – REMOVE AND INSTALL
(Includes 6675-A, A7, A8 and A9)

OP 6675-I PISTON – ONE – REMOVE AND INSTALL
(Includes 6675-A, A7 and A10)

OP 6675-J PISTONS – ALL – REMOVE AND INSTALL
(Includes 6675-A, A7, A8 and A10)

OP 6675-K CONNECTING ROD AND/OR PISTON PIN – ONE – REMOVE AND INSTALL
(Includes 6675-A, A7 and A11)

OP 6675-L CONNECTING RODS AND PISTON PINS – ALL – REMOVE AND INSTALL
(Includes 6675-A, A7, A8 and A11)

OP 6675-M SUMP BOLTS – TORQUE
(Includes removing and installing any components necessary to gain access to all the sump bolts)

1. Remove the sump shield if fitted.

2. Tighten the sump bolts following the procedure described on page 37.

   NOTE – Access to the two rear bolts will be facilitated by the use of a $\frac{3}{8}$ in. square drive socket.

3. Refit the sump shield if fitted.

OP 6731-A OIL FILTER ELEMENT – RENEW
(Does not include change engine oil)

1. Unscrew the securing bolt and withdraw the filter body and element.
2. Remove the sealing ring from the groove in the filter body mounting flange and the washer from the securing bolt.
3. Thoroughly clean the filter body.
4. Insert the new element into the body and fit the sealing ring, supplied with the element, to the groove in the filter body mounting flange.

   NOTE – Do not fit the ring at one point and then work it round the groove, as the rubber may stretch, thus leaving a surplus which may cause an oil leak.
5. Refit the filter assembly to the oil pump body and tighten the securing bolt to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.).

OP 6731-B OIL FILTER ELEMENT AND ENGINE OIL – RENEW

1. Remove the sump plug and drain the engine oil while it is hot.
2. Renew the oil filter, see Operation No. 6731-A.
3. Refit the sump drain plug and tighten to a torque of 20 to 25 lb. ft. (2.76 to 3.46 kg.m.).
4. Refill the sump with an approved grade of engine oil, see Lubrication and Maintenance section.

OP 6900-A OIL PRESSURE SWITCH OR GAUGE SENDER UNIT – REMOVE AND INSTALL

To Remove

1. Raise the bonnet and fit wing covers.
2. Disconnect the lead.
3. Unscrew the switch or sender unit.

To Replace

4. Refit the switch or sender unit.
5. Connect the lead.
6. Remove the wing covers and lower the bonnet.

OP 6900-A1 EXTRA: OIL PRESSURE – CHECK
(with switch or sender unit removed)

Tools Required

500 X Gang Gauge

1. Remove the switch or sender unit, see Operation No. 6900-A sub-operations 1 to 3.

2. Connect a suitable gauge, such as gang gauge Tool No. 500 X, to the oil pressure tapping.
3. Start engine and increase speed to record maximum pressure. If necessary warm up engine before taking final reading.
4. Remove the gauge after stopping the engine.
5. Refit the switch or sender unit, see Operation No. 6090-A sub-operations 4 to 6.

OP 6900-B TEMPERATURE GAUGE OR WARNING LIGHT SENDER UNIT – REMOVE AND INSTALL

To Remove

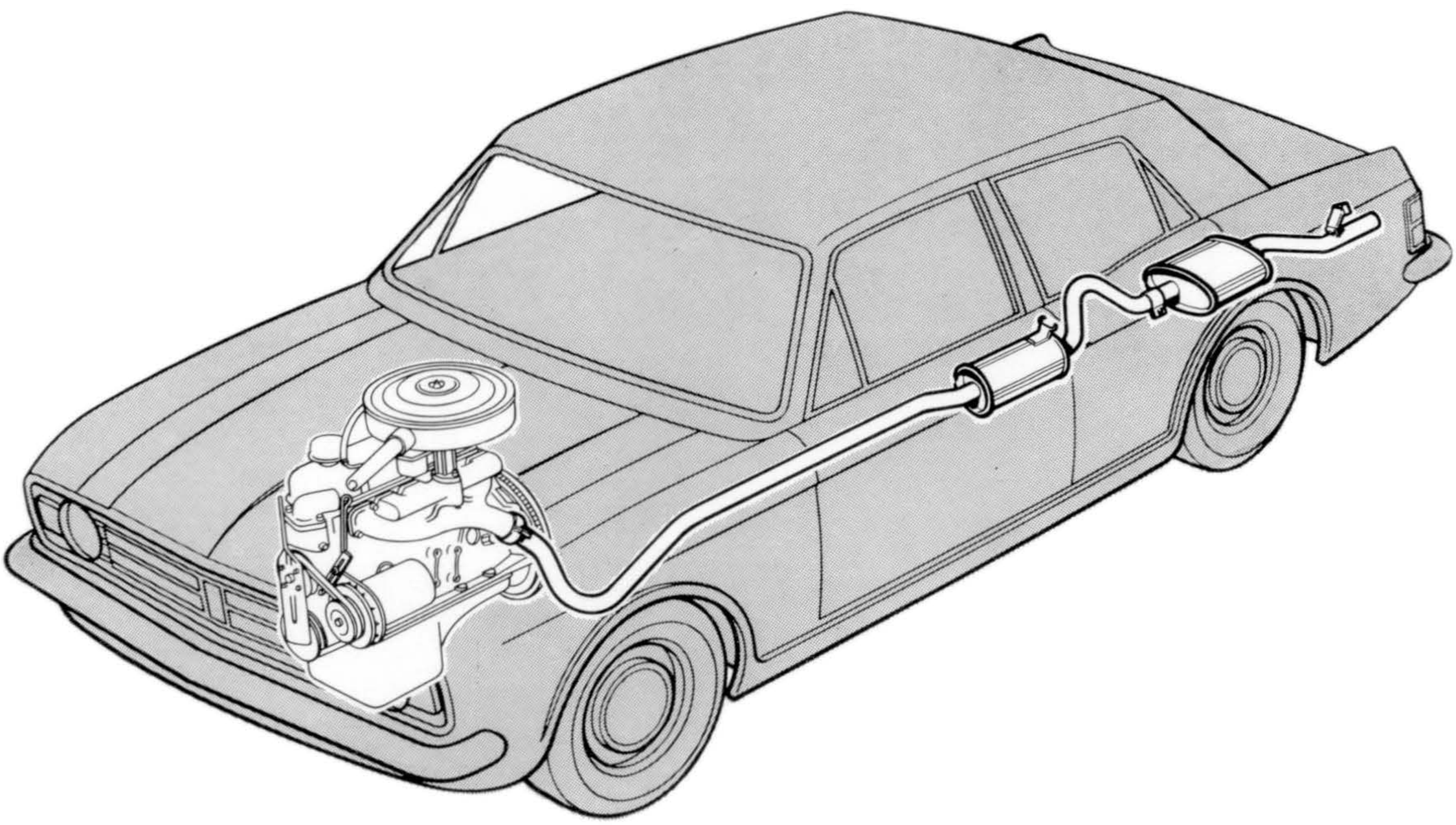
1. Raise the bonnet and fit wing covers.
2. Disconnect the lead.
3. Ensure that the radiator filler cap is secure and remove the sender unit.

To Replace

4. Install the sender unit and top-up the radiator if any coolant has been lost.
5. Reconnect the lead.
6. Remove the wing covers and close the bonnet.

6/2

EXHAUST SYSTEM



SECTION INDEX

GENERAL DESCRIPTION

CLEARANCE DIMENSIONS

SERVICE AND REPAIR OPERATIONS

OPERATION 5220-A EXHAUST SYSTEM – RENEW

,, 5230-A EXHAUST SYSTEM INLET PIPE ASSEMBLY – RENEW

,, 5231-A EXHAUST SYSTEM OUTLET PIPE ASSEMBLY – RENEW

GENERAL DESCRIPTION

The exhaust system is in two parts consisting of an inlet pipe and front muffler assembly and a rear muffler and tailpipe assembly. The exhaust is routed along the driveshaft tunnel to the front muffler then over the rear axle to the rear muffler and tailpipe alongside the fuel tank. The suspension of the front muffler assembly is by two rubber "O" rings hooked on brackets, welded to thə floor pan and muffler assembly. On 1,300 c.c. saloons and all estate cars the rear muffler suspension is by a support strap attached to the side rail and tailpipe. All other variants have two "O" rings hooked onto brackets, bolted to the side rail and tailpipe.

A different inlet pipe and front muffler assembly is used for each engine, to allow for the change in height between the 1,300 c.c. and 1,600 c.c. engines, and the differences in the position of the rear muffler and tailpipe.

The inlet pipe and front muffler assembly is attached to the exhaust manifold by a new style clamp and sealing ring. The front muffler assembly and rear muffler assembly are securely fastened together by either a 'U' bolt or a steel strap type clamp.

The various different front and rear muffler assemblies can be identified by the Part Number marking on the muffler.

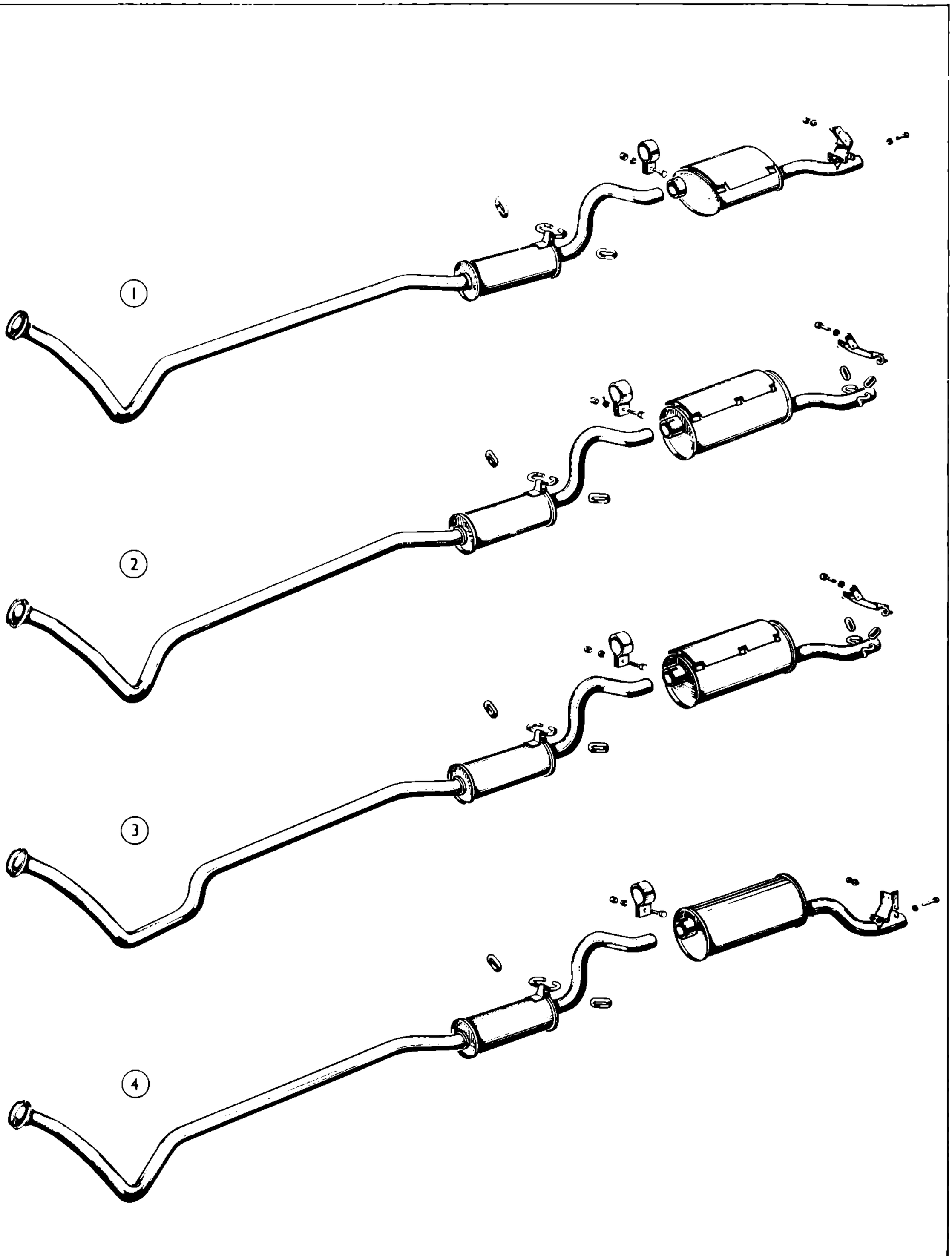
Model	*Front Muffler Assembly*	*Colour Code*	*Rear Muffler Assembly*	*Colour Code*
1,300 c.c. saloon—Manual	69BB-5230-C1A -C2A	Red	69BB-5232-B1A -B2A	Red
—Automatic ...	69BB-5230-E1A -E2A	Green	69BB-5232-C1A -C2A	Yellow
1,300 c.c. estate car—Manual ...	69BB-5230-F1A -F2A	Blue	69BB-5232-D1A -D2A	Blue
1,600 c.c. saloon—Manual and Auto				
—R.H.D. ...	69BB-5230-D1A -D2A	Yellow	69BB-5232-C1A -C2A	Yellow
—L.H.D. ...	69BB-5230-E1A -E2A	Green	69BB-5232-C1A -C2A	Yellow
1,600 c.c. estate car—Manual and Auto	69BB-5230-G1A	Orange	69BB-5232-D1A	Blue
—R.H.D. ...	-G2A		-D2A	
—L.H.D. ...	69BB-5230-M1A -M2A	Blue/Orange	69BB-5232-D1A -D2A	Blue
G.T. and 1600E—R.H.D. ...	69BB-5230-T1A -T2A	Violet	69BB-5232-E1A -E2A	Violet/Green

CLEARANCE DIMENSIONS

1,300 and 1,600 c.c. ALL MODELS EXCEPT G.T. and 1600E	A clearance of 2.00 in. (5.08 cm.) must be provided between the exhaust inlet pipe and the chassis side rail.
G.T. and 1600E	A clearance of 0.75 in. (1.95 cm.) must be provided between the exhaust inlet pipe and the handbrake attachment bracket.
ESTATE CARS	A clearance of 1.10 in. (2.79 cm.) must be provided between the exhaust tail pipe and the rear skirt panel.
1,300 and 1,600 c.c. SALOONS	A clearance of 0.75 in. (1.95 cm.) must be provided between the exhaust tail pipe and the rear skirt panel.

Tightening Torques lb. ft. (kg.m.)

Exhaust manifold clamp nuts — except GT ...	15 to 20 (2.1 to 2.8)
Exhaust manifold clamp nuts — GT only	6 to 8 (0.85 to 1.1)
Rear muffler clamp — steel strip type ...	12 to 15 (1.7 to 2.1)
Rear muffler clamp — 'U' bolt type	10 to 12 (1.4 to 1.7)



1. 1300cc Manual
2. 1600cc Manual
3. 1300/1600cc Automatic
4. 1300/1600cc Estate Car

Exhaust System — All models except G.T.

SERVICE AND REPAIR OPERATIONS

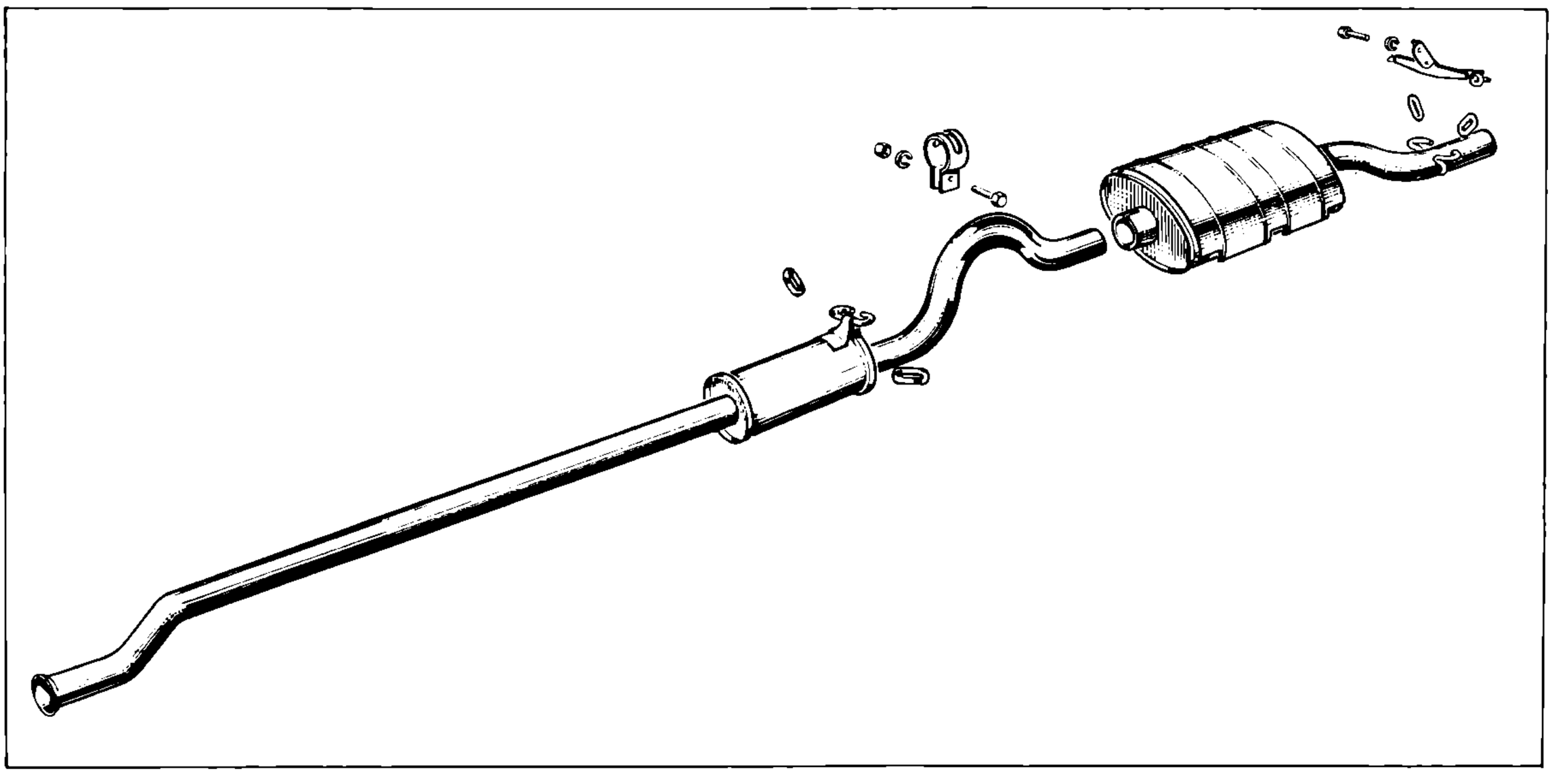
OP 5220-A EXHAUST SYSTEM – RENEW

To Remove

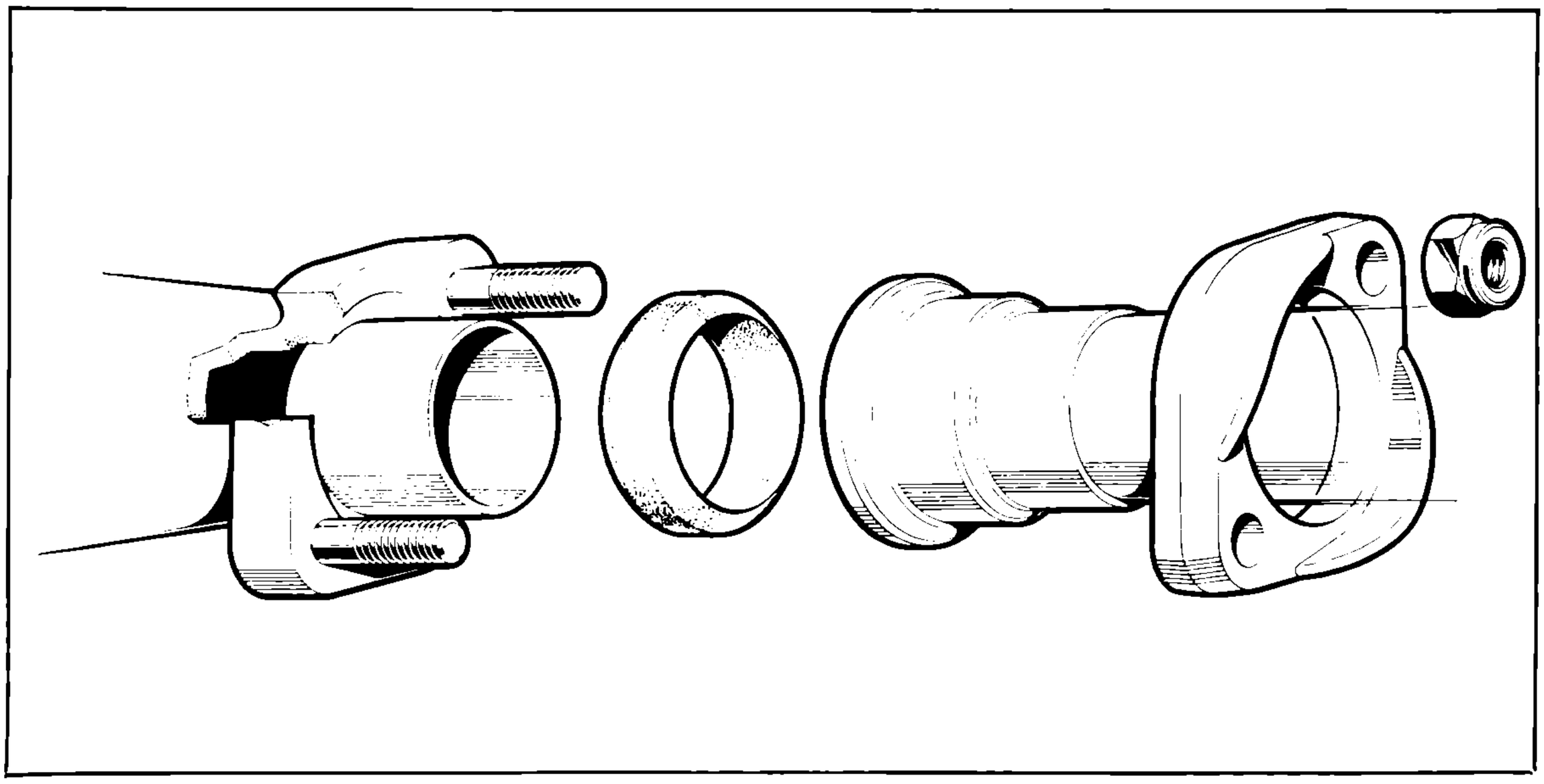
1. Jack up the car, support on stands and remove the jack.
2. Slacken the clamp at the inlet pipe to rear muffler.
3. Where fitted, unscrew the bolts from the tailpipe bracket to disconnect the support strap and reinforcing plate. Alternatively, unhook the rear 'O' rings.
4. Remove the rear muffler assembly.
5. Remove the inlet pipe to exhaust manifold clamp and sealing ring.
6. Unhook front muffler 'O' rings and remove front assembly from the car.

To Install

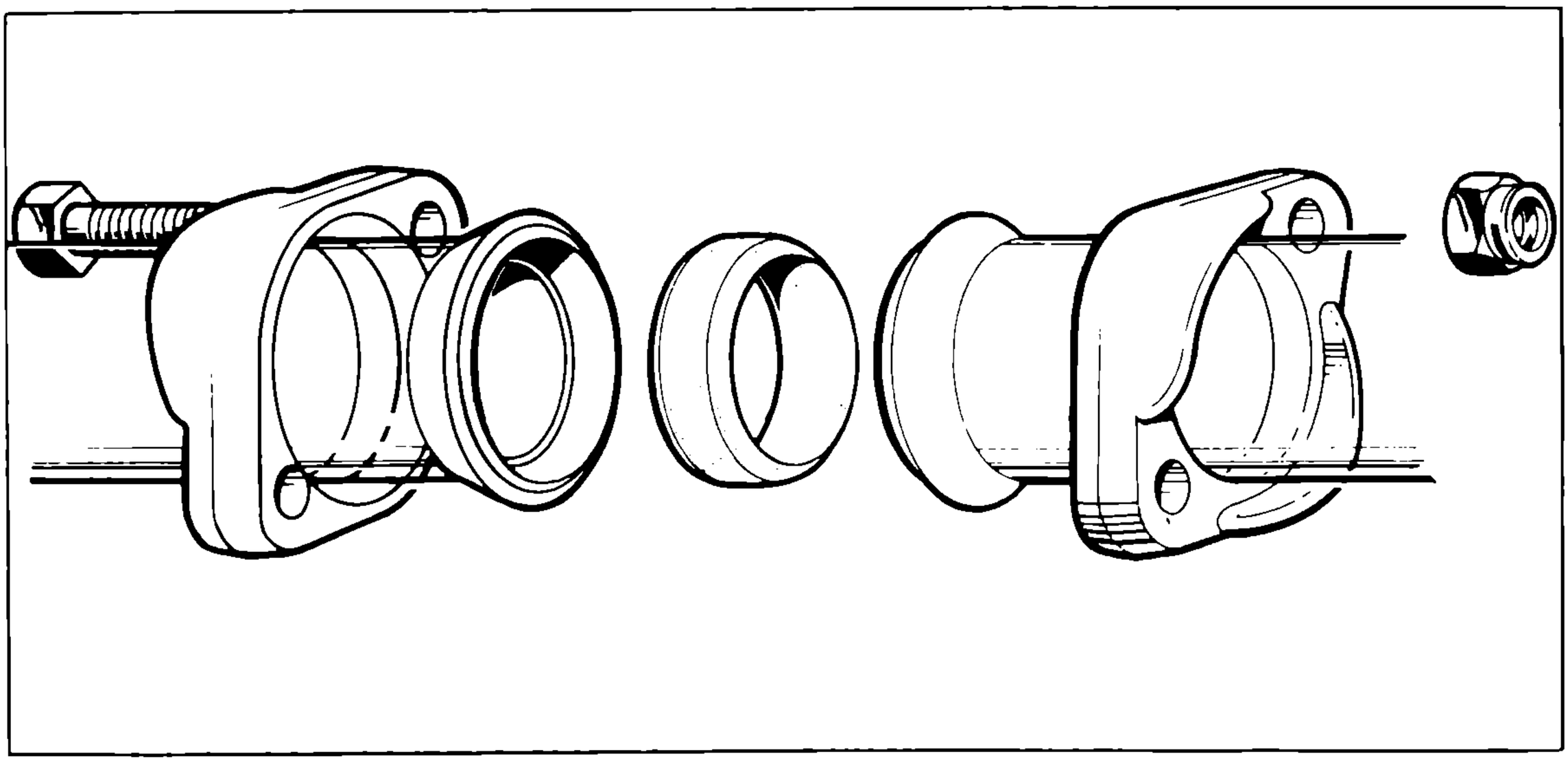
7. Fit the 'O' rings to the front muffler assembly and body bracket.
8. Fit the spacer and sealing ring in front of the inlet pipe.
9. Fit the front of the inlet pipe to the exhaust manifold, and secure lightly with the clamp.
10. Locate the clamp over the rear muffler stub and assemble the rear muffler to the front muffler up to the location pip.
11. Fit the rear 'O' rings or rear support strap and reinforcing plate.
12. Align the exhaust system using the dimensions shown above, and tighten the manifold clamp nuts and the rear muffler clamp to the specified torques.
13. Start the engine and check for exhaust leaks.
14. Jack up the car, remove the stands and lower the car to ground.



Exhaust System — G.T.



Exhaust Manifold Clamp except 1600E & G.T.



Exhaust Manifold Clamp 1600E & G.T.

OP 5230-A INLET PIPE AND FRONT MUFFLER – RENEW

To Remove

1. Jack up the car, support on stands and remove jack.
2. Slacken the clamp at the inlet pipe to rear muffler joint and slide forward.
3. Remove the inlet pipe to exhaust manifold clamp and sealing ring.
4. Unhook the 'O' rings supporting the front muffler.
5. Disconnect the inlet pipe from the rear muffler and remove the front assembly.

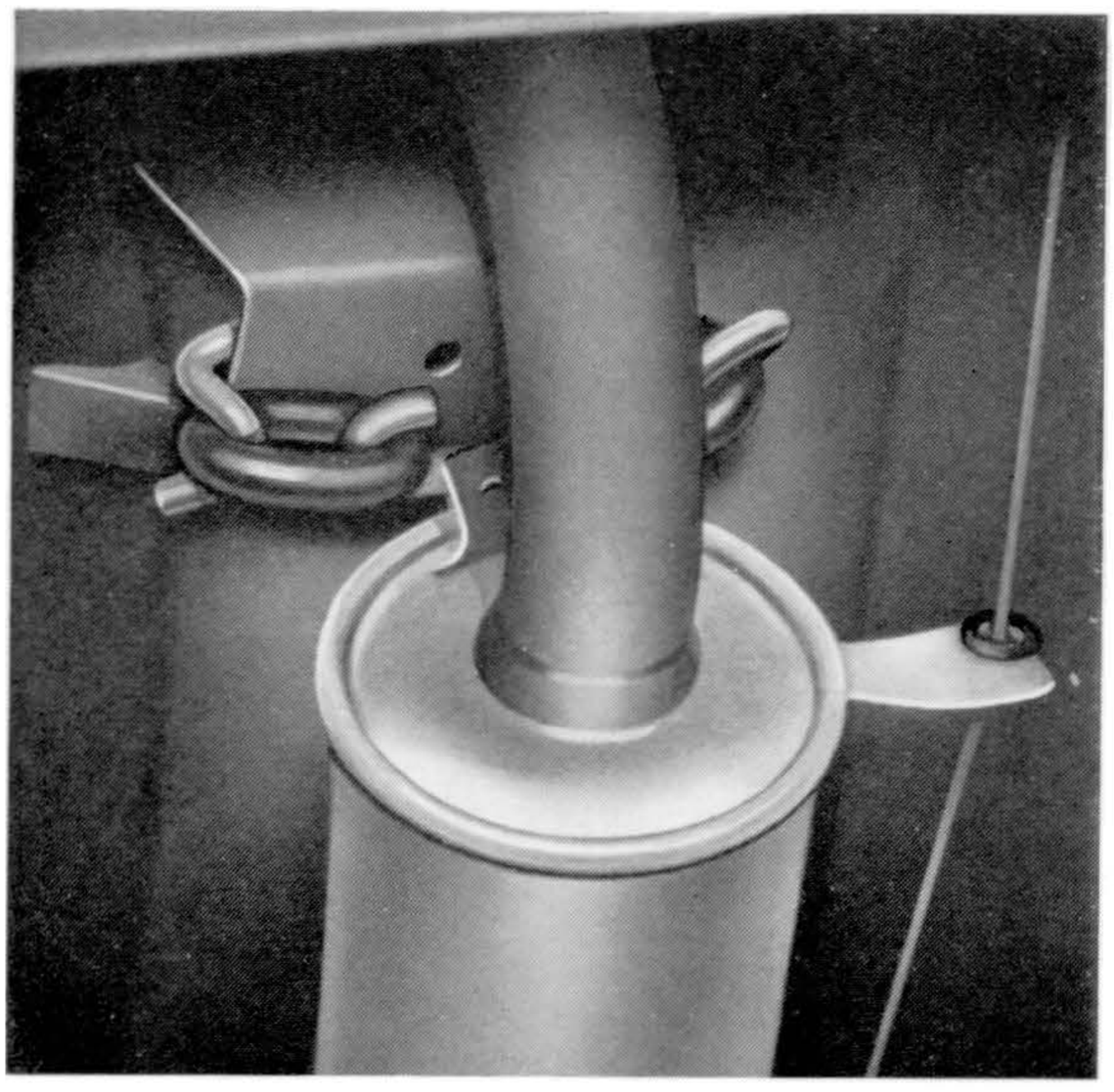
To Install

6. Position the front muffler assembly beneath the car, with the clamp located on the rear muffler stub, insert into the rear muffler assembly up to the location pip.
7. Fit 'O' rings to the brackets to support the front muffler.
8. Fit the spacer and sealing ring in front of the inlet pipe.
9. Fit the front of the inlet pipe to the exhaust manifold and secure lightly with the clamp.
10. Align the exhaust system using the dimensions shown overleaf, and tighten the manifold clamp nuts and the rear muffler clamp to the specified torques.
11. Start the engine and check for exhaust leaks.
12. Jack up the car, remove the stands and lower the car to the ground.

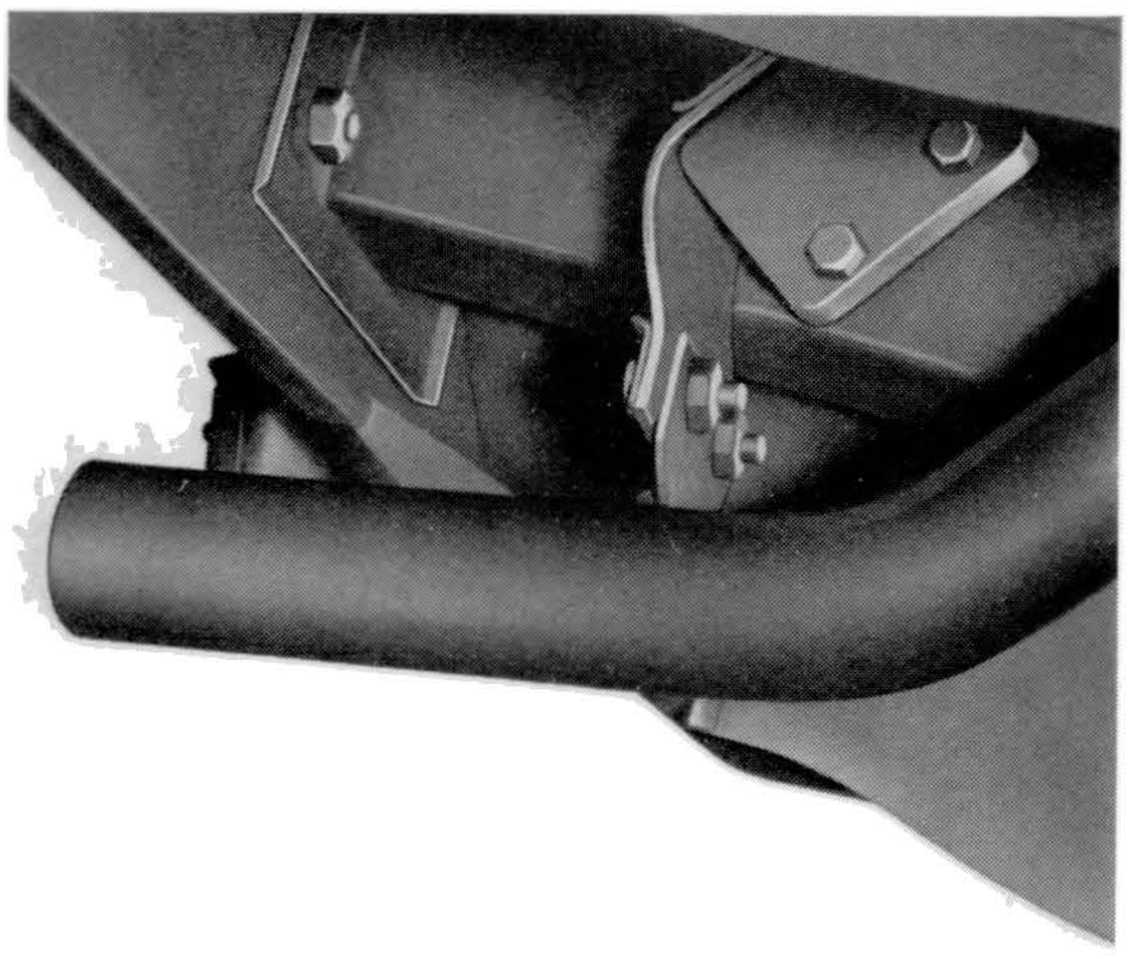
OP 5231-A REAR MUFFLER AND TAILPIPE – RENEW

To Remove

1. Jack up the car, support on stands and remove the jack.
2. Slacken the clamp at the inlet pipe to rear muffler.



Front Muffler Support Bracket



Tail Pipe Support Strap

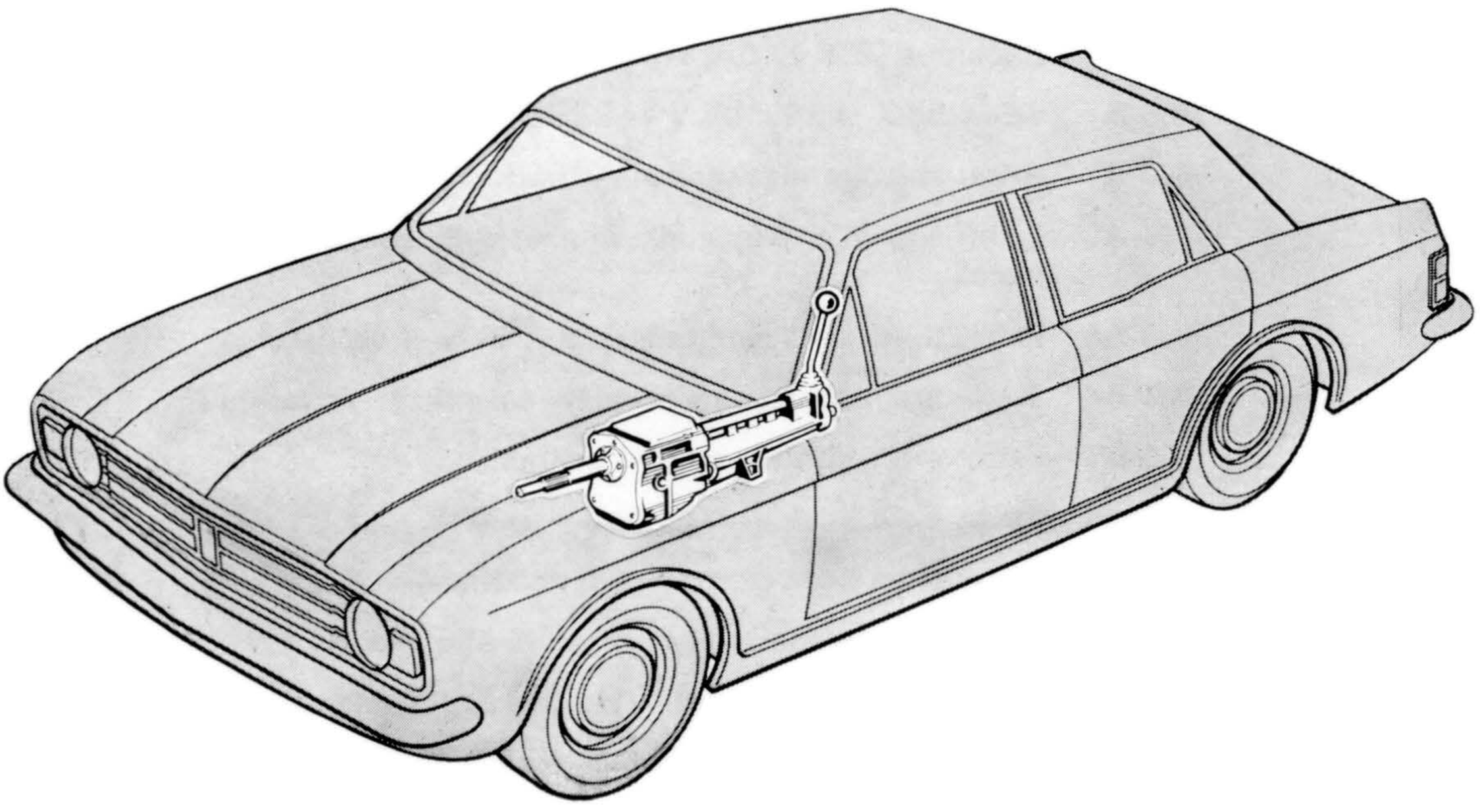
3. Where fitted, unscrew the bolts from the tailpipe bracket to disconnect the strap and reinforcing plate. Alternatively, unhook the rear 'O' rings.
4. Disconnect the rear muffler and tailpipe and remove the assembly.

To Install

5. Locate the clamp over the rear muffler stub and assemble the rear muffler to the front muffler up to the location pip.
6. Connect the support strap or 'O' rings.
7. Align the exhaust system with the dimensions shown overleaf, and tighten the rear muffler clamp to the specified torques.
8. Start the engine and check for exhaust leaks.
9. Jack up the car, remove the stands and lower the car to the ground.

7/1

CLUTCH and GEARBOX



SECTION INDEX

GENERAL DESCRIPTION

OPERATION	7000-A	GEARBOX AND CLUTCH HOUSING ASSEMBLY — REMOVE AND INSTALL
,,	7000-A1	Extra: clutch release bearing—renew
,,	7000-A2	Extra: clutch pressure plate and/or disc — remove and install
,,	7000-A3	Extra: clutch pilot bearing — renew
,,	7000-A6	Extra: main drive gear bearing retainer oil seal — renew
,,	7000-A7	Extra: extension housing rear oil seal — renew
,,	7000-A8	Extra: extension housing rear bush — renew
,,	7000-B	**CLUTCH RELEASE BEARING — RENEW** (Includes OPS 7000-A and A1)
,,	7000-C	**CLUTCH DISC AND/OR PRESSURE PLATE — REMOVE AND INSTALL** (Includes OPS 7000-A and A2)
,,	7000-D	**CLUTCH PILOT BEARING — RENEW** (Includes OPS 7000A, A2 and A3)
,,	7003-A	GEARBOX ASSEMBLY — REMOVE AND INSTALL
,,	7003-A1	Extra: selector mechanism — overhaul
,,	7003-A2	Extra: extension housing and mainshaft assembly — remove and install
,,	7003-A3	Extra: third top synchroniser assembly — overhaul
,,	7003-A4	Extra: first/second synchroniser assembly — overhaul
,,	7003-A5	Extra: extension housing — overhaul
,,	7003-A6	Extra: main drive gear oil seal — renew
,,	7003-A7	Extra: main drive gear remove and install
,,	7003-A8	Extra: countershaft gear — remove and install
,,	7003-A9	Extra: reverse idler gear — remove and install
,,	7003-A10	Extra: reverse selector fork — remove and install
,,	7003-B	**SELECTOR MECHANISM — OVERHAUL** (Includes 7003-A and A1)
,,	7003-C	**THIRD/TOP SYNCHRONISER ASSEMBLY — OVERHAUL** (Includes 7003-A, A1, A2 and A3)
,,	7003-D	**FIRST/SECOND SYNCHRONISER ASSEMBLY — OVERHAUL** (Includes 7003-A, A1, A2 and A4)
,,	7003-E	**MAIN DRIVE GEAR BEARING RETAINER OIL SEAL — RENEW** (Includes 7003-A and A6)

OPERATION	7003-F	**MAIN DRIVE GEAR — REMOVE AND INSTALL** (Includes 7003-A, A1, A6 and A7)
,,	7003-G	**COUNTERSHAFT GEAR — REMOVE AND INSTALL** (Includes 7003-A, A1, A2, A6, A7, and A8)
,,	7003-H	**REVERSE IDLER GEAR — REMOVE AND INSTALL** (Includes 7003-A, A1, A2 and A9)
,,	7003-J	**REVERSE SELECTOR FORK — REMOVE AND INSTALL** (Includes 7003-A, A1, A2, A9, and A10)
,,	7003-K	**GEARBOX ASSEMBLY — OVERHAUL** (Includes 7003-A, A1, A2, A3, A4, A5, A6, A7, A8, A9 and A10 where applicable)
,,	7003-L	**EXTENSION HOUSING — REMOVE AND INSTALL** (Includes 7003-A, A1 and A2)
,,	7201-D	**COLUMN GEARCHANGE LINKAGE — OVERHAUL**
,,	7500-A	CLUTCH HYDRAULIC SYSTEM — BLEED
,,	7501-A	CLUTCH FLEXIBLE HYDRAULIC PIPE — RENEW
,,	7501-B	CLUTCH HYDRAULIC SLAVE CYLINDER — REMOVE AND INSTALL
,,	7501-B1	Extra: clutch hydraulic slave cylinder — overhaul
,,	7501-C	**CLUTCH HYDRAULIC SLAVE CYLINDER — OVERHAUL** (Includes 7501-B and B1)
,,	7534-A	CLUTCH HYDRAULIC MASTER CYLINDER — REMOVE AND INSTALL
,,	7534-A1	Extra: clutch hydraulic master cylinder — overhaul
,,	7534-B	**CLUTCH HYDRAULIC MASTER CYLINDER — OVERHAUL** (Includes 7534-A and A1)

GENERAL DESCRIPTION

CLUTCH

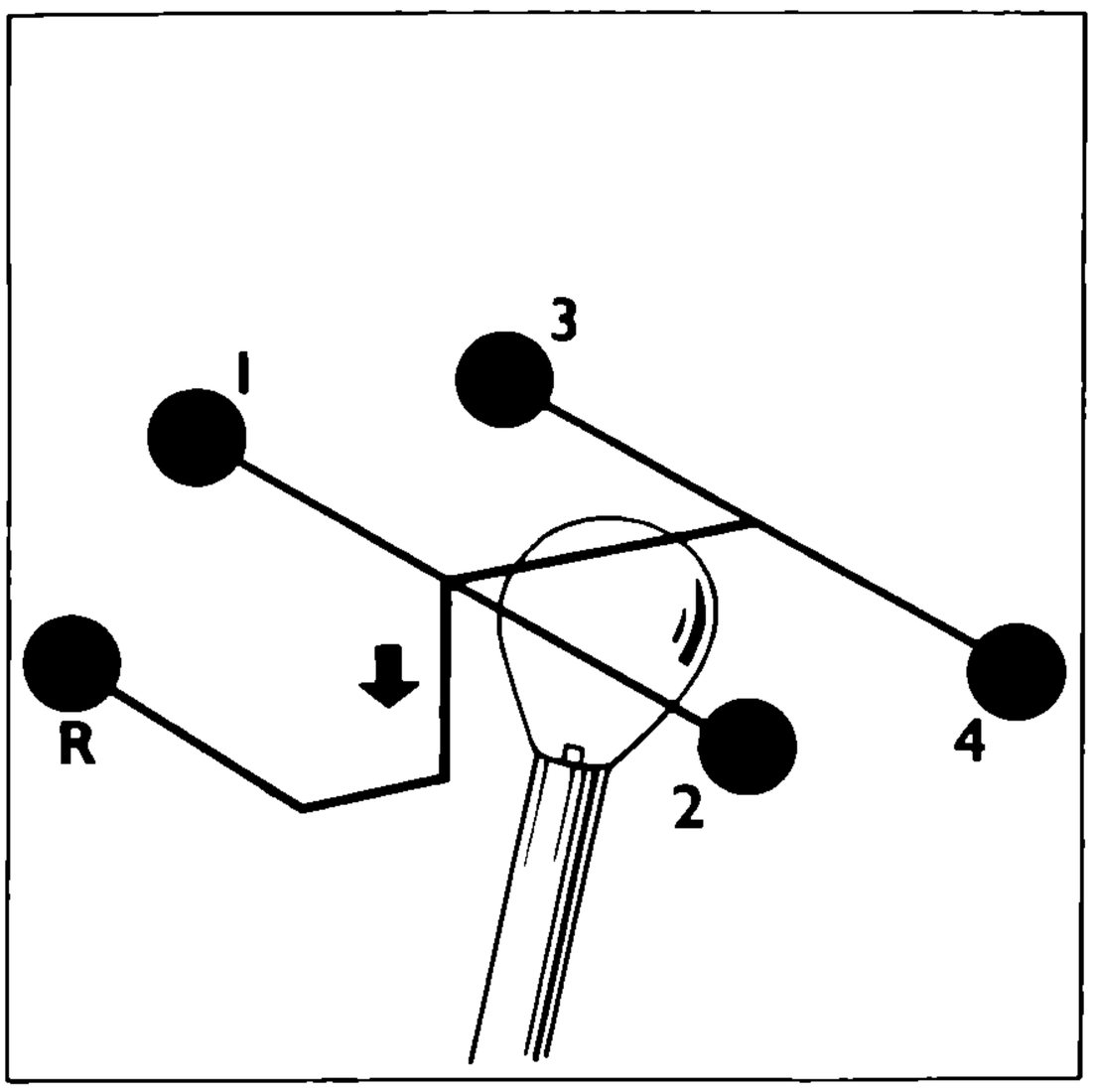
The clutch mechanism consists of a single dry plate disc with a diaphragm spring pressure plate which is bolted to the engine flywheel. The clutch release system is self-adjusting and is hydraulically actuated. A flexible pipe line connects the operating cylinder with the master cylinder bolted to the engine rear bulkhead.

The diaphragm spring is pivoted on specially shouldered pins and retained to these pins by two fulcrum rings. The spring is retained to the pressure plate by three spring steel clips which are riveted to the pressure plate. When the diaphragm's centre is moved towards the flywheel by the release bearing the diaphragm's outer edge deflects towards the gearbox causing the clutch to disengage.

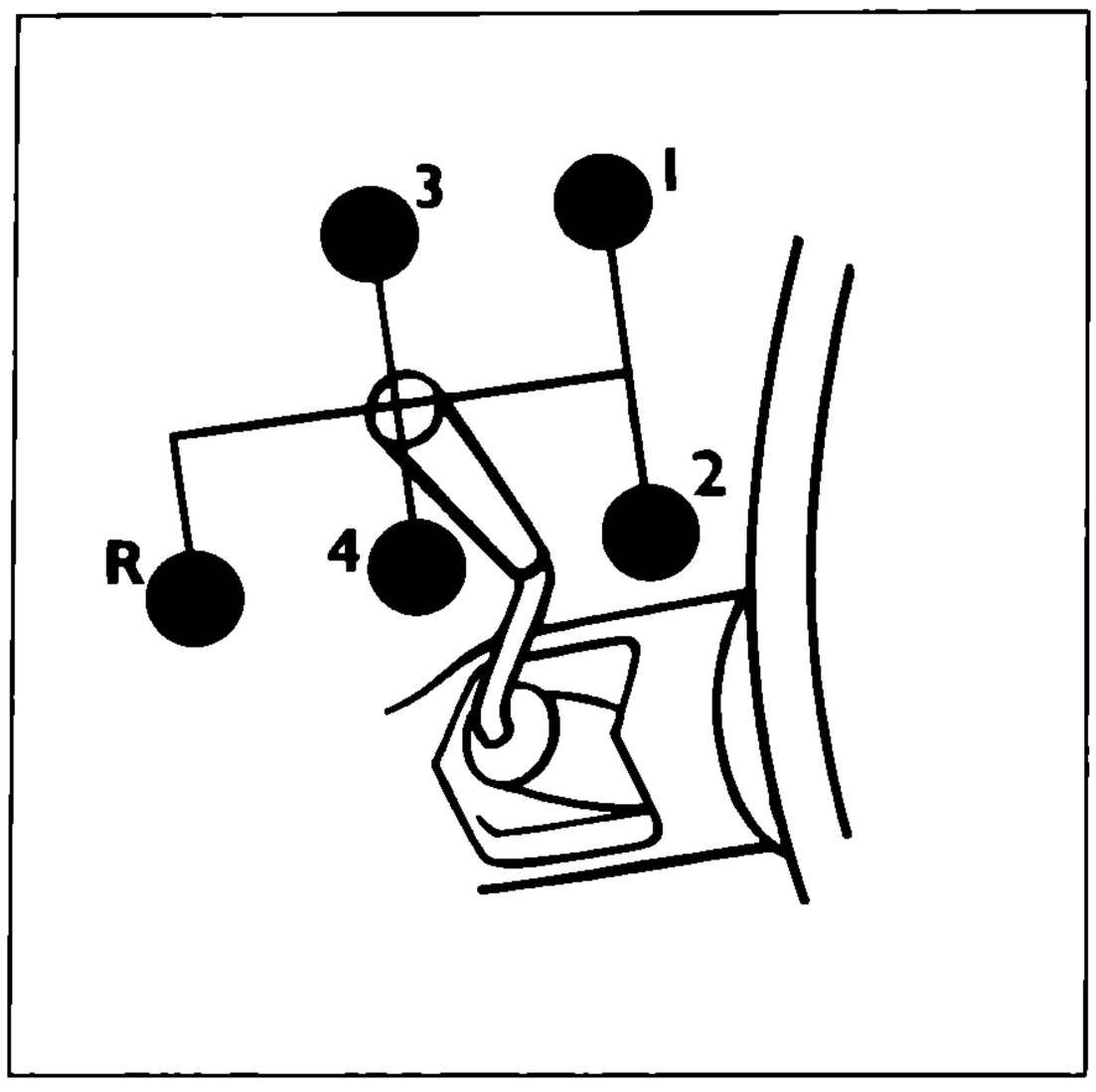
FLOOR CHANGE GEARBOX

The gearbox has four forward ratios and one reverse. All the forward gears are engaged through forged blocker ring synchromesh units.

The constant mesh gears, i.e. the main drive gear, the three other forward gears on the mainshaft and the corresponding gears on the countershaft, are helically cut to promote quiet running. The reverse gear on the countershaft incorporates straight cut spur teeth which mesh, through an idler gear, with teeth machined on the outside of the first/second gear synchroniser sleeve. Gear selection is by means of a remote floor change lever. The gear lever operates directly on the single selector rail which has pinned to it a selector lever. Movement of the gear lever, and thus the selector rail, causes the selector lever to "pick up" in the appropriate selector fork and move it to the required position. Movement of the first/second or third/top selector fork causes the appropriate synchroniser sleeve to move as necessary so that it engages with the dog teeth on the required gear. When reverse gear is required, movement of the reverse selector relay lever draws the reverse idler into mesh with both the reverse gear on the countershaft and on the mainshaft.



Gear Lever Positions — Floorchange

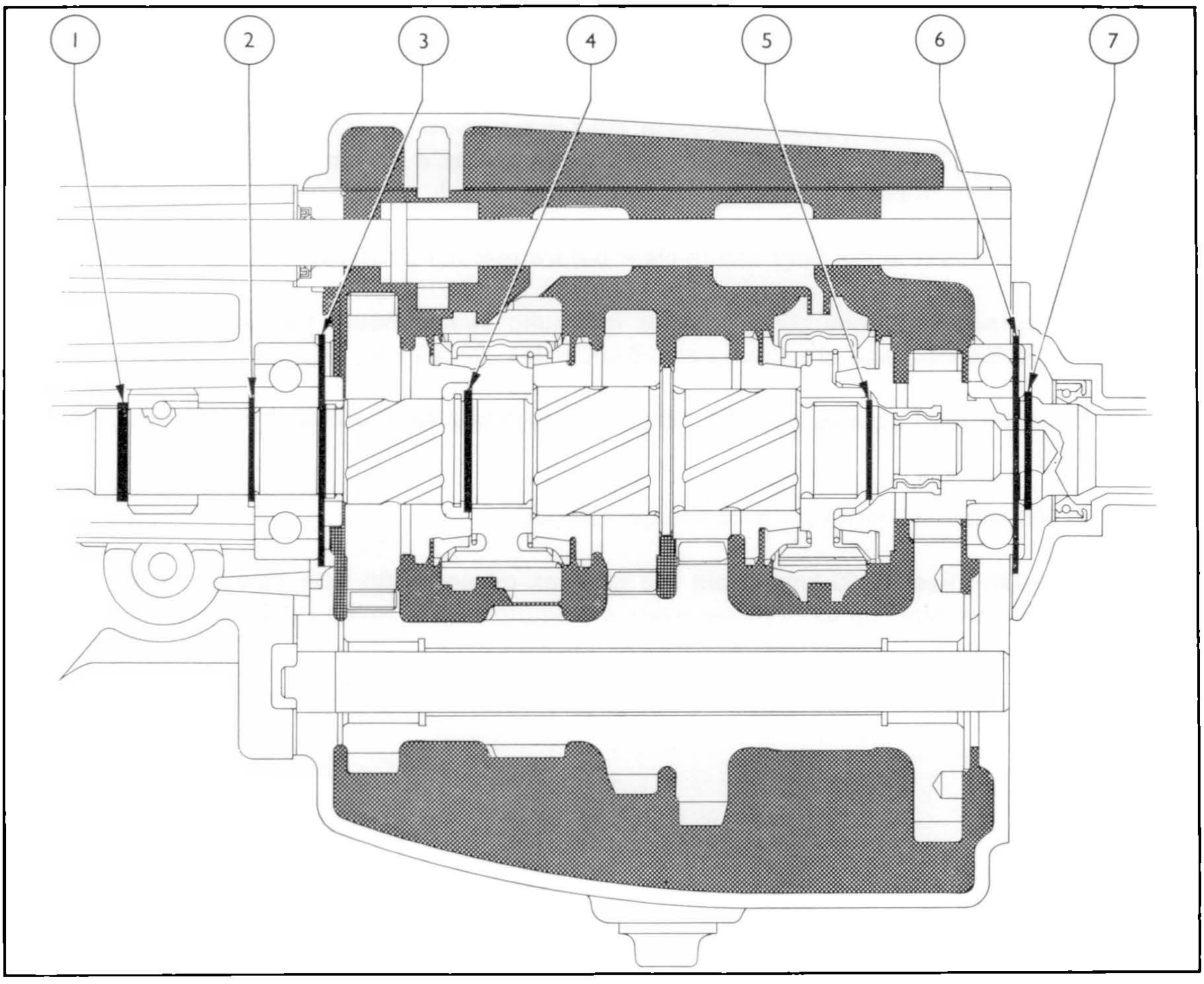


Gear Lever Positions — Column Change

Engagement of two gears at once is prevented by a guard cam pivoted in the gearbox top cover on the right-hand side. This engages with the selector forks which are not in use and holds them positively in the disengaged position. It is emphasised that the selector forks are not attached to the selector rail. The first/second and third/top forks, while they are mounted on the rail, are free to slide. Gear engagement only takes place when the selector lever locates in the appropriate fork and moves it into the required position.

Two selective circlips compensate for the tolerances which must be allowed in manufacture. Excessive end-float or backlash can be eliminated without resorting to unnecessarily close, and thus expensive, limits and fits. Whenever overhauling the gearbox, or a part of the gearbox that involves removing a circlip, always fit new circlips, never replace circlips that have been used. Of course, every care should be taken to ensure that the correct size circlip is selected and properly fitted.

Routine maintenance is confined to topping up the gearbox oil at 6,000 mile (10,000 km.) intervals. At the first 3,000 miles (5,000 km.), the gearbox oil must be drained and renewed.



Circlip Locations (2 and 3 are selective)

GEARBOX — COLUMN CHANGE

The column change gearbox is of similar design to that used previously in the Cortina Range; and is available on standard, de-luxe and super vehicles.

The gearbox has four forward ratios and one reverse. All the forward gears are engaged through forged blocker ring synchromesh units.

The constant mesh gears between the countershaft, mainshaft and main drive gear are helical to ensure quiet operation whilst reverse idler gear is spur cut and meshes with teeth cut on the outside of the first/second gear synchroniser sleeve, and cluster gear.

A column change gear lever connects a rod linkage to the selector housing mounted on top of the gearbox. The system is similar to the Corsair V4 with two distinct movements for engaging the gear and gate.

Routine maintenance is confined to topping up the gearbox oil at 6,000 mile (10,000 km.) intervals. At the first 3,000 miles (5,000 km.), the gearbox oil must be drained and renewed.

PERIODIC SERVICE ATTENTION

The clutch master cylinder fluid level should be checked at the first 3,000 miles (5,000 km.) and subsequent 6,000 mile (10,000 km.) service intervals.

Top-up to the correct level, approximately ½ in. (12.7 mm.) below the top face, with approved fluid, Part No. ME-3833-F. The cap and the area surrounding it should be wiped with a clean rag before removing the cap, to prevent dirt entering when it is removed.

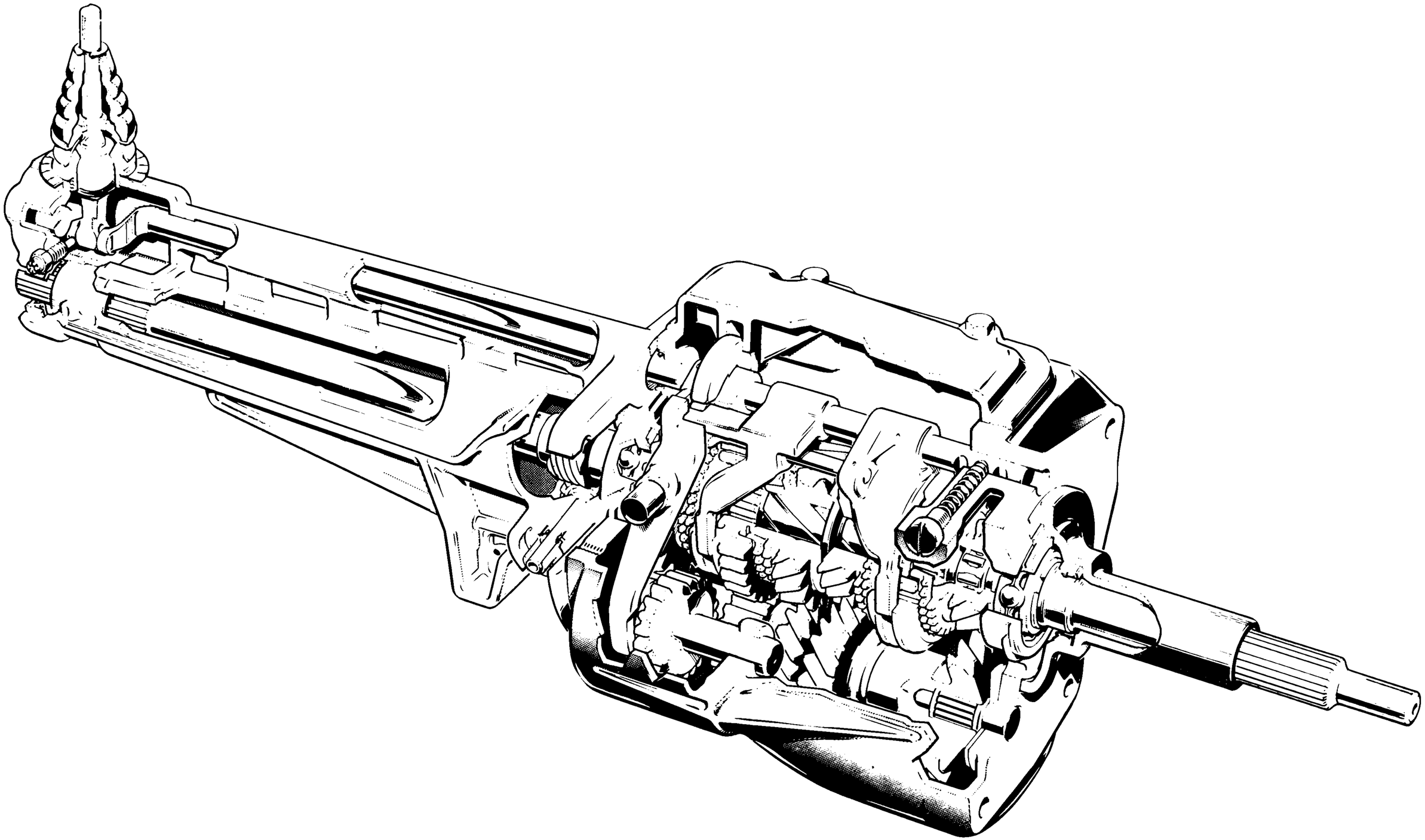
Ensure that the air vent in the filler cap is clear before replacing the cap.

The master cylinder and operating cylinder hydraulic seals should be replaced at the first 39,000 miles (65,000 km.) and at subsequent 36,000 miles (60,000 km.) intervals.

The gearbox filler plug screws into the side of the gearbox casing and the drain plug screws into the bottom.

At the first 600 miles (1,000 km.) top-up the gearbox oil.

At the first 3,000 miles (5,000 km.) drain the gearbox oil and refill with new oil of the correct grade; thereafter topping-up as required every subsequent 6,000 miles (10,000 km.).



The Floor Change Gearbox

QUICK REFERENCE DATA

DATA

Clutch

Type	Single dry plate
Actuation	... Hydraulic
Hydraulic fluid	... ME-3833-F
Master cylinder diameter	... 0.70 in. (1.78 cm.)
Operating cylinder diameter	... 0.875 in. (2.22 cm.)
Clutch disc lining — outside diameter	7½ in. (19.8 cm.)
Pressure plate — diameter	... ... 7½ in. (19.8 cm.)
— to flywheel bolt tightening torque	... 12 to 15 lb. ft. (1.6 to 2.0 kg. m.)

Gearbox

Grade of lubricant	... ... S.A.E. 80 E.P.
Gearbox capacity—Floor Change—Refill ...	1.7 Imp. pints (2.1 U.S. pints, 0.96 litres)
—Initial fill	1.97 Imp. pints (2.4 U.S. pints, 1.11 litres)
—Column Change—Refill ...	2⅛ Imp. pints (2.55 U.S. pints, 1.2 litres)
—Initial fill	2⅜ Imp. pints (2.85 U.S. pints, 1.34 litres)
Speedometer driven gear ...	... 24 or 25 depending on axle ratio
Speedometer driving gear	6 (1,300 c.c.) 7 (G.T. and 1,600 c.c.)

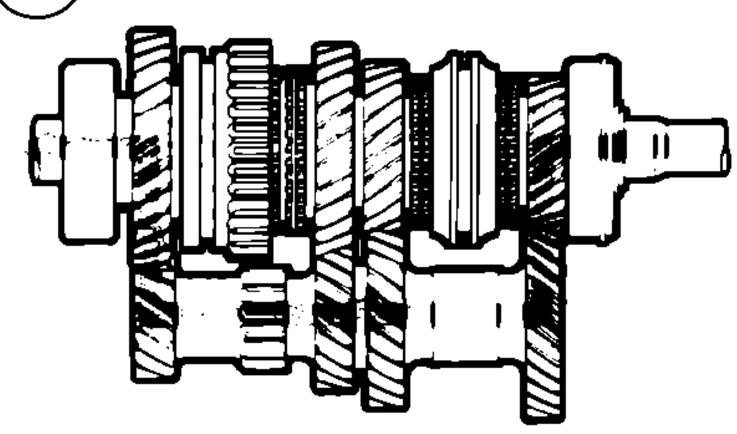
Ratios

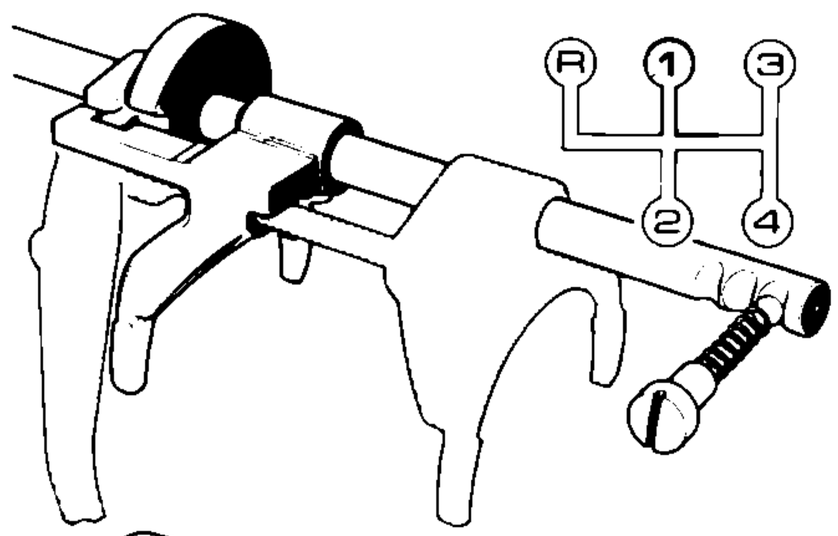
	1,300 c.c.		1,600 c.c.		G.T.	
	Gearbox	*Overall*	*Gearbox*	*Overall*	*Gearbox*	*Overall*
First	3.543	14.615	3.543	13.818	2.972	11.591
Second	2.396	9.883	2.396	9.344	2.010	7.839
Third	1.412	5.824	1.412	5.507	1.397	5.448
Top ...	1.000	4.125	1.000	3.900	1.000	3.900
Reverse	3.963	16.347	3.963	15.456	3.324	12.964

Tightening Torques, lb. ft. (kg.m.)

Clutch pressure plate to flywheel ...	12 to 15 (1.66 to 2.07)
Clutch housing to transmission case ...	40 to 45 (5.53 to 6.22)
Transmission gear shift cables ...	10 to 12 (1.38 to 1.66)
Abutment housing to extension housing	15 to 18 (2.07 to 2.49)
Transmission case drain and filler plugs	25 to 30 (3.46 to 4.15)
Mainshaft assembly retaining nut	20 to 25 (2.76 to 3.46)
Transmission extension to transmission case	30 to 35 (4.15 to 4.84)

1





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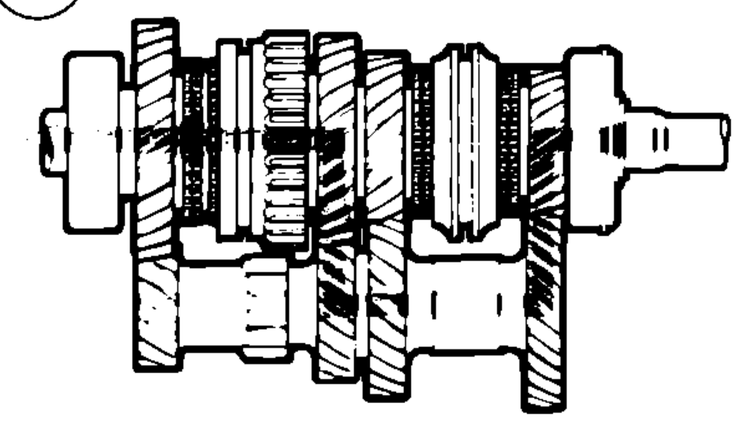

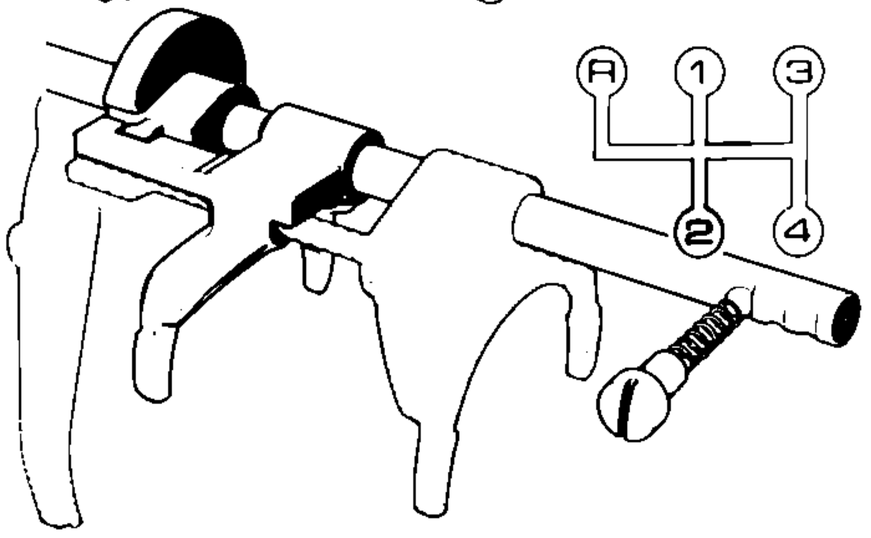

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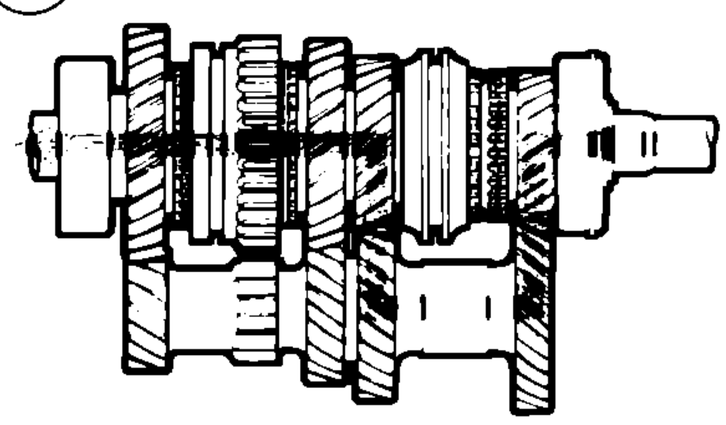

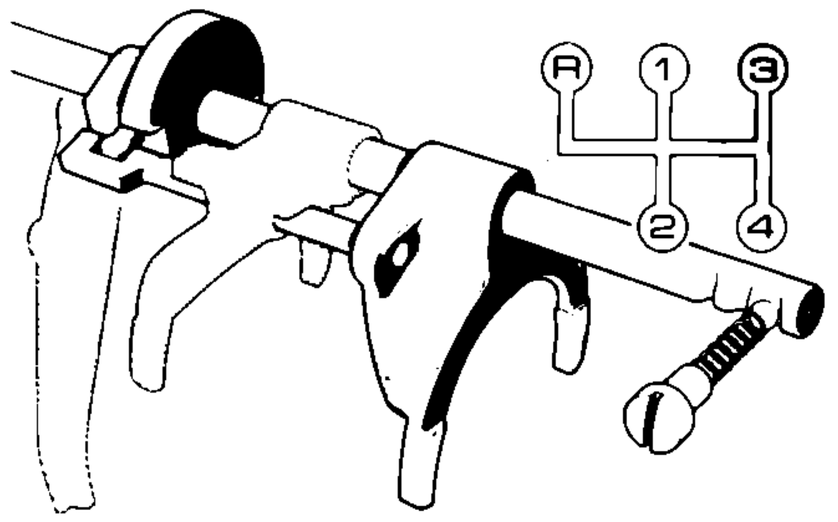

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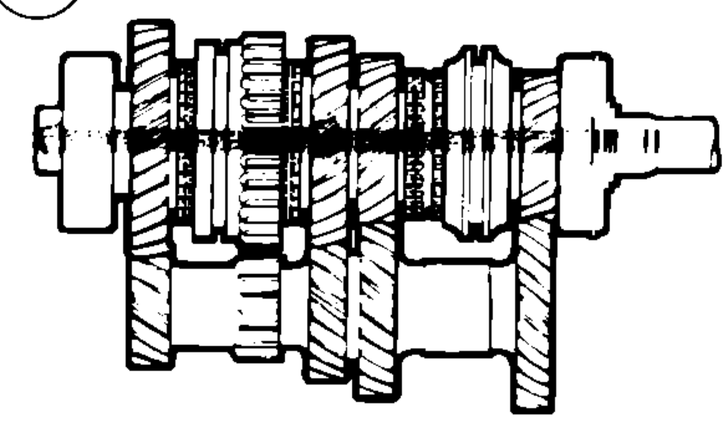

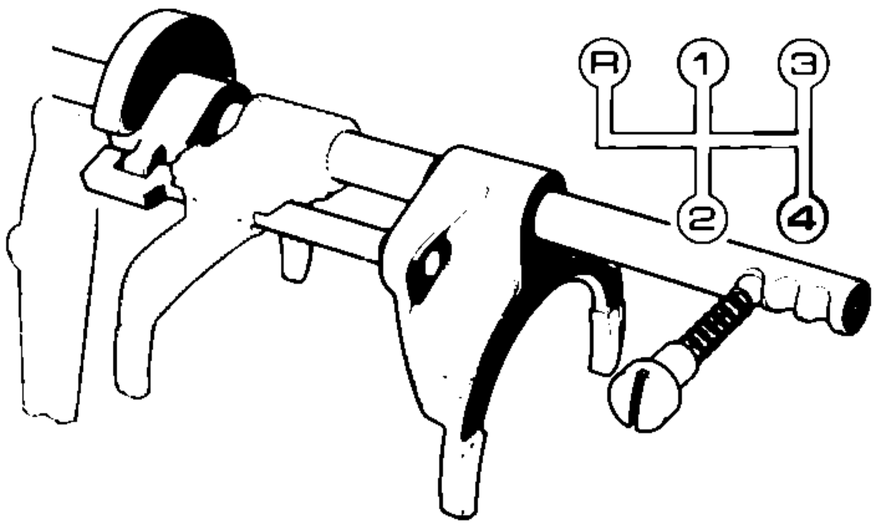

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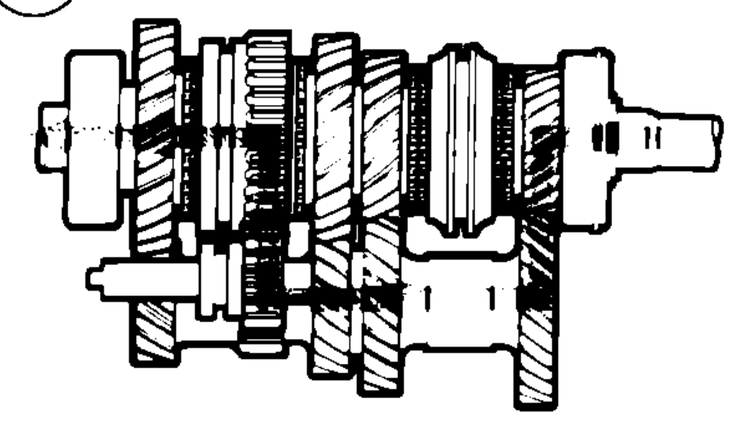
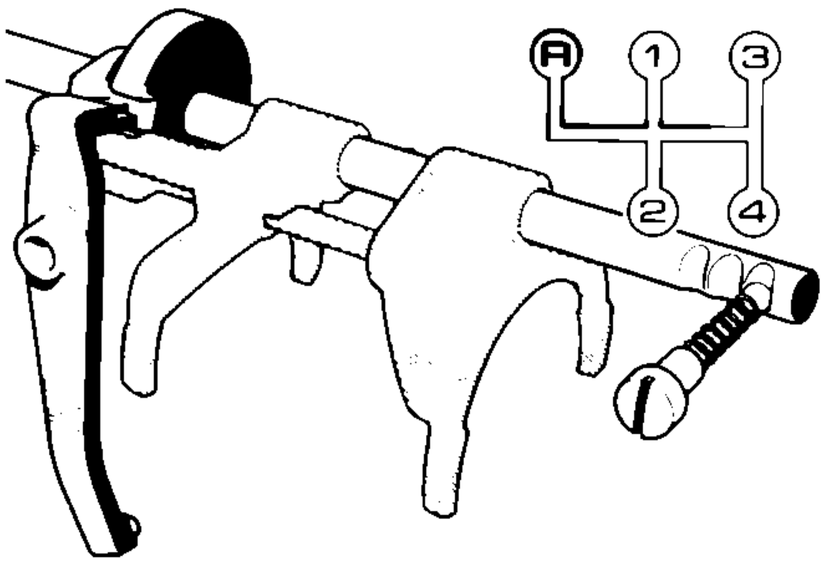




Power Train and Selector Positions in each gear — Floor Change

SERVICE AND REPAIR OPERATIONS

OP 7000-A GEARBOX AND CLUTCH HOUSING ASSEMBLY — REMOVE AND INSTALL

To Remove

1. Open the bonnet and disconnect the battery.
2. Disconnect the throttle linkage at the carburettor.
3. *(a)* **G.T. and Super (Floor Change)**
   (i) Remove centre consul after removing the crossheaded screws. Unscrew the gear lever knob.

   (b) **G.T. and Super and De luxe (Floor Change)**

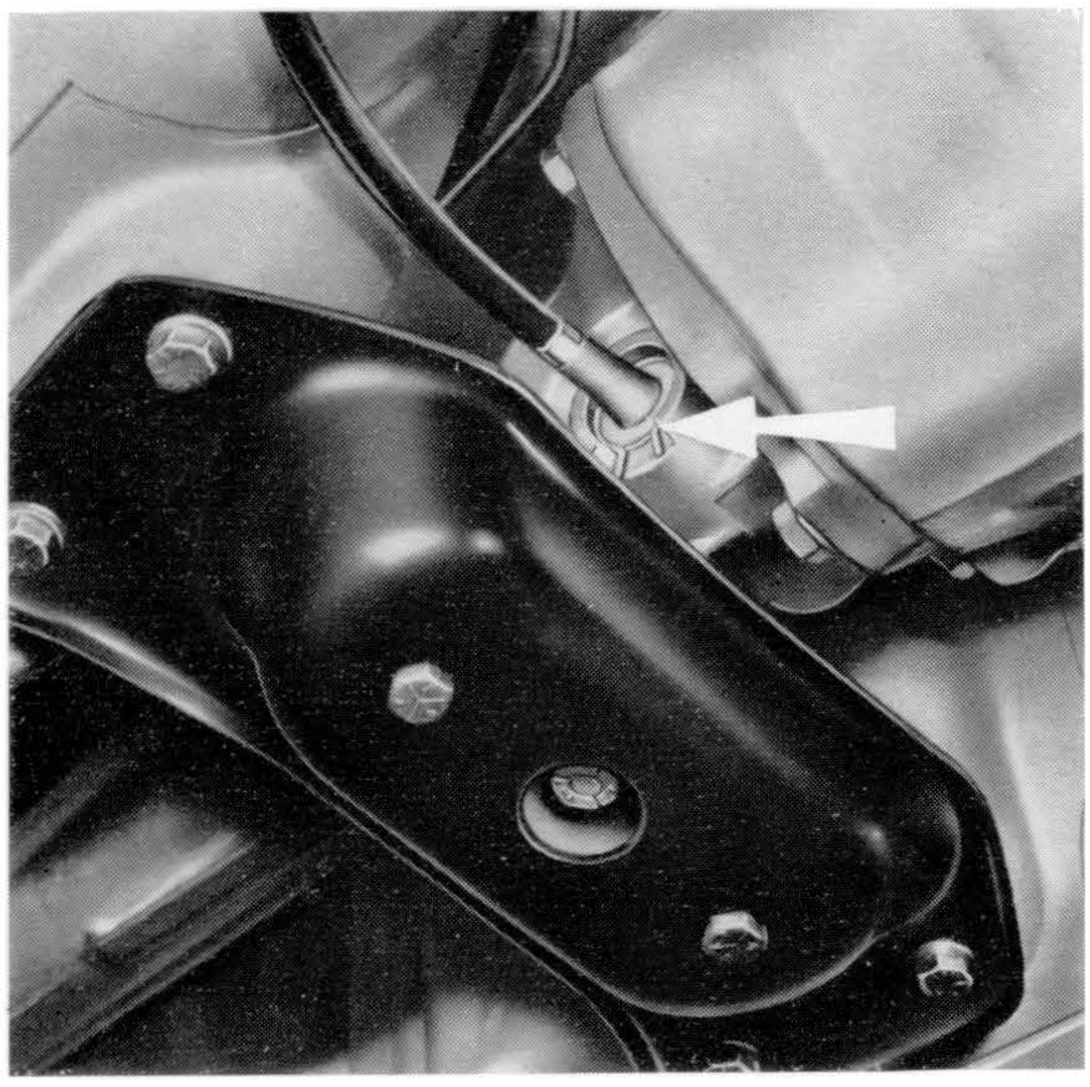
   (i) Remove circlip holding the gear lever spring in compression. Bend up the lock tab and unscrew the plastic dome nut. Withdraw the gear lever.

   (c) **Column Change**

   (i) Disconnect the gear selector rod at the lower end from the gear selector cross-shaft by removing the spring clip.

   (ii) Disconnect the cross-shaft from the pivot on the gearbox casing by removing the spring clip, two flat washers and one wave washer.

   (iii) Disconnect the gate selector rod from the gate selector lever on the gearbox top cover.
4. Jack up the car and fit stands all round.
5. Remove the four bolts joining the drive shaft to the rear axle pinion flange after marking the flanges for correct reassembly. Lower the rear and slide the front yoke from the gearbox. Fit a dummy yoke in the gearbox to prevent oil loss.
6. *(a)* **Floor Change**
   (i) Remove circlip and withdraw the speedometer cable from the gearbox extension housing.



Speedometer Cable Retaining Clip (Floor Change)

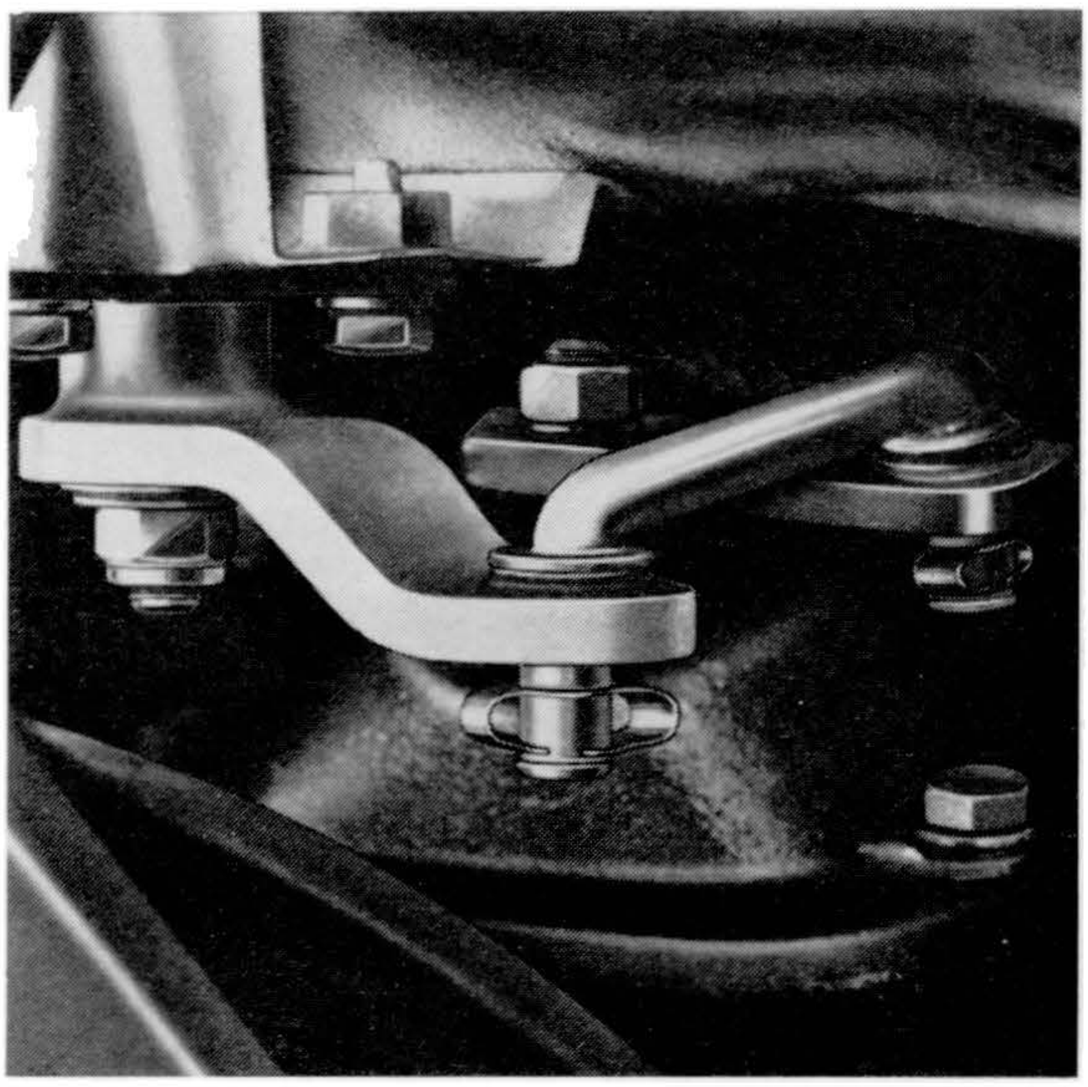
(b) **Column Change**

Unscrew the forked retainer and disconnect the speedometer cable.

7. Disconnect the exhaust pipe from the manifold.
8. Remove the clutch operating cylinder circlip and move the cylinder to one side.
9. Remove the two starter motor securing bolts and move the starter motor to one side.
10. Remove the bolts securing the clutch housing to the engine. Note that a top bolt also secures an earth strap.
11. Remove the bolts securing the lower dust cover and detach the cover.
12. Place a support jack beneath the rear of the engine.
13. Remove the four bolts securing the gearbox crossmembers to the body. Slide the gearbox rearwards whilst supporting its weight and detach it from the engine.
14. Remove the crossmember centre bolt and detach it from the gearbox.

To Replace

15. Place the crossmember on the mounting and fit the centre bolt to attach it to the gearbox.
16. Ensure that the adaptor plate is positioned on the rear of the engine and offer the gearbox up so that the main drive gear spigot enters the crankshaft pilot bearing. Push the gearbox fully home.
17. Replace the four crossmember-to-body bolts and spring washers. Remove the engine support jack.
18. Replace the bolts securing the clutch housing to the engine. The uppermost pair are plain bolts and one also secures an earth strap. The remainder are dowel bolts.
19. Replace the lower dust cover.



Gate Selector Levers (Column Change)

Gear Selector Levers (Column Change)

20. Refit the starter motor.
21. Replace the clutch operating cylinder and retain it with a circlip.
22. Reconnect the exhaust pipe to the manifold.

23. *(a)* **Floor Change**

(i) Replace the speedometer cable end at the extension housing and retain it with the circlip.

(b) **Column Change**

(i) Replace the speedometer cable end and retain it with the forked retainer.

24. Refit the drive shaft aligning the mating marks, and replace the four nuts and bolts at the pinion flange.

25. *(a)* **Floor Change**

(i) Locate the gear lever in the extension housing so that the forked end engages correctly with the selector rail. Secure in position by screwing the plastic dome nut into the extension housing and lock by bending down a tab on the integral locking plate. Depress the spring and fit the circlip. Check that all gears are obtainable. If necessary move the gear lever knob so that the gear shift pattern is correctly shown and lock up to the gear lever with the ferrule.

G.T. and Super

(ii) Refit centre consul and replace the crossheaded screws.

(b) **Column Change**

(i) Connect the gate selector rod to the lever on the top cover, securing it with a spring clip.

(ii) Slide the gear selector cross-shaft arm onto the pivot on the gearbox casing. Secure it with a flat washer, wave washer, flat washer and spring clip; in that order.

(iii) Reconnect the gear selector rod to the cross-shaft and retain with a spring clip.

Jack up, remove stands and lower the car to the ground.

26. Check gearbox oil level and top up if necessary.
27. Jack up, remove stands and lower the car to the ground.

OP 7000-A1 EXTRA: CLUTCH RELEASE BEARING — RENEW

To Remove

1. Remove the release arm rubber gaiter.
2. Withdraw the release arm and bearing assembly from the clutch housing.
3. Unhook the release arm from the bearing.
4. Press the release bearing from the hub.

To Replace

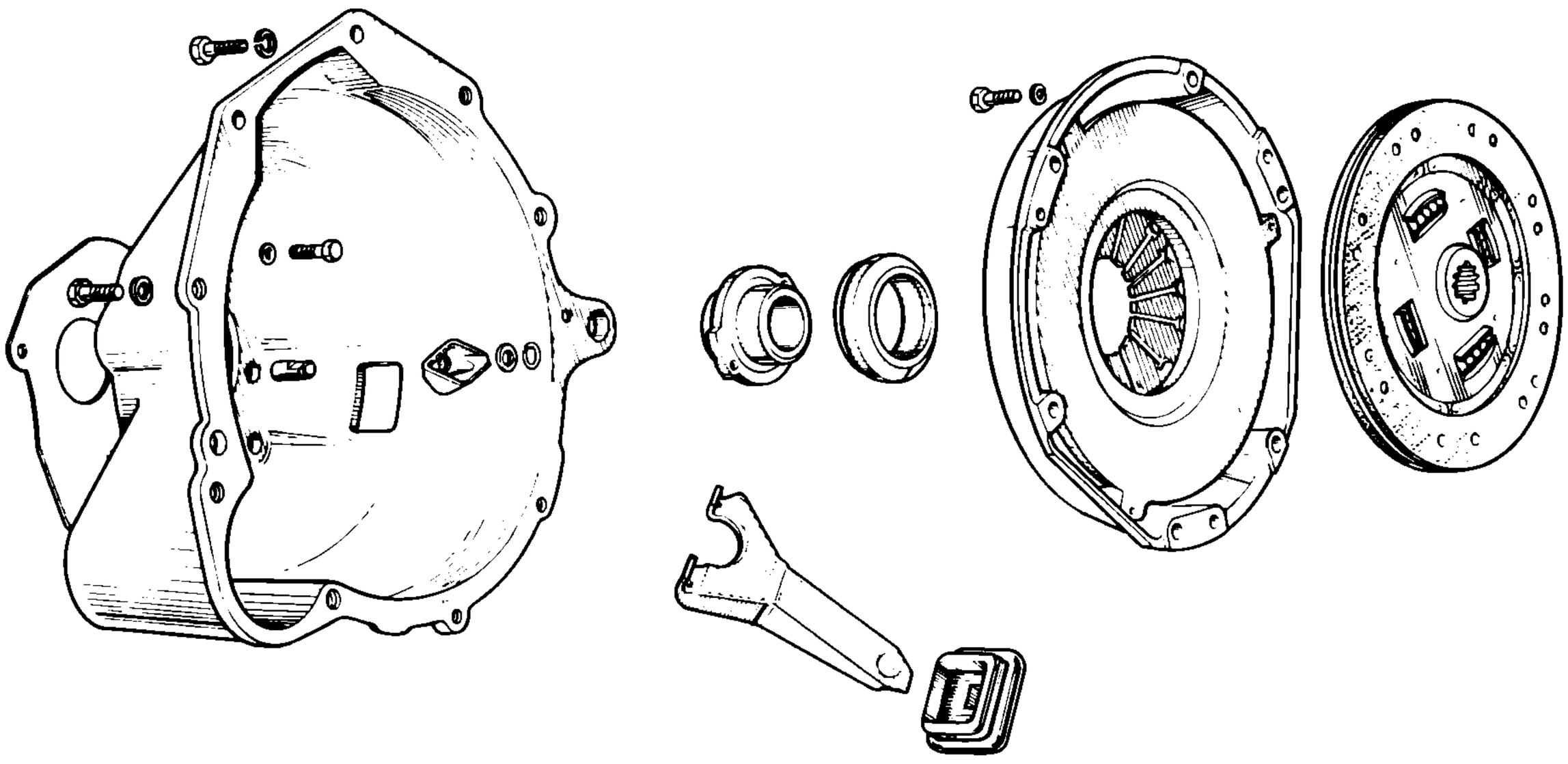
5. Press the release bearing onto the hub.
6. Engage the release arm in the hooked ends of the release bearing.
7. Pass the release arm through the aperture in the clutch housing and slide the release bearing onto the main drive gear bearing retainer.
8. Replace the rubber gaiter.

OP 7000-A2 EXTRA: CLUTCH PRESSURE PLATE AND/OR DISC — REMOVE AND INSTALL

Tools Required

P7091-A or Tool P7137 Clutch disc locator

1. Slacken the six clutch retaining bolts evenly, working diagonally across the clutch.
2. Remove the clutch disc and pressure plate.
3. Place the clutch disc in position on the flywheel with the larger hub towards the flywheel (the flywheel side of the disc is marked near the centre). Align the clutch disc with the locator Tool No. P7091-A or Tool No. P7137.
4. Refit the pressure plate assembly, locating on the dowels. Fit the six securing bolts and spring washers; torque to 12 to 15 lb. ft. (1.7 to 2.1 kg.m.).
5. Remove locator tool.



Clutch Components - Exploded View

OP 7000-A3 EXTRA: CLUTCH PILOT BEARING — RENEW

Tools Required

7600-A or B	Clutch pilot bearing remover (main tool)
CP 7600-6	Clutch pilot bearing remover (adaptor)
P 7137	Spigot bearing replacer and clutch disc locator

1. Push the adaptor, Tool No. CP 7600-6, behind the bearing and screw the main tool, 7600-A or B, into the adaptor. Tighten the wing nut to extract the bearing.
2. Position the new bearing on Tool No. P 7137 and tap it into place in the crankshaft flange.

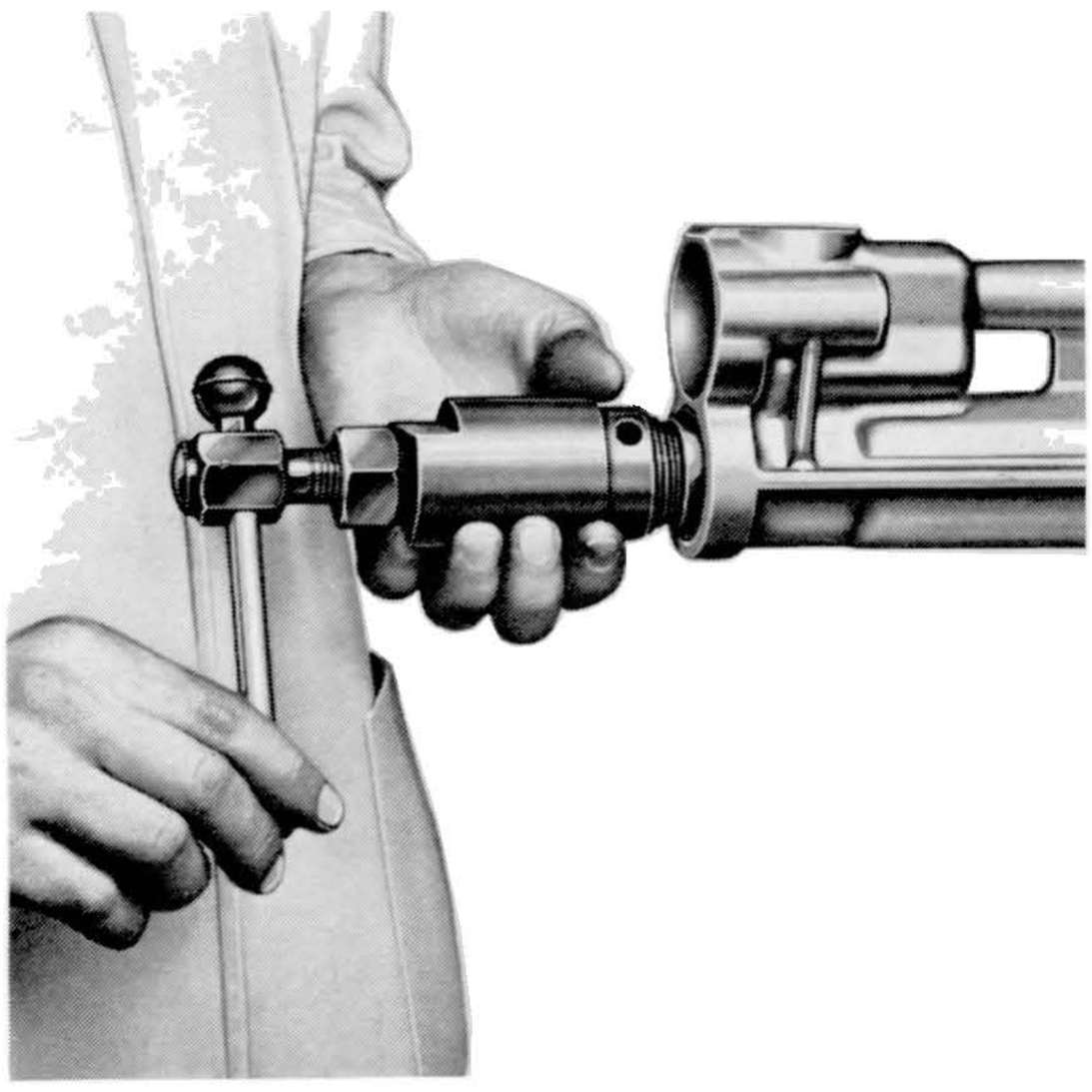
OP 7000-A6 EXTRA: MAIN DRIVE GEAR BEARING RETAINER OIL SEAL — RENEW

Tools Required

P 7136	Main Drive gear oil seal replacer

To Dismantle

1. Remove clutch release arm and bearing.
2. Unscrew the three bolts and spring washers securing the main drive gear retainer to the gearbox case.
3. Withdraw the retainer and paper gasket.
4. Remove the retainer oil seal with suitable tool.
5. Place a new oil seal on the replacer (Tool No. P.7136) so that when fitted the lips of the seal face the gearbox. Drive the seal into the retainer.



Removing Extension Housing Oil Seal (Floor Change)

Replacing Extension Housing Oil Seal (Floor Change)

To Re-assemble

1. Fit the main drive gear bearing retainer to the gearbox. Cover the main drive gear splines before fitting the retainer and oil seal to prevent damage to the seal lip on assembly. First fit a new gasket on the gearbox front face. Ensure that the oil groove in the retainer is in line with the oil passage in the gearbox casing and that the gasket does not cover this passage. Coat the three retaining bolts with sealer (Part No. EM-4G-47) and fit them, complete with spring washers. Tighten securely.
2. Replace clutch release arm and bearing.

OP 7000-A7 EXTRA: EXTENSION HOUSING REAR OIL SEAL — RENEW

Tools Required

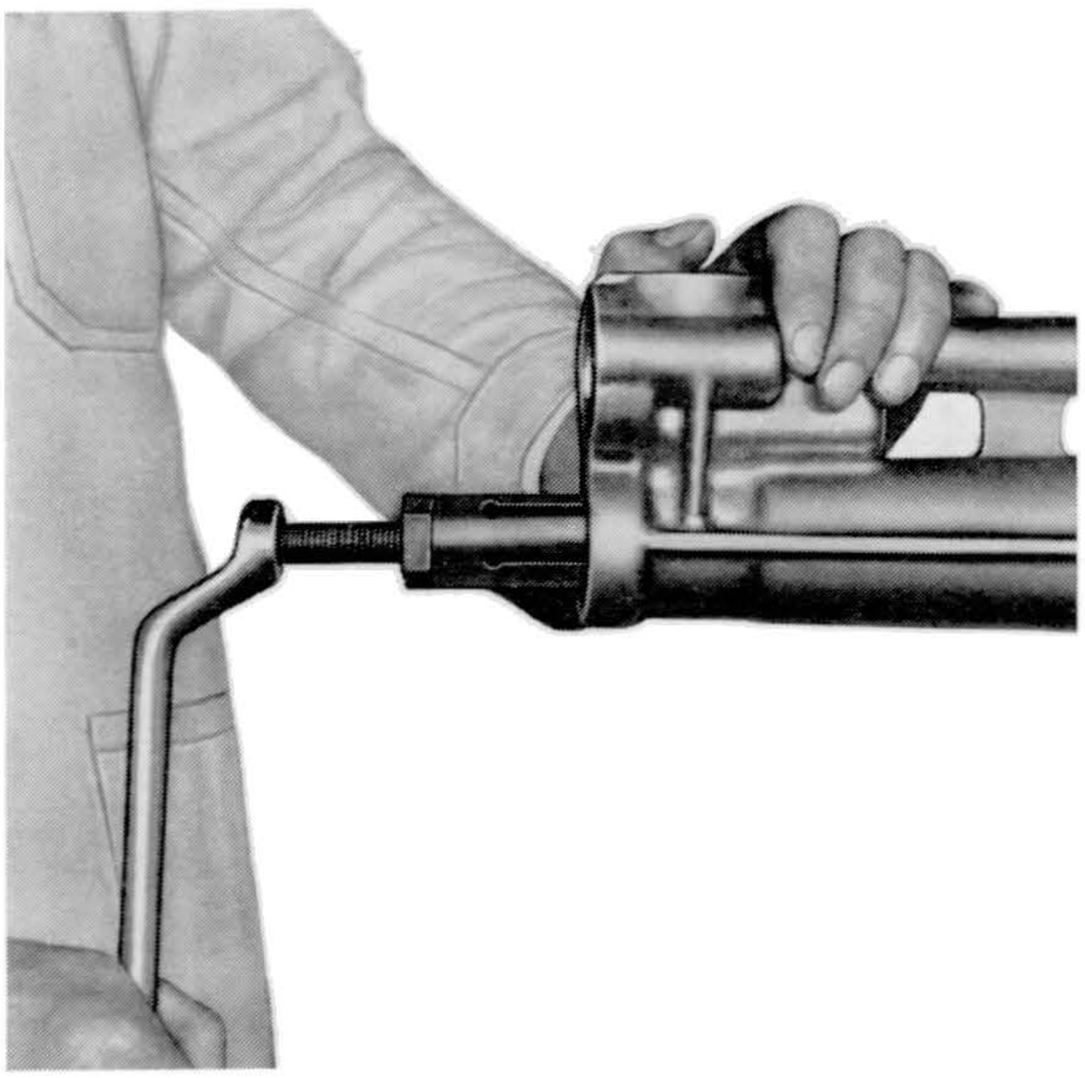
7657	Extension housing oil seal remover
P 7657-4	Extension housing oil seal remover (adaptor)
P 7095	Extension housing oil seal replacer

1. Extract the extension housing oil seal by screwing Tool No. P 7657-4 into Tool No. 7657 and screw the assembly into the seal. Tighten the tool centre bolt to withdraw the seal.
2. Fit new extension housing oil seal by driving it squarely into position using Tool No. P 7095.

OP 7000-A8 EXTRA: EXTENSION HOUSING REAR BUSH — RENEW

Tools Required

7657	Extension housing oil seal remover
P 7657-4	Extension housing oil seal remover (adaptor)
P 7095	Extension housing oil seal replacer
P 7149	Extension housing bush remover
P 7150	Extension housing bush replacer



Removing Extension Housing Bush (Floor Change)

1. Extract the extension housing oil seal by screwing Tool No. P 7657-4 into Tool No. 7657 and screw the assembly into the seal. Tighten the tool centre bolt to withdraw the seal.

2. Extract extension housing bush using Tool No. P 7149.

3. Assemble a new bush to the replacing Tool No. P 7150 and drive into position.

4. Fit new extension housing oil seal by driving it squarely into position using Tool No. P 7095.

Group Operations

7000-B CLUTCH RELEASE BEARING — RENEW
(Includes Ops 7000-A and A1)

7000-C CLUTCH DISC AND/OR PRESSURE PLATE — REMOVE AND INSTALL
(Includes Ops 7000-A and A2)

7000-D CLUTCH PILOT BEARING — RENEW
(Includes Ops. 7000-A, A2 and A3)

OP 7003-A GEARBOX ASSEMBLY — REMOVE AND INSTALL

To Remove

1. Open the bonnet and disconnect the battery.

2. Disconnect the throttle linkage at the carburettor.

3. *(a)* **G.T. and Super (Floor Change)**

(i) Remove centre consul after removing the cross-headed screws. Unscrew the gear lever knob.

(b) **G.T. and Super and De luxe (Floor Change)**

(i) Bend up the lock tab and unscrew the plastic dome nut. Withdraw the gear lever.

(c) **Column Change**

(i) Disconnect the gear selector rod at the lower end from the gear selector cross-shaft by removing the spring clip.

(ii) Disconnect the cross-shaft from the pivot on the gearbox casing by removing the spring clip, two flat washers and one wave washer.

(iii) Disconnect the gate selector rod from the gate selector lever on the gearbox top cover.

4. Jack up the car and fit stands all round.

5. Remove the four bolts joining the drive shaft to the rear axle pinion flange after marking the flanges for correct reassembly. Lower the rear and slide the front yoke from the gearbox. Fit a dummy yoke in the gearbox to prevent oil loss.

6. *(a)* **Floor Change**

   (i) Remove circlip and withdraw the speedometer cable from the gearbox extension housing.

   (b) **Column Change**

   (i) Unscrew the forked retainer and disconnect the speedometer cable.

7. Disconnect the exhaust pipe from the manifold.

8. Remove the clutch operating cylinder circlip and move the cylinder to one side.

9. Remove the two starter motor securing bolts and move the starter motor to one side.

10. Remove the bolts securing the clutch housing to the engine. Note that a top bolt also secures an earth strap.

11. Remove the bolts securing the lower dust cover and detach the cover.

12. Place a support jack beneath the rear of the engine.

13. Remove the four bolts securing the gearbox crossmember to the body. Slide the gearbox rearwards whilst supporting its weight and detach it from the engine.

14. Remove the clutch release arm and bearing.

15. Unscrew the four bolts securing the clutch housing to the gearbox and remove it.

16. Remove the crossmember centre bolt and detach it from the gearbox.

To Replace

17. Place the crossmember on the mounting and fit the centre bolt to attach it to the gearbox.

18. Fit the clutch housing to the gearbox and tighten the four bolts. Fit the clutch release arm and bearing.

19. Ensure that the adaptor plate is positioned on the rear of the engine and offer the gearbox up so that the main drive gear spigot enters the crankshaft pilot bearing. Push the gearbox fully home.

20. Replace the four crossmember-to-body bolts and spring washers. Remove the engine support jack.

21. Replace the bolts securing the clutch housing to the engine. The uppermost pair are plain bolts and one also secures an earth strap. The remainder are dowel bolts.

22. Replace the lower dust cover.

23. Refit the starter motor.

24. Replace the clutch operating cylinder and retain it with a circlip.

25. Reconnect the exhaust pipe to the manifold.

26. *(a)* **Floor Change**

(i) Replace the speedometer cable end at the extension housing and retain it with the circlip.

(b) **Column Change**

(i) Replace the speedometer cable end and retain it with the forked retainer.

27. Refit the drive shaft aligning the mating marks, and replace the four nuts and bolts at the pinion flange.

28. *(a)* **Floor Change**

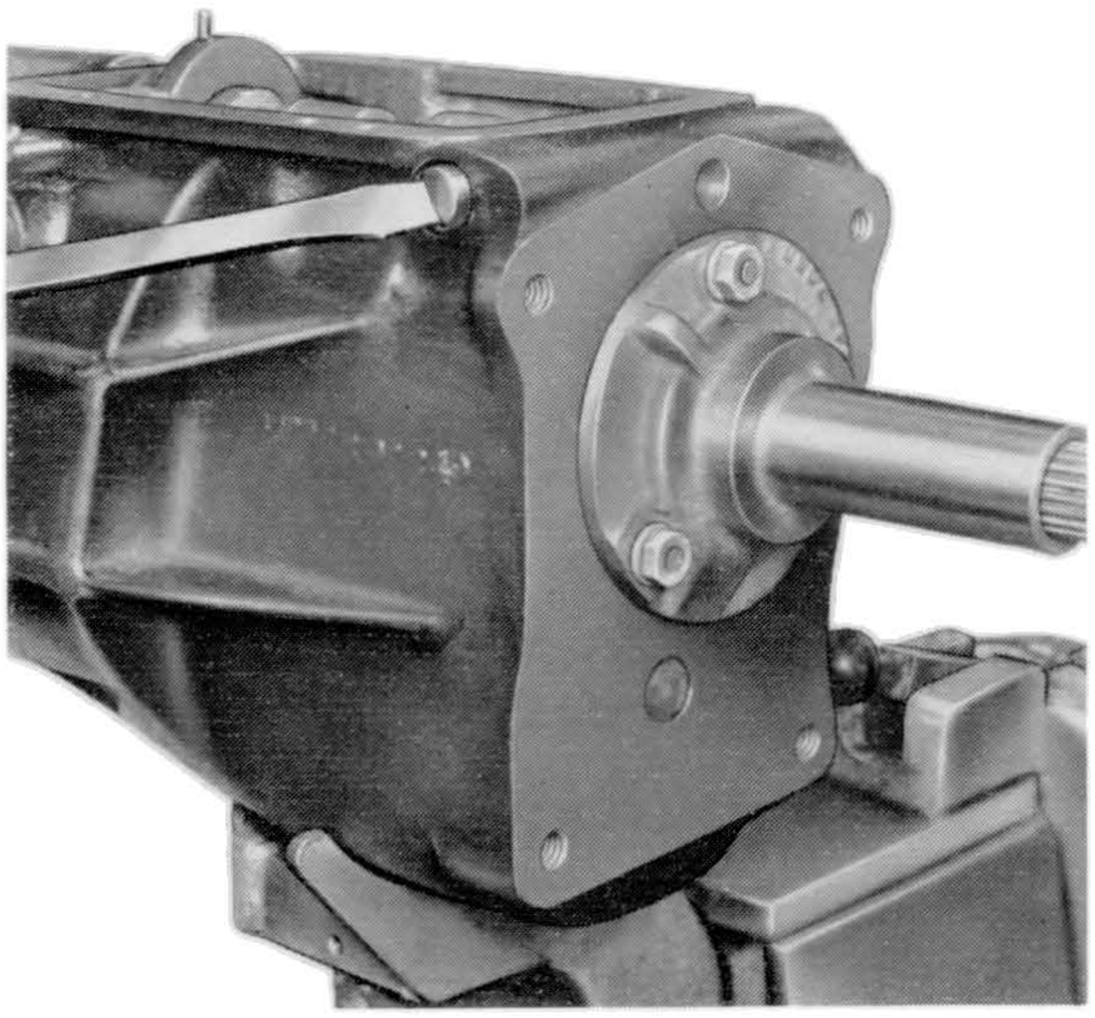
(i) Locate the gear lever in the extension housing so that the forked end engages correctly with the selector rail. Secure in position by screwing the plastic dome nut into the extension housing, and lock by bending down a tab on the integral locking plate. Depress the spring and fit the circlip. Check that all gears are obtainable. If necessary move the gear lever knob so that the gear shift pattern is correctly shown and lock up to the gear lever with the ferrule.

G.T. and Super

(ii) Refit centre console and replace the cross-headed screws.

(b) **Column Change**

(i) Connect the gate selector rod to the lever on the top cover, securing it with a spring clip.



Removing Selector Ball and Spring Retaining Screw (Floor Change)

Selector Ball and Spring (Floor Change)

(ii) Slide the gear selector cross-shaft arm onto the pivot on the gearbox casing. Secure it with a flat washer, wave washer, flat washer and spring clip; in that order.

(iii) Reconnect the gear selector rod to the cross-shaft and retain with a spring clip.

Jack up, remove stands and lower the car to the ground.

29. Check gearbox oil level and top up if necessary.

30. Jack up, remove stands and lower the car to the ground.

OP 7003-A1 EXTRA: SELECTOR MECHANISM — OVERHAUL — FLOOR CHANGE
(Includes removing selector lever and selector forks)

Tools Required

200A	Engine Stand.
P 7089	Gearbox Mounting Bracket.

To Remove

1. Using the gearbox mounting bracket Tool No. P 7089, mount the gearbox on the engine stand.

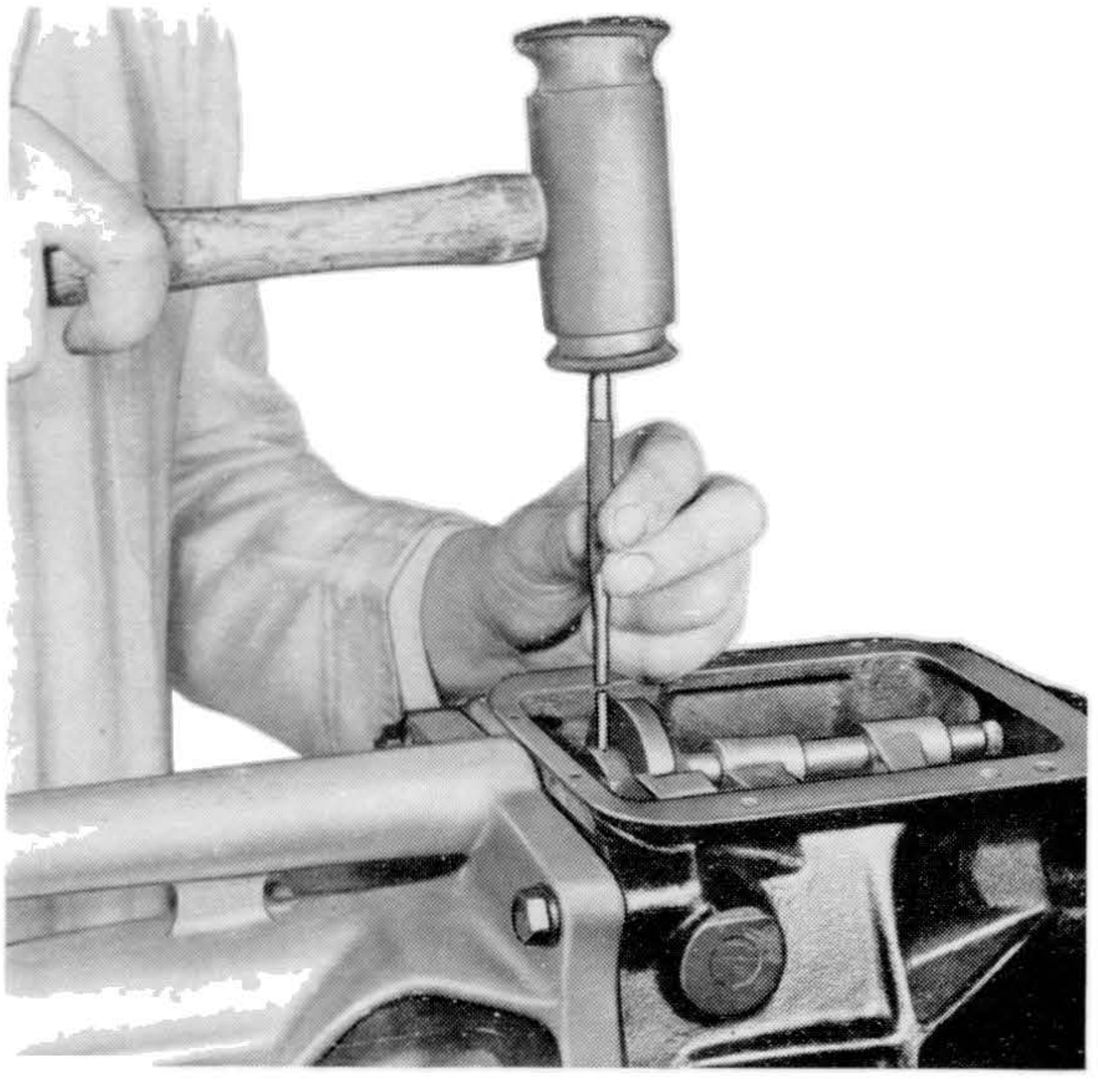
2. Remove the four bolts securing the top cover plate to the gearbox. Lift off the plate.

3. Using a suitable tool, prise off the blanking plug from the rear of the extension housing.

4. Remove the plunger screw from the side of the gearbox case.

5. Using suitable punch, remove the spring pin securing the selector boss to the rail. Ensure that the spring pin can be punched through clear of any mainshaft components. If necessary position the synchroniser hub on the mainshaft to suit.

Fitting Selector Rail Oil Seal (Floor Change)



Replacing Selector Boss Spring Pin (Floor Change)

6. Withdraw the selector rail rearwards taking care not to let the selector boss and 'c' cam drop into the gearbox casing.

7. To remove the selector forks, move the first/second gear and third/top gear synchromesh hubs to their foremost positions towards the main drive gear bearing. Lift out the forks.

8. If necessary remove the selector rail plunger spring from its bore in the gearbox casing.

To Install

9. Position the assembled selector fork on their synchroniser sleeves and move the synchromesh hubs into the neutral position so that the selector fork extension arms locate beneath the reverse idler selector arm mounted on the side of the gearbox casing.

10. Grease the selector rail oil seal in the rear of the gearbox casing and slide the rail through the extension housing. Position the selector boss and the 'C' Cam so that the cam locates in the cut-outs in the selector fork extension arms. Pass the selector rail through the boss and selector forks until the spring pin holes in the boss and selector rail align. During this operation take care not to damage the selector rail oil seal.

11. Fit the spring pin to retain the selector boss to the selector rail.

12. Assemble the plunger ball and spring to their bore and fit securing screw using sealer.

13. Apply sealer to the blanking plug and tap it in the extension housing behind the selector rail.

14. Fit a new gasket, using a suitable sealing compound to the top of the gearbox. Locate the cover plate on its dowels to the gearbox casing and secure with the four bolts.

15. Remove the gearbox from the engine stand and detach the mounting bracket.

OP 7003-A1 EXTRA: SELECTOR MECHANISM — OVERHAUL — COLUMN CHANGE

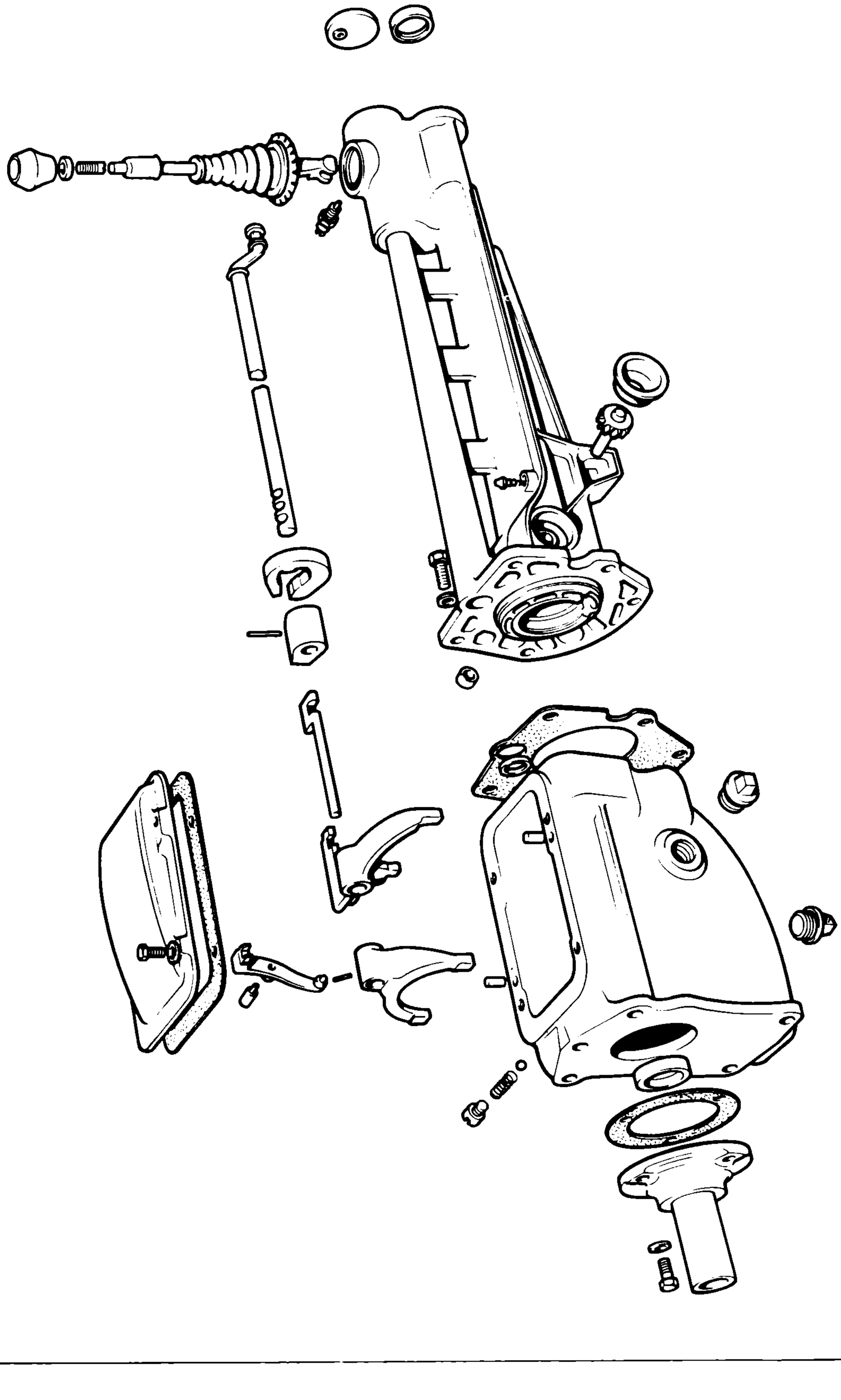
Tools Required

P 6061	Spring compressor
P 7103	Adaptor
P 7102	Oil seal replacer
P 7102 detail "c" or "d"	Oil seal protector
P 7116	Oil seal protector

To Dismantle

1. Remove the gearbox top cover and springs.

2. Bend back the tab that locks the gate selector arm retaining nut on the top of the case. Unscrew the nut, remove the tab washer and lift off the arm and flat washer. Remove the gate selector finger from inside the cover, taking care not to damage the oil seal.



Gearbox Externals — Exploded View (Floor Change)

3. Unscrew the locknut and remove the flat washer retaining the selector lever to the cross-shaft. Remove the circlip and flat washer located at the opposite end of the cross-shaft to the selector lever.

4. Insert spring compressor Tool No. P 6061 and adaptor Tool No. P 7103 between the top cover and the outer spring seat. Compress the spring and remove the circlip locating this seat on the cross-shaft.

5. Using a suitable lever, part the gear selector fingers and remove the circlip which is located between them.

6. Carefully withdraw the cross-shaft taking care not to damage the oil seals at either side of the gearbox top cover.

7. Remove the outer spring seat, spring and shift fingers from the gearbox top cover.

8. Inspect the seals in the gearbox top cover. Any seals that are cracked, scored, stretched, or swollen, or that are in any way considered unserviceable should be replaced.

9. Remove any unserviceable oil seals from the top cover and clean the area thoroughly before fitting new seals.

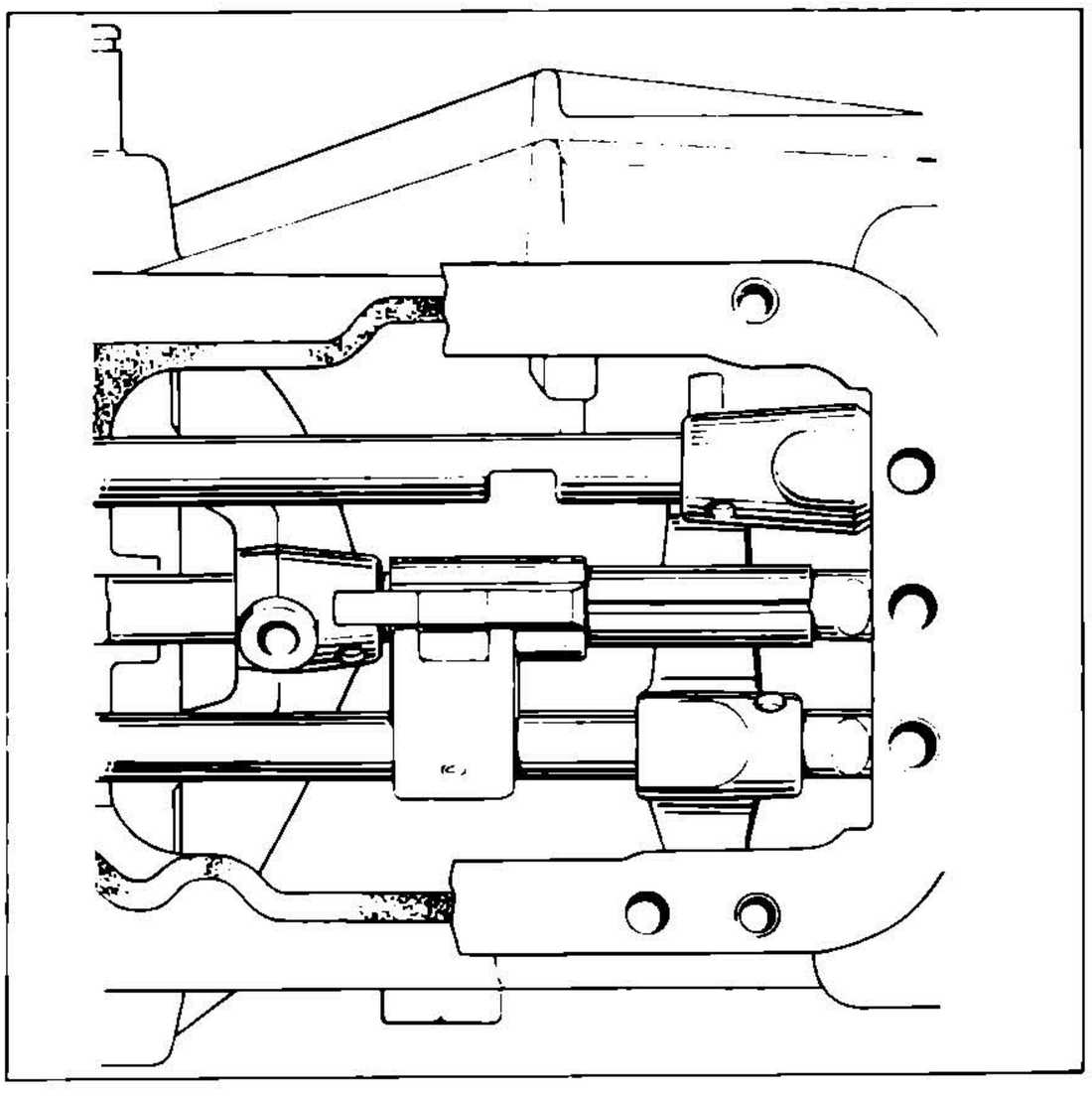
10. Three seals of two different sizes are fitted to the cover. The seal fitted in the largest counter-bore hole for the cross-shaft is 1.20 in. (30.48 mm.) diameter, the seal fitted at other end of this shaft and the seal for the gate selector finger being same diameter, 1.00 in. (25.4 mm.).

To Reassemble

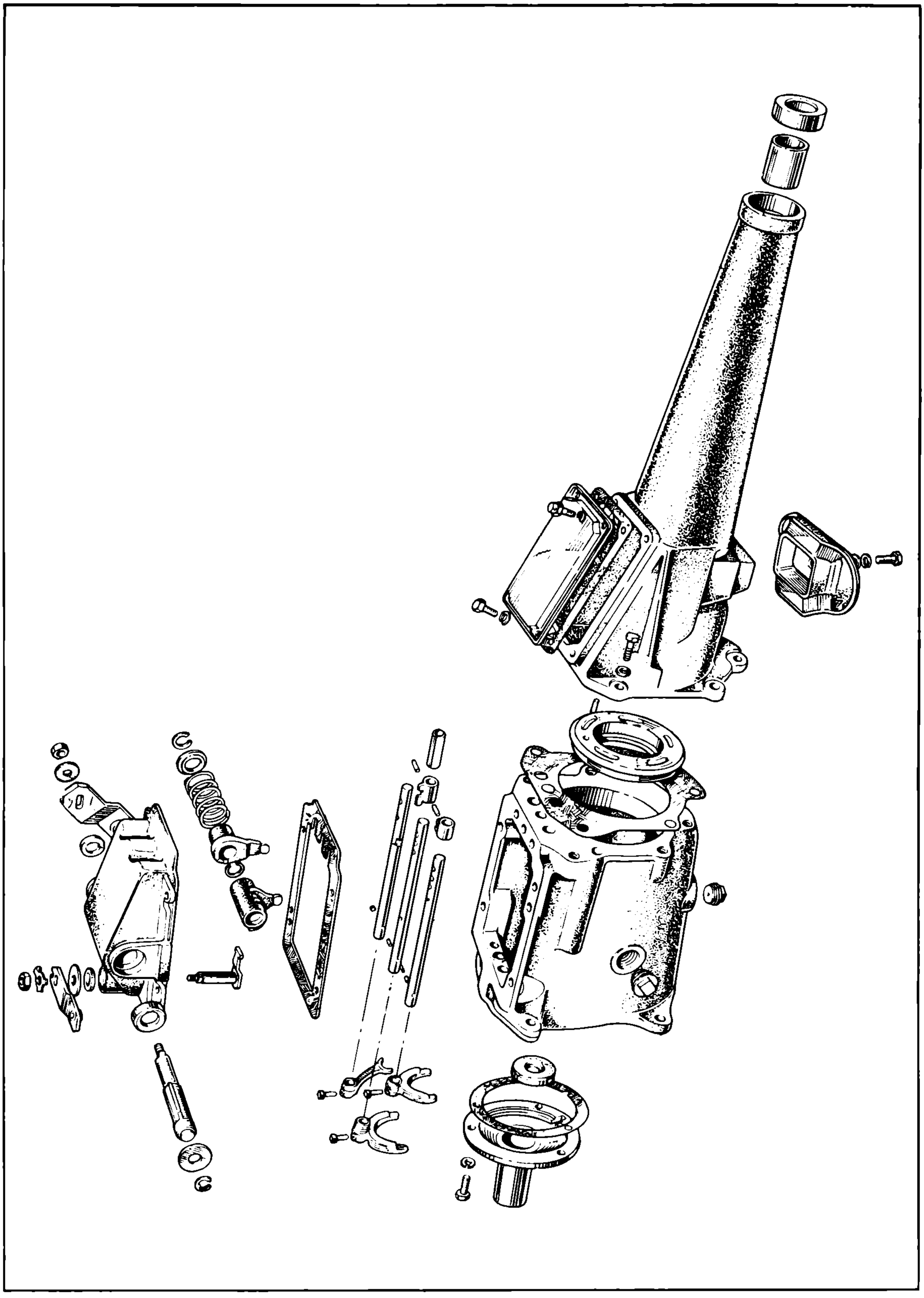
11. Fit the larger diameter seal to the adaptor Tool No. 7102 and driver Tool No. 575 so that the seal lip, when fitted to the cover, will face inwards. Drive the seal right home.

12. Using the same driver Tool No. 575 and adaptor Tool No. 7102, fit the other two oil seals (lip inwards) in a similar manner.

Selector Fork and Screw (Column Change)



Selector Fork and Gate Positions (Column Change)



Gearbox Externals – Exploded View (Column Change)

13. Locate the shift fingers in the cover adjacent to the larger cross-shaft drilling.

14. Insert the reverse stop spring and outer spring seat in the cover in that order.

15. Place the cross-shaft seal protector Tool No. P 7102 detail 'c', over the threaded end of the cross-shaft on R.H.D. cars, or use Tool No. P 7102 detail 'd', over the circlip groove end for L.H.D. cars.

16. Grease the protector and then pass the cross-shaft and seal protector assembly (protector first) through the top cover, commencing at larger diameter seal.

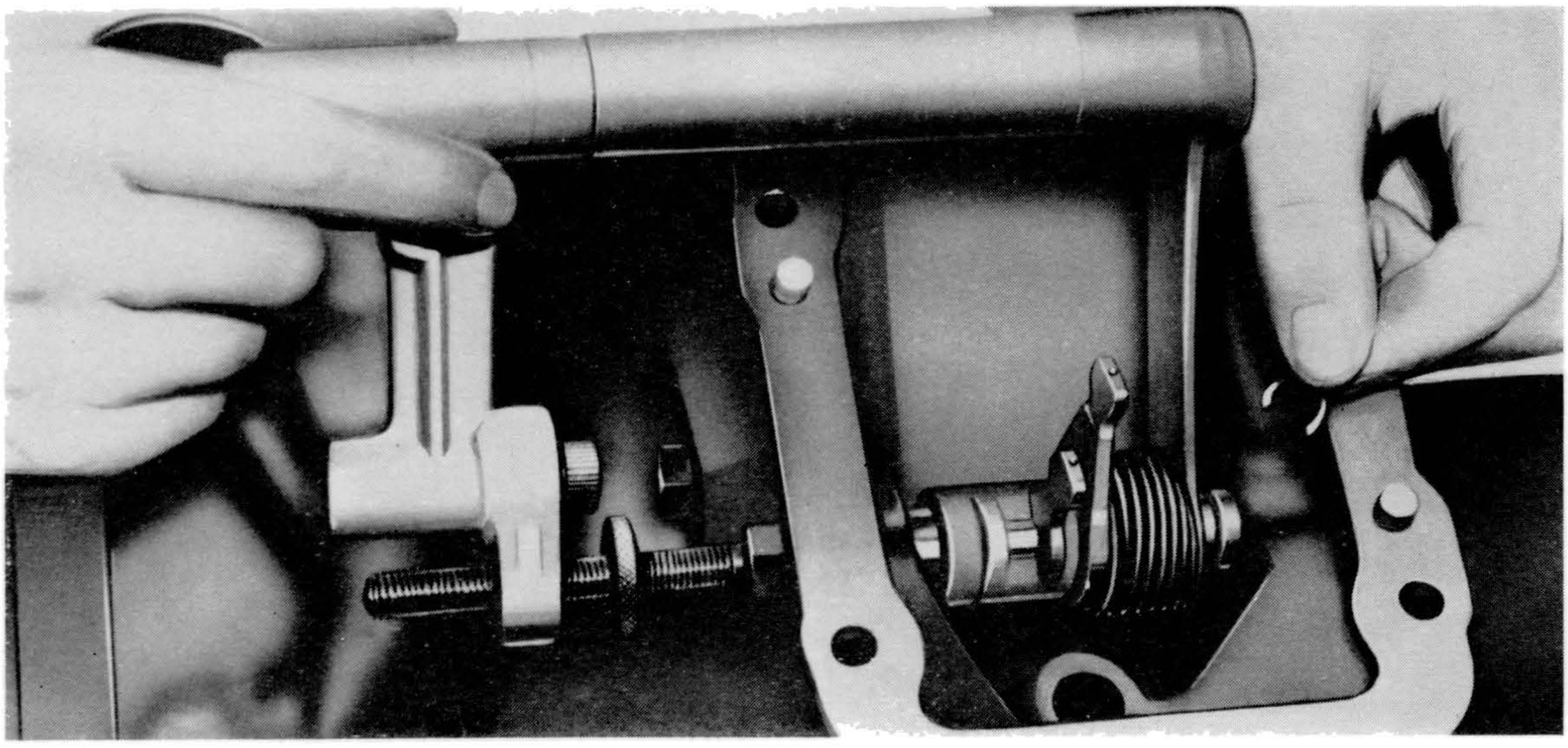
    NOTE – To ensure correct assembly of the cross-shaft to the shift fingers the two 'flats' machined on the threaded end of the cross-shaft must be at right-angles to the shift finger.

17. Using a suitable lever, part the shift fingers and fit a circlip to the groove in the cross-shaft.

18. Fit spring compressor Tool No. P 6061 between the gearbox top cover side wall and the outer spring seat. Compress the spring and fit a circlip to the cross-shaft to retain the outer spring seat in its correct position.

19. Push the cross-shaft right home whilst keeping the seal protector in position. Remove the seal protector. Fit the selector lever to the cross-shaft so that it points forward, fit a flat washer and locknut. Tighten the nut securely. Fit a flat washer and a circlip to the other end of the cross-shaft.

20. Fit a seal protector Tool No. P 7116, to the gate selector finger and from inside the cover pass the gate selector finger through the bore in the top of top cover, taking care not to damage the oil seal. The end of the finger must engage in the groove in the forward shift finger on the cross-shaft.



Compressing the Top Cover Spring (Column Change)

21. Fit the gate selector arm from the exterior of the top cover so that the outer end of the arm is positioned to left-hand side of the top cover and parallel to the cross-shaft. The straight edge of the arm should be to the front of the car.

22. Fit a tab washer and nut, then tighten securely. Lift up the tab to lock the nut.

23 Replace the gearbox top cover, using a new gasket. Ensure that the selector rail balls and springs are correctly located and then secure the cover with four bolts and lockwashers.

24. Check that all gears can be selected.

OP 7003-A2 EXTRA: EXTENSION HOUSING AND MAINSHAFT ASSEMBLY — REMOVE AND INSTALL

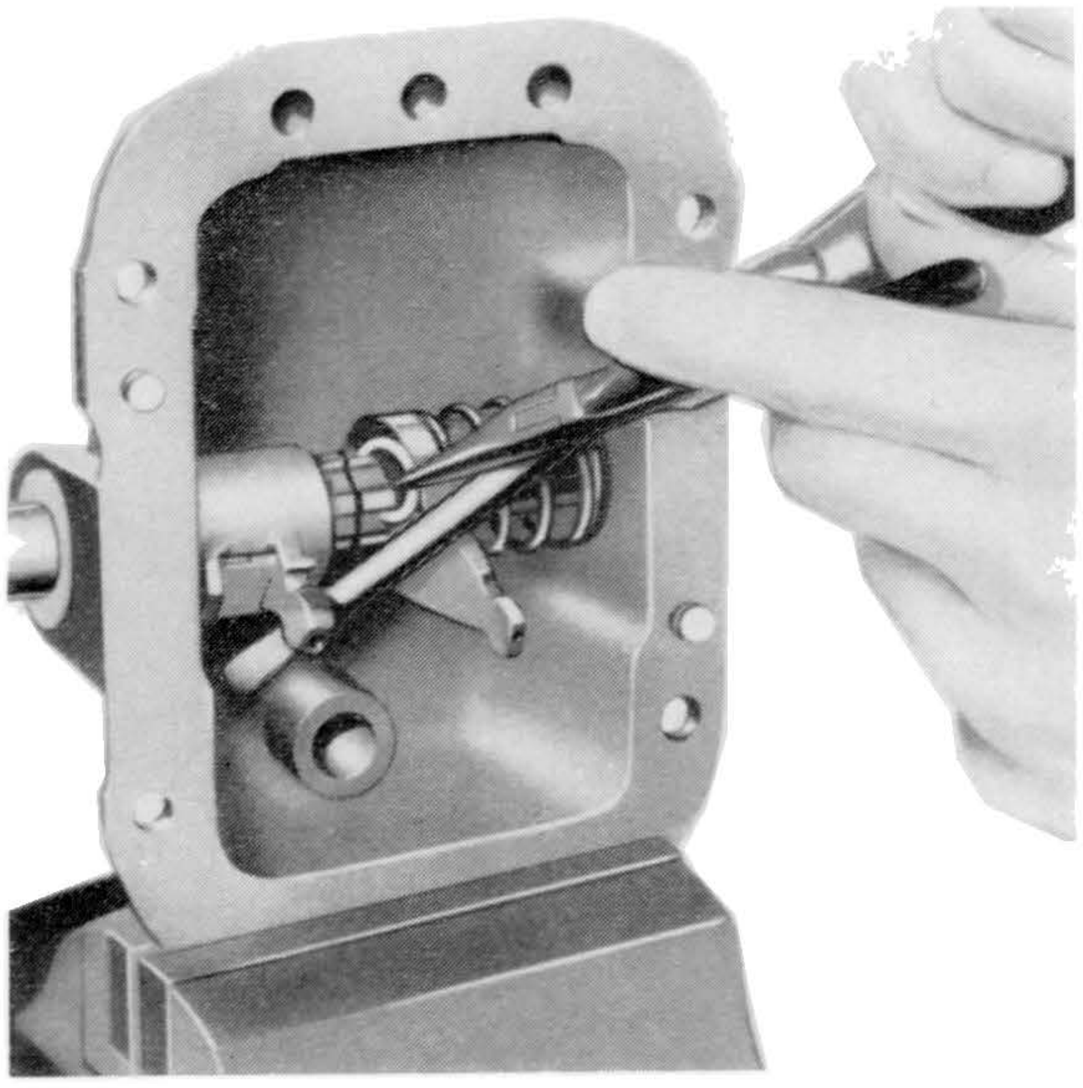
Tools Required

P 7113	Dummy Countershaft
575	Light Driver Handle (Floor Change)
P 7152	Selector Rail Oil Seal Replacer (Floor Change)

To Remove

1. Unscrew the bolts securing the extension housing to the gearbox casing. Five bolts for the column change box and four on the floor change box.

2. *(a)* **Column Change Only**
   (i) Detach extension housing from gearbox casing.



Removing the Centre Circlip (Column Change)

Refitting the Top Cover Oil Seal (Column Change)

(b) **Floor Change Only**

Using a hide mallet, tap the extension housing slightly rearwards until it is possible to rotate it so that the countershaft aligns with the cut-away in the extension housing flange.

3. Tap the countershaft rearwards using a drift until it is just clear of the front of the gearbox casing. Push the countershaft out using a dummy countershaft (Tool No. P 7113). The cluster gear will now drop to the bottom of the gearbox.

4. (*a*) **Floor Change**

(i) Remove extension housing and mainshaft assembly. It is necessary to push the third/top synchroniser sleeve slightly forward to provide clearance between the synchroniser and the cluster gear.

(*b*) **Column Change**

(i) Withdraw the mainshaft assembly from the gearbox.

To Install

5. (*a*) **Floor Change**

(i) If necessary fit a new oil seal to the selector rail aperture in the rear face of the gearbox case using P 7152 oil seal replacer and the driver handle 575.

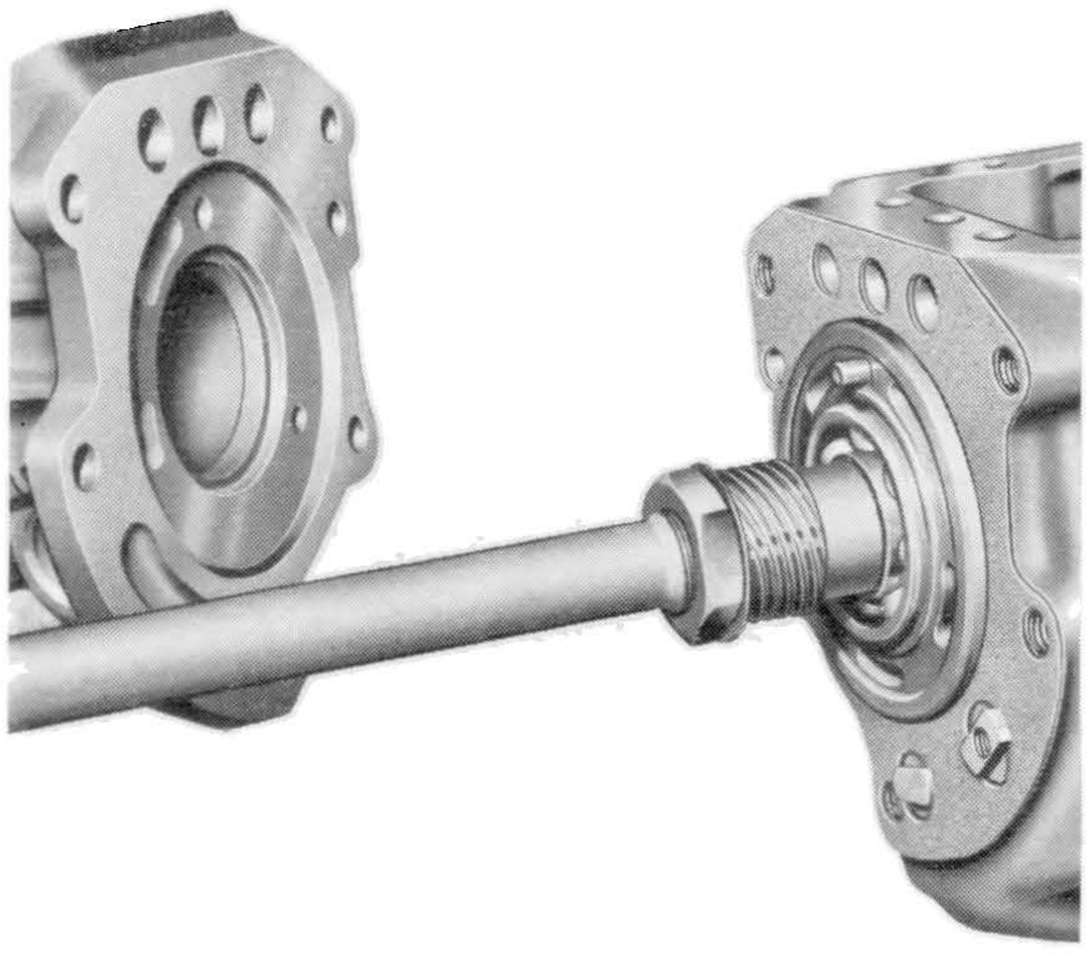
6. Thread cord or suitable plastic covered wire under the cluster gear at each end to facilitate lifting it into position later. Take care that the thrust washers in the case at each end of the countershaft gear are not displaced.

7. Fit a new gasket to the extension housing using a jointing compound.

8. (*a*) **Floor Change**

(i) Slide the extension housing and mainshaft into position after pulling the third/top synchroniser sleeve forward to clear the cluster gear. Ensure the top gear blocker ring locates correctly. It is important that care is taken when locating the spigot on the main drive gear bearing as the needle rollers could be dislodged.

(ii) Align the cut-away on the extension housing with the countershaft aperture in the rear face of the gearbox.



Extension Housing Removed (Column Change)

(*b*) **Column Change**

Pass the mainshaft into the gearbox, locating the front spigot in the main drive gear bearing. Tap the mainshaft in, aligning the dowel pin on the rear bearing carrier with the centre selector rail hole.

9. Carefully, with pieces of string at each end, lift the countershaft gear into mesh with the mainshaft and main drive gears. Take care that the thrust washers in the case at each end of the countershaft gear are not displaced.

10. Check that the cluster gear bore aligns with the apertures of the countershaft. Push the dummy countershaft out by inserting the countershaft from the rear. Finally tap the countershaft into place using a hide or copper mallet. Ensure that the lug on the rear of the countershaft is positioned so that it will fit in the recess on the extension housing flange.

11. Rotate the extension housing so that the bolt holes align. Push the extension housing fully home onto the gearbox case.

12. Using a suitable sealer on the bolts, secure the extension housing to the gearbox case. Tighten the bolts to the correct torque.

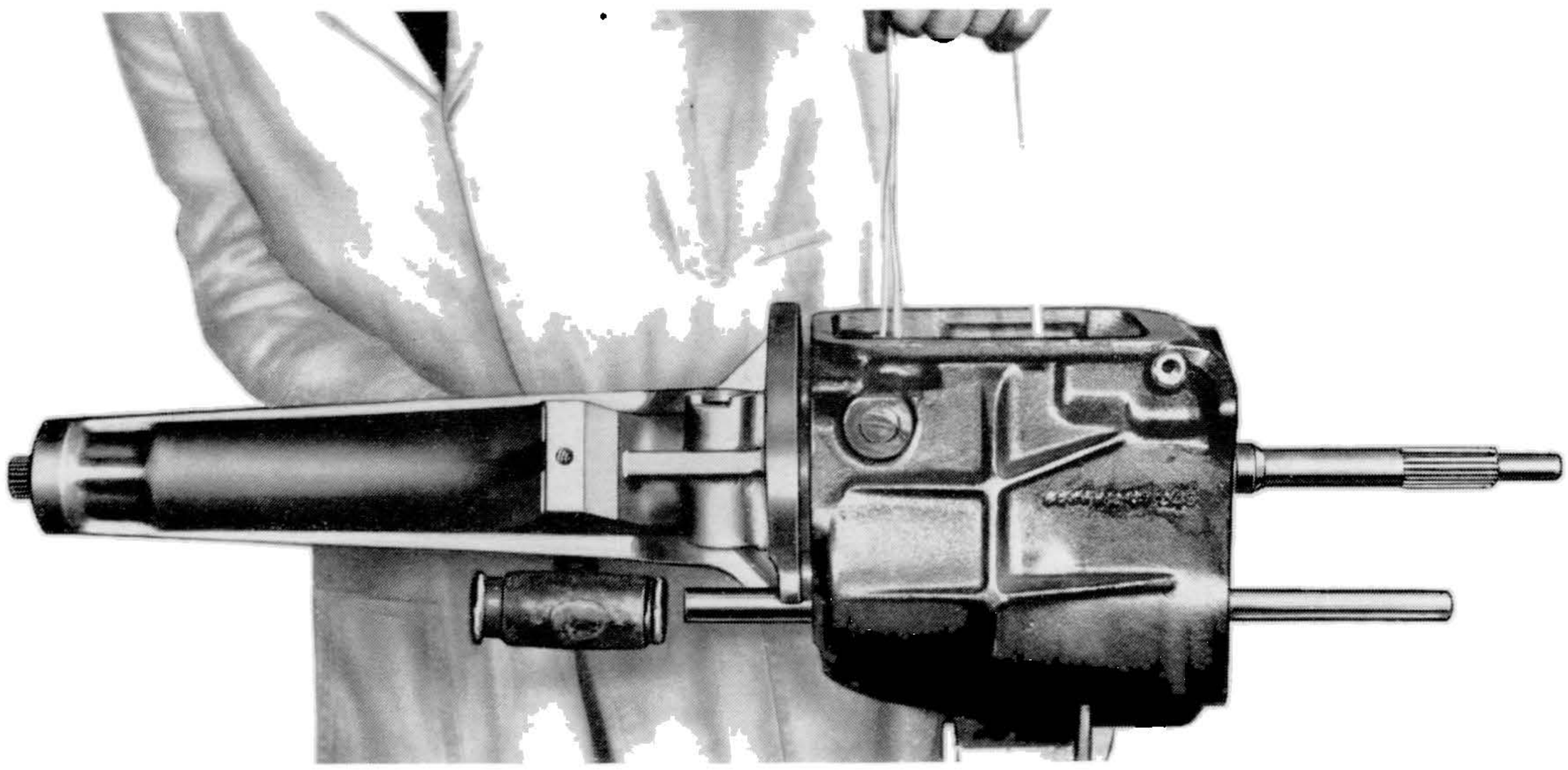
OP 7003-A3 EXTRA: THIRD TOP SYNCHRONISER ASSEMBLY — OVERHAUL

Tools Required

P 4090-9	Split Rings
P 4090-7A/b	Replacer Adaptor
370	Press Base Plate
STN 7245	Thrust Button

To Dismantle

1. Lift off top gear blocker ring from the main drive gear side of the third/top gear synchroniser assembly.



Replacing the Countershaft (Floor Change)

2. Remove circlip at forward end of mainshaft and discard it. Locate the split rings Tool No. P.4090-9 around the rear face of the third gear and in the base plate of the press. Press the mainshaft out of the third/top gear synchroniser and the third gear whilst supporting the mainshaft from beneath to prevent it dropping.

3. Dismantle the synchroniser assembly by pulling the sleeve off the hub and withdrawing the blocker bars and springs.

4. Check all parts for wear. If the synchroniser hub or sleeve show signs of damage or wear, both must be renewed.

To Reassemble

5. Slide the synchroniser sleeve over the hub and locate a blocker bar in each of the three slots cut in the hub.

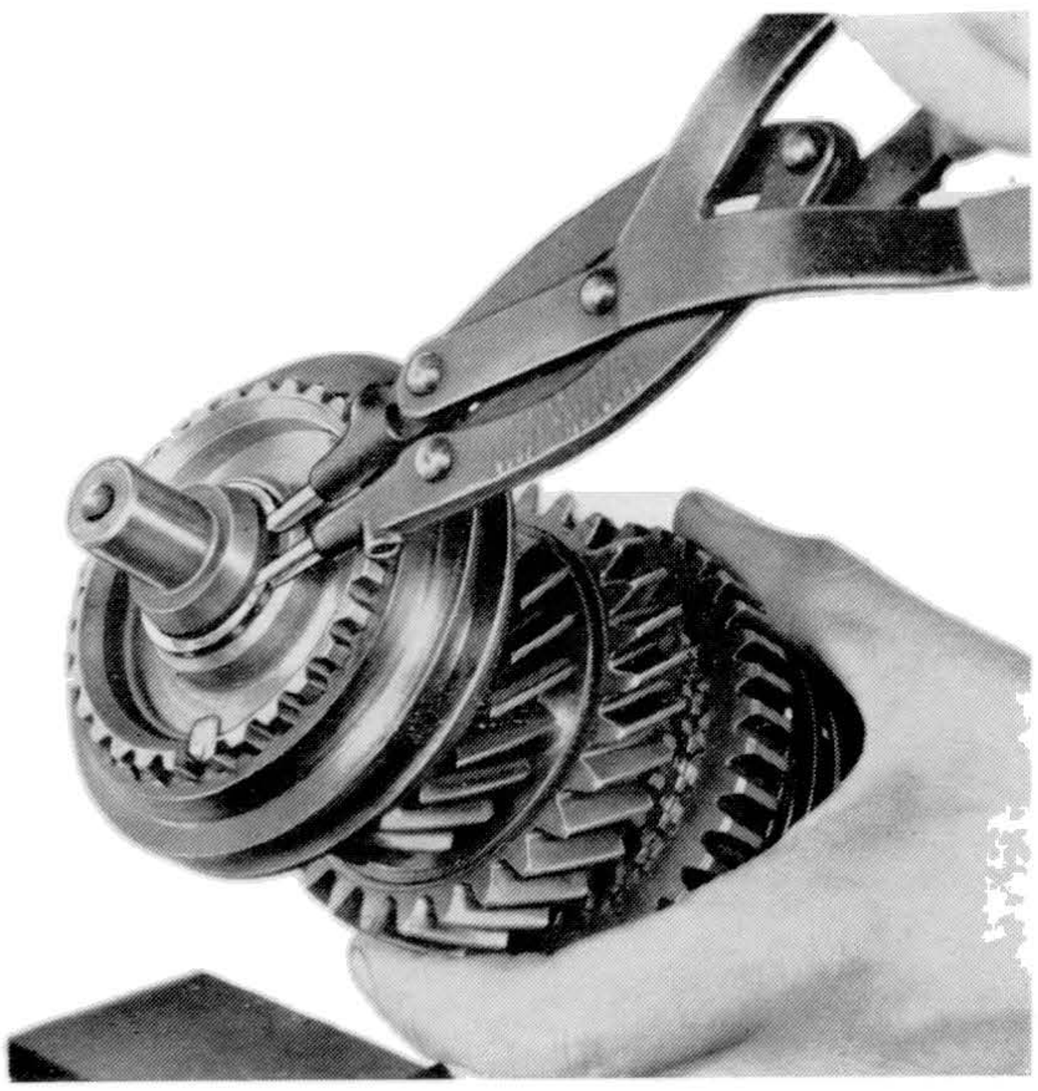
   NOTE — If a new synchroniser unit is being installed, slide the sleeve off the hub and clean all traces of preservative from the hub, sleeve, blocker bars and springs. Lightly oil them.

6. Install a blocker bar spring to run around, clockwise or anti-clockwise, inside the synchroniser sleeve beneath the blocker bars. The tagged end of the spring must locate in the "U" section of a blocker bar. Fit the other spring to the opposite face of the synchroniser unit ensuring that the spring tag locates in the same blocker bar as the spring just fitted and runs in the same rotational direction. View direct onto one side of the synchroniser assembly and note the direction of rotation of the spring (clockwise or anti-clockwise). View direct onto the other side of the synchroniser assembly — the direction of rotation of the spring should be the same as for the first spring, when viewed face on.

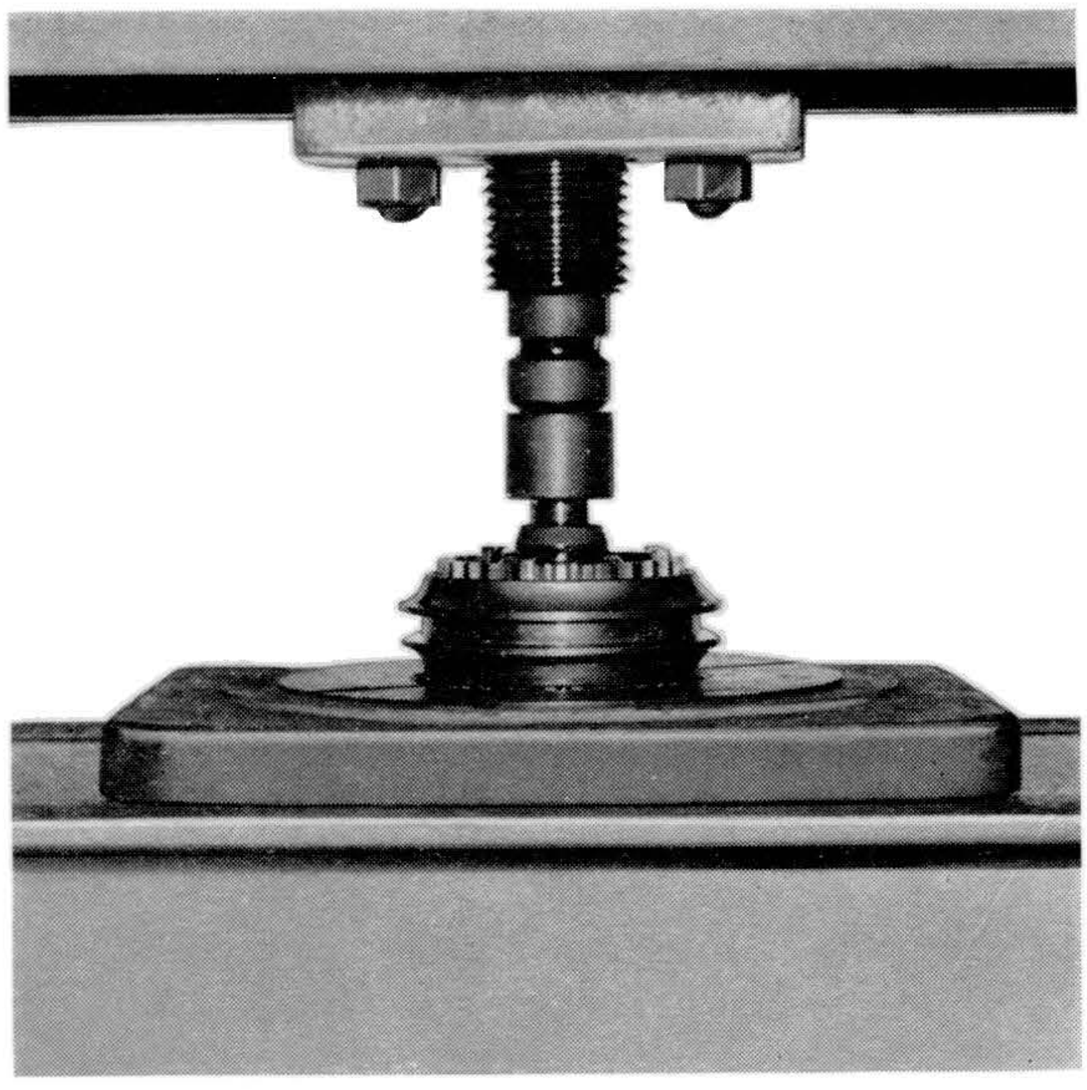
7. Position the third gear on the mainshaft so that the dog teeth face forward. Assemble the blocker ring on the third gear cone.

8. Position the synchroniser assembly on the mainshaft with the boss forward.

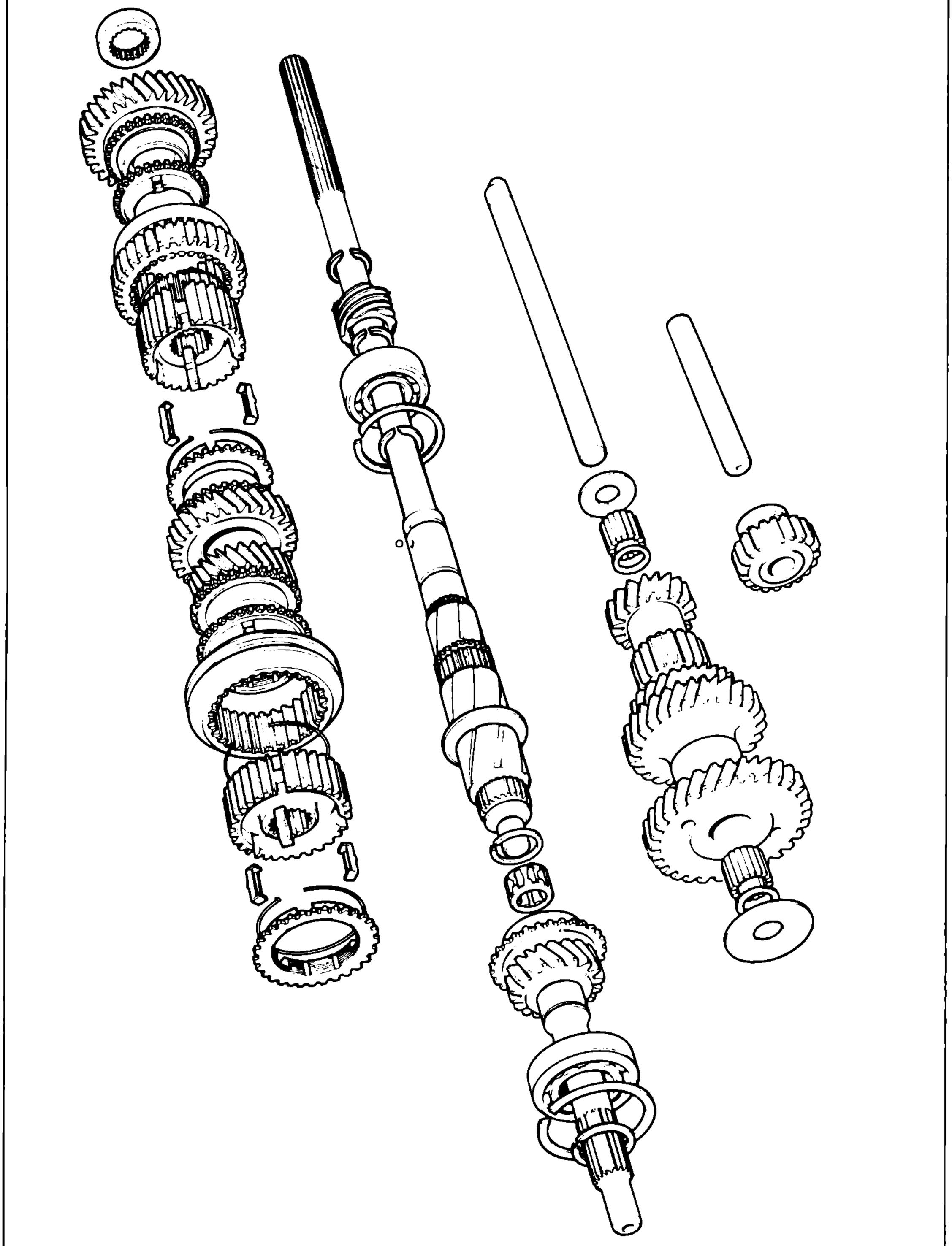
9. Support the hub on Tool No. P.4090-7A/b and locate it in the bed of a press. Press the hub fully home and then fit a new circlip on the mainshaft in front of the hub.



Removing Third/Fourth Synchroniser Circlip



Removing Third/Fourth Synchroniser Assembly



Gearbox Internals (Floor Change)

10. Prior to fitting the mainshaft and extension housing assembly to the gearbox locate the top gear blocker ring on the main drive gear cone.

OP 7003-A4 EXTRA: FIRST/SECOND SYNCHRONISER ASSEMBLY — OVERHAUL
(Includes removing first and second gears)

Tools Required

P.4000-31A/a	Replacer adaptor — 1st gear and mainshaft bearing
P.4090-6	Split rings — 1st gear and mainshaft bearing replace
P.4090-7A/a	Split rings — 1st gear
P.4090-7A/b	Replacer adaptor — 1st/2nd synchro hub assembly
P.4090-9	Split rings — 2nd gear
P.7146	Mainshaft nut spanner (Column Change)
P.7154	Master spacer (Floor Change)
370	Press base plate

To Dismantle

1. (*a*) **Floor Change only**

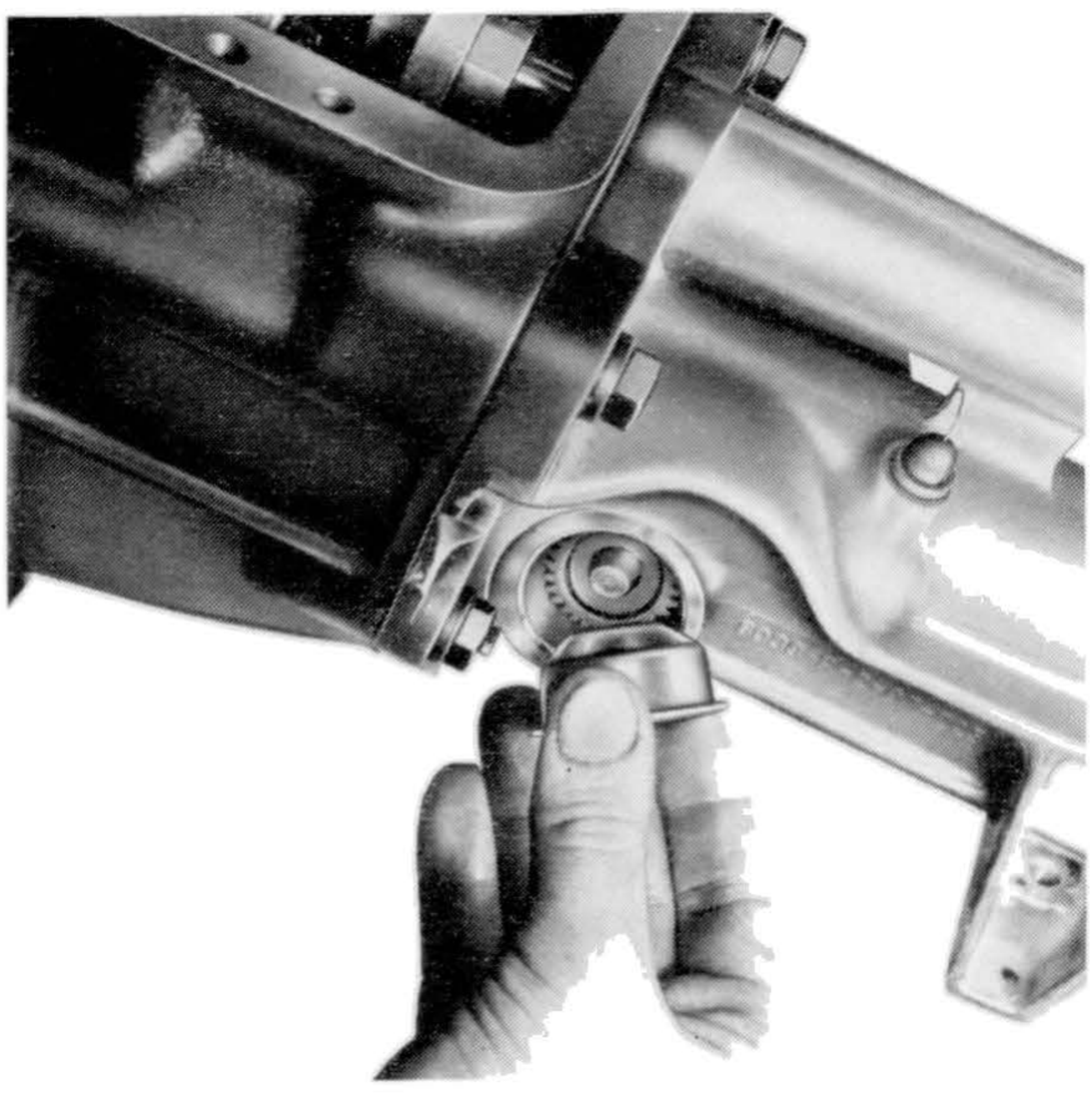
   (i) Withdraw speedometer drive gear after removing the plug on the extension housing.

   (*b*) **Column Change only**

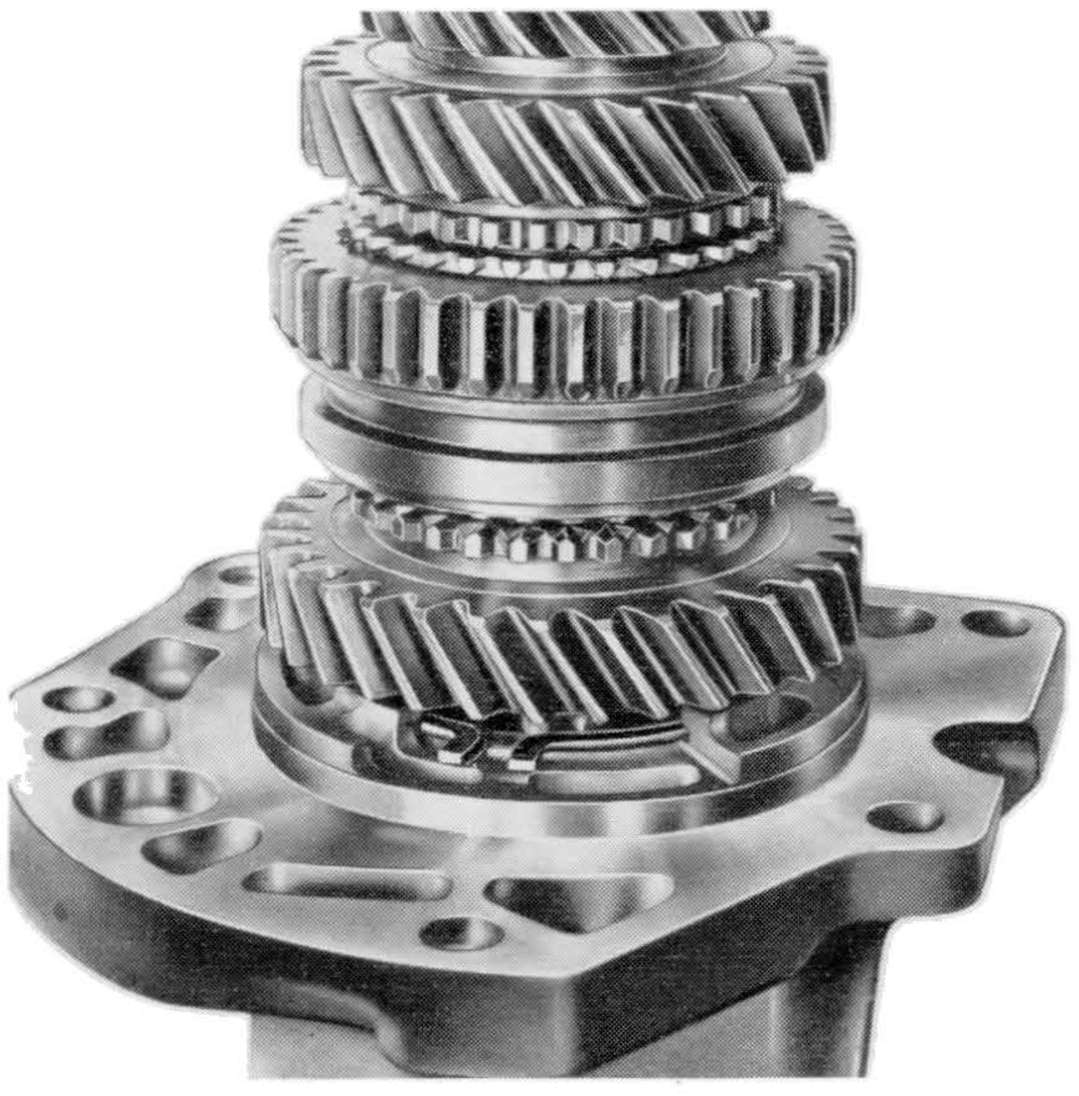
   (i) Lift up the retaining tab behind the mainshaft nut and unscrew the nut (use ring spanner Tool No. P.7146). Remove the speedometer drive gear, lock ball and spacer from mainshaft.

2. (*a*) **Floor Change only**

   (i) Remove the circlip securing the mainshaft bearing to the extension housing from its groove.



Speedometer Driven Gear Retaining Plug (Floor Change)



Circlip Securing Mainshaft Bearing to Extension Housing (Floor Change)

Gearbox Internals – Exploded View (Column Change)

(ii) Tap mainshaft assembly out of extension housing using a hide mallet.

(iii) Remove circlips retaining speedometer drive gear and mainshaft bearing to mainshaft.

3. Position the split rings Tool No. P.4090-7A/a behind the first gear and place assembly in the press base Tool No. 370. Press the first gear, spacer, mainshaft bearing (and speedometer gear, floor change only) from the mainshaft.

4. Remove circlip securing first and second synchroniser assembly to mainshaft.

5. Position split rings Tool No. P.4090-9 behind the second gear, and place the assembly in the press base Tool No. 370. Press the second gear and first and second synchroniser assembly complete with blocker rings off the mainshaft. Dismantle the synchroniser assembly.

6. Check all parts for wear. If the synchroniser hub or sleeve show sign of damage or wear, both must be renewed. The mainshaft bearing must be discarded.

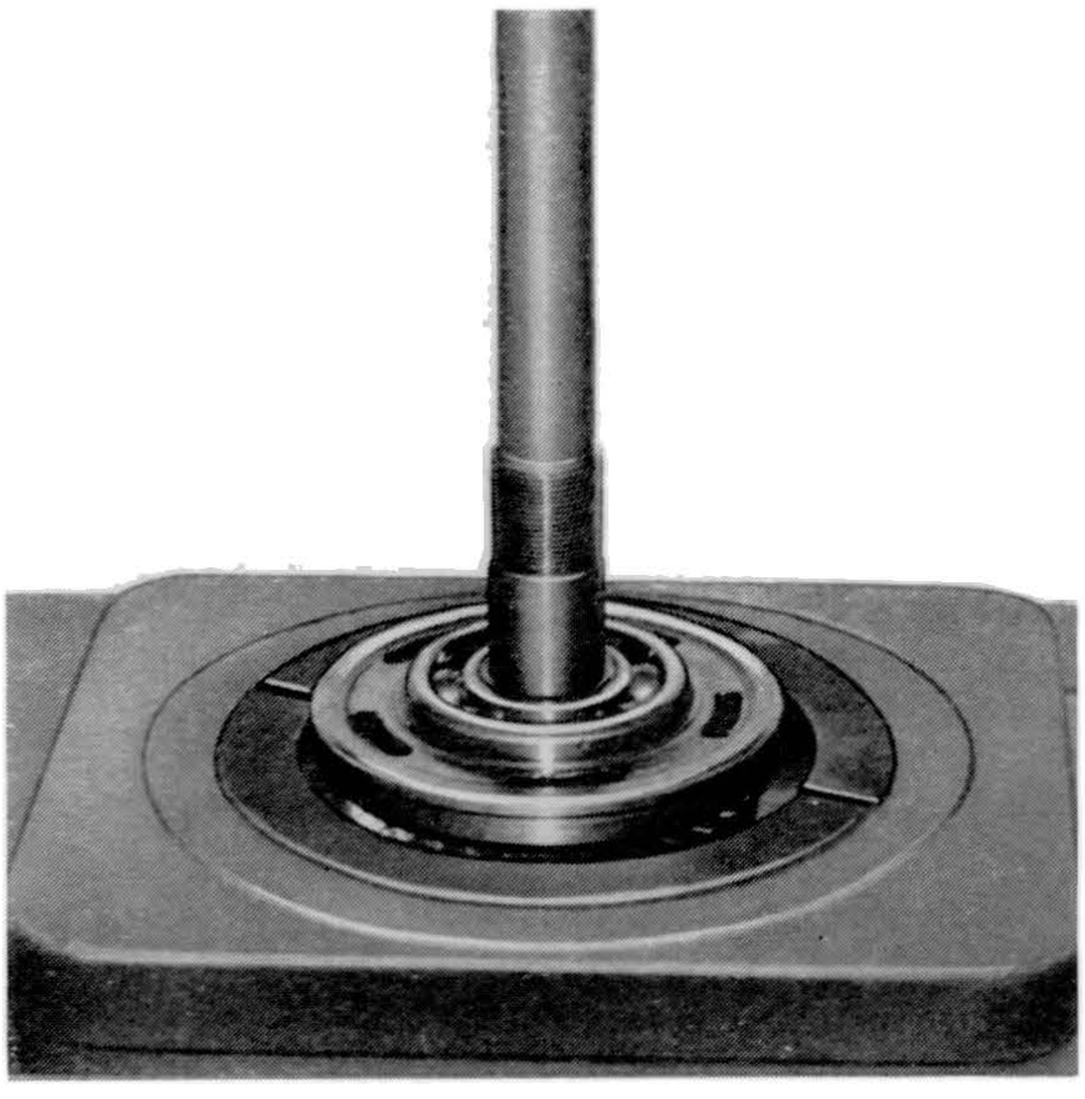
To Reassemble

7. Assemble the second speed gear to the mainshaft so that the cone and dog teeth are rearwards.

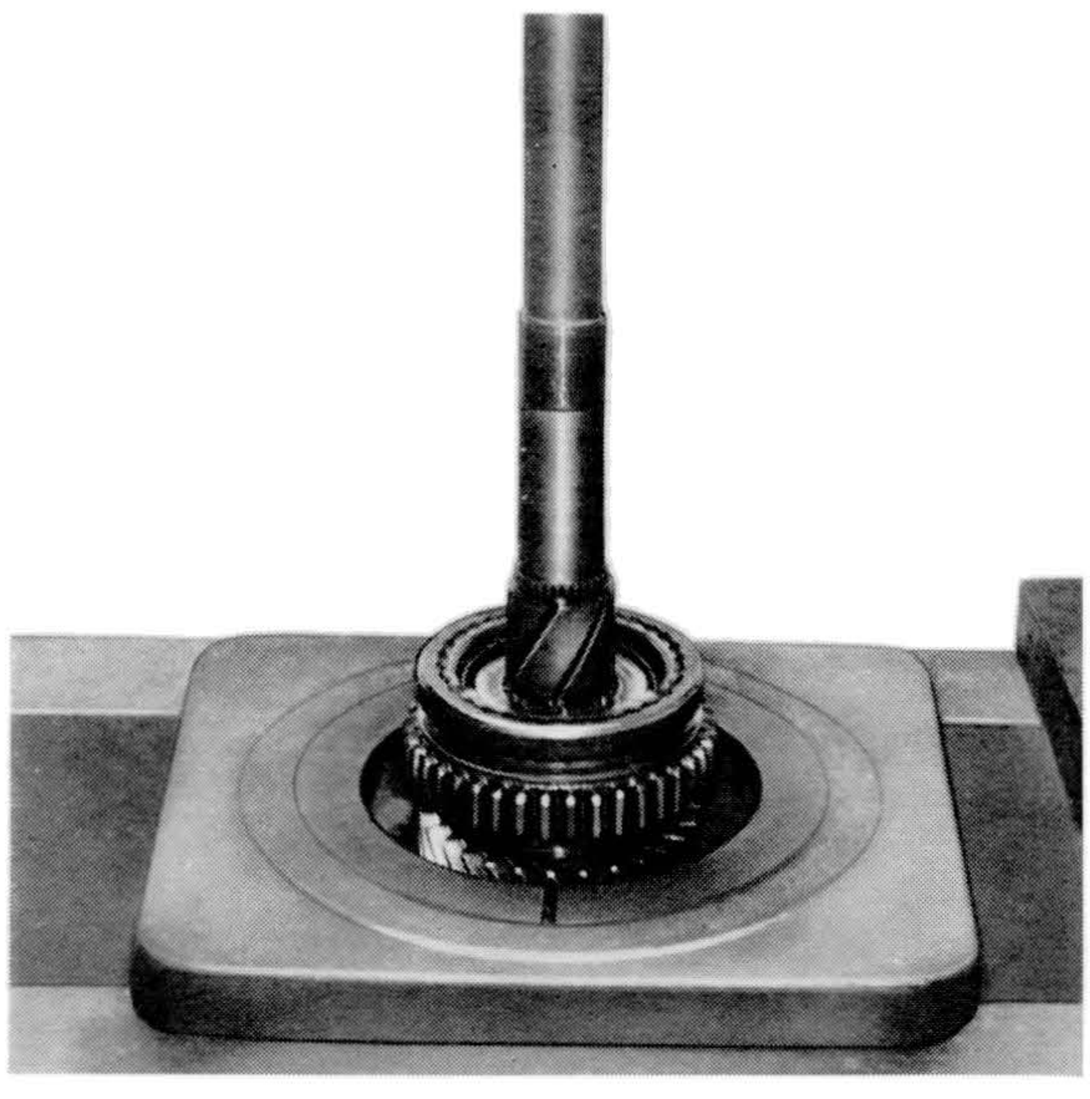
8. Slide the synchroniser sleeve over the hub and locate a blocker bar in each of the three slots cut in the hub.

   NOTE — If a new synchroniser unit is being installed, slide the sleeve off the hub and clean all traces of preservative from the hub, sleeve, blocker bars and springs. Lightly oil them.

9. Install a blocker bar spring to run around, clockwise or anti-clockwise, inside the synchroniser sleeve beneath the blocker bars. The tagged end of the spring must locate in the "U" section of a blocker bar. Fit the other spring to the opposite face of the synchroniser unit ensuring that the spring tag locates in the same blocker bar as the spring just fitted and runs in the same rotational direction. View direct onto one side of the synchroniser assembly and note



Removing First Gear and Mainshaft Bearing



Removing First/Second Gear Synchroniser

the direction of rotation of the spring (clockwise or anti-clockwise). View direct onto the other side of the synchroniser assembly — the direction of rotation of the spring should be the same as for the first spring, when viewed face on.

10. Assemble a blocker ring to the cone on second gear.

11. Fit the synchroniser assembly onto the mainshaft so that the reverse gear teeth on the periphery of the synchroniser sleeve are forwards.

12. Locate the replacer, P.4090-7A/b, so that the plain side abuts the rear of the synchroniser hub.

13. Locate the mainshaft in the press base plate, 370.

14. Press the synchroniser assembly onto the mainshaft as far as possible. Secure the synchroniser assembly in position with the circlip.

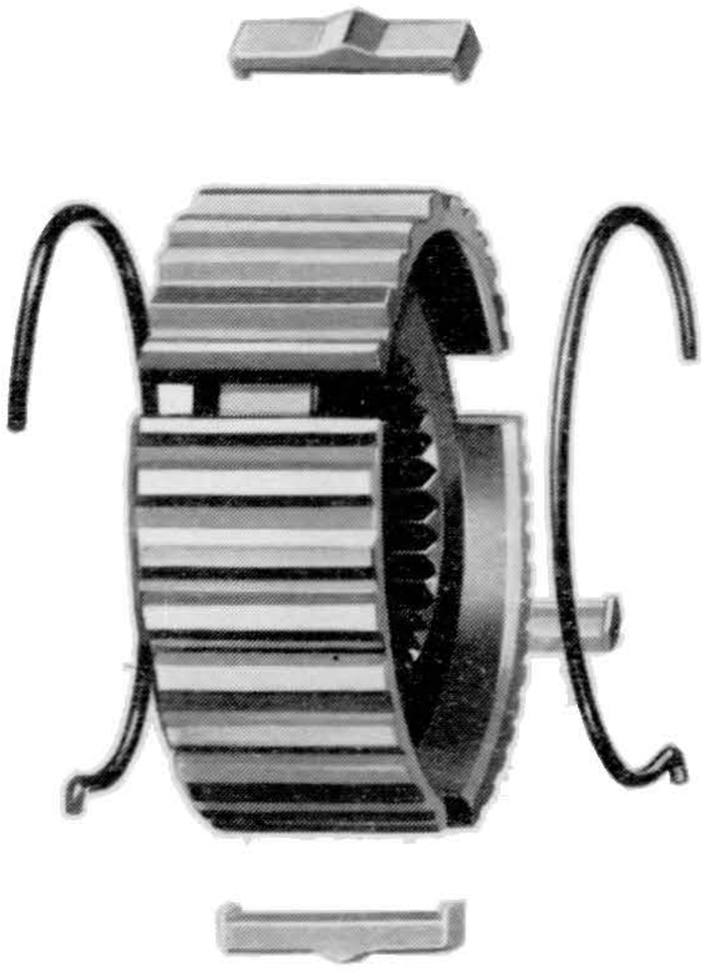
15. Assemble a blocker ring to the first gear side of the first/second synchroniser assembly on the mainshaft. Fit the first speed gear, cone side forwards to the mainshaft.

16. (*a*) **Floor Change Only**

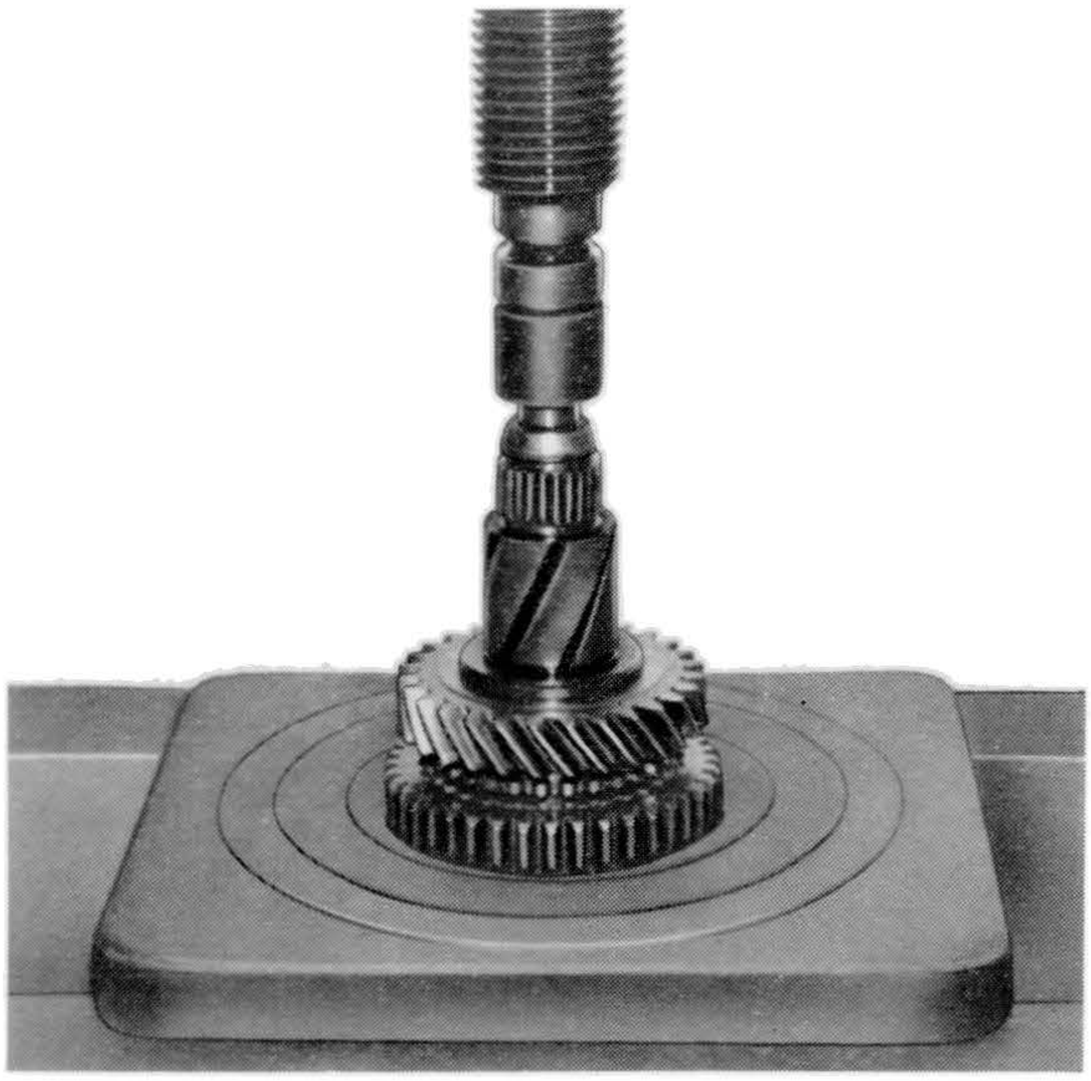
(i) Position the spacer (or oil slinger) on the mainshaft so that the larger diameter is adjacent to the first speed gear.

(ii) Assemble the master spacer, P.7154, to the mainshaft bearing recess in the extension housing so that the flat side is visible. Assess which circlip would be required to clamp the spacer into the bearing recess so that there is no end-float. Then measure the width of the bearing outer track, using a micrometer. If this dimension is different to the larger dimension marked on the spacer, it will be necessary to vary the circlip to compensate.

Example		*in.*	*mm.*
(*a*)	Dimension marked on spacer	= 0.6683	16.98
(*b*)	Measured thickness of mainshaft bearing outer track	= 0.6660	16.92
(*c*)	Subtract (*b*) from (*a*)	0.0023	0.06



Synchroniser Spring Rotation



Replacing First, Second Gear Synchroniser Assembly

Therefore the circlip required must be approximately 0.0023 in. (0.06 mm.) thicker than the one selected when using the spacer. The circlip selected must not exceed the required increase in thickness, if it does it may be too large and will not go into the circlip groove. The following table shows the part numbers, dimensions and colour codings of the circlip:—

Part No.	*Size—in. (mm.)*	*Colour Code*
2824E-7030-A ...	0.0731 (1.857)	... Yellow
2824E-7030-B ...	0.0720 (1.829)	... Red
2824E-7030-C ...	0.0708 (1.798)	... ... Blue
2824E-7030-D ...	0.0696 (1.768)	... ... Violet
2824E-7030-E	0.0684 (1.737)	... ... Green
2824E-7030-F ...	0.0682 (1.707)	... ... Magenta
2824E-7030-G ...	0.0670 (1.676)	... ... Plain

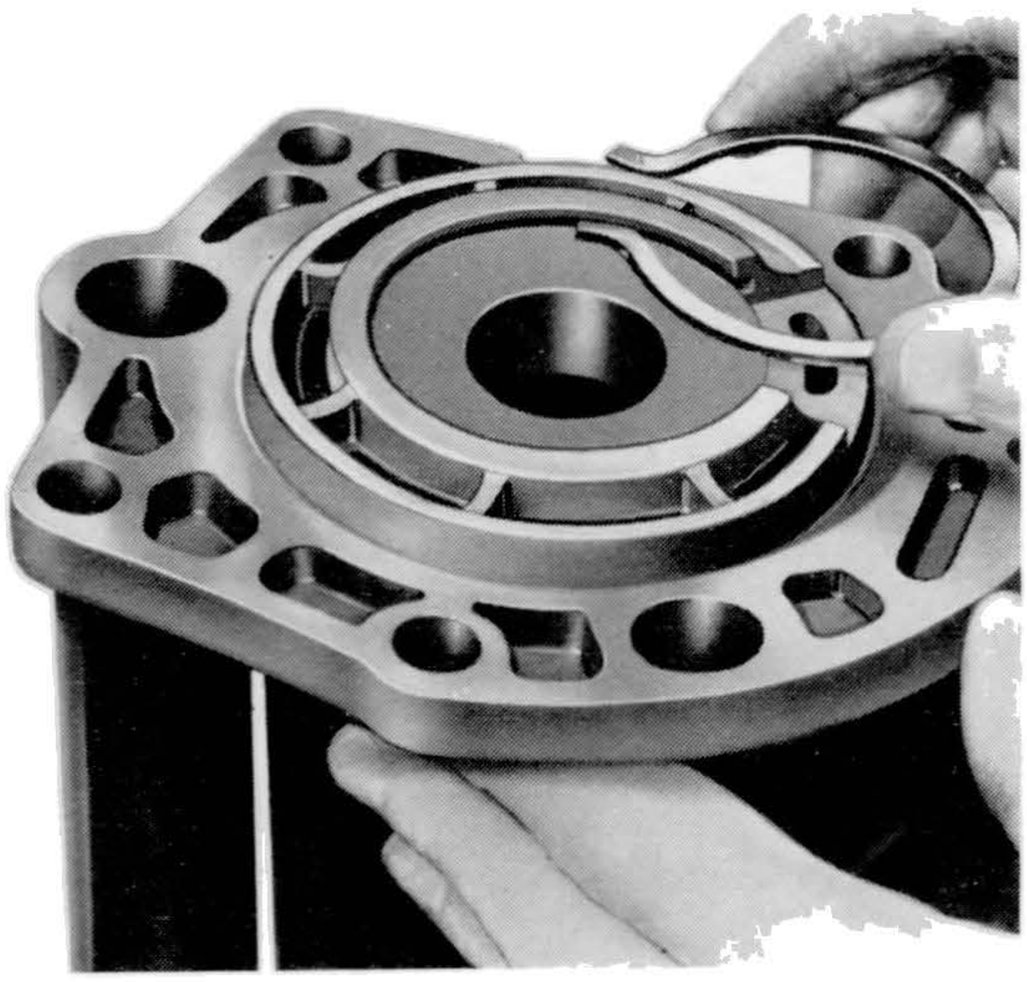
(iii) Position the selected circlip loosely on the mainshaft adjacent to the spacer (or oil slinger) fitted in sub-operation 19.

Locate the replacer, P.4000-31A/a, on the bearing so that the recessed side abuts the inner race.

With the split rings, P.4090-6, in the press base plate, 370, locate the bearing and replacer so that they fit into the split rings. Press the bearing into position on the mainshaft.

With the thickest circlip which fits the groove, secure the bearing to the mainshaft, using one of the following selective range:—

Part No.	*Size—in. (mm.)*	*Colour Code*
2824E-7669-A	0.0707 (1.796)	Plain
2824E-7669-B ...	0.0719 (1.826)	Pink
2824E-7669-C ...	0.0731 (1.857)	Magenta
2824E-7669-D ...	0.0743 (1.887)	Violet
2824E-7669-E ...	0.0755 (1.918)	Green
2824E-7669-F	0.0767 (1.948)	Blue
2824E-7669-G ...	0.0779 (1.979)	Red
2824E-7669-H ...	0.0791 (2.009)	Yellow



Assessing Circlip Retaining Mainshaft Bearing to Extension Housing (Floor Change)

Replacing Mainshaft Bearing

Locate ball bearing in mainshaft indent, and press speedometer drive gear onto mainshaft so that it just clears circlip groove in mainshaft. Fit new circlip to mainshaft to retain gear in position.

Heat the front end of the extension housing using a suitable hot plate or by placing in hot water. This will expand the extension housing so that the mainshaft can easily be fitted. **DO NOT USE A WELDING TORCH.**

Fit the circlip to secure the mainshaft bearing to the extension housing.
Refit the speedometer driven gear and fit a new plug, using a suitable sealer, to the extension housing.

(*b*) **Column Change Only**

(i) Slide first gear onto mainshaft so that the dog teeth are located adjacent to the blocker ring on the first/second gear synchroniser.

(ii) Fit the collar behind the first gear and position the bearing carrier on the mainshaft with the dowel hole to the rear. Fit the mainshaft bearing and slightly withdraw the bearing carrier to fit over the bearing.

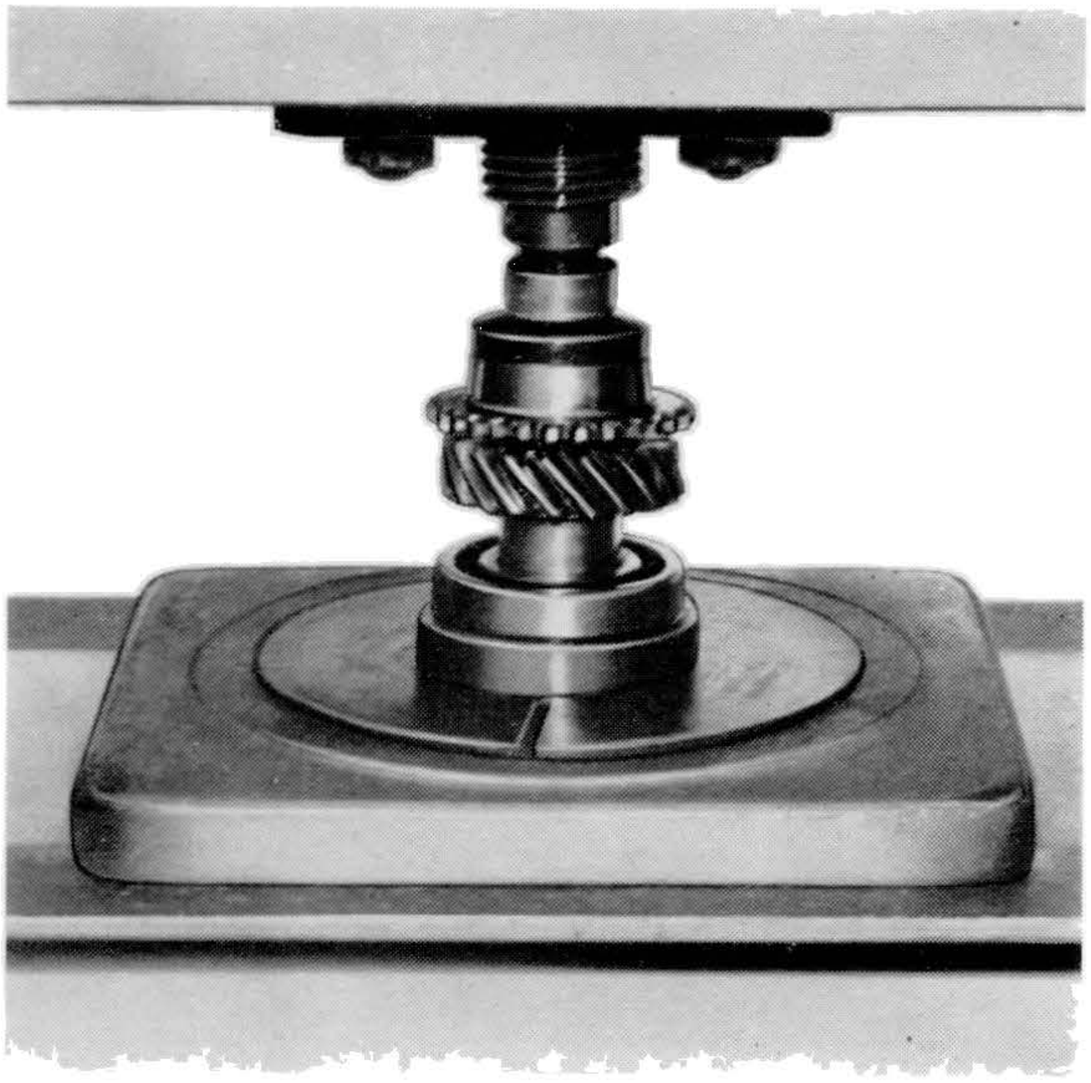
(iii) Locate adaptor Tool No. P.4000-31A/a, over bearing and insert in split rings Tool No. P.4090-6, in bed of press. Press the bearing home onto its journal.

(iv) Place the spacer and lock-ball on the mainshaft and slide on the speedometer gear and lock tab. Screw on the mainshaft nut and torque to 25 lb. ft. (3.4 kg.m.) (use ring spanner, Tool No. P.7146). Bend the lock tabs to retain the nut.

OP 7003-A5 EXTRA: EXTENSION HOUSING – OVERHAUL
(Identical to operation 7000-A8)

OP 7003-A6 EXTRA: MAIN DRIVE GEAR BEARING RETAINER OIL SEAL – RENEW
(Identical to operation 7000-A6)

Removing Main Drive Gear Bearing



Replacing Main Drive Gear Bearing

OP 7003-A7 EXTRA: MAIN DRIVE GEAR — REMOVE AND INSTALL

Tools Required

P.4000-39a	Replacer adaptor
P.4000-39b	Thrust pad
P.4090-6	Split rings – replacing
P.4090-10	Split rings – removing
370	Press base plate

To Dismantle

1. Remove the spigot bearing from the recess in the end of the main drive gear.

2. Using a suitable copper drift, tap the main drive gear and bearing assembly out through the front of the gearbox.

3. Remove the circlips from the main drive gear and the bearing. Discard the circlips.

4. With the split rings, P 4090-10, located round the bearing, press the bearing off the main drive gear. Use the 370 base plate to position the split rings in the press.

To Reassemble

5. Position the recessed adaptor, Tool No. P 4000-39a, so that the centre boss locates on the bearing inner track. Fit the thrust button, Tool No. P 4000-39b, to the cone end of the main drive gear.

6. With the split rings, Tool No. P 4090-6, in the base plate, 370, locate the main drive gear so that the adaptor, Tool No. P 4000-39a, is downwards and press the bearing fully home.

   NOTE — The tools used to replace the bearing, which is an interference fit, ensure that all the load is taken through the inner bearing track. If the bearing is fitted so that the press load is taken through the ball bearings, then the bearing will be damaged. Therefore, ensure that the correct tools are used.

7. Fit the circlip to secure the bearing to the main drive gear. This circlip is a selective fit, therefore fit the thickest one that will fit the groove in front of the bearing.

8. Fit the circlip to the periphery of the bearing.

9. Assemble the main drive gear to the gearbox and, using a copper drift on the bearing outer race, tap it into place until the circlip on the bearing contacts the gearbox case. Take care that the dog teeth on the main drive gear are not damaged by the cluster gear.

   NOTE — The bearing is an interference fit in the casing. Therefore, when fitting the bearing, it is important that the outer race is tapped. Do not tap on the main drive gear, this will result in a load passing through the ball bearings, consequently the bearing will be damaged.

10. Assemble the spigot bearing to the recess in the end of the main drive gear.

OP 7003-A8 EXTRA: COUNTERSHAFT GEAR — REMOVE AND INSTALL

To Dismantle

1. Remove the countershaft gear and the two thrust washers from the gearbox. In both ends of the countershaft gear there are twenty-one needle rollers retained by a small retaining washer on each side of each set of rollers. Remove the needle rollers, the washers and the dummy countershaft (P 7113).

To Reassemble

2. Slide the dummy countershaft into the countershaft gear. Fit a retainer washer over the dummy countershaft and push it into the gear bore. Grease the needle rollers and assemble twenty-one into the recess, fit the second retaining washer. Repeat this procedure for the rollers at the other end of the gear. Grease the thrust washers and locate them so that their convex side fits into the recess.
3. Position the countershaft gear in the bottom of the gearbox case, taking care not to displace the thrust washers. Position the thrust washers so that the "ears" are located on each side of the location boss and with the flat on the washer uppermost.

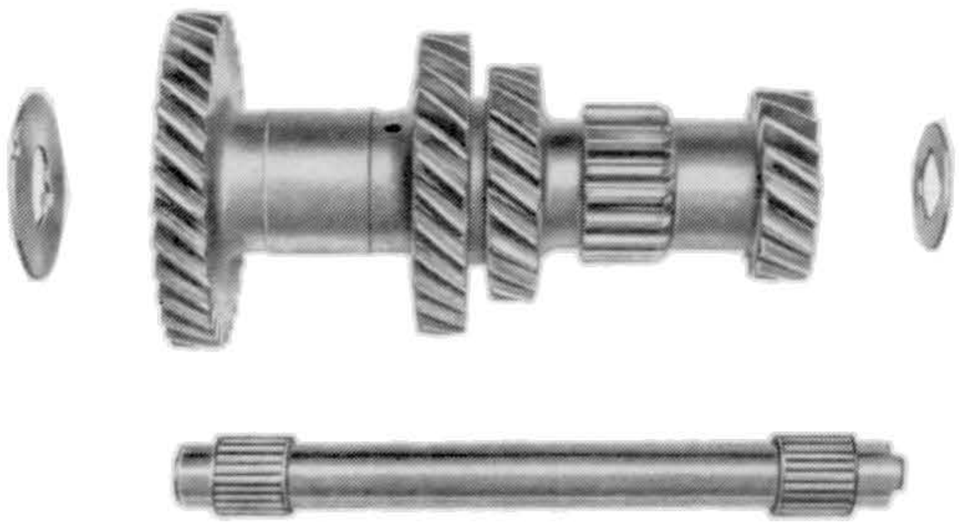
OP 7003-A9 EXTRA: REVERSE IDLER GEAR — REMOVE AND INSTALL

Tools Required

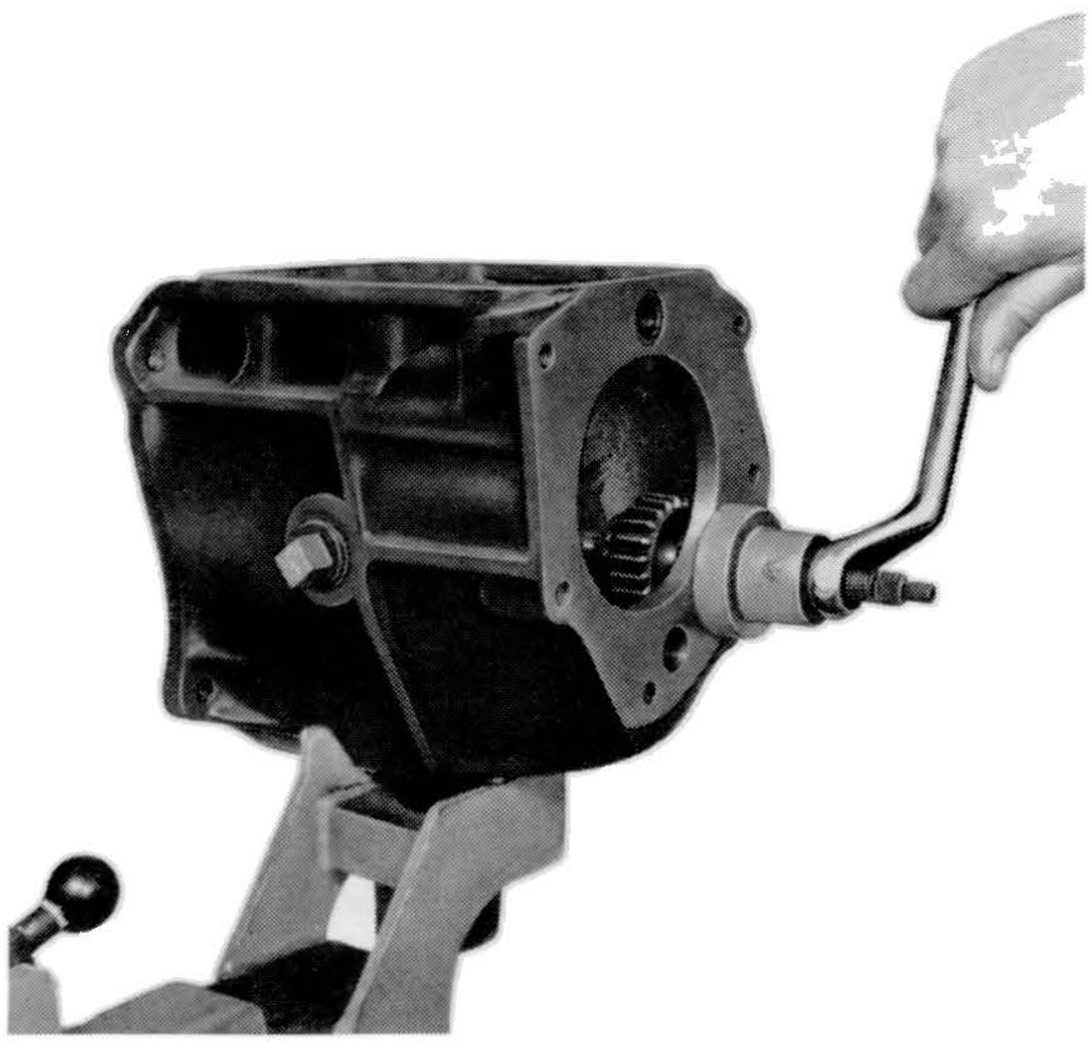
P 7043 Reverse Idler Shaft Remover

To Remove

1. Withdraw the reverse idler shaft with Tool No. P 7043. Should this tool not be available, locate a nut, a flat washer and a sleeve on a $\frac{5}{16}$ in. 24 UNF threaded bolt. Screw the bolt into the reverse idler shaft and tighten the nut to withdraw the shaft.



Countershaft Assembly — Exploded



Removing Reverse Idler Shaft

To Install

2. Push the idler shaft into the gearbox, fit the reverse idler gear on the shaft and locate the reverse selector relay lever in the groove in the reverse idler gear.
3. Hammer the reverse idler shaft into position using a copper mallet.

OP 7003-A10 EXTRA: REVERSE SELECTOR FORK — REMOVE AND INSTALL (FLOOR CHANGE ONLY)

To Remove

1. Slide the reverse relay lever from the fulcrum pin on the gearbox casing. *Do not remove the pin.*

GROUP OPERATIONS

OP 7003-B SELECTOR MECHANISM – OVERHAUL
(Includes OPS 7003-A and A1)

OP 7003-C THIRD/TOP SYNCHRONISER ASSEMBLY – OVERHAUL
(Includes OPS 7003-A, A1, A2 and A3)

OP 7003-D FIRST/SECOND SYNCHRONISER ASSEMBLY – OVERHAUL
(Includes OPS 7003-A, A1, A2 and A4)

OP 7003-E MAIN DRIVE GEAR BEARING RETAINER OIL SEAL – RENEW
(Includes OPS 7003-A and A6)

OP 7003-F MAIN DRIVE GEAR – REMOVE AND INSTALL
(Includes OPS 7003-A, A1, A2, A6 and A7)

OP 7003-G COUNTERSHAFT GEAR – REMOVE AND INSTALL
(Includes OPS 7003-A, A1, A2, A6, A7 and A8)

OP 7003-H REVERSE IDLER GEAR – REMOVE AND INSTALL
(Includes OPS 7003-A, A1, A2 and A9)

OP 7003-J REVERSE SELECTOR FORK – REMOVE AND INSTALL – FLOOR CHANGE ONLY
(Includes OPS 7003-A, A1, A2, A9 and A10)

OP 7003-K GEARBOX ASSEMBLY – OVERHAUL
(Includes OPS 7003-A, A1, A2, A3, A4, A5, A6, A7, A8, A9 and A10 where applicable)

OP 7003-L EXTENSION HOUSING – REMOVE AND INSTALL
(Includes OPS 7003-A, A1 and A2)

OP 7201-D COLUMN GEARCHANGE LINKAGE — OVERHAUL

Tools Required

P 7138 Linkage adjusting gauge

To Dismantle

1. Remove the main gearchange rod.
   (a) Remove four screws securing the steering column upper shroud and detach shroud.

(b) Remove the steering wheel.

(c) Remove the circlip, flat washer, wave washer and upper nylon bearing at the top of the gearchange rod.

(d) Lift out the gear lever, after depressing the two spring-loaded pins beneath the rubber cover.

(e) From under the bonnet, remove the gate selector pivot arm after unscrewing the locknut. There is a wave washer beneath the arm which is also removed.

(f) Disconnect the gear selector down-rod from the lever on the gearchange rod, by removing the spring circlip.

(g) Remove the floor cover plate inside the car. It is secured by two crosshead screws.

(h) Depress the plunger on the top of the gearchange rod, move the rod to one side to just clear the bracket and lift it upwards out of the car.

2. There is a pivot bracket bolted to the rear bulkhead just below the heater pressing. Disconnect the two gate selector rods attached to the arm which pivots on the bracket; they are secured by spring clips.

   Remove the pivot arm by unscrewing the locknut.

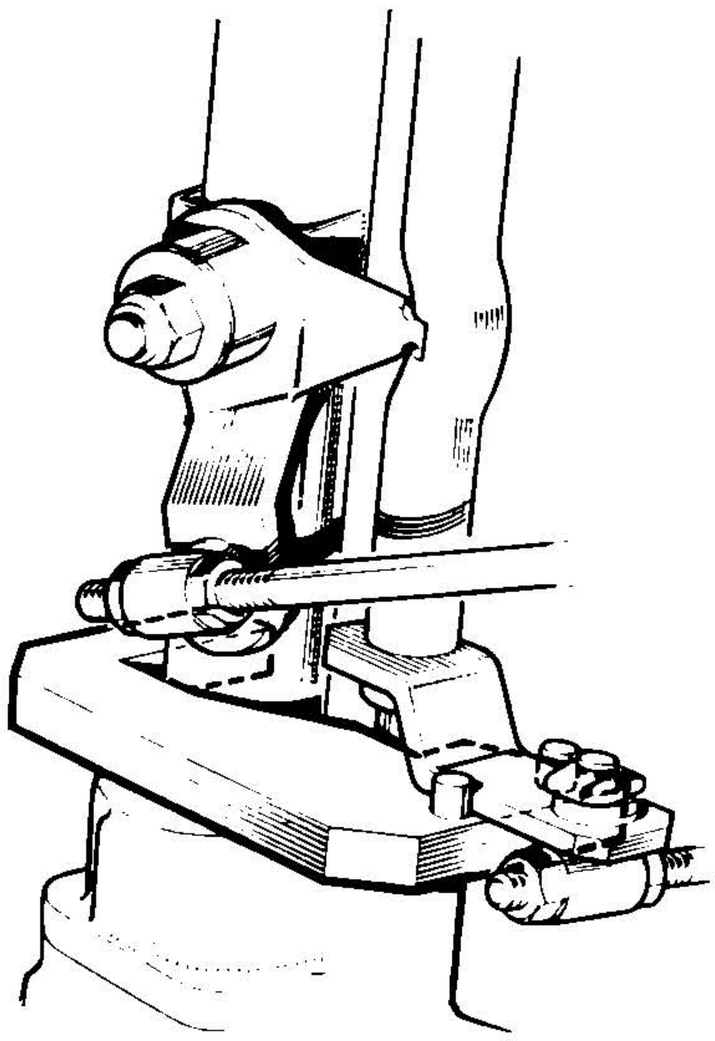
3. There is a gear selector cross rod which pivots between a bracket bolted to the body side rail and a pin in the gearbox case.

   Remove the two bolts securing the bracket to the side rail. Remove the spring clip securing the small lever on the end of the cross rod to the lever on the gearbox top cover. Remove the spring clip on the pin in the gearbox case and remove the cross rod.

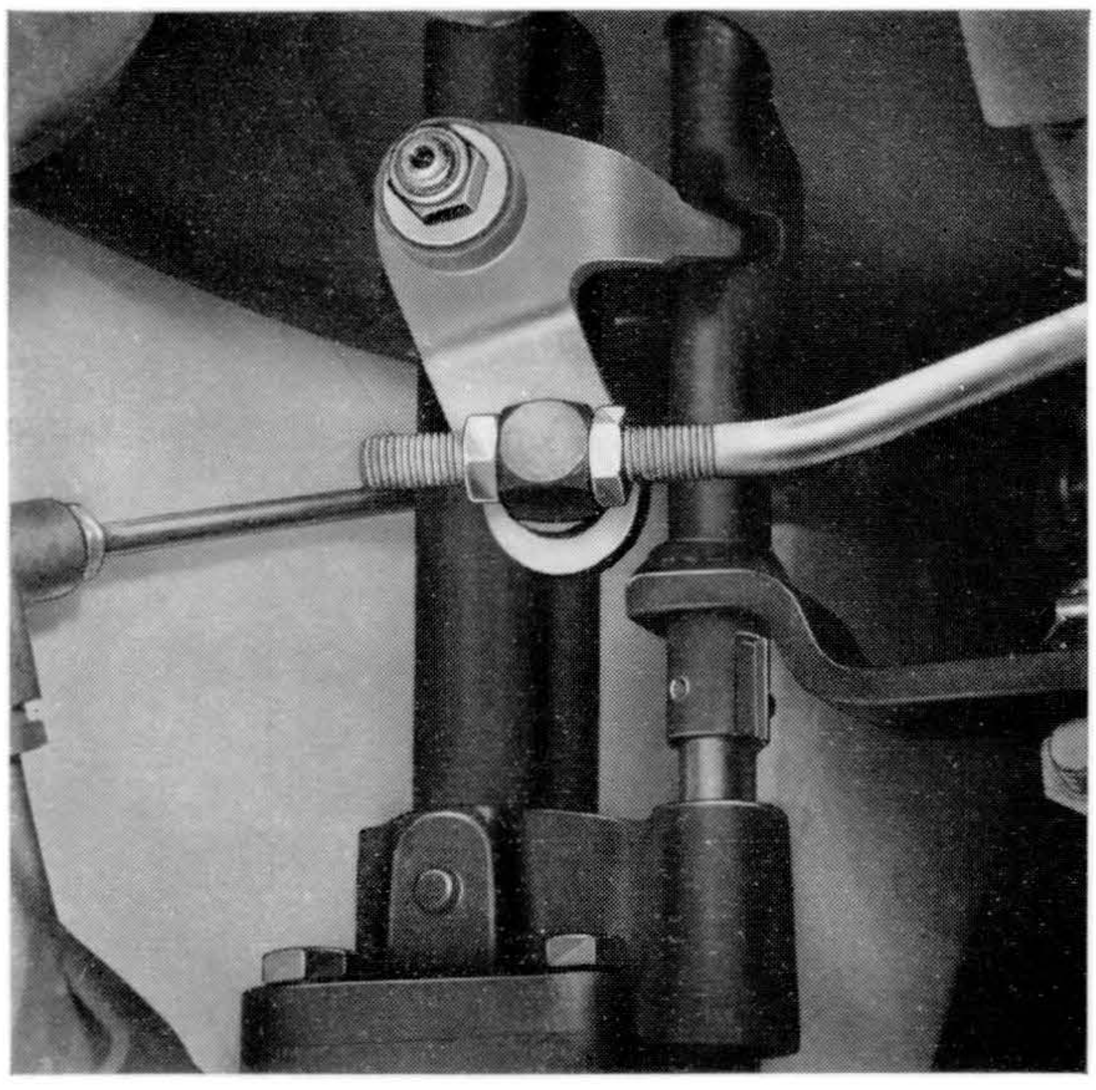
To Reassemble

4. Ensure that all the bushes in the linkage are not worn or distorted.

5. Slide the gear selector cross rod onto the pivot pin in the gearbox case. Retain it with a flat washer, wave washer, flat washer and a spring pin through the hole in the pivot, in that order.



Column Change Linkage Adjustment



Column Change – Lower Linkage

6. Place the bracket over the other end of the cross rod and secure it to the body side rail with two bolts and spring washers.
7. Reconnect the small rod between the cross rod and the lever on the gearbox top cover. Retain it with a spring clip at each end.
8. Replace the gate selector pivot arm on the vertical pin on the bracket beneath the heater pressing. Retain it with a wave washer, flat washer and locknut.
9. Reconnect the rod between lever on the top cover and the pivot arm. Secure with a spring clip.
10. Slide the main gearchange rod into position through the aperture in the floor pan and engage the pin at the lower end in the bore in the steering box. Depress the plunger at the top and locate it in the bracket. Release the plunger. Replace the floor cover plate.
11. Refit the gate selector arm to the pivot on the steering column, ensuring that a wave washer is beneath it. Replace the flat washer and locknut, engaging the arm in the slot in the gear-change rod.
12. Reconnect the gate selector rod to the pivot arm beneath the heater pressing. Secure with a spring clip.
13. Reconnect the gear selector down rod to the arm welded to the gearchange rod. Secure with a spring clip.
14. Replace the nylon bearing, wave washer, flat washer and circlip at the top of the gearchange rod.
15. Replace the gear lever.
16. Refit the steering wheel and shroud.
17. Adjust the linkage.

    (a) Slacken the adjusting nuts on the gate selector arm and gear selector arm at the bottom of the steering column.

    (b) Fit the setting gauge (Tool No. P 7138) between the gear selector arm and the top face of the steering box, ensuring that the protruding pins are on each side of the selector arm (see illustration).

    (c) Screw up the locknuts to just touch the square pivots.

    (d) Finally tighten the locknuts.

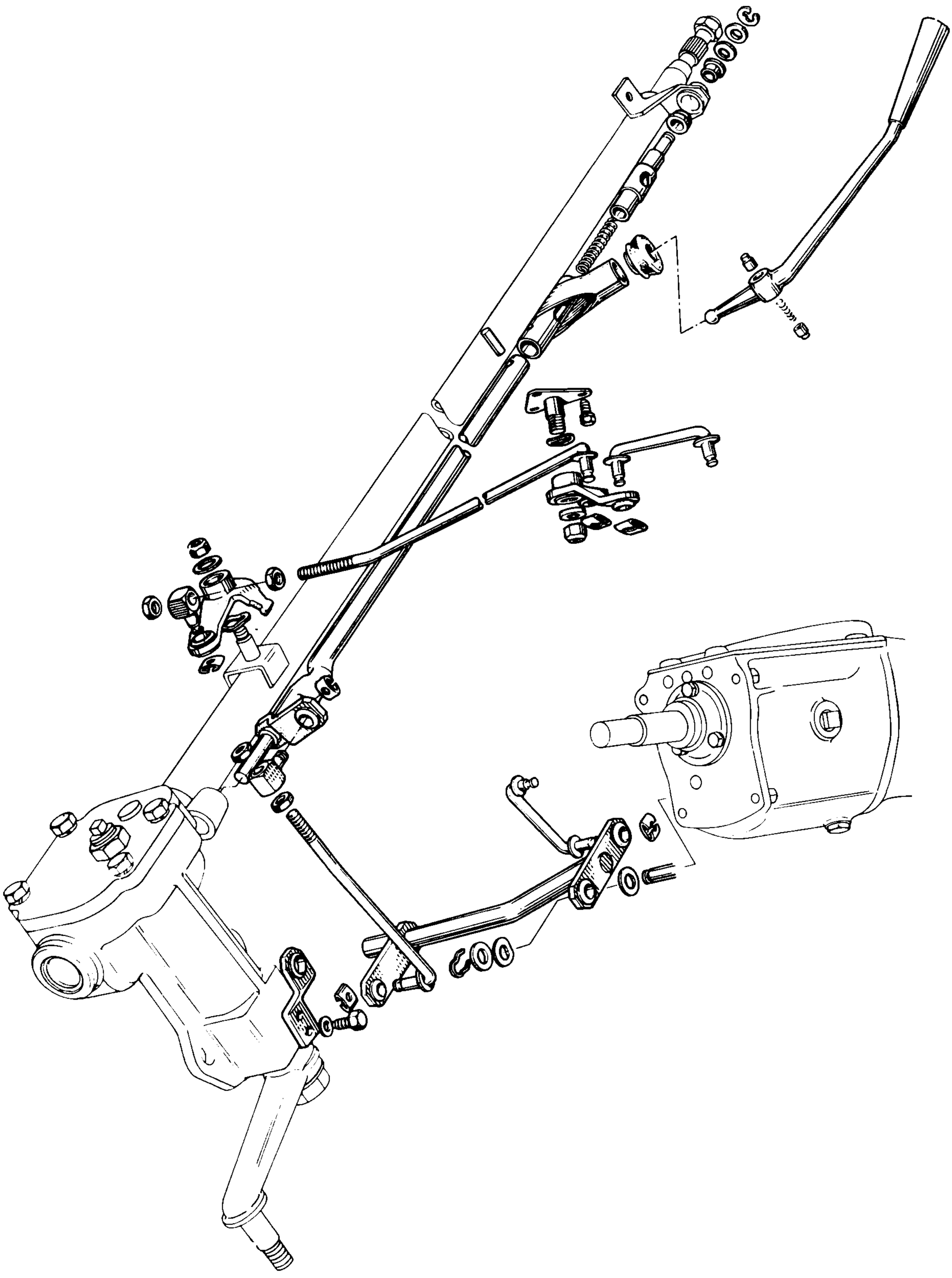
    (e) Check all gears can be engaged.

OP 7500-A CLUTCH HYDRAULIC SYSTEM — BLEED

Tools Required

P 2006 Bleeder tube

1. Clean the area round the bleed valve on the operating cylinder and remove the dust excluding rubber cap.
2. Fit a bleeder tube (P 2006) on the bleed valve and place the other end of the tube in a bottle containing fluid, Part No. ME-3833-F, keeping the end of tube beneath the surface of the fluid throughout the bleeding operation.



Column Gearchange – Exploded View

3. Open the bleed valve by turning it anti-clockwise and depress and release the clutch pedal several times. For each stroke some fluid or air should be pumped out of the tube. If neither fluid nor air is pumped out, the bleed valve is not properly opened or there is a blockage in the pipe line.

   NOTE — Where air in the system is suspected, remember that initial application of the clutch pedal will cause air trapped in the bleed tube to be forced into the fluid container.

4. Continue depressing and releasing the clutch pedal until no more air bubbles emerge from the tube, ensuring that the fluid level in the reservoir is maintained during the bleeding operation.

   Do not replenish the reservoir with fluid obtained from the system as it may be aerated or contaminated.

5. Close the bleed valve tightly with the pedal fully depressed, when fluid alone comes out of the bleed tube with each stroke of the clutch pedal. Refit the dust excluding rubber cap.

6. Refill the reservoir to the correct level and refit the cap.

OP 7501-A CLUTCH FLEXIBLE HYDRAULIC PIPE — RENEW

Tools Required

P 2006 Bleeder tube

P 2012 Brake line plugs

To Remove

1. Jack up the car and fit suitable stands.

2. From underneath the car, unscrew the flexible hose at the clutch slave cylinder and fit a brake plug.

Clutch Operating Cylinder – Exploded View

3. From under the bonnet, unscrew the flexible hose at the clutch master cylinder and fit a brake plug.
4. Prise up the clip retaining the pipe to the nearside apron and remove the pipe.

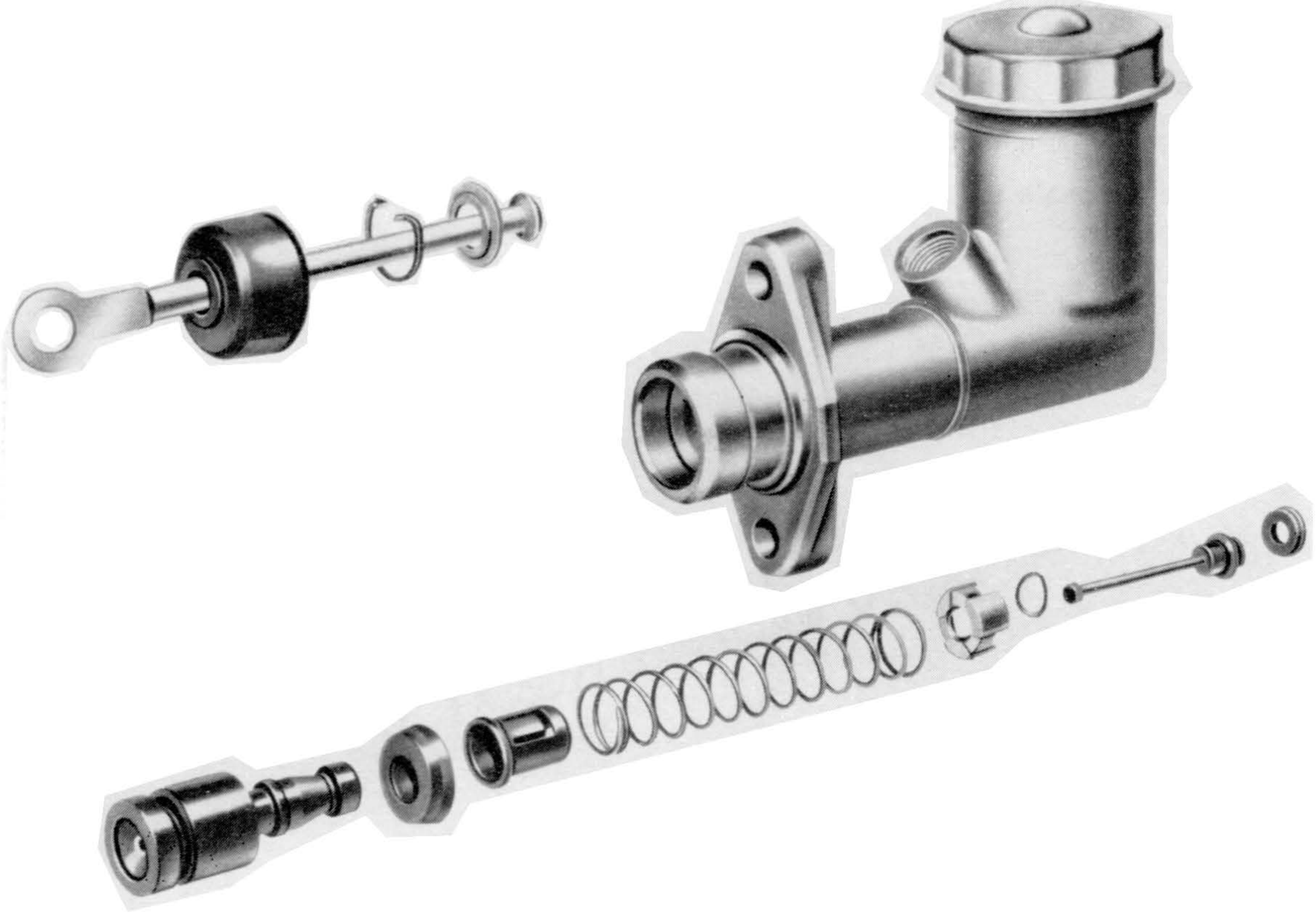
To Replace

5. Remove the brake plug from the clutch master cylinder, and fit the flexible hose.
6. Remove the brake plug from the slave cylinder and fit the flexible hose.
7. Fit the flexible pipe behind the nearside apron clip, and bend the clip into place.
8. Jack up the car, remove stands and lower to the ground.

OP 7501-B CLUTCH HYDRAULIC SLAVE CYLINDER — REMOVE AND INSTALL

To Remove

1. Jack up the front of the car and fit chassis stands.
2. Detach the fluid pipe by unscrewing the union nut, using a blanking plug to prevent dirt entering the pipe.
3. Remove the retaining circlip from around the cylinder body after slipping the rubber boot off the operating cylinder.



Clutch Master Cylinder – Exploded View

4. Push the cylinder forwards out of its location, removing the boot and the push rod simultaneously.

To Replace

5. Slide the cylinder into its location in the clutch housing flange from the front. Push the push-rod through the rubber boot and insert the push-rod with the boot hanging loose, into the operating cylinder and clutch release arm.
6. Fit a circlip, ensuring that it is correctly located in its groove and fit the rubber boot on the operating cylinder.
7. Reconnect the fluid pipe, tighten the union nut.
8. Bleed the system as described in OP 7500-A.

OP 7501-B1 EXTRA: CLUTCH HYDRAULIC SLAVE CYLINDER — OVERHAUL

To Dismantle

1. Remove the piston and seal by extracting the circlip from the cylinder body, and then removing the piston and spring assembly from the cylinder.
2. Unscrew the bleed valve on the side of the operating cylinder.
3. Pull the spring and then the rubber piston seal off the spigot at the front of the piston.
4. Wash all parts in hydraulic fluid, Part No. ME-3833-F, methylated spirit or commercial alcohol and examine the rubber piston seal carefully. Renew the seal if there is any sign of damage to the sealing lip.

To Reassemble

5. Locate the piston seal on the spigot at the front end of the piston with the recess in the seal away from the piston. Locate the spring on the piston spigot.
6. Dip the piston and seal in hydraulic fluid and carefully insert, spring first, into the cylinder.
7. Replace the bleed valve but do not tighten.

Group Operation

OP 7501-C CLUTCH HYDRAULIC SLAVE CYLINDER — OVERHAUL
(Includes 7501-B and B1)

OP 7534-A CLUTCH MASTER CYLINDER — REMOVE AND INSTALL

To Remove

1. Disconnect the clutch master cylinder push-rod from the pedal by unscrewing the nut and withdrawing the spring washer and concentric bolt.
2. Detach the fluid pipe by unscrewing the union nut, using a blanking plug to prevent dirt entering the line.
3. Withdraw the master cylinder after removing two spring washers and nuts securing the master cylinder to the bulkhead.
4. Empty the contents of the fluid reservoir into a waste container.

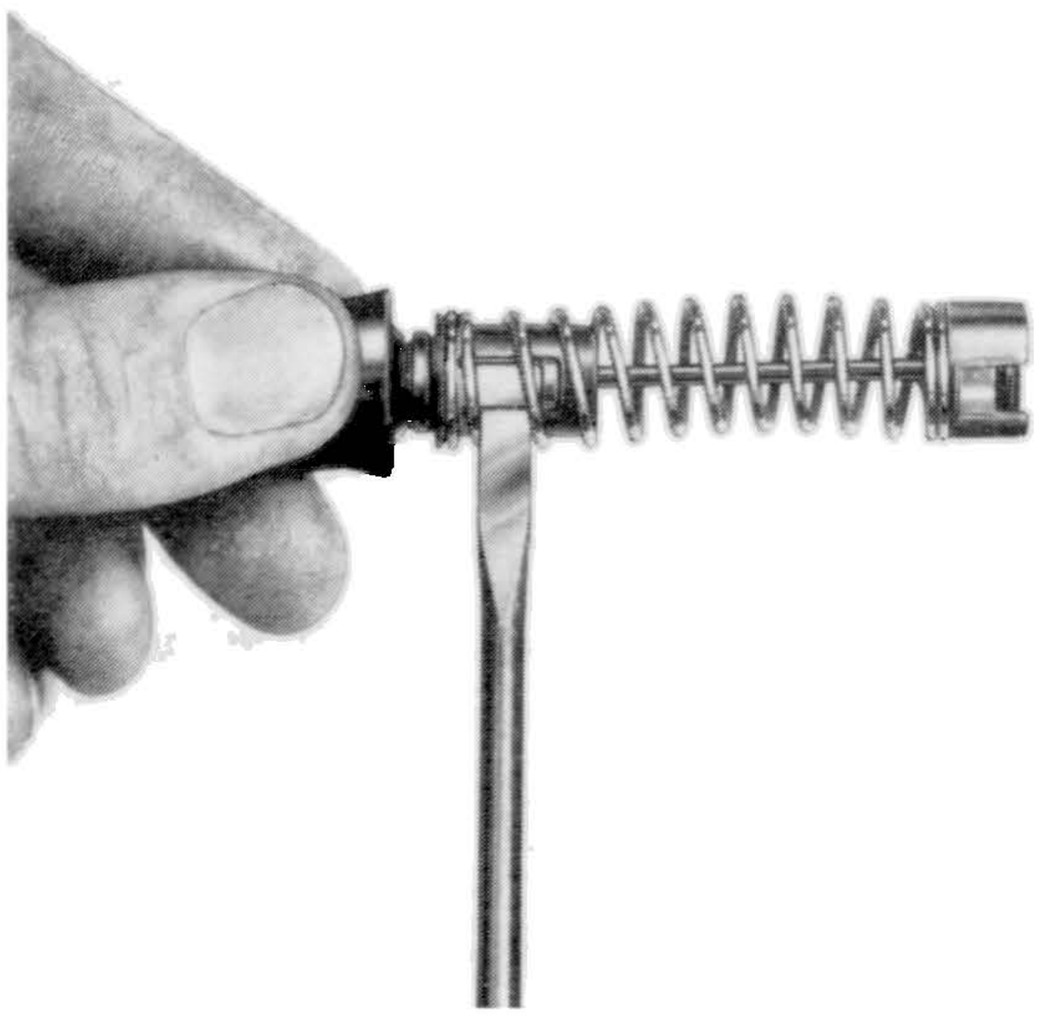
To Install

5. Refit the master cylinder to the engine bulkhead, securing with two spring washers and nuts.
6. Reconnect the fluid pipe, do not overtighten the union.
7. Reconnect the clutch master cylinder push rod to the pedal by passing the concentric bolts through the push rod and then the pedal. Fit a spring washer and nut; tighten to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) torque.
8. Top-up the master cylinder reservoir with clean approved fluid, ME-3833-F, and then bleed the system; see OP 7500-A. Check the action of the clutch.

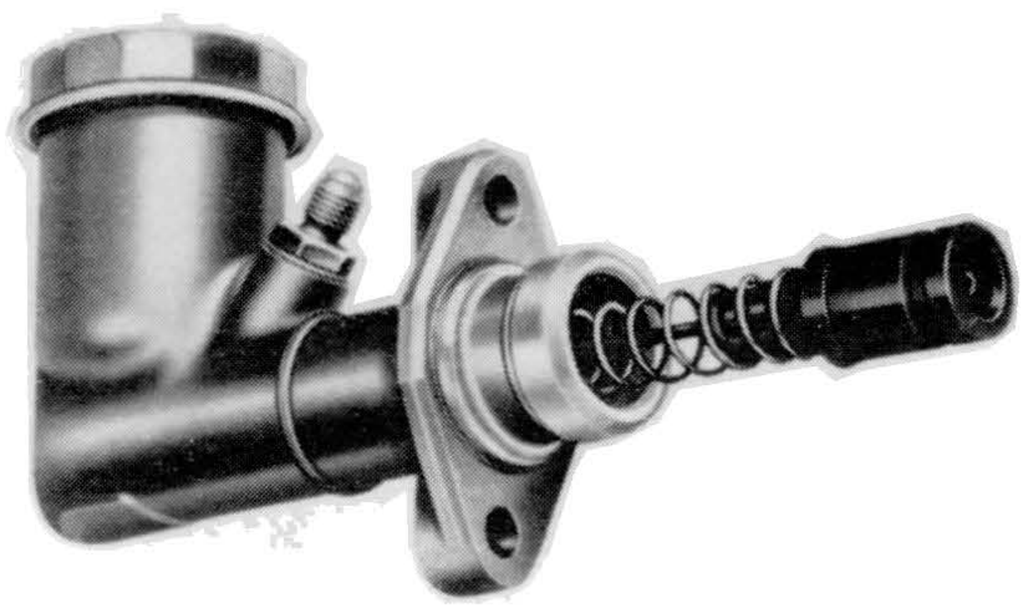
OP 7534-A1 EXTRA: CLUTCH MASTER CYLINDER — OVERHAUL

To Dismantle

1. Remove the rubber boot. Withdraw the circlip and remove the pushrod.
2. Withdraw the piston and valve assembly from the cylinder.
3. Remove the piston from the valve assembly. The spring retainer is held in position on the spigot end of the piston by a tab which engages under a shoulder on the front of the piston. Lift up the tab and remove the spring retainer, spring and valve assembly from the piston.
4. Dismantle the valve assembly by compressing the spring and moving the valve stem to one side in the retainer, so releasing the end of the valve stem from the key-hole slot in the retainer. Slide the valve spacer and shim off the valve stem.
5. Remove the rubber valve seal and piston seal if necessary.
6. Wash the parts in methylated spirits, approved fluid ME-3833-F, or commercial alcohol. Carefully inspect the piston rubber seal and renew if there is any sign of damage to the sealing lip.



Removing the Piston Valve



Refitting the Piston Valve Assembly

To Reassemble

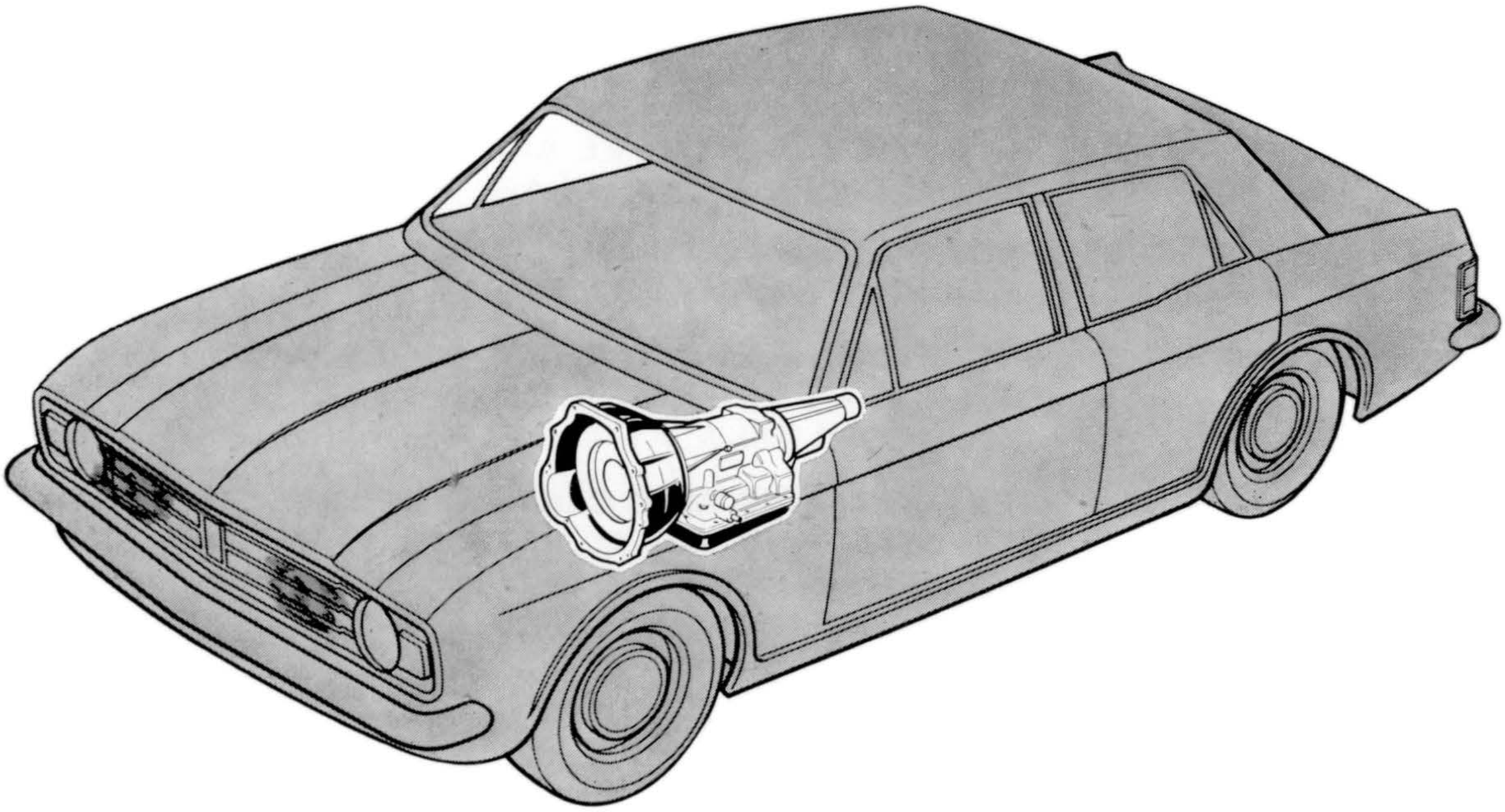
7. Replace the piston seal with the lip away from the large diameter of the piston.
8. Fit the valve seal to the valve stem with the lip outwards and away from the spring. Slide the shim, valve spacer, with legs over the valve seal, and return spring over the valve stem. Ensure that the convex face of the shim abuts the valve stem flange.
9. Fit the spring retainer in the rear end of the return spring, compress the spring and locate the valve stem in the key-hole slot in the end of the spring retainer.
10. Insert the front of the piston in the spring retainer, and secure it by locating the spring retainer tab under the front shoulder of the piston.
11. Dip the piston and seal in hydraulic fluid and insert the piston assembly in the cylinder, valve seal end first.
12. !nstall the push-rod in the master cylinder. Locate the washer and fit the retaining circlip.
13. Refit the rubber boot to the clutch master cylinder.

Group Operation

OP 7534-B CLUTCH MASTER CYLINDER – OVERHAUL
(Includes 7534-A, and A1)

7/2

AUTOMATIC TRANSMISSION



SECTION INDEX

GENERAL DESCRIPTION

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,, 7007-A2 Extra: front pump – remove and install

,, 7007-A3 Extra: front pump – overhaul

,, 7007-A4 Extra: front or rear clutch, primary sun gear or front band – replace

,, 7007-A5 Extra: front clutch – overhaul

,, 7007-A6 Extra: rear clutch – overhaul

,, 7007-A7 Extra: gear set, one-way clutch, centre support, sun gear and shaft assembly and/or rear band – remove and install

,, 7007-A8 Extra: output shaft and/or parking gear – remove and install

,, 7007-A9 Extra: selector and parking pawl levers – remove and install

,, 7007-A10 Extra: gearbox case – renew

,, 7007-B **FRONT PUMP – REMOVE AND INSTALL**
(Includes OPS 7007-A, A1 and A2)

,, 7007-C **FRONT PUMP – OVERHAUL**
(Includes OPS 7007-A, A1, A2 and A3)

,, 7007-D **FRONT OR REAR CLUTCHES, PRIMARY SUN GEAR OR FRONT BAND – REMOVE AND INSTALL**
(Includes OPS 7007-A, A1, A2, and A4)

,, 7007-E **GEAR SET, ONE-WAY CLUTCH, CENTRE SUPPORT, SUN GEAR AND SHAFT ASSEMBLY AND/OR REAR BAND – REMOVE AND INSTALL**
(Includes OPS 7007-A, A1, A2, A4 and A7)

,, 7007-F **PARKING GEAR AND/OR OUTPUT SHAFT – REMOVE AND INSTALL**
(Includes OPS 7007-A, A1, A2, A4, A7 and A8)

,, 7007-G **SELECTOR AND PARKING PAWL LEVERS – REMOVE AND INSTALL**
(Includes OPS 7007-A, A1, A2, A4, A7 and A9)

,, 7007-H **GEARBOX CASE – RENEW**
(Includes OPS 7007-A, A1, A2, A4 and A7 to A10)

,, 7007-J **AUTOMATIC TRANSMISSION – OVERHAUL**
(Includes OPS 7007-A, A1 to A9, 7008-A3, A5, A7 and 7009-A3)

OPERATION	7008-A	AUTOMATIC TRANSMISSION, SUMP AND/OR GASKET – REMOVE AND INSTALL
,,	7008-A1	Extra: downshift cable – renew
,,	7008-A2	Extra: front servo – remove and install
,,	7008-A3	Extra: front servo – overhaul
,,	7008-A4	Extra: rear servo – remove and install
,,	7008-A5	Extra: rear servo – overhaul
,,	7008-A6	Extra: valve bodies assembly or oil pick-up tubes – remove and install
,,	7008-A7	Extra: valve bodies assembly – overhaul
,,	7008-B	**DOWNSHIFT CABLE – RENEW** (Includes OPS 7008-A and A1)
,,	7008-C	**FRONT SERVO – REMOVE AND INSTALL** (Includes OPS 7008-A and A2)
,,	7008-D	**FRONT SERVO – OVERHAUL** (Includes OPS 7008-A, A2 and A3)
,,	7008-E	**REAR SERVO – REMOVE AND INSTALL** (Includes OPS 7008-A and A4)
,,	7008-F	**REAR SERVO – OVERHAUL** (Includes OPS 7008-A, A4 and A5)
,,	7008-G	**VALVE BODIES ASSEMBLY OR OIL PICK-UP TUBES – REPLACE** (Includes OPS 7008-A and A6)
,,	7008-H	**VALVE BODIES ASSEMBLY – OVERHAUL** (Includes OPS 7008-A, A6 and A7)
,,	7009-A	EXTENSION HOUSING ASSEMBLY – REMOVE AND INSTALL
,,	7009-A1	Extra: speedometer drive gear – remove and install
,,	7009-A2	Extra: governor assembly – remove and install
,,	7009-A3	Extra: governor – overhaul
,,	7009-B	**GOVERNOR ASSEMBLY – REMOVE AND INSTALL** (Includes OPS 7009-A, A1 and A2)
,,	7009-C	**GOVERNOR ASSEMBLY – OVERHAUL** (Includes OPS 7009-A, A1, A2 and A3)
,,	7010-A	BRAKE BANDS – ADJUST – FRONT AND REAR
,,	7011-A	EXTENSION HOUSING REAR OIL SEAL – RENEW
,,	7012-A	CONVERTER ASSEMBLY – REMOVE AND INSTALL
,,	7012-A1	Extra: drive plate – remove and install
,,	7013-A	STARTER INHIBITOR SWITCH – ADJUST
,,	7013-A1	Extra: starter inhibitor switch – renew

OPERATION	7013-B	**STARTER INHIBITOR SWITCH – RENEW** (Includes OPS 7013-A and A1)
,,	7020-A	ENGINE AND GEARBOX STABILISER BRACKET – REPLACE
,,	7021-A	SELECTOR EQUALISER – REMOVE AND INSTALL
,,	7206-A	STEERING COLUMN AND TRANSMISSION CONNECTING ROD – REMOVE AND INSTALL
,,	7209-A	GEAR SELECTOR SHAFT ON STEERING COLUMN – REMOVE AND INSTALL
,,	7210-A	GEAR SELECTOR SHAFT ON STEERING COLUMN – ADJUST
,,	7210-A1	Extra: drive selection indicator – adjust

GENERAL DESCRIPTION

The automatic transmission consists of a torque converter and a hydraulically controlled automatic epicyclic gearbox with three forward gears and one reverse. In all gears the drive is through the torque converter which results in maximum flexibility, especially in top gear. The gears are selected automatically by engaging clutches and/or applying brake bands in various combinations by a hydraulic control system. The hydraulic control system and the torque converter are supplied with oil under pressure by one gear type oil pump.

A manually controlled mechanical parking pawl lock is incorporated so that the transmission output shaft can be locked when the vehicle is stationary.

To avoid inadvertent movement of the car, it is not possible to start the engine unless P or N is selected. This is controlled by the inhibitor switch mounted on the gearbox.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

Check transmission fluid level at the first 3,000 miles (5,000 km.) and every subsequent 6,000 miles (10,000 km.) with the gearbox at normal operating temperature at idling speed in P.

DATA

GEAR RATIOS

First	2.393 : 1
Second ...	1.450 : 1
Third ...	1.000 : 1
Reverse ...	2.094 : 1

LUBRICANT	M-2C33-F
Capacity (including converter)	11.25 Imp. pints (13.5 U.S. pints, 6.39 litres)
Normal operating temperature	100 to 115°C. (212 to 236°F.)

TABLE OF SHIFT SPEEDS

The speeds mentioned below are to the nearest m.p.h. (k.p.h.).

Gear change			1 to 2	2 to 3	3 to 2	2 to 1
1,300 c.c.	Light throttle		7 to 10 (11 to 16)	9 to 14 (14 to 22)	—	—
	Full throttle	...	23 to 32 (37 to 51)	36 to 50 (58 to 80)	—	—
	Kick-down		29 to 39 (47 to 63)	51 to 61 (80 to 98)	43 to 58 (69 to 93)	20 to 34 (32 to 55)
1,600 c.c.	Light throttle		4 to 8 (6 to 13)	8 to 12 (13 to 19)	—	—
	Full throttle		23 to 32 (37 to 51)	39 to 50 (63 to 80)	—	—
	Kick-down	...	31 to 40 (50 to 64)	53 to 63 (85 to 101)	47 to 59 (76 to 95)	22 to 34 (35 to 55)

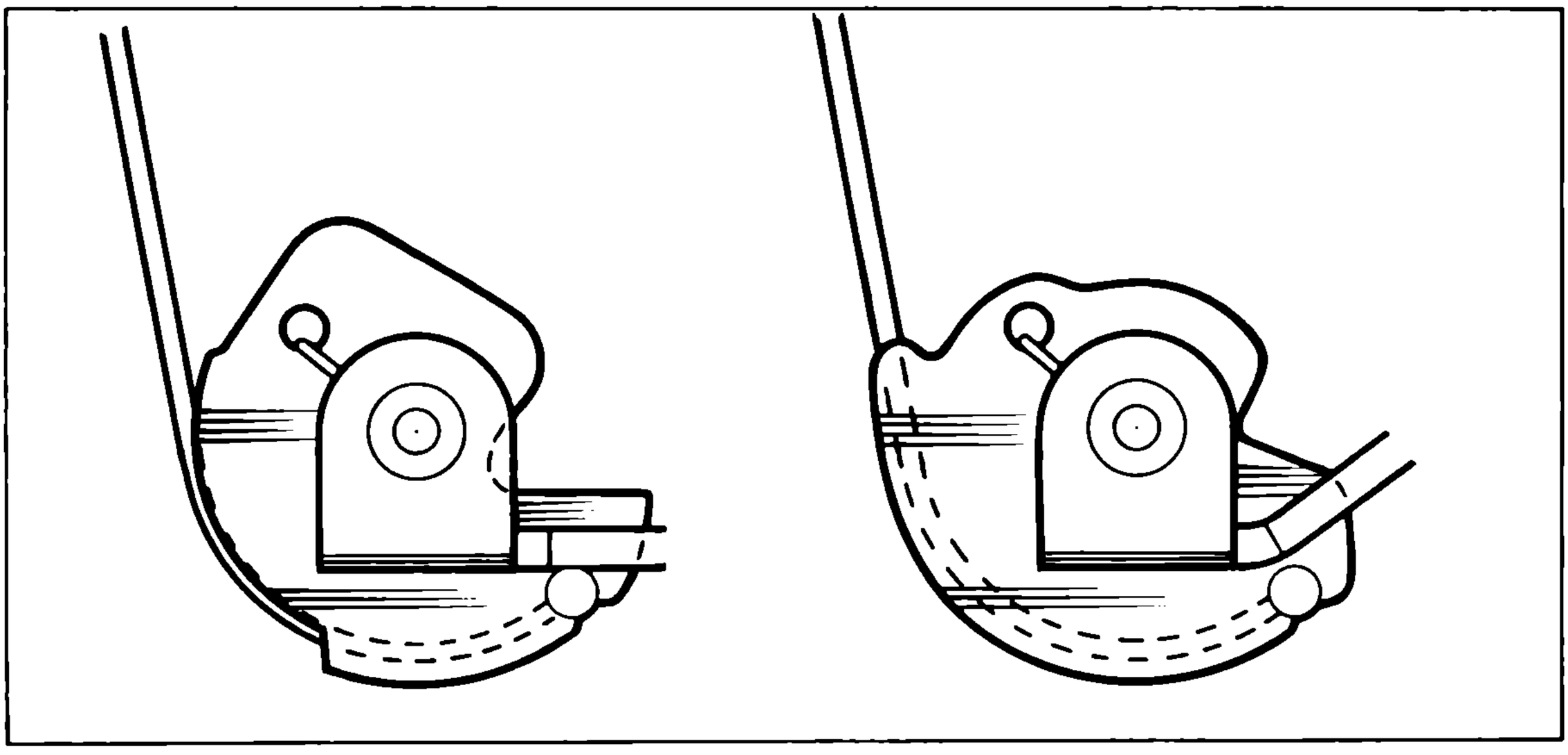
Downward change from 3 to 2 should take place at approximately $\frac{3}{4}$ full throttle at speeds below about 25 m.p.h. (40 k.p.h.).

IDENTIFICATION

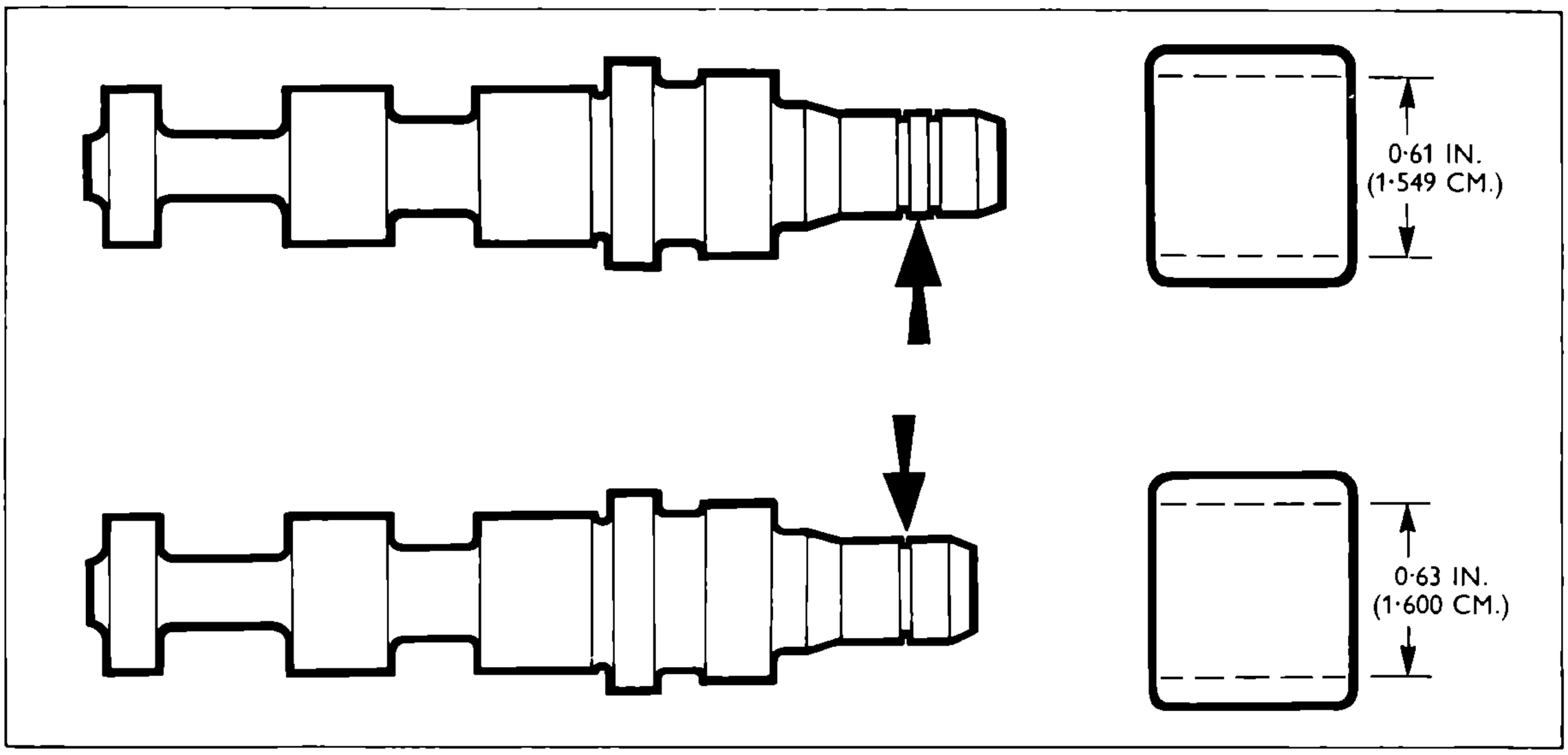
There are slight differences between the transmissions fitted to 1,300 c.c. and 1,600 c.c. cars. The means of identifying the differing components are as follows:—

PART	*IDENTIFICATION MARK/NUMBER*	
	1,300	**1,600**
Transmission Assembly – Inertia Starter	41EE	75EE
– Pre-Engaged	51EE	77EE
Valve Body Assembly	12	50
Cam	EB	EA
Front Servo Assembly	3	4
Governor Assembly ...	3	4
Primary Regulator Valve and Sleeve ...	See illustration	
Downshift Valve Cable	47	70
Converter Assembly – Inertia Starter	28	28
– Pre-engaged Starter ...	54	54

Torque converter nominal diameter	9.5 in. (241.3 mm.)
K factor	 225
Stall speed ...	1,700 to 1,900 rev./min.



Cam Identification **1,600 c.c.** **1,300 c.c.**



Primary Regulator Valve and Sleeve Identification **1,300 c.c. Upper—1,600 c.c. Lower**

Tightening Torques, lb. ft. (kg.m.)

Transmission case to converter housing	$\frac{5}{16}$ in. – 18 UNC ...	8 to 13 (1.11 to 1.80)
Extension housing to transmission case	$\frac{5}{16}$ in. – 18 UNC ...	30 to 55 (4.15 to 7.60)
Gearbox sump	$\frac{5}{16}$ in. – 18 UNC ...	8 to 13 (1.11 to 1.80)
Front servo to transmission case ...	$\frac{5}{16}$ in. – 18 UNC ...	8 to 13 (1.11 to 1.80)
Rear servo to transmission case ...	$\frac{3}{8}$ in. – 16 UNC ...	13 to 27 (1.80 to 3.73)
Pump adaptor to front pump housing ...	10 – 24 UNC	**25 to 35 lb. in.** (0.27 to 0.41)
	$\frac{5}{16}$ in. – 18 UNC ...	17 to 22 (2.35 to 3.04)
Pump adaptor to transmission case ...	$\frac{5}{16}$ in. – 18 UNC ...	8.0 to 18.5 (1.11 to 2.56)
Rear adaptor to transmission case	$\frac{1}{4}$ in. – 20 UNC ...	4 to 7 (0.55 to 0.97)
	10 – 24 UNC	**20 to 30 lb. in.** (0.24 to 0.35)
Centre support to transmission case ...	$\frac{3}{8}$ in. – 16 UNC ...	10 to 18 (1.38 to 2.49)
Pressure point (use sealer)	$\frac{1}{8}$ in. – 27 NPTF ...	4 to 5 (0.55 to 0.69)
Gearbox drain plug	$\frac{3}{8}$ in. – 24 UNF ...	9 to 12 (1.4 to 1.66)
Oil tube collector to lower body ...	10 – 24 UNC	**20 to 30 lb. in.** (0.24 to 0.35)
Governor line plate to lower body ...	10 – 24 UNC	**20 to 30 lb. in.** (0.24 to 0.35)
Lower body end plate to lower body ...	10 – 24 UNC	**20 to 30 lb. in.** (0.24 to 0.35)
Upper body front or rear end plate to upper body	10 – 24 UNC	**20 to 30 lb. in.** (0.24 to 0.35)
Upper body to lower body	10 – 24 UNC	**20 to 30 lb. in.** (0.24 to 0.35)
Valve bodies assembly to transmission case	$\frac{1}{4}$ in. – 20 UNC ...	4.5 to 9 (0.62 to 1.24)
Front pump strainer to lower body	10 – 24 UNC	**20 to 30 lb. in.** (0.24 to 0.35)
Downshift valve cam bracket to valve body ...	10 – 32 UNF	**20 to 30 lb. in.** (0.24 to 0.46)
Governor body to sleeve	$\frac{1}{4}$ in. – 20 UNC ...	4 to 5 (0.55 to 0.69)
Governor cover plate to governor body ...	10 – 24 UNC	**20 to 48 lb. in.** (0.24 to 0.55)
Front servo lever adjusting screw locknut ...	$\frac{3}{8}$ in. – 16 UNC ...	15 to 20 (2.07 to 2.76)
Rear servo adjusting screw locknut ...	$\frac{9}{16}$ in. – 12 UNC ...	30 to 40 (4.15 to 5.53)
Starter inhibitor switch locknut	$\frac{7}{16}$ in. – 14 UNC ...	4 to 6 (0.55 to 0.83)
Downshift valve control cable adaptor to case	$\frac{1}{2}$ in. – 13 UNC ...	8 to 9 (1.11 to 1.24)
Filler tube connector adaptor to case ...	$\frac{1}{2}$ in. – BSP ...	20 to 30 (2.76 to 4.15)
Filler tube to connector sleeve nut	$1\frac{1}{16}$ in. – 16 UNS ...	17 to 18 (2.35 to 2.49)
Drive plate to torque converter	$\frac{3}{8}$ in. – 24 UNF ...	25 to 30 (3.45 to 4.14)

SERVICE AND REPAIR OPERATIONS

OP 7007-A AUTOMATIC TRANSMISSION ASSEMBLY - REMOVE AND INSTALL

Tools Required

CBW1A	Pressure test gauge
CBW35B	Bench cradle
CBW38	Hydraulic test equipment (adaptor)
CBW547-50-3A	Inhibitor switch locknut adaptor
	Tachometer
	Pedal depressor

To Remove

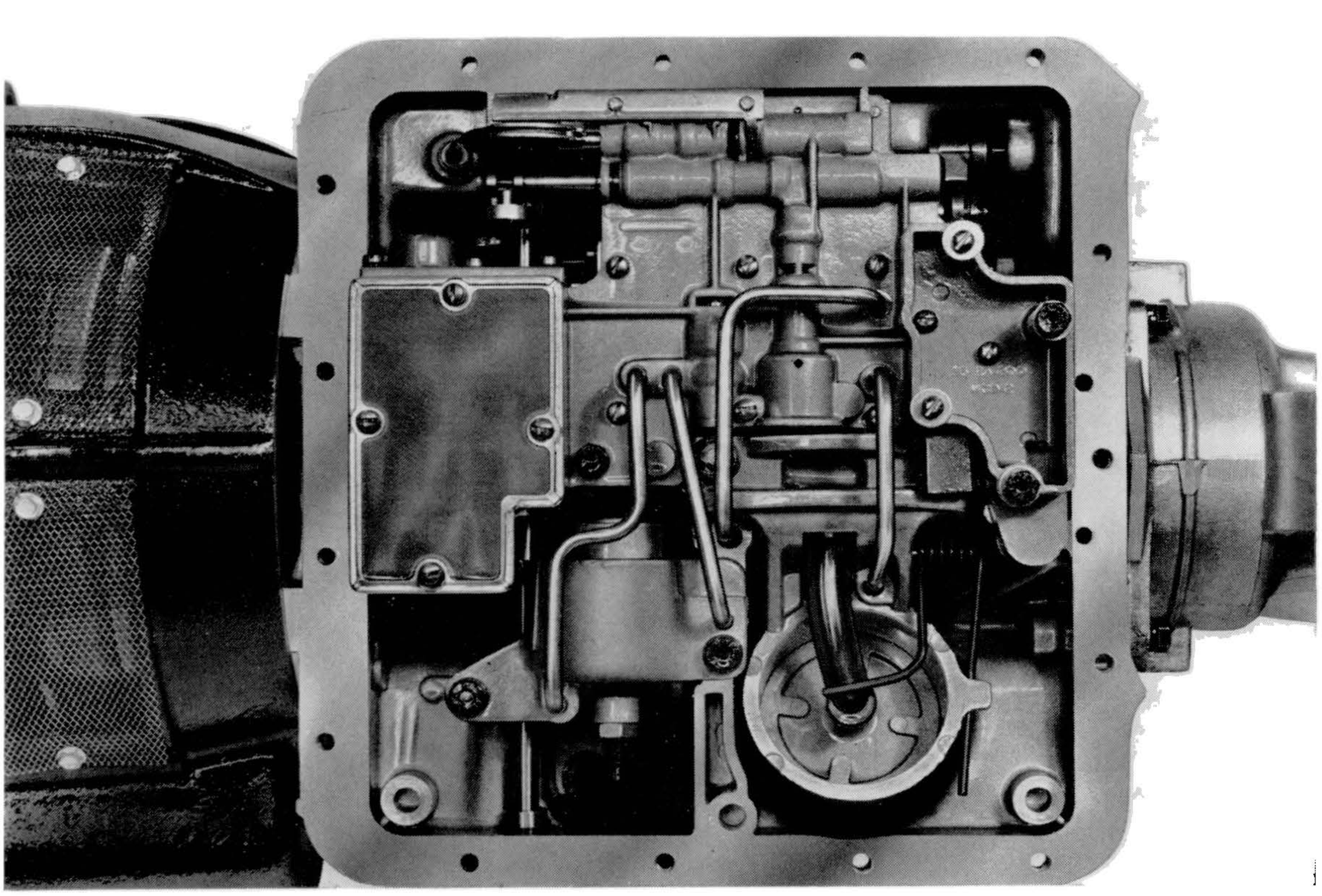
1. Open the bonnet and fit wing covers.
2. Disconnect the battery earth cable.
3. Detach the downshift cable from the bracket on the rocker cover and from the throttle linkage.
4. Remove the upper four bolts securing the engine to the torque converter housing. One of the bolts holds the dipstick tube in position.
5. Jack up the car and fit stands all round.
6. Disconnect the speedometer cable from the transmission assembly by removing the clip and bolt, and disconnect the handbrake cable from the relay lever.
7. Remove the starter motor (secured by two bolts when pre-engaged type or three bolts if inertia type starter).
8. Remove the drive plate to converter bolts through the starter motor aperture. To do this rotate the crankshaft so that the bolts are accessible, and slacken the bolts evenly.
9. Detach the engine to transmission stiffener bracket.
10. Remove the converter dust cover. Drain the transmission sump.
11. Disconnect the selector cable from the operating arm and from the support bracket.
12. Mark the drive shaft coupling flange and pinion flange to ensure correct alignment on replacement. Unscrew four self-locking nuts and remove four bolts at the coupling flange and tap the coupling gently to free the joint. On vehicles fitted with a two-piece drive shaft, remove the two bolts securing the centre bearing carrier to its bracket. Lower the rear end of the shaft, sliding it back so that the front end will clear the mainshaft splines. Fit a dummy drive shaft to the gearbox to prevent oil loss.
13. Unhook the handbrake secondary cable from the lower end of the relay lever and disengage it from the eyelet on the rear support crossmember.
14. Position a transmission jack under the gearbox and remove the gearbox supporting crossmember from the gearbox and the car underbody.
15. Disconnect the wires from the inhibitor switch, noting their positions.
16. Disconnect the reversing lamp earthing wire (black lead), if fitted, from the rear of the transmission by removing one of the gearbox to extension housing bolts.
17. Detach the exhaust pipe from the manifold and pull to one side.
18. Lower the transmission jack as necessary and remove the dipstick and tube assembly.

19. Remove the remaining two bolts securing the converter housing to the engine.
20. Position a jack under the front of the engine so that the engine is supported.
21. Remove the transmission from beneath the car on the transmission jack. Clean the case with petrol or paraffin and place unit in a bench cradle, CBW35B, with the sump uppermost. If it is necessary to rest the transmission on the ground be careful to lower it gently on to the sump to avoid damage to the oil transfer pipes.

    NOTE – The converter dust cover is sandwiched between the converter housing and the engine cylinder block. On removing the transmission the plate will be free and will probably fall from the locating dowels.
22. Remove the torque converter and remove six bolts and spring washers securing the converter housing to the transmission case and remove the converter housing.

To Install

23. Refit the converter housing to the transmission case and secure with six bolts and spring washers.
24. Align the front pump drive tangs with the slots in the inner gear and carefully replace the torque converter, taking care not to damage the oil seal.
25. Locate the converter dust cover on the dowels in the cylinder block rear face.
26. Reposition the gearbox using the transmission jack and fit the two lower converter housing to engine bolts.



Oil Transfer Pipe Positions

27. Secure the torque converter to the drive plate through the starter motor aperture. Turn the crankshaft or torque converter until one bolt hole in the drive plate is aligned with a hole in the converter and fit a self-locking bolt. Do not fully tighten this bolt. Rotate the crankshaft until a bolt hole at 90° to the first is accessible, and fit another bolt. Other securing bolts can then be fitted in a similar manner, after which they should all be tightened evenly to a torque of 25 to 30 lb. ft. (3.6 to 4.14 kg.m.).

28. Reposition the dipstick and tube assembly and secure with the appropriate upper housing bolt.

29. Remove the jack from the front of the engine. Jack up the rear end of the gearbox and refit the support bracket to the car underside and the extension housing. Remove the transmission jack.

30. Remove the dummy and slide the drive shaft onto the transmission output shaft splines, align the coupling marks made when dismantling and secure with four bolts and new self-locking nuts. On cars with two-piece drive shafts, locate the centre bearing carrier in position and secure to its bracket with two bolts.

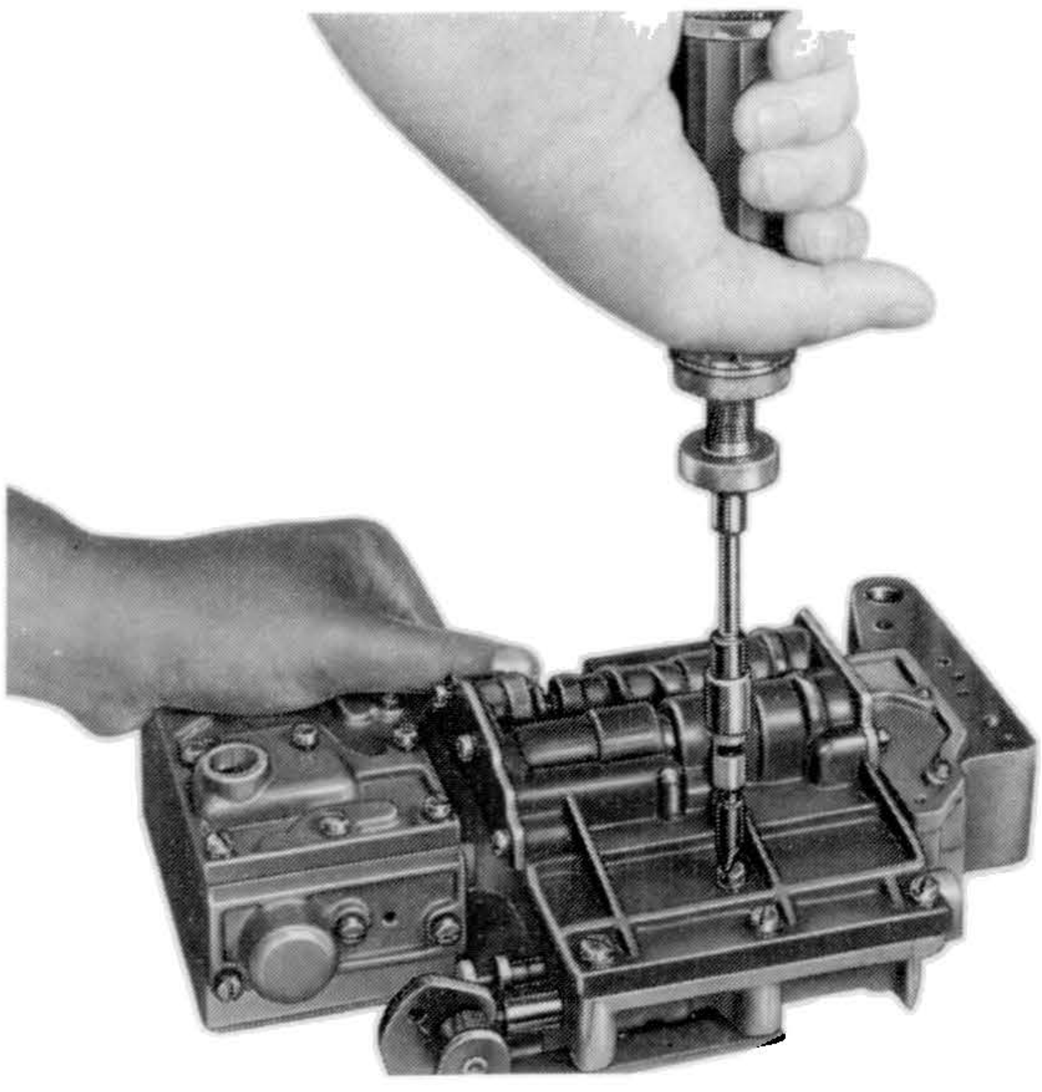
31. Reconnect the selector cable to the operating arm on the transmission and to the support bracket on the underbody. Adjust if necessary, put the selector lever (in the car) in position "D", pull the operating arm (on the transmission) fully rearwards and adjust the cable length to suit.

32. Replace the converter housing lower dust cover and locate the engine to transmission stiffener bracket.

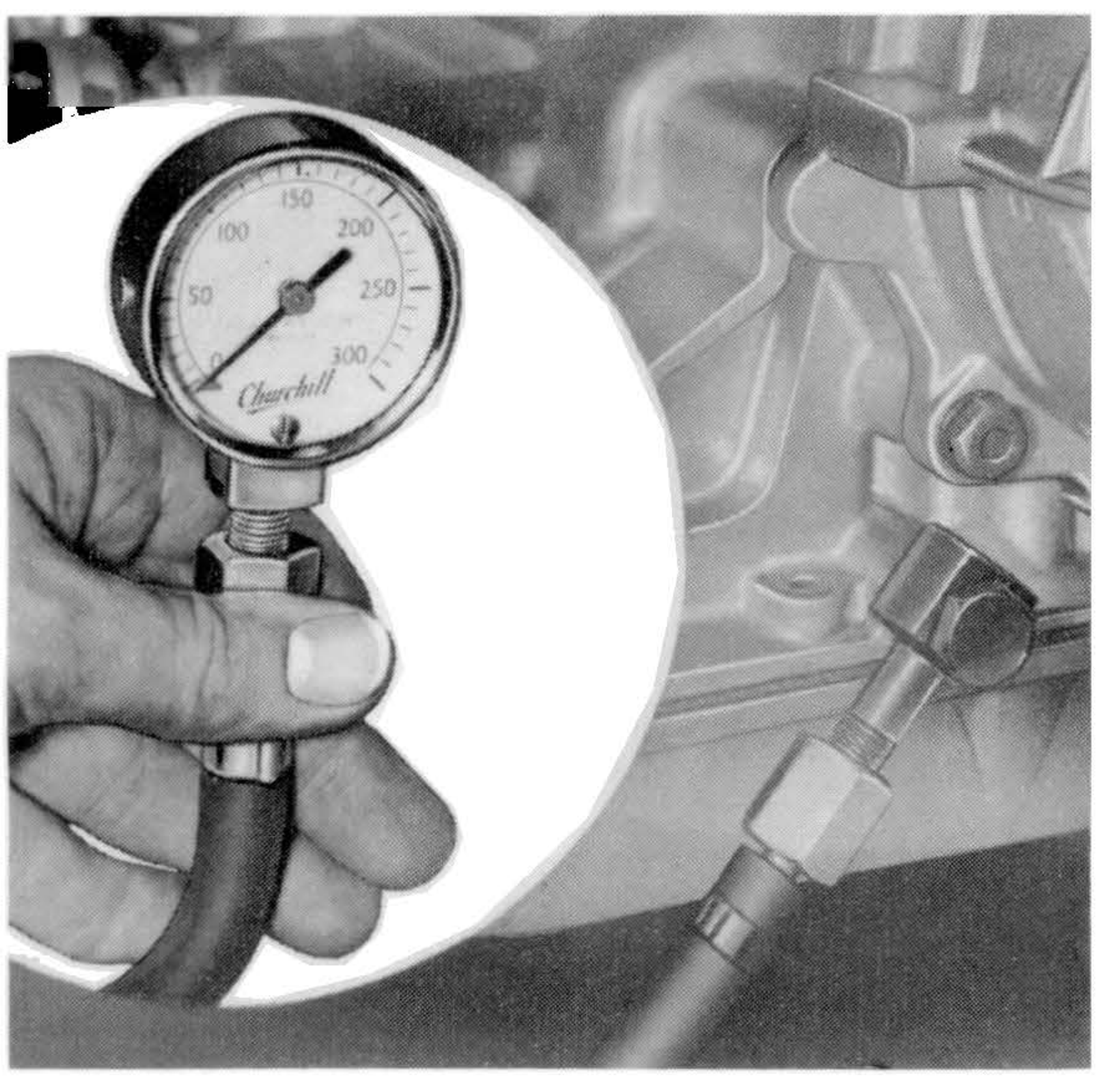
33. Fit the starter motor in its location and secure with the two bolts (pre-engaged starters) or three bolts (inertia starters).

34. Reconnect the speedometer cable and retain with the clip and bolt.

35. Replace the remaining three converter housing to engine bolts. Tighten all the bolts securely.



Tightening Valve Body Screws



Checking Line Pressure

36. Fit the handbrake cable. Engage the handbrake cable in the eyelet on the rear support crossmember and connect it to the relay lever.

37. Connect the exhaust pipe to the exhaust manifold.

38. Adjust the starter inhibitor switch. Select "D" or "L". Connect a lamp and battery across the smaller starter inhibitor terminals and another across the two larger reversing light terminals. Slacken the locknut, unscrew the switch and then screw it in until the reversing light terminals lamp goes out. Note the switch position. Continue screwing in the switch until the other lamp for the starter inhibitor terminals lights and again note the switch position. Screw out the switch until it is midway between the two positions and then tighten the locknut using Tool No. CBW.547A-50-3A. Refit the leads to the appropriate switch terminals and check that the starter only operates when the selector lever is at "P" or "N" and the reversing light terminals lamp only operates in "R". If the switch does not operate correctly it should be renewed.

39. Jack up front end of the car and remove stands.

40. Connect battery (negative earth).

41. Refill the transmission to within $\frac{3}{8}$ in. from the full mark on the dipstick, bearing in mind that, unless a new torque converter has been fitted, less than 11.25 Imp. pints (13.5 U.S. pints, 6.39 litres) will be required since the converter is not drained when removed. Use only automatic-transmission fluid M-2C33-F. After a road test of not less than five miles, check the fluid level. Top-up as necessary.

42. Connect and adjust the downshift valve cable. Locate the outer cable adjuster in the bracket on the engine compartment bulkhead. Connect the inner cable to the accelerator linkage and adjust by one of two methods.

When making an adjustment to the downshift cable, the carburettor throttle lever must be positioned against the throttle stop screw as outlined in Method I.

Similarly when using Method II the throttle lever must be positioned against the throttle stop screw, with the choke off to enable adjustment to be made at 500 rev./min.

The two procedures are detailed below; Method I may be used for a cable as fitted in production where there is no wear in the accelerator linkage and the original crimped collar is still on the downshift cable.

Method II should be used in service since cables supplied for service use have the collar free to move on the cable and therefore cannot be adjusted as in Method I.

Method I

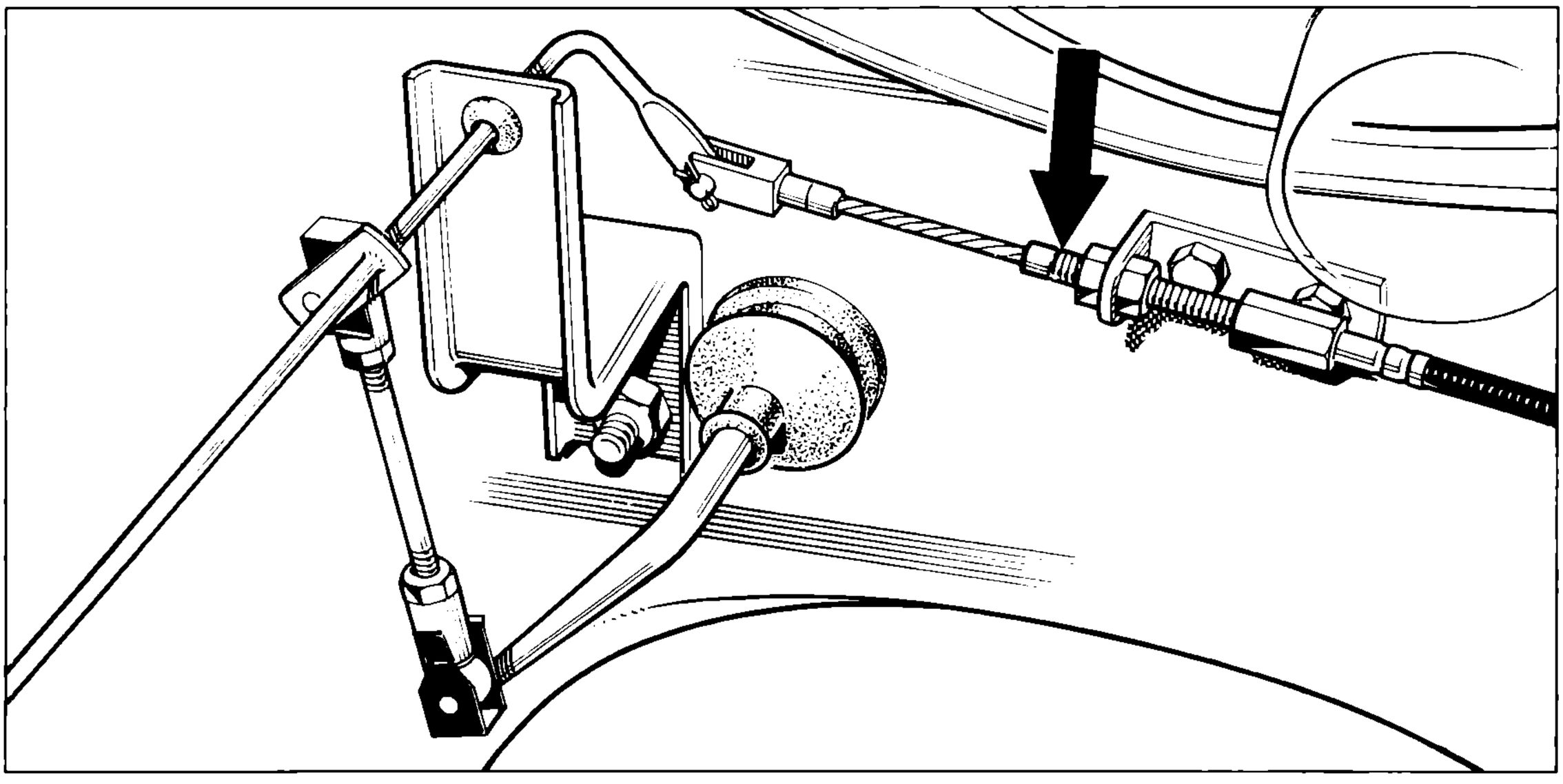
1. Check that the throttle lever is resting against the throttle stop screw, when adjusted to give the correct idling speed. Turn the fast idle cam manually, with the air cleaner removed if necessary, to achieve this result.
2. Adjust the downshift valve cable so that the crimped collar is just in contact with the adjuster.
3. Re-check that the throttle lever is still against its stop.

Method II

1. Ensure that the engine and automatic transmission are at their normal operating temperature and that the choke is fully open.

2. Check that the transmission fluid level is correct.
3. Attach a line pressure gauge CBW.1A to the pressure take-off point in the rear face of the automatic box using the adaptor, CBW.38.
4. Connect a tachometer to the engine.
5. Adjust the carburettor slow-running, setting the idling speed to 580 rev./min. in neutral.
6. Remove any free play from the accelerator linkage.
7. Apply the foot and handbrake.
8. Select 'D'.
9. Adjust the carburettor throttle screw to give an engine idling speed of 580 to 620 rev./min.
10. With the brakes applied and "D" still selected, note the pressure gauge reading which should be between 50 and 65 lb./sq. in. (3.52 and 4.62 kg./sq. cm.) at 500 rev./min.
11. Increase the engine speed to 1,000 rev./min. and note the new pressure gauge reading. This should be 75 to 85 lb./sq. in. (5.27 to 5.98 kg./sq. cm.) for 1,300 c.c. models or for 1,600 c.c. models there should be a pressure increase of 15 to 20 lb./sq. in. (1.05 to 1.41 kg./sq. cm.).

    NOTE – Do not hold an engine speed of 1,000 rev./min. for longer than 20 seconds with 'D' selected. Also, if during the test the engine speed exceeds 1,000 rev./min. release the accelerator pedal and allow the engine speed to fall to 500 rev./min., note the pressure and re-start the test.
12. If the pressure is incorrect adjust the downshift valve cable.
13. Re-test for correct pressure or pressure/rise.
14. Road test the car and check the quality of the change.



Downshift Cable Adjustment

Method III

This method is only applicable if the sump is removed.

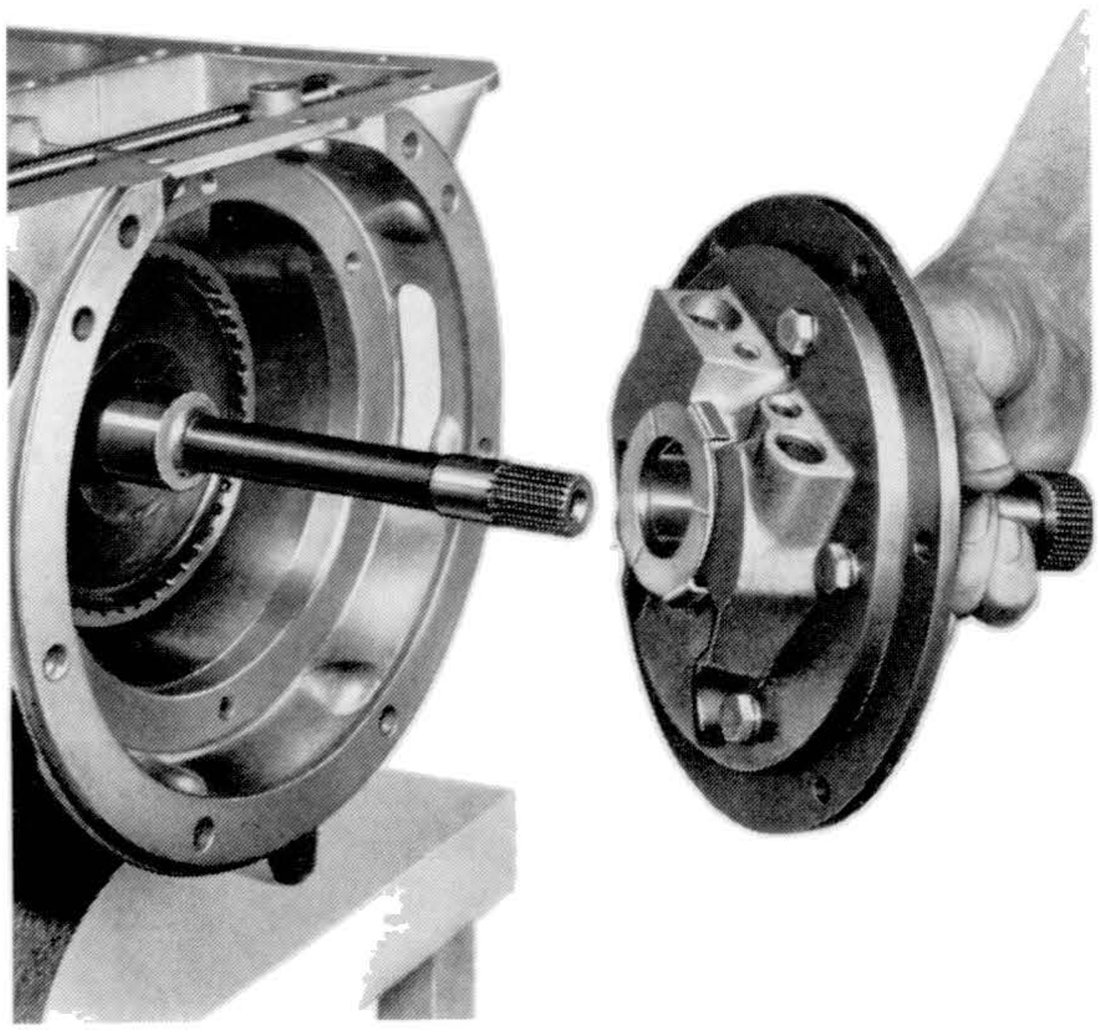
1. Remove all free play from the accelerator linkage.
2. Note the position of the downshift valve cam when the throttle butterfly is closed, i.e. accelerator pedal is released. The heel of the downshift valve cam should lay against the large diameter of the downshift valve, see "idling position", with all slack in the inner cable taken up.
3. With the throttle butterfly fully open, i.e. accelerator pedal pressed down fully in the "kick-down" position, the constant radius lobe of the cam should be in contact with the downshift valve, as seen in "kick-down" position. The position of the cam can be altered by adjusting the downshift valve cable length.

OP 7007-A1 EXTRA: VALVE BODIES ASSEMBLY – REMOVE AND INSTALL

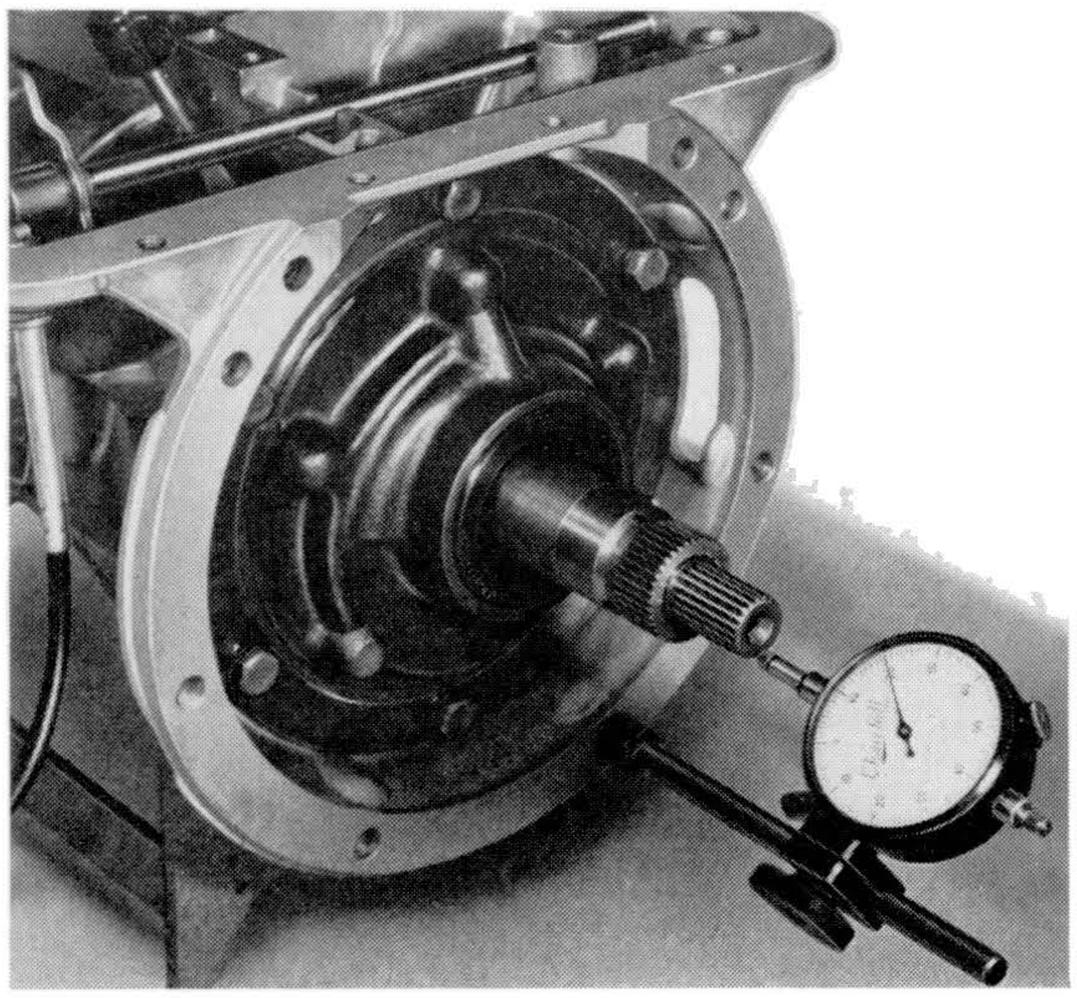
To Remove

1. To remove the sump and gasket, unscrew fifteen bolts and lockwashers around the sump flange.
2. Remove the magnet located on one of the bolt heads.
3. Remove four fluid transfer pipes, which are pushed into the valve bodies assembly and the body of the servos and are held in position by the sump.

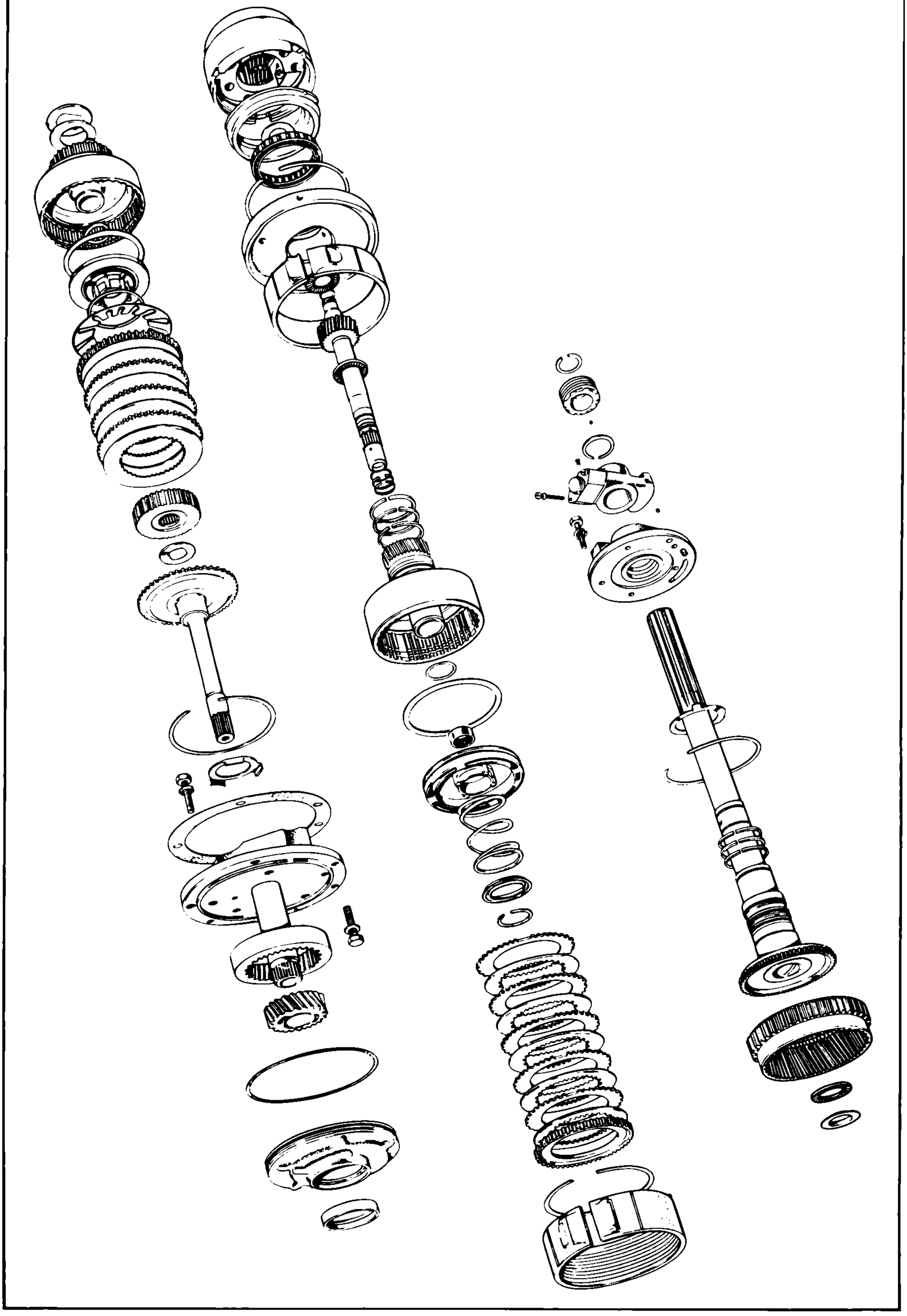
   To remove these pipes use a screwdriver with a protected blade, and prise the pipes out.
4. Disconnect the cable from the downshift cam and remove three bolts securing the valve bodies assembly, two longer bolts passing through the rear housing and a shorter bolt situated to the rear of the front strainer. Draw the valve bodies assembly down evenly to avoid distorting the four pipes between the valve bodies and the front pump.



Front Pump



Checking End-float



To Install

5. Check valve operation. Refer to OP 7008-A6.
6. Position the valve bodies assembly, engaging the oil tubes in the oil tube collector and making sure that the manual control valve is engaged with the peg on the operating lever. Secure the assembly with three bolts, flat and spring washers.

   The two longer bolts pass through the rear housing and the shorter bolt is positioned centrally just to the rear of the front pump strainer.
7. Connect the cable to the downshift cam.
8. Fit the fluid transfer pipes.

   These pipes are a push fit and are held in position by the sump, when fitted. These tubes are of different length and are shaped in such a way that they cannot be refitted incorrectly.
9. Position the magnet on a suitable bolt head.
10. Ensure that the lower face of the gearbox and the sump flange are perfectly clean. Fit a new gasket and replace the sump. Secure with fifteen bolts and spring washers, tightening them evenly to a torque of 8 to 13 lb. ft. (1.1 to 1.8 kg.m.).

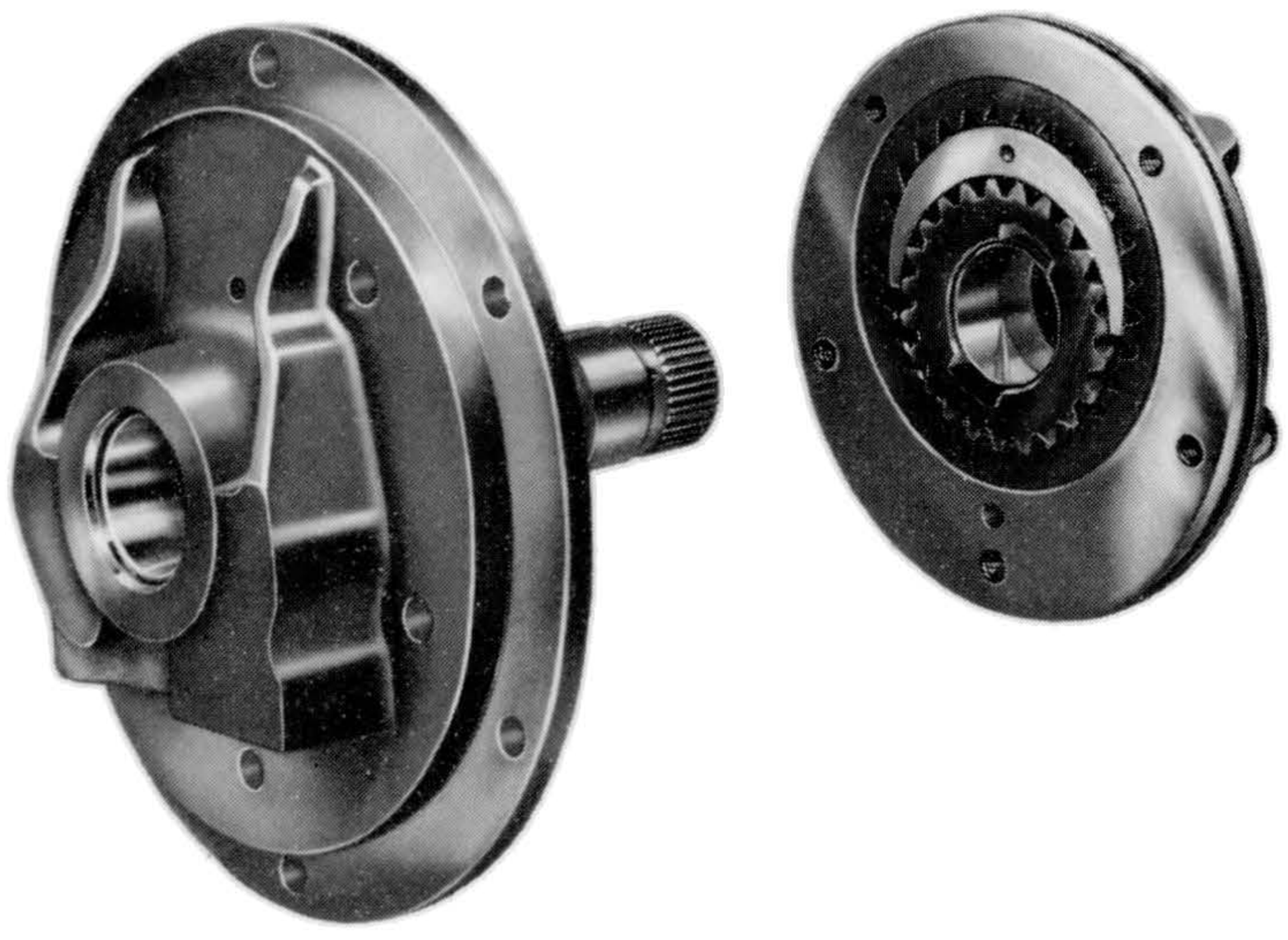
OP 7007-A2 EXTRA: FRONT PUMP – REMOVE AND INSTALL

Tools Required

P 4008 Crown wheel and pinion backlash gauge
P 4008-1 Crown wheel and pinion backlash gauge (adaptor)

To Remove

1. Check the gear train end-float. Using a screwdriver between the case and the front of the front clutch, push the gear train as far rearwards as possible to take up any end-float. Set up a dial indicator gauge, Tool Nos. P.4008 and P.4008-1, on the front face of the gearbox with the dial indicator set on the end of the input shaft, and set the gauge to zero. Lever the gear train assembly forward, inserting the screwdriver between the ring gear and rear wall of the transmission case, reading the gauge to determine the end-float.



Front Pump—Exploded View

2. Withdraw the front pump assembly, gasket and thrust washer after removing the six bolts and spring washers.

To Install

3. Position the thrust washer on the rear face of the front pump and, using a new gasket, replace the front pump and secure with six bolts and lockwashers.

4. Check the gear train end-float. Using a screwdriver between the case and the front of the front clutch, push the gear train as far rearwards as possible to take up any end-float. Set up a dial indicator gauge, Tool Nos. P 4008 and P 4008-1, on the front face of the gearbox with the dial indicator set on the end of the input shaft, and set the gauge to zero. Lever the gear train assembly forward, inserting the screwdriver between the ring gear and rear wall of the transmission case, reading the gauge to determine the end-float. If this figure is not between 0.010 to 0.030 in. (0.254 to 0.762 mm.) remove front pump and replace the thrust washer with a thicker or thinner one as appropriate to give the correct end-float. Re-check end-float.

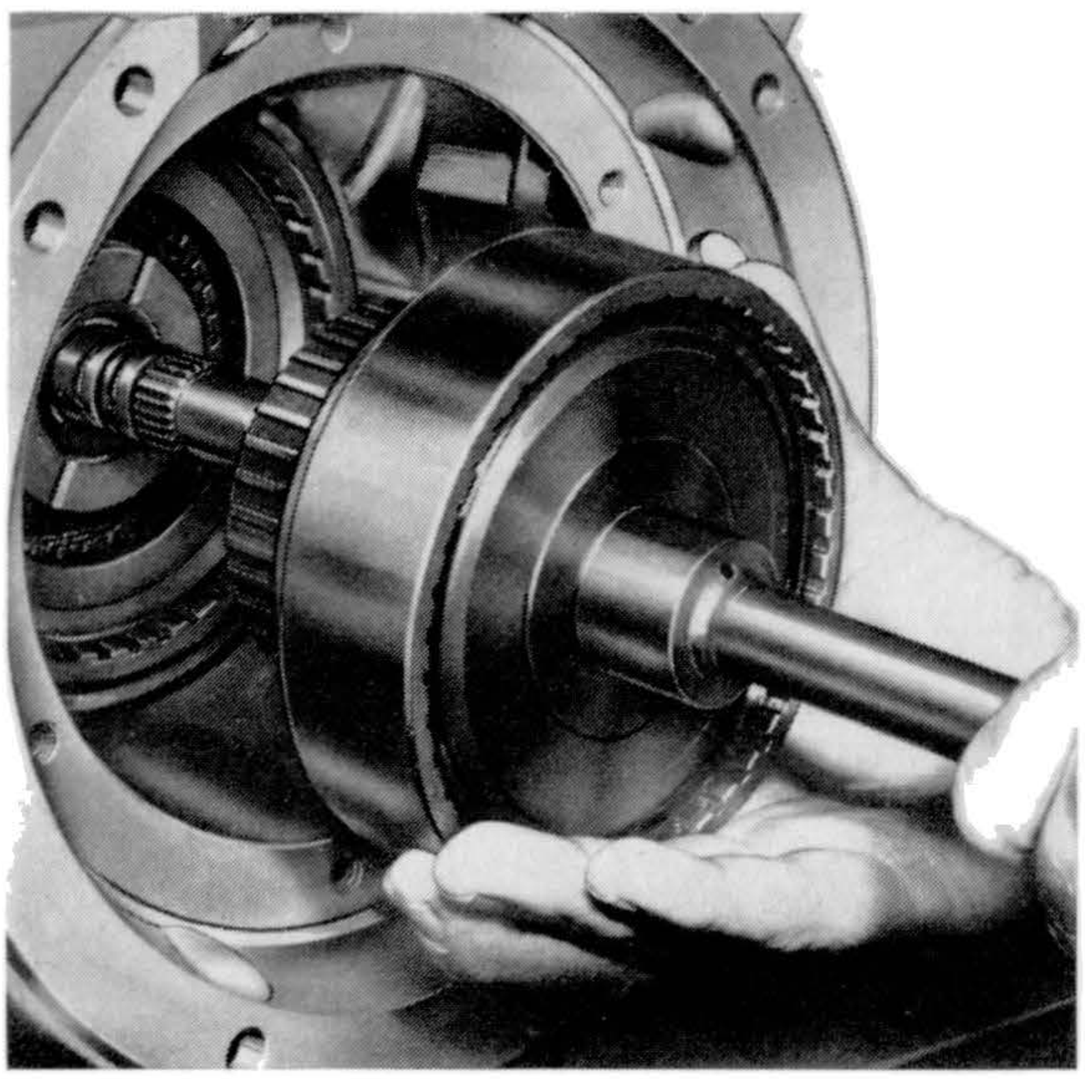
OP 7007-A3 EXTRA: FRONT PUMP – OVERHAUL

To Dismantle

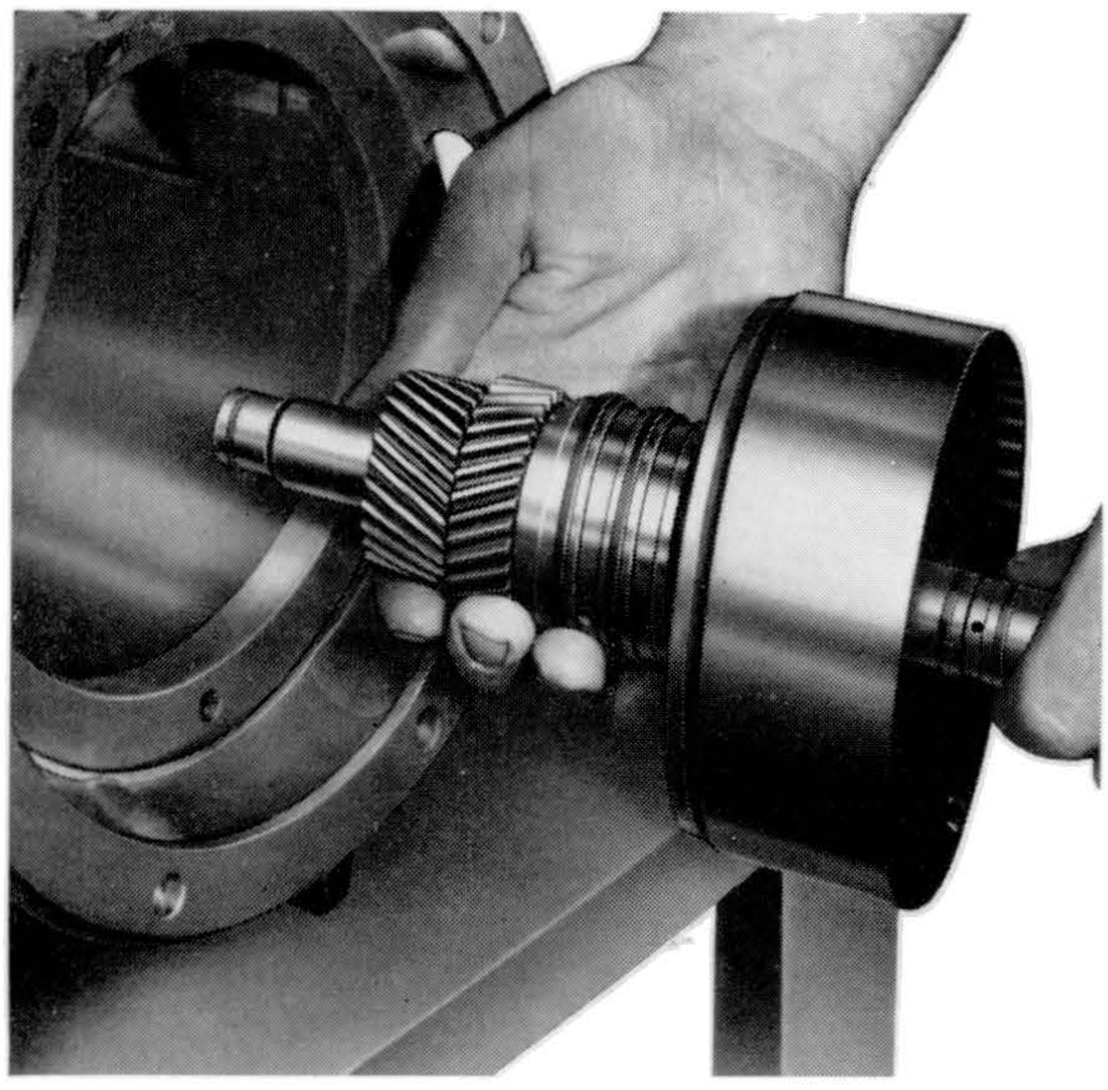
1. Remove five bolts, one cheese-head screw and spring washers to separate the pump housing from the pump adaptor.

2. Mark both the inner and outer gear faces to ensure that when reassembled the gears are replaced the same way round as removed. Remove both gears.

3. Remove the sealing ring from around the periphery of the pump housing. Carefully clean and inspect each part for signs of wear, paying particular attention to the white metal bearings in the pump housing, the adaptor and the driving gear. If necessary, remove the seal from the pump housing.



Removing Front Clutch and Input Shaft



Removing Rear Clutch and Sun Gears

To Reassemble

4. If removed, replace the seal in the pump housing. This seal has a bright metal outer diameter.

5. Replace the inner and outer gears in the pump housing, noting the marks made when dismantling, and lightly lubricate them with transmission fluid.

6. Fit a new sealing ring around the periphery of the pump housing.

7. Position the pump housing on the pump adaptor, lining up the hole in pump housing segment with the corresponding hole in the pump adaptor. Secure the pump adaptor with five bolts and lockwashers, and one cheese-headed screw and lockwasher. Torque the five bolts to 17 to 22 lb. ft. (2.4 to 3.1 kg.m.) and the cheese-head screw to 25 to 35 lb. in. (0.3 to 0.4 kg.m.).

OP 7007-A4 EXTRA: FRONT OR REAR CLUTCH, PRIMARY SUN GEAR OR FRONT BAND – REMOVE AND INSTALL

Tools Required

CBW 34	Front band spacer gauge
CBW 548	Torque screwdriver
CBW 548-2	Front Servo adaptor

To Remove

1. The front servo is secured by two bolts and spring washers and removal of these bolts will enable the servo to be withdrawn. When removing the servo ensure that the operating strut, which transmits movement from the servo to the band, does not fall out, otherwise it may be lost.

2. Withdraw the front clutch and input shaft assembly. Two thrust washers are positioned between the front and rear clutches, the phosphor bronze washer bearing against the ground rear face of the front clutch and the steel washer, which has two flats on its internal diameter, locating on the rear clutch projection.

3. Withdraw the rear clutch and sun gears. The needle thrust race and washer are positioned on the rear of the front sun gear shaft and should be removed. Disengage the front band from the stop in the transmission case, tilt slightly and remove.

4. Carefully remove two sealing rings from the front end of the forward sun gear shaft. Withdraw the forward sun gear shaft from the rear clutch assembly.

To Install

5. Slide one needle thrust race onto the forward end of the forward sun gear shaft and seat it on the front face of the forward sun gear. Pass the forward sun gear shaft through the centre of the rear clutch assembly, so sandwiching the thrust race between the rear face of the reverse sun gear and the front face of the forward sun gear.

6. Replace two sealing rings on the shaft in the appropriate grooves. Fit a steel thrust washer to the front of the rear clutch, engaging the internal flats on the washer with the corresponding flats on the rear clutch. Fit a phosphor bronze thrust washer alongside the steel thrust washer. Centralise the sealing rings on the shaft and centralise the thrust washer in the centre of the front clutch.

7. Carefully assemble the front clutch to the rear clutch in a vertical position.

   Replace the needle thrust race on the rear of the forward sun gear shaft. Fit a steel washer to the shaft, after the thrust race, with the lip towards the rear.

   Offer up the front and rear clutch assemblies passing through the front band. When correctly positioned rotate the output shaft to ensure that the assembly will turn freely.

8. Reposition the forward band in the case, engaging the end of the band with the fixed stop on the centre web of the case.

9. Refit the front servo. Retain the operating strut to the servo operating arm by means of petroleum jelly and offer the servo assembly into position, engaging the strut with the brake band.

10. Adjust the brake band (see illustration OP 7010-A). Slacken the adjusting screw locknut, move the servo lever outwards and place a 0.25 in. (6.35 mm.) gauge CBW 34 between the servo piston pin and the adjusting screw. Tighten the adjusting screw to 10 lb. in. (0.14 kg.m.), using torque screwdriver CBW 548 and the adaptor CBW 548-2 to tighten the locknut to 15 to 20 lb. ft. (2.1 to 2.8 kg.m.) and then remove gauge.

11. Rotate the output shaft and locate the governor weight at the bottom of the assembly.

12. Apply clean dry air at a pressure not exceeding 60 lb./sq. in. (4.2 kg./sq. cm.) to port (C) (see page 29). A thump indicates that the front clutch is functioning.

13. Check that the governor weight moves when the air is applied.

14. Apply clean dry air at a pressure not exceeding 60 lb./sq. in. (4.2 kg./sq. cm.) to port (A) (see page 29) for a period of several seconds. Check for leaks.

15. Release the air pressure and listen for a thump indicating that the rear clutch is releasing.

OP 7007-A5 EXTRA: FRONT CLUTCH – OVERHAUL

Tools Required

CBW 42 Front clutch piston replacer

Refitting Front Clutch Piston

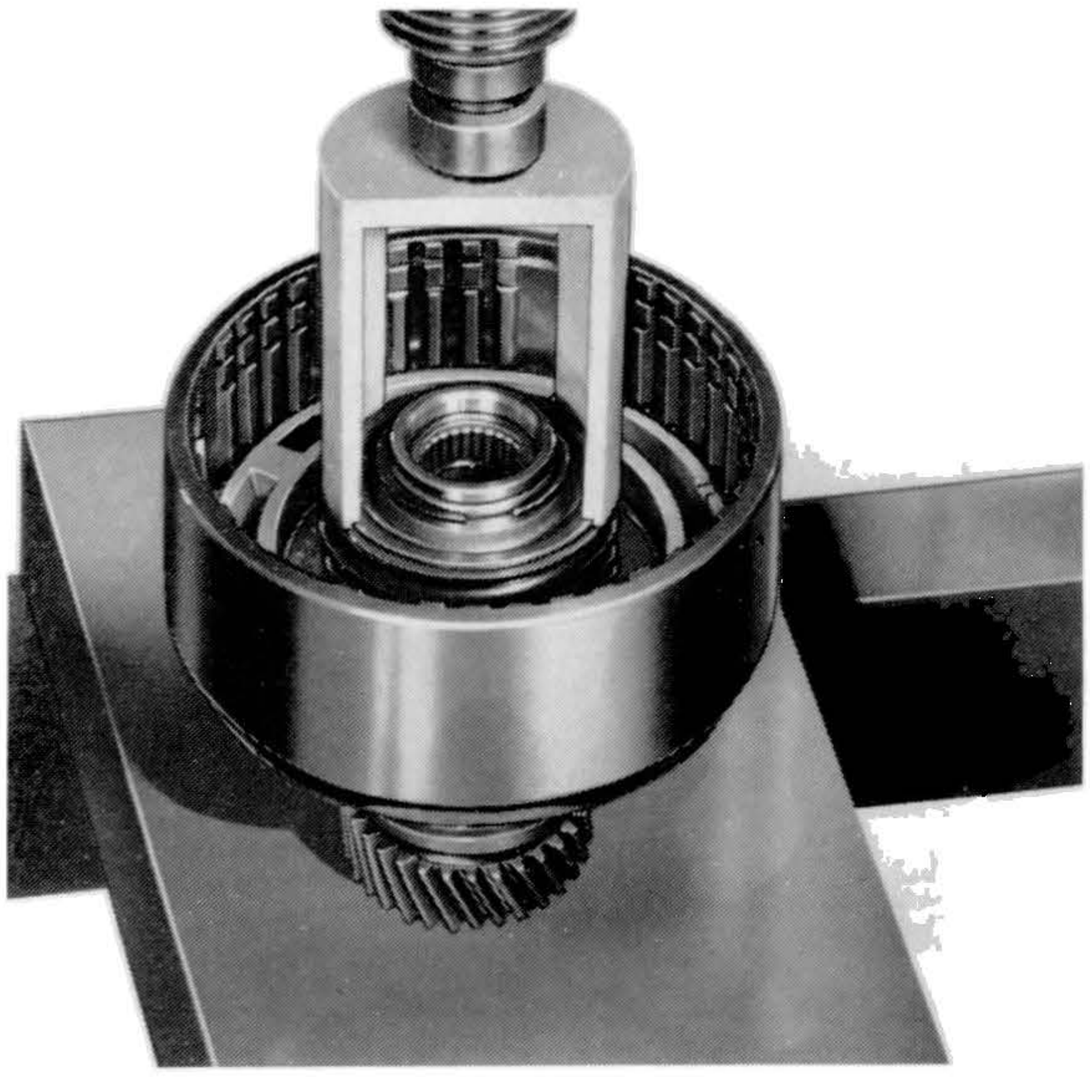
Refitting Front Clutch Plates

To Dismantle

1. With the aid of a screwdriver remove the circlip retaining the input shaft to the clutch cylinder. Then withdraw the input shaft and thrust washer.
2. Remove the clutch plates, noting their positions. An internally toothed plate should be the first plate viewed when the input shaft is removed and the thick externally splined pressure plate the last, the plates alternating.
3. Remove the clutch inner hub which will reveal a further large circlip retaining a diaphragm spring and piston. Remove this circlip and spring.
4. To remove the piston, it is necessary to blank off one end of the clutch cylinder piston guide and apply air pressure, via a suitable adaptor, at the other end of the guide. The outer face of the piston has a steel pressure ring pressed into it. Remove the rubber sealing ring from the outer periphery of the piston and also the seal from the piston guide in the clutch cylinder.

To Reassemble

5. Thoroughly clean and inspect all parts and lubricate them with transmission fluid prior to assembly. Replace the rubber seals around the periphery of the piston and piston guide. Refit the piston, using Tool No. CBW.42, ensuring that the steel pressure ring on the outer face of the piston is correctly seated. Reposition the spring with the fingers resting on the steel pressure ring of the piston and secure with a large circlip.
6. Refit the thick externally splined pressure plate, with the plain face outwards, and alternating internally and externally splined clutch plates ending with an internally splined plate. The front clutch externally toothed plates are flat, whereas those for the rear clutch are slightly dished.
7. Replace the central hub and thrust washer.
8. Reposition the input shaft and secure with a large circlip.



Dismantling Rear Clutch

Fitting Rear Clutch Piston

OP 7007-A6 EXTRA: REAR CLUTCH – OVERHAUL

Tools Required

CBW 37A	Clutch spring compressor
CBW 41	Rear clutch piston replacer
7066	Circlip pliers
7066 J	'J' type circlip plier points

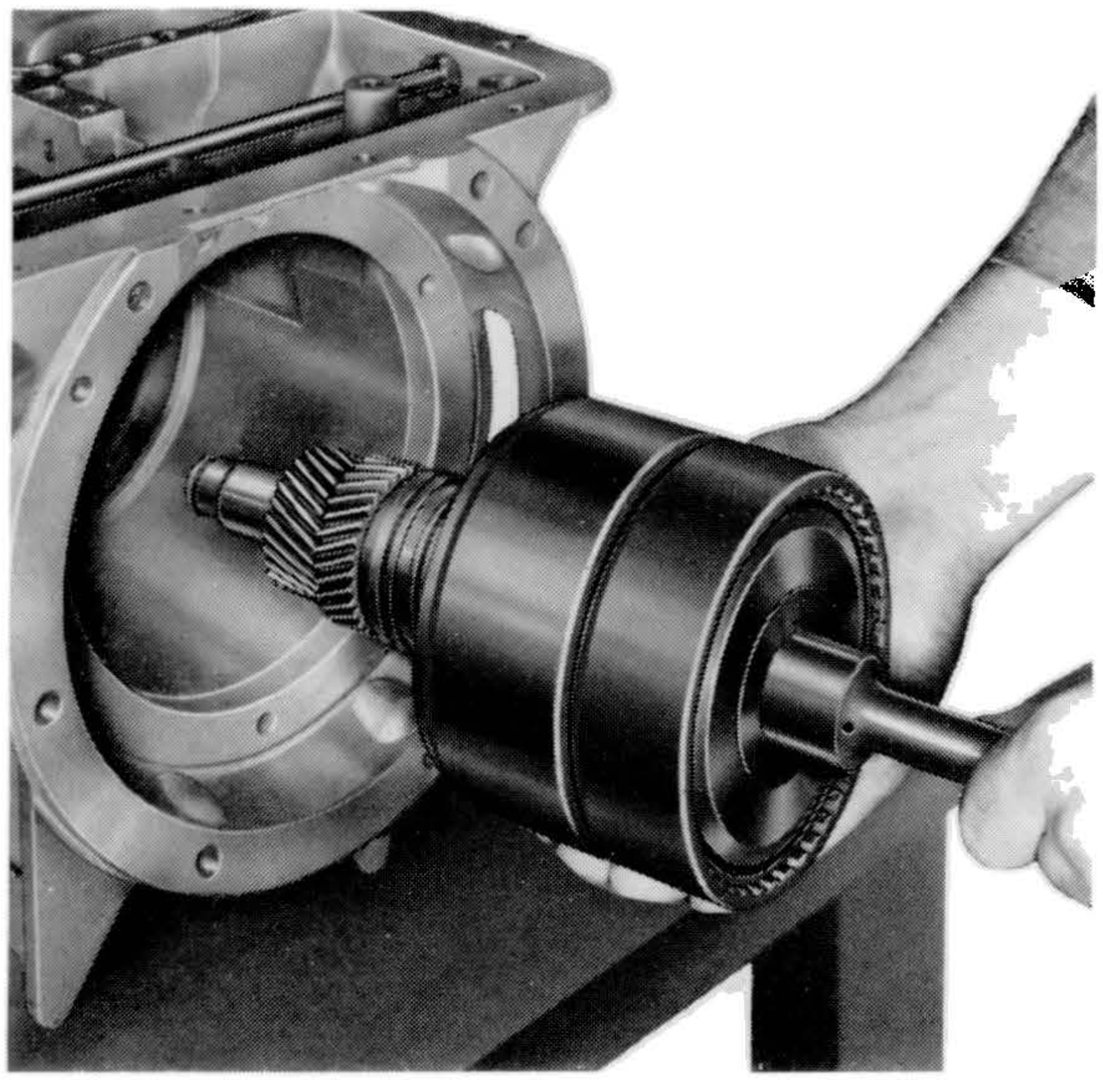
To Dismantle

1. Remove the large circlip retaining the clutch plates, with the aid of a screwdriver.
2. Remove the thin spacer plate, adaptor and alternate internally and externally splined plates. Locate the clutch spring compressor, CBW.37A, on the clutch spring retaining plate so that the ends of the circlip are opposite the large "window" in the tool. Place the assembly in a press and press down onto the tool to compress the spring. Using circlip pliers, 7066 with 'J' type points, remove the circlip and release the press until the spring is fully released. Remove from the press.
3. Remove the spring and spring seat.
4. To remove the piston, apply air pressure to the hole in the groove next to the sealing ring closest to the front drum.
5. Remove the rubber sealing rings from around the periphery of the piston and piston guide.
6. Carefully remove three sealing rings from the reverse sun gear shaft.

To Reassemble

7. Thoroughly clean and inspect all parts, paying particular attention to the needle race which supports the forward sun gear shaft.
8. Replace the three sealing rings on the reverse sun gear shaft.
9. Replace the rubber seals around the periphery of the piston and piston guide.

Fitting Rear Clutch Plates



Fitting Front and Rear Clutches

10. Position the piston (using CBW.41), spring and spring seat; fit the clutch spring compressor tool (CBW.37A) and, using a press, compress the spring until the circlip groove on the piston guide is uncovered. Refit the circlip, ensuring that it is seating correctly in the groove. Release the press and remove the clutch spring compressor.

11. Replace the clutch plates, externally splined plate first, and then alternating internally and externally splined plates, ending with a thin spacer plate (and adaptor). Secure the clutch plates with a large circlip.

    NOTE that the outer splined plates for the rear clutch are slightly dished, whereas the front clutch plates are flat. These dished plates can be fitted so that the dishing is either towards or away from the piston, but they must all face the same way.

12. Slide one needle thrust race onto the forward end of the forward sun gear shaft and seat it on the front face of the forward sun gear. Pass the forward sun gear shaft through the centre of the rear clutch assembly, so sandwiching the thrust race between the rear face of the reverse sun gear and the front face of the reverse sun gear.

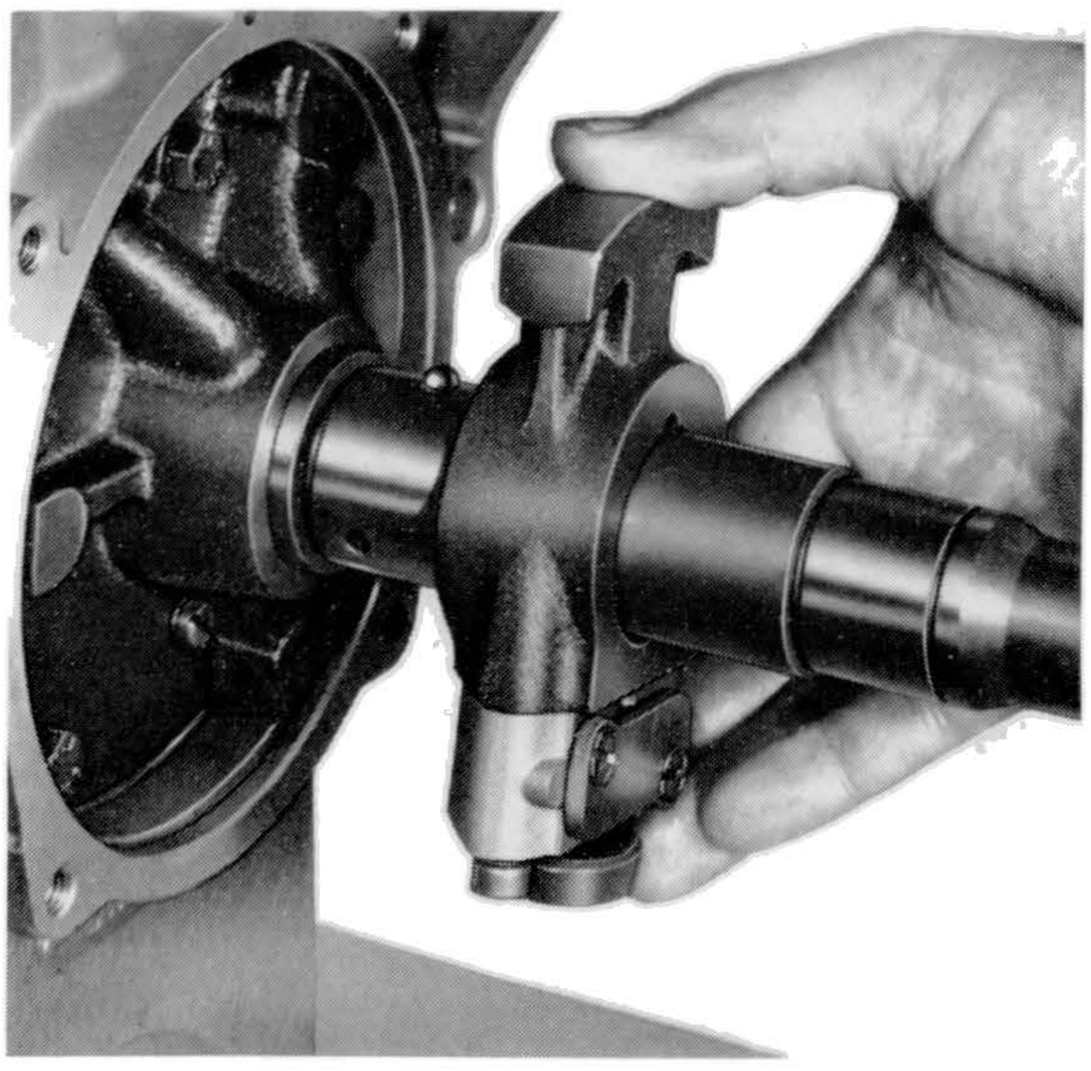
OP 7007-A7 EXTRA: GEAR SET, ONE-WAY CLUTCH, CENTRE SUPPORT, SUN GEAR AND SHAFT ASSEMBLY AND/OR REAR BAND - REMOVE AND INSTALL

Tools Required

CBW 547A-50	Torque wrench
CBW 547-50-2	Rear servo adaptor

To Remove

1. The rear servo is secured by two bolts and spring washers and removal of these bolts will enable the servo to be withdrawn. When removing the servo ensure that the operating strut which transmits movement from the servo to the band, does not fall out, otherwise it may be lost.



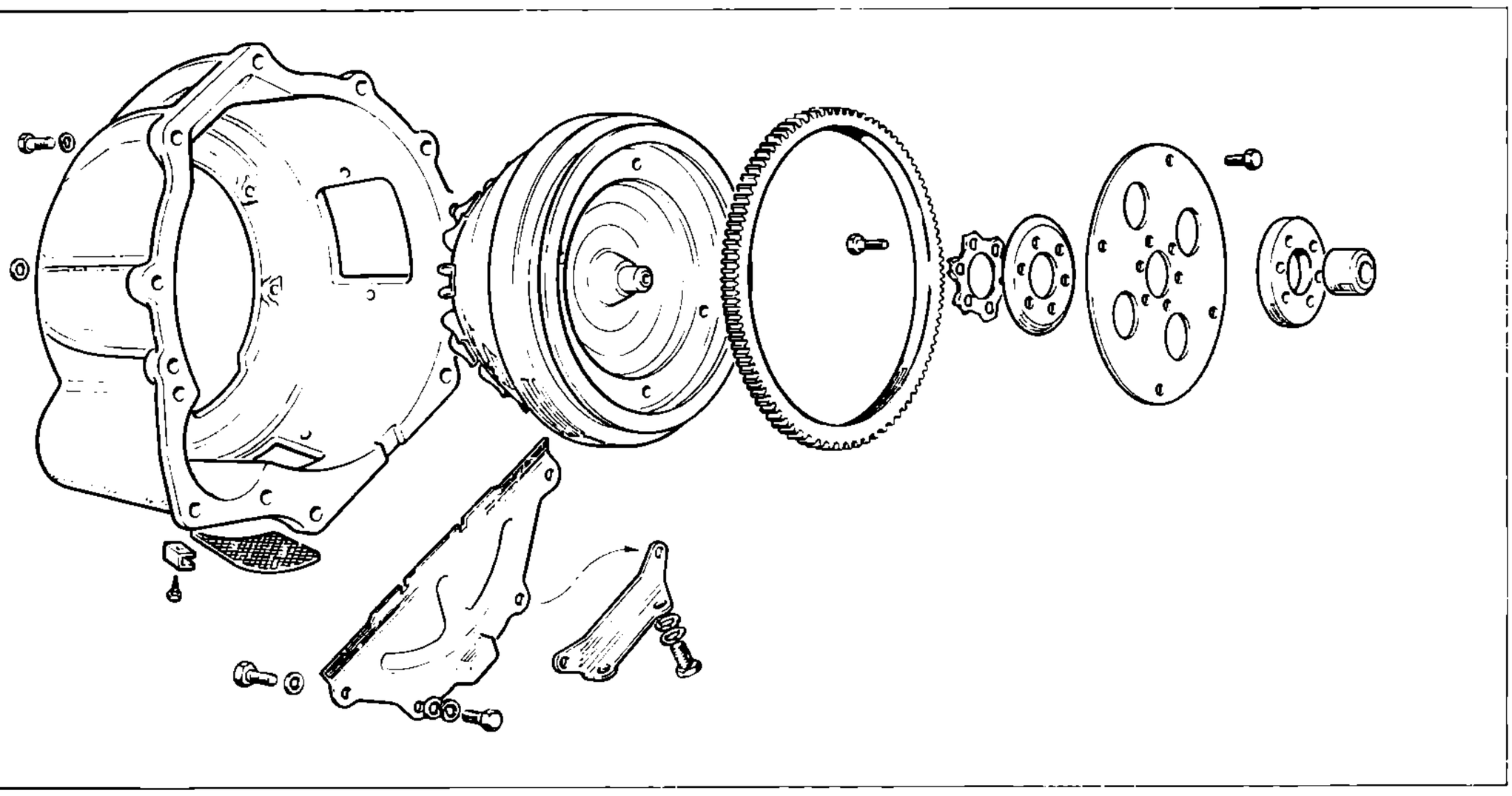
Fitting the Governor

Fitting One-way Clutch

2. Mark where the screws are located and unscrew the two centre support securing screws and lockwashers. These screws are around the outside of the case in line with the centre support and positioned 120° either side of the rear servo front securing screw. Mark the centre support in relation to the case, and remove the centre support.
3. Withdraw the gear set planet gear assembly. A steel washer and needle thrust washer are positioned between the planet gear assembly and the output shaft.
4. Disengage the rear band from the stop and remove.
5. Extract the one-way clutch from the outer race and then remove the outer race which is secured by a circlip in the planet gear assembly.
6. Remove the three sealing rings from the sun gear shaft.

To Install

7. Fit the one-way clutch outer race to the planet gear carrier, engaging the lugs on the outer race with the driving lugs on the carrier. Secure with a large circlip. Fit the one-way clutch to the outer race with the lips to the outside. Turning the cage whilst pressing inwards will assist in fitting the one-way clutch. Then, fit the centre support to the assembly, so that the centre boss is inside the one-way clutch. Place the steel washer onto the rear of the planet gear assembly with the lip rearwards, and then fit the large needle thrust race after the steel washer.
8. Fit new sealing rings on the sun gear shaft.
9. Position the rear band in the case, engaging the end of the band with the adjuster.
10. Offer up the planet gear assembly and centre support, engaging the planet gears with the ring gear. Align the marks, made when dismantling, on the centre support with the marks on the case and gently tap the centre support into position. Ensure that the holes in the centre support are in line with the case holes and fit the two external securing bolts and lockwashers. These lockwashers are also oil seals, and must, therefore, be fitted with the rim facing the gearbox case.



The Torque Converter and Adaptor Plate

11. Refit the rear servo. Retain the operating strut to the servo operating arm by means of petroleum jelly and offer the servo assembly into position, engaging the strut with the brake band. The forward bolt for the rear servo is longer and has a reduced diameter at one end to locate the centre support.

12. To adjust the rear brake band, slacken the adjusting screw locknut on the right-hand side of the gearbox case and then tighten the adjusting screw 10 lb. ft. (1.382 kg.m.). Slacken the adjusting screw one turn and tighten the locknut using CBW 547A-50 and CBW 547A-50-2 adaptor. To facilitate this operation on the car, a hole, sealed with a plug, is provided in the transmission tunnel.

OP 7007-A8 EXTRA: OUTPUT SHAFT AND/OR PARKING GEAR – REMOVE AND INSTALL

To Remove

1. Remove the four bolts and spring washers securing the extension housing to the gearbox and carefully withdraw the extension housing rearwards.

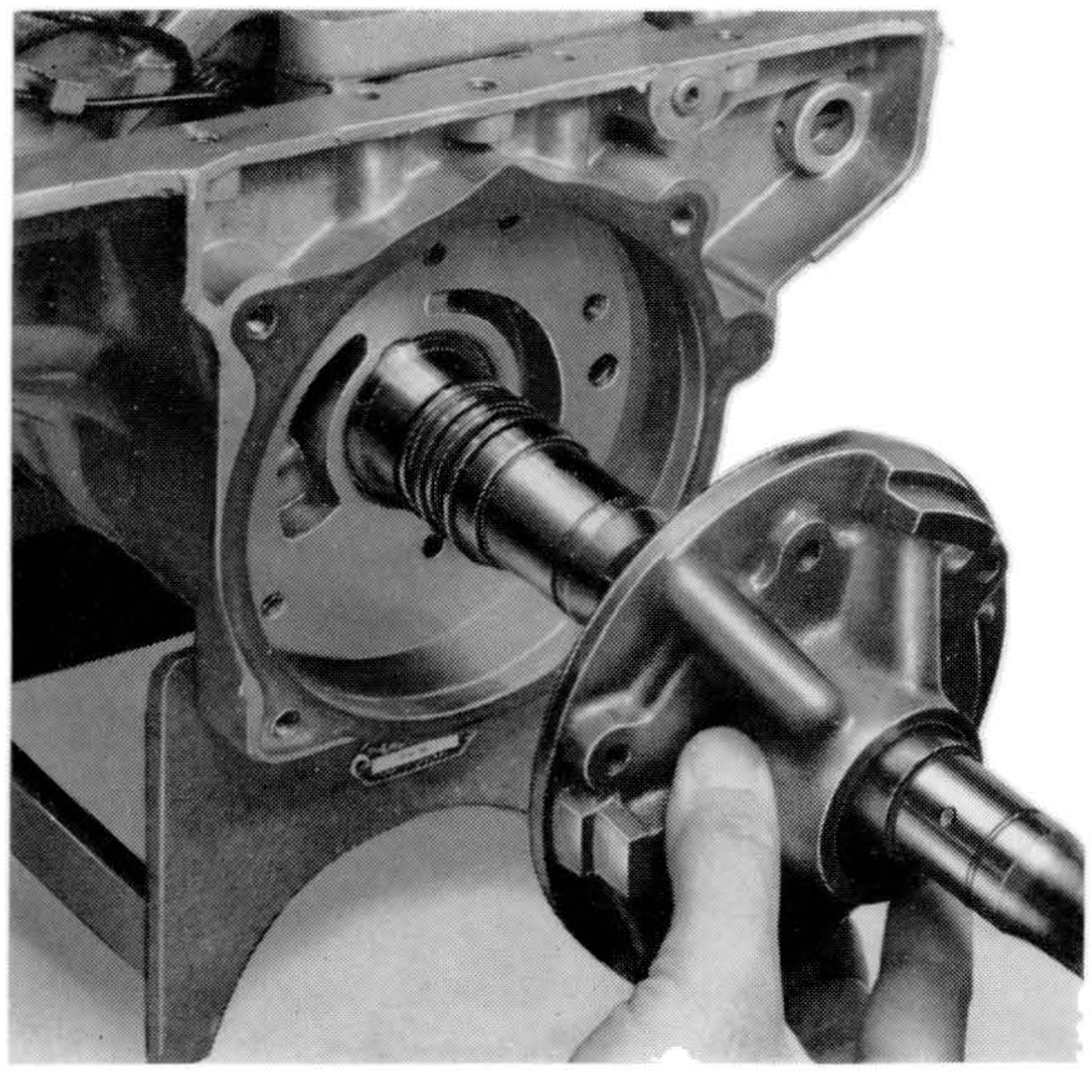
2. The speedometer driving gear is retained against a shoulder on the output shaft by a circlip, the drive being transmitted by a ball. Expand the circlip and remove. Remove the speedometer driving gear, ball and wave washer.

3. Before removing the governor it should be noted that the small rectangular plate secured by two countersunk screws should face rearwards. Remove the circlip and draw the governor rearwards, care should be taken not to lose the driving ball.

4. Remove the bolts securing the rear adaptor to the casing and slide off the adaptor.

5. Remove the sealing rings from the output shaft.

6. Withdraw the output shaft and thrust washer. If necessary, separate the output shaft from the ring gear by removing the circlip which retains them together.



Fitting the Rear Adaptor

To Install

7. Replace the circlip which retains the shaft to the ring gear. It should be noted that the retaining circlip is a selective fit. Three circlips are available, see below, and the one used should be selected to give a minimum end-float.

   0.055 in. (1.397 mm.) 0.057 in. (1.448 mm.) 0.059 in. (1.499 mm.)

8. Before fitting the output shaft, position the rear thrust washer on the inside rear face of the transmission case, retaining it in position, if necessary, with petroleum jelly. The three lugs on this thrust washer will contact protrusions in the transmission case casting to prevent the thrust washer from turning.

9. Fit new sealing rings on the output shaft.

10. Slide on the rear adaptor plate and secure to the body.

11. Refit the governor. Turn the output shaft until the governor driving ball hole is uppermost and position the ball. Then, slide on the governor assembly ensuring that the governor plate, secured by two screws, is facing rearwards. Fit the governor retaining circlip using circlip pliers.

12. Replace the speedometer driving gear. Fit the wave washer and position the drive ball in the output shaft and fit the speedometer driving gear against the locating shoulder.

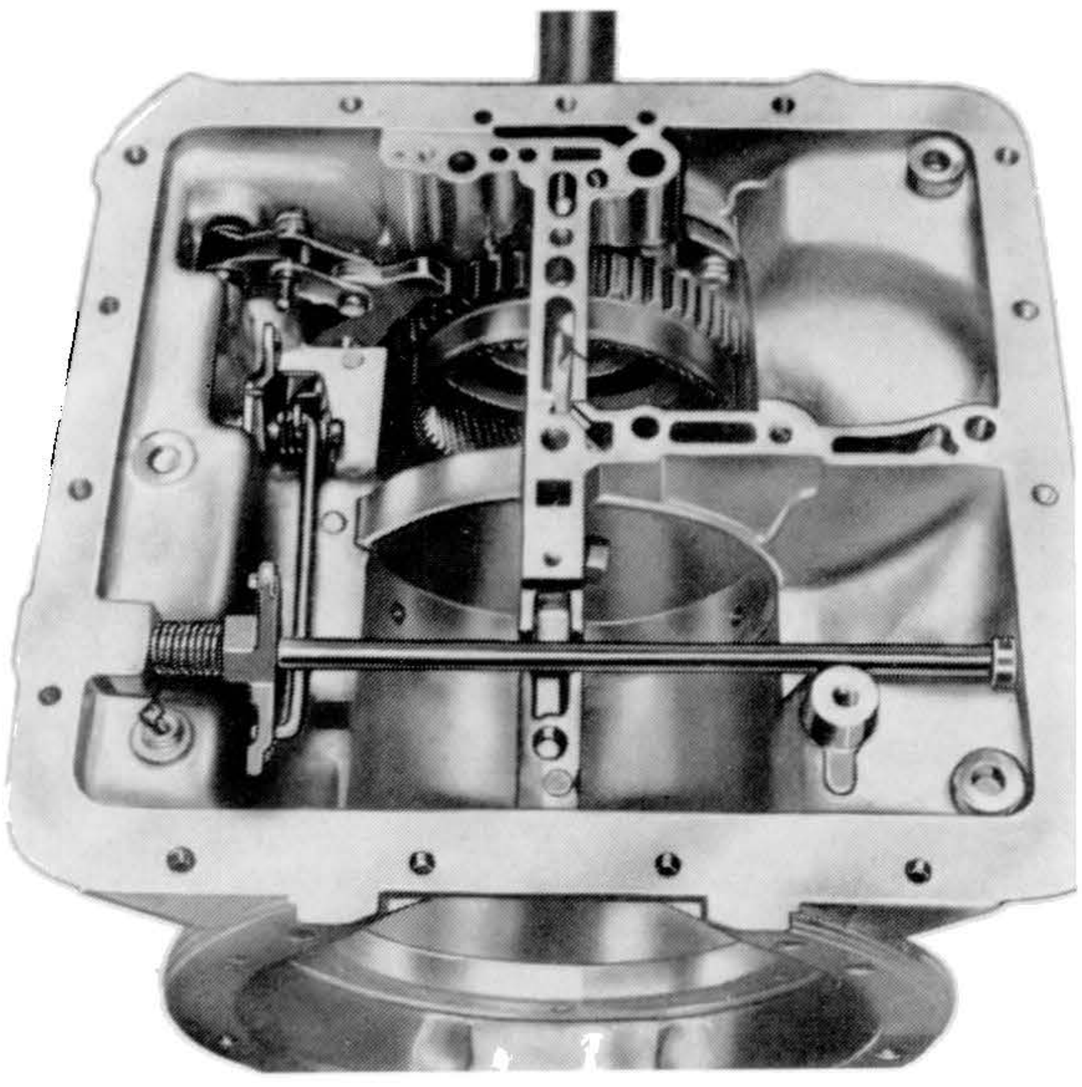
    Secure with a circlip.

13. Clean the rear face of the gearbox and place a new gasket in position. Refit the extension housing and secure with four bolts and lockwashers.

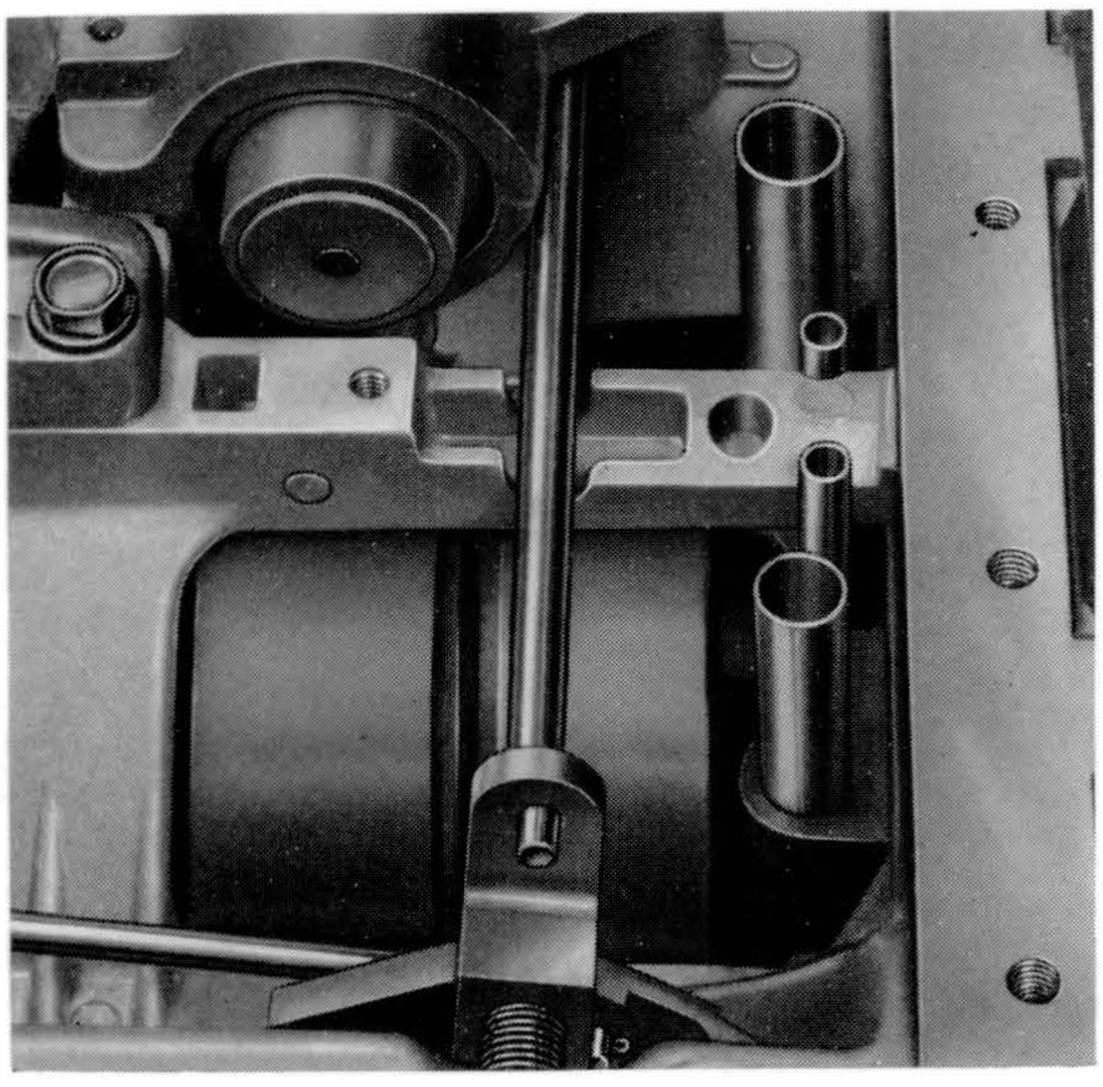
OP 7007-A9 EXTRA: SELECTOR AND PARKING PAWL LEVERS – REMOVE AND INSTALL

Tools Required

CBW 547A-50-3A Inhibitor switch locknut wrench



Manual Valve Lever



Location of Oil Tubes

To Remove

1. Drive out the tension pin securing the cross-shaft locating collar.
2. Push the manual valve lever against the bias spring and remove the lever locating pin which is now exposed.
3. Hold the manual valve operating lever in position and withdraw the cross-shaft from the side of the casing remote from the operating levers.
4. Carefully lift the manual valve lever from its position and remove the detent ball, detent spring and the cross-shaft bias spring. Turn the manual valve lever slightly and disconnect the parking pawl actuating link.
5. Withdraw the parking pawl actuating mechanism after removing the spring clip. A careful note should be made of the manner in which the spring is fitted before removal.
6. From outside the case drive out the tension pin retaining one parking pawl pivot pin and drive out the pivot from inside the case. The second pivot pin is not secured but is retained by a lug on the extension housing. If the case is up-ended and gently tapped this pin will fall out and the parking pawl can be removed.

To Install

7. Reposition the parking pawl mechanism in the box and replace two pivot pins. The stepped pivot should be tapped right home and a new tension pin fitted to the case to prevent this pivot coming out.
8. The parking pawl actuating mechanism should be repositioned, in the manner removed, on the pivot in the transmission case. Before continuing with the assembly check the working of the parking pawl by manual operation.
9. Replace the seals in the cross-shaft bosses in the transmission case. Reconnect the manual valve lever to the parking pawl actuating link. Carefully slide the cross-shaft into the case opposite to the inhibitor switch and position on the shaft the collar, manual valve lever and bias spring, in that order. Pass the shaft through the opposite boss in the case. Position the detent spring and ball and compress these with a piece of small diameter tube, at the same time sliding the manual valve detent arc over the ball. Pull the manual valve lever against the bias spring slightly to enable the locating pin to be fitted into the cross-shaft and release the lever so that the cut-out engages with the locating pin. Locate the cross-shaft collar in the correct position and secure with a new tension pin.

OP 7007-A10 EXTRA: GEARBOX CASE – RENEW

To Remove

1. Slacken the inhibitor switch locknut using CBW 547A-50-3A and remove the switch.
2. Unscrew the downshift valve cable retainer and remove the cable.
3. Remove the locknut from the rear band adjuster and screw the adjuster screw into the case to remove it.
4. Remove the dipstick tube adaptor.
5. Remove the oil cooler outlet blanking plugs.

To Install

6. Refit the oil cooler outlet blanking plugs.
7. Refit the rear band adjuster by screwing it into the case from inside and fit the locknut to thread onto it outside the case.
8. Reconnect the downshift valve cable.
9. Replace the dipstick tube adaptor.

OP 7007-B FRONT PUMP – REMOVE AND INSTALL
(Includes OPS 7007-A, A1 and A2)

OP 7007-C FRONT PUMP – OVERHAUL
(Includes OPS 7007-A, A1, A2 and A3)

OP 7007-D FRONT OR REAR CLUTCHES, PRIMARY SUN GEAR OR FRONT BAND – REMOVE AND INSTALL
(Includes OPS 7007-A, A1, A2 and A4)

OP 7007-E GEAR SET, ONE-WAY CLUTCH, CENTRE SUPPORT, SUN GEAR AND SHAFT ASSEMBLY AND/OR REAR BAND – REMOVE AND INSTALL
(Includes OPS 7007-A, A1, A2, A4 and A7)

OP 7007-F PARKING GEAR AND/OR OUTPUT SHAFT – REMOVE AND INSTALL
(Includes OPS 7007-A, A1, A2, A4, A7 and A8)

OP 7007-G SELECTOR AND PARKING PAWL LEVERS – REMOVE AND INSTALL
(Includes OPS 7007-A, A1, A2, A4, A7 and A9)

OP 7007-H GEARBOX CASE – RENEW
(Includes OPS 7007-A, A1, A2, A4 and A7 to A10)

OP 7007-J AUTOMATIC TRANSMISSION – OVERHAUL
(Includes 7007-A, A1 to A9, 7008-A3, A5, A7 and 7009-A3)

Front Servo – Exploded View

OP 7008-A AUTOMATIC TRANSMISSION SUMP, AND/OR GASKET – REMOVE AND INSTALL
(Transmission assembly in situ).

To Remove

1. Jack up the car and fit stands.
2. Remove the gearbox drain plug to drain the transmission fluid, bearing in mind that the fluid will be extremely hot if the transmission has just been used.
3. To remove the sump, unscrew fifteen bolts and spring washers around the flange and remove the sump together with its gasket.
4. Remove and clean the magnet located on one of the bolt heads.

To Install

5. Position the magnet on a suitable bolt head.
6. Ensure that the mating faces of the sump and casing are clean, fit a new gasket to the sump flange and replace the sump. Tighten the bolts evenly to 8 to 13 lb. ft. (1.1 to 1.8 kg.m.). Replace the drain plug and tighten to 9 to 12 lb. ft. (1.4 to 1.7 kg.m.).
7. Remove stands and lower the car to the ground.
8. Refill the transmission to within $\frac{3}{8}$ in. from the full mark on the dipstick, bearing in mind that unless a new torque converter has been fitted, less than 11.25 Imp. pints (13.5 U.S. pints, 6.39 litres), will be required since the converter is not drained when removed. Use only automatic transmission fluid M-2C33-F.
9. Start the engine and check for leaks.
10. Road test the vehicle over a distance of not less than five miles, then check the transmission fluid level. Top-up as necessary.

OP 7008-A1 EXTRA: DOWNSHIFT CABLE – RENEW

To Remove

1. Disconnect the downshift valve cable from the accelerator linkage. Slacken the locknut securing the downshift valve outer cable to the bracket. Remove the split pin locking the downshift cable clevis pin and remove the pin. Draw the cable from the engine compartment rear bulkhead bracket.
2. Disconnect the downshift valve cable from the cam. Unscrew the downshift valve cable retainer and remove the cable.

To Install

3. Screw the downshift valve cable retainer into the gearbox case and connect the inner cable to the cam.
4. Locate the outer cable adjuster in the bracket on the engine compartment bulkhead. Connect the inner cable to the accelerator linkage and adjust as described in OP 7007-A, sub-operation 42.

OP 7008-A2 EXTRA: FRONT SERVO – REMOVE AND INSTALL

To Remove

1. Remove the two fluid transfer pipes by prising them out with a protected screwdriver blade.
2. The servo is secured by two bolts and spring washers and removal of these bolts will enable the servo to be withdrawn. When removing the servo ensure that the operating strut, which transmits movement from the servo to the band, does not fall out and become lost.

To Install

3. Refit the front servo. Affix the operating strut to the servo operating arm by means of petroleum jelly and offer the servo assembly into position, engaging the strut with the brake band.
4. Adjust the front band, see OP 7010-A.
5. Apply clean dry air to port (B) (see page 29) at a pressure not exceeding 60 lb./sq. in. (4.2 kg./sq. cm.) for several seconds. Observe movement of piston pin.
6. Fit the fluid transfer pipes. These pipes are a push fit and are held in position by the sump. Each tube is different in length and shape.

OP 7008-A3 EXTRA: FRONT SERVO – OVERHAUL

To Dismantle

1. Depress the servo piston and piston guide assembly, just sufficient to overcome spring pressure, and remove the circlip. The piston spring will then push the piston and its guide from the servo housing.
2. Withdraw the piston from its guide and extract the spring.
3. Remove the 'O' ring from the guide and the two circular section sealing rings from the piston.
4. To remove the operating lever from the housing it is necessary to withdraw the lever's pivot which is retained by a pin in the servo housing. This pin can be tapped out with the aid of a $\frac{1}{8}$ in. (3.18 mm.) diameter drift.

   NOTE – Where the retaining pin is not fitted, mount the servo body in the protected jaws of a vice with the operating lever to the left of the operator. Drive out the lever pivot in a downward direction.

To Reassemble

5. The operating lever should be fitted so that the adjusting screw will pass through the hole in the end of the housing. Fit the pivot through the housing and operating lever, ensuring that the retaining pin holes in the housing and pivot are in line. Fit the retaining pin.

   NOTE – Where the retaining pin is not fitted, mount the servo body in the protected jaws of a vice with the operating lever to the right of the operator. Fit the lever pin with the three flutes uppermost.
6. Fit two circular section sealing rings to the piston and the 'O' ring to the piston guide.
7. Insert the piston into the guide so that the flanges of the piston and guide abut.
8. Place the piston retracting spring in the piston and insert the assembly, piston first, into the housing. Retain with a circlip after depressing the piston guide just sufficient to overcome spring pressure.

OP 7008-A4 EXTRA: REAR SERVO – REMOVE AND INSTALL

To Remove

1. Remove the four fluid transfer pipes by prising them out with a protected screwdriver blade.
2. The servo is secured by two bolts and spring washers and removal of these bolts will enable the servo to be withdrawn. When removing the servo ensure that the operating strut, which transmits movement from the servo to the band, does not fall out, otherwise it may be lost.

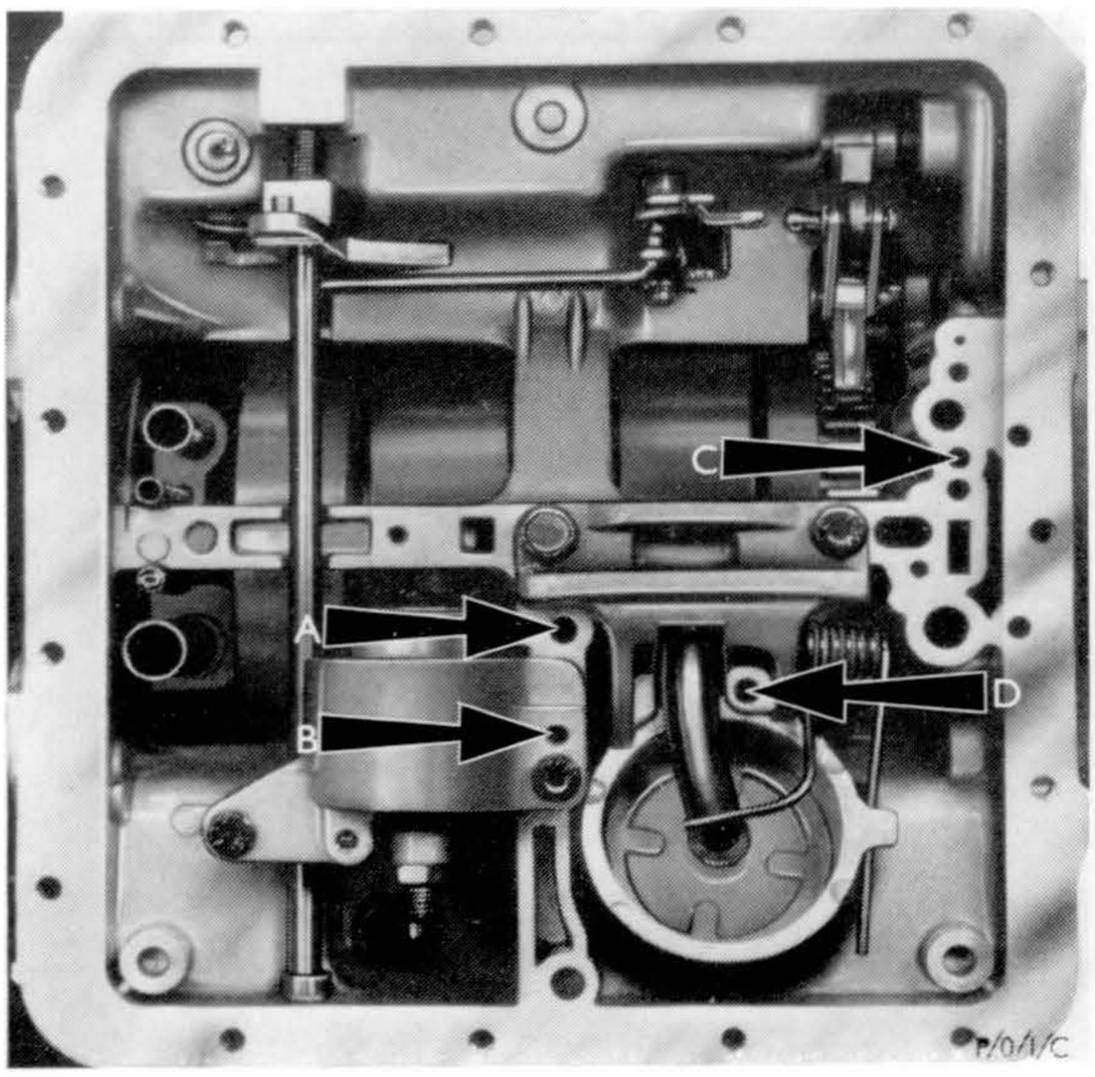
To Install

3. Refit the rear servo. Affix the operating strut to the servo operating arm by means of petroleum jelly and offer the servo assembly into position, engaging the strut with the brake band. The forward bolt is longer and has a reduced diameter at one end to locate the centre support.
4. Adjust the rear brake band as in OP 7010-A.
5. Apply clean dry air at a pressure not exceeding 60 lb./sq in. (4.2 kg./sq. cm.) at port (D) for several seconds. Observe movement of the piston.
6. Fit the fluid transfer pipes. These pipes are a push fit and are held in position by the sump, when fitted. Each pipe is different in length and shape and cannot be fitted incorrectly.

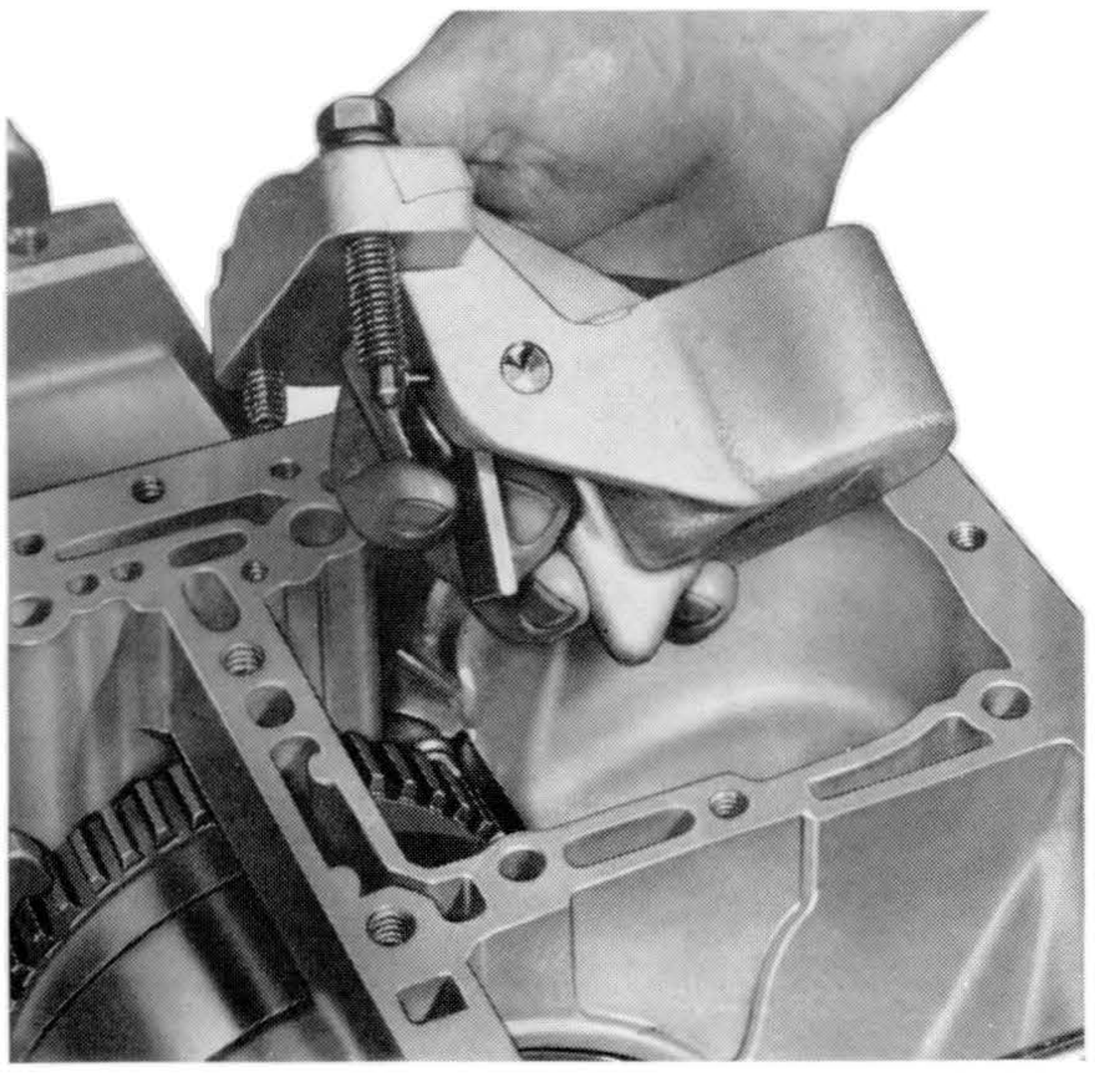
OP 7008-A5 EXTRA: REAR SERVO – OVERHAUL

To Dismantle

1. Withdraw the servo piston by removing the operating spring and lever, the pivot of which will have to be drifted out of the housing.
2. Pull out the piston. Remove the sealing ring from the piston.



Air Test Port Locations



Replacing Rear Servo

To Reassemble

3. Fit the sealing ring to the piston and fit the piston into the housing.
4. Fit the operating lever and shaft. Replace the spring in tension.

OP 7008-A6 EXTRA: VALVE BODIES ASSEMBLY OR OIL PICK-UP TUBES – REMOVE AND INSTALL

To Remove

1. Remove the four fluid transfer pipes by prising them out with a protected screwdriver blade.
2. Withdraw the valve bodies assembly. Disconnect the downshift valve cable from the cam. Remove the two rear bolts passing through the strainer and the bolt just to the rear of the front pump strainer. Take care to draw off the valve bodies assembly evenly to avoid damage to the front pump tubes.
3. Withdraw the four oil tubes from the front pump adaptor. It will be seen that the outside pair are of unequal diameter and, therefore, cannot be refitted incorrectly. The inner pair, however, are identical and can be interchanged.

To Install

NOTE – Valve operation may be checked prior to installing the valve bodies assembly, as follows. Clean dry air must be used at a pressure not exceeding 60 lb./sq. in. (4.2 kg./sq. cm.).

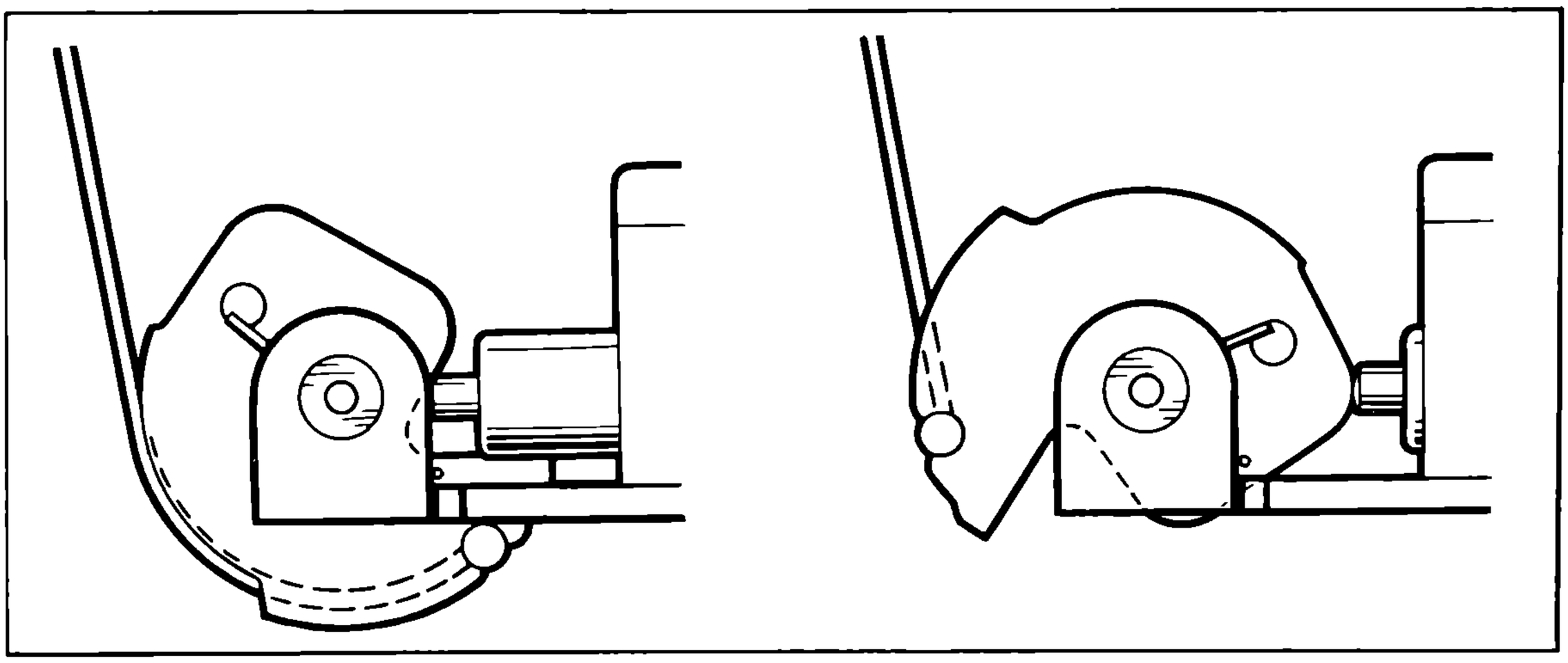
(*a*) Apply air to port (W) (see page 32). A buzzing noise indicates that the converter check valve is functioning correctly.

(*b*) Apply air to port (X) and check that following valves move:

1 – 2 shift valve	Servo orifice valve
2 – 3 shift valve	Modulator valve.

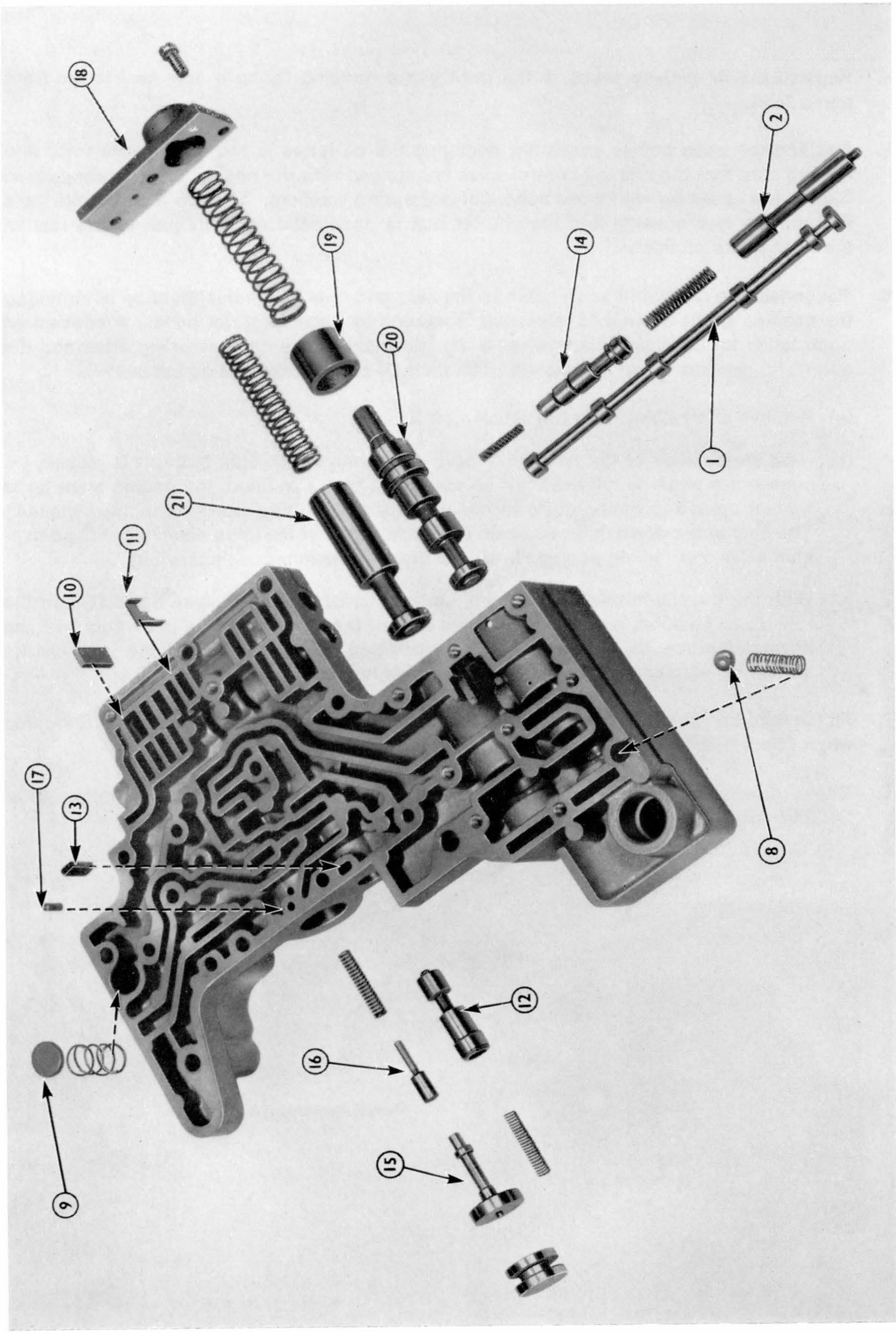
(*c*) Apply air to port (Y). The secondary regulator valve is not visible but should be heard.

(*e*) Apply air to port (Z) and check that the throttle exhaust valve moves.



"Idling" "Kick down"

Downshift Valve Cable Adjustment



Lower Valve Body and Valves (Exploded)

4. Replace the oil pick-up tubes in the front pump housing fitting a new seal to the front pump inlet.

5. Position the valve bodies assembly, engaging the oil tubes in the oil tube collector and making sure that the manual control valve is engaged with the peg on the operating lever. Secure the assembly with three bolts, flat and spring washers. The two longer bolts pass through the rear housing and the shorter bolt is positioned centrally just to the rear of the front pump strainer.

6. Reconnect the downshift valve cable to the cam and check its adjustment by determining the position of the downshift valve cam in relation to the accelerator pedal. A convenient opportunity for checking this is when a new downshift valve cable is being fitted and the automatic gearbox sump is removed. The method of adjustment is as follows:—

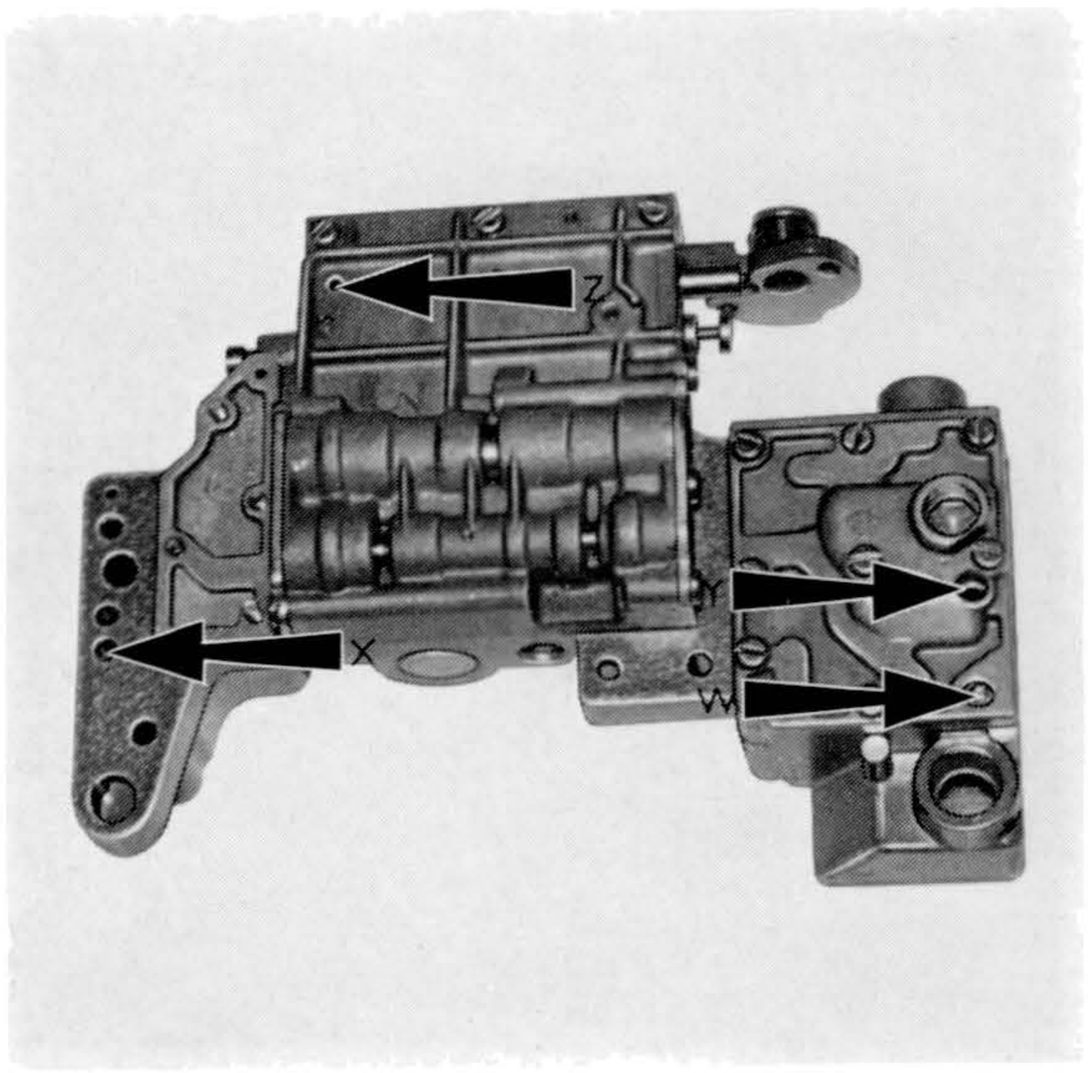
(a) Remove all free play from the accelerator linkage.

(b) Note the position of the downshift valve cam when the throttle butterfly is closed, i.e. accelerator pedal is released. (If an automatic choke is fitted, the engine must be at normal operating temperature to ensure that the throttle butterfly is fully closed.) The heel of the downshift valve cam should lay against the large diameter of the downshift valve, see "idling position", with all slack in the inner cable taken up.

(c) With the throttle butterfly fully open, i.e. accelerator pedal pressed down fully in the kick-down position, the constant radius lobe of the cam should be in contact with the downshift valve, as seen in "kick-down position". The position of the cam can be altered by adjusting the downshift valve cable length.

7. Fit the fluid transfer pipes. These pipes are a push fit and are held in position by the sump when fitted. Each tube is different in length and shape.

8. Check downshift cable adjustment with a pressure check as in sub-operation 42 of OP 7007-A.



Valve Port Locations

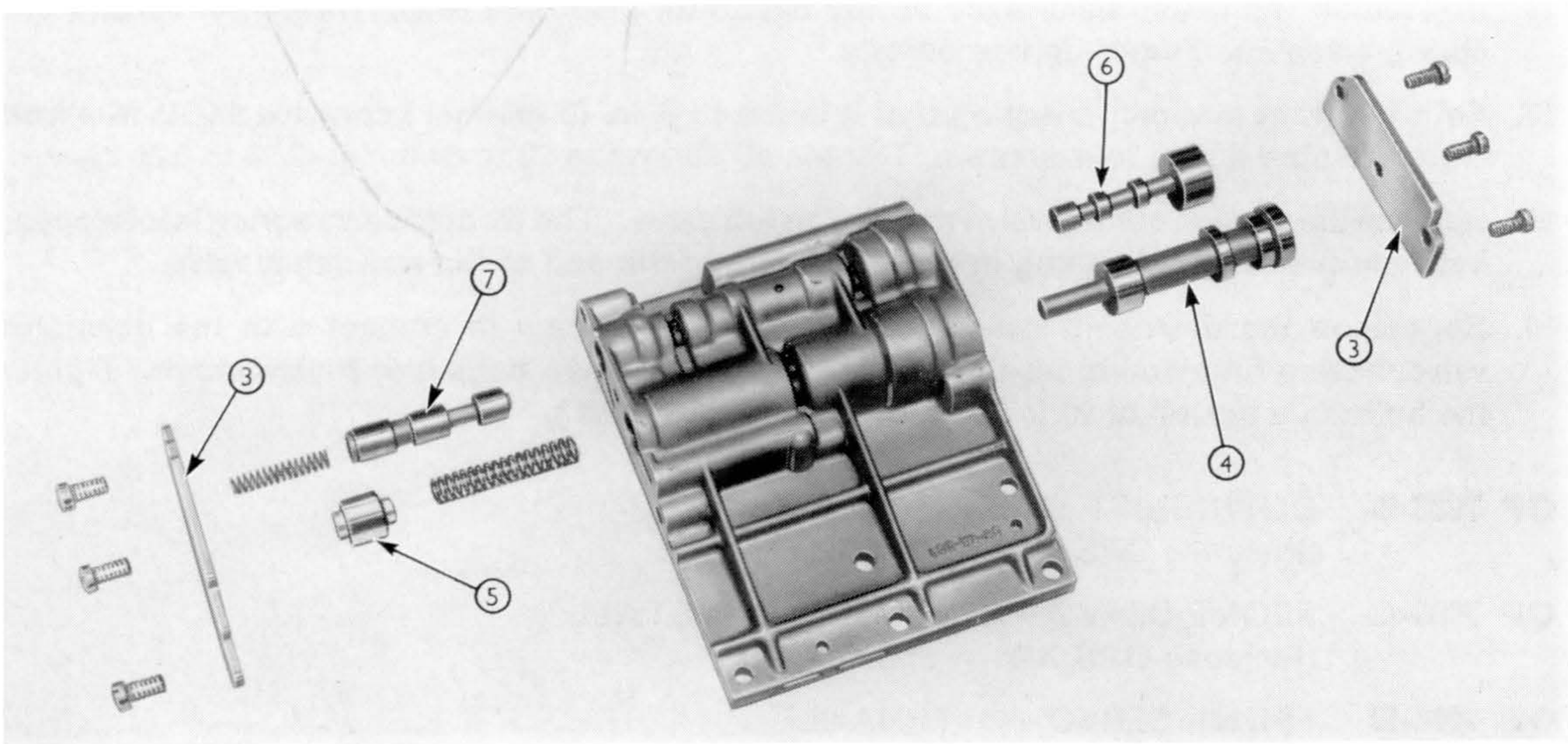
OP 7008-A7 EXTRA: VALVE BODIES ASSEMBLY - OVERHAUL

To Dismantle

To facilitate fitting the valves, etc. it is advisable to dismantle the assembly on a clean steel bench covered with clean white paper.

To avoid confusion each component of the valve bodies assembly should be washed separately in clean petrol, paraffin or industrial solvent, carefully inspected and replaced in the order in which they were removed. Before installing the parts they should be lubricated with automatic transmission fluid.

1. Withdraw the manual control valve (1). Unscrew the two bolts securing the downshift valve cam bracket to the valve body and remove the bracket and cam assembly. When the cam has been removed, the downshift valve (2), with its spring, may be withdrawn.
2. Remove the strainer, which is secured by four short screws with spring washers.
3. Separate the upper and lower valve bodies by removing the six cheese-head screws (one long and five short) from the lower valve body and the two cheese-head screws from the upper valve body.
4. Remove the governor line plate. Unscrew the two screws located inside the rear pump strainer body, and two screws located at the periphery of the strainer body, and remove the governor line plate.
5. The upper valve body has two end plates (3), each secured by three cheese-headed screws. Remove these retainer plates followed by the second to third shift valve (4), spring, plunger (5), and the first to second shift valve (6) from the rear of the body. From the front of the body withdraw the first to second shift valve spring (7) and plunger.
6. Remove the oil tube collector by unscrewing eight cheese-head screws. The separator plate can now be removed carefully, revealing the converter check valve (8), rear check valve (9), the throttle valve keep plate (10), and throttle stop plate (11), throttle valve and spring in the lower valve body.



Upper Valve Body and Valves

7. The servo orifice control valve (12) is retained by a keep plate (13), the downshift and throttle valve (14) by a keep plate (10), and the modulator valve (15) by a small dowel pin (17). Remove the keep plate and dowel pin and remove both valves and springs.

8. Remove the three screws securing the primary and secondary regulator valves retainer plate and remove the retainer plate (18). Care should be taken when removing these screws since two regulator valve springs are retained by the plate. With the plate removed, withdraw the primary regulator valve spring, sleeve (19) and valve (20). Remove the secondary regulator valve spring and valve (21).

To Reassemble

9. Fit the regulator valves. Fit the primary regulator valve, sleeve and spring in the lower valve body. Then, replace the secondary regulator valve, followed by its spring. Fit the retainer plate with the three screws to 20 to 30 lbs. in. (0.24 to 0.35 kg.m.).

10. Refit the modulator valve spring, valve plunger, valve and plug. Secure the plug with dowel. Refit the servo orifice control valve and spring, locating the spring inside the counterbore in the end valve and retain it with a keep plate.

11. Reposition the throttle valve keep plate, throttle valve return spring, throttle valve and stop plate. Fit the converter check valve spring, the ball and rear check valve spring and the disc type valve.

12. Carefully position the separator plate on top of the lower valve body, making sure that the check valves are not displaced.

13. Refit the oil tube collector with eight screws and spring washers. Finger tighten screws.

14. Reposition the first to second spring, plunger and shift valve and fit the second to third plunger, spring and shift valve in the upper valve body. These valves, springs and plungers are of different diameter and cannot be confused. Refit the retainer plates, using three screws and spring washers for each. Tighten the screws to 20 to 30 lbs. ins. (0.24 to 0.30 kg.m.). The retainer plates are dissimilar and cannot be confused.

15. Locate the governor line plate and retain it with two screws and spring washers from underneath the rear pump strainer body. Finger tighten screws.

16. Reposition the upper valve body on the separator plate and retain with eight screws and spring washers. Finger tighten screws.

17. Refit the front strainer, ensuring that it is flat to $\frac{1}{32}$ in. (0.794 mm.) concave and is free from kinks. Secure it with four screws. Tighten all screws to 20 to 30 lb. in. (0.24 to 0.35 kg.m.).

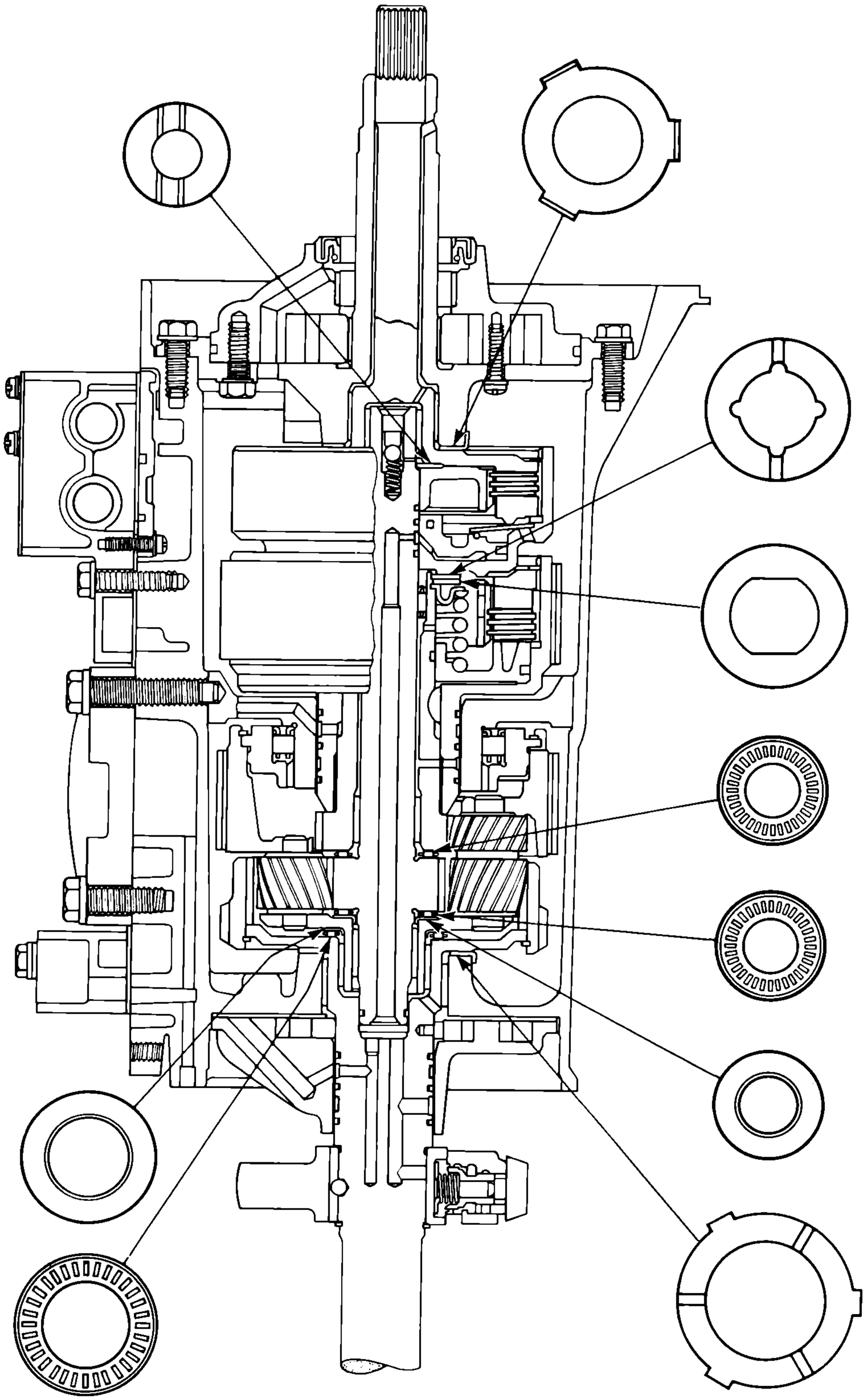
18. Replace the manual control valve and downshift valve. The throttle valve spring is interposed between two valves, locating in a counterbore in the end of the downshift valve.

19. Reposition the downshift cam and bracket with the cam in contact with the downshift valve, having first wound up the spring. Retain with two bolts and lockwashers. Tighten the bolts to a torque of 20 to 30 lb. in. (0.24 to 0.35 kg.m.).

OP 7008-B DOWNSHIFT CABLE – RENEW
(Includes OPS 7008-A and A1)

OP 7008-C FRONT SERVO – REMOVE AND INSTALL
(Includes OPS 7008-A and A2)

OP 7008-D FRONT SERVO – OVERHAUL
(Includes OPS 7008-A, A2 and A3)



Location of Thrust Washers

OP 7008-E REAR SERVO – REMOVE AND INSTALL
(Includes OPS 7008-A and A4)

OP 7008-F REAR SERVO – OVERHAUL
(Includes OPS 7008-A, A4 and A5)

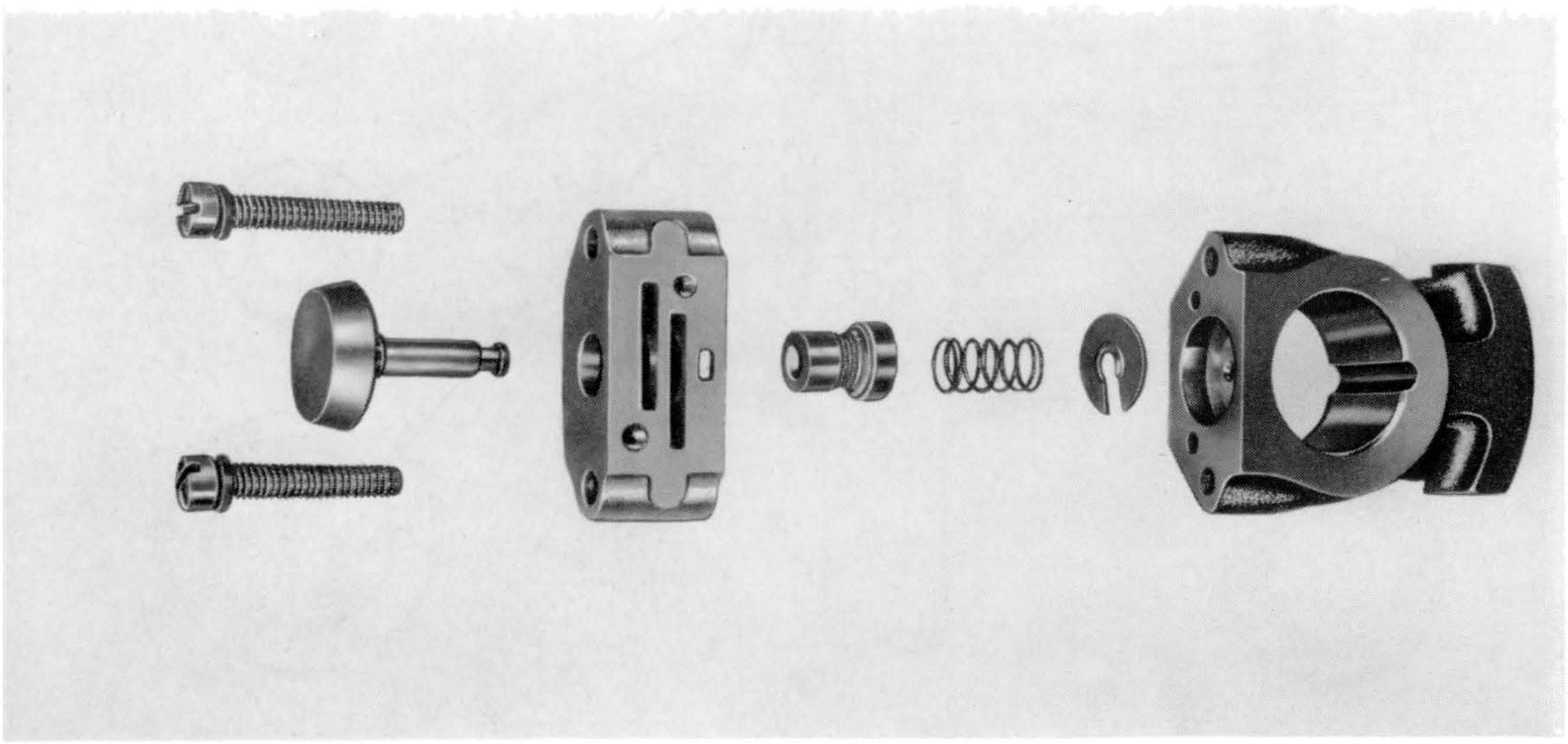
OP 7008-G VALVE BODIES ASSEMBLY OR OIL PICK-UP TUBES – REMOVE AND INSTALL
(Includes OPS 7008-A and A6)

OP 7008-H VALVE BODIES ASSEMBLY – OVERHAUL
(Includes OPS 7008-A, A6 and A7)

OP 7009-A EXTENSION HOUSING ASSEMBLY – REMOVE AND INSTALL
(Transmission assembly in situ)

To Remove

1. With the handbrake applied jack up the front end and fit stands.
2. Mark the drive shaft coupling flange and pinion flange to ensure correct alignment on replacement. Unscrew four self-locking nuts and remove the four bolts. Tap the coupling flange gently to free the joint. Lower the rear end of the shaft and slide it back so that the front end will clear the transmission output shaft splines and remove the shaft.
3. Support the gearbox with a block of wood and a jack beneath the gearbox sump.
4. Remove the bolt and spring washer from the centre of the engine rear mounting. Unscrew four bolts, flat washers and spring washers and remove the engine rear support from the floor pan.
5. Unscrew the bolt securing the speedometer cable retainer to the extension housing, remove the retainer, withdraw the speedometer cable and speedometer driven gear.
6. Remove four bolts and spring washers securing the extension housing to the gearbox and carefully withdraw the housing.



Governor — Exploded View

To Install

7. Clean the rear face of the gearbox and place a new gasket in position. Refit the extension housing, securing it with four bolts and lockwashers, tightened to a torque of 30 to 55 lb. ft. (4.15 to 7.60 kg.m.).
8. Refit the crossmember to the floor pan and secure, using two bolts, flat and spring washers, each side. Ensure that the mounting rubber is in good condition and lower the gearbox. Secure the gearbox to the mounting, using a bolt and spring washer.
9. Replace the speedometer driven gear and reconnect the cable. Secure the cable with a retainer plate, washer and bolt.
10. Slide the drive shaft onto the transmission output shaft splines, align the coupling marks on the flanges and secure with four bolts and new self-locking nuts.
11. Remove the stands and lower the car to the ground.
12. Check transmission fluid level.

OP 7009-A1 EXTRA: SPEEDOMETER DRIVE GEAR – REMOVE AND INSTALL

To Remove

1. Expand and remove the circlip. Remove the speedometer driving gear, ball and wave washer.

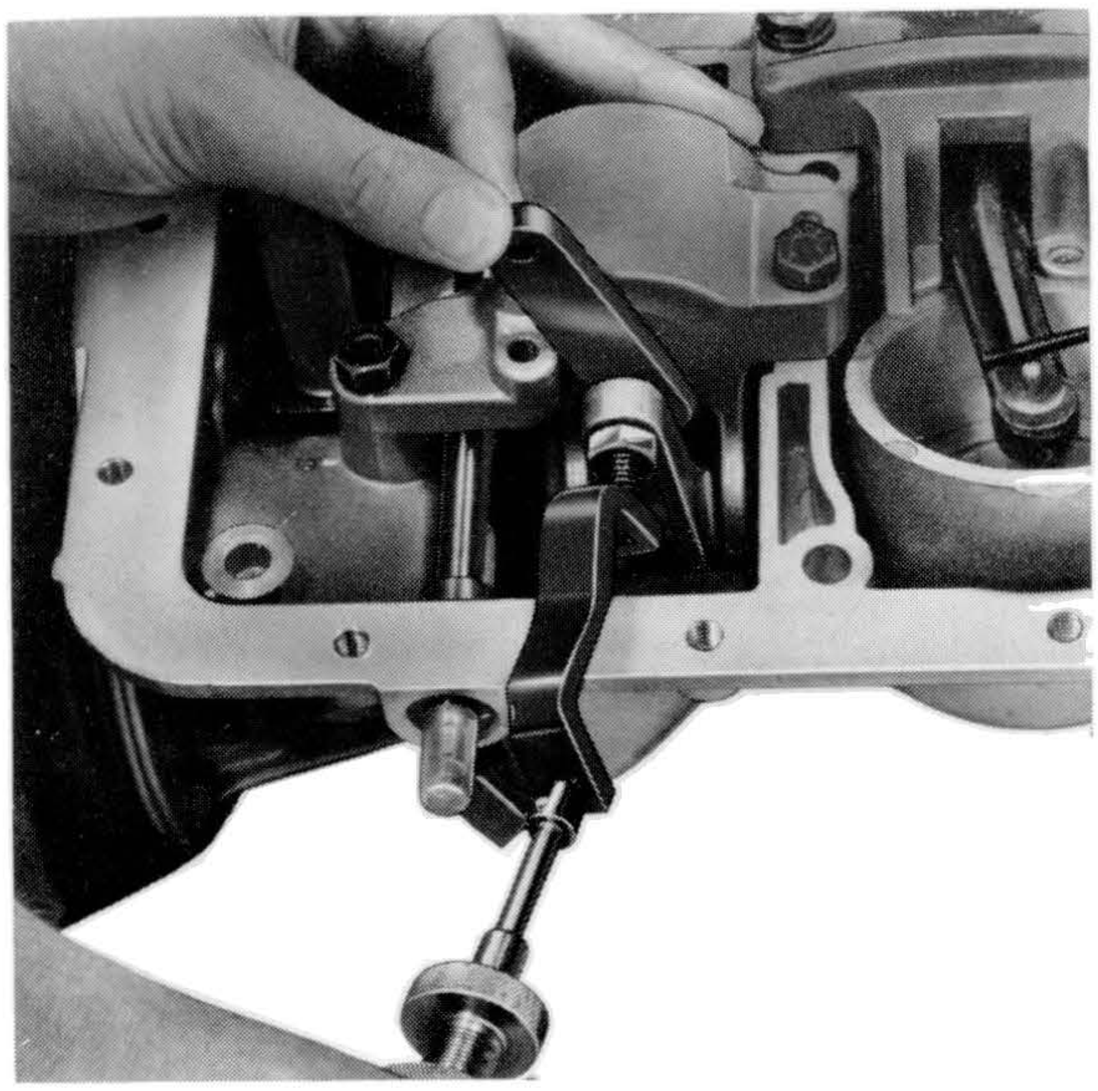
To Install

2. Fit the wave washer and position the drive ball in the output shaft, fit the speedometer driving gear against the locating shoulder and secure with a circlip.

OP 7009-A2 EXTRA: GOVERNOR ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Before removing the governor it should be noted that the small rectangular plate secured by two countersunk screws should face rearwards. Remove the circlip and draw the governor rearwards. Care should be taken not to lose the ball.



Front Band Adjustment

To Install

2. Turn the output shaft until the governor driving ball hole is uppermost and position the ball. Slide on the governor assembly ensuring that the governor cover plate, secured by two screws, is facing rearwards. Fit the governor retaining circlip using circlip pliers.

OP 7009-A3 EXTRA: GOVERNOR – OVERHAUL

To Dismantle

1. Separate the two parts of the governor body by removing the two cheese-headed screws, together with their spring washers. The governor valve and spring can be removed from the governor weight by removing the governor spring retainer, which partially encircles the governor weight stem. If necessary, remove the cover plate which is retained by two screws to the governor body.

To Reassemble

2. If the cover plate has been removed, refit and retain with two screws. Pass the stem of the governor weight through the body from the top; slide the valve, smaller diameter first, over the governor weights stem, followed by the spring and secure with a retainer, dished side to the spring. Secure the two parts of the governor body together, after cleaning the mating faces, with two cheese-headed screws and spring washers.

OP 7009-B GOVERNOR ASSEMBLY – REMOVE AND INSTALL
(Includes OPS 7009-A, A1 and A2)

OP 7009-C GOVERNOR ASSEMBLY – OVERHAUL
(Includes OPS 7009-A, A1, A2 and A3)

Rear Band Adjustment

OP 7010-A BRAKE BANDS – ADJUST – FRONT AND REAR

Tools Required

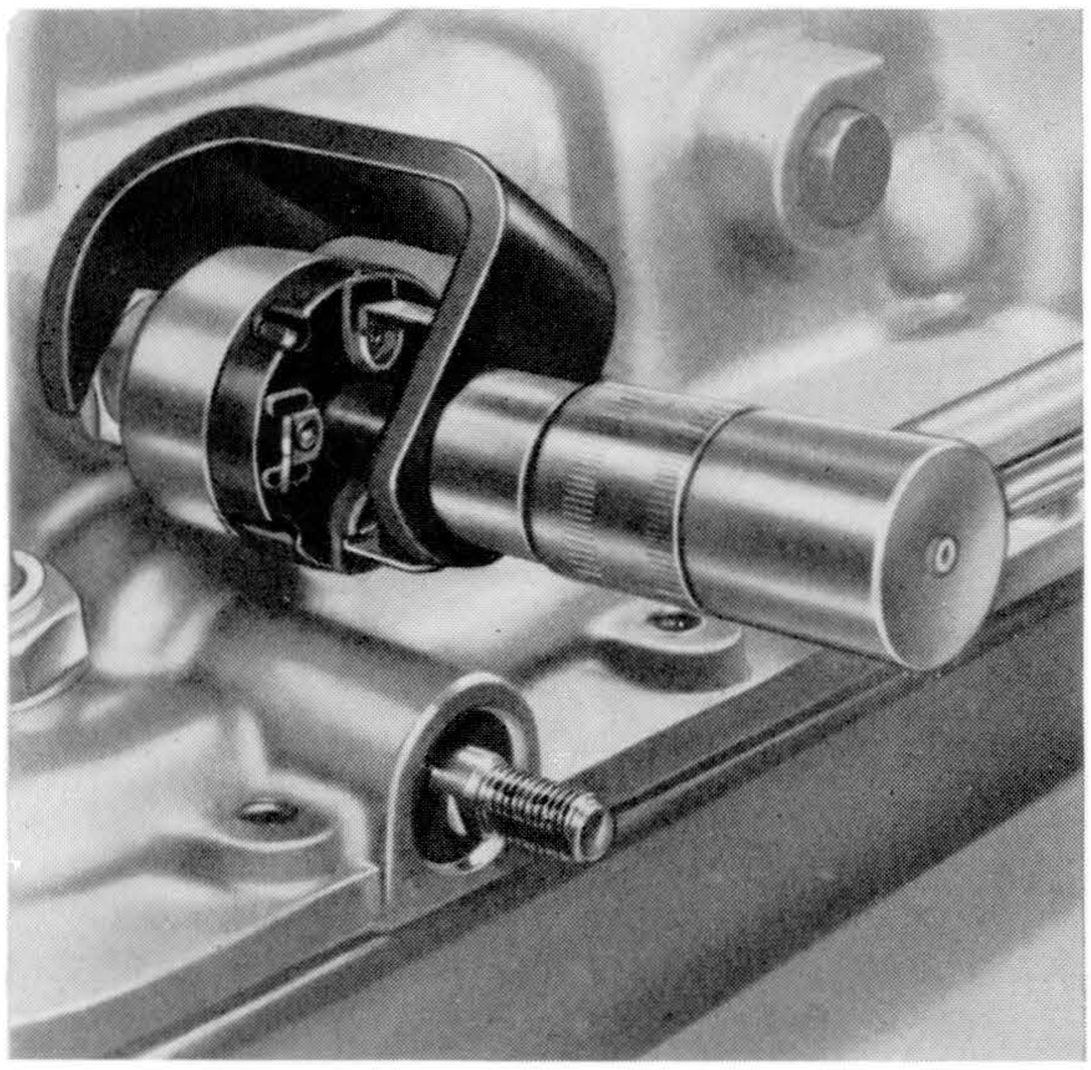
CBW 548	Torque screwdriver
CBW 34	Setting gauge (0.25 in. [6.35 mm.])
CBW 547A-50	Torque wrench
CBW 547A-50-2	Rear servo adaptor
CBW 548-2	Front servo adjuster

Front Band

1. Remove gearbox drain plug and drain fluid.
2. Remove the fifteen bolts and lockwashers securing the sump and detach the sump.
3. Slacken the adjusting screw locknut, move the servo lever outwards and place an 0.25 in. (6.35 mm.) thick gauge (Tool No. CBW 34) between the piston pin and the adjusting screw.
4. Tighten the adjusting screw to 10 lb. in. (0.14 kg.m.) with the Tool No. CBW 548-2 and then tighten the locknut to 15 to 20 lb. ft. (2.1 to 2.8 kg.m.). Remove the gauge block.
5. Ensure that the mating faces are clean and refit the sump with a new gasket. Tighten the fifteen bolts, with lockwashers, to 8 to 10 lb. ft. (1.1 to 1.4 kg.m.).
6. Refill transmission to within $\frac{3}{8}$ in. from the full mark on the dipstick, bearing in mind that less than 11.25 Imp. pints (13.5 U.S. pints, 6.39 litres) will be required since the converter has not been drained. Use only automatic transmission fluid M-2C33-F.
7. Start the engine and check for leaks.
8. Road test the vehicle over a distance of not less than five miles, then check the fluid level. Top-up as necessary.

Rear Band

9. Slacken the adjusting screw locknut on the right-hand side of the gearbox case.
10. Tighten the adjusting screw to 10 lb. ft. (1.4 kg.m.) with Tool No. CBW 547A-50 and adaptor CBW 547A-50-2.



Inhibitor Switch Locknut Wrench

11. Slacken the adjusting nut one full turn and then tighten the locknut to a torque of 30 to 40 lb. ft. (4.2 to 5.5 kg.m.).

    NOTE – To facilitate rear band adjustment a hole, sealed with a plug, is provided in the car body floor pan.

OP 7011-A AUTOMATIC TRANSMISSION EXTENSION HOUSING REAR OIL SEAL – RENEW
(Transmission assembly in situ)

This operation is identical to OP 7657-A (see Section 7/1).

OP 7012-A CONVERTER ASSEMBLY – REMOVE AND INSTALL

1. Remove the automatic transmission and converter assembly, see OP 7007-A.
2. Pull the converter assembly from the automatic transmission.
3. Replace the automatic transmission and converter assembly, see OP 7007-A.

OP 7012-A1 EXTRA: DRIVE PLATE ASSEMBLY– REMOVE AND INSTALL

1. Remove the four bolts securing the drive plate assembly.
2. Replace drive plate assembly.

OP 7013-A STARTER INHIBITOR SWITCH – ADJUST

Tools Required

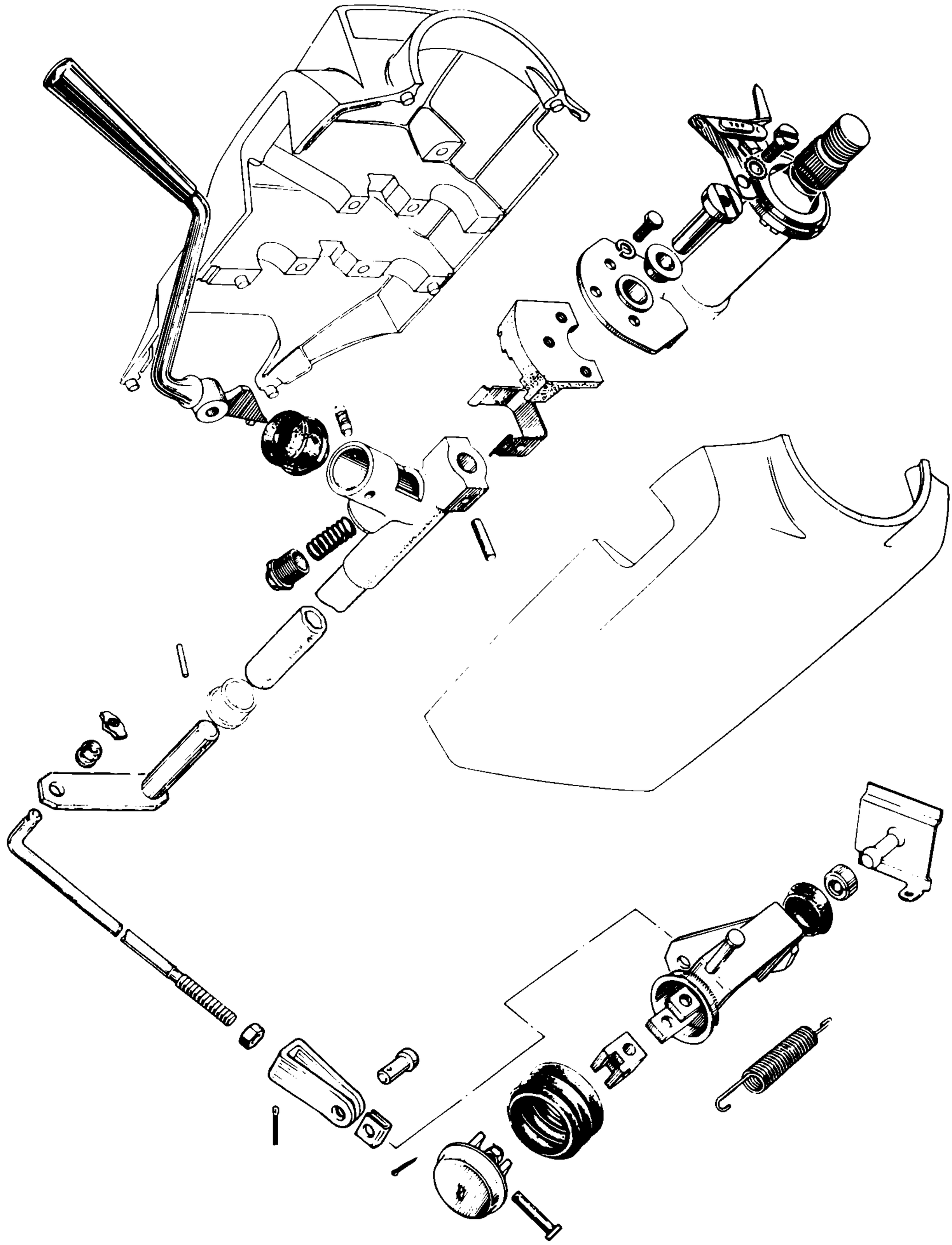
BW 547A-50-3A Inhibitor switch locknut wrench

1. Remove the starter and reversing light wires from the switch.
2. Slacken the inhibitor switch locknut with Tool No. CBW 547A-50-3A.
3. Select "D" or "L", connect a lamp or battery across the smaller starter inhibitor terminals and another across the two larger reversing light terminals. Screw the switch in or out until the reversing light terminals lamp goes out. Note the switch position. Continue screwing in the switch until the other lamp for the starter inhibitor terminals lights and again note the switch position. Screw out the switch until it is midway between the two positions.
4. Tighten the locknut, using Tool No. CBW 547A-50-3A.
5. Refit the leads to the appropriate switch terminals and check that the starter motor only operates when the selector lever is at "P" or "N" and that the reversing lights (where fitted) only operate in "R". If the switch does not operate correctly it should be renewed.

OP 7013-A1 EXTRA: STARTER INHIBITOR SWITCH – RENEW

To Remove

1. Slacken the inhibitor switch locknut and remove the switch, noting the number of turns required to remove it.



Automatic Selector Linkage (RHD)

To Install

2. Fit the inhibitor switch, turning the same number of turns.
3. Adjust the switch; see OP 7013-A.

OP 7013-B STARTER INHIBITOR SWITCH – RENEW
(Includes OPS 7013-A and A1)

OP 7020-A ENGINE AND GEARBOX STABILISER BRACKET – REPLACE

To Remove

1. Jack up the front end of the car and fit suitable stands.
2. Remove the screws and clips retaining the engine splash shield.
3. Loosen the generator mounting bolts.
4. Remove the two different sized bell housing bolts securing the bracket.

To Install

5. Offer up the bracket to the mountings and locate it loosely with the generator and bell housing bolts. Tighten the generator mounting bolts.
6. Torque the bell housing bolts to 25 to 30 lb. ft. (3.6 to 4.14 kg.m.).
7. Replace the engine splash shield.
8. Jack up the car, remove the stands, and lower the car to the ground.
9. Open bonnet and adjust fan belt tension, if required, to give $\frac{1}{2}$ in. (12.7 mm.) total movement between the water pump and generator pulleys.

OP 7021-A SELECTOR EQUALISER – REMOVE AND INSTALL

To Remove

1. Jack up the front end of the car and fit suitable stands.
2. Remove the connecting rod to arm and block clevis pin.
3. Unhook the selector equaliser spring.
4. Remove the coupling block to equaliser clevis pin.
5. Remove the selector equaliser nylon bush and rubber boot.
6. Remove the manual valve cross-shaft clevis.

To Install

7. Replace the manual valve cross-shaft clevis.
8. Refit the selector equaliser bush and rubber boot.
   NOTE – The equaliser *must* be free on the bush. If this is not the case, check for paint on the pin, or corrosion in the equaliser bore.

9. Replace coupling block and equaliser clevis pin. Secure with a split pin.
10. Replace selector equaliser spring.
11. Refit connecting rod clevis pin, and adjust manual linkage.
12. Jack up the car and remove the body stands.

OP 7206-A STEERING COLUMN AND TRANSMISSION CONNECTING ROD – REMOVE AND INSTALL

To Remove

1. Jack up the front end of the car and fit suitable stands.
2. Remove the connecting rod to arm and block clevis pin.
3. Detach the spring clip and insulator securing the connecting rod to the gear selector lever.
4. Release the connecting rod locknut and unscrew the rod from the clevis bracket.

To Install

5. Replace the connecting rod in the clevis bracket, leaving slack for adjustment.
6. Refit the rod in the gear selector lever, and replace the insulator and spring clip.
7. Replace the connecting rod to arm and block clevis pin.
8. Adjust the manual linkage, and tighten the clevis locknut.
9. Jack up the car and remove body stands.

OP 7209-A GEAR SELECTOR SHAFT ON STEERING COLUMN – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. From underneath the shroud, remove the four cross-head retaining screws and remove the shroud.
3. Drive out the selector lever retaining pin, and remove the lever.
4. Remove the screw in the top of the fulcrum pin and remove the pin.
5. Drive out the pin retaining the gear selector lever to the downshaft tube.
6. Unscrew the four cross-head screws retaining the toe plate, and remove the packing piece.
7. Unscrew the four cross-head screws retaining the parcel tray and remove the tray from the spring clips.
8. Remove the downshaft tube assembly.

To Install

9. Replace downshaft tube assembly.
10. Refit the pin retaining the gear selector lever to the downshaft tube.

11. Refit the fulcrum pin, with bush, and refit the pointer linkage to the fulcrum pin.
12. Refit the packing piece and secure in position with the toe plate.
13. Replace the parcel tray, securing in position with the four cross-head screws.
14. Refit the selector lever, retaining in position with a pin, and replace the rubber boot.
15. Replace the shroud, securing the two halves with four cross-head screws.
16. Jack up the front of the car, fit suitable stands, and adjust the gear change linkage as specified.
17. Jack up and remove body stands, and reconnect battery.

OP 7210-A GEAR SELECTOR SHAFT ON STEERING COLUMN – ADJUST

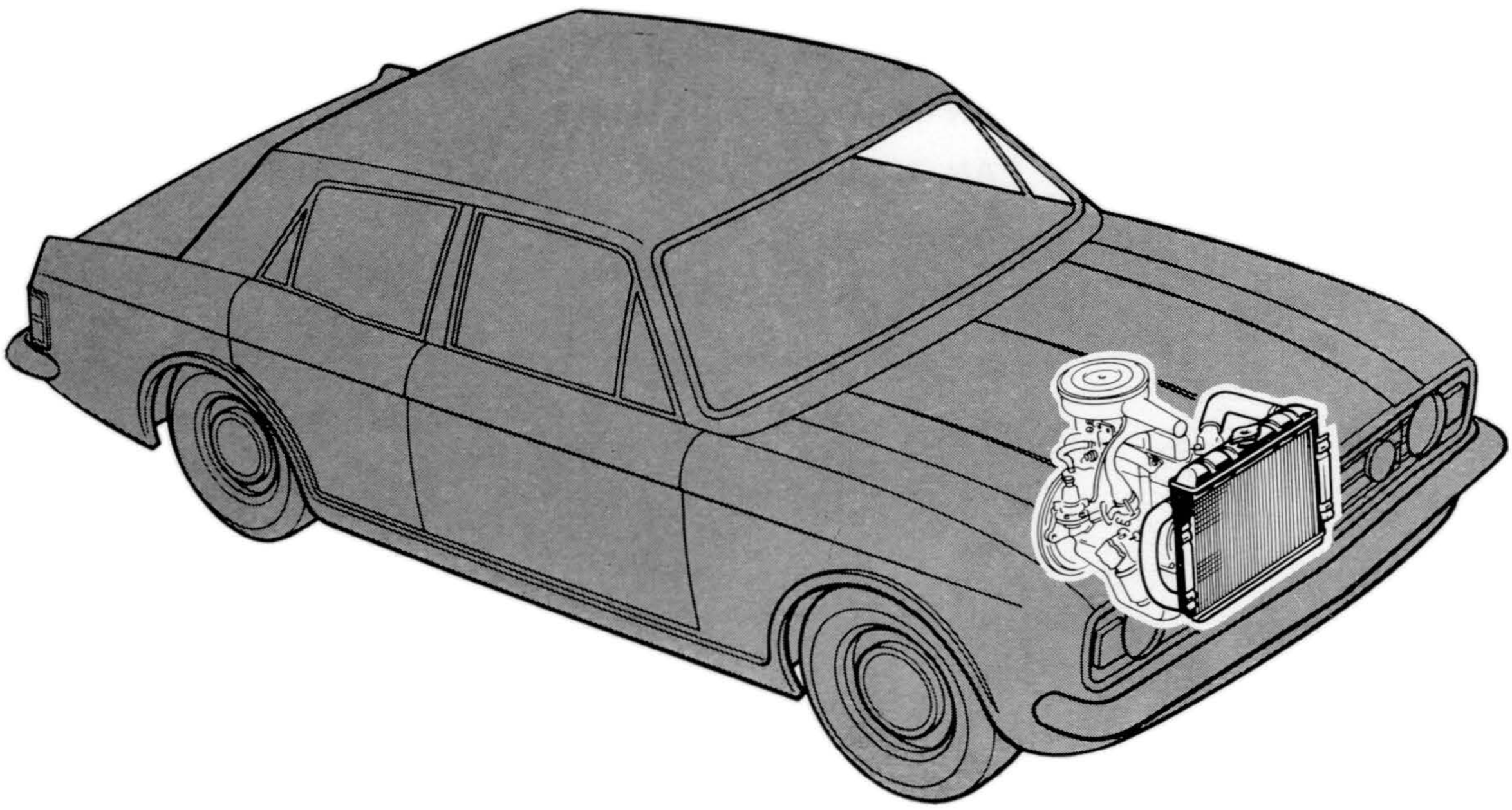
1. Engage 'reverse' on drive selection lever at steering column.
2. Jack up front end of car and fit stands.
3. Disconnect short connecting rod to transmission selector arm at block clevis pin.
4. The transmission selector arm has six positions. From the arm's most rearward position towards the back of the vehicle, move it forward to the fifth gate position, 'reverse'. Be sure that the correct gate has been selected.
5. Hold the transmission selector arm carefully forward to take up slack movement in the indent and with the clevis nut slackened off adjust position of clevis assembly on short connecting rod until holes in clevis and transmission selector arm are in line.
6. Reassemble clevis assembly to transmission selector arm and tighten clevis nut.
7. Jack up car and remove body stands.
8. Check drive selector lever in all positions.

OP 7210-A1 EXTRA: DRIVE SELECTION INDICATOR – ADJUST

1. Engage neutral on the drive selection lever.
2. Remove steering column shroud by unscrewing the four crosshead locating screws underneath the shroud. This will expose the selection indicator assembly.
3. The pointer should be adjusted by locating a small screwdriver within the notch provided on the indicator cam assembly and moving the outer ring until the pointer is in the desired position. DO NOT PRISE THE POINTER ITSELF OR BREAKAGE MAY OCCUR.
4. Replace steering column shroud to check that pointer is indicating neutral position.
5. Replace the four crosshead locating screws in shroud.
6. Check drive for all positions indicated by pointer.

8

COOLING SYSTEM



SECTION INDEX

GENERAL DESCRIPTION

QUICK REFERENCE DATA

SERVICE AND REPAIR OPERATIONS

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,,	8005-A1	Extra: radiator hoses – renew
,,	8115-A	DRAIN PLUG – REMOVAL AND INSTALL
,,	8150-A	RADIATOR GRILLE – REMOVE AND INSTALL
,,	8250-A	RADIATOR TOP HOSE – RENEW
,,	8250-A1	Extra: thermostat or water outlet – renew
,,	8250-A2	Extra: thermostat – test
,,	8286-A	RADIATOR BOTTOM HOSE – RENEW
,,	8501-A	WATER PUMP ASSEMBLY – REMOVE AND INSTALL
,,	8501-A1	Extra: water pump – overhaul
,,	8501-B	**WATER PUMP – OVERHAUL** (Includes OPS 8501-A and A1)
,,	8606-A	FAN – REMOVE AND INSTALL
	8620-A	FAN BELT – RENEW
,,	8620-B	FAN BELT – ADJUST

GENERAL DESCRIPTION

The pressurised cooling system is of the impeller-assisted thermo-syphon type with the pump fan assembly bolted to the front face of the cylinder block.

Coolant is circulated from the base of the radiator up through the pump and into the cylinder block. The coolant then circulates through the cylinder block and cylinder head to the thermostat, located at the front of the cylinder head. At operating temperature or above, hot coolant is returned to the radiator top tank. The coolant then flows down the radiator tubes and is cooled by air, passing through the radiator, induced by the fan. The fan is belt-driven from the crankshaft pulley in tandem with the generator.

A wax-type thermostat in conjunction with a by-pass assists rapid warming up and also maintains a reasonably constant operating temperature. When the coolant is cold, the thermostat is in the closed position and coolant flow is restricted to within the engine by means of the by-pass tube.

The water temperature is measured electrically by a gauge on the car facia panel and a temperature sensitive sender unit in the engine water jacketing.

The cooling system is designed to use Ford Anti-Freeze, Part Number M97B18-C in a 50% solution. This Anti-freeze is normally added in production and a tag on the radiator filler neck or a sticker on the windscreen denotes this.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

Daily

Check the coolant level and top-up if necessary.

At first 600 miles (1,000 km.)

Check the fan belt tension.
Check the coolant level and top-up if necessary.

At first 3,000 miles (5,000 km.) and every subsequent 6,000 miles (10,000 km.) or six months

Check the fan belt tension.
Check the coolant level and top-up if necessary.

36,000 miles (60,000 km.)

Change long life anti-freeze and hoses.

The anti-freeze mixture should NOT be drained from the system and replaced by water during the summer.

DATA

Cooling system capacities:—		
1300cc. with heater ...	10.2 Imp. pints (12.24 U.S. pints, 5.81 litres)	
without heater	8.82 Imp. pints (10.58 U.S. pints, 5.03 litres)	
1600cc. with heater ...	11.45 Imp. pints (13.74 U.S. pints, 6.53 litres)	
without heater	10.07 Imp. pints (12.06 U.S. pints, 5.74 litres)	
Radiator cap release pressure	...	13 p.s.i. (0.90 kg./sq. cm.)
Core height	... ...	12 in. (305 mm.)
Fins/inch —1300 cc. ...	...	 9
—1600 cc. ...		 12

Thermostat – starts to open	85° to 89°C (185° to 192°F)
– fully open	99° to 102°C (210° to 216°F)
Fan belt tension	... 40 to 50 lb. (18.2 to 22.1 kg.)
Fan belt free play	½ in. (13 mm.)

Anti-Freeze Concentration

Specific Gravity (providing no other additive is in the coolant)	Proportion of Anti-freeze (by volume)	Remains Fluid to °C	Remains Fluid to °F	Solidifies at °C	Solidifies at °F
1.080	50%	—37°	—34°	—58°	—72°
1.065	40%	—25°	—13°	—48°	—54°
1.050	30%	—16°	+ 3°	—39°	—38°
1.042	25%	—13°	+ 9°	—29°	—20°
1.034	20%	— 9°	+15°	—19°	— 3°
1.026	15%	— 7°	+20°	—14°	+ 7°
1.016	10%	— 4°	+25°	— 8°	+17°

SERVICE AND REPAIR OPERATIONS

OP 8005-A RADIATOR ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Position a drain tray under the radiator, open the drain plug and remove the radiator cap. Leave the radiator to drain. Long life anti-freeze is used and should be retained.
2. Disconnect the radiator top and bottom hoses.
3. Remove the radiator assembly.
4. Remove the drain tap and the flexible overflow pipe from the base of the filler neck.

To Install

5. Replace the drain tap and the flexible overflow pipe.
6. Fit the radiator.
7. Reconnect the radiator top and bottom hoses and tighten the two hose clips.
8. Refill the cooling system with the anti-freeze solution, and check for leaks.

OP 8005-A1 EXTRA: RADIATOR HOSES – RENEW

1. Unscrew the two hose clips and remove the hoses.
2. Refit the hoses, and secure firmly with the hose clips.
3. Test for leaks.

OP 8115-A DRAIN TAP – REMOVE AND INSTALL (RADIATOR OR CYLINDER BLOCK)

To Remove

1. Drain the radiator coolant as in OP 8005-A.
2. Remove the radiator or cylinder block drain plug.

To Install

3. Replace the radiator or cylinder block drain plug.
4. Refill the cooling system with the anti-freeze solution, and test for leaks.

OP 8150-A RADIATOR GRILLE – REMOVE AND INSTALL

To Remove

1. Open the bonnet.
2. Remove the five screws securing the headlamp bezels and remove the bezels.
3. Drill out the six rivets and remove two screws securing the radiator grille, and pull the grille from the surround.

To Install

4. Reposition the grille in the surround and secure it with the two screws, and either pop-rivets or self-tapping screws.
5. Replace the headlamp bezels and secure the bezels with the five screws.
6. Close the bonnet.

OP 8250-A RADIATOR TOP HOSE – RENEW

To Remove

1. Partially drain the radiator to below the top hose level and store the anti-freeze.
2. Remove the top hose.

To Install

3. Replace the top hose and tighten the two retaining clips.
4. Top-up the radiator coolant level with the anti-freeze solution, and test for leaks.

OP 8250-A1 EXTRA: THERMOSTAT OR WATER OUTLET – RENEW

To Remove

1. Remove the water outlet and gasket.
2. Extract the thermostat from the recess in the cylinder head.

To Install

3. Locate the thermostat in the recess at the front of the cylinder head, fit a new gasket and fit the water outlet connection.

OP 8250-A2 EXTRA: THERMOSTAT – TEST

1. Suspend the thermostat in water in a suitable container so that it does not touch the sides of the container.
2. Gradually heat the water, frequently checking the temperature with an accurate thermometer. The thermometer must not touch the container.
3. The thermostat should start to open at 85°C to 89°C (185°F to 192°F) and be fully opened at 99°C to 102°C (210°F to 216°F).
4. If the thermostat does not function properly, do not attempt any adjustment, but replace with a new unit.

OP 8286-A RADIATOR BOTTOM HOSE – RENEW

To Remove

1. Drain the cooling system as in OP 8005-A.
2. Remove the bottom hose.

To Install

3. Replace the radiator bottom hose and tighten the two retaining clips.
4. Refill the cooling system with the long life anti-freeze, and check for leaks.

OP 8501-A WATER PUMP ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Drain the cooling system as in OP 8005-A.
2. Detach the bottom radiator hose from the water pump and remove the heater hose if a heater is fitted.

3. Slacken the generator adjusting arm clamp bolt and mounting bolts, pivot the generator towards the engine and remove the fan belt.
4. Remove the fan and water pump pulley.
5. Remove the water pump and gasket.

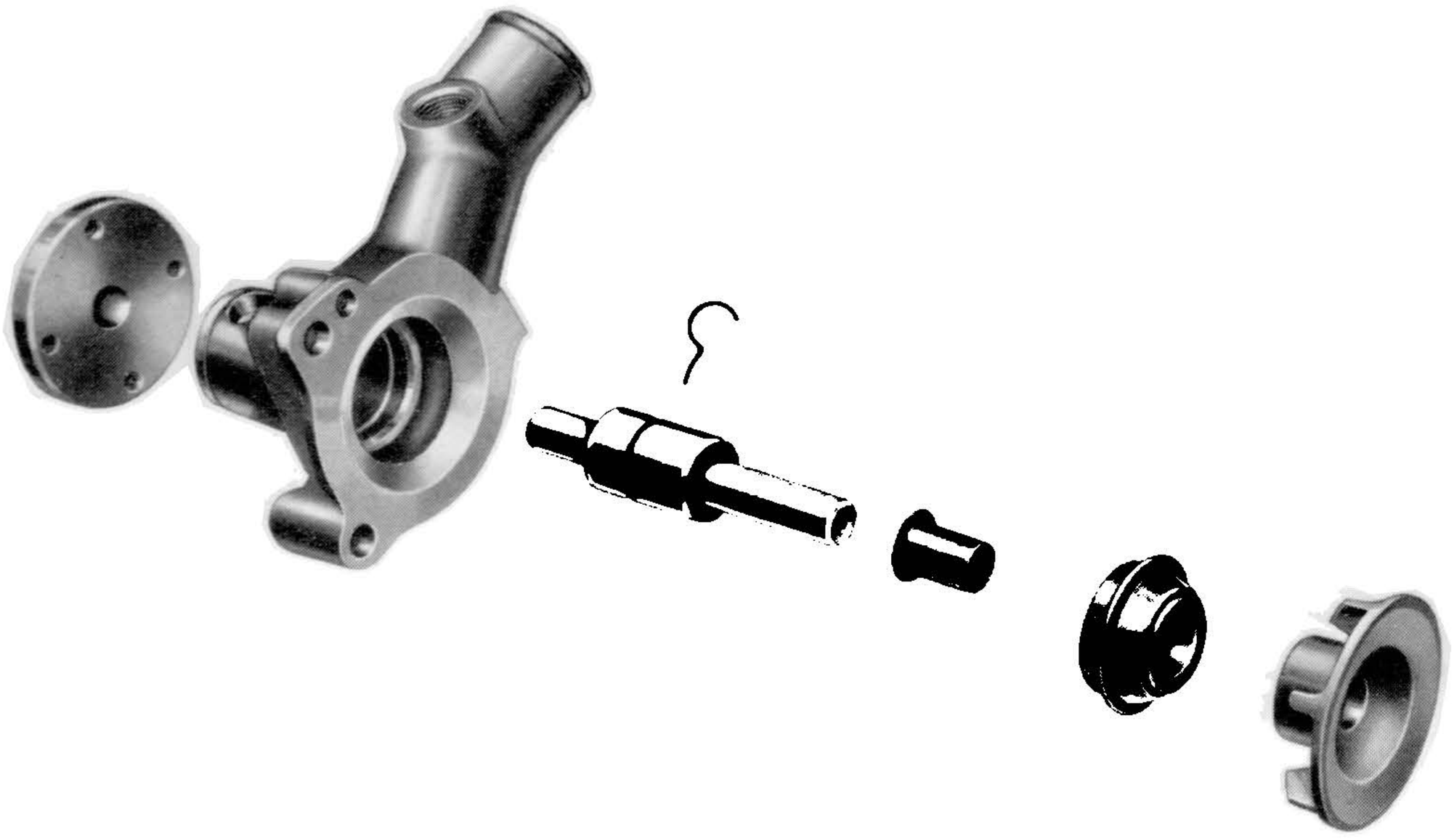
To Install

6. Clean the front face of the cylinder block and locate a new gasket on the block face.
7. Fit the water pump.
8. Fit the fan and pulley to the pulley hub.
9. Locate the fan belt around the pulleys and adjust the fan belt tension to give $\frac{1}{2}$ in. (12.7 mm.) total movement between the generator and water pump pulleys. Tighten the generator clamp and mounting bolts.
10. Reconnect the radiator hose and the heater hose, if a heater is fitted, and tighten the retaining clips.
11. Refill the cooling system with long life anti-freeze solution, and test for leaks.

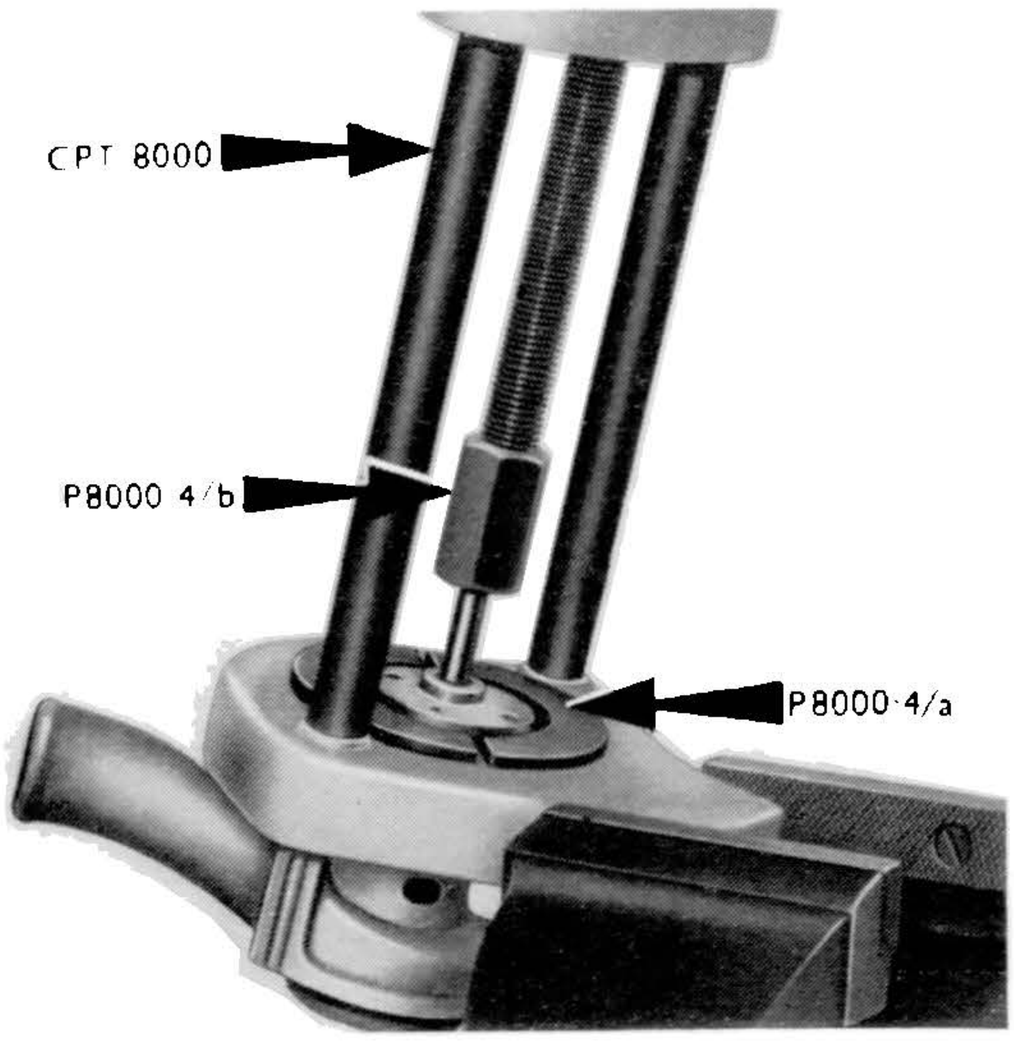
OP 8501-A1 EXTRA: WATER PUMP - OVERHAUL

Tools Required

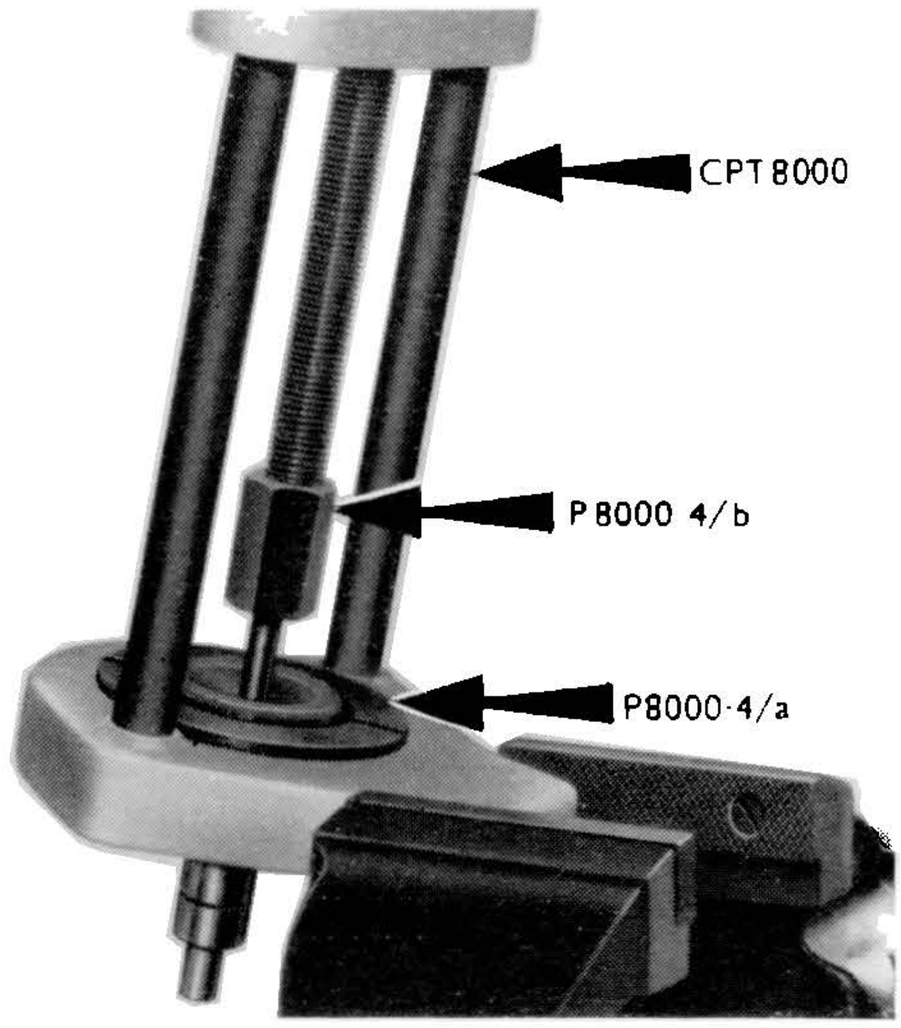
CPT 8000	Hand press
P 8000-4	Water pump overhaul kit



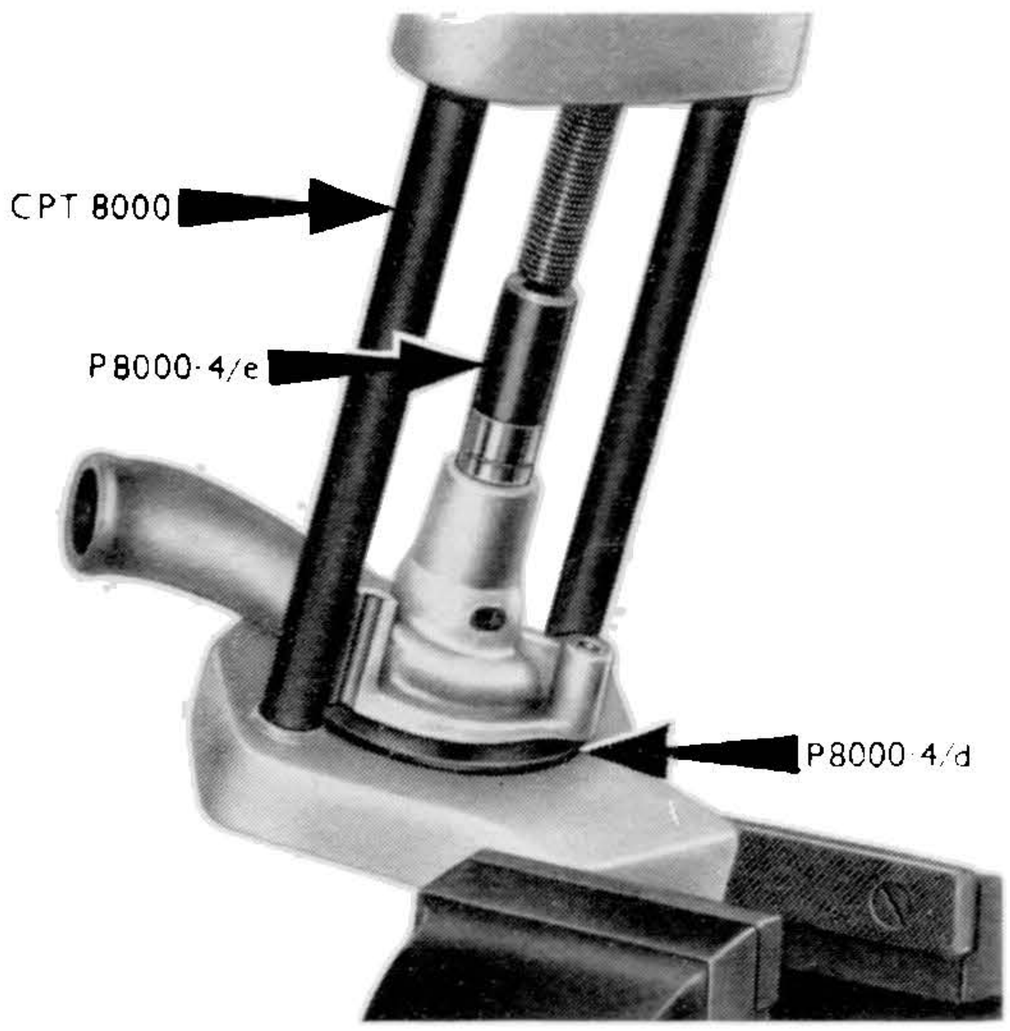
Water Pump – Exploded



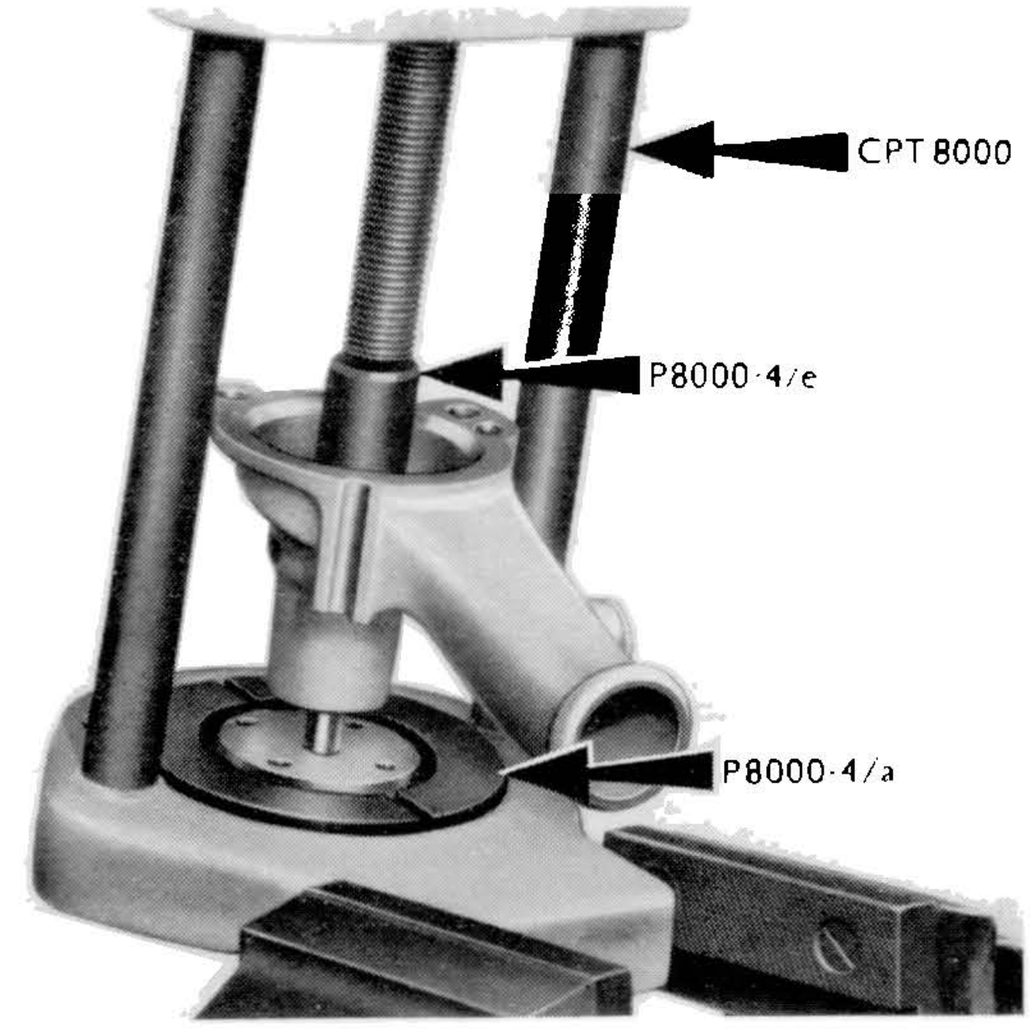
Removing the Pulley Hub



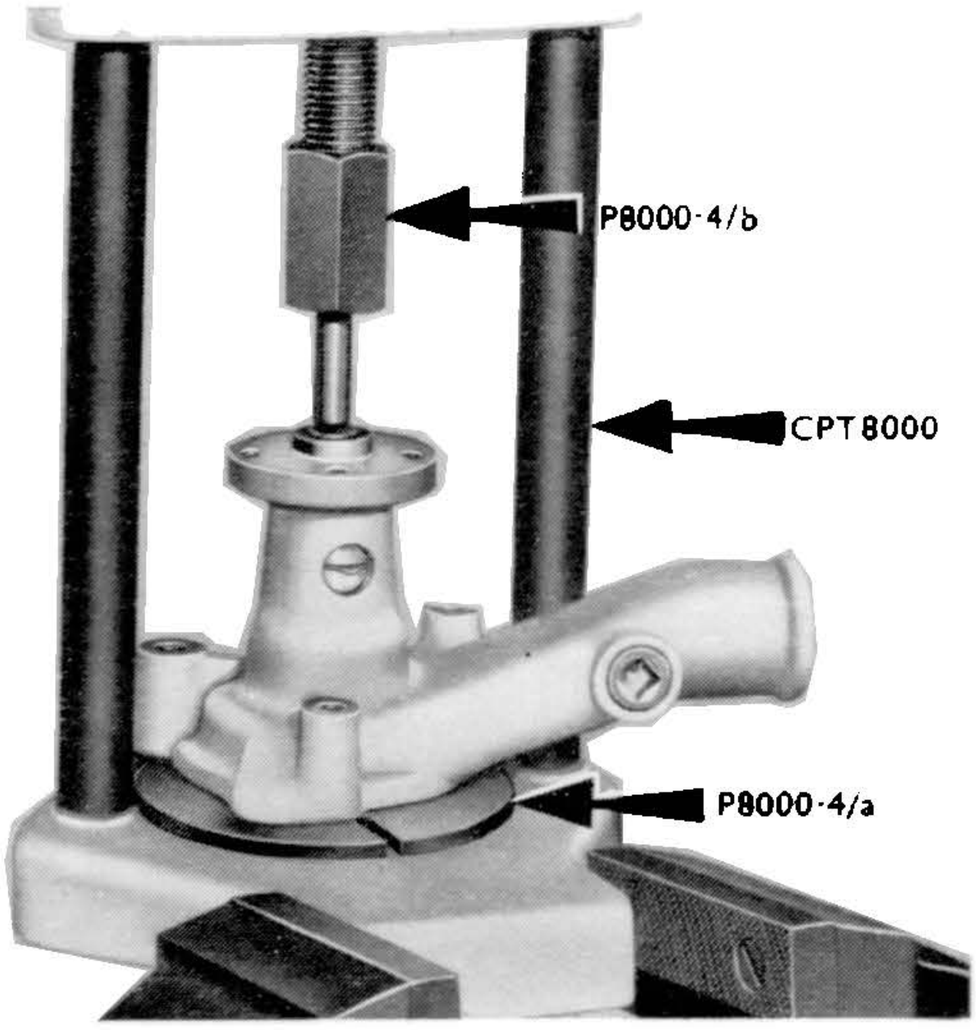
Removing the Shaft and Bearing Assembly



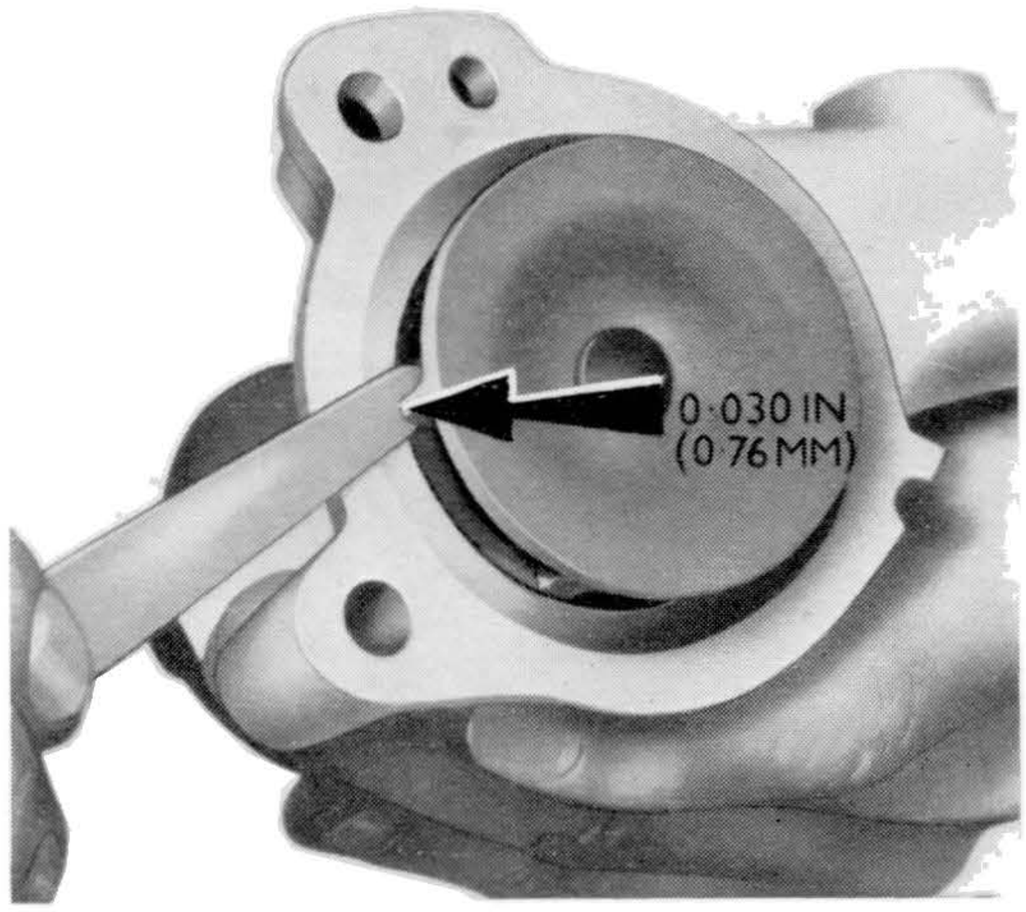
Refitting the Shaft and Bearing



Fitting the Pulley Hub



Fitting the Impeller



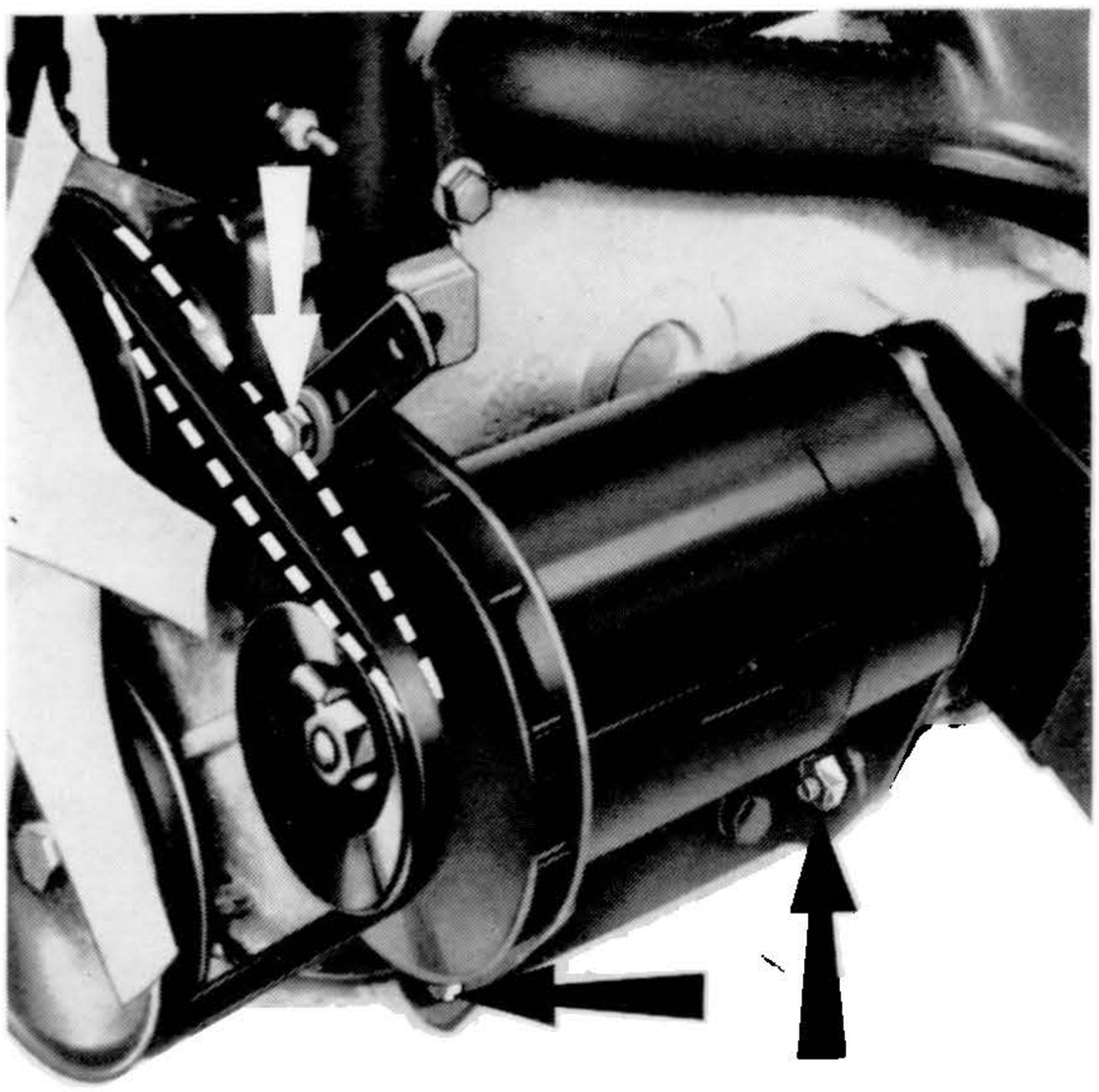
Checking the Impeller Blades Clearance

To Dismantle

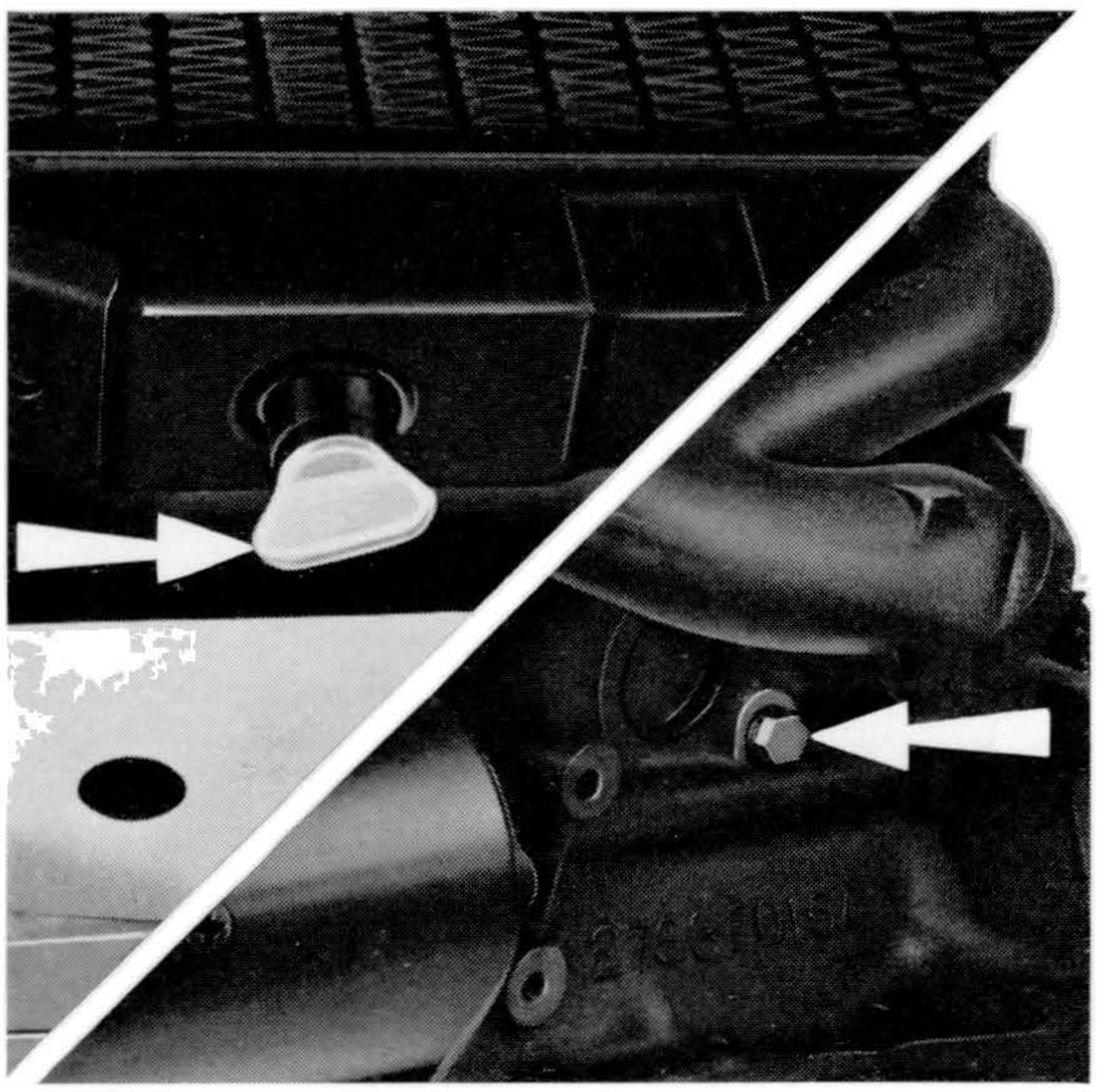
1. Withdraw the bearing retainer clip from the slot in the housing.
2. Remove the pump pulley hub from the shaft using the split ring (detail 'a') and centre screw adaptor (detail 'b') in conjunction with the hand press Tool No. CPT 8000.
3. Press the impeller, seal, slinger, shaft and bearing assembly out of the housing, using the ring and thrust block adaptors, details 'd' and 'e'. Adaptor detail 'e' is hollow and fits over the shaft and bears against the outer diameter of the bearing.
4. Press the impeller off the end of the shaft, using adaptors, details 'a' and 'b', ensuring that the vanes avoid the slots.
5. Remove the pump seal from the shaft and carefully split the slinger bush with a chisel to detach it from the shaft.

To Reassemble

6. Press the shaft and bearing assembly into the housing (short end of shaft to the front of the housing) until the groove in the shaft is in line with the groove inside the housing, again using the ring and thrust block adaptors, details 'd' and 'e'.
7. Refit the bearing retainer clip in the groove of the bearing and housing.
8. Press the pump pulley hub on to the front end of the shaft until the end of the shaft is flush with the end of the hub, using the split ring (detail 'a') and thrust block adaptor (detail 'e').
9. Press a new slinger onto the shaft (flanged end first) using driver Tool No. P 8000-4/f so that the non-flanged end is approximately $\frac{1}{2}$ in. (12.7 mm.) from the shaft end, the tool will automatically position the slinger at this dimension. As a rough guide the flanged end of the slinger will just be 'in-line' with the impeller side of the 'window' in the housing.



Fan Belt Tension Adjusting Bolts



The Coolant Drain Plugs

10. Using the tool, Tool No. P 8000-4B/k, or by hand if the former type seal is being fitted, push the new seal over the shaft and into the counterbore in the water pump housing. Press the impeller onto the shaft, using Tool Nos. P 8000-4 'a' and 'b', until a clearance of 0.030 in. (0.762 mm.) is obtained between the impeller blades and the housing face. During this operation the slinger will also be pushed into its final position by the impeller.

OP 8501-B WATER PUMP – OVERHAUL
(Includes OPS 8501-A and A1)

OP 8606-A FAN – REMOVE AND INSTALL

To Remove

1. Position a drain tray under the radiator, open the drain plug and remove the radiator cap. Leave the radiator to drain. Long life anti-freeze is used and should be retained.
2. Disconnect the radiator top and bottom hoses.
3. Remove the radiator assembly.
4. Unscrew the four bolts, fitted with washers, and remove the fan.

To Install

5. Reposition the fan and secure with four bolts and washers.
6. Fit the radiator.
7. Reconnect the radiator top and bottom hoses and tighten the two hose clips.
8. Refill the cooling system with the anti-freeze solution.

OP 8620-A FAN BELT – RENEW

To Remove

1. Slacken the generator mounting bolts and move the generator towards the engine.
2. Slip the belt over the edge of the generator pulley, taking care not to damage the pulley. The belt may then be detached from the crankshaft and fan pulleys.

To Install

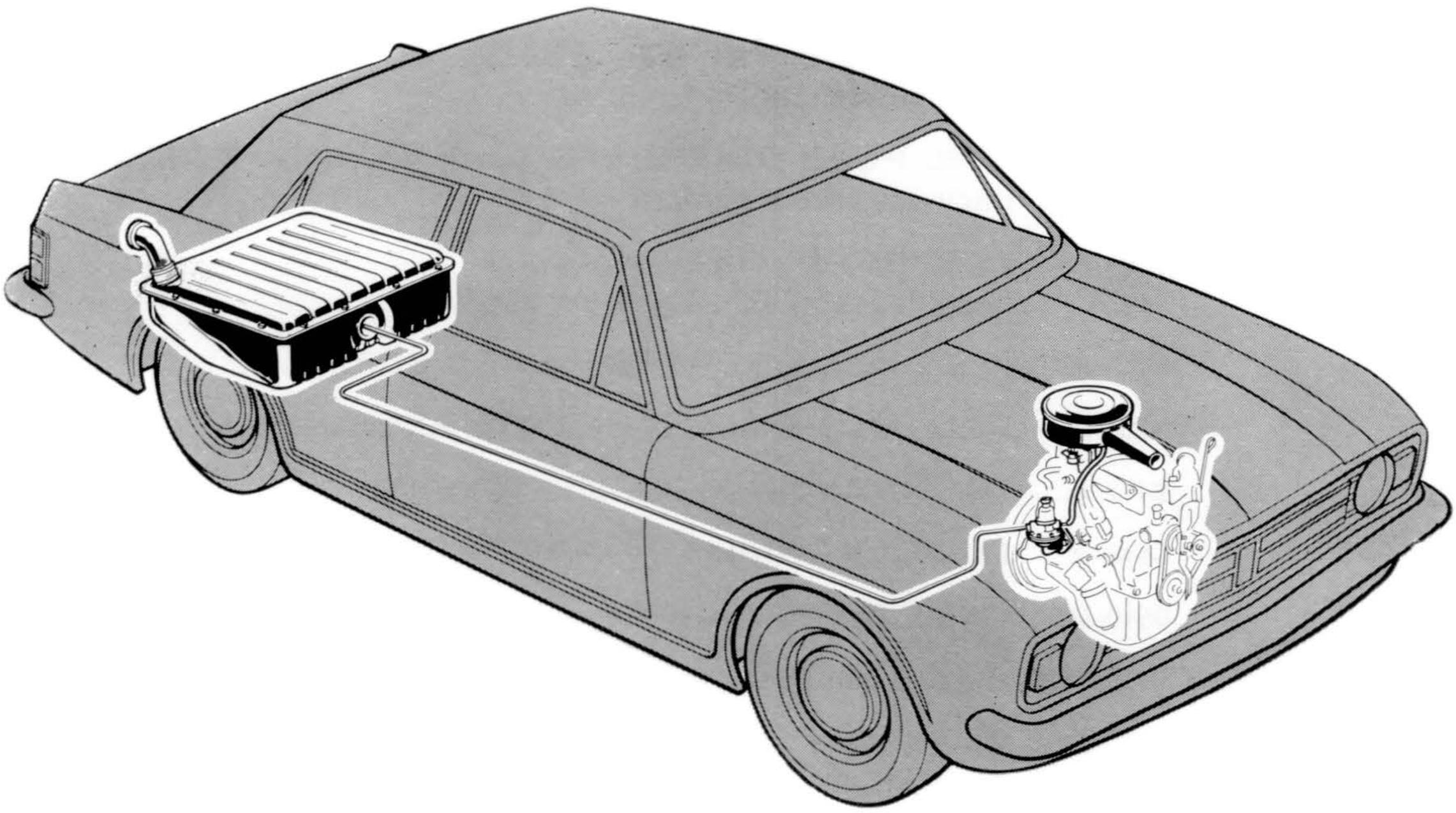
3. Pass the new fan belt around the water pump and crankshaft pulleys and engage it in the generator pulley.
4. Adjust the fan belt tension to give $\frac{1}{2}$ in. (13 mm.) total movement between the water pump and generator pulleys.
5. Tighten the generator mounting bolts.

OP 8620-B FAN BELT – ADJUST

1. Slacken the generator adjustment locking bolt and the generator mounting bolts.
2. Move the generator as necessary until there is $\frac{1}{2}$ in. (13 mm.) free movement at a point mid-way between the generator and fan pulleys.
3. Tighten the adjusting bolt and generator mounting bolts.

9

FUEL SYSTEM



SECTION INDEX

GENERAL DESCRIPTION

QUICK REFERENCE DATA

SERVICE AND REPAIR OPERATIONS

OPERATION	9000-A	FUEL SYSTEM AND CARBURETTOR - CLEAN
"	9002-A	FUEL TANK - REMOVE AND INSTALL
"	9275-A	FUEL GAUGE TANK UNIT - REMOVE AND INSTALL
"	9280-A	FUEL GAUGE - REMOVE AND INSTALL
"	9350-A	FUEL PUMP - REMOVE AND INSTALL
"	9350-A1	Extra: diaphragm - renew
"	9350-A3	Extra: valves - renew
"	9350-B	**FUEL PUMP DIAPHRAGM - RENEW** (Includes OPS 9350-A and A1)
"	9350-C	**FUEL PUMP MECHANISM - OVERHAUL** (Includes OPS 9350-A, A1 and A2)
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"	9725-A	THROTTLE CONTROL ROD - REMOVE AND INSTALL
"	9735-A	THROTTLE PEDAL ASSEMBLY - REMOVE AND INSTALL

GENERAL DESCRIPTION

The fuel system for the saloon has a 10 Imp. gallon (12 U.S. gallon, 45.4 litre) fuel tank located in the luggage compartment floor pan. A flush fitting filler cap is located in the luggage compartment rear panel, the filler pipe being connected to the tank by a short length of hose retained with clips. Fuel tank ventilation is by a groove in the filler cap sealing flange. The fuel tank gauge unit and fuel pipe are located in the front face of the tank.

The estate car has an 8 Imp. gallon (9.6 U.S. gallon, 36.4 litre) vented fuel tank located under the rear floor pan. The filler cap for this model is located on the right-hand rear wing and the fuel gauge tank unit in the top face of the fuel tank.

A nylon fuel line connects the fuel tank to a diaphragm type mechanical fuel pump, mounted on the right-hand side of the engine and operated by the camshaft. The fuel pump incorporates a gauze screen and an inverted sediment bowl. To meet the increased performance requirements, the G.T. engines have a fuel pump with a higher delivery pressure. From the fuel pump a nitrile rubber pipe delivers fuel to the carburettor.

The carburettors for the 1,300 c.c. and 1,600 c.c. engines (except G.T.) are of the "Ford" single venturi downdraught type incorporating idling, main, power valve and diaphragm type accelerator pump systems.

A "Weber" dual barrel downdraught carburettor is used on the G.T. engine. This carburettor has an idling, a main, a full load enrichment and a diaphragm type accelerator pump system. The barrels and throttle plates are the same size, but the primary venturi is smaller than the secondary. The throttle plate opening is at different rates, the primary commencing to open first, followed by the secondary, both plates reaching full throttle simultaneously. Each barrel incorporates a main and an auxiliary venturi. The primary barrel also incorporates an atomiser bar located below the auxiliary venturi. The idling and progression systems operate in both barrels, although slow-running adjustment is provided in the secondary barrel only. The full load enrichment system discharges into the secondary barrel, while the accelerator pump discharges into the primary barrel.

Throttle operation is controlled by an accelerator on a cross-shaft mounted inside the car on the engine compartment bulkhead. A connecting rod transmits accelerator pedal movement to a shaft attached to the carburettor throttle lever. The rear end of this shaft pivots in a bracket on the engine compartment bulkhead. As the "Weber" carburettor primary throttle plate opens in the opposite direction to the "Ford" carburettor, G.T. cars have a different throttle shaft to the other cars. Where an automatic transmission is fitted, a lever extension on the throttle shaft is provided for the downshift cable. Manual choke control (where fitted) is by a cable from a choke control knob on the car facia to the choke lever on the carburettor.

The air cleaner used on the Cortina is of the paper element type.

Air/fuel mixture is ducted into the engine by a cast aluminium inlet manifold, a high efficiency manifold being used on the G.T. engine. Exhaust gases leave the engine by a cast iron manifold on the 1,300 c.c. and 1,600 c.c. (except G.T.) engines and by a fabricated multi-branch exhaust manifold on the G.T. engine.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

At first 600 miles (1,100 km.)

Clean the sediment from the fuel pump sediment bowl
Adjust the carburettor slow-running

At first 3,000 miles (5,000 km.) or three months and every subsequent 6,000 miles (10,000 km.) or six months

Clean the sediment from the fuel pump sediment bowl
Clean the air cleaner element
Adjust the carburettor slow-running

At first 21,000 miles (35,000 km.) and every subsequent 18,000 miles (30,000 km.) or eighteen months

Renew the air cleaner paper element (where fitted)

DATA

Fuel Tank

Capacity:	
Saloon	10 Imp. gallons (12 U.S. gallons, 45.4 litres)
Estate car	8 Imp. gallons (9.6 U.S. gallons, 36.3 litres)

Ford Carburettor

Number:	**1,300 c.c.**	**1,600 c.c.**
manual transmission	C7BH-9510-A	C7BH-9510-B
auto transmission ...	C7BH-9510-C	C7BH-9510-D
Throttle barrel diameter	34 mm.	36 mm.
Venturi diameter ...	25 mm.	28 mm.
Main jet:		
manual ...	1.32 mm.	1.50 mm.
automatic ...	1.27 mm.	1.47 mm.
Idling speed ...	580 to 620 rev./min.	
Fast idle speed:		
manual	1,300 to 1,500 rev./min.	900 to 1,100 rev./min.
automatic—standard	Domestic 1,850 to 2,050 rev./min.	
	Export 2,300 to 2,350 rev./min.	
Float setting (up):		
manual ...	1.12 to 1.14 in. (28.5 to 29.0 mm.)	1.15 to 1.17 in. (29.2 to 29.7 mm.)
automatic	1.15 to 1.17 in. (29.2 to 29.7 mm.)	
Float setting (down):		
manual ...	1.38 to 1.40 in. (35.0 to 35.5 mm.)	1.41 to 1.43 in. (35.8 to 36.3 mm.)
automatic	1.41 to 1.43 in. (35.8 to 36.3 mm.)	
Choke plate pull-down:		
manual	0.14 to 0.16 in. (3.5 to 4.0 mm.)	0.16 to 0.18 in. (4.0 to 4.6 mm.)
automatic	0.13 to 0.15 in. (3.3 to 3.8 mm.)	

De-choke (automatic only)	0.170 to 0.210 in. (4.32 to 5.08 mm.)		0.20 to 0.24 in. (5.08 to 6.096 mm.)
Accelerator pump stroke:			
manual	0.145 to 0.155 in. (3.68 to 3.93 mm.)	0.135 to 0.145 in. (3.43 to 3.68 mm.)	0.135 in. to 0.145 in. (3.43 to 3.78 mm.)
automatic	0.145 to 0.155 in. (3.68 to 3.93 mm.)	0.170 to 0.180 in. (4.32 to 4.57 mm.)	0.135 in. to 0.145 in. (3.43 to 3.78 mm.)
Accelerator pump lever	0.40 in. (10.16 mm.)	0.30 in. (7.62 mm.)	0.30 in. (7.62 mm.)
Accelerator pump spring	... ...	... ...	... ... RED
Vacuum piston link hole	... ...	... ...	... ... Inner
Thermostatic spring slot	... ...	... ...	... ... Centre

Weber Carburettor

Identification number	32-DFM	
	Primary	*Secondary*
Venturi diameter	26	27
Main jet	150	155
Air correction jet ...	160	140
Emulsion tube type	F6	F6
Idling jet	50	45
Accelerator pump jet	... 65	
Needle valve ...	1.75 mm.	
Idling speed ...	700 to 740 rev./min.	
Fast idle speed ...	2,500 rev./min.	
Fast idle setting ...	0.95 to 1.05	
Float level ...	7 to 7.5 mm.	
Float stroke	15.00 to 15.50 mm.	
Choke plate pull-down	5 mm.	
Choke plate opening	7.5 to 8.5 mm. with lever backed off 10 mm.	
Accelerator pump lever fulcrum	No. 2 hole for cold and temperate climates	

Fuel Pump

Colour identification:	
except G.T. ...	Unmarked
G.T. (late models)	GREEN
Delivery pressure:	
except G.T.	1 to 2 lb/.sq. in. (0.07 to 0.14 kg./sq. cm.)
G.T. (late models) ...	$3\frac{1}{2}$ to 5 lb./sq. in. (0.25 to 0.35 kg./sq. cm.)
Inlet vacuum: all models	... ... 8.5 in. (21.6 cm.) Hg.

Tightening Torques, lb. ft. (kg.m.)

Fuel pump ...	$\frac{5}{16}$ in. – 18 UNC		12 to 15 (1.66 to 2.07)
Manifold:			
Nuts	$\frac{5}{16}$ in. – 24 UNF	...	15 to 18 (2.07 to 2.49)
Bolts	$\frac{5}{16}$ in. – 18 UNC	...	15 to 18 (2.07 to 2.49)
Air cleaner (except G.T.)	$\frac{1}{4}$ in. – 20 UNC	...	3 to 5 (0.42 to 0.69)
Air cleaner body (G.T. only)	5 mm. × 0.8 mm.	...	2.5 to 3 (0.35 to 0.42)
Air cleaner cover (G.T. only)	$\frac{5}{16}$ in. – 24 UNF	...	5 to 7 (0.69 to 0.97)
Fuel tank	10 – 12		3 to 5 (0.42 to 0.69)

SERVICE AND REPAIR OPERATIONS

OP 9000-A FUEL SYSTEM AND CARBURETTOR – CLEAN (excludes Fuel Tank)

1. Raise the bonnet and fit wing covers.
2. Remove the air cleaner.
3. Clean the air cleaner element. If a wire gauze type filter is fitted, the filter element and body should be washed in petrol and allowed to dry. Soak the element in engine oil and allow to drain before replacing it in the air cleaner body. The paper element type should be shaken clean or blown out with compressed air. Renew if unserviceable.
4. Weber carburettor only. Disconnect the choke plate operating rod at the lower end.

   Ford carburettor – auto-choke only. Remove the thermostatic spring and water housing.
5. Disconnect the fuel pipe and remove the carburettor upper body. The accelerator pump discharge valve (Ford carburettor only) is exposed when the upper body is removed. DO NOT dislodge it from its seating, as it may enter the engine and cause serious damage.
6. Clean the float chamber with petrol. Blow out the jets and passages. Clean the gauze filter, located above the needle valve housing on the "Ford" carburettor and beneath the fuel inlet connection on the "Weber".
7. Refit the carburettor upper body but do not connect the fuel pipe.
8. Weber carburettor only. Disconnect the choke plate operating rod at the lower end.

   Ford carburettor – auto-choke only. Fit the thermostatic spring and water housing. Locate the spring in the centre slot and align the housing marks before tightening the screws.
9. Remove the fuel pump to carburettor pipe and blow it out with an air line. Refit the pipe and connect both ends.
10. Remove the fuel pump sediment bowl and filter, blow them clean or wash them in petrol and refit them to the pump.
11. Refit the air cleaner.
12. Remove the wing covers and close the bonnet.

OP 9002-A FUEL TANK – REMOVE AND INSTALL

SALOON

Tools Required

P.9082 Fuel tank sender unit lock ring wrench

Bostik model D hand gun

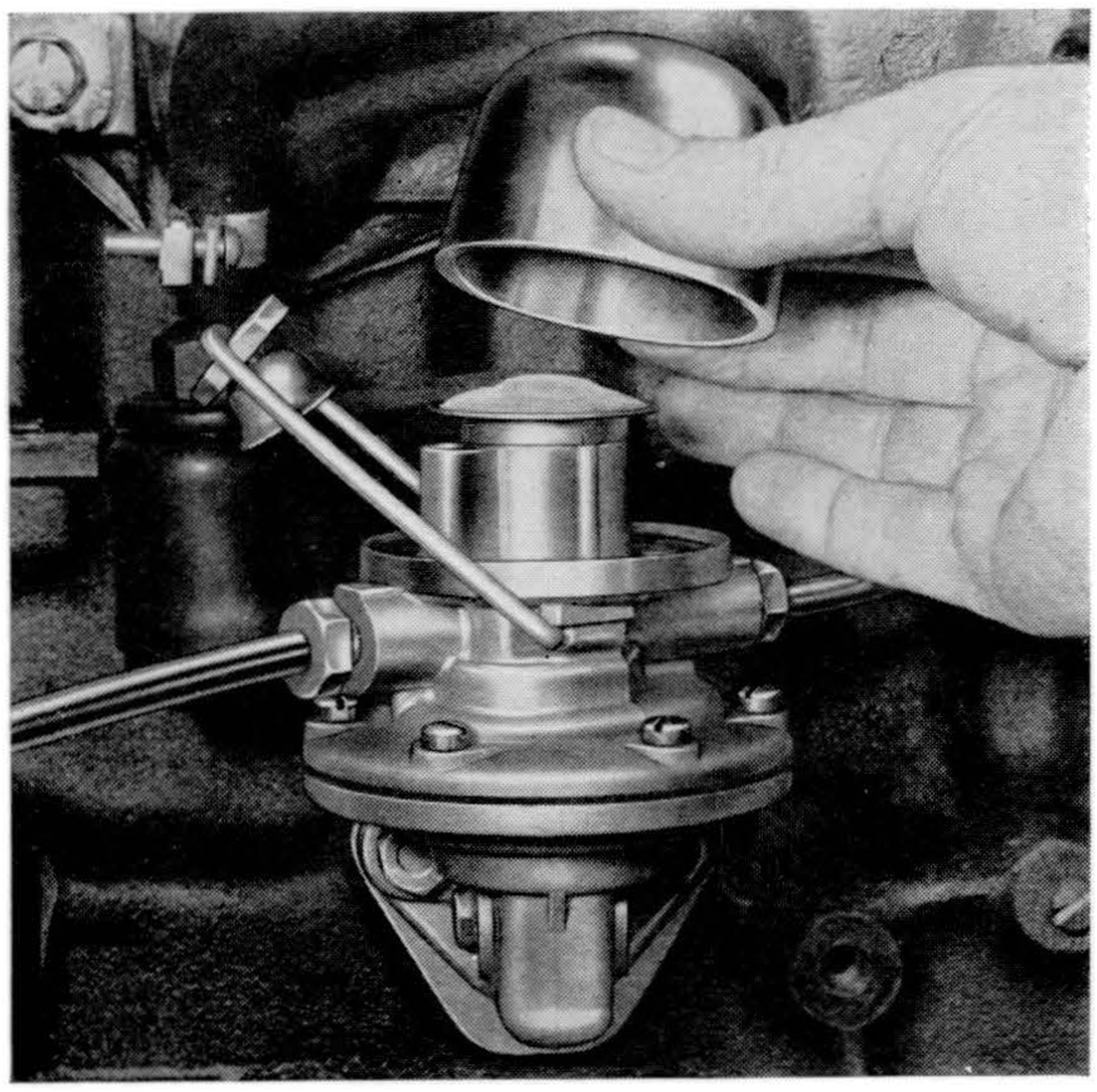
To Remove

1. Drain the fuel from the tank by syphoning into a suitable container.
2. Disconnect the fuel gauge wire and the fuel pipe from the sender unit.
3. Open the boot and remove the floor covering, if fitted, from the luggage compartment floor.

4. Slacken the two hose clips on the flexible pipe which connects the filler pipe with the fuel tank neck and then slide the filler pipe away from the fuel tank.
5. Remove the fuel tank shield, where fitted.
6. Remove the self-tapping bolts securing the fuel tank to the floor pan and lift out the fuel tank.
7. The fuel gauge sender unit can be removed, if necessary, using Tool No. P.9082. Remove the sealing ring from the fuel tank.

To Install

8. Fit a new sealing ring in the fuel gauge sender unit recess in the tank, then fit the gauge unit, using Tool No. P.9082, to provide an efficient seal.
9. Apply a bead of Bostik sealing compound No. 1222 F on the floor pan where it mates with the fuel tank flange, using a suitable sealer gun. Alternatively, Bostik No. 6 may be used. Fit the fuel tank, retaining it with the self-tapping bolts.
10. Fit the fuel tank shield where applicable.
11. Slide the flexible pipe which connects the filler pipe with the fuel tank neck over the tank neck and secure the hose clips.
12. Refit the floor covering in the luggage compartment, where applicable.
13. Fit the fuel pipe and fuel gauge unit wire to the sender unit.
14. Refill the tank and replace the filler cap.



Removing the Sediment Bowl

15. Check the operation of the fuel gauge by switching on the ignition and observing the needle, bearing in mind that the gauge takes about thirty seconds to reach a true reading.

ESTATE CAR

Tools Required

P.9082 Fuel tank sender unit lock ring wrench.

To Remove

1. Jack up the rear of the car and fit stands. Remove the jack.
2. Drain the fuel from the tank by syphoning into a suitable container.
3. Remove the spare wheel.
4. Slacken the two hose clips on the filler pipe hose and remove the hose.
5. Disconnect the fuel pipe from the sender unit.
6. Remove the fuel tank retaining bolts and partially lower the fuel tank.
7. Disconnect the sender unit wire and vent pipe.
8. Remove the fuel tank.
9. The fuel gauge sender unit can be removed, if necessary, using Tool No. P.9082. Remove the sealing ring from the fuel tank.

To Install

10. Fit a new sealing ring in the fuel gauge sender unit recess in the tank then fit the gauge unit, using Tool No. P.9082 to provide an efficient seal.
11. Position the fuel tank beneath the car.
12. Connect the sender unit wire and the vent pipe.
13. Fit the fuel tank.
14. Connect the fuel pipe.
15. Fit the filler pipe hose and tighten the clips.
16. Refit the spare wheel.
17. Jack up the car and remove stands, lower to ground and remove the jack.
18. Strain the fuel and return to the tank. Refit the filler cap.

OP 9275-A FUEL TANK GAUGE UNIT - REMOVE AND INSTALL

SALOON

Tools Required

P.9082 Fuel tank sender unit lock ring wrench

To Remove

1. Drain the fuel tank by syphoning the fuel into a suitable container.

2. Disconnect the fuel tank gauge unit wire and feed pipe.

3. Unscrew the sender unit with Tool No. P.9082 and remove. Remove the sealing ring from the fuel tank.

To Install

4. Fit a new sealing ring in the recess in the tank and fit the sender unit, using Tool No. P.9082 to provide an efficient seal.

5. Reconnect the wire and feed pipe to the unit.

6. Refill the tank.

ESTATE CAR

See Operation No. 9002-A

OP 9280-A FUEL GAUGE – REMOVE AND INSTALL – EXCEPT G.T.

To Remove

1. Disconnect the battery.

2. Turn the combined fuel/water temperature gauge approximately $\frac{1}{3}$ of a turn anti-clockwise and pull the instrument and outer bezel away from the facia.

3. Make a note of the wiring positions and remove the wires from the fuel gauge.

4. Remove the combined fuel/water temperature gauge inner chrome bezel and glass.

5. Remove the two nuts securing the fuel gauge to the rear face of the instrument and withdraw the gauge through the front of the combined instrument.

To Install

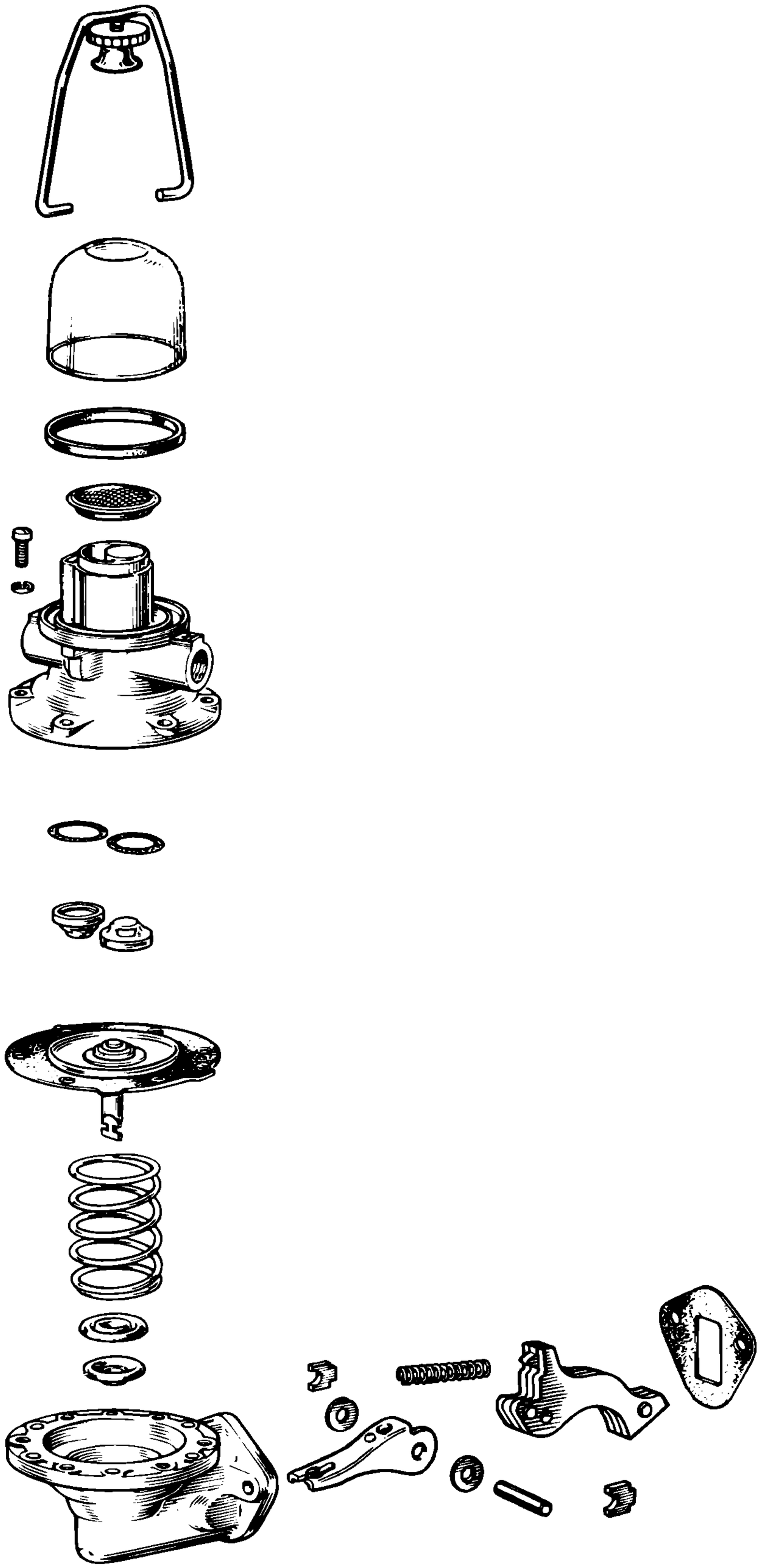
6. Position the instrument in the combined instrument case and secure it with two nuts.

7. Replace the glass and inner chrome bezel.

8. Reconnect the wires to the fuel gauge.

9. Replace the outer bezel and combined fuel/water temperature gauge in the facia and secure them by turning the gauge approximately $\frac{1}{3}$ of a turn clockwise.

10. Reconnect the battery.



Fuel Pump — Exploded

– G.T. ONLY

To Remove

1. Turn the fuel gauge approximately $\frac{1}{3}$ of a turn anti-clockwise and pull the instrument out of the facia.

2. Make a note of the wiring positions then disconnect the wires and illumination bulb from the fuel gauge and remove.

To Install

3. Reconnect the wires and illumination bulb to the gauge.

4. Push the gauge into the facia and rotate approximately $\frac{1}{3}$ of a turn clockwise.

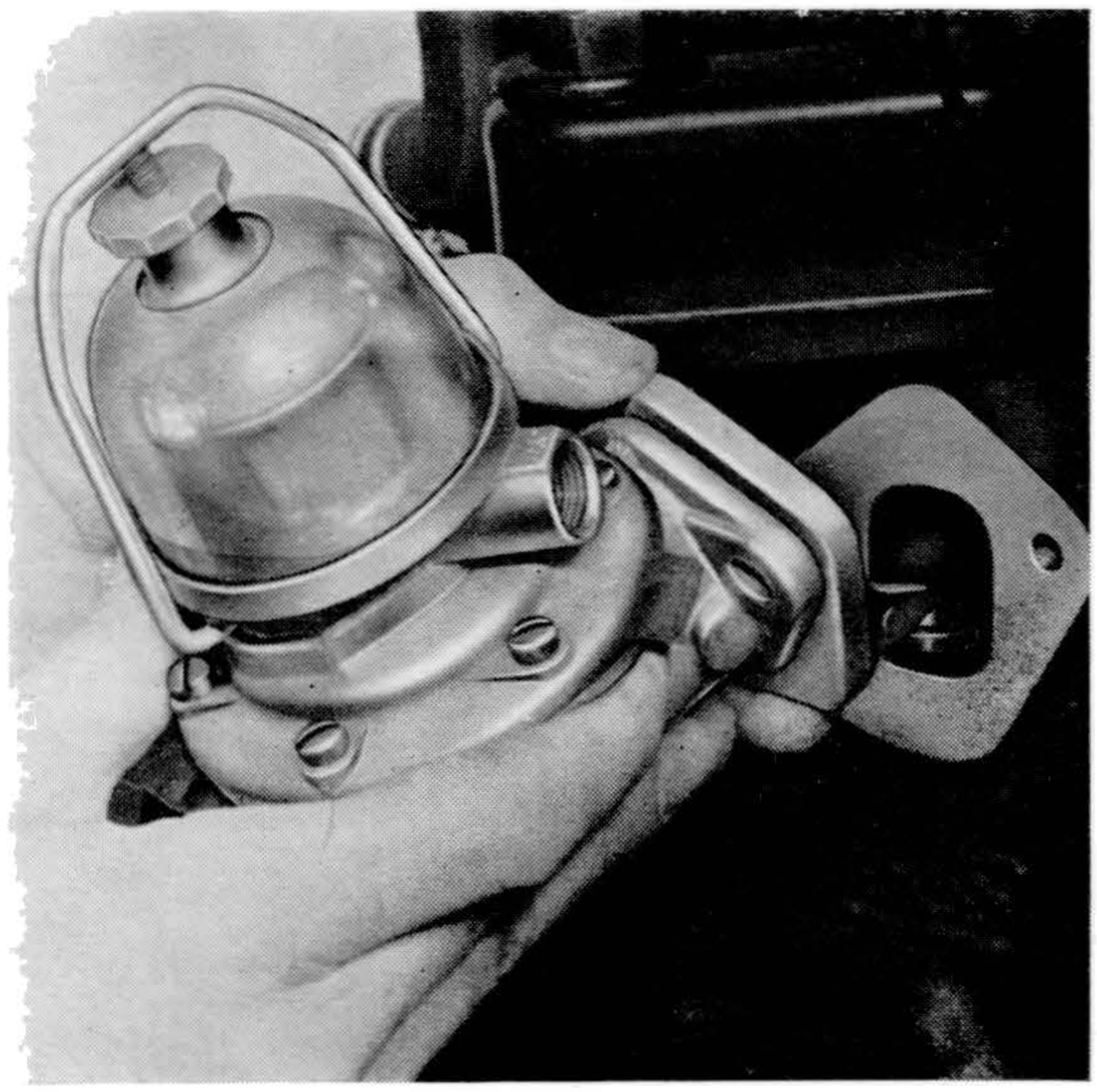
OP 9350-A FUEL PUMP ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Raise the bonnet and fit wing covers.

2. Disconnect the fuel lines at the pump. The line should be suitably plugged to prevent loss of fuel or the ingress of foreign matter. Avoid sharp objects that damage the line.

3. Unscrew and remove the two bolts and spring washers securing the fuel pump to the cylinder block and detach the fuel pump, lifting the operating lever to clear the eccentric and the slotted hole in the block. Remove the gasket.



Refitting the Fuel Pump

To Install

4. Clean the mounting face on the cylinder block, removing any trace of gasket which may be adhering to the face.

5. Fit a new gasket to the fuel pump flange and insert the rocker arm through the slot in the block wall so that the arm lies on the camshaft eccentric. Secure the fuel pump to the cylinder block with two spring washers and bolts, tightening the bolts evenly to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.).

6. Ensure that the pipe joints are clean and refit the fuel pipes.

7. Run the engine and check for leaks at the joints.

8. Remove the wing covers and lower the bonnet.

OP 9350-A1 EXTRA: DIAPHRAGM – RENEW

To Remove

1. Slacken the clamp nut and remove the sediment bowl and gasket.

2. Remove the filter and clean.

3. Mark the position of the diaphragm tabs on both halves of the pump body, remove the screws and separate the two halves of the pump body. Check to see that the pip on the lower body is in line with the smaller diaphragm tab.

4. Turn the diaphragm, approximately a quarter turn (in either direction), to free the diaphragm rod from the rocker arm link, and detach the diaphragm.

5. Remove the diaphragm spring, oil seal retaining washer and rubber oil seal.

To Install

6. Replace the oil seal, oil seal retainer and the diaphragm spring.

7. Insert the end of the rod in the slotted end of the link. Engage the grooves in the pull rod end by turning the diaphragm a quarter of a turn, so that the **smaller tab** on the diaphragm aligns with the mating pins on the lower body flange.

8. Replace the pump upper body, align the mating marks and loosely secure with six screws.

9. Operate the rocker arm several times to centralise the diaphragm and fully tighten the screws with the rocker arm fully depressed.

10. Replace the filter.

11. Replace the sediment bowl and gasket and secure with the clamp.

OP 9350-A3 EXTRA: VALVES – RENEW
(Fuel pump removed and upper and lower bodies separated.)

To Remove

1. Carefully relieve the staking and remove the valves from the upper body. Blow out pump chamber to remove debris. Remove all sharp edges and inspect sheets.

To Install

2. Fit the gaskets in the upper body, then fit two new valve assemblies.

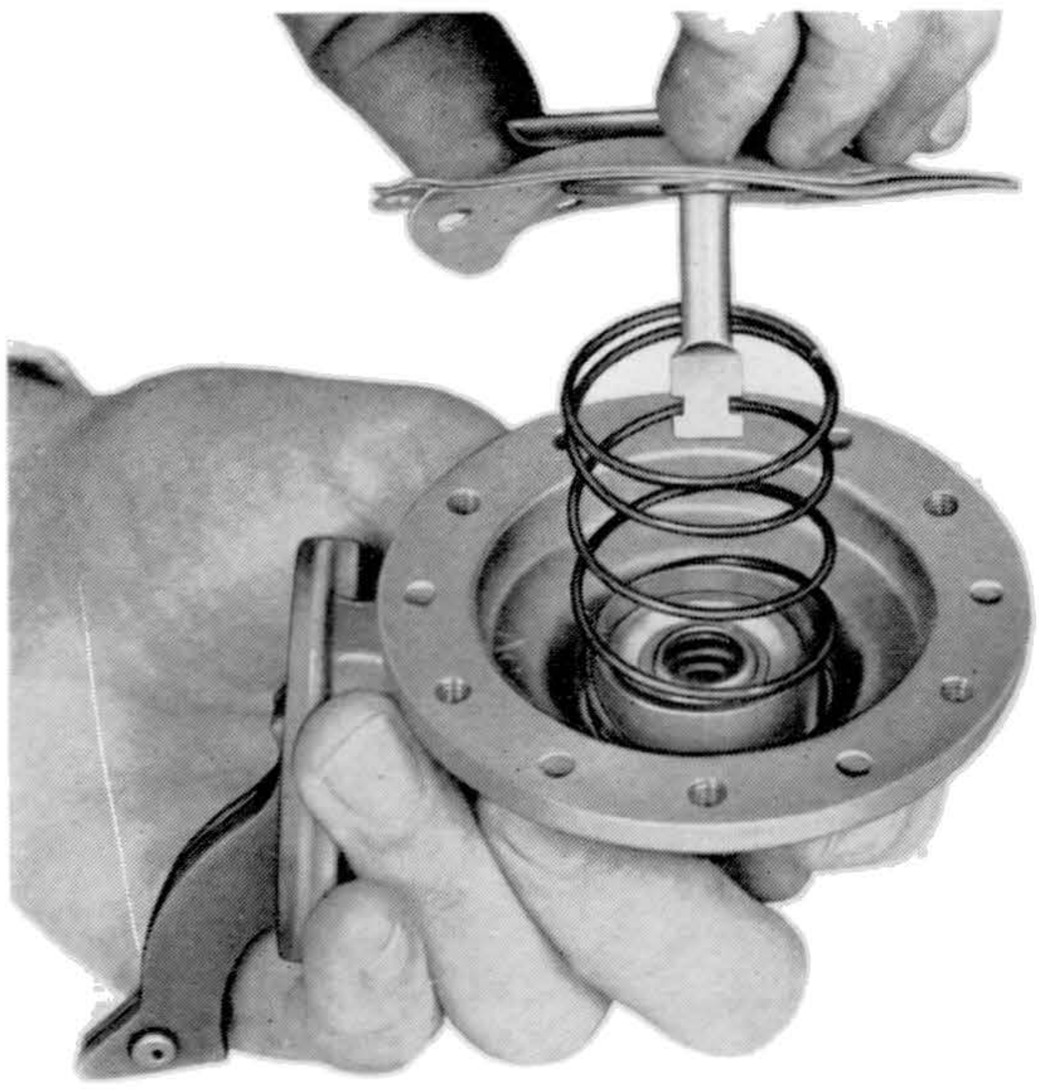
   NOTE – The valves will only seat properly when in their correct locations and the right way up.

3. Ensure that the valves are pressed fully home and retain each valve securely by staking at six points around its housing. Blow out pumping chamber to remove debris.

OP 9350-B FUEL PUMP DIAPHRAGM – RENEW
(Includes OPS 9350-A and A1)

OP 9350-C FUEL PUMP MECHANISM – OVERHAUL
(Includes OPS 9350-A, A1 and A2)

OP 9350-D FUEL PUMP VALVES – RENEW
(Includes OPS 9350-A and A3)



Refitting the Diaphragm

Refitting the Upper Body

OP 9350-E FUEL PUMP DIAPHRAGM AND VALVES - RENEW
(Includes OPS 9350-A, A1 and A3)

OP 9350-F FUEL PUMP - OVERHAUL
(Includes OPS 9350-A, A1, A2 and A3)

OP 9425-A INLET MANIFOLD - REMOVE AND INSTALL

To Remove

1. Raise the bonnet and fit wing covers.
2. Partially drain the cooling system.
3. Remove the air cleaner, see Operation No. 9600-A sub-operations 1 to 3.
4. Disconnect the throttle shaft from the carburettor throttle lever.
5. Disconnect the fuel pipe and the distributor vacuum pipe from the carburettor.
6. Disconnect the choke cable, on automatic choke models remove the thermostatic spring and water housing.
7. Unscrew the retaining nuts and lift the carburettor and gasket off the manifold.
8. Disconnect the water outlet hose and the crankcase ventilation hose from the inlet manifold.
9. Unscrew the retaining nut and bolts and remove the inlet manifold.

To Install

10. Coat the manifold face around the water port with EM-4G-14 jointing compound and locate on the cylinder head. Refit the inlet manifold and tighten the nut and bolts evenly to a torque of 15 to 18 lb. ft. (2.07 to 2.49 kg.m.).
11. Reconnect the water hose and the crankcase ventilation hose to the inlet manifold.
12. Position a new gasket on the mounting flange and refit the carburettor to the manifold.

Inlet and Exhaust Manifolds — Except G.T.

13. Reconnect the distributor vacuum pipe and the fuel pipe to the carburettor.
14. Reconnect the throttle shaft to the throttle lever.
15. Reconnect the choke cable with both the choke control knob and the lever in the OFF position. On automatic choke models fit the thermostatic spring and water housing. Locate the spring in the centre slot and align the housing marks before tightening the screws.
16. Refit the air cleaner, see Operation No. 9600-A sub-operations 4 to 6.
17. Refill the cooling system.
18. Remove the wing covers and close the bonnet.

OP 9428-A EXHAUST MANIFOLD – REMOVE AND INSTALL

To Remove

1. Raise the bonnet and fit wing covers.
2. Disconnect the exhaust pipe from the manifold.
3. Remove the exhaust manifold.

To Install

4. Fit the exhaust manifold to the cylinder head, ensuring that the manifold centre gasket is the correct way up. Tighten the retaining nuts and bolts evenly to a torque of 15 to 18 lb. ft. (2.07 to 2.49 kg.m.).
5. Locate the exhaust pipe on the exhaust manifold, fit the clamp and tighten securely.
6. Remove the wing covers and close the bonnet.

Inlet and Exhaust Manifolds — G.T. only

OP 9441-A INLET MANIFOLD GASKET – RENEW

To Remove

1. Raise the bonnet and fit wing covers.
2. Remove the air cleaner, see Operation No. 9600-A sub-operations 1 to 3.
3. Disconnect the throttle shaft from the carburettor throttle lever.
4. Partially drain the cooling system.
5. Unscrew the manifold nuts and bolts and pull the manifold to one side.
6. Remove the gasket.

To Install

7. Apply EM-4G-14 jointing compound on both sides of the gasket around the water port and fit to the cylinder head.
8. Fit the manifold assembly and tighten the nuts and bolts evenly to a torque of 15 to 18 lb. ft. (2.07 to 2.49 kg.m.).
9. Fit the air cleaner, see Operation No. 9600-A sub-operations 4 to 6.
10. Refill the cooling system.
11. Adjust the slow-running, see Operation No. 9510-C.
12. Remove the wing cover and close the bonnet.

OP 9448-A EXHAUST MANIFOLD GASKET – RENEW

To Remove

1. Raise the bonnet and fit wing covers.
2. Unscrew the manifold nuts and bolts and pull the manifold to one side.
3. Remove the gaskets.

To Install

4. Position the centre gasket on the studs, ensuring that it is the correct way up and locate the manifold on the studs.
5. Position the other gaskets between the manifold flanges and the cylinder head, fit the nuts and bolts and tighten evenly to a torque of 15 to 18 lb. ft. (2.07 to 2.49 kg.m.).
6. Remove the wing covers and close the bonnet.

OP 9510-A CARBURETTOR AND/OR GASKET – REMOVE AND INSTALL

To Remove

1. Raise the bonnet and fit wing covers.
2. Remove the air cleaner, see Operation No. 9600-A sub-operations 1 to 3.

3. Disconnect the fuel and the distributor vacuum pipes at the carburettor.

4. Disconnect the throttle control shaft from the throttle lever.

5. (*a*) Manual Choke
Disconnect the choke cable.

(*b*) Automatic Choke
If the gasket is being replaced, remove the thermostatic spring and water housing.

If the carburettor is being replaced, partially drain the cooling system and disconnect the automatic choke hoses.

6. Remove the carburettor retaining nuts and spring washers and lift the carburettor and gasket off the manifold.

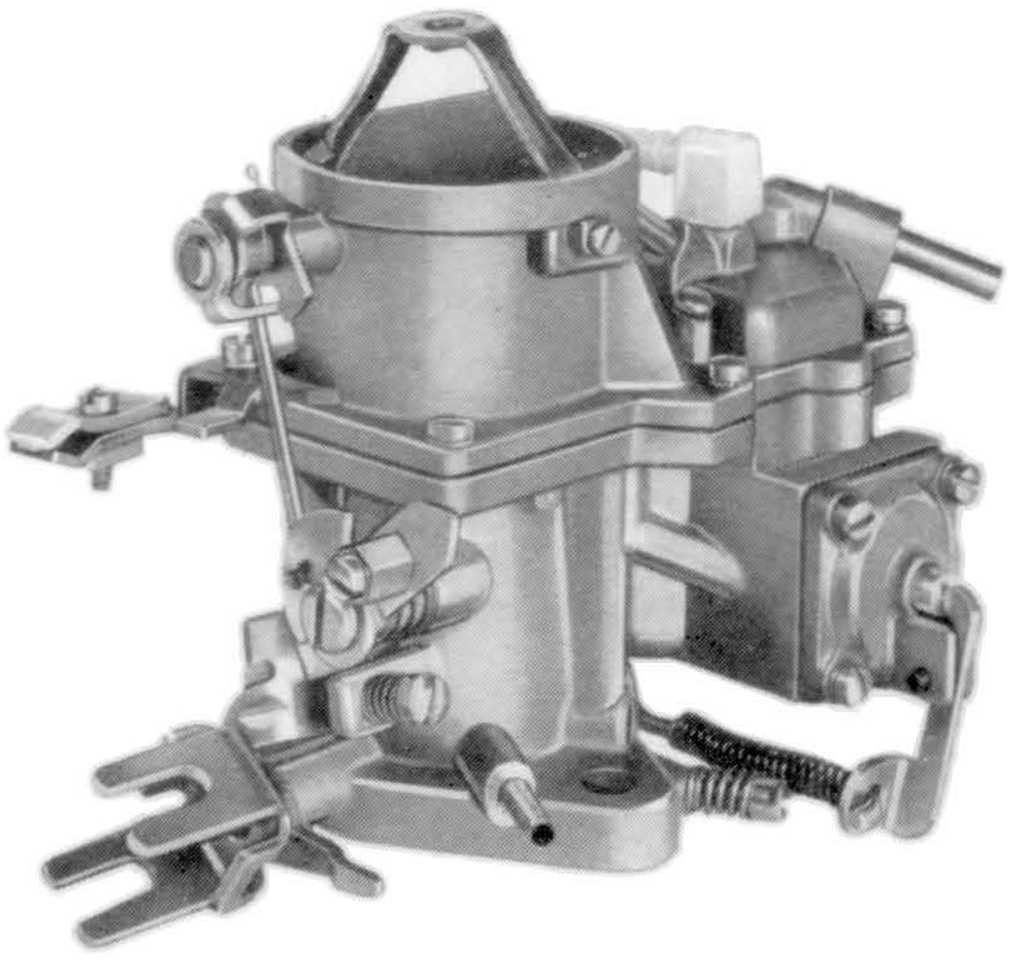
To Install

7. Locate a new gasket on the manifold flange and position the carburettor over the studs. Refit the spring washers and nuts on the mounting studs and tighten them securely.

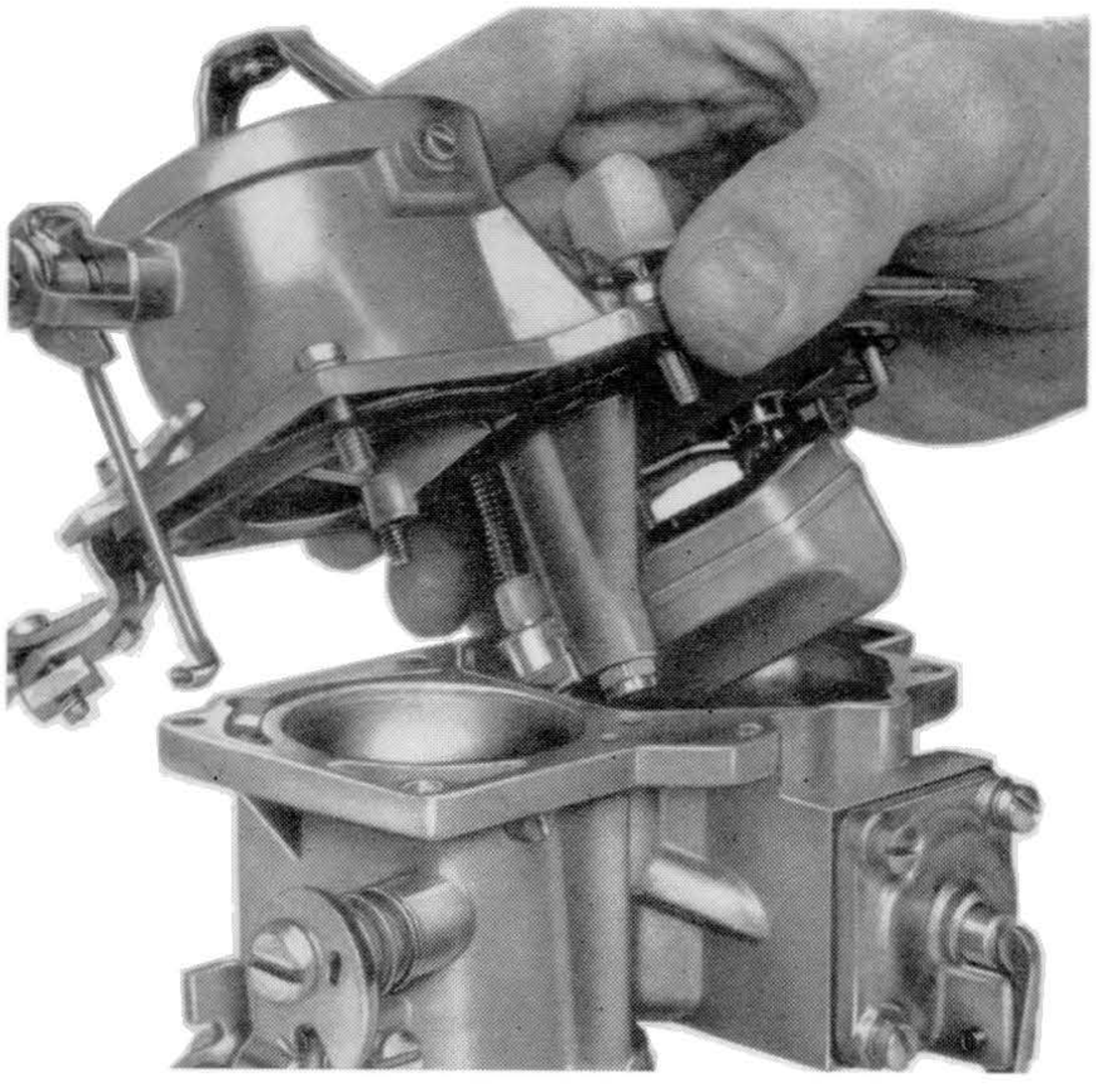
8. Reconnect the fuel and the distributor vacuum pipes to the carburettor.

9. Refit the throttle shaft to the throttle lever.

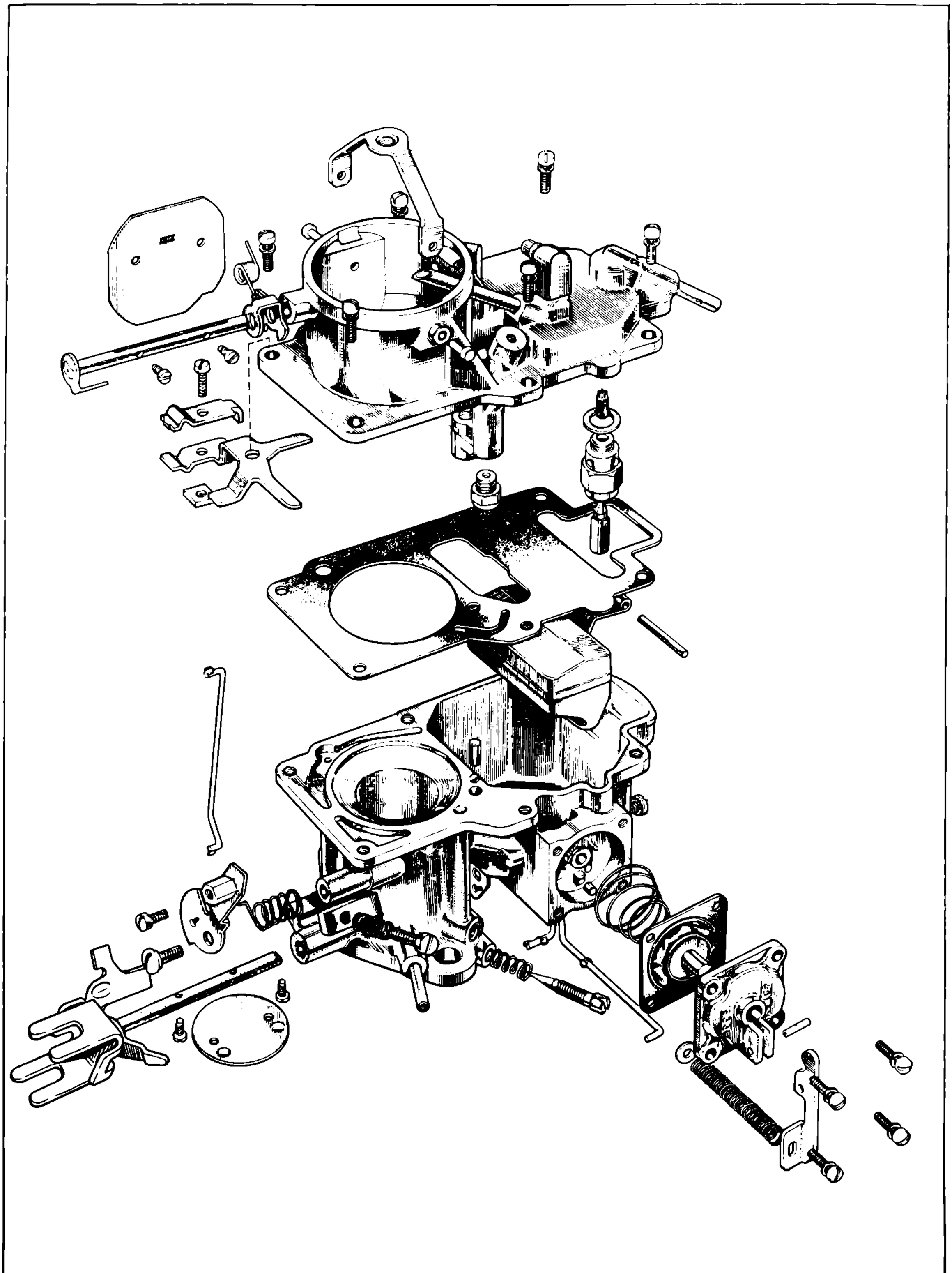
10. (*a*) Manual Choke
Reconnect the choke cable with both the choke control knob and the lever in the OFF position.



Ford Carburettor — Manual Choke



Removing the Carburettor Upper Body



Ford Carburettor — Manual Choke — Exploded

(*b*) Automatic Choke

Connect the hoses to the automatic choke and refill the cooling system.

Alternatively, fit the thermostatic spring and water housing. Locate the spring in the centre slot and align the housing marks before tightening the screws.

11. Refit the air cleaner, see Operation No. 9600-A sub-operations 4 to 6.
12. Remove the wing covers and close the bonnet.

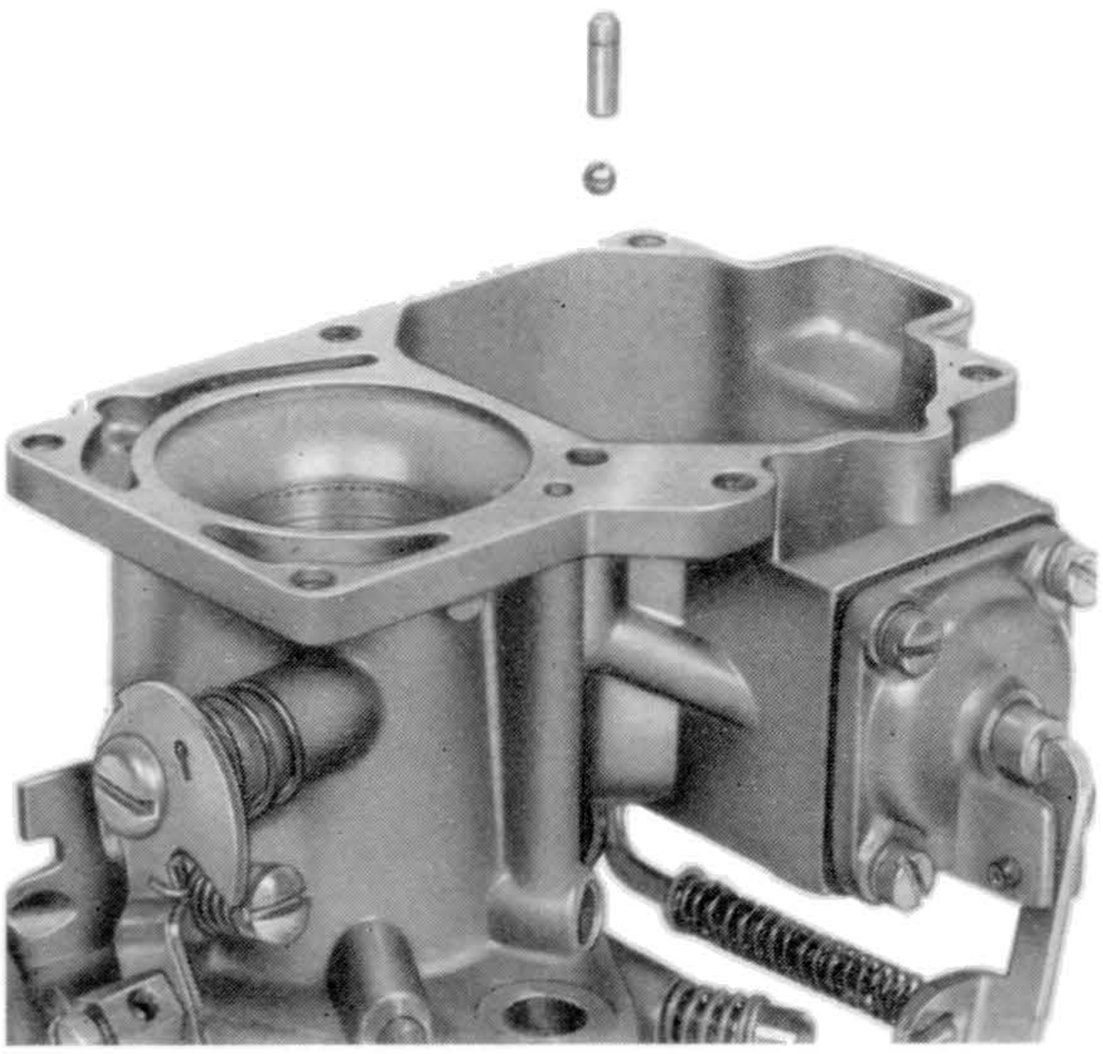
OP 5910-A2 EXTRA: CARBURETTOR – OVERHAUL

FORD CARBURETTOR

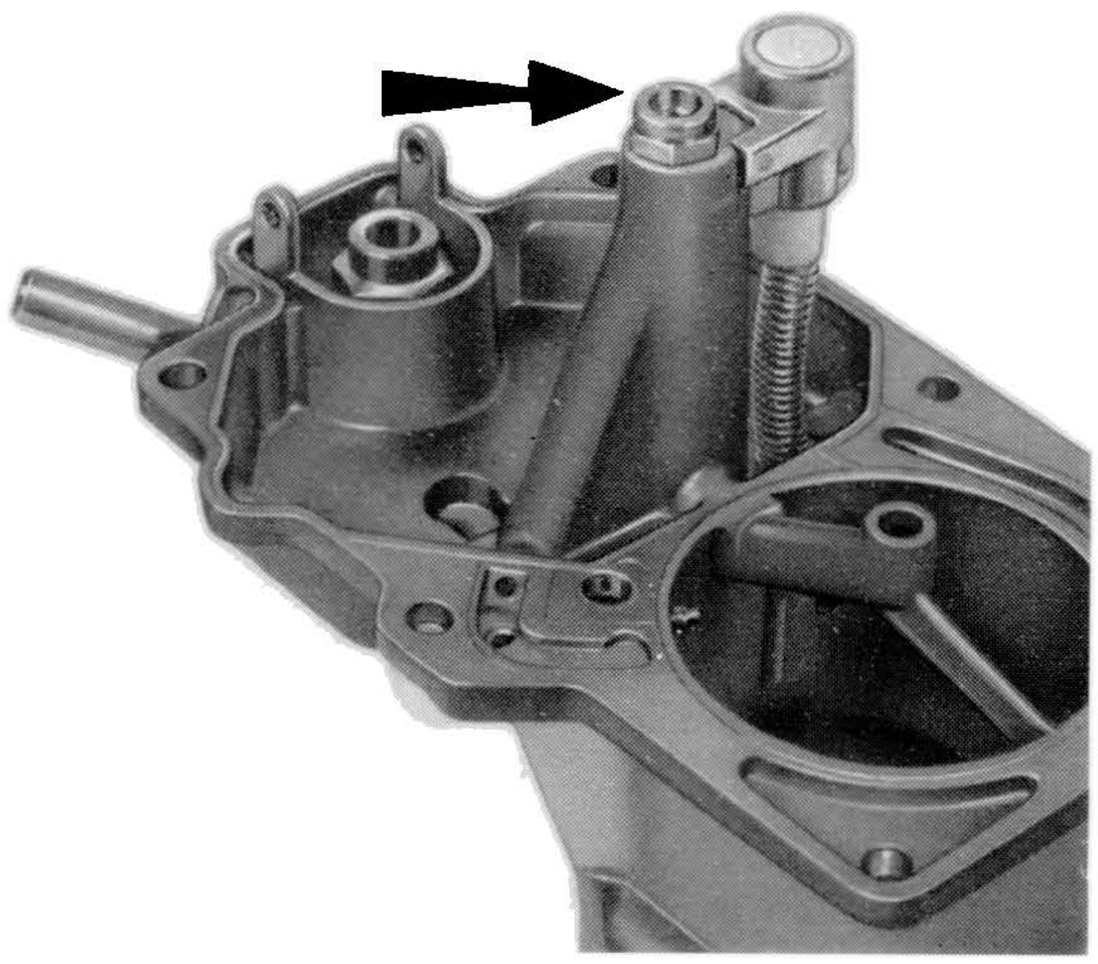
Manual Choke

To Dismantle

1. Remove the six screws and spring washers securing the carburettor upper body to the lower. Carefully lift off the body and unlatch the choke link at the same time. The gasket should come away with the upper component and care should be exercised to see it is not adhering to the lower body.
2. Withdraw the float arm pivot pin and remove the float.
3. Extract the needle valve.
4. Lift off the gasket from the upper body.
5. Remove the accelerator pump discharge ball valve and weight from the lower body.
6. Undo the needle valve housing and extract the gauze screen.
7. Unscrew the main jet.



Accelerator Pump Ball Valve and Weight



Main Jet

8. If it is required to remove the choke plate and shaft, first remove the two air cleaner retainer pins using side cutters and then remove the retainer.

9. Unscrew the two screws clamping the choke plate within its spindle and remove the plate.

10. Remove the burrs from around the choke plate screw holes and withdraw the choke spindle and slide the choke pull-down stop and spring off the spindle.

11. Unscrew the four screws securing the accelerator pump in position and remove the accelerator pump body and operating arm, diaphragm and return spring.

12. Disconnect the accelerator pump push rod and spring assembly from the pump operating lever and the arm on the throttle spindle.

13. Remove the accelerator pump push rod arm from the throttle spindle.

14. Unscrew the cheese head pivot screw and remove the choke lever and return spring.

15. Undo the two screws clamping the throttle plate within its spindle and remove the plate.

16. Remove the burrs from around the throttle plate screw holes and withdraw the throttle spindle from the body.

17. Undo the volume control needle screw and remove the spring.

18. Remove the throttle stop screw and spring.

To Reassemble

19. Slide the throttle spindle into the body and fit the throttle plate to the shaft. Centralise the throttle plate in the throttle barrel with the throttle plate in the closed position. Ensure that the two indentations in the throttle plate face the same way as the screw head recesses in the throttle shaft.

20. Replace the volume control screw and spring, tightening it until it just seats and then back off one turn.

21. Replace the throttle stop screw and spring.

22. Fit the accelerator pump push rod arm to the throttle spindle.

23. Connect the accelerator pump push rod and spring assembly to the arm and to the pump operating lever.

24. Fit the diaphragm and plunger into the accelerator pump cover and locate the diaphragm return spring within the pump housing. Carefully replace the cover, securing it with the four screws and spring washers.

25. Slide the pull-down spring and stop onto the choke spindle and insert the spindle into the carburettor body. Refit the choke plate and centralise in the air intake.

26. Replace the air cleaner retainer and secure with two pins squeezed into the holes.

27. Refit the main jet.

28. Locate the gauze screen in the needle valve housing and replace the needle valve housing.

29. Install the needle in the needle valve housing, needle end upwards.

30. Position a new gasket on the upper body.

31. Replace the float assembly, sliding the pivot pin into position.

32. Check the float and fuel level setting and adjust if necessary, see Operation No. 9510-C.

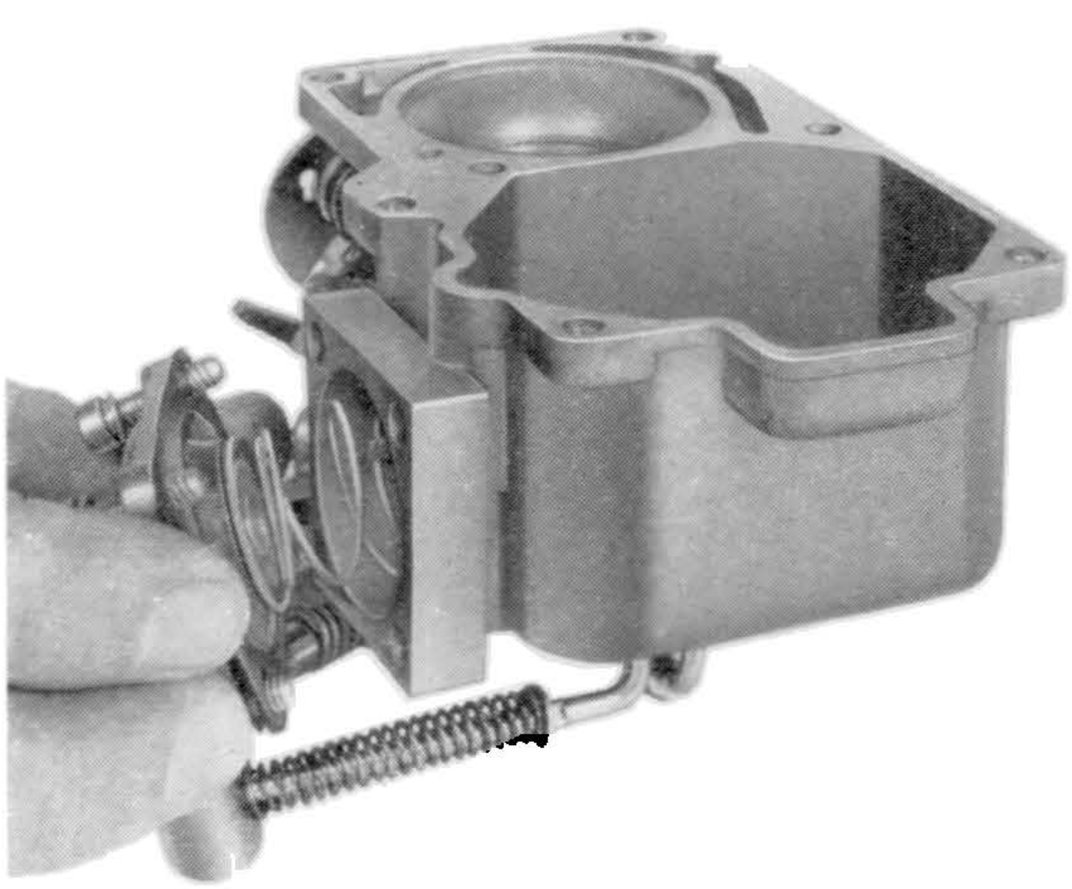
33. Place the return spring on the bearing abutment of the body and refit the choke lever with its pivot screw.

34. Replace the accelerator pump, discharge ball valve and weight.

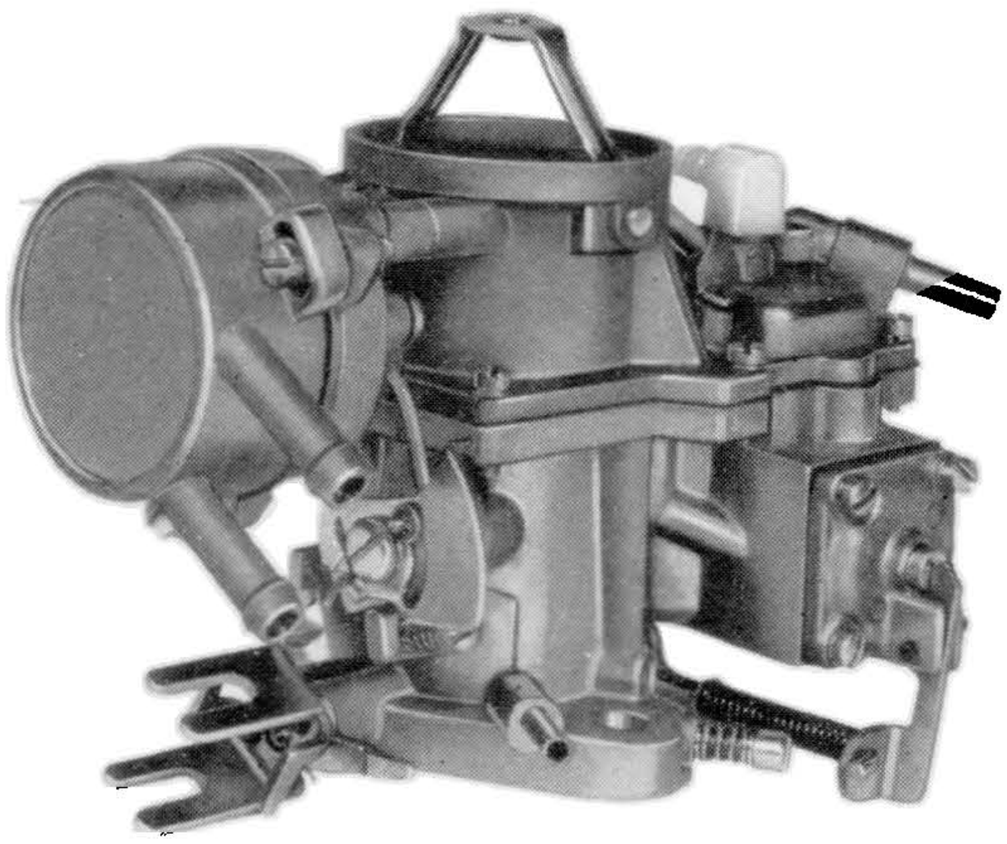
35. Insert one end of the choke link into the pull-down stop and the other into the fast idle cam and carefully refit the upper body to the lower body. Secure the upper to the lower body with the six screws. The rear left-hand screw also secures the choke cable abutment bracket. Tighten these screws while holding the choke lever in the closed position.

    NOTE – Failure to observe this procedure will result in the choke lever being over-centred and the choke rendered inoperative. **Do not force** the lever back to the correct position if this occurs, as the choke link will be damaged, but slacken the upper body screws until the lever can be turned to the correct position and then retighten.

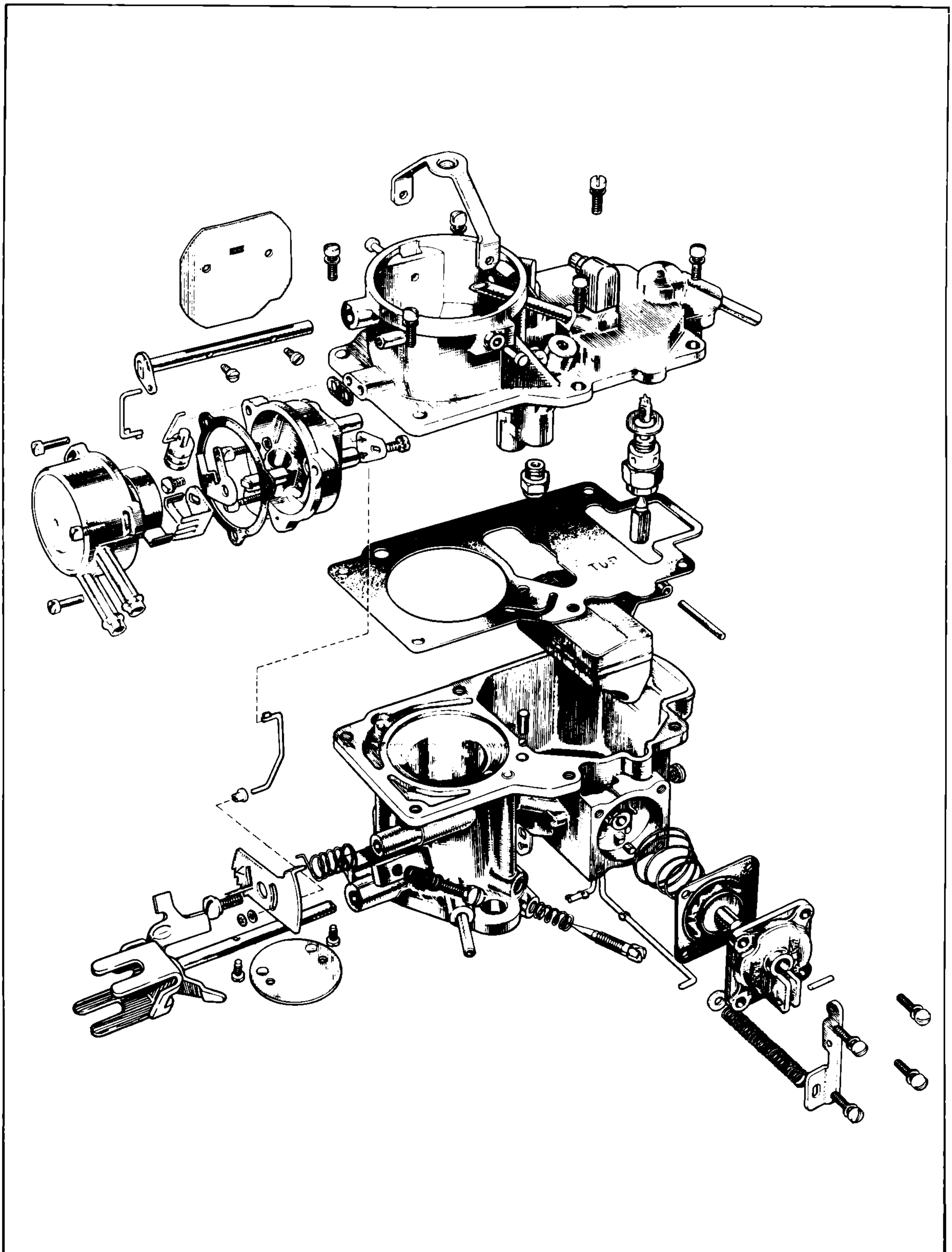
36. Check and adjust, if necessary, the choke plate pull-down, the fast idle setting and the accelerator pump stroke, see Operation No. 9510-C.



Fitting the Accelerator Pump



Ford Carburettor — Automatic Choke

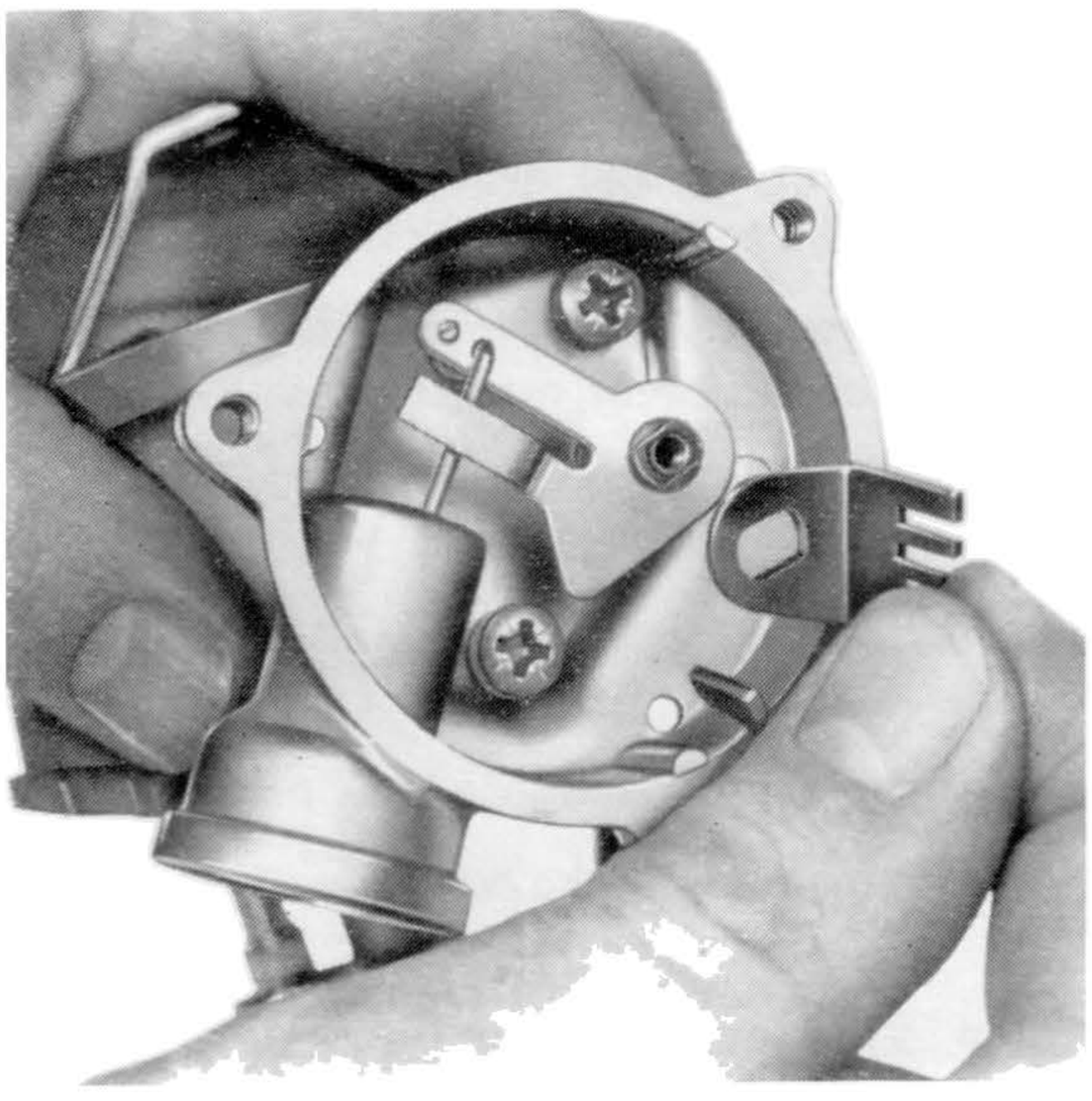


Ford Carburettor — Automatic Choke — Exploded

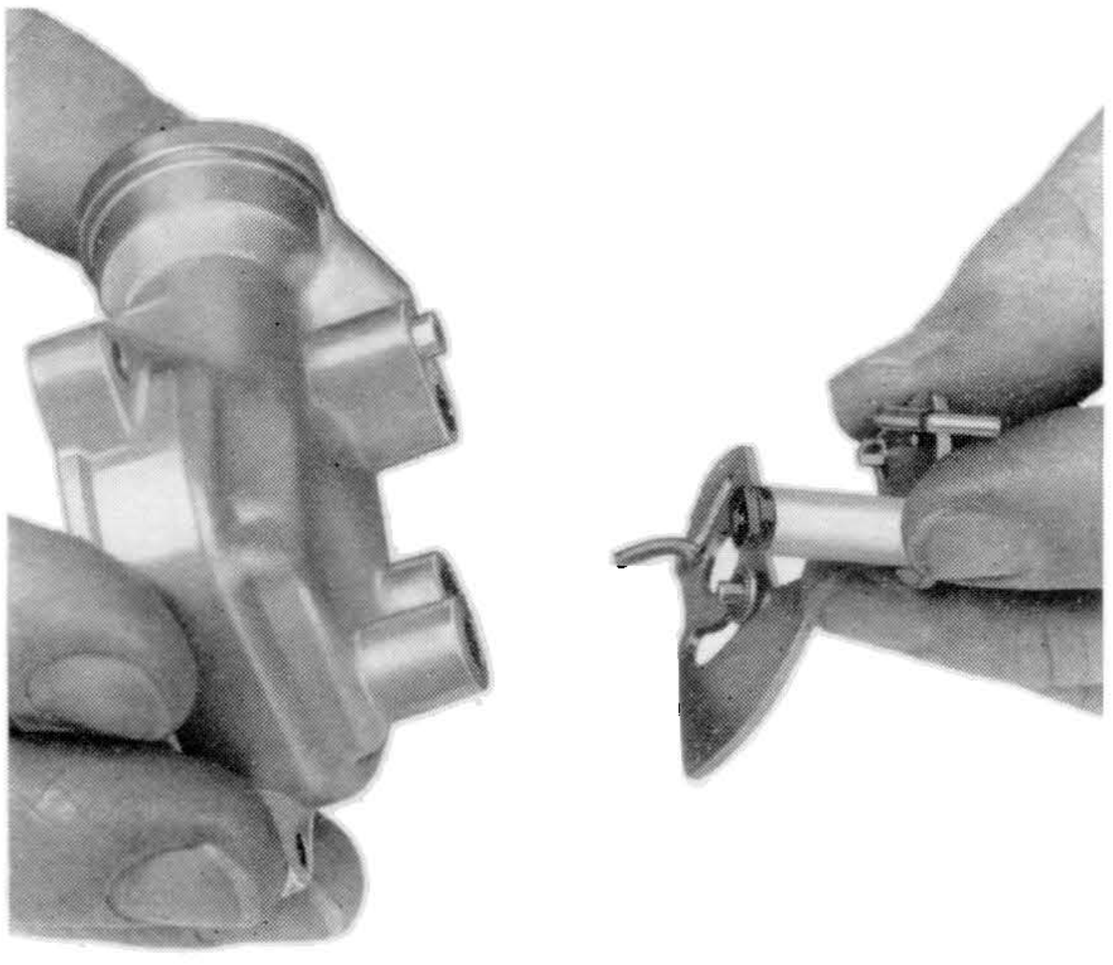
Automatic Choke

To Dismantle

1. Remove the shoulder screw retaining the fast idle cam and rod assembly to the lower body.
2. Remove the six screws holding the upper body to the lower carburettor body and carefully lift off the upper body. The gasket should come away with the upper body and care should be exercised to see it is not adhering to the lower body.
3. Withdraw the float arm pivot pin and remove the float.
4. Extract the needle valve.
5. Lift off the gasket from the upper body.
6. Remove the weight and the accelerator pump discharge ball valve.
7. Remove the needle valve housing and extract the gauze screen.
8. Remove the main jet.
9. Remove the thermostatic spring and water housing, if not already removed.
10. Remove the screw securing the thermostatic spring lever. Remove the thermostatic spring lever, the choke piston lever, the choke piston link and the piston from the inner housing.
11. Remove the two screws retaining the choke inner housing and withdraw the inner housing and gasket from the carburettor.
12. Remove the choke control lever and shaft assembly and the choke control rod from the inner housing. Carefully remove the "Teflon" bushing.



Removing the Thermostatic Spring Lever



Removing the Choke Control Lever

13. If it is required to remove the choke plate and shaft, first remove the two air cleaner retainer pins using side cutters, and remove the air cleaner retainer.
14. Remove the two screws securing the choke plate to the shaft and withdraw the choke plate.
15. Remove the burrs from around the choke plate screw holes and withdraw the choke shaft and lever assembly.
16. Unscrew the four screws securing the accelerator pump in position and remove the accelerator pump body, operating arm, diaphragm and return spring.
17. Disconnect the accelerator pump push rod and spring assembly from the pump operating lever and the arm on the throttle spindle.
18. Remove the accelerator pump push rod arm from the throttle spindle.
19. Undo the two screws clamping the throttle plate within its spindle and remove the plate.
20. Remove the burrs from around the throttle plate screw holes and withdraw the throttle spindle from the body.
21. Unscrew the volume control needle screw and spring.
22. Remove the throttle stop screw and spring.

To Reassemble

23. Slide the throttle spindle into the body and fit the throttle plate to the shaft. Centralise the throttle plate in the throttle barrel with the throttle plate in the closed position. Ensure that the two indentations in the throttle plate face the same way as the screw head recesses in the throttle shaft.
24. Replace the volume control screw and spring, tightening it until it just seats and then back off one turn.
25. Replace the throttle stop screw and spring.
26. Fit the accelerator pump push rod arm to the throttle spindle.
27. Connect the accelerator pump rod and spring assembly to the arm and to the pump operating lever.
28. Fit the diaphragm and plunger into the accelerator pump cover and locate the diaphragm return spring within the pump housing. Carefully replace the cover, securing it with the four screws and spring washers.
29. Replace the accelerator pump discharge ball valve and weight.
30. Insert the choke shaft and lever assembly into the carburettor upper body and fit the choke plate to the shaft and centralise in the air intake.
31. Replace the air cleaner retainer and secure with two pins squeezed into the holes.
32. Insert the choke control lever and shaft assembly into the inner choke housing. At the same time fit the "Teflon" bushing.
33. Fit the piston, the piston lever and the link, located in the inner position on the lever, in the inner housing. Locate the piston lever on the shaft and fit the thermostatic spring lever and screw to the control lever shaft.

34. Fit the inner housing with the choke control and fast idle rods positioned in the choke control lever. Position the vacuum gasket and secure the housing with the two screws.

35. Fit the thermostatic spring and water housing assembly so that the thermostatic spring engages with the central slot in the lever and the index mark is aligned with the central mark on the inner housing. Secure the housing with the three screws.

36. Refit the main jet.

37. Locate the gauze screen in the needle valve housing and replace the needle valve housing.

38. Refit the needle valve in the housing, needle end upwards.

39. Position a new gasket on the carburettor upper body.

40. Refit the float and retain it with the float arm pivot pin.

41. Check the float and fuel level setting and adjust if necessary, see Operation No. 9510-C.

42. Fit the upper body on the lower carburettor body. Secure the upper to the lower body with the six screws.

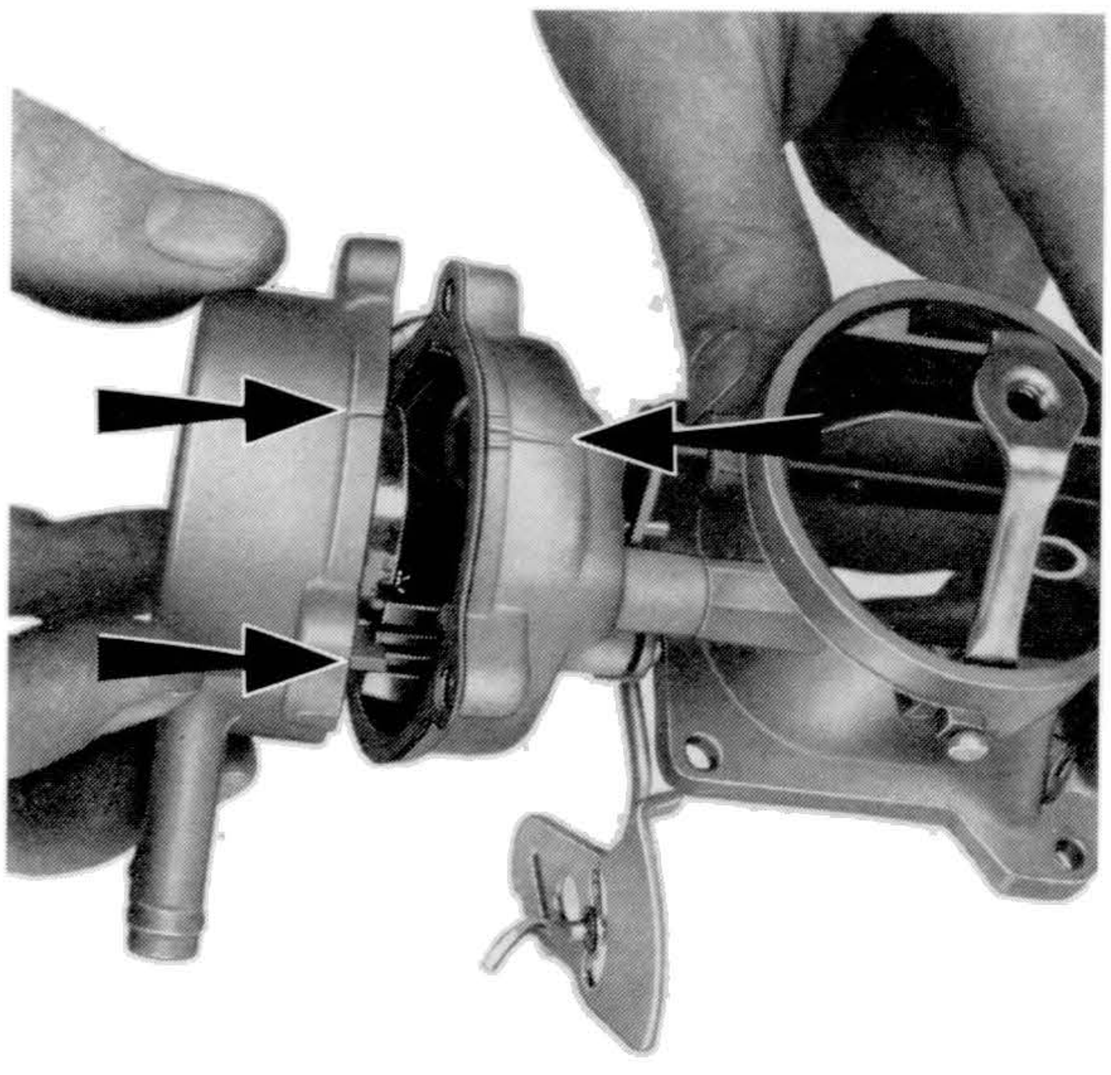
43. Refit the fast idle cam and secure it with the screw.

44. Check and adjust if necessary, the choke plate pull-down, fast idle, de-choke and the accelerator pump stroke, see Operation No. 9510-C.

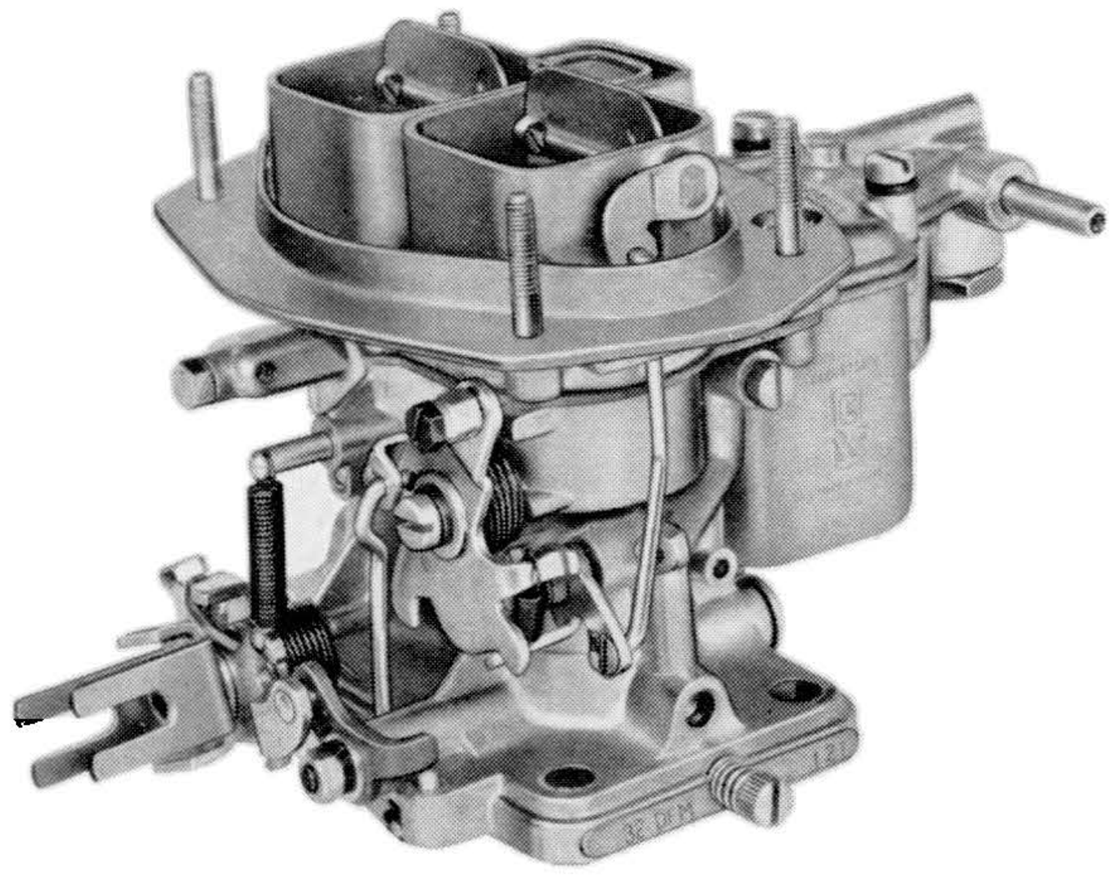
WEBER CARBURETTOR

To Dismantle

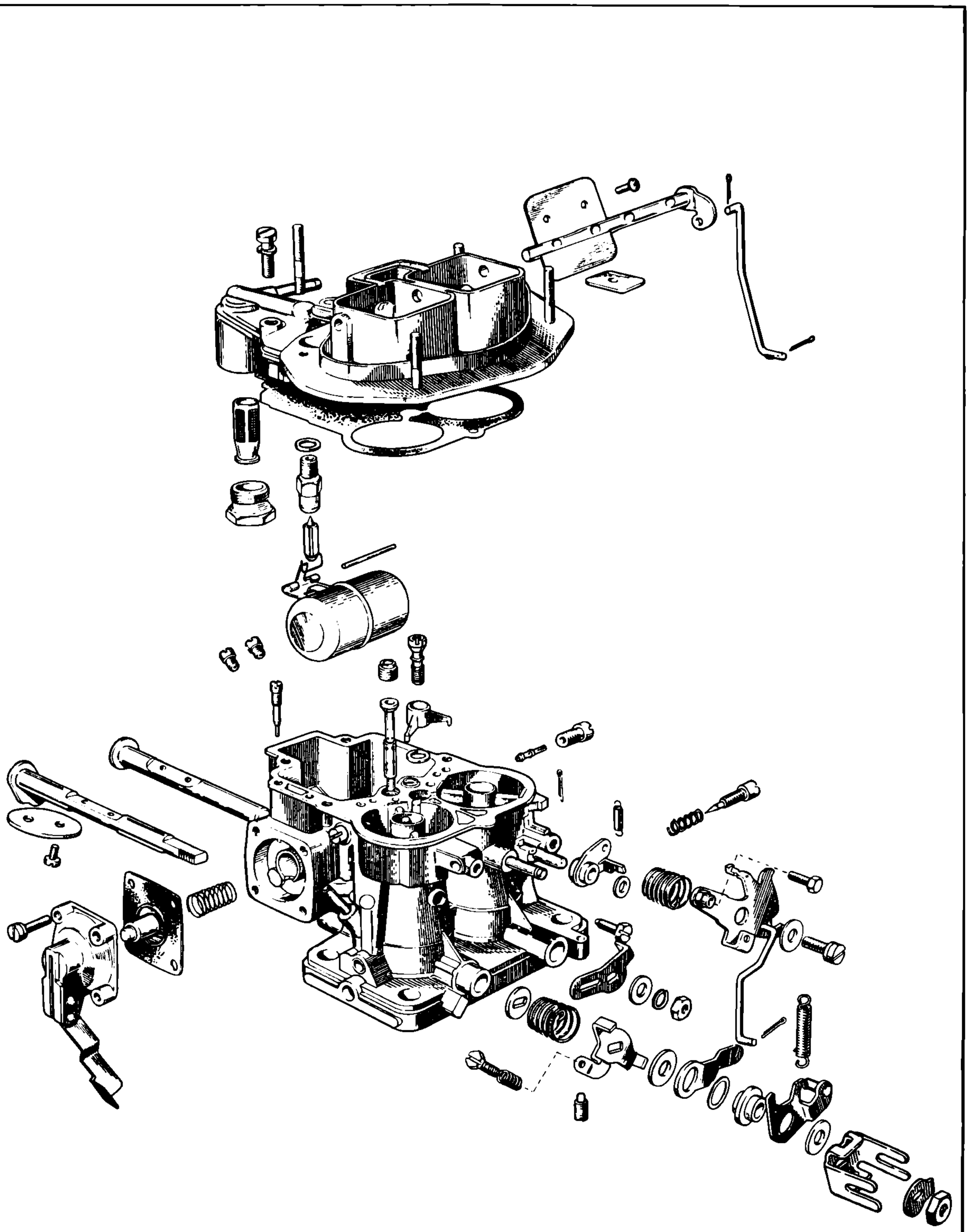
1. Remove the fuel filter retainer from the carburettor cover and then withdraw the gauze filter.



Fitting the Thermostatic Spring and Water Housing



Weber Carburettor



Weber Carburettor — Exploded

2. Disconnect the choke plate operating rod at the lower end by removing the split pin and nylon washer.

3. Unscrew the upper body retaining screws and then remove the upper body.

4. Push out the float pivot pin and remove the float and needle valve.

5. Remove the gasket from the upper body.

6. Unscrew the needle valve housing.

7. Remove the accelerator pump cover, diaphragm and spring by unscrewing the four retaining screws.

8. If necessary, drive out the pivot pin from the plain end with a suitable punch and remove the accelerator pump lever.

9. Remove the split pin retaining the upper end of the choke plate operating rod to the spindle lever and detach.

10. Unscrew the choke plate screws and remove the plates. Withdraw the spindle.

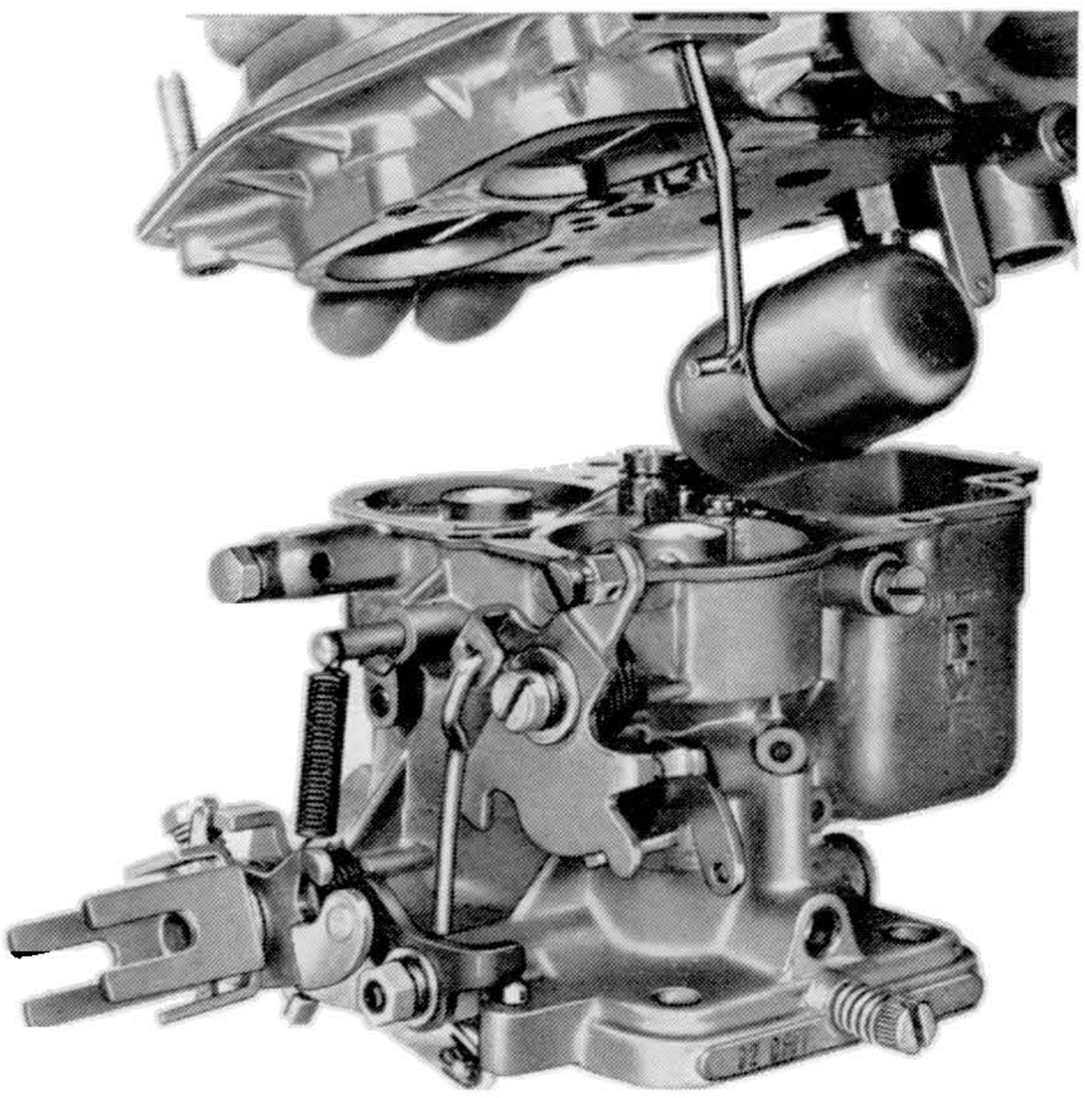
11. Unscrew the primary and secondary main jets from the base of the float chamber.

12. Unscrew the accelerator pump discharge valve from the top of the carburettor body and remove along with the discharge jet.

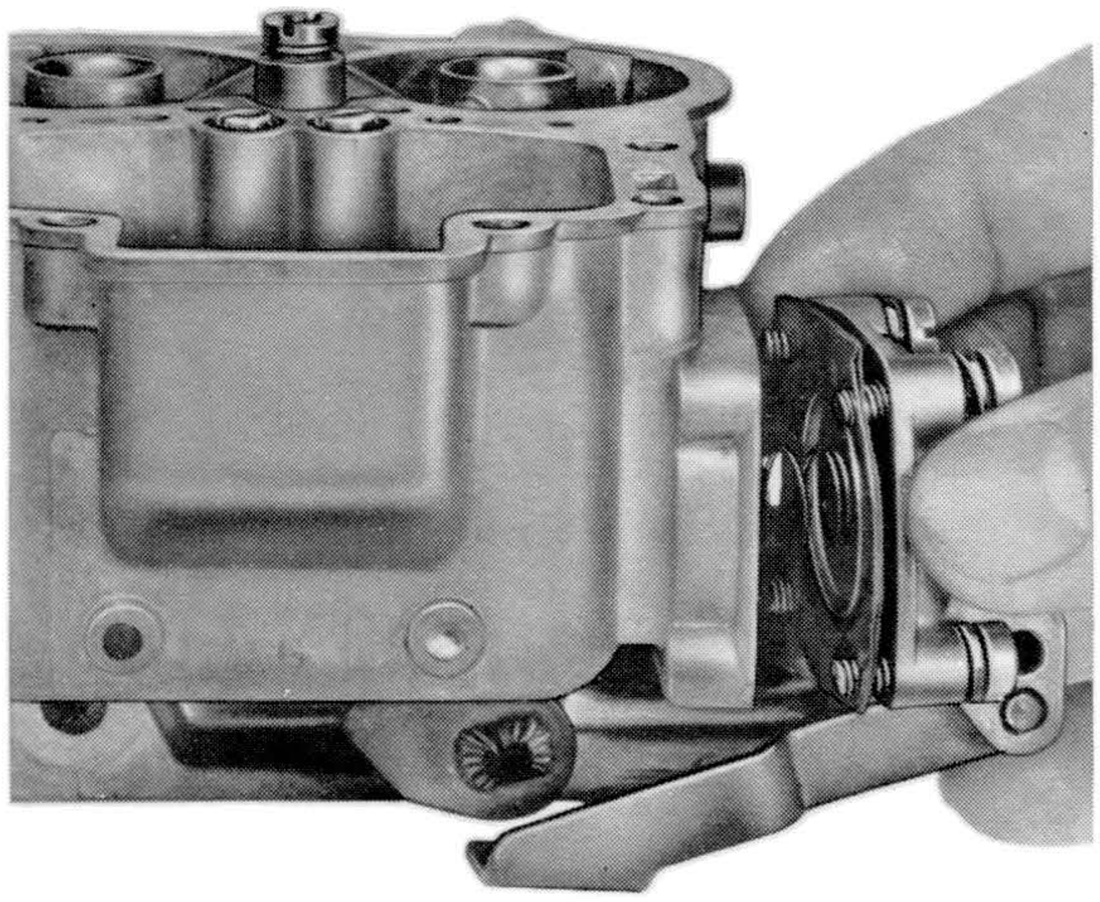
13. Remove the air correction jets from the top of the carburettor body, invert the latter and slide out the emulsion tubes.

14. Unscrew the two idling jet holders, one from either side of the carburettor body. Remove the idling jets.

15. Remove the volume control screw and spring from the base of the body.



Removing the Upper Body



Removing the Accelerator Pump

16. Remove the secondary throttle return spring between the carburettor body and the secondary throttle lever.

17. Bend back the locking tab on the primary throttle shaft, unscrew the nut and remove the throttle control lever, spacer, secondary throttle control lever and spring from the primary throttle shaft.

18. Disconnect the fast idle connecting rod and remove the bush, washers and fast idle lever from the spindle.

19. Unscrew the nut and remove the washer and lever from the secondary throttle spindle.

20. Unscrew the throttle plate screws, remove both plates, and withdraw the primary and secondary throttle spindles.

21. Remove the retaining screw and remove the choke operating lever, spring and washer.

To Reassemble

22. Insert the gauze filter into the top cover and screw in the brass plug.

23. Insert the choke spindle into its bore from the right-hand side. Fit the choke plates with the offset portion to the rear, ensuring that the plate chamfers are parallel to the air intake when the plates are closed.

24. Centralise the plates in the air intake and secure each with the two retaining screws. Peen over the threaded ends of the screws.

25. Fit the dust seal to the air cleaner flange, pass the choke rod through the seal and flange, and connect it to the spindle lever.

26. Locate the choke relay lever and washer on its spindle and retain it with a new split pin.

27. Assemble the fast idle rod and toggle spring to the choke operating lever.

28. Locate the return spring around the pivot boss on the carburettor body with the straight end inserted into the location hole.

29. Locate the choke operating lever on the pivot boss and connect the toggle spring to the relay lever. Ensure that the fast idle rod lies between the two throttle spindle bosses and that the relay lever toggle spring arm abuts the cam portion of the choke operating lever.

30. Retain the choke operating lever with the retaining screw fitted with a plain and spring washer.

31. Hook the end of the return spring under the fast idle rod bracket.

32. Insert the secondary throttle spindle into its bore from the front.

33. Turn the throttle spindle until the slot is parallel with the carburettor barrel and the threaded holes inwards. Insert the throttle plate into the slot so that the face marked 78° is outwards with this mark below the throttle spindle. This ensures that the throttle plate chamfers are in the right direction.

34. Centralise the throttle plate in the carburettor barrel and throttle spindle. Fit the retaining screws and peen over the threaded ends after tightening.

35. Fit the throttle lever with the abutment lever against the stop. Retain the lever with the washers and nut.

36. Check the clearance between the secondary throttle plate and the carburettor barrel at its widest point with the throttle closed. Adjust the stop as necessary to give a clearance of 0.0015 in. (0.038 mm.).

37. Insert the primary throttle spindle into its bore.

38. Turn the throttle spindle until the slot is parallel with the carburettor barrel and the threaded holes inwards. Insert the throttle plate into the slot so that the face marked 78° is outwards with this mark below the throttle spindle.

39. Centralise the throttle plate in the carburettor barrel and throttle spindle. Fit the retaining screws and peen over the threaded ends after tightening.

40. Locate the slotted washer, return spring and idling stop lever on the throttle spindle. Engage the hooked end of the spring around the lower arm on this lever, and the straight end on top of the carburettor flange between the throttle barrels. Ensure that the spring coils are not trapped between the lever, the washer or the spindle boss.

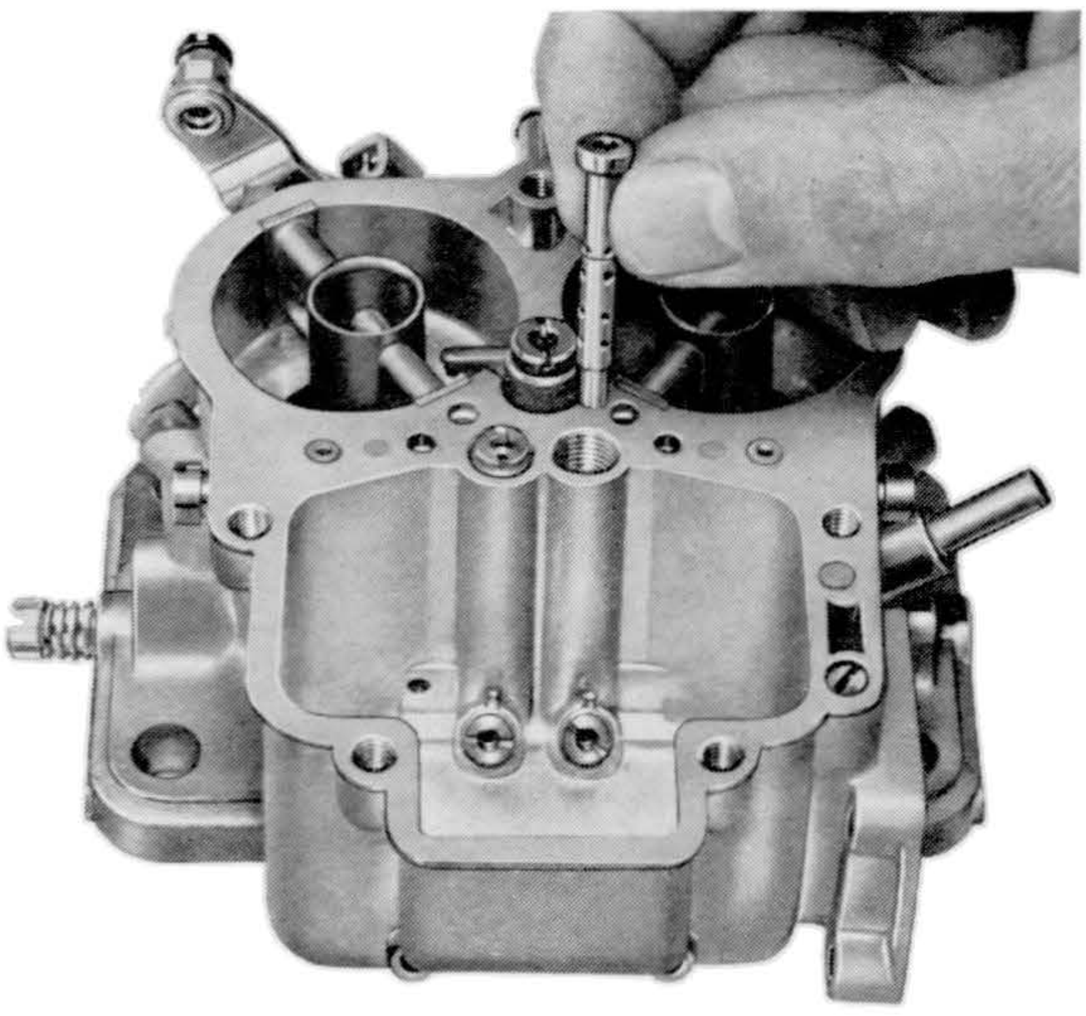
41. Locate a plain washer on the spindle followed by the fast idle lever and wave washer already assembled to the bush.

42. Engage the fast idle connecting rod to the fast idle lever.

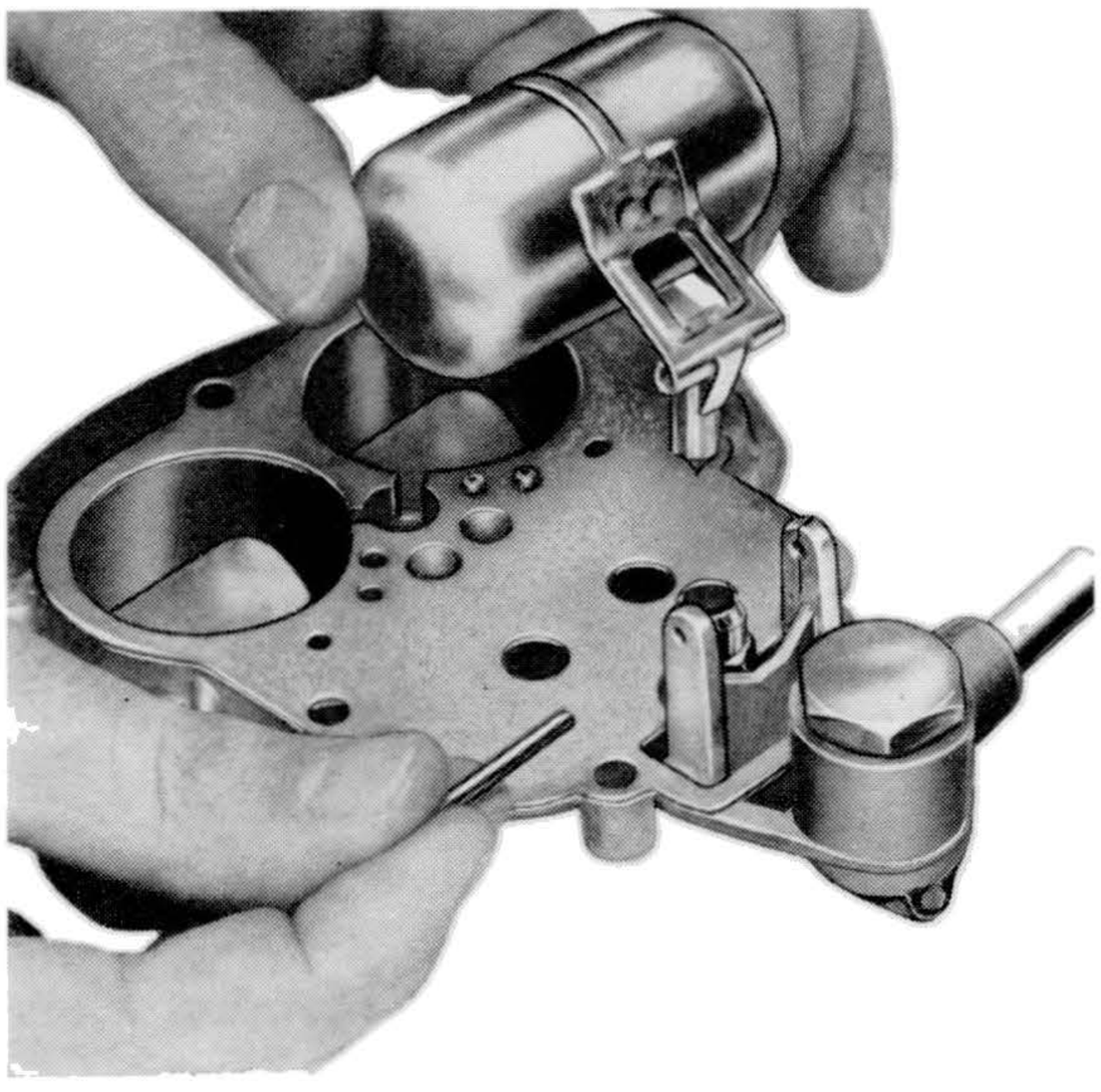
43. Locate the throttle relay lever on the bush, engaging the peg with the slotted hole in the secondary throttle lever.

44. Fit the remaining plain washer and the throttle lever. Fit a new locking plate, screw on the nut, and bend over the tab.

45. Connect the throttle relay lever return spring and fit the split pin to the fast idle connecting rod.



Refitting the Emulsion Tube



Refitting the Float

46. Locate the idling jets in the jet holders and fit one on each side of the float chamber.
N.B. – Primary 50 Secondary 45.

47. Screw the main jets into their locations in the float chamber.
N.B. – Primary 150 Secondary 155.

48. Insert the emulsion tubes into the emulsion tube wells and retain with the air correction jets.
N.B. – Primary 160 Secondary 140.

49. Locate the accelerator pump jet in place with a new gasket and retain with the discharge valve.

50. If removed, refit the accelerator pump lever, insert the plain end of the pivot pin in the lower (No. 2) hole and drive the pin into the cover until the serrated end is flush with the casting.

51. Locate the accelerator pump spring in the recess and position the diaphragm on the cover with the plunger in the operating lever recess.

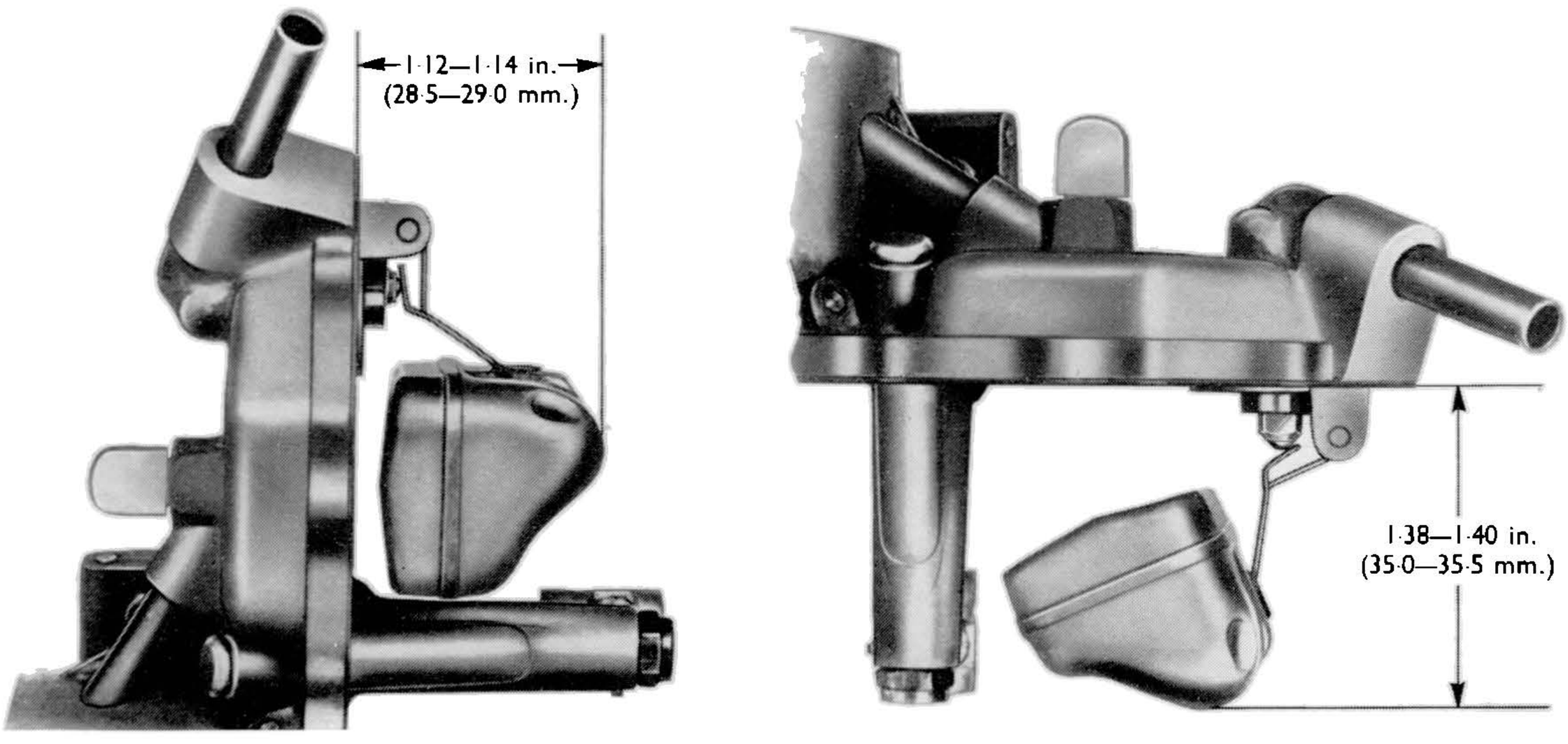
52. Locate the four screws with spring washers in the cover and through the corresponding holes in the diaphragm. Position the assembly on the carburettor body with the operating lever engaging the cam. Pull the lever away from the cam to the limit of the diaphragm travel while tightening the screws.

53. Screw the needle valve housing, fitted with a new gasket, into the float chamber cover.

54. Locate a new gasket on the carburettor upper body, locate the needle valve in the housing and fit the float and pivot pin to the pivot bracket.

55. Check the float and fuel level setting and adjust if necessary, see Operation No. 9510-C.

56. Fit the carburettor upper body to the lower body and connect the choke plate operating rod to the relay lever.



Float and Fuel Level Setting

57. Carefully screw the volume control screw home and then back off 1½ turns.

58. Fit the throttle stop screw until it just contacts the throttle stop lever and then screw in a further half-turn.

59. Check and adjust, if necessary, the fast idle setting, the choke plate pull-down and the choke plate opening, see Operation No. 9510-C.

OP 9510-C CARBURETTOR – OVERHAUL
(includes OPS 9510-A and A2)

OP 9510-M CARBURETTOR – ADJUST

Tools Required

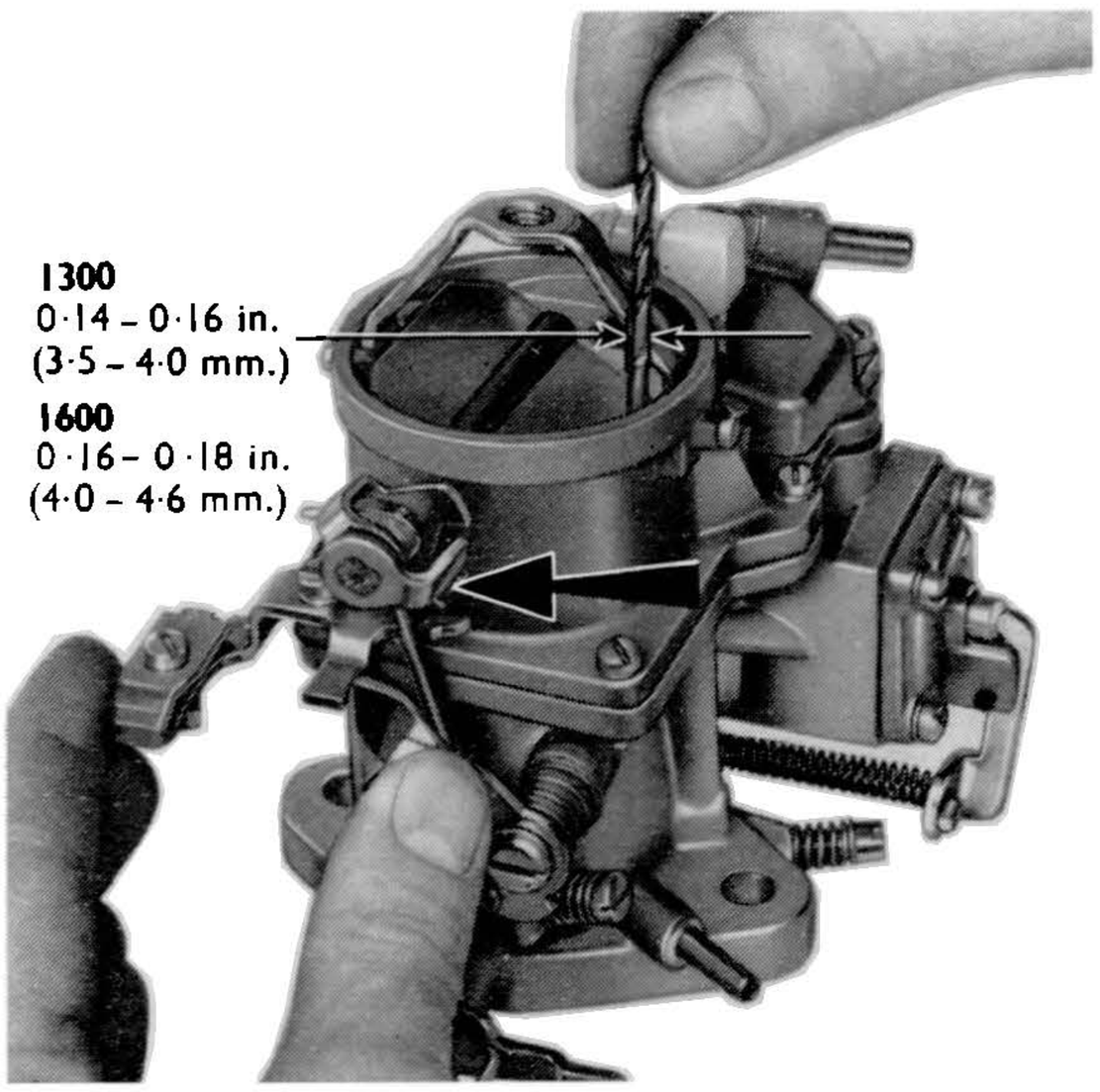
500 X Gang gauge (vacuum gauge)
Tachometer
Exhaust gas analyser

FORD CARBURETTOR

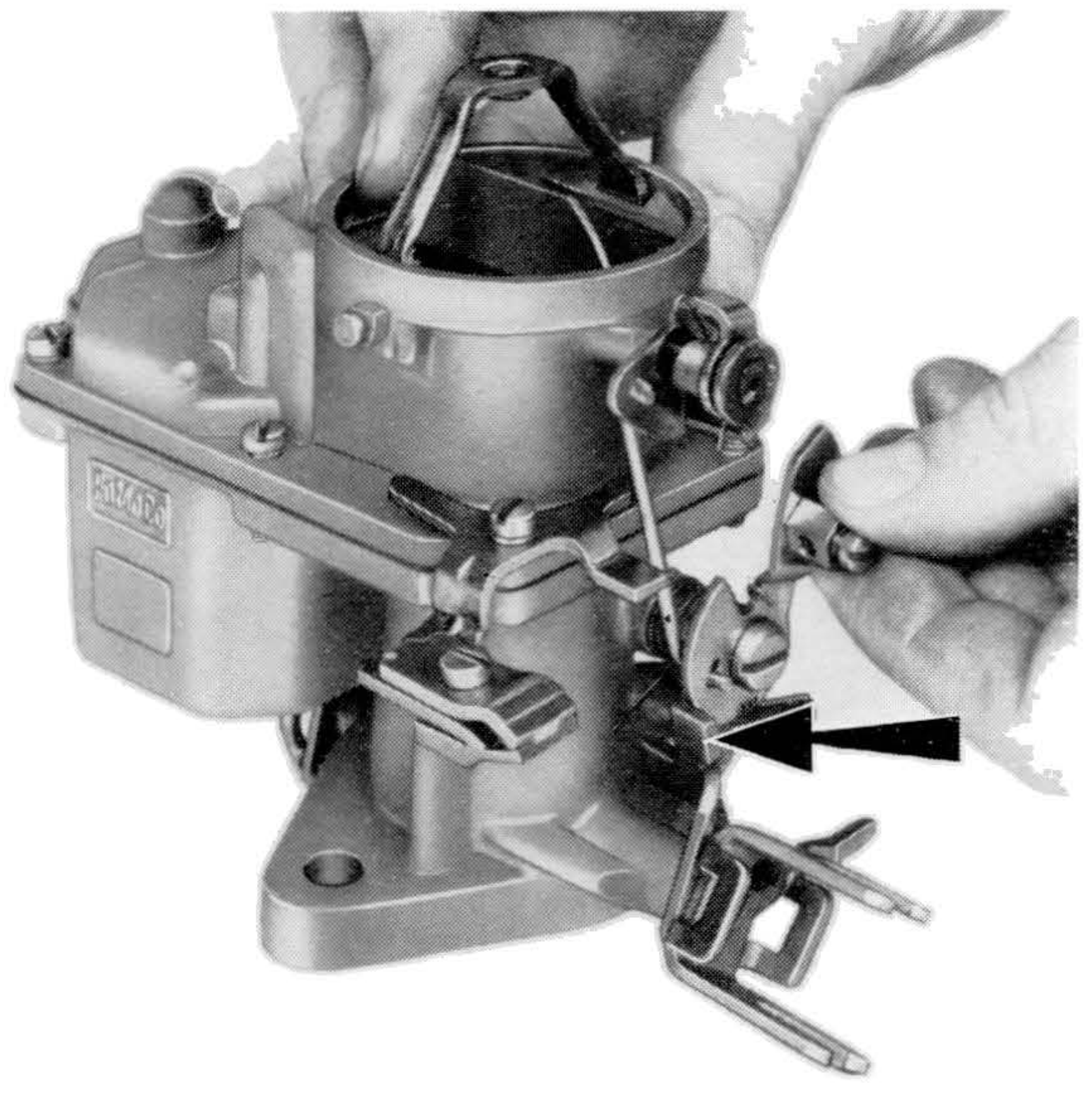
1. Remove the air cleaner, see Operation No. 9600-A sub-operations 1 to 3.
Float and Fuel Level Setting

2. Disconnect the fuel and the vent pipe.

3. Remove the upper to lower body screws and carefully lift the upper body off, ensuring that the gasket comes away with it. Unlatch the choke link as the upper body is lifted off.
NOTE – The choke cable bracket is retained by the rear left-hand screw. Also, the accelerator pump discharge valve will be exposed in its bore when the upper body is removed. Exercise care when operating the throttle linkage in this condition as the valve and weight may be ejected. Serious damage will occur if the valve enters the engine.



Choke Plate Pull-Down Adjustment (Manual Choke)



Fast Idle Adjustment (Manual Choke)

4. Hold the carburettor upper body in the vertical position with the float hanging down.

5. Measure the distance from the bottom of the float to the upper body gasket and adjust to 1.12 to 1.14 in. (28.5 to 29.0 mm.) if necessary, by bending the tab contacting the needle valve.

6. Turn the upper body upright and again measure the distance from the bottom of the float, with the float hanging down, to the gasket. Adjust to 1.38 to 1.40 in. (35.0 to 35.5 mm.) if necessary, by bending the tab resting against the needle valve housing.

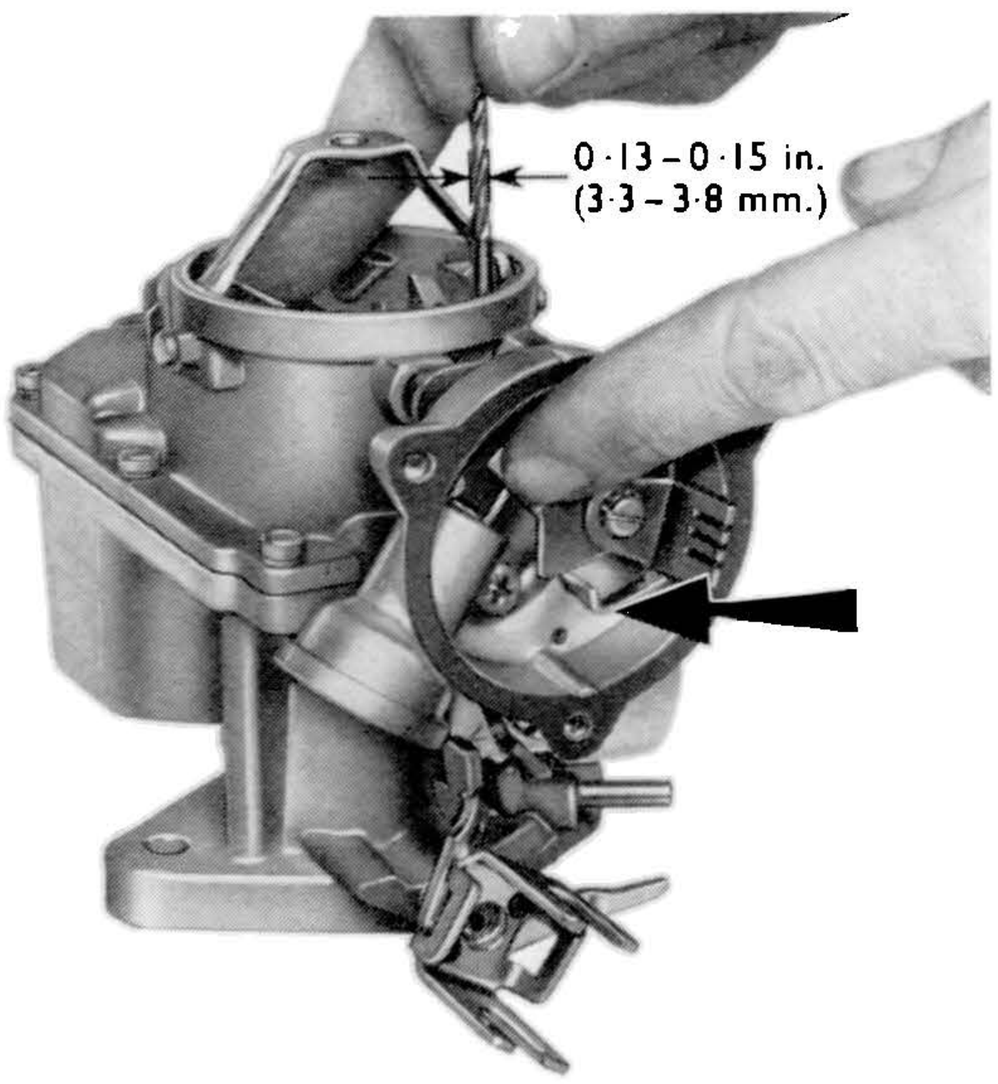
7. Refit the upper body to the lower body, at the same time connect the choke link to the fast idle cam. Position the choke cable bracket beneath the rear left-hand retaining screw. Tighten all the retaining screws while holding the choke lever in the closed position.

   NOTE – Failure to observe this procedure will result in the choke lever being over-centred and the choke rendered inoperative. **Do not force** the lever back to the correct position if this occurs, but slacken the retaining screws and retighten with the lever in the closed position.

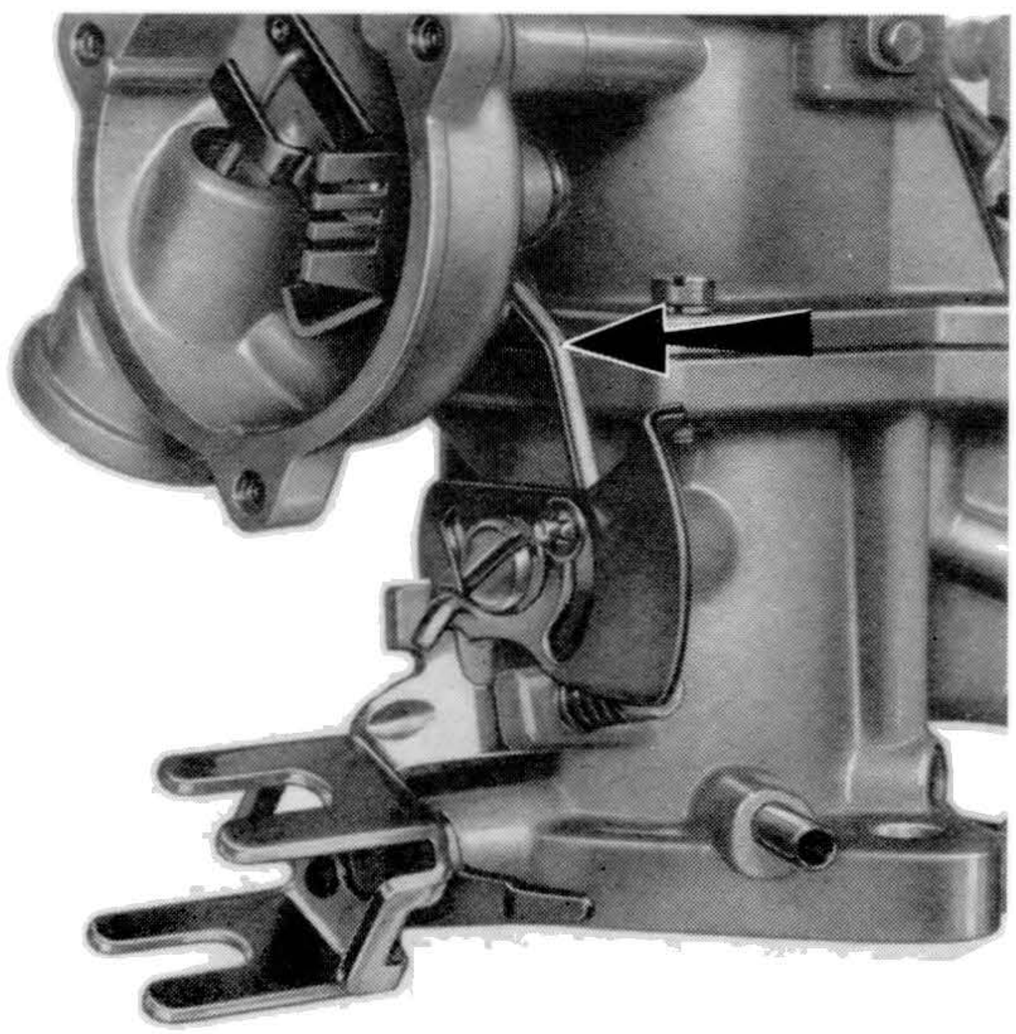
8. Reconnect the fuel and the vent pipe.

Choke Plate Pull-down (Manual Choke only)

9. Rotate the choke lever to its stop and depress the choke plate. Check the clearance between the lower edge of the choke plate and the inside of the carburettor air intake. This measurement should be 0.14 to 0.16 in. (3.5 to 4.0 mm.) for the 1,300 c.c. and 0.16 to 0.18 in. (4.0 to 4.6 mm.) for the 1,600 c.c. engine. A drill or gauge rod can be used in this operation and inserted between the choke plate and the inside of the carburettor air intake. If necessary, bend the tab on the choke spindle to adjust the clearance.



Choke Plate Pull-Down Adjustment (Automatic Choke)



Fast Idle Adjustment Position (Automatic Choke)

Fast Idle (Manual Choke only)

10. Connect a tachometer to the engine.

11. Run the engine until it reaches its normal operating temperature and idling speed of 580 to 620 rev./min.

12. With the engine still running, hold the choke plake in the fully opened (vertical) position and rotate the choke lever until it is stopped by the choke linkage.

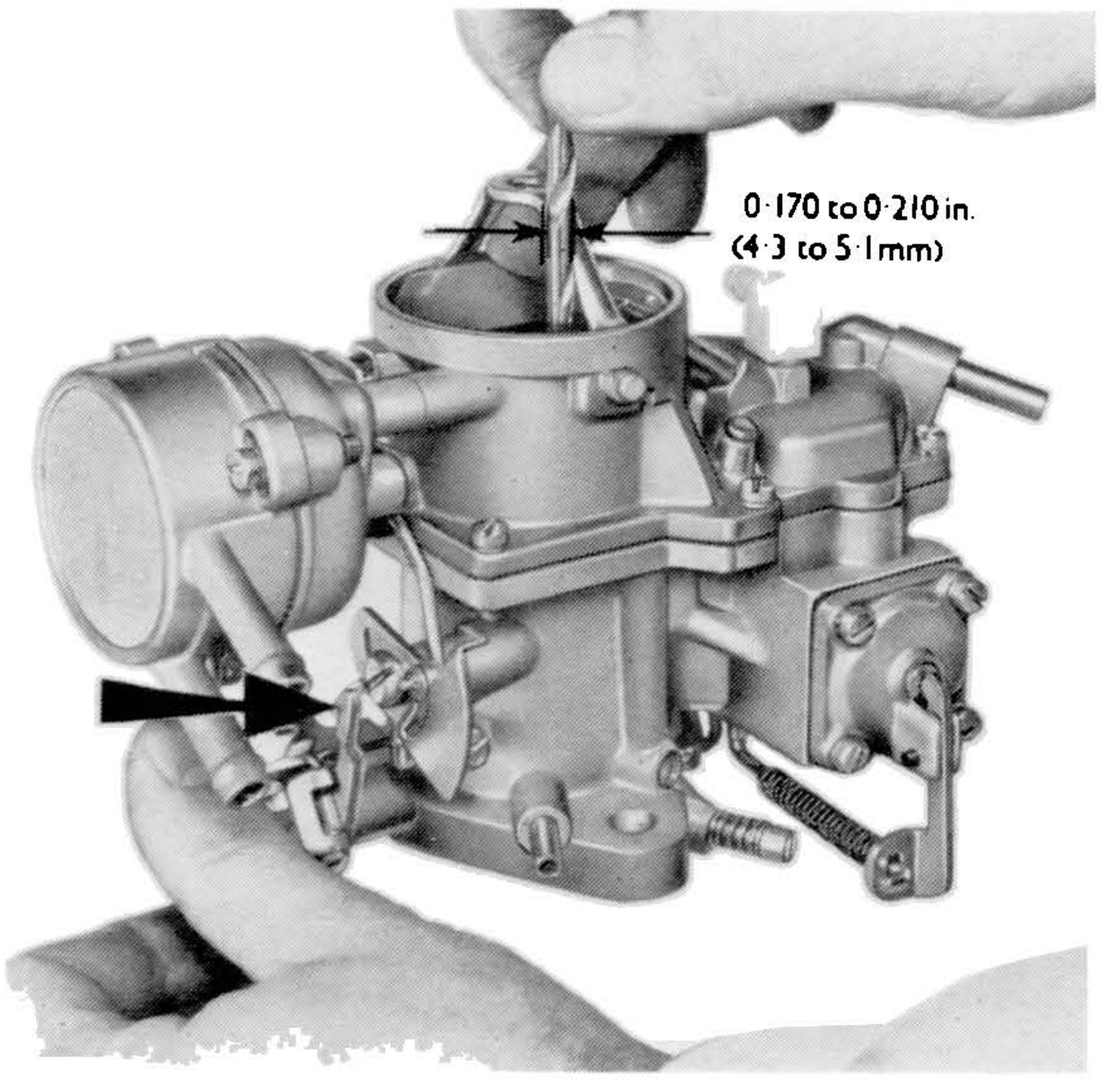
13. Measure the engine speed and adjust, if necessary to 1,100 to 1,300 rev./min. for the 1,300 c.c. engine and 900 to 1,100 rev./min. for the 1,600 c.c. engine by bending the tab contacting the fast idle cam.

14. Refit the air cleaner, see Operation No. 9600-A sub-operations 4 to 6.

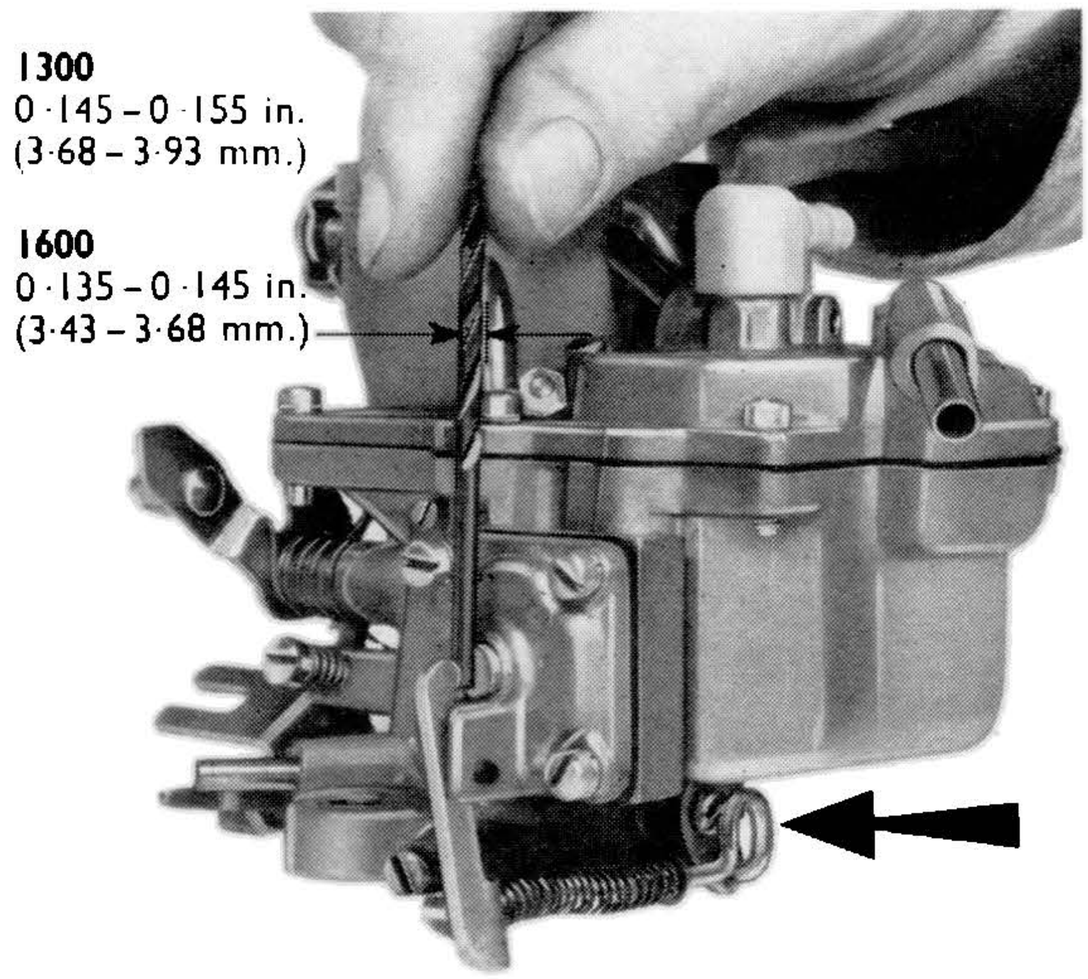
Choke Plate Pull-down (Auto-Choke only)

15. Remove the thermostatic spring and water housing.

16. Hold the vacuum piston in its fully depressed position and manually close the choke plate until its movement is stopped through the linkage, partially opening the throttle, as necessary, for the fast idle tab to clear the cam. The bottom of the choke plate should now be 0.13 to 0.15 in. (3.3 to 3.8 mm.) from the carburettor body. This can be measured with a suitable drill or gauge rod. If necessary, bend the extension of the choke thermostat lever (the part that rests against the vacuum piston lever) to adjust the clearance.



De-choke Adjustment (Automatic Choke)



Accelerator Pump Stroke Adjustment (Manual Choke)

Fast Idle (Auto Choke only)

17. With the choke plate pull-down correctly adjusted and held in the pull-down position, check that the throttle lever fast idle tab is in the first, or high speed, step on the fast idle cam. If necessary bend the fast idle rod at its existing bend to achieve this result.

18. Fit the thermostatic spring and water housing. Locate the spring in the centre slot and align the housing marks before tightening the screws.

19. Connect a tachometer to the engine.

20. Run the engine until it reaches its normal operating temperature.

21. Position the throttle lever fast idle tab on the first step of the cam and check the engine speed. Adjust if necessary to 1,850 to 2,050 rev./min. for temperate climates or 2,200 to 2,400 rev./min. for cold climates by bending the tab contacting the fast idle cam.

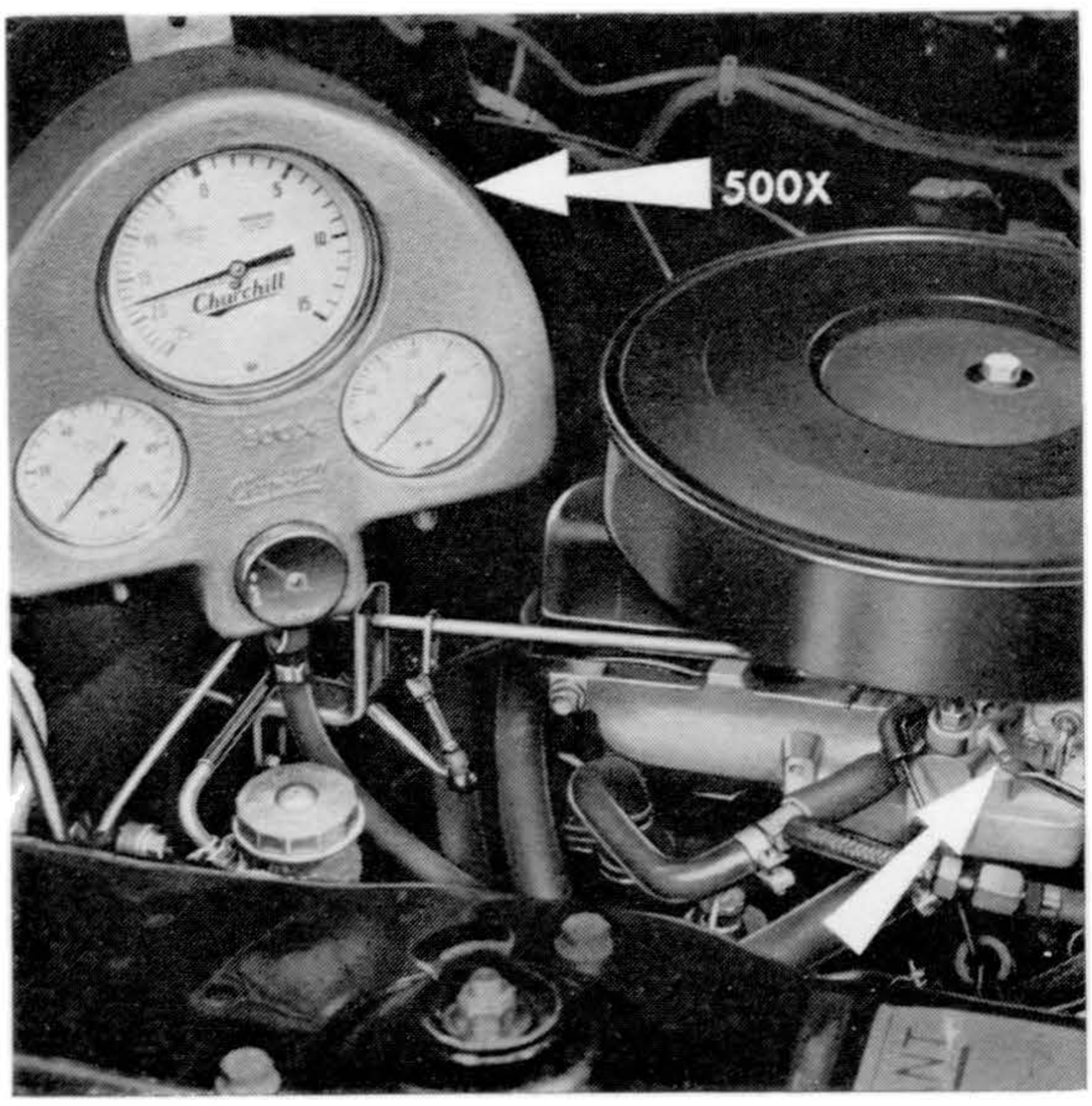
De-choke (Auto Choke only)

22. Open the throttle fully and hold it against the stop. Check the clearance between the bottom of the choke plate and the carburettor body. Adjust if necessary to 0.170 to 0.210 in. (4.32 to 5.08 mm.) by bending the projection on the fast idle cam. A drill or gauge rod can be used to measure the clearance.

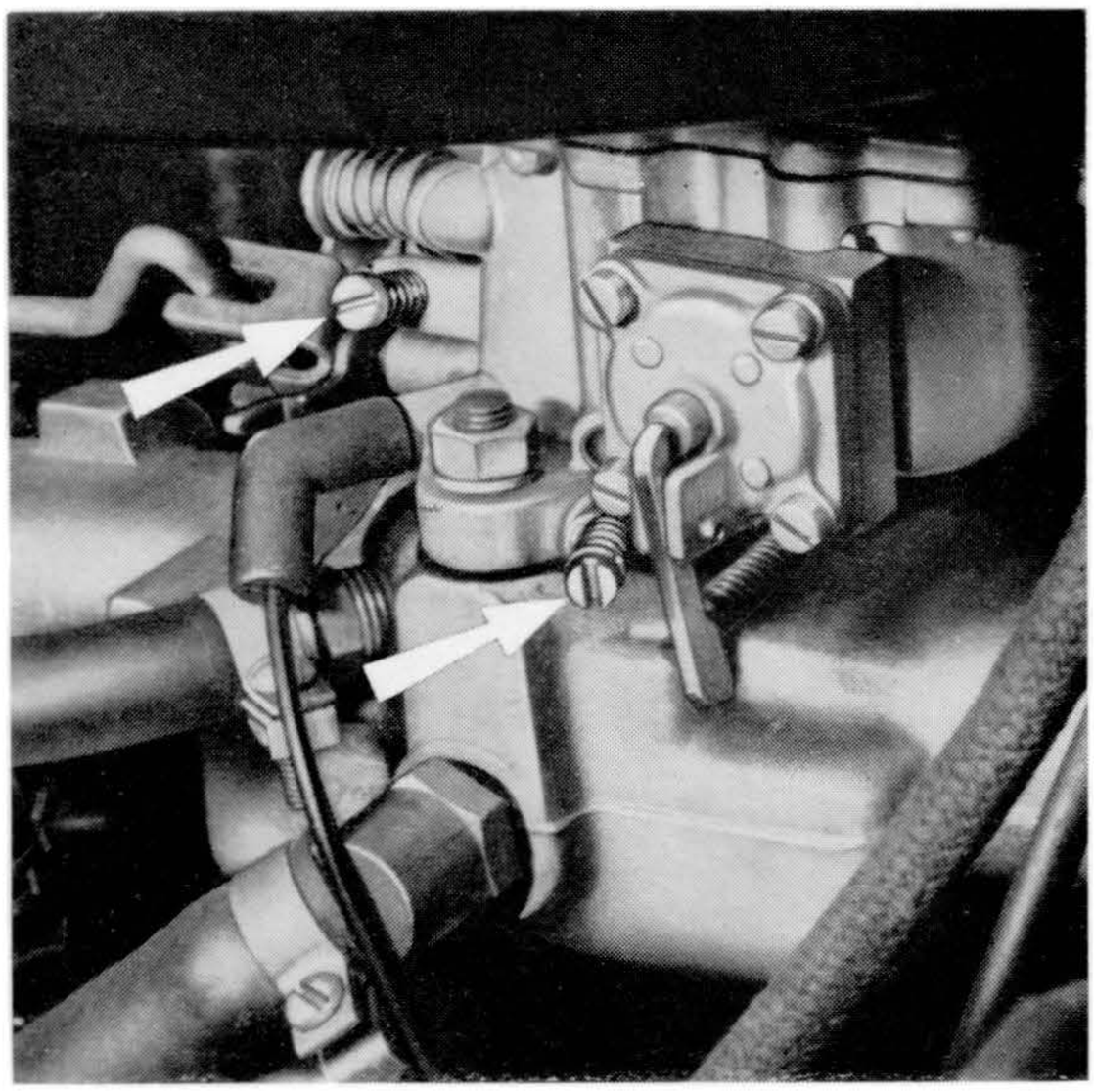
Accelerator Pump Stroke

23. Unscrew the throttle stop screw a few turns until the throttle plate is fully closed.

24. Depress the accelerator pump diaphragm plunger and check the clearance between the operating lever and the plunger. This should be 0.145 to 0.155 in. (3.68 to 3.93 mm.) for all 1.300 c.c. engines and 0.135 to 0.145 in. (3.43 to 3.68 mm.) for manual choke and 0.170 to 0.180 in. (4.32 to 4.57 mm.) for automatic choke 1.600 c.c. engines. This can be checked with a suitable drill or gauge rod. Bend the gooseneck of the pump push rod to adjust the stroke. Close the gooseneck to lengthen the stroke or expand it to shorten the stroke.



Adjusting the Slow-Running with a Vacuum Gauge



Slow-Running Adjustment Screws

25. Reset the throttle stop screw to its original position.

Slow-running Adjustment

26. Connect a vacuum gauge with a suitable Tee connector into the crankcase ventilation tube.

27. Run the engine and adjust the throttle stop screw until the correct idling speed is obtained. Adjust the volume control screw to obtain the maximum vacuum, readjusting the idling speed as necessary.

    NOTE – The crankcase emission valve must be connected to the manifold while carrying out these adjustments.

28. Remove the vacuum gauge and tachometer, refit the plug to the manifold or, where fitted, reconnect the crankcase ventilation tube.

    NOTE – An exhaust gas analyser can be used instead of a vacuum gauge to adjust the slow-running. Connect it in accordance with the manufacturer's instructions and adjust the volume control screw to give the optimum mixture strength.

WEBER CARBURETTOR (G.T.)

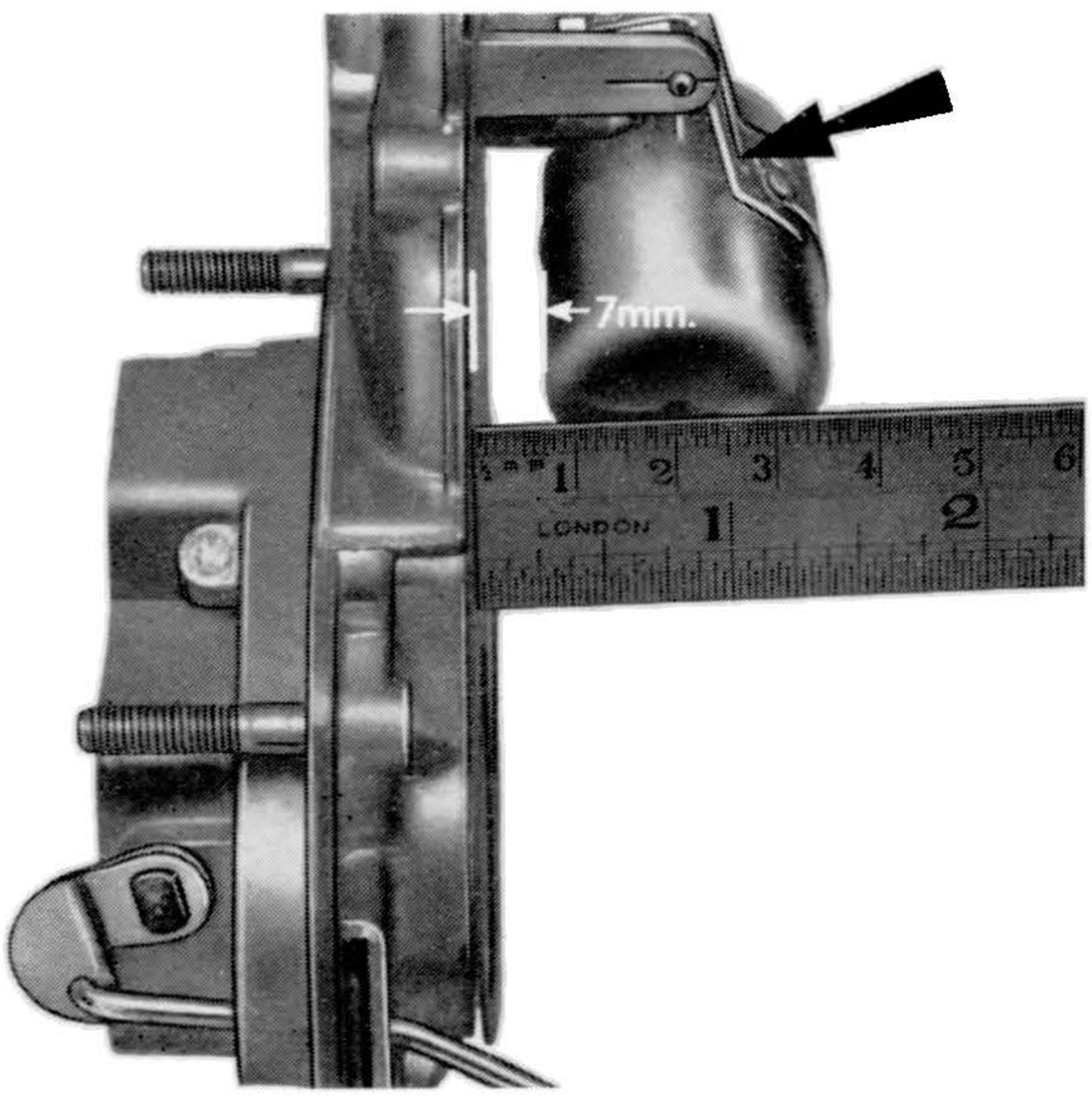
1. Remove the air cleaner, see Operation No. 9600-A sub-operations 1 to 3.

Float and Fuel Level Setting

2. Disconnect the fuel pipe.

3. Disconnect the choke plate operating rod at the lower end.

4. Remove the upper to lower body screws and carefully lift the upper body off, ensuring that the gasket comes away with it.



Float and Fuel Level Setting

5. Hold the carburettor cover in the vertical position with the float hanging down and with the tab which is hooked to the needle valve in light contact with the ball and perpendicular.

6. Measure the distance between the float and the cover gasket, and adjust to 7 mm., if necessary, by bending the arm between the pivot and the float, at the float end.

7. Check that the travel is 8 mm., i.e. 15 mm. from the cover gasket. If necessary, adjust the position of the tab which abuts the needle valve housing to obtain this travel.

8. Refit the upper body to the lower body.

9. Reconnect the choke plate operating rod.

10. Reconnect the fuel pipe.

Fast Idle

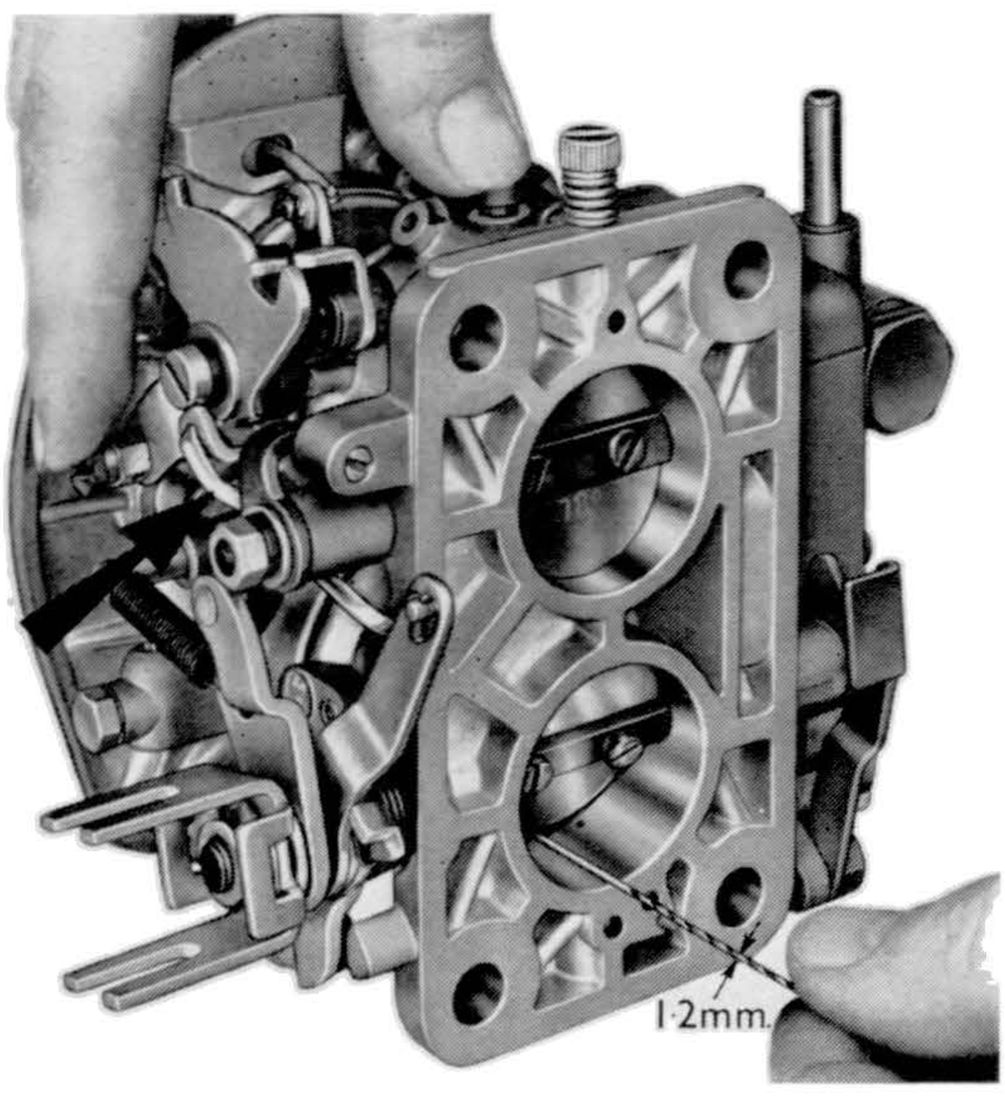
11. Connect a tachometer to the engine.

12. Run the engine until it reaches its normal operating temperature and idling speed of 680 to 720 rev./min.

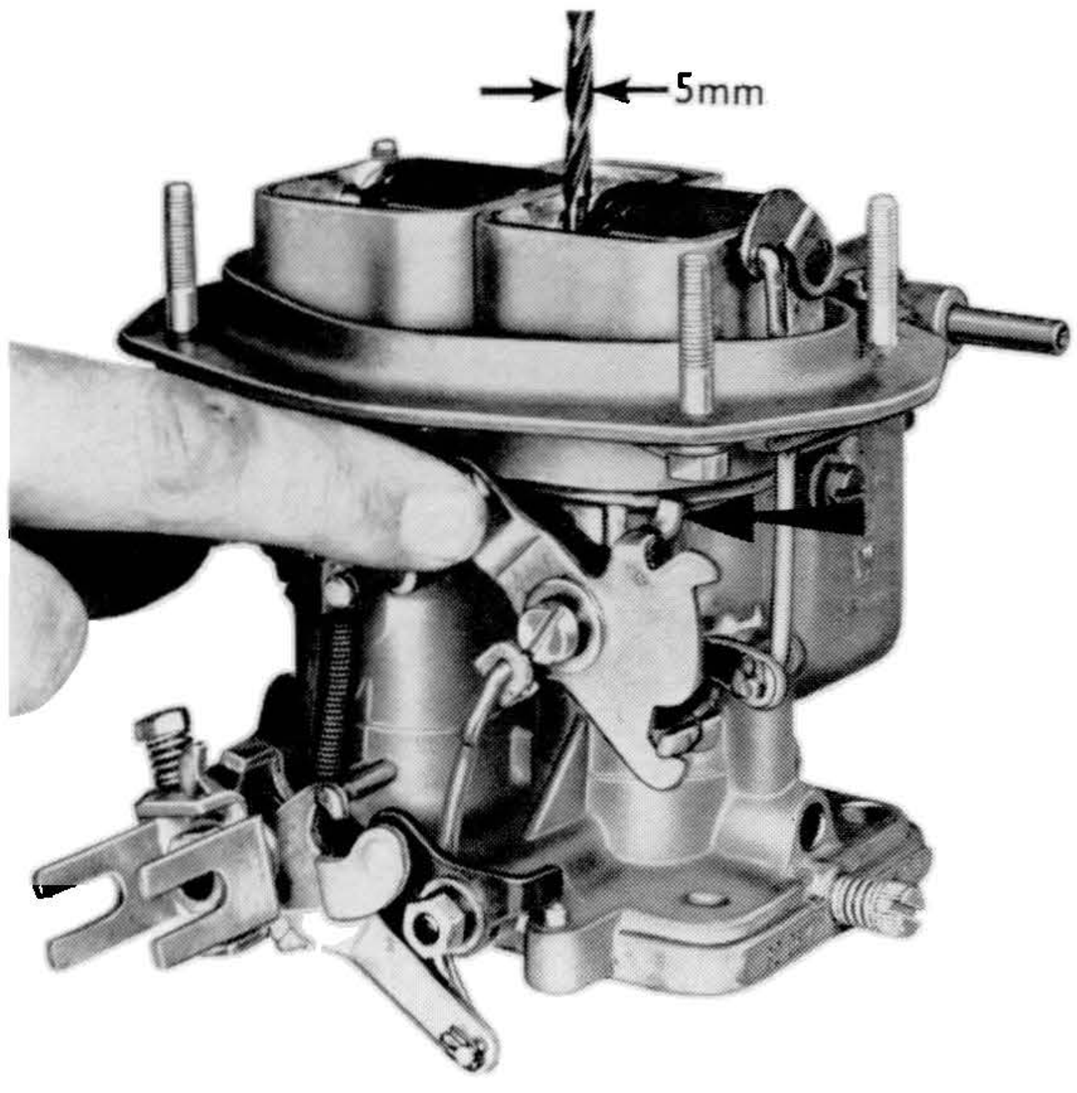
13. With the engine still running, hold the choke plate in the fully opened (vertical) position and rotate the choke lever until it is stopped by the choke linkage.

14. Measure the engine speed and adjust, if necessary, to 2,500 rev./min. by bending the fast idle connecting rod.

NOTE – The fast idle adjustment can be made statically, with the carburettor removed, by measuring the clearance between the primary throttle plate and the carburettor body adjacent to the progression holes, with the choke fully closed. Adjust to 1.2 mm., if necessary, by bending the fast idle interconnecting rod as before.



Fast Idle Adjustment — Statically



Choke Plate Pull-Down Adjustment

Choke Plate Pull-down

15. With the choke fully closed, hold the choke lever against its stop. Open the choke plates against the action of the toggle spring and measure the clearance between the lower edge of the choke plates and the inside wall of the air horn. This should be 5 mm., and can be adjusted by bending the choke lever stop.

Choke Plate Opening

16. From the fully closed position move the lever back 10 mm., measured along the line of the choke cable. Measure the clearance between the lower edge of the choke plates and the inside wall of the air horn. Adjust, if necessary, to 7.5 to 8.5 mm. by slightly bending the cam follower tag on the relay lever. Bend the tag towards the cam to increase the opening and outwards to decrease. As this adjustment is very sensitive only a small degree of bending should be made at a time.

17. Refit air cleaner, see Operation No. 9600-A sub-operations 4 to 6.

Slow-running Adjustment

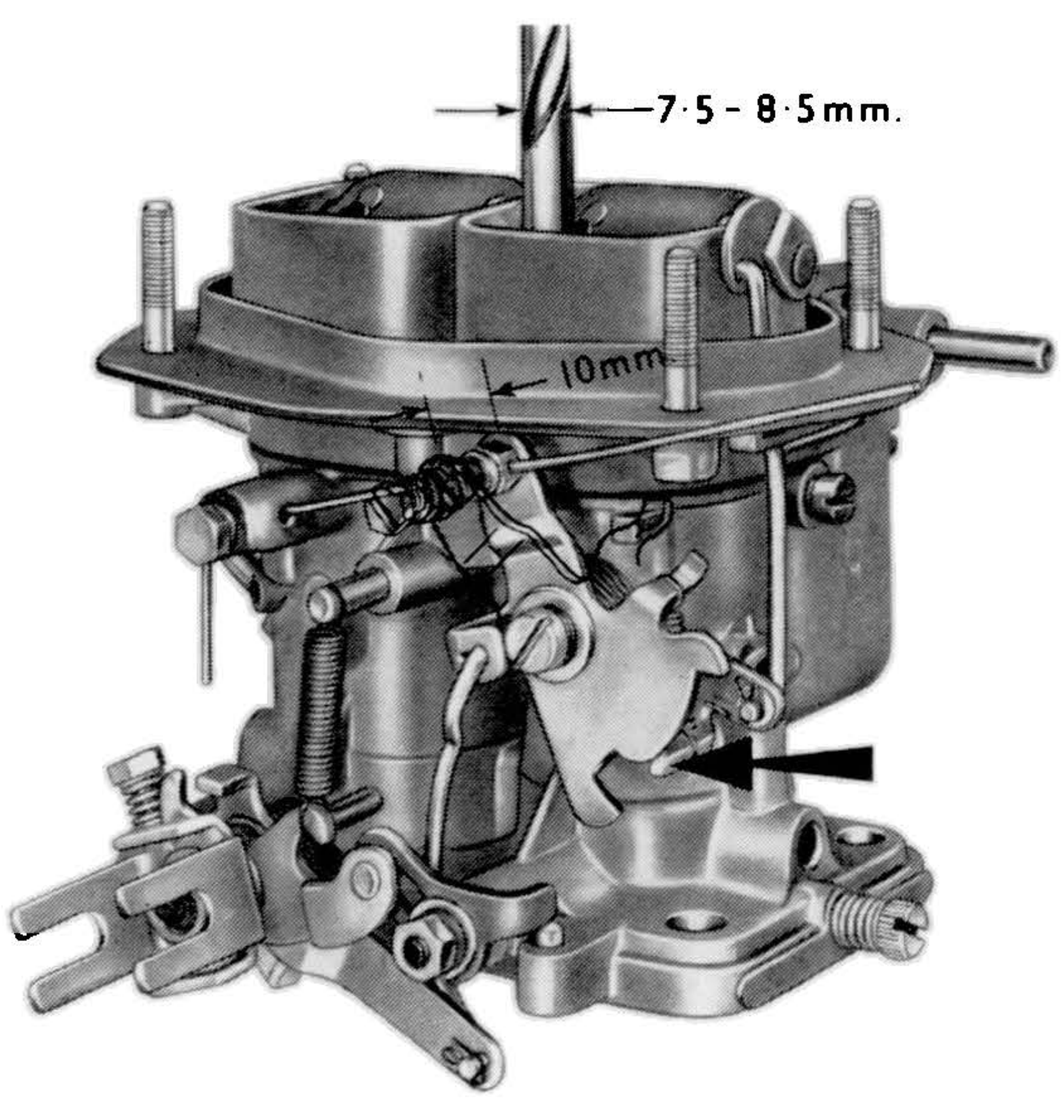
18. Connect a vacuum gauge with a suitable Tee connector into the crankcase ventilation tube.

19. Run the engine and adjust the throttle stop screw until the correct idling speed is obtained. Adjust the volume control screw to obtain the maximum vacuum, readjusting the idling speed as necessary.

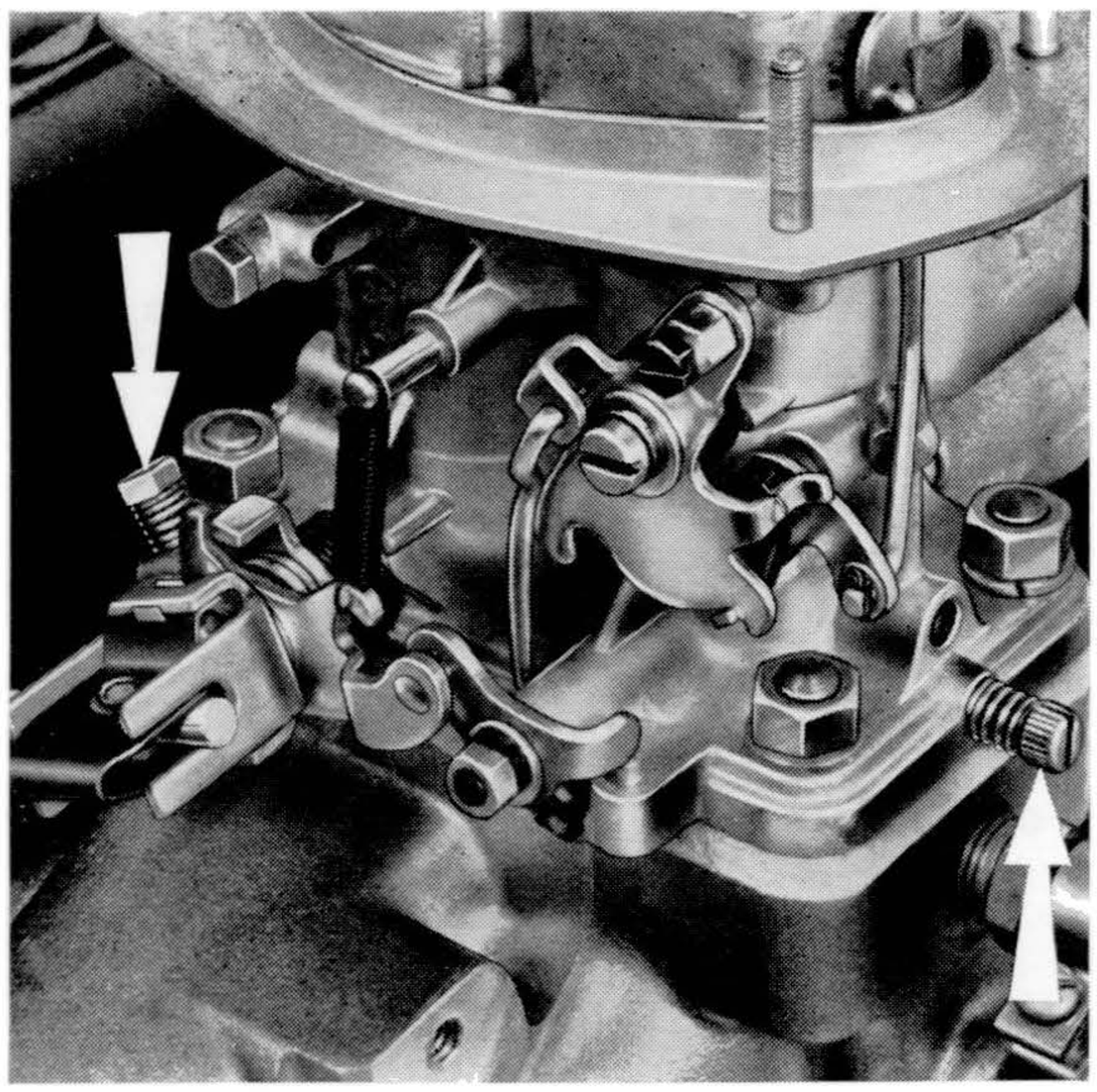
    NOTE – The crankcase emission valve must be connected to the manifold while carrying out these adjustments.

20. Remove the vacuum gauge and tachometer and reconnect the crankcase ventilation tube.

    NOTE – An exhaust gas analyser can be used instead of a vacuum gauge to adjust the slow-running. Connect it in accordance with the manufacturer's instructions and adjust the volume control screw to give the optimum mixture strength.



Choke Plate Opening Adjustment



Slow-Running Adjustment Screws

OP 9533-A CARBURETTOR JETS AND FLOAT CHAMBER – CLEAN

1. Remove the air cleaner, see Operation No. 9600-A sub-operations 1 to 3.

2 Weber Carburettor. Disconnect the choke plate operating rod at the lower end.
Ford Carburettor – Auto-choke only. Remove the thermostatic spring and water housing.

3. Remove the upper to lower body screws and carefully lift the upper body off, ensuring that the gasket comes away with it. On the "Ford" carburettor unlatch the choke link as the upper body is lifted off, note also that the manual choke bracket is retained by the rear left-hand screw.

   NOTE – On the "Ford" carburettor the accelerator pump discharge valve will be exposed in its bore when the upper body is removed. Exercise care when operating the throttle linkage in this condition as the valve and weight may be ejected. Serious damage will occur if the valve enters the engine.

4. Wash the float chamber with clean petrol (gasoline).

5. Remove the main jet, "Ford" carburettor, or all jets on the "Weber" carburettor, blow through to clean and refit.

6. Refit the upper body to the lower body.

   On the "Ford" carburettor connect the choke link to the fast idle cam while fitting the upper body, also position the manual choke cable bracket beneath the rear left-hand retaining screw. Tighten the retaining screws on this carburettor while holding the choke lever in the closed position.

   NOTE – Failure to observe this procedure will result in the choke lever being over-centred and the choke rendered inoperative. **Do not force** the lever back to the correct position if this occurs, but slacken the retaining screws and retighten with the lever in the closed position.

7. Weber carburettor. Reconnect the choke plate operating rod.

   Ford carburettor – Auto-choke only. Fit the thermostatic spring and water housing. Locate the spring in the centre slot and align the housing marks before tightening the screws.

8. Refit the air cleaner, see Operation No. 9600-A sub-operations 4 to 6.

OP 9600-A AIR CLEANER – REMOVE AND INSTALL

FORD CARBURETTOR

To Remove

1. Unscrew the centre bolt and lift the air cleaner assembly off the carburettor.

2. Remove the cover from the body.

3. Remove the element from the body.

To Install

4. Locate the body on the carburettor with the spout facing towards the front of the engine compartment.

5. Place the element into the body and centralise it on its seat.

6. Position the cover on the body with the alignment arrow pointing along the spout and retain with the centre bolt tightened to a torque of 3 to 5 lb. ft. (0.42 to 0.69 kg.m.).

WEBER CARBURETTOR

To Remove

1. Unscrew the two nuts in the dished section of the air cleaner and lift the cover off.

2. Lift out the paper element.

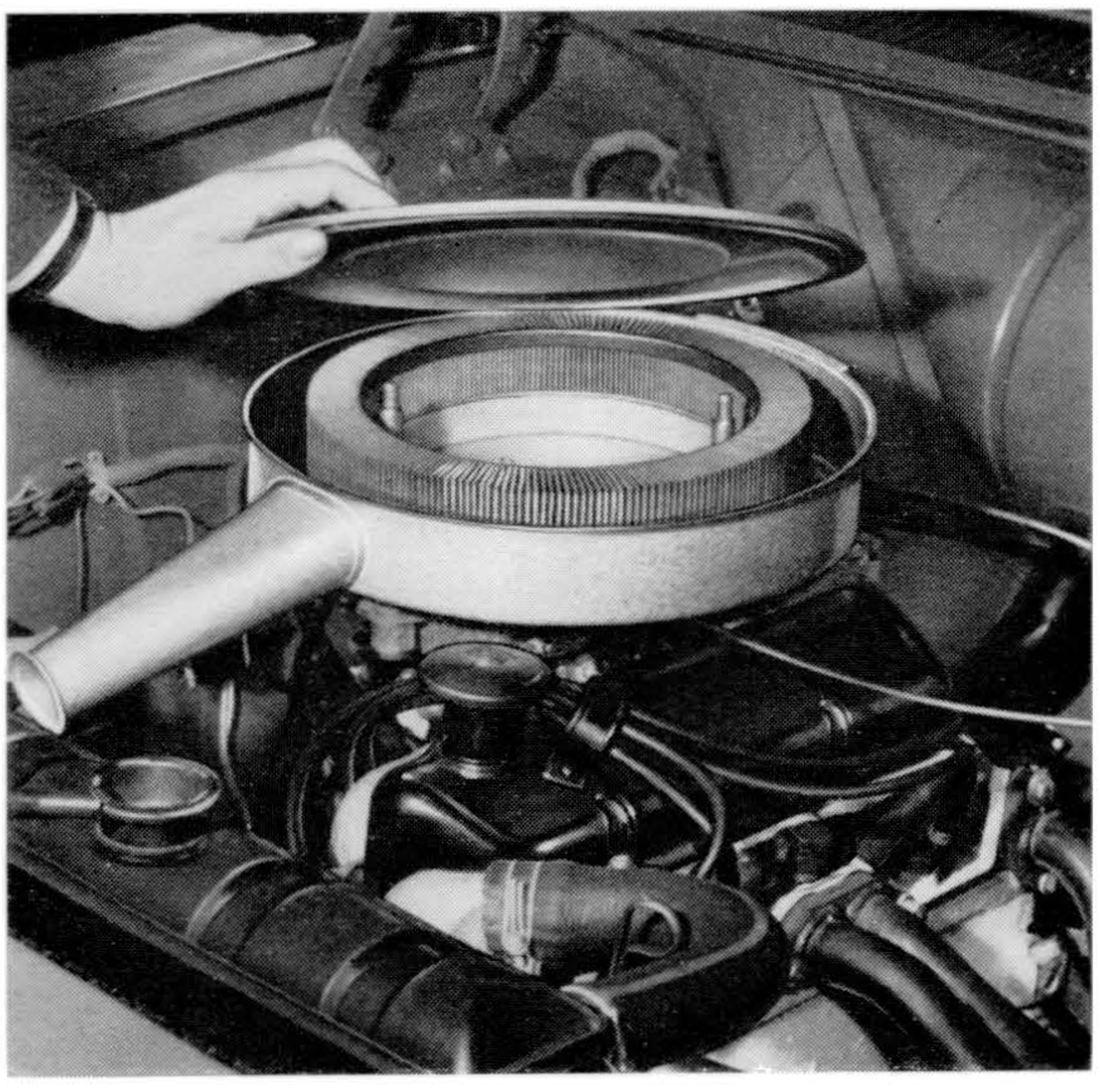
3. Bend back the locking tabs, unscrew the nuts and remove the locking plates, plain washers and rubber washers. Lift the air cleaner body off. Remove the gasket and tubular inserts.

To Install

4. Locate the tubular inserts over the studs and fit a new gasket. Locate the air cleaner body on the carburettor, fit the rubber and plain washer followed by new locking plates and retain with the nuts. Bend up the locking tabs after tightening the nuts to a torque of 2.5 to 3 lb. ft. (0.35 to 0.42 kg.m.).

5. Replace the element and centralise it on its seat.

6. Carefully fit the top cover, aligning the arrow on the cover with the cleaner spout. Tighten the two nuts securely to a torque of 5 to 7 lb. ft. (0.69 to 0.97 kg.m.).



Paper Element Air Cleaner — G.T.

OP 9700-A CHOKE CONTROL CABLE - RENEW

To Remove

1. Raise the bonnet and fit wing covers.
2. Disconnect the choke cable at the carburettor.
3. Remove the choke control from the facia by pulling out the inner cable and then unscrewing the chrome bezel and removing the outer cable.

To Install

4. Replace the outer cable and tighten the chrome bezel. Feed the inner cable through the outer until it protrudes at the carburettor end.
5. Reconnect the choke cable with both the choke control knob and the lever in the OFF position.
6. Remove the wing covers and close the bonnet.

OP 9725-A THROTTLE CONTROL ROD – REMOVE AND INSTALL

To Remove

1. Raise the bonnet and fit wing covers.
2. Remove the clip and pull the connecting rod upper ball joint socket off the control shaft lever.
3. Press the ends of the clip together and pull the control rod back towards the bulkhead to disconnect the clip from the carburettor throttle lever.
4. Withdraw the control rod from the bulkhead bracket.

To Install

5. Position the end of the rod in the grommet located in the hole in the bulkhead bracket.
6. Press the ball end of the rod into the clip and then push the clip into the throttle, thus re-forming the universal joint.
7. Reconnect the connecting rod upper ball joint socket to the control rod lever and refit the clip.
8. Remove the wing covers and close the bonnet.

OP 9735-A THROTTLE PEDAL ASSEMBLY – REMOVE AND INSTALL

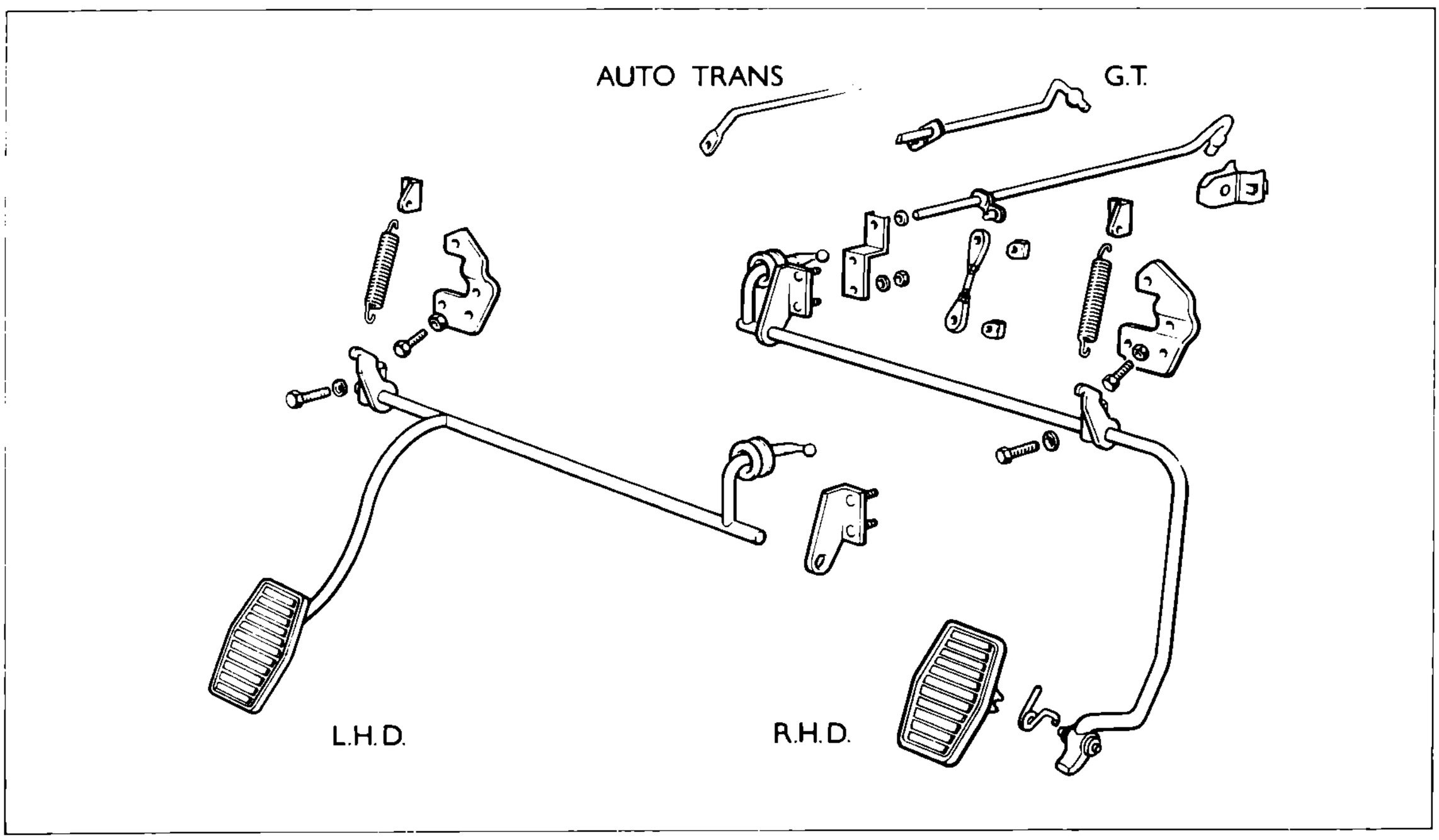
To Remove

1. Remove the heater assembly as in OP 18467-A of section 10.
2. Disconnect the throttle return spring from the lever on the cross-shaft.
3. Remove the clip and disconnect the connecting rod lower ball joint socket from the cross-shaft.
4. Remove the bolt and spring washer securing the cross-shaft to the bracket at the pedal end of the cross-shaft.

5. Remove the two nuts and spring washers from the engine side of the bulkhead, which secure the cross-shaft support bracket and the throttle control rod pivot bracket.
6. Remove the pedal assembly carefully manoeuvring the ball ended part of the cross-shaft through the grommet in the bulkhead.

To Install

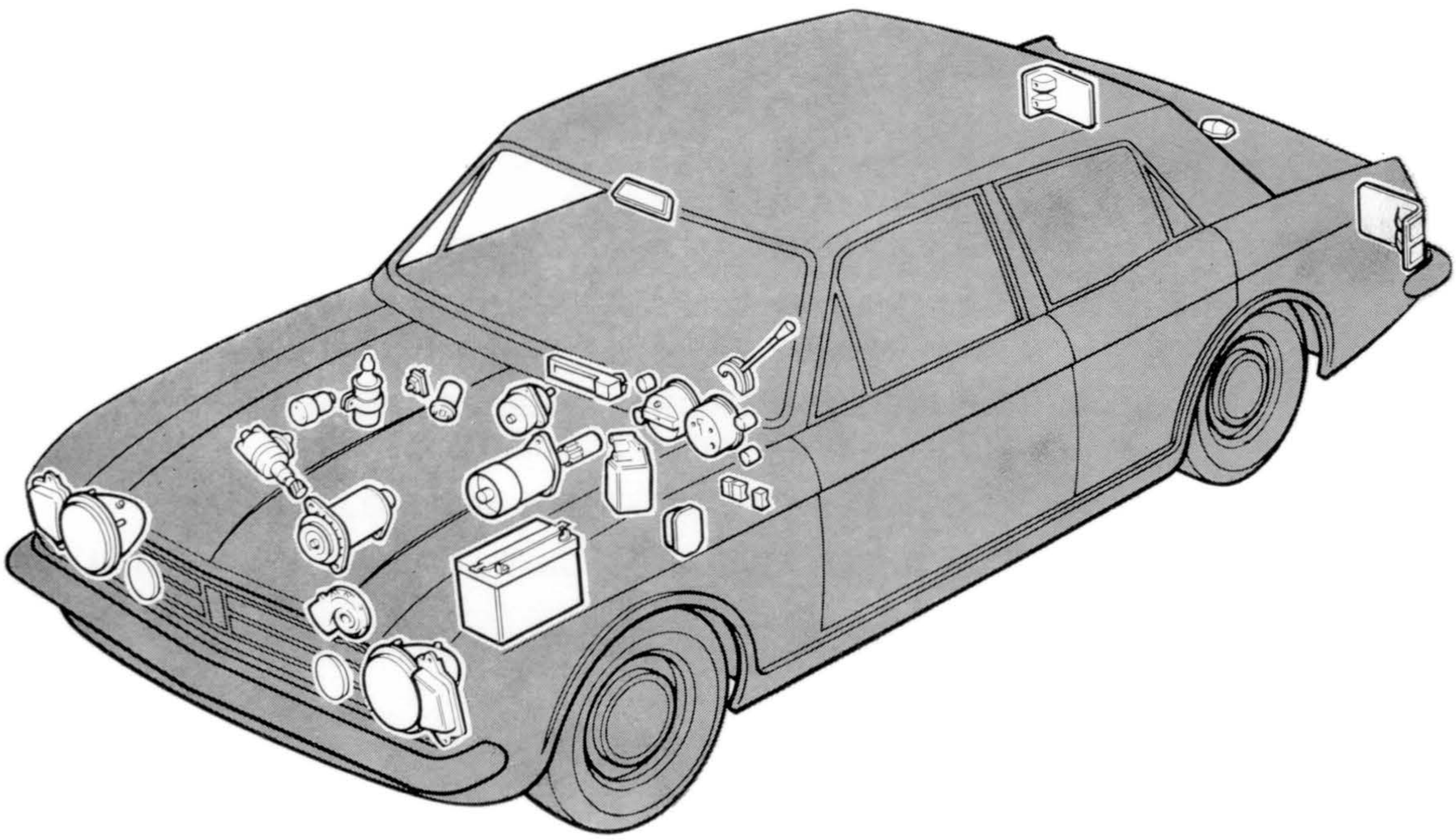
7. Insert the ball ended part of the cross-shaft through the grommet in the bulkhead and position the assembly in place.
8. Insert the cross-shaft support bracket studs from the car interior through the bulkhead and fit the throttle control rod pivot bracket and secure with spring washers and nuts.
9. Secure the cross-shaft to the bracket at the pedal end of the shaft with a spring washer and bolt.
10. Reconnect the throttle return spring to the lever on the cross-shaft.
11. Adjust the accelerator pedal return stop, if necessary, until the front face of the accelerator pedal pad is 5.04 in. (128.0 mm.) R.H.D., or 4.52 in. (114.8 mm.) L.H.D., from the floor pan.
12. With the carburettor in the idling position adjust the connecting rod length to the distance between the ball ends and then tighten the locknuts.
13. Reconnect the connecting rod lower ball joint socket to the cross-shaft and refit the clip.
14. Check that full throttle is obtained when the accelerator pedal is depressed and that the throttle returns to the idling position, again, when the pedal is released. Readjust if necessary.
15. Replace the heater assembly as in OP 18467-A of section 10.



Accelerator Linkage

10

ELECTRICAL SYSTEM



SECTION INDEX

GENERAL DESCRIPTION

CHARGING SYSTEM

GENERAL DESCRIPTION

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OPERATION	10001-A	GENERATOR ASSEMBLY – REMOVE AND INSTALL
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,,	10001-A2	Extra: generator front bearing – renew (Generator pulley removed)
,,	10001-A3	Extra: brushes – renew and commutator – clean (Generator pulley removed)
,,	10001-A4	Extra: generator – overhaul (Generator brushes and commutator removed)
,,	10001-B	**GENERATOR PULLEY – REMOVE AND INSTALL** (Includes OPS 10001-A and A1)
,,	10001-C	**GENERATOR BRUSHES – RENEW AND COMMUTATOR – CLEAN** (Includes OPS 10001-A, A1 and A3)
,,	10001-D	**GENERATOR ASSEMBLY – OVERHAUL** (Includes OPS 10001-A, A1, A3 and A4)
,,	10001-E	**GENERATOR FRONT BEARING – RENEW** (Includes OPS 10001-A, A1 and A2)
,,	10001-M	CHARGING CIRCUIT – TEST AND ADJUST
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,, 11001-C **STARTER MOTOR BRUSHES – RENEW AND COMMUTATOR – CLEAN**
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,, 12100-A2 Extra: condenser – renew (distributor cap removed)

,, 12100-A3 Extra: points – renew (distributor cap removed)

,, 12100-A4 Extra: distributor breaker plate assembly – remove and install (distributor cap removed)

,, 12100-A5 Extra: distributor breaker plate assembly – overhaul (breaker plate removed)

,, 12100-A6 Extra: governor weights and springs – renew (breaker plate removed)

,, 12100-A7 Extra: vacuum unit – renew (breaker plate removed)

,, 12100-A8 Extra: distributor – overhaul (governor weights and vacuum unit removed)

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,, 12100-E DISTRIBUTOR ASSEMBLY – TEST AND ADJUST

,, 12199-A CONTACT BREAKER POINTS – RENEW (DISTRIBUTOR IN SITU)

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,, 10844-A DUAL BRAKE TEST LIGHT AND/OR BULB – REMOVE AND INSTALL

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,, 10883-A TEMPERATURE GAUGE – REMOVE AND INSTALL

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,, 11654-M COMBINED LIGHT SWITCH, PANEL SWITCH, DUAL BRAKE TEST SWITCH AND HAZARD LIGHT SWITCH ASSEMBLY – REMOVE AND INSTALL

,, 13000-A HEADLAMPS - ALL - ALIGN

,, 13005-A HEADLAMP SEALED BEAM UNIT - REMOVE AND INSTALL

,, 13005-A1 Extra: remaining sealed beam unit – remove and install

,, 13005-B HEADLAMP SEALED BEAM UNITS – REMOVE AND INSTALL
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,, 13200-A COMBINED DIRECTION INDICATOR AND HAZARD WARNING LAMP ASSEMBLY – ONE - REMOVE AND INSTALL – U.S. ONLY

,, 13200-A FRONT INDICATOR AND/OR SIDE LAMP ASSEMBLY - REMOVE AND INSTALL

,, 13335-A DIRECTION INDICATOR, HEADLAMP FLASHER AND HORN SWITCH ASSEMBLY – REMOVE AND INSTALL

,, 13350-A FLASHER UNIT – REMOVE AND INSTALL

,, 13368-A COMBINED DIRECTION INDICATOR AND HAZARD WARNING LAMP LENS AND/OR BULB – ONE – REMOVE AND INSTALL – U.S. ONLY

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,,	13404-A2	Extra: rear lamp assembly – one – remove and install
,,	13404-A3	Extra: rear lamp bezel and/or lens – remove and install
,,	13404-B	**REAR DIRECTION INDICATOR AND/OR STOP/TAIL LAMP BULBS – ALL – REMOVE AND INSTALL** (Includes OPS 13404-A and A1)
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,,	13404-D	**REAR LAMP ASSEMBLIES – BOTH – REMOVE AND INSTALL** (Includes OPS 13404-A, A1 and A2 × 2)
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,,	13404-F	**REAR LAMP BEZELS AND/OR LENS – BOTH SIDES – REMOVE AND INSTALL** (Includes OPS 13404-A, A1, A2 × 2 and A3 × 2)
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,,	13543-B	REAR LICENCE PLATE LAMP – REMOVE AND INSTALL
,,	13740-A	INSTRUMENT PANEL LIGHT SWITCH – REMOVE AND INSTALL
,,	13776-A	INTERIOR LIGHT – REMOVE AND INSTALL
,,	13801-A	HORN – REMOVE AND INSTALL
,,	13990-A	WARNING LIGHT BULB – RENEW
,,	14067-A	FUSE BLOCK ASSEMBLY – REMOVE AND INSTALL
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,,	15055-A	CIGARETTE LIGHTER ASSEMBLY – REMOVE AND INSTALL
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,,	17262-A	SPEEDOMETER INNER CABLE – REMOVE AND INSTALL
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,,	17360-A	TACHOMETER – REMOVE AND INSTALL
,,	17508-A	WINDSCREEN WIPER ASSEMBLY – REMOVE AND INSTALL
,,	17508-A1	Extra: windscreen wiper motor brushes – renew
,,	17508-A2	Extra: windscreen wiper motor or linkage – renew

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,,	17508-A4	Extra: windscreen wiper motor – overhaul
,,	17508-B	**WINDSCREEN WIPER MOTOR BRUSHES – RENEW** (Includes OPS 17508-A and A1)
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,,	17508-D	**WINDSCREEN WIPER LINKAGE – OVERHAUL** (Includes OPS 17508-A, A2 and A3)
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,,	18309-M	HEATER CONTROL CABLES – BOTH – ADJUST
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,,	18467-A3	Extra: heater motor – remove and install
,,	18467-C	**HEATER RADIATOR – REMOVE AND INSTALL** (Includes OPS 18467-A and A2)
,,	18467-D	**HEATER MOTOR – REMOVE AND INSTALL** (Includes OPS 18467-A, A2 and A3)
,,	18470-A	FACE LEVEL VENT – REMOVE AND INSTALL
,,	18503-A	HEATER CONTROLS BEZEL – REMOVE AND INSTALL
,,	18503-B	HEATER CONTROLS MOUNTING PANEL – REMOVE AND INSTALL

WIRING SYSTEM

ILLUSTRATIONS OF LOOM CONNECTIONS

WIRING DIAGRAMS

GENERAL DESCRIPTION

The electrical system is of 12 volts with a negatively earthed battery, in line with latest practice. The lead-acid battery, of either 38 or 57 amp. hour capacity is mounted on a tray in the engine compartment, forward of the right-hand suspension leg. A conventional generator, of either 22 amp or 25 amp maximum output, is used to charge the battery. This is mounted on a bracket at the left-hand side of the engine, and is driven at 1½ times engine speed by the fan belt. On automatic transmission cars, the generator is driven at 1.8 times engine speed, since engine speeds tend to be slower. A three-bobbin regulator controls the generator output by inserting a resistance in the field coil circuit. The three bobbins are the cut-out, the voltage regulator and the current regulator.

Three types of starter motor are available and are all fitted to the lower right-hand side of the engine. The first type is the conventional inertia starter motor, with the brushes on either side of the commutator. The second starter motor is a pre-engaged type, which, as the name implies, engages with the ring gear before beginning to rotate, and does not disengage until the starter control is released.

The third type is also pre-engaged, but differs from the others in that the brushes are situated so that they bear on the end of a face type commutator.

All three starter motors engage with either the ring gear, shrunk onto the engine flywheel, or where fitted, with a ring gear integral with the automatic transmission torque converter. Current is supplied to the motor by a solenoid switch which is controlled by the ignition switch on the facia.

The ignition system consists of a Ford distributor, an oil filled coil and Autolite Powertip spark plugs. The distributor is mounted on the right-hand side of the engine, and driven by a skew gear from the camshaft.

The ignition advance is controlled according to engine speed by governor weights within the distributor body, and according to engine load by vacuum control from the inlet manifold. The oil filled coil is used in conjunction with a special starter solenoid, and a ballast resistor wire. This arrangement ensures that during starting, full battery voltage is applied to the coil to facilitate engine firing. All high tension leads are of the suppressor type.

Two instrument dials are fitted as standard. These are a speedometer, incorporating a main beam warning light, and a cluster of fuel and temperature gauges and generator and oil pressure warning lights. Switches for the driving lights, instrument panel lights and heater blower are of the tumbler type. Headlamp dipping and flashing together with direction indicator and horn controls are combined in a single steering column lever. Direction indicator warning lights are mounted on the facia, as is the ignition switch. The rotary type windscreen wiper switch is combined with a windscreen washer plunger on the facia.

On G.T. models, the instrument cluster is replaced by a tachometer, and separate fuel and temperature gauges together with an ammeter and oil pressure gauge are mounted above the centre of the facia. In addition, an electric clock is mounted on the console.

The wiring loom is in four sections. The main loom connects all the instruments, controls and warning lights, stop light switch and interior light. The left-hand loom connects the left-hand front lights, horn, temperature sender unit, generator and regulator. The right-hand front lights, battery, oil pressure warning light switch, ignition and starting systems are connected by the right-hand loom. The rear lights, number plate light and fuel tank gauge unit are connected by the rear loom.

CHARGING SYSTEM

GENERAL DESCRIPTION

The 12 volt negatively earthed battery of 38 amp hour (57 amp hour optional) capacity is mounted on a tray in the engine compartment forward of the right-hand suspension leg.

The generator, of either 22 or 25 amp output is mounted at the left-hand side of the engine. It is driven by the fan belt at 1.5 times engine speed on manual transmission, slightly faster on automatic transmission since engine speeds in traffic tend to be slower.

A regulator, consisting of a cut-out, a voltage regulator and a current regulator controls the generator output by inserting a resistance into the field coil circuit.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

Weekly

Check battery electrolyte level

At first 600 miles (1,000 km.)

Top-up battery and check connections

Adjust fan belt tension

Every 3,000 miles (5,000 km.) or three months and every subsequent 6,000 miles (10,000 km.) or six months

Lubricate the generator rear bearing with engine oil

Check battery condition, check connection 3 and top-up

Adjust fan belt tension and tighten generator mounting bolts to correct torque

DATA

Table showing relationship between Regulator, Generator and Battery

	Regulator			*Generator*			*Battery*	
Equip-ment	*Part No.*	*Make*	*Identi-fication No.*	*Part No.*	*Identi-fication No.*	*Rated Output*	*Part No.*	*Capacity*
Standard	3004E-10505-A 3004E-10505-C	Autolite Lucas	†GR.5000 *37344	2701E-10002-A	C.40	22 amp.	113E-10658-A	38 A/H
Optional	3004E-10505-B 3004E-10505-D	Autolite Lucas	†GR.5001 *37342	2730E-10002-A	C.40L	25 amp.	113E-10658-D	57 A/H

† On regulator cover

* Stamped on Regulator Base

Battery

Type ...	Lead acid
Voltage	12
Capacity (amp hr.)—Standard equipment	38 at 20 hr. rate
—Cold climate	57 at 20 hr. rate
Specific gravity charged	1.275 to 1.290
Low limit while discharging at 20 hr. rate	... 1.105

Generator

Type	... 12 volt, two brush
Speed (ratio to engine)—Manual transmission	1.5 : 1
—Automatic transmission	1.8 : 1
Maximum charge	22 amps (standard) 25 amps (option)
Fan belt tension (total free movement)	... ½ in. (13 mm.)

Regulator

	Lucas	*Autolite*
Cut-out—Cut-in voltage ...	9.12 to 13.4 volts	
—Drop-off voltage ...	9.25 to 11.25 volts	
—Armature to core air gap	0.035 to 0.045 in. (0.9 to 1.1 mm.)	0.025 to 0.037 in. (0.64 to 0.94 mm.)
—'Follow-through' of moving contact	0.010 to 0.020 in. (0.3 to 0.5 mm.)	0.015 to 0.025 in. (0.38 to 0.64 mm.)
Current regulator on-load setting	Maximum rated generator output ± 1½ amp.	
Armature to core air gap	0.045 to 0.049 in. (1.14 to 1.24 mm.)	0.014 to 0.019 in. (0.36 to 0.48 mm.)
Voltage regulator open circuit setting	14.4 to 15.6 volts at 20°C (68°F)	
Armature to core air gap	0.045 to 0.049 in. (1.14 to 1.24 mm.)	0.024 to 0.028 in. (0.61 to 0.71 mm.)

SERVICE AND REPAIR OPERATIONS

OP 10001-A GENERATOR ASSEMBLY - REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Disconnect the leads from D and F terminals on the rear of the generator.
3. Slacken the three generator securing bolts and tilt the generator towards the engine.
4. Remove the fan belt.
5. Remove the generator securing bolts and detach the generator.

To Install

6. Fit the generator and retain with three bolts.
7. Replace the fan belt and tighten the generator bolts so that the fan belt has $\frac{1}{2}$ in. (13 mm.) free movement at a point mid-way between the generator and water pump pulleys.
8. Reconnect the D and F leads to the generator and reconnect the battery.

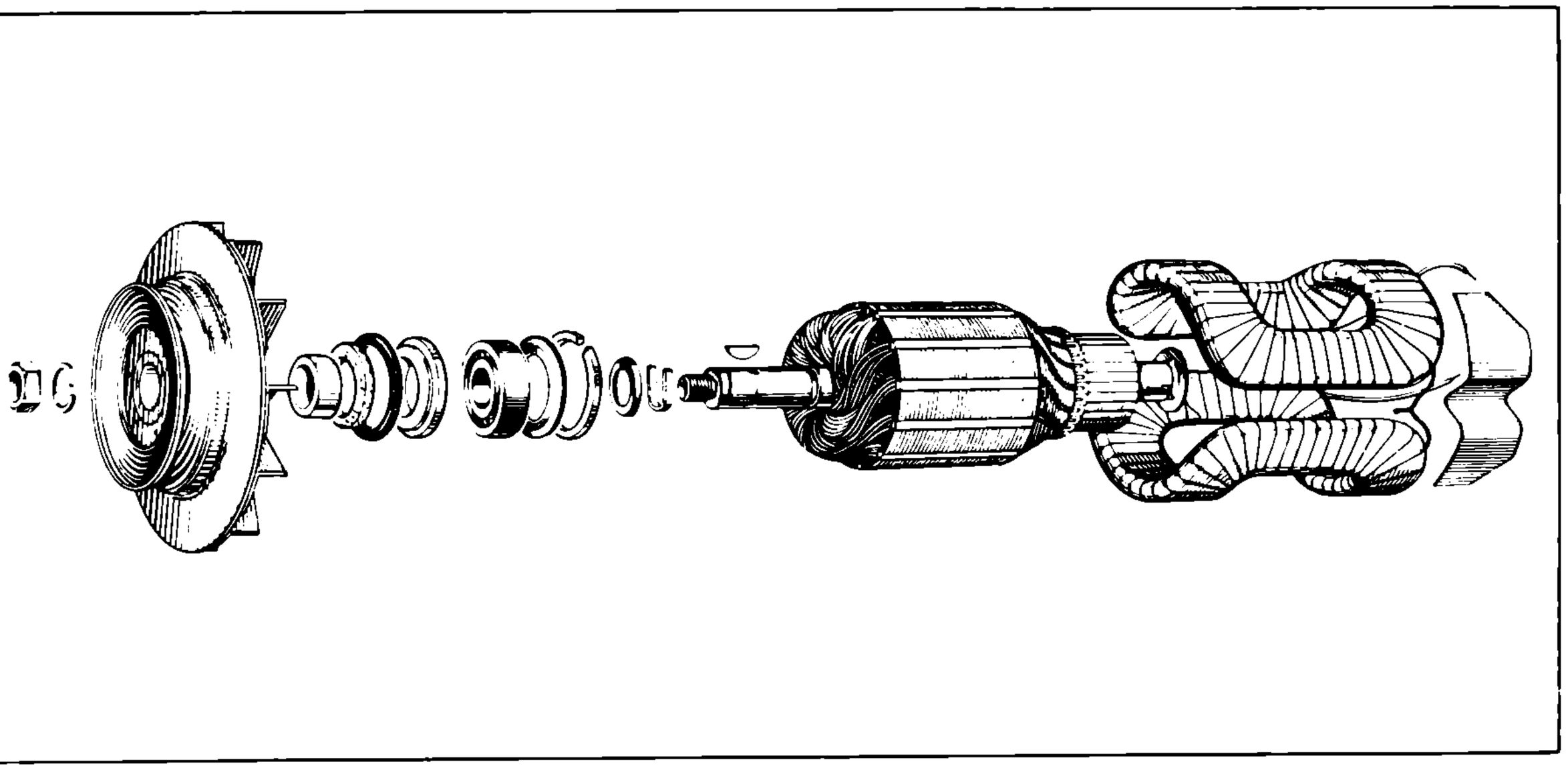
OP 10001-A1 EXTRA: GENERATOR PULLEY - REMOVE AND INSTALL (GENERATOR ASSEMBLY REMOVED)

To Remove

1. Hold the generator pulley and slacken the pulley securing nut.
2. Remove the nut, lockwasher, generator pulley, Woodruff key and spacer.

To Install

3. Fit the spacer and pulley to the generator, taking care to correctly position the key in its key-way.
4. Secure the pulley with a lockwasher and nut.



Generator — Exploded View

OP 10001-A2 EXTRA: GENERATOR FRONT BEARING – RENEW (GENERATOR PULLEY REMOVED)

To Remove

1. Unscrew and remove the two through bolts.
2. Lift the drive end bracket and armature from the yoke.
3. Remove the Woodruff key and press the armature from the end bracket.
4. Remove the circlip securing the bearing retaining plate.
5. Extract the bearing from the drive end bracket.

To Install

6. Place the felt ring and corrugated washer in the end bracket.
7. Pack the bearing with a suitable grease, and press into position.
8. Locate the bearing retaining plate in position.
9. Replace the circlip from the pulley side of the end bracket.
10. Fit the armature to the end bracket, and install the assembly in the yoke, fitting the peg on the bracket into the radial groove in the yoke.
11. Locate the two fibre washers over the end of the armature shaft.
12. Replace the endplate and secure with the two through bolts.

OP 10001-A3 EXTRA: GENERATOR BRUSHES – RENEW AND COMMUTATOR – CLEAN (GENERATOR PULLEY REMOVED)

To Remove

1. Unscrew and remove the two generator through bolts.
2. Withdraw the commutator end bracket from the yoke.
3. Remove the generator drive end bracket and armature.
4. Unscrew the brush securing screws and remove the brushes.

To Reassemble

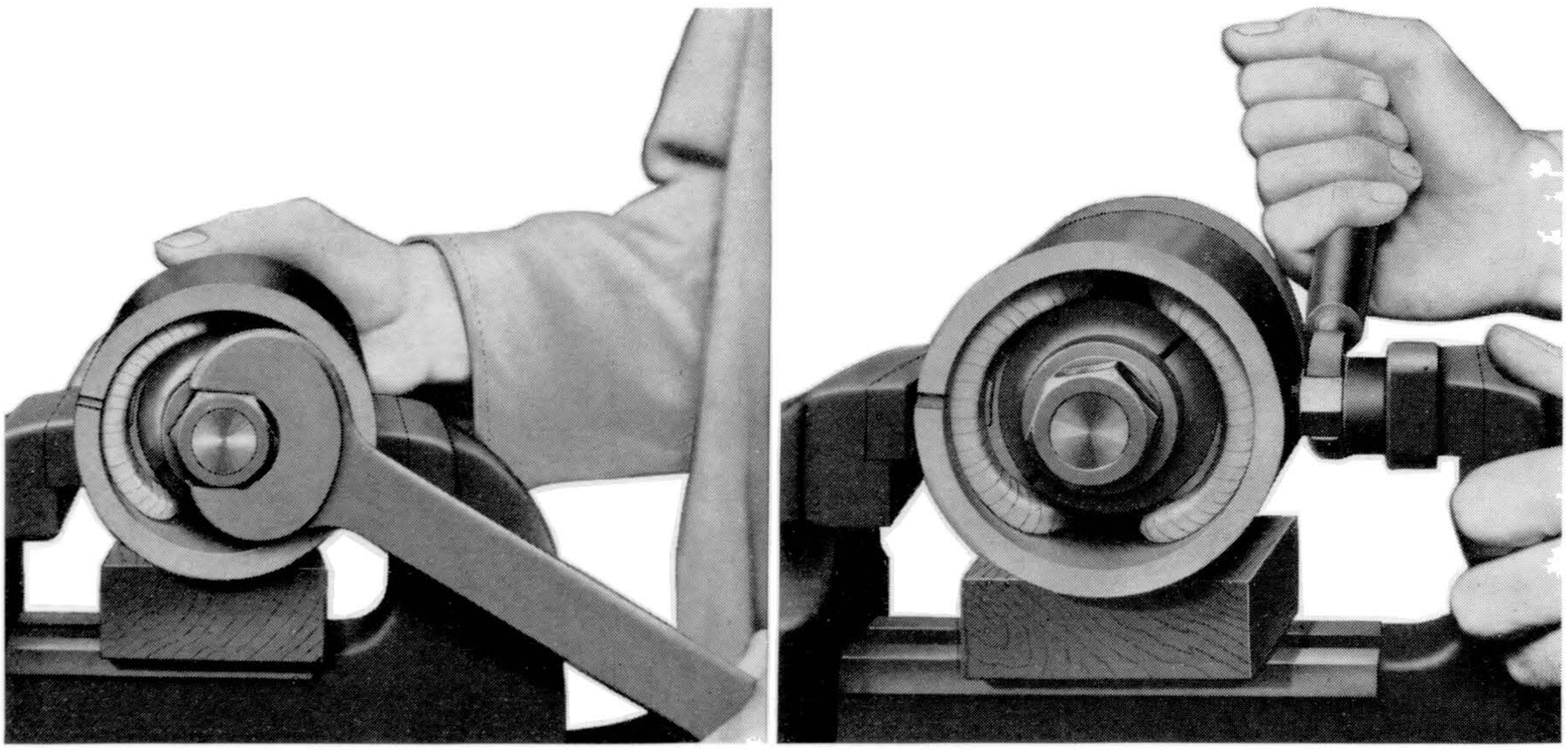
5. Clean the brush holders and fit new brushes.
6. Check the circuit to earth with a simple bulb circuit.
7. Clean the armature. Test the insulation between commutator and armature, and the continuity of the coil windings to the commutator. Undercut the commutator segments if necessary (fabricated type only).
8. Refit the drive end bracket and armature to the yoke.
9. Refit the commutator end bracket and replace the through bolts.
10. Check the position and free movement of brush springs.

OP 10001-A4 EXTRA: GENERATOR – OVERHAUL
(GENERATOR BRUSHES AND COMMUTATOR REMOVED)

Tools Required

CPT.9504	Pole piece screwdriver
CPT.9507	Endplate bush remover and replacer
CPT.9509	Pole expander

1. Remove the terminal post from the yoke (secured by a rivet).
2. Using the pole piece screwdriver remove the pole piece securing screws.
3. Remove the pole pieces and field coils after marking the pole pieces and yoke so that they can be refitted in their original positions.
4. Disconnect the field coil wires at the field posts (note connections).
5. Relocate the field coils to the field posts.
6. Rivet the terminal post to the yoke.
7. Replace the pole pieces and field coils to the yoke.
8. Remove the commutator end bracket bush.
9. Fit a new bush (bush must have been soaked in oil for 24 hours).
10. Remove the circlip securing the bearing retainer plate to the drive end bracket and remove the plate.
11. Press out the bearing assembly.
12. Clean the bearing housing and fit a new bearing.
13. Rivet the bearing retainer plate to the drive end bracket.
14. Test the field coils for continuity and earth.



Pole Shoe Expander

OP 10001-B GENERATOR PULLEY – REMOVE AND INSTALL
(Includes OPS 10001-A and A1)

OP 10001-C GENERATOR BRUSHES – RENEW AND COMMUTATOR – CLEAN
(Includes OPS 10001-A, A1 and A3)

OP 10001-D GENERATOR ASSEMBLY – OVERHAUL
(Includes OPS 10001-A, A1, A3 and A4)

OP 10001-E GENERATOR FRONT BEARING – RENEW
(Includes OPS 10001-A, A1 and A2)

OP 10001-M CHARGING CIRCUIT – TEST AND ADJUST

To isolate the source of any charging system fault, the following checks should be carried out:—

The following gives all the information required to check and adjust all parts of the charging system. Normally, the area of the fault will be pin-pointed with diagnosis equipment, and only that part of the system will require attention. For this reason, this operation should not be considered as a basic repair operation.

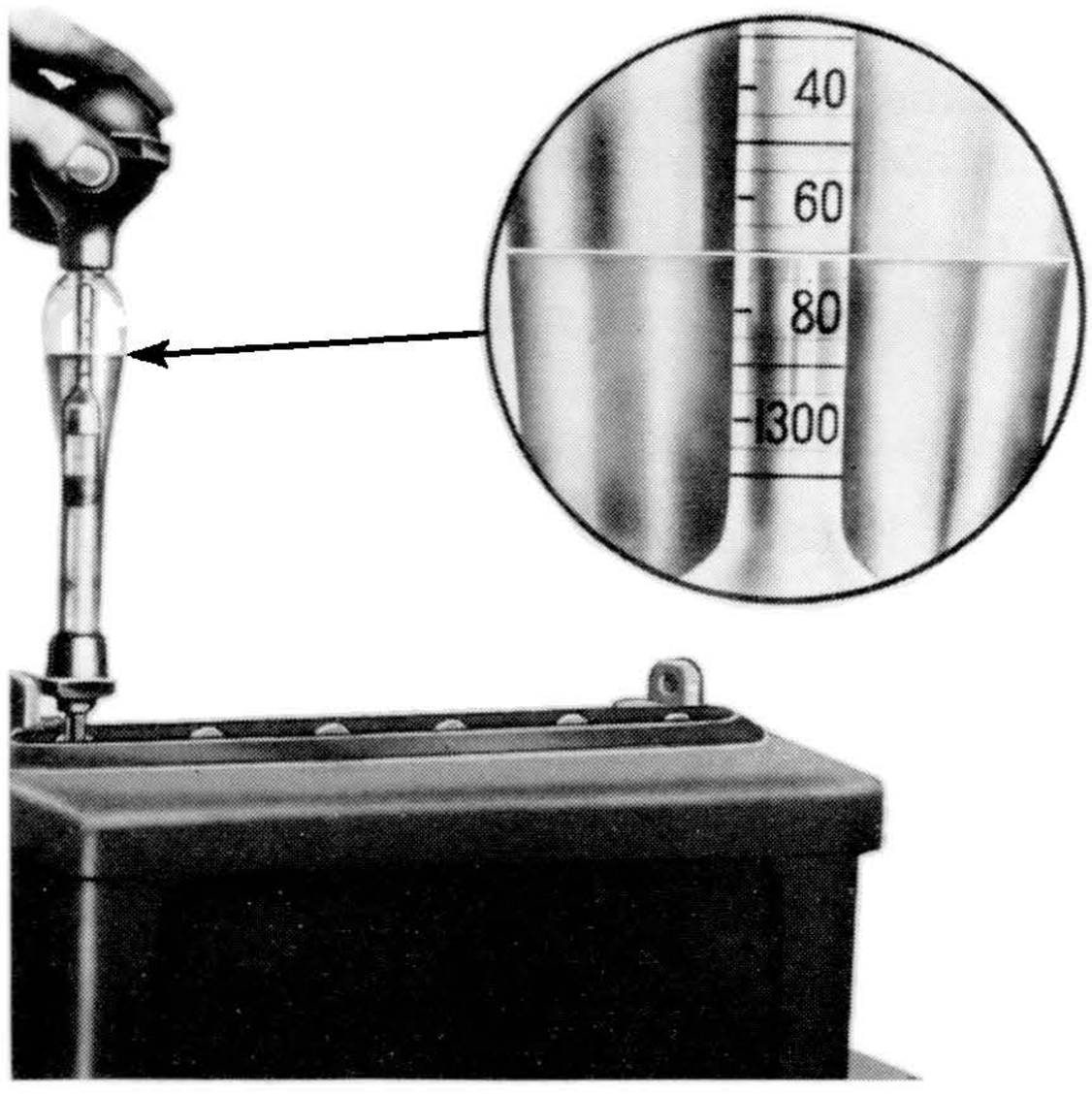
1. **Fan belt tension**

   Check, and if necessary adjust, the fan belt to give $\frac{1}{2}$ in. (13 mm.) total free movement at a point mid-way between the generator and water pump pulleys.

2. **Battery condition**

   (*a*) Ensure that the battery exterior is clean and free from cracks and corrosion particularly around the terminals.

Commutator End Plate



Checking Battery Specific Gravity

(*b*) Check the specific gravity with a hydrometer. If the electrolyte level is less than $\frac{1}{4}$ in. (7 mm.) above the plates, distilled water should be added and the battery bench charged for at least one hour before carrying out the check. Draw enough electrolyte into the hydrometer to make the scale float. Repeat the test for each cell.

(*c*) The following table relates the specific gravity to the battery condition at 16°C (60°F):—

Hydrometer Reading	*Battery Condition*
1.280	Fully charged
1.240	75% charged
1.200	50% charged
1.160	25% charged
1.120	Discharged

If the electrolyte temperature varies from 16°C (60°F), adjust the reading obtained as follows:—

Add 0.004 for every $5\frac{1}{2}$°C (10°F) above 16°C (60°F)

Subtract 0.004 for every $5\frac{1}{2}$°C (10°F) below 16°C (60°F)

For example:—

1.272 specific gravity at 27°C (80°F)

=1.272 + 0.008

=1.280 at 16°C (60°F), i.e. battery fully charged.

1.204 specific gravity at 10°C (50°F)

=1.204 — 0.004

=1.200 at 16°C (60°F), i.e. battery 50% charged.

(*d*) If one cell is about 0.030 lower than the rest it is possibly failing. An extended bench charge may revive it.

If the readings are irregular, with one or more cells 0.050 lower than the rest, the battery is not fit for further use.

If the readings are reasonably uniform, the battery is probably healthy, although low readings indicate a bench charge is required.

(*e*) Take a high rate discharge test across the battery terminals.

If a hand test instrument is used, push the probes onto the battery terminals and hold for 10 seconds. Note the voltmeter reading for the 10 seconds.

If a test set (such as Crypton, Ford and Sun) is used, connect the ammeter and voltmeter to the battery terminals: negative to negative and positive to positive. Turn the control knob to give an ammeter reading of 150 amps. Note the voltmeter reading for 10 seconds.

In both tests there should be virtually no voltage fall-off and the reading should be approximately 7.2 to 9.5 volts.

Any appreciable drop-off or a voltage of less than 5 volts indicates that the battery has reached the end of its useful life.

DIAGNOSIS CHART OF TEST RESULTS

Specific Gravity Readings	High Rate Discharge Test Readings	Battery Condition
Readings uniform and within Range 1.260—1.280	Readings High and Steady	Healthy and in reasonable State of Charge
Readings uniform but lower than 1.260	Readings Low and Steady	Healthy but requires Charging
One cell about 0.030 lower than remainder	Reading shows Falling Voltage	Probable Failing Cell
Irregular Readings more than one cell 0.050 lower than remainder	Reading Low and showing rapid fall	Battery at End of Life
Very Low Readings	Very Low Voltage	Battery has internal fault or is in deeply sulphated condition

The High Rate Discharge Test and the Specific Gravity Test are complementary, no advantage will be gained by performing one test and not the other.

3. **Generator Output Test**

(*a*) Disconnect the wires from the "D" and "F" regulator terminals and join them together.

(*b*) Connect a 0—30 voltmeter between this junction and earth.

(*c*) Run the engine at approximately 1,000 rev./min.

NOTE – Do not exceed this speed or the generator may be damaged.

(*d*) The voltmeter reading should rise rapidly without fluctuation to more than 24 volts.

(*e*) Should the reading be incorrect, connect a jumper wire between the "D" and "F" terminals on the generator, and connect the voltmeter between this wire and earth.

(*f*) If the reading is now more than 20 volts, the continuity of the "D" or "F" leads is suspect. If the reading is still incorrect, there is a fault in the generator.

4. **Test and Reset if Necessary the Regulator Open Circuit**

(*a*) Remove the connecting block from the regulator.

(*b*) Insert the blade of a small screwdriver between the block and the terminal, depress the spring clip, and remove each terminal in turn.

(*c*) Replace each wire onto the regulator, with the exception of the wire(s) on the terminal "B".

(*d*) If two wires have been removed from the "B" terminal, these should be connected together.

(*e*) Connect a voltmeter between the "WL" terminal and the regulator base.

(*f*) Start the engine and increase its speed to 2,000 rev./min.

(*g*) Note the voltmeter reading which should be steady and between the limits shown in column 2.

In this case the unit will require no further attention.

(*h*) Should the voltage lie outside the values shown in column 3 this will indicate a constructional fault in the unit, and it should be replaced.

(*i*) If the voltage values lie outside those given in column 2, but within those given in column 4, the unit should be reset as follows to the values given in column 5.

(*j*) Drill out the plastic rivets and remove the cover.

NOTE — The top cover must not be removed during the Warranty Period.

(*k*) With the engine speed as quoted above, turn the adjustment cam with the Lucas Tool No. 54381742; clockwise to raise the voltage setting and anti-clockwise to lower the voltage setting.

Column 1	Column 2	Column 3	Column 4	Column 5
Ambient Temperature	*Voltage Checking Limits*	*Voltage Failure Limits*	*If between*	*Reset to*
10°C (50°F)	14.5 to 15.8	14.1 to 16.3	14.0 to 14.5	14.5
			15.8 to 16.3	15.8
20°C (68°F)	**14.4 to 15.6**	**14.0 to 16.0**	**14.0 to 14.5**	**14.5**
			15.5 to 16.0	**15.5**
30°C (86°F)	14.3 to 15.3	13.8 to 15.8	13.8 to 14.3	14.3
			15.3 to 15.8	15.3
40°C (104°F)	14.2 to 15.1	13.6 to 15.6	13.8 to 14.3	14.3
			15.0 to 15.5	15.0

NOTE – The figures given above are the "cold" setting values, i.e. the unit should be allowed to cool to the ambient temperature shown in column 1. The readings obtained will be incorrect if this procedure is not followed.

(*l*) Reduce the engine speed and then raise it to the previously stated speed to check the setting.

(*m*) If the voltage continues to rise with engine speed, check the regulator to body earth, then replace the regulator.

(*n*) Refit the cover using spire clips and self-tapping screws.

(*o*) Remove the voltmeter, refit the terminals into the connecting block and replace the block.

5. Test and Reset if Necessary the Current Regulator Bobbin

(*a*) The voltage regulator bobbin must be rendered inoperative by holding the points together with a spring clip (if the vehicle warranty has expired), or by earthing the terminal "WL", through a ½ ohm resistor capable of carrying 30 amps, to the regulator base.

(*b*) Remove the connecting block from the regulator.

(*c*) Insert the blade of a small screwdriver between the block and the terminal, depress the spring clip, and remove each terminal in turn.

(*d*) Replace each wire onto the regulator, with the exception of the wire(s) on the terminal "B".

(*e*) Connect the "B" terminal wires to the load side of an ammeter. Connect the other side of the ammeter to the "B" terminal.

(*f*) Switch on the vehicle's headlamps to place a load on the battery.

(*g*) Start the engine and increase its speed to approximately 3,000 r.p.m. (2,500 r.p.m. with automatic transmission).

(*h*) The ammeter should indicate the rated generator output ± 1 amp (22 amp standard, 25 amp optional equipment).

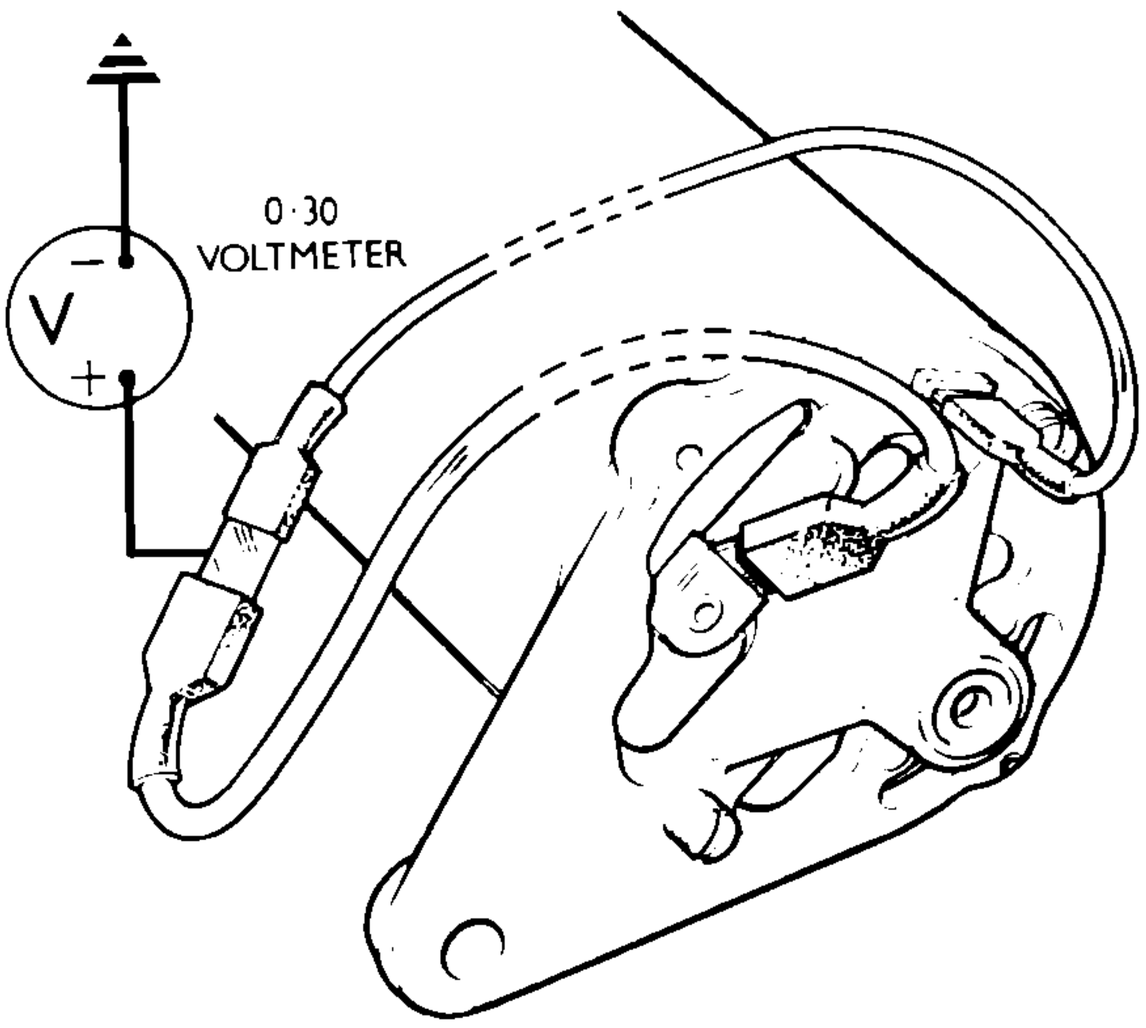
(*i*) Adjust the setting as required by turning the adjustment cam or screw. Anti-clockwise to lower the setting; clockwise to raise it.

(*j*) Decrease and then increase engine speed to the figure specified before and recheck settings.

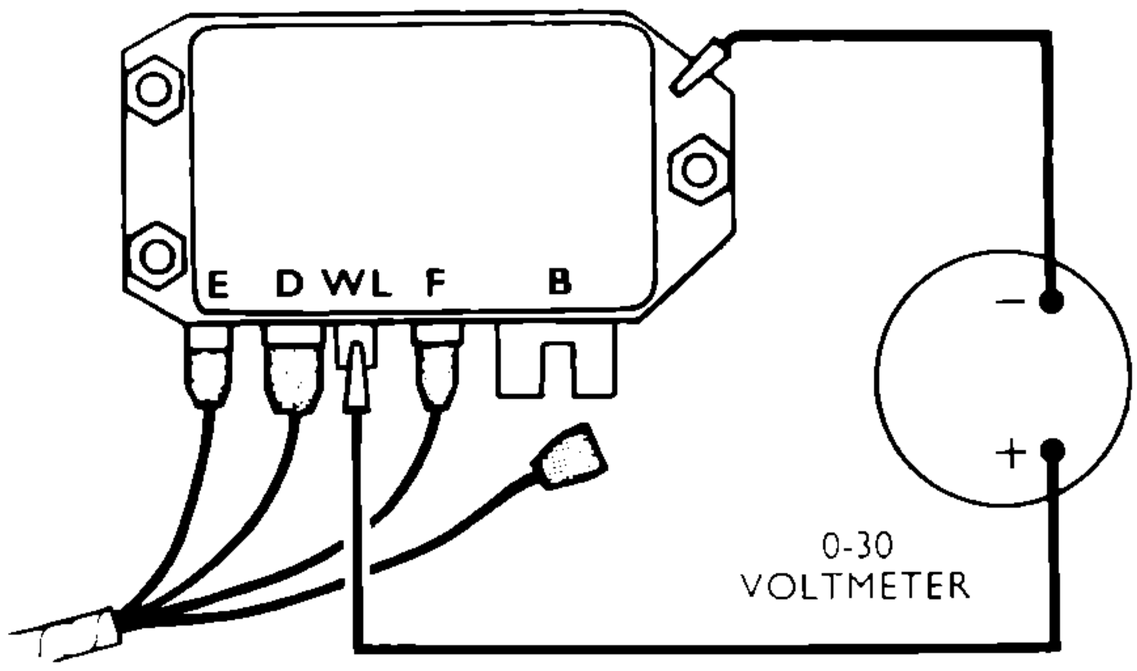
(*k*) Switch off engine, refit the terminals into the connecting block, and replace the block.

6. Test the Cut-in Voltage

(*a*) Remove the connecting block from the regulator.



Generator Output Test



Open Circuit Voltage Test

(*b*) Insert the blade of a small screwdriver between the block and the terminal, depress the spring clip and remove each terminal in turn.

(*c*) Replace each wire onto the regulator.

(*b*) Connect a voltmeter between the "WL" terminal and the regulator base.

(*e*) Switch on the vehicle's headlamps.

(*f*) Start the engine and gradually increase its speed, observing the voltmeter needle which should climb steadily to 12.6—13.4 volts and then drop slightly as the points close.

(*g*) If the closure occurs outside the limits quoted, decrease the engine speed and rotate the cam or screw slightly:—

Clockwise to raise the setting and anti-clockwise to lower it.

Increase the engine speed and recheck the setting.

7. **Adjust the Air Gap Settings** (if required)

(*a*) Remove the regulator from the car.

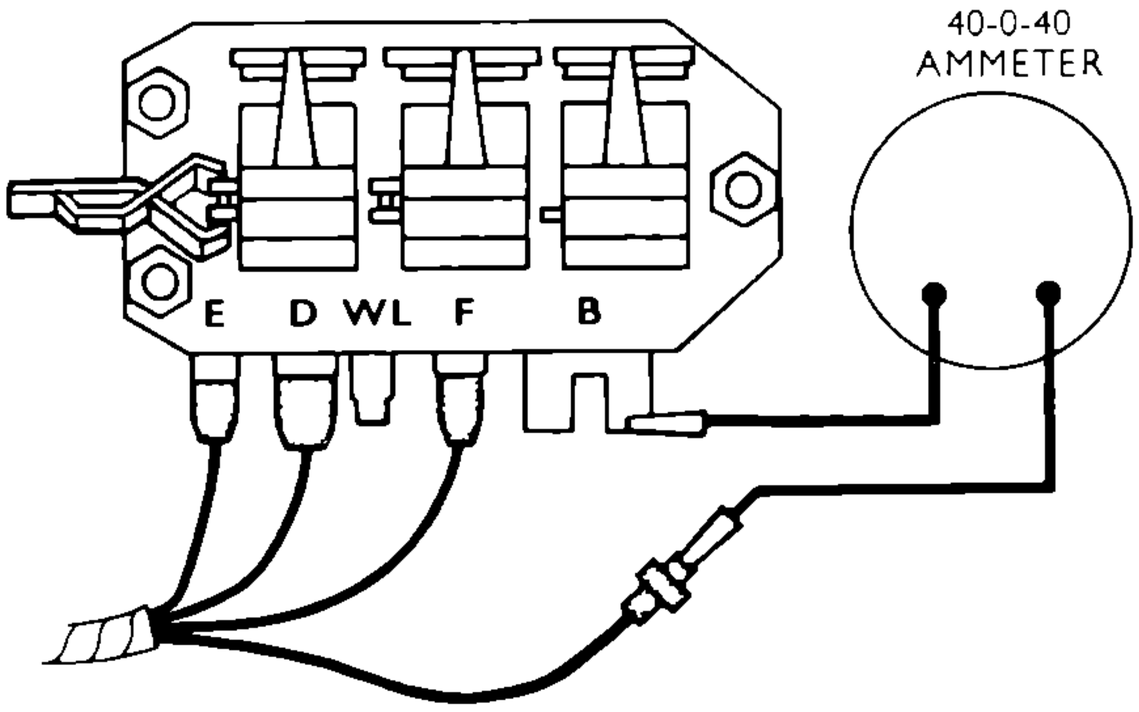
(*b*) Turn voltage regulator adjustment cam to the position giving minimum lift.

(*c*) Slacken the adjustable contact locknut and screw the contact out a few turns (Lucas regulators only).

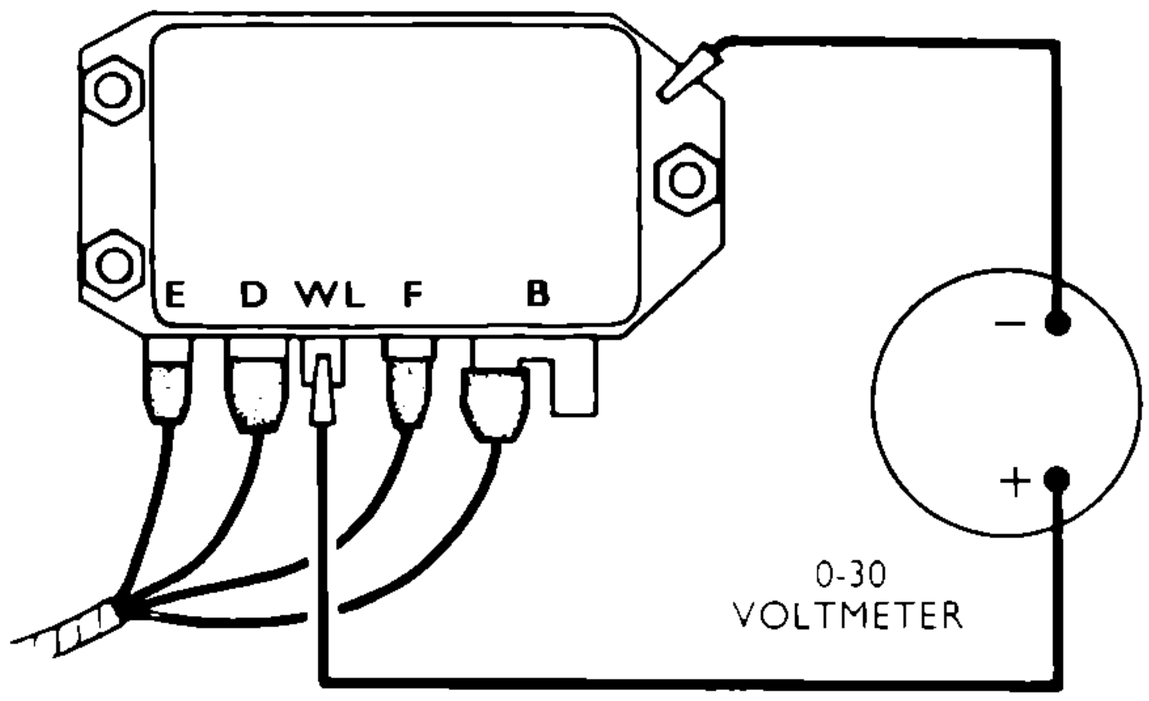
(*d*) Insert a 0.045 to 0.049 in. (1.14 to 1.24 mm.) feeler blade for Lucas regulators, or a 0.024 to 0.028 in. (0.61 to 0.71 mm.) feeler blade for Autolite regulators, between the armature and the copper coloured shim on top of the core face. Position the feeler blade as far back as the rivet heads will allow.

(*e*) Screw in the adjustable contact until it just traps the feeler blade and then retighten the locknut (Lucas regulators only).

(*f*) Recheck the gap.



Current Regulator On-Load Test



Cut-in Voltage Test

(*g*) Repeat the operation (items *b*, *c*, *d*, *e* and *f*) for the current regulator cam to obtain an air-gap of 0.045 to 0.049 in. (1.14 to 1.24 mm.) for Lucas regulators or 0.014 to 0.019 in. (0.36 to 0.48 mm.) for Autolite regulators.

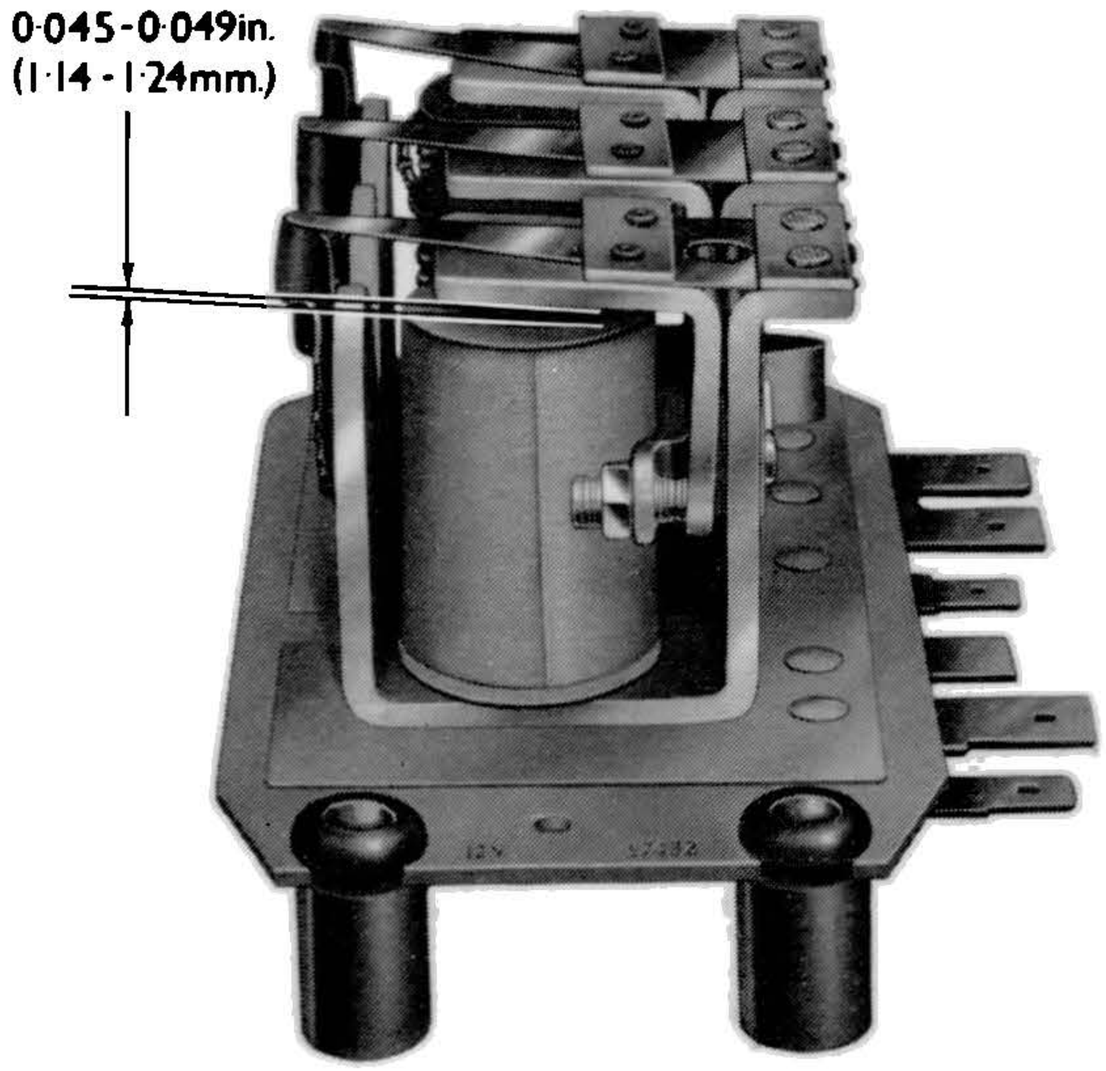
(*h*) Insert a 0.015 in. (0.4 mm.) feeler blade between the top of the cut-out relay core and the armature. Press the armature onto the feeler blade to trap it. The contacts, which are between the cut-out and current relays, should just touch. If necessary, bend the fixed contact.

(*i*) The cut-out air-gap is 0.035 to 0.045 in. (0.9 to 1.1 mm.), measured with a feeler gauge in the same way as for the current and voltage regulators. Adjustment is carried out by carefully bending the back stop as required.

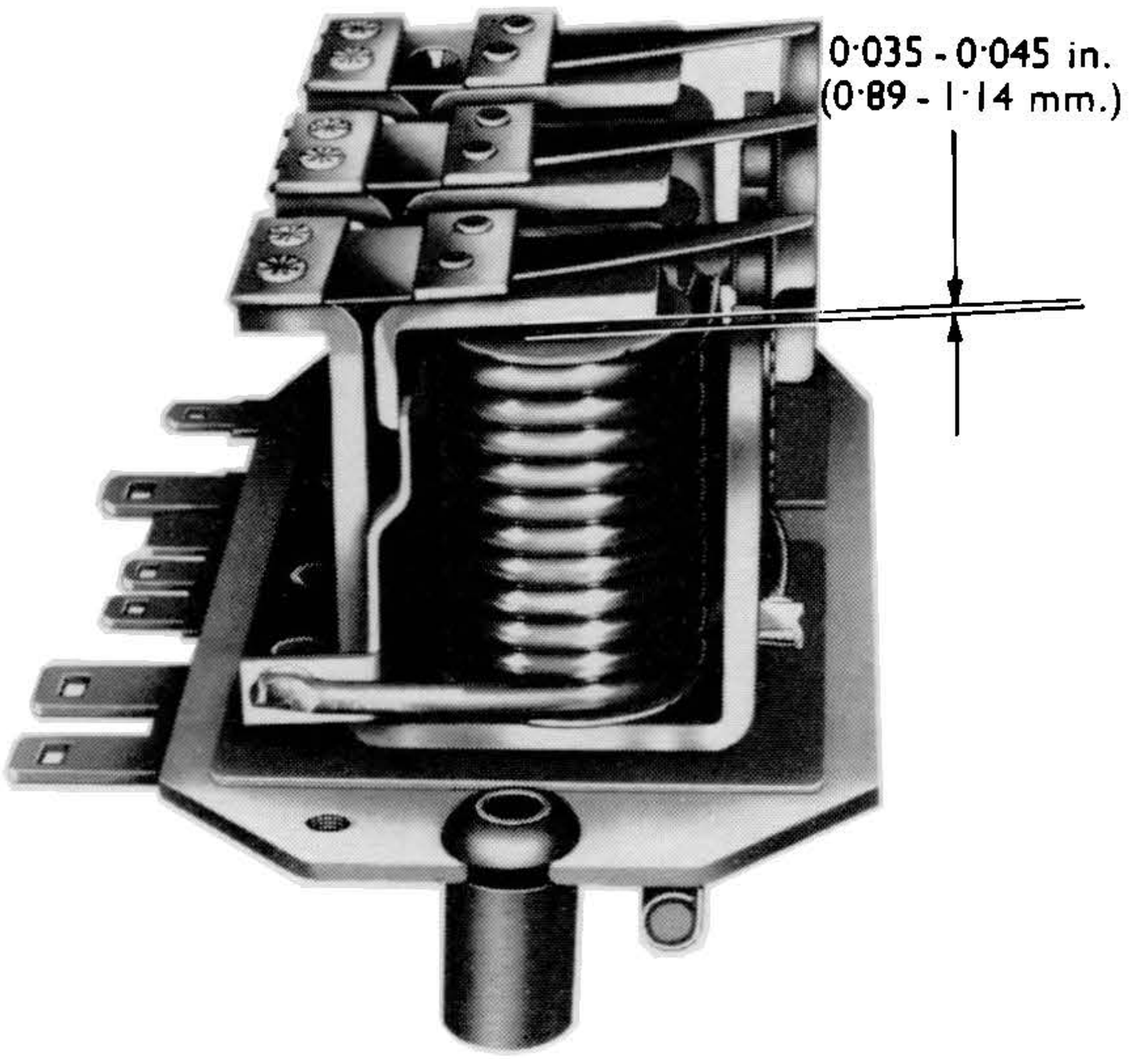
(*j*) After setting the air-gaps replace the regulator in the car and carry out the electrical settings.

OP 10505-A VOLTAGE REGULATOR UNIT – REMOVE AND INSTALL

1. Disconnect the battery.
2. Remove the leads from the regulator, noting connections.
3. Unscrew two screws securing the unit to the right-hand side of the engine compartment.
4. Replace the regulator and secure it with two screws.
5. Reconnect the leads in the same positions as removed.
6. Reconnect the battery.



Voltage Regulator Air-gap Setting (Lucas)



Cut-out Air-gap Setting (Lucas)

STARTING SYSTEM

GENERAL DESCRIPTION

The engine is started by the starter motor pinion engaging with the flywheel ring gear or, on automatic transmission cars, with the torque converter inertia ring. Electricity for starting is supplied to the starter motor through a solenoid controlled by a "key start" ignition switch mounted on the facia panel.

There are three types of starter motor:—

Type 1 Inertia type – This is a twenty-nine slot lap wound machine with a three hole fixing to the engine. It is fitted to both automatic and manual transmission cars when "cold start" equipment is not requested.

Type 2 Pre-engaged type A – This is a thirty-seven slot lap wound machine with a two hole fixing. It is fitted to automatic transmission cars when "cold start" equipment is requested.

Type 3 Pre-engaged type B – This is a twenty-nine slot wave wound machine with a two hole fixing. It is fitted to manual transmission cars when "cold start" equipment is requested. Also, if a customer requires a pre-engaged starter but the car does not take "cold start" equipment as standard, this starter motor is available as an option on both manual and automatic transmission cars.

It should be noted that this starter motor uses a face commutator instead of the drum type as used on the other two starters.

Both the pre-engaged starters, types 2 and 3, incorporate a "built-in" solenoid.

QUICK REFERENCE DATA

DATA

Type 1 – Inertia Starter Motor

Teeth on pinion ...	 10
Teeth on ring gear	 110
Gear ratio	... ... 11 : 1
Minimum brush length	... 0.4 in. (10.3 mm.)
Brush spring pressure	... 34 oz. (0.96 kg.)

Type 2 – Pre-engaged Starter Motor, Type A

Teeth on pinion ...	 11
Teeth on ring gear...	 132
Gear ratio	... ... 12 : 1
Minimum brush length	... 0.4 in. (10.3 mm.)
Brush spring pressure	32 oz. (0.91 kg.)

Type 3 – Pre-engaged Starter Motor, Type B

Teeth on pinion ...	 11
Teeth on ring gear...	 132
Gear ratio	... ... 12 : 1
Minimum brush length	0.375 in. (9.52 mm.)
Brush spring pressure	... 28 oz. (0.805 kg.)

SERVICE AND REPAIR OPERATIONS

OP 11001-A INERTIA STARTER MOTOR ASSEMBLY — REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Remove the starter motor lead from the starter.
3. Remove the upper securing bolt.
4. With the handbrake applied, jack up the front of the car and fit stands.
5. Slacken the starter motor lower mounting bolts.
6. Support the motor, remove the bolts and then remove the motor.

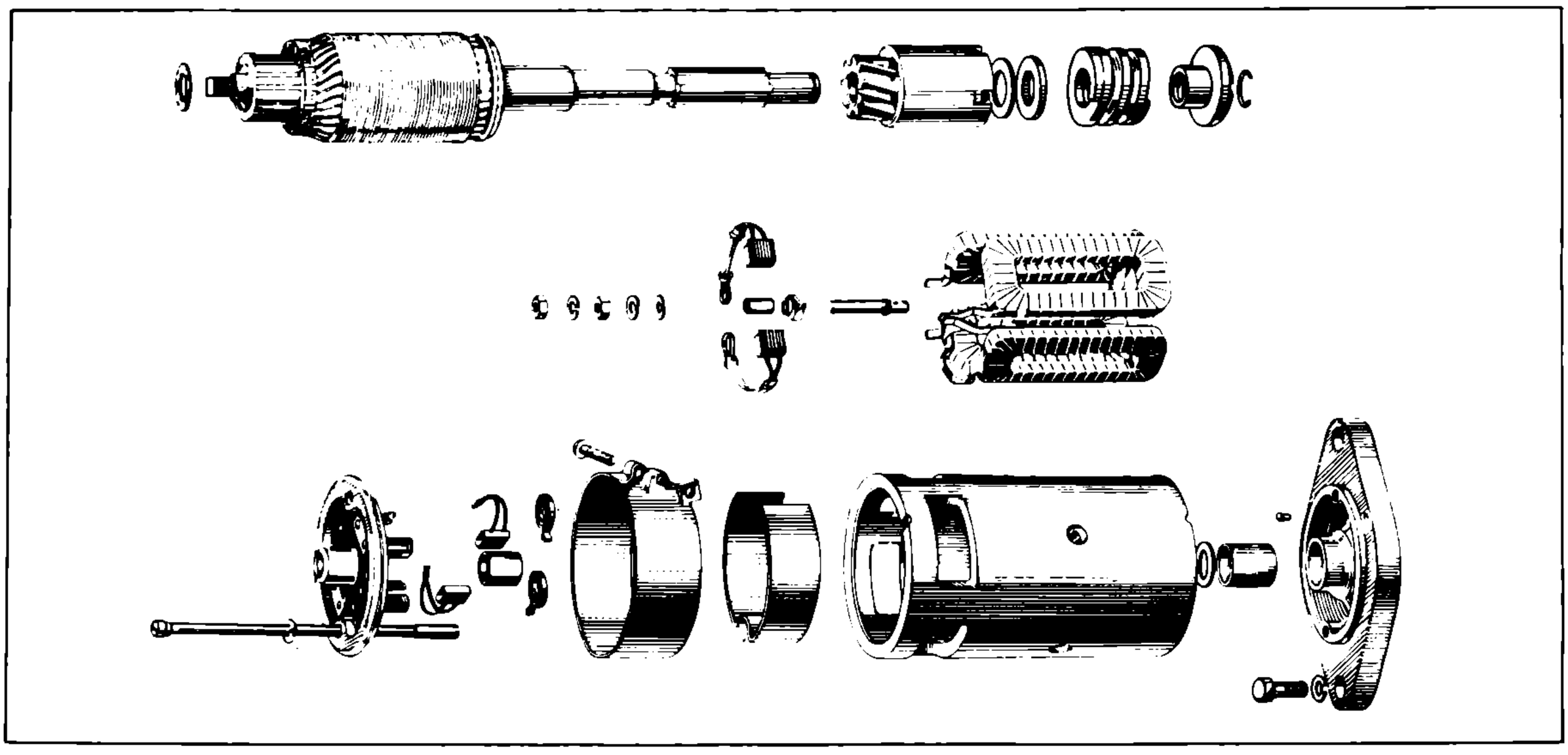
To Install

7. Replace the starter motor and refit the lower mounting bolts.
8. Fit the upper bolt and tighten the three bolts securely.
9. Lower the car to the ground.
10. Reconnect the lead to the starter.
11. Reconnect the battery.

OP 11001-A1 EXTRA: DRIVE COMPONENTS – REMOVE AND INSTALL (INERTIA STARTER MOTOR REMOVED)

To Remove

1. Compress the spring and remove the circlip.
2. Remove the main drive spring washer, pinion and barrel assembly.
3. Screw the sleeve out of the sleeve nut.
4. Remove the distance collar and cups, return spring and washer.



Inertia Starter Motor — Exploded View

To Install

5. Refit the return spring, cups, and distance collar.
6. Reassemble the pinion and barrel assembly to the shaft.
7. Replace the main drive spring, spring cup; compress the spring and replace the circlip.

OP 11001-A2 EXTRA: BRUSHES — RENEW AND COMMUTATOR — CLEAN (INERTIA STARTER MOTOR REMOVED)

To Remove

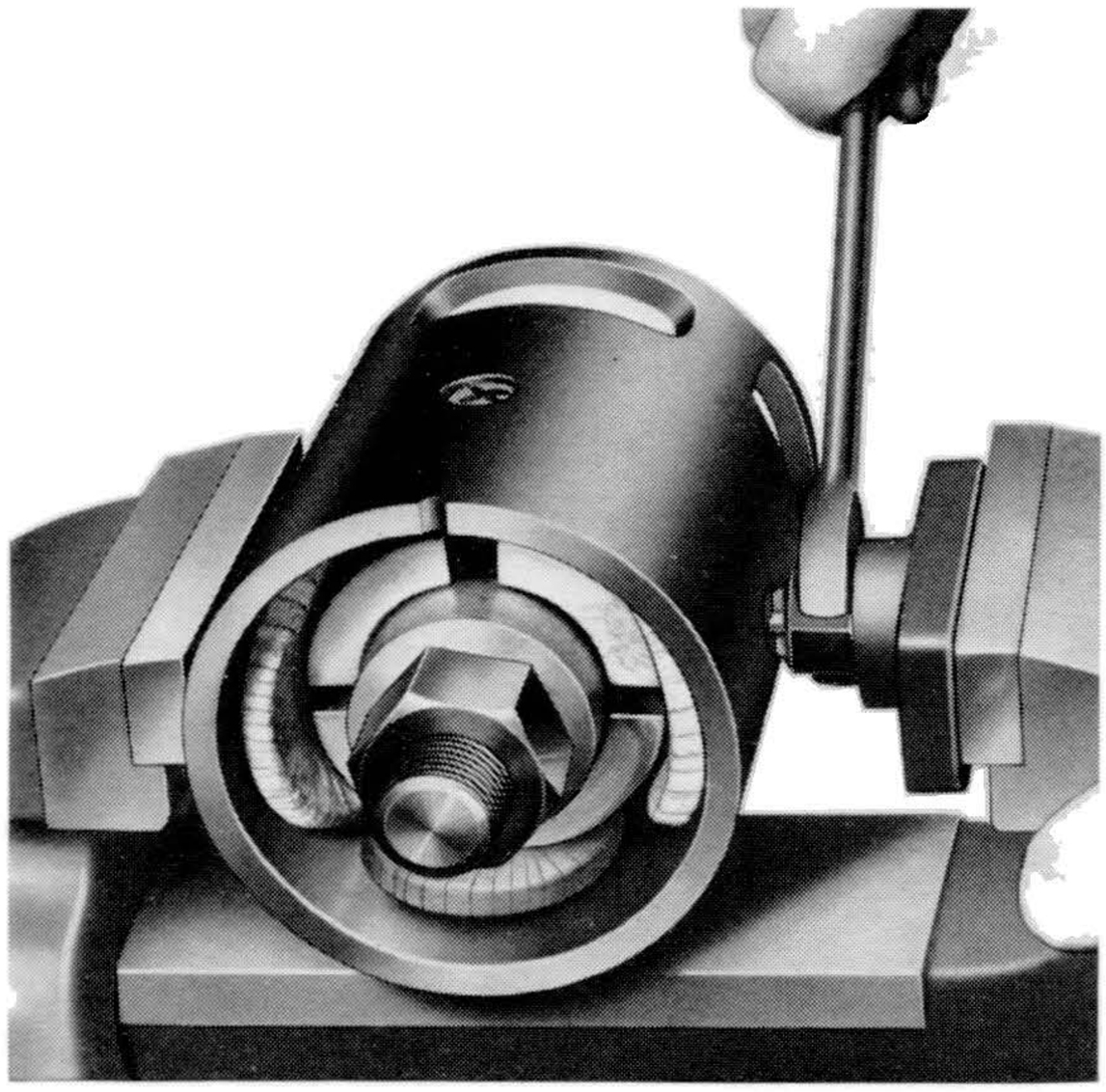
1. Slacken the clamp and slide the cover along the body.
2. Raise the brush holding springs and withdraw the brushes.
3. Unscrew two through bolts and remove the starter motor drive end plate and armature. Clean off the commutator.
4. Remove the commutator end plate.
5. Unsolder the brush leads connected to the earthed holders.
6. Cut the brushes from the field coils, leaving approximately $\frac{1}{4}$ in. (7 mm.) copper wire attached to the field coils.

To Install

7. Solder new brushes to the ends of the copper wire still attached to field coils.

   NOTE — Do not attempt to solder new brushes directly onto aluminium field coils. This requires special equipment.
8. Solder new brushes to the earthed holders.
9. Replace the starter motor drive end plate and armature.
10. Replace the commutator end plate and insert the brushes.
11. Relocate the cover band and tighten.

Field Coils in Position



Pole Shoe Expander

OP 11001-A3 EXTRA: INERTIA STARTER MOTOR – OVERHAUL (DRIVE COMPONENTS BRUSHES AND COMMUTATOR REMOVED)

Tools Required

CPT.9504	Pole piece screwdriver
CPT.9509	Pole expander

1. Remove the four pole pieces in the yoke.
2. Install new field coils and replace the pole pieces in the yoke.
3. Test the coils for continuity.
4. Remove the two end plate bushes.
5. Replace the two end plate bushes.

OP 11001-B INERTIA STARTER MOTOR DRIVE COMPONENTS – REMOVE AND INSTALL
(Includes OPS 11001-A and A1)

OP 11001-C INERTIA STARTER MOTOR BRUSHES – RENEW AND COMMUTATOR – CLEAN
(Includes OPS 11001-A, A1 and A2)

OP 11001-D INERTIA STARTER MOTOR – OVERHAUL
(Includes OPS 11001-A, A1, A2 and A3)

OP 11001-A PRE-ENGAGED STARTER MOTOR ASSEMBLY (TYPE A) – REMOVE AND INSTALL

1. Disconnect the battery.
2. Remove the starter motor leads from the starter.
3. Remove the upper securing bolt.
4. With handbrake applied, jack up the front of the car and fit stands.
5. Slacken the starter motor lower mounting bolt.
6. Support the motor, remove the bolt and then remove the motor.
7. Replace the starter motor and refit the lower mounting bolt.
8. Fit the upper bolt and tighten both bolts securely.
9. Lower the car to the ground.
10. Reconnect the leads to the starter.
11. Reconnect the battery.

OP 11001-A1 EXTRA: DRIVE COMPONENTS (PRE-ENGAGED TYPE A) – REMOVE AND INSTALL

Tools Required

CP.4111	Differential bearing cone remover

To Remove

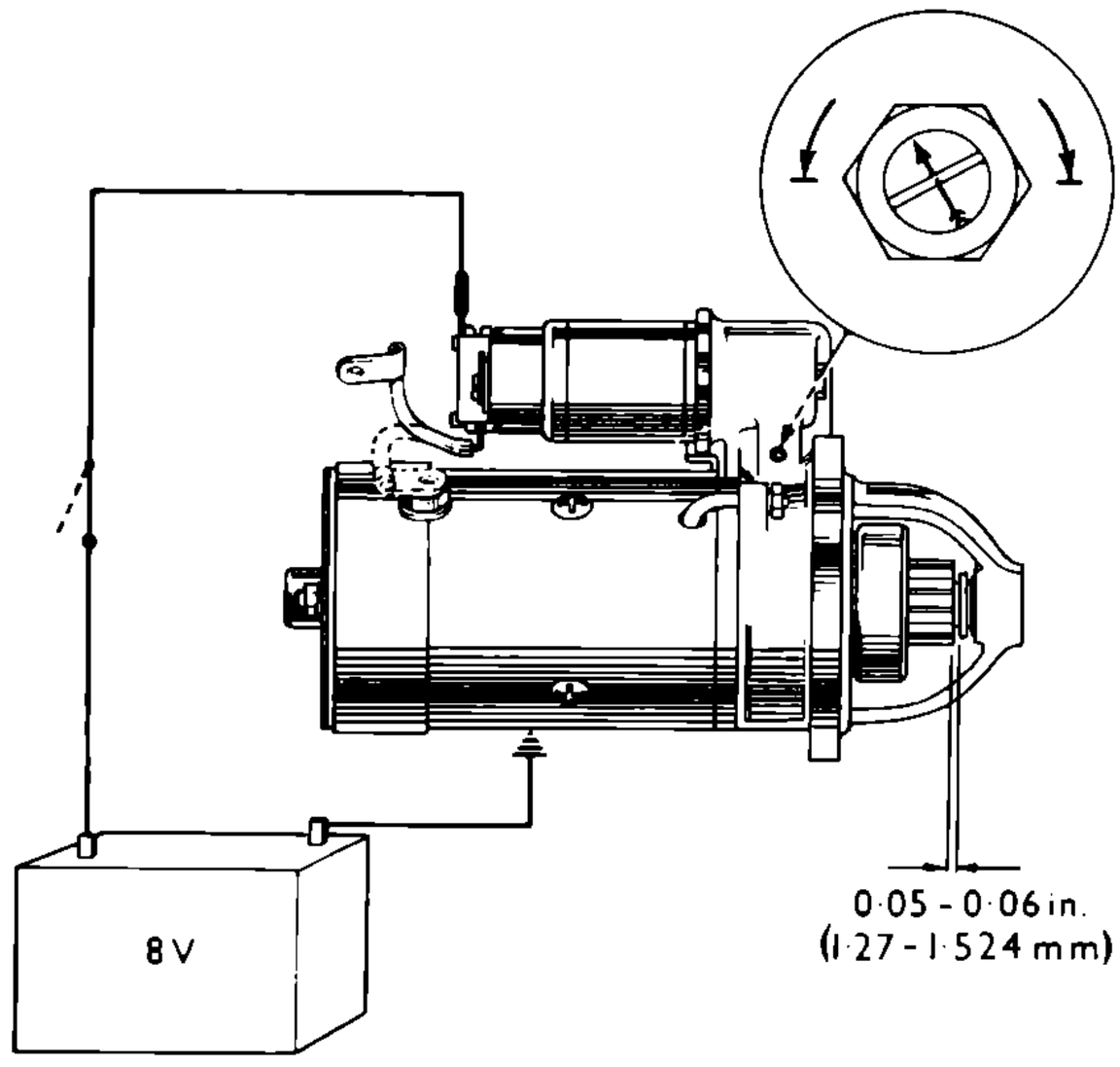
1. Unscrew the two hook-bolt nuts securing the drive end housing and remove the housing, armature, pinion gear and drive engaging lever.
2. Slide back the brush cover band, lift the brush springs with a piece of wire and withdraw the brushes.
3. Remove the hook-bolt nuts securing the commutator end plate and detach the plate.
4. Locate the armature in a soft jawed vice and tap off the circlip retaining cover. Remove the circlip and detach the drive pinion assembly.
5. Remove the spring from the pinion assembly after removing the retaining circlip.

   NOTE – Do not grip the one-way clutch in a vice whilst carrying out this operation as it will be damaged.

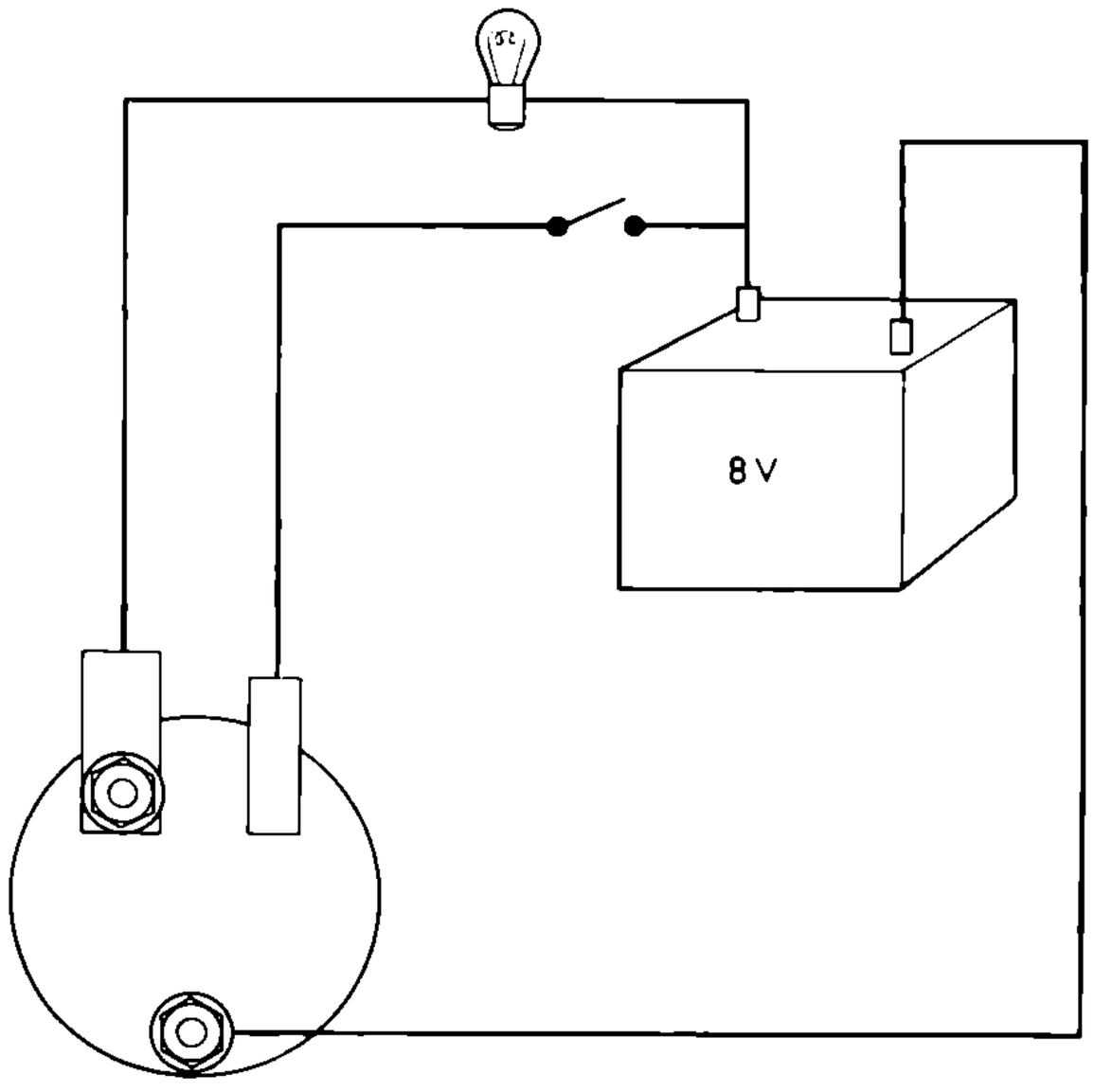
   The drive pinion and clutch are serviced as a complete unit as repairs to the unit are impractical.

To Install

6. Refit the spring and retainer plate to the drive pinion and clutch unit; secure them with the circlip.
7. Replace the assembly on the armature shaft with the spring retainer nearest the starter.
8. Place the circlip retaining cover on the armature shaft first and then fit the circlip. Pull the cover up over the circlip (Tool No. CP.4111).
9. Replace the commutator end plate and refit the brushes. See sub-operations 9 to 12 of OP 11001-A1.
10. Reset the pinion gear travel.
    (i) Remove the connection from the solenoid to the starter body terminal.



Pinion Clearance Setting



Testing Solenoid Operation

(ii) Energise the solenoid with an 8 volt supply. Slacken the eccentric pivot pin locknut and turn the pin until the correct setting of 0.005 to 0.010 in. (0.127 to 0.254 mm.) is obtained between the pinion and thrust washer. Note that the arc of adjustment is 180° as indicated by arrows on the casing.

NOTE – This should not take more than approximately 2 minutes, otherwise the solenoid will overheat.

(iii) Connect, through a switch, an 8 volt supply between the solenoid small unmarked terminal and the large terminal "STA". Connect a test lamp between the switch side of the battery and the large blade terminal.

(iv) Insert a stop of $\frac{1}{8}$ in. thickness between the pinion and drive end bracket to prevent the pinion moving fully outwards.

(v) Close the switch, thus causing the 8 volt supply to energise the shunt winding. The test lamp should now light, indicating the solenoid contacts have closed satisfactorily.

(vi) Switch off and remove the $\frac{1}{8}$ in. stop, restricting the pinion movement.

Switch on again and hold the pinion in the fully engaged position by hand.

Drive Pinion Circlip

Removal **Replacement**

(vii) Switch off and observe the test lamp, which should go out, indicating that the solenoid contacts have opened satisfactorily.

OP 11001-A2 EXTRA: BRUSHES – RENEW, AND COMMUTATOR – CLEAN (PRE-ENGAGED TYPE A)

1. Slacken the cover band screw and slide the cover band away from the brush apertures.
2. Lift the brush springs with a wire hook and pull the brushes out of their holders.
3. Unscrew the two hook bolt nuts and carefully pull the commutator end plate from the starter motor, together with the earth brushes.
4. Cut the brush leads leaving $\frac{1}{4}$ in. (7 mm.) attached to the field coils and discard the old brushes. Do not attempt to unsolder the brushes because, as aluminium field coils are fitted, difficulty will be experienced in re-soldering unless special equipment is used.
5. Clean the commutator with a petrol-moistened cloth, or if necessary polish it with very fine glass paper.

   Do not use emery cloth and never undercut the mica insulation.
6. Check the brushes for freedom of movement in the brush holders and then solder the new brushes to the old leads. If necessary trim the new brush leads to the required length.

   The field coil or insulated brushes are longer than the earthed brushes and have a braided covering. Fit these brushes so that they both point towards the field coil terminal, when the starter motor yoke is viewed from the commutator end.
7. Before fitting the end plate, check the brush springs and renew if necessary. Take care to close the ends of the brush spring posts after fitting new springs.

   It is also advisable to check the insulated brush holders to ensure that they are not earthing. Use a battery and bulb for this test, or, if available, a multimeter.
8. Check that the insulator band is located between the yoke and the end of the field coils, and pass the insulated brushes through the apertures in the yoke.
9. Replace the commutator end plate on the starter motor yoke, passing the earthed brushes through the other apertures in the yoke and engage the dowel pin in the end plate with the notch in the yoke end.
10. Refit the hook-bolt nuts and spring washers. Tighten to 6 lb. ft. (0.83 kg.m.).
11. Lift the brush springs and insert the brushes into their holders, ensuring that they slide freely. (The field coil brushes locate in the insulated brush holders.)
12. Slide the brush cover band over the brush apertures and tighten the screw securely.

OP 11001-A3 EXTRA: PRE-ENGAGED STARTER MOTOR (TYPE A) – OVERHAUL

Tools Required

CPT.9504	Pole piece screwdriver
CPT.9509	Pole expander

1. Remove the four pole pieces in the yoke.
2. Install new field coils and replace the pole pieces in the yoke.
3. Test the coils for continuity.

4. Remove the two end plate bushes.
5. Replace the two end plate bushes.

OP 11001-B PRE-ENGAGED STARTER MOTOR (TYPE A) DRIVE COMPONENTS – REMOVE AND INSTALL
(Includes OPS 11001-A and A1)

OP 11001-C PRE-ENGAGED STARTER MOTOR (TYPE A) BRUSHES – RENEW, AND COMMUTATOR – CLEAN
(Includes OPS 11001-A, A1 and A2)

OP 11001-D PRE-ENGAGED STARTER MOTOR (TYPE A) – OVERHAUL
(Includes OPS 11001-A, A1, A2 and A3)

OP 11001-A PRE-ENGAGED STARTER MOTOR ASSEMBLY (TYPE B) – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Remove the starter motor leads from the starter.
3. Remove the two solenoid fixing nuts and connecting strap and remove the solenoid.
4. Remove the upper securing bolt.
5. With handbrake applied, jack up the front of the car and fit stands.
6. Slacken the starter motor lower mounting bolt.
7. Support the motor, remove the bolt and then remove the motor.

To Install

8. Replace the starter motor and refit the lower mounting bolt.
9. Fit the upper bolt and tighten both bolts securely.
10. Fit the solenoid and secure with the two nuts.
11. Lower the car to the ground.
12. Reconnect the leads to the starter.
13. Reconnect the battery.

OP 11001-A1 EXTRA: DRIVE COMPONENTS (PRE-ENGAGED TYPE B) – REMOVE AND INSTALL

Tools Required

CP.4111-A Puller

To Remove

1. Remove the split pin, shim washer(s) and thrust plate from the armature shaft.
2. Remove the two bolts holding the commutator end plate.
3. Remove the end plate, complete with brush box moulding.

4. Unscrew the two fixing stud nuts and remove the drive end bracket, armature, pinion gear and drive engaging lever.

5. Locate the armature in a soft jawed vice and tap off the circlip retaining cover. Remove the circlip and detach the drive pinion assembly.

6. Remove the spring from the pinion assembly after removing the retaining circlip.

   NOTE – Do not grip the one-way clutch in a vice whilst carrying out this operation as it will be damaged.

To Install

7. Refit the spring and retainer plate to the drive pinion and clutch unit, secure them with the circlip.

8. Replace the assembly on the armature shaft.

9. Place the circlip retaining cover on the armature shaft, then fit the circlip. Pull the cover up over the circlip (Tool No. CP.4111-A).

10. Replace the drive end bracket and armature assembly, and secure in position with the two spring washers and nuts.

11. Replace the commutator end plate, with brushes.

12. Replace the two screws holding the end plate.

13. Replace the thrust washer.

14. The armature end-float must not exceed 0.010 in. (0.25 mm.), and this can be adjusted by suitable shims between the thrust plate and split pin.

15. Replace the split pin.

16. (i) Remove the connection from the solenoid to the starter body terminal.

    (ii) Energise the solenoid with an 8 volt supply. Measure the distance between the leading edge of the pinion and the thrust washer on the armature shaft extension. The correct clearance should be 0.005 to 0.150 in. (0.13 to 3.81 mm.).

    NOTE – This should not take more than approximately 2 minutes, otherwise the solenoid will overheat.

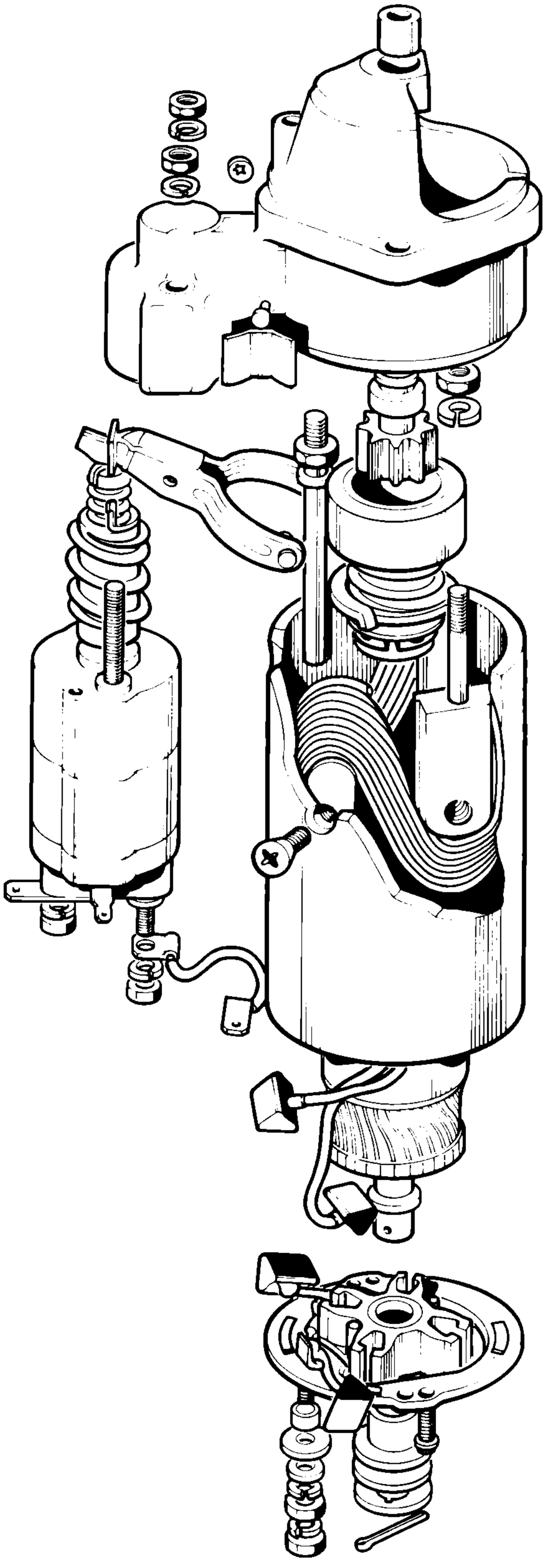
    (iii) Connect, through a switch, an 8 volt supply between the solenoid small unmarked terminal and the large terminal "STA". Connect a test lamp between the switch side of the battery and the large blade terminal.

    (iv) Insert a stop of $\frac{1}{8}$ in. (3.2 mm.) thickness between the pinion and drive end bracket to prevent the pinion moving fully outwards.

    (v) Close the switch, thus causing the 8 volt supply to energise the shunt winding. The test lamp should now light, indicating that the solenoid contacts have closed satisfactorily.

    (vi) Switch off and remove the $\frac{1}{8}$ in. (3.2 mm.) stop. Switch on again and hold the pinion in the fully engaged position by hand.

    (vii) Switch off and observe the test lamp, which should go out, indicating that the solenoid contacts have opened satisfactorily.



Pre-Engaged Starter Motor — Exploded View

OP 11001-A2 EXTRA: BRUSHES – RENEW AND COMMUTATOR – CLEAN (PRE-ENGAGED TYPE B)

Tools Required

CP.9501 Spring tension scale

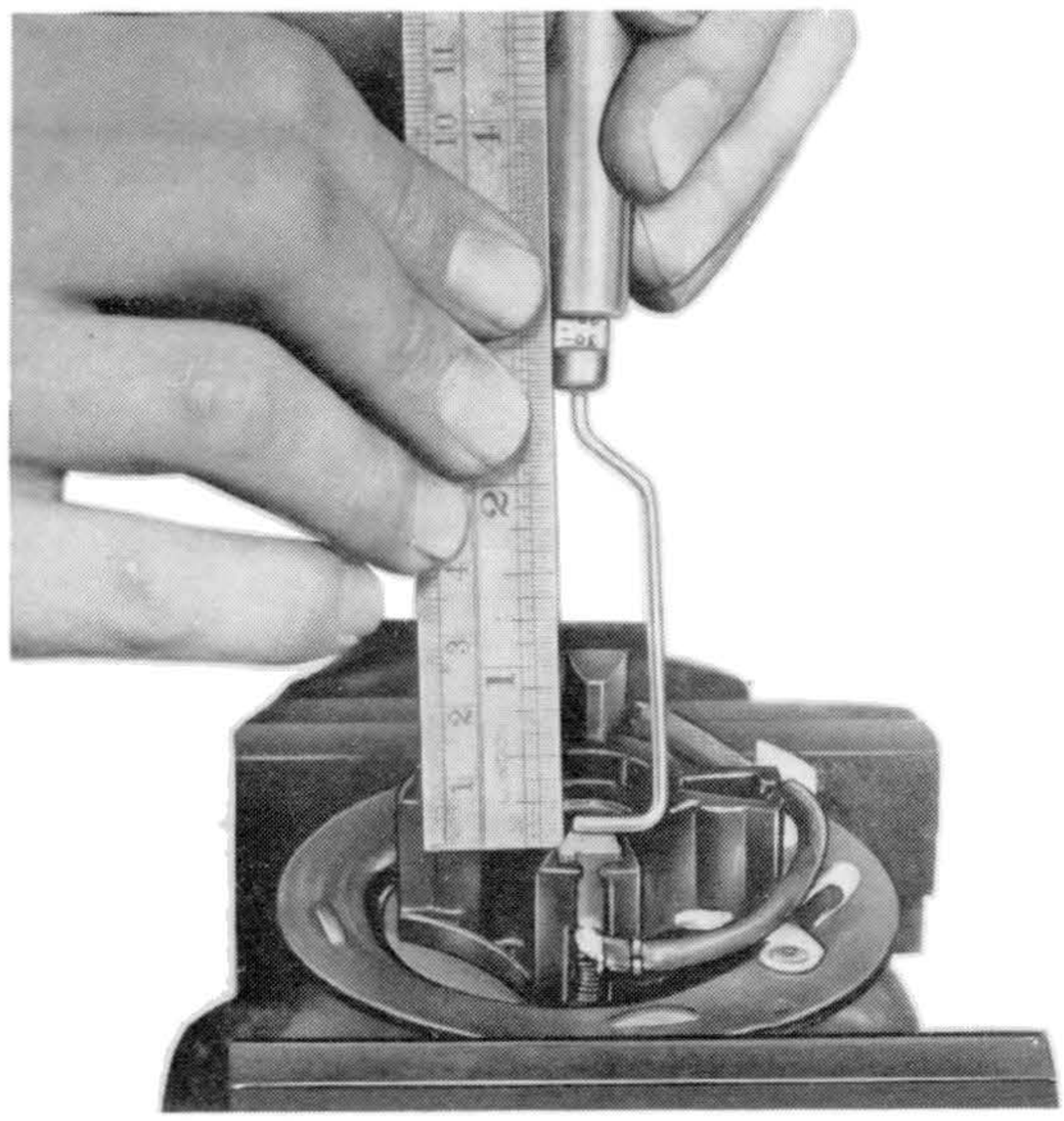
To Remove

1. Remove the split pin, shim washer and thrust plate from the armature shaft.
2. Remove the two screws holding the commutator end plate.
3. Remove the end plate, complete with brush box moulding.
4. Cut off the brush flexible connectors as near to the terminal as possible.
5. Solder the new brushes onto the end of the terminal post.
6. Cut off the brush flexible connectors $\frac{1}{8}$ in. (3.2 mm.) from the hot pressed joint on the field winding.
7. Solder the flexibles of the new brushes in their place.
8. Clean the end commutator with a petrol moistened cloth or, if necessary, polish it with very fine glass paper.

   Do not use emery cloth, and never undercut the mica insulation.

To Install

9. Check the brushes for freedom of movement, and clean with a petrol-moistened cloth if necessary.
10. Check the brush springs by placing new brushes in the holder and press them down with the spring tension scale (Tool No. CP.9501). With the brushes protruding $\frac{1}{16}$ in. (1.5 mm.), the spring balance should read 28 oz. (0.81 kg.). If these pressures are incorrect, the end bracket assembly must be replaced.



Brush Spring Pressure

11. It is also advisable to check the insulated brush holders to ensure that they are not earthing. Use a battery and bulb for this test.
12. Replace the end plate, complete with brush box moulding.
13. Replace the two screws holding the commutator end plate.
14. Replace the thrust washer.
15. The armature end-float must not exceed 0.010 in. (0.25 mm.) and this can be adjusted by suitable shims between the thrust plate and split pin.
16. Replace the split pin.

OP 11001-A3 EXTRA: PRE-ENGAGED STARTER MOTOR (TYPE B) – OVERHAUL

Tools Required

CPT.9504	Pole piece screwdriver
CPT.9509	Pole expander

1. Remove two opposite pole shoes, and loosen the other two retaining screws.
2. Install new field coils, and replace the two pole pieces.
3. Test the coils for continuity.
4. Remove the commutator end bush by means of a suitable sized tap.
5. Press out the drive end bush.
6. Press the new porous bronze bushes into position after soaking in engine oil for 24 hours.

OP 11001-B PRE-ENGAGED STARTER MOTOR DRIVE COMPONENTS – TYPE B – REMOVE AND INSTALL
(Includes OPS 11001-A and A1)

OP 11001-C PRE-ENGAGED STARTER MOTOR BRUSHES – TYPE B – RENEW AND COMMUTATOR – CLEAN
(Includes OPS 11001-A, A1 and A2)

OP 11001-D PRE-ENGAGED STARTER MOTOR – TYPE B – OVERHAUL
(Includes OPS 11001-A, A1, A2 and A3)

OP 11450-A STARTER SOLENOID – REMOVE AND INSTALL

1. Open the bonnet and disconnect the battery.
2. Disconnect the leads from the starter solenoid.
3. Remove the starter solenoid.
4. Replace the starter solenoid.
5. Reconnect the leads to the starter solenoid.
6. Reconnect the battery and check the starter solenoid operation.

IGNITION SYSTEM

GENERAL DESCRIPTION

The ignition system consists of a ballast resistor coil, with a Ford distributor and spark plugs. The high tension leads are of the suppressor type.

The oil filled coil is used in conjunction with a special starter solenoid and a ballast resistor wire. This arrangement ensures that full battery voltage is applied to the coil during starting.

A re-designed coil is now used, with inhibitive stud type connections, and a stone-coloured anti-tracking type coil cap. In addition, the coil is now located on the front timing cover.

The Autolite distributor is driven by a skew gear from the camshaft, and controls the spark advance both by governor weights and by vacuum from the inlet manifold.

Different distributors are used for each engine and compression ratio, and their identification numbers are given overleaf.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

At first 600 miles (1,000 km.)

Examine and adjust distributor points

Check and adjust the ignition timing

Every 6,000 miles (10,000 km.)

Examine and adjust distributor points

Check and adjust the ignition timing

Clean and adjust the spark plugs

Lubricate the distributor cam spindle wick with two drops of engine oil

Lubricate the distributor cam with lithium base grease

Clean the distributor cap, H.T. leads and coil

Check and adjust dwell angle.

CAUTION – Do not over-lubricate any part of the distributor, otherwise lubricant may reach the breaker contacts, resulting in burning and difficult starting. Points which have become dirty or contaminated with oil or grease should be cleaned with a stiff brush and carbon tetrachloride.

NOTE – The distributor contact breaker points should only be changed if they are worn, badly burnt, or if excessive metal transfer has occurred or have a "high resistance". Contacts showing a greyish colour and only slight signs of pitting need not be renewed. The resistance is considered "high" when the voltage drop across the points exceeds 0.25 volts.

DATA

Distributor points gap	0.025 in. (0.64 mm.)
Dwell angle ...	38° to 40°
Firing order ...	... 1, 2, 4, 3
Rotation	... ... Anti-clockwise
Spark plug, type and gap	... Autolite AG22. 0.023 in. (0.59 mm.)
Mechanical advance spring location ...	... Secondary spring adjacent to advance slot
Advance slot—H.C. and L.C.	15L
—G.T.	10L

IGNITION TIMING

(*a*) Establish that the correct distributor is fitted.

(*b*) Check the octane rating of the fuel that is to be used with the engine, as this can affect the initial advance.

(*c*) The initial advance is "built-in" to the engine and when one of the marks on the crankshaft pulley aligns with the appropriate mark on the front cover timing pointer the initial advance setting is correct and no further adjustment is required at this stage.

Distributor Number

1,300 c.c. — H.C.	C7AH-A
1,300 c.c. — L.C.	C7AH-B
1,600 c.c. — H.C.	C7BH-A
1,600 c.c. — 8.5 : 1 c.r.	C8EH-G
1,600 c.c. — L.C.	C7BH-B
1,600 c.c. — G.T.	C7BH-C

Compression Ratio	*Octane Number*	*Star Rating*	*Initial Advance (Crankshaft Degrees)*				
			1,300 c.c.	*1,600 c.c.*	*1,600 c.c. (E.E.C.)*	*G.T.*	*G.T. (E.E.C.)*
G.T. 9.0 : 1	97	4	—	—	—	8	4
H.C. 9 : 1	97	4	10	10	4	—	—
	94	3	6	6	—	—	—
8.5 : 1	94	3	—	—	4	—	—
L.C. 8 : 1	89	—	10	10	—	—	—
	86	—	4	4	—	—	—

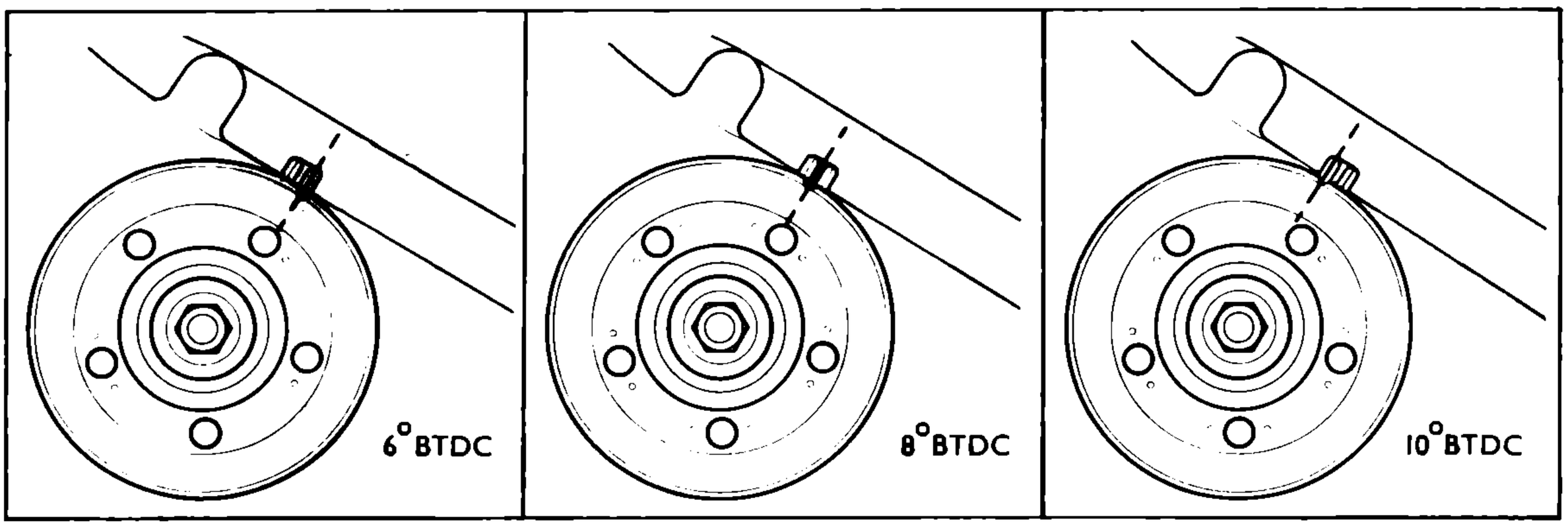
NOTE – If the car is normally operated at a high altitude the distributor setting may be **advanced** by 4° for each 2,000 ft. (600 m.) above sea level. Where the car is operated at varying altitudes the initial advance must, at all times, be set for the lowest altitude at which the car is operated.

SERVICE AND REPAIR OPERATIONS

OP 12024-A IGNITION COIL – REMOVE AND INSTALL

To Remove

1. Disconnect the battery cables.
2. Remove the wires from the ignition coil.
3. Undo the bolt securing the ignition coil mounting bracket mount.
4. Remove the coil from the bracket.



Ignition Timing Marks

To Install

5. Reposition the ignition coil and bracket and secure in position with the bolt.

6. Reconnect the wires to the coil.

7. Reconnect battery cables.

OP 12100-A DISTRIBUTOR ASSEMBLY - REMOVE AND INSTALL

To Remove

1. Disconnect the high tension leads from the spark plugs.

2. Disconnect the high tension lead and the low tension lead from the coil.

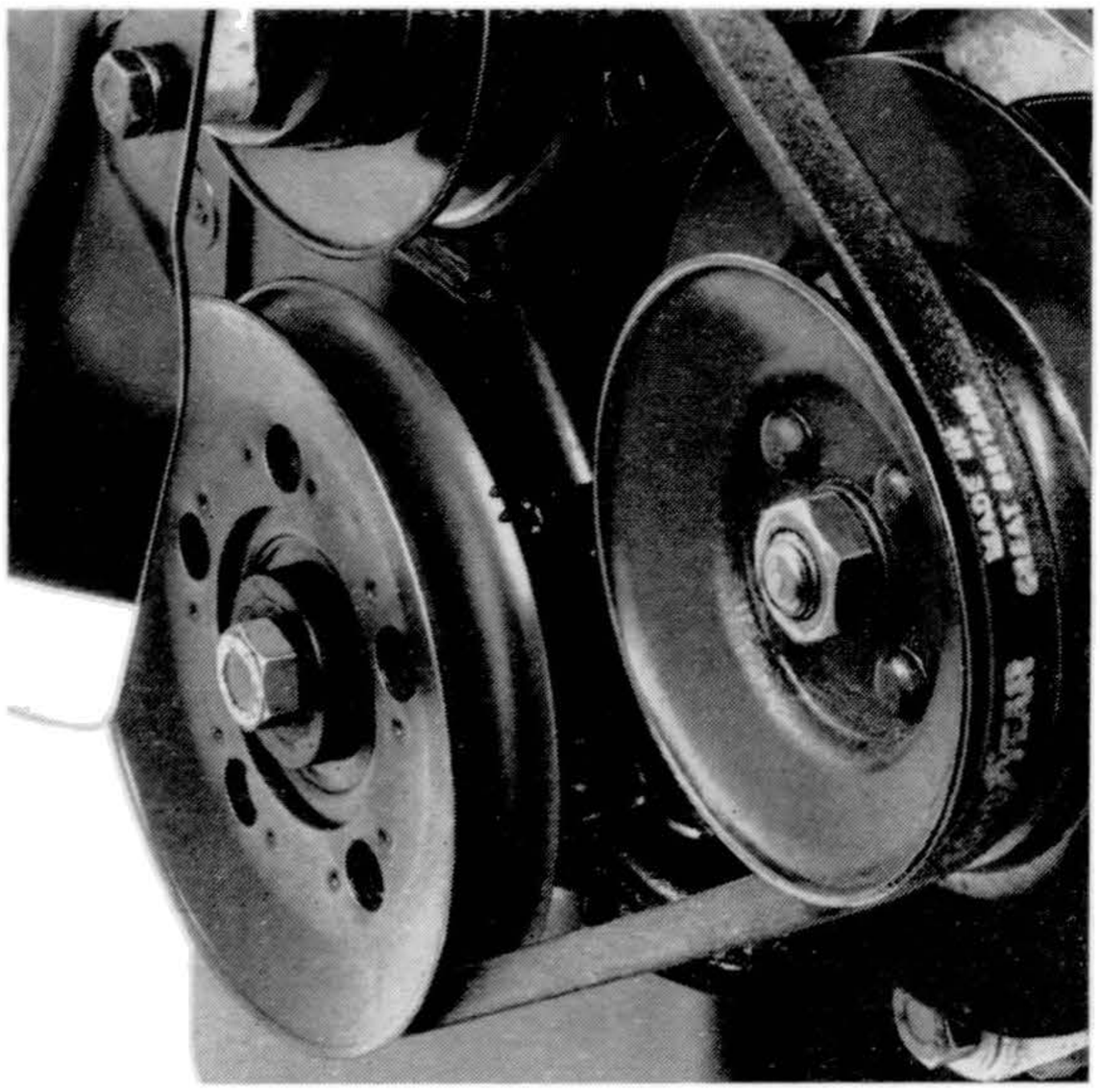
3. Disconnect the vacuum line from the distributor.

4. Unscrew the bolt retaining the distributor on the engine and carefully withdraw the distributor.

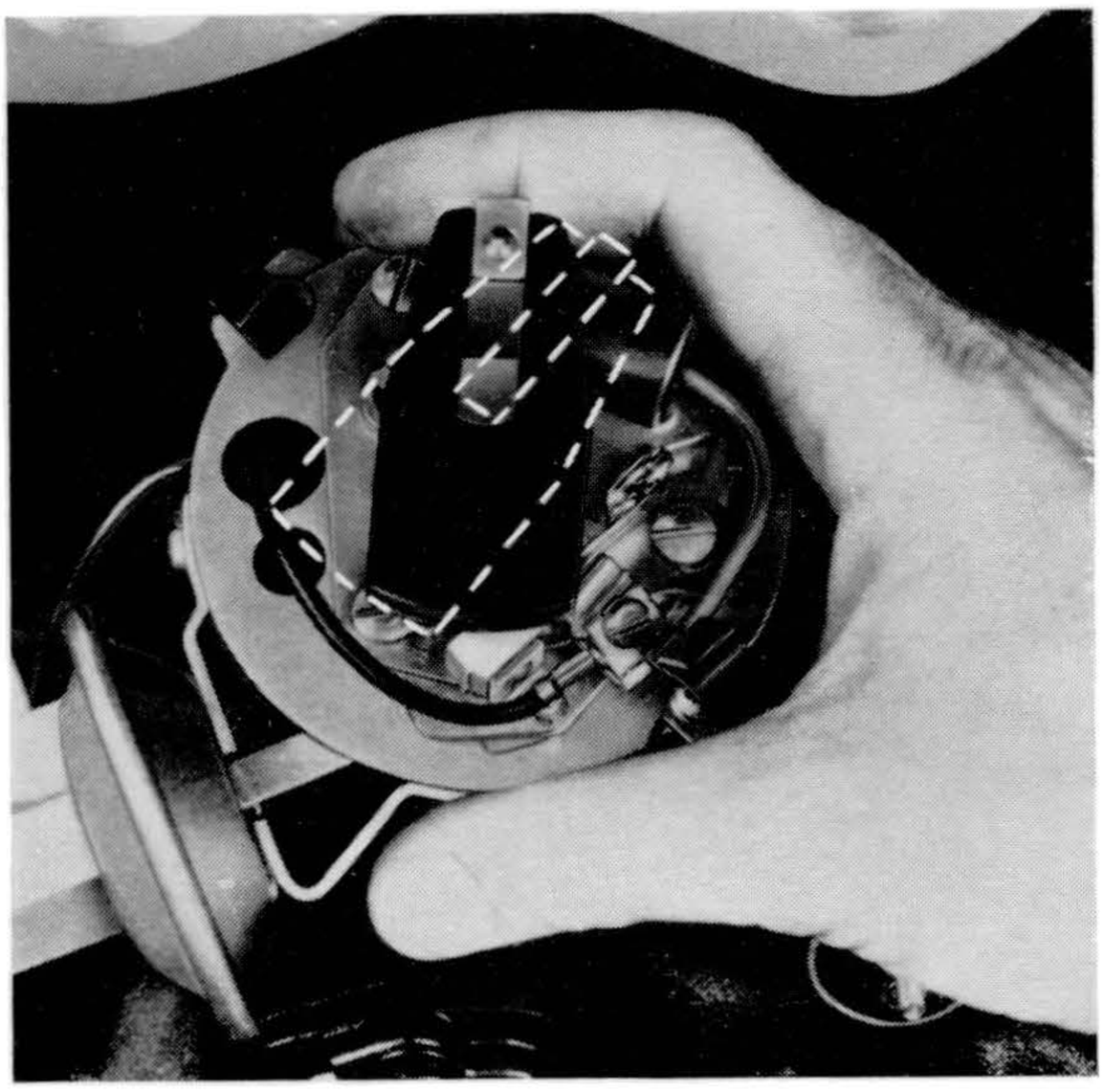
To Install

5. Turn the engine crankshaft until the appropriate timing mark on the timing cover is in line with the notch on the crankshaft pulley as the No. 1 piston comes up on the compression stroke.

6. With the vacuum advance unit pointing to the rear of the engine position the rotor to point to No. 2 spark plug.



Ignition Timing Marks



Refitting the Distributor (1,300 c.c.)

7. Insert the distributor and, as the gears mesh, the rotor should rotate slightly. If necessary re-position the clamp, without turning the distributor, so that the hole is in line with the one in the cylinder block. Fit the retaining bolt and tighten.

A. To Adjust the Timing without the use of a Timing Light

(*a*) Slightly turn the distributor body as necessary until the contact breaker points are just opening when the rotor is adjacent to No. 1 H.T. electrode in the distributor cap.

NOTE – Excessive movement from the specified position would indicate that the gears are meshing one or more teeth out. Remove the distributor and refit if this occurs.

(*b*) Tighten the distributor body clamp bolt sufficiently to hold the distributor in position. **Do not over-tighten.**

8. Replace the distributor cap.

9. Reconnect the spark plug leads (firing order 1, 2, 4, 3, anti-clockwise rotation) and connect the grommet to the rocker cover bracket.

10. Reconnect the low tension lead to the coil.

B. To Adjust the Timing using a Timing Light

(*a*) Connect the leads of the timing light, using the clips provided, in accordance with the manufacturer's instructions.

(*b*) Check that the timing marks on the crankshaft pulley and front cover are visible and mark with chalk or paint if necessary.

(*c*) Start the engine and allow it to idle. Ensure that the distributor vacuum pipe is disconnected.

(*d*) Point the timing light at the timing pointer. Check that the mark on the crankshaft pulley is adjacent to the appropriate mark on the front cover timing pointer.

If the mark of the pulley is above and to the left of the correct timing mark, the engine is too far advanced. Slacken the distributor body clamp and turn body anti-clockwise slightly to retard the ignition.

Should the mark be below and to the right of the correct timing mark, the distributor body should be turned clockwise slightly to advance the ignition.

(*e*) After making an adjustment, tighten the clamp sufficiently to hold the distributor in position. **Do not over-tighten.**

The operation of the governor weights may be checked by opening and closing the throttle. As the throttle is gradually opened, the mark should move away from the indicator upwards; and as the throttle is closed the notch will move down in line with the indicator. Any tendency for erratic advance shown by the mark jumping suddenly away from the indicator shows that the governor weights are binding, or that the springs are weak.

11. Reconnect the distributor vacuum pipe.

12. A slight readjustment to the distributor may be necessary and should be carried out on the road in the following manner:—

(i) Warm up the engine to normal operating temperature.

(ii) Accelerate in top gear on wide throttle opening from 20 m.p.h. (32 k.p.h.) to 40 m.p.h. (64 m.p.h.).

(iii) If heavy pinking occurs, **retard** the ignition until a trace pink can just be heard under these conditions of acceleration.

NOTE – It is not necessary to advance the ignition beyond the initial setting (except under high altitude operating conditions previously detailed). Also, there is no need to use a fuel of a higher octane rating than that specified.

OP 12100-A1 EXTRA: DISTRIBUTOR CAP – REMOVE AND INSTALL

1. Remove the spark plug leads and high tension lead from the distributor cap.
2. Release the two spring clips and remove the cap.
3. Replace the cap, and retain with the two spring clips.
4. Replace the leads, taking care to place these in their correct sockets.

OP 12100-A2 EXTRA: CONDENSER – RENEW (DISTRIBUTOR CAP REMOVED)

1. Unscrew the condenser lead, and the condenser retaining screw.
2. Replace the condenser, retain in position and replace the wire.

OP 12100-A3 EXTRA: POINTS – RENEW (DISTRIBUTOR CAP REMOVED)

1. Loosen the retaining screw, and remove the low tension, and condenser wires from the points.
2. Unscrew the retaining and adjusting screws, and remove the points.
3. Replace the points, and lightly retain in position.
4. Adjust the points to give a points gap of 0.025 in. (0.64 mm.).
5. Tighten the adjusting screw.
6. Replace the two wires and retain in position.

OP 12100-A4 EXTRA: DISTRIBUTOR BREAKER PLATE ASSEMBLY – REMOVE AND INSTALL (DISTRIBUTOR CAP REMOVED)

To Remove

1. Remove the circlip on the vacuum unit pivot post.
2. Remove the two screws securing the breaker plate assembly to the distributor body.
3. Remove the breaker plate assembly.

To Install

4. Replace the breaker plate assembly, and secure it with the two screws.
5. Replace the circlip on the end of the vacuum unit pivot post.

OP 12100-A5 EXTRA: DISTRIBUTOR BREAKER PLATE ASSEMBLY – OVERHAUL (BREAKER PLATE REMOVED)

To Dismantle

1. Remove the large circlip on the pivot post.
2. Remove the flat washer, wave washer, and upper contact breaker plate, turning the upper breaker plate as necessary to disengage the holding down screw from the keyhole slot in the lower plate. Take care not to lose the earth spring between the upper and lower breaker plates.
3. Remove the rubber grommet holding the low tension wire in position in the lower plate.

To Reassemble

4. Replace the rubber grommet in the lower plate, taking care to leave enough wire to reach the contact breaker connection.
5. Replace the earth spring on the pivot post, followed by the upper contact breaker plate, and engage the holding down spindle in the keyhole slot.
6. Retain in position by the wave washer, flat washer and large circlip.
7. Check the clearance between the breaker plates beneath the nylon bearing nearest the holding down pin.

   The maximum clearance is 0.010 in. (0.25 mm.). To reduce the clearance, screw the nut further onto the holding down screw.

OP 12100-A6 EXTRA: GOVERNOR WEIGHTS AND SPRINGS – RENEW (BREAKER PLATE REMOVED)

To Remove

1. Prise off the clips retaining the governor weights and remove the weights.
2. Unclip the advance springs after noting which spring fits to which post.

To Install

3. Refit the springs to the posts, ensuring that the primary spring (larger coil diameter) is fitted to the post from which it was removed.
4. Refit the governor weights with their flat edge adjacent to the cam spindle and retain them with the spring clips.

OP 12100-A7 EXTRA: VACUUM UNIT – RENEW (BREAKER PLATE REMOVED)

1. Remove the two crosshead screws and spring washers securing the vacuum unit, and remove the unit.
2. Replace the vacuum unit, and retain in position with the two crosshead screws and spring washers.

OP 12100-A8 DISTRIBUTOR – OVERHAUL (GOVERNOR WEIGHTS AND VACUUM UNIT REMOVED)

To Dismantle

1. Remove the felt pad in the top of the cam spindle and then expand and remove the retaining circlip. Lift off the cam spindle, noting in which slot the advance stop is located.
2. Drive out the drive gear retaining pin and withdraw the gear with the two washers located above it. Withdraw the action plate and shaft from the distributor body. Remove the thrust washers below the action plate.
3. Unscrew the bolt on the end of the vacuum unit and withdraw the vacuum spring, stop and shim(s).

To Reassemble

4. Reassemble the vacuum spring, stop and shim(s) to the vacuum unit. Replace the bolt and sealing washer.
5. Slide the thrust washers onto the shaft below the action plate. Fit the shaft and action plate to the distributor body and slide on the thrust washer, wave washer and gear. Refit the tension pin.
6. If a new gear or shaft is being fitted it will be necessary to drill a new tension pin hole.

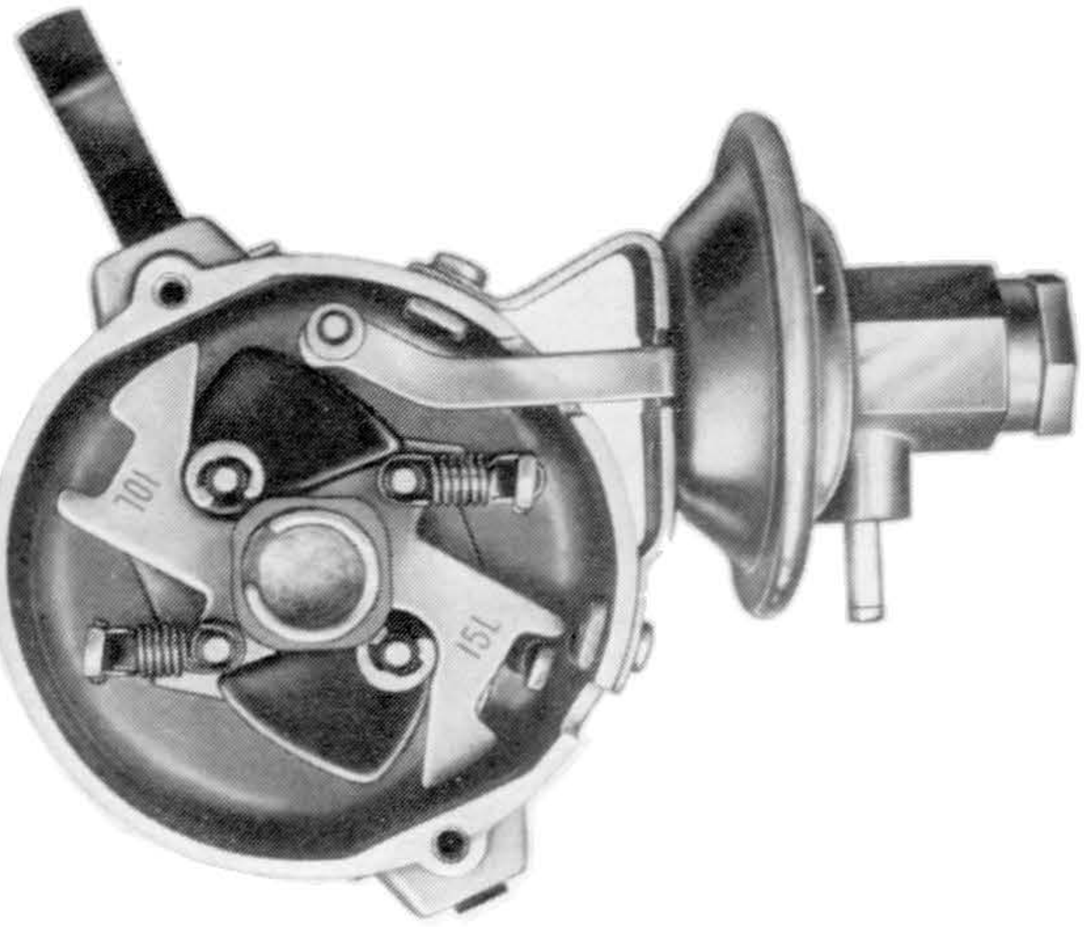
   Note that a new gear will already have a pilot drilling for the tension pin hole.

   (*a*) Assemble the thrust washers to the shaft and fit it into the distributor body.

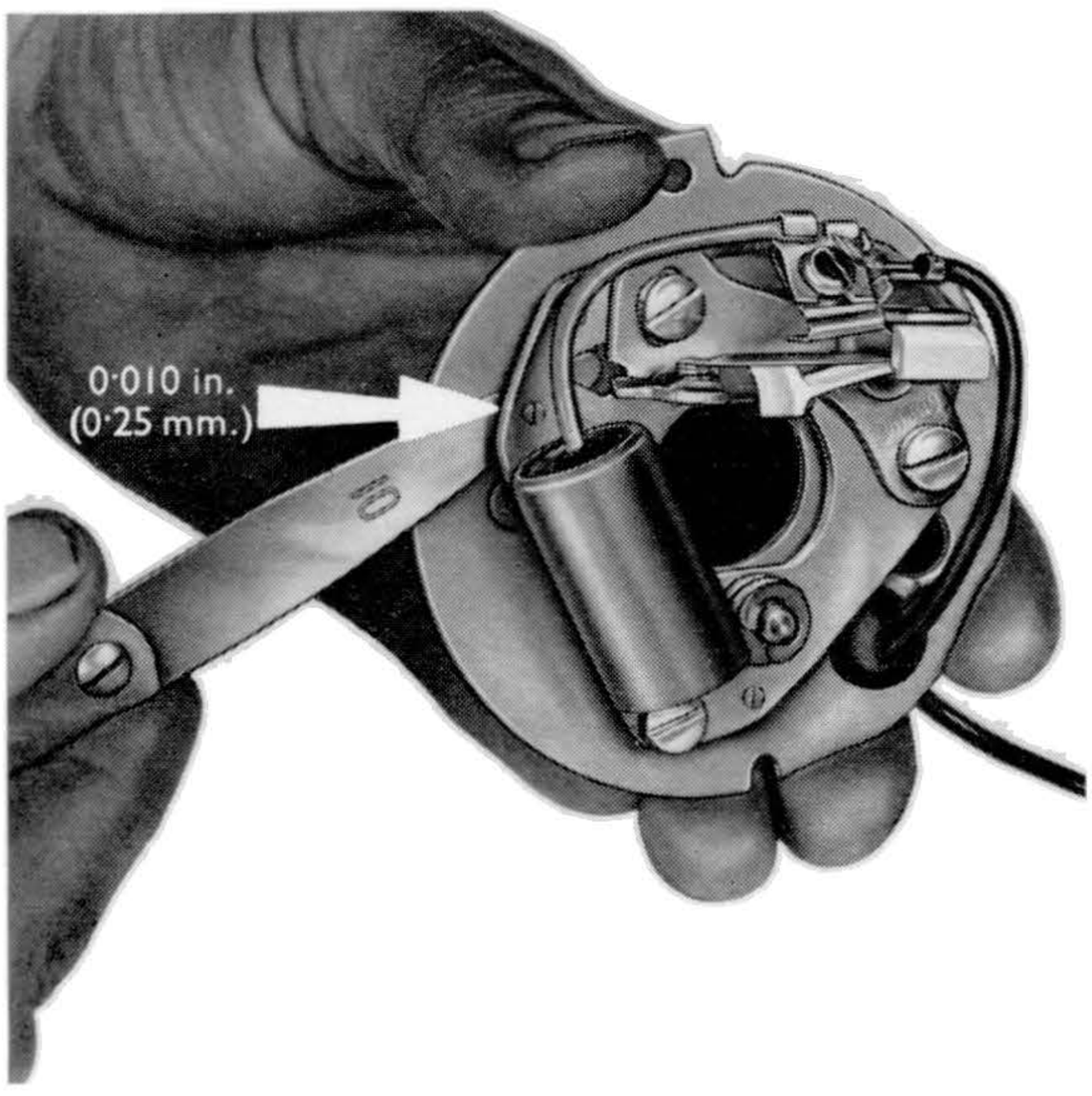
   (*b*) Obtain or make a 0.015 in. (0.38 mm.) thick shim.

   (*c*) Assemble a new thrust washer, wave washer and the 0.015 in. (0.38 mm.) shim on the distributor shaft.

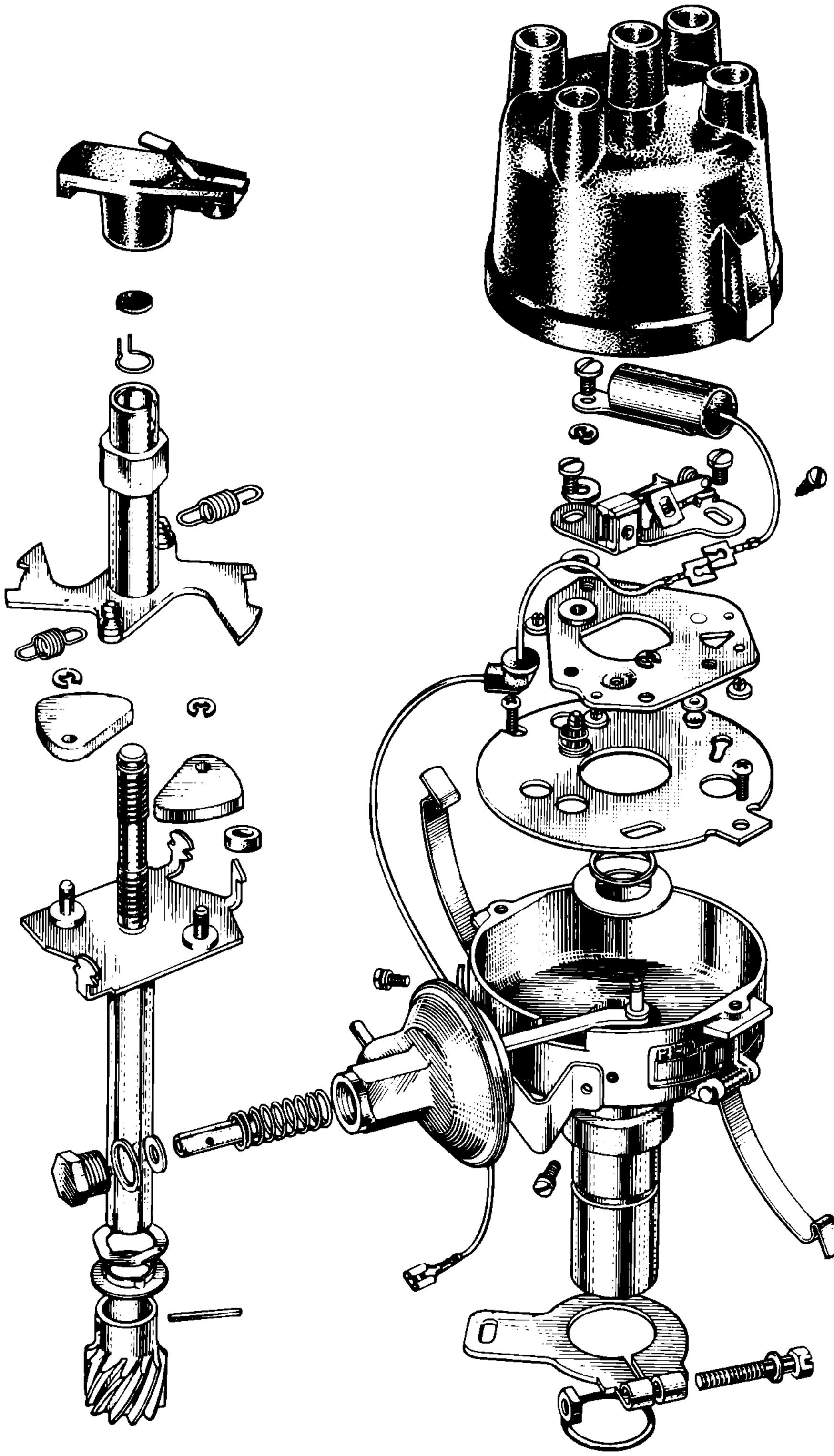
   (*d*) If a new gear is being used, position the pilot hole at 90° to the rotor arm slot, with zero advance in the mechanism.



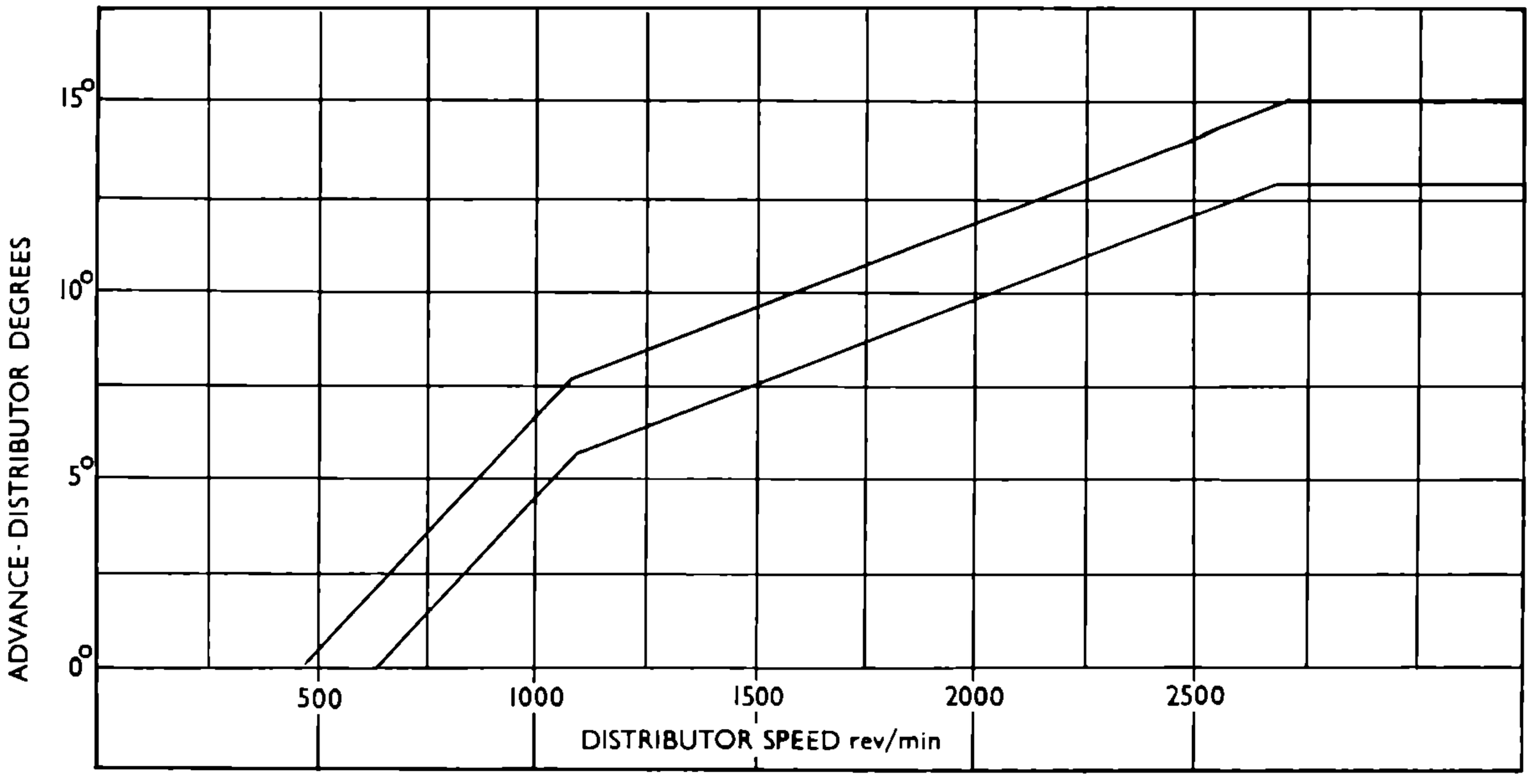
Assembling Mechanical Advance — H.C.



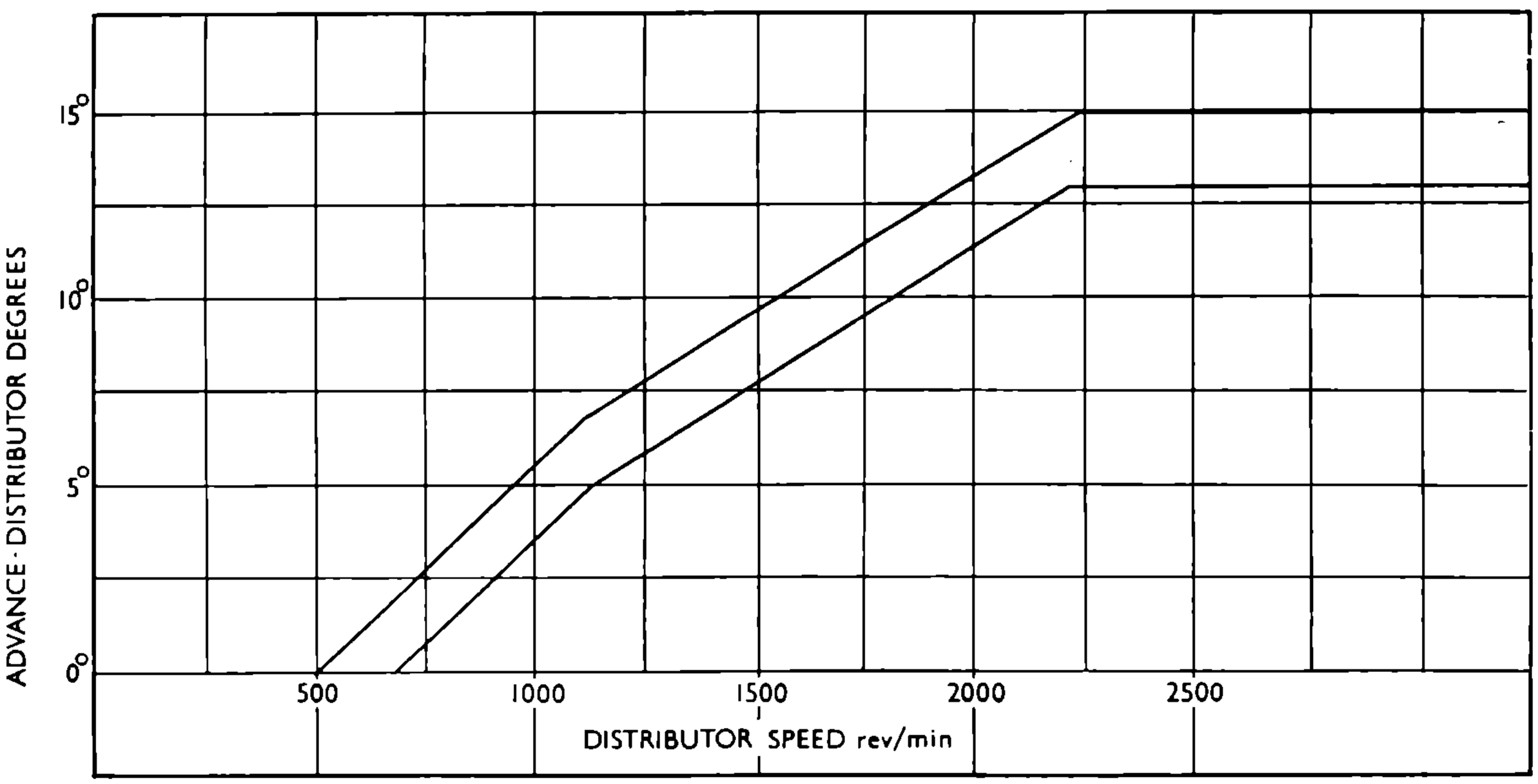
Checking Contact Breaker to Lower Breaker Plate Clearance



Distributor Assembly — Exploded View



Mechanical Advance — 1,300 c.c. and 1,600 c.c — High Compression



Mechanical Advance — 1,300 c.c. and 1,600 c.c. — Low Compression

(*e*) Using a suitable screw compression clamp, push the gear along the shaft until the spring washer is compressed and all slack is removed. **Do not over-tighten.**

(*f*) Position the assembly carefully in Vee blocks under a press drill. Drill a $\frac{1}{8}$ in. (3.18 mm.) hole through gear and shaft using the pilot hole as a guide. When using the original gear with a new shaft, drill the roll pin hole through the gear at right angles to the original hole.

(*g*) Remove the drill and install a new roll pin.

(*h*) Release the compression of the clamp and extract the 0.015 in. (0.38 mm.) shim.

7. Replace the cam spindle, ensuring that the advance stop is located in the correct slot, and secure with the spring circlip. Replace the felt wick.

OP 12100-B GOVERNOR WEIGHTS AND SPRINGS – RENEW
(Includes OPS 12100-A, A1, A4 and A6)

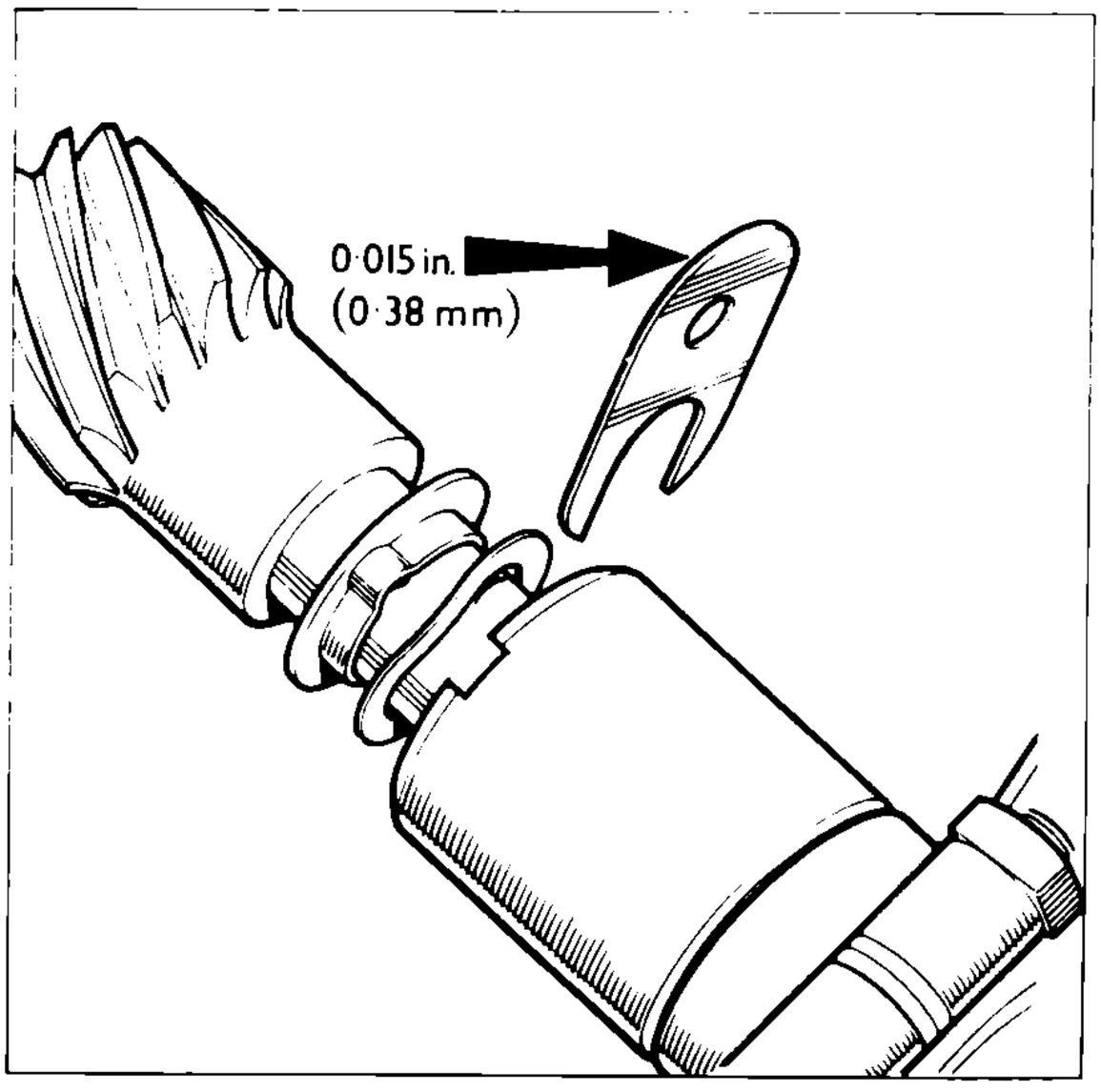
OP 12100-C VACUUM UNIT – RENEW
(Includes OPS 12100-A, A1, A4 and A7)

OP 12100-D DISTRIBUTOR – OVERHAUL
(Includes OPS 12100-A, A1, A2, A3, A4, A5, A6, A7 and A8)

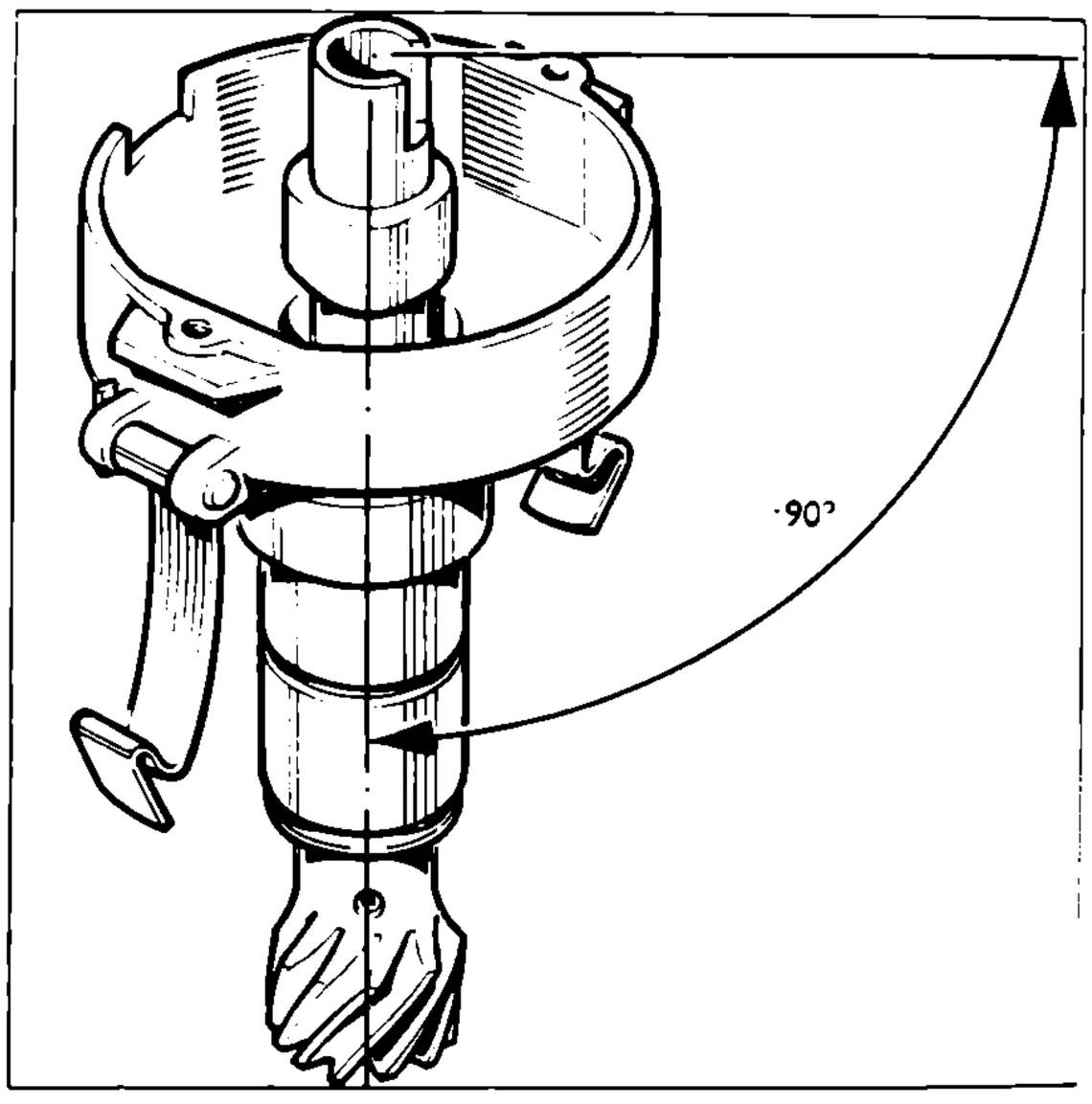
OP 12100-E DISTRIBUTOR ASSEMBLY – TEST AND ADJUST

The following instructions indicate the general principles to be followed for testing the distributor on a tester. The method of testing, however, may vary for machines of different manufacture. For specific instructions refer to the equipment manufacturer's handbook.

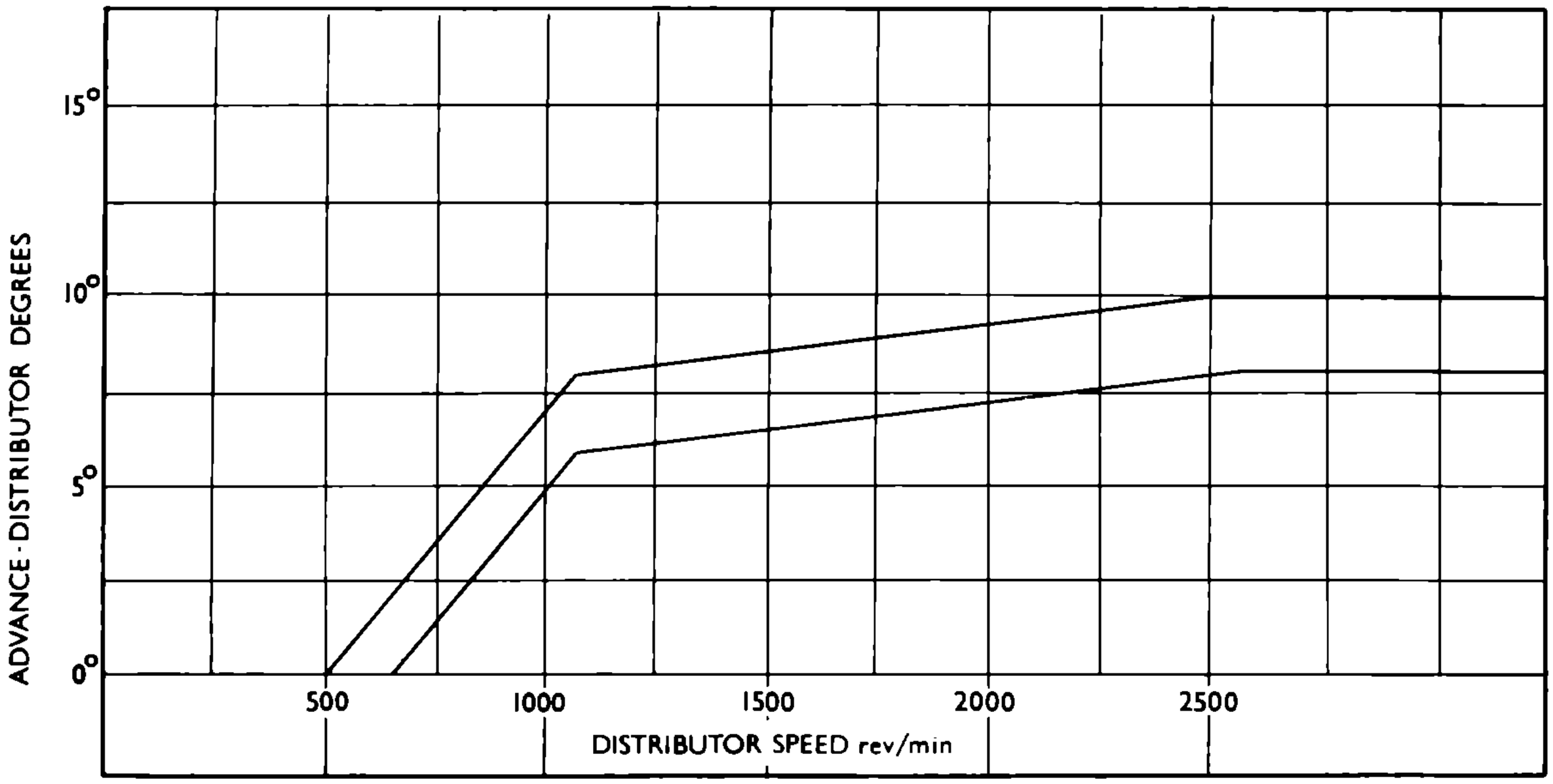
1. Mount the distributor on the tester, using an adaptor shaft, where necessary, to connect the drive from the machine to the distributor gear. Check that the distributor is free to rotate and that the adaptor shaft has the correct end-float, usually $\frac{1}{16}$ in. (1.5 mm.).
2. Make the necessary electrical connections and zero the instrument if required.



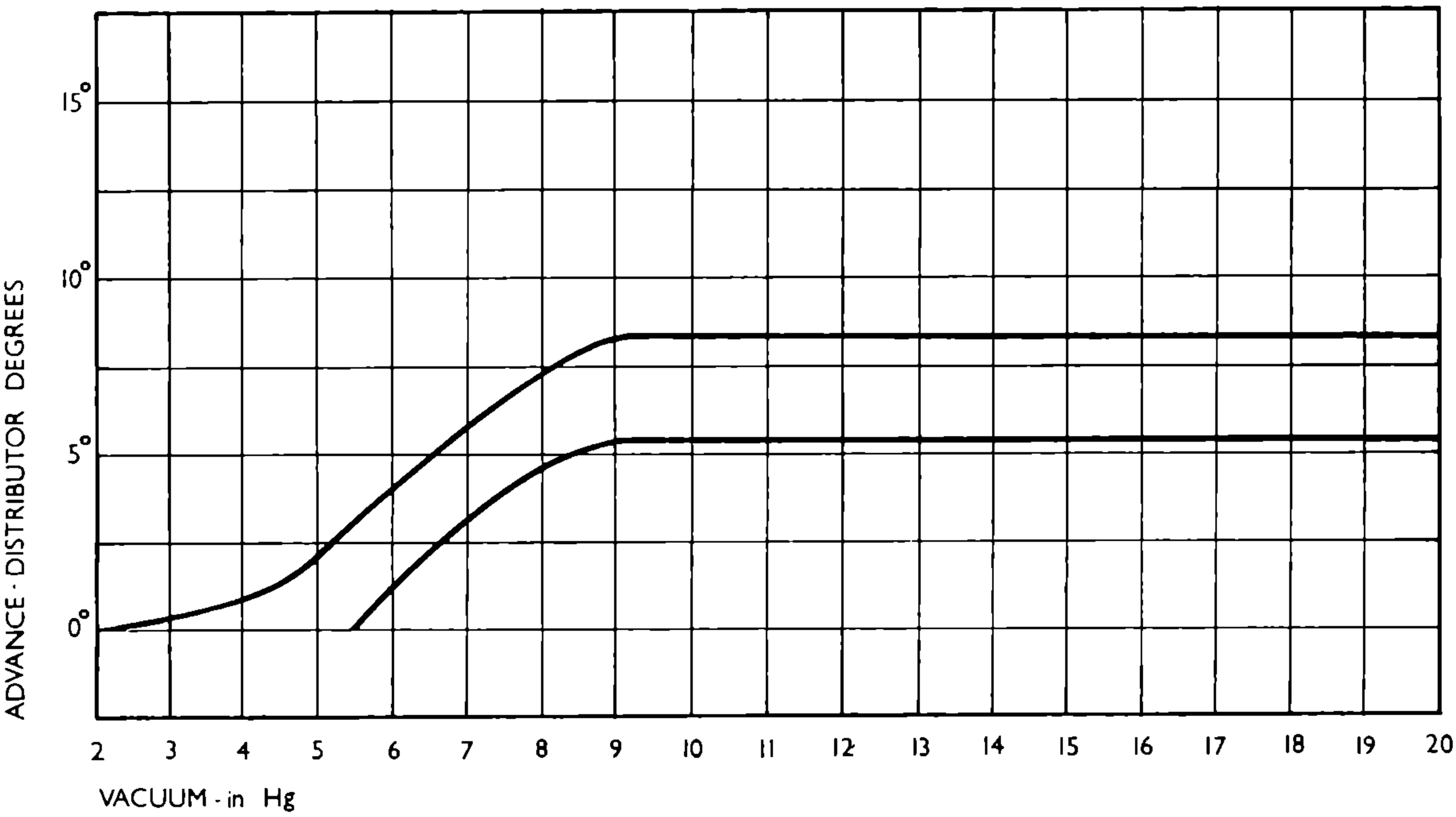
Setting Distributor Shaft End-Float



Fitting a New Drive Gear



Mechanical Advance — G.T.



Vacuum Advance — All Models

3. **Dwell Angle**

(*a*) Turn the cylinder selector to the figure corresponding to the number of lobes on the cam of the distributor; in this case four.

(*b*) Turn the selector test switch to the cam angle position and operate the distributor at approximately 1,000 rev./min. (crankshaft).

(*c*) Adjust the distributor breaker point gap to a dwell angle of 42°.

(*d*) Increase the speed up to a maximum of 5,000 rev./min. (crankshaft) and check the dwell reading, which must be between 39° and 42°. If the reading changes more than 3° check for a worn distributor shaft or worn bushings.

4. **Mechanical Operation**

(*a*) Make the necessary connections for the stroboscopic timing light or sparking protractor, refer to equipment manufacturer's handbook.

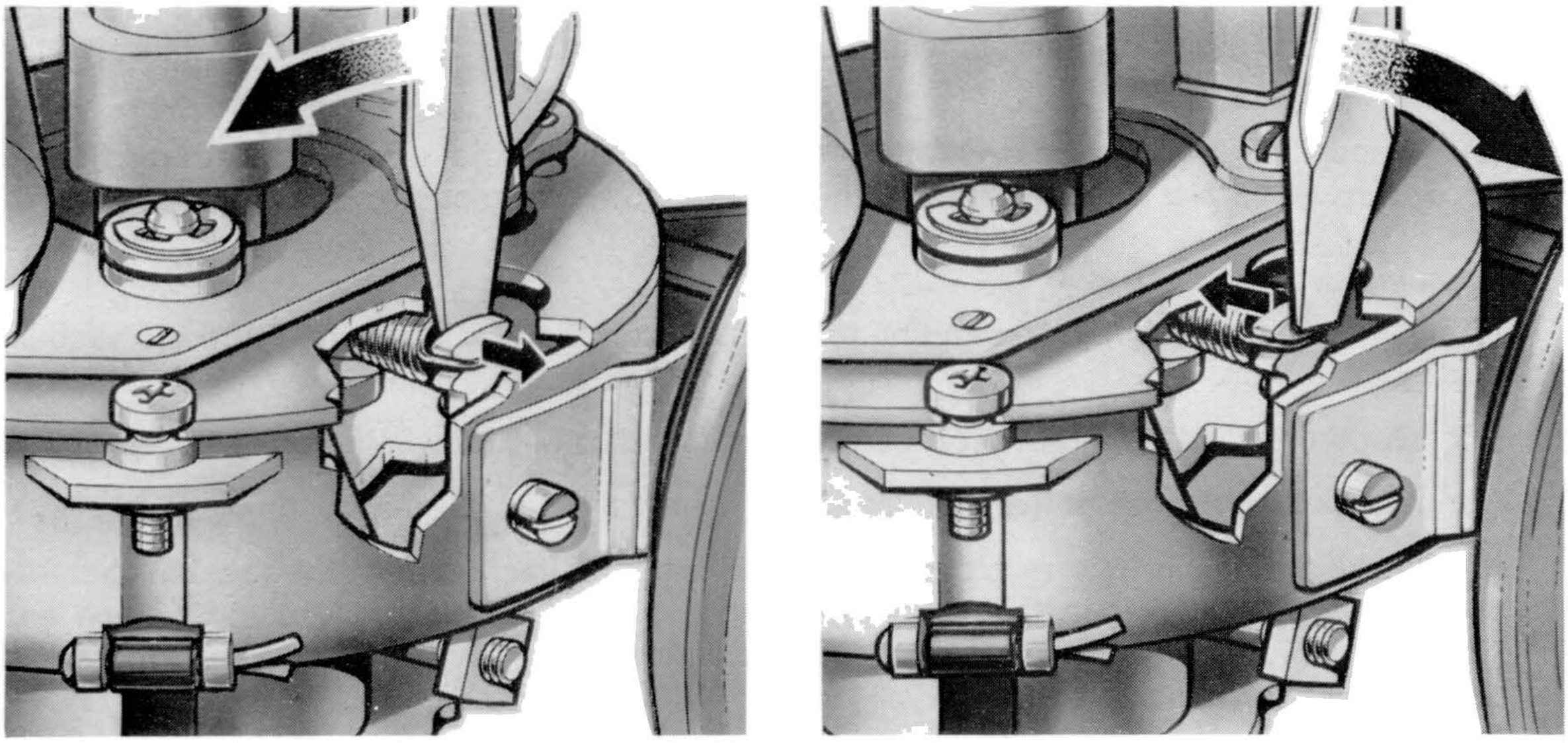
(*b*) Adjust the speed control to vary the distributor speed between 400 and 5,000 rev./min. (crankshaft). Erratic or thin faint flashes of light preceding the regular flashes as the speed of rotation is increased can be due to weak breaker arm spring tension.

(*c*) Operate the distributor at approximately 2,500 rev./min. (crankshaft).

(*d*) Move the protractor scale with the adjustment control so that the zero degree mark on the scale is opposite one of the neon flashes. The balance of all the flashes should come within plus or minus 1 , evenly spaced around the protractor scale. A larger variation than 1 or erratic or wandering flashes may be caused by a worn cam or distributor shaft or a bent distributor shaft.

Breaker Plate Wear

A worn breaker plate will cause the breaker point gap and contact dwell to change as the engine speed and load conditions are varied.



Decrease **Increase**

Adjusting Mechanical Advance

(*e*) Adjust the test set to 0° advance, zero vacuum, and 1,000 rev./min. (crankshaft). Check the dwell angle. Apply vacuum to the distributor diaphragm and increase it very slowly while observing the indicated dwell angle. The maximum dwell angle variation should not exceed 6° when going from zero to maximum vacuum at constant rev./min. If the dwell angle variation exceeds this limit, there is excessive wear at the contact breaker plate pivot pin or the diaphragm.

5. Distributor spark advance

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

Normally, this should not require adjustment as it is pre-set during manufacture. However, incorrect assembly or weakening of the advance springs will change the advance curves and adjustment will be required, if engine performance is not to be affected. Similarly, when fitting new components in the distributor, adjustment may be necessary. If a new distributor shaft is fitted, the spring anchor tabs on the action plate will have to be adjusted to give the correct mechanical advance.

Mechanical Advance

(*a*) Operate the distributor in the direction of rotation (anti-clockwise) and adjust the speed to 300 rev./min. (distributor). Move the protractor scale so that one of the flashes lines up with the zero degree mark.

(*b*) Slowly increase the speed to 700 rev./min. (distributor) H.C., 800 rev./min. (distributor) L.C. and G.T.

If the correct advance is not indicated at this speed, stop the distributor and bend the primary spring anchor tab to change its tension. **Bend the anchor tab away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension).**

(*c*) After an adjustment has been made to one spring, check the minimum advance point again.

(*d*) Operate the distributor at 2,500 rev./min. (distributor). If this advance is not to specifications, stop the distributor and bend the secondary spring anchor tab to give the correct advance.

(*e*) Check the advance at the other speeds shown in the diagrams and readjust if necessary. Operate the distributor both up and down the speed range.

Vacuum Advance

(*a*) Connect the test set vacuum line to the fitting on the diaphragm and turn the vacuum supply switch on.

(*b*) Set the test set to 0° advance, zero vacuum, and at 1,000 rev./min. (crankshaft).

(*c*) Check the advance at the vacuum settings shown in the diagrams.

(*d*) If the advance is incorrect, change the calibration shims between the vacuum chamber spring and plug. After installing or removing a shim, position the gasket in place and tighten the plug. **The addition of a shim will decrease advance and the removal of a shim will increase advance.**

(*e*) After one vacuum setting has been adjusted, check the advance at other vacuum settings on the curve. **Do not change the original speed setting when going to a**

different vacuum setting. If the other settings are not within limits, it indicates incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fibre stop has been installed in the vacuum chamber of the diaphragm housing.

OP 12199-A CONTACT BREAKER POINTS – RENEW (DISTRIBUTOR IN SITU)

To Remove

1. Remove the distributor cap.
2. Loosen the retaining screw, and remove the low tension and condenser wires from the points.
3. Unscrew the retaining and adjusting screws, and remove the points.

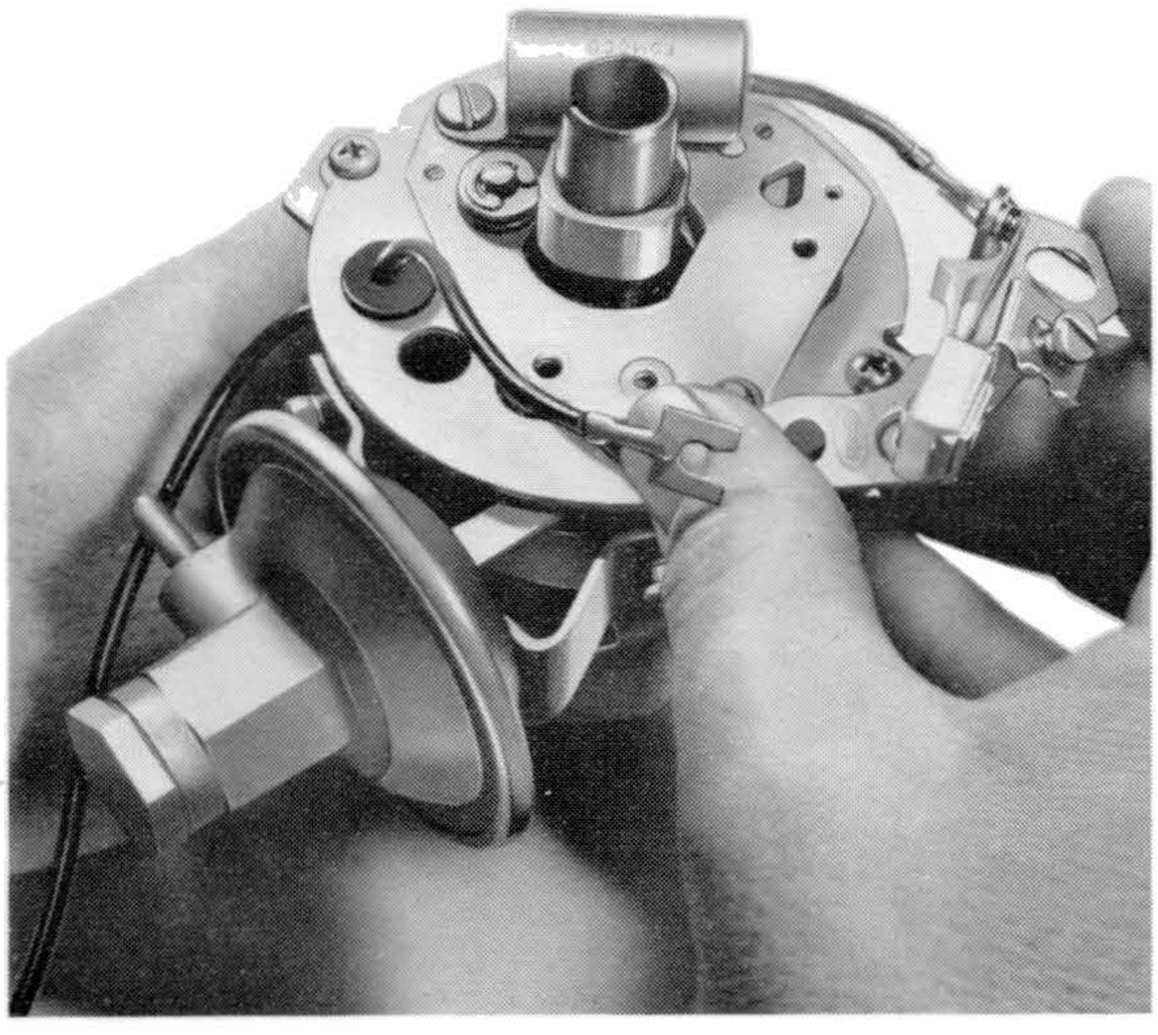
To Install

4. Replace the points and lightly retain in position.
5. Adjust the points to give a gap of 0.025 in. (0.64 mm.).
6. Tighten the adjusting screw.
7. Replace the two wires and retain in position.
8. Replace the distributor cap.

OP 12300-A CONDENSER – RENEW (DISTRIBUTOR IN SITU)

1. Remove the distributor cap.
2. Unscrew the condenser lead, and the condenser retaining screw.
3. Reposition the condenser, retain in position and replace the wire.
4. Replace the distributor cap.

Adjusting Contact Breaker Points



Fitting the Contact Breaker Assembly

OP 12405-A SPARK PLUGS – REMOVE AND INSTALL

1. Disconnect the spark plug leads.
2. Remove the spark plugs.
3. Replace the spark plugs.
4. Reconnect the spark plug leads.

OP 12405-A1 EXTRA: SPARK PLUGS – CLEAN AND RESET

1. Sandblast spark plugs.
2. File centre electrode flat and at 90°.
3. Set spark plug gap to 0.023 in. (0.59 mm.).

OP 12405-B SPARK PLUGS – CLEAN AND RESET
(Includes OPS 12405-A and A1)

INSTRUMENTS, CONTROLS AND ANCILLARIES

GENERAL DESCRIPTION

The instruments are of the bayonet fitting type and consist of fuel and temperature gauges mounted in a combined instrument, together with generator and oil pressure warning lights, and a separate speedometer incorporating a main beam warning light. These instruments are of Ford manufacture and the fuel and temperature gauges operate at 5 volts, which has the advantage of giving steady constant readings unaffected by sudden current changes, i.e. flashing the headlights or sounding horn, etc. Switches for the instrument panel lights, headlights and heater blower are of the tumbler type, fitted with black moulded knobs designed to give a positive action. The light switch has three positions: OFF, sidelight and headlight operation. Similarly the heater blower switch, mounted on the heater controls bezel, gives a two-speed control. Two levers mounted on the facia control the direction and temperature of the air delivered from the heater. The direction control lever allows cold, warm or hot air to be directed into the interior of the vehicle or on to the windscreen. The temperature control lever operates via a flexible cable which opens or closes a water valve mounted on the engine. This varies the amount of heated water passing through the heater element and thus the amount of warm air developed by the heater. In addition adjustable "face level ventilators" mounted on the facia allow variable amounts of cold air to be circulated through the vehicle. The amount of air passing through the ventilators is controlled by a knob mounted in the centre of the movable "eyeball", rotating the knob opens or closes a butterfly type valve.

The single speed windscreen wiper motor is controlled by a rotary switch incorporating the windscreen washer pump. Direction indicators and horn are operated from a single lever mounted on the steering column, while a floor-mounted switch controls headlight dip and main beam.

Direction indicator warning lights and the ignition switch are on the facia. The ignition switch has three positions in addition to the OFF position. When the key is turned clockwise to the first position the ignition and auxiliary circuits become live. Turning the key further against the spring stop will operate the starter motor.

NOTE – If the engine does not start, the key must be returned to the OFF position before the starter motor can be operated again, thus preventing damage through operating the starter motor whilst the engine is running. The key turned anti-clockwise will operate certain accessory circuits.

On G.T. models a tachometer replaces the combined instrument, and separate fuel and temperature gauges together with an ammeter and a tube-type oil pressure gauge are used. This bank of four instruments is mounted in the facia.

The oil pressure gauge is operated via a small bore pipe from a sender unit tapped into right-hand side of the engine. In addition on G.T. models an electric clock is mounted in the forward part of the centre console. The clock, which is bayonet fitting, can be adjusted for gain or loss by moving a small lever on the rear of the case. Moving the lever towards the + will speed up the clock and moving the lever towards the — will slow down the clock.

The driving lights consist of two headlamps, two side lights, two combined rear and stop lights and four direction indicator lights, two at the front and two at the back. The side lights and front direction indicator lights are mounted in the headlamp bezel. The headlamp is normally

a sealed beam unit but a semi-sealed unit with pre-focussed bulbs is also available. The bulbs for the rear/stop light and rear direction indicator lights can be removed from inside the luggage compartment.

Mounted on a separate panel under the facia are the hazard light switch, dual brake warning light and dual brake test switch. The dual brake warning light is illuminated by depressing the test switch. Illumination at any other time will indicate that there is a failure in one or other of the brake circuits.

Supplementary side lamps are mounted on the front fenders and all the lighting circuits are now fused. The fuses are grouped together in one fuse block mounted on the engine side apron panel and are rated at 8 amps. Where back-up lamps are fitted a separate fuse is provided, this fuse is located in the luggage compartment.

QUICK REFERENCE DATA

PERIODIC SERVICE ATTENTION

Weekly

Check operation of all lights

First 600 miles (1,000 km.)

Check operation of all instruments, controls and lights
Align headlamps if necessary

First 3,000 miles (5,000 km.) or three months and every subsequent 6,000 miles (10,000 km.) or six months

Check operation of all instruments, controls and lights
Align headlamps if necessary

DATA

Horns

Type	5 in. (127 mm.) 'beep'
Current draw	5 amp

Light Bulbs and Flasher Unit

Headlamp	60/45W* sealed beam
Side light	5W* wedge base
Front and Rear direction indicator	24W*
Flasher unit	48W*
Tail and Stop light	6/24W*
Licence plate	5W wedge base
Interior light	6W festoon
Warning lights	2.2W wedge base
Instrument panel light	2.2W wedge base
Clock	1.2W wedge base

* U.K.

SERVICE AND REPAIR OPERATIONS

OP 9280-A FUEL GAUGE – REMOVE AND INSTALL (EXCEPT G.T.)

To Remove

1. Disconnect the battery.
2. Turn the combined fuel/water temperature gauge approximately $\frac{1}{3}$ of a turn anti-clockwise using the tool detailed under OP 17255-A, and pull the instrument and outer bezel away from the facia.
3. Make a note of the wiring positions and remove the wires from the instrument.
4. Remove the combined fuel/water temperature gauge inner chrome bezel and glass.
5. Remove the two nuts securing the fuel gauge to the rear face of the instrument and withdraw the gauge through the front of the combined instrument.

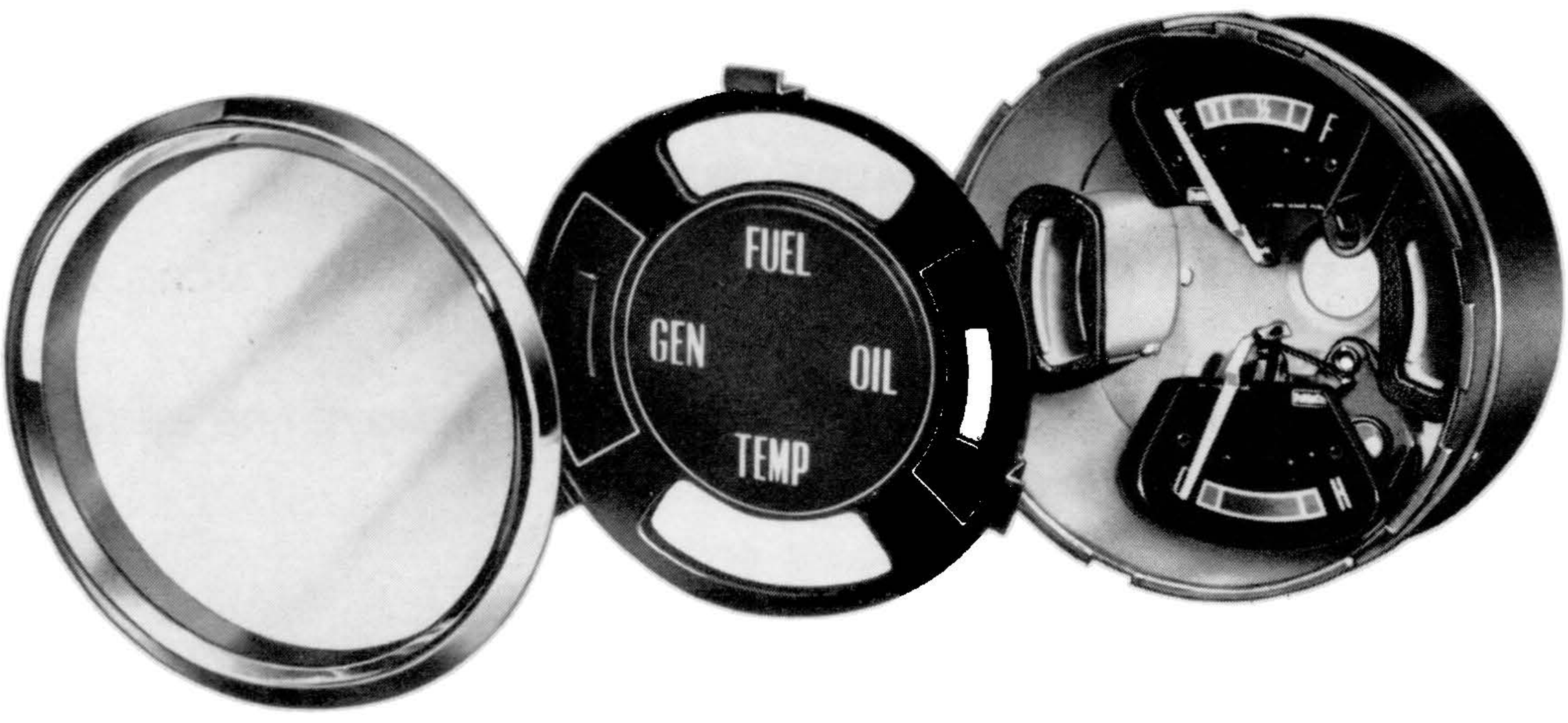
To Install

6. Position the instrument in the combined instrument case and secure it with two nuts.
7. Replace the glass and inner chrome bezel.
8. Reconnect the wires to the fuel gauge.
9. Replace the outer bezel and combined fuel/water temperature gauge in the facia and secure them by turning the gauge approximately $\frac{1}{3}$ of a turn clockwise.
10. Reconnect the battery.

OP 9280-A FUEL GAUGE – REMOVE AND INSTALL (G.T. ONLY)

To Remove

1. Turn the instrument approximately $\frac{1}{3}$ turn anti-clockwise using the tool detailed under OP 17255-A, and pull the instrument out of the facia.
2. Make a note of the wiring positions, then disconnect the wires and illumination bulb from the gauge, and remove the gauge.



Combined Fuel Gauge and Water Temperature Gauge

To Install

3. Reconnect the wires and illumination bulb.
4. Push the instrument into the facia and rotate approximately $\frac{1}{3}$ of a turn clockwise.

OP 10505-B INSTRUMENT VOLTAGE REGULATOR – REMOVE AND INSTALL

To Remove

1. Remove the speedometer, see OP 17255-A.
2. Make a note of the wiring positions and remove the wires from the regulator.
3. Remove one bolt securing the regulator to the rear face of the speedometer and remove the regulator.

To Install

4. Position the regulator on the speedometer and secure it with one bolt.
5. Reconnect the wires to the regulator.
6. Replace the speedometer, see OP 17255-A.

OP 10670-A AMMETER – REMOVE AND INSTALL (G.T. ONLY)
SEE OP 9280-A FUEL GAUGE – REPLACE (G.T. ONLY)

OP 10844-A DUAL BRAKE TEST LIGHT AND/OR BULB – REMOVE AND INSTALL

To Remove

1. From under the facia pull out the dual brake test light bulb and holder.
2. Push the light housing and name disc out of the facia.

To Install

3. Position the name disc and light housing in the facia.
4. Slide the dual brake test light bulb and holder into the light housing.

OP 10880-A OIL PRESSURE GAUGE – REMOVE AND INSTALL (G.T. ONLY)
SEE OP 9280-A FUEL GAUGE – REPLACE (G.T. ONLY)

OP 10883-A TEMPERATURE GAUGE – REMOVE AND INSTALL (BOTH MODELS)
SEE OP 9280-A FUEL GAUGE – REPLACE (BOTH MODELS)

OP 11572-A IGNITION SWITCH AND/OR LOCK BARREL – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Unscrew the ignition switch bezel.
3. Push the ignition switch backwards and make a note of the various wiring positions.
4. Disconnect the wires and remove switch.

To Install

5. Reconnect the wires to the ignition switch and from underneath the facia position the switch.
6. Replace the bezel and tighten.
7. Reconnect the battery and check the operation of the ignition.

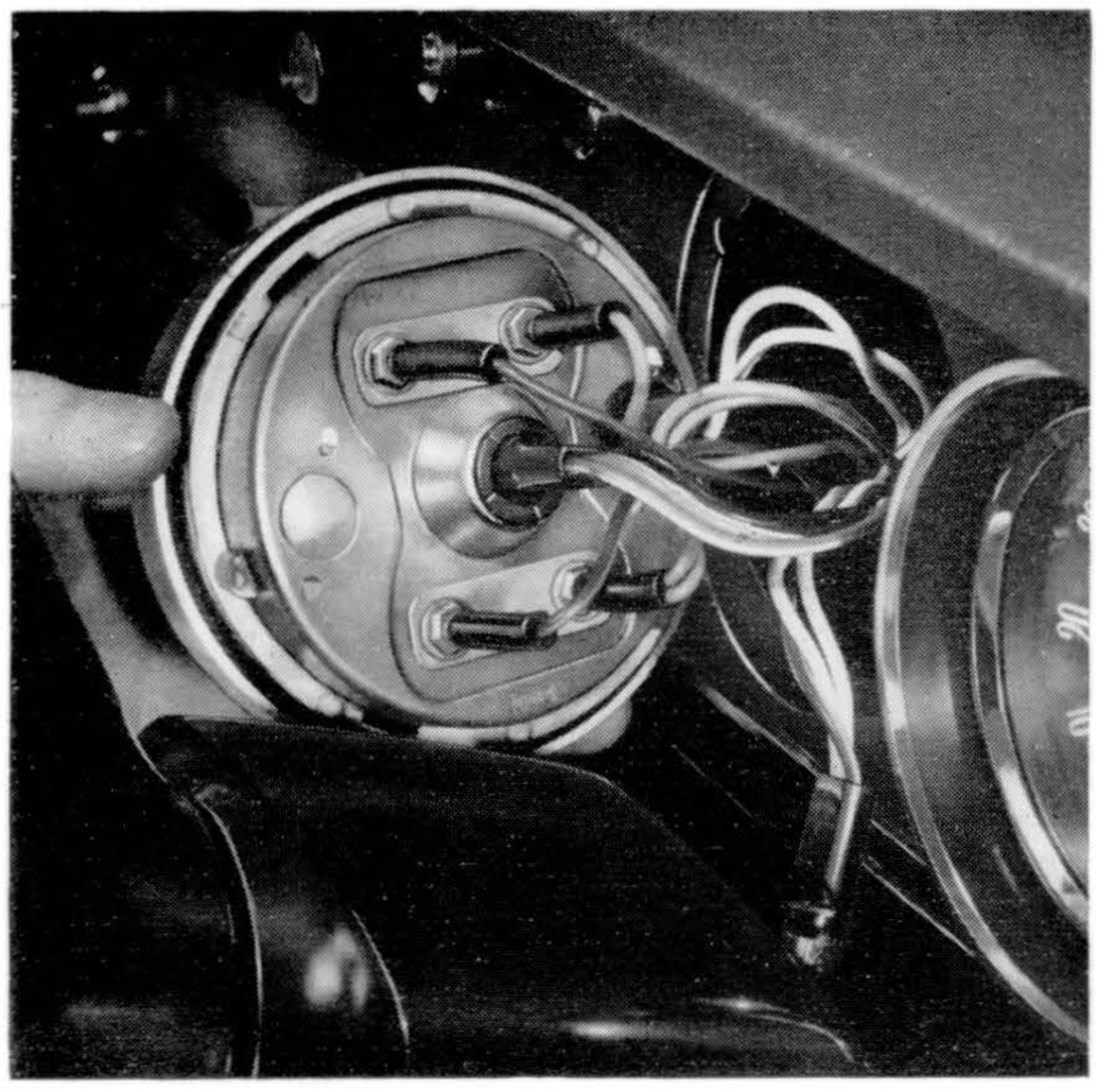
OP 11654-M COMBINED LIGHT SWITCH, PANEL SWITCH, DUAL BRAKE TEST SWITCH AND HAZARD LIGHT SWITCH ASSEMBLY - REMOVE AND INSTALL

To Remove

1. From under the facia disconnect the wiring plugs from the light switch and the combined panel and dual brake test switch.
2. Remove the wires from the hazard light switch, taking a note of their positions.
3. Using a suitable flat-bladed screwdriver depress the two lugs securing the top edge of the combined switch assembly to the facia and push the top of the switch assembly out of the facia.
4. Repeat operation 3 for the two bottom securing lugs and push the switch assembly out of the facia.

To Install

5. Position the combined switch assembly in the facia and push towards the facia to engage the four securing lugs.
6. Connect the wires to the hazard light switch.
7. Replace the wiring plugs to the combined panel and dual brake test switch and the light switch.
8. Check the operation of the light switch, combined panel and dual brake test switch and the hazard light switch.



Fuel Gauge and Water Temperature Gauge

OP 13000-A HEADLAMPS – ALL – ALIGN

The headlamps can be aligned with any suitable alignment equipment, but if this is not available, the following procedure should be carried out:—

1. Position the car on level ground 10 ft. (3 m.) in front of a suitable darkened board which is marked with a vertical and horizontal line.

   This board must be at right-angles to the car centre-line.

2. Bounce the car to ensure correct settlement of the suspension and then measure the height 'H' from the ground to the centre of the headlamps.

3. Position the board so that the vertical line is exactly in line with the car centre-line.

   Position the board, also, so that the horizontal line is parallel to the ground and at a height 'H' from the ground.

4. Remove each headlamp outer bezel and switch on the headlamps.

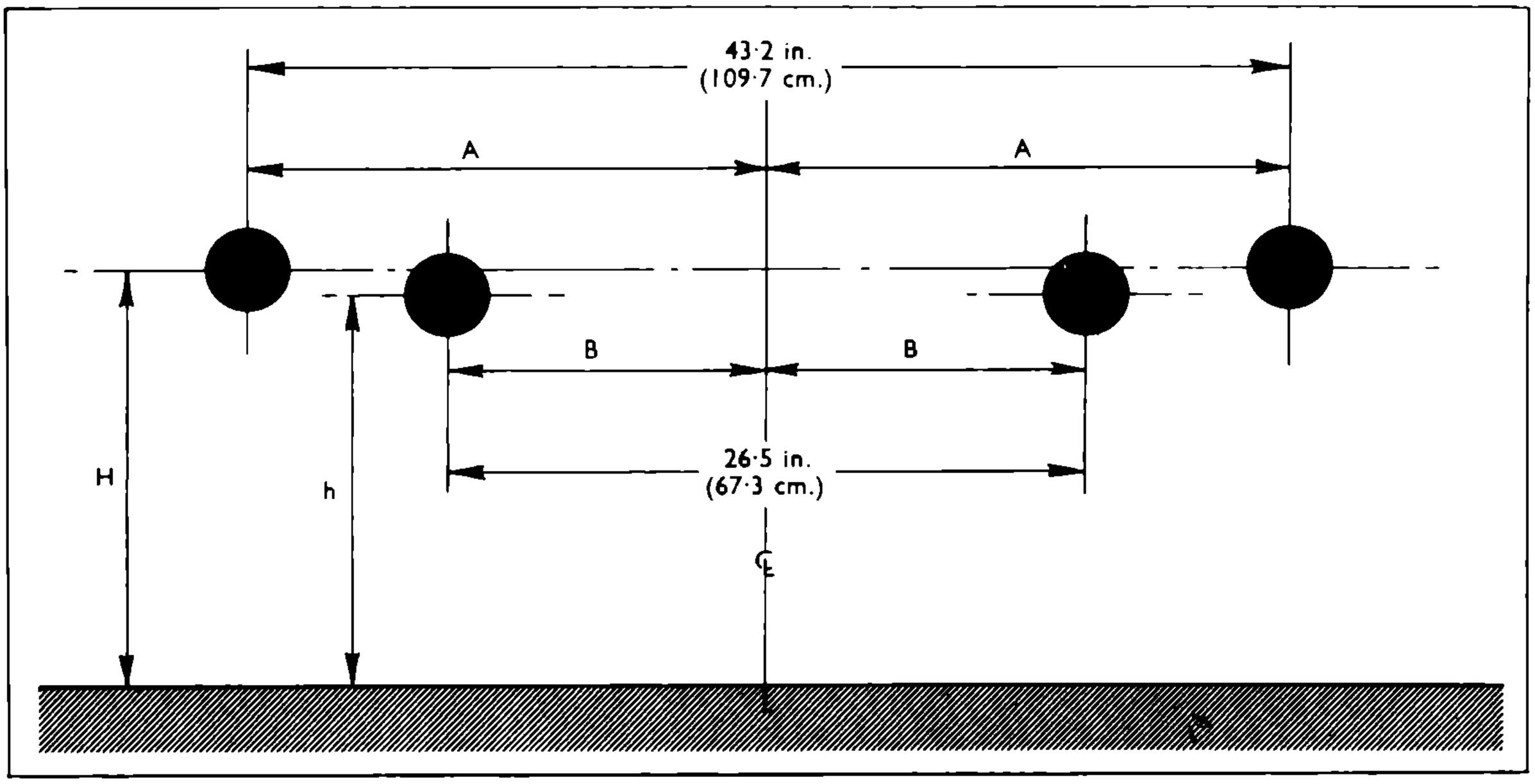
5. By means of the horizontal and vertical adjusting screws, adjust each headlamp so that the centres of brightest illumination lie on the horizontal dividing line 43.2 in. (109.7 cm.) apart and equidistant from the vertical dividing line.

6. Switch off the headlamps and refit the outer bezels.

OP 13005-A HEADLAMP SEALED BEAM UNIT – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Remove four screws securing the head and sidelamp bezel and pull the bezel forward.
3. Remove three screws securing the headlamp chrome bezel and remove the bezel.
4. Pull the sealed beam unit forward, disconnect the headlamp wiring plug and remove the sealed beam unit.



Headlamp Alignment Chart

To Install

5. Plug the headlamp wiring plug into the sealed beam unit.
6. Fit the chrome bezel over the sealed beam unit and position them in the headlamp nacelle.
7. Secure the headlamp and bezel with three screws.
8. Replace the head and sidelamp bezel and secure with four screws.
9. Connect the battery and check the operation of the headlamps.

OP 13005-A1 EXTRA: REMAINING SEALED BEAM UNIT – REMOVE AND INSTALL

Repeat sub-operations 2 to 4 above.

OP 13005-B HEADLAMP SEALED BEAM UNITS – BOTH – REMOVE AND INSTALL
(Includes OPS 13005-A and A1)

OP 13200-A COMBINED DIRECTION INDICATOR AND HAZARD WARNING LAMP ASSEMBLY – ONE – REMOVE AND INSTALL

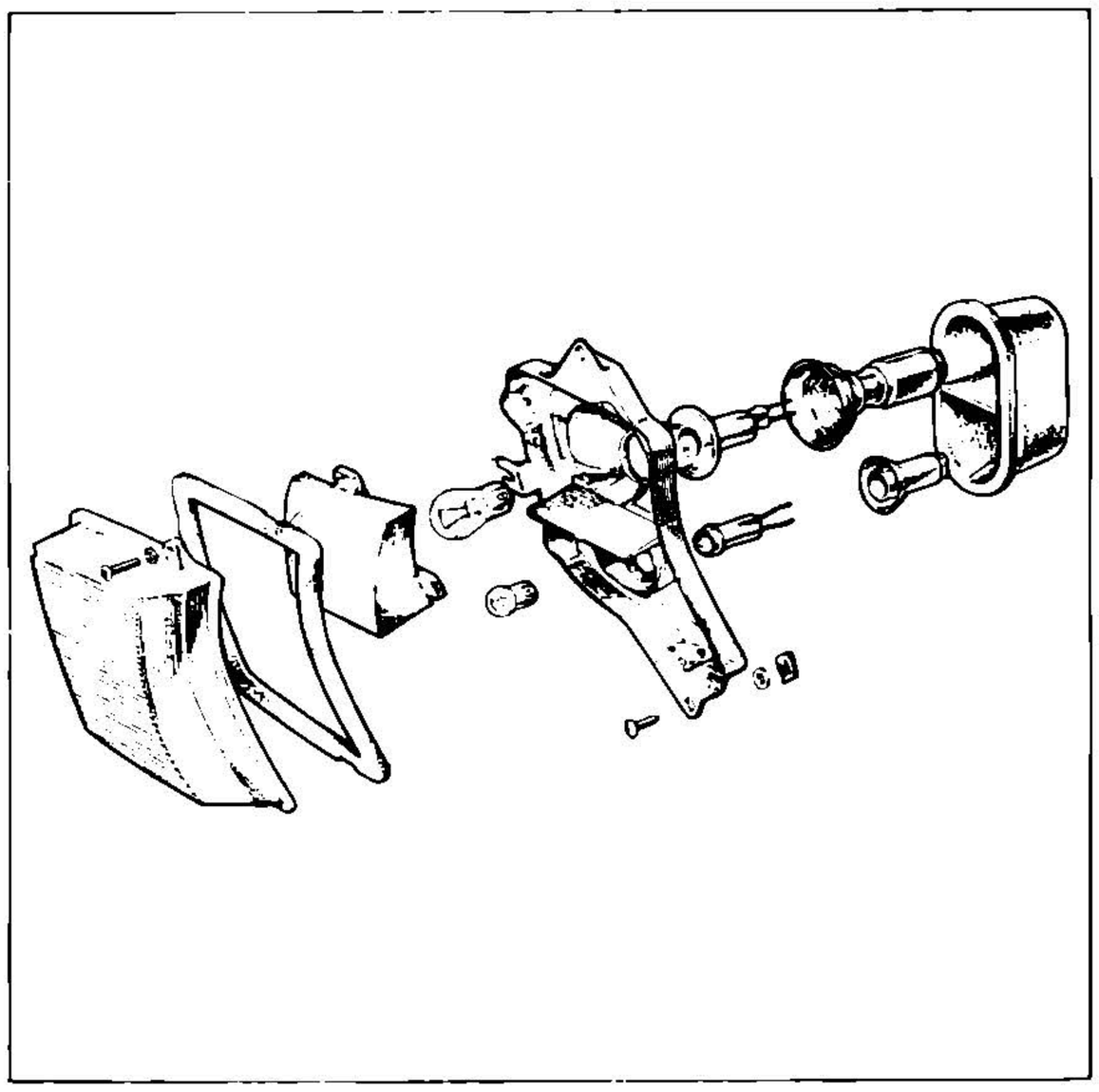
To Remove

1. Remove three screws each side securing the headlamp bezels to the body and carefully move them out of the way.
2. Drill out the six rivets securing the top of the radiator grille and remove two screws securing the bottom of the grille.
3. Pull the grille away from the body and disconnect the wires to the lamp.
4. Note the position of the lamp on the radiator grille then remove two nuts securing the lamp to the grille.
5. Remove the lamp, rubber insulator and mounting bracket.

To Install

6. Position the lamp and insulator on the radiator grille to the dimensions previously noted.

Removing Headlamp Sealed Beam Unit



Side and Indicator Lamp

7. Replace the mounting bracket and secure the assembly with two nuts.
8. Reconnect the wires to the lamp.
9. Replace the radiator grille and secure the top with six rivets and the bottom with two screws.
10. Replace the headlamp bezels and secure them with three screws each side.

OP 13200-A FRONT INDICATOR AND/OR SIDE LAMP ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Remove four screws securing the head and sidelamp bezel and pull the bezel forward.
3. Disconnect the side and indicator spring-loaded bulb holders.
4. Slacken the screw securing the side and indicator lens assembly to the bezel and remove the lens assembly.

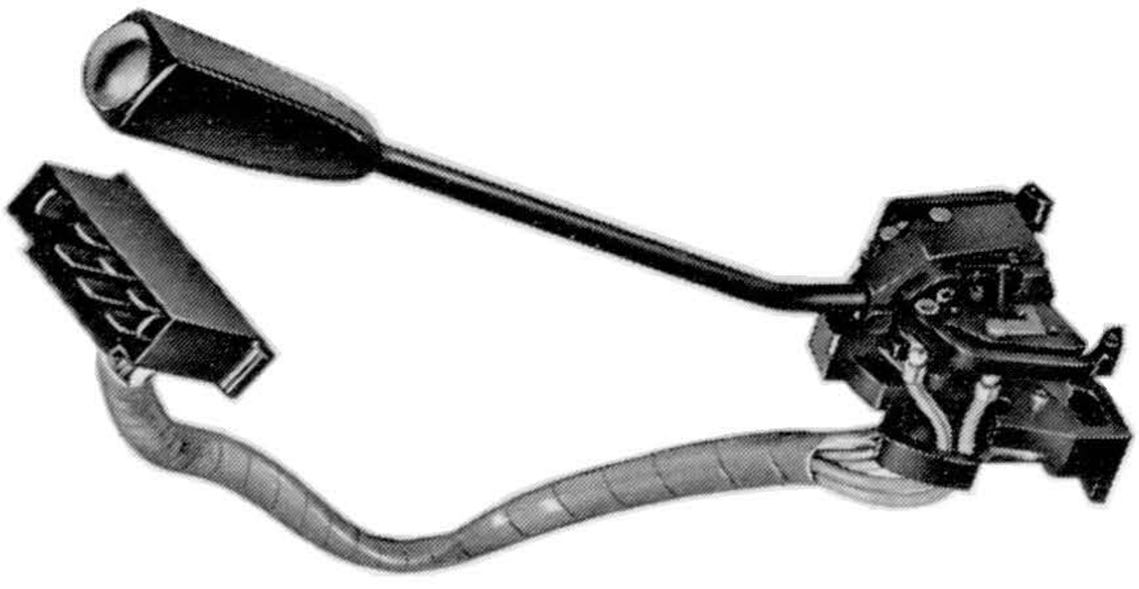
To Install

5. Position the side and indicator lens assembly in the bezel and secure with one screw.
6. Replace the side and indicator spring-loaded bulb holders.
7. Position the head and sidelamp bezel on the body and secure it with four screws.
8. Connect the battery and check the operation of the side and indicator lamps.

OP 13335-A DIRECTION INDICATOR, HEADLAMP FLASHER AND HORN SWITCH ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.



Direction Indicator, Headlamp Flasher and Horn Switch

2. Remove four screws securing the steering column shrouds and remove the shrouds.
3. Remove two screws securing the switch to the steering column.
4. Disconnect the multi-pin plug and remove the switch.

To Install

5. Connect the multi-pin plug to the harness.
6. Position the switch on the steering column and secure it with two screws.
7. Locate the steering column shrouds and secure them with four screws.
8. Connect the battery and check the operation of the switch.

OP 13350-A FLASHER UNIT – REMOVE AND INSTALL

To Remove

1. Open the bonnet and disconnect the battery.
2. Remove one screw securing the flasher unit to the steering column brace.
3. Remove the connector to the flasher unit and remove the unit.

To Install

4. Replace the connector to the flasher unit.
5. Position the flasher unit and secure it with one screw.
6. Reconnect the battery and check the operation of the flasher unit.

OP 13368-A COMBINED DIRECTION INDICATOR AND HAZARD WARNING LAMP LENS AND/OR BULB – ONE – REMOVE AND INSTALL

To Remove

1. Remove the clamping screw securing the lamp bezel and carefully prise the bezel off the lamp.
2. Remove the lens and bulb.

To Install

3. Replace the bulb and position the lens on the lamp.
4. Secure the lens to the body of the lamp with the bright metal bezel. Replace the bezel clamping screw.

OP 13404-A REAR DIRECTION INDICATOR AND/OR STOP/TAIL LAMP BULBS – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Open the luggage compartment lid or tailgate and pull off rear lamp trim cover.
3. Pull out the spring-loaded rear and indicator bulb holders and remove the bulbs.

To Install

4. Replace the bulbs in the holders and clip the two bulb holders into the rear lamp assembly.
5. Replace the rear lamp trim cover.
6. Reconnect the battery.

OP 13404-A1 EXTRA: REMAINING REAR DIRECTION INDICATOR AND/OR STOP/TAIL LAMP BULBS - REMOVE AND INSTALL (SEE OP 13404-A)

OP 13404-A2 EXTRA: REAR LAMP ASSEMBLY - ONE - REMOVE AND INSTALL

To Remove

1. From inside the luggage compartment remove four screws securing the lamp assembly to the body and remove the lamp.

To Install

2. Position the lamp assembly on the body and from inside the luggage compartment secure it with four screws.

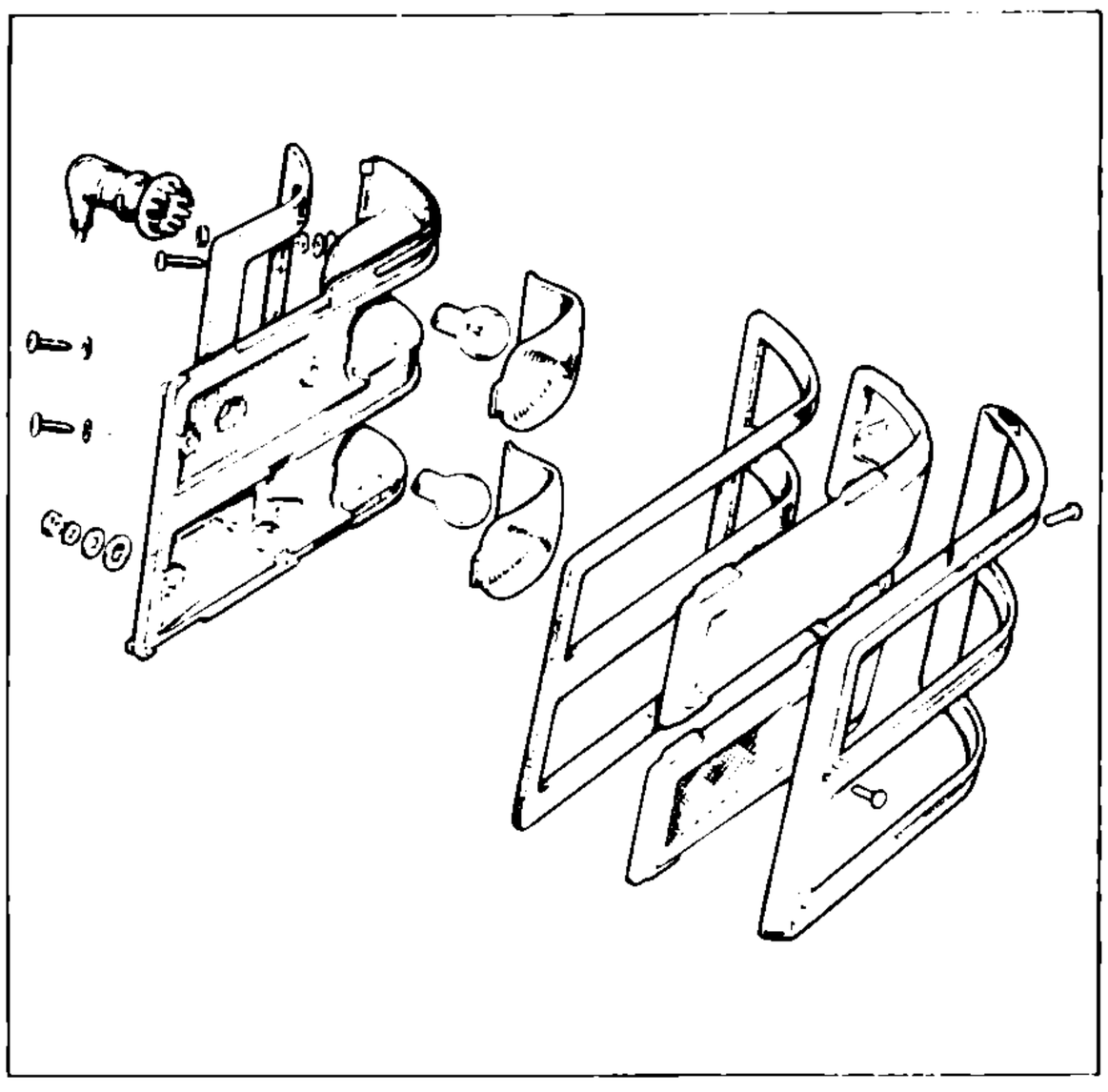
OP 13404-A3 EXTRA: REAR LAMP BEZEL AND/OR LENS - REMOVE AND INSTALL

To Remove

1. Remove the rivets securing the lamp bezel.
2. Remove four screws securing the lens to the lamp backplate and remove the bezel, sealing gasket and lens.

To Install

3. Position the sealing gasket, lens and bezel on the backplate and secure them with four screws and rivets.



Rear and Indicator Lamp

OP 13404-B REAR DIRECTION INDICATOR AND STOP/TAIL LAMP BULBS – ALL – REMOVE AND INSTALL
(Includes OPS 13404-A and A1)

OP 13404-C REAR LAMP ASSEMBLY – ONE – REMOVE AND INSTALL
(Includes OPS 13404-A and A2)

OP 13404-D REAR LAMP ASSEMBLIES – BOTH – REMOVE AND INSTALL
(Includes OPS 13404-A, A1 and A2×2)

OP 13404-E REAR LAMP BEZEL AND/OR LENS – ONE SIDE – REMOVE AND INSTALL
(Includes OPS 13404-A, A2 and A3)

OP 13404-F REAR LAMP BEZELS AND/OR LENS – BOTH SIDES – REMOVE AND INSTALL
(Includes OPS 13404-A, A1, A2×2 and A3×2)

OP 13480-A STOP LIGHT SWITCH – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Make a note of the wires to the switch then disconnect them.
3. Unscrew the locknut and remove the stop light switch.

To Install

4. Locate the stop light switch in its mounting bracket and secure it with a locknut.
5. Reconnect the wires to the switch.
6. Connect the battery and check the operation of the stop light switch.

OP 13543-B REAR LICENCE PLATE LAMP – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Disconnect the earth and feed wires inside the luggage compartment and pull the wires through the hole in the floor.
3. Press the lens retaining levers inwards from underneath the bumper and lift off the lens assembly.
4. Prise the lamp body out of the bumper bar.

To Install

5. Pass the earth and feed wires through the aperture in the bumper and press the lamp body into place.

6. Pass the wires through the hole in the luggage compartment floor and reconnect. Locate the sealing grommet.
7. Clip the lens assembly into place in the lamp body.
8. Reconnect the battery and check the operation of the lamp.

OP 13740-A INSTRUMENT PANEL LIGHT SWITCH – REMOVE AND INSTALL
(SEE OP 11654-A)

OP 13776-A INTERIOR LIGHT – REMOVE AND INSTALL

To Remove

1. Disconnect the battery.
2. Remove two screws securing the interior light and pull the light away from the headlining.
3. Make a note of the wiring positions then disconnect the wires.

To Install

4. Connect the wires to the interior light.
5. Position the light on the headlining and secure it with two screws.
6. Reconnect the battery and check the operation of the light.

OP 13801-A HORN – REMOVE AND INSTALL

To Remove

1. Open the bonnet and disconnect the battery.
2. Remove ten screws, five each side, securing the headlamp bezels and remove the bezels.
3. Remove six rivets and two screws securing the radiator grille to the body and remove the grille.
4. Make a note of the wiring positions then disconnect the wires from the horn.
5. Remove two bolts securing the horn and remove the horn.

To Install

6. Position the horn in the car and secure it with two bolts.
7. Reconnect the wires to the horn.
8. Replace the radiator grille and secure it with two screws, and either pop-rivets or self-tapping screws.
9. Replace the headlamp bezels and secure them with ten screws, five each side.

10. Reconnect the battery and check the operation of the horn.

OP 13990-A WARNING LIGHT BULB – REMOVE AND INSTALL

To Remove

1. From behind the instrument panel pull the bulb holder out of the lens socket.

2. Remove the bulb from the bulb holder.

To Install

3. Fit the new bulb (12 v, 2.2 w) into the bulb holder.

4. Push the bulb holder fully home in the lens socket.

OP 14067 FUSE BLOCK ASSEMBLY – REMOVE AND INSTALL

To Remove

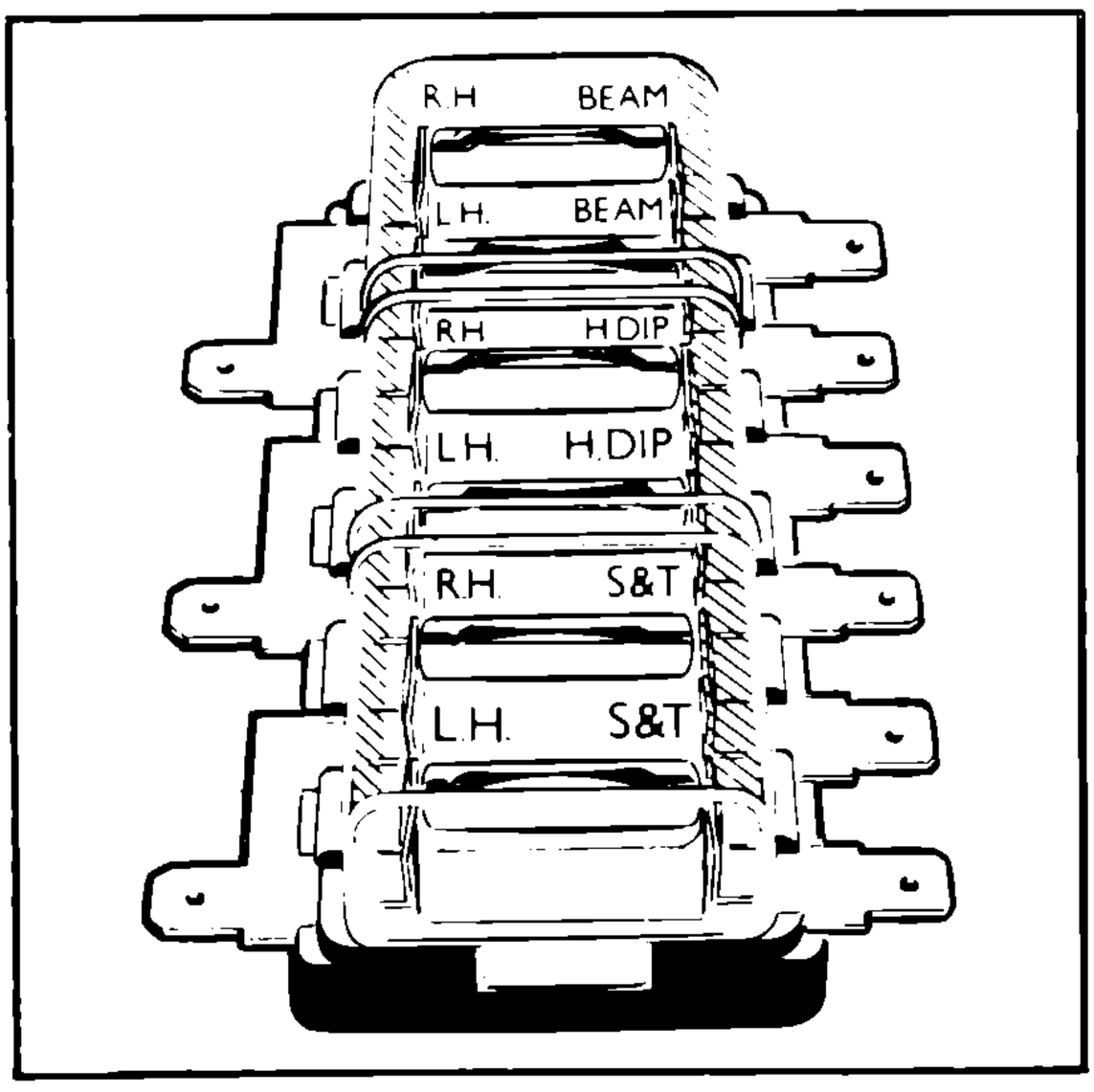
1. Open the bonnet and pull off the two non-reversible wiring plugs on the fuse block.

2. Pull off the transparent fuse cover, remove two screws securing the fuse block to the body and remove the fuse block.

To Install

3. Position the fuse block and secure it with two screws, then replace the transparent fuse cover.

4. Reconnect the two non-reversible wiring plugs to the fuse block, close the bonnet and check the operation of the lighting circuits.



Fuse Block Assembly

OP 15000-A CLOCK AND/OR BULB – REMOVE AND INSTALL (G.T. ONLY)

To Remove

1. Carefully prise the clock out of the console.
2. Remove the bulb.

To Install

3. Fit the bulb (12 v, 1.2 w) to the bulb holder.
4. Push the clock into the console and align as necessary.

OP 15055-A CIGARETTE LIGHTER ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Open the bonnet and disconnect the battery.
2. Make a note of the wiring positions and remove the wires from the lighter.
3. Unclip the cigarette lighter illuminating bulb from the lighter body.
4. From behind the facia unscrew and remove the lighter body.
5. Remove the front section of the lighter through the facia.

To Install

6. Position the front section of the lighter in the facia.
7. From behind the facia replace the element body.
8. Clip the cigarette lighter illuminating bulb into the lighter body.
9. Replace the wires to the lighter.
10. Reconnect the battery and check the operation of the cigarette lighter and illuminating bulb.

OP 17255-A SPEEDOMETER HEAD – REMOVE AND INSTALL

To Remove

1. Remove the combined fuel/water temperature gauge or tachometer (G.T. only).
2. Through the combined fuel/water temperature gauge or tachometer aperture, disconnect the speedometer cable and illumination bulb.
3. Turn the speedometer approximately $\frac{1}{3}$ of a turn anti-clockwise and remove the instrument and bezel from the facia.

To Install

4. Replace the bezel and speedometer in the facia and secure them by turning the speedometer approximately $\frac{1}{3}$ of a turn clockwise.
5. Reconnect the speedometer cable and illumination bulb.
6. Replace the combined fuel/water temperature gauge or tachometer (G.T. only).

OP 17262-A SPEEDOMETER INNER CABLE – REMOVE AND INSTALL

To Remove

1. Remove the combined fuel/water temperature gauge or tachometer (G.T. only).
2. Through the aperture in the facia disconnect the speedometer cable from the speedometer and withdraw the inner cable.

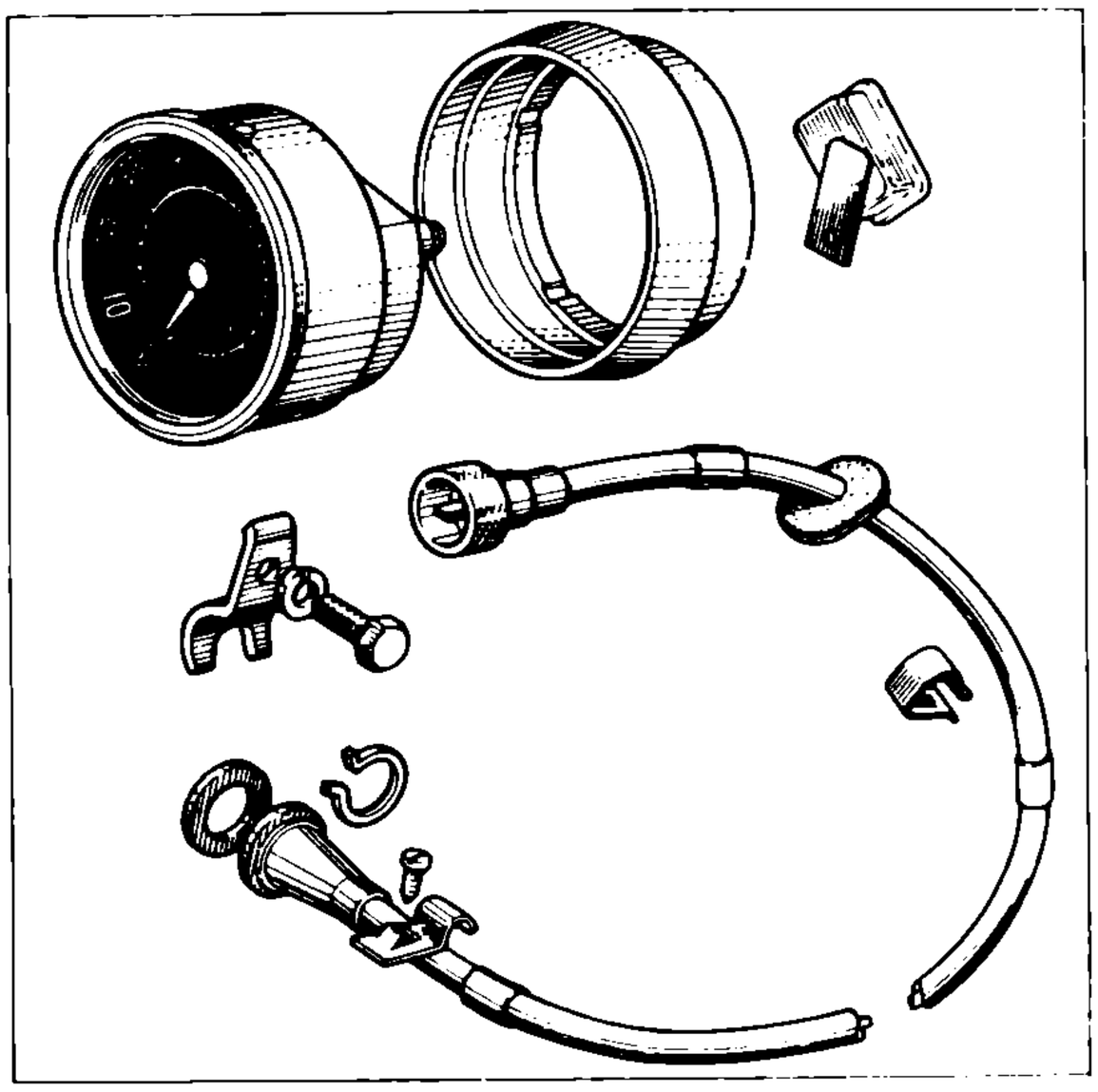
To Install

3. Through the aperture in the facia feed the speedometer inner cable into the outer cable.
4. Locate the inner cable square drive in the gearbox and secure the outer cable with a retaining plate and bolt.
5. Replace the other end of the inner cable in the speedometer and secure the outer cable with the knurled retainer.

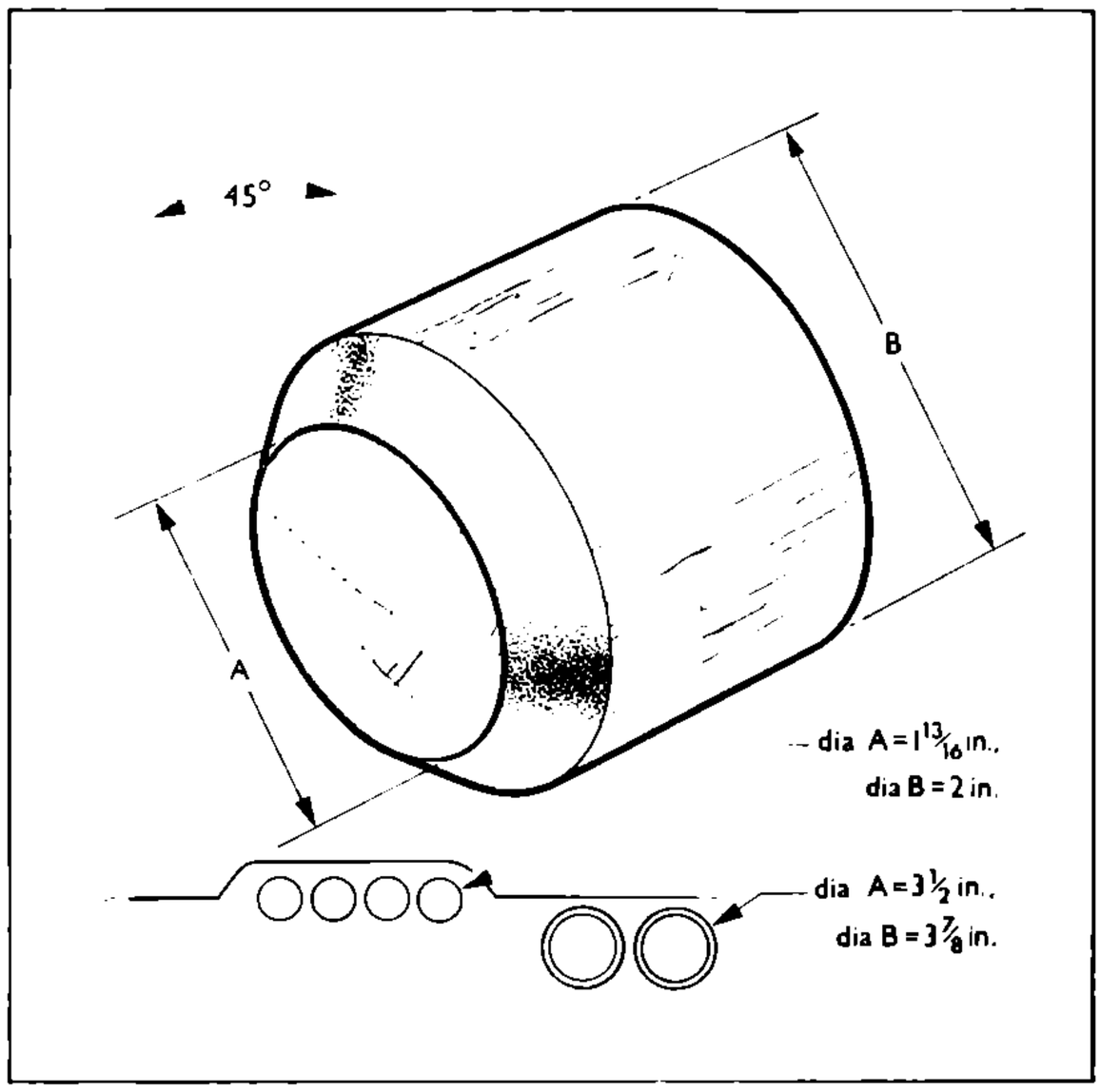
OP 17262-B SPEEDOMETER INNER AND OUTER CABLES – REMOVE AND INSTALL

To Remove

1. Jack up the front of the car and fit stands.
2. Remove one bolt securing the speedometer cable retaining plate to the gearbox, remove the retaining plate and disconnect the speedometer cable.
3. Open the bonnet and remove the speedometer cable clip.
4. Push the speedometer cable rubber grommet out of the bulkhead.
5. Remove the speedometer from the facia, disconnect the cable and remove the cable.



Speedometer Head



Instrument Removal Tools

To Install

6. Replace the speedometer cable in the car, reconnect the speedometer and replace the speedometer in the facia.

7. Reposition the rubber grommet in the bulkhead.

8. Secure the speedometer cable to the bulkhead with a clamping clip.

9. Position the cable in the gearbox and secure it with a retaining plate and bolt.

10. Remove the jack and stands.

OP 17360-A TACHOMETER ASSEMBLY - REMOVE AND INSTALL
(SEE OP 17255-A)

OP 17508-A WINDSCREEN WIPER ASSEMBLY - REMOVE AND INSTALL

To Remove

1. Disconnect the battery.

2. Remove the wiper arms and two nuts securing wiper spindles to body.

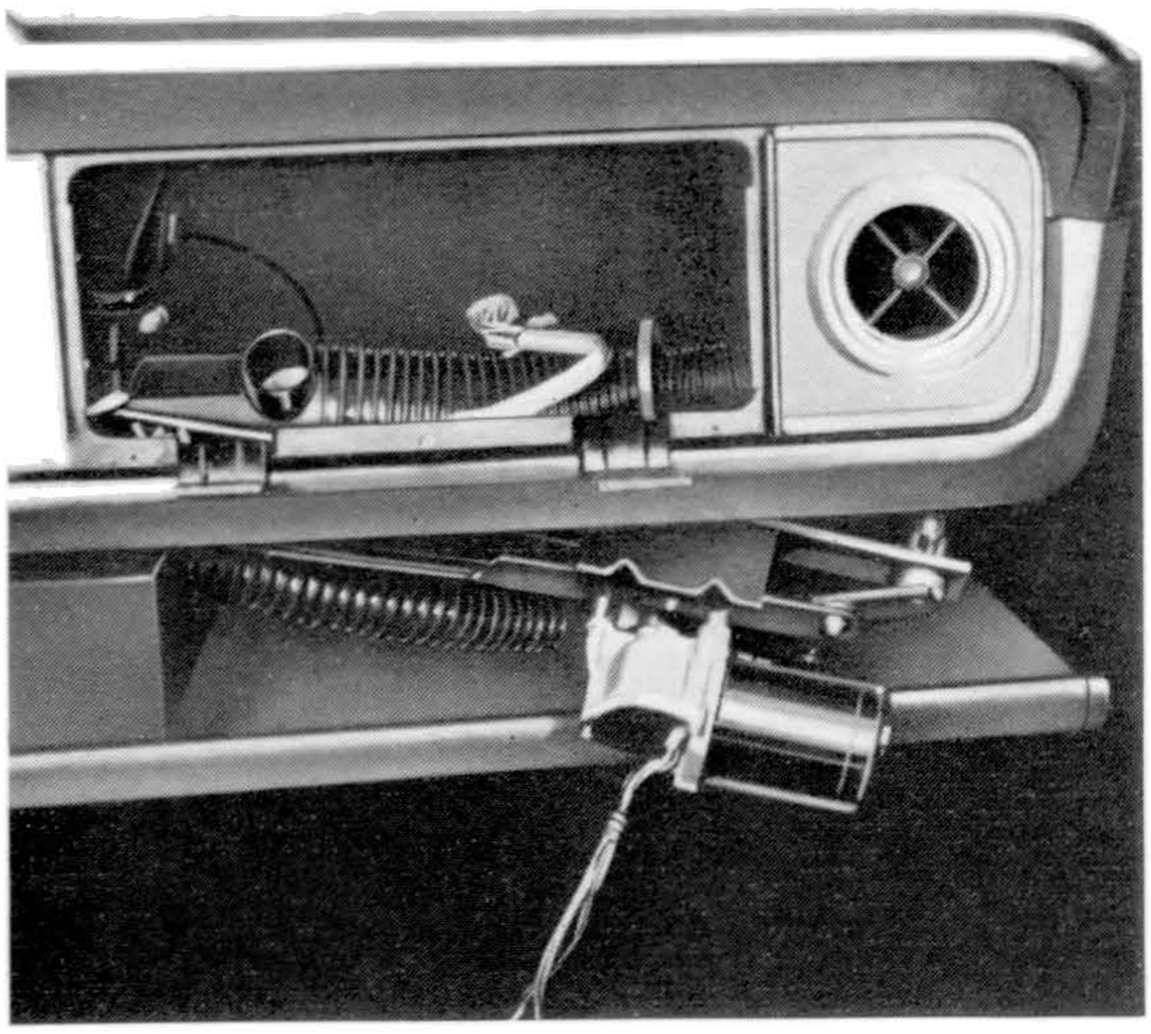
3. Remove the front parcel tray.

4. From under the facia remove the screw securing the motor bracket to the body.

5. Take a note of the wires and then remove the wires from the windscreen wiper motor.

6. Remove the wiper switch from the facia and disconnect the wires to the windscreen wiper motor.

7. Remove two screws securing the glove box catch and remove the catch.



Removing the Windscreen Wiper Motor

8. Remove four screws securing the glove box lid and remove the lid.
9. Drill out nine "pop" rivets securing glove box to the facia and remove the glove box.
10. Pull the face level vent and demister flexible pipes off and remove the windscreen wiper motor.

To Install

11. Locate the windscreen wiper motor behind the facia.
12. Secure the motor to the body with the two wiper spindle nuts.
13. Replace the face level vent and demister flexible pipes.
14. Locate the glove box in the facia and secure it with nine "pop" rivets.
15. Replace the glove box lid and secure with four screws.
16. Replace the glove box catch and secure it with two screws.
17. Reconnect the wires from the windscreen wiper motor to the wiper switch and replace the switch.
18. Replace the feed wires to the wiper motor making sure that these are routed BELOW the speedometer cable.
19. Replace the screw securing the wiper bracket to the body.
20. Replace the wiper arms and front parcel tray.
21. Reconnect battery.

OP 17508-A1 EXTRA: WINDSCREEN WIPER MOTOR BRUSHES – RENEW

To Remove

1. Remove the two bolts securing the motor case to the gearbox housing and withdraw the motor case complete with the armature.
2. Withdraw the brushes from their holders and remove the springs.
3. Remove three screws securing the brush mounting plate to the wiper gearbox, pull the wiring plug out of the side of the gearbox case and remove the brush mounting plate.
4. Remove the screw and earth wire (nearest the motor case) on the gearbox cover plate and slacken the second securing screw, then slide the cover plate out of the way.
5. Disconnect the white/green and black/green wires from the terminals on the switch cover assembly and remove the wiring assembly from the windscreen wiper motor.
6. Disconnect the wiper motor multi-pin wiring connector from the harness and remove the wiper motor feed wires and brushes from the vehicle.

To Install

7. Connect the new wiper motor feed wire and brush assembly into the loom via the multi-pin connector.
8. Connect the white/green wire to the terminal marked green and the black/green wire to the terminal marked black on the switch cover assembly.

9. Slide the gearbox cover plate into position ensuring that the white/green and black/green wires are correctly positioned in the cut-out on the cover plate.
10. Replace the cover plate securing screw with the earth terminal under its head and fully tighten both screws.
11. Remove the old brush wires from the brush mounting plate and fit the new wires into their respective slots in the mounting plate.
12. Position the brush mounting plate on the gearbox case and secure it with three screws.
13. Replace the brushes and springs in their holders and refit the armature and motor case, ensuring that the brushes are located correctly on the commutator.
14. Secure the motor case to the gearbox with two bolts, temporarily connect the battery and check the operation of the windscreen wiper assembly.

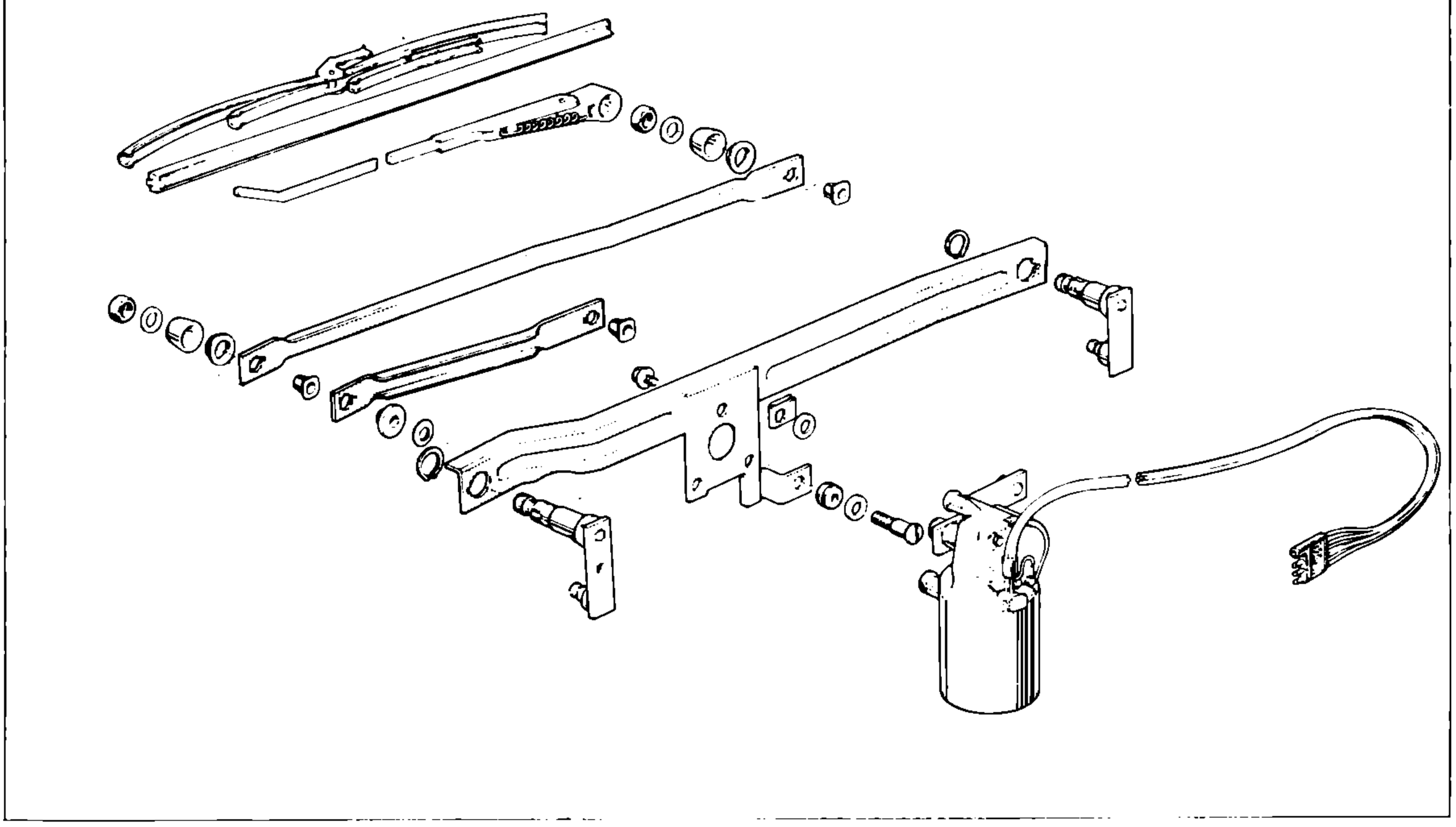
OP 17508-A2 EXTRA: WINDSCREEN WIPER MOTOR OR LINKAGE – RENEW

To Remove

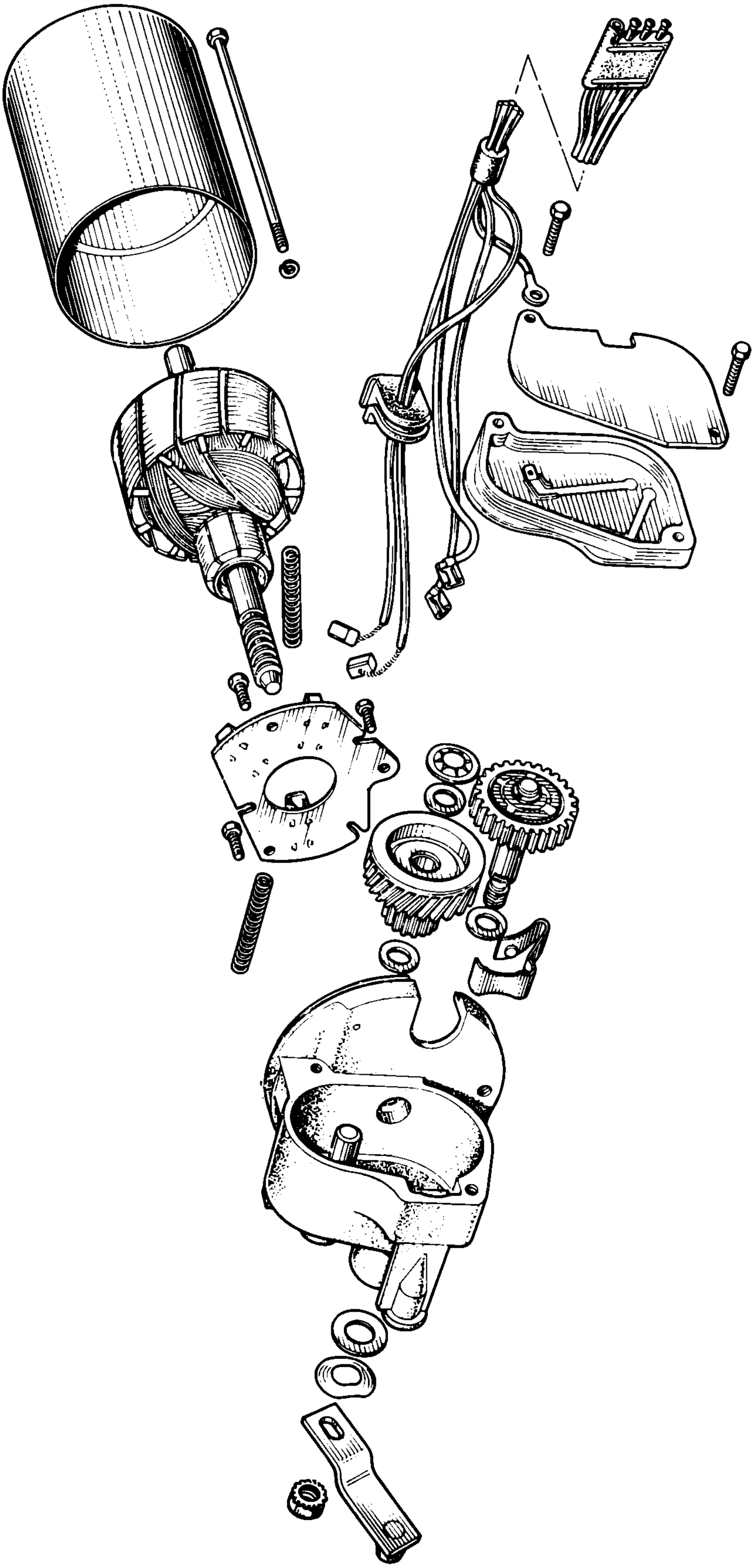
1. Carefully prise the short wiper link off the motor operating arm and remove the plastic pivot bush.
2. Remove three screws securing the wiper motor to the linkage and separate the motor and linkage.

To Install

3. Position the wiper motor on the linkage and secure it with three bolts.



Windscreen Wiper Linkage – Exploded



Windscreen Wiper Motor – Exploded

4. Replace the plastic pivot bush on the wiper motor operating arm and connect the short wiper link.

OP 17508-A3 EXTRA: WINDSCREEN WIPER LINKAGE – OVERHAUL

To Dismantle

1. Separate the linkage from the wiper motor (see OP 17508-A2).
2. Carefully prise the long wiper link from the two plastic pivot bushes securing the link to the wiper spindles and remove the long link and bushes.
3. Prise the short wiper link from the plastic pivot bush securing it to the left-hand wiper spindle and remove the short link bush and spring washer.
4. Remove the two circlips securing the wiper spindles to the main link frame and remove both spindles.

To Reassemble

5. Position both wiper spindles in the main frame and secure each of them with a circlip.
6. Replace the spring washer and plastic pivot bush to the left-hand wiper spindle then replace the short wiper link.
7. Replace the long wiper link plastic pivot bushes to the wiper spindles and replace the long link.
8. Couple the wiper motor to the linkage (see OP 17508-A2).

OP 17508-A4 EXTRA: WINDSCREEN WIPER MOTOR – OVERHAUL

To Dismantle

1. Separate the wiper motor from the linkage (see OP 17508-A2).
2. Remove the brushes, wiring loom and brush mounting plate (see OP 17508-A1).
3. Remove the remaining screw securing the gearbox cover plate and switch cover assembly, then remove the cover plate and assembly.
4. Pull the spring steel armature stop out of the gearbox case.
5. Remove the spring clip and washer securing the wiper pinion gear and withdraw the gear and washers.
6. Remove the nut securing the motor operating arm and remove the arm, wave and flat washers.
7. Withdraw the output gear and park switch assembly and washer from the gearbox case.

To Reassemble

8. Replace the washer and output gear and park switch assembly in the gearbox.
9. Replace the wave and flat washers and motor operating arm on the output shaft and secure them with a nut.

10. Replace the washer and wiper pinion gear in the gearbox and secure it with a washer and spring clip.

11. Insert the spring steel armature stop in the gearbox case.

12. Replace the switch cover assembly and gearbox cover plate and temporarily secure them with one screw.

13. Replace the brush mounting plate, wiring loom and brushes (see OP 17508-A1).

14. Couple the wiper motor and linkage (see OP 17508-A2).

OP 17508-B WINDSCREEN WIPER MOTOR BRUSHES – RENEW
(Includes OPS 17508-A and A1)

OP 17508-C WINDSCREEN WIPER MOTOR OR LINKAGE – RENEW
(Includes OPS 17508-A and A2)

OP 17508-D WINDSCREEN WIPER LINKAGE – OVERHAUL
(Includes OPS 17508-A, A2 and A3)

OP 17508-E WINDSCREEN WIPER MOTOR – OVERHAUL
(Includes OPS 17508-A, A1, A2 and A4)

OP 17535-A COMBINED WINDSCREEN WASHER AND WIPER SWITCH ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Push a suitable rod into the hole on the underside of the washer/wiper knob until the retaining pin is released then pull off the knob.

2. Unscrew the washer/wiper assembly bezel and remove it.

3. From under the facia remove the wires to the wiper switch and the pipes to the washer pump, taking a note of their respective positions.

4. Remove the combined washer pump and wiper switch assembly from the vehicle.

   NOTE – There are two types of windscreen wiper switch, one has an integral washer pump, the other has a detachable pump.

To Install

5. Connect the wires to the wiper switch and the pipes to the washer pump.

6. Position the washer/wiper assembly under the facia and secure it with its bezel.

7. Position the washer/wiper knob on its shaft, with the hole in the knob pointing downwards and push the knob in to engage the retaining pin.

8. Check the operation of the windscreen washer and wiper assembly.

OP 18309-A HEATER CONTROL ASSEMBLY - REMOVE AND INSTALL

To Remove

1. Release the two spring clips securing the two heater control cables to the heater operating arms and pull the cables out of the operating arms.
2. Remove the heater control bezel (see OP 18503-A).
3. Remove the heater controls mounting panel (see OP 18503-B).
4. Pull the heater control assembly forward out of the facia and remove two spring clips securing the heater control cable outers to the quadrant, pull the two inner cables off the quadrant and remove them.

To Install

5. Position the two heater control cables on the quadrant, loop the two cable inners on their respective levers and secure the outers with two spring clips.
6. Position the heater control assembly in the facia.
7. Replace the heater controls mounting panel (see OP 18503-B).
8. Replace the heater controls bezel (see OP 18503-A).
9. Position the two heater control cable inners in the operating arms and secure them with two screws.
10. Secure the cable outers to the heater with two spring clips.

OP 18309-M HEATER CONTROL CABLES - ADJUST

The following operation should be carried out whenever the heater control cables are disconnected from the heater, or if the heater cannot be fully shut off.

1. Set the heater controls to the "OFF" and "HOT" positions.
2. Remove the spring clip (A) securing the direction control cable to the heater.
3. Position the heater distribution valve firmly in the "OFF" position by raising the end of the lever (B) to the end of its travel.
4. Take up any slack in the direction control cable and secure the cable to the heater with a spring clip.
5. Remove the spring clip (C) securing the temperature control cable to the heater.
6. Position the heater mixing valve (D) firmly in the "HOT" position by raising the end of the lever to the end of its travel.
7. Take up any slack in the temperature control cable and secure the cable to the heater with a spring clip.
8. Check the operation of the heater controls.

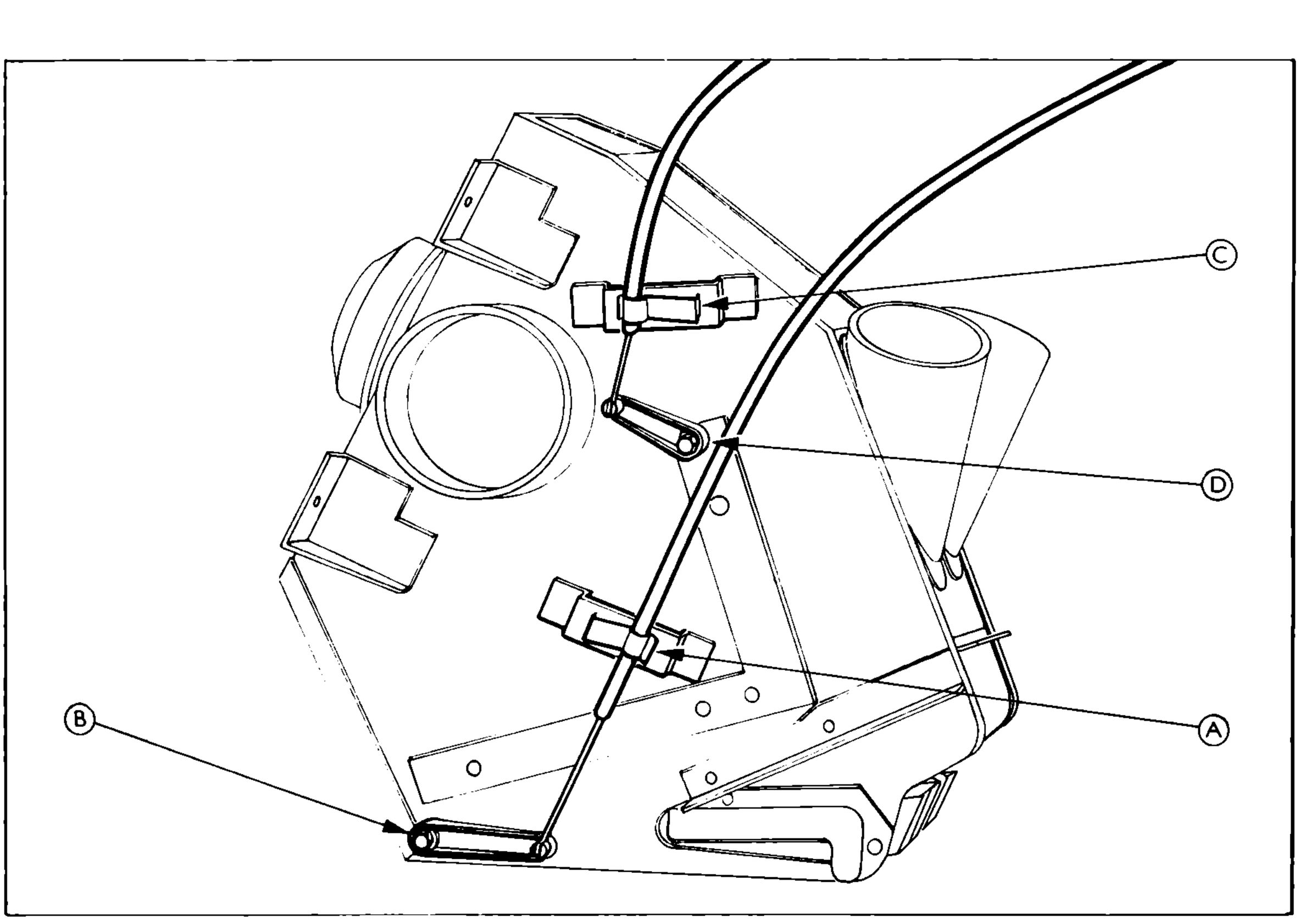
OP 18467-A HEATER ASSEMBLY - REMOVE AND INSTALL

To Remove

1. Disconnect the battery and drain the cooling system.
2. Remove the parcel tray.
3. From inside the engine compartment slacken two wire clips and disconnect the two heater pipes from the bulkhead.
4. Remove two screws and detach the heater pipe plate and sealing gasket from the bulkhead.
5. Remove the heater control cables, see OP 18309.
6. Make a note of the wiring positions and disconnect the wires from the heater blower motor.
7. Remove the face level vent and demister flexible pipes from the heater.
8. Remove four bolts and remove the heater.

To Install

9. Position the heater in the car and secure it to the bulkhead with four bolts.
10. Reconnect the face level vent and demister flexible pipes to the heater.



Heater Cable Adjustment

11. Replace the wires to the heater blower motor.
12. Replace the heater control cables, see OP 18309-A.
13. Replace the heater pipe plate and sealing gasket on the bulkhead and secure them with two screws.
14. Reconnect the two heater pipes and secure them with two wire clips.
15. Replace the parcel tray.
16. Reconnect the battery, fill the cooling system and check the operation of the heater.

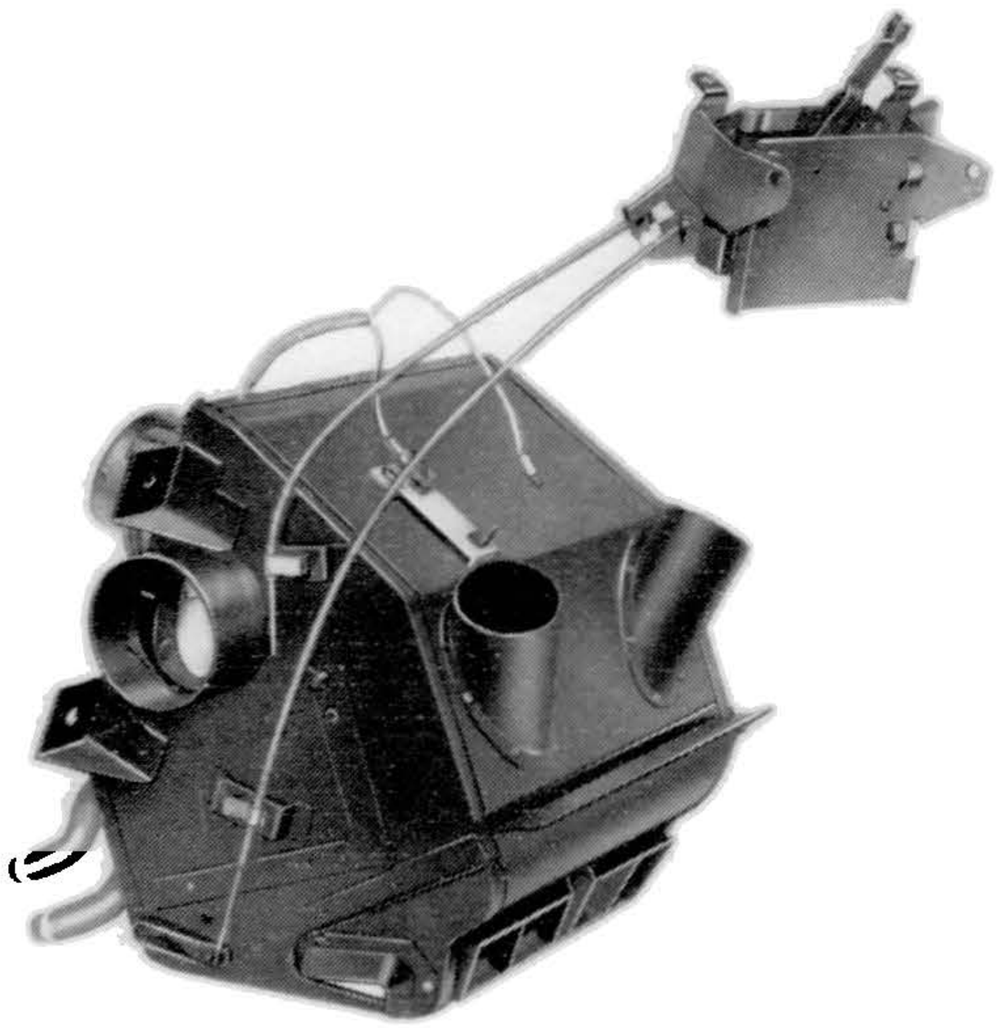
OP 18467-A2 EXTRA: HEATER RADIATOR – REMOVE AND INSTALL

To Remove

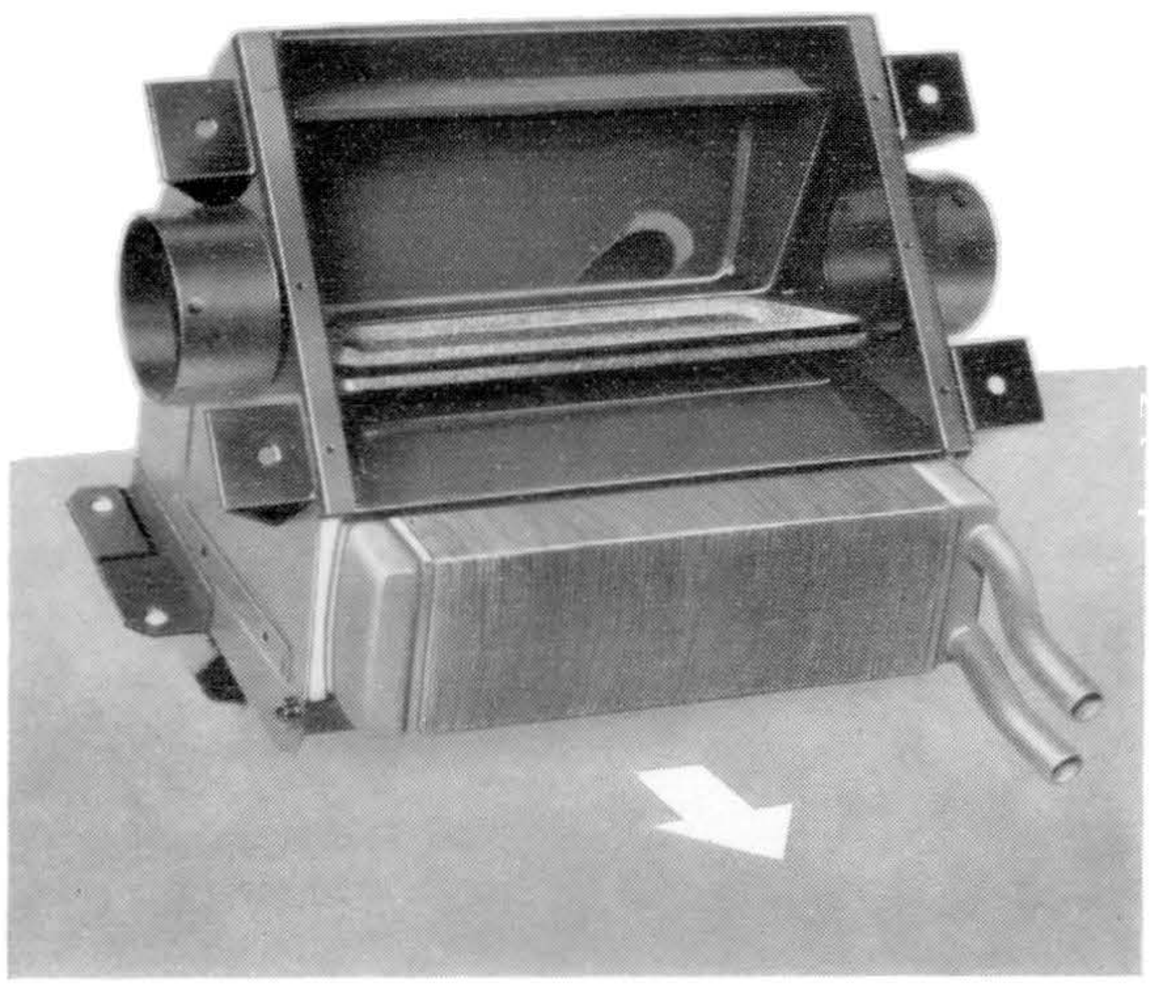
1. Remove thirteen screws and remove the heater blower motor and mounting plate as an assembly.
2. Pull off the rear lower panel and remove the foam packing.
3. Carefully slide the radiator out of the heater.

To Install

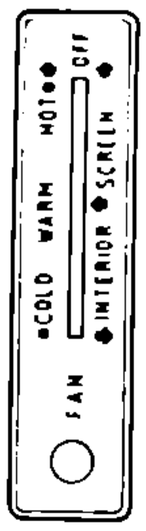
4. Slide the radiator into the heater.
5. Position the foam packing and replace the rear lower panel.
6. Replace the heater blower motor and mounting plate and secure them with thirteen screws.



The Heater Unit



Removing the Heater Radiator



The Heater and Controls

OP 18467-A3 EXTRA: HEATER MOTOR – REMOVE AND INSTALL

To Remove

1. Remove thirteen screws and remove the blower motor and mounting plate as an assembly.
2. Remove the sealing gasket from the mounting plate.
3. Remove the rubber gasket and pull the blower motor wires through the motor mounting plate.
4. Remove the spring clip and withdraw the blower motor fan.
5. Unscrew three screws securing the motor to the mounting plate and remove the motor.

To Install

6. Position the motor in the mounting plate and secure it with three screws.
7. Replace the blower motor fan and secure it with a spring clip.
8. Feed the blower motor wires through the motor mounting plate and replace the rubber gasket.
9. Replace the sealing gasket on the mounting plate.
10. Replace the blower motor and mounting plate on the heater and secure them with thirteen screws.

OP 18467-C HEATER RADIATOR – REMOVE AND INSTALL
(Includes OPS 18467-A and A2)

OP 18467-D HEATER MOTOR – REMOVE AND INSTALL
(Includes OPS 18467-A and A3)

Face Level Vents

OP 18470-A FACE LEVEL VENT – REMOVE AND INSTALL

To Remove

1. From under the facia pull the flexible air supply pipe from the vent.
2. Rotate the vent clockwise to disengage the three retaining pins and remove the vent from under the facia.

To Install

3. From under the facia position the vent and rotate it anti-clockwise to engage the three retaining pins.
4. Connect the flexible air supply pipe to the back of the vent.

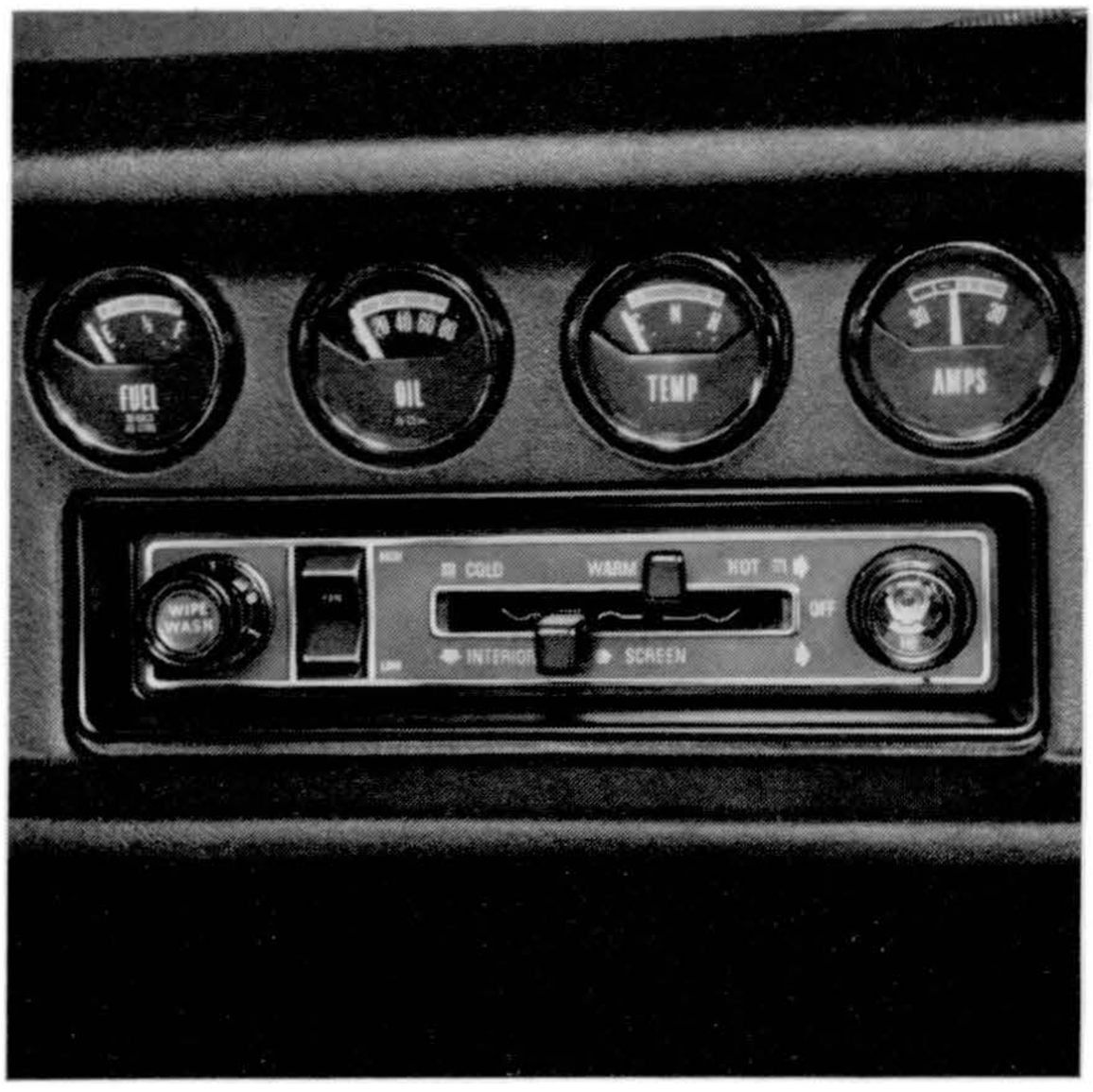
OP 18503-A HEATER CONTROLS BEZEL – REMOVE AND INSTALL

To Remove

1. Remove the cigar lighter (see OP 15055-A).
2. Remove the combined windscreen washer and wiper knob and bezel (see OP 17535-A).
3. Push a suitable rod into the holes on the undersides of the heater control knobs until the retaining clips are released, then pull off the knobs.
4. Pull the heater controls bezel out of the facia and remove the bezel.

To Install

5. Position the bezel on the facia.
6. Push the heater control knobs on to their respective arms until the retaining clips engage.



Heater Controls and Bezel

Heater Controls Mounting Panel

7. Replace the combined windscreen washer and wiper knob and bezel (see OP 17535-A).
8. Replace the cigar lighter (see OP 15055-A).

OP 18503-B HEATER CONTROLS MOUNTING PANEL – REMOVE AND INSTALL

To Remove

1. Remove the cigar lighter (see OP 15055-A).
2. Remove the combined windscreen washer and wiper knob and bezel (see OP 17535-A).
3. Remove the heater controls bezel panel (see OP 18503-A).
4. Remove two screws securing the heater controls to the mounting panel and four screws securing the mounting plate to the facia.
5. Pull the mounting panel out of the facia and disconnect the wiring from the heater switch and remove the panel from the vehicle.
6. From behind the mounting panel, using a suitable flat-bladed screwdriver, depress the lug securing the top of the switch to the mounting panel and push the top of the switch out of the panel.
7. Repeat sub-operation 6 for the bottom lug and remove the fan switch from the mounting panel.

To Install

8. Position the fan switch on the mounting panel and push it in to engage the retaining lugs.
9. Connect the wiring to the heater fan switch.
10. Position the mounting panel in the facia and secure it with four screws.
11. Replace the two screws securing the heater controls to the mounting plate.
12. Replace the heater bezel panel (see OP 18503-A).
13. Replace the combined windscreen washer and wiper knob and bezel (see OP 17535-A).
14. Replace the cigar lighter (see OP 15055-A).

Important

Following the completion of any service work, normal test procedures should be used to ensure that a satisfactory repair has been performed. In addition, as a precautionary measure, the dual brake warning light should be checked by depressing the test switch with the ignition "ON".

If it was necessary to disturb the automatic transmission (where fitted) or its controls, to work on the engine, perform a road test to ensure that the transmission functions correctly as follows:—

1. Drive the vehicle at 30 m.p.h. in 'D', release the accelerator pedal and as the road speed falls to about 25 m.p.h. select 'L'. Ensure that second gear is engaged with resultant increase in braking effect.
2. With the selector linkage correctly adjusted, check that the starter operates ONLY when 'N' or 'P' is selected and that the back-up lamps operate ONLY when 'R' is selected. (See OP 7007-A sub-operation 38.)

ELECTRICAL WIRING

ELECTRICAL WIRING

The loom connection illustrations have the wiring colour identified by a number.

The code for these numbers is as follows:—

Code		*Colour*
1	...	Red
4	...	Red/Blue tracer
5	...	Red/Black tracer
6	...	Red/White tracer
7	...	Red/Light Green tracer
8	...	Red/Brown tracer
11	...	Yellow
14	...	Yellow/Green tracer
19	...	Yellow/Purple tracer
21	...	Green
22	...	Green/Red tracer
23	...	Green/Yellow tracer
24	...	Green/Blue tracer
25	...	Green/Black tracer
26	...	Green/White tracer
31	...	Light Green
34	...	Light Green/Blue tracer
35	...	Light Green/Black tracer
38	...	Light Green/Brown tracer
41	...	Blue
42	...	Blue/Red tracer
45	...	Blue/Black tracer
46	...	Blue/White tracer
47	...	Blue/Light Green tracer
51	...	Black
52	...	Black/Red tracer
57	...	Black/Light Green tracer
61	...	White
62	...	White/Red tracer
64	...	White/Green tracer
65	...	White/Blue tracer
66	...	White/Black tracer
68	...	White/Brown tracer
71	...	Brown
73	...	Brown/Yellow tracer
74	...	Brown/Green tracer
77	...	Brown/White tracer
79	...	Brown/Purple tracer
80	...	Brown/Orange tracer
81	...	Purple
82	...	Purple/Red tracer
85	...	Purple/Blue tracer
86	...	Purple/Black tracer
87	...	Purple/White tracer
91	...	Pink/White tracer

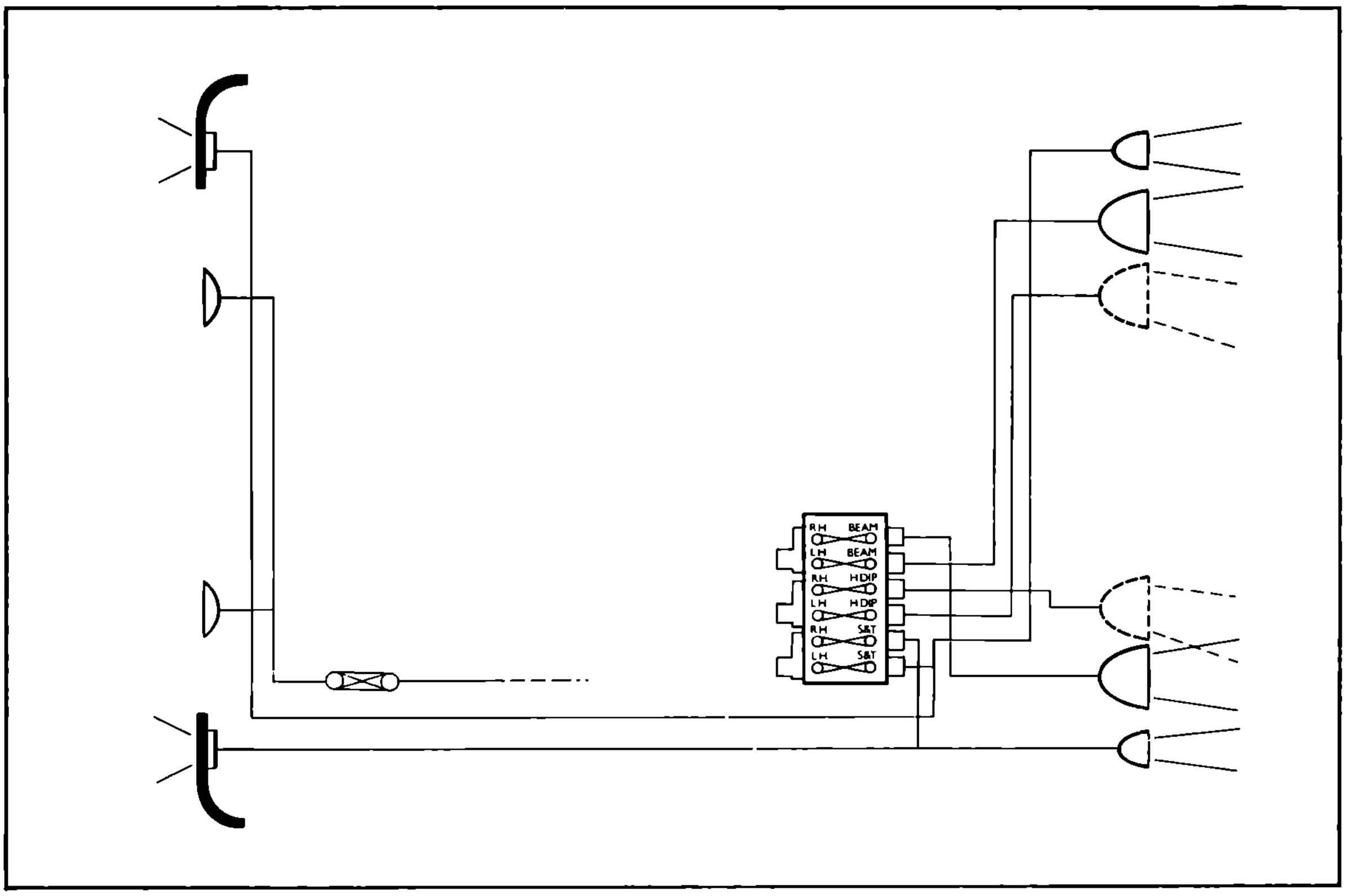
NOTE – Where a connector is numbered, this indicates that the wires on each side of the connector are the same colour.

The wiring diagrams have the wiring colour identified by symbolic letters and the individual items in the diagram are identified by a number. The codes for these diagrams are overleaf.

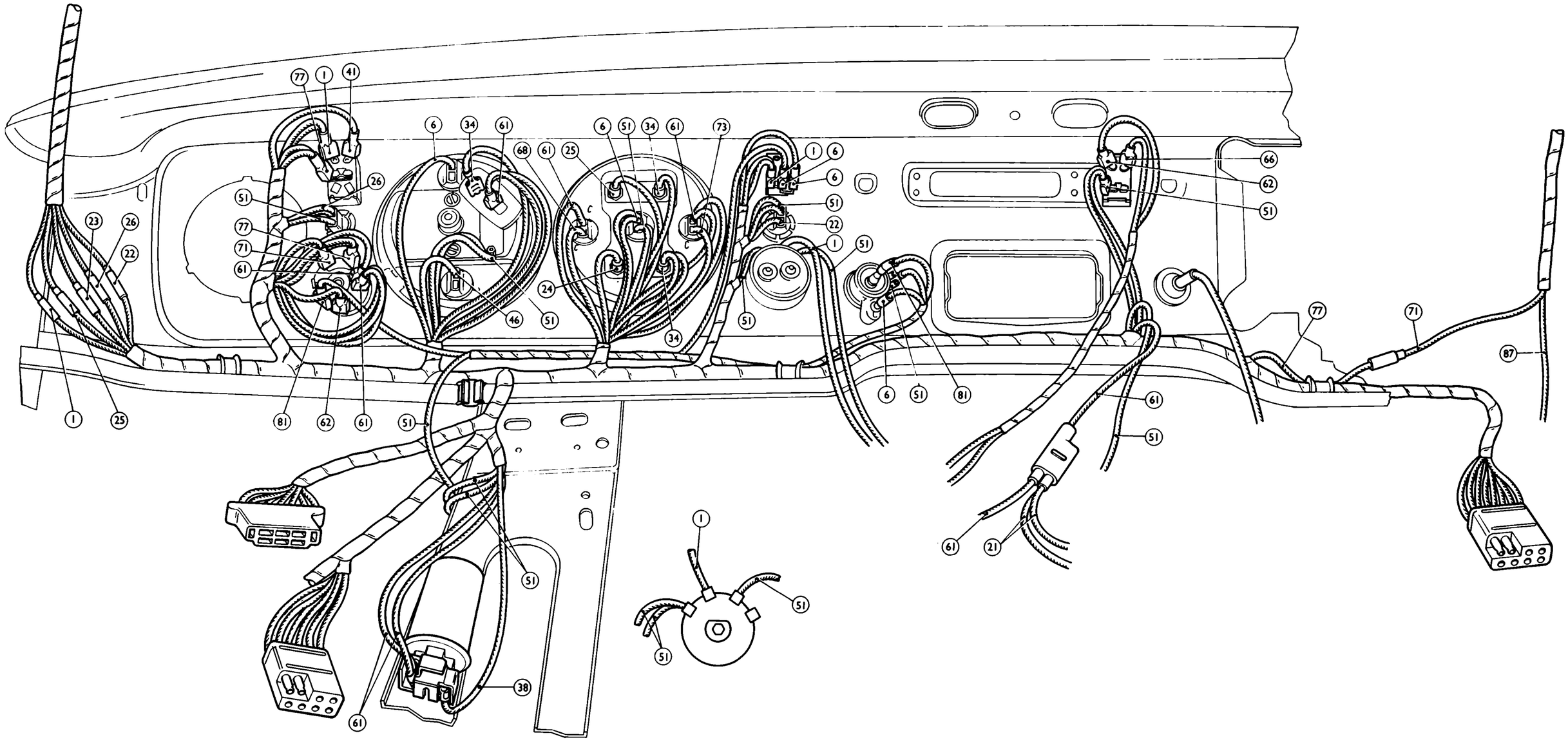
Code		*Wire Colour*	*Code*		*Wire Colour*
R	...	Red	Y	...	Yellow
Bk		Black	LG	...	Light Green
Bl		Blue	P	...	Purple
W		White	O	...	Orange
Br	...	Brown	Pk	...	Pink
G		Green	S	...	Slate

Code		*Item*	*Code*		*Item*
1		R.H. Side Lamp (Front)	33		R.H. Indicator Warning Light
2		L.H. Side Lamp (Front)	34	...	L.H. Indicator Warning Light
3		R.H. Direction Indicator (Front)	35	...	Ignition Switch
4	...	L.H. Direction Indicator (Front)	36	...	Ammeter
5	...	R.H. Headlamp	37	...	Oil Pressure Gauge
6		L.H. Headlamp	38	...	Temperature Gauge
7		R.H. Front Loom Connector	39	...	Fuel Gauge
8		L.H. Front Loom Connector	40	...	Instrument Illumination Bulb
9		Oil Pressure Switch	41		Dual Brake Warning Light
10		Temperature Gauge Sender Unit	42		Generator Warning Light
11		Coil	43	...	Oil Pressure Warning Light
12	...	Distributor	44	...	Instrument Voltage Stabiliser
13		Starter Motor	45	...	Speedometer
14		Generator	46	...	Tachometer
15	...	Body Earth	47	...	Clock
16	...	Battery	48	...	Turn Signal Unit
17	...	Horn	49	...	Hazard Unit
18		Fuses	50	...	Automatic Quadrant Illumination Lamp
19	...	Regulator	51		R.P.O. Connectors
20	...	R.H. Bulkhead Multi-Way Connector	52	...	Radio Fuse
21		L.H. Bulkhead Multi-Way Connector	53	...	Heater Switch
22	...	Starter Motor Solenoid	54	...	Cigar Lighter
23	...	Dual Brake Warning Switch	55	...	Windscreen Wiper Switch
24	...	Blower Motor Ballast	56	...	Steering Column Connector
25	...	Heater Motor	57	...	Radio
26	...	Back-up Lamp Switch (Manual Trans.)	58	...	Hazard Warning Light Switch
27	...	Back-up Lamp Switch (Automatic Trans.)	59	...	Panel Light Switch
28		Windscreen Wiper Motor	60	...	Dual Brake Test Switch
29	...	Stop Lamp Switch	61		Lighting Switch
30	...	Foot Dip Switch	62		Interior Light
31	...	R.H. Courtesy Light Switch	63		Turn Signal Switch
32	...	L.H. Courtesy Light Switch	64		Horn Switch
			65	...	Column Dip Switch
			66	...	Headlamp Flasher Switch
			67	...	Fuel Tank Sender Unit

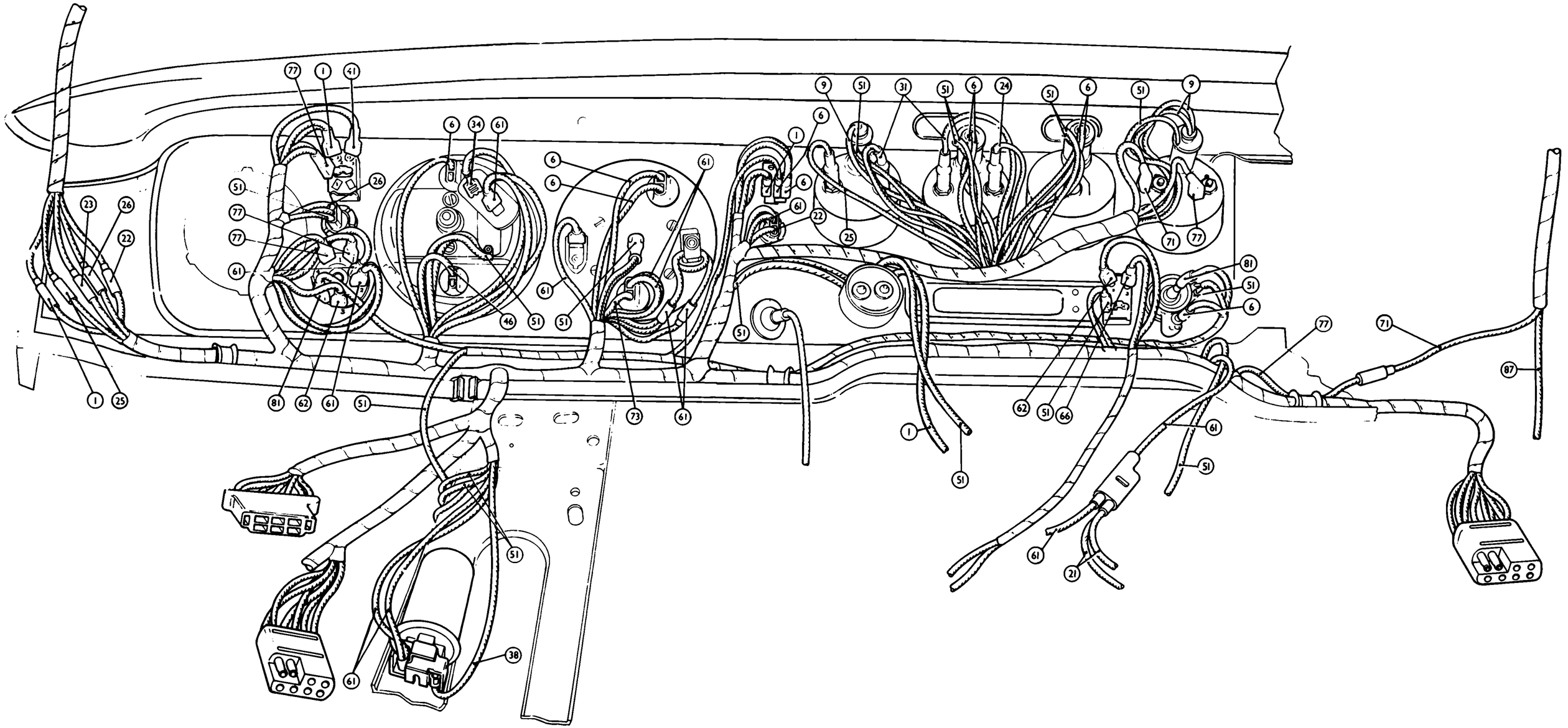
Code	*Item*	*Code*	*Item*
68 ...	Radio Speaker	77 ...	L.H. Reversing Lamp
69 ...	Rear Wiring Connector	78 ...	Licence Plate Lamp
70 ...	R.H. Stop Lamp	79 ...	Road Lamp Relay
71 ...	L.H. Stop Lamp	80	Tachometer Earth
72 ...	R.H. Direction Indicator (Rear)	81 ...	Speedometer Earth
73 ...	L.H. Direction Indicator (Rear)	82 ...	Main Beam Warning Light
74 ...	R.H. Side Lamp (Rear)	83 ...	R.H. Road Lamp
75 ...	L.H. Side Lamp (Rear)	84 ...	L.H. Road Lamp
76 ...	R.H. Reversing Lamp		



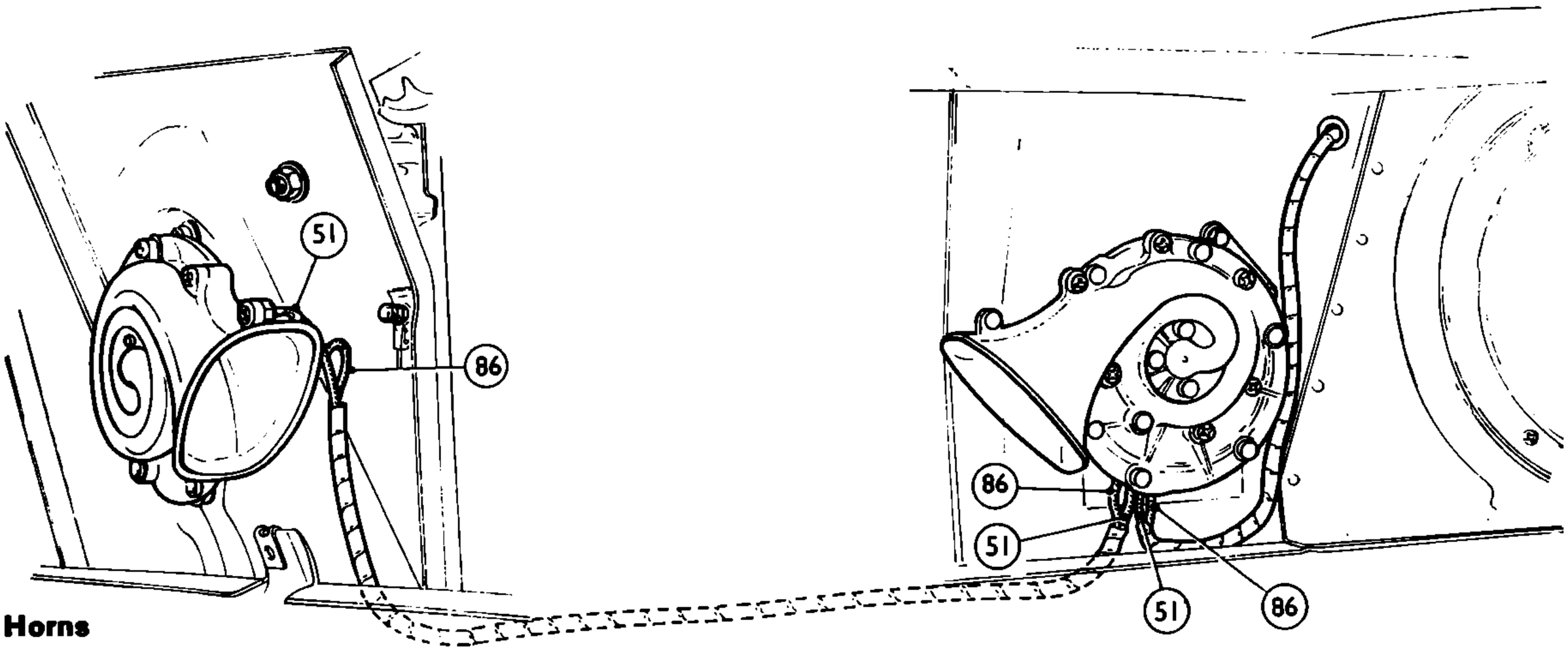
Fused Lighting Circuits



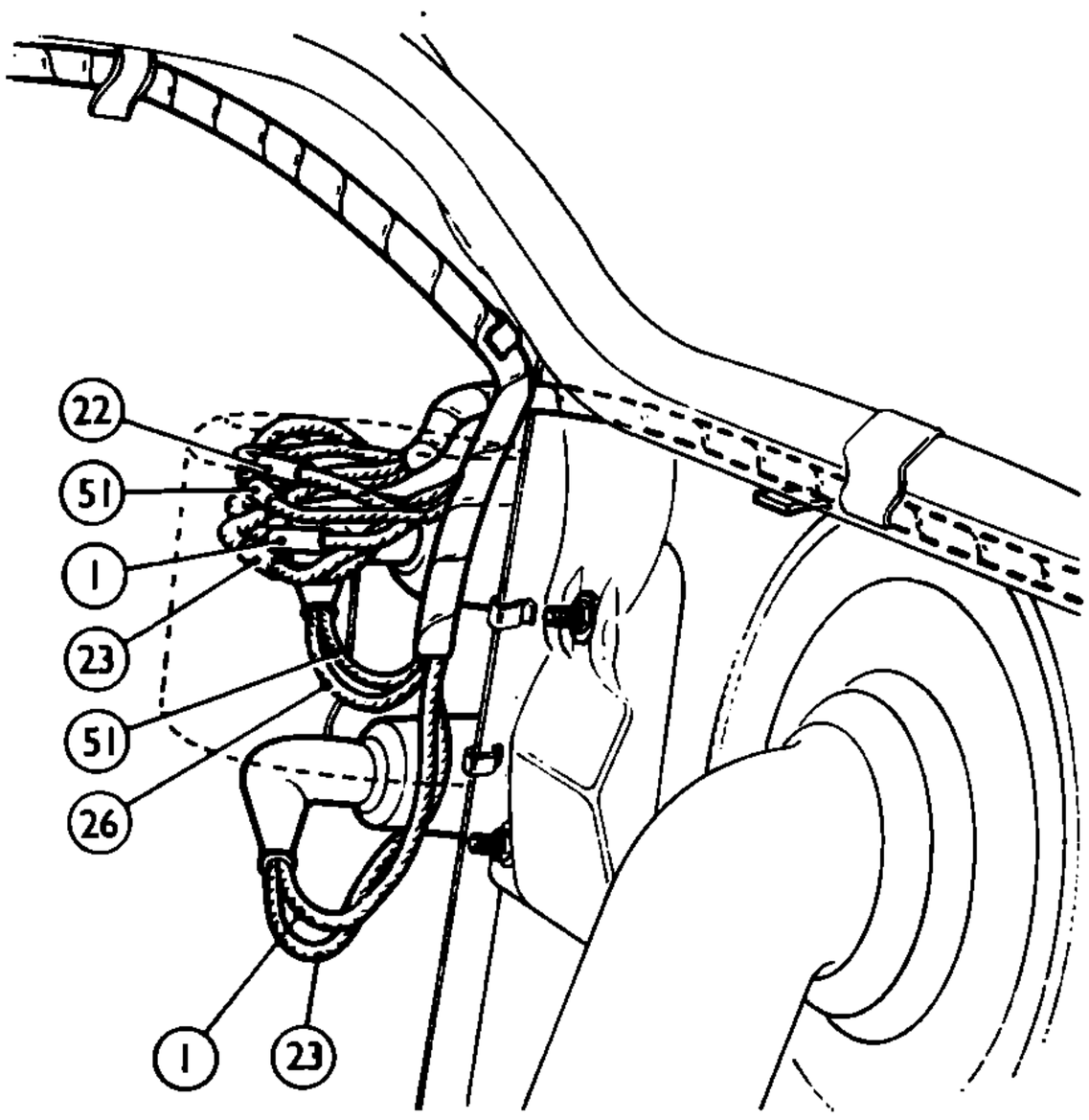
FACIA PANEL — Standard, De-luxe and Super



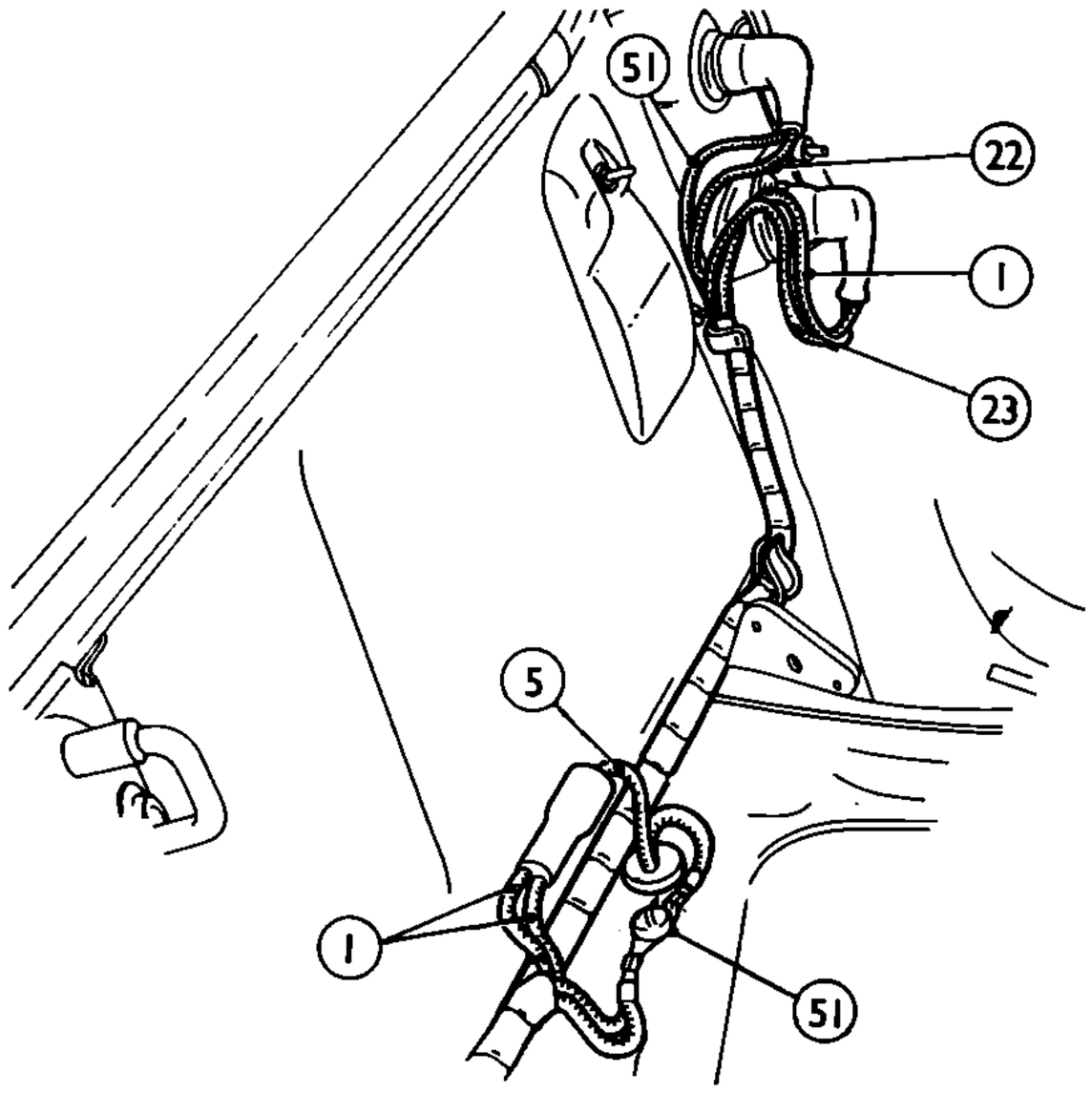
FACIA PANEL — G.T.



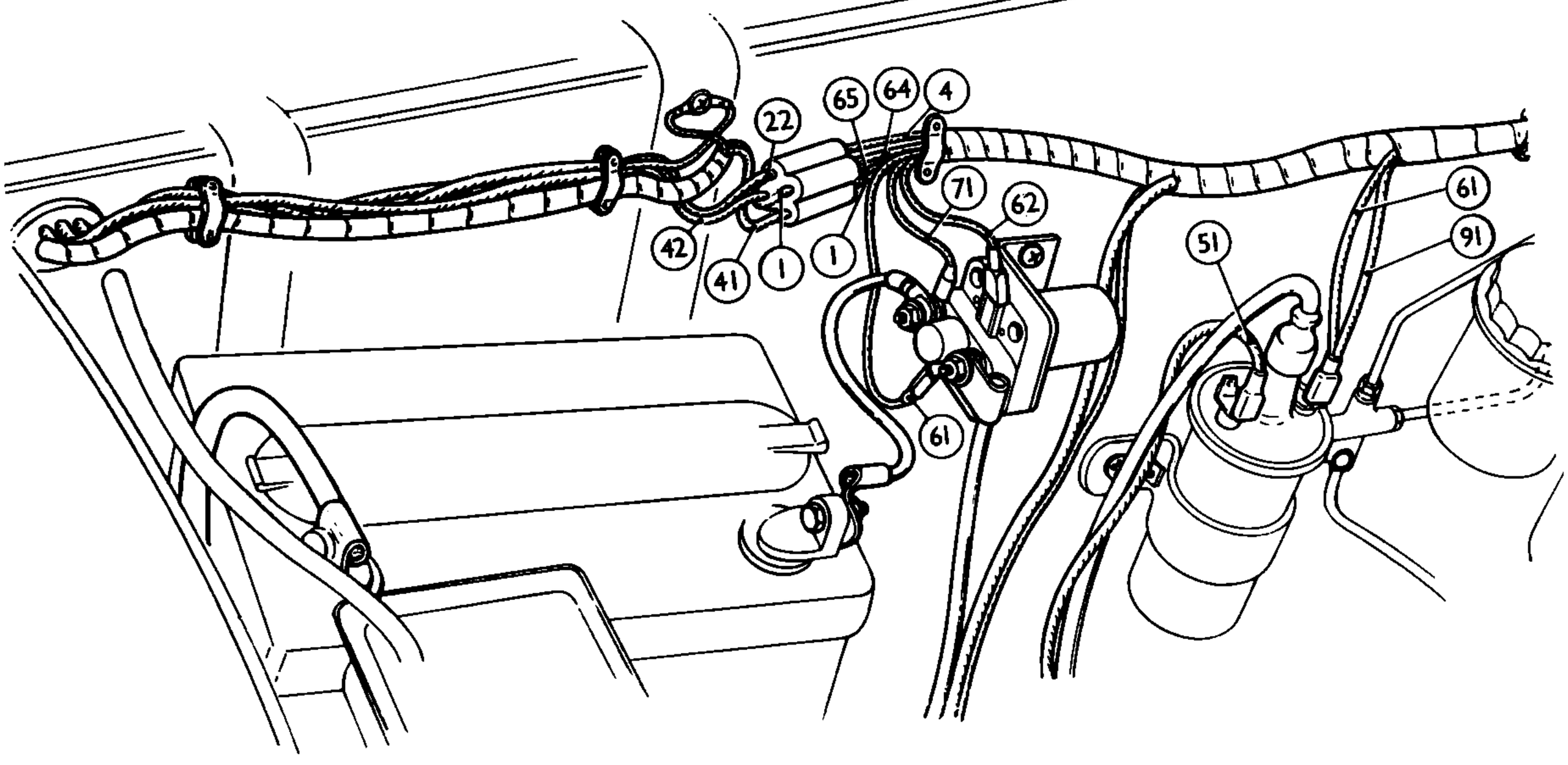
Horns



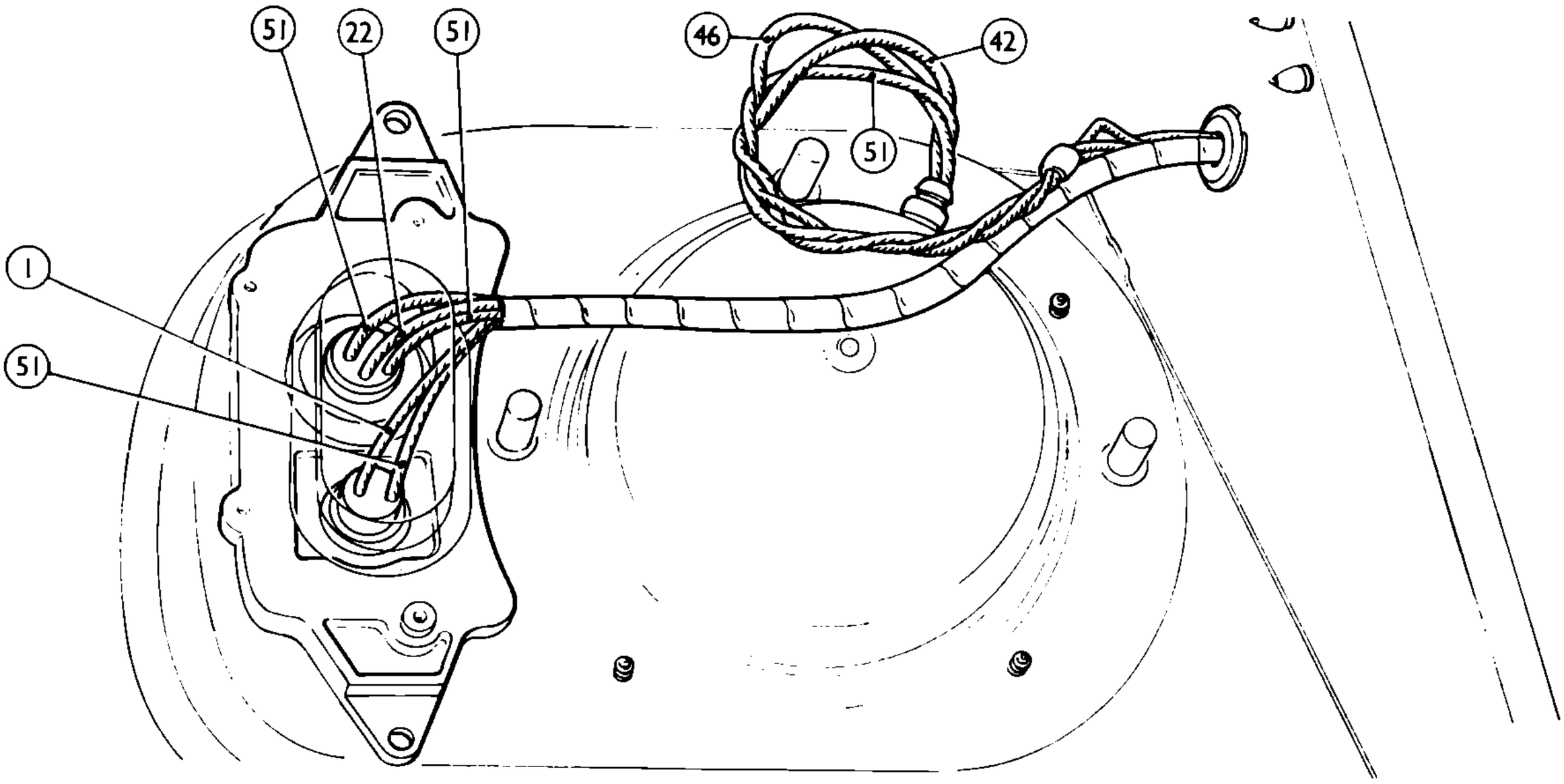
Rear Lights — Right-hand Side



Rear Lights — Left-hand Side

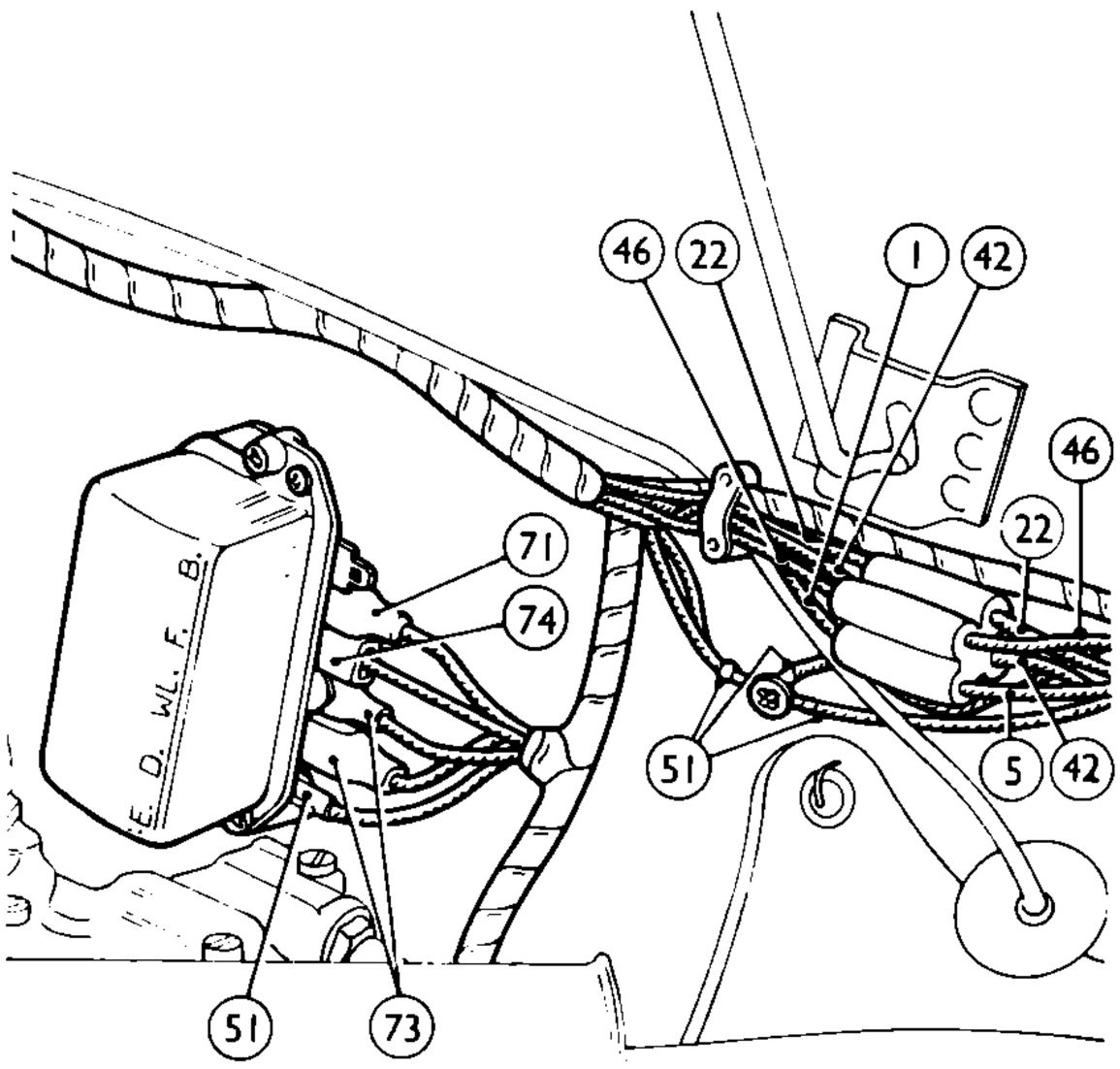


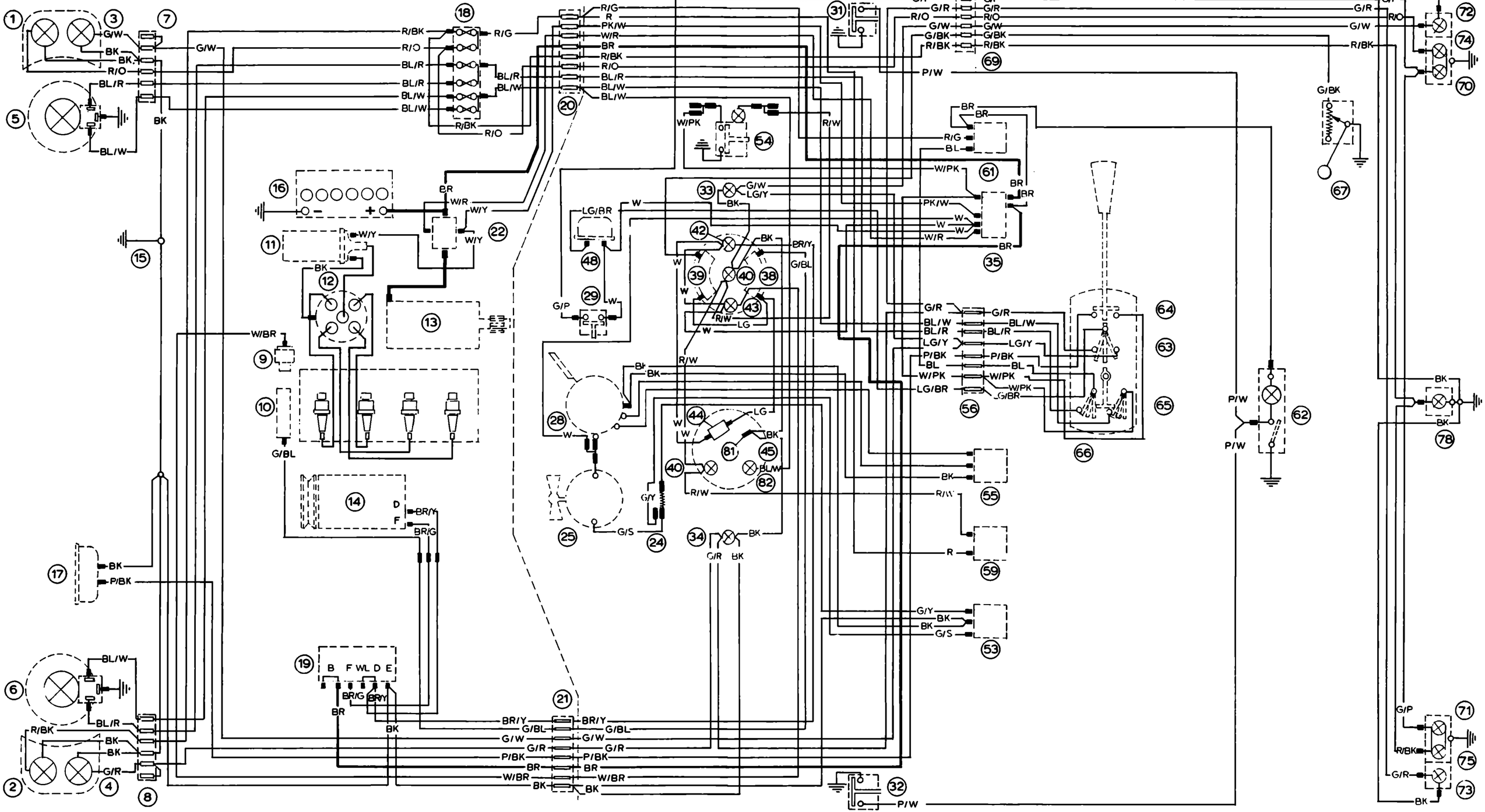
Engine Compartment — Right-hand Side



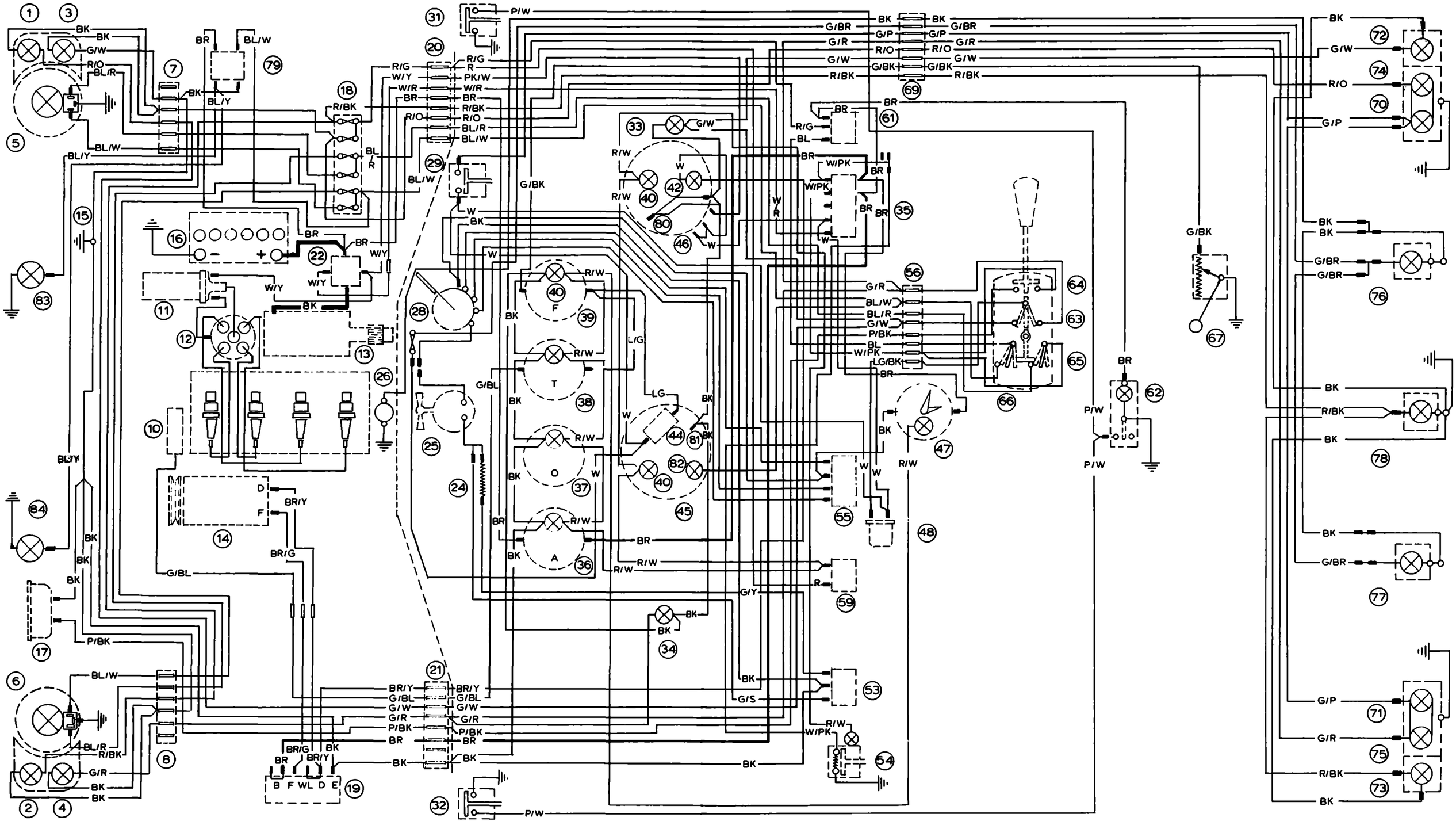
Front Lights

Engine Compartment — Left-Hand Side





WIRING DIAGRAM — R.H.D. AND L.H.D. CARS — STANDARD, DE LUXE AND SUPER



WIRING DIAGRAM — R.H.D. AND L.H.D. CARS — G.T. AND 1600

12

BODYWORK

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UNDERBODY REPAIR PROCEDURES

UNDERBODY TOLERANCE CHARTS

GENERAL DESCRIPTION

The body is of all steel welded construction with safety glass in all windows and single curvature windscreen and rear window.

The wide opening doors fitted with bar type check straps, incorporate zero torque door locks. An exterior key-operated lock is provided on the driver's door.

The well proved "Aeroflow" ventilation system is incorporated in the car, therefore fixed quarter lights are normally fitted to the front doors. Opening front door vent windows are available if required as an option.

Seating is within the wheelbase, bucket type front seats are provided with floor gear change. Bench or bucket front seats are available with column change or automatic transmission.

Reclining seats are available as an option on the Super and G.T. Four Door models.

The rear luggage compartment incorporates a self-locking counterbalanced lid, with the spare wheel mounted on the left-hand side of the compartment.

SEALING MATERIALS

There are four types of sealing materials used in the construction of the car, but only one is required for Service. This is "type 3" which is used for windscreen sealing and is water resistant, non-drying and remains permanently flexible. A material known to conform to these requirements is "SR-51-B" manufactured by Expandite Ltd., Chase Road, London, N.W.10.

The finish coats of paint are applied in two stages.

Stage 1 is the application of special primer paints, which are baked or stoved on the body for thirty minutes at 149°C (300°F), to produce a tough durable paint film with excellent adhesion properties. When hard this paint film is sanded to produce a really smooth surface, in preparation for stage 2.

Stage 2 is the application of Acrylic resin base enamel which is in turn baked or stoved for thirty minutes at 121°C to 129°C (250°F to 265°F). The end result is a hard high-gloss paint film with excellent colour retention and adhesion properties.

WARNING

Before starting any operation which involves the use of an oxy-acetylene cutting or welding torch, ensure that the fuel lines or electrical wiring are removed from the area to prevent a fire hazard.

When carrying out repairs which involve the removal of the fuel tank, sender unit, carburettor or fuel line, ensure that any petrol fumes which may be present are dispersed by positioning the vehicle in a well ventilated area. In cases like these it is a wise precaution to disconnect the battery to prevent a possible electrical fault from starting a fire.

Remember Safety Precautions Are For Your Protection, So Observe Them.

OP M 1005-A BUMPER BAR – FRONT – REMOVE AND INSTALL

To Remove

1. Remove two bolts, one each side, from the inside of the front wings.
2. Remove two chrome headed bolts and nuts from the centre of the bumper.
3. Remove the bumper assembly.

To Install

4. Position the bumper and loosely retain it with the two centre bolts and nuts.
5. Replace the two bolts securing the ends of the bumper.
6. Finally tighten all four bolts.

OP M 1005-A1 EXTRA: BUMPER BRACKET – EACH – REPLACE

To Remove

1. Remove the two bolts securing the bumper bracket to engine side apron panel.
2. Remove the bracket.

To Install

3. Position the bracket on the engine side apron panel and secure it with two bolts.

OP M 1010-A BUMPER BAR – REAR – REMOVE AND INSTALL

To Remove

1. Remove the licence plate light, see OP 13543-A, section 10.
2. Remove four chrome headed bolts and nuts securing the rear bumper.
3. Remove the bumper.

To Install

4. Position the bumper on the bumper brackets.
5. Secure the bumper with four bolts and nuts.
6. Replace the licence plate lamp as in OP 13543-A, section 10.

OP M 1010-A1 EXTRA: BUMPER BRACKET – EACH – REPLACE

To Remove

1. Remove two bolts securing the bracket to the body.
2. Remove the bumper bracket.

To Install

3. Locate the bumper bracket on the body.
4. Secure the bracket with two bolts.

OP M 1030-A RADIATOR GRILLE – REMOVE AND INSTALL

To Remove

1. Remove four screws each side securing the two headlight bezels and move the bezels out of the way.
2. Remove two screws securing the bottom edge of the radiator, then drill out the six rivets securing the top of the radiator and remove the radiator.

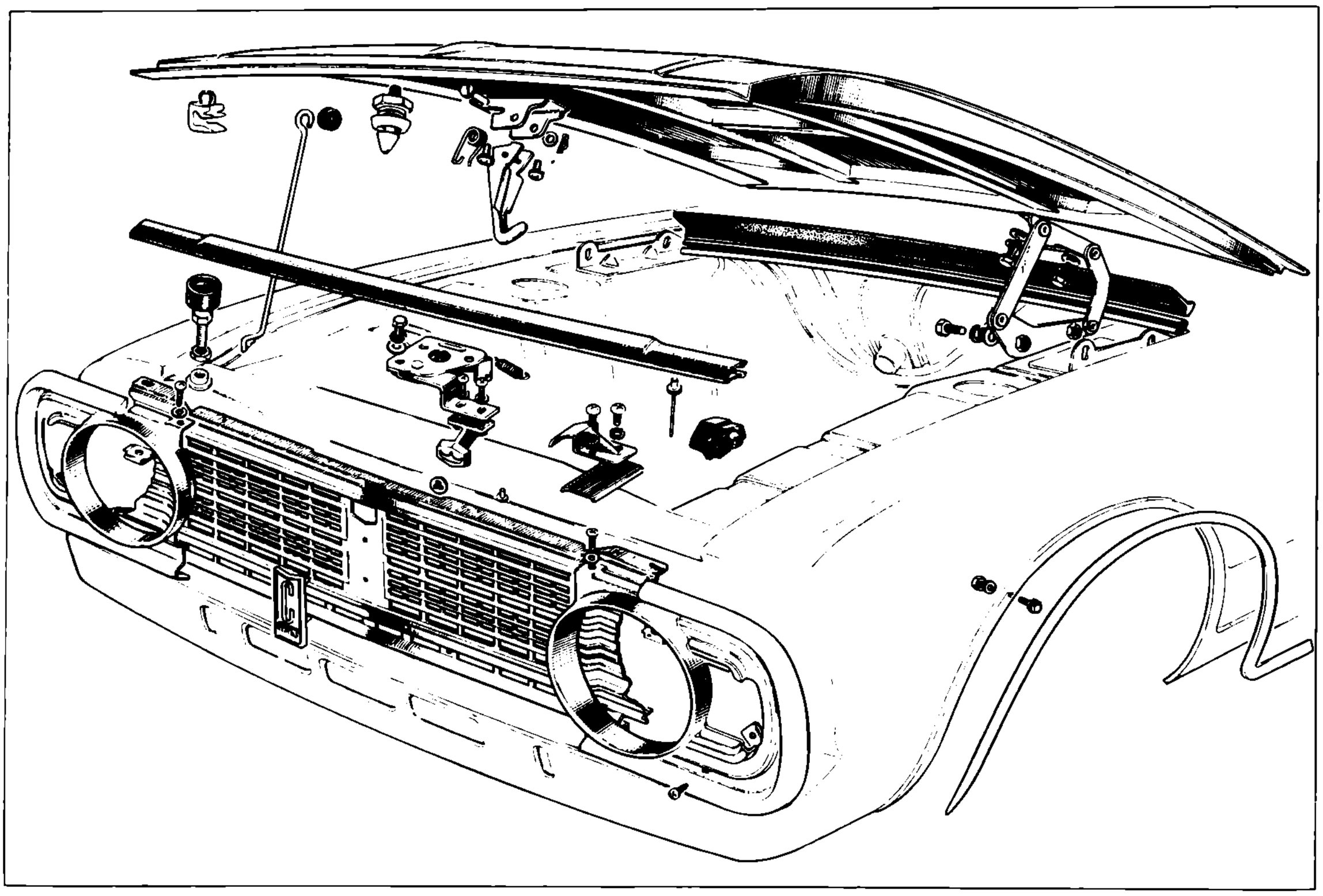
To Install

3. Position the radiator on the body, secure the top edge with six rivets and the bottom edge with two screws.
4. Replace the two headlight bezels and secure them with four screws each side.

OP M 1035-A BONNET ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Open the bonnet, fit wing covers and place a cloth on the scuttle to prevent accidental damage.
2. If the bonnet lid alignment is satisfactory, scribe a line around the hinges on the underside of the bonnet lid.



Radiator and Bonnet Lid

3. Remove two bolts securing the bonnet lid to one of the hinges and rest the lid on the front scuttle panel.
4. Support the bonnet lid, remove two bolts from the second hinge and detach the bonnet lid.

To Install

5. Place the bonnet lid on the front scuttle panel and alternately lift each side and loosely replace two securing bolts to each hinge.
6. Align the hinges to the marks scribed on the underside of the bonnet lid and lightly tighten the bolts.
7. Close bonnet and check alignment. Adjust if necessary.
8. Fully tighten securing bolts.
9. Remove the protective cloth from the front scuttle and remove the wing covers.

OP M 1037-A BONNET STRIKER POST – REMOVE AND INSTALL

To Remove

1. Open and prop up the bonnet.
2. Unscrew the adjusting bolt and remove the bolt, spring seats and spring.

To Install

3. Locate the spring seats, spring and bolt on the bonnet lid and tighten the bolt.
4. Close the bonnet and check the height of the bonnet to the surrounding body panels and adjust if necessary.

OP M 1038-A BONNET LOCK ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Open and prop up the bonnet.
2. Remove ten screws, five each side, securing the two headlamp bezels and remove the bezels.
3. Drill out six rivets and remove the two screws securing the radiator grille and remove the grille.
4. Remove three bolts securing the lock mechanism, disconnect the operating cable and remove the lock assembly.

To Install

5. Locate the lock mechanism under the radiator upper panel, connect the operating cable and secure with three bolts.
6. If necessary slacken the two release handle securing screws and adjust the handle until it lines up with surrounding radiator mouldings, then tighten the securing screws.

7. Replace the radiator grille and secure it with two screws, and either pop-rivets or self-tapping screws.
8. Replace the two headlamp bezels and secure them with ten screws, five each side.

OP M 1039-A BONNET SAFETY CATCH – REMOVE AND INSTALL

To Remove

1. Open and prop up the bonnet.
2. Remove two bolts securing the safety catch to the bonnet and remove the catch.

To Install

3. Position the safety catch on the bonnet and secure it with two bolts.
4. Close the bonnet and check the operation of the safety catch.

OP M 1040-A BONNET SAFETY CATCH STRIKER PLATE – REMOVE AND INSTALL

To Remove

1. Remove the two screws securing the striker plate to the body and remove the striker plate.

To Install

2. Position the striker plate on the body and secure it with two screws.

OP M 1042-A BONNET STAY – REMOVE AND INSTALL

To Remove

1. Open and support the bonnet.
2. Release one end of the stay from its retaining clip and disconnect the other end from the rubber bushed mounting bracket on the bonnet.

To Install

3. Reconnect the stay to its mounting bracket on the bonnet and secure the other end in its retaining clip.
4. Close the bonnet.

OP M 1043-C BONNET HINGE – ONE – REMOVE AND INSTALL

To Remove

1. Open the bonnet, fit wing covers and place a cloth on the scuttle to prevent accidental damage.
2. Scribe a line around the hinge on the underside of the bonnet, and on the bracket welded to the front mudguard apron.
3. Remove the two bolts securing the bonnet lid, and rest the lid on the front scuttle panel.
4. Remove the two bolts securing the hinge to the apron bracket.

To Install

5. Loosely replace the four hinge bolts.
6. Align the hinge to the marks scribed on the underside of the bonnet lid, and the apron bracket, and lightly tighten the bolts.
7. Close the bonnet and check alignment. Adjust if necessary.
8. Fully tighten the securing bolts.
9. Remove the protective cloth from the front scuttle and remove the wing covers.

OP M 1060-A DOOR ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Remove the circlip and withdraw the door check strap pivot pin.
2. Support the door and remove four bolts securing the door to the hinges.
3. Remove the door and anti-slip shims.

To Install

4. Replace the door and secure lightly with four bolts.
5. Shut the door and check the alignment of the door to bodywork and adjust if necessary.
6. Carefully open the door and fully tighten the securing bolts.
7. Replace the check strap pivot pin and secure it with a circlip.
8. Carefully open the door and fully tighten the securing screws.
9. Replace the check strap pivot pin and secure it with a circlip.
10. Replace the door trim panels and handles.

OP M 1060-A2 EXTRA: DOOR SHELL – REPLACE

To Remove

1. Remove the trim panel and interior handles.
2. Remove the remote control assembly (see Op. M 1076-A)
3. Remove the door lock mechanism (see Op. M 1075-A)
4. Remove the door window glass (see Op. M 1050-A)
5. Remove the window regulator (see Op. M 1051-A)
6. Remove the vent window assembly (see Op. M 1052-A)
7. Remove the door exterior handle (see Op. M 1077-A)
8. Remove the door window glass lower stop, door bump rubbers and weatherstrip.

To Install

9. Replace the door window glass lower stop, door bump rubbers and weatherstrip.
10. Replace the door exterior handle (see Op. M 1077-A)

11. Replace the vent window assembly (see Op. M 1052-A)
12. Replace the window regulator (see Op. M 1051-A)
13. Replace the door window glass (see Op. M 1050-A)
14. Replace the door lock mechanism (see Op. M 1075-A)
15. Replace the remote control assembly (see Op. M 1076-A)
16. Replace the trim panel and interior handles.

OP M 1060-D DOOR SHELL – REMOVE AND INSTALL
(Includes OPS M 1060-A and A2)

OP M 1061-A FRONT DOOR UPPER OR LOWER HINGE – REMOVE AND INSTALL

To Remove

1. Remove the door trim panel and handles.
2. Remove the circlip and withdraw the pivot pin securing door check strap.
3. Support the door and remove four bolts securing the door hinges to the door.
4. Remove the door and parcel shelf.
5. Pull the floor carpet back and remove the cowl side trim panel.
6. Remove the three nuts and washer plate securing each hinge to the body and remove the hinge and anti-slip shim.

To Install

7. Locate the hinges on the body and secure them with washer plate and three nuts.
8. Lightly secure the door to the hinges with four bolts.
9. Shut the door and check the alignment of the door to the bodywork and adjust if necessary.
10. Carefully open the door and fully tighten the hinge securing bolts.
11. Replace the cowl side trim panel and carpet.
12. Replace the parcel shelf.
13. Locate the door check strap with the pivot pin and secure it with a circlip.
14. Replace the door trim panel and handles.

OP M 1063-A DOOR EXTERIOR HANDLE – REMOVE AND INSTALL

To Remove

1. Close the window and remove the door trim panel and handles.
2. Remove the screw securing the rear end of the handle to the door.
3. Through the door access hole remove the screw securing the front end of the handle.
4. Remove the handle and rubber sealing gaskets.

To Install

5. Position the rubber gaskets and handle on the door and secure the rear end with a screw.
6. Through the door access hole replace the screw securing the front of the handle.
7. Check the operation of the door handle plunger and replace the door trim panel and handles.

OP M 1063-A1 EXTRA: DOOR EXTERIOR HANDLE – OVERHAUL

To Dismantle

1. Remove the circlip from the end of the handle.
2. Withdraw the end plate, spring and lock barrel assembly.
3. Slacken the locknut and unscrew the adjusting bolt.
4. Remove the cast end of the lock barrel.
5. Insert the key in the barrel and withdraw the lock barrel from the chrome bezel.

To Reassemble

6. Insert the lock barrel in the chrome bezel and remove the key.
7. Replace the cast end of the lock barrel and secure it with the adjusting bolt and locknut.
8. Insert the lock barrel assembly, spring and end plate in door handle.
9. Replace the circlip in the end of the handle.

OP M 1063-B DOOR EXTERIOR HANDLE – OVERHAUL
(Includes OPS M 1063-A and A1)

OP M 1064-A DOOR CHECK STRAP – REMOVE AND INSTALL

To Remove

1. Remove the door trim panel and handles.
2. Remove the circlip and withdraw the check strap pivot pin.
3. Through door access hole remove two bolts securing the check strap to the door.
4. Remove the check strap through door access hole.

To Install

5. Locate the check strap in the door and secure it with two bolts.
6. Replace the check strap pivot pin and secure it with a circlip.
7. Replace the door trim panel and handles.

Door Handle — Exploded

OP M 1066-A DOOR STRIKER PLATE - REMOVE AND INSTALL AND/OR ADJUST

To Remove

1. Remove three screws and remove the striker plate and anti-slip shim.

To Install

2. Position the anti-slip shim and striker plate on the door post and lightly secure them with three screws.
3. Shut the door ensuring the lock is fully engaged and not on safety and move it in or out until the door is flush with the bodywork.
4. Depress the door handle release button and carefully open the door.
5. Check that the striker plate is vertical, then fully tighten the three striker plate securing screws.
6. Shut the door and check the alignment of the door to the bodywork.
7. Check push button effort and free play.

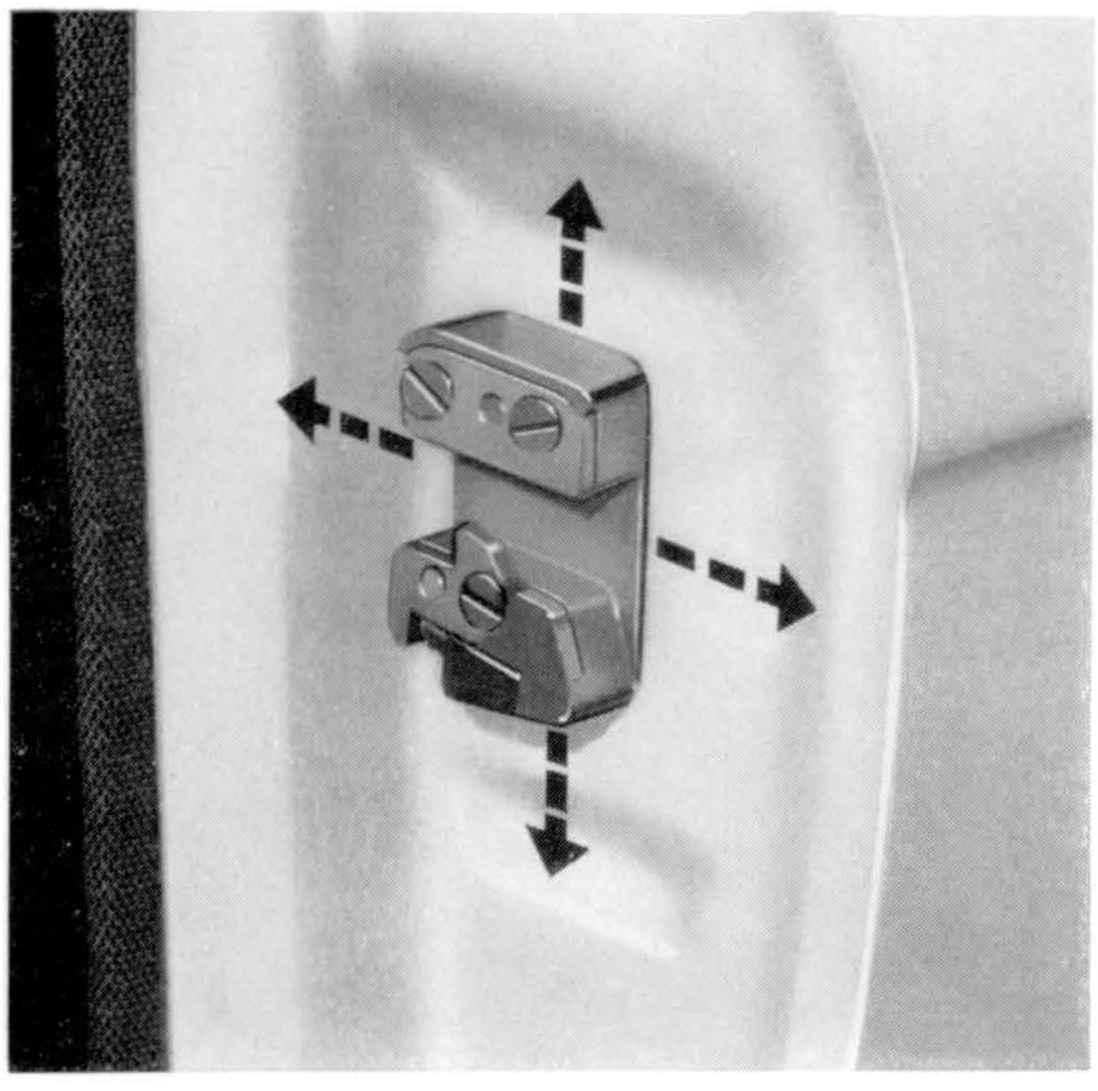
OP M 1069-A DOOR REMOTE CONTROL HANDLE - REMOVE AND INSTALL

To Remove

1. Remove the central screw securing the door remote control handle and remove the handle.

To Install

2. Position the remote control handle on its control shaft and secure it with a screw.



Door Striker Plate Adjustment

OP M 1070-A WINDOW REGULATOR HANDLE – REMOVE AND INSTALL

To Remove

1. Remove the central screw securing the door regulator handle and remove the handle.

To Install

2. Position the door regulator handle on its control shaft and secure it with a screw.

OP M 1072-A DOOR TRIM PANEL – REMOVE AND INSTALL

To Remove

1. Remove the window regulator handle, remote control handle and interior lock knob.
2. Remove two screws securing the combined armrest/door pull and remove the armrest.
3. Pull the trim panel away from the door inner panel to release the securing spring clips and remove the panel.

To Install

4. Position the trim panel on the door and press the spring clips into their appropriate holes in the door inner frame.
5. Replace the combined armrest/door pull and secure it with two screws.
6. Replace the window regulator handle, remote control and interior lock knob.

OP M 1072-B WINDOW REGULATOR ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Lower the window and remove the door trim panel and handles.
2. Support the window glass and remove four screws securing the window regulator assembly to the door.
3. Disconnect the window regulator operating arm from the window glass lower run and remove the regulator assembly through the door access hole.

To Install

4. Position the regulator assembly in the door and connect the operating arm to the window glass lower run.
5. Secure the regulator to the door with four screws.
6. Replace the door trim panel and handles.

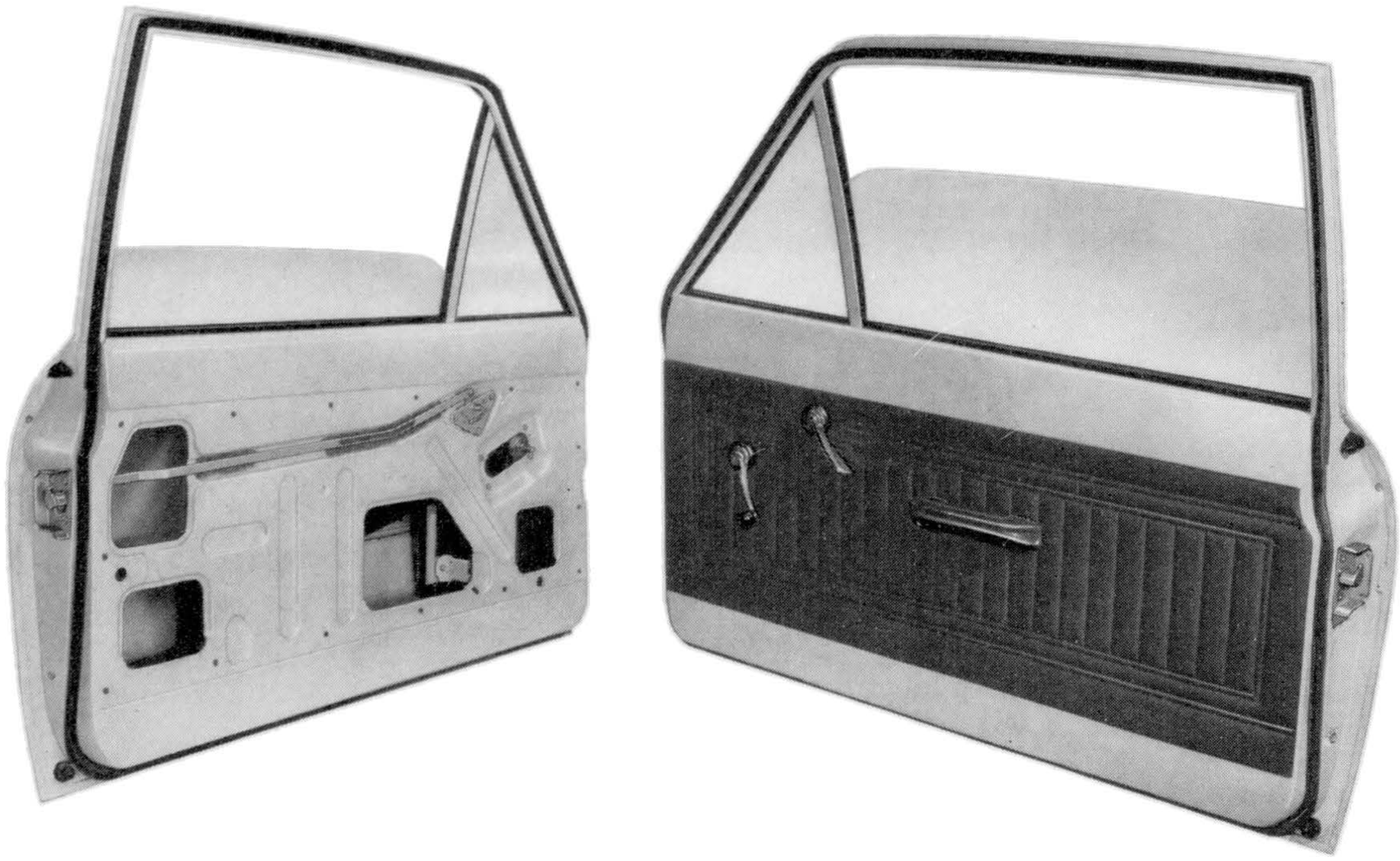
OP M 1072-C DOOR LOCK ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Close the window and remove the door trim panel and handles.
2. Remove the spring clip securing the door lock remote control arm to the lock mechanism and disconnect the arm.
3. Remove the screw securing the lower end of the window glass rear run.
4. Pull down the rear run to disengage the top end and remove the rear run through the door access hole.
5. Remove three screws securing the lock mechanism and dovetail plate to the door and remove the lock mechanism through the door access hole.

To Install

6. Position the lock mechanism in the door through the access hole.
7. Secure lock and dovetail plate to the door with three screws.
8. Replace window glass rear run, clip the top end in position and secure the lower end with a screw.
9. Connect the door lock remote control arm to the lock mechanism and secure it with a spring clip.
10. Check operation of lock, and push button free play. Adjust if necessary to $\frac{1}{16}$ in. (1.6 mm.).
11. Replace the door trim panel and handles.



Front Door Components

OP M 1072-D DOOR REMOTE CONTROL ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Remove the door trim panel and handles.
2. Remove the spring clip securing the remote control arm to the lock mechanism and disconnect the arm.
3. Remove three screws securing the remote control mechanism to the door and remove the remote control assembly.

To Install

4. Locate the remote control assembly on the door and secure it with three screws.
5. Connect the remote control operating arm to the lock mechanism and secure it with a spring clip.
6. Replace the door trim panel and handles.

OP M 1072-G FIXED VENT WINDOW GLASS AND/OR WEATHERSTRIP – REMOVE AND INSTALL

To Remove

1. Lower the window and remove the door trim panel and handles.
2. Remove the screw securing the lower end of the vent window dividing channel.
3. Drill out the two "pop" rivets securing the top end of the dividing channel and remove the channel from the door.
4. Pull out the vent window and weatherstrip.

To Install

5. Locate the vent window and dividing channel in the door.
6. Secure the lower end of the dividing channel with a screw and the top end with two "pop" rivets.
7. Replace the door trim panel and handles.

OP M 1072-H DOOR WINDOW GLASS SILENT CHANNEL – REMOVE AND INSTALL

To Remove

1. Remove the screw securing the bottom of the window glass lower rear run and pull down the metal backing to disconnect the run from the door.
2. Pull the silent channel out of the door frame and lower rear run.

To Install

3. Replace the silent channel in the door frame starting at the top front edge.
4. Position the lower rear glass run metal backing over the silent channel and position the top edge in the door. Secure the lower edge with a screw.

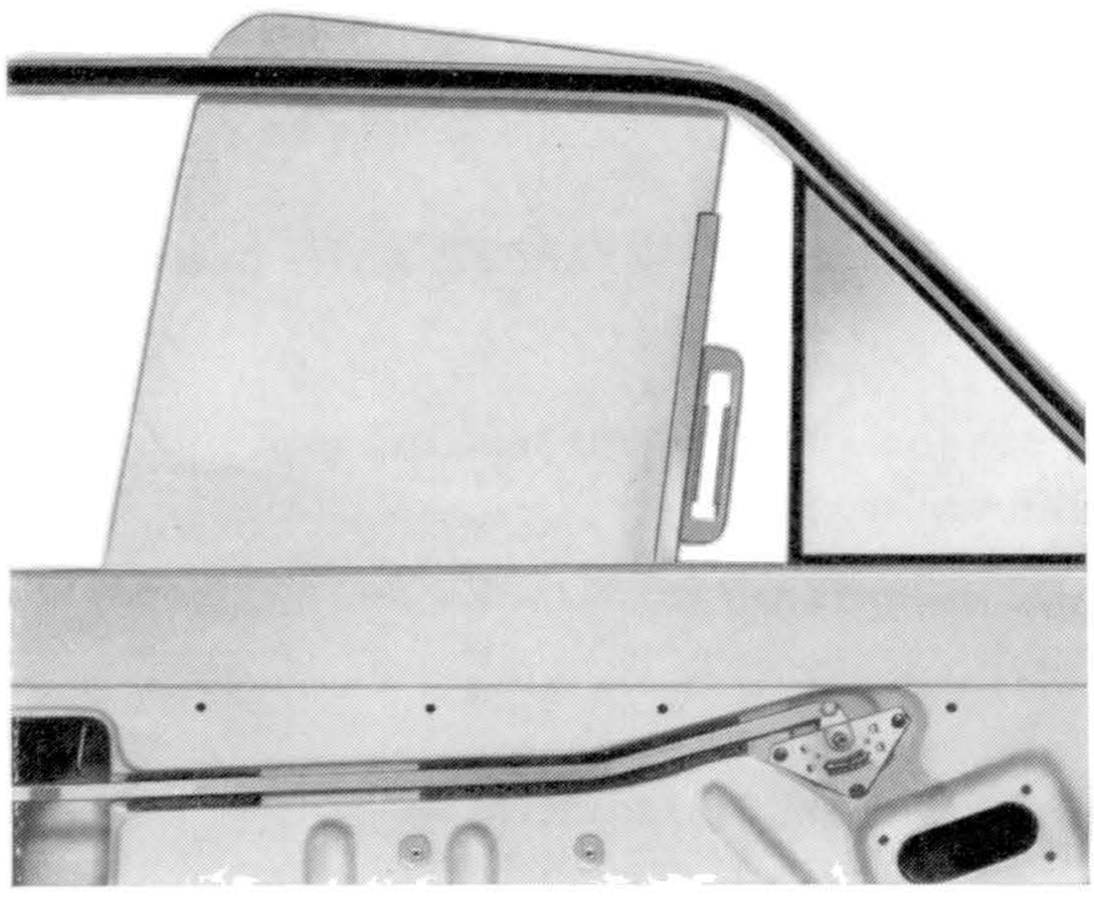
OP M 1072-I FRONT DOOR WINDOW GLASS - REMOVE AND INSTALL

To Remove

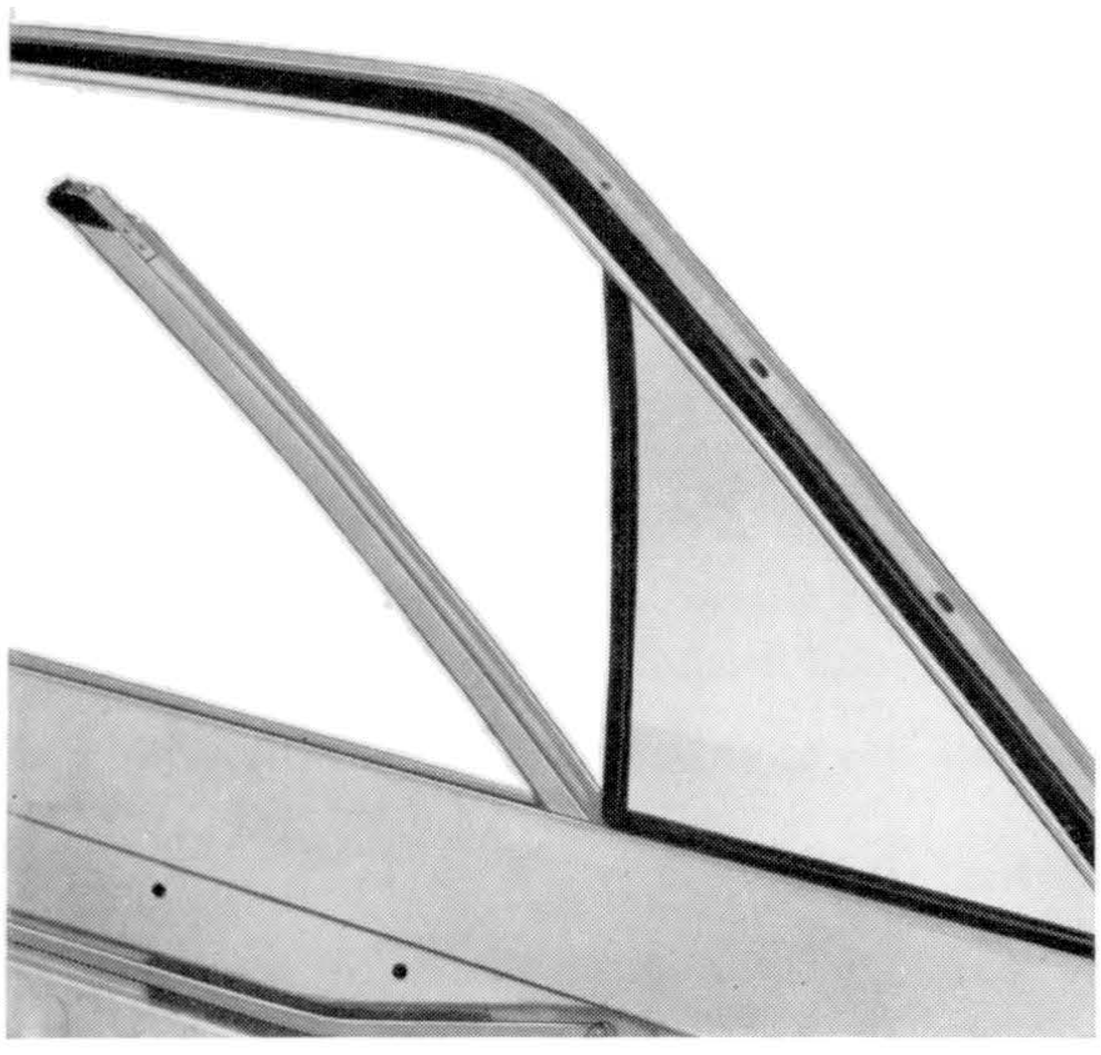
1. Remove the door trim panel and handles.
2. Remove the door inner and outer belt weatherstrips.
3. Replace the window winder handle, close the window and remove the screw securing the lower end of the window glass rear run.
4. Pull down the rear run to disengage the top end and remove the run through the door access hole.
5. Open and support the window then remove four screws securing the window regulator to the door.
6. Disconnect the window regulator operating arm from the window glass lower run and remove the regulator through the door access hole.
7. Drill out the two "pop" rivets securing the top end of the vent window dividing channel.
8. Remove the screw securing the lower end of the vent window dividing channel and remove the channel from the door.
9. Rotate the window glass through 90° and remove it from the door.

To Install

10. Enter the window glass in the door.
11. Position the dividing channel in the door and locate the window glass in the dividing channel.
12. Secure the top end of the dividing channel with two "pop" rivets and the lower end with a screw.



Removing Door Window Glass



Removing Door Vent Window Dividing Channel

13. Locate the window regulator in the door and connect the operating arm to the window glass lower run.
14. Secure the window regulator to the door with four screws.
15. Close the window and replace the window glass rear run, clip the top end in position and secure the lower end with a screw.
16. Replace the door inner and outer belt weatherstrips.
17. Replace the door trim panel and handles.

OP M 1105-A LUGGAGE COMPARTMENT LID ASSEMBLY - REMOVE AND INSTALL

To Remove

1. Cover the rear cowl panel with a cloth to prevent accidental damage.
2. If the luggage compartment lid alignment is satisfactory open the lid and scribe a line around the hinges on the underside of the lid.
3. Remove two bolts securing the luggage compartment lid to one of the hinges and rest the lid on the rear cowl panel.
4. Support the luggage compartment lid, remove two bolts from the second hinge and detach the lid.

To Install

5. Place the luggage compartment lid carefully on the rear cowl panel and alternately lift each side and loosely replace the two securing bolts to each hinge.
6. Align the hinges to the marks scribed on the underside of the lid and lightly tighten the bolts.
7. Close lid and check alignment. Adjust if necessary.
8. Fully tighten securing bolts.
9. Remove the protective cloth from the rear cowl.

OP M 1108-A LUGGAGE COMPARTMENT STRIKER POST - REMOVE AND INSTALL

To Remove

1. Open the luggage compartment lid and scribe a line around the catch.
2. Remove the two bolts securing the catch in position.

To Install

3. Replace the catch and lightly secure the two bolts.
4. Close the luggage compartment lid, check alignment and operation, adjust if necessary.
5. Fully tighten the bolts and close the luggage compartment lid.

OP M 1109-A LUGGAGE COMPARTMENT LOCK – REMOVE AND INSTALL

To Remove

1. Open the luggage compartment lid and remove the circlip from the end of the lock spindle.
2. Remove three bolts securing the lock assembly to the luggage compartment lid and remove the lock.

To Install

3. Position the lock assembly in the luggage compartment lid and secure it with three bolts.
4. Replace the circlip on the end of the lock spindle.

OP M 1109-A1 EXTRA: LUGGAGE COMPARTMENT LOCK BARREL – REMOVE AND INSTALL

To Remove

1. Open luggage compartment lid and remove the circlip from the end of the lock spindle.
2. Remove the lock assembly.
3. Carefully prise the lock barrel assembly from the luggage compartment lid.
4. Slacken the locknut and remove the lock spindle, cam, spacer and return spring.
5. Withdraw the lock barrel from the chrome bezel.

To Install

6. Insert the lock barrel in the chrome bezel.
7. Refit the return spring, spacer and cam.
8. Secure the assembly with the lock spindle and tighten the locknut.
9. Replace the lock barrel assembly in the luggage compartment lid.
10. Replace the lock assembly.
11. Refit the circlip on the end of the lock spindle.

OP M 1109-B LUGGAGE COMPARTMENT LOCK BARREL – REMOVE AND INSTALL
(Includes OPS M 1109-A and A1)

OP M 1111-A LUGGAGE COMPARTMENT TORSION BAR – ONE – REMOVE AND INSTALL

To Remove

1. Open and support the luggage compartment lid and remove one screw and clip securing the centre of the torsion bars to the body.
2. Using a suitable spanner release cranked end of the torsion bar from the mounting bracket on the rear cowl reinforcing panel.
3. Disengage the other end of the torsion bar from the hinge and remove the torsion bar.

To Install

4. Locate the torsion bar in the hinge.
5. Using a suitable spanner force the cranked end of the torsion bar into position on its mounting bracket on the rear cowl reinforcing panel.
6. Replace the clip and screw securing the centre of the torsion bars to the body, remove the support and close the luggage compartment lid.

OP M 1111-A1 EXTRA: REMAINING TORSION BAR – REMOVE AND INSTALL
(See OP M 1111-A)

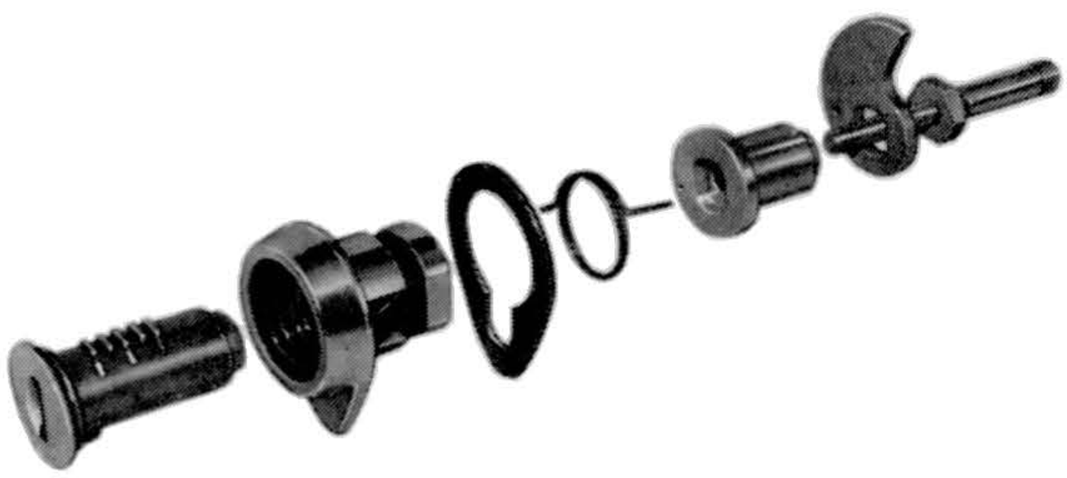
OP M 1111-A2 EXTRA: LUGGAGE COMPARTMENT HINGE – ONE – REMOVE AND INSTALL

To Remove

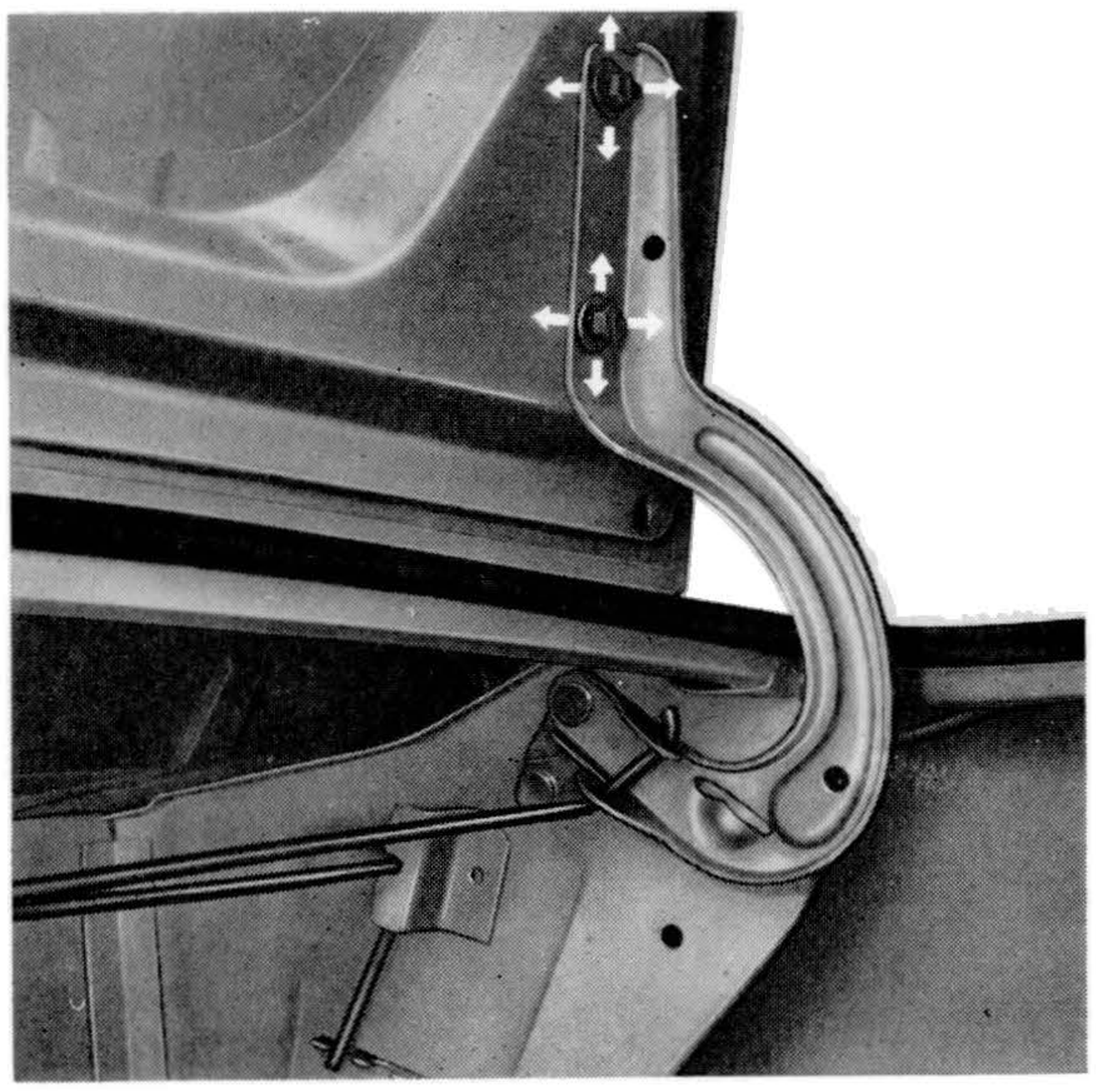
1. Open the luggage compartment lid and remove one screw and clip securing the centres of the torsion bars to the body.
2. Note the position of the torsion bar in the mounting bracket on the rear cowl reinforcing panel, and release the cranked end with a suitable spanner.
3. Disengage the other end of the torsion bar from the hinge and remove.
4. Scribe a line around the hinge on the underside of the luggage compartment, and on the bracket welded to the rear wheel arch.
5. Remove the two bolts securing the hinge to the luggage compartment lid, and support the lid.
6. Remove the two nuts securing the hinge to the wheel arch bracket, and remove the hinge.

To Install

7. Loosely replace the four hinge bolts.



Luggage Compartment Lock — Exploded



Luggage Compartment Hinge Adjustment

8. Align the hinge to the marks scribed, and partially tighten the bolts.
9. Close the luggage compartment lid and check alignment. Adjust if necessary.
10. Fully tighten the securing bolts.
11. Replace the end of the torsion bar in the hinge.
12. Fit the cranked end of the torsion bar in its correct position.
13. Replace the clip and screw securing the centres of the torsion bars to the body.

OP M 1111-B LUGGAGE COMPARTMENT TORSION BARS – BOTH – REMOVE AND INSTALL
(Includes OPS M 1111-A and A1)

OP M 1111-C LUGGAGE COMPARTMENT HINGE – ONE – REMOVE AND INSTALL
(Includes OPS M 1111-A, A1 and A2)

OP M 1111-D LUGGAGE COMPARTMENT HINGES – BOTH – REMOVE AND INSTALL
(Includes OPS M 1111-A, A1 and A2×2)

OP M 1150-A TAILGATE DOOR ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Open the tailgate and using a pencil scribe the tailgate around the hinges.
2. Support the tailgate and remove the six bolts (three each side) securing the tailgate to the hinges and remove the tailgate.

To Install

3. Position the tailgate on the hinges and temporarily locate it with six bolts (three each side).
4. Align the hinges to the lines previously scribed on the tailgate, fully tighten the securing bolts and check the adjustment of the tailgate.

OP M 1150-A1 EXTRA: DOOR SHELL – REPLACE

To Remove

1. Remove the tailgate window and weatherstrip (see OP M 1210-A).
2. Open the tailgate and remove the trim panel.
3. Remove the tailgate exterior handle and lock mechanism (see OPS M 1155-A and M 1160-A).
4. Remove the four screws (two each side) securing the two locating pegs on the tailgate inner panel and remove the pegs.
5. Remove the tailgate badges, and weatherstrip.

To Install

6. Replace the weatherstrip and tailgate badges.

7. Replace the two locating pegs on the tailgate and secure them with four screws (two each side).
8. Replace the tailgate exterior handle and lock mechanism (see OPS M 1155-A and M 1160-A).
9. Replace the tailgate trim panel.
10. Replace window and weatherstrip (see OP M 1210-A).

OP M 1155-A ESTATE CAR TAILGATE LOCK – REMOVE AND INSTALL

To Remove

1. Open the tailgate and remove the tailgate trim panel.
2. Remove the circlip securing the lock operating crank arm to the handle and disconnect the crank arm.
3. Remove the three screws securing the lock to the tailgate inner panel and withdraw the lock.

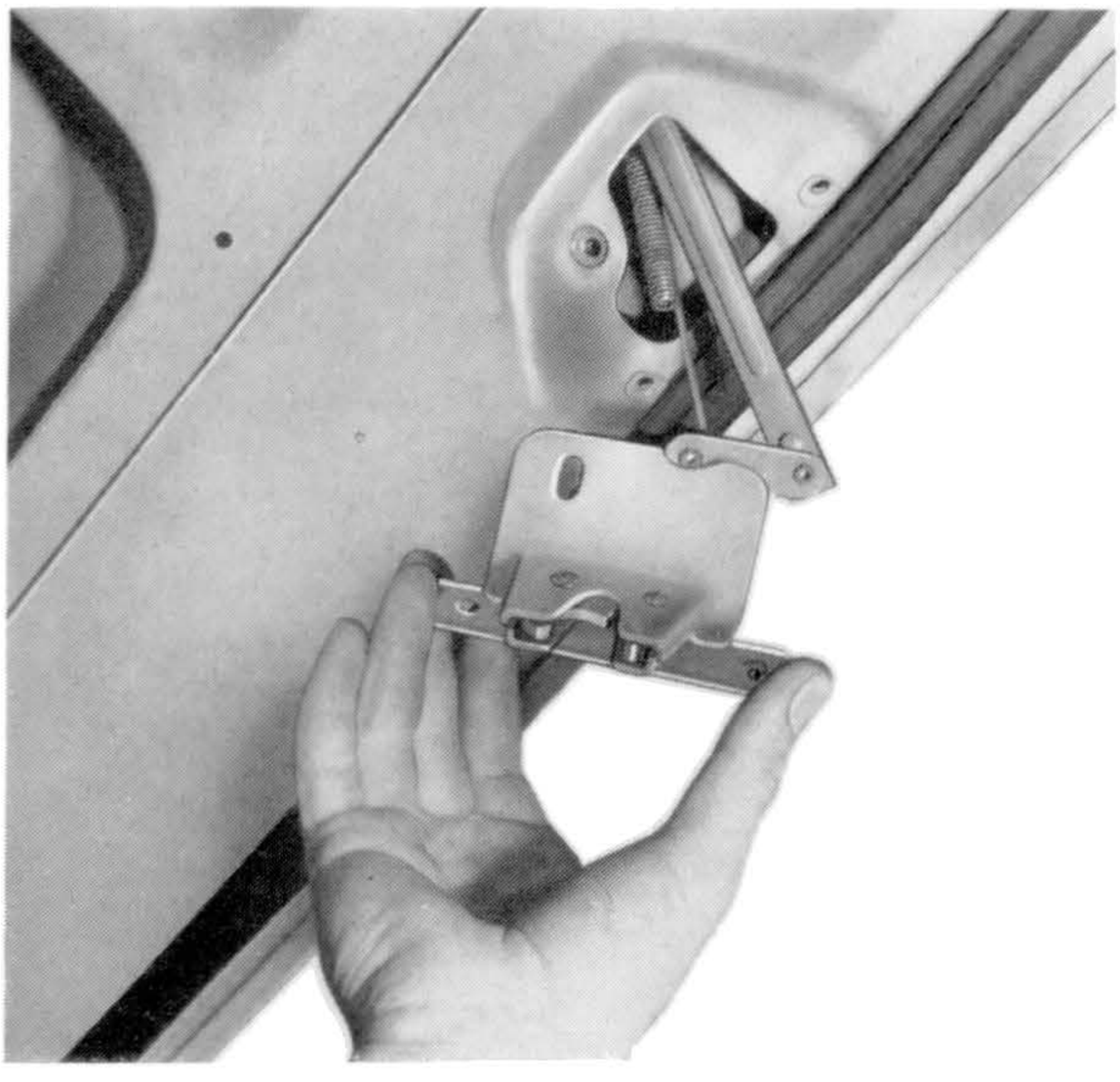
To Install

4. Position the lock in the tailgate and secure it with three screws.
5. Reconnect the lock operating crank arm to the handle and secure it with a circlip.
6. Replace the tailgate trim panel and check the operation of the lock.

OP M 1156-A TAILGATE DOOR LOCK STRIKER PLATE – REMOVE AND INSTALL

To Remove

1. Open the tailgate, remove the three screws securing the catch to the floorpan and remove the catch.



Tailgate Lock — Replace

Rear View — Estate Car

To Install

2. Replace the catch on the floorpan and loosely retain it with three screws.
3. Close the tailgate and move the catch until the correct alignment is obtained then fully tighten the catch securing screws.

OP M 1160-A TAILGATE DOOR EXTERNAL HANDLE ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Open the tailgate and remove the trim panel.
2. From inside the car remove the circlip from the end of the handle operating rod.
3. Remove the nut securing the handle to the tailgate and remove the handle.
4. With the handle in the unlocked position remove the circlip securing the handle escutcheon and remove the escutcheon.
5. Carefully drive out the steel pin securing the lock barrel in the handle and remove the lock barrel.

To Install

6. Locate the lock barrel in the handle and secure it with a steel pin.
7. Replace the escutcheon and locate it with a circlip.
8. Replace the handle in the tailgate and secure it with a nut.
9. Replace the lock to handle crank arm and secure it to the lock operating rod with a circlip.
10. Replace the tailgate trim panel and check the operation of the handle and lock.

OP M 1165-A TAILGATE DOOR HINGE AND TORSION BAR ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Ensure the handle is in the unlocked position, open the tailgate and using a pencil scribe a line around the hinge to tailgate mounting plates.
2. Remove the six bolts (three each side) securing the tailgate to the hinges and remove the tailgate.
3. Remove both 'Aeroflow' interior trim panels.
4. Remove two screws (one each side) securing the sides of the hinge trim panel to the roof to rear quarter panel.
5. Carefully pull down the rear edge of the hinge trim panel to release the six securing clips, then slide the trim panel backwards to free the front edge and remove the trim panel.
6. Remove eight bolts (four each side) securing the hinge and torsion bar assembly to the roof panel and remove the torsion bar assembly.

To Install

7. Locate the hinge and torsion bar assembly in the roof panel and secure it with eight bolts (four each side).

8. Position the front edge of the hinge trim panel in the channel securing the rear edge of the headlining and secure the rear edge of the trim panel with six trim clips.
9. Secure the sides of the hinge trim panel with two screws (one each side).
10. Replace both the 'Aeroflow' interior trim panels.
11. Place the tailgate on the hinges and loosely retain it with eight bolts (four each side).
12. Align the hinges to the lines previously scribed on the tailgate and fully tighten the retaining bolts. Close the tailgate and check that it is correctly aligned. Readjust if necessary.

OP M 1205-A WINDSCREEN GLASS AND/OR MOULDING – REMOVE AND INSTALL

To Remove

1. Cover the bonnet and cowl top with a cloth to prevent accidental damage.
2. Remove the windscreen wiper arms.
3. Using a lipping tool, push the weatherstrip lip under the top and sides of the windscreen aperture flange, from inside the car.
4. From inside the car push out the windscreen and weatherstrip as an assembly.
5. Prise out the joint cover clips and pull the finish strip out of the weatherstrip and remove the weatherstrip from the glass.

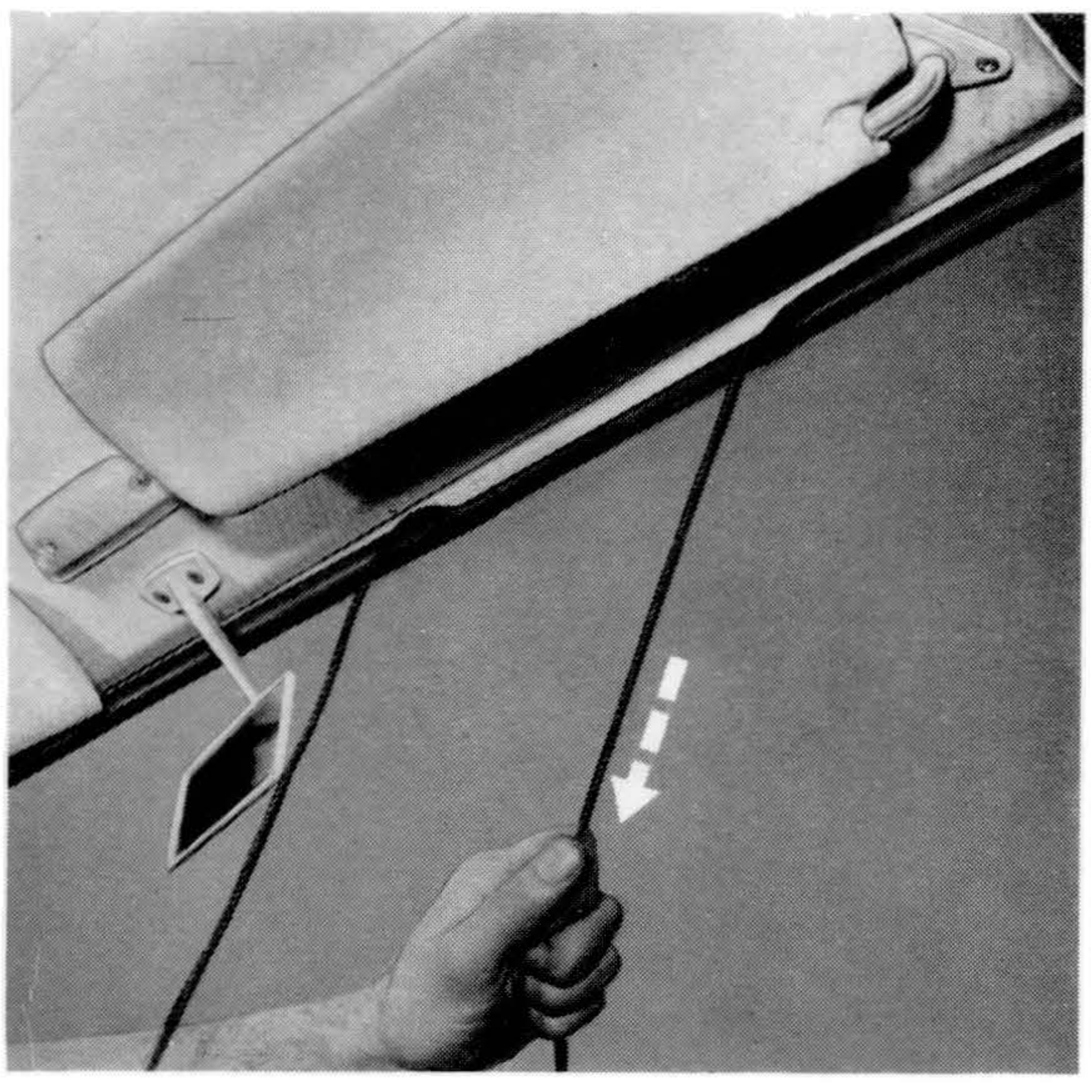
   NOTE – A second method of windscreen removal often employed by experienced operators is described below. However, if this method is used to remove a laminated windscreen, extreme care must be used as there is a certain element of risk involved.

Ensure that the operator is wearing light shoes, then—

(*a*) Sit in the front seat.

(*b*) To avoid scratching the glass place a piece of soft cloth between the operator's shoes and the windscreen glass.

Removing the Windscreen



Replacing the Windscreen

(*c*) Place both feet in the top corner of the windscreen and push firmly.

(*d*) When the weatherstrip is free of the body flange in that area, repeat the procedure at intervals along the top edge of the windscreen until, from outside the vehicle, the glass and weatherstrip can be removed together.

To Install

6. Refit the weatherstrip around the windscreen glass.
7. Fit a drawcord in the weatherstrip rubber to body groove allowing a crossover of approximately 6 in. (15 cm.) at the bottom.
8. Using a sealer gun fitted with a $\frac{1}{8}$ in. (3 mm.) swan-necked nozzle, apply a suitable sealer (SR-51-B) to the weatherstrip rubber to body groove, with special attention to the corners.
9. Position the windscreen in the body aperture with the cord ends inside the car.
10. Pull out the cord whilst applying hand pressure to the outside of the glass.
11. Using a sealer gun fitted with a $\frac{1}{8}$ in. (3 mm.) swan-necked nozzle, apply a suitable sealer (SR-51-B) to the rubber to glass groove.
12. Replace the finish strip in its groove in the weatherstrip. The lipping tool will help in replacement. Replace the joint cover clips.
13. Replace the windscreen wipers.
14. Remove the cloth covering the bonnet and cowl top and remove any surplus sealer from around the windscreen.

OP M 1210-A REAR WINDOW GLASS AND/OR MOULDING – REMOVE AND INSTALL

To Remove

1. Cover the luggage compartment lid and rear quarter panels with a cloth to prevent accidental damage.
2. Using a lipping tool push the weatherstrip lip under the top and sides of the rear window aperture flange, from inside the car.
3. From inside the car push out the window and weatherstrip as an assembly.
4. Remove the joint clips and pull the finish strip out of the weatherstrip and remove the weatherstrip from the glass.

   NOTE – A second method of screen removal is outlined in operation M 1205-A.

To Install

5. Refit the weatherstrip around the rear window glass.
6. Fit a drawcord in the weatherstrip rubber to body groove, allowing a crossover of approximately 6 in. (15 cm.) at the bottom.
7. Using a sealer gun fitted with a $\frac{1}{8}$ in. (3 mm.) swan-necked nozzle, apply a suitable sealer (SR-51-B) to the weatherstrip rubber to body groove, with special attention to the corners.
8. Position the rear window in the body aperture with the cord ends inside the car.

9. Pull out the cord whilst applying light hand pressure to the outside of the glass.
10. Using a sealer gun fitted with a $\frac{1}{8}$ in. (3 mm.) swan-necked nozzle, apply a suitable sealer (SR-51-B) to the rubber to glass groove.
11. Replace the finish strip in its groove in the weatherstrip. The lipping tool will help in replacement. Replace the joint clips.
12. Remove the cloth covering the bonnet and cowl top and remove any surplus sealer from replacement. Replace the joint clips.

OP M 1215-A REAR QUARTER WINDOW GLASS AND/OR MOULDING – REMOVE AND INSTALL

To Remove

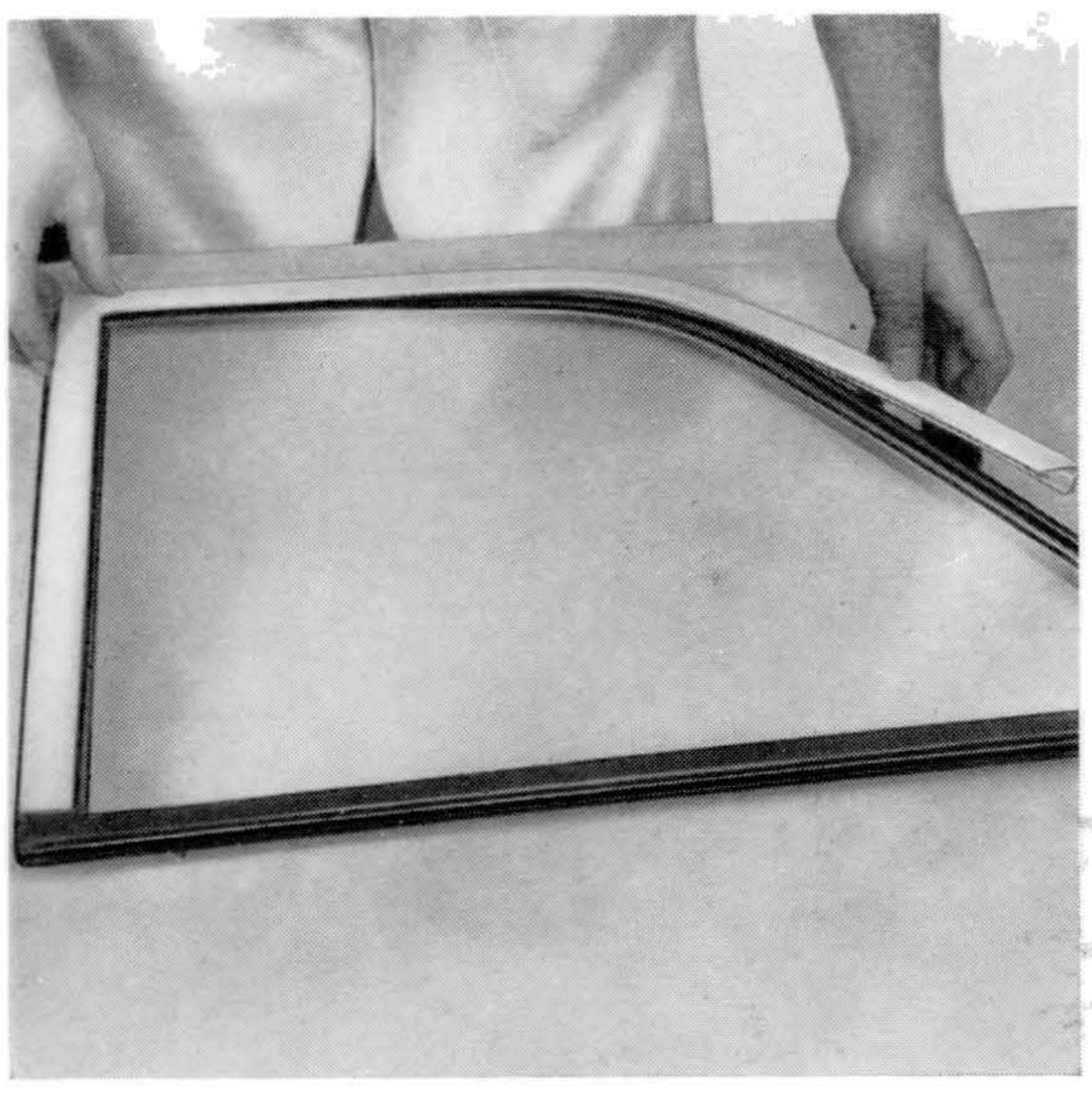
1. Using a lipping tool push the weatherstrip lip under the top and sides of the body aperture flange.
2. From inside the car push out the window and weatherstrip as an assembly.
3. Carefully prise the metal moulding out of the weatherstrip.

   NOTE – If the glass is being replaced due to accident damage, remove all traces of hardened sealer and shattered glass from the weatherstrip and body aperture flange.

To Install

4. Replace the weatherstrip around the rear quarter glass.
5. Using a sealer gun fitted with a $\frac{1}{8}$ in. (3 mm.) swan-necked nozzle, apply a suitable sealer (SR-51-B) to the rubber to glass groove.
6. Refit the metal moulding to the rear quarter window weatherstrip, starting at top front corner of the weatherstrip and working towards either end.

Removing Rear Quarter Window



Rear Quarter Window and Moulding

7. Fit a drawcord in the weatherstrip rubber to body groove allowing a crossover of approximately 6 in. (15 cm.) at the bottom.
8. Using a sealer gun fitted with a $\frac{1}{8}$ in. (3 mm.) swan-necked nozzle, apply a suitable sealer (SR-51-B) to the rubber to body groove of the weatherstrip, paying particular attention to the bottom corners.
9. Locate the rear quarter window in the body aperture with the cord ends within the car.
10. Pull out the cord whilst applying light hand pressure to the outside of the glass.
11. Remove any surplus sealer from around the rear quarter window.

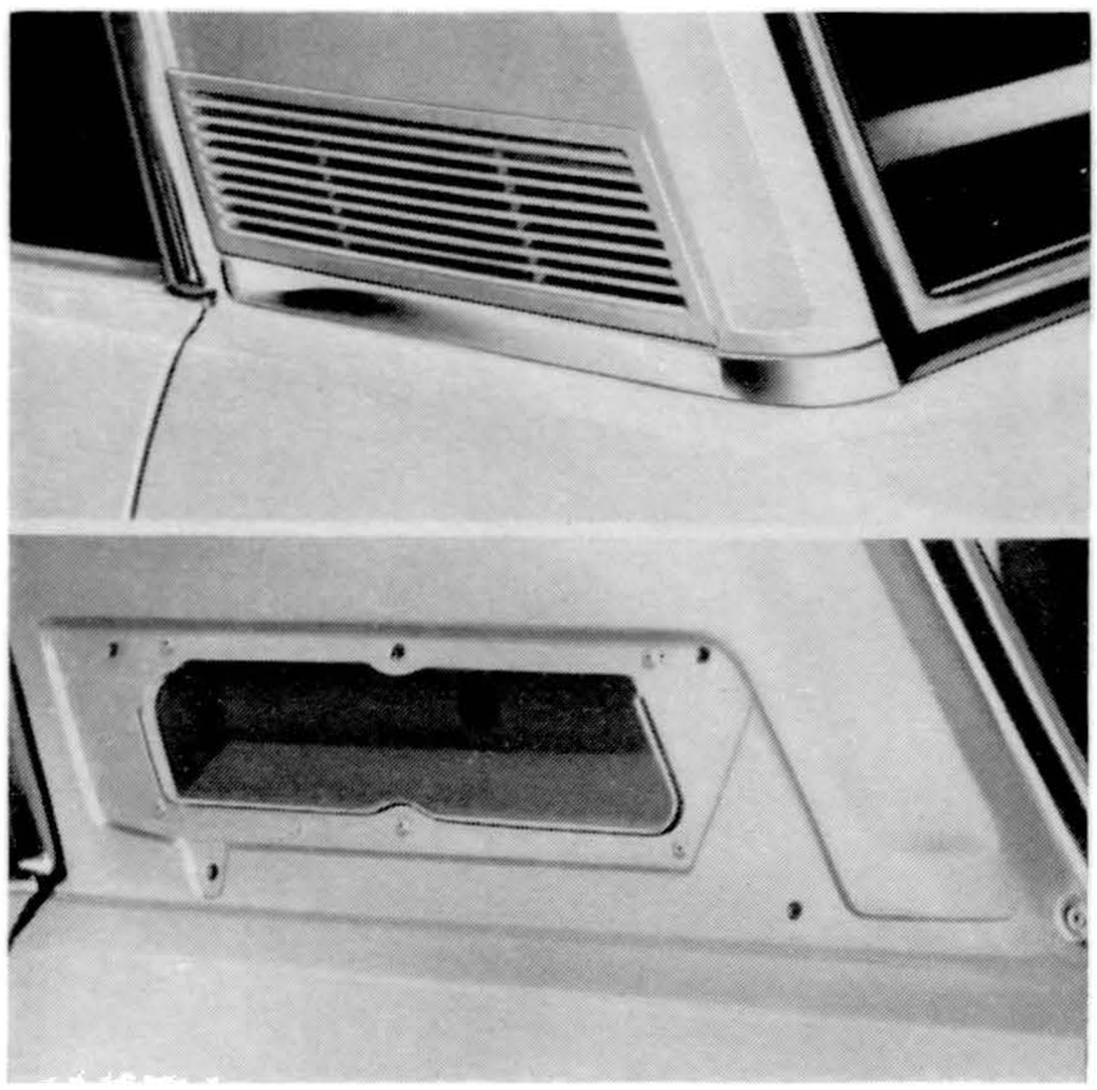
OP M 1220-A "AEROFLOW" EXTERIOR EXTRACTION LOUVRE - REMOVE AND INSTALL (SALOON)

To Remove

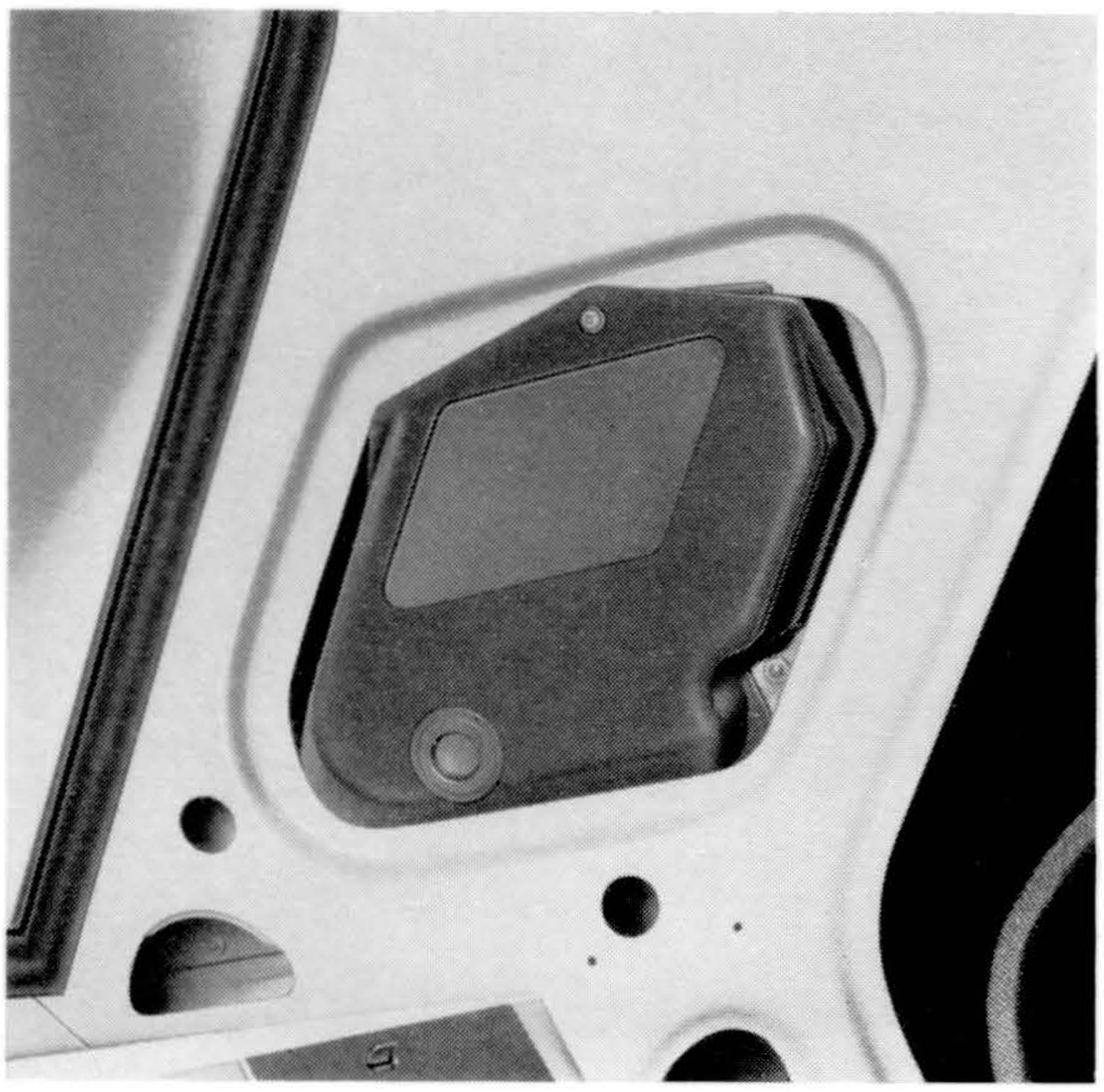
1. Remove the rear seat cushion and backrest.
2. Prise up four retaining tangs and remove the rear parcel shelf trim pad.
3. Pull the rear door finish strip away in the area adjacent to the "Aeroflow" trim panel.
4. Pull down the top edge of the rear quarter trim panel and drill out the "pop" rivet securing the lower edge of the "Aeroflow" trim panel.
5. Pull the "Aeroflow" trim panel away from the roof to rear quarter panel and remove.
6. Remove five nuts securing the exterior louvre and bright metal garnish moulding and withdraw louvre and moulding from the car.

To Install

7. Clip the rear end of the garnish moulding over the stud on the rear edge of the roof to rear quarter panel.
8. Locate the exterior louvre and garnish mouldings in position and secure with five nuts.



Rear Extraction Louvre — Saloon



Extraction Box — Saloon

9. Replace the extraction trim panel and secure the lower edge with a "pop" rivet.
10. Replace the rear quarter trim panel and rear door finish strip.
11. Replace the rear parcel shelf and secure with four retaining tangs.
12. Replace the rear seat cushion and backrest.

OP M 1220-A "AEROFLOW" EXTERIOR EXTRACTION LOUVRE - REMOVE AND INSTALL (ESTATE CAR)

To Remove

1. Open the tailgate and carefully pull off the 'Aeroflow' interior trim panel.
2. Remove the rubber plug from the extraction box, then remove four nuts securing the exterior louvre to the roof to rear quarter panel and remove the louvre and gasket.

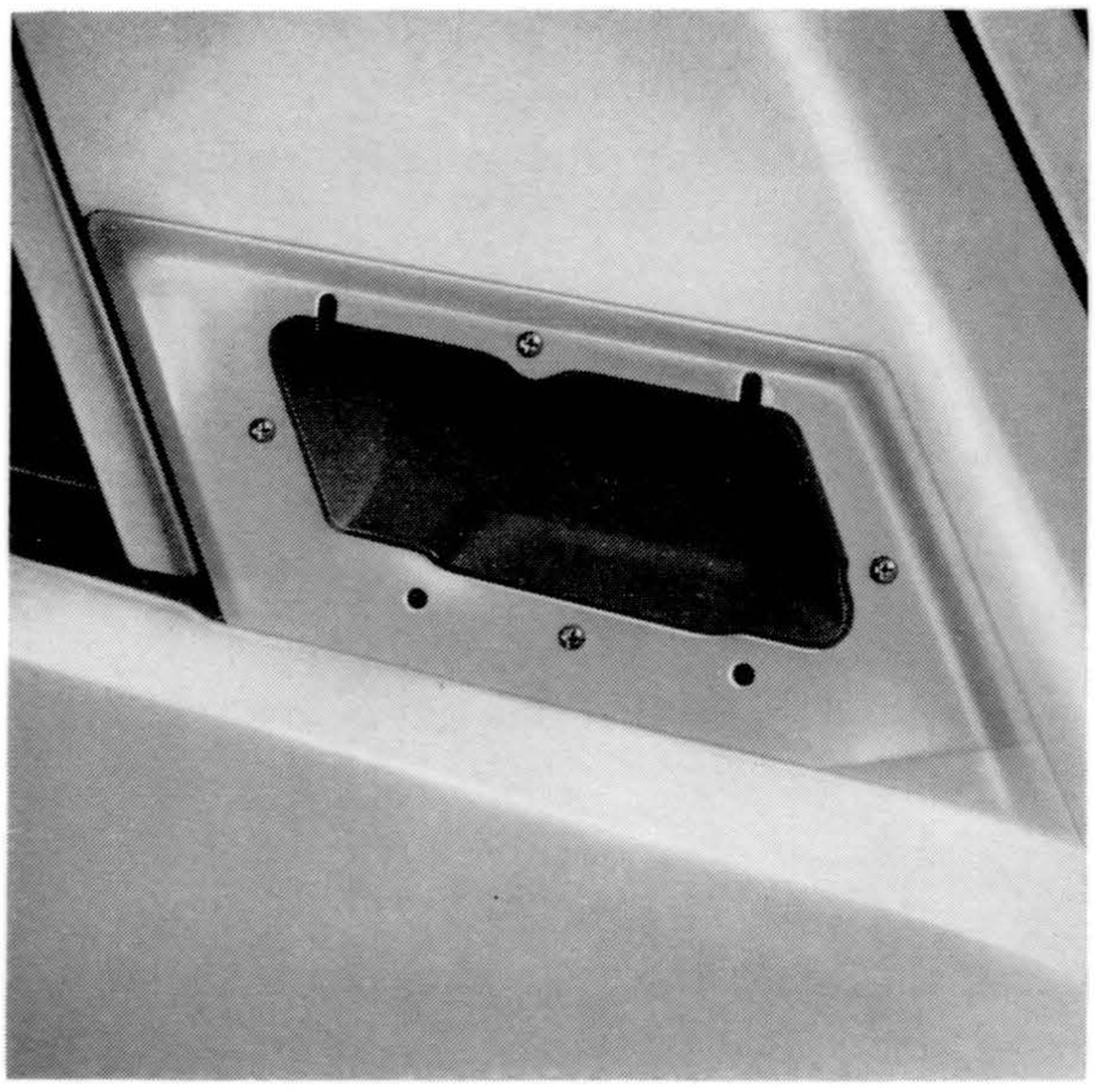
To Install

3. Position the exterior louvre and gasket on the roof to rear quarter panel and from inside the car secure it with four nuts.
4. Replace the rubber plug in the extraction box, then replace the 'Aeroflow' interior trim panel.

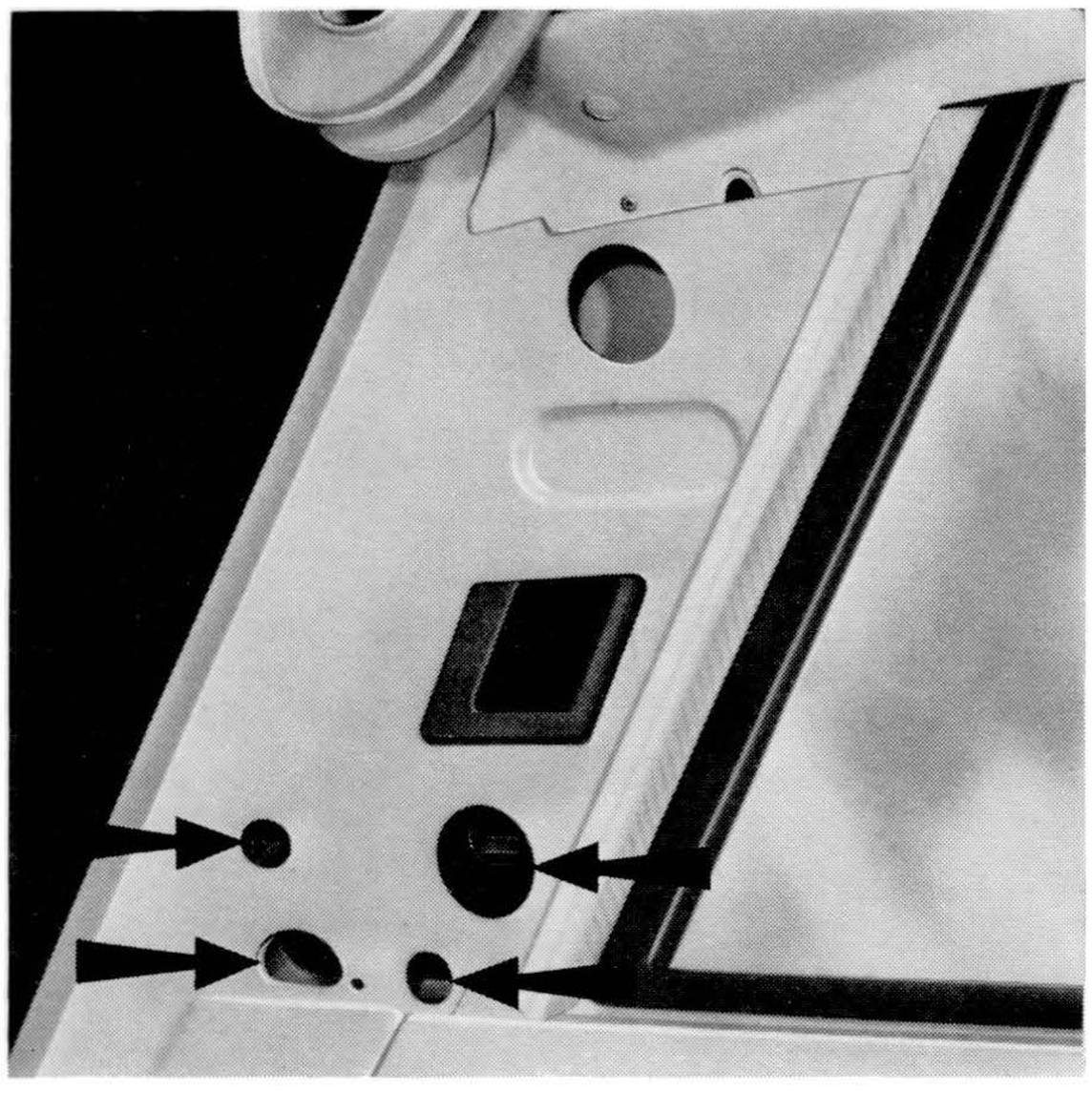
OP M 1220-A1 EXTRA: EXTRACTION BOX - REMOVE AND INSTALL (SALOON)

To Remove

1. Remove one screw securing the top edge of the extraction box.
2. From outside the car remove five screws securing the extraction box and remove the box from the car.



Extraction Box — Estate Car



Rear Extraction Louvre — Estate Car

To Install

3. Locate the extraction box in the roof to rear quarter panel and secure the top end with one screw.
4. Replace the five screws securing the extraction box.

OP M 1220-A1 EXTRA: EXTRACTION BOX – REMOVE AND INSTALL (ESTATE CAR)

To Remove

1. Remove the rear quarter trim panel.
2. From outside the car remove the four screws securing the extraction box to the roof to rear quarter panel.
3. From inside the car pull the extraction box away from the roof to rear quarter panel and remove it through the access hole in the rear quarter panel.

To Install

4. Ensure that the rubber sealing gasket is correctly positioned around the mounting face of the extraction box, then position the extraction box in roof to rear quarter panel through the rear quarter panel access hole.
5. From outside the car secure the extraction box with four screws.
6. Replace the rear quarter trim panel.

OP M 1305-A FRONT PARCEL SHELF – REMOVE AND INSTALL

To Remove

1. Remove the heater trim panel (see OP M 1355-A).
2. Prise out the four trim clips, two each side, securing the parcel shelf to the heater and cowl side panel and remove the parcel shelf.

To Install

3. Position the parcel shelf on its mounting brackets and secure the shelf with four trim clips, two each side.
4. Replace the heater trim panel (see OP M 1355-A).

OP M 1305-A1 EXTRA: COWL SIDE TRIM PANEL – REMOVE AND INSTALL

To Remove

1. Prise the metal tag securing the front edge of the cowl side trim panel backwards.
2. Pull the front edge of the trim panel away from the cowl side, move the panel towards the rear of the vehicle and remove the panel.

To Install

3. Position the trim panel in the vehicle ensuring that the lip on the rear edge of the panel is correctly positioned over the door aperture flange.
4. Push the metal tag forwards to secure the front edge of the trim panel.

OP M 1305-B COWL SIDE TRIM PANEL – REMOVE AND INSTALL
(Includes OPS M 1305-A and A1)

OP M 1310-A REAR PARCEL SHELF – REMOVE AND INSTALL

To Remove

1. Remove the rear seat cushion and backrest (see OP M 1325-A).
2. (*Where fitted*) Remove four nuts securing the radio speaker and grille to the rear parcel shelf and remove the grille.
3. Prise up the four tags securing the front edge of the parcel tray and remove the parcel tray.

To Install

4. Position the rear parcel tray in the vehicle ensuring that the rear edge is tucked under the rear window weatherstrip flange.
5. Secure the front edge with four metal tags.
6. (*Where fitted*) Reposition the radio speaker and grille and secure them with four nuts.

OP M 1315-A REAR QUARTER TRIM PANEL – REMOVE AND INSTALL (SALOON)

To Remove

1. Remove the rear seat cushion.
2. Remove two screws from the lower edge of the backrest, two nuts securing the top edge of the backrest and remove the backrest.
3. Pull the trim pad away from the body to release the spring clips and remove the trim pad.

To Install

4. Position the trim pad and press the edges to engage the securing spring clips.
5. Replace the backrest and secure it with two screws and nuts.
6. Replace the rear seat cushion.

OP M 1315-A REAR QUARTER TRIM PANEL – REMOVE AND INSTALL
(ESTATE CAR)

To Remove

1. Pull the rear seat squab forward, release the backrest retaining clips and fold the backrest forward.
2. R.H. Panel only

   Drill out the three pop rivets securing the trim panel around the fuel filler cover and carefully remove the trim panel and securing clips.

   L.H. Panel only

   Carefully remove the trim panel and securing clips.

To Install

3. R.H. Panel only

   Position the trim panel on the rear quarter panel and secure with its trim clips. Replace the three pop rivets around the fuel filler cover.

   L.H. Panel only

   Position the trim panel on the rear quarter panel and secure with its trim clips.

4. Lift the rear seat backrest and clip into position. Fold the rear squab backwards and ensure that it is seating correctly.

OP M 1320-A DRIP RAIL MOULDINGS – ONE SIDE – REMOVE AND INSTALL

To Remove

1. Starting from the front of the vehicle carefully prise off the front moulding from the drip rail.
2. Repeat operation 1 for the rear moulding.

To Install

3. Position the rear moulding on the drip rail and using a rubber mallet carefully tap the moulding over the drip rail.
4. Repeat operation 3 for the front moulding.

OP M 1325-A REAR SEAT BACKREST (SALOON) – REMOVE AND INSTALL

To Remove

1. Remove the rear seat cushion (see OP M 1327-A).
2. Remove two screws securing the bottom corners of the backrest.
3. From inside the luggage compartment remove two nuts securing the top corners of the backrest.
4. Remove the rear seat backrest.

To Install

5. Position the backrest in the vehicle.
6. From inside the luggage compartment secure the top corners of the backrest with two nuts.
7. Secure the bottom corners of the backrest with two screws.
8. Replace the rear seat cushion (see OP M 1327-A).

OP M 1325-A REAR SEAT BACKREST (ESTATE CAR) – REMOVE AND INSTALL

To Remove

1. Release the two retaining catches and pull the backrest towards the front of the car into the horizontal position.
2. Carefully release the backrest trim from the floorpan.

3. Remove four bolts (two each side) securing the backrest to the wheel arches and remove the backrest.

To Install

4. Position the backrest in the vehicle and secure it to the wheel arches with four bolts (two each side).
5. Pull the top of the backrest towards the rear of the vehicle and engage the two retaining catches.
6. Stick the backrest trim to the floorpan with suitable adhesive.

OP M 1327-A REAR SEAT CUSHION (SALOON) – REMOVE AND INSTALL

To Remove

1. Lift the front edge of the rear seat cushion upwards to disengage the cushion from the heel plate and remove the cushion from the vehicle.

To Install

2. Position the rear seat cushion in the vehicle and press the front edge downwards to engage the cushion frame in the heel plate.

OP M 1327-A REAR SEAT CUSHION (ESTATE CAR) – REMOVE AND INSTALL

To Remove

1. Tilt the rear seat cushion forward and remove two bolts (one each side) securing the cushion to its mounting brackets and remove the cushion.

To Install

2. Position the rear seat cushion in the vehicle and secure it to its mounting brackets with two bolts (one each side).

OP M 1330-A BUCKET SEAT – FRONT – REMOVE AND INSTALL

To Remove

1. Pull back the floor carpet to expose the front seat mounting brackets.
2. Remove four bolts securing the mounting brackets and reinforcing plates to the floorpan.
3. Remove the seat, mounting brackets and reinforcing plates.

To Install

4. Position the seat, mounting brackets and reinforcing plates in the car and secure them with four bolts.
5. Replace the carpet.

   NOTE – Additional leg room can be obtained by reversing the mounting brackets which are offset for this purpose.

OP M 1331-A BENCH SEAT ASSEMBLY – REMOVE AND INSTALL

To Remove

1. Pull back the floor carpet to expose the front seat mounting brackets.

2. Remove the eight bolts (four each side) securing the mounting brackets to the floor pan.
3. Remove the seat, complete with mounting brackets.

To Install

4. Position the seat, with mounting brackets, in the car, and secure them with the bolts.
5. Replace the carpet.

OP M 1340-A INTERIOR MIRROR – REMOVE AND INSTALL

To Remove

1. Remove two screws securing the interior mirror to the windscreen header panel and remove the mirror.

To Install

2. Position the interior mirror on the windscreen header panel and secure it with two screws.
3. Screw the anti-vibration pad anti-clockwise until the pad is firmly pressing on the windscreen.

OP M 1345-A SUN VISOR – REMOVE AND INSTALL

To Remove

1. Remove three screws securing sun visor to the windscreen header panel.
2. Remove the sun visor.

To Install

3. Locate the sun visor in position on the windscreen header panel.
4. Secure the sun visor with three screws.

OP M 1351-A GLOVE LOCKER LID – REMOVE AND INSTALL

To Remove

1. Open the glove locker lid and remove four securing screws and detach the lid.

To Install

2. Locate the lid on its hinges and secure it with four screws.

OP M 1355-A HEATER TRIM PANEL (Where Fitted) – REMOVE AND INSTALL

To Remove

1. Remove four screws securing the top edge of the heater trim panel.
2. Carefully slide the trim panel from around the heater and remove the panel.

To Install

3. Position the trim panel around the heater.
4. Secure the top of the trim panel with four screws.

OP M 1360-A HEADLINING – RENEW (SALOON)

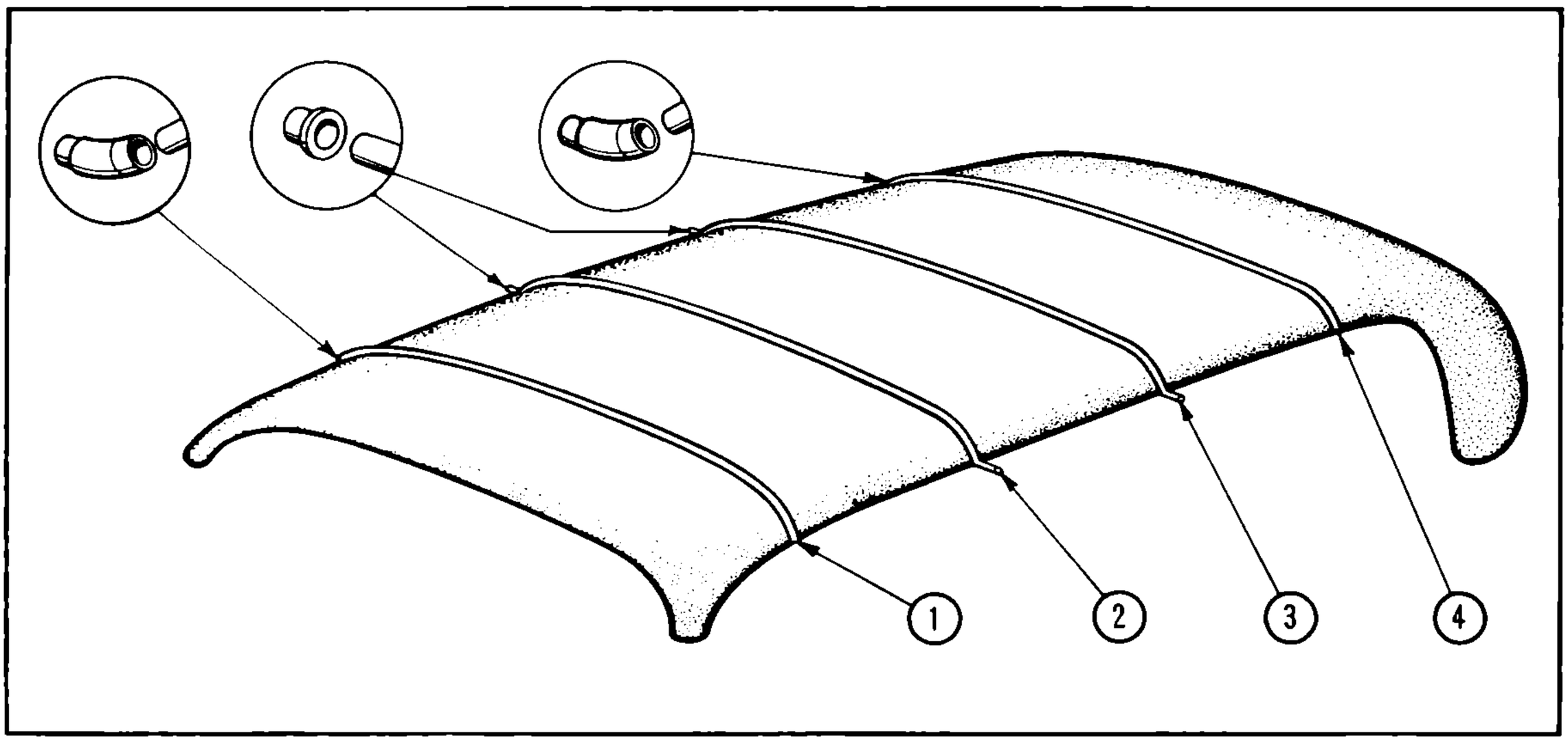
To Remove

1. Remove four screws and detach the sun visors.
2. Remove two screws and detach the rear view mirror.
3. Disconnect the battery, remove two screws and pull down the interior light and disconnect the wiring.
4. Pull the door finish strips away from the door aperture flanges adjacent to the headlining and extraction trim panel.
5. Remove the rear seat cushion and backrest.
6. Remove two screws and detach the two extraction trim panels.
7. Remove the wiper arms and blades.
8. Remove the windscreen and rear window.
9. Carefully free the edges of the headlining from the door aperture flanges, windscreen header panel and rear window header panel.
10. Disconnect the four listing wires from their nylon sockets and remove the headlining and listing wires as an assembly.

To Install

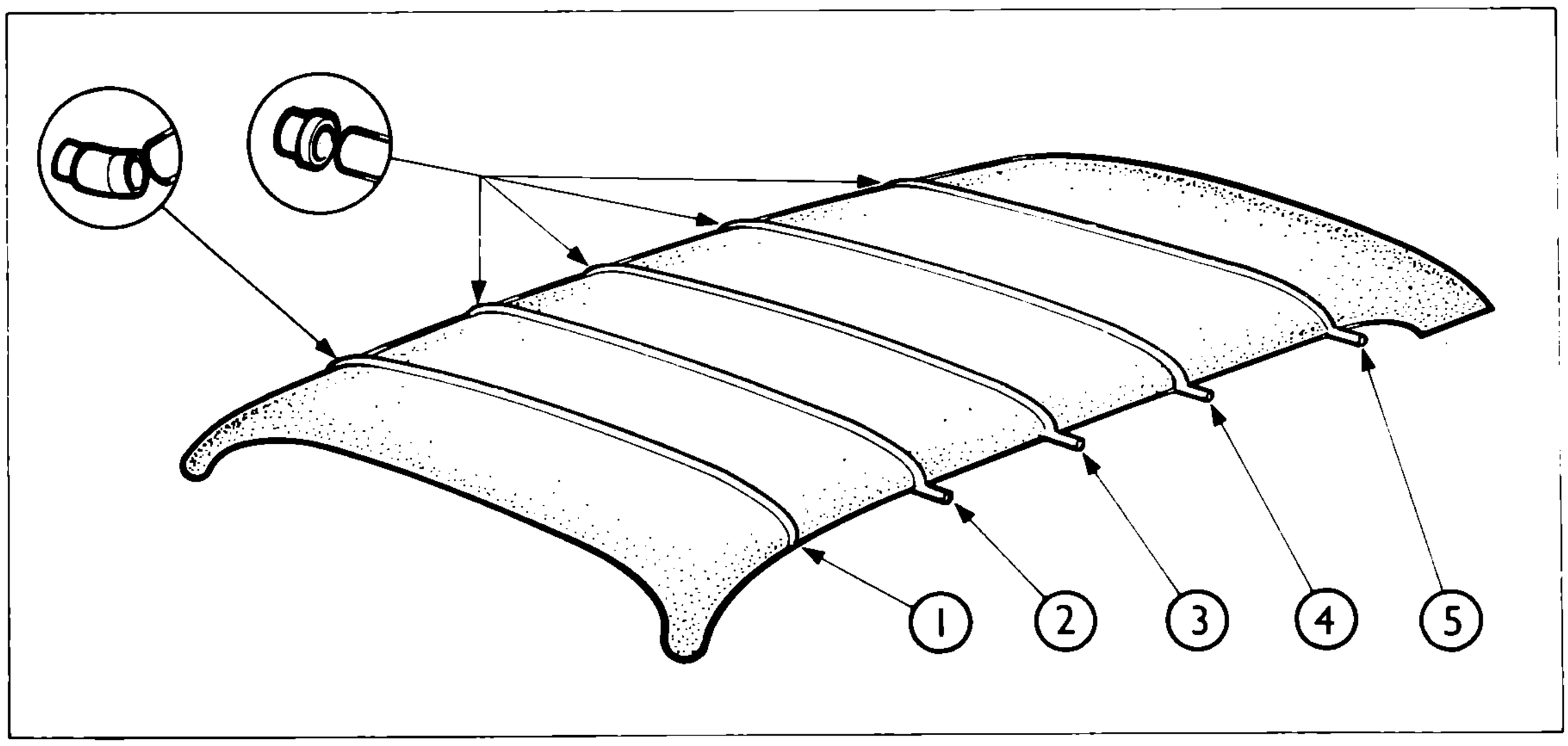
11. If a new headlining is being fitted, transfer the listing wires from the old headlining to the appropriate cotton sleeve in the new headlining.

    NOTE – The listing wires are colour coded with a daub of paint. Starting at the front the colours are: 1=Blue, 2=Green, 3=Brown, 4=Yellow.



Listing Wire Colour Code — Saloon

12. Break the cotton sleeves to allow the listing wires to protrude approximately 4 to 6 in. (101 to 152 mm.), then locate the headlining complete with listing wires in the car and position the listing wires in their respective sockets.
13. Apply adhesive to the edges of the headlining and the windscreen header panel, door aperture flanges and rear window header panel.
14. Carefully position the front edge of the headlining on the windscreen header panel and temporarily secure with suitable spring clips.
15. Pull the rear edge of the headlining back and starting at the centre position the headlining on the rear window header panel.
16. Carefully stick the sides of the headlining to the door aperture flanges and temporarily secure them with suitable spring clips.
17. Remove any creases in the headlining and then trim the headlining round the flanges allowing approximately ½ in. (12.7 mm.) of material to overlap the flanges.
18. Remove the spring clips and stick the edges of the headlining over the windscreen, rear window and body flanges.
19. Replace the windscreen and rear window.
20. Replace the wiper arms and blades.
21. Replace the extraction trim panels and secure with two screws.
22. Replace the rear seat cushion and backrest.
23. Refit the door aperture finish strips.
24. Cut a hole in the headlining and pull the interior light wires through and connect them to the interior light.
25. Position the interior light and secure it with two screws.
26. Replace the rear view mirror and secure it with two screws.
27. Replace the two sun visors and secure with six screws.
28. Reconnect the battery.



Listing Wire Colour Code — Estate Car

OP M 1360-A HEADLINING – RENEW (ESTATE CAR)

To Remove

1. Remove four screws and detach the sun visors.
2. Remove two screws and detach the rear view mirror.
3. Disconnect the battery, remove two screws and pull down the interior light and disconnect the wiring.
4. Pull the door finish strips away from the door aperture flanges adjacent to the headlining.
5. Remove the two interior extraction trim panels.
6. Remove the tailgate hinge trim panel.
7. Drill out the pop rivets securing the tailgate trim panel retaining channel and remove the channel.
8. Remove the wiper arms and blades.
9. Remove the windscreen.
10. Remove the rear quarter windows.
11. Carefully free the edges of the headlining from the door aperture flanges, windscreen header panel and roof panel rear reinforcing panel.
12. Disconnect the five listing wires from their nylon sockets and remove the headlining and listing wires as an assembly.

To Install

13. If a new headlining is being fitted, transfer the listing wires from the old headlining to the appropriate cotton sleeve in the new headlining.

    NOTE – The listing wires are colour coded with a daub of paint. Starting at the front the colours are: 1=Blue, 2=Green, 3=Brown, 4=Yellow, 5=Red.

14. Break the cotton sleeves to allow the listing wires to protrude approximately 4 to 6 in. (101 to 152 mm.), then locate the headlining complete with listing wires in the car and position the listing wires in their respective sockets.
15. Apply adhesive to the edges of the headlining and the windscreen header panel, door aperture flanges and rear window header panel.
16. Carefully position the front edge of the headlining on the windscreen header panel and temporarily secure with suitable spring clips.
17. Pull the rear edge of the headlining back and starting at the centre, position the headlining on the roof rear reinforcing panel ensuring that there are no creases or wrinkles and temporarily secure with suitable spring clips.
18. Carefully stick the sides of the headlining to the door aperture flanges and temporarily secure them with suitable spring clips.
19. Remove any creases in the headlining and then trim the headlining round the flanges allowing approximately $\frac{1}{2}$ in. (12.7 mm.) of material to overlap the flanges.

    Remove the spring clips and stick the edges of the headlining over the windscreen aperture flange, door aperture flanges and roof rear reinforcing panel.
20. Replace the windscreen.

21. Position the tailgate hinge trim panel retaining channel on the roof rear reinforcing panel and secure it with pop rivets.
22. Replace the tailgate hinge trim panel.
23. Replace the two interior extraction trim panels.
24. Refit the door aperture finish strips.
25. Cut a hole in the headlining and pull the interior light wires through and connect them to the interior light.
26. Position the interior light and secure it with two screws.
27. Replace the rear view mirror and secure it with two screws.
28. Replace the two sun visors and secure with six screws.
29. Replace the wiper arms and blades.
30. Replace the rear quarter windows.
31. Reconnect the battery.

UNDERBODY REPAIR PROCEDURES

Dimensional drawings of the underbody and upper body framework are contained at the end of this section.

These drawings, used in conjunction with a level floor and suitable stands, will be of assistance when checking or undertaking repairs to the bodywork.

Alternatively, a body checking and repair fixture known as the Churchill "700" system, available from V. L. Churchill & Co. Ltd., may be used. This specialist piece of equipment is suitable for all Ford passenger cars produced from July 1954 onwards and is adaptable for all future models.

To ensure accurate alignment of the front suspension and engine mounting points, a jig or checking fixture is available from V. L. Churchill & Co. Ltd. under Tool No. P 5517.

Outlined below are the recommended procedures to be followed when checking or replacing parts in the engine compartment and underbody.

CHECKING THE ENGINE COMPARTMENT

If the damaged car is still on its wheels and misalignment of the body within the engine compartment is suspected, carry out a full steering geometry check as outlined in Section 5.

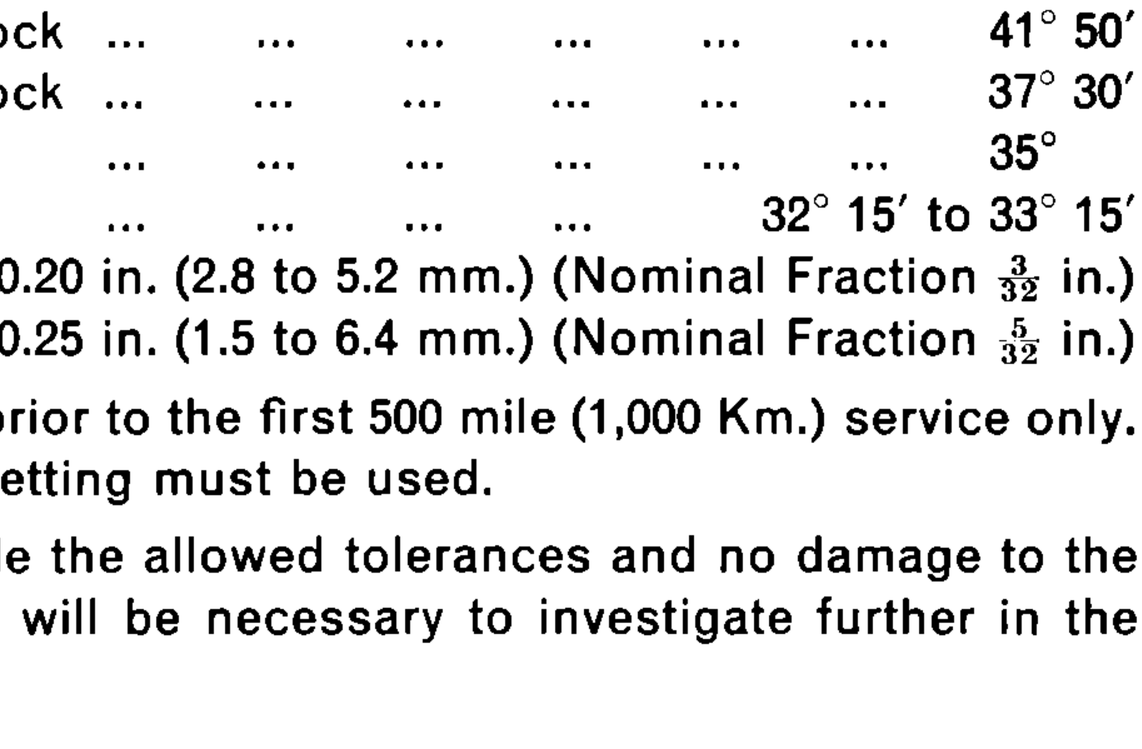
WHEEL ALIGNMENT (unladen)

	STANDARD	*HEAVY DUTY*
Castor	—0° 54′ to +0° 36′	+0° 07′ to 1° 37′
Camber	1° 00′ to 2° 30′	1° 35′ to 3° 05′
King Pin Inclination	6° 23′ to 7° 53′	5° 47′ to 7° 17′
Maximum theoretical wheel lock angles—back lock		41° 50′
—front lock		37° 30′
Wheel lock angles, setting figures—back lock		35°
—front lock		32° 15′ to 33° 15′
Toe-in (Service Setting)*	0.10 to 0.20 in. (2.8 to 5.2 mm.) (Nominal Fraction $\frac{3}{32}$ in.)	
Toe-in (Production Setting)* ...	0.06 to 0.25 in. (1.5 to 6.4 mm.) (Nominal Fraction $\frac{5}{32}$ in.)	

*The production toe-in setting should be used prior to the first 500 mile (1,000 Km.) service only. From and including that service, the Service Setting must be used.

If these checks indicate any discrepancy outside the allowed tolerances and no damage to the suspension or steering controls exists, then it will be necessary to investigate further in the following manner.

Engine Compartment Jig



Remove the engine assembly, the front suspension crossmember, the front suspension, the stabiliser brackets and the steering box from the car.

Ensure that the undersides of the front body side members are clean at the stabiliser bracket mountings and attach the two jig adaptor plates, one either side. Remove the detachable locating pins and place the jig in position within the engine compartment, locating the lower portion between the front body side members.

From under the front mudguards, pass the longer threaded locating pins, one either side, through the foremost hole in each front body side member for the steering box securing bolts. Engage the corresponding holes in the jig and tighten the locating pins.

Fit the locating pins through the holes in the jig adaptors to engage in the corresponding holes in the jig.

To check the alignment of the suspension unit upper mounting holes in the engine side apron panels, engage the set of three parallel pins. The pins should pass through the holes in the engine side apron panel and reinforcement and should not be forced into engagement.

Check the clearance between the upper face of the engine side apron panel and the underside of the jig top plate. A clearance of $\frac{1}{8}$ in. (3.18 mm.) should be present.

If distortion to any major component affecting the front suspension (e.g. a distorted front side member or apron panel) is disclosed as a result of tests carried out, no attempt should be made to straighten members, etc. by using hydraulic body jacks with the jig in position, or damage to the jig will result. In view of the importance of the front end alignment, it is suggested that in general, serious distortion to these items should be corrected by replacing affected parts.

When rebuilding the engine compartment as part of an accident repair, the jig Tool No. P 5517 may be used to align and assemble any or all of the engine compartment components. Thus, if necessary, a complete engine compartment may be built and welded together as a sub-assembly around the jig. The two longest locating pins which are threaded may be used to hold the body side members and side apron panels to the jig during this operation. To establish a dimension between the stabiliser brackets, utilise the $\frac{1}{16}$ in. (1.6 mm.) flats machined on the two tapered wedges supplied with the jig. The top of the engine side apron panels may be held in position with the smaller parallel pins located in the inner holes in the jig outriggers.

NOTE – If a complete engine compartment is built around the jig in this manner, offer the welded assembly in the body **with the jig in position.** When correctly aligned to the body, the sub-assembly may then be welded in position. Do not remove the jig until both front mudguards and the radiator grille panel have been welded in position, otherwise distortion to the engine compartment may occur.

Once the assembly has been finally welded in position, remove the parallel pins locating the top edges of the engine side apron panels and using an $\frac{11}{32}$ in. (8.7 mm.) drill, drill the six holes, three each side, for the front suspension units top mounting bolts.

Three drill bushes are provided in each outrigger to ensure accurate alignment of the holes.

CHECKING THE UNDERBODY

Two methods can be used to check the underbody for misalignment. The first method is to use the Churchill "700" system fixture as outlined below.

The fixture consists of two heavy steel girders which are let into an existing floor to provide a level working base. These are drilled and tapped to allow four steel stands to be bolted to them at pre-determined locations. Two adaptors to suit the model being checked are then secured to each stand, one either side. In this way, eight locations on the body within specified limits are established and any distortion to the underbody is at once indicated.

Since the car jacking positions are used as "pick up" points, only minor dismantling of mechanical parts is necessary to carry out a complete alignment check.

The "700" system body fixture ensures the correct alignment of critical underbody parts straightened or renewed during repair.

For example, if obvious extensive damage exists to the front end area of the car, it is usually possible to secure the car by the jacking points and rear longitudinal members. The undamaged section of the car is then held firmly within specified tolerances and the frontal area may be repaired.

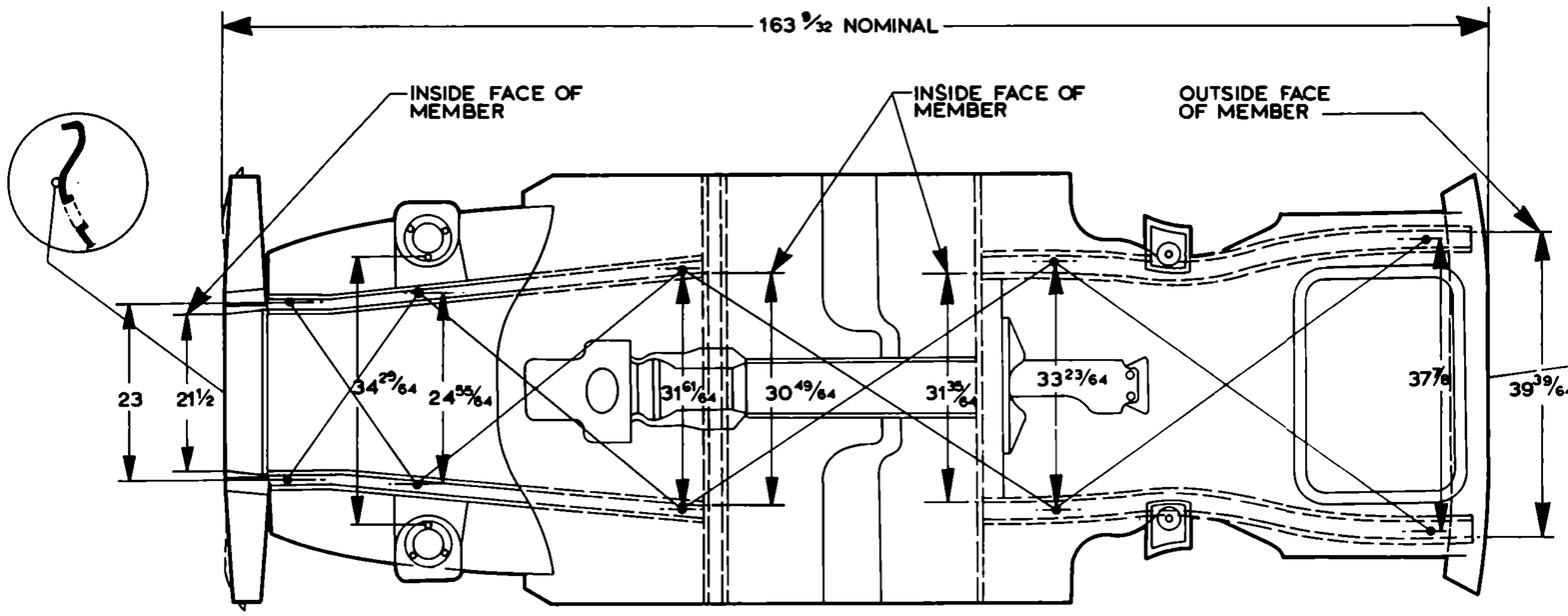
When damaged sections have been cut away or straightened, the fixture front stand and adaptor is then fitted. By engaging locating pins, it is then possible to ensure correct alignment of new or straightened parts relative to the undamaged body section.

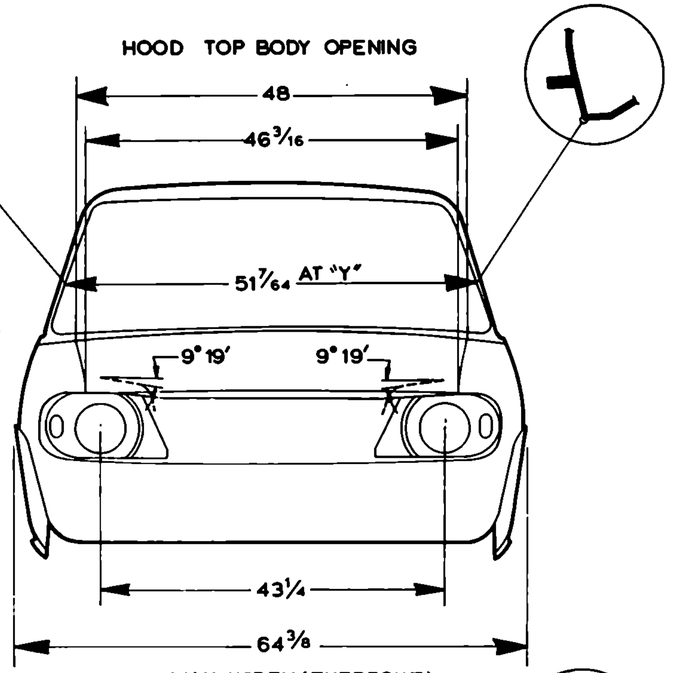
The second method, if the equipment described above is not available, is to use the dimensioned drawings contained at the end of this section. The checking operation should be carried out in the following manner:—

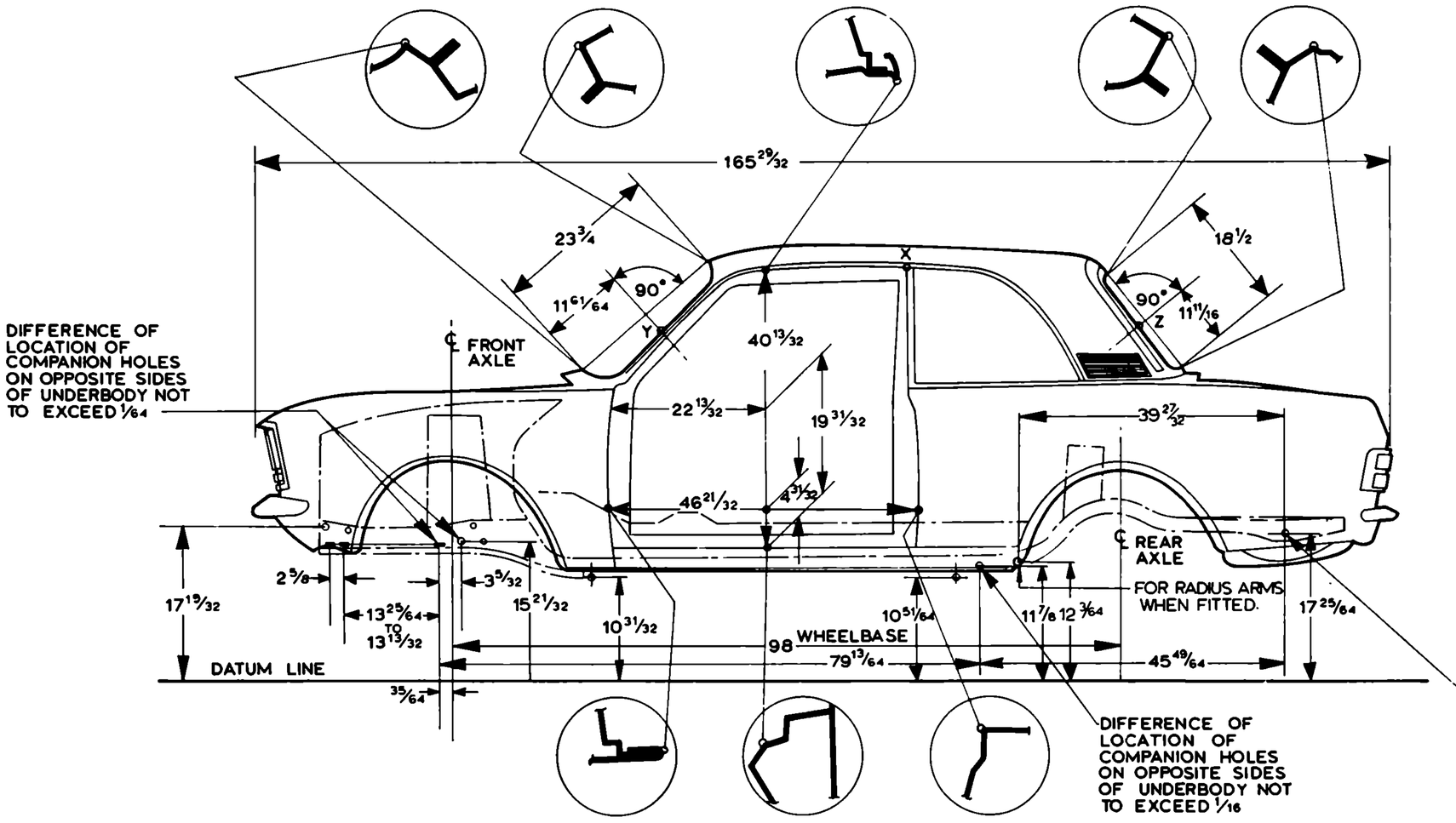
Support the body on suitable stands or adjustable supports on a level floor extending the full length of the car. Check the dimensions shown along the whole length of the body and note any discrepancy outside the allowed tolerances shown on the chart overleaf.

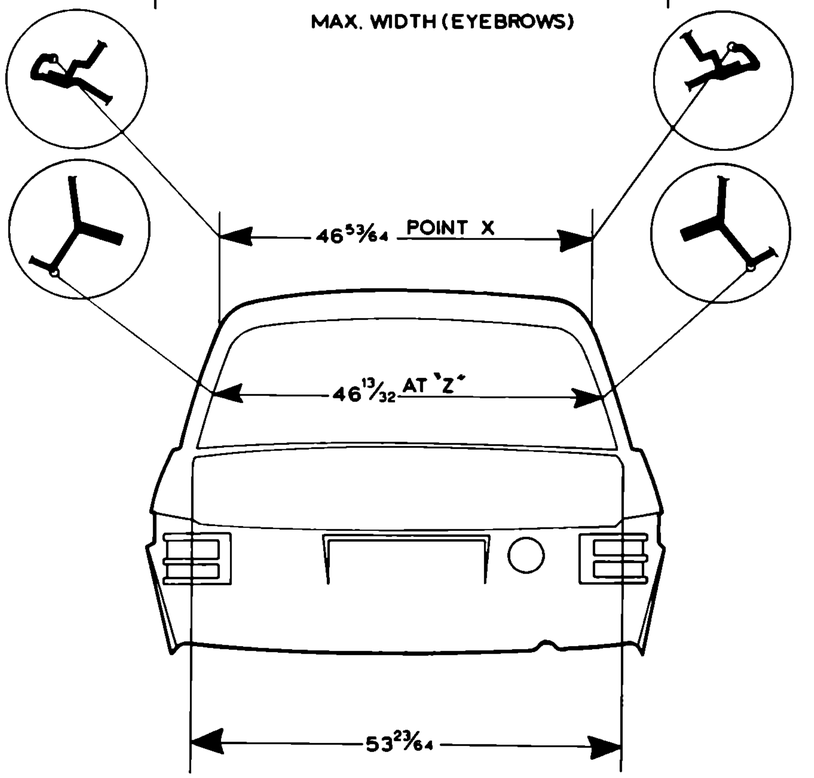
The diagonals marked on the plan view can be checked by using large callipers or a pair of trammels, or alternatively, they may be checked by using a plumb bob and line. The latter method enables a simple and accurate check to be made. Suspend the plumb bob from the appropriate reference points on the body and carefully mark the floor at each location. Connect these points by a chalk line and then draw a line through the intersecting points of the diagonals.

Finally, check the dimensions between the front and rear side members.









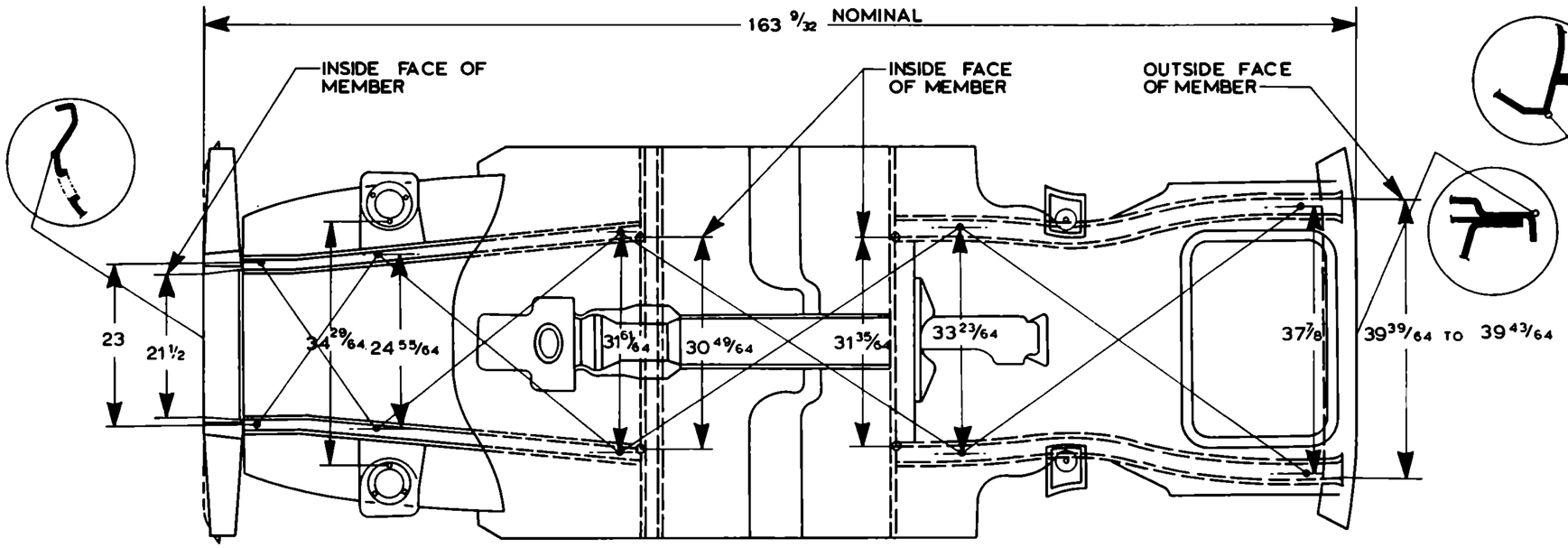
REAR SPRING SHACKLE BOLT HOLES MUST BE SQUARE IN HORIZONTAL AND VERTICAL PLANES WITHIN 3/32 IN 18 INCHES.

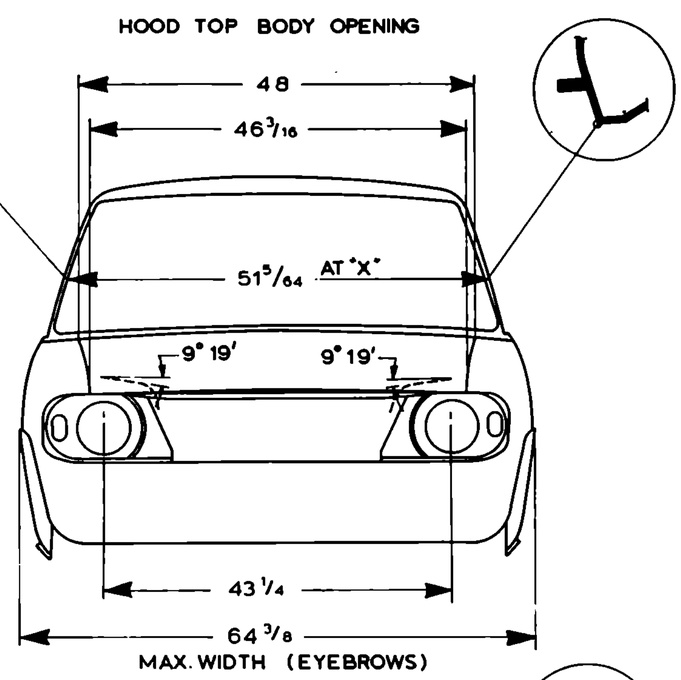
BODY TOLERANCE CHART
Cortina 2-Door Model

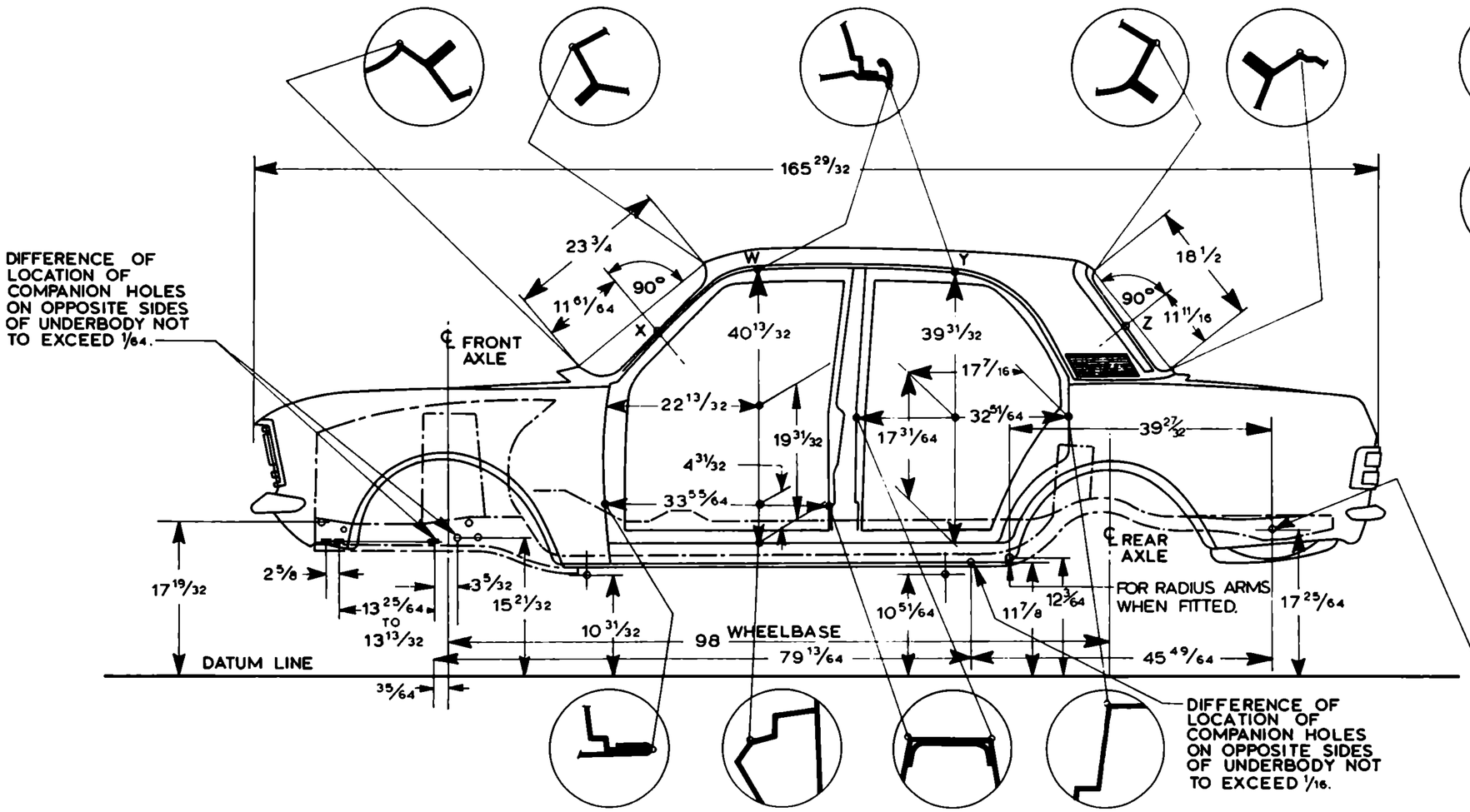
ALL DIMENSIONS IN INCHES

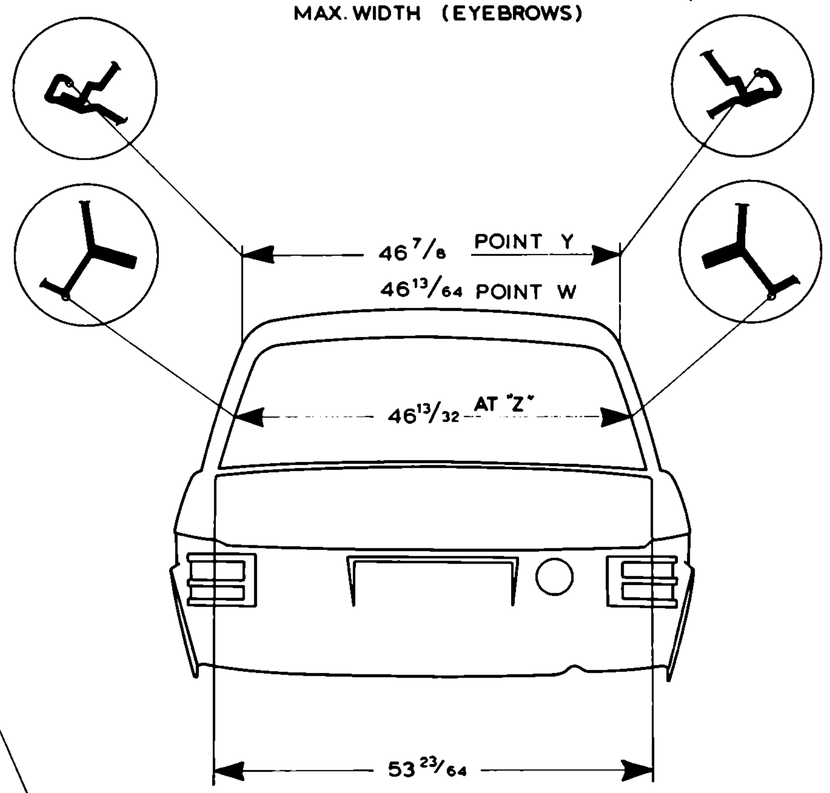
METRIC EQUIVALENTS (IN DIMENSIONAL SEQUENCE)

Inches	*Centimetres*	*Inches*	*Centimetres*	*Inches*	*Centimetres*
$\frac{1}{64}$	0.04	$17\frac{19}{32}$	44.69	$39\frac{43}{64}$	100.77
$\frac{1}{16}$	0.16	$18\frac{1}{2}$	46.99	$39\frac{31}{32}$	101.52
$\frac{3}{32}$	0.24	$19\frac{31}{32}$	50.72	$40\frac{13}{32}$	102.63
$\frac{35}{64}$	1.39	$21\frac{1}{2}$	54.61	$43\frac{1}{4}$	109.86
$2\frac{5}{8}$	6.67	$22\frac{13}{32}$	56.91	$45\frac{49}{64}$	116.24
$3\frac{5}{32}$	8.01	23	58.42	$46\frac{3}{16}$	117.32
$4\frac{31}{32}$	12.62	$23\frac{3}{4}$	60.32	$46\frac{13}{64}$	117.36
$10\frac{51}{64}$	27.42	$24\frac{55}{64}$	63.14	$46\frac{7}{8}$	109.06
$10\frac{31}{32}$	27.86	$30\frac{49}{64}$	78.14	$46\frac{13}{32}$	117.87
$11\frac{11}{16}$	29.69	$31\frac{35}{64}$	80.13	48	121.92
$11\frac{7}{8}$	30.16	$31\frac{61}{64}$	81.16	$51\frac{5}{64}$	129.73
$11\frac{61}{64}$	30.36	$32\frac{51}{64}$	83.30	$53\frac{23}{64}$	135.53
$13\frac{25}{64}$	34.01	$33\frac{23}{64}$	84.73	$64\frac{3}{8}$	163.51
$13\frac{13}{32}$	34.05	$33\frac{55}{64}$	86.00	$79\frac{13}{64}$	201.18
$15\frac{21}{32}$	39.77	$34\frac{29}{64}$	87.51	98	248.92
$17\frac{25}{64}$	44.17	$37\frac{7}{8}$	96.20	$163\frac{9}{32}$	414.73
$17\frac{7}{16}$	44.29	$39\frac{39}{64}$	100.61	$165\frac{29}{32}$	421.40
$17\frac{31}{64}$	44.41				









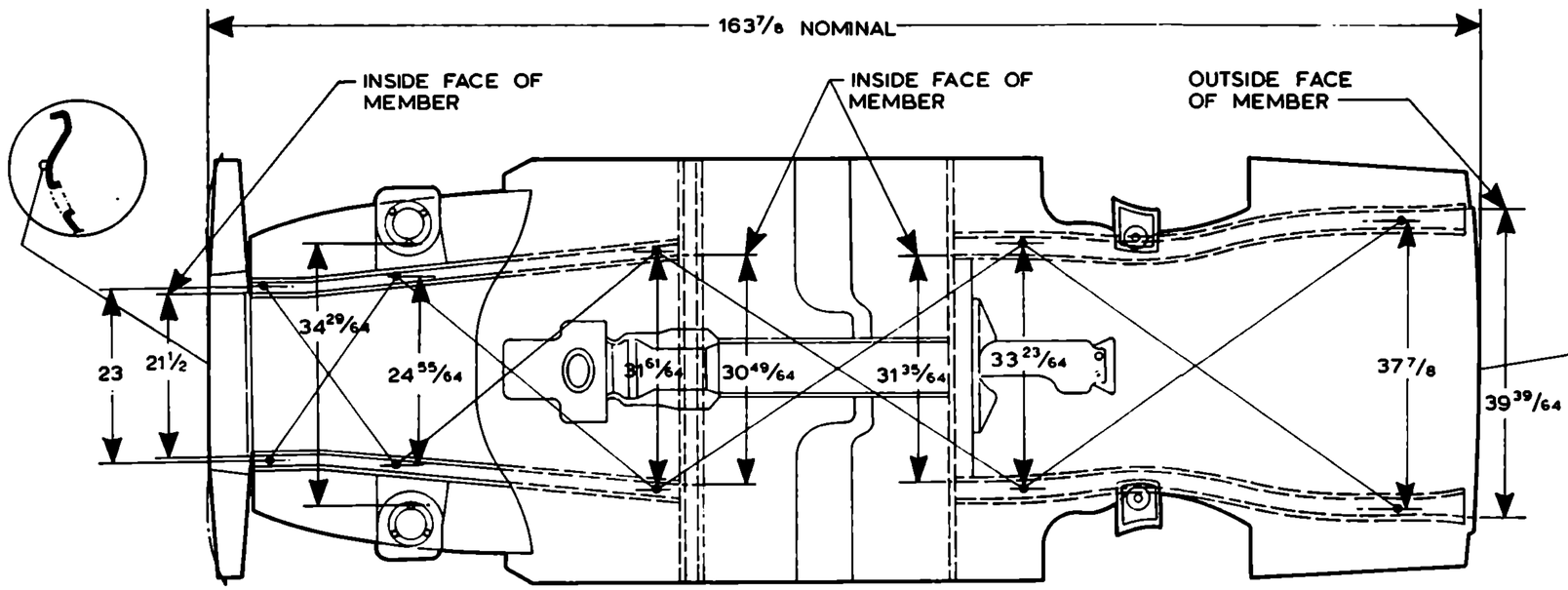
REAR SPRING SHACKLE BOLT HOLES MUST BE SQUARE IN HORIZONTAL AND VERTICAL PLANES WITHIN 3/32 IN 18 INCHES

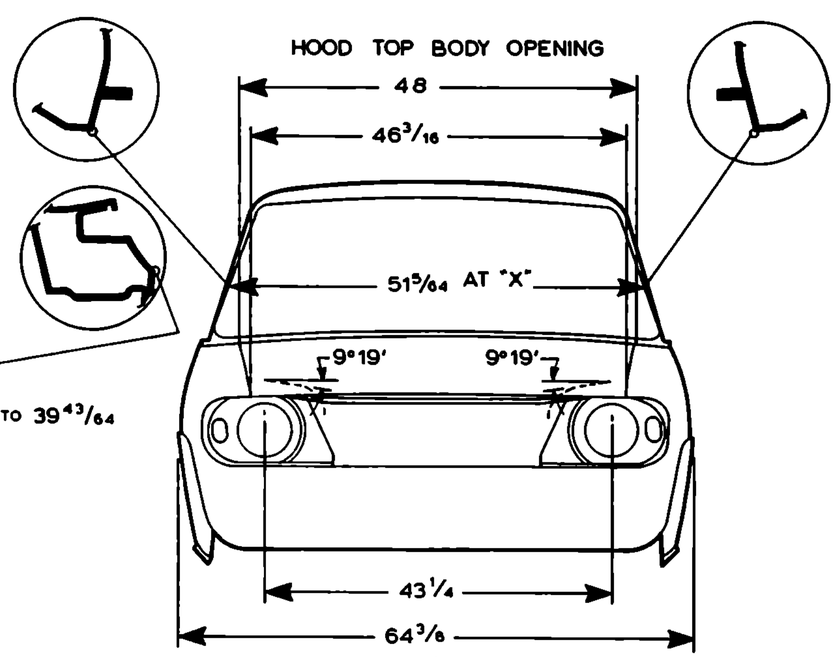
ALL DIMENSIONS IN INCHES

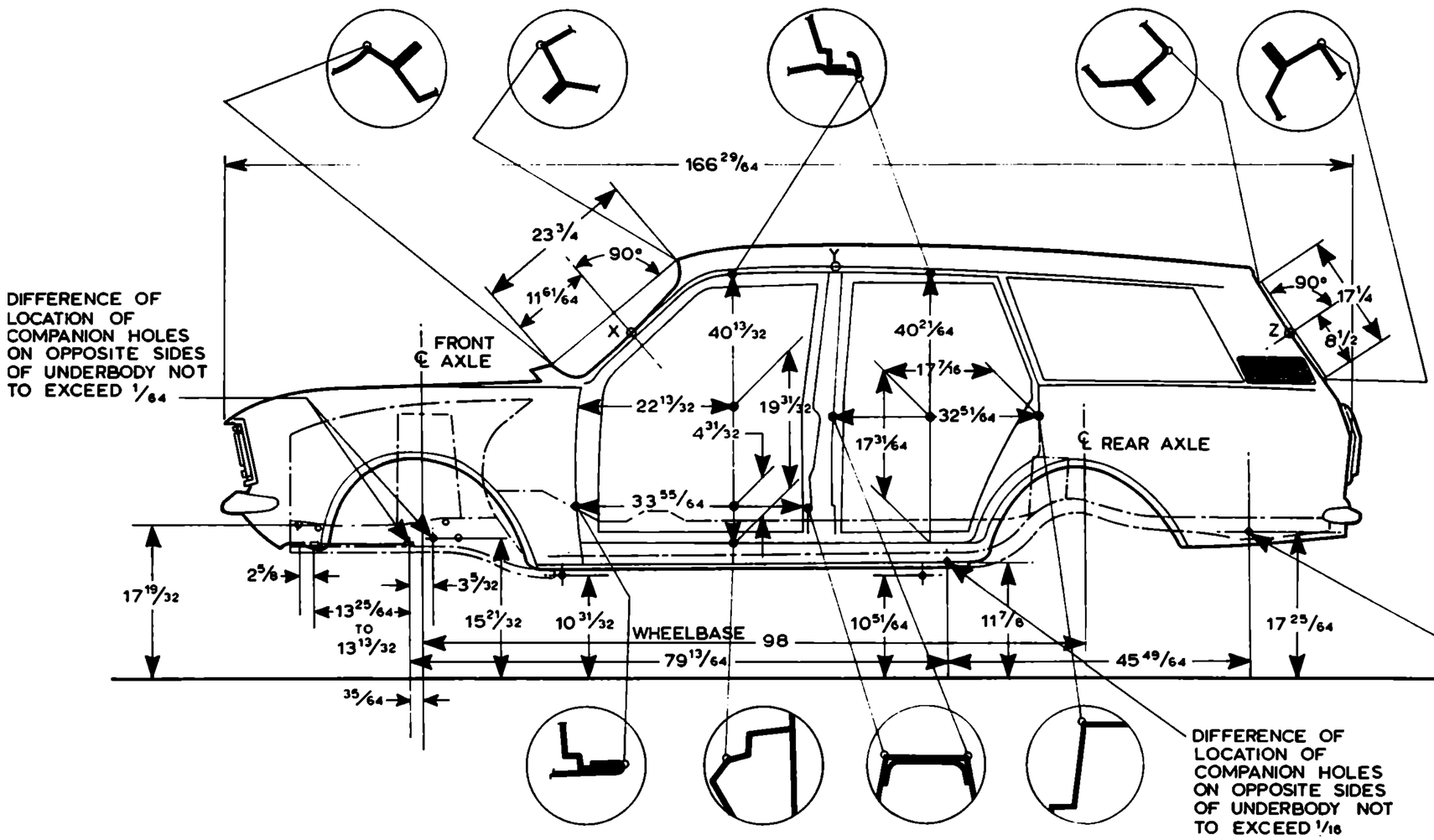
BODY TOLERANCE CHART
Cortina 4-Door Model

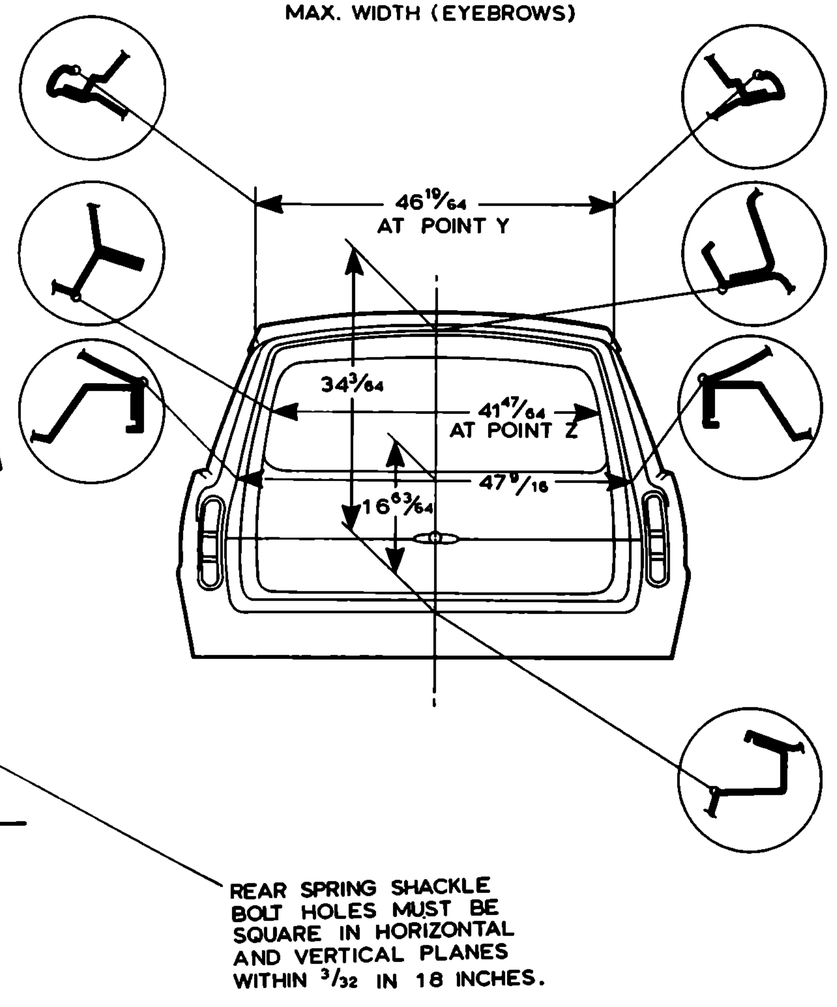
METRIC EQUIVALENTS (IN DIMENSIONAL SEQUENCE)

Inches	*Centimetres*	*Inches*	*Centimetres*	*Inches*	*Centimetres*
1/64	0.04	17 19/32	44.69	40 13/32	102.63
1/16	0.16	18 1/2	46.99	43 1/4	109.86
3/32	0.24	19 31/32	50.72	45 49/64	116.24
35/64	1.39	21 1/2	54.61	46 3/16	117.32
2 5/8	6.67	22 13/32	56.91	46 13/32	117.87
3 5/32	8.01	23	58.42	46 21/32	118.51
4 31/32	12.62	23 3/4	60.32	46 53/64	118.94
10 51/64	27.42	24 55/64	63.14	48	121.92
10 31/32	27.86	30 49/64	78.14	51 7/64	129.82
11 11/16	29.69	31 35/64	80.13	53 23/64	135.53
11 7/8	30.16	31 61/64	81.16	64 3/8	163.51
11 61/64	30.36	33 23/64	84.73	79 13/64	201.18
13 25/64	34.01	34 29/64	87.51	98	248.92
13 13/32	34.05	37 7/8	96.20	163 9/32	414.73
15 21/32	39.77	39 39/64	100.61	165 29/32	421.40
17 25/64	44.17	39 43/64	100.77		









ALL DIMENSIONS IN INCHES

BODY TOLERANCE CHART

Cortina Estate Car Model

METRIC EQUIVALENTS (IN DIMENSIONAL SEQUENCE)

Inches	*Centimetres*	*Inches*	*Centimetres*	*Inches*	*Centimetres*
$\frac{1}{64}$	0.04	$17\frac{7}{16}$	44.29	$37\frac{7}{8}$	96.20
$\frac{1}{16}$	0.16	$17\frac{31}{64}$	44.41	$39\frac{39}{64}$	100.61
$\frac{3}{32}$	0.24	$17\frac{19}{32}$	44.69	$39\frac{43}{64}$	100.77
$\frac{35}{64}$	1.39	18	45.72	$40\frac{21}{64}$	102.43
$2\frac{5}{8}$	6.67	$19\frac{31}{32}$	50.72	$40\frac{13}{32}$	102.63
$3\frac{5}{32}$	8.01	$21\frac{1}{2}$	54.61	$41\frac{47}{64}$	106.01
$4\frac{31}{32}$	12.62	$22\frac{13}{32}$	56.91	$43\frac{1}{4}$	109.86
$8\frac{1}{2}$	21.59	23	58.42	$45\frac{49}{64}$	116.24
$10\frac{51}{64}$	27.42	$23\frac{3}{4}$	60.32	$46\frac{3}{16}$	117.32
$10\frac{31}{32}$	27.86	$24\frac{55}{64}$	63.14	$46\frac{19}{64}$	117.59
$11\frac{7}{8}$	30.16	$30\frac{49}{64}$	78.14	$47\frac{9}{16}$	120.81
$11\frac{61}{64}$	30.36	$31\frac{35}{64}$	80.13	48	121.92
$13\frac{25}{64}$	34.01	$31\frac{61}{64}$	81.16	$51\frac{5}{64}$	129.73
$13\frac{13}{32}$	34.05	$32\frac{51}{64}$	83.30	$64\frac{3}{8}$	163.51
$15\frac{21}{32}$	39.77	$33\frac{23}{64}$	84.73	$79\frac{13}{64}$	201.18
$16\frac{63}{64}$	43.14	$33\frac{55}{64}$	86.00	98	248.92
$17\frac{1}{4}$	43.82	$34\frac{3}{64}$	86.55	$163\frac{7}{8}$	416.24
$17\frac{25}{64}$	44.17	$34\frac{29}{64}$	87.51	$166\frac{29}{64}$	422.79

13

LUBRICATION AND MAINTENANCE

SERVICING INTERVALS

First Service: 600 Miles (1,000 Km.) Second Service: 3,000 Miles (5,000 Km.)

continuing at subsequent 6,000 Mile (10,000 Km.) intervals

LUBRICANTS AND FLUIDS

FRONT WHEEL BEARINGS		Lithium base grease EMIC-3
BRAKE FLUID RESERVOIR		... ... ME-3833-F
STEERING GEAR		S.A.E. 90 E.P. gear oil
REAR AXLE		... ... S.A.E. 90 Hypoid oil
ENGINE	... ...	Ford Specification ESE-M2C101-B
	SAE Grade	Use between
	5W-20W, 5W-30	—40° to + 32°F
	10W-30	—10° to + 70°F
	10W-40	—10° to + 90°F
	10W-50	—10° to +120°F
	20W-40	—25° to + 90°F
	20W-50	+32° to +120°F
	20W-50 "All season"	+25° to +120°F
	10W ...	—10° to + 32°F
	20W-20	+25° to + 70°F
	30	+32° to + 90°F
	40	... +50° to +120°F
GEARBOX		S.A.E. 80 Gear Oil
AUTOMATIC TRANSMISSION		M-2C33-F
GENERATOR		Engine Oil
DISTRIBUTOR ...		Engine oil and grease – Ford Part No. 68AB-19D533-AA
GENERAL ...		Lithium base grease – EMIC-3 with 1% molybdenum disulphide
ANTI-FREEZE		Ford Part No. M97B18-C in 50% solution

Approved Lubricants

Multigrade oil is used in production for the engine for "initial fill" and this oil should not normally be changed until the first 3,000 miles (5,000 km.) have been completed. The tabulated list of engine and transmission oils is divided into three categories.

"*Category A*"

Lubricants which carry official Ford of Britain approval, are available readily throughout the United Kingdom and are manufactured by a company supplying Ford of Britain with lubricants for production use. Lubricants in this category are listed in all Domestic Editions of Owner Handbooks, Ford Service Voucher Books and similar publications.

"*Category B*"

Lubricants which carry official Ford of Britain approval, are available throughout the United Kingdom, but are not manufactured by a supplier to Ford of Britain.

"*Category C*"

Lubricants which carry a qualified Ford of Britain approval by meeting all technical requirements, but not necessarily being generally available throughout the United Kingdom.

It does not follow that the lubricants listed under Categories A, B and C will be necessarily marketed in any Export territory or, if available, under the same brand name. However, to enable you to obtain lubricants of the same specification the appropriate Ford Specification Numbers are also quoted on page 2. In any case, temperature variations in individual territories could involve a change of viscosity and in some cases the brand name will change according to the particular viscosity rating of the lubricant concerned.

All the approved engine and transmission lubricants tabulated are miscible and compatible with one another but if, for instance, an S.A.E. 10W engine oil were added to one of S.A.E. 10W/30 type then the viscosity rating of the latter would be affected according to the percentage of dilution.

SERVICING INTERVALS

MAINTENANCE OPERATIONS

Carry out the operations listed below at the mileage shown or at the equivalent monthly intervals, whichever occur first	Daily attention	Weekly attention	At first 600 miles (1,000 km.)	At first 3,000 miles (5,000 km.) or three months (whichever is reached first)	At first 9,000 miles (15,000 km.) or nine months (whichever is reached first) and each subsequent 6,000 miles (10,000 km.) or six months	At first 21,000 miles (35,000 km.) and every subsequent 18,000 miles (30,000 km.)	At first 39,000 miles (65,000 km.) and every subsequent 36,000 miles (60,000 km.)	Item number
Check and top up engine oil level	●		●					1
Change engine oil and renew oil filter element				●	●	●	●	32
Top up steering box			●	●	●	●	●	8
Check and if necessary top up brake and clutch fluid reservoir		●	●	●	●	●	●	4
Clean sparking plugs and set gaps				●	●	●	●	33
Examine distributor points and adjust, clean distributor cap and coil			●	●	●	●	●	9
Lubricate distributor, and check ignition timing				●	●	●	●	10
Lubricate generator rear bearing				●	●	●	●	34
Clean sediment from fuel filter			●	●	●	●	●	11
Clean oil filler cap				●	●	●	●	35
Clean crankcase emission valve				●	●	●	●	36
Check and adjust valve clearances			●	●	●	●	●	12
Clean air cleaner				●	●			37
Renew air cleaner element (where applicable)						●	●	46
Adjust fan belt tension and tighten generator mounting bolts to correct torque			●	●	●	●	●	13
Check heater and radiator hose clips			●					14
Check battery condition, check connections and top up				●	●	●	●	38
Check and top up battery electrolyte level		●	●					3
Check and top up radiator level	●		●	●	●	●	●	2
Check and top up windshield washer		●	●	●	●	●	●	5
Correct tyre pressures		●	●	●	●	●	●	6
Tighten cylinder head and manifold bolts to correct torque			●					15
Tighten sump bolts to the correct torque			●					16
Check wheel nuts for tightness			●					17
Check door operation, adjust striker where necessary			●					18

SERVICING INTERVALS

MAINTENANCE OPERATIONS

Carry out the operations listed below at the mileage shown or at the equivalent monthly intervals, whichever occur first.

	Daily attention	Weekly attention	At first 600 miles (1,000 km.)	At first 3,000 miles (5,000 km.) or three months (whichever is reached first)	At first 9,000 miles (15,000 km.) or nine months (whichever is reached first) and each subsequent 6,000 miles (10,000 km.) or six months	At first 21,000 miles (35,000 km.) and every subsequent 18,000 miles (30,000 km.)	At first 39,000 miles (65,000 km.) and every subsequent 36,000 miles (60,000 km.)	Item number
Change gearbox oil				●				39
Top up gearbox oil			●		●	●	●	19
Top up rear axle oil			●	●	●	●	●	20
Check torque of rear spring 'U' bolts			●	●	●	●	●	21
Check rear spring inserts				●	●	●	●	40
Check torque of front suspension crossmember bolts			●	●	●	●	●	22
Check boot type gaiters on front suspension and steering joints				●	●	●	●	41
Check front wheel toe in			●			●	●	23
Remove road wheels, check front brake pads for wear, examine rear brake shoes and self-adjusting mechanism and blow clean				●	●	●	●	42
Inspect brake hoses for signs of leaks or chafing			●	●	●	●	●	24
Renew all brake seals, hydraulic fluid and flexible brake hoses							●	48
Check front wheel bearings and adjust if necessary			●	●	●			25
Repack and adjust front wheel bearings						●	●	47
Reposition road wheels (if required)				●	●	●	●	43
Lubricate handbrake cable at dash panel grommet and adjust cable (if necessary)				●	●	●	●	44
Lubricate door locks, lock cylinders, bonnet safety catch pivot, door striker wedge and all oil can points			●	●	●	●	●	26
Check for water and oil leaks			●					27
Check operation of all lights	●							7
Check operation of all controls, instruments and lights (align if necessary)			●	●	●	●	●	28
Check seat belt for security and wear				●	●	●	●	45
Top up/check automatic transmission fluid level			●	●	●	●	●	29
Check carburettor idling mixture setting and adjust if required			●	●	●	●	●	30
Road or roller test.			●	●	●	●	●	31

APPROVED LUBRICANTS (applicable to U.K. only)

Manufacturer	Engine	Gearbox**	Rear Axle
Ford Specification	ESE-M2C101-B	ME-568-D	EM-2C-22 EM-2C-29
Category "A"			
Amoco (U.K.) Ltd.	Amoco Permalube SAE 20-20W Amoco Super Permalube SAE 10W-30 Amoco Super Permalube SAE 20W-50	Amoco Multi-Purpose Gear Lubricant SAE 80	Amoco Multi-Purpose Gear Lubricant SAE 90
B.P. (Shell-Mex and B.P. Ltd).	B.P. Super Visco-Static 10W-40 B.P. Super Visco-Static 20W-50	B.P. Gear Oil SAE 80 EP	B.P. Gear Oil SAE 90 EP
Castrol Ltd.	Castrol GTX*	Castrol Hypoy Light	Castrol Hypoy
Alexander Duckham Ltd.	Duckham's Q5500 Duckham's Q20-50*	Duckham's Hypoid 80	Duckham's Hypoid 90
Esso Petroleum Co. Ltd.	Esso Motor Oil 20W Esso Extra Motor Oil 10W/30 or Uniflo† Esso Extra Motor Oil 20W/50	Esso Gear Oil GP 80	Esso Gear Oil GP 90/140
Mobil Oil Co. Ltd.	Mobiloil Super 10W/50† Mobiloil Special 20W/50	Mobilube GX 80	Mobilube GX 90
Petrofina (Great Britain) Ltd.	Fina Supergrade Motor Oil 10W/30 Fina Supergrade Motor Oil 20/W50*	Fina Pontonic MP SAE 80	Fina Pontonic MP SAE 90
Regent Oil Co. Ltd. (Texaco Ltd.)	Havoline Motor Oil 20-20W Havoline Motor Oil 10W/30 Havoline Motor Oil 20W/50	Regent Multi-Gear Lubricant EP 80	Regent Multi-Gear Lubricant EP 90
Shell (Shell-Mex and B.P. Ltd.)	Shell Super Motor Oil 101 (10W/30) Shell Super Motor Oil 100 (20W/50)*	Shell Spirax 80 EP	Shell Spirax 90 EP

* "All season" SAE 20W/50 Oils

† Conforms to 10W-50 temperature requirements

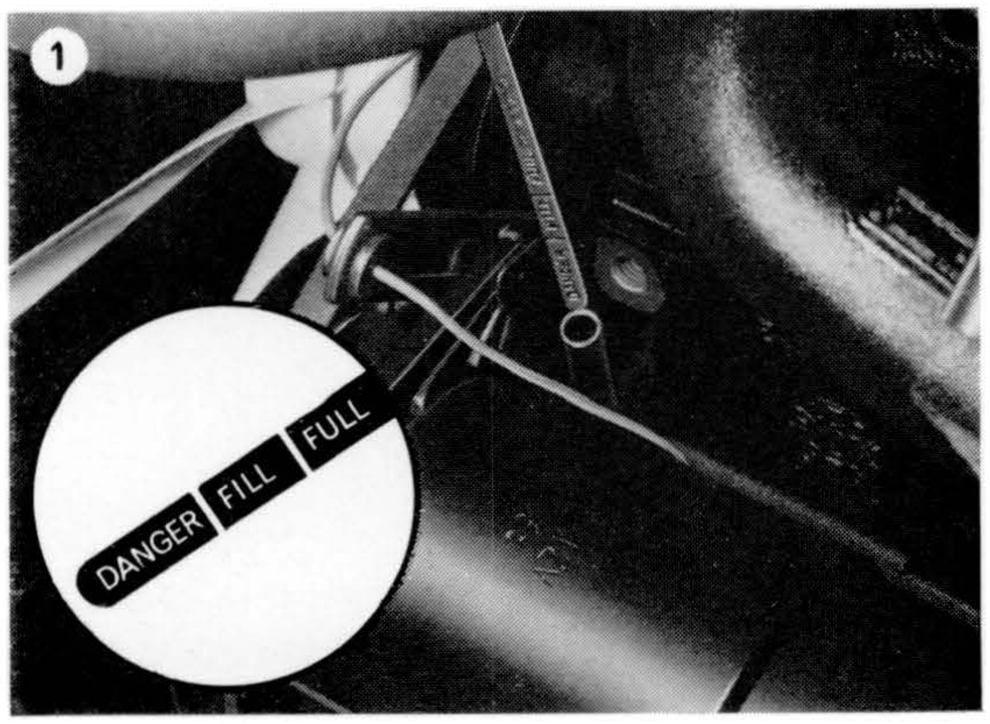
** Automatic transmission uses only Ford Fluid M-2C33-F

1 Top-up Engine Oil

The car should be standing on level ground and the oil level checked with the dipstick.

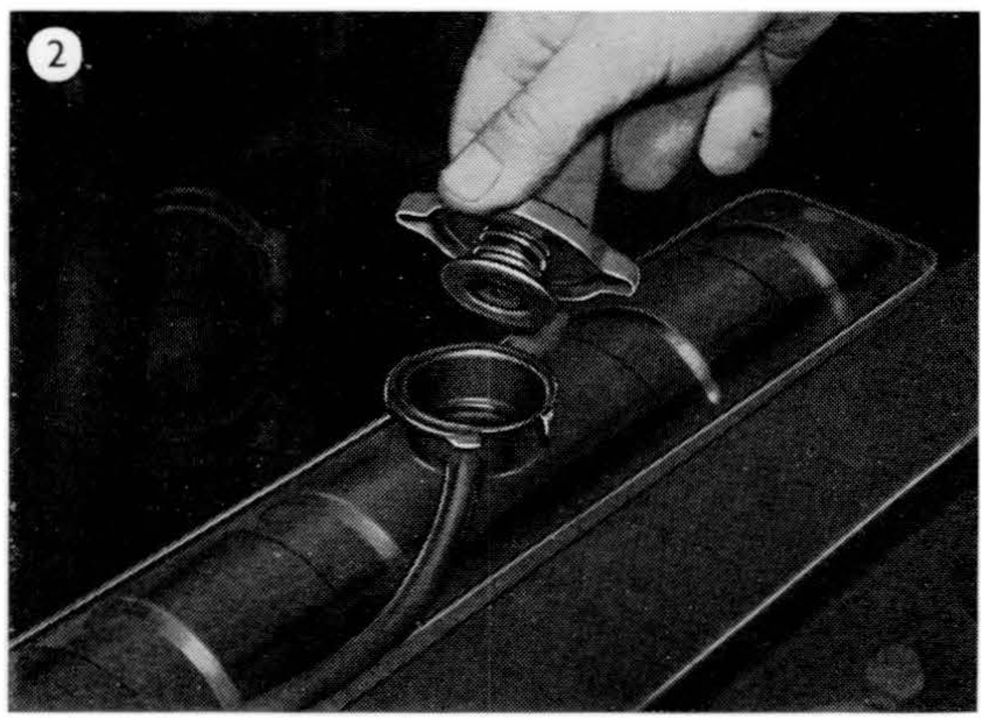
Withdraw the dipstick, wipe it with a clean rag, replace, and again withdraw. The mark made by the oil on the lower end of the dipstick will indicate the oil level. If necessary, oil should be added through the valve rocker cover after removing the filler cap.

When the level reaches the 'Full' mark, any extra oil added will be wasted, but in no circumstances allow the oil level to fall below 'Fill' into the sector marked 'Danger'.



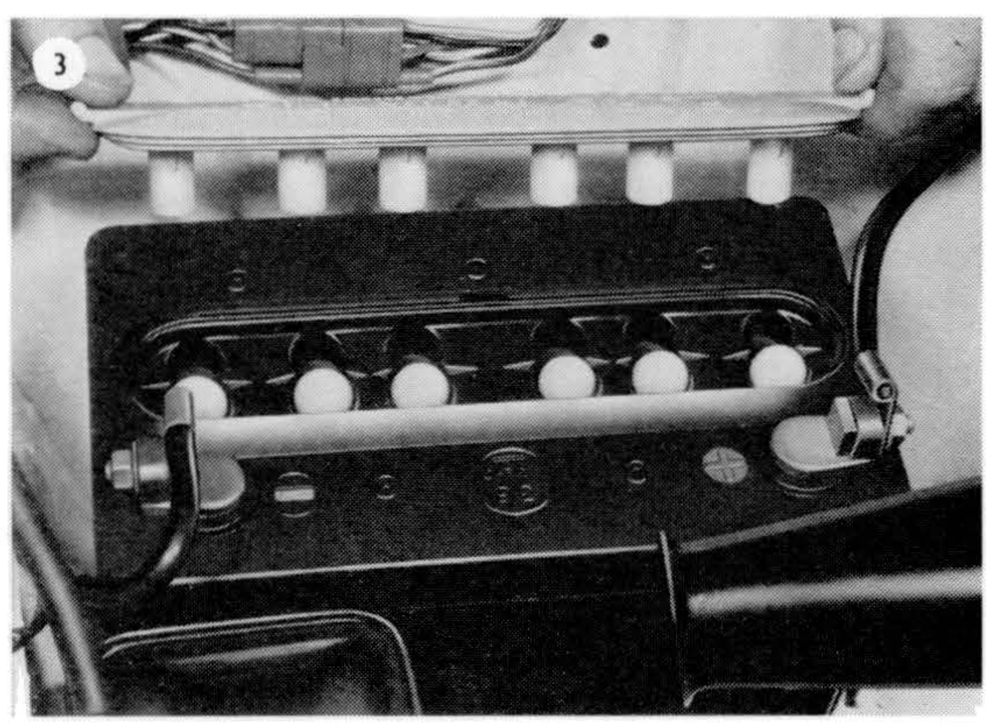
2 Check and Top-up Radiator

Remove radiator filler cap and top-up to the correct level with 50% water and 50% Ford anti-freeze Part No. M97B18C.



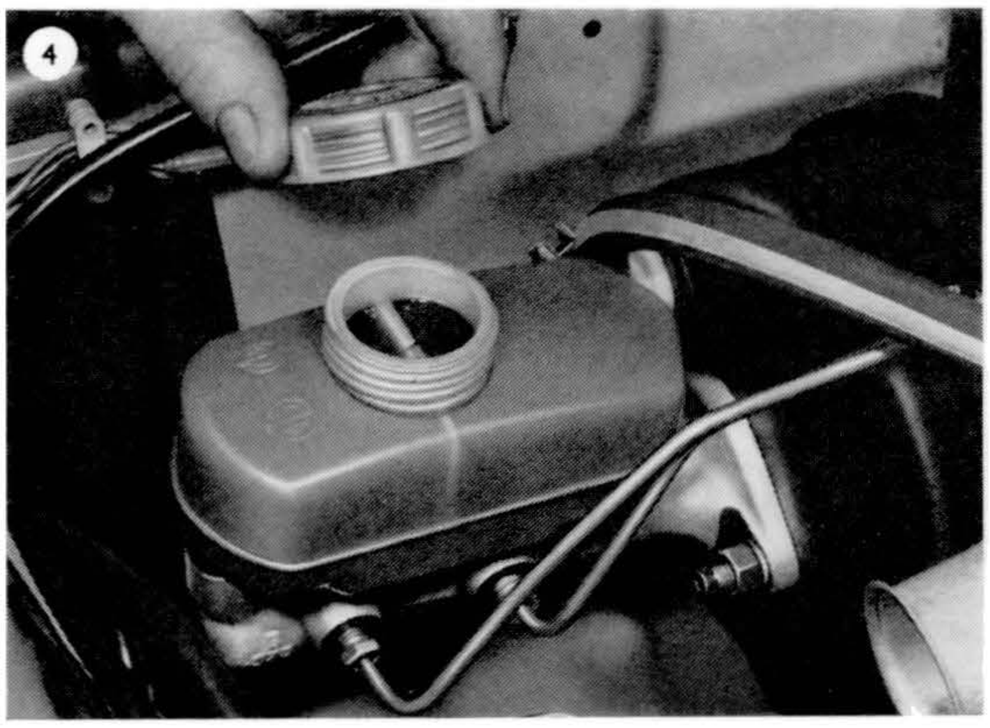
3 Check and Top-up Battery Electrolyte Level

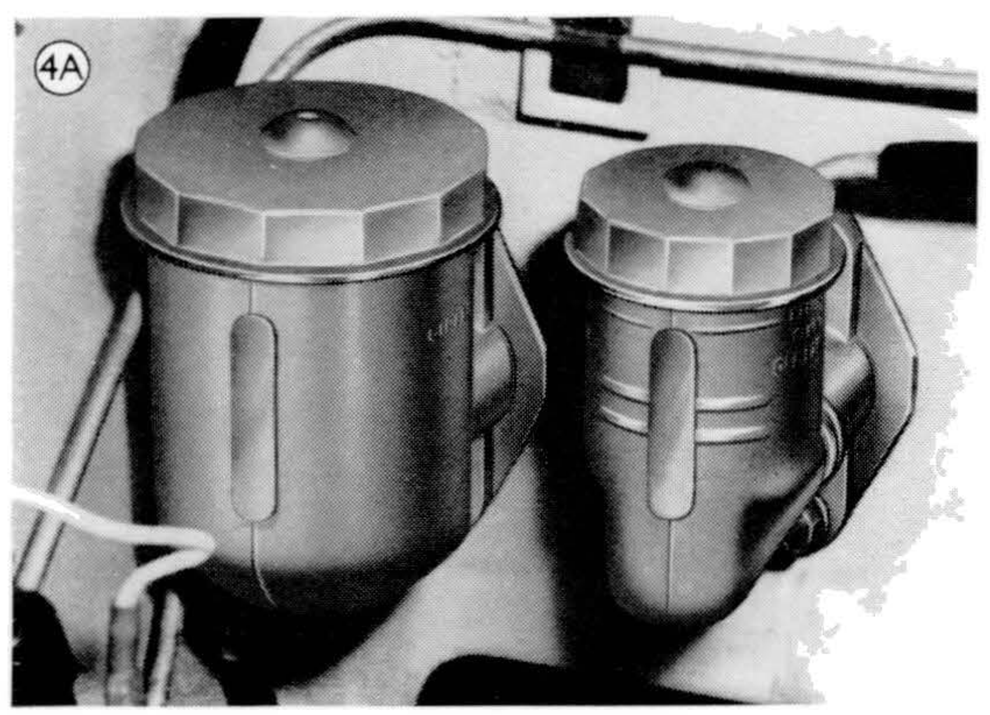
The electrolyte level should be ¼ to ⅜ in. (6 to 9 mm.) above tops of the plates. If below this level add distilled water to filling trough until the trough begins to fill with water. Check security of battery and coat terminals with petroleum jelly.

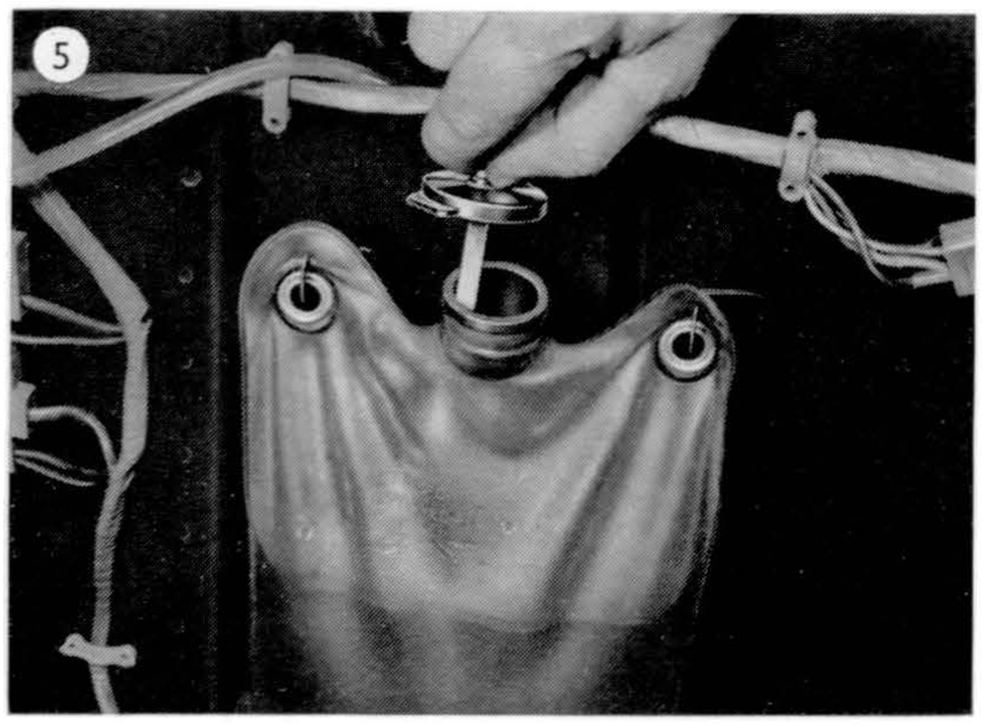


4 Top-up Brake and Clutch Fluid Reservoirs

Clean area around reservoir caps. Unscrew caps and check fluid level. If necessary top-up with correct Ford fluid ME-3833-F and refit caps.







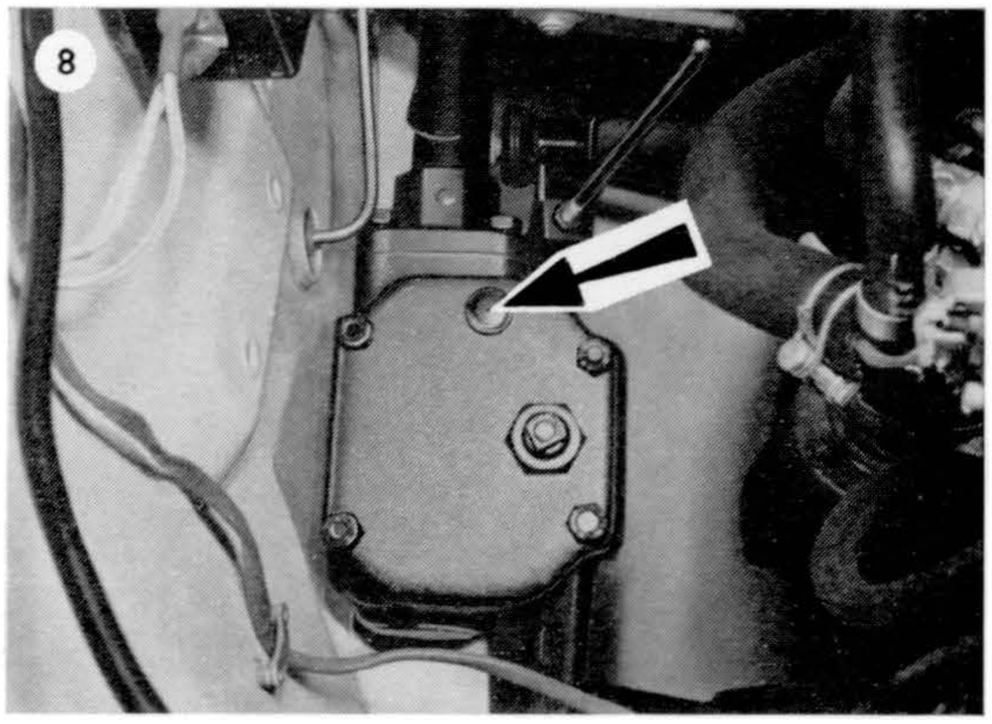
5 Check and Top-up Windshield Washer

The windscreen washer fluid container should be topped-up with the solvent solution obtainable from your Authorised Dealer. Alternatively, use water.

6 Correct Tyre Pressures

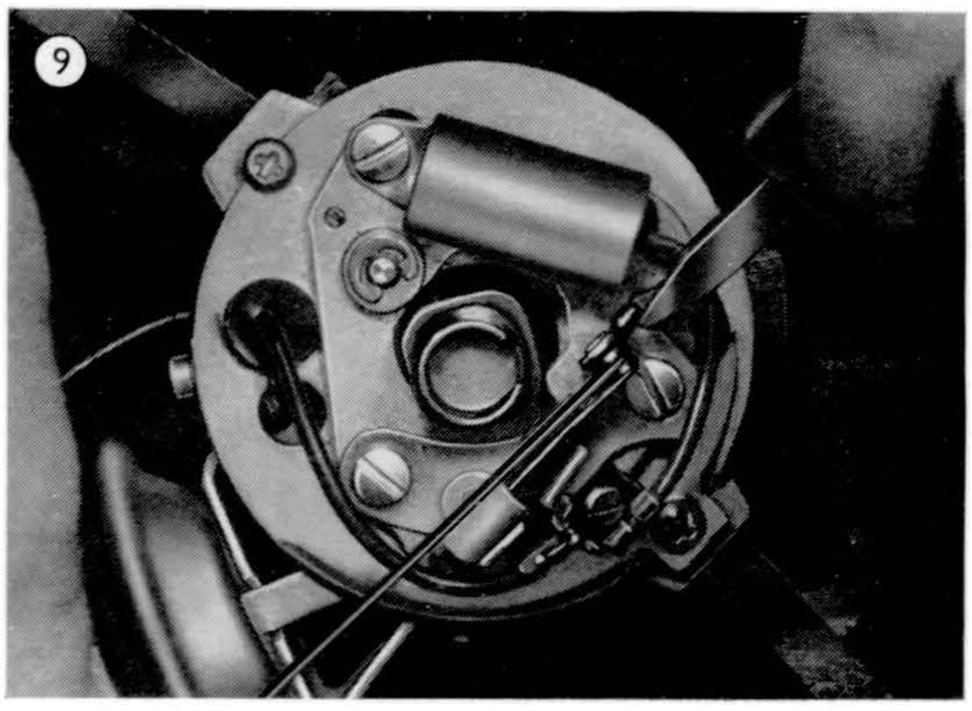
For Tyre Pressures see Section 1, Wheels, Hubs and Tyres, Page 5.

7 Check Operation of all Lights



8 Top-up Steering Box

Remove rubber filler plug. Top-up with approved oil if necessary. Refit plug.



9 Examine and Adjust Distributor Points and Clean Distributor Cap and Coil

To adjust point gap, slacken locking screws and ensure that moving contact breaker arm heel is on the highest point of cam. Move fixed contact point to clearance applicable, (0.025 in. (0.64 mm.)), tighten locking screws and re-check gap.

10 Lubricate Distributor

Remove distributor cap and rotor. Apply two drops of engine oil to lubricating pad inside of cam body. Apply a film of grease Part No. 681F-12107-AA to cam. Replace rotor and cap.

11 Clean Sediment from Fuel Filter

Unscrew clamp nut on top of pump, detach glass bowl and clean sediment from pump body and screen, using petrol. Check gasket. Replace filter screen glass bowl and tighten clamp nut.

12 Check and Adjust Valve Clearances

Check clearances when engine hot. Inlets 0.010 in. (0.254 mm.). Exhausts 0.017 in. (0.432 mm.). G.T. clearances. Inlets 0.012 in. (0.305 mm.), Exhausts 0.022 in. (0.559 mm.).

Valves Open	Valves to Adjust
1 ex. and 6 in.	3 in. and 8 ex.
3 in. and 8 ex.	1 ex. and 6 in.
2 in. and 4 ex.	5 ex. and 7 in.
5 ex. and 7 in.	2 in. and 4 ex.

Following adjustment, tighten locknut and recheck clearance. Refit rocker cover and check for oil leaks.

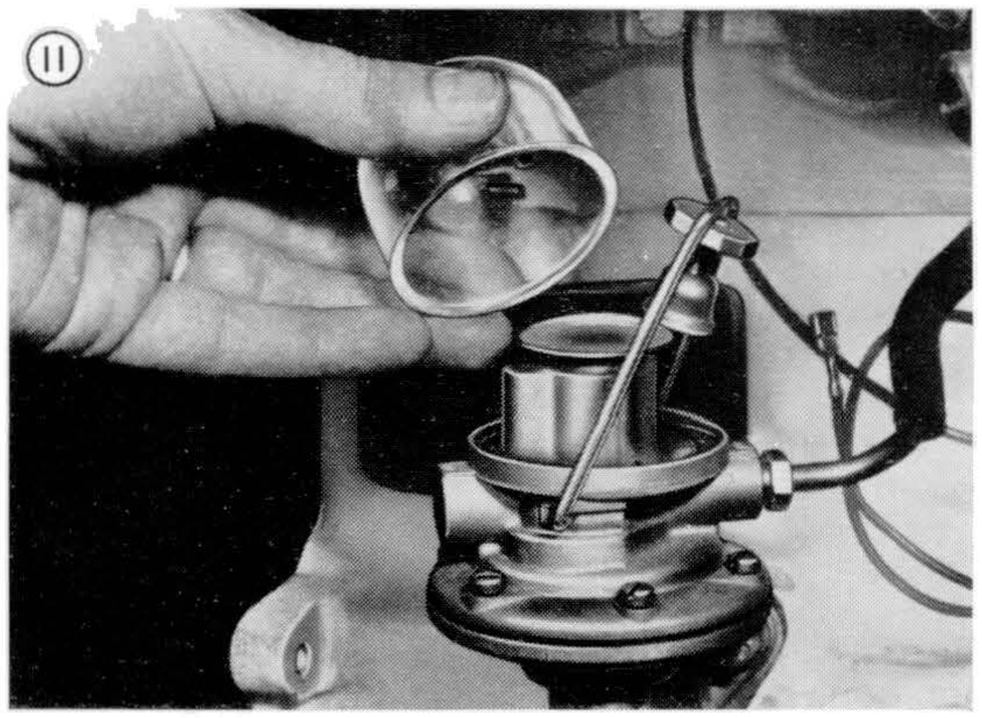
13 Adjust Fan Belt Tension and tighten Generator Mounting Bolts to Correct Torque

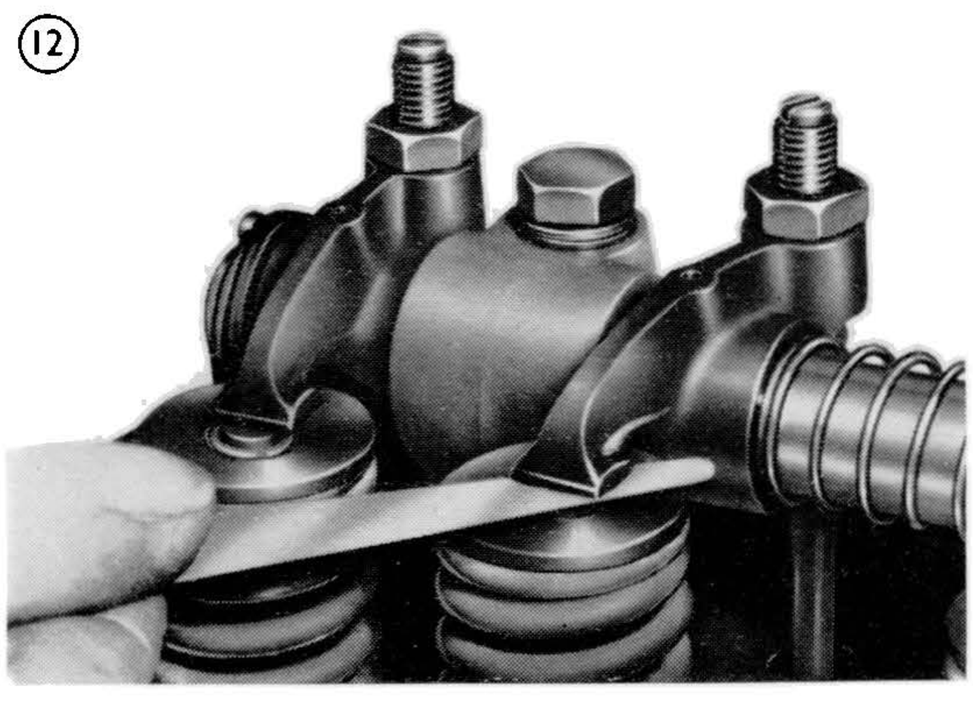
Free movement of $\frac{1}{2}$ in. (1.3 cm.) measured midway between generator and water pump pulleys. If required adjust by slackening front and rear lower mounting bolts and front adjusting bolt. Move generator to give correct belt tension. Tighten bolts.

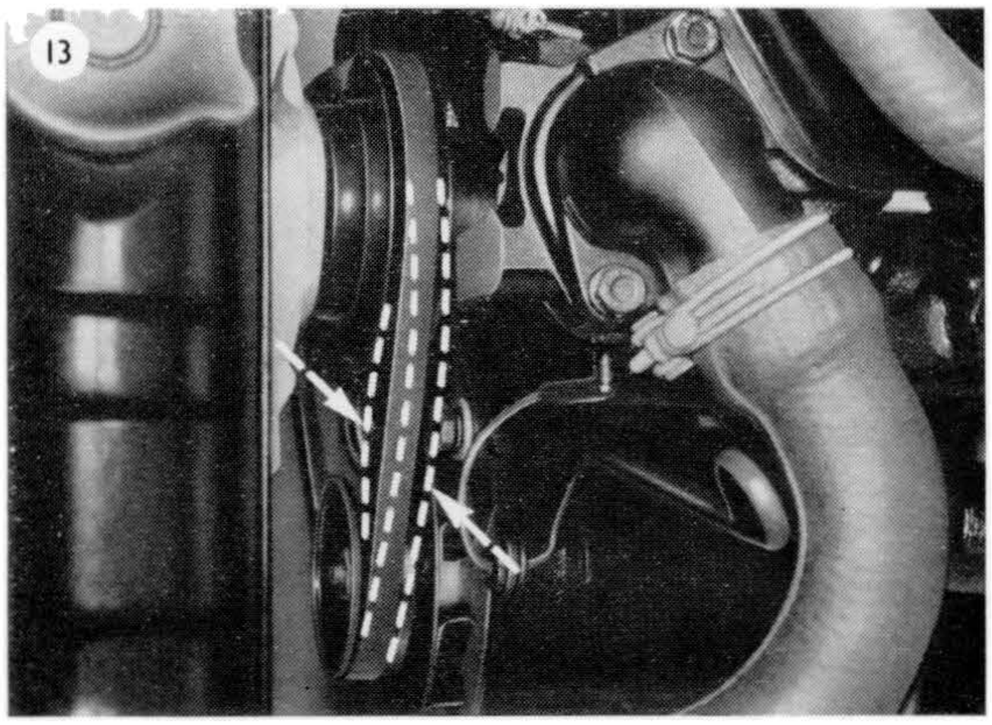
14 Check Heater and Radiator Hose Clips

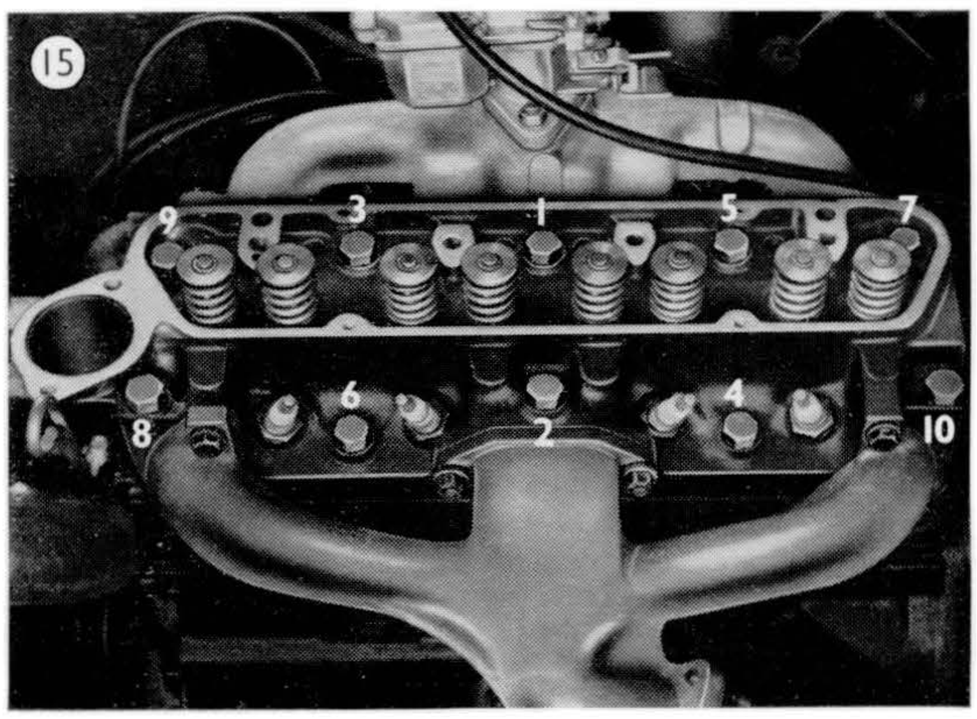
15 Tighten Cylinder Head and Manifold Bolts to the Correct Torques

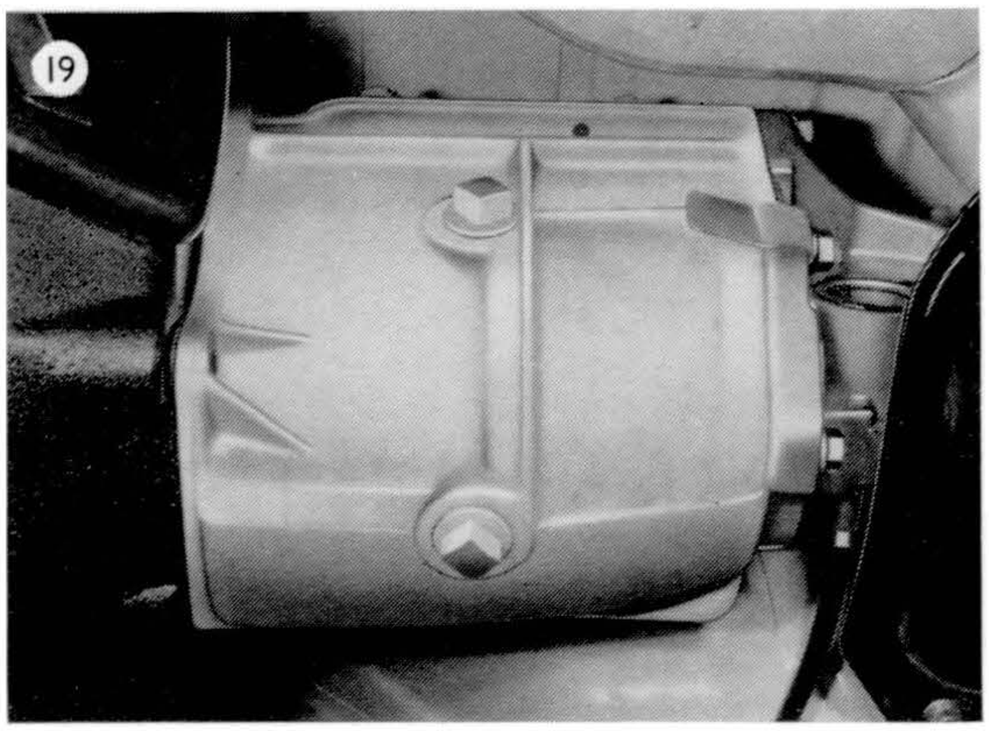
Tighten cylinder head bolts to 65 to 70 lb./ft. (8.89 to 9.67 kg.m.) torque when engine hot. Also check security of sump and manifold bolts.







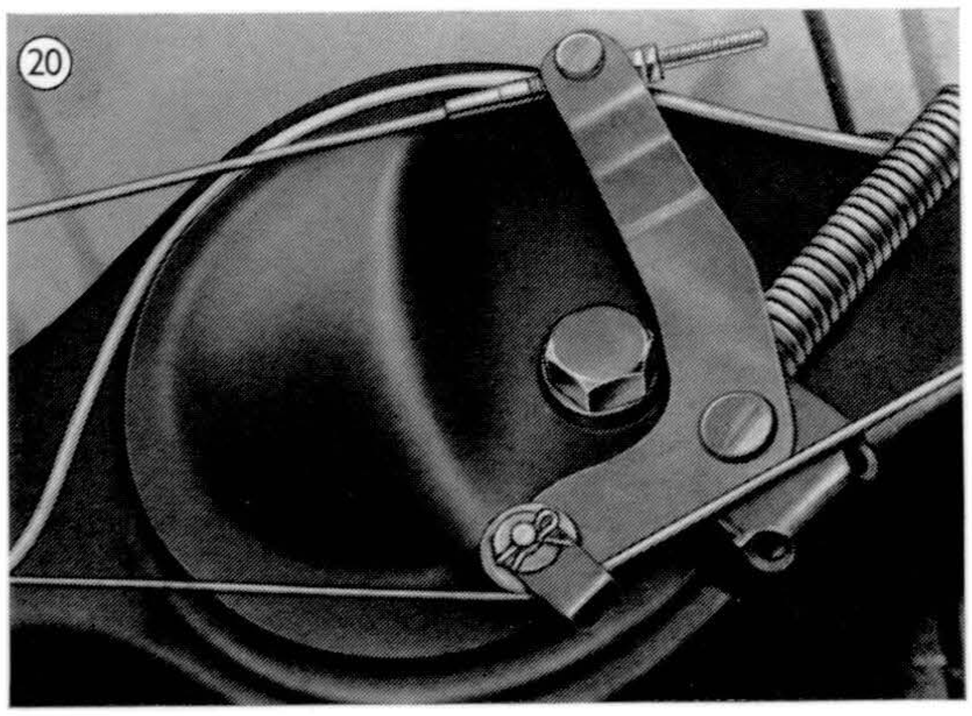




16 Tighten Sump Bolts to correct Torque
7 to 9 lb. ft. (0.97 to 1.24 kg.m.).

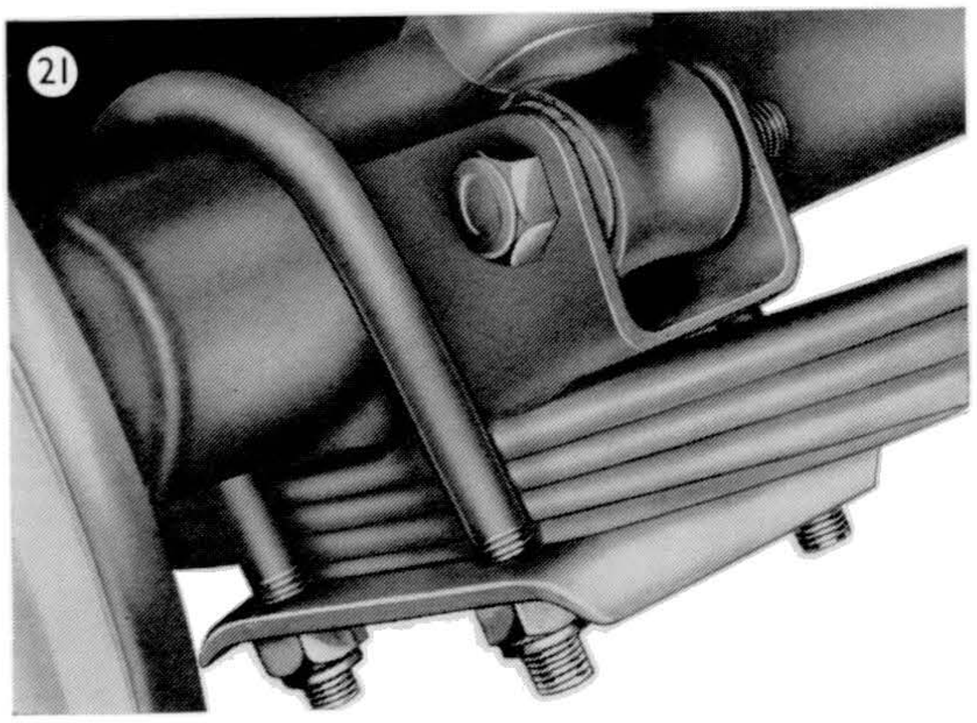
17 Check Wheel Nuts for Tightness

18 Check Door Operation, Adjust Striker where necessary

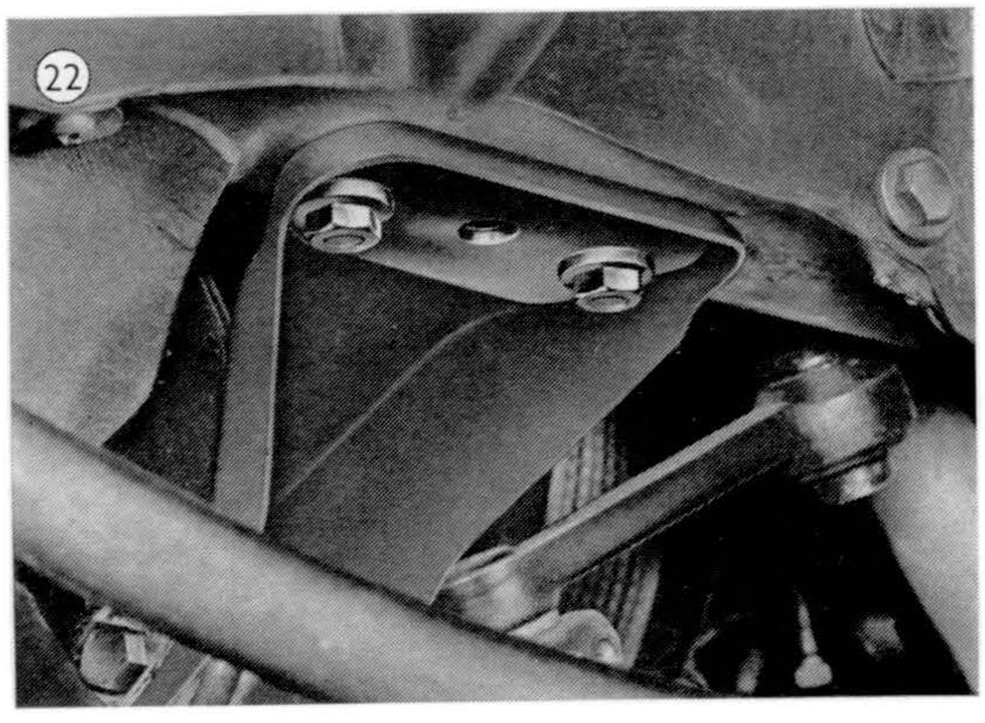


19 Top-up Gearbox Oil
Remove filler/level plug and top-up with the correct grade of oil. Refit plug.

20 Top-up Rear Axle
Remove filler/ievel plug. If necessary top-up with approved oil. Refit plug.



21 Check Torque of Rear Spring 'U' Bolts
Tighten bolts to a torque of 20 to 25 lb. ft. (2.76 to 3.46 kg.m.).



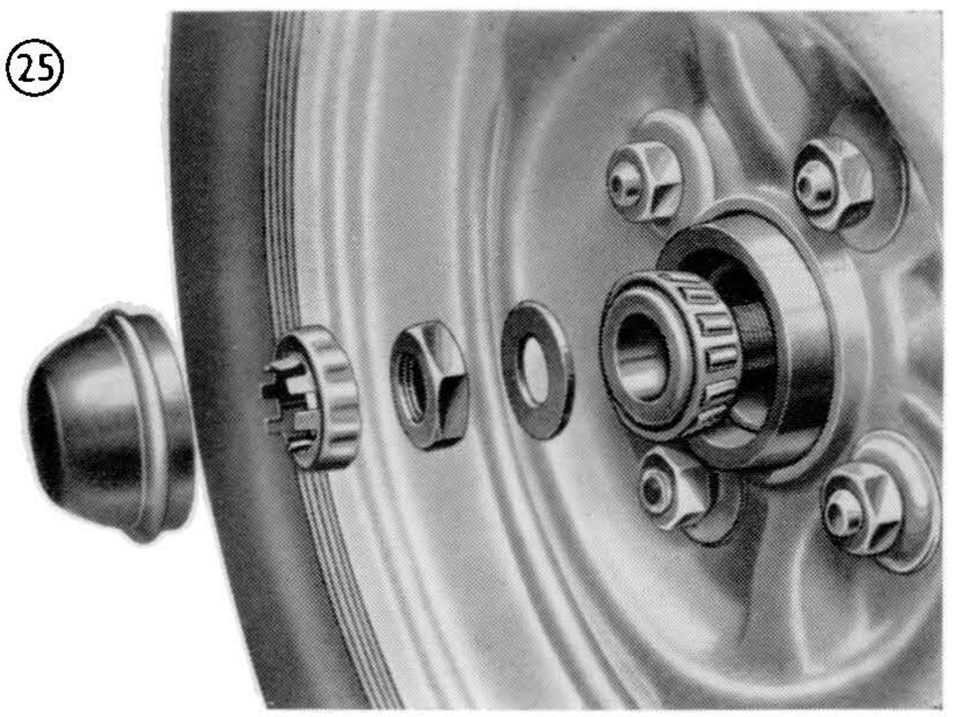
22 Check Torque of Front Suspension Crossmember Bolts
25 to 30 lb. ft. (3.16 to 4.15 kg.m.).

23 Check Front Wheel Toe-in

24 Inspect Brake Hoses for signs of Leaks or Chafing

25 Check Front Wheel Bearing Adjustment

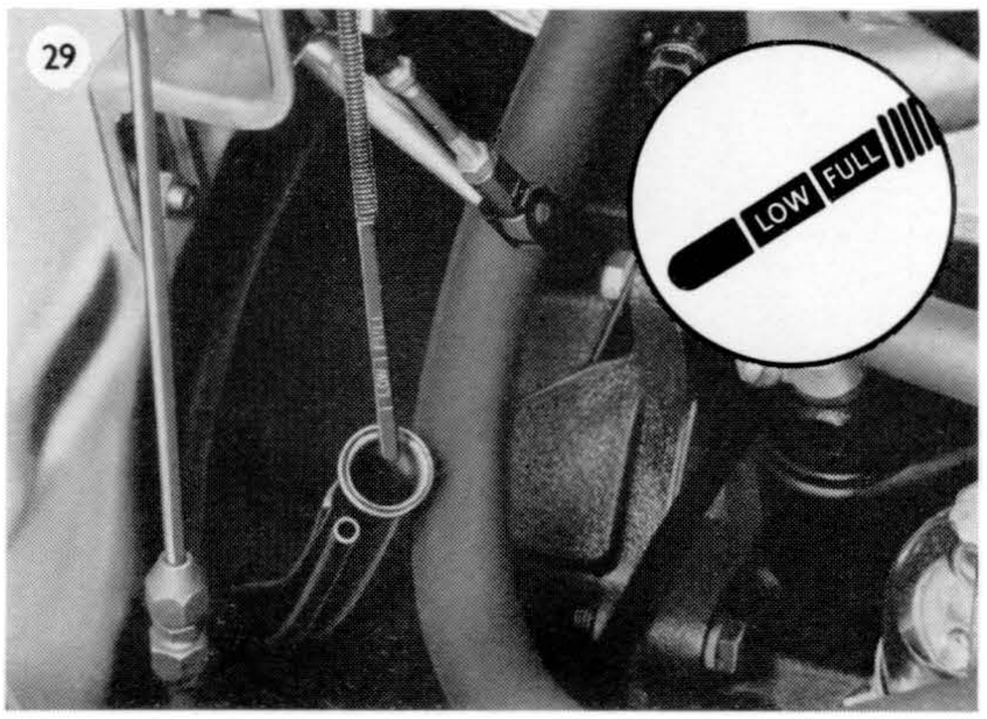
Remove hub cap, slacken wheel nuts, jack up car and remove wheel and dust cap. Remove split pin from bearing nut retainer and unscrew. Now check bearing adjusting nut with torque wrench to 27 lb. ft. (3.73 kg.m.) whilst rotating hub. Refit the nut retainer so that a slot lines up with the split pin hole in the wheel spindle, and slacken nut and retainer 90° or two slots. (Fit new split pin.)



26 Lubricate Door Locks, Lock Cylinders, Bonnet Safety Catch Pivot and all oil can points

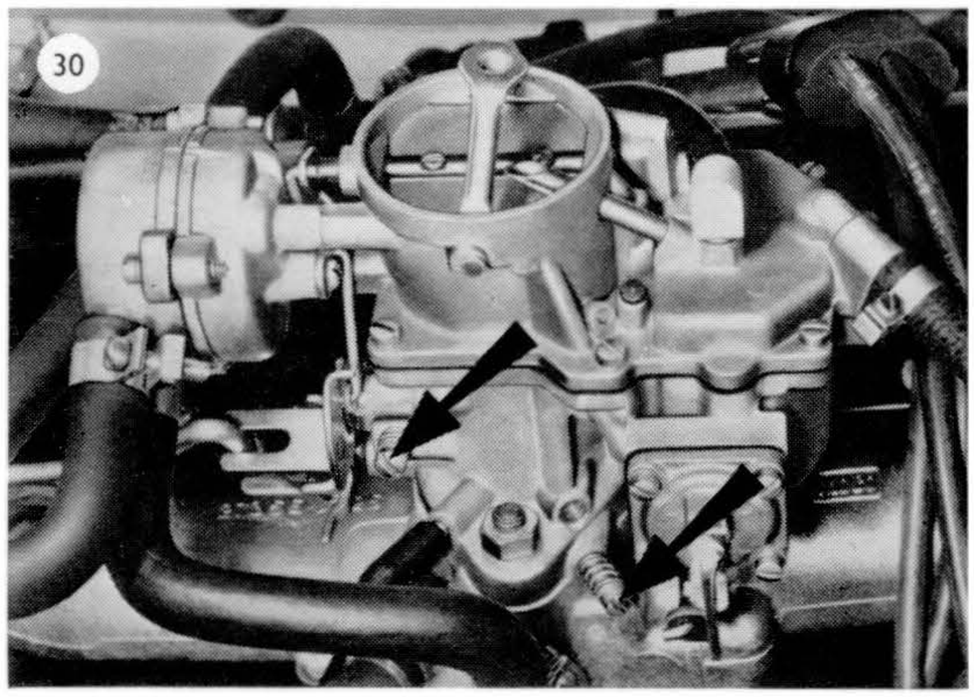
27 Check for Water and Oil Leaks

28 Check Operation of all Controls, Instruments and Lights (align if necessary).



29 Top-up Automatic Transmission

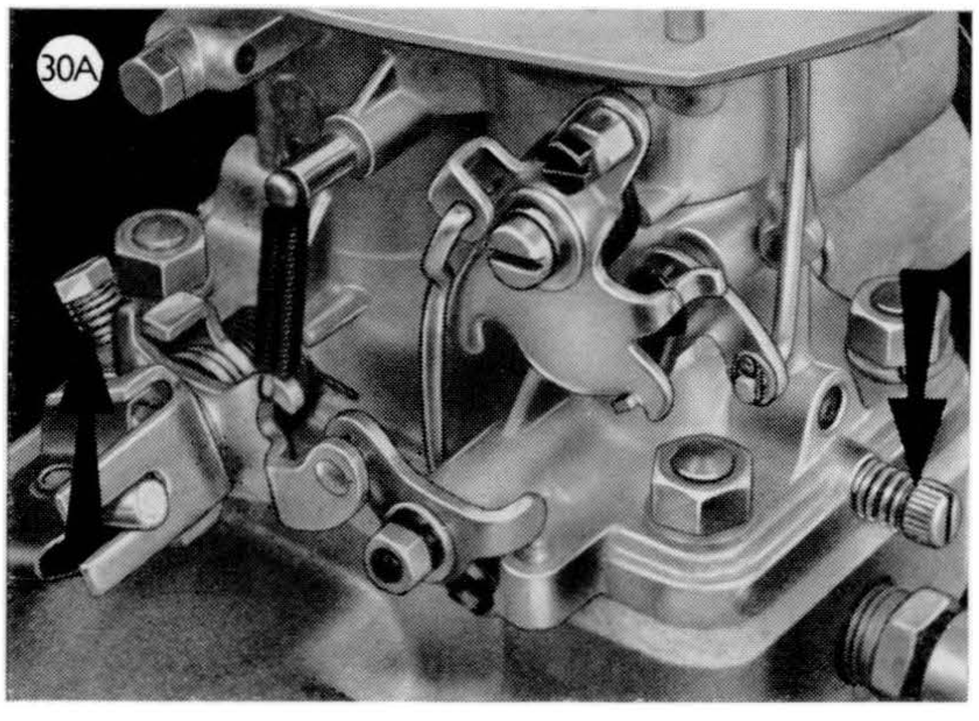
With gearbox at operating temperature and engine idling, withdraw dipstick and wipe with clean rag. Insert dipstick and again withdraw. If necessary top-up to the correct level with approved fluid M-2C33-F.

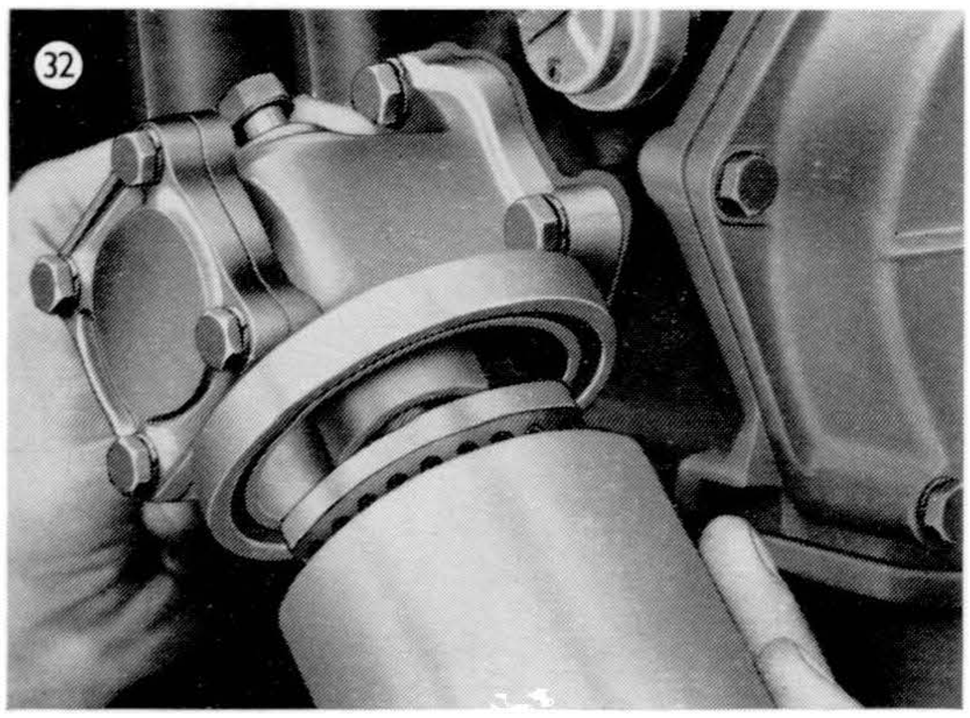


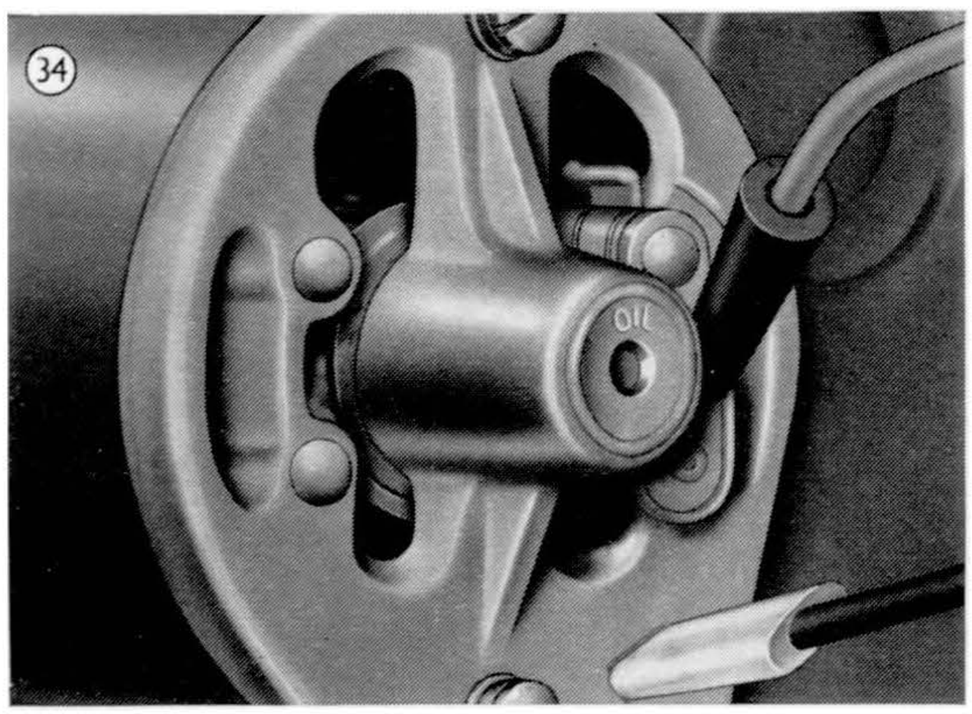
30 Adjust Carburettor

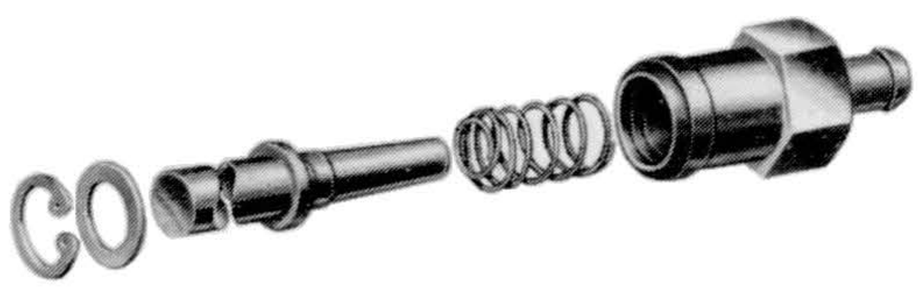
Carry out the following carburettor adjustments for Standard and G.T. models (see illustrations for screw identification).

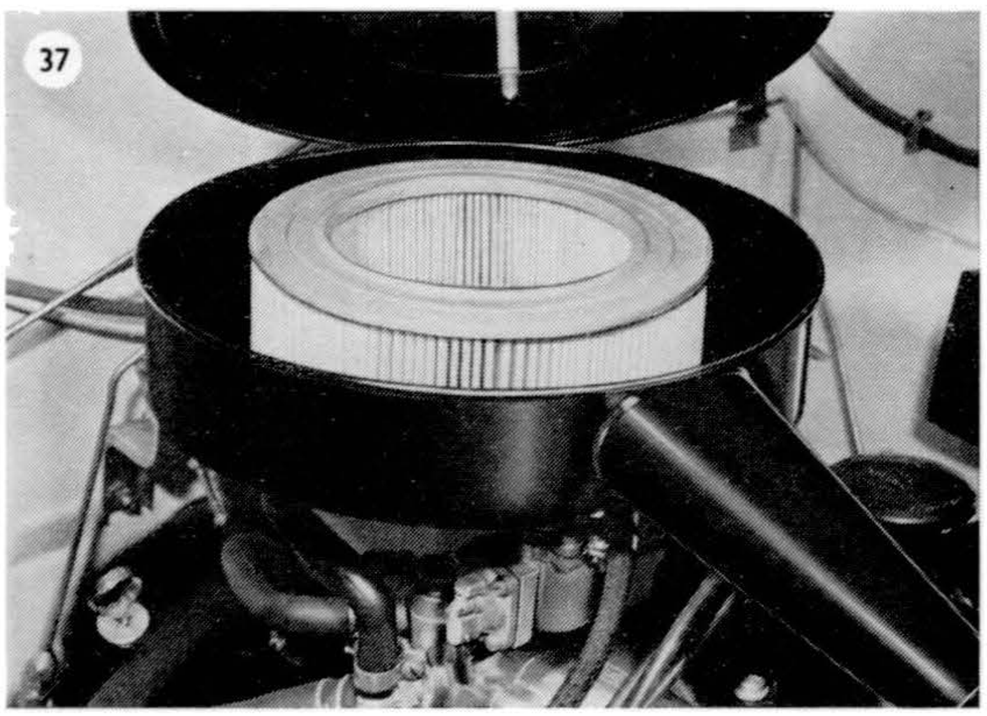
With engine at normal operating temperature, adjust slow-running screw, to obtain correct idle speed. Unscrew volume control screw until engine 'hunts'. Screw in until engine runs evenly. Adjust slow-running screw if necessary. Repeat operation until engine runs satisfactorily.











31 Road Test

As an additional check and to obtain the best results from any particular brand of fuel, the car should be tested on the open road (when fully 'run-in').

Carefully note, by stop watch, the time taken to accelerate from 30 m.p.h. to 50 m.p.h. in top gear *with the throttle fully open*. The optimum ignition setting can be obtained by slackening the clamp bolt at the base of the distributor and turning the body clockwise to advance or anti-clockwise to retard the ignition.

It must be remembered, however, that only small deviations from the normal setting outlined above are necessary to effect this compensation.

32 Change Engine Oil and Renew Oil Filter Element

Remove sump drain plug, allow oil to drain and replace plug. Unscrew oil filter centre bolt, remove casing, filter element and rubber sealing ring. Fit new sealing ring and element then refit cleaned casing and securing bolt. Tighten bolt. Remove oil filler cap and clean. Refill engine with approved oil to correct level. Clean and replace oil filler cap. Start engine and check for oil leaks.

33 Clean Sparking Plugs and Set Gaps

The sparking plugs should be cleaned and the gaps set at 0.023 in. (0.584 mm.) for all models although for maximum efficiency it could be advantageous to renew the spark plugs every 10,000 miles (16,000 km.). Ensure that the sparking plugs insulators and leads are clean to prevent 'H.T.' tracking.

34 Lubricate Generator Rear Bearing

Inject a few drops of engine oil through aperture in centre of generator rear end plate.

35 Clean Oil Filler Cap

36 Clean Crankcase Emission Valve

This is located on the right-hand side of the engine compartment to the rear of the carburettor. Disconnect hose and pull valve from grommet. Do not run engine. Remove valve circlip, seal, valve and valve spring. Wash components in petrol and reassemble.

37 Clean Air Cleaner

Dry Gauze Type - Remove top cover. Wash element in petrol, allow to dry, dip in engine oil and shake surplus oil out. Refit element, cover and screw.

Paper Element Type – Remove top cover, withdraw element, shake out and replace. Refit top cover. Renew every 21,000 miles (35,000 km.).

38 Check Battery Condition, Check Connection and Top-up (see Fig. 3)

39 Change Gearbox Oil

Remove drain plug (see Fig. 19) and allow oil to drain. Remove filler and level plug, refill gearbox with approved oil and replace plug.

40 Check Condition of Rear Spring Inserts

41 Check Boot Type Gaiters on Front Suspension and Steering Joints

42 Check Condition of Front Brake Pads

Check for pad wear. Jack up car, remove wheel and measure thickness of pad material. If between $\frac{1}{8}$ to $\frac{1}{16}$ in. (3.18 to 1.59 mm.) renew pads. Refer to operation for packing front wheel bearings.

43 Reposition Road Wheels and Correct Tyre Pressures

Spare to left front, left front to left rear, left rear to right front, right front to right rear, right rear to spare wheel compartment.

44 Lubricate Handbrake Cable in Dash Panel Grommet

45 Check Seat Belts for Security and Wear

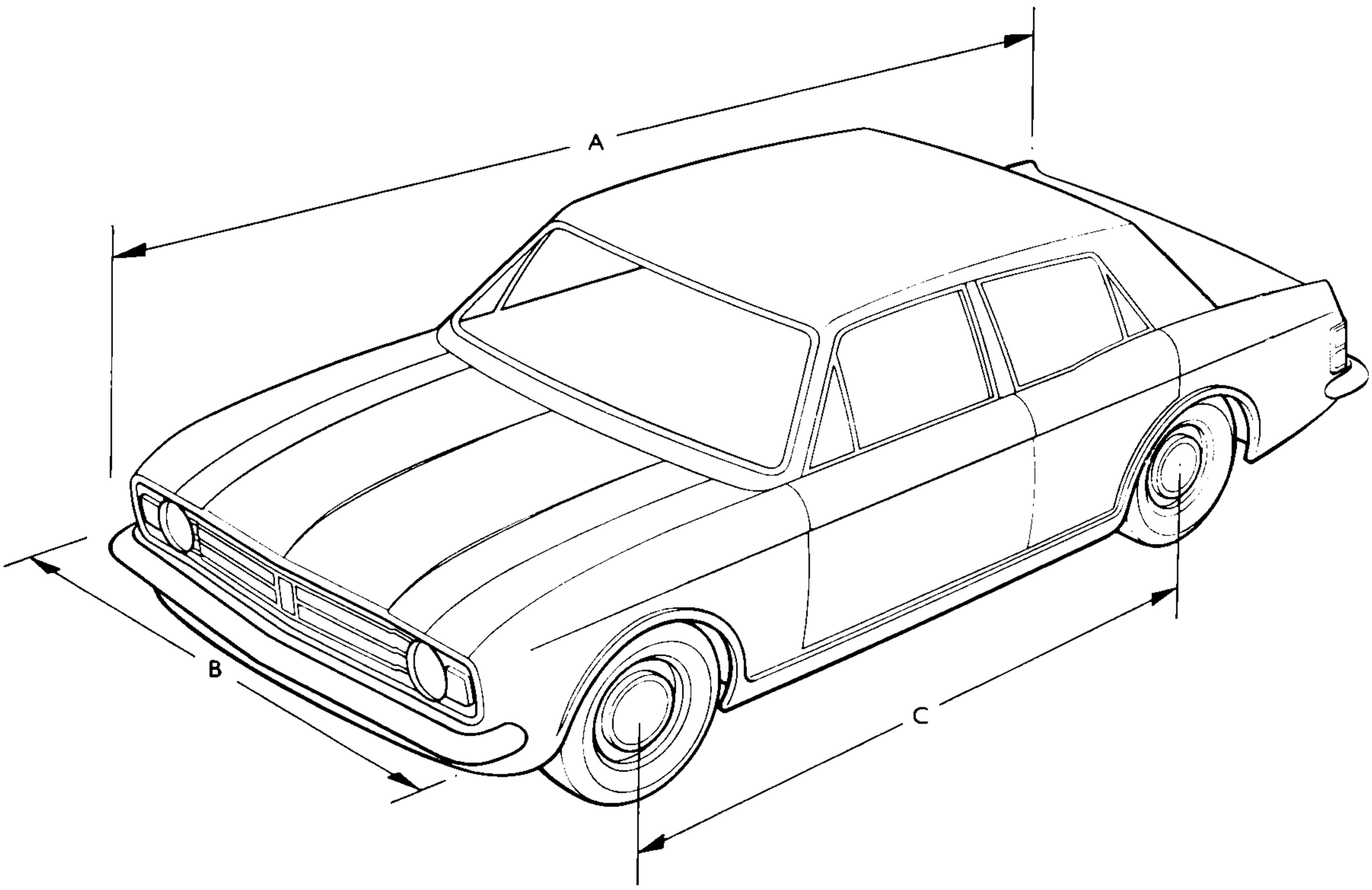
46 Renew Air Cleaner Element (where applicable)

47 Repack and Adjust Front Wheel Bearings

Remove hub cap, slacken wheel nuts, jack up car and remove wheel and dust cap. Withdraw retaining pin clips and pins. Mark brake pads for identification. Remove pads and shims. Unscrew brake fluid pipe connection at bracket on suspension unit, and position suitable container in which to drain off brake fluid. Unscrew calliper mounting bolts, lift away calliper and suitably support. Withdraw split pin, bearing adjusting nut retainer, adjusting nut, thrust washer, outer bearing, hub and inner bearing. Wash all parts and reassemble using lithium base grease in bearings and hub. **Do not completely pack hub - allow for expansion.** Adjust bearings:- Tighten adjusting nut to 27 lb. ft. (3.7 kg.m.) torque, whilst rotating hub. Fit nut retainer. Slacken nut and retainer 90° or 2 castellation slots. Fit new split pin and replace dust cap. Refit calliper (use new tabwasher), reconnect fluid pipe and tighten connection. Tighten calliper bolts to 45 to 50 lb. ft. (6.22 to 6.91 kg.m.). Bend locking tabs. Refit brake pads, shims, retaining pins and clips. Replace wheel, tighten nuts, lower car to ground, check wheel nuts and refit hub cap. Bleed brakes.

14/1

SPECIFICATIONS, SERVICING AND REPAIR DATA



1. WHEELS and TYRES

Tubeless cross-ply tyres, on 4J × 13 wheels, are fitted to all de luxe cars. 4.5J × 13 wheels are fitted to super saloons and all estate cars.

Tyre sizes may be 5.60 or 6.00 × 13 depending on model application. G.T. models use 165 × 13 tubeless radial-ply tyres on 4.5J × 13 wheels, and these tyres and wheels are available on the other models when requested. The 1600E also uses 165 × 13 tyres, on 5.5J × 13 wheels.

2. BRAKES

Hydraulic operation. Front – disc type. Rear – internal expanding drum type, leading and trailing shoe. Footbrake on all four wheels, handbrake on rear wheels only. Dual-line brakes are available for certain export territories.

3. STEERING

High efficiency recirculatory ball type. Ratio 16.4 : 1. Three spoke steering wheel, diameter 15.46 in. (39.4 cm.).

4. REAR AXLE

Semi-floating, pressed steel banjo housing with hypoid final drive. Heavy duty roller and ball bearings. Open type drive shaft. Axle ratio 4.125 : 1 (1,300 c.c.), 3.9 : 1 (1,600 c.c.) and 3.777 : 1 (G.T.).

5/1 FRONT SUSPENSION

Independent front wheel suspension: directly operated coil springs mounted on special double-acting hydraulic shock absorbers, integral with wheel spindle and located on body in bonded rubber upper mount. Lower end of the suspension unit is located by a stabiliser bar and a track control arm.

5/2 REAR SUSPENSION

Longitudinal, asymmetrical semi-elliptic leaf springs with hydraulic double-acting shock absorbers, telescopic type on saloon cars, lever type on estate cars. 1600E models, incorporate radius arms.

6/1 ENGINE

Four cylinder in line, overhead valve, four-stroke, with direct flow cylinder head and "bowl-in-piston" combustion chambers. Cylinder block cast integrally with upper half of crankcase. Push rod operated valves with integral guides. Five-bearing crankshaft with integral weights, dynamically balanced. Separate inlet and exhaust port to each cylinder. Three-ring aluminium alloy piston – two compression and one oil control – chromed top rings. Chain-driven camshaft carried in babbit-lined bearings with mechanical chain tensioner. Three-point suspension of engine and gearbox. Lubrication by externally mounted high efficiency vane or eccentric bi-rotor pump with full flow filter. Positive fully or semi-closed ventilation system. Two-piece exhaust system with two mufflers.

7/1 CLUTCH and GEARBOX

Single dry plate clutch, diaphragm spring, strap drive. Permanently lubricated clutch release bearing, hydraulically operated, self-adjusting.

Four-speed gearbox with synchromesh on all forward gears. Remote floor change gear shift or optional column change with bench seats.

7/2 AUTOMATIC TRANSMISSION

Hydraulically controlled epicyclic gearbox with three speeds and a torque converter.

8. COOLING SYSTEM

Pressurised, thermostatically controlled. Belt drive to fan and water pump. Tube and corrugated fin radiator.

9. FUEL SYSTEM

Camshaft operated mechanical diaphragm pump incorporating sediment bowl. Electrical petrol gauge. Tank capacity on saloon cars is 10 Imp. gallons (12 U.S. gallons, 45.4 litres) and on estate cars is 8 Imp. gallons (9.6 U.S. gallons, 36.3 litres).

Single barrel downdraught carburettors are fitted to 1,300 c.c. and 1,600 c.c. cars. G.T. cars have a duel barrel downdraught carburettor. Cars with automatic transmission incorporate an automatic choke.

(NOTE – In some territories G.T. cars may be available with automatic transmission but these cars would not have an automatic choke.)

10. ELECTRICAL SYSTEM

Charging System

Two-brush ventilated generator, compensated voltage control, "Vee" belt drive, 12 volt battery 38 amp hr. or 57 amp hr. when cold start equipment fitted.

Starting System

One of three types of starter motor may be fitted; Inertia type is standard equipment, Pre-engaged starter fitted when cold start equipment is specified, alternative types of pre-engaged starter fitted to manual and automatic transmission. Starter motor operated by solenoid and controlled by "key start" ignition switch.

Ignition System

Oil filled coil for use with ballast resistor. Distributor with mechanical and vacuum advance. Autolite AG22 spark plugs with suppressed H.T. leads.

Instruments, Lights, Controls and Ancillaries

Instruments located directly in front of the driver in two circular instruments: speedometer incorporating odometer and main beam warning light and fuel and temperature gauges incorporating generator/ignition and oil pressure warning lights.

G.T. cars also have two circular instruments located directly in front of the driver: speedometer incorporating odometer and main beam warning light and tachometer. An additional instrument panel is provided and this incorporates an ammeter, oil pressure, fuel and temperature gauges. A clock is incorporated in the centre console.

Additional warning lights provided on the facia for turn indicators and, where fitted, brake warning light, hazard flasher, parking lights, etc.

(NOTE – Some of these are export only.)

Driving lights include dipping headlights, side lights, tail and stop lights, licence plate lamp, turn indicators.

Key start ignition switch, headlight/sidelight switch, choke control (where fitted), wipers/washers switch, heating and ventilation controls all mounted on facia. Antenna on steering column controls indicators, dipped and main beam, headlamp flasher and horn.

11. ACCESSORIES

A wide range of accessories is available for the Cortina, including radio, fog and pass lamps, overriders, engine and luggage compartment lamps, cigar lighter, mud-flaps, radiator blind, etc. Fitting instructions will be found in section 11.

12. BODYWORK

The body is of all steel welded construction with safety glass in all windows and single curvature windscreen and rear window.

The wide opening doors fitted with bar type check straps, incorporate zero torque door locks. An exterior key-operated lock is provided on the driver's door.

The well proved "Aeroflow" ventilation system is incorporated in the car, therefore fixed quarter lights are normally fitted to the front doors. Opening front door vent windows are available if required as an option.

Seating is within the wheelbase, bucket type front seats are provided with floor gear change. Bench or bucket front seats are available with column change or automatic transmission.

Reclining seats are available as an option on the Super and G.T. Four-door models.

The rear luggage compartment and the estate car tailgate incorporate a self-locking counter-balanced lid, with the spare wheel mounted on the left-hand side of the compartment on saloons, and under the rear floor on estate cars.

13. LUBRICATION and MAINTENANCE

Full details of lubricants and servicing procedures are contained in section 13. The first service is at 600 miles (1,000 km.), the second at 3,000 miles (5,000 km.) continuing at 6,000 miles (10,000 km.) intervals.

14/2 SPECIAL TOOLS

All the special tools needed for the Cortina are listed in this section, each with a brief description.

WEIGHTS and DIMENSIONS

Wheelbase	... 98 in. (2489 mm.)
Overall length—saloon ...	168.0 in. (4267 mm.)
—estate car	169.2 in. (4303 mm.)
Overall width	63.81 in. (1621 mm.)
Overall height	54.7 in. (1389 mm.)
Kerb weight—saloon—1,300 c.c.	1929 lb. (874 kg.)
—1,600 c.c.	1969 lb. (892 kg.)
—G.T.	2032 lb. (921 kg.)
—estate car—1,300 c.c. de luxe ...	2075 lb. (941 kg.)
—1,600 c.c. de luxe ...	2091 lb. (950 kg.)
—1,600 c.c. super	2110 lb. (957 kg.)
Ground clearance (minimum)	... 5.15 in. (131 mm.)
Turning circle	... 30 ft. (9144 mm.)
Track—front	52.5 in. (1330 mm.)
—rear	51.0 in. (1290 mm.)

General Recommended Tightening Torques, lb. ft. (kg.m.)

$\frac{1}{4}$ in.—20 UNC	5 to 7 (0.69 to 0.97)
$\frac{5}{16}$ in.—18 UNC	12 to 15 (1.66 to 2.07)
$\frac{5}{16}$ in.—24 UNF	12 to 15 (1.66 to 2.07)
$\frac{3}{8}$ in.—16 UNC	17 to 22 (2.35 to 3.04)
$\frac{3}{8}$ in.—24 UNF	22 to 27 (3.04 to 3.73)
$\frac{7}{16}$ in.—14 UNC	30 to 35 (4.15 to 4.84)
$\frac{7}{16}$ in.—20 UNF	40 to 45 (5.53 to 6.22)
$\frac{1}{2}$ in.—13 UNC	45 to 50 (6.22 to 6.91)
$\frac{1}{2}$ in.—20 UNF	50 to 60 (6.91 to 8.29)
$\frac{9}{16}$ in.—12 UNC	60 to 70 (8.29 to 9.67)
$\frac{9}{16}$ in.—18 UNF	65 to 75 (8.98 to 10.37)
$\frac{5}{8}$ in.—11 UNC	... 75 to 85 (10.37 to 11.75)
$\frac{5}{8}$ in.—18 UNF	100 to 110 (13.82 to 15.20)

1. WHEELS, HUBS and TYRES

Wheels

Size—with cross-ply tyres on de luxe saloons	4J×13
—with cross-ply tyres on super saloons and estate cars	4.5J×13
—with radial-ply tyres ...	4.5J×13
—1600E	... 5.5J×13

Tyre Usage and Inflation

Model	*Tyre Usage*	*Normal Pressure*		*Fully Laden Pressure*	
		Front	*Rear*	*Front*	*Rear*
1,300 c.c. saloon	5.60×13 Cross-ply	24 (1.7)	24 (1.7)	24 (1.7)	28 (2.0)
	165×13 Radial-ply	24 (1.7)	28 (2.0)	24 (1.7)	28 (2.0)
1,600 c.c. saloon	5.60×13 Cross-ply	24 (1.7)	24 (1.7)	24 (1.7)	28 (2.0)
	165×13 Radial-ply	24 (1.7)	28 (2.0)	24 (1.7)	28 (2.0)
Estate car	6.00×13 Cross-ply	24 (1.7)	24 (1.7)	24 (1.7)	33 (2.3)
	165×13 Radial-ply	24 (1.7)	30 (2.1)	24 (1.7)	30 (2.1)
G.T.	165×13 Radial-ply	24 (1.7)	28 (2.0)	24 (1.7)	28 (2.0)
1600E	165×13 Radial-ply	24 (1.7)	24 (1.7)	24 (1.7)	30 (2.1)

Check Tyre Pressures Frequently

The "cold" pressure (after car has been parked one hour) should be as specified in above table. It is usual for a "hot" tyre to exceed the specified "cold" pressure. Do not let air out of a "hot" tyre.

Sustained High Speed Driving

Vehicles fitted with cross-ply tyres

For sustained high speed driving (one hour or more) over 75 m.p.h. cold inflation pressure must be increased by 4 lb./sq. in. provided that the pressures shown in the maximum tyre pressure column under the heading "Rear Tyres" are not exceeded.

Vehicles fitted with radial-ply tyres

No increase in cold inflation pressure is required for high speed motoring.

For Reliable Vehicle Control always maintain the specified tyre pressures.

2. BRAKING SYSTEM

Type ... Hydraulically operated, disc front, drum rear

Front Brakes

Disc diameter—trailing calliper (all except G.T.)	9.625 in. (24.45 cm.)
—leading calliper (G.T. only)	9.625 in. (24.45 cm.)
Disc thickness—trailing calliper (all except G.T.)	0.38 in. (9.7 mm.)
—leading calliper (G.T. only)	0.50 in. (12.700 mm.)
Disc run-out	0.002 in. (0.05 mm.) T.I.R.
Pad lining area—trailing calliper (all except G.T.)	17.60 sq. in. (115 sq. cm.)
—leading calliper (G.T. only)	20.64 sq. in. (133.2 sq. cm.)
Pad identification—trailing calliper, 1,600 c.c. model	Yellow – Red – Red – Yellow
—leading calliper (G.T. only)	Green – Red – Red – Red
Swept area—trailing calliper (all except G.T.)	171.90 sq. in. (1109.1 sq. cm.)
—leading calliper (G.T. only)	189.50 sq. in. (1222.7 sq. cm.)

Rear Brakes

	8 inch (except G.T.)	**9 inch** (G.T. only)
Drum diameter	8 in. (20.3 cm.)	9 in. (22.9 cm.)
Lining width	1.5 in. (38.1 mm.)	1.75 in. (44.5 mm.)
Lining thickness	0.188 in. (4.78 mm.)	0.188 in. (4.78 mm.)
Lining area (per shoe)	9.43 sq. in. (60.84 sq. cm.)	12 sq. in. (77.4 sq. cm.)
Total swept area	75.5 sq. in. (487.0 sq. cm.)	99.0 sq. in. (639.0 sq. cm.)
Rear wheel cylinder diameter ...	0.70 in. (17.78 mm.)*	0.87 in. (22.10 mm.)

*Only applies to single line system, dual line with 8 in. rear brakes may have rear wheel cylinder diameter 0.7 in. (17.78 m.) or 0.87 in. (22.10 m.) depending on model application (see Braking System, section 2).

Master Cylinder

Bore diameter—1,300 and 1,600 c.c. (single line)	0.625 in. (15.875 mm.)
—G.T. (single line)	0.70 in. (17.78 mm.)
—Dual line depending on model application	0.70 in. (17.78 mm.), 0.75 in. (19.05 mm.), 0.875 in. (22.22 mm.), 0.812 in. (20.64 mm.)
Stroke (maximum) depending on model application	1.375 in. (34.93 mm.) or 1.22 in. (30.99 mm.)

Tightening Torques, lb. ft. (kg.m.)

Brake calliper to front suspension unit	45 to 50 (6.22 to 6.91)
Rear back plate to axle housing ...	15 to 18 (2.07 to 2.49)
Hydraulic unions	5 to 7 (0.69 to 1.00)
Bleed valves	5 to 7 (0.69 to 1.00)
Road wheel nuts to hub studs	50 to 55 (6.91 to 7.60)
Front brake disc to hub	30 to 34 (4.15 to 4.70)

3. STEERING GEAR

Type	Recirculating ball
Lubricant	S.A.E. 90 E.P.
Lubricant capacity	420 c.c.
Ratio (steering box) at straight ahead position	16.4 : 1
Number of turns of steering wheel, lock to lock	$4\frac{1}{2}$ approx.
Steering wheel diameter	$15\frac{1}{2}$ in. (40.4 cm.)
Steering shaft bearing adjustment	Shims
Steering shaft bearing pre-load	0.002 to 0.004 in. (0.051 to 0.102 mm.)
Steering shaft shim thickness and identification:	
105E-3592-B ... ... Paper	0.010 in. (0.254 mm.)
105E-3595-A ... ... Steel	0.004 in. (0.102 mm.)
105E-3595-B ... ... Steel	0.010 in. (0.254 mm.)
3014E-3595-A ... ... Steel	0.002 in. (0.051 mm.)
Rocker shaft end-float adjustment	Adjusting stud and locknut
Rocker shaft bush diameter (finish)	0.8755 to 0.8765 in. (22.24 to 22.26 mm.)
Number of balls in nut	13
Diameter	$\frac{5}{16}$ in. (7.94 mm.)
Number of balls in bearings (each)	12
Diameter	$\frac{7}{32}$ in. (5.56 mm.)

Wheel Alignment (unladen)

	Standard	*Heavy Duty*
Castor—saloon	—0° 54′ to 0° 36′	0° 07′ to 1° 37′
Camber	1° 00′ to 2° 30′	1° 35′ to 3° 05′
King pin inclination	6° 23′ to 7° 53′	5° 47′ to 7° 17′
Maximum theoretical wheel lock angles—back lock ...	41° 50′	
—front lock ...	37° 30′	
Wheel lock angles, setting figures—back lock	35°	
—front lock	32° 15′ to 33° 15′	
Toe-in (Service setting)*	0.10 to 0.20 in. (2.8 to 5.2 mm.) (26′ to 52′ included angle)	
Toe-in (Production setting)*	0.06 to 0.25 in. (1.5 to 6.4 mm.) (16′ to 1° 6′ included angle)	

* The Production toe-in setting should be used prior to the 500 mile (1,000 km.) service only. From and including that service, the Service setting must be used.

Tightening Torques, lb. ft. (kg.m.)

Idler arm bracket to body	25 to 30 (3.4 to 4.1)
Drop arm nut	60 to 80 (8.2 to 11.0)
Steering wheel nut	20 to 25 (2.7 to 3.4)
Steering spindle arm to front suspension unit ...	30 to 35 (4.1 to 4.8)
Steering and idler arm joints	25 to 30 (3.4 to 4.1)
Steering gear to body	25 to 30 (3.4 to 4.1)
Steering gear top cover	18 to 20 (2.5 to 2.7)

4. REAR AXLE

Type	Semi-floating hypoid
Axle ratio:—	
1,300 c.c. models—standard ...	4.125 : 1
—optional ...	4.444 : 1
1,600 c.c. models—standard ...	3.900 : 1
—optional ...	4.125 : 1
1,600 c.c. G.T.	3.777 : 1
Number of teeth on crown wheel:—	
4.444 : 1 ratio	40
4.125 : 1 ratio	33
3.900 : 1 ratio	39
3.777 : 1 ratio	34
Number of teeth on pinion:—	
4.444 : 1 ratio	9
4.125 : 1 ratio	8
3.900 : 1 ratio	10
3.777 : 1 ratio	9
Crown wheel and pinion backlash	0.005 to 0.007 in. (0.127 to 0.178 mm.)
*Pinion bearing pre-load	20 to 26 lb. in. (0.230 to 0.299 kg.m.) including oil seal drag 13 to 19 lb. in. (0.150 to 0.219 kg.m.) without oil seal drag
*Differential bearing pre-load (cap spread)	0.008 to 0.010 in. (0.200 to 0.250 mm.)

*If the part-used original bearings are used, then the pre-loads should be set to half these figures.

Differential pinion thrust washer thickness ...	... 0.030 to 0.032 in. (0.762 to 0.813 mm.)
Differential pinion inside diameter	0.628 to 0.630 in. (15.953 to 16.004 mm.)
Oil capacity	2 Imp. pints (2.4 U.S. pints, 1.1 litres)
Grade of oil (Summer and Winter)	... ... S.A.E. 90 Hypoid
"Initial fill" lubricant	... ... EM-2C-29
Grade of (topping-up) lubricant	... ... S.A.E. 90 hypoid gear oil

Pinion Bearing Shims

105E-4672-A	0.1304 to 0.1308 in. (3.312 to 3.322 mm.)
2925E-4672-AA	0.1309 to 0.1313 in. (3.325 to 3.335 mm.)
105E-4672-B	0.1314 to 0.1318 in. (3.338 to 3.348 mm.)
2925E-4672-AB	0.1319 to 0.1323 in. (3.350 to 3.360 mm.)
105E-4672-C	0.1324 to 0.1328 in. (3.363 to 3.373 mm.)
2925E-4672-AC	0.1329 to 0.1333 in. (3.376 to 3.386 mm.)
105E-4672-D	0.1334 to 0.1338 in. (3.388 to 3.399 mm.)
2925E-4672-AD	0.1339 to 0.1343 in. (3.401 to 3.411 mm.)
105E-4672-E	0.1344 to 0.1348 in. (3.414 to 3.424 mm.)
2925E-4672-AE	0.1349 to 0.1353 in. (3.426 to 3.437 mm.)
105E-4672-F	0.1354 to 0.1358 in. (3.439 to 3.449 mm.)
2925E-4672-AF	0.1359 to 0.1363 in. (3.452 to 3.462 mm.)
105E-4672-G	0.1364 to 0.1368 in. (3.465 to 3.475 mm.)
2925E-4672-AG	0.1369 to 0.1373 in. (3.477 to 3.487 mm.)
105E-4672-H	0.1374 to 0.1378 in. (3.490 to 3.506 mm.)
2925E-4672-AH	0.1379 to 0.1383 in. (3.503 to 3.513 mm.)
105E-4672-J	0.1384 to 0.1388 in. (3.515 to 3.526 mm.)
2925E-4672-AJ	0.1389 to 0.1393 in. (3.528 to 3.538 mm.)
105E-4672-K	0.1394 to 0.1398 in. (3.541 to 3.551 mm.)
2925E-4672-AK	0.1399 to 0.1403 in. (3.553 to 3.564 mm.)
105E-4672-L	0.1404 to 0.1408 in. (3.566 to 3.576 mm.)
2925E-4672-AL	0.1409 to 0.1413 in. (3.579 to 3.589 mm.)
105E-4672-M	0.1414 to 0.1418 in. (3.592 to 3.602 mm.)
2925E-4672-AM	0.1419 to 0.1423 in. (3.604 to 3.614 mm.)
105E-4672-N	0.1424 to 0.1428 in. (3.617 to 3.627 mm.)
2925E-4672-AN	0.1429 to 0.1433 in. (3.630 to 3.640 mm.)
105E-4672-R	0.1434 to 0.1438 in. (3.642 to 3.653 mm.)
2925E-4672-AR	0.1439 to 0.1443 in. (3.655 to 3.665 mm.)
105E-4672-T	0.1444 to 0.1448 in. (3.668 to 3.678 mm.)
2925E-4672-AT	0.1449 to 0.1453 in. (3.680 to 3.691 mm.)

Tightening Torques, lb. ft. (kg.m.)

Crown wheel to differential case bolts	... 50 to 55 (6.931 to 7.600)
Differential carrier to axle housing nuts	... 15 to 18 (2.074 to 2.489)
Differential bearing locking plate bolts	... 12 to 15 (1.659 to 2.074)
Differential bearing cap bolts	... 45 to 50 (6.221 to 6.931)
Axle shaft bearing retainer bolts	... 15 to 18 (2.074 to 2.489)
Universal joint flange to pinion flange	... 15 to 18 (2.074 to 2.489)
Rear axle filler plug	... 25 to 30 (3.460 to 4.148)
Axle shaft bearing assembly pressure (minimum) ...	... ... 1,200 lb. (544 kg.)
Axle shaft bearing retainer pressure (minimum) ...	... ... 1,500 lb. (680 kg.)

5/1. FRONT SUSPENSION

Front Suspension Springs

Part Number	*Identification*	*Model Application*
3014E-5310-B	Green ...	Standard
3016E-5310-A	Brown ...	G.T. and H.D. G.T.
3014E-5310-A	Yellow ...	H.D. only

Front Suspension Units

Part Number	*Position*	*Identification*	*Model Application*
68BB-3K033-HA	R.H.	Green & White	G.T.
68BB-3K034-HA	L.H.	Green & White	G.T.
3036E-3K033-F	R.H.	Yellow & White	H.D. G.T.
3036E-3K034-F	L.H.	Yellow & White	H.D. G.T.
68BB-3K033-FA	R.H.	Red & White	Standard
68BB-3K034-FA	L.H.	Red & White	Standard
3034E-3K033-G	R.H.	Blue & White	H.D.
3034E-3K034-G	L.H.	Blue & White	H.D.

Bump Rubbers

Part Number	*Model Application*
69AB-3025-AA	Standard except G.T.

NOTE – The G.T. is only fitted with Bump Rubbers for heavy duty applications.

*Load—1,300/1,600 c.c. (Green)	582 lb. (263.99 kg.)
—G.T. Std./H.D. (Brown)	599 lb. (271.70 kg.)
—Heavy Duty (Yellow) (except G.T.)	582 lb. (263.99 kg.)
Deflection rate—1,300/1,600 c.c. inc. Estate cars	74 lb./in. (13.30 kg./cm.)
—G.T. (inc. Heavy Duty G.T.)	139 lb./in. (24.90 kg./cm.)
—Heavy Duty	98 lb./in. (17.60 kg./cm.)
Wheel travel—Jounce	3.75 in. (9.22 cm.)
—Rebound	4.27 in. (10.86 cm.)
Mean diameter of coils	4.84 in. (12.29 cm.)
Wire diameter—1,300/1,600 c.c. inc. Estate cars	0.438 in. (11.13 mm.)
—G.T. (inc. Heavy Duty G.T.)	0.492 in. (12.50 mm.)
—Heavy Duty	0.460 in. (11.68 mm.)
Shock absorber type	Direct double-acting telescopic
Fluid capacity	350 c.c.
Fluid—type	M-100502-E
Bore diameter	1.25 in. (3.18 cm.)
Stroke	8.16 in. (20.72 cm.)

*Normal Laden Condition

5/2. REAR SUSPENSION

Type	Semi-elliptic leaf spring with radius arms on 1600E and early G.T. models
Spring length (between eye centres)	47 in. (114.4 cm.)
Width of leaves	2 in. (5.1 cm.)

Rear Springs

Model	*Part Number*	*Number of Leaves*
Saloon (not H.D.) ...	3050E-5560-A ...	3
(H.D.) ...	3050E-5560-B ...	4
G.T. (not H.D.) ...	3050E-5560-C ...	4
(H.D.)	3050E-5560-D ...	5
Estate Car (not H.D.)	3050E-5560-F ...	5
(H.D.) ...	3050E-5560-G ...	6

Rear Shock Absorbers

Model	*Part Number*	*Colour Code*
Saloon (not H.D.) ...	3014E-18080-D	... White and Brown
	or 3004E-18080-B	
(H.D.) ...	3014E-18080-E	... Red and Blue
	or 3004E-18080-C	
G.T. (not H.D.) ...	3014E-18080-D	... White and Brown
	or 3004E-18080-B	
(H.D.)	3014E-18080-E	... Red and Blue
	or 3004E-18080-C	
Estate Car—L.H.	3014E-18K004-A	—
—R.H.	3014E-18080-C	—

Rate—1,300 and 1,600 c.c. saloons and G.T. (inc. Heavy Duty) ... ... 85 lb./in. (15.30 kg./cm.)
—Estate cars (inc. Heavy Duty) ... ... 90 to 180 lb./in. (16.20 to 32.4 kg./cm.)

Wheel Travel:

Jounce	—1,300 and 1,600 c.c. saloons and G.T.	3.3 in. (8.38 cm.)
	—Estate cars	3.03 in. (7.63 cm.)
	—1,300 and 1,600 c.c. saloons and G.T. Heavy Duty	4.05 in. (10.17 cm.)
	—Estate cars, Heavy Duty	3.78 in. (9.42 cm.)
Rebound	—1,300 and 1,600 c.c. saloons	5.5 in. (13.97 cm.)
	—G.T.	5.4 in. (13.72 cm.)
	—Estate cars	5.37 in. (13.48 cm.)
	—1,300 and 1,600 c.c. saloons, Heavy Duty	4.98 in. (12.46 cm.)
	—G.T., Heavy Duty	4.90 in. (12.44 cm.)
	—Estate cars, Heavy Duty	5.37 in. (13.48 cm.)
*Load	—1,300, 1,600 c.c. and G.T. (inc. Heavy Duty)	560 lb. (255 kg.)
	—Estate cars (inc. Heavy Duty)	803 lb. (366 kg.)

Tightening Torques, lb. ft. (kg.m.)

*Stabiliser bar attachment clamp bushing ...	...	15 to 20 (2.07 to 2.76)
*Stabiliser to front track control arm nut ...	...	25 to 30 (3.46 to 4.15)
Front suspension upper mount retaining nut	...	20 to 25 (2.76 to 3.46)
Front suspension unit upper support ...	...	15 to 18 (2.07 to 2.49)
Front track control arm ball stud	...	30 to 35 (4.15 to 4.84)
*Front track control arm inner bushing ...	...	22 to 27 (3.04 to 3.73)
Shock absorber to body	...	25 to 30 (3.46 to 4.15)
*Rear spring 'U' bolts	...	20 to 35 (2.76 to 3.46)
*Rear spring front hanger	...	25 to 30 (3.46 to 4.15)

*Rear spring shackle nuts	12 to 15 (1.66 to 2.07)
*Shock absorber to rear axle	40 to 45 (5.53 to 6.22)
*Radius arm to axle (G.T. and 1600E only)	22 to 37 (3.04 to 3.73)
*Radius arm to body (G.T. and 1600E only)	45 to 50 (6.22 to 6.91)

*To be tightened in kerb weight position, i.e. the car resting on its wheels.

6/1. ENGINE

General

Type ...	... 4 cylinder-in-line O.H.V.
Bore	3.1881 in. (80.978 mm.)
Stroke—1,300 c.c. ...	2.480 in. (62.99 mm.)
—1,600 c.c.	3.056 in. (77.62 mm.)
Cubic capacity—1,300 c.c.	79.2 cu. in. (1,298 c.c.)
—1,600 c.c.	97.6 cu. in. (1,599 c.c.)
Compression ratio—High	... 9 : 1
—Low	... 8 : 1
—G.T.	... 9 : 1
Compression pressure—1,300 c.c. H.C.	168 lb./sq. in. (11.81 kg./sq. cm.) at 360 rev./min.
—1,300 c.c. L.C. ...	157 lb./sq. in. (11.04 kg./sq. cm.) at 360 rev./min.
—1,600 c.c. H.C. and G.T.	188 lb./sq. in. (13.22 kg./sq. cm.) at 300 rev./min.
—1,600 c.c. L.C. ...	170 lb./sq. in. (11.95 kg./sq. cm.) at 300 rev./min.
Maximum brake horsepower—1,300 c.c.—9 : 1 c.r.	... 61.5 (gross) / 58 (nett) at 5,000 rev./min.
—8 : 1 c.r. ...	... 57 (gross) / 53.5 (nett) at 5,000 rev./min.
—1,600 c.c.—9 : 1 c.r. ...	... 75 (gross) / 71 (nett) at 5,000 rev./min.
—8 : 1 c.r. ...	... 74 (gross) / 69.5 (nett) at 5,000 rev./min.
—G.T. —9 : 1 c.r. ...	... 93 (gross) / 88 (nett) at 5,400 rev./min.
Maximum torque—1,300 c.c.—9 : 1 c.r. ...	... 75.5 lb. ft. (10.434 kg.m.) (gross) / 71.5 lb. ft. (9.88 kg.m.) (nett) at 2,500 rev./min.
—8 : 1 c.r. ...	... 72 lb. ft. (10.0 kg.m.) (gross) / 68 lb. ft. (9.45 kg.m.) (nett) at 2,500 rev./min.
—1,600 c.c.—9 : 1 c.r. ...	... 97 lb. ft. (13.41 kg.m.) (gross) / 91.5 lb. ft. (12.64 kg.m.) (nett) at 2,500 rev./min.
—8 : 1 c.r. ...	... 93 lb. ft. (12.9 kg.m.) (gross) / 87.5 lb. ft. (12.1 kg.m.) (nett) at 2,500 rev./min.
—G.T. —9 : 1 c.r. ...	... 102 lb. ft. (14.10 kg.m.) (gross) / 96 lb. ft. (13.27 kg.m.) (nett) at 3,600 rev./min.
Idling speed—except G.T.	... ... 580 to 620 rev./min.
—G.T. only ...	680 to 720 rev./min.

Minimum stable vacuum at idling speed—except G.T.	18 in. (45.7 cm.) Hg.
—G.T. only	16 in. (40.6 cm.) Hg.
Maximum vacuum variation at idling speed	2 in. (5.1 cm.) Hg.
Firing order	1, 2, 4, 3
Location of No. 1 cylinder	Next to radiator
Engine mounting	3-point suspension on sandwich type bonded rubber mountings

Camshaft

Material	Special Ford cast iron alloy
Drive	Single roller chain, with tensioner
Sprocket location	Offset dowel and two bolts
Bearings	Steel back, white metal bush
Oversize bearing available	0.020 in. (0.513 mm.) o/s on O.D. Std. I.D.
Journal diameter	1.5597 to 1.5605 in. (39.617 to 39.637 mm.)
Bearing—inside diameter	1.5615 to 1.5620 in. (39.662 to 39.675 mm.)
Bearing length—Front and rear	0.79 in. (20.13 mm.)
—Centre	0.68 in. (17.31 mm.)
Bearing clearance	0.001 to 0.0023 in. (0.025 to 0.058 mm.)
Bearing bore in cylinder block	1.6885 to 1.6895 in. (42.888 to 42.913 mm.) Std.
End-float	0.0025 to 0.0075 in. (0.064 to 0.191 mm.)
Thrust plate thickness	0.176 to 0.178 in. (4.47 to 4.52 mm.)
Maximum cam lift—Except G.T.—Inlet	0.2108 in. (5.350 mm.)
—Exhaust	0.2176 in. (5.523 mm.)
—G.T. only—Inlet	0.2309 in. (5.865 mm.)
—Exhaust	0.2321 in. (5.905 mm.)
Cam heel to toe dimension—Except G.T.—Inlet	1.3308 in. (33.802 mm.)
—Exhaust	1.3176 in. (33.467 mm.)
—G.T. only—Inlet	1.3109 in. (33.277 mm.)
—Exhaust	1.3121 in. (33.327 mm.)

Connecting Rods and Big End Bearings

Type		"H" section steel forging	
		1,300 c.c.	**1,600 c.c.**
Weight—Small end	(White)	248 to 250 grams	268 to 270 grams
	(Standard)	250 to 254 grams	270 to 274 grams
	(Blue)	254 to 256 grams	274 to 276 grams
—Big End	(White)	359 to 361 grams	363 to 365 grams
	(Standard)	361 to 365 grams	365 to 369 grams
	(Blue)	365 to 367 grams	369 to 371 grams
—Total	(White)	603 to 611 grams	627 to 635 grams
	(Standard)	611 to 619 grams	635 to 643 grams
	(Blue)	619 to 627 grams	643 to 651 grams
Length between centres—1,300 c.c.		4.133 to 4.135 in. (104.98 to 105.03 mm.)	
—1,600 c.c.		4.927 to 4.929 in. (125.15 to 125.20 mm.)	
Big end bearings		Steel back copper/lead, lead/bronze or aluminium/tin liners (optional in pairs)	
Big end bore		2.0825 to 2.0830 in. (52.896 to 52.908 mm.)	
Bearing liner wall thickness		0.0719 to 0.07225 in. (1.8269 to 1.8347 mm.)	
Undersize bearings available		0.002 in. (0.05 mm.), 0.010 in. (0.25 mm.), 0.020 in. (0.51 mm.), 0.030 in. (0.76 mm.), 0.040 in. (1.02 mm.) on I.D.	

Crankpin to bearing clearance	0.0009 to 0.0029 (0.0229 to 0.0737 mm.)
End-float on crankpin	0.004 to 0.010 in. (0.10 to 0.25 mm.)
Effective bearing length	0.83 to 0.87 in. (21.1 to 22.1 mm.)
Small end bush	Steel backed bronze
Small end bush inside diameter	Graded
Grade—White	0.8121 to 0.8122 in. (20.627 to 20.630 mm.)
—Red	0.8122 to 0.8123 in. (20.630 to 20.632 mm.)
—Yellow	0.8123 to 0.8124 in. (20.632 to 20.635 mm.)
—Blue	0.8124 to 0.8125 in. (20.635 to 20.638 mm.)

Crankshaft and Main Bearings

Material	Nodular Graphite Cast Iron
Main bearing journal diameter—BLUE	2.1253 to 2.1257 in. (53.983 to 53.993 mm.)
—RED	2.1257 to 2.1261 in. (53.993 to 54.003 mm.)
—GREEN	2.1153 to 2.1157 in. (53.729 to 53.739 mm.)
—YELLOW	2.1157 to 2.1161 in. (53.739 to 53.749 mm.)
Regrind diameters—0.010 in. (0.25 mm.) u/s	2.1152 to 2.1157 in. (53.726 to 53.739 mm.)
—0.020 in. (0.51 mm.) u/s	2.1055 to 2.1060 in. (53.480 to 53.492 mm.)
—0.030 in. (0.76 mm.) u/s	2.0955 to 2.0960 in. (53.226 to 53.238 mm.)
Main journal length—Front	1.219 to 1.239 in. (30.96 to 31.47 mm.)
—Centre	1.247 to 1.249 in. (31.67 to 31.73 mm.)
—Rear	1.308 to 1.318 in. (33.22 to 33.48 mm.)
—Intermediates	1.273 to 1.283 in. (32.33 to 32.59 mm.)
Main journal fillet radius—Front, Intermediate and Rear	0.096 to 0.110 in. (2.40 to 2.79 mm.)
—Centre	Double radius of 0.07 and 0.08 in. (1.8 and 2.0 mm.)
Main bearings—Except G.T.	Steel back white metal liners
—G.T. only	Steel back copper/lead, lead/bronze or aluminium/tin liners (optional in sets)
Undersize bearings available	0.010 in. (0.25 mm.), 0.020 in. (0.51 mm.), 0.030 in. (0.76 mm.) on I.D.
Oversize bearings available	0.015 in. (0.38 mm.) o/s on O.D., (each size)
Bearing bore in cylinder block	2.2710 to 2.2715 in. (57.68 to 57.70 mm.) Std.
Crank throw—1,300 c.c.	1.238 to 1.242 in. (31.44 to 31.54 mm.)
—1,600 c.c.	1.526 to 1.530 in. (38.76 to 38.86 mm.)
Crankpin journal diameter	1.9368 to 1.9376 in. (49.20 to 49.213 mm.)
Crankpin journal length	1.062 to 1.066 in. (26.975 to 27.076 mm.)
Crankpin journal fillet radius	0.070 to 0.084 in. (1.78 to 2.13 mm.)
Crankshaft end-float	0.003 to 0.011 in. (0.08 to 0.28 mm.)
Thrust washers	Steel back white metal half washer
Thrust washer thickness	0.091 to 0.093 in. (2.31 to 2.36 mm.)
Spigot bearing bore	0.826 to 0.827 in. (20.98 to 21.01 mm.)

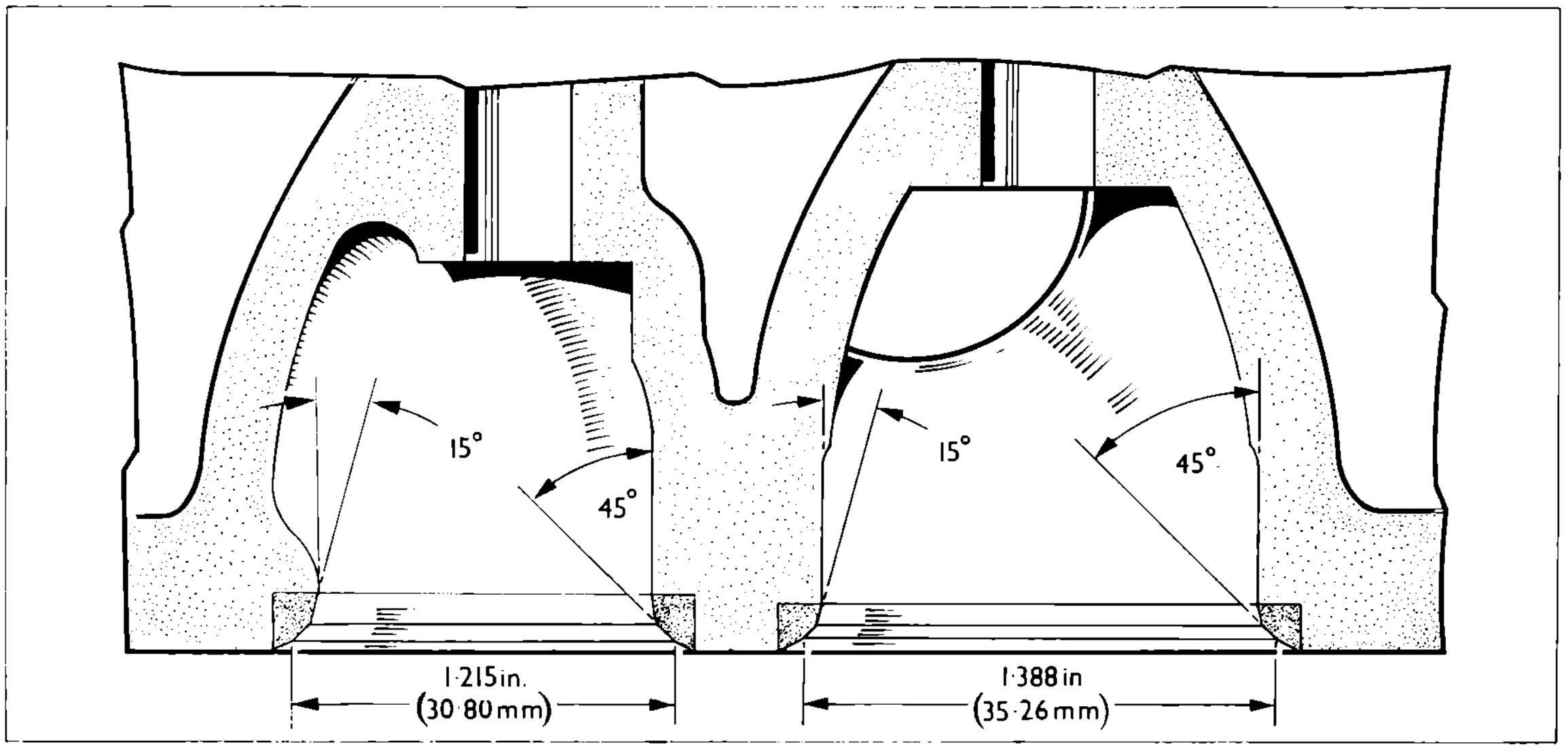
Cylinder Block

Type	Cylinder cast integral with top half of crankcase
Material	Ford cast iron alloy
Water jackets	Full length
Height, sump face to head face—1,300 c.c.	7.224 to 7.229 in. (183.49 to 183.62 mm.)
—1,600 c.c.	8.326 to 8.331 in. (211.48 to 211.61 mm.)

Standard cylinder bore diameter	Graded
Grade point ...	Across block, 2.338 in. (59.39 mm.) from head face
Grade—0	3.1869 to 3.1872 in. (80.948 to 80.955 mm.)
—1	3.1872 to 3.1875 in. (80.955 to 80.963 mm.)
—2	3.1875 to 3.1878 in. (80.963 to 80.970 mm.)
—3	3.1878 to 3.1881 in. (80.970 to 80.978 mm.)
—4	3.1881 to 3.1884 in. (80.978 to 80.986 mm.)
—5	3.1884 to 3.1887 in. (80.986 to 80.993 mm.)
—6	3.1887 to 3.1890 in. (80.993 to 81.001 mm.)
—7	3.1890 to 3.1893 in. (81.001 to 81.008 mm.)
Cylinder liners available	Std. and 0.020 in. (0.51 mm.) o/s on O.D.
Bore for cylinder liners ...	3.3115 to 3.3125 in. (84.112 to 84.138 mm.) Std.

Cylinder Head

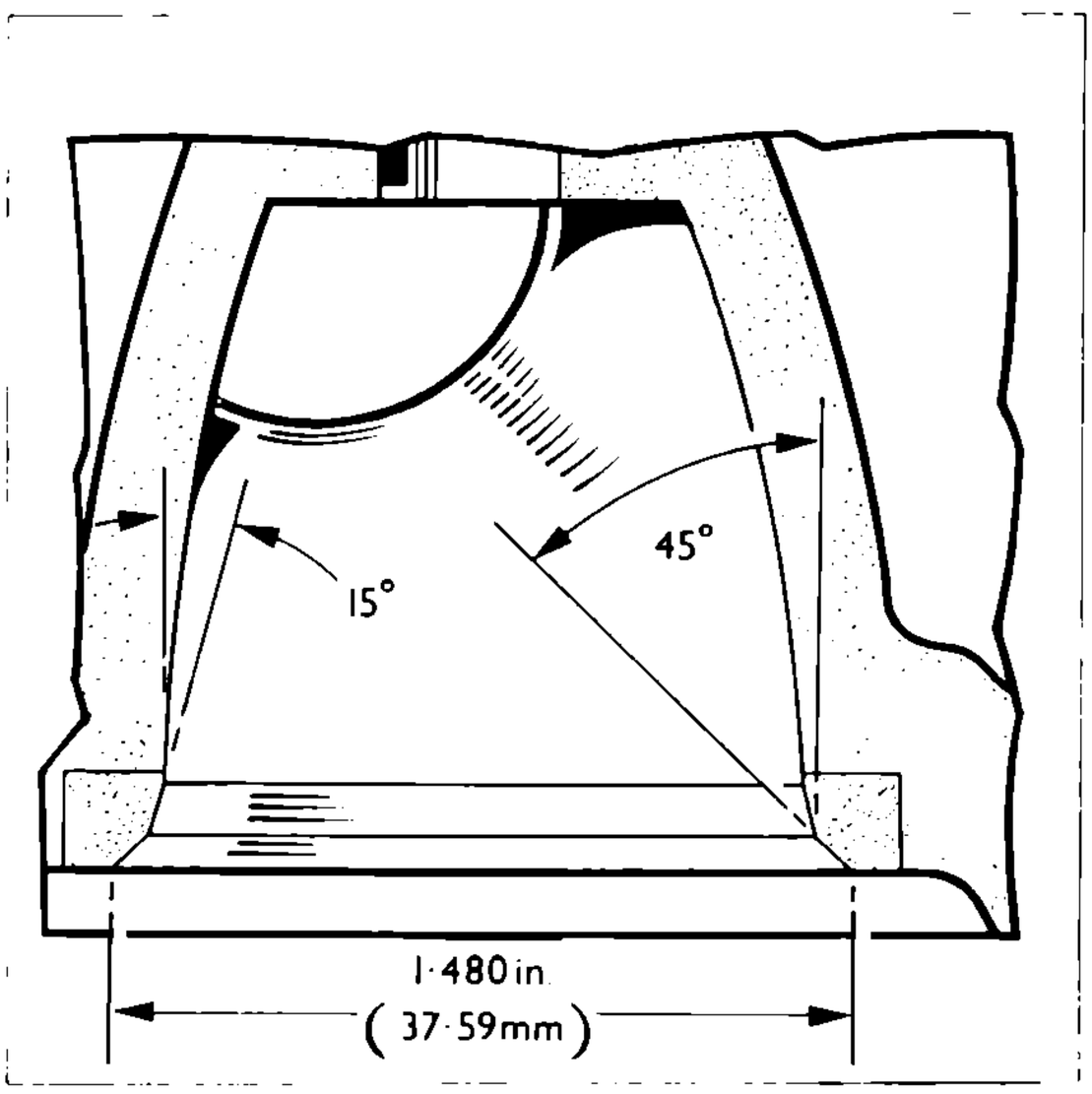
Type	Cast iron with vertical valves. Separate inlet and exhaust ports
Valve guides ...	... Machined directly in the head but guide bushes are available
Bore for guide bushes ...	... 0.4383 to 0.4391 in. (11.133 to 11.153 mm.)
Valve guide inside diameter	0.3113 to 0.3125 in. (7.907 to 7.938 mm.)
Valve guide length—Inlet	1.82 to 1.84 in. (46.2 to 46.7 mm.)
—Exhaust	2.07 to 2.09 in. (52.6 to 53.1 mm.)
Valve seat angle ...	... 44° 30′ to 45° inlet and exhaust
Valve seat width—Inlet ...	$\frac{1}{16}$ in. (1.59 mm.)
—Exhaust	$\frac{5}{64}$ in. (1.98 mm.)



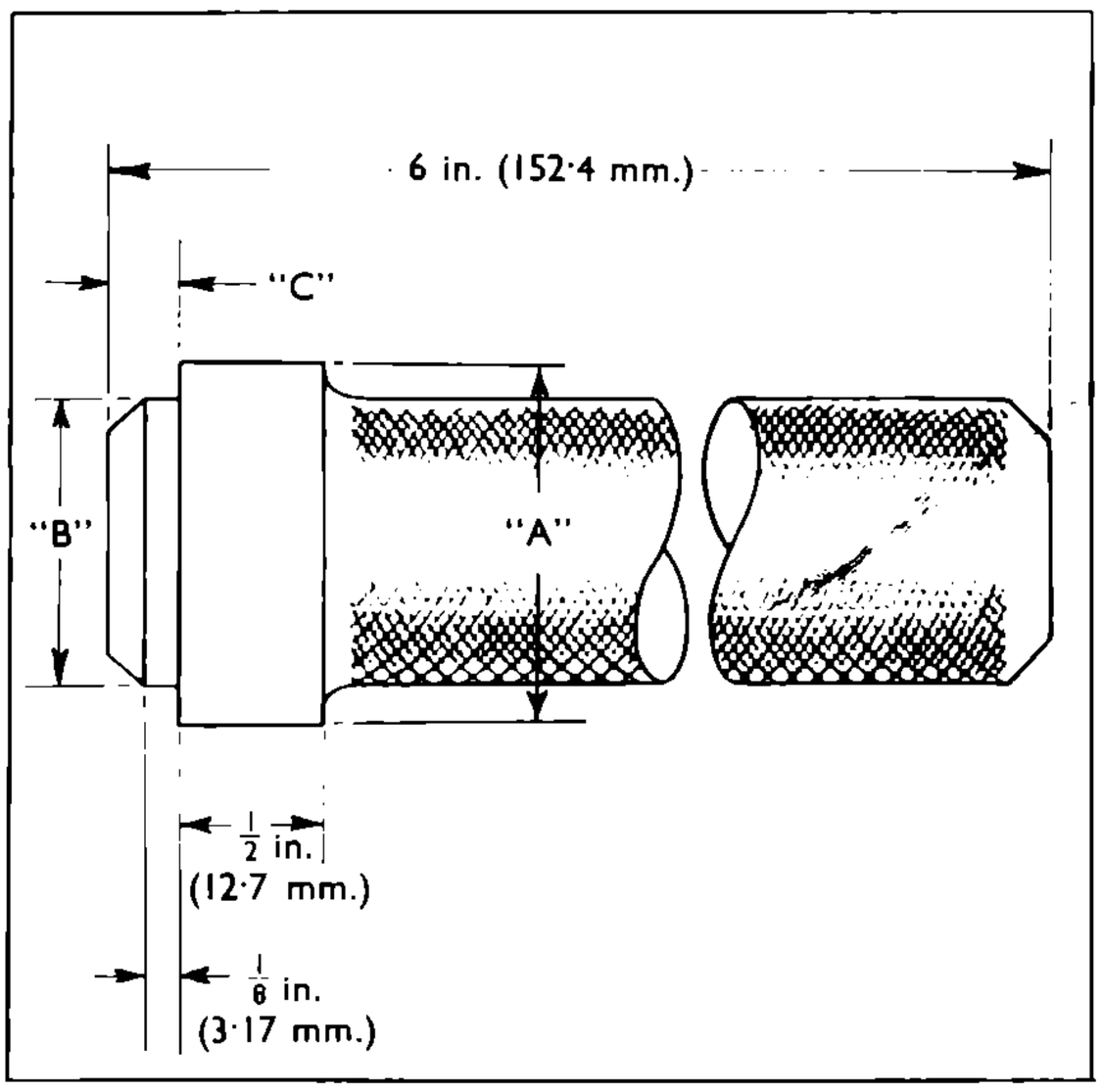
Valve Seat Insert Machining Dimensions (except 1600) inlet

Valve Seat Inserts

Insert	*Valve*	*I.D. of Recess in Head*	*Depth of Recess in Head*
Standard	Inlet (1,300)	1.5620 to 1.5625 in. (39.675 to 39.688 mm.)	0.1765 to 0.1815 in. (4.48 to 4.57 mm.)
	Inlet (1,600)	1.6690 to 1.6695 in. (42.393 to 42.405 mm.)	0.2165 to 0.2215 in. (5.499 to 5.626 mm.)
	Exhaust	1.2680 to 1.2685 in. (32.207 to 32.220 mm.)	0.2175 to 0.2225 in. (5.521 to 5.654 mm.)
0.010 in. (0.25 mm.) o/s dia. std. depth	Inlet (1,300)	1.5720 to 1.5725 in. (39.815 to 39.942 mm.)	0.1765 to 0.1815 in. (4.48 to 4.57 mm.)
	Inlet (1,600)	1.6790 to 1.6795 in. (42.647 to 42.659 mm.)	0.2165 to 0.2215 in. (5.499 to 5.626 mm.)
	Exhaust	1.2780 to 1.2785 in. (32.461 to 32.474 mm.)	0.2175 to 0.2225 in. (5.521 to 5.654 mm.)
0.010 in. (0.25 mm.) o/s dia. and depth	Inlet (1,300)	1.5720 to 1.5725 in. (29.815 to 39.942 mm.)	0.1865 to 0.1915 in. (4.74 to 4.86 mm.)
	Inlet (1,600)	1.6790 to 1.6795 in. (42.647 to 42.659 mm.)	0.2265 to 0.2315 in. (5.753 to 5.880 mm.)
	Exhaust	1.2780 to 1.2785 in. (32.461 to 32.474 mm.)	0.2275 to 0.2325 in. (5.781 to 5.904 mm.)
0.020 in. (0.51 mm.) o/s dia. std. depth	Inlet (1,300)	1.5820 to 1.5825 in. (40.069 to 40.196 mm.)	0.1765 to 0.1815 in. (4.48 to 4.57 mm.)
	Inlet (1,600)	1.6890 to 1.6895 in. (42.901 to 42.913 mm.)	0.2165 to 0.2215 in. (5.499 to 5.626 mm.)
	Exhaust	1.2880 to 1.2885 in. (32.715 to 32.728 mm.)	0.2175 to 0.2225 in. (5.521 to 5.664 mm.)



1600 Inlet Valve Seat Insert Machining Dimensions



Valve Seat Insert Replacer

Valve Seat Inserts — *cont.*

Insert	*Valve*	*I.D. of Recess in Head*	*Depth of Recess in Head*
0.020 in. (0.51 mm.) o/s dia. and depth	Inlet (1,300)	1.5820 to 1.5825 in. (40.069 to 40.196 mm.)	0.1965 to 0.2015 in. (4.99 to 5.12 mm.)
	Inlet (1,600)	1.6890 to 1.6895 in. (42.901 to 42.913 mm.)	0.2365 to 0.2415 in. (6.007 to 6.134 mm.)
	Exhaust	1.2880 to 1.2885 in. (32.715 to 32.728 mm.)	0.2375 to 0.2425 in. (6.031 to 6.164 mm.)

Flywheel and Ring Gear

Type	Ring gear shrunk on
Number of teeth on ring gear—inertia type starter ...	110
—pre-engaged type starter	132
Ring gear fitting temperature	600°F (316°C)
Maximum run-out	0.005 in. (0.13 mm.)
Clutch pilot spigot bearing	Sintered bronze
Torque converter spigot bush	Not required
Flywheel weight—1,300 and 1,600 c.c. (L.C. and U.K. only)	26 lb. (11.8 kg.)
—1,300 and 1,600 c.c. (except L.C. and U.K.) and G.T.	18½ lb. (8.39 kg.)

Lubrication System

Main, camshaft and connecting rod big end bearings	Pressure fed
Piston pin and cylinder wall lubrication:	
	Splash, and from oil squirt holes in connecting rods
Timing chain lubrication	Metered jet of oil
Rocker shaft lubrication ...	Controlled feed from camshaft front journal
Oil pump ...	Eccentric bi-rotor or sliding vane types
Oil pressure ...	35 to 40 lb./sq. in. (2.46 to 2.81 kg./sq. cm.)
Oil filter type	Full flow with a replaceable element
Sump capacity (including oil filter)—1,300 c.c.	6.4 Imp. pints (7.7 U.S. pints, 3.63 litres)
—1,600 c.c.	7.2 Imp. pints (8.6 U.S. pints, 4.09 litres)
Oil filter capacity ...	⅔ Imp. pint (0.8 U.S. pint, 0.38 litre)

Grade of oil:

Ambient Temperature Range	*Viscosity Rating*
Up to 0°F (—18°C)	5W/20 or 5W/30
0°F to 32°F (—18°C to 0°C) ...	10W, 10W/30 or 10W/40
32°F to 90°F (0°C to 32°C)	20W/20, 30, 10W/30, 10W/40, 20W/40 or 20W/50
Over 90°F (32°C)	40, 20W/40 or 20W/50

Crankcase ventilation — Positive semi-closed system

Eccentric Bi-Rotor Type Pump

Capacity	2 Imp. galls. (2.4 U.S. galls., 9.085 litres)/min. at 2,000 rev./min.
Pump body bore diameter	0.500 to 0.501 in. (12.70 to 12.73 mm.)
Drive shaft diameter	0.498 to 0.4985 in. (12.65 to 12.66 mm.)
Drive shaft to body clearance	0.0015 to 0.003 in. (0.038 to 0.08 mm.)
Inner and outer rotor clearance	... 0.006 in. (0.15 mm.) maximum
Outer rotor and housing clearance	... 0.010 in. (0.25 mm.) maximum
Inner and outer rotor end-float ...	0.005 in. (0.13 mm.) maximum

Sliding Vane Type Pump

Capacity	2.8 Imp. galls. (3.36 U.S. galls., 12.719 litres)/min. at 2,000 rev./min.
Pump body bore diameter	0.500 to 0.501 in. (12.70 to 12.73 mm.)
Drive shaft diameter	0.498 to 0.4985 in. (12.65 to 12.66 mm.)
Drive shaft to body clearance	0.0015 to 0.003 in. (0.038 to 0.08 mm.)
Vane clearance in rotor	... 0.005 in. (0.13 mm.) maximum
Rotor and vane end-float	... 0.005 in. (0.13 mm.) maximum
Vane to housing clearance at centre of cam form ...	... 0.010 in. (0.25 mm.) maximum
Rotor to housing clearance	... 0.005 in. (0.13 mm.) maximum

Pistons

Type	Solid skirt with thermal slots
Material	Aluminium alloy tin plated
Weight (except G.T.)	366 to 372 grams
—G.T.	396 to 402 grams
Combustion bowl depth—1300 H.C.	0.540 to 0.548 in. (13.72 to 13.92 mm.)
—1300 L.C.	0.640 to 0.648 in. (16.26 to 16.46 mm.)
—1600 H.C. and G.T. ...	0.496 to 0.504 in. (12.60 to 12.80 mm.)
—1600 L.C.	0.599 to 0.607 in. (15.22 to 15.42 mm.)
Number of rings	Two compression, one oil control
Width of ring grooves—Compression rings	0.0796 to 0.0806 in. (2.022 to 2.047 mm.)
—Oil control ring	0.1578 to 0.1588 in. (4.008 to 4.034 mm.)
Piston pin bore diameter	... ... Graded
Grade—W	0.8117 to 0.8118 in. (20.617 to 20.620 mm.)
—One spot	0.8118 to 0.8119 in. (20.620 to 20.622 mm.)
—Two spot	0.8119 to 0.8120 in. (20.622 to 20.625 mm.)
—Three spot	0.8120 to 0.8121 in. (20.625 to 20.627 mm.)
Piston pin bore offset	0.040 in. (1.016 mm.) towards thrust face
Piston clearance in cylinder bore—1,300 c.c. ...	0.0019 to 0.0025 in. (0.0483 to 0.0635 mm.)
—1,600 c.c. ...	0.0013 to 0.0019 in. (0.0330 to 0.0483 mm.)
Piston pull—1,300 c.c.	... 7 to 11 lb. (3 to 5 kg.) pull on 0.0025 in. (0.064 mm.) feeler blade, 0.5 in. (12.7 mm.) wide
—1,600 c.c.	... 7 to 11 lb. (3 to 5 kg.) pull on 0.0020 in. (0.050 mm.) feeler blade, 0.5 in. (12.7 mm.) wide
Effective piston diameter	... ... Graded

1,300 c.c. — Grade—0	... ...	3.1847 to 3.1850 in. (80.891 to 80.899 mm.)
—1	... ...	3.1850 to 3.1853 in. (80.899 to 80.907 mm.)
—2†	... ...	3.1853 to 3.1856 in. (80.907 to 80.914 mm.)
—3†	... ...	3.1856 to 3.1859 in. (80.914 to 80.922 mm.)
—4	... ...	3.1859 to 3.1862 in. (80.922 to 80.930 mm.)
—5	... ...	3.1862 to 3.1865 in. (80.930 to 80.937 mm.)
—6*	... ...	3.1865 to 3.1868 in. (80.937 to 80.945 mm.)
—7*	... ...	3.1868 to 3.1871 in. (80.945 to 80.952 mm.)

† Grades 2 and 3 supplied in service as std. piston SMALL

* Grades 6 and 7 supplied in service as std. piston LARGE

1,600 c.c. — Grade—0	... ...	3.1853 to 3.1856 in. (80.906 to 80.914 mm.)
—1	... ...	3.1856 to 3.1859 in. (80.914 to 80.922 mm.)
—2	... ...	3.1859 to 3.1862 in. (80.922 to 80.929 mm.)
—3	... ...	3.1862 to 3.1865 in. (80.929 to 80.937 mm.)
—4	... ...	3.1865 to 3.1868 in. (80.937 to 80.945 mm.)
—5*	... ...	3.1868 to 3.1871 in. (80.945 to 80.952 mm.)
—6*	... ...	3.1871 to 3.1874 in. (80.952 to 80.960 mm.)
—7*	... ...	3.1874 to 3.1877 in. (80.960 to 80.968 mm.)

* Grades 5, 6 and 7 supplied in service as Service Pistons

Oversize pistons available	... 0.0025 in. (0.064 mm.), 0.015 in. (0.38 mm.), 0.030 in. (0.76 mm.)
Clearance between block face and piston crown	
at T.D.C.—1,300 c.c.	... ... 0.005 to 0.023 in. (0.13 to 0.58 mm.)
—1,600 c.c.	... ... 0.025 to 0.043 in. (0.64 to 1.09 mm.)

Piston Pins

Type	... Fully floating, retained by end circlips
Material	... ... Machined seamless steel tubing
Length	... ... 2.80 to 2.81 in. (71.1 to 71.4 mm.)
Outside diameter	... 0.8119 to 0.8123 in. (20.622 to 20.632 mm.)
Inside diameter	... ... 0.497 to 0.503 in. (12.62 to 12.78 mm.)
Weight	... ... 114 to 116.5 grams
Interference fit in piston ...	0.0001 to 0.0003 in. (0.003 to 0.008 mm.) selective
Clearance in small end bush	0.0001 to 0.0003 in. (0.003 to 0.008 mm.) selective

Piston Rings

Load to compress ring to the correct gap:

6.22 to 9.04 lb. (2.82 to 4.10 kg.) applied diametrically at a point 90° from the gap

Upper Compression Ring

Material	Cast iron and chrome plated, with "Running in" compound on periphery
Type	Tapered
Radial thickness	0.122 to 0.130 in. (3.10 to 3.30 mm.)
Width	0.077 to 0.078 in. (1.96 to 1.98 mm.)
Ring to groove clearance	0.0016 to 0.0036 in. (0.041 to 0.091 mm.)
Ring gap	0.009 to 0.014 in. (0.23 to 0.36 mm.)

Load to compress ring to the correct gap:

7.22 to 10.49 lb. (3.27 to 4.76 kg.) applied diametrically, at a point 90° from the gap

Lower Compression Ring

Material	Cast iron
Type	Externally stepped on lower face
Radial thickness	0.146 to 0.156 in. (3.71 to 3.96 mm.)
Width	0.077 to 0.078 in. (1.96 to 1.98 mm.)
Ring to groove clearance	0.0016 to 0.0036 in. (0.041 to 0.091 mm.)
Ring gap	0.009 to 0.014 in. (0.23 to 0.36 mm.)

Oil Control Ring

Material	Cast iron
Type	"Micro-land" scraper with slotted channel
Radial thickness	0.122 to 0.130 in. (3.10 to 3.30 mm.)
Width	0.155 to 0.156 in. (3.94 to 3.96 mm.)
Ring to groove clearance	0.0018 to 0.0038 in. (0.046 to 0.097 mm.)
Ring gap	0.009 to 0.014 in. (0.23 to 0.36 mm.)

Load to compress ring to the correct gap:
5.75 to 8.45 lb. (2.61 to 3.83 kg.) applied diametrically, at a point 90° from the gap

Oversize rings available ... ... 0.0025 in. (0.064 mm.), 0.015 in. (0.38 mm.), 0.030 in. (0.76 mm.)

Push Rods and Tappets

Push rod diameter—1,300 c.c.	0.218 to 0.222 in. (5.54 to 5.64 mm.)
—1,600 c.c.	0.250 to 0.254 in. (6.35 to 6.45 mm.)
Push rod length—1,300 c.c.	6.49 to 6.52 in. (164.8 to 165.6 mm.)
—1,600 c.c.	7.63 to 7.66 in. (193.8 to 194.6 mm.)
Tappet length	1.85 in. (47.0 mm.)
Tappet stem diameter	0.4360 to 0.4365 in. (11.072 to 11.085 mm.)
Block bore for tappet	0.437 to 0.438 in. (11.10 to 11.12 mm.)
Tappet clearance in block	0.0005 to 0.002 in. (0.013 to 0.05 mm.)

Rocker Shaft and Rockers

Shaft diameter	0.623 to 0.624 in. (15.82 to 15.85 mm.)
Rocker arm ratio	1.54 : 1
Rocker bore	0.625 to 0.6265 in. (15.88 to 15.913 mm.)
Shaft clearance in rocker	0.001 to 0.0035 in. (0.03 to 0.089 mm.)

Timing Chain

Type	Single roller
Pitch	0.375 in. (9.53 mm.)
Roller diameter	0.25 in. (6.35 mm.)
Roller width	0.225 in. (5.62 mm.)
Number of links	46

Valves

Valve stem diameter—Inlet	0.3095 to 0.3105 in. (7.861 to 7.887 mm.)
—Exhaust	0.3086 to 0.3096 in. (7.838 to 7.864 mm.)
Valve stem to guide clearance—Inlet	0.0008 to 0.003 in. (0.020 to 0.08 mm.)
—Exhaust	0.0017 to 0.0039 in. (0.043 to 0.099 mm.)
Oversize stems available	0.003 in. (0.08 mm.), 0.015 in. (0.38 mm.)
Valve head diameter—Inlet—1,300 c.c.	1.405 to 1.415 in. (35.69 to 35.94 mm.)
—Inlet—1,600 c.c.	1.497 to 1.507 in. (38.02 to 38.28 mm.)
—Exhaust—All	1.234 to 1.244 in. (31.50 to 31.75 mm.)

Valve length—1,300 c.c.—Inlet ...	4.367 to 4.387 in. (110.92 to 111.43 mm.)
—Exhaust	4.345 to 4.365 in. (110.36 to 110.87 mm.)
—1,600 c.c.—Inlet ...	4.267 to 4.287 in. (108.38 to 108.89 mm.)
—Exhaust	4.255 to 4.275 in. (108.08 to 108.59 mm.)
Valve face angle	... ... 45° to 45° 15′

Valve Springs

Free length	... ... 1.48 in. (37.6 mm.)
Internal diameter	... 0.802 to 0.814 in. (20.37 to 20.67 mm.)
Total number of coils ...	 6
Wire diameter	... 0.151 to 0.153 in. (3.84 to 3.89 mm.)
Fitted length (valve closed)	... ... 1.263 in. (32.08 mm.)
Spring load at fitted length	... ... 44 to 49 lb. (19.96 to 22.23 kg.)

Valve Timing and Clearances

Nominal valve timing—Except G.T.:

Valve clearances 0.015 in. (0.38 mm.) inlet and 0.027 in. (0.69 mm.) exhaust

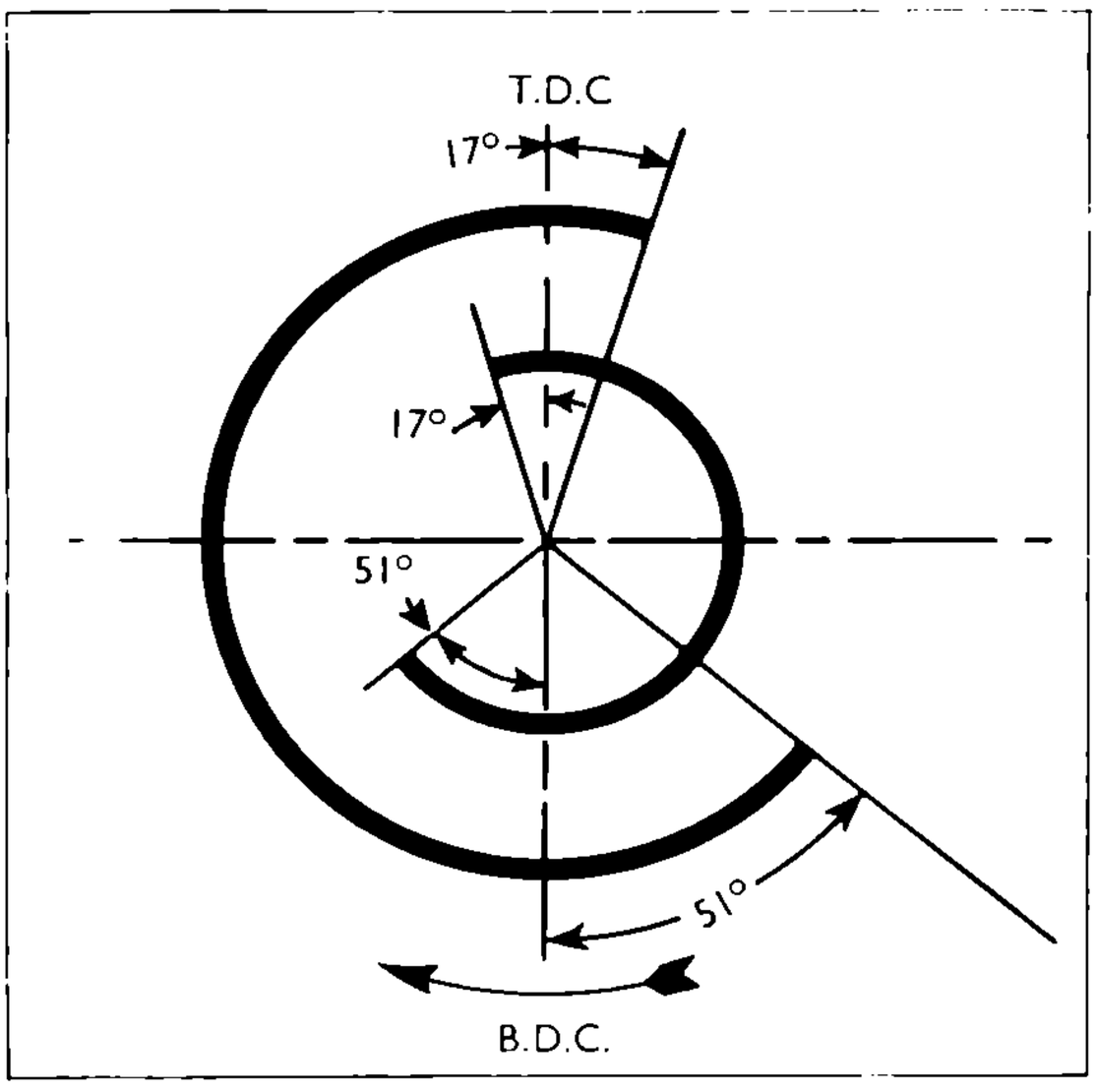
Inlet opens	17° B.T.D.C.
Inlet closes	51° A.B.D.C.
Exhaust opens	51° B.B.D.C.
Exhaust closes	17° A.T.D.C.

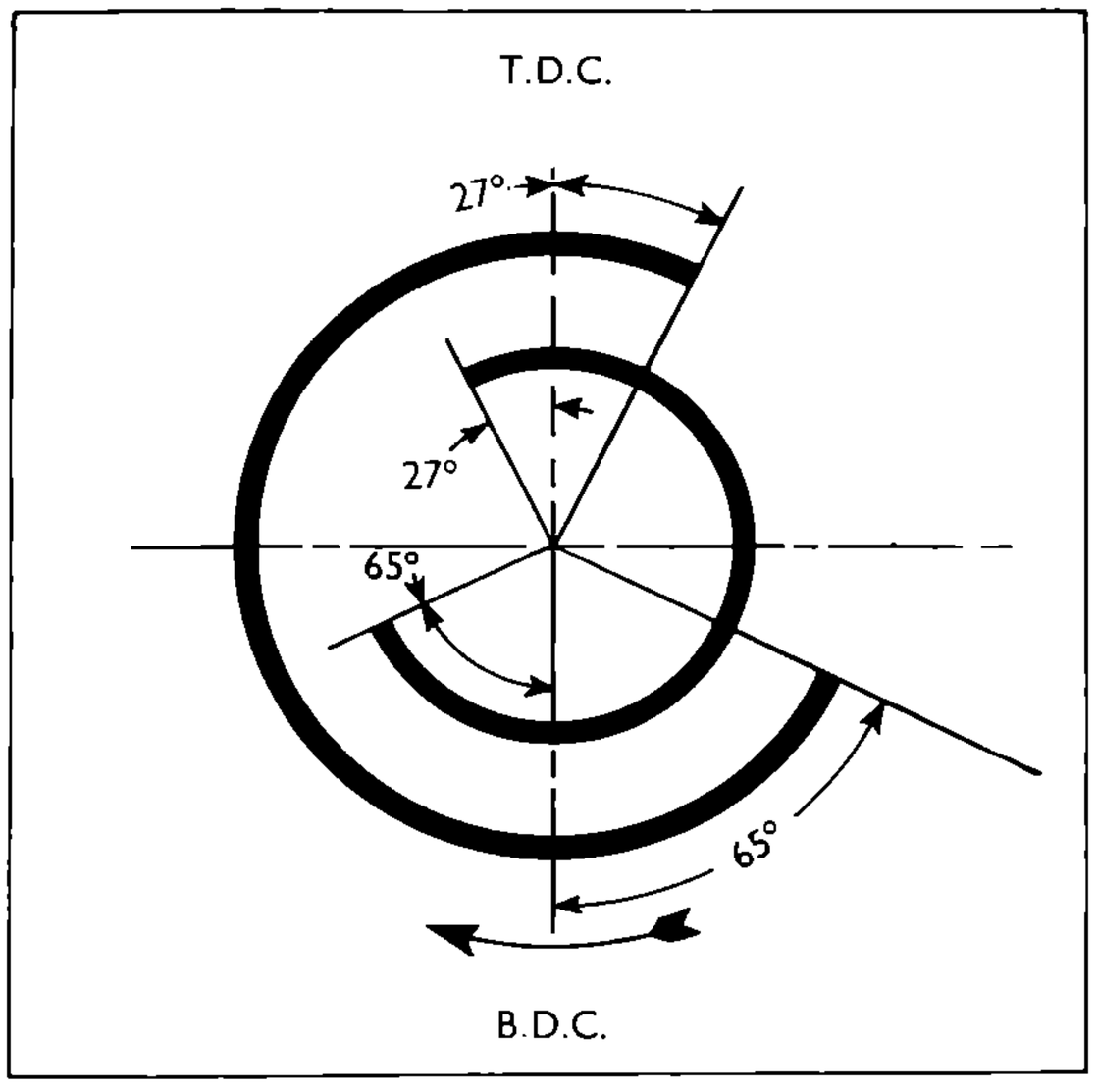
Nominal valve timing—G.T.:

Valve clearances 0.016 in. (0.41 mm.) inlet and 0.026 in. (0.66 mm.) exhaust

Inlet opens	27° B.T.D.C.
Inlet closes	65° A.B.D.C.
Exhaust opens	65° B.B.D.C.
Exhaust closes	27° A.T.D.C.

Valve lift—Except G.T.—Inlet	0.315 in. (8.00 mm.)
—Exhaust	0.319 in. (8.10 mm.)
G.T.—Inlet	0.3440 in. (8.74 mm.)
—Exhaust	0.3357 in. (8.53 mm.)





1300/1600 **Nominal Valve Timing Diagrams** G.T.

Valve clearance—Except G.T.—(cold)—Inlet ...	0.008 to 0.010 in. (0.20 to 0.25 mm.)
—Exhaust	0.018 to 0.020 in. (0.46 to 0.51 mm.)
—(hot) —Inlet ...	... ... 0.010 in. (0.25 mm.)
—Exhaust	... ... 0.017 in. (0.43 mm.)
G.T.—(cold)—Inlet ...	0.011 to 0.013 in. (0.28 to 0.33 mm.)
—Exhaust	0.021 to 0.023 in. (0.53 to 0.58 mm.)
—(hot) —Inlet ...	... ... 0.012 in. (0.31 mm.)
—Exhaust	0.022 in. (0.56 mm.)

Tightening Torques, lb. ft. (kg.m.)

Cylinder head	$\frac{7}{16}$ in. – 14 UNC	65 to 70 (8.98 to 9.67)
Main bearing cap	$\frac{7}{16}$ in. – 14 UNC	65 to 70 (8.98 to 9.67)
Connecting rod big end ...	$\frac{3}{8}$ in. – 24 UNF	30 to 35 (4.15 to 4.84)
Flywheel	$\frac{3}{8}$ in. – 24 UNF	50 to 55 (6.91 to 7.60)
Oil filter centre bolt ...	$\frac{3}{8}$ in. – 24 UNF	12 to 15 (1.66 to 2.07)
Manifolds—bolts	$\frac{5}{16}$ in. – 18 UNC	15 to 18 (2.07 to 2.49)
—nuts	$\frac{5}{16}$ in. – 24 UNC	15 to 18 (2.07 to 2.49)
Sump	$\frac{1}{4}$ in. – 20 UNC	6 to 8 (0.83 to 1.11)
Crankshaft pulley	$\frac{7}{16}$ in. – 20 UNF	24 to 28 (3.32 to 3.87)
Camshaft thrust plate	$\frac{1}{4}$ in. – 20 UNC	2.5 to 3.5 (0.35 to 0.48)
Rocker cover	$\frac{1}{4}$ in. – 20 UNC	2.5 to 3.5 (0.35 to 0.48)
Sump drain plug	$\frac{1}{2}$ in. – 20 UNF	20 to 25 (2.76 to 3.46)
Tappet adjusting screw locknut	$\frac{5}{16}$ in. – 24 UNF	8 to 12 (1.11 to 1.66)
Manifold clamp	... ...	7 to 10 (0.97 to 1.38)

6/2. EXHAUST SYSTEM

	Model	*Inlet Pipe and Front Muffler*	*Rear Muffler and Tail Pipe*
1,300 c.c. saloon	—Manual	3034E-5230-Y	3034E-5232-T
1,300 c.c. saloon	—Automatic	3034E-5230-V	3036E-5232-R
1,300 c.c. estate car	—Manual	3034E-5230-U	3036E-5232-Z
1,600 c.c. saloon	—R.H.D.	3036E-5230-AT	3036E-5232-R
	—L.H.D.	3034E-5230-V	3036E-5232-R
1,600 c.c. estate car	—R.H.D.	3036E-5230-AU	3036E-5232-Z
	—L.H.D.	3036E-5230-BA	3036E-5232-Z
G.T. and 1600E	—R.H.D.	3036E-5230-AV	3036E-5232-U
	—L.H.D.	3036E-5230-AR	3036E-5232-U

EXHAUST EMISSION CONTROL SYSTEM

Air relief pressure	13 in. (330.2 mm.) Hg.
Setting plug identification	... ... Blue
Air pump belt—free travel	... ... $\frac{1}{2}$ in.
—tension	... ... 30 to 40 lb.
Pulley identification—1,600 c.c.	... ... Unmarked
—1,600 c.c. G.T.	... ... White
Backfire-suppressor valve identification—1,600 c.c. ...	... ... Unmarked
—1,600 c.c. G.T. ...	... ... Blue

7/1. CLUTCH AND RELEASE MECHANISM

Type	Single dry plate, diaphragm spring
Actuation ...	... ... Hydraulic
Hydraulic fluid	... ... ME-3833-F

Master Cylinder

Bore diameter	0.70 in. (17.78 mm.)

Slave Cylinder

Bore diameter	0.875 in. (22.22 mm.)

Clutch Disc

Lining outside diameter ...	... ... 7.5 in. (19.1 cm.)
Lining inside diameter ...	... 5.36 in. (13.61 cm.)
Total friction area	44.17 sq. in. (284.98 sq. cm.)

GEARBOX

Ratios	1,300 c.c.		1,600 c.c.		G.T.	
	Gearbox	*Overall*	*Gearbox*	*Overall*	*Gearbox*	*Overall*
First	3.543	14.615	3.543	13.818	2.972	11.591
Second ...	2.396	9.883	2.396	9.344	2.010	7.839
Third	1.412	5.824	1.412	5.507	1.397	5.448
Top	1.000	4.125	1.000	3.900	1.000	3.900
Reverse	3.963	16.347	3.963	15.456	3.324	12.964

Main Drive Gear

Number of teeth	... ... 17 (19 G.T.)
Inside diameter gear end ...	0.9725 to 0.9732 in. (2.4702 to 2.4719 cm.)
Main shaft pilot end diameter ...	0.5895 to 0.5901 in. (1.497 to 1.499 cm.)

Countershaft:

	Except G.T.	*G.T. only*
Number of teeth	32	30
	28	26
	22	22
	17	17
	19	19

End-float	... 0.008 to 0.020 in. (0.203 to 0.508 mm.)
Bore diameter	... 0.933 to 0.934 in. (2.370 to 2.372 cm.)
Thrust washer thickness	... 0.061 to 0.063 in. (0.155 to 0.160 cm.)
Number of rollers ...	 40
Countershaft diameter	0.6818 to 0.6823 in. (1.732 to 1.733 cm.)

First Gear:

End-float	... 0.005 to 0.017 in. (0.127 to 0.432 mm.)
Internal diameter ...	... 1.192 to 1.193 in. (3.028 to 3.030 cm.)
Number of teeth ...	 32

Second Gear:

End-float	... 0.005 to 0.017 in. (0.127 to 0.432 mm.)
Gear inside diameter	... 1.457 to 1.458 in. (3.701 to 3.704 cm.)
Number of teeth ...	 28

Third Gear:

End-float	... 0.005 to 0.017 in. (0.127 to 0.432 mm.)
Gear inside diameter	... 1.376 to 1.377 in. (3.495 to 3.498 cm.)
Number of teeth ...	... ... 21 (23 G.T.)

Reverse Idler Gear:

Inside diameter	0.7500 to 0.7508 in. (1.905 to 1.907 cm.)
Shaft diameter	0.7465 to 0.7470 in. (1.896 to 1.898 cm.)
Number of teeth	 22

Speedometer Driven Gear:

Number of teeth and colour:

1,300 c.c. saloon and estate car, 4.125 axle ...	...	22 natural
1,300 c.c. saloon, 4.444 axle	...	24 green
1,300 c.c. estate car, 4.444 axle	...	23 black
1,600 c.c. saloon, estate car and G.T., 3.9 axle	...	24 green
1,600 c.c. saloon and estate car, 4.125 axle	...	25 blue

Speedometer Driving Gear:

Number of teeth	6 (1,300 c.c.)	7 (G.T. and 1,600 c.c.)
Main shaft nut tightening torque	20 to 25 lb. ft. (2.76 to 3.46 kg.m.)	

Lubrication:

Oil capacity ...	1.97 Imp. pints (2.40 U.S. pints, 1.11 litres)
Grade of oil ...	... ... S.A.E. 80 E.P.

Tightening Torques, lb. ft. (kg.m.)

Clutch housing to transmission case	40 to 45 (5.53 to 6.22)
Clutch pressure plate to flywheel ...	12 to 15 (1.66 to 2.07)
Clutch housing to transmission case ...	40 to 45 (5.53 to 6.22)
Transmission gear shift cables ...	10 to 12 (1.38 to 1.66)
Abutment housing to extension housing	15 to 18 (2.07 to 2.49)
Transmission case drain and filler plugs	25 to 30 (3.46 to 4.15)
Main shaft assembly retaining nut	20 to 25 (2.76 to 3.46)
Transmission extension to transmission case	30 to 35 (4.15 to 4.84)

7/2. AUTOMATIC TRANSMISSION

Type	3-speed epicyclic with 3 element hydro-kinetic torque converter
Identification number—1,300 c.c. (Inertia starter)	41 EE
—1,600 c.c. (Inertia starter) ...	75 EE
—1,300 c.c. (Pre-engaged starter) ...	51 EE
—1,600 c.c. (Pre-engaged starter) ...	77 EE
Fluid type	M-2C-33F
Fluid capacity (including converter)	$11\frac{1}{4}$ Imp. pints (13.5 U.S. pints, 6.39 litres)
Gear ratios—First ...	2.393 : 1
—Second	1.450 : 1
—Third	1.000 : 1
—Reverse	2.094 : 1
Torque converter nominal diameter ...	9.5 in. (241.3 mm.)
K factor	225
Control pressure ...	100 lb./sq. in. (7.03 kg./sq. cm.) hot at 1000 rev./min. in D
Operating temperature ...	100 to 115°C (212 to 236°F)

Approximate Shift Speeds

1,300 c.c.	1 to 2	2 to 3	3 to 2	2 to 1
Light throttle	7 to 10 m.p.h. (11 to 16 k.p.h.)	9 to 14 m.p.h. (14 to 22 k.p.h.)	—	—
Part throttle	—	—	18 to 25 m.p.h. (28 to 40 k.p.h.)	—
Full throttle	23 to 32 m.p.h. (37 to 51 k.p.h.)	36 to 50 m.p.h. (58 to 80 k.p.h.)	—	—
Kick-down	29 to 39 m.p.h. (47 to 63 k.p.h.)	51 to 61 m.p.h. (80 to 98 k.p.h.)	43 to 58 m.p.h. (69 to 93 k.p.h.)	20 to 34 m.p.h. (32 to 55 k.p.h.)

Approximate Shift Speeds — *continued*

1,600 c.c.	1 to 2	2 to 3	3 to 2	2 to 1
Light throttle	4 to 8 m.p.h. (6 to 13 k.p.h.)	8 to 12 m.p.h. (13 to 19 k.p.h.)	—	—
Part throttle	—	—	18 to 25 m.p.h. (28 to 40 k.p.h.)	—
Full throttle	23 to 32 m.p.h. (37 to 51 k.p.h.)	39 to 50 m.p.h. (63 to 80 k.p.h.)	—	—
Kick-down	31 to 40 m.p.h. (50 to 64 k.p.h.)	53 to 63 m.p.h. (85 to 101 k.p.h.)	47 to 59 m.p.h. (76 to 95 k.p.h.)	22 to 34 m.p.h. (35 to 55 k.p.h.)

Engine maximum shift speed	5,000 rev./min.
Number of plates—front clutch	3 inner, 2 outer
—rear clutch	3 inner, and outer
Front servo spring—1,300 c.c.	29 lb. (13.15 kg.) rate
—1,600 c.c.	40 lb. (18.14 kg.) rate
Valve body assembly identification—1,300 c.c.	12
—1,600 c.c.	50
Primary regulator valve and identification—1,300 c.c.	—30 two grooves
—1,600 c.c.	—20 one groove
Primary regulator valve spring diameter—1,300 c.c.	0.586 in. (14.88 mm.)
—1,600 c.c.	0.604 in. (15.34 mm.)
Governor identification—1,300 c.c.	3
—1,600 c.c.	4
Governor valve identification—1,300 c.c.	Milled and 1 groove
—1,600 c.c.	Milled only
Speedometer driving gear—1,300 c.c.	6 teeth
—1,600 c.c.	7 teeth
Gear train end-float	0.010 to 0.030 in. (0.25 to 0.76 mm.)
Thrust washer thickness—211E-7019-A	0.061 to 0.063 in. (1.55 to 1.60 mm.)
—211E-7019-B	0.078 to 0.080 in. (1.98 to 2.03 mm.)

Tightening Torques, lb. ft. (kg.m.)

Transmission case to converter housing	$\frac{5}{16}$ in. – 18 UNC	8 to 13 (1.11 to 1.80)
Extension housing to transmission case	$\frac{5}{16}$ in. – 18 UNC	8 to 13 (1.11 to 1.80)
Gearbox sump	$\frac{5}{16}$ in. – 18 UNC	8 to 13 (1.11 to 1.80)
Front servo to transmission case	$\frac{5}{16}$ in. – 18 UNC	8 to 13 (1.11 to 1.80)
Rear servo to transmission case	$\frac{3}{8}$ in. – 16 UNC	13 to 27 (1.80 to 3.73)
Pump adaptor to front pump housing	10 – 24 UNC	**25 to 35 lb. in.** (0.27 to 0.41)
	$\frac{5}{16}$ in. – 18 UNC	17 to 22 (2.35 to 3.04)
Pump adaptor to transmission case	$\frac{5}{16}$ in. – 18 UNC	8.1 to 8.5 (1.11 to 2.56)
Rear adaptor to transmission case	$\frac{1}{4}$ in. – 20 UNC	4 to 7 (0.55 to 0.97)
	10 – 24 UNC	**20 to 30 lb. in.** (0.24 to 0.35)

Tightening Torques, lb. ft. (kg.m.) — *continued*

Centre support to transmission case	$\frac{3}{8}$ in. – 16 UNC	...	10 to 18 (1.38 to 2.49)
Outer lever to manual valve shaft	$\frac{5}{16}$ in. – 24 UNF	...	7 to 9 (0.97 to 1.24)
Pressure point (use sealer)	$\frac{1}{8}$ in. – 24 NPTF	...	4 to 5 (0.55 to 0.69)
Oil tube collector to lower body	10 – 24 UNC	**20 to 30 lb. in.**	(0.24 to 0.35)
Governor line plate to lower body	10 – 24 UNC	**20 to 30 lb. in.**	(0.24 to 0.35)
Lower body end plate to lower body	10 – 24 UNC	**20 to 30 lb. in.**	(0.24 to 0.35)
Upper body front or rear end plate to upper body	10 – 24 UNC	**20 to 30 lb. in.**	(0.24 to 0.35)
Upper body to lower body	10 – 24 UNC	**20 to 30 lb. in.**	(0.24 to 0.35)
Valve bodies assembly to transmission case	$\frac{1}{4}$ in. – 20 UNC	...	4.5 to 9 (0.62 to 1.24)
Front pump strainer to lower body	10 – 24 UNC	**20 to 30 lb. in.**	(0.24 to 0.35)
Downshift valve cam bracket to valve body ...	10 – 32 UNF	**20 to 40 lb. in.**	(0.24 to 0.46)
Governor body to sleeve	$\frac{1}{4}$ in. – 20 UNC	...	4 to 5 (0.55 to 0.69)
Governor cover plate to governor body ...	10 – 24 UNC	**20 to 48 lb. in.**	(0.24 to 0.55)
Front servo lever adjusting screw locknut ...	$\frac{3}{8}$ in. – 16 UNC	...	15 to 20 (2.07 to 2.76)
Rear servo adjusting screw locknut	$\frac{7}{16}$ in. – 14 UNC	...	25 to 30 (3.45 to 4.15)
Starter inhibitor switch locknut	$\frac{7}{16}$ in. – 14 UNC	...	4 to 6 (0.55 to 0.83)
Downshift valve control cable adaptor to case	$\frac{1}{2}$ in. – 13 UNC	...	8 to 9 (1.11 to 1.24)
Filler tube connector adaptor to case	$\frac{1}{2}$ in. – BSP	...	20 to 30 (2.76 to 4.15)
Filler tube to connector sleeve nut	$1\frac{1}{16}$ in. – 16 UNS	...	17 to 18 (2.35 to 2.49)
Stone guards to converter housing	8	...	1.4 to 1.6 (0.19 to 0.22)
Drive plate to torque converter	$\frac{3}{8}$ in. – 24 UNF	...	40 to 45 (6.22 to 6.91)

8. COOLING SYSTEM

Anti-Freeze Concentration

Specific Gravity (providing no other additive is in the coolant)	Proportion of Anti-freeze (by volume)	Remains Fluid to °C	Remains Fluid to °F	Solidifies at °C	Solidifies at °F
1.080	50%	—37°	—34°	—58°	—72°
1.065	40%	—25°	—13°	—48°	—54°
1.050	30%	—16°	+ 3°	—39°	—38°
1.042	25%	—13°	+ 9°	—29°	—20°
1.034	20%	— 9°	+15°	—19°	— 3°
1.026	15%	— 7°	+20°	—14°	+ 7°
1.016	10%	— 4°	+25°	— 8°	+17°

Capacity:

Complete system (with heater)—1,300 c.c. ...	10.2 Imp. pints (12.74 U.S. pints, 5.81 litres)
—1,600 c.c./G.T.	11.45 Imp. pints (13.74 U.S. pints, 6.53 litres)
Complete system (without heater)—1,300 c.c.	8.82 Imp. pints (10.58 U.S. pints, 5.03 litres)
—1,600 c.c./G.T.	10.07 Imp. pints (12.08 U.S. pints, 5.74 litres)

Radiator

Type	Corrugated High Efficiency Fin
Pressure cap	13 p.s.i. (0.91 kg./sq. cm.)
Core height	... ... 12.0 in. (305 mm.)
Fins/inch—1,300 c.c.	 9
—1,600 c.c. and G.T. ...	 12

Thermostat

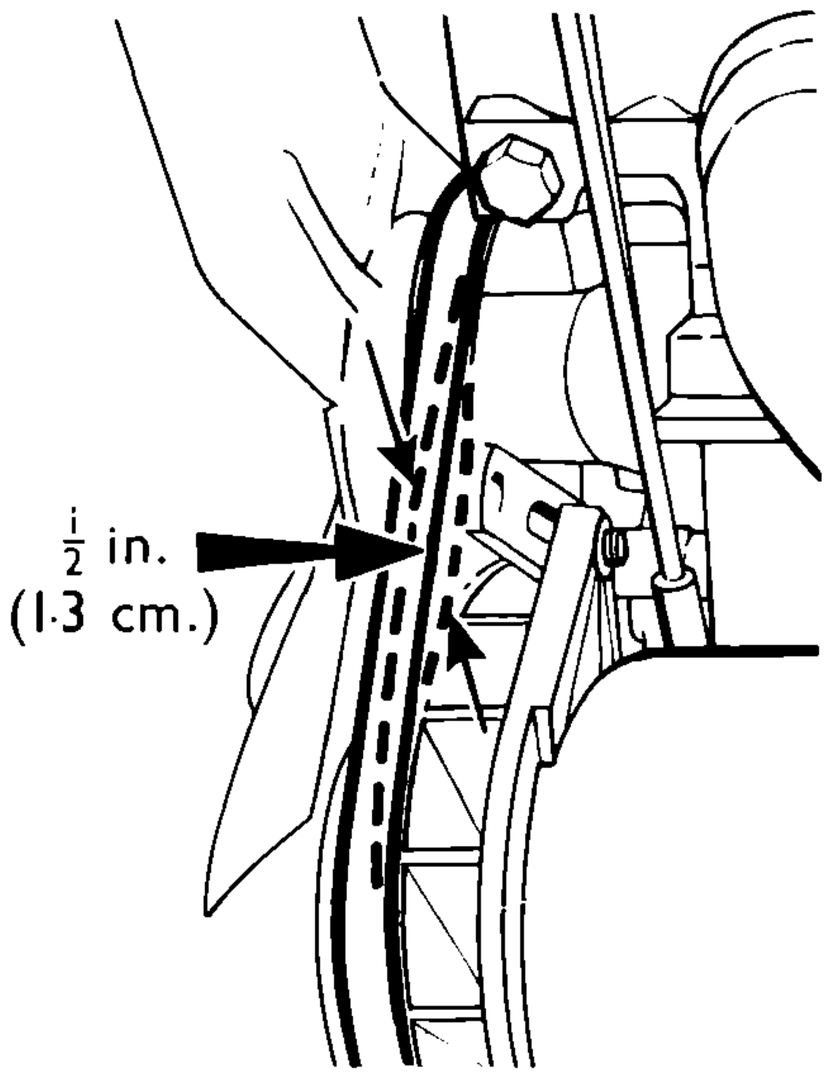
Thermostat—Type	... ... Wax
—Location ...	... ... Cylinder head
—Starts to open	85° to 89°C (185° to 192°F)
—Fully open ...	99° to 102°C (210° to 216°F)

Fan

Type—Standard ...	... 2-blade 11 in. (279.4 mm.)
Heavy duty	8 blades 12 in. (304.8 mm.)
Speed ratio (fan to engine)	1.125 : 1

Fan Belt

Width	0.38 in. (9.7 mm.)
Outside length (Standard Transmission)	29 in. (74 cm.)
Free play	... $\frac{1}{2}$ in. (13 mm.)
Tension	40 to 50 lb. (18.14 to 22.18 kg.)



9. FUEL SYSTEM

Fuel Tank

Capacity—Saloon ...	10 Imp. gallons (12 U.S. gallons, 45.4 litres)
—Estate car	8 Imp. gallons (9.6 U.S. gallons, 36.3 litres)

CARBURETTOR

1,300 c.c.

Type	Ford single venturi, downdraught with accelerator pump and power valve
Starting device—Manual transmission	Semi-automatic strangler type choke
—Auto transmission	Automatic choke
Identification number—Manual transmission	C7BH-A
—Auto transmission	C7BH-C
Idling speed	580 to 620 rev./min.
Fast idle—Manual transmission	1,100 to 1,300 rev./min.
—Auto transmission—Standard	1,850 to 2,050 rev./min.
—Cold climate	2,200 to 2,400 rev./min.
Float setting (up)	1.12 to 1.14 in. (28.4 to 29.0 mm.)
(down)	1.38 to 1.40 in. (35.1 to 35.6 mm.)
Choke pull-down—Manual transmission	0.14 to 0.16 in. (3.6 to 4.1 mm.)
—Auto transmission	0.13 to 0.15 in. (3.3 to 3.8 mm.)
De-choke (Auto transmission only)	0.18 to 0.20 in. (4.6 to 5.1 mm.)
Accelerator pump stroke	0.145 to 0.155 in. (3.68 to 3.93 mm.)
Throttle barrel diameter	34 mm.
Venturi diameter	25 mm.
Main jet—Manual transmission	1.32 mm.
—Auto transmission	1.27 mm.

Air correction jet	... 1.50 mm.
Idling jet	... 0.60 mm.
Idling air bleed (first)	... 1.05 mm.
—(second)	... 0.65 mm.
Idle channel restrictor—Manual transmission	... 1.15 mm.
—Auto transmission ...	... 1.10 mm.
Power jet	... 0.7 mm.
Pump jet	... 0.45 mm.
Pump spring	... ... RED
Vacuum piston link hole	... Inner
Thermostatic spring slot	... Centre

1,600 c.c. (Except G.T.)

Type	Ford single venturi, downdraught with accelerator pump and power valve
Starting device—Manual transmission	... Semi-automatic strangler type choke
—Auto transmission	... ... Automatic choke
Identification number—Manual transmission	... ... C7BH-B
—Auto transmission	... ... C7BH-D
Idling speed	... 580 to 620 rev./min.
Fast idle—Manual transmission	... 900 to 1,100 rev./min.
—Auto transmission—Standard	... 1,850 to 2,050 rev./min.
—Cold climate	... 2,200 to 2,400 rev./min.
Float setting (up)	1,12 to 1.14 in. (28.4 to 29.0 mm.)
(down)	1.38 to 1.40 in. (35.1 to 35.6 mm.)
Choke pull-down	... 0.16 to 0.18 in. (4.0 to 4.6 mm.)
De-choke (Auto transmission only)	... 0.18 to 0.20 in. (4.6 to 5.1 mm.)
Accelerator pump stroke—Manual transmission	0.135 to 0.145 in. (3.43 to 3.68 mm.)
—Auto transmission	0.170 to 0.180 in. (4.32 to 4.57 mm.)
Throttle barrel diameter	36 mm.
Venturi diameter	28 mm.
Main jet—Manual transmission	1.50 mm.
—Auto transmission	1.47 mm.
Air correction jet	1.50 mm.
Idling jet	0.65 mm.
Idling air bleed (first)	1.05 mm.
(second)	0.6 mm.
Idle channel restrictor	1.35 mm.
Power jet	0.90 mm.
Pump jet	0.55 mm.
Pump spring	... RED
Vacuum piston link hole (Auto transmission only)	Inner
Thermostatic spring slot (Auto transmission only)	Centre

G.T.

Type	Dual barrel, two venturis per barrel, downdraught
Identification number	... 32-DFM
Idling speed	680 to 720 rev./min.
Fast idle speed	1,100 to 1,300 rev./min.

	Primary		*Secondary*
Venturi diameter	26		27
Auxiliary venturi	4.5		4.5
Main jet	150		155
Air correction jet	160		140
Emulsion tube type	F6		F6
Slow-running petrol jet	50		45
Slow-running air jet (bush)	180		70
Progression holes	1×100	1×70	2×120
Slow-running volume control port	70		120
Full load enrichment jet	—		100
Full load air bleed	—		100
Full load mixture jet	—		110
Accelerator pump jet	65		
Accelerator pump back bleed	50		
Needle valve	1.75 mm.		
Float level	7.0 to 7.5 mm.		
Float stroke	8 mm.		
Fast idle setting			1.2 mm.
Choke plate pull-down			5 mm.
Choke plate opening	7.5 to 8.5 mm. with lever backed off 10 mm.		

Fuel Pump

Type	Mechanical, driven from eccentric on camshaft
Delivery pressure—all except G.T.	1 to 2 lb./sq. in. (0.07 to 0.14 kg./sq. cm.)
—G.T.	3½ to 5 lb./sq. in. (0.25 to 0.35 kg./sq. cm.)
Inlet vacuum—all models	8.5 in. (21.6 cm.) Hg.
Diaphragm spring—Test length—all except G.T.	0.468 in. (11.88 mm.)
—Test pressure—all except G.T.	3¼ to 3½ lb. (1.47 to 1.59 kg.)
—Test length—G.T.	0.641 in. (16.27 mm.)
—Test pressure—G.T.	9¼ to 10 lb. (4.31 to 4.54 kg.)
Rocker arm spring—Test length—all models	0.44 in. (11.18 mm.)
—Test pressure—all models	5 to 5½ lb. (2.27 to 2.5 kg.)

Air Cleaner

Type—Standard (except G.T.) ...	... Wire gauze
—Standard (G.T.)	Paper element
—Optional	Paper element

Tightening Torques, lb. ft. (kg.m.)

Fuel pump	5/16 in. – 18 UNC	...	12 to 15 (1.66 to 2.07)
Manifold—Nuts	5/16 in. – 24 UNF	...	15 to 18 (2.07 to 2.49)
—Bolts	5/16 in. – 18 UNC	...	15 to 18 (2.07 to 2.49)
Air cleaner (except G.T.)	¼ in. – 20 UNC	...	3 to 5 (0.42 to 0.69)
Air cleaner (G.T. only) ...	5 mm. ×0.8 mm.	...	5 to 7 (0.69 to 0.97)
Air cleaner cover (G.T. only)	5/16 in. – 24 UNF	...	5 to 7 (0.69 to 0.97)
Fuel tank	10 – 12	... ...	3 to 5 (0.42 to 0.69)

10. ELECTRICAL EQUIPMENT

Battery

Type	Lead acid
Voltage	12
Capacity (amp hr.)—Standard equipment	38 at 20 hr. rate
—Cold climate	57 at 20 hr. rate
Plates/cell—Standard equipment	9
—Cold climate	13
Specific gravity charged	1.275 to 1.290
Low limit while discharging at 20 hr. rate	1.105
Electrolyte capacity—Standard equipment	4.5 Imp. pints (5.4 U.S. pints, 2.5 litres)
—Cold climate	6.4 Imp. pints (7.7 U.S. pints, 3.6 litres)

Coil

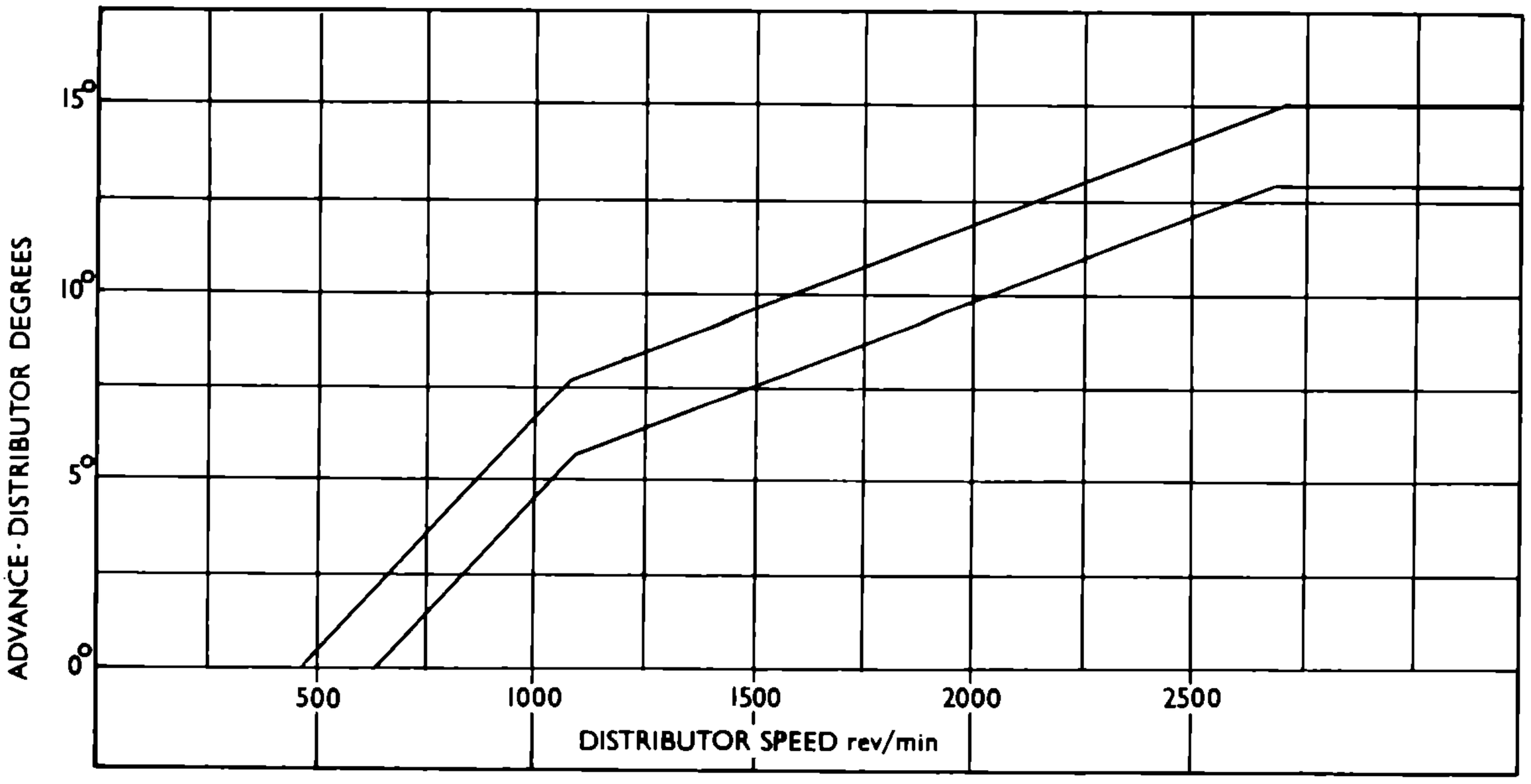
Type	12 volt, oil filled type for use with ballast resistor
Resistance at 20°C (68°F)—Primary	3.1 to 3.5 ohms
—Secondary	4.750 to 5.750 ohms
Output	30 k.v.

Generator

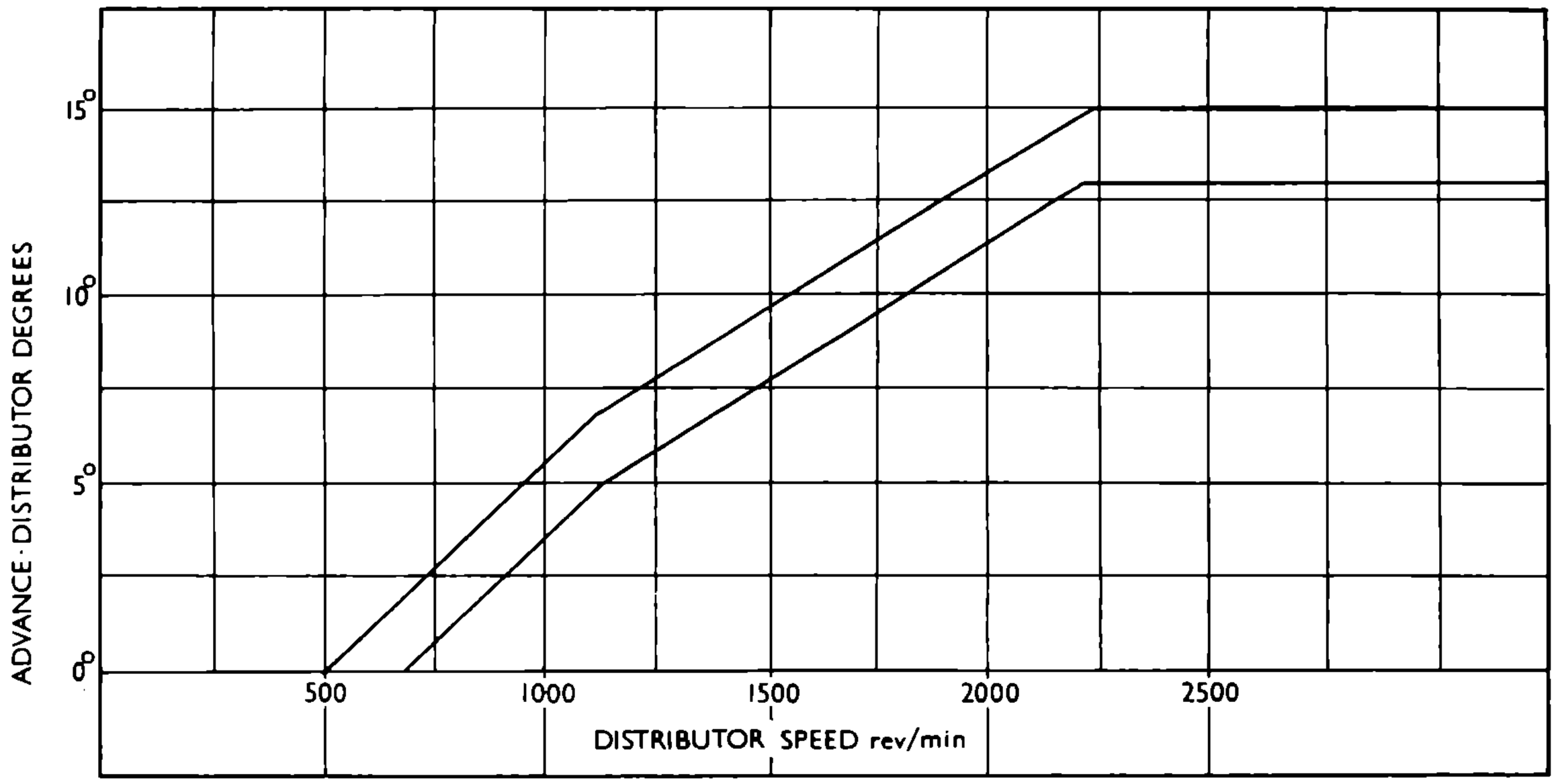
	Standard	*Cold Start*
Type	C-40	C-40L
Speed (ratio to engine)—Manual transmission	1.5 : 1	
—Automatic transmission	1.8 : 1	
Brush length	0.718 in. (18.23 mm.)	
Maximum charge	22 amps	25 amps
Maximum output	264 watts	300 watts
Fan belt tension (total free movement)	$\frac{1}{2}$ in. (13 mm.)	

Distributor

Type	Single pair contact breaker point
Automatic advance	Mechanically and vacuum controlled
Drive	Skew gear from camshaft
Rotation	Anti-clockwise from rotor end
Identification number—1,300 c.c. H.C.	C7AH-A
—1,300 c.c. L.C.	C7AH-B
—1,600 c.c. H.C.	C7BH-A
—1,600 c.c. L.C.	C7BH-B
—1,600 c.c. G.T.	C7BH-C
Identification colour—H.C.	RED
—L.C.	GREEN
—G.T.	BLUE
Shaft pre-load	Set with 0.015 in. (0.38 mm.) shim
Breaker arm spring tension	17 to 21 oz. (481.9 to 567.0 gms.)
Condenser capacitance	0.21 to 0.25 microfarad
Contact breaker points gap	0.025 in. (0.64 mm.)
Dwell angle	38° to 40°
Firing order	1, 2, 4, 3
High tension lead resistance	5,000 to 9,000 ohms/ft. (164 to 295 ohms/cm.)



Mechanical Advance - 1,300 c.c. and 1,600 c.c. High Compression



Mechanical Advance - 1,300 c.c. and 1,600 c.c. Low Compression

Initial Advance:

Compression Ratio	*Octane Number (Research)*	*Star Raring*	*Initial Advance* 1,300 *c.c.*	*Initial Advance* 1,600 *c.c.*
G.T. 9 : 1	97	4	—	8°
H.C. 9 : 1	97	4	10°	10°
	94	3	6°	6°
L.C. 8 : 1	89	—	10°	10°
	86	—	4°	6°

High Compression – 1,300 and 1,600

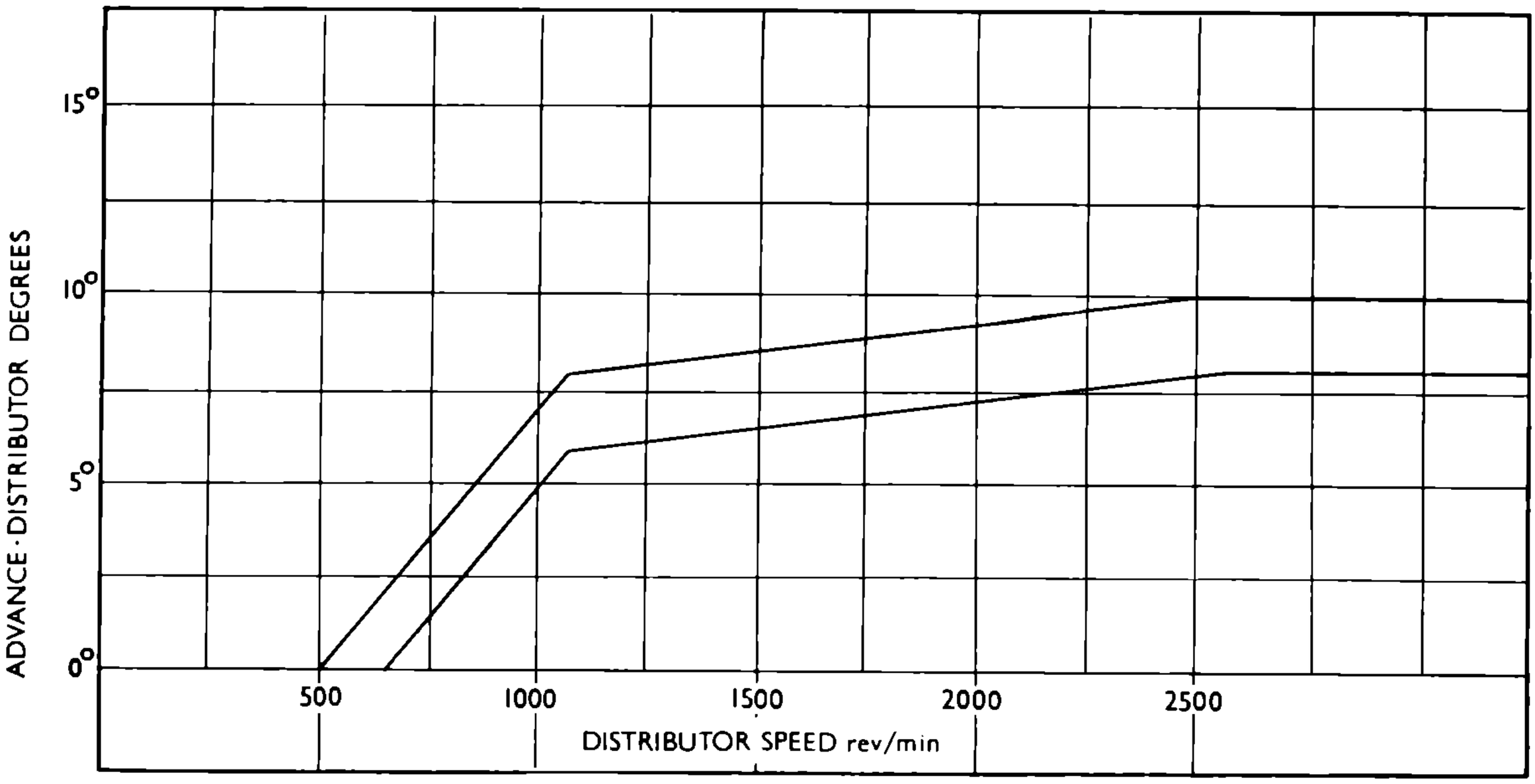
Mechanical		*Vacuum*	
Distributor Speed (rev./min.)	*Distributor Advance (Degrees)*	*Vacuum (in. (cm.) of Hg.)*	*Distributor Advance (Degrees)*
700	½ to 2½	5½ (14.0)	0 to 3¼
1,000	4½ to 6½	6 (15.2)	1¼ to 4¼
1,400	7 to 9	7 (17.8)	3¼ to 6
2,300	11 to 13	8 (20.3)	4½ to 7¼
2,700	13 to 15	9+ (22.9)	5½ to 8½

Low Compression – 1,300 and 1,600

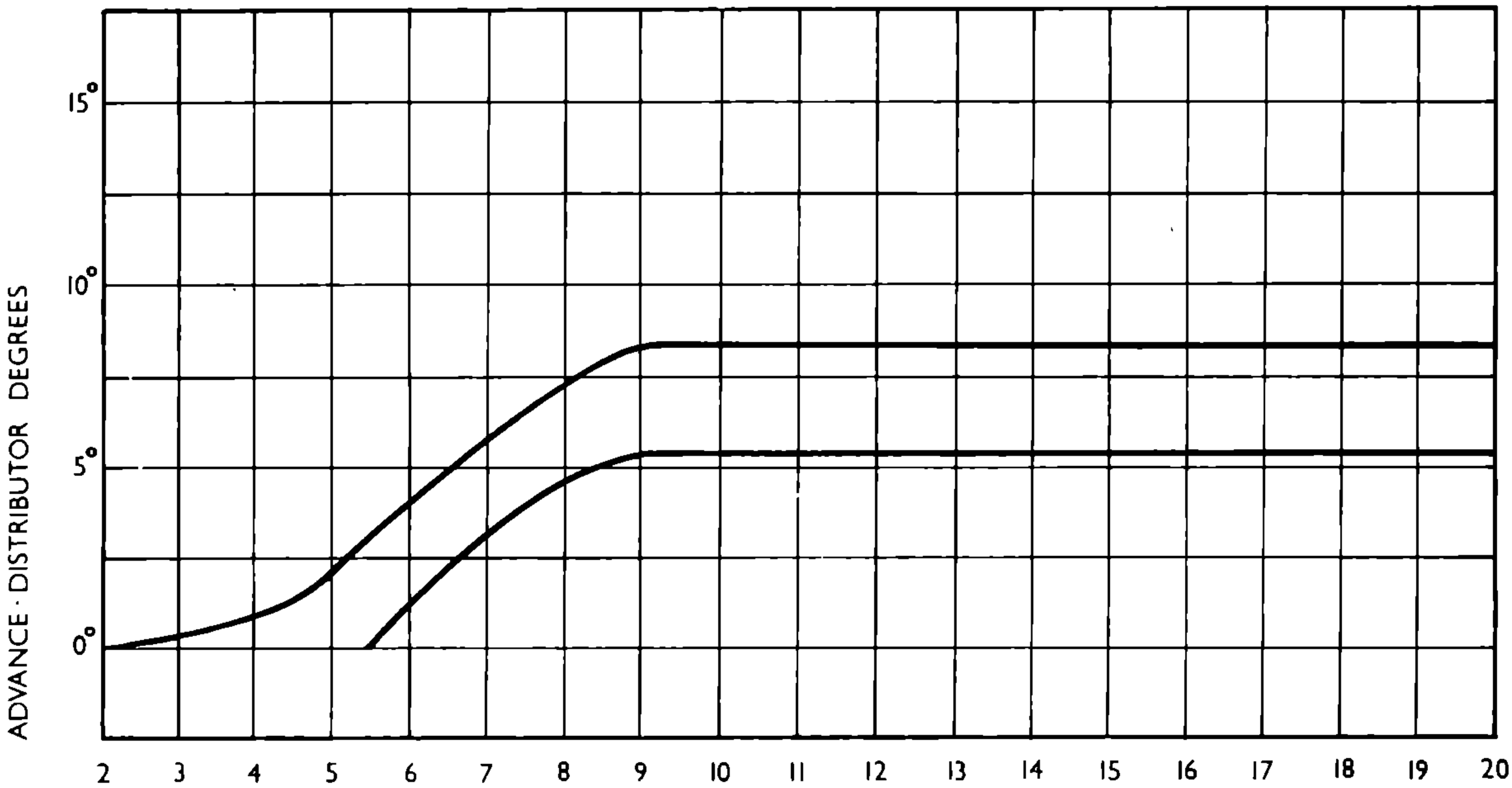
Mechanical		*Vacuum*	
Distributor Speed (rev./min.)	*Distributor Advance (Degrees)*	*Vacuum (in. (cm.) of Hg.)*	*Distributor Advance (Degrees)*
700	½ to 2	5½ (14.0)	0 to 3¼
1,000	3½ to 5½	6 (15.2)	1¼ to 4¼
1,400	7 to 9	7 (17.8)	3¼ to 6
1,700	9 to 11	8 (20.3)	4½ to 7¼
2,250	13 to 15	9+ (22.9)	5½ to 8½

G.T.

Mechanical		*Vacuum*	
Distributor Speed (rev./min.)	*Distributor Advance (Degrees)*	*Vacuum (in. (cm.) of Hg.)*	*Distributor Advance (Degrees)*
700	1 to 3	5½ (14.0)	0 to 3¼
1,000	5 to 7	6 (15.2)	1¼ to 4¼
1,200	6 to 8	7 (17.8)	3¼ to 6
1,800	7 to 9	8 (20.3)	4½ to 7¼
2,600	8 to 10	9+ (22.9)	5½ to 8½

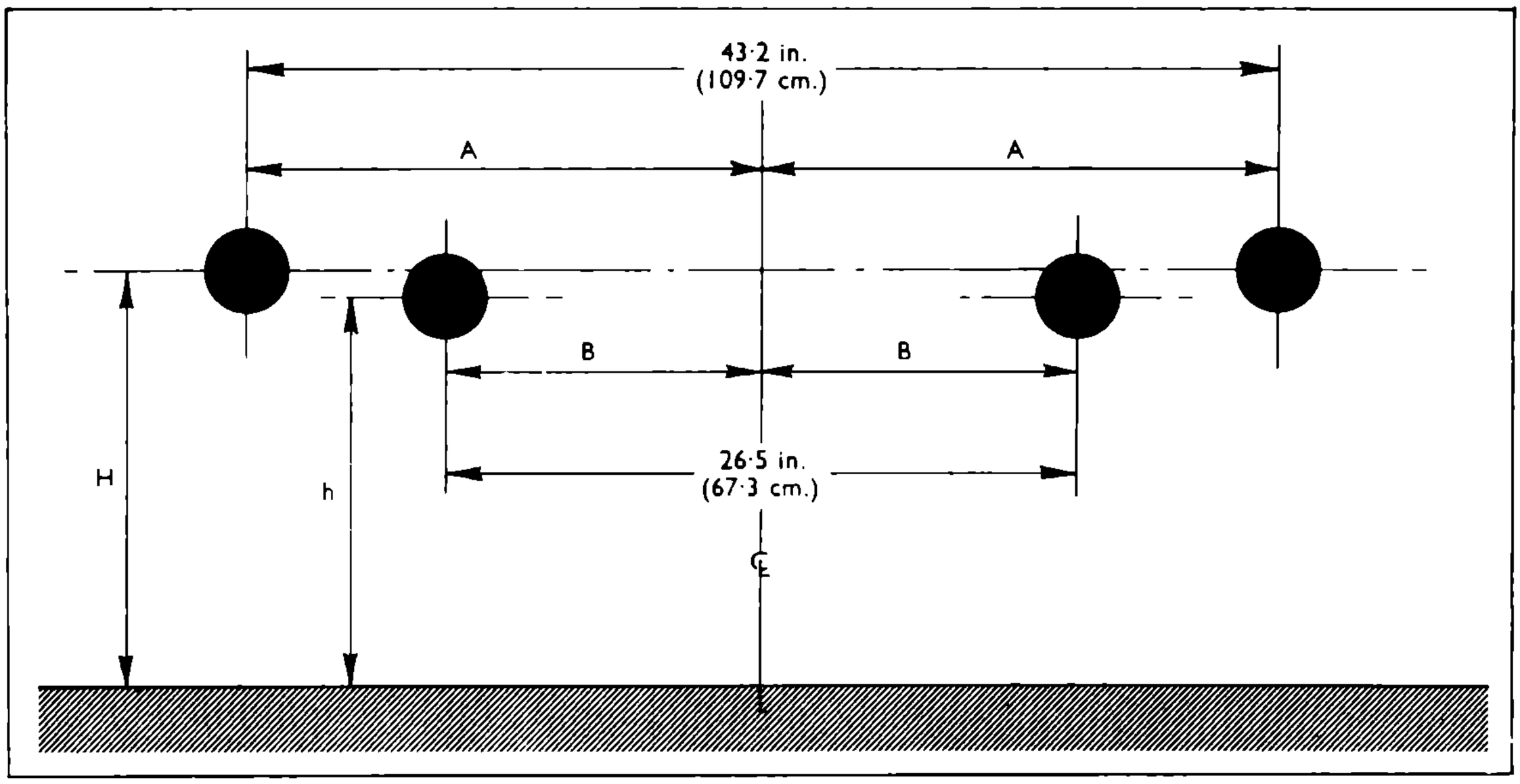


Mecnanical Advance—G.T.



Vacuum Advance

Headlamp Alignment Chart



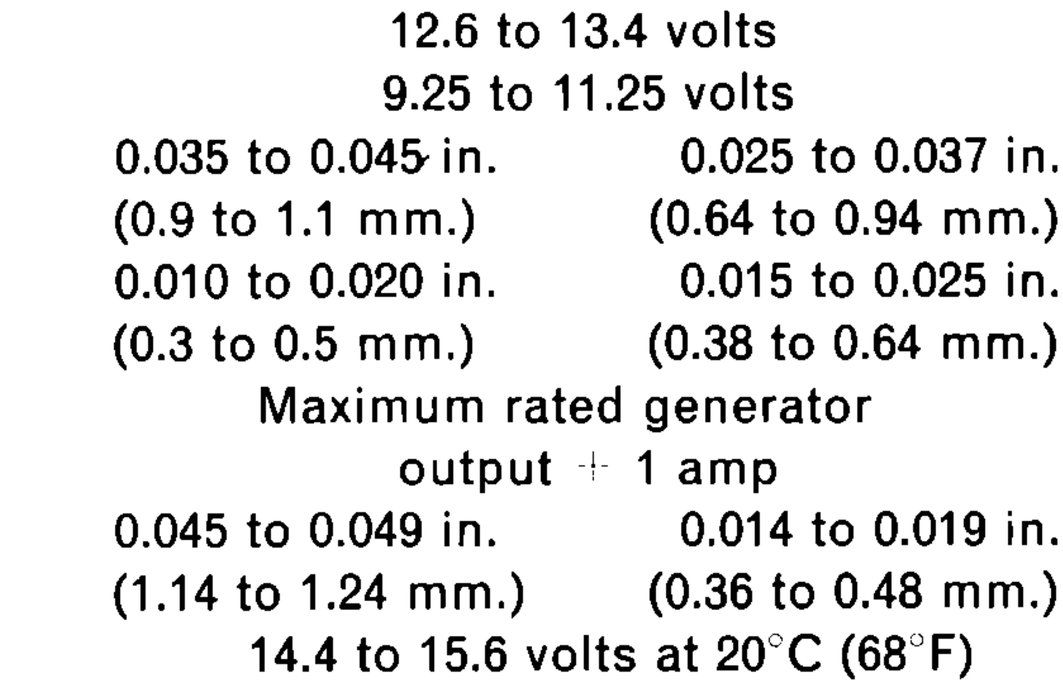
'H' and 'h' – "Height" measured from ground to lamp centres, marked on alignment board, 10 ft. (3 m.) in front of car.

Align lamp 'bright centres' on horizontal dividing line equi-distant from vertical dividing line.

The two inner "bright centres' are for the 1600E only.

Regulator	*Lucas*	*Autolite*
Cut-out—Cut-in voltage	12.6 to 13.4 volts	
—Drop-off voltage ...	9.25 to 11.25 volts	
—Armature to core air gap	0.035 to 0.045 in. (0.9 to 1.1 mm.)	0.025 to 0.037 in. (0.64 to 0.94 mm.)
—'Follow-through' of moving contact	0.010 to 0.020 in. (0.3 to 0.5 mm.)	0.015 to 0.025 in. (0.38 to 0.64 mm.)
Current regulator on-load setting	Maximum rated generator output + 1 amp	
Armature to core air gap	0.045 to 0.049 in. (1.14 to 1.24 mm.)	0.014 to 0.019 in. (0.36 to 0.48 mm.)
Voltage regulator open circuit setting	14.4 to 15.6 volts at 20°C (68°F)	
Armature to core air gap ...	0.045 to 0.049 in. (1.14 to 1.24 mm.)	0.024 to 0.028 in. (0.61 to 0.71 mm.)

Atmospheric Temperature	*Setting Voltage*	*Checking Voltage*
10°C (50 F)	14.4 to 15.0	14.5 to 15.8
20°C (68°F)	14.2 to 14.8	14.4 to 15.6
30°C (86°F)	14.0 to 14.6	14.3 to 15.3
40°C (104°F)	13.8 to 14.4	14.2 to 15.1



Resistance of shunt windings ... ... { Cut-out ... ... 8.8 to 9.6 ohms; Voltage Regulator ... 10.8 to 12.0 ohms }

"Swamp" resistor ... { resistance measured between centre tag and base 13.25 to 14.25 ohms; resistance measured between tag ends before fitting ... 53 to 57 ohms }

Field resistor ... { either 55 to 65 ohms (identification colour—Red); or 37 to 43 ohms (identification colour—Yellow) }

Table Showing Relationship Between Regulator, Generator and Battery

Equipment	*Regulator*			*Generator*			*Battery*	
	Part No.	*Make*	*Identification No.*	*Part No.*	*Identification No.*	*Rated Output*	*Part No.*	*Capacity*
Standard	3004E-10505-A 3004E-10505-C	Autolite Lucas	†GR.5000 *37344	2701E-10002-A	C.40	22 amp	113E-10658-A	38 A/H
Optional	3004E-10505-B 3004E-10505-D	Autolite Lucas	†GR.5001 *37342	2730E-10002-A	C.40L	25 amp	113E-10658-D	57 A/H

†On regulator cover

* Stamped on Regulator Base

Sparking Plugs

Size ... ... 14 mm.
Type ... ... Autolite AG.22
Gap ... ... 0.023 in. (0.58 mm.)

Inertia Starter Motor

Ampere draw (zero r.p.m.) ... ... 340 at 7.4 volts
Ampere draw (1,000 starter r.p.m.) ... 245 at 8.7 volts
Gear ratio ... ... 11 : 1
Teeth on pinion 10
Teeth on ring gear 110
Lock torque ... ... 6.4 lb. ft. (0.884 kg.m.)

Pre-Engaged Starter Motor—Both Types

Gear ratio ... ... 12 : 1
Teeth on pinion 11
Teeth on ring gear ... 132

Bulbs

	Quantity	*Wattage Fitting*
Headlights	2	60/45 Sealed Beam
Sidelights—front	2	6
Front direction indicators ...	2	24
Rear direction indicators ...	2	24
Rear stop/tail lights	2	6/24
Rear number plate	1	6 Wedge Base
Interior light	1	3 Festoon
Instrument panel warning lights	7	2.2 Wedge Base
Clock illumination bulb	1	1.2 Wedge Base

Fuses

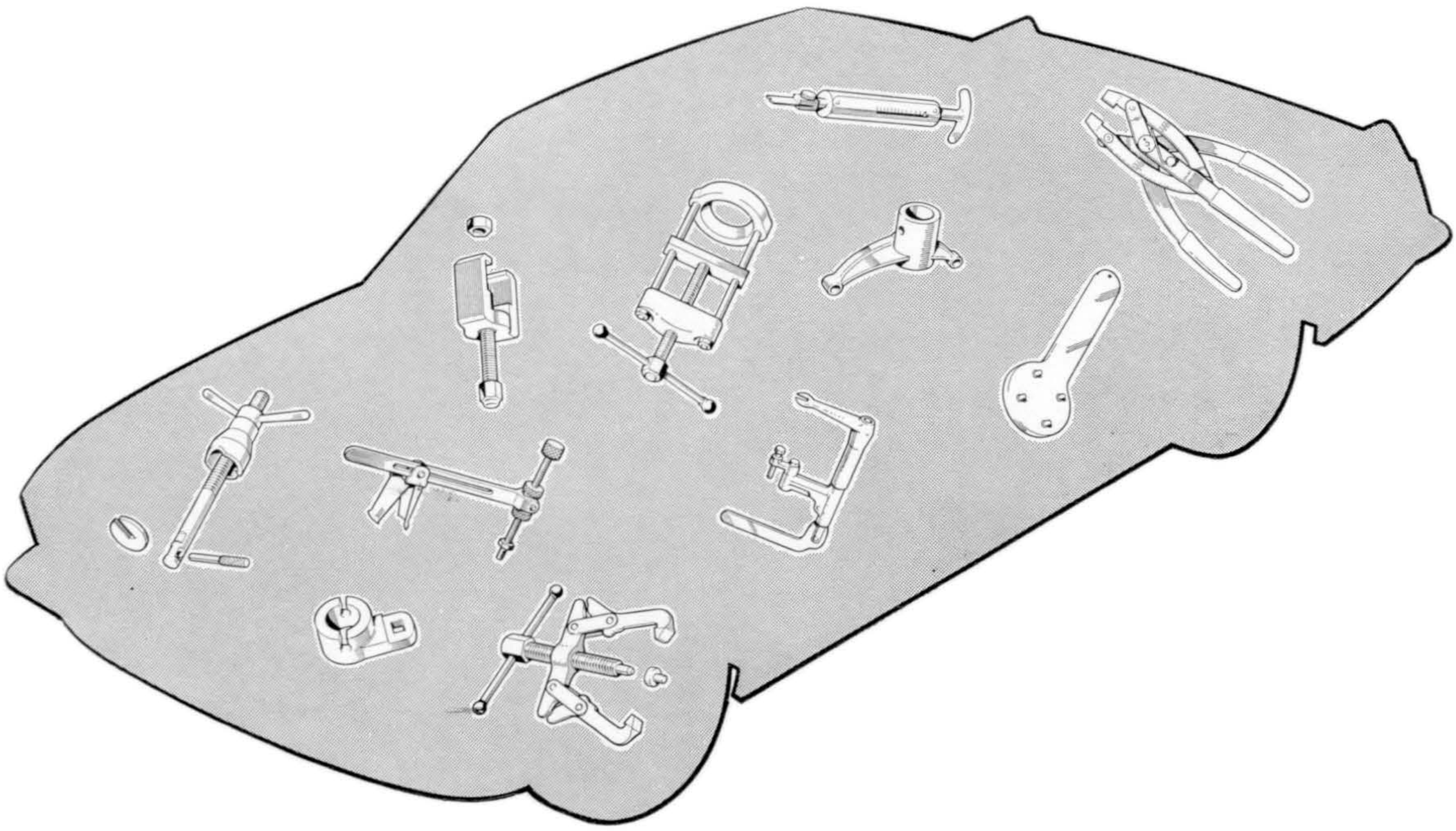
Number	... 6
Continuous rating ...	8 amps
Maximum loading ...	21 amps

Tightening Torques, lb. ft. (kg.m.)

Spark plug	14 × 1.25 mm.	24 to 28 (3.32 to 3.87)
Starter motor retaining bolts	$\frac{3}{8}$ in. – 16 UNC	20 to 25 (2.76 to 3.46)
Generator pulley	$\frac{7}{16}$ in. – 20 UNF	14 to 17 (1.93 to 2.35)
Generator mounting bolts	$\frac{5}{16}$ in. – 24 UNF	15 to 18 (2.07 to 2.49)
Generator mounting bracket	$\frac{3}{8}$ in. – 16 UNC	20 to 25 (2.76 to 3.46)

14/2

SPECIAL TOOLS



GENERAL DESCRIPTION

This Repair Manual issued for the Cortina Range contains repair and overhaul procedures which, in some cases, require the use of special service tools to ensure the completion of a satisfactory and economical repair.

The purpose of this section is to list all tools of this kind numerically within sections.

Enquiries regarding the supply of these tools should be directed to:—

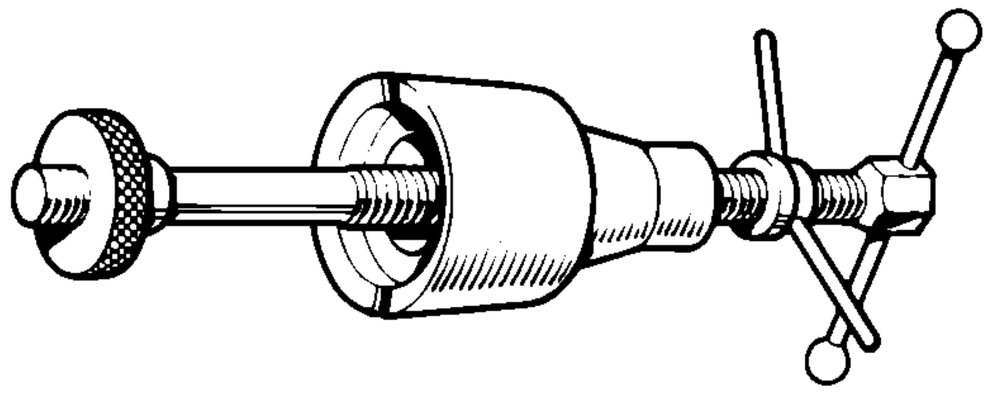
U.K.: V. L. Churchill and Co. Ltd.,
London Road,
Daventry,
Northants.

Overseas Locations: through local Churchill Tool Distributors, or, in the event of difficulty, from Room 1/436,
Ford Motor Company Limited,
Warley,
Brentwood,
Essex,
England.

1. HUBS AND DRUMS

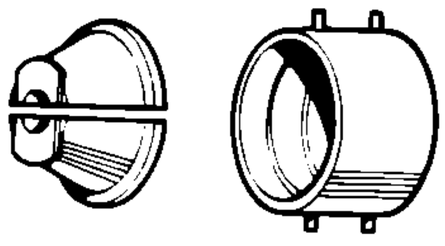
PT 1024 Front Hub Bearing Cups Remover/ Replacer (Main Tool)

Used in conjunction with P 1024-3 Adaptor Set.



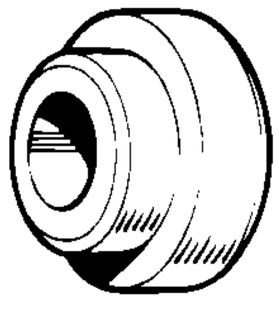
P 1024-3 Front Hub Bearing Cups Remover/ Replacer (Adaptor)

Consists of three split ring adaptors and one solid ring adaptor. These are used in conjunction with PT 1024 to remove and replace the front hub bearing cups.



P 1029 Front Hub Grease Retainer Replacer

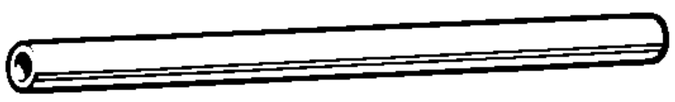
Used in conjunction with the 550 Driver Handle and ensures square replacement of the front hub grease retainer.



2. BRAKES

P 2006 Brake Bleeder Tubes

A set of four transparent flexible plastic tubes used when bleeding hydraulic brakes on current models.

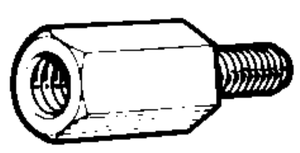


P 2012 Brake Line Plugs

A set of six brass plugs used to seal the open ends of hydraulic lines when dismantling hydraulic brakes.

P 2031 Brake Line Plugs

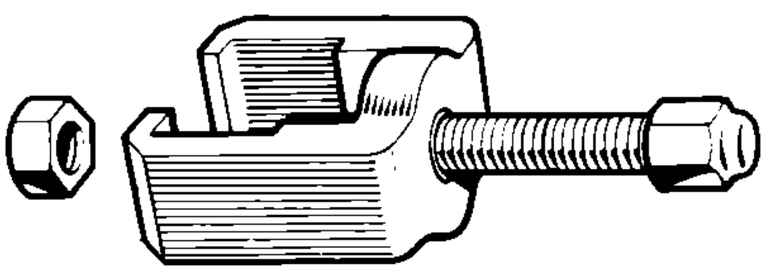
A set of four plugs to seal the open ends of hydraulic lines on dual line brake systems whilst dismantling.



3. STEERING GEAR

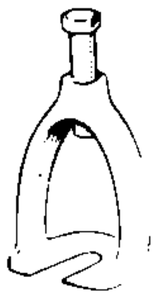
P 3041C Drop Arm Remover

Specifically designed to remove the drop arm correctly and without fear of damaging component parts.
The thrust pad provided should be used at all times.



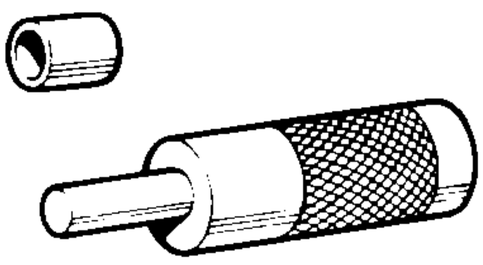
P 3073-9 Steering Joint Taper Separator

This tool considerably reduces any possibility of damage to components when "breaking" taper joints.



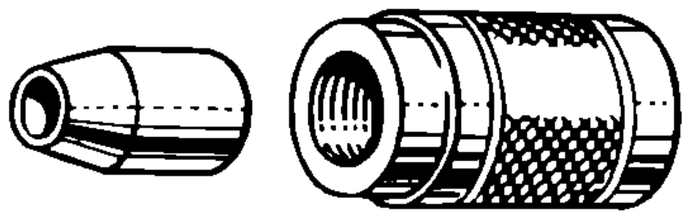
P 3083 Gearchange Linkage Tube Bush Replacer

Consists of one driver and one adaptor. Ensures the correct replacement of the bush, so that the bore of the bush retains its tolerance.



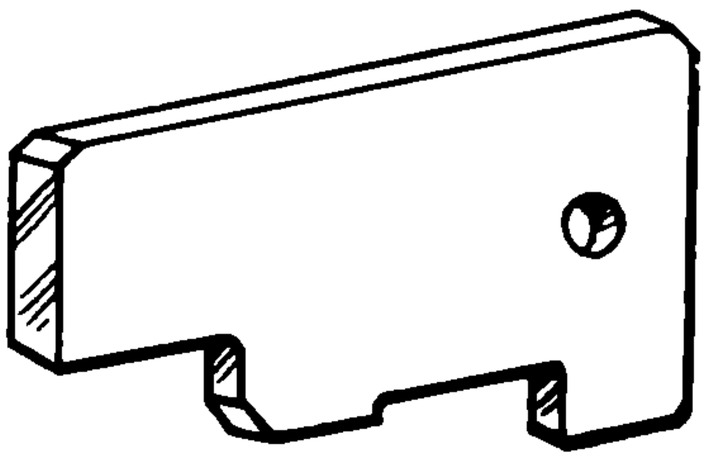
P 3085 Steering Rocker Shaft Oil Seal Replacer

Enables the rocker shaft oil seal to be replaced "in situ". It consists of one driver and one pilot sleeve.



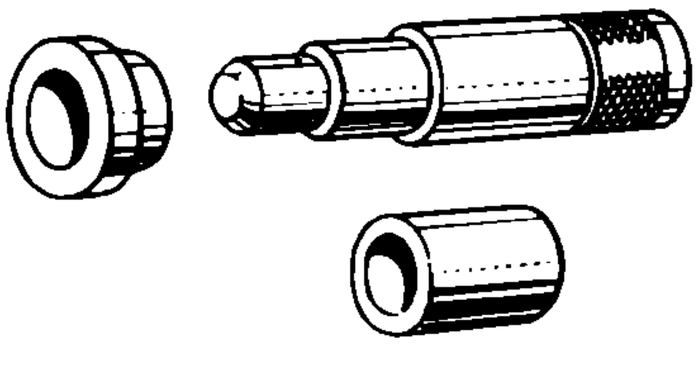
P 3086 Spindle Body Gauge

An accurately machined gauge of $\frac{1}{4}$ in. thick steel plate, used to check spindle bodies suspected of distortion.



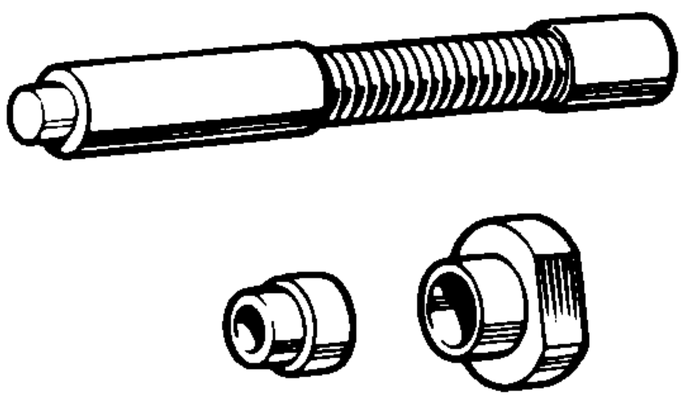
P 3087 Steering Rocker Shaft Bush Oil Seal Replacer

Only suitable for replacing the oil seal and bushes. For details of removing, see the appropriate Service Bulletin.



P 3089A Steering Rocker Shaft Broaching Kit

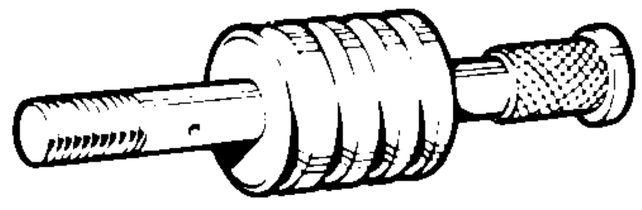
The dummy cover plate details "e" and "d" are not required for the '68 Cortina Steering Box. The support detail "b" has a $\frac{7}{8}$ in. wide flat on the side to clear the lug on the steering box.



4. REAR AXLE

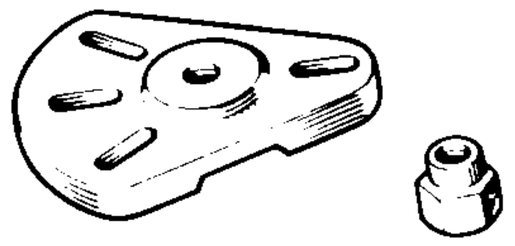
CPT 3072 Slide Hammer (Main Tool)

Used in conjunction with adaptor sets for the removal of rear hubs, axle shafts and axle shaft oil seals.



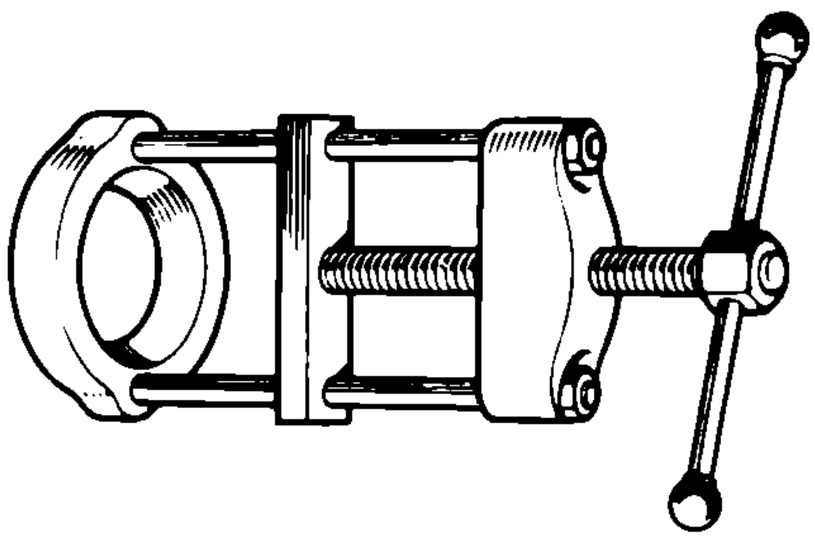
P 3072-4A Rear Hub and Axle Shaft Remover (Adaptor)

The slotted holes in the body are so arranged that the tool may be fitted to all current passenger cars, whether of the 4 or 5 stud type.



CP 4000 Hand Press (Main Tool)

Used in conjunction with different adaptor sets to assist in the completion of various rear axle operations.

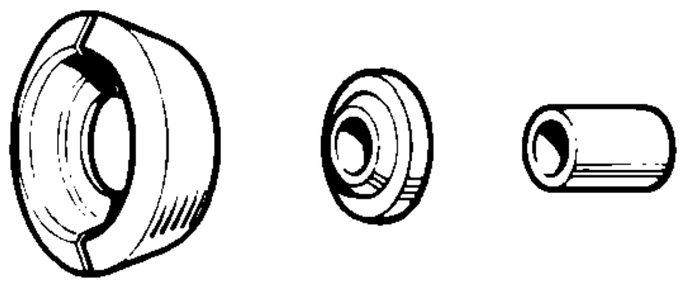


P 4000-27A Differential Bearing Cone Remover (Adaptor)

Consists of:—One split ring adaptor and one thrust pad. Used in conjunction with Main Tool No. CP 4000 to remove the differential bearing cone.

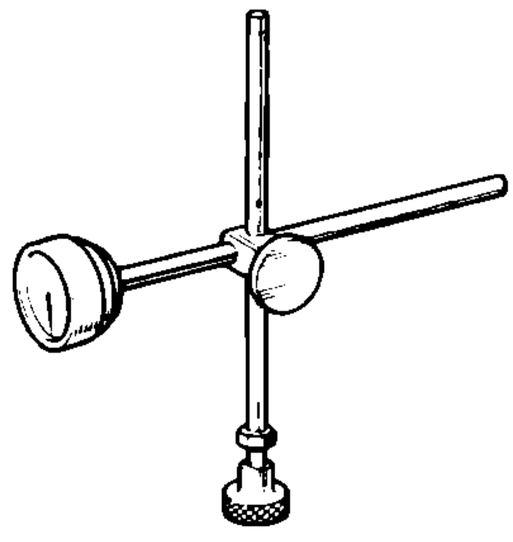
P 4000-28 Pinion Bearing Cone Remover/Replacer

Consists of:—One split ring adaptor, one replacer adaptor and one guide. Used in conjunction with either the Main Tool No. CP 4000 or the 370 Universal Taper Base.



P 4008 Crown Wheel and Pinion Backlash Gauge (Main Tool)

Used to measure the backlash between pinion and crown wheel.

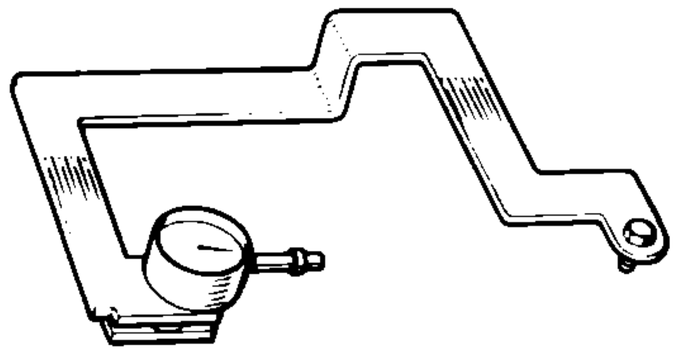


P 4008-1 Crown Wheel and Pinion Backlash Gauge (Adaptor)

Consists of:—One mounting post and one locking nut. Used in conjunction with Main Tool P 4008 to measure the backlash between pinion and crown wheel.

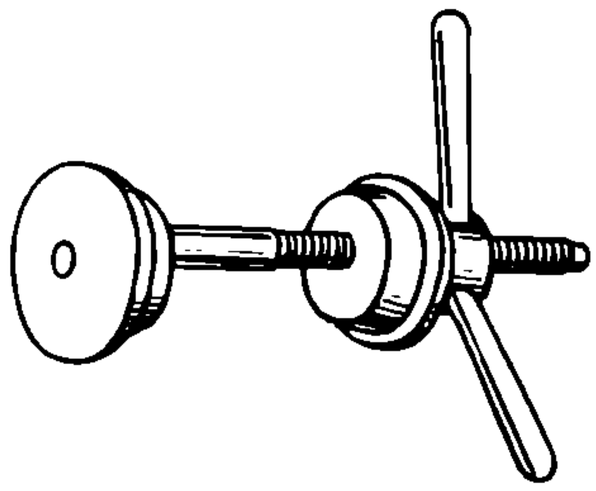
P 4009 Differential Bearing Preload Gauge

Secured to the differential bearing cup on one side, the dial gauge on the opposite side indicates the preload.



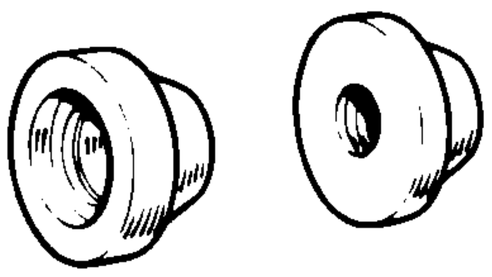
P 4013A Drive Pinion Bearing Cups and Oil Seal Replacer (Main Tool)

Used together with the necessary adaptor to replace the drive pinion bearing cups. By reversing the top pad the oil seal may also be replaced.



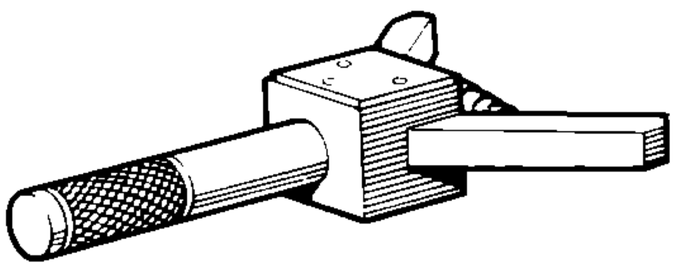
P 4013-3 Drive Pinion Cups and Oil Seal Replacer (Adaptor)

Used in conjunction with Main Tool No. P 4013A to effect easy replacement of the drive pinion bearing cups and oil seal.



P 4015A Drive Pinion Bearing Cups Remover

The spring loaded legs in the tool are placed behind the cup and the handle is struck with a mallet to remove the cup.

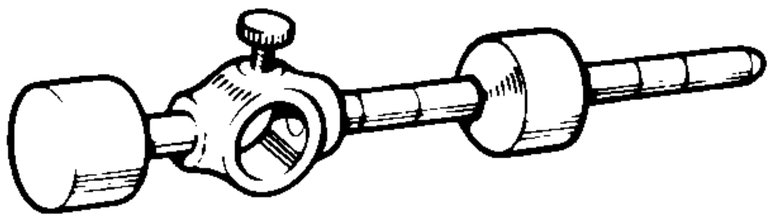


P 4028 or P 4097 Flange Holding Wrench

Fits in the holes of the drive pinion flange.

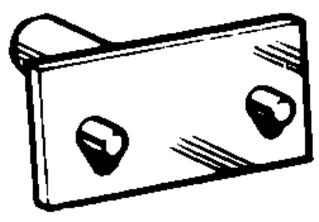
CP 4030 Drive Pinion Bearing Preload Gauge

Used in conjunction with a suitable adaptor, the sliding weight is moved along the beam until it rests at the correct figure.



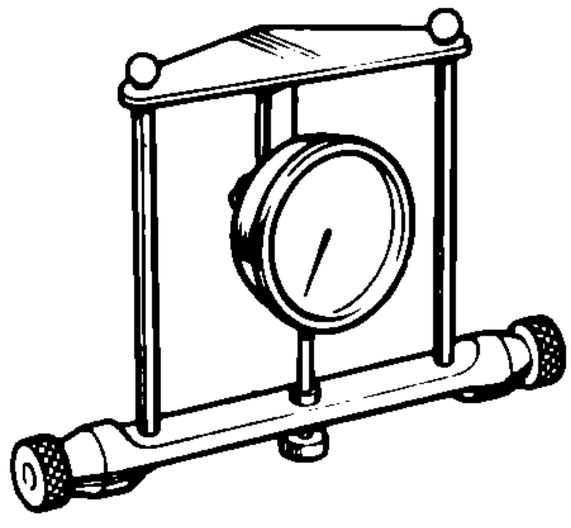
P 4030-1 or P 4030-4 Pre-load Gauge Adaptor

Used in conjunction with the Main Tool CP 4030, this tool enables the final pinion preload setting to be obtained.



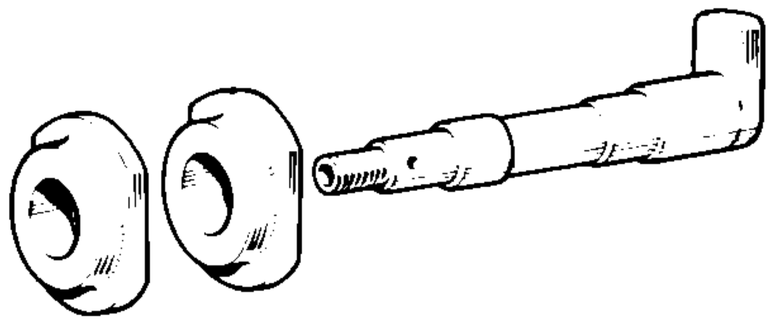
P 4075 Drive Pinion Depth Gauge (Main Tool)

Used in conjunction with P 4075-4 adaptor set, indicates precisely the thickness of the spacer shim required when reassembling.



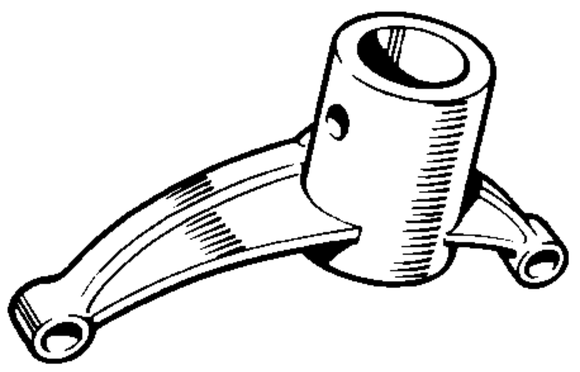
P 4075-4 Drive Pinion Depth Gauge Adaptor

This consists of a dummy pinion and two spacers, used with P 4075.



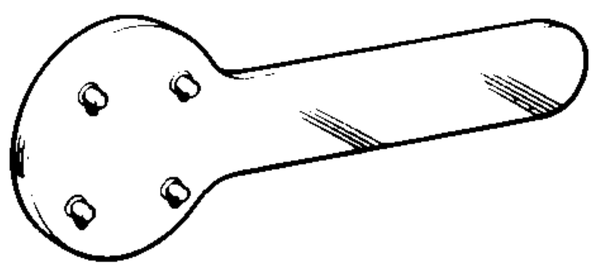
P 4077A Differential Carrier Bracket

Used in conjunction with the 200A or B Engine Stand, provides a convenient means of holding the differential carrier when stripping or rebuilding.



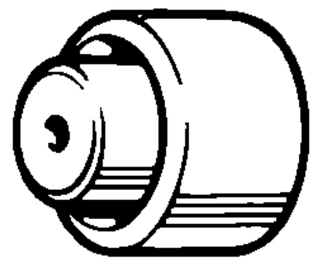
P 4079 Differential Bearing Adjusting Nut Wrench

A specially designed peg-style wrench which is used to turn the differential bearing adjusting nut when carrying out final adjustments.



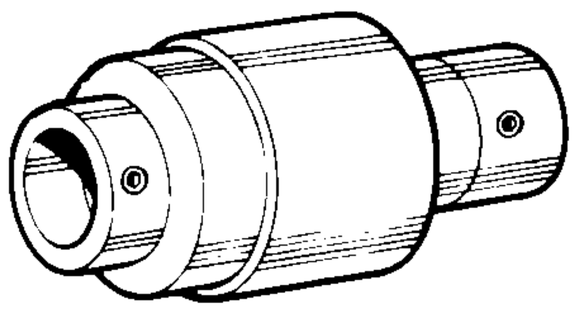
P 4080 Differential Bearing Cone Replacer

Used in conjunction with the 550 Universal Handle, to ensure square replacement of the differential bearing cone without fear of damage.



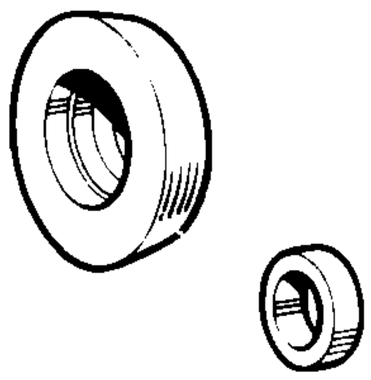
P 4084 Spring Indicator for Press

Consists of:—A spring-loaded barrel assembly accurately graduated in 200 lb. steps. It enables the correct fitting pressure to be gauged when replacing the axle shaft bearing and inner retainer.



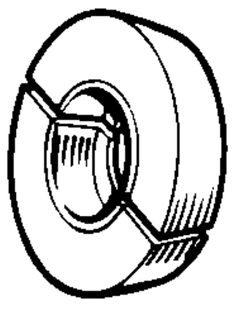
P 4090-2 Axle Shaft Bearing and Inner Retainer Replacer

Used in conjunction with the 370 Taper Base and a workshop press, to replace the axle shaft bearing and inner retainer.



P 4090-6 Rear Axle Bearing and Retainer Remover

Used in conjunction with the 370 Taper Base, this tool is essential for efficient removal of the bearing and bearing retainer.

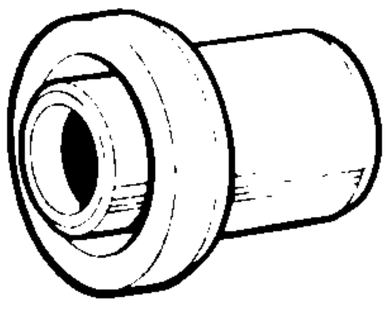


P 4097 or P 4028 Flange Holding Wrench

Fits in the holes of the pinion drive flange.

P 4129A Drive Pinion Oil Seal Replacer

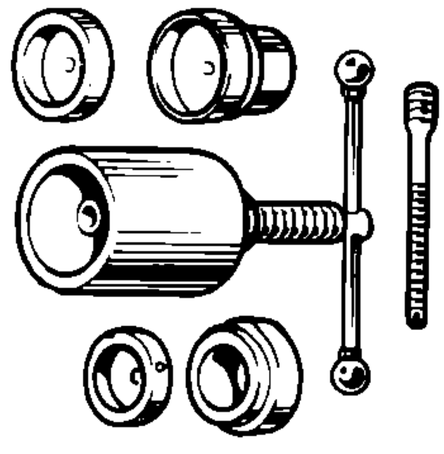
Used to replace the pinion oil seal.



5. FRONT AND REAR SUSPENSION

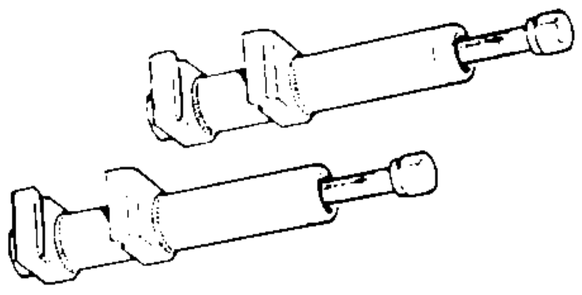
P 5029 Rear Spring Bush Remover and Replacer

Used to ensure simple removal and square positive replacement of the bushes.



P 5045 Coil Spring Adjustable Restrainers

These tools have adjustable jaws which grip the coils of the spring to keep it compressed.



P 5041A Front Suspension Unit Bump Stop Platform Wrench

Consists of a single-sided peg wrench.

P 5043 Front Suspension Unit Gland and Bush Replacer

This tool is essential to ensure that the gland and bush assembly is replaced on the piston rod without damage.

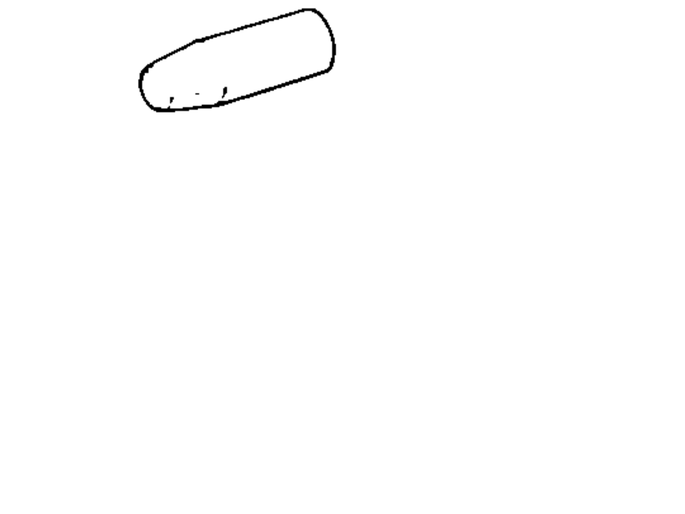
6. ENGINE

P 4063 Cylinder Head Locating Studs

Used to assist in the location of the cylinder head without risk of damaging the cylinder head gasket.

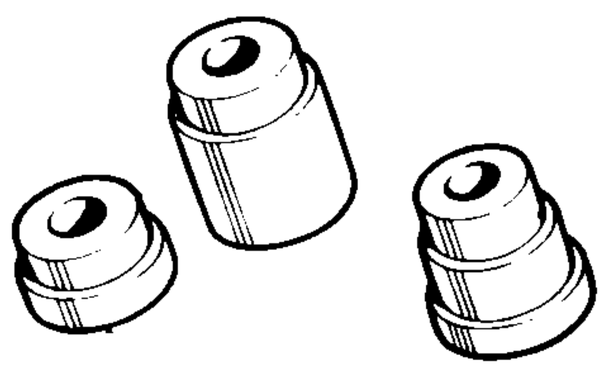
P 6031 Camshaft Bush Remover and Replacer (Main Tool)

Used with P 6031-3 adaptors to remove and replace the camshaft bushes.



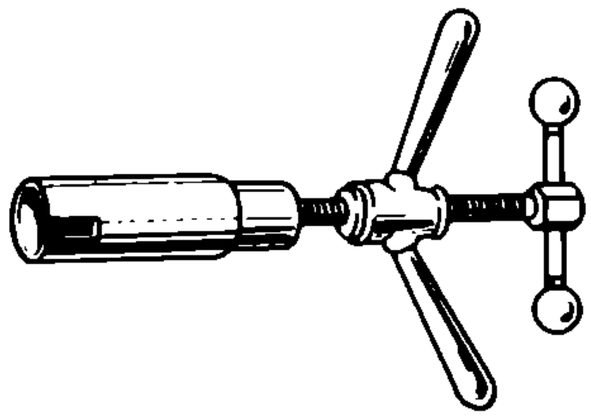
P 6031-3 Camshaft Bush Remover and Replacer (Adaptor)

Used with P 6031 main tool to remove and replace the camshaft bushes.



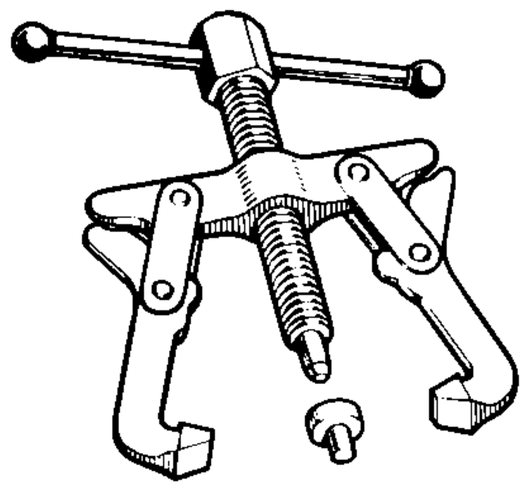
CP 6032A or B Crankshaft Sprocket Replacer

Used to replace the crankshaft gears and sprockets as fitted to the range of passenger cars.



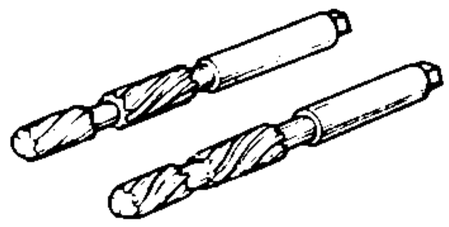
CP 6041 Crankshaft Pulley Remover

A two-legged puller with specially shaped feet to fit closely to the belt groove of the pulley.



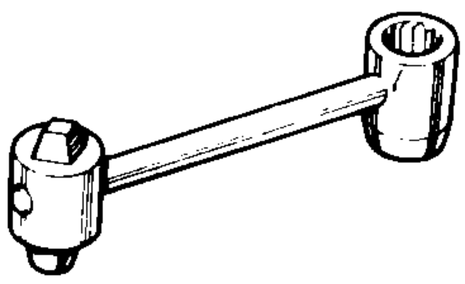
P 6056-015 and P 6056-030 Valve Guide Reamers

Enables the valve guide bore to be reamed 0.015 in. or 0.030 in. oversize in order to fit oversize valve stems.



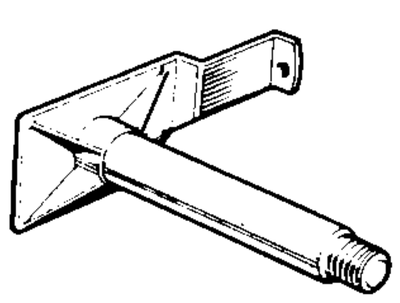
P 6064 Drain Plug Wrench

Used to remove the gearbox and rear axle filler/level plugs.
Size 0.52 in. A/F double square socket. 0.583 in. A/F double square socket and $\frac{3}{8}$ in. and $\frac{7}{16}$ in. square plugs.



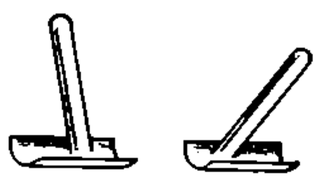
P 6107 Engine Bracket

Enables the engine to be mounted on the 200A or B Engine stand.



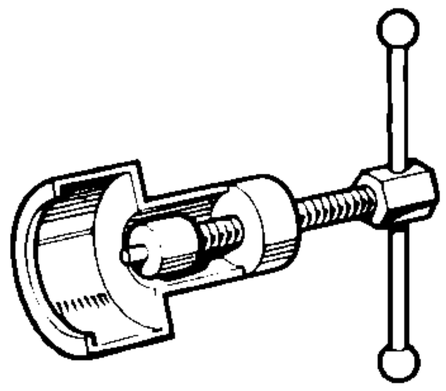
P 6110 Main Bearing Liner Remover and Replacer

A set of two pins coloured as follows: Rear journal pin – Black. Front and Centre journals pin – Blue.



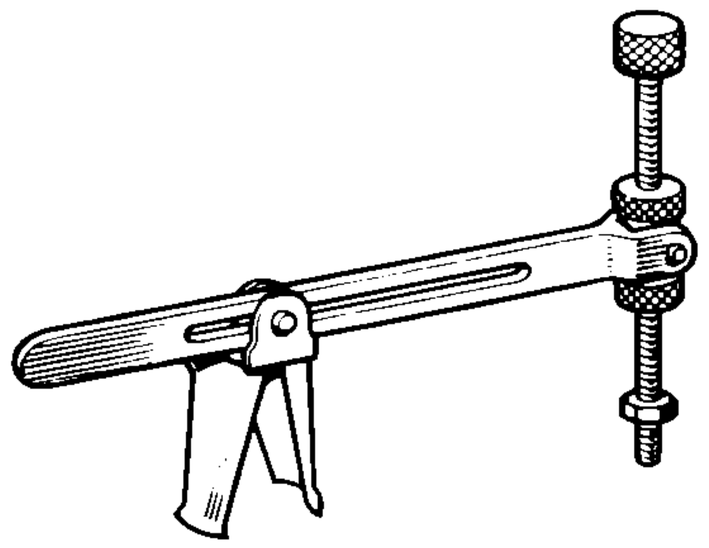
P 6116 Crankshaft Sprocket Remover

A robust tool, to enable the crankshaft sprocket to be removed with ease.



6118A Valve Spring Compressor (Main Tool)

One end bolts into a rocker shaft support bolt hole, utilising P 6118-3A adaptor. Pivoted at this point is the lever handle along which an adjustable foot can be moved.

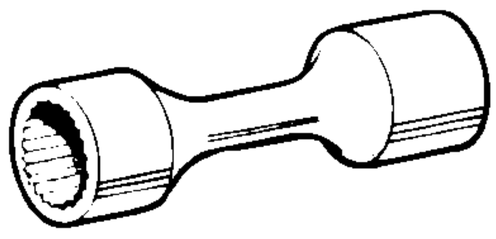


P 6118-3A Valve Spring Compressor (Adaptor)

Used with 6118A to assist in valve removal and replacement.

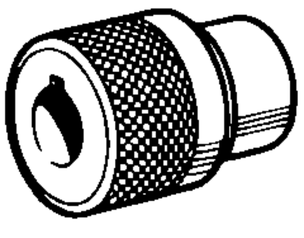
P 6129 Cylinder Head Bolt Socket

Enables the cylinder head bolts to be torqued without removing the rocker shaft assembly.



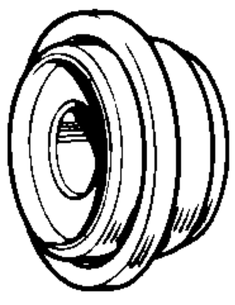
P 6150 Crankshaft Front Oil Seal Aligner

Ensures the correct alignment of the crankshaft front oil seal with the crankshaft when replacing the front cover.



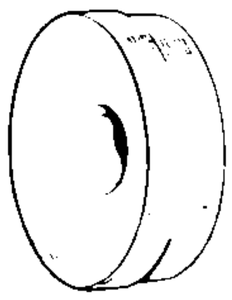
P 6161 Crankshaft Front Cover Oil Seal Remover and Replacer

This is a double-ended tool used with the 550 handle.



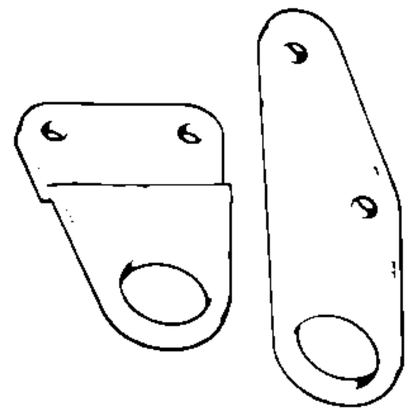
P 6165 Crankshaft Rear Oil Seal Remover and Replacer

This is a double-ended tool used with the 550 handle.



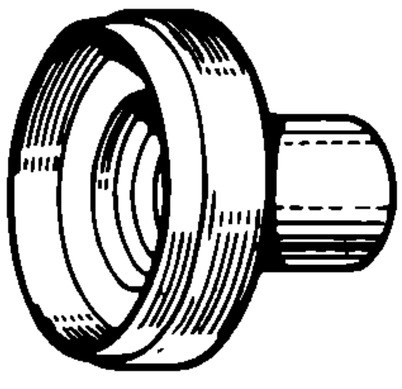
P 6171 Engine Lifting Brackets

Consists of two plates which bolt to the manifold faces of the cylinder head.



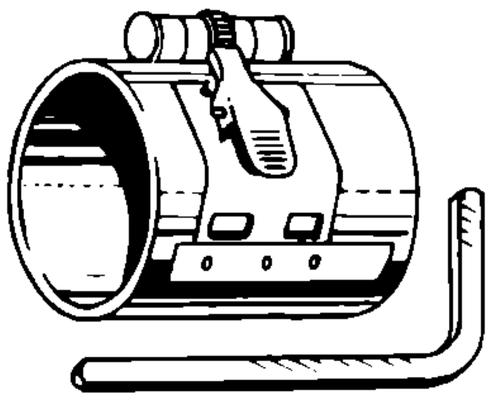
CP 6173 Crankshaft Rear Oil Seal Alignment

Ensures the correct alignment of the crankshaft rear oil seal when assembling the rear oil seal retainer.



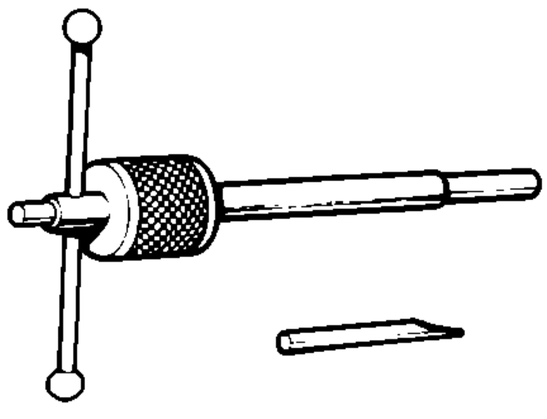
38-U-3 Piston Ring Compressor

This consists of an adjustable spring steel cylinder and an adjusting key.



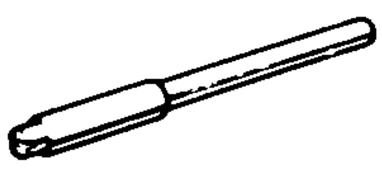
316 X Valve Seat Cutter (Main Tool)

Used with 316-10, 317-20, 317-25, 317-6-22, 317-6-25, 317-P-20, 317-P-22, 317-T-20 and 317-T-25, to cut the valve seats.



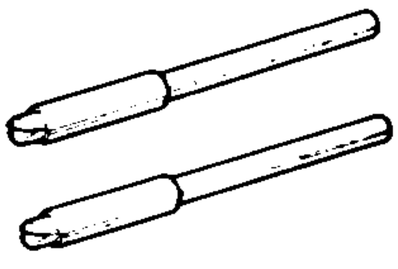
316-10 Valve Seat Cutter Pilot

Used with 316X, 317-20, 317-25, 317-6-22, 317-6-25, 317-P-20, 317-P-22, 317-T-20 and 317-T-25.



F1 and F2-316-10 Valve Seat Cutter Pilots

Used in place of 316-10 when valve stem bores are 0.015 or 0.030 in. oversize

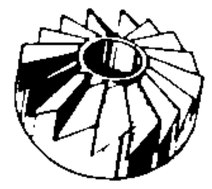


317-20 Valve Seat Cutter – Exhaust

This cutter has an angle of 45°.

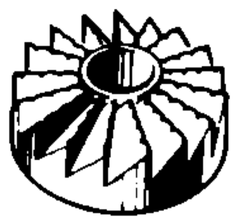
317-25 Valve Seat Cutter – Inlet

This cutter has an angle of 45°.



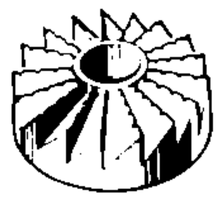
317-G-20 45° Valve Seat Glaze Breaker – Exhaust

This cutter has an angle of 45°.



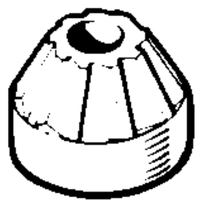
317-G-25 45° Valve Seat Glaze Breaker – Inlet

This cutter has an angle of 45°.



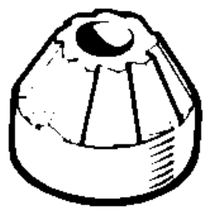
317P-20 75° Valve Seat Narrowing Cutter – Exhaust

This cutter has an angle of 75°.



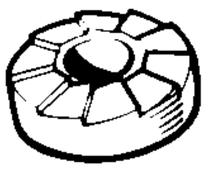
317P-22 75° Valve Seat Narrowing Cutter – Inlet

This cutter has an angle of 75°.

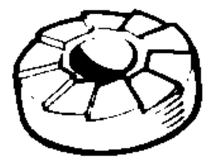


317T-20 15° Valve Seat Narrowing Cutter – Exhaust

This cutter has an angle of 15°.



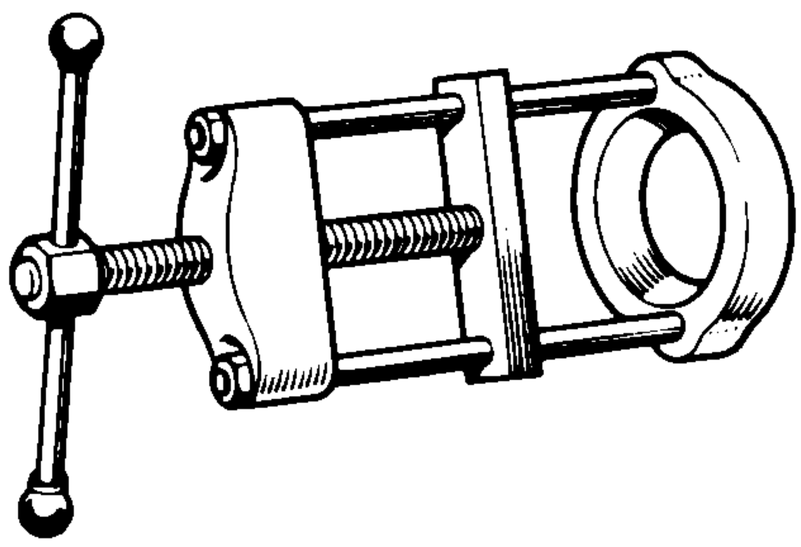
317T-25 15° Valve Seat Narrowing Cutter – Inlet



This cutter has an angle of 15°.

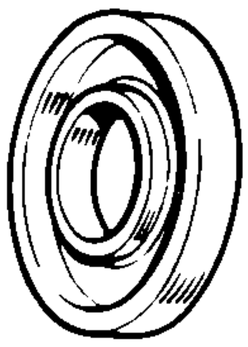
7. GEARBOX

CP 4000 Hand Press (Main Tool)



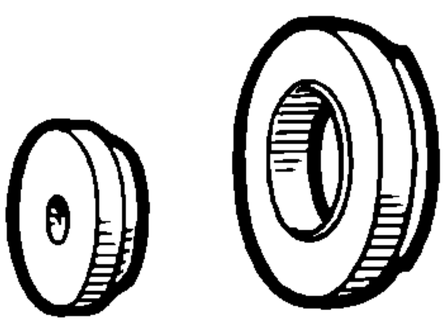
Used in conjunction with different adaptor sets to assist in the completion of various gearbox operations.

P 4000-31A Mainshaft Bearing and Hub Replacer



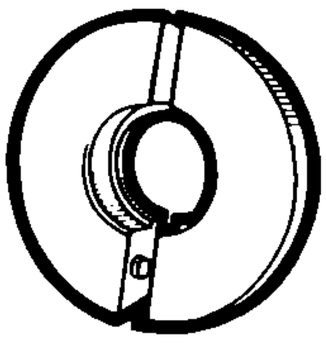
Consists of a ring and a collar, used with the 370 taper base and a workshop press.
Use detail "a" only for replacing main shaft bearing.

P 4000-39 Main Drive Gear Bearing Replacer



Consists of a replacer adaptor and a floating guide, used in conjunction with P 4090-6, the 370 taper base or CP 4009 and a workshop press.

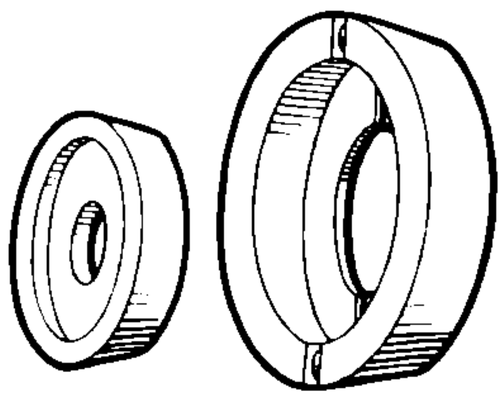
P 4090-6 Mainshaft Hubs Remover



Used in conjunction with the 370 taper base P 4000-31A, to replace mainshaft bearing.

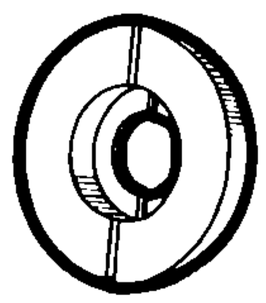
P 4090-7A Mainshaft Bearing and First Gear Remover

Use detail "a" only to remove first gear and mainshaft bearing. Use detail "b" only to replace synchro hubs.



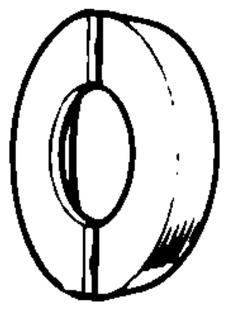
P 4090-9 Synchroniser Hub Remover

Consists of a pair of split rings and used in conjunction with the 370 taper base.



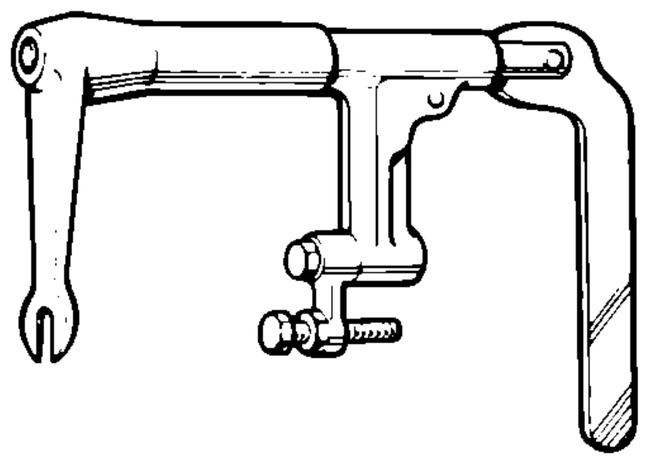
P 4090-10 Main Drive Gear Bearing Remover

Used in conjunction with the 370 taper base and a workshop press, to remove the main drive gear bearing.



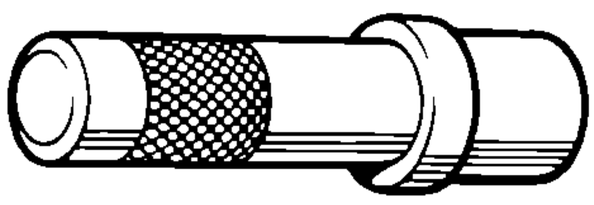
P 6061 Spring Compressor (Main Tool)

Used to compress the reverse stop spring to assist removal of the circlip.



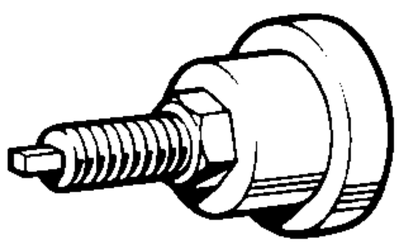
P 7038 Transmission Extension Bearing Remover/ Replacer

Used to replace the transmission extension bearing and is essential particularly when thin shell bearings are fitted.



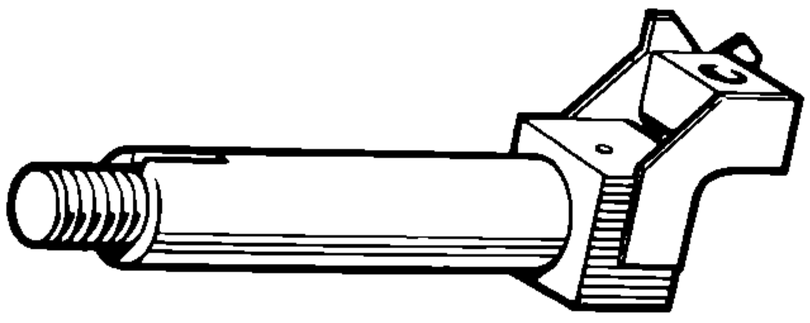
P 7043 Mainshaft Ball Bearing and Idler Shaft Remover

Used to remove the reverse idler shaft.

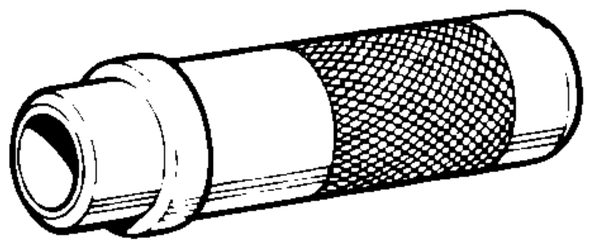


P 7089 Gearbox Bracket

Used in conjunction with the 200A or B Engine Stand, this bracket enables the gearbox to be held in a rigid position for stripping or rebuilding.

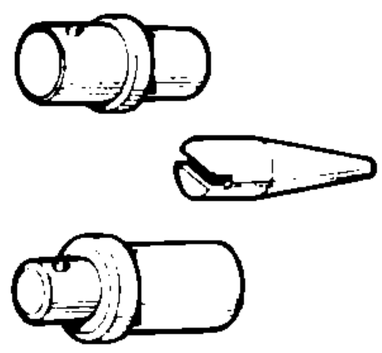


P 7095 Transmission Mainshaft Oil Seal Replacer



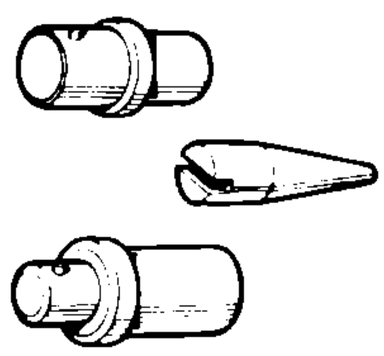
This driver-type tool ensures correct location of the transmission mainshaft oil seal without danger of damage to components.

P 7102 R.H. Gear Selector Housing Oil Seal Replacer



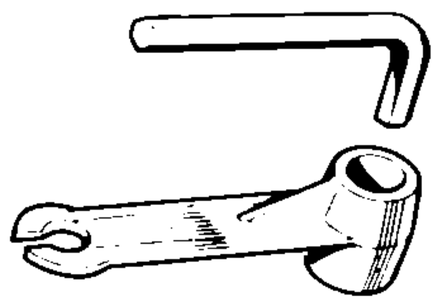
Consists of two replacer pads and one seal protector, used in conjunction with the 575 Light Universal Handle, to replace the gear selector housing oil seal.

P 7102 L.H. Gear Selector Housing Oil Seal Replacer



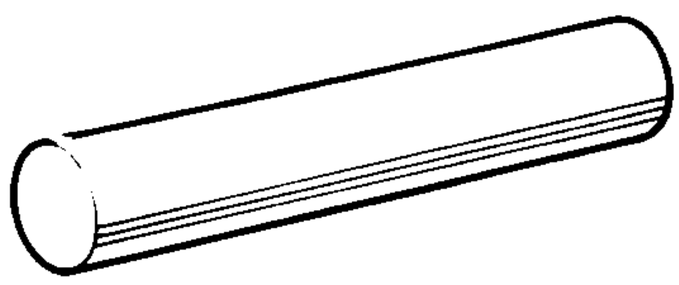
Consists of two replacer pads and one seal protector, used in conjunction with the 575 Light Universal Handle, to replace the gear selector housing oil seal.

P 7103 Gear Selector Housing Spring Compressor



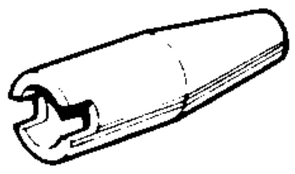
This tool simplifies removal or replacement of the transmission gear selector shaft circlip.

P 7113 Dummy Countershaft



An accurately machined shaft which provides a means of removing the cluster gear assembly complete from the gearbox.

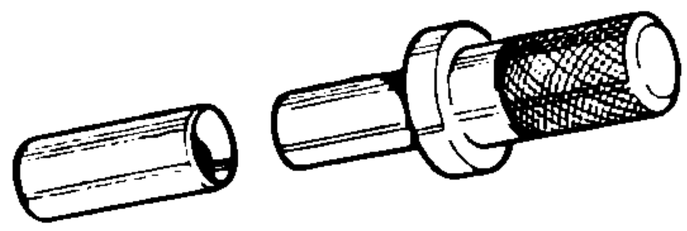
P 7116 Gear Selector Housing Oil Seal Protector



Provides a safeguard for the oil seal in the top of the gearchange housing when fitting the lever and shaft assembly.

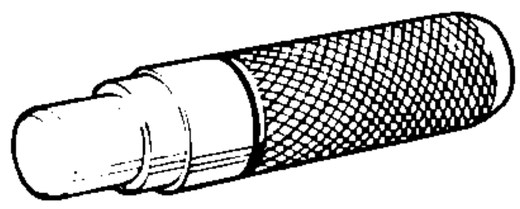
P 7136 Main Drive Gear Oil Seal Replacer

This tool ensures the accurate replacement of the oil seal.



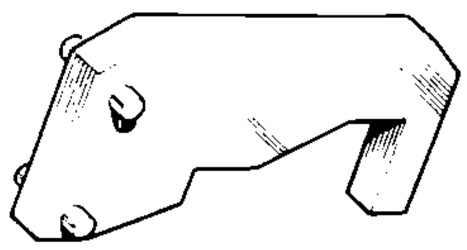
P 7137 Spigot Bearing Replacer and Clutch Disc Locator

This tool eliminates the danger of damaging the bearing during replacement, and ensures correct alignment of clutch disc.



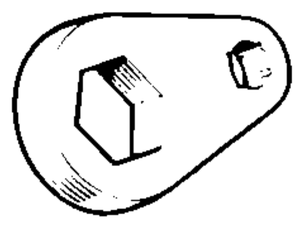
P 7138 Gearchange Relay Rod Setting Gauge

Consists of a setting plate and spacer. This tool may be used for both left- and right-hand drive cars.



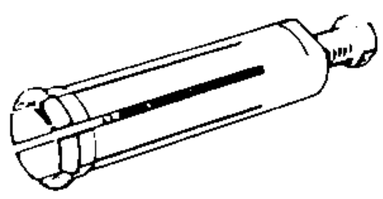
P 7146 Mainshaft Nut Wrench

A specially shaped wrench with a $\frac{1}{2}$ in. square drive used in conjunction with a suitable tension wrench to ensure correct torque loading of the mainshaft nut.



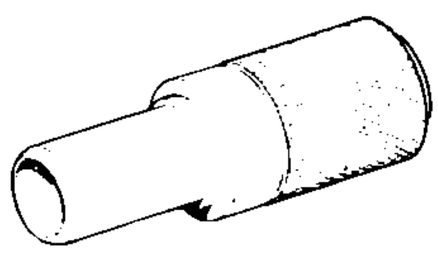
P 7149 Transmission Extension Housing Bush Remover

This tool enables the extension housing bush to be removed with the gearbox in situ.



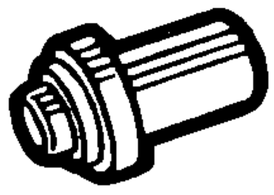
P 7150 Transmission Extension Housing Bush Replacer

Ensures accurate replacement of the extension housing bush with the gearbox in situ.



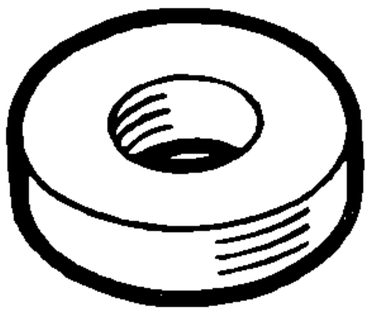
P 7152 Selector Rail Oil Seal Replacer

Use in conjunction with 575 light handle.



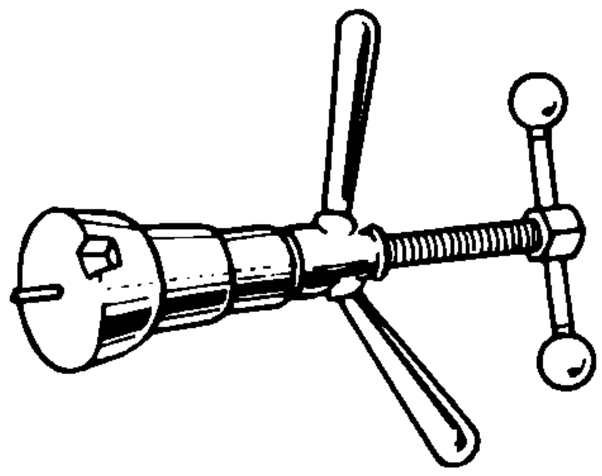
P 7154 Circlip Assessment Gauge

Floor change only. Used to assess mainshaft bearing circlip thickness.



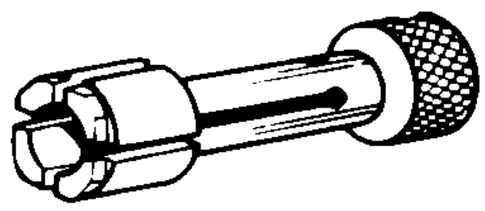
7600A or B Flywheel Bearing Remover (Main Tool)

Used in conjunction with a suitable adaptor, facilitates removal of the flywheel bearing.



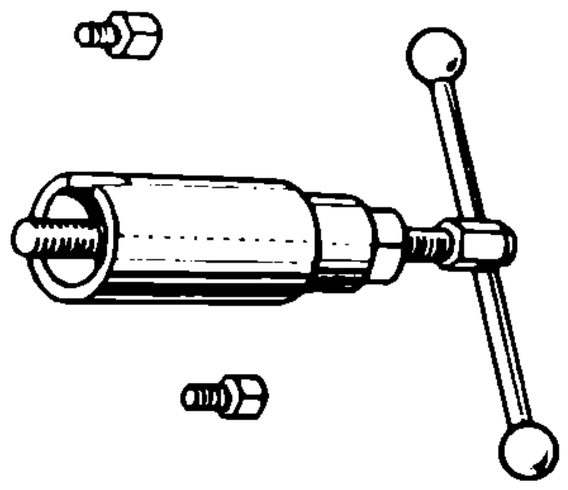
CP 7600-6 Flywheel Bearing Remover (Adaptor)

A split collet used in conjunction with 7600A or B Main Tool



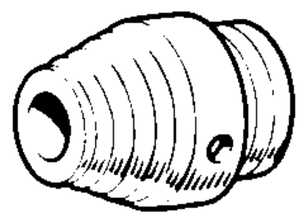
7657 Mainshaft Oil Seal Remover (Main Tool)

Used in conjunction with a suitable adaptor to remove the mainshaft oil seal without the need of removing the gearbox from the car.



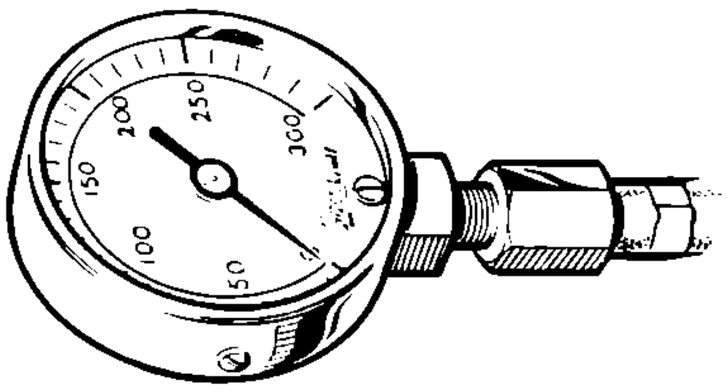
P 7657-4 Mainshaft Oil Seal Remover (Adaptor)

Used in conjunction with 7657 Main Tool the hollow centre allows the tool to be applied over the shaft, thus allowing the seal to be removed.



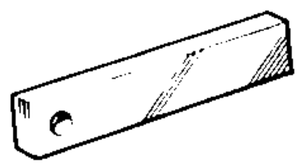
CBW 1A Pressure Test Gauge

Only one of the eight pressure take-off adaptors is required on the Cortina automatic transmission.



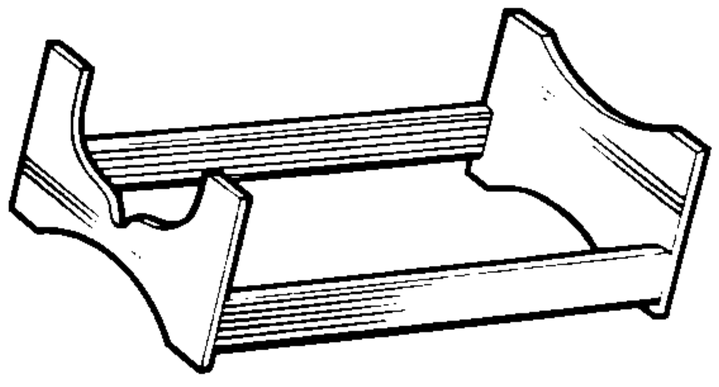
CBW 34 Front Band Spacer Gauge

A small steel gauge which is essential to obtain the correct setting when adjusting the front band.



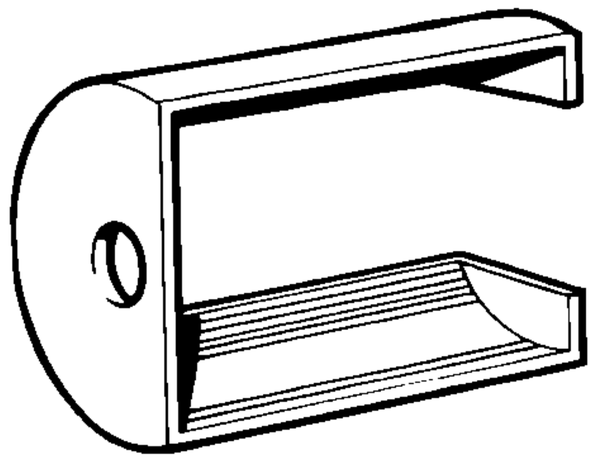
CBW 35B Bench Cradle

The use of this tool permits complete freedom to carry out the various adjustments and assembly operations without difficulty.



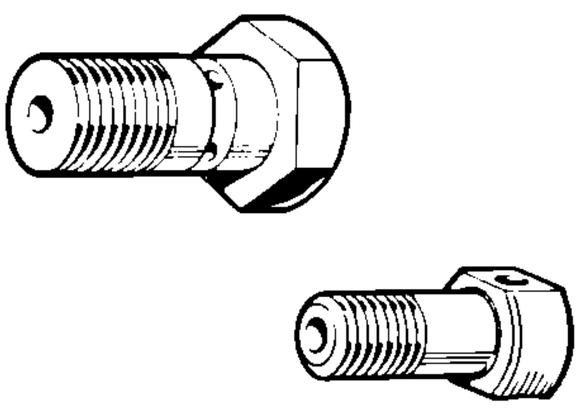
CBW 37A Clutch Spring Compressor

Used in conjunction with a suitable hydraulic press, this tool enables the spring to be compressed, facilitating removal of the snap ring.



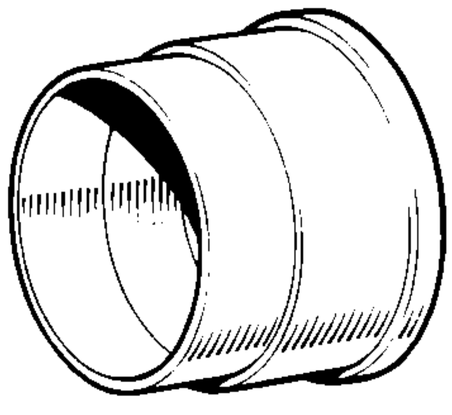
CBW 38 Hydraulic Test Equipment (Adaptor)

Used in conjunction with CBW 1A Main Tool, this tool enables all the necessary pressure tests to be carried out.



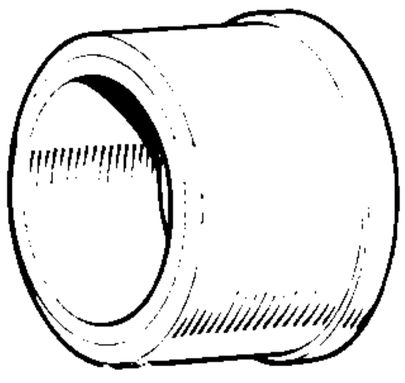
CBW 41 Rear Clutch Piston Replacer

On the rear clutch the replacer is fitted prior to installing the piston assembly. Correct use of this tool will obviate the danger of damage and resultant leakage.



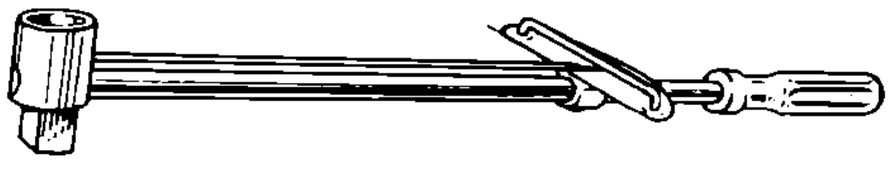
CBW 42 Front Clutch Piston Replacer

Provides a sure means of protection for the oil rings and is essential when replacing the front clutch piston



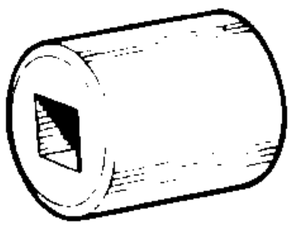
CBW 547A-50 Spring Beam Tension Wrench (Main Tool)

Enables the correct torque to be applied to various locations, using the appropriate adaptor.



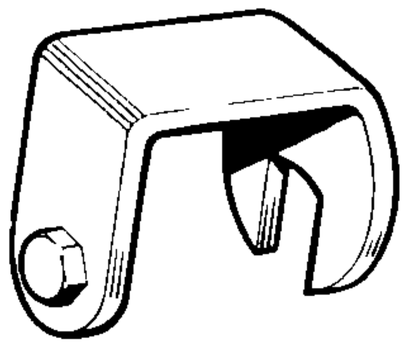
CBW 547A-50-2 Rear Servo Adaptor Socket

A $\frac{5}{16}$ in. bi-square $\times$ $\frac{3}{8}$ in. square drive socket used in conjunction with CBW 547A-50 Main Tool and an extension to set the rear band adjustment.



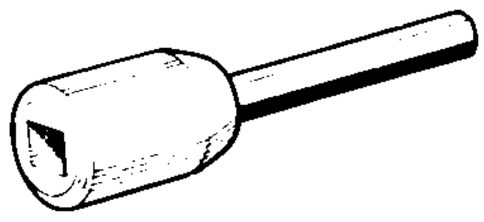
CBW 547A-50-3A Inhibitor Switch Locknut Adaptor

This special "U" shaped adaptor makes it possible to replace the inhibitor switch with the gearbox "in situ".



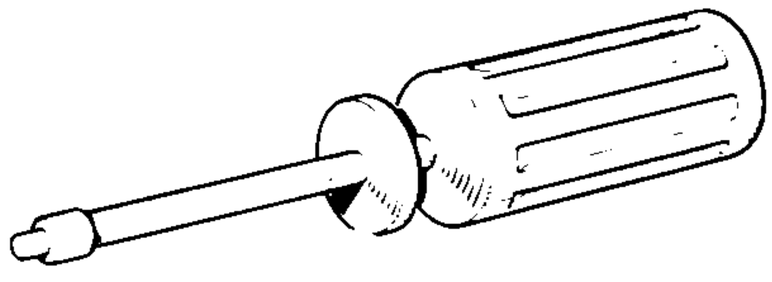
CBW 547A-50-4 Pressure Take-Off Plug Adaptor

Used in conjunction with CBW 547A-50 Main Tool and suitable extension, this tool ensures that the pressure point plug is replaced without over-tightening.



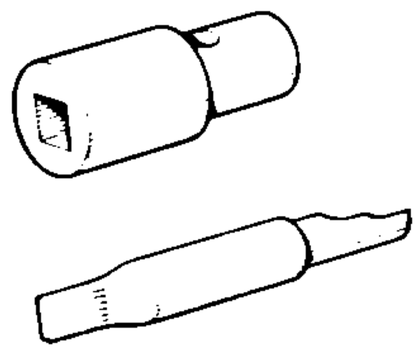
CBW 548 Spintorq Screwdriver (Main Tool)

A small pre-set torque screwdriver with a $\frac{1}{4}$ in. square drive, adjustable from 0 to 45 lbs./in., supplied complete with setting key.



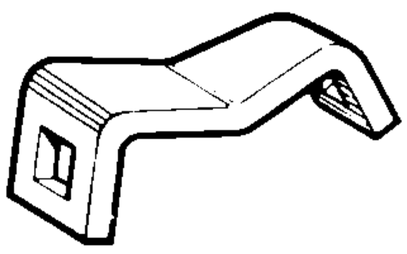
CBW 548-1 Spintorq Screwdriver (Adaptor)

Used in conjunction with CBW 548 Main Tool, this small blade enables all slotted head screws to be tightened to their specified torque setting.



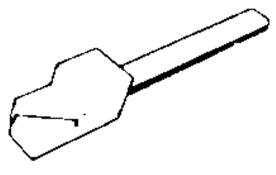
CBW 548-2 Front Servo (Adaptor)

Used in conjunction with CBW 548 Main Tool, and CBW 34, this "U" shaped adaptor can be used with the transmission "in situ".



7066J Circlip Pliers 'J' Type Points

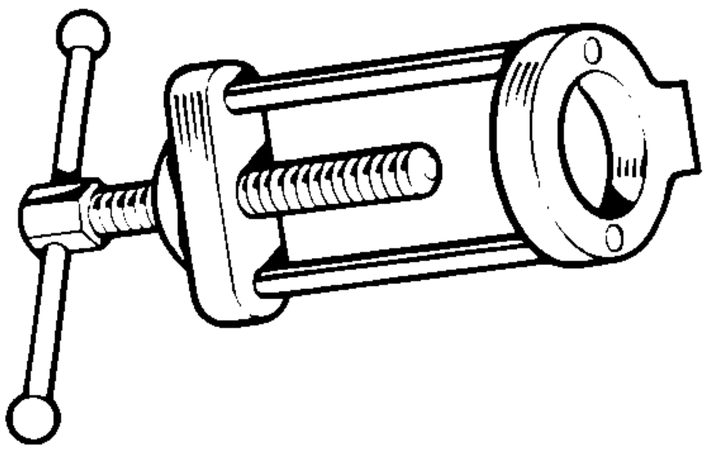
Used in conjunction with the 7066 circlip pliers when removing or replacing the front clutch spring circlip. Specify 'J' type points when ordering.



8. COOLING SYSTEM

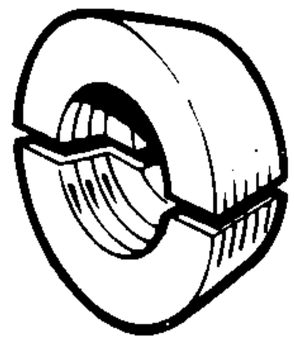
CPT 8000 Water Pump Overhaul Tool (Main Tool)

Consists of four adaptors, used in conjunction with a workshop press.



CPT 8000-4B Water Pump Overhaul Tool (Adaptors)

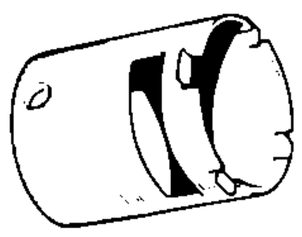
Used with CPT 8000 Main Tool to enable the water pump to be dismantled and reassembled.



9. FUEL SYSTEM

P 9082 Fuel Tank Sender Unit Lock Ring Wrench

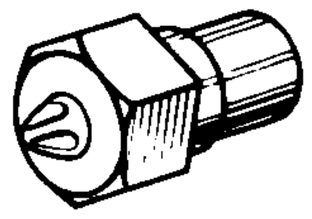
This tool simplifies removal and replacement of the fuel tank sender unit.



10. ELECTRICAL SYSTEM

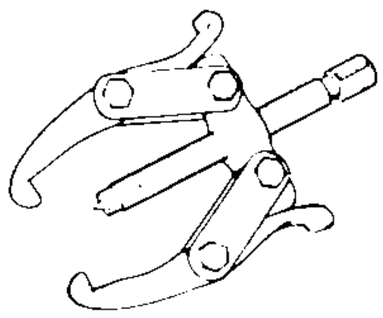
CP 9504 Pole Piece Screwdriver

A generator is mounted in a vice complete with the body of the tool and a suitable bit. It is then easy to turn the bit with a spanner and slacken off the screw.



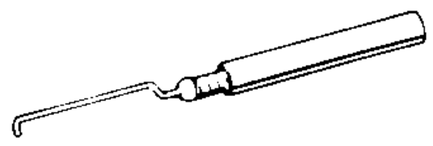
CP 4111 Differential Bearing Cone Remover

Used to replace the cover from the drive pinion circlip on pre-engaged starter motors.



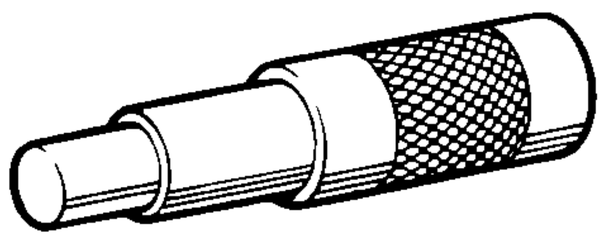
CP 9501 Spring Tension Scale

Used to check the tension of the starter motor brush springs.



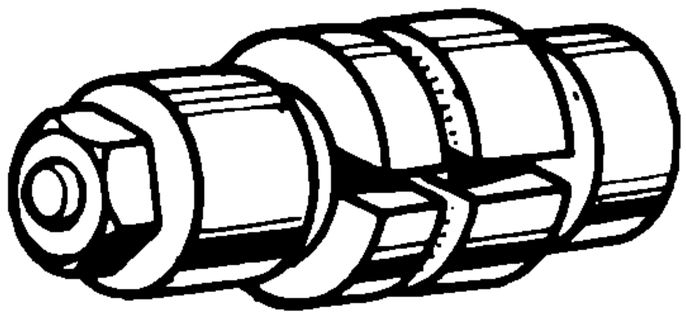
CP 9507 End Plate Bushing Remover/Replacer

Used to remove and replace the bearing from the commutator end bracket.



CP 9509 Pole Piece Expander

Expands the pole pieces and firmly presses them into position in the generator without fear of damage or distortion.



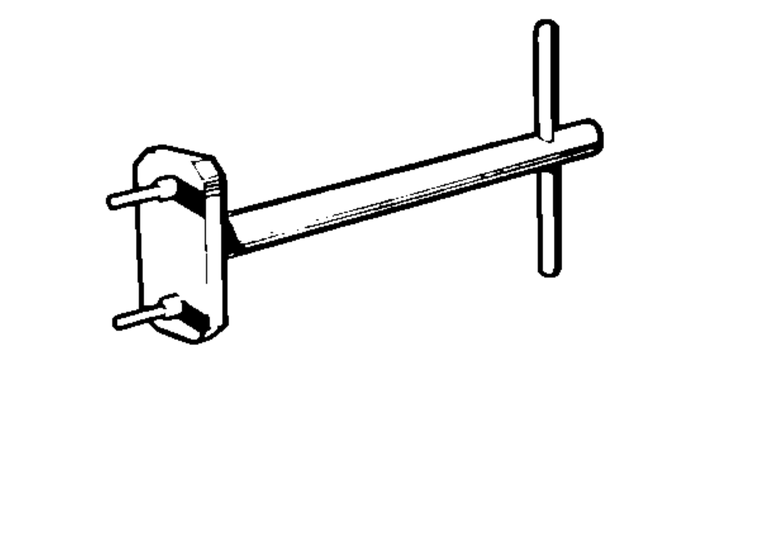
CP 9521 Wiring Loom Retaining Clip Replacer

Necessary to replace the "fir tree" retaining clip.
This tool has two prongs which locate in the blind holes provided in the clip enabling it to be squarely pressed home.

12. BODY

P 5517 Front Suspension Unit Mounting Alignment Jig

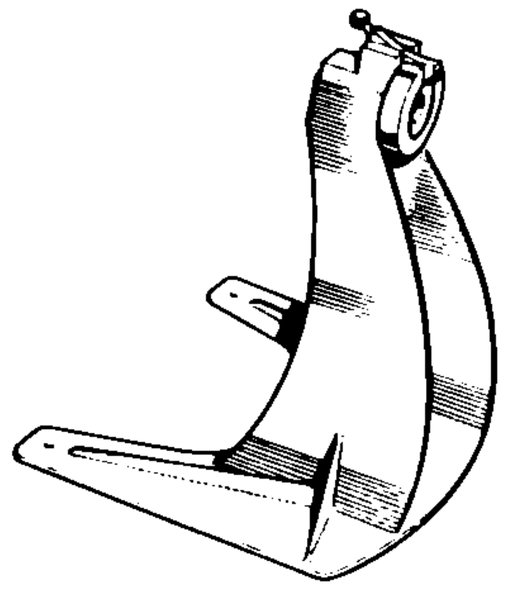
Of fibre-glass construction. This jig is an essential item for efficient accident repair.



GENERAL TOOLS

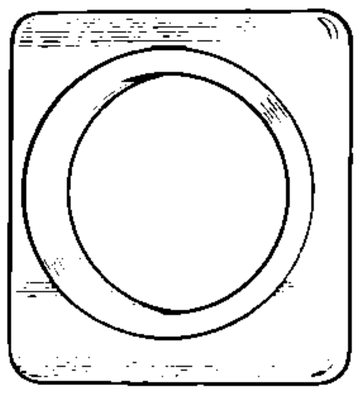
200A or B Engine Stand

Using the appropriate mounting brackets, the various engines, gearboxes and differential assemblies can be mounted on this stand to facilitate dismantling and reassembly.



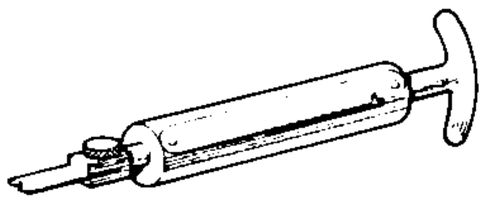
370 Universal Taper Base

This tool fits most workshop presses to take the various split adaptors, etc., in place of the hand tools.



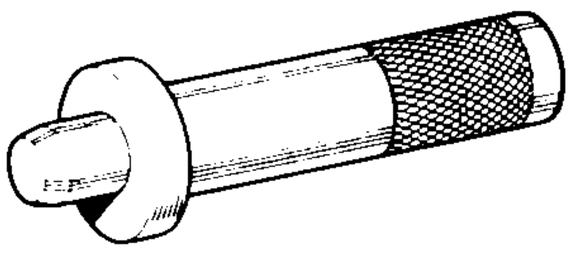
512 Piston Pull Gauge

Used for determining accurate piston fit etc.



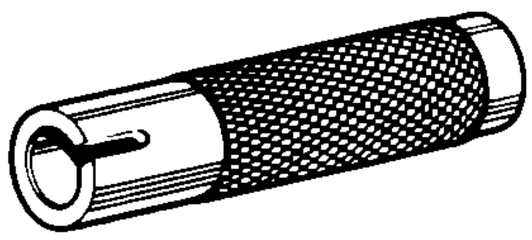
550 Universal Handle

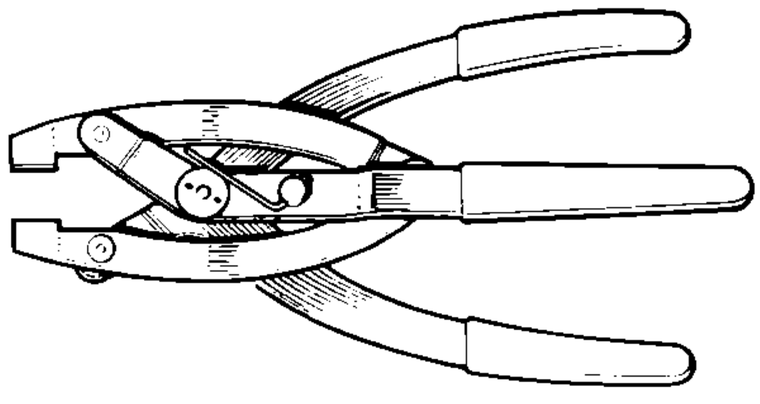
This tool has a spigot at one end onto which various oil seal replacers, etc., will fit.



575 Light Universal Handle

This tool is a lighter version of the 550 universal handle.



7066 Circlip Pliers

Medium sized circlip pliers for removal and replacement of various circlips, etc.