

VW 1600 TRANSPORTER

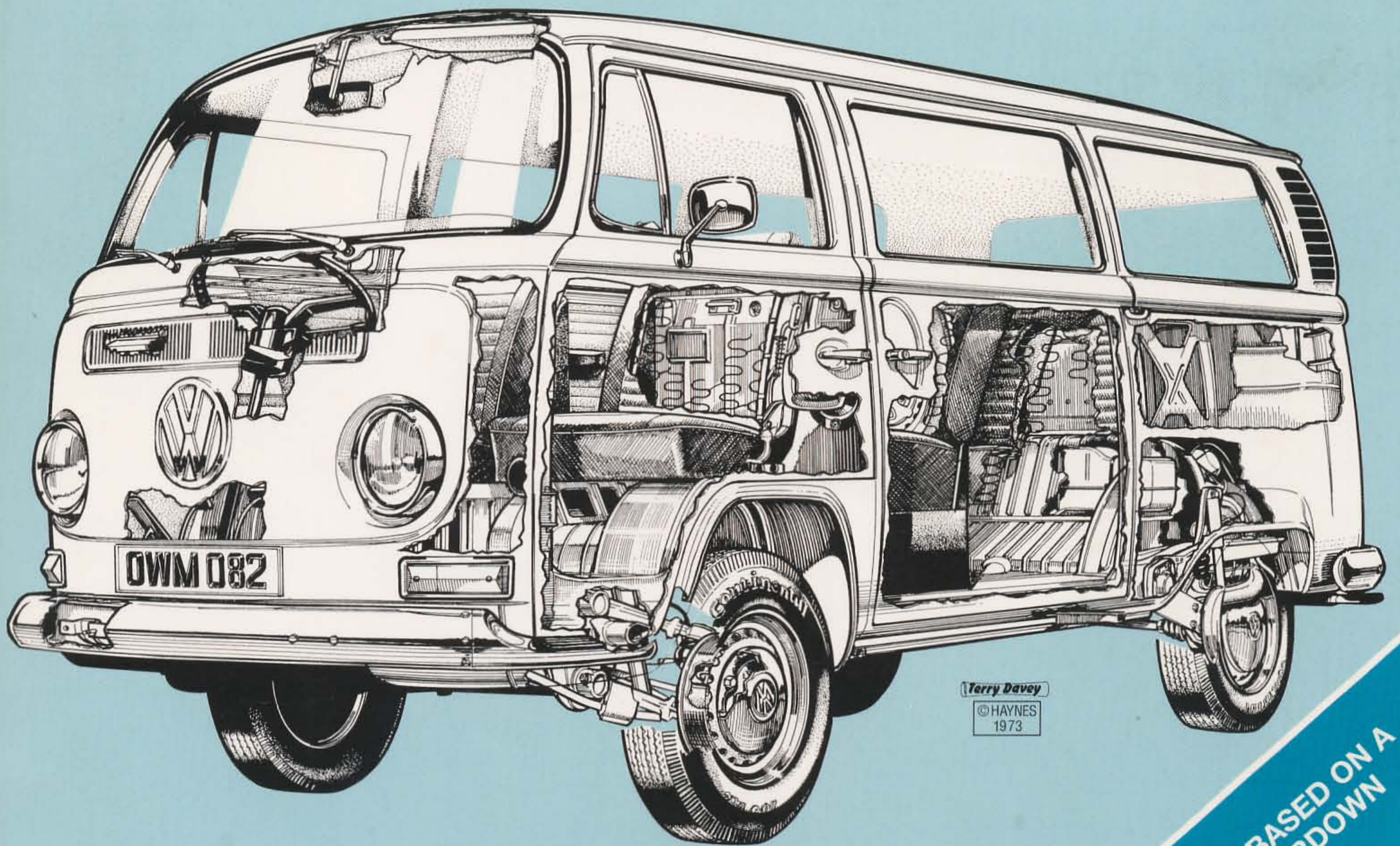
1968 thru 1979

All models □ 96.7 cu in (1584 cc)

96030 (082)



Automotive Repair Manual



Terry Davey

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1973



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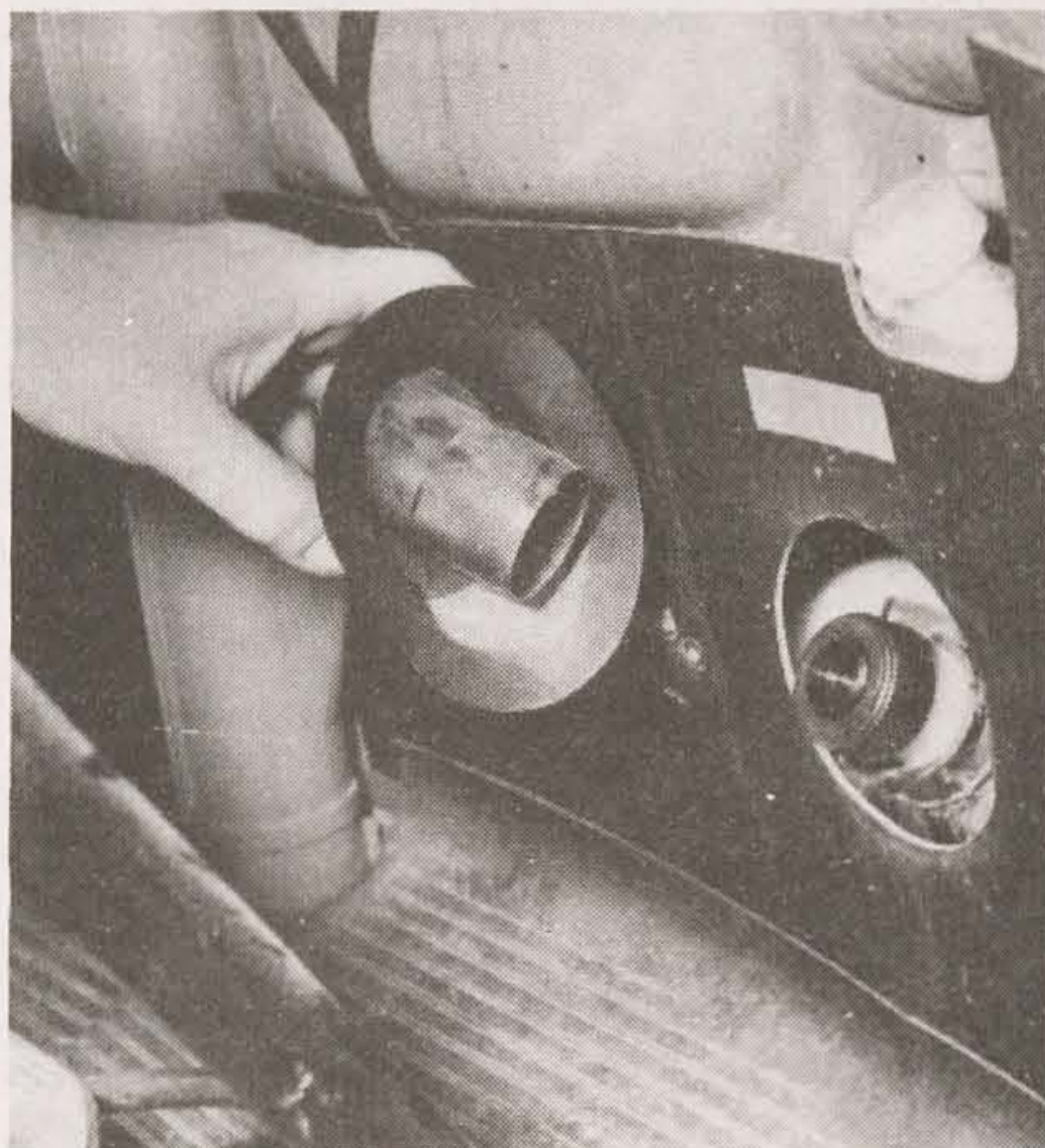
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The windscreen washer reservoir is mounted on the vertical panel in the front of the cab just below the brake fluid reservoir.



Engine oil dipstick.

to the front panel of the cab just below the hydraulic fluid reservoir. It has a protective cover and tucked inside is a tube with an ordinary tyre valve for pressurisation purposes (photo).

The screen washer reservoir should be full of clean water - with an additive of anti-smear compounds as wished. The tank should be pressurised from an ordinary tyre inflator to the maximum pressure of 42 psi/3 kg cm² which is marked on the tank.

If the jets do not direct water on to the screen as they should, refer to Chapter 9 for details.

In the UK correctly functioning screen washers are a legally required fitment to all cars.

3 EFFICIENCY AND PERFORMANCE MAINTENANCE

a) Engine

Lubricating oil - Top up to level	Weekly
Lubricating oil - Drain, clean filter screen and refill with	
Lubricating oil - fresh oil.	3 months
Fan belt - Check tension and adjust if required.	1 month
Air cleaner - Clean out bowl and refill with oil (oil bath type).	3 months
Air cleaner - Renew paper element (paper element type)	6 months
Air cleaner - Check correct operation of warm air control flaps.	1 month
Battery - Check electrolyte level.	Weekly
Distributor - Check contact points gap. Adjust	
Distributor - and/or renew.	3 months
Distributor - Lubricate cam.	3 months
Valve clearances - Check and adjust as required	
Valve clearances - (renew rocker cover gaskets).	6 months
Spark plugs - Removal clean and reset.	6 months
Spark plugs - Renew.	12 months
Fuel pump - Clean filter.	6 months
Carburettor - Check setting of throttle cable	
Carburettor - and lubricate linkage.	6 months
Cover plates and fan housing - Check security of all screws and grommets.	3 months
b) Suspension	
Front wheel bearings - Repack with grease.	2 years
Rear wheel bearings - Repack with grease.	2 years
c) Transmission and final drive	
Gearbox oil - Check level and top up as needed.	3 months
Gearbox oil - Drain and refill with fresh oil except type 091 manual gearbox (August 1975 on) which is 'filled for life'	2 years
Clutch pedal free play - Check movement and adjust.	As necessary
Axle shaft flexible gaiters - Check for splits	3 months
Renew charcoal filter (Fuel Evaporative System)	30 000 miles

4 EFFICIENCY AND PERFORMANCE MAINTENANCE PROCEDURES

a) Engine

Lubricating oil.

To top up the oil, remove the filler cap from the filler pipe at the right hand side of the engine. Remove the dipstick to prevent possible blow back up the filler pipe when pouring oil in. A suitable container or funnel is needed in order to add oil without spillage. The top dipstick mark is the correct capacity level. The lower mark is half full. Do not overfill or let the level drop significantly below the full mark.

When changing the engine oil the filter screen - which is simply wire gauze should be flushed out with paraffin to clear the gauze. This entails removing the circular retaining plate

pulley when undoing or tightening the bolt push a suitable article through one of the holes in the pulley and jam it against the crankcase flange.

3 If, when the nut has been removed, the pulley is a very tight fit, do not apply force at the edges or you are likely to distort it. Soak the boss with penetrating oil and hook something through the two holes if any leverage is necessary.

4 If the pulley has been removed during the course of an overhaul remember that the lower rear engine plate has to be re-fixed before the pulley (photo). There is no access to the two securing screws after the pulley is in position.

5 The nut should be tightened to a torque of 33 ft/lbs when the pulley has been replaced (photos), and Fig.1.5.

10 Oil pump - removal and renovation

1 Remove the crankshaft pulley wheel and the lower rear cover plate.

2 The oil pump gears may be removed relatively easily because once the oil pump cover plate has been released by removing the four retaining nuts, the gears may be drawn out of the pump body.

3 The pump body itself is mounted over the same four studs as the cover plate and is clamped between the two halves of the crankcase. To remove the pump body from the engine without splitting the crankcase is best done with a special tool which fits over the studs, locks to the inside of the body and draws it out. If you do not have such a tool then the best way is first to slacken the crankcase clamping stud nuts above and below the pump. This relieves the pressure on the body. A suitable tool can then be tapped against the edge of the pump body and, in easy stages, it can be eased out over the studs. Do not force a tool into the gap between the pump body and the crankcase as this could damage the mating faces and upset the correct alignment of the pump on replacement.

If the crankcase is to be split anyway leave the pump body to be taken out then.

4 It is possible to check the pump fairly comprehensively without removing the body from the crankcase but it is, of course, far less convenient and liable to cause measurement inaccuracies.

5 First check the cover plate. If it is very badly scored it should be renewed anyway. Light scoring can be ground out using carborundum paste on a piece of plate glass.

6 Check that the driving spindle is a good fit in the body. Any apparent rocking indicates that the inside of the pump body must also be worn. The driven gear spindle should be tight in the body. The gear should be a good fit on it with no play.

7 Provided both gear spindles are in good shape refit the gears and measure the end clearance between them and the end of the pump body. This is done by putting a straight edge across the body and using a feeler gauge to measure the gap between the straight edge and the gears (See Fig.1.4). Make sure no traces of gasket remain on the flange of the body when doing this. The gap should not exceed 0.1 mm (0.004 inch) or inadequate oil pressure will result. The wear is most likely to be in the pump body in this case and this will need renewal.

11 Cylinder heads - removal

1 Take the engine out of the car

2 Remove the exhaust system, heat exchangers and upper cylinder cover plates as described in the Fuel and Cooling Chapters. The inlet manifold together with carburettor should also be taken off. See the Fuel system Chapter for details.

3 Prise off the spring clip, downwards, which clamps the rocker cover to the head. Take off the cover.

4 Undo the two nuts, evenly, which secure the rocker shaft pedestals and then pull off the pedestals, shaft and rockers as a complete assembly. Pull out the four pushrods and push them through a piece of cardboard so that the location of each one is

known and which is the top and bottom end.

5 Before starting to undo the eight nuts which hold the cylinder head down onto the cylinder barrels it must be appreciated that when the head is released the four pushrod tubes will be freed and the cylinder barrels also. If the cylinder barrels are not being taken off the pistons they will rest in position but the engine must not be turned. If the engine is to be turned the barrels should be temporarily tied down to the crankcase with string or wire. If the barrels are disturbed then they must be removed so that new cylinder base gaskets may be fitted (See Section 26).

6 Using a socket spanner, the cylinder head stud nuts should be slackened $\frac{1}{4}$ to $\frac{1}{2}$ turn each only, in the reverse order of the final tightening sequence as given in Fig.1.12. Continue releasing each nut a little at a time until they are all slack. When all are removed the head may be drawn back a little way.

7 Remove the pushrod tubes from between the head and crankcase and make sure the cylinders are disengaged from the head before pulling the head right off.

12 Cylinder heads - dismantling and renovation of rocker gear, valves and springs

1 To remove the rocker arms from the shaft the spring clips at each end should be removed and the thrust washers and wave washers taken off. The end rockers may then be removed. The rocker shaft support pedestals may need tapping off if they are tight in order to remove the two inner rocker arms, clips and washers. If possible lay out the parts in the order in which they were dismantled in a place where they need not be disturbed.

2 To remove the valves it is necessary to use a proper tool to compress the valve springs. The tops of the springs are almost level with the edge of the head casting. If you are unable to obtain a G clamp with extended ends (to clear the edge of the head when the spring is compressed) it will be necessary to use a short piece of tube, with an aperture cut in the side, in conjunction with a conventional spring compressor. The aperture is to enable one to get at the split collets on the valve stem.

3 Compress the spring using the clamp and if the tubular spacer is being used make sure that the pressure is applied squarely and that the tube cannot slip. As soon as the two split conical collars round the valve stem are revealed, use a small screwdriver through the aperture to hook them off the valve stem. It is advisable to maintain one's hold on the spring clamp while doing this to prevent anything from slipping. When the collets are clear release the spring clamp.

4 The spring retainer collar and spring may then be lifted off. There may be small sealing rings round the valve stems and these too should be taken off. The valve can now be pushed through the guide and taken out. If it tends to stick then it will be because of carbon or sludge deposits on the end of the valve stems and these should be cleaned off as necessary. The end of the valve stem could also be burred due to the 'hammering' action of the rocker arm; in which case the burrs should be carefully stoned off. Do not force a tight valve through the guide or you will score the guide. Keep valves in order so that they may be replaced in the same port. Push them through a numbered piece of cardboard to avoid getting them mixed up.

5 After the cylinder head has been removed and the valves taken out, the head itself should be thoroughly cleaned of carbon in the combustion chamber and examined for cracks. If there are any visible cracks the head should be scrapped. Cracks are most likely to occur round the valve seats or spark plug holes. Bearing in mind that one head will cost (new) nearly 20% of the cost of a complete replacement engine economies should be considered as well as the likelihood of obtaining a used head from a breaker's yard. If the latter, make sure that the head you get is the same type as the old one - and in better condition!

6 Occasions occur when the head has been removed because of 'blowing' between the head and cylinder (photo). This is usually caused when head studs and nuts have not been tightened to the correct torque or tightened unevenly. Provided there are no signs

shells to an un-reground crankshaft this is possible. If very noticeable however, it indicates that the journal is out of round. If rods on a reground crankshaft are slightly tight the engine will need running-in. If very tight then the regrinding tolerances are wrong and it should be returned to the machinists for correction.

6 Place the assembled crankshaft on the bench once more, as before, with each connecting rod facing its proper cylinder position.

7 If you are fitting the connecting rod to an assembled crankcase/crankshaft lay out the rods alongside their respective cylinder positions as already explained and fit the shells into the rods and caps. Turn the crankshaft so that the journal for the rod to be fitted is nearest its crankcase opening. The cap must then be placed on the journal and the rod fitted to it. This is easy if you have four hands and fingers ten inches long! It is helpful to have a piece of bent metal rod which can be put through from the opposite side of the crankcase to hold the cap on the journal whilst the rod and nuts are being fitted. A certain amount of patience is essential as it is more than likely that you will drop a bolt or bearing cap into the crankcase at some stage and have to shake it out. Do not use grease to hold parts together for this assembly. It will probably affect lubrication seriously. The most important thing to ensure is that a bearing shell does not drop out unnoticed and get trapped and damaged while you are fiddling about. So if a shell drops in the crankcase go easy on rotating the crankshaft until you get it out. As soon as the first connecting rod is fitted tighten the bolts to the correct torque and check that it moves freely but without any clearance. You will be refitting new shells to the original journal sizes so if something seems amiss - bearing too tight or too loose - make sure you have bought the correct shells by comparing the numbers and oversize (if any) with the old ones removed.

24 Crankcase, crankshaft, camshaft and cam followers - re-assembly

1 The items in this section heading are grouped together for the very good reason that they all have to be assembled together. None may be omitted. (See Fig. 1.10).

2 Both crankcase halves must be perfectly clean, inside and out. All traces of jointing compound must be removed from the mating faces, the roots of the studs, and the chamfers in the stud hole mating faces. Use a solvent such as carbon tetrachloride to remove sealing compound and not a scraper which could damage the aluminium surfaces. The distributor drive gear should have been removed. The oil pump suction pipe must be tightly fitted. If loose it must be peened in position.

3 Place the left hand half of the crankcase on the bench with the flywheel end away from you and leaning over so that it rests on the cylinder head studs.

4 Oil the four cam followers for the left half and place them in their bores. If new followers are being fitted, it is possible that their heads may be slightly thicker than the originals, so compare them (photo). If they are thicker then it is essential to check the clearance between them and the crankcase with the cam lift at its highest point. So having placed the cam followers in position replace the camshaft temporarily, with its shell bearings and revolve it (photos). If any of the cam lobes should jam the followers against the crankcase then clearance will have to be provided by relieving the crankcase by about 1-2 mm behind each cam follower head. This can be done by a small, end face, grindstone in a power drill by a competent handyman. Great precision is not important provided that there is no damage to the actual cam follower bore and the resulting clearance is adequate to permit full unobstructed movement of the cam and follower. Be sure to remove all traces of metal after such work. Repeat this check for the four cam followers in the right hand half of the crankcase.

5 Fit the flanged No. 1 bearing shell at the flywheel end of the crankshaft. Once again make sure that the off-centre locating dowel peg hole goes towards the flywheel end (photo). Look to see that the corresponding dowel pegs in the crankcase will mate

up. The bearing surface of the journal should be well lubricated with clean oil but keep the outside surfaces of the bearing shell clean and dry.

6 Place one half of the split shell in position at No. 2 bearing in the crankcase, engaging the dowel pin in the hole (photo). Lubricate the bearing with clean oil.

7 The crankshaft assembly should now be placed into position in the left hand crankcase half (photo). The three dowel holes in the circular bearings will need lining up so that they will locate snugly and Nos. 3 and 4 connecting rods must pass through their respective apertures. It is a good idea to lift the assembly up by Nos. 1 and 2 connecting rods for this operation. Do not force anything into place. The circular bearings may need rotating a little until you can feel the pegs engage. Ensure the thrower disc locates within the oil thrower recess in the casting. Once all the bearing pegs are located a little pressure will ensure that the assembly and bearings are completely seated. If it is stubborn for any reason lift it out, pause, look, think and have another go.

8 Next fit the camshaft bearing shells into clean locations, engaging the notches in the crankcase (photo). Then oil the bearings in readiness for the camshaft.

9 Turn the crankshaft carefully until two teeth, each marked with a dimple are visible and well clear of the edge of the crankcase. There is a single tooth on the camshaft gear similarly marked which must mesh between them (photo). Engage the teeth and roll the camshaft round, in mesh still, into its bearing location. Then turn the gears again to check that the timing marks are still correctly aligned.

10 Now fit the four tappets (cam followers) into the right hand half of the crankcase and if it seems as though they might fall out when it is lifted and tilted then put a dab of grease behind the lip of each one to help stick it in position.

11 Fit the other half of No. 2 bearing shell into the right half of the crankshaft locating it over its dowel peg correctly.

12 Now thinly coat the two clean, smooth mating surfaces of the crankcase halves with aluminium alloy jointing compound (photo). Use a good quality product such as Volkswagen themselves recommend or 'Hylomar'. Neither is cheap but then you do not want your crankcase to leak oil when it gets hot. Make sure the two surfaces are coated completely but thinly and evenly. Take care to cover round the base of the studs. Do not let any compound get into oilways or other places where it is not wanted and may cause obstruction or binding.

13 The six larger studs may have rubber sealing rings at the roots and these should all be renewed if fitted.

14 Place the right hand half of the crankcase over the studs of the left and carefully slide it down until it just touches the crankshaft bearings (photo).

15 Coat the circular camshaft sealing plug with jointing compound and place it in position in its groove in the left hand half at the flywheel end of the camshaft, with the recess facing inwards.

16 Move the two halves together, tapping lightly with a block of wood if necessary. Use no force - none should be necessary.

17 Now stop and check:

- 1 Are all the connecting rods protruding from their proper holes? Cap nuts tight?
- 2 Are all four bearings, two gears and oil thrower disc fitted to the crankshaft?
- 3 Are all eight cam followers in position?
- 4 You did not forget the camshaft? (It has been known). Did you mesh the timing properly?
- 5 Camshaft sealer plug?

All in order, replace all the nuts on the studs finger tight. Revolve the crankshaft just to make sure that everything moves freely at this stage at least.

18 It is important to tighten down the stud nuts evenly and in the correct order. Tighten first the six large nuts to a torque of 1.5 mkg (11 ft lbs) only, followed by all the smaller nuts to the same torques. Then tighten the small nut near the lower large stud clamping round No. 1 main bearing to its full torque of 2 mkg (14 ft lbs).

housing. Also ensure that the accelerator cable is in a position where it will not get trapped or kinked.

4 With the rear of the vehicle raised move the engine into position underneath so that it can be lifted. Ideally it will be raised on a trolley jack.

5 There is little fore and aft clearance inside the engine compartment. For this reason the engine must not be tilted otherwise the gearbox input shaft may get snagged up with the clutch cover.

6 As soon as the input shaft is lined up with the clutch centre, feed the accelerator cable through the guide tube in the fan housing.

7 Push the engine forward so that the lower mounting studs engage in the holes and the crankcase moves right up to the transmission casing. It may be necessary to waggle the engine about a little to achieve this. It is important to note that any attempt to draw the engine into position with the mounting bolts when there is a considerable gap may crack the crankcase or transmission casing.

8 The upper right hand mounting bolt should engage its head into the transmission casing and the nut can be fitted from inside the engine compartment. The two lower nuts and the upper left hand bolt are fitted from underneath the car. The bolt goes into a captive nut or threaded lug on the crankcase.

9 When the engine is in position reconnect or adjust the following from underneath:—

- Fuel line
- Heater hoses
- Heater flap control wires
- Starter cables
- Adjust the clutch pedal free play

The following items must be connected from above.

- Accelerator cable (see adjustment details in Chapter 3)
- Generator leads (3) brown at the fan end, red on the left D+ terminal near the pulley, and green on the D-terminal
- Automatic choke lead (black)
- Solenoid cut off valve on carburettor (black)
- Coil - black to 15 - green from distributor to terminal 13
- HT leads (See Chapter 4).
- Oil pressure switch (blue/green)
- Fuel pipes
- All hoses
- Replace distributor and set ignition timing (see Chapter 4).
- Replace the rear cover plate, ensuring that all screws are correctly fitted and the small insulator plates secured round the inlet manifold pre-heater pipes.
- Remove the dipstick (to prevent blow back up the filler pipe) and fill the engine to the top mark on the dipstick.
- Reconnect the battery.

10 If the engine does not fire and run fairly quickly it is likely to get flooded due to the operation of the automatic choke. In such cases press the accelerator to the floor and hold it there until the engine fires. If it still fails to start go through the ignition and fuel system fault diagnosis as outlined in the respective chapters.

11 Once the engine starts see that the oil warning light goes out and then go immediately to the engine compartment to see if there is anything going on which should not. Let the engine run until normal working temperature is reached and then adjust the carburettor as necessary. Then stop the engine, let it stand for a minute or so and recheck the oil level.

12 Road test, if the performance is not satisfactory make small alterations to the distributor timing setting, testing on the road after each adjustment.

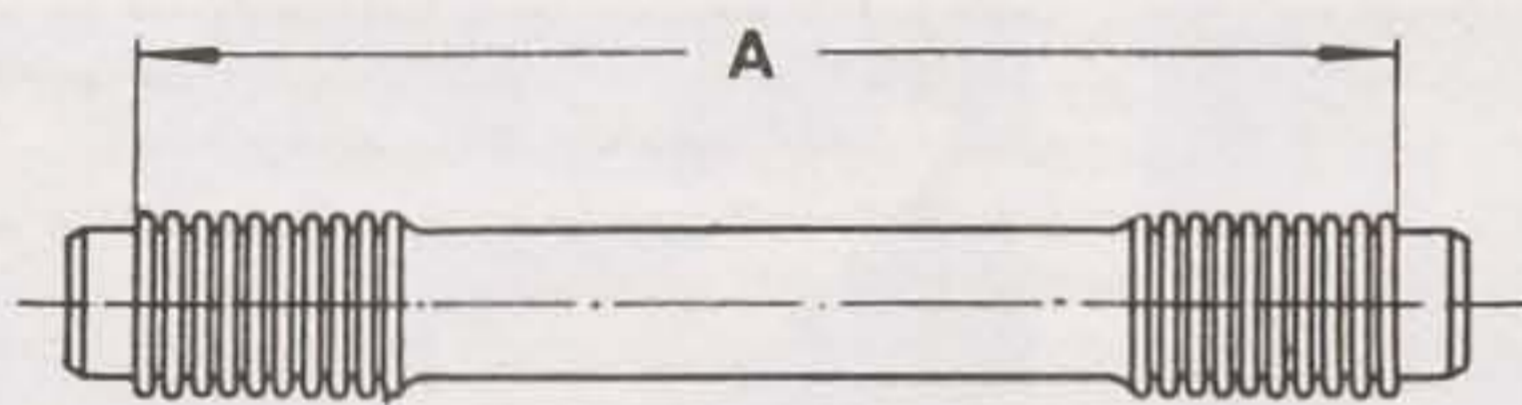


FIG.1.13 PUSHROD TUBE - OVERALL LENGTH (Sec 28)

A 191 mm (7.5 ins) minimum before installation

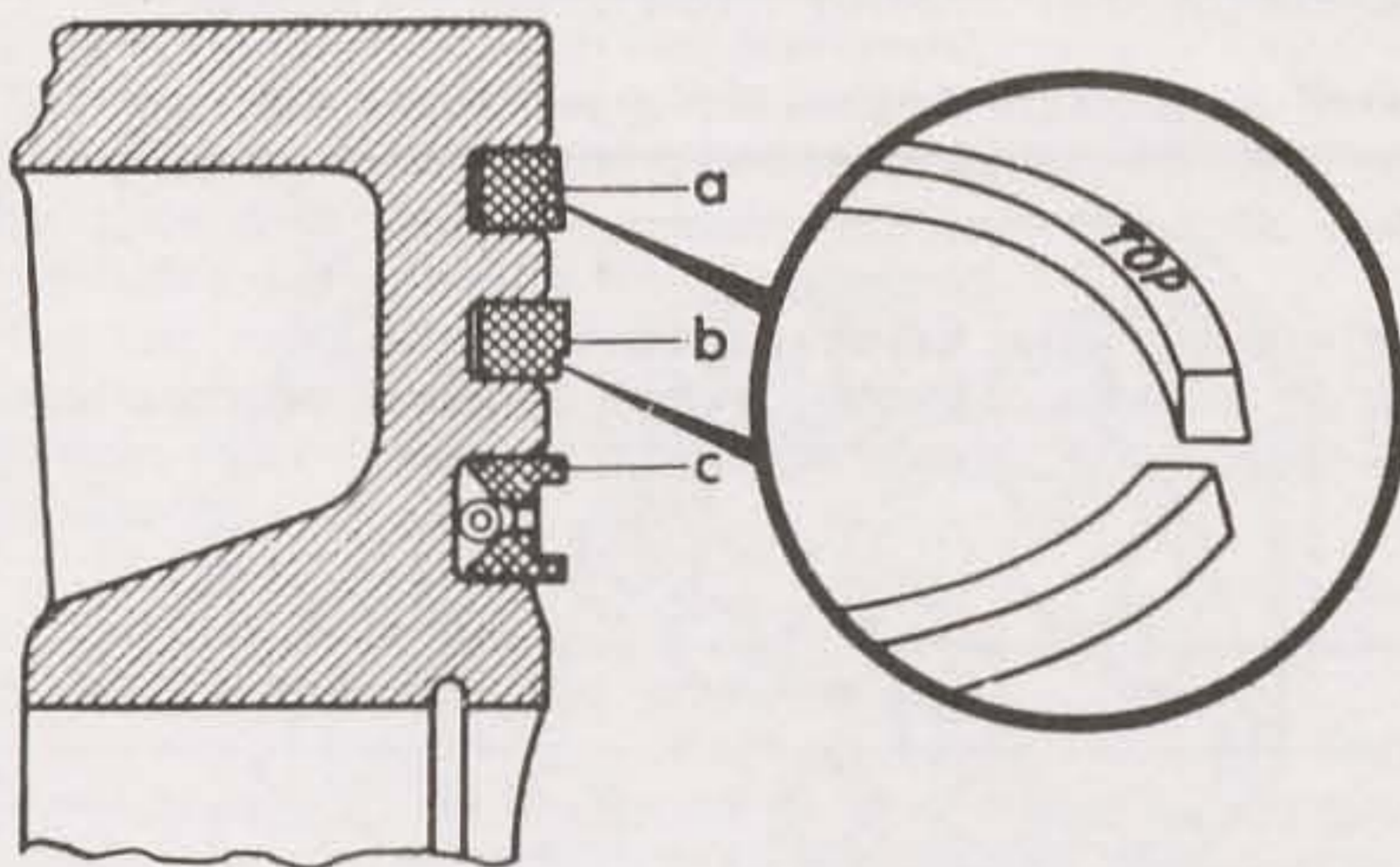


FIG.1.14 PISTON RINGS (Sec 26)

- (a) Top compression ring
- (b) Lower compression ring with stepped lower edge
- (c) Oil control ring

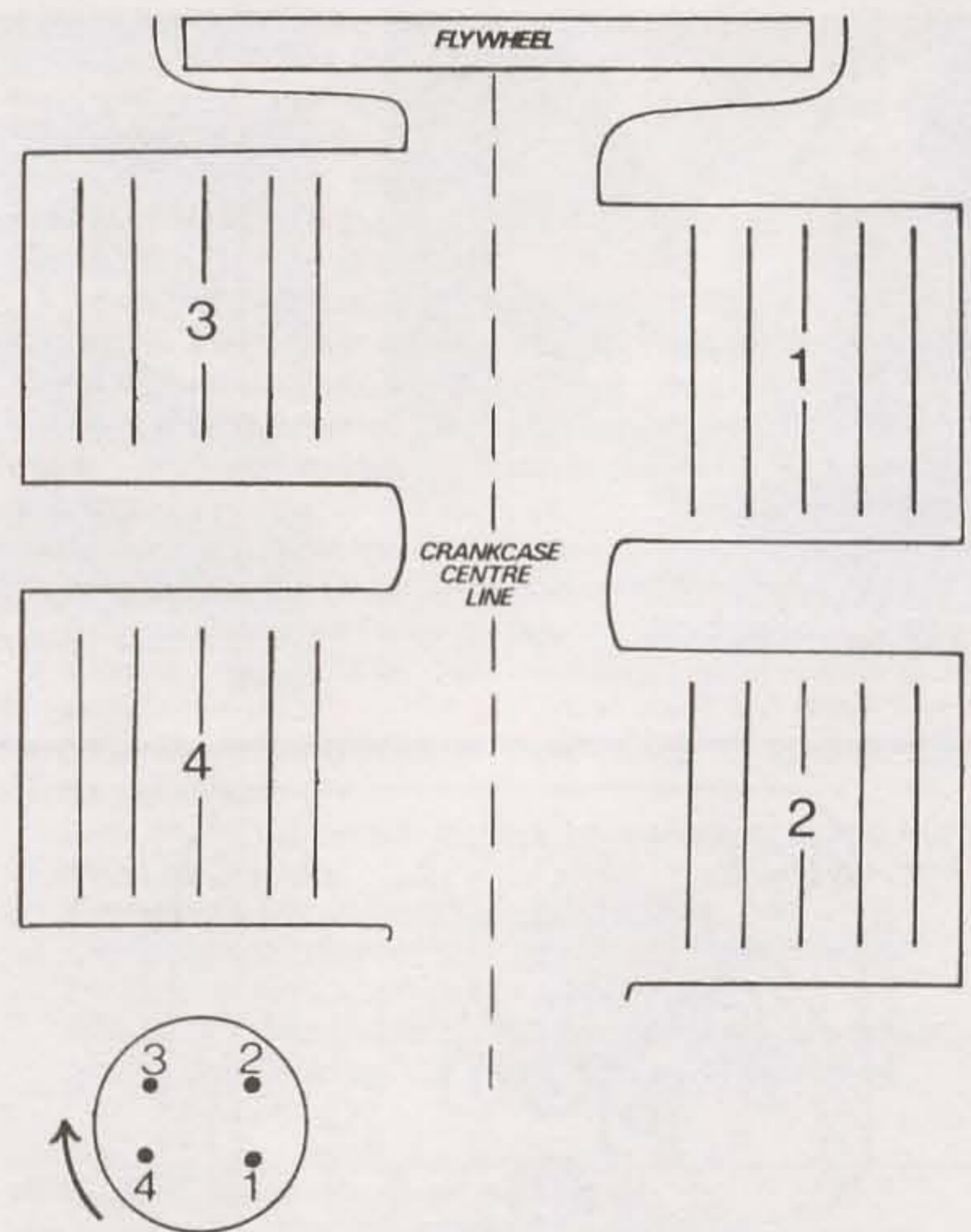
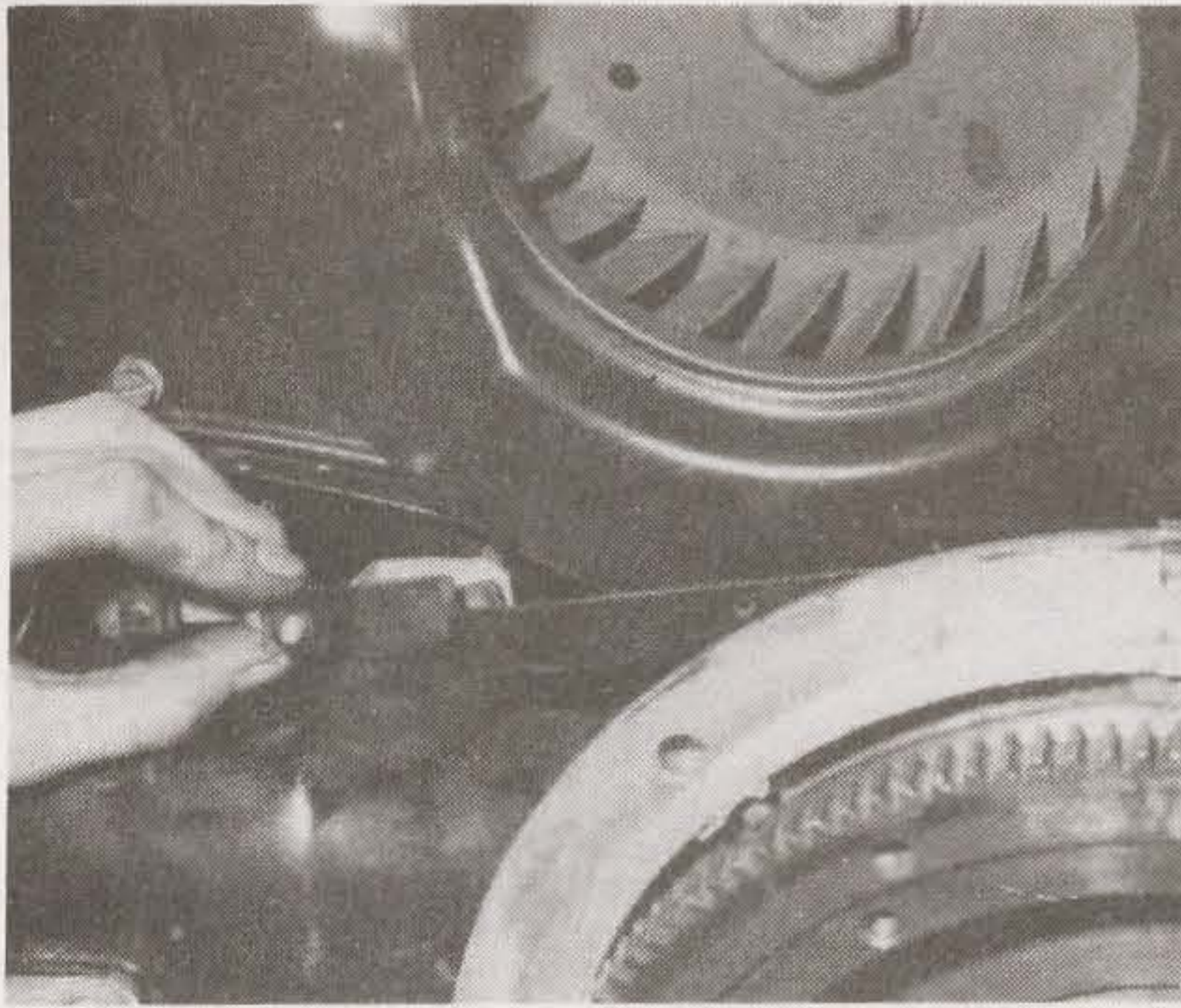
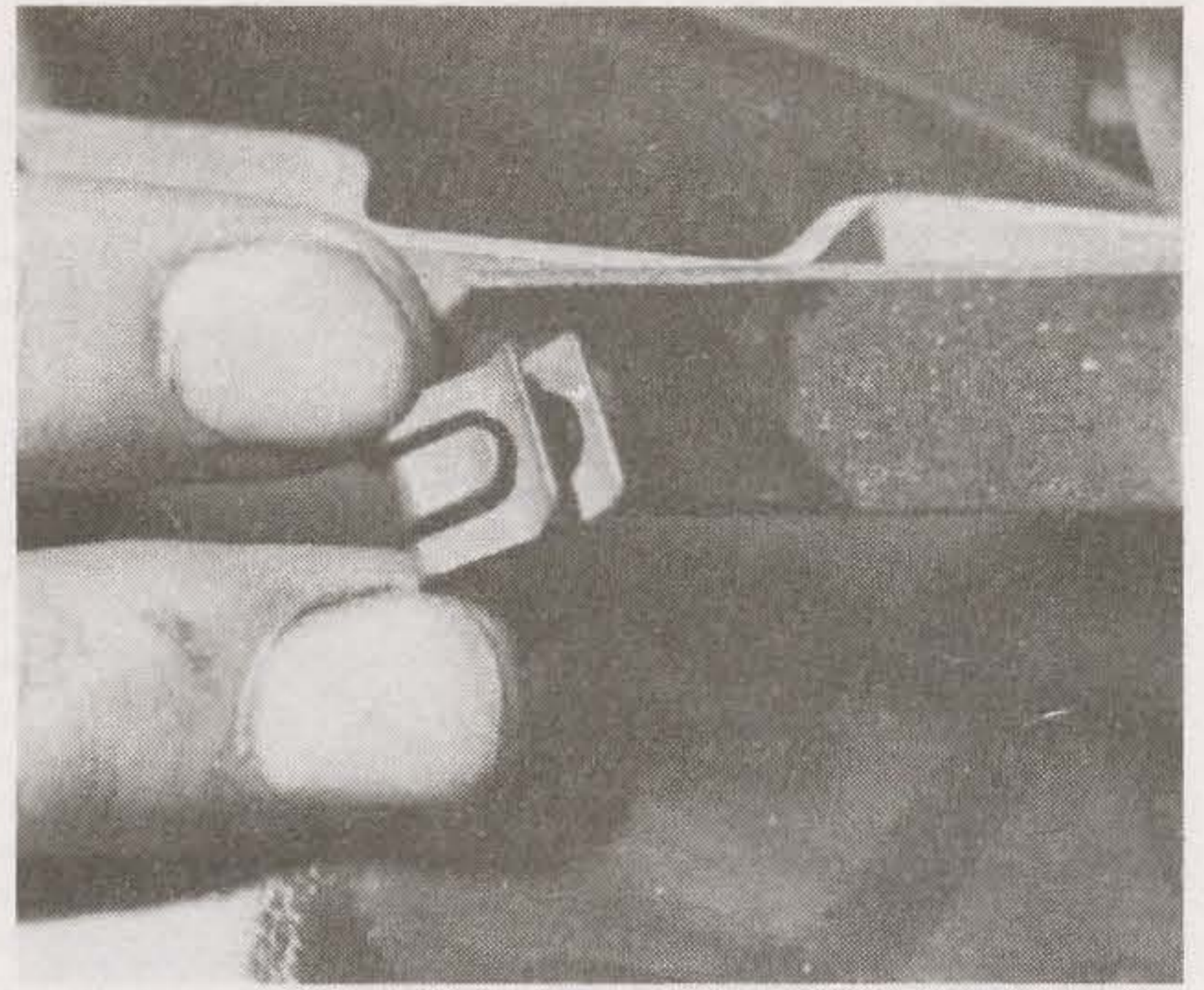


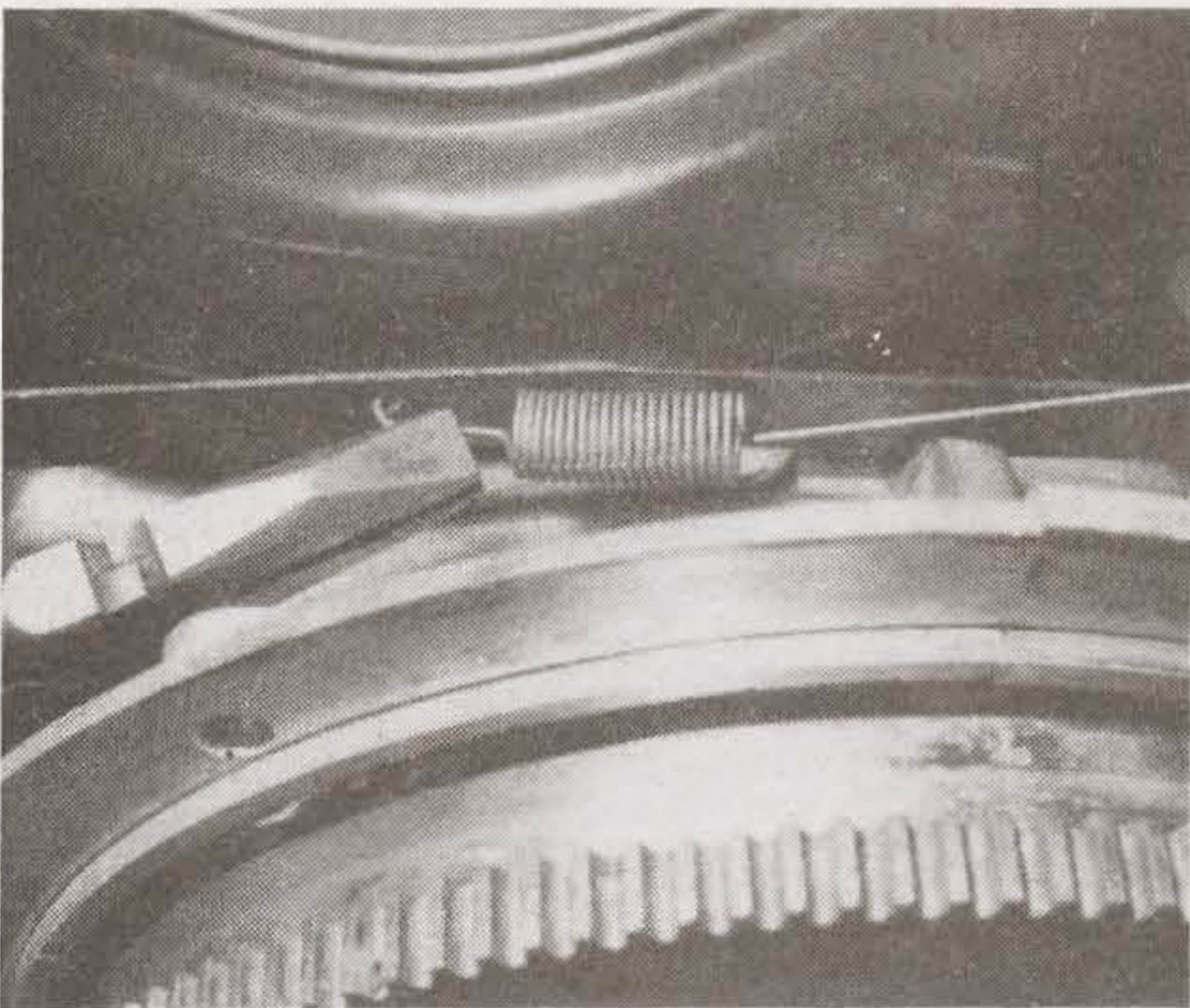
FIG 1.15 PLAN VIEW OF PISTONS SHOWING FIRING ORDER (Sec. 34)



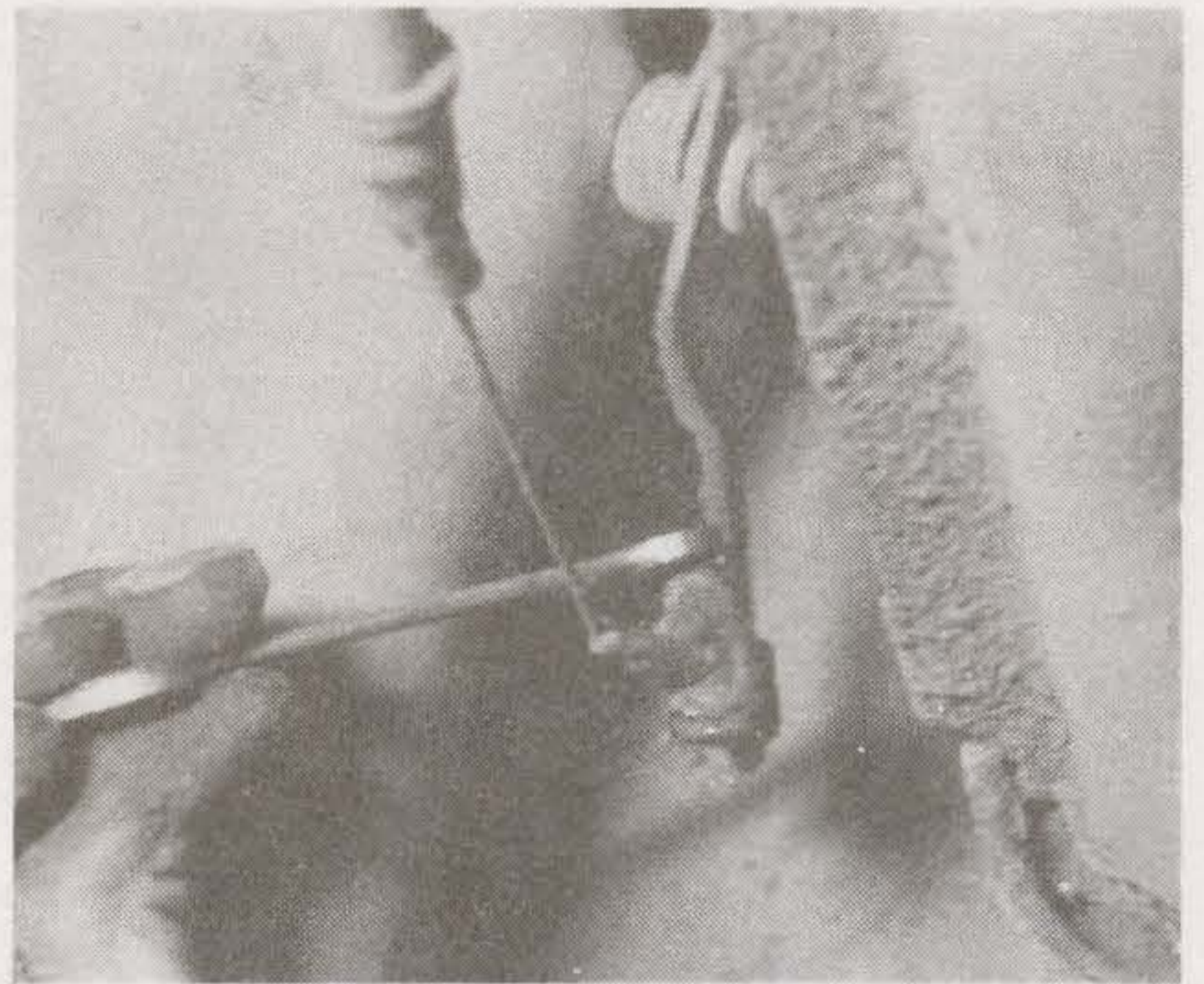
5.16a Replace the connecting rod for the fan housing baffle plates



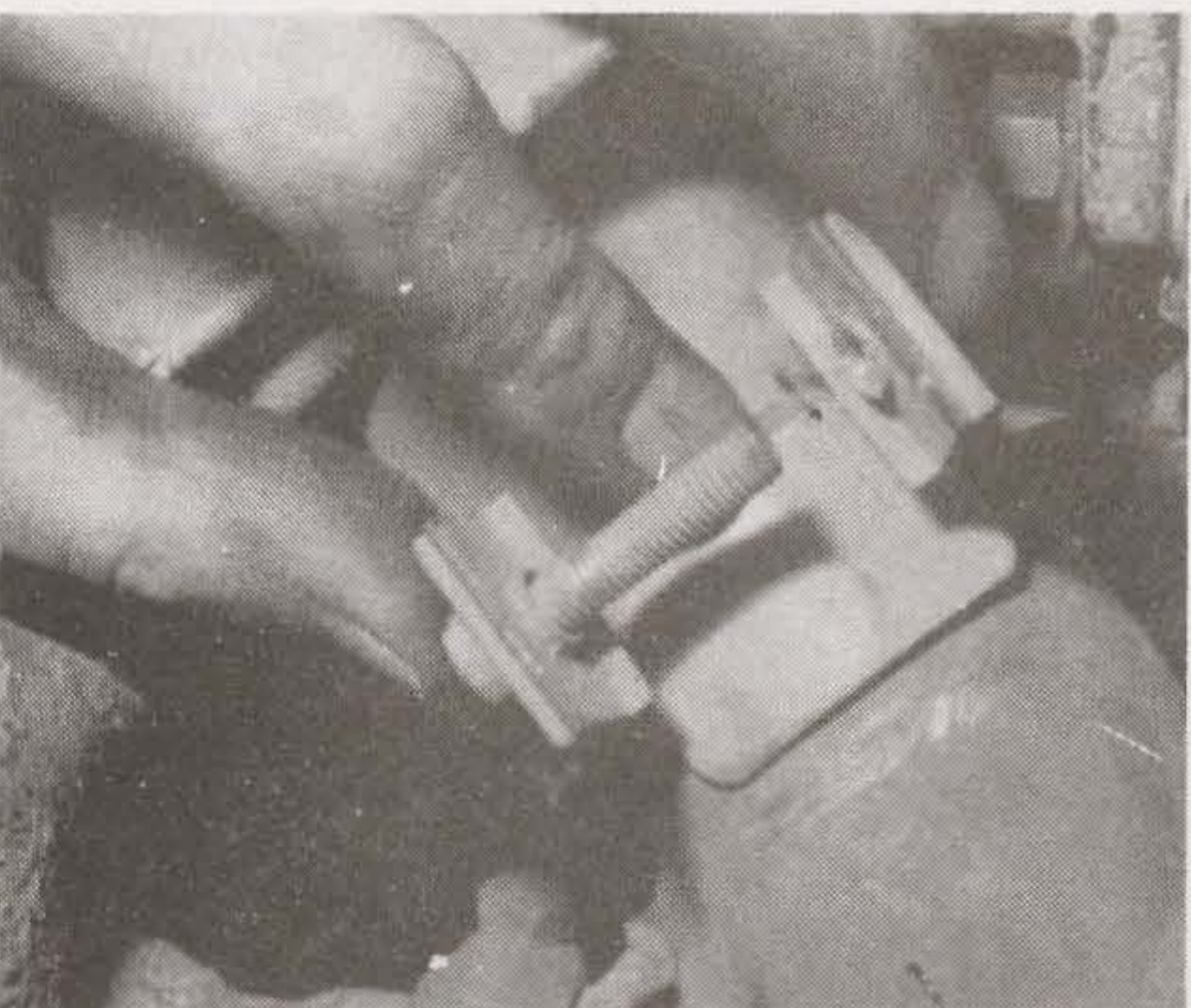
5.16b Securing the special clips



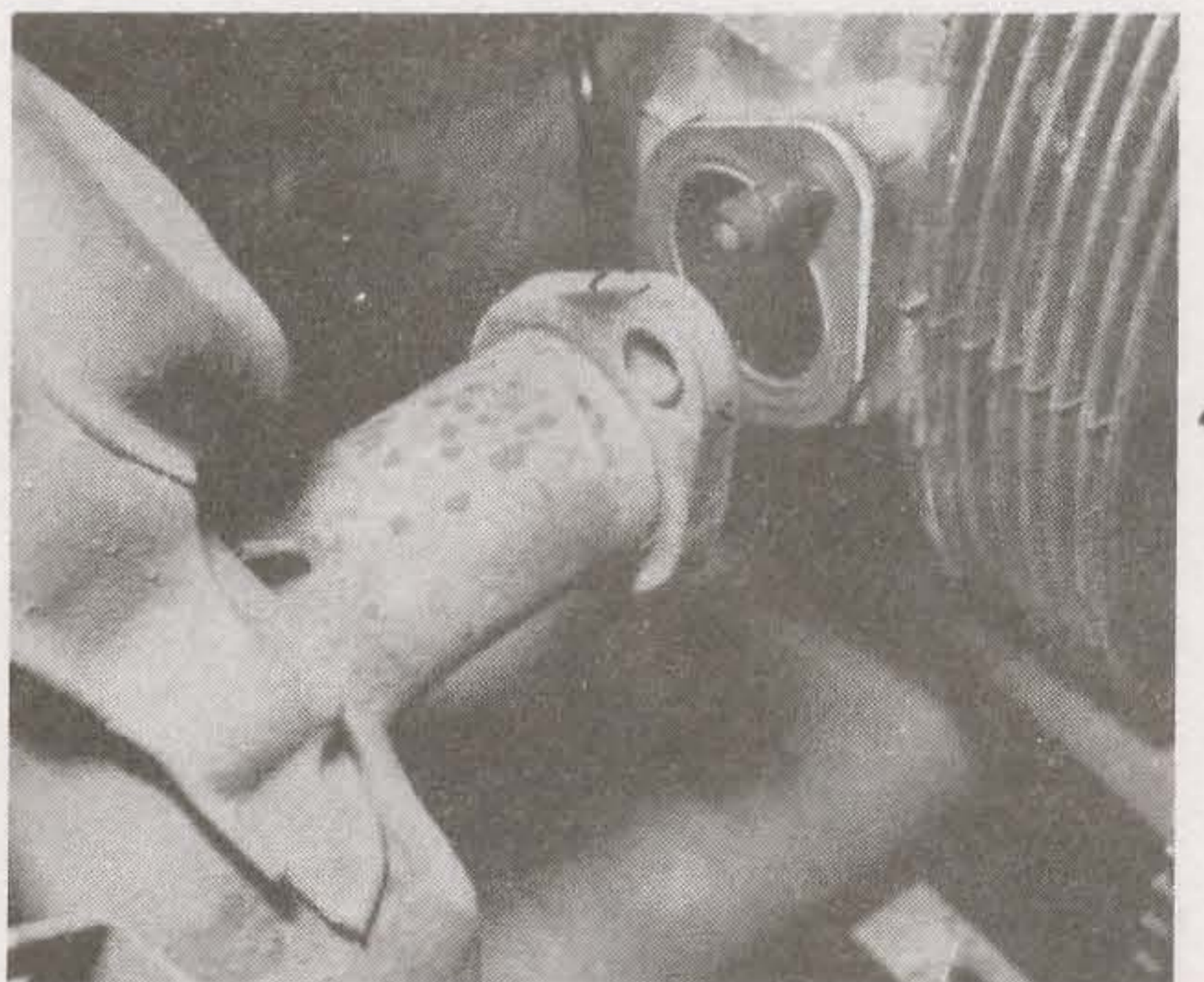
5.16c and return spring



6.4 Unclamping the heat exchanger control cables



6.6 Undoing the heat exchanger sleeve clip



6.7 Drawing the heat exchanger off the front studs

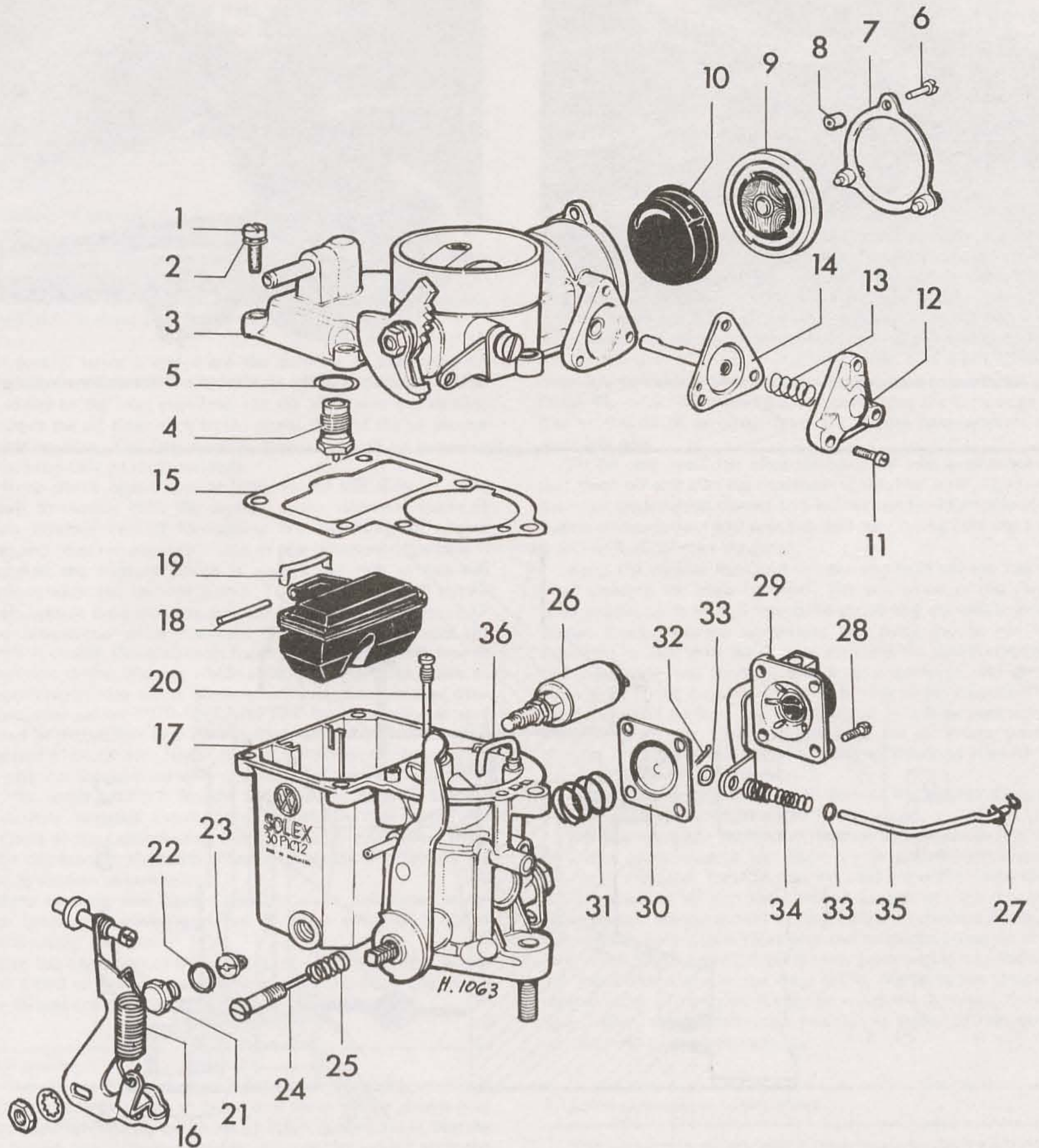


Fig 3.2.A. CARBURETTOR SOLEX 30 PICT/2

- | | | | |
|---|-----------------------------|----------------------------------|---------------------------------------|
| 1 Screw | 10 Cap | 19 Float pin bracket | 28 Screw |
| 2 Lockwasher | 11 Screw | 20 Air correction jet | 29 Pump cover |
| 3 Upper body | 12 Cover | 21 Main jet plug | 30 Pump diaphragm |
| 4 Needle valve | 13 Spring | 22 Washer | 31 Spring |
| 5 Seal | 14 Vacuum diaphragm | 23 Main jet | 32 Cotter pin |
| 6 Screw | 15 Gasket | 24 Volume control screw | 33 Washer |
| 7 Retaining ring | 16 Accelerator cable spring | 25 Spring | 34 Spring for connecting link |
| 8 Spacer | 17 Main body | 26 Pilot jet & cut off valve 'A' | 35 Connecting link |
| 9 Insert with spring and heater element | 18 Float and pin | 27 Lock ring | 36 Injector tube for accelerator pump |

cylinder and the pin taken out of the cylinder so as to release the float inside.

10 Fuel tank - ventilation and activated carbon filter unit

1 There may be one or more vent pipes on the fuel tank to cope with expansion due to heat and to prevent spillage when the vehicle is parked at, or assumes, unusual angles.

These pipes and rising vent tubes are partially enclosed in the rear vertical body panels on the latest models.

2 Where the market calls for it there is a filter unit of activated carbon which traps hydro carbon fumes evaporating from the petrol. This filter is incorporated in the fuel tank venting system and the container is mounted in the ceiling of the engine compartment at the right. It is automatically "rinsed" when the engine is running, by air which is fed to it from the fan housing. The fumes thus driven from the filter are carried by a hose into the air cleaner where they are fed to the engine (see Fig. 3.7).

11 Throttle valve positioner

1 As part of the exhaust emission control system a throttle valve positioner is fitted which effects the closure of the throttle valve independently of the accelerator pedal. In over-run conditions (where the momentum of the vehicle is driving the engine against a closed throttle) the throttle is prevented from closing completely. This allows more air into the fuel mixture and thus prevents unburnt fuel from a rich mixture being passed through the exhaust to atmosphere. It reduces the effect of engine braking incidentally.

2 Two types of positioner device have been fitted. Prior to August 1969 the unit was in one piece and fitted to the carburettor. After 1969 the device is split into two sections connected by hoses. One part remaining on the carburettor and the other fitted to the side of the engine compartment. The later type incorporates a modification which not only holds the throttle flap open on over-run. It also reduces the speed at which the throttle closes on sudden deceleration. This is done by an additional connection to the carburettor. Engine braking is affected even more noticeably.

3 Operation is quite straightforward. Vacuum from the intake manifold, (which increases on over-run) operates a diaphragm connected to a valve which in turn permits the same vacuum pressure to operate in a second chamber. This affects a second diaphragm which controls mechanically the position of the throttle spindle. The second chamber is open to atmosphere via a restricted drilling. Variations in atmospheric pressure are compensated by an aneroid bellows which varies the preload on the control diaphragm and valve.

4 Adjustment of the unit should be contemplated only after having made sure that the carburettor and ignition are correctly set up. The method of adjustment is different for each type of positioner fitted. For both, make sure that the engine is warmed up to operating temperature and the choke flap fully open. In order to carry out the adjustment correctly it is essential to know the engine speed so a tachometer is required.

5 For the one piece type undo the lock screw and turn the adjuster on the altitude corrector clockwise until the stop washer on the pull rod touches the housing. The engine speed should then be 1700-1800 rpm. If the speed is outside this range then slacken the locknuts on the pull rod and rotate the pull-rod to either shorten or lengthen it. Shorten the rod to increase the engine speed and vice versa.

Then turn the altitude corrector adjuster screw until the engine is back to idle speed of 850 rpm (plus or minus 50 rpm).

Increase engine speed to 3000 rpm on the throttle and then release the throttle. The time taken to regain idle speed should be 3-4 seconds. If necessary, further adjustment of the screw can be made to alter this.

6 The two part version is adjusted by first making sure that the idle speed is correct at 850 rpm (± 50 rpm).

When the throttle valve is closed make sure that the intermediate lever (attached to the pull rod) does not contact either the carburettor body or the throttle flap lever. If it does adjust the pull rod as necessary by lengthening or shortening it.

Next pull the intermediate lever back to the stop and adjusting screw on the return spring bracket. At this position the engine speed should be 1700-1800 rpm. Adjust the speed if necessary with the stop screw.

Using the throttle lever, increase engine speed to 3000 rpm. On release the engine speed should drop back to idle in $3\frac{1}{2}$ - $4\frac{1}{2}$ seconds. Adjustment for this can be made on the altitude corrector adjusting screw which is in the other part of the unit at the side of the engine compartment.

12 Inlet manifold - removal, inspection and replacement

1 The inlet manifold on the early models was a single piece affair with the attendant pre-heater pipe. On later models the inlet manifold is in three sections. Each outer section fits inside the ends of the centre section and there is a rubber sealing boot over each connection held by hose clips. The outer sections are each twin branch leading to the twin port head.

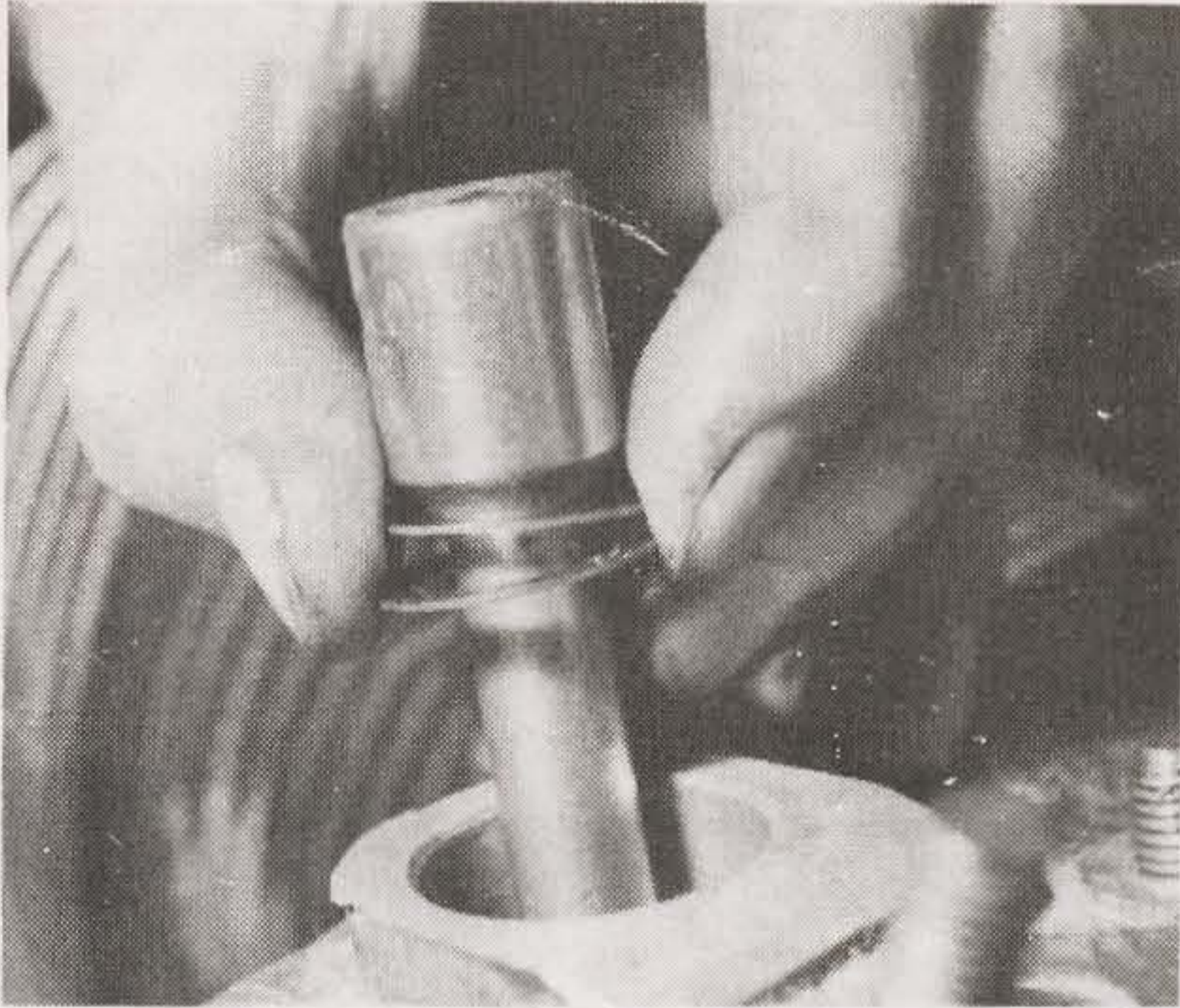
2 It is not practicable to remove the inlet manifold with the engine installed in the vehicle. With the engine out the fan housing or generator pedestal must be removed before the manifold (centre section on later models) can be taken out.

3 It is important that the mating flanges where the manifold joins the cylinder heads are perfectly flat. On the three piece versions the connecting hoses must be free of cracks and the clips perfectly secure. Entry of air at any of these points will upset the engine tune.

Similarly there must be no distortion or cracks in the manifold castings.

4 When replacing the manifolds always use new gaskets for the cylinder heads (photo). See that the joining surfaces are quite clean. Jointing compound must not be used.

On later models reassemble all three sections loosely at first and get the rubber boots in position over the joints (photo). Tighten down the end sections - taking care not to overtighten and then clamp the centre section. Finally tighten the rubber connector clips (photo).



6.5 Fitting the distributor drive shaft thrust washer over a suitable guide rod



6.8a Replacing the distributor drive shaft. Note the fuel pump drive cam on the shaft

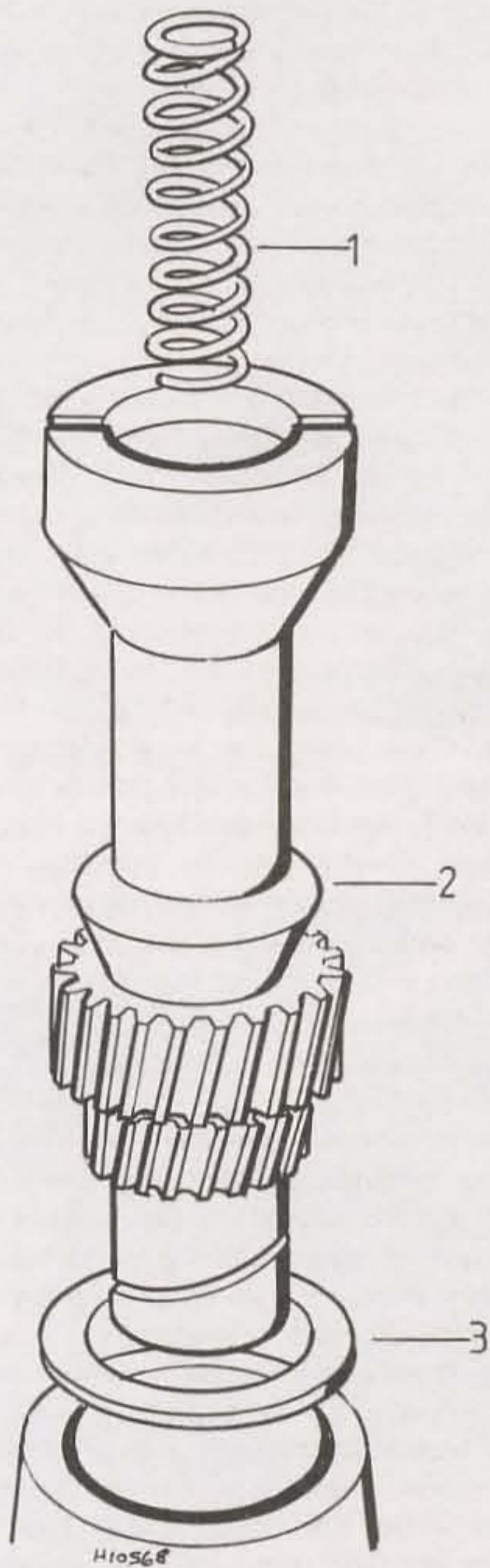
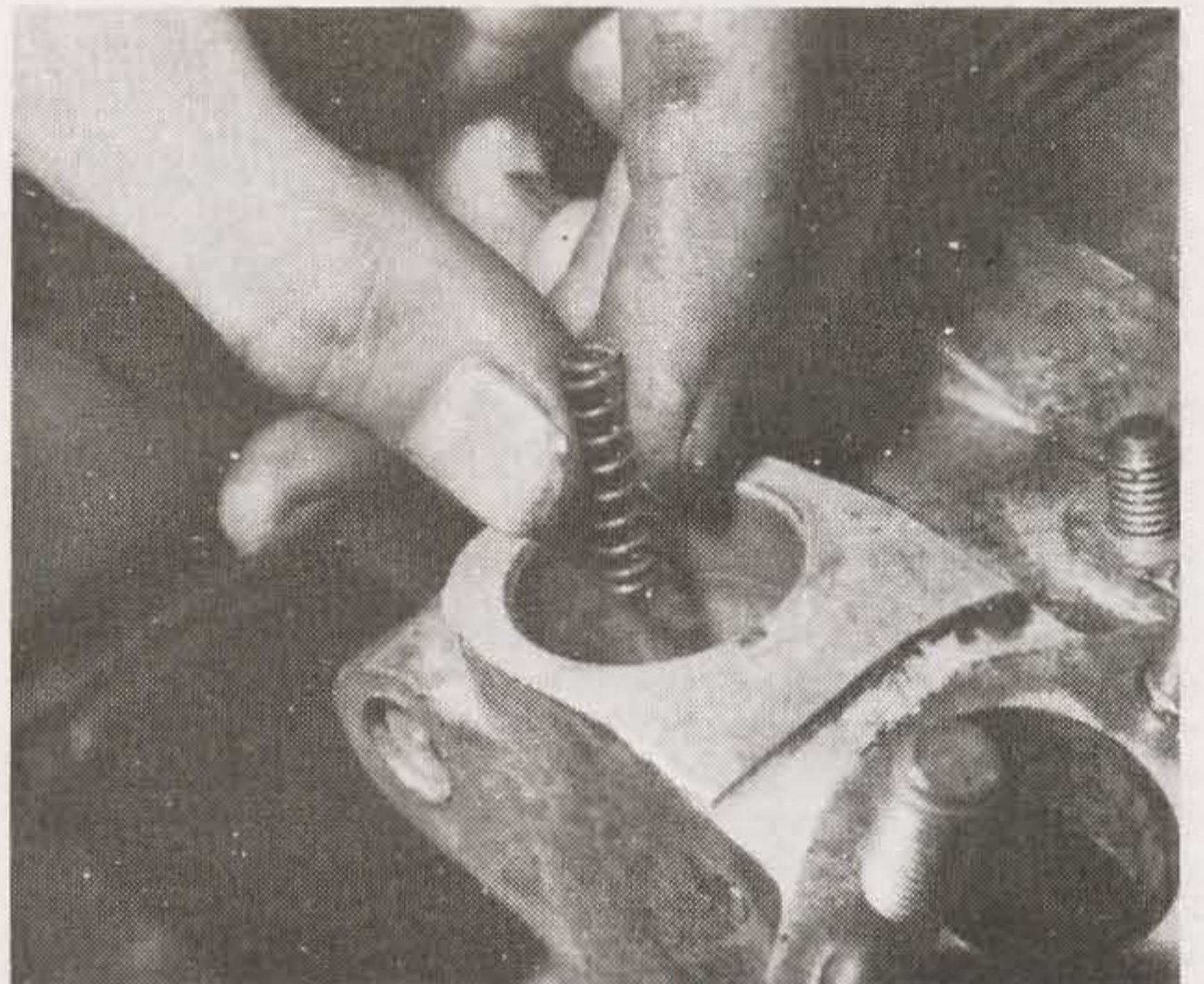


FIG.4.3 DISTRIBUTOR DRIVE SHAFT (Sec 6)

- 1 Spacer spring
- 2 Fuel pump drive cam
- 3 Thrust washer



6.8b Replacing the thrust spring

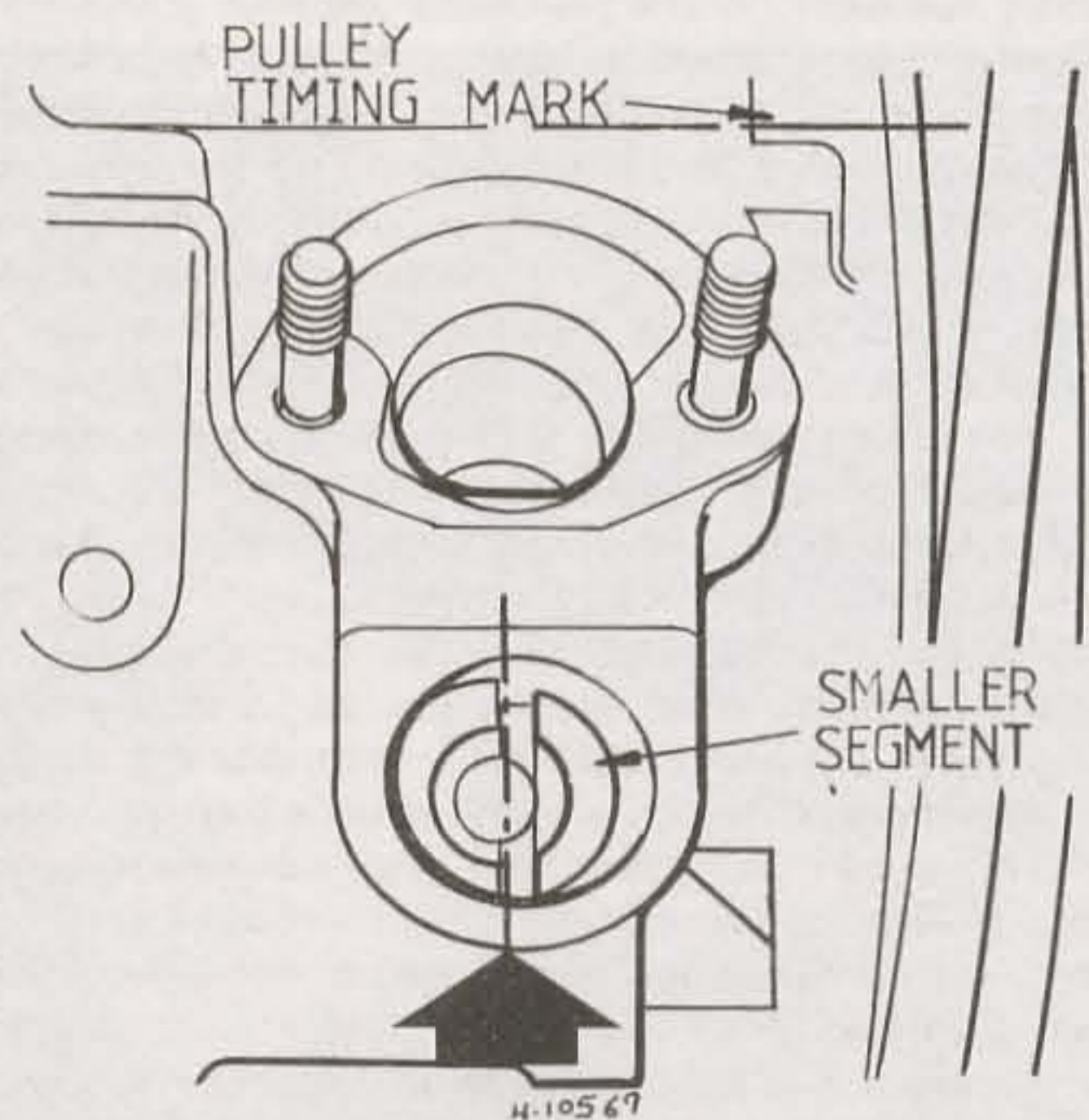
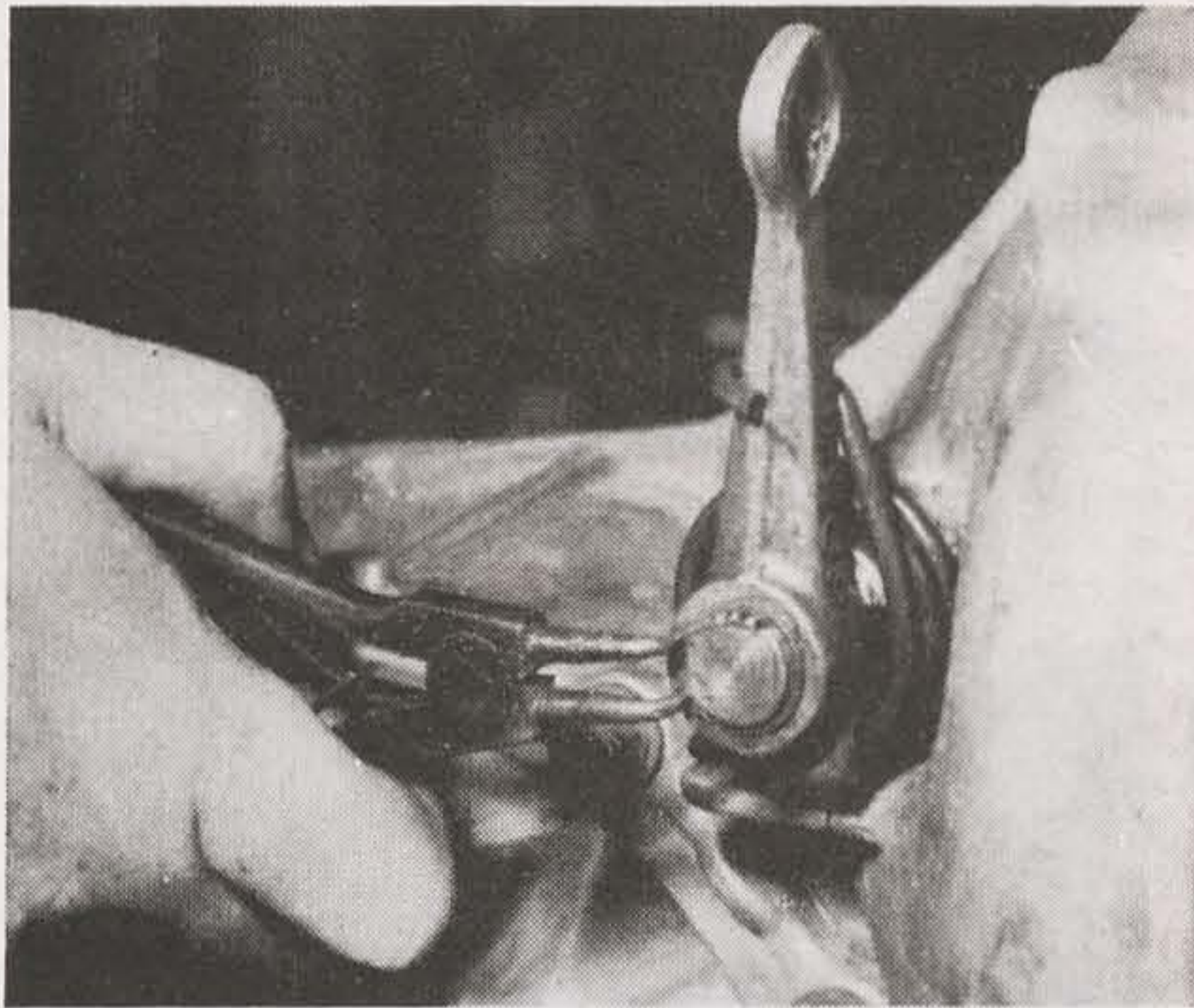


FIG 4.4 CORRECT SETTING OF DISTRIBUTOR DRIVE SHAFT. NO 1 PISTON AT FIRING POINT (Sec 6)

5 Fault diagnosis

Symptoms	Reason/s	Remedy
Judder when taking up drive	Loose engine/gearbox mountings or over flexible mountings Badly worn friction surfaces or friction plate contaminated with oil deposits Worn splines in the friction plate hub or on the gearbox input shaft Badly worn roller bearings in flywheel centre for input shaft spigot	Check and tighten all mounting bolts and replace any 'soft' or broken mountings. Remove engine and replace clutch parts as required. Rectify any oil leakage points which may have caused contamination. Renew friction plate and/or input shaft. Renew roller bearings in flywheel gland nut.
Clutch spin (failure to disengage) so that gears cannot be meshed	Clutch actuating cable clearance too great Clutch friction disc sticking because of rust on lining or splines (usually apparent after standing idle for some length of time) Damaged or misaligned pressure plate assembly	Adjust clearance. As temporary remedy engage top gear, apply handbrake, depress clutch and start engine. (If very badly stuck engine will not turn). When running rev up engine and slip clutch until disengagement is normally possible. Renew friction plate at earliest opportunity. Replace pressure plate assembly.
Clutch slip - (increase in engine speed does not result in increase in vehicle speed - especially on hills)	Clutch pedal free play too little or non-existent resulting in partially disengaged clutch at all times Clutch friction surfaces worn out (beyond further adjustment of operating cable) or clutch surfaces oil soaked	Adjust clearance. Replace friction plate and remedy source of oil leakage.



4.9 The release shaft operating lever showing circlip splines and return spring

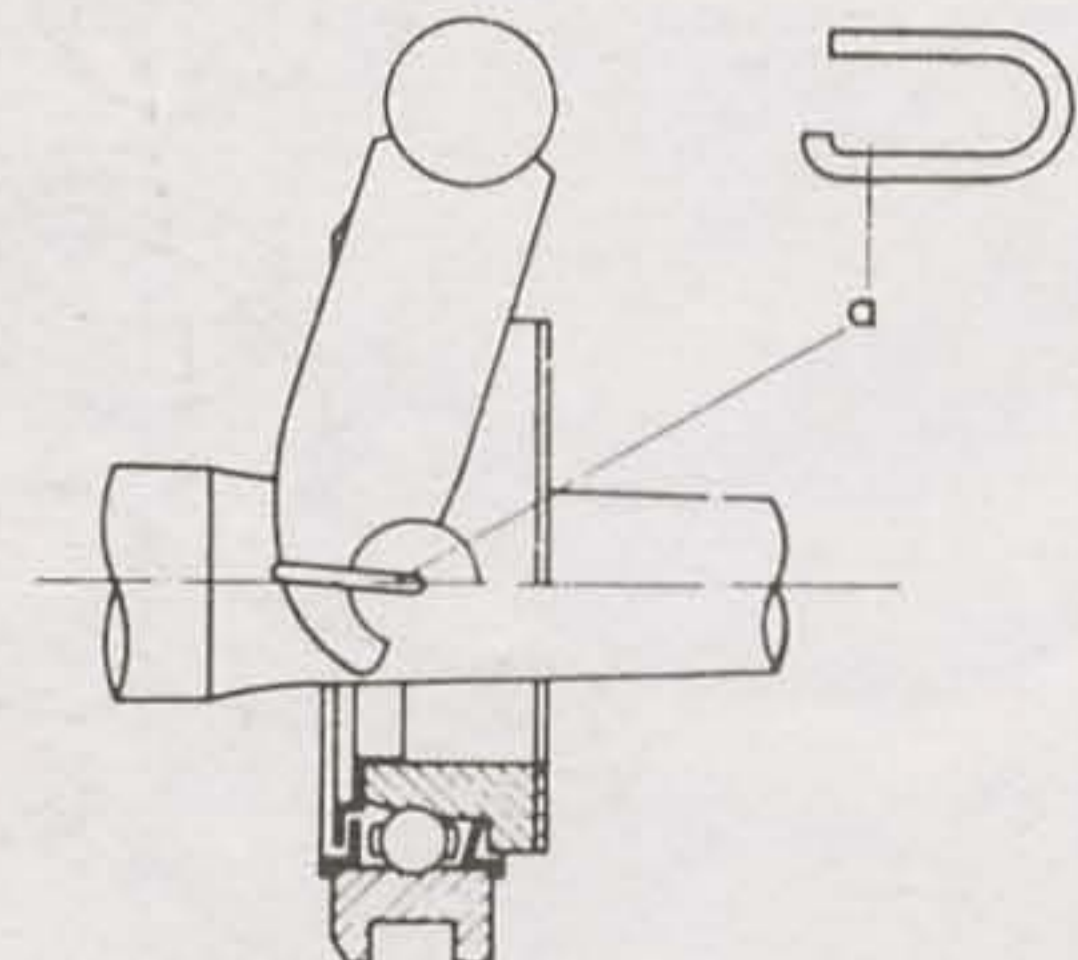


FIG:5.5 CLUTCH RELEASE BEARING. CROSS SECTION SHOWING SHAPE AND LOCATION OF RETAINING CLIP (a)

plastic plugs from the drillings opposite. Before doing this make sure you obtain some new plugs to drive in when reassembling. Check the spring free length which should be 25 mm (1 inch). If less than 22 mm they should be changed. The balls should be free from pitting and grooves and the selector rods themselves should not be a sloppy fit in the bores. The detent grooves in the rails should not be worn. When the rails are removed do not lose the interlock plungers which fit between the selector rod grooves.

9 Examine all parts of the casing for signs of cracks or damage, particularly near the bearing housings and on the mating surfaces.

10 It should not normally be necessary to completely wash all the gearbox components in fluid. Wipe components on clean cloth for examination. In this way the likelihood of dry spots during the first moments of use after reassembly are minimised. The casing itself should be thoroughly washed out with paraffin and flushed afterwards with water. Do not leave the needle roller bearings in position when doing this.

5 Transmission reassembly - general

Spend time in preparing plenty of clean, clear space and if your work bench is rough cover it with hardboard or paper for a good non-gritty surface. Do not start until you have all the necessary parts and gaskets assembled and make sure that all the ones you have obtained are going to fit. Gasket sets often contain items covering a variety of models so you will not need them all - this is why it helps to keep the old gaskets you take off until the job is eventually finished.

5A Input shaft - reassembly

1 First reassemble the input shaft, beginning by putting the needle roller cage for 3rd gear in position on the shaft. Then put 3rd gear with its matching synchro ring onto the roller bearings with the cone towards the front end of the shaft.

2 The 3rd/4th gear synchro hub assembly goes on next. This has to line up with the key in the shaft. Once the keyway in the centre part of the hub is lined up with the key in the shaft the hub can be driven on using a suitable piece of tube and heavy hammer. There are three very important points to note when doing this. Make sure that the hub is on the right way round - some models have a groove in the outer sleeve 1 mm deep and this must be towards the front end of the shaft. If there is no indication then you may put the hub on either way round. Secondly, make sure that you only drive the centre part of the hub. Otherwise it will come apart and have to be reassembled. Thirdly, the slots in the baulk ring must be lined up with the keys in the hub. This is best done by someone holding the baulk ring in position with the keys whilst the hub is driven on the final amount. Be careful not to trap any fingers!

3 Next the inner race for the 4th gear needle roller bearing has to be driven on to the shaft in the same manner that the hub was driven on before it. Drive it right down to the hub. Then replace the needle roller cage followed by the baulk ring and 4th gear. The baulk ring also has the three cut-outs which engage with the sliding keys in the hub.

4 Finally, place the thrust washer on the end of the shaft.

5B Pinion shaft - reassembly

1 As pointed out earlier, the pinion shaft has been dismantled only as far as the pinion bearing which has been left in position (photo). If this bearing has been renewed then the gearbox and final drive will need resetting and this is a skilled job requiring special equipment and a selection of special shims.

2 The first 'loose' item therefore which goes behind the pinion

is the shim (if any) controlling endfloat. The endfloat is measured by a feeler gauge after the 1st gear and synchro hub have been fitted. The measurement is between the face of the gear and the thrust washer which is locked in front of the pinion taper roller bearing. The measurement range is from 0.10 - 0.25 mm/0.004 - 0.010 ins

3 If the gap is outside this range then the shims must be altered to suit.

4 Now put 1st gear (the largest one with helically cut teeth) in position on the needle roller bearings with the cone face of the synchro pointing away from the pinion gear (photo).

5 Select the 1st gear baulk ring and place it over 1st gear and then replace the 1st and 2nd gear hub over the splines on the shaft with the selector fork groove of the outer sleeve facing towards the front end of the shaft (photo). Make sure that the three cut-outs in the synchro ring engage with the sliding keys in the hub before pushing the hub fully home. Remember that the baulk rings for 1st and 2nd gears are slightly different. The 1st gear ring has narrower cut-outs than those in the 2nd gear ring.

6 Now check the 1st gear endfloat as mentioned in paragraph 2.

7 Put the 2nd gear baulk ring in position in the hub so that the slots engage with the sliding keys.

8 Replace 2nd gear with the cone towards the hub (photo).

9 Third gear, which has a large bearing boss integral with it, should now be replaced with the needle roller bearing which fits together with 3rd gear, inside 2nd gear (photo).

10 Next fit the circlip on the shaft retaining third gear in position (photo).

11 The clearance between this gear and the circlip should be 0.10 - 0.25 mm/.004 - .010 ins. If the gap is outside this range then a circlip of different thickness is necessary to correct it.

12 Next fit the spacer spring, 4th gear and the inner race of the roller bearing (photo).

13 In order to drive the race and gear onto the shaft select a tube or socket of the required diameter. When the race is nearly fully on, put the circlip in position also and drive that on with it until it reaches the groove (photo).

5C Main casing - installing bearings and reverse gearshaft

1 Two sets of needle roller bearings are fitted in the main casing. One set comprises two roller cages and a spacer between and in this the reverse drive shaft runs. Drive one cage into the casing with a socket on an extension or suitable drift so that it is flush with one end of the bore. The metal face of the needle cage end should face inwards. The spacer should then be inserted with its slot so lined up that it will engage with the locking bolt which is screwed in through the side of the casing. Put the locking bolt in position and then drive the other needle roller bearing into the other end of the bore. Alternatively the bearings and spacer can be assembled to the shaft and put into the casing as an assembly (photo).

2 The gear may then be fitted to the other end and the circlip replaced (photo).

3 The other bearing supports the rear end of the input shaft front half and a circlip retains the bearing at each end.

5D Gear carrier - fitting bearings

1 The needle roller bearing for the forward end of the pinion shaft should be lined up so that the hole for the locking screw corresponds with the recess in the bearing (photo). Tap it into position and fit the locking screw.

2 The special ball bearing with the flanged outer race should then be fitted into position from the outside of the carrier casing (photo).

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When the lever is in 2nd gear position it should be exactly vertical with the cranked upper section inclined at about 30° to the rear.

Sideways movement measured at the lever knob, with a gear engaged should not exceed 35 mm. In neutral it should not exceed 70 mm. If it is more than this it indicates that there is excessive wear in the linkage somewhere.

3 Adjustments can be made to the gear lever position by slackening the two bolts in the mounting bracket at its base. Engage second gear first and then loosen the bolts. Depress the clutch pedal and then align the lever into the correct position. Under the bracket there is a stop plate (for reverse gear). Push this to the left until it touches the shoulder on the lever but does not move the lever. Tighten the mounting bolts. Move the lever to first gear. The line of movement should be exactly longitudinal, without any tendency to move diagonally. If there is

diagonal movement loosen the bolts again and turn the stop plate a little to correct it. Later models have lugs on the stop plate to avoid this misalignment possibility.

4 To remove the front section of the shift rod is not difficult but the rear section requires the gearbox to be removed first because the rod can only be taken out from the rear.

To remove front section remove the under tray, undo the square headed locking screw on the muff coupling and then draw the muff back. The front section of rod can then be drawn off the front mounting pin. The guide sleeve at the front end can be renewed. Use molybdenum grease (Castrol MS3) for lubrication. With the gear box removed the rear section can be drawn out complete with the coupling once the front bellows have been taken off and both couplings disconnected. The bushes on the rod and the inserts in the coupling can be renewed as required.

11 Fault diagnosis

It is sometimes difficult to decide whether it is worthwhile removing and dismantling the gearbox for a fault which may be nothing more than a minor irritant. Gearboxes which howl, or where the synchromesh can be 'beaten' by a quick gear change, may continue to perform for a long time in this state. A worn gearbox usually needs a complete rebuild to eliminate noise because the various gears, if re-aligned on new bearings, will continue to howl when different wearing surfaces are presented to each other.

The decision to overhaul therefore, must be considered with regard to time and money available, relative to the degree of noise or malfunction that the driver has to suffer.

Symptom	Reason/s	Remedy
Ineffective synchromesh	Worn baulk rings or synchro hubs	Remedy.
Jumps out of one or more gears (on drive or over-run)	Weak detent springs, worn selector forks, worn synchro hubs or all three	Dismantle and renew.
Noisy, rough, whining and vibration	Worn bearings, (initially) resulting in extended wear generally due to play and backlash	Dismantle and renew.
Noisy and difficult engagement of gear	Clutch fault	Examine clutch operation.

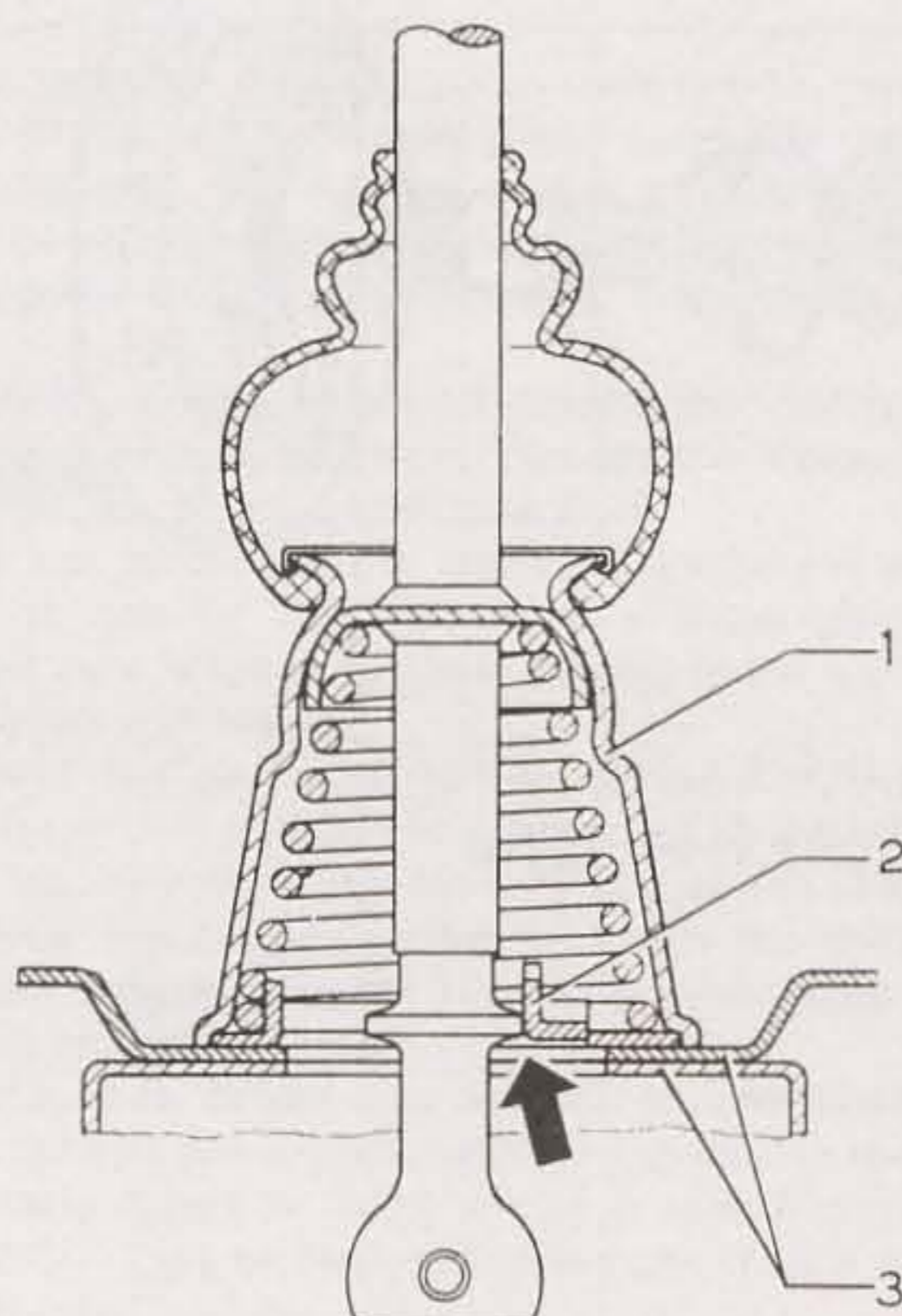


FIG.6.10 GEAR LEVER - LATERAL CROSS SECTION (Sec 10)

- 1 Mounting bracket
- 2 Stop plate
- 3 Floor panel

Arrow indicates lever shoulder against the stop plate in 2nd gear position.

Servo							
Boosting factor	...	...	...	...	...	...	2.05
Torque wrench settings							
Tandem master cylinder/support screws	...	...	...	...	...	...	lbs/ft 29/33
Front wheel cylinder and backplate on steering knuckle	...	...	...	...	...	...	mkg 4/4.5
Disc caliper on steering knuckle	...	...	...	...	...	...	40/43
Rear axle shaft (for brake drum)	...	...	...	...	...	...	72
Rear back plate bolts	...	...	...	...	...	...	10
							253
							25
							35
							3.5

1 General description

Prior to August 1970, hydraulically operated drum brakes were fitted to all four wheels. The front brakes had two wheel cylinders and leading shoes for each drum. The rear brakes had a single wheel cylinder operating one leading and one trailing shoe. After August 1970 disc brakes were fitted to the front wheels. At the same time the rear brake shoes were increased in width and the drum was made detachable from the hub.

All shoes for drum brakes may be individually adjusted nearer to the drums by a threaded adjuster tappet which is moved by a notched wheel. Disc brakes are self adjusting.

A master hydraulic cylinder is operated by the foot pedal and generates the pressures which passes to the four wheel cylinders. The pipe lines are rigid metal except where they link from body to moving assemblies. The master cylinder is the tandem type which maintains the hydraulic pressure to either the front or rear wheels should the other fail.

The handbrake operates on the rear wheels only and the leverage from the handle is transmitted by two cables running in tubes inside the floor frame tube.

Hydraulic fluid level is maintained in the master cylinder by a reservoir situated on the bulkhead below the dash panel in the driving compartment. The braking system operates when pressure on the foot pedal moves a piston in the master cylinder (in effect a pump). This pressurizes the hydraulic fluid in the pipe lines and forces the pistons outwards in the wheel cylinders. These in turn press the shoes against the drums. When pressure is relieved the shoes are drawn off the drums by retractor springs. The friction pads of the disc brakes are forced against the disc by hydraulic pistons also. When the pressure is relieved the piston seals flex sufficiently to permit the piston to retract fractionally. No springs are necessary.

The master cylinder piston is fitted with a spring loaded check valve which maintains a slight residual pressure in the fluid lines but not enough to actually move pads or shoes. This ensures instantaneous movement when the brake pedal is applied.

On models fitted with disc brakes a hydraulic pressure regulating valve is fitted in the rear circuit which alters the braking pressure to the rear wheels depending on decelerating and load conditions. Servo is available as an option from 1971 on.

2 Brake adjustment - (including the handbrake)

1 Brake adjustment is carried out with each wheel in turn jacked up sufficiently to allow it to revolve freely. Disc brakes adjust themselves automatically.

2 To adjust the front shoes remove the wheel nave plate and turn the wheel until the hole in the drum is at the top. The teeth of the notched adjusting wheel on the top cylinder will then be visible. Turn the notched wheel in the direction as shown in Fig.8.1 depending on which front wheel is being adjusted. The adjuster should be moved in the appropriate direction with a screwdriver engaged in the notch until it can be moved no further and the wheel is locked. Then back off the adjuster one or two notches until the wheel revolves freely.

Repeat the adjustment on the other shoe by turning the drum so that the hole is opposite at the bottom. On later models the hole in the drum was discontinued and holes were put in the

back plate instead, covered with detachable rubber plugs. The adjustment mechanism is the same. The rotation of the adjuster wheels for the front drums, will be opposite to that shown in the diagram; also the position of the cylinders will be the other side of the vertical centre line when viewed from the back plate side.

If any shoe(s) needs considerable adjustment (because they have been allowed to go unadjusted too long) then they will have to 'bed in' again to a different radius and this will call for further adjustment after a short interval. This is why regular brake adjustment is necessary to ensure top braking efficiency at all times. The linings will also last longer as it will ensure that the whole surface area is used evenly all the time.

3 The rear brake adjustment is similar except that both adjuster wheels are at the bottom (see Fig.8.1). On the earlier models access to the adjusters is through a hole in the drum, but later versions with detachable drums have the access holes behind through the back plate. The holes have detachable rubber sealing plugs.

When adjusting the rear brakes remember that when turning the wheels the drag of the transmission will be felt. Do not confuse this with binding brake shoes.

4 Having completed adjusting one wheel it is good practice to operate the brake pedal once or twice and then adjust again. Sometimes the shoes can move fractionally off-centre during adjustment. The extra time required is well worth the trouble.

5 If a shoe still rubs against the drum a little even after being backed off more than 3 notches, leave it (provided it is only superficial). However, if the binding is quite severe then it is possible that the lining is very unevenly worn. In such instances remove the drum and have a look.

6 Once the rear brake shoes have been adjusted to the drums the handbrake may be checked. If both back wheels can be jacked off the ground together it will save some time. Pump the footbrake two or three times (to centralise the shoes) and apply the handbrake six notches. In this position it should be just possible to rotate the rear wheels by hand.

7 On early models the cable adjusters are located under a rubber shroud just ahead of the base of the gear lever in the cab floor (photo). On later models, the adjusting nuts are at the equaliser under the car.

8 Slacken the locknut on the threaded end of each cable. Then tighten each cable with the adjusting nut (holding the cable with a screwdriver in the slotted end) until an equal amount of drag can be felt on each rear wheel when it is turned. Make sure any adjustment is kept even between the two rear wheels.

9 The brakes should hold the wheels when a further 2 - 3 notches are pulled on the handbrake.

10 Understand that the handbrake cable adjustment is purely to compensate for stretch in the cable. It must not be made until after the shoes have been correctly adjusted to the drums.

3 Front drums and brake shoes - inspection and renewal

1 The front brake drums form part of the wheel hub casting so they have to be taken off the stub axle. This involves releasing the front wheel bearings, details of which are given in Chapter 10. Before pulling the drum off, back off the shoe adjusters as far as they will go.

2 With the drum removed (photo) first check that both wheel cylinders are working. With an assistant operating the brake pedal, jam each shoe in turn with a screwdriver against the back

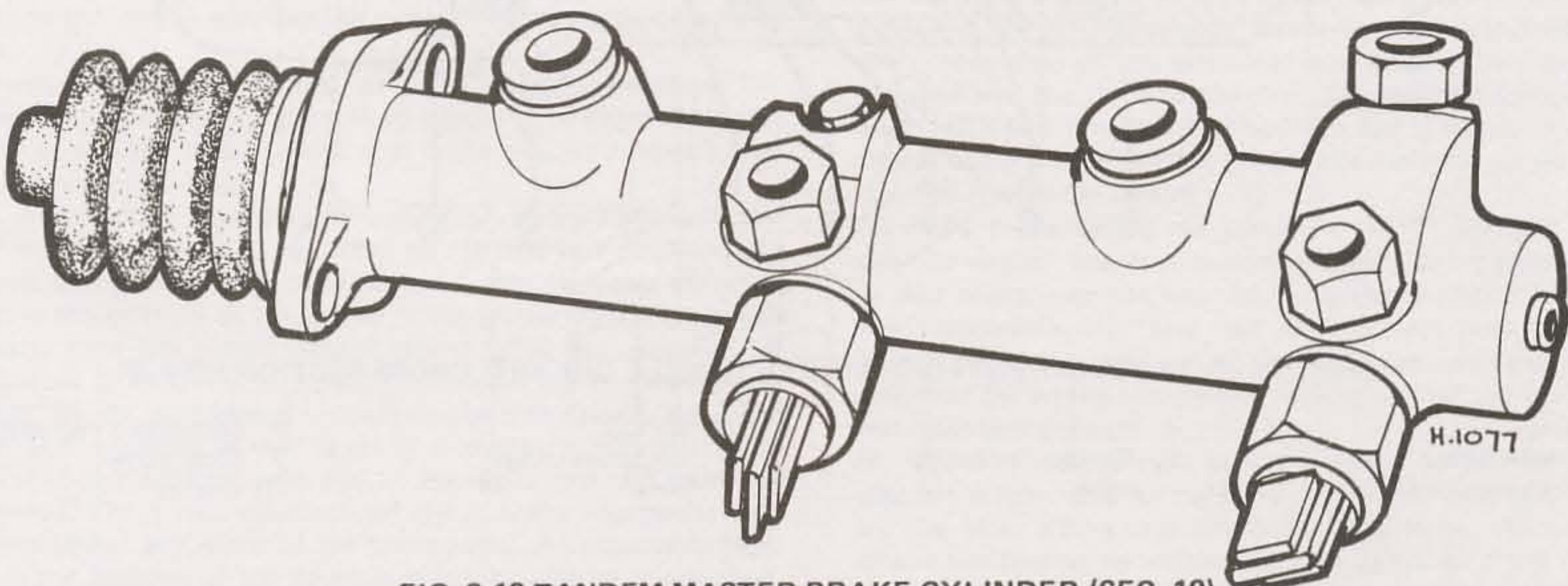
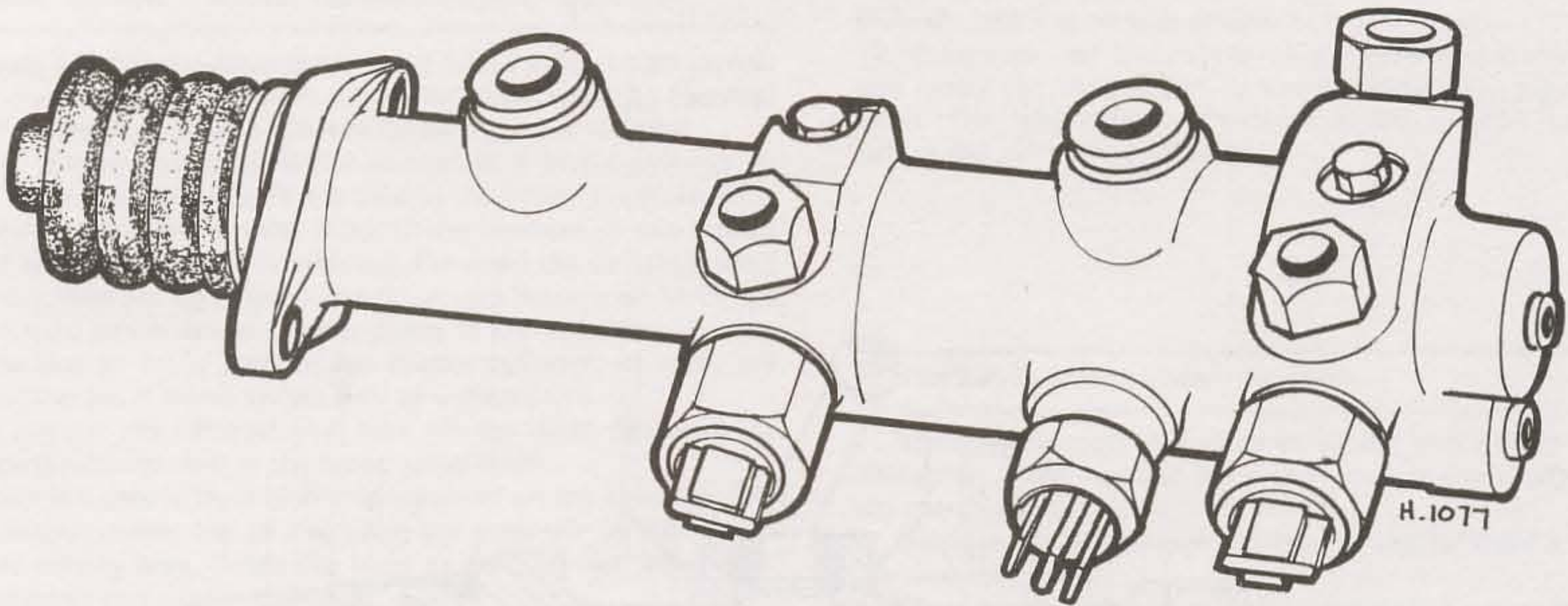
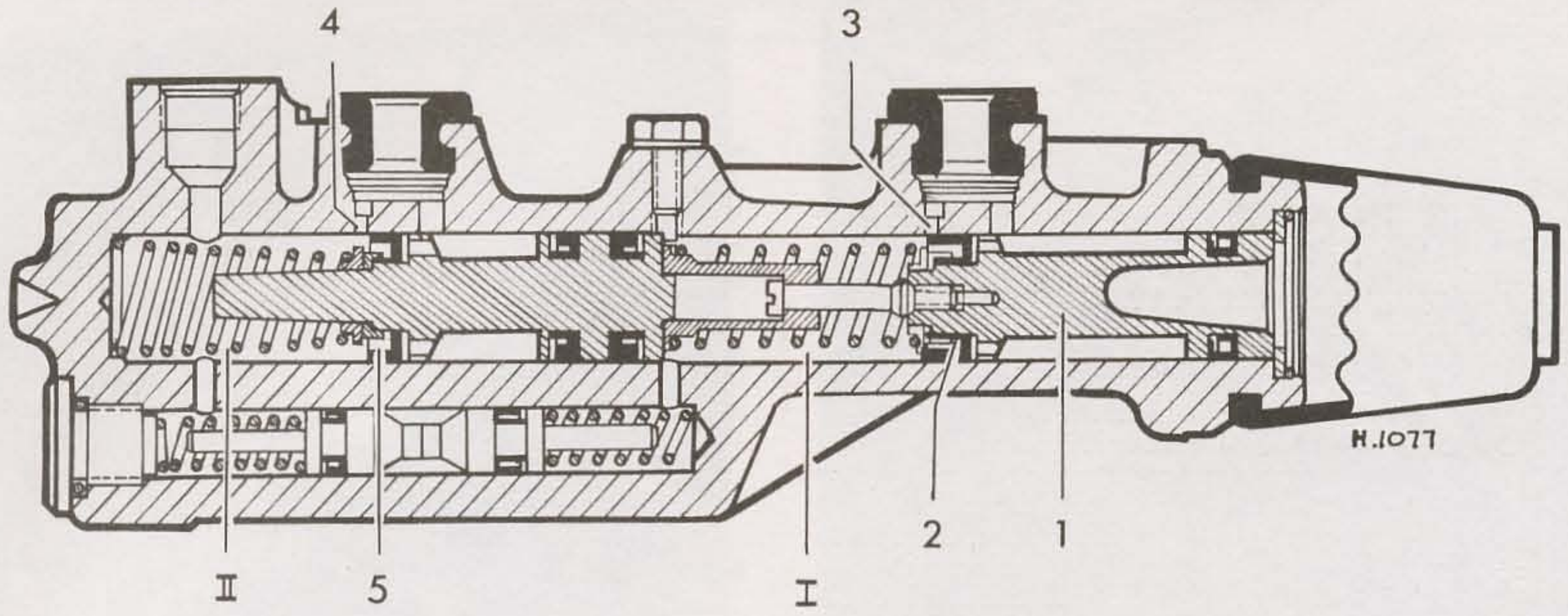


FIG. 8.10 TANDEM MASTER BRAKE CYLINDER (SEC. 10)

Top: Cross Section

1 Rear brake circuit piston

2 Primary cup

3 Port

4 Port

5 Primary cup

I Rear brake circuit

II Front brake circuit

Centre: Tandem brake master cylinder with hydraulic warning device up to Chassis 219061567

Lower: Tandem brake master cylinder with electrical warning device from chassis 219061567

Fuses	1967	1968 - 69	1970	1971 - 72
No of fuses	8	10	12	12
No 1	Left headlamp. Low beam	Brake lights Horn Flashers	Interior light	Parking lights Right rear lamp Number plate
No 2	Right headlamp. Low beam	Windscreen wipers	Interior light Emergency flasher	Left rear light
No 3	Left head lamp. Main beam	Left head lamp. main beam	Horn	Right head lamp low beam
No 4	Right head lamp. Main beam	Right head lamp main beam	Stop lights	Left head lamp low beam
No 5	Left rear light	Left headlamp low beam	Windscreen wipers	Right head lamp main beam
No 6	Right rear light	Right headlamp low beam	Spare	Left head lamp main beam
No 7	Brake lights Direction indicators Windscreen wipers	Right rear light Number plate	Left headlamp main beam	Spare
No 8	Horn Interior lights	Left rear light	Right head lamp main beam	Interior light Emergency flasher
No 9		Emergency flasher Interior lights	Left head lamp. Low beam	Interior light Ignition buzzer
No10		Radio	Right head lamp. Low beam	Horn Brake lights
No11			Left hand rear lights	Windscreen wipers
No12			Right hand rear lights	Direction indicators Brake lights Fuel gauge

Identification; Red 16 amp, White 8 amp

NOTE: The fuse box arrangements given are a typical selection. There are so many different wiring circuits that it will always pay dividends to check which fuse controls which circuit when everything is working, quietly at home. This can easily be done by switching everything on and removing the fuses in turn to see what stops working and starts when the fuse is put back. Fuses usually blow in snow storms or in heavy traffic. It is useful to know which one to pull out when the horn will not stop operating.

Torque wrench settings

	lbs/ft	mkg
Generator pulley nut	43	6.0
Generator fan nut	43	6.0

1 General description

The system is 12 volt comprising:

A battery with negative earth mounted at the right side of the engine compartment.

A D.C. generator mounted on a pedestal above the engine driven by a belt from the crankshaft pulley. The generator armature shaft also carries the cooling fan at the opposite end.

A voltage regulator and cut-out unit mounted behind the air cleaner in the engine compartment.

A starter motor of the pre-engaged type (one which meshes with the flywheel ring gear before the power is switched to the motor).

The battery provides the necessary power storage source for operating the starter and providing the current to operate the lights, accessories and ignition circuit. It is kept in a state of full charge by the generator. The regulator controls the generator output. This control automatically adjusts according to the state of charge of the battery, the electrical load demanded and engine revolutions in such a way that the generator is never overloaded and the battery never over or undercharged. It must be appreciated that indiscriminate additions of electrical accessories can upset this balance.

The starter motor is mounted on the transmission casing. Drive pinion engagement and switching is effected by a solenoid. The pinion is engaged by the solenoid before the same solenoid switches current to the starter motor itself. The pinion is driven through a one-way roller clutch to obviate any damage from over-run.

Later models are wired to accept an electrical diagnosis system, details of which are given in the chapter.

2 Battery - removal and replacement

- 1 The battery is fixed by clamps in the engine compartment.
- 2 On models with computer diagnosis there is a small lead to a connection for sensing the battery electrolyte level. Detach this.
- 3 Unclamp the battery terminals (earth or negative terminal first) and lift the battery out vertically to prevent electrolyte spillage. On later models, the air cleaner must be removed before the battery can be lifted out.
- 4 When replacing the battery see that both terminals and terminal clamps are clean and free from corrosion or deposits of any sort. Smear them with petroleum jelly (not grease) before connection.

3 Battery - maintenance and inspection

- 1 Normal weekly battery maintenance consists of checking the electrolyte level of each cell to ensure that the separators are covered by ¼ inch of electrolyte. If the level has fallen, top up the battery using distilled water only. Do not overfill. If a battery is overfilled or any electrolyte spilled, immediately wipe away the excess as electrolyte attacks and corrodes any metal it comes into contact with very rapidly. As the battery is not conveniently accessible a small hand mirror is essential in order to see into the cells. A suitably shaped container, such as a flexible plastic bottle with an extended spout is needed to add distilled water with some measure of control. If you have neither of these take the battery out to check it.

holders and push them to one side so that the pressure is relieved. The yoke complete with the brush holder mounting plate may then be drawn off the armature. Watch out for the washers on the end of the shaft (photo).

9 To renew the brushes, two may be detached by simply removing the screws whilst the other two need to be cut off and new ones soldered to the braided leads. Leave sufficient length to solder the new ones onto easily.

10 To remove the end frame from the drive end of the shaft first push back the stop ring with a suitable tube so that the jump ring underneath can be released from its groove. The end cover assembly complete with pinion may then be drawn off.

11 The pinion drive should turn one-way only inside the clutch easily. If it does not the whole unit needs renewing. The pinion teeth should not be badly worn or chipped. The yoke of the pinion operating lever should be a good fit in the groove of the pinion sleeve.

12 Reassembly is a reversal of the dismantling procedure. Thoroughly grease the moving parts of the pinion operating lever first. When replacing the yoke engage the cut-out and tongue correctly (photo).

13 The carbon brushes should all be held up in their holders and this can be achieved if the springs are jammed against the sides of the brushes. The armature has two washers on the end and these must be fitted so that the thrust washer goes on first and the insulating washer after that.

14 When the pinion stop ring is refitted stake it into position over the jump ring after the latter has been fitted in its groove.

15 When refitting the solenoid ensure the plunger hooked end is securely placed over the operating lever.

16 The screw heads and joint faces of the commutator end cover, the solenoid and end frame should all be treated with sealing compound to keep water out. Use the Volkswagen product specially prepared for this if possible. It is important that it is not applied too thickly, otherwise clearance distances may be upset. If, after reassembly, the endfloat of the shaft exceeds 0.012 inch it should be reduced by adding shim washers under the U retaining clip on the end of the armature shaft under the small cover.

17 Because the pinion end bearing (bush) is located in the clutch housing, it is not possible to rotate the starter under load or at speed when not fitted to the engine. The customary bench tests are therefore not applicable to this starter.

15 Fuses and relays

1 The fuses are located under the dash panel. (photo) If any fuse should blow it is normally due to a short in the circuit concerned. With the aid of the wiring diagram, therefore, first check visually at all the points in the circuit where such a fault is most likely to occur. Likely places are where wires pass through individual holes into lamp units or through holes in the bodywork where grommets have been disturbed. In the ignition circuit check the connections at the coil and choke. Feel switches to see if they are hot, which they should not be.

2 If no obvious solutions occur disconnect all items on the particular circuit (e.g. the parking light bulbs if that is the circuit concerned). Fit another fuse of the proper rating. Then reconnect one item at a time, switching on each time until the fuse blows again. This will isolate the faulty part of the circuit and a closer examination can be made in that area. If you choose to fit a fuse of a much higher rating to try and overcome persistent blowing, the least that can happen is that the wiring will burn out somewhere. The worst result could be a fire.

3 Relays are in effect remote switches which avoid having to carry the full operating current of the apparatus through the actual operating switch (a starter solenoid is a relay). The fuse rack incorporates a relay console as well so that they may be simply plugged into it for renewal or additional wiring requirements. There are normally at least two relays fitted, one a combined relay for lights, flashers, horn etc, and another for the turn signal/emergency flasher circuit. Relays should be checked

by substitution of a servicable unit where malfunction of a circuit covered by them occurs.

4 On pre-August 1969 models which are fitted with an emergency flasher system the relay is not mounted on the fuse rack but separately on top of the upper steering column support bracket. It is best to remove the dash panel when making connections to it so that the wires may be seen easily.

5 If additional electrical accessories are to be connected to the fuse block, it is easier to make a neat job if the fuse rack is first detached in the following way.

6 Remove the glovebox or parcels shelf to expose the fuse rack securing screws and the retaining clip.

7 Release the clip and pull the fuse rack straight up out of its holder. The screws and wiring harness clip may be released if necessary to provide even more working access.

16 Direction indicators - fault tracing and repair

1 One of the most usual causes of failure is due simply to bad connections to earth. This can occur at the bulb holders (usual) or the terminal connections. If, therefore, the flashers can be heard but do not light - or only operate slowly - check all the bulbs, holders and screws for signs of whitish corrosion deposits (which may have been caused by seepage of water past the lamp housing seals). Check also the appropriate fuse.

2 First check that the flasher relay itself is not faulty. The simplest way to do this is by substitution with a new one. The relay is located on the fuse rack under the dash panel or in pre-August 1969 models on the steering column support bracket.

3 If the fault is in the switch itself the steering wheel must be taken off (Chapter 11) so that the switch may be removed. This combined switch if faulty must be renewed as a unit (photo).

17 Windscreen wipers - fault finding

1 If the wipers do not work when they are switched on, first check the fuse. If this is sound then there is either an open circuit in the wiring or switch, the wiper motor is faulty, or the pivot spindles or linkages may be binding.

2 If the wipers work intermittently then suspect a short circuit in the motor or a poor contact to earth. The earth is connected at the main mounting screw. Alternatively, the armature shaft endfloat adjustment may be too tight or the wiper linkage may be binding.

3 Should the wipers not stop when they are turned off there must be a short circuit in the switch or wiring.

4 Do not run the wipers with the blades on a dry screen when testing. Excessive friction overloads the motor.

18 Windscreen wiper mechanism - removal and replacement

1 Disconnect the battery earth lead.

2 Slacken the clamping screw on the wiper arm brackets and pull the arms off the spindles.

3 Remove the hexagon nut, washers and seals from around the spindles.

4 Remove the heater branch connections under the instrument panel.

5 Disconnect the cables from the motor.

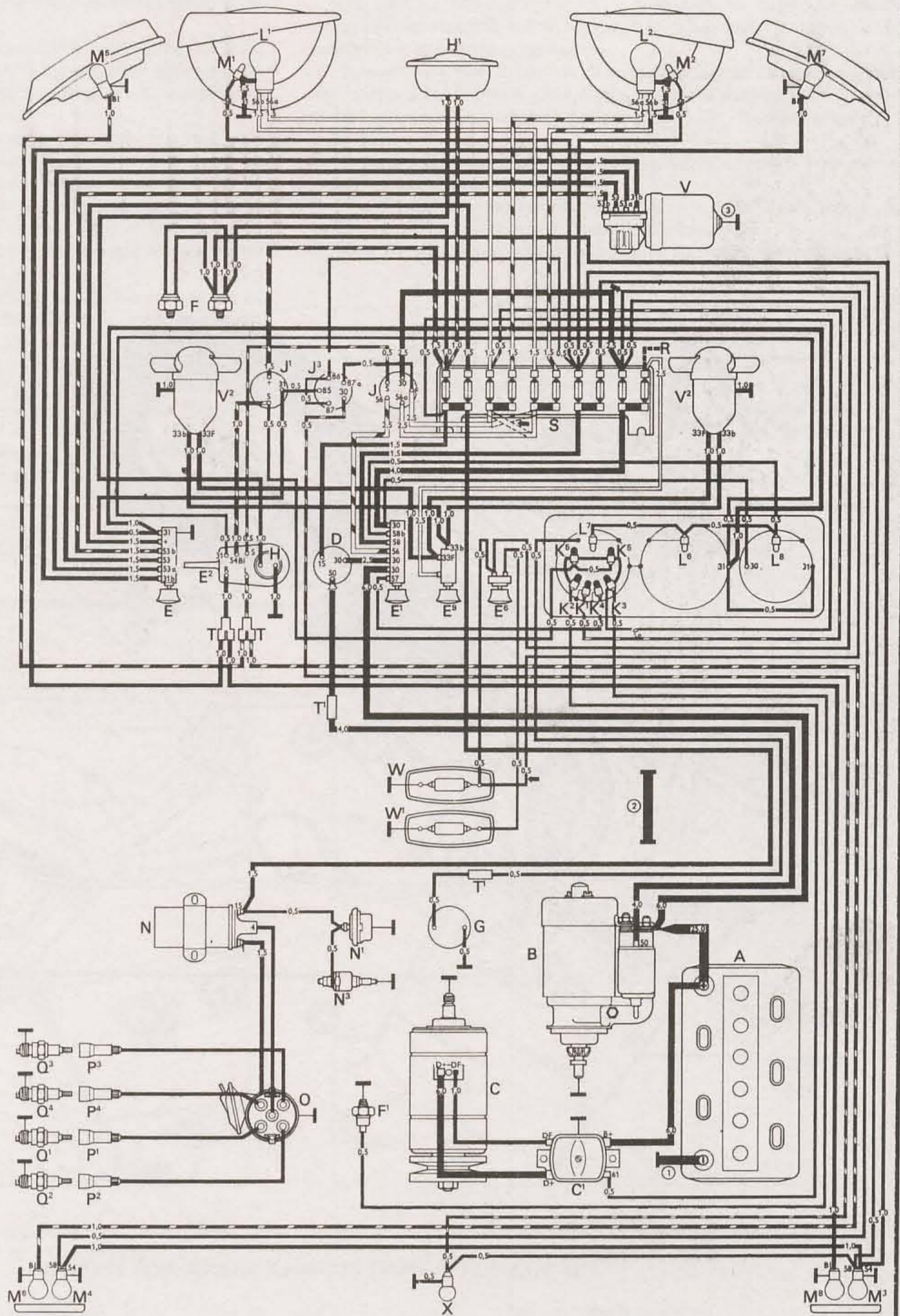
6 Undo the screw which holds the motor and frame to the mounting bracket. The motor and the linkage can then be removed together.

7 To separate the motor from the wiper mechanism first mark its position in relation to the frame. Then pry the ball joint connections apart with a screwdriver and undo the securing screws.

8 Replacement of the motor and wiper mechanism is a reversal

WIRING DIAGRAM 1968 TO 1969 EXCEPT NORTH AMERICAN MODELS

- A Battery
- B Starter
- C Generator
- C1 Regulator
- D Ignition/starter lock
- E Windscreen wiper switch
- E1 Lighting switch
- E2 Headlight flasher and dimmer switch
- E6 Interior light switch
- E9 Ventilator fan motor switch
- F Brake light switch
- F1 Oil pressure switch
- G Fuel gauge sender unit
- H Horn half ring
- H1 Horn
- J Headlight flasher and dimmer relay
- J1 Turn signal relay
- J3 Parking light relay (for Austria only)
- K1 High beam warning lamp
- K2 Generator charging warning lamp
- K3 Oil pressure warning lamp
- K4 Parking light warning lamp
- K5 Turn signal warning lamps
- L1 Twin filament bulb, left, for headlight
- L2 Twin filament bulb, right, for headlight
- L6 Speedometer light
- L7 Fuel gauge light
- L8 Clock light
- M1 Parking light, left
- M2 Parking light, right
- M3 Brake and tail lights, right
- M4 Brake and tail lights, left
- M5 Turn signal, front left
- M6 Turn signal, rear left
- M7 Turn signal, front right
- M8 Turn signal, rear right
- N Ignition coil
- N1 Automatic choke
- N3 Electro-magnetic cut-off valve (fuel)
- O Distributor
- P1 Spark plug connector, No 1 cylinder
- P2 Spark plug connector, No 2 cylinder
- P3 Spark plug connector, No 3 cylinder
- P4 Spark plug connector, No 4 cylinder
- Q1 Spark plug, No 1 cylinder
- Q2 Spark plug, No 2 cylinder
- Q3 Spark plug, No 3 cylinder
- Q4 Spark plug, No 4 cylinder
- R Radio
- S Fuse box
- T Cable adaptor
- T1 Cable connector, single
- V Windscreen wiper motor
- V2 Ventilator fan motor, front
- W Interior light front
- W1 Interior light, rear
- X License plate light
- 1 Battery to frame ground strap
- 2 Transmission to frame ground strap
- 3 Windscreen wiper motor to body ground strap



Prior to 1972 the steering gear was of the worm and peg type but in 1972 this changed to worm and roller. At the same time the steering ratio was increased making the steering lighter than before. The linkage from the steering gear to the wheels requires more sections due to the forward drive layout of the vehicle. From the drop arm (pitman arm) there is a drag link to a swing lever, independently pivoted and from this the tie rods run to each steering arm on the wheels. A hydraulic steering damper unit is also installed (photo).

2 Maintenance axle beam and steering linkage

Careful maintenance of the front suspension will save you money. Prior to 1967 there were greasing points on the tie rod ends, four on the axle tubes, four on the king pin links on either side, and two on the swing lever to service every 3000 miles. Since 1967 the tie rods do not need lubricating, one point is provided on the swing lever and one at the axle end of the steering damper. There are three points on the axle beam, one in the centre and one at each end (photo). Before greasing, which should be done annually or every 6000 miles, whichever is the soonest, jack the car up under the frame to take the weight off the front wheels and suspension, and clean off the grease nipple. If you do not take the weight off the front wheels grease will not go in. Maintenance for the rest of the suspension and steering is discussed under the appropriate section.

3 Front wheel bearings - removal, replacement and adjustment

1 The front wheel hubs each run on two taper roller bearings. Adjustment is effected by a clamp nut which is locked into position by a socket head screw incorporated into it.

2 The left hand front hub has a left hand thread. The axle is hollow to permit the speedometer drive cable to go through it. This cable is driven by a square hole in the bearing dust cover. Jack up the wheel and remove the securing bolts and wheel.

3 To remove the bearing dust cover, first take out the circlip securing the speedometer cable and tap the dust cover from side to side until it comes free.

4 Undo the socket head screw and undo the wheel bearing clamp nut.

5 If the thrust washer is now taken off the hub may be removed. There will be the outer races of each bearing left in the hub and the inner race of the inner bearing left on the axle. These should be drifted out of the hub from the inside if the bearings are to be renewed. If the same bearings are being replaced, they may be left in position and merely flushed out. The race on the shaft should be drifted off also. Note that if the races are renewed then the oil seal on the inner part of the hub will be driven out at the same time as the race. This must be renewed as well.

6 It is possible that the bearing race is a loose fit on the shaft. If this is so, which would tend to let it turn, a few centre punch marks around the axle where it fits will give it some grip once again when fitted.

7 Refitting new bearings means that the outer races will first have to be driven into the hub and the new oil seal fitted on the inside. Coat the bearings and the space between them in the hub with liberal quantities of Castrol LM Grease and place the hub back on the shaft. Fit the outer bearing followed by the thrust washer and screw on the clamp nut (photos).

8 To adjust the bearing endfloat correctly the nut should be tightened up firmly to make sure the bearings are properly located, spinning the wheel at the same time to ensure the bearings are not overtightened. Then the nut should be backed off until the axial play is between 0.03 - 0.12 mm (0.001 - 0.005 inch) at the spindle. This seems quite a lot and can result in some quite noticeable rock at the outer rim of the wheel. It is nevertheless correct although the axial play should be kept to the lower limit where possible. When correct tighten the socket screw (photo).

9 Replace the hub cover and re-secure the speedometer drive cable where appropriate.

4 Front suspension ball joints - inspection and renewal

1 With the exception of the correct setting of the camber adjusting bush on the upper joint pin there are no adjustments which can be made. When the joints are worn beyond specification limits they must be renewed. Each joint has a removable plug (photo). When removed, a grease nipple can be fitted to add more grease if the joint should squeak. Regular greasing is not necessary. These plugs are not fitted for this reason. They merely cover a special recess which is used in conjunction with a special jig for checking that the arm is not bent. Later models do not have the plugs. A special recess is machined to the body of the joint.

2 Testing of the play in the suspension ball joints cannot be carried out as on some cars by the accepted method of jacking up the vehicle and then lifting the wheel independently. This is because the lower halves of the ball joint bearing cups are strongly spring loaded. The play is therefore measured by drawing the pins of the ball joints downwards to see how far they move. As the pins are attached to the steering knuckle this means that the wheel has to be moved downwards in relation to the torsion arms. This is done by means of a lever with a pivoting hooked section attached (see Fig.10.2). To check the lower joint play hook the swinging section under the lower torsion arm and lever the upper torsion arm down. To check the upper joint put the hook and arm between the torsion arms to lever the upper arm up.

3 In order to renew the ball joints they have first to be removed from the knuckle by unscrewing the taper pin nuts and pressing them out of the knuckle eyes with a claw clamp. This may be done without removing the hub or backplate but care must be taken to avoid damaging the hydraulic pipe. If a claw clamp is not available and it is known that the ball joints are going to be renewed anyway it is possible to loosen the tapers by striking the sides of the eyes in the steering knuckle. Such striking should be firm and smart. Excessive striking could distort the knuckle.

4 The ball joints then have to be removed from the torsion arms. As they are a splined press fit into the torsion arms the torsion arms will have to be removed. This is not difficult (see next section).

5 With the torsion arms removed the best thing to do is to take them along to a VW agent and get him to fit the new ball joint to them. Without the proper press tools the greatest difficulty will be encountered in removing the old joints and installing the new ones. If the torsion arm should get damaged it could be very expensive.

6 The eccentric bush on the upper joint pin will have to be removed and fitted to the new joint.

7 Replace the torsion arms and then refit the ball joint pins into the steering knuckle. Note that the eccentric bush of the top joint pin has a notch which normally faces forward. If the notch did not face forward on the joint you took off then it would be as well to have the steering geometry checked out completely. This is a wise precaution in any case.

5 Torsion arms - removal and replacement

1 If indications show that a torsion arm is damaged then it must be renewed.

2 First remove the wheel hub assembly. If a lower torsion arm is being removed the stabiliser bar must also be taken off (see Section 7.)

3 Loosen the locknuts on the ends of the torsion arm securing and then screw the pins right out. The torsion arm can then be pulled out of the axle tube. The torsion arm tube is positioned in two bearings - an inner bush and outer needle roller. If either of these is seriously worn causing radial movement of the torsion

axle tube) by fitting the securing bolts and nuts and tightening them to the specified torques.

17 Front axle assembly - removal and replacement

- 1 If the front axle assembly is badly worn or damaged requiring a considerable amount of repair (or total replacement) it can be readily removed.
- 2 Disconnect the brake hoses at the brackets and plug the ends - use the bleeder valve dust caps if they are still there.
- 3 Disconnect the speedometer cable from the left front wheel bearing dust cover and pull it through from behind the steering knuckle.
- 4 Remove the cover plate under the foot pedal cluster underneath.
- 5 Engage 1st or 3rd gear so that the muff coupling and screw which join the front and rear gear change rods is accessible. The screw is locked with wire. Remove the screw and disengage and remove the front section.
- 6 From inside the driving compartment remove the gear change lever assembly (see Chapter 6).
- 7 Disconnect the clutch cable at the pedal end and the handbrake cables from the handbrake lever.
- 8 Disconnect the drag link from the swing lever in the steering linkage.
- 9 Remove the bolt securing the steering damper at the axle bracket end and turn it downwards.
- 10 Now raise vehicle and support it securely on stands at each side under the floor frame members. Raise it so that the wheels are just clear of the floor.
- 11 Support the front axle assembly under the lower tube with a trolley jack and remove the bolts holding the side plates to the frame side member, two bolts at each side.
- 12 The axle assembly may then be lowered and wheeled out.
- 13 Replacement is a reversal of the removal procedure bearing the following points in mind. Any gap between the side plates and side members should be taken up by packing pieces of suitable thickness. The four securing belts on early models were fitted with two lockwashers. These were discontinued on later models and the bolts were shortened by 5 mm. The starter bolts may be used on earlier vehicles but if the larger bolts are used the lockwashers must also be fitted. When the axle is in position and before the bolts are tightened the assembly should be turned forward to take up any slack between the bolts and the holes. This prevents movement under braking forces. Then tighten the bolts to the correct torque.

18 Steering geometry and wheel alignment

- 1 The correct alignment of the front wheels does not normally alter and the need for checking and realigning occurs only after certain conditions, namely:
 - a) Renewal of track rod joints.
 - b) Damage to front suspension or steering linkage.
 Theoretically, if worn ball joints, wheel bearings and so on, are all renewed the steering geometry will automatically be correct. This, of course, presumes that no adjustment has been made in a misguided attempt to compensate for wear. If adjustments have been made then, of course, when the various parts are renewed the steering will have to be realigned.
- 2 The only adjustments which can be made are to the adjustable tie rod (wheel toe), the drag link (centering) and upper ball joint eccentric bush (camber). The alteration of camber automatically alters the king pin inclination at the same time.

King pin inclination is the old term for steering pivot angle and recalls the times when the steering pivoted on pins rather than ball joints.

3 Adjustments of steering geometry should never be made in a haphazard manner. In order to check all the angles correctly proper equipment is needed. Further more, it is quite pointless trying to realign the steering if one or more of the components is worn. A reputable garage would not normally undertake to re-adjust steering which had significant wear - although they may be prepared to inform you of the state of the alignment.

19 Wheels and tyres (to 1970)

1 To provide equal, and obtain maximum wear from all the tyres, they should be rotated on the vehicle at intervals of 6,000 miles to the following pattern:-

- Spare to right rear
- Right rear to left front
- Left front to left rear
- Left rear to right front
- Right front to spare.

Wheels should be re-balanced when this is done if they were balanced on the vehicle. However, some owners balk at the prospect of having to buy five new tyres all at once and tend to let two run on and replace a pair only. The new pair should always be fitted to the front wheels, as these are the most important from the safety aspect of steering and braking.

2 Never mix tyres of a radial and crossply construction on the same car, as the basic design differences can cause unusual and very dangerous handling and braking characteristics. If an emergency should force the use of two different types, make sure the radials are on the rear wheels and drive particularly carefully. If three of the five wheels are fitted with radial tyres then make sure that no more than two radials are in use on the car (and those at the rear). Rationalise the tyres at the earliest possible opportunity.

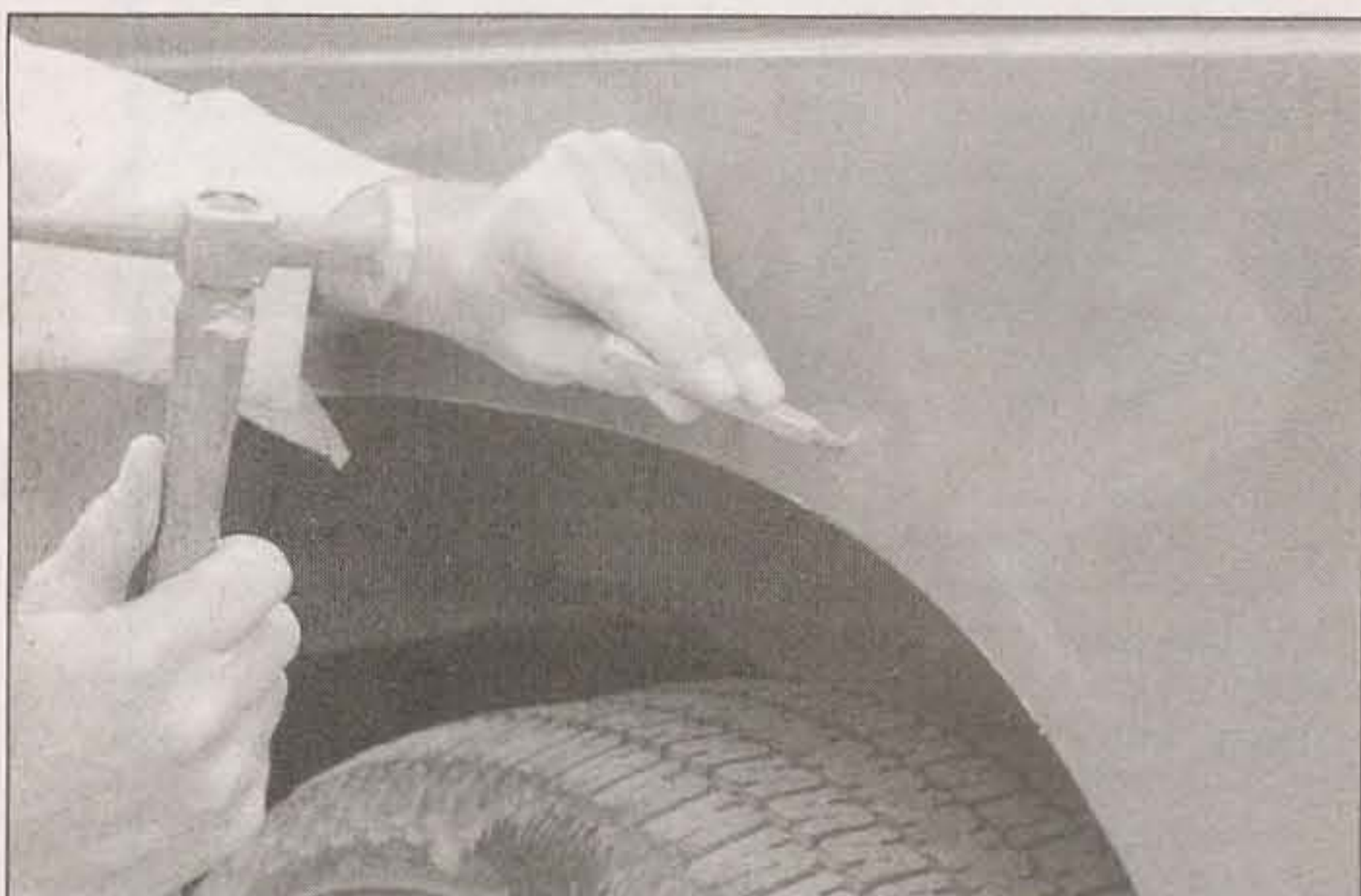
3 Wheels are normally not subject to servicing problems, but when tyres are renewed or changed the wheels should be balanced to reduce vibration and wear. If a wheel is suspected of damage - caused by hitting a kerb or pot hole which could distort it out of true, change it and have it checked for balance and true running at the earliest opportunity.

4 The tightening of the wheel bolts or nuts is to be done carefully. The torque requirement is quite high - 94 lb ft - which is just about all you can give it using the spanner and handle provided for changing the wheel in the event of a puncture. The bolts or nuts should be tightened evenly and if they have to be undone in an emergency get them checked properly as soon as possible. The tightness of wheel bolts is included in the service check.

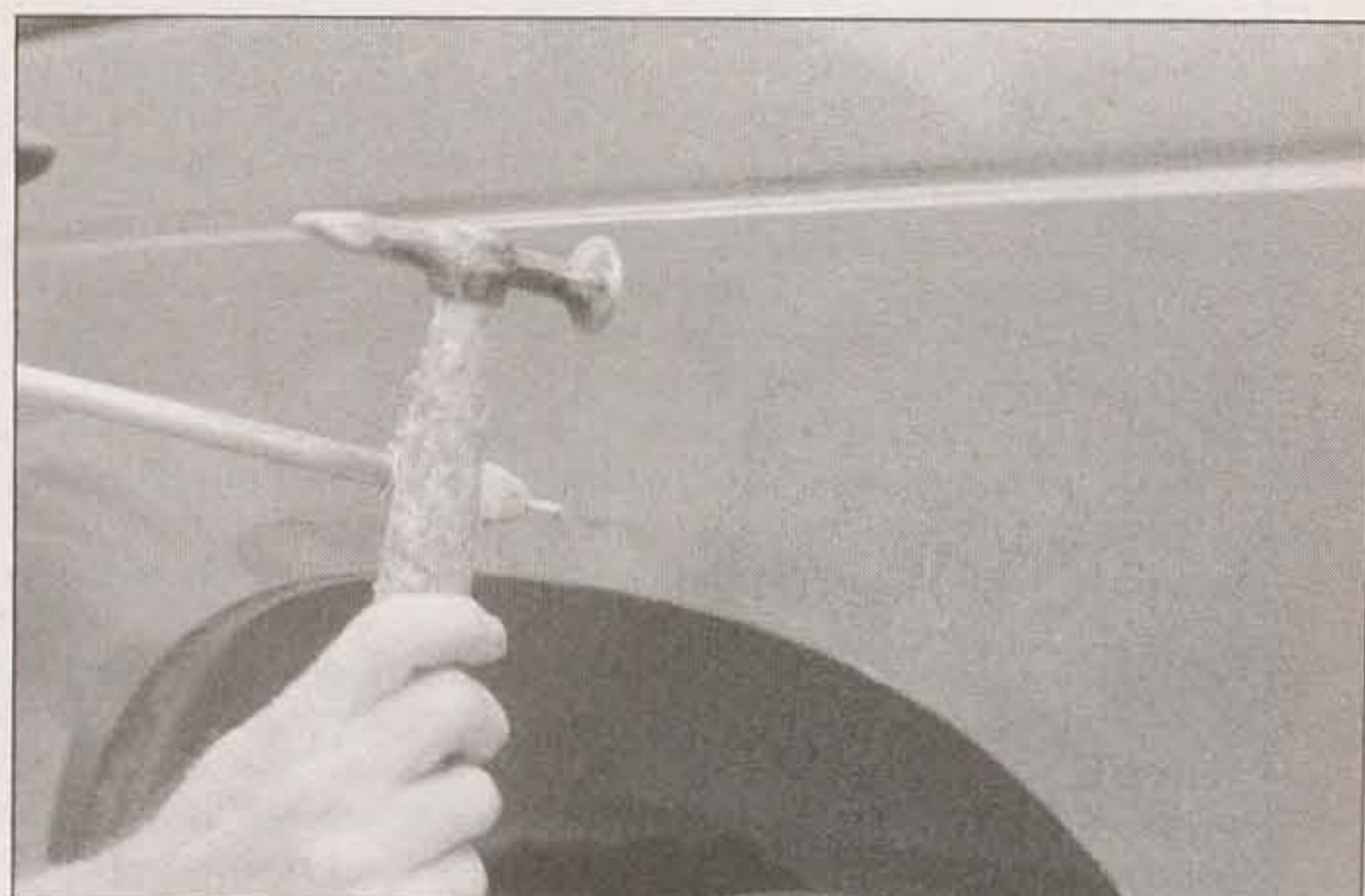
20 Wheels and tyres (1971 on)

- 1 Radial tyres are fitted as standard to all later models.
- 2 Any wheel changing which is carried out in order to even out tread wear should be restricted to moving the wheels between front and rear on the same side only - *not* from side to side.
- 3 The spare can be introduced into the pattern of movement, provided the roadwheel which it replaces, is marked with the side of the car from which it came, for future reference.
- 4 Never mix radial tyres of steel and textile construction on the same vehicle.
- 5 Refer to paragraphs 3 and 4 of Section 19.

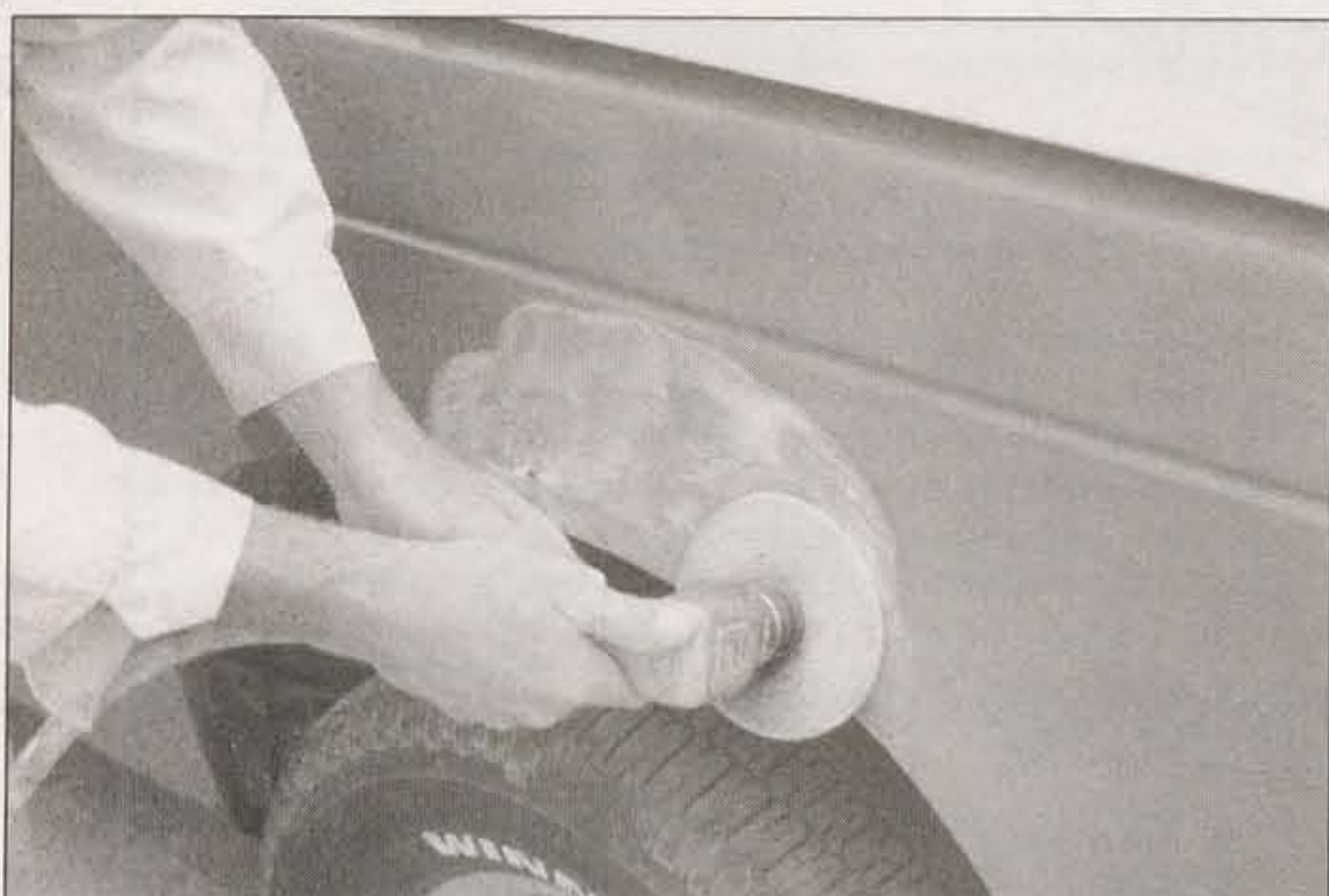
These photos illustrate a method of repairing simple dents. They are intended to supplement *Body repair - minor damage* in this Chapter and should not be used as the sole instructions for body repair on these vehicles.



1 If you can't access the backside of the body panel to hammer out the dent, pull it out with a slide-hammer-type dent puller. In the deepest portion of the dent or along the crease line, drill or punch hole(s) at least one inch apart . . .



2 . . . then screw the slide-hammer into the hole and operate it. Tap with a hammer near the edge of the dent to help 'pop' the metal back to its original shape. When you're finished, the dent area should be close to its original contour and about 1/8-inch below the surface of the surrounding metal



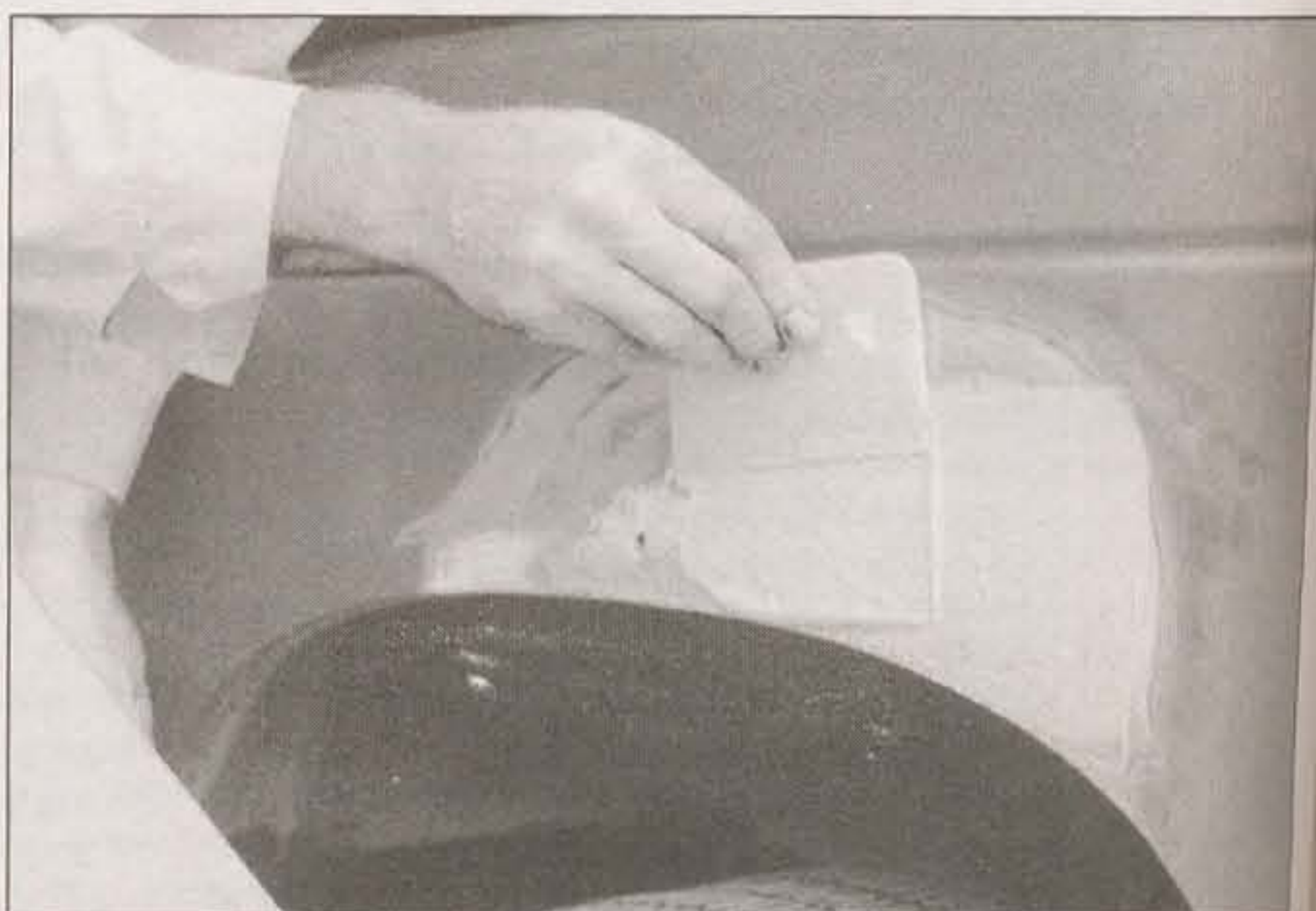
3 Using coarse-grit sandpaper, remove the paint down to the bare metal. Hand sanding works fine, but the disc sander shown here makes the job faster. Use finer (about 320-grit) sandpaper to feather-edge the paint at least one inch around the dent area



4 When the paint is removed, touch will probably be more helpful than sight for telling if the metal is straight. Hammer down the high spots or raise the low spots as necessary. Clean the repair area with wax/silicone remover



5 Following label instructions, mix up a batch of plastic filler and hardener. The ratio of filler to hardener is critical, and, if you mix it incorrectly, it will either not cure properly or cure too quickly (you won't have time to file and sand it into shape)



6 Working quickly so the filler doesn't harden, use a plastic applicator to press the body filler firmly into the metal, assuring it bonds completely. Work the filler until it matches the original contour and is slightly above the surrounding metal

4 Engine

Pushrod tubes - renewal with engine in position

- 1 Damaged or leaking pushrod tubes can be renewed without the necessity of removing the engine.
- 2 Refer to Chapter 1 and remove the rocker cover.
- 3 Remove the rocker shaft and withdraw the pushrods.
- 4 Using a screwdriver, lever the damaged pushrod tube out.
- 5 Compress the new telescopic type pushrod tube and install it complete with new seals so that the thinner end of the tube is towards the cylinder head.
- 6 Refit the components which were removed and then adjust the valve clearances. Refit the rocker cover.

5 Cooling, heating and exhaust systems

Supplementary fuel fired heater - fault diagnosis

Symptom	Reason
Fuse blown	Fault in heater relay Fault in temperature regulating switch
Heater fails to run-on for specified period when ignition switched off	Fault in thermostwitch
Air circulation blower does not operate at two speeds	Fault in heater relay
Air circulation and combustion air blower continue to run after specified period although heater switched off	Fault in heater relay Fault in thermostwitch
Heater gives off smoke and fumes	Fault in combustion air blower Fault in fuel pump Fault in exhaust pipe

6 Fuel system

Air cleaner (1973 on)

- 1 On later models, a paper element type air cleaner is used instead of the earlier oil bath type.
- 2 To renew the element, pull off the vacuum hose from the temperature control device on the intake spout and release the vertically positioned toggle clip.
- 3 Pull the air cleaner casing from its lower and front mountings.
- 4 Release the four toggle clips and separate the two sections of the casing. Wipe out the casing and discard the filter element.
- 5 Refit the new element by reversing the removal operations, noting that the casing engages in the rubber grommet before engaging it with its lower mounting.

Solex carburettor - throttle valve damper

- 6 After August 1975 a throttle valve damper is fitted to the Solex 34 PICT 3 carburettor.
- 7 Adjustment should be made with the damper plunger pushed fully in so that there is a gap of 0.04 in (1.0 mm) between the end of the plunger and the operating lever.

Single Solex carburettor - modified adjustment

Note: Procedure for twin-carburettors is as described in Chapter 3.

- 8 On the Solex 34 PICT 3 carburettor, the following idling adjustment procedure is recommended to eliminate stalling during warm-up or the throttle valve sticking when the engine is at the normal operating temperature.

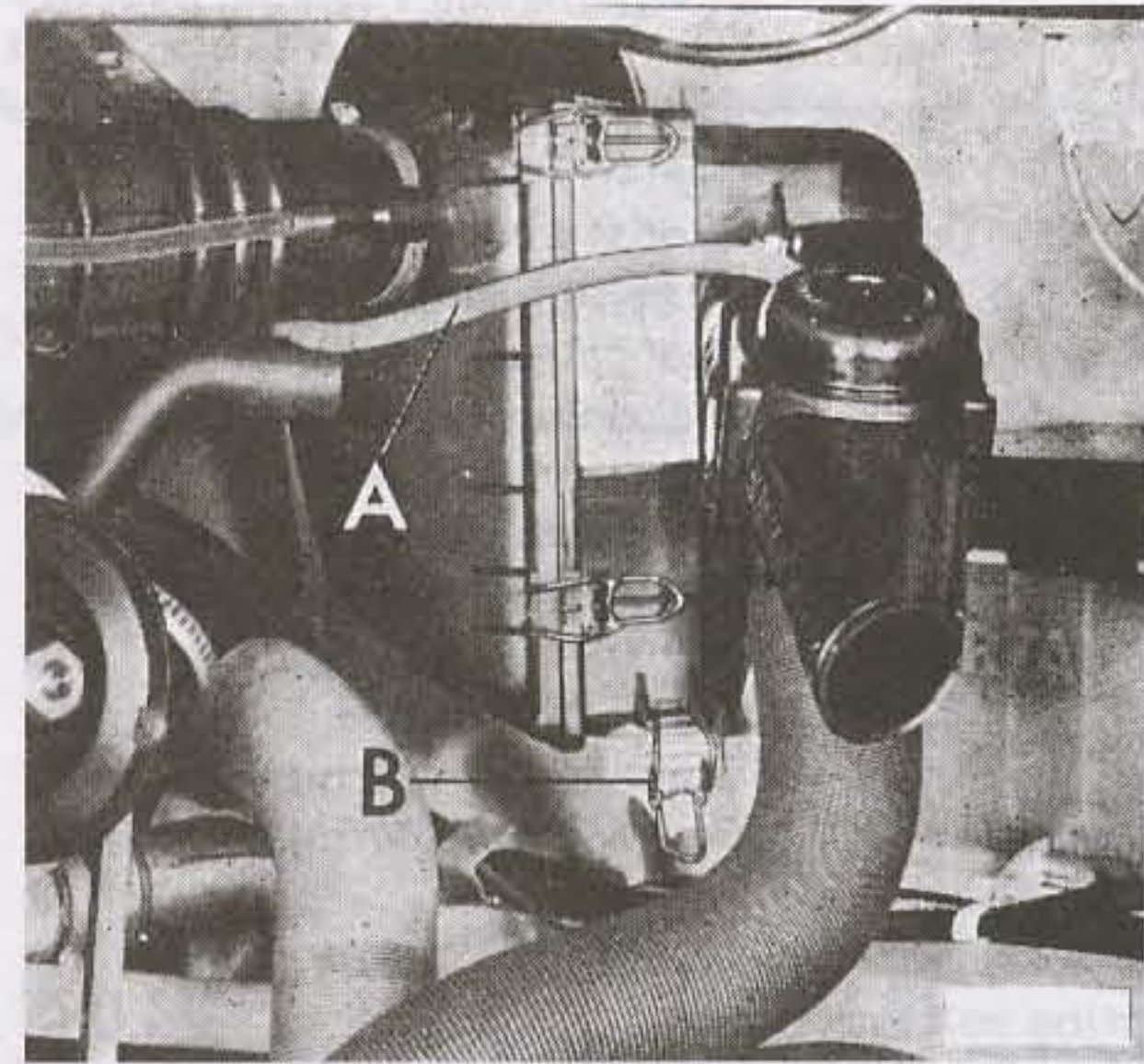


FIG.12.2 AIR CLEANER (PAPER ELEMENT TYPE)

A Vacuum pipe

B Toggle clip

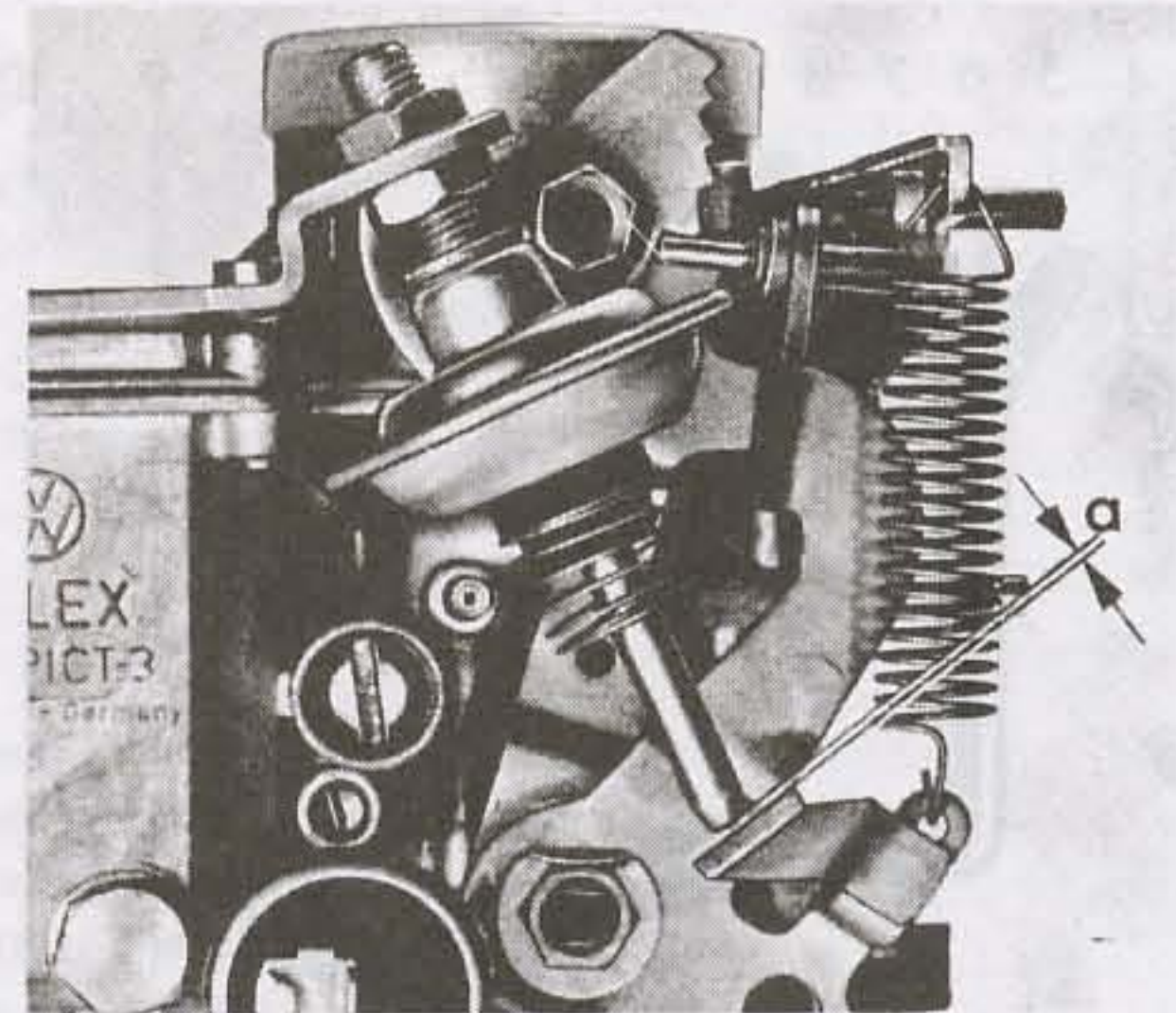


FIG.12.3 CARBURETTOR THROTTLE VALVE DAMPER

$a = 0.04 \text{ in (1.0 mm)}$

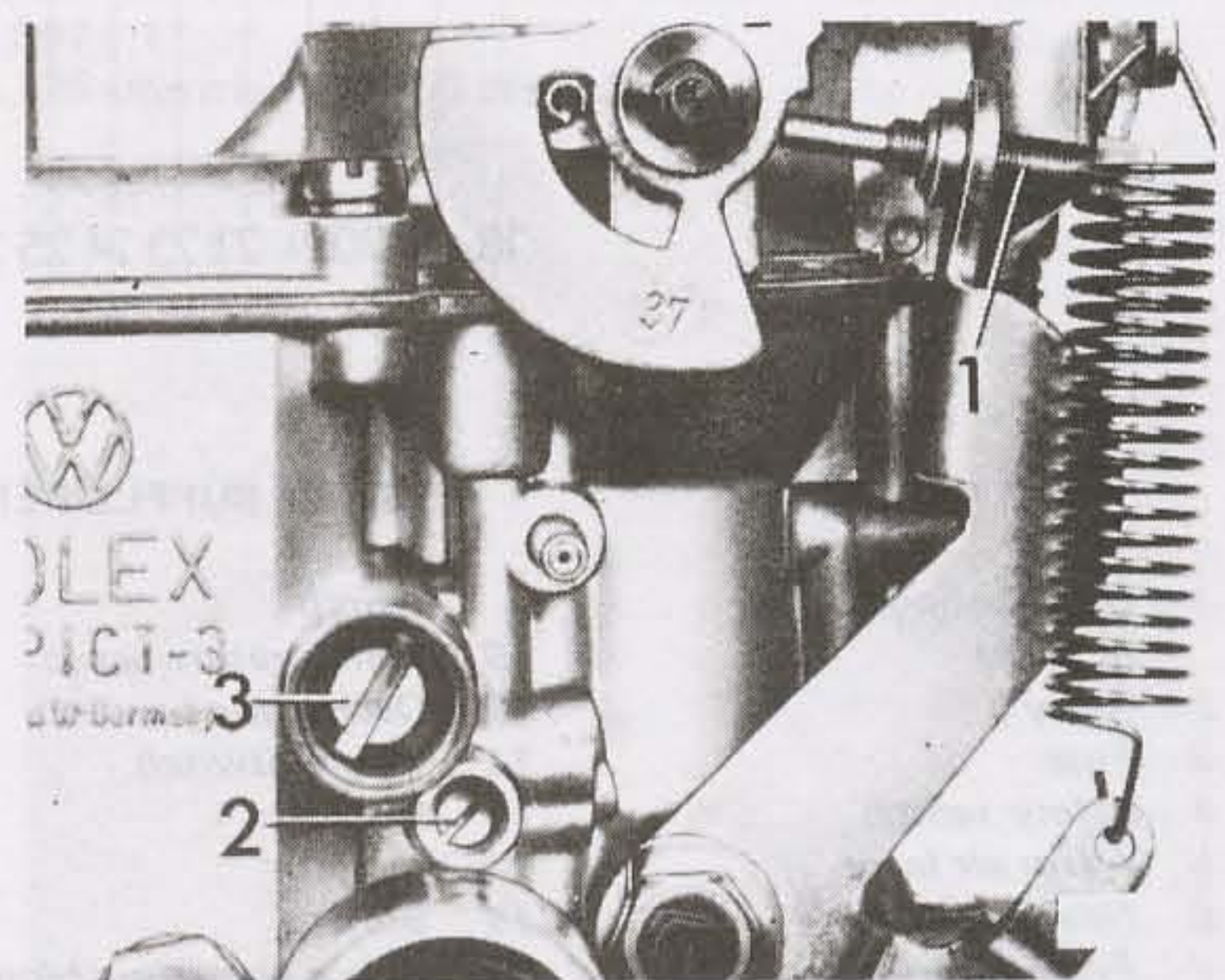


FIG. 12.4. CARBURETTOR ADJUSTING POINTS

1 Throttle adjusting screw

2 CO adjusting screw

3 Idle adjusting screw

99 Adjust the union nut on the reverse rocker lever support until the support is just free to slide in and out of its clamp sleeve.

100 Push the reverse (middle) selector shaft until its circlip contacts the face of the gear carrier. Hand tighten the union nut.

101 Without touching its shift fork, press reverse sliding gear towards the gear carrier until there is a clearance between the sliding gear and the mainshaft 2nd gear of between 0.020 and 0.039 in (0.50 and 1.00 mm). Tighten the union nut to 22 lbf lb (3.0 kgf m).

102 Disengage reverse gear and select 2nd gear. Check that there is a clearance between the teeth of reverse sliding gear and 1st/2nd gear sleeve. If not, readjust the reverse lever support after releasing the union nut.

103 Finally check that the interlock mechanism is doing its job by only allowing the selection of one gear at a time. Check that the selector fork lock bolts are all tight at 18 lbf ft (2.5 kgf m).

104 Stick a new gasket to the flange of the transmission case and locate the pinion driveshaft bearing shims in position (refer to paragraph 110 if the pinion/crownwheel has yet to be adjusted).

105 Insert the gear train into the casing so that the twelve sided shoulder of the pinion bearing seats in its recess.

106 Fit a new retaining nut and with the special tool used to release it, tighten it to 160 lbf lb (21.8 kgf m). Release the nut one quarter of a turn and retighten to the correct torque. Stake the nut by means of its retaining ring.

107 Insert and tighten the bolts which hold the gear carrier to the transmission case. Work in a diagonal sequence and tighten to a torque of 14 lbf ft (1.9 kgf m).

108 To the face of the gear carrier bolt on the selector link and bracket, the selector link and link shaft.

109 If the gearchange lever housing was overhauled, fit a new bush/oil seal. Fit the housing to the gear carrier making sure that the selector inner lever engages with the balljoint of the link. Fit the securing bolts and tighten to 11 lbf ft (1.5 kgf m).

Final drive - fitting

110 If the differential has been dismantled or certain components renewed (see paragraph 127) then it is essential that the setting of the crownwheel and pinion is left to your dealer due to the need for special gauges. Under these circumstances, the jig setting of the selector mechanism (paragraphs 85 to 103) should be carried out by him at the same time.

111 Where the differential/final drive has remained undisturbed during the gearbox overhaul operations, then refit it in the following way.

112 Fit the differential into the transmission housing so that the crownwheel and pinion mesh.

113 Fit a new oil seal and O-ring to each of the adjusting rings.

114 Screw in the right-hand adjusting ring (they should have been marked L or R before removal) by the exact number of turns recorded at dismantling until its mark is correctly aligned.

115 Centralise the differential in the transmission housing and screw in the opposite bearing adjuster ring again to the original depth and stopping when the marks on ring and housing are in alignment. Release this ring one complete turn until the clutch bellhousing has been fitted.

116 To the right-hand side fit a new spacer, a lockplate seal, the lockplate, the kidney shaped plates and the Phillips screws.

117 Into the open end of the gearcase, locate the reverse gear sleeve onto the end of the mainshaft.

118 Insert the input shaft, without its circlip but with a threaded connecting stud screwed into its end, and pick up the reverse sleeve. Draw the sleeve towards you on the input shaft and screw the shaft up tight with the mainshaft. Now unscrew it just a fraction (one spline) until the sleeve can be pushed forward freely.

119 Fit a new circlip into the input shaft groove.

120 Using a new joint gasket, bolt the clutch bellhousing to the front of the transmission case. Tighten the bolts to 14 lbf ft (1.9 kgf m).

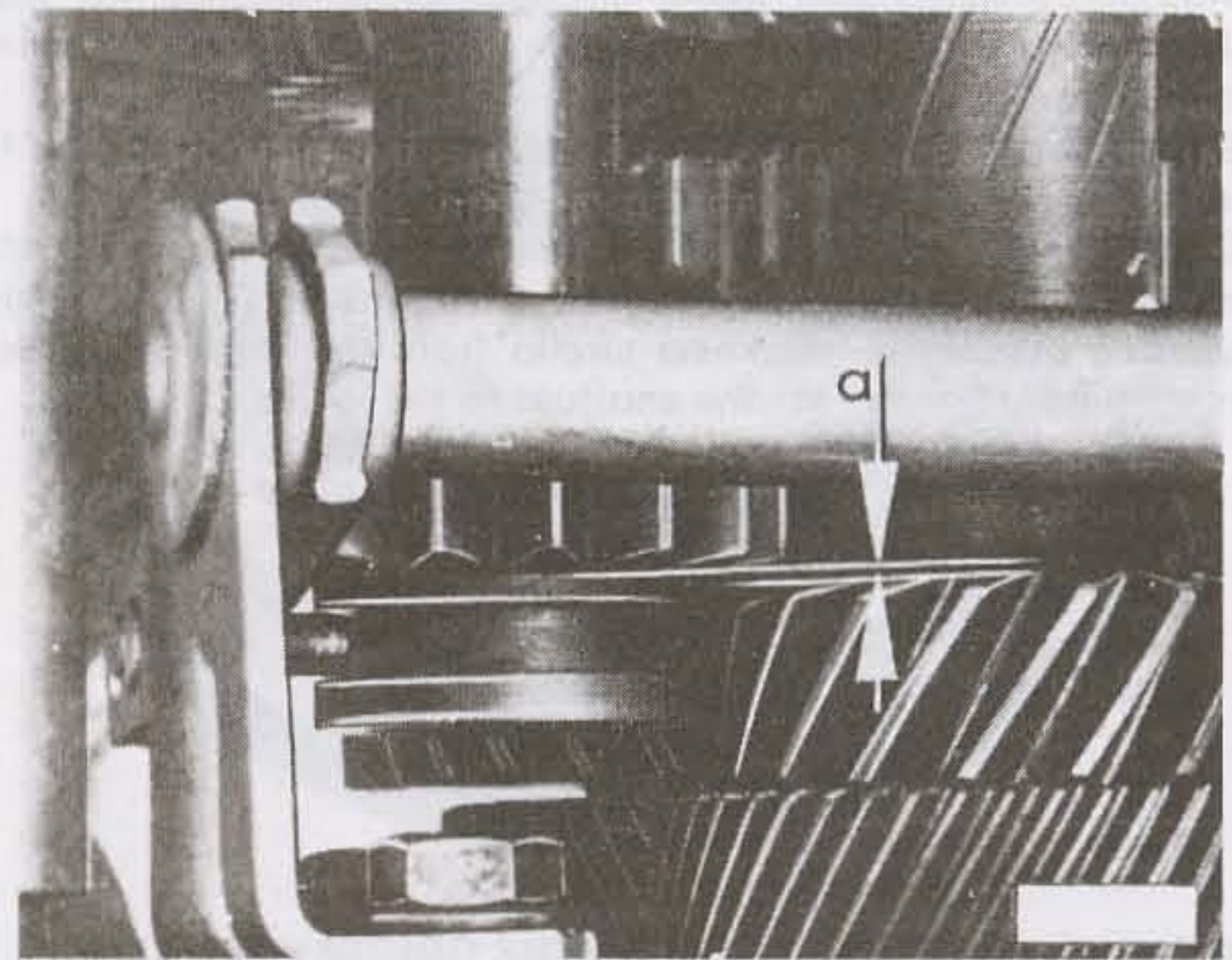


FIG.12.21 REVERSE SLIDING GEAR CLEARANCE (a) TO MAINSHAFT

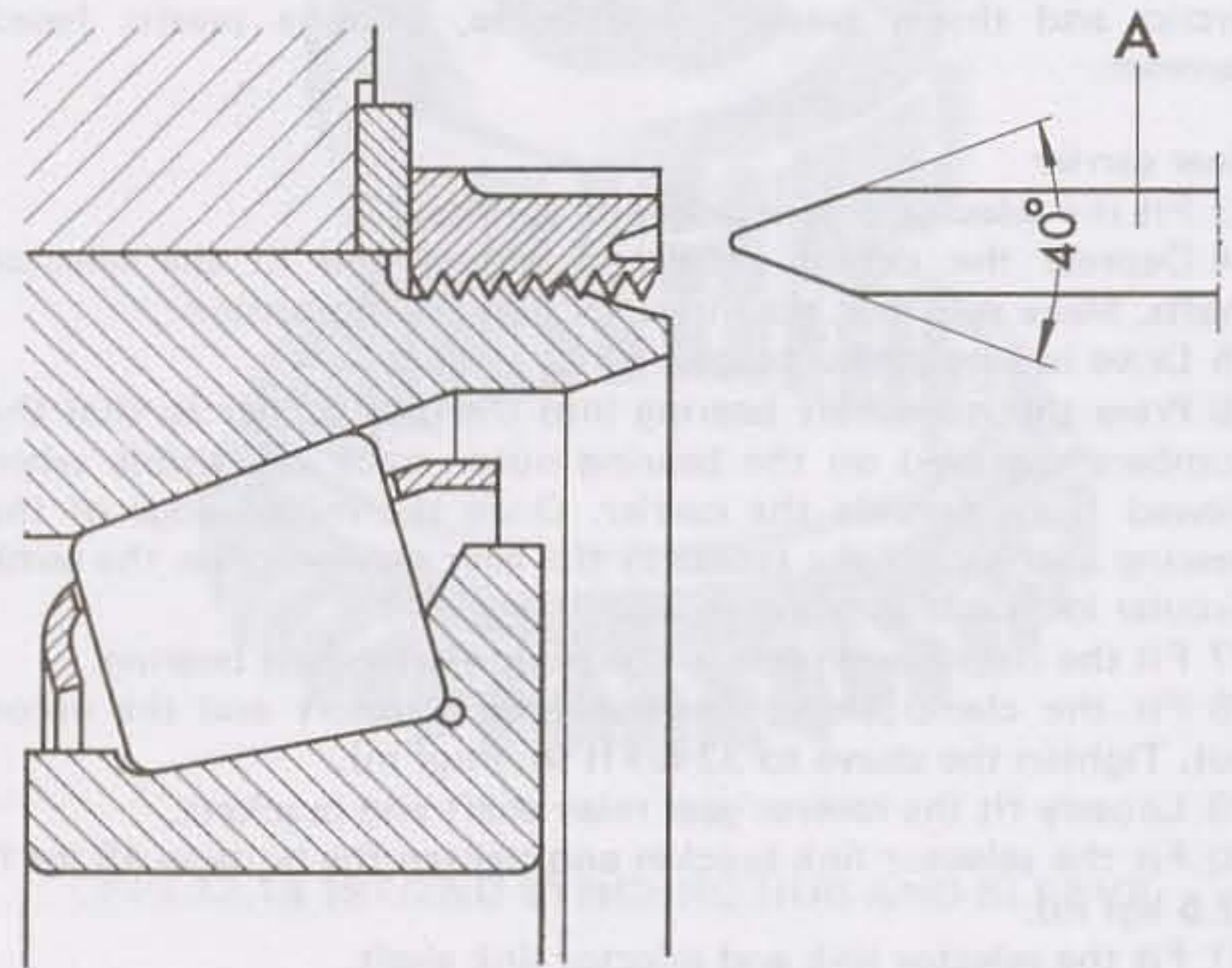


FIG.12.22 PINION DRIVESHAFT NUT STAKING DIAGRAM

A Staking tool

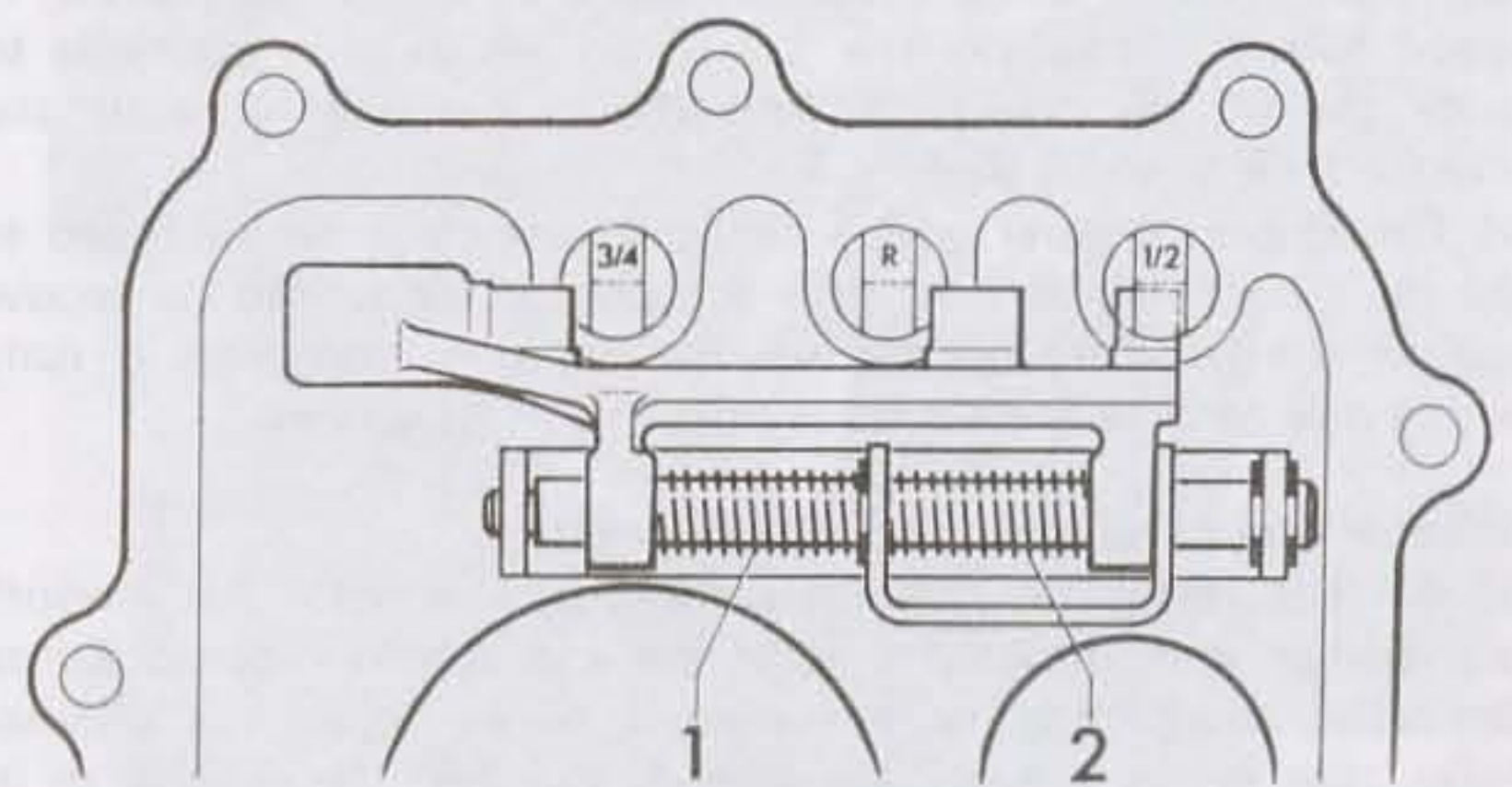


FIG.12.23 INTERMEDIATE SELECTOR LEVER SPRING ARRANGEMENT

1 Weaker spring

2 Stronger spring

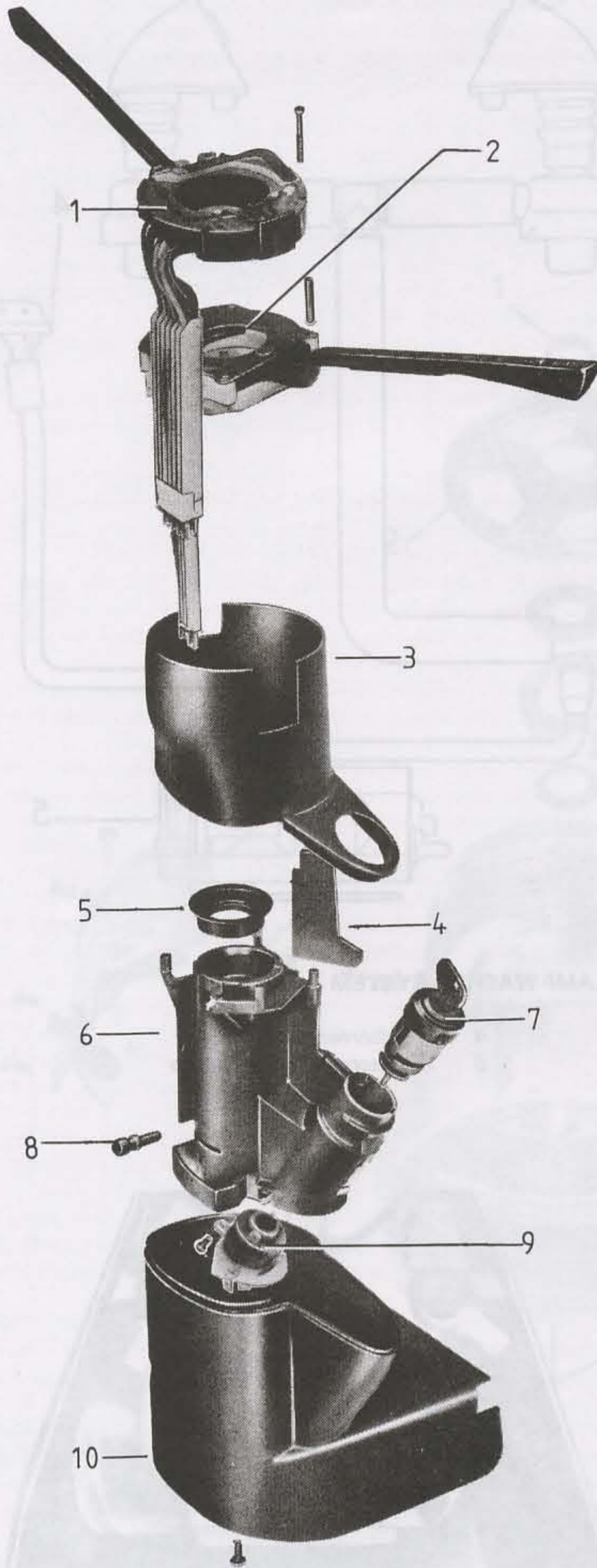


FIG.12.36 STEERING COLUMN LOCK AND SWITCHES (1975 ON)

- | | | | |
|---|----------------------------|----|--------------------------|
| 1 | Direction indicator switch | 7 | Lock cylinder |
| 2 | Wiper switch | 8 | Lock spear head screw |
| 3 | Column/switch upper trim | 9 | Ignition switch |
| 4 | Cover plate | 10 | Column/switch lower trim |
| 5 | Spacer | | |
| 6 | Switch/lock housing | | |

housing lower trim to the base of the steering lock housing.
 75 Remove the lock by sliding it up and off the steering column.
 76 The ignition switch can be detached from the steering lock housing once the small securing screw is extracted.
 77 To remove the lock cylinder, pull the lock cover plate out of the housing using a pair of pliers. A small hole will now be exposed into which a probe should be inserted to depress the spring which will enable the cylinder to be withdrawn. On some late models this hole may have to be drilled in accordance with the diagram. Use a 1/8 in (3.0 mm) diameter drill (Fig.12.37).
 78 Refitting is a reversal of removal but observe the following points.
 79 Fit the steering wheel with spokes horizontal and front roadwheels in the straight ahead position. Tighten the retaining nut to 36 lbf ft (4.9 kgf m).
 80 Set a clearance between the base of the steering wheel hub and the direction indicator switch of between 0.063 and 0.13 in (2.0 and 3.0 mm) before tightening a new lock shear bolt and breaking off its head.

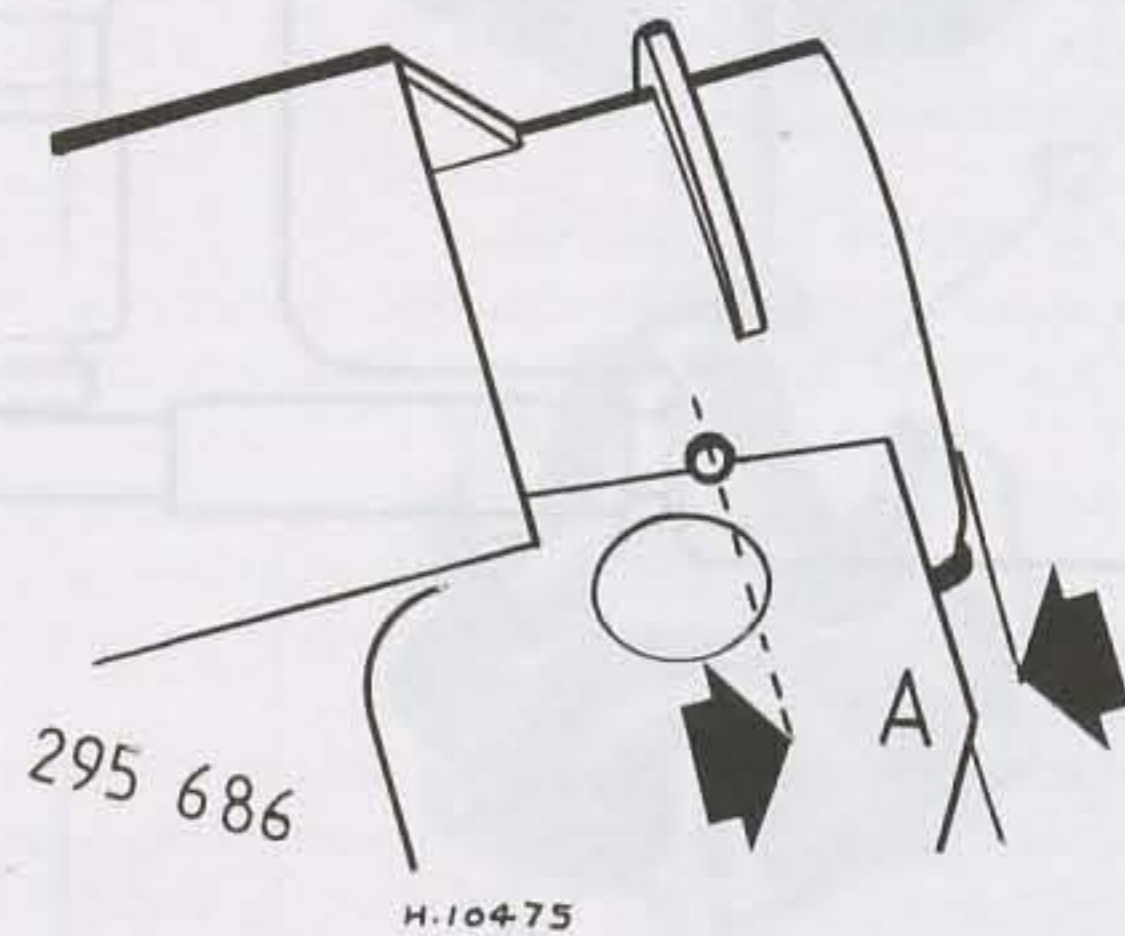


FIG.12.37 STEERING COLUMN LOCK CYLINDER RELEASE HOLE DRILLING DIAGRAM

a 0.51 in (13.0 mm)

10 Steering and suspension

Rear torsion bars

1 On vehicles produced from August 1974, the torsion bars have different numbers of splines on their inner and outer ends. The inner end has 48 splines and the outer end 52 splines.
 2 Turning one spline of the inner end alters the torsion bar setting angle 7° 30'. Turning the spring plate one spline in the opposite direction alters the angle 6° 55'. The result of this is that the smallest alteration in angle which can be achieved is 0° 35'.
 3 To carry out the adjustment, fit the spring plate to the torsion bar and using a protractor, measure the angle as described in Chapter 10, Section 10.
 4 Any deviation in excess of 0° 35' from the specified setting angle should be corrected. To do this, either move the torsion bar on one spline and the spring plate back one spline or in the reverse sequence.

Steering gear roller shaft oil seal - renewal

5 A defective oil seal (see Fig.10.6) can be renewed on vehicles built after 1972 in the following way.
 6 Mark the relative position of the steering drop arm to the roller shaft, flatten the tab of the lockplate and unscrew the retaining nut. With a suitable puller, remove the drop arm.
 7 Using a very sharp probe, tap it through the oil seal and lever it out. Take care not to damage the roller shaft or housing during this operation.
 8 Wipe out the oil seal recess and tape over the splines of the

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