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Section T19
OIL PUMP

The oil pump is an internal/external gear type which is secured to the front face of the transmission housing. The oil pump cover contains an oil pressure regulator valve train, a stator valve and an heat exchanger by-pass valve. The pump is connected mechanically to the engine flexplate and operates whenever the engine is running.

As the engine flexplate revolves it turns the torque converter pump which is keyed to the inner gear of the oil pump. The inner gear turns the outer gear and causes oil to be lifted from the transmission sump via an oil strainer.

As the gears turn, the oil is carried in pockets formed by the gear teeth, past a crescent shaped projection of the pump. Beyond the crescent, the gear teeth move closer together causing the oil to be squeezed out at pressure from between the teeth. At this point the oil is delivered through the pump outlet to the pressure system (*see Fig. T221*).

The oil pressure is controlled by a pressure regulator valve. As the pressure builds up, the oil is directed through an orifice to the top of the pressure regulator valve. When the desired pressure is reached, the valve moves against spring pressure, opening a passage to feed the torque converter.

When the torque converter is full, oil returns to the transmission heat exchanger by way of an external pipe. Upon leaving the heat exchanger, the oil is fed by way of another external pipe to the transmission lubricating system.

Should the heat exchanger become obstructed, returning oil is diverted to the by-pass valve, unseating the valve and permitting oil to flow directly to the lubrication system.

As pressure continues to increase, the pressure regulator valve moves to expose a port which directs excess oil to the suction side of the pump. The pressure regulator valve is spring-balanced to regulate line pressure at approximately 70 lb/sq. in. (4.9 kg/sq. cm.).

Note There is a change to the regulator valve fitted to 1971 onwards transmission. Early transmissions (prior to 1971) were fitted with a regulator valve having oil holes and an orifice cup plug. later transmissions (1971 onwards) have a solid type of regulator valve. The solid type of valve must only be fitted to a pump cover with a squared off pressure regulator boss (*see Fig. T222*). The earlier type of valve with oil holes and cup plug can be used to service either type of pump cover.

Oil pump—To remove

1. Remove the transmission from the car.
2. Remove the sump and oil strainer.
3. Remove the stator solenoid lead (if fitted) from the connector in the transmission casing.

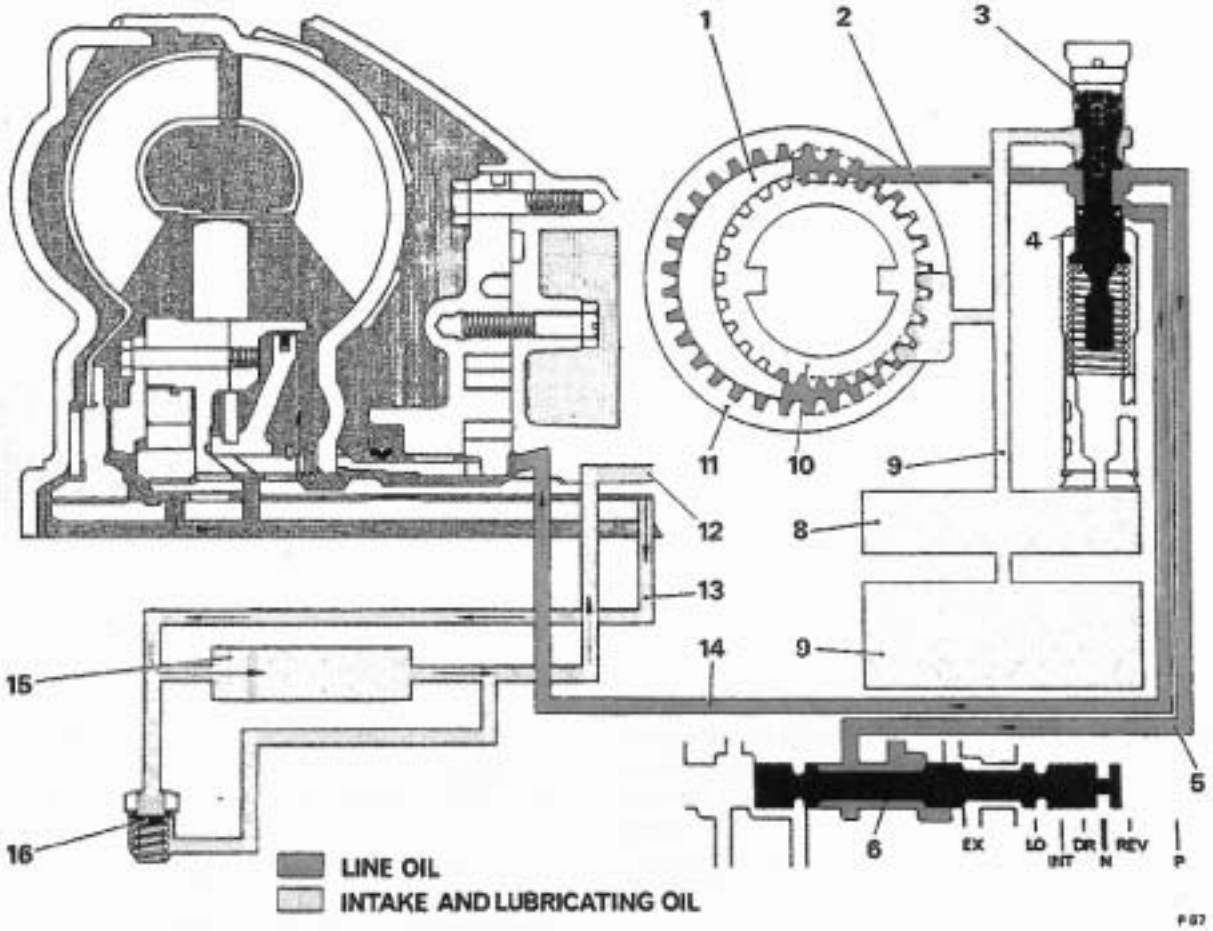

FIG. T221 OIL PUMP AND PRESSURE REGULATING SYSTEM

1 Pump crescent
2 Pump outlet
3 Line pressure oil
4 Pressure regulator valve
5 Line pressure oil
6 Manual valve
7 Transmission sump
8 Strainer assembly
9 Pump intake
10 Drive gear
11 Driven gear
12 Lubricating oil
13 Converter return
14 Converter oil
15 Heat exchanger by-pass
16 Heat exchanger

4. Remove the lead from the clips.

Note Before removing the pump, opportunity should be taken to check the front unit end play as follows.

5. Remove one of the screws securing the oil pump also the 'O' ring, at either the 10 o'clock or 5 o'clock position.

6. Fit slide hammer RH 7958 (J-6125) into the pump in the tapped hole from which the setscrew was removed.

7. Secure a dial test indicator on the slide hammer bolt, then adjust the indicator to register against the end of the turbine shaft.

8. Hold the output shaft forward whilst pushing the turbine shaft rearward to its stop.

9. Set the dial indicator to zero.

10. Pull the turbine shaft forward as shown in Figure T223.

11. Make a note of the indicator reading (shaft travel).

12. If the transmission is to be dismantled further it will enable the correct adjusting washer to be selected during assembly, thus ensuring that the front unit has the correct amount of end float. End float should be between 0·003 in. and 0·024 in. (0,076 mm. and 0,610 mm.). The selective washer which controls the end float is located between the pump cover and the forward clutch housing. If the end float is not within the limits, select a new washer, referring to the following chart.

THICKNESS	COLOUR
0·060 in. to 0·064 in. (1,52 mm. to 1,63 mm.)	Yellow
0·071 in. to 0·075 in. (1,803 mm. to 1,905 mm.)	Blue
0·082 in. to 0·086 in. (2,08 mm. to 2,18 mm.)	Red
0·093 in. to 0·097 in. (2,36 mm. to 2,46 mm.)	Brown
0·104 in. to 0·108 in. (2,64 mm. to 2,74 mm.)	Green
0·115 in. to 0·119 in. (2,92 mm. to 3,02 mm.)	Black
0·126 in. to 0·130 in. (3,20 mm. to 3,30 mm.)	Purple

Note An oil soaked washer may tend to discolour. If necessary, measure the washer to ascertain the thickness.

13. Remove the dial indicator gauge. If oil is to be removed, do not remove the slide hammer at this stage.

14. Proceed with the removal of the oil pump as follows.

15. Remove the seven remaining setscrews securing the pump.

16. Fit slide hammer RH 7958 (J-6125), with a $\frac{3}{8}$ in. × 16 threaded adapter, into the other threaded hole in the pump body.

17. Remove the pump from the casing by driving it outward using the slide hammers (*see Fig. T224*).

Note Operate the slide hammers simultaneously otherwise the pump will tilt and jam in the bore of the casing.

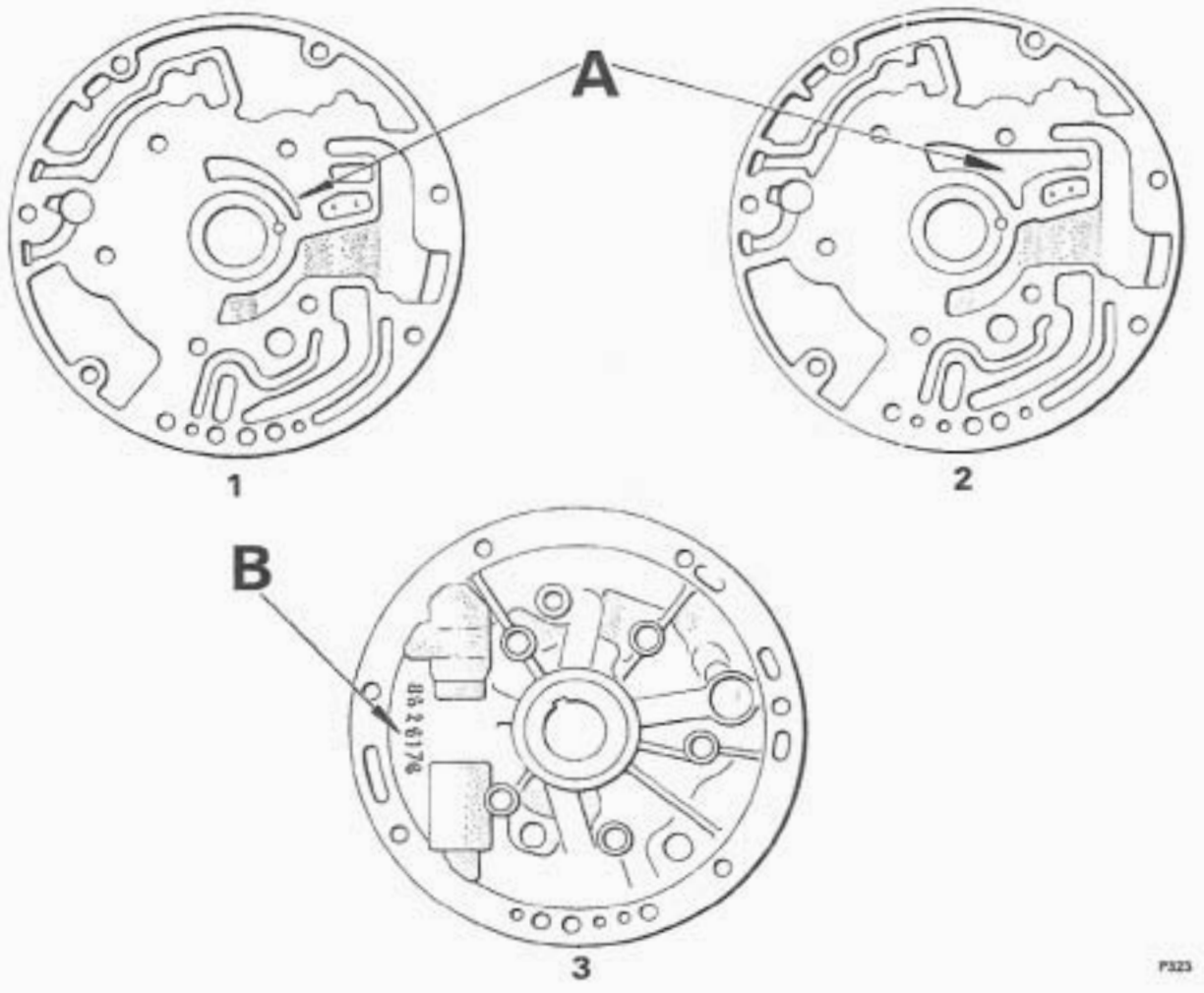

FIG. T222 PUMP COVER IDENTIFICATION

1 Oil pump cover type 1
2 Oil pump cover type 2
3 Oil pump cover type 2 (opposite side)
A Note differences in oil passages
B Identification number

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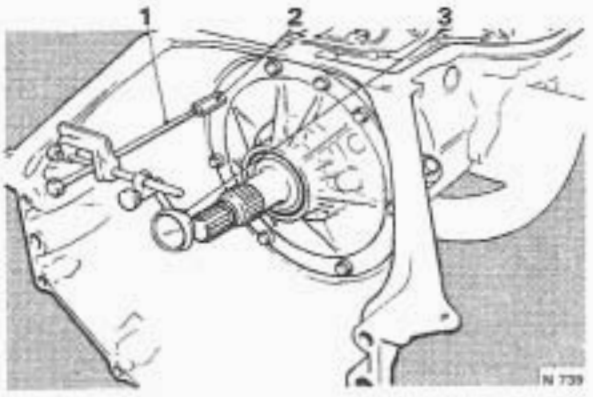

FIG. T223 CHECKING THE FRONT UNIT END FLOAT

1 RH 7958 (J 6125-1)
2 RH 7958 (J 6125-2)
3 Dial indicator (J-8001)

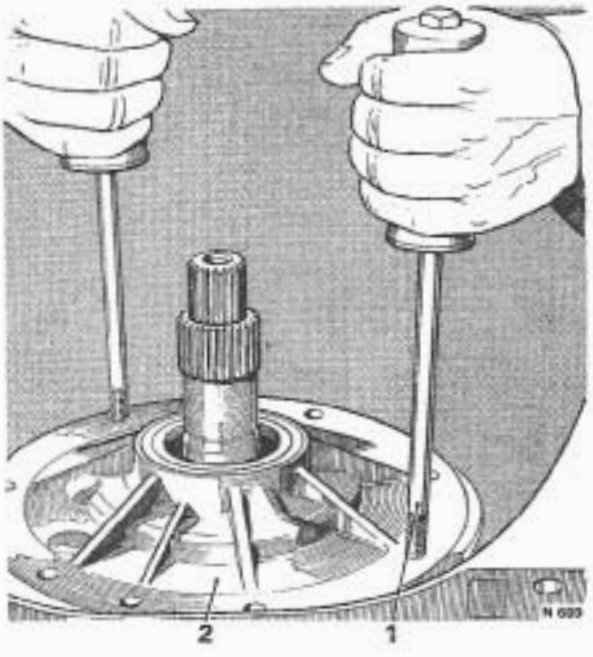

FIG. T224 REMOVING THE OIL PUMP

1 Slide hammer
2 Oil pump

18. Remove the slide hammers from the pump.
19. Remove and discard the square sectioned 'O' ring and the gasket.

Oil pump—To dismantle

1. Using adaptor RH 7960 (J-21364) in the rear unit holding fixture RH 7959 (J-6116), fit the pump into the holding fixture with the stator shaft pointing downward. Take care not to damage the shaft.
2. Remove the stator solenoid (if fitted) from the pump cover; discard the gasket.
3. Compress the regulator boost valve, against spring pressure, then remove the circlip (*see Fig. T225*).

Caution The pressure regulator spring is under extreme pressure and care should be exercised when removing the boost valve and sleeve.

4. Remove the regulator boost valve sleeve and valve.
5. Remove the pressure regulator spring.
6. Remove the regulator valve, spring retainer and spacer or spacers (if fitted).
7. Remove the five setscrews which secure the pump cover to the pump body; separate the cover and body; note that the setscrews are of differing lengths.
8. Mark the driving and driven gears to facilitate correct assembly. Do not use a scriber or a punch; an indelible pencil is recommended.
9. Remove the gears from the pump body as shown in Figure T226.
10. Remove the retaining pin and the plug from the end of the regulator bore.
11. If fitted, remove the stator valve retaining pin; remove the stator valve and spring.
12. Remove the two oil rings from the pump cover.
13. Remove the fibre adjusting washer.
14. Remove the converter return check valve from the by-pass assembly (if fitted).

Note Do not remove the heat exchanger by-pass valve unless it is necessary to renew the seat, valve or spring.

15. The sealing qualities of the by-pass valve can be checked by pouring a small quantity of thinners or spirits into the valve pocket and checking for excessive leakage.

If it is necessary to remove the heat exchanger by-pass valve seat proceed as follows.

Note On service replacement pumps the cooler by-pass valve is not used.

1. Using pump by-pass valve seat remover RH 7963 (J-21361), in conjunction with slide hammer RH 7958 (J-6125) and the $\frac{3}{8}$ in. × 16 threaded adapter, fit the removal tool into the valve seat and drive upward on the slide hammer (*see Fig. T227*); remove and discard the valve seat.

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Note The seat may be removed also by threading the seat with a $\frac{3}{8}$ in. × 16 tap and using the $\frac{3}{8}$ in. × 16 adapter on the slide hammer to drive out the seat. If this method is used, flush out the bore of the by-pass valve to remove all swarf and foreign material before fitting the new seat.

2. Remove the by-pass valve and spring.
3. If the pump oil seal requires renewal, drive out the seal with a hammer and chisel.
4. Take care not to damage the pump cover, especially the seal bore diameter.

Oil pump—To inspect

Wash all parts, except the stator solenoid (if fitted), in clean paraffin (kerosene) then dry them with compressed air.

1. Examine the gear pockets and the crescent for scoring or other damage.
2. Fit the gears into the pump body then check the end clearance as shown in Figure T228. The clearance should be between 0·0008 in. and 0·0035 in. (0,020 mm. and 0,099 mm.).
3. Examine the face of the pump body for scores or burrs.
4. Examine the oil passages for blockages and porosity.
5. Examine the threads into which the cover securing setscrews fit.
6. Examine the pump body face for overall flatness.
7. Examine the bush for scores or burrs.
8. Examine the setscrew 'O' rings for damage; renew if necessary.
9. Examine the pump cover face for overall flatness.
10. Examine the stator valve bore and the pressure regulator valve bore for scores or dirt (*see Fig. T229*).
11. Ensure that all the oil passages are clear and are not interconnected due to porosity.
12. Examine for scores or damage the face against which the pump gears rotate.
13. Examine the stator shaft for damaged splines or scored bushes.
14. Examine the oil ring grooves for damage or wear.
15. Examine the heat exchanger by-pass valve for free operation and good sealing qualities.
16. Examine for damage the face against which the selective washer fits.
17. Fit the oil sealing rings into their bore in the forward clutch housing and check for slack or badly fitting rings.
18. Ensure that the pressure regulator and the boost valve will move freely in their bores.

Oil pump—To assemble

Note Before commencing with the assembly of the oil pump, always ensure that any new or replacement parts to be used are applicable to the assembly in question and are not intended for either an earlier or later assembly. **Always consult the relevant Parts Lists, Spares Information Sheets and Service Bulletins.**

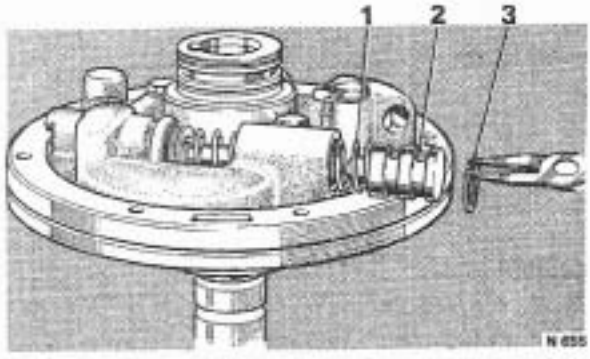

FIG. T225 REMOVING THE REGULATOR VALVE RETAINING CIRCLIP

1 Regulator valve spring
2 Boost valve sleeve
3 Circlip

1. Fit the oil pump driving and driven gears into the pump body with the alignment marks and tangs uppermost.
2. Fit the pressure regulator spring spacer or spacers, if any were removed, then fit the retainer and spring into the bore.
3. Lightly lubricate the pressure regulator valve with clean transmission fluid then fit the valve into the opposite end of the bore, stem end first.

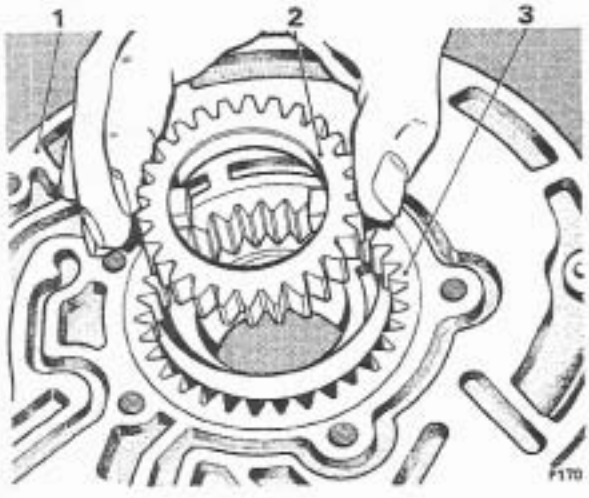

FIG. T226 REMOVING THE PUMP GEARS

1 Pump body
2 Driving gear (tangs uppermost)
3 Driven gear

FIG. T227 REMOVING THE BY-PASS VALVE SEAT

1 By-pass valve seat extractor

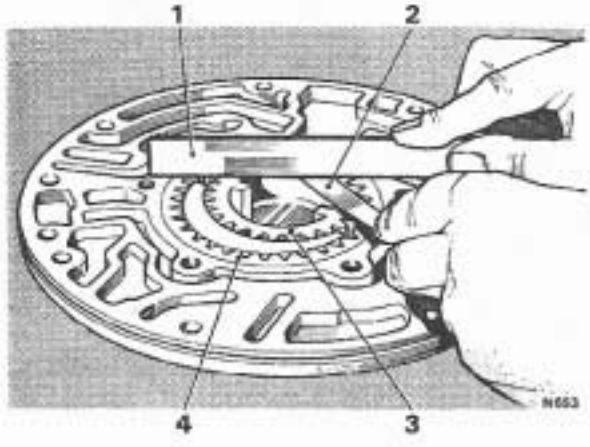

FIG. T228 CHECKING GEAR END CLEARANCE

1 Straight edge
2 Feeler gauge
3 Inner (driving gear)
4 Outer (driven gear)

4. Lightly lubricate the boost valve and sleeve then fit the valve into the sleeve with the stem of the valve outermost. Fit both parts into the bore in the pump cover by compressing the sleeve against the pressure regulator valve spring.

5. Retain the sleeve with the circlip.

6. Fit the pressure regulator valve end plug and retaining pin into the opposite end of the bore.

7. Lightly lubricate the stator valve then fit the valve and spring into the bore in the pump cover; fit the retaining pin.

8. Fit the previously selected front unit adjustable thrust washer (fibre) over the pump cover delivery sleeve.

Note The correct washer size should have been determined at the time of the front unit end float check as described under 'Oil pump — To remove'.

9. Fit the oil rings.

10. If previously removed, fit the heat exchanger by-pass valve spring (large end first), valve and valve seat; lightly lubricate the valve. Use the pump by-pass valve fitting tool RH 7964 (J-21360) to fit the valve seat (*see Fig. T230*).

11. Fit the converter by-pass valve into the by-pass valve assembly.

12. Fit the pump body into the rear unit holding fixture RH 7959 (J-6116), with the stator shaft pointing downward. Take care not to scratch or damage the shaft.

13. Lubricate the pump gears with clean transmission fluid then fit the pump cover to the pump body.

14. Fit the cover securing setscrews in their original positions with the clip adjacent to the stator valve. Leave the screws one turn slack.

15. Fit the pump body and cover alignment band J-21368 around the pump assembly. Tighten the wing nut on the band to align the cover with the body (*see Fig. T231*).

16. With the band in position, tighten the body-to-cover securing setscrews to 18 lb. ft. (2,49 kg. m.). Remove the band.

17. Fit a new square sectioned 'O' ring to the pump.

18. If necessary, fit a new pump oil seal using seal installing tool RH 7953 (J-21359).

19. Fit the stator solenoid (if fitted). Tighten the securing setscrews to 12 lb. ft. (1,66 kg. m.).

20. Fit the stator wire to the clip.

Oil Pump—To fit

1. Fit a new gasket to the oil pump, retaining it with petroleum jelly.

2. Align the holes in the gasket with the corresponding holes in the pump cover.

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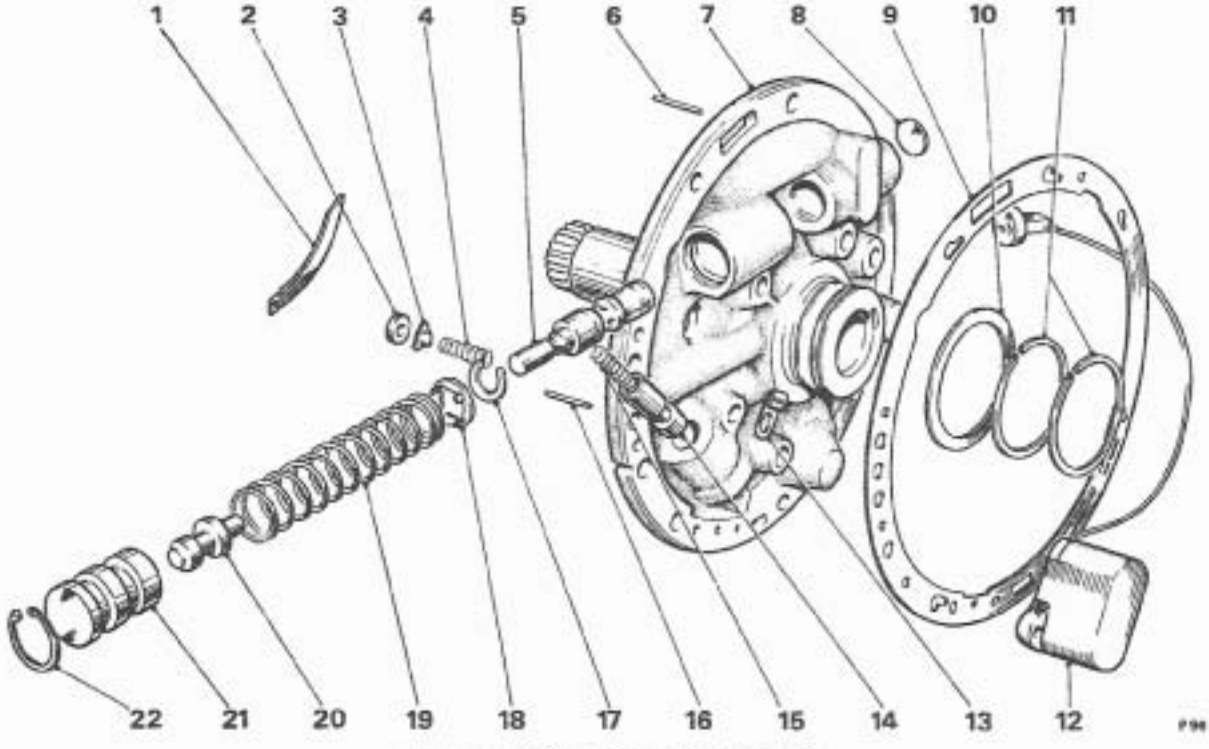

FIG. T229 PUMP COVER—EXPLODED

1 Converter out — check valve (early cars)
2 Heat exchanger by-pass valve seat
3 Heat exchanger by-pass valve
4 Heat exchanger by-pass valve spring
5 Pressure regulator valve
6 Retaining pin
7 Pump cover
8 Bore plug
9 Gasket
10 Selective washer
11 Oil sealing rings
12 Stator solenoid (early cars)
13 Wire retaining clip (early cars)
14 Stator valve (early cars)
15 Stator valve spring (early cars)
16 Retaining pin
17 Spacer
18 Spring retainer
19 Spring-pressure regulator
20 Boost valve
21 Sleeve
22 Snap ring

3. Lubricate the turbine shaft journals with clean transmission fluid. Lubricate the hooked oil seal rings on the pump delivery sleeve with petroleum jelly; ensure that the ends of the rings are interlocked.

4. Fit two $\frac{3}{16}$ in. × 18 slide hammer bolts RH 7958 (J-6125), through two opposite threaded holes in the pump assembly. The bolts will serve as guide pins when the pump is being fitted to the casing.

5. Position the pump assembly in the transmission casing, then screw the two threaded guide bolts into the corresponding holes in the transmission casing.

6. Feed the stator connector and lead (if fitted) through the hole in the casing adjacent to the pressure regulator (*see Fig. T232*).

7. Fit the pump assembly into the transmission casing.

8. Fit new 'O' rings to the pump securing setscrews then fit the setscrews. Do not remove the guide bolts until all but two of the setscrews have been fitted.

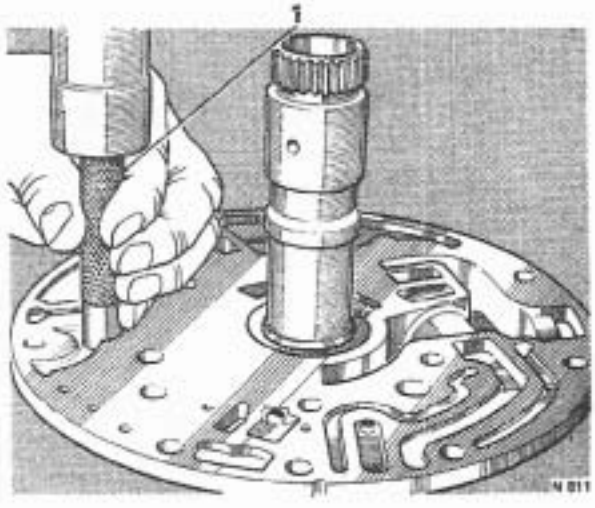

FIG. T230 FITTING THE BY-PASS VALVE SEAT
1 Punch

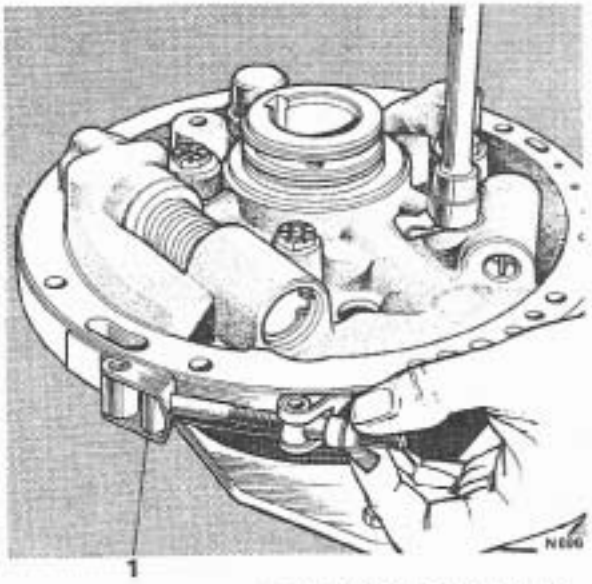

FIG. T231 ALIGNING THE PUMP COVER WITH PUMP BODY

1 Alignment band

9. Remove the guide bolts, but leave out one securing screw at either the 5 o'clock or 10 o'clock position so that the front unit end float can be re-checked. Torque tighten the setscrews to 18 lb. ft. (2,49 kg. m.).

FIG. T232 FITTING THE OIL PUMP

1 Stator solenoid connector (if fitted)

Note If the turbine shaft cannot be rotated as the the pump is being pulled into position, it is possible that either the forward or direct clutch housings have not been correctly indexed with all the clutch plates. This condition should be corrected before the pump is finally pulled into position.

10. Recheck the front unit end float as described earlier in this Section.

11. Fit the remaining setscrew using a new 'O' ring; torque tighten the setscrew to 18 lb. ft. (2,49 kg. m.).

12. Fit the remainder of the units (*see Section T14*).

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Section T20
CONTROL RODS, LEVERS and PARKING LINKAGE

The control rods, levers and parking linkage consist of an assembly of levers and rods which are operated by the electric gearchange actuator; some are fitted to the transmission interior and some externally. The inside detent lever is connected to the manual control valve in the control valve unit and is retained in the desired position by a spring-loaded detent roller.

The parking brake actuating rod causes the parking pawl to engage the transmission whenever Park is selected. This provides a mechanical lock which will hold the car on the steepest of gradients.

On **early cars** an emergency 'Get-You-Home' lever is pivoted on a pin secured to a bracket on the 'controls' side of the transmission. The lever is connected to the gearchange operating lever, and in the event of gear change actuator failure, will enable the driver to manually select the desired Range.

When the gear selector lever on the steering column is moved and the ignition is switched on, the electric actuator will move the gearchange operating lever to the required position via an adjustable rod. The gearchange operating lever is secured to the outer end of the manual shaft and the inside detent lever is secured to the inner end of the shaft, thus the inside detent lever will move a corresponding distance, moving the manual control valve. By this means it is possible for the driver to position the manual valve to give him the gear range he desires.

When the lever on the steering column is moved to Park, a rod which is secured to the inside detent lever causes the parking pawl to engage with a gear ring on the rear unit planet carrier. The rear unit planet carrier is mechanically connected to the transmission output shaft, thus the shaft is prevented from rotating.

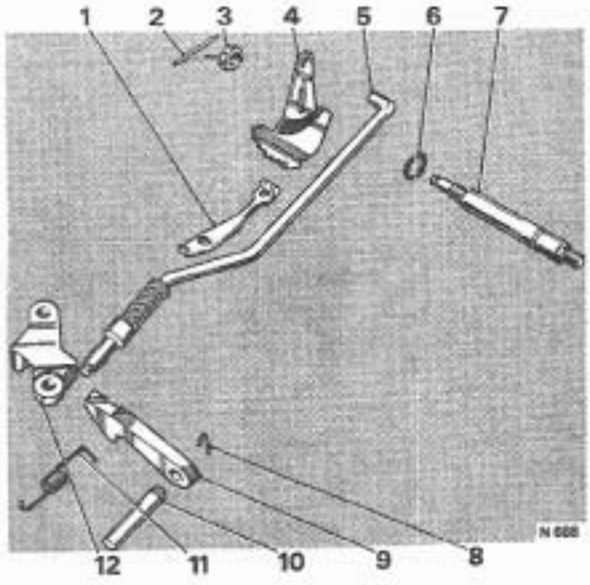

FIG. T233 MANUAL AND PARKING LINKAGE—EXPLODED

1 Detent roller and spring
2 Retaining pin
3 Lock nut
5 Inside detent lever
4 Parking brake actuating rod
6 Manual shaft seal
7 Manual shaft
8 Spring retainer
9 Parking pawl
10 Parking pawl shaft
11 Pawl return spring
12 Parking brake bracket

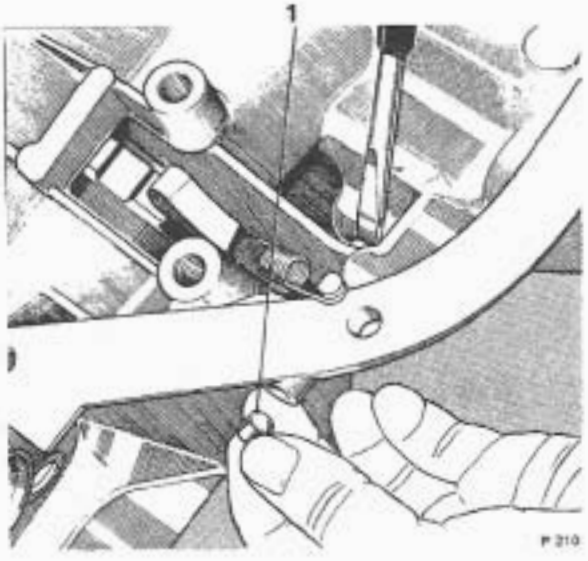

FIG. T234 REMOVING CUP PLUG

1 Cup plug

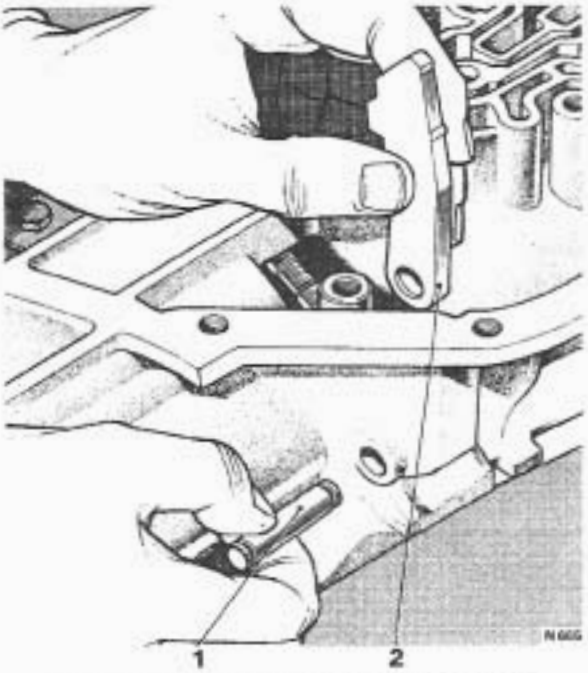

FIG. T235 FITTING THE PARKING PAWL AND SHAFT

1 Shaft
2 Parking pawl

Control rods, levers and parking linkage—To remove

1. The units may be removed from the transmission whether or not the transmission has been removed from the car.
2. If the transmission has not been removed, drain and remove the sump as described in Section T14.
3. If the gearchange electric actuator and the neutral start and height control switches have not been removed, disconnect the gearchange operating rod and the switch operating rod by removing the split pins and clevis pins from the levers at each end; remove the rods.
4. Remove the split pin and clevis pin which secures the link rod to the transmission operating lever.
5. Remove the nut and clamping washer which retains the transmission operating lever to its pivot pin; remove the lever.
6. Remove the lock-nut which retains the gearchange operating lever to the manual shaft; remove the lever.
7. On some early units a shield may be fitted to exclude moisture and dirt from between the shaft and shaft bore in the case; remove the shield from the shaft.
8. Remove the setscrew which secures the detent spring and roller assembly to the control valve unit; remove the detent spring assembly. Refer to Figure T233 for an exploded view of the internal parts.
9. Remove the pin which secures the manual shaft to the case.
10. Slacken the lock-nut which secures the inside detent lever to the manual shaft.
11. Prise the inside detent lever from the manual shaft then remove the lock-nut.
12. Remove the parking brake actuating rod, detent lever and manual shaft from the case.

Note Do not remove manual shaft seal unless replacement is required.

13. Remove the setscrews securing the parking brake bracket; remove the bracket.
14. Remove the parking pawl return spring.

Note The following operations are to be completed only if one or more of the parts involved requires replacement.

15. Remove the spring retainer from the parking pawl shaft. Remove the parking brake pawl shaft cup plug by placing screwdriver between parking pawl shaft and case rib and prying outward (*see Fig. T234*).
16. Remove the parking pawl and the shaft.

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Control rods, levers and parking linkage—To inspect

1. Wash all parts in clean paraffin (kerosene) then dry them with compressed air.
2. Examine the gearchange operating rod for signs of bending.
3. Examine the jaws for cracks or damage.
4. Examine the link rod for signs of bending.
5. Examine the switch actuating rod for cracks or signs of bending.
6. Examine the 'Get-You-Home' lever (if fitted), gearchange operating lever and the gearchange actuator lever for damage and wear in the clevis pin bores.
7. Examine the Oilite bushes in the 'Get-You-Home' lever (if fitted) for excessive wear.
8. Ensure that the pin is securely riveted in the gearchange operating lever.
9. Examine the parking actuator rod for cracks, damaged snap ring groove or broken spring retaining lugs.
10. Examine the actuator spring for distortion or damage. Ensure that the actuator fits freely on the actuator rod.
11. Examine the parking pawl for cracks or excessive wear.
12. Examine the manual shaft for damaged threads or shaft roughness at the gearchange operating lever end.
13. Examine the inside detent lever for cracks or a loose pin.
14. Examine the parking pawl shaft for damaged oil seal or retaining clip grooves.
15. Examine the parking pawl return spring for distortion or damaged ends.
16. Examine the parking pawl bracket for cracks or excessive wear.
17. Examine the detent spring and roller assembly for cracks or damage.

Control rods, levers and parking linkage—To fit

1. Fit the parking pawl with the tooth toward the centre of the transmission then fit the parking pawl shaft (*see Fig. T235*).
2. Fit the parking pawl shaft retaining clip.
3. Fit the parking pawl return spring with the squared end hooked around the pawl.
4. Fit the parking pawl bracket so that the ends fit one each side of the pawl (*see Fig. T236*). Fit the securing setscrews and torque tighten them to 18 lb. ft. (2,49 kg. m.).
5. Fit the actuator rod into the inside detent lever from the side opposite to the pin.

FIG. T236 FITTING THE PARKING PAWL BRACKET

1 Parking pawl bracket
2 Parking brake pawl

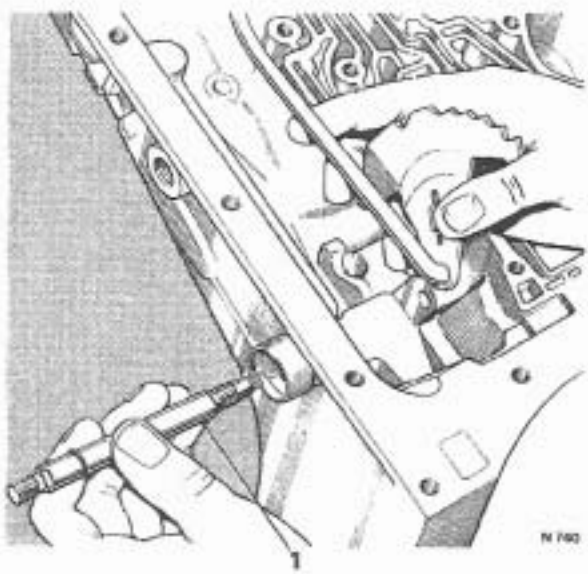

FIG. T237 FITTING THE MANUAL SHAFT

1 Manual shaft

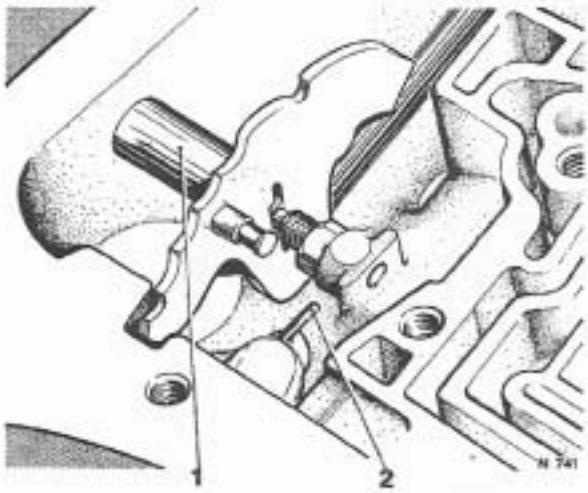

FIG. T238 FITTING THE MANUAL SHAFT RETAINING PIN

1 Manual shaft
2 Retaining pin

6. Fit the actuating rod plunger under the parking brake bracket and over the parking pawl.

7. Lubricate the manual shaft around the area occupied by the 'O' ring with Shell Retinax A grease. Fit the shaft into the case and through the detent lever (*see Fig. T237*).

8. Fit the lock-nut onto the manual shaft then torque tighten the nut (*see Chapter P*).

9. Fit the retaining pin into the transmission casing, aligning it with the groove in the manual shaft (*see Fig. T238*).

10. Fit the detent spring and roller. Torque tighten the retaining setscrew to 8 lb. ft. (1,11 kg. m.).

11. If a shield was removed, apply Shell Retinax A grease to the inside of the shield then fit the shield over the shaft.

12. Fit the gearchange operating lever to the manual shaft with the cranked side lowermost and away from the transmission. Fit the lock-nut and tighten it to 18 lb. ft. (2,49 kg. m.) (*see Chapter P*).

13. Fit the transmission operating lever. Fit the clamping washer and nut; torque tighten the nut to between 8 lb. ft. and 10 lb. ft. (1,11 kg. m. and 1,39 kg. m.).

14. Fit the gearchange operating rod, the switch operating rod and the link rod. Lubricate the clevis pins with Molytone 265 grease then fit new split pins.

15. If the length of either the gearchange operating rod or the switch operating rod has been altered, adjust them as described in Section T5.

16. Fit the sump (*see Section T14*).

Section T21
TURBINE SHAFT, FORWARD and DIRECT CLUTCHES, SUN GEAR SHAFT and FRONT BAND

The turbine shaft is a splined shaft which connects the torque converter to the forward clutch.

The forward clutch comprises a housing, splined onto the turbine shaft, steel clutch driving plates which are driven by the clutch housing, composition faced plates which are splined onto a clutch hub and a hydraulically operated clutch piston. The mainshaft is splined into the forward clutch hub.

The direct clutch is similar in construction to the forward clutch (*see Fig. T239*).

The composition plates are splined to a hub which is integral with the forward clutch back plate. The steel plates are splined to a housing which in turn is splined to the sun gear shaft. The clutch is applied hydraulically by a piston housed in the direct clutch drum.

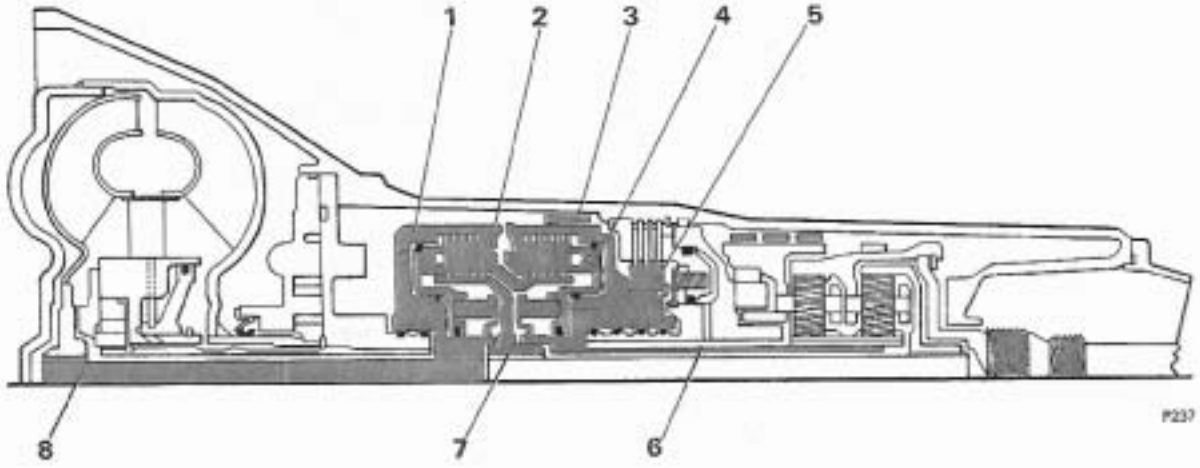

FIG. T239 SECTIONED VIEW OF TRANSMISSION SHOWING FORWARD AND DIRECT CLUTCHES

1 Forward clutch drum
2 Direct clutch hub
3 Second over-run (front) band
4 Direct clutch drum
5 Intermediate roller
6 Sun gear shaft
7 Forward clutch hub
8 Turbine shaft

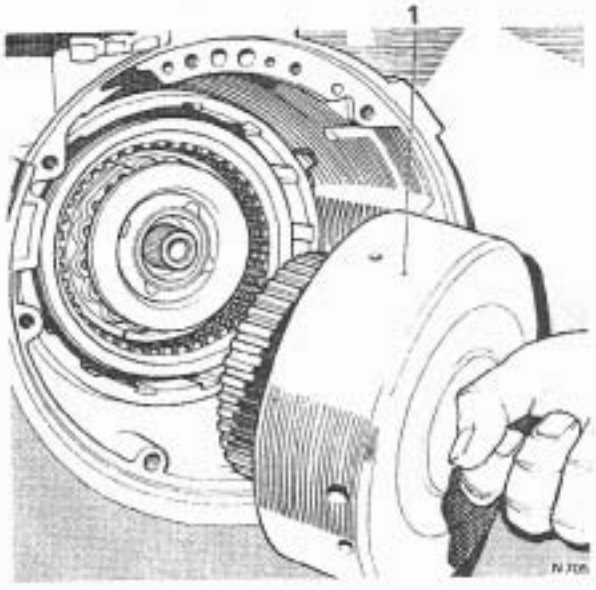

FIG. T240 REMOVING THE FORWARD CLUTCH ASSEMBLY

1 Forward clutch assembly

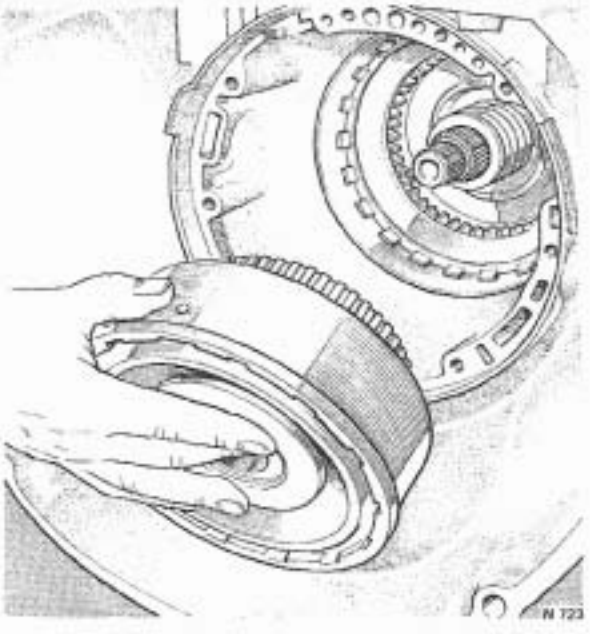

FIG. T241 REMOVING THE DIRECT CLUTCH AND INTERMEDIATE SPRAG ASSEMBLY

The front band is a lined steel band which is anchored to the transmission case at one end and is servo operated at the other end. The band fits around the direct clutch drum, and when moved by the servo, holds the drum stationary.

Whenever the forward clutch is applied, the drive transmitted by the turbine is connected to the transmission mainshaft. When the forward clutch is released the clutch return springs push back the hydraulic piston, the plates are released and the connection between the converter and the mainshaft is broken. As a result, the transmission is in Neutral.

Whenever the direct clutch is applied, drive from the forward clutch is divided and follows two different paths to the gear unit (*see Section T22*).

By following one path, the drive continues through the forward clutch to the mainshaft and the rear gear unit internal (annulus) gear. The other path is via the forward clutch back plate, through the direct clutch to the sun gear shaft.

As the direct clutch is applied, clockwise torque from the converter causes an intermediate inner roller race to overrun the roller clutch assembly.

An illustrated summary of the power flow through the transmission is given in Section T22.

Turbine shaft, forward and direct clutches, sun gear shaft and front band—To remove

1. Remove the transmission from the car. Withdraw the converter assembly.
2. Remove the oil pump.
3. Withdraw the turbine shaft and the forward clutch from the transmission (*see Fig. T240*).
4. Remove the thrust washer from between the forward clutch hub and the direct clutch housing; the washer may have come out with the forward clutch.
5. Withdraw the direct clutch and intermediate roller assembly (*see Fig. T241*). The sun gear shaft may come out with the direct clutch assembly.
6. Remove the sun gear shaft if not previously removed.
7. Remove the front band.

Note The opportunity should be taken at this time to check the end float of the rear unit; proceed as follows.

Rear unit end float—To check

1. Remove the transmission rear extension housing.
2. Fit speedometer gear extractor bolt J-21797, or a similar suitable bolt into one of the holes in the end of the transmission case.
3. Mount a dial test indicator onto the bolt so that the indicator stem registers with the end of the output shaft (*see Fig. T242*).

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4. Set the dial indicator to zero.

5. Move the output shaft to and fro, noting the indicator reading to enable the correct end float adjusting washer to be used when the transmission is assembled. The end float should be between 0·007 in. and 0·019 in. (0,178 mm. and 0,483 mm.).

6. The adjusting washer which controls this end float is the steel washer with the three tabs, located between the thrust washer and the rear face of the transmission case. The notches on the tabs serve to identify washer thickness.

7. If a different washer thickness is required to bring end float within the specified limits, it can be selected with the aid of the following chart.

THICKNESS		IDENTIFICATION NOTCH AND/OR NUMERAL	
0·074 in. (1,880 mm.	to 0·078 in. to 1,981 mm.)	None	1
0·082 in. (2,083 mm.	to 0·086 in. to 2,184 mm.)	On side of 1 tab	2
0·090 in. (2,286 mm.	to 0·094 in. to 2,388 mm.)	On side of 2 tabs	3
0·098 in. (2,489 mm.	to 0·102 in. to 2,591 mm.)	On end of 1 tab	4
0·106 in. (2,692 mm.	to 0·110 in. to 2,794 mm.)	On end of 2 tabs	5
0·114 in. (2,896 mm.	to 0·118 in. to 2,997 mm.)	On end of 3 tabs	6

Forward clutch and turbine shaft— To dismantle

1. With adaptor RH 7960 (J-21364) in the rear unit holding fixture RH 7959 (J-6116), fit the forward clutch assembly into the holding fixture with the turbine shaft lowermost; take care not to damage the shaft.

2. Remove the large snap ring which retains the direct clutch hub to the forward clutch drum. Remove the direct clutch hub.

3. Remove the forward clutch hub. Remove the thrust washers, one from each side of the hub. An exploded view of the forward clutch is given in Figure T243.

4. Remove five composition and five steel clutch plates.

5. Place the forward clutch on the bed of a press with turbine shaft lowermost.

6. Using clutch spring compressor RH 7965 (J-4670) in conjunction with adaptor RH 7966 (J-21664), compress the clutch return springs until the retaining snap ring is accessible. Remove the snap ring (*see Fig. T244*).

7. Remove the tools then remove the spring retainer and the sixteen clutch release springs.

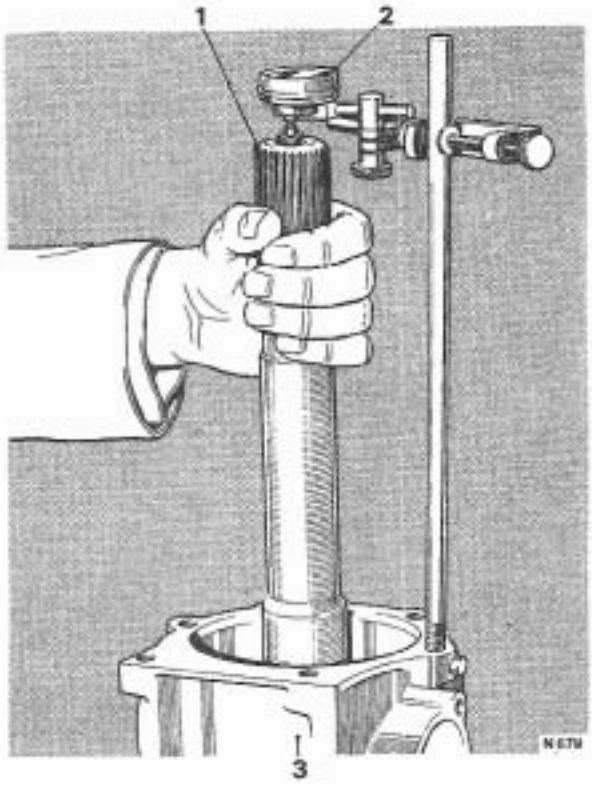

FIG. T242 CHECKING REAR UNIT END FLOAT

1 Output shaft
2 Dial indicator gauge
3 Transmission case

8. Remove the piston from the clutch drum (*see Fig. T245*).

9. Remove and discard the inner and outer seals from the clutch piston.

10. Remove and discard the piston centre seal from the forward clutch drum.

11. It is not necessary to remove the turbine shaft from the forward clutch drum unless either the shaft or the drum is damaged and requires renewal. In such a case proceed as follows.

12. Place the forward clutch drum on the bed of a press with the turbine shaft lowermost.

13. Using a 0·375 in. (9,525 mm.) drive extension approximately 3·00 in. (7,62 cm.) long, or similar tool as a drive, press the turbine shaft out of the forward clutch housing.

Forward clutch and turbine shaft— To inspect

1. Wash all parts except the composition clutch plates in clean paraffin (kerosene) then dry them with compressed air.

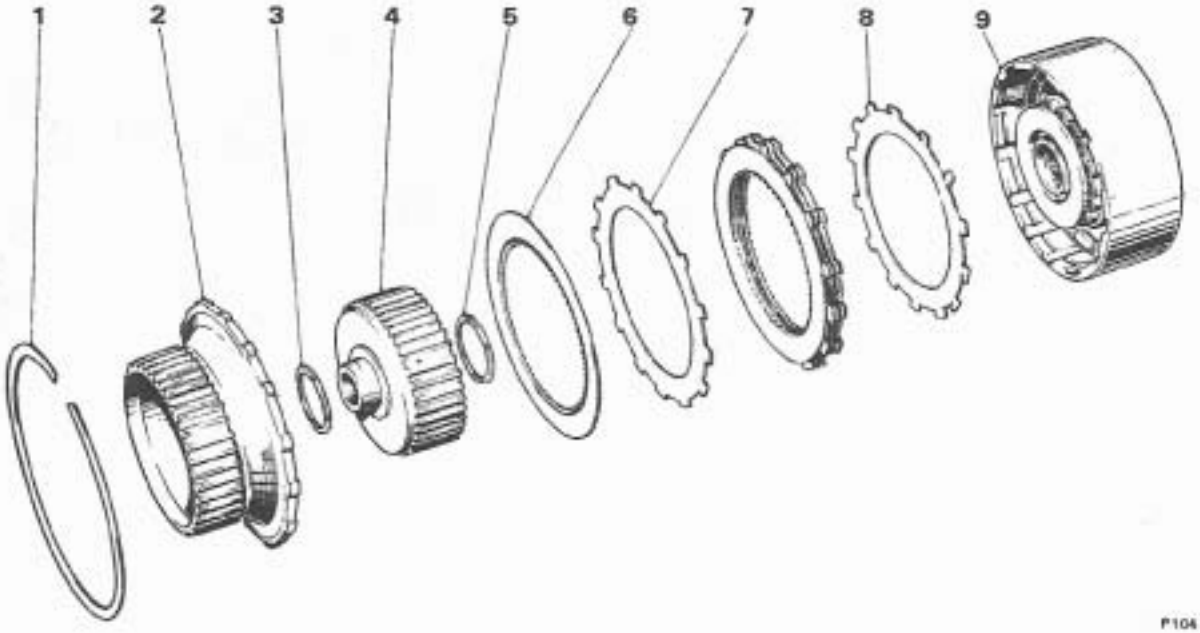

FIG. T243 FORWARD CLUTCH WITH FORWARD AND DIRECT CLUTCH HUBS—EXPLODED

1 Snap ring
2 Direct clutch hub
3 Thrust washer
4 Forward clutch hub
5 Thrust washer
6 Composition plate
7 Flat steel plate
8 Waved steel plate
9 Forward clutch assembly

2. Examine the driving and driven clutch plates for signs of burning, scoring or wear. If the driven (composition) plates are black in colour or have a glazed appearance they should be renewed. The steel driving plates should have a matt grey finish, but if they are discoloured or warped it is a sign of overheating and the plates must be renewed.

3. Examine the sixteen clutch release springs for collapsed coils or signs of distortion. If more than one spring shows these symptoms, the sixteen springs must be renewed.

4. Examine the clutch hubs for worn splines. Ensure that the lubrication holes are clear and that the thrust faces are not scored or damaged.

5. Examine the piston for cracks.

6. Examine the clutch drum for wear, scoring and cracks.

7. Ensure that the oil passages are clear.

8. Ensure that the check ball in the clutch drum is free in its chamber.

9. Ensure that the lubrication holes in the turbine shaft are clear.

10. Examine the splines on the turbine shaft for damage and the shaft for cracks or distortion.

11. Examine the bush journals for damage.

Forward clutch and turbine shaft—To assemble

If the turbine shaft was removed from the forward clutch drum, proceed as follows.

1. Place the clutch drum on the bed of a press with the front face (flat side) uppermost.

2. Lightly lubricate the shorter splined end of the turbine shaft then, align the splines with the mating splines in the forward clutch housing. Using the press, carefully press the turbine shaft into the forward clutch drum until the shaft bottoms on the hub of the drum.

Caution The shaft should be started in the drum, then the pressure on the press arbor relaxed to allow the shaft to straighten itself. Repeat this step several times until it is evident that the shaft is squarely aligned with the drum. If the shaft is not started squarely, damage to the shaft or drum splines may occur.

3. Invert the forward clutch drum on the press so that the turbine shaft is downward.

4. Lubricate new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the piston with petroleum jelly then fit the

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seals with the seal lip facing away from the return spring pockets.

Note The forward and direct clutch pistons have identical inside and outside diameters, therefore, ensure that the correct piston is installed in the clutch assemblies.

5. Lubricate a new piston centre seal with clean transmission fluid. Lubricate the seal groove in the forward clutch housing with petroleum jelly then fit the seal with the lip uppermost.

6. Fit the forward and direct clutch inner seal protector RH 7968 (J-21362) over the forward clutch hub.

7. Fit the clutch piston inside the forward and direct clutch piston installing tool RH 7949 (J-21409) then fit the assembly into the forward clutch housing (*see Fig. T246*).

8. Fit the clutch piston by rotating it clockwise until it is seated in the drum.

9. Fit the sixteen clutch release springs into the spring pockets in the clutch piston.

10. Place the clutch drum on the bed of a press with the turbine shaft lowermost.

11. Position the spring retainer on the springs.

12. Using clutch spring compressor RH 7965 (J-4670) in conjunction with adapter RH 7966 (J-21664), compress the springs ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then release the tension on the springs. Remove the tools.

Caution Ensure that the clutch release springs are not leaning. If necessary, push the springs into an upright position using a small screwdriver.

13. Remove the forward clutch from the press then fit it to the holding fixture RH 7959 (J-6116) with the turbine shaft lowermost; take care not to damage the shaft.

14. Fit the thrust washer onto the outside of the forward clutch hub. Retain the washers in position with petroleum jelly. The bronze washer is fitted to the side of the hub which faces the forward clutch housing.

15. Fit the forward clutch hub to the forward clutch housing.

16. Lubricate with clean transmission fluid the four flat steel clutch plates, the five composition faced plates and the one waved (notched) steel clutch plate.

17. Fit the clutch plate in the forward clutch housing. Commence with the waved steel plate and fit alternate steel and composition plates, finishing with a composition plate.

18. Fit the direct clutch hub into the forward clutch drum; fit the snap ring.

19. Fit the forward clutch assembly onto the oil pump delivery sleeve then check clutch operation by

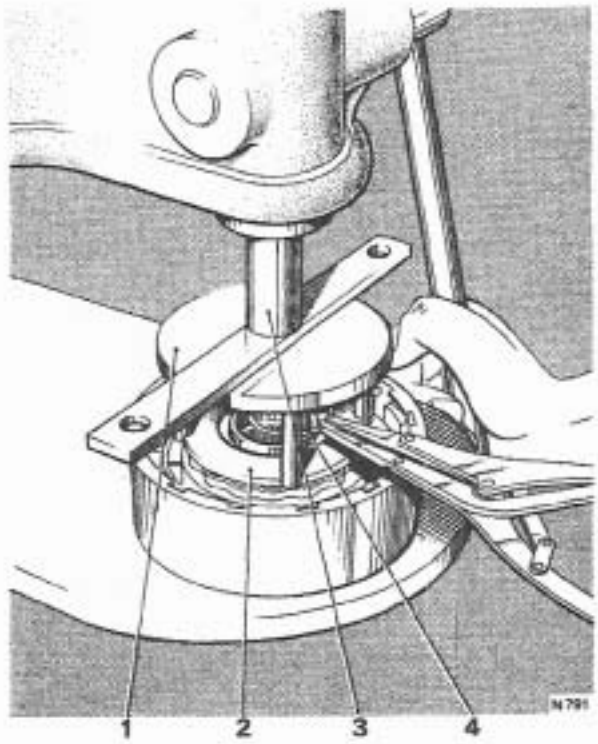

FIG. T244 REMOVING AND FITTING THE FORWARD CLUTCH HOUSING SNAP RING

1 Clutch spring compressor
2 Adapter
3 Press ram
4 Snap ring

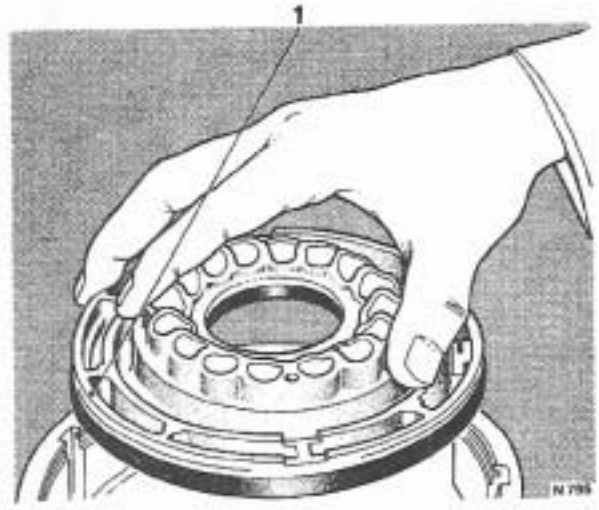

FIG. T245 REMOVING THE FORWARD CLUTCH PISTON

1 Clutch piston

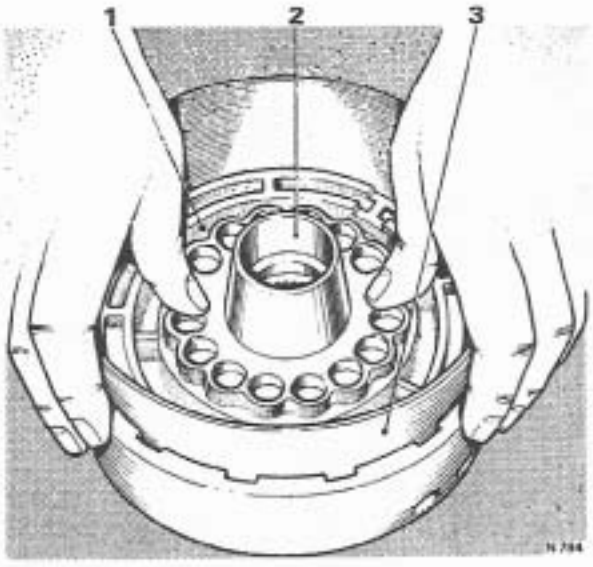

FIG. T246 FITTING THE FORWARD CLUTCH PISTON

1 Forward clutch piston
2 Seal protector
3 Piston fitting tool

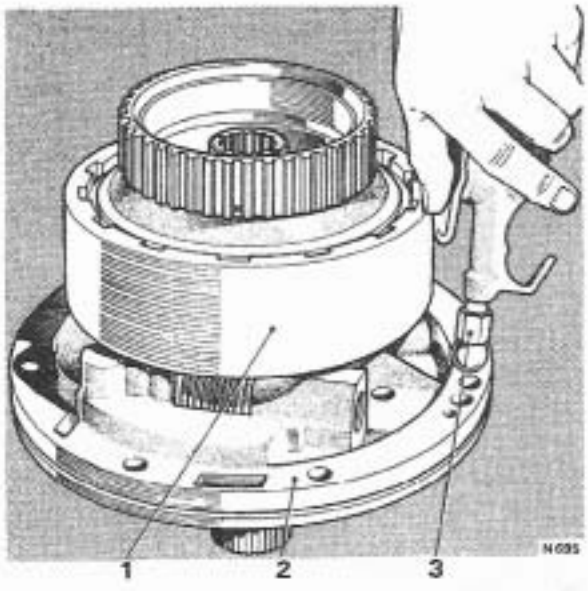

FIG. T247 AIR TESTING THE FORWARD CLUTCH

1 Forward clutch assembly
2 Oil pump
3 Air line nozzle

applying air pressure at approximately 70 lb/sq. in. (4,92 kg/sq.cm.) through the forward clutch apply passage in the pump (*see Fig. T247*). The clutch should be heard and felt to apply.

Direct clutch and intermediate roller assembly—To dismantle

1. Remove the snap ring which retains the roller retainer.
2. Remove the retainer (*see exploded view in Figure T248*).
3. Remove the roller outer race and bushes then withdraw the roller clutch assembly from the outer race.
4. Turn the unit over then remove the large snap ring which retains the direct clutch back plate in the clutch housing; remove the back plate.
5. Remove the five composition plates and the five steel plates (*see exploded view of direct clutch in Figure T249*).
6. Using clutch spring compressor RH 7965 (J-4670) in conjunction with rear clutch spring compressor RH 7967 (J-6129) and adapter RH 7966 (J-21664), compress the clutch return springs and remove the snap ring (*see Fig. T250*).
7. Remove the tools then lift off the spring retainer and remove the sixteen clutch release springs.
8. Withdraw the direct clutch piston from the clutch drum.
9. Remove and discard the piston inner and outer seals.
10. Remove and discard the piston centre seal from the direct clutch drum.

Direct clutch, sun gear shaft intermediate roller assembly—To inspect

1. Wash all parts, except the composition faced clutch plates, in clean paraffin (kerosene) then dry them with compressed air.
2. Examine the roller assembly for loose rollers.
3. Examine the roller bushes for wear or distortion.
4. Examine the inner and outer races for scratches or wear.
5. Examine the clutch drum for cracks, ensure that the oilways are clear and look for excessive wear on the clutch plate driving lugs.
6. Examine the driving and driven clutch plates for signs of burning, scoring or wear. If the composition plates are black in colour or have a glazed appearance they should be renewed. The steel driving plates should have a matt grey finish, but if they are discoloured or warped it is a sign of overheating and the plates must be renewed.
7. Examine the back plate for scratches or other damage.
8. Examine the sun gear shaft for cracks. Examine the splines for damage, examine the bushes for scoring

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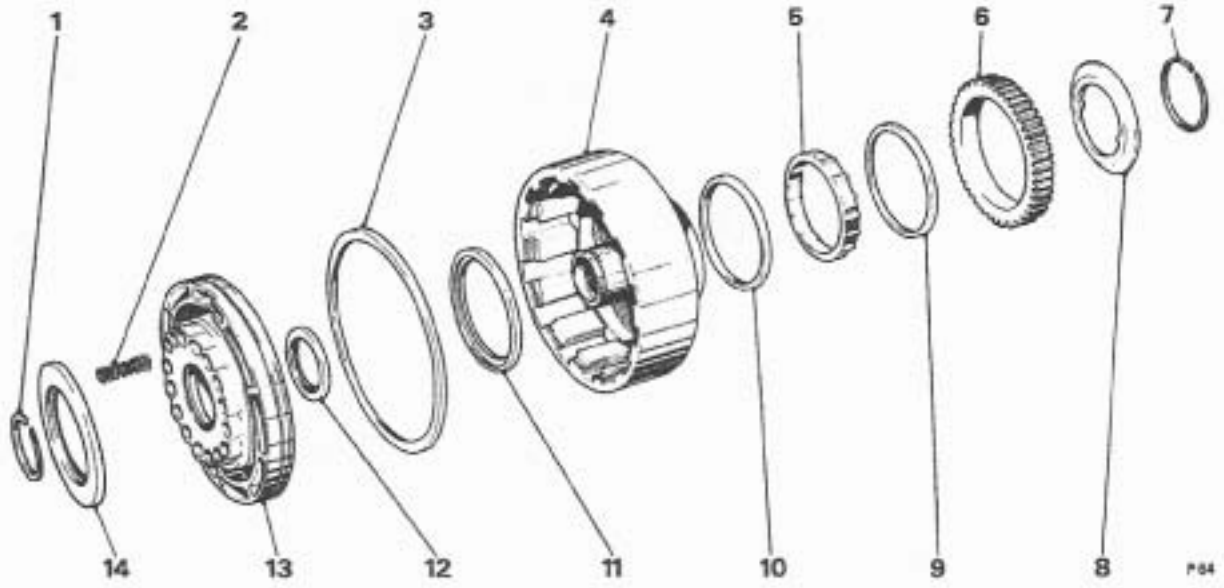

FIG. T248 DIRECT CLUTCH AND INTERMEDIATE SPRAG ASSEMBLY

1 Snap ring
2 Piston release spring (16)
3 Piston outer seal
4 Direct clutch drum and sprag inner race
5 Sprag assembly
6 Sprag outer race
7 Snap ring
8 Sprag retainer
9 Sprag bush
10 Sprag bush
11 Piston centre seal
12 Piston inner seal
13 Direct clutch piston
14 Clutch spring retainer

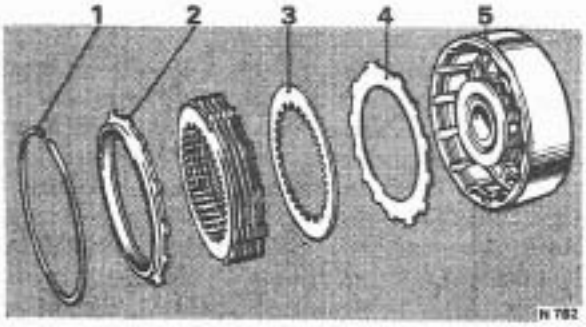

FIG. T249 DIRECT CLUTCH—EXPLODED

1 Snap ring
2 Back plate
3 Composition plate
4 Steel plate
5 Direct drum and piston assembly

and the ground bush journals for damage. Ensure that the oil feed hole is clear.

9. Examine the piston for cracks. Ensure that the check balls operate freely.

10. Examine the springs for collapsed coils or distortion. If one or more springs show these symptoms all sixteen springs must be renewed.

11. Examine the front friction band for wear at the anchor and apply lugs and for the presence of metallic particles in the band lining. Also examine the band lining for cracks, flaking, burning and for the lining becoming loose.

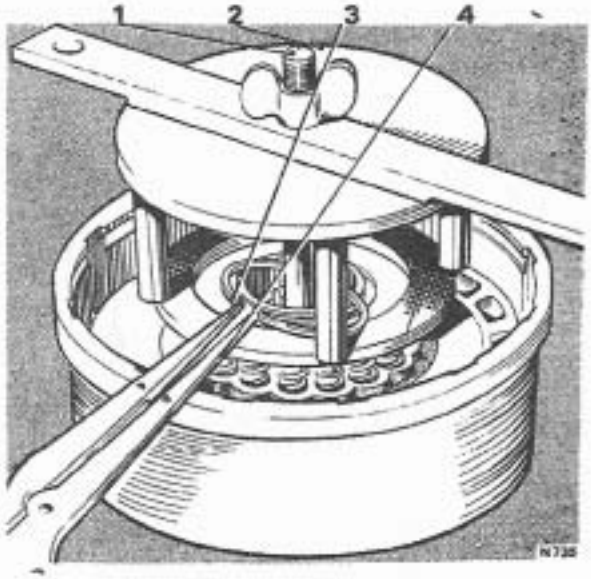

FIG. T250 REMOVING AND FITTING THE DIRECT CLUTCH HOUSING SNAP RING

1 Spring compressing tool
2 Clutch spring compressor (seated on adapter)
3 Snap ring
4 Snap ring pliers

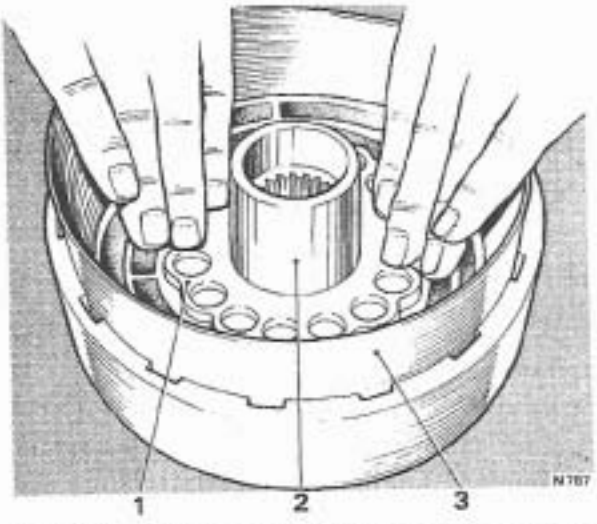

FIG. T251 FITTING THE DIRECT CLUTCH PISTON

1 Direct clutch piston
2 Inner seal protector
3 Outer seal protector

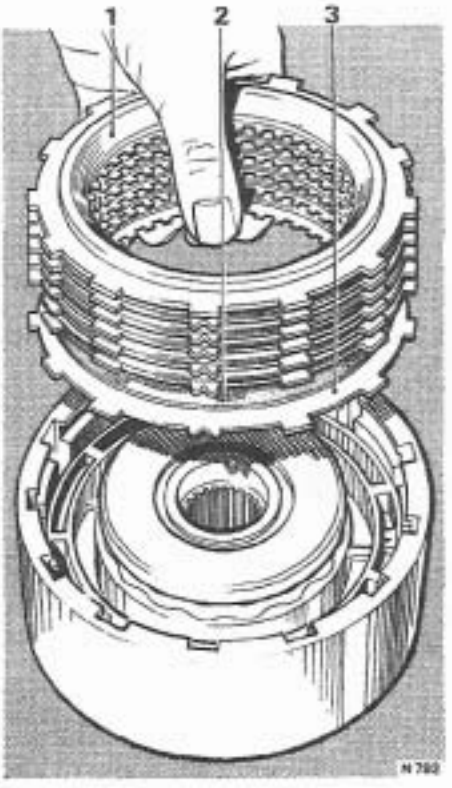

FIG. T252 FITTING THE DIRECT CLUTCH PLATES

1 Back plate
2 Composition plate (5)
3 Steel plate (5)

Direct clutch and intermediate roller assembly—To assemble

1. Lubricate new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the direct clutch piston then fit the seals with the lips facing away from the spring pockets.

Note Ensure that the piston is correct (i.e. direct clutch piston — check ball in piston).

2. Lubricate a new centre seal with clean transmission fluid. Lubricate the seal groove in the direct clutch housing then fit the seal with the lip uppermost.
3. Fit the forward and direct clutch inner seal protector RH 7968 (J-21362) over the direct clutch hub.
4. Fit the clutch piston inside the forward and direct clutch piston installing tool RH 7949 (J-21409). Fit the assembly into the direct clutch housing (*see Fig. T251*).
5. Fit the piston by turning it clockwise as it is pushed down.
6. Fit the sixteen clutch release springs into the spring pockets in the clutch piston.
7. Position the spring retainer over the springs.
8. Using clutch spring compressor RH 7965 (J-4670), rear clutch spring compressor RH 7967 (J-6129) and adapter RH 7966 (J-21664), compress the springs, ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then remove the tools.

Caution Ensure that the clutch release springs are not leaning. If necessary, push the springs into an upright position using a small screwdriver.

9. Lubricate the five flat and one waved steel plates and the composition plates with clean transmission fluid then fit the plates into the clutch drum. Commence with the waved steel plate and then alternate composition and steel plates.

Note Do not use radially grooved composition plates at this point of the assembly.

10. Fit the direct clutch backing plate over the clutch plates and fit the large snap ring.

Note Install rollers that may have come out of the roller cage by compressing the energising spring with the forefinger and inserting the roller from the outside.

11. Turn the clutch unit over and install the roller clutch assembly onto the intermediate clutch inner cam.
12. Fit the intermediate clutch outer race with a clockwise turning motion.

Note When fitted, the outer race should **not** turn anti-clockwise.

13. Fit the roller clutch retainer and snap ring.
14. Fit the direct clutch assembly onto the centre

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support then air test the direct clutch to ensure that it operates correctly (*see Fig. T253*). Use an air pressure of approximately 70 lb/sq. in. (4,92 kg/sq. cm.).

Note If air is applied to the reverse passage (right-hand oil feed hole) it will escape from the direct clutch passage (left-hand oil feed hole). This is considered normal. Also, apply air to the left-hand oil feed hole to actuate the piston and apply the direct clutch.

Turbine shaft, forward and direct clutches, sun gear shaft and front band—To fit

1. Fit the front band so that the band anchor hole fits over the band anchor pin and the band apply lug faces the servo hole (*see Fig. T254*).
2. Fit the sun gear shaft with the longer splined end innermost.
3. Fit the direct clutch housing and intermediate sprag roller assembly onto the centre support as follows.
4. Ensure that the ends of the oil sealing rings on the centre support are interlocked, and that the rings are lubricated.
5. Carefully slide the direct clutch drum onto the centre support sleeve, at the same time, engage the drum internal splines with the splines on the sun gear shaft.
6. Ensure that the clutch drum hub 'bottoms' on the sun gear shaft and that the splines on the forward end of the sun gear shaft are flush with the splines in the direct clutch drum.

Note It will be necessary to rotate the clutch drum to allow the sprag roller outer race to line up with the intermediate clutch plates. If necessary, remove the direct clutch driving and driven plates to facilitate the handling of the drum.

7. Fit the bronze thrust washer onto the forward clutch hub; retain the washer in position with petroleum jelly.
8. Position the transmission horizontally in the transmission holding fixture then fit the forward clutch assembly and the turbine shaft.
9. Ensure that the end of the mainshaft fully enters into the forward clutch hub.
10. It will be necessary to rotate the clutch drum to allow the direct clutch driving hub to line up with the clutch plates in the direct clutch.
11. When the forward clutch is correctly seated it should be approximately 1·25 in. (3,175 cm.) from the oil pump face in the transmission casing.

Note The missing internal splines in the forward clutch hub are lubrication passages and do not have to be aligned with any particular splines on the mainshaft.

12. Fit the oil pump.

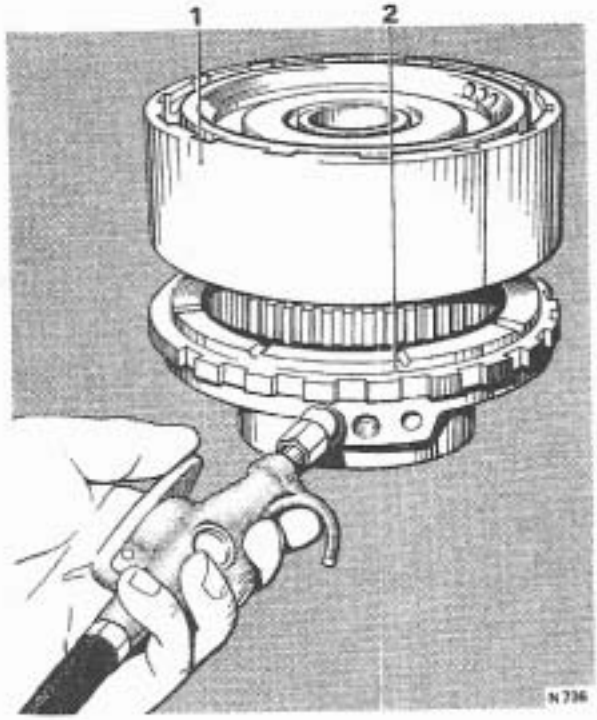

FIG. T253 AIR TESTING THE DIRECT CLUTCH

1 Direct clutch assembly
2 Centre support assembly

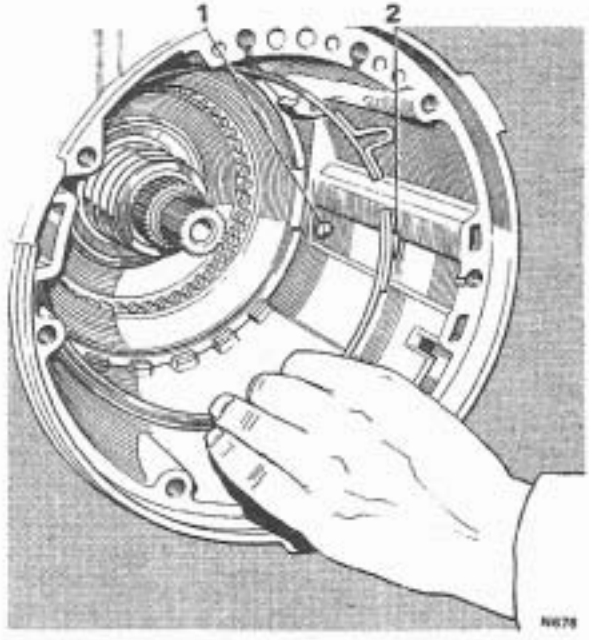

FIG. T254 FITTING THE FRONT BAND

1 Anchor pin
2 Front band

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Section T22
INTERMEDIATE CLUTCH, GEAR UNIT, CENTRE SUPPORT and REACTION CARRIER

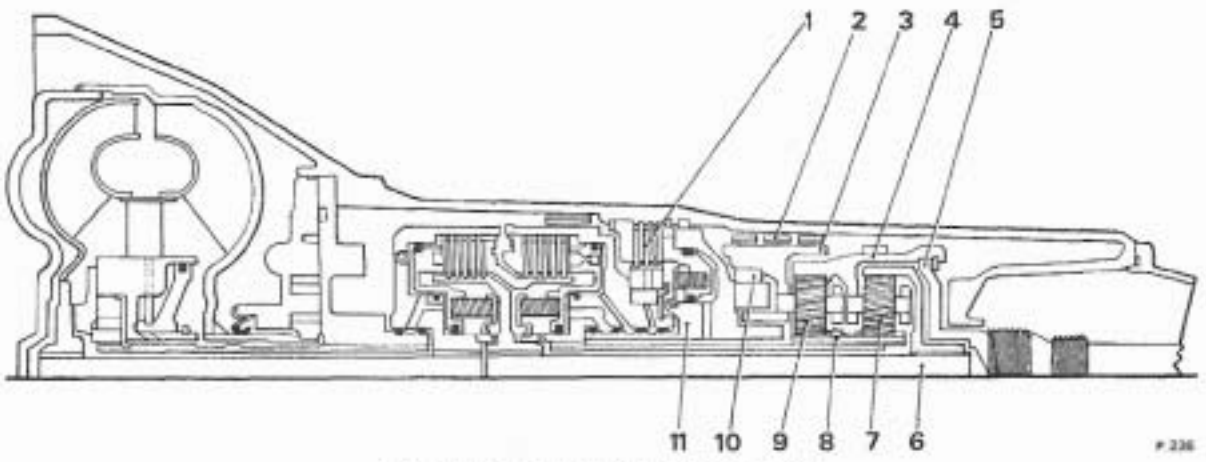

FIG. T255 SECTIONED VIEW OF THE TRANSMISSION SHOWING THE INTERMEDIATE CLUTCH AND GEAR UNIT

1 Intermediate clutch
2 Rear band
3 Reaction carrier
4 Output carrier
5 Output shaft driving flange
6 Mainshaft
7 Rear planet pinion
8 Sun gear
9 Front planet pinion
10 Rear sprag
11 Centre support

The intermediate clutch comprises three steel plates, three composition plates and an apply piston. The steel plates are slotted directly into the transmission casing whilst the composition plates engage in splines machined in the intermediate roller outer race.

The compound planetary gear unit consists of an internal gear, which is splined onto the mainshaft, an output planet carrier and pinions, an output shaft which is mechanically connected to the output carrier, and a sun gear which is splined onto the mainshaft (*see Fig. T255*).

The centre support is keyed and bolted to the transmission casing and forms part of the reaction carrier roller assembly. The oil delivery sleeve, which supplies oil pressure to the direct clutch and the intermediate roller is an integral part of the centre support. The support also houses the piston which applies the intermediate clutch.

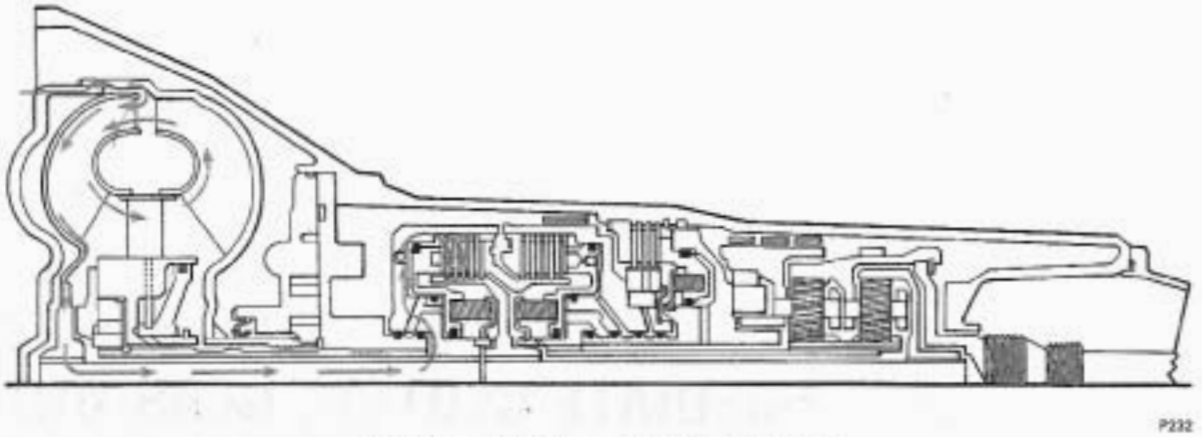

FIG. T256 NEUTRAL—ENGINE RUNNING

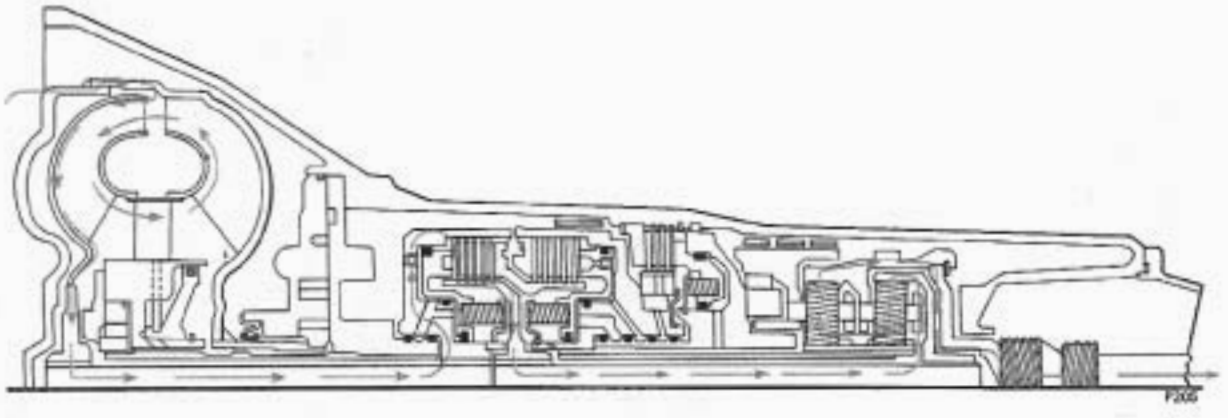

FIG. T257 DRIVE RANGE—1ST GEAR

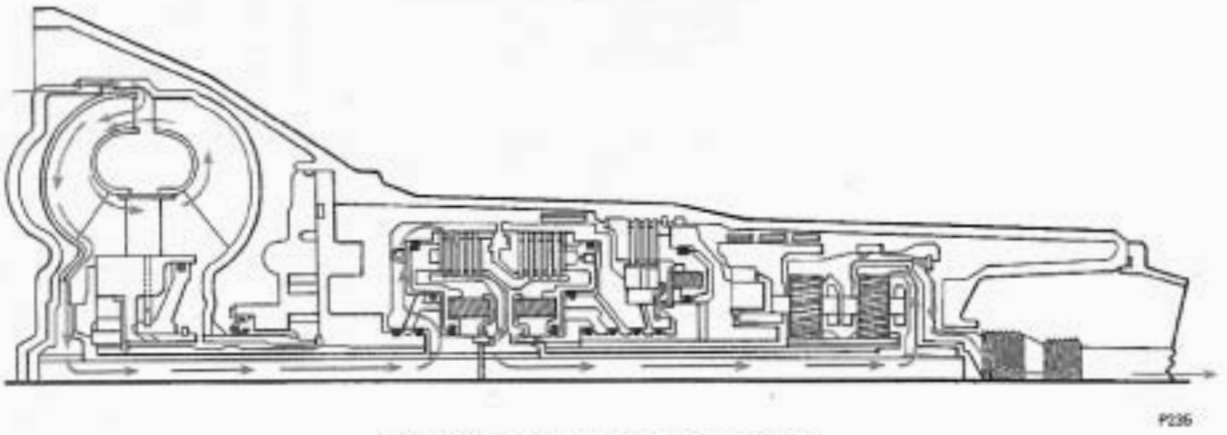

FIG. T258 DRIVE RANGE—2ND GEAR

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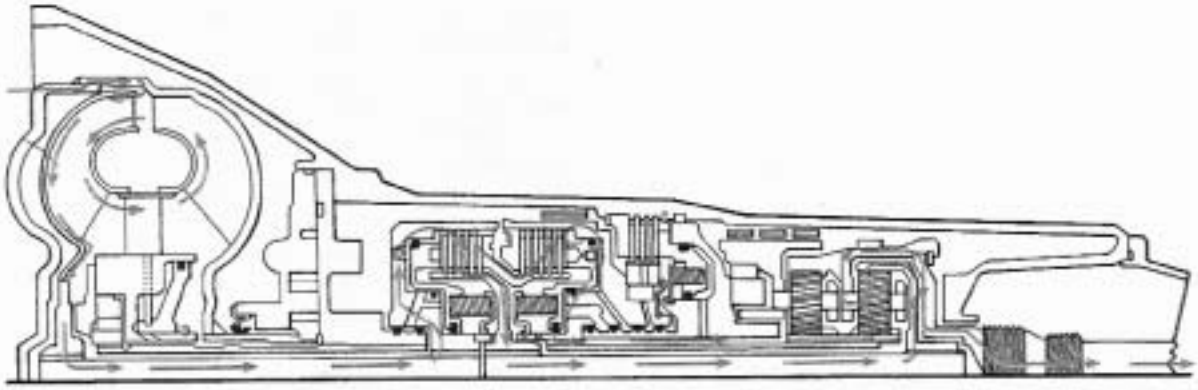

P234

FIG. T259 DRIVE RANGE—3RD GEAR

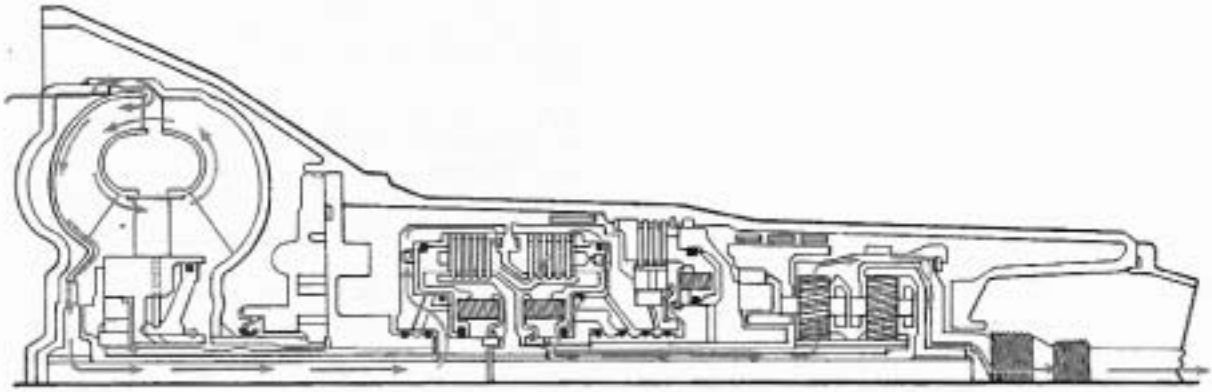

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FIG. T260 REVERSE

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The reaction carrier comprises a drum, a set of planet pinions and the outer race of the Low roller. The roller outer race is pressed into, and dowelled to, the reaction drum.

When the mainshaft rotates, the internal gear to which it is splined is driven clockwise. This causes the rear planet pinions to idle clockwise and drive the sun gear anti-clockwise.

The front and rear sun gears are integral so they turn as one. As a result, the front planet pinions also idle clockwise and drive the front internal gear clockwise.

The front internal gear is an integral part of the output carrier and is thus connected to the output shaft. This reacts with a force on the front pinions which are trying to drive the front internal gear clockwise. This reaction tends to rotate the front carrier assembly anti-clockwise instead of allowing the force to turn the internal gear and output shaft against the weight of the car.

To make the gear set effective in driving the car, a roller assembly is used to hold the carrier against anti-clockwise rotation. This roller assembly is in effect a one-way clutch which allows a rotating part to turn one way but not the other.

The roller assembly is fitted in such a manner that its elements will lock and prevent the reaction carrier from rotating anti-clockwise. This provides the required reaction and causes the front planet pinions to drive the front internal gear and output shaft in reduction at a ratio of approximately 2·5 : 1. This gear ratio, coupled with a maximum torque converter reduction of approximately 2 : 1 gives an overall ratio of almost 5 : 1 in first gear.

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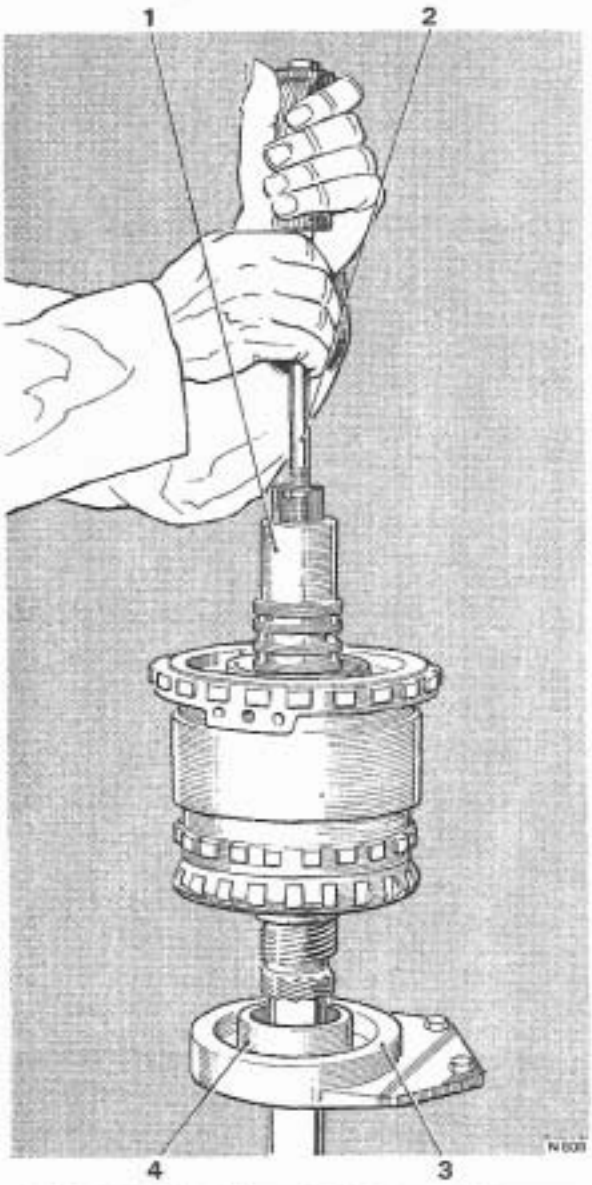

FIG. T261 FITTING THE GEAR UNIT INTO THE HOLDING FIXTURE

1 Gear assembly removal and fitting adapter
2 Slide hammer
3 Adapter
4 Holding fixture

As the speed of the car increases, less torque multiplication is required so that the coupling will become more efficient, and it is desirable also to move to a lower ratio. This is accomplished with the aid of the intermediate roller and clutch.

When the intermediate clutch is applied, the drive plates become locked to the reaction plates, and by doing so they lock the intermediate roller outer race to the transmission case.

This, in effect, holds the direct clutch drum, sun gear shaft and sun gear against anti-clockwise rotation. When the sun gear is stationary, the power flow is as follows.

Converter output is transmitted clockwise through the forward clutch to the mainshaft and rear internal gear. As the rear internal gear turns clockwise, the rear pinions rotate clockwise on their pins and 'walk around' the stationary sun gear. This moves the output carrier and output shaft clockwise in reduction at a ratio of approximately 1·5 : 1 (second gear).

The front gear unit is not required for second gear operation. However, because the output carrier is integral with the front internal gear, the front internal gear runs clockwise in reduction. This causes the front planet pinions to run clockwise around the stationary sun gear, turning the reaction carrier clockwise. This clockwise rotation of the reaction carrier causes the rear roller assembly to over-run or to become ineffective.

As the speed of the car increases further, a lower ratio is again required. The transmission is moved to third or direct gear. This is achieved by applying the direct clutch as well as the forward clutch so that both the rear internal gear and the sun gear rotate at the same speed.

In order to obtain Reverse, a rear friction band is used. This band locks the reaction carrier against clockwise rotation which would cause the Low or rear roller to over-run. Power flow through the transmission in Reverse is as follows.

Turbine torque from the converter is transmitted to the forward clutch drum; the forward clutch is released, thus disconnecting the flow of power to the mainshaft and rear internal gear. Instead of power flowing through the forward clutch, it flows from the turbine shaft, through the forward clutch drum, through the direct clutch hub to the direct clutch which is applied. This applies power to the sun gear shaft and sun gear, turning them clockwise. With the sun gear driving clockwise, the front pinions revolve anti-clockwise as idlers. This drives the front internal gear and output shaft anti-clockwise or in a reverse direction. The overall ratio in Reverse with maximum converter ratio and gear reduction is approximately 4 : 1.

In Intermediate range (second gear) with the accelerator pedal released, the car will slow down, using the engine as a brake. In this situation, however, the rear wheels will drive the transmission through the output shaft and, as a result, the intermediate roller would attempt to over-run. To prevent this happening the front band is applied to the direct clutch drum, holding

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it stationary, thus keeping the transmission in second gear to provide effective engine braking.

For even greater engine braking, the transmission can be placed into Low range. At speeds below approximately 40 m.p.h. (64 k.p.h.) the transmission will move to first gear. When the car is in first gear and the throttle is closed, the Low roller tends to over-run. When the Low/Reverse band is applied, the reaction carrier is prevented from over-running the roller and the transmission is retained in first gear.

The following illustrations and text give a summary of the flow of power through the transmission in various gears.

Summary of power flow

Neutral—Engine running

Forward clutch released, direct clutch released, intermediate clutch released, roller clutch ineffective, front band released, intermediate roller clutch ineffective, rear band released.

In Neutral, all clutches and bands are released; therefore no power is transmitted from the torque converter turbine to the planetary gear train or output shaft (*see Fig. T256*).

Drive range—First gear

Forward clutch applied, direct clutch released, intermediate clutch released, roller clutch effective, front band released, intermediate roller clutch ineffective, rear band released.

With the selector in Drive range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear clockwise. Clockwise motion of the rear internal gear causes the pinions to turn clockwise, driving the sun gear anti-clockwise. In turn, the sun gear drives the front pinions clockwise, driving the front internal gear, output carrier and output shaft clockwise at a reduction of approximately 2·5 : 1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and roller clutch assembly to the transmission case (*see Fig. T257*). (The approximate stall ratio equals 5 : 1).

Drive range—Second gear

Forward clutch applied, direct clutch released, intermediate clutch applied, roller clutch ineffective, front band released, intermediate roller clutch effective, rear band released.

In second gear, the intermediate clutch is applied to allow the intermediate roller clutch to hold the sun gear against anti-clockwise rotation. Turbine torque, through the forward clutch, is applied clockwise through the mainshaft, to the rear internal gear. Clockwise rotation of the rear internal gear turns the pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise at approximately 1·5 : 1 ratio (*see Fig. T258*).

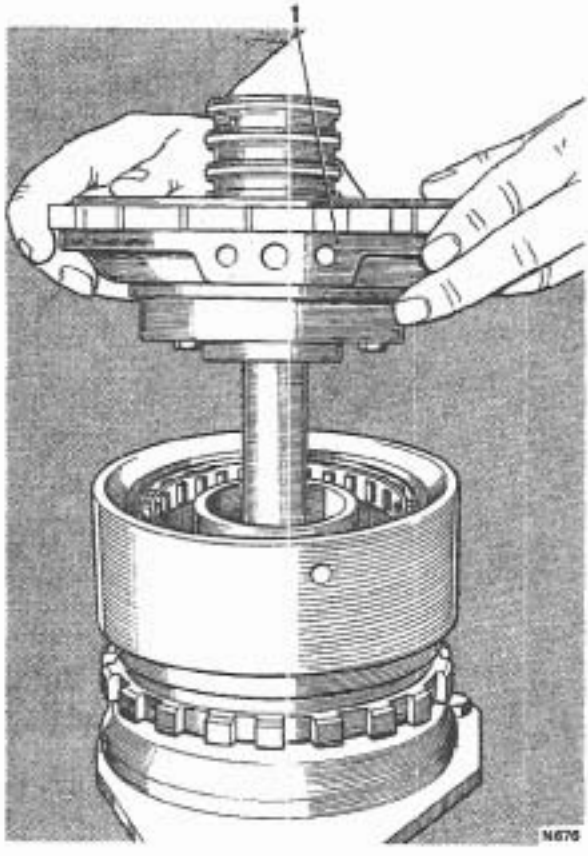

FIG. T262 REMOVING THE CENTRE SUPPORT ASSEMBLY

1 Centre support

Drive range—Third gear

Forward clutch applied, direct clutch applied, intermediate clutch applied, roller clutch ineffective, front band released, intermediate roller ineffective, rear band released.

In direct drive, engine torque is transmitted to the converter, then through the forward clutch to the mainshaft and the rear internal gear (*see Fig. T259*). Because the direct clutch is applied, equal power is transmitted also to the sun gear shaft and the sun gear. Since both the sun gear and the internal gears are now turning at the same speed, the planetary gear set is essentially locked and turns as one unit in direct drive (ratio 1 : 1).

Reverse

Forward clutch released, direct clutch applied, intermediate clutch released, roller clutch ineffective, front band released, intermediate roller clutch ineffective, rear band applied.

In Reverse, the direct clutch is applied to transmit turbine torque from the forward clutch drum to the sun gear shaft and sun gear (*see Fig. T260*). The rear band is applied; this prevents the reaction carrier from

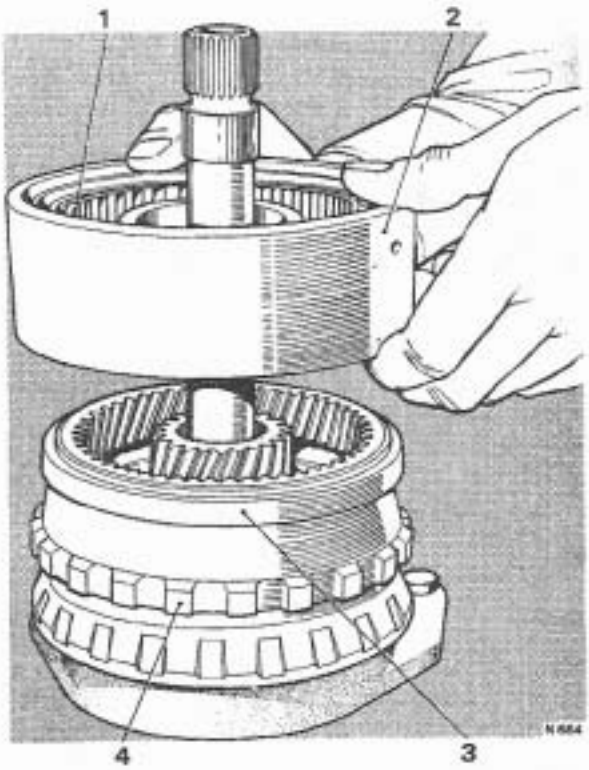

FIG. T263 REMOVING THE REACTION CARRIER AND REAR SPRAG ASSEMBLY

1 Sprag assembly
2 Reaction carrier
3 Gear ring
4 Output carrier

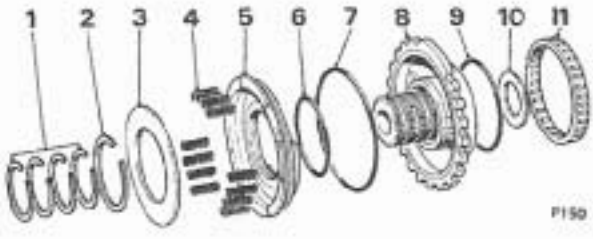

FIG. T264 CENTRE SUPPORT—EXPLODED

1 Teflon oil seal rings
2 Snap ring
3 Intermediate clutch spring retainer
4 Intermediate clutch release springs
5 Intermediate clutch piston
6 Intermediate clutch inner seal
7 Intermediate clutch outer seal
8 Centre support assembly
9 Support to case spacer
10 Thrust washer
11 Roller assembly

turning clockwise. Clockwise torque to the sun gear causes the front pinions and front internal gear to turn anti-clockwise in reduction. The front internal gear is directly connected to the output shaft, thus providing the reverse output gear ratio of approximately 2 : 1. The reverse torque multiplication at stall (converter and gear ratios) is approximately 4 : 1.

Intermediate clutch, gear unit, centre support and reaction carrier—To remove

Before the intermediate clutch, gear unit and their associated parts can be removed, the transmission must be removed from the car.

Remove the following units.

1. Sump, strainer and intake pipe assembly.
2. Control valve unit.
3. Rear servo.
4. Control valve spacer, check balls and front servo.
5. Oil pump.
6. Turbine shaft, forward clutch, direct clutch, sun gear shaft and front band.
7. Remove the centre support bolt from the transmission case. This is the socket-headed cap screw located in the lower face of the transmission case at the rear of the control valve unit oil passages.
8. Remove the snap ring which secures the intermediate clutch back plate.
9. Remove the back plate then withdraw the three composition plates and the three steel plates.
10. Using a pair of long-nose pliers remove the snap ring which retains the centre support in the case.
11. Fit tool RH 7962 (J-21795) onto the end of the mainshaft so that the tangs engage in the groove in the shaft.
12. Tighten the screw on the tool to secure the tool on the shaft and to prevent movement of the rearmost sprag during the removal of the gear unit.
13. Obtain a length of tube of suitable diameter which will fit over the output shaft and can be used as a handle. This will prevent damage to the case bush when removing the gear unit, centre support and reaction carrier.

Note Slightly slacken the transmission holding fixture pivot pin so that the gear unit assembly does not bind when it is being removed from the case.

14. With the transmission case in a horizontal position, move the complete assembly toward the front of the case to facilitate the subsequent removal.
15. Carefully withdraw the complete assembly from the case.

Caution Do not drop or bump the assembly in the transmission casing during the removal operation. This could result in damage to the output shaft bush in the case as well as to the assembly itself.

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16. Remove the output shaft thrust washer from either the output shaft or the case.
17. Using adapter RH 7960 (J–21364) in the rear unit holding fixture RH 7959 (J–6116), fit the gear unit assembly into the holding fixture with the mainshaft pointing upward (*see Fig. T261*); remove the tool RH 7962 (J–21795).
18. Remove the rear unit selective washer from the transmission case.
19. Remove the support to case spacer.
20. Remove the rear band assembly. To facilitate removal, rotate the band lugs away from the pins and pull the band assembly out of transmission case.
21. Remove the centre support assembly from the reaction carrier (*see Fig. T262*).
22. Withdraw the centre support to reaction carrier thrust washer.

Note The thrust washer and the race may have adhered to the back of the centre support. If so, remove them from the centre support.

23. Remove the reaction carrier and roller clutch assembly from the output carrier (*see Fig. T263*); remove the roller clutch assembly from the reaction carrier.

Centre support and intermediate clutch piston—To dismantle

1. Remove the four oil seal rings from the centre support (*see the exploded view in Fig. T264*); discard the rings.

Note From **Transmission Serial Number 70-RR-2106** and onwards, a 'Teflon' oil sealing ring is fitted into the ring groove at the base of the centre support tower. On these later centre supports remove only the three cast iron oil sealing rings.

2. Using clutch spring compressor RH 7965 (J–4670) and rear clutch spring compressor RH 7967 (J–6129), compress the springs then remove the snap ring (*see Fig. T265*).
3. Remove the tools then remove the spring retainer and the clutch release springs.
4. Remove the intermediate clutch piston from the centre support.
5. Remove and discard the inner and outer seals from the clutch piston.

Note **Do not** remove the three setscrews which secure the roller clutch inner race to the centre support.

Centre support and intermediate clutch piston—To inspect

1. Wash all parts in clean paraffin (kerosene) then dry with compressed air.
2. Examine the roller clutch inner race for scratches and indentations. Ensure that the lubrication hole is clear.

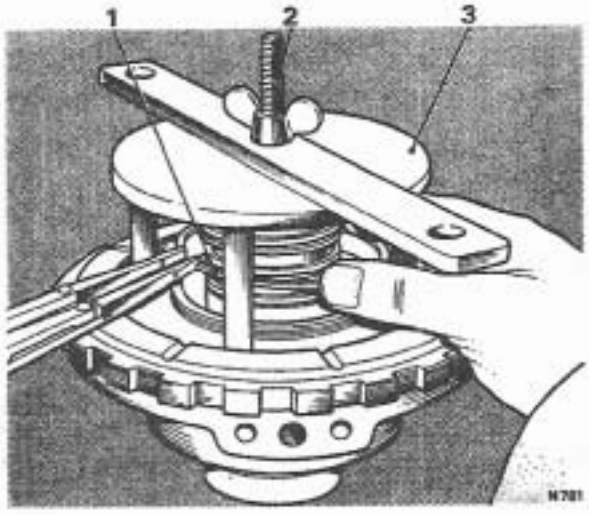

FIG. T265 REMOVING AND FITTING THE INTERMEDIATE CLUTCH PISTON SNAP RING

1 Snap ring
2 Rear clutch spring compressor
3 Clutch spring compressor

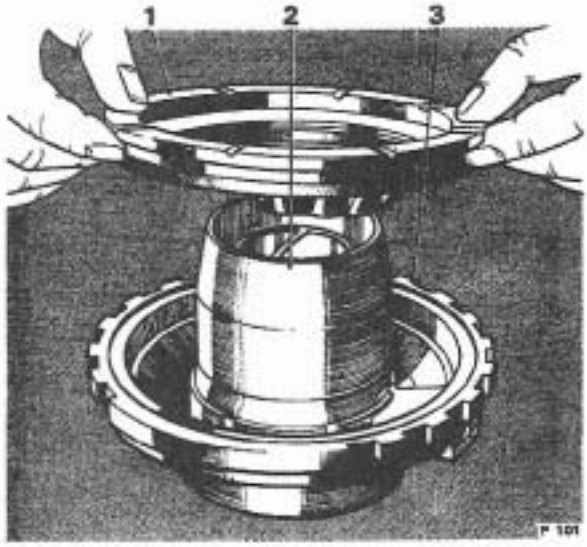

FIG. T266 FITTING THE INTERMEDIATE CLUTCH PISTON

1 Intermediate clutch piston
2 Guide sleeve
3 Centre support

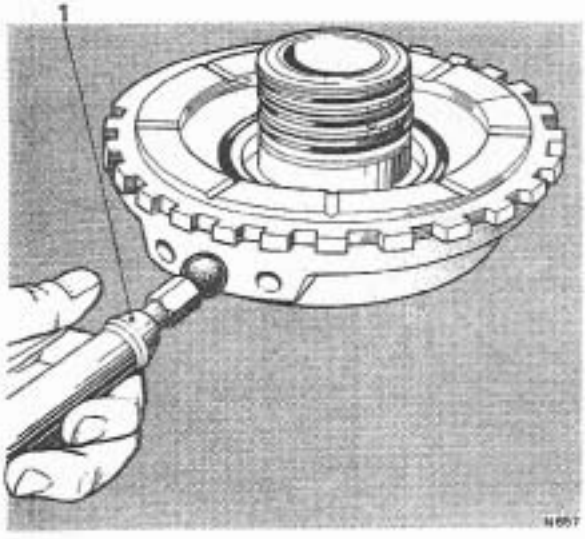

FIG. T267 AIR TESTING THE INTERMEDIATE CLUTCH

1 Air line nozzle

3. Examine the bush for scoring or wear.
4. Ensure that the oil ring grooves are clean and are not damaged.
5. Air test the lubrication passages to ensure that they are clear and are not interconnected.
6. Examine the piston bore in the centre support for scratches or damage.
7. Examine the piston seal grooves for damage and ensure that they are clean.
8. Examine the piston for cracks or porosity.
9. Examine the springs for collapsed coils or signs of distortion. Check the spring length against that of a new spring before deciding whether to renew the complete set of springs.

Centre support and intermediate clutch piston—To assemble

1. Lubricate a new inner and a new outer seal with clean transmission fluid. Lubricate the seal grooves in the intermediate clutch piston and fit the seals with the lips facing away from the spring pockets.
2. Fit the intermediate clutch inner seal protector RH 7969 (J-21363) over the centre support hub.
3. Fit the intermediate clutch piston as shown in Figure T266. Ensure that it seats fully in the centre support.
4. Fit the three clutch release springs into the pockets in the clutch piston.
5. Position the spring retainer centrally over the springs.
6. Using clutch spring compressor RH 7965 (J-4670) in conjunction with rear clutch spring compressor RH 7967 (J-6129) compress the spring retainer, ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then remove the tools.

Transmissions prior to Serial Number 70-RR 2106

7. Fit four new oil sealing rings onto the centre support; interlock the ends of the rings.

Note **Transmission Serial Number 70-RR-2106** and onwards, fit three new oil sealing rings onto the centre support and interlock the end of the rings. If the 'Teflon' oil sealing ring requires replacement, fit a fourth cast iron oil sealing ring.

8. Air test the operation of the intermediate clutch piston. Apply an air pressure of approximately 70 lb/sq.in. (4,92 kg/sq.cm.) through the centre oil feed hole to actuate the clutch piston (*see Fig. T267*); the piston should be heard and felt to move.

Gear unit—To dismantle

1. Using adapter RH 7960 (J-21364) in rear unit holding fixture RH 7959 (J-6116), fit the gear unit into the holding fixture with the output shaft pointing downward. An exploded view of the gear unit is shown in Figure T268.
2. Remove the centre support-to-sun gear races and thrust bearing. The outer race may have been removed with the centre support.
3. Remove the sun gear from the output carrier assembly.

Remove the reaction carrier to output carrier thrust washer and front internal gear ring.

4. Invert the gear unit in the holding fixture so that the mainshaft is pointing downward.
5. Remove the snap ring which retains the output shaft in the output carrier; remove the output shaft.
6. Remove the thrust bearing and races from the rear internal gear.
7. Withdraw the rear internal gear and mainshaft from the output carrier; remove the thrust bearing and races from the inner face of the rear internal gear.
8. Remove the circlip from the end of the mainshaft then remove the rear internal gear.
9. Remove the output carrier from the holding fixture.

Output shaft—To inspect

1. Wash the output shaft in clean paraffin (kerosene) then dry off with compressed air.

Examine the bushing for wear.

2. Examine the bearing and thrust washer faces for damage.
3. Examine the governor drive gear for rough or damaged teeth.
4. Examine the splines for damage.
5. Check the orificed cup plug in the lubrication passage. Ensure that the orifice is clear (*see Fig. T269*).

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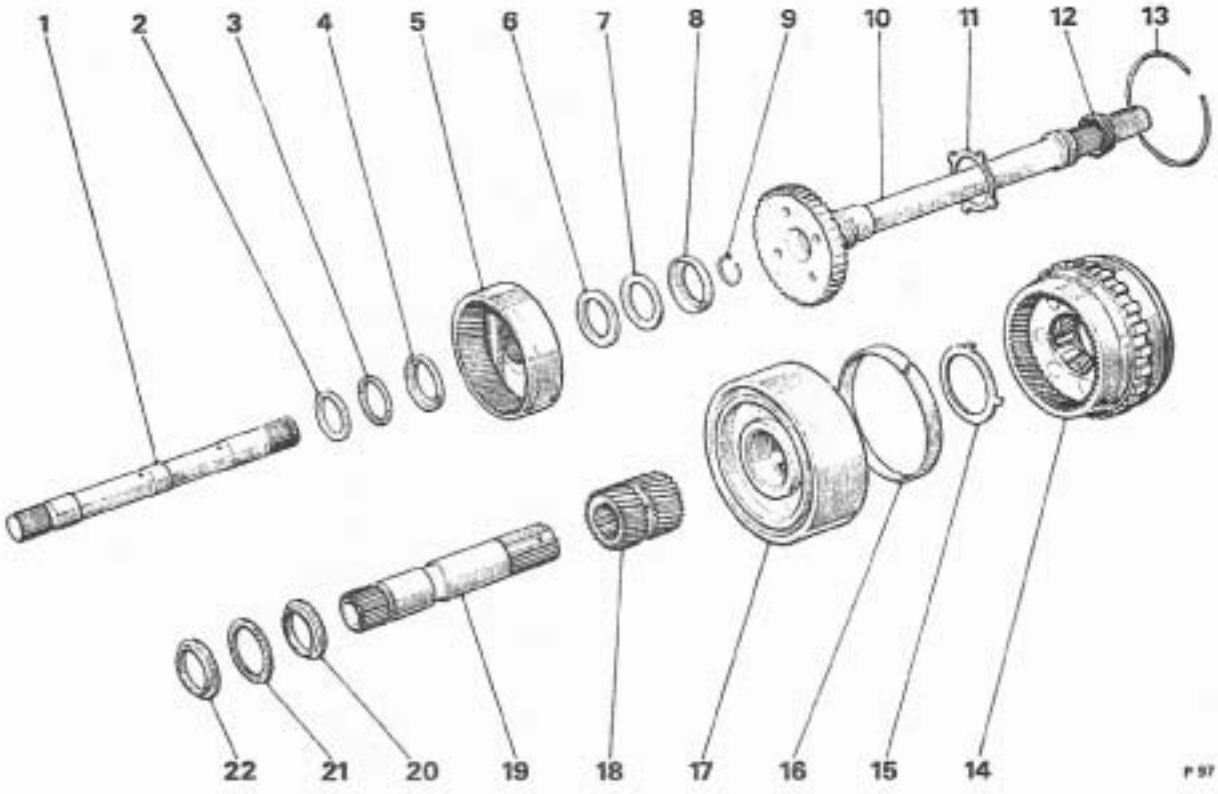

FIG. T268 GEAR UNIT—EXPLODED

1 Mainshaft
2 I/D flanged race
3 Thrust bearing
4 O/D flanged race
5 Rear internal gear
6 I/D flanged race
7 Thrust bearing
8 O/D flanged race
9 Snap ring
10 Output shaft
11 Flanged thrust washer
12 Speedometer drive gear
13 Snap ring
14 Output carrier assembly
15 Thrust washer
16 Front internal gearing
17 Reaction carrier assembly
18 Sun gear
19 Sun gear shaft
20 I/D flanged race
21 Thrust bearing
22 I/D flanged race

6. Examine the driving teeth for damage.

7. Examine the speedometer drive gear for rough or damaged teeth. If a gear is badly worn or damaged it can be renewed as follows.

Speedometer drive gear—To remove

Note A nylon speedometer drive gear is installed **only** at the factory. All replacement drive gears are manufactured from steel.

1. If a **nylon gear** is fitted to the shaft, depress the retaining clip and slide the gear off the output shaft (*see Fig. T270*).

2. If a **steel gear** is fitted to the shaft, install the

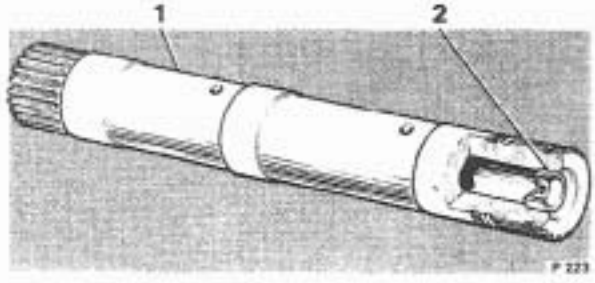

FIG. T269 MAINSHAFT AND PLUG ASSEMBLY

1 Mainshaft
2 Orifice cup plug

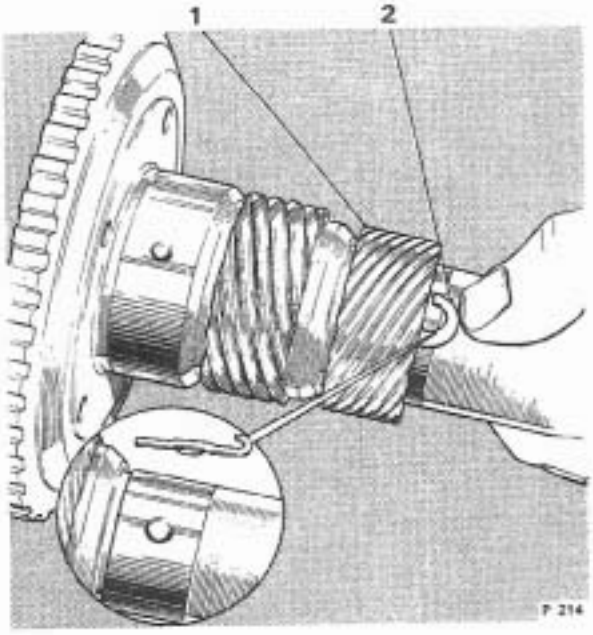

FIG. T270 REMOVING NYLON SPEEDOMETER DRIVE GEAR

1 Nylon gear
2 Retaining clip

speedometer drive gear remover J–21427 with pulley puller RH 7791 (J–8433) and attach using bolts J–21797 onto the output shaft, so that the puller bolt indexes with the end of the shaft.

3. The flat face of the remover tool should be under the front face of the drive gear (*see Fig. T271*).

4. Tighten the bolt on the puller until the gear is free on the shaft.

5. Remove the tools and the gear from the shaft.

Speedometer drive gear—To fit

1. To fit a **nylon gear,** (*see note under Speedometer drive gear — To remove*) align the slot in the speedometer drive gear with the retaining clip and install the drive gear (*see Fig. T272*).

2. To fit a steel gear, lightly lubricate the bore of the gear then fit it over the output shaft.

3. Support the output shaft and drive the new steel gear into position on the shaft using a suitable length of tube and a mallet.

Caution Use a tube which fits closely over the output shaft. The ends of the tube must be square with the bore. Ensure that the end of the tube which contacts the gear is smooth and free from burrs.

4. Any contact with the gear teeth as the gear is driven into position will result in damage to the gear.

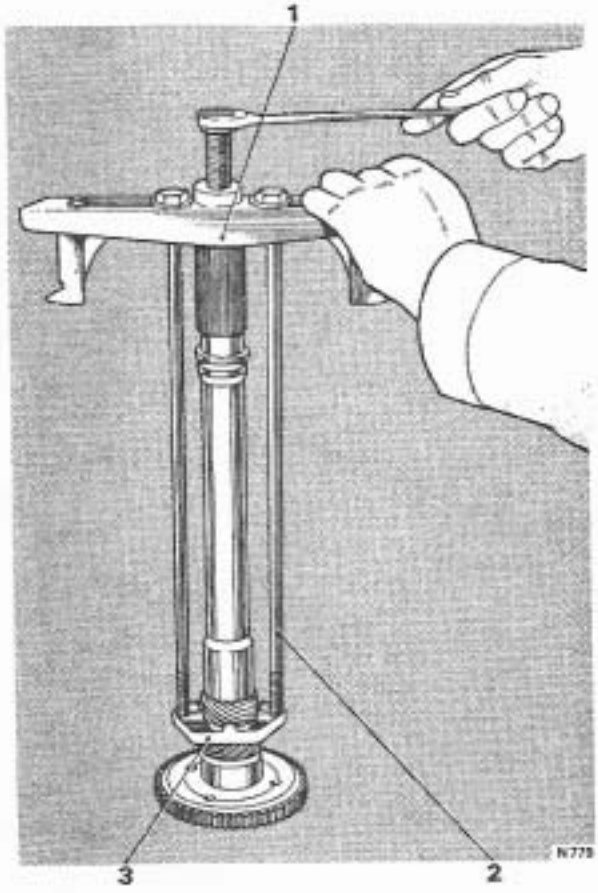

FIG. T271 REMOVING A STEEL SPEEDOMETER DRIVE GEAR

1 Pulley remover
2 Removal bolts
3 Drive gear extractor

5. Drive the gear down the shaft until the distance from the rear face of the gear to the end of the output shaft measures 15·00 in. (38,1 cm.) (*see Fig. T273*).

Mainshaft—To inspect

1. Wash the mainshaft in clean paraffin (kerosene) then dry with compressed air.

2. Examine the shaft for cracks or distortion.

3. Examine the splines for damage.

4. Examine the ground journals for scratches or damage.

5. Examine the snap ring groove for damage.

6. Examine for an orificed cup plug in the end of the mainshaft.

7. If a cup plug is fitted to the mainshaft, remove with a 0·25 in. (6,35 mm.) diameter rod 12·00 in. (30,48 cm.) long.

8. The deletion of the cup plug improves the flow of lubricant.

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Rear internal gear and sun gear—To inspect

1. Wash the rear internal gear and the sun gear in clean paraffin (kerosene) then dry with compressed air.
2. Examine all the gear teeth for wear or damage.
3. Examine the splines for damage.
4. Examine the gears for cracks.

Output carrier assembly—To inspect

1. Wash the output carrier assembly in clean paraffin (kerosene) then dry with compressed air.
2. Examine the front internal gear for damaged teeth.
3. Examine the pinion gears for damage, rough bearings or excessive side movement.
4. Check the end float of the pinions with the aid of a feeler gauge (*see Fig. T273*). The end float should be between 0·009 in. and 0·024 in. (0,228 mm. and 0,610 mm.).
5. Examine the parking gear lugs for cracks or damage.
6. Examine for damage the splines which drive the output shaft.
7. Examine the front internal gear ring for flaking or cracks.

Reaction carrier assembly—To inspect

1. Examine the surface on which the rear band applies, for signs of burning or scoring.
2. Examine the sprag outer race or roller clutch outer cam, for scoring or wear.

Note The normal wear pattern on an inner or outer race may tend to make the races look worse than they are. Do not discard the races unless the track is pitted, scored or uneven.

3. Examine the thrust washer surfaces for signs of scoring or wear.
4. Examine the bush for damage. If the bush is damaged, the carrier must be renewed.
5. Examine the pinion gears for damage, rough bearings, or excessive side movement.
6. Check the pinion end float. This should be between 0·009 in. and 0·024 in. (0,228 mm. and 0,610 mm.).

Pinion gears—To renew (reaction and output carrier assemblies)

Should the pinion gears need renewing, proceed as follows.

Note If it is necessary to replace the pinion gear pinion washer, pinion pin or needle bearing roller always consult the appropriate service literature to ascertain that the correct parts are to be fitted.

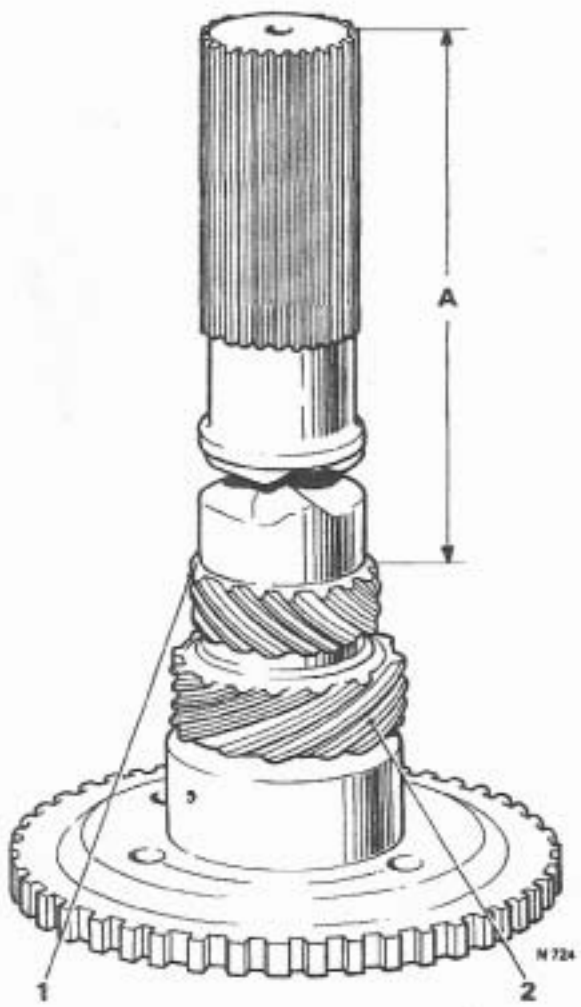

FIG. T272 SPEEDOMETER DRIVING GEAR—FITTED

1 Speedometer driving gear
2 Governor driving gear
A 15.00 in. (38,1 cm.)

A change in the outside diameter of the pinion pin has taken place, this also effects the parts listed above. When measuring the diameter of a pin, measure near the end.

Early type — 0·3928 in. to 0·3930 in. (9,97 mm. to 9,98 mm.)

Later type — 0·4340 in. to 0·4342 in. (11,02 mm. to 11,03 mm.)

Carrier assemblies with larger pins are interchangeable with carrier assemblies having smaller pins.

1. Support the carrier assembly on its **front face.**
2. Using a 0·50 in. (12,7 mm.) diameter drill remove the stake marks from the end of the pinion pin(s). Ensure that the drill does not remove any

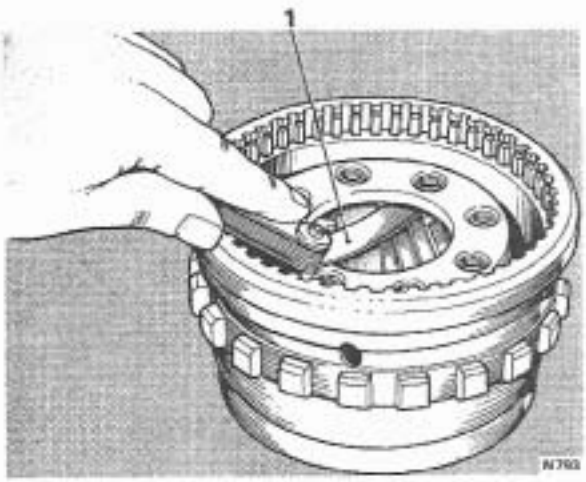

FIG. T273 CHECKING OUTPUT CARRIER PINION END FLOAT

1 0.009 in. to 0.024 in. (2,29 mm. to 6,1 mm.)

metal from the carrier as this will weaken the component and could result in a failure.

3. Using a tapered punch, drive or press the pinions out of the carrier.

4. Remove the punch, gears, thrust washers and needle roller bearings.

5. Examine the pinion thrust faces in the pinion gear pockets for burrs and stone off as necessary. Thoroughly wash and dry the carrier.

6. Ensure that the new gears are clean and free from burrs then fit the needle bearings into each pinion gear. Use petroleum jelly to retain the bearings and use a pinion pin as a guide when fitting the bearings.

7. Fit a bronze and a steel thrust washer on each side of the pinion gear with the steel washer next to the gear (*see exploded view in Fig. T274*). Hold the washers in place with a smear of petroleum jelly.

8. Fit the pinion gear assembly into position in the carrier, then fit a pilot pin through the rear face of the assembly to centralise and hold the parts in position.

9. Drive a new pinion pin into position from the front, rotating the pinion whilst the pin is being driven in.

10. Ensure that the headed end of the pin is flush or below the face of the carrier.

11. Secure the punch in a bench vice so that it can be used as an anvil.

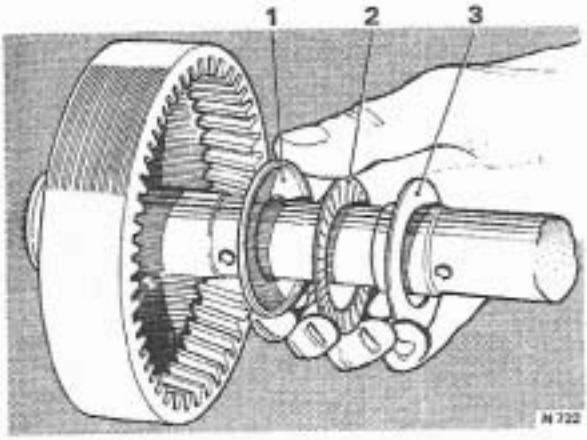

FIG. T274 FITTING RACES AND THRUST BEARINGS TO INNER FACE OF REAR INTERNAL GEAR

1 O/D flanged race
2 Thrust bearing
3 I/D flanged race

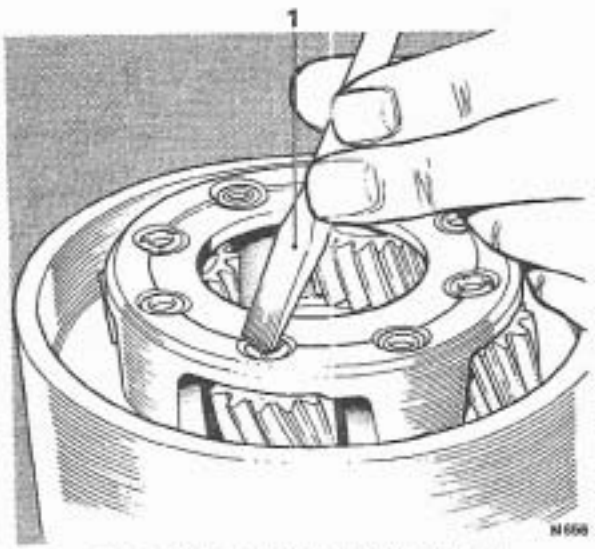

FIG. T275 STAKING A PINION PIN

1 Blunt chisel

12. Support the carrier with the head of the pin resting on the punch then, using a chisel with a radiused end stake the opposite end of the pin in three places (*see Fig. T275*).

Note Both ends of the pin must lie below the face of the carrier, otherwise a foul may occur between the pin and the adjacent component.

Repeat the fitting procedure for the remaining pins.

Rear roller assembly—To inspect

If a sprag clutch is fitted in place of a roller clutch proceed as follows:

1. Wash the assembly in clean paraffin (kerosene) then dry with compressed air.

2. Examine the roller for damaged members.

3. Examine the roller cage and retaining spring for damage.

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Roller clutch assembly—To inspect

If a roller clutch is fitted in place of a sprag clutch proceed as follows:

1. Inspect the roller clutch for damaged rollers or springs.
2. Inspect the roller clutch cage for damage.

Note If the later type roller clutch parts require replacement and the components are not available, consult the latest applicable service literature regarding the fitting of the earlier type of sprag clutch.

Clutch plates and rear band—To inspect

1. Examine the condition of the composition plates.
2. Check that the composition material has not lifted or flaked. If the plates are black, burned or shiny they should be renewed.
3. Examine the condition of the reaction (steel) plates. Check for scores or damage. The plates are normally matt grey in colour. If they are burned or distorted they must be renewed.
4. Examine the rear band for cracks or distortion.
5. Examine the ends of the band for damage at the anchor lugs and the apply lug.
6. Examine the lining for cracks, flaking and burning.
7. Ensure that the lining is secured to the band.

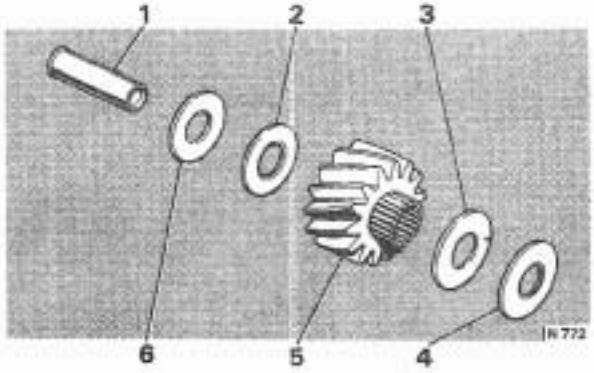

FIG. T276 PLANET PINION GEAR—EXPLODED

1 Pinion pin
2 Steel washer
3 Steel washer
4 Bronze washer
5 Planet pinion
6 Bronze washer

Gear unit and centre support—To assemble

1. Ensure that all parts are clean. Lightly lubricate with clean transmission fluid all bushes, journals, gears, bearings and sprag races.
2. Fit the rear internal gear onto the mainshaft, circlip groove end; fit the circlip.
3. Fit the races and thrust bearing onto the inner face of the rear internal gear, retaining them with a smear of petroleum jelly.
4. Fit the large diameter race first with the flange uppermost (*see Fig. T276*).
5. Fit the thrust bearing into the race.
6. Fit the smaller diameter race over the bearing with the inner flange toward the bearing.
7. Ensure that the pinion gears are adequately lubricated then fit the output carrier onto the mainshaft so that the pinion gears mesh with the rear internal gear.
8. Fit the assembly into the rear unit holding fixture RH 7959 (J-6116) with the mainshaft pointing downward. Take care not to damage the shaft.
9. Fit the races and thrust bearing onto the outer face of the rear internal gear, retaining them with a smear of petroleum jelly. The small diameter (flanged I/D) race must be fitted first with the flange uppermost (*see Fig. T277*).
10. Fit the thrust bearing into the race.

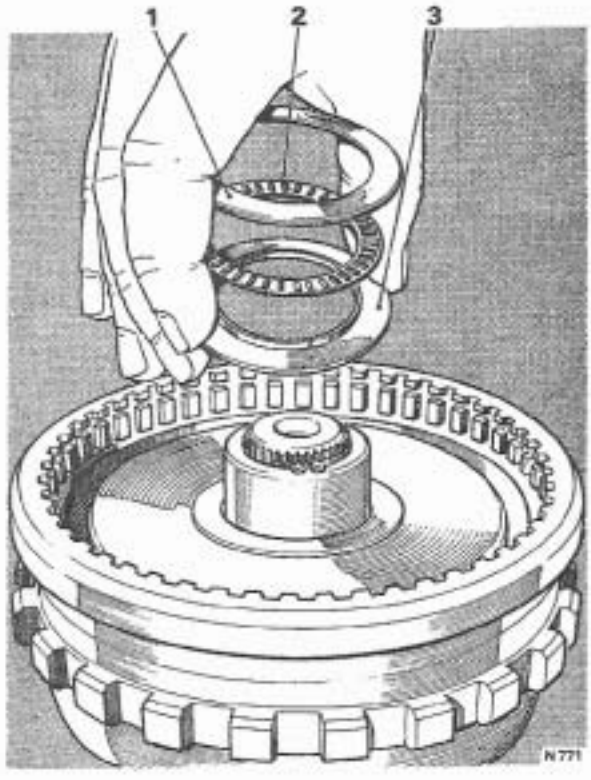

FIG. T277 FITTING RACES AND THRUST BEARINGS TO OUTER FACE OF REAR INTERNAL GEAR

1 O/D flanged race
2 Thrust bearing
3 I/D flanged race

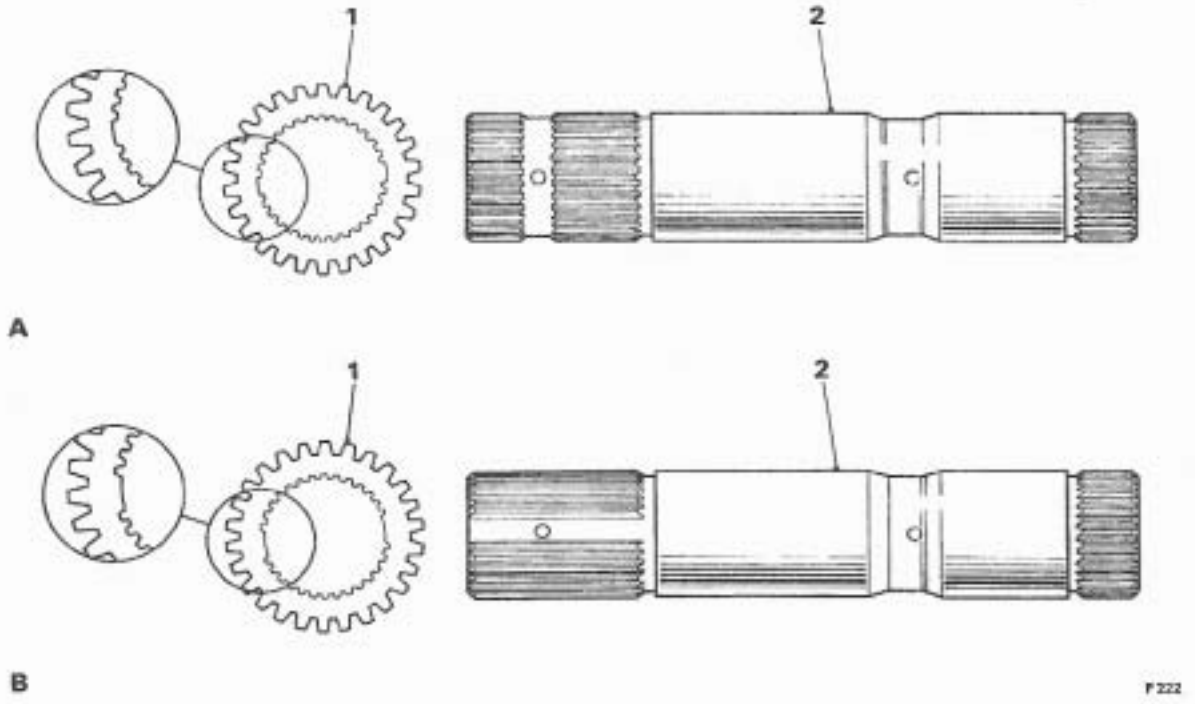

FIG. T278 IDENTIFICATION OF SUN GEAR AND SHAFT

A Later design
B Earlier design
1 Sun gear
2 Sun gear shaft

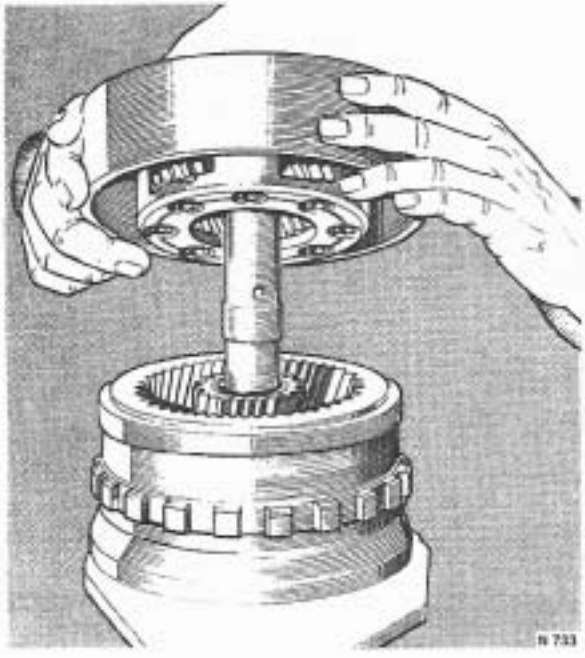

FIG. T281 FITTING THE REACTION CARRIER TO THE OUTPUT CARRIER

11. Fit the large diameter (flanged O/D) race against the bearing with the flange cup over the bearing.
12. Fit the output shaft into the output carrier and fit the snap ring with the chamfer uppermost.
13. Fit a new 'O' ring to the output shaft.
14. Invert the assembly in the holding fixture so that the output shaft points downward.
15. Smear the tab side of the thrust washer with petroleum jelly then fit the washer into the output carrier so that the bent tabs engage in the tab pockets.
16. Fit the sun gear (*see Fig. T278*); ensure that the end with the chamfered inside diameter faces down.
17. Fit the sun gear shaft (*see Fig. T278*) with the longer of the splined ends lowermost.
18. A new design of sun gear and shaft was introduced on **Transmission Serial Number RR-71-1287** and onwards (*see Fig. T278 for identification*). The old sun gear will only fit onto the old shaft but the new sun gear will fit either the new or old shaft. (refer to the latest applicable service literature).
19. Fit the ring over the output carrier.
20. Ensure that the reaction carrier pinion gears are adequately lubricated then fit the reaction carrier onto the output carrier as shown in Figure T279; mesh the pinion gears with the front internal gear.

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Note When a new output carrier and/or reaction carrier is being installed and the front internal gear ring prevents assembly of the carriers, replace the front internal gear ring with the service ring.

The front internal gear ring is a selective fit at the factory but not in service.

21. Fit the large diameter (flanged O/D) race onto the sun gear with the flange facing against the sun gear shaft.

22. Fit the thrust bearing onto the race.

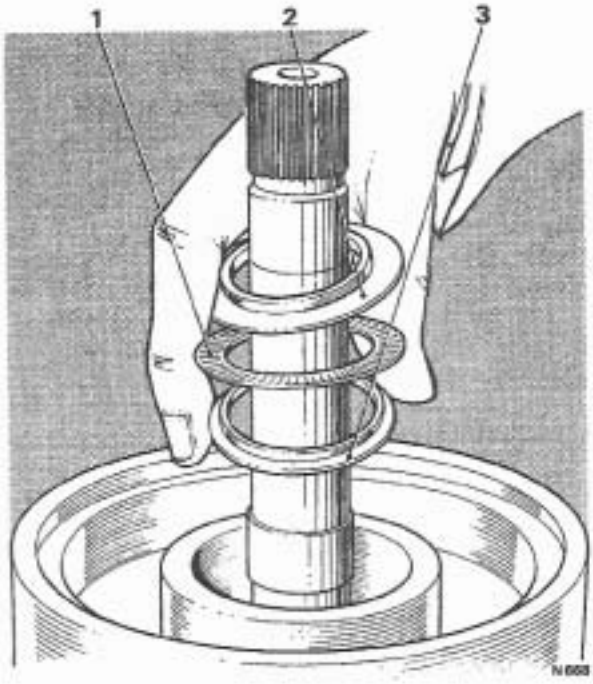

FIG. T282 FITTING RACES AND THRUST BEARINGS TO SUN GEAR

1 Thrust bearing
2 I/D flanged race
3 I/D flanged race

23. Smear the small diameter race with petroleum jelly then fit the race onto the centre support with the flange as shown in Figure T280.

24. Smear the bronze thrust washer with petroleum jelly then fit the washer into the recess in the centre support.

Transmissions with a sprag clutch

25. Using the rear sprag fitting tool RH 7971 (J–21367), fit the rear sprag assembly onto the centre support inner race with the bronze drag strip uppermost (*see Fig. T281*).

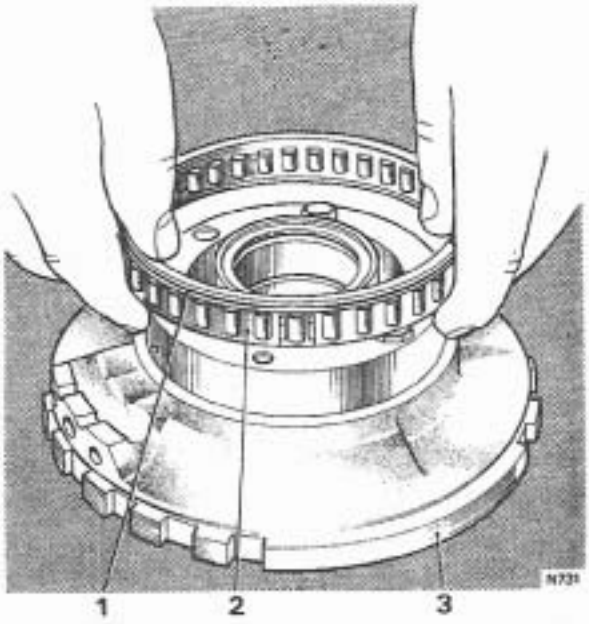

FIG. T281 FITTING THE REAR SPRAG TO THE CENTRE SUPPORT (SPRAG CLUTCH)

1 Sprag ridge uppermost
2 Sprag assembly
3 Centre support assembly

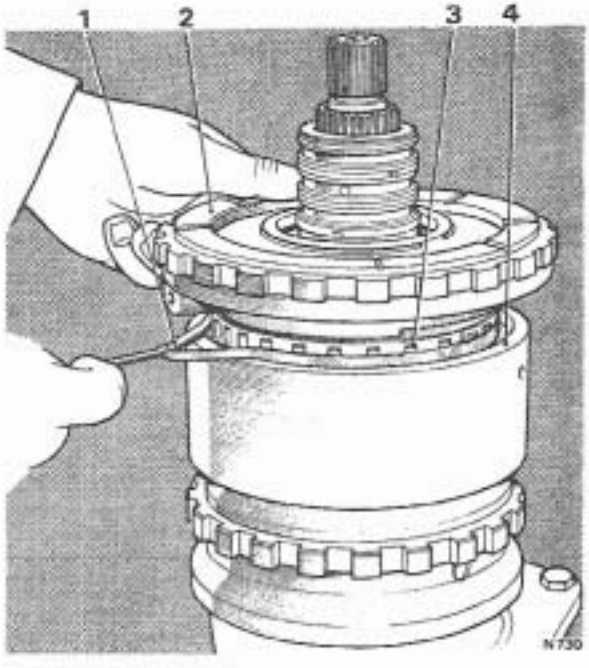

FIG. T282 FITTING THE CENTRE SUPPORT TO THE REACTION CARRIER (SPRAG CLUTCH)

1 Rubber band
2 Central support
3 Sprag
4 Reaction carrier

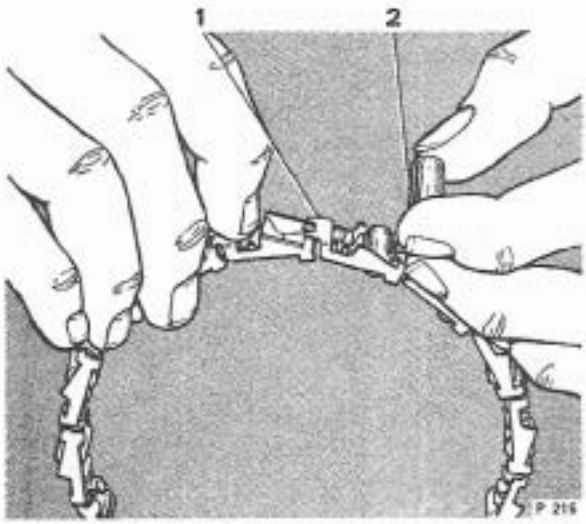

FIG. T283 FITTING A ROLLER TO THE ROLLER CLUTCH CAGE (ROLLER CLUTCH)

1 Cage
2 Roller

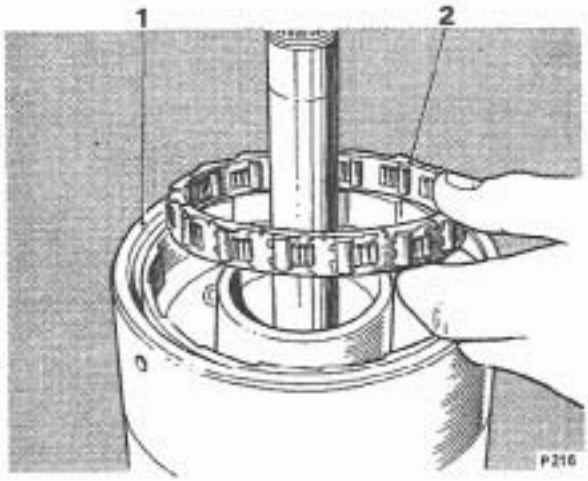

FIG. T284 FITTING THE ROLLER CLUTCH ASSEMBLY TO THE REACTION CARRIER (ROLLER CLUTCH)

1 Reaction carrier
2 Roller clutch assembly

Note The rear sprag fitting tool **must** be used to prevent hidden damage to the soft, bronze drag strips.

26. Fit the centre support and sprag assembly into the sprag outer race in the reaction carrier as follows.

27. Fit a strong rubber band around the outside diameter of the sprag assembly to hold the sprags in place.

28. Start the sprag assembly into the outer race, ensuring that all the sprags are inside the outer race. When this is done, cut or stretch the rubber band to remove it (*see Fig. T282*) then complete the procedure by pressing on the centre support.

Note With the reaction carrier held, the centre support should turn **anti-clockwise only.**

Transmissions with a roller clutch

29. Fit the rollers that may have come out of the roller clutch cage, by compressing the energising spring with the forefinger and inserting the roller from the outside (*see Fig. T283*).

Note Ensure that the energising springs are not distorted and that the curved end leaf of the springs are positioned against the rollers.

30. Fit the roller clutch assembly into the reaction carrier (*see Fig. T284*).

31. Fit the centre support assembly into the roller clutch fitted into the reaction carrier (*see Fig. T285*).

Note With the reaction carrier held, the centre support should turn **anti-clockwise only.**

All Transmissions

32. Fit the tool RH 7970 (J–21365) onto the end of the mainshaft so that the tangs engage the groove in the shaft.

33. Tighten the screw on the tool to secure the tool on the shaft and to prevent movement of the clutch assembly when the gear unit assembly is fitted.

34. Remove the gear unit from the holding fixture and lay it on its side.

35. Fit the thrust washer on the rear face of the output shaft with the bent tabs in the tab pockets. Retain the thrust washer with a smear of petroleum jelly.

Intermediate clutch gear unit, centre support and reaction carrier—To fit

1. Fit the rear band assembly into the transmission case so that the band lugs engage with the anchor pins (*see Fig. T286*).

2. Inspect the support to case spacer for burrs or raised edges, remove with a stone or fine emery cloth. Ensure that the spacer is clean.

3. Fit the support to case spacer against the shoulder at the bottom of the case splines and the gap located adjacent to the band anchor pin (*see Fig. T287*).

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Note Do not confuse this spacer [0·040 in. (1,016 mm.) thick and with both sides flat] with either the centre support to case snap ring (one side bevelled) or the backing plate to case snap ring [0·093 in. (2,362 mm.) thick with both sides flat].

4. Fit the previously selected rear unit adjusting washer (*see 'Rear unit end float — To check', in Section T21*) into the slots provided inside the rear of the transmission case; retain the washer with a smear of petroleum jelly.

5. Fit the transmission case into the holding fixture (if it has been removed). Do not over-tighten the fixture side pivot pin as this will cause binding when the gear unit is fitted.

6. Fit over the output shaft the same length of tube that was used to remove the unit. It can then be used as a handle to facilitate the fitting of the assembled gear unit. It will also prevent the output shaft splines from damaging the bush in the case.

Caution Do not drop or bump the assembly in the transmission case during the fitting procedure. This could result in damage to the output shaft case bush as well as to the assembly itself.

7. Fit the gear unit with the centre support and the reaction carrier. Align the slots then carefully guide the assembly horizontally into the transmission case making certain that the centre support bolt hole is properly aligned with the hole in the case.

8. Position the transmission vertically with the front end of the case uppermost. Remove tool RH 7970 (J–21365).

9. Lubricate the centre support retaining snap ring with clean transmission fluid then fit the snap ring into the transmission case with the bevelled side uppermost and the flat side against the centre support; position the gap adjacent to the front band anchor pin.

10. Expand the snap ring until the centre support is against the shoulder of the case

11. Fit the case to centre support bolt.

Note To correct carry out this operation, it will be necessary to produce a locating tool and then to proceed as follows.

12. Produce the locating tool from 0·375 in. (0,95 cm.) diameter, cold roll steel or from a screwdriver with a 0·375 in. (0,95 cm.) diameter shank. The stock should be approximately 12·00 in. (30,5 cm.) long. Grind the stock to a blunt point, tapering it 0·875 in. (2,22 cm.) from the end of the bar to a 0·125 in. (0,32 cm.) diameter at the end.

13. Bend the bar to a 45° angle 2·50 in. (6,35 cm.) from the pointed end (*see Fig. T288*).

14. Place the centre support locating tool into the direct clutch passage in the case, with the handle of the tool pointing to the right as viewed from the front of

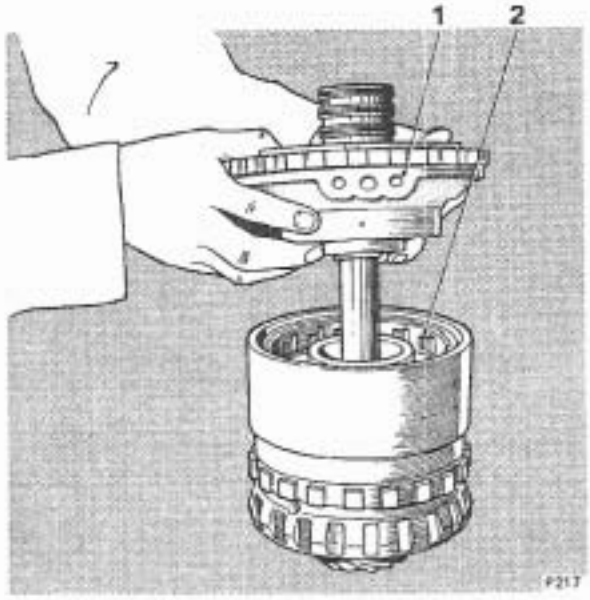

FIG. T285 FITTING THE CENTRE SUPPORT INTO THE REACTION CARRIER (ROLLER CLUTCH)

1 Centre support
2 Roller clutch

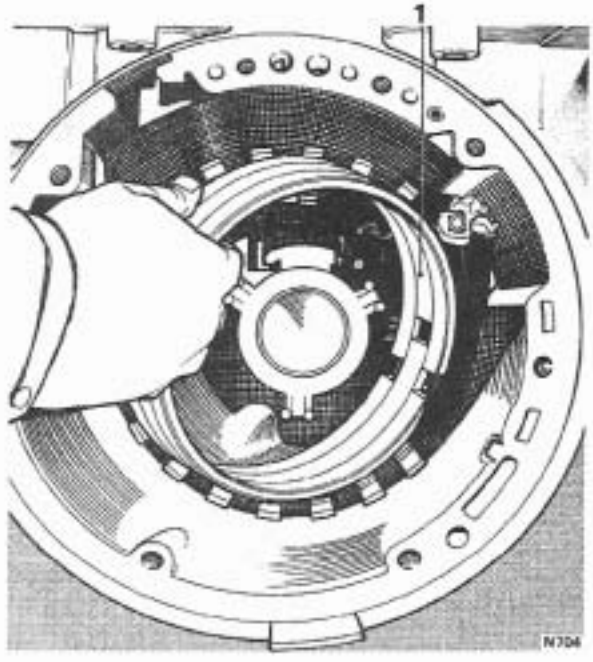

FIG. T286 FITTING THE REAR BAND

1 Rear band

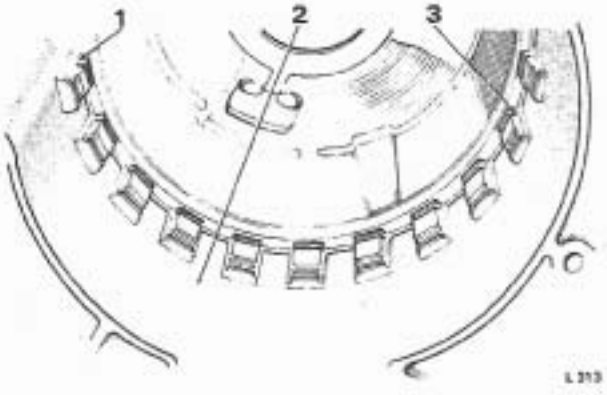

FIG. T287 FITTING THE INTERMEDIATE CLUTCH PLATES

1 Steel plate (3)
2 Composition plate
3 Back plate

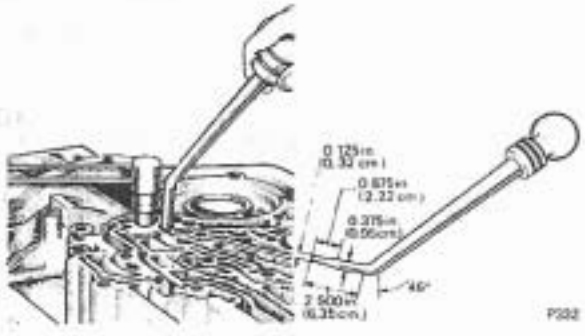

FIG. T288 LOCATING CENTRE SUPPORT

the transmission and parallel to the bell housing mounting face.

15. Apply pressure downward on the tool handle which will tend to rotate the centre support anti-clockwise as viewed from the front of the transmission.

16. While holding the centre support firmly anti-clockwise against the case splines, torque the case to centre support bolt to 23 lbs. ft. (3,2 kg.m.).

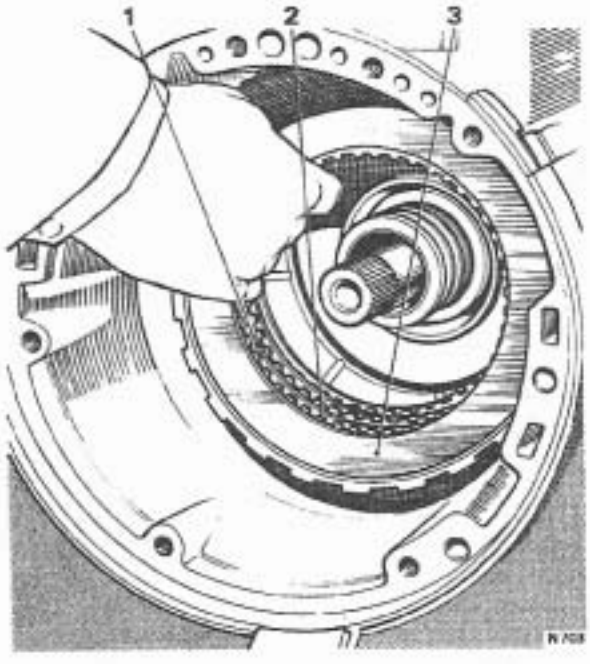

FIG. T289 FITTING THE INTERMEDIATE CLUTCH PLATES

1 Steel plate
2 Composition plate
3 Back plate

Note When using the locating tool, take care not to raise burrs on the case valve body mounting face.

17. Lubricate the three steel and three composition clutch plates with clean transmission fluid then fit the clutch plates. Commence with a steel plate then fit alternate composition and steel plates, finishing with a composition plate (*see Fig. T289*).

18. Fit the intermediate clutch back plate with the machined face against the clutch plate.

19. Fit the large snap ring, easuring that the ring gap faces the opposite side to the front band anchor pin.

20. Check the rear unit end float.

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Section T23
TRANSMISSION CASE

The transmission case is an alloy die casting comprising the housing for the main transmission components. It also forms the bell housing which encloses the torque converter.

The lower inner face of the case forms part of the hydraulic passages onto which the control valve unit fits. A bore in the rear of the case contains a bush in which the output shaft runs. A machined face at the front of the case accepts the oil pump and contains oil passages which convey transmission fluid from the pump to several points in the case.

Transmission case—To inspect

1. When the transmission has been completely dismantled, the case should be thoroughly washed in clean paraffin (kerosene) then dried with compressed air.
2. Ensure that all the oil passages are flushed out.
3. Take care not to raise burrs on the ends of the passages.

Note If the case assembly requires replacement and contains the centre support which has the centre support to case spacer fitted, ensure the spacer is removed from the old case and installed in the new case.

External leaks

Determine the exact source of the leak and use the approved epoxy repair procedure for minor porosity.

Internal leaks

1. Inspect the case assembly for internal porosity or cross channel leaks in the valve body face passages.

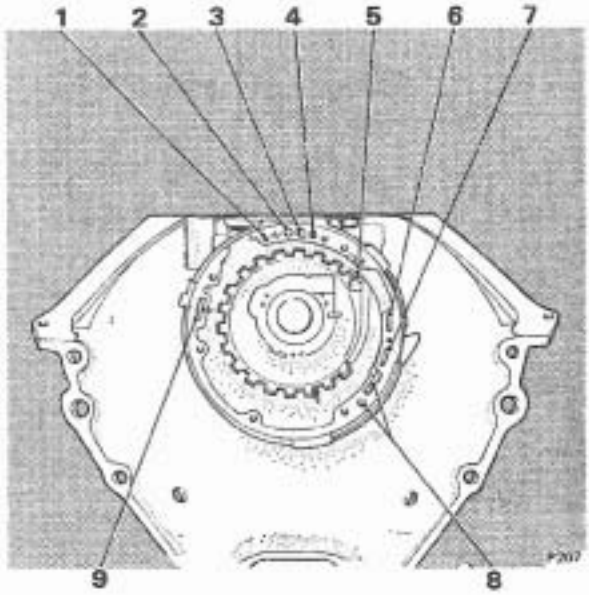

FIG. T290 TRANSMISSION CASE OIL PASSAGES

1 Reverse
2 Line
3 Drive
4 Modulator or Intermediate
5 Intermediate clutch cup plug
6 To cooler
7 Cooler return
8 Vent
9 Pump intake

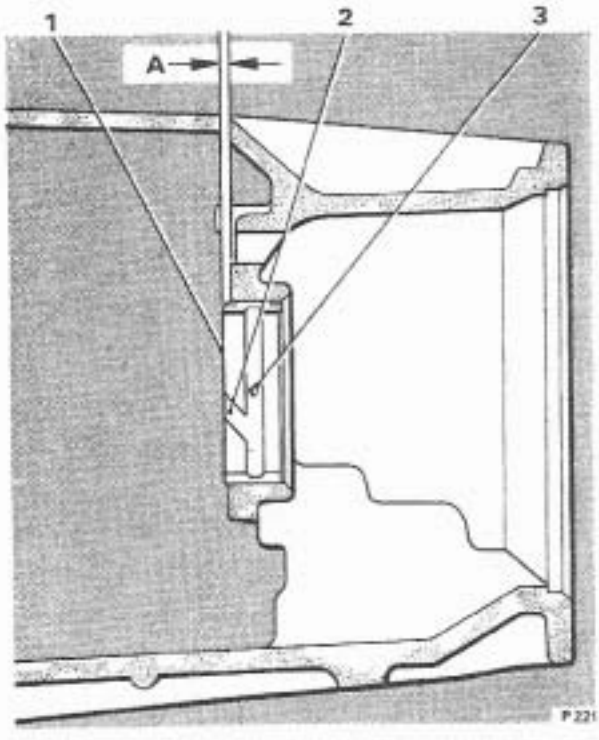

FIG. T291 FITTING A NEW CASE BUSH

1 Bush (GM 8623941)
2 Stake mark
3 Bush to be fitted with oil groove in direction shown
A 0.040 in. to 0.055 in. (1,016 mm. to 1,307 mm.)

2. Inspect for porosity or defects in the modulator valve bore, case intake bore and pump case face.

3. If internal leakage is confirmed from any of the foregoing points, fit a new case.

4. During internal inspection of the case also check for a loose or missing intermediate clutch cup plug, for identification refer to Figure T290; if necessary, fit a new plug.

External damage

External damage is usually caused by handling, road hazards or converter to flex-plate bolts becoming loose as a result of incorrect fitting. When external damage is evident such as described in the foregoing sentence, fit a new case.

Internal damage

If the internal damage is due to the incorrect installation of the spacer and/or the snap rings resulting in damage to the snap ring grooves, fit a new case and ensure that the snap rings are assembled in their correct location.

High oil pressure can also result in internal damage, if this is the cause fit a new case and rectify the problem (usually the trouble can be located in the pressure regulator valve system).

Internal inspection of the case may also reveal that fretting or peening on the shoulder at the bottom of the case splines has taken place; if this condition is any more than the very slightest, fit a Centre Support Service Package. Changing the transmission for this condition is not usually considered necessary.

If the case bushing is found to be worn or scored fit new bushing (*see Fig. T291*).

Inspect the case for stripped threads in the bolt holes and where possible 'Heli-Coil' the damaged bolt hole(s) (*see Fig. T292 and 'Heli-Coil' Information Chart*).

Repair procedure for minor case porosity

1. Proceed with the repair by bringing the transmission fluid up to the operating temperature 82°C. (180°F.).

2. Locate the source of the oil leak.

3. Thoroughly clean the area to be repaired with cleaning solvent and a brush; dry-off with compressed air. A clean, dry soldering acid brush may be used to clean the area and also apply the epoxy cement.

4. Following the manufacturer's instructions, mix a sufficient amount of epoxy cement, such as 3 M — Scotch Weld — 2216 or equivalent, to carry out the necessary repair.

Note Observe the manufacturer's cautions in handling.

5. While the transmission is still at operating temperature, apply epoxy cement to the area under repair. Ensure that the area is completely covered.

6. If 3M — Scotch Weld — 2216 has been used allow 1 hour to pass before starting the engine; equivalent epoxy cements may take longer to cure, always check the manufacturer's instructions.

7. Finally, bring the transmission fluid up to the normal operating temperature of 82°C. (180°F.) and check the transmission for leaks.

Intermediate clutch plug—To fit

1. Place the transmission case in the holding fixture and position with the front end facing up.

2. Ensure that the intermediate clutch cup plug hole is thoroughly clean and enter the intermediate clutch cup plug into the hole open end out. Drive the plug into the case until it is flush or slightly below the top of the hole using a 0·375 in. (9,525 mm.) diameter rod 10·00 in. (25,40 cm.) long.

Note Ensure that the rod used is large enough to locate on the lip edge of the plug and **not** the bottom of the plug.

3. Stake the plug securely in the case.

Case bushing—To remove

1. To remove the case bushing, support the case and using tool J-21465-8 with driver handle J-8092 (or J-8400-1) remove the bush.

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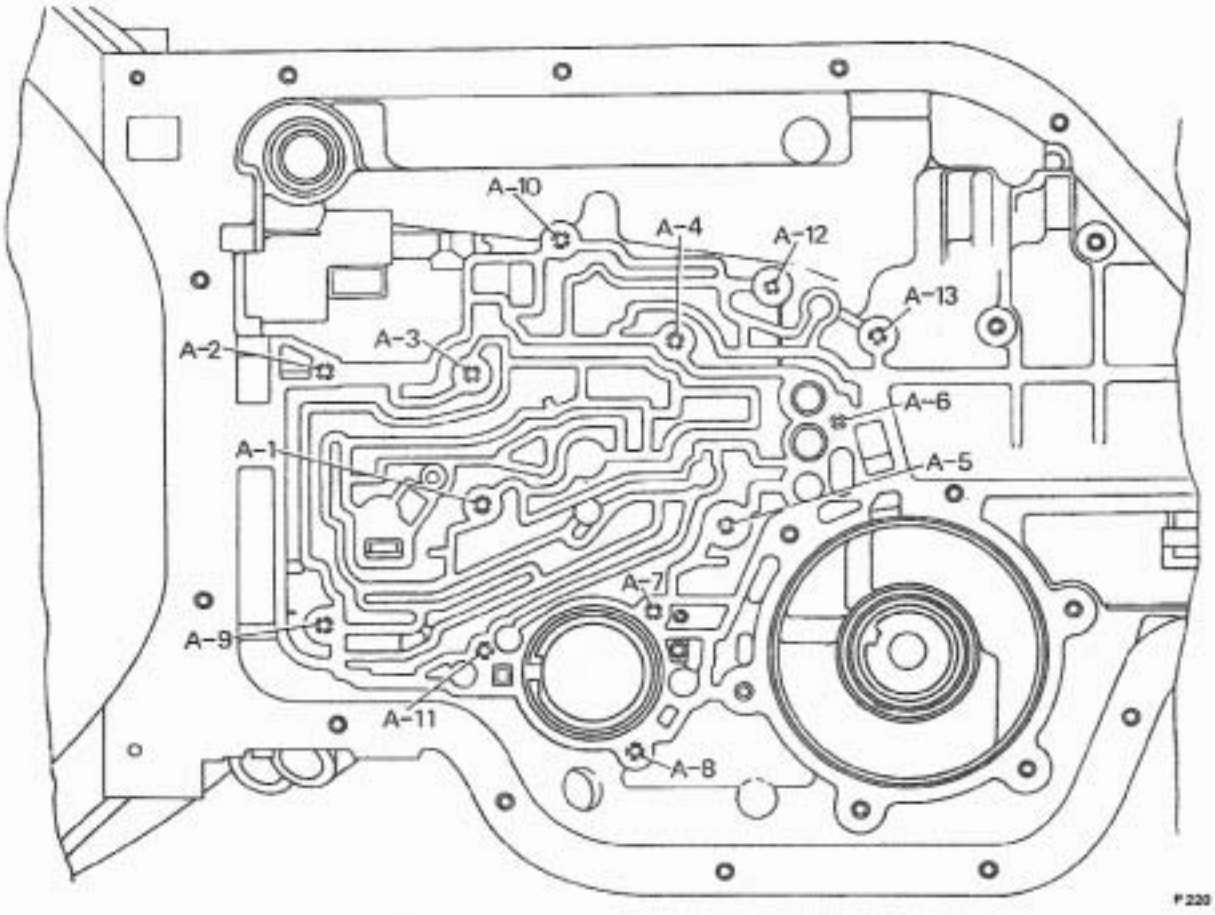

FIG. T292 HELI-COIL IDENTIFICATION—VIEW OF UNDERSIDE OF TRANSMISSION CASE

Case bushing—To fit

1. Support the transmission case and using tool J–21465–9, drive handle J–8092 and extension J–21465–13. Press or drive the bush into the case until 0·040 in. (1,016 mm.) to 0·055 in. (1,307 mm.) **above** the selective thrust washer face (*see Fig. T291*).

Note Ensure that the bushing is fitted with the lubrication passage facing the front of the transmission case.

2. Stake the bushing with tool J–21465–0.

3. The stake marks to be inside the lubrication grooves.

Heli-Coils

Before commencing these operations always refer to Figure T292 and the 'Heli-Coil' Information Chart, for correct drill and tap sizes.

1. Shield the area around the hole to be heli-coiled, this will contain any small particles of metal.

2. Drill out the old threads and clean any particles from the hole.

Note Drill out only to the depth of the original hole. When drilling hole A–4 (*see Fig. T292*), the drill may go through to the inside of the case; located just behind this hole are the intermediate clutch splines. If the hole goes through, the burrs **must** be removed from the clutch splines.

3. Tap the hole with the **heli-coil tap.**

4. Fit the standard insert (STI) heli-coil.

5. Remove the shields and **ensure that all particles of metal, etc. are removed.**

Heli-Coil Information for Torque Converter Transmission

Transmission Out of Vehicle and Partially or Completely Dismantled.

Location	Hole No.	Drill size	Tap size	Heli-Coil size
Pump to Case	All	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC
Valve Body to Case	A–1 through A–4 (*See Fig. T292*)	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC
Valve Body to Case	A–5 and A–6 (*See Fig. T292*)	0.266 in. (6,747 mm.)	1/4–20 UNC–2B	1/4–20 STI-NC
Converter To Flex-Plate	All	0,391 in. (9,922 mm.)	3/8–16 UNC–2B	3/8–16 STI-NC

Transmission in Vehicle and Partially Dismantled.

Location	Hole No.	Drill size	Tap size	Heli-Coil size
Case Extension to Case	All	0.391 in. (9,922 mm.)	3/8–16 UNC–2B	3/8–16 STI-NC
Governor Cover to Case	All	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC
Modulator Retainer to Case	—	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC

Location	Hole No.	Drill size	Tap size	Heli-Coil size
Speedometer Driven Gear Assembly to Case	—	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC
Oil Pan to Case	All	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC
Rear Servo Cover to Case	All	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC
Parking Brake Bracket to Case	All	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC
Valve Body to Case	A–7 through A–10 (*See Fig. T292*)	0.328 in. (8,334 mm.)	5/16–18 UNC–2B	5/16–18 STI-NC
Valve Body to Case	A–11 (*See Fig. T292*)	0.266 in. (6,747 mm.)	1/4–20 UNC–2B	1/4–20 STI-NC
Solenoid to Case	A–12 and A–13 (*See Fig. T292*)	0.266 in. (6,747 mm.)	1/4–20 UNC–2B	1/4–20 STI-NC

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Section T24
WORKSHOP TOOLS

The following is a list of special tools to be used when servicing the Automatic Transmission. General tools are not included as it is felt that these will be available locally.

Tool Number	*Description*	
RH 7949 (J–21409)	Forward and direct clutch piston fitting tool.	This tool enables the forward and direct clutch piston outer seal to enter the clutch drum easily and without damage to the seal.
J–21427	Speedometer drive gear removal tool.	This tool, when used in conjunction with J–21797 and J–8433 enables the speedometer driving gear to be removed from the output shaft.
J–21797	Speedometer drive gear removal bolt (2 off).	See previous description.
RH 7791 (J–8433)	Pulley extractor.	See previous description.
RH 7962 (J–21795)	Gear assembly removal and fitting adapter.	This tool must be used whenever the gear assembly is removed or fitted. It fits onto the end of the mainshaft and when the centre screw is tightened, prevents the rear sprag from moving.
RH 7955 (J–8763)	Transmission holding fixture.	This fixture accepts the transmission case and, when used in conjunction with base RH 7956 (J–3289–20), enables the transmission to be dismantled and assembled at a workable height and in the most convenient position.
RH 7956 (J–3289–20)	Base — holding fixture.	See previous description.
RH 7954 (J–21359)	Pump oil seal inserting tool.	This tool facilitates the fitting of the oil pump seal with the pump either fitted to or removed from the transmission.
J–21368	Pump body and cover alignment band.	This band ensures accurate alignment between the pump cover and the body whilst the securing setscrews are tightened.
RH 7969 (J–21363)	Intermediate clutch inner seal protector.	The seal protector fits over the centre support hub and ensures that the intermediate clutch piston inner seal is not damaged as the piston is fitted.

Workshop Tools — continued

Tool Number	*Description*	
RH 7964 (J–21360)	Pump by-pass valve seat fitting tool.	This tool is a punch which should be used when fitting a new by-pass valve seat.
RH 7957 (J–21370)	Band apply pin selector gauge (use J–21370–5 pin).	This gauge must be used, in conjunction with pin J–21370–5, to select the correct band apply pin in the rear servo.
RH 7971 (J–21367)	Rear sprag fitting tool.	This tool fits over the hub of the centre support and abuts the sprag inner race. The tool must be used when fitting the sprag to guard against damage to the soft bronze drag strips on the sprag itself.
RH 7952 (J–21366)	Converter retaining clamp.	This is a clamp which bolts onto the front face of the transmission case and prevents the torque converter from moving whilst the transmission is being handled.
RH 7968 (J–21362)	Forward and direct clutch inner seal protector.	This tool fits over the hub of the forward clutch and the direct clutch and protects the piston inner seal whilst the piston is being fitted.
RH 7963 (J–21361)	Pump by-pass valve seat remover.	When used in conjunction with slide hammer RH 7958 (J–6125), this tool will extract the by-pass valve seat from the oil pump.
RH 7966 (J–21664)	Clutch spring compressor adapter.	This adapter, when used in conjunction with RH 7965 (J–4670) — clutch spring compressor — facilitates the compressing of both the forward and direct clutch springs. The tool should be used when removing or fitting the clutch spring retainer snap ring.
RH 7965 (J–4670)	Clutch spring compressor.	See previous description.
RH 7674	Circlip and snap ring pliers.	By utilising the various nose pieces this tool can be used for the removal and fitting of the various circlip and snap rings in the transmission and electric actuator.
RH 7961 (J–21885)	Control valve accumulator piston fitting tool.	This tool is in the form of a clamp and facilitates the fitting of the accumulator spring and piston.
RH 7954 (J–21369)	Converter leak test fixture.	This fixture can be fitted to the neck of the torque converter and, when air pressure is applied to the valve, enables the converter to be pressure tested to check for leaks.
RH 7958 (J–6125)	Slide hammer assemblies.	The slide hammers have various uses when overhauling the transmission and are recommended when removing the oil pump.
RH 7950 (J–5154)	Rear extension oil seal fitting tool.	This tool should be used to fit a new oil seal to the rear extension. It can be used to fit a seal when the transmission is fitted to the car.
RH 7960 (J–21364)	Rear unit holding fixture adapter.	This adapter, when used in conjunction with rear unit holding fixture J–6116 will hold the rear unit whilst it is being dismantled or assembled.
RH 7959 (J–6116)	Rear unit holding fixture.	See previous description.
R 5244	Oil pressure gauge.	When coupled to the transmission main line oil feed, the gauge enables the oil pressure to be checked with the car either stationary or moving during a road test.
RH 7967 (J–6129)	Rear clutch spring compressor.	When used in conjunction with tools J–4670 — compressor and J–21664 — adapter the tool will facilitate the removal and fitting of the direct clutch housing snap ring.
RH 7841	Roll pin insertion and extraction tool.	The roll pin can be easily fitted to and removed from the brake drum and worm shaft with the aid of this tool.
RH 7843	Compressor — actuating lever spring.	This tool fits onto the electric gearchange actuator and will compress the actuating lever spring to facilitate removal of the retaining pin.
RH 7914	Adapter — main line oil pressure tapping to gauge.	The adapter screws into the main line blanking plug orifice in the left-hand side of the transmission and accepts the oil pressure gauge pipe (use with R 5244).

Workshop Tools — continued

Tool Number		
R 5280	Adapter — air checking.	Rubber-nosed adapter for use when air testing.
RH 7951 (J-21477)	Wrench — oil cooler pipe.	This wrench is used in conjunction with a ratchet spanner (slackening) or torque spanner (tightening).
RH 7970 (J-21365)	Retainer — rear sprag.	This tool is fitted to the mainshaft to prevent movement of the rear sprag when the gear unit assembly is fitted.
J-21465-8	Removal fitting tool — case bush.	This tool with J-8092 is for removing and fitting the transmission case bushing.
RH 7794 (J-8092)	Universal handle.	See previous description.
J-21465-9	Adapter ring — case bush.	Used for fitting the new case bushing.
J-21465-10	Staking tool — case bush.	Used for staking bushing in transmission casing.
J-21465-13	Extension — case bush.	Used for fitting the new case bushing.

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