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Section T8
REMOTE GEARCHANGE SELECTOR

The remote gearchange selector is clamped to the steering column assembly just below the steering wheel.

An exploded view of the selector is shown in Figure T 22.

Movement of the selector lever moves a pointer over an indicator scale which is marked 'N', '4', '3', '2' and 'R' representing Neutral, three forward gear ranges, and Reverse.

The selector is in the form of a switch. When the lever is moved from Neutral, an electrical signal is transmitted to the electric actuator which is mounted on the gearbox rear extension and connected to the gearchange lever on the gearbox. On receiving the signal, the electric actuator will automatically select the required gear range. The gearbox will remain in the selected range until the lever is again moved.

The electric actuator is wired so that, should the driver stop the car in a gear other than 'Reverse' then switch off the engine, he can still lock the transmission by moving the selector lever to the 'Reverse' gear position.

Having done this, if he moves the selector lever out of this position or the lever is accidentally moved to a drive position, the actuator will not respond until the ignition is switched on.

Remote gearchange selector—To remove

Remove the screws retaining the upper and lower halves of the cowling. These halves should always be retained as a set. Carefully remove the upper half of the cowling.

Remove the screw retaining the lower half of the cowling to its clamping bracket; remove the lower half of the cowling.

Disconnect the indicator lamp.

Disconnect the micro switch.

Remove the screw securing the switch insulating plate.

Remove the gearchange selector.

Remote gearchange selector—To dismantle

Remove the screws securing the micro switch(es) to the rear face of the base assembly and remove the micro switch(es).

Remove the operating arm from the spindle of the quadrant.

Remove the single 5 B.A. screw securing the pointer to the quadrant boss and remove the pointer.

Note Care must be taken not to scratch the pointer or the indicator scale.

Remove the two 5 B.A. screws and shake-proof washers securing the indicator support bracket to the two bosses on the base assembly, then remove the indicator support bracket assembly.

Remove the two hexagon-headed 3 B.A. screws securing the gate assembly to the underside of the base.

Remove the circlip, clevis pin and spring securing the gear selector lever to the quadrant, then remove the lever with the gate assembly attached.

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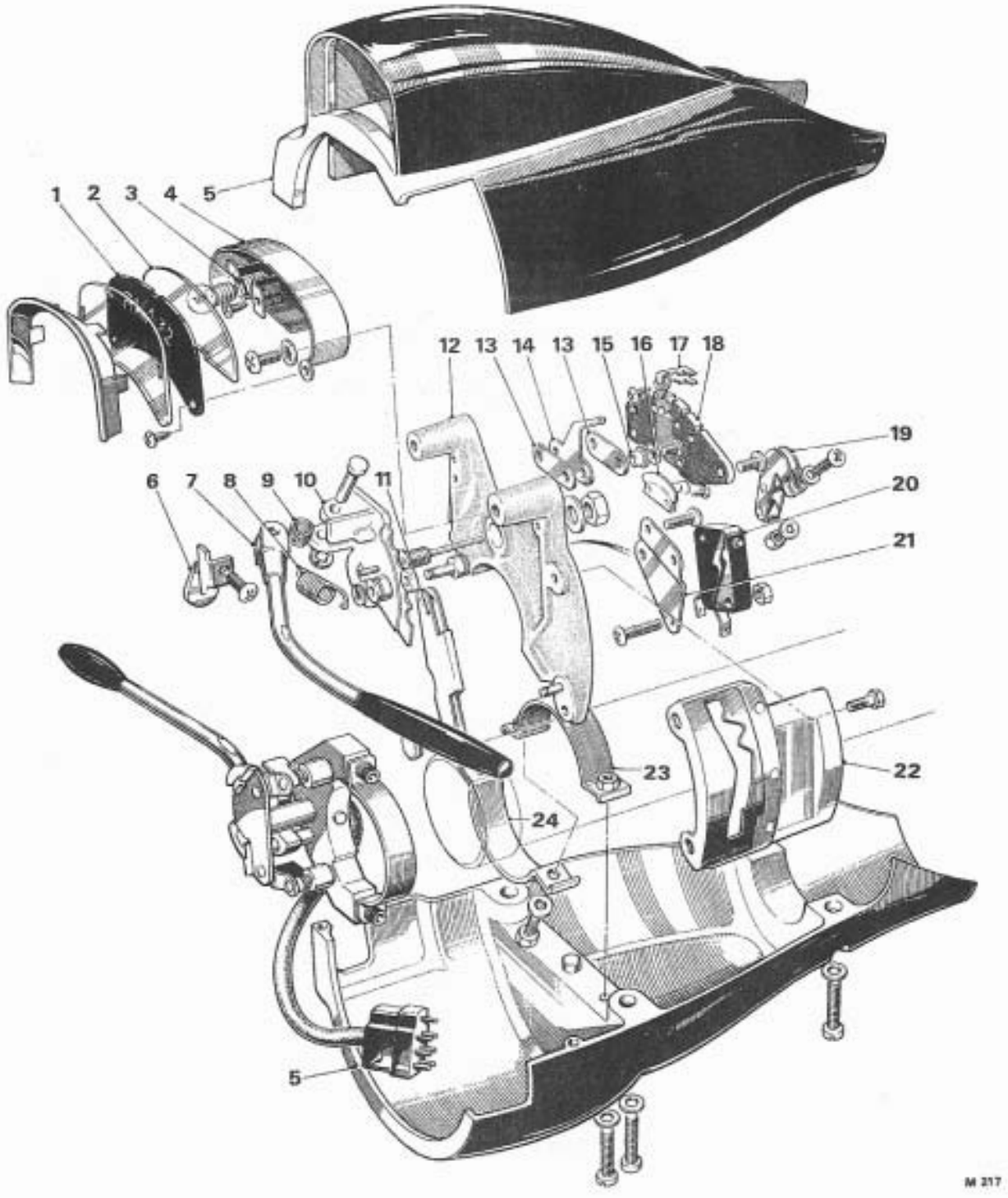

FIG. T22 REMOTE GEARCHANGE SELECTOR

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Remove the two 5 B.A. screws and washers securing the phosphor-bronze contact, two insulating strips and two insulating dowels to the quadrant and remove these items.

Remove the retaining clip from the rocking arm.

Remove the tension spring from the rocking arm and quadrant, and remove the rocking arm assembly.

Remove the ¼ in. UNF nut and washer from the quadrant spindle and remove the quadrant assembly from the base assembly.

Remote gearchange selector—To assemble

Fit the quadrant assembly onto the base and nip the ¼ in. UNF nut and washer onto the spindle. Check that the quadrant is free to rotate.

Remove the quadrant and lubricate the spindle with Ragosine 204G. Refit the quadrant and finally tighten the ¼ in. UNF nut.

Do not overtighten the nut, since the bearing boss tends to spread slightly and a tight bearing may be formed.

Fit the rocking arm assembly, then check to ensure that the roller lines up correctly with the quadrant with respect to height above the base.

Remove the rocking arm and hook the tension spring onto the anchor pin roller on the underside of the quadrant and onto the spring anchor on the underside of the rocking arm.

This operation is made easier by rotating the quadrant anti-clockwise beyond its normal travel, so that the spring is not under tension. Rotate the quadrant clockwise whilst holding the rocking arm clear, then allow the roller to locate on the detent forms. Fit the spring on the top side of the quadrant and rocking arm.

Note Do not fit the retaining clip to the rocking arm at this stage. (They are difficult to remove, should the need arise).

Move the quadrant to a mid-way selection and fit the phosphor-bronze contact. This contact is assembled between two insulating strips and all are located by two insulating dowels. This sandwich assembly is then secured to the quadrant by two 5 B.A. screws and washers.

Note Extreme caution must be taken with the moving contact, so that it is not bent or damaged in any way.

Before fitting the selector lever assembly carry out the following checks.

Check that the clevis pin will slide through both the fork end on the lever and the holes in the mounting bosses on the quadrant, then check that the fork end will slide between these bosses.

Lightly smear Ragosine 204G on the outside of the fork end, the inside of the bosses, the clevis pin and the clevis pin holes, then locate the fork end in the bosses by the clevis pin and fit the spring inside the fork end and over the clevis pin. Push home the pin and fit the circlip. Check that the lever will return easily under the load of the spring.

Secure the gate assembly to the underside of the base by means of the two hexagon-headed 3 B.A. screws. Check that, when the position of the lever is controlled by the detents, it lines up with the profile of the gate liner and that the extreme positions of the lever are not limited by the gate.

Fit the insulating plate complete with the feed and supply contacts fitted to it. When the unit is screwed

FIG. T22 REMOTE GEARCHANGE SELECTOR

1 Indicator scale
2 Filter—indicator lamp
3 Bulb holder
4 Bracket—indicator support
5 Cowl halves—upper and lower
6 Pointer—gearchange selector
7 Lever—assembly gear selection
8 Spring—tension rocking arm
9 Spring—lever gear selector
10 Quadrant assembly—5 position
11 Rocking arm
12 Base assembly—gear selector
13 Insulating strips
14 Spring—contact gearchange selector
15 Dowel—insulating
16 Supply contact
17 Feed contact
18 Plate insulating—5 position
19 Operating arm—reverse lamp
20 Micro switch
21 Bracket micro switch mounting
22 Bracket—supply assembly—5 position
23 Clamp—cowl to steering column
24 Clamp—gearchange selector base

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down by the three 5 B.A. screws, check that the inside leg of the moving contact is pressing onto the supply contact and that at the extremities of its travel the hemispherical head is still making good contact with the supply contact.

Each selection should then be made in turn, checking that the outside leg on the moving contact lines up correctly with each of the feed contacts.

Mount this assembly on the two bosses on the base by means of the two 5 B.A. screws and shake-proof washers.

Fit the blue filter with its flattened end in front of the bulb and behind the bracket mounting screw heads. Bend the top radiused end over the bulb and check that it follows the contours of the support bracket.

Hold the filter in this position by means of a 0·025 in. 0,64 mm.) feeler gauge held from the front of the unit, fit the indicator scale over the support bracket and secure it with two self-tapping screws. The scale should drop onto the bracket and its lip must not be forced down.

Feed the pointer under the indicator scale, then with '3 range' selected, use a thin-bladed Phillips head screwdriver, to feed the single 5 B.A. screw through the pointer leg and screw it into the quadrant boss. Care should be taken not to scratch either the pointer or the indicator scale.

Each selection should then be made and the alignment of the pointer checked.

Screw the micro switch onto the two bosses on the rear face of the base assembly. Fit the operating arm onto the spindle of the quadrant. **On a car not fitted with refrigeration** set the operating arm so that the single micro switch is depressed when the selection is 'R'. **On a car fitted with refrigeration** the two micro switches require setting so that the fast idle micro switch is depressed just as the selector is engaging 'N'. Check that the 'R' micro switch is operated satisfactorily. The screw is 5 B.A., therefore it should not be overtightened.

Fit the retaining clip to the rocking arm pivot.

Lightly smear Ragosine 204G on the quadrant detents, then operate the switch several times to ensure that the Ragosine is spread evenly.

Remote gearchange selector—To fit

Fit the remote gearchange selector onto the steering column, locating the dowel in the hole in the column outer tube. The two ¼ in. UNF screws which pass through the clamping bracket and into the base are fitted with spring washers.

Connect the selector switch and the micro switch wiring so that the looms leave clearance for fitting the cowling.

Fit the lower half of the cowling onto its clamping bracket then fit the upper half of the cowling.

Note Care must be taken when tightening the cowling retaining screws, since the unit, being made of plastic, will crack if over-stressed.

Check the clearance between the steering wheel hub and the cowling.

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Section T9
GEARBOX — TO REMOVE AND FIT

Gearbox — To remove

Drive the car on to a ramp; this is necessary to enable the gearbox to be lowered when it is disconnected from the engine.

Chock both front wheels and one of the rear wheels to prevent the car from moving. Jack up the other rear wheel to enable the propeller shaft to be rotated. Release the handbrake.

Disconnect the negative lead from the car battery which is located in the luggage compartment.

Disconnect the handbrake return spring from the operating lever.

Withdraw the split pin then remove the clevis pin from the pivot point in the end of the operating lever.

Remove the setscrews securing the centre portion of the box-section cross-member on which the hand brake operating and balance levers are mounted. The centre portion may now be moved to one side, or lowered from the underside of the car, but it must be suitably supported to avoid 'kinking' the handbrake cables.

Note The cross-member must not be allowed to hang on the handbrake cables.

Remove the four bolts which secure the propeller shaft rear flange to the final drive flange. It is advisable to leave one bolt loosely in position to support the shaft.

Similarly remove the four bolts from the front of the shaft.

Remove the bolt from the rear flange, then lower the propeller shaft front end and remove the shaft by pulling it forward and downward.

Note Stand the propeller shaft in an upright position with the ball and trunnion end uppermost.

Remove the nine cheese-headed screws which secure the under cover to the bell housing and crankcase end cover; remove the under cover.

Place a clean container, capable of holding at least three gallons, underneath the gearbox sump drain plug. Remove the drain plug then allow the oil to drain; fit and tighten the plug.

Carefully rotate the torus cover until the torus cover drain plug is at its lowest point. Place the container under the plug, remove the plug and allow the oil to drain; fit and tighten the plug.

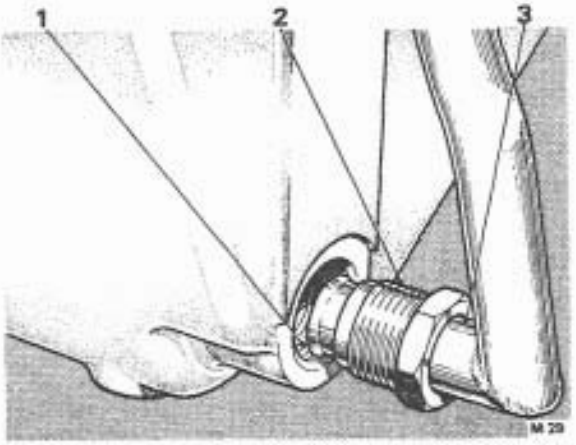

FIG. T23 DIPSTICK AND FILLER TUBE REMOVED

1 Sump tapped boss
2 Sleeve nut
3 Dipstick and filler tube

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Slacken the flared nut which secures the gearbox dipstick tube to the front of the sump. Remove the dipstick from under the bonnet. Disconnect the wiring loom from the dipstick tube. Remove the setscrew which secures the dipstick tube to the rear of 'A' bank cylinder head then remove the dipstick tube (*see Fig. T23*).

Unscrew and withdraw the speedometer drive cable from the speedometer drive unit in the gearbox rear extension; mask the end of the cable and drive unit to prevent the ingress of dirt.

Remove the controls as follows (*see Fig. T24*).

Remove the split pin and clevis pin from the gear-change rod at the actuator end.

Slacken the pinch bolt in the T.V. lever then remove the lever.

Remove the split pin and clevis pin from the link rod at the neutral start and height control switch lever end.

Remove the two nuts which secure the 'Get-You-Home' lever pivot to the side cover.

Slacken the pinch bolt in the gear selection lever; withdraw the levers and rods from the side cover.

Loosely fit the T.V. lever to its shaft.

Disconnect the accelerator rod at the fork end, adjacent to the right-hand engine mount.

Remove the pinch bolt from the ball joint at the top of the T.V. adjuster rod at the lever adjacent to the rear of 'A' bank cylinder head; disconnect the rod.

Remove the gearbox electric gearchange actuator as described in Section T7 of this Chapter.

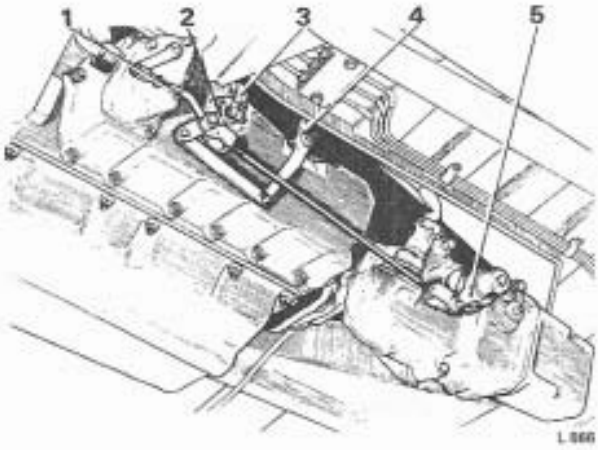

FIG. T24 CONTROLS DISCONNECTING POINTS

1 Link rod
2 Gear selector lever
3 T.V. lever
4 Get-you-home lever
5 Electric actuator lever

Note It is possible to remove the gearbox with the actuator in position, but if the gearbox is to be dismantled it is advisable to remove the actuator before removing the gearbox.

Remove the two nuts and plain washers which secure the neutral start and height control switches to the gearbox side cover; remove the switch box and tie it to a convenient point under the car to prevent it being damaged while the gearbox is being removed.

Remove the six bolts which secure the torus cover to the engine flex-plate; retain the six spacing washers. It should be noted that the torus cover end plate is secured to the torus cover by the same set of bolts; also the starter ring is secured to the drive-plate in a similar manner. Neither the end cover nor the starter ring need be removed.

Position a jack under the rear of the engine sump, ensuring that the load is spread evenly by placing a piece of wood between the jack head and the sump.

Raise the jack to take the weight of the engine and gearbox.

Remove any dirt from around the engine and gearbox mounting brackets then scribe correlation marks on the upper face of the engine mounts. The marks should coincide with the lower contour of the mounting feet on the bell housing (*see Fig. T25*). This procedure is necessary to ensure that the engine/gearbox unit is correctly aligned during subsequent refitting.

Note The sub-frame mounted brackets should be correlated to the sub-frame if and when they are removed.

Support the gearbox by using a jack and a suitable, locally manufactured platform, dimensions of which are given in Figure T26.

Remove the four bolts which secure the bell housing mounting bracket to the engine mounts.

Remove the setscrews and plain washers which secure the starter motor to the bell housing then withdraw the starter motor. It is not necessary to disconnect the starter motor wire unless the motor is to be removed completely for overhaul purposes.

Unscrew the setscrews which secure the bell housing to the engine crankcase rear face. The top three setscrews may be seen from the rear underbonnet position.

Note It is not possible to remove completely all the setscrews owing to the close proximity of adjacent components, but the setscrews may be unscrewed sufficiently to clear their mating threads without having first to move the gearbox.

Carefully move the gearbox backward until the nose of the torus end cover has cleared the bore in the engine crankshaft. Remove and retain the thrust washer located in the end of the crankshaft bore. If

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the washer is a slight interference fit in the crankshaft it may be left in position.

Lower the gearbox until it clears the underside of the body, then remove the gearbox from the car (*see Fig. T27*).

Notes on changing a gearbox or engine

A replacement gearbox is supplied less fluid coupling and bell housing. The torus cover, end cover and tori are balanced as an assembly, but the tori may be renewed separately, if necessary. The starter ring is balanced with the crankshaft assembly but this may be renewed, if necessary. If, after renewing any of these items, the engine shows signs of roughness due to out of balance units, the crankshaft and torus assemblies must be re-balanced.

After balancing, prior to initial assembly, the torus cover assembly is marked with paint or indelible ink. The flex-plate on the end of the crankshaft is marked in a similar manner. When fitting the gearbox to the engine these marks should be aligned, as near as possible in order to neutralise any slight out-of-balance residuals.

Gearbox — To fit

Ensure that the gearbox and torus drain plugs are fitted with a new washer and that the plugs are torque tightened to the correct loading.

Fit the setscrew in the bell housing hole adjacent to the near side cross-shaft lever.

Support the gearbox in a cradle on a jack in a similar manner to that used for gearbox removal. Raise the gearbox to a position in line with the engine. Position the T.V. adjusting rod in its approximate operating position.

Fit the thrust washer into the bore in the end of the crankshaft, retaining it with a smear of petroleum jelly.

Align the paint marks on the flex-plate and the torus cover as accurately as possible.

Ease the gearbox forward until the end cover spigot is located in the bore in the end of the crankshaft and the bell housing dowels are aligned with the end of the dowel holes. Push the gearbox forward until the bell housing front face meets the rear face of the crankcase.

Fit and tighten the securing setscrews.

Fit the six bolts which secure the torus cover to the flex-plate; fit one spacing washer between the flex-plate and the end cover as each bolt is fitted.

Remove the cradle and jack from beneath the gearbox. The engine and gearbox assembly can be

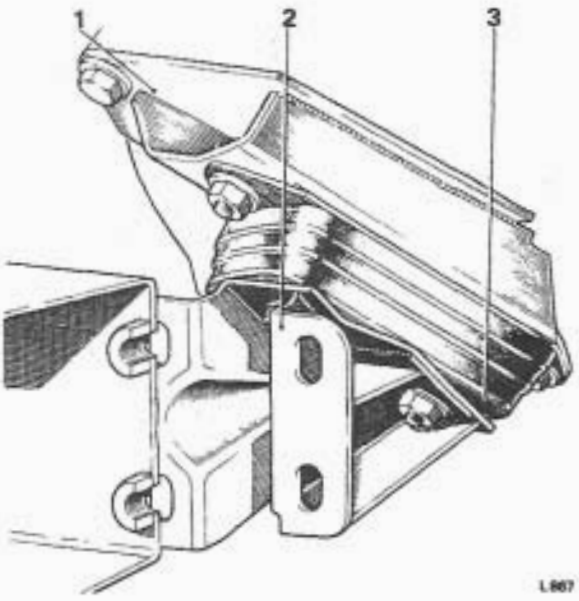

FIG. T25 ENGINE REAR MOUNTING AND BRACKETS

1 Bell housing bracket
2 Sub-frame bracket
3 Rear engine mount

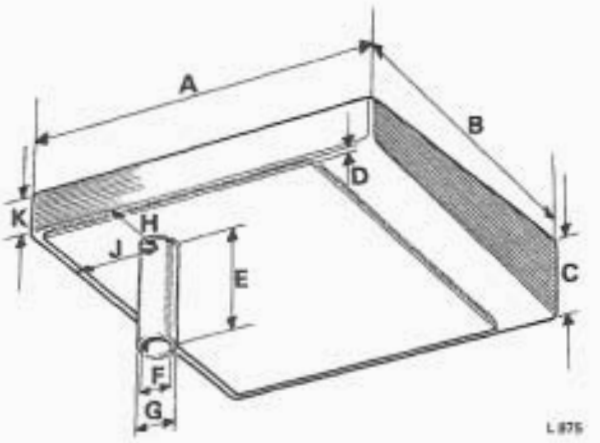

FIG. T26 GEARBOX REMOVAL CRADLE

A	15·00 in. (38,1 cm)	F	1·125 in. (2,86 cm)
B	10·00 in. (25,4 cm)	G	1·625 in (4,13 cm)
C	3·50 in. (8,89 cm)	H	3·250 in. (8,26 cm)
D	0·025 in. (6,3 mm)	J	5·00 in. (12,7 cm)
E	4·50 in. (11,4 cm)	K	1·75 in. (4,45 cm)

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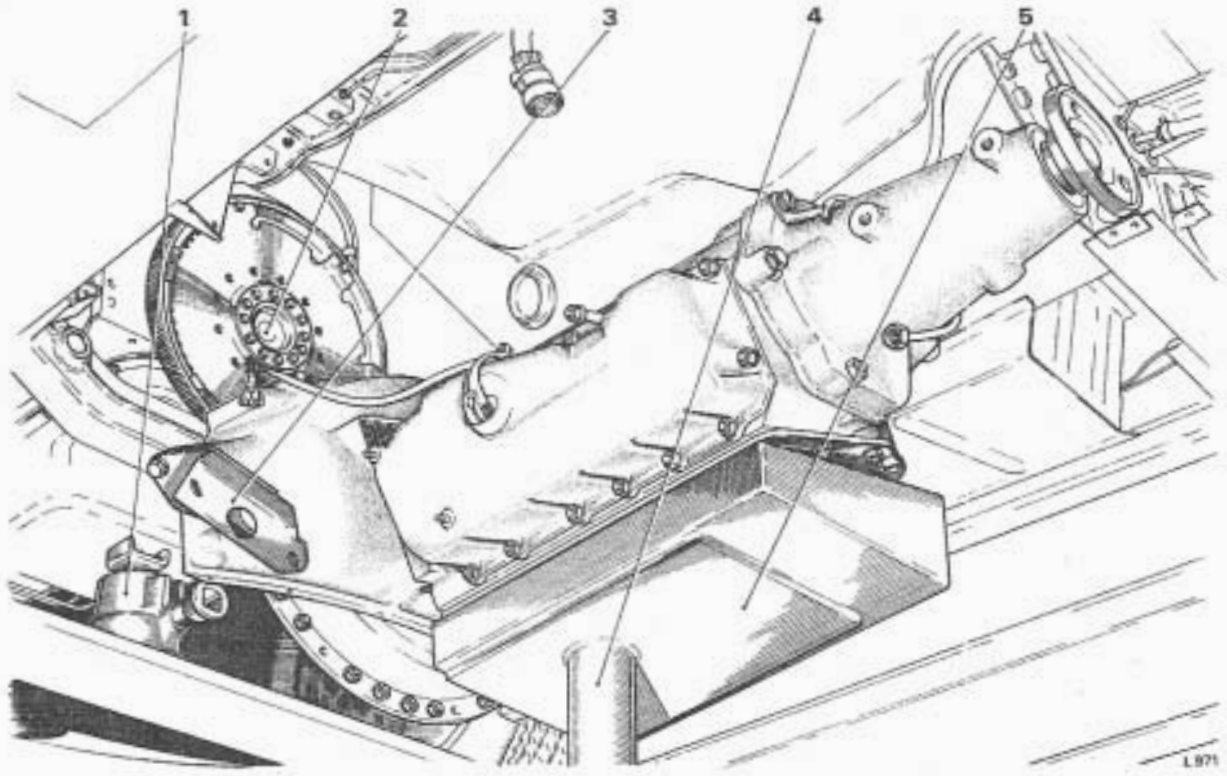

FIG. T27 REMOVING THE GEARBOX

1 Engine support jack
2 Thrust washer
3 Engine mount
4 Trolley jack extension
5 Platform

manoeuvred as a unit when fitting the rear mounts by operating the jack which supports the engine.

Position the engine rear mounting brackets so that the correlation marks are aligned then fit and torque tighten the bolts. Note that an earthing strip is secured to the right-hand engine mount.

Fit the remainder of the components by reversing the procedure given for dismantling, noting the following points.

Before fitting the bell housing bottom cover, check for correct torque tightness, all the bolts which secure together the starter ring, flex-plate, torus end cover and torus cover.

Road test

Before testing the car, fill the gearbox with Automatic Transmission Fluid as described in Section T2—'Servicing—To drain and fill'.

Test the car on the road, carefully noting the change points then comparing them with the table of change points shown in Section T2—'Servicing'.

If satisfactory changes cannot be obtained after adjusting the controls it may be necessary to remove the sump, then to adjust the bands as described in Section T14.

Finally, when the automatic changes are satisfactory, examine the gearbox for signs of oil leakage.

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DIMENSIONAL DATA FOR SECTION T9 — GEARBOX — TO REMOVE AND FIT

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Torus cover drain plug.	Torque tighten to between 18 lb.ft. and 20 lb.ft. (2,5 kgm. and 2,8 kgm.).	——	——
Bolts — torus cover to flex-plate, end cover and starter ring.	Torque tighten to between 18 lb.ft. and 20 lb.ft. (2,5 kgm. and 2,8 kgm.)	——	——
T.V. lever pinch bolt.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,415 kgm. and 0,553 kgm.)	——	——
Gear change lever pinch bolt.	Torque tighten to between 8 lb.ft. and 10 lb.ft. (1,1 kgm. and 1,4 kgm.)	——	——
Setscrews — bell housing to crankcase.	Torque tighten to between 29 lb.ft. and 32 lb.ft. (4,01 kgm. and 4,4 kgm.)	——	——
Setscrews—bell housing brackets to engine mounts.	Torque tighten to between 29 lb.ft. and 32 lb.ft. (4,01 kgm. and 4,4 kgm.)	——	——
Bolts — propeller shaft front flange to gearbox coupling flange.	Torque tighten to between 70 lb.ft. and 75 lb.ft. (9,7 kgm. and 10,4 kgm.)	——	——
Bolts — propeller shaft rear flange to final drive flange.	Torque tighten to between 45 lb.ft. and 50 lb.ft. (6,2 kgm. and 6,9 kgm.)	——	——

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Section T10
FLUID COUPLING

The fluid coupling is a unit, fitted to the front of the gearbox, which transmits engine torque to the transmission. It is a sealed unit comprising two torus members, housed in a torus cover; the torus cover is sealed at the front by an end cover. The torus cover itself is a partially machined steel pressing which is driven by a flex-plate bolted to the engine crankshaft. Steel pressings are used to fabricate the torus members, the vanes being located in slots and retained by tangs. Oil sealing is effected by an 'O' ring at the front end and a lip-type oil seal at the rear where the torus cover neck adjoins the front pump.

Operation

As soon as the engine starts, the gearbox front pump, driven by the shaft on to which the torus cover is splined, transfers oil from the gearbox sump into the torus cover, completely filling it.

The two torus members, which are splined on to separate shafts, rotate in the oil and are so shaped that oil is flung from the driving member on to the vanes of the driven member (*see Fig. T29*). The reaction of this oil causes the driven member to rotate also. A certain amount of slip between the two members is unavoidable, but this becomes negligible at higher engine speeds. It is the rearmost of the two components which is the driving member.

Fluid turbulence in the coupling is kept to a minimum by careful design of the torus members. The generation of heat by fluid friction is reduced by the provision of a circular flow path between the torus vanes and by maintaining a constant flow of oil through the coupling when the engine is running. In addition to this, further cooling is effected by the inclusion of vents in the bell housing which permit air at ambient temperature to be drawn into the bell housing interior by the rotary action of the torus cover. This air is then expelled through other vents in the bell housing bottom cover.

The fluid exhaust from the coupling passes through a check valve, situated between the intermediate shaft and the main shaft, then is returned to the gearbox to lubricate the bearings and clutches.

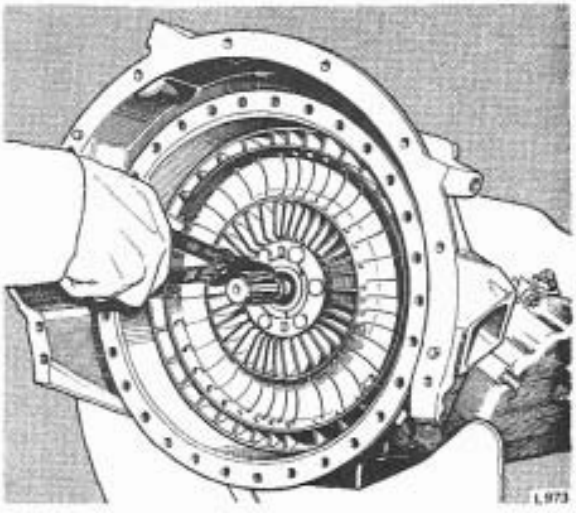

FIG. T28 REMOVING THE INTERMEDIATE SHAFT SNAP RING

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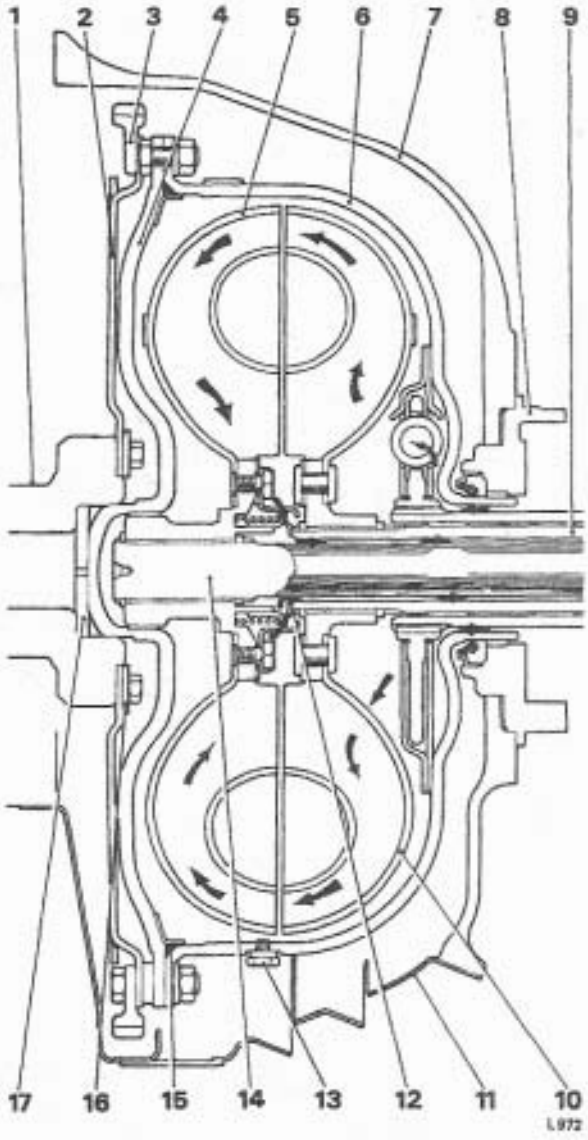

FIG. T29 FLUID COUPLING OIL FLOW

1 Crankshaft
2 Drive plate
3 Starter ring
4 End cover
5 Driven torus
6 Torus cover
7 Bell housing
8 Front pump
9 Intermediate shaft
10 Driving torus
11 Bottom cover
12 Check valve
13 Torus drain plug
14 Mainshaft
15 'O' ring
16 Clamping ring
17 Thrust plate

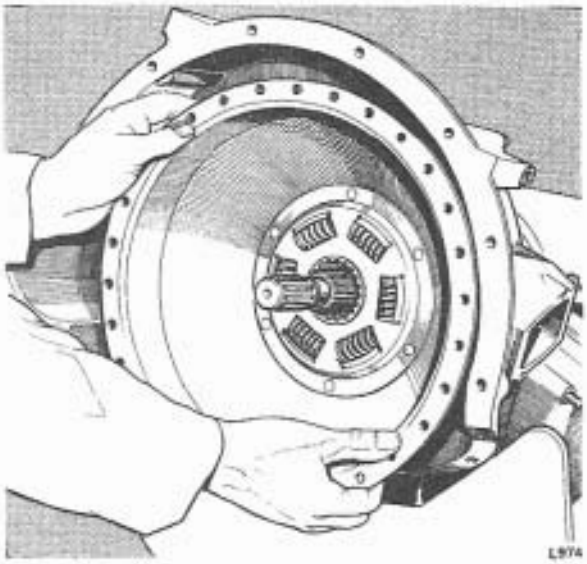

FIG. T30 REMOVING THE TORUS COVER

Fluid coupling — To remove

The fluid coupling can be removed from the gearbox only after the gearbox has been removed from the car (*see Section T9—'Gearbox—To remove and fit'*).

Note It is possible for the gearbox to be removed from the car without draining the oil, thus, before attempting to remove the torus cover, ensure that it has been drained of oil.

Remove the twenty-two $\frac{5}{16}$ in. bolts and the two fitted bolts which secure the end cover to the torus cover; remove the cover and discard the 'O' ring.

Remove the snap ring which secures the driven torus on the main shaft, then withdraw the torus.

Note When removing either torus, check for excessive play on the splined shafts. Excessive play can contribute to noisy operation.

If difficulty is experienced in removing the driven torus, a sharp blow with a soft-headed mallet on the end of the main shaft will free the torus hub from the splines.

Remove the snap ring from the intermediate shaft, then withdraw the driving torus (*see Fig. T28*).

Remove the torus cover as shown in Figure T30; if does not slide freely from the splines, care must be exercised to avoid rocking it excessively, otherwise damage may occur to the oil seal and bush in the front

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pump. The cover should be pushed firmly backward then drawn sharply off the shaft. When removing the cover, care must be taken not to damage the machined sealing surface on the neck of the torus cover.

If the gearbox is to be further dismantled, remove the four setscrews which secure the bell housing to the gearbox casing, then lift off the bell housing.

Check the torus relief valve for freedom of movement and full travel in the retainer.

If the valve appears to be serviceable and no complaints of slip have been received, it should be sufficient to clean the valve without dismantling. If, however, it is considered necessary, remove the torus relief valve and spring from the driven torus as follows.

Turn back the locking tabs on the retainer, unscrew the setscrews and lift the retainer, relief valve and spring from the recess in the torus hub (*see Fig. T31*).

Examine the outside of the torus cover and the inside of the bell housing for signs of oil which may indicate a leaking front pump seal. If signs of oil are evident on the bell housing-to-gearbox casing joint faces, it is probably an indication that the front pump-to-gearbox casing 'O' ring is leaking.

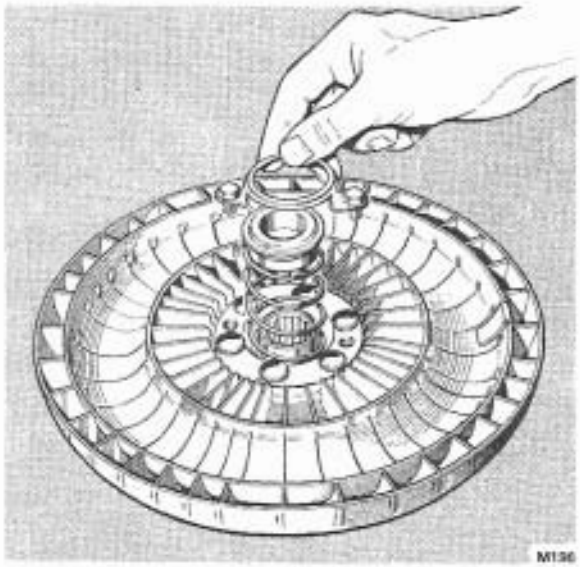

FIG. T31 REMOVING THE TORUS CHECK VALVE

Fluid coupling — To inspect

Examine the splines for signs of wear or damage; check the fit of the torus member and the hub of the spring drive in the torus cover on their respective splines.

Check the torus vanes for slackness.

Examine the neck of the torus cover, particularly the il seal and bearing diameters; small burrs may be removed with a smooth stone.

Examine the drain plug threads in the torus cover.

Check, for security and uneven wear, the bush in the torus cover end cover.

Examine, for scores, the sealing face of the relief valve, the inside diameter of the valve and the seating on the end of the intermediate shaft. Examine the spring for distortion.

If the valve has not been removed, check the retaining setscrews for security.

Fluid coupling — To fit

Fit the fluid coupling to the gearbox casing, noting the following points.

When fitting the bell housing to the gearbox ensure that the shortest of the four securing setscrews is entered into the bottom hole adjacent to the gearbox side cover as shown in Figure T32.

Ensure that all locking devices, including snap rings, are correctly fitted as the work proceeds.

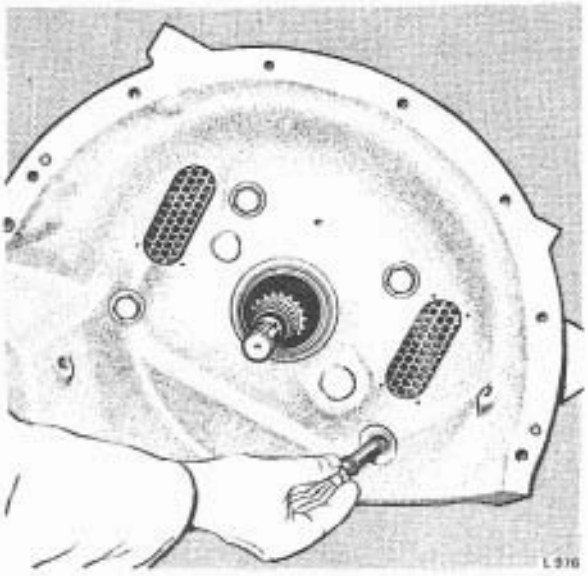

FIG. T32 FITTING THE BELL HOUSING SHORT SETSCREW

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If the relief valve retainer has been removed, a new one must be fitted.

Lubricate the neck of the torus cover with clean gearbox oil before fitting and take care not to damage the front pump oil seal and bush.

Fit a new 'O' ring to the torus cover end cover.

When fitting the end cover lubricate the bush, then ensure that the $\frac{1}{4}$ in. (6,35 mm.) and $\frac{5}{16}$ in. (7,94 mm.) dowel holes are aligned. Fit the fitted bolts first, then the remaining twenty-two bolts.

Note Tighten the bolts evenly; final tightening and torque loading may be left until the remaining bolts are fitted when the gearbox is fitted to the engine.

DIMENSIONAL DATA FOR SECTION T10—FLUID COUPLING

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Driven torus check valve spring free length.	3·531 in. (89,69 mm.) (approx.)	——	——
Load required to reduce spring length to 0·719 in. (18,26 mm.)	8 lb. 8 oz. to 9 lb. 8 oz. (3,856 kg. to 4,309 kg.)	——	——
Setscrews — bell housing to gearbox casing.	Torque tighten to between 60 lb.ft. and 65 lb.ft. (8,3 kgm. and 8,9 kgm.)	——	——
Setscrews — relief valve retainer to torus hub.	Torque tighten to between 8 lb.ft. and 10 lb.ft. (1,1 kgm. and 1,4 kgm.)	——	——
Torus cover drain plug.	Torque tighten to between 5 lb.ft. and 7 lb.ft. (0,69 kgm. and 0,97 kgm.)	——	——
Clearance between end cover bush and driven torus hub journal.	0·0015 in. to 0·0035 in. (0,037 mm. to 0,087 mm.)	0·0055 in. (0,127 mm.)	——

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Section T11
SIDE COVER, SUMP AND FILTER

The side cover, sump and filter can be removed while the gearbox is in position in the car but this should be necessary only when investigating a defect.

Before removal, the side cover and sump should be examined carefully for signs of oil leakage; if a leak is observed it must be traced and rectified. If the gearbox has been removed from the car, the examination should be carried out before the gearbox is inverted on its stand.

To avoid the risk of dirt entering the gearbox as work proceeds, the gearbox and adjacent underbody areas should be thoroughly cleaned, especially in the vicinity of the side cover and sump.

The following instructions apply when working on the gearbox whilst it is installed in the car. The procedure is generally the same when the gearbox is on the bench except that the control levers will have been removed and the sump will be uppermost.

Side cover — To remove

Place a clean container under the sump drain plug; remove the plug then drain the oil. Fit the plug. It is essential to drain at least some of the sump oil before removing the side cover due to the angle at which the gearbox is inclined.

Slacken the pinch bolt in the T.V. lever, remove the lever from its shaft then tie both lever and rod out of the way.

Remove the split pin and clevis pin from the link rod at the neutral start and height control switch lever end (*see Fig. T24*).

Remove the two nuts and washers which secure the neutral start and height control switch housing to the side cover. Remove the housing then tie it to a convenient point out of the way of the side cover.

Slacken the pinch bolt in the gearchange lever.

Remove the two nuts which secure the 'Get-You-Home' lever to the side cover.

Remove the control rods and levers from the side cover then secure them to the rear extension where they will be out of the way.

Place a suitable container beneath the side cover in order to catch the small amount of oil which resides in the lower part of the cover.

Remove the nuts and washers then lift off the side cover. It should be noted that the top left-hand nut is size 2B.A. and not $\frac{7}{16}$ in. A/F as are the others. When removing the side cover it may be necessary to pull down the gearbox slightly, compressing the mounts, so that the side cover clears the corner of the transmission tunnel.

Discard the side cover gasket.

Sump and filter — To remove

Unscrew the flared nut which secures the dipstick and oil filler tube to the front of the sump.

Slacken the setscrew which secures the tube to the rear of 'A' bank cylinder head.

Remove the dipstick tube from the sump (*see Fig. T23*).

Remove the nuts and plain washers which secure the sump to the gearbox casing.

Lower the sump; discard the gasket.

Before cleaning the interior of the sump examine the oil residue for metallic deposits, also look for particles

of clutch plate or band lining which may indicate an imminent failure.

Remove the filter by carefully easing it from the rear oil feed pipe then sliding it rearward from the front pipe. Care must be taken not to damage the filter by wrenching the mesh away from the sheet metal base or by stretching the gauze so as to increase the filtration size. Wash the filter in clean paraffin; **do not** use a cloth.

Side cover, sump and filter — To fit

Before fitting the side cover, sump and filter the following precautions must be observed.

Examine the interior of the gearbox for cleanliness and check that all pipes are secure in their sockets. Ensure that all setscrews and nuts are tight, and where lock washers are fitted that they are correctly locked.

Check that the rubber seal and the two steel washers are correctly positioned on the selector shaft as shown in Figure T38—Section T12—Control valve unit.

Ensure that the filter is clean and that new gaskets are fitted to the sump and the side cover.

Fit the components by reversing the procedure given for dismantling.

Replenish the gearbox with oil to the full mark on the dipstick as described in Section T2—'Servicing—To drain and fill'.

DIMENSIONAL DATA FOR SECTION T11 – SIDE COVER, SUMP AND FILTER

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Nuts — $\frac{7}{16}$ A/F — side cover to gearbox casing.	Torque tighten to between 8 lb.ft. and 10 lb.ft. (1,1 kgm. and 1,4 kgm.)	——	——
Nut — 2B.A. — side cover to gearbox casing.	Torque tighten to between 48 lb.in. and 60 lb.in. (0,553 kgm. and 0,691 kgm.)	——	
Nuts — Sump to gearbox casing.	Torque tighten to between 16 lb.ft. and 18 lb.ft. (2,1 kgm. and 2,5 kgm.)	——	
Sump drain plug.	Torque tighten to between 40 lb.ft. and 45 lb.ft. (5,5 kgm. and 6,2 kgm.)	——	

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Section T12
CONTROL VALVE UNIT

The control valve unit comprises an assembly of valves, springs and plugs which are contained in die cast aluminium bodies. The outer body forms a bearing for the manual control shaft and the throttle control shaft to which the respective control levers are fitted. Pipes convey oil from the governor to the control valve unit. Metered oil is then passed from the control valve unit, through pipes and a series of drillings, to various parts of the gearbox. The whole assembly is secured to a machined face on the left-hand side of the gearbox and enclosed by the side cover.

Operation

The position of the shift valves in Range 4 — first gear and the various oil passages which are used to obtain this gear are shown in Figure T33. The operation of the valves when each gaer is selected in each Range is described in the following paragraphs.

RANGE 4

First gear — Part throttle

When the manual selector lever is in Range 4, oil at main line pressure is allowed to flow directly to the front servo to apply the front friction band.

In first gear, road speed would be low, therefore governor pressure would be low.

At part throttle, the T valve would be slightly open and consequently the throttle valve also would be slightly open, allowing main line oil to bleed past the throttle valve to form throttle valve (T.V.) pressure. This pressure is then regulated by the T.V. regulator valve.

T.V. pressure moves the T.V. regulator valve against spring pressure, allowing oil to bleed past the valve and become T.V. 2 pressure. This pressure assists the springs which hold the shift valves in their rearmost position.

T.V. pressure, acting on the regulator plug in the pressure control valve, assists the pressure control valve in regulating the front pump capacity (*see Section T17—Pressure control valve*).

T.V. pressure, acting on the compensator valve, moves the valve, against spring pressure, so that main line pressure oil is allowed to bleed past the valve to form compensator pressure. Compensator pressure assists main line pressure in the front servo (*see Section T14—Front servo*). Compensator pressure is also fed to the double transition valve, moving the valve against spring pressure. This is not important in first gear, as front clutch apply oil is fed past the double transition valve and this is not applied until second gear.

Main line oil pressure is fed to the centre clutch and to the rear servo also to release the rear band. The rear drum is held stationary by the action of the sprag clutch so that both gear trains are in reduction, giving a gear ratio of 3·82 : 1.

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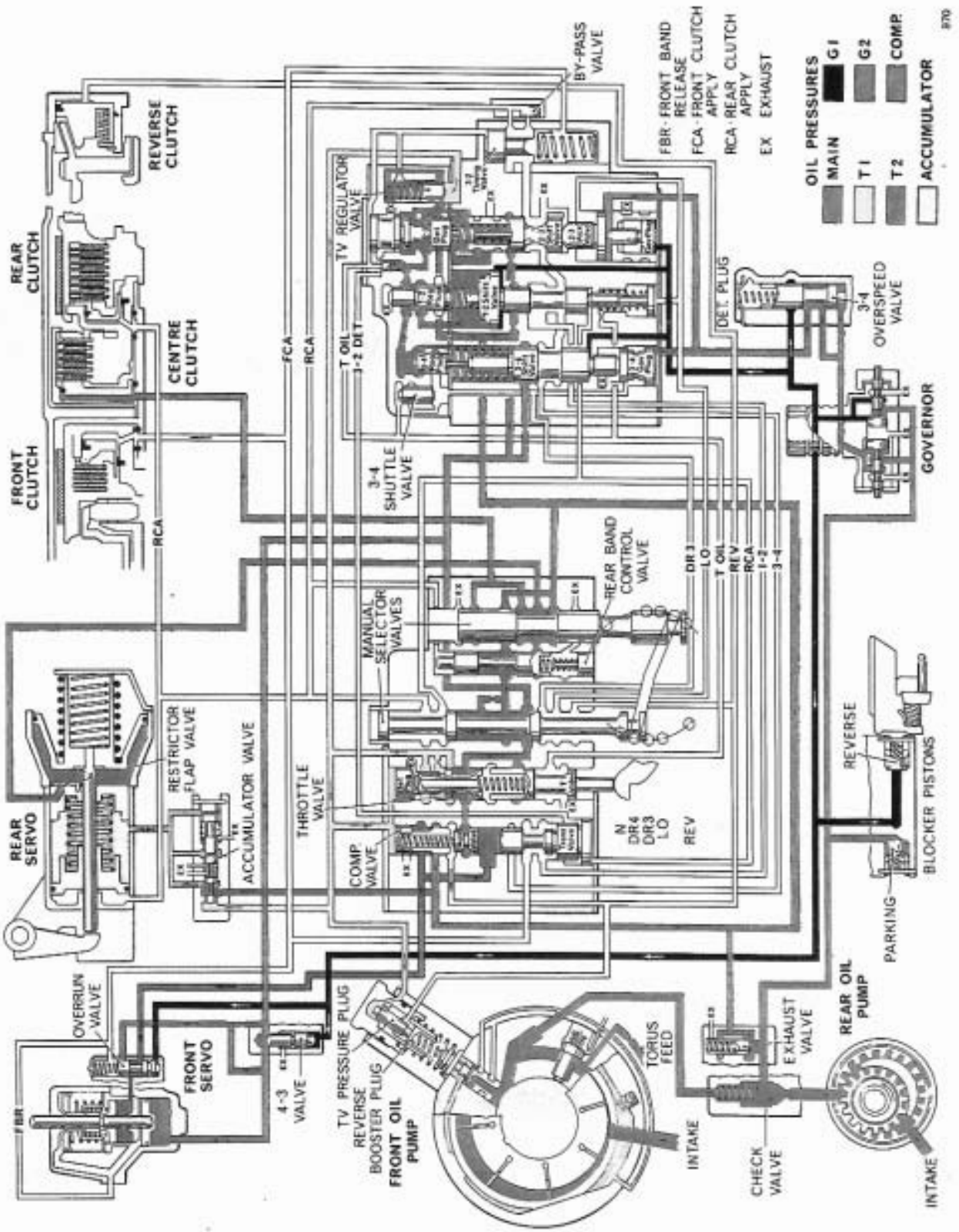
OIL PRESSURES
MAIN
G1
T1
G2
T2
COMP.
ACCUMULATOR
FBR - FRONT BAND RELEASE
FCA - FRONT CLUTCH APPLY
RCA - REAR CLUTCH APPLY
EX EXHAUST
BY-PASS VALVE
REVERSE CLUTCH
REAR CLUTCH
CENTRE CLUTCH
FRONT CLUTCH
TV REGULATOR VALVE
T OIL 1-2 DET
3-4 SHUTTLE VALVE
DET. PLUG
3-4 OVERSPEED VALVE
GOVERNOR
REAR BAND CONTROL VALVE
MANUAL SELECTOR VALVES
RESTRICTOR FLAP VALVE
ACCUMULATOR VALVE
THROTTLE VALVE
COMP VALVE
REAR SERVO
REVERSE
BLOCKER PISTONS
PARKING
REAR OIL PUMP
OVERRUN VALVE
FRONT SERVO
4-3 VALVE
TV PRESSURE PLUG
REVERSE BOOSTER PLUG
FRONT OIL PUMP
TORUS FEED
EXHAUST VALVE
INTAKE
CHECK VALVE
INTAKE

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Second gear — Part throttle

With the throttle still slightly open, throttle pressure remains low.

As road speed increases, G1 pressure (*see Section T16—Rear pump and governor*) increases and, acting on the 1-2 shift valve, eventually overcomes the springs and T.V. 2 pressure, thus moving the 1-2 shift valve group into the second gear position. T.V. 2 pressure in this group is then cut off by the 1-2 regulator plug and the existing T.V. 2 oil is forced to exhaust. The regulator plug locks the shift valve in gear after an up or down-change and so prevents 'hunting' between gears.

Compensator oil remains high enough to keep the double transition valve open.

The movement of the 1-2 shift valve opens a port which allows main line oil to flow past the open double transition valve, to engage the front clutch and to release the front band.

Main line oil pressure is still fed to the front servo apply chamber, but main line oil, acting on the larger area of the servo 'release' pistons, overcomes the apply oil pressure.

The sprag clutch still holds the rear drum, giving rear train reduction. As the front train is now in direct drive (clutch on, band off) the gearbox gives a reduction of 2·63 : 1.

Down-change

The 2-1 down-change occurs automatically at extremely low road speeds only. When G1 pressure falls below a minimum value, the action of T.V. 2 pressure, plus spring pressure, on the 2-1 shift valve group moves the shift valve back and holds it in the first gear position. Oil pressure to the front clutch is cut off, the front band applied and first gear is obtained.

Third gear — Part throttle

With the throttle still only partially open, throttle pressure remains low.

As road speed increases, G1 pressure will reach its maximum value (at 1 300 r.p.m. output) whilst G2 pressure is still increasing.

When the road speed, and thus governor oil pressures become sufficiently high, the combined G1 and G2 pressures on the 2-3 shift valve group overcome the opposing spring and T.V. 2 pressure and the 2-3 shift valve is forced to move; the 3-2 detent plug is forced back, cutting off T.V. 2 pressure and permitting the displaced oil to exhaust.

As the 2-3 shift valve moves, a port is opened which allows main line pressure oil to flow past the 3-2 timing valve to engage the rear clutch. The sprag clutch allows the rear drum to rotate (*see Section T15—Rear servo and accumulator*).

Main line oil pressure is also tapped from the rear clutch apply line to close the double transition valve against compensator pressure.

When the double transition valve closes, the port which supplied pressure oil for front clutch 'apply' and front band 'release' is sealed. As a result, the front clutch is released by its springs and the front band is applied by the main line oil feed from the selector valve.

The front gear train is then in reduction and the rear train in direct drive, giving a gear ratio of 1·45 : 1.

Down-change

If road speed is allowed to fall, governor pressure will decrease accordingly. When G1 pressure falls below a minimum value, action of the spring will force the 2-3 shift valve into the second gear position.

When this occurs, the main line oil ports to the double transition valve and the rear servo release chambers are sealed. As compensator pressure forces the double transition valve open, main line oil flows past it to engage the front clutch and release the front band. The rear clutch is released, the rear gear train freewheels and the gearbox reverts to second gear.

Fourth gear — Part throttle

Still using a part throttle, the throttle pressure remains low.

Due to the increased road speed in third gear, G1 pressure will reach its maximum and the effect of the increasing G2 pressure will assume a relatively greater importance. When sufficiently high, the combined action of G1 and G2 pressure on the 3-4 governor plug overcomes the opposing spring and T.V. 2 pressure, causing the 3-4 shift valve to move. The 3-4 regulator plug will retain the 3-4 shift valve to prevent 'hunting' in a similar manner to that described for the other two shift valves.

As the 3-4 shift valve moves, a port is opened which allows main line oil pressure to flow past the **closed** double transition valve to engage the front clutch and to release the front band.

The front gear train will then be in direct drive. As the rear train has remained in direct drive from third gear, the gearbox now transmits torque through a 1 : 1 gear ratio.

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Down-change

When road speed in fourth gear is allowed to fall, G2 pressure is reduced accordingly. G1 pressure is not affected until the car speed is considerably reduced.

When G2 pressure is sufficiently low, the combined action of T.V. 2 pressure and spring pressure on the 3-4 shift valve group forces the valve to move into the third gear position.

The flow of main line oil past the 3-4 shift valve is thus cut off, removing the pressure from the front clutch and the front servo release piston. The front clutch is then released by its springs and the front servo is applied by main line oil pressure from the selector valve.

As the rear clutch remains unaffected, the gearbox reverts to third gear.

Forced down-change

A forced down-change can be obtained by fully opening the throttle and applying a slightly greater force on the accelerator pedal, depressing the spring loaded button. This forces the throttle valve assembly to the end of its travel, where the T valve uncovers a port, permitting oil at main line pressure to flow through a non-return valve and bleed past the T.V. regulator valve to increase T.V. pressure to the same value as main line pressure, and to act on the regulator plugs in opposition to governor pressures.

Oil at main line pressure acts on the 3-2 detent plug, the 1-2 regulator plug and the 3-4 shuttle valve. Oil then passes around the shuttle valve to the back of the 3-4 regulator valve, thus applying main line pressure on the 3-4 shift valve.

Subsequent valve operation will depend on the road speed; if this is below 71 m.p.h. (114 k.p.h.) the 3-4 shift valve will move to effect a change to third gear, and maintain third gear until a speed of between 73 m.p.h. and 75 m.p.h. (117 k.p.h. and 121 k.p.h.) is attained, when an upchange will occur.

The up-change is caused by increased G2 pressure acting on the overspeed valve, moving it against spring pressure to uncover a port which allows G1 pressure to substitute for G2 pressure and so increase the pressure on the 3-4 governor plug which moves the 3-4 shift valve assembly.

If the road speed is below 22 m.p.h. (35 k.p.h.) the 3-2 detent plug is moved against its spring pressure towards the 2-3 shift valve and uncovers a port which permits main line oil pressure to act on the double transition valve and the 3-2 timing valve; the 3-2 detent plug and the 2-3 shift valve will then move to change down into second gear.

The 3-2 timing valve, which on earlier Rolls-Royce and Bentley gearboxes delayed the application of the rear band and disengagement of the rear clutch until the front clutch was applied, is retained. As the rear band is not applied except in Range 2, this feature figures less in importance than hitherto.

Up-change to third gear will not occur until approximately 40 m.p.h. (64 k.p.h.) because of main line pressure acting on the 3-2 lock valve instead of T2 pressure acting on the 2-3 shift valve.

If the road speed is below 8 m.p.h. (13 k.p.h.) the 1-2 shift valve assembly will move to effect the down-change, and the subsequent up-change will occur at a slightly higher speed than normal. This is due to main line oil pressure acting on the front of the 1-2 detent plug and the higher T.V. pressure acting on the 1-2 regulator plug.

SELECTOR POSITIONS

Range 3

When Range 3 is selected, main line oil pressure is directed to the 3-4 shift valve, via the 3-4 shuttle valve and the 3-4 regulator plug, where it holds the 3-4 shift valve in the third gear position. Main line oil pressure is also directed to the 3-4 governor plug, where it resists governor pressure and prevents an up-change to fourth gear except at high speed.

The up-change to fourth gear requires the operation of the overspeed valve. If the car is driven at speeds of between 75 m.p.h. and 77 m.p.h. (121 k.p.h. and 124 k.p.h.) with full throttle, G2 pressure lifts the overspeed valve and substitutes G1 pressure for G2 pressure, thus increasing the thrust on the 3-4 governor plug and forcing the 3-4 shift valve to move to fourth gear position.

The 2-3 shift valve operates in the same way in Range 3 as in Range 4, the up and down-change points being the same in either selector position.

Range 2

When Range 2 is selected, main line oil pressure is directed to the 2-3 auxiliary valve to oppose governor pressure acting on the 2-3 governor plug. This has the effect of locking the 2-3 shift valve group in the second gear position and prevents the gearbox from changing up. Main line oil pressure is also directed to the 1-2 detent plug, which moves the 1-2 shift valve group, against spring and T.V. 2 pressure, to prevent the gearbox changing down to first gear.

A special feature, obtainable in Range 2, is the application of the rear band to assist engine braking.

When Range 2 is selected, the manual valve moves to cut off the supply of main oil line pressure which is

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holding the rear servo in the 'off' position. However, the rear band control valve provides an alternative path as long as rear clutch apply oil holds the rear band control valve back against spring pressure, the oil behind the rear band control valve now being open to exhaust. As rear clutch apply oil pressure falls off, the rear band control valve moves forward, cutting-off rear band release oil and allowing the rear servo to apply the rear band.

Reverse

When the selector lever is moved into the reverse position, main line oil pressure is directed to the rear band release piston, the compensator valve and the reverse cone clutch. It also acts on the reverse booster plug in the pressure control valve (*see Section T17—Pressure control valve*). Main line oil pressure acting on the compensator valve shuts off compensator pressure and this, together with the use of a clutch to engage reverse gear, permits instant change from forward drive to reverse drive and back again when necessary, but a safety blocker piston prevents Reverse from being engaged at speeds in excess of 10 m.p.h. (16 k.p.h.).

Parking

When parking the car, the transmission can be locked by engaging reverse gear with the engine switched off. This locks the transmission by means of a spring-loaded pawl which engages with teeth around the outer diameter of the reverse annulus gear. The transmission will remain locked, regardless of the position of the steering column mounted selector switch. When the selector lever is moved to Neutral and the ignition is switched on, the pawl will be disengaged by the gearbox electric actuator (*see Section T7—'Gearbox electric actuator'*).

Neutral

When the engine starts, the front pump immediately builds up oil pressure. The rear band is released by main line oil pressure (rear band release oil), the front servo and front clutch remain released (no oil feed) therefore the drive is disconnected in both front and rear epicyclic units.

OVERHAUL

Control valve unit — To remove

The control valve unit can be removed from the gearbox, without removing the gearbox from the car.

Remove the gearbox sump drain plug and allow the oil to drain into a clean container.

Remove the gearbox electric actuator as described in Section T 7.

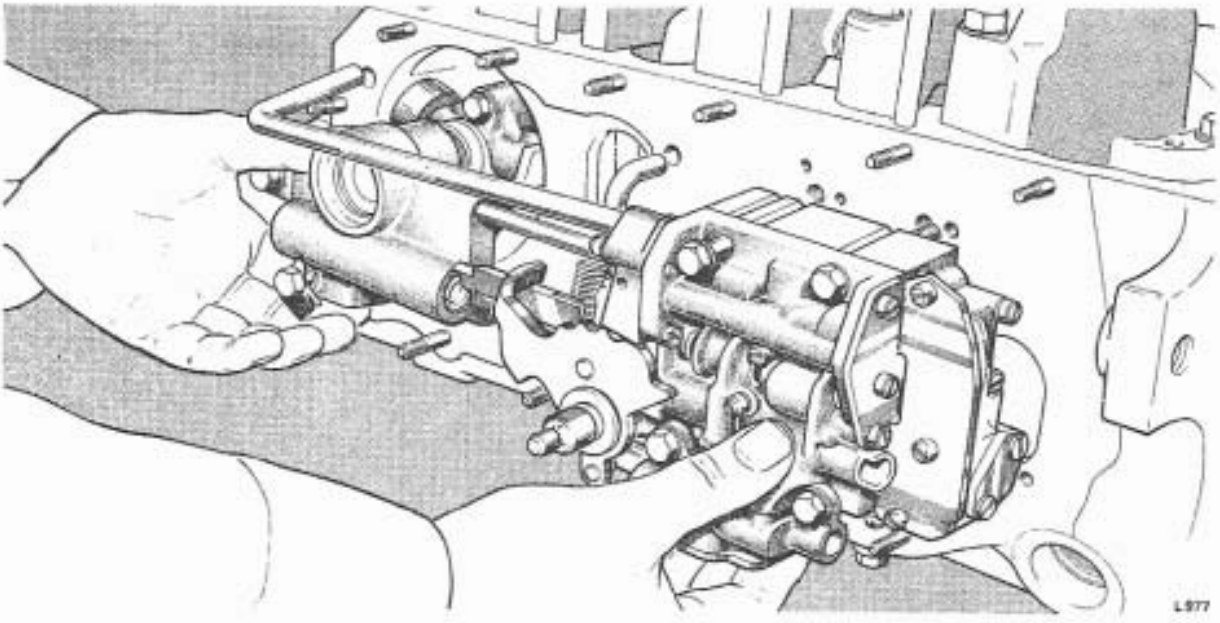

FIG. T34 REMOVING THE CONTROL VALVE UNIT

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Remove the side cover as described in Section T11.

The control valve unit cannot be removed from the gearbox unless the parking brake bracket is also removed. The rear servo and neutral clutch oil feed pipes locate in both the control valve unit and the gearbox; as a result, the unit must be lifted away from the gearbox instead of being moved forward. Therefore, the following instructions give the procedure to be adopted for the removal of the control valve unit and the parking brake bracket.

Unlock the tab washer, then unscrew and withdraw the parking pawl support screw.

Remove the parking lever roller from the crankpin; the parking pawl will be left loose in the casing as it cannot be withdrawn until the parking brake bracket has been removed.

Unlock the front setscrew tab washer, then remove the two securing setscrews and washers.

Prepare to remove the control valve unit as follows.

Remove the two pressure control valve T.V. oil pipes from the holes in the control valve unit and the gearbox casing.

Check the tightness of the four hexagon-headed setscrews which secure the control valve unit to the gearbox casing; slackness may have caused oil leakage between the mating faces and contributed to faulty operation.

Rotate the selector lever until it is possible to fit a spanner to all four setscrews then remove the setscrews and washers; note that the longest setscrews fit into the top two holes.

Withdraw the control valve unit and the parking brake bracket. Endeavour to withdraw the oil pipes with as little sideways movement as possible, otherwise the holes may be pulled out of shape and could be a possible source of oil leakage.

Remove the parking pawl from the gearbox casing.

Remove the reverse clutch oil pipe, then separate the control valve unit from the parking brake bracket by pulling them apart to disengage the governor oil pipes.

If the gearbox is to remain without a control valve unit whilst the unit is dismantled, precautions must be taken to prevent the ingress of dust and dirt by fitting the side cover.

Control valve unit — To dismantle

If faulty operation of the control valve unit is suspected, it will probably be due to dirt which has found its way into the valve bores; wear of the valves or bores is unlikely. It is recommended that the unit be renewed rather than dismantled, but if this is not convenient, the unit should be dismantled, cleaned, assembled and rig and/or road tested before being put back into Service.

The importance of cleanliness cannot be overemphasised when handling parts of the control valve unit. Minute particles of fluff from cloth, or even from the hands, if present in the valve bores are sufficient to prevent correct operation. For this reason a brush and filtered cleaning fluid, or compressed air, is recommended for cleaning purposes.

If the unit is to be removed but not dismantled it must be protected from dirt and other foreign matter by wrapping in waxed paper until required for use.

An exploded view of the control valve unit, on which parts are shown in their relative positions is given in Figure T35.

To avoid damage to the valves or bores, extreme care must be taken when dismantling the unit.

A workbench with a clean flat surface should be used, preferably covered with clean greaseproof paper; it is recommended that the control valve unit be left flat on this surface for as much of the dismantling operation as possible.

As valves and springs are removed, they should be washed and lightly oiled with clean gearbox oil and placed in a suitable container until they are required for inspection or assembly.

In order to assist later assembly, all valves, springs, screws and washers should be kept in their original groups, together with the casting from which they were removed.

As an aid to the identification of the various components of the unit, reference is frequently made in parenthesis in the following text to the exploded view of the unit shown in Figure T35.

Control valve outer body — To dismantle

Remove the oil feed pipes then lift the manual valve body (60) from the main control valve unit; withdraw the neutral and rear servo manual valve (62).

Remove the two securing screws and spring washers, then lift the outer body (53) and oil guide plate (48) from the control valve inner body (47).

The compensator plug retaining pin (55) is a sliding fit and may fall out during handling of the outer case; care must be taken to ensure that it is not lost.

Remove the spring steel by-pass valve (28) from the outer body, noting its position to assist in assembly.

Rotate the selector lever (67) as far as possible away from the detent plunger retainer (38) then withdraw the plunger and spring (35 and 36).

Carefully withdraw the manual control valve (37) from the outer body; the valve is slender and may be bent if carelessly handled.

Remove the three securing screws and washers then remove the detent plunger retainer (38) and oil guide

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plate (58) from the outer case. Note the different lengths of the securing screws to ensure correct refitting.

Rotate the throttle valve lever away from the outer body, then withdraw the T valve and throttle valve spring (33 and 34). Care must be taken to ensure that the throttle valve lever is not allowed to contact and damage the empty bore.

Carefully shake the throttle valve (32) and the transition valve (56) from the outer body.

Unscrew the three securing screws and remove the compensator valve plate (49). Withdraw the compensator valve and spring (50 and 51) and the detent plug (52).

The compensator plug (54) need not be removed provided that it moves freely in the bore; its movement should be felt when gently shaking the outer body. If the plug is to be removed, first withdraw the retaining pin (55), then using a soft metal rod in each end of the bore, carefully manoeuvre the plug from the port.

If the selector lever (67) or throttle valve lever are to be removed, withdraw the pin (68) from the outer end of the throttle lever shaft. The selector lever can then be lifted from the throttle valve shaft (30) complete with washer and sealing washer (70 and 69).

Front and inner valve bodies — To dismantle

Place the inner valve body (47) flat on the bench, then firmly holding the front valve body (3) against spring pressure, remove the three securing screws and washers. Slowly release the holding pressure, then remove the front body and oil guide plate (23). Note the position of the three securing screws for correct fitting.

Withdraw from the front body the T.V. regulator valve and spring (6 and 5) the 1-2 regulator plug (4), the 3-4 regulator plug (42) and the 4-3 shuttle valve (43).

Remove from the inner body the 3-4 shift valve and spring (46 and 45), the 1-2 shift valve and spring (11) and (9), and the 2-3 shift valve, spring and guide pin (12, 8 and 10).

Remove the two countersunk screws retaining the 3-2 detent plug plate (1), then remove the plate and the 3-2 detent plug (2).

If access is required to the oil check ball valve, remove the three securing screws and cover plate (44) from the front body. The valve ball and spring (40) and (41) can then be lifted from their seating.

Overspeed valve body — To dismantle

Remove the three screws and washers retaining the overspeed valve body (27), then remove the body and oil guide plate (26); note the position of the three securing screws for correct fitting.

Using the screwdriver, inserted through the slot of the overspeed valve spring retainer (22), compress the spring and extract the retainer. Withdraw the overspeed valve and spring (25 and 23).

Tilt the inner valve body so that the valves protrude. Remove the 3-4 governor plug (29), the 2-3 detent plug and spring (18 and 14) and the 2-3 governor plug (20).

Care must be taken when removing the 2-3 auxiliary valve (16) as its bearing surface is small and it may cant over in the bore. The 2-3 governor plug sleeve (17) should be therefore left in the bore temporarily in order to align the 2-3 auxiliary valve; press out the valve together with the sleeve using a soft rod inserted into the opposite end of the bore.

3-2 timing valve body — To dismantle

Remove the two securing screws and washers then remove the 3-2 timing valve body (13).

Depress the valve spring retaining cap (21) and withdraw the retaining pin (24) Carefully release the retaining cap and withdraw the cap, valve and spring (21, 15 and 19).

Manual valve body — To dismantle

Remove the four screws which secure the cover plate to the valve body; remove the plate (59).

Push the retainer (66) against spring pressure, until the retaining pin (39) can be pushed out.

Remove the retainer, spring and the rear band control valve (66, 55 and 63).

Control valve unit — To inspect

After cleaning, inspect the valves and bores for burrs and scoring, also check that the selector valve is not bent. If scoring in excess of faint lining is found it may cause leakage, in which case the control valve unit must be renewed. Individual parts must not be renewed as valves and valve bores are machined to fine limits when assembled to give the correct clearance between valve and bore. No attempt must be made to polish valves or to scrape bores as the machine marks on these parts are an essential feature and provide the oil pockets in which the valves 'float' for free operation.

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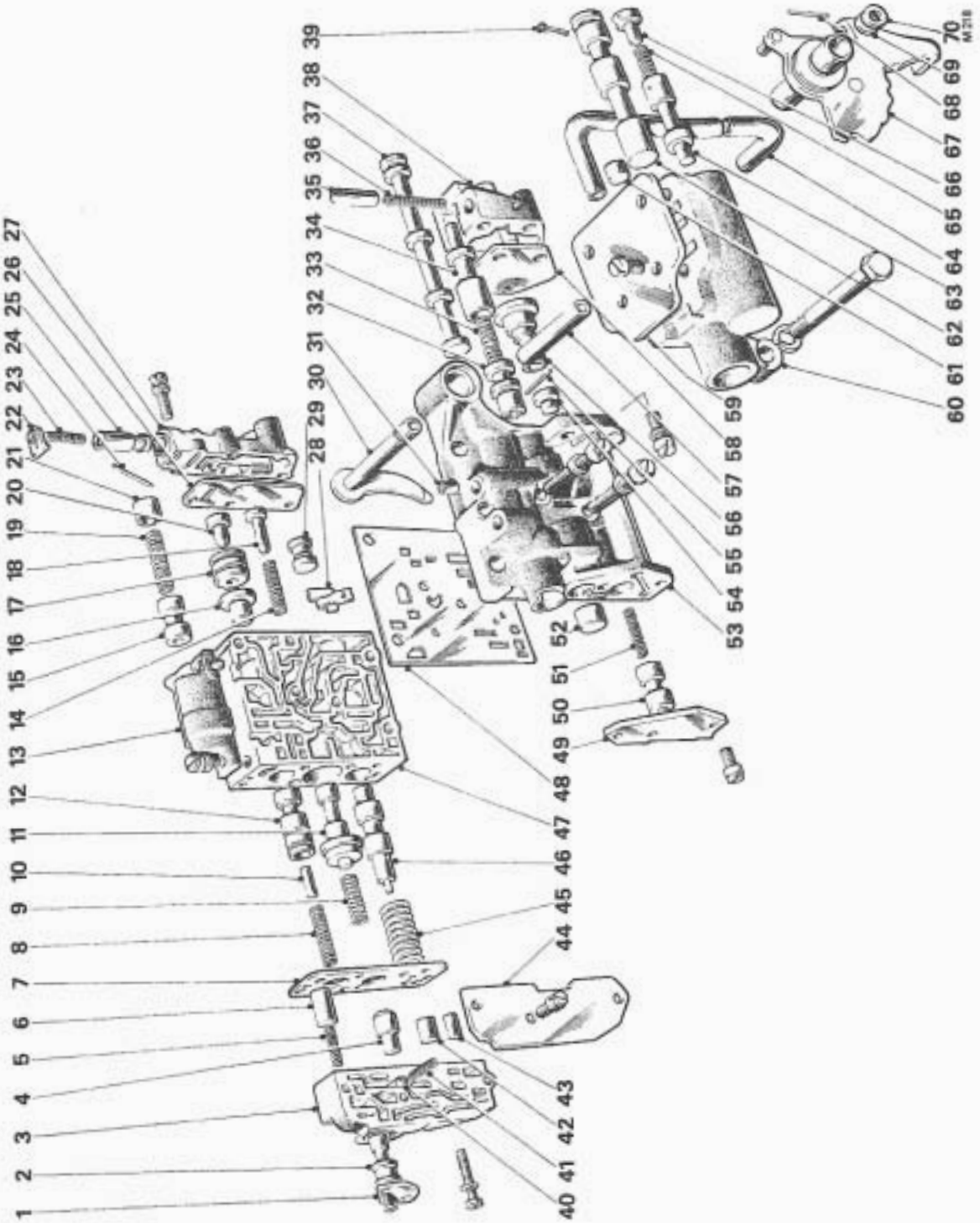

FIG. T35 CONTROL VALVE UNIT

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FIG. T35 CONTROL VALVE UNIT

1 3-2 Detent plug plate
2 3-2 Detent plug
3 Front valve body
4 1-2 Regulator plug
5 T.V. Regulator valve spring
6 T.V. Regulator valve
7 Oil guide plate
8 2-3 Shift valve spring
9 1-2 Shift valve spring
10 Guide pin
11 1-2 Shift valve
12 2-3 Shift valve
13 3-2 Timing valve body
14 2-1 Detent plug spring
15 3-2 Timing valve
16 2-3 Auxiliary valve
17 2-3 Governor plug sleeve
18 2-1 Detent plug
19 3-2 Timing valve spring
20 2-3 Governor plug
21 Spring retaining cap
22 Spring retainer
23 Overrun control valve spring
24 Retaining pin
25 Overrun control valve
26 Oil guide plate
27 Overrun control valve body
28 By-pass valve
29 3-4 Governor plug
30 Throttle valve shaft
31 Oil transfer tube
32 Throttle valve
33 Throttle valve spring
34 T valve
35 Detent plunger
36 Detent plunger spring
37 Manual control valve
38 Detent plunger retainer
39 Retainer pin
40 Oil check ball
41 T oil check ball spring
42 3-4 Regulator plug
43 4-3 Shuttle valve
44 Front body cover plate
45 3-4 Shift valve spring
46 3-4 Shift valve
47 Inner valve body
48 Oil guide plate
49 Compensator valve plate
50 Compensator valve
51 Compensator valve spring
52 Detent plug
53 Outer valve body
54 Compensator plug
55 Compensator plug retaining pin
56 Transition valve
57 Neutral clutch oil pipe
58 Detent plug retainer plate
59 Cover
60 Manual valve body
61 Plug
62 Neutral and rear servo manual valve
63 Rear band control valve
64 Rear servo oil pipe
65 Rear band control valve spring
66 Retainer
67 Selector lever
68 Retaining pin
69 Sealing washer
70 Washer

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Using a surface plate, check the inner and outer valve bodies for distortion. If the faces are distorted, renew the control valve unit.

Clean the joint face of the gearbox casing and examine for damage. Under no circumstances must this face be scraped; the machine marks form an oil seal when the control valve unit is bolted down.

Clean the oil pipes and check them for damage and obstruction.

Check the bores in the control valve unit for scoring and burrs.

Check pipes, which should be a push fit in the bores.

Check all springs for loss of tension and for breakage. Check the 3-2 timing valve spring retainer and the 3-4 overspeed valve spring retainer for damage and distortion.

Using a surface plate, ensure that all spacer and retainer plates are not distorted.

Check all tapped screw holes for stripped threads.

Check the throttle valve operating shaft for distortion and damage.

Ensure that the spring steel by-pass valve is not broken or distorted and is still retainable in the outer valve body.

Control valve unit — To assemble

Before assembling any part of the control valve unit, ensure that the components are perfectly clean and coated with gearbox oil; valves must not be fitted in a dry condition.

As each valve is entered into its bore, check that it slides under its own weight and that it is fully home before another valve is fitted.

If the various control valve unit springs have been separated from their respective assemblies, and difficulty is experienced in identifying them, refer to Figure T36 where they can be seen in comparison to a scale.

Sealing compound must not be used between joint faces.

Overspeed and inner valves bodies — To assemble

Insert the overspeed valve, spring and retainer (25, 23 and 22) into the overspeed valve body (27). Centralise the spring in the retainer recess.

Hold the inner valve body (47) in one hand with the valve bores vertical and the radiused corner lowermost and to the right. Using the free hand, insert together the 2-3 auxiliary valve (16) and 2-3 governor plug sleeve (17) vertically upwards into the 'LO' bore. This method is recommended as the plug sleeve ensures correct alignment of the narrow edged valve, thus effecting a smooth entry into its bore without canting over or picking up on the annular groove. Turn over the valve body and insert the 2-3 governor plug (20)

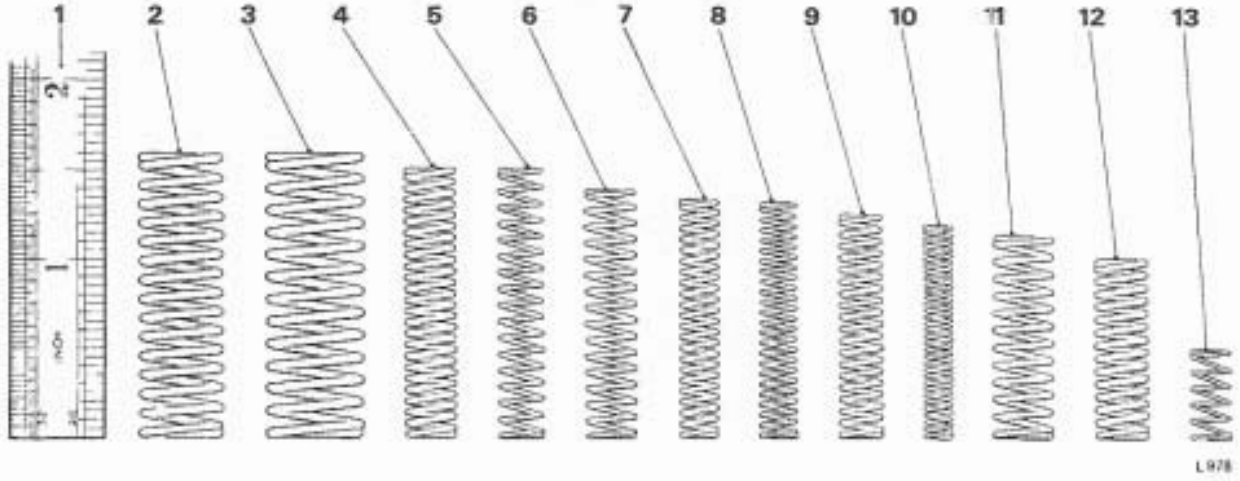

FIG. T36 CONTROL VALVE UNIT SPRINGS

1 Scale
2 3-2 Timing valve spring
3 3-4 Shift valve spring
4 2-3 Shift valve spring
5 Rear band control valve spring
6 2-1 Detent plug spring
7 Detent plunger spring
8 T.V. regulator valve spring
9 Overspeed valve spring
10 Compensator valve spring
11 1-2 Regulator plug spring
12 Throttle valve spring
13 T oil ball check spring

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into its sleeve; the plug should come to rest approximately 0·250 in. (6,35 mm.) below the surface of the sleeve, indicating that the 2-3 auxiliary valve is fully home in the bore.

Fit the 2-1 detent plug and spring (18 and 14) and the 3-4 governor plug (29) into their respective bores, taking particular care when manoeuvring the latter into the larger of the two bores.

Fit the overspeed oil guide plate (26) into position and secure the already assembled overspeed valve unit to the inner body.

Inner and front valve bodies — To assemble

Position the oil check ball valve (40) on its seating in the front valve body (3) then fit the spring (41) and the cover plate (44). The valve seating will be found in the passage adjacent to the centre screw hole (*see Fig. T37*).

Insert the 3-2 detent plug (2) into its bore in the front body and fit the detent plug retaining plate (1); ensure that the plate covers the adjacent oil ports.

Fit to the front body, the T.V. regulator valve and spring (6 and 5), the 1-2 regulator plug (4), the 3-4 regulator plug (42) and the 4-3 shuttle valve (43).

Hold the inner body (47) with the valve bores vertical and the radiused corner lowermost and to the right. Insert into their respective bores the 3-4 shift valve and spring (46 and 45), the 1-2 shift valve and spring (11 and 9) and the 2-3 shift valve, spring and guide pin (12, 8 and 10); the guide pin fits inside the spring, within the hollow stem of the valve.

Lay the inner and front bodies flat on the bench and position the front oil guide plate (7) against its mating face on the front body. Bring the assemblies together, ensuring that the 2-3 shift valve spring (8) engages with the 3-2 detent plug and that the 1-2 shift valve spring (9) engages with the 1-2 regulator plug (4). Firmly hold the two assemblies together then fit and tighten the three securing screws and washers.

3-2 timing valve body — To assemble

Insert the 3-2 timing valve, spring and retaining cap (15, 19 and 21) into the timing valve body (13). Depress the retaining cap against the tension of the spring and fit the retaining pin (24) into its oblique drilling in the timing valve body; release the cap.

Secure the timing valve body to the lower face of the inner body (47), using the two screws and washers, ensuring that the oil ports are fully covered.

Manual valve body — To assemble

Fit the rear band control valve (63) into the smaller bore in the manual valve body (60), then fit the spring

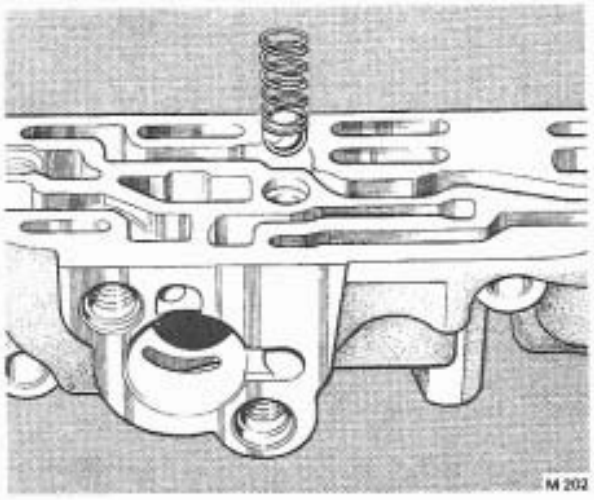

FIG. T37 POSITIONING THE OIL CHECK BALL VALVE

(65) into the bore in the end of the valve.

Fit the retainer (66) so that the small diameter locates the spring and the pin hole aligns a similar hole in the body.

Fit the pin (39) so that the retainer is located in the body and the pin itself is retained when the plate (59) is fitted.

Fit the plate (59) and secure it with the four setscrews.

Fit the neutral and rear servo manual valve.

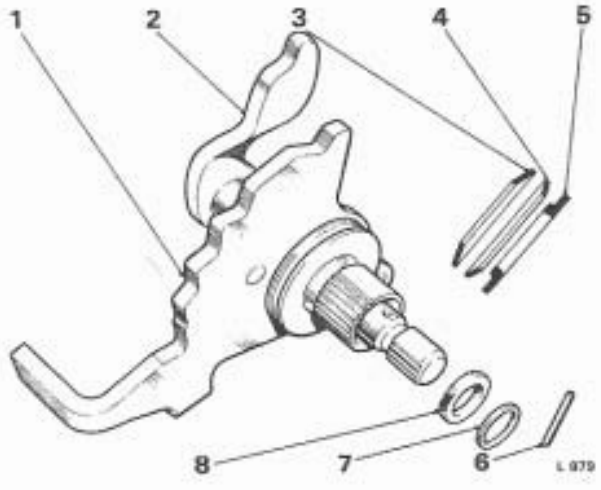

FIG. T38 SELECTOR AND THROTTLE VALVE LEVERS

1 Selector lever
2 Throttle valve lever
3 Inner washer
4 Outer washer
5 Rubber seal
6 Retaining pin
7 Flat washer
8 Sealing washer

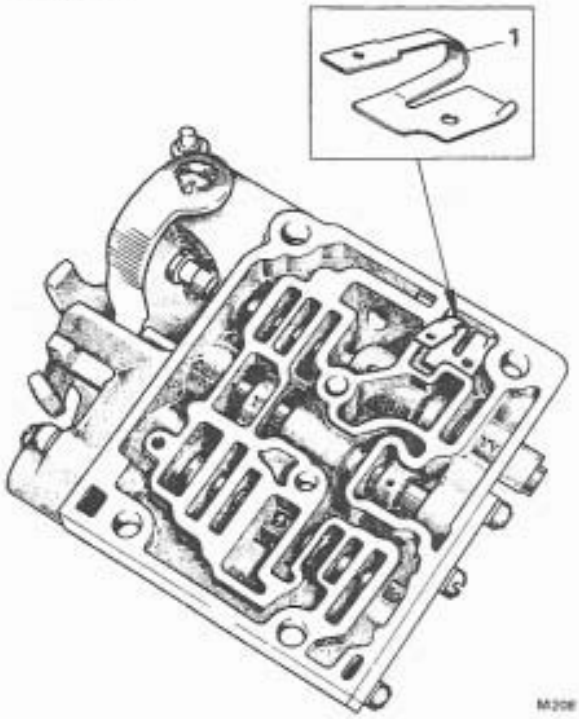

FIG. T39 OUTER BODY AND BY-PASS VALVE

1 By-pass valve

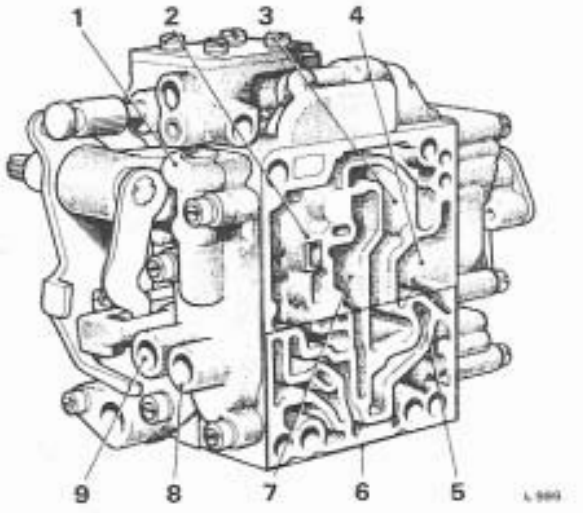

FIG. T40 AIR PRESSURE TEST POINTS— CONTROL VALVE UNIT

1 Overspeed valve housing
2 Blanking area
3 2-3 Shift valve group
4 1-2 Shift valve group
5 G1 Passage
6 Blanking area
7 3-4 Shift valve group
8 G2 Oil duct
9 G1 Oil duct

Outer valve body — To assemble

If the selector lever (67) and throttle valve lever and shaft (30) have been removed from the outer body (53) assemble them as shown in Figure T38; fit a new sealing washer (69) to the throttle lever shaft.

Fit the compensator plug (54) to its bore, if it has been removed, using a rod fitted into the hole in the large end of the plug to assist in manoeuvring it into position. Fit the retainer pin (55) to its drilling in the outer valve body (53), ensuring that it passes across the valve bore, then enters the socket at the far side and does not project above the joint face of the body.

Fit the compensator valve and spring (50 and 51) and the detent plug (52) into their bores in the outer body.

Position the compensator valve plate (49) against its mating face on the outer body (53), then fit and tighten the three securing screws.

Hold the outer body (53) with its valve bores vertical and the selector lever pivot lowermost and to the left. Using the free hand, insert into the centre lower bore as one assembly, the throttle valve (32) and the T valve and throttle valve spring (34 and 33). Move them gently upwards until the throttle valve butts against the detent plug (52). Turn over the outer body and insert the double transition valve (56).

Set the throttle valve lever against the protruding end of the throttle valve stem and hold the selector lever (67) clear of the throttle valve lever. Check that the throttle valve is home in its bore.

Fit the oil guide plate (58) and detent plunger retainer (38), ensuring that the tip of the throttle valve lever is entered into the slot in the plunger retainer body. Secure the assembly with the three setscrews and washers provided; ensure that the shortest screw of the three is fitted through the boss on the outer body (53), otherwise the selector plunger will not enter the retainer during later assembly.

Rotate the selector lever (67) away from the plunger body then fit the detent plunger and spring (35 and 36) into their bore in the retainer body.

Insert the selector valve (37) up to the third land, into its bore in the outer body (53), then rotate the selector lever (67) until the actuating pin on the lever engages between the top lands of the selector valve.

Do not force the pin against the valve, otherwise the valve stem may bend. Depress the selector plunger (35) and further rotate the selector lever until the plunger engages in a notch. Release the plunger and check that the selector lever moves freely into each of the operating positions.

Fit the by-pass valve (28) to the cavity in the outer body as shown in Figure T39.

Check that the compensator plug retaining pin (55) is correctly fitted and does not protrude above the

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joint face of the outer body. Position the oil guide plate (48) on the outer body with its radiused corner towards the selector lever pivot. Align the plate with the aid of the four main setscrews and assemble the outer body and plate to the inner body. Leave the main setscrews in position until the two assembly screws and washers have been tightened. Fit and tighten the two securing screws and washers.

Finally, fit the assembled manual valve body to the top of the outer valve body, ensuring that the two oil transfer tubes (31) are correctly located, and that the groove in the end land of the neutral and rear servo manual valve engages with the top actuating pin on the selector lever.

Control valve unit — To test

The control valve unit can be tested for correct operation using a special test rig, or by fitting it to the gearbox and carrying out a road test as described under 'Change points—To check' in Section T3.

Before fitting the control valve unit to the gearbox, the freedom of the shift valve groups and the overspeed valve in their bores can be checked by means of an air test; this test can also be used, however, as an aid to fault diagnosis.

To check the freedom of the 1-2 shift valve group, apply an air pressure of approximately 70 lb/sq. in. (4,9 kg/sq. cm.) to the G1 passage as shown in Figure T40.

Air pressure applied to the G1 oil duct will move the 2-3 shift group. The lower half of the control valve unit must be suitably blanked off to achieve this.

Movement of the 2-3 and 3-4 shift valve groups and of the overspeed valve can be checked by covering area '2' (*see Fig. T40*), and applying air pressure to the G2 oil duct. If difficulty is experienced in observing the movement of the overspeed valve, a piece of stiff wire inserted through the centre of the spring and allowed to rest on the valve will indicate when the valve moves.

It should be noted that movement of the 2-3 shift valve group occurs when air is applied to either the G1 or G2 oil duct; in the first case air pressure operates on the 2-3 G1 or governor plug and in the second case on the 2-3 G2 or auxiliary plug.

Control valve unit — To fit

Before fitting the control valve unit, ensure that the mating faces of the unit and the gearbox are perfectly clean.

Fit the parking brake bracket to the control valve unit.

Rotate the selector lever to a position where it will clear the parking brake lever.

Fit the reverse clutch oil pipe to the control valve unit.

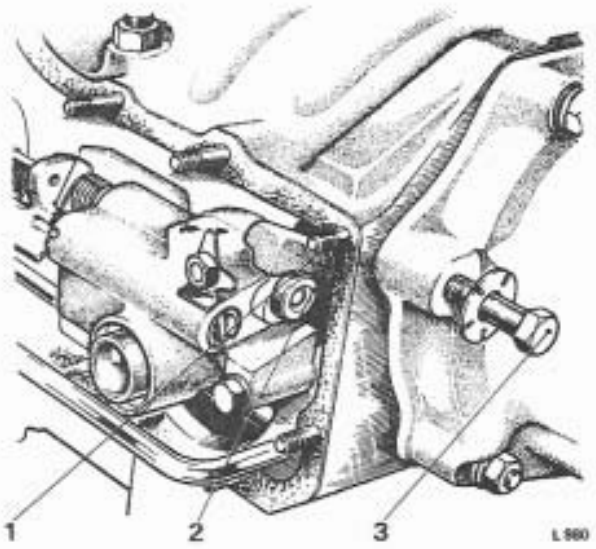

FIG. T41 FITTING THE PARKING PAWL ROLLER

1 Parking pawl
2 Roller
3 Parking pawl locating setscrew

Fit the parking pawl in its approximate working position in the casing.

Ensure that the ends of the sealing rings on the governor tower are locked then slide the governor tower over the rings. As the control valve unit nears the gearbox casing, fit the ends of the two oil pipes into their respective bores in the casing.

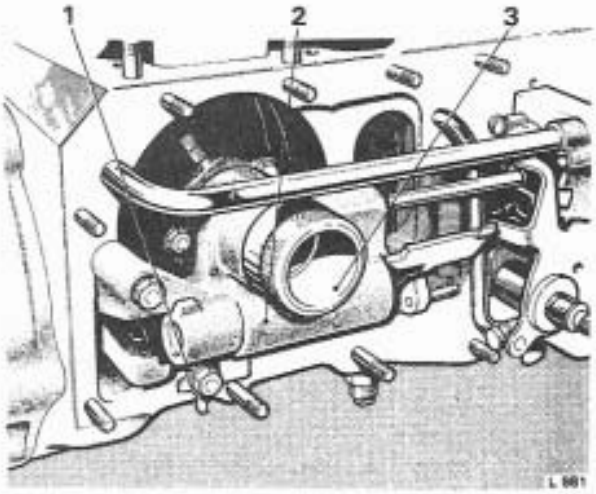

FIG. T42 ALIGNING THE PARKING BRAKE BRACKET

1 Lock-washer 2 Parking brake bracket
3 Guide sleeve

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Fit the two parking brake bracket securing setscrews, taking care to position the special washer on the setscrew adjacent to the parking blocker piston, so that the large tab secures the blocker piston retaining pin. Screw in the setscrews until they are finger tight.

Fit the four setscrews and washers which secure the control valve unit to the gearbox; the two largest setscrews fit into the top holes and also secure the manual valve body to the outer body. Do not tighten the setscrews.

Lubricate and fit the parking pawl roller (*see Fig. T41*).

Position the parking pawl then fit the supporting setscrew with a new tab washer. Torque tighten the setscrew and secure it with the tab washer, by bending one tab against the hexagon head and two tabs against the rear extension casing.

If the parking lever return spring is still in position, it should be removed whilst the parking brake bracket bore is concentrically positioned around the governor tower.

Insert the alignment gauge RH329 into the annulus formed between the governor tower and the parking brake bracket (*see Fig. T42*).

Torque tighten the parking brake bracket setscrews and the control valve unit setscrews; the alignment gauge should be free to rotate.

Turn the gearbox output shaft through several revolutions, and at the same time, ensure that the gauge remains free. If not, slacken the setscrews and reposition the bracket.

If difficulty is experienced in successfully aligning the parking brake bracket, slacken the rear oil pump securing setscrews, then again align the bracket. The slight movement gained by slackening the pump setscrews may just be sufficient to allow the parking brake bracket to be correctly aligned.

When the gauge has remained free through at least one revolution of the governor, with all the pump, parking brake bracket and control valve unit securing screws torque tightened, remove the gauge then lock the special tab washer.

Fit the parking lever return spring.

Move the selector lever to the reverse position to check for parking pawl engagement.

Ensure that the manual valve and the selector valve operate when the lever is moved.

Ensure that the conical steel washers and the oil seal are correctly positioned on the selector shaft.

Fit the pressure control valve oil pipe and T.V. oil pipes; carefully tap home the pipes using a soft-headed mallet.

Fit the side cover as described in Section T11.

After fitting the control levers, the control setting should be checked and, if necessary, adjusted before and during the subsequent road test (*see Section T5—'Control linkage'*).

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DIMENSIONAL DATA FOR SECTION T12—CONTROL VALVE UNIT

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Check ball spring — T oil — free length.	0·437 in. (approx.) (11,11 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·250 in. (6,35 mm.)	1¾ oz. to 2¾ oz. (50,4 gm. to 64,6 gm.)	——	——
Compensator valve spring—free length.	1·1875 in. (approx.) (30,16 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·890 in. (22,62 mm.)	6¾ oz. to 9¾ oz. (184,3 gm. to 269,3 gm.)	——	——
1–2 detent plug spring — free length.	1·375 in. (approx.) (34,93 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·719 in. (18,26 mm.)	2 lb. 9 oz. to 3 lb. 3 oz. (1,162 kg. to 1,446 kg.)	——	——
Detent spring — free length.	1·328 in. (approx.) (33,73 mm.) (approx.)	——	——

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Dimensional Data—*continued*			
Load required to compress spring to a length of 0·937 in. (23,81 mm.)	5 lb. 11 oz. to 6 lb. 15 oz. (2,580 kg. to 3,247 kg.)	——	——
Throttle valve spring — free length.	0·947 in. — 0·045 in. (24,07 mm. — 1,14 mm.)	——	——
Load required to compress spring to a length of 0·638 in. (16,20 mm.)	6 lb. 5 oz. to 6 lb. 13 oz. (2,86 kg. to 3,09 kg.)	——	——
Timing valve spring — free length.	1·593 in. (approx.) (40,48 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·796 in. (20,24 mm.)	5 lb. 10 oz. to 6 lb. 6 oz. (2,55 kg. to 2,89 kg.)	——	——
T.V. regulator valve spring — free length.	1·325 in. (approx.) (33,65 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·812 in. (20,4 mm.)	1 lb. 6½ oz. to 1 lb. 9½ oz. (0,637 kg. to 0,722 kg.)	——	——
1–2 regulator plug spring — free length.	1·125 in. (approx.) (28,588 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·469 in. (11,91 mm.)	1 lb. 14 oz. to 2 lb. 2 oz. (0,85 kg. to 0,96 kg.)	——	——
2–3 shift valve spring — free length.	1·531 in. (approx.) (38,89 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·926 in. (23,52 mm.)	3 lb. 2 oz. to 3 lb. 4½ oz. (1,42 kg. to 1,49 kg.)	——	——
Overspeed valve spring — free length.	1·246 in. (approx.) (31,65 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·846 in. (21,48 mm.)	5 lb. 1 oz. to 5 lb. 5 oz. (2,3 kg. to 2,4 kg.)	——	——
3–4 shift valve spring — free length.	1·578 in. (approx.) (40,08 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·883 in. (21,16 mm.)	4 lb. 7 oz. to 4 lb. 13 oz. (2,0 kg. to 2,2 kg.)	——	——
Rear band control valve spring free length.	1·500 in. (38,10 mm.)	——	——
Load required to compress spring to a length of 0·725 in. (18,47 mm.)	1 lb. 2½ oz. to 1 lb. 5½ oz. (0,52 kg. to 0,61 kg.)	——	——
Screws — front body to inner body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,42 kgm. and 0,55 kgm.)	——	——
Screws — outer body to inner body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,42 kgm. and 0,55 kgm.)	——	Tighten with 4 main setscrews in position to align holes.
Screws — 3–2 timing valve body to inner body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,42 kgm. and 0,55 kgm.)	——	——
Screws — overspeed valve body to inner body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,42 kgm. and 0,55 kgm.)	——	——

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DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Dimensional Data—*continued*			
Screws — compensator valve plate to outer body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,42 kgm. and 0,55 kgm.)	—	—
Screws — cover plate to front body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,42 kgm. and 0,55 kgm.)	—	—
Screws — detent plunger retainer to outer valve body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,42 kgm. and 0,55 kgm.)	—	—
Screws — cover plate to manual valve body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,42 kgm. and 0,55 kgm.)	—	—
Setscrews — control valve unit to gearbox.	Torque tighten to between 6 lb.ft. and 8 lb.ft. (0,83 kgm. and 1,11 kgm.)	—	—

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Section T13
PARKING BRAKE BRACKET

The parking brake bracket is an aluminium alloy casting which is secured to the left-hand side of the gearbox, adjacent to the governor. It forms part of the oil supply passages between the governor and the control valve unit as well as housing the lever and crank assembly which actuates the parking pawl. Also housed in the bracket are two spring-loaded blocker pistons (*see Fig. T43*); one piston prevents reverse gear from being engaged until the car is almost at a standstill and the other prevents the parking pawl from engaging the transmission locking ring whilst the engine is running.

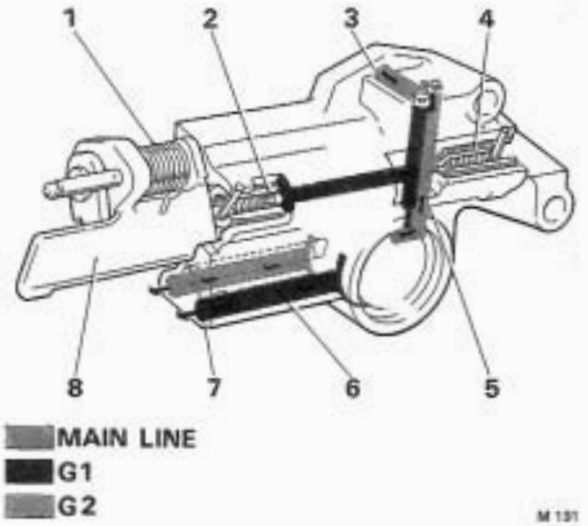

FIG. T43 PARKING BRAKE BRACKET —OPERATION

1 Parking brake lever spring
2 Reverse blocker piston
3 Main line oil from pump
4 Parking blocker piston
5 G1 Oil to reverse blocker piston
6 G1 Oil to control valve unit
7 G2 Oil to control valve unit
8 Parking brake lever

Operation

The rearmost piston is the parking pawl blocker piston. This piston is dependent upon main line oil pressure for its operation. As long as main line oil pressure holds the piston out, against spring pressure, the parking pawl is prevented from engaging the annular teeth on the reverse annulus gear. When the engine is switched off and oil pressure ceases to act on the piston, the piston is returned by the spring, allowing the pawl to engage when Reverse is selected.

The foremost piston, the reverse blocker piston, prevents the driver from engaging reverse gear whilst travelling in a forward direction above a speed of approximately 8 m.p.h. (12,9 k.p.h.).

This piston is dependent upon governor one (G1) pressure for its operation. When G1 pressure falls below a certain value, the piston return spring pushes back the piston, allowing Reverse to be engaged.

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Parking brake bracket—To remove

The parking brake bracket can be removed from the gearbox whilst the gearbox is in position in the car. The side cover and the control valve unit must also be removed.

Remove the sump drain plug then drain the gearbox oil into a suitable clean container.

Remove the side cover (*see Section T11*).

Remove the parking brake bracket together with the control valve unit as described in Section T5.

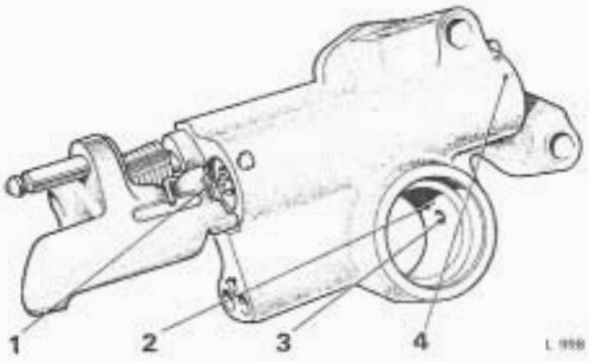

FIG. T44 AIR PRESSURE TEST POINTS

1 Reverse blocker piston
2 G1 Oil duct
3 Main oil pressure duct
4 Parking pawl blocker piston

Parking brake bracket—To dismantle

The parking brake bracket assembly need not be dismantled unless the fault diagnosis described in Section T4 indicates faulty operation of the reverse piston or the parking blocker piston and this is confirmed by an air test (*see Section T6*).

To remove the reverse blocker piston, cut off the head of the retaining pin and rotate the parking lever arm to clear the piston. Depress the spring and slide out the pin using thin-nosed pliers. Withdraw the spring and piston from the bore.

Removal of the parking blocker piston is similar except that the retaining pin is free to be removed without cutting off its head. Use snap ring pliers to withdraw the piston if it resists removal.

Parking brake bracket—To inspect

Clean all parts paying particular attention to the oil passages and slots in the main casting; it is not unusual to find a small amount of sludge and metallic dust. Use a compressed air line to clear the oil passages and the reverse clutch oil pipe.

Examine the governor sleeve bore for excessive wear caused by the oil sealing ring or by misalignment of the governor sleeve.

Insert the oil sealing rings into their running position in the governor sleeve bore. Check the ring end clearance with feeler gauges; if the clearance is larger than that given in 'Dimensional Data' at the end of this Section, renew the rings. If the new ring gaps are too wide, fit a new governor bracket.

Examine the casting for cracks and other damage; also examine the piston bores and pistons for scoring and burrs which might restrict free movement. Check that the three oil plugs are secure in their ducts.

Check that the parking lever assembly rotates freely in the bearing, and that the return spring pillar is secure in the parking brake lever.

Examine the roller and the crankpin for damage and for excessive wear.

Examine the parking brake pawl for damage and for excessive wear. Check that the support screw rotates freely in the bore in the pawl.

Examine the teeth of the brake annulus for damage and wear.

Examine the reverse clutch oil pipe for damage and for restriction, particularly at the bend; ensure that it fits snugly in the bore in the gearbox casing.

Parking brake bracket—To assemble

Assemble the parking brake bracket by reversing the procedure given for dismantling, noting the following points.

Lubricate all moving parts with clean gearbox oil during assembly.

When fitting the reverse blocker piston, fit a new retaining pin from the back of the casing and peen the other end of the pin to lock it in position.

Parking brake bracket — To test

The parking and reverse blocker pistons should be tested for freedom of movement in their bores after assembly. Intermittent application of air pressure, at approximately 70 lb/sq. in. (4,9 kg/sq. cm.) to the points shown in Figure T44 should cause the pistons to move to and fro in their bores.

To test the parking blocker piston, cover the main oil pressure port in the bore of the governor sleeve, then apply air pressure to the main oil pressure inlet; the parking blocker piston should then protrude from the parking brake bracket.

To test the reverse piston, rotate the parking lever arm to allow full travel of the piston, then apply air pressure to the G1 oil duct in the governor sleeve bore; the reverse blocker piston should protrude fully from the parking brake bracket.

Parking brake bracket — To fit

If the parking brake bracket has been renewed due to wear in the governor sleeve bore, the oil sealing rings must be removed from the governor tower and the gaps checked as described earlier in this Section. The 'run-out' of the governor tower should also be checked as described in Section *T16*

Fit the parking brake bracket together with the control valve unit as described in Section T12.

DIMENSIONAL DATA FOR SECTION T13—PARKING BRAKE BRACKET

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Reverse blocker and parking blocker pistons — clearance in bore.	0·0003 in. to 0·0015 in. (0,008 mm. to 0,038 mm.)	0·003 in. (0,08 mm.)	——
Reverse blocker piston spring —free length.	0·938 in. (approx.) (23,81 mm.) (approx.)	——	——
Load required to compress spring length to 0·562 in. (14,29 mm.)	1 lb. 2 oz. to 1 lb. 6 oz. (0,51 kg. to 0,62 kg.)	——	——
Parking blocker piston spring —free length.	1·061 in. (approx.) (26,96 mm.) (approx.)	——	——
Load required to compress spring length to 0·516 in. (13,1 mm.)	7 lb. 8 oz. to 8 lb. 8 oz. (3,4 kg. to 3,8 kg.)	——	——
Governor tower bore diameter	1·1875 in. to 1·1885 in. (30,162 mm. to 30,187 mm.)	——	Renew parking brake bracket if the governor rings have heavily scored the bore.
Governor sealing rings closed gap (butt clearance).	0·005 in. to 0·015 in. (0,13 mm. to 0,40 mm.)	0·020 in. (0,51 mm.)	Check in 1·1875 in. (30,162 mm.) diameter minimum bore
Setscrews — parking brake bracket to gearbox casing.	Torque tighten to between 16 lb.ft. and 18 lb.ft. (2,21 kg. m. and 2,49 kg. m.)	——	——
Parking pawl support screw.	Torque tighten to between 25 lb.ft. and 28 lb.ft. (3,46 kg. m. and 3,87 kg. m.)	——	——
Clearance between roller and crankpin.	0·0005 in. to 0·004 in. (0,013 mm. to 0,10 mm.)	0·007 in. (0,18 mm.)	——

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Section T14
FRONT SERVO

The front servo comprises two cast iron casings and an aluminium alloy valve housing.

The two casings form a cylinder which is divided into band apply and band release chambers by the ring seals of three pistons (*see Fig. T45*). The alloy valve housing contains the overrun control valve and the main line exhaust and non-return valves. A further valve, the 4-3 timing valve is housed in the servo main casing. The servo is secured to the gearbox bottom face and its function is to apply or release the front drum friction band.

Operation

Band apply effort is produced by the action of main line oil pressure in the lower chamber augmented by compensator pressure in the centre chamber. During overrun, when the throttle is closed and compensator pressure is removed, there would be a tendency for the band to slip and cause 'hunting' between two gears. This is avoided as governor (G1) pressure moves the overrun valve into a position whereby main oil pressure is directed into the compensator chamber, thus increasing the piston area over which band apply main pressure is acting (*see Fig. T46*). As a result the band is held firmly applied until the road speed has dropped low enough to enforce the down-change.

The 4-3 timing valve is provided to delay front band application until the front clutch is released during the down-change. Whenever G1 pressure, acting on the large diameter of the valve, overcomes main line oil pressure, acting on the small diameter, the valve moves to close the direct band apply port. As a result of this, band apply oil is forced to take a by-pass route which includes a 0·055 in. (1,41 mm.) restriction. Thus, band application is retarded and does not take place until the clutch releases.

Band apply main pressure is continuously applied in all forward ranges but band release is obtained, when required for second and fourth gears, by allowing main pressure to act over the larger total area of the band release pistons. Band release pressure thus overcomes band apply pressure and the band is released.

The front servo valve body houses the main line non-return and exhaust valves. The non-return valve is a simple ball and spring arrangement designed to prevent the front pump from discharging oil through the rear pump.

The exhaust valve opens under light spring pressure to reduce quickly the control pressures by allowing oil in the servos and control valves to exhaust when pump delivery ceases.

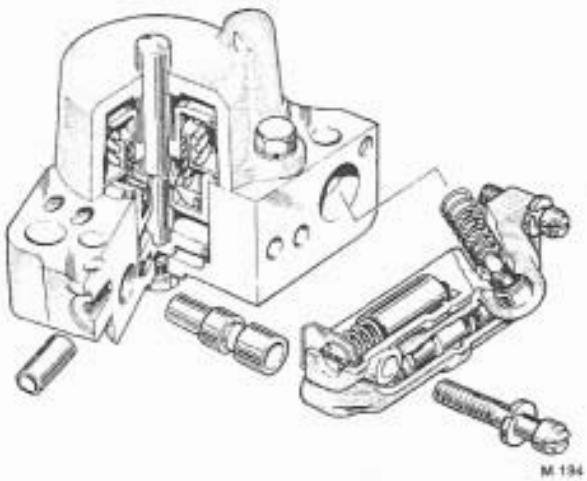

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FIG. T45 FRONT SERVO

Chapter T

The front servo can be removed from the gearbox while the gearbox is in the car.

Front and rear servos — To remove

Drain the gearbox sump then remove the sump and filter as described in Section T11.

The front servo cannot be removed without removing the rear servo, therefore, the following instructions cover the removal of both servos; the disconnecting points are shown in Figure T47.

Slacken the front and rear band adjusting screw lock-nuts then unscrew the adjusting screws approximately five complete turns to release the pressure on the servo operating rods.

Hook a piece of bent wire into the coils of the rear band release spring then secure it to prevent the spring from falling when the servo is removed.

Remove the governor oil delivery pipe; if necessary use slight leverage near the ends of the pipe.

Slacken the five setscrews which secure both the servo units to the gearbox casing.

Remove the three setscrews which secure the rear servo.

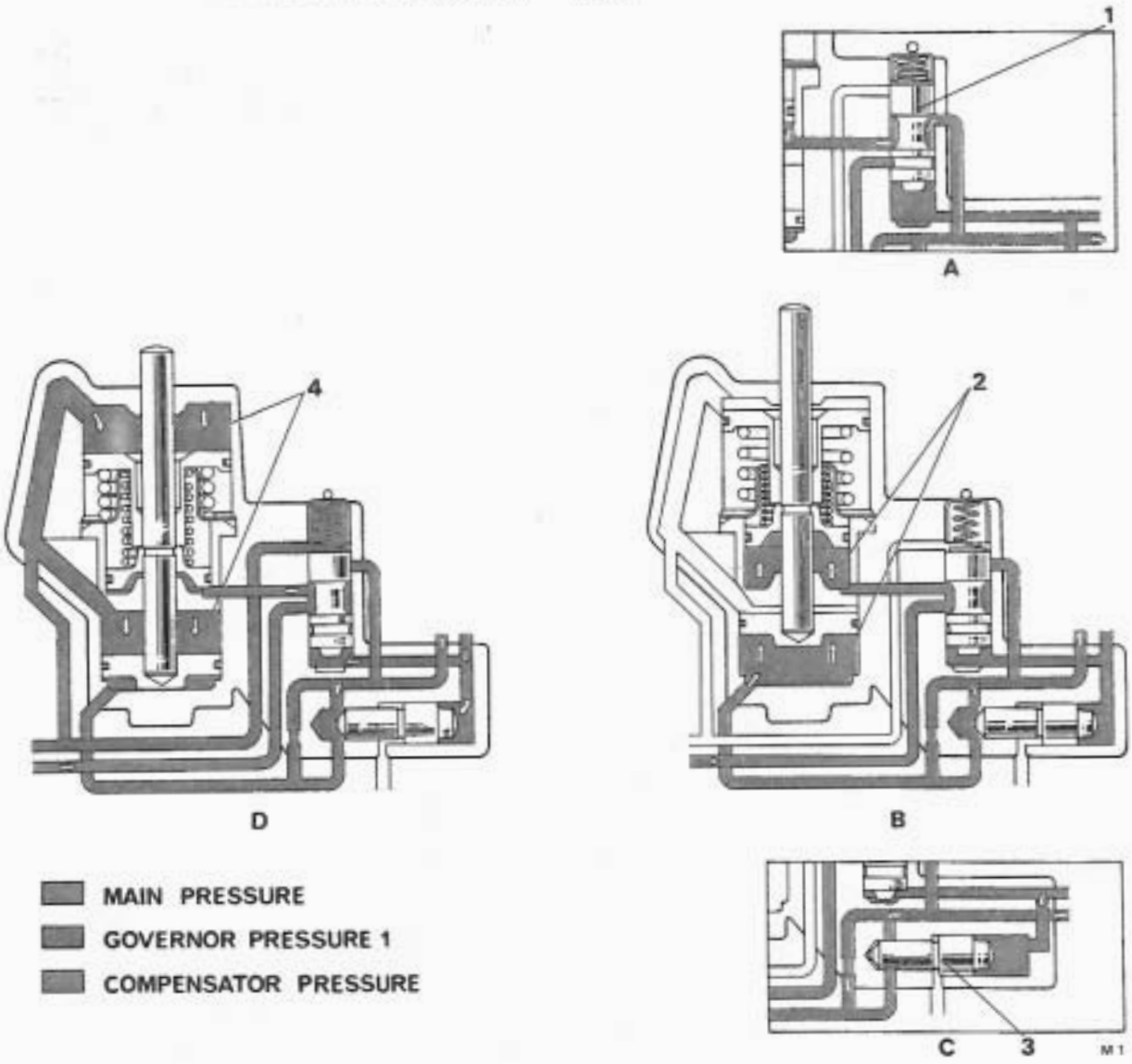

FIG. T46 FRONT SERVO OPERATION

A Increased apply pressure
B Band applying
C Delayed band apply
D Band releasing

1 Overrun valve
2 Band apply chambers
3 4-3 Timing valve
4 Band release chambers

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Carefully withdraw the rear servo from the front servo, then remove the rear servo from the gearbox. If the gearbox is installed in the car, care must be taken during this operation to support the rear servo, so avoiding damage to the front servo and oil pipes.

Remove the rear band release spring.

Support the front servo then remove the two securing setscrews.

Push the rear oil pump discharge pipe as far as possible into the rear pump, then carefully remove the front servo unit from the gearbox casing. Turn it to disengage the rear oil pump discharge pipe whilst at the same time withdrawing it from the front pump oil delivery pipe.

If difficulty is experienced in disengaging the servo unit from the rear oil pump discharge pipe, slacken, and if necessary, remove the front servo valve body.

If the valve body has to be removed, unscrew the three securing screws then slide the body forward. Lift it from the servo body taking care to retain the non-return ball valve and spring.

When fault diagnosis has indicated that a front servo unit might be defective, it should be checked as described under 'Front servo — To test'. This will assist in locating the faulty part before the servo is dismantled and inspected.

Front servo unit — To dismantle

When dismantling the front servo, reference should be made to the exploded view of the servo shown in Figure T48.

Hold the servo unit with the aluminium valve body uppermost, thus preventing the 4-3 timing valve from falling out when the valve body is removed.

Hold the valve body against spring pressure then remove the three securing screws.

Slowly release the pressure then, as the bodies move apart, remove the non-return valve and spring.

Tilt the servo body and allow the 4-3 valve to slide from its bore.

Depress the overrun valve retainer and withdraw the pin, retainer, spring and valve. If the retainer sticks in the bore, fit the valve body to the servo body without the non-return valve and spring.

Apply an intermittent blast of compressed air at

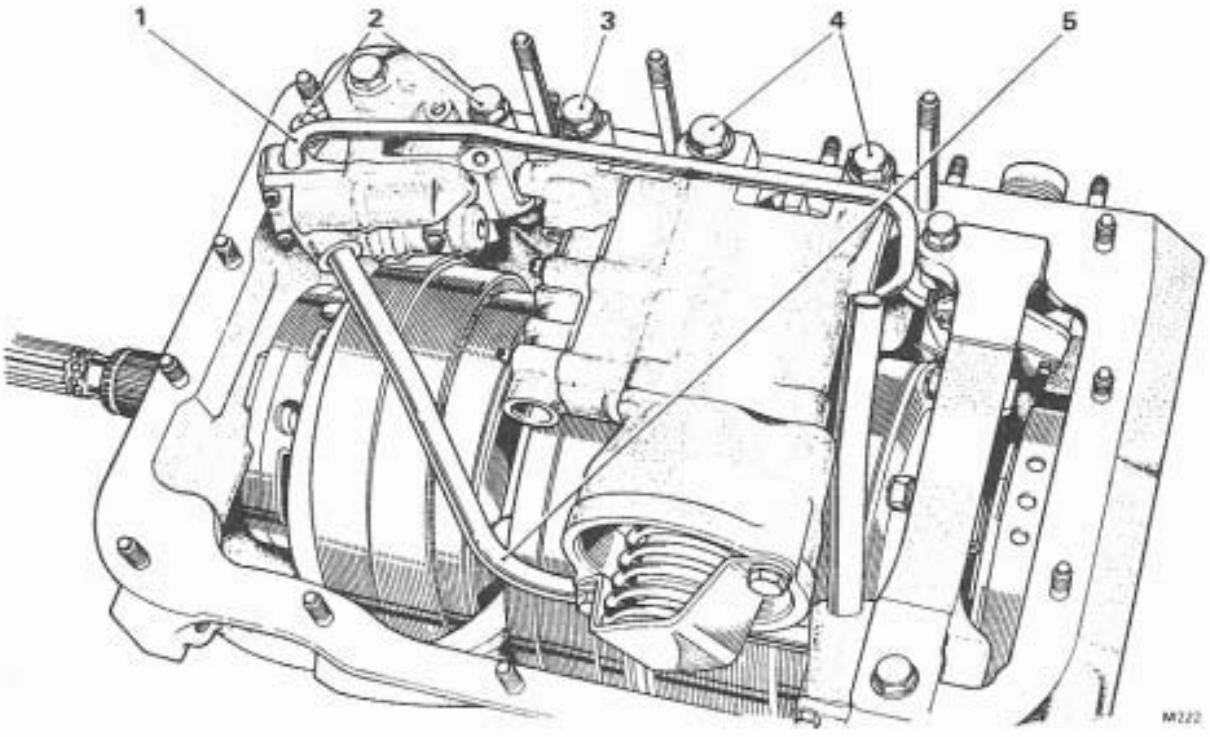

FIG. T47 SERVO DISCONNECTING POINTS

1 Governor oil pipe
2 Front servo securing setscrews
3 Junction body securing setscrew
4 Rear servo securing setscrews
5 Rear pump to servo oil pipe

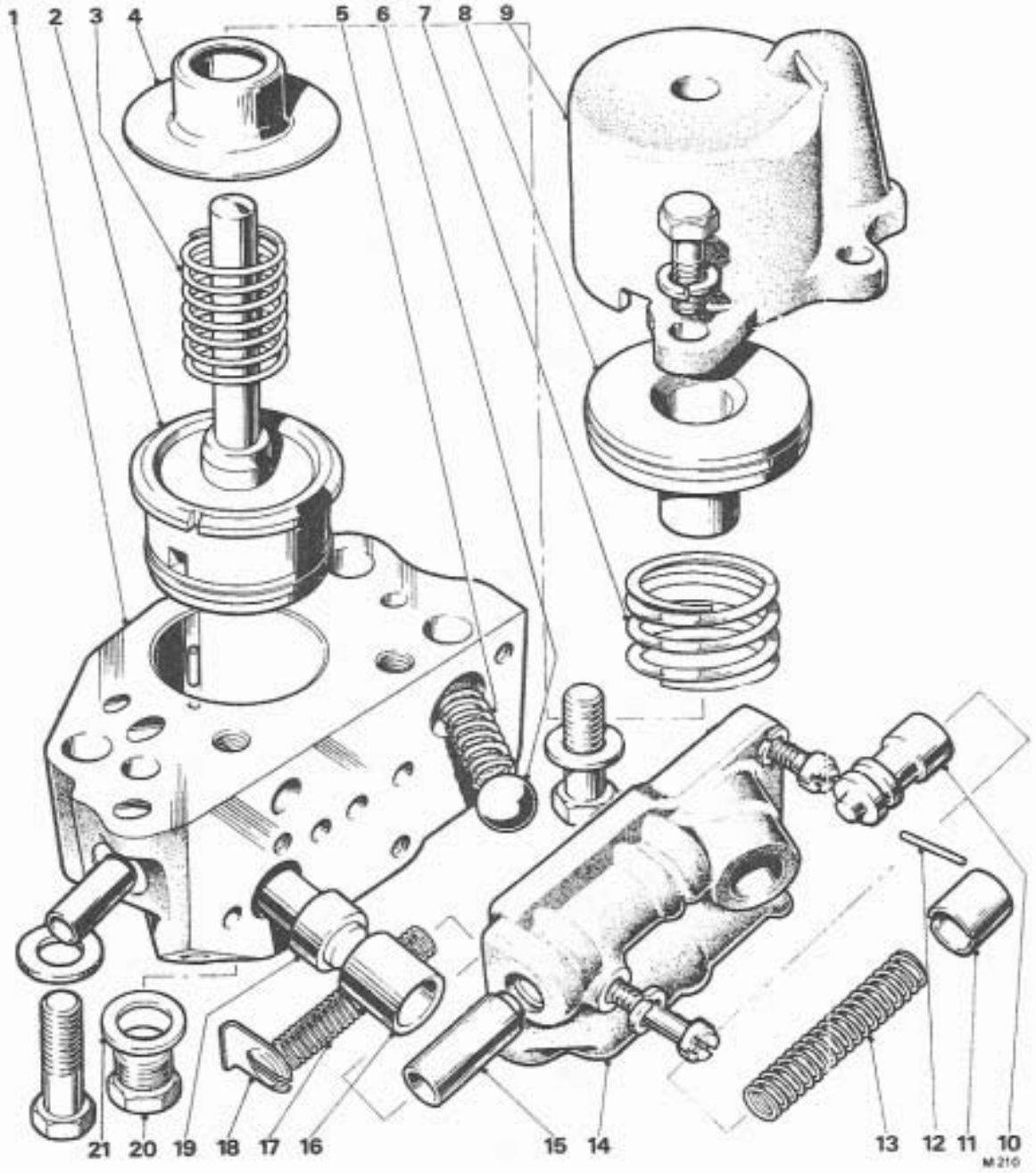

FIG. T48 FRONT SERVO EXPLODED

1 Front servo main body
2 Apply piston assembly
3 Apply piston return spring
4 Retainer
5 Spring
6 Non-return ball valve
7 Spring
8 Band release piston
9 Band release cylinder
10 Overrun control valve
11 Retainer
12 Pin
13 Spring
14 Valve body
15 Exhaust valve
16 4-3 Timing restrictor
17 Spring
18 Retainer
19 4-3 Timing valve
20 Main body blanking plug
21 Blanking plug washer

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approximately 70 lb/sq. in. (4,92 kg/sq. cm.) to the band release oil duct (*see Fig. T50*). This will have the effect of forcing out the retainer without damage to the component parts. Do not use leverage between the valve and the dividing walls in the face of the valve body casting.

Depress the exhaust valve spring, with the aid of a screwdriver blade through the slot in the retainer then slide out the retainer. Withdraw the spring and valve.

To dismantle the remainder of the servo unit, remove the three screws which secure the band release cylinder then withdraw the cylinder from the servo body.

Remove the two springs and the retainer from the servo operating rod.

Remove the blanking plug and discard the washer.

Withdraw the compensator and band apply piston assembly from the servo body. The assembly is an interference fit in the body and a drift, inserted through the blanking plug orifice, should be used to push out the piston assembly. The compensator and band apply piston assembly cannot be further dismantled.

Front servo — To inspect

Thoroughly clean all parts before inspecting, using a suitable cleaning fluid, brush and compressed air.

Oil ducts and valve bores must be washed and blown through to remove any particles that may eventually reach the control valve unit and cause faulty operation of the gearbox.

Ensure that the leak hole in the non-return valve seating and the restrictor hole in the servo body are free from dirt or sludge.

Do not remove piston rings unless necessary; careless handling will distort the rings. The piston ring inside the compensator piston assembly cannot be removed, but every effort should be made to flush the compensator chamber by introducing cleaning fluid and moving the operating rod backward and forward.

Check that the plug in the servo body is secure.

Examine the springs for breakages or distortion.

Examine the piston bores in the servo body and the front band release cylinder for signs of scoring.

Check that the dowel in the servo body has not become damaged. This dowel is a loose fit in the servo body and is easily removable.

Examine the valves and bores for scoring. Oil the valves then check that they slide freely in the bores under their own weight.

Examine the ball valve seat for damage and security.

Examine the piston ring assembly externally for scores and the piston rings for chipped edges or uneven contact. Hold the outer body of the assembly then move the operating rod backward and forward to check for freedom of movement; a cushioned effect coupled with the characteristic scraping action of a piston ring should be felt.

Check the face of the alloy valve body for distortion using a surface plate. Any distortion, particularly in the section between the main line oil passage and the overrun valve (*see Fig. T49*), will mean renewal of the body.

The valve body, complete with valves and springs, can be renewed as a separate assembly, but the ball valve seating cannot be renewed independently.

Unserviceability of the servo body, front band release cylinder, valves or piston assembly will mean renewing the complete servo unit as these items are selectively fitted on initial assembly. Other components such as piston rings can be renewed independently.

Front servo — To assemble

When assembling the front servo ensure that all parts are clean. Lightly oil all moving parts with clean gearbox oil. **Do not** use jointing compound on mating faces.

If necessary, fit a new piston ring on to the band apply piston then fit the assembly into the bore of the servo body. Enter the piston ring squarely to avoid marking the cylinder walls.

Align the dowel slot in the sleeve with the dowel in the servo body, then push the sleeve in by hand as far as possible; the sleeve is an interference fit in the body (*see 'Dimensional Data'*) at the end of this Section and a press tool may be necessary to push the sleeve fully home.

If necessary, fit a new piston ring on to the band release piston, using three 0·0015 in. (0,04 mm.) feeler gauges to enter the piston ring over the steps in the bore.

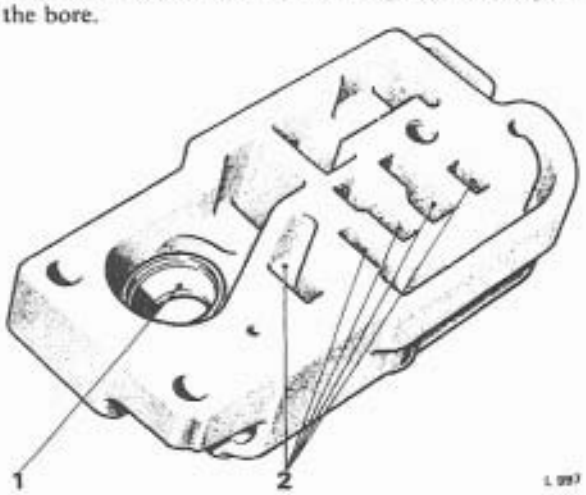

FIG. T49 FRONT SERVO VALVE BODY
1 Main line oil
2 Overrun control valve oil ports

Fit, on to the shaft of the band release piston, the compensator piston return spring, retainer and band release piston return spring.

Fit the band release piston to the servo body, then enter, but do not tighten the three securing setscrews. Turn the band release cylinder anti-clockwise to ensure that the flange does not overlap the front pump delivery duct. Torque tighten the screws.

Fit the exhaust valve, spring and retainer, taking care to centralise the exhaust valve spring in the depression in the retainer to obviate side thrust on the valve.

Fit the overrun valve, spring, retainer and pin. Ensure that the end of the overrun valve retainer pin is below the valve body face otherwise it will prevent the two faces meeting, thus permitting oil leakage.

Fit the 4-3 timing valve into its bore in the servo body.

Fit the ball valve and spring, then fit the valve body onto the servo body, securing it with the three screws. Evenly torque tighten the screws to prevent distortion of the body.

Fit the blanking plug together with a new washer.

Front servo — To test

The front servo can be tested functionally only by using a special test rig, or by fitting it to the gearbox and carrying out a road test.

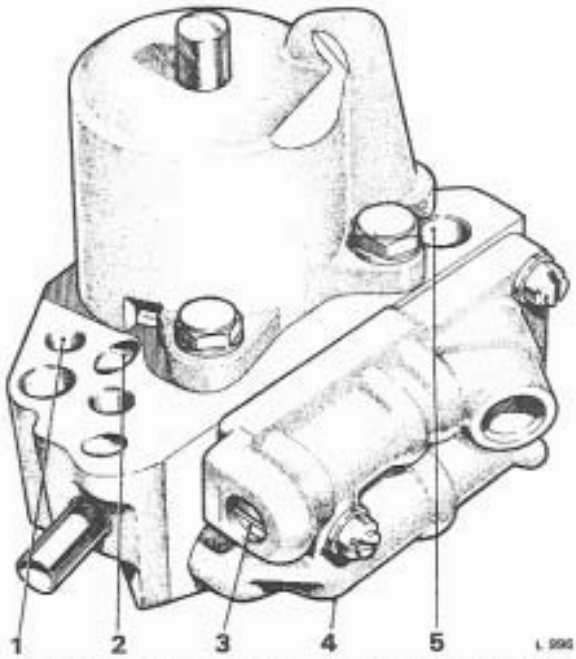

FIG. T50 FRONT SERVO—AIR PRESSURE TEST

1 Band apply duct
2 Band release duct
3 Exhaust valve retainer
4 Overrun control valve housing
5 Front pump delivery duct

Movement of the servo pistons and freedom of the valves in their bores can be tested however by applying an air pressure of approximately 70 lb/sq. in. (4,92 kg/sq. cm.) to specified oil ducts and observing the movement. Internal leaks or sluggish valves, which could cause faulty operation of the gearbox, will not be revealed by these tests.

To test the front servo, proceed as follows.

Apply air pressure to the band apply duct (*see Fig. T50*). The operating rod should move out to its fullest extent, and the 4-3 timing valve should be heard and seen to move through the small hole in the servo body.

If the 4-3 valve does not move, shake the valve to the other end of its bore then repeat the check; this valve is not subject to spring pressure, therefore it will not return once it has moved.

Hold a finger on the overrun valve housing then apply air pressure intermittently to the main line duct; movement of the valve should be felt. If doubt exists, exert a slight pressure on the overrun valve retainer, using a metal rod, then repeat the check; movement of the rod should be felt.

Cover the front pump delivery duct then apply air pressure to the other end of the duct. Oscillation of the valve should be felt and will probably be heard.

Front and rear servos — To fit

As stated earlier the front servo cannot be removed without removing the rear servo, therefore, the following paragraphs describe the fitting of both the front and rear servos.

Fit the rear oil pump discharge pipe into its bore in the rear pump, ensuring that it is fully home.

Check that the front pump oil delivery pipe is fully home in its bore in the front pump.

Rotate the front drum band until the slot for the operating rod is in the correct position and the other end of the band is engaged with the adjusting screw.

Engage the band operating rod in the band slot, then manoeuvre the servo unit into position, engaging the front pump delivery pipe and the rear pump discharge pipe in their respective bores. Do not fit the securing setscrews at this stage.

Fit the rear band release spring in the housing in the end of the rear band, using petroleum jelly to hold it temporarily in position.

Engage the short end of the strut in the spring coil then tie the ends of the band together with a piece of wire; this will hold the spring in position during subsequent operations. The wire should be fixed in such a manner that it can be easily removed at a later stage.

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Rotate the band until it engages with the adjusting screw.

Hold the servo operating lever against the operating rod, then move the rear servo unit forward to enter the transfer pipe on the front servo unit into its bore, at the same time engage the socket on the operating lever with the end of the operating strut.

Push both servo units to the face on the gearbox casing, then fit the securing setscrews. Tighten the setscrews evenly, ensuring that the front and rear oil pump pipes engage smoothly and easily; the rear servo must be supported during this operation. Torque load the setscrews to the figure given in 'Dimensional Data' at the end of this Section.

Check that the rear band release spring is in the correct position, then remove the locking wire from the ends of the band, ensuring that none of the wire is left in the gearbox.

Adjust the setting of the front and rear bands as follows.

Bands — To set

Setting of **both** bands must be carried out whenever a servo unit has been removed and may also be necessary to rectify faulty gearbox operation.

The procedure is the same whether the gearbox is on the bench or fitted to the car.

Front band — To set

The tools used when setting the front band are spanner RH 131 and gauge UR 3144 — see 'T.S.D. 2331—Workshop Tools'.

The spanner RH 131 is necessary only if the gearbox is fitted to the car. The outer box spanner fits on to the lock-nut while the inner spanner adjusts the band screw.

Unscrew the blanking plug from the front servo body then screw in the setting tool.

Turn the plunger nut by hand until the plunger makes contact with the servo piston.

Turn the drum by hand in the opposite direction to normal rotation to centralize the band.

Using a spanner, screw in the plunger five complete turns.

Check that the knurled washer cannot be rotated; if it is loose, slacken the band adjusting screw until the washer is gripped.

Hold the knurled washer as shown in Figure T51, then tighten the band adjusting screw until the washer **just slips.**

Hold the adjusting screw to prevent it from turning, then tighten the lock-nut.

Check that the tension on the knurled washer has not changed, indicating that the setting has not altered.

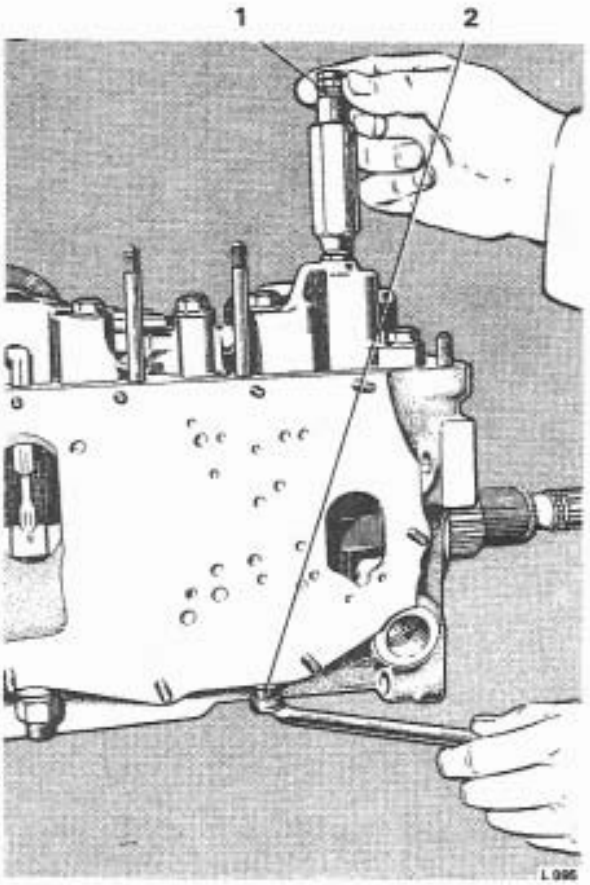

FIG. T51 ADJUSTING THE FRONT BAND

1 Band adjusting tool washer
2 Band adjusting screw

Slacken the plunger nut at least five turns to relieve the pressure on the screw thread in the servo body.

Unscrew the tool then fit and tighten the blanking plug.

Rear band — To set

The tools required for setting the rear band are spanner RH 131 and gauge RH 7838 —see 'T.S.D.

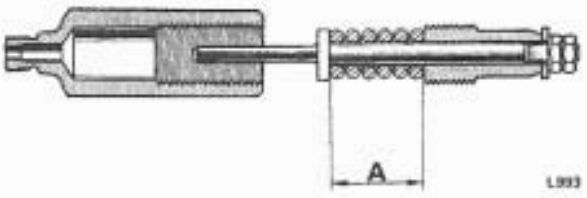

FIG. T52 CHECKING THE FRONT BAND ADJUSTING TOOL

A 1·160 in. ± 0·003 in (29,46 mm ± 0,07 mm)

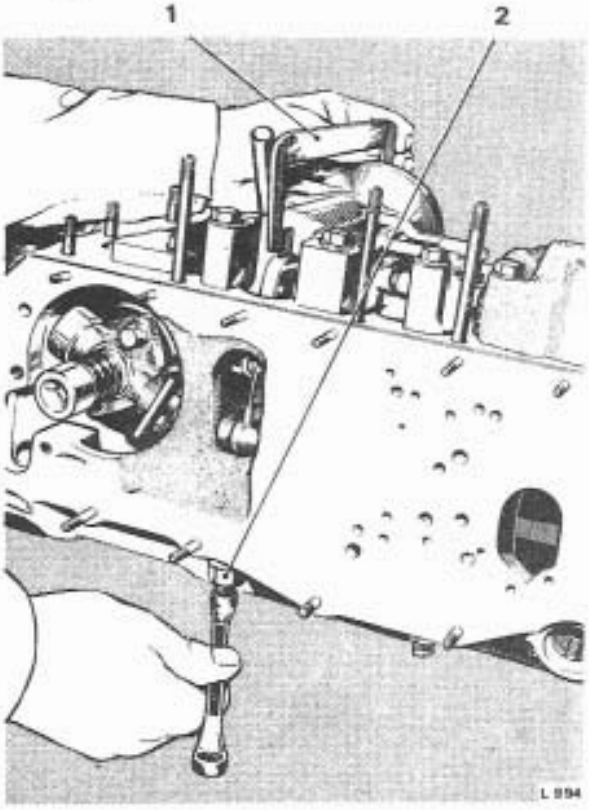

FIG. T53 ADJUSTING THE REAR BAND

1 Band adjusting gauge
2 Adjusting screw lock-nut

2331—Workshop Tools'.

Check that there is clearance between the end of the operating lever and the rear servo operating rod. If necessary, slacken the band adjusting screw.

Turn the rear drum in the opposite direction to normal rotation to centralize the band. To ensure that the band is properly centralized, hold a screwdriver against the riveted end of the band then shock it into position on the drum.

Hold the band setting gauge with the cut-away leg firmly against the spring end of the servo, and the other end of the gauge resting on the servo operating rod as shown in Figure T 53.

Screw in the adjusting screw until the face of the operating lever just touches the gauge. Care must be taken not to allow the gauge to be pushed by the operating lever, otherwise an incorrect setting will be obtained.

Should this occur, slacken the adjusting screw then recommence the setting operation, which must always be carried out by adjusting the operating lever so that it moves toward the gauge and not away from it.

Firmly hold the adjusting screw and tighten the lock-nut.

Check that the setting has not altered.

Fit the governor oil delivery pipe.

Fit the filter and sump (*see Section T11*), then after replenishing the gearbox with oil, carry out a road test as described in Section T3.

Gauge (UR 3144) — To check

Correct setting of the bands, particularly the front band, plays a great part in promoting smooth gear changes. Due to this fact it is recommended that the front band setting gauge be regularly checked for correct adjustment. The tool should be checked approximately every three to six months, depending on how often it is used.

To check the gauge UR 3144 , proceed as follows.

Unscrew the plunger assembly from its housing, then check the length of the spring under compression (*see Fig. T52*); the length of the spring should be 1·160 in. ± 0·003 in. (3,87 mm. ± 0,08 mm.).

If the spring length is incorrect, adjust the nut until the correct length is obtained, then lock together the two nuts and peen over the end of the thread to ensure that they do not work loose.

Screw the plunger assembly back into its housing.

DIMENSIONAL DATA FOR SECTION T14—FRONT SERVO

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Line exhaust valve return spring —free length.	1·765 in. (approx.) (44,85 mm.) (approx.)	———	———
Load required to reduce spring length to 1·250 in. (31,75 mm.)	2 lb. 9½ oz. to 2 lb. 14½ oz. (1,18 kg. to 1,32 kg.)	———	———
Overrun control valve return spring free length.	2·119 in. (approx.) (53,82 mm.) (approx.)	———	———

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DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Dimensional Data—*continued*			
Load required to compress spring length to 0·920 in. (23,37 mm.)	6 lb. 14 oz. to 7 lb. 10 oz. (3,12 kg. to 3,46 kg.)	—	—
Check valve spring —free length.	1·437 in. (approx.) (36,51 mm.) (approx.)	—	—
Load required to compress spring length to 0·500 in. (12,70 mm.)	1 lb. 13 oz. to 2 lb. 3 oz. (0,82 kg. to 0,99 kg.)	—	—
Apply piston return spring—free length.	1·515 in. (approx.) (38,50 mm.) (approx.)	—	—
Load required to compress spring length to 0·718 in. (18,26 mm.)	18 lb. to 22 lb. (8,16 kg. to 9,98 kg.)	—	—
Release piston return spring—free length.	0·728 in. (approx.) (18,48 mm.) (approx.)	—	—
Load required to compress spring length to 0·585 in. (14,86 mm.)	54 lb. 3 oz. to 60 lb. 3 oz. (24,57 kg. to 61,04 kg.)	—	—
Release piston ring gap.	0·002 in. to 0·007 in. (0,05 mm. to 0,18 mm.)	0·012 in. (0,30 mm.)	Measure in bore diameter 1·750 in. (44,45 mm.)
Side clearance of release piston ring in piston groove.	0·0005 in. to 0·0025 in. (0,013 mm. to 0,064 mm.)	0·0045 in. (0,115 mm.)	—
Apply piston ring gap.	0·002 in. to 0·014 in. (0,05 mm. to 0,35 mm.) inside diameter of ring.	0·019 in. (0,48 mm.)	—
	0·002 in. to 0·007 in. (0,05 mm. to 0,18 mm.) outside diameter of ring.	0·012 in. (0,30 mm.)	—
Side clearance of apply piston ring in piston groove.	0·0005 in. to 0·0025 in. (0,013 mm. to 0,064 mm.)	0·0045 in. (0,115 mm.)	—
Front servo sleeve fit in servo body.	0·000 in. to 0·001 in. (0,00 mm. to 0,02 mm.) interference.	—	Slackness in bore is not permissible. Renew servo if outside limits.
Line exhaust valve clearance in bore.	0·0007 in. to 0·0015 in. (0,017 mm. to 0,04 mm.)	0·002 in. (0,05 mm.)	Renew assembly valve body if clearances exceed these limits.
Overrun control valve clearance in bore.	0·0009 in. to 0·0017 in. (0,022 mm. to 0,043 mm.)	0·0022 in. (0,062 mm.)	
4–3 timing valve clearance in bore.	0·0007 in to 0·00175 in. (0,017 mm. to 0,043 mm.)	0·00225 in. (0,062 mm.)	Renew servo if outside limits.
Setscrews — front servo body to release cylinder.	Torque tighten to between 8 lb.ft. and 10 lb.ft. (1,11 kgm. and 1,38 kgm.)	—	—
Setscrews — front servo to gearbox casing.	Torque tighten to between 29 lb.ft. and 32 lb.ft. (4,0 kgm. and 4,4 kgm.)	—	—
Blanking plug—front servo.	Torque tighten to between 6 lb.ft. and 7 lb.ft. (0,8 kgm. and 0,9 kgm.)	—	Renew aluminium washer whenever plug is refitted.
Setscrews — front servo valve body to servo body.	Torque tighten to between 3 lb.ft. and 4 lb.ft. (0,4 kgm. and 0,5 kgm.)	—	—
Band adjusting screw locknut.	Torque tighten to between 45 lb.ft. and 50 lb.ft. (6,2 kgm. and 6,9 kgm.)	—	—