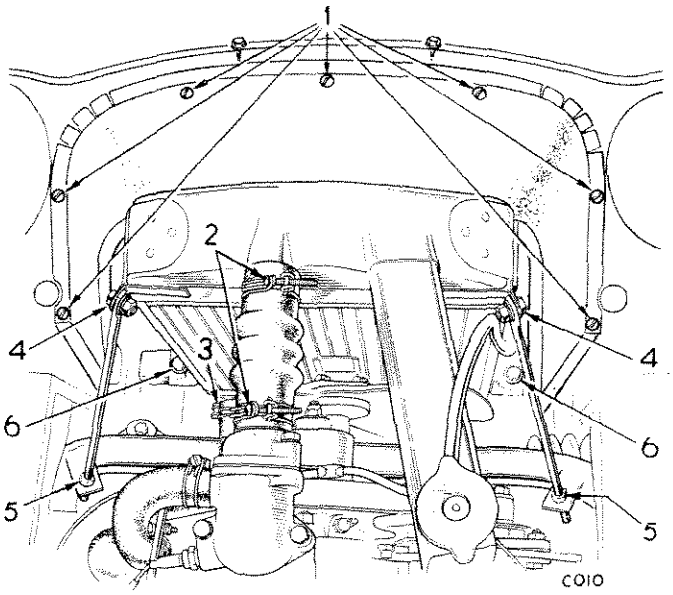


1 Air deflector attachment screws
2 Top hose clips
3 Bottom hose clips
4 Radiator stay attachments
5 Adjusting nuts
6 Radiator attachments

Fig. 8. Radiator and air deflector attachment

ENGINE AND GEARBOX REMOVAL (cont'd.)

Remove :

— starter motor (not shown).
— bonnet (see group 5).
— radiator and air deflector by detaching items in the order shown on Fig. 8.
— engine torque reaction arm (item 61, Fig. 1).
— clutch slave cylinder (accessible from under vehicle) and allow it to hang on hose.

Working inside the vehicle and referring to Fig. 12, remove :

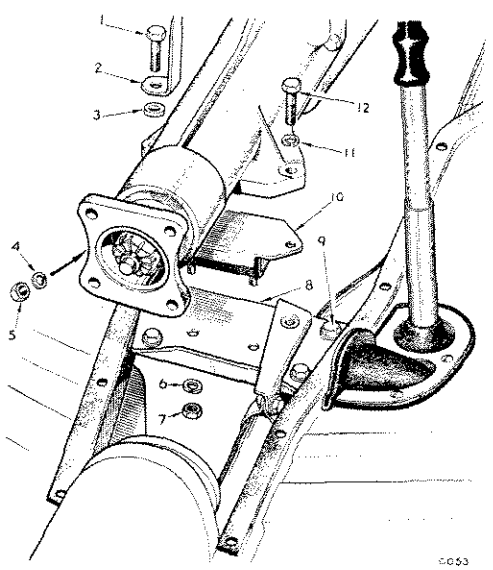
— seat cushions and carpets.
— attachments 'B' and 'C', and facia support.
— attachments 'A' and centre floor cover.
— speedometer cable.
— front end of propeller shaft.
— overdrive solenoid cables (if fitted).

Remove the gearbox top cover and fit a temporary cardboard cover to prevent the entry of foreign matter.

Attach a lifting cable to the engine lifting eyes and, supporting the engine unit on a hoist, release :

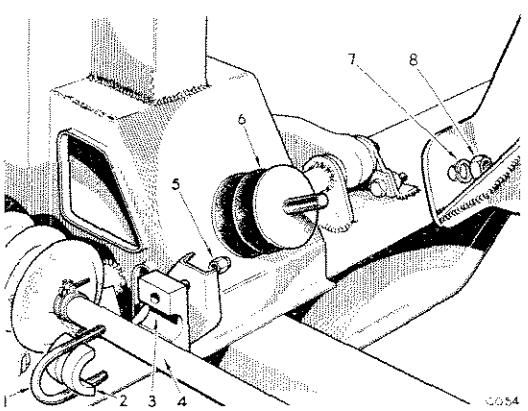
— front engine mounting (6), Fig. 10.
— rear mounting (10), Fig. 9.
— crossmember (8), Fig. 9.

Lift the engine and gearbox unit, tilting it rearwards at an angle of 35 - 40° as shown on Fig. 11. Manoeuvre the unit clear of the vehicle.



1 Bolt
2 Stay
3 Washer
4 Washer
5 Nyloc nut
6 Washer
7 Nut
8 Crossmember
9 Bolt
10 Rear mounting
11 Washer
12 Bolt

Fig. 9. Rear Engine Mounting



1 'U' bolt
2 Clamp (outer)
3 Clamp (inner)
4 Steering unit
5 Nyloc nut
6 Engine mounting
7 Lockwasher
8 Nut

Fig. 10. Front Engine Mounting

ENGINE INSTALLATION

Refit the clutch unit and gearbox to the engine.

Using a wire sling and hoist, tilt the engine 35-40° rearwards and manoeuvre it into position.

Refit :
- crossmember (8) and rear mounting (10), Fig. 9.
- front mounting (6), Fig. 10.
- torque reaction arm (61), Fig. 1, and adjust to take up clearance between buffer and chassis.
- gearbox cover, propeller shaft, speedometer drive and overdrive solenoid cables (if fitted).
- centre floor cover attachments 'A', facia support and attachments 'B' and 'C', Fig. 12.
- seat cushions and carpets.
- clutch slave cylinder and adjust as described on page 0·014.
- steering unit (3) and tighten the 'U' bolts (2) and coupling bolt (1), Fig. 7.
- front crossmember (4), Fig. 7.
- starter motor.
- air deflector and radiator (see page 1·110).
- exhaust pipe flange.

Refer to Fig. 5 and refit :
- engine earthing strap.
- fan belt and adjust (see page 0·016).
- horn cables (1).
- temperature transmitter cable (3).
- vacuum pipe (8).
- fuel pipe (2).
- tachometer drive cable (7).
- fuel pipe (5).
- oil pressure pipe (6).
- coil, S.W. cable (4).

Refer to Fig. 6 and refit :
- carburettors (9).
- accelerator rod (11).
- mixture control cable (10).
- heater hoses (13) and (14).
- heater valve control (12).
- exhaust pipe.

Refit the bonnet (see group 5), re-connect the battery, refill the radiator, engine oil sump and gearbox to the correct levels.

Prime the carburettors, start the engine and tune the carburettors as described on page 1·305.

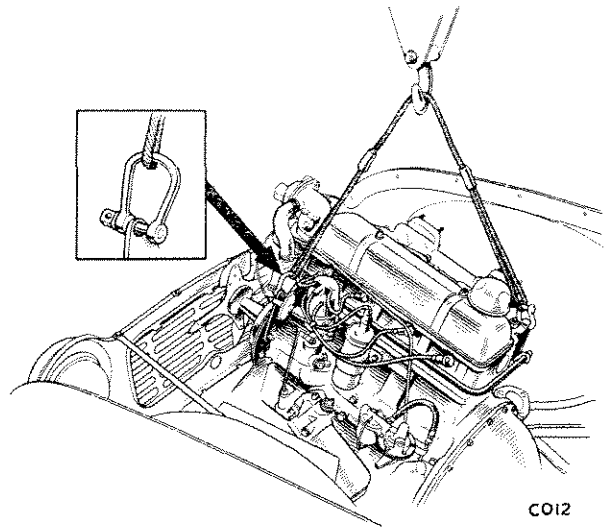


Fig. 11. Removing engine unit

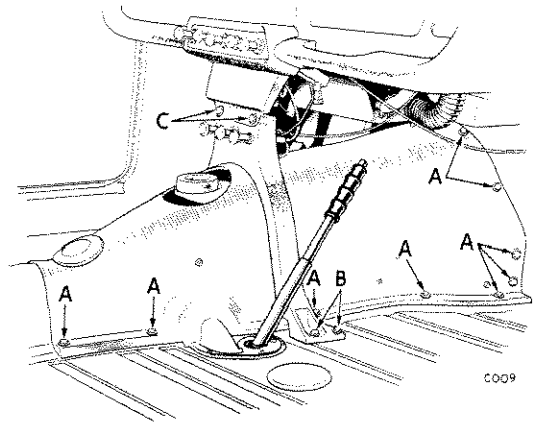
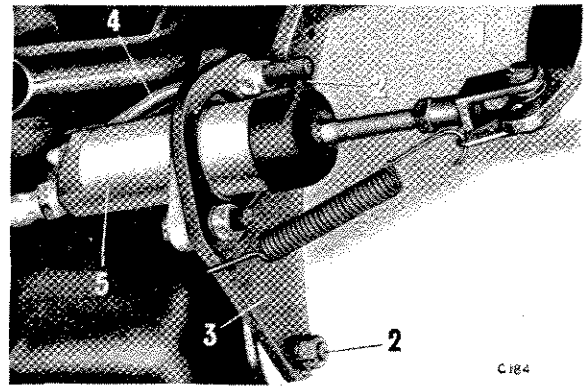


Fig. 12. Centre floor cover attachments



1 Pin
2 Bolt
3 Mounting bracket
4 Stay
5 Slave cylinder

Fig. 13. Clutch slave cylinder attachment

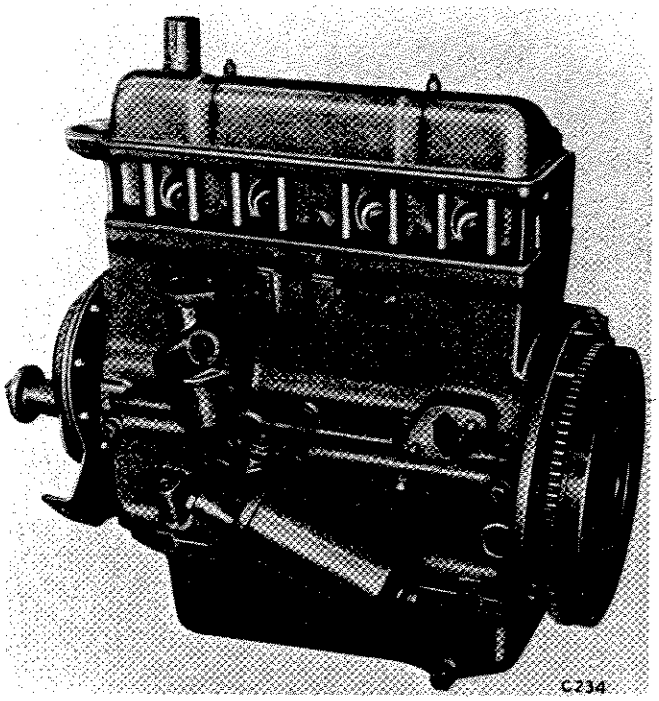


Fig. 14. Left-hand view of reconditioned engine as supplied under the Unit Exchange Plan

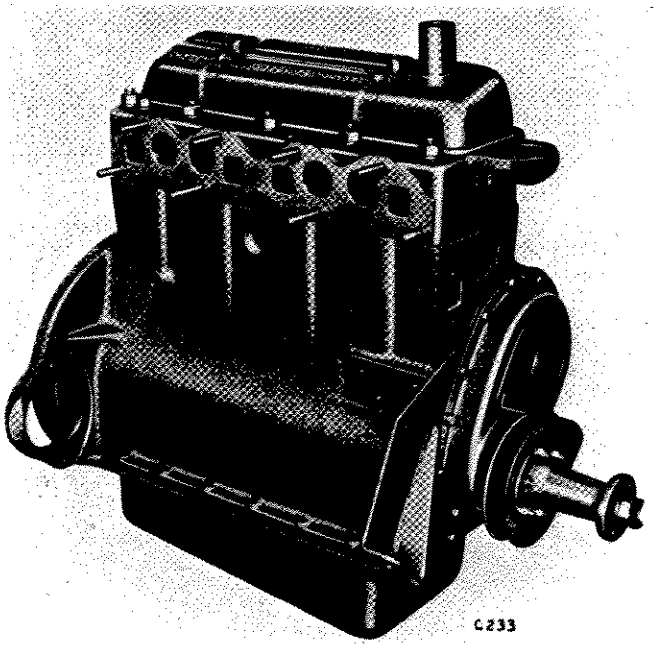


Fig. 15. Right-hand view of reconditioned engine as supplied under the Unit Exchange Plan

Removing Auxiliary Equipment

Before returning an engine for reconditioning, drain the sump and remove the following items:—

1 Gearbox and clutch unit
2 Generator and fan belt
3 Water Pump
4 Fuel Pump
5 Distributor
6 Coil
7 Inlet and exhaust manifold
8 Starter motor
9 Temperature transmitter
10 Top water elbow and thermostat
11 Sparking plugs

Refiitting Auxiliary Equipment

Remove all masking tape from the apertures in the reconditioned unit and ensure that all joint faces are clean. Using new gaskets, fit the following items;—

1 Clutch unit and gearbox
2 Water pump
3 Generator and fan belt
4 Distributor. For timing see page 1·131
5 Fuel pump
6 Coil. Ensure a good earth to the cylinder block
7 Inlet and exhaust manifolds
8 Top water elbow and thermostat
9 Temperature transmitter
10 Starter motor
11 Sparking plugs

ENGINE DISMANTLING

Remove the gearbox and clutch assembly. Place the engine on a stand or bench and dismantle as follows :—

Refer to Fig. 16 and from L.H.S. remove :

— heater pipe (2).
— by-pass hose (1).
— coil (6).
— oil filter (5) and pipe (3).
— fuel pump (4).
— H.T. leads, distributor (7) and pedestal.
— breather pipe (8).

Refer to Fig. 17 and from R.H.S. remove :

— fan belt (10).
— adjusting link (11).
— water pump (9).
— generator and mounting bracket (12).
— manifolds (13) and gasket.
— thermostat housing (14).

To complete the dismantling, refer to Figs. 1 and 2 when carrying out the following operations. Note that items 1 to 82 are shown on Fig. 1, and items 83 to 161 are shown on Fig. 2.

Remove :

— rocker cover (9).
— rocker shaft assembly and push rods (69).
— cylinder head nuts, lifting eye (13), plain washers, cylinder head (18) and gasket (19).

Using a valve spring compressor, remove :

— split collets (1).
— inner, outer and auxiliary springs (75), (76) and (74).
— upper and lower spring caps (78) and (73).

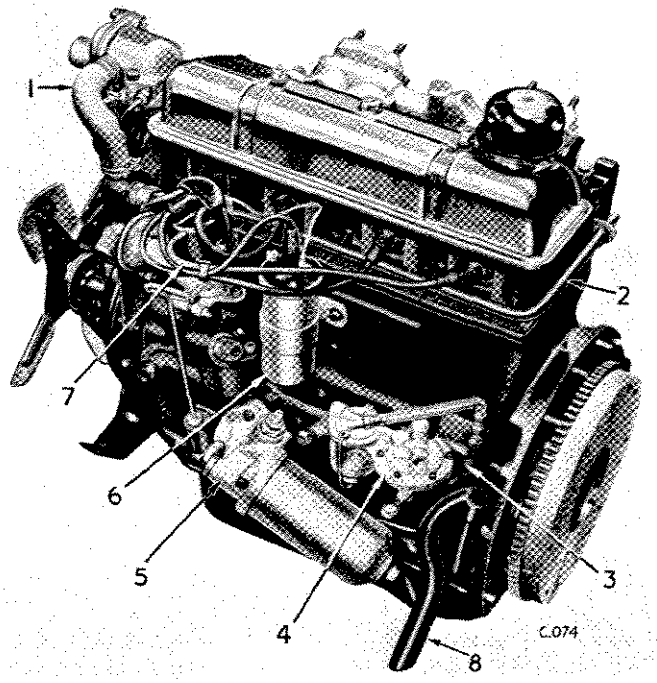
Mark the valves, 1 to 8 from the front, to identify them, and remove them from the cylinder head.

Withdraw the distributor driving gear (98), shaft (156), tappets (68) and dipstick (49).

Release the lockplates (118), remove the bolts (119) and detach the flywheel (117).

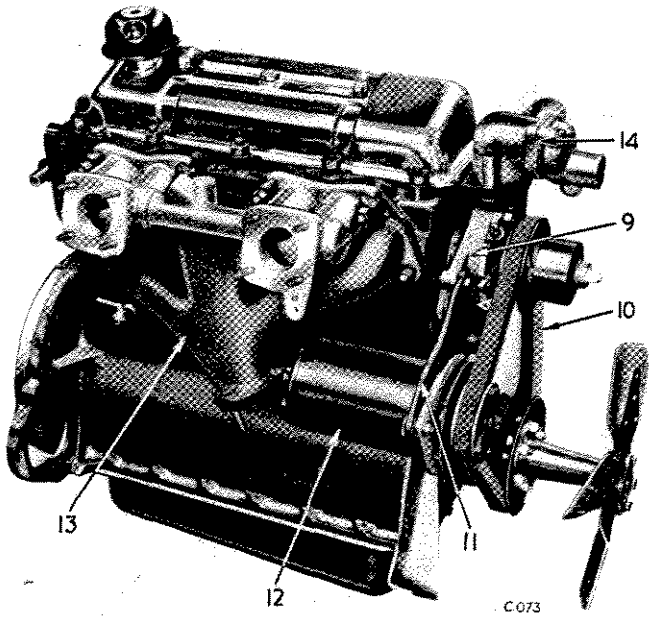
Remove the dog bolt (143), withdraw the fan and pulley assembly. If necessary, strip the assembly as follows :

— release the lockplates (154), unscrew four bolts (153) and remove items (152), (151), (150), (149), (148), (147), (146).
— unscrew six nuts (144), withdraw the bolts (140) and detach items (145), (142) and (141).



1 By-pass hose
2 Heater pipe
3 Oil pressure pipe
4 Fuel pump
5 Oil filter
6 Ignition coil
7 Distributor
8 Breather pipe

Fig. 16. Left-hand view of engine unit



9 Water pump
10 Fan belt
11 Adjusting link
12 Generator
13 Exhaust manifold
14 Thermostat housing

Fig. 17. Right-hand view of engine unit

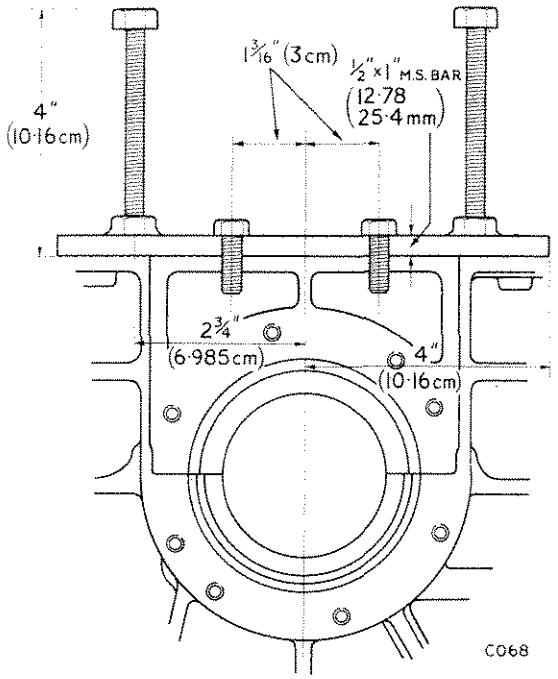


Fig. 18. Removing rear main bearing cap

Unscrew the bolts (83) and remove the timing cover (84) and gasket (85).

Release the lockplates (93), unscrew two bolts (91) and remove sprockets (94), chain (86), disc (139), sprocket (138), shims (136), (137), and keys (134).

Unscrew two bolts (95) and withdraw bearing (96) and camshaft (97).

Unscrew the attachment details (59), (60), (63) and remove the bearer plate (58).

Remove :

- oil sump (39), gasket (37), oil pump (47) and gasket (48).
- connecting rod caps (127) and bearing shells (126).
- cylinder liners (20) complete with pistons; then withdraw pistons from liners.
- circlips (114) and eject the gudgeon pins (113).
- front sealing block (51), main bearing caps (27, (38), (56).
- thrust washers (132) and lower oil scroll (26).
- crankshaft (133), bearing shells (125), (131), (135), thrust washers (159) and upper oil scroll (26).
- remaining plugs, copper washers, studs and bearings.

ENGINE RECONDITIONING

General Recommendations

Scrape old gasket material from the joint faces and clean all engine components, preferably in a trichlorethylene degreasing plant, giving particular attention to oilways.

Assess the serviceability of all components by careful examination and by checking the measurements of worn surfaces against the maximum worn tolerances given on pages 1·103-4-5.

When rebuilding the engine, use new gaskets, lockplates, and renew damaged studs, nuts, bolts, spring washers and leaking core plugs.

Use Hylomar, Wellseal or Hermatite jointing compounds for all gasket joints and sealing block faces.

Tighten all nuts, bolts and studs to the appropriate torque figures listed on pages 9 and 10.

Crankshaft Regrinding

Measure the diameter of the crankshaft journals and crankpins at various points to determine maximum wear, taper and ovality. If the wear exceeds the worn tolerance quoted on page 1·104 regrind the crankshaft to the nearest undersize dimension.

Undersize Bearings

Dimensions of undersize bearings are given on page 1·104.

Camshaft Bearings

Remove three shouldered setscrews 'A' (Fig. 20). Drift the sealing disc from the rear camshaft bearing. Use the extractor, Tool No. S.32-1, to withdraw the worn bearings from the cylinder block. When fitting each new bearing, align its oil feed and location holes with those in the block and ensure that the bearing does not turn whilst pulling it into position. Refit the locating setscrews, using $\frac{1}{16}$" (1·6 mm.) thickness plain steel washers under the setscrew heads.

Renew the rear sealing disc.

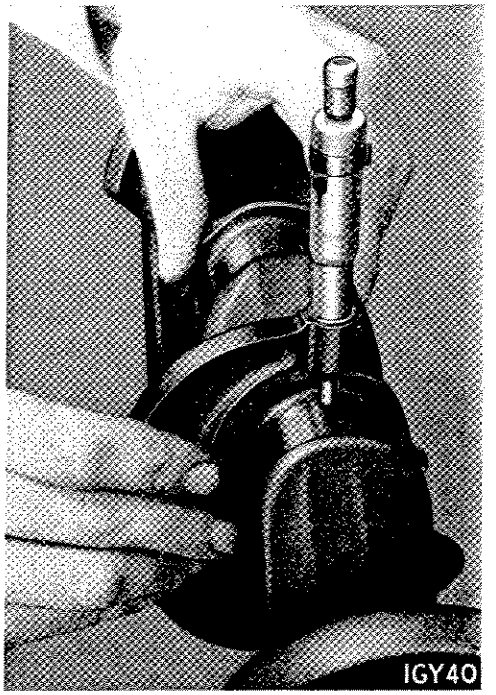


Fig. 19. Measuring Crankpins

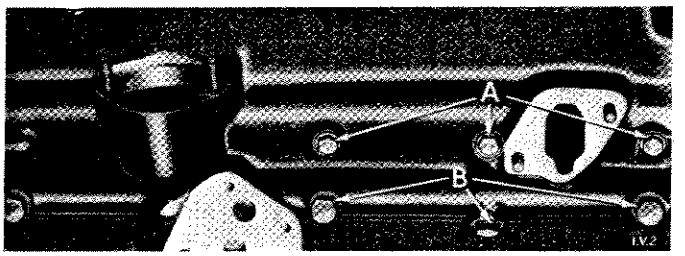
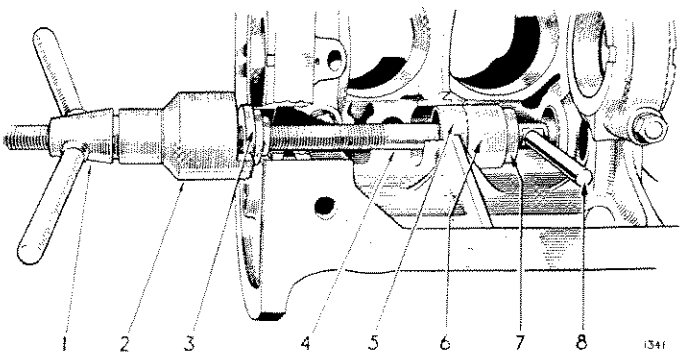


Fig. 20. Showing camshaft bearing locating screws "A", and oil gallery sealing plugs "B"



1 Handle
2 Thrust piece
3 Centraliser
4 Shaft
5 Camshaft bearing
6 Guide and remover
7 Lock
8 Guide pin

Fig. 21. Using tool No. S.32-1 to fit camshaft bearings

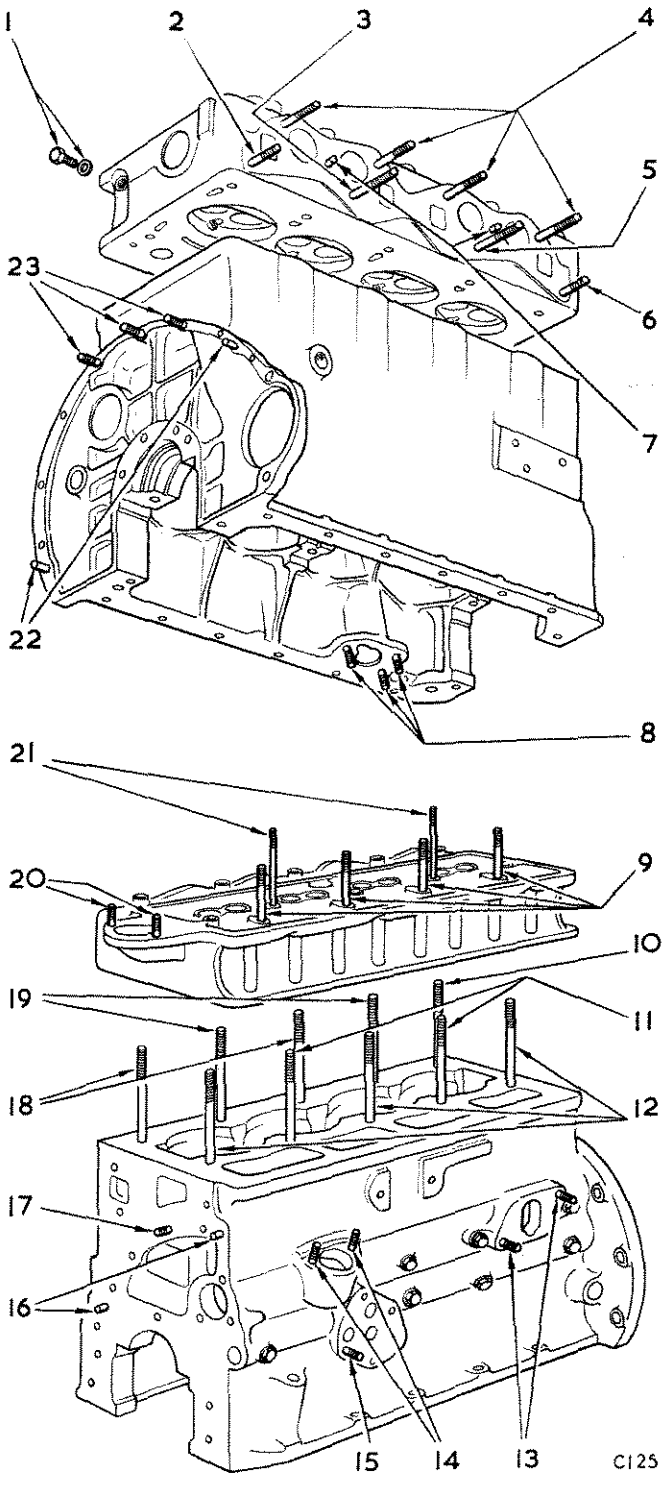


Fig. 22.
Showing the position of studs and dowels

Studs

Refit all studs and dowels to the cylinder block as shown on Fig. 22.

POSITIONS OF STUDS AND DOWELS

1 $\frac{3}{8}$" U.N.C. × $\frac{3}{8}$" (9·525 mm.) setscrew and copper washer

2 $\frac{3}{8}$" U.N.C. × $1\frac{15}{16}$" (49·21 mm.) stud

3 $\frac{3}{8}$" U.N.C. × $2\frac{3}{8}$" (60·33 mm.) stud

4 $\frac{3}{8}$" U.N.C. × $2\frac{1}{16}$" (52·39 mm.) stud

5 $\frac{3}{8}$" U.N.C. × $2\frac{3}{8}$" (60·33 mm.) stud

6 $\frac{3}{8}$" U.N.C. × $1\frac{11}{16}$" (42·86 mm.) stud

7 $\frac{5}{16}$" × $\frac{3}{4}$" (7·94 mm. × 19·05 mm.) dowel

8 $\frac{5}{16}$" U.N.C./N.F. × $1\frac{5}{16}$" (33·34 mm.) stud

9 $\frac{3}{8}$" U.N.C./N.F. × $3\frac{1}{8}$" (79·38 mm.) stud

10 $\frac{1}{2}$" U.N.C./N.F. × $5\frac{1}{2}$" (139·7 mm.) stud

11 $\frac{1}{2}$" U.N.C./N.F. × 9" (228·6 mm.) stud

12 $\frac{1}{2}$" U.N.C./N.F. × 5" (127 mm.) stud

13 $\frac{5}{16}$" U.N.C./N.F. × $1\frac{5}{16}$" (33·34 mm.) stud

14 $\frac{5}{16}$" U.N.C./N.F. × $1\frac{5}{16}$" (33·34 mm.) stud

15 $\frac{5}{16}$" U.N.C./N.F. × $2\frac{3}{16}$" (55·56 mm.) stud

16 $\frac{5}{16}$" × $\frac{3}{4}$" (7·94 mm. × 19·05 mm.) dowel

17 $\frac{5}{16}$" U.N.C./N.F. × $1\frac{5}{16}$" (33·34 mm.) stud

18 $\frac{1}{2}$" U.N.C./N.F. × $5\frac{3}{8}$" (142·87 mm.) stud

19 $\frac{1}{2}$" U.N.C./N.F. × $9\frac{1}{2}$" (241·3 mm.) stud

20 $\frac{5}{16}$" U.N.C./N.F. × $1\frac{5}{16}$" (33·34 mm.) stud

21 $\frac{5}{16}$" U.N.C./N.F. × $3\frac{11}{16}$" (93·66 mm.) stud

22 $\frac{5}{16}$" × $\frac{3}{4}$" (7·94 mm. × 19·05 mm.) dowel

23 $\frac{5}{16}$" U.N.C./N.F. × $1\frac{5}{16}$" (33·34 mm.) stud

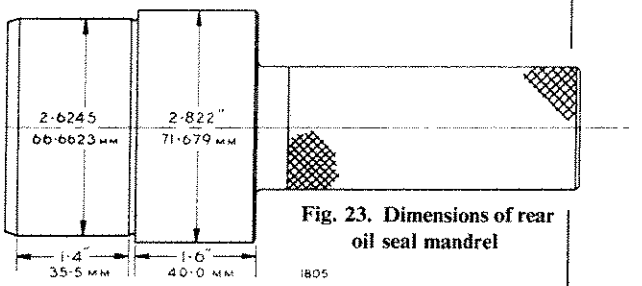


Fig. 23. Dimensions of rear oil seal mandrel

Rear Oil Seal

Ensure that both halves of the rear oil seal bear the same serial numbers.

Apply jointing compound to the contacting faces and loosely attach one half of the seal to the cylinder block, and the other half to the rear bearing cap.

Lay the mandrel (Fig. 24) into the rear bearing housing (without shell bearings). Fit the rear bearing cap (without shell bearing) and tighten the cap bolts sufficiently to nip the mandrel.

Tighten the oil seal securing bolts and remove the bearing cap and mandrel.

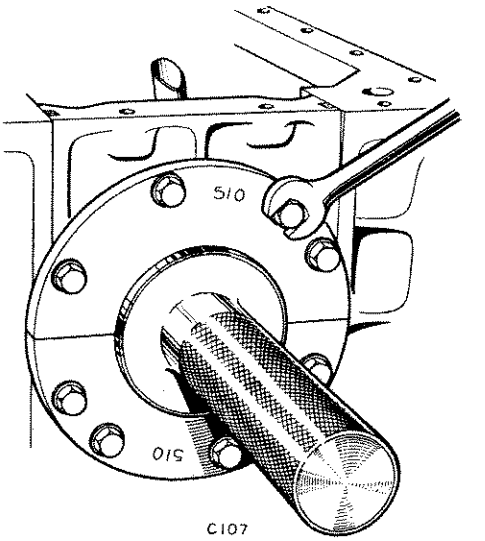


Fig. 24. Using a mandrel to centralise the rear oil seal

Crankshaft and Bearings

Fit the bearing shells in the crankcase. Ensure that the locating tags register in the recesses provided. Lubricate the journals and install the crankshaft.

Placing the white metal faces of the thrust washers against the thrust faces of the crankshaft, slide the thrust washers into position.

Similarly, assemble the bearing shell and thrust washers to the centre main bearing cap, and the bearing shells to the outer caps. Fit the bearing cap assemblies in position, ensuring that the markings on the caps are placed adjacent to identical markings on the crankcase, as shown in Fig. 26.

Fit the main bearing cap bolts (55) with spring washers and, ensuring that the rear face of the rear bearing cap is aligned with the rear face of the crankcase, securely tighten the cap bolts.

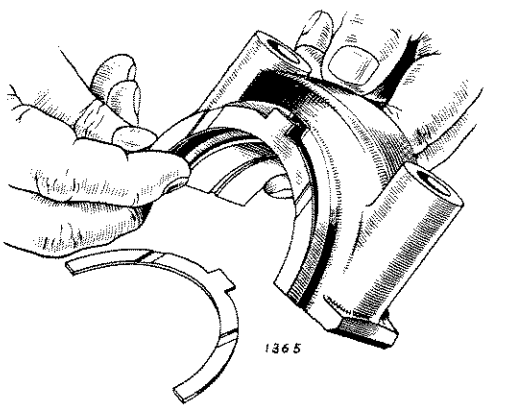


Fig. 25. Fitting thrust washers to centre main bearing cap

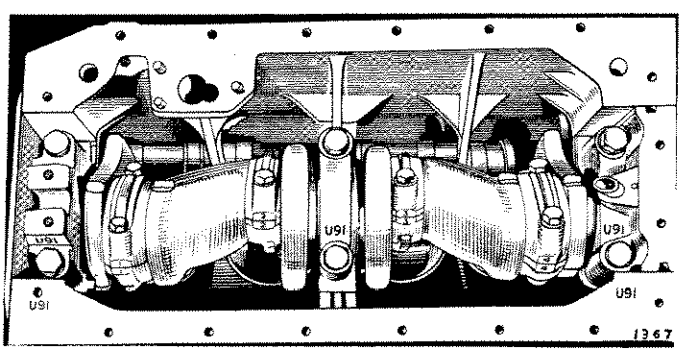


Fig. 26. Disposition of bearing cap numbers relative to the cylinder block

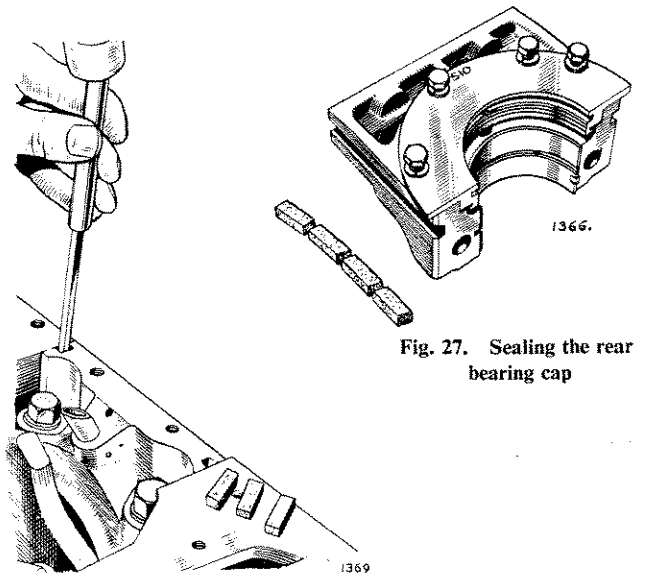


Fig. 27. Sealing the rear bearing cap

Rear Sealing Block

Ram lengths of felt, soaked in jointing compound, into the rear bearing cap slots, as shown in Fig. 27. Trim off the excess felt with a sharp knife.

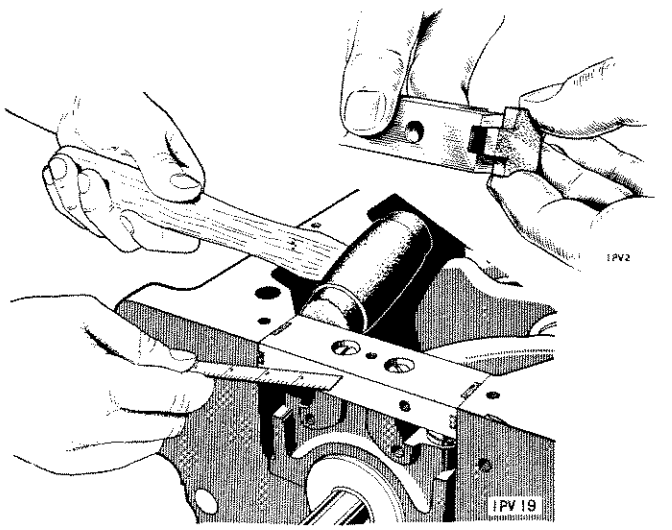


Fig. 28. Fitting "T" packings and aligning the front sealing block

Front Sealing Block

Coat the two 'T'-shaped packings with jointing compound and position them in the end recesses of the front sealing block. Align the block with the front face of the crankcase and secure it with two cheese-headed screws.

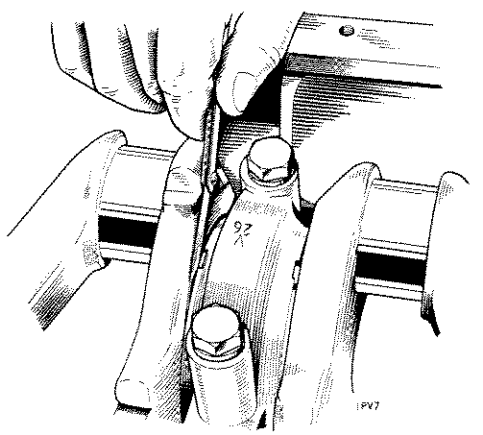


Fig. 29. Using feeler gauges to check crankshaft end float

Crankshaft End Float

Check the end float by moving the crankshaft endwise, as shown. The correct end float is 0·004″ - 0·006″ (0·1 - 0·15 mm.)

Excess end float can be reduced by fitting 0·005″ (0·127 mm.) oversize thrust washers.

Connecting Rods

Small End Bush

Use Tool No. 20SM. FT.6201 to renew small end bush. Ensure that the small end bush oil feed holes are aligned.

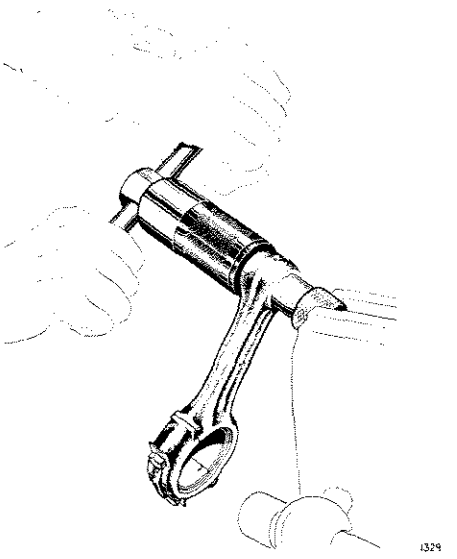
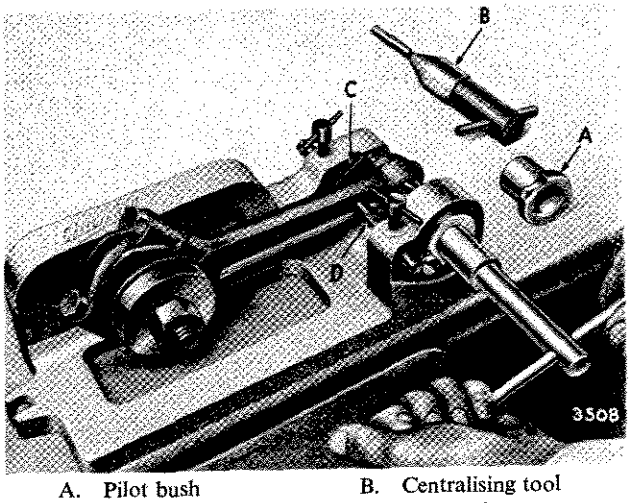


Fig. 30. Simultaneously removing the old bush and fitting a new one in a single operation

Reaming the Gudgeon Pin Bush

Use Tool No. 6200.A. to ream the gudgeon pin bushes as shown.



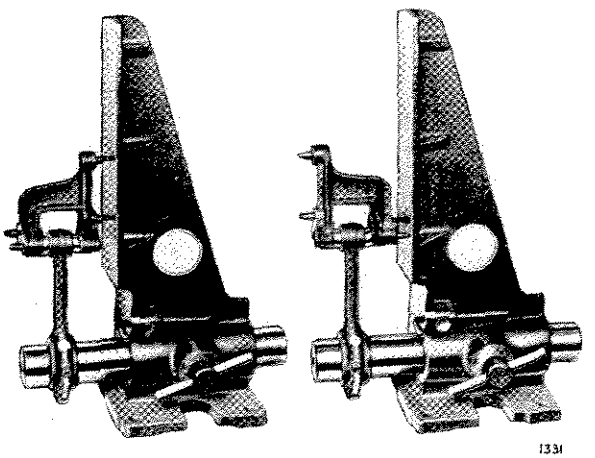
A. Pilot bush
B. Centralising tool
C. Positioning plate
D. Steady pin

Fig. 31. Gudgeon pin bush reaming fixture

Connecting Rod Alignment

Use connecting rod alignment jig No. 335, with adaptor No. 336-2, to check twist 'A' and bend 'B'. Determine amount of misalignment by inserting feeler gauges between the face of the fixture and one of the buttons.

Correct misalignment with a bending iron and re-check.



"B" "A"

Fig. 32. Checking for bend at "B", and twist at "A"

Cylinder Liners

The cylinder liners are of the wet type with flanged upper faces, on the sides of which are machined two pairs of flats, 90° to one another. These flats provide alternative fitting positions to overcome wear along the axis of thrust.

The lower portion of each liner is provided externally with a reduced diameter, surmounted by a flanged face for spigoting into a machined recess in the cylinder block. This spigot also accommodates the liner gasket which is used for water sealing.

Pistons and Liners

Pistons and liners are graded "F", "G" or "H" according to their dimensions. The appropriate symbol is stamped on the top face of each piston and liner. When fitting new pistons and liners, ensure that they are both of the same grade, for example, "F" piston to "F" liner. Dimensions are given on page 1·103.

Piston Measurement The piston dimensions given on page 1·103 are the maximum when measured across the thrust faces at the top of the skirt 'BB' and bottom of the skirt 'AA' (Fig. 33).

Piston Weight The maximum variation in weight between four pistons comprising a "set" must not exceed 4 drams (7·09 grams).

Piston Rings (Fig. 34)

Rings are fitted to each piston as follows :

1. Taper faced compression ring. Fit with taper towards top and "T" or "Top" marking on upper face.
2. 2nd compression ring (plain).
3. Oil control ring.

Gaps First insert the ring into the liner, then use a piston to push the ring squarely down the bore to a point ½" (6 mm.) from the top. Measure the gap with feeler gauges (Fig. 35).

Ring to Groove Clearance Piston ring thickness, width of ring groove in the piston and recommended clearances are given on page 1·103.

Fitting Connecting Rods to Pistons

Ensure that the oil feed holes and cross drillings are unobstructed. Heat the piston in boiling water and assemble to the connecting rod as shown. Secure the gudgeon pin with circlips.

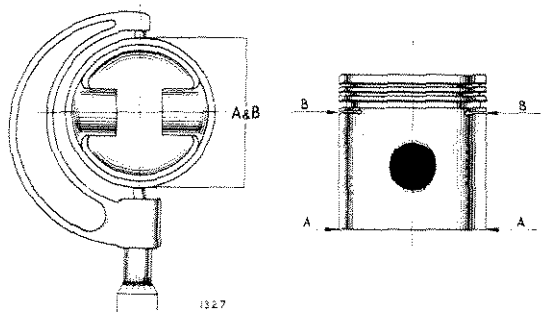


Fig. 33. Measuring piston across thrust face

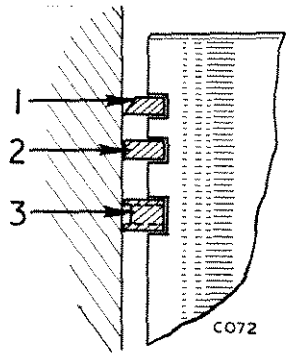


Fig. 34. Location of piston rings

1 Taper faced compression ring
2 Plain compression ring
3 Oil control ring

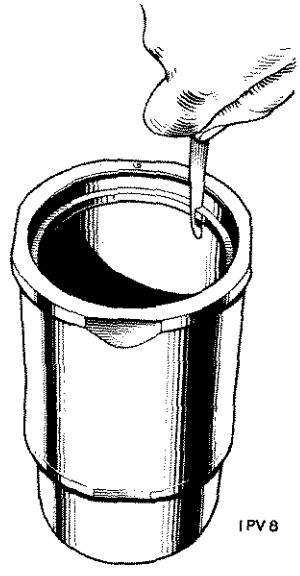
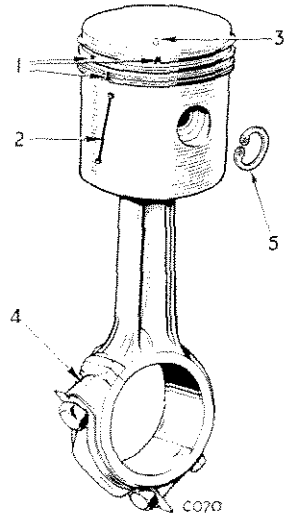


Fig. 35. Measuring ring gaps



1 Piston rings
2 Slot in piston
3 Identification symbol
4 Cap
5 Circlip

Fig. 36. Disposition of piston slot relative to the bearing cap

Measuring Cylinder Liners

Check the cylinder liner bore diameters with a cylinder gauge or comparator such as the Mercer dial gauge shown on Fig. 37. Select an extension piece of suitable length, screw it into the instrument and lock it with the knurled locking ring. Using a new liner of known bore diameter or a 3″ to 4″ micrometer, set the feeler foot and extension piece to the correct bore diameter, rotate the dial to zero the needle, and tighten the locking screw.

Insert the gauge into the cylinder liner bore and, by taking readings at different positions, determine the maximum bore wear which normally occurs towards the top of the bore across its thrust axis. Replace liners worn in excess of the limits given on page 1·103 either with new standard-sized liners and pistons or with re-bored liners and oversize pistons.

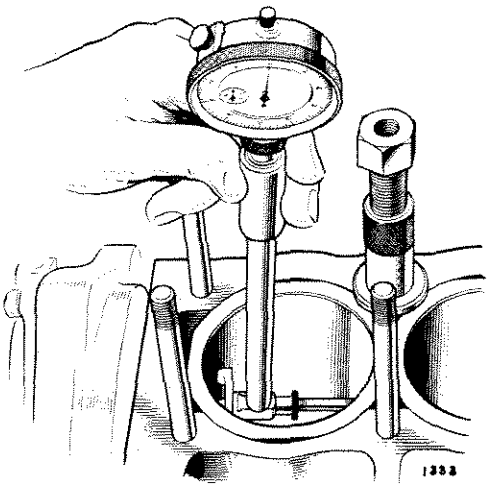


Fig. 37. Measuring cylinder bores

Fitting Pistons to Liners

Using a piston ring clamp, compress the piston rings and insert each piston into its liner. Fit new Figure "8" gaskets coated with jointing compound. Lower each liner and piston assembly into the block. Ensure that the connecting rod offset is towards the camshaft side of the engine. Secure each pair of liners with a clamp, as shown on Fig. 56.

Fit the bearing shells to the connecting rods and caps, locating the bearing tags in the recesses provided. Fit the connecting rods to the crankpins, and assemble the caps. Fit new lockplates, and securely tighten the connecting rod bolts and turn up the lockplate tabs.

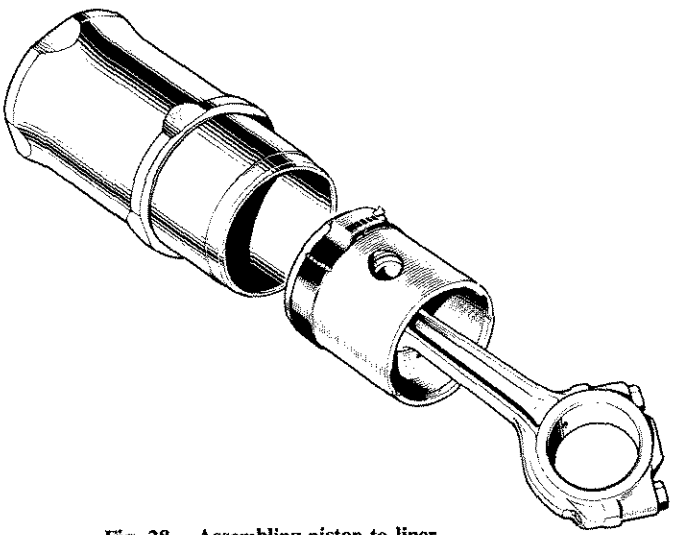


Fig. 38. Assembling piston to liner

Measuring Liner Protrusion

Place a straight edge across the top of the liner and measure its protrusion above the cylinder block.

Liner protrusion — ·003″/·005″ (0·08 mm./ 0·13 mm.)

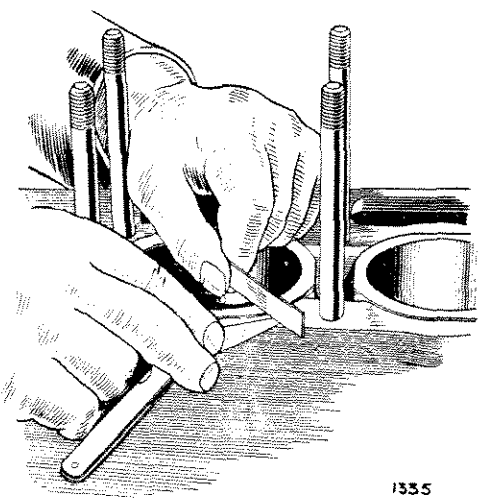


Fig. 39. Measuring liner protrusion

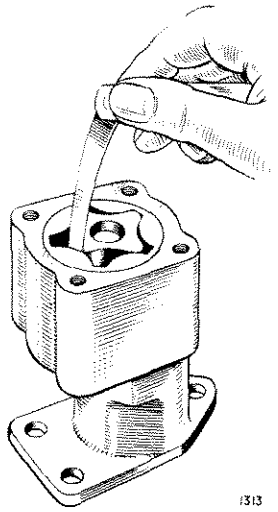


Fig. 40. Measuring clearance between rotors

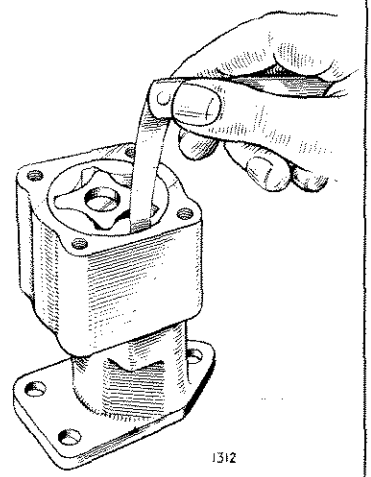


Fig. 41. Measuring clearance between outer rotor and body

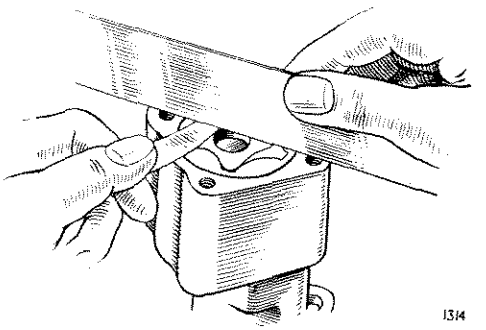
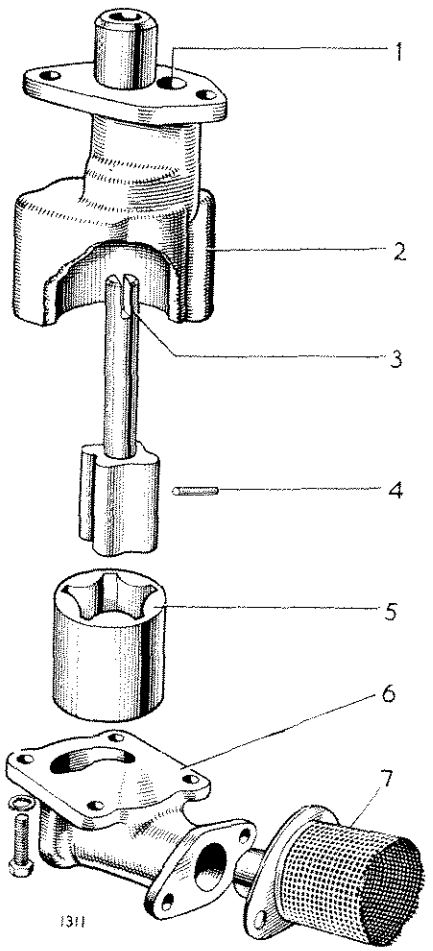


Fig. 42. Measuring rotor end clearance



Oil Pump

Measure clearance between inner and outer rotors.

This must not exceed 0·010″ (·254 mm.).

Measure clearance between outer rotor and body.

This must not exceed 0·010″ (·254 mm.).

Measure the rotor end clearance.

This should not exceed 0·004″ (0·102 mm.).

Re-face the end plate face if worn.

Re-assemble the pump as shown and attach it to the cylinder block.

1 Oil pump outlet
2 Oil pump body
3 Shaft and inner rotor
4 Securing pin
5 Outer rotor
6 End plate
7 Filter

Fig. 43. Arrangement of oil pump components

Flywheel

Flywheel Clutch Face

If the flywheel clutch face is deeply scored, renew the flywheel, or alternatively, skim the face in a lathe, maintaining the following tolerances :

Max. flywheel face run-out relative to spigot face = ·003″ (·0762 mm.) at a radius of 5″.

Balance = 1 dram.

Starter Ring Gear

The four compressions invariably cause the crankshaft to stop at one of two positions. This concentrates wear on the leading edge of the starter ring gear teeth at the two points of starter pinion engagement.

Provided that the teeth are not sufficiently worn to cause jamming, the life of the starter ring may be extended by rotating the ring gear 60° or 120° around the flywheel and re-bolting in position, or by refitting the flywheel to the crankshaft on its second dowel hole.

When the second method is chosen, obliterate the original T.D.C. arrow on the flywheel and re-mark at the appropriate position.

To Remove the Starter Ring Gear

Remove the six bolts and place short lengths of ¼″ dia. (6·35 mm.) M.S. rod in the tapped holes in the clutch face of the flywheel. Refit the bolts and force the ring gear from the flywheel by progressively tightening the bolts.

To Refit the Ring Gear

Pull the ring gear onto its spigot by progressively tightening the bolts.

Fitting the Flywheel to the Crankshaft

Ensure that the flywheel attachment flange on the crankshaft and the corresponding spigot and face on the flywheel are clean. Screw a ⅜″ U.N.F. stud into one of the crankshaft holes as a pilot and fit the flywheel to the crankshaft flange, ensuring that the dowel and dowel hole correspond. Tighten the flywheel attachment bolts and secure them with the lockplates. Using a dial indicator gauge as shown on Fig. 46, measure the flywheel face for run-out.

Maximum run-out must not exceed ·003″ (·0762 mm.).

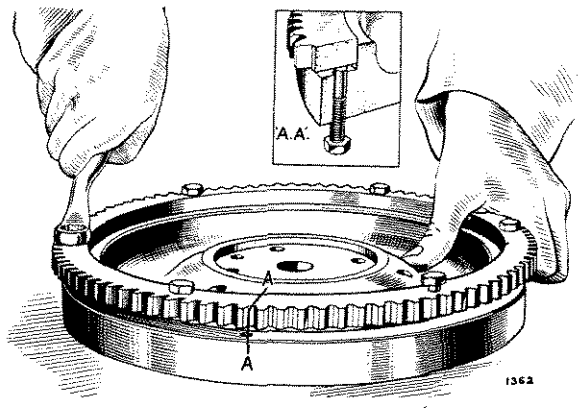


Fig. 44. Fitting ring gear to flywheel. Inset shows method of removing ring gear

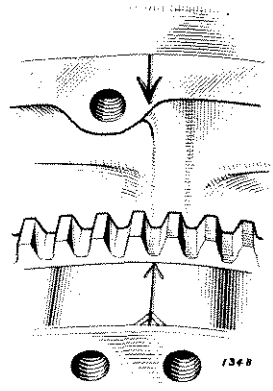


Fig. 45. T.D.C. marks on flywheel and cylinder block

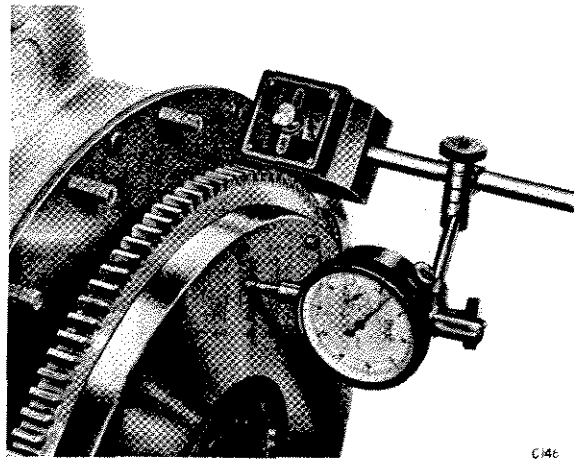
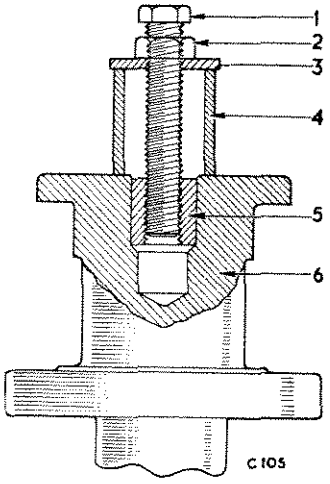
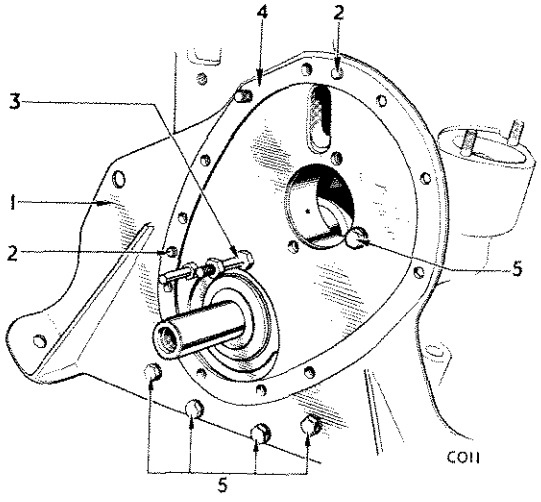


Fig. 46 Checking flywheel clutch face for run-out



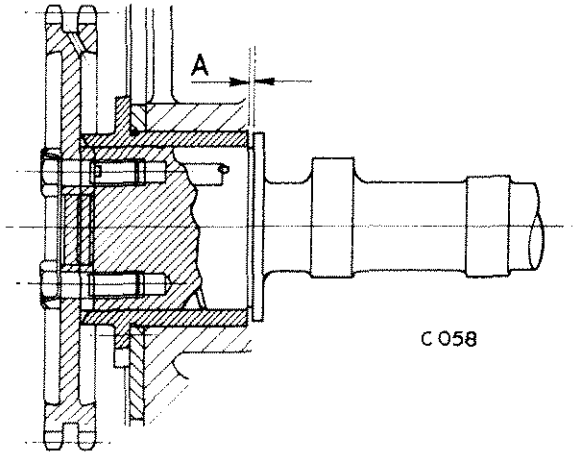
1 Setscrew
2 Lock nut
3 Washer
4 Distance tube
5 Bush
6 Crankshaft

Fig. 47. Withdrawing spigot bush



1 Engine bearer plate
2 Dowels
3 Stud
4 Gasket
5 Bolts

Fig. 48. Front bearer plate attachments



A—0·003″ to 0·0075″ (0·08 mm. to 0·19 mm.)

Fig. 49. Camshaft end-float

Crankshaft Spigot Bush

If it is necessary to renew the spigot bush and its removal is found difficult, cut a $\frac{3}{16}$″ (14·5 mm.) diameter thread in the bush and, using a distance tube and plain washer, withdraw the bush, as shown.

Drive a new spigot bush into the crankshaft bore.

Engine Bearer Plate

Using a straight edge, check the face of the bearer plate for flatness, and correct any irregularities.

Locate the gasket (4) and bearer plate (1) on two dowels (2) and secure with five bolts (5), stud (3) and spring washers, as shown on Fig. 48.

Oil Sump

Using a straight edge, check the sump flanges for distortion and rectify as necessary.

When fitting the oil sump, note that a long bolt is used to secure the breather pipe bracket and two short bolts are fitted to the front sealing block.

Camshaft

End Float

Assemble the camshaft front bearing to the camshaft and temporarily attach the camshaft sprocket.

Measure the end float of the front bearing on the camshaft journal as shown on Fig. 49. End float should be 0·003″ to 0·0075″ (0·08 mm.-0·19 mm.).

Installation

Lubricate the camshaft bearings and insert the camshaft into the cylinder block. Fit the front camshaft bearing and secure it with two bolts and spring washers.

Tappets

Lubricate each tappet and insert it into the cylinder block, making sure that it rotates freely.

Cylinder Head Assembly

Examination

Remove carbon from the cylinder head and examine the valve seats for scores, burns and wear.

Inspect the valve springs for cracks or distortion and check the fitted load. Check the cylinder head welch plug for evidence of leakage and, renew it if necessary.

Valve Guides

Check valve guide wear by inserting a new valve, lifting it $\frac{1}{8}$″ (3·2 mm.) from its seat and rocking it sideways. Movement of the valve head across its seat must not exceed 0·020″ (0·5 mm.). If required, renew the guide by using Churchill Tool No. S.60A-2.

Valve guide protrusion above top face of the cylinder head — 0·78″ (19·84 mm.).

1 Tommy bar
2 Wing nut
3 Bearing assembly
4 Tool body
5 Centre spindle
6 Distance piece
7 Knurled nut
X 0·78″ (19·84 mm.)

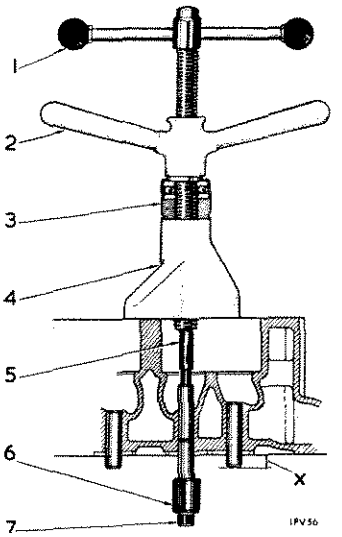


Fig. 50. Fitting new valve guides

Valve Seat

When re-cutting the valve seats, ensure that the pilot of the cutter is a close fit in the valve guide. Should it be necessary to use a 15° cutter for reducing the seat width, do not exceed dimension 'B'.

Valve seat angle — 45°.

Valve Seat Inserts

When the original valve seat cannot be rectified by re-cutting, use Churchill Tool No. 6056 with adaptors to bore out the old seats.

If both inlet and exhaust seat inserts are required, bore out the inlet seat recess first, fit the insert and then bore the exhaust recess, cutting into the edge of the inlet insert.

Remove all swarf from the cylinder head and, drive the insert squarely into its bore. Secure it by peening the edges of the combustion chamber.

Cut a new seat on each valve insert as described under "Valve Seats".

A. 0·06″ (1·5 mm.)
B. Inlet 1·716″ max. (43·59 mm.)
Exhaust 1·438″ max. (36·35 mm.)
C. 0·10″ max. (2·5 mm.)

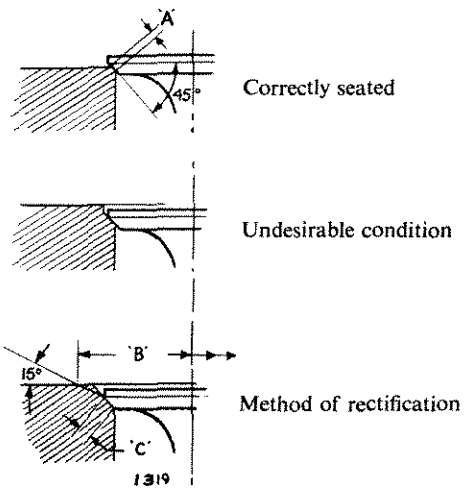


Fig. 51. Valve seat conditions

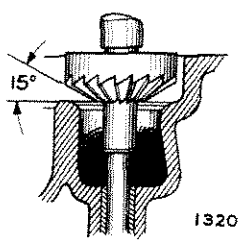


Fig. 52. Using a 15° cutter to remove valve seat "steps"

1 0·25″—0·253″ (6·35—6·43 mm.)
2 0·044″ × 89° included (1·12 mm. × 89° included)
3 1·717″—1·716″ (43·61—43·59 mm.)
4 1·439″—1·438″ (36·53—36·51 mm.)

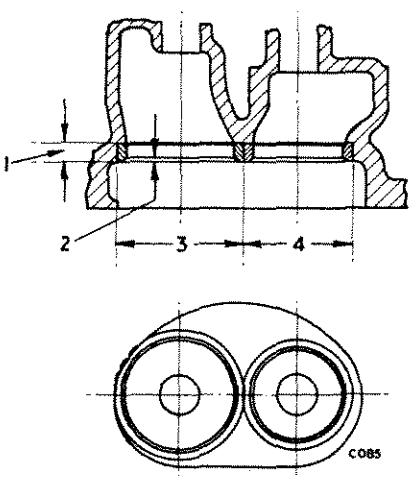
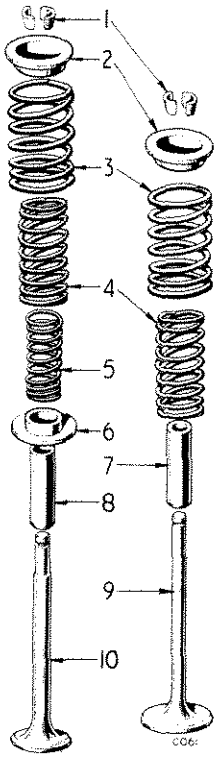
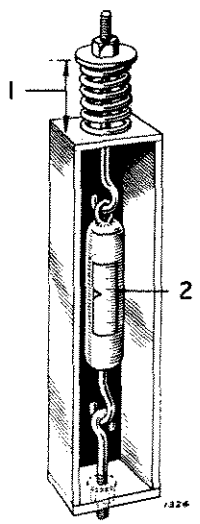


Fig. 53. Valve seat insert dimensions



1 Split collets
2 Upper collars
3 Outer valve springs
4 Inner valve springs
5 Auxiliary valve spring
6 Lower collars
7 Inlet valve guide
8 Exhaust valve guide
9 Inlet valve
10 Exhaust valve

Fig. 55. Valve details



1 Fitted length
2 Fitted load

Fig. 57. Using spring balance to check valve springs

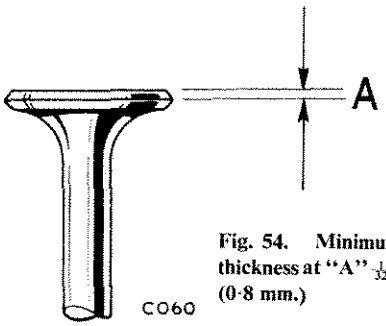


Fig. 54. Minimum thickness at "A" $\frac{1}{32}$" (0·8 mm.)

Valves

Check valve stems for wear and distortion. Examine the condition of each valve face and re-face, or renew the valve as required. Remove the minimum necessary to clean up the face. Reject valve if its head thickness is less than $\frac{1}{32}$" (0·8 mm.).

Valve Seat Grinding

Grind the valves into their respective seatings in the cylinder head.

Test each seating by lightly smearing the valve face with engineer's marking blue. Insert the valve into its seating and rotate it not more than $\frac{1}{8}$" (3 mm.) in each direction. A complete circle should appear on the valve seating, indicating satisfactory seating.

Valve Springs

If a spring testing machine is not available, use a spring balance as shown on Fig. 57 to check the valve springs. Valve spring data is given on page 1·103.

Assembly

Remove all trace of grinding paste, lubricate the valve stems and fit them to the guides. Assemble the valve springs, collars and split collets as shown on Fig. 55. Ensure that closed coils of the valve springs are nearest the cylinder head.

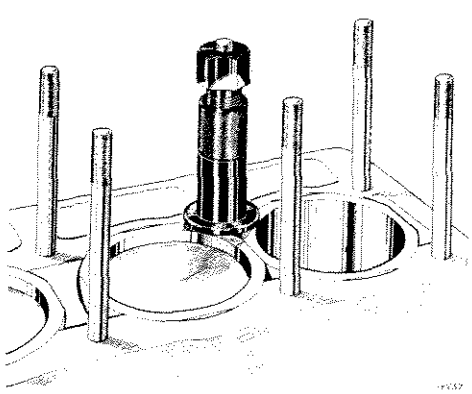
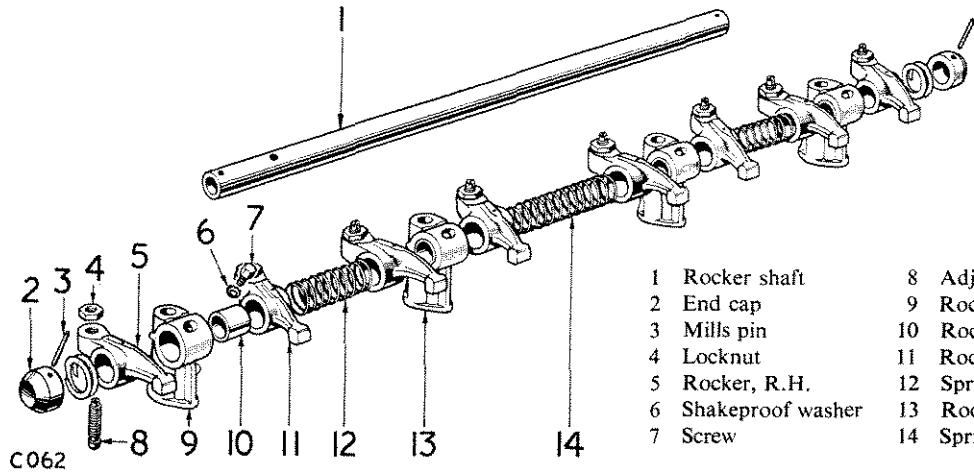


Fig. 56. Cylinder liner retainers, tool No. S.138



1	Rocker shaft	8	Adjuster
2	End cap	9	Rocker pedestal (rear)
3	Mills pin	10	Rocker bush
4	Locknut	11	Rocker, L.H.
5	Rocker, R.H.	12	Spring
6	Shakeproof washer	13	Rocker pedestal
7	Screw	14	Spring

Fig. 58. Rocker shaft details

Cylinder Head Re-assembly

Remove the cylinder liner retainers S.138, coat a new cylinder head gasket with jointing compound and fit this over the cylinder head studs.

Lower the cylinder head onto the block, and fit the lifting eye, plain washers and nuts. Tighten the nuts in the order shown in Fig. 59.

Insert the eight push rods, ensuring that their lower ends engage correctly in the tappets.

Lubricate and assemble the components onto the rocker shaft as shown on Fig. 58. Note that each pair of rockers are offset and that a shouldered screw and shakeproof washer are used to locate the rear pedestal on the shaft. Slacken off the locknuts (4) and screw in the adjusters (8) to avoid bending the pushrods. Lower the rocker shaft assembly over the four studs simultaneously locating the rocker adjusters in the push rod cups.

Fit and progressively tighten the four rocker shaft nuts.

Rocker Clearances

Check and if necessary adjust the rocker clearances when the tappet is resting on the back of the cam. To obtain this position, turn the camshaft until number one push rod has reached its highest point, then turn a further full revolution to ensure that the push rod is fully down and the tappet is resting on the back of the cam.

If adjustment is necessary, slacken off the locknut and turn the adjusting screw until the correct clearance is obtained. (Fig. 60).

Tighten the locknut and re-check the clearance. Treat each rocker similarly.

Rocker clearances 0·01″ (0·25 mm.) cold.

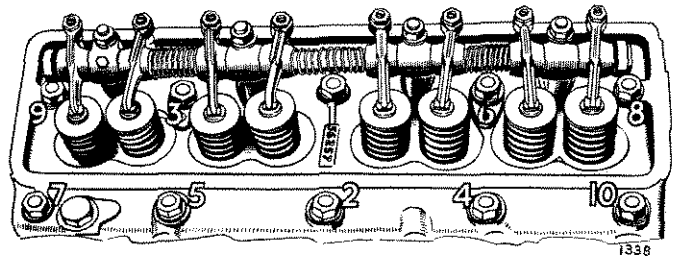
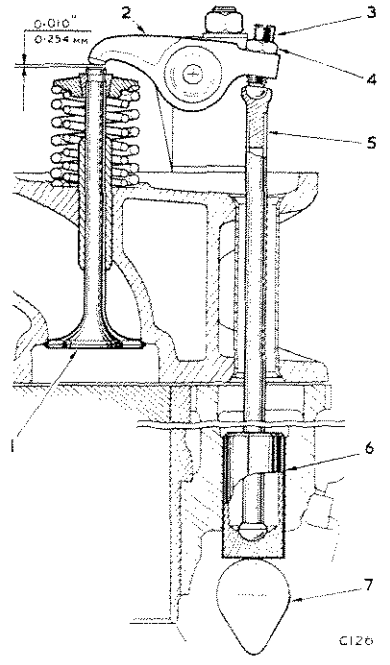


Fig. 59. Cylinder head nut tightening sequence



1 Valve
2 Rocker
3 Adjuster
4 Locknut
5 Push rod
6 Tappet
7 Camshaft

Fig. 60. Section through valve operating details

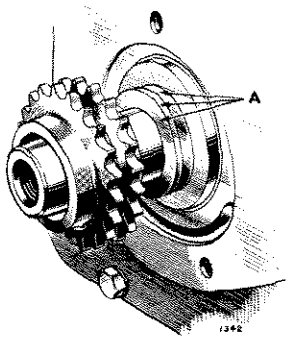


Fig. 61. Showing shims "A" behind the sprocket

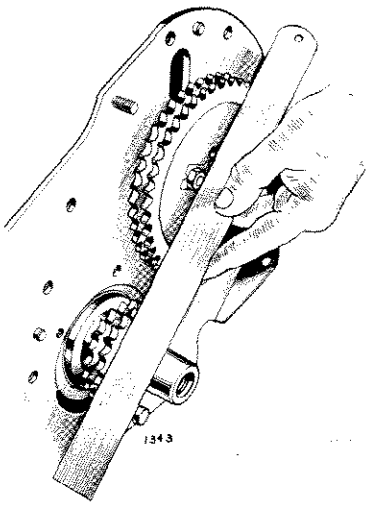
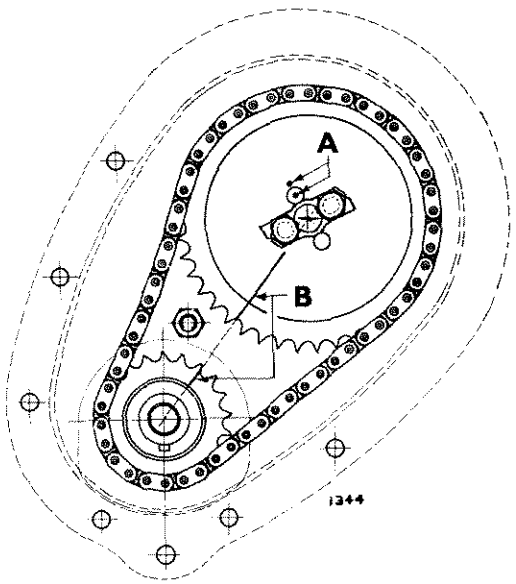


Fig. 62. Checking sprocket alignment

Alignment of Timing Sprockets

Timing sprocket alignment is controlled by shims interposed between the rear face of the crankshaft sprocket and a shoulder on the crankshaft.

To align the sprockets, temporarily fit the camshaft sprocket and check the alignment by placing a straight edge across both sprockets. Remove or fit shims as required.



Valve Timing with Marked Sprockets

If the original sprockets are being refitted, set the valve timing by utilizing the timing marks on the sprockets as shown on Fig. 63.

A. Punch marks
B. Scribed lines

Fig. 63. Relative position of timing marks when No. 1 piston is at T.D.C. (compression stroke)

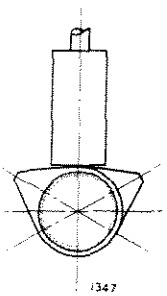


Fig. 64. Position of cams at the point of balance

Valve Timing with Unmarked Sprockets

Temporarily attach the camshaft sprocket and turn the camshaft until number one push-rod has reached its highest point. In this position, adjust number eight rocker clearance to ·040″ (1 mm.).

Repeat the procedure with number two push-rod and adjust number seven rocker until its clearance is identical to that of number eight rocker.

Again turn the camshaft until numbers seven and eight valves have reached the point of balance, that is, where one valve is about to open and the other about to close. Fig. 64 illustrates the position of the cams at this point.

Move the camshaft slowly to a point where the clearances between the rockers and valve stems are exactly equal, this is the point of balance.

Turn the crankshaft to bring numbers one and four pistons to T.D.C.

Fitting Timing Chain

Exercising the greatest care, remove the timing sprocket without disturbing the camshaft. Encircle both sprockets with the timing chain and offer up the camshaft sprocket to the camshaft. Manoeuvre the sprocket by slipping a link at a time or by reversing the sprocket until a pair of holes exactly coincide with those of the camshaft.

NOTE : The camshaft timing sprocket is provided with four holes which are equally spaced but offset from a tooth centre. Half tooth adjustment is obtained by rotating the sprocket 90 degrees from its original position.

A quarter tooth adjustment may be obtained by turning the sprocket "back to front". By rotating it 90 degrees in this reversed position, three-quarters of a tooth variation is obtained.

After securing the sprocket, re-check the timing to ensure that the camshaft has not been disturbed during this operation. With number one piston at T.D.C., numbers seven and eight rocker clearances should be identical.

Adjust the rocker clearances to 0·010″ (0·254 mm.).

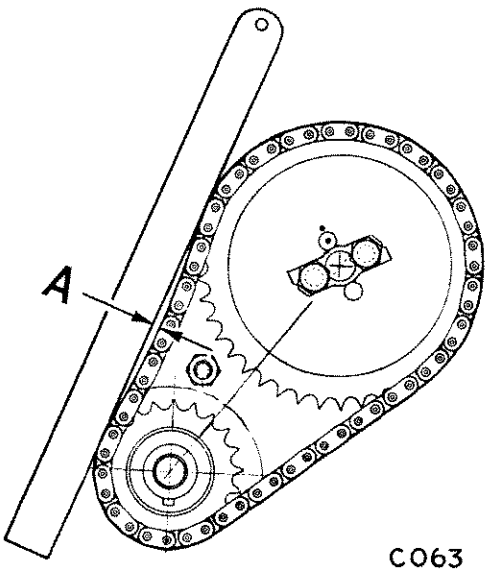


Fig. 65. Checking the timing chain for wear. Dimension "A" should not exceed 0·4″ (10 mm.)

VALVE TIMING

Inlet opens 17° B.T.D.C.
Inlet closes 57° A.B.D.C.
Exhaust opens 57° B.B.D.C.
Exhaust closes 17° A.T.D.C.

Inlet and exhaust cam period 127° at 0·0093″ (0·236 mm.) tappet clearance

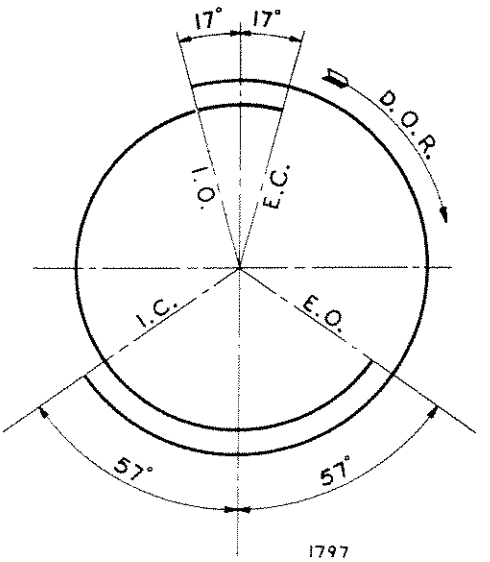


Fig. 66. Valve timing. (Theoretical reference only)

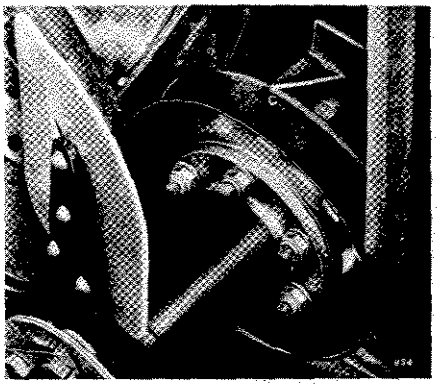
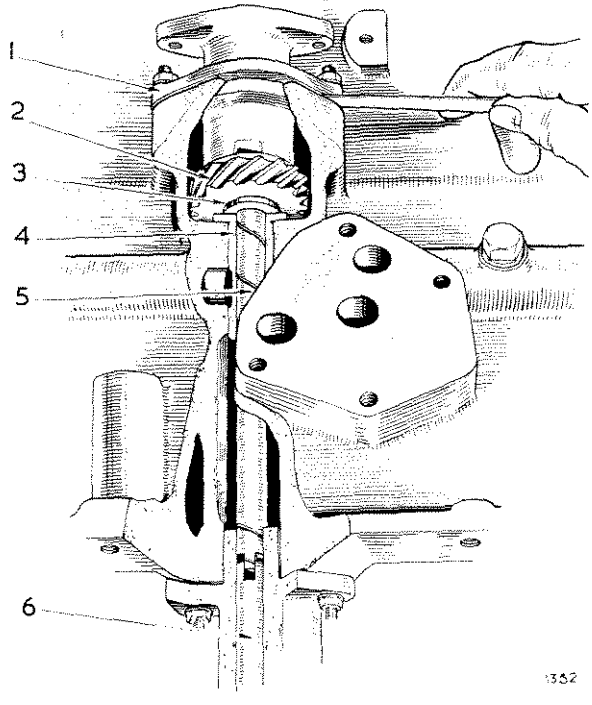


Fig. 67. A small hole in the fan pulley is aligned with a pointer when No. 1 piston is at T.D.C.



1 Distributor pedestal
2 Distributor drive gear
3 0·5″ (12·7 mm.) I.D. washer
4 Oil pump drive shaft bush
5 Oil pump drive shaft
6 Oil pump rotor shaft

Fig. 68. Measuring distributor drive gear end-float

Timing Cover (Figs. 1 and 4)

Renew a worn or damaged oil seal.

Remove a worn tensioner by opening the blade sufficiently to spring it over the pin. Fit a new blade by reversing this procedure.

Fit a fibre washer (62) to the extended centre attachment stud (63). Position the oil thrower (139), dished face outwards, adjacent to the sprocket on the crankshaft and insert a Woodruff key (134) into the keyway.

Fit a new gasket (85) on the dowels and stud. Compress the chain tensioner (90) and fit the timing cover (84), releasing the tensioner when it engages the edge of the cover. Secure the timing cover with the bolts (83).

Fan Pulley Assembly

Assemble the hub (142) and extension (145) to the pulley (141), placing the hub keyway 180° away from the small T.D.C. indicator in the pulley flange. (See Fig. 67).

Fit the shouldered rubber bushes (146) to the fan, (four front and four rear) and insert a distance sleeve (147) through each pair of bushes. Assemble the fan to the extension.

NOTE: A $\frac{1}{16}$″ (1·6 mm.) diameter hole is drilled through the balancer (152), plate (151), fan (148) and extension (145); these components are correctly positioned when the shank of a $\frac{1}{16}$″ (1·6 mm.) drill can be pushed through the aligned holes.

Fit the fan pulley assembly to the crankshaft and secure it with the dog bolt (143). When fully tightened, the position of the "starter dogs" should be equivalent to "ten minutes to four" (No. 1 piston at T.D.C.). Adjust if necessary by altering the thickness of shims between the extension and dog bolt.

Rocker Cover

Apply jointing compound to the cover flange face and fit a new cork gasket. Leave to dry on a flat surface with a weight on top of the cover. Fit the rocker cover to the cylinder head and secure it, using a fibre washer, plain washer and nyloc nut on each attachment stud.

Distributor Drive Gear End Float (Fig. 68)

Determine the requisite amount of packing under the distributor pedestal to give 0·003″ to 0·007″ (0·076 to 0·178 mm.) distributor drive gear end float by the following procedure :-

Insert the oil pump drive shaft (5) through the bush (4) and rotate the shaft to engage its driving tongue with the oil pump driving slot. Measure the thickness of a plain washer having an internal diameter of $\frac{1}{2}$″ (12·7 mm.). Slide the washer (3) and gear (2) over the shaft and fit the distributor pedestal.

Measure the gap between the pedestal and cylinder block as shown. Subtract this dimension from the washer thickness to determine the end float of the gear.

Example 1

If the washer thickness is	0·062″	1·57 mm.
and the width of the gap is	0·060″	1·52 mm.
Then the gear float will be	+ 0·002″	0·05 mm.

The float of 0·002″ (0·0508 mm.) is insufficient and requires packing of 0·003″ (0·08 mm.) thickness to produce an end float of 0·005″ (0·12 mm.) (mean tolerance).

Example 2

Thickness of washer	0·062″	1·57 mm.
Width of gaps	0·065″	1·65 mm.
Gear interference	0·003″	0·08 mm.

In this example, the interference of 0·003″ (0·08 mm.) requires packing of 0·008″ thickness (0·2 mm.) to give an end float of 0·005″ (0·12 mm.).

Remove the pedestal, gear and drive shaft, and withdraw the ½″ I.D. washer from the shaft.

To Position Timing Gear

Position the crankshaft at T.D.C. with No. 1 piston on the compression stroke.

Fit the Woodruff key to the oil pump drive shaft and lower the shaft into the bush, engaging the driving tongue with the oil pump driving slot. Rotate the shaft so that the key is pointing outwards at right angles to the cylinder block.

Lower the distributor drive gear onto the shaft, allowing it to turn as it meshes with the camshaft gear.

With the gear resting on the bush, the distributor drive slots must be in the position shown on Fig. 69.

Fit the paper packing washers and secure the distributor pedestal.

Distributor Timing

Adjust the distributor points to 0·015″ (0·4 mm.). Secure the clamp plate to the pedestal and lower the distributor into the pedestal, engaging its driving dog with the slot of the gear. With the crankshaft at T.D.C. and firing on No. 1 cylinder, the rotor arm must be positioned as shown in Fig. 70.

Set the vernier adjustment (2) in the centre of its scale and adjust the distributor in a clockwise direction until the C.B. points are commencing to open. Tighten the clamp bolt (1) and rotate the screw (4) until one extra division appears on the scale (2). One division is equal to 4° crankshaft angle.

NOTE : These settings are nominal and should be adjusted to give the best road test performance.

Distributor rotation — anti-clockwise.

Firing order — 1, 3, 4, 2.

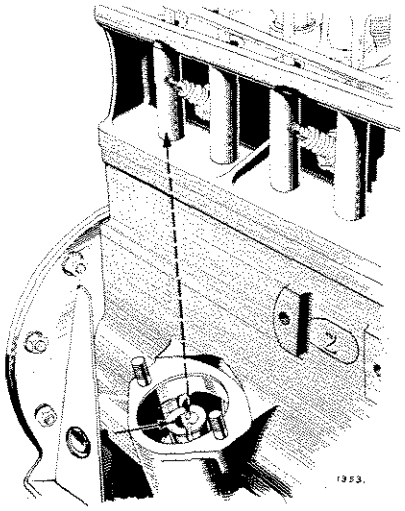
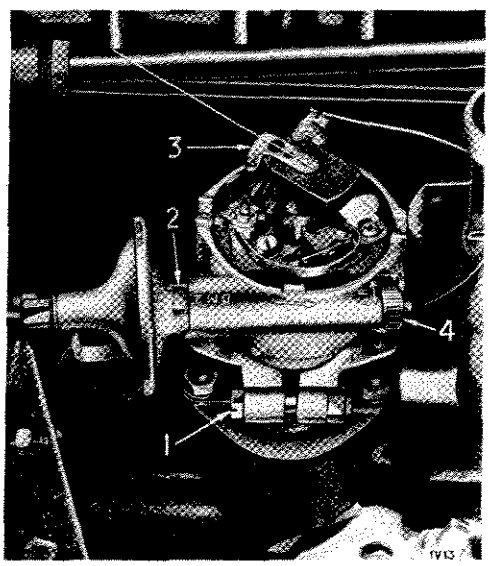


Fig. 69. Driving slot aligned with No. 1 push rod tube when No. 1 piston is at T.D.C. compression stroke. Note the offset shown arrowed



1 Clamp bolt
2 Adjusting scale
3 Rotor arm
4 Thumb-screw

Fig. 70. Ignition distributor

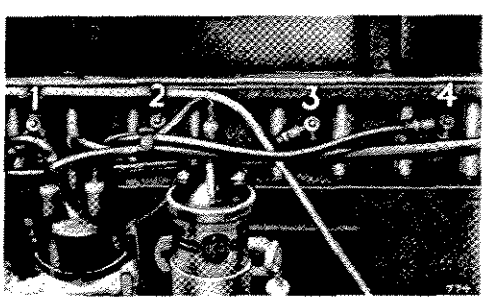
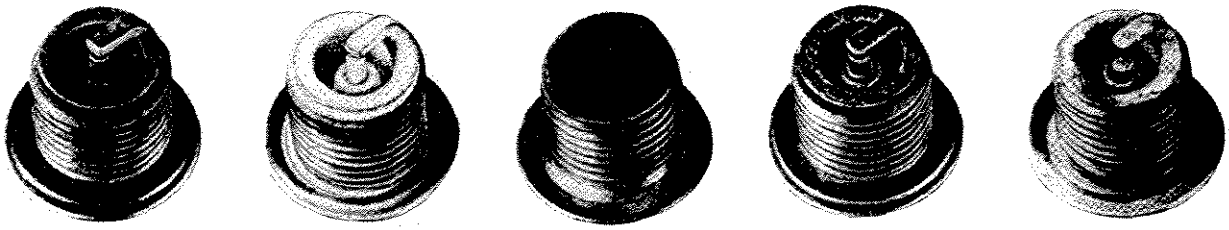


Fig. 71. H.T. Cables



Correct grade | Too hot running | Too cool running | Mixture too rich | Worn out plug

Fig. 72. Guide to sparking plug conditions

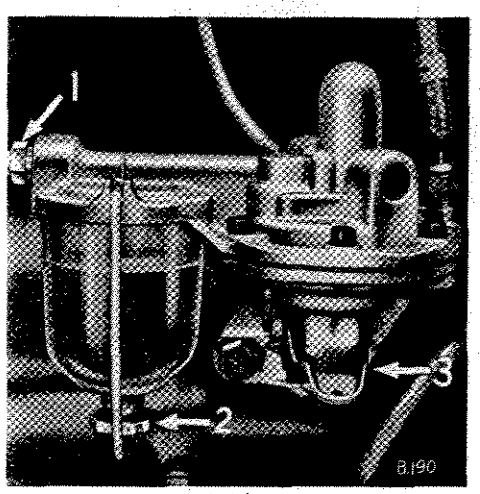


Fig. 73. Fuel pump

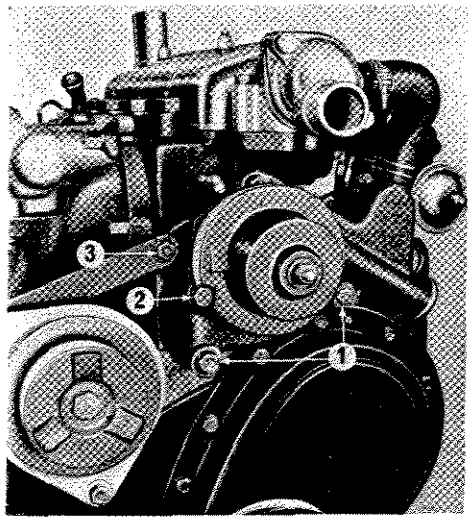


Fig. 74. Water pump

Sparking Plugs

The life of spark plugs and the periods at which they should be cleaned varies with the condition of the engine and the work it performs. As a general recommendation, adjust electrode gaps to 0·025″ (·635 mm.) every 3,000 miles, and renew plugs every 12,000 miles.

Fig. 72 provides an easy guide for identifying the various plug conditions.

Smear the threads of new plugs with graphite grease to prevent the possibility of seizure and damage to the cylinder head.

Coil and H.T. Cables

Secure the coil to the cylinder block and connect the H.T. cables as shown on Fig. 71. These cables are of special construction and must under no circumstances be replaced by tinned copper cored cables. See "H.T. ignition cables" (Group 6).

FUEL PUMP

Installation

Service the fuel pump as described on page 1·301 and assemble it to the engine. The rear nut is also used to secure the oil pressure pipe clip.

Water Pump

Service the water pump as described on page 1·204 and assemble it to the engine as shown on Fig. 74.

Generator

Service the generator as described in Group 6, assemble it to the engine as shown, and adjust the fan belt as described on page 0·016.

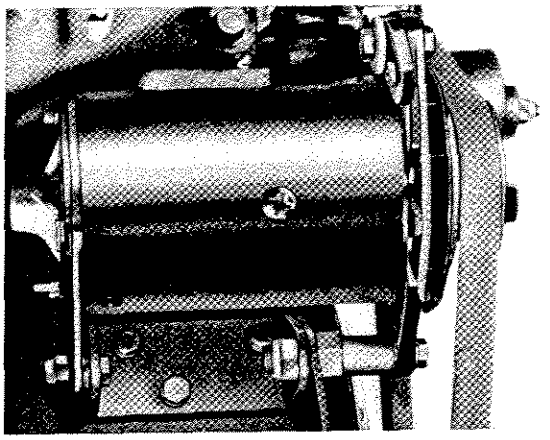


Fig. 75. Generator attachments

Manifolds

Assemble the inlet and exhaust manifolds and attach them to the engine. The details are shown on page 1·401.

Carburettors

To avoid damage, fit the carburettors after the engine has been installed in the chassis. Connect the controls, pipes and attach the air cleaners (Fig. 76). Service the carburettors as described on page 1·303.

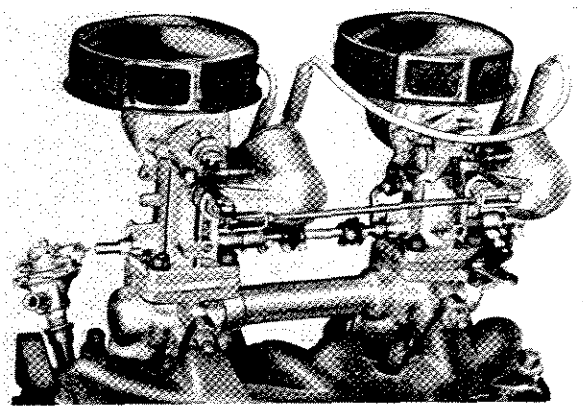
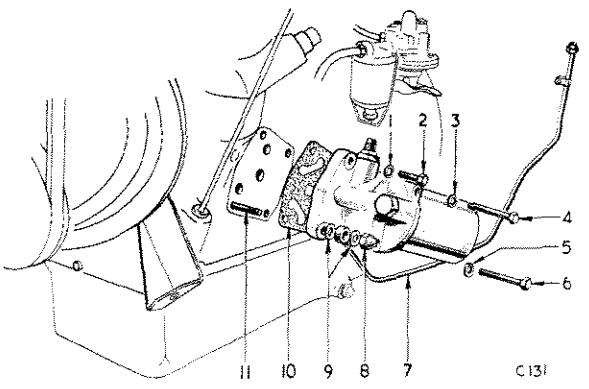


Fig. 76. Manifolds and carburettor assembly

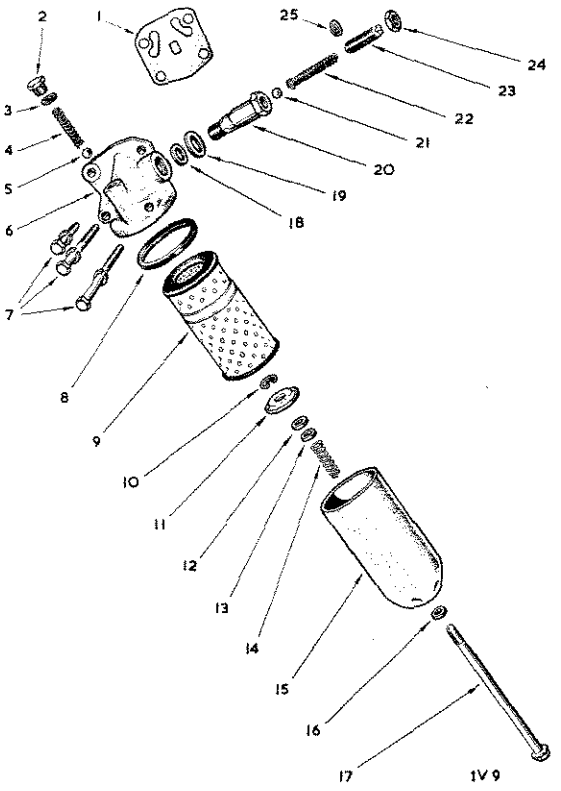
Oil Filter

Renew the element as described on page 0·016 and secure the unit to the crankcase. Connect the oil pressure pipe as shown on Fig. 77.



1 Spring washer
2 Bolt
3 Spring washer
4 Bolt
5 Spring washer
6 Bolt
7 Oil pressure pipe
8 Cap nut
9 Copper washers
10 Gasket
11 Stud

Fig. 77. Oil pressure pipe attachment



1	Gasket	14	Spring
2	Cap nut	15	Container
3	Washer	16	Rubber seal
4	Spring	17	Bolt
5	By-pass valve ball	18	Sealing ring
6	Body	19	Washer
7	Bolts	20	Valve body
8	Rubber sealing ring	21	Ball—relief valve
9	Filter element	22	Spring
10	Spring clip	23	Adjusting screw
11	Locating disc	24	Locknut
12	Rubber seal	25	Lead wire
13	Washer		

Fig. 78. Exploded view of full-flow oil filter

Pressure Relief Valve Adjustment

To test relief valve operation, proceed as follows :—

1. Run the engine until normal operating temperature is attained.
2. Slowly increase the engine speed to approximately 2,000 r.p.m. and observe the oil pressure gauge. Pressure should rise steadily to 75 lb./sq. in. (5·273 kg./cm.^{2}) and at 2,000 r.p.m. fall to 70 lb./sq. in. (4·921 kg./cm.^{2}).
3. If necessary, adjust the relief valve pressure by slackening the locknut (24). Rotate the screw (23) clockwise to increase the relief valve opening pressure and counter clockwise to reduce it. When correct adjustment is obtained, tighten the nut (24).

COOLING SYSTEM

Description

Circulation of water in the pressurized cooling system shown on Fig. 1, is assisted by a belt driven water pump of the impeller type and controlled by a thermostat.

Filling

Close the drain taps (1 and 2) and set the heater control in the hot position.

Remove the filler cap (3), fill with clean soft water, and refit the cap. Warm up the engine and replenish the water level if necessary.

Draining

Remove the filler cap, set the heater control in the hot position and open the radiator and cylinder block drain taps.

Flushing

Periodically flush the cooling system, using a proprietary flushing compound and follow the instructions supplied.

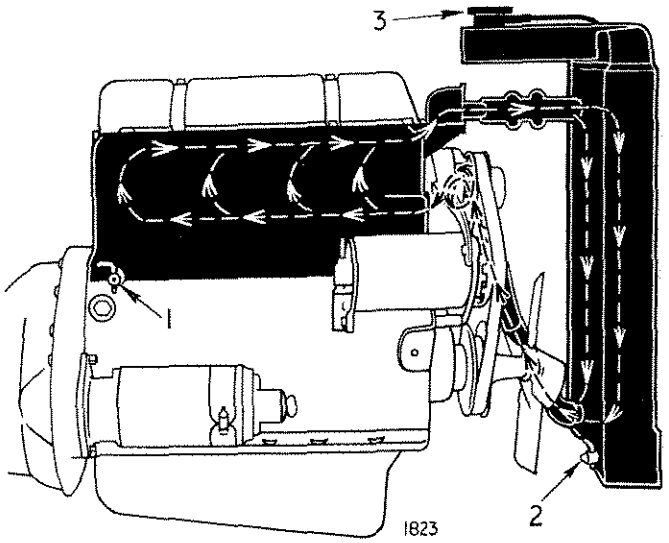


Fig. 1. Water circulation

Pressure Testing

Use an A.C. pressure tester to test the cooling system as follows :

With the engine warm, remove the filler cap, and top up the water level. Using an adaptor, fit the pressure tester to the filler neck and pump up to a pressure of 4 lb. sq. in. (0·281 kg/cm²).

The cooling system should maintain this pressure for 10 seconds.

A more severe test may be applied by following the above procedure with the engine running. Absence of external leaks accompanied by pressure fluctuations usually indicates a leaking cylinder head gasket.

Filler Cap

Use an A.C. pressure tester to check the operation of the filler pressure cap as follows :

1. Rinse the cap in water to remove sediment and fit the cap to the tester whilst wet, as shown on Fig. 2.
2. Pump up the pressure until the gauge pointer stops rising.
3. Reject the cap if it will not register and maintain 4 lb. sq. in. (0·281 kg./cm²) for 10 seconds without additional pumping.

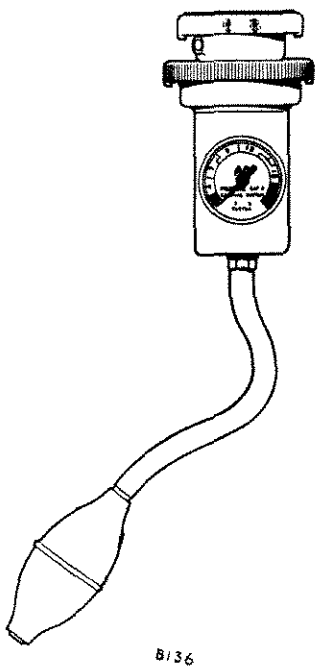


Fig. 2. Testing the radiator filler cap

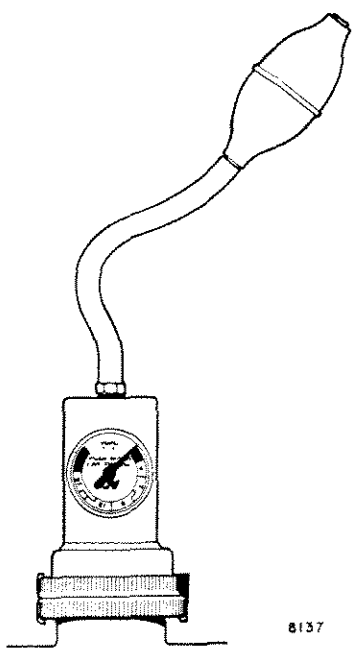
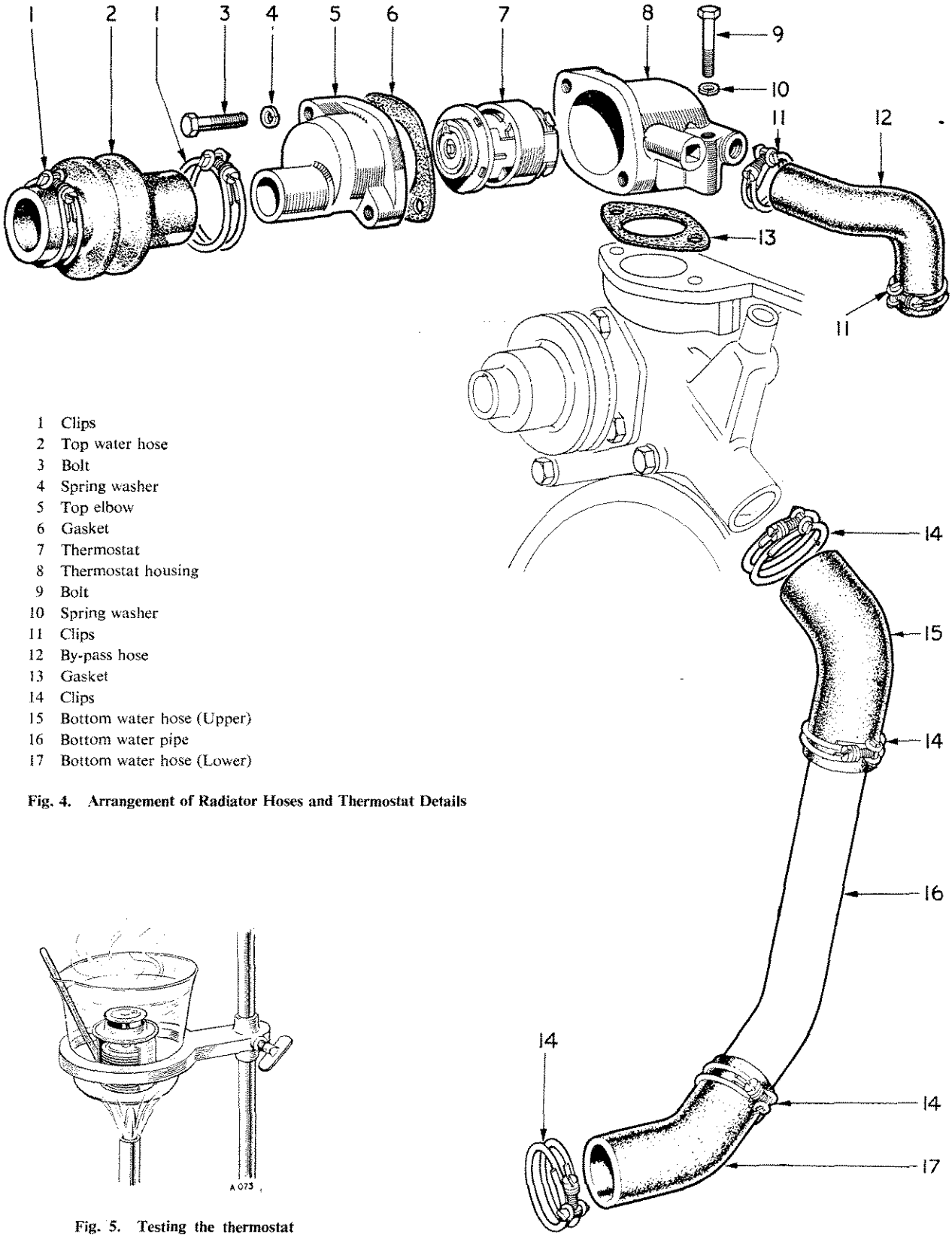


Fig. 3. Testing the cooling system



1 Clips
2 Top water hose
3 Bolt
4 Spring washer
5 Top elbow
6 Gasket
7 Thermostat
8 Thermostat housing
9 Bolt
10 Spring washer
11 Clips
12 By-pass hose
13 Gasket
14 Clips
15 Bottom water hose (Upper)
16 Bottom water pipe
17 Bottom water hose (Lower)

Fig. 4. Arrangement of Radiator Hoses and Thermostat Details

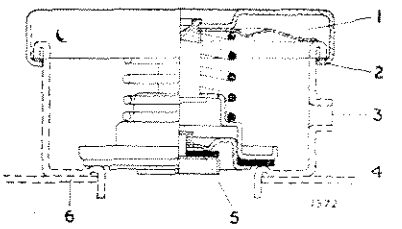
Fig. 5. Testing the thermostat

Anti-freeze Mixtures

To protect the cooling system during frosty weather, use an inhibited Glycol base anti-freeze solution. Because of the searching effect of these solutions, check the system for leaks before adding the anti-freeze.

Approved brands of anti-freeze are given on page 13. For quantities of anti-freeze mixtures required to safeguard the system at specific temperatures, consult the manufacturer's recommendations.

It is recommended that fresh anti-freeze is used each year, since the inhibitor becomes exhausted and the components in contact with the cooling water may corrode. When topping up the coolant, use a mixture of anti-freeze and water.



1 Spring friction plate
2 Retaining lugs
3 Pressure release pipe
4 Pressure valve seal
5 Vacuum valve seal
6 Header tank

Fig. 6. Section through radiator filler cap

Thermostat

To remove the thermostat, drain the cooling system, detach the bolts (3) (Fig. 4), spring washers (4) and swing the outlet cover (5) sideways on the flexible hose (2). Detach the gasket (6) and remove the thermostat (7) from its housing (8).

Testing the Thermostat

Test the thermostat by heating it in water together with a thermometer as shown on Fig. 5. Note the temperatures at which the valve starts to open.

Opening temperatures - 70°C. (158° F.).
Maximum Valve Lift - 0·281″/0·407″ (7·137/10·337 mm.).

To Refit

Reverse the removal procedure.

Radiator

Removal

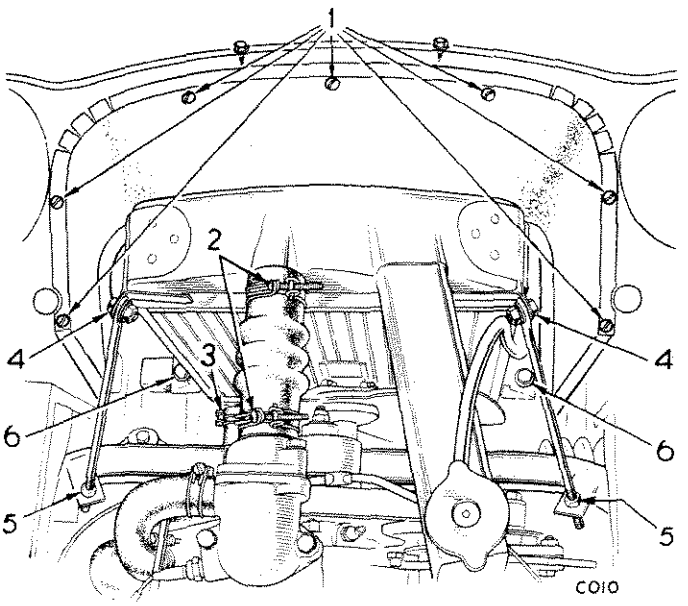
Drain the cooling system and remove or disconnect items in the order shown on Fig. 7.

Lift out the radiator.

Refitting

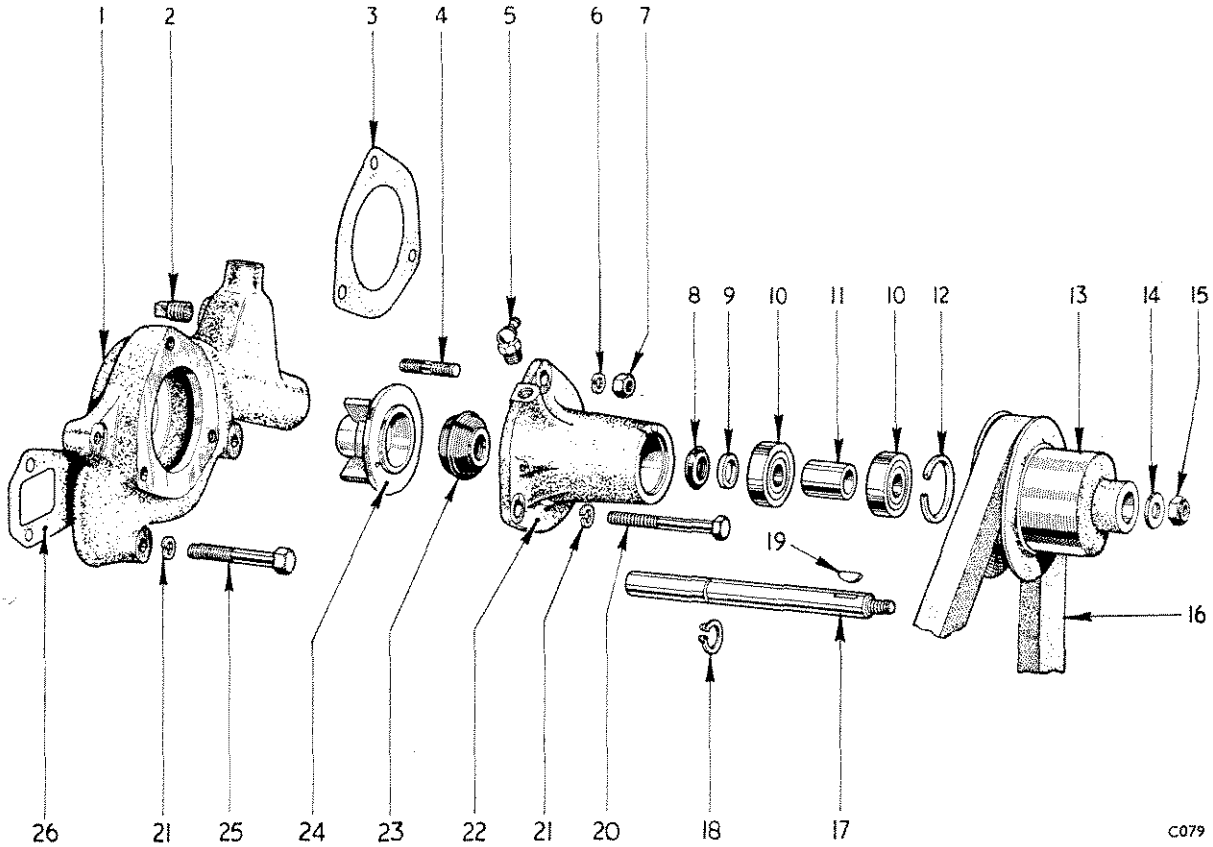
Reverse the sequence of operations shown on Fig. 7.

NOTE: Composition packings are fitted between the lower radiator attachment points and the chassis brackets.



1 Air deflector attachment screws
2 Top hose clips
3 Bottom hose clips
4 Radiator stay attachment
5 Adjusting nuts
6 Radiator attachments

Fig. 7. Radiator and air deflector attachments



1 Body
2 Heater return pipe blanking plug
3 Gasket
4 Stud
5 Grease nipple
6 Spring washer
7 Nut
8 Spinner
9 Distance washer
10 Ball race
11 Distance tube
12 Circlip
13 Pulley
14 Plain washer
15 Nyloc nut
16 Driving belt
17 Shaft
18 Circlip
19 Woodruff key
20 Bolt
21 Spring washer
22 Bearing housing
23 Seal and bellows assembly
24 Impeller
25 Bolt
26 Gasket

Fig. 8. Arrangement of Water Pump Details

Water Pump (Fig. 8)

Removal

1. Disconnect the battery and drain the cooling system.
2. Slacken the generator attachments, swing the generator inwards and remove the driving belt.
3. Disconnect the lower radiator hose (15), Fig. 4, and by-pass hose (12).
4. Remove three bolts (25) and spring washers and detach the water pump from the cylinder block.

To remove the bearing housing only, remove nut (7), spring washer (6) and unscrew two bolts (20). Remove the housing (22) and gasket (3) from the pump body (1).

To Refit

Reverse the removal procedure and tension the driving belt. (See page 0·208).

FUEL PUMP

To Clean the Pump Filter

Loosen the thumb nut below the glass sediment bowl. Swing the wire frame to one side and remove the sediment chamber, cork gasket and gauze filter for cleaning.

When re-assembling, renew the cork washer if damaged.

Run the engine and check for leakage.

To Dismantle Fuel Pump

(a) Clean the exterior of the pump and file a mark across both flanges to facilitate re-assembly.

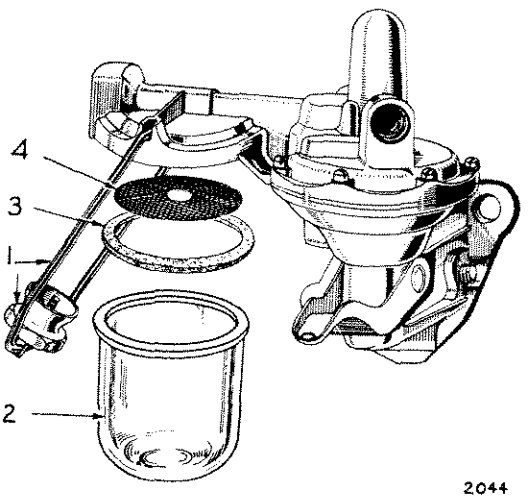
(b) Dismantle in the sequence given on Fig. 2. Re-assemble by reversing the sequence.

(c) To remove the diaphragm assembly (12) first turn it through 90° in an anti-clockwise direction and lift out of engagement with link lever (24).

NOTATION FOR FIG. 2

Ref. No.	Description
1	Stirrup
2	Glass sediment bowl
3	Cork seal
4	Gauze filter
5	Securing screw
6	Lock washer
7	Upper body
8	Screw for retaining plate
9	Valve retaining plate
10*	Inlet and outlet valve assemblies
11	Valve gasket
12	Diaphragm assembly
13	Diaphragm spring
14	Oil seal retainer
15	Oil seal
16	Primer lever
17	Cork washer
18	Primer lever shaft
19	Hand primer spring
20	Circlip
21	Rocker arm pin
22	Washer
23	Rocker arm
24	Link lever
25	Rocker arm spring
26	Lower body

* These valves are identical, but on fitting them to the upper body the spring of the inlet valve is pointing towards the diaphragm and the spring of the outlet valve away from the diaphragm, as shown in the illustration.



1 Retaining stirrup
2 Glass sediment bowl
3 Cork seal
4 Gauze filter

Fig. 1. Fuel pump

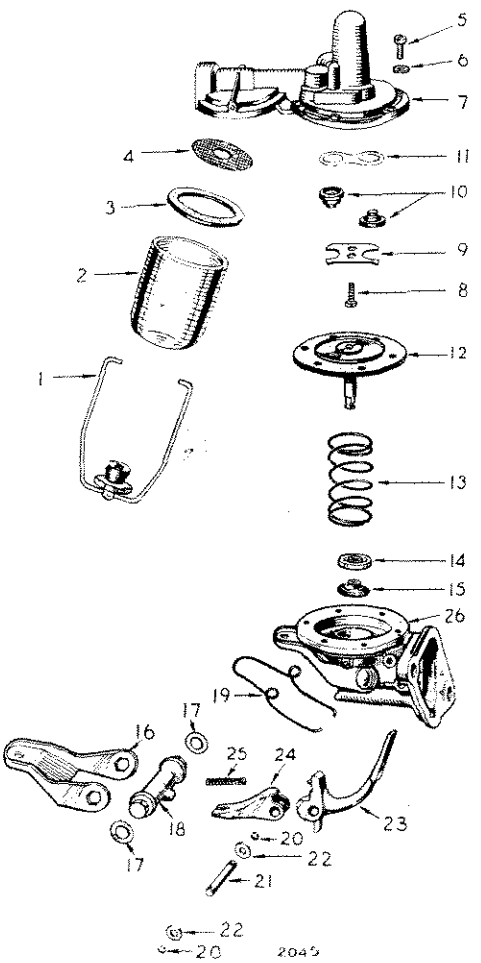


Fig. 2. Fuel pump details

CARBURETTOR DETAILS

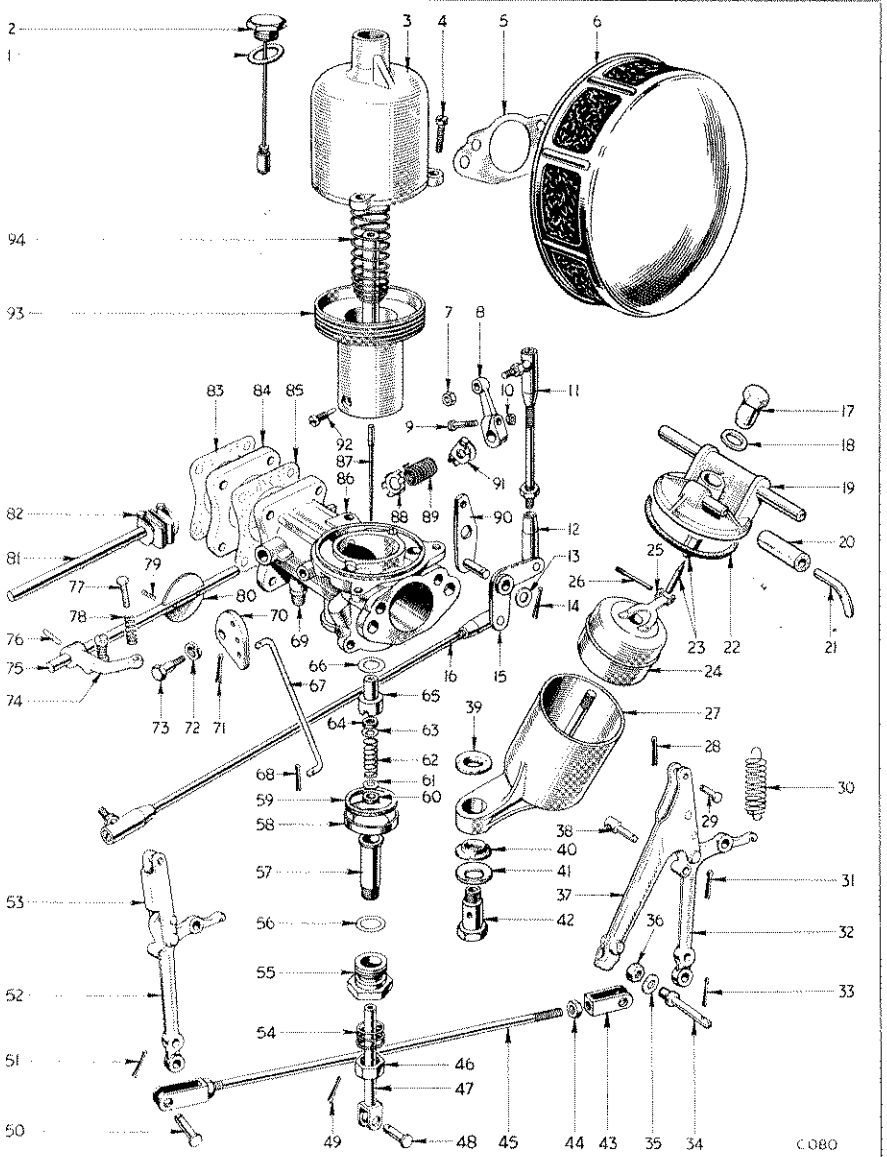


Fig. 3. Carburettor details

Key to Fig. 3

1 Fibre washer
2 Damper assembly
3 Suction chamber
4 Screw
5 Gasket
6 Air cleaner
7 Nut
8 Throttle lever
9 Pinch bolt
10 Nut
11 Link rod coupling
12 Link rod coupling
13 Plain washer
14 Split pin
15 Relay lever
16 Link rod assembly
17 Cap nut
18 Washer
19 Front chamber cover
20 Fuel pipe coupling
21 Fuel pipe
22 Joint washer
23 Needle valve
24 Float
25 Fork
26 Hinge pin
27 Float chamber
28 Split pin
29 Clevis pin
30 Jet lever return spring
31 Split pin
32 Jet lever
33 Split pin
34 Choke cable connector
35 Washer
36 Nut
37 Jet link and choke cable support
38 Clevis pin
39 Washer
40 Shouldered washer
41 Washer
42 Float chamber attachment bolt
43 Fork end
44 Nut
45 Jet control connecting link
46 Jet adjusting nut
47 Jet head
48 Clevis pin
49 Split pin
50 Clevis pin
51 Split pin
52 Jet lever
53 Jet lever link
54 Loading spring
55 Jet locking nut
56 Washer
57 Bottom half jet bearing
58 Sealing ring
59 Cork washer
60 Cork gland washer
61 Copper gland washer
62 Spring between gland washer
63 Copper gland washer
64 Cork gland washer
65 Top half jet bearing
66 Washer
67 Choke/throttle interconnecting link
68 Split pin
69 Vacuum union
70 Lever cam
71 Split pin
72 Double spring washer
73 Shouldered bolt
74 Throttle stop
75 Throttle spindle
76 Pin
77 Stop adjusting screw
78 Spring
79 Throttle butterfly screw
80 Butterfly
81 Throttle connecting rod
82 Coupling
83 Gasket
84 Insulator
85 Gasket
86 Carburettor body
87 Needle
88 Anchor plate
89 Return spring
90 Pivot lever
91 End clip
92 Needle locking screw
93 Piston
94 Piston spring

CARBURETTORS

Replenishing Dampers

Every 3,000 miles (5,000 km.) remove the dampers and replenish the dashpots with thin engine oil, grade SAE20 (but no thicker than SAE30). The oil level is correct when the damper is approximately $\frac{1}{4}$" (6 mm.) above the dashpots when resistance is felt. The function of the damper assembly is to provide the appropriate degree of enrichment for acceleration and starting from cold.

Cleaning Suction Chamber and Piston

At approximate intervals of twelve months, detach the piston unit. Clean the piston and the inside bore of the suction chamber. Re-assemble dry except for a few spots of thin oil on the piston rod.

Replenish the damper reservoir.

1 Damper
2 Oil well
3 Suction chamber
4 Piston
5 Piston rod
6 Screw

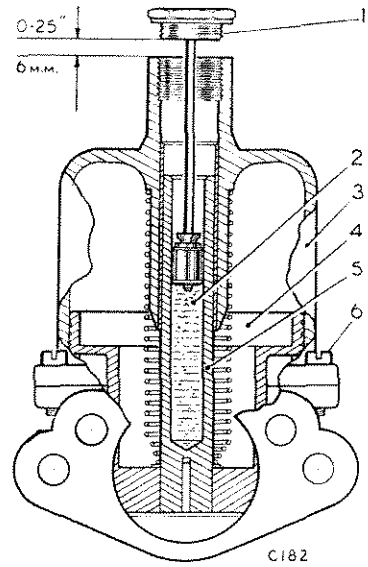


Fig. 4. Replenishing the dampers

Jet and Throttle Interconnection Adjustment

With the choke control fully 'in', the engine warm and idling on a closed throttle, adjust the screw (77) to give a clearance of $\frac{1}{16}$" (1·5 mm.) between the end of the screw and rocker lever (70).

Always check this adjustment when the throttle stop screw "A" is altered.

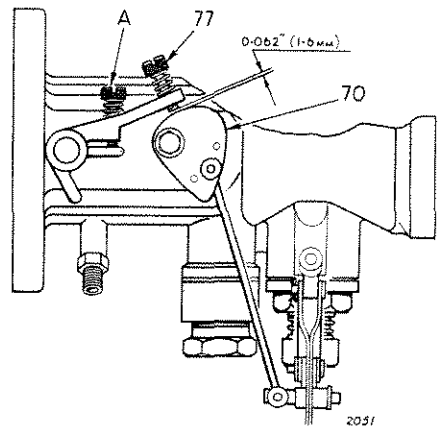


Fig. 5. Jet and throttle interconnection adjustment

Float-chamber Fuel Level

The level of fuel in the float-chamber is adjusted by setting the fork lever in the float-chamber lid as follows:

1. Disconnect the fuel feed pipe from the float-chamber lid, remove the cap nut (17) and lift the lid from the float-chamber.
2. Invert the lid of the float-chamber and with the shank of the forked lever resting on the needle of the delivery valve, pass a $\frac{7}{16}$" (11 mm.) diameter gauge between the inside radius of the forked lever and the face of the float-chamber lid as shown.
   If the forked lever does not contact both the needle valve and gauge, bend the lever at the start of the forked section as required, taking care to keep both prongs of the fork level with each other.
3. Re-assemble the carburettor and connect the fuel pipe.

1 Gauge
2 Fork
3 Valve

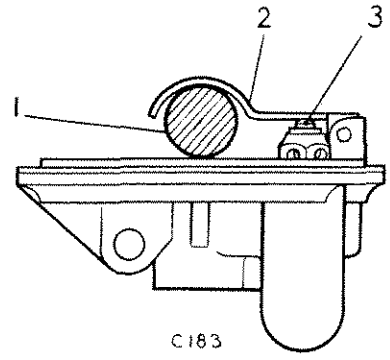


Fig. 6. Adjusting the float-chamber fuel level

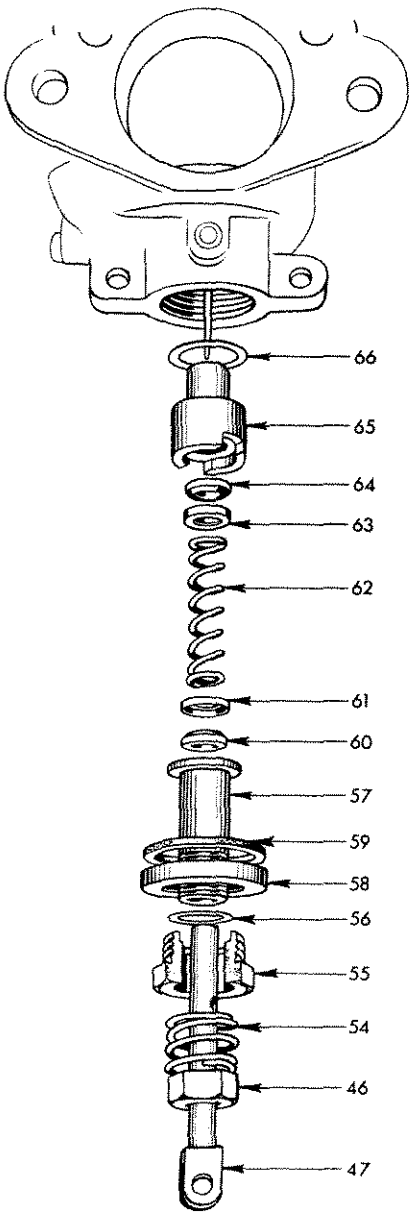


Fig. 7. Carburettor jet details
(The key to annotations is given on Page 1·302)

Jet Gland Replacement (Figs. 3 and 7)

If persistent slow leakage is observed at the base of the jet unit (a mere surface dampness can generally be disregarded) it is probable that the three cork gland washers (59), (60) and (64) require replacement.

To Remove

1. Remove air cleaner (6).
2. Remove return spring (30), pivot pins (48), (50), and swing linkage to one side.
3. Withdraw jet (47), unscrew adjusting nut (46) and remove spring (54).
4. Remove gland nut (55), sealing ring (58), gland washer (59), copper washer (56), jet bearing assembly (57), spring (62) and jet bearing assembly (65).
5. Remove the copper washer (66) and washers (63) and (64) from the jet bearing (65).
6. Remove the washers (60) and (61) from jet bearing (57).

To Replace

Using new cork washers (59), (60), (64), copper washers (56) and (66), and brass washers (61) and (63) proceed as follows :

1. Fit the cork washer (60) and brass washer (61) to the jet bearing (57). Ensure that the concave side of the brass washer contacts the cork washer.
2. Insert the spring (62) into the jet bearing (57).
3. Fit the cork washer (64) and brass washer (63) into the jet bearing (65).
4. Fit the sealing ring (58) and gland washer (59) over the gland nut (55). Ensure that the concave side of the sealing ring contacts the gland washer.
5. Fit the washer (56) to jet bearing (57) and insert jet bearing through the gland nut (55).
6. Fit the washer (66) to the bearing (65) and place the assembly on the spring (62).
7. Insert the jet bearing assembly into the carburettor, leaving the gland nut slack.
8. Centralise the jet as follows :

Jet Centralising

If the suction piston is lifted by hand and released, it should fall freely and hit the inside "jet bridge" with a soft metallic click when the jet adjusting nut (26) (Fig. 8) is screwed to its topmost position.

If a click is audible, only when the jet is in the fully lowered position, the jet should be centralised as follows :

Holding the jet (47) in its upper position, move the jet assembly laterally until the jet is concentric with the needle (87), then tighten gland nut (55). The piston should now fall freely and hit the jet bridge with a soft metallic click.

Withdraw the jet and again lift and release the piston, noting any difference in the sound of impact. If a sharper impact sound results, repeat the centralising operation to achieve identical sounds with and without the jet.

Re-connect the jet lever (52), replenish the dampers and tune the carburettors before replacing the air cleaner.

TUNING CARBURETTORS

Twin carburettor installations cannot be successfully tuned unless the general condition of the engine, ignition and the fuel system is satisfactory.

Tuning procedure is as follows:

1. Warm up the engine, remove air cleaners and disconnect choke cable. Slacken clamping bolts (82) on throttle spindle (81) and detach connecting rod (45). Ensure that the screw (77) is clear of its abutment during subsequent adjustments.
2. With the engine idling at approximately 500 r.p.m., check the hiss of air at carburettor intakes with a piece of tubing approximately 0·3″ (7·5 mm.) bore.
3. Maintaining this idling speed, set both throttle adjusting screws to equalise the level of hiss at the carburettor intakes.
   To reduce hiss, UNSCREW the adjusting screw.
4. When adjustment is satisfactory, re-tighten the throttle spindle clamping bolt and re-check hiss.
5. Check mixture at each carburettor by lifting the piston approximately $\frac{1}{8}$″ (3 mm.) with a pen-knife blade.
   If the engine speed increases, the mixture is too rich and the nut (26) (Fig. 8) should be screwed up one flat. If the engine speed decreases unscrew nut (26) one flat.
6. Continue adjustment on each carburettor until, when the piston is lifted, no increase, or a very slight increase followed by a fall in engine speed is noticed. The mixture is then satisfactory and the exhaust note should be regular and even.
7. Re-connect the choke controls and reset the screw (77) to give 0·062″ (1·6 mm.) clearance between the end of the screw and rocker lever (70).
8. Refit air cleaners.

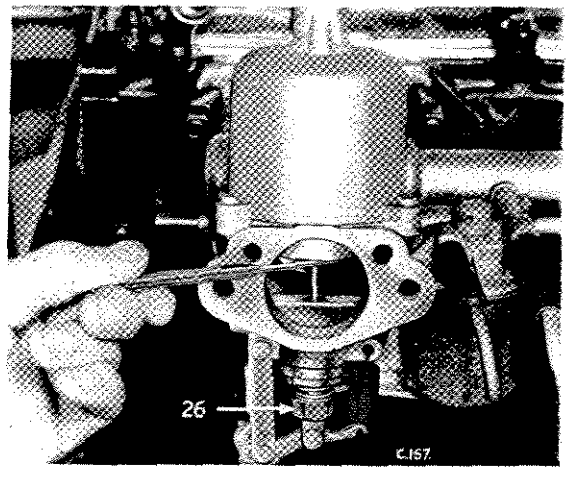


Fig. 8. Checking jet setting

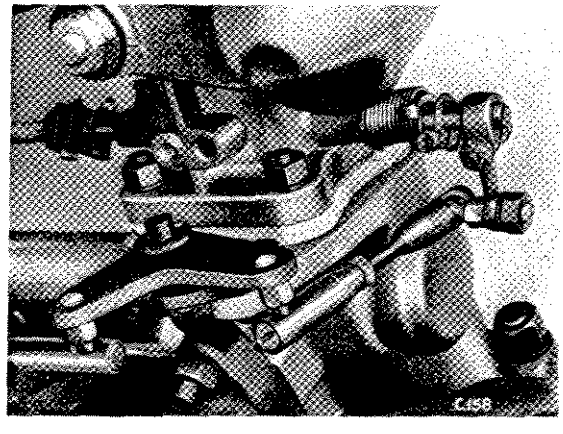


Fig. 9. Relay lever connections

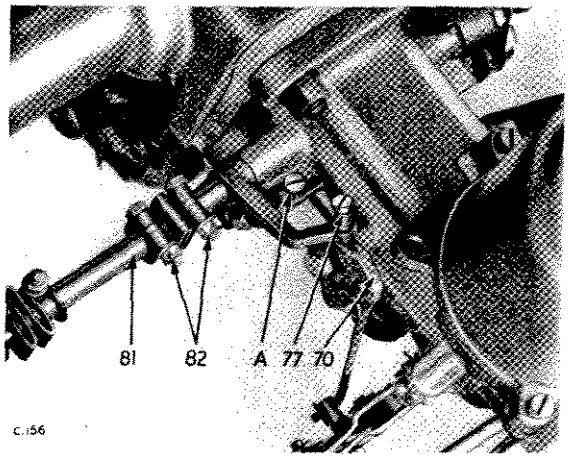


Fig. 10. Jet and throttle interconnection

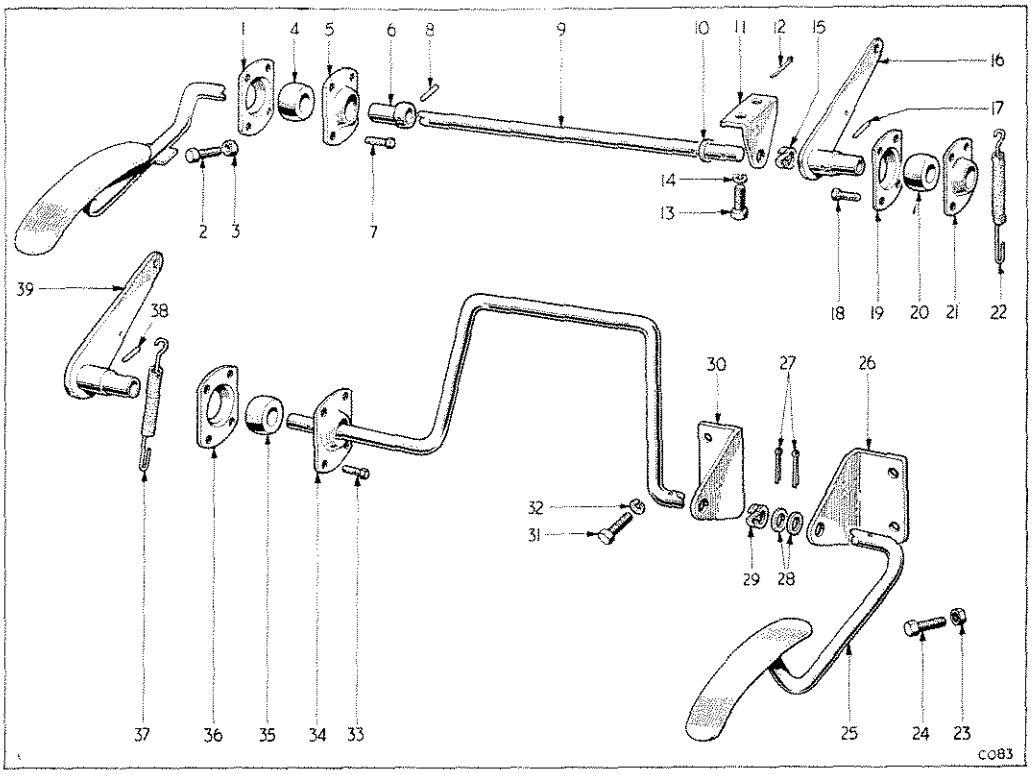


Fig. 11. Arrangement of accelerator pedal details (L.H. and R.H. drive)

1 Bearing housing (half)
2 Screw (pedal limit stop)
3 Nut
4 Self-aligning bearing
5 Bearing housing (half)
6 Pedal bush
7 Self-tapping screw (bearing housing attachment)
8 Mills pin
9 Cross shaft
10 Plain washer
11 Mounting bracket
12 Split pin
13 Setscrew } Bracket
14 Lock washer } attachment
15 Spring washer (between lever and bracket)
16 Lever assembly
17 Mills pin (securing lever)
18 Self-tapping screw (bearing housing attachment)
19 Bearing housing (half)
20 Self-aligning bearing
21 Bearing housing (half)
22 Return spring
23 Nut } Accelerator pedal
24 Setscrew } limit stop
25 Accelerator pedal shaft
26 Fulcrum bracket (pedal to toe-board)
27 Split pin (locating pedal shaft in fulcrum bracket)
28 Plain washer (between split pin and bracket)
29 Double spring washer (pedal shaft)
30 Fulcrum bracket (pedal to toe-board)
31 Setscrew } Fulcrum bracket
32 Spring washer } to bulkhead
33 Self-tapping screw (bearing housing attachment)
34 Bearing housing (half)
35 Self-aligning bearing (on pedal shaft)
36 Bearing housing (half)
37 Return spring
38 Mills pin (securing lever to pedal shaft)
39 Lever assembly

Instructions for removing and refitting the following items are given in the Body Section (Group 5) :—

Fuel tank and gauge. Fuel gauge (facia).

DISMANTLING CARBURETTOR ASSEMBLY

First clean off surfaces of carburettor with paraffin. Remove all connecting linkage and pipes from carburettor.

Unscrew damper (1) from suction chamber. Remove four screws from cover (3) and take cover from main body (50). Remove return spring (4), washer (5), diaphragm (6), retaining ring (55) and air valve (7).

If it is necessary to renew the diaphragm, remove four screws (56) securing diaphragm to air valve.

Take out adjusting screw (37), (a coin will suffice), and bushing screw (42) from base of carburettor. Remove eight screws (39) and (40), three short and five long (float chamber to main body), and take off base unit of carburettor (float chamber (36), together with float gasket (49).

Take out jet (43) and spring (44), washer (45), "O" ring (46). Remove needle valve (34).

Examine the butterfly assembly for wear.

Clean and check all dismantled components, and renew unserviceable items.

Re-assembly

Re-assemble the carburettor by reversing the above procedure.

Float Chamber Fuel Level (Fig. 15)

To check the float level, remove the carburettor from the engine and remove the float chamber. Invert the carburettor. Check that the highest point of the float, when the needle is against its seating, is 0·73" (18·5 mm.) above the face of the main body. Reset the level by carefully bending the tag which contacts the end of the needle. The addition of a thin fibre washer under the needle valve seat will effectively lower the fuel level.

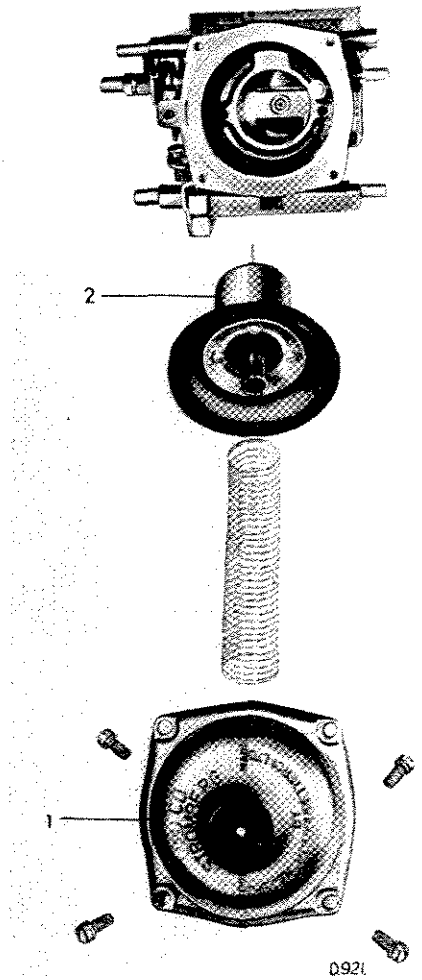


Fig. 14 Top view of carburettor with cover (1) and air valve assembly (2) removed

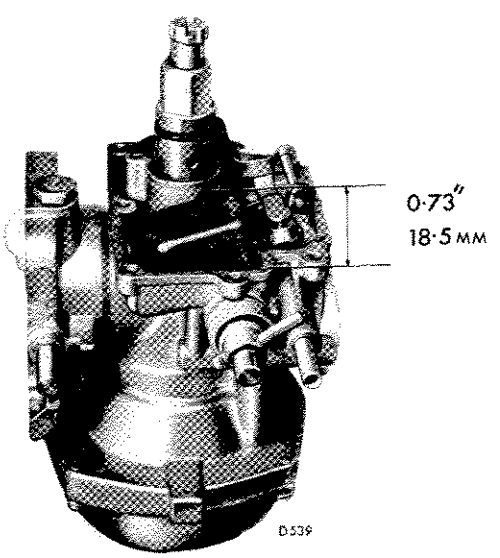


Fig. 15. Checking float chamber

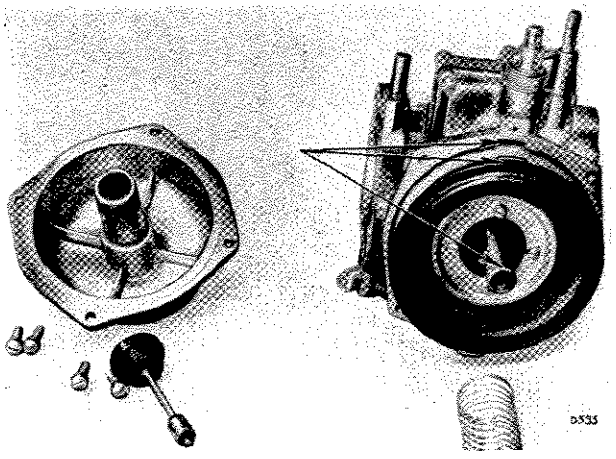


Fig. 16. Diaphragm location point

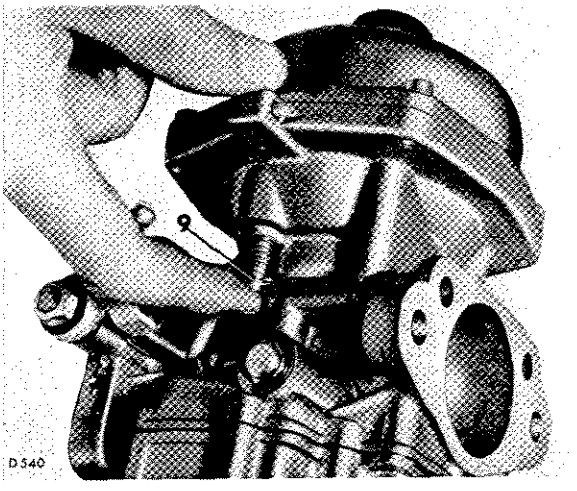


Fig. 17. Checking air valve for freedom with spring-loaded pin (9)

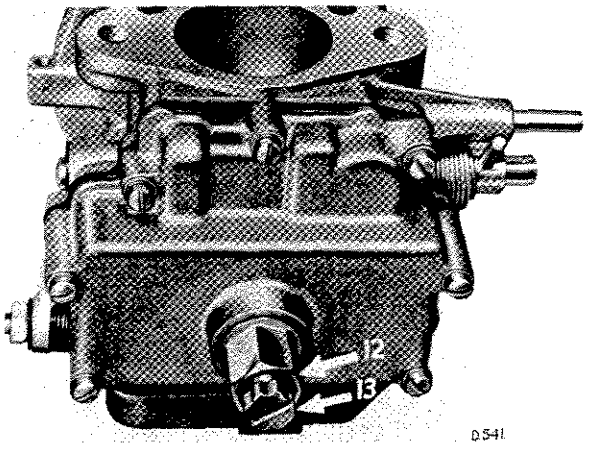


Fig. 18. Jet assembly (12) and adjusting screw (13)

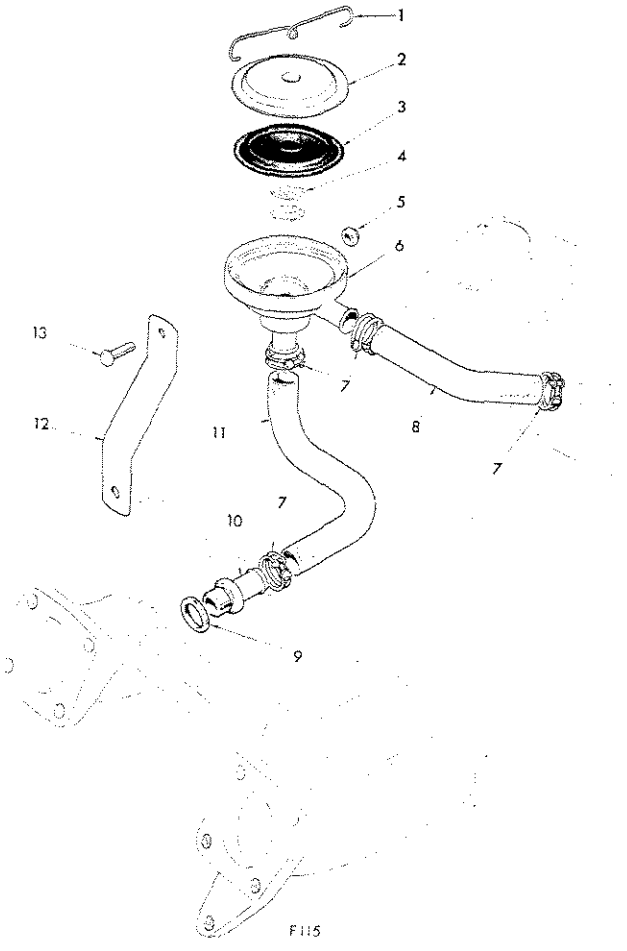
Jet Centralisation

Efficient operation of the carburettor depends upon a freely moving air valve and a correctly centred needle in the jet orifice. The air valve may be checked for freedom by lifting the valve with the spring-loaded pin (9) (Fig. 17). A valve failing to fall freely indicates a sticking valve, or an off-centred jet, and/or the needle (29) fouling the jet orifice. Rectify by removing and cleaning the valve and bore in paraffin, or by re-centralising the needle in the jet.

NOTE: When required, the jet needle must be renewed by one bearing the same code number. The shoulder of the needle must be fitted flush with the lower face of the air valve.

Procedure (Fig. 12)

1. Lift the air valve (18) and fully tighten the jet assembly (12).
2. Screw up the orifice adjuster until the top of the orifice (19) is just above the bridge (28).
3. Slacken off the jet assembly (12) approximately one half turn to release the orifice bush (23).
4. Allow the air valve (18) to fall; the needle will then enter the orifice and thus centralise it.
5. Slowly tighten the assembly (12), checking frequently that the needle remains free in the orifice. Check by raising the air valve approximately $\frac{1}{4}''$ (6·35 mm.) and allowing it to fall freely. The piston should then stop firmly on the bridge.
6. Reset the engine idling.



1 Clip
2 Cap
3 Diaphragm
4 Spring
5 Nut
6 Regulator valve body
7 Clip
8 Hose
9 Cork washer
10 Adaptor
11 Hose
12 Bracket
13 Bolt

Fig. 26. Crankcase breather regulator valve details (TR.4A.)

Crankcase breather valve (Fig. 26)

At 12,000 mile intervals, slacken the pipe clips (7) and remove the breather pipes (8) and (11). Remove the nut (5) and bolt (13) and lift off the valve assembly. Disengage the clip (1) from the valve body and lift out the diaphragm (3) and spring (4). Clean the components by swilling them in methylated spirits (denatured alcohol). Ensure that the breather pipes are clean and serviceable.

Reverse the dismantling sequence to re-assemble.

1 Carburettor gasket
2 Insulating washer
3 Carburettor gasket
4 Induction manifold
5 Stud—induction to exhaust manifold
6 Stud—induction manifold to carburettor
7 Dowel—accelerator relay lever
8 Manifold gasket
9 Bridge clamp securing manifold
10 Lockwasher
11 Nut
12 Bridge clamp securing manifold
13 Lockwasher
14 Nut
15 Exhaust manifold
16 Lockwasher
17 Nut
18 Gasket—front exhaust pipe to manifold
19 Studs—manifold to front exhaust pipe
20 Nut
21 Lockwasher

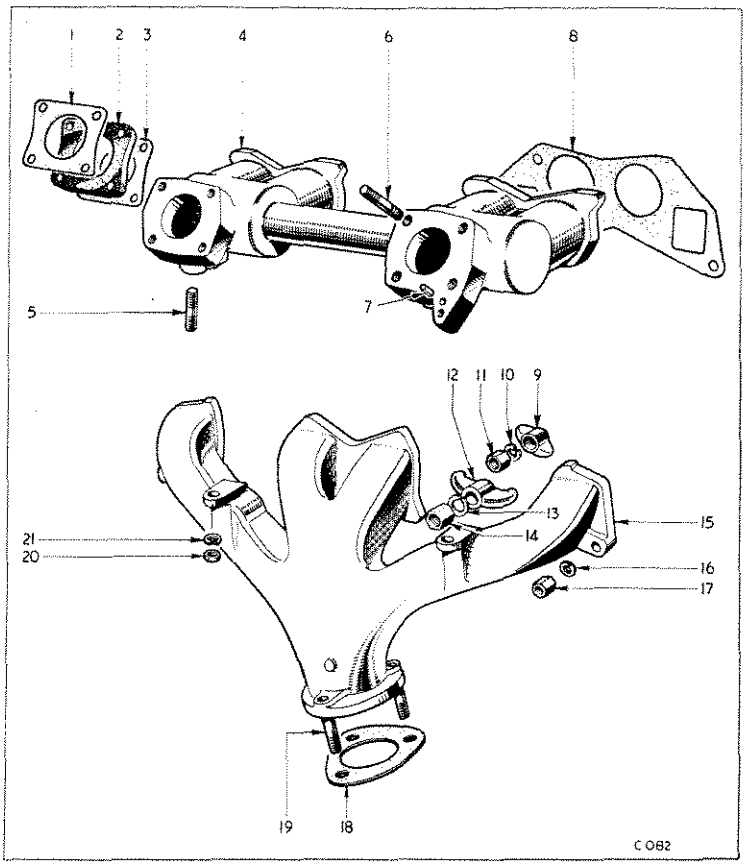
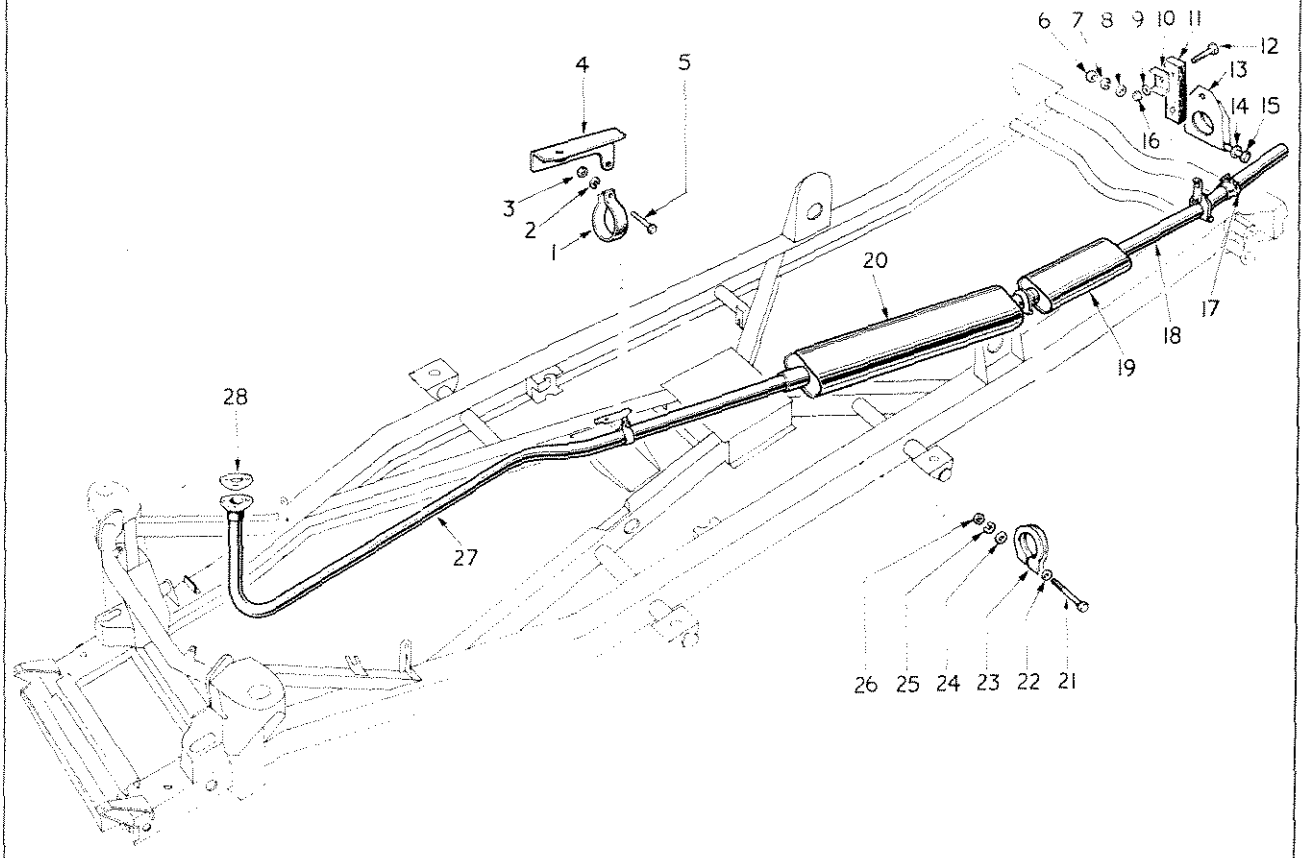


Fig. 1. Arrangement of manifold details



1 Clip
2 Spring washer
3 Nut
4 Bracket to gearbox mounting
5 Bolt
6 Nut
7 Spring washer
8 Plain washer
9 Plain washer
10 Plate
11 Mounting strap
12 Bolt
13 Clip
14 Plain washer
15 Pinch bolt
16 Nyloc nut
17 Tail pipe extension and clip
18 Tail pipe
19 Auxiliary silencer
20 Silencer
21 Pinch bolt
22 Plain washer
23 Clips—front and rear pipes to silencer
24 Plain washer
25 Spring washer
26 Nut
27 Front exhaust pipe
28 Exhaust flange gasket

Fig. 2. Arrangement of details comprising the exhaust system

1 Carburettor joint washer
2 Insulating washer
3 Induction manifold
4 Stud — induction to exhaust manifold
5 Stud — carburettor attachment
6 Manifold gasket
7 Bridge clamp
8 Lockwasher
9 Nut
10 Bridge
11 Exhaust manifold
12 Lockwasher
13 Nut
14 Gasket — manifold to downpipe
15 Stud — manifold to downpipe
16 Nut
17 Lockwasher

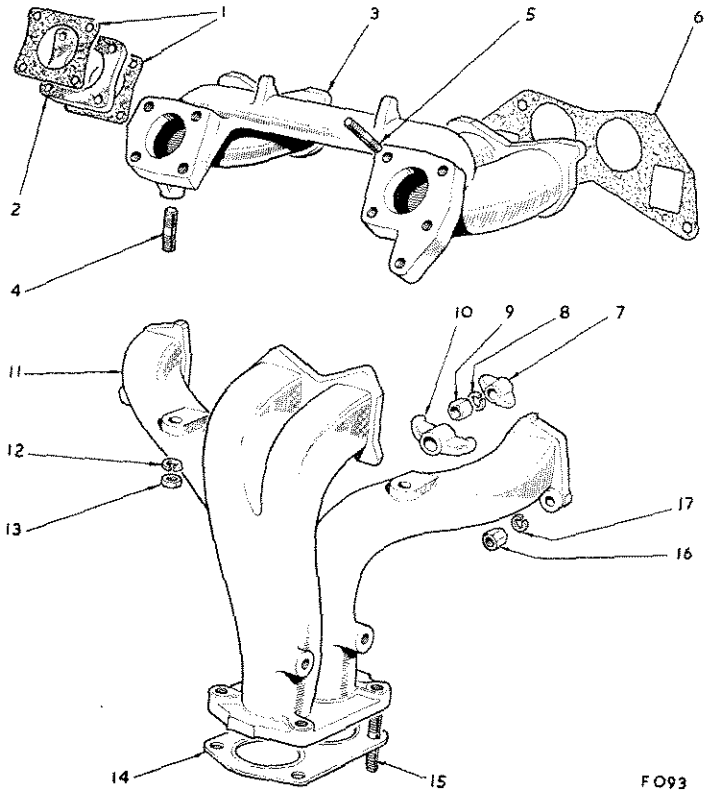
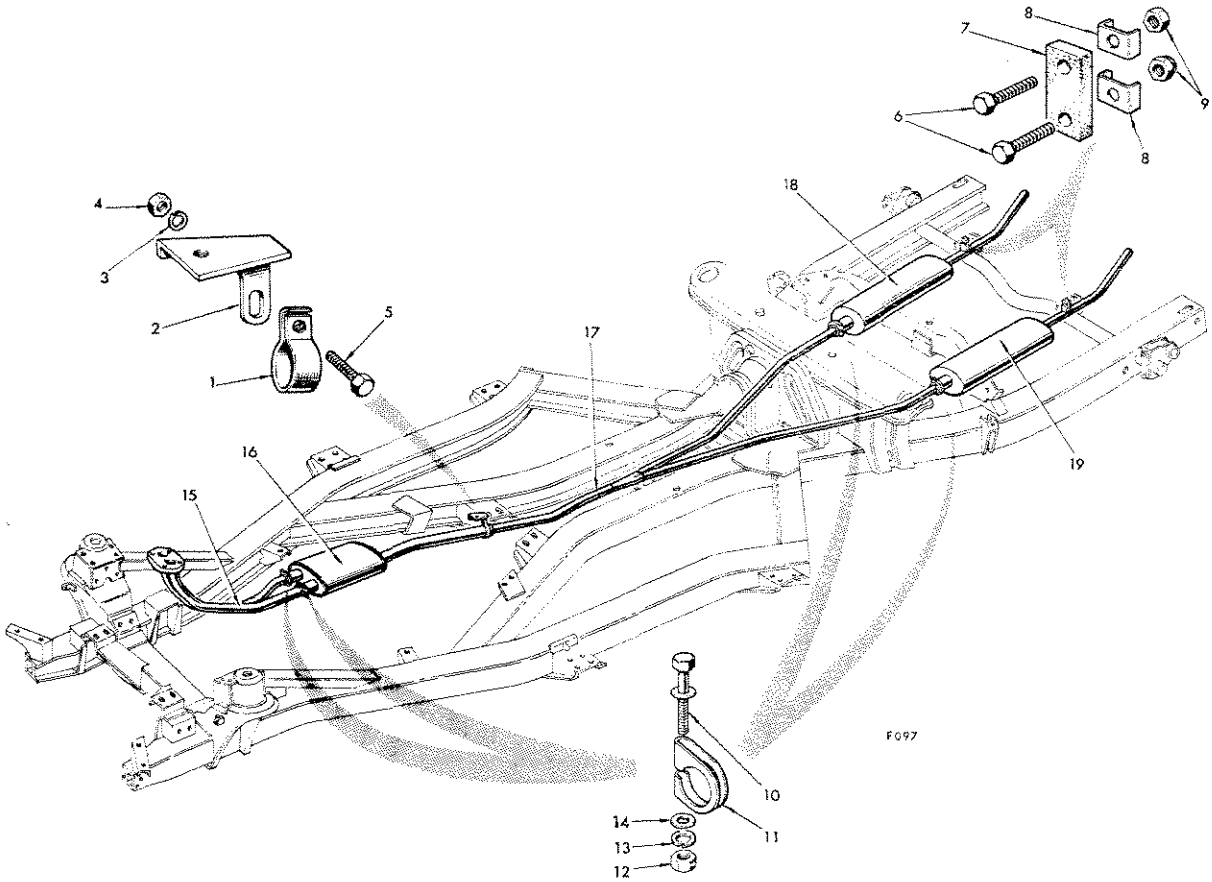


Fig. 3. Arrangement of manifold details (TR.4A.)



1 Clip
2 Bracket
3 Spring washer
4 Nut
5 Bolt
6 Bolt
7 Flexible strap
8 Plate
9 Nut
10 Bolt
11 Clip
12 Nut
13 Spring washer
14 Plain washer
15 Front exhaust pipes
16 Front silencer
17 Intermediate pipes
18 Tail pipe and silencer R.H.
19 Tail pipe and silencer L.H.

Fig. 4. Arrangement of details comprising the exhaust system (TR.4A.)

TRIUMPH TR4

WORKSHOP MANUAL

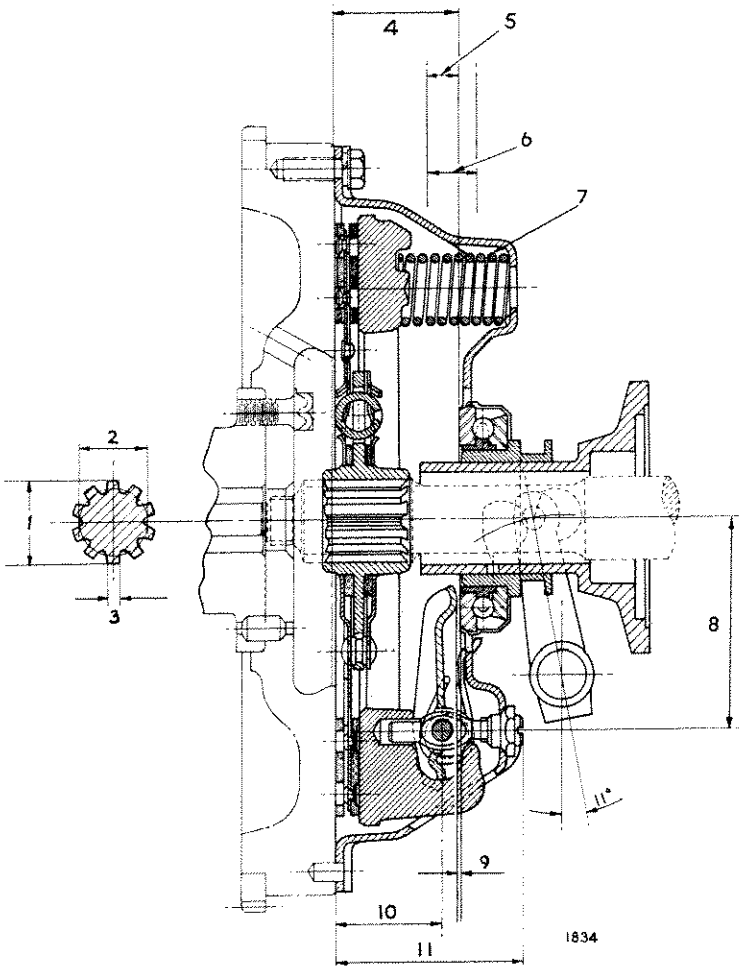
GROUP 2

Comprising:

TR4 WORKSHOP MANUAL

GROUP 2

CONTENTS



CLUTCH DATA

TYPE — 9A6. "Single Dry Plate".
OPERATION — Hydraulic.
ADJUSTMENT — Slave cylinder push-rod.
DRIVEN PLATE — Belleville washer type, cushioned by White/Light Green Springs.
FACINGS — Wound yarn (R.Y.Z.).

1	Spline diameter (O/D)	1·247″/1·245″	(31·7/31·6 mm.)
2	Spline diameter (I/D)	1·010″/1·005″	(25·65/25·53 mm.)
3	Splines	1·25″ (31·75 mm.) × 10 S.A.E. Splines	
4	Release lever height	1·895″ (using 0·33″ (8·38 mm.) gauge plate in place of driven plate)	(48·13 mm.)
5	Minimum travel to release	0·38″	(9·65 mm.)
6	Maximum travel available	0·47″	(11·94 mm.)
7	Thrust springs—9 cream	120 - 130 lbs.	(54·4 - 59·0 kg.)
8	Release lever pivot centres	3·19″	(81·0 mm.)
9	Bearing to lever top clearance	0·1″	(2·54 mm.)
10	Release lever pivot centres	1·55″ approx.	(39·4 mm.)
11	Maximum height of adjusters	2·9″	(73·7 mm.)

Fig. 1. Sectional view of the clutch

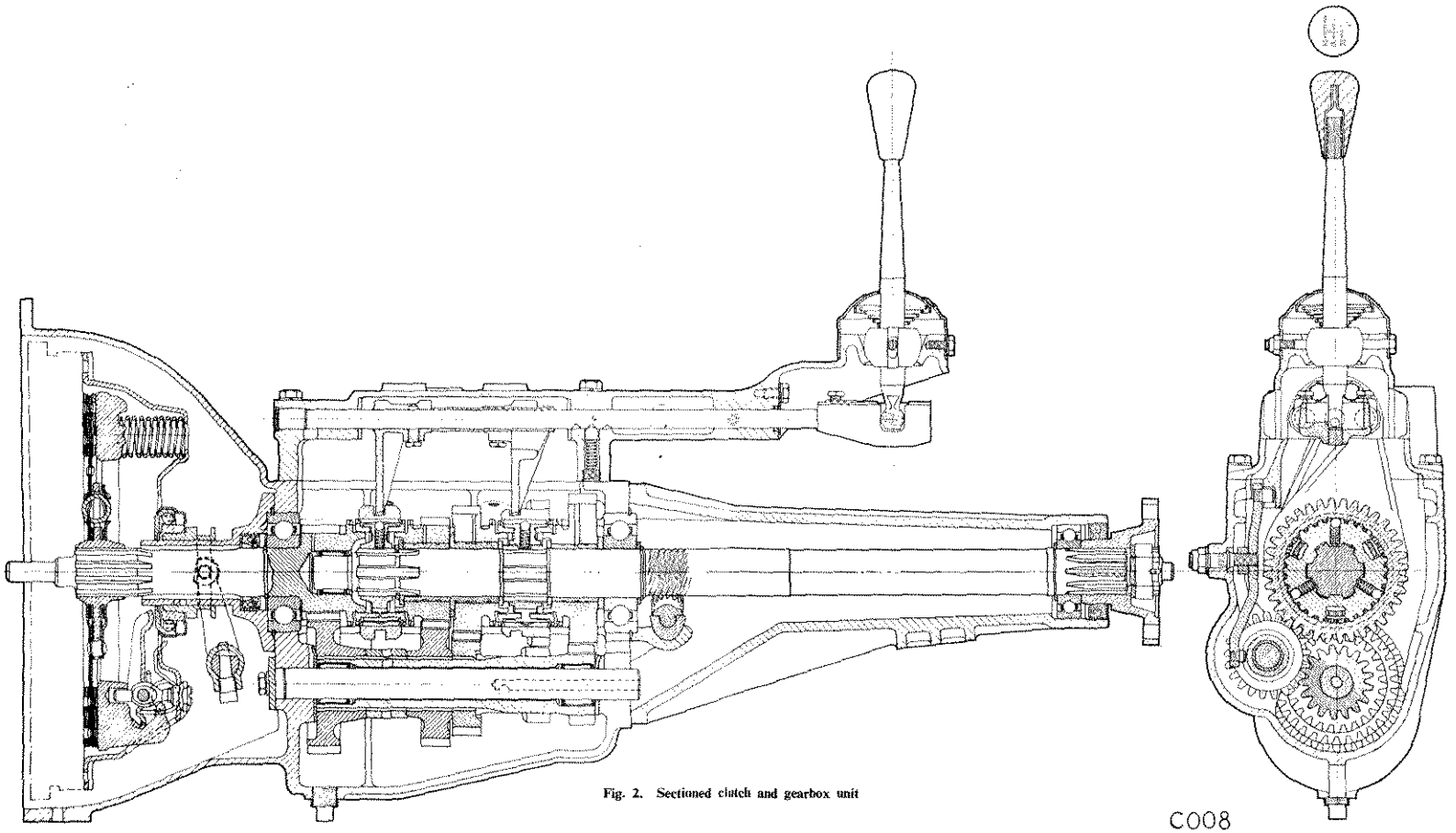
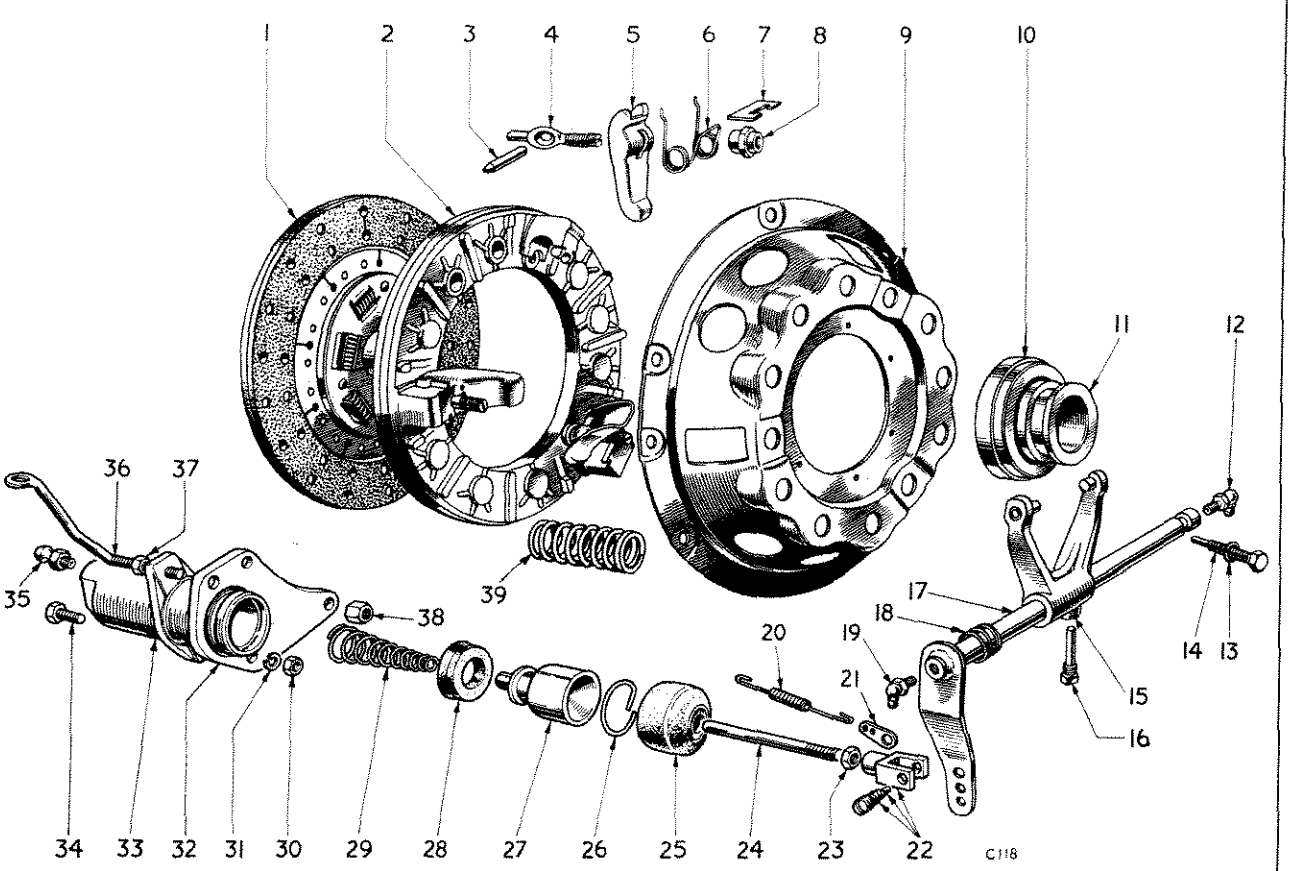


Fig. 2. Sectioned clutch and gearbox unit



1 Driven plate assembly
2 Pressure plate
3 Release lever pin
4 Eyebolt
5 Release lever
6 Anti-rattle spring
7 Strut
8 Adjusting nut
9 Clutch cover
10 Release bearing
11 Bearing sleeve
12 Grease nipple
13 Washer
14 Shaft locating bolt
15 Clutch operating fork
16 Screwed taper pin
17 Clutch operating shaft
18 Fork return spring
19 Grease nipple
20 Push rod return spring
21 Spring anchor plate
22 Clevis fork, spring and pin
23 Locknut
24 Push rod
25 Rubber end cover
26 Circlip
27 Piston
28 Piston seal
29 Piston return spring
30 Nut
31 Spring washer
32 Slave cylinder bracket
33 Slave cylinder
34 Bolt
35 Bleed nipple
36 Stay
37 Nut
38 Nut
39 Clutch thrust spring

Fig. 3. Clutch and slave cylinder details

MASTER CYLINDER

A. Clutch Driving Condition

When the clutch pedal is released, the push rod (9) is returned to its stop (12) by the pedal return spring. This permits the plunger (7) to move rearwards under pressure of the spring (5). The flange on the end of the valve shank (4) contacts the spring retainer (6) and as the plunger continues to move rearwards, the valve shank (4) lifts the seal (1) from its seat on the end of the cylinder bore and compresses the spring (2). Hydraulic fluid can then flow past the three legged distance piece (3) and seal (1) either to or from the reservoir.

B. Clutch Released Condition

Initial movement of the push rod (9) and plunger (7) releases the valve shank (4) and permits the spring (2) to press the valve shank (4) and seal (1) against its seat. This cuts off communication between the cylinder and reservoir. Continued movement of the plunger displaces fluid through the hydraulic pipelines and releases the clutch.

Maximum stroke available—
1·38″ (35·05 mm.).

Stroke position at maximum cut off—
0·099″ (2·5 mm.).

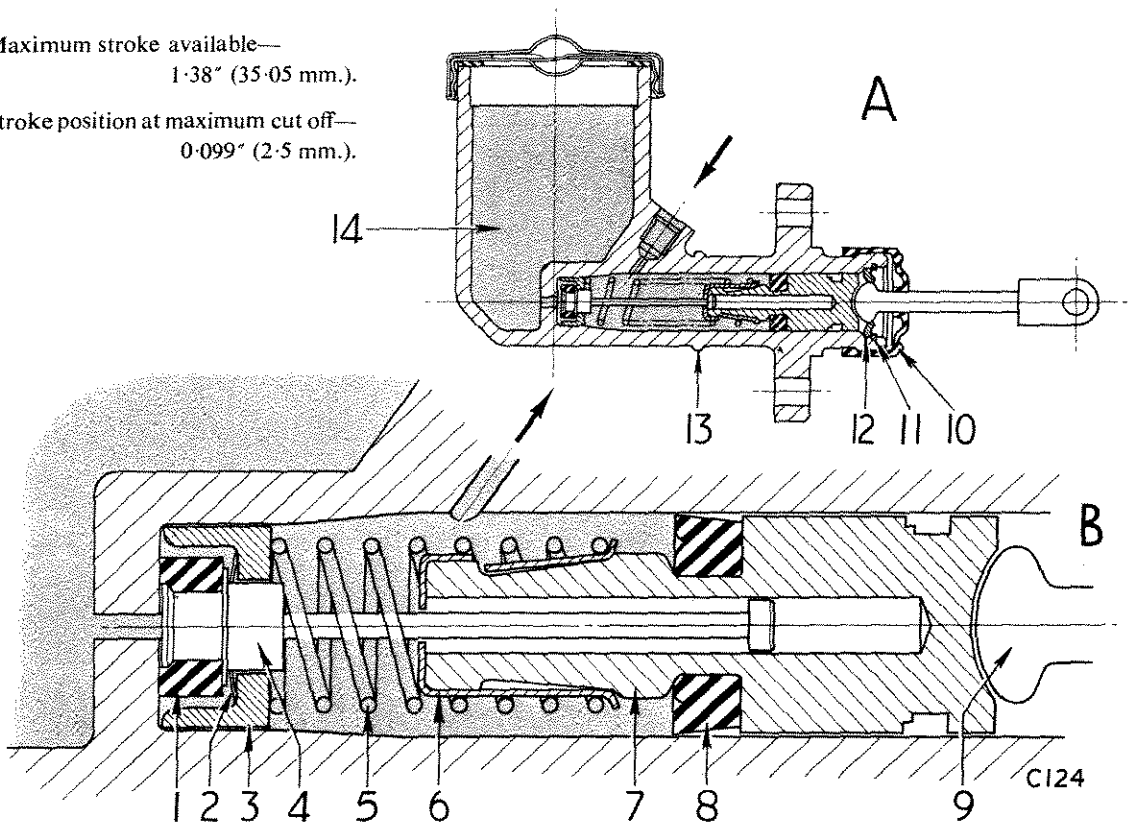


Fig. 4. Section through clutch master cylinder

1 Valve seal
2 Spring (valve seal)
3 Distance piece
4 Valve shank
5 Plunger return spring
6 Spring retainer
7 Plunger
8 Plunger seal
9 Push rod
10 Dust cover
11 Circlip
12 Push rod stop
13 Identification ring
14 Fluid reservoir

Clutch Master Cylinder (Figs. 4 and 5)

Removal

Clutch and brake master cylinders cannot be removed individually, but only as an assembly, therefore :

1. Empty the clutch and brake hydraulic systems.
2. Detach the fluid pipes from the master cylinders.
3. Remove the brake and clutch pedal clevis pins (1).
4. Remove setscrews (4) and nuts (3) from the cylinder support bracket (11) and lift the bracket, complete with cylinders, from the scuttle.
5. Remove the master cylinders from the support bracket.

Dismantling

1. Remove the dust cover (10). Depress the push rod (9), remove the circlip (11) and withdraw the push rod (9) together with items (10), (11) and (12).
2. Shake out the plunger, spring and valve assembly. If necessary, apply low pressure compressed air to the outlet union to eject the plunger assembly.
3. Lift the locating clip on the spring retainer (6) and remove the retainer from the plunger (7) with the valve and spring assembly.
4. Detach the valve shank (4) by passing it through the offset hole in the retainer (6). Remove the spring (5), distance piece (3) and spring (2) from the valve shank (4). Using fingers, detach the seal (1) from item (4) and the seal (8) from item (7).

Inspection

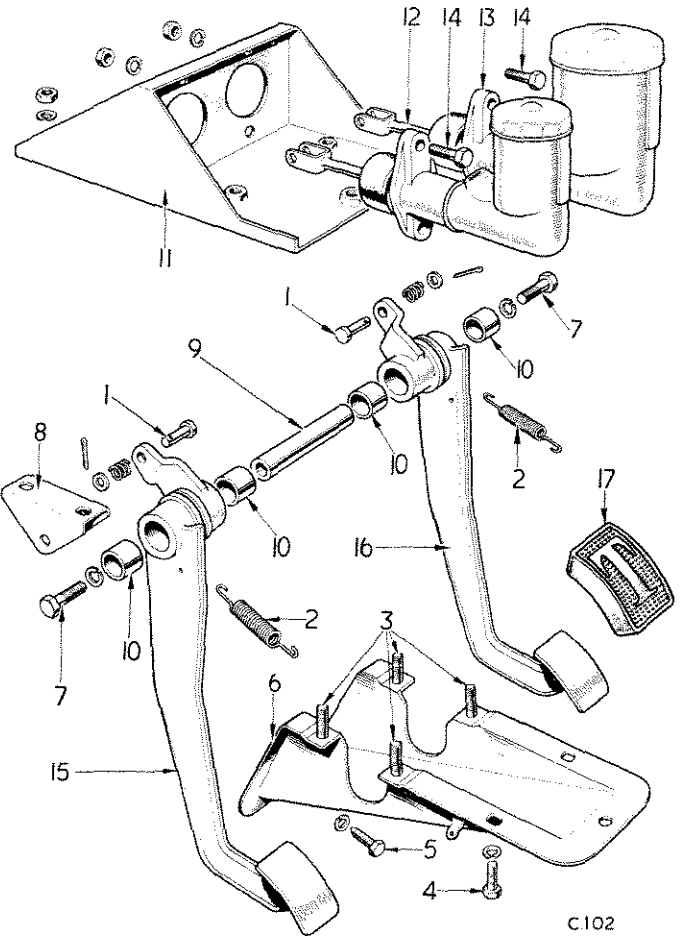
Clean and examine all components for deterioration, renewing items as necessary.

Re-Assembly

1. Refit the seals (1) and (8) to items (4) and (7) as shown on Fig. 4.
2. Fit the spring (2), distance piece (3) and spring (5) to the valve shank (4), attach the spring retainer (6) and fit the assembly to the plunger (7). Lubricate the components with clean hydraulic fluid and fit them to the master cylinder bore. Fit the push rod (9) with stop plate (12), circlip (11) and dust cover (10).

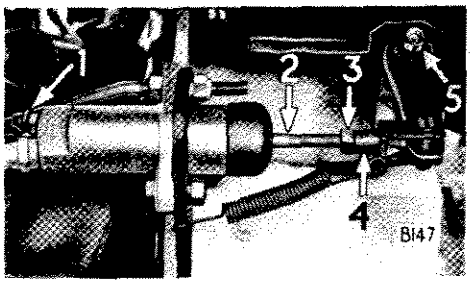
To Refit

Re-assemble the master cylinder to the bracket and secure this to the bulkhead as shown on Fig. 5. Re-connect the clutch and brake pedals to the push rods, using new split pins to secure the clevis pins (1). Refill and bleed the clutch and brake hydraulic systems.



1 Clevis pin
2 Pedal return spring
3 Bolts } Pedal shaft cover assembly to
4 Bolts } master cylinder support bracket
5 Setscrew (pedal shaft cover assembly to bulkhead)
6 Pedal shaft cover assembly
7 Setscrew (pedal stay to pedal shaft support bracket)
8 Pedal shaft support bracket
9 Pedal shaft
10 Pedal pivot bush
11 Master cylinder support bracket
12 Push rod
13 Bracket master cylinder
14 Setscrew (master cylinder to support bracket)
15 Clutch pedal
16 Bracket pedal
17 Pedal pad

Fig. 5. Master cylinder support and pedal details



1 Bleed nipple
2 Push-rod
3 Locknut
4 Clevis fork
5 Grease nipple
6 Engine drain plug

Fig. 6. Clutch slave cylinder linkage

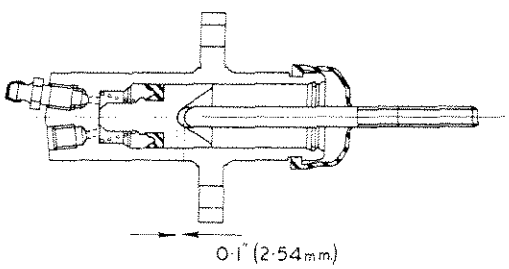


Fig. 7. Sectioned slave cylinder and push-rod

Clutch Adjustment (Fig. 6)

Check, and if necessary, adjust the clearance between the clutch operating piston and the push rod (2). The correct clearance is 0·1". To adjust:—

1. Slacken the nut (3) and unscrew the push rod (2) until all clearance between the push rod and the cupped end of the operating piston (inside slave cylinder) is taken up.
2. Adjust the position of the locknut (3) until a feeler gauge of 0·1" thickness may be inserted between the locknut face and the clevis fork (4).
3. Without disturbing the locknut on the push rod, screw the push rod into the clevis until the nut contacts the clevis face, then lock up the nut (3).

Bleeding the Hydraulic System

The clutch hydraulic system is bled in a similar manner to that described for the brakes in Group 3

Slave Cylinder (Fig. 3)

To Remove

1. Drain the hydraulic system by attaching a tube to the bleed nipple (35) and pumping the clutch pedal.
2. Detach the stay (36), bolt (34), nut (30) and spring washer (31). Detach the rubber end cover.
3. Withdraw the slave cylinder from its bracket and disconnect the flexible hose by holding the hose union with a spanner whilst rotating the slave cylinder. AVOID TWISTING THE HOSE.

To Refit

Reverse the removal procedure, refill and bleed the clutch hydraulic system

To Dismantle

Remove the circlip (26) and using low pressure compressed air, eject the piston and spring (29). Detach the seal (28) from the piston (27). Clean the components with hydraulic fluid.

To Re-Assemble

Fit the seal (28), with its lip facing inwards, to the piston (27). Assemble the piston and spring (29) to the cylinder bore and secure with the circlip (26).

Clutch Release Bearing (Fig. 8)

To Remove:

With the gearbox removed from the vehicle, remove the grease nipple (12), locating bolt (13) and taper bolt (10). Withdraw the cross shaft (8) and remove the release bearing (1) and sleeve (2). Press the sleeve from the bearing.

To Re-assemble:

Reverse the removal procedure and wire lock the bolt (10).

Servicing the Clutch Unit

Removal

Remove the gearbox as detailed on page 2·205 and progressively unscrew the clutch attachment setscrews. Lift the cover assembly and driven plate from the flywheel face.

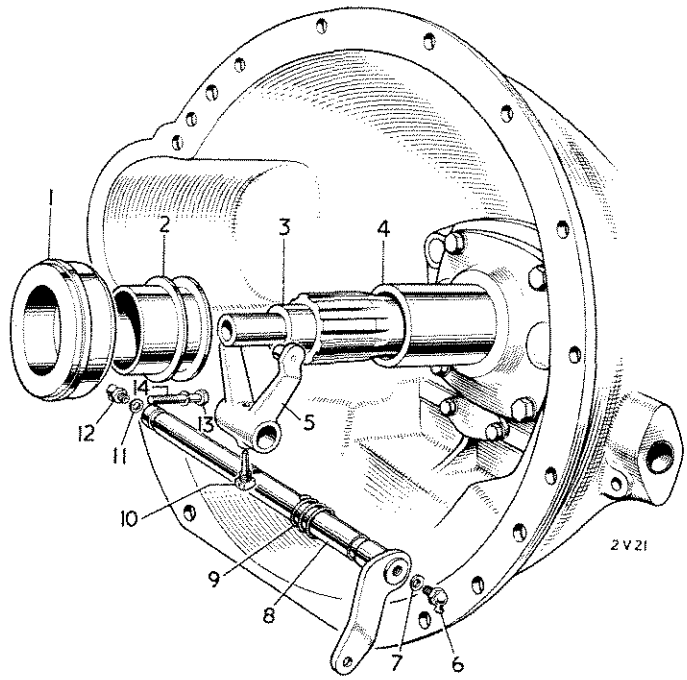
Dismantling

A Churchill clutch fixture, No. 99A, is recommended for dismantling and re-assembling the clutch unit.

Before dismantling, mark the following parts to facilitate re-assembly and maintain the original degree of balance.

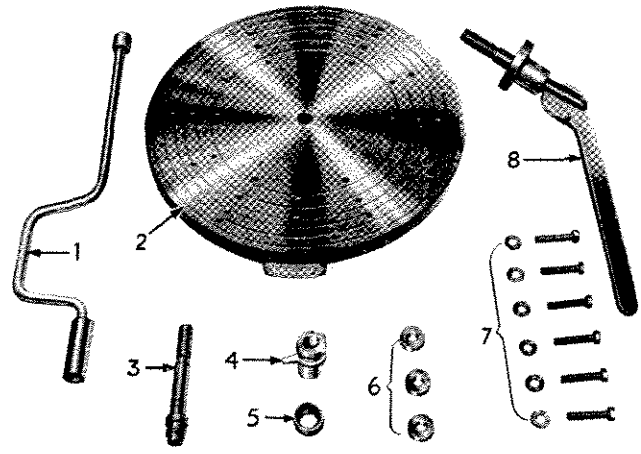
(a) Cover pressing.
(b) Lugs on the pressure plate.
(c) Release levers.

1. Clean the top of the base plate and place three (number 3) spacers on the positions marked 'D'.
2. Place the cover assembly on the base plate so that the release levers are directly above the spacers, and the bolt holes of the cover are in line with tapped holes in the base plate.
3. Screw the actuator into the centre hole and press the handle down to clamp the cover housing to the base plate.
4. Use six bolts to secure the cover pressing to base plate. Remove the actuator.
5. Remove three adjusting nuts. Considerable torque may be necessary.
6. Release the cover pressing from base plate, lift nine thrust springs from the pressure plate and remove three anti-rattle springs from the cover.
7. Lift up inner end of each release lever and disengage the strut.
8. Gripping the tip of the release lever and the eye bolt, lift out the assembly from the pressure plate. Repeat procedure for 2nd and 3rd levers.
9. Remove the eye bolts from release levers and take out pins. Remove the struts from pressure plate.



1	Release bearing	8	Cross-shaft
2	Bearing sleeve	9	Anti-rattle spring
3	Input shaft	10	Tapered locking bolt
4	Front cover	11	Fibre washer
5	Fork	12	Grease nipple
6	Grease nipple	13	Locating bolt
7	Fibre washer	14	Lockwasher

Fig. 8. Clutch release details



1	Brace	5	Adaptor
2	Base plate	6	Spacers
3	Pillar	7	Washers and setscrews
4	Gauge finger	8	Actuator

Fig. 9. Clutch assembly fixture No. 99A

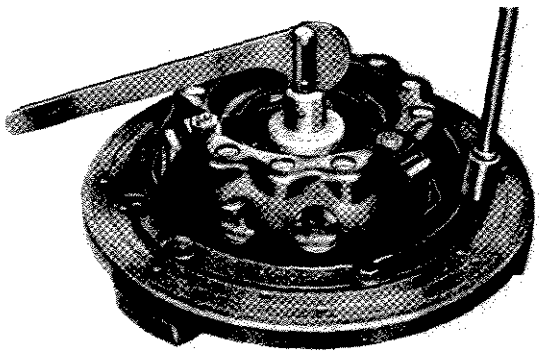


Fig. 10. Securing cover assembly to base plate

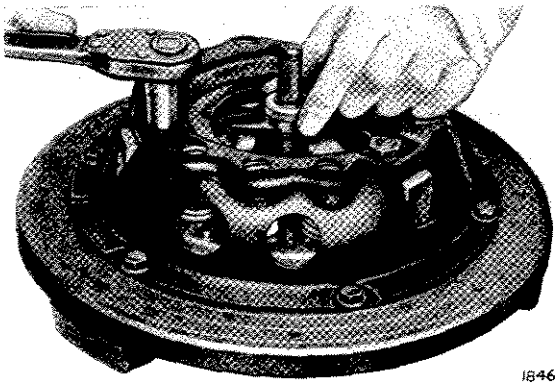


Fig. 11. Adjusting the release levers

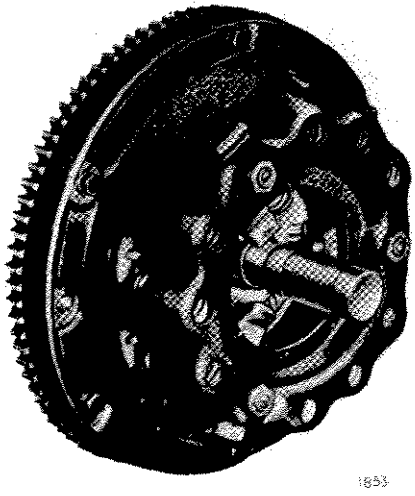
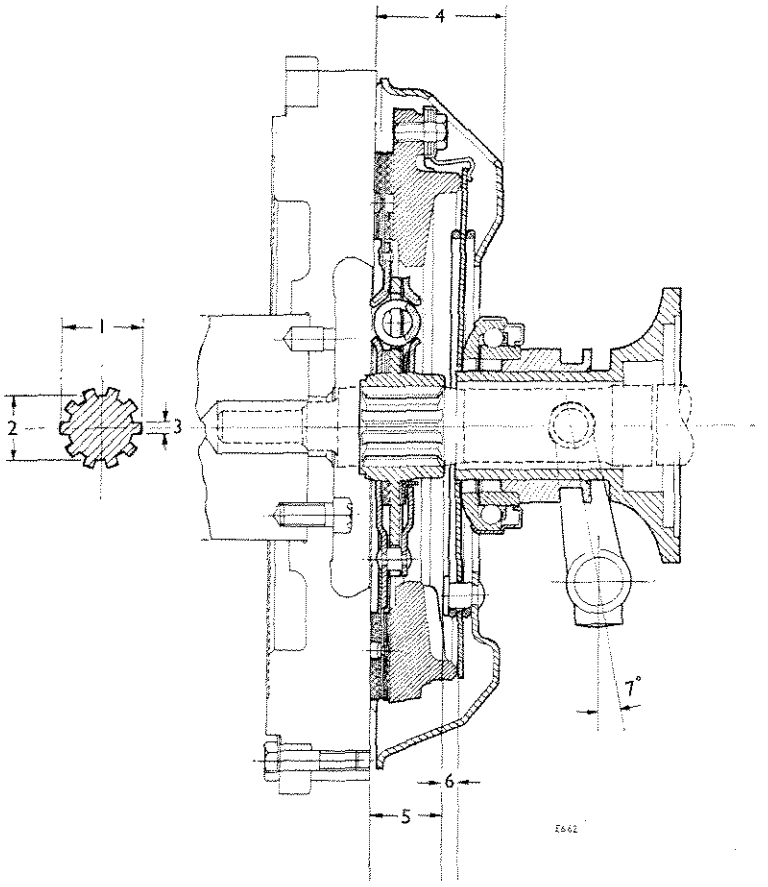


Fig. 12. Using Tool No. 20S.72 to centralize the clutch driven plate

Assembly

Before assembling, lubricate all bearing surfaces and arrange the components with strict regard to the markings made previously.

1. Place strut in position in lug of pressure plate.
2. Assemble pin to eye bolt and feed threaded portion through release lever.
3. By holding the strut in the pressure plate to one side, feed the plain end of the eye bolt (assembled to release lever) into the pressure plate.
4. Place the strut into groove in the outer end of the release lever.
5. Repeat with remaining release levers.
6. Place the pressure plate and the assembled release levers, with the latter over the spacers, on the base plate of the Churchill Fixture.
7. Assemble the springs to their seats on the pressure plate. Fit the anti-rattle springs and place the cover pressing over the pressure plate, allowing the lugs to protrude through the cover.
8. Secure cover pressing to base plate.
9. Screw on adjuster nuts until their heads are flush with the tops of the eye bolts.
10. Fit the actuator into the centre hole of the base plate and pump handle up and down half a dozen times to settle the components. Remove actuator.
11. Secure pillar firmly into centre of base plate and to it assemble adaptor No. 7, recessed side downwards, and gauge finger.
12. Adjust nuts to raise or lower the release levers sufficiently to just contact the finger gauge.
13. Remove pillar, refit actuator and operate the clutch a dozen or so times. Re-check with finger gauge and make any adjustments necessary.
14. Lock the adjusting nuts by peening over the collars into the nuts of the eye bolts.
15. Remove completed assembly from base plate.

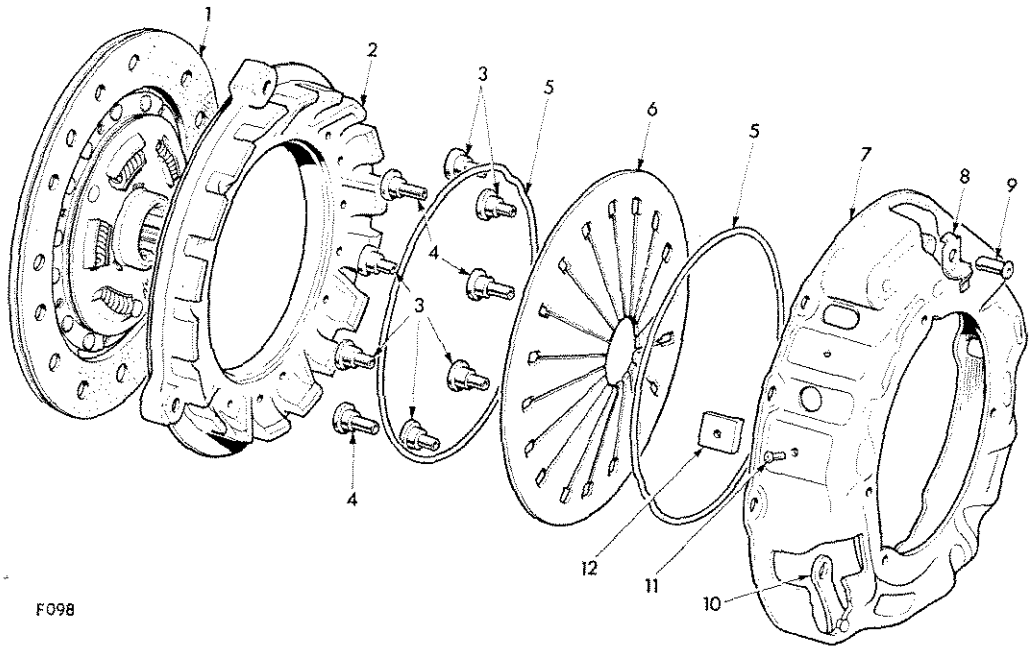


CLUTCH DATA

TYPE — Borg & Beck 8½″ dia. TYPE DS.
OPERATION — Hydraulic.
ADJUSTMENT — Non adjustable.
DRIVEN PLATE — Belleville washer type cushioned by Yellow/Lt. Green Springs.
FACINGS — Wound Yarn.

1.	Spline diameter (O/D)	1·247″/1·245″ (31·7/31·6 mm.)
2.	Spline diameter (I/D)	1·010″/1·005″ (25·65/25·53 mm.)
3.	Splines	1·25″ (31·75 mm.) × 10 S.A.E. Splines
4.	Flywheel face to cover	2·10″ (51·05 mm.)
5.	Flywheel face to spring tips (fully released position)	1·15″/1·29″ (29·21/32·77 mm.)
6.	Maximum travel	0·27″/0·29″ (6·76/7·37 mm.)

Fig. 13. Sectioned view of the clutch (TR.4A.)



1 Driven plate
2 Pressure plate
3 Rivets
4 Locating pins
5 Fulcrum rings
6 Diaphragm spring
7 Cover pressing
8 Retractor clips
9 Rivet
10 Pressure plate strap
11 Rivet
12 Balance weight

Fig. 14. Clutch details (TR.4A.)

CLUTCH UNIT

The diaphragm spring clutch unit fitted to TR.4A models must not be dismantled for any reason.

Should any fault develop in the unit, a complete replacement assembly must be fitted.

GEARBOX DETAILS (Moving Parts)

GEARBOX

DIMENSIONS AND TOLERANCES

	Ins.	mm.	Remarks
Input Shaft			
Spline Size	10 × 1¼″ S.A.E.		
Bore for Torrington Needle Roller Bearing			
Mainshaft			
1st, 2nd and 3rd Gear	1·2505″	31·7627	
Journal Diameter	1·2500″	31·75	
Overall End Float of 2nd and 3rd Gear Bushes and Thrust Washers on Mainshaft	0·003″ to 0·009″	0·0762 to 0·2286	Obtained by selective use of thrust washers below.
Overall End Float of 1st Speed Gear Bushes and Thrust Washers on Mainshaft	0·003″ to 0·009″	0·0762 to 0·2286	Obtained by selective use of Thrust Washers, Part Numbers 129941-4.
Inside Diameter of 1st, 2nd and 3rd Gear Bushes	1·251″ 1·252″	31·7754 31·8008	
Outside Diameter of 1st and 3rd Gear Bushes	1·4983″ 1·4978″	38·057 38·044	
End Float of 1st, 2nd and 3rd Gear on Bushes	0·004″ to 0·008″	0·1016 to 0·2032	0·004″ to 0·006″ 0·1016 to 0·1524 Recommended
Mainshaft Spigot Bearing Outside Diameter	0·8750″ 0·8745″	22·225 22·2123	

1ST AND 2ND/3RD SPEED GEAR THRUST WASHERS

Part No.	Colour	Thickness Ins.	mm.
129941	Self-finish	0·120″/0·118″	3·048/2·997
129942	Green	0·123″/0·121″	3·124/3·0734
129943	Blue	0·126″/0·124″	3·200/3·1496
129944	Orange	0·129″/0·127″	3·2766/3·2258
134670	Yellow	0·134″/0·132″	3·4036/3·352 8

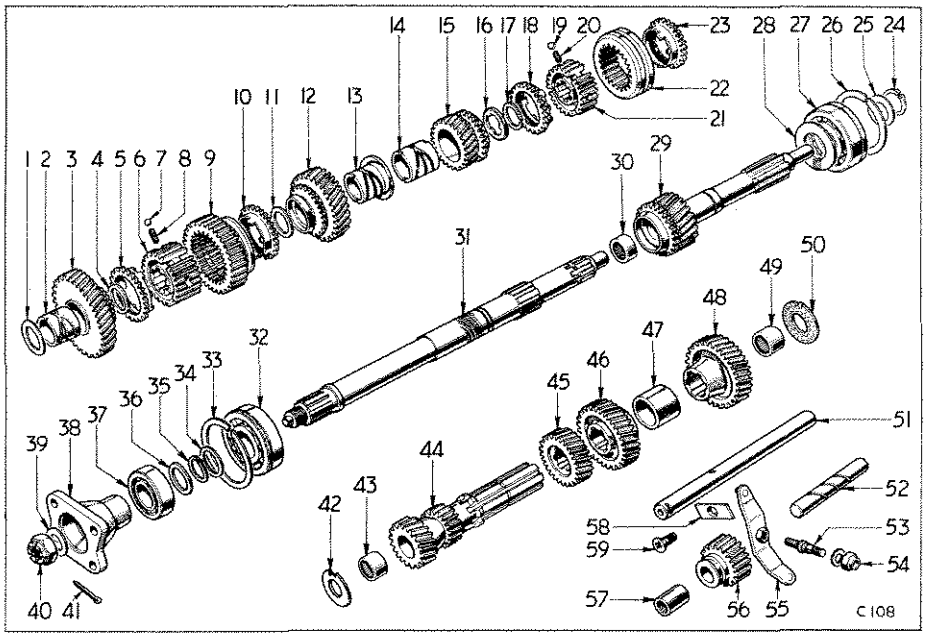


Fig. 1. Gearbox Details (Moving Parts)

Key to Fig. 1

1 Thrust washer
2 Bush—1st speed gear
3 1st speed gear
4 Thrust washer
5 1st speed synchro cup
6 1st/2nd speed synchro hub
7 Synchro ball
8 Spring
9 Reverse mainshaft gear and synchro outer sleeve
10 2nd speed synchro cup
11 Thrust washer
12 2nd speed gear
13 Bush—2nd speed gear
14 Bush—3rd speed gear
15 3rd speed gear
16 Thrust washer
17 Circlip
18 3rd speed synchro cup
19 Synchro ball
20 Spring
21 3rd/top synchro hub
22 Synchro sleeve
23 Top gear synchro cup
24 Circlip
25 Distance washer
26 Circlip
27 Ball race
28 Oil deflector plate
29 Input shaft
30 Needle roller bearing
31 Mainshaft
32 Ball race
33 Circlip
34 Distance washer
35 Circlip
36 Distance washer
37 Rear ball race
38 Flange
39 Plain washer
40 Slotted nut
41 Split pin
42 Rear thrust washer
43 Needle roller bearing
44 Countershaft hub
45 2nd speed countershaft gear
46 3rd speed countershaft gear
47 Distance piece
48 Countershaft gear
49 Needle roller bearing
50 Front thrust washer
51 Countershaft
52 Reverse gear shaft
53 Pivot stud
54 Nyloc nut and washer
55 Reverse gear operating lever
56 Reverse gear
57 Reverse gear bush
58 Locating plate
59 Screw

GEARBOX DETAILS (Fixed Parts)

GEARBOX — continued

	Ins.	mm.	
Bore of 1st Speed gear	1·5005″ 1·4995″	38·1127 38·087	
Bore of 2nd Speed Gear ..	1·5672″ 1·5680″	39·807 39·827	
Bore of 3rd Speed Gear	1·5005″ 1·4995″	38·1127 38·087	
Countershaft			
Countershaft Diameter	0·8125″ 0·8120″	20·637 20·625	
Bore of Countershaft Hub for Needle Rollers	1·063″ 1·062″	27·000 26·975	
Thickness of Front Thrust Washer	0·068″ 0·066″	1·7272 1·6764	
Thickness of Rear Thrust Washer	0·105″ 0·107″	2·667 2·718	
Recommended Countershaft End Float	0·007″ 0·012″	0·1778 0·3048	
Synchromesh Release Loads			
1st and 2nd Gear Synchro. Unit ..	25 lbs. to 27 lbs.	11·34 kg. to 12·247 kg.	
3rd and Top Gear Synchro. Unit ..	19 lbs. to 21 lbs.	8·618 kg. to 9·525 kg.	
Selector Shaft Release Loads			
1st/2nd	32 lbs. to 34 lbs.	14·515 kg. to 15·422 kg.	
3rd/Top	26 lbs. to 28 lbs.	11·793 kg. to 12·701 kg.	From gearbox number CT9899, 3rd/Top selector shaft release load became identical to the reverse selector shaft release load. See note on page 2·214.
Reverse	26 lbs. to 28 lbs.	11·793 kg. to 12·701 kg.	