

WORKSHOP

MAINTENANCE & REPAIR

MANUAL

DRAKE
PUBLICATIONS

Chapter 1 Engine

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Specifications

Vehicle type	R.1150 (16)		R.1151 (16TS)		R.1152 (US emission control)	
Engine type (HC)	697 - 01		807 - 01		821 - 02	
(LC)	697 - 02		807 - 02			
Engine type (HC)	R.1153 (16TA)					
	821 - 01					
ENGINE						
Type	697 - 01	697 - 02	807 - 01	807 - 02	821 - 01	821 - 02
No. of cylinders	4		4		4	
Valve positions	in - line		in - line		in - line	
BHP at 5000 rev/min	63	60			71	
at 5200 rev/min						70
at 5750 rev/min			87.5	81.5		
Max. torque at 2800 rev/min	81	76				
(lb/ft) at 3000 rev/min			90	88	87	85
Compression ratio	8.6	7.6	8.6	7.6	8.6	8.6

Bore: in	2.992	3.032	3.032
mm	76	77	77
Stroke: in	3.189	3.307	3.307
mm	81	84	84
Firing order	1 3 4 2	1 3 4 2	1 3 4 2
Cubic capacity cc...	1470	1565	1565
Static ignition advance (degrees)	0 ± 1	0 ± 1	6 ± 1
Idling speed rev/min	600 - 700	650	600 in 'A' 675
	607	807	821
Cylinder head depth			
Standard in	3.175	3.681	3.207
mm	80.65	93.50	81.45
Minimum after planning			
in	3.163	3.670	3.195
mm	80.35	93.20	81.15
Liner bottom dia. in	3.228	3.248	3.248
mm	82	82.5	82.5
Liner bore in	2.992	3.032	3.032
mm	76	77	77
Liner projection after correct base seal fitted			
in	0.006 - 0.0081	0.006 - 0.008	0.006 - 0.008
mm	0.15 - 0.20	0.15 - 0.20	0.15 - 0.20
Liner seal	Base diameter 3.228 in (82mm)		3.248 in (82.5mm)
Thickness			
Blue spot in	0.08		0.08
mm	0.003		0.003
Red spot in	0.10		0.10
mm	0.004		0.004
Green spot in	0.12		0.12
mm	0.0047		0.0047
Crankshaft			
No. of main bearings	5		
Main bearing shells	807/821 aluminium-tin	697 white metal	
End plug	0.002 to 0.009 in (0.05 to 0.23 mm)		
Thrust washer availability	0.110 in (2.80 mm)		
	0.114 in (2.90 mm)		
	0.116 in (2.95 mm)		
	2.158 in (54.8 mm)		
Main bearing journal diameter			
Regrind diameter for oversize shell bearings.	(807 and 821 types) 2.148 in (54.55 mm)		
Roll hardened crankshaft	(697 type) 2.138 in (54.30 mm)		
Regrind tolerances	(807 and 821 types) 0.0005/0.00004 in (0.013/0.001 mm)		
	(697 type) 0.0005/0.00012 in (0.013/0.003 mm)		
Crankpin diameter	1.890 in (48 mm)		
Regrind diameter for oversize shell bearings	(807 and 821 types) 1.880 in (47.75 mm)		
Roll hardened crankshaft	(697 type) 1.870 in (47.50 mm)		
Regrind tolerances	(all types) 0.0007/0.0001 in (0.018/0.002 mm)		
Connecting rods			
Bearing shells	(807 and 821 types) aluminium/tin		
	(697 type) white metal		
Pistons			
Type	Alloy		
Gudgeon pin length	(697 type) 2 5/8 in (67 mm)		
	(807 and 821 types) 2 11/16 in (68 mm)		
Gudgeon pin diameter	0.787 in (20 mm)		
Fitting method	Press fit in small end, floating in piston		
Piston Rings			
Number	3 (two compression, one oil control)		
Valves			
Head diameter (inlet)	697 and 821 types 1.378 in (35 mm)		
	807 type 1.575 in (40 mm)		
(exhaust)	697 and 821 types 1.220 in (31 mm)		
	807 type 1.392 in (35.35 mm)		

Stem diameter (all engine types) inlet		
inlet and exhaust	0.315 in (8.00 mm)	
Seat widths		
inlet	(type 697 and 821) 0.051/0.063 in (1.3/1.6 mm)	
	(type 807) 0.059/0.071 in (1.5/1.8 mm)	
exhaust	(all types) 0.067/0.079 in (1.7/2 mm)	
Valve guide internal diameter	0.315 in (8 mm)	
External diameter, standard	0.512 in (13 mm)	
Oversize (identified by one groove)	0.516 in (13.10 mm)	
Oversize (identified by two grooves)	0.522 in (13.25 mm)	
Valve timing		
Outlet valve opens	697 and 821 types 10° BTDC	807 type 21° BTDC
Inlet valve closes	42° After TDC	59° After TDC
Exhaust valve opens	46° BTDC	59° BTDC
Exhaust valve closes	10° After TDC	21° After TDC
Minimum valve lift		
Inlet	(697 and 821 types) 0.319 in (8.11 mm)	
Exhaust	0.295 in (7.50 mm)	
Inlet	(type 807) 0.342 in (8.69 mm)	
Exhaust	0.342 in (8.69 mm)	
Valve springs		
Type		
Single	(697 type)	
Double	(807 and 821 type)	
Free length	(697 type) 1 29/32 in (48.4 mm)	
External	(807 type) 1 29/32 in (48.4 mm)	
Internal	1 33/64 in (38.4 mm)	
External	(807 type, early) 2 9/64 in (54.3 mm)	
Internal	1 3/4 in (44.7 mm)	
External	(807 type, later) 2 9/64 in (54.3 mm)	
Internal	1 27/32 in (46.8 mm)	
Camshaft		
Number of bearings	4	
End-float	0.002 to 0.0045 in (0.05 to 0.12 mm)	
Flange clearance	0.002 to 0.0047 in (0.05 to 0.12 mm)	
Valve clearances		
Inlet	0.008 in (0.20 mm)	
Exhaust	0.010 in (0.25 mm)	
Tappet diameter, standard	0.472 in (12 mm)	
oversize	0.480 in (12.20 mm)	
Push rod length	(697 and 821 types) 3 15/32 in (88 mm)	
Inlet	(807 type) 7 in (178 mm)	
Exhaust	4 11/32 in (110 mm)	
Pushrod diameter	(all types) 0.236 in (6 mm)	
Oil capacity (engine)...	7 pts (4 litres) (8½ US pints)	
Oil pressure at 650 rev/min	30 - 35 lb/in ²	
TORQUE WRENCH SETTINGS	lb/ft	Kg/m
Cylinder head (Stage 1 & 2) COLD		
697 and 821 types	50 - 55	74.4 - 81.8
807 type	55 - 60	81.8 - 89.2
Stage 3 (50 minutes after cooling from operating temp.)		
697 and 821 types	55 - 60	81.8 - 89.2
807 type	60 - 65	89.2 - 96.7
Rocker arm pillar nuts and bolts	15 - 20	22.3 - 29.8
Crankshaft main bearing cap bolts	45	67.0
Connecting rod bearing cap bolts	30	44.6
Crankshaft sprocket bolt	45 - 58	67.0 - 86.3
Crankcase oilway screwed plugs: 8 mm	60	89.2
4.5 mm	30	44.6
Flywheel securing bolts	40	59.5
Manifold securing bolts and nuts: (697 and 821 types)	10 - 20	14.9 - 29.8
(807 type) inlet	20 - 25	29.8 - 37.2
exhaust	15 - 25	22.3 - 37.2

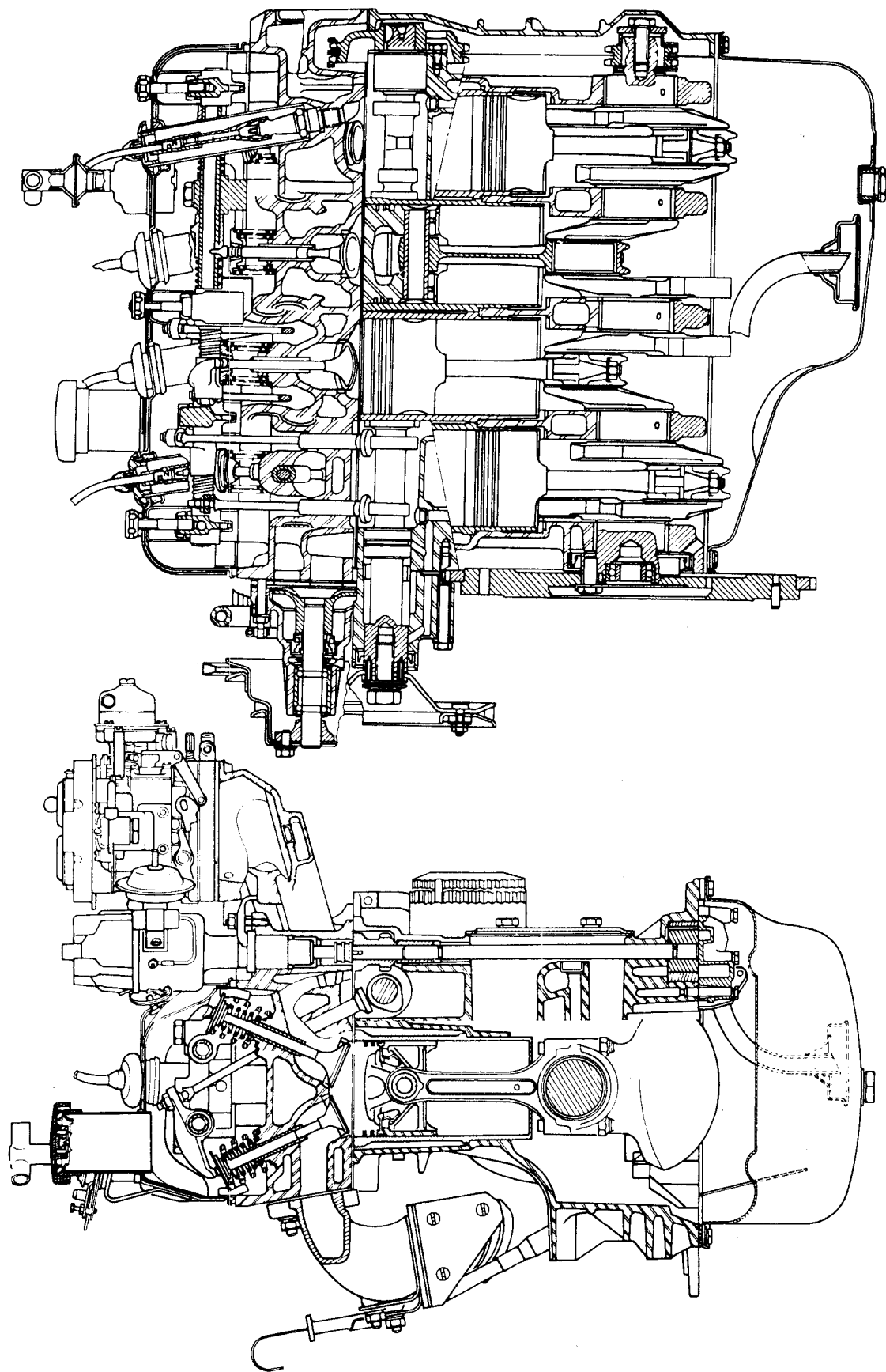


Fig.1.1 Sectional views of the type 807 engine

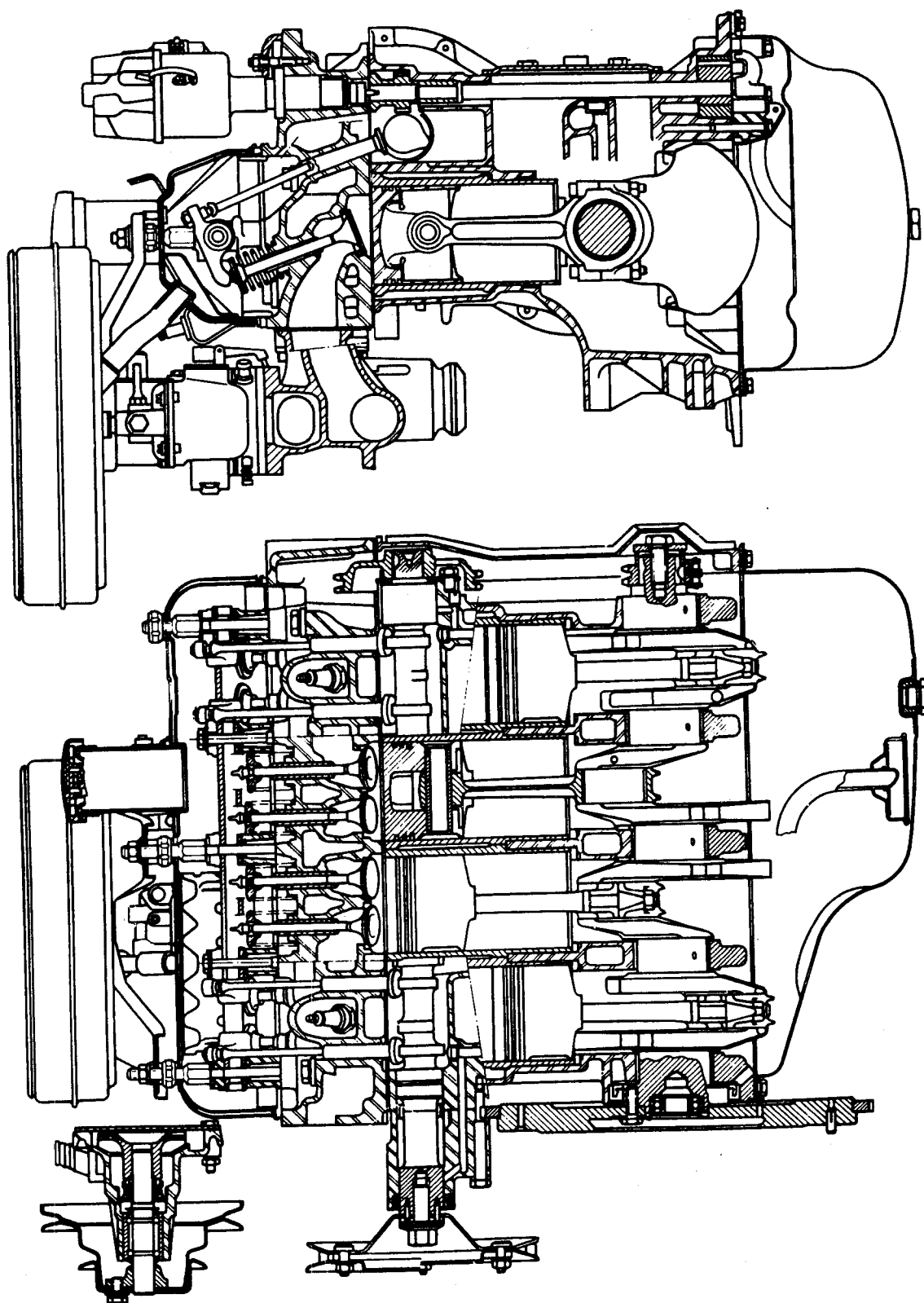


Fig.1.2 Sectional views of the types 697 and 821 engines

1 General description

- 1 The engines fitted to the four models covered by this manual are basically similar in design but vary in detail. Reference should be made to Specifications before proceeding with this chapter in order to establish the exact type of engine fitted to a particular model vehicle.
- 2 The type 697 engine is supplied in low or high compression form as is also the type 807 whilst the type 821 is available for the USA model or vehicles fitted with automatic transmission.
- 3 All types of engine are four cylinder, in-line units mounted at the front of the vehicle. The gearbox is located ahead of the engine unit and is integral with the final drive unit which connects through drive shafts to the front road wheels.
- 4 From the foregoing description it will be apparent that the flywheel and clutch are located at the forward end of the engine block and the timing gear at the rear.
- 5 Cooling is by a conventionally front mounted radiator and water circulation system.
- 6 Major castings are of light alloy and the cylinder block is fitted with wet liners.
- 7 A five bearing crankshaft is used and the bearings themselves are of renewable shell type.
- 8 Overhead valves are fitted to all engines and are operated by pushrods and tappets from the camshaft. Except for the type 807 engine which has valves mounted in vee formation, all valves are mounted in-line.
- 9 The camshaft also operates the fuel pump by means of an eccentric and the distributor and oil pump through geared drive.
- 10 A full set of metric spanners and sockets is required for servicing the engine and in view of the possibility of stripping threads in the alloy castings, the torque tightening figures given in Specifications must be strictly adhered to.
- 11 Sectional views of the type 807 and 697/821 engines are shown in Figs.1.1 and 1.2.

2 Major operations with engine in position in vehicle

- 1 Where major overhaul or servicing is required it will be wise to remove the complete engine/gearbox-transmission unit and obtain the ease of access provided by mounting the unit on a bench. However, the following operations may be carried out with the engines still in place in the vehicle.
- 2 Removal of the cylinder head. Attention to valves, rocker gear and pushrods.
- 3 Removal of the sump, permitting attention to the cylinder liners, pistons, piston rings, connecting rods and big-ends and oil pump.
- 4 Removal of the engine ancillaries including the distributor and starter motor.

3 Major operations with the engine/gearbox removed

- 1 Due to the front mounted location of the gearbox, overhaul or servicing of the following components can only be undertaken after removal of the gearbox* or engine/gearbox-transmission combined assembly and the gearbox/transmission unit separated from the engine.
 - 2 Timing gear, chain and cover.
 - 3 Camshaft and tappets (cam followers).
 - 4 Crankshaft main bearings.
 - 5 Crankshaft.
 - 6 Flywheel*
 - 7 Clutch assembly*
- These components may be serviced after gearbox removal leaving the engine in position.

4 Method of engine removal

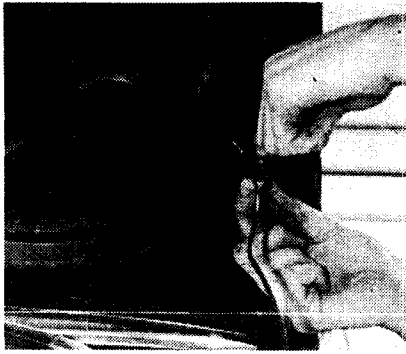
- 1 As previously explained, although the front mounted gearbox-

transmission unit may be removed (Chapter 6) leaving the engine in position in the vehicle, the engine can only be withdrawn complete with the gearbox-transmission unit and this combined assembly will obviously be very heavy and necessitate the use of a hoist and the help of an assistant.

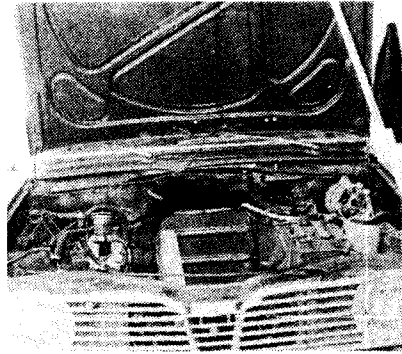
- 2 Where the car has seen considerable service and the engine compartment is very dirty then an application of grease solvent such as 'Gunk' prior to removal will be worthwhile.
- 3 Obtain a trolley type jack and assemble to hand all necessary spanners, freeing fluid and rags. Place clean containers of adequate capacity ready to receive the coolant and oils which will require draining.

5 Engine/gearbox-transmission unit - removal

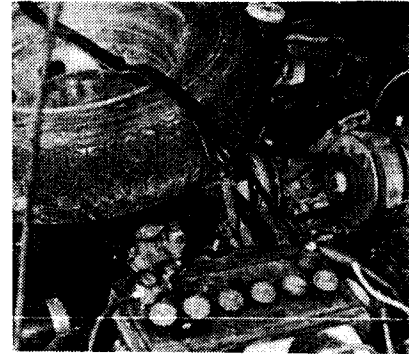
- 1 Raise the bonnet and remove the check strap (photo).
- 2 Prop the bonnet lid open as far as it will go using a piece of wood or alternatively disconnect the fingers and remove the lid completely (photo).
- 3 Detach the spring from the spare wheel clip (photo).
- 4 Remove the spare wheel.
- 5 Disconnect the HT and LT leads from the coil noting the location of the LT lead tags for exact replacement (photo). On TS models, the coil is mounted on the spare wheel carrier.
- 6 Remove the spare wheel carrier securing bolts and withdraw the carrier (photos).
- 7 Disconnect the battery earth (negative) lead (photo).
- 8 Drain the cooling system as described in Chapter 2, retaining the coolant if required for further use.
- 9 Drain the oil from the engine/gearbox unit (photo).
- 10 Remove the radiator as described in Chapter 2, ensuring the leads to the fan motor and temperature transmitter unit are first disconnected (photo). The hose clips are not suitable for re-use and the opportunity should be taken to renew them with worm-drive types.
- 11 Remove the air cleaner and disconnect the controls from the carburettor (photo). With 1150/697 and 1152/821 engined models, up to 1968, disconnect the accelerator return spring, the accelerator linkage and swivel lever and detach the cable from the cylinder head clip, Fig.1.3. On models produced after 1968, remove the accelerator return spring, cable and cable locknut connection on the rocker box cover.
- 12 Disconnect the fuel line from the inlet pipe of the fuel pump and the return pipe to the fuel tank (photo). Plug the pipes to prevent fuel loss.
- 13 Mark the electrical leads to the alternator for correct replacement and detach them, Fig.1.4.
- 14 Remove the bolt from the adjustment strap to alternator connection and loosen the mounting bolts (photo).
- 15 Push the alternator in towards the engine so that the alternator drive belt may be removed (photo).
- 16 Remove the alternator mounting bolts and withdraw the unit (photo).
- 17 Disconnect the earth link strap which is fitted between the transmission case and the body frame (photo).
- 18 Disconnect the cylinder block earth screw (photo).
- 19 Disconnect the lead to the oil pressure transmitter unit (photo).
- 20 Disconnect the leads from the starter motor (photo). Where access to the terminals is difficult, it will be preferable to wait until the engine has been lifted out from its mountings by about 8 inches (203.2 mm) before disconnecting the leads.
- 21 Unscrew and remove the starter motor upper securing bolt.
- 22 Where fitted, disconnect the leads to the reverse lamp switch (photo).
- 23 Disconnect the heater hoses from their connections with the water pump and cylinder head, Fig.1.5 (photo).
- 24 Disconnect the two water hoses from the carburettor.
- 25 Disconnect the engine breather hoses.
- 26 Disconnect the distributor advance vacuum hose from the inlet manifold (photo).
- 27 With 1151/807 engined models, remove the flame trap capsule and pipe. Remove the dipstick and its locating tube.



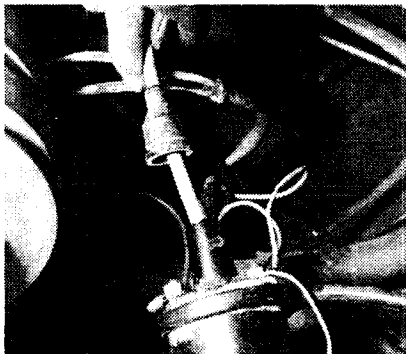
5.1 Removing bonnet check strap



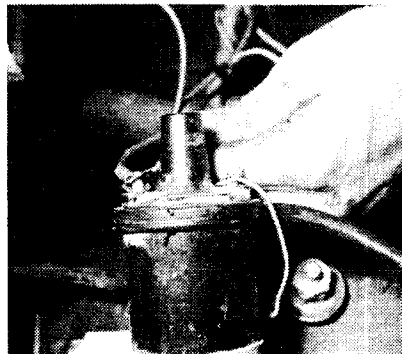
5.2 Propping the bonnet lid



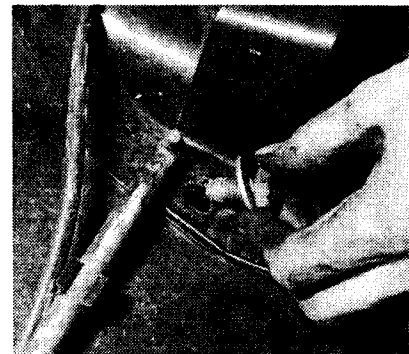
5.3 Spare wheel carrier clip spring



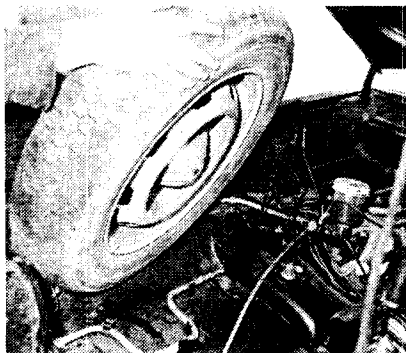
5.5A Removal of HT leads



5.5B Removal of LT leads



5.6A Removing the spare wheel carrier bolt



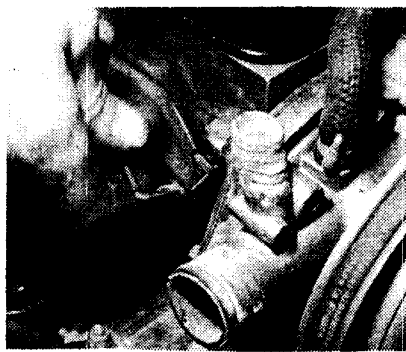
5.6B Removing the spare wheel



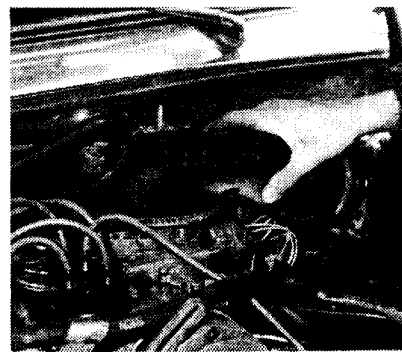
5.7 Disconnecting battery earth (negative) lead



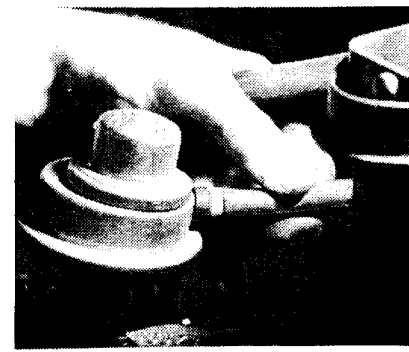
5.9 Sump drain plug



5.10 Water temperature transmitter lead



5.11 Air cleaner removal



5.12 Removing the fuel lines from the fuel pump

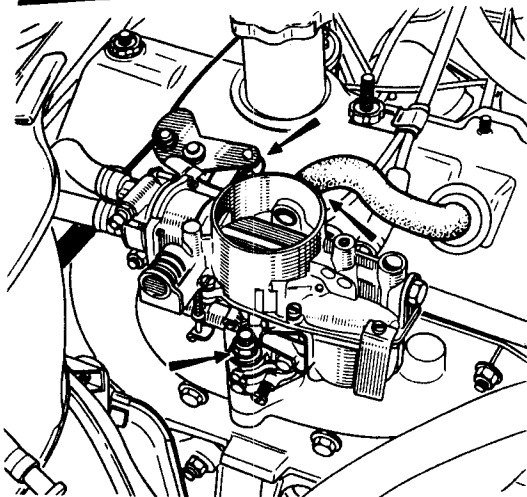


Fig.1.3. The accelerator cable and swivel linkage

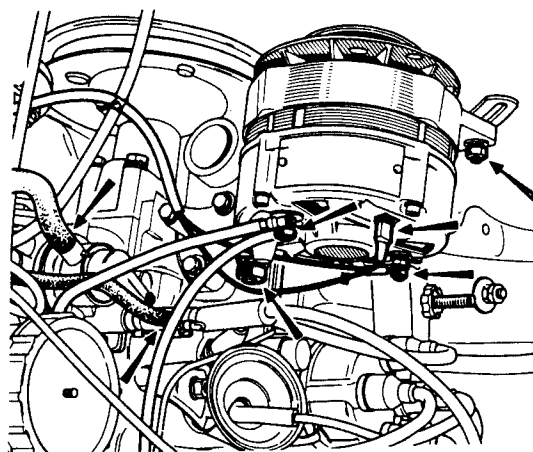


Fig.1.4 Alternator leads and adjustment strap bolt

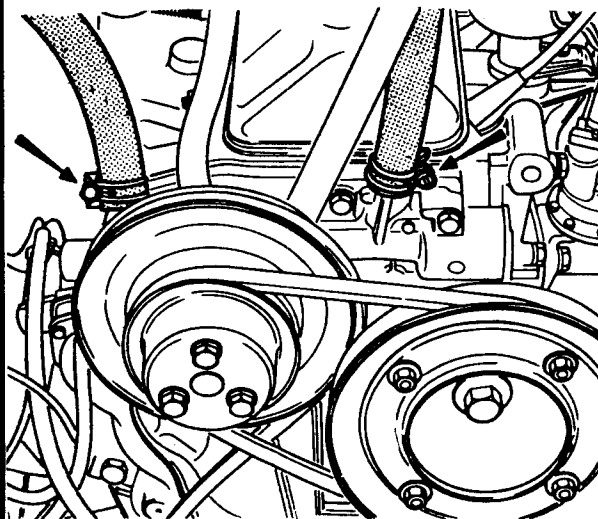


Fig.1.5 Heater hose connections

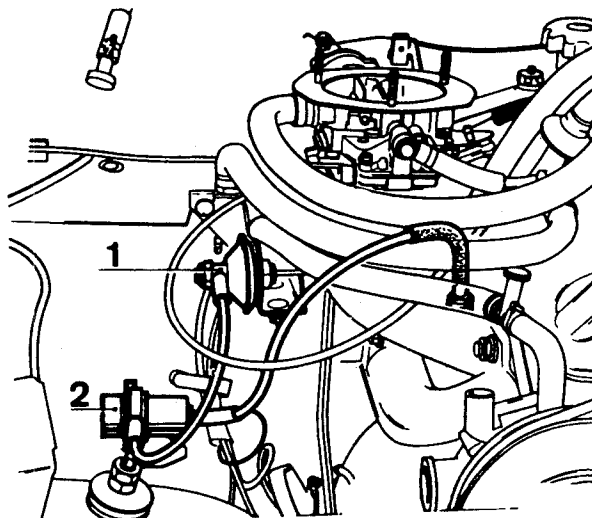


FIG.1.6 COMPONENTS OF THE ANTI-POLLUTION DEVICE FITTED TO MODEL 1152 FOR THE USA

1 Capsule

2 Solenoid flap valve

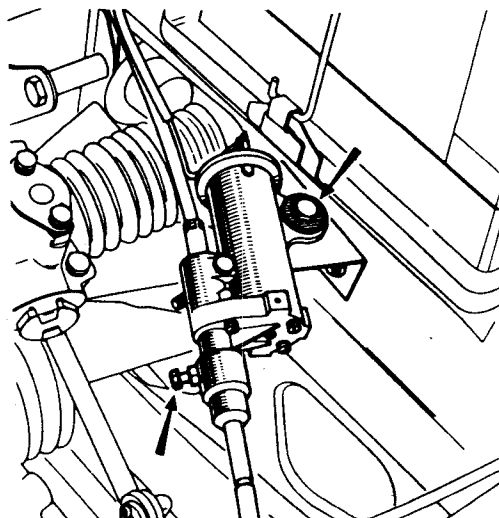


Fig.1.7 Speedometer cable driven centrifugal switch, part of the anti-pollution device

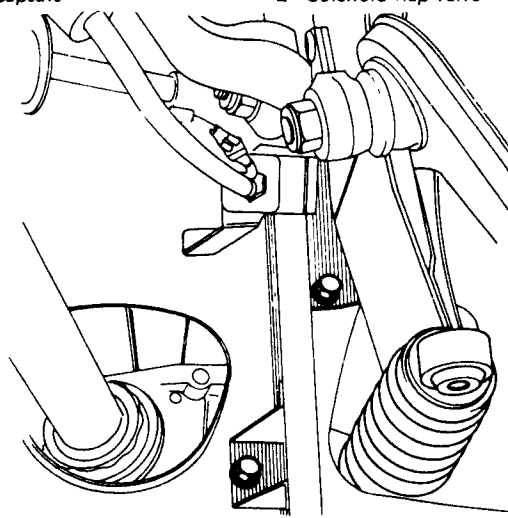
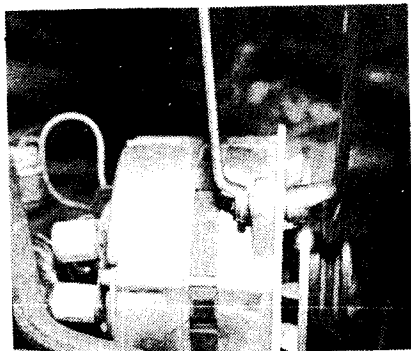
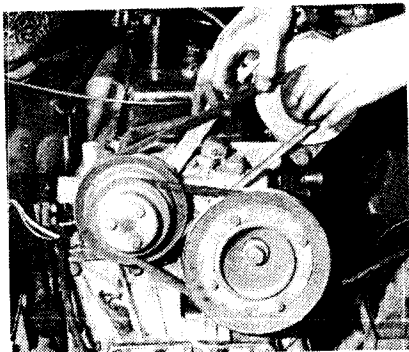


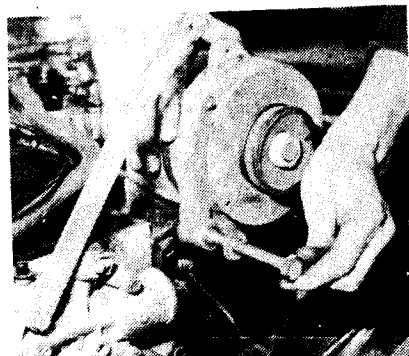
Fig.1.8 Two of the four steering crossmember securing bolts



5.14 Loosening the alternator adjustment strap bolt



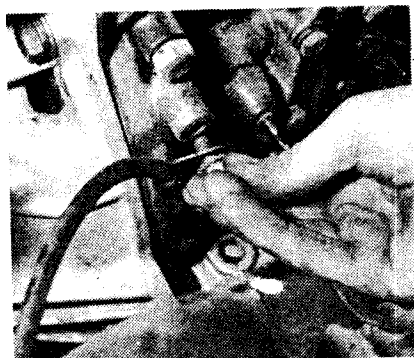
5.15 Removing the alternator driving belt



5.16 Removing the alternator mounting bolt



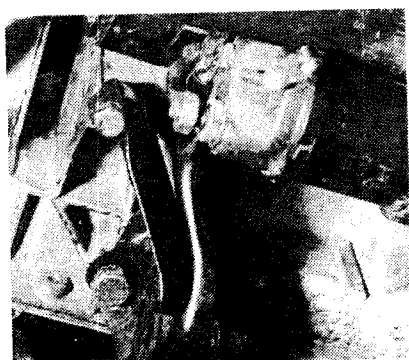
5.17 Disconnecting an earthing strap



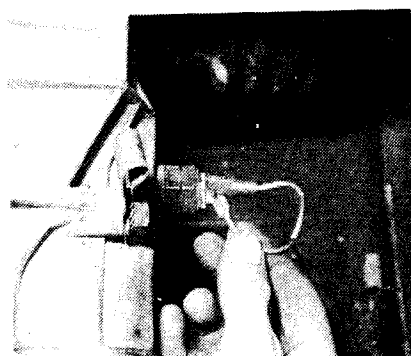
5.18 Unscrewing the cylinder block earth screw



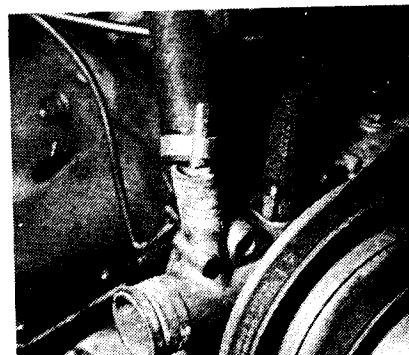
5.19 Detaching the oil pressure transmitter lead.



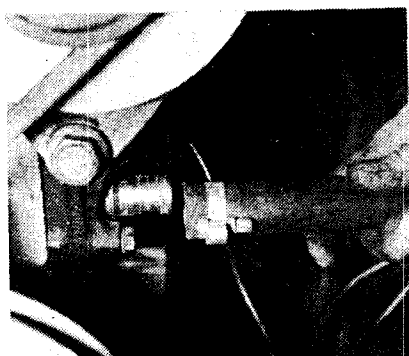
5.20 The starter motor leads



5.22 The reversing lamp switch and leads



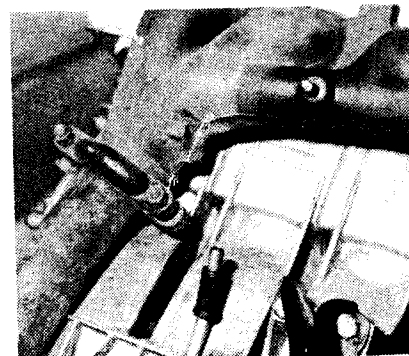
5.23A Heater hose connection to water pump



5.23B Heater hose connection to cylinder block



5.26 Vacuum hose connection to inlet manifold



5.29A Exhaust manifold to downpipe clamp

28 With 1152 - 1153/821 engined models, disconnect the vacuum pipe on the 'Master-Vac', servo brake unit. Model 1152 models (North American Market) are fitted with anti-pollution device. Pull pipe from the capsule (1) Fig.1.6 and the vacuum pipe from the solenoid flap valve (2). A full description of this system is given in Chapter 3, Section 26.

29 Disconnect the manifold to exhaust pipe clamp and remove the bottom retaining bolt (photos). Remove the manifold heat shield.

30 Refer to Fig.1.7 and release the locknut and bolt which secure the speedometer drive cable in the switch (1152 only models). Remove the switch securing bolt and swing the switch unit aside. On other models release the cable directly from the gearbox in similar manner (photos).

31 The steering rack unit must now be removed as it is located above the gearbox-transmission unit. Loosen the road wheel nuts, jack up the front of the car securely and remove the road wheels. Remove the two steering arm to rack eye bolts (photo). This is achieved by first moving the steering to full lock and removing the bolt which is accessible, then turn to full opposite lock and withdraw the second bolt.

32 Refer to Fig.1.8 and unscrew and remove the four bolts (two only shown one side) which secure the steering unit supporting crossmember to the engine compartment sides. The bolt heads are accessible from below the wheel arches (photo).

33 Unscrew and remove the two nuts and bolts which secure the steering column upper section to the flexible coupling (photo). Remove the steering gear assembly from its location by using a twisting action to the pinion end as arrowed in Fig.1.9. Prior to removal of the steering rack, the lower section of the steering column should be rotated until the steering rack eyes are sufficiently retracted to permit withdrawal of the pinion end of the gear. The pinion end of the steering rack will be either left or right when viewed from the front of the car to provide right or left hand steering respectively.

34 Refer to Fig.1.10 and disconnect the link arm on the gear-change lever (photo).

35 Disconnect the clutch operating cable from the clutch release lever and the cable sleeve stop, Fig.1.11.

36 Remove the two bolts which retain the gearchange lever to the gearbox and move the lever to one side, hooking it to the battery tray.

37 Unscrew the two bolts from the front mounting pad (gear-change lever side - left or right according to left or right hand steering) and free the two anchor washers (photo). Remove the two bolts which connect the mounting pad to the front housing and withdraw the mounting pad and bracket (photos). It may be advisable at this stage to employ a second jack to support the transmission case. Do not allow the jack lifting platform to damage the light alloy ribs of the case, use a packing piece to obviate this.

38 Remove the radiator locating bracket (photo).

39 The drive shafts must now be freed from the transmission. Drive out the spring roll pins (photo) which secure the shafts to the transmission sun wheels, Fig.1.12. The flexible couplings will become disengaged once they are pulled and immediately the roll pins are removed, restraining clips must be used to keep the couplings in engagement. Suitable clips are supplied with new drive couplings but a length of wire and a worm drive clip will provide a good substitute. Compress the couplings by hand pressure and wrap the wire round, securing the two ends to the drive shaft by the clip Fig.1.13.

40 With the drive couplings now restrained, use the scissors type jack (supplied with the car) to prise the transmission away from the body frame, Fig.1.14, (photo). By placing the jack first on one side and then the other, each drive shaft may be released from engagement with the transmission sun wheels (photo).

41 Refit the front road wheels and lower the car carefully, remembering that there are two jacks in position and the transmission mounting pad has been removed.

42 The only remaining connections to the power unit should be the rear mountings and the starter cables (if these have not previously been disconnected). Check that this condition prevails.

43 Prepare a lifting attachment. This may be a rope passed over the starter motor on one side of the engine and passing between the sump and clutch cover on the other (photos). Alternatively, make up a lifting bar to bolt into the starter motor upper bolt hole and the cylinder block earth bolt hole. On no account use any other bolts or points of attachment to lift the engine as the alloy construction will either cause the threads to strip or break or distort the point of attachment.

44 Raise the hoist just sufficiently to take the weight of the engine /transmission unit and allow the jacks to be removed.

45 Refer to Fig.1.15 and remove the mounting pad bolts from either side of the engine.

46 Hoist the engine slowly and carefully and when it is withdrawn by about 8 inches (203.2 mm) the starter cables may be disconnected if they have not previously been so removed due to inaccessibility.

47 Check for fouling of engine ancillaries and guide the lifting rope past the steering column (photo).

48 Raise the front (gearbox) end of the unit as high as possible and continue hoisting until the complete unit clears the engine compartment (photo).

49 If a mobile hoist is used, roll it away with the unit suspended or if a static hoist is used, roll the car backwards until the unit can be lowered to the ground (photo).

6 Engine/automatic gearbox-transmission unit - removal

1 The procedure given in the preceding section for engine/gearbox-transmission unit removal will generally apply to model 1153 (TA) automatic gearbox - type 821 engined vehicles but the following instructions must also be implemented.

2 Refer to Fig.1.16 and disconnect the speedometer cable (T) the gearchange control arm, (V) the governor cable (G) the combination plug from the electronic gear selection unit (C). Also remove the housing earth wire, the pipe to the vacuum capsule (D) and lift the wiring harness from its clips.

3 The drive shafts cannot be withdrawn from the transmission sun wheels until the suspension units are tilted outwards to provide sufficient room for their withdrawal. In order to tilt the suspension units, the suspension upper ball joints must first be disconnected by using wedges or a ball joint extractor, Fig.1.17. Before tilting the suspension, detach the brake caliper unit to avoid straining the flexible brake hose.

3 Before lowering the car back onto its road wheels (paragraph 33, section 5 of this Chapter) reconnect the upper suspension arm ball joint.

7 Engine ancillaries - removal

1 Unscrew and remove the inlet/exhaust manifold assemblies complete with carburettor from 697 and 821 type engines. On 807 type engines which have crossflow design heads, the inlet and exhaust manifolds are fitted on opposite sides of the engine and are removed individually (photos). The distributor, fuel pump and rocker box cover must be removed before the inlet manifold can be removed from the type 807 engine.

2 Unscrew and remove the fuel pump securing nuts and lift the fuel pump away.

3 Unscrew and remove the sparking plugs.

4 Unscrew and remove the oil pressure transmitter unit and oil pressure transmitter switch from their cylinder block locations.

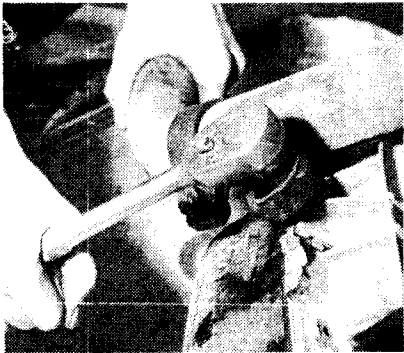
5 Remove the distributor from its location in the cylinder block (photo). Unscrew the securing nut and lift it from its recess, (photo).

6 Remove the water pump (as described in Chapter 2) and drive belts.

7 Unscrew the oil filter.

8 Withdraw the dipstick.

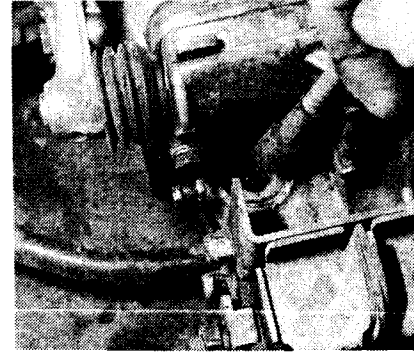
9 Remove the starter motor bolts and withdraw the starter (photo).



5.29B Exhaust pipe bottom securing bolt



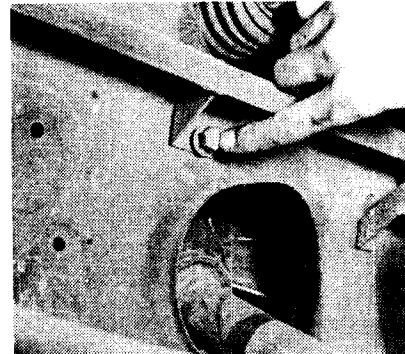
5.30A Unscrewing the speedometer cable locating bolt



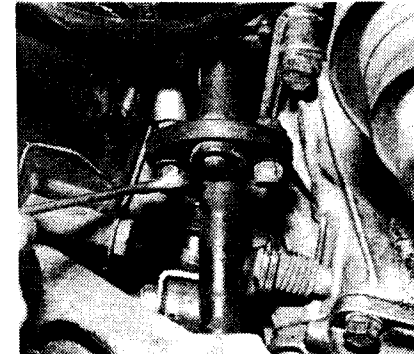
5.30B Withdrawing the speedometer cable from the gearbox



5.31 Removing the steering arm to rack eye bolt



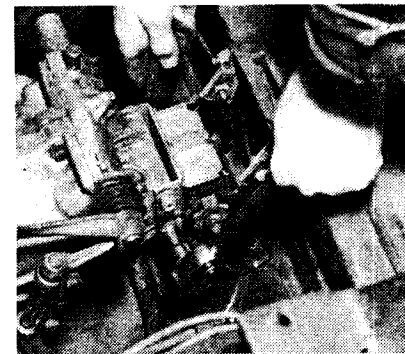
5.32 Steering crossmember securing bolts



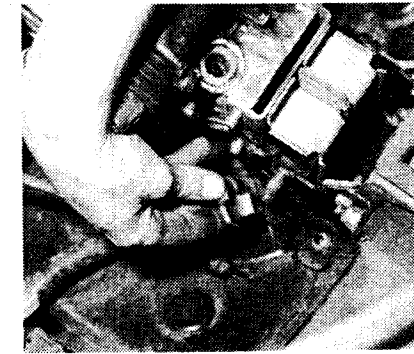
5.33 Removing steering flexible coupling bolt



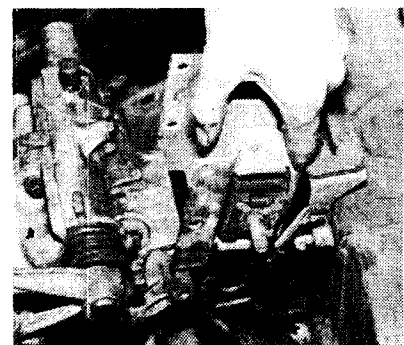
5.34 Gearchange lever to link arm connection



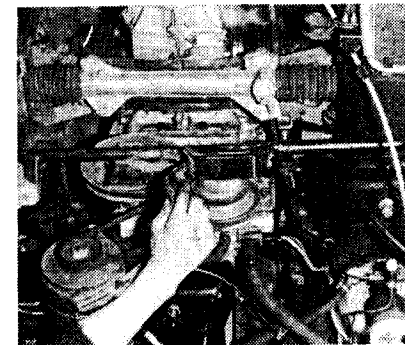
5.37A Removing a front mounting securing nut



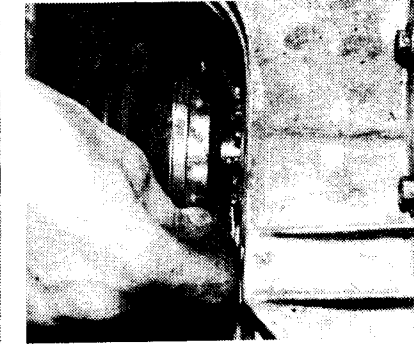
5.37B Withdrawing anchor washer from front mounting



5.37C Removing the front mounting



5.38 Radiator locating bracket



5.39 Removal of a spring roll pin from a drive shaft

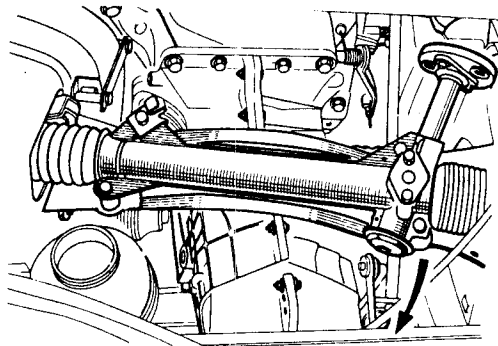


Fig. 1.9 Removing the steering unit/crossmember assembly

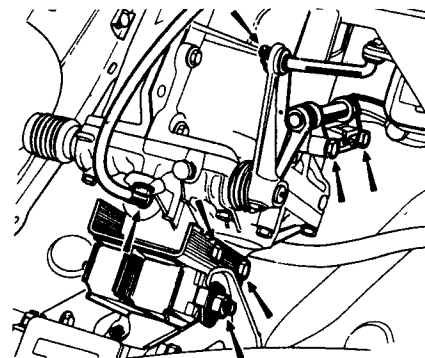


Fig. 1.10 Gear change lever link arm and front mounting connections

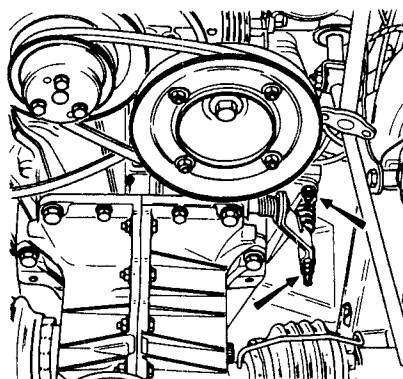


Fig. 1.11 Clutch operating cable attachment to release lever

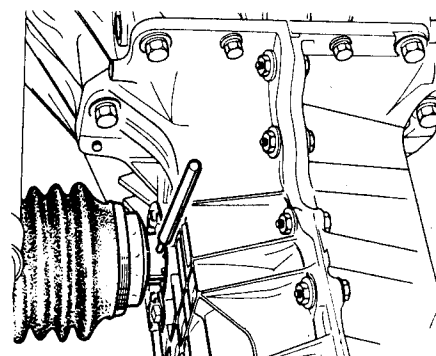


Fig. 1.12 Removing a drive shaft roll pin

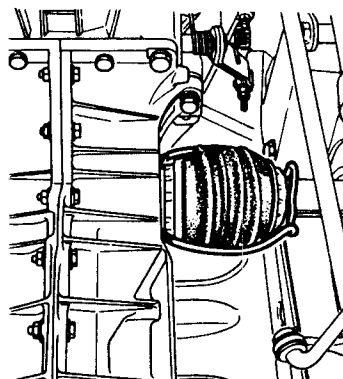


Fig. 1.13 Drive shaft joint with restraining clip

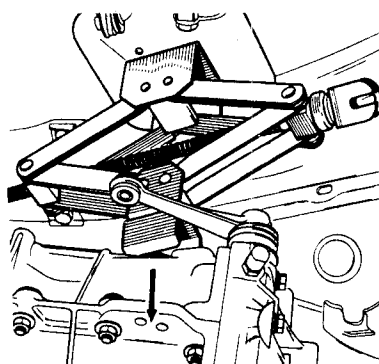


Fig. 1.14 Prising the power unit in order to remove the drive shaft connection to the transmission unit sun wheel.

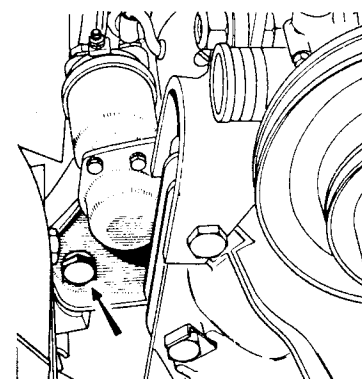


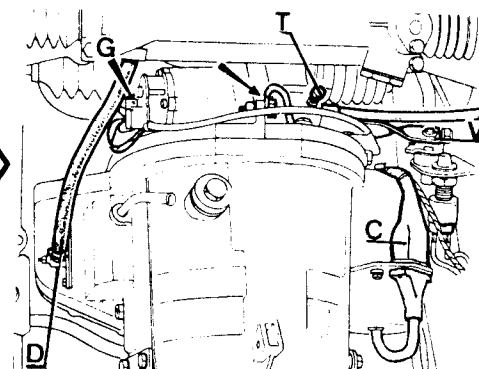
Fig. 1.15 An engine side mounting pad securing bolt

FIG. 1.16 AUTOMATIC TRANSMISSION MODELS (MODEL 1153) POINTS OF DISCONNECTION (ADDITIONAL TO THOSE FOR OTHER MODELS) PRIOR TO ENGINE/TRANSMISSION REMOVAL

Key

C Electronic gear selection unit
D Vacuum capsule

G Governor cable
T Speedometer cable
V Gearchange control arm

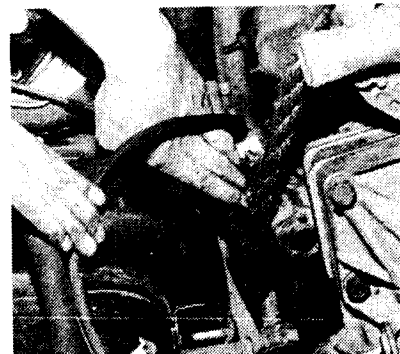




5.40A Prising the transmission unit to free the drive shafts



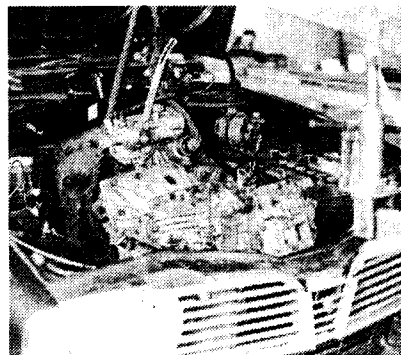
5.40B Pulling the drive shafts from engagement with the sun wheels



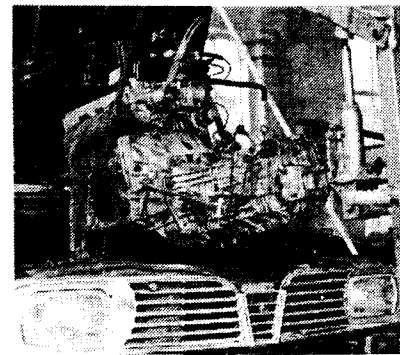
5.43A Placing lifting ropes in position



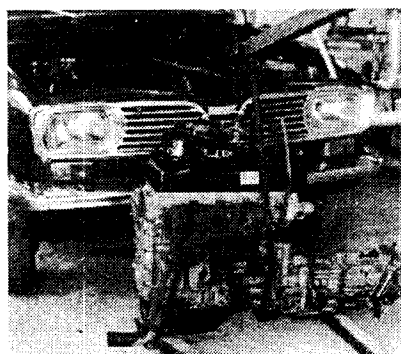
5.43B Placing lifting ropes in position



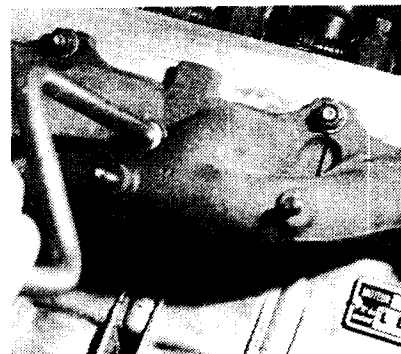
5.47 Starting to remove the engine/transmission unit



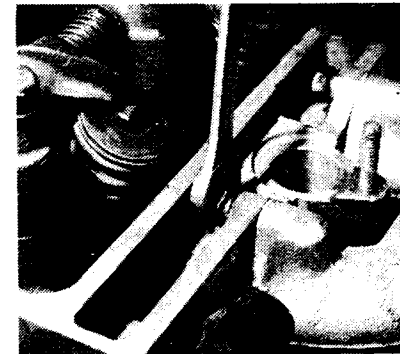
5.48 Hoisting the engine/transmission unit from the engine compartment



5.49 Lowering the engine/transmission unit to the ground



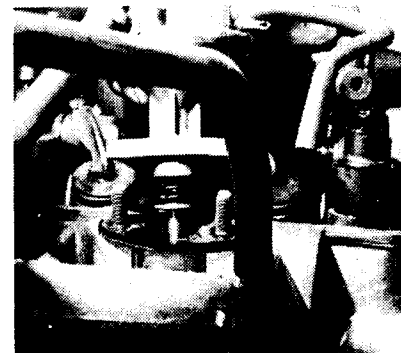
7.1A Removing the 807 type exhaust manifold



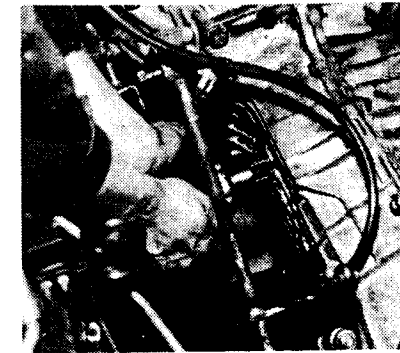
7.1B Removing the 807 type inlet manifold



7.5A Removing the distributor securing nut



7.5B Removing the distributor from its location



7.9 Removing the starter motor

8 Engine/gearbox-transmission - separation (part 1 - MANUAL)

- 1 Remove the securing bolts from the flywheel housing to engine front face.
- 2 Pull the gearbox-transmission unit straight out from the engine unit. Take the weight of the gearbox during withdrawal so that at no time does the weight of this unit hang upon the input shaft of the gearbox while it is still engaged with the splines of the clutch driven plate (photo).
- 3 Mark the (now exposed) clutch pressure plate cover in relation to its position on the flywheel for exact refitting.
- 4 Slacken the clutch cover securing bolts in diametrically opposite sequence, a turn at a time until all diaphragm spring pressure is relieved (photo). Fully unscrew the bolts and remove them. Withdraw the pressure plate assembly and driven plate. Do not allow either component to fall during removal and keep oil and grease from the friction surfaces of the driven plate (photo).
- 5 The engine is now stripped of ancillary components and is ready for dismantling.

8 Engine/gearbox-transmission - separation (part 2 - AUTOMATIC)

- 1 Remove the securing bolts from the convertor housing to engine front plate.
- 2 Pull the automatic transmission unit straight out from its connection with the engine.
- 3 Refer to Fig.1.18 and fit on retaining plate to avoid displacement of the convertor from the gearbox.

9 Engine dismantling - general

- 1 Prior to dismantling the engine, assemble a supply of rags, tins, brushes, paraffin and masking tape for part identification purposes. Pencil and paper is essential to make sketches before dismantling an assembly.
- 2 As each component is removed, keep like parts together or in strict sequence for such items as tappets, rockers, valves and push rods.
- 3 Check for mating and identification marks on bearing caps before dismantling. If they are not marked, centre punch them or use quick drying paint so that they are fitted in their original position and the right way round.
- 4 As each component is removed, wash it in paraffin and remove any carbon or corrosion. Checks for wear cannot be accurate if the part is covered in carbon or congealed oil!
- 5 Do not attempt to save gaskets during the dismantling process. Order a complete top and bottom overhaul set well in advance of requirement. This also applies to oil seals and valve springs as they are seldom held in stock by other than Renault main dealers.
- 6 As bolts and studs are removed, check the condition of their threads also the tapped holes. Renew any bolts which have suspect threads but where the holes in the alloy engine castings have had their threads stripped then they will either have to be drilled out and re-tapped to an oversize or a patent thread insert used. Take professional advice before taking this action as in many cases the thickness of metal involved may not permit a larger hole to be tapped.

10 Cylinder head - removal (Type 697 and 821 engines)

- 1 Unscrew and remove the three rocker box cover retaining nuts and lift off the cover.
- 2 Unscrew the three studs and two bolts which secure the rocker shaft pillars, Fig.1.19. Unscrew each of these a turn or two at a time in alternate sequence to avoid any possibility of distortion to the shaft by the pressure of the compressed valve springs.
- 3 Lift off the rocker shaft assembly. Remove the water pump

to camshaft pulley drive belt as described in Section 14.

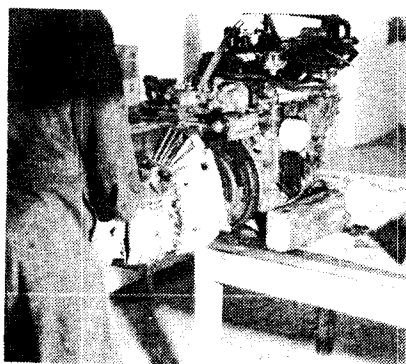
- 4 Withdraw the push rods and place them in strict sequence for correct replacement.
- 5 Unscrew the cylinder head bolts, Fig.1.20. Unscrew them a turn or two at a time working from the centre bolts outwards to avoid any possibility of distortion to the head.
- 6 At this stage, if the cylinder head is pulled directly upwards, the 'wet' cylinder liners will also be drawn upwards as they will almost certainly be stuck to the underside of the cylinder head. Movement of the liners in this way will break the seals at the bottom of the liners and where major dismantling is being carried out, renewal of the seals is no problem. Where top overhaul only is being undertaken, then the following procedure must be strictly followed. Temporarily screw in one of the centre cylinder head bolts finger tight and then tap the sides of the cylinder head with a plastic or hide faced mallet. Withdraw the bolt and move the head until it begins to swivel about its locating dowel showing that the liner seal to the head has been broken.
- 7 Remove the centre bolt, lift the head sufficiently far to enable the tappets to be withdrawn (keep them in strict order for replacement) and then lift the head right off.
- 8 Withdraw the fuel pump push rod and oil seal.
- 9 Remove the tappet chamber seal.
- 10 Where further dismantling is not required, liner clamps should be fitted similar to those shown in Fig.1.21, their purpose being to keep the liner bottom seals unbroken during further overhaul operations and decarbonising. Simple clamps may be devised, held in position by temporarily screwing in the cylinder head bolts.

11 Cylinder head - removal (type 807 engine)

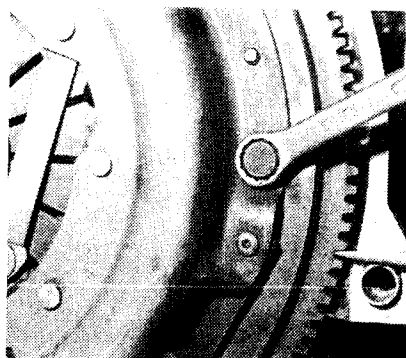
- 1 The removal procedure described in the preceding section will generally apply but the detail differences are covered in the following operations.
- 2 Remove the three rocker box securing nuts (photo).
- 3 Remove the rocker box cover (photo).
- 4 Remove the rubber washers and cups from the sparking plug tubes (photos) the water pump to camshaft pulley drive belt (Section 14).
- 5 Unscrew the rocker arm adjusting screws Fig.1.22 and lift out the pushrods, keeping them in strict order (photo). Unscrew and remove the cylinder head bolts working from the centre outwards a turn or two at a time. These bolts serve as combined rocker pillar and cylinder head bolts and once they are removed the rocker shaft assembly may be lifted away. The pair of bolts which retain the rear most rocker pillars cannot be fully withdrawn as they impinge upon the engine bulkhead. Use an elastic band to support them as shown in Fig.1.23 during removal (forward) of the rocker shaft assembly.
- 6 Carry out operations described in paragraphs 6-10 inclusive in the preceding section.

12 Cylinder head, rocker gear and valves - dismantling (type 807)

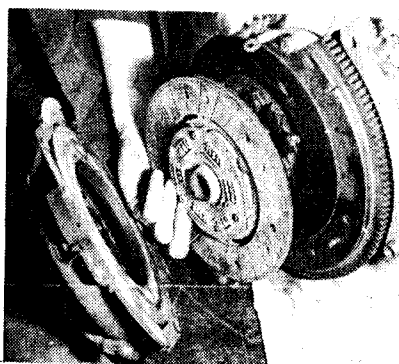
- 1 Provided care is exercised, the water pump, water temperature transmitter and alternator bracket need not be removed from the cylinder head during operations described in this section.
- 2 Drift out the spring roll pins which retain the rocker shafts to their pillars, Fig.1.24.
- 3 Slide off the rocker arms and springs and clean them and place them in order for replacement. Do not remove the concave plugs from the shaft ends.
- 4 All valves can be removed with the aid of a conventional type spring compressor, except No 1 inlet. For this, obtain a piece of tubing or an open ended spanner (photo). With the head laid flat on a bench and using a small block of wood or metal within the combustion head (photo) to prevent the valve dropping, press down on the spring until the split collets, Fig.1.25 can be removed.
- 5 Lift off the valve spring top cups, the springs and the base washers (photo).
- 6 Withdraw each valve from its guide and keep it in strict order for correct replacement.



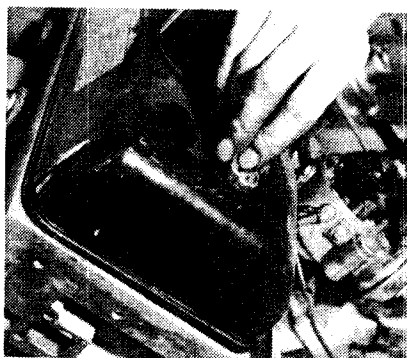
8.2 Withdrawing the gearbox-transmission unit



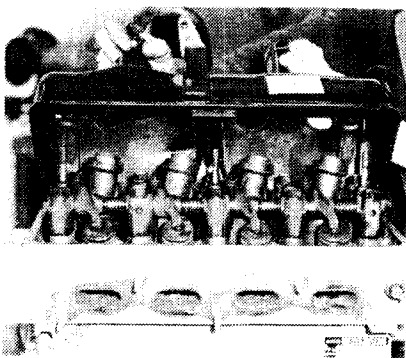
8.4A Slackening the clutch cover bolts



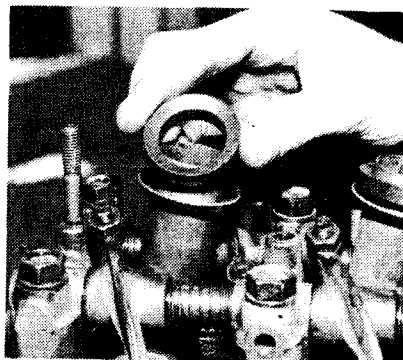
8.4B Withdrawing the clutch pressure plate and driven plate



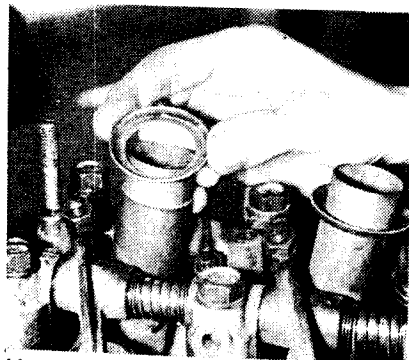
11.2 Unscrewing the rocker box cover nuts



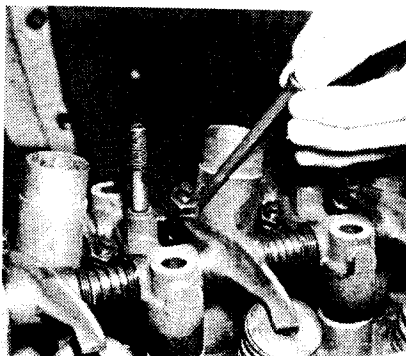
11.3 Removing the rocker box cover



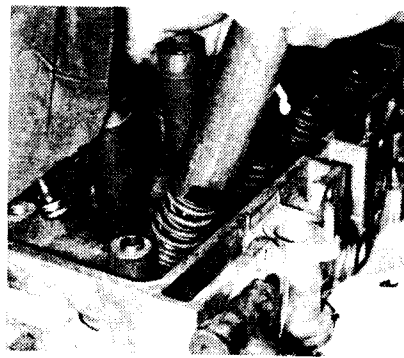
11.4A Removing the sparking plug tube washers



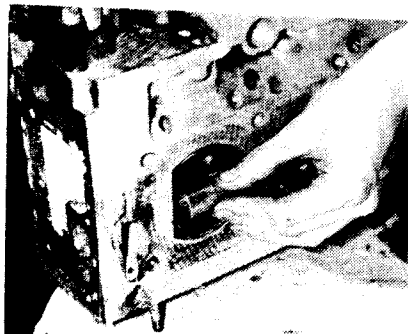
11.4B Removing the sparking plug tube cups



11.5 Lifting out the push rods



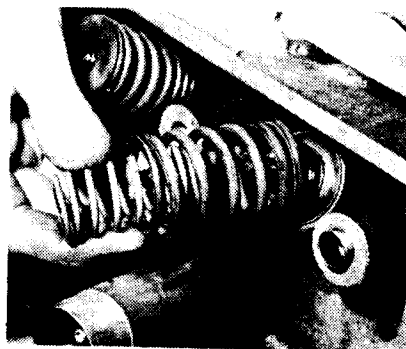
12.4A Compressing a valve spring with a piece of tubing



12.4B Supporting the valve heads with a block



12.5A Removing valve top cup and spring



12.5B Removing the inner valve spring

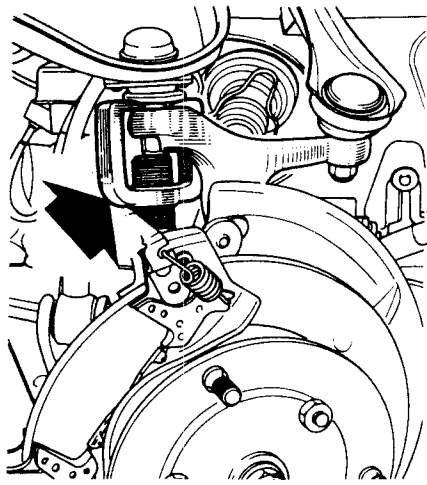


Fig.1.17 Upper ball joint fitted with extractor

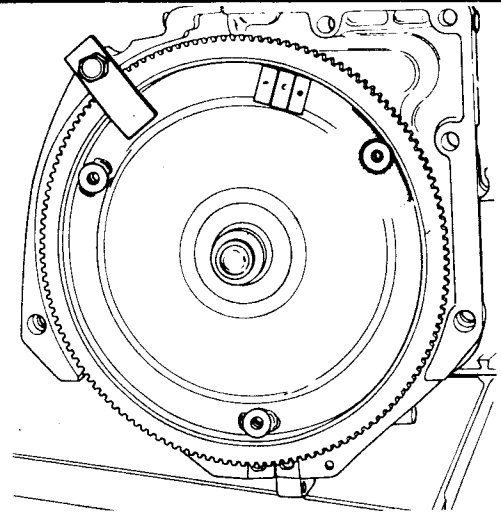


Fig.1.18 Automatic transmission converter temporary retaining plate

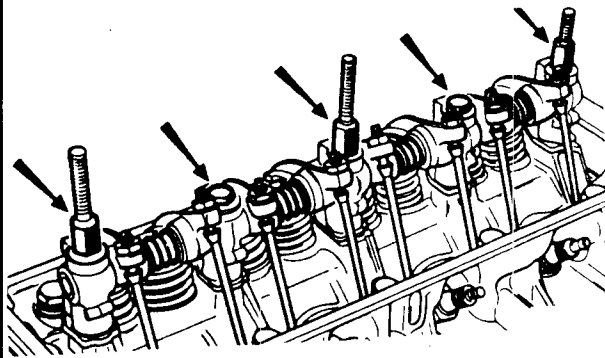


Fig.1.19 Rocker securing bolts and nuts on type 697 and 821 engines

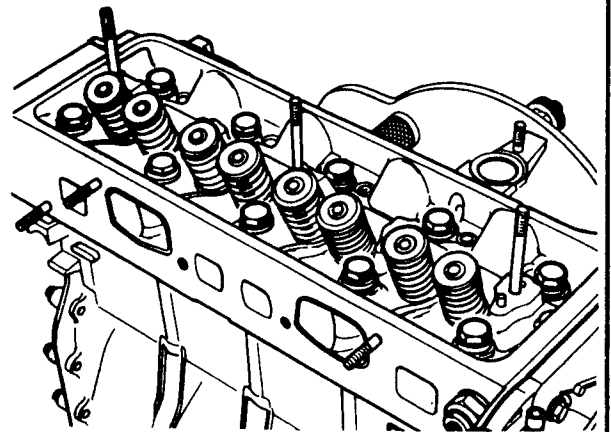


Fig.1.20 Cylinder head bolts on type 697 and 821 engines

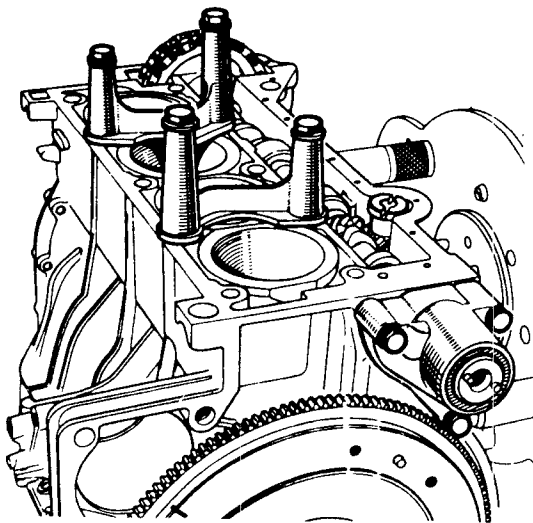


Fig.1.21 Liner clamps in position

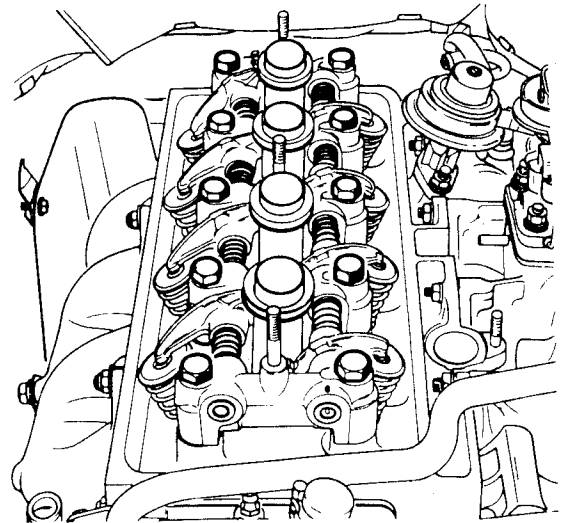


Fig.1.22 Combined rocker pillar and cylinder head bolts on a type 807 engine

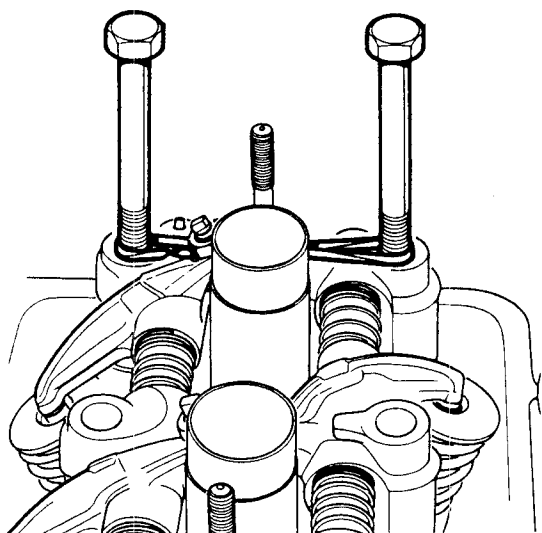


Fig.1.23 Retaining the two end cylinder head bolts in the partly withdrawn position on a type 807 engine

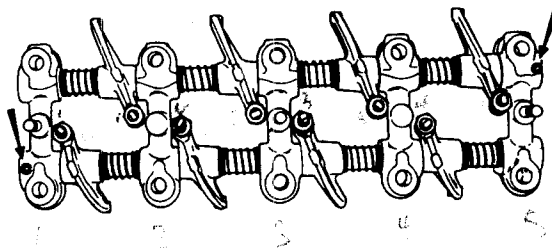


Fig.1.24 Type 807 rocker shaft securing roll pin positions

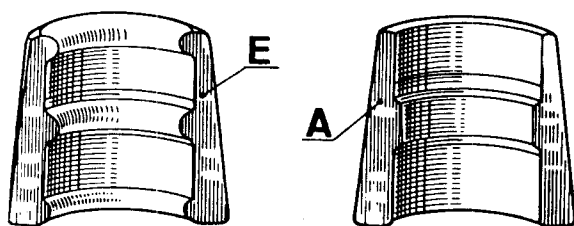
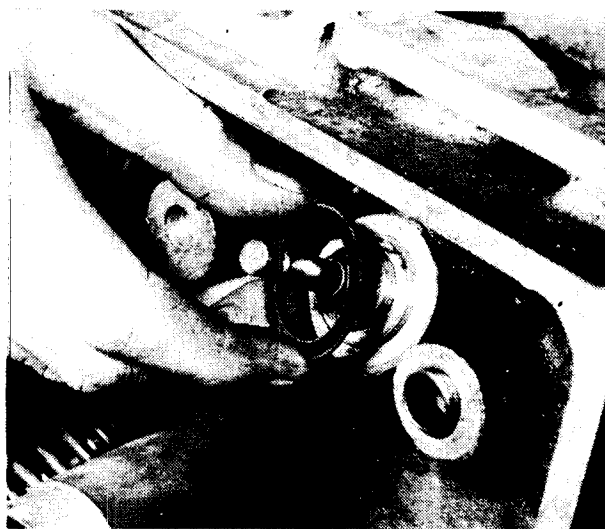


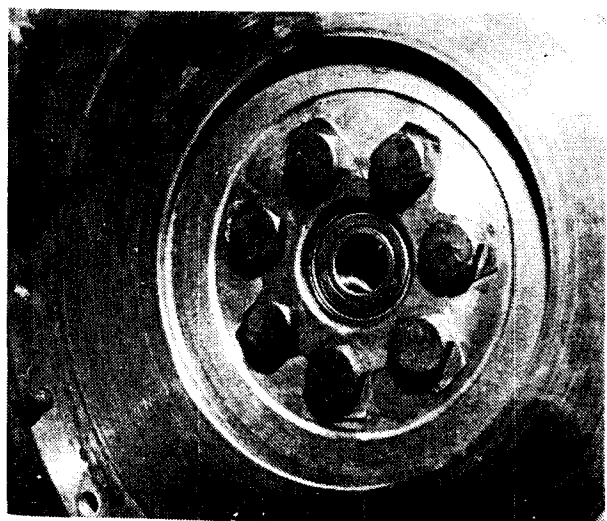
FIG.1.25 VALVE COLLETS

A Inlet type

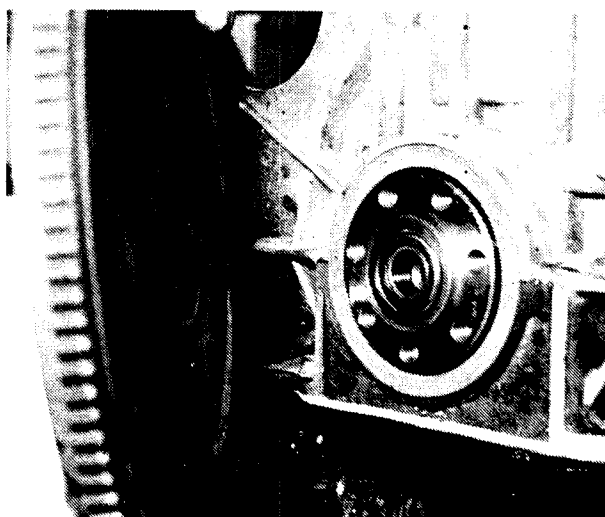
E Exhaust type



12.5C Removing the valve base washers



15.2 The flywheel securing bolts



15.3 Removing the flywheel

13 Cylinder head, rocker gear and valves - dismantling (types 697/821)

- 1 Removal of the in-line type valves and rocker shaft assembly follows a procedure similar to that described in the preceding section for vee-inclined valves..
- 2 Note the location of the shaft retaining spring roll pins.
- 3 Do not remove the concave plugs from the shaft ends.
- 4 Remove the valve assemblies using a normal clamp type spring compressor and taking great care that the valves are kept in sequence for correct replacement into their original guides. Remove No 1 inlet as previously explained.

14 Camshaft and water pump pulleys - removal

- 1 Unscrew and remove the four bolts from the camshaft pulley outer flange. Remove the pulley adjusting shims.
- 2 Detach the drive belt from the water pump pulley and then remove the three bolts which secure the water pump pulley to the pump shaft flange.

15 Flywheel - removal

- 1 As explained in section 3, attention may be given to the flywheel, with the engine still in position in the car, the gearbox-transmission only having been removed.
- 2 Bend down the tabs of the securing bolt lockwashers and unscrew each of the seven bolts, Fig.1.26 (photo).
- 3 Pull the flywheel straight off and do not knock the starter ring gear teeth during handling (photo).

16 Automatic transmission - convertor driving plate - removal

- 1 The procedure described in the preceding section applies to the removal of the torque convertor driving plate which is fitted instead of a flywheel with automatic transmission, Fig.1.27. Note convertor/plate mating marks for exact replacement.

17 Sump - removal

- 1 The sump can be removed while the engine is still in position in the car.
- 2 Ensure that the engine oil has been drained and unscrew and remove the sump securing bolts. Remove them a turn or two at a time in diametrically opposite sequence.
- 3 Withdraw the sump and discard the gasket.

18 Oil pump - removal

- 1 Accessible after removal of the sump, the oil pump is secured to the crankcase by five fixing bolts.
- 2 Refer to Fig.1.21 and withdraw the oil pump/distributor drive from its engagement with the camshaft.
- 3 Unscrew and remove the pump securing bolts and remove the pump taking care not to damage the gauze filter, Fig.1.28 or rotors (photo).

19 Timing cover, gear and camshaft - removal

- 1 Refer to Fig.1.28 and unscrew and remove the thirteen timing cover bolts (photo). Note any difference in length in the bolts and mark them for correct replacement.
- 2 Lift the cover away to expose the timing chain and gear.
- 3 Refer to Fig.1.29 and insert a 3 mm Allen key in the chain tensioner cylinder retaining screw, having first bent back the screw lock tab. Turn the screw in a clockwise direction until the pad

assembly is withdrawn from contact with the timing chain.

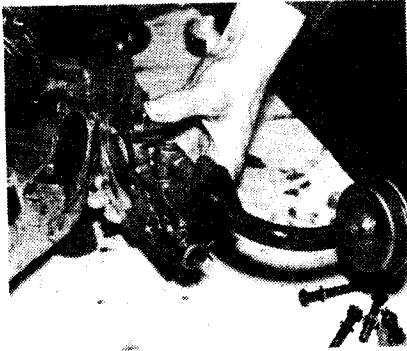
- 4 Unscrew and remove the two tensioner securing screws and remove the tensioner assembly (photo).
- 5 Refer to Fig.1.30 and unscrew and remove the crankshaft sprocket retaining bolt. If the crankshaft tends to rotate during this operation, use a 'slogger' type spanner. Remove the washer and thrust ring.
- 6 Unscrew and remove the four nuts from the two chain anti-flail guards and remove them.
- 7 Bend down the tabs on the camshaft flange securing bolt lockwashers and unscrew and remove the bolts. Remove the camshaft bearing (3 bolts) from the flywheel end of the engine (photo).
- 8 Refer to Fig.1.31 and using either an extractor similar to the one shown or two levers behind the crankshaft sprocket, withdraw the crankshaft flange (integral with camshaft) must be eased from its location to keep the chain as straight as possible. When the crankshaft sprocket has been withdrawn past the end of the crankshaft, then the chain may be removed from both the crankshaft and camshaft sprockets.
- 9 Withdraw the camshaft taking great care not to damage the camshaft bearing surfaces during the operation (photo).
- 10 Should components of the chain tensioner have worn or require attention, the component fitting sequence is shown.

20 Piston/liner assemblies, connecting rods and big-end bearings - removal

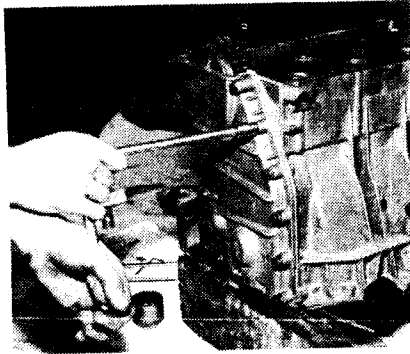
- 1 These components may be removed with the engine in position in the car, if required, after removal of the cylinder head and sump.
- 2 It is important that where the existing cylinder liners are to be replaced, they are identified for position. Mark the top edges with quick drying paint to indicate each liner's position in the line and also its orientation so that it will be refitted exactly the same way round.
- 3 Check the numbering of the connecting rods and the big-end caps. These should run from 1 to 4 from the clutch end of the engine and are marked on the camshaft side of the unit, Fig.1.32. In the event of these components not being marked, then dot punch them in such a way that the bearing caps will be fitted the correct way round when the mating marks are adjacent (photo).
- 4 Unscrew and remove the big-end bearing cap nuts.
- 5 Withdraw the big-end bearing caps complete with shell bearings.
- 6 Withdraw each cylinder liner/piston/connecting rod assembly upwards from the cylinder block (photo). The lower liner seals will be broken during this operation and must be cleaned from the liner and block mating faces. The seals are supplied colour identified to show thickness but it is unlikely that the original identification marks will still be visible and the seal refitting procedure must be carried out on reassembly as described in section 45 of this Chapter.
- 7 After removal of each connecting rod, temporarily refit its matching bearing cap and shell bearing.
- 8 Withdraw each connecting rod/piston assembly from its cylinder liner. Do not allow the piston rings to spring outwards during removal from the liners but restrict them with the fingers to avoid breakage.

21 Piston rings - removal

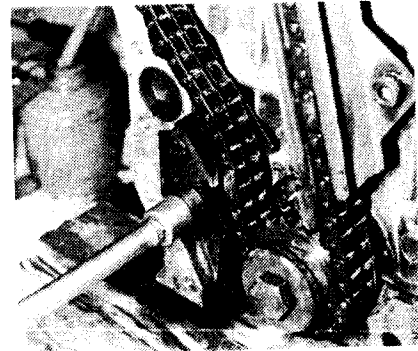
- 1 Removal of rings from their grooves is an operation calling for care as they are of cast construction and will snap if opened too wide.
- 2 Cut three pieces of thin sheet tin (or use three old feeler gauges) and prise the open ends of the ring apart with the thumb nails just enough to permit the first strip of tin (or feeler) to be slid behind the ring. Slide in the other two pieces of tin and position them equidistantly round the periphery of the piston. The



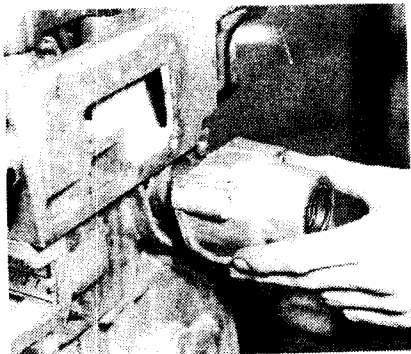
18.3 Removing the oil pump



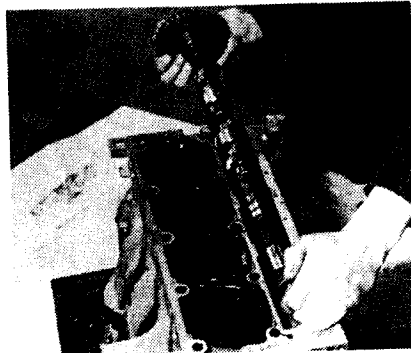
19.1 Unscrewing the timing cover bolts



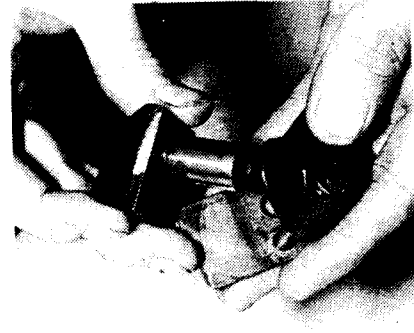
19.4 Unscrewing the timing chain tensioner assembly



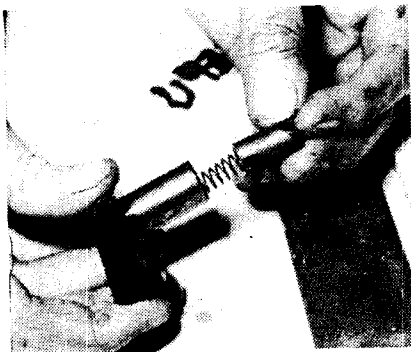
19.7 Removing the camshaft bearing



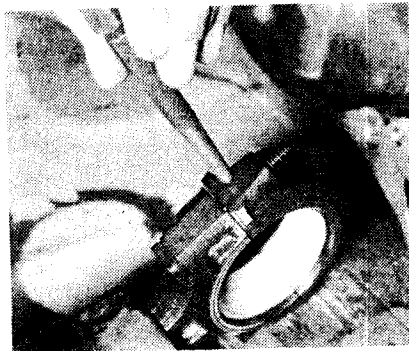
19.9 Lifting the camshaft from its location



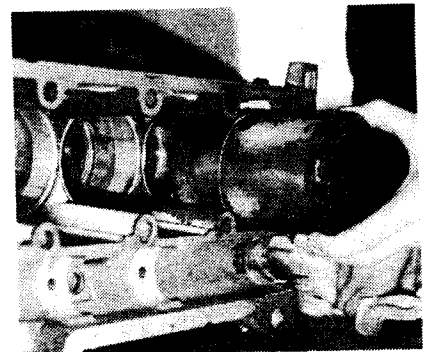
19.10A Components of the timing tensioner



19.10B Components of the timing tensioner



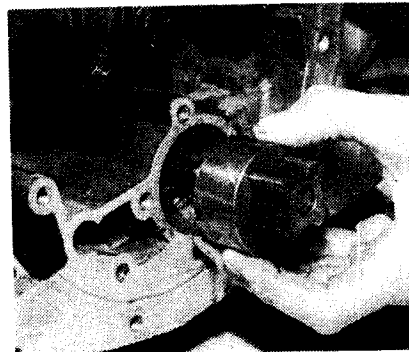
20.3 Big-end mating and alignment marks



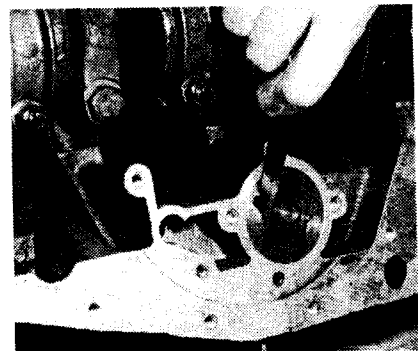
20.6 Withdrawing a piston/liner assembly from the block



23.2 Marking a main bearing cap



24.8 Inserting oil pump rotors into their crankcase location



24.9 Checking rotor clearance of the oil pump

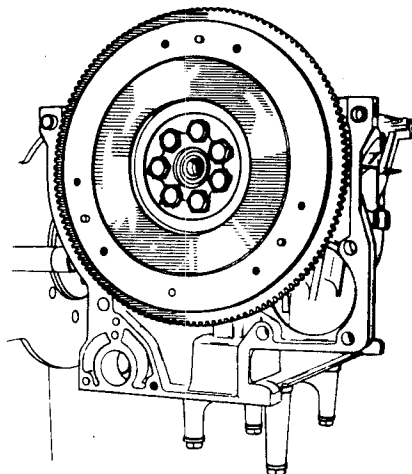


Fig.1.26 Flywheel securing bolts and locking plate

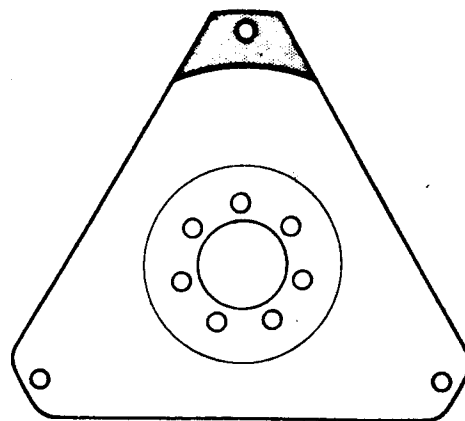


Fig.1.27 Torque converter driving plate fitted to the crankshaft instead of flywheel, with automatic transmission vehicles

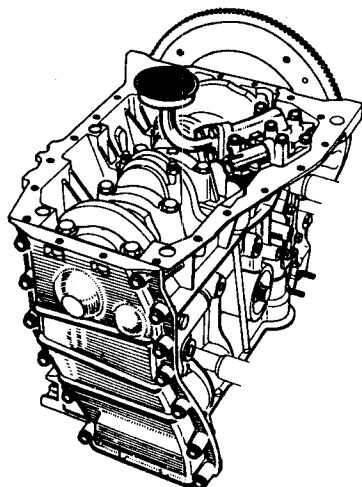


Fig.1.28 Location of the oil pump

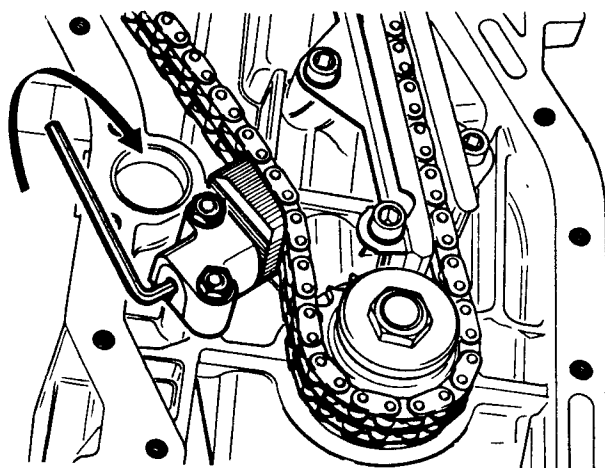


Fig.1.29 Using Allen key to withdraw tensioner pad from chain

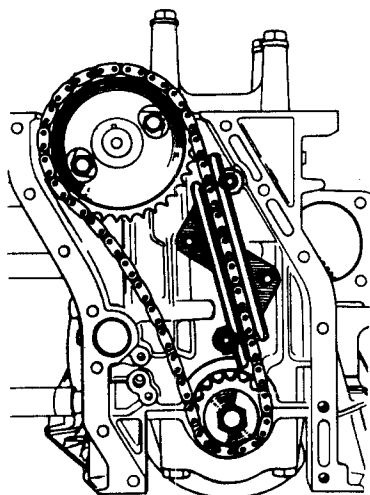


Fig.1.30 Location of timing chain guards

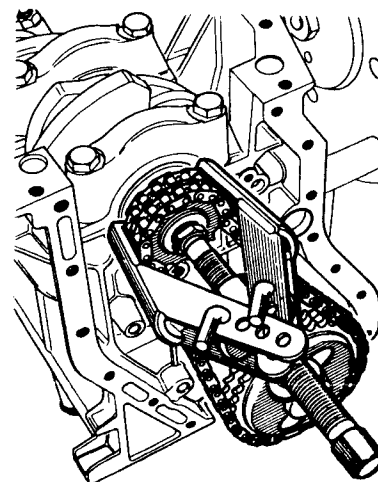


Fig.1.31 Using an extractor to remove the crankshaft sprocket

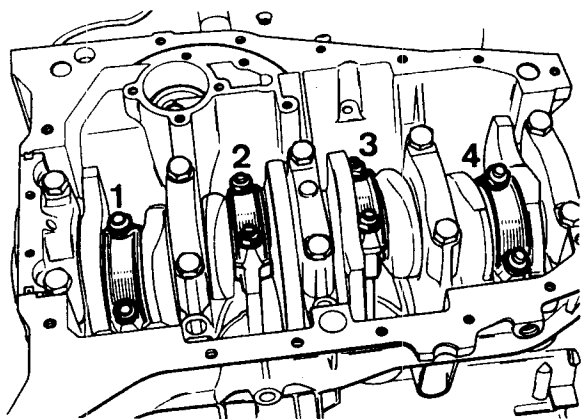


Fig.1.32 Big-end cap numbering (on crankshaft side for correct location)

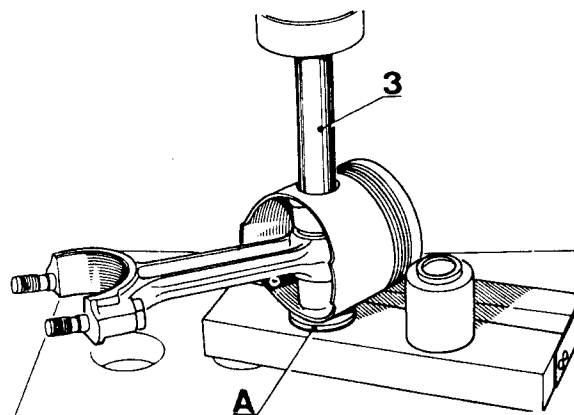


FIG.1.33 SPECIAL TOOLS REQUIRED FOR GUDGEON PIN FITTING

A is insertion limit guide 3 press and mandrel

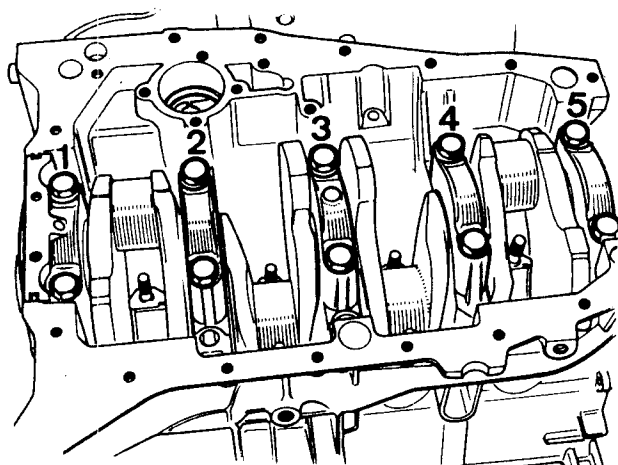


Fig.1.34 Main bearing numbering, caps and crankcase (on crankshaft side for correct location)

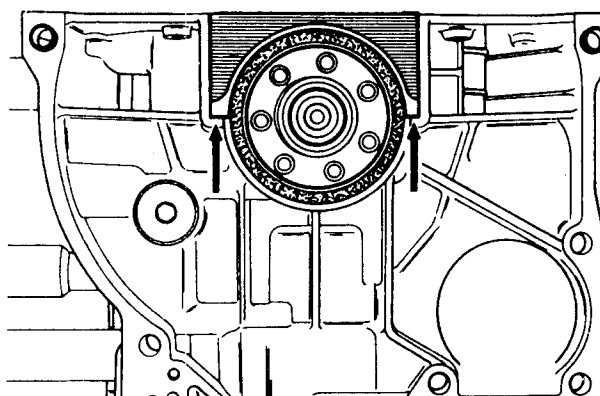


Fig.1.35 Direction to tap No.1 main bearing cap to release it

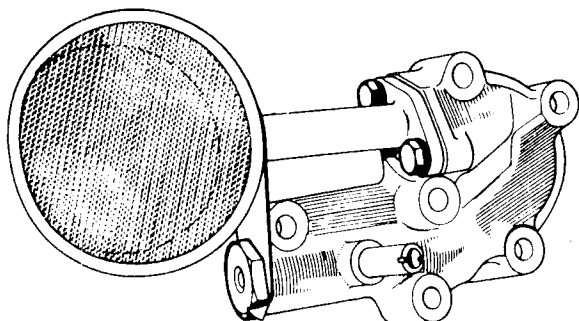


Fig.1.36 Oil pump fitted to type 697 engines of early manufacture

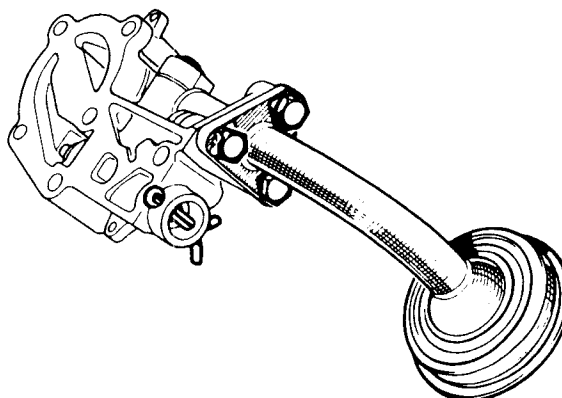


Fig.1.37 Later type oil pump

piston ring may now be drawn off as the strips will permit it to ride safely over the lands and other grooves of the piston.

22 Gudgeon pin - removal

1 The gudgeon pins fitted to these engines are an interference fit in the connecting rod small end but a running fit in the piston. It is preferable that the removal or fitting of gudgeon pins be left to a Renault agent as the connecting rod must first be heated to 250°C (482°F) and a press and special guide tools employed, Fig.1.33.

23 Crankshaft and Main bearings - removal

- 1 Invert the engine block so that the sump flange is uppermost.
- 2 Mark the five main bearing caps in sequence from the front either by dot punching or using quick drying paint, Fig.1.34, (photo). Ensure that the position of the mating marks on both the caps and crankcase will automatically ensure their correct orientation on refitting.
- 3 Unscrew and remove the main bearing cap bolts and remove all the caps except no.1, which cannot be removed by hand pressure.
- 4 Refer to Fig.1.35 and tap the no. 1 main bearing cap in the direction indicated by the arrows.
- 5 Remove the seal.
- 6 Remove the two bearing side seals.
- 7 With model 821 engines, remove the two white metal type thrust washers from either side of the centre main bearing.
- 8 Carefully lift out the crankshaft from the halves of the crankcase bearings.
- 9 Unless the shell bearings are to be renewed, they may be left in position but temporarily screw on the bearing caps which will give some measure of protection to the shell bearings during further servicing operations on the engine block.

24 Oil pump - overhaul

- 1 The design of the oil pump may vary in type according to date of engine manufacture. Fig.1.36 shows the type fitted to early model 697 engines and the later type oil pump is shown in Fig.1.37, this being fitted to all other types of engine of later manufacture.
- 2 With early type pumps, bend back the locking tab and unscrew and remove the relief valve screwed plug.
- 3 Withdraw the spring, guide and ball.
- 4 Unscrew and remove the two strainer flange securing bolts and lift the pipe and strainer assembly away.
- 5 With the later type pumps, unscrew and remove the three strainer/pipe assembly securing bolts.
- 6 Remove the split pin from the relief valve orifice and withdraw the cup, spring, guide and piston, Fig.1.38.
- 7 Examine and clean all components. Any scored parts or weak springs should be renewed. If a new oil pump assembly is to be fitted instead of an earlier type, then this will necessitate the fitting of a later type domed sump.
- 8 The inner oil pump rotor was probably removed at the time of removing the pump from the crankcase. Both rotors should now be tested for wear by trying them in position in the crankcase housing (photo).
- 9 Using feeler gauges, test the lobe clearance, with the rotors held in two different positions, Fig.1.39, and check that the clearances fall within the tolerances quoted (photo). In the event of wear having occurred, renew the rotors as a matched pair. Scoring or wear of the lobe surfaces is usually due to neglect of oil and filter changes.

25 Oil filter - removal and replacement

- 1 The oil filter is of canister, screw-in, throw away type located on the left hand side of the crankcase.
- 2 The old filter may be very tight to remove and by prising a screwdriver against one of the filter case notches it may be possible to lever it undone (photo).
- 3 If this fails use a small chain wrench or a worm drive clip to which two bolts have been riveted or welded. After tightening the worm drive screw fully, pressure against the bolts will unscrew the filter from its base.
- 4 Before fitting a new filter, grease the surface of the rubber sealing gasket and screw it in by hand (photo) until it seats then screw in a further quarter turn by hand. Do not screw the filter in by using a wrench or tool.
- 5 Start the engine, check for leaks and top up the engine oil level as necessary.

26 Engine components - examination for wear

With the engine stripped down and all parts thoroughly cleaned, it is now time to examine every thing for wear. The following items should be checked and where necessary renewed or renovated as described in the following sections.

27 Crankshaft - examination and renovation

- 1 Examine the crankpin and main journal surfaces for signs of scoring or scratches. Check the ovality of the crankpins at different positions with a micrometer. If more than 0.001 inch (0.0254 mm) out of round, the crankpins will have to be reground. It will also have to be reground if there are any scores or scratches present. Also check the journals in the same fashion. Specialist engineering firms will carry out this work and supply new shell bearings to the correct undersizes.
- 2 There are certain differences in hardening between the various engine type crankshafts and it is imperative that the proposed regrinding matches the figures given in Specifications. Figs.1.40 and 1.41 show points of identification for type 821 engines and 697/307 types.

28 Big-end and main bearings - examination and renovation

Big end bearing failure is accompanied by a noisy knocking from the crankcase and a slight drop in oil pressure. Main bearing failure is accompanied by vibration which can be quite severe as the engine speed rises and falls and a drop in oil pressure.

Bearings which have not broken up, but are badly worn, will give rise to low oil pressure and some vibration. Inspect the big-ends, main bearings, and thrust washers for signs of general wear, scoring, pitting and scratches. The bearings should be matt grey in colour. With lead indium bearings should a trace of copper colour be noticed the bearings are badly worn as the lead bearing material has worn away to expose the indium underlay. Renew the bearings if they are in this condition or if there is any sign of scoring or pitting.

The undersizes available are designed to correspond with the regrind sizes, ie, .010 inch (0.254 mm) bearings are correct for a crankshaft reground .010 undersize. The bearings are in fact slightly more than the stated undersize as running clearances have been allowed for during their manufacture.

Very long engine life can be achieved by changing big-end bearings at intervals of 30,000 miles (48,000 km), irrespective of bearing wear. Normally crankshaft wear is infinitesimal and a change of bearings will ensure mileages of between 100,000 to 120,000 miles (160,000 to 192,000 km) before crankshaft regrinding becomes necessary. Crankshafts normally have to be reground because of scoring due to bearing failure.

Never file the bearings caps to try and take up bearing wear.

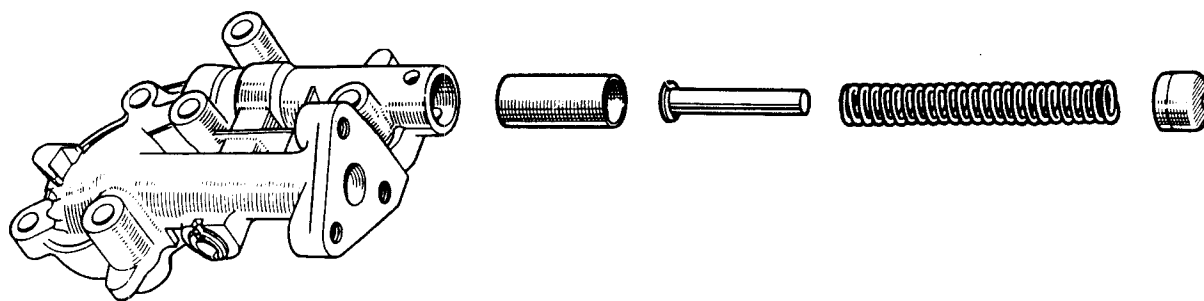


Fig.1.38 Later type oil pump components

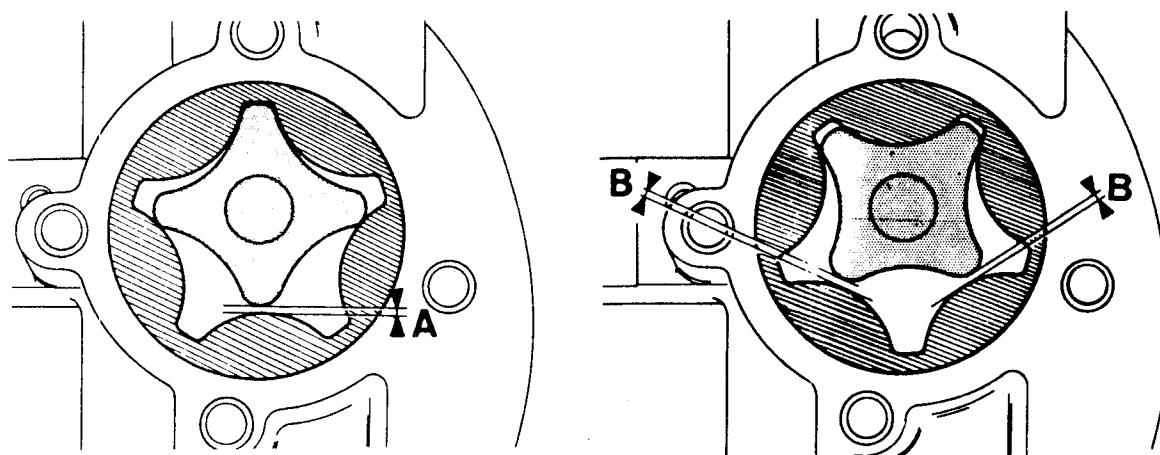
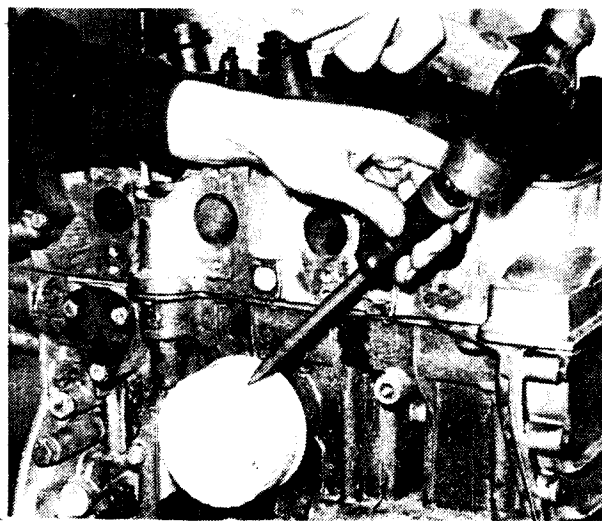
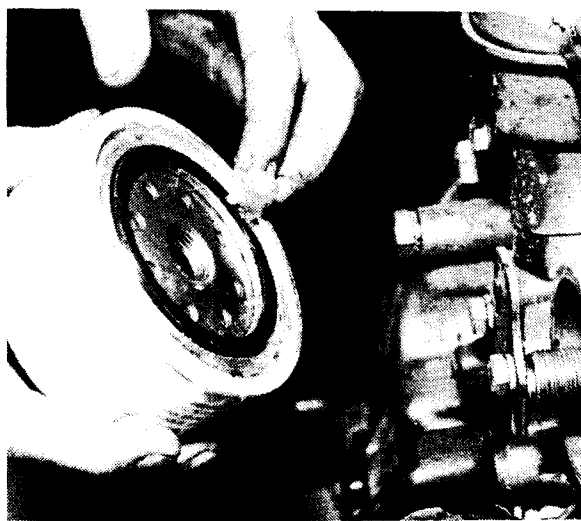


FIG.1.39 OIL PUMP ROTOR CLEARANCES TO BE CHECKED IN TWO DIFFERENT POSITIONS

$A = 0.002 \text{ to } 0.012 \text{ in } (0.04 \text{ to } 0.29 \text{ mm})$
 $B = 0.001 \text{ to } 0.006 \text{ in } (0.02 \text{ to } 0.14 \text{ mm})$



25.2 Unscrewing the oil filter



25.4 Greasing the oil filter gasket prior to screwing in by hand

29 Cylinder liners - examination and renovation

1 The cylinder bores must be examined for taper, ovality, scoring and scratches. Start by carefully examining the top of the cylinder bore. If they are at all worn a very slight ridge will be found on the thrust side. This marks the top of the piston ring travel. The owner will have a good indication of the bore wear prior to dismantling the engine, or removing the cylinder head. Excessive oil consumption accompanied by blue smoke from the exhaust is a sure sign of worn cylinder bores and piston rings.

2 Measure the bore diameter just under the ridge with a micrometer and compare it with the diameter at the bottom of the bore, which is not subject to wear. If the differences between the two measurements are more than 0.006 inch (0.1524 mm) then it will be necessary to fit new pistons and liner assemblies. If no micrometer is available remove the ring from a piston and place the piston in each bore in turn about $\frac{1}{4}$ inch below the top of the bore. If an 0.010 inch (0.254 mm) feeler gauge can be slid between the piston and the cylinder wall on the thrust side of the bore then remedial action must be taken.

3 Should the liners have been disturbed they must be completely removed from the cylinder block and new seals fitted otherwise once the seals have been disturbed the chances are that water will leak into the sump.

30 Pistons and piston rings - examination and renovation

If the old pistons are to be refitted carefully remove the piston rings and then thoroughly clean them. Take particular care to clean out the piston ring grooves. At the same time do not scratch the aluminium in any way. If new rings are to be fitted to the old pistons then the top ring should be stepped so as to clear the ridge left above the previous top ring. If a normal but oversize new ring is fitted it will hit the ridge and break because the new ring will not have worn in the same way as the old, which will have worn in union with the ridge.

Before fitting the rings on the pistons each should be inserted approximately 3 inches (76.2 mm) down the cylinder bore and the gap measured with a feeler gauge.

This should be between 0.015 inch (0.3810 mm) and 0.038 inch (0.9652 mm). It is essential that the gap should be measured at the bottom of the ring travel, as if it is measured at the top of a worn bore and gives a perfect fit, it could easily seize at the bottom. If the ring gap is too small rub down the ends of the ring with a very fine file until the gap, when fitted, is correct. To keep the rings square in the bore for measurement line each up in turn by inserting an old piston in the bore upside down, and use the piston to push the ring down about 3 inches (76.2 mm). Remove the piston and measure the piston ring gap.

When refitting new pistons and rings to new liners the piston ring gap can be measured at the top of the bore as the bore will not now taper. It is not necessary to measure the side clearance in the piston ring grooves with the rings fitted as the groove dimensions are accurately machined during manufacture. When fitting new oil control rings to old pistons it may be necessary to have the groove in this instance widened by machining to accept the new wider rings.

31 Connecting rod and gudgeon pin - examination and renovation

1 A visual check only can be carried out to observe whether any movement or play can be seen when the piston is held still and the connecting rod pushed and pulled alternately.

2 If there has been evidence of small end knock with the engine at normal working temperature then the connecting rod/piston assembly should be taken to a Renault dealer as special tools are required to dismantle and refit these components.

32 Camshaft and camshaft bearings - examination and renovation

1 Examine the chain sprockets. If these are worn or the teeth are hooked, drift out the two securing pins and press off the sprocket.

2 Check the clearance between the camshaft and the flange as shown in Fig.1.42. Use feelers to measure the gap which should be between 0.002 and 0.0047 inch (0.05 and 0.12 mm). If the clearance is incorrect, the flange will have to be pressed off and a new one pressed on.

3 If the sprocket is removed for any reason, it must always be renewed.

4 If the camshaft is renewed as an assembly, then the distributor drive pinion must also be renewed as both components are supplied as matched pairs.

5 The camshaft front bearing contains two oil seals as shown in Fig.1.43. They should both be renewed and a check made that there is no wear in the actual bearing itself.

33 Tappets - examination and renovation

Examine the bearing surface of the mushroom tappets which lie on the camshaft. Any indentation in this surface or any cracks indicate serious wear and the tappets should be renewed. Thoroughly clean them out, removing all traces of sludge. It is most unlikely that the sides of the tappets will prove worn, but, if they are a very loose fit in their bores and can readily be rocked, they should be exchanged for new units. It is very unusual to find any wear in the tappets, and any wear is likely to occur at a very high mileages.

34 Valves and valve seats - examination and renovation

1 Examine the heads of the valves for pitting and burning, especially the heads of the exhaust valves. The valve seatings should be examined at the same time. If the pitting on valve and seat is very slight the marks can be removed by grinding the seats and valves together with coarse, and then fine, valve grinding paste. Where bad pitting has occurred to the valve seats it will be necessary to recut them and fit new valves. If the valve seats are so worn that they cannot be recut, then it will be necessary to recut them and fit new valves. If the valve seats are so worn that they cannot be recut, then it will be necessary to fit new valve seat inserts. These latter two jobs should be entrusted to the local Renault agent or engineering works. In practice it is very seldom that the seats are so badly worn that they require renewal. Normally, it is the exhaust valve that is too badly worn for replacement, and the owner can easily purchase a new set of valves and match them to the seats by valve grinding.

2 Valve grinding is carried out as follows. Smear a trace of coarse carborundum paste on the seat face and apply a suction grinder tool to the valve head. With a semi-rotary motion, grind the valve head to its seat, lifting the valve occasionally to redistribute the grinding paste (photo). When a dull matt even surface finish is produced on both the valve seat and the valve, wipe off the paste and repeat the process with fine carborundum paste, lifting and turning the valve to redistribute the paste as before. A light spring placed under the valve head will greatly ease this operation. When a smooth unbroken ring of light grey matt finish is produced on both valve and valve seat faces, the grinding operation is completed.

3 Scrape away all carbon from the valve head and the valve stem. Carefully clean away every trace of grinding compound, taking great care to leave none in the ports or in the valve guides. Clean the valves and valve seats with a paraffin soaked rag then with a clean rag, and finally, if an air line is available, blow the valves, valve guides and valve ports clean.

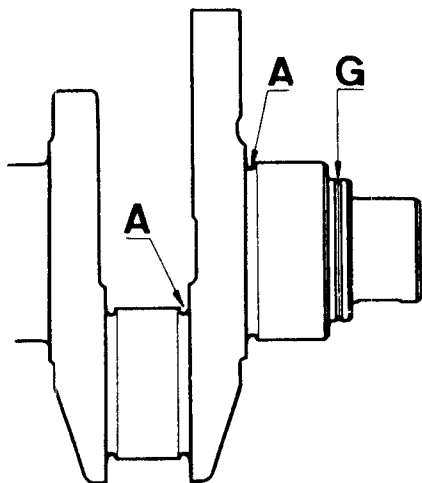


FIG.1.40 CRANKSHAFT IDENTIFICATION DRAWING (TYPE 821 ENGINE)

A = Under cuts
 G - single groove for 821 - 02 engine
 G - twin grooves for 820 - 01 engine

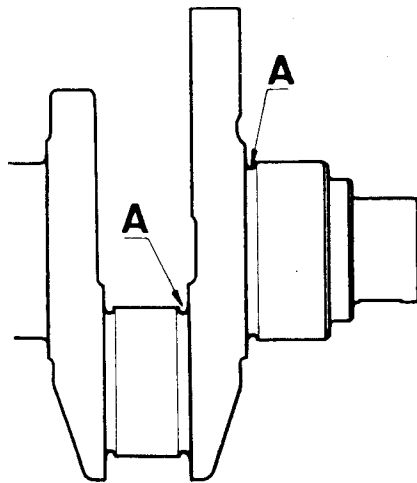


FIG.1.41 CRANKSHAFT IDENTIFICATION DRAWING (TYPE 697 AND 807 ENGINES)

A = Undercuts, no grooves on main journal

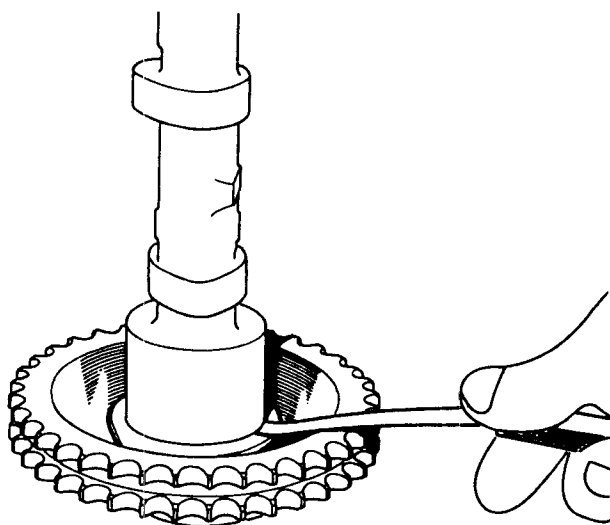


Fig.1.42 Checking the camshaft flange clearance

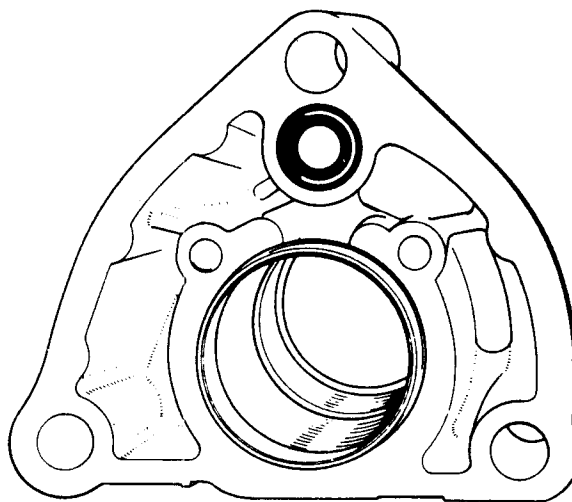
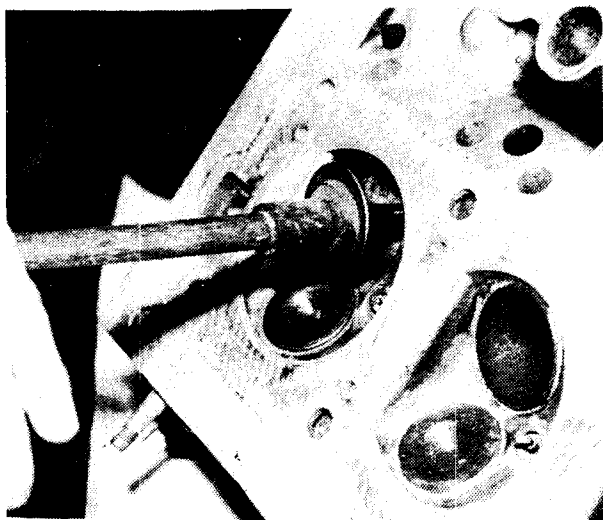
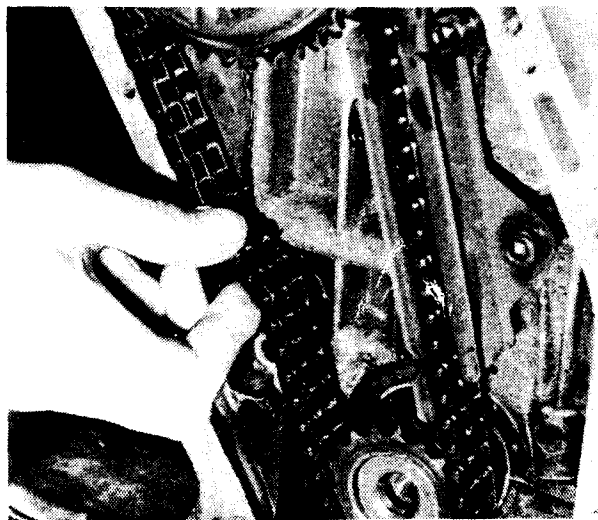


Fig.1.43 Camshaft front bearing showing oil seals



34.2 Grinding in a valve



36 Testing timing chain wear

35 Valve guides - examination and renovation

1 Examine the valve guides internally for wear. If the valves are a very loose fit in the guides and there is the slightest suspicion of lateral rocking using a new valve, then new guides will have to be fitted. If the valve guides have been removed compare them internally by visual inspection with a new guide as well as testing them for rocking with a new valve.

2 Valve guide renewal should be left to a Renault agent who will have the required press and mandrel. Work of this kind in a light alloy head without the correct tools can be disastrous.

36 Timing gears and chain - examination and renovation

Examine the teeth on both the crankshaft gearwheel and the camshaft gearwheel for wear. Each tooth forms an inverted 'V' with the gearwheel periphery, and if worn, the side of each tooth under tension will be slightly concave in shape when compared with the other side of the tooth, ie, one side of the inverted 'V' will be concave when compared with the other. If any sign of wear is present the gearwheels must be renewed.

Examine the links of the chain for side slackness and renew the chain if any slackness is noticeable when compared with a new chain (photo). It is a sensible precaution to renew the chain at about 30,000 miles (48,000 km) and at a lesser mileage if the engine is stripped down for a major overhaul. The actual rollers on a very badly worn chain may be slightly grooved.

37 Timing chain tensioner - examination and renovation

1 If the timing chain is badly worn it is more than likely that the tensioner will be too.

2 Examine the side of the tensioner which bears against the chain and renew it if it is grooved or ridged.

38 Cylinder block - examination and renovation

1 Check for cracks. The cost of welding the alloy material must be weighed against a new casting. Threaded holes which have stripped, may have proprietary thread inserts installed to rectify.

39 Rockers and rocker shaft - examination and renovation

Check the shaft for straightness by rolling it on the bench. It is most unlikely that it will deviate from normal, but, if it does, then a judicious attempt must be made to straighten it. If this is not successful purchase a new shaft. The surface of the shaft should be free from any worn ridges caused by the rocker arms. If any wear is present, renew the shaft. Wear is only likely to have occurred if the rocker shaft oil holes have become blocked.

Check the rocker arms for wear of the rocker bushes, for wear of the adjusting ball ended screws. Wear in the rocker arm bush can be checked by gripping the rocker arm tip and holding the rocker arm in place on the shaft, noting if there is any lateral rocker arm shake. If shake is present, and the arm is very loose on the shaft, a new bush or rocker arm must be fitted.

Check the tip of the rocker arm where it bears on the valve head for cracking or serious wear on the case hardening. If none is present reuse the rocker arm. Check the lower half of the ball on the end of the rocker arm adjusting screw. On high performance engines wear on the ball and top of the pushrod is easily noted by the unworn 'pip' which fits in the small central oil hole on the ball. The larger this 'pip' the more wear has taken place to both the ball and the pushrod. Check the pushrods for straightness by rolling them on the bench. Renew any that are bent.

40 Flywheel starter ring - examination and renovation

1 If the teeth on the flywheel starter ring are badly worn, or if some are missing, then it will be necessary to remove the ring. This is achieved by splitting the ring with a cold chisel. The greatest care should be taken not to damage the flywheel during this process.

2 To fit a new ring heat it gently in boiling water. With the ring at this temperature, fit it to the flywheel with the front of the teeth facing the flywheel register. The ring should be tapped gently down onto its register and left to cool naturally when the shrinkage of the metal on cooling will ensure that it is a secure and permanent fit. Great care must be taken not to overheat the ring, as if this happens, the temper of the ring will be lost.

3 Note carefully that the chamfered side of the teeth on the ring must provide a lead in to the starter motor drive and must be fitted the correct way round.

4 Do not attempt to renew the starter ring gear on the torque convertor fitted to an automatic gearbox (model R1153 vehicle). Leave it to a specialist or exchange the convertor as an assembly - see Chapter 7.

41 Cylinder head and piston crowns - decarbonisation

This can be carried out with the engine either in or out of the car. With the cylinder head off carefully remove with a wire brush and blunt scraper all traces of carbon deposits from the combustion spaces and the ports. The valve head stems and valve guides should also be freed from any carbon deposits. Wash the combustion spaces and ports down with petrol and clean the cylinder head surface free of any gasket cement or foreign matter with the Renault product 77-01-390-107.

Clean the pistons and top of the cylinder bores. If the pistons are still in the block then it is essential that great care is taken to ensure that no carbon gets into the cylinder bores as this could scratch the cylinder walls or cause damage to the piston and rings. To ensure this does not happen, first turn the crankshaft so that two of the pistons are at the top of their bores. Stuff rag into the other two bores or seal them off with paper and masking tape. The waterways should also be covered with small pieces of masking tape to prevent particles of carbon entering the cooling system and damaging the water pump.

There are two schools of thought as to how much carbon should be removed from the piston crown. One school recommends that a ring of carbon should be left round the edge of the piston and on the cylinder bore wall as an aid to low oil consumption. Although this is probably true for early engines with worn bores, on later engines the thought of the second school can be applied, which is that for effective decarbonisation all traces of carbon should be removed.

If all traces of carbon are to be removed, press a little grease into the gap between the cylinder walls and the two pistons which are to be worked on. With a blunt scraper carefully scrape away the carbon from the piston crown, taking great care not to scratch the aluminium. Also scrape away the carbon from the surrounding lip of the cylinder wall. When all carbon has been removed, scrape away the grease which will now be contaminated with carbon particles, taking care not to press any into the bores. To assist prevention of carbon build-up the piston crown can be polished with a metal polish such as Brasso. Remove the rags or masking tape from the other two cylinders and turn the crankshaft so that the two pistons which were at the bottom are now at the top. Place a rag or masking tape in the cylinders which have been decarbonised and proceed as just described.

If a ring of carbon is going to be left round the piston then this can be helped by inserting an old piston ring into the top of the bore to rest on the piston and ensure that carbon is not accidentally removed. Check that there are no particles of carbon in the cylinder bores. Decarbonising is now complete.

42 Engine reassembly - general

1 To ensure maximum life with minimum trouble from a rebuilt engine, not only must everything be correctly assembled, but all the parts must be spotlessly clean, all the oilways must be clear, locking washers and spring washers must always be fitted where indicated and all bearing and other working surfaces must be thoroughly lubricated during assembly. Before assembly begins renew any bolts or studs, the threads of which are in any way damaged, and whenever possible use new spring washers.

2 Check the core plugs for signs of weeping and renew any that are suspect.

3 To do this drive a punch through the centre of the core plug.

4 Using the punch as a lever lift out the old core plug.

5 Thoroughly clean the core plug orifice and using a thin headed hammer as an expander firmly tap a new core plug in place, convex side facing out.

6 Apart from your normal tools, a supply of clean rag, an oil can filled with engine oil (an empty plastic detergent bottle thoroughly cleaned and washed out will invariably do just as well), a new supply of assorted spring washers, a set of new gaskets and a torque spanner should be collected together.

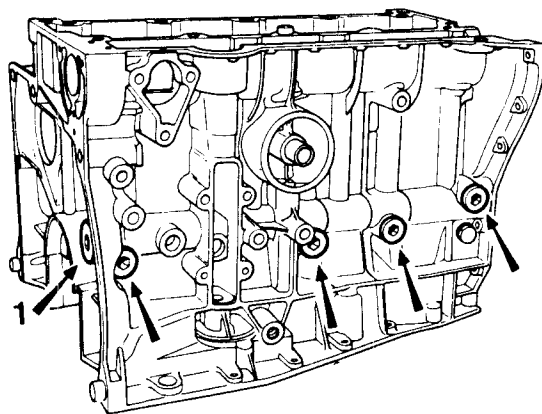


Fig.1.44 Oilways socket screws

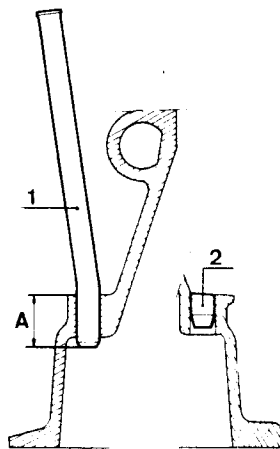


FIG.1.46 FITTING OF DIPSTICK TUBE AND BLANKING PLUG TO TYPE 697 AND 821 ENGINES

- 1 Dipstick tube
2 Blanking plug
A 47/64 in (18.5 mm)

43 Cylinder block - preparation for reassembly

1 Where regular oil changing has been neglected or a bearing has broken up then it will be wise to clean out the oilways of the block using wire to probe and a paraffin syringe and finally blowing through with air from a tyre pump or a compressed air line.

2 Access to the oilways is obtained by unscrewing and removing the socket screws arrowed in Fig.1.44. When refitting these plugs tighten to a torque of 30 lb ft (44.6 kg m) except no.1 which should be tightened to 60 lb ft (89.3 kg m).

3 Check the projection of the oil filter attachment stud, this should project as shown in Fig.1.45. Adjust if necessary by screwing in or out, taking great care not to damage the threads in the process.

4 On 697 and 821 type engines note the position of the dipstick tube (left hand side) and blanking plug (right hand side) and ensure that they are positioned correctly as shown in Fig.1.46.

5 On 807 type engines, the dipstick and plug are reversed as shown in Fig.1.47.

6 Type 697 engines of late manufacture are fitted with cylinder blocks of similar type to those used in the 807 and 821 engines. This type of cylinder block has shorter depth (29/16 inch, 65mm) tapped holes to accommodate the two rearmost cylinder head bolt holes. When using an early type cylinder head with original bolts, then the bolts must either be shortened or packing washers or distance pieces used to prevent them 'bottoming'.

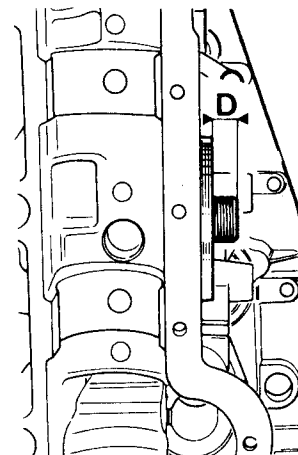


FIG.1.45 CORRECT PROJECTION OF THE OIL FILTER STUD

D = 3/8 to 1/2 in (9.5 to 12.5 mm)

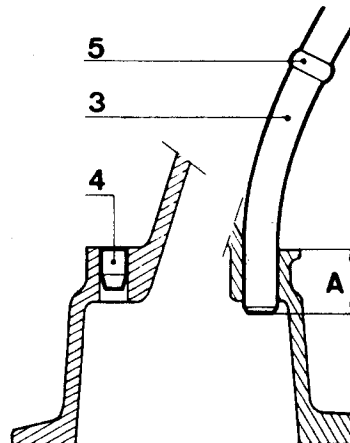


FIG.1.47 FITTING OF DIPSTICK TUBE AND BLANKING PLUG TO TYPE 807 ENGINE

- 3 Dipstick tube
4 Blanking plug
5 Seam
A 47/64 in (18.5 mm)

44 Engine reassembly - crankshaft

- 1 Fit the upper sections of the main bearing shells into their crankcase locations (photo). These are the oil holes and grooves. Ensure that the locating tags engage correctly with the cut-outs in the bearing recesses.
- 2 Stick the two thrust washers into place, one on either side of the centre main bearing (photo). Use grease to hold them in position and ensure that the white metallised sides face the crankshaft webs.
- 3 Oil the bearings and crankshaft journals and lay the crankshaft carefully in position in the crankcase (photo).
- 4 Fit the lower halves (plain) sections of the shell bearings to the main bearing caps (photo). Oil the seals and fit them (bolts, finger tight) to main bearings 2, 3, 4 and 5, not no.1. On type 821 engines, the centre main bearing has a locating dowel and the thrust washers should have locating tabs.
- 5 Check the crankshaft end-float. This may be done by using either a dial gauge or feeler gauges and prising the crankshaft first in one direction and then the other. The total permissible end-float must be between 0.002 and 0.009 inch (0.05 and 0.23 mm) and if outside these tolerances, then the thrust washers must be changed for ones of different thickness as listed in Specifications.
- 6 With type 697 engines, check the size of the front bearing cap oil hole, Fig.1.48. It should be 0.472 in (12 mm) in diameter. If it is smaller than this, drill it out and deburr the ends of the hole.
- 7 With its shell bearing in position, fit the front main bearing cap (no.1) and screw in the bolts, finger tight (photo). Refer to Fig.1.49 and measure the gap 'C'. If the gap is less than 0.197 in (5 mm) obtain two seals 0.201 inch (5.1 mm) thick, if greater, obtain two seals 0.213 inch (5.4 mm) thick (colour identified by white spots).
- 8 If the two side seals into position in the front main bearing cap (photo). The seal groove must be to the outside and projecting by approximately 0.008 inch (0.2032 mm) as shown in Fig.1.50.
- 9 Fitting of the front main bearing cap is critical. Obtain two studs (10 mm x 150) and temporarily screw them into the crankcase. Tape the side seals (photo) to protect them during fitting and then carefully slide the bearing cap down the two studs, Fig.1.51. When the bearing cap is almost home, check that the side seals are still projecting, withdraw the protective tape and studs and fit the securing bolts (photo).
- 10 Tighten all main bearing cap bolts to a torque of 45 lb ft (67 kg m) (photo).
- 11 Renew the crankshaft front oil seal. Remove the old seal and then start the new seal into place using the fingers only (photo). The seal lips are very delicate and great care must be taken to avoid damaging them. Drive it into position by using a piece of tubing of appropriate diameter (photo).

45 Engine reassembly - pistons, connecting rods, liners

- 1 As previously explained, the fitting of the pistons to the connecting rods will have been carried out by the Renault agent due to the difficulty of removing and inserting the gudgeon pin. Check that the pistons have been fitted correctly however by noting that the arrows on the piston crowns will face towards the front of the engine when the connecting rod identification markings are facing the camshaft.
- 2 Locate the shell bearings in the connecting rod and cap big-end bearings (photo).
- 3 Fit the piston rings squarely into their respective liner bores, one at a time and push them half way down the bores. Measure the ring gaps with a feeler gauge, these should not be less than 0.010 inch (0.2540 mm). Remove and file or grind the ring ends if necessary. Keep the sets of three rings once measured, identified for fitting to the relative liner.
- 4 Fit the piston rings to each piston. Use the method described for removal in section 21. Note that the top ring is the thinner one (oil control) and the two compression rings are marked GOE-

TOP on their face.

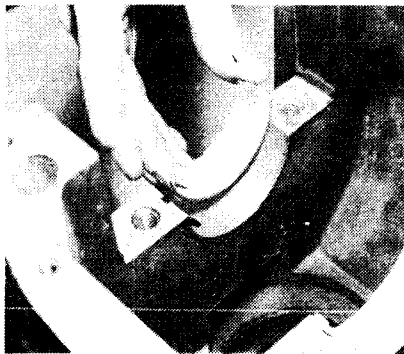
- 5 Liberally oil the rings and ring grooves and turn the rings so that the gaps are at three different points of circle (photo).
- 6 Attention must now be given to fitting the liners. If the original liners are being fitted and the bottom liner seals were identified by their colour coding on dismantling then it is a single matter to fit new seals of identical colour coding. Where new liners are being fitted or where it was not possible to identify the original seals, then the following procedure must be carried out.
- 7 Establish whether the liner diameter at its bottom end is 3.228 inch (82 mm) or 3.248 inch (82.5 mm) and obtain a selection of bottom seals (one of each from the sizes listed in specifications).
- 8 Smear a little grease onto the seating section of the liner and slide on a seal. Press the liner into position by hand. Maintaining hand pressure, place a steel straightedge across the top of the liner and with feelers measure the gap between the top face of the cylinder block and the undersurface of the straightedge. This gap is equivalent to the protrusion of the cylinder liner above the top face of the block and should measure 0.006 to 0.008 inch (0.15 to 0.20 mm). Try different seal thicknesses until the protrusion is correct: Remember to take the measurement with the liner in two different positions and if the measurement differs greatly, take an average. Where original liners are being refitted, place the liners so that the locating marks made before removal are correctly aligned. Repeat the foregoing operations on the remaining three liners and mark them so that during final assembly they will take up the positions which they held during seal measurement.
- 9 Oil the interior of the liner bore and then using a clamp (photo) slide the piston/connecting rod assembly into the liner. The use of plenty of oil and striking blows with the hand will facilitate this operation (photo). Ensure that fitting takes into account the liner, piston crown and connecting rod alignment marks so that the piston will not have to be rotated in its bore which will cause the staggered ring gaps to line up with each other and cause gas blow-by (photo).
- 10 Grease the seat of the liner and check that the correct bottom seal is in position (photo). Place the liner/piston/connecting rod assembly into position in the cylinder block with all locating marks correctly aligned (piston crown arrow facing front, connecting rod numbers facing camshaft, liner positioning marks correct).
- 11 Oil the crankpins and pull each connecting rod down so that the respective (numbered) big-end bearing cap complete with shell bearing can be fitted to the crankpin and the big-end bolts tightened to a torque of 30 lb ft (44.7 Kg m). Washers are not fitted under the big-end nuts (photos).
- 12 Fit the remaining three piston/liner assemblies in the same way and then apply clamps to keep the liners and seals in position during the remaining engine reassembly operations, Fig.1.21.

46 Oil pump - refitting

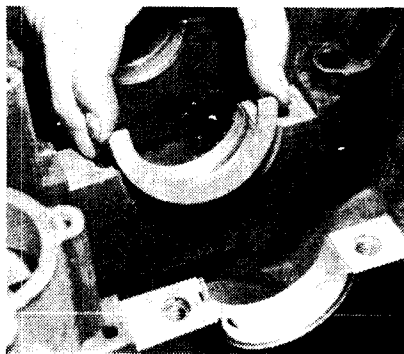
- 1 Locate the inner (complete with drive shaft) and outer rotors in the crankcase recess.
- 2 Fit the oil pump body and screw in and tighten the securing bolts (photo).
- 3 For further operations with the engine in an upright position, stand the lower faces of the crankcase on blocks of wood in order to protect the oil pump and strainer from damage.

47 Camshaft and timing gear - reassembly

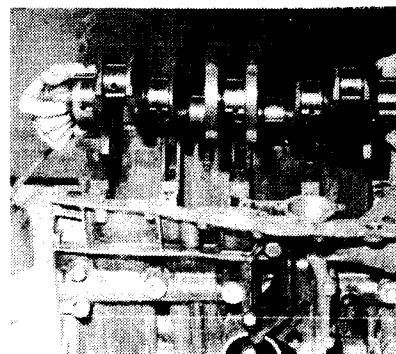
- 1 With the engine in an upright position, oil the camshaft bearing surfaces in the crankcase. Slide the camshaft into position but projecting from the face of the engine by approximately 3 inches (76.2 mm).
- 2 Place the chain on the camshaft sprocket.
- 3 Fit the crankshaft sprocket within the loop of the timing chain (photo).
- 4 By turning the crankshaft and the camshaft and repositioning the crankshaft sprocket teeth in the links of the chain, a position



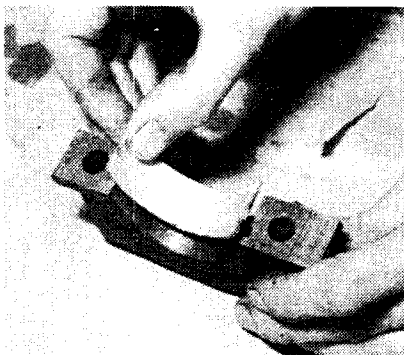
44.1 Fitting a main bearing shell



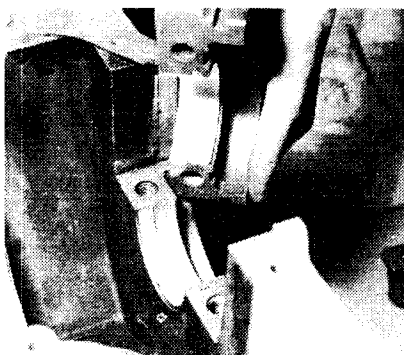
44.2 Fitting a crankshaft thrust washer



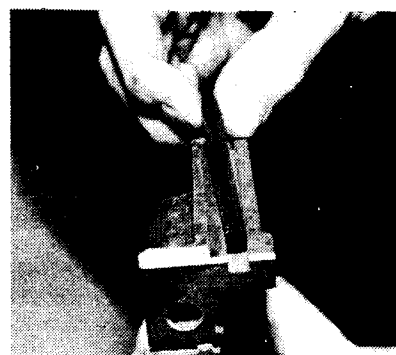
44.3 Fitting the crankshaft



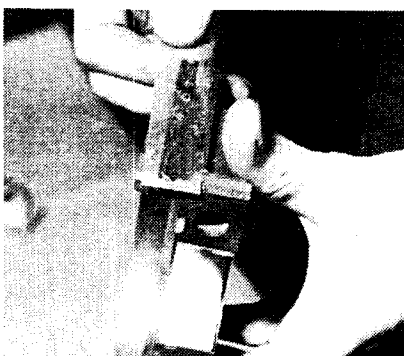
44.4 Fitting a shell to a main bearing cap



44.7 Fitting the front main bearing cap



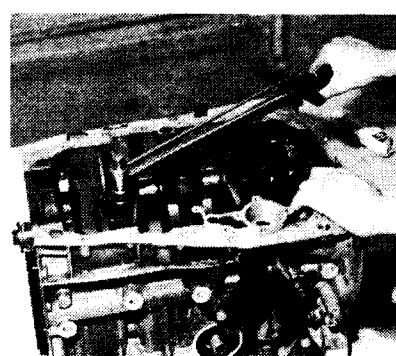
44.8 Fitting the front main bearing side seals



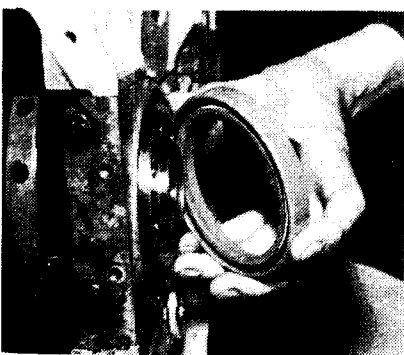
44.9A Taping the main bearing side seals



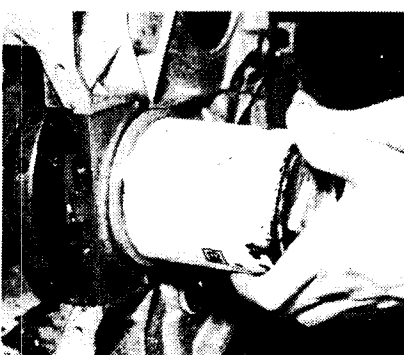
44.9B Withdrawing protective tape from the front main bearing side seals



44.10 Tightening a main bearing cap bolt



44.11A Locating a crankshaft front oil seal



44.11B Driving home the crankshaft front oil seal



45.2 Fitting a big-end bearing shell

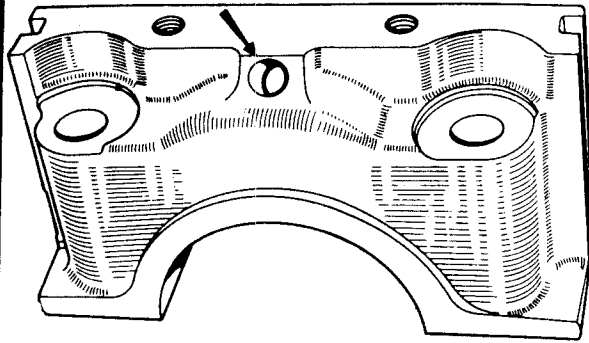


Fig.1.48 Front main bearing cap on type 697 engine (oil hole arrowed)

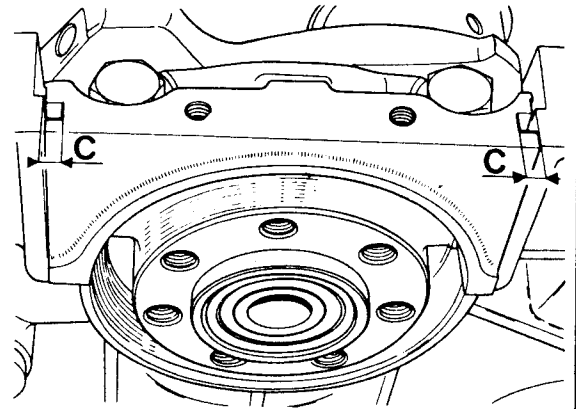


Fig.1.49 No.1 main bearing cap fitted to measure seal gap (C)

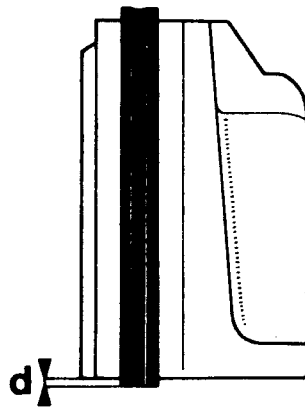


Fig.1.50 No.1 main bearing cap seal projection (D)

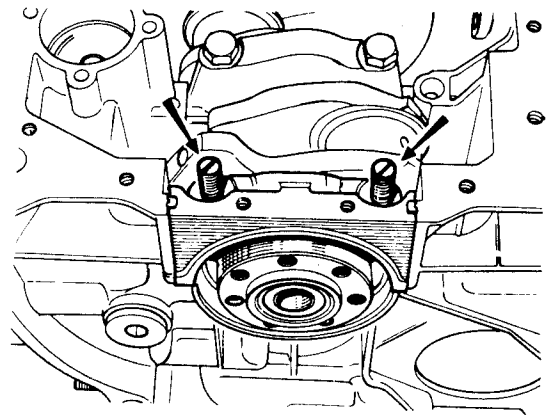


Fig.1.51 Locating studs temporarily fitted to No.1 main bearing cap

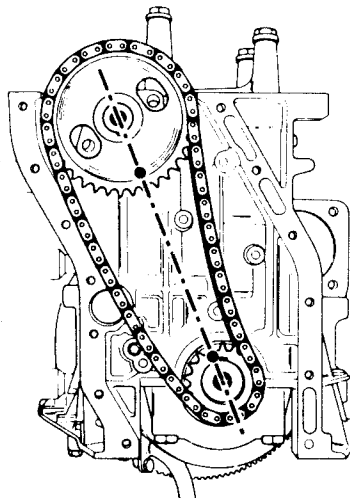


Fig.1.52 Correct alignment of camshaft and crankshaft sprockets

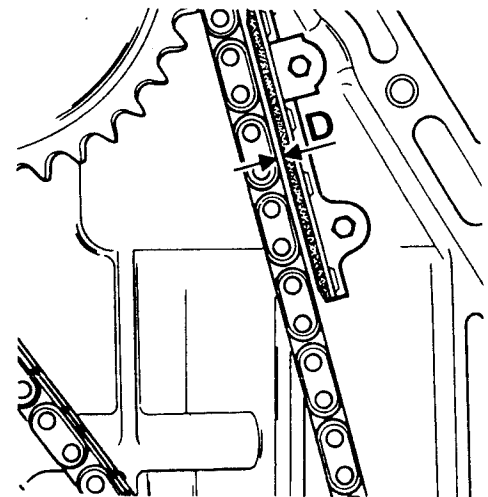


Fig.1.53 Timing chain to guard clearance (0.032 in 0.8 mm)



45.5 Correctly fitted piston rings



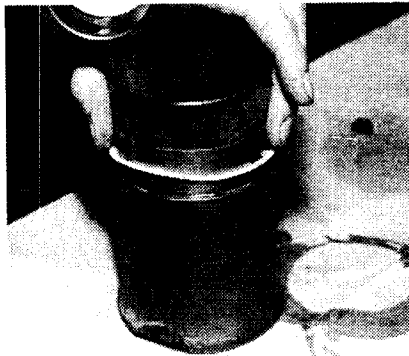
45.9A Fitting a piston ring clamp



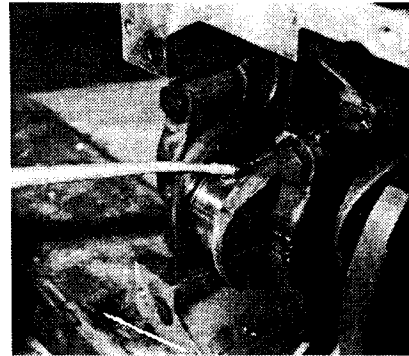
45.9B Sliding the piston/connecting rod assembly into its liner



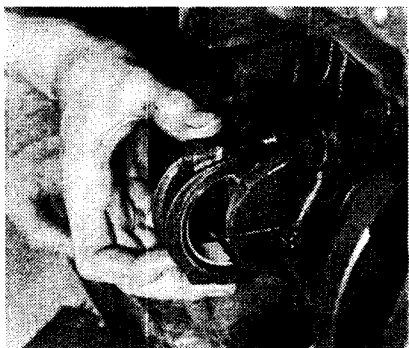
45.9C Piston crown directional arrow (faces front of engine)



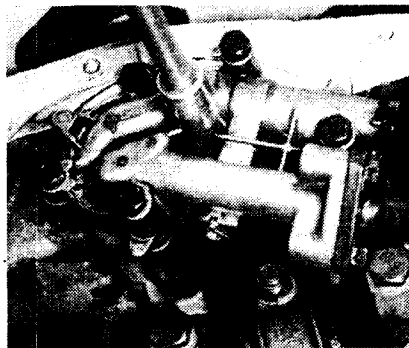
45.10. Locating a liner bottom seal



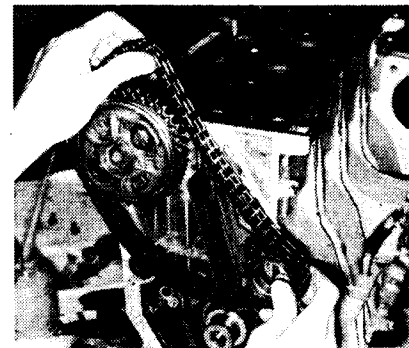
45.11A. Oiling the crankpins



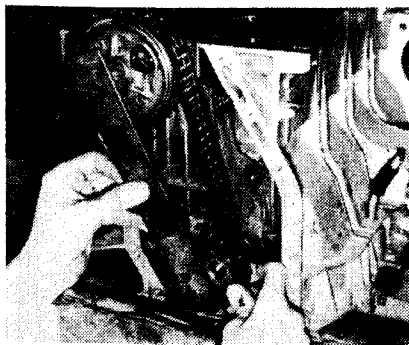
45.11B Fitting a big-end bearing cap



46.2 Fitting the oil pump securing bolts



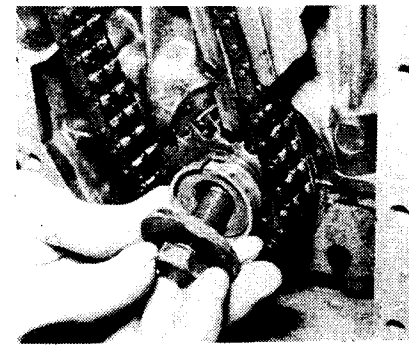
47.3 Fitting crankshaft sprocket to timing chain



47.4 Checking alignment of timing marks



47.5 Driving the crankshaft sprocket home



47.6 Fitting the crankshaft sprocket bolt

will be reached where the crankshaft sprocket can be slid onto its key and the timing marks on both sprockets will be in exact alignment with the shaft centres as shown in Fig.1.52 (photo).

5 Drive on the crankshaft sprocket using a tubular drift and at the same time push in the camshaft to its final position, keeping the chain as straight as possible (photo).

6 Fit the distance piece, thrust washer and bolt to the crankshaft, tightening the bolt to a torque of 45 to 58 lb ft (67 to 86.3 kg m) (photo).

7 Screw in the two camshaft flange bolts and bend down the tabs of the locking plates (photo).

8 Locate the plunger and spring into the slipper of the chain tensioner.

9 Fit the tensioner assembly (two bolts) together with its thrust plate (photo).

10 Insert a 0.118 in (3mm) Allen key into the retaining cylinder and turn clockwise until the slipper just touches the chain (photo). Remove the key and lock the cylinder bolt (photo).

11 Fit the chain anti-flail guards (one on Type 697 engine) so that there is a parallel gap between the guard and the chain of 0.032 inch (0.8 mm) as shown in Fig.1.53.

12 Stick new timing cover gaskets into position with grease and fit the cover and securing bolts finger tight (photo). Check that the edge of the timing cover is in alignment with the cylinder head mating surface of the crankcase before finally tightening the timing cover bolts.

13 Using a new gasket fit the camshaft front bearing (photo) which has been fitted with new seals as described in section 32. Fit the camshaft pulley so that the roll pins have their gaps as shown in Fig.1.54. Tightening the pulley belt will pull the roll pins into position.

48 Sump - refitting

1 Cut off the parts of the front (no. 1) main bearing side seals which were left standing proud.

2 Smear the mating faces of the crankcase with grease and stick the sump gaskets in position so that the bolt holes align.

3 Offer up the sump and screw all the bolts in finger tight. Tighten fully in diametrically opposite sequence.

4 Check the security of the sump drain plug.

5 On the type 697 engine a flat or domed type sump pan may be met with in service. If a flat type is renewed with a domed type, then a different pattern oil pump strainer must be fitted.

49 Distributor drive gear - refitting

1 Turn the engine so that no. 1 piston is at TDC (firing) this will position the cams at number 4 cylinder in balance and no. 1 cams with their circular profiles uppermost.

2 Insert the oil pump/distributor drive gear to mesh with the camshaft gear as follows (Photo) with type 697 and 821 engines the slot must be parallel with the centre of the engine and the small D segment nearest the camshaft, Fig.1.55. With type 807 engines, position the drive so that the small D segment is nearest the camshaft and the slot at an angle of 53° (A) as shown in Fig.1.56. An additional guide to location is provided by the flat (P).

3 Pour some engine oil into the cavity below the camshaft.

50 Valves - reassembly

1 Apply engine oil to the valve stems and slide them back into their original position in the cylinder head.

2 Fit the base washers, the valve springs and the spring cap. (photo).

3 Using a compressor, compress the valve springs so that the split collets may be located in the recess in the valve stem. (photo) The use of a little grease will help to keep the collets in position while the compressor is released. Note the different types of collets used for inlet and exhaust valves, Fig.1.25.

4 Once all the valves have been reassembled, tap the ends of the stems with a soft faced hammer to ensure that the collets are correctly seated.

51 Rocker shafts - reassembly

1 With type 697 and 821 engines simply slide on the pillars, rocker arms and springs in the order shown in Fig.1.57. Note that the rocker shaft holes should be towards the pushrod side and the pillar bolt holes must align with the holes in the shaft to permit passage of the retaining bolts.

2 With type 807 engines, commence by sliding the two shafts into the pillar which is fitted at the clutch end, Fig.1.58 noting that both this pillar and all the others will have their machined faces towards the clutch end of the engine when finally installed. Fit the roll pin to secure the inlet valve rocker shaft. Fit the components to both shafts and then secure the exhaust valve rocker shaft with a roll pin (Fig.1.24). The correct location of the type 807 rocker gear is shown diagrammatically in Fig. 1.59.

3 During assembly of both types of rocker gear, oil the components liberally.

52 Cylinder head - refitting

1 Ensure that the cylinder head and cylinder block mating faces are scrupulously clean.

2 Insert the tappets into their original cylinder head locations and tap each one lightly to retain them in their bores when the head is being lowered (photo). Application of some stiff grease to the tappets will assist their retention.

3 Tap the cylinder head locating dowel into position in the top face of the cylinder block. Remove the liner clamps.

4 Clean out the cylinder block blind bolt holes as any trapped oil will prevent correct head fitting.

5 The following operations require extreme accuracy and care, if the fitting of the cylinder head is to give a leak-free installation and the maintenance of good performance. **Do not use gasket cement.**

6 Carefully position a new gasket on the top face of the cylinder block. Check that all the bolt and water holes are clear. (Photo)

7 Fit the rubber seal round the edge of the tappet chamber ensuring that its ends dovetail into (not overlap) the cylinder head gasket. It should be noted that with type 697 engines two different designs of tappet chamber seals are available according to the number of cylinder bolt holes (5 or 9 holes) and the appropriate type of seal should be ordered in advance of requirement.

8 With type 807 engines, the rocker shaft assemblies should be positioned on the cylinder head before it is installed. With other types of engine, fit the cylinder head and then install the rocker assembly.

9 Lower the cylinder head extremely carefully into position on the block and then check the alignment of the distributor hole by testing the distributor in position and adjusting the head fractionally until the distributor is a perfect sliding fit into its location. Install the sparking plug tubes.

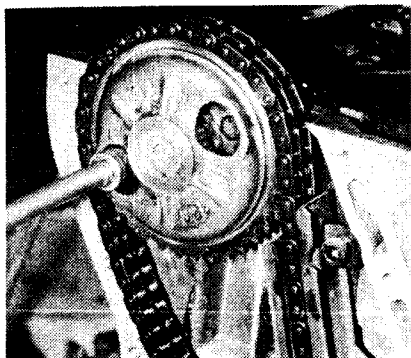
10 Smear the cylinder head bolt threads with heavy grease and screw them into position. Note that the two shorter ones are located at the timing cover end. If the cylinder head is being refitted with the engine in position in the car, remember to insert the two rearmost bolts into the rocker pillars and retain them with an elastic band (Fig.1.23) **before** installing the head (80) engine (photo).

11 Oil the washers which are fitted under the cylinder head bolt heads and then screw in all the bolts finger tight.

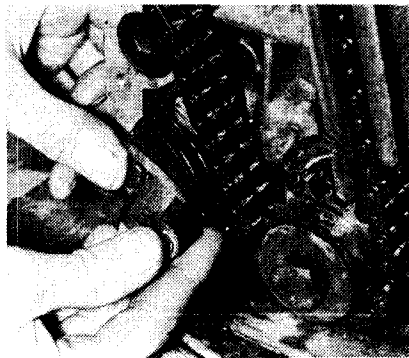
12 Using a torque wrench, tighten the cylinder head bolts in three separate stages and in the sequence shown in Fig.1.60 (the illustration shows the combined rocker pillar/cylinder head bolts on the type 807 engine (Photo)). With the 697/821 engines, the cylinder head bolts do not secure the rocker pillars but should be tightened in the same relative order.

Stage 1. Tighten to 30 lb/ft (44.6 kg/m) COLD.

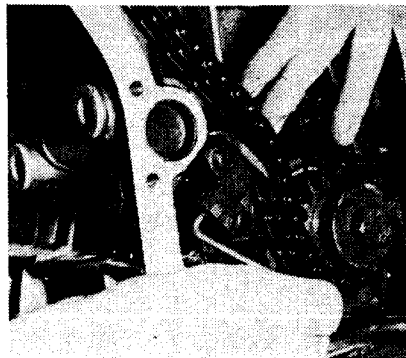
Stage 2. Tighten to 50 - 55 lb/ft (74 to 82 kg/m) for type 697 and 821 engines, tighten to 55 - 60 lb/ft (82 to 89.3 kg/m) for



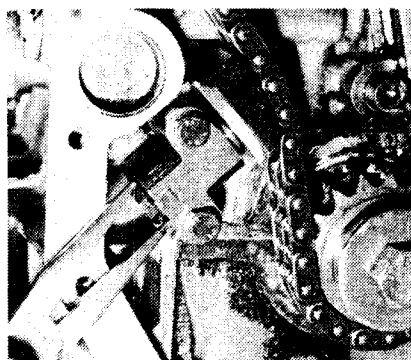
47.7 Tightening the crankshaft flange bolts



47.9 Fitting the timing chain tensioner securing bolts



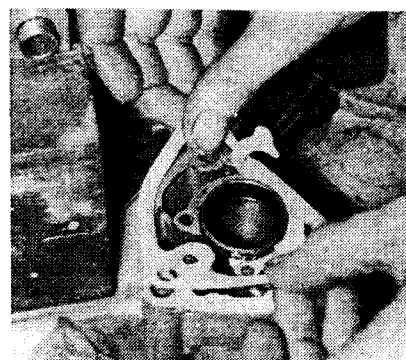
47.10A Adjusting the timing chain tensioner



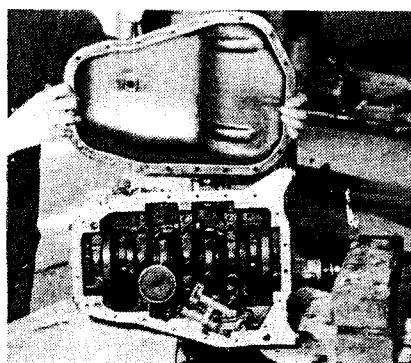
47.10B Bending the timing chain tensioner bolt tab



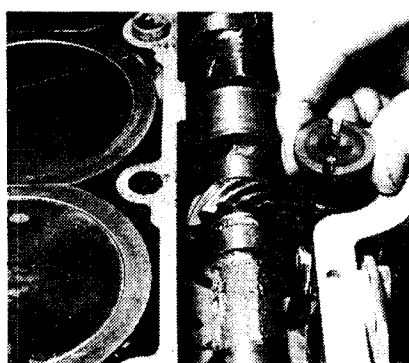
47.12 Fitting a timing cover gasket



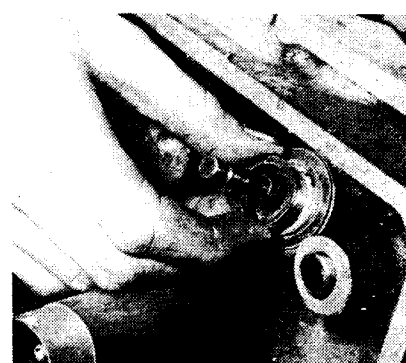
47.13 Fitting a camshaft bearing gasket



48.2 Correct location of the sump gasket



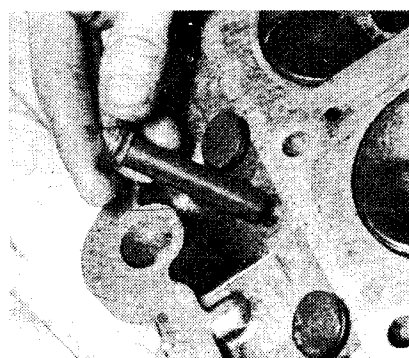
49.2 Inserting the oil pump/distributor drive



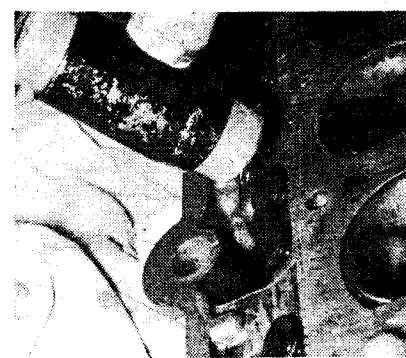
50.2 Fitting a valve spring base washer



50.3 Fitting the valve collets



52.2A Inserting the tappets



52.2B Tapping the tappets to retain them in position

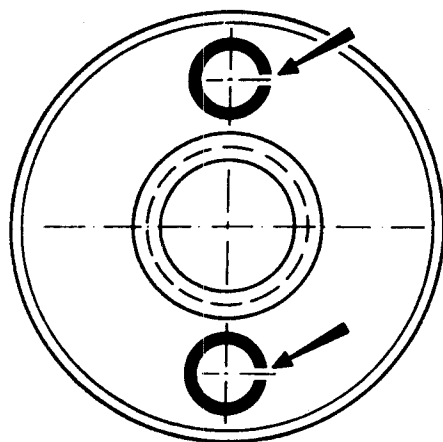


Fig.1.54 Correct gap position of camshaft roll pins

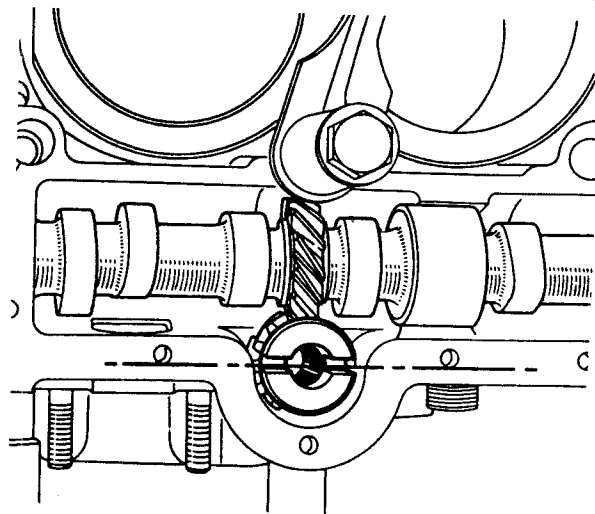


Fig.1.55 Smaller segment location on distributor drive shaft (type 697 and 821 engines)

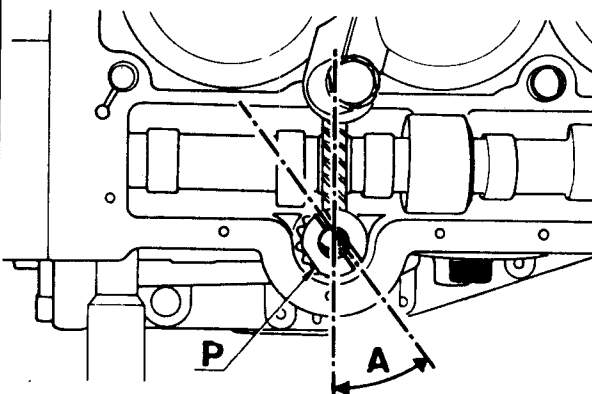


Fig.1.56 Smaller segment location on distributor drive shaft (type 807 engines) A is 53° P is flat

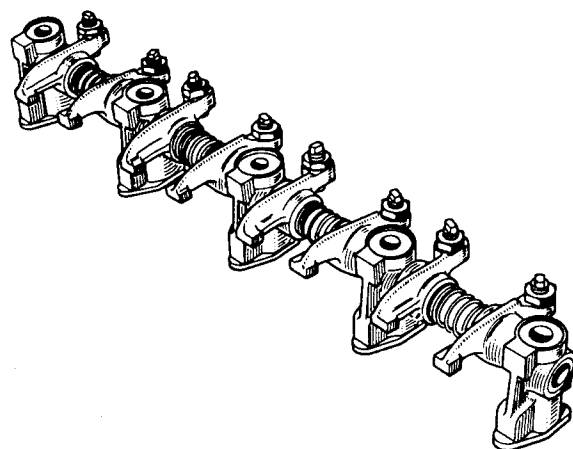


Fig.1.57 Components of the rocker shaft correctly fitted (type 697 and 821)

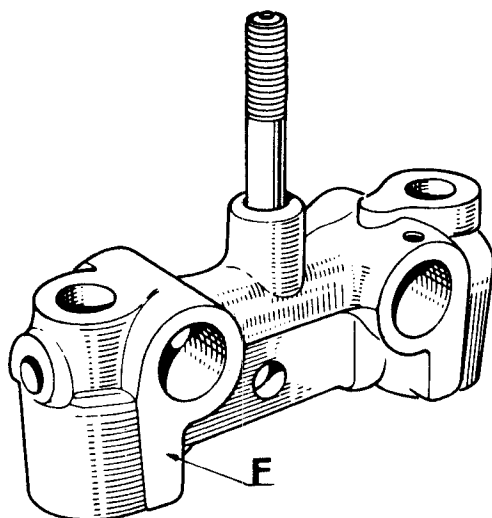


Fig.1.58 Rocker pillar (type 807 engine) F is machined face

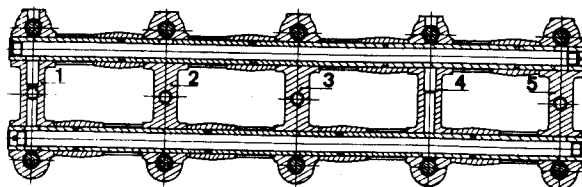


FIG.1.59 ROCKER GEAR FITTED TO TYPE 807 ENGINE

Rocker pillars 1 and 4 are similar but 1 has roll pin hole
Rocker pillars 2, 3 and 5 are similar but 5 has roll pin hole
Rocker pillar 4 has no stud hole

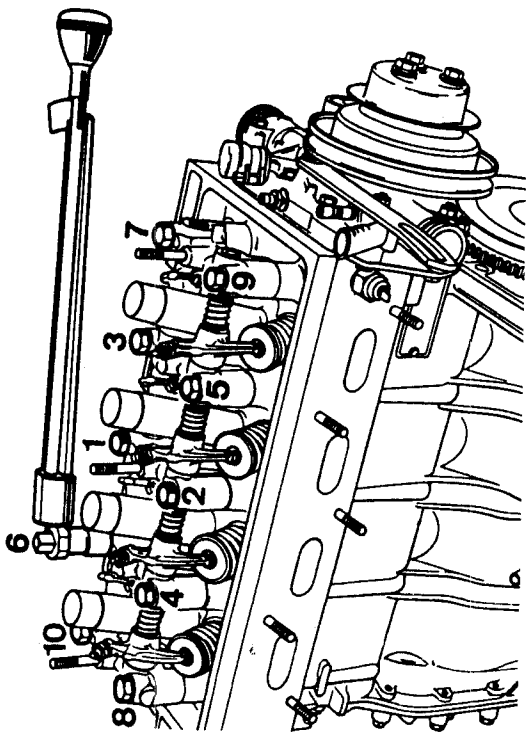
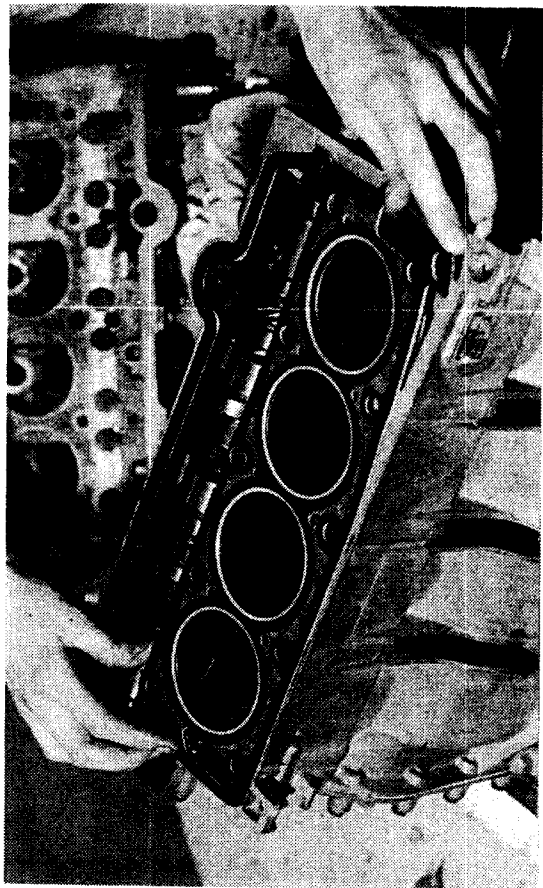
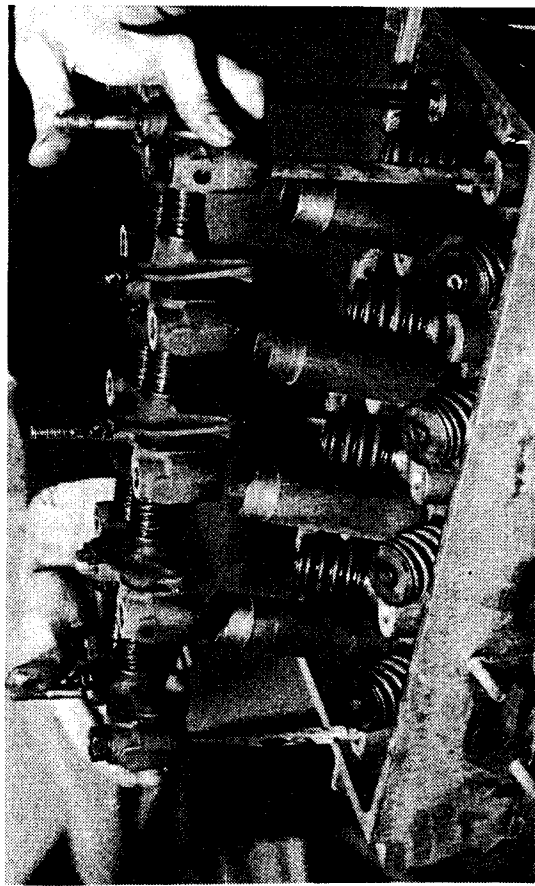


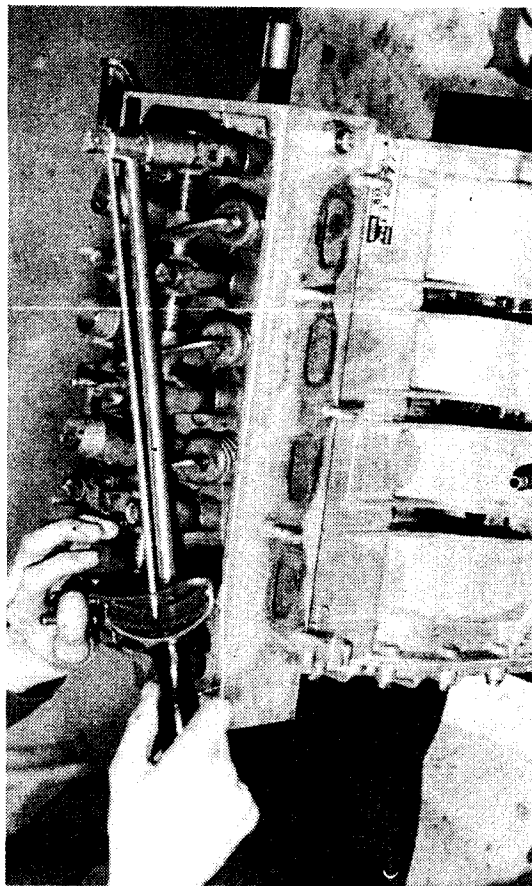
Fig.1.60 Cylinder head bolt tightening sequence



52.6 Locating a new cylinder head gasket



52.10 Installing the rocker gear and end bolts (807 type engine)



52.12 Tightening the dual purpose rocker pillar/cylinder head bolts on a type 807 engine

type 807 engines. COLD.

Stage 3. Start the engine and let it reach normal running temperature, switch off and allow it to cool for 50 minutes. Tighten 807 bolts to 60 - 65 lb/ft (89.3 to 96.7 kg/m) and 697 and 821 bolts to 55 - 60 lb/ft (32 to 89.3 kg/m).

13 After the first 300 miles (500 km) repeat the stage 3 operations and re-check the valve clearances.

Note that before tightening a bolt to a specified torque, the bolt should first be unscrewed by a quarter of a turn.

14 With type 697 and 821 engines, install the rocker shaft assembly, tightening the securing nuts to a torque of 15 - 20 lb/ft (22.3 - 29.8 Kg/m).

15 Fit the pushrods, ensuring that they are returned to their original locations. Push rod installation is achieved by pushing each rocker arm against its shaft coil spring to obtain access to the push rod hole in the cylinder head. In some cases, it may be necessary to slack off the adjuster screw and locknut completely and to rotate the engine in order to bring the tappet to its lowest point of travel before the push rod can be fitted. Note that the push rods fitted to the type 807 engine are of different length, the shorter ones being the inlet ones and the longer ones the exhaust ones.

53 Valve/Rocker clearances - adjustment

1 Final and precise adjustment of the valve stem to the rocker arm clearances will be carried out with the engine temperature as described for Stage 3 cylinder head bolt tightening in the preceding section. Approximate settings made when the engine is on the bench will require rotation of the engine and this may be done by turning the exposed flywheel or connector plate. When the engine is in the car and a manual gearbox is fitted, top gear should be engaged and the starting handle dog utilised or a front road wheel jacked up and turned. With automatic transmission cars, neither of these methods are possible and 'inching' the engine while using the starter motor will have to be resorted to. On no account try and rotate the engine by using a spanner on the camshaft pulley securing nut.

2 Turn the engine by means of one of the methods described until no. 1 piston is at T.D.C. on the compression stroke. This may be ascertained by placing a finger over no. 1 plug hole and feeling the build-up of pressure. A rod placed in the plug hole will indicate the highest point of travel of the piston which will be for all practical purposes T.D.C.

Both valves for that particular cylinder will now be fully closed and the clearances should be checked using feeler gauges (photo). The correct clearances are INLET 0.008 in (0.20 mm) EXHAUST 0.010 in (0.25 mm).

3 If the clearance requires adjustment, loosen the locknut, and with the feeler in position turn the adjuster screw until the feeler blade is nipped and will not move. Now unscrew the adjuster until the feeler blade is a stiff sliding fit. Tighten the locknut and recheck the clearance. (photo).

4 Repeat the adjustment procedure on the other valves bearing in mind the engine firing order (1 - 3 - 4 - 2) as if the cylinders are tackled in this sequence, much less engine turning will be required. With type 807 engine the inlet valves are on the right when viewed from the front of the car. With type 697 and 821 engines, inlet valves are 2 - 3 - 6 - 7 and exhaust valves 1 - 4 - 5 - 8 when counted from the front of the car.

54 Inlet and exhaust manifolds - refitting (type 807 engine)

1 Clean the mating faces of both inlet and exhaust manifolds and the cylinder block.

2 Ensure that the distributor, rocker cover and fuel pump have not yet been fitted as the manifolds cannot be located with these components in position.

3 Check that the coolant passages are clear in the inlet manifold and free from scale and sludge.

4 Fit the four small gaskets to the inlet manifolds (dry),

checking that the water passages are clear (photo).

5 Fit the single gasket to the exhaust manifold (photo) again dry without the application of jointing compound.

6 Locate the manifolds on their studs and fit the plain washers, lock washers and nuts, tightening them to (exhaust 15 - 25 lb/ft 22 - 37 kg/m) and (inlet 20 - 25 lb/ft 29.8 - 37 kg/m). (photo).

7 When securing the exhaust manifold, attach the heat shield and dipstick tube.

55 Inlet and exhaust manifolds - refitting (types 697/821)

1 With these types of engine, the inlet and exhaust manifold is combined assembly, Fig.1.61.

2 Fit the gasket and tighten the nuts and bolts to 10 - 20 lb/ft (14.9 - 29.8 kg/m).

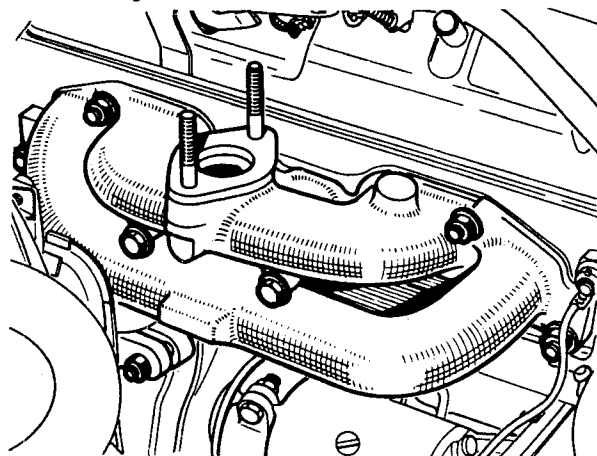


Fig.1.61 Inlet and exhaust manifold bolts and nuts (type 697 and 821 engines)

56 Flywheel and clutch - reassembly

1 Carefully clean the mating faces of the flywheel and the camshaft flange.

2 Check that the oil drain hole from the flywheel recess is clear by probing with wire.

3 Locate the flywheel on the crankshaft flange and fit a new lockplate and screw in one bolt to retain the components (photo).

4 Screw in the remaining bolts, finger tight. Tighten them in diametrically opposite sequence to 40 lb/ft (59.5 kg/m) holding the flywheel against the direction of rotation if necessary, but inserting a screwdriver in the ring gear and levering against the gearbox mating dowel (photo).

5 Secure the securing bolts by bending up the tabs of the locking plate (photo).

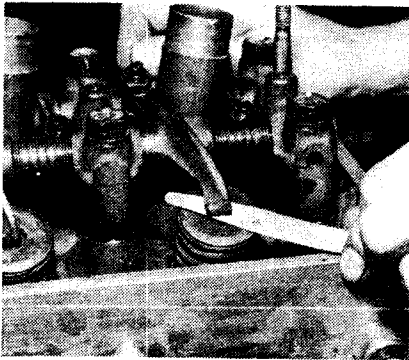
6 Place the clutch friction disc against the face of the flywheel, ensuring that the friction disc centre splined hub has its longest boss towards the gearbox.

7 Fit the pressure plate assembly in position on the flywheel and screw in the securing bolts finger tight. Now tighten each bolt in diametrically opposite sequence just two turns each.

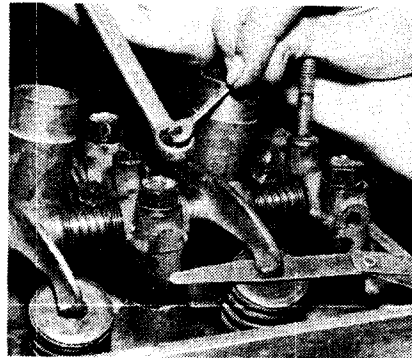
8 With the driven plate (friction disc) only under slight pressure it must be centralised. Use an old gearbox primary shaft stepped dowel or a screwdriver and centralise the splined hub with the spigot bush in the flywheel (photo). The object of this operation is to enable the gearbox primary shaft to pass through the driven plate hub and engage with the flywheel spigot bush. If the plate is not exactly central, the force of the pressure plate when finally tightened down will not permit the plate to move sideways order to create the correct alignment.

9 Fully tighten the pressure plate cover bolts.

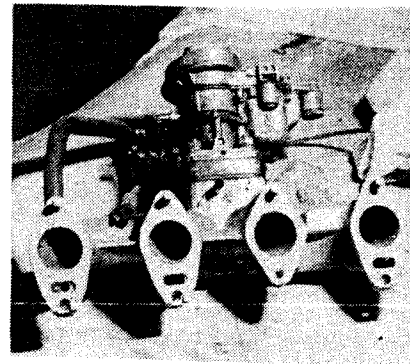
10 The components of the clutch, including the release mechanism should all be checked (before fitting to the engine) as described in Chapter 5.



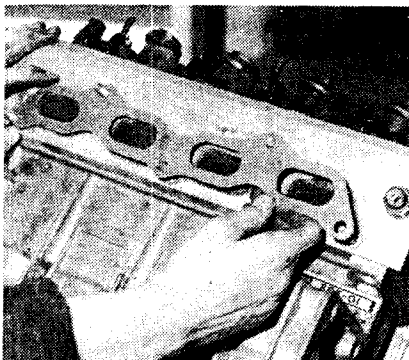
53.2 Checking a valve clearance



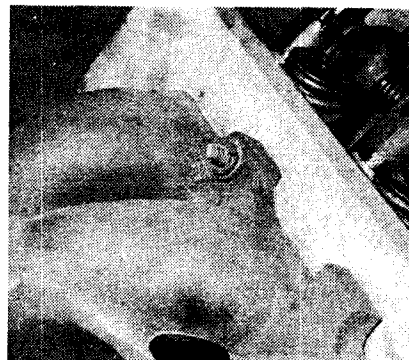
53.3 Adjusting a valve clearance



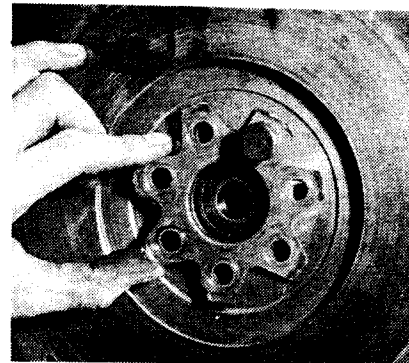
54.4 Inlet manifold, type 807 engine



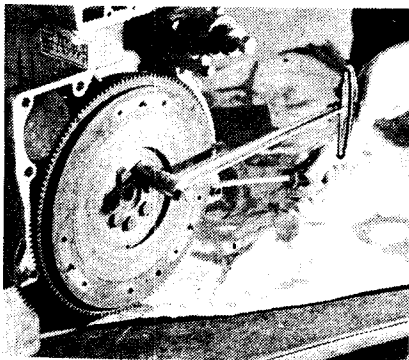
54.5 Exhaust manifold gasket, type 807 engine



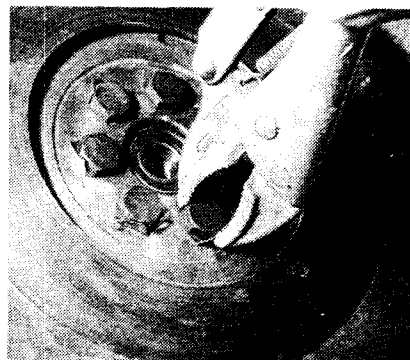
54.6 Exhaust manifold stud showing plain and lock washer



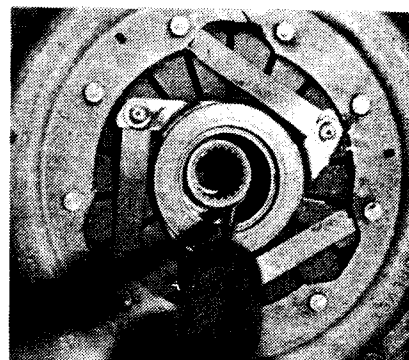
56.3 Fitting a flywheel lockplate and bolt



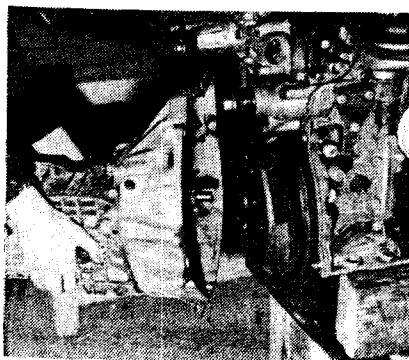
56.4 Tightening the flywheel securing bolts



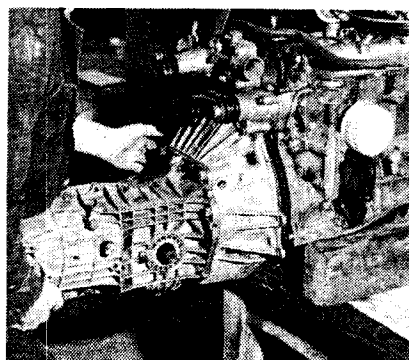
56.5 Bending the flywheel bolt locking plate tabs



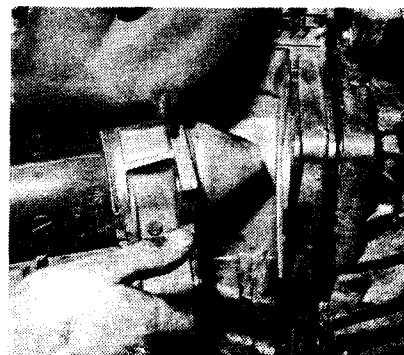
56.8 Centralising the clutch driven plate



57.2 Mating the gearbox/transmission with the engine



57.3 Final location of the gearbox and engine



57.4 Fitting the starter motor

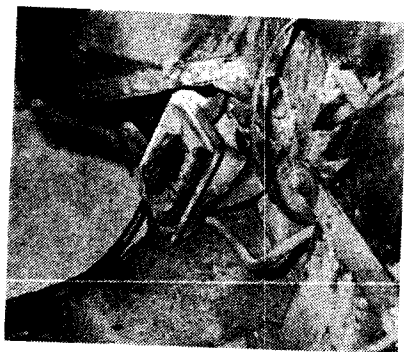
11 With model 1153TA vehicles which are fitted with automatic transmission, the connector plate will be fitted to the camshaft as opposed to a flywheel and clutch mechanism. Fuller details of the components concerned are given in Chapter 7 together with full fitting procedure.

57 Engine to gearbox/transmission - refitting

- 1 Check that the release bearing and lever are correctly located as described in Chapter 5.
- 2 Adequately support the engine and gearbox/transmission units at the same relative height so that the gearbox primary shaft will slide in horizontally into the splined hub of the friction disc (photo).
- 3 The help of an assistant to keep the engine still will be useful. Keep the gearbox - transmission quite level and push it into engagement with the engine. In order to engage the primary shaft of the gearbox with the driven plate splines and finally with the flywheel bush, it may be necessary to turn the gearbox unit slightly or to raise or lower it fractionally, but on no account allow the weight of the gearbox - transmission unit to hang upon the clutch assembly while the primary shaft is passing through it and support it at all times (photo).
- 4 Refit the bell housing securing bolts and fit the starter motor (lower securing bolts only) (photo).
- 5 Locate the rocker cover using a new gasket if required.
- 6 The combined engine/gearbox - transmission unit is now ready for refitting to the engine compartments.
- 7 Before coupling an automatic gearbox, remember to remove the connector retaining plate fixed on dismantling.

58 Engine - replacement

- 1 Clean the engine compartment and tie back any cables and wires.
- 2 Check the condition of the engine (two) rear mountings and the single mounting which supports the front of the gearbox. If the rubber shows signs of deterioration or is oil soaked, renew them (photo).
- 3 Fit the rope slings or lifting attachment.
- 4 Using the hoist or crane, lift the unit into the engine compartment at a steep angle with the gearbox end pointing upwards (photo).
- 5 When the unit has been manoeuvred to within 8 inches (203.2 mm) approximately of its final location, fit the starter motor leads (photo).
- 6 Continue to move the unit until the rear mounting bolts can be fitted. Use a screwdriver to align the mounting holes so that the bolts will pass through the holes easily without damaging the threads (photo).



58.2 Engine mounting showing signs of deterioration



58.4 Hoisting the engine/transmission unit into the car



58.5 Fitting the starter motor leads

7 With the weight of the engine still held by the hoist, use the scissors type jack as used for removal (section 5 paragraph 40) to refit the drive shafts. Remember to lubricate the splines with Molykote grease, use new roll pins (photo) sealing the ends with recommended sealer and, above all, keep the restraining clips in position on the shafts until the front gearbox mounting has been connected. Should you inadvertently pull the drive joints apart, refer to Chapter 8 for the refitting procedure.

8 Place a jack under the gearbox - transmission unit and remove the lifting tackle. Carefully lower the unit so that the front gearbox mounting can be connected (photo).

9 Remove the jack, fit the radiator support bracket, and the radiator (photo).

59 Ancillaries and connections - refitting and remaking

1 This is a reversal of removal and disconnection operations listed in section 5 of this Chapter.

2 The following groups of components are given as a check list and any specific fitting procedure is described in the following paragraphs.

Cooling system

- 3 Connect the radiator hoses (photo).
- 4 Connect the heater hoses.
- 5 Connect the manifold water hoses.
- 6 Refill the cooling system as described in the next Chapter.

Fuel System

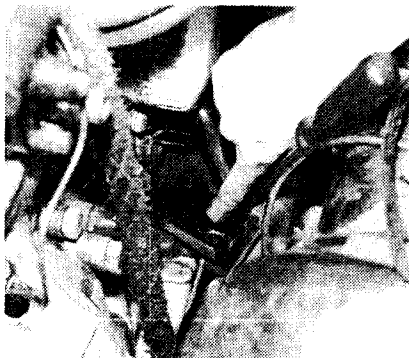
- 7 Refit the air cleaner.
- 8 Refit the accelerator linkage (photo).
- 9 Refit the engine breather hose (photo).
- 10 Refit the vacuum hoses (distributor and brake servo).
- 11 Refit the fuel pipes to pump, carburettor and tank. (photo)
- 12 Refit exhaust manifold to pipe.
- 13 On type 807 engines, fit the flame trap capsule and pipe

Steering gear

- 14 Refit the steering gear crossmember assembly (photo).
- 15 Re-connect the steering eye bolts (photo).
- 16 Reconnect the steering column flexible joint (photo).

Transmission

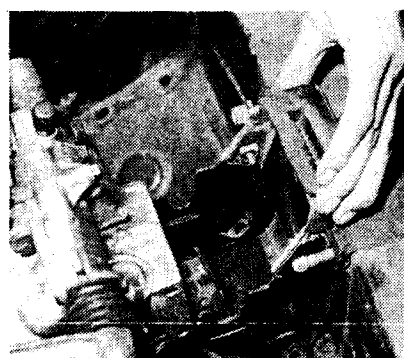
- 17 Reconnect the gearchange link arm (photo).
- 18 Reconnect the clutch cable to release arm and adjust the clutch free movement (see Chapter 5).
- 19 Refit the speedometer drive cable to gearbox and centrifugal



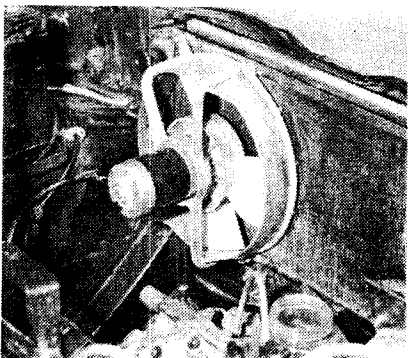
58.6 Prising the engine mountings to align the bolt holes



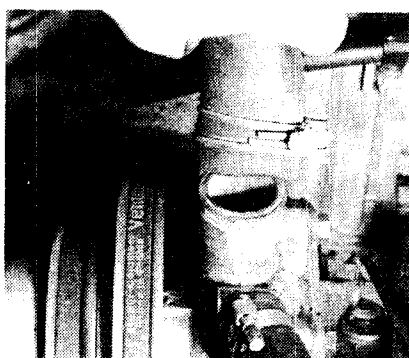
58.7 Fitting a roll pin to a drive shaft



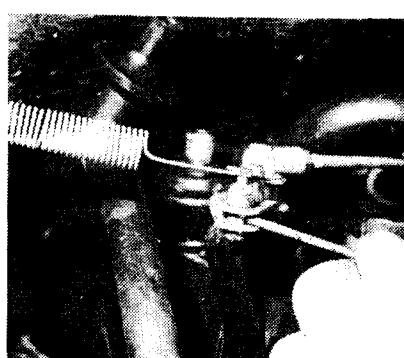
58.8 Connection of the gearbox front mounting



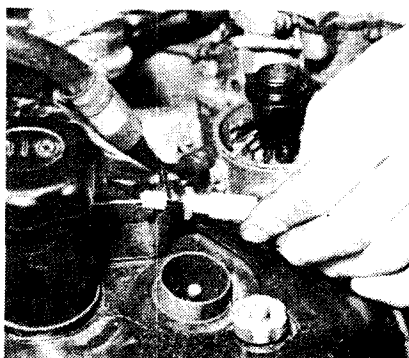
58.9 The radiator and fan in position



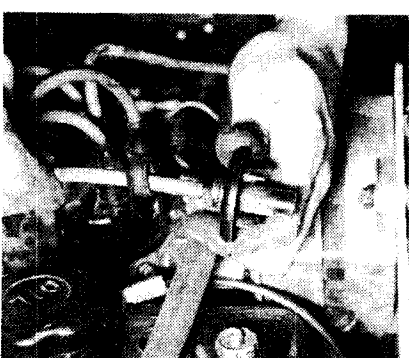
59.3 Connecting the radiator hoses



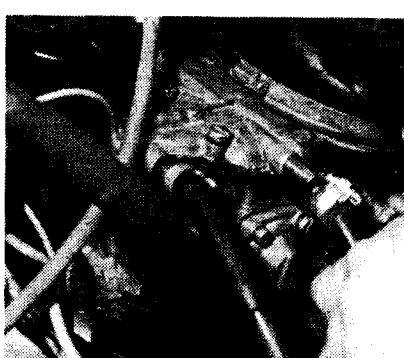
59.8A Refitting the accelerator linkage



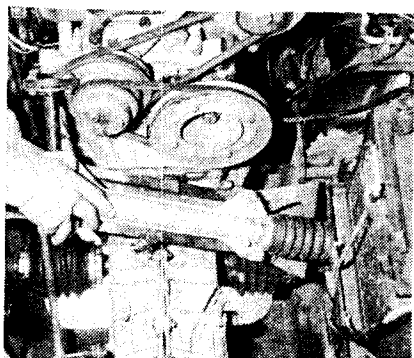
59.8B Accelerator cable bracket on rocker box cover



59.9 Engine breather hose



59.11 Refitting the fuel pipes to carburettor



59.14 Refitting the steering assembly attached to its crossmember



59.15 Connecting the steering eye bolts



59.16 Reconnecting the steering column flexible joint

switches (photo).

20 With automatic transmission, reverse the disconnection procedure given in section 6 of this Chapter.

Electrical

20 Connect the earth straps.

21 Connect oil and water transmitter leads.

22 Alternator leads and alternator to its mountings.

23 Connect the radiator cooling fan leads.

24 Fit the sparking plugs and coil.

25 Fit the distributor (photo). The distributor should only require dropping into its recess and turning the shaft until the large and small segments of the drive shaft mate. This will automatically provide the correct engine timing and can be checked by fitting the rotor arm and noting that it is pointing to no. 1 plug contact in the distributor cap when the engine is in the position of no. 1 piston at T.D.C on compression stroke. Where the timing is incorrect, then refer to section 49 and refit the distributor drive shaft to the camshaft as fully described.

26 Connect the HT and LT ignition leads.

27 Connect the battery (photo).

Drive belts

28 The two drive belts (camshaft to water pump and water pump to alternator) must be fitted with care to avoid early destruction of belts and heavy loading of water pump or alternator bearings. Release the alternator strap adjuster bolt and push the alternator in towards the engine. Slip the belt over the alternator and water pump pulleys and then prise the alternator away from the engine until the belt is fairly taut. Tighten the adjuster strap bolt when the belt can be pushed and pulled in the centre of its longest run to give a total deflection of between 5/32 in and 15/64 in (4 to 6 mm) for new belts on type 697 and 821 engines. For type 807

engines, the deflection is 1/8 in to 11/64 in (3 to 4.5 mm). Where belts are being refitted which have seen previous service then the deflection should be 9/32 in to 3/8 in (7 to 9.5 mm) and 13/64 in to 5/16 in (5 to 8 mm) respectively.

29 Fit the primary drive belt to the water pump pulley. Fit the camshaft belt driving pulley flange within the loop of the belt and then fit the pulley flange to the end of the camshaft. Refit any shims and fit the securing nuts finger tight only. Tighten the camshaft pulley nuts whilst rotating the engine. The correct mid-way deflection of the water pump to the camshaft belt is a total of 5/32 in (3.96 mm) for those fitted to type 697 and 821 engines and 1/8 in (3.2 mm) for belts fitted to type 807 engines. Where this deflection is incorrect, loosen the camshaft pulley flange nuts slightly and prise the flange away from the water pump at the same time turning the engine. Retighten the nuts when belt tension is correct.

30 Fit the spare wheel carrier, the spare wheel and the bonnet.

60 Engine - initial start up after major overhaul

1 Refill the engine and gearbox - transmission units with the correct grade and quantity of oil. (photo)

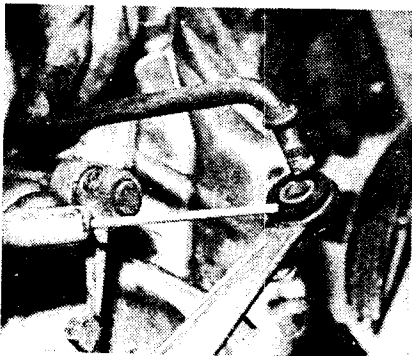
2 Check that there is fuel in the tank and turn the engine over on the starter to prime the fuel pump.

3 Start the engine with the carburettor set to a fast tick over and then inspect for leaks.

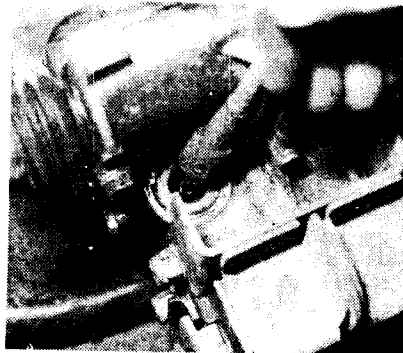
4 Give the car a test run and with the engine at the normal working temperature adjust the carburettor as described in Chapter 3.

5 Check the torque of the cylinder head bolts as described for stage 3 section 52, adjust the valve clearances.

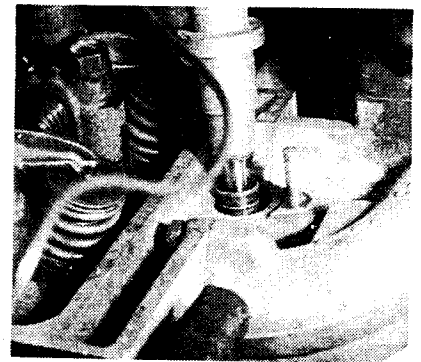
6 Repeat the operations described in the preceding paragraph after 500 miles (800 km) and change the engine oil.



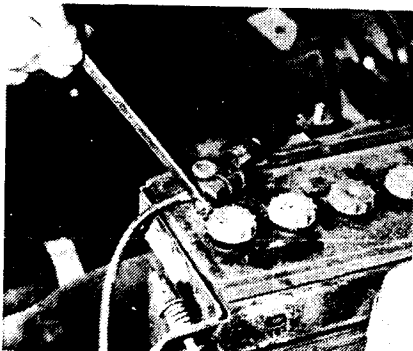
59.17 Connecting the gearchange link arm



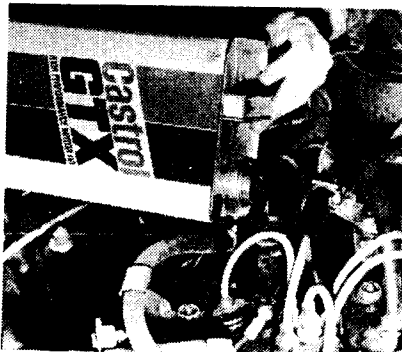
59.19 Reconnecting the speedometer cable



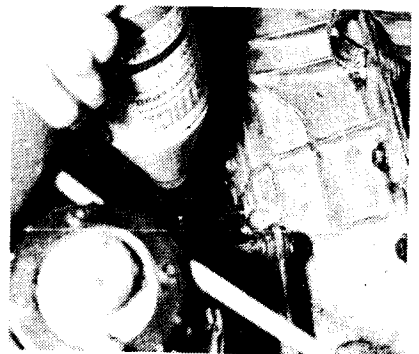
59.25 Fitting the distributor



59.27 Connecting the battery earth lead



60.1A Filling the engine with oil



60.1B Filling the gearbox/transmission unit.

Symptom	Reason/s	Remedy
No current at starter	Flat or defective battery Loose battery leads	Charge or replace battery. Push - start car. Tighten both terminals and earth ends of earth lead.
Current at starter motor	Defective starter solenoid or switch or broken wiring Engine earth strap disconnected Jammed starter motor drive pinion Defective starter motor	Run a wire direct from the battery to the starter motor or by - pass the solenoid. Check and retighten strap. Place car in gear and rock from side to side. Alternatively, free exposed square end of shaft with spanner. Remove and recondition.
No spark at sparking plug	Ignition damp or wet Ignition leads to spark plugs loose Shorted or disconnected low tension leads Dirty, incorrectly set, or pitted contact breaker points Faulty condenser Defective ignition switch Ignition leads connected wrong way round Faulty coil Contact breaker point spring not set or broken	Wipe dry the distributor cap and ignition leads. Check and tighten at both sparkplug and distributor cap ends. Check the wiring on the CB and SW terminals of the coil and to the distributor. Clean, file smooth, and adjust. Check contact breaker points for arcing, remove and fit new. By - pass switch with wire. Remove and replace leads to spark plugs in correct order. Remove and fit new coil. Check spring is not touching metal part of distributor. Check insulator washers are correctly placed. Renew points if the spring is broken.
No fuel at carburettor float chamber or at jets	No petrol in petrol tank Vapour lock in fuel line (In hot conditions or at high altitude) Blocked float chamber needle valve Fuel pump filter blocked Choked or blocked carburettor jets Faulty fuel pump	Refill tank! Blow into petrol tank, allow engine to cool, or apply a cold wet rag to the fuel line. Remove, clean, and replace. Remove, clean, and replace. Dismantle and clean. Remove, overhaul, and replace.
Excess of petrol in cylinder or carburettor flooding	Too much choke allowing too rich a mixture to wet plugs Float damaged or leaking or needle not seating Float lever incorrectly adjusted	Remove and dry sparking plugs or with wide open throttle, push - start the car. Remove examine, clean and replace float and needle valve as necessary. Remove and adjust correctly.
No spark at spark plug	Ignition failure - Sudden Ignition failure - Misfiring precludes total stoppage Ignition failure - In severe rain or after traversing water splash	Check over low and high tension circuits for breaks in wiring Check contact breaker points, clean and adjust. Renew condenser if faulty.
No fuel at jets	No petrol in petrol tank Petrol tank breather choked Sudden obstruction in carburettor(s) Water in fuel system	Dry out ignition leads and distributor cap. Refill tank. Remove petrol cap and clean out breather hole or pipe. Check jets, filter, and needle valve in float chamber for blockage. Drain tank and blow out fuel lines.

Chapter 4 Ignition system

Contents

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Specifications

Firing order	1 3 4 2		
Ignition system	12v, battery, coil, camshaft driven distributor		
Distributor - Index Number			
Vehicle type	Compression ratio 8:6	Compression ratio 7:6	Static ignition timing °BTDC
R1150	4159 or 4160	4162, 4164, 4193, 4194	0 ± 2
1966, 1967, 1968			
R1150			
1969 model	4239 or 4240	4193, 4194	0 ± 1
R1151	4215 or 4217		2 ± 1
1968 model	4235, 4236, 4231, 4232	4237, 4238	0 ± 1
R1151	4215		0 ± 1
1969 model	4219, 4220		6 ± 1
R1152			
all years			
R1153			
all years			
Contact breaker gap	0.016 to 0.020 in (0.4 to 0.5 mm)		
Spark plugs	AC 45XL or AUTOLITE AG 32		
Model R1150	AC 44XL or MARCHAL 35 HS		
Model R1151	AC 44XL		
Model R1152	AC 44XL		
Model R1153	0.024 in (0.6 mm)		
Spark plug gap	Ducellier 2765A (12v)		
Coil type			

1 General Description

In order that the engine may run correctly it is necessary for an electrical spark to ignite the fuel/air mixture in the combustion chambers at exactly the right moment in relation to engine speed and loading. The ignition system is based on feeding low tension voltage from the battery to the coil where it is converted to high tension voltage. The high tension voltage is powerful enough to jump the gap between the electrodes of the sparking plugs in the cylinders many times a second under high compression, providing that the system is in good condition and all the adjustments are correct.

The system is divided into two circuits; the low tension and high tension.

The low tension (sometimes called primary) circuit consists of the battery, lead wire to the control box, lead from the control box to the ignition switch, lead from ignition switch to the coil low tension windings (SW or + terminal) and from the coil low tension windings (CB or - terminal) to the contact breaker points and condenser in the distributor.

The high tension circuit comprises the high tension or secondary windings in the coil, the heavily insulated lead from the coil to the distributor cap centre contact, the rotor arm, and the leads from the four distributor cap outer contacts (in turn) to the sparking plugs.

Low tension voltage is stepped up by the coil windings to high tension voltage intermittently by the operation of the contact points and the condenser in the low tension circuit. High tension voltage is then fed via the centre contact in the distributor cap to the rotor arm.

The rotor arm rotates clockwise at half engine revolutions inside the cap and each time it comes in line with one of the outer contacts in the cap the contact points open and the high voltage is discharged jumping the gap from rotor arm to contact and thence along the plug lead to the centre electrode of the plug where it jumps the other gap - sparking in the process - to the outer plug electrode and thence to earth.

The static timing of the spark is adjusted by revolving the outer body of the distributor in relation to the distributor shaft. This alters the position at which the points open in relation to the position of the crankshaft (and thus the pistons).

The timing is also altered automatically by a centrifugal device which further alters the position of the complete points mounting assembly in relation to the shaft when engine speed increases, and by a vacuum control working from the inlet manifold which varies the timing according to the position of the throttle and consequently load on the engine. Both of these automatic alterations advance the timing of the spark at light loads and high speeds. The mechanical advance mechanism consists of two weights, which move out from the distributor shaft as engine speed rises due to centrifugal force. As they move out, so the cam rotates relative to the shaft and the contact breaker opening position is altered.

The degree to which the weights move out is controlled by springs, the tension of which significantly controls the extent of the advance to the timing.

The vacuum advance device is a diaphragm and connecting rod attached to the cam plate. When the diaphragm moves in either direction the cam plate is moved, thus altering the timing. The diaphragm is actuated by depression (vacuum) in the inlet manifold and is connected by a small bore pipe to the carburettor body above the throttle flap.

- 4 Apply two or three drops of oil through the holes in the base plate in order to lubricate the centrifugal weight mechanism.
- 5 Check the contact breaker gap and condition of the points as described in Section 4.
- 6 Remove, clean and adjust the spark plugs as described in Section 13.
- 7 Wipe the external surfaces of all HT leads, and ignition components with a petrol moistened rag to remove oil film which might cause tracking. Wipe the inside of the distributor cap with a clean, dry non-fluffy rag.
- 8 Examine the condition of the ignition lead insulation periodically and renew them if signs of cracking or deterioration are observed.

3 Firing Sequence and Ignition Lead Positions

- 1 The firing order is 1 3 4 2. The distributor rotor revolves clockwise and the HT plug lead positions are as shown in the figure.
- 2 The procedure for removing and refitting the distributor drive gear and the correct meshing with the camshaft is fully described in Chapter 1.

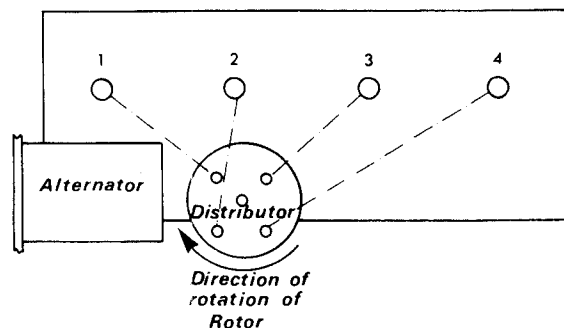
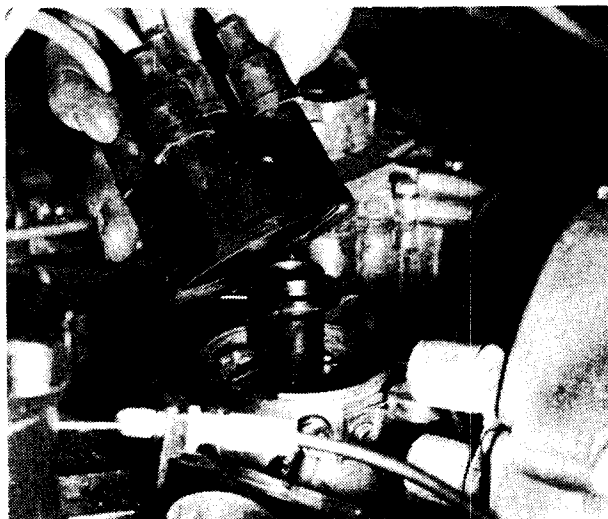


Fig.4.1 Sparking plug HT lead connections

2 Routine Maintenance

- 1 Every 5000 miles (8000 km) snap back the spring clips which hold the distributor cap in position and lift off the cap (photo).



2.1 Removing distributor cap

- 2 Pull the rotor arm from its spindle.
- 3 Apply a smear of petroleum jelly to the high points of the square contact breaker cam and apply two or three drops of engine oil to the felt pad which is located within the recess at the top of the cam spindle.

4 Distributor Contact Breaker Points - Adjustment

- 1 Snap back the distributor cap clips and remove the cap.
- 2 Pull off the rotor arm and remove the spark plugs (to facilitate rotation of the engine).
- 3 Either use the starting handle (if fitted) or jack up one of the front wheels and turn it (after engaging top gear) so that any one of the cam high points opens (fully) the contact breaker points. On automatic cars use the camshaft pulley wheel to turn the engine. Ensure that the fibre heel of the spring contact breaker arm is on the highest point of the cam.
- 2 Slacken the screw which secures the fixed contact breaker plate to the distributor base plate and move the fixed contact breaker until, using feeler gauges the gap between the points is between 0.016 and 0.020 inch (0.4 to 0.5 mm), (photo).
- 3 Tighten the locking screw and re-check the gap. Ideally, the feeler gauge should just fall by its own weight when in position between the points and the gap is correct.
- 4 Refit the rotor, distributor cap and spark plugs and their leads.

5 Contact Breaker Points - Removal, Servicing, Refitting

- 1 At the time of checking the contact breaker points gap, examine the faces of the points for burning. Such burning

usually takes the form of a 'pip' on one point and a 'crater' or depression on the other. With later types of hollow points the effects of arcing or burning are not so apparent. Severe burning of the contact faces is usually due to a faulty condenser or to poor earth connections from the battery or engine or transmission earthing straps.

2 Remove the spring clip from the contact swivel post and withdraw the insulating washer.

3 Unscrew the nut and locknut from the LT terminal on the outside of the distributor body (photo). Only unscrew the terminal nuts sufficiently far to enable the spade connector and lead from the contact breaker arm to be slipped out from beneath the head of the terminal bolt located on the inside of the distributor body.

4 Press the spring arm of the contact breaker inwards and disengage it from its securing anchor. Withdraw the contact breaker arm assembly from its swivel post.

5 Unscrew and remove the fixed contact securing screw and remove the contact breaker arm.

6 The faces of both contact points should be dressed on an oilstone, keeping them perfectly square and ensuring that all pips and depressions are removed. Where severe burning has occurred or the faces have been ground on previous occasions and have become thin, renew them.

7 Clean the faces of old or new points with methylated spirit before fitting in order to remove oil or protective grease.

8 Refitting is a reversal of removal but ensure that the fibre washers located above and below the spring arm breaker are in position and do not overtighten the LT terminal nuts.

9 Adjust the gap as described in the preceding section.

6 Condenser - Removal, Testing, Replacement

1 Faulty ignition resulting in misfiring and uneven running can be caused by a faulty condenser which is mounted externally on the body of the distributor.

2 If the contact breaker points show signs of excessive burning and pitting on the faces of the contacts it is an indication that the condenser has probably broken down and should be renewed.

3 To check the efficiency of the condenser remove the distributor cap and rotor arm. Then rotate the engine so that the points are closed - that is with the breaker arm resting between two high points on the cam.

4 Switch on the ignition and with a non-conductive article such as a splinter of wood, move the contacts open by levering on the spring of the moving breaker. If there is a severe flashing spark it indicates that the condenser has probably failed.

5 An additional test to confirm condenser failure is to open the points (this can be done by placing a piece of paper or postcard between the contacts) and disconnecting the condenser lead from the breaker terminal post. Then put a voltmeter or 12v bulb with two wander leads between the terminal post and the condenser lead. Switch on the ignition and if there is a reading or the bulb lights the condenser is faulty and must be replaced.

6 To renew the condenser, detach the wire from the terminal post, remove the mounting screw and replace the old unit with a new one. Check that arcing has been virtually eliminated by testing as already described.

7 Distributor - Removal and Replacement

1 Disconnect the HT leads from the spark plugs and between the distributor cap and the coil.

2 Disconnect the LT lead from the terminal on the side of the distributor body. Pull off the hose from the vacuum unit.

3 The method of retaining the distributor in the cylinder block varies according to model and may be by lever plate secured by one of the distributor pillar studs (photo), or a lock screw and nut screwed into the distributor drive shaft housing. Disconnect the appropriate component and withdraw the distributor.

4 Refitting is a reversal of removal and provided the distributor drive shaft has not been removed, the ignition timing will automatically be correct when the unit is replaced as the large and small shaft segments will engage to give the correct timing position.

5 If the distributor drive shaft has been withdrawn or partially withdrawn and rotated, then it will be necessary to refit the driving gear as described in Chapter 1 before the distributor unit is located in the engine block.

8 Distributor - Dismantling and Reassembly

1 Remove the distributor cap, rotor, contact breaker arms and externally mounted condenser all as previously described.

2 Remove the retaining spring (1) from the end of the drive shaft (references are to Fig 4.3)

3 Withdraw the pin (2) and slide off the washers and bush from the drive shaft.

4 Remove the baseplate securing screws and withdraw the baseplate (3).

5 The cam plate assembly (4) complete with counterweights and springs may now be withdrawn upwards through the distributor body.

6 If wear is evident in the bushes, counterweight holes or the springs are stretched then it will be economical to exchange the complete distributor unit for a factory exchange one. Ensure that the replacement unit carries the same index number as the original. The appropriate index numbers, and vehicle and engine applications, are listed in the specifications section of this chapter.

7 Reassembly is a reversal of dismantling but clean and lubricate all components first.

9 Ignition - Timing (Models R.1150-R.1151-R.1152)

1 Jack up the front left hand road wheel, engage top gear and turning the road wheel in the forward direction of rotation, rotate the engine until the mark on the flywheel aligns with the zero mark on the clutch housing. It will be found easier to turn the engine if the spark plugs are first removed.

2 The position of the flywheel is now correct for the models R.1150 - R.1151 (1969 model) and R.1152. For R.1151 (1968 model) continue to turn the engine until the flywheel mark is opposite an estimated 2 degree mark on the casing.

3 Connect a 12v test bulb between the distributor LT terminal and a good earth and switch on the ignition.

4 Loosen the distributor clamp according to type and turn the distributor body in an anticlockwise direction until the test bulb lights up. If the distributor is turned too far inadvertently, turn the distributor sharply back to its original position and carry out the setting operation again as it is important that the timing point shall be reached by turning the distributor in an anticlockwise direction only.

5 Retighten the distributor securing device, remove the test bulb and switch off the ignition. Fit the distributor cap and HT leads.

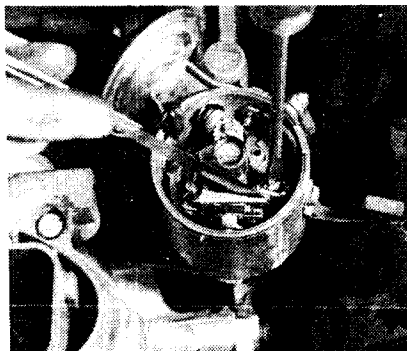
10 Ignition Timing - (Model R.1153)

1 The ignition timing on vehicles fitted with automatic transmission may be set by using a test lamp or by stroboscope.

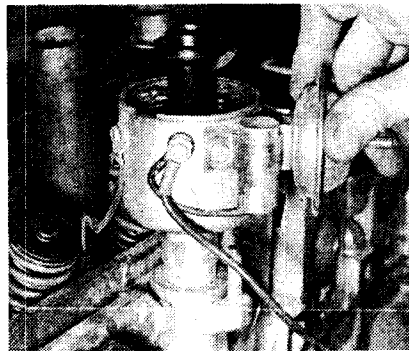
2 Remove the spark plugs and connect a test bulb between the LT terminal on the distributor case and earth.

3 Turn the engine by means of the camshaft pulley in a direction opposite to that of normal rotation (as approved), until the timing mark on convertor, visible through an aperture in the convertor housing, is in alignment with the housing 60 mark.

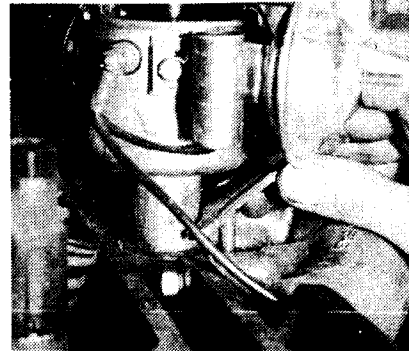
4 Switch on the ignition and having loosened the distributor fixing, rotate the distributor until the bulb just goes out. During this operation keep the distributor shaft cam turned anti-



4.2 Checking contact breaker gap



5.3 Distributor LT terminal



7.3 Distributor fixing plate

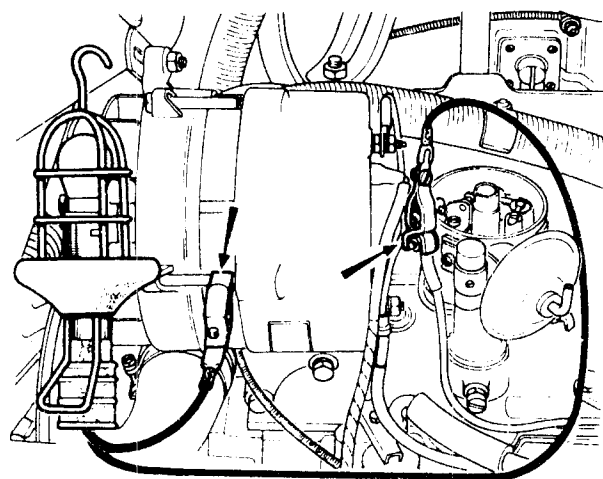


Fig.4.2 Test bulb connected for timing the ignition. Distributor fixing screw and locknut also shown

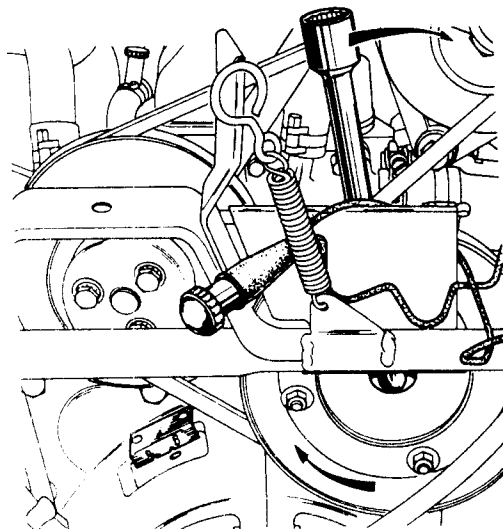


Fig.4.3 Timing marks, visible through converter housing aperture on automatic transmission model vehicles. Direction and method of movement of camshaft pulley is shown

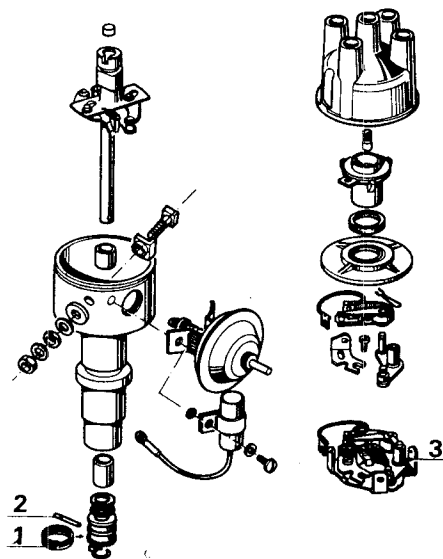


FIG.4.4 EXPLODED VIEW OF THE DISTRIBUTOR

- 1 Shaft pin retaining spring
- 2 Retaining pin
- 3 Contact breaker base plate

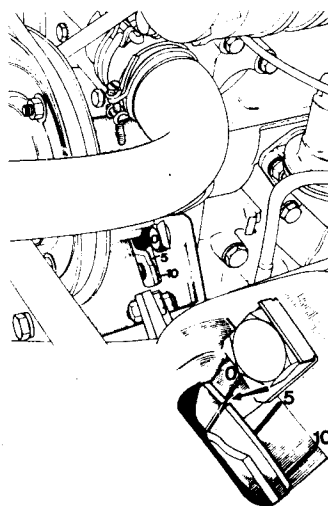


Fig.4.5 Timing marks, visible through clutch housing aperture on manually operated gearbox vehicles

clockwise in order to take up any slack in the mechanical advance mechanism.

- 5 Switch off the ignition and tighten the distributor clamp.
- 6 If a stroboscopic lamp is used, connect the red (+) and the black (-) to the battery. Connect the HT lead to number 1 or 4 spark plug or to the coil.
- 7 Disconnect the vacuum pipe from the distributor.
- 8 Run the engine at a slow tickover (750 rpm) and unclip the distributor fixing device.
- 9 Illuminate the TDC mark on the convertor and then rotate the distributor until the convertor mark appears to be in stationary alignment with the 60 mark on the housing.
- 10 Switch off the engine.
- 11 Tighten the distributor fixing.
- 12 Remove the stroboscopic lamp and connections.

11 The Coil

- 1 This is located close to the battery.
- 2 It is essential that the LT leads and the leads to the rev counter and idling speed damper (emission fume control) should be correctly connected as shown.
- 3 Check occasionally, the security of the main HT lead in the coil socket.

12 The Ignition/Steering Lock Switch

- 1 A combined multiple position ignition starter and steering anti-theft lock is provided on all vehicles. On the R.1150 and R.1151 there is a four position switch (NEIMAN). With R.1152 models a 'DAVAUTO' three position switch is fitted and with R.1153 models a Neiman type switch is fitted but the starter position is over-riden by the selector lever switch operating only when in the N or P positions associated with automatic transmission.
- 2 Wiring arrangement of the switches used in manual gearbox cars is shown in the figure.
- 3 Never remove the key from the ignition lock while the vehicle is in motion.

13 Spark Plugs - Servicing, Adjustment, Engine Condition Indications

- 1 Regular servicing of the spark plugs is essential to economical and top engine performance. Cleaning and adjustment of the spark plugs is described in the 'Routine Maintenance' section of this manual.
- 2 The appearance and condition of the spark plugs gives a very good indication of the state of tune and wear of the power unit as shown in the figure.
- 3 Spark plugs should be renewed at or before a maximum operating life of 10,000 miles (16,000 km) as their sparking efficiency under compression will almost certainly be much reduced after such a mileage.
- 4 Do not experiment with other than the specified grades of plug but when renewing them check that the manufacturers specification has not changed in the light of operating experience.

14 Fault Finding

1 Engine troubles normally associated with, and usually caused by faults in, the ignition system are:-

- a) Failure to start when the engine is turned.
- b) Uneven running caused by misfiring or mistiming.
- c) Even running at low engine speed and misfiring when engine speeds up or is under the load of acceleration of hill climbing.
- d) Even running at higher engine speeds and misfiring or stoppage at slow speed.

For a) First check that all wires are properly connected and dry. If the engine fails to catch when turned on the starter do not continue turning or the battery will be flattened and the problem made worse. Remove one spark plug lead from a plug and turn the engine again and see if a spark will jump from the end of the lead to the top of the plug or the engine block. It should jump a gap of $\frac{1}{4}$ inch with ease. If the spark is there, ensure that the static ignition timing is correct and then the fuel system. If there is no spark at the plug lead proceed further and remove the HT lead from the centre of the distributor which comes from the coil. Try again by turning the engine to see if a spark can be obtained from the end. If there is a spark the fault lies between the contact in the distributor cap and the plug. Check that the rotor arm is in good condition and making proper contact in the centre of the distributor cap and that the plug leads are properly attached to the cap. The four terminals inside the cap should be intact, clean and free from corrosion. If no spark comes from the coil HT lead, check next that the contact breaker points are clean and the gap is correct. If there is still no spark obtainable it may be assumed that the low tension circuit is at fault. To check the low tension circuit properly it is best to have a voltmeter handy or a 12v bulb in a holder with two wander leads attached. The procedure now given is arranged so that the interruption in the circuit - if any - can be found. Starting at the distributor, put one of the two leads from the tester (be it lamp or voltmeter) to the moving contact terminal and the other to earth. A reading (or light) indicates that there is no break in the circuit between the ignition switch and the contact points. Check next that the condenser is ok as described in Section 6. If this is satisfactory it means that the coil is not delivering HT to the distributor and must therefore be renewed. If there is no LT reading on the first check point repeat the test between the CB (-) terminal of the coil and earth. If a reading is now obtained there must be a break in the wire between the CB (-) terminal and the contact points. If there is no reading at this second check point repeat the test between the SW (+) terminal of the coil and earth. If this produces a reading then the low tension post of the coil windings must be open-circuited and the coil must be renewed. If there is no reading at this third check point there must be a break between the ignition switch and the coil. If this is the case, a temporary lead between the + terminals of both coil and battery will provide the means to start the engine until the fault is traced.

For b) Uneven running and misfiring should be checked first by ensuring that all HT wires are dry and properly connected. Ensure also that the leads are not short circuiting to earth against metal pipework or the engine itself. If this is happening an audible click can usually be heard from the place where the unwanted spark is being made.

For c) If misfiring occurs at high speeds the points gap is too small or the spark plugs need renewal due to failure under more severe operating pressures.

For d) If misfiring is occurring at low engine speeds and the engine runs satisfactorily at high speed, the points gap is probably the cause - being too great.

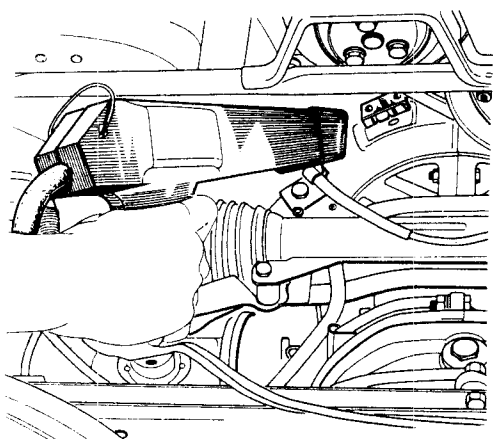


Fig.4.6 Using a stroboscope to check the ignition timing on an automatic transmission model.

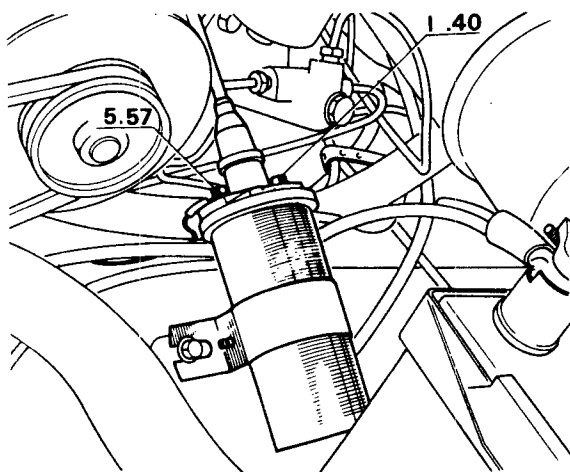


FIG.4.7 LOCATION AND CONNECTIONS OF THE COIL

5 Lead to ignition switch 1 LT lead to distributor
57 Lead to idling speed damper 40 Lead to rev. counter

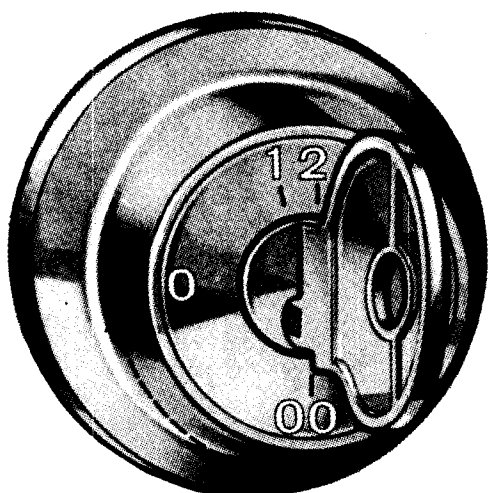


FIG.4.8 THE IGNITION/STEERING LOCK SWITCH

Position 00 Steering locked
0 Steering unlocked (for pushing vehicle)
1 Ignition on (steering unlocked)
2 Starter operates (ignition on, steering unlocked)

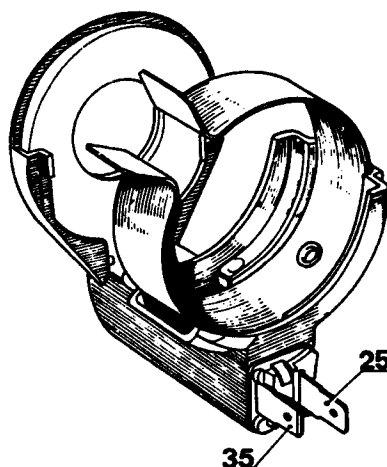
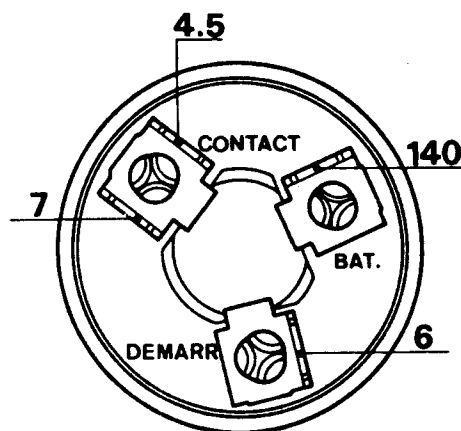
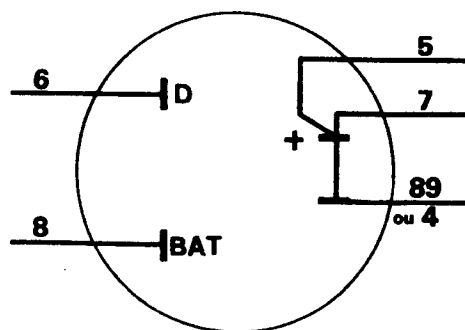
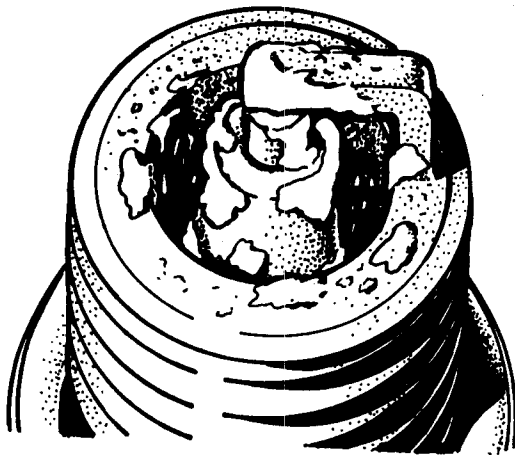


FIG. 4.9 WIRING ARRANGEMENTS FOR IGNITION/STEERING LOCK SWITCHES

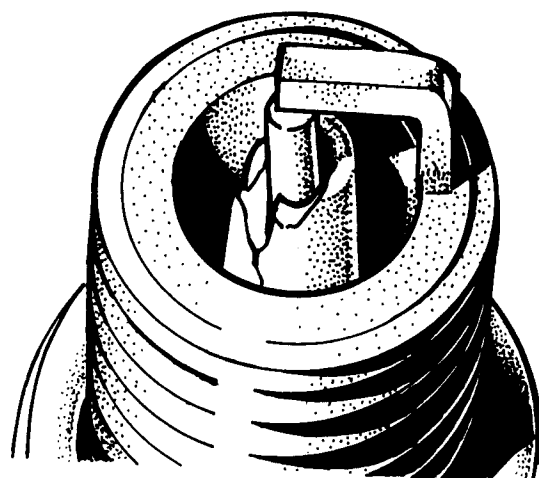
Upper - NEIMAN four position - terminals
4 regulator + 7 Fuse
5 Coil 8 Switch + from battery
6 Starter relay 8-9 Feed to voltmeter

Centre - DAVAUTO three position - terminals
4 regulator + 7 Fuse
5 Coil 140 Feed + from battery
6 Starter relay

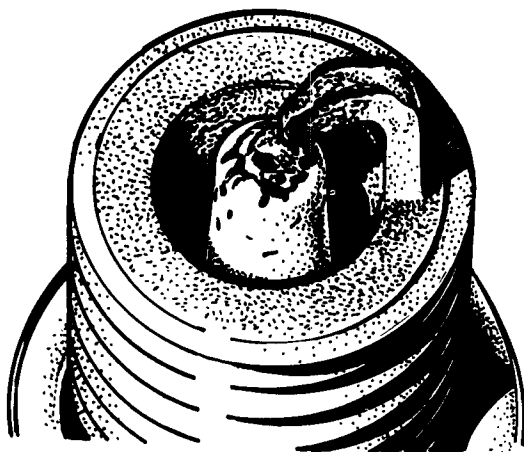
Lower - NEIMAN - illumination - terminals
25 + 35 - (earth)



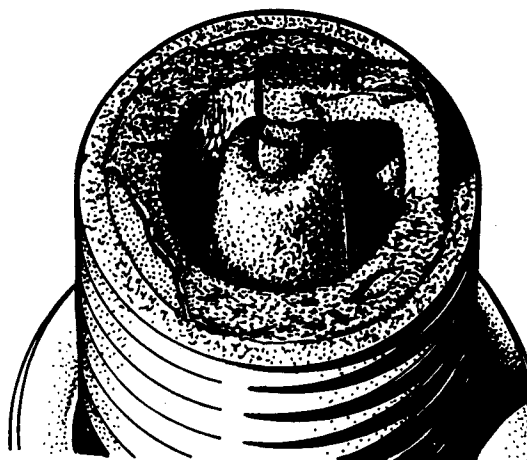
White deposits and damaged porcelain insulation indicating overheating



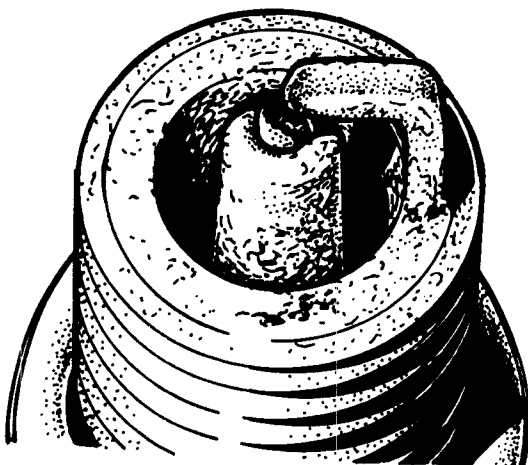
Broken porcelain insulation due to bent central electrode



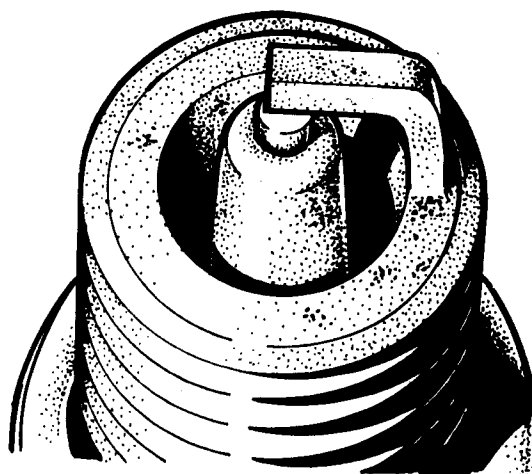
Electrodes burnt away due to wrong heat value or chronic pre-ignition (pinking)



Excessive black deposits caused by over-rich mixture or wrong heat value



Mild white deposits and electrode burnt indicating too weak a fuel mixture



Plug in sound condition with light greyish brown deposits

Chapter 5 Clutch

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Specifications

Type	Single dry plate with diaphragm spring pressure plate
Identification	200D
Friction disc thickness	0.304 in (7.7 mm)
Release bearing	Ball, grease sealed
Clutch free movement	5/64 - 1/8 in (2 - 3 mm)

1 General Description

- 1 All manual gearbox models are fitted with a single dry plate diaphragm clutch. The clutch assembly comprises a pressure plate and cover which is bolted to the face of the flywheel and contains the diaphragm spring and fulcrum rings.
- 2 The clutch driven plate (friction disc) is free to slide along the splined first motion shaft of the gearbox and is held in position between the machined faces of the flywheel and pressure plate by the force of the diaphragm spring. The friction lining material is riveted to the driven plate which incorporates a spring cushioned hub to absorb rotational transmission shocks and ensure smooth clutch engagement.
- 3 The circular diaphragm spring is mounted on shouldered pins and held in place in the cover by fulcrum rings. The spring is held to the pressure plate by steel clips.
- 4 The clutch is actuated by cable from a pendant type foot pedal. The cable actuates the release arm which in turn pushes the release bearing (ball bearing sealed type), forwards to bear against the release plate to move the centre of the diaphragm spring inwards.
- 5 The diaphragm spring is sandwiched between two annular rings which act as fulcrum points. As the centre of the spring is pushed in, the outside of the spring is pushed out which causes the pressure plate to move backwards and cease contact with the driven plate (friction disc).
- 6 When the clutch pedal is released, the diaphragm spring forces the pressure plate into contact with the high friction linings on the driven plate and at the same time pushes the driven plate slightly forward on its splines to engage its friction lined surfaces with the flywheel. The driven plate is now firmly sandwiched between the pressure plate and the flywheel in order that the drive is taken up and transmitted without significant power loss or slip.

7 As the lining material wears due to frictional abrasion, the pressure plate automatically moves closer to the friction disc to compensate. The arrangement obviates the necessity for regular clutch adjustment, provided the clearance is correctly set originally or after dismantling or reassembly, as described in Section 2.

8 The correct clutch assembly may be identified by checking the type number which is located as shown in the figure. A sectional diagram of the clutch assembly is also given.

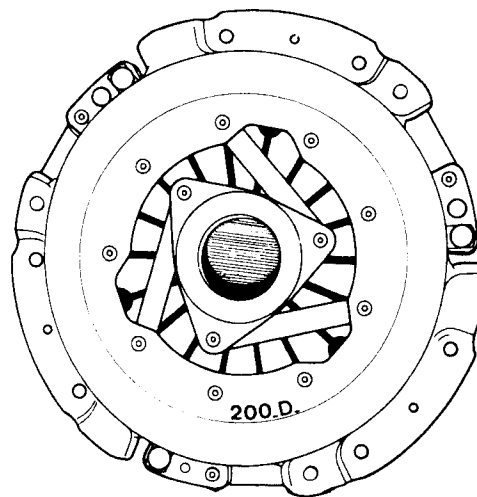


Fig.5.1 Clutch pressure plate cover showing position of type index number

2 Clutch Clearance - Adjustment

- 1 Loosen the locknut on the threaded end of the clutch operating cable. (References are to Fig 5.3)
- 2 Unscrew or screw up the adjusting nut (2) until there is a free movement of between 5/64 and 1/8 inch (2 to 3 mm) at the lowest point of the clutch operating lever arm. The measurement can most easily be made by holding a rule against the transmission case and noting the dimensions with the arm first lightly pushed inwards and then pulled outwards.
- 3 When the correct free movement is obtained, tighten the locknut.
- 4 For those vehicles which are fitted with a protective under-tray, the cable locknut must be reached with a socket fitted to a universal jointed drive and the adjuster nut held in position with a long open ended spanner.

3 Clutch Pedal - Removal and Replacement

- 1 Remove the left hand glove compartment in order to gain access to the pedal shaft. The compartment is retained to the fascia by self-tapping screws.
- 2 Release the pedal return spring by unhooking it.
- 3 Detach the pedal to shaft retaining clip and withdraw the pedal from its shaft.
- 4 The clutch cable forked clevis may now be detached from the pedal.
- 5 Refitting is a reversal of dismantling but grease the pedal shaft sleeve before reassembly and check the clearance (section 2).
- 6 The tension type pedal spring has been replaced (as a spare) by a coil type spring which fits round the pedal shaft sleeve.

4 Clutch Cable - Removal and Refitting

- 1 Disconnect the clutch cable from the release lever arm by unscrewing and removing the cable adjuster and locknuts.
- 2 Remove the clutch outer cable stop attachment from the clutch housing and push the cable from the stop attachment.
- 3 Remove the clutch pedal (Section 3) and detach the clutch cable from it.
- 4 Cut through the bead of sealing compound at the point where the cable passes through the engine compartment bulkhead. Withdraw the cable assembly into the car interior.
- 5 Refitting is a reversal of removal, but fit the cable into the clutch housing stop attachment before connecting the cable to the foot operating pedal.
- 6 Apply fresh sealant to the bulkhead cable entry and adjust the clutch free movement (Section 2).

5 Clutch - Removal and Component Inspection

- 1 Withdraw the gearbox as described in Chapter 6.
- 2 Mark the position of the clutch pressure plate cover in relation to its location on the face of the flywheel.
- 3 Unscrew the clutch cover securing bolts. These should be unscrewed in diametrically opposite sequence, a few turns at a time until the diaphragm spring pressure is released and the pressure plate assembly can be withdrawn. During withdrawal of the pressure plate assembly, do not let the driven plate fall.
- 4 Examine the driven plate friction linings for wear and loose rivets. Check the disc for distortion, cracks, broken hub springs or worn splines in its hub. The surface of the linings may be highly glazed but provided the woven pattern of the friction material can be clearly seen, then the plate is serviceable. Any sign of oil staining will indicate renewal of the driven plate and investigation and rectification of the oil leak (probably crank-shaft front main bearing and seals) being required.
- 5 Check the amount of wear which has taken place on the

friction linings and, if they are worn level with or to within 1/16 inch (1.6 mm) of the heads of the securing rivets, the driven plate should be renewed as an assembly. Do not attempt to re-line it yourself as it is rarely successful.

- 6 Examine the machined faces of the flywheel and the pressure plate and if scored or grooved, renew both components on a factory exchange basis.
- 7 Check the segments of the pressure plate diaphragm spring for cracks and renew the assembly if apparent.
- 8 Where clutch engagement has been fierce or clutch slip has occurred in spite of the driven plate being in good condition, renew the pressure plate assembly complete.
- 9 Check the clutch release bearing which is located in the fork of the release lever. See that it spins freely without shake or slackness and that its pressure face is not scored or chipped. Where renewal is needed, refer to Section 7.

6 Clutch - Refitting

- 1 Clean the machined face of the flywheel with a petrol soaked rag.
- 2 Locate the driven plate on the face of the flywheel so that the longer projection of the splined hub is on the gearbox side.
- 3 Locate the pressure plate assembly on the flywheel (sandwiching the driven plate) so that the cover/flywheel mating marks are in alignment.
- 4 Screw in the securing bolts in diametrically opposite sequence until they are slightly more than finger tight.
- 5 The driven plate must now be centralised by inserting either an old gearbox first motion shaft or a suitably stepped mandrel or dowel which will pass through the hub of the driven plate and engage with the spigot bush in the centre of the flywheel. As the pressure plate securing bolts have not yet been tightened, the insertion of the centralising tool will cause the driven plate to move sideways or up and down as necessary until it is centralised. Try the tool in two or three different positions to ensure perfect centralising and to enable the gearbox first motion shaft to pass through the clutch driven plate during refitting of the gearbox to the engine.
- 6 Fully tighten the pressure plate assembly to flywheel bolts in diametrically opposite sequence.
- 7 Refit the gearbox to the engine as described in Chapter 6.
- 8 Adjust the clutch free movement as described in Section 2.

7 Clutch Release Bearing - Removal and Refitting

- 1 Remove the gearbox as described in Chapter 6.
- 2 Withdraw the pins which secure the release fork to the cross shaft. An extractor may be needed for this operation, similar to the one shown in the figure, although the use of a lever having a rounded forked end may suffice. The pins may be one of two types which are shown in another figure.
- 3 The fork may now be swung round on its shaft to enable the release bearing to be removed. Alternatively, the release cross shaft may be withdrawn and the fork/bearing assembly removed for separation on the bench.
- 4 The release bearing should be drawn from its retaining hub using a suitable extractor.
- 5 Press the release bearing onto its hub and fit the complete release fork assembly to the release cross shaft. Rotate the fork until the holes are in alignment with those in the cross shaft and press in the retaining pins so that in their final position, their shoulders will be standing 1/32 inch (1 mm) proud.
- 6 The clutch release ball bearing is grease sealed and requires no lubrication during its service life.
- 7 Refit the gearbox as described in Chapter 6 and adjust the clutch free movement.

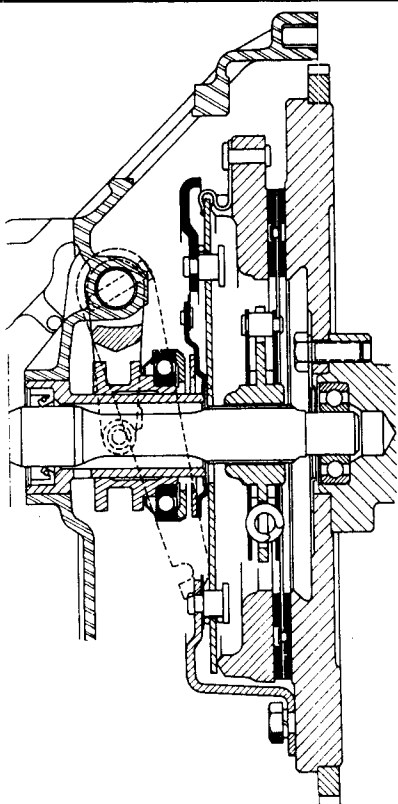


Fig. 5.2 Sectional view of the clutch assembly

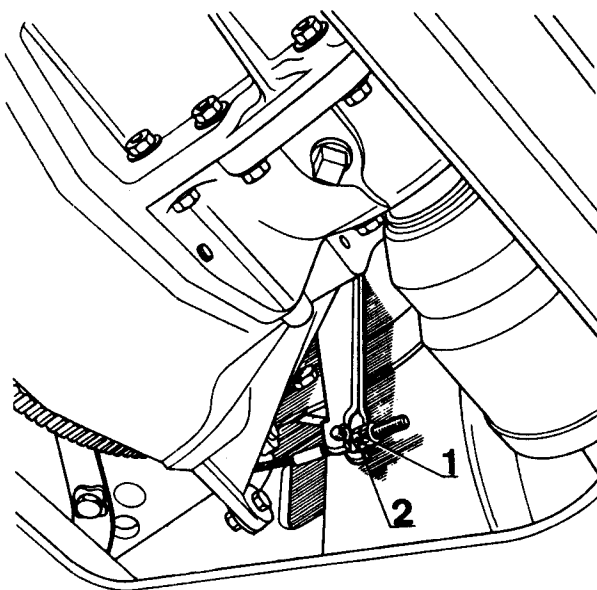


FIG. 5.3 CLUTCH CABLE TO RELEASE ARM CONNECTION

1 Locknut

2 Adjuster nut

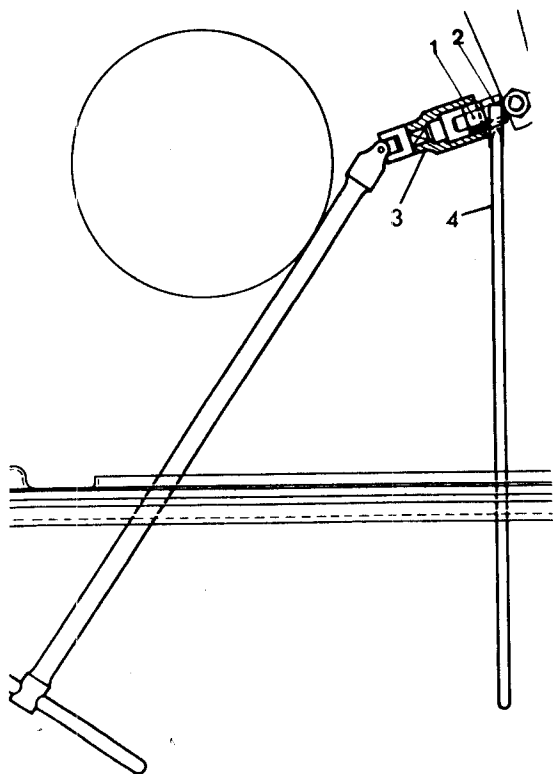


FIG. 5.4 ADJUSTING CLUTCH CABLE NUTS ON CARS FITTED WITH AN UNDER TRAY

1 Locknut
2 Adjuster nut

3 Universal jointed socket wrench
4 Open ended spanner

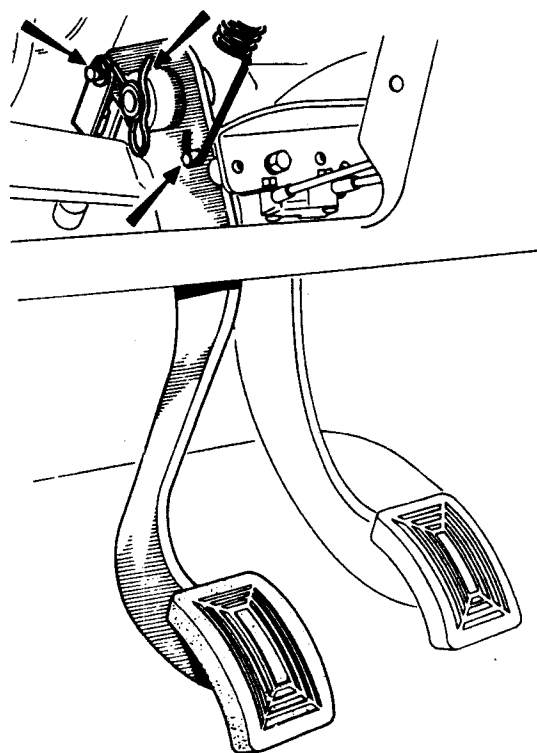


Fig. 5.5 Clutch operating pedal, showing pedal return spring (early type) pedal to shaft retaining clip and cable clevis.

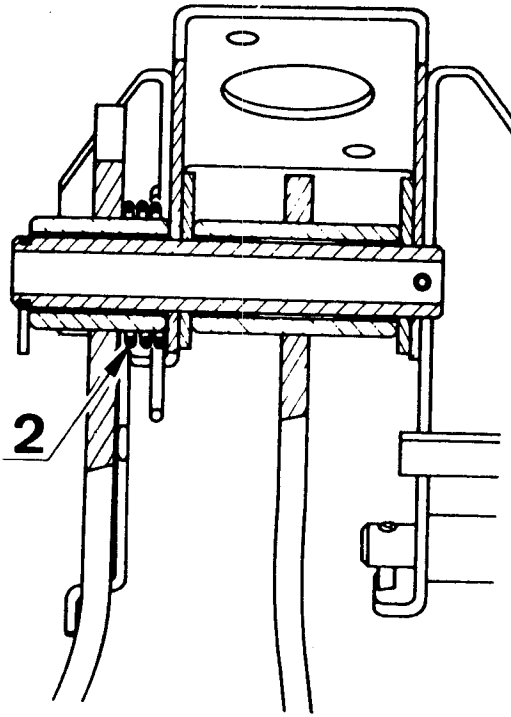


Fig.5.6 Later type pedal return spring (2)

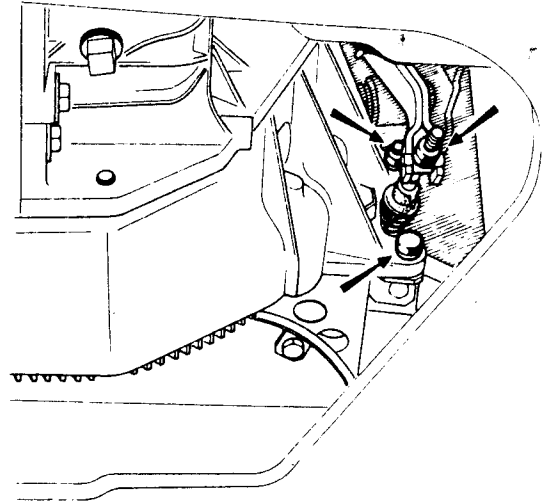


Fig.5.7 Clutch cable stop securing bolts on bell housing

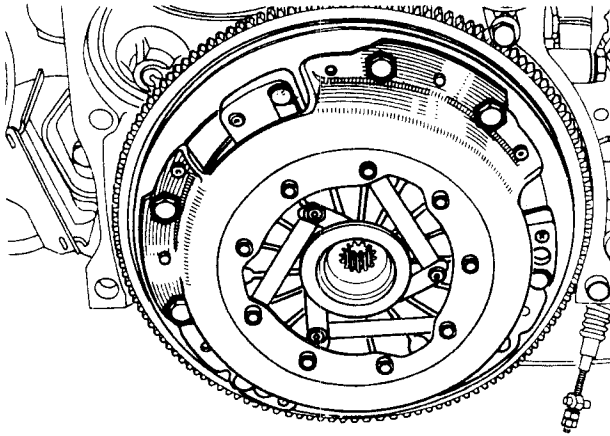


Fig.5.8 Clutch assembly to flywheel securing bolts

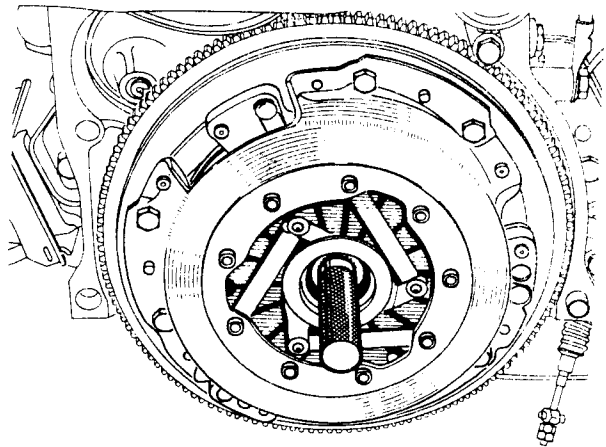


Fig.5.9 Centralising the clutch driven plate using a dowel

8 Clutch Spigot Bearing - Removal and Replacement

- 1 This is of ball bearing, grease sealed, type and is located in the crankshaft flange to which the flywheel is bolted. The bearing supports the nose of the gearbox first motion shaft after the shaft has passed through the clutch assembly and flywheel.
- 2 Remove the gearbox (Chapter 6).
- 3 Remove the clutch assembly from the flywheel (Section 5).
- 4 Remove the flywheel (Chapter 1).
- 5 Using an expanding type of bearing puller, extract the bearing assembly from its recess in the crankshaft/flywheel flange.
- 6 The new bearing is supplied pre-greased so do not clean it but fit it as supplied using a suitable tubular drift to bear upon the outer track of the bearing.
- 7 Refit the flywheel (Chapter 1).
- 8 Refit and centralise the clutch assembly (Section 6).
- 9 Refit the gearbox (Chapter 6) and adjust the clutch free movement (Section 2).

9 Gearbox First Motion Shaft Oil Seal - Renewal

- 1 The seal is located in a recess at the rear of the clutch release bearing guide through which the gearbox first motion shaft passes.
- 2 Evidence of oil on the clutch assembly or driven plate may be due to a defective first motion shaft oil seal.
- 3 Remove the gearbox (Chapter 6).
- 4 Separate the clutch bellhousing from the gearbox (photo).
- 5 The oil seal, now exposed, should be prised from its location (photo).
- 6 With Model R.1150 vehicles check that a 0.315 inch (8 mm) drain hole has been drilled at the base of the release bearing tubular guide as arrowed in the figure.
- 7 Where this is not apparent, one should be drilled ensuring that it is in alignment with the centre line of the gearbox and the hole edges are deburred on completion of drilling.
- 8 Drive a new oil seal into position, using a tubular drift and ensuring that the lips of the seal point towards the gearbox.
- 9 Fit the clutch bellhousing to the gearbox, first taping the splines of the first motion shaft to prevent the oil seal lips being cut as the bellhousing passes over the shaft.
- 10 Fit the gearbox to the engine (Chapter 6).
- 11 Adjust the clutch free movement.

10 Clutch Faults

There are four main faults to which the clutch and release mechanism are prone. They may occur by themselves or in conjunction with any of the other faults. They are clutch squeal, slip, spin and judder.

11 Clutch Squeal - Diagnosis and Cure

- 1 If on taking up the drive or when changing gear, the clutch squeals, this is a sure indication of a badly worn clutch release bearing.
- 2 As well as regular wear due to normal use, wear of the clutch release bearing is much accentuated if the clutch is ridden, or held down for long periods in gear, with the engine running. To minimise wear of this component the car should always be taken out of gear at traffic lights and for similar hold-ups.
- 3 The clutch release bearing is not an expensive item, but difficult to get at.

12 Clutch slip - Diagnosis and Cure

- 1 Clutch slip is a self-evident condition which occurs when the clutch friction plate is badly worn, the release arm free travel is insufficient, oil or grease have got onto the flywheel or pressure plate faces, or the pressure plate itself is faulty.
- 2 The reason for clutch slip is that, due to one of the faults listed above, there is either insufficient friction from the driven plate to ensure solid drive.
- 3 If small amounts of oil get onto the clutch, they will be burnt off under the heat of clutch engagement, and in the process, gradually darkening the linings. Excessive oil on the clutch will burn off leaving a carbon deposit which can cause quite bad slip, or fierceness, spin and judder.
- 4 If clutch slip is suspected, and confirmation of this condition is required, there are several tests which can be made.
- 5 With the engine in second or third gear and pulling lightly up a moderate incline, sudden depression of the accelerator pedal may cause the engine to increase its speed without any increase in road speed. Easing off on the accelerator will then give a definite drop in engine speed without the car slowing.
- 6 In extreme cases of clutch slip the engine will race under normal acceleration conditions.
- 7 If slip is due to oil or grease on the linings a temporary cure can sometimes be effected by squirting carbon tetrachloride into the clutch. The permanent cure is, of course, to renew the clutch driven plate and trace and rectify the oil leak.

13 Clutch Spin - Diagnosis and Cure

- 1 Clutch spin is a condition which occurs when there is too little or no free movement at the release arm or cable or there is an obstruction in the clutch either on the primary gear splines, or in the operating lever itself, or the oil may have partially burnt off the clutch linings and have left a resinous deposit which is causing the clutch disc to stick to the pressure plate or flywheel.
- 2 The reason for clutch spin is that due to any, or a combination of, the faults just listed, the clutch pressure plate is not completely freeing from the centre plate even with the clutch pedal fully depressed.
- 3 If clutch spin is suspected, the condition can be confirmed by extreme difficulty in engaging first gear from rest, difficulty in changing gear, and very sudden take-up of the clutch drive at the fully depressed end of the clutch pedal travel as the clutch is released.
- 4 If these points are checked and found to be in order then the fault lies internally in the clutch, and it will be necessary to remove the clutch for examination.

14 Clutch Judder - Diagnosis and Cure

- 1 Clutch judder is a self-evident condition which occurs when the gearbox or engine mountings are loose or too flexible, when there is oil on the faces of the clutch friction plate, or when the clutch pressure plate has been incorrectly adjusted.
- 2 The reason for clutch judder is that due to one of the faults just listed, the clutch pressure plate is not freeing smoothly from the friction disc, and is snatching.
- 3 Clutch judder normally occurs when the clutch pedal is released in first or reverse gears, and the whole car shudders as it moves backwards or forwards.

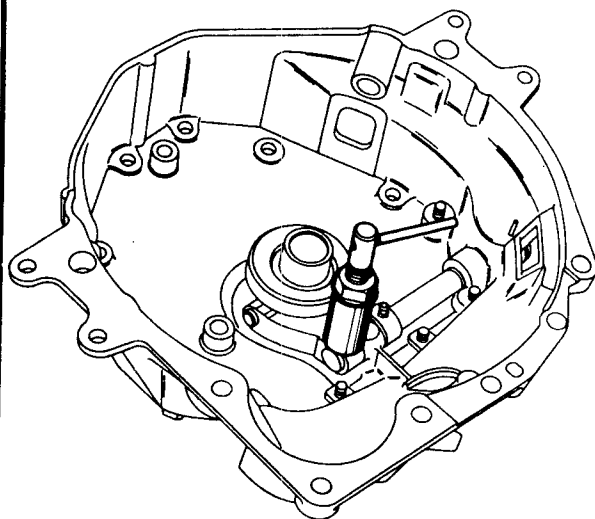


Fig.5.10 Removing the release fork to cross shaft securing pins with an extractor

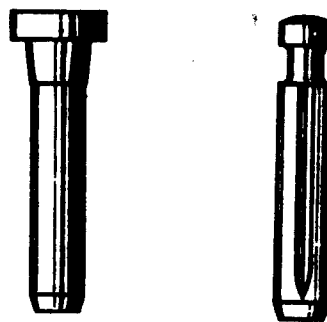


Fig.5.11 Alternative types of release fork to cross shaft securing pins

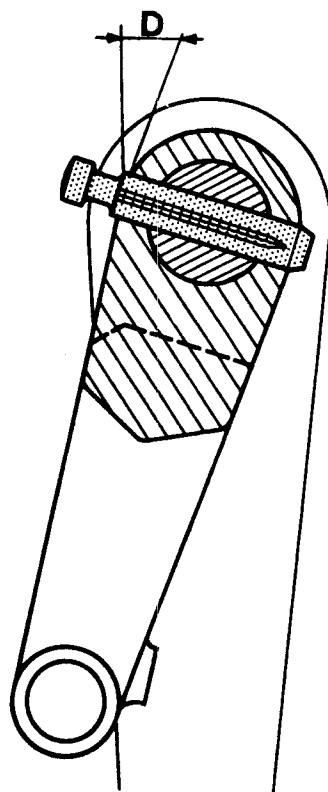


Fig.5.12 Shoulder projection of correctly located release fork to cross shaft retaining pins. $D = 1/32$ in (1 mm)

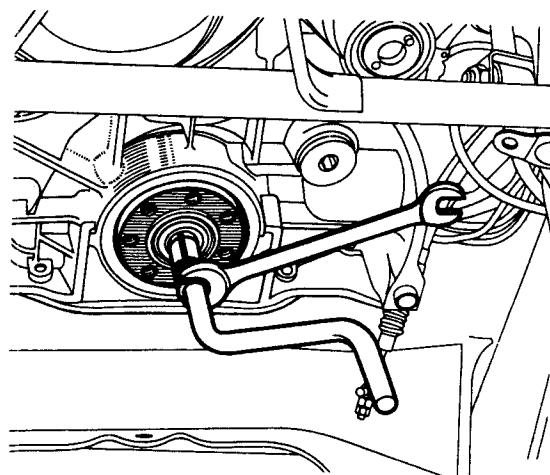
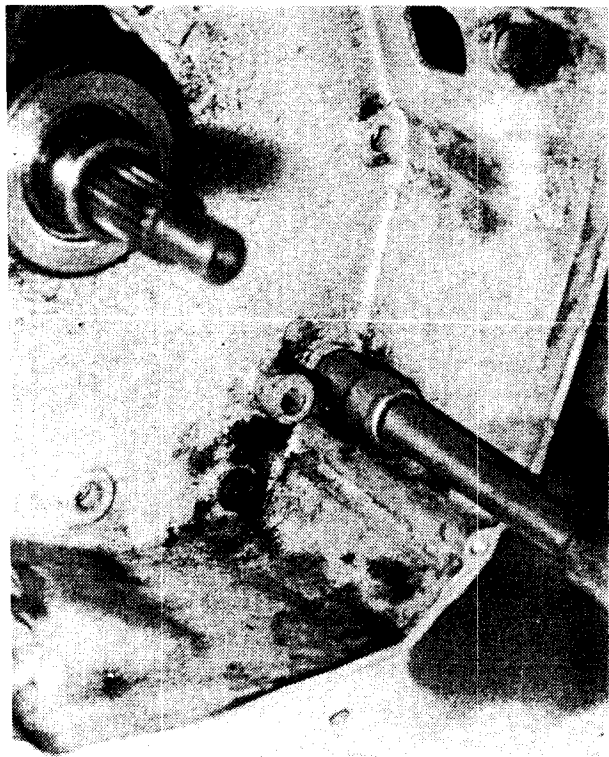
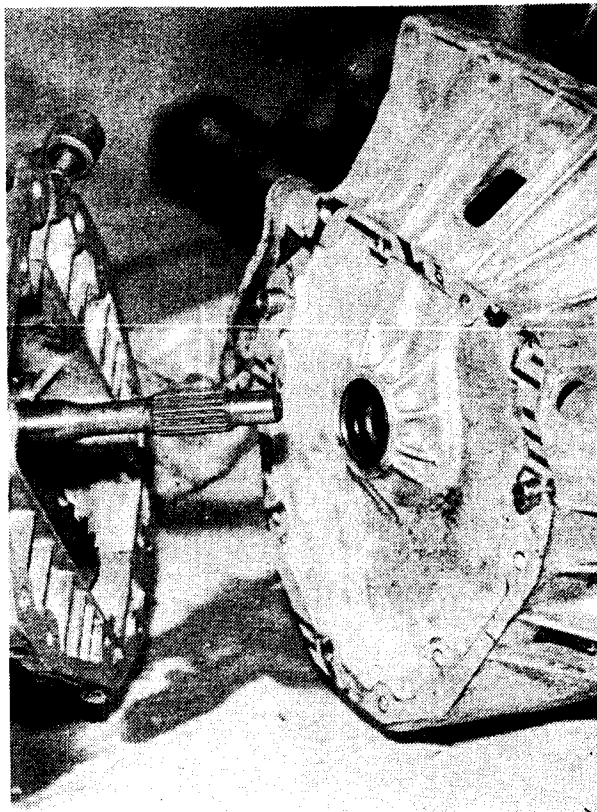


Fig.5.13 Withdrawing the first motion shaft spigot ball bearing from the flywheel mounting flange of the crankshaft, using an expanding type of extractor



9.4 Removing bell housing to gearbox bolts



9.5 Removing the bell housing to expose the first motion shaft oil seal

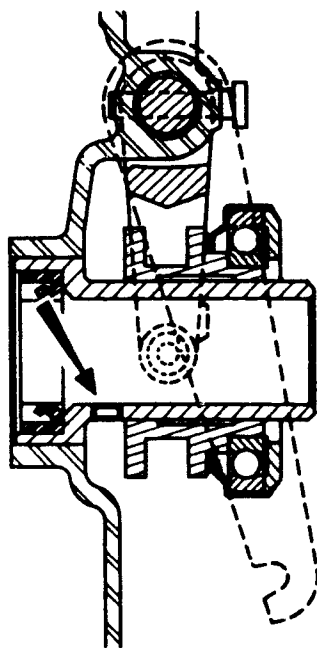


Fig.5.14 Cross sectional view of the clutch release bearing, the bearing mounting hub and the tubular release bearing guide. The gearbox first motion shaft oil seal and oil drain hole (model R1150 only) are also shown

Chapter 6 Manual gearbox

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Specifications

Renault type designation	336
Operation	manual, four forward speeds and reverse. Synchromesh on all forward gears.
Housing	Pressure die-cast aluminium, split longitudinally. Gearbox and final drive integral.
Gear ratios	
1st	3.61 : 1
2nd	2.25 : 1
3rd	1.48 : 1
4th	1.03 : 1
Reverse	3.07 : 1
Crownwheel	
No. of teeth	34
Pinion	
No. of teeth	8 or 9
Speedometer drive	6 x 12 for 9 x 34 crownwheel and pinion 6 x 14 for 8 x 34 crownwheel and pinion
Oil capacity	3 pints (imp.) 3½ pints (U.S.) 1.64 litres
Manufacturing data	

Model R1150
Up to the 1968 model
With differential adjustment by shims

Index	Steering LH	RH	Crown wheel and pinion	Pinion Protrusion
336 - 02	X			
336 - 03		X	9 x 34 Normal	51.6 mm (2.032")
336 - 10	X			
336 - 11		X	9 x 34 Normal	51.6 mm (2.032")

With differential adjustment by nuts

Index	Steering LH	RH	Crown wheel and pinion	Pinion Protrusion
336 - 06	X		9 x 34	51.6 mm
336 - 07		X	Normal	(2.032")
336 - 12	X		9 x 34	51.6 mm
336 - 13		X	Normal	(2.032")
336 - 14	X		8 x 34	53 mm
336 - 15		X		(2.087")

Commencing with the 1968 model
New reverse gear position
Up to January 1968

Index	Steering LH	RH	Crown wheel and pinion	Pinion Protrusion
336 - 20	X		9 x 34	51.6 mm
336 - 21		X	Normal	(2.032")
336 - 22	X		9 x 34	51.6 mm
336 - 23		X	Normal	(2.032")
336 - 24	X		8 x 34	53 mm
336 - 25		X		(2.087")

From January 1968 to October 1968
Fitting of a strengthened crown wheel and pinion (9 x 34)

Index	Steering LH	RH	Crown wheel and pinion	Pinion Protrusion
336 - 30	X		9 x 34	53 mm
336 - 31		X	Strengthened	(2.087")
336 - 32	X		9 x 34	53 mm
336 - 33		X	Strengthened	(2.087")
336 - 24	X		8 x 34	53 mm
336 - 25		X		(2.087")

From November 1968
Fitting of a strengthened clutch housing

Index	Steering LH	RH	Crown wheel and pinion	Pinion Protrusion
336 - 34	X		9 x 34	53 mm
336 - 35		X	Strengthened	(2.087")
336 - 36	X		9 x 34	53 mm
336 - 37		X	Strengthened	(2.087")
336 - 24	X		8 x 34	53 mm
336 - 25		X		(2.087")

From February 1969
Addition of a tapped boss for fitting a reverse light switch

Index	Steering LH	RH	Crown wheel and pinion	Pinion Protrusion
336 - 40	X		9 x 34	53 mm
336 - 43		X	Strengthened	(2.087")
336 - 41	X		9 x 34	53 mm
336 - 42		X	Strengthened	(2.087")