SUPPLEMENTARY INFORMATION

FOR

4·2 LITRE "E" TYPE AND 2+2 CARS

(SERIES 2)

This Supplement covers the variations between the 4·2 Litre (Series 2) "E" Type, 2+2 (Series 2) and the 3·8 Litre versions of the "E" Type. Insert the Supplement at the end of the 3·8 Litre "E" Type Service Manual, Publication No. E.123.

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SECTION A

GENERAL INFORMATION

The Routine Maintenance Service periods have been increased to 3,000 mile (5,000 km.) stages as follows:—

1,000 MILES (1,600 KM.)
FREE SERVICE

1. Road test and check for oil, petrol, hydraulic fluid or coolant leaks.
2. Check torque loading of cylinder head nuts.
3. Check oil or fluid levels and top up as necessary:—
   (a) Brake reservoirs,
   (b) Clutch reservoir (if fitted),
   (c) Power steering reservoir (if fitted),
   (d) Top up carburetter hydraulic dampers and check carburation,
   (e) Battery,
   (f) Screen washer bottle,
   (g) Radiator header tank (add anti-freeze when necessary),
   (h) Manual gearbox,
   (i) Final drive unit.
4. Drain and refill
   (a) Engine sump,
   (b) Automatic transmission unit (if fitted).
5. Adjust front band on automatic transmission unit (if fitted).
6. Check driving belts for correct tension.
7. Clean and adjust contact-breaker points.
8. Check all brake pipe unions, petrol pipe unions, and hoses for leakage.
9. Check tightness of all front and rear suspension bolts and nuts.
10. Check tightness of nuts on all steering connections including column universal joints.
11. Check tightness of road wheel nuts and wheel alignment.
12. Check tyres for damage and adjust pressures.
13. Check operation of all lights and systems.
14. Check door locks and bonnet release control.
15. Lubricate all grease nipples (excluding wheel bearings).

3,000 MILES (5,000 KM.)
CHECK SERVICE

Repeat these servicing items at the under-mentioned subsequent periods:—

9,000 miles (15,000 Km.)
15,000 miles (25,000 Km.)
21,000 miles (35,000 Km.)
27,000 miles (45,000 Km.)
33,000 miles (55,000 Km.)
39,000 miles (65,000 Km.)
45,000 miles (75,000 Km.)
51,000 miles (85,000 Km.)
57,000 miles (95,000 Km.)
63,000 miles (105,000 Km.)
69,000 miles (115,000 Km.)

1. Check oil or fluid levels and top up as necessary:—
   (a) Engine sump,
   (b) Brake reservoirs,
   (c) Clutch reservoir (if fitted),
   (d) Power steering reservoir (if fitted),
   (e) Top up carburetter hydraulic dampers and check carburation,
   (f) Battery,
   (g) Screen washer bottle,
   (h) Radiator header tank (add anti-freeze when necessary),
   (i) Manual gearbox,
   (j) Final drive unit.
2. Check driving belts for correct tension.
3. Examine brake pads for wear and check operation of brake stop lights.
4. Examine tyres for damage and adjust pressures.
5. Check tightness of road wheel nuts.

6,000 MILES (10,000 KM.)
MINOR SERVICE

Repeat these servicing items at the under-mentioned subsequent periods:—

18,000 miles (30,000 Km.)
30,000 miles (50,000 Km.)
42,000 miles (70,000 Km.)
54,000 miles (90,000 Km.)
66,000 miles (110,000 Km.)

1. Check oil or fluid levels and top up as necessary:—
   (a) Brake reservoirs,
   (b) Clutch reservoir (if fitted),
   (c) Power steering reservoir (if fitted),
   (d) Top up carburetter dampers,
   (e) Battery and check connections,
   (f) Screen washer bottle,
   (g) Radiator header tank (add anti-freeze when necessary),
   (h) Manual gearbox or automatic transmission unit,
   (i) Final drive unit.
2. Drain and refill:—
   (a) Engine sump. Fit new oil filter element and seal.
3. Check driving belts for correct tension.
4. Check brake pads for wear and advise wear-rate to owner.
5. Check tyres for damage and tread depth. If uneven wear evident, check wheel alignment. Adjust pressures.
6. Check tightness of road wheel nuts.
7. Check headlamp alignment and functioning of mandatory lights including stop lights.
8. Lubricate all grease nipples, excluding wheel bearings.

12,000 MILES (20,000 KM.)
MAJOR SERVICE

Repeat these servicing items at the under-mentioned subsequent periods:—

24,000 miles (40,000 Km.)
48,000 miles (80,000 Km.)
60,000 miles (100,000 Km.)

1. Check oil or fluid levels and top up as necessary:—
   (a) Brake reservoirs,
   (b) Clutch reservoir (if fitted),
   (c) Power steering reservoir (if fitted),
   (d) Top up carburetter hydraulic dampers,
   (e) Battery and check connections,
   (f) Screen washer bottle,
   (g) Radiator header tank (add anti-freeze when necessary),
   (h) Automatic transmission,
   (i) Final drive unit.
2. Drain and refill:—
   (a) Engine sump. Fit new oil filter element and seal,
   (b) Manual gearbox. Clean overdrive filter (if fitted),
   (c) Final drive unit (if 'Powr-Lok' differential fitted. Use only special limited slip oil).
3. Renew sparking plugs.
4. Renew air cleaner element and fuel line filter element.
5. Clean and adjust contact breaker points. Check operation of centrifugal advance mechanism. Lubricate distributor.
6. Check driving belts for wear and tension.
7. Adjust top timing chain if required.
8. Lubricate all grease nipples including front and rear wheel bearings.
9. Check all suspension and exhaust mountings for security.
10. Check all steering connections, ball joints etc., for security and wear.
11. Check brake pads for degree of wear and advise wear-rate to owner.
12. Check functioning of all mandatory lights including stop lights and alignment of headlamps.
13. Check tyres for damage and tread depth. If uneven wear evident, check wheel alignment. Adjust pressures.
14. Oil can lubrication of door locks, bonnet hinges and locks, boot hinges and lock, seat slides, fuel filler flap hinges, control linkages.
15. Detect and report any oil, petrol, water, hydraulic fluid leakage and damaged hoses or other damaged parts.

36,000 MILES (60,000 KM.)
MAJOR SERVICE

Repeat these servicing items at the under-mentioned subsequent period:—

72,000 miles (120,000 Km.)

1. Check oil or fluid levels and top up as necessary:—
   (a) Clutch reservoir (if fitted),
   (b) Power steering reservoir (if fitted),
   (c) Top up carburetter hydraulic dampers,
   (d) Battery and check connections,
   (e) Screen washer bottle,
   (f) Radiator header tank (add anti-freeze when necessary),
   (g) Automatic transmission,
   (h) Final drive unit.
2. Drain and refill:—
   (a) Engine sump. Fit new oil filter element and seal,
   (b) Manual gearbox. Clean overdrive filter (if fitted),
   (c) Braking system. Retract wheel cylinder pistons to expell all old fluid,
   (d) Final drive unit (if 'Powr-Lok' differential fitted. Use only special limited slip oil).
3. Renew sparking plugs.
4. Renew air cleaner element and fuel line filter element.
5. Clean and adjust contact breaker points. Check operation of centrifugal advance mechanism. Lubricate distributor.
6. Check driving belts for wear and tension.
7. Adjust top timing chain if required.
8. Lubricate all grease nipples including front and rear wheel bearings.
9. Check all suspension and exhaust mounting for security.
10. Check all steering connections, ball joints etc., for security and wear.
11. Check brake pads for degree of wear and advise wear-rate to owner.
12. Check functioning of all mandatory lights including stop lights and alignment of headlamps.
13. Check tyres for damage and tread depth. If uneven wear evident, check wheel alignment. Adjust pressures.
14. Oil can lubrication of door locks, bonnet hinges and lock, boot hinges, and lock, seat slides, fuel filler flap hinges, control linkages.
15. Detect and report any oil, petrol, water, hydraulic fluid leakage and damaged hoses or other damaged parts.

RECOMMENDED LUBRICANTS

Component	MOBIL	CASTROL	SHELL	ESSO	B.P.	DUCKHAM	REGENT Caltex/Texaco
Engine	Mobil Super or Mobil Special	Castrol GTX	Shell Super Oil	Esso Extra Motor Oil 10W/30 Esso Extra Motor Oil 20W/40	Super Visco-Static 10W/40	Q20–50 or Q5500	Havoline 20W/40 or 10W/30
Upper cylinder lubrication	Mobil Upperlube	Castrollo	Shell U.C.L. or Donax U.	Esso U.C.L.	U.C.L.	Adcoid Liquid	Regent U.C.L.
Distributor oil can points Oil can lubrication	Mobiloil A	Castrol GTX	Shell Super Oil	Esso Extra Motor Oil 20W/40	Energol SAE 30	Q20–50	Havoline 30
Gearbox Final Drive Unit (not 'Powr-Lok')	Mobilube GX 90	Castrol Hypoy	Spirax 90 EP	Esso Gear Oil GP 90/140	Gear Oil SAE 90 EP	Hypoid 90	Multigear Lubricant EP.90
Front wheel bearings Rear wheel bearings Distributor cam Final drive half-shafts Steering tie-rods Wheel swivels Door hinges Steering housing	Mobil grease MP	Castrolease LM	Retinax A	Esso Multi-purpose Grease H	Energrease L.2	LB 10	Marfak All Purpose
Automatic transmission unit Power steering system	Mobilfluid 200	Castrol T.Q.	Shell Donax T6	Esso Automatic Transmission Fluid	Automatic Transmission Fluid Type A	Nolmatic	Texamatic Fluid

SECTION B

ENGINE

DATA

Camshaft

Permissible end float	·004″ to ·006″ (·10 to ·15 mm.)

Connecting Rod

Big end—Diameter clearance	·0015″ to ·0033″ (·037 to ·083 mm.)

Crankshaft Main Bearings

Journal diameter	2·750″ to 2·7505″ (69·85 to 69·86 mm.)
Journal length	
—Front	$1\frac{9}{16}$″ (39·06 mm.)
—Centre	$1\frac{3}{8}$″ + ·001″ — ·0005″ (34·37 mm. + ·025 mm. — ·0125 mm.)
—Rear	$1\frac{11}{16}$″ (42·86 mm.)
—Intermediate	$11\frac{7}{32}$″ ± ·002″ (30·96 mm. ± ·05 mm.)

Cylinder Block

Bore size for fitting liners	3·761″ to 3·762″ (94·03 to 94·05 mm.)
Outside diameter of liner	3·765″ to 3·766″ (94·13 to 94·15 mm.)
Interference fit	·003″ to ·005″ (·08 to ·13 mm.)
Overall length of liner	6·959″ to 6·979″ (17·39 to 17·45 cm.)
Outside diameter of lead-in	3·758″ to 3·760″ (93·95 to 94·00 mm.)
Size of bore honed after assembly—cylinder block—Nominal	92·07 mm. (3·625″)

Gudgeon Pin

Length	3·00″ (75 mm.)

ENGINE

Piston and Piston Rings

Gudgeon pin bore	·8571″ to ·8753″ (2·188 to 2·1883 mm.)
Piston rings—Width Compression	·0770″ to ·0780″ (1·97 to 2·00 mm.)
Oil Control	Self expanding (Maxiflex)
Piston rings—Thickness	·151″ to ·158″ (3·775 to 3·95 mm.)
Piston rings—Gap when fitted to cylinder bore	
Oil Control	·015″ to ·033″ (·38 to ·82 mm.)

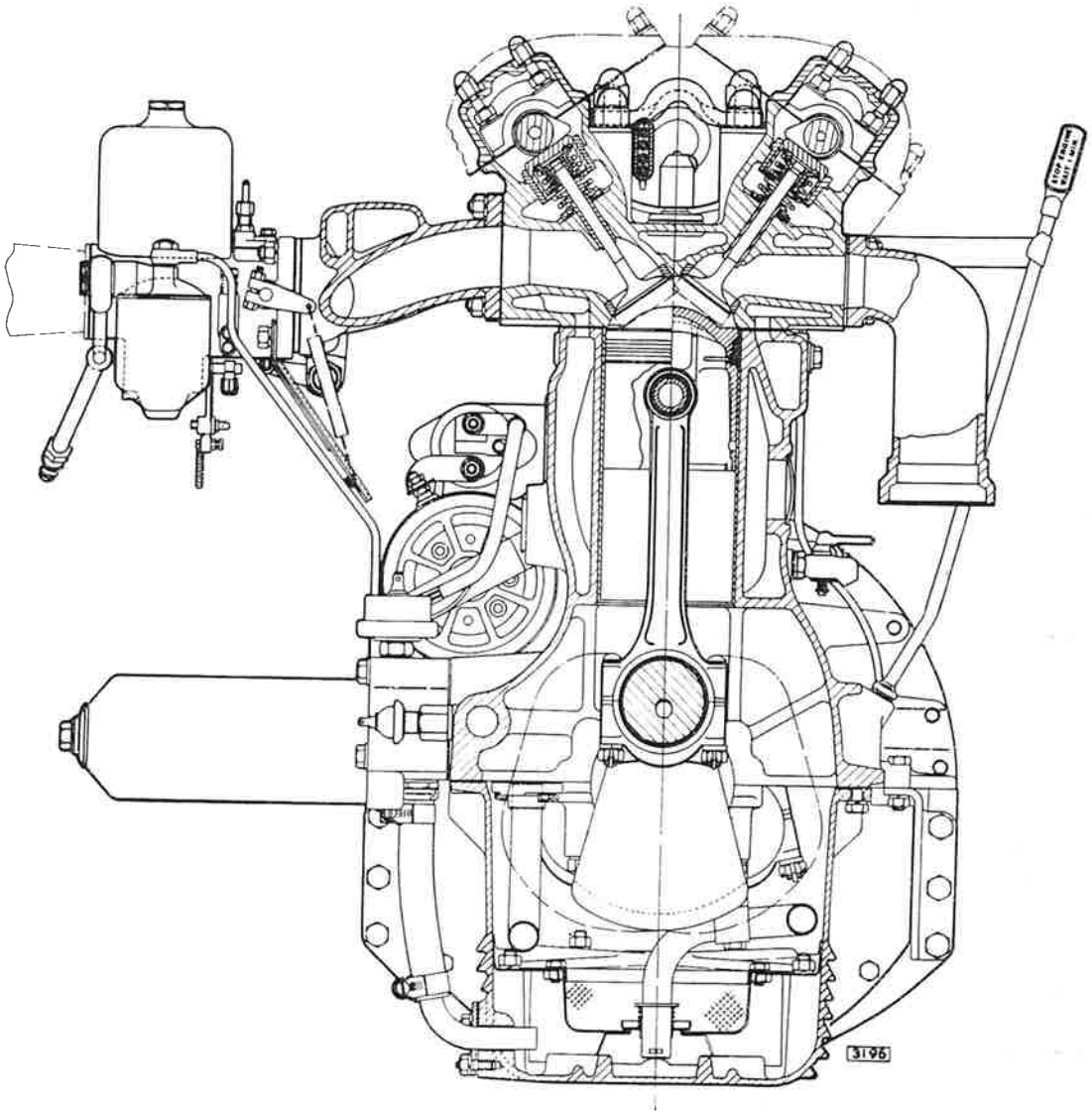


Fig. 1. *Cross sectional view of the engine.*

ENGINE REMOVAL AND REFITTING

REMOVAL

Remove the bonnet.

Disconnect the battery.

Drain the cooling system and cylinder block; conserve the coolant if antifreeze is in use.

Slacken the clip on the breather pipe; unscrew the two wing nuts and withdraw the top of the air cleaner.

Disconnect the petrol feed pipe from under the centre carburetter.

Slacken the clamps and remove the water hoses from the cylinder head and radiator to the header tank. Slacken the two clamps and withdraw the water pump hose. Remove the heater hoses from the inlet manifold.

Disconnect the brake vacuum hose from the inlet manifold.

Pull off the two Lucar connectors from the fan thermostat control in the header tank.

Remove the two bolts securing the header tank mounting bracket to the front cross member. Remove the two nuts and two bolts securing the header tank straps to the radiator and fan cowl. Withdraw the header tank complete with mounting bracket and straps.

Disconnect the throttle linkage at the rear carburetter.

Disconnect:—

The two coil leads.

The water temperature transmitter.

The battery cable and solenoid switch cable from the starter.

The output cables from the alternator.

The engine earth strap from the left hand side member.

Withdraw the oil filter canister; catch the escaping oil in a drip tray.

Remove the crankshaft pulley, damper and drive belt. Mark the pulley and damper to facilitate refitting. Remove the ignition timing pointer from the sump.

Remove the revolution counter generator complete with cables.

Remove the four nuts and washers securing each exhaust downpipe from the manifold. Unclip the pipes at the silencers and withdraw the downpipes. Collect the sealing rings between the pipes and the manifold.

On standard transmission cars, proceed as follows:—

Remove the seats. Remove the knob and locknut from the gear lever. Remove two hexagon headed setscrews and two chromium-plated nuts and detach the radio/ash tray console panel from the gearbox tunnel. If a radio is fitted, disconnect the electrical cables from the control head to enable the panel to be completely removed.

On 2+2 cars, raise the central arm-rest; lift out the bottom panel; withdraw five self-tapping screws and remove the central arm-rest. Lift off the trimmed cover panel from the gearbox tunnel.

On all other cars, withdraw two pan-headed screws and two seat belt attachments before lifting off the trimmed cover. Withdraw the self-tapping screws and remove the gearbox cover.

Disconnect the reverse lamp cables from the switch on the gearbox top cover.

Disconnect the speedometer drive cable from the gearbox.

Remove the clutch slave operating cylinder from the clutch cover.

Disconnect the propeller shaft.

On automatic transmission cars, proceed as follows:—

Withdraw the transmission dipstick and unscrew the dipstick tube from the transmission oil pan.

Place the selector lever in L and, from underneath the car, unscrew the nut securing the selector cable adjustable ball joint to the transmission lever. Release the nut securing the outer cable clamp to the abutment bracket.

Remove the speedometer drive cable from the transmission extension housing.

Disconnect the transmission oil cooler pipes from the right hand side of the radiator block and from the transmission unit. Withdraw the clips and remove the pipes.

Disconnect the kickdown cable at the rear of the cylinder head.

Remove the central arm-rest and lift off the trimmed cover panel from the gearbox tunnel. Withdraw the drive screws securing the cover plate on the transmission tunnel. Disconnect the propeller shaft.

For all models, proceed as follows:—

Remove the nuts securing the torsion bar reaction tie plate on each side and tap the bolts back flush with the face of the tie plate. With the aid of a helper, place a lever between the head of the bolt just released and the torsion bar. Exert pressure on the bolt head to release the tension on the upper bolt. Remove the nut and tap the upper bolt back flush with the face of the tie plate. Withdraw the bolts securing the tie plate on each side to the body underframe channels through the side members. Tap the tie plate off the four bolts.

Note: Failure to relieve the tension on the upper bolts when tapping them back to the tie plate will result in stripping the threads. If this occurs, new bolts must be fitted and the torsion bars re-set.

Support the engine by means of two individual lifting tackles using the hooks provided on the cylinder head. Insert a trolley jack under the transmission (or gearbox) and support the transmission.

Remove the self-locking nut and washer from the engine stabiliser.

Remove the bolts securing the rear engine mounting plate. Remove the bolts from the front engine mountings.

Raise the engine on the lifting tackles and, keeping the combined engine and transmission assembly level, move forwards ensuring that the water pump pulley clears the sub-frame top cross member. Carefully raise the front of the engine and withdraw forwards and upwards.

REFITTING

Refitting is the reverse of the removal procedure. After the unit is in place, it is important that the engine stabiliser is adjusted and that the clutch slave cylinder is mounted correctly.

On automatic transmission 2+2 cars, the kickdown cable must be adjusted and the manual linkage connected in accordance with the instructions given in Section FF.

THE CYLINDER BLOCK

OVERHAUL

Reboring is normally recommended when the bore wear exceeds ·006″ (·15 mm). Reboring beyond the limit of ·030″ (·76 mm) is not recommended and, when the bores will not clean out at ·030″ (·76 mm), liners and standard size pistons should be fitted.

The worn liners must be pressed out from below utilising the stepped block illustrated.

PISTONS AND GUDGEON PINS

Piston Grades

Grade Identification Letter	To suit cylinder bore size
F	3·6250″ to 3·6253″ (92·075 to 92·0826 mm.)
G	3·6254″ to 3·6257″ (92·0852 to 92·0928 mm.)
H	3·6258″ to 3·6261″ (92·0953 to 92·1029 mm.)
J	3·6262″ to 3·6265″ (92·1055 to 92·1131 mm.)
K	3·6266″ to 3·6269″ (92·1156 to 92·1123 mm.)

Oversize Pistons

Oversize pistons are available in the following sizes: +·010″ (·25 mm.) ±·020″ (·51 mm.) +·030″ (·76 mm.).

There are no selective grades in oversize pistons as grading is necessary purely for factory production methods.

Tapered Periphery Rings

All engine units are fitted with tapered periphery piston rings and these must be fitted the correct way up.

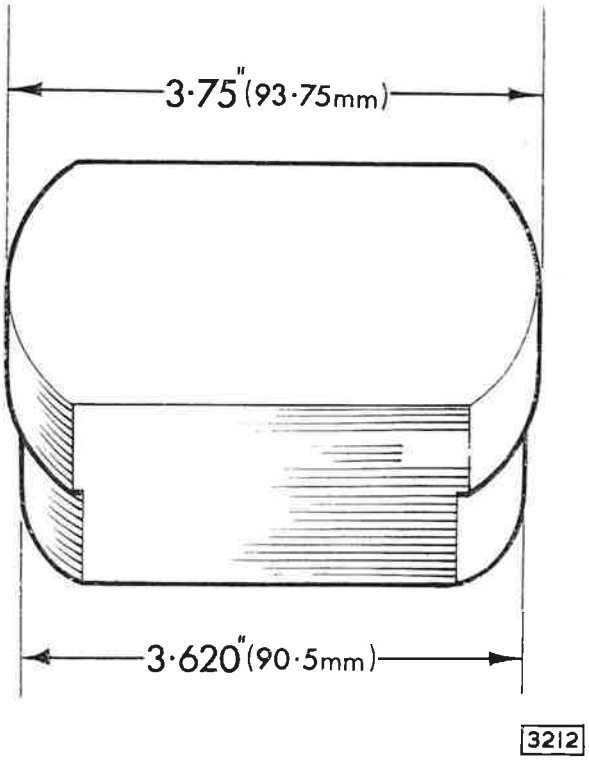


Fig. 2. *Stepped block for cylinder liner removal.*

The narrowest part of the ring must be fitted uppermost; to assist in identifying the narrowest face a letter "T" or "Top" is marked on the side of the ring to be fitted uppermost.

The oil control ring consists of two steel rails with a spacer between. These rails are held together on assembly with an adhesive. The expander, which is fitted inside the oil control ring, should be assembled with the ends of the expander ring (internal ring) butted together. If the internal ring is fitted to the piston groove with the ends overlapping, the outer ring assembly cannot be seated properly.

Pistons

Skirt clearance (measured at bottom of skirt at 90 to gudgeon pin pin axis)	·0007″ to ·0013″ (·018 to ·03 mm.)

Ring gap—when fitted to bore

Top compression	·015″ to ·020″ (·38 to ·51 mm.)
Lower compression	·010″ to ·015″ (·254 to ·38 mm.)
Scraper	·015″ to ·045″ (·38 to 1·143 mm.)
Side clearance in groove	·001″ to ·003″ (·02 to ·07 mm.)

Gudgeon Pins

Grades	(Red) ·8753″ to ·8754″ (22·23 to 22·24 mm.) (Green) ·8752″ to ·8753″ (22·22 to 22·23 mm.)
Clearance in piston	·0001″ to ·0003″ (·0025 to ·0076 mm.)

Cargraph Treatment—Piston Rings

The chromium plated ring (top compression) is Cargraph treated on the outside diameter to assist in bedding in the chromium surface. This coating is coloured Red for identification purposes and **should not be removed.** Excess oil or grease may be removed with clean paraffin but **rings should not be soaked in any degreasing agent.**

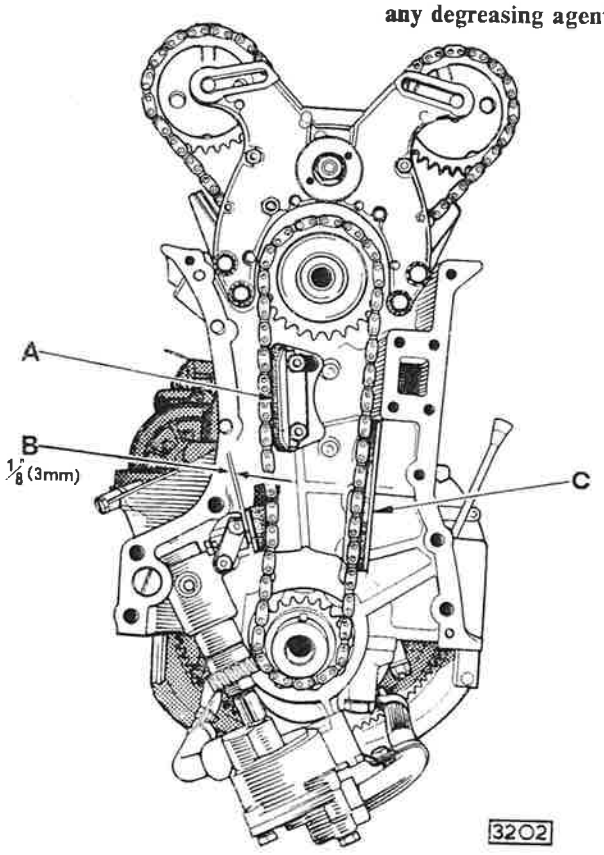


Fig. 3. *The timing gear arrangement.*

When fitting a new lower timing chain, set the intermediate damper (A) in light contact with the chain when there is a ⅛″ (3 mm) gap between the rubber slipper and the tensioner body. In the case of a worn chain, the gap (B) may have to be increased to avoid fouling between the chain and the cylinder block. Set the lower damper (C) in light contact with the chain.

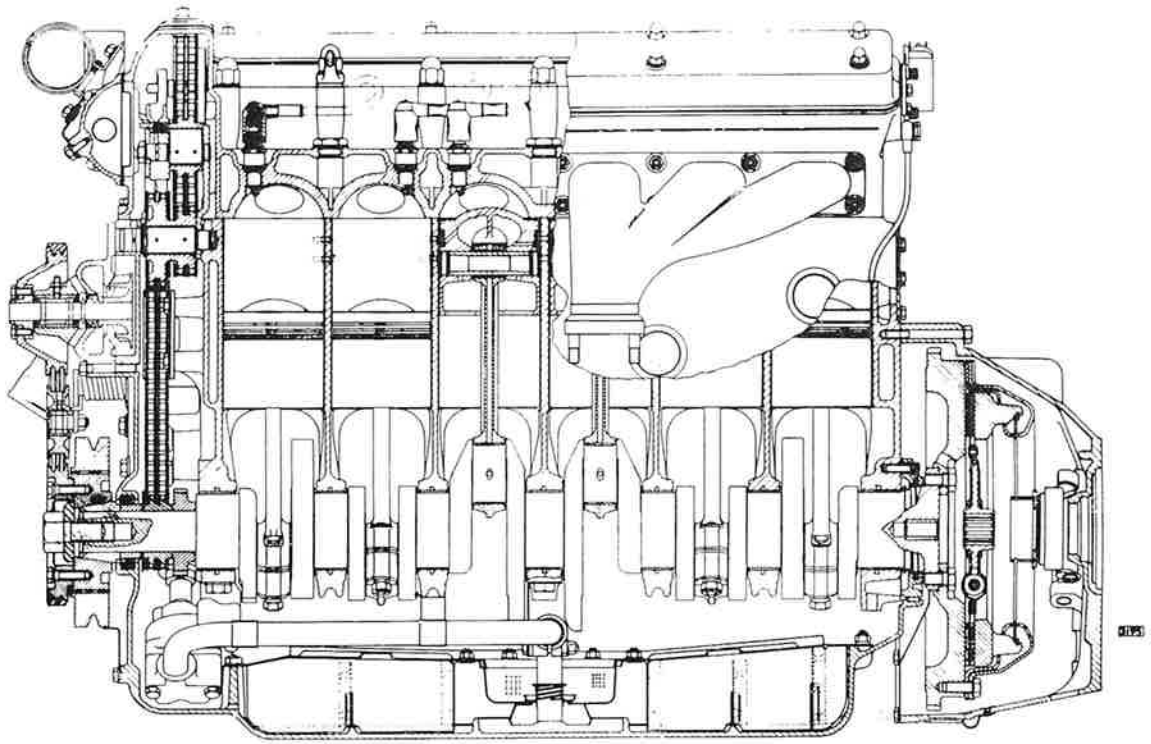


Fig. 4. *Longitudinal section of the engine.*

OIL SUMP

REMOVAL

Drain the sump; disconnect the oil return pipe and remove the crankshaft damper.

Remove the self-locking nut and washer from the top of the engine stabiliser. Screw down the lower flanged washer to the limit of the stud thread.

Sling the engine from the rear lifting loop and raise the engine approximately 1" (25·4 mm.).

Remove the sump securing screws, lower the front end and withdraw forward.

REFITTING

Refitting is the reverse of the removal procedure but care must be taken to ensure that the rear oil seal is positioned correctly. Adjust the engine stabiliser after refitting.

Check for oil leakage after refilling the sump and running the engine.

VALVE GUIDES

Valve guides have circlips fitted to ensure positive location in the cylinder head. These valve guides are chamfered at the upper ends and have the outside diameter reduced at the lower end to provide a "lead-in" when fitting.

Oil seals are also fitted to the inlet valve guide—a second groove being machined in the guide above the circlip groove to seat the oil seal.

Checking Valve Guides

Examine the guides for evidence of wear in the bore. The clearance between the valve stem and the guide when new is ·001″–·004″ (·025–·10 mm).

If it is found necessary to renew worn valve guides, they must be fitted in accordance with the following instructions and only genuine factory replacement parts used.

Valve Guide—Replacement

Heat the cylinder head by immersing in boiling water for 30 minutes. With a piloted drift, drive out the old valve guide from the combustion chamber end.

Note: If carbon deposits around the valve guide in the combustion chamber are quite heavy, they should be cleaned off thoroughly before attempting to drive out the old valve guide.

Valve guides when fitted during engine assembly are to the following dimensions and may be fitted in mixed form.

(1) ·501″ to ·502″ (12·70 to 12·725 mm.)
(2) ·503″ to ·504″ (12·776 to 12·801 mm.)

The valve guide (2) will be identified by the machining of one circular groove on the shank of the guide: valve guide (1) will **not** have the groove.

When removing worn guides, care must be taken to identify each individual guide to its particular bore in the cylinder head.

Replacement guides are available in the following sizes and will have identification grooves machined in the shank as noted:—

1st oversize (one groove)	·503″ to ·504″ (12·776 to 12·801 mm.)
2nd oversize (two grooves)	·506″ to ·507″ (12·852 to 12·877 mm.)
3rd oversize (three grooves)	·511″ to ·512″ (12·979 to 13·005 mm.)

Valve guides with one groove should only be fitted as replacements for those originally fitted without a groove: the bore in the cylinder head will not require reaming before fitting.

Guides with two grooves should be used as replacements for those with one groove and guides with three grooves for those with two. Cylinder head bores should be reamed to the following dimensions:—

Valve Guide	Ream to Size
2nd oversize (two grooves)	.505″ $^{+.0005″}_{-.0002″}$ (12.83 mm. $^{+.012}_{-.005}$ mm.)
3rd oversize (three grooves)	.510″ $^{+.0005″}_{-.0002″}$ (12.95 mm. $^{+.012}_{-.005}$ mm.)

Coat the valves with graphite grease and fit the circlips. Reheat the cylinder head. With a piloted drift, drive in the valve guide from the top until the circlip registers in the groove machined in the guide bore of the cylinder head. Visually check that the circlip has seated correctly.

SECTION C

CARBURETTERS AND FUEL SYSTEM

CARBURETTERS

Removal

Drain the cooling system.

Disconnect the battery.

Slacken the hose clip securing the water hose from the inlet manifold to the header tank. Remove the hose.

Disconnect the two electrical connections from the thermostat fan control in the header tank.

Remove the throttle return springs.

Unclip hose connection to breather pipe.

Remove the two butterfly nuts at the carburetter trumpets and remove the air cleaner elbow.

Remove the carburetter trumpet from the carburetters having removed the six nuts and spring washers together with the three gaskets.

Disconnect the throttle linkage at the rear carburetter.

Remove the three banjo union bolts and six fibre washers from the float chambers.

Ensure that the three float chamber filters are not mislaid.

Disconnect the mixture control outer and inner cables.

Remove the suction pipe from the front carburetter.

Disconnect the brown/black cable from the oil pressure switch.

Slacken the clips and disconnect the heater pipes at the water manifold and below the inlet manifold.

On 2+2 cars fitted with automatic transmission, disconnect the kickdown cable at the rear of the cylinder head.

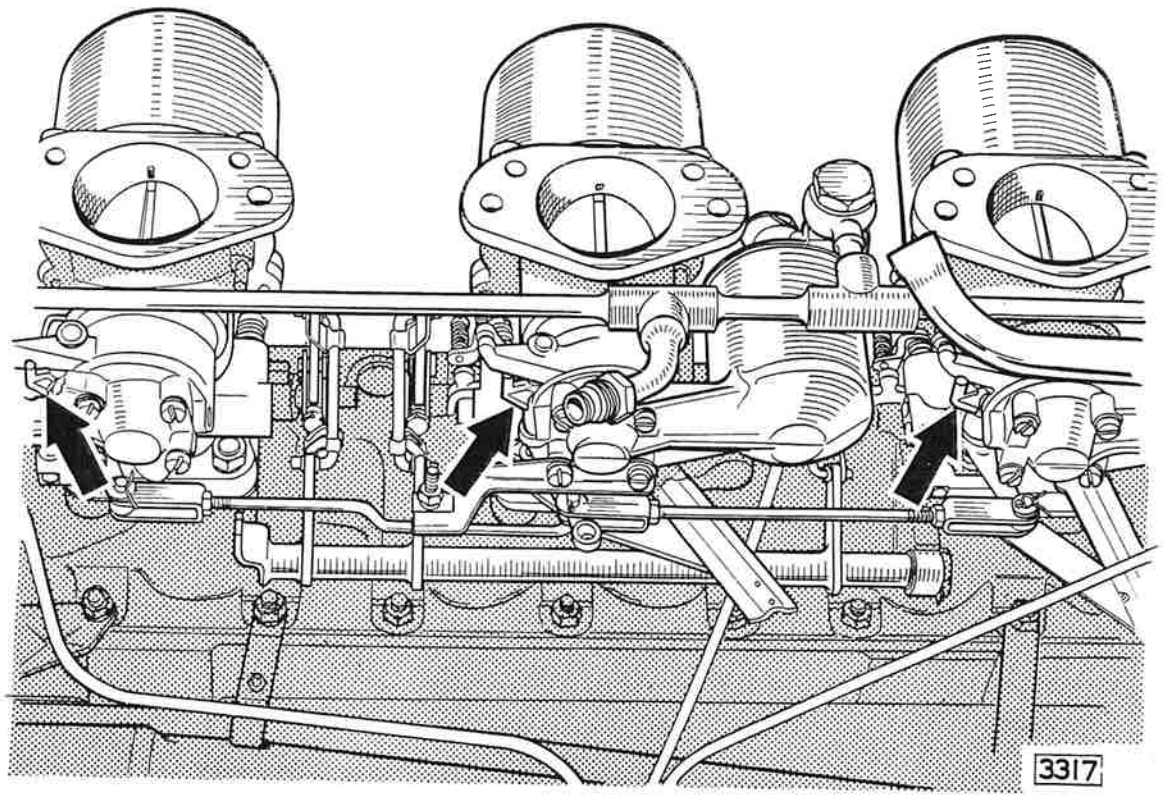


Fig. 1. *Refitting the mixture control rods with the jet levers against the stops.*

CARBURETTERS AND FUEL SYSTEM

Remove the inlet manifold complete with the carburetters and linkage.

Remove the four nuts and spring washers, together with the return spring bracket from each carburetter. Remove all three carburetters together.

If necessary, remove the mixture control linkage from each carburetter by removing the split pins and withdrawing the clevis pins.

Refitting

Refitting is the reverse of the removal procedure except that new gaskets should be fitted to the inlet manifold, to either side of the heat insulating gasket and also to the carburetter trumpet flanges.

Adjust the kickdown cable as detailed on page FFY.s.24.

CARBURETTER TUNING

The method of tuning carburetters is identical with that given for 3·8 litre "E" Type cars, however, the idling speed on standard transmission cars should be 700 r.p.m. in order to eliminate any chatter from the constant mesh gears in the all-synchromesh gearbox.

On automatic transmission 2+2 cars, the idling speed should be 500 r.p.m.

The fuel feed line filter incorporates a renewable fibre filter element. This element should not be cleaned but must be renewed every 12,000 miles. When renewing, the two sealing washers should also be replaced.

If sediment build-up is excessive, the element should be renewed more frequently than stated above.

THE FUEL SYSTEM

THE PETROL PUMP

Description (Fig. 2)

The pump consists of three main assemblies, the main body casting (A); the diaphragm armature and magnet assembly (M) contained within the housing; and the contact breaker assembly housed within the end cap (T2). A non-return valve assembly (C) is affixed to the end cover moulding to assist in the circulation of air through the contact breaker chamber.

The main fuel inlet (B) provides access to an inlet air bottle (I) while access to the main pumping chamber (N) is provided by an inlet valve assembly. This assembly consists of a Melinex valve disc (F) permanently assembled within a pressed-steel cage, held in position by a valve cover (E1).

The outlet from the pumping chamber is provided by an identical valve assembly which operates in the reverse direction. Both inlet and outlet valve assemblies together with the filters are held in position by a clamp plate (H). The valve assemblies may be removed by detaching the clamp plate (H) after removing the self-tapping screws. A filter (E) is provided on the delivery side of the inlet valve assembly. The delivery chamber (O) is bounded by a flexible plastic spring loaded diaphragm (L) contained by the vented cover (P). Sealing of the diaphragm (L) is provided by the rubber sealing ring (L.2).

The magnetic unit consists of an iron coil housing, an iron core (Q), an iron armature (A1) provided with a central spindle (P1) which is permanently united with the diaphragm assembly (L1), a magnet coil (R) and a contact breaker assembly consisting of parts (P2), (U1), (U), (T1) and (V). Between the coil housing and the armature are located eleven spherically edged rollers (S). These rollers locate the armature (A1) centrally within the coil housing and permit freedom of movement in a longitudinal direction.

The contact breaker consists of a bakelite pedestal moulding (T) carrying two rockers (U) and (U1) which are both hinged to the moulding at one end by the rocker spindle (Z). These rockers are interconnected at their top ends by means of two small springs arranged to give a throw-over action. A trunnion (P2) is carried by the inner rocker and the armature spindle (P1) is screwed into this trunnion. The outer rocker (U) is fitted with two tungsten points which contact with corresponding tungsten points which form part of the

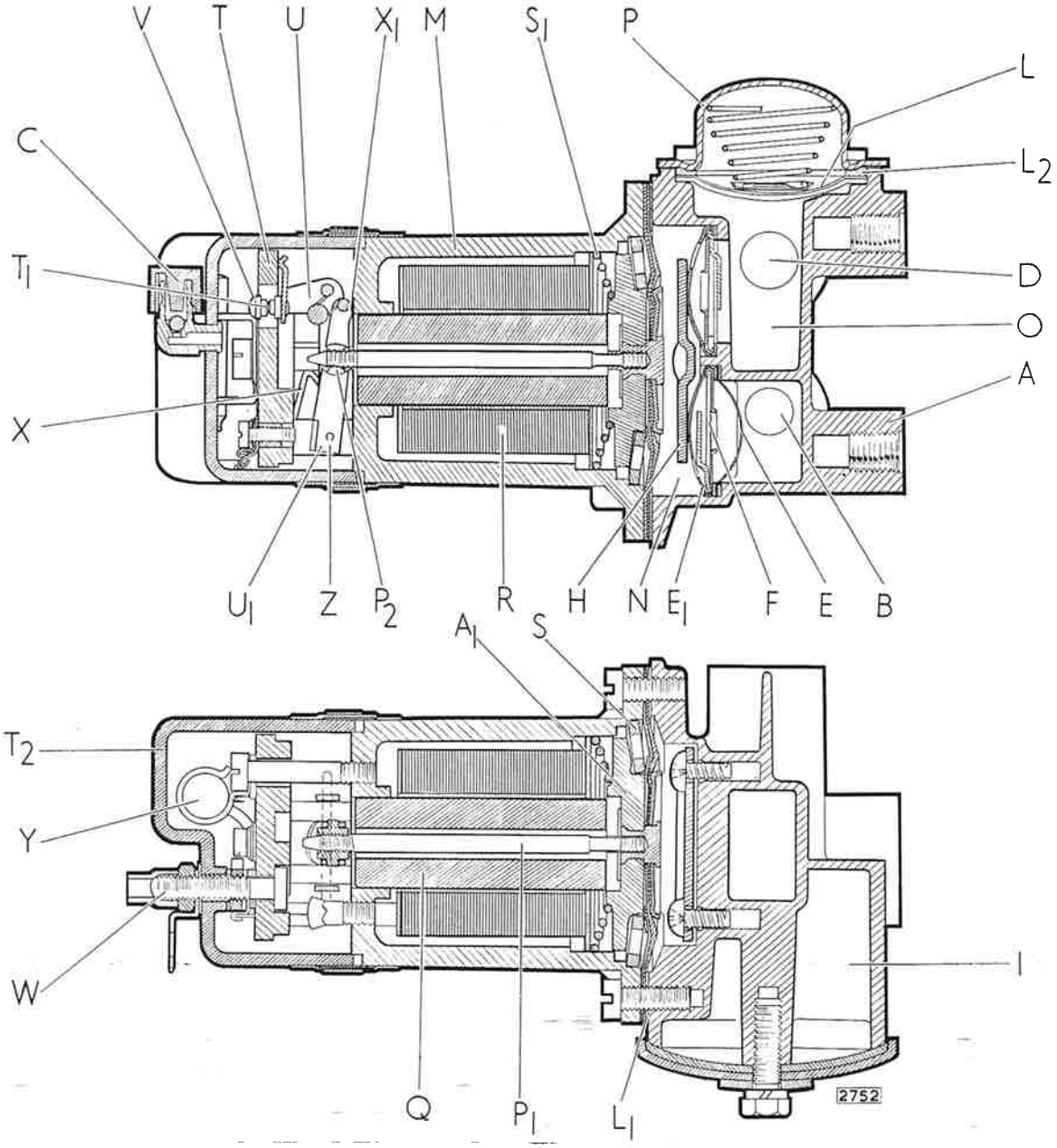


Fig. 2. *The Petrol Pump.*

WARNING: If at any time, it becomes necessary to blow through the fuel feed pipes the outlet pipes must be disconnected from the pumps. Failure to observe this procedure will cause the Melinex valves to be displaced or damaged.

spring blade (V) connected with one end of the coil. The other end of the coil is connected to a terminal (W) while a short length of flexible wire (X) connecting the outer rocker to one of the screws holding the pedestal moulding onto the coil housing provides an earth return to the body of the pump. It is important that the body of the pump be effectively earthed to the body of the vehicle by means of the earthing terminal provided on the flange of the coil housing.

OPERATION

When the pump is at rest the outer rocker (U) lies in the outer position and the tungsten points are in contact. Current passes from Lucar connector (W) through the coil and back to the blade (V), through the points and to earth, thus energising the coil and attracting the armature (A1). The armature, together with the diaphragm assembly, then retracts thereby sucking petrol through the inlet valve into the pumping chamber (N). When the armature has travelled nearly to the end of its stroke, the throw-over mechanism operates and the outer rocker moves rapidly backwards, thus separating the points and breaking the circuit.

The spring (S1) then reasserts itself forcing the armature and diaphragm away from the coil housing. This action forces petrol through the delivery valve at a rate determined by the requirements of the engine. As the armature nears the end of its stroke the throw-over mechanism again operates, the tungsten points remake contact and the cycle of operations is repeated.

The spring blade (V) rests against the small projection moulding (T) and it should be set so that, when the points are in contact, it is deflected away from the moulding. The gap at the points should be approximately ·030″ (·75 mm.) when the rocker (U) is manually deflected until it contacts the end face of the coil housing.

REMOVAL

Remove both inlet and outlet pipes from the side of the pump by withdrawing the banjo bolt and washers. Disconnect the electrical feed cable to the pump by unscrewing the knurled knob on the end of the pump. Remove the two self-locking nuts attaching the pump to the bracket and withdraw the two washers from each stud. The pump can now be withdrawn from the bracket leaving the two rubber grommets in position. The rubber grommets in the brackets should be examined for deterioration and replaced if necessary, otherwise excessive petrol pump noise may result.

REFITTING

Refitting is the reverse of the removal procedure.

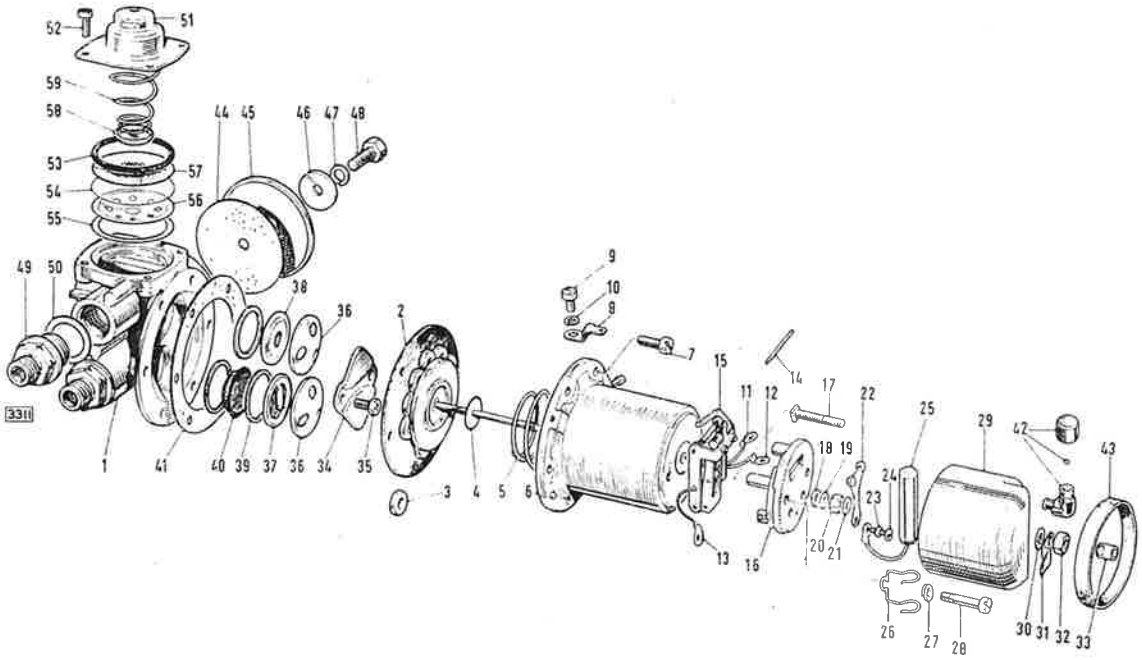


Fig. 3. *Exploded view of the petrol pump.*

1. Pump body.
2. Diaphragm and spindle assembly.
3. Roller—armature centralising.
4. Washer—impact.
5. Spring—armature.
6. Housing—coil.
7. Screw—securing housing—2 B.A.
8. Connector—earth.
9. Screw—4 B.A.
10. Spring washer.
11. Terminal tag.
12. Terminal tag.
13. Earth tag.
14. Rocker pivot pin.
15. Rocker mechanism.
16. Pedestal.
17. Terminal stud.
18. Spring washer.
19. Lead washer.
20. Terminal nut.
21. Washer.
22. Contact blade.
23. Washer.
24. Screw.
25. Condenser.
26. Clip.
27. Spring washer.
28. Screw.
29. End cover.
30. Shakeproof washer.
31. Lucas connector.
32. Nut.
33. Insulating sleeve.
34. Clamp plate.
35. Screw.
36. Valve cap.
37. Inlet valve.
38. Outlet valve.
39. Sealing washer.
40. Filter.
41. Gasket.
42. Vent valve.
43. Sealing band.
44. Joint.
45. Inlet air bottle cover.
46. Dished washer.
47. Spring washer.
48. Screw.
49. Outlet connection.
50. Fibre washer.
51. Cover.
52. Screw.
53. 'O' ring.
54. Diaphragm barrier.
55. Sealing washer.
56. Diaphragm plate.
57. Diaphragm.
58. Spring end cap.
59. Diaphragm spring.

DISMANTLING (Fig. 3).

Contact Breaker

Remove the insulated sleeve (33), terminal nut (32), and connector (31), together with its shakeproof washer (30). Remove the tape seal (if fitted) and take off the end-cover.

Unscrew the 5 B.A. screw (24) which holds the contact blade (22) to the pedestal (16) and remove the condenser (25) from its clip. This will allow the washer (23), terminal tag (11), and the contact blade to be removed.

Coil housing and diaphragm

Unscrew the coil housing securing screws (7), using a thick-bladed screwdriver to avoid damaging the screw heads.

Remove the earthing screw (9).

The coil housing (6) may now be removed from the body (1). Next remove the diaphragm and spindle assembly (2) by taking hold of the diaphragm and unscrewing it anti-clockwise until the armature spring (5) pushes the diaphragm away from the coil housing. It is advisable to hold the housing over the bench so that the 11 brass rollers (3) will not fall on the floor. The diaphragm and its spindle are serviced as a unit and should not be separated.

Pedestal and rocker

Remove the end-cover seal washer (21), unscrew the terminal nut (20), and remove the lead washer (19). This will have flattened on the terminal tag and thread and is best cut away with cutting pliers or a knife. Unscrew the two 2 B.A. screws (28), holding the pedestal to the coil housing, remove the earth terminal tag (13) together with the condenser clip (26). Tip the pedestal and withdraw the terminal stud (17) from the terminal tag (12). The pedestal (16) may now be removed with the rocker mechanism (15) attached.

Push out the hardened steel pin (14) which holds the rocker mechanism to the pedestal and separate the two.

Body and valves

Unscrew the two Phillips screws (35) securing the valve clamp plate (34), remove the valve caps (36), valves (37) and (38), sealing washers (39) and filter (40).

Note: Dismantling of the delivery flow-smoothing device should only be undertaken if the operation of it is faulty, and if the necessary equipment for pressure-testing after assembly is available. On this understanding proceed as follows:

Remove the four 4 B.A. screws (52) securing the delivery flow-smoothing device vented cover (51), remove the cover, the diaphragm spring (59), rubber 'O' ring (53), spring cap (58), diaphragm (57), barrier (54), diaphragm plate (56) and sealing washer (55).

Remove the single 2 B.A. screw (48), securing the inlet air bottle cover (45). Remove the cover and gasket (44).

Unscrew the inlet and outlet connections.

INSPECTION

If gum formation has occurred in the fuel used in the pump, the parts in contact with the fuel will have become coated with a substance similar to varnish. This has a strong stale smell and may attack the neoprene diaphragm. Brass and steel parts so affected can be cleaned by being boiled in a 20 per cent. solution of caustic soda, dipped in a strong nitric acid solution and finally washed in boiling water. Light alloy parts must be well soaked in methylated spirits and then cleaned.

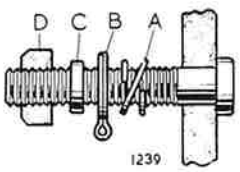


Fig. 4. *The terminal arrangement.*

A—*Double coil spring washer.*
B—*Cable tag.*
C—*Lead washer.*
D—*Countersunk nut.*

Clean the pump and inspect for cracks, damaged joint faces and threads.

Examine the plastic valve assemblies for kinks or damage to the valve plates. They can best be checked by blowing and sucking with the mouth.

Check that the narrow tongue on the valve cage, which is bent over to retain the valve and to prevent it being forced out of position, has not been distorted but allows a valve lift of approximately $\frac{1}{16}$ in. (1·6 mm.).

Examine the delivery flow-smoothing device diaphragm, barrier, plate, spring, and spring cap for damage. If in doubt, renew the diaphragm.

Examine the inlet air bottle cover for damage. Examine the valve recesses in the body for damage and corrosion; if it is impossible to remove the corrosion, or if the recess is pitted, the body must be discarded.

Clean the filter with a brush and examine for fractures, renew if necessary.

Examine the coil lead tag for security and the lead insulation for damage.

Examine the contact breaker points for signs of burning and pitting; if this is evident, the rocker assembly and spring blade must be renewed.

Examine the pedestal for cracks or other damage, in particular to the narrow ridge on the edge of the rectangular hole on which the contact blade rests.

Examine the non-return vent valve in the end-cover for damage, ensure that the small ball valve is free to move.

Examine the diaphragm for signs of deterioration.

Renew the following parts: all fibre and cork washers, gaskets, and 'O' section sealing rings, rollers showing signs of wear on periphery, damaged bolts, and unions.

ASSEMBLY

Pedestal and rocker

Note: The steel pin which secures the rocker mechanism to the pedestal is specially hardened and must not be replaced by other than a genuine S.U. part.

Invert the pedestal and fit the rocker assembly to it by pushing the steel pin (14, Fig. 3) through the small holes in the rockers and pedestal struts. Then position the centre toggle so that, with the inner rocker spindle in tension against the rear of the contact point, the centre toggle spring is above the spindle on which the white rollers run. This positioning is important to obtain the correct "throw over" action; it is also essential that the rockers are perfectly free to swing on the pivot pin and that the arms are not binding on the legs of the pedestal.

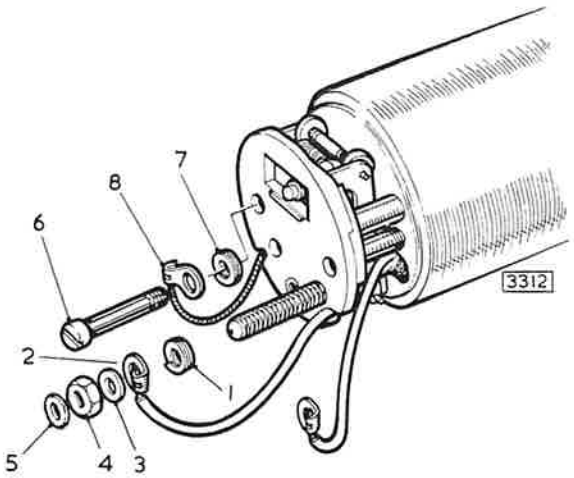


Fig. 5. *Attaching the pedestal to the coil housing.*

If necessary the rockers can be squared up with a pair of thin-nosed pliers.

Assemble the square-headed 2 B.A. terminal stud to the pedestal, the back of which is recessed to take the square head.

Assemble the 2 B.A. spring washer (1) (Fig. 5), and put the terminal stud through the 2 B.A. terminal tag (2), then fit the lead washer (3) and the coned nut (4) with its coned face to the lead washer. (This makes better contact than an ordinary flat washer and nut).

Tighten the 2 B.A. nut and finally add the end-cover seal washer (5).

Assemble the pedestal to the coil housing by fitting the two 2 B.A. pedestal screws (6), ensuring that the spring washer (7) on the left-hand screw (9 o'clock position) is between the pedestal and the earthing tag (8). When a condenser is fitted, its wire clip base is placed under the earthing tag and the spring washer is not required.

Tighten the screws, taking care to prevent the earthing tag (8) from turning, as this will strain or break the earthing flex. Do not tighten the screws or the pedestal will crack.

Do not fit the contact blade at this stage.

Diaphragm assembly

Place the armature spring into the coil housing with its larger diameter towards the coil (5, Fig. 3).

Before fitting the diaphragm make sure that the impact washer is fitted to the armature. (This is a small neoprene washer that fits in the armature recess). Do not use jointing compound or dope on the diaphragm.

Fit the diaphragm by inserting the spindle in the hole in the coil and screwing it into the threaded trunnion in the centre of the rocker assembly.

Screw in the diaphragm until the rocker will not "throw over"; this must not be confused with jamming the armature on the coil housing internal steps.

Fit the 11 brass centralizing rollers (3, Fig. 3) by turning back the diaphragm edge and dropping the rollers into the coil recess. The pump should be held in the left hand, rocker end downwards, to prevent the rollers from falling out.

Fit the contact blade and adjust the finger settings as described in "Contact gap setting", then carefully remove the contact blade.

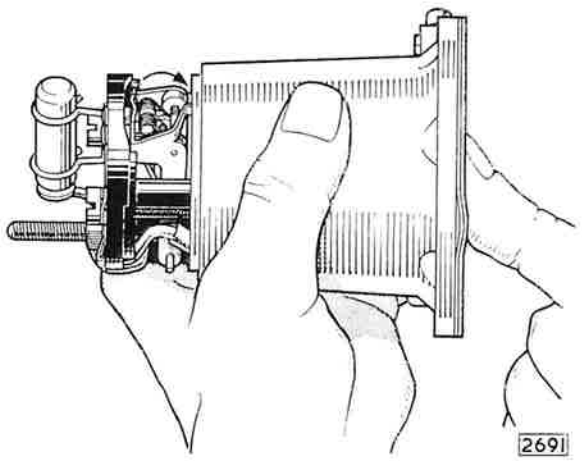


Fig. 6. *Setting the diaphragm.*

Holding the coil housing assembly in the left hand in an approximately horizontal position (see Fig. 6), push the diaphragm spindle in with the thumb of the right hand, pushing firmly but steadily. Unscrew the diaphragm, pressing and releasing with the thumb of the right hand until the rocker just "throws over". Now turn the diaphragm back (unscrew) to the nearest hole and again 4 holes (two-thirds of a complete turn). The diaphragm is now correctly set.

Press the centre of the armature and fit the retaining fork at the back of the rocker assembly. This is done to prevent the rollers from falling out when the coil housing is placed on the bench prior to fitting the body, and is not intended to stretch the diaphragm before tightening the body screws.

Body components

The valve assemblies are retained internally in the body by a clamp plate secured with self-tapping screws (35, Fig. 3). The inlet valve recess in the body is deeper than the outlet recess to allow for the filter and extra washer. Another feature of these pumps is the incorporation of an air bottle on the inlet and a flow-smoothing device on the delivery side.

The inlet air bottle is a chamber in the body casting blanked off by a simple cover and joint washer held by a single screw. The delivery flow-smoothing device is formed by a perforated metal plate which is in contact with a plastic barrier backed by a rubber diaphragm, all held in position by a spring and end-cap retained by a vented cover. This assembly seals the delivery chamber in the body.

Screw in the inlet and outlet connections with their sealing rings. Assemble the outlet valve components into the outless recess in the following order, first a joint washer, then the valve, tongue side downwards, then the valve cap.

Assemble the inlet valve into the inlet recess as follows: first a joint washer, then the filter, dome side downwards, then another joint washer, followed by the valve assembly, tongue side upwards, then the valve cap.

Take care that both valve assemblies nest down into their respective recesses, place the clamp plate on top, and tighten down firmly to the body with the two screws.

Replace the inlet air bottle cover with its joint washer and tighten down the central screw.

Place the sealing washer in the bottom of the delivery flow-smoothing device recess, follow this with the perforated diaphragm plate, dome side downwards, then the plastic barrier, followed by the rubber diaphragm. Insert the "O" section sealing ring into the recess and ensure that it seats evenly. Place the diaphragm spring, large end towards the vented cover, into the cover, place the spring end-cap on the small end of the spring, pass the assembly tool through the cover, spring, and end cap and turn it through 90° so that tension may be applied to the spring during assembly. Finally fit the spring and cap assembly onto the diaphragm, tighten the four retaining screws, and

release the assembly tool. The pump should be pressure-tested after disturbance of the flow-smoothing device.

Body attachment

Fit the joint washer to the body, aligning the screw holes.

Offer up the coil housing to the body, ensuring correct seating between them.

Line up the six securing screw holes, making sure that the cast lugs on the coil housing are at the bottom, insert the six 2 B.A. screws finger-tight. Fit the earthing screw with its Lucar connector.

Remove the roller retaining fork before tightening the body securing screws, making sure that the rollers retain their position; a displaced roller will cut the diaphragm. It is not necessary to stretch the diaphragm before tightening the securing screws.

Tighten the securing screws in sequence as they appear diametrically opposite each other.

Contact blade (Fig. 7)

Fit the contact blade and coil lead to the pedestal with the 5 B.A. washer and screw. The condenser should be fitted with the tag placed under the coil lead tag.

Adjust the contact blade so that the points are a little above the points on the rocker when closed, also that when the contact points make or break, one pair of points completely covers the other. As the contact blade is provided with a slot for the attachment screw, some degree of adjustment is possible.

Tighten the contact blade attachment screw when the correct setting is obtained.

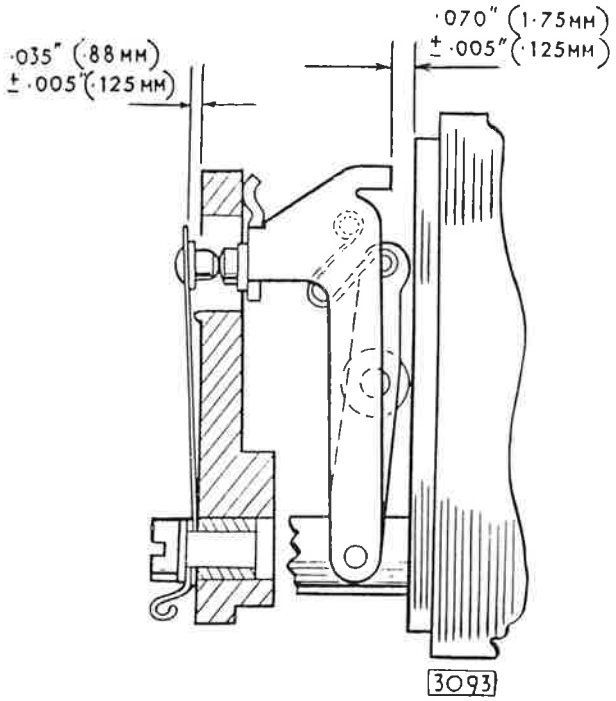


Fig. 7. *Rocker and contact clearances.*

Contact gap setting

Check that when the outer rocker is pressed onto the coil housing, the contact blade rests on the narrow rib or ridge which projects slightly above the main face of the pedestal. If it does not, slacken the contact blade attachment screw, swing the blade clear of the pedestal, and bend it downwards a sufficient amount so that when repositioned it rests against the rib lightly, over-tensioning of the blade will restrict the travel of the rocker mechanism.

Correct positioning gives a gap of ·035″ ±·005″ (·9±·13 mm.) between the pedestal and tip of spring blade (Fig. 7).

Check the gap between rocker finger and coil housing with a feeler gauge, bending the stop finger, if necessary, to obtain a gap of ·070±·005 in. (1·8±·13 mm.).

End-cover

Tuck all spare cable into position so that it cannot foul the rocker mechanism. Ensure that the end-cover seal washer is in position on the terminal stud, fit the bakelite end-cover and lock washer, secure with the brass nut, fit the terminal tag or connector, and the insulated sleeve.

The pump is now ready for test.

After test, replace the rubber sealing band over the end cover gap and seal with adhesive tape.

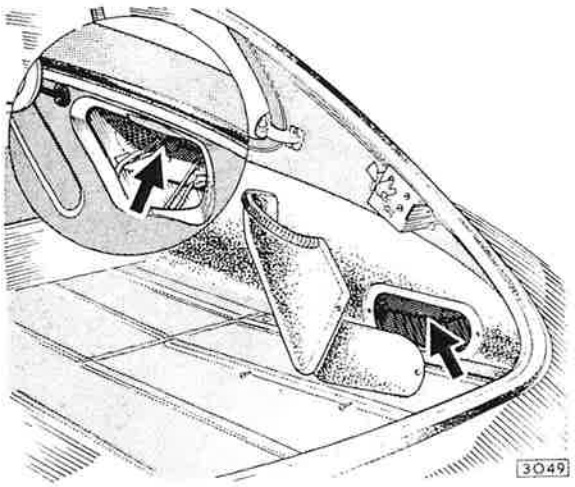


Fig. 8. *The location of the petrol pump. (Fixed head coupe). Inset shows location in open 2-seater model.*

SECTION D

COOLING SYSTEM

'E' Type series 2 have a sealed cooling system with a vertical flow radiator and an expansion tank.

The thermostat is retained in a revised housing.

The radiator top tank incorporates a plain (non-pressure) cap, the pressure cap being fitted to the expansion tank mounted on the bulkhead.

PRESSURE CAP RATING

With Standard Equipment .. .. 7 lb.
With Air-Conditioning System .. 13 lb.

Instructions for filling or checking the coolant level in the system differ from those stated for earlier cars fitted with the cross flow radiator, as follows:—

Filling Up

Remove the radiator and expansion tank filler caps.

Fill the radiator to the bottom of the filler neck. Replace the filler cap and tighten down fully.

Top up the expansion tank to the half-way mark, refit the cap and tighten down fully.

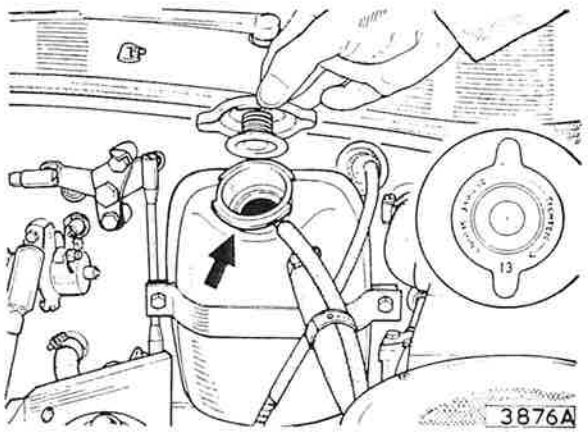


Fig. 1. The expansion tank and pressure cap. (Inset shows the pressure cap fitted to cars with Air-Conditioning Equipment).

Note: Care must be taken to ensure that the radiator and the expansion tank filler caps are not reversed.

Checking the Coolant Level

IMPORTANT: The coolant level must be checked at the expansion tank and NOT at the radiator top tank.

Check when the system is COLD.

Remove the pressure cap and top up to the half-way mark in the tank.

Replace the pressure cap and tighten down fully.

Refilling the Cooling System— Important

When refilling the cooling system following complete drainage, place the heater temperature control in the "Hot" position to allow the heater circuit to be filled with coolant. Re-check the level after running the engine for a short period.

THE RADIATOR

Removal

Release the filler cap, open the drain tap and drain the cooling system. Conserve the coolant if anti-freeze is in use.

Disconnect the multi-pin socket from the left-hand side of the bonnet.

Remove two bolts. self-locking nuts and washers securing the bonnet linkage to the sub-frame.

Withdraw two hexagon-headed pivot pins and washers securing the bonnet pivot to the sub-frame front lower cross tube, and remove the bonnet assembly.

Release the hose clips and disconnect the top and bottom hoses from the radiator.

Disconnect the oil cooler pipes (2 + 2 automatic transmission cars only) and blank off the unions to prevent loss of oil.

Remove six setscrews securing the cowl to the matrix side brackets. Disconnect the fan thermostat switch cables at the cable junction.

Release the radiator duct panel from the bottom of the matrix by removing two setscrews.

Remove the two bottom fixing nuts and rubber mounting washers.

Lift out the radiator matrix and collect the rubber washers fitted between the bottom tank and the mounting brackets.

NOTE : If air-conditioning equipment is fitted to the car, the condenser unit should be left in position after removal of the two setscrews securing the side support brackets to the matrix.

DO NOT DISTURB THE HOSE CONNECTIONS AT THE CONDENSER UNIT. IT IS DANGEROUS FOR AN UNQUALIFIED PERSON TO ATTEMPT TO DISCONNECT OR REMOVE ANY PART OF THE AIR-CONDITIONING SYSTEM.

Care must be taken when removing the radiator matrix that the fins of the condenser are not damaged.

Refitting

Refitting is the reverse of the removal procedure.

THERMOSTAT

The thermostat differs from that stated on Page D. 8. in respect of the mounting only.

Removal

Drain sufficient coolant from the system to allow the level to fall below the thermostat.

Disconnect the three hoses from the thermostat housing.

Remove three nuts and washers and detach the housing to gain access to the thermostat.

Refitting

Refitting is the reverse of the removal procedure.

Renew all gaskets.

To avoid distortion of the flange faces do not over-tighten the nuts.

RADIATOR COWL

Removal

Disconnect the cables from the twin fan motors.

Remove six setscrews securing the cowl to the radiator and remove the cowl complete with fan motors and mounting brackets.

Refitting

Refitting is the reverse of the removal procedure.

FAN MOTORS

Remove the fan cowl as detailed above.

Remove three nuts and setscrews securing each fan mounting bracket to the cowl and detach the bracket assembly.

Remove four nuts and washers securing each motor and detach the motor units from the brackets.

WATER PUMP

The water pump and mounting remain basically the same as detailed in the 3.8 'E' Type Service Manual with the exception of the pump body and the impeller (See Fig. No. 3) which have been redesigned to give a higher flow rate of coolant.

It is important to note when fitting the impeller to the spindle that the dimension shown in Fig. 2 is obtained when measured with a feeler gauge.

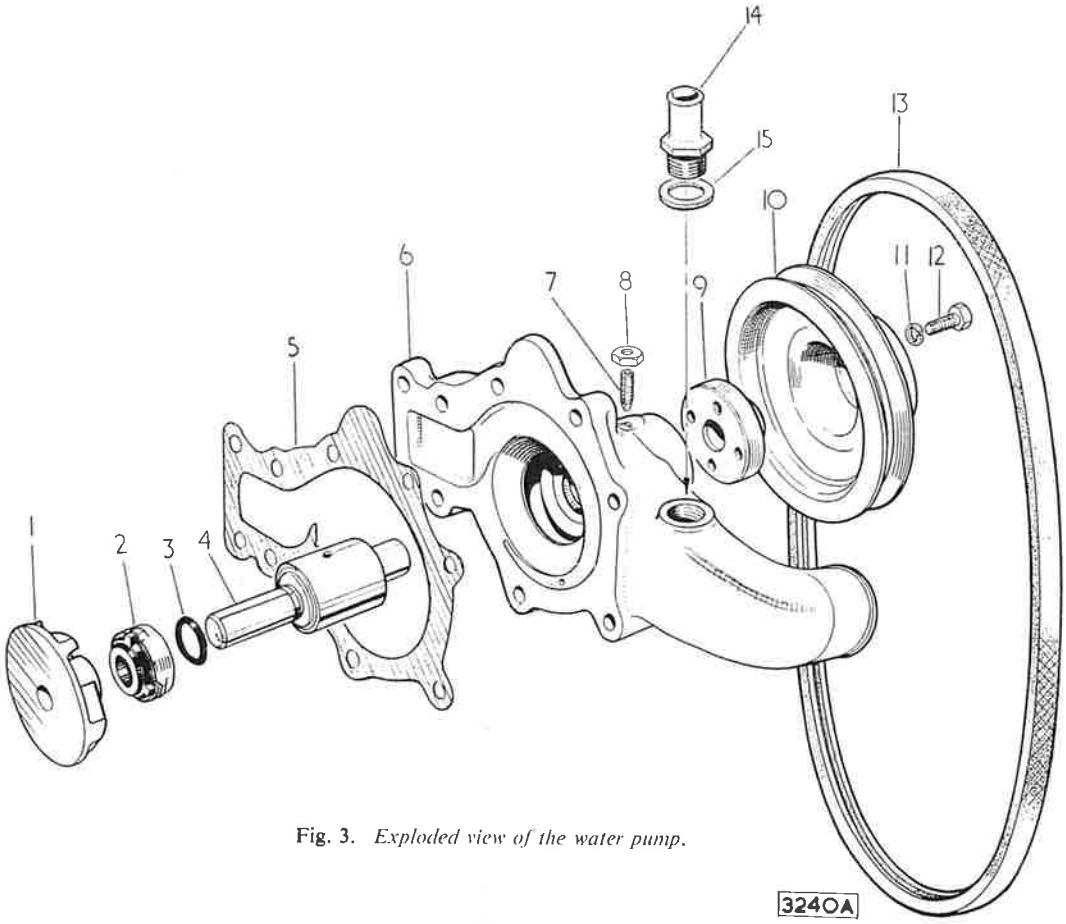


Fig. 3. *Exploded view of the water pump.*

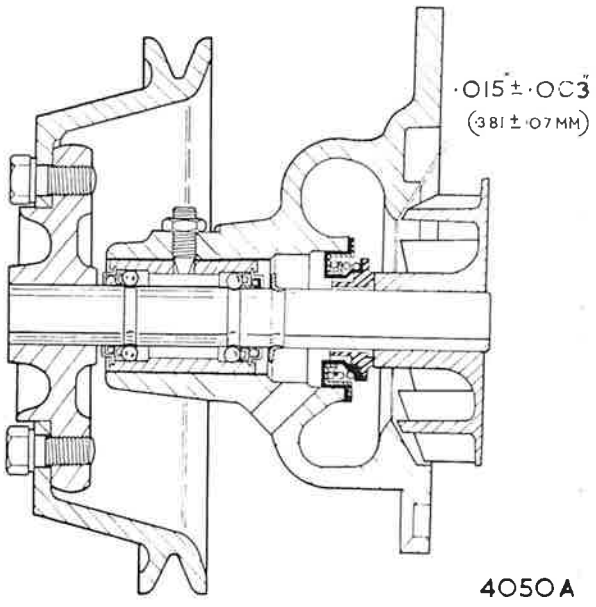


Fig. 2. *Sectioned view of water pump.*

1. Impeller.
2. Seal.
3. Thrower.
4. Spindle and bearing assembly.
5. Gasket.
6. Pump body.
7. Allen-headed lockscrew.
8. Locknut.
9. Pulley carrier.
10. Pulley.
11. Spring washer.
12. Setscrew.
13. Drive belt.
14. Adaptor for heater return pipe.
15. Copper washer.

SECTION E

CLUTCH

DESCRIPTION

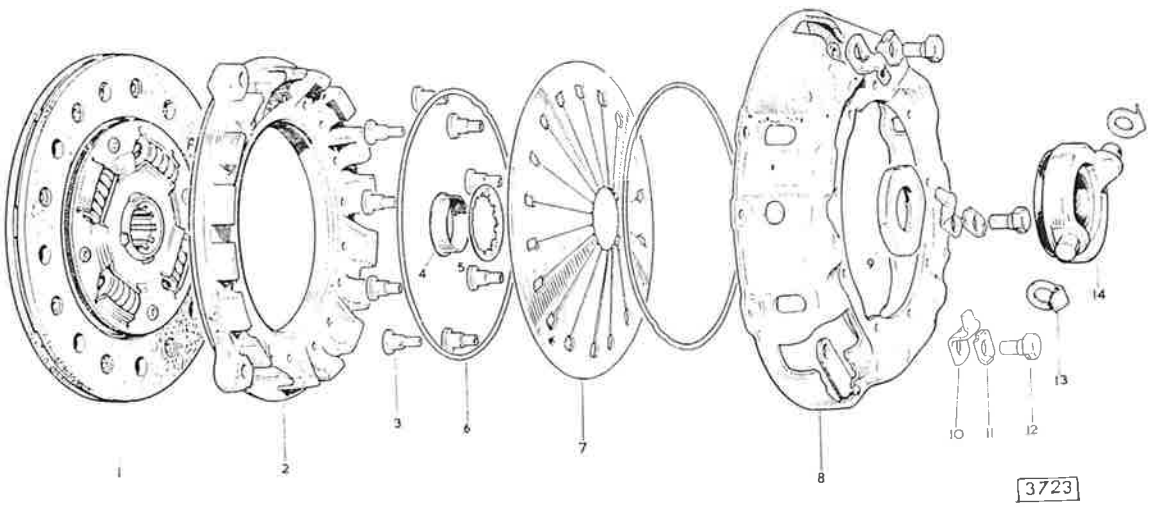
A Borg and Beck diaphragm spring clutch is fitted to all cars equipped with manual transmission.

The diaphragm spring is riveted inside the cover pressing with two fulcrum rings interposed between the shoulders of the rivets and the cover pressing. The diaphragm spring also pivots on these two fulcrum rings. Depressing the clutch pedal actuates the release bearing causing a corresponding deflection of the diaphragm spring thus pulling the pressure plate from the driven plate and freeing the clutch.

DATA

Make	Borg and Beck
Model	BB9/412G
Clutch Release Bearing	Graphite
Operation	Hydraulic
Hydraulic Fluid	Castrol/Girling Crimson Clutch/Brake Fluid

THE CLUTCH UNIT



1. Driven plate.
2. Pressure plate.
3. Rivet.
4. Centre sleeve.
5. Belleville washer.
6. Fulcrum ring.
7. Diaphragm spring.
8. Cover pressing.
9. Release plate.
10. Retainer.
11. Tab washer.
12. Setscrew.
13. Retainer.
14. Release bearing.

Fig. 1. *Exploded view of the diaphragm spring clutch.*

SERVICING

The Borg and Beck diaphragm spring clutch is serviced in the U.K. ONLY by fitting an exchange unit which is available from the Works, Spares Division, Coventry. Individual parts are available from the same source for the repair of this clutch in Overseas Markets where exchange units may not be readily available. IT IS ESSENTIAL when overhauling the diaphragm spring clutch, to rigidly observe the service instructions detailed below and particular attention is drawn to the necessary special tools required.

GENERAL INSTRUCTIONS

To enable the balance of the assembly to be preserved after dismantling, there are corresponding paint marks on the cover plate and driving plate. In addition, there are corresponding reference numbers stamped in the flanges of the cover and driving plate.

When reassembling ensure that the markings coincide, and that, when refitting the clutch to the flywheel, the letter "B" stamped adjacent to one of the dowel holes coincides with the "B" stamped on the edge of the flywheel.

The clutch is balanced in conjunction with the flywheel by means of loose balance pieces which are fitted under the appropriate securing bolt. Each balance piece must be refitted in its original position, the number stamped on the balance weight corresponding to the number stamped on the cover plate. There are three balance weights stamped 1, 2 and 3, the weight stamped 3 being the heaviest.

If it is necessary to fit a replacement unit, clutch units supplied as spares have no reference numbers and therefore must be balanced with the flywheel. The balance weight number should be stamped on the cover adjacent to the weight position. The letter 'B' should be stamped on the cover opposite the 'B' on the flywheel.

If the graphite release bearing ring is badly worn it should be replaced by a complete bearing assembly.

CLUTCH REMOVAL

In order to remove the clutch, the engine and gearbox must first be removed (see Page B.Y.s.4).

Remove gearbox and clutch housing from engine.

Remove the bolts securing the clutch to the flywheel and withdraw the clutch assembly.

Retain any balance weight fitted.

DISMANTLING

Removing Release Plate

The centrally mounted release plate is held in position by a small centre sleeve which passes through the diaphragm spring and belleville washer into the release plate.

To free the plate, collapse the centre sleeve with a hammer and chisel. To avoid any possible damage whilst carrying out this operation, support the release plate in the locating boss of the special tool which should be held firmly in a vice.

Separating the Pressure Plate from Cover Pressing

Knock back the locking tabs and remove the three setscrews securing the pressure plate to the straps

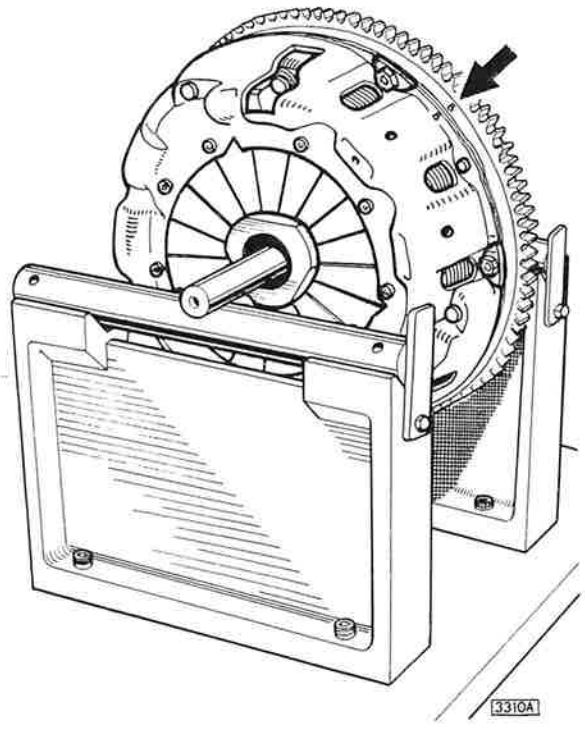


Fig. 2. *Clutch and flywheel balancing.*

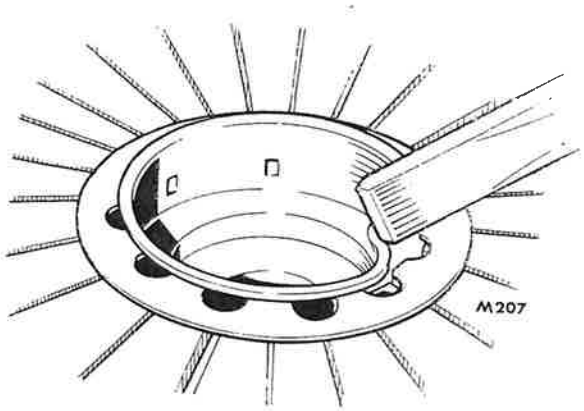


Fig. 3. *Collapsing the centre sleeve with a hammer and chisel.*

riveted to the cover pressing. These straps within the cover pressing must NOT be detached as this is an assembly reduced to its minimum as a spare part.

Dismantling the Cover Assembly

Remove the rivets securing the diaphragm spring and fulcrum rings by machining the shank of the rivets using a spot face cutter.

IT IS ESSENTIAL that the thickness of the cover is not reduced in excess of ·005" (·127 mm.) at any point. The remaining portions of the rivets may be removed with a standard pin punch.

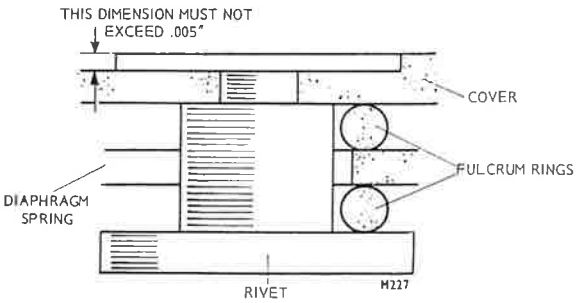


Fig. 4. *Do not reduce the thickness of the cover pressing in excess of ·005" (·127 m.m.).*

REBUILDING

The Cover Assembly

Prior to rebuilding, check the cover pressing for distortion. Bolt the cover firmly to a **flat** surface plate and check that measurements taken at various points from the cover flange to the machined land inside the cover pressing do not vary by more than ·007" (·2 mm.). If the measurement exceeds this figure the cover must be replaced.

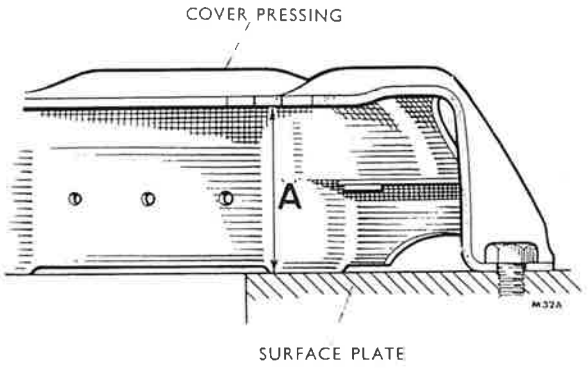
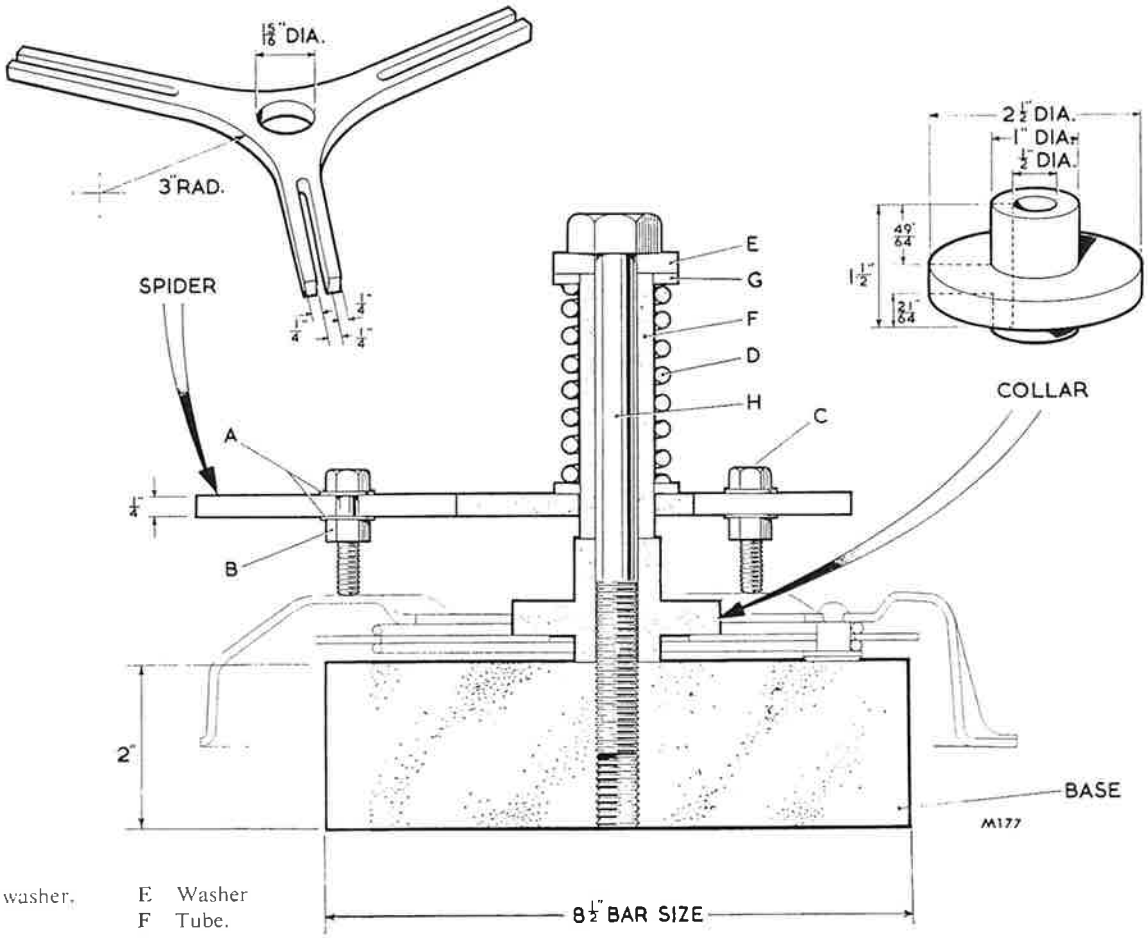


Fig. 5. *The measurement "A" must not vary by more than ·007" (·2 mm.).*

To achieve a satisfactory result when riveting the diaphragm spring into the cover pressing, a special tool must be fabricated to the specifications given in Fig. 6.

All parts except the spring can be made from mild steel. Position the fulcrum ring inside the cover pressing so that the location notches in the fulcrum ring engage a depression between two of the larger diameter holes in the cover pressing.

Place the diaphragm spring on the fulcrum ring inside the cover and line the long slots in the spring with the small holes in the cover pressing. Locate a further fulcrum ring on the diaphragm spring so that the location notches are diametrically opposite the location notches in the first ring. Fit new shouldered rivets, ensuring that the shouldered portion of each seats on the machined land inside the cover.



A Flat washer.
B Nut.
C Setscrew.
D Spring.
E Washer
F Tube.
G Washer.
H Bolt.

Fig. 6. *Dimension of special tool for compressing the diaphragm spring when riveting the spring to cover pressing.*

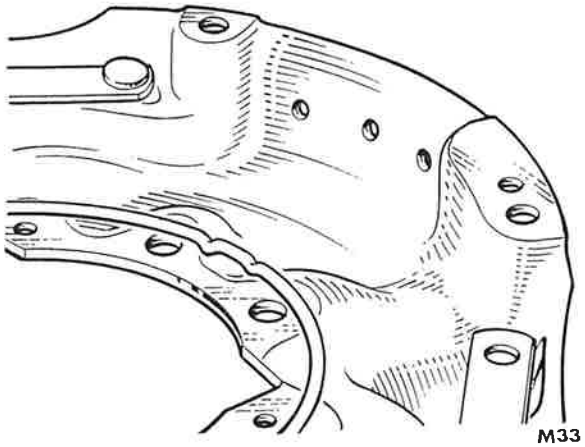


Fig. 7. *Assembly of cover pressing and fulcrum ring.*

Place the base of the special tool on to the rivet heads. Invert the clutch and base plate.

Fit the collar to the large bolt and fit the large bolt complete with spring, spider and collar into the tapped hole in the base. Position the three setscrews on the spider so that they contact the cover pressing. Tighten down the centre bolt until the diaphragm spring becomes flat and the cover pressing is held firmly by the setscrews.

Rivet securely with a hand punch.

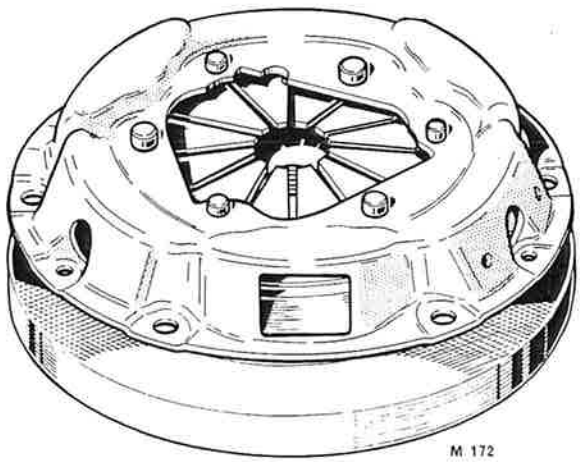


Fig. 8. *Clutch and base plate inverted.*

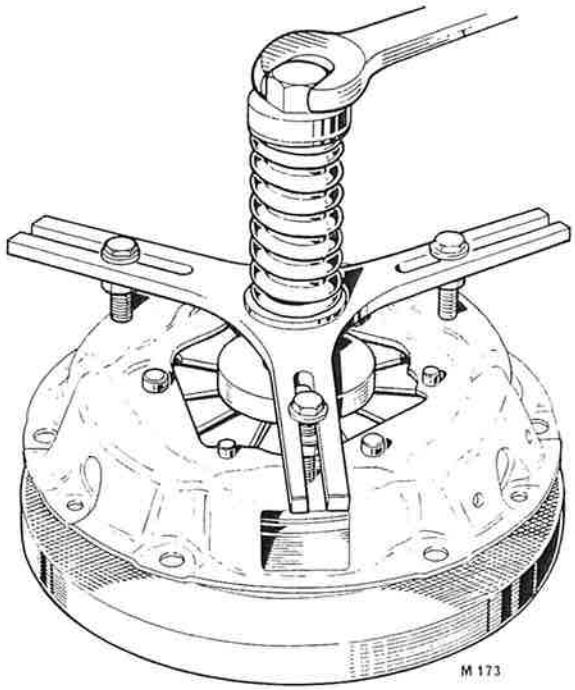


Fig. 9. *Tighten down the large nut so that the diaphragm spring is compressed flat.*

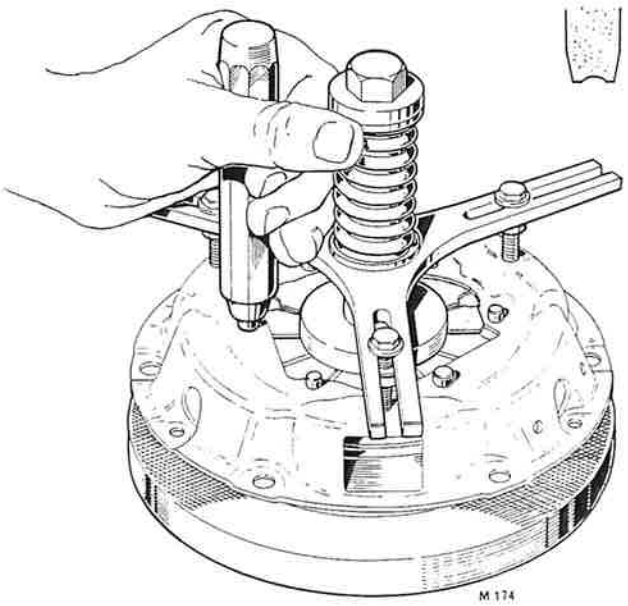
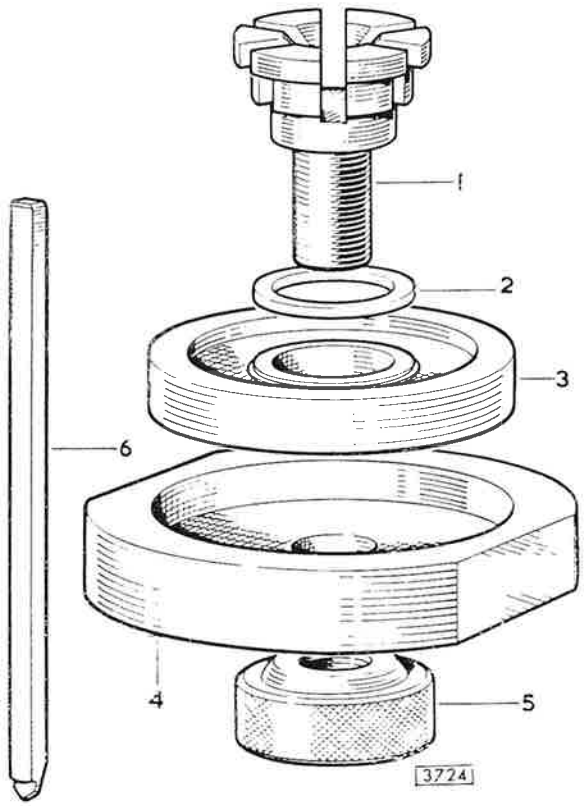


Fig. 10 *Riveting with a hand punch.*

Assembling the Pressure Plate to Cover Pressing

Before assembling the pressure plate to the cover pressing, examine the plate for any signs of wear. Should it have been damaged or have excessive scoring, it is strongly recommended that a new plate is fitted. If, however, renewal of the pressure plate is not possible, grinding of the original unit may be undertaken by a competent machinist, bearing in mind that incorrect grinding of the plate may seriously affect the operation of the clutch. IN NO CIRCUMSTANCES MUST THE PRESSURE PLATE BE GROUND TO A THICKNESS OF LESS THAN 1·070" (27.178 mm.)



1. Staking guide.
2. Washer.
3. Locating base.
4. Base plate.
5. Knurled nut.
6. Punch.

Fig. 11. *Special Tool (SSC805).*

Position the pressure plate inside the cover assembly so that the lugs on the plate engage the slots in the cover pressing. Insert the three setscrews through the straps which are riveted to the cover pressing and lock with the tab washers.

Fitting a New Release Plate

A special tool (Part No. SSC.805) is available from Automotive Products Ltd., Service and Spares Division, Banbury, England, for completion of this operation. Ensure that all parts of the clutch and special tool are clean.

Grip the base of the tool in a vice and place the locating boss into the counterbore of the base plate. Place the release plate, face downwards, into the counterbore of the locating boss.

Apply a little high melting point grease to the tips of the diaphragm spring fingers and position the clutch, pressure plate friction face upwards, on to the release plate.

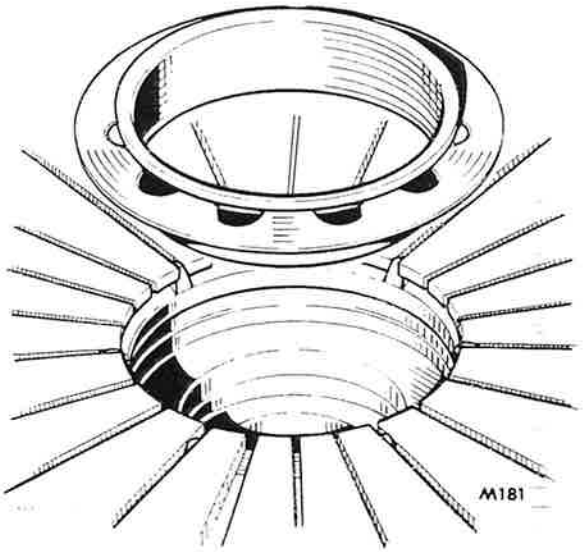


Fig. 12. *Fitting the sleeve and belleville washer.*

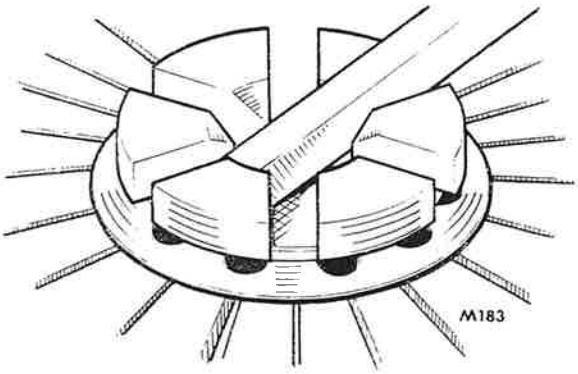


Fig. 13. *Staking the sleeve to the release plate.*

Place the belleville washer, concave surface towards the spring, on to the centre of the diaphragm spring and then push the centre sleeve through the spring into the release plate.

Drop the special washer into the sleeve and insert the staking guide into the centre of the assembly. Fit the knurled nut to the thread on the staking guide, tighten down until the whole assembly is solid. Using the special punch, stake the centre sleeve in six places into the groove in the release plate.

REFITTING

Place the driven plate on the flywheel, taking care that the larger part of the splined hub faces the gear-

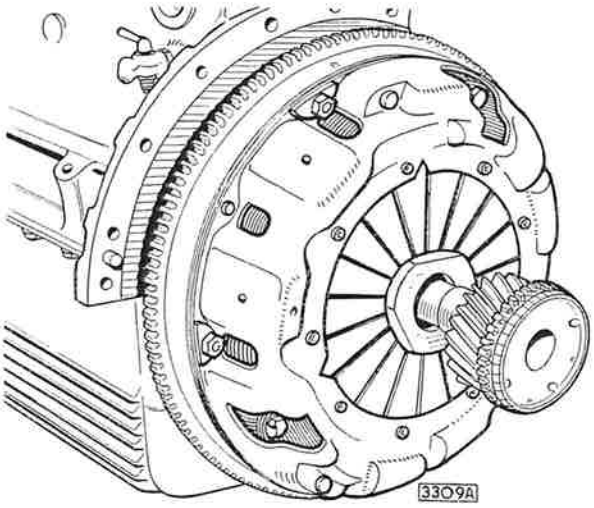


Fig. 14. *Centralising the driven plate on the flywheel by means of a dummy plate.*

box. Centralize the plate on the flywheel by means of the dummy shaft (a constant pinion shaft may be used for this purpose). Secure the cover assembly with the six setscrews and spring washers, tightening the screws a turn at a time by diagonal selection. Ensure that the "B" stamped adjacent to one of the dowel holes coincides with the "B" stamped on the periphery of the flywheel.

CONDITION OF CLUTCH FACINGS

The possibility of further use of the friction facings of the clutch is sometimes raised, because they have a polished appearance after considerable service. It is natural to assume that a rough surface will give higher frictional value against slipping, but this not correct. Since the introduction of non-metallic facings of the moulded asbestos type, in service a polished surface is a common experience, but it must not be confused with a glazed surface which is sometimes encountered due to the conditions discussed below.

The ideal smooth or polished condition will provide a normal contact, but a glazed surface may be due to a film or a condition introduced, which entirely alters the frictional value of the facings. These two conditions might be simply illustrated by the comparison between a polished wood and a varnished surface. In the former the contact is still made by the original material whereas, in the latter instance, a film of dried varnish is interposed between the contact surfaces.

The following notes are issued with a view to giving useful information on this subject:—

(a) After the clutch has been in use for some little time under perfect conditions (that is, with the clutch facings working on true and polished or ground surfaces of correct material, without the presence of oil, and with only that amount of slip which the clutch provides for under normal conditions) then the surface of the facings assumes a high polish, through which the grain of the material can be clearly seen. This polished facing is of mid-brown colour and is then in a perfect condition.

(b) Should oil in small quantities gain access to the clutch in such a manner as to come into contact with the facings, it will burn off due to the heat generated by slip which occurs under normal starting conditions. The burning off of the small amount of lubricant has the effect of gradually darkening the facings, but provided the polish on the facings remains such that the grain of the material can be clearly distinguished, it has very little effect on clutch performance.

(c) Should increased quantities of oil or grease obtain access to the facing, one or two conditions, or a combination of the two, may arise, depending upon the nature of oil, etc.

  (i) The oil may burn off and leave on the surface a carbon deposit which assumes a high glaze and causes slip. This is a very definite, though very thin deposit, and in general it hides the grain of the material.

  (ii) The oil may partially burn and leave a resinous deposit on the facings, which frequently produces a fierce clutch, and may also cause a "spinning" clutch due to tendency of the facings to adhere to the flywheel or pressure plate face.

  (iii) There may be a combination of (i) and (ii) conditions which is likely to produce a judder during clutch engagement.

(d) Still greater quantities of oil produces a black soaked appearance to the facings, and the effect may be slip, fierceness, or judder in engagement, etc., according to the conditions. If the conditions under (c) or (d) are experienced, the clutch driven plate should be replaced by one fitted with new facings, the cause of the presence of oil removed and the clutch and flywheel face thoroughly cleaned.

FAULT FINDING

SYMPTOM	CAUSE	REMEDY
Drag or Spin	(a) Oil or grease on the driven plate facings.	Fit new facings or replace plate.
	(b) Misalignment between the engine and splined clutch shaft.	Check over and correct the alignment.
	(c) Air in clutch system.	"Bleed" system. Check all unions and pipes.
	(d) Bad external leak between the clutch master cylinder and the slave cylinder.	Renew pipe and unions.
	(e) Warped or damaged pressure plate or clutch cover.	Renew defective part.
	(f) Driven plate hub binding on splined shaft.	Clean up splines and lubricate with small quantity of high melting point grease.
	(g) Distorted driven plate due to the weight of the gearbox being allowed to hang on clutch plate during assembly.	Fit new driven plate assembly using a jack to take overhanging weight of the gearbox.
	(h) Broken facings of driven plate.	Fit new facings, or replace plate.
	(i) Dirt or foreign matter in the clutch.	Dismantle clutch from flywheel and clean the unit; see that all working parts are free. **Caution:** Never use petrol or paraffin for cleaning out clutch.
Fierceness or Snatch	(a) Oil or grease on driven plate facings.	Fit new facings and ensure isolation of clutch from possible ingress of oil or grease.
	(b) Misalignment.	Check over and correct alignment.
	(c) Worn out driven plate facings.	Fit new facings or replace plate.
Slip	(a) Oil or grease on driven plate facings.	Fit new facings and eliminate cause.
	(b) Seized piston in clutch slave cylinder.	Renew parts as necessary.
	(c) Master cylinder piston sticking.	Free off piston.
Judder	(a) Oil, grease or foreign matter on driven plate facings.	Fit new facings or driven plate.
	(b) Misalignment.	Check over and correct alignment.
	(c) Bent splined shaft or buckled driven plate.	Fit new shaft or driven plate assembly.

FAULT FINDING *(continued)*

SYMPTOM	CAUSE	REMEDY
Rattle	(a) Damaged driven plate. (b) Excessive backlash in transmission. (c) Wear in transmission bearings. (d) Bent or worn splined shaft. (e) Release bearing loose on throw out fork.	Fit new parts as necessary.
Tick or Knock	Hub splines worn due to misalignment.	Check and correct alignment then fit new driven plate.
Fracture of Driven Plate	(a) Misalignment distorts the plate and causes it to break or tear round the hub or at segment necks.	Check and correct alignment and fit new driven plate.
	(b) If the gearbox during assembly be allowed to hang with the shaft in the hub, the driven plate may be distorted, leading to drag, metal fatigue and breakage.	Fit new driven plate assembly and ensure satisfactory re-assembly.
Abnormal Facing Wear	Usually produced by over-loading and by excessive clutch slip when starting.	In the hands of the operator.

SECTION F
GEARBOX

DESCRIPTION

The gearbox is of the four speed type with baulk-ring synchromesh on all forward gears. With the exception of reverse, the detents for the gears are incorporated in the synchro assemblies, the three synchro balls engaging with grooves in the operating sleeve. The detent for reverse gear is a spring loaded ball which engages on a groove in the selector rod.

Two interlock balls and a pin located at the front of selector rods prevent the engagement of two gears at the same time.

The gears are pressure fed at approximately 5 lb. per sq. in. (0·35 kg/cm.²) from a pump driven from the rear of the mainshaft.

DATA

Identification number	**Open 2 seater and F.H. Coupe 2+2**		**KE 101 onwards KJS 101 onwards**
	Ratios		
1st gear	2.933:1	3rd gear	1.389:1
2nd gear	1.905:1	4th gear	1.000:1
	Reverse	3.378:1	

1st gear—end float on mainshaft ·005″ to ·007″ (·13—·18 mm.)

2nd gear—end float on mainshaft ·005″ to ·008″ (·13—·20 mm.)

3rd gear—end float on mainshaft ·005″ to ·008″ (·13—·20 mm.)

Countershaft gear unit end float ·004″ to ·006″ (·10—·15 mm.)

RECOMMENDED LUBRICANTS

Mobilube GX 90	Castrol Hypoy	Spirax 90 E.P.	Esso Gear Oil GP 90/140	Gear Oil SAE 90 E.P.	Hypoid 90	Multigear Lubricant EP90

GEARBOX

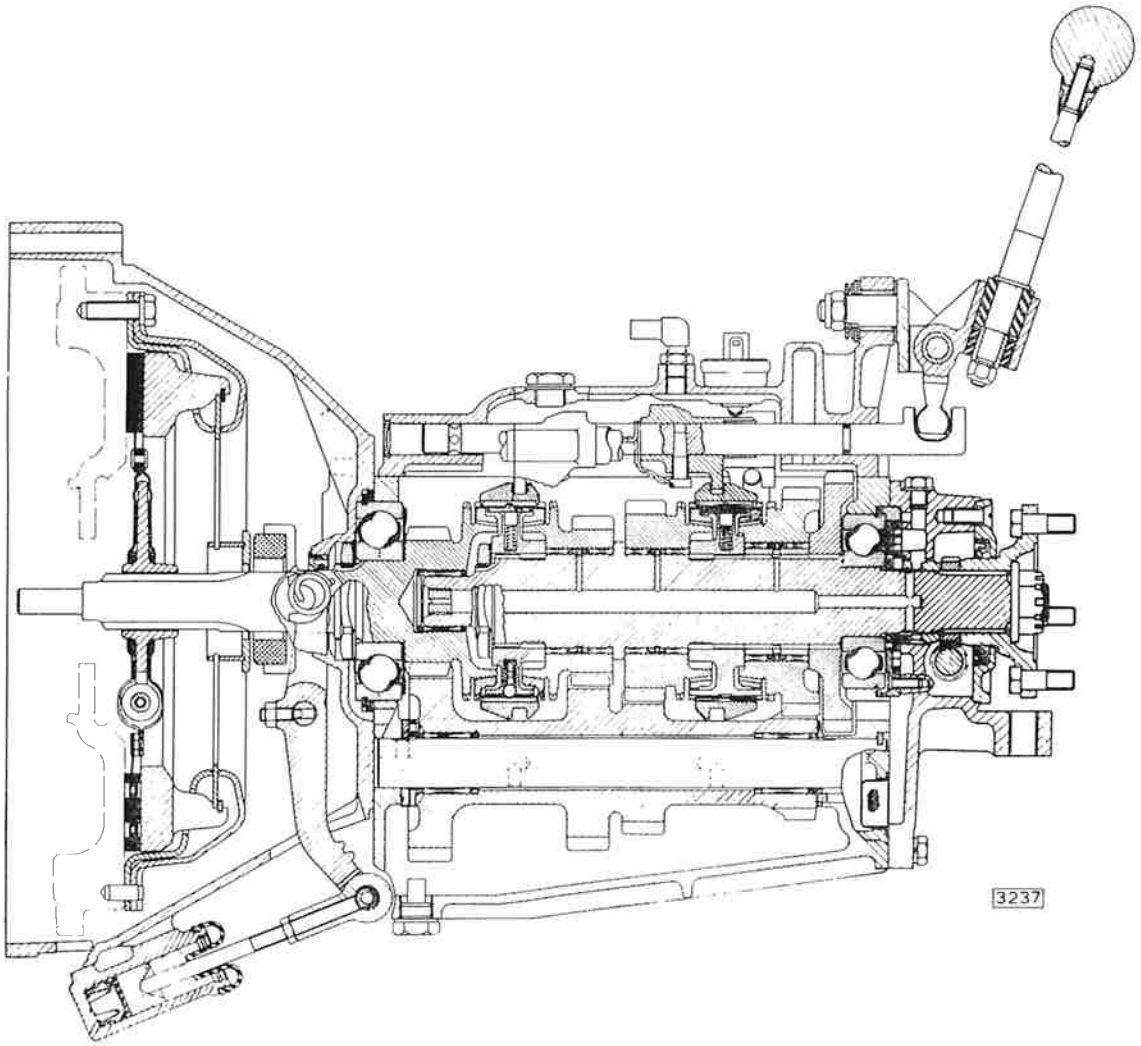


Fig. 1. *Longitudinal section of clutch and gearbox.*

GEARBOX DISMANTLING

REMOVAL OF CLUTCH HOUSING

Detach the springs and remove the carbon thrust bearing.

Unscrew the two nuts and remove the clutch slave cylinder.

Remove the allen screw, push out the fulcrum pin and detach the clutch fork.

Tap back the locking tabs and break the locking wire and remove the eight setscrews.

Detach the clutch housing.

REMOVAL OF TOP COVER

Place the gear lever in neutral.

Remove the eight setscrews and two nuts and lift off the lid.

REMOVAL OF REAR EXTENSION

Engage first and reverse gears to lock the unit.

Remove the split pin and unscrew the flange nut.

Withdraw the flange.

Remove the four setscrews and detach the rear cover.

Remove the speedometer pinion and bush assembly after unscrewing the retaining bolt.

Withdraw the speedometer driving gear from the mainshaft.

Remove the seven setscrews and withdraw the extension.

Collect the distance piece and oil pump driving pin.

REMOVAL OF OIL PUMP

From the inside face of the rear extension break the staking and remove the three countersunk screws securing the oil pump gear housing. Withdraw the housing by entering two of the securing screws into the tapped holes in the housing; screw in the two screws evenly until the housing is free.

Mark the gears with marking ink so that they can be replaced the same way up in the housing.

REMOVAL OF COUNTERSHAFT

Remove the fibre plug from the front end of the countershaft.

Drive out the countershaft from the front of the casing.

Important:

Ensure that the rear washer (pegged to casing) drops down in a clockwise direction looking from the rear to avoid trapping the washer with the reverse gear when driving the mainshaft forward (see Fig. 2). This is effected by rocking the gearbox casing and moving the reverse lever backwards and forwards, or by pushing the washer down with a piece of wire bent at right angles.

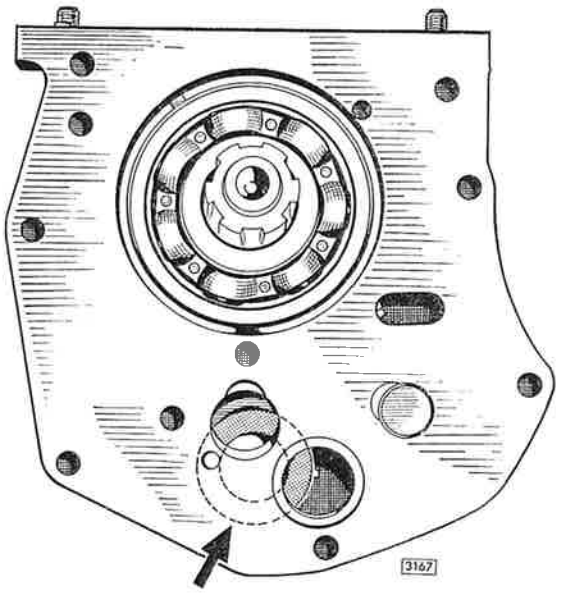


Fig. 2. *Ensure that the rear washer (indicated by arrow) drops down in a clockwise direction.*

REMOVAL OF CONSTANT PINION SHAFT

Rotate the constant pinion shaft until the cutaway portions of the driving gear are facing the top and bottom of the casing otherwise the gear will foul the countershaft.

With the aid of two levers ease the constant pinion shaft and front bearing assembly forward until it can be withdrawn (see Fig. 3).

DISMANTLING THE CONSTANT PINION SHAFT

Remove the roller bearing from inside the constant pinion shaft. On early cars, a spacer was also fitted along with the needle roller bearing.

Tap back the tab washer and remove the large nut, tab washer and oil thrower.

Tap the shaft sharply against a metal plate to dislodge the bearing.

REMOVAL OF MAINSHAFT

Rotate the mainshaft until one of the cutaway portions in 3rd/Top synchro hub is in line with the countershaft (see Fig. 4), otherwise the hub will foul the constant gear or the countershaft.

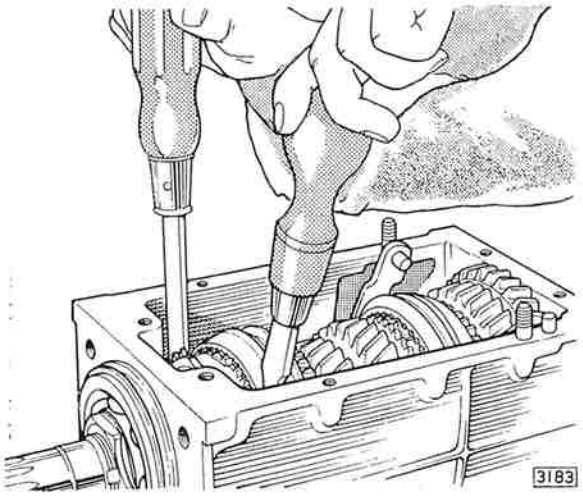


Fig. 3. *With the aid of two levers ease the constant pinion shaft forward.*

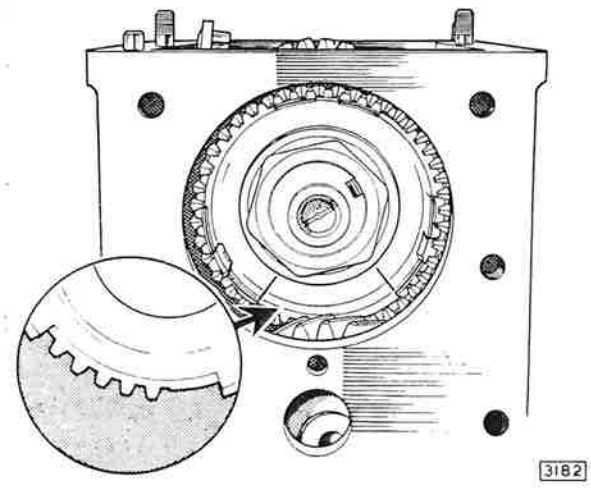


Fig. 4. *Rotate the mainshaft until one of the cutaway portions in 3rd/Top synchro hub is in line with the countershaft.*

Tap or press the mainshaft through the rear bearing ensuring that the reverse gear is kept tight against the first gear (see Fig. 5).

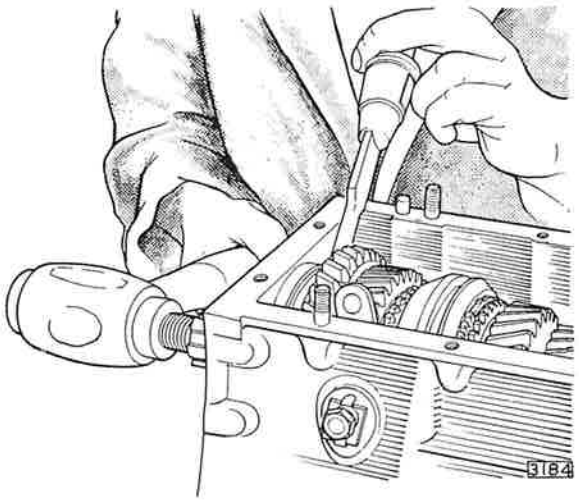


Fig. 5. *Tapping the mainshaft through the rear bearing.*

Remove the rear bearing from the casing and fit a hose clip to the mainshaft to prevent the reverse gear from sliding off (see Fig. 6).

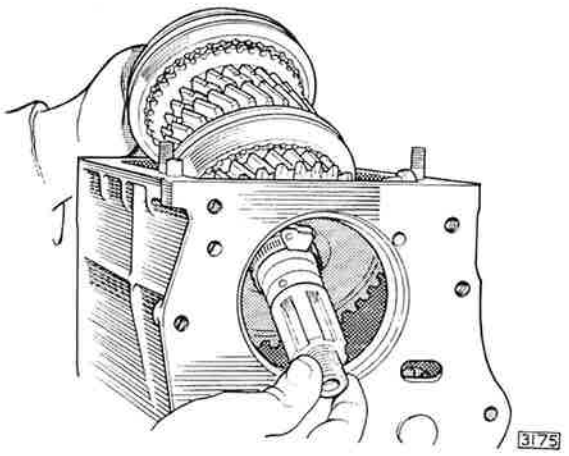


Fig. 6. *Removal of the mainshaft. Note the hose clip fitted to the mainshaft to retain the reverse gear.*

Slacken the reverse lever bolt until the lever can be moved to the rear.

Lift out the mainshaft forward and upward.

Lift out the countershaft gear unit and collect the needle bearings and retaining rings.

Withdraw the reverse idler shaft and lift out the gear.

DISMANTLING THE MAINSHAFT

Note: The needle rollers are graded on diameter and must be kept in sets for their respective positions.

Remove the hose clip.

Withdraw the reverse gear from the mainshaft.

Withdraw the 1st gear and collect the 120 needle rollers, spacer and sleeve.

Withdraw the 1st/2nd synchro assembly and collect the two loose synchro-rings.

Withdraw the 2nd speed gear and collect the 106 needle rollers leaving the spacer on the mainshaft.

Tap back the tab washer and remove the large nut retaining the 3rd/Top synchro assembly to the mainshaft.

Withdraw the 3rd/Top synchro assembly from the mainshaft and collect the two loose synchro-rings.

Withdraw the 3rd speed gear and collect the 106 needle rollers and spacer.

DISMANTLING THE SYNCHRO ASSEMBLY

Completely surround the synchro assembly with a cloth and push out the synchro hub from the operating sleeve. Collect the synchro balls and springs, and the thrust members, plungers and springs.

DISMANTLING TOP COVER

Unscrew the self-locking nut and remove the double coil spring, washer, flat washer and fibre washer securing the gear lever to the top cover.

Withdraw the gear lever and collect the remaining fibre washer.

Remove the locking wire and unscrew the selector rod retaining screws.

Withdraw the 3rd/Top selector rods and collect the selector, spacing tube and interlock ball. Note the loose interlock pin at the front end of the 1st/2nd selector rod.

Withdraw the reverse selector rod and collect the reverse fork, stop spring and detent plunger.

Withdraw the 1st/2nd selector rod and collect the fork and short spacer tube.

GEARBOX RE-ASSEMBLING

ASSEMBLING THE SYNCHRO ASSEMBLIES

The assembly procedure for the 1st/2nd and 3rd/Top synchro assemblies is the same.

Note: Although the 3rd/Top and 1st/2nd synchro hubs are similar in appearance they are not identical and to distinguish them a groove is machined on the edge of the 3rd/Top synchro hub (see Fig. 7).

Assemble the synchro hub to the operating sleeve with;

(i) The wide boss of the hub on the opposite side to the wide chamfer end of the sleeve (see Fig. 8).

(ii) The three ball and springs in line with the teeth having three detent grooves (see Fig. 10).

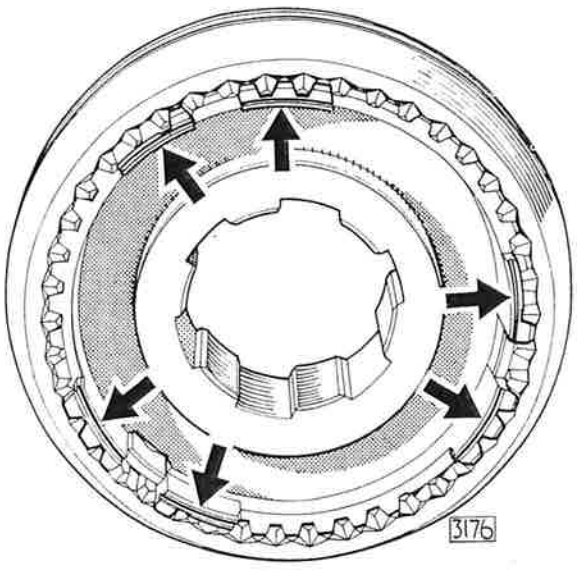


Fig. 7. *Identification grooves—3rd/Top, synchro assembly.*

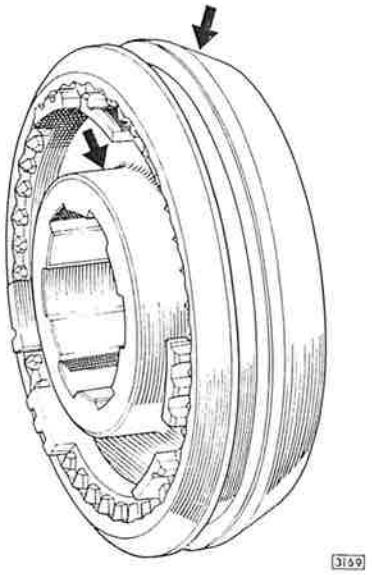


Fig. 8. *Assembly of synchro hub.*

Pack up the synchro hub so that holes for the ball and springs are exactly level with the top of the operating sleeve (see Fig. 11).

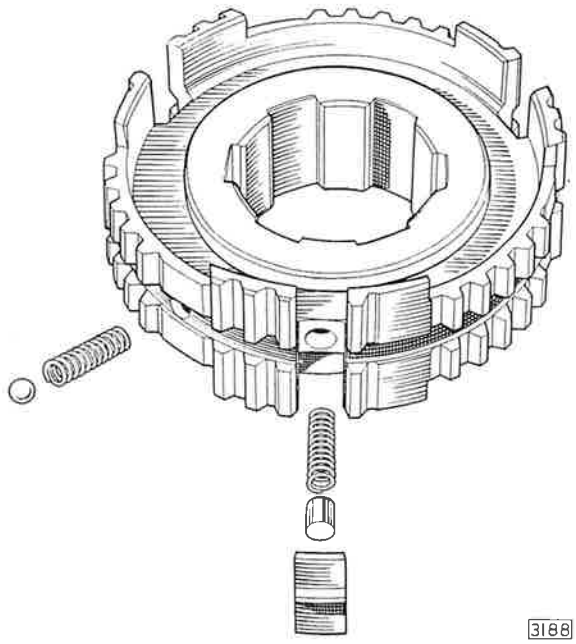


Fig. 9. *Showing the relative positions of the detent ball, plunger and thrust member.*

Fit the three springs, plungers and thrust members to their correct positions with grease; press down the thrust members as far as possible. Fit the three springs and balls to the remaining holes with grease.

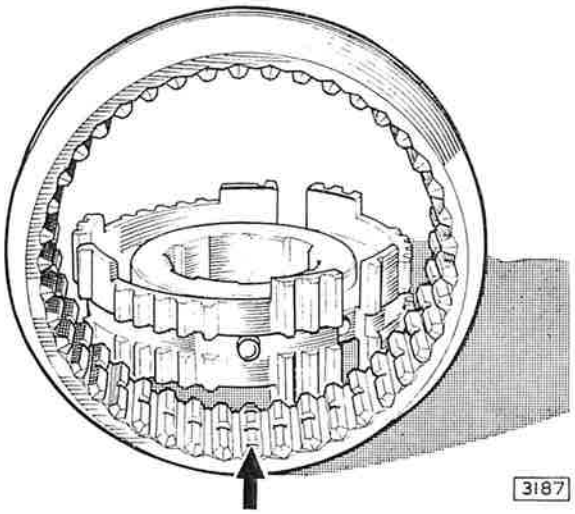


Fig. 10. *Fitting the synchro hub in the sleeve.*

Compress the springs with a large hose clip or a piston ring clamp as shown in Fig. 12 and carefully lift off the synchro assembly from the packing piece.

Depress the hub slightly and push down the thrust members with a screwdriver until they engage the neutral groove in the operating sleeve (see Fig. 13).

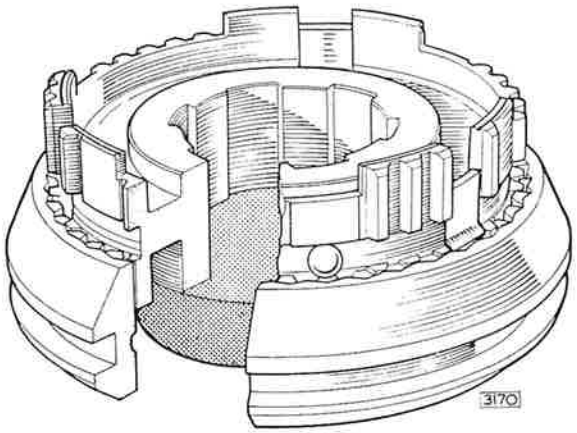


Fig. 11. *Fitting the springs, plungers and thrust members.*

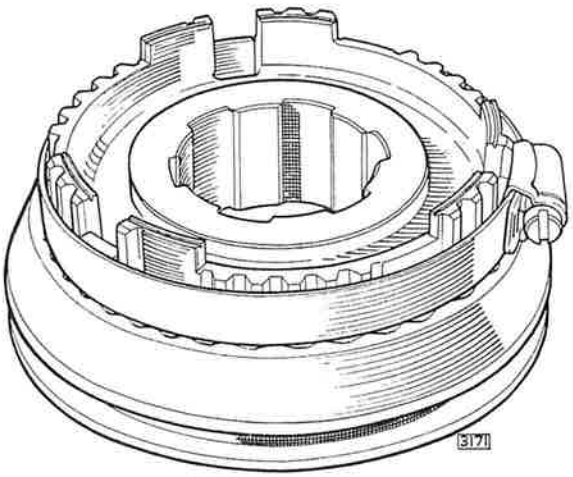


Fig. 12. *Compressing the springs.*

Finally tap the hub down until the balls can be heard and felt to engage the neutral groove (see Fig. 14).

Fig. 13. *Pushing down the thrust members.*

ASSEMBLING THE CLUSTER GEAR

Fit one retaining ring in the front end of the cluster gear. Locate the 29 needle roller bearings with grease and fit the inner thrust washer ensuring that the peg on the washer locates in a groove machined on the face of the cluster gear.

Fit a retaining ring, 29 needle roller bearings and a second retaining ring to the rear end of the cluster gear.

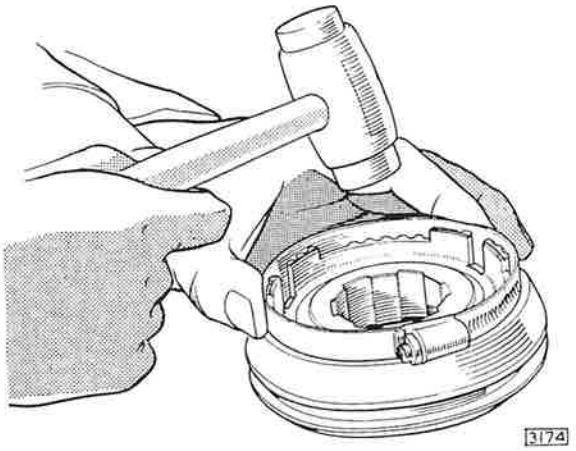


Fig. 14. *Tapping the hub into position.*

CHECKING THE CLUSTER GEAR END FLOAT

Fit the reverse idler gear, lever and idler shaft.

Fit the pegged rear washer to its boss on the casing with grease.

Locate the outer thrust washer to the front of the cluster gear with grease; lower the cluster gear into position carefully. Insert a dummy shaft and check the clearance between the rear thrust washer and the cluster gear. The clearance should be ·004″–·006″ (·10 mm.–15 mm.) and is adjusted by means of the outer thrust washers. This is available in the following selective thicknesses:—

Part Number	Thickness
C.1862/3	·152″ (3·86 mm.)
C.1862	·156″ (3·96 mm.)
C.1862/1	·159″ (4·04 mm.)
C.1862/2	·162″ (4·11 mm.)
C.1862/4	·164″ (4·17 mm.)

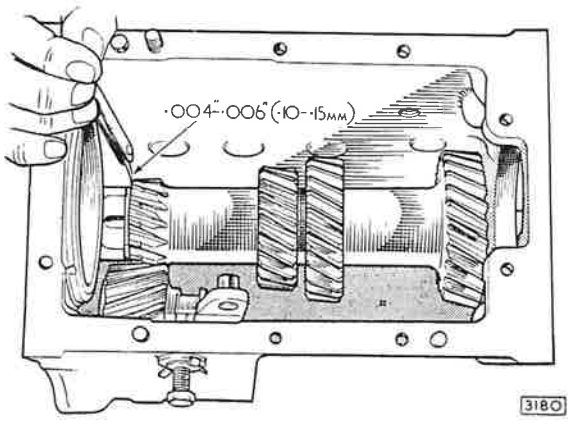


Fig. 15. *Checking the clearance between the rear thrust washer and the countershaft cluster gear.*

GEARBOX

ASSEMBLING THE CONSTANT PINION SHAFT

Assembling is the reverse of the dismantling procedure but care must be taken to ensure that the bearing is seated squarely on the constant pinion shaft.

ASSEMBLING THE MAINSHAFT

The re-assembly of the mainshaft is the reverse of the dismantling instructions but the following instructions should be noted.

(i) The end float of the gears on the mainshaft is given in "Data" at the beginning of this section and if found to be excessive the end float can only be restored by the fitting of new parts.

(ii) The needle rollers which support the gears on the mainshaft are graded on diameter and rollers of one grade only must be used for an individual gear. The grades are identified by /1, /2, and /3 after the part number.

(iii) The "E" Type constant pinion, countershaft and 3rd speed gear have a groove machined around the periphery of the gear, see Fig. 16. This is to distinguish the "E" Type gears from those fitted to the same type of gearbox on other models which have different ratios.

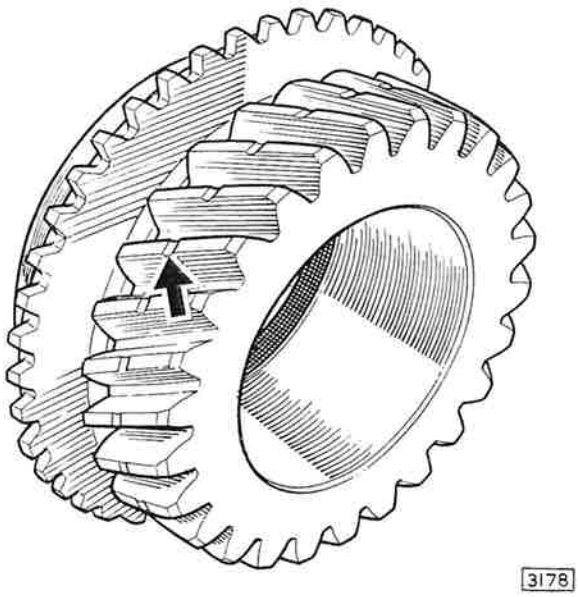


Fig. 16. *Showing the groove which identifies the 'E' type gears.*

(iv) Fit a hose clip to prevent the reverse gear from sliding off when assembling the mainshaft to the casing.

ASSEMBLING THE GEARS TO THE CASING

Withdraw the dummy shaft from the cluster gear and, at the same time, substitute a thin rod keeping both the dummy shaft and the rod in contact until the dummy shaft is clear of the casing. The thin rod allows the cluster gear to be lowered sufficiently in the casing for insertion of the mainshaft.

Fit a new paper gasket to the front face of the casing.

Enter the mainshaft through the top of the casing and pass the rear of shaft through the bearing hole.

Enter the constant pinion shaft at the front of the casing with the cutaway portions of the tooth driving member at the top and bottom.

Tap the constant pinion shaft into position and enter the front end of the mainshaft into the spigot bearing of the constant pinion shaft.

Hold the constant pinion shaft in position and with a hollow drift tap the rear bearing into position.

Withdraw the thin rod from the front bore of the cluster gear approximately half way and lever the cluster gear upwards, rotating the mainshaft and constant pinion shaft gently until the cluster gear meshes. Carefully insert the countershaft from the rear and withdraw the rod. Fit the key locating the countershaft in the casing.

REFITTING REAR EXTENSION

Refit the gears to the oil pump the same way as removed, having previously coated the gears and the inside of the pump body with oil. Secure the pump housing with the three countersunk screws and retain by staking.

Fit a new paper gasket to the rear face of the casing.

Fit the distance piece and driving pin to the oil pump in the rear extension.

Offer up the rear extension and secure with the seven screws.

Fit the speedometer driving gear to the mainshaft.

Fit the speedometer driven gear and bush with the hole in the bush in line with the hole in the casing and secure with the retaining bolt.

Fit a new gasket to the rear cover face.

Fit a new oil seal to the rear cover with the lip facing forward.

Fit the rear cover to the extension noting that the setscrew holes are offset.

Fit the four bolts to the companion flange, slide on the flange and secure with flat washer with split pin.

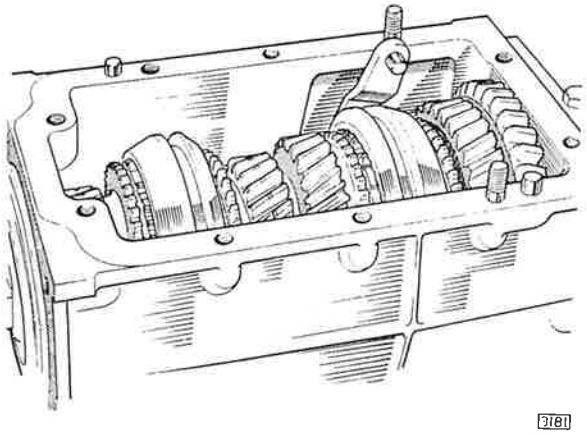


Fig. 17. *Re-assembled gearbox prior to refitting of top cover.*

RE-ASSEMBLING THE TOP COVER

(see Fig. 20).

Re-assembly of the top cover is the reverse of the dismantling instructions. When assembling the selector rods do not omit to fit the interlock balls and pin.

Renew the "O" rings on the selector rods.

To adjust the reverse plunger fit the plunger and spring.

Fit the ball and spring and start the screw and locknut; press the plunger inwards as far as possible and tighten the screw to lock the plunger.

Slowly slacken the screw until the plunger is released and the ball engages with the circular groove in the plunger. Hold the screw and tighten the locknut.

FITTING THE TOP COVER

Fit a new paper gasket.

Ensure that the gearbox and the top cover are in the neutral position.

Ensure that the reverse idler gear is out of mesh with the reverse gear on the mainshaft by pushing the lever rearwards.

Engage the selector forks with the grooves in the synchro assemblies.

Secure the top cover with the nuts and bolts noting that they are of different lengths.

REFITTING THE CLUTCH HOUSING

Refitting the clutch housing is the reverse of the removal procedure.

Fit a new oil seal to the clutch housing with the lip of the seal facing the gearbox. The oil seal has a metal flange and should be pressed in fully.

The two clutch housing securing bolts adjacent to the clutch fork trunnions are secured with locking wire; the remainder are secured with tab washers.

Note: After refitting the gearbox, run the car in top gear as soon as possible to attain the necessary mainshaft speed to prime the oil pump.

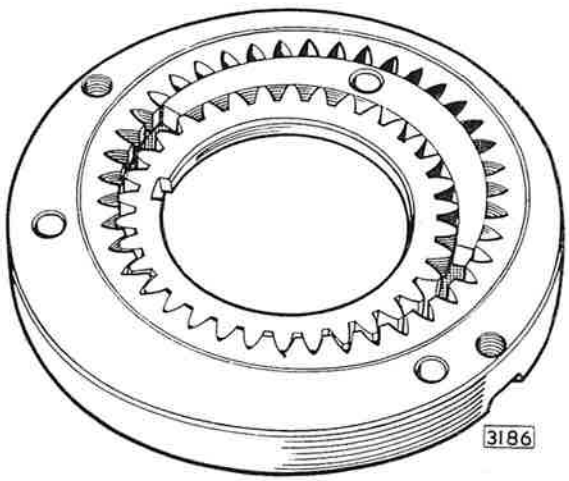


Fig. 18. *The oil pump.*

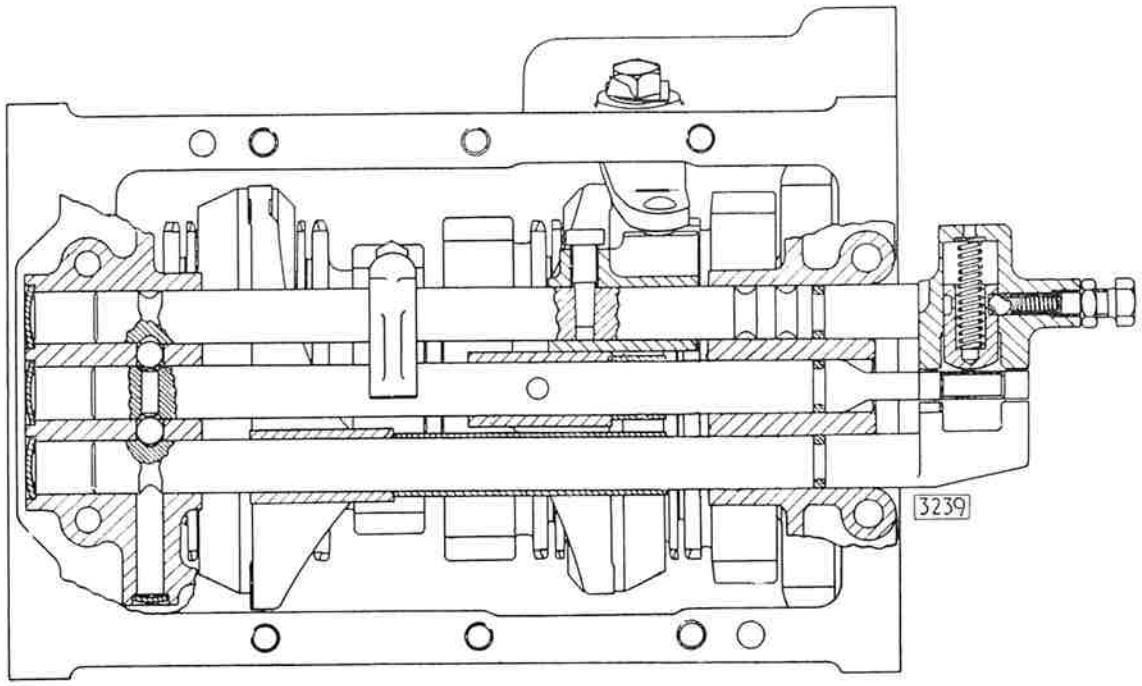


Fig. 19. *Plan view of gearbox showing selector arrangement.*

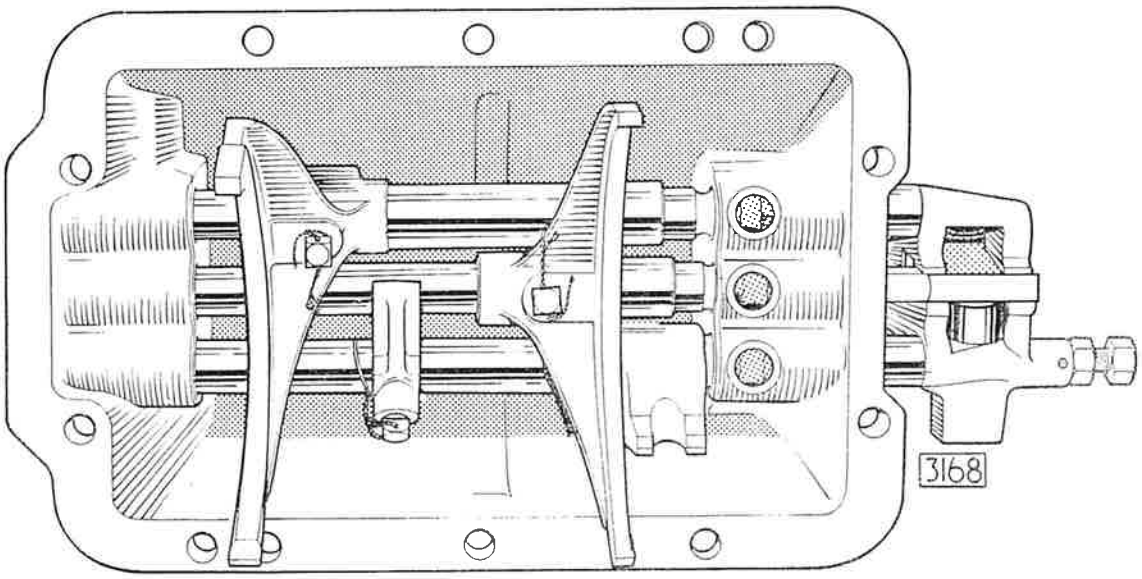


Fig. 20. *View of the underside of the top cover.*

SECTION FF

AUTOMATIC TRANSMISSION

GENERAL DATA

Maximum ratio of torque converter	2·00:1
1st Gear reduction	2·40:1
2nd Gear reduction	1·46:1
3rd Gear reduction	1·00:1
Reverse Gear reduction	2·00:1

AUTOMATIC SHIFT SPEEDS

2·88:1 Final Drive

Selector Position	Throttle Position	Upshifts 1 – 2	Upshifts 2 – 3	Downshifts 3 – 2	Downshifts 3 – 1	Downshifts 2 – 1
				M.P.H.		
	Minimum	7 – 9	12 – 15	8 – 14	—	4 – 8
D1	Full	38 – 44	66 – 71	23 – 37	—	—
	Kickdown	52 – 56	81 – 89	73 – 81	20 – 24	20 – 24
	Minimum	—	12 – 15	8 – 14	—	—
D2	Full	—	66 – 71	23 – 37	—	—
	Kickdown	—	81 – 89	73 – 81	—	—
L	Zero	—	—	60	—	12 – 20
				K.P.H.		
	Minimum	11 – 14	19 – 24	13 – 23	—	6 – 13
D1	Full	61 – 71	106 – 114	37 – 60	—	—
	Kickdown	83 – 90	130 – 143	118 – 130	32 – 39	32 – 39
	Minimum	—	19 – 24	13 – 23	—	—
D2	Full	—	106 – 114	37 – 60	—	—
	Kickdown	—	130 – 143	118 – 130	—	—
L	Zero	—	—	96	—	19 – 32

AUTOMATIC SHIFT SPEEDS *(Continued)*

185×15 SP 41 HR Tyres – 3·31:1 Final Drive

Selector Position	Throttle Position	Upshifts 1 – 2	Upshifts 2 – 3	Downshifts 3 – 2	Downshifts 3 – 1	Downshifts 2 – 1
				M.P.H.		
	Minimum	6 – 8	11 – 13	7 – 13	—	3 – 7
D1	Full	33 – 40	58 – 62	19 – 33	—	—
	Kickdown	45 – 49	70 – 78	63 – 71	17 – 21	17 – 21
	Minimum	—	11 – 13	7 – 13	—	—
D2	Full	—	58 – 62	19 – 33	—	—
	Kickdown	—	70 – 78	63 – 71	—	—
L	Zero	—	—	60	—	10 – 18
				K.P.H.		
	Minimum	9 – 13	18 – 21	11 – 21	—	5 – 11
D1	Full	53 – 64	93 – 100	31 – 53	—	—
	Kickdown	73 – 80	113 – 126	101 – 114	28 – 34	28 – 34
	Minimum	—	18 – 21	11 – 21	—	—
D2	Full	—	93 – 100	31 – 53	—	—
	Kickdown	—	113 – 126	101 – 114	—	—
L	Zero	—	—	96	—	16 – 29

Note: Shift points are approximate and not absolute values. Reasonable deviations from the above values are permissible.

TIGHTENING TORQUE FIGURES

	lb. ft.	kgm.
Front pump to transmission case bolts	17 – 22	2·35 – 3·04
Front servo to transmission case bolts	30 – 35	4·15 – 4·70
Rear servo to transmission case bolts	40 – 45	5·53 – 6·22
Centre support to transmission case bolts	20 – 25	2·76 – 3·46
Upper valve body to lower valve body bolts	4 – 6	0·55 – 0·83
Control valve body to transmission case bolts	8 – 10	1·11 – 1·38
Pressure regulator assembly to transmission case bolts	17 – 22	2·35 – 3·04
Extension assembly to transmission case bolts	28 – 33	3·87 – 4·56
Oil pan to transmission case bolts	10 – 13	1·38 – 1·80
Case assembly—gauge hole plug	10 – 15	1·38 – 2·07
Oil pan drain plug	25 – 30	3·46 – 4·15
Rear band adjusting screw lock nut	35 – 40	4·70 – 5·53
Front band adjusting screw lock nut	20 – 25	2·76 – 3·46
Detent lever attaching nut	35 – 40	4·70 – 5·53
Companion flange nut	90 – 120	12·44 – 16·58
Bearing retainer to extension housing bolts	28 – 33	3·87 – 4·56

	lb. in.	kgm.
Front pump cover attaching screws	25 – 35	0·29 – 0·40
Rear pump cover attaching screws $\frac{1}{4}$" (6·30 mm.)	50 – 60	0·58 – 0·69
Rear pump attaching screws Nos. 10–24	20 – 30	0·24 – 0·35
Governor inspection cover attaching screws	50 – 60	0·58 – 0·69
Governor valve body to counterweight screws	50 – 60	0·58 – 0·69
Governor valve body cover screws	20 – 30	0·24 – 0·35
Pressure regulator cover attaching screws	20 – 30	0·24 – 0·35
Control valve body screws	20 – 30	0·24 – 0·35
Control valve body plug	10 – 14	0·11 – 0·16
Control valve lower body plug	7 – 15	0·08 – 0·17

SPECIAL SERVICE TOOLS

Service tools are not available from Borg-Warner Limited. Distributors and Dealers should obtain the following tools illustrated in this manual from Messrs. V. L. Churchill & Co. Ltd., London Road, Daventry, Northants.

Description

Mainshaft end play gauge (CB.W.33).

Rear clutch spring compressor (C.B.W. 37A used with W.G.37).

Hydraulic pressure test gauge equipment (C.B.W. 1A used with adaptor C.B.W.1A-5A).

Spring beam torque wrench (used in conjunction with the following adaptor) (C.B.W.547A-50).

Rear band adjusting adaptor (C.B.W.547A-50-2).

Torque screwdriver (used in conjunction with the following adaptor) (C.B.W.548).

Front band adjusting adaptor (C.B.W.548-2).

Front band setting gauge (C.B.W.34).

Circlip pliers (used with "J" points) (7066).

Bench cradle (C.W.G.35).

Rear clutch piston assembly sleeve (C.W.G.41).

Front clutch piston assembly sleeve (C.W.G.42).

Rear pump discharge tube remover (C.W.G.45).

AUTOMATIC TRANSMISSION

DESCRIPTION AND OPERATION

The Model 8 automatic transmission incorporates a fluid torque converter in place of the usual flywheel and clutch. The converter is coupled to a hydraulically operated planetary gearbox which provides three forward ratios and reverse. All forward ratios are automatically engaged in accordance with accelerator position and car speed.

Overriding control by the driver is available upon demand for engine braking by manual selection of "L".

TORQUE CONVERTER

The feature of using a hydraulic converter in conjunction with a three-speed automatic gearbox provides a means of obtaining a smooth application of engine power to the driving wheels and additional engine torque multiplication to the 1st and 2nd gears of the gearbox.

The converter also provides extreme low-speed flexibility when the gearbox is in 3rd gear and, due to the ability of multiplying engine torque, it provides good acceleration from very low road speed without having to resort to a down-shift in the gearbox.

Torque multiplication from the converter is infinitely variable between the ratios of 2:1 and 1:1. The speed range, during which the torque multiplication can be achieved, is also variable, depending upon the accelerator position.

The hydraulic torque converter for use in conjunction with the automatic gearbox has a mean fluid circuit diameter of 11" (27·9 cm.).

It is of the single-phase, three-element type, comprising an impeller connected to the engine crankshaft, a turbine connected to the input shaft of the gearbox, and a stator mounted on a sprag-type one-way clutch supported on a fixed hub projecting from the gearbox case.

THE GEAR SET

The planetary gear set consists of two sun gears, two sets of pinions, a pinion carrier, and a ring gear. Helical, involute tooth forms are used throughout. Power enters the gear set via the sun gears. In all forward gears power enters through the forward sun gear; in reverse, power enters through the reverse sun gear. Power leaves the gear set by the ring gear. The pinions are used to transmit power from the sun gears to the ring gear. In reverse a single set of pinions is used, which causes the ring gear to rotate in the opposite direction to the sun gear. In forward gears a double set of pinions is used to cause the ring gear to rotate in the same direction as the sun gear. The carrier locates the pinions in their correct positions relative to the sun gears and the ring gear (and also forms a reaction member for certain conditions). The various mechanical ratios of the gear set are obtained by the engagement of hydraulically operated multi-disc clutches and brake bands.

CLUTCHES

Multi-disc clutches operated by hydraulic pistons connect the converter to the gear set. In all forward gears the front clutch connects the converter to the forward sun gear; for reverse the rear clutch connects the converter to the reverse sun gear.

BANDS

Brake bands, operated by hydraulic servos, hold elements of the gear set stationary to effect an output speed and a torque increase. In Lockup the rear band holds the planet carrier stationary and provides the 1st gear ratio of 2·40:1 and, in reverse, a ratio of 2·00:1. The front band holds the reverse sun gear stationary to provide the 2nd gear ratio of 1·46:1.

ONE-WAY CLUTCH

In D1, a one-way clutch is used in place of the rear band to prevent anti-clockwise rotation of the planet carrier, thus providing the 1st gear ratio of 2·40:1. This one-way clutch, allowing the gear set to freewheel in 1st gear, provides smooth ratio changes from 1st to 2nd, and vice-versa.

Selector Position		Ratio	Applied	Driving		Held
L	Lock-up	1st	Front Clutch Rear Band Sprag Clutch	Forward	Sun	Planet Carrier
D1	Drive One	1st	Front Clutch Sprag Clutch	Forward	Sun	Planet Carrier
L D1 D2	Lock-up Drive One Drive Two	2nd 2nd	Front Clutch Front Band	Forward	Sun	Reverse Sun
D1 D2	Drive One Drive Two	3rd	Front Clutch Rear Clutch	Forward Secondary	Sun Sun	
R	Reverse	Reverse	Rear Clutch Rear Band	Reverse	Sun	Planet Carrier

MECHANICAL POWER FLOW

First Gear (Lockup selected)

The front clutch is applied, connecting the converter to the forward sun gear. The rear band is applied, holding the planet carrier stationary, the gear set providing the reduction of 2·40:1. The reverse sun gear rotates freely in the opposite direction to the forward sun gear.

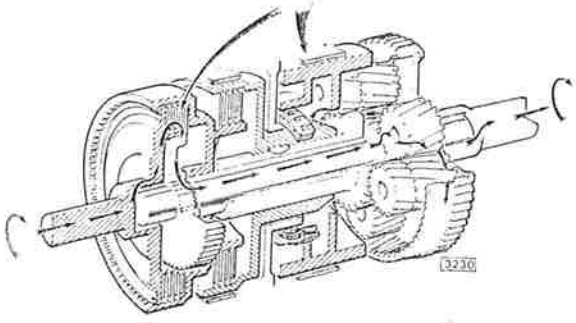


Fig. 1. *Mechanical power flow—1st gear (L) selected.*

First Gear (Drive 1 selected)

The front clutch is applied, connecting the converter to the forward sun gear. The one-way clutch is in operation, preventing the planet carrier from rotating anti-clockwise; the gear set provides the reduction of 2·40:1. When the vehicle is coasting the one-way clutch over-runs and the gear set freewheels.

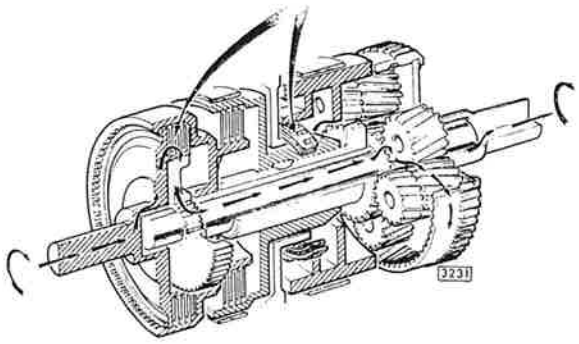


Fig. 2. *Mechanical power flow—1st gear (D) selected.*

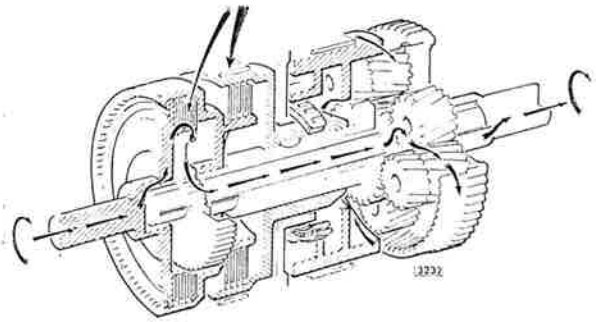


Fig. 3. *Mechanical power flow—2nd gear (L or D2) selected.*

Second Gear (Lockup or Drive 2 selected)

Again the front clutch is applied, connecting the converter to the forward sun gear. The front band is applied, holding the reverse sun gear stationary; the gear set provides the reduction of 1·46:1.

Third Gear

Again the front clutch is applied, connecting the converter to the forward sun gear. The rear clutch is applied, connecting the converter also to the reverse sun gear; thus both sun gears are locked together and the gear set rotates as a unit, providing a ratio of 1:1.

Neutral and Park

In neutral the front and rear clutches are off, and no power is transmitted from the converter to the gear set. The front and rear bands are also released. In "P" the Front Servo Apply and Release and Rear Servo circuits are pressurised while the engine is running, so that the rear band is applied.

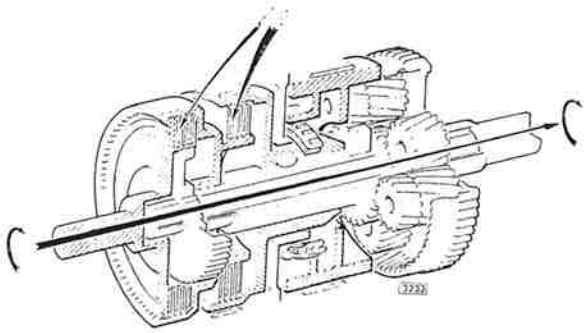


Fig. 4. *Mechanical power flow—3rd gear (D) selected.*

Reverse Gear

The rear clutch is applied, connecting the converter to the reverse sun gear. The rear band is applied, holding the planet carrier stationary, the gear set providing the reduction of 2·00:1 in the reverse direction.

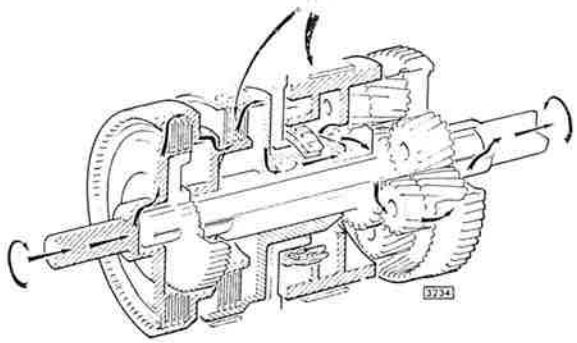


Fig. 5. *Mechanical power flow—Reverse (R) selected.*

THE HYDRAULIC SYSTEM

The hydraulic system contains a front and rear pump, both of the internal/external gear pattern, picking up fluid from the oil pan through a common strainer. Shift control is provided by a centrifugally operated hydraulic governor on the transmission output shaft. This governor works in conjunction with valves in the valve body assembly located in the base of the transmission. These valves regulate fluid pressure and direct it to appropriate transmission components.

The Front Pump

The front pump, driven by the converter impeller,

is in operation whenever the engine is running. This pump, through the primary and secondary regulator valves supplies the hydraulic requirements of the transmission with the engine running when the vehicle is stationary, as well as at low vehicle speeds before the rear pump becomes effective.

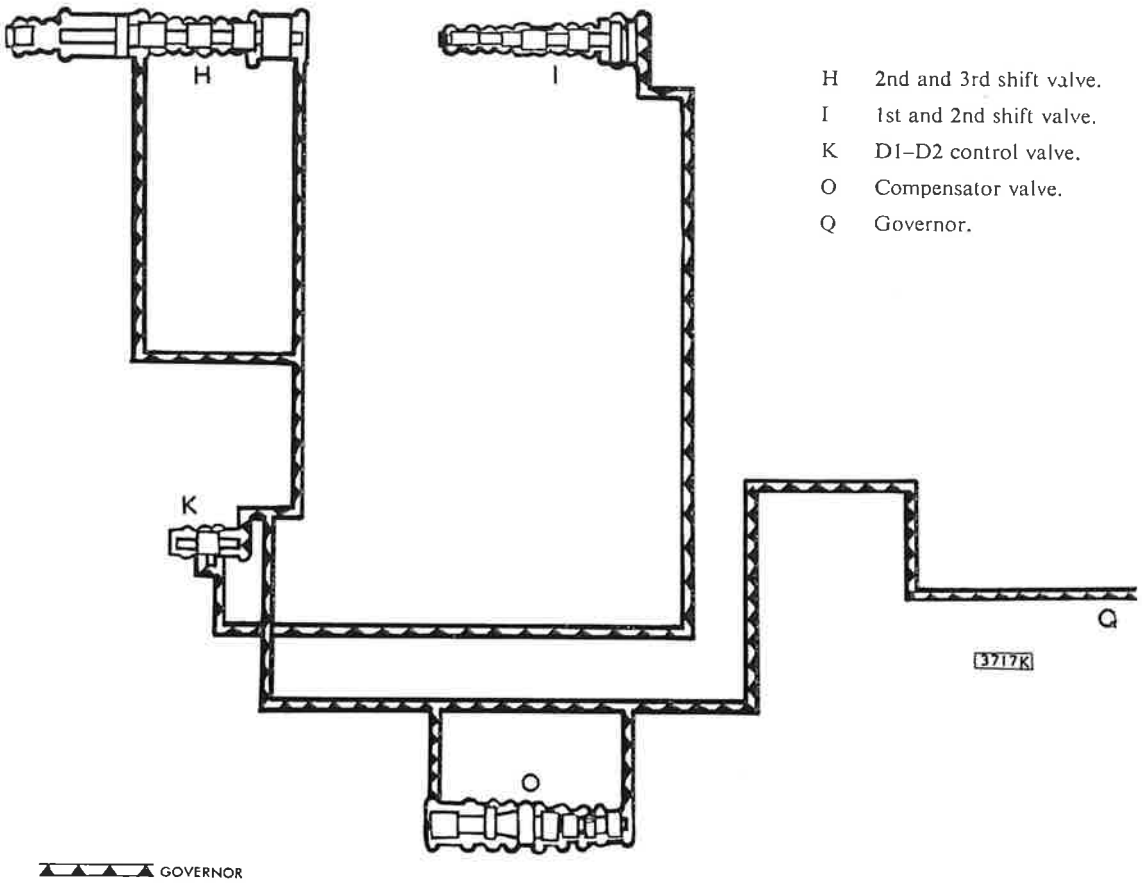


Fig. 6. *Governor circuit.*

The Rear Pump

The rear pump is driven by the output shaft of the transmission. It is fully effective at speeds above approximately 20 m.p.h. (32 k.p.h.) and then supplies most of the hydraulic requirements.

If, due to a dead engine, the front pump is inoperative, the rear pump, above approximately 20 m.p.h. (32 k.p.h.) can provide all hydraulic requirements, thus enabling the engine to be started through the transmission.

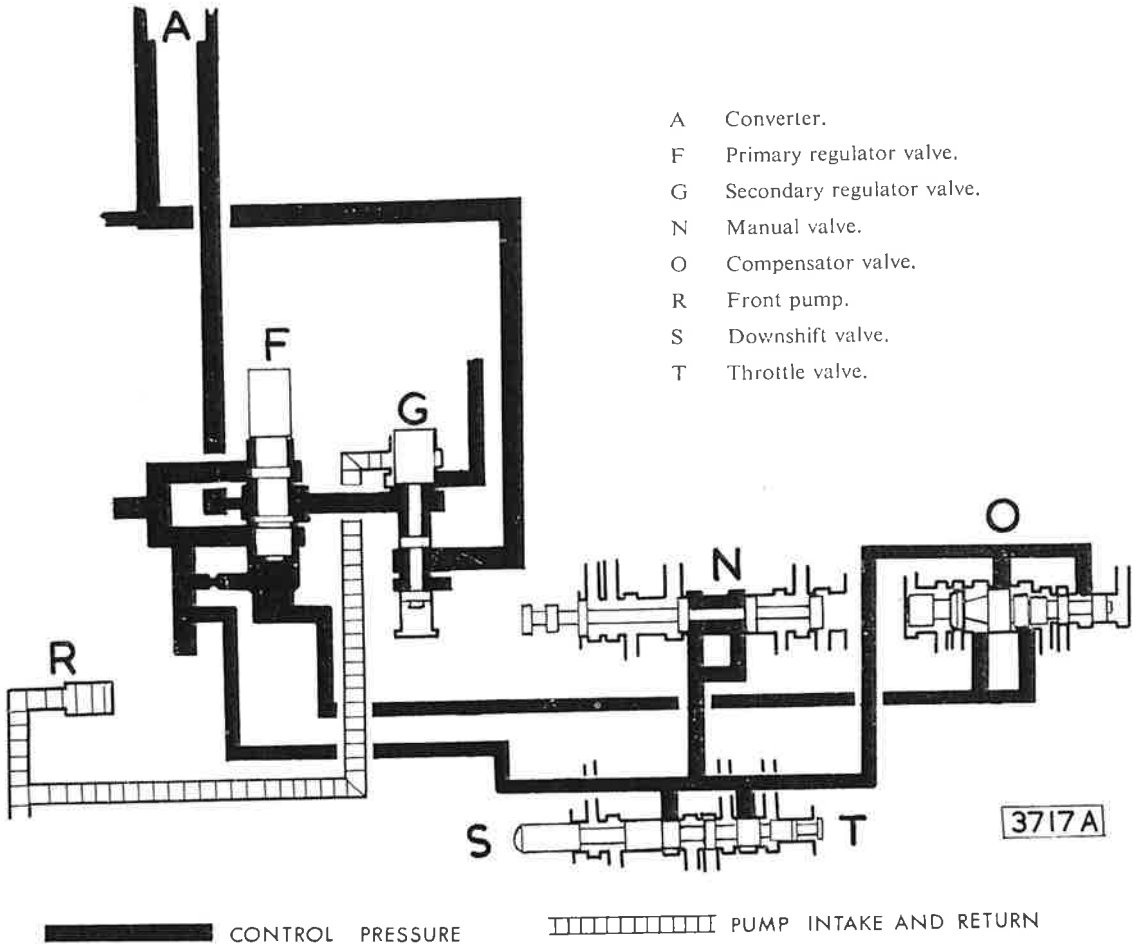
The Governor

The governor, revolving with the output shaft, is essentially a pressure regulating valve which reduces line pressure to a value which varies with output shaft speed. This variable pressure is utilised in the control system to effect up and down shifts through the 1–2 and 2–3 shift valves. Rotation of the governor at low speeds causes the governor weight and valve to be affected by centrifugal force. The outward force is opposed by an opposite and equal hydraulic force produced by pressure acting on the regulating area of the governor valve. The governor valve is a regulating valve and will attempt to maintain equilibrium. Governor pressure will rise in proportion to the increase in centrifugal force caused by higher output shaft speed.

As rotational speed increases the governor weight moves outward to rest on a stop in the governor body, and can move no further. When this occurs, a spring located between the counter weight and the valve

becomes effective. The constant force of this spring then combines with the centrifugal force of the governor valve and the total force is opposed by governor pressure. This combination renders governor pressure less sensitive to output shaft speed variations.

It can be seen from the above, that the governor provides two distinct phases of regulation, the first of which is a fast rising pressure for accurate control of the low speed shift points.



A Converter.
F Primary regulator valve.
G Secondary regulator valve.
N Manual valve.
O Compensator valve.
R Front pump.
S Downshift valve.
T Throttle valve.

Fig. 7. *Hydraulic circuit—neutral.*

THE CONTROL SYSTEM

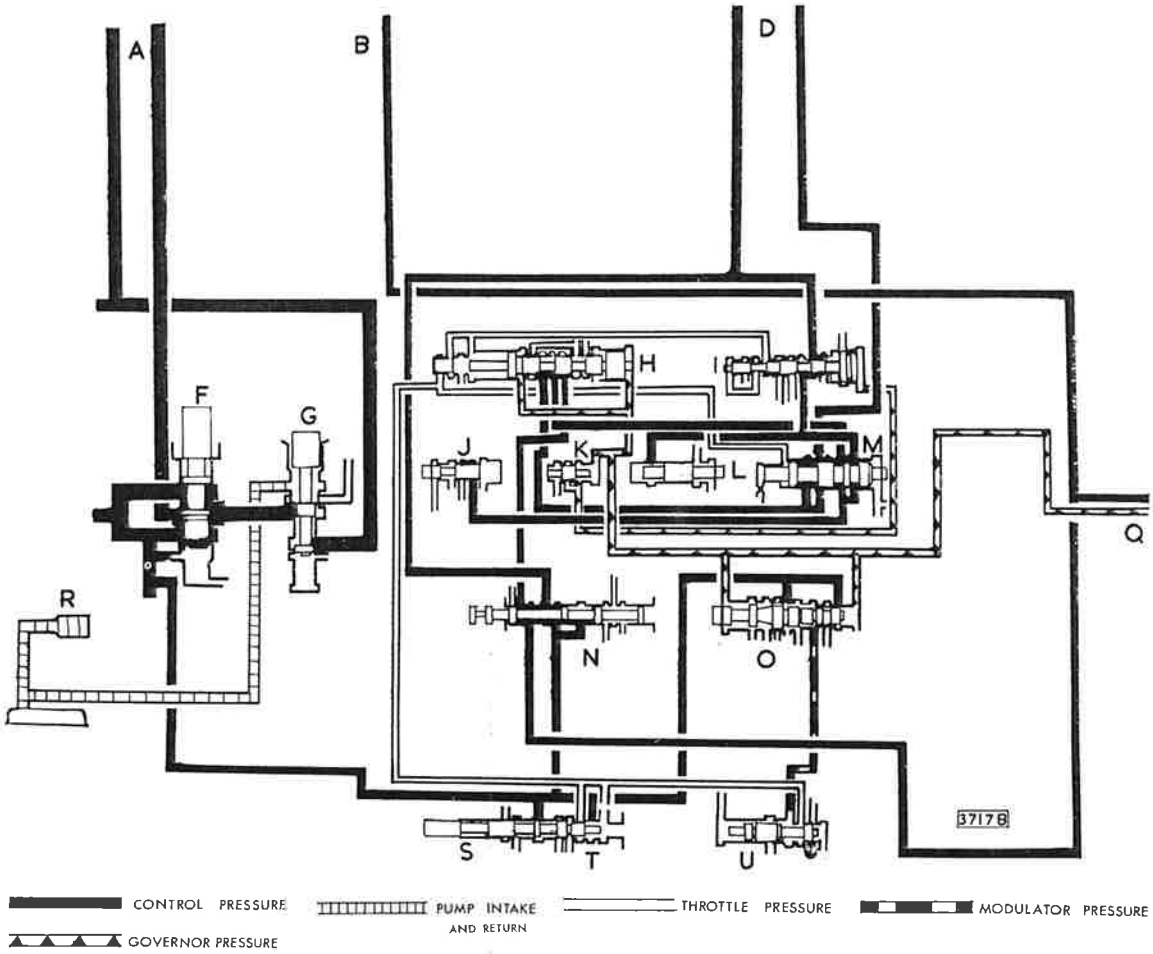
Neutral—Engine Running (see Fig. 7)

When the selector is moved to the neutral position, the manual control valve is positioned so that control pressure cannot pass through the manual valve to the clutches or servos; therefore, the clutches and servos cannot apply. There is no transmission of power through the transmission in the neutral position.

The pressure regulation system, however, is functioning. With the engine running, the front pump is driven and fluid is picked up from the pan by the front pump inlet. Fluid, circulated by the front pump is directed to the control pressure regulator. The primary regulator valve will maintain correct control pressure by expelling the excess fluid to feed the secondary regulator valve. The secondary regulator valve maintains correct pressure for converter feed and lubrication, then forces the excess fluid back to the pump inlet.

Control pressure is directed to the manual control valve, where it is blocked by two lands on the valve. Control pressure is also directed to the throttle valve and the downshift valve and, with the valve closed

(accelerator at idle position) it is blocked by lands on the valves. Control pressure to the compensator valve is regulated by that valve, and compensating pressure is directed to the primary regulator valve.



A	Converter.	I	1st and 2nd shift valve.	O	Compensator valve.
B	Front clutch.	J	Transition valve.	Q	Governor.
D	Front servo.	K	D1–D2 control valve.	R	Front pump.
F	Primary regulator valve.	L	Front servo orifice valve.	S	Downshift valve.
G	Secondary regulator valve.	M	Servo orifice control valve.	T	Throttle valve.
H	2nd and 3rd shift valve.	N	Manual valve.	U	Throttle modulator valve.

Fig. 8. *Hydraulic circuit—1st gear (D1 range).*

First Gear, D1 Range (see Fig. 8)

When the selector lever is placed in the D1 position, with the car standing still, and the engine running, the manual control valve is moved to admit control pressure to apply the front clutch.

Control pressure is also directed to the governor, but with the car standing still, the control pressure is blocked at the governor valve.

Control pressure from the manual valve is directed through another passage to the apply side of the front servo and the 1–2 shift valve.

From the 1–2 shift valve pressure then passes to the servo orifice control valve and the front servo release valve where it is blocked.

Control pressure is then directed from the servo orifice control valve via the 2–3 shift valve and again through the control valve to the release side of the front servo.

Pressure is also present at the transition valve where it is blocked.

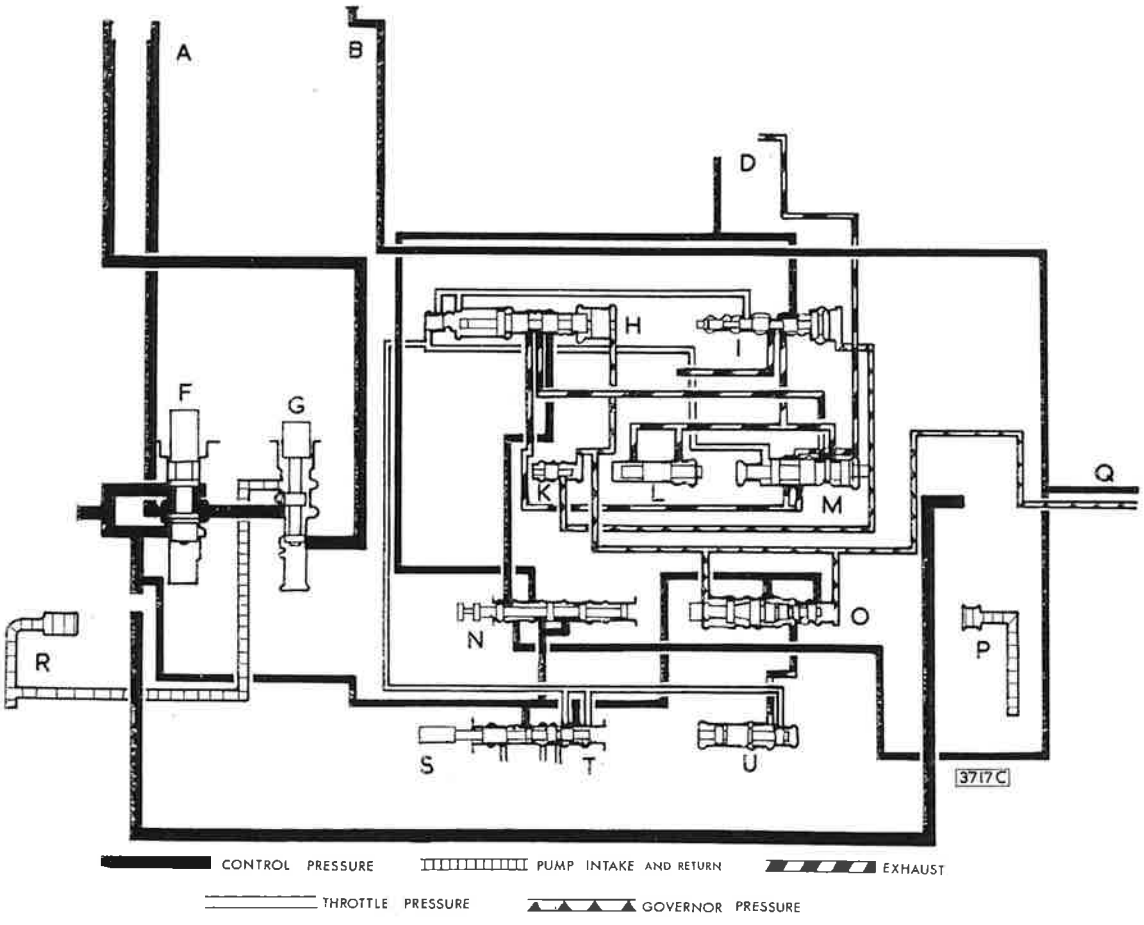
With pressure on both sides of the front servo piston, the servo is held in a released position. The

one-way clutch takes the reaction torque on the rear drum, thus eliminating need for rear servo action.

The front pump supplies the pressure to operate the transmission and this pressure is controlled as it was in the neutral position.

When the accelerator is depressed and the car starts to move, centrifugal force, acting on the governor weight and valve, moves the valve to regulate governor pressure, which is directed to the 1–2 shift valve, 2–3 shift valve, and plug, and the compensator valve. Movement of the accelerator also opens the throttle valve so that throttle pressure is directed to the modulator valve, orifice control valve, and the shift plug on the end of the 2–3 shift valve. Throttle pressure to the modulator valve is re-directed to the compensator valve to increase control pressure.

Throttle pressure to the shift plug on the 2–3 shift valve is reduced, and the reduced pressure is directed to the ends of the 1–2 shift valve and the 2–3 shift valve. This reduced pressure on the shift valves opposes governor pressure.



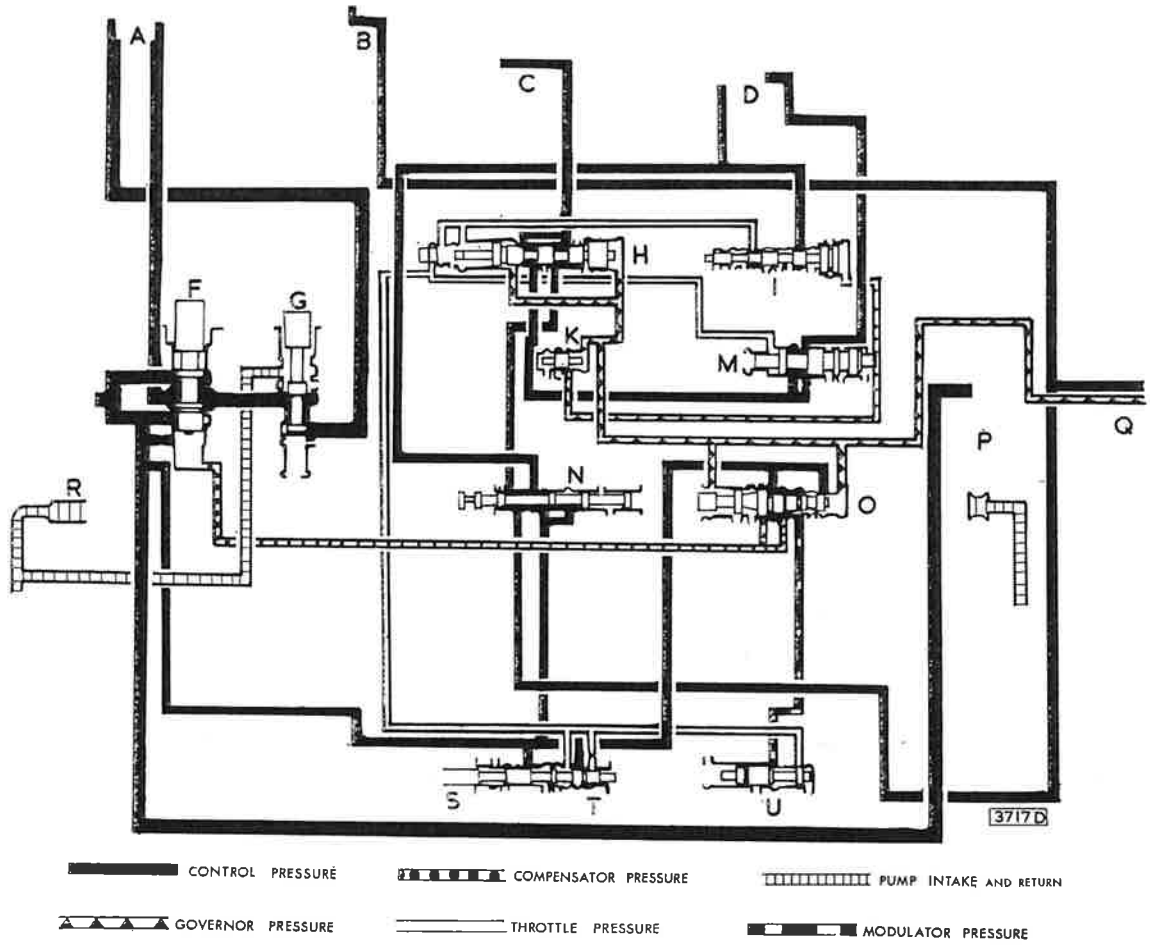
A	Converter	I	1st and 2nd shift valve.	P	Rear pump.
B	Front clutch.	K	D1–D2 control valve.	Q	Governor.
D	Front servo.	L	Front servo orifice valve.	R	Front pump.
F	Primary regulator valve.	M	Servo orifice control valve.	S	Downshift valve.
G	Secondary regulator valve.	O	Compensator valve.	T	Throttle valve.
H	2nd and 3rd shift valve.			U	Throttle modulator valve.

Fig. 9. *Hydraulic circuit—2nd gear (D1 range).*

Second Gear, D1 Range (Fig. 9)

As the car speed increases, the governor pressure builds up until it can overcome the opposite force of the 1–2 shift valve spring and reduced throttle pressure on the end of the valve and so moves the valve. When the 1–2 shift valve moves, control pressure at the valve is shut off and the front servo release pressure is

exhausted, first slowly through a restricting orifice and then fast through the front servo release orifice valve. This leaves the front clutch and the front band applied.



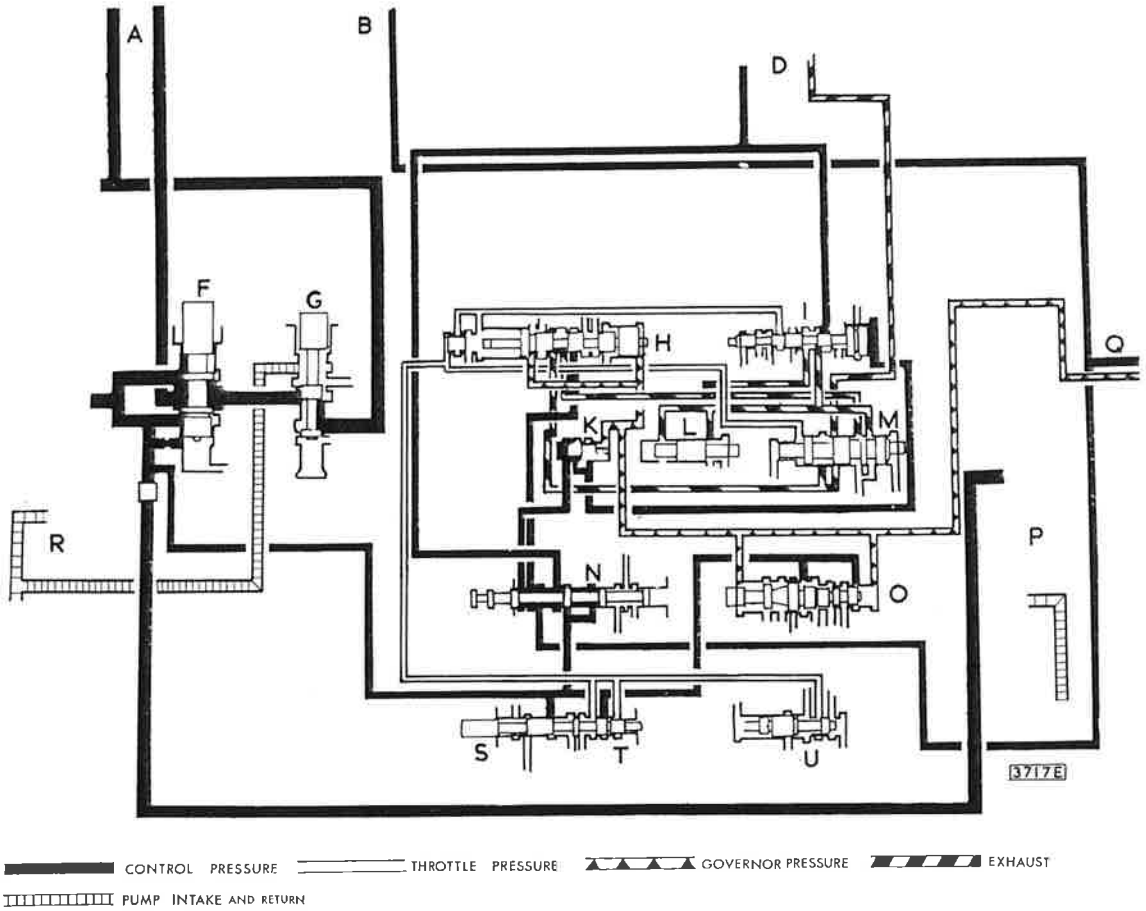
A	Converter.	H	2nd and 3rd shift valve.	P	Rear pump.
B	Front clutch.	I	1st and 2nd shift valve.	Q	Governor
C	Rear clutch.	K	D1–D2 control valve.	R	Front pump.
D	Front servo.	M	Servo orifice control valve.	S	Downshift valve.
F	Primary regulator valve.	N	Manual valve.	T	Throttle valve.
G	Secondary regulator valve.	O	Compensator valve.	U	Throttle modulator valve.

Fig. 10. *Hydraulic circuit—3rd gear (D1 or D2 range).*

Third Gear, D1 or D2 Range (Fig. 10)

As the car speed continues to increase, the governor pressure also increases until it overcomes the 2–3 shift valve spring and the reduced throttle pressure on the end of the 2–3 shift valve, thus causing the valve to move. When the valve moves, control pressure is admitted to the rear clutch and through the annulus of the servo orifice control valve to the release side of the front servo, thus applying the rear clutch and placing the front servo in the released position. This leaves the front clutch and the rear clutch applied.

As the governor pressure continues to increase, it acts against modulator pressure at the compensator valve to increase compensator pressure and decrease control pressure through the movement of the valve in the primary regulator.



A	Converter.	I	1st and 2nd shift valve.	P	Rear pump
B	Front clutch.	K	D1–D2 control valve.	Q	Governor.
D	Front servo.	L	Front servo orifice valve.	R	Front pump.
F	Primary regulator valve.	M	Servo orifice control valve.	S	Downshift valve.
G	Secondary regulator valve.	N	Manual valve.	T	Throttle valve.
H	2nd and 3rd shift valve.	O	Compensator valve.	U	Throttle modulator valve.

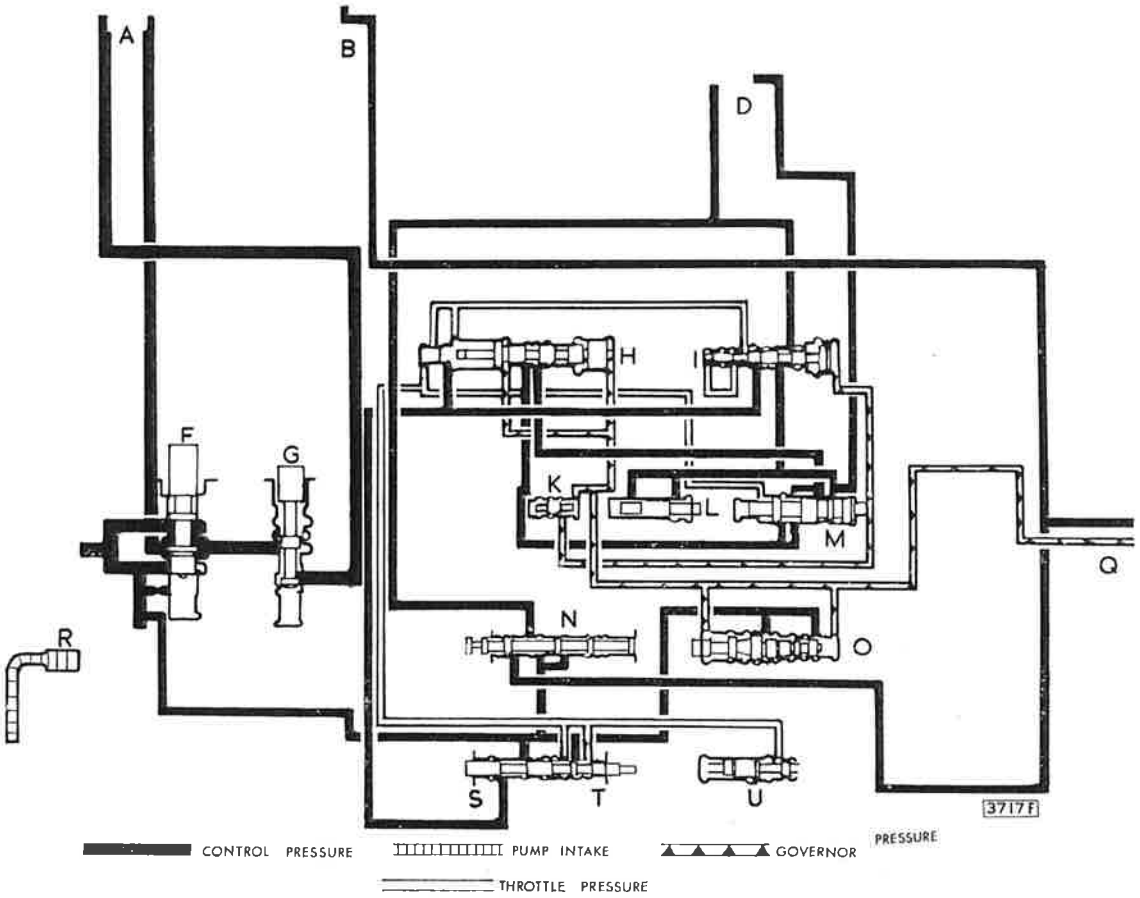
Fig. 11. *Hydraulic circuit—2nd gear (D2 range).*

Second Gear, D2 Range (Fig. 11)

When the selector lever is placed in the D2 (drive) position, with the car standing still and the engine running, control pressure passes through the manual valve to the D1 and D2 control valve, overcomes any governor pressure acting on this valve and passes through the valve to the governor pressure area of the 1–2 shift valve, thus positioning it in the 2nd gear position.

Pressure is exhausted from the release side of the front servo, which results in the front clutch and front band being applied.

All upshifts from 2nd gear ratio direct will be similar to the description of 3rd gear D1 range.



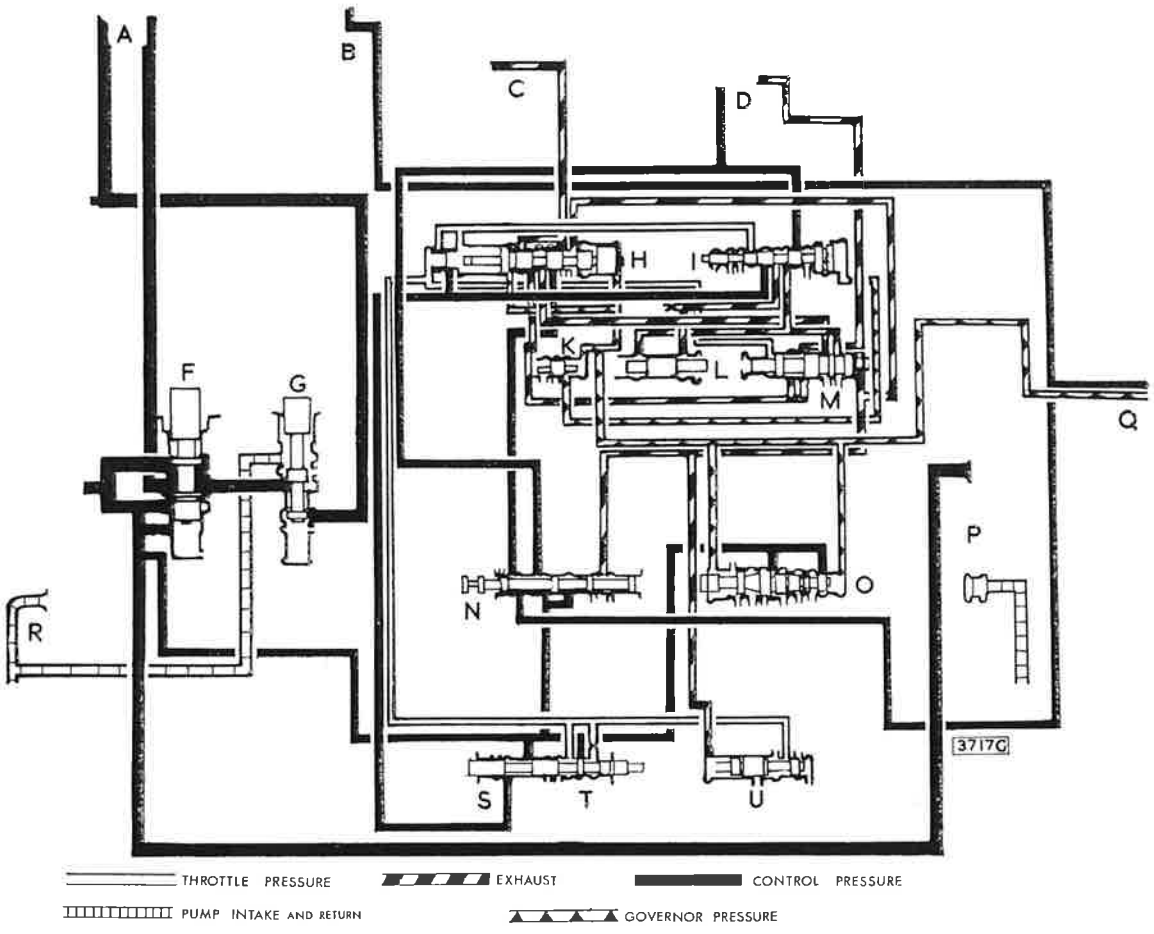
A	Converter.	I	1st and 2nd shift valve.	Q	Governor.
B	Front clutch.	K	D1–D2 control valve.	R	Front pump.
D	Front servo.	L	Front servo orifice valve.	S	Downshift valve.
F	Primary regulator valve.	M	Servo orifice control valve.	T	Throttle valve.
G	Secondary regulator valve.	N	Manual valve.	U	Throttle modulator valve.
H	2nd and 3rd shift valve.	O	Compensator valve.		

Fig. 12. *Hydraulic circuit—2–1 kickdown (D1 range).*

2–1 Kickdown, D1 Range (Fig. 12)

At car speeds up to approximately 20 m.p.h. (32 k.p.h.), after the transmission has shifted from 1st to 2nd or 3rd gear, the transmission can be downshifted to 1st gear by depressing the accelerator pedal beyond the wide open throttle position.

Movement of the accelerator to kickdown position causes the throttle cable to move the downshift valve to allow control pressure to pass through the downshift valve to another land on the 1–2 shift valve. The combination of control pressure and the 1–2 shift valve spring is sufficient to overcome governor pressure and return the valve to the 1st gear position. In this position, control pressure is admitted to the release side of the front servo. This places the front servo in the released position, leaving the front clutch applied and the one-way clutch holding the rear drum.



A	Converter.	I	1st and 2nd shift valve.	Q	Governor.
B	Front clutch.	K	D1–D2 control valve.	R	Front pump.
C	Rear clutch.	L	Front servo orifice valve.	S	Downshift valve.
D	Front servo.	M	Servo orifice control valve.	T	Throttle valve.
F	Primary regulator valve.	N	Manual valve.	U	Throttle modulator valve.
G	Secondary regulator valve.	O	Compensator valve.		
H	2nd and 3rd shift valve.	P	Rear pump.		

Fig. 13. *Hydraulic circuit—3–2 kickdown (D1 or D2 range).*

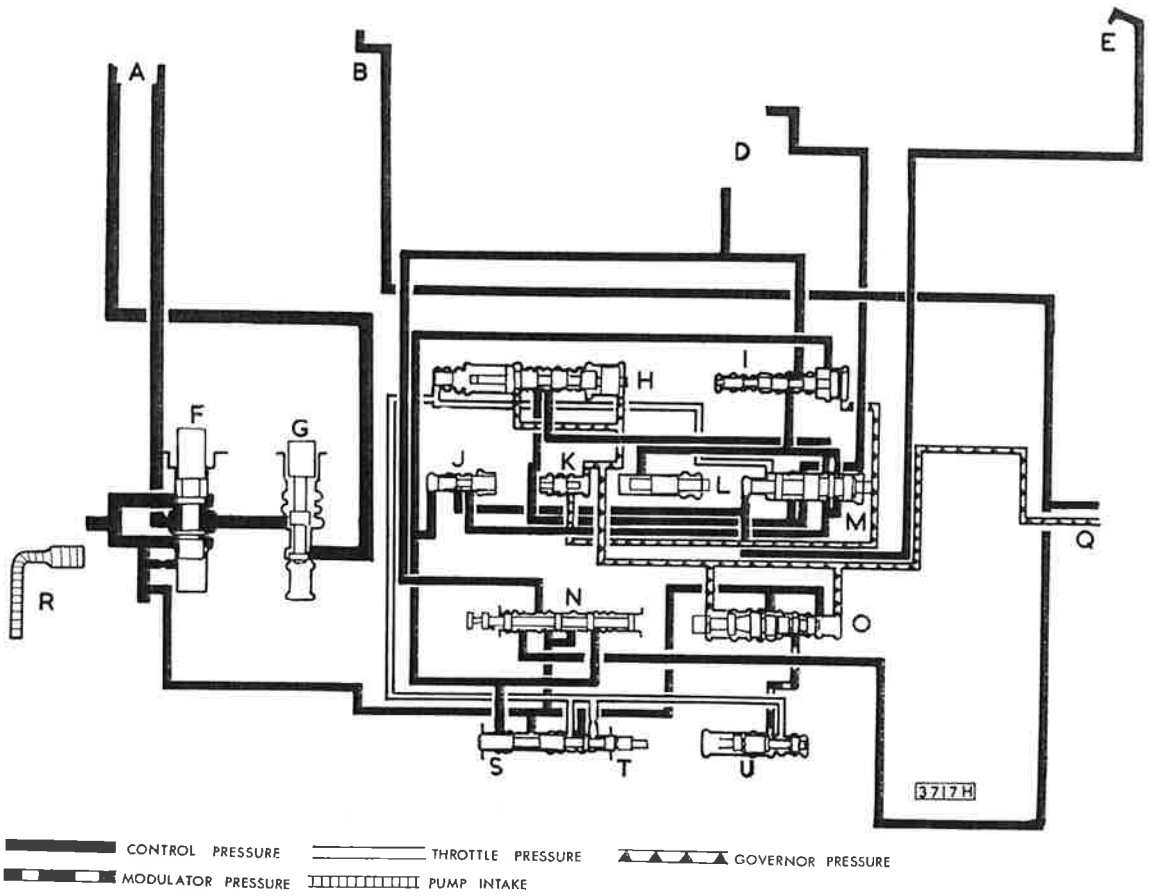
3–2 Kickdown, D1 or D2 Range (Fig. 13)

At car speeds between approximately 22 to 66 m.p.h. (35 to 106 k.p.h.) after the transmission has shifted to 3rd gear, the transmission can be downshifted from 3rd gear to 2nd gear by depressing the accelerator pedal beyond the wide open throttle position.

Movement of the accelerator causes the throttle cable to move the downshift valve to allow control pressure to pass through the downshift valve to the spring end of the 2–3 shift valve. The combination of control pressure at the end on the 2–3 shift valve and 2–3 shift valve springs is sufficient to overcome governor pressure to move the valve. When the valve is in 2nd gear position, control pressure to the rear clutch and through the servo orifice control valve to the release side of the front servo is shut off. The rear clutch circuit exhausts through the exhaust port of the manual control valve, whereas the front servo release circuit exhausts through the 1–2 shift valve, orifice and front servo release orifice valve. This leaves the front clutch and front band applied.

If the accelerator is left in the kickdown position, governor pressure will increase as the car speed increases until the governor pressure is greater than the combined pressures on the 2–3 shift valve, and the transmission will again upshift to 3rd gear.

At speeds above approximately 66 m.p.h. (106 k.p.h.) the governor pressure is so great that the combined pressures on the 2–3 shift valve cannot overcome the governor pressure; therefore, there is no kickdown.



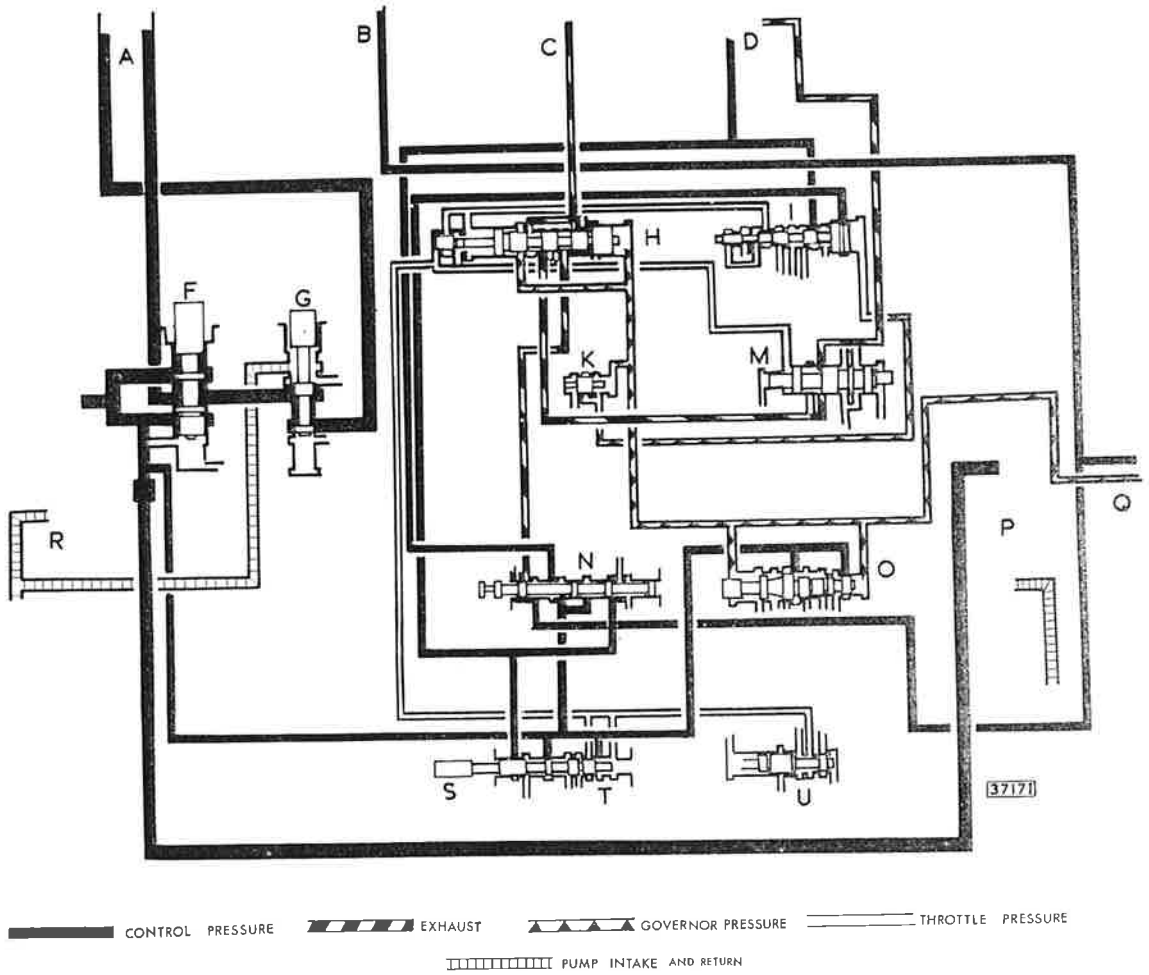
A	Converter.	I	1st and 2nd shift valve.	Q	Governor.
B	Front clutch.	J	Transition valve.	R	Front pump.
D	Front servo.	K	D1–D2 control valve.	S	Downshift valve.
E	Rear servo.	L	Front servo orifice valve.	T	Throttle valve.
F	Primary regulator valve.	M	Servo control valve.	U	Throttle modulator valve.
G	Secondary regulator valve.	N	Manual valve.		
H	2nd and 3rd shift valve.	O	Compensator valve.		

Fig. 14. *Hydraulic circuit—Lockup (1st gear).*

Lockup—First Gear (Fig. 14)

When the selector lever is placed in the Lockup position, the manual control valve is moved to admit through one port, control pressure to the governor feed and to apply the front clutch. Another port supplies both sides of the front servo which is held in the released position and also to the rear servo to apply the rear band through the servo orifice control and transition valves. A third port supplies pressure to move the transition valve and to an additional land on the 1–2 shift valve.

In this position, there is no automatic upshift to a higher gear ratio, since the combination of control pressure on the 1–2 shift valve and the 1–2 shift valve spring is greater than governor pressure acting against the valve, so that the valve cannot move. The combination of control pressure on the 2–3 shift valve and the 2–3 valve spring is also greater than the governor pressure acting against the valve so that the 2–3 shift valve cannot move.

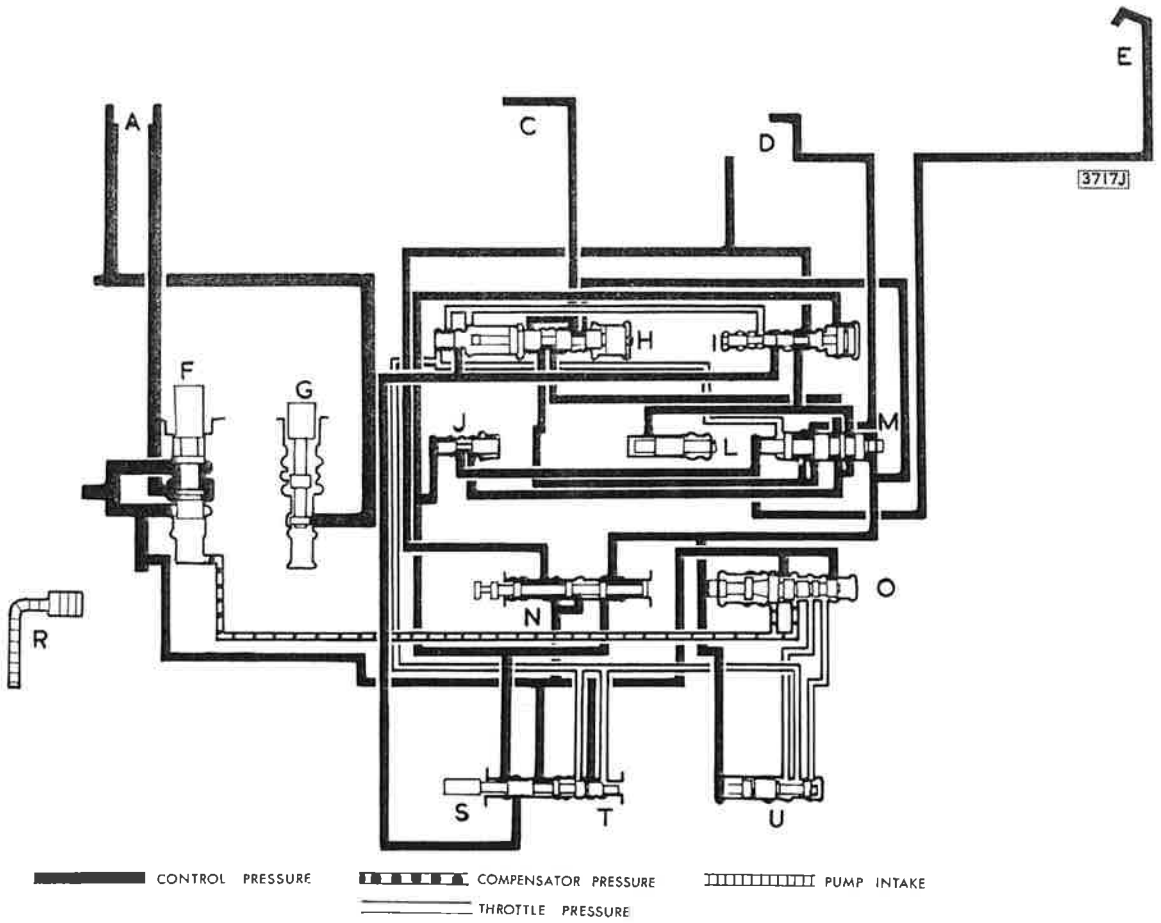


A	Converter.	H	2nd and 3rd shift valve.	P	Rear pump.
B	Front clutch.	I	1st and 2nd shift valve.	Q	Governor.
C	Rear clutch.	K	D1–D2 control valve.	R	Front pump.
D	Front servo.	M	Servo orifice control valve.	S	Downshift valve.
F	Primary regulator valve.	N	Manual valve.	T	Throttle valve.
G	Secondary regulator valve.	O	Compensator valve.	U	Throttle modulator valve.

Fig. 15. *Hydraulic circuit—Lockup (2nd gear).*

Lockup—Second Gear

In L the manual control valve opens to exhaust the rear clutch and front servo release circuit from the 2–3 shift valve. This causes a downshift from 3rd gear whenever L is selected at speed. In this condition, governor pressure will have moved the 1–2 shift valve; the result is that supply to the rear servo through the servo orifice control valve and transition valve is blocked and as front servo release pressure also exhausts through the 2–3 shift valve, the front band will be applied. This band, in conjunction with the front clutch, provides 2nd gear.



A	Converter.	H	2nd and 3rd shift valve.	O	Compensator valve.
C	Rear clutch.	I	1st and 2nd shift valve.	R	Front pump.
D	Front servo.	J	Transition valve.	S	Downshift valve.
E	Rear servo.	L	Front servo orifice valve.	T	Throttle valve.
F	Primary regulator valve.	M	Servo orifice control valve.	U	Throttle modulator valve.
G	Secondary regulator valve.	N	Manual valve.		

Fig. 16. *Hydraulic circuit—reverse gear.*

Reverse (Fig. 16)

When the selector lever is placed in the reverse position, the manual control valve moves to admit control pressure to the rear clutch, both sides of the front servo and the rear servo. This applies the rear clutch and the rear band.

Control pressure is also directed to the modulator valve to move the valve so when the throttle valve is opened by depressing the accelerator, the throttle pressure passes through the modulator valve to two lands on the compensator valve to reduce compensating pressure, thus increasing control pressure.

High control pressure is desired in reverse, since the reaction forces increase appreciably and higher pressure is required to hold the rear drum.

MAINTENANCE

It is most IMPORTANT that the following maintenance instructions are closely followed and absolute cleanliness is maintained when topping-up or filling the transmission.

It is **vitally important** when checking the fluid level that no dirt or foreign matter enters the transmission, otherwise trouble will almost certainly arise. Before removing the transmission dipstick, the surrounding area must be cleaned off to prevent dirt from entering the dipstick aperture. When filling the transmission with fluid ensure that the fluid container and funnel are perfectly clean.

In countries where ambient temperatures are unusually high, dust and/or mud must not be allowed to decrease the effective areas of the stoneguards in the converter housing or the slots in the transmission case. Also any foreign matter on the oil pan must be removed as it would act as a temperature insulator.

EVERY 3,000 MILES (5,000 KM.)

Check Transmission Fluid Level

The transmission filler tube is located on the right-hand side of the engine under the bonnet just forward of the bulkhead. Check the fluid level every 3,000 miles (5,000 km.).

Before checking the fluid level, the car should be on level ground and the transmission should be at the normal operating temperature.

Set the handbrake firmly and select P position.

The engine should be at normal idle.

When the engine is running, remove the dipstick, wipe clean and replace in the filler tube in its correct position.

Withdraw immediately and check.

If necessary, add fluid to bring the level to the FULL mark on the dipstick. The difference between FULL and LOW marks on the stick represents approximately 1½ pints (2 U.S. pints or 0·75 litres).

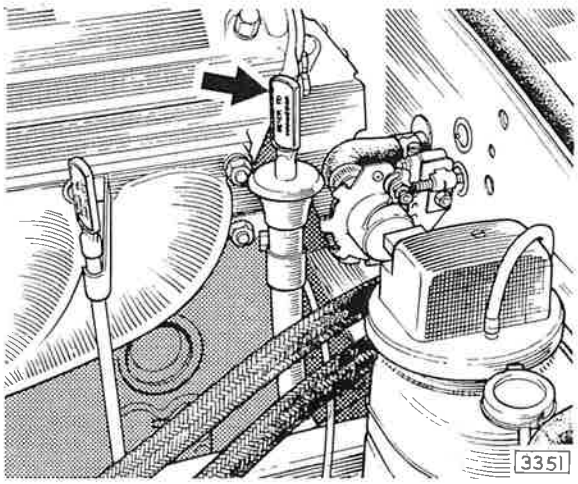


Fig. 17. *Automatic transmission dipstick.*

Be careful not to overfill.

If fluid is checked with transmission cold, a false reading will be obtained and filling to the FULL mark will cause it to be overfilled.

If it is found necessary to add fluid frequently, it will be an indication that there is a leakage in the transmission and it should be investigated immediately to prevent damage to transmission.

Total fluid capacity (including cooler) 16 Imperial pints from dry (19 U.S. pints, 9 litres).

RECOMMENDED AUTOMATIC TRANSMISSION FLUIDS

Mobil	Castrol	Shell	Esso	B.P.	Duckham	Regent Caltex/Texaco
Mobilfluid 200	Castrol T.Q.	Shell Donax T.6	Esso Automatic Transmission Fluid	Automatic Transmission Fluid, Type A	Nolmatic	Teaxamatic Fluid

If these recommended lubricants are not available, only a transmission fluid conforming to the following specification should be used:—

Automatic Transmission Fluid, Type "A" or Type "A" Suffix "A" (AQ–ATF)

ROAD TEST AND FAULT DIAGNOSIS

TESTING THE CAR

It is important to gain as much information as possible on the precise nature of any fault. In all cases the following road test procedure should be completely carried out, as there may be more than one fault.

Check that the starter will operate only with the selector in "P" and "N" and that the reverse light operates only in "R".

Apply the brakes and, with the engine at normal idling speed, select N–D, N–L, N–R. Transmission engagement should be felt in each position selected.

Check the engine stall speed (see converter diagnosis) with the transmission in "L" and "R". Check for slip or clutch break-away.

Note: Do not stall for longer than 10 seconds, or the transmission will overheat.

With the transmission at normal running temperature, select "D1". Release the brakes and accelerate with minimum throttle opening. Check for 1–2 and 2–3 shifts.

Note: At minimum throttle opening the shifts may be difficult to detect. Confirmation that the transmission is in 3rd gear may be obtained by selecting "L", when a 3–2 downshift will be felt.

At just over 30 m.p.h. (48 k.p.h.), select "N", switch off the ignition and let the car coast. At 30 m.p.h. (48 k.p.h.), switch on the ignition and select "L". The engine should start through the rear wheels, indicating that the rear oil pump of the transmission is operating.

Stop and restart, using full-throttle acceleration, i.e., accelerator at the detent. Check for 1–2 and 2–3 shifts according to the shift speed chart.

At 26 m.p.h. (42 k.p.h.), in 3rd gear, depress the accelerator to full-throttle position. The car should accelerate in 3rd gear and should not downshift to 2nd.

At 30 m.p.h. (48 k.p.h.), in 3rd gear, depress the accelerator to the kick-down position, i.e., through the detent. The transmission should downshift to 2nd gear.

At 18 m.p.h. (29 k.p.h.) in 3rd gear, depress the accelerator to the kick-down position. The transmission should downshift to 1st gear.

Stop and restart, using forced throttle acceleration (i.e., accelerator through the detent). Check for 1–2 and 2–3 shifts according to shift speed chart.

At 40 m.p.h. (64 k.p.h.) in 3rd gear, release the accelerator and select "L". Check for 3–2 downshift and engine braking. Check for inhibited 2–1 downshift and engine braking.

Stop, and with "L" still engaged, release the brakes and, using full throttle, accelerate to 20 m.p.h. (32 k.p.h.). Check for no slip or clutch break-away noise and no up-shifts.

Stop and select "R". Release the brakes and reverse, using full throttle if possible. Check for no slip or clutch break-away noise.

Stop on brakes facing downhill on gradient and select "P". Release the brakes and check that the parking pawl will hold the car. Re-apply brakes before disengaging the parking pawl. Repeat with car facing uphill.

Check that the selector is trapped by the gate in "Park" position.

At 30 m.p.h. (48 k.p.h.), in 3rd gear, D1, coast to a stop. Check roll out shifts for quality and speed in m.p.h. or k.p.h.

The front pump can be checked, with the selector in neutral, by revving the engine between idle and 2,000 r.p.m. A high pitched whine indicates a noisy front pump, a restricted front pump suction line, or a dirty oil screen.

At idle or slightly above idle speed in neutral, a gear whine indicates dragging front clutch plates. A tendency for the car to creep in neutral is a further

indication of dragging front clutch plates. Check carefully, to avoid confusing this with front pump or engine noises.

PRESSURE TESTS

See "Throttle Cable Adjustment" section and ascertain correct adjustment of throttle cable and engine idle. The pressure gauge is used to check transmission pressures, which should correspond to values given below.

Note: Figures given in table are normal for transmission temperatures from 150° to 185°F. only (65·5°C. to 85°C.).

Selector Position	Control Pressure Idle r.p.m.	Control Pressure Stall r.p.m.
D2	50–60	150–185
D1	50–60	150–185
L	50–60	150–185
R	50–60	190–210
N	55–60	—

Recording stall speed and stall pressures at the time the coverter is being checked will reduce the overall stalling time, which should be kept to a minimum.

Pressures which have been recorded should be analysed as follows: Low pressure indicates leakage in the circuit tested. Low pressure in all selector positions would indicate leakage, faulty pump or incorrect pressure regulation. High pressures, in all selector positions, indicate faulty pressure regulation incorrect cable adjustment or stuck valves.

FAULT DIAGNOSIS

Converter

If the general vehicle performance is below standard, check the engine stall speed with the revolution indicator by applying maximum pressure on the foot brake pedal, selecting lock-up, and fully depressing the accelerator. If the engine stall speed is up to 300 r.p.m. below normal, the engine is not developing its full power.

Inability to start on steep gradients combined with poor acceleration from rest indicates that the converter stator one-way clutch is slipping. This condition permits the stator to rotate in an opposite direction to the turbine and torque multiplication cannot occur. Check the stall speed, and if it is more than 600 r.p.m. below normal the converter assembly must be renewed.

Below standard acceleration in 3rd gear above 30 m.p.h. (48 k.p.h.), combined with a substantially reduced maximum speed, indicates that the stator one-way clutch has locked in the engaged condition. The stator will not rotate with the turbine and impeller, therefore the fluid flywheel phase of the converter performance cannot occur. This condition will also be indicated by excessive overheating of the transmission, although the stall speed will remain normal. The converter assembly must be replaced.

Stall speed higher than normal indicates that the converter is not receiving its required fluid supply or that slip is occurring in the clutches of the automatic gearbox.

Note: When checking stall speeds ensure that the transmission is at normal operating temperature. Do not stall for longer than 10 seconds, or the transmission will overheat.

The torque converters are sealed by welding and serviced by replacement only.

The stoneguards in the converter housing must be unobstructed.

Stall Speed Test

This test provides a rapid check on the correct functioning of the converter as well as the gearbox.

The stall speed is the maximum speed at which the engine can drive the torque impeller while the turbine is held stationary. As the stall speed is dependent both on engine and torque converter characteristics, it will vary with the condition of the engine as well as with the condition of the transmission. It will be necessary, therefore, to determine the condition of the engine in order to correctly interpret a low stall speed.

To obtain the stall speed, allow the engine and the transmission to attain normal working temperature, set the handbrake, chock the wheels and apply the footbrake. Select "L" or "R" and fully depress the accelerator. Note the reading on the revolution indicator.

Note: To avoid overheating, the period of stall test must not exceed 10 seconds.

R.P.M.	Condition Indicated
Under 1,000	Stator freewheel slip
1,600–1,700	Normal
Over 2,100	Slip in the transmission gearbox

Clutch and Band Checks

To determine if a clutch or band has failed, without removing a transmission, check as detailed below.

Refer to the chart on page FF.s.5, showing the clutches and bands applied in each gear position.

Apply the handbrake and start the engine.

Engage each gear ratio and determine if drive is obtained through the component to be checked. If a clutch or band functions in one selector position it is reasonable to assume that the element in question is normal and that trouble lies elsewhere. If the clutch or band is tried in two positions and no drive is obtained in either position, it can be assumed that the element is faulty.

Air Pressure Checks

Air pressure may be used to test various transmission components in the car on the bench. Care should be exercised when air pressure checks are being made to prevent oil blowing on the clothing or into the eyes.

Knowledge of various circuits should be acquired referring to Figs. 6 to 16. It is necessary to remove the valve body to complete these checks.

Apply air pressure to the front clutch passage. A definite thump will indicate engagement. A similar sound should be heard when the rear clutch circuit is tested.

If clutch engagement noise is indefinite it is almost certainly due to damaged piston rings.

Servo action may be watched as air is applied to apply circuits of each servo.

It can be assumed, that if air pressure checks indicate that clutches and servos are being applied normally with air pressure, then the trouble lies in the hydraulic system.

A. *Front servo apply.*
B. *Front clutch.*
C. *Rear servo.*
D. *Rear clutch.*
E. *Governor feed.*

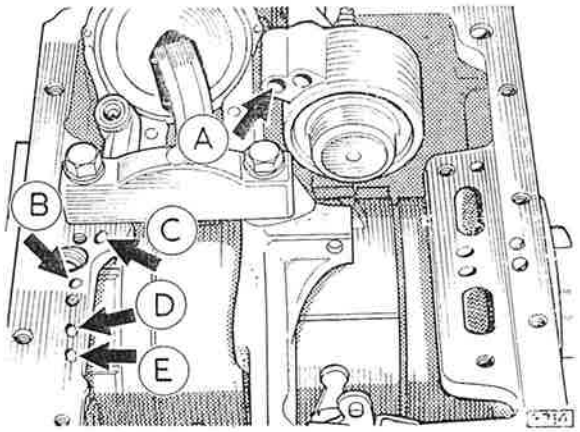


Fig. 18. *Showing pressure passages with valve body removed.*

FAULT DIAGNOSIS

	In Car	On Bench
ENGAGEMENT		
Harsh	B. D. c. d.	2, 4
Delayed	A, C, D, E, F, a, c, d	b
None	A, C, a, c, d	b, 9, 10, 11, 13
No forward	A, C, a, c, d	B, 1, 4, 7
No reverse	A, C, F, a, c, j, k, h	b, 2, 3, 6
Jumps in forward	C, D, E, F	4, 7, 8
Jumps in reverse	C, D, E	2
No neutral	C, c	2
UPSHIFTS		
No. 1–2	C, E, a, c, d, f, g, h, j	b, 5, 17
No. 2–3	C, a, c, d, f, g, h, k, l	b, 3, 17
Shift points too high	B, C, c, d, f, g, h, j, k, l	b
Shift points too low	B, c, f, g, h, l	B
UPSHIFT QUALITY		
1–2 slips or runs up	A, B, C, E, a, c, d, f, g, k	b, 1, 5
2–3 slips or runs up	C, a, c, d, f, g, h. k, l	b, 3, 5
1–2 harsh	B, C, E, c, d, f, g, h	1, 7, 8
2–3 harsh	B, C, E, s, d, f	4
1–2 Ties up or grabs	F, c	4, 7, 8
2–3 Ties up or grabs	E, F, C	4
DOWNSHIFTS		
No. 2–1	B, C, c, h, j	7
No. 3–2	B, c, h, k	4
Shift points too high	B, C, c, f, h, j, k, l	b
Shift points too low	B, C, c, f, h, j, k, l	b
DOWNSHIFT QUALITY		
2–1 Slides		7
3–2 Slides	B, C, E, a, c, d, f, g	b, 3, 5
2–1 Harsh		b, 1, 7
3–2 Harsh	B, E, c, d, f, g, 5	3, 4, 5
REVERSE		
Slips or chatters	A, B, F, d, c, g	b, 2, 3, 6

FAULT DIAGNOSIS *(continued)*

	In Car	On Bench
LINE PRESSURE		
Low idle pressure	A, C, D, a, c, d	b, 11
High idle pressure	B, c, d, e, f, g	
Low stall pressure	A, B, a, c, d, f, g, h	b, 11
High stall pressure	B, c, d, f, g	
STALL SPEED		
Too low (200 r.p.m. or more)		13
Too high (200 r.p.m. or more)	A, B, C, F, a, c, d, f	b, 1, 3, 6, 7, 9, 13
OTHERS		
No push starts	A, C, E, F, c	12
Transmission overheats	E, F, e	1, 2, 3, 4, 5, 6, 13, 18
Poor acceleration		13
Noisy in neutral	m	2, 4
Noisy in park	m	14
Noisy in all gears	m	2, 4, 14, 16
Noisy during coast (30–20 m.p.h.)		16, 19
Park brake does not hold	C, 15	15

KEY TO THE FAULT DIAGNOSIS CHART

1. **Preliminary Checks in Car**
   - A. Low fluid level.
   - B. Throttle cable incorrectly assembled or adjusted.
   - C. Manual linkage incorrectly assembled or adjusted.
   - D. Engine idle speed.
   - E. Front band adjustment.
   - F. Rear band adjustment.

2. **Hydraulic Faults**
   - (a) Oil tubes missing or broken.
   - (b) Sealing rings missing or broken.
   - (c) Valve body screws missing or not correctly tightened.
   - (d) Primary valve sticking.
   - (e) Secondary valve sticking.
   - (f) Throttle valve sticking.
   - (g) Compensator or modulator valve sticking.
   - (h) Governor valve sticking leaking or incorrectly assembled.
   - (i) Orifice control valve sticking.
   - (j) 1–2 shift valve sticking.
   - (k) 2–3 shift valve sticking.
   - (l) 2–3 shift valve plunger sticking.
   - (m) Regulator.

3. **Mechanical Faults**
   1. Front clutch slipping due to worn plates or faulty parts.
   2. Front clutch seized or plates distorted.
   3. Rear clutch slipping due to worn or faulty parts.
   4. Rear clutch seized or plates distorted.
   5. Front band slipping due to faulty servo, broken or worn band.
   6. Rear band slipping due to faulty servo, broken or worn band.
   7. One-way clutch slipping or incorrectly installed.
   8. One-way clutch seized.
   9. Broken input shaft.
   10. Front pump drive tangs on converter hub broken.
   11. Front pump worn.
   12. Rear pump worn or drive key broken.
   13. Converter blading and/or one-way clutch failed.
   14. Front pump.
   15. Parking linkage.
   16. Planetary assembly.
   17. Fluid distributor sleeve in output shaft.
   18. Oil cooler connections.
   19. Rear pump.

SERVICE ADJUSTMENTS

THROTTLE/KICKDOWN CABLE ADJUSTMENT

The importance of correct throttle cable adjustment cannot be over-emphasised. The shift quality and correct shift positions are controlled by precise movement of the cable in relation to the carburetter throttle shaft movement.

Preliminary Testing

Test the car on a flat road.

With the selector in the D1 or D2 position and at a minimum throttle opening, the 2–3 upshift should occur at 1,100–1,200 r.p.m.

A "run-up" of 200–400 r.p.m. at the change point indicates LOW pressure.

At full throttle opening, a jerky 2–3 upshift or a sharp 2–1 downshift (in D1 when stopping the car) indicates HIGH pressure.

Install a pressure gauge, 0–200 lb./sq. in. (0–14 kg./sq. cm.) in the line pressure point at the left hand rear face of the transmission unit. Start the engine and allow to reach normal operating temperature.

Select D1 or D2, apply the handbrake firmly and increase the idling speed to exactly 1,250 r.p.m.

The pressure gauge reading should be 72·5±2·5 lb./sq. in. (5·097±·175 kg/cm. sq.).

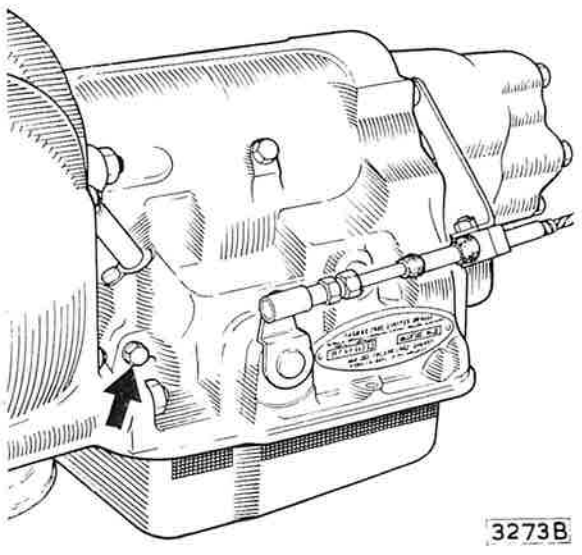


Fig. 19. *The transmission pressure take-off point.*

Adjustment

If road and pressure tests indicate that the throttle/kickdown cable setting is incorrect, adjustment is made at the fork end (see Fig. 20).

Release the fork end locknut, remove the split pin and fork end clevis pin.

To LOWER the pressure, turn the fork end clockwise: to RAISE the pressure, turn anti-clockwise.

Note: One full turn will alter the setting by 9 lb./sq. in. (·63 kg./sq. cm.).

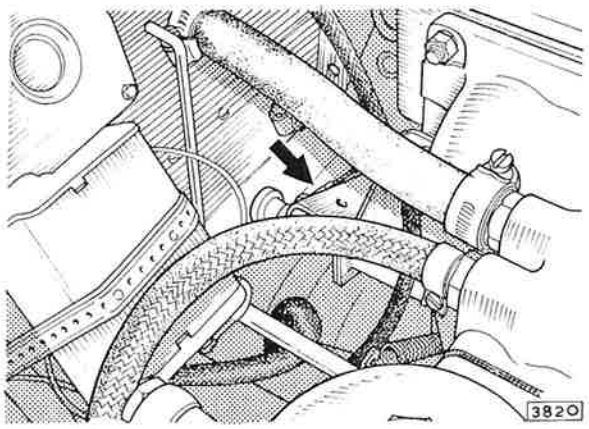


Fig. 20. *The kickdown cable adjustment.*

Slight adjustment only should be necessary; excessive adjustment will result in loss of "kickdown" or an increase in shift speeds.

Refit the fork end joint pin and split pin and tighten the locknut.

Restart the engine and check the pressure at 1,250 r.p.m.

Check that the carburetter butterfly valves are closed at idling speed after adjustment is completed.

If, after repeated attempts to stabilize the change points, the pressure still fluctuates, the throttle/kickdown inner cable may be binding or kinked and the cable should be replaced.

Throttle/Kickdown Cable Renewal

Disconnect the cable at the fork end.

Remove the cable retaining clip after withdrawing the setscrew.

Lift the carpets and the underfelts from the gearbox tunnel on the left-hand side.

Remove six drive screws and detach the aperture cover plate now exposed.

Remove the Allen-headed screw and washer retaining the outer cable.

Withdraw the outer cable and locate the spring clip securing the inner cable to the control rod operating the kickdown cam in the transmission unit.

Spring the clip open with a small screw driver and withdraw the inner cable.

Refitting is the reverse of the removal procedure.

Adjust the length of the operating cable to $3\frac{5}{16}$" (84·1 mm.) between the centre line of the clevis and the end of the outer cable.

Check that the carburetter butterfly valves are closed before commencing adjustments described under the previous heading.

MANUAL LINKAGE ADJUSTMENT

(See Fig. 23)

Remove the transmission tunnel finisher assembly and the carpet at the side of the transmission cover. Remove the rubberised felt and withdraw the set-screws securing the cover plate at the left-hand side of the transmission cover.

Loosen the linkage cable locknut and remove the cable from the transmission lever. Push the transmission lever fully forward to the Lockup detent. Place the gear selector lever in the Lockup position.

Adjust the cable end to fit freely on to the transmission lever. Temporarily re-attach the cable to the lever. Move the gear selector lever through the various positions checking that gating at positions L, D1, R and P does not interfere with the transmission lever setting at the detent positions. The transmission lever must locate the transmission detents positively. Once correct adjustment is established, be sure the linkage cable is secured to the transmission lever and the locknut is tightened.

REMOVAL OF OIL PAN

Prior to front band adjustment or a check of internal parts, the gearbox fluid must be drained and the oil pan removed. When this is done an inspection should be made. A few wear particles in the dregs of the fluid in the pan are normal. An excess of wear particles whether ferrous or non-ferrous, or pieces of band lining material, would indicate that further checking should be done. A new gasket should be used when refitting the pan and the 14 attaching screws torqued to 10–15 lb. ft. (1·38–2·07 kgm.). Always use fresh fluid when refilling.

FRONT BAND ADJUSTMENT

(See Fig. 21)

The front band should be adjusted after the first 1,000 miles (1,600 km.) of operation and at 21,000 mile (35,000 km.) intervals thereafter.

Drain the oil by removing the oil filler connection and remove the oil pan. Loosen the adjusting screw locknut on the servo, apply lever and check that the screws turn freely in the lever. Install a $\frac{1}{4}$" (6·4 mm.) thick gauge block between the servo piston pin and the servo adjusting screw, then tighten the adjusting screw with a suitable torque wrench or adjusting tool until 10 lb. ins. (0·12 kgm.) is reached. Retighten the adjusting screw locknut to 20–25 lb. ft. (2·76–3·46 kgm.). Remove the $\frac{1}{4}$" (6·3 mm.) spacer.

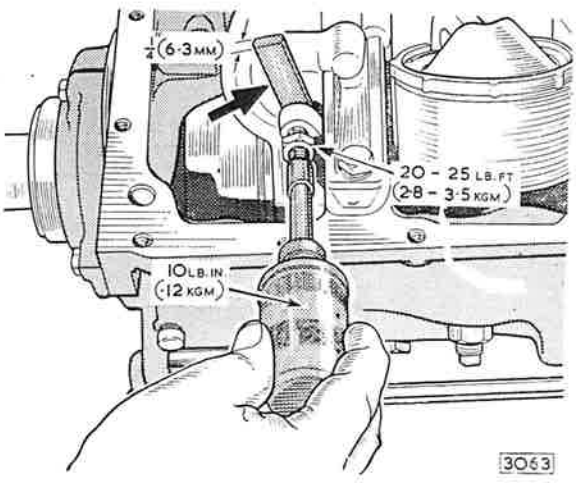


Fig. 21. *Front band adjustment.*

REAR BAND ADJUSTMENT

The rear band adjustment at the first 1,000 miles (1,600 km.) and at 21,000 miles (35·000 km.) intervals thereafter is made externally. To make the adjustment, first loosen and back off the adjusting screw locknut three or four turns and then make sure that the adjusting screw works freely in the threads in the case. Turn the adjusting screw in with a torque wrench or special tool for this purpose to 10 lb. ft. (1·382 kgm.) torque reading. Back the adjusting screw off $1\frac{1}{2}$ turns exactly, then retighten the locknut to 35–40 lb. ft. (4·84–5·53 kgm.). The adjusting screw is on the right-hand side of the casing and an access hole is provided in the transmission cowl.

GOVERNOR

The governor can be inspected without removal of the oil pan. Remove the inspection cover and gasket. This will expose the governor, but the output shaft may have to be turned to position the governor head at the opening. First check for freedom of the valve by pushing and pulling on the governor weight. If removal of the governor body is desired, take out the two screws which retain it, being careful that they are not dropped inside the extension housing After removal of the body, dismantle it completely and clean all parts. When reassembling the governor, torque the governor body plate screws to 20–30 lb. in. (0·24–0·36 kgm.). When replacing the governor body on to the transmission, torque the screws which retain it to 50–60 lb. in. (0·60–0·72 kgm.). Replace the governor inspection cover, using a new gasket and torque its retaining screws to 50–60 lb. in. (0·60–0·72 kgm.).

It should be noted that if any of the four governor screws mentioned above are loose, the governor will not function correctly.

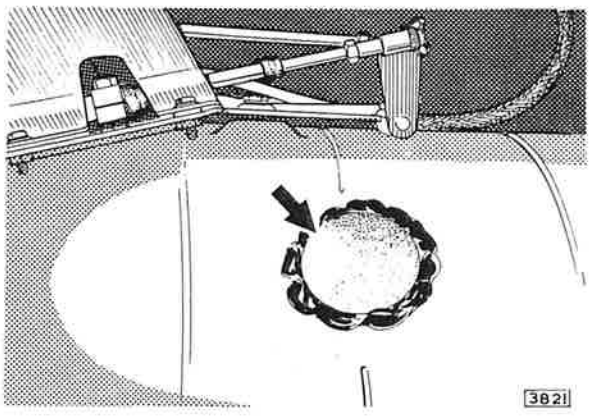


Fig. 22. *Rear band adjustment access point.*

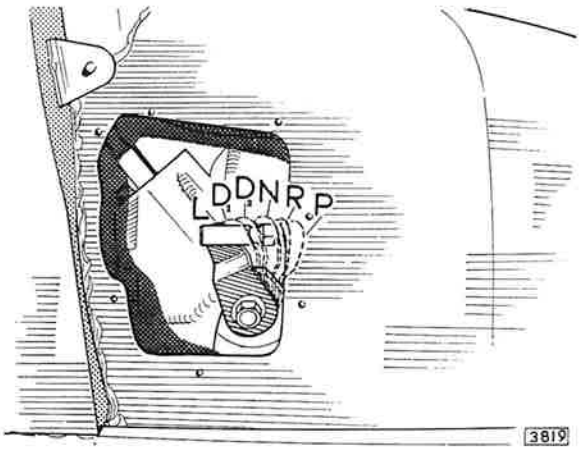


Fig. 23. *Manual selector linkage adjustment.*

TRANSMISSION UNIT

REMOVAL AND REFITTING

To remove the transmission unit, it is necessary to withdraw the engine and transmission as a complete unit from the car before separating the transmission.

Removal

Disconnect the battery.

Remove the bonnet.

Drain the cooling system and cylinder block. Conserve the coolant if antifreeze is in use.

Slacken the clip on the breather pipe; unscrew the two wing nuts and withdraw the top of the air cleaner.

Disconnect the petrol feed pipe under the centre carburetter.

Slacken the clamps and remove the water hoses from the cylinder head and radiator to the header tank.

Remove the transmission oil cooler pipes from the radiator block.

Remove the heater hoses from the inlet manifold.

Disconnect the brake vacuum pipe.

Pull off the two Lucar connectors from the fan control thermostat in the header tank.

Remove the two bolts securing the header tank mounting bracket to the front cross member. Remove two nuts and two bolts securing the header tank straps to the radiator and fan cowl. Remove the header tank complete with bracket and straps.

Disconnect the throttle linkage at the rear carburetter and the kickdown cable at the rear of the cylinder head.

Disconnect:—

The two coil leads.

The water temperature transmitter cable.

The battery cable and solenoid switch cable from the starter motor.

The oil pressure cable at the top of the oil filter body.

The main harness connector and the Lucar connector for the 3AW warning light control from the alternator.

The engine earth strap from the left-hand side member.

Withdraw the bolt securing the oil filter canister and remove the canister complete with filter. Catch the escaping oil in a drip pan.

Remove the crankshaft pulley; damper and drive belt. Remove the ignition timing pointer from the sump. Mark the pulley and damper to facilitate refitting.

Slacken the two clamps of the water pump hose and withdraw the hose.

Remove the revolution counter generator complete with cables.

Remove the four nuts and washers securing each exhaust downpipe to the manifold. Unclip the pipes at the silencers and withdraw the downpipes. Collect the sealing rings between the downpipes and the manifold.

Withdraw the transmission dipstick and unscrew the dipstick tube from the oil pan.

Place the selector lever in L and withdraw the nut securing the selector cable adjustable ball joint to the transmission lever. Release the nut securing the outer cable clamp to the abutment bracket.

Remove the two lower nuts securing the torsion bar reaction tie plate on each side and tap the bolts back flush with the face of the tie plate. With the aid of a helper, place a lever between the head of the bolt just released and the torsion bar. Exert pressure on the bolt head to relieve the tension on the upper bolt. Remove the nut and tap the upper bolt back flush with the face of the tie plate. Tap the tie plate off the four bolts.

Note: Failure to relieve the tension on the upper bolts when tapping them back against the face of the tie plate will result in stripping the threads. If this occurs, new bolts must be fitted and the torsion bars re-set.

Disconnect the speedometer cable from the rear extension of the transmission unit.

Support the engine by means of two individual lifting tackles using the hooks on the cylinder head. Insert a trolley jack under the transmission and support the unit.

Remove the self-locking nut and stepped washer from the engine stabiliser.

Remove the bolts securing the rear mounting plate. Disconnect the propeller shaft at the front universal joint.

Remove the bolts from the front engine mountings.

Raise the engine on the lifting tackles and, keeping the unit level, move forwards ensuring that the converter housing clears the torsion bar anchor brackets and that the water pump pulley clears the sub-frame top cross member. Carefully raise the front of the engine and withdraw the complete unit forwards and upwards.

Refitting

Reverse the removal procedure to refit the transmission and engine. IT IS IMPORTANT that the engine stabiliser is adjusted properly and that the kickdown linkage is set correctly when refitting.

TRANSMISSION UNIT

Removal

Disconnect the kickdown linkage at the operating shaft. Drain the oil from the transmission unit. Remove the bolts securing the transmission to the converter housing and withdraw the unit.

TORQUE CONVERTER AND FLYWHEEL

Removal

Withdraw the cover from the front of the converter housing. Remove the starter motor and withdraw the setscrews securing the converter housing to the engine.

Remove the four setscrews, accessible through the starter motor mounting aperture, securing the torque converter to the flywheel. Rotate the engine to gain access to each setscrew in turn.

Remove the setscrews and locking plate securing the flywheel to the crankshaft and withdraw the flywheel.

TRANSMISSION
DISMANTLING AND ASSEMBLY

TRANSMISSION—DISMANTLING

Dismantling should not begin until the transmission exterior and work area have been thoroughly cleaned.

Place the transmission (bottom side up) on a suitable stand or holding fixture.

Remove the oil pan bolts, oil pan and gasket. Remove the oil screen retaining clip, lift off the oil screen from the regulator; lift and remove the screen from the rear pump suction tube. (See Fig. 24).

Use a screwdriver to prise the compensator tube from the valve body and regulator assemblies (Fig. 25).

The control pressure tube should be prised from the valve body, then removed from the regulator (Fig. 26).

Remove the rear pump suction tube by pulling and twisting it at the same time.

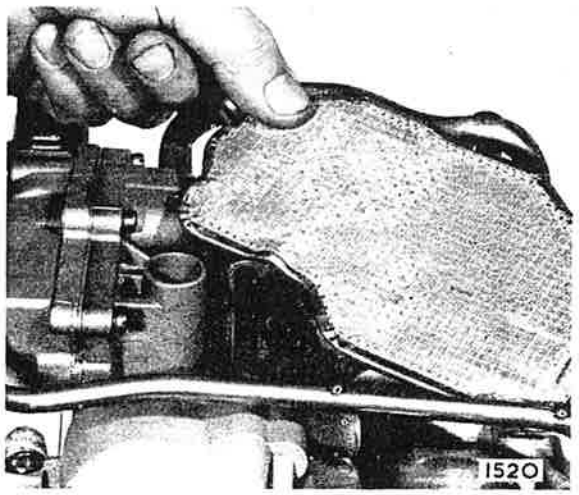


Fig. 24. *Removing the screen from the rear suction tube.*

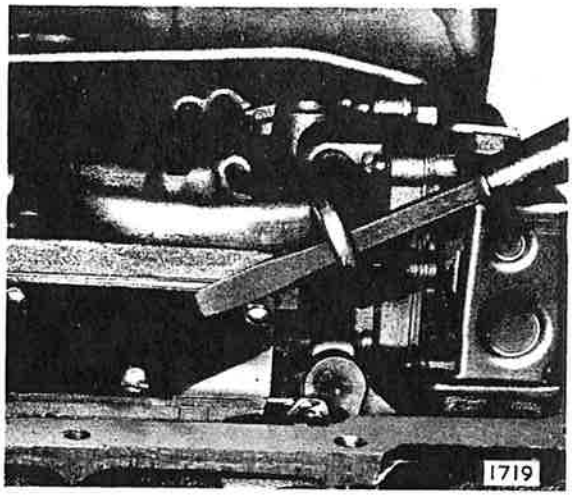


Fig. 25. *Removing the compensator tube.*

Carefully remove the pressure regulator spring retainer. Maintain pressure on the retainer to prevent distortion of the retainer, and sudden release of the springs (Fig. 27).

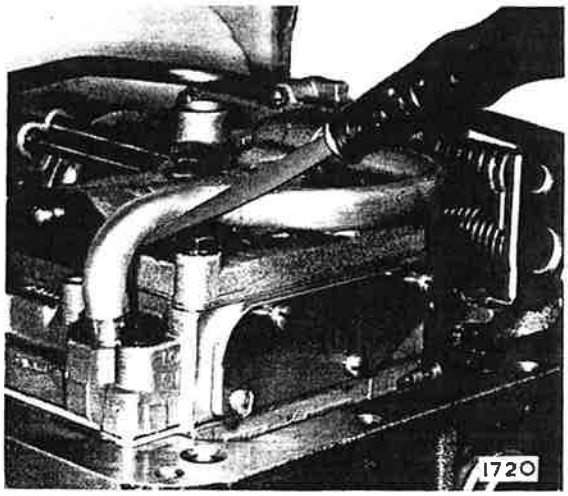


Fig. 26. *Removing the line pressure tube.*

Remove springs and spring pilots, but do not remove the regulator valves at this time. The valves will be protected as long as they remain in the regulator body.

Remove the two regulator attaching capscrews and lockwashers, then lift the regulator assembly from the transmission case (Fig. 28).

Loosen the front and rear servo adjusting screw locknuts and adjusting screws. This will aid in dismantling and later, in assembling, the transmission.

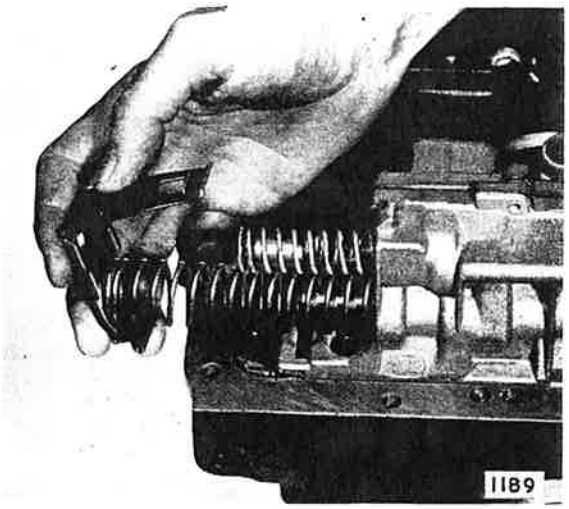


Fig. 27. *Removing the pressure spring retainer.*

Remove the three valve body attaching capscrews and lockwashers (Fig. 29).

Loosen the front servo to case capscrew and lockwasher approximately $\frac{5}{16}$″ (7·94 mm.) (Fig. 30).

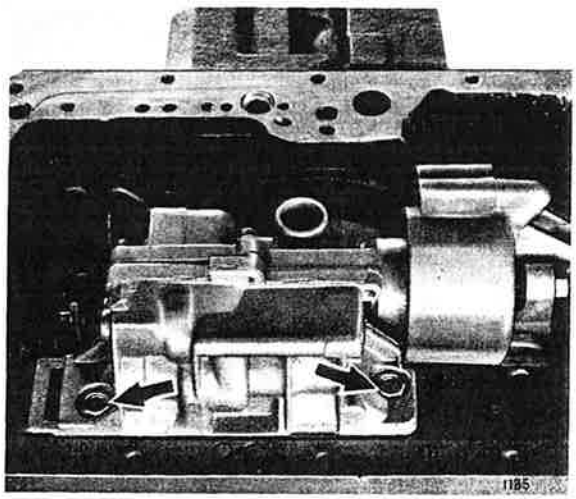


Fig. 28. *The regulator retaining screws.*

Place the manual selector lever in park or reverse position. Lift the valve body until the throttle control rod will clear the manual detent lever, then remove the hook from the throttle cam using the index finger or a screwdriver.

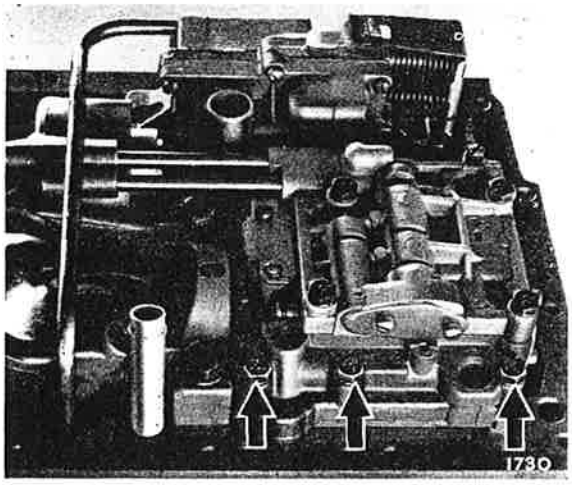


Fig. 29. *The valve body attaching screws.*

Lift the valve body and servo until the valve body will clear the linkage and slide it off the servo apply and release tubes (Fig. 31).

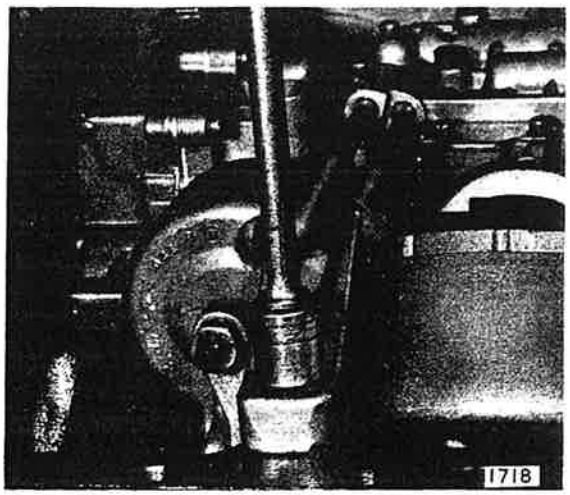


Fig. 30. *Slackening the front servo screws.*

Remove the front servo apply and release tubes (Fig. 32).

Remove the front servo bolt and lift the servo from the transmission, catching the servo strut with the index and middle finger of the left hand (Fig. 33).

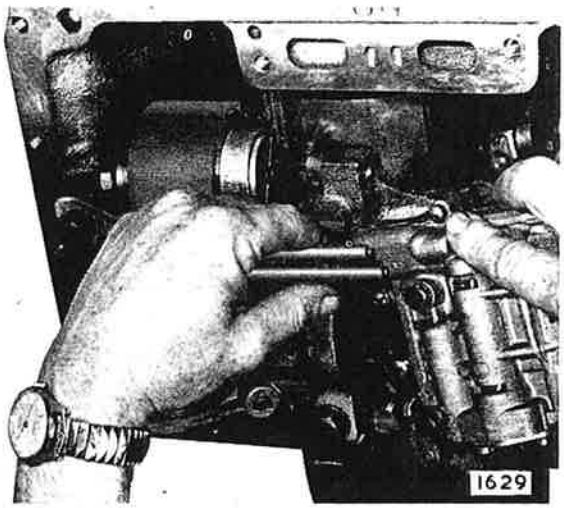


Fig. 31. *Lifting the valve body to clear the front servo.*

Remove the two rear servo attaching capscrews and lockwashers, then lift the rear servo assembly from the transmission (Fig. 34).

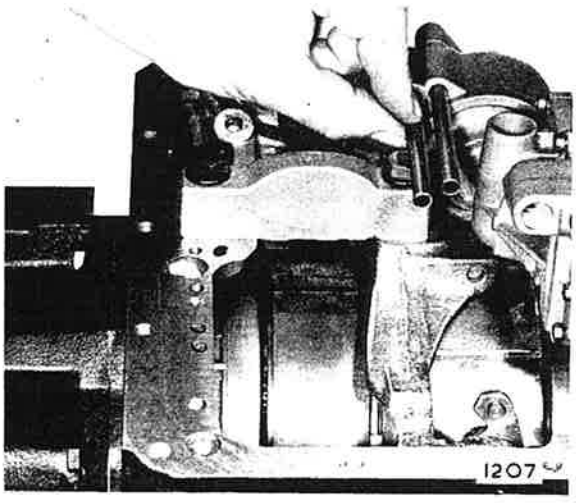


Fig. 32. *Withdrawing the apply and release tubes.*

Remove the rear band apply and anchor struts.

Remove the rear pump outlet tube, using special extractor tool Part No. CWG.45 (Fig. 35).

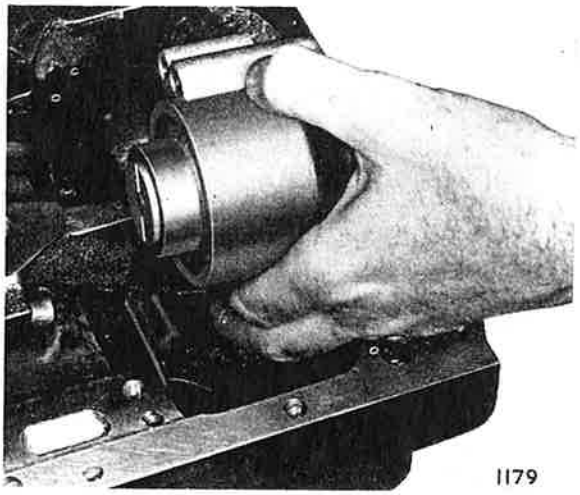


Fig. 33. *Removing the front servo.*

Check the end play at this time. Should the end play need correcting it will be done during assembly of the transmission (see Fig. 36). Place an indicator against the end of the input shaft. Prise between the front of the case and the front clutch to move clutch assemblies to their extreme rearward position. Set the indicator to "O". Prise between the planet carrier and the internal gear with a screwdriver to move the clutches to their extreme forward position. Read the end play on the indicator. The allowable limits are 0·008″–0·044″ (0·2–1·1 mm.). It is preferable to have approximately 0·020″ (0·5 mm.). Should correction be necessary, remove the output shaft, extension housing and companion flange as an assembly so that the selective washer can be changed.

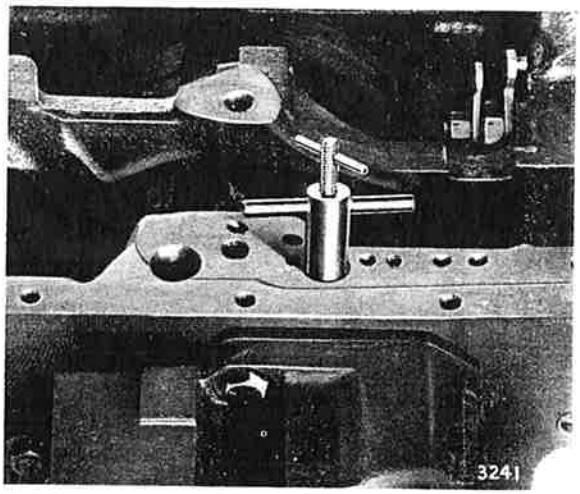


Fig. 35. *Removing the rear pump outlet tube (Extractor Tool Part No. CWG45).*

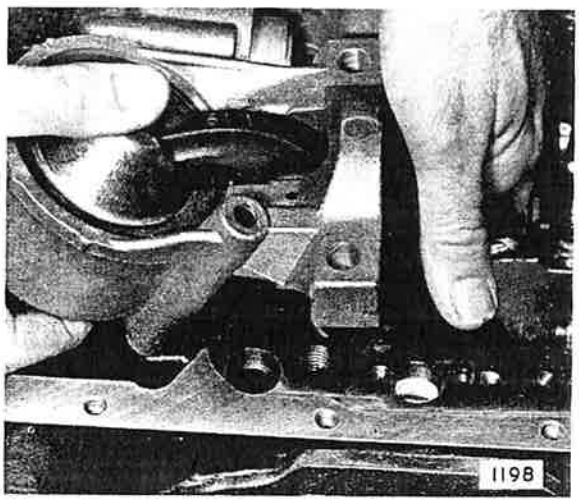


Fig. 34. *Removing the rear servo.*

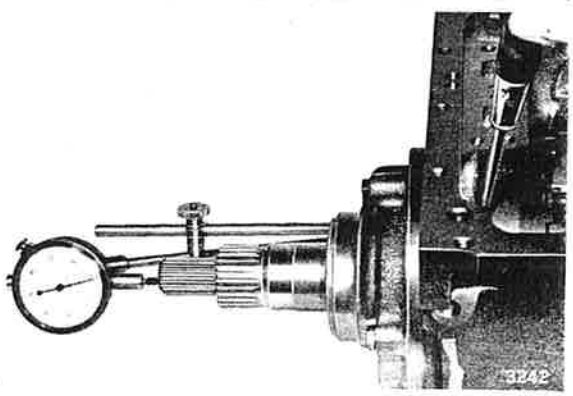


Fig. 36. *Checking end play.*

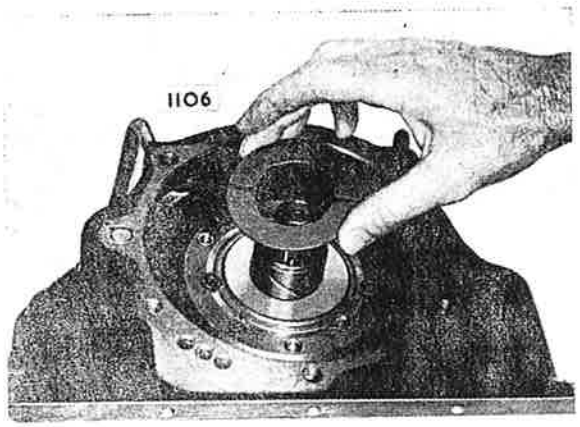


Fig. 37. *Removing the selective thrust washer.*

Selective thrust washers are available in the following thicknesses:

0·061″–0·063″	0·074″–0·076″	0·092″–0·094″
(1·53–1·58 mm.)	(1·85–1·90 mm.)	(2·3–2·35 mm.)
0·067″–0·069″	0·081″–0·083″	0·105″–0·107″
(1·68–1·73 mm.)	(2·03–2·08 mm.)	(2·63–2·68 mm.)

Place the shift selector in park position to hold the output shaft, then remove the companion flange nut, lockwasher, flat washer and flange.

Remove the bearing retainer capscrews, the bearing retainer and the bearing retainer gasket.

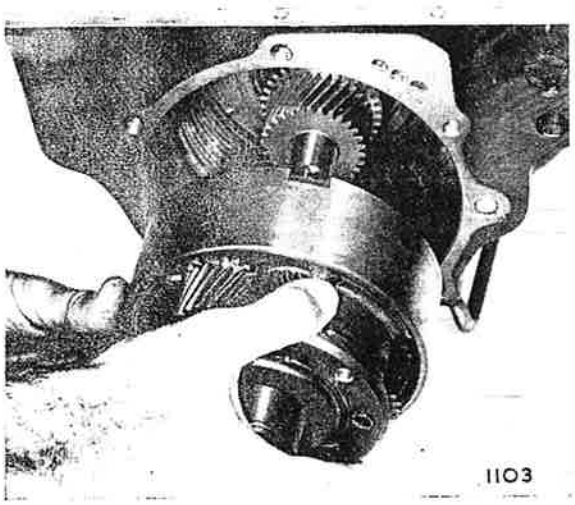


Fig. 38. *Removing the planet carrier.*

Slide the speedometer drive gear off the output shaft.

Remove the governor inspection cover and gasket.

Remove the five extension housing capscrews and remove the output shaft and extension housing assembly.

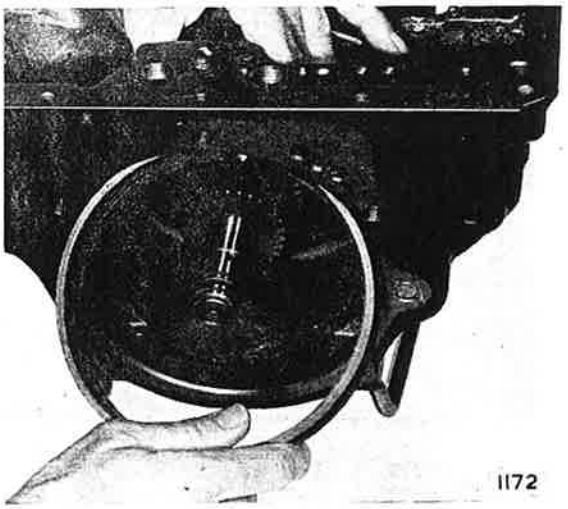


Fig. 39. *Removing the rear band.*

Remove the two hook type seal rings from the rear of the primary sun gear shaft.

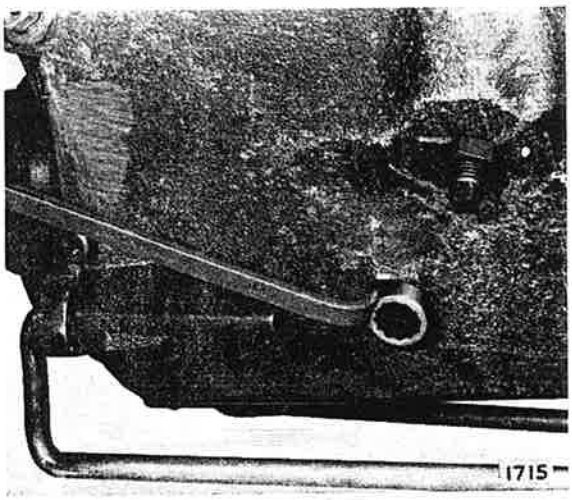


Fig. 40. *Removing one of the centre support bolts.*

Remove the selective thrust washer from the rear of the planet carrier (Fig. 37).

Pull the planet carrier from the transmission (Fig. 38).

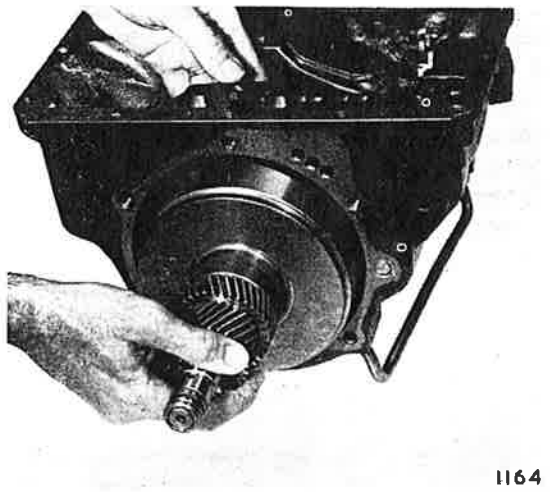


Fig. 41. *Removing the clutch assemblies.*

Pull the rear band through the rear opening of the transmission. Hold the two ends of the band together with the left hand while pulling rearward through the rear of the case with the right hand (Fig. 39).

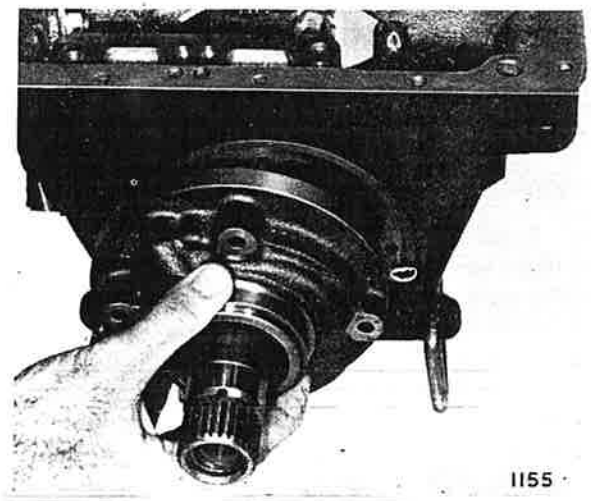


Fig. 42. *Removing the front pump.*

Remove the two centre support bolts; one from each side of the case (Fig. 40).

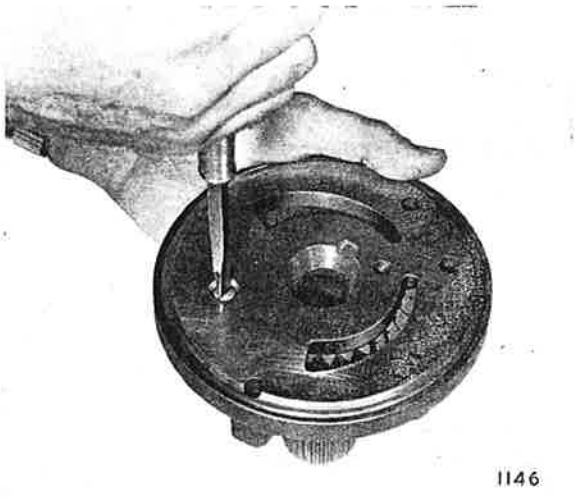


Fig. 43. *Removing the attaching setscrew.*

Remove the centre support, push on the end of the input shaft to start the rearward movement of the centre support.

Remove the front and rear clutch assemblies, placing them in a suitable stand for dismantling (Fig. 41). (The planet carrier can be used as a stand for dismantling and assembling the clutches).

Remove the front band (up and out of the case).

Remove the front pump oil seal. Use a seal puller or punch.

Remove the four front pump attaching capscrews and lift off the front pump (Fig. 42).

Remove the front pump oil seal ring from the case.

Front Pump—Dismantling

Remove the stator support attaching screw and remove the stator support (Fig. 43). Mark the top of the internal and external gears with marking ink or a crayon. Lift the gears from the pump body.

Inspect the pump body, the internal and external tooth gears, and stator supports for scores, scratches and excessive wear.

Minor scratches and scores can be removed with crocus cloth or jewellers' rouge. However, parts showing deep scratches, scores or excessive wear should be replaced. If excessive wear or scoring is observed, replace the complete pump assembly (since the gears and body are carefully matched when built, these parts should not be interchanged or individually replaced).

Front Pump—Assembling

Drive a new seal into the pump body until it bottoms.

Lubricate all pump parts with transmission fluid before assembly. Install the internal and external gears in the pump body with marks previously made in the upward position. Insert the stator support on the pump body and install the retaining screw. Torque the screw to 25–35 lb. in. (0·29–0·40 kgm.). Check the gears for free movement.

Manual Linkage—Dismantling

Pull the retainer clip from the forward end of the linkage rod (Fig. 44). Disconnect the rod from the manual valve detent lever. Release the detent ball and spring by rocking the manual valve lever to the extreme of its travel. The ball will be released with considerable force, but can be caught in a shop towel or even in the hands. Remove the manual lever locknut, the manual detent lever, and then pull the manual control lever from the transmission. Prise the manual lever oil seal from the transmission case with a screwdriver.

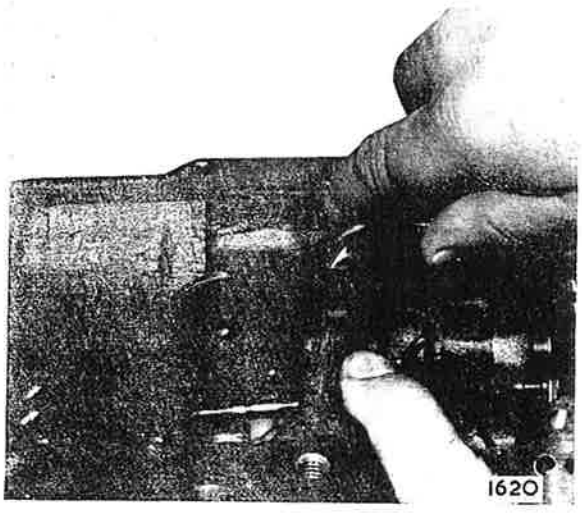


Fig. 44. *Removing the retainer clip from the linkage rod.*

Manual Linkage—Assembling

Install a new manual lever oil seal. Assemble the manual control lever through the transmission case boss. Place the manual valve detent lever and locknut on the manual control lever shaft. Rock the manual valve lever to its extreme travel, then install the detent spring. Place the ball in position on the spring, then using the lubrication ball and spring (Fig. 45), rock the manual valve lever back over the ball and spring. Connect the linkage rod and insert the retainer spring clip.

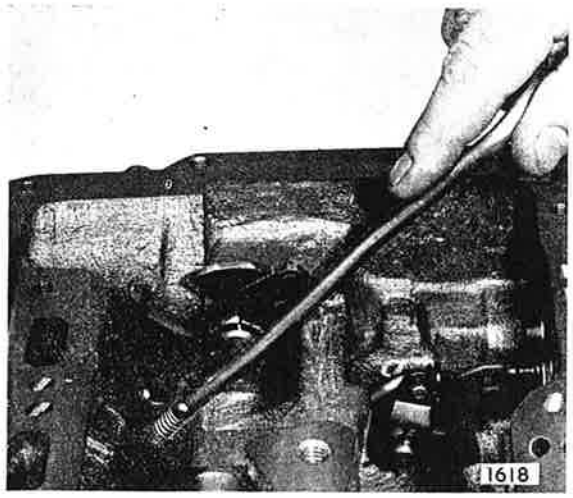


Fig. 45. *Releasing the detent ball.*

Park Linkage—Dismantling

Pull the retainer clip from the rear of the parking brake linkage rod. Disconnect the linkage rod from the torsion lever. Remove the retainer spring from the torsion lever pin and slide the washer with the torsion lever off the pin. Tap the toggle lever rearward to loosen the pin retainer (Fig. 46), then pull the retainer using snap ring pliers (Fig. 47). The toggle lever pin and toggle lever can now be removed. A magnet may be used to pull the parking pawl anchor pin from the transmission case. The parking pawl is now free to be removed.

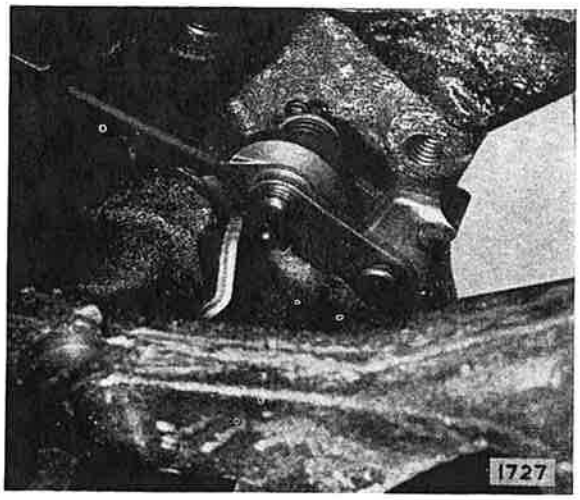


Fig. 46. *Tapping the toggle lever rearwards.*

Parking Linkage—Assembling

Assemble the parking pawl and shaft. Use a new toggle lever retainer to assemble the toggle lever and toggle pin. Assemble the torsion lever pin, then the washer, and then place the retainer spring on the torsion lever pin. Connect the linkage rod to the torsion lever and insert the spring clip.

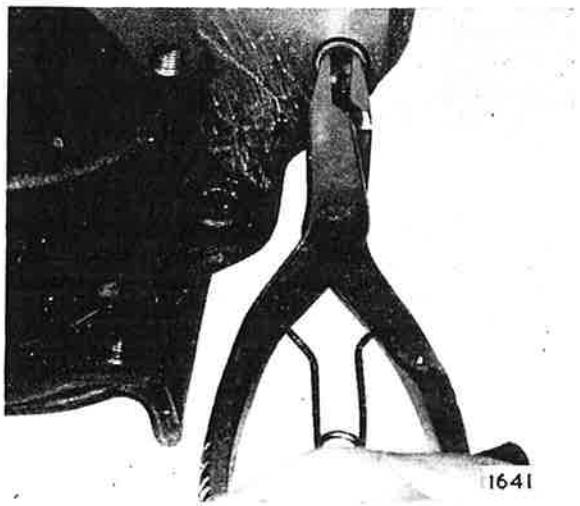


Fig. 47. *Removing the toggle lever pin retainer.*

Clutches—Dismantling

Place the clutch pack in a suitable stand. The planet carrier will work very well for this purpose.

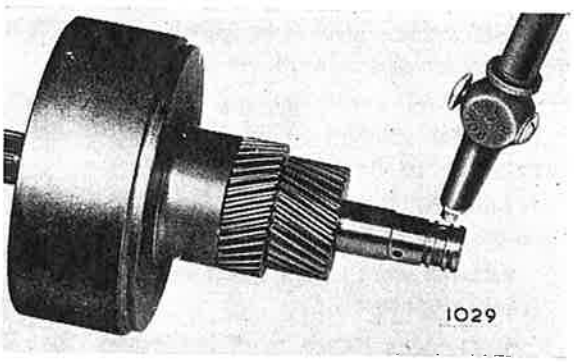
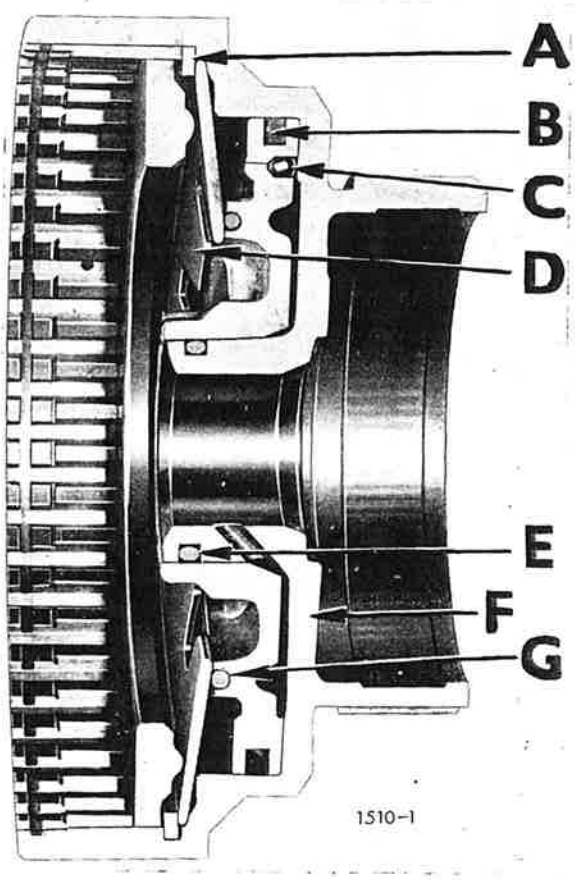


Fig. 48. *Applying compressed air to the clutch feed hole.*



A. *Clutch spring ring.*
B. *Sealing ring.*
C. *$\frac{3}{16}$" steel ball.*
D. *Clutch spring.*
E. *Sealing ring.*
F. *Cylinder.*
G. *Piston.*

Fig. 49. *Sectioned view of the clutch front drum.*

Lift the complete front clutch assembly from the rear clutch and forward sun gear.

Remove the snap ring and lift the input shaft from the clutch cylinder. (The clutch hub thrust washer may stick to the input shaft).

Lift the clutch hub and thrust washer from the clutch assembly.

Lift the front clutch plates and the pressure plate from the assembly.

Remove the clutch return spring snap ring and then the return spring. It is not necessary to compress the spring to remove the snap ring.

Compressed air applied to the clutch feed hole in the clutch hub will force the piston from the clutch cylinder (Fig. 48).

Remove the rubber seal rings from the clutch hub and clutch piston.

Remove the two front clutch sealing rings from the forward sun gear shaft (Fig. 50).

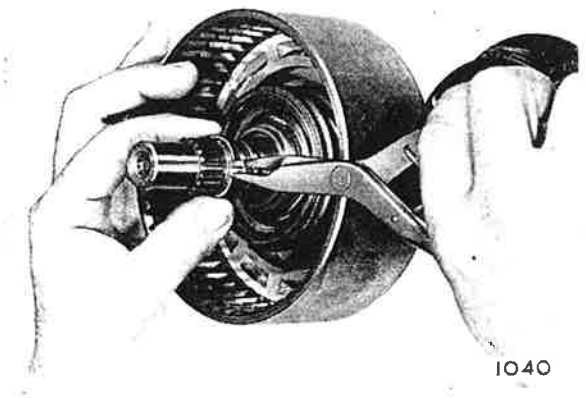


Fig. 50. *Removing the two front clutch sealing rings.*

Remove the thrust washer and thrust plate from the shoulder of the rear clutch hub.

Lift the rear clutch assembly up and off the forward sun gear shaft.

Remove the rear clutch ring.

Remove the clutch pressure plate and the clutch plates.

Use the service tool to compress the clutch return spring, then remove the spring retainer snap ring. Release the spring, but do not permit the spring retainer to catch in the snap ring groove as the spring is being released (Fig. 51).

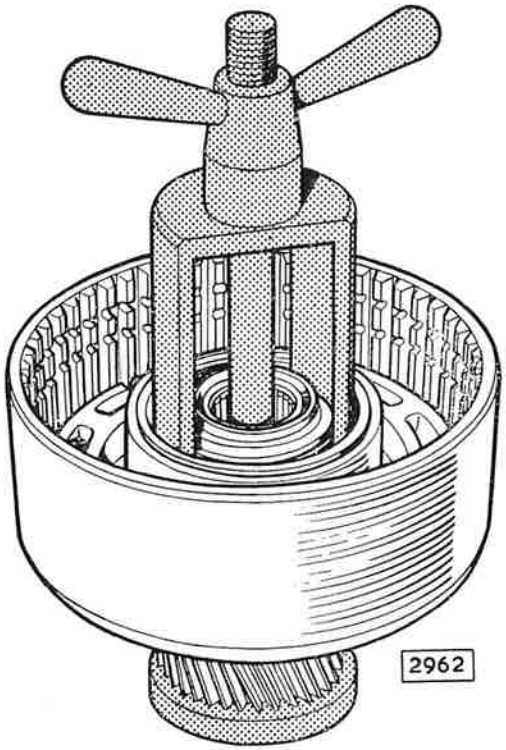


Fig. 51. *Dismantling the clutch using the special tool (Part No.* CBW37A).

Replace the forward sun gear shaft in the clutch hub, being careful not to break the cast iron sealing rings. The clutch piston can now be removed from the clutch cylinder by blowing compressed air through the rear clutch passage of the forward sun gear.

Remove the forward sun gear from the clutch cylinder and remove the two rear clutch sealing rings from their grooves in the shaft.

Remove the rubber seal rings from the clutch hub and the clutch piston.

Inspection of Clutches

Inspect all parts for burrs, scratches, cracks and wear. Check all the front clutch plates and the rear clutch friction plates for flatness. Check the rear

clutch steel plates for proper cone. Lay plates on a flat surface when checking for flatness and cone. Cone should be 0·010″ to 0·020″ (0·25 to 0·5 mm.). Replace friction plates when wear has progressed so that the grooves are no longer visible. Replace all warped plates. Replace complete set of steel or friction plates in any clutch. Do not replace individual plates (Fig. 52).

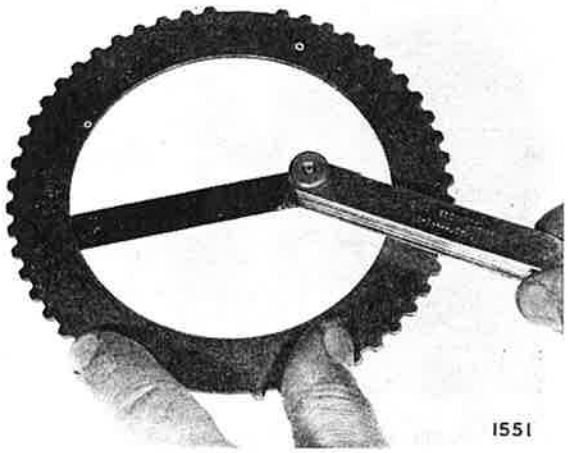


Fig. 52. *Checking a clutch plate.*

Inspect the band surfaces of the drum for wear. If only slightly scored the drum may be refaced. Renew if excessive.

Inspect the clutch bushing and the needle bearing for wear and brinelling and for scores. The cast iron sealing rings are normally replaced. If the transmission is being rebuilt and has had little service, the rings may be re-used if they have not worn excessively and are not scratched or distorted.

Inspect the forward sun gear for broken or worn teeth. Inspect all journals and thrust surfaces for scores. Inspect all fluid passages for obstruction or leakage. Inspect the front clutch lubrication valve for freedom (Fig. 53).

Clutches—Assembling

Place the planet carrier on the assembly bench.

Place the forward sun gear in the carrier. Be sure the thrust washer is on the shaft (Fig. 54).

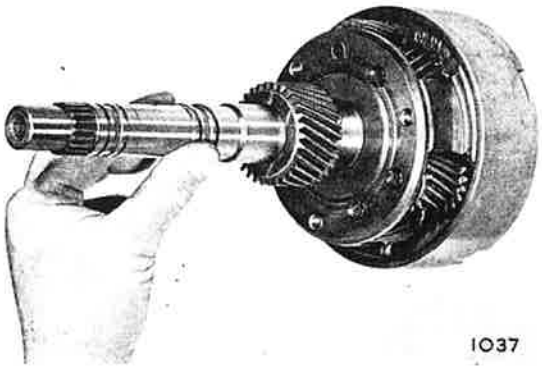


Fig. 54. *Placing the forward sun gear on the carrier.*

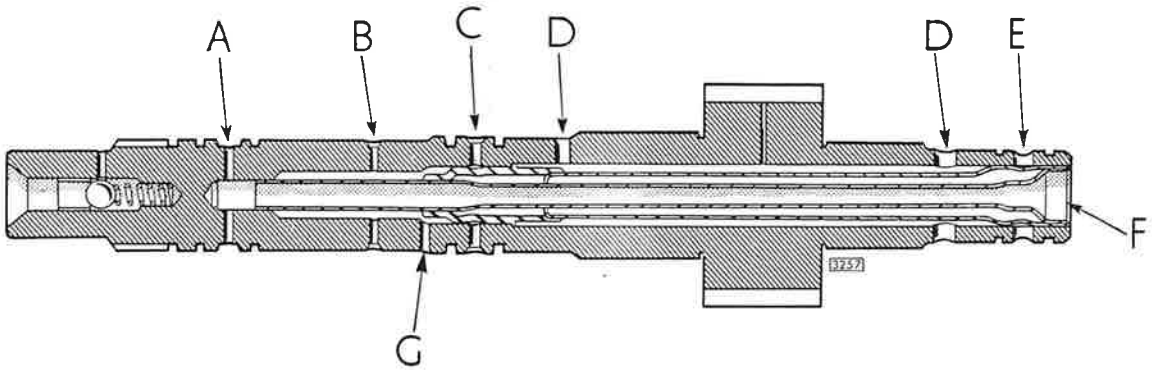


Fig. 53. *Longitudinal section of the forward sun gear showing oil ways. A, F—Front clutch: C, E—Rear clutch: B, D, G—lubrication.*

Assemble the rubber "O" ring in its groove on the rear clutch hub (Fig. 55).

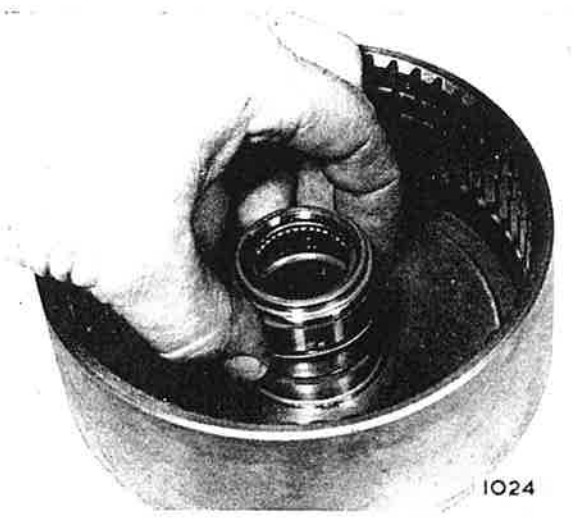


Fig. 55. *Fitting the "O" ring on the rear clutch hub.*

Assemble the square section rubber seal ring in its groove on the rear clutch piston (Fig. 56).

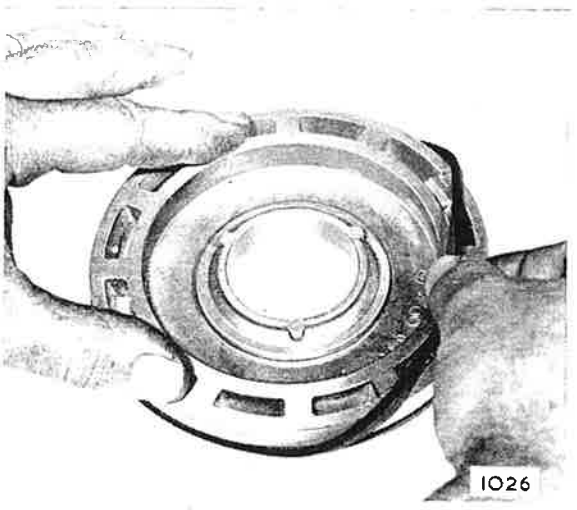


Fig. 56. *Fitting the rear clutch piston sealing ring.*

Assemble the clutch piston in the rear clutch cylinder using Tool Part No. CWG.41 to force it into position. Be sure to lubricate the seal rings so that they will assemble easier.

Place the rear clutch return spring and spring retainer in position on the clutch piston. The rear clutch spring fixture is then used to compress the spring, then the snap ring is assembled in its groove in the clutch.

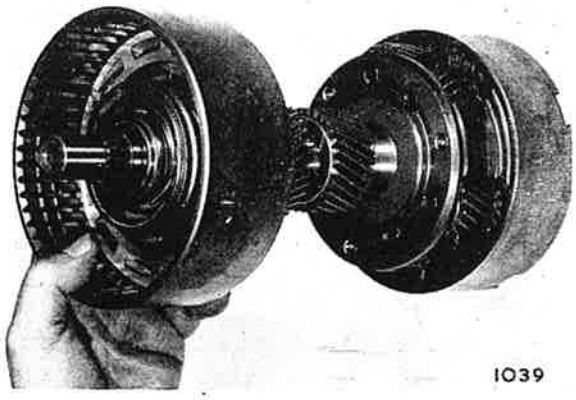


Fig. 57. *Fitting rear clutch over primary sun gear ring.*

Install the rear clutch cast iron sealing rings in their grooves on the forward sun gear. Be sure that the rings are free in their grooves. Centre each ring in its groove, so that ends do not overlap edges of groove.

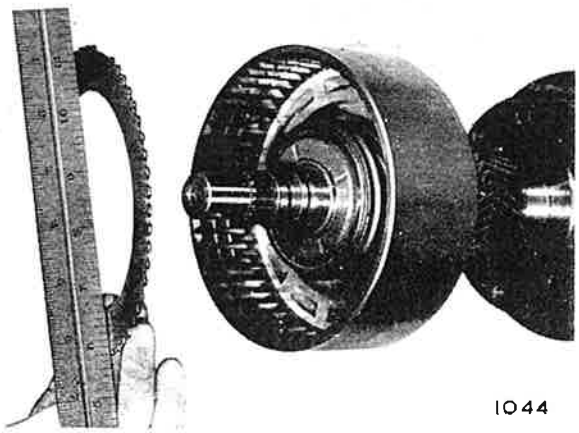


Fig. 58. *Fitting a rear clutch steel plate.*

Place the rear clutch piston and cylinder assembly over the forward sun gear and gently slide it down over the sealing rings (Fig. 57).

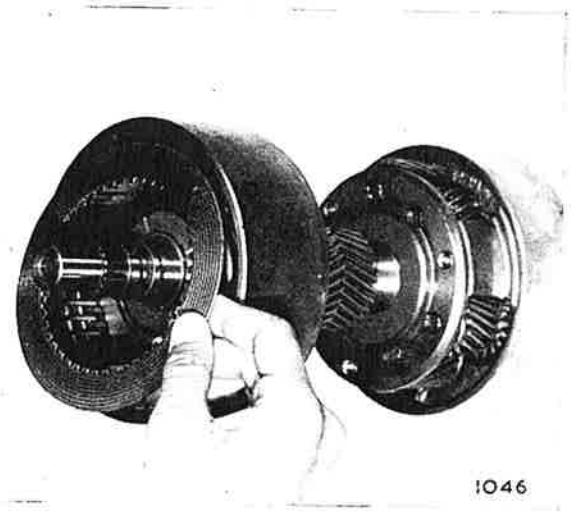


Fig. 59. *Fitting a rear clutch friction plate.*

Install a rear clutch steel plate with its concave face up or forward facing in the transmission. Note that these plates are identified by missing teeth on the O.D. and are not interchangeable with front clutch steel plates (Fig. 58).

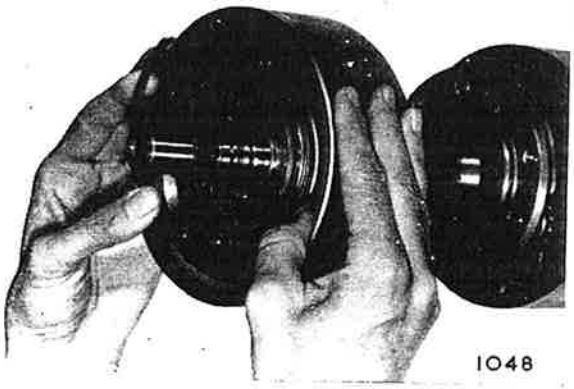


Fig. 60. *Fitting the snap ring.*

Install a rear clutch friction plate, then alternating with first a steel and then a friction plate, complete the clutch pack (Fig. 59).

Install the rear clutch pressure plate.

Install the rear clutch snap ring. This ring has one tanged end (Fig. 60).

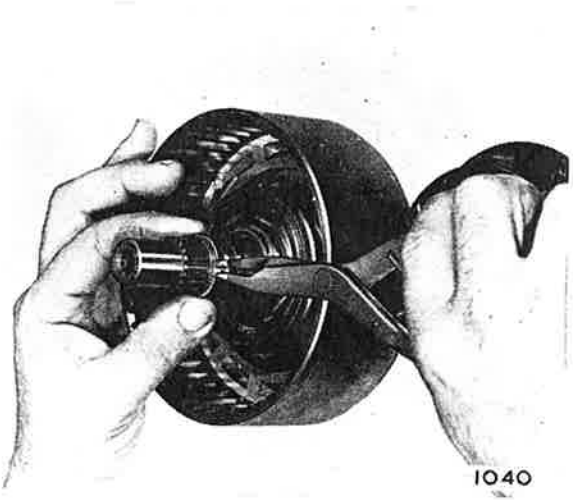


Fig. 61. *Fitting the sealing rings.*

Install the front clutch cast iron sealing rings in their grooves on the forward sun gear. Centre each ring in its groove so that ends do not overlap edges of the groove (Fig. 61).

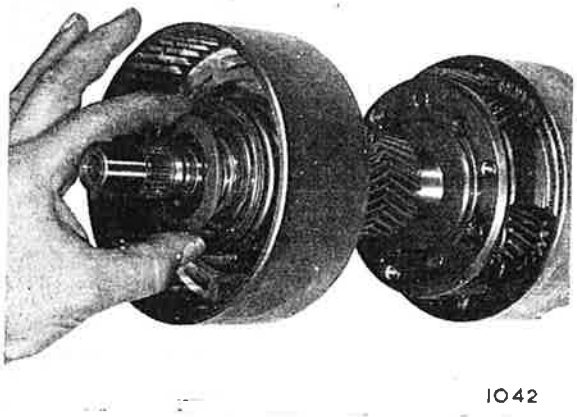


Fig. 62. *Fitting the front thrust plate.*

Install the front clutch cylinder thrust plate (Fig. 62). Be sure flats on the washer match flats on shaft.

Install the front clutch cylinder thrust washer (Fig. 63).

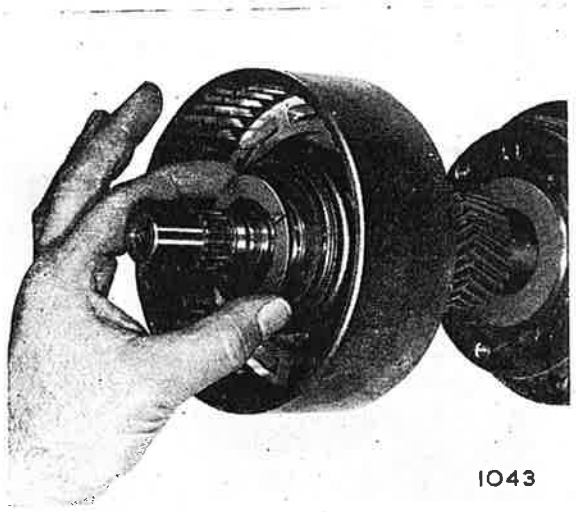


Fig. 63. *Fitting the front clutch cylinder thrust washer.*

Assemble the front clutch hub "O" ring into its groove in the clutch hub.

Assemble the front clutch piston square section rubber sealing ring in the groove of the clutch piston.

Install the clutch piston into the clutch cylinder after thoroughly lubricating the parts. Press the piston into position using Tool Part No. WG.42.

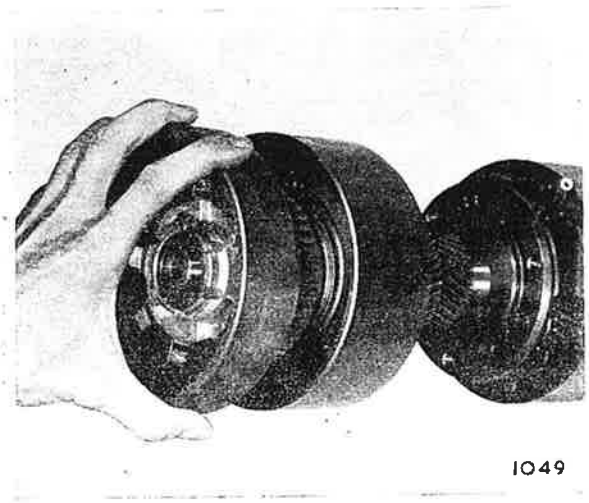


Fig. 64. *Assembling the front clutch.*

Install the front clutch belleville spring and snap ring. This snap ring is thicker than the other two clutch snap rings and has two tanged ends instead of one.

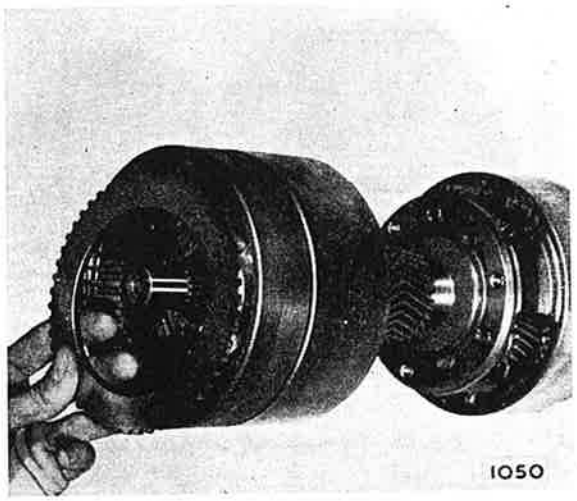


Fig. 65. *Fitting the front pressure plate.*

Assemble the front clutch assembly over the forward sun gear shaft and into the rear clutch, being careful not to distort or break the cast iron sealing rings. Use a short oscillating movement to engage splines of the rear clutch friction plates (Fig. 64).

Install the front clutch pressure plate (Fig. 65).

Install the front clutch hub, followed by front clutch hub thrust washer (Fig. 66).

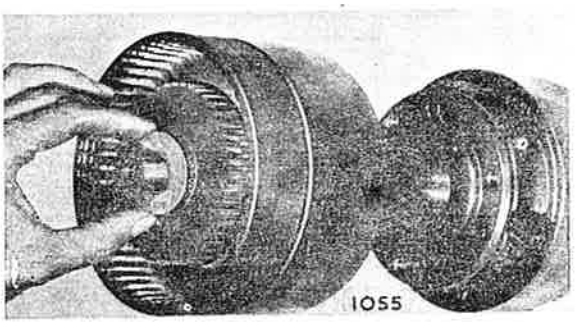


Fig. 66. *Fitting the front clutch hub thrust washer.*

Install a front clutch friction plate over the splines of the hub (Fig. 67). Next, install a front clutch outer plate, meshing splines in the cylinder, alternating as above, complete assembly of plates (Fig. 68).

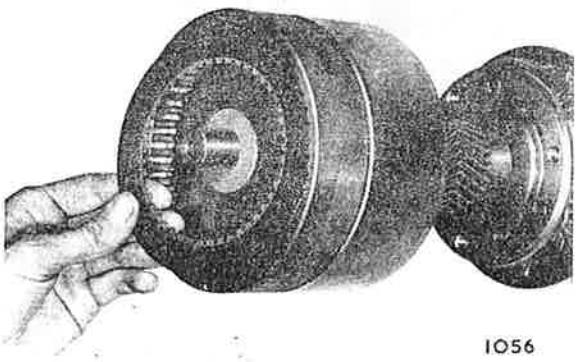


Fig. 67. *Fitting a front friction plate.*

Assemble the input shaft to the front clutch cylinder.

Assemble the snap ring that holds the input shaft in place (Fig. 69).

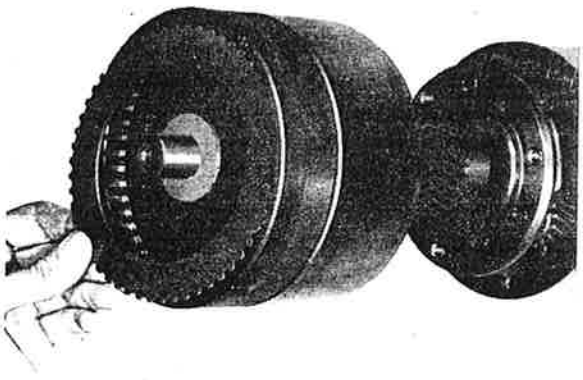


Fig. 68. *Fitting a front clutch outer plate.*

Place the thrust washer on the input shaft and the clutch assemblies are complete (Fig. 70).

Centre Support

The centre support is serviced as an assembly. Therefore, there is no dismantling or assembly procedure.

Inspect the support for burrs or distortion, the race bearing surface for scores or scratches.

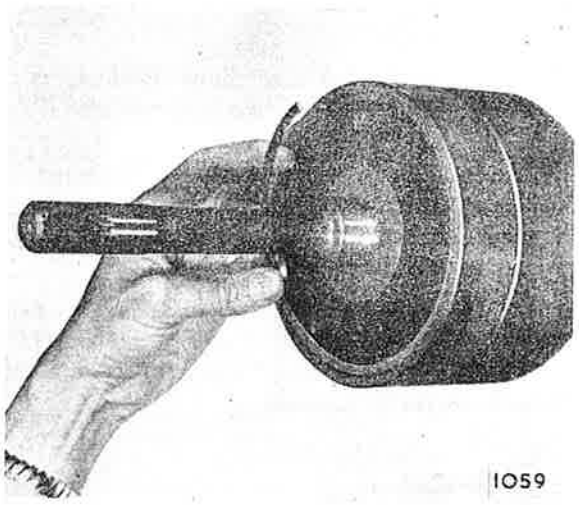


Fig. 69. *Fitting the snap ring.*

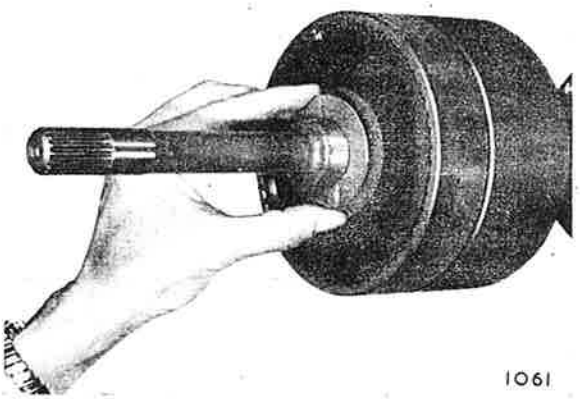


Fig. 70. *Placing the thrust washer in position.*

Pinion Carrier Assembly

The pinion carrier is serviced as an assembly. Therefore there is no dismantling or assembly procedure.

Inspect the band surface and the inner and outer bushing for scores. Rotate pinions on their shafts to check for freedom of movement and for worn or broken teeth. Use a feeler gauge to check pinion end play. End play should be 0·010″ to 0·020″ (·23 to ·5 mm.). Inspect pinion shafts for tightness to the planet carrier.

Sprag Clutch

A sprag-type one-way clutch assembly is incorporated in the planet carrier assembly and is held in place by a snap ring.

When installing the sprag clutch, the flange side of the sprag cage is located down into the outer race of the planet carrier assembly with the copper tension springs towards the centre support.

After the planet carrier and sprag assembly are installed in the case, the planet carrier will freewheel when turned counterclockwise and lock when turned clockwise (from the rear).

Output Shaft

Remove the extension housing and bearing from the output shaft by lifting the housing and tapping the shaft with a heavy plastic hammer.

Remove the bearing spacer washer.

Slide the oil collector and tubes from the shaft.

Remove the four sealing rings.

Remove the governor snap ring, governor and governor drive ball from the output shaft.

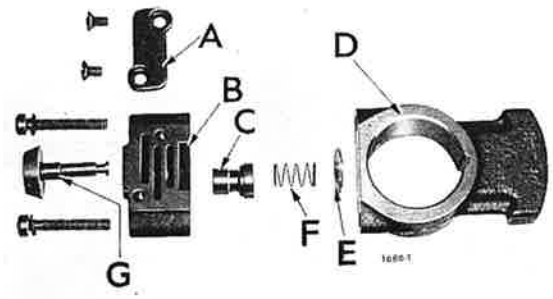
Lift the rear pump from the shaft and remove the rear pump drive key.

The snap ring may be removed and the output shaft removed from the ring gear; however, this is not necessary unless replacing one of these parts.

Inspect the output shaft thrust surfaces and journals for scores and the internal gear for broken teeth. Check the ring grooves, splines and gear teeth for burrs, wear or damage. The output shaft is a two-piece assembly and is serviced separately. Inspect the distributor and sleeve mating surfaces for excessive wear and for burrs, scores or leakage.

Governor

Remove the governor body cover plate attaching screws and remove the plate (Fig. 71). Remove the governor body attaching screws, then remove the body from the counter weight. Slide the spring retainer from the stem of governor weight and remove the spring. Remove the valve and weight from the governor body.



A. *Governor body cover plate.*
B. *Governor body.*
C. *Valve.*
D. *Counter weight.*
E. *Spring retainer.*
F. *Spring.*
G. *Weight.*

Fig. 71. *Exploded view of the governor.*

Inspect the governor weight, valve and bore for scores. Minor scores may be removed with crocus cloth. Replace the governor valve, weight or body if deeply scored. Check for free movement of the weight and valve in the bore. Inspect all fluid passages in the governor body and counterweight for obstruction. All fluid passages must be clean. Inspect the mating surfaces of the governor body and counterweight for burrs and distortion. Check governor spring retainer washer for burrs. The mating surfaces must be smooth and flat.

Re-install governor body cover plate, torqueing screws to 20–30 lb. in. (0.24 to 0.35 kgm.).

Install the governor valve in the bore of the body. Install the weight in the governor valve. Compress the spring and slide the retainer onto the stem of the weight and release the spring tension. Install the governor body on the counterweight.

Note: Make sure the fluid passages in the body and counterweight are aligned.

Torque the governor body attaching screws to 50–60 lb. in. (0·58 to 0·69 kgm.).

Rear Pump

Withdraw the five $\frac{1}{4}$" (6·4 mm.) screws, also the No. 10 U.N.C. screw and remove the cover. Mark the top face of the gears with marking ink or a crayon to assure correct re-installation of gears upon assembly (Fig. 72). Remove the drive and driven gears from the pump body.

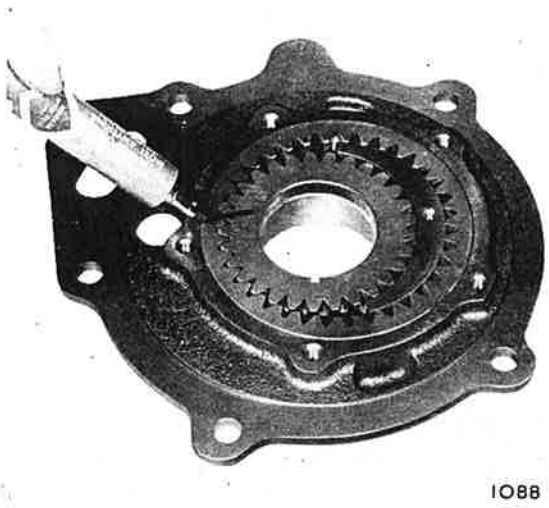


Fig. 72. *Marking the top face of the gears.*

Inspect the gear pockets and crescent of the pump body for scores or pitting. Inspect the bushing and drive and driven gear bearing surfaces for scores. Check all fluid passages for obstructions and clean if necessary. Inspect the mating surfaces, gear teeth, pump body and cover for burrs. If any pump parts are defective beyond minor burrs or scores, which cannot be removed with a crocus cloth, replace complete pump as a unit.

Lubricate parts with transmission fluid and replace both gears with the marks facing upward. Install the pump cover, attaching screws and lock-washers. Tighten the $\frac{1}{4}$" (6·4 mm.) screws to 50–60 lb. in. (0·58 to 0·69 kgm.) torque and the number 10 screw to 20–30 lb. in. (0·24 to 0·35 kgm.) torque (Fig. 73).

Check the pump for free movement of the gears.

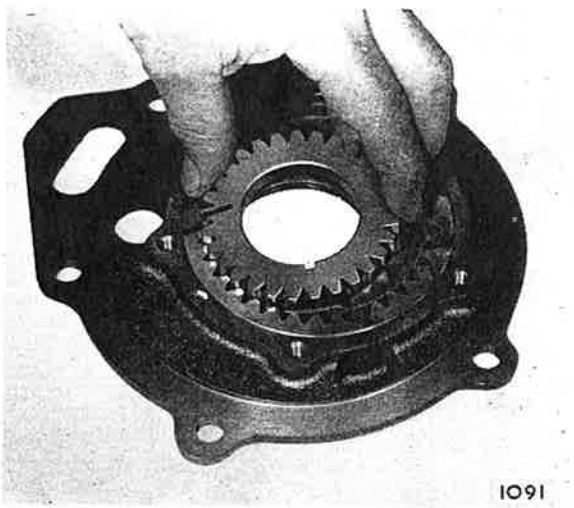


Fig. 73. *Replacing the gears.*

Output Shaft and Rear Pump—Assembling

Install the rear pump drive key in the output shaft.

Install rear pump assembly over the shaft.

Install the governor drive ball into the recess in the output shaft, using a spot of petrolatum to hold in place.

Install governor assembly, with plate on the governor body down (facing pump assembly). Install snap ring to lock governor in place (Fig. 74).

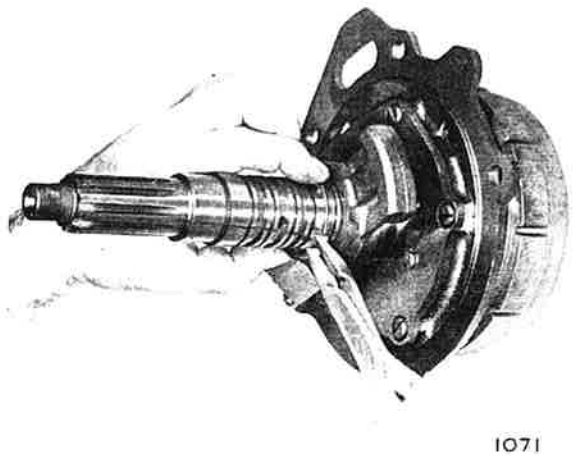


Fig. 74. *Fitting the snap ring.*

Install the four output shaft sealing rings, making sure they are free in their grooves (Fig. 75).

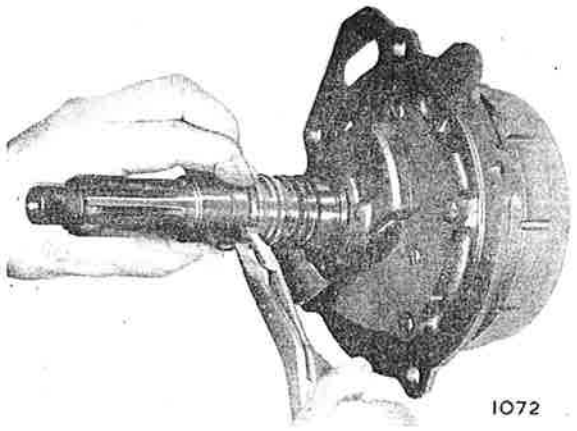


Fig. 75. *Fitting the output shaft sealing ring.*

Install oil collector sleeve and tube assembly. Compress each ring with the fingers and carefully slide the sleeve over them (Fig. 76).

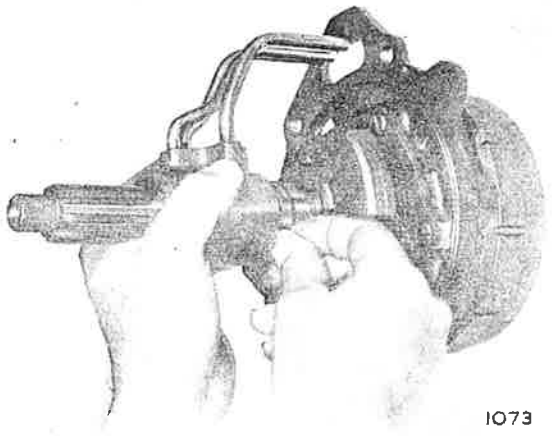


Fig. 76. *Installation of the oil collector sleeve and tube.*

Assemble the bearing spacer washer against the shoulder on the output shaft (Fig. 77).

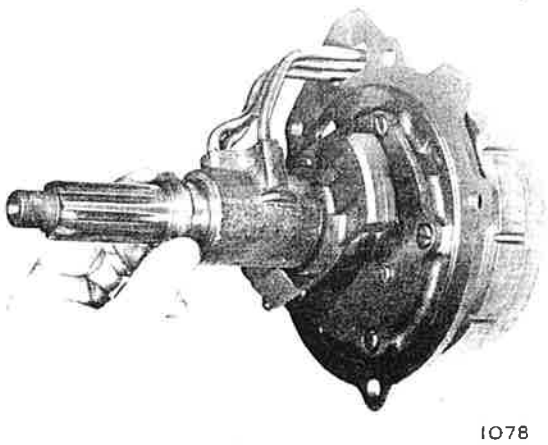


Fig. 77. *Fitting the bearing spacer washer.*

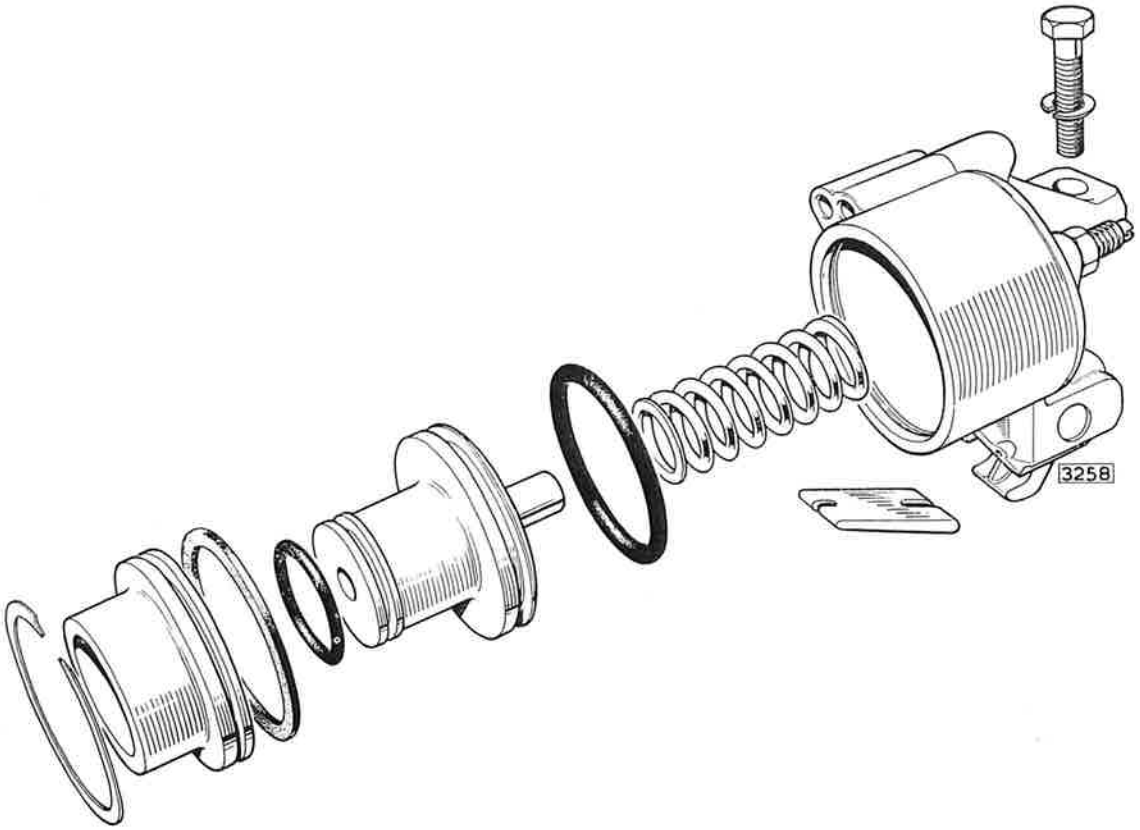


Fig. 78. *Exploded view of the front servo.*

Front Servo—Dismantling

Use a small screwdriver to remove the snap ring.

Pull the sleeve and piston from the servo body.

Remove the piston from the servo sleeve.

Remove all sealing rings.

If the servo lever needs attention, it may be removed by first driving the roll pin from the servo and then removing the pivot pin and lever. Use a $\frac{1}{8}$" (3.1 mm.) drift punch to remove the roll pin.

Inspect the servo parts for cracks, scratches and wear. Check the adjusting screw for freedom in the lever. Check the lever for freedom of movement.

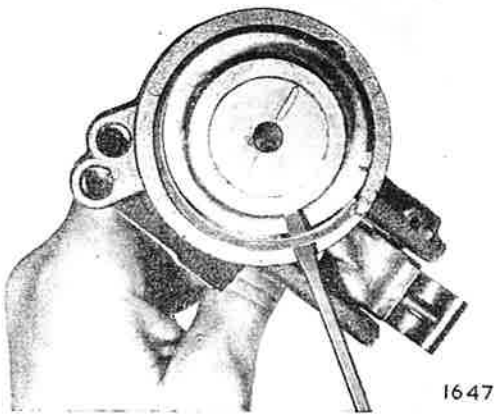


Fig. 79. *Removing the snap ring.*

Front Servo—Assembling

Assemble the servo lever, pivot pin and the roll pin.

Assemble the sealing rings on the sleeve and piston.

Assemble the piston to the sleeve, place the spring in the piston, and assemble the sleeve, piston and spring into the housing.

Replace the snap ring.

Fig. 80. *Assembling the front servo.*

Rear Servo—Dismantling

Remove the actuating lever roll pin with a $\frac{1}{8}$" (3·1 mm.) drift punch.

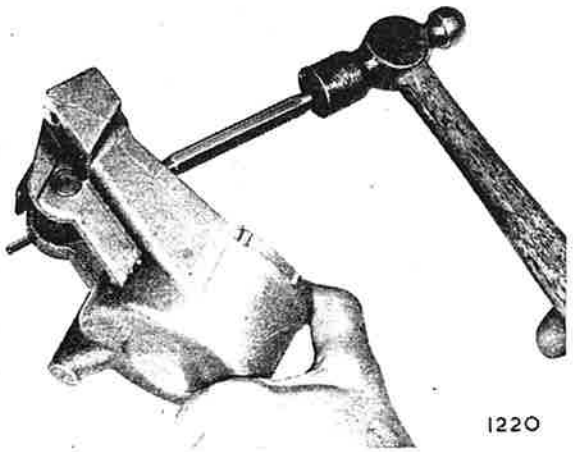


Fig. 81. *Removing the rear servo roll pin.*

Remove the lever and shaft.

Depress the spring retainer while removing the snap ring.

Remove the servo release spring, piston and rubber "O" ring.

Inspect the servo body for cracks, burrs and obstructed passages and the piston bore and stem for scores. Inspect the actuating lever and shaft for wear and brinnelling.

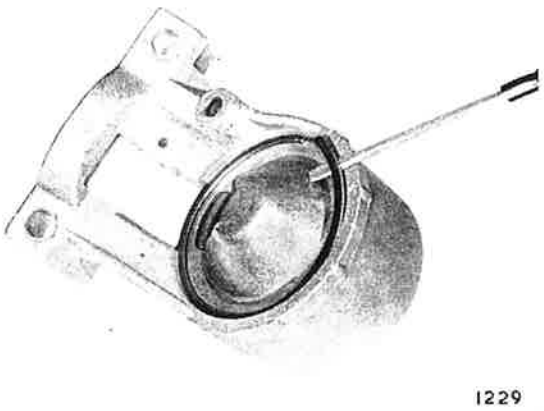


Fig. 82. *Removing the rear servo snap ring.*

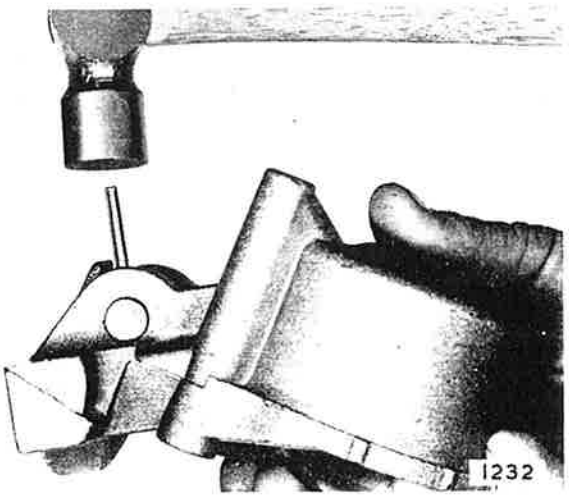


Fig. 83. *Replacing the roll pin.*

Rear Servo—Assembling

Lubricate all parts of the servo with transmission fluid before starting assembly.

Install a new "O" ring and then install piston in the servo body.

Install the release spring, retainer and snap ring.

Replace the servo lever, shaft and roll pin.

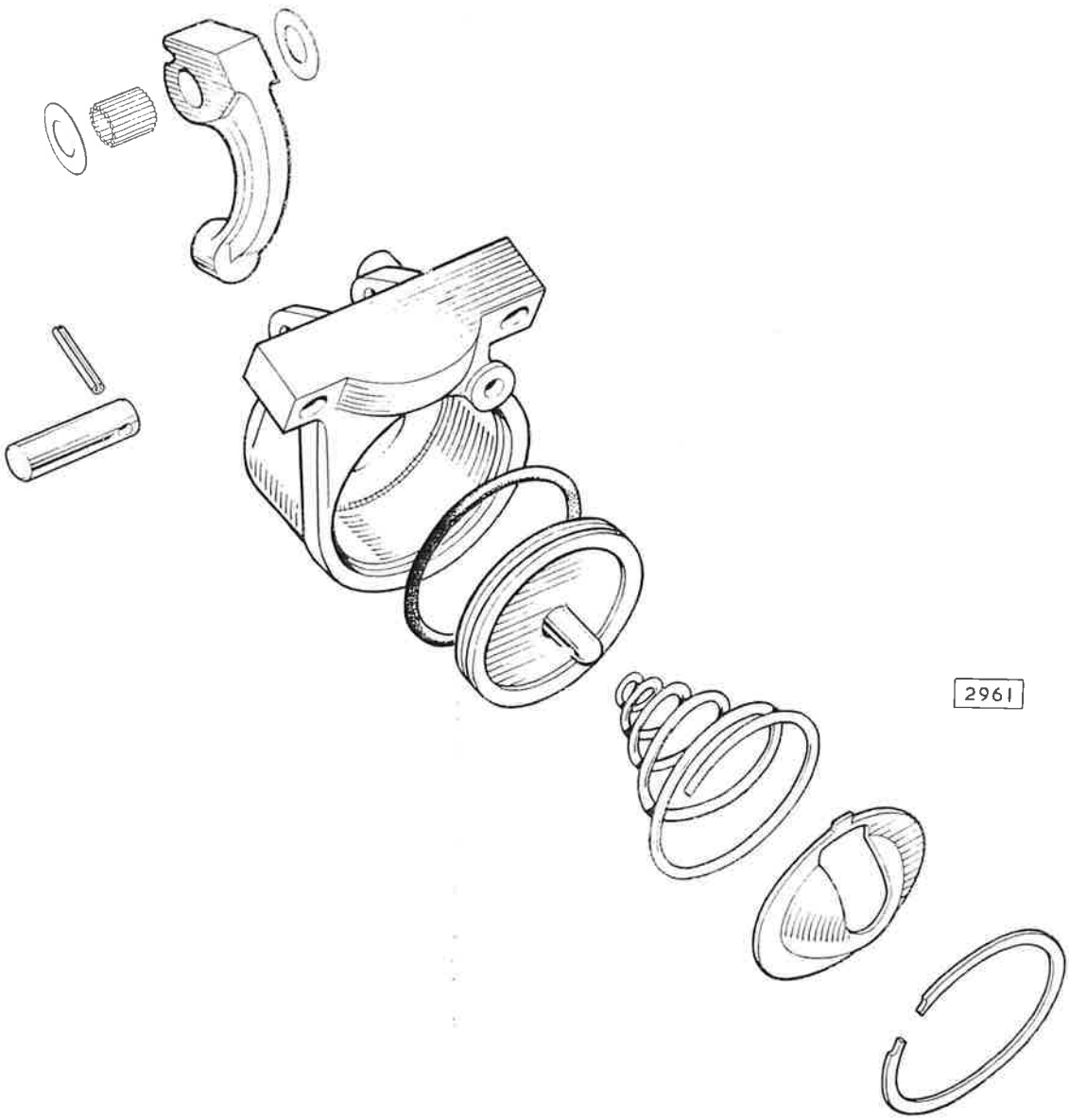


Fig. 84. *Exploded view of the rear servo.*

Pressure Regulator

Remove the valves from the regulator body. Remove the regulator body cover attaching screws and remove the cover. Remove the separator plate from the regulator body.

Wash all parts thoroughly in cleaning solvent and dry with compressed air. Inspect the regulator body and cover mating surfaces for burrs. Check all fluid passages for obstructions. Inspect the control pressure and converter pressure valves and bores for burrs and scores. Remove all burrs carefully with crocus cloth. Check free movement of the valves in their respective bores. The valves should fall freely into the bores when both the valve and bore are dry. Inspect the valve springs for distortion.

When assembling, be careful to avoid damaging the parts. Replace the separator plate and then the cover on the regulator body. Install and torque the attaching screws to 20–30 lb. in. (0·24–0·35 kgm.).

Insert the valves in the pressure regulator body.

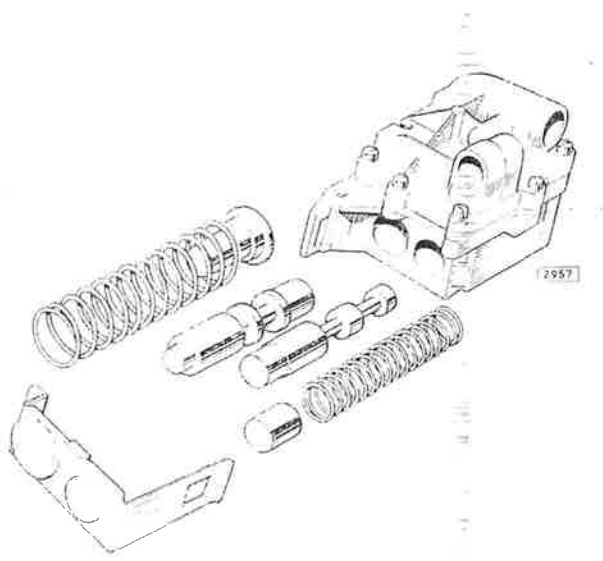


Fig. 85. *Regulator assembly. Valves, springs and retainer shown exploded.*

Valve Body—Dismantling

During dismantling of the control valve assembly, avoid damage to the valve parts and keep the parts clean. Place the valve parts and the assembly on a clean surface while performing the dismantling operation.

Remove the manual valve from the upper valve body.

Remove the four cap screws that retain the valve bodies.

Remove the cover and separator plates from the valve bodies. The body plate is attached to the lower valve body by a cheese head screw and to the upper valve body by a cheese head and a flat head screw. The separator plate and the lower valve body cover are held together by two cheese head screws.

Remove the front upper valve body plate retained by two screws. Remove the compensator valve plug, sleeve, springs and valve. Remove the modulator valve and spring assembly. The outer spring is retained to the modulator valve by a stamped retainer. The spring may be removed by tilting and pressing outward on the retainer.

Remove the downshift valve and spring.

Remove the rear upper valve body plate and throttle return spring retained by three screws to the body. Then remove the compensator cut back valve and the throttle valve.

Remove the four screws that retain the end body to the lower body. Remove the 2–3 shift valve inner and outer springs and the 2–3 shift valve. Remove the orifice control valve and spring and the transition valve spring and valve. Remove the orifice control valve plug and the 2–3 shift valve plug from end body. The end body plate should be removed for cleaning the end body.

Remove the four cheese head screws that retain the lower valve body side plate. Remove the 2–3 governor plug, the D1 and D2 control valve spring and valve.

The rear pump check valve, spring and sleeve generally should not be removed. The sleeve may be removed with snap ring pliers, if necessary.

Remove the end plate from the lower valve body cover. Then remove the 1–2 shift valve and spring and the front servo release orifice valve and spring.

Note: When removing all plates, be sure to hold the plates until screws are removed and release slowly as they are spring loaded.

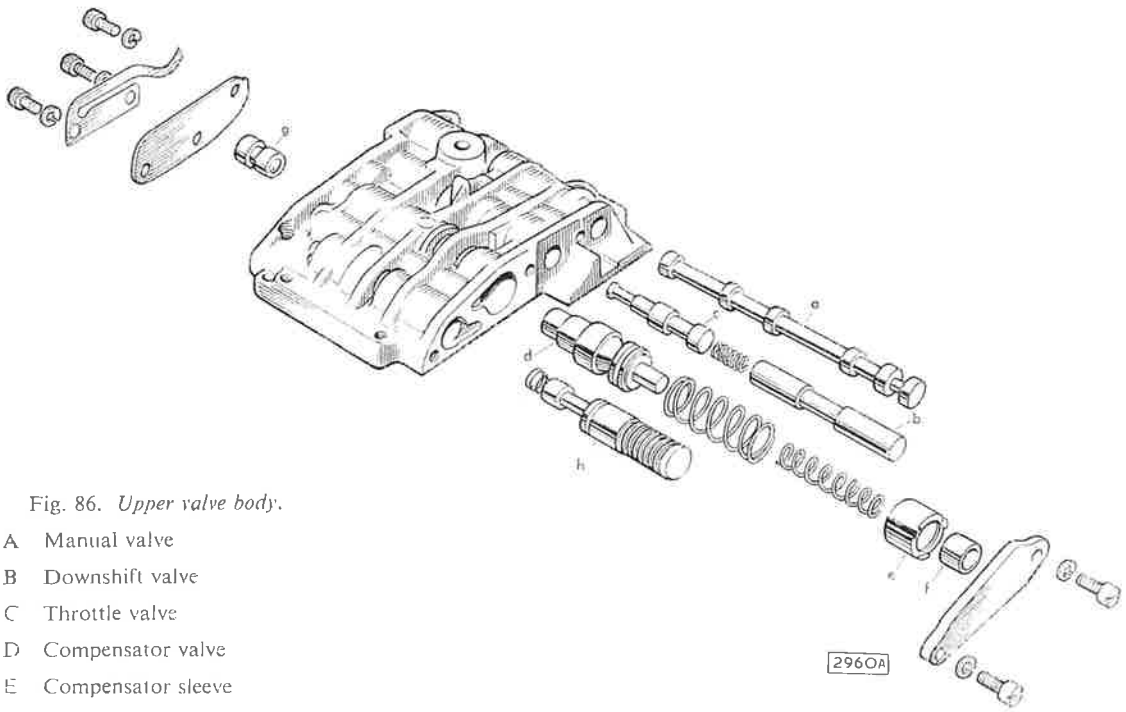


Fig. 86. *Upper valve body.*

A Manual valve
B Downshift valve
C Throttle valve
D Compensator valve
E Compensator sleeve
F Compensator sleeve plug
G Compensator cut-back plug
H Throttle modulator valve

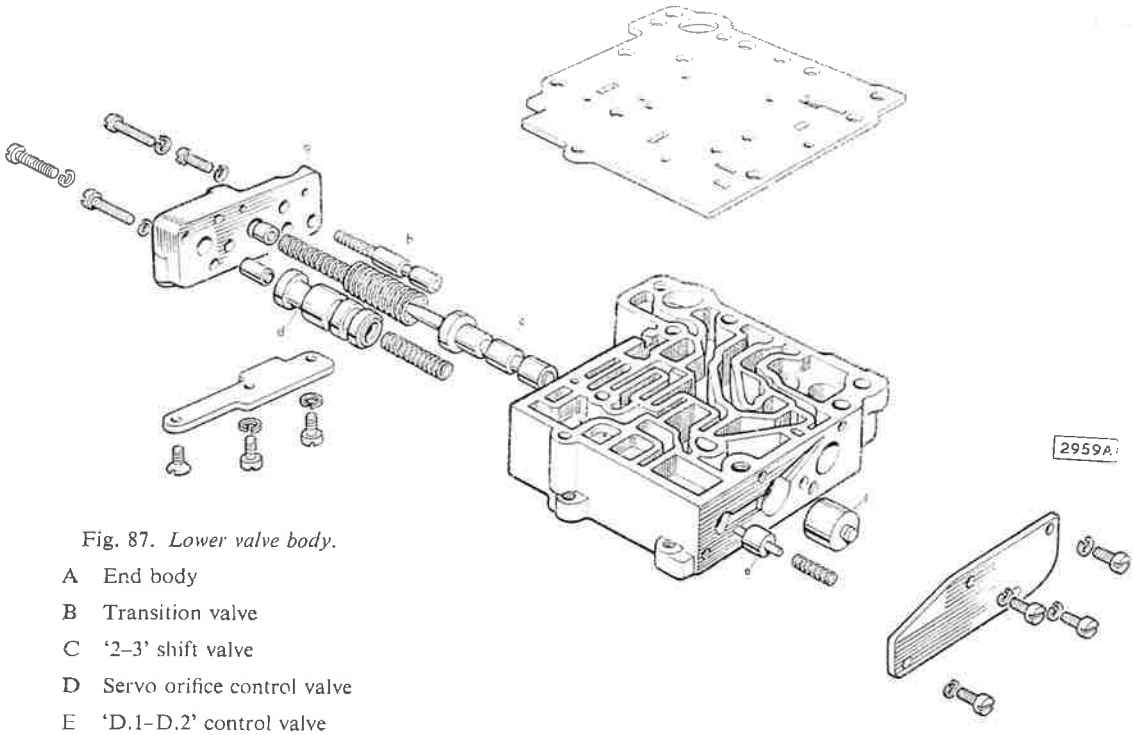


Fig. 87. *Lower valve body.*

A End body
B Transition valve
C '2–3' shift valve
D Servo orifice control valve
E 'D.1–D.2' control valve
F '2–3' governor plug

Inspection

Clean all parts thoroughly in a cleaning solvent, then dry them with compressed air. Inspect all fluid passages for obstructions. Inspect the check valve for free movement. Inspect all mating surfaces for burrs and distortion. Inspect all plugs and valves for burrs and scores.

Note: Crocus cloth can be used to polish the valves and plugs if care is taken to avoid rounding the sharp edges.

Valve Body—Assembling

When assembling the control valve bodies, always use the following procedure:

Install the valve body plate on the upper valve body (retained by one cheese head and one flat head screw). Do not tighten the screws. If the rear pump check valve sleeve, valve and spring were removed from the lower valve body, install them, carefully staking the sleeve in the bore with the smooth end against the valve.

Place the upper body on the lower body and install the cheese head screw, but do not tighten the screw.

Place the lower valve body separator plate and cover on the lower valve body and install the two head screws, leaving them loose.

Install the four cap screws and lockwashers; torque the four screws to 72 lb. in. (·84 kgm.), then tighten the cheese head screws and flat head screw to 20–30 lb. in. (0·23–0·35 kgm.).

Try all valves dry in their respective bores, rotating them to make sure that they are free before final assembly in the valve body. If any sticking or binding occurs, the valve bodies will have to be separated and each surface lapped on crocus cloth, using a surface plate or a glass plate, to ensure against low or high spots or a warped condition.

Note: Lubricate all valves and plugs with automatic transmission fluid before final assembly in their respective bores.

Install the 1–2 shift valve spring and valve in the lower valve body cover. Install the front servo release orifice valve spring and valve and the cover end plate with two cheese head screws.

Install the range control valve and spring, the governor plug, and then install the side plate with four cheese head screws.

Install the orifice control valve spring and valve, the 2–3 shift valve, the 2–3 shift valve inner and outer springs, the transition valve, and spring in the lower valve body.

Replace the end body plate using one flat head and two cheese head screws and torque to 20–30 lb. in. (0·23–0·35 kgm.). Install the orifice control valve plug and the 2–3 shift valve plug in the lower valve body. Install the end body to the lower valve body, guiding the 2–3 shift valve inner spring into the 2–3 shift valve plug. Three long and one short special cheese head screws are used to retain the end body.

Note: Make sure the inner spring is piloted on the 2–3 shift valve plug.

Install the modulator valve and spring assembly. Install the compensator valve, compensator inner and outer springs, compensator plug and sleeve (be sure end of sleeve with the three protrusions is toward the plate and the smooth end to the spring in the upper valve body). Assemble the plate which is retained by two cheese headed screws.

Install the compensator cut-back valve in the rear end of the upper body. Install the rear plate so that the edge of the plate fits into the band of the throttle valve and install one screw to hold the rear plate in place. Install the throttle return spring and install the two remaining cheese headed screws.

Install the manual valve. Torque on all cheese headed screws should be 20–30 lb. in. (0·23 to 0·35 kgm.)

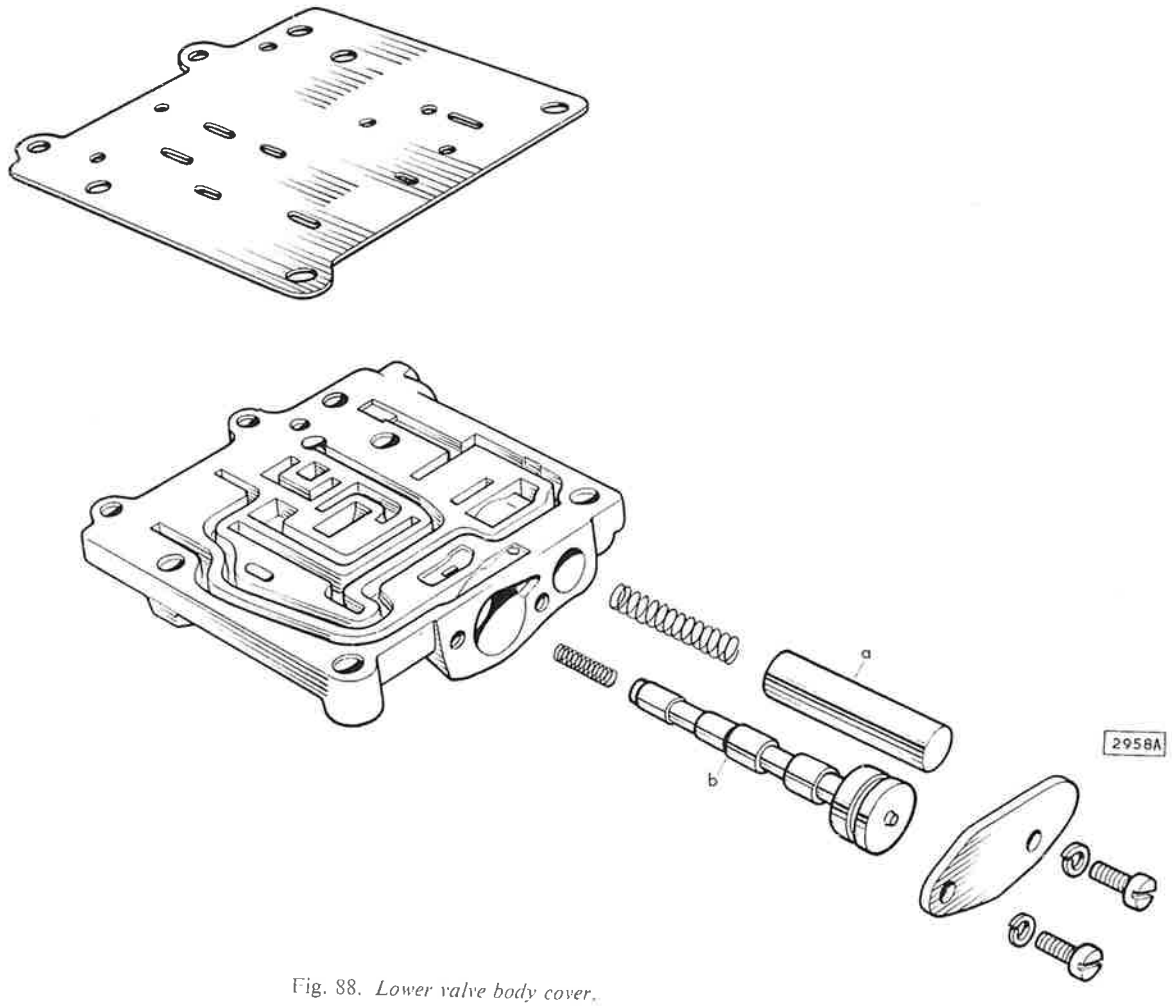


Fig. 88. *Lower valve body cover.*

A Front servo release orifice valve

B '1–2' shift valve

TRANSMISSION ASSEMBLING

Lubricate all parts as they are assembled, with the same fluid used for filling the transmission. Petrolatum can be used sparingly to hold gaskets or thrust washers in position during assembly.

Wash the transmission case and dry with compressed air.

Install a new front pump to case gasket, then install the front pump. Torque the four attaching cap screws to 17–22 lb. ft. (2·35 to 3·04 kgm.).

Install the front band through the bottom of the case, positioning the band so that the anchor end is aligned with the anchor in the case.

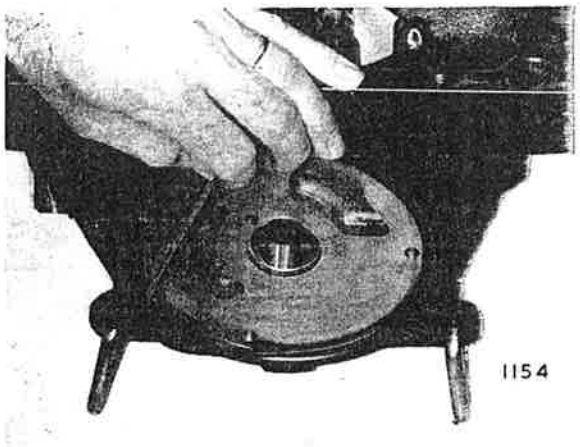


Fig. 89. *Fitting a new front pump gasket.*

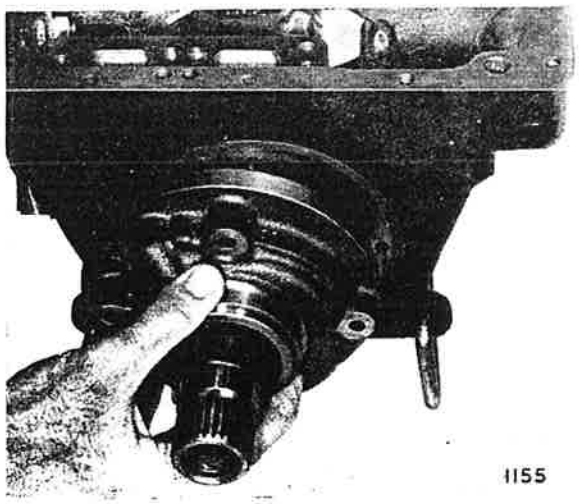


Fig. 90. *Installing the front pump.*

Install the front clutch, rear clutch and forward sun gear assembly in the case. Handle the clutch assemblies in a manner that will prevent the clutches being pulled apart.

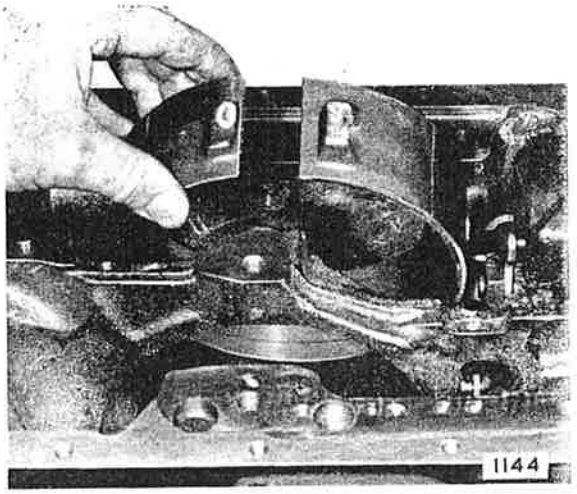


Fig. 91. *Installing the front band.*

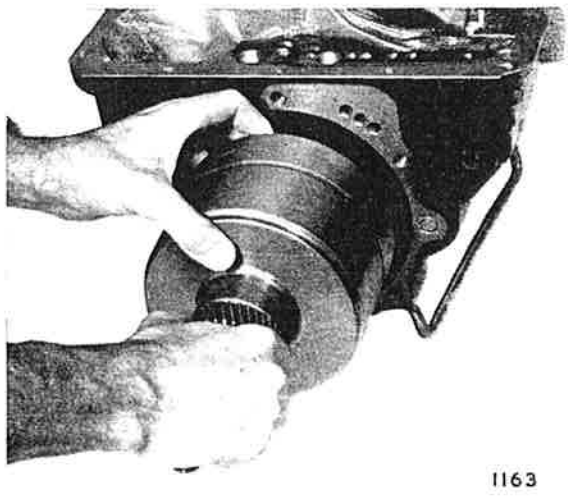


Fig. 92. *Installing the front clutch.*

Install the centre support in the transmission case with the three positioning holes aligned with the holes in the case.

Install the centre support cap screws with the rolled edge of each lockwasher towards the case. Torque to 20–25 lb. ft. (2·76 to 3·46 kgm.).

Install the rear band through the rear of the case. Be sure that the end with the depression or dimple is placed toward the adjusting screw.

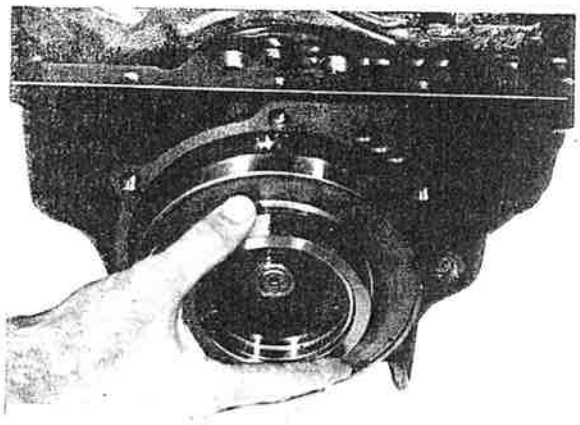


Fig. 93. *Installing the centre support.*

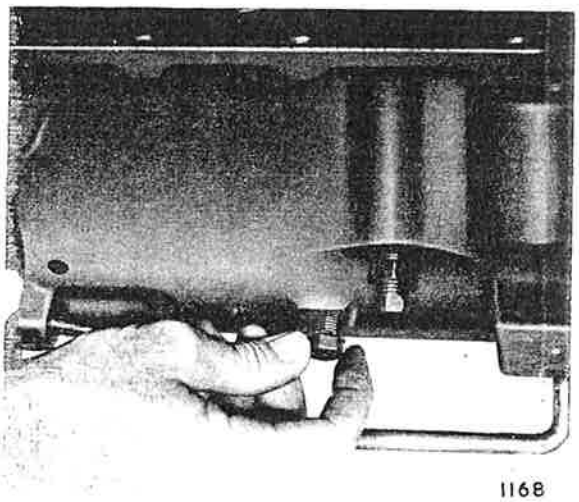


Fig. 94. *Fitting the centre support cap screws.*

Use petrolatum sparingly to hold the forward sun gear thrust plate and needle bearing in the planet carrier, while the carrier is assembled over the sun gear.

Install the hook type seal rings on the rear of the forward sun gear. Check the rings for free movement in their grooves.

Choose a selective washer to give the correct end play (end play determined during dismantling is used to determine the need for a different thrust washer).

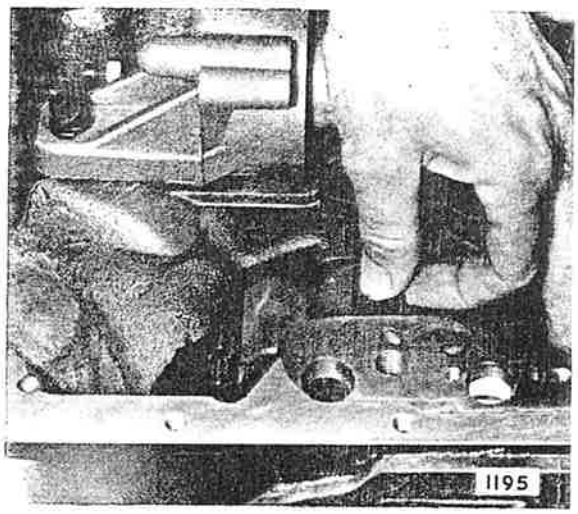


Fig. 95. *Fitting the rear band.*

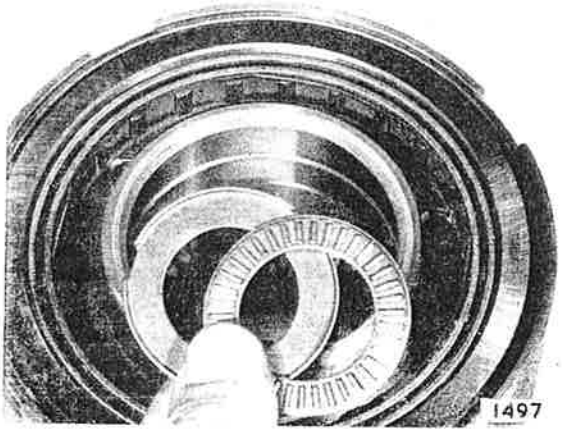


Fig. 96. *Fitting the thrust plate and needle bearing.*

Install washer on the rear of the planet carrier.

Use petrolatum to hold the rear pump to case gasket to rear of the case.

Install the ring gear and output shaft assembly. Align the three oil tubes as the assembly is fitted and tap them in position.

Place the rear pump to extension housing gasket in position, then assemble the extension housing. Torque the five extension housing cap screws to 28–33 lb. ft. (3·87 to 4·56 kgm.).

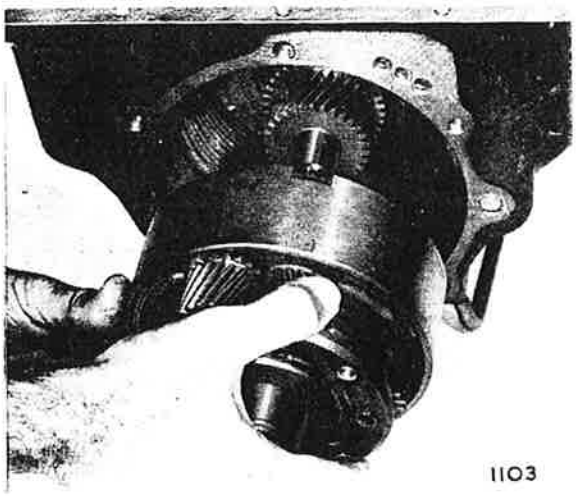


Fig. 97. *Assembling the carrier over the sun gear.*

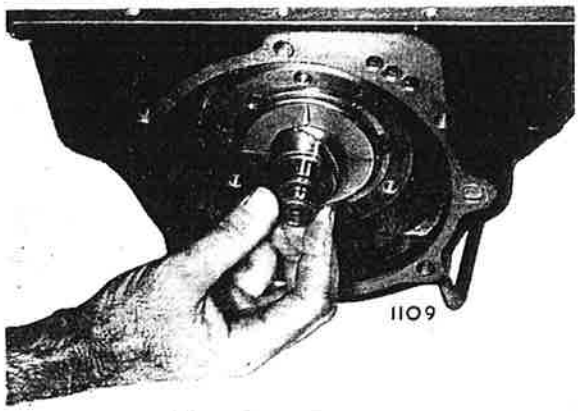


Fig. 98. *Fitting the sealing rings.*

Install the bearing snap ring, and then tap the ball bearing into position in the extension housing and on the output shaft (be sure spacer washer is on shaft ahead of bearing).

Slide the speedometer drive gear on the output shaft.

Install rear seal in bearing retainer. Assemble the bearing retainer in its gasket.

Install the companion flange, flat washer, lock-washer and nut. Torque the nut to 90–120 lb. ft. (12·44–16·58 kgm.).

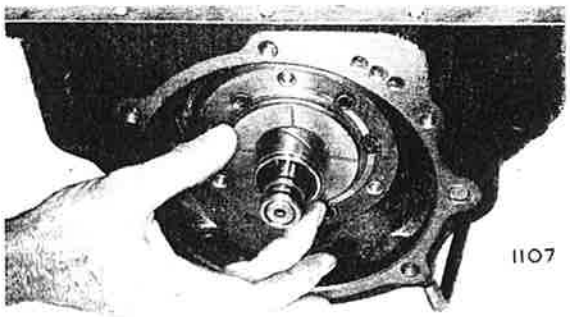


Fig. 99. *Fitting the washer on the rear of planet carrier.*

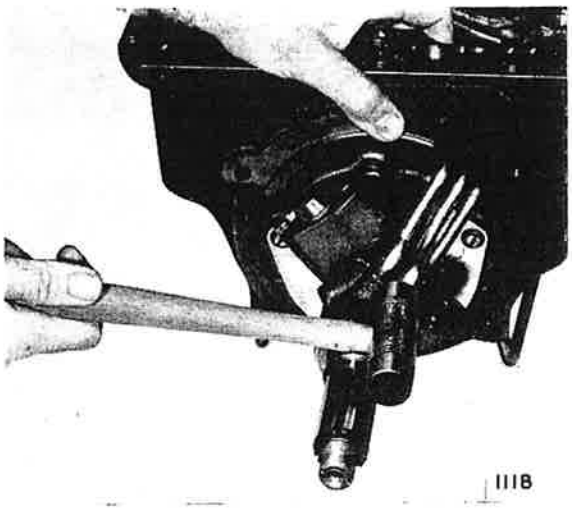


Fig. 100. *Tapping the output shaft assembly into position.*

Front Servo Installation

Rotate the front band into position so that the anchor end is positioned over the anchor pin in the case.

Position the servo strut with the slotted end aligned with the servo actuating lever, and hold it in position with the middle and index fingers of the left hand.

Engage the end of the band with the small end of the strut then position the servo over the dowel pin.

Install the attaching cap screw but do not screw it in more than two or three threads at this time.

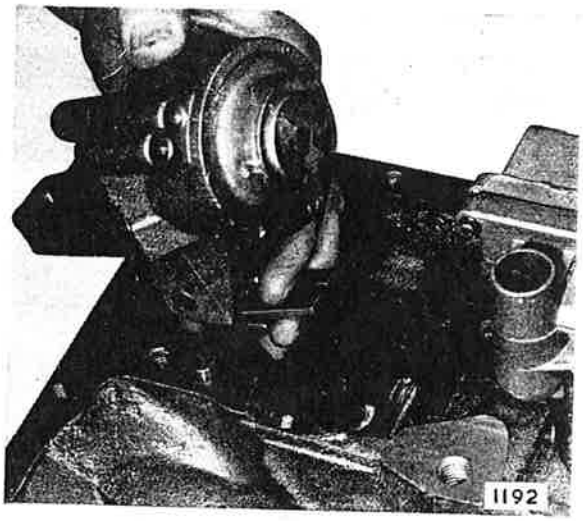


Fig. 101. *Installing the front servo.*

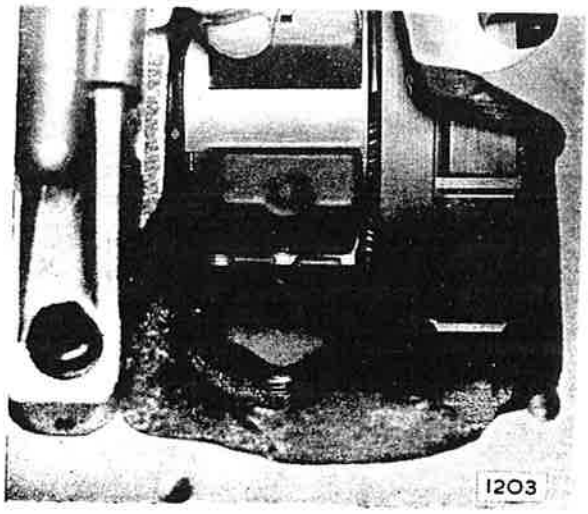


Fig. 102. *Engaging the servo anchor strut.*

Rear Servo Installation

Position the servo anchor strut over the adjusting screw, then rotate the rear band to engage this strut. Place the servo actuating lever strut with the notched end to the band and lift the other end with index finger or screwdriver, while locking the servo lever over the strut.

Install the long pointed bolt in the forward servo hole so that it will engage the centre support.

The other shorter bolt is used in the rear position.

Torque the bolts to 40–50 lb. ft. (5·53–6·91 kgm.).

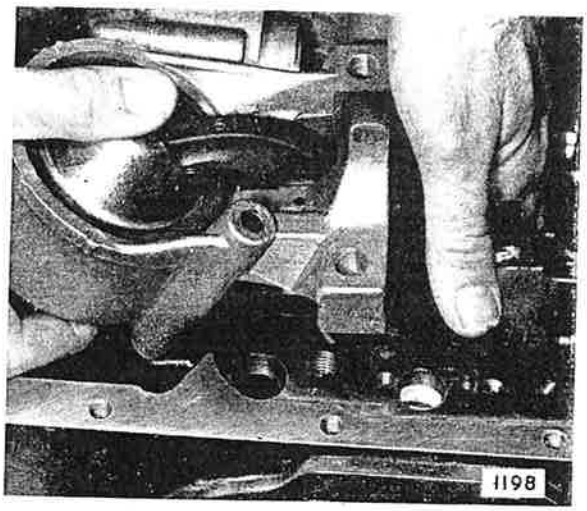


Fig. 103. *Fitting the rear servo.*

Valve Body Installation

Place the manual selector in park or reverse position. Carefully align the valve body with the servo tubes and gently slide the valve body further onto the tubes.

The front servo must be pulled up off the dowel to allow easy assembly. Be careful at this point—the servo apply strut may become disengaged from the servo. Before seating the valve body on the case, install the nipple end of the throttle cable into the throttle cam.

Next, align the manual valve with the inside lever pin and the valve body will then drop into position. Torque the three valve body attaching cap screws to 8–10 lb. in. (0·09–0·12 kgm.).

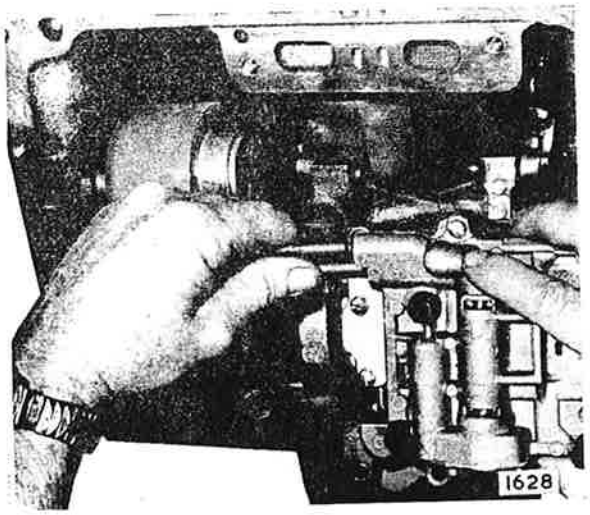


Fig. 104. *Fitting the servo tubes.*

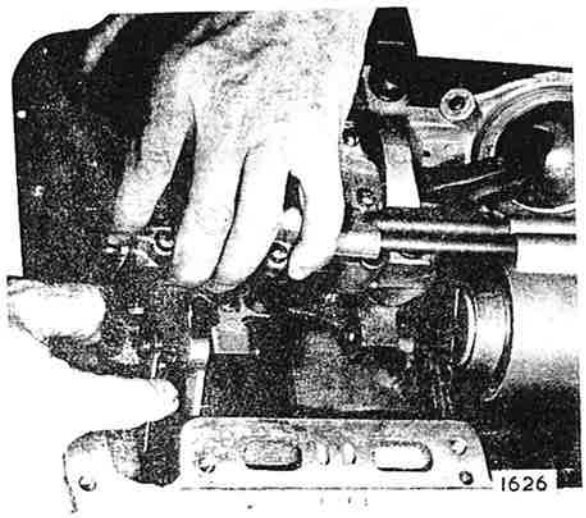


Fig. 105. *Positioning the valve body.*

Torque the front servo attaching cap screw to 30–35 lb. ft. (4·15–4·84 kgm.) and adjust the front servo.

Replace the control pressure tube, by first assembling the long straight end into the regulator, then rocking the tube downward into the control valve body. If too much resistance is encountered, it will help to loosen the control body attaching cap screws until the tube can be assembled.

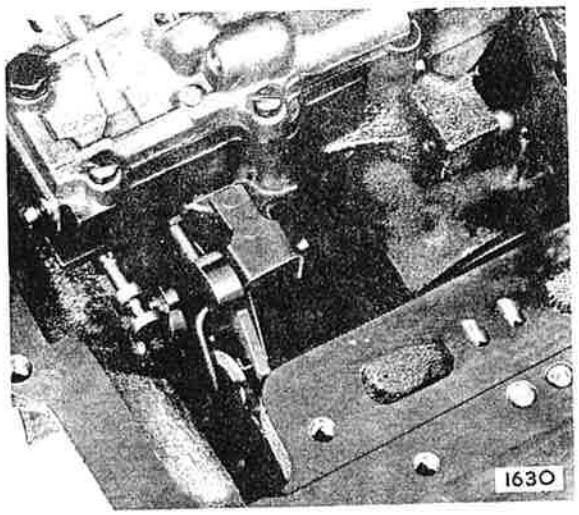


Fig. 106. *The valve body in position.*

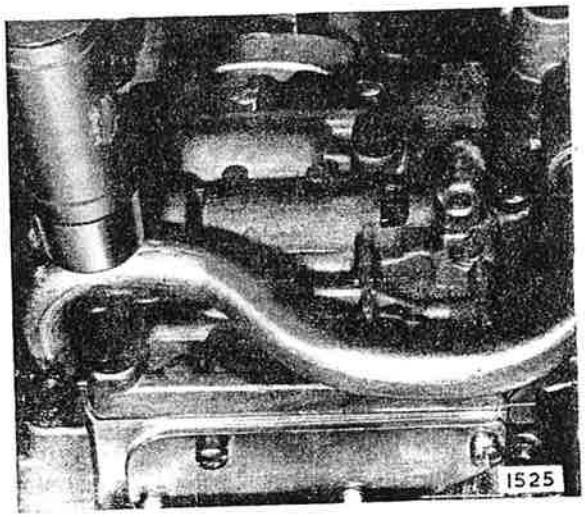


Fig. 107. *Replacing the control pressure tube.*

Pressure Regulator Installation

Assemble the regulator, with the valves in position in their bores, to the case with the attaching cap screws.

Torque cap screws to 17–22 lb. ft. (2·35–3·04 kgm.). Install both springs and guides, then install the spring retainer.

Install the front servo apply and release tubes in the servo.

Install the rear pump inlet and outlet tubes, using new "O" rings.

Replace the compensator tube by aligning one end with the pressure regulator and the other end with the control valve body and then tap it into position.

Assemble the long end of the lubrication tube into the rear pump, then rock the other end into position and tap it into the pressure regulator assembly.

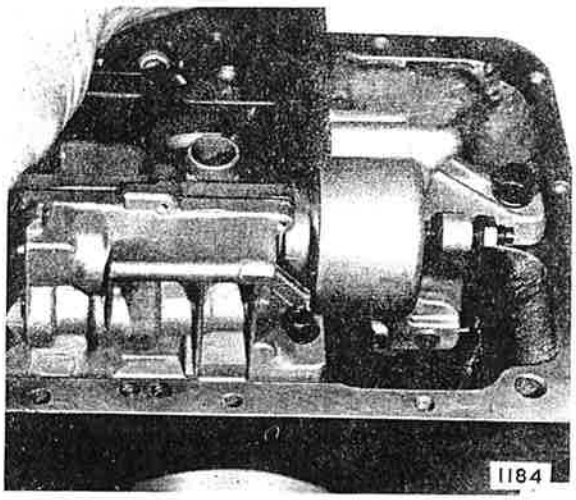


Fig. 108. *The pressure regulator installed.*

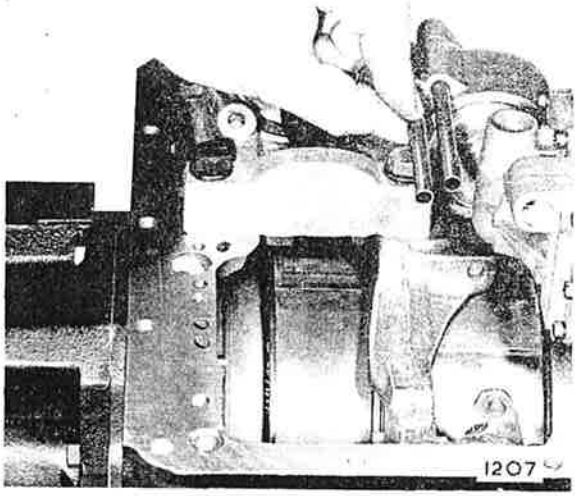


Fig. 110. *Fitting the apply and release tubes.*

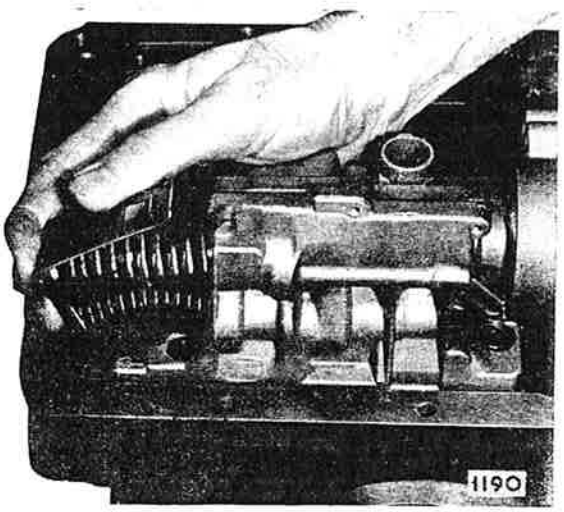


Fig. 109. *Fitting the pressure regulator springs.*

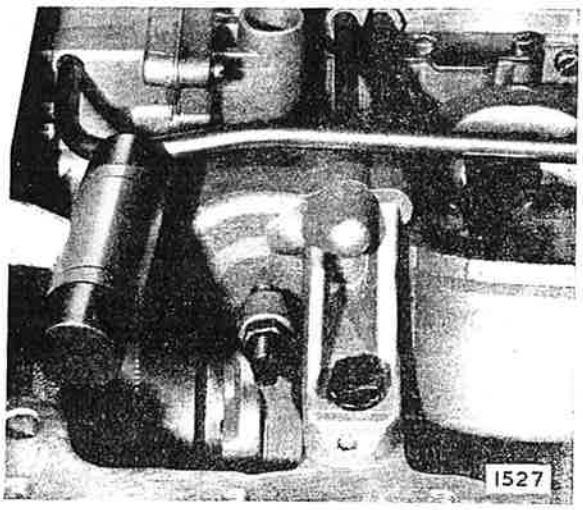


Fig. 111. *Fitting the lubrication tube.*

Replace the front band lubrication tube. Be sure the tube is aligned so that the open end will direct oil onto the front drum surface at the front band gap. Tube should point at approximately the centre of the gap.

Assemble the oil screen assembly onto the rear pump inlet tube and then rock into position over the front pump inlet on the pressure regulator assembly. Hook the screen retainer under the lubrication tube, lay across screen, and snap onto compensator tube.

Install the oil pan gasket, the oil pan and torque the 14 cap screws to 10–20 lb. ft. (1·38–2·76 kgm.).

Adjust the rear band.

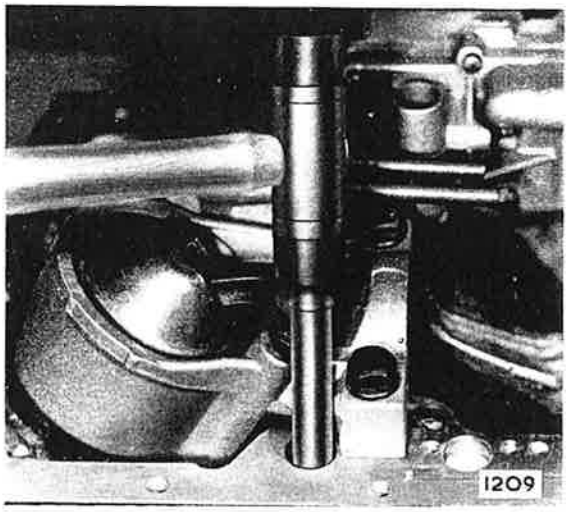


Fig. 113. *Fitting the rear pump inlet tube.*

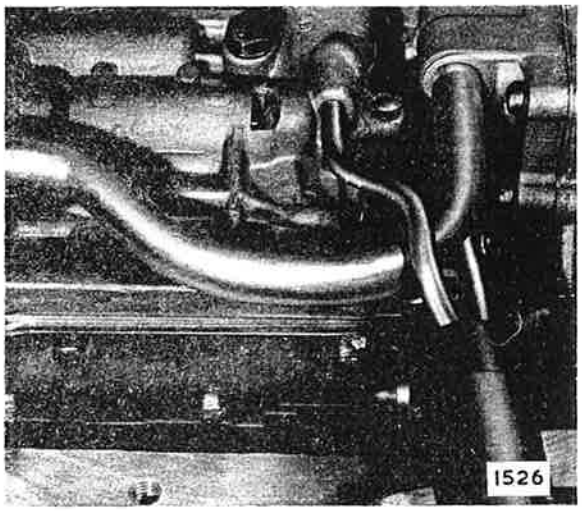


Fig. 112. *Replacing the compensator tube.*

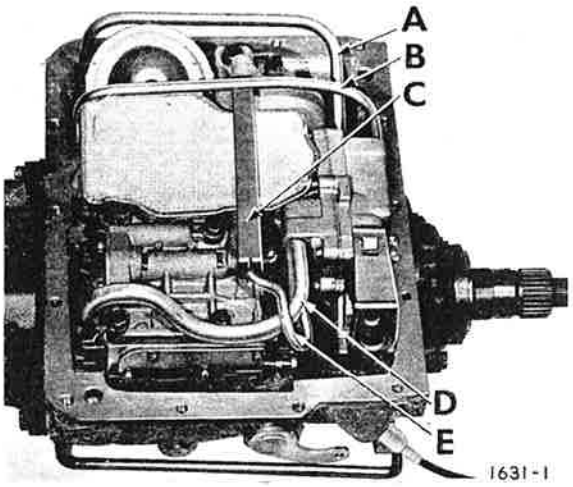


Fig. 114. *View of the Model 8 transmission inverted.*

CONVERTER AND CONVERTER HOUSING

When installing the converter housing, the maximum allowable runout should not exceed 0·010″ (0·25 mm.) for bore or face indicator readings relative to crankshaft centre line; however, it is preferable to have less than 0·006″ (0·015 mm.) reading for both.

When installing the transmission to the converter housing and converter assembly, be certain that the converter lugs are properly aligned with the front pump drive gear, so that the parts will not be damaged by forcing impeller hub drive tangs against the pump drive gear lugs.

1. Converter housing.
2. Stud.
3. Stoneguard assembly.
4. Cover (bottom).
5. Cover (front).
6. Right hand support bracket.
7. Left hand support bracket.
8. Drive plate assembly.
9. Dowel.
10. Setscrew.
11. Plate.
12. Setscrew.
13. Tab washer.
14. Support bracket.
15. Coil spring.
16. Retainer.
17. Spring seat (rubber).
18. Pin assembly.
19. Oil outlet pipe.
20. Flexible hose.
21. Flexible hose.
22. Clip.
23. Bracket.
24. Clip.
25. Oil return pipe.
26. Bracket.
27. Clamp.
28. Clip.
29. Transmission dipstick assembly.
30. Tube assembly.
31. Clip.
32. Strut.

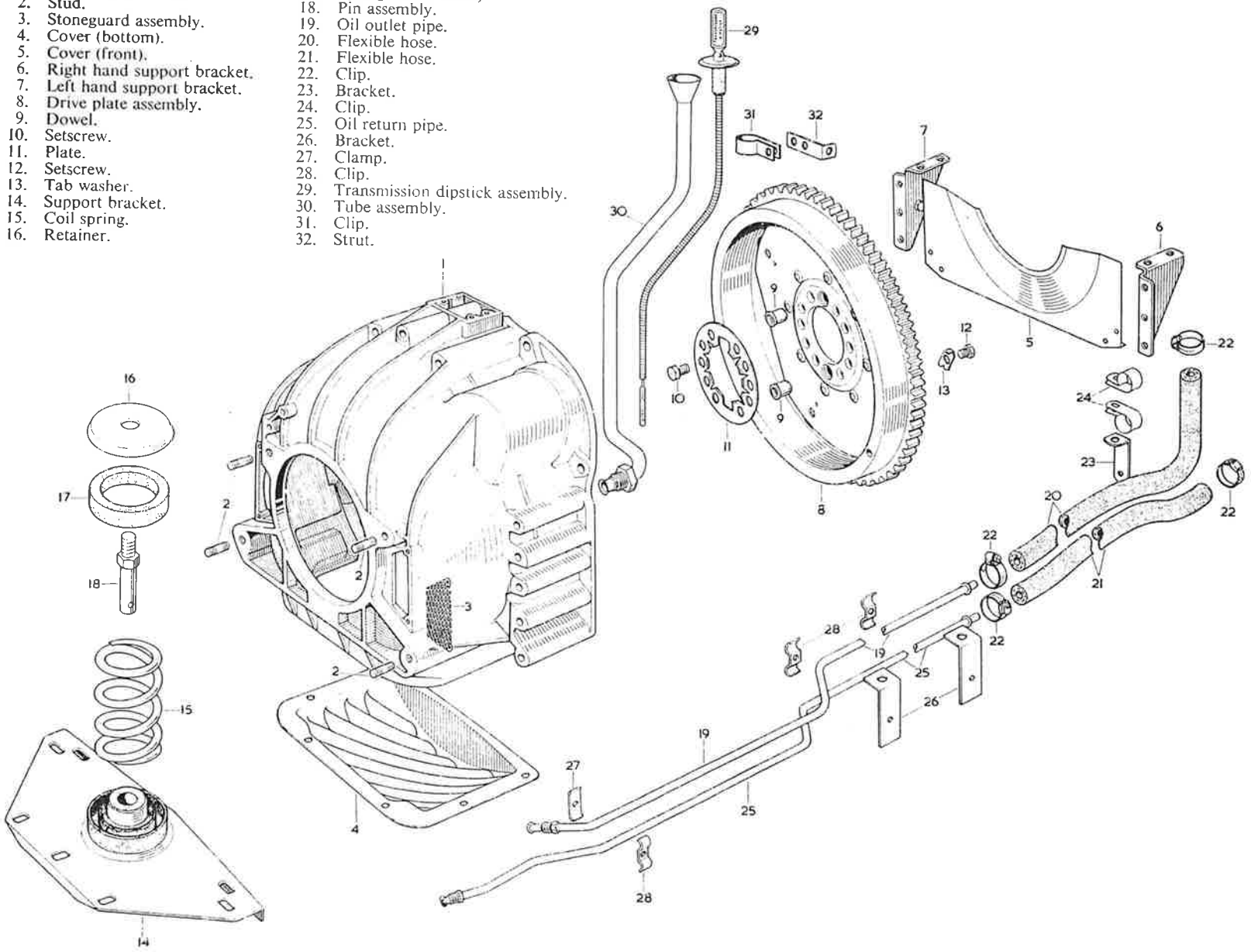


Fig. 115. *Converter housing, transmission mounting, etc.*

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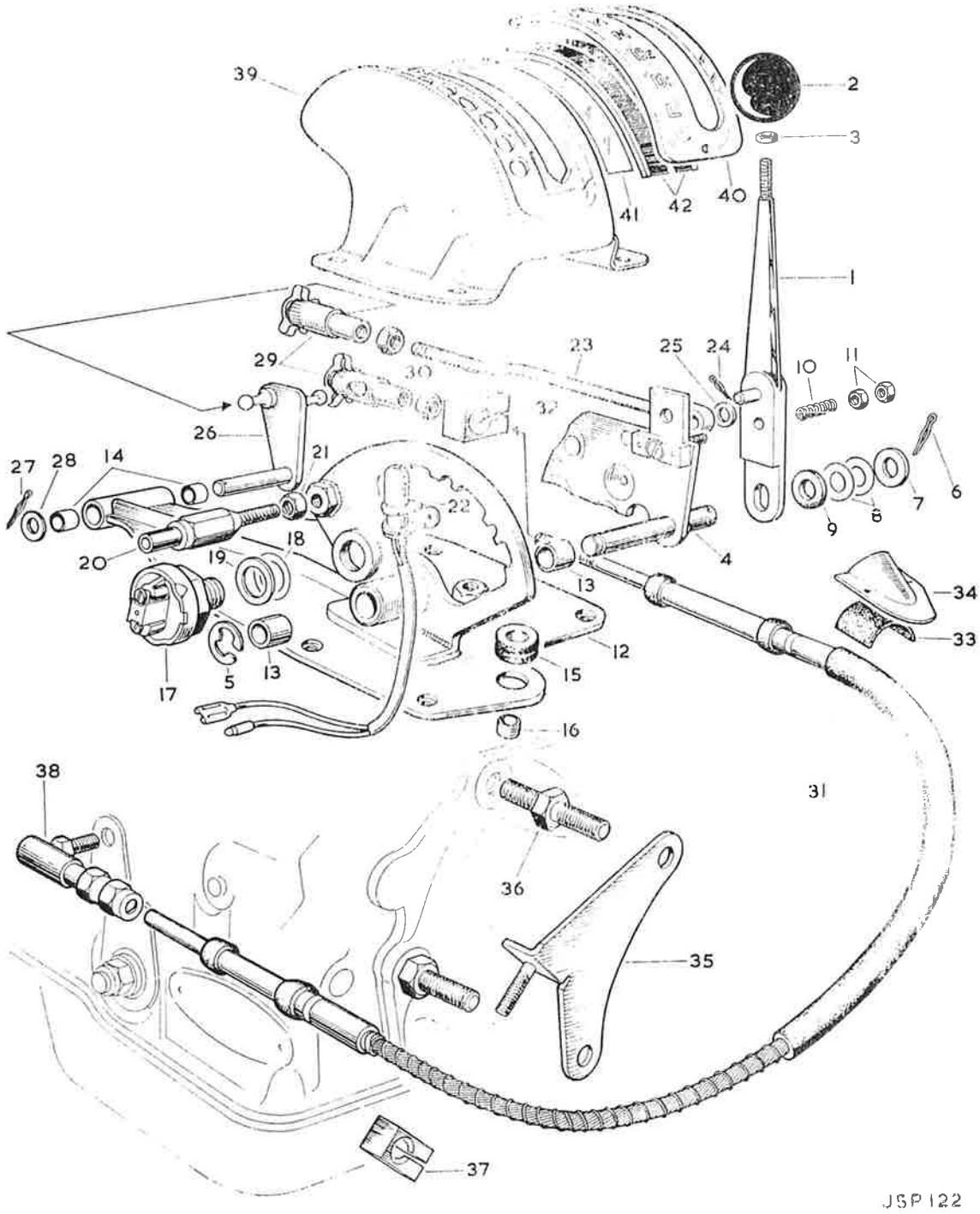

Fig. 116. *The transmission controls.*

1. Selector lever assembly.
2. Knob.
3. Nut.
4. Cam plate assembly.
5. Circlip.
6. Split pin.
7. Washer.
8. Shim.
9. Washer (rubber).
10. Spring.
11. Nut.
12. Mounting plate and selector gate assembly.
13. Bush.
14. Bush.
15. Grommet.
16. Distance tube.
17. Reverse lamp switch.
18. Shim.
19. Shim.
20. Starter cut-out switch.
21. Nut.
22. Lamp assembly.
23. Operating rod assembly.
24. Split pin.
25. Washer.
26. Transfer lever assembly.
27. Split pin.
28. Washer.
29. Ball joint.
30. Nut.
31. Gear control cable assembly.
32. Clamp.
33. Pad.
34. Plate.
35. Abutment bracket.
36. Stud.
37. Clamp.
38. Adjustable ball joint.
39. Cover assembly.
40. Indicator plate.
41. Light filter.
42. Seal.

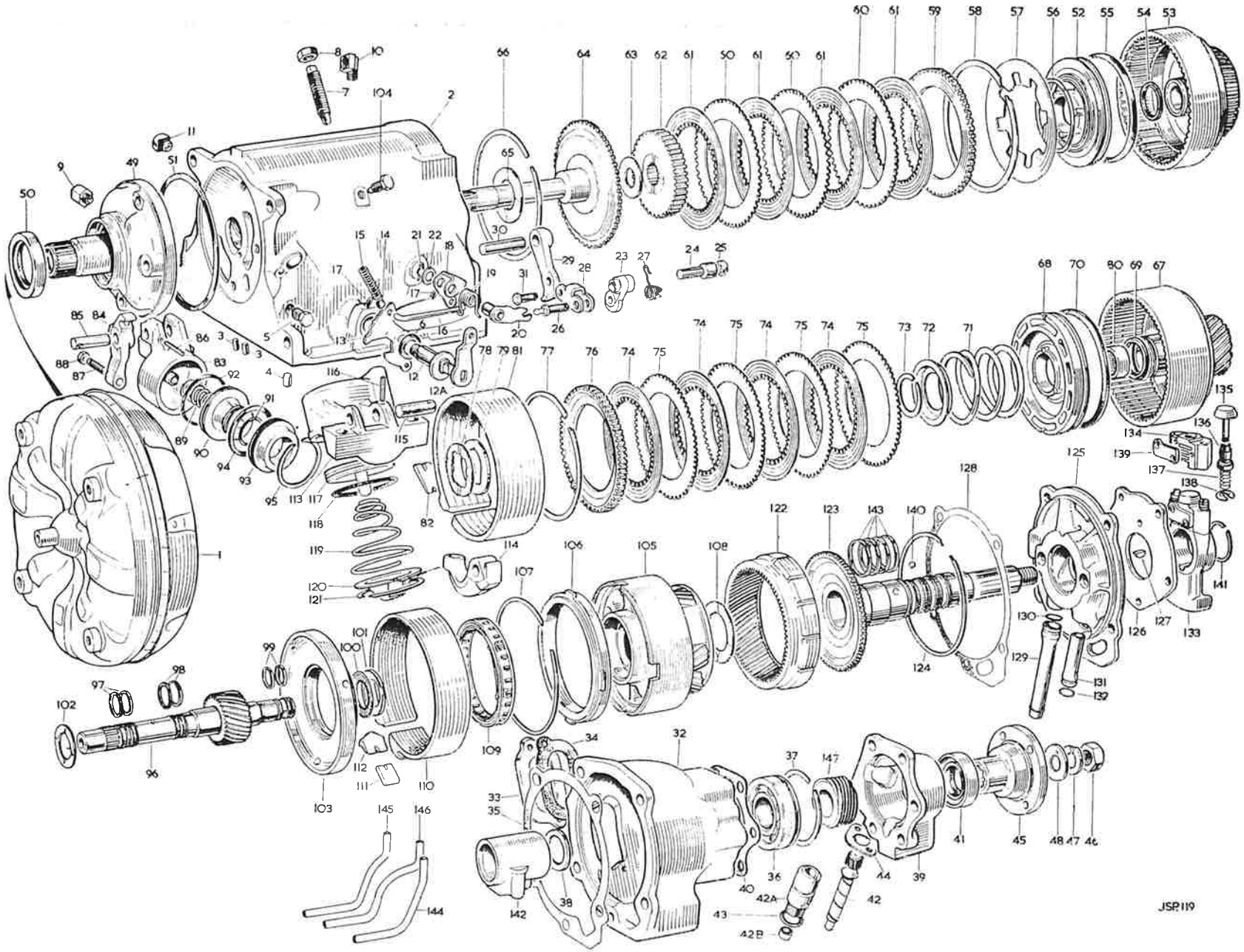

Fig. 117. *Exploded view of the transmission unit.*

1. Converter assembly.
2. Transmission case assembly.
3. Plug.
4. Dowel.
5. Plug.
6. Oil seal.
7. Screw.
8. Nut.
9. Union.
10. Union.
11. Breather assembly.
12. Manual control shaft assembly.
12A. Selector lever.
13. Lever assembly.
14. ⅜" ball.
15. Spring.
16. Link.
17. Clip.
18. Torsion lever.
19. Spring.
20. Forked lever.
21. Clip.
22. Washer.
23. Toggle lever.
24. Toggle pin.
25. Plug.
26. Ball pin.
27. Spring.
28. Link.
29. Pawl.
30. Pivot pin.
31. Pin.
32. Extension case assembly.
33. Cover plate.
34. Gasket.
35. Gasket.
36. Bearing.
37. Snap ring.
38. Spacing washer.
39. Speedometer housing.
40. Gasket.
41. Oil seal assembly.
42. Speedometer driven gear.
42A. Bearing.
42B. Oil seal.
43. "O" ring.
44. Plate.
45. Flange.
46. Nut.
47. Lockwasher.
48. Washer.
49. Front pump assembly.
50. Oil seal assembly.
51. Sealing ring.
52. Piston assembly.
53. Cylinder.
54. Sealing ring (inner).
55. Sealing ring (outer).
56. Split ring.
57. Spring.
58. Snap ring.
59. Pressure plate.
60. Clutch plate (drive).
61. Clutch plate (friction).
62. Hub.
63. Thrust washer (fibre).
64. Input shaft assembly.
65. Thrust washer.
66. Snap ring.
67. Front drum assembly.
68. Piston assembly.
69. Sealing ring (inner).
70. Sealing ring (outer).
71. Spring.
72. Seat.
73. Snap ring.
74. Clutch plate (friction).
75. Clutch plate (drive).
76. Pressure plate.
77. Snap ring.
78. Thrust washer (bronze).
79. Thrust washer (steel).
80. Needle bearing.
81. Brake band.
82. Strut (servo).
83. Body.
84. Lever.
85. Pivot pin.
86. Roll pin.
87. Screw.
88. Nut.
89. Return spring.
90. Piston assembly.
91. "O" ring (small).
92. "O" ring (large).
93. Piston sleeve.
94. Sealing ring.
95. Snap ring.
96. Forward sun gear assembly.
97. Sealing ring.
98. Sealing ring.
99. Sealing ring.
100. Thrust bearing.
101. Race.
102. Thrust washer (bronze).
103. Centre support assembly.
104. Screw.
105. Planetary gears and rear drum assembly.
106. Outer race.
107. Snap ring.
108. Thrust washer.
109. One way clutch assembly.
110. Brake band for rear drum.
111. Strut (servo).
112. Anchor strut.
113. Body assembly.
114. Lever.
115. Shaft.
116. Roll pin.
117. Piston.
118. "O" ring.
119. Return spring.
120. Plate.
121. Snap ring.
122. Ring gear.
123. Mainshaft assembly.
124. Snap ring.
125. Rear pump assembly.
126. Plate.
127. Key.
128. Gasket.
129. Oil inlet tube.
130. "O" ring.
131. Oil outlet tube.
132. "O" ring.
133. Governor assembly.
134. Governor body.
135. Governor weight.
136. Governor valve.
137. Spring.
138. Retainer.
139. Cover plate.
140. ¼" ball.
141. Snap ring.
142. Oil collector sleeve.
143. Piston ring.
144. Oil collector tube (front).
145. Oil collector tube (intermediate).
146. Oil collector tube (rear).
147. Speedometer drive gear.