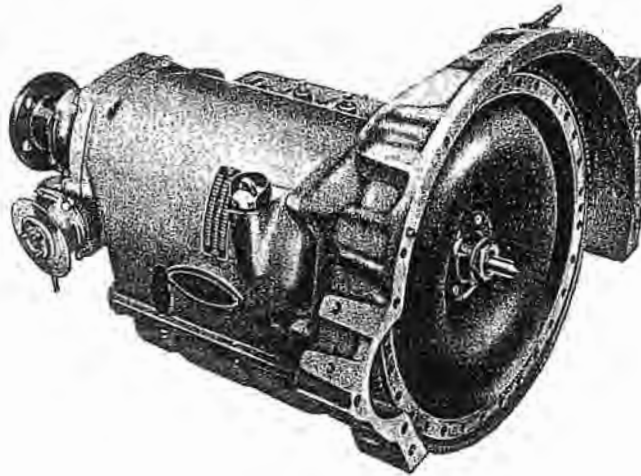




ROLLS-ROYCE

WORKSHOP MANUAL



AUTOMATIC GEARBOX

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T.S.D. Publication 2042

PREFACE

The purpose of this Manual is to provide those responsible for the maintenance and overhaul of the Rolls-Royce and Bentley Automatic Gearbox with information on proved methods of servicing.

The Manual gives complete information on dismantling, assembling and adjusting the gearbox. In addition, it includes an explanation of the gearbox operation with a methodical sequence of fault investigation which is essential for quick and accurate diagnosis. Also included is a list of special tools which are designed to simplify the servicing and overhauling of the gearbox.

Subsequent information regarding modification or procedure will be brought to the notice of the reader through Service Bulletins which may be filed at the back of the Manual for reference. It is advisable to endorse the superseded information, thus ensuring that the later procedure only will be followed.

Service personnel at Pym's Lane, Crewe and Hythe Road, Willesden, London, N.W.10 are always prepared to answer queries or give advice on individual servicing problems, but it will assist them if queries are accompanied by the serial number of the gearbox and the chassis number of the car.

All enquiries should be addressed to

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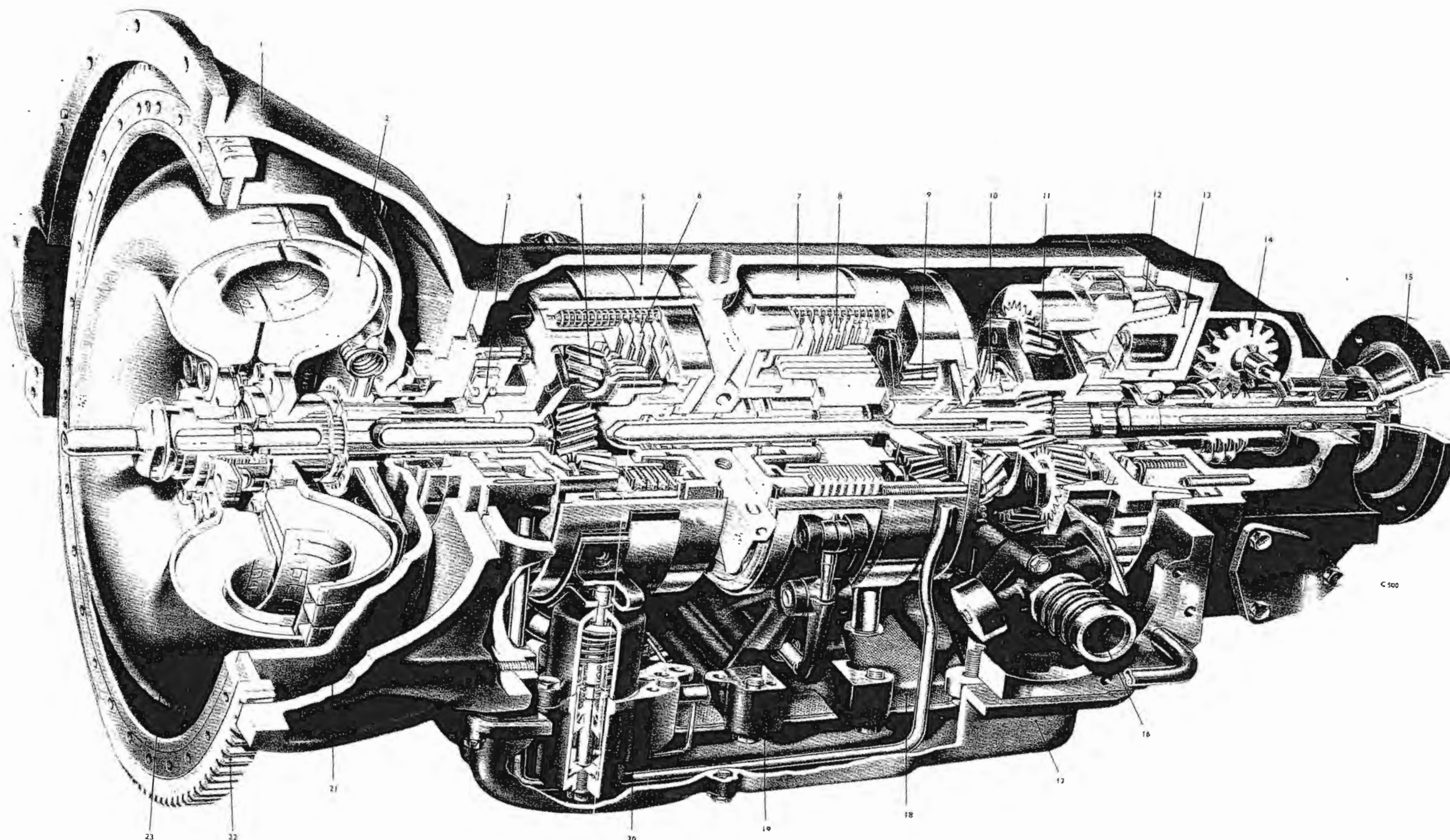
The Technical Publications Department

Rolls-Royce Limited

Pym's Lane, Crewe

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[illegible]



- 1 BELL HOUSING
- 2 DRIVING TORUS
- 3 FRONT PUMP
- 4 FRONT EPICYCLIC UNIT
- 5 FRONT BAND
- 6 FRONT CLUTCH
- 7 REAR BAND
- 8 REAR CLUTCH

- 9 REAR EPICYCLIC UNIT
- 10 REAR PUMP DRIVE GEAR
- 11 REVERSE EPICYCLIC UNIT
- 12 STATIONARY CONE
- 13 REVERSE CLUTCH PISTON
- 14 SPEEDOMETER DRIVE GEAR
- 15 OUTPUT FLANGE

- 16 GOVERNOR
- 17 OIL SUMP
- 18 SCAVENGE FILTER
- 19 REAR SERVO
- 20 FRONT SERVO
- 21 TORUS COVER
- 22 STARTER RING
- 23 DRIVEN TORUS

Fig. 1 The automatic gearbox

CHAPTER I

DESCRIPTION

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CHAPTER 1

DESCRIPTION

SECTION 1 — GENERAL DESCRIPTION

The Rolls-Royce and Bentley Automatic Gearbox (see Fig. 1) transmits tractive power from the engine to the propeller shaft in one reverse and four forward ratios. The gear changes are made automatically and are obtained through a fluid coupling and three hydraulically controlled epicyclic gear trains. In all forward ranges, the driving torque is applied continuously to the road wheels during the changes from one ratio to another.

A gear range selector lever is provided on the steering column of the car and can be used by the driver, within certain speed ranges, to overrule the automatic mechanism and to select the gear he considers most suitable for the road and traffic conditions as he sees them. The selector lever has five positions: 'N', '4', '3', '2' and 'R'; representing Neutral, three forward ranges and Reverse. A gate is provided between positions '3' and '2' to identify these ranges and on all cars, except those intended for use abroad, stops are provided which prevent the lever being moved into or out of Neutral or Reverse unless a button in the end of the selector lever is pressed.

In all ranges except Neutral, when the engine is running, the drive is engaged. At low throttle openings and with the hand brake applied, the car will remain stationary due to slip in the fluid coupling; at higher engine speeds the coupling becomes more efficient and the car will move off whenever the brakes are released.

Range 4

For normal motoring the selector lever should be placed in range '4'. The car will then start from rest in first gear at low throttle openings, but when accelerated, will change progressively through second and third into the fourth or 'top' gear. Further depression of the accelerator pedal causes the changes to be progressively delayed so that they occur at higher road speeds and facilitate more rapid acceleration of the car.

If at any time the accelerator pedal is depressed beyond the full throttle position (kick-down), a full throttle down-change occurs which increases driving torque and so further increases acceleration.

Range 3

Under normal motoring conditions, only first, second and third gears are obtainable in range '3'. A 'safety' up-change to fourth gear is provided, however, to prevent the engine from being 'over-revved' in third gear. The 3-4 change is delayed until a speed of approximately 78 m.p.h. to 80 m.p.h. is reached and thus maximum acceleration can be obtained in third gear. For this reason, range '3' is often known as the performance range.

If at any time the driver requires a change from fourth to third gear under less than full throttle conditions, for example to obtain increased engine braking, he can promote the 4-3 change by moving the selector lever to range '3'.

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Similarly, in traffic which enforces for any length of time speeds between 9 m.p.h. and 25 m.p.h., the driver can move the selector lever to range '3' to avoid the continual changes which might otherwise occur between third and fourth gears.

The change point figures given for range '3' are applicable to 'S3' cars. As the change points differ slightly between 'S' series and 'R' series cars a table of change points has been included in 'Chapter 2—Servicing.'

Range 2

In range '2', under normal circumstances only second gear is engaged. The car will start from rest in second gear and will remain in that gear until the selector lever is moved to a higher range. **There is no safety up-change and therefore a speed of 50 m.p.h. must never be exceeded in range '2';** otherwise serious damage to the engine may result.

First gear is obtainable temporarily by means of full throttle 'kick-down', or should extreme loading on the engine at low speeds require it. Such circumstances are extremely rare and will probably never be met under road test conditions.

As described above for range '3', the selection of range '2' will prevent continual changes between second and third gears in extremely slow traffic conditions. Furthermore, range '2' is most useful for ensuring maximum engine braking when descending steep or dangerous gradients.

Neutral

In Neutral 'N' the drive is disconnected, allowing the planet gears to idle without transmitting torque. The selector lever is also made to interrupt the electrical supply to the starter motor except when in Neutral; this is a safeguard to prevent the engine being started with the car in gear, where it would have a tendency to move forward, especially if the automatic choke caused the engine to run at a fairly high idling speed when starting from cold.

Reverse

It is possible to select Reverse while the car is moving forward below a speed of approximately 8 m.p.h. to 10 m.p.h. This action puts great stress upon the transmission and therefore should not be attempted.

Reverse has an important secondary effect in this transmission. When the selector lever is moved to position 'R' while the engine is stationary, a pawl is caused to engage with an annular gear on the reverse unit in the gearbox which effectively locks the transmission and prevents the car from moving, even when parked on the steepest gradients. When parked on a hill, the hand brake must be firmly applied before the selector lever is moved to another range; the parking lock would then be released and the car could move if not held by the brakes.

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SECTION 2 — MECHANICAL ARRANGEMENT

The four forward gears are obtained by using two epicyclic gear trains of differing ratios. Reverse gear is obtained through the rear epicyclic unit. The reverse unit idles when the forward ranges are selected, but when engaged, it revolves in a reverse direction and provides a further slight gear reduction.

The forward gears are obtained as follows

First—Front and rear epicyclic trains both in reduction.

Second—Front train in direct drive, rear train in reduction.

Third—Front train in reduction, rear train in direct drive.

Fourth—Front and rear trains both in direct drive.

The line of drive through each epicyclic unit is dependent upon hydraulically controlled friction bands and clutches. When the friction bands hold the drums stationary, the clutches are disengaged and the unit is in reduction. When the bands are released the clutches are engaged, locking two elements of each gear train together and thus providing a direct drive through the unit.

The clutch in the front unit locks together the sun gear and the planet gear carrier, thus preventing rotation of the planet gears and effectively locking the unit in direct drive.

The clutch in the rear unit locks the annulus gear to the intermediate shaft. If there were no slip in the fluid coupling this would be equivalent to locking together the annulus and sun gears, so preventing rotation of the planet gears and enforcing direct drive through the unit. In fact, slight slip is always present in the fluid coupling and therefore the planet gears revolve slowly around the annulus to accommodate it, similar in principle to a differential. The subsequent result nevertheless, is direct drive through the unit with slight loss in the fluid coupling.

In Reverse, both the band and the clutch of the rear epicyclic unit are freed, permitting all the gears to rotate. The rear unit annulus and the reverse unit sun gears are solidly connected and rotate together in the opposite direction to that of the input torque. The reverse unit annulus gear is held stationary by its cone clutch and the reverse unit planet gears therefore revolve inside it, transmitting the reversed torque through the planet gear carrier to the output shaft.

The fluid coupling is not directly driven by the engine flywheel; the torus cover is bolted to the flywheel and drives the rear torus member at a reduced speed in first gear through the gear train of the front epicyclic unit. This speed reduction allows the coupling to slip at higher engine speeds than would otherwise be possible and reduces the tendency of the car to creep forward when a forward range is selected.

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SECTION 3 — GEAR RATIOS

The line of drive through the four gear ratios is as follows

First gear

The drive is transferred from the flywheel to the front gear train which is in reduction. From there it passes

to the fluid coupling via the intermediate shaft. The fluid coupling drives the mainshaft which in turn transfers the drive through the rear train, which is in reduction, to the output shaft. With both gear trains in reduction the gearbox will be in bottom or first gear, ratio 3.82:1 (see Fig. 2).

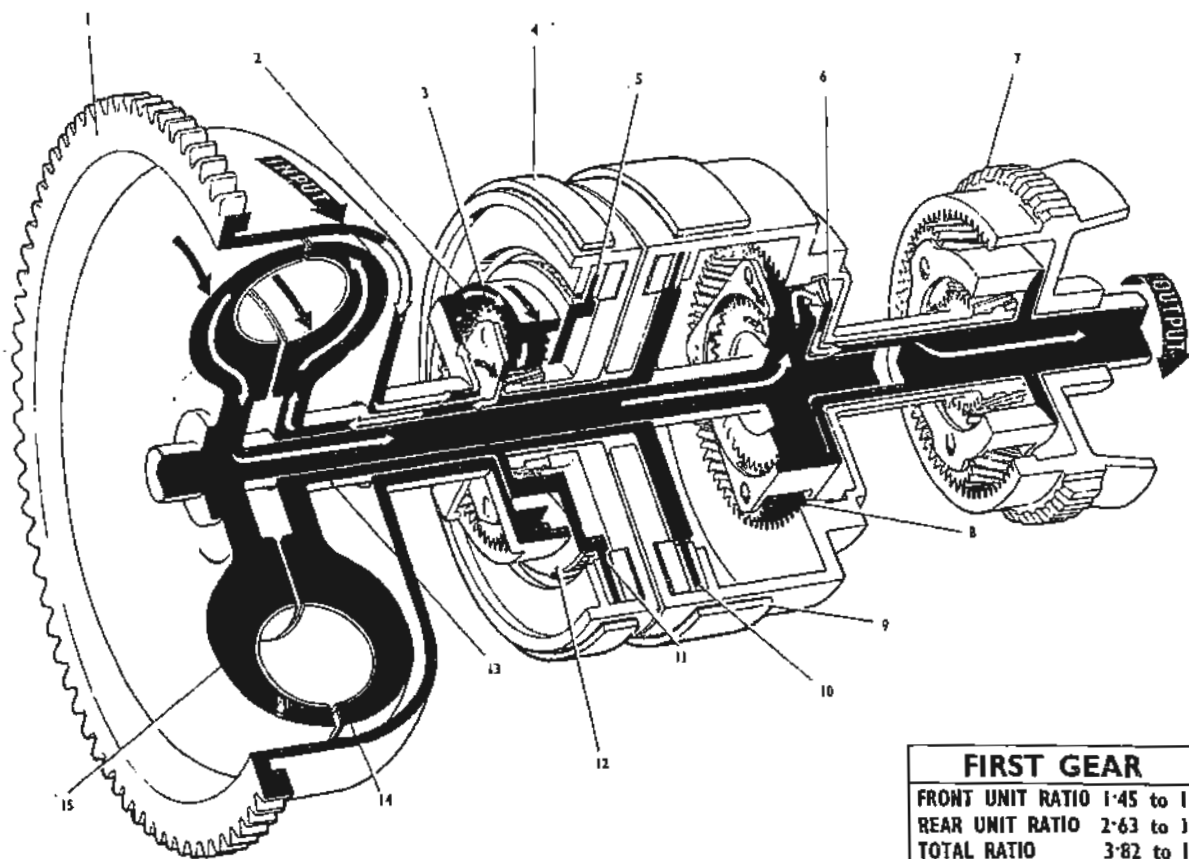


Fig. 2 Line of drive in first gear

FIRST GEAR	
FRONT UNIT RATIO	1.45 to 1
REAR UNIT RATIO	2.63 to 1
TOTAL RATIO	3.82 to 1

- | | | |
|-------------------------|--------------------------|-------------------------------|
| 1 TORUS COVER driving | 6 PLANET CARRIER driving | 11 SUN GEAR stationary |
| 2 ANNULUS GEAR driving | 7 REVERSE UNIT idling | 12 PLANET CARRIER rotating |
| 3 PLANET GEAR rolling | 8 PLANET GEARS rolling | 13 INTERMEDIATE SHAFT driving |
| 4 FRONT BAND holding | 9 REAR BAND holding | 14 REAR TORUS driving |
| 5 FRONT CLUTCH released | 10 REAR CLUTCH released | 15 FRONT TORUS driving |

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Second gear

The drive is transferred from the flywheel to the front gear train which is in direct drive. From the front gear train the drive passes to the fluid coupling via the intermediate shaft. The fluid coupling drives the mainshaft

which in turn transfers the drive through the rear train, which is in reduction, to the output shaft. Only the rear train is in reduction so the gearbox will be in second gear, ratio 2.63:1 (see Fig. 3).

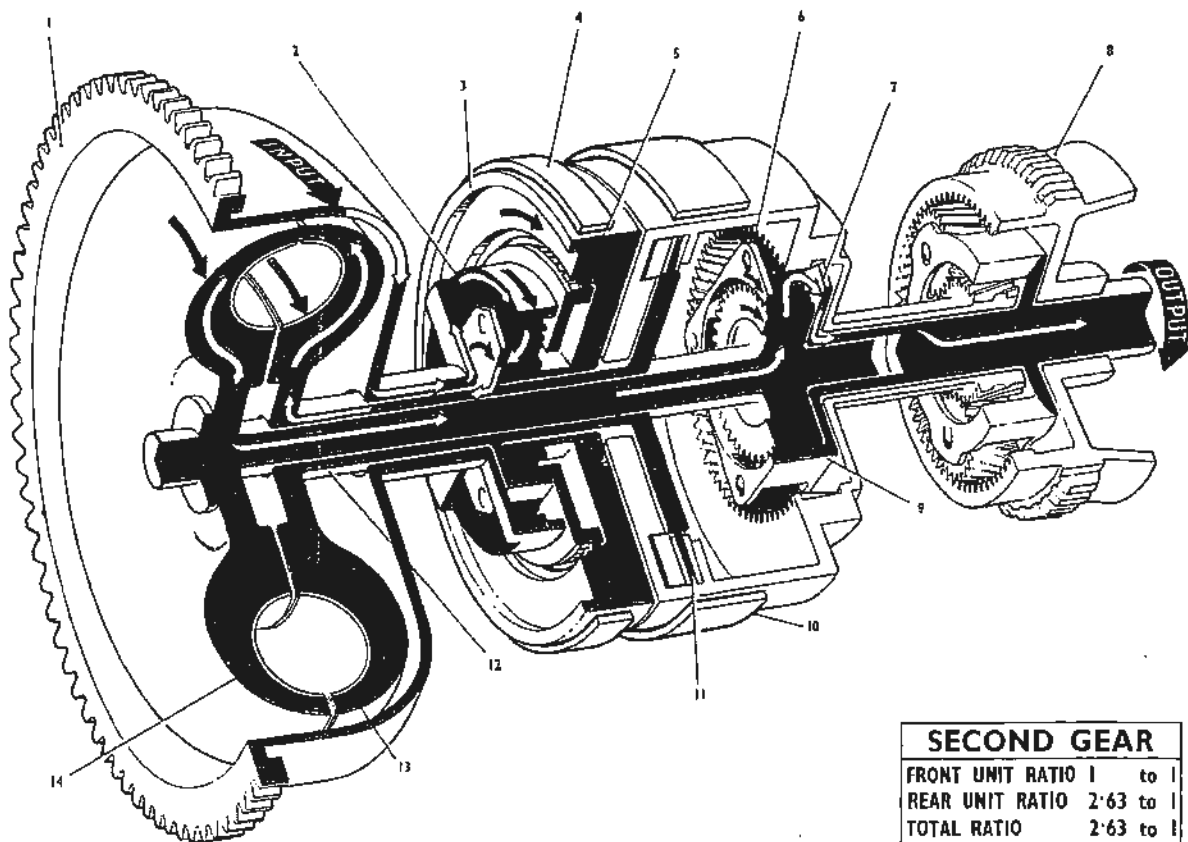


Fig. 3 Line of drive in second gear

- 1 TORUS COVER driving
- 2 ANNULUS GEAR driving
- 3 FRONT DRUM revolving
- 4 FRONT BAND released
- 5 FRONT CLUTCH applied

- 6 PLANET GEARS rolling
- 7 PLANET CARRIER driving
- 8 REVERSE UNIT idling
- 9 SUN GEAR driving

- 10 REAR BAND holding
- 11 REAR CLUTCH released
- 12 INTERMEDIATE SHAFT driving
- 13 REAR TORUS driving
- 14 FRONT TORUS driving

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Third gear

The drive is transferred from the flywheel to the front gear train which is in reduction. Here the drive is divided, going to the fluid coupling via the intermediate shaft, also going directly to the rear train via the intermediate shaft. The rear train is in direct drive,

hence torque is applied to the output shaft from the fluid coupling, via the mainshaft, and also from the intermediate shaft. As a result of the front train only being in reduction the gearbox will be in third gear, ratio 1.45:1 (see Fig. 4).

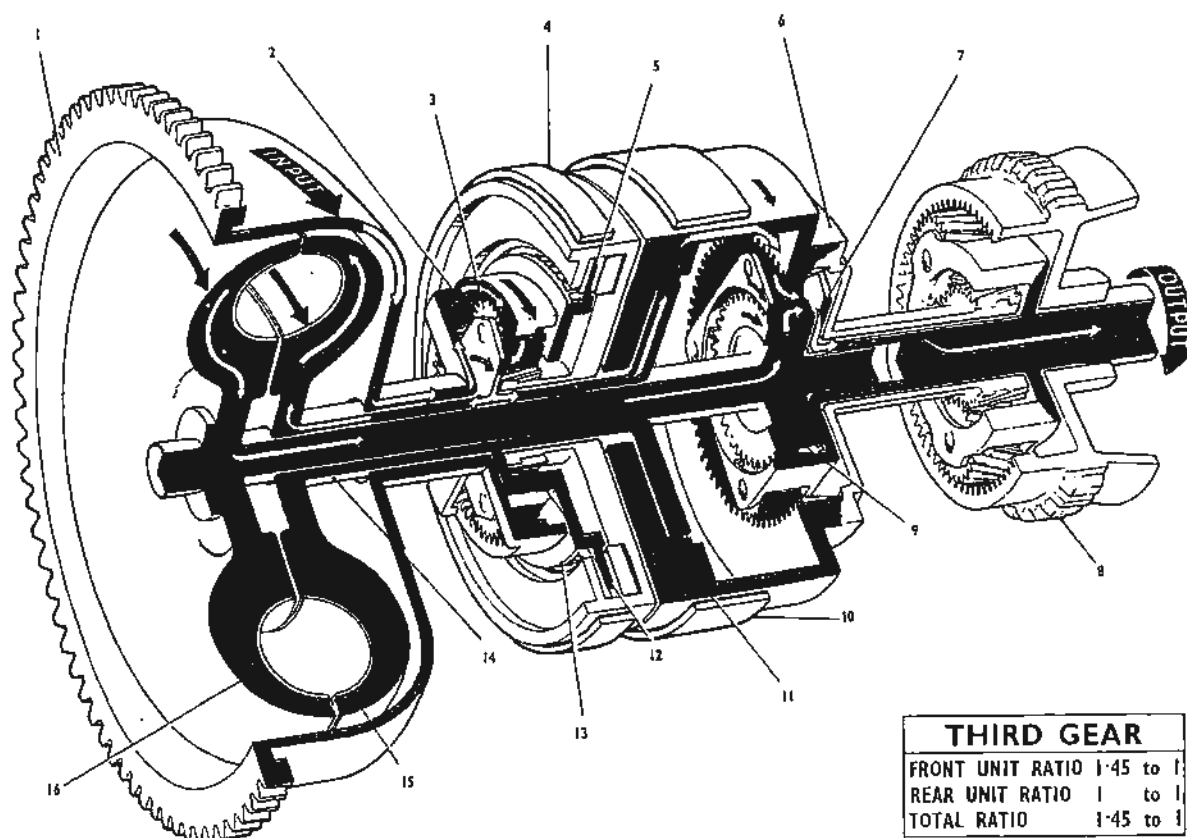


Fig. 4 Line of drive in third gear

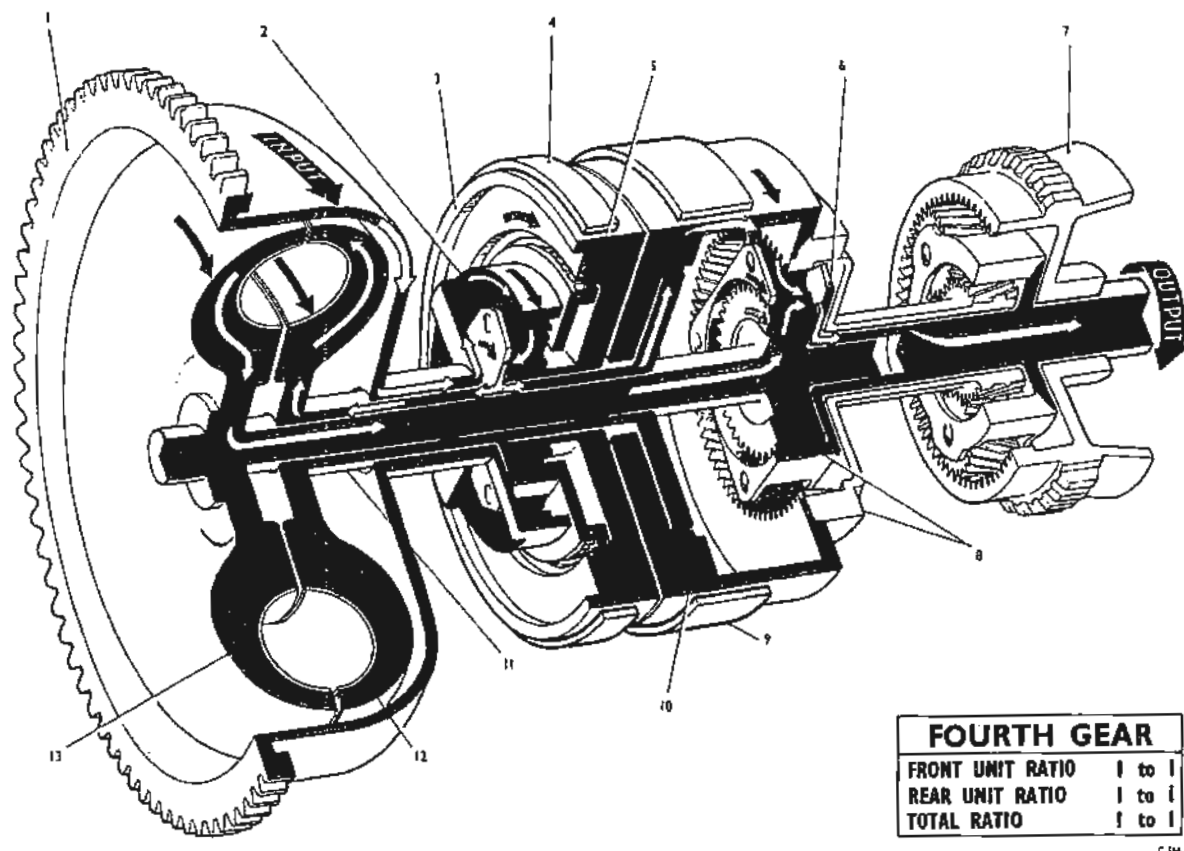
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|-------------------------|--------------------------|-------------------------------|
| 1 TORUS COVER driving | 6 ANNULUS GEAR driving | 12 SUN GEAR stationary |
| 2 ANNULUS GEAR driving | 7 PLANET CARRIER driving | 13 PLANET CARRIER rotating |
| 3 PLANET GEARS rolling | 8 REVERSE UNIT idling | 14 INTERMEDIATE SHAFT driving |
| 4 FRONT BAND holding | 9 SUN GEAR driving | 15 REAR TORUS driving |
| 5 FRONT CLUTCH released | 10 REAR BAND released | 16 FRONT TORUS driving |
| | 11 REAR CLUTCH applied | |

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Fourth gear

The drive is transferred from the flywheel to the front gear train which is in direct drive. Here the drive is again divided, going forward to the fluid coupling and rearward to the rear gear train. The rear gear train is

in direct drive, hence the torque is delivered to the output shaft. With both gear trains being in direct drive the gearbox will be in fourth or 'top' gear, ratio 1:1 (see Fig. 5).



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Fig. 5 Line of drive in fourth gear

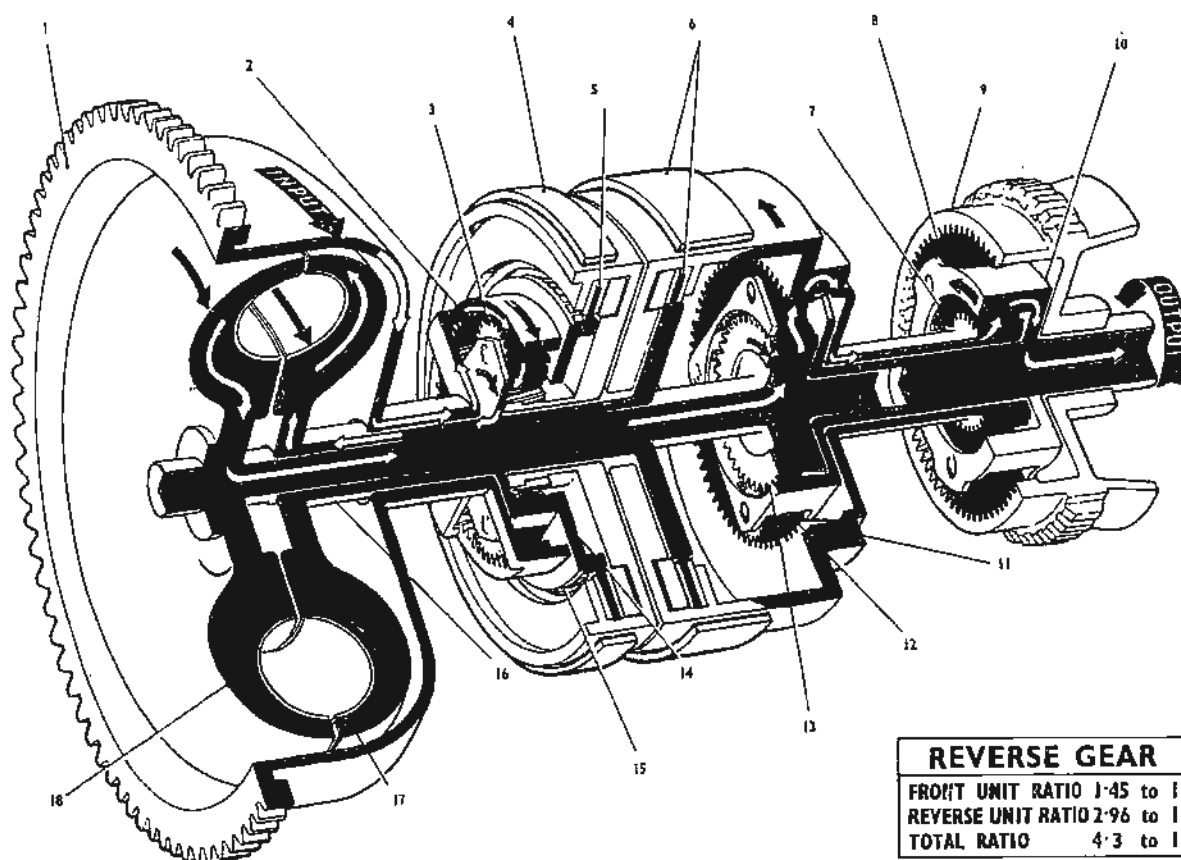
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|------------------------|--------------------------------|-------------------------------|
| 1 TORUS COVER driving | 6 PLANET CARRIER driving | 9 REAR BAND released |
| 2 ANNULUS GEAR driving | 7 REVERSE UNIT idling | 10 REAR CLUTCH applied |
| 3 FRONT DRUM revolving | 8 ANNULUS AND SUN GEAR driving | 11 INTERMEDIATE SHAFT driving |
| 4 FRONT BAND released | | 12 REAR TORUS driving |
| 5 FRONT CLUTCH applied | | 13 FRONT TORUS driving |

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Reverse

The drive is transferred from the flywheel to the front train which is in reduction. From the front gear train the drive passes to the fluid coupling via the intermediate shaft. The fluid coupling drives the mainshaft and rear unit sun gear. The rear unit sun gear transmits the drive via the output shaft planet gears to the

rear unit annulus gear which is fastened to the reverse unit sun gear. The reverse unit is in reduction and drive is transmitted by the reverse unit planet carrier to the output shaft in reverse direction. With the front, rear and reverse trains in reduction the ratio is 4.3:1 (see Fig. 6).



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Fig. 6 Line of drive in reverse gear

- | | | |
|----------------------------|-----------------------------------|-------------------------------|
| 1 TORUS COVER driving | 7 SUN GEAR driving | 13 SUN GEAR driving |
| 2 ANNULUS GEAR driving | 8 PLANET GEARS rolling | 14 SUN GEAR stationary |
| 3 PLANET GEAR rolling | 9 ANNULUS GEAR stationary | 15 PLANET CARRIER rotating |
| 4 FRONT BAND holding | 10 PLANET CARRIER driving | 16 INTERMEDIATE SHAFT driving |
| 5 FRONT CLUTCH released | 11 ANNULUS GEAR opposite rotation | 17 REAR TORUS driving |
| 6 BAND AND CLUTCH released | 12 PLANET GEARS rolling | 18 FRONT TORUS driving |

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Neutral

The drive is transferred from the flywheel to the front train. The gears idle and no torque is transmitted to the output shaft (see Fig. 7).

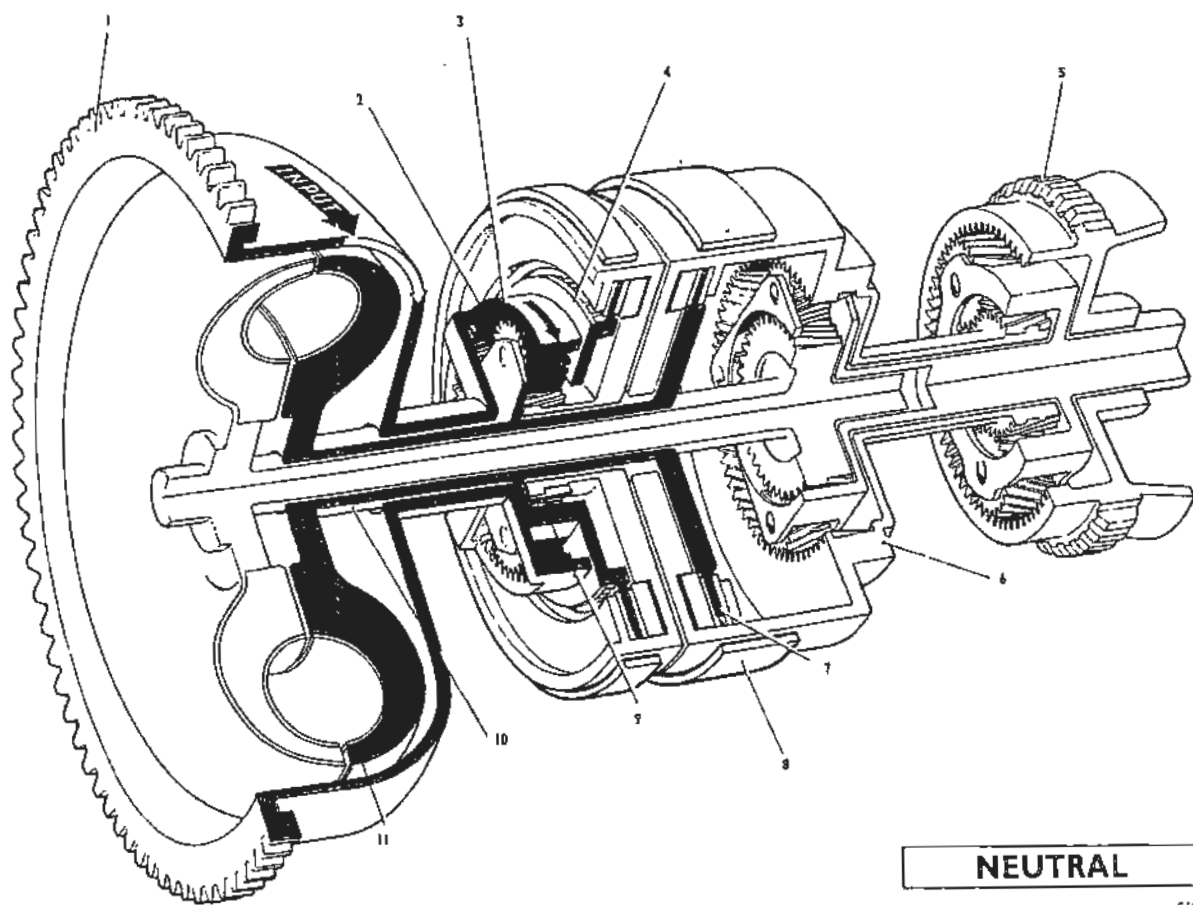


Fig. 7 Neutral

- | | | |
|--------------------------------|-------------------------------|-------------------------------------|
| 1 TORUS COVER <i>driving</i> | 5 REVERSE UNIT <i>idle</i> | 8 REAR BAND <i>released</i> |
| 2 ANNULUS GEAR <i>driving</i> | 6 ANNULUS GEAR <i>idle</i> | 9 SUN GEAR <i>idling</i> |
| 3 PLANET GEARS <i>rotating</i> | 7 REAR CLUTCH <i>released</i> | 10 INTERMEDIATE SHAFT <i>idling</i> |
| 4 PLANET CARRIER <i>idling</i> | | 11 REAR TORUS <i>idling</i> |

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SECTION 4 -- AUTOMATIC CONTROL

The automatic gear changes are controlled by hydraulic pressure, regulated according to road speed and accelerator position and directed through shift valve ports to the appropriate clutch and servo pistons. A pressure dependent upon engine power is obtained by connecting a hydraulic valve with the engine throttle. An indication of road speed is given by a governor controlling two hydraulic valves. The driver superimposes his requirements on the automatic control by means of a selector valve.

The oil flow to the servos and clutch pistons is controlled by three shift valve assemblies, each one positioned by governor and throttle pressures to control a gear change; the 1-2 shift assembly controls the gear change between first and second gear, the 2-3 valve assembly controls the change between second and third and the 3-4 valve assembly controls the three to four change. As each valve moves to change gear, ports are opened to permit main pressure to act on the appropriate clutch and servo pistons until in fourth gear all the shift valves have moved across (see Fig. 8). The process is reversed for the down change.

Oil pressure is generated by the two oil pumps, one driven by the input shaft and the other one by the output shaft, thus ensuring that oil pressure is available whenever the engine is running or the car is moving.

The two pumps draw oil from the gearbox sump through a common wire mesh scavenger filter and feed it at approximately 70 lb./sq. in. to 100 lb./sq. in., into a common outlet passage leading to a governor and to a manually operated selector valve unit. A spring-loaded non-return valve is interposed between the two pumps to prevent loss of oil when one pump is not working. Oil is also delivered to the fluid coupling and provides lubrication for the bearings of the gearbox, as explained later.

The governor, driven by the gearbox output shaft provides a signal of road speed in terms of oil pressure. It indicates two pressures which increase at different rates to provide accurate control at high and low road speeds. Oil from the governor is prevented from passing to the automatic control valve unit when the car is stationary, but when the car begins to move the centrifugal force of the governor weights causes valve ports

	FRONT BAND	FRONT CLUTCH	REAR BAND	REAR CLUTCH	REVERSE CLUTCH
Neutral	Off	Off	Off	Off	Off
Reverse	On	Off	Off	Off	On
1st Gear	On	Off	On	Off	Off
2nd Gear	Off	On	On	Off	Off
3rd Gear	On	Off	Off	On	Off
4th Gear	Off	On	Off	On	Off

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to open and oil is permitted to flow to the control valve unit at pressures increasing progressively with car speed.

In addition to the selector valve and the automatic control valves, the valve unit contains a throttle valve connected by rods and levers to the engine throttle; this provides a signal of engine power in terms of oil pressure. When the selector valve is in any of the drive positions, oil at pump pressure is directed to the throttle valve ports which are opened and closed with the throttle, thus providing an oil pressure which increases progressively with throttle opening.

This oil pressure is passed into the valve unit to oppose the force of governor pressure acting on each of the shift valve assemblies. These valves are therefore positioned to direct oil pressure to apply the lowest gear ratio when governor pressure is nil (road wheels not turning) and move to select higher gear ratios as the governor pressure increases and overcomes the opposing throttle pressure to move the shift valve. It will be seen also that lower gear ratios will be selected whenever increasing throttle opening causes throttle pressure to overcome governor pressure and move the valve the other way.

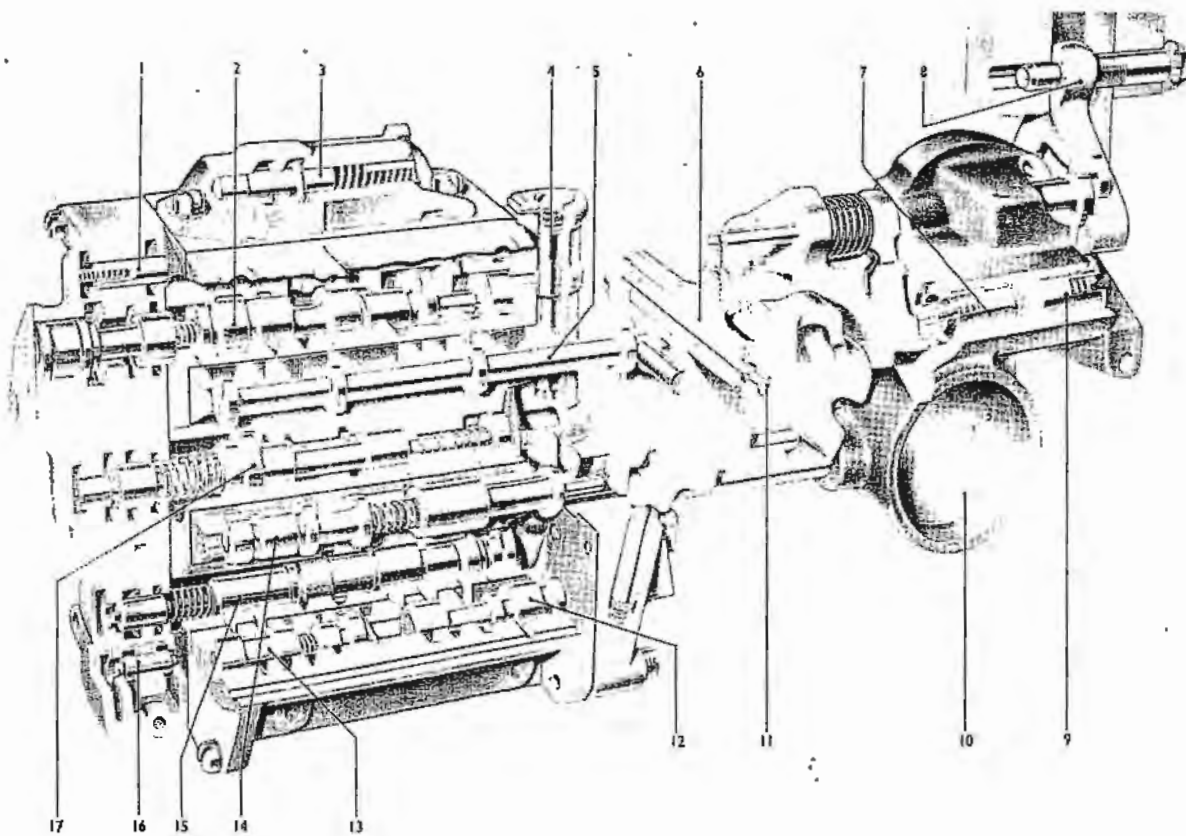


Fig. 8 Control valve assembly

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|-------------------------|--------------------------|--------------------------|
| 1 T.V. REGULATOR VALVE | 7 REVERSE BLOCKER PISTON | 12 TRANSITION VALVE |
| 2 2-3 SHIFT VALVE GROUP | 8 PARKING PAWL | 13 COMPENSATION VALVE |
| 3 3-2 TIMING VALVE | 9 PARKING BLOCKER PISTON | 14 THROTTLE VALVE GROUP |
| 4 OVERSPEED VALVE | 10 GOVERNOR SLEEVE | 15 3-4 SHIFT VALVE GROUP |
| 5 SELECTOR VALVE | 11 THROTTLE SHAFT | 16 3-4 SHUTTLE VALVE |
| 6 SELECTOR SHAFT | | 17 1-2 SHIFT VALVE GROUP |

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When selecting the gear ratios in the above manner, the shift valves are positioned to direct oil to the servos and clutches which engage or disengage the clutches and apply or release the friction bands in various combinations as shown in the table on Page 11. In addition, the hydraulic holding force of the friction bands is increased by compensator pressure as the torque increases.

These results are obtained by intermediate oil pressures which act on various relay, timing and locking valves and plugs, some of which are solely positioned

by oil pressure and others by oil and spring pressures.

The function of the oil pressures may be summarized as follows

The main pressure is applied through the shift valve ports to the clutch pistons and band servos, while the compensator pressure is applied direct to the band servos.

The throttle pressures act on the shift valves in opposition to governor pressures, the shift valves are therefore positioned to permit the main pressure to pass to the appropriate servo and clutch pistons.

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SECTION 5 — FLUID COUPLING

The fluid coupling torus is housed in a sealed cover secured to and rotating with the engine flywheel. As soon as the engine starts, an oil pump, driven from the shaft onto which the torus cover is splined, transfers oil from the gearbox sump into the torus cover, filling it completely.

Two torus members, located on separate shafts, rotate in the oil and are so shaped that oil is flung from the driving member into the vanes of the driven member. The reaction of this oil causes the driven member also to rotate although there is no mechanical connection between the two components. There is always a certain amount of slip between the two members but this becomes negligible at higher engine speeds. Note that it is the rear of the two components which is the driving member.

Turbulence of the fluid in the coupling is kept to a minimum by careful design of the torus members. These are fabricated from steel pressings with the vanes

located in slots and retained by tangs.

The generation of heat by fluid friction in the coupling is reduced by the provision of a circular flow path between the torus vanes and by the maintenance of a constant flow of oil through the coupling whenever the engine is running.

The fluid exhaust from the coupling passes through a relief valve between the main and the intermediate shafts and is returned to the gearbox to lubricate the bearings and clutches.

As the fluid in the coupling is under pressure both from pumps and from centrifugal force, great care must be taken in sealing the coupling chamber to prevent leakage. Good sealing is dependent upon the accuracy of the face joints and the close spacing of the bolts securing the torus cover to the flywheel and the flywheel to the crankshaft. The seal fitted between the torus cover and the front oil pump body must, of course, be in good condition.

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SECTION 6 — FRONT EPICYCLIC UNIT

The torus cover, bolted to the engine flywheel, is splined onto the tubular front drive-shaft which is integral with the front unit annulus gear (see Fig. 9); drive is therefore transferred direct from the engine to the annulus gear of the front epicyclic unit.

Four planet gears revolve inside the annulus, engaging also with a sun gear. The planet gears rotate on needle roller bearings and hardened pins riveted into a planet carrier integral with the front clutch hub and the hollow intermediate shaft. This shaft projects forward through the front drive shaft to support and drive the rear torus member, and rearward through the sun

gear to support and drive the clutch hub of the rear epicyclic unit. Splines and spring rings are used to drive and retain the various driven components on the shaft.

The epicyclic gear train is housed in the front drum, adjacent to the clutch pack. The sun gear of the train is integral with the clutch cover which is retained in the drum bore by a spring ring. In the clutch pack, the four lined (driving) plates are splined to the clutch hub and the steel (driven) plates are located by three pins pressed into the drum.

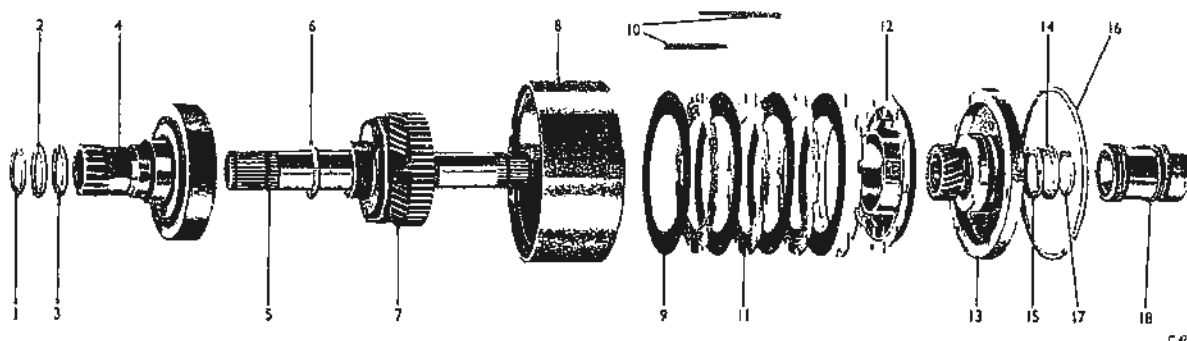


Fig. 9 Front epicyclic unit — exploded

- | | | |
|--------------------------------------|----------------------------------|--|
| 1 SNAP RING | 7 FRONT PLANET CARRIER | 13 CLUTCH COVER AND SUN GEAR WITH INNER SEAL |
| 2 BACKING WASHER | 8 FRONT DRUM | 14 BACKING WASHER |
| 3 THRUST WASHER | 9 DRIVING PLATE (4) | 15 THRUST WASHER |
| 4 FRONT DRIVE-SHAFT AND ANNULUS GEAR | 10 CLUTCH RETURN SPRING (6 SETS) | 16 SNAP RING—FRONT DRUM |
| 5 INTERMEDIATE SHAFT | 11 DRIVEN PLATE (4) | 17 SNAP RING |
| 6 THRUST WASHER | 12 CLUTCH PISTON AND SEAL | 18 DELIVERY SLEEVE AND RINGS |

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The clutch is engaged when the plates are compressed by the hydraulic application of an annular piston, located between the plates and the clutch cover. The clutch is released by the counter action of six concentric pairs of coil springs. The steel plates are perfectly flat but the friction plates are slightly corrugated to assist separation when the clutch is released. Leakage past the piston is prevented by two synthetic rubber seals; one on the clutch cover spigot and the other on the outer working surface of the piston.

The front friction band passes twice round the drum. A bracket on one end of the band abuts the band

adjusting screw while the other end contacts the operating rod of the hydraulic servo responsible for band application. The friction band comprises a spring steel strap to which the wear resisting lining is either bonded or riveted. The lining is ironed to obtain maximum bedding area on the outer surface of the drum. The face of the lining is grooved to assist lubrication of the band.

Direct drive through the unit is obtained when the band is released and the clutch is engaged. Conversely, when the band is applied and the clutch is released, the drive is transferred through the unit in a reduction of 1.45:1.

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SECTION 7 — REAR EPICYCLIC UNIT

The rear drum has eight flat steel plates and eight corrugated composition faced plates to transmit the torque and is fitted with guide pins inside the six pairs of clutch release springs. Earlier gearboxes fitted to 'SI' and 'R' type cars have only seven steel plates and seven composition plates in the rear drum. In addition to carrying the annulus gear for the rear epicyclic unit (see Fig. 10), the drum is drilled and tapped to take the flange which transmits the drive to the reverse epicyclic gear train.

The hollow intermediate shaft carrying the front and rear drums is supported in an oil delivery sleeve clamped in the centre web of the gearbox main casing by a cap secured by two setscrews.

Passing through the centre of the intermediate shaft is the mainshaft, on the end of which is the rear

unit sun gear. The forward end of the output shaft acts as the planet gear carrier for the rear epicyclic unit and in addition carries the spigot bearing which locates the rear end of the mainshaft.

The planet gears, which run on needle rollers and hardened pins riveted to the planet carrier, rotate inside the annulus gear on the rear drum which carries the driven clutch plates.

The clutch hub carrying the driving plates is splined to the hollow intermediate drive shaft, and the clutch is similar to the front one in operation, except that it locks the annulus gear and intermediate shaft together, preventing the planet gears from rotating.

The rear friction band is similar to the front one, except that it wraps once round the drum and is of double width to resist the higher torque.

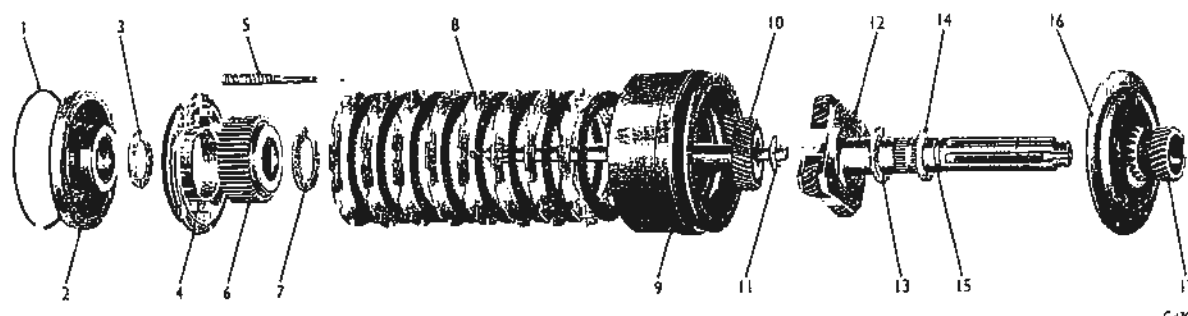


Fig. 10 Rear epicyclic unit — exploded

- | | | |
|---|-------------------------------|-----------------------------|
| 1 SNAP RING—REAR DRUM | 6 CLUTCH HUB | 11 ADJUSTABLE THRUST WASHER |
| 2 CLUTCH COVER AND INNER SEAL | 7 THRUST WASHER | 12 REAR UNIT PLANET GEARS |
| 3 THRUST WASHER | 8 CLUTCH PLATES (7 OR 8 SETS) | 13 THRUST WASHER |
| 4 CLUTCH PISTON AND OUTER SEAL | 9 REAR DRUM | 14 BACKING WASHER |
| 5 CLUTCH RETURN SPRINGS AND PINS (6 SETS) | 10 REAR UNIT SUN GEAR | 15 OUTPUT SHAFT |
| | | 16 REVERSE DRIVE FLANGE |
| | | 17 REVERSE SUN GEAR |

ROLLS-ROYCE AUTOMATIC GEARBOX

SECTION 8 — REVERSE EPICYCLIC UNIT

The reverse unit contains three planet gears only (see Fig. 11). They rotate on needle roller bearings and hardened pins riveted into a planet carrier which is splined onto the gearbox output shaft. As the rear unit planet carrier is integral with this shaft, the rear and reverse planet carriers rotate as one. The reverse planet carrier serves also to support the skew gear driving the rear pump and governor.

The reverse annulus gear is an integral part of the reverse clutch cone. The cone surfaces run between an

outer friction cone fitted to the gearbox rear casing and an inner cone which forms part of the clutch piston. The piston moves axially on four guide pins which prevent its rotation.

When Reverse is selected, hydraulic pressure drives the clutch piston forward to trap the reverse cone between the inner and outer friction rings, thus holding the reverse annulus gear stationary. At the same time, both the rear clutch and the rear band are released, allowing the drum to rotate freely.

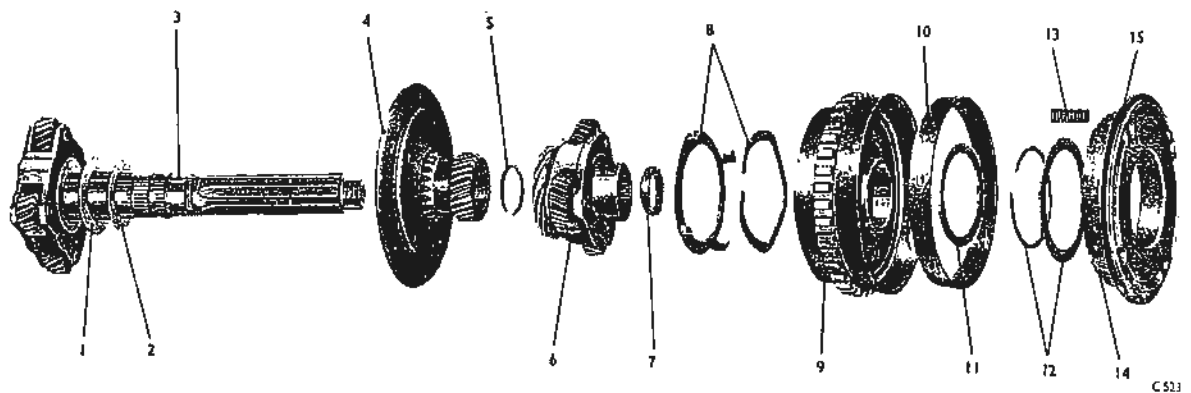


Fig. 11 Reverse epicyclic unit — exploded

- | | | |
|-------------------------------------|--------------------------------|----------------------------------|
| 1 THRUST WASHER | 6 REVERSE PLANET CARRIER | 11 THRUST WASHER |
| 2 BACKING WASHER | 7 SPACER | 12 SPRING RETAINER AND SNAP RING |
| 3 OUTPUT SHAFT | 8 CUSHIONING RING AND RETAINER | 13 CLUTCH RETURN SPRING (4) |
| 4 REVERSE DRIVE FLANGE AND SUN GEAR | 9 REVERSE ANNULUS GEAR | 14 REVERSE CLUTCH PISTON |
| 5 SNAP RING | 10 STATIONARY CONE | 15 PISTON OUTER SEAL |

ROLLS-ROYCE AUTOMATIC GEARBOX

As driving torque is applied to the rear sun gear, the planet gears are forced to revolve and drive the rear drum and reverse sun gear in the reverse direction to the applied torque. The reverse planet gears are thus forced to revolve around the stationary annulus to follow the rotating sun gear. The reverse epicyclic unit is therefore in reduction and the entire assembly of rear and reverse planet carriers and output shaft are driven in reverse.

The cone clutch is disengaged by six springs and oil leakage past the piston is prevented by annular seals.

If Reverse is selected when the engine is switched off, a spring-loaded pawl is caused to engage with a second (external) annulus gear on the reverse clutch cone. This has the effect of locking the transmission so that the car cannot move, even, for example, when parked on steep gradients. When the engine is running, main line pressure from the pump causes a parking

blocker piston to protrude from the parking bracket so as to prevent the pawl from moving into engagement with the parking lock annulus. Thus the pawl can only be engaged when Reverse is selected with the engine switched off.

In a similar manner, the reverse blocker piston is acted upon by governor pressure and forced to protrude from the parking bracket so as to prevent the selection of reverse gear when the car is moving forward at more than 8 m.p.h. to 10 m.p.h.

The gearbox output shaft is carried in a pair of ball bearings in the rear extension casing. On the output shaft is the skew gear which drives the speedometer and the road wheel brake servo, and finally, the driving flange for the propeller shaft universal joint. With 'R' series cars the front bearing is retained in the rear extension by a circlip and, apart from driving the brake servo, the servo drive supplies the means to drive the ride control unit.

ROLLS-ROYCE AUTOMATIC GEARBOX

SECTION 9 — BEARINGS AND THRUST WASHERS

The complete rotating assembly is carried in plain bearings at the front and centre, and in ball bearings at the rear. Axial thrust is transmitted by phosphor-bronze thrust washers, backed by steel washers.

The front plain bearings are between the front end of the intermediate shaft, the front annulus gear shaft and the front pump casing.

The centre plain bearing is also an oil delivery sleeve which supports the intermediate shaft between the front and rear drums. It also provides a bearing surface for the rear drum when in reduction. A spigot bearing in the front end of the output shaft supports the rear end of the main shaft; the output shaft also carries the reverse sun gear on the plain bearing.

The two ball bearings are housed in the rear extension.

Thrust washers are situated as follows

A pair of steel and phosphor-bronze washers between the rear torus hub and the end face of the front annulus gear shaft.

One phosphor-bronze washer between the hub of the planet gear carrier and the front annulus gear.

A pair of steel and phosphor-bronze washers between the front sun gear and planet gear carrier.

A pair of steel and phosphor-bronze washers behind the front unit sun gear bearing; these are retained on the intermediate shaft by a snap ring.

A phosphor-bronze washer on each side of the rear unit clutch hub.

A phosphor-bronze adjusting washer between the rear face of the rear unit sun gear and the front face of the rear unit planet carrier. This washer is to be selected to give the required mainshaft end float.

A pair of steel and phosphor-bronze washers between the rear unit planet carrier and the reverse drive flange.

ROLLS-ROYCE AUTOMATIC GEARBOX

SECTION 10 — BAND SERVO UNITS

The band servo units consist of cylinders in which an assembly of pistons move under hydraulic pressure to apply or release the friction bands on the drums of the epicyclic gear trains. Both servos incorporate valves which promote smoother gear changes by synchronising band application with clutch release under various conditions of road wheel torque.

Front servo

The body of the front servo comprises two cast iron casings and an aluminium alloy valve housing. The two casings form a cylinder which is divided into band apply and band release chambers by the ring seals of three pistons (see Fig. 12). The alloy valve housing contains the overrun control valve and the main line exhaust and non-return valves. A further valve, the

4-3 timing valve, is housed in the servo main casing. On early 'R' series cars the main line exhaust valve is fitted in the gearbox casing and not in the front servo.

The band apply effort is produced by the action of main pressure in the lowest chamber, augmented by compensator pressure in the centre chamber. During overrun, when the throttle is closed and compensator pressure is removed, there would be a tendency for the band to slip and cause 'hunting' between two gears. This is avoided as governor 1 pressure moves the overrun valve into position to release main pressure into the compensator chamber, thus increasing the piston area over which band apply main pressure is acting (see Fig. 13). As a result, the band is held firmly applied until the road speed has fallen so low as to enforce the down-change.

The 4-3 timing valve is provided to delay band application until the front clutch is released during the down-change. Whenever governor 1 pressure overcomes the main compensator pressures on the valve, the valve moves to close the direct band apply port and force the band apply pressure to by-pass the valve through a 0.055 in. restriction. As a result, band application is retarded and does not take place until the clutch releases.

Band apply main pressure is continuously applied in all forward ranges but band release is obtained when required (for second and fourth gears) by allowing main pressure to act over the larger total area of the band release pistons. Band release pressure thus overcomes band apply pressure and the band is released. A point of difference between 'S' series and 'R' series servos is that in early 'R' series servos, the oil feed passage between the band apply chambers contains a quick release valve which passes the oil acting on the large apply piston to exhaust when release oil is fed

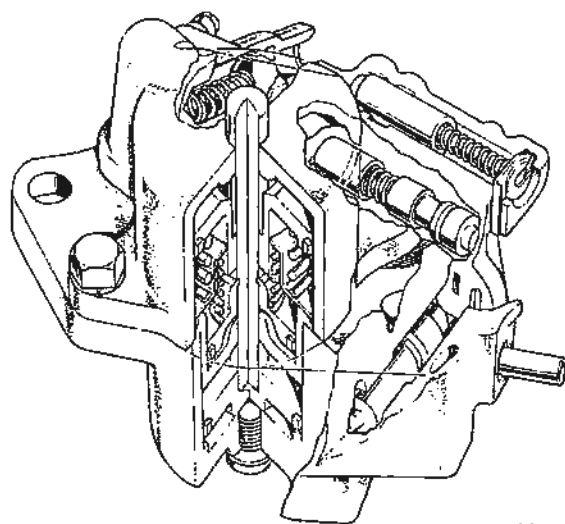


Fig. 12 Front servo

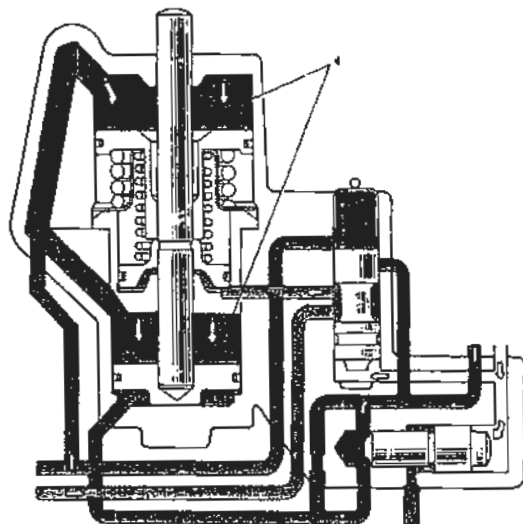
ROLLS-ROYCE AUTOMATIC GEARBOX

to the unit. Oil feeds from one apply chamber to the other via the hollow operating push rod (see Fig. 14).

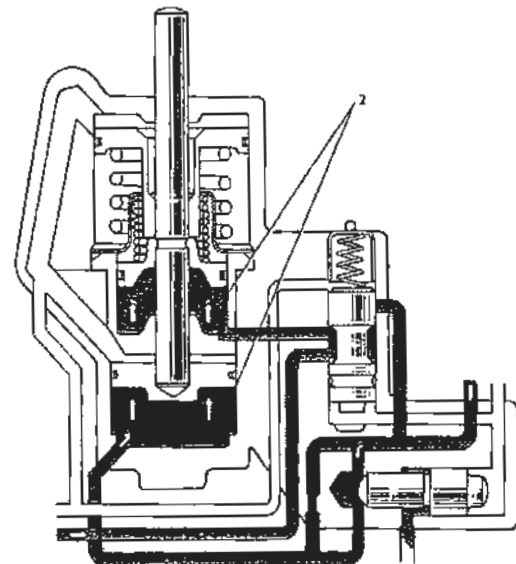
The front servo valve body is a convenient housing for the main line non-return and exhaust valves. The non-return valve is a simple ball and spring arrangement designed to prevent the front pump from discharging through the rear pump. The exhaust valve opens under light spring pressure to reduce the control pressures quickly by allowing oil in the servos and control valves to exhaust when pump delivery ceases.

- | | |
|-----------------------|-------------------------|
| 1 OVERRUN VALVE | 3 4-3 TIMING VALVE |
| 2 BAND APPLY CHAMBERS | 4 BAND RELEASE CHAMBERS |




Fig. 13 Front servo operation

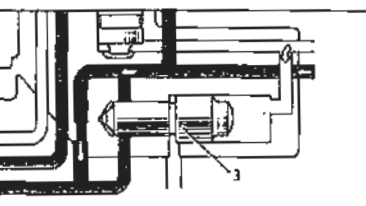


BAND RELEASING



BAND APPLYING

- | | |
|---|----------------------|
|  | MAIN PRESSURE |
|  | GOVERNOR PRESSURE |
|  | COMPENSATOR PRESSURE |

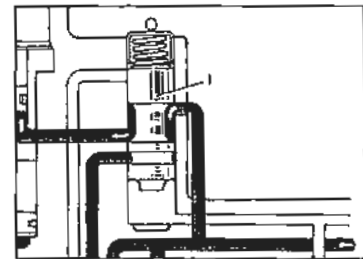


DELAYED BAND APPLY

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Rear servo

The rear servo (see Fig. 15) is larger than the front unit as the rear band has to be held against the greater torque transmitted by the rear epicyclic gear train. The servo is applied by a powerful pair of coil springs



INCREASED APPLY PRESSURE

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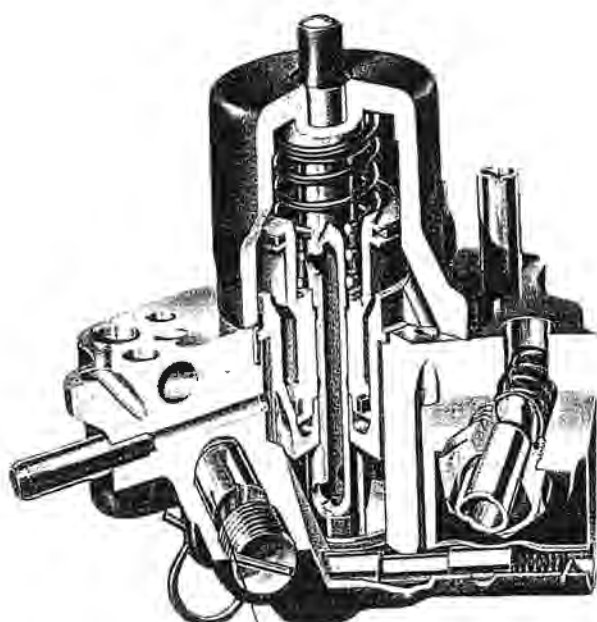
assisted hydraulically by compensator pressure; it is released hydraulically by main line pressure alone.

The body of the servo comprises two cylinders divided into compensator and band release chambers by three piston ring seals; the compensator chambers

are hydraulically connected through the hollow stem of the operating push rod.

The main band apply springs are retained by a sheet steel strap, the inner spring being contained within the concentric compensator cylinder.

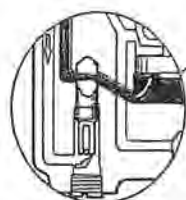
Two valves are housed in the servo body. A spring steel restrictor valve impedes the exhaust of oil from one of the release chambers, thus delaying band application. During band release, the valve lifts and allows unobstructed flow of oil back into the chamber. The second valve is operated by main pressure and it allows oil to by-pass the restrictor valve and promote rapid band application if required, for example, for a fast change from reverse to forward speed, during snow rocking. This valve is closed, however, by main pressure, in second gear and above except on early gearboxes when it functions only when range '2' is selected.



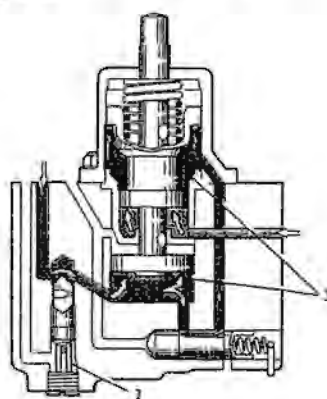
- 1 and 2 4-3 TIMING VALVE
3 BAND APPLY CHAMBERS
4 RELEASE CHAMBER

- 5 COMPENSATOR CHAMBER
6 RELEASE SPRING
7 QUICK RELEASE VALVE

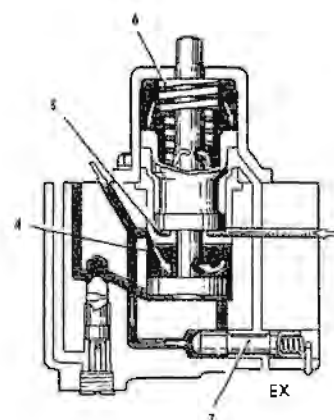
Fig. 14 Front servo operation 'R' Series



DELAYED
BAND-APPLY



BAND APPLYING



BAND RELEASING

c 741

- MAIN PRESSURE
□ GOVERNOR PRESSURE
■ COMPENSATOR PRESSURE

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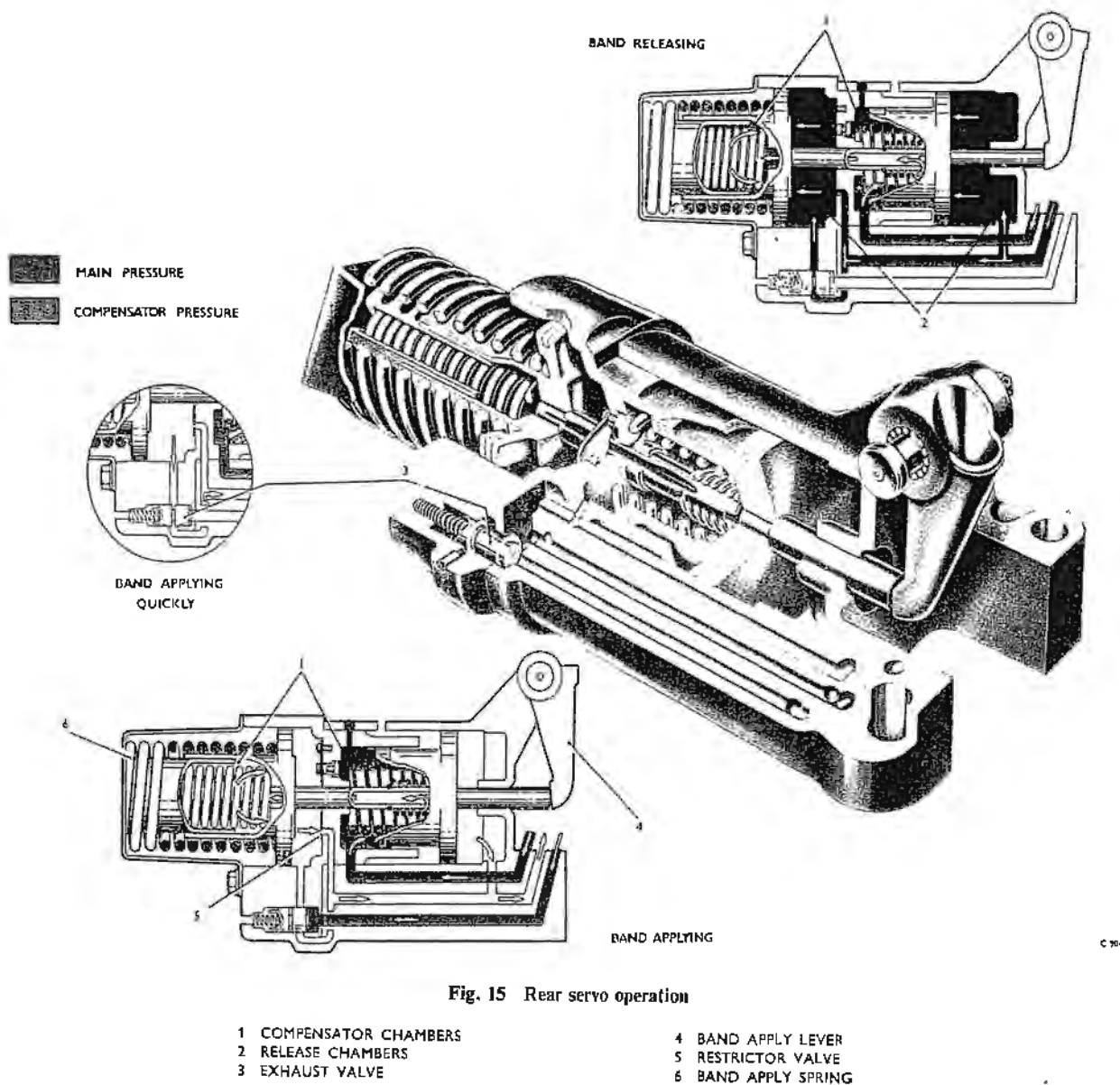


Fig. 15 Rear servo operation

- 1 COMPENSATOR CHAMBERS
- 2 RELEASE CHAMBERS
- 3 EXHAUST VALVE

- 4 BAND APPLY LEVER
- 5 RESTRICTOR VALVE
- 6 BAND APPLY SPRING

On later gearboxes compensator pressure is taken from this servo at a point in its release stroke, to act

on the 4-3 valve in the front servo as previously explained.

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SECTION 11 — FRONT OIL PUMP

The front pump is mounted in the front of the gearbox, concentric with the mainshaft. The pump rotor is keyed to the front drive shaft and rotates with it. The pump body is located by a dowel washer on one of the setscrews which secure the pump to the gearbox casing.

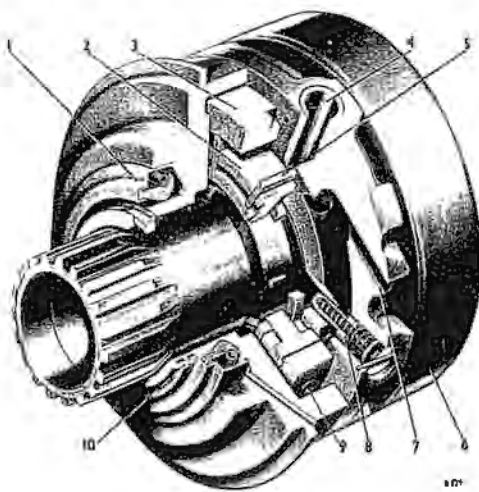


Fig. 16 Front pump

- | | |
|-------------------------------|--------------------------------------|
| 1 OIL SEAL | 6 DRIVE SHAFT AND FRONT ANNULUS GEAR |
| 2 ROTOR | 7 OUTLET |
| 3 SLIDE | 8 RELIEF VALVE |
| 4 PRESSURE CONTROL VALVE PORT | 9 PRIMING SPRINGS |
| 5 VANE | 10 PISTON-RING TYPE SEALS |

The rotor carries seven sliding vanes which contact the inner diameter of a variable delivery slide (see Fig. 16). The slide can move diametrically across the rotor, from a position of maximum eccentricity on one side to the corresponding position on the opposite side. This movement progressively changes the oil eccentricity space between the rotor and slide, thus controlling the pump delivery. Maximum delivery is obtained on full eccentricity, reducing to zero as the slide moves towards the concentric point; opposite eccentricity causes the pump to return oil from the rear pump to the gearbox sump. The slide position thus controls the delivery from both front and rear pumps.

A concentric pair of coil springs holds the slide in the maximum delivery position in order to prime the pump rapidly on starting. According to the demands of the hydraulic system, a pressure control valve varies the oil flow through ports directing pressure to the outer surfaces of the slide, so moving it into the delivery position required.

The controlling forces in the pressure control valve are pump output (main) pressure and throttle pressure. Main pressure action on the spring-loaded valve tends to reduce pump delivery, while T.V. pressure assists the spring in opposing main pressure and increasing pump delivery. T.V. pressure thus causes pump output to increase with increased throttle openings.

ROLLS-ROYCE AUTOMATIC GEARBOX

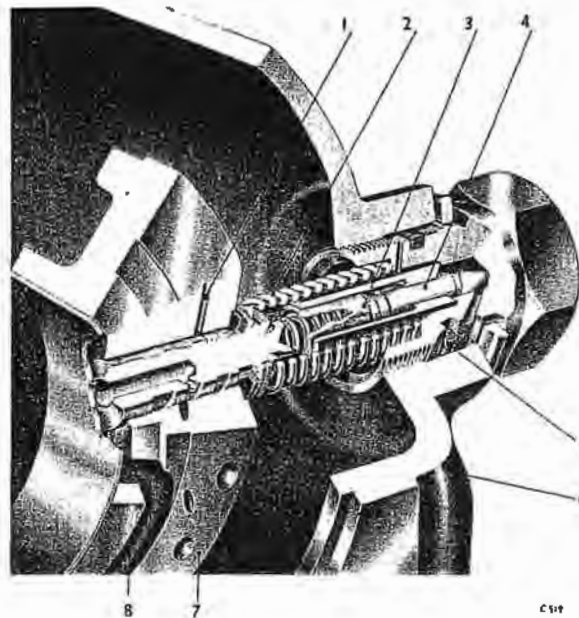


Fig. 17 Pressure control valve

- | | |
|-----------------------------|---------------------|
| 1 OIL PASSAGE TO PUMP SLIDE | 5 SEALING RING |
| 2 RETURN SPRING | 6 GEARBOX CASING |
| 3 REVERSE BOOSTER PLUG | 7 PUMP CASING |
| 4 T.V. OIL REGULATOR PLUG | 8 OIL DELIVERY DUCT |

When Reverse is selected, additional pressure is required to hold on the reverse cone clutch, and this pressure is directed to act on the reverse booster plug (see Fig. 17), thus overtaking T.V. pressure and boosting pump delivery pressure to a level sufficient to hold the reverse clutch firmly engaged. A relief valve is fitted to the pump to fix a maximum limit on the pressure in the system.

The pump draws oil from the gearbox sump through a fine gauze filter and delivers it to the valve housing of the front servo. Here it is joined by delivery from the rear pump through a non-return ball valve. This valve prevents the front pump from discharging through the rear pump, although a small bleed bypasses the valve to allow the front pump to maintain oil in the rear pump and pipe when the car is stationary or in reverse gear.

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SECTION 12 — REAR OIL PUMP AND GOVERNOR

The rear pump and governor (see Fig. 18) are mounted on a shaft driven by a bronze skew gear on the reverse planet gear carrier. The shaft is split and incorporates a spring drive between the steel driven gear and the pump gears, to suppress pump noise. 'R' type and early S1 rear pumps were not fitted with a spring drive, the rear pump having a solid drive between gears.

The pump consists of a small gear, meshing with a

larger annulus gear which itself rotates in the pump casing. The inlet and outlet ports are separated by a crescent shaped projection of the pump casing which also forms a seal between the periphery of both gears. Oil is carried in sealed pockets between the gear teeth from the inlet to the outlet port.

A flat plate secured by four screws seals the chamber. Oil is drawn through an inlet pipe which projects into the sump filter and is delivered through a pipe to the front servo.

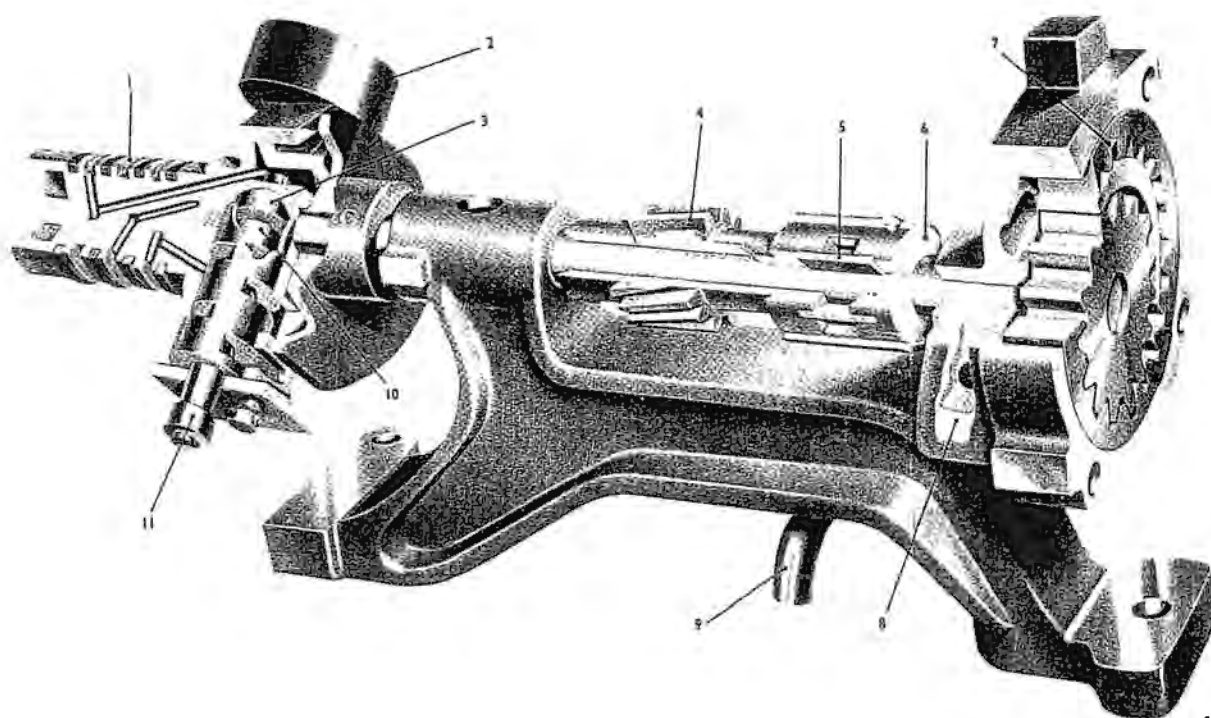


Fig. 18 Rear pump and governor

- | | | |
|---------------------------|-----------------|------------------|
| 1. PISTON-RING TYPE SEALS | 5. DRIVE VANE | 8. DELIVERY PORT |
| 2. G1 WEIGHT | 6. DRIVING DOG | 9. INTAKE PIPE |
| 3. G1 VALVE | 7. ANNULUS GEAR | 10. G2 VALVE |
| 4. DRIVEN GEAR | | 11. G2 WEIGHT |

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The governor consists of a small casting bolted to a flange which is pinned to the oil pump drive shaft. Oil is fed to the casting through a stationary sleeve, which is a close fit around three annular grooves, these are sealed from each other by four piston-ring type seals. From the annular grooves the oil flows through drillings to ports controlled by two valves and operated by governor weights.

The valves are balanced by metered oil pressure tending to hold them in, and centrifugal force trying to

move them out. Each valve attains equilibrium when the centrifugal force equals the pressure holding it in, and as one governor weight is heavier than the other, the governor delivers two pressures both of which are functions of road speed. Oil at these pressures, termed G1 and G2, flows through drillings in the sleeve to pipes leading to the control valve unit. G1 pressure builds up more quickly with speed than G2 pressure, because the G1 governor weight is the heavier of the two.

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SECTION 13 — CONTROL LINKAGE

The drive selector lever on the steering column has five positions marked 'N', '4', '3', '2' and 'R'. It is connected to the gearbox selector lever by a system of rods and levers, connected by ball joints and clevis pins, as also is the accelerator pedal to the gearbox throttle valve.

As the engine and gearbox unit is flexibly mounted a method of preventing relative movement interfering with the controls is necessary.

Various methods are used and are briefly explained in the following paragraphs.

The early 'R' type has a swinging link or trapeze secured to the steering column and carries a shaft to which both the throttle and selector levers are mounted. This swinging link is positioned by the use of two rods connecting the selector lever with its intermediate lever. Accelerator pedal movement is transferred to the engine by means of a cross-shaft mounted on the bulkhead.

Control arrangement for later 'R' type and 'S1' types differ from the early model in that the control cross-shaft is not mounted on the bulkhead, but runs through the gearbox bell housing. This is fitted on both left and right-hand cars and eliminates the swinging link on the steering column.

'S2' and 'S3' cars are again slightly different, right-hand drive cars having the throttle control shaft bolted

to the underside of the body and the gear selector cross-shaft located on the chassis frame at one side and by a swinging link attached to the bell housing bottom cover at the other side.

On left-hand drive cars all the controls are on the left-hand side of the car; the swinging link pivots on a bracket secured to the frame. Gearbox control levers are mounted on concentric control shafts which pass through oil seals in the gearbox side cover and through a bearing integral with the control valve unit. The levers are splined to their respective shafts and can be fitted in one position only (see Fig. 53, Chapter 3—Overhaul).

The outer shaft operates the selector valve by means of a pin engaging in a groove in the end of the valve.

Selector positions are determined by a spring loaded plunger engaging with notches in a plate which is integral with the lever shaft. Projections on the plate contact a blade which moves a cam to engage or disengage the parking pawl when the selector lever is moved into or out of reverse. The blade is spring-loaded to permit the pawl to be held out of engagement by the parking blocker piston.

The lever on the inner shaft varies the throttle valve pressure by acting on the stem of the valve, compressing the throttle valve spring in the control valve unit.

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SECTION 14 — OIL CIRCULATION

Oil for the fluid coupling, the hydraulic servo system and gearbox lubrication is supplied from the sump which is filled through a filler neck on the right-hand side of the gearbox. The oil is drawn through a gauze filter in the sump by the two pumps as previously described. The flow to the fluid coupling passes forward through the annular space between the front drive

shaft and the pump body, into the fluid coupling. When the coupling has filled with oil, a relief valve opens to permit a flow between the main and intermediate drive shafts to lubricate the bearings, and through holes drilled in the shafts to lubricate the clutches, gears, splines and thrust washers of the rotating assemblies (see Fig. 19).

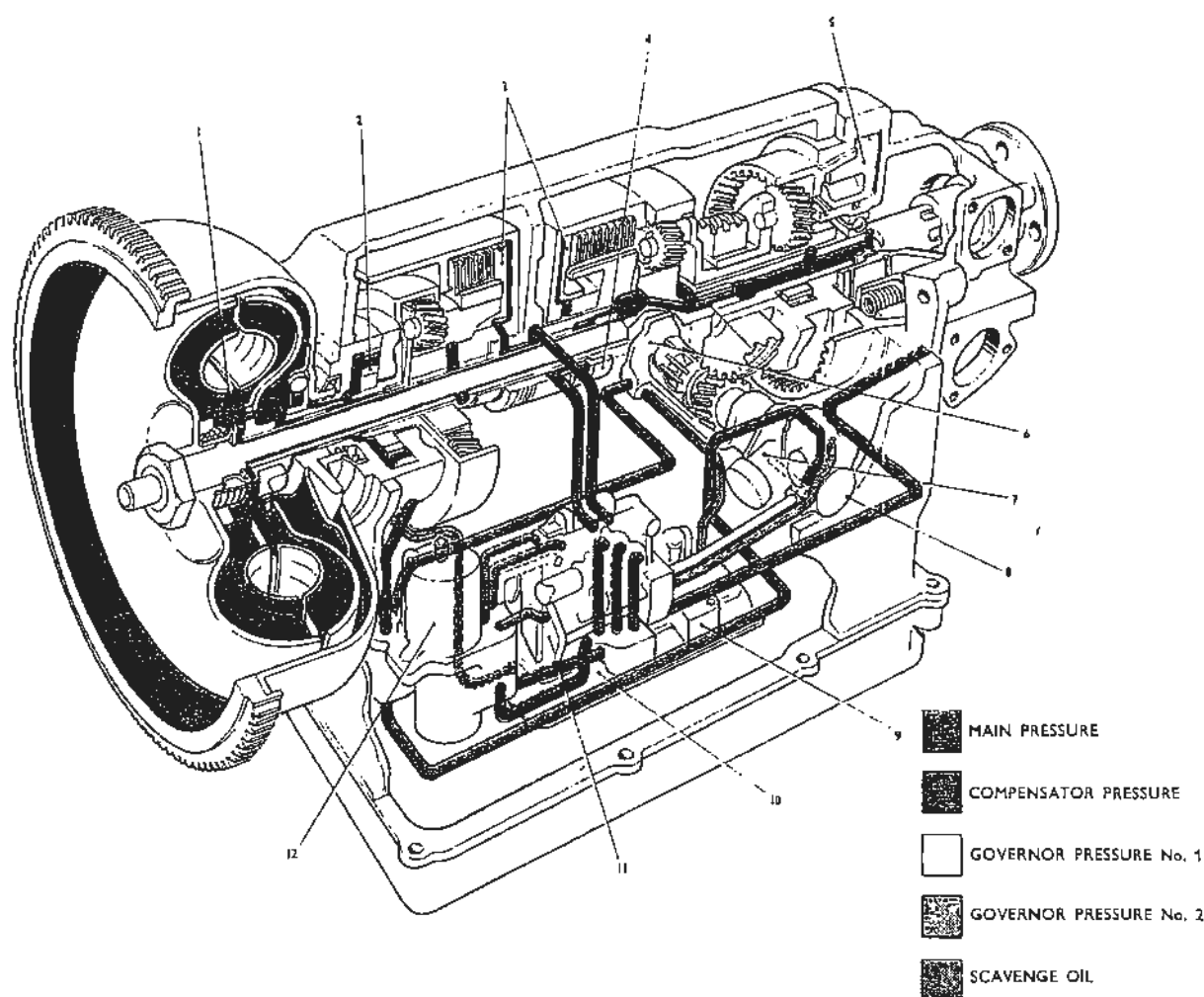


Fig. 19 Oil circulation diagram

- 1 CHECK VALVE
- 2 FRONT PUMP
- 3 CLUTCH PISTONS

- 4 OIL DELIVERY SLEEVE
- 5 REVERSE PISTON
- 6 REAR PUMP

- 7 GOVERNOR
- 8 GOVERNOR SLEEVE
- 9 REAR SERVO

- 10 FILTER
- 11 CONTROL VALVE UNIT
- 12 FRONT SERVO

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Pipes carry the oil from both pumps to the casing of the front servo unit from where it passes through drillings in the main casing to the control valve assembly, then back to operate the servo pistons. The oil feed to the governor is through drillings in the casing; the governor pressures pass from the governor sleeve to the control valve assembly through the two straight oil pipes.

The annular spaces in the governor sleeve are sealed from each other by piston-ring type oil seals.

The oil flow from the control valve assembly passes through drillings in the main casing to the front and rear servo units and to an oil delivery sleeve on the intermediate shaft between the front and rear drums. This sleeve forms the centre plain bearing and is located in the centre web of the main casing by a dowel in the bearing cap. Oil passes through the delivery sleeve to the front and rear clutches; oil leakage is prevented by piston-ring type oil seals.

The oil to the reverse clutch passes through a pipe and drillings in the rear casing.

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SECTION 15 -- CONTROL PRESSURES

Main pressure, obtained direct from the two oil pumps, is used to operate all the servo pistons and to supply oil for conversion to lower controlling pressures by the governor and control valves.

Compensator pressure is obtained by metering main pressure through ports controlled by a compensator valve, spring and auxiliary valve. This pressure is lower than pump pressure and is directed to the front and rear band servos to increase the holding force as driving torque increases.

Throttle valve (T.V.) pressure, obtained as already described, acts on the compensator valve to regulate the compensator pressure in accordance with throttle opening.

T.V. oil is metered past the T.V. regulator valve to act on the shift valves and also to the regulator plugs which controls the ports permitting pressure to act on

the shift valves. The regulator plugs lock the shift valves in gear after an up or down change and so prevent 'hunting'.

Governor pressure No. 1 (G1), obtained by metering oil past the valve controlled by the larger governor weight, is directed to the 3-4 shift valve, overrun valve 3-4 overspeed valve, 1-2 shift valve, 2-3 G1 plug, reverse blocker piston and the 4-3 timing valve in the front servo.

The high rate of pressure increase, caused by the large governor weight, gives accurate control at low road speeds.

Governor pressure No. 2 (G2), obtained by metering oil past the valve controlled by a small governor weight, is directed to the 2-3 auxiliary valve, the 3-4 overspeed valve and the 3-4 governor plug.

The rate of G2 pressure increase is greatest at high road speed, G1 pressure having reached its maximum.



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SECTION 16 — VALVE OPERATION

The position of the shift valves in range four—first gear, and the different oil passages used to obtain this gear are shown in Figure 20. A detailed description of the operation of the valves in selecting each gear is described in the following paragraphs.

FIRST GEAR

Range 4 part throttle

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

Road speed would be low, therefore governor pressure would be low.

The T valve would be slightly open and consequently the throttle valve would be slightly open, allowing main pressure to bleed past the throttle valve to form T.V. pressure. This pressure is regulated by the T.V. regulator valve.

T.V. pressure lifts the T.V. regulator valve against its spring and bleeds past the valve to assist the springs in holding closed the shift valves. T.V. pressure acting on the regulator plug assists the pressure control valve in regulating the front pump capacity to maintain the pump pressure at a controlled amount above T.V. pressure. Acting on the compensator valve, T.V. pressure moves it against its spring so that it opens to allow main oil pressure to bleed past to form compensator pressure.

Compensator pressure assists main pressure in the front servo in holding the front band 'on'; it also assists the rear servo springs to hold the rear band 'on'. Compensator pressure also moves the transition valve, but this is not important in first gear, as front clutch 'apply' oil is fed past the compensator valve and this is not applied until second gear. Both gear trains are then in reduction and the gearbox transmits torque in first gear ratio 3.82:1.

SECOND GEAR

Range 4 part throttle

If the manual selector valve remains in '4' range position, main oil pressure would still be fed to the front servo 'apply' chambers. However, as will be seen later, main pressure is also fed to the front servo 'release' chambers and acting over the larger area of the 'release' pistons, forces main 'apply' oil to exhaust.

The throttle valve remains slightly open and so the throttle pressures remain low.

When the road speed increases, G1 pressure becomes important, and G1 pressure acting on the 1-2 shift valve eventually overcomes the T.V. pressure and moves the 1-2 shift valve group into the second gear position. T.V. pressure on this group is then cut off by the 1-2 regulator valve and the existing T.V. oil forced to exhaust.

Compensator oil would remain high enough to keep the transition valve open. This was unimportant in first gear, but the movement of the 1-2 shift valve opens a port which allows main pressure to flow past the open transition valve to engage the front clutch and to release the front band.

The rear servo remains applied, assisted by compensator pressure, therefore the rear gear train will be in reduction. As the front gear train would then be in direct drive (clutch on, band off), the gearbox transmits torque in the ratio 2.63:1 i.e.—has changed to second gear.

Down-change

The 2-1 down-change occurs automatically only at extremely low road speeds. When G1 pressure falls below a minimum value the action of T.V. pressure on the 1-2 regulator valve and the action of the coil spring on the 1-2 shift valve moves the 1-2 shift valve back against the reduced G1 pressure and holds the

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valve group in the first gear position.

The main pressure feed is then cut off, therefore the front clutch is released by its springs and the front band is applied by the main pressure feed from the manual selector valve. The gearbox thus changes down to first gear.

THIRD GEAR

Range 4 part throttle

With the main selector still in '4' range position, main oil will still flow directly to the front servo and if band release pressure is exhausted from the servo, the front band will be applied.

With the throttle valve remaining only slightly open, throttle and compensator pressures remain low.

Road speed will increase in second gear, and as a result G1 pressure will approach its maximum value whilst G2 pressure becomes more effective.

When the speed, and thus the governor pressures become high enough, the combined action of T1 and G2 pressures on the 2-3 shift valve group overcomes the opposing spring and T.V. pressure and the shift valve group is forced to move.

As the 2-3 shift valve moves, a port is opened which allows main pressure to flow past the 3-2 timing valve to engage the rear clutch and release the rear friction band.

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

When the transition valve closes, the port, which supplied pressure for front clutch 'apply' and front band 'release', is sealed. As a result, the front clutch is released by its springs and the front band is applied by the main line feed from the manual selector valve. The front gear train is then in reduction (band on, clutch off), and the rear train is in direct drive (band off, clutch on).

The gearbox will therefore transmit torque in the ratio 1.45:1, i.e.—has changed to third gear.

Down-change

If road speed is allowed to fall, governor pressure will decrease accordingly. G2 pressure is particularly sensitive to changes in speed and if it is allowed to fall below a minimum value, the combined action of coil spring and T.V. pressure will force the 2-3 shift valve back into the second gear position.

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

Note: The 3-2 timing valve is effective only during full throttle down-changes as described on Page 41.

FOURTH GEAR

Range 4 part throttle

The manual selector valve remains in '4' range position and so main pressure is still fed to the front servo 'apply' chambers. However, as was seen in second gear, main pressure will also be fed to the 'release' chambers of the servo, and, acting over the larger piston areas, will cause the front band to release.

The throttle valve remains only slightly open and so throttle and compensator pressures remain low.

Due to increasing road speed in third gear, G1 pressure will reach a maximum, and G2 pressure assume a greater importance. When sufficiently high, the combined action of G1 and G2 pressures on the 3-4 shift valve group overcomes the opposing spring tension and T.V. pressure, and the shift group is forced to move.

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

The front gear train will then be in direct drive (clutch on, band off), therefore as the rear train has remained in direct drive from third gear, the gearbox transmits torque directly, ratio 1:1, i.e.—has changed to fourth gear.

Down-change

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

When G2 pressure is sufficiently low, the combined action of T.V. pressure on the 3-4 regulator valve and coil spring tension on the 3-4 shift valve forces the 3-4 shift valve group to move. As soon as the regulator valve moves, a port is opened which allows T.V. pressure to act directly on the 3-4 shift valve, forcing the valve into the third gear position.

The flow of main pressure past the shift valve is thus stopped, removing the pressure from the front clutch

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and servo. The front clutch is then released by its springs and the front servo is applied by main pressure from the selector valve. As the rear clutch and band remain unaffected, the gearbox reverts to third gear.

4-3 Timing valve

To prevent the front band from slipping when high torque is transmitted during the 4-3 down-change, the 4-3 timing valve in the front servo closes one main band 'apply' port and forces band 'apply' oil to meter through a restricted by-pass channel. This has the effect of delaying front band application until the front clutch has released.

Forced down-change

A forced down-change can be obtained by fully opening the throttle and then exerting slightly greater force on the accelerator pedal. This forces the throttle valve assembly to the end of its travel where the T valve uncovers a port, permitting oil at main pressure to flow through a non-return valve and bleed past the T.V. regulator valve to increase T.V. pressure to approximately the same value as main pressure, and to act in opposition to governor pressures on the lock valves. Oil at main pressure acts on the 2-3 detent plug and also passes through a port partially covered by the 3-4 regulator valve which is forced over to cut off T.V. pressure and substitute main pressure on the 3-4 shift valve. The cushion of resistance felt on the accelerator pedal is provided by T.V. pressure acting on the end of the throttle valve assembly.

Subsequent valve operation will depend on the road speed; if this is below 72 m.p.h. the 3-4 shift valve will change down to third gear and maintain it until approximately 78 m.p.h. to 80 m.p.h. when an up-change will occur through the action of the overspeed valve in increasing the pressure acting on the 3-4 governor plug. This action is achieved by the increased G2 pressure acting on the overspeed valve and moving

it against its spring to uncover a port which allows G1 pressure to substitute for G2 pressure and so increase the pressure on the 3-4 governor plug and move the 3-4 shift valve assembly over. If the road speed is below 38 m.p.h. the 3-2 detent plug is moved against its spring pressure towards the 2-3 shift valve and uncovers a port which permits main pressure to act on the transition valve and the 3-2 timing valve; the 3-2 detent plug and 2-3 shift valve will then move to change down into second gear.

If below 20 m.p.h. a change to first gear will occur.

A feature of the 3-2 change is the operation of the 3-2 timing valve which delays the application of the rear band and disengagement of the rear clutch until the front clutch is applied. The main pressure acting on the end of the 3-2 timing valve moves it to close the unrestricted passage; the discharge to exhaust of the rear servo must, therefore, pass through the restriction, thus delaying rear band application and rear clutch release, until movement of the transition valve permits main pressure to act on the front servo release piston and the front clutch engage piston. This pressure is also passed to the 3-2 timing valve to uncover the unrestricted passage thus speeding up the final application of the rear band. Up-change to third gear will not occur until approximately 35 m.p.h. because of main pressure on the 3-2 detent plug instead of T.V. pressure acting on the 2-3 shift valve.

If the road speed is below 20 m.p.h. the 1-2 shift valve assembly will operate to change down, and the subsequent up-change will occur at a slightly higher speed than normal due to pump pressure acting on the 1-2 detent plug and the higher T.V. pressure acting on the 1-2 regulator plug.

The change points given in the above paragraphs are for S3 cars. Earlier models have slightly different change points, as does the Bentley Continental range. A chart showing the variations between the different models is given in 'Chapter 2—Servicing'.

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SECTION 17—SELECTOR POSITIONS

Valve movement in the following selector positions is similar in principal to that described in 'Section 16 — Valve Operation'.

Range 3

When range '3' is selected, main pressure is directed to the 3-4 shift valve via the 3-4 shuttle valve and the 3-4 regulator valve plug, where it assists T.V. pressure in holding the 3-4 shift valve in the third gear position. Main oil pressure is also directed to the 3-4 governor plug where it resists governor pressure and prevents an up-change to fourth gear except at high speed.

The up-change to fourth gear requires the operation of the overspeed valve. If the car is driven at about 78 m.p.h. to 80 m.p.h. with full throttle, G2 pressure lifts the overspeed valve and substitutes G1 pressure for G2 pressure, thus increasing the thrust on the 3-4 governor plug and forcing the shift valve to change to fourth gear.

The 2-3 valve works in the same way in range '3' as in range '4,' the up and down change points being the same in either selector position.

Range 2

When range '2' is selected, main pressure is directed to oppose governor pressure acting on the 2-3 governor plug, locking the 2-3 valve group in the low speed position to prevent the gearbox from changing up beyond second gear. Main pressure is also directed to 1-2 detent plug, which moves the 1-2 shift valve group, against spring and T.V. pressure, to prevent the gearbox changing down to first gear.

Reverse

When the selector lever is moved into the reverse position, main pressure is directed to the rear band release piston, the compensator valve and the reverse cone clutch. It also acts on the reverse plug in the pump

pressure control valve and raises main pressure to about 195 lb./sq. in. which ensures that the rear clutch is engaged quickly and securely. The main pressure acting on the compensator valve shuts off compensator pressure and this, together with use of a clutch to engage Reverse, permits instant change from forward to reverse drive and back again when necessary, but a safety blocker piston, operated by governor pressure, prevents Reverse from being selected at more than 8 m.p.h. to 10 m.p.h.

Parking

When parking the car, the transmission can be locked by engaging Reverse. This locks the gearbox by a spring-loaded pawl which engages with teeth around the outer diameter of the reverse annulus gear. The parking pawl is disengaged when Neutral is selected for the engine to be started. It cannot then be re-engaged when the engine is running or when the car is moving because, oil pressure from either of the pumps, will cause a parking blocker piston to emerge and hold the pawl out of engagement. When the pumps stop, the main exhaust valve allows the pressure to drop immediately, so retracting the blocker piston and allowing the parking pawl to engage when Reverse is selected.

Neutral

When the selector lever is moved into the neutral position it disengages the parking pawl; starting the engine causes the front pump to build up oil pressure. The rear band is released by oil pressures acting on the servo spring; the front servo and front clutch remain released (no oil pressure) therefore the drive is disconnected in both front and rear epicyclic units.

Slight drag on the bands and clutches may transmit a small amount of torque through the fluid coupling to the road wheels, but this is negligible when the bands are thoroughly bedded in.

CHAPTER 2

SERVICING

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CHAPTER 2

SERVICING

SECTION 1 — PERIODIC MAINTENANCE

Careful and regular maintenance is necessary to ensure maximum reliability; the table below gives the recommended periods.

Cleanliness is vital, as the smallest particle of dirt in the oil may interfere with the correct operation of the hydraulic valves in the gearbox.

It is recommended that all work on the automatic gearbox whether it be periodic servicing or the rectification of a suspected fault, should follow the systematic procedure outlined below.

- 1 Check gearbox oil level.
- 2 Check for oil leaks.
- 3 Lubricate control joints.
- 4 Ascertain that the engine is correctly tuned, then test change points and for slip and noise.

If any faults are discovered, further checks may be necessary to assist diagnosis. The checks to be made will depend on the symptoms but with the majority of faults, checks should be made in the following order

- 1 Check control linkage.
- 2 Check oil pressure.
- 3 Check band adjustment.
- 4 Partially dismantle to isolate faulty unit by air pressure check.

Warning

To check the gearbox with the engine running and the car stationary, **do not** move the selector lever from Neutral unless the hand brake is fully applied or the rear wheels are jacked up clear of the ground. This is particularly important if the engine is running faster than the correct 'hot' idling r.p.m. Chock the wheels and use the foot brake when using high engine r.p.m.

SERVICING PERIODS

MAINTENANCE	PERIOD
Check oil level first 3,000 then	Every 6,000 miles
Check for leaks first 3,000 then	
Lubricate control linkage	
Road test to check gear changes	
Drain transmission and refill with new fluid	Every 24,000 miles
Clean oil breather in top of dipstick	

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Oil level — To check

The oil level can be checked accurately only when the engine is running and the gearbox has warmed up to its correct operating temperature.

If the oil level is near or below the 'L' mark on the dipstick, top-up to the 'F' mark while the engine is still running and check for oil leakage as described under 'To check for leaks'.

The following transmission fluids are recommended for topping-up the Rolls-Royce automatic gearbox in service and for use when refilling the gearbox in accordance with the Service Maintenance Schedules.

B.P.	..	..	Energol ATF Type A.
Castrol	..	..	Castrol TQ.
Esso	..	..	Esso Automatic Transmission Fluid.
Mobil	..	..	Mobilfluid 200.
Shell	..	..	Donax T6.

Automatic Transmission Fluid WA-389 should be considered as an 'initial fill' fluid only and should be used in all new and reconditioned gearboxes.

Quantities of this oil are supplied with each new or reconditioned gearbox supplied by the Rolls-Royce Spares Department. At the first oil change (normally 24,000 miles) any one of the above recommended fluids can be used.



Fig. 21 Checking the oil level

1 BAND ADJUSTMENT ACCESS PLATE

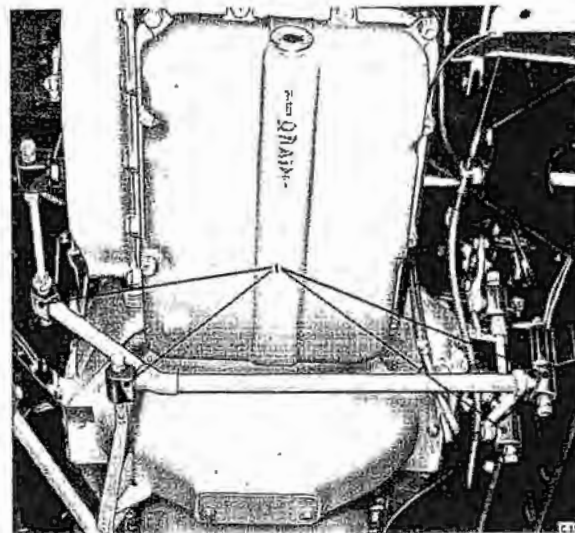


Fig. 22 Selector cross shaft disconnecting points

1 DISCONNECTING POINTS

Transmission Fluid WA-389 can be used for topping-up and refilling in service but this fluid will be available for this purpose only at Rolls-Royce Service Stations at Crewe and Willesden.

The recommended procedure for topping-up is as follows

- 1 Select 'N', ensure that the hand brake is applied, then start the engine and run at idling speed to warm up the transmission.
- 2 Whilst the transmission is warming up, remove the dipstick access cover and thoroughly clean around the dipstick.
- 3 Remove and clean the dipstick before checking the oil level (see Fig. 21).
- 4 If topping-up is necessary, pour in the correct oil in small quantities checking frequently to ensure that the level does not exceed the 'F' mark. Overfilling, which may itself result in oil loss through the breather due to excessive frothing, may also be indicated by a continuous 'patter' noise when the car is moving.

To drain and refill

Efficient draining of the oil from the fluid coupling is assisted by warming up the gearbox prior to draining. Do not flush the transmission but ensure that it has drained thoroughly.

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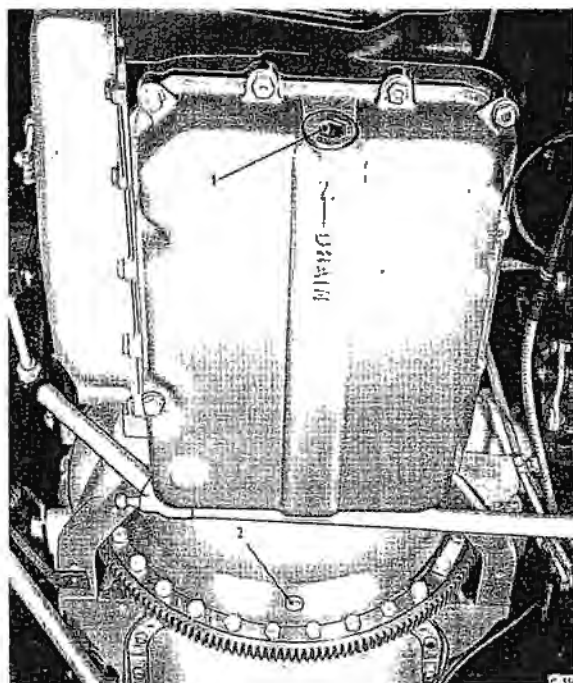


Fig. 23 Drain plugs

- 1 GEARBOX SUMP DRAIN PLUG
- 2 TORUS COVER DRAIN PLUG

Proceed as follows

- 1 Clean the area around the sump drain plug and remove the plug.
- 2 Remove the lower bell housing cover. On right-hand drive cars it would facilitate removal of the cover if the control cross-shaft is removed first (see Fig. 22 for removal points). Turn the fly-wheel to bring the fluid coupling drain plug to the lowest point, remove the plug and drain the fluid into a clean container (see Fig. 23). Do not use the drained fluid again, but after disposing of the fluid examine the residue carefully for evidence of gearbox wear, i.e. particles of clutch plate lining, servo band lining, white metal and bronze bushes and cast iron dust.
- 3 Refit both plugs, together with new sealing washers; tighten the sump plug to 35 lb.ft. to 45 lb.ft. and the fluid coupling drain plug to 6 lb.ft. to 7 lb.ft. When filling, ensure that the fluid and containers are scrupulously clean; the

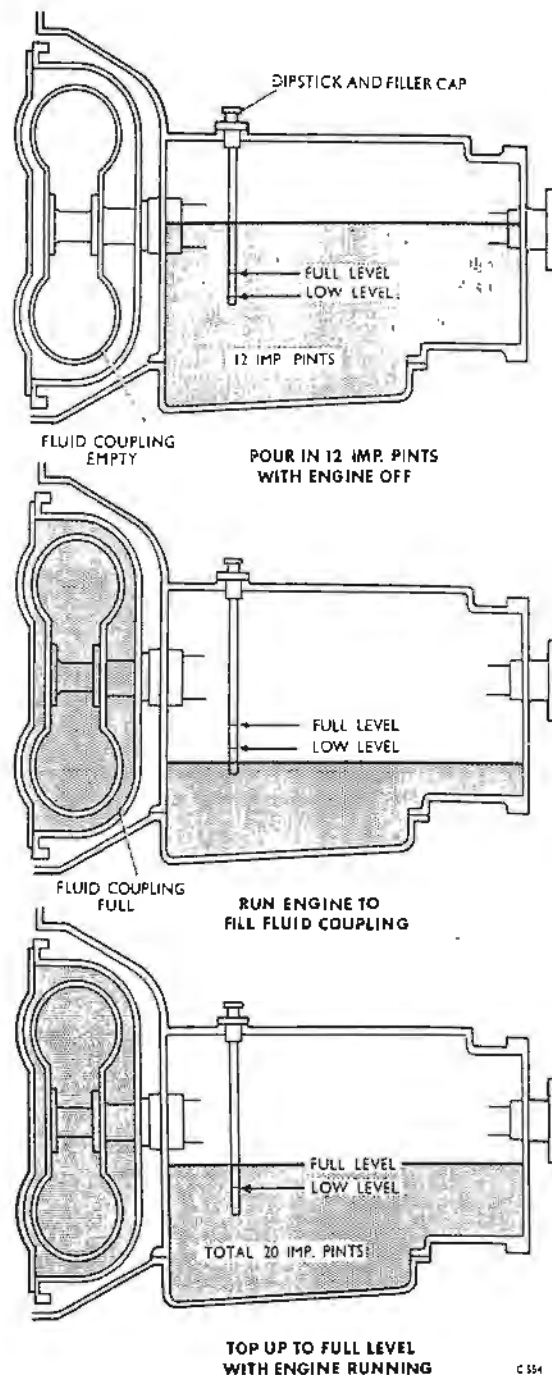


Fig. 24 Filling and topping-up with oil

fluid coupling and sump are filled through the same orifice. A new, or overhauled gearbox requires 20 Imperial pints or 24 U.S. pints of fluid. A gearbox just drained of fluid will require approximately $\frac{3}{4}$ Imperial pint or 1 U.S. pint less

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to reach the full mark. Fill up as follows (see Fig. 24)

- 1 Remove the dipstick and pour in 12 Imperial pints (14 U.S. pints) of fluid.
- 2 With the control lever in Neutral and the hand brake applied, start the engine and run it at fast idle for a few minutes.
- 3 Stop the engine and add a further 6 Imperial pints (7 U.S. pints).
- 4 Whilst running the engine at slow idle, check the fluid level with the dipstick; if necessary add sufficient fluid to bring the level to the 'F' mark. Do not overfill.

Ride control oil pump — To prime

'R' type cars are fitted with a ride control oil pump which is driven from the gearbox rear extension. As some of the gearbox oil is pumped by the ride control pump into the rear dampers, the ride control oil system should always be bled to remove air whenever the gearbox has been drained and refilled. To do this proceed as follows

- 1 Jack up the rear wheels.
- 2 Remove the blank from the four-way connection on the ride control oil delivery pipe (see Fig. 25).
- 3 Run the engine at a fast idle speed with the selector lever in range '4', or, alternatively, turn the rear wheel in a forward direction to prime the ride control pump by forcing air and oil through the open connection.

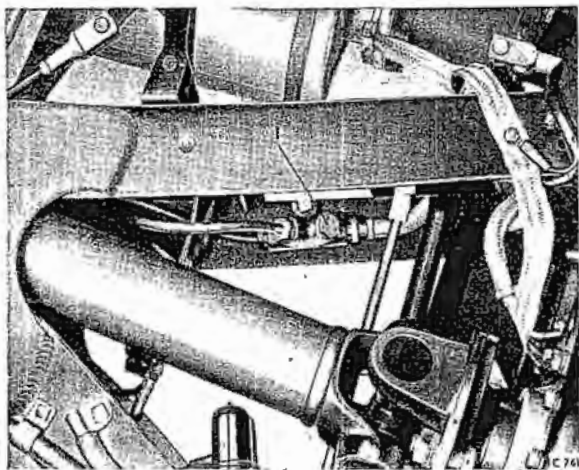


Fig. 25 Priming ride control oil pump

1 BLANKING PLUG

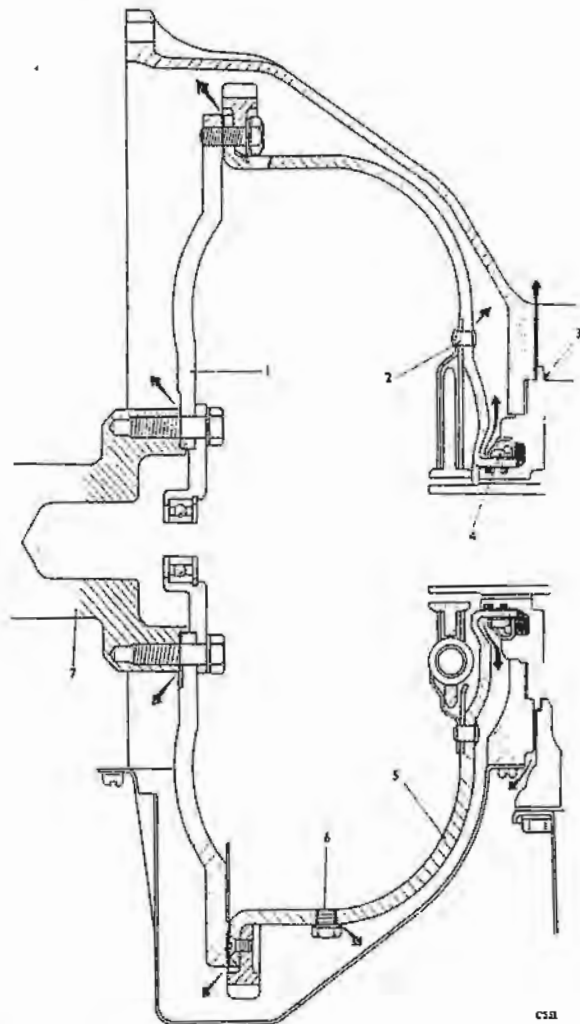


Fig. 26 Sources of leakage

- | | |
|-------------------------------|-----------------------|
| 1 FLYWHEEL | 4 FRONT PUMP OIL SEAL |
| 2 DAMPER RIVETS | 5 TORUS COVER |
| 3 GEARBOX-TO FRONT PUMP JOINT | 6 DRAIN PLUG |
| | 7 CRANKSHAFT |

- 4 When all air has been expelled, refit the blank.

If it is necessary to check the ride control system after this operation, fit a pressure gauge in place of the blank and run the engine to give a speed of approximately 20 m.p.h. with the selector lever in range '3' or '4'.

The pressure should not be more than 3 lb./sq. in. with the ride control in 'soft' or be between 30 lb./sq. in. and 35 lb./sq. in. with the control in 'hard'.

Remove the gauge and fit the blank.

If adjustment is necessary, shorten the control rod situated near the gearbox to increase the pressure.

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If it is suspected that air is still present in the system, each rear damper should be bled by removing the bleed plug on each damper, then run the engine as previously described until all air is expelled.

Finally top-up the gearbox to the 'F' mark.

To check for leaks

If the oil level is low at checking periods, check for evidence of oil leakage or foaming and loss of fluid from the breather in the top of the dipstick (see Chapter 3 — Section 15 — Gearbox casing).

Possible sources of oil leakage are illustrated in Figure 26; the action to be taken when leakage is confirmed is given in the table.

If the action to be taken requires the removal of the gearbox, a road test should be made after topping-up

and before removal.

When rebuilding after leakage investigation, use of jointing compound should be restricted to a very light smear to the threads of setscrews which might allow external leakage. Jointing compound should not be used internally; if used, it may cause defective gearbox operation.

Control joints — To lubricate

All control joints should be lubricated with grease, which should be worked well into the working surface, with the fingers. If excessive play in the joints is discovered during greasing, tighten the joint taking care to avoid upsetting the adjustment. If play in the joints is excessive it may be necessary to reset the linkage as described under 'Controls — To adjust'.

OIL LEAKAGE SOURCES

SOURCE	ACTION
Between flywheel and crankshaft flange ..	Remove gearbox and flywheel to re-make the joint between the flywheel and crankshaft.
Torus cover and flywheel	Check that torus cover plug and washer is correctly fitted. Remove gearbox and torus cover to re-make joint between torus cover and flywheel. Fit a new joint washer. Check torus cover-to-gearbox oil seals and damper rivets.
Front of transmission — behind bell housing	Remove gearbox. Remove front oil pump and re-make joint between front pump and gearbox joint by fitting a new joint washer. Check torus cover-to-gearbox oil seals.
Oil sump	Check drain plug and washer for correct fitting. Remove sump and re-make joint with a new joint washer.
Side cover	Check that the pressure line blanking plug and washer is correctly fitted. Remove side cover and re-make joint with a new joint washer ensuring that the setscrews are fitted with sealing washers. Check throttle and selector shaft oil seals.
Rear of transmission	Remove gearbox, examine rear oil seal. Re-make joint between rear extension and gearbox joint face by fitting a new joint. Check rear extension plug and sealing washer.
Ride control unit and system if fitted ..	Check pipes to rear dampers with engine running and ride control in 'hard'. Remove faulty unit or pipe and re-make joint or joints. Fitting instructions for the ride control pump are given in Chapter 3.

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SECTION 2 — TESTING

There are two tests which can be made in order to check the functioning of the automatic gearbox.

- 1 A road test is necessary to ensure that the gear changes are occurring at the correct road speed and engine power.
- 2 The second test is to check the operating oil pressures to assist diagnosis of a suspected defect. This entails the fitting of a gauge to a pressure tapping in the gearbox and testing to record the operating pressures.

Change points — To test

The change points are given in the table in the sequence in which the tests should be made. The oil level, engine tune and control settings should be correct before the test is made, otherwise subsequent analysis of the results will be very difficult.

The point at which the gear change occurs can be recognised by a slight change in note of the engine. The change should be smooth at low throttle openings but may be more noticeable at higher engine torques. Slipping can be recognised by a tendency for the engine to speed up at the change point on the up-changes, or a tendency for the car to lose road speed on the down-changes.

The speedometer readings at which each change point occurs should be recorded, whether correct or faulty, and the test continued until all results are obtained. The test should not be terminated because of a defect unless damage to the transmission can be caused by continued running.

Compare the recorded results with the table of change points and, if a defect exists, with the Fault Diagnosis Section which gives the action required for rectification, on the assumption that oil level, engine tune and idling speed are correct.

Although the symptoms for faulty control settings are included in the Fault Diagnosis Section, it will simplify diagnosis if they are checked before the road test, because many of the possible faults can be caused by incorrect control settings.

The speedometer reading at which the change occurs will be dependent on throttle position, increasing progressively from light throttle to the full throttle position; slight variation from the figures quoted in the table is permissible providing the changes are smooth and that there are no other symptoms of incorrect operation.

Change points for Phantom IV and Phantom V cars are slightly lower than the figures given for 'S' Series cars, whilst Bentley Continental cars have higher change points due to a smaller weight on the governor G2 valve.

CHANGE POINTS BENTLEY 'R' SERIES AND SILVER DAWN

RANGE 4	UP-CHANGES (M.P.H.)				DOWN-CHANGES (M.P.H.)		
	1-2	2-3	3-4		4-3	3-2	2-1
Light throttle	5-7	9-12	18-21	Closed throttle	12-10	8-5	5-3
Full throttle	14-16	26-30	55-62	Kick-down	53-48	19-15	8-6

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BENTLEY S1 SERIES AND SILVER CLOUD

RANGE 4	UP-CHANGES (M.P.H.)		DOWN-CHANGES (M.P.H.)
	1-2 2-3 3-4		4-3 3-2 2-1
Light throttle	5-8 11-14 20-24	Closed throttle	14-11 9-6 6-3
Full throttle	16-18 30-34 63-70	Kick-down	60-55 21-17 9-7

BENTLEY S2, S3 SERIES AND SILVER CLOUD II AND III

RANGE 4	UP-CHANGES (M.P.H.)		DOWN-CHANGES (M.P.H.)
	1-2 2-3 3-4		4-3 3-2 2-1
Light throttle	8-10 15-16 24-26	Closed throttle	16-12 10-6 7-3
Full throttle	26-27 40-41 78-80	Kick-down	73-71 38-33 20-17

Oil pressure tests

If a road test is being made to check for a suspected defect, or if a defect has been found on a previous road test, some of the possible causes listed in the Fault Diagnosis Section can be eliminated by jacking up the rear wheels to check the operating oil pressures.

For this test it is necessary to fit a tachometer for checking engine r.p.m. also to fit a pressure gauge (R 5244) to the pressure tapping between the band adjusting screws, in such a way that the gauge can be observed while testing (see Fig. 27).

Oil pressure tests should be performed in the order given in the table, after fitting the gauge and tachometer and running the engine for a few minutes to warm the gearbox oil.

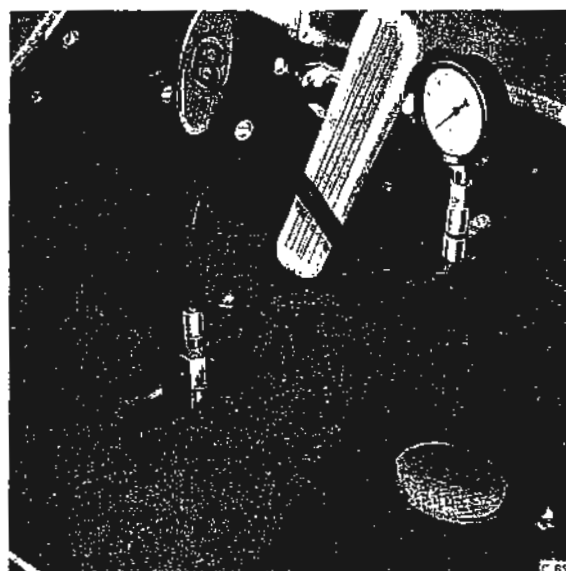


Fig. 27 Checking oil pressure

OIL PRESSURE TESTS

TEST CONDITION	RANGE	TACHOMETER READING	OIL PRESSURE LB./SQ. IN.
Engine running, car stationary	4	450 r.p.m.	75 (min.)
Engine running, car stationary	R	450 r.p.m.	90 (min.)

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SECTION 3 — FAULT DIAGNOSIS

Reliable fault diagnosis and rectification necessitates following the correct order of servicing and testing, recording the results of each test and then consulting the following paragraphs.

The recommended sequence of tests to simplify diagnosis of obscure defects is as follows

- 1 Check oil level and for leaks.
- 2 Lubricate and check control linkage.
- 3 Fit pressure gauge and carry out road test, recording oil pressure and change points; adjust bands if necessary.

The following Fault Diagnosis Table is set out in three columns.

The first column gives the conditions under which the fault may occur.

The second column gives the probable cause of the condition in the most likely order of occurrence, whilst the third column gives the action to be taken to remedy the fault.

In this way it is hoped the reader will be able to pinpoint a suspected defect more quickly than hitherto.

DIAGNOSIS

CONDITION	CAUSE	REMEDY
High upshifts 1 All upshifts 	1 Throttle linkage too long. 2 Governor valves sticking. 3 Broken or sticking governor oil seal rings.	1 Adjust throttle linkage. 2 Remove side cover, parking bracket and governor. Check governor valves. 3 Remove side cover and parking bracket. Check governor rings.
Low upshifts 1 All upshifts 	1 Throttle linkage too short. 2 Governor valves sticking. 3 Leaking throttle pressure. 4 Broken or weak shift valve spring.	1 Adjust throttle linkage. 2 Remove side cover, parking bracket and governor. Check governor valves. 3 Remove side cover and control valve unit. Overhaul control valve unit. Also check regulator plug. 4 Remove side cover and control valve unit. Check shift valve springs.

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DIAGNOSIS—continued

CONDITION	CAUSE	REMEDY
Misses upshifts 1 No upshift above 1st	1 Shift valves sticking. 2 Governor valves sticking. 3 Low oil pressure due to oil delivery sleeve rings broken or sticking. 4 Inoperative rear pump due to failure of bronze driving gear.	1 Remove side cover and control valve unit. Overhaul control valve unit. 2 Remove side cover, parking bracket and governor. Check governor valves. 3 Remove sump, side cover and control valve unit. Air test oil delivery sleeve for excessive leakage. 4 Remove sump to check. Remove gearbox to overhaul.
2 Misses 1st and 3rd	1 Front band incorrectly adjusted. 2 Broken front band. 3 Front servo rings broken or sticking. 4 Missing or loose plug in front servo. 5 Front unit locked.	1 Remove sump and adjust front band. 2 Remove gearbox and renew front band. 3 Remove sump, side cover and control valve unit. Air test front servo for operation and overhaul if necessary. 4 Remove sump to check then refit and tighten plug. 5 Remove gearbox. Overhaul front unit.
3 Misses 2nd and 4th	1 Excessive leak from oil delivery sleeve.	1 Remove sump, side cover and control valve unit. Air test oil delivery sleeve for excessive leakage, and check correct fitting of centre bearing cap.
Slips during upshifts 1 Slips — light throttle upshifts	1 Throttle linkage incorrectly adjusted. 2 Bands incorrectly adjusted. 3 Low oil pressure. 4 Throttle valve forced out of bore.	1 Adjust throttle linkage. 2 Remove sump and adjust bands. 3 Fit pressure gauge and check oil pressure. 4 Remove side cover and control valve unit. Overhaul control valve unit.
2 Slips — heavy throttle upshifts	1 Throttle linkage incorrectly adjusted. 2 Bands incorrectly adjusted. 3 Low oil pressure. 4 Throttle valve forced out of bore. 5 Sticking T.V. plug in regulator valve. 6 Damaged oil seals in regulator valve. 7 Rear servo rings broken or sticking. 8 Oil delivery sleeve rings broken or sticking. 9 Clutch plates worn or burned.	1 Adjust throttle linkage. 2 Remove sump and adjust bands. 3 Fit pressure gauge and check oil pressure. 4 Remove side cover and control valve unit. Overhaul control valve unit. 5 Remove regulator valve and check T.V. pressure plug. 6 Remove regulator valve and check seals. 7 Remove sump, side cover and control valve unit. Air test rear servo for operation and overhaul if necessary. 8 Remove sump, side cover and control valve unit. Air test oil delivery sleeve for excessive leakage. 9 Remove gearbox and overhaul front and rear clutchpacks.
3 Slips 1-2, 3-4	1 Low oil pressure due to oil delivery sleeve rings broken or sticking. 2 Front servo rings broken or sticking. 3 Front unit clutch plates worn or burned. 4 Broken or collapsed oil seal in front clutch piston.	1 Remove sump, side cover and control valve unit. Air test oil delivery sleeve for excessive leakage. 2 Remove sump, side cover and control valve unit. Air test front servo for correct operation and overhaul if necessary. 3 Remove gearbox and overhaul front clutch pack. 4 Remove gearbox and overhaul front clutch pack.

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DIAGNOSIS—continued

CONDITION	CAUSE	REMEDY
Slips during upshifts—continued 4 Slips 2-3	1 Throttle linkage incorrectly adjusted. 2 Front band incorrectly adjusted. 3 Restriction or heavy leak in oil circuit. 4 Sticking control valves. 5 Rear clutch plates worn or burned.	1 Adjust throttle linkage. 2 Remove sump and adjust front band. 3 Remove sump, side cover and control valve unit. Air test oilways to check front servo, rear servo and rear clutch. Check for sticking 4-3 timing valve in front servo. 4 Remove side cover and control valve unit. Overhaul control valve unit. 5 Remove gearbox and overhaul rear clutch pack.
Intermittent slip 1 All ranges	1 Low oil level. 2 Incorrect oil pressure. 3 Intermittent sticking regulator valve.	1 Check oil level and top-up as required. 2 Fit pressure gauge and check oil pressure. 3 Remove regulator valve and check for freedom of movement.
Rough changes 1 Rough upshift	1 Throttle linkage incorrectly adjusted. 2 Bands incorrectly adjusted. 3 Incorrect oil pressure. 4 Control valves sticking.	1 Adjust throttle linkage. 2 Remove sump and adjust bands. 3 Fit pressure gauge and check oil pressure. 4 Remove side cover and control valve unit. Overhaul control valve unit.
2 Rough 3-2 closed throttle downshift	1 Throttle linkage incorrectly adjusted. 2 Incorrect oil pressure. 3 Bands incorrectly adjusted. 4 Excessive oil leak, or broken or sticking, check valve in rear servo. 5 Engine revs. too high in closed throttle position. 6 Control valves sticking.	1 Adjust throttle linkage. 2 Fit pressure gauge and check oil pressure. 3 Remove sump and adjust bands. 4 Remove sump and servos. Overhaul rear servo. 5 Adjust correctly the engine slow running speed. 6 Remove side cover and control valve unit. Overhaul control valve unit.
3 Rough 4-3 downshift ..	1 Incorrect oil pressure. 2 Bands incorrectly adjusted. 3 Control valves sticking. 4 Sticking 4-3 timing valve in front servo.	1 Fit pressure gauge and check oil pressure. 2 Remove sump and adjust bands. 3 Remove side cover and control valve unit. Overhaul control valve unit. 4 Remove sump and servos. Check timing valve.
4 Rough neutral to drive ..	1 Engine slow running set too fast in closed throttle position. 2 Bands incorrectly adjusted. 3 Sticking rear servo apply piston.	1 Correctly adjust the engine slow running speed. 2 Remove sump and adjust bands. 3 Remove sump, side cover and control valve unit. Air test rear servo and, if necessary, remove rear servo to overhaul.
No forced downshift 1 No. 4-3 forced downshift ..	1 Throttle linkage incorrectly adjusted. 2 Control valves sticking. 3 T.V. pressure plug sticking.	1 Adjust throttle linkage. 2 Remove side cover and control valve unit. Overhaul control valve unit. 3 Remove regulator valve and check T.V. pressure plug.
2 No 3-2 forced downshift ..	1 Throttle linkage incorrectly adjusted. 2 Sticking 3-2 timing valve or control valves sticking. 3 T.V. pressure plug sticking.	1 Adjust throttle linkage. 2 Remove side cover and control valve unit. Overhaul control valve unit. 3 Remove regulator valve and check T.V. pressure plug.

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DIAGNOSIS—continued

CONDITION	CAUSE	REMEDY
Reverse malfunction 1 Slips in reverse	<ol style="list-style-type: none"> 1 Low oil pressure. 2 Damaged reverse piston oil seal. 3 Reverse piston supply restricted or leaking. 4 Front band incorrectly adjusted. 5 Stationary cone key missing. 	<ol style="list-style-type: none"> 1 Fit pressure gauge and check oil pressure. 2 Remove gearbox and check reverse piston oil seal in rear extension. 3 Remove side cover and check reverse feed pipe for correct fitting or obstruction. 4 Remove sump and adjust front band. 5 Remove gearbox and check rear extension to see if cone key is locating stationary cone.
2 Locks in reverse	<ol style="list-style-type: none"> 1 Reverse piston sticking or reverse cone sticking to stationary cone. 2 Reverse parking pawl incorrectly fitted. 	<ol style="list-style-type: none"> 1 Try to free clutch by burnishing as described in Chapter 2—Reverse epicyclic unit. If this fails, remove gearbox and check piston in rear extension. 2 Remove side cover and check for correct operation of parking pawl.
3 Jumps out of reverse	<ol style="list-style-type: none"> 1 Selector lever incorrectly adjusted. 2 Locking pawl in selector lever badly worn. 3 Parking brake lever return spring is too strong. 	<ol style="list-style-type: none"> 1 Adjust selector controls. 2 Remove selector controls from steering column and overhaul controls. 3 Remove side cover. Check that the gear selector lever will remain in reverse notch; if not, check parking brake lever return spring, also detent plunger spring.
4 Cannot select reverse	<ol style="list-style-type: none"> 1 Selector linkage incorrectly adjusted. 2 Reverse blocker piston sticking out. 3 G1 valve sticking out allowing G1 oil to hold reverse blocker piston out. 4 Link pin connecting gear lever to operating tube on steering column in misplaced position. 	<ol style="list-style-type: none"> 1 Adjust selector linkage. 2 Remove side cover and parking bracket. Check reverse blocker piston. 3 Remove side cover, parking bracket and governor. Check G1 valve. 4 Remove selector controls on steering column and overhaul controls.
5 Will go into reverse above 8–10 m.p.h.	<ol style="list-style-type: none"> 1 Reverse blocker piston sticking in. 	<ol style="list-style-type: none"> 1 Remove side cover and parking bracket. Check reverse blocker piston.
6 Clashes when changing to reverse	<ol style="list-style-type: none"> 1 Reverse blocker piston sticking in. 2 Incorrectly fitted parking pawl. 	<ol style="list-style-type: none"> 1 Remove side cover and parking bracket. Check reverse blocker piston. 2 Remove side cover and check parking pawl for correct operation.
7 No forward drive after changing from reverse	<ol style="list-style-type: none"> 1 Reverse piston sticking or reverse cone sticking to stationary cone. 	<ol style="list-style-type: none"> 1 Try to free clutch by burnishing as described in Chapter 2—Reverse epicyclic unit. If this fails, remove gearbox and check reverse piston and cone in rear extension.
8 Inoperative parking brake ..	<ol style="list-style-type: none"> 1 Parking blocker piston sticking out or parking pawl binding. 	<ol style="list-style-type: none"> 1 Remove side cover and parking bracket. Check parking blocker piston and parking pawl.
Car fails to move 1 No drive	<ol style="list-style-type: none"> 1 Selector linkage incorrectly adjusted. 2 No oil pressure. 3 Low oil level. 4 Manual control operating pin not engaged with manual control valve. 5 Regulator valve sticking. 	<ol style="list-style-type: none"> 1 Adjust selector linkage. 2 Fit pressure gauge to check then measure oil level, also check for excessive leaks. 3 Check oil level and top-up as required, also check for excessive leaks. 4 Remove side cover and check operation of manual control valve. 5 Remove regulator valve and check for freedom of movement.

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DIAGNOSIS—continued

CONDITION	CAUSE	REMEDY
Car fails to move—continued 2 No drive when engine is first started	1 Low oil pressure. 2 Badly leaking torus check valve. 3 Reverse piston sticking or reverse cone sticking to stationary cone.	1 Fit pressure gauge and check oil pressure. 2 This will be revealed by an abnormally high oil level in the gearbox due to the check valve failing to hold oil in the torus assembly. In such a case, remove gearbox and overhaul check valve in driven torus. 3 Try to free the reverse clutch by burnishing as described in Chapter 2 — Reverse epicyclic unit. If this fails, remove the gearbox and check reverse piston and cone in rear extension.

OIL PRESSURE DIAGNOSIS

It will be seen by reading the Fault Diagnosis Table that a considerable number of defects can be caused if oil pressure is too high or too low.

The following list of causes of high and low oil pressure is useful when used in conjunction with the fault diagnosis table.

Low oil pressure

- 1 Oil level low.
- 2 Boost plug sticking.
- 3 Pressure regulator or spring defects

- 4 Blocked filter.
- 5 Oil foaming or air locks.
- 6 Internal leaks.
- 7 Pump slide sticking.

High oil pressure

- 1 Pressure regulator valve sticking.
- 2 Boost plug sticking.
- 3 Pump relief valve sticking.
- 4 Blocked oil passages.

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SECTION 4 — CONTROL LINKAGE

It is recommended that the control linkage be checked before road testing the car to investigate a suspected defect, but if the symptoms exhibited on road test are shown by fault diagnosis to be attributable to control linkage another check should be made before proceeding any further.

Shortening the T.V. rod or screwing in the T.V. adjusting screw (if fitted) may correct such defects as a high up-change and rough up and down-changes. Lengthening the rod or screwing out the T.V. adjusting screw may correct such defects as low heavy throttle up-changes, slipping or incorrect 'kick-down'. Sticking throttle linkage will give inconsistent oil pressure and may cause a rough down-change when the car is slowing to a halt.

Selector linkage should be checked by disconnecting the selector rod on the side of the gearbox and checking the lever through its full range. The lever should click into each of its five positions. If the linkage is correctly adjusted it should be possible, with the steering column lever in the appropriate position, to connect the rod without springing the lever from any of its notches.

If necessary, adjust the controls to obtain the correct changes following the procedure given under 'Controls — To adjust'. If a fault still persists after road test, refer to the Fault Diagnosis Table for the next check.

Controls — To adjust

S2 and S3 cars

The following paragraphs explain the correct method of adjusting the throttle and selector controls on both R.H. and L.H. cars, commencing with throttle controls.

On right-hand drive cars, drive the car onto a ramp or over an inspection pit, then disconnect the T.V. rod at the gearbox end by removing the split pin and clevis pin (see (2) in Figure 28).

Ensure that the choke is in the 'Off' position and that the 'fast-idle' cam is out of action.

Remove the split T.V. lever (1) by slackening the 2 B.A. pinch bolt. Slacken the lock-nut on the 2 B.A. adjusting screw so that it lies approximately half-way through the lever (early 'S2' and Silver Cloud II cars were not fitted with a split T.V. lever).

Tighten the lock-nut and refit the lever to the gearbox.

Detach rod (3) by removing the pinch bolts and ball joint adjusting screws. Check the distance between the ball joint centres as indicated in Figure 28. This should be approximately 6.200 in.

Slacken the clamp holes on the carburettor levers (7) and the throttle stop lock-nut. Screw out the throttle stop screw slowly until the joint (6) begins to toggle over. Screw in the throttle stop screw one full turn and lock the lock-nut.

Refit rod (3); there should be a minimum clearance in the ball joints without being tight.

Slacken the clamp bolt (5) on the manifold shaft and insert a 0.3125 in. distance piece between the boomerang lever and the bell housing as indicated in Figure 28. If no assistance is available to hold this in position it may be secured with adhesive tape.

Hold the throttle stop lever (7) against the throttle stop screw, ensure that there is approximately 0.020 in. end float in shaft (4), then push the two levers towards each other; tighten the clamp bolt.

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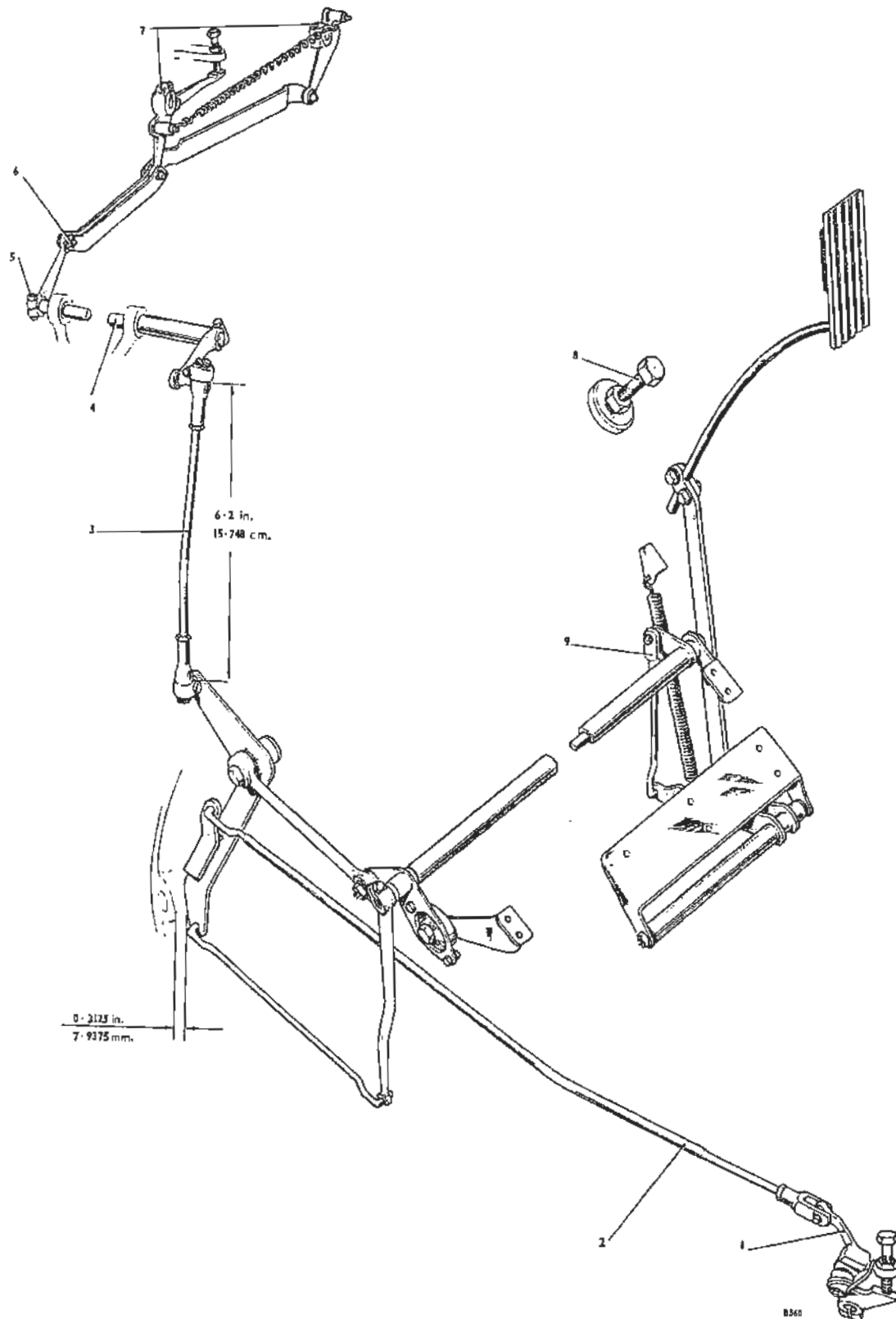


Fig. 28 Throttle and T.V. control linkage — R.H. drive cars

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Remove the 0.3125 in. distance piece; check that the boomerang lever does not foul the bell housing when it is released. If this does occur, the size of the distance piece must be increased.

Adjust the T.V. rod (2) so that when the clevis pin is inserted into the hole in the split lever, the lever will be held forward to the limit of its travel. Lengthen rod (2) by two full turns of the jaw, then tighten the lock-nut.

It will then be necessary to synchronise the carburettors (see T.S.D. 729 Section K4).

Before fitting the dashpots check that the butterflies are opening fully by depressing the accelerator pedal onto the full throttle stop.

If the butterflies do not open fully, screw down the full throttle stop (8) or shorten the rod (9). This is dependent upon the position of the accelerator pedal and the customer's requirements.

If rod (9) is shortened, the pedal will be higher in the throttle closed position.

If the throttles open too wide, reverse the two adjustments.

Check throughout that the split pin, lock-nuts and pinch bolts are fitted then road test the car.

On left-hand drive cars, first drive the car onto a ramp or over an inspection pit, then disconnect the T.V. rod (2) (see Fig. 29) at the gearbox end by removing the split pin and clevis pin.

Ensure that the choke is in the 'Off' position and the 'fast-idle' cam out of action.

Remove the split T.V. lever (1) by slackening the 2 B.A. pinch bolt. Slacken the lock-nut on the 2 B.A. adjusting screw and adjust the screw so that it lies approximately half-way through the lever. Lock the 2 B.A. nut. Refit the lever to the gearbox. (The split T.V. lever is not fitted to early 'S' Series cars).

Detach rod (3) by removing the pinch bolts and ball joints adjusting screws. Check the distance between the centres as indicated in Figure 29. This should be approximately 6.200 in.

Slacken the clamp bolts on the carburettor levers (7), and the throttle stop lock-nut. Screw out the throttle stop screw slowly until the joint (6) begins to toggle over. Screw in the stop screw one full turn and lock the lock-nut.

Refit rod (3) ensuring that the clearance in the ball joints is at a minimum, but that the joints are not tight.

Slacken the clamp bolt on lever (5) on the manifold shaft and insert a 0.250 in. distance piece between lever (11) and the steady bracket boss (10) as indicated in Figure 29. If no assistance is available to hold this in position it may be secured with adhesive tape.

Hold the throttle stop lever (7) against the throttle stop screw, ensure that there is 0.020 in. end float in shaft (4), then push the two levers toward each other and tighten the clamp bolt. Remove the 0.250 in. distance piece.

Adjust rod (2) so that when the clevis pin is inserted into the hole in the split T.V. lever, the lever will be held forward to the limit of its travel. Lengthen rod (2) by two full turns of the jaw and tighten the lock-nut.

It will then be necessary to synchronise the carburettors (see T.S.D. 729 Section K4).

Before fitting the dashpots, check that the butterflies open fully, by depressing the accelerator pedal onto the full throttle stop.

If the butterflies do not open fully, screw down the full throttle stop (8) or shorten rod (9). This is dependent upon the position of the accelerator pedal and the customer's requirements. Shortening rod (9) will raise the accelerator pedal; if the stop (8) is screwed in, the pedal will be lower in the full throttle position. If the throttles open past full throttle, reverse the two adjustments.

Check throughout that all split pins, lock-nuts and pinch bolts are fitted then test the car on the road for correct gear changes and 'kick-down'.

Final adjustment — Split T.V. lever

Gear change adjustments should be made on the split T.V. lever.

If the changes are too 'jerky' and 'hang-on' screw out the adjusting screw.

If the changes are 'slippy' and too close together screw in the adjusting screw.

Tighten the adjusting screw after each adjustment.

'Kick-down' adjustments should be made on the accelerator pedal stop.

If 'kick-down' is too easy **raise** the throttle stop.

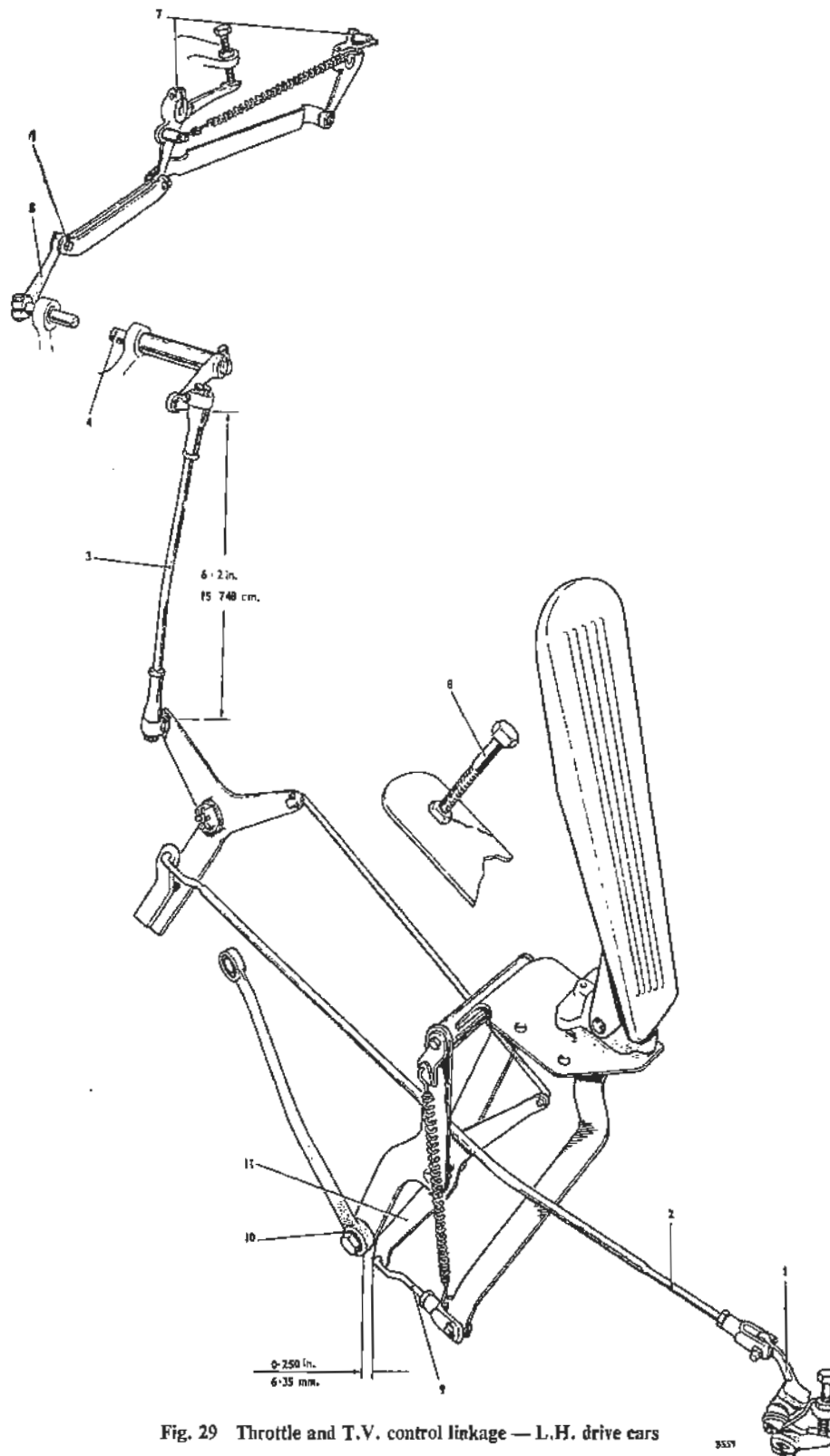
If 'kick-down' is too difficult or unobtainable screw in the throttle stop.

Final adjustment — Plain T.V. lever

Gear change adjustments should be made on rod (2).

If the changes are too 'jerky' and 'hang-on' **shorten** rod (2).

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If the changes are 'slippy' and too close together lengthen rod (2).

'Kick-down' — Fixed throttle stop

'Kick-down' adjustments should be made on rod (9).

If 'kick-down' is too easy lengthen rod (9).

If 'kick-down' is too difficult or unobtainable shorten rod (9).

Selector control setting is comparatively simple and one rod only need be adjusted.

Set the selector lever, mounted on the steering column, to its Neutral position. Ensure that the selector lever on the gearbox is in its most forward position, then check that slight 'sponge' exists on either side of the Neutral stop position of the lever on the steering column.

On right-hand drive cars, if the selector lever on the column is hard against the top of its stop in the Neutral position, adjust the control rods as follows

Slacken the lock-nut fitted to either side of the ball socket on the end of the rod, between the cross-shaft lever and the fulcrum lever; unscrew the ball joint adjusting screw and disconnect the socket from the ball end. Lengthen the control rod by unscrewing the socket until the correct adjustment is obtained. Assemble the joint and tighten the lock-nuts; the joint must be free but without excessive movement.

After connecting the controls, check that there is slight 'sponge' on either side of each position of the selector lever mounted on the steering column.

On left-hand drive cars, if the selector lever on the steering column is hard against the top of its stop in the Neutral position, adjust the control rods as follows

Slacken the lock-nut fitted to either side of the ball socket on the end of the rod between the selector lever on the side of the gearbox and the fulcrum lever. Unscrew the ball joint adjusting screw and disconnect the socket from the ball end. Shorten the control rod by screwing the ball socket up the rod until the correct adjustment is obtained. Finally, re-assemble the ball joint and tighten the lock-nuts; ensure that the joint is free but without excessive movement.

After connecting the controls, check that there is slight 'sponge' on either side of each position of the selector lever mounted on the steering column.

It may be necessary, after setting the selector controls, to reset the starter and reverse light micro switches.

The setting instructions are the same for R.H. and L.H. drive cars.

Micro-switches — To set

Reverse and Neutral

Move the selector lever on the steering column into the Neutral position. Set the starter switch so that, with the peg on the gear change operating lever touching the starter switch button, the starter switch is heard to actuate. Move the switch approximately 0.030 in. nearer to the operating peg and secure it in this position.

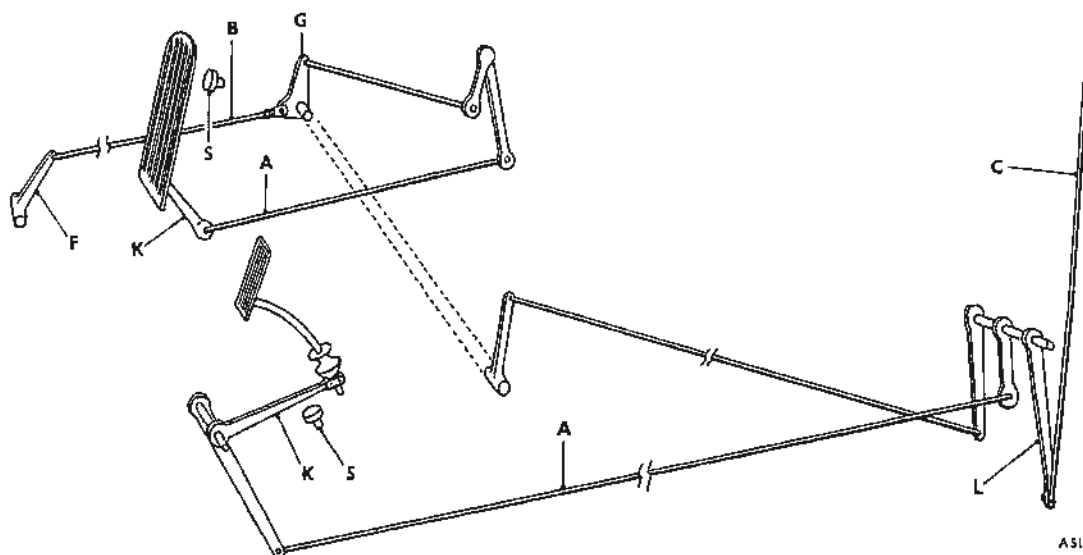


Fig. 30 Throttle and T.V. control linkage — early S1 cars

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To set the reversing light switch, move the selector lever on the steering column into the Reverse position. Set the reversing light switch so that, with the peg on the gear change operating lever touching the reversing light switch button, the switch is heard to actuate. Move the switch approximately 0.030 in. nearer to the operating peg and secure it in this position.

Controls — To adjust

S1 cars

On early S1 cars, disconnect rods (A) and (B) (see Fig. 30).

With the lever (F) held forward to the limit of its travel check the distance between the rear face of the gearbox and the centre of the hole in lever (F); this should be 8.375 in. ± 0.060 in. If necessary, remove the lever and bend it to suit.

Ensure that the choke is in the 'Off' position and the fast idle cam out of action. Adjust rod (C) so that the lever (L) hangs vertically or just rearward of the vertical position. It is sufficient to ascertain the position of this lever by eye.

With lever (F) held forward to the limit of its travel, adjust rod (B) until it will just fit the hole in lever (G) then lengthen rod (B) by $1\frac{1}{2}$ turns of the jaw.

Adjust the pedal of left- or right-hand drive cars as follows

On right-hand drive cars, adjust rod (A) so that in the full throttle position the accelerator pedal will just make contact with the pedal stop. Check that lever (K) is clear of the toe board in the closed throttle position.

On left-hand drive cars, select one of the three holes in lever (K) which will give the nearest approximation to the 0.375 in. clearance as shown in Figure 31. Connect rod (A) in the selected hole and adjust to give the 1.750 in. dimension shown in Figure 31 in the throttle closed position. Adjust the pedal 'on-stop' so that at full throttle the pedal just makes contact with it.

When the controls have been set initially it will be necessary to test the car on the road.

On late S1 cars (see Fig. 32), to set the controls, follow the instructions given in the first four paragraphs of 'Controls — To adjust,' on early 'S1' and

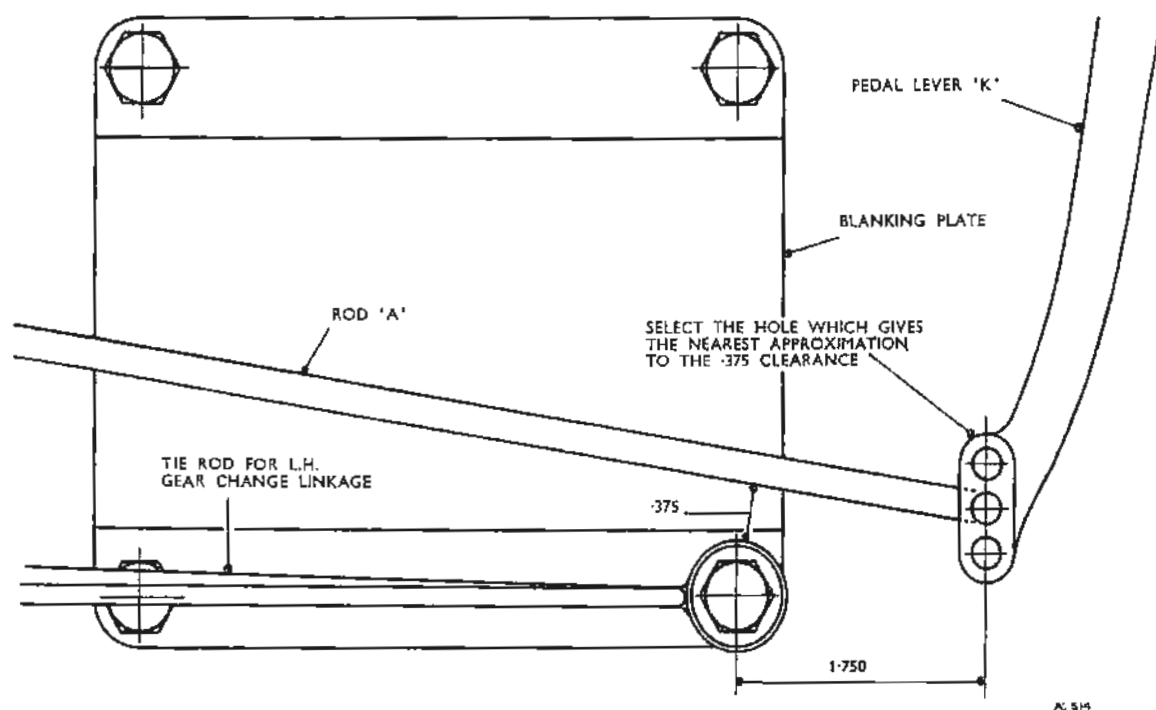
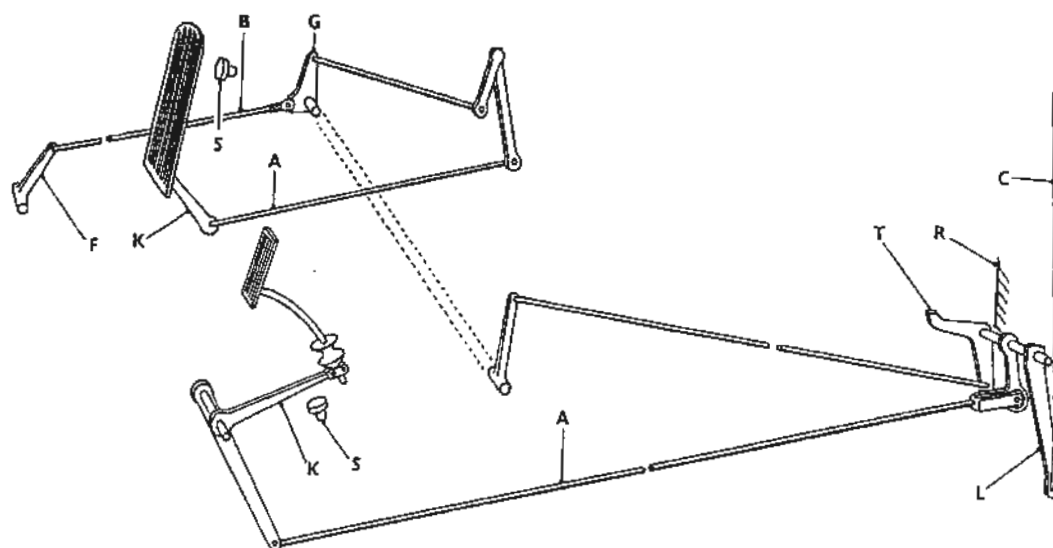


Fig. 31 T.V. linkage — S1 cars

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Fig. 32 Throttle and T.V. control linkage — late S1 cars

Silver Cloud cars, then adjust the pedals of left- or right-hand drive cars as follows.

On right-hand drive cars, hold the lever (T) in contact with the 'on-stop' (R) (carburettors in the full throttle position) and with the accelerator pedal in contact with the 'on-stop' (S), adjust rod (A) so that it will just fit the hole in the pedal lever. Lengthen rod (A) by 0.250 in. (8 turns of the jaw).

On left-hand drive cars, select one of the three holes in lever (K), to give the nearest approximation to the 0.375 in. dimension, as shown in Figure 31. Connect rod (A) using the selected hole, then adjust to give the 1.750 in. dimension as shown in Figure 31. With the throttles closed, adjust the pedal 'on-stop' (S) so that the pedal will just make contact with it at the same time as lever (T) contacts the 'on-stop'. Raise the pedal 'on-stop' (S) by $2\frac{1}{2}$ turns.

When the controls have been set initially it will be necessary to test the car on the road.

Final adjustment

Gear change adjustments should be made on rod (B).

If the gear changes are 'jerky' and 'hang on' **shorten** rod (B).

If the gear changes are sloppy and too close together **lengthen** rod (B).

'Kick-down' adjustment

R.H. drive cars

'Kick-down' adjustments should be made on rod (A).

If the 'kick-down' is too easy **lengthen** rod (A).

If the 'kick-down' is too difficult or unobtainable **shorten** rod (A).

'Kick-down' adjustment

L.H. drive cars

'Kick-down' adjustments should be made on throttle stop (S).

If the 'kick-down' is too easy **raise** stop (S).

If the 'kick-down' is too difficult or unobtainable **lower** stop (S).

Selector controls

If necessary, adjust the gearbox selector controls, Neutral and Reverse micro-switches in a similar manner to that described in 'Controls — To adjust', 'S2' and 'S3' and Silver Cloud II and III cars.

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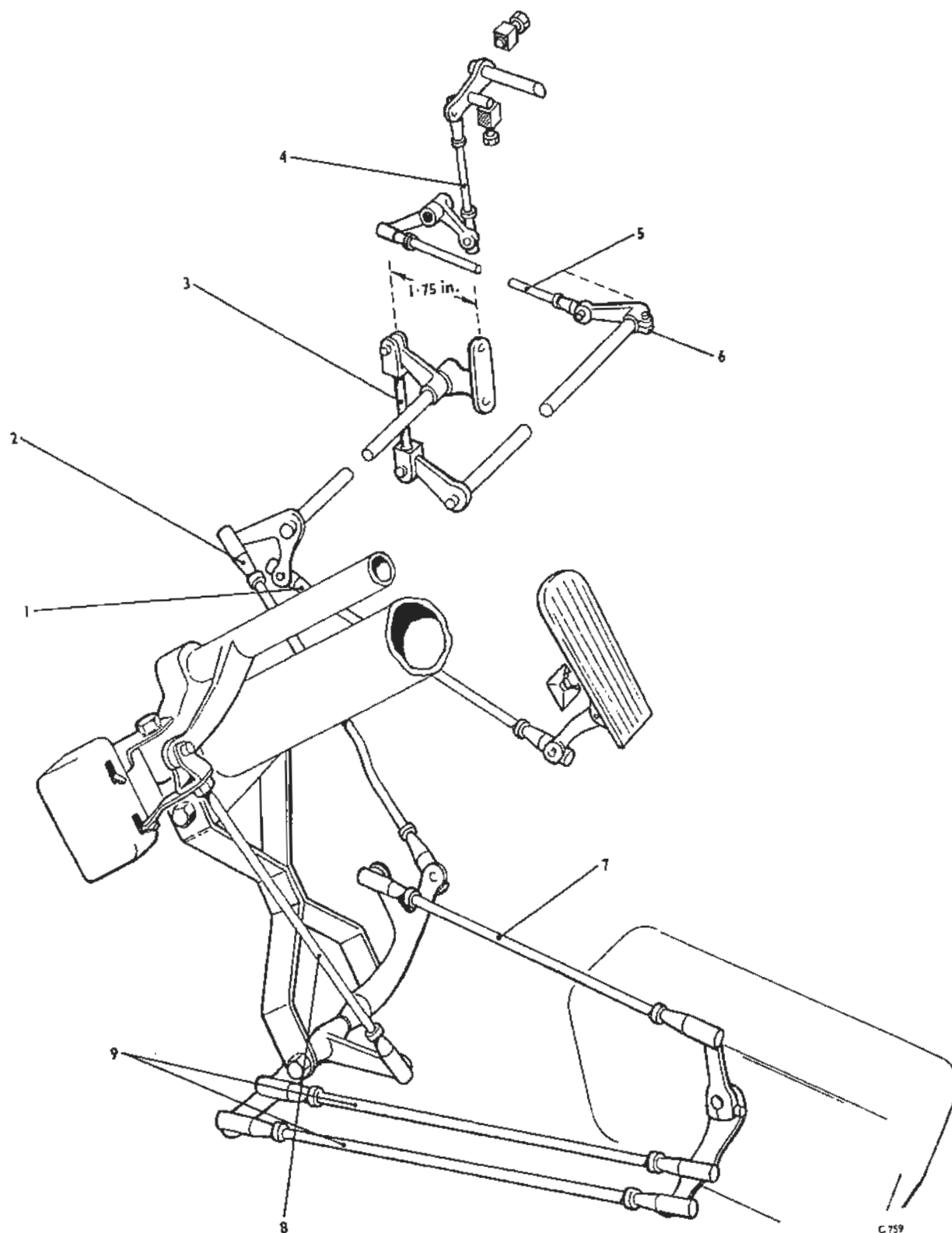


Fig. 33 T.V. and selector controls (1952 cars)

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Controls — To adjust

'R' Series 1952 cars

To adjust the selector control setting disconnect the accelerator to cross-shaft control rod (1) at its upper end (see Fig. 33). Select range '3' and adjust the two parallel rods (9) to bring the swinging link to a position at right angles to the steering column; these rods must be maintained at equal lengths. If necessary, adjust rod (8) to maintain the steering column control in its central position in the quadrant (range '3'). This completes the selector link setting.

To adjust the throttle valve controls adjust rod (7) to the same length as rods (9). Hold the T.V. lever onto its forward stop, then adjust rod (2) to position the lever on the right-hand end of the cross-shaft, 1.750 in. from the bulkhead; this should be measured at right angles from the bulkhead to the clevis pin centre. It may be necessary to slacken the pinch bolt (6) on the outer end of the countershaft to permit this adjustment.

If necessary, adjust rod (3) to 2.875 in. between clevis pin centres then check rod (4) and, if necessary, adjust to 4.500 in. between ball joint centres.

Adjust rod (5) to bring the cross-shaft lever approximately 2° below the horizontal to maintain the throttle fully closed and the T.V. lever against its forward stop. The slackened pinch bolt will allow the shaft to turn inside the lever to obtain these positions. Tighten pinch bolt (6) and move the linkage to the throttle open position. The T.V. lever should reach its rearward stop when the throttles touch their open stop.

Finally, connect rod (1), adjusting its length to slightly depress the accelerator pedal. Set the accelerator pedal maximum stop to contact the pedal in the full throttle position. If necessary, set the Neutral and Reverse micro-switches as previously explained.

Final adjustment

Gear change adjustments should be made on rod (7).

If the gear changes are 'jerky' and 'hang-on', **shorten** rod (7).

If the gear changes are 'slippy' and too close together, **lengthen** rod (7).

'Kick-down' adjustment

R.H. drive cars

'Kick-down' adjustments should be made on rod (1).

If the 'kick-down' is too easy, **lengthen** rod (1).

If the 'kick-down' is too difficult or unobtainable, **shorten** rod (1).

'Kick-down' adjustment

L.H. drive cars

'Kick-down' adjustments should be made on the accelerator full throttle stop.

If the 'kick-down' is too easy, **raise** the stop.

If the 'kick-down' is too difficult or unobtainable, **lower** the stop.

Controls — To adjust

'R' Series 1953 cars

On right-hand drive cars, disconnect the accelerator to bulkhead lever (5) (see Fig. 34 R.H. drive).

Adjust rod (4) to set the bulkhead lever 15° to 20° below horizontal then, with the throttle stop screw out of action, adjust rod (3) so that the carburettor lever is held against the closed stop.

The rearward edge of lever (2) should then be approximately vertical and the long lever on the other end of the cross-shaft should be at an angle which holds its connecting rod clear of the anti-toggle pin on the lever.

Adjust rod (1) so that the T.V. lever is held against its stop.

Move the controls from the throttle open to throttle closed position. If the limits of travel are not coincident with both throttle and T.V. stops, **lengthen** the rod connected to the lever which fails to reach its **open** stop, or, **shorten** the rod connected to the lever which fails to reach its **closed** stop.

To increase the movement of the T.V. lever relative to the carburettor throttle lever, shorten rods (1) and (3). Lengthening the rods will decrease the movement.

Adjust rod (5) to a length which permits the stop under the pedal head to just clear the toe board in the full throttle position. This should give clearance of 0.375 in. between the pedal lever and the toe board in the throttle closed position. If pedal travel is insufficient to allow this, remove a rubber stop from beneath the pedal and re-adjust the rod.

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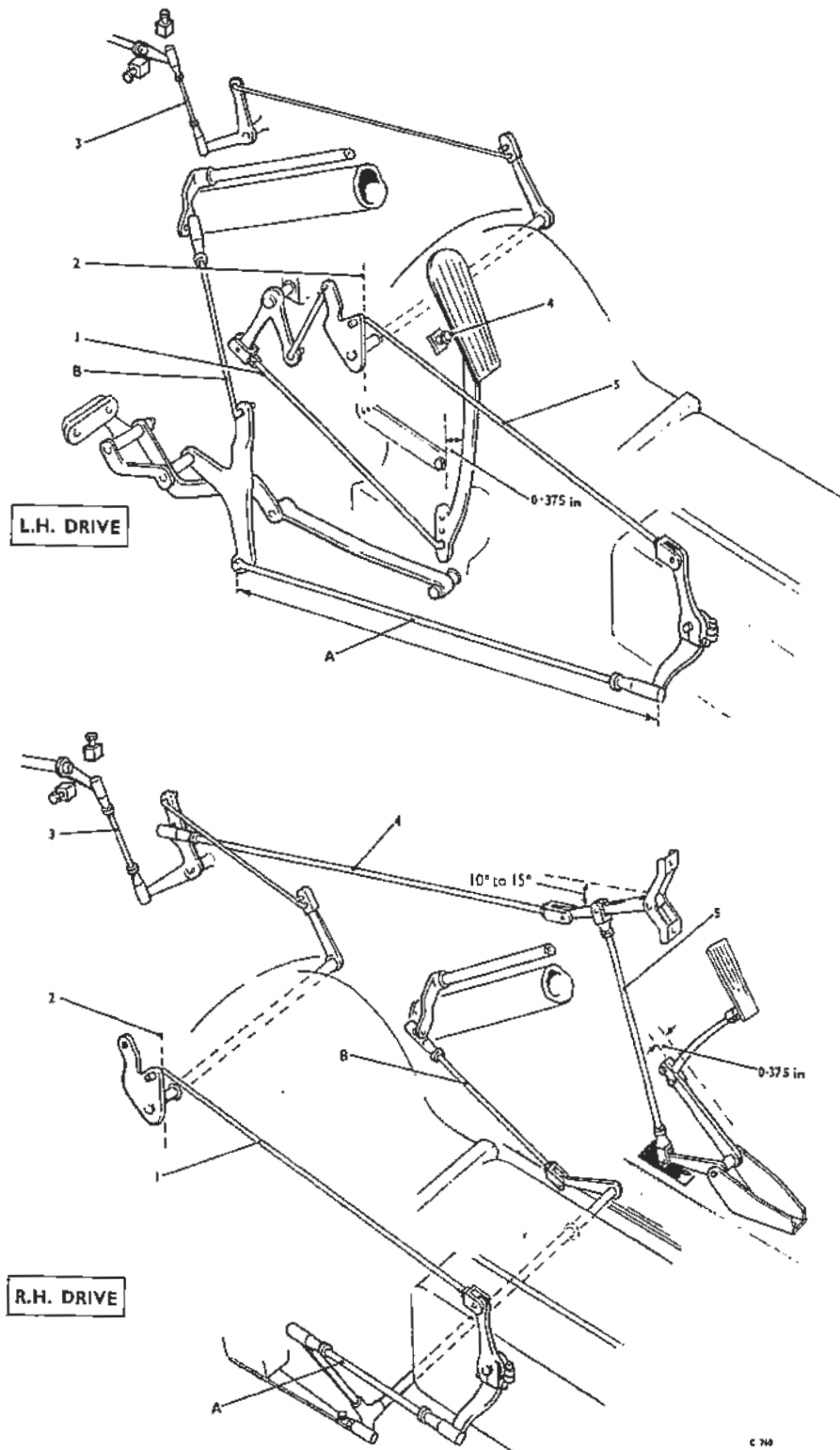


Fig. 34 T.V. and selector controls (1953 cars)

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On left-hand drive cars, disconnect rod (1) (see Fig. 34 L.H. drive).

Adjust rods (3) and (5) so that, with the throttle closed stop screw out of action, the carburettor throttle lever is held against the closed throttle stop and the T.V. lever is near, or up against its stop. The rearward edge of lever (2) should be approximately vertical whilst the long lever at the other end of the cross-shaft should be at an angle which holds its connecting rod clear of the anti-toggle pin on the lever.

If the rods need to be re-adjusted to enable a lever to reach a stop or if the T.V. lever travel needs increasing or decreasing relative to the carburettor lever, proceed as described for right-hand drive cars.

Adjust rod (1) so that, when coupled to the lowest of the three holes in the accelerator pedal lever, the arm clears the adjacent setscrew by at least 0.375 in. when in the throttle closed position. After adjusting the engine idling speed to 375 r.p.m. set the full throttle pedal stop to give a small pedal clearance in the full throttle position.

Final adjustment

Gear change adjustments should be made as follows

On right-hand drive cars, if the gear changes are 'jerky' and 'hang-on' **shorten** rod (1).

If the gear changes are 'slippy' and too close together, **lengthen** rod (1).

On left-hand drive cars, alter rod (5) if the conditions are similar.

'Kick-down' adjustment

R.H. drive cars

'Kick-down' adjustments should be made on rod (5).

If the 'kick-down' is too easy, **lengthen** rod (5).

If the 'kick-down' is too difficult or unobtainable, **shorten** rod (5).

'Kick-down' adjustment

L.H. drive cars

'Kick-down' adjustments should be made on throttle stop (4).

If the 'kick-down' is too easy **raise** the stop.

If the 'kick-down' is too difficult or unobtainable, **lower** the stop.

Selector controls — To set

The notches in the gearbox detent control lever should retain the controls in each selected position, the quadrant lever being just clear of the Neutral and gate stops in positions '4' and '3' respectively. If the selector lever vibrates during running it is permissible to spring it slightly towards the Neutral stop in range '4' position.

On left-hand drive cars the setting of the intermediate linkage is controlled by the length of rod (A) and should be 17.750 in. between ball and pin centres.

On right-hand drive cars rod (A) should be adjusted so that the lever on the right-hand side of the cross-shaft projects 0.500 in. below the level of the chassis frame with the selector in Neutral.

When the intermediate linkage is correct it should be necessary only to adjust the length of rod (B) to re-set the position of the selector lever relative to the gearbox lever on both left- and right-hand drive cars. If there is any tendency for the selector lever to vibrate when in range '4', lengthen the rod by one or two half turns as necessary.

If necessary, set the Neutral and Reverse micro-switches as explained earlier.

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SECTION 5 — AIR PRESSURE CHECK AND INVESTIGATION

The air pressure test assists diagnosis by indicating which unit is exhibiting excessive oil leakage and in some cases can be used to check unit functioning. The tests can only be made after removal of the gearbox sump, side cover and control valve unit, which should follow investigation of the possible causes listed in the Fault Diagnosis Section.

Removal of the control valve unit and reverse clutch oil pipe reveals the oil passages to which the air pressure should be applied. Using the tool (J-4353-1) connected to a compressed air supply of approximately 80 lb./sq. in. apply air pressure to the oil passages referring to Figure 35 for identification of the oil passages. Excess oil should be blown out into a cloth before close examination.

Front servo

The front servo will apply the front band when air pressure is applied to the front band apply passage. Small air leaks are permissible only — through the servo to casing joint face — from the 4-3 timing valve exhaust hole — and from the front band release passage; no other leaks are permissible. Excessive leakage from the front band apply passage or from the compensator passage may cause slipping on 2-3 up-change or when starting from rest.

As the front servo is returned by spring pressure to the released position, application of air pressure to the front band release passage will not actuate the servo or band, but it will indicate excessive leakage. Slight leakage past the piston ring gaps is permissible. Excessive leakage will cause slipping on 3-4 up-change and if it

is very excessive will cause missing of second and fourth gears. On early servos a sticking quick-release valve may cause slipping in range '3'.

Air pressure applied to the G1 to 4-3 timing valve passage should give slight leakage only from the front band apply passage. If the valve is sticking, slipping may occur on the 2-3 up-change, 4-3 down-change, or intermittently in all ranges. In some instances a rough 4-3 down-change may occur.

Rear servo

The rear servo will actuate the rear band when air pressure is applied intermittently to the rear band release passage. Air will escape through the piston ring gaps but leakage should not be sufficient to impair operation. A small amount of air may escape from the compensator passage and from the servo to casing face joint but there should be no other leakage. Excessive leakage will cause slipping on 2-3 up-change or a rough 3-2 closed-throttle down-change.

When air pressure is directed into the compensator passage a feed into both front and rear servos, tending to tighten the bands, should be indicated by slight leakage past the piston ring gaps of both servos. Excessive leakage will cause slipping on heavy throttle up-changes.

Other possible rear servo defects are faulty restrictor valve, exhaust valve sticking open or servo piston sticking when applying; these cannot be diagnosed by the air pressure check but will give such incorrect operation as rough '3-2 closed-throttle down-change, or slow band apply when selecting drive from Neutral.

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Front epicyclic unit

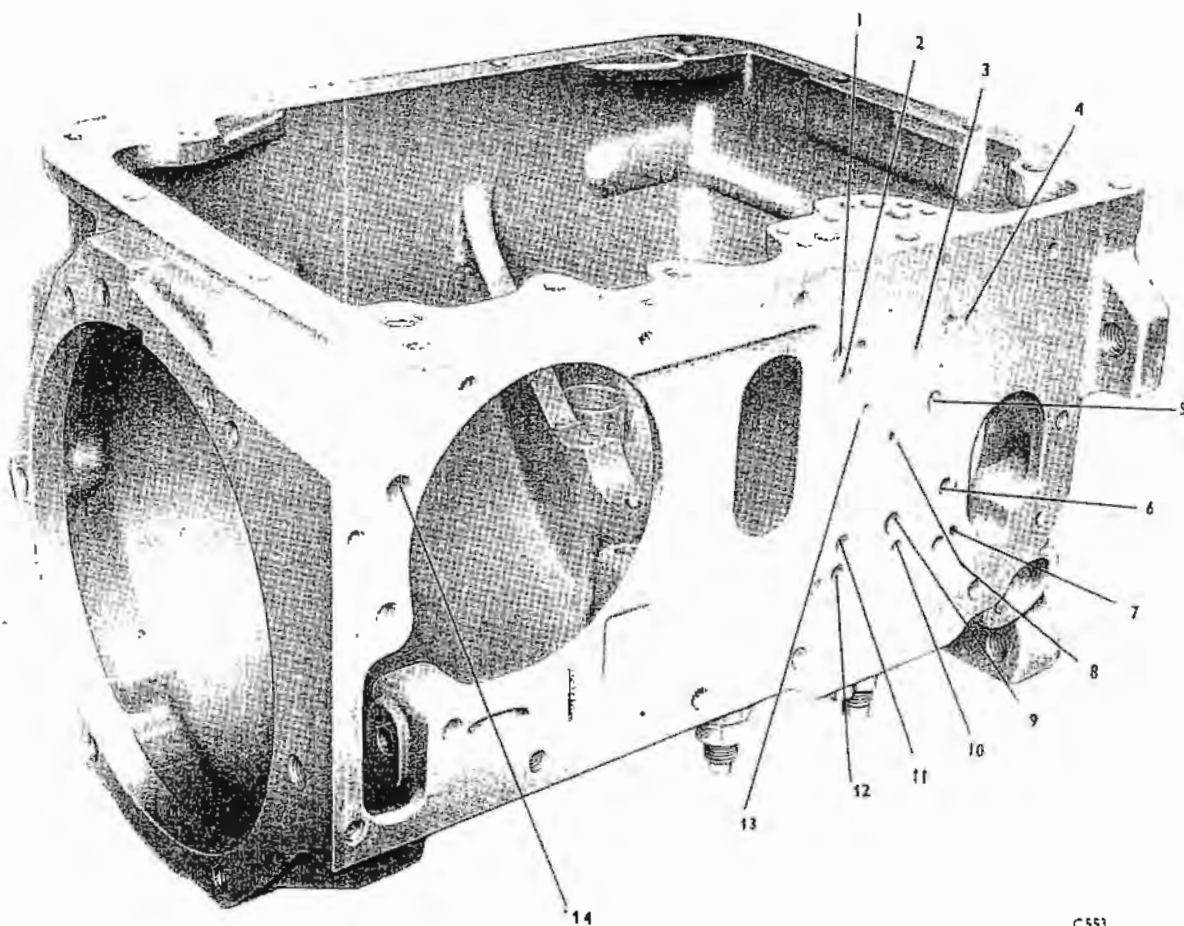
The front unit contains the front clutch which can be felt or heard to operate when air pressure is applied intermittently to the front clutch apply passage. Excessive air leakage will indicate either faulty clutch piston seals, or a faulty oil delivery sleeve; the latter can be checked more accurately by removing the servos to enable a closer inspection of the source of leakage. Leakage from the oil delivery sleeve may affect front or rear unit operation, or both.

It may be possible to rectify leakage from the oil delivery sleeve if it is due to loose bearing cap set-

screws or bad fitting of the cap to the sleeve, but any other fault will require removal of the gearbox to permit removal and investigation of the front unit or oil delivery sleeve.

A sufficient loss of oil pressure or any other fault which causes the clutch to slip will cause slipping on 1-2 and 3-4 up-changes; if very excessive, second and fourth gears will be missed.

A locked front unit due to faulty gears will prevent a forced 4-3 down-change and missing of first and third gears; this will not be shown up by the air pressure check.



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Fig. 35 Oil passage identification

- | | | |
|--------------------------|-------------------------|-------------------------|
| 1 REAR BAND RELEASE | 6 FRONT BAND RELEASE | 10 PRESSURE GAUGE BLANK |
| 2 COMPENSATOR OIL | 7 T.V. OIL TO REGULATOR | 11 FRONT CLUTCH APPLY |
| 3 G1 TO 4-3 TIMING VALVE | 8 1-2 OIL TO REAR SERVO | 12 REAR CLUTCH APPLY |
| 4 FRONT BAND APPLY | 9 EXHAUST | 13 EXHAUST |
| 5 MAIN LINE PRESSURE | | 14 REVERSE CLUTCH APPLY |

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Rear epicyclic unit

The rear unit and its clutch can be checked in the same way as the front clutch by applying air pressure to the rear clutch apply passage. A slipping rear clutch will result in slipping on the 2-3 up-change and if both front and rear clutches are slipping as a result of leakage from the oil delivery sleeve, there may be no up-change above first.

Reverse epicyclic unit

The reverse unit clutch test is the same as for the front and rear clutches, the pressure being applied through the reverse clutch apply passage after removal of the reverse clutch oil pipe. Excessive leakage from around the clutch piston indicates faulty piston seals; this may cause slipping or 'no drive' in Reverse, and can only be rectified by removing and dismantling the gearbox to overhaul the reverse clutch.

A tendency for the reverse clutch to stick in engagement, after moving the selector lever from Reverse, will prevent forward drive because the transmission will lock. It may be possible to rectify such a fault before detailed investigation by operating the transmission to free it and burnish the clutch surfaces, as described in the following paragraphs.

Free the reverse clutch by selecting Reverse and increasing engine speed; then select range '4'. When the change occurs, reduce engine speed to idling. Repeat this operation until the transmission is free.

If, after five attempts, the transmission is still not free, do not continue the procedure, as a more detailed investigation will be necessary to eliminate the fault.

When the transmission has been freed satisfactorily by running the engine, the clutch should be burnished by driving the car forward at 1 m.p.h. to 2 m.p.h.; select Reverse and when the change is nearly complete, again select forward drive.

Repeat this procedure five or six times and then select range '4' and drive at about 20 m.p.h. for a few minutes to cool the gearbox. Repeat this cycle five times and then road test.

Governor and parking bracket

The governor and parking brake bracket can be checked together for excessive leakage, after removing the governor feed pipe and refitting it so that the servo end of the pipe is swung clear of the gearbox. Air pressure can then be applied to the open end of the pipe.

With the governor weights pressed inward to close the ports, there will be some leakage past the piston ring gaps in the governor sleeve; air will escape from the sleeve and from the G1 and G2 passages and valves, but this should not be excessive.

There may also be slight leakage from the parking and reverse blocker pistons.

There should be little or no leakage from the bracket to casing face joint. Excessive leakage would prevent any up-change.

If the reverse blocker piston sticks in, due to insufficient governor pressure or for any other reason, reverse engagement above the maximum speed of 10 m.p.h. will be possible.

If the reverse blocker piston sticks out, due to leakage of main pressure into the governor passage (broken piston ring), it will prevent selection of Reverse below 10 m.p.h.

If the parking blocker piston sticks out, it will prevent engagement of the parking pawl when Reverse is selected for parking. Clashing when Reverse is engaged may be caused by incorrect operation of the parking pawl.

The governor valves should have no tendency to stick and if they are moved outwards during the air pressure check, there should be an increase in the air flow from the G1 and G2 passages and governor valve exhaust ports. Sticking valves or excessive leakage in the governor will cause such defective operation as high or low up-changes—slipping in '4' and '3' ranges or slipping with failure to drive in Reverse.

Other passages which may be checked during this diagnosis procedure are the main pump feed passages, the exhaust port for the control valve unit and the passage to the pressure gauge blank.

Air pressure applied to the main line passage will result in a large escape of air from between the front drum and front pump; this is normal and comes from the rear side of the front pump.

The exhaust port for the control valve unit should permit unrestricted flow into the inside of the main casing.

Pressure control valve

During removal of the pressure control valve (see Fig. 36), which is spring-loaded, care must be taken to ensure that the damper spring, reverse booster plug and throttle regulator plug do not fall out.

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After thorough cleaning, compressed air applied into the passages of the regulator and reverse booster plugs should remove stickiness; the plugs should move freely in the bores. The plugs and damper spring should be assembled using petroleum jelly to retain them in position.

Before trying the control valve in the piston valve bore, it is recommended that oil is flushed through the bore by motoring the engine over by means of the starter. Do not introduce cleaning solution into the bore.

The piston valve should be tried for free movement in its bore before being refitted.

Control valve unit

The control valve unit cannot be checked satisfactorily in position, therefore, if the foregoing checks indicate satisfactory functioning of other units in the gearbox and the fault is shown by the Diagnosis Section to be attributable to the control valve unit, it should be removed (see Fig. 37), dismantled and overhauled as described in Chapter 3. It should be noted when removing that screws are tight, as leakage between the face joints may seriously affect valve operation.

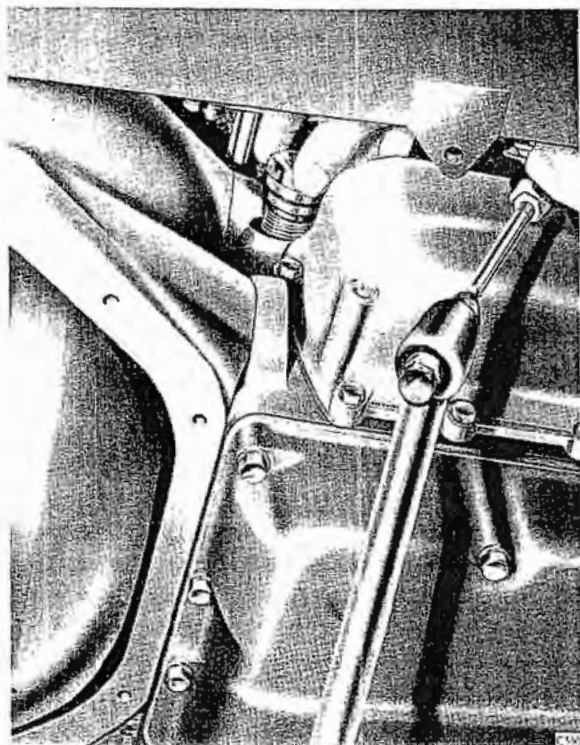


Fig. 36 Removing pressure control valve from beneath the car

Fluid coupling

Slipping or faulty gear changes are unlikely to be caused by the fluid coupling, except in the unlikely event of damaged torus members, which might cause slipping and overheating at all speeds. Temporary slipping on starting the car, without the recommended three minutes warming-up period, can result from a leaking torus check valve. This is because of insufficient oil in the fluid coupling, as a result of excessive drainage through the relief valve into the sump. Such a defect raises the oil level on the dipstick, which can therefore be used to check for the fault.

Check the oil level as previously described and wait ten minutes with the engine stopped. Note the level on the dipstick without running the engine; if it has increased more than half an inch, excessive leakage is confirmed and rectification is necessary.

Any fault associated with the fluid coupling will require removal of the gearbox before it can be rectified.

Noise

The source of any noise that occurs in the gearbox should be traced by reference to the phase of operation associated with the faulty unit. The method of testing to ensure this is described in the following paragraphs.

Planet gear noise will be heard as a low growl at idling, rising to a high pitched whine as speed is increased.

Front unit noise will be at a higher pitch than that of the rear unit, while reverse gear noise can be heard only when accelerating in Reverse. Tests should be made by accelerating through the gears in range '4' and noting the character of the noise at the change points. Noise in both first and second gears is caused by the rear unit.

Noise in both first and third is caused by the front unit.

Rear unit noise may be heard also when slowing down in Reverse.

Slight gear noise in Neutral, which disappears when drive is selected, is usually attributable to the rear unit.

Oil pump noise may be most pronounced at a certain engine or road speed. As the front pump is operating only when the engine is running and the rear pump only when the output shaft is turning, it is possible to diagnose which pump is defective by static and road tests.

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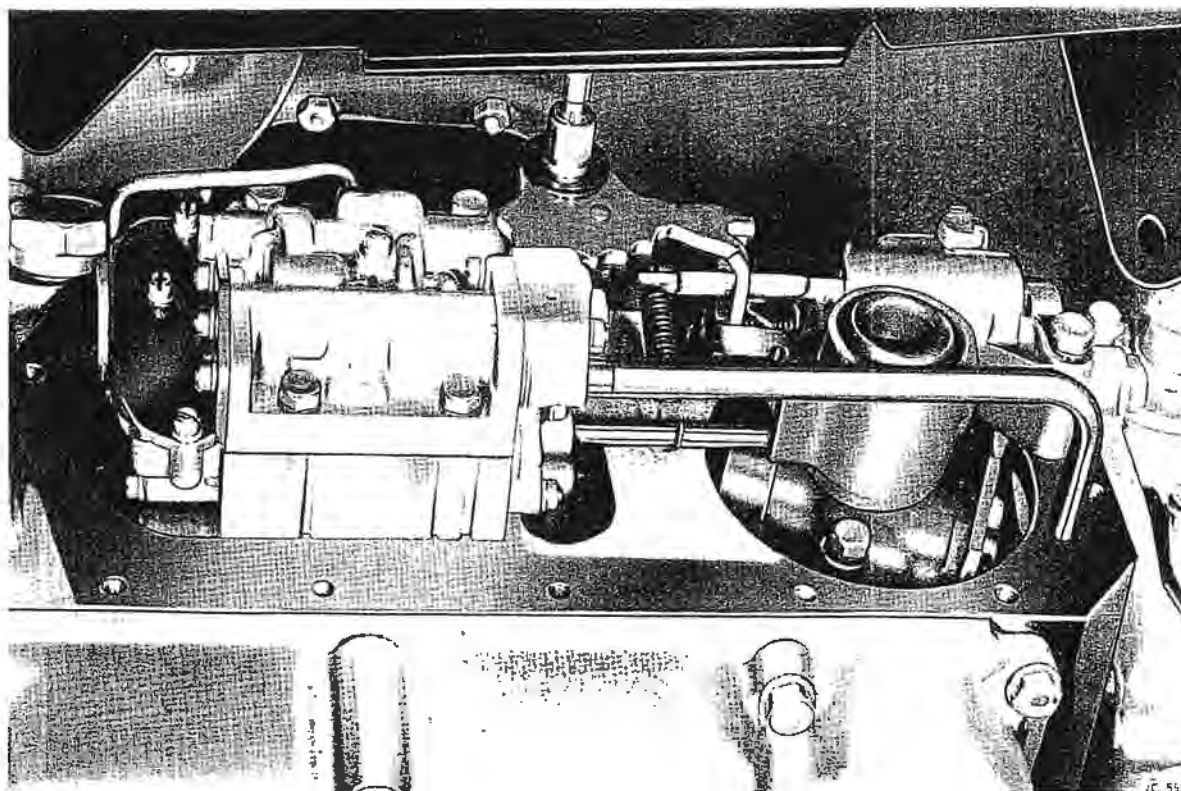


Fig. 37 Side cover removed and selector lever moved to Reverse position prior to removal of control valve unit

The test should be started in Neutral and the throttle opened gradually while noting the engine speed at which noise, if any, is most pronounced. Select range '4' and drive the car on the road until the noise is most pronounced, then quickly switch off the engine and select Neutral to stop the front pump. If the noise still persists and was not noticeable when the car was stationary, the rear pump is suspect. There are two possible faults which can cause noise in the rear pump. Noise caused by the rear pump driving gear is a whine similar to axle noise and will usually be most noticeable above 20 m.p.h. If doubt exists, axle noise can be eliminated by disconnecting the gearbox output shaft, then with the selector in range '4', run the engine up to the speed at which noise was most noticeable.

The other possible cause of noise in the rear pump is inner gear noise, which is usually a low growl occurring at speeds above 35 m.p.h.

An important point to remember is that, in the tests for suspected noise in the rear pump, coasting with engine switched off should not exceed 25 m.p.h. and should be kept to the minimum necessary to confirm or eliminate the fault, as the low oil pressure possible with a faulty rear pump may cause incorrect operation or inadequate lubrication with possible damage to other units in the gearbox.

The fluid coupling is unlikely to cause noise or slipping unless it is damaged or incorrectly fitted. A metallic scraping noise would result from fouling of the rotating parts. Worn torus member splines may result in increased gear noise in Neutral.

Rectification of units

Removal, overhaul and refitting of all units is described in Chapter 3.

The units which can be removed and refitted without removal of the gearbox are as follows

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- 1 Pressure control valve.
- 2 Control valve unit (necessitates removal of side cover).
- 3 Parking brake bracket (necessitates removal of side cover and control valve unit).
- 4 Governor and rear oil pump (necessitates removal of side cover, sump control valve unit, parking brake bracket and both servos).
- 5 Front and rear servos (necessitates removal of sump and re-adjustment of bands).
- 6 Road wheel brake servo drive.
- 7 Speedometer drive.

The units which require removal of the gearbox before they can be rectified are as follows

- 1 Fluid coupling.
- 2 Front oil pump.
- 3 Front epicyclic unit.
- 4 Rear epicyclic unit.
- 5 Reverse epicyclic unit.

Towing

Towing or coasting with the engine switched off, should be confined to as short a distance as possible and to a speed not greater than 25 m.p.h.

Before attempting to tow, examine the gearbox for mechanical damage and leaks, and check the oil level. The car should not be towed if there is mechanical damage or if the oil level is low, but if satisfactory, the gearbox should be prepared for towing by slackening the rear band adjusting screw $4\frac{1}{2}$ turns and relocking the adjusting screw.

When towing, the selector lever should always be in Neutral, and, where possible, the towing speed maintained between 15 m.p.h. and 25 m.p.h.

An alternative method of preparing the car for towing is to disconnect and remove the rear half of the propeller shaft. This method is permissible if the gearbox is faulty and facilities for transporting the car are not available.

CHAPTER 3

OVERHAUL

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IMPORTANT

Filter gearbox fluid through lintless filter cloth or a 30 mesh filter — when washing parts use a brush, compressed air and clean fluid — do not use rag.

KEEP EVERYTHING CLEAN

Screw threads

Ensure, by running screws fully home with fingers, that threads are free. Use oil and torque load to final tightness.

Joints

Renew external joint washers. Internal joints are made by specially machined joint faces; they do not require jointing compound and must not be refaced.

Thrust washers

Label thrust washers during removal; exact knowledge of their running position will assist subsequent inspection and assembly.

New parts

Use the Spares Schedule (CPL10.1 Vol. 3) for identification of parts. Ensure that bolts and screws have the correct thread.

Lubrication

Use gearbox fluid for oiling parts during assembly. If grease is necessary to hold parts in position, use petroleum jelly.

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SUMMARY OF REPAIR DATA

The torque loadings given in this Summary apply to nuts and bolts assembled with gearbox oil on the threads and the bolt or nut faces.

Inspection and assembly check dimensions apply only to the methods described later in the Sections.

SECTION 1—GEARBOX—TO REMOVE AND FIT

Torus cover drain plug	18 lb.ft. to 20 lb.ft.
Torus cover to flywheel	18 lb.ft. to 20 lb.ft.
Throttle lever to spindle	3 lb.ft. to 4 lb.ft.
Selector lever to shaft	8 lb.ft. to 10 lb.ft.

SECTION 2—FLUID COUPLING

Mainshaft nut	50 lb.ft. to 55 lb.ft.
Bell housing to gearbox casing	60 lb.ft. to 65 lb.ft.
Relief valve retainer to torus hub	8 lb.ft. to 10 lb.ft.
Intermediate shaft end float	0.005 in. to 0.008 in.

SECTION 3—SIDE COVER, SUMP AND FILTER

Side cover to gearbox casing	8 lb.ft. to 10 lb.ft.
Sump to gearbox casing	16 lb.ft. to 18 lb.ft.
Sump drain plug	40 lb.ft. to 45 lb.ft.

SECTION 4—CONTROL VALVE UNIT

Control valve unit to gearbox casing	6 lb.ft. to 8 lb.ft.
Front body to inner valve body	3 lb.ft. to 4 lb.ft.
Outer body to inner valve body	3 lb.ft. to 4 lb.ft.
Overspeed valve body to inner valve body	3 lb.ft. to 4 lb.ft.
Front body cover plate to front valve body	3 lb.ft. to 4 lb.ft.
Compensator valve plate to outer valve body	3 lb.ft. to 4 lb.ft.
Selector plunger body to outer body	3 lb.ft. to 4 lb.ft.

SECTION 5—PARKING BRAKE BRACKET

Parking brake bracket to gearbox casing	16 lb.ft. to 18 lb.ft.
Parking pawl support screw	25 lb.ft. to 28 lb.ft.

SECTION 6—FRONT AND REAR SERVO UNITS

Front servo body to cylinder	8 lb.ft. to 10 lb.ft.
Front servo to gearbox casing	29 lb.ft. to 32 lb.ft.
Front servo screwed plug	6 lb.ft. to 7 lb.ft.
Front servo valve body to servo body	3 lb.ft. to 4 lb.ft.
Rear servo strap to body	16 lb.ft. to 18 lb.ft.
Rear servo to gearbox casing	29 lb.ft. to 32 lb.ft.
Band adjusting screw lock-nut	45 lb.ft. to 50 lb.ft.

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SECTION 7—REAR PUMP AND GOVERNOR

Rear pump and governor to gearbox casing	16 lb.ft. to 18 lb.ft.
Rear pump cover to rear pump body	..	..	..	..	..	..	..	8 lb.ft. to 10 lb.ft.
Governor body to driving flange	..	..	..	..	..	..	..	8 lb.ft. to 10 lb.ft.
G2 valve retaining plate to governor body	..	..	..	..	..	..	..	3 lb.ft. to 4 lb.ft.
Governor tower run-out	..	..	..	..	..	..	..	0.005 in. max.
Governor drive flange run-out	..	..	..	..	..	..	..	0.001 in. max.
Governor sleeve oil sealing ring gap	..	..	..	..	..	..	..	0.001 in. to 0.006 in.
Pump drive-shaft end float	..	..	..	..	..	..	..	0.0005 in. to 0.0025 in.

SECTION 8—PRESSURE CONTROL VALVE

Pressure control valve to gearbox casing	45 lb.ft. to 50 lb.ft.
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SECTION 9—FRONT PUMP AND DRIVE-SHAFT

Body to cover	12 lb.ft. to 15 lb.ft.
Pump to gearbox casing	10 lb.ft. to 13 lb.ft.
Vanes diametrical clearance	..	..	..	..	..	..	..	0.0012 in. to 0.0042 in.
Vanes end clearance	..	..	..	..	..	..	..	0.0008 in. to 0.002 in.
Rotor end clearance	..	..	..	..	..	..	..	0.0008 in. to 0.002 in.
Slide end clearance	..	..	..	..	..	..	..	0.0008 in. to 0.002 in.
Cover sealing ring gap	..	..	..	..	..	..	..	0.005 in. to 0.010 in.
Bell housing to gearbox casing nip	0.003 in. to 0.013 in.

SECTION 10—RIDE CONTROL UNIT

Driving key end float	0.020 in. to 0.040 in.
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SECTION 11—SPEEDOMETER DRIVE

Drive-shaft end float	0.020 in. to 0.038 in.
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SECTION 13—REVERSE UNIT

Reverse housing to gearbox casing	29 lb.ft. to 32 lb.ft.
Coupling flange nut	..	..	..	..	..	..	..	150 lb.ft. to 180 lb.ft.
Drive-flange to rear drum	..	..	..	..	..	..	..	16 lb.ft. to 18 lb.ft.
Mainshaft end float	..	..	..	..	..	..	..	0.004 in. to 0.015 in.
Output shaft end nip	..	..	..	..	..	..	..	0.004 in. to 0.010 in.
Reverse planet carrier end float	..	..	..	..	..	..	..	0.004 in. to 0.015 in.

SECTION 14—DRUM ASSEMBLY

Centre bearing cap to gearbox casing	..	..	..	..	..	..	..	45 lb.ft. to 50 lb.ft.
Rear planet pinion annulus to rear drum	..	..	..	..	..	..	..	3 lb.ft. to 4 lb.ft.
Oil delivery sleeve sealing ring gap	..	..	..	..	..	..	..	0.003 in. to 0.009 in.
Front drum end float on intermediate shaft	..	..	..	..	..	..	..	0.002 in. to 0.004 in.

SECTION 15—GEARBOX CASING

Oil pressure check point plug	16 lb.ft. to 18 lb.ft.
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CHAPTER 3

OVERHAUL

SECTION 1 — GEARBOX — TO REMOVE AND FIT

Gearbox — To remove S2 and S3 cars

Run the car over a pit or on to a ramp; this is necessary to enable the gearbox to be lowered when disconnected from the engine. To prevent the car from moving, chock both front wheels and one of the rear wheels with wooden blocks.

Jack the other rear wheel clear of the ground so that the propeller shaft can be rotated.

Disconnect the battery.

Remove the setscrews and washers securing the inner left and inner right-hand undersheets to the chassis frame; remove the undersheets (see Fig. 38).

Gearbox and throttle controls — To remove S2 and S3 cars

Note Care must be taken not to bend or alter the lengths of any of the control rods when they are being removed.

On left-hand drive cars, to remove the controls remove the nut and washer retaining the rubber mounted isolating stay. Withdraw the isolating stay from its anchor bolt fitted forward of the valve box cover.

Disconnect the ball socket from the selector lever on the side of the gearbox. The gearbox control assembly can then be lifted clear on to the chassis frame.

Release the throttle valve lever pinch bolt and withdraw the lever from its shaft.

Remove the bolt, washers and nut at the lower end of the connecting link.

Slacken the pinch bolt and adjusting screw at the upper end of the throttle control rod, then remove the ball socket from the control rod lever mounted on the engine.

Remove the split pin, castellated nut and washers securing the throttle levers to the bell housing.

The throttle levers can then be lifted clear of the gearbox without further dismantling.

On right-hand drive cars, remove the gearbox control cross-shaft by disconnecting the four ball joints.

Unscrew the setscrews securing the gearbox control assembly stay to the chassis right-hand side member.

Remove the nut, bolt, washers and distance tube from the gear selector control pivot; remove the control assembly.

Disconnect the T.V. rod from the T.V. lever by removing the split pin and clevis pin.

Disconnect the coupling rod from the throttle control cross-shaft lever by removing the split pin.

Slacken the pinch bolt and adjusting screw at the lower end of the throttle control rod.

Remove the control rod from the throttle lever, mounted on the bell housing.

Remove the nut, bolt and washer at the cross-shaft bracket; disconnect the rubber mounted connecting link.

Brake control rods and servo motor — To remove S2 and S3 cars

Refer to Figure 39 for identification of the control rods and levers.

On left-hand drive cars, remove the intermediate rod (12) as follows

Remove the split pin and clevis pin from the bell crank lever fitted on the chassis left-hand side member.

Slacken the lock-nut and unscrew the intermediate rod from the jaw (13) fitted to the bell crank lever on the chassis right-hand side member; the lock-nut must be retained in position approximately relative to the intermediate shaft to facilitate adjustment on re-assembly.

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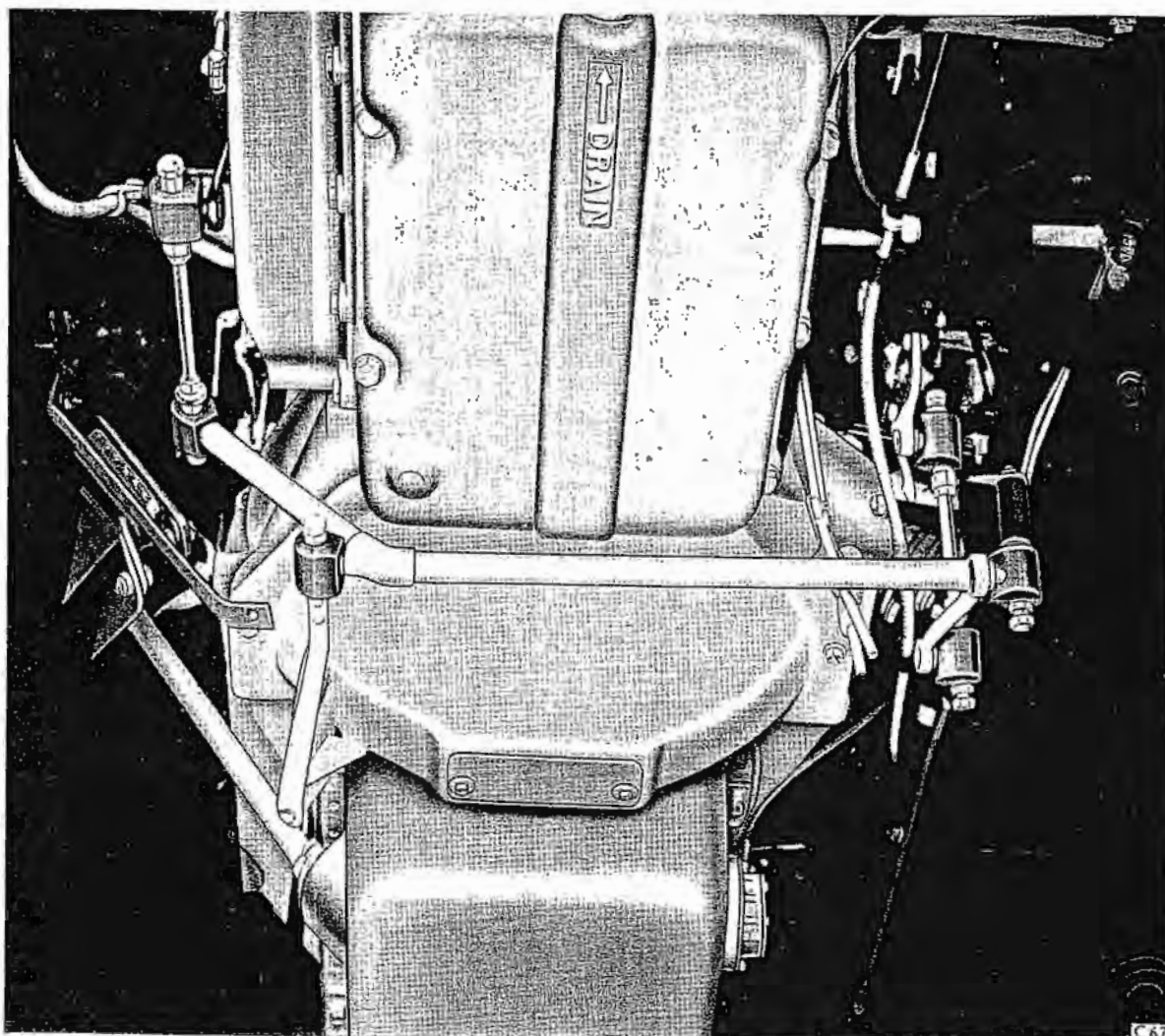


Fig. 38 Undersheets removed

On right-hand drive cars, unhook the pull-off spring (9) from the on-stop bracket (6).

On all cars, uncouple the hand brake cable from lever (3) by removing the split pin, washer and clevis pin.

Remove the 2 B.A. nut and bolt securing the hand brake cable clip to the engine right-hand rear mounting, then lift the cable clear of the servo motor and adjacent components.

Disconnect the brake rod (7) as follows

Remove the setscrew retaining the locking plate on the rear end of the brake rod (7) and remove the locking plate. Withdraw the clevis pin and lift the brake

rod clear of the servo levers.

Disconnect the rear brake linkage control rod (4) at the outer servo lever (5) by removing the setscrew retaining the locking plate and withdrawing the clevis pin. Lift the control rod clear of the servo levers.

Disconnect and remove the forward and reverse brake rods (fitted between the servo levers and the master cylinder operating lever) as follows

Remove the setscrews retaining the locking plates on the forward ends of the upper and lower brake rods; remove the locking plates and withdraw the clevis pins.

Remove the nut, bolt, washers and distance pieces securing the rear end of each of the brake rods to the

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master cylinder operating lever, noting the positions of the distance pieces.

Scribe a mark showing the alignment of the chassis frame and the on-stop bracket (6). Remove the nut and bolt from the front of the on-stop bracket, slacken the rear nut and bolt and swing the on-stop bracket clear of the servo levers.

Remove the setscrew securing the servo motor to the gearbox, then remove the servo motor complete with sealing washer.

Engine and gearbox components — To remove

S2 and S3 cars

Release the worm drive clip securing the rubber hose to the engine induction manifold and detach the hose. Unscrew the two nuts and bolts securing the air cleaner to the bonnet, then remove the air cleaner.

Uncouple the two fuel breather pipes at the unions adjacent to the distributor.

Remove the setscrew and clip from the rear of the crankcase.

Remove the clip from the bell housing bottom cover and withdraw the two fuel breather pipes.

The following two paragraphs apply to 'S2' cars only.

Remove the setscrew securing the distributor wiring clip to the left-hand cylinder head and move the leads aside to gain access to the crankcase breather.

Remove the two setscrews securing the crankcase breather to the crankcase, then remove the two setscrews securing the breather pipe assembly to the flywheel bottom cover; withdraw the breather pipe assembly from beneath the car.

Remove the six setscrews retaining the flywheel bottom cover and remove the cover.

Remove the gearbox drain plug and aluminium sealing washer; drain the fluid into a suitable container then refit the plug.

Rotate the engine flywheel to bring the fluid coupling drain plug to its lowest position, then remove the plug and sealing washer. Drain the fluid from the coupling into a suitable container, then refit the drain plug.

Disconnect the speedometer drive at the gearbox end.

Remove the four nuts securing the propeller shaft to the gearbox output flange. (To prevent the propeller shaft from turning whilst unscrewing these nuts,

select Reverse gear by moving the selector lever on the gearbox as far as possible towards the rear of the car).

Remove the split pin and castellated nut securing the propeller shaft centre bearing support bracket to the chassis frame; slide the shaft towards the rear of the car.

Disconnect the starter motor lead at the motor. Remove the three setscrews retaining the starter motor; remove the motor.

Remove the setscrews securing the fluid coupling outer cover to the engine flywheel, taking care not to misplace the balance weights (if fitted).

Remove the nuts, bolts and washers securing the engine rear mountings to the chassis frame.

Place a jack under the engine sump, using a suitable block between the jack head and the sump to spread the load. Raise the engine by means of the jack until the metal and bonded rubber plate can be removed from between each of the engine rear mountings and the chassis frame.

On some cars, metal packing pieces are fitted between the chassis frame and the mounting plates for alignment purposes; in these cases, the metal packings should be marked so that they can later be refitted in their original positions.

Remove the two nuts, bolts and washers securing each of the engine rear mounting blocks to the mounting brackets on the bell housing.

Remove the two setscrews and washers retaining each of the engine rear mounting brackets; remove the brackets.

Before finally disconnecting the gearbox from the engine, support the gearbox in a cradle attached to the lifting platform of a trolley jack (see Fig. 40).

With the gearbox supported in the cradle, remove the eight setscrews securing the bell housing and gearbox to the engine.

Carefully ease the gearbox away from the engine until the fluid coupling assembly is clear of the two dowels in the engine flywheel and the centre spigot is clear of the flywheel bearing. Note that two dowel pins in the bell housing joint face locate in holes in the rear joint face of the engine crankcase.

Remove and discard the joint fitted between the flywheel and the fluid coupling outer cover.

When the gearbox is fully withdrawn, lower it and remove it from beneath the car.



Fig. 39 Brake rod disconnecting points—'S' series cars.

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Notes on changing a gearbox or engine S2 and S3 cars

A replacement gearbox is supplied less fluid coupling and bell housing. The fluid coupling outer cover is fitted to the engine flywheel for crankshaft balancing purposes therefore, when fitting a replacement gearbox, the bell housing, fluid coupling outer cover and the driving and driven torus member must be transferred from the old gearbox to the replacement unit, as described in 'Chapter 3—Section 2'.

If the gearbox is to be retained and the engine renewed, the fluid coupling outer cover must be retained with the engine flywheel with which it was originally balanced; remove the cover as described in 'Chapter 3—Section 2'.

In order to maintain a balanced assembly, it is important that the components of the flywheel assembly be kept together. Should it be necessary to renew a component such as the starter ring, a replacement unit may be fitted provided that the vibration characteristics prove satisfactory on engine and road tests.

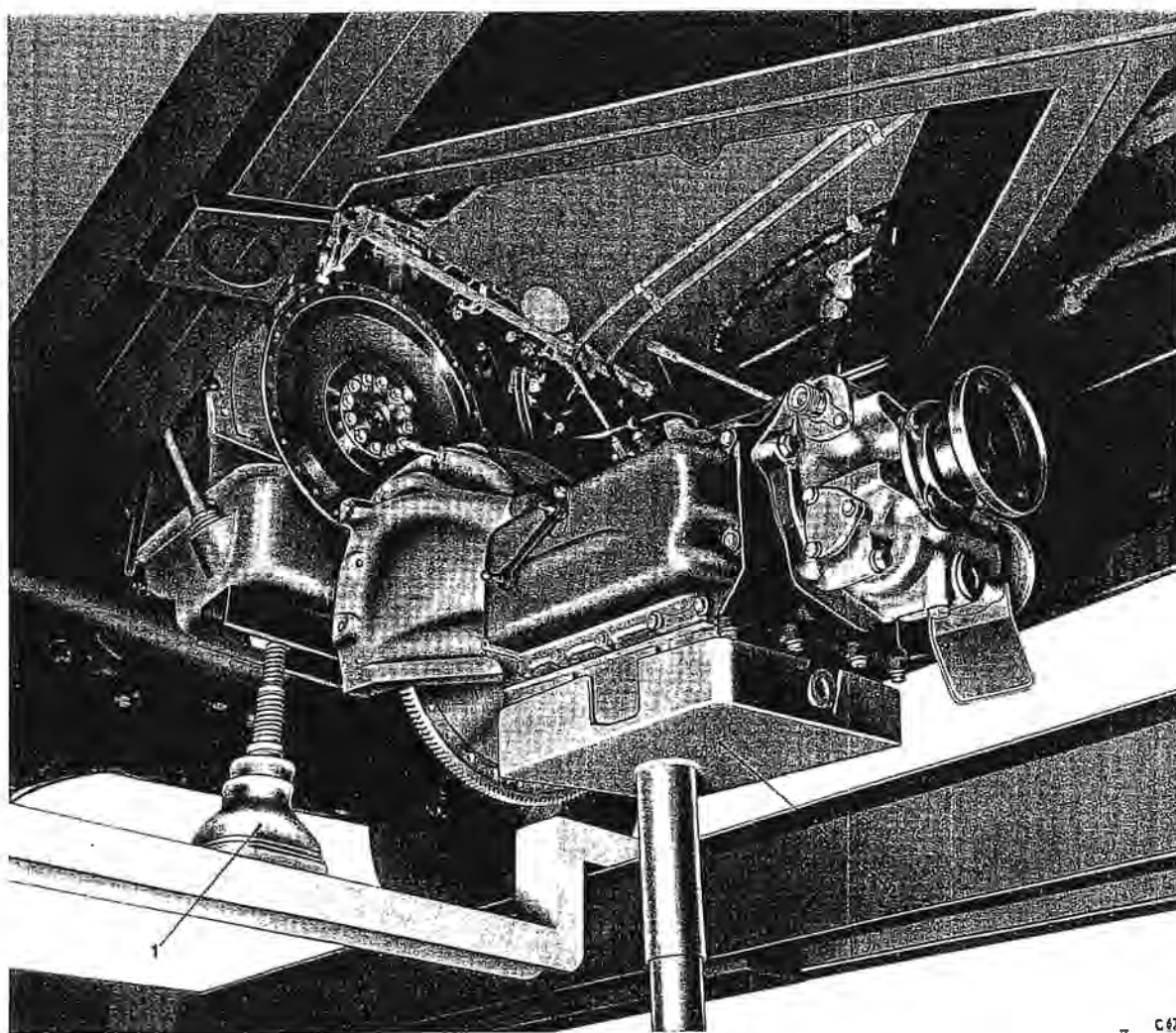


Fig. 40 Removing the gearbox

1 ENGINE SUPPORT JACK 2 TROLLEY JACK CRADLE

ROLLS-ROYCE AUTOMATIC GEARBOX

Gearbox — To fit

S2 and S3 cars

Assemble the fluid coupling as described in 'Chapter 3—Section 2'.

Fit the fluid coupling and gearbox drain plugs using new sealing washers. Care must be taken not to over-tighten the plugs.

To ensure correct balance of the crankshaft assembly, the fluid coupling outer cover can be fitted to the engine flywheel in one position only, one dowel being larger than the other.

Ensure that the joint faces of the engine flywheel and the fluid coupling outer cover are clean and free from burrs. Smear a little petroleum jelly on to the joint face of the flywheel and fit a new gasket.

Rotate the flywheel until the small dowel and fouling pin are in the lowest position possible, then rotate the fluid coupling outer cover until the dowel sockets are aligned with the dowels.

Support the gearbox in a cradle attached to the lifting platform of a trolley jack, then raise the gearbox to a position in line with the engine. Ease the gearbox forward until the centre spigot is located in its bearing and the dowels in the bell housing and the engine flywheel are located in their respective sockets. Check that the flywheel gasket has not been disturbed, then fit two setscrews into horizontally opposed holes in the fluid coupling outer cover and flywheel; tighten them evenly.

Fit the eight setscrews securing the bell housing to the engine. Note that the two lower setscrews on the left-hand side and the lowest setscrew on the right-hand side of the bell housing are larger than the other five screws.

Fit the remaining torus cover setscrews and tighten them evenly to the torque figure shown in the 'Summary of Repair Data'. If balancing weights are to be fitted, they must be attached with the fluid coupling setscrews, paying particular attention to the numbers stamped on each weight and on the coupling cover.

Remove the cradle and jack from beneath the gearbox.

The gearbox and engine can then be manoeuvred as a unit to facilitate assembly of the rear mountings.

Fit each of the engine rear mounting brackets to the bell housing, then fit the mounting blocks to these brackets.

Fit one 'L'-shaped metal and bonded rubber plate

between each of the engine rear mounts and the chassis frame; the upturned portion should face towards the front of the engine. If metal packing pieces were originally fitted under the engine rear mountings, ensure that they are refitted to the same mountings from which they were removed.

Fit the remaining components by reversing the procedure described for their removal, noting the following points.

Control rods and servo motor — To fit

S2 and S3 cars

When fitting the servo motor to the gearbox, ensure that the sealing washer and drive pins are correctly located before tightening the centre setscrew.

All control rod ends and pivot pins should be greased on assembly and the pivot pins locked with locking plates or with new split pins, as applicable.

When connecting the control rod between the upper servo lever and the lower connecting point of the master cylinder operating lever, the shorter distance piece must be fitted between the control rod and the right-hand member of the master cylinder operating lever (when viewed from the rear of the car). The longer distance piece must be fitted between the control rod and the left-hand member of the lever.

The control rod from the lower servo lever must be fitted to the upper connecting point of the master cylinder operating lever with the shorter distance piece between the control rod and the left-hand member of the lever; the longer distance piece must be fitted between the control rod and the right-hand member of the lever.

After fitting the servo motor and controls, check the adjustment of the servo as described in Section G4 of TSD 729, S1 and S2 Workshop Manual. For S3 Cars see TSD 729 Workshop Manual — Supplement 2003.

Breather pipes — To fit

S2 cars only

To simplify the fitting of the breather pipe assembly, slide the right-hand fuel breather pipe from the assembly clip.

Ensure that the joint face of the engine breather and its mating face on the crankcase are clean, then fit a new 'Klingerit' joint to the breather.

Working from beneath the car, fit into position the left-hand fuel breather and engine breather pipes.

ROLLS-ROYCE AUTOMATIC GEARBOX

Similarly, position the right-hand fuel breather and slide it into the assembly clip adjacent to the flywheel cover. Connect the fuel breather pipe unions, then fit and tighten the setscrews securing the engine breather to the engine.

On S3 cars only fit the two fuel breather pipes by reversing the procedure given for dismantling.

Throttle and selector controls — To fit S2 and S3 cars

Grease the control joints during assembly; they must be free without excessive movement.

On right-hand drive cars, assemble the gear selector control pivot as follows

Insert the pivot bolt through the chassis frame bracket from the outer side. Fit in the following order, one plain washer, distance piece, pivot bracket and second plain washer on to the bolt, then fit and tighten the nut. The pivot must be free but without excessive movement.

On all cars connect the remaining gear and throttle controls in the reverse order given for dismantling.

Control adjustment should be carried out as explained in 'Chapter 2 — Servicing — Controls — To adjust'.

Road test S2 and S3 cars

Before testing the car, fill the gearbox with Automatic Transmission Fluid as described in 'Chapter 2 — Servicing — To drain and re-fill'.

Test the car on the road, the change points being carefully noted and compared with the change points table shown in 'Chapter 2 — Servicing'.

If correct automatic changes are not obtained after adjustment of the controls, it may be necessary to remove the sump and adjust the bands as described in 'Chapter 3—Section 6'.

When the automatic gear changes are obtained satisfactorily, check that there are no fluid leaks, then fit the undersheets.

Gearbox — To remove S1 cars

The procedure for the removal and fitting of the gearbox on 'S1' series cars is similar to the description for the removal of 'S2' and 'S3' series gearboxes, therefore the following paragraphs will describe the operation briefly and the major differences in more detail.

Run the car over a pit or on to a ramp to enable the gearbox to be lowered on removal. Chock the front wheels and jack up one rear wheel to enable the propeller shaft to be turned.

Disconnect the battery.

Remove the undersheets.

Disconnect the selector controls.

Throttle controls — To remove S1 cars

On right-hand drive cars disconnect the rod from the dynamo bracket lever to the right-hand gearbox cross-shaft lever.

On left-hand drive cars disconnect the rod from the accelerator pedal to the bell crank lever on the bell housing, also the rod from the bell crank lever to the left-hand cross-shaft lever.

Disconnect the hand brake cable at the lever adjacent to the brake master cylinder and tie the cable to a convenient point to keep it clear of the servo motor. Disconnect the brake rods from the servo motor, remove the motor central retaining setscrew and withdraw the servo motor from the gearbox.

Disconnect the speedometer drive cable.

Remove the bell housing bottom cover.

Remove the torus cover drain plug and drain the torus.

Remove the gearbox sump plug and drain the gearbox; refit and tighten the torus cover and gearbox drain plugs.

Disconnect the propeller shaft at the gearbox end; disconnect the propeller shaft centre bearing and slide the shaft rearward.

Remove the L.T. lead from the forward end of the starter motor. Unscrew the four setscrews retaining the starter motor to the bell housing then, supporting the starter motor, remove the setscrews and 'U' brackets and withdraw the starter motor. Remove also the blanking plate from the alternative starter position on the opposite side of the bell housing.

Disconnect the torus cover from the flywheel by removing the setscrews also, if fitted, remove the dowel cover strips and numbered balance weights.

At this point the weight of the engine and gearbox should be supported.

Fit a jack into position under the engine sump just forward of the flywheel. Use a suitable block between the jack head and the sump in order to spread the load.

ROLLS-ROYCE AUTOMATIC GEARBOX

Disconnect the gearbox at the rear end then, with the gearbox supported in a trolley jack, remove the setscrews securing the halves of the bell housing together. To obtain access to the top setscrews remove the cover screwed to the floor board.

Finally, drive out the two dowel bolts, fitted one on each side of the bell housing, then remove the gearbox, ensuring that the gearbox mainshaft is clear of its nose bearing in the flywheel before lowering the gearbox.

Notes on changing a gearbox or engine S1 cars

The notes given under the above heading for 'S2' and 'S3' cars apply to 'S1' cars but with the following additions.

If the gearbox is to be retained in the car but a replacement engine is to be fitted, the front half of the bell housing, secured to the engine by eight screws, must be transferred from the old engine to the new one.

It is important that the torus cover be retained with the flywheel as flywheel assemblies vary; some are fitted with an inertia ring, and some without.

In order to maintain a balanced assembly, it is important that parts of the flywheel should be kept together and only in extreme necessity should separate parts be fitted and only then if vibration characteristics prove satisfactory on road test.

Gearbox — To fit

S1 cars

To fit the gearbox reverse the procedure for dismantling, noting the following points.

Ensure that the flywheel and torus cover faces are clean before fitting a new gasket.

Torque tighten the setscrews evenly.

Lubricate all control joints when refitting and if control setting is required refer to 'Chapter 2 — Servicing — Controls — To adjust'.

Gearbox — To remove

'R' series cars

Removal procedure for 'R' series gearboxes differs very little from the description in the previous paragraphs for the removal of 'S' series gearboxes. Any points of major difference which arise will be explained in more detail.

Run the car over a pit or on to a ramp, chock the front wheels and jack up one rear wheel.

Disconnect the battery.

Remove the undersheets and the section of exhaust pipe which runs along the left-hand side of the gearbox. Disconnect at the manifold flange and at the silencer. Release the pipe steady brackets and remove the exhaust pipe downward, taking care to retain the corrugated flange joints.

On cars other than Wraith there are two exhaust pipes and it may be necessary to remove both to simplify gearbox removal.

Slacken the pinch bolts and remove the gear change lever and the T.V. lever from the side of the gearbox.

On left-hand drive cars the rods and levers can be tied to a convenient point out of the way, without further disconnection.

On right-hand drive cars disconnect and remove the manual selector cross-shaft which runs beneath the gearbox.

Remove the ride control operating lever.

On left-hand drive cars unscrew the 2 B.A. nut and bolt and remove the bracket completely.

On right-hand drive cars, disconnect the operating rod from the lever at the base of the steering column and from the bracket at the front end of the fore-and-aft tie rod.

Remove the brake rods and servo motor by disconnecting at the points shown in Figure 41.

Disconnect the speedometer cable and the earthing strip in the vicinity of the ride control oil pipe.

Disconnect the propeller shaft at the gearbox end then at the centre bearing; slide it toward the rear of the car.

Remove the starter motor in the manner described for 'S1' cars.

On '1952' cars remove the four nuts on the starter motor drive cover, draw aside the bonding strip and withdraw rearward the engaging mechanism, distance piece and gaskets, then remove the starter motor forward.

Remove the bell housing bottom cover and remove the torus drain plug; drain the torus cover and refit and tighten the drain plug.

Remove the sump plug and drain the sump; refit and tighten the drain plug.

ROLLS-ROYCE AUTOMATIC GEARBOX

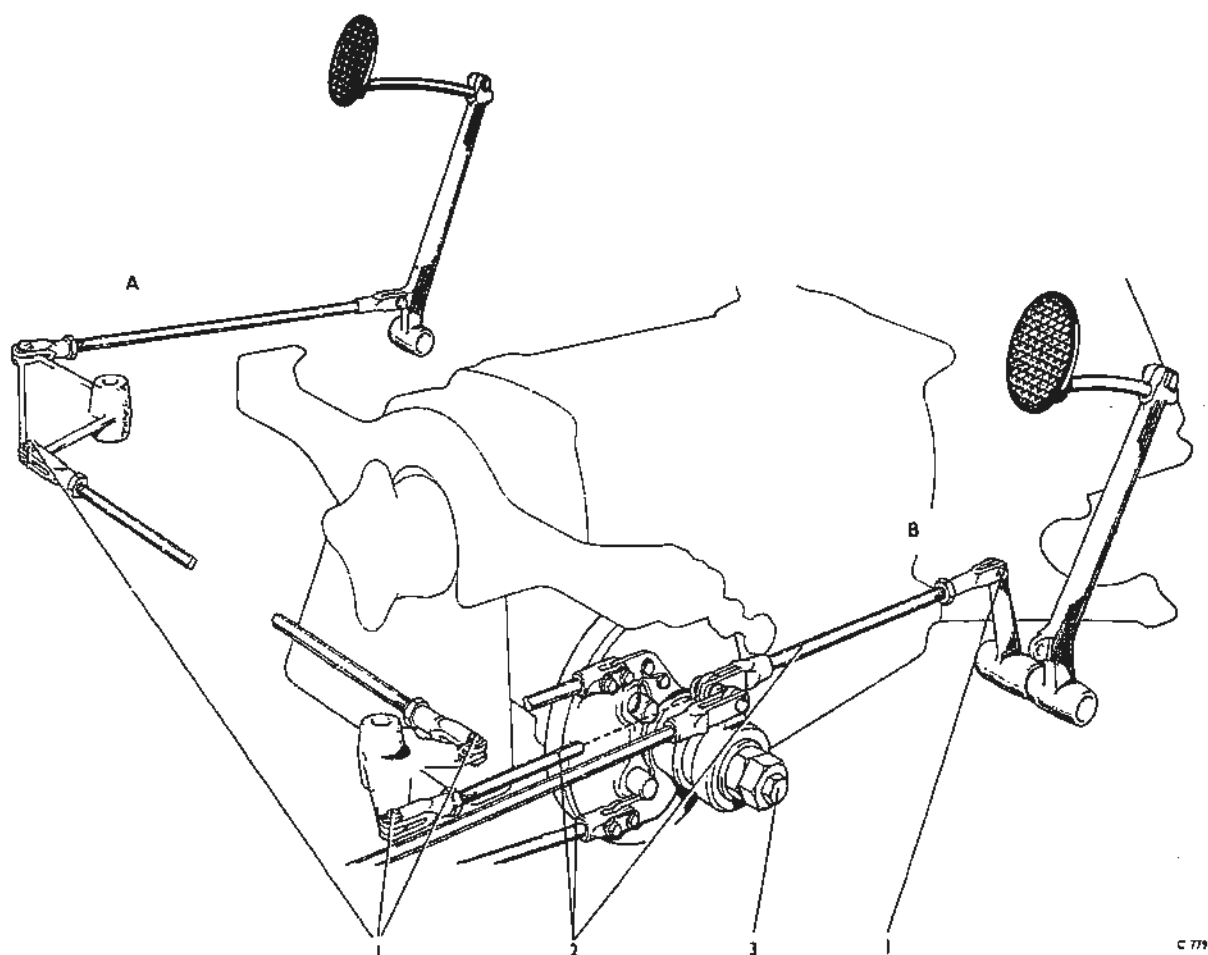


Fig. 41 Brake rod disconnecting points — 'R' series cars

- | | | |
|---------------------------|-----------------------------|----------------------------|
| A LEFT-HAND DRIVE LINKAGE | 1 CLEVIS PINS | B RIGHT-HAND DRIVE LINKAGE |
| | 2 FORKED END RODS | |
| | 3 CENTRE SECURING SETSCREWS | |

In addition to the rear mounting, the gearbox is located at its rear end by a fore-and-aft tie rod and a transverse torque reaction bracket (see Fig. 42).

On left-hand drive cars a chassis frame stiffening tube, retained by two 0.437 in. bolts under the front universal joint, must be removed before disconnecting the tie rod and reaction bracket; the rear mounting transverse support cannot be removed until the gearbox and engine unit has been raised slightly.

Remove the fore-and-aft tie rod by unscrewing the two 0.312 in. nuts and washers securing the tie rod flange to the gearbox; then remove the three bolts, washers and nuts securing the tie rod rear bracket to

the cruciform gusset.

Remove the tie rod and bracket, collecting the triangular packing piece fitted under the bracket. The nuts on the tie rod itself need not be disturbed.

On some chassis with riveted frames, the tie rod is retained at the rear end by a flange which is bolted to a transverse bracket integral with the frame.

Remove the torque reaction bracket by slackening the inner nut on each end of the bracket to remove the oval rubbers from their retaining cups; disconnect from the gearbox by removing the seven retaining screws and allow the bracket to rest on the chassis frame.

ROLLS-ROYCE AUTOMATIC GEARBOX

Disconnect the gearbox rear mounting from its support bracket by removing the two 0.312 in. nuts, spring washers and bolts. The nuts are accessible through holes in the bracket.

Support the engine by fitting a jack in position under the sump, just in front of the flywheel. Use a suitable block between the head of the jack and the sump to spread the load. Raise the jack sufficiently to take the load off the gearbox rear support bracket, which can be disconnected from the chassis frame by removing four nuts, spring washers and bolts. Remove the bracket.

Disconnect the torus cover from the flywheel, retaining any dowel strips and balance weights which may be fitted.

Support the gearbox in a cradle attached to a trolley jack then disconnect the halves of the bell housing by removing eight setscrews. Move the cover attached to the front floor board to gain access to the top two setscrews. Finally, drive out the two dowel bolts, one either side of the bell housing; the gearbox is then ready for removal.

Move the gearbox rearward to draw the gearbox mainshaft out of its locating bearing in the flywheel then lower and draw the gearbox out from under the car.

Notes on changing a gearbox or engine 'R' series cars

The instructions given for 'SI' cars apply to 'R' series cars also.

Gearbox — To fit 'R' series cars

To fit the gearbox, reverse the procedure given for removal, noting the following points.

Before fitting the gearbox to the engine, place the torque reaction bracket in position across the chassis frame.

Ensure that the flywheel and torus cover faces are clean and free from damage marks and that a new flywheel-to-torus cover gasket is fitted.

When fitting the bell housing halves together fit the two dowel bolts first, fit and tighten the remaining setscrews, then finally tighten the dowel bolts, torque loading to the correct figures in the 'Summary of Repair Data'.

If, when fitting the torque reaction bracket, the outer

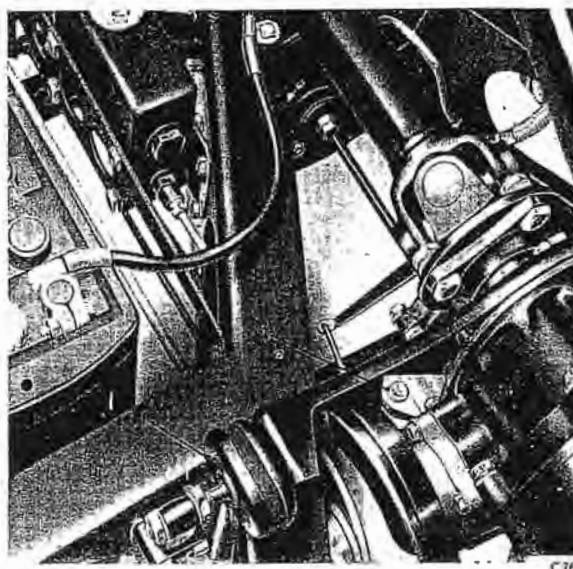


Fig. 42 Rear mounting—'R' series cars

- 1 TORQUE REACTION
BRACKET
- 2 REAR MOUNTING BOLTS
- 3 TIE ROD BOLT

nuts have been disturbed, slacken all the nuts then tighten the inner nuts evenly two full turns beyond the point at which the rubbers are felt to be nipped. Lock by tightening the outer nuts.

Connect the propeller shaft to the gearbox, ensuring that the centre bearing is positioned centrally.

Assembly of the brake rods is straightforward. Before fitting the servo motor take care to fit the friction washer with its chamfer towards the gearbox and to locate the driving pins before tightening the centre retaining setscrew.

Prime the ride control system after fitting the gearbox linkage. The procedure for priming is explained in Chapter 2.

Grease all controls joints when refitting and if the controls need resetting refer to 'Chapter 2 — Servicing — Controls — To adjust'.

When fitting a '1952' starter motor, fit a new joint on each side of the distance piece.

After fitting a gearbox and before road testing fill up the gearbox as described in Chapter 2 and run the engine with the control lever in Neutral for a few minutes to check for leaks.

Road test the car taking particular note of the gear changes and, if satisfactory, fit the undersheets.

ROLLS-ROYCE AUTOMATIC GEARBOX

SECTION 2—FLUID COUPLING

Fluid coupling — To remove

The fluid coupling can be removed from the gearbox casing only after removal of the gearbox from the car, as described in Section 1. Removal of the coupling includes dismantling to component parts and the opportunity should be taken during this operation to inspect parts for defects, signs of oil leakage and incipient failure.

The joint faces of the torus cover and flywheel should be inspected for dark patches which may indicate the passage of leaking oil.

Before removing the mainshaft nut, check for tightness. Any slackness may have allowed movement of the torque member on the splines and caused wear or noisy operation of the gearbox.

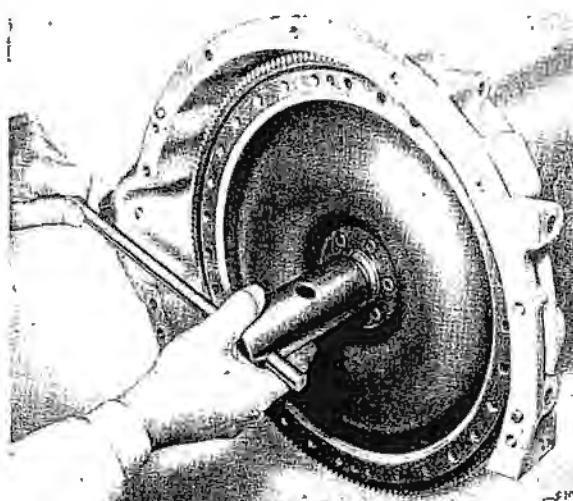


Fig. 43 Removing mainshaft nut

Move the selector lever on the control valve unit to the Reverse position; this will lock the mainshaft by engaging the parking pawl and so facilitate straightening of the locking plate and removal of the mainshaft nut (see Fig. 43).

Remove the nut and locking plate.

Before removing either the torus members or the torus cover, check for play on the splined shaft; excessive play can contribute to noisy operation.

If the fit on the splines is satisfactory, mark the mating splines to facilitate correct assembly.

Withdraw the front (driven) torus member from the splines. If difficulty is experienced, a sharp blow with a soft-faced mallet on the end of the mainshaft will free the torus hub from the splines.

Remove the rear (driving) torus snap ring from the groove in the intermediate shaft and draw the torus member from the splines (see Fig. 44).

Remove the torus cover (see Fig. 45). If it does not slide freely from the splines extreme care must be taken to avoid rocking it excessively, otherwise damage to the oil seals may occur. The cover should be pushed firmly backward and then drawn sharply forward off the shaft. **Care must be taken** not to damage the machined sealing surfaces on the torus neck by careless handling.

Check the end float of the intermediate shaft by drawing the shaft forward and inserting a feeler blade between the bronze washer and the end of the front drive-shaft; clearance in excess of the limits given in the 'Summary of Repair Data' could contribute to noisy operation. If the clearance is incorrect, assess the thickness of the steel washer required for replacement.

ROLLS-ROYCE AUTOMATIC GEARBOX

If the gearbox is to be further dismantled, examine the exterior of the bell housing-to-gearbox mating faces for signs of oil which may indicate a leaking front pump cover or front pump seal.

Remove the four setscrews securing the bell housing to the gearbox casing and withdraw the housing. **Note** Early bell housings are in two parts and must be kept 'mated' as a unit.

Check the torus relief valve for freedom and full travel in the retainer. If the valve appears to be serviceable and no complaint has been received of slip as described in Chapter 2, cleaning without dismantling should be sufficient. If, however, it is considered necessary, the torus relief valve and spring can be removed from the driven torus by turning back the locking tabs on the retainer, unscrewing the setscrews and lifting the retainer, relief valve and spring from the recess in the torus hub (see Fig. 46).

Clean all parts thoroughly, using paraffin or a degreasing agent.

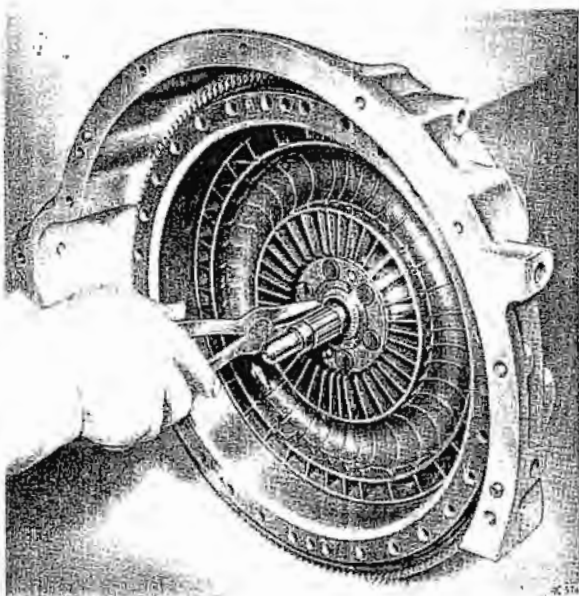


Fig. 44 Removing intermediate shaft snap ring

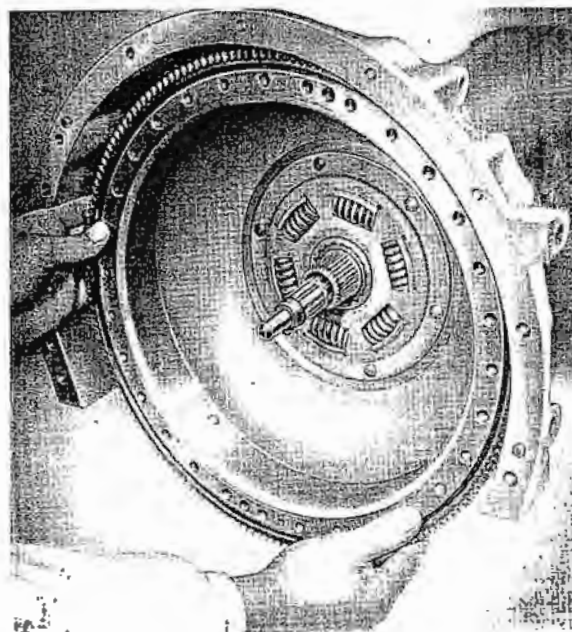


Fig. 45 Withdrawing the torus cover

Fluid coupling — To inspect

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

Examine all rivets, also the torus vanes, for slackness.

Examine the inner and outer surfaces of the torus cover oil seal neck for scores and other damage.

Examine the torus cover-to-flywheel joint face, for damage and distortion which may allow oil leakage.

Examine the starter ring teeth for wear and damage.

Examine the bell housing for cracks and other damage.

Examine for scoring the bearing face of the relief valve, the inside diameter of the valve and the seating on the end of the intermediate shaft.

Examine the spring for distortion. If the valve has not been removed check the retainer setscrews for security.

Remove the oil seal rings from the front drive-shaft and fit them in the bore of the torus cover oil seal neck. Check that the gap is within the limits given in the 'Summary of Repair Data'.

ROLLS-ROYCE AUTOMATIC GEARBOX

Fluid coupling — To fit

The assembly of the fluid coupling and the refitting to the gearbox casing are straightforward, but the following points must be borne in mind.

Ensure that all locking devices, including spring rings, are correctly positioned as the work proceeds.

Fit a new relief valve retainer if it has been disturbed, and a new mainshaft lock-washer.

Ensure that all nuts and bolts are tightened to the correct torque loading as given in the 'Summary of Repair Data' at the front of this Chapter.

Fit a new torus cover oil seal into the housing in the front pump cover as described in Section 9. Care must be taken to avoid damage to the piston-ring type oil seals when fitting the torus cover.

When fitting the starter ring, care must be taken to ensure that it is fitted the correct way round. A fouling pin is fitted to the starter ring on 'S2' and 'S3' series cars to ensure that this does not happen but, if a new starter ring is being fitted, a check should be made to see that a fouling pin is fitted to the starter ring.

If the bell housing has been renewed, check the 'nip' on the front oil pump flange as described in Section 9.

Check the end float of the intermediate shaft before fitting the rear torus. Renew the steel washer, if necessary.

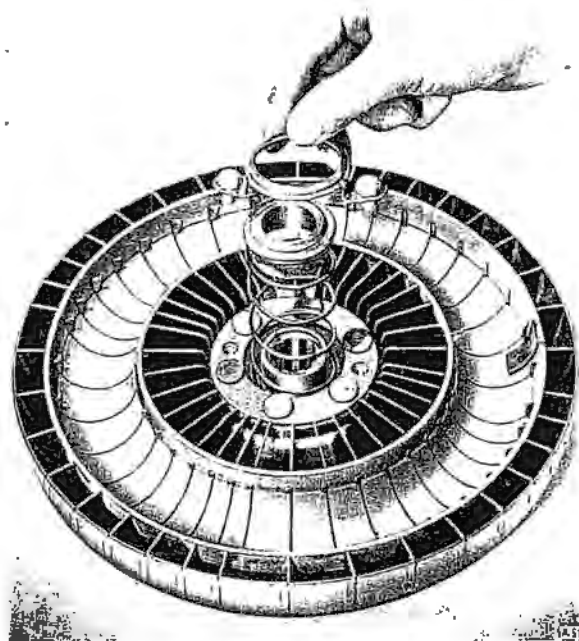


Fig. 46 Removing torus check valve

Lock the gearbox against rotation by placing the selector lever in 'Reverse' before tightening and locking the mainshaft nut.

ROLLS-ROYCE AUTOMATIC GEARBOX

SECTION 3 — SIDE COVER, SUMP AND FILTER

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

Early gearboxes are fitted with a sump consisting of a metal pressing with a hole in one side through which the ride control oil passes.

A light alloy sump is fitted to gearboxes having the ride control oil passing through the main casing. The alloy sump is also fitted to all gearboxes without a ride control unit.

Before removal, the side cover and sump should be examined carefully for signs of oil leakage; if a leak

is present, it must be traced and rectified. If the gearbox has been removed from the car, the examination should be carried out before the gearbox is inverted on its stand.

To avoid the risk of dirt entering the gearbox as work proceeds, the gearbox and adjacent chassis members should be thoroughly cleaned, especially in the vicinity of the side cover and sump. Apertures in the box must be kept covered as much as possible.

The sump must be drained before removal of the gearbox, then filled after refitting.

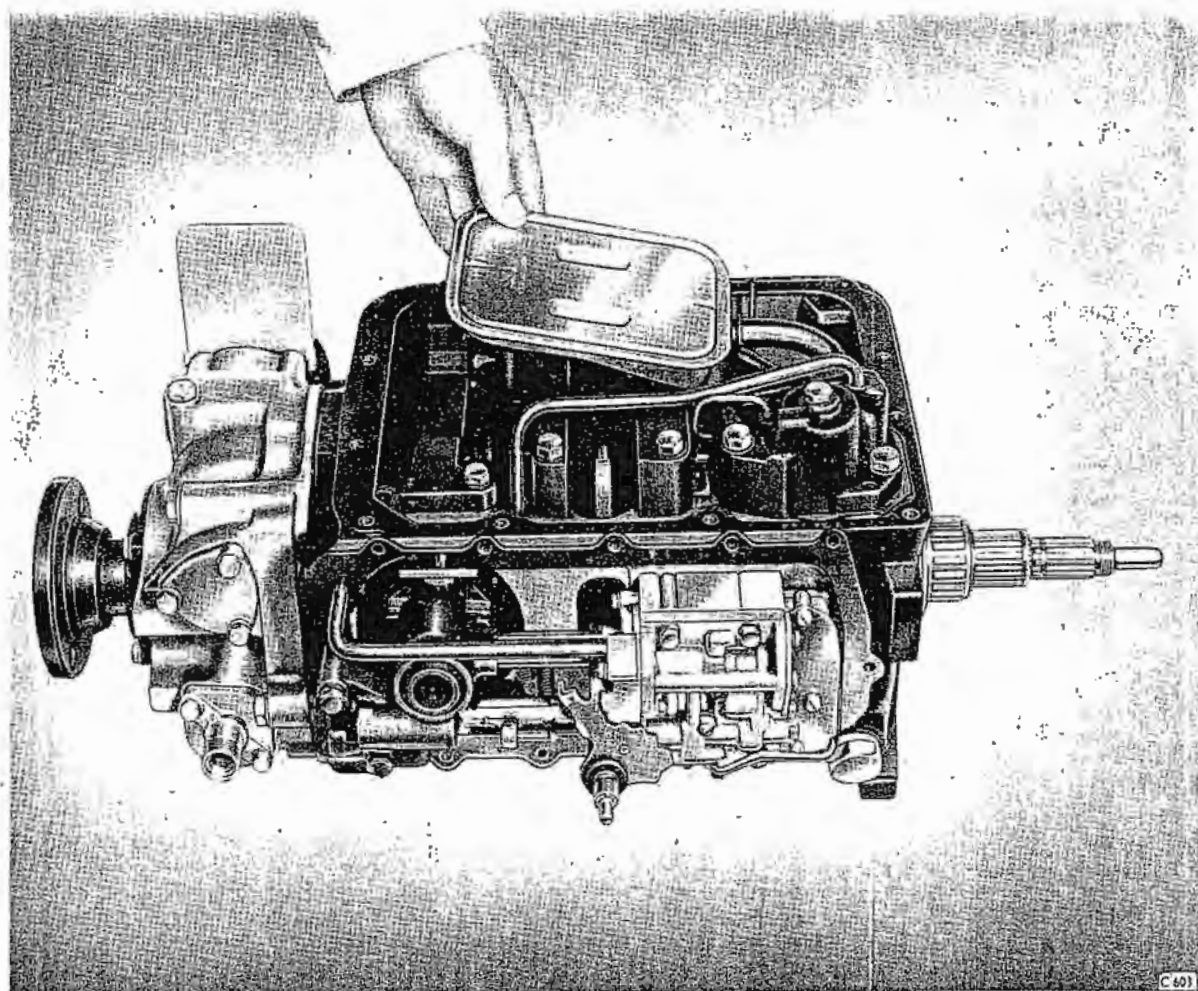


Fig. 47 Removing the filter

ROLLS-ROYCE AUTOMATIC GEARBOX

The following instructions are for working on the gearbox whilst it is installed in the car. The procedure is generally the same when the gearbox is on the bench except that the selector lever will have been disconnected from the control unit and the sump will be uppermost.

Side cover — To remove

Disconnect the selector and throttle levers by unscrewing the pinch bolts and sliding the levers from their shafts; tie the levers and rods to convenient points on the chassis.

On left-hand drive cars, remove the isolating stay from its anchor bolt on the side cover.

Remove the securing setscrews and aluminium washers, then withdraw the side cover and paper gasket. Discard the gasket.

Sump and filter — To remove

Remove the securing setscrews, then withdraw the sump and paper gasket; discard the gasket. Before cleaning the interior of the sump, examine the oil residue for deposits such as white metal or bronze powder which may indicate an approaching failure. Examine the sump for damage and cracks.

To remove the sump on a '1952' gearbox remove the

ride control pipe connection on the ride control oil pump, release the clip securing the pipe to the sump flange, then unscrew the securing setscrews and remove the sump.

Remove the filter by easing it gently from the rear oil feed pipe and sliding it rearward from the front oil pipe (see Fig. 47). Care must be taken not to damage the filter by wrenching the mesh away from the sheet metal base or by stretching the gauze and so increasing the filtration size of the mesh. Clean the filter thoroughly using a brush; **do not** use a cloth.

Side cover, sump and filter — To fit

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

Examine the interior of the gearbox for cleanliness and check that all pipes are secure in their sockets and that all nuts and bolts are tight.

Check that the rubber seal and the two steel washers are correctly positioned on the selector shaft, as shown in Figure 53 — 'Section 4 — Control valve unit'.

Check that the filter is clean, then fit it to the oil feed pipes.

Fit the sump, together with a new paper gasket.

Fit the side cover, together with a new paper gasket, ensuring that aluminium washers are fitted on all setscrews.

Fit the control levers.

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SECTION 4—CONTROL VALVE UNIT

The control valve unit can be removed from the gearbox while installed in the car but the side cover must be removed first as described in Section 3. Draining and removing the sump are recommended to prevent oil spillage when removing the side cover and to avoid the risk of foreign matter entering the sump while work is in progress.

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

The importance of cleanliness cannot be over-emphasized when handling parts of the control valve unit. Minute particles of fluff from cloth, or even from the hands, are sufficient to prevent correct operation if present in the valve bores. For this reason a brush or compressed air, used in conjunction with a filtered cleaning fluid, is recommended for washing. If the unit is to be removed but not dismantled it must be protected from dirt and other foreign matter by wrapping in waxed paper until required for refitting.

An exploded view of the control valve unit, on which the parts are shown in their relative positions, is given in Figure 48, and the main differences between '1952' and '1953' control valve units are shown in Figures 49, 50, 51 and 54.

Control valve unit — To remove

Remove the sump and side cover as described in Section 3.

Remove the pressure control valve oil pipe from the holes in the control valve unit and the gearbox casing. Light leverage under the bends of the pipe may be necessary to free it.

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

Rotate the selector lever until it is possible to fit a spanner to all four setscrews securing the control valve unit; unscrew and remove the setscrews. Draw the unit slightly away from the gearbox face and slide it toward the front end, working it sideways carefully to free the pipes. Withdraw the pipes from their respective holes. Leave the parking brake lever spring on the parking brake lever pin.

If the gearbox is to remain standing during dismantling of the control valve unit, precautions must be taken to prevent the ingress of dust or dirt.

Control valve unit — To dismantle

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

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

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

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

As an aid to the identification of the various components of the unit, reference is frequently made in brackets in the following text to the exploded view of the unit shown in Figure 48.

ROLLS-ROYCE AUTOMATIC GEARBOX

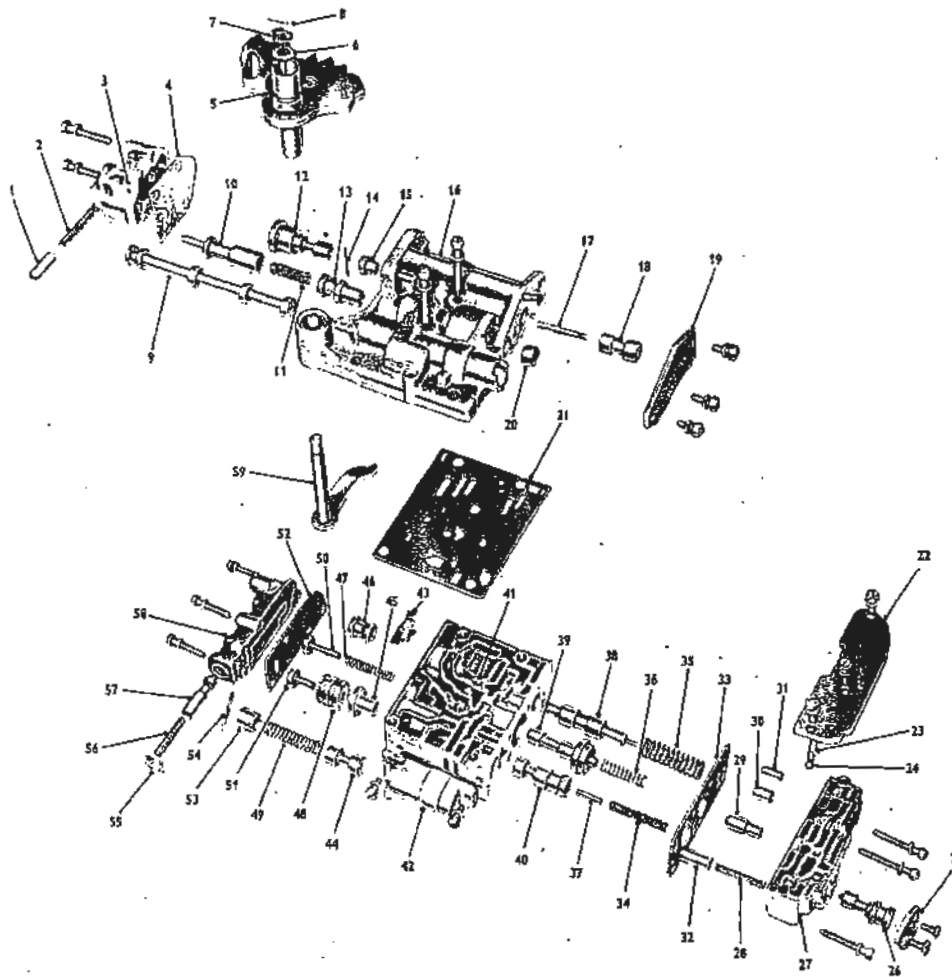


Fig. 48 Control valve unit exploded

- | | | | |
|-----------------------------------|--------------------------------|---------------------------|-------------------------------|
| 1 DETENT PLUNGER | 16 OUTER VALVE BODY | 29 1-2 REGULATOR PLUG | 45 2-3 AUXILIARY VALVE |
| 2 DETENT PLUNGER SPRING | 17 COMPENSATOR VALVE SPRING | 30 3-4 REGULATOR PLUG | 46 3-4 GOVERNOR PLUG |
| 3 DETENT PLUNGER RETAINER | 18 COMPENSATOR VALVE | 31 4-3 SHUTTLE VALVE | 47 2-1 DETENT PLUG SPRING |
| 4 DETENT PLUNGER RETAINER PLATE | 19 COMPENSATOR VALVE PLATE | 32 T.V. REGULATOR VALVE | 48 2-3 GOVERNOR PLUG SLEEVE |
| 5 SELECTOR LEVER | 20 DETENT PLUG | 33 OIL GUIDE PLATE | 49 3-2 TIMING VALVE SPRING |
| 6 SEALING WASHER | 21 OIL GUIDE PLATE | 34 2-3 SHIFT VALVE SPRING | 50 2-1 DETENT PLUG |
| 7 WASHER | 22 FRONT BODY COVER PLATE | 35 3-4 SHIFT VALVE SPRING | 51 2-3 GOVERNOR PLUG |
| 8 PIN | 23 OIL CHECK BALL SPRING | 36 1-2 SHIFT VALVE SPRING | 52 OIL GUIDE PLATE |
| 9 MANUAL CONTROL VALVE | 24 OIL CHECK BALL | 37 GUIDE PIN | 53 VALVE SPRING RETAINING CAP |
| 10 T VALVE | 25 3-1 DETENT PLUG PLATE | 38 3-4 SHIFT VALVE | 54 RETAINING PIN |
| 11 T VALVE SPRING | 26 3-2 DETENT PLUG | 39 1-2 SHIFT VALVE | 55 SPRING RETAINER |
| 12 TRANSITION VALVE | 27 FRONT VALVE BODY | 40 2-3 SHIFT VALVE | 56 OVERSPEED VALVE SPRING |
| 13 THROTTLE VALVE | 28 T.V. REGULATOR VALVE SPRING | 41 INNER VALVE BODY | 57 OVERSPEED VALVE |
| 14 COMPENSATOR PLUG RETAINING PIN | | 42 3-2 TIMING VALVE BODY | 58 OVERSPEED VALVE BODY |
| 15 COMPENSATOR PLUG | | 43 BY-PASS VALVE | 59 THROTTLE VALVE LEVER |
| | | 44 3-2 TIMING VALVE | |

ROLLS-ROYCE AUTOMATIC GEARBOX

Control valve outer body — To dismantle

Remove the two securing screws and spring washers, then lift the outer body (16) and oil guide plate (21) from the control valve inner body (41). The compensator plug retaining pin (14) is a sliding fit and may fall out during handling of the outer case; care must be taken to ensure that it is not lost.

Remove the spring steel by-pass valve (43) from the outer body, noting its position to assist re-assembly. This valve is fitted on '1953' control valve units but not the '1952' type (see Fig. 54).

Rotate the selector lever (5) as far as possible away from the detent plunger housing (3), then withdraw the plunger and spring (1 and 2).

Carefully withdraw the selector valve (9) from the outer body; the valve is slender and may be bent if carelessly handled.

Unscrew the three securing screws and remove the plunger housing (3) and oil guide plate (4) from the outer case. Note the different lengths of the securing screws to ensure correct refitting.

Rotate the throttle valve lever (59) away from the outer body, then withdraw the T valve and spring (10 and 11). Care must be taken to ensure that the throttle valve lever is not allowed to contact and damage the empty bore.

Carefully shake from the outer body the throttle valve (13) and the transition valve (12).

Unscrew the three securing screws and remove the compensator plate (19). Withdraw the compensator valve and spring (18 and 17) and the detent plug (20).

The compensator plug (15) need not be removed provided that it moves freely in the bore; its movement should be felt when gently shaking the outer body. If the plug is to be removed, first withdraw the retaining pin (14), then using a soft metal rod in each end of the bore, carefully manoeuvre the plug from the port.

If the selector lever (5) or throttle valve lever (59) are to be removed, withdraw the pin (8) from the outer end of the throttle lever shaft. The selector lever can then be lifted from the shaft complete with washer and sealing ring (7 and 6).

Front and inner valve bodies — To dismantle

Place the inner valve body (41) flat on the bench, then firmly holding the front body (27) against spring pressure, remove the three securing screws. Slowly release the holding pressure, then remove the front body and oil guide plate (33). Note the position of the three securing screws for correct refitting.

Withdraw from the front body the T.V. regulator valve and spring (32 and 28), the 1-2 regulator plug (29), the 3-4 regulator plug (30) and the 4-3 shuttle valve (31) if fitted.

Remove from the inner body the 3-4 shift valve and spring (38 and 35), the 1-2 shift valve and spring (39 and 36), and the 2-3 shift valve, spring and guide pin (40, 34 and 37). The difference between the '1952' and '1953' 3-4 shift valve groups, also the T.V. regulator valve, front body and guide plate is shown in Figure 49.

Remove the two countersunk screws retaining the 3-2 detent plug plate (25) and remove the plate and the 3-2 detent plug (26).

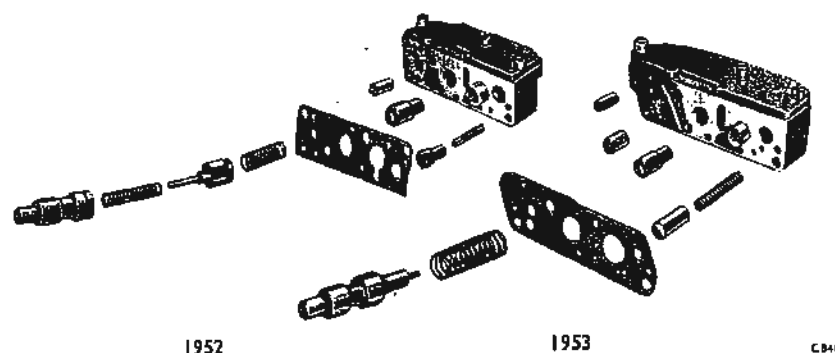


Fig. 49 Front body and valves, oil guide plates and 3-4 shift valve groups

ROLLS-ROYCE AUTOMATIC GEARBOX

If access is required to the oil check ball valve, remove the three securing screws and cover plate (22) from the front body. The valve ball and spring (24 and 23) can then be lifted from their seating.

Overspeed valve body — To dismantle

Remove the three screws retaining the overspeed valve body (58), then remove the body and oil guide plate (52).

Note the position of the three securing screws for correct refitting.

Using a screwdriver inserted through the slot of the overspeed valve spring retainer (55), compress the spring and extract the retainer. Withdraw the overspeed valve and spring (57 and 56). Figure 50 shows the difference between '1952' and '1953' overspeed valve assemblies.

Tilt the inner valve body so that the valves protrude. Remove the 3-4 governor plug (46), the 2-1 detent plug and spring (50 and 47) and the 2-3 governor plug (51). Early control valve units are not fitted with a 2-1 detent plug spring (see Fig. 51). Note also the difference in the oil guide plates.

Care must be taken in removing the 2-3 auxiliary valve (45) as its bearing surface is small and it may cant over in the bore. The 2-3 governor plug sleeve (48) should therefore temporarily be left in the bore in order to align the 2-3 auxiliary valve; press out the valve together with the sleeve using a soft rod inserted into the opposite end of the bore.

3-2 Timing valve body — To dismantle

Remove the two securing screws and the 3-2 timing valve body (42).

Depress the valve spring retaining cap (53) and withdraw the retaining pin (54). Carefully release the retaining cap and withdraw the cap, valve and spring (53, 44 and 49).



Fig. 50 Overspeed valves and oil guide plates



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Fig. 51 2-1 detent plug and 2nd speed start spring

Control valve unit — To inspect

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

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

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

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

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

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

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

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

Check all tapped screw holes for stripped threads.

Check the throttle valve operating shaft for distortion and damage.

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

ROLLS-ROYCE AUTOMATIC GEARBOX

Control valve unit — To assemble

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

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

Sealing compound **must not** be used between joint faces.

Overspeed and inner valve bodies — To assemble

Insert the overspeed valve, spring and retainer (57, 56 and 55) into the overspeed valve body (58). Centralise the spring in the retainer recess.

Hold the inner valve body (41) in one hand with the valve bores vertical and with the radiused corner lowermost and to the right. Using the free hand, insert together the 2-3 auxiliary valve (45) and 2-3 governor plug sleeve (48) vertically upwards into the 'LO' bore. This method is recommended as the plug sleeve ensures correct alignment of the narrow edged valve, thus effecting a smooth entry into its bore without canting over or picking up on the annular groove. Turn over the valve body and insert the 2-3 governor plug (51) into its sleeve; the plug should come to rest approximately 0.250 in. below the surface of the sleeve, indicating that the 2-3 auxiliary valve is fully home in the bore.

Fit the 2-1 detent plug and spring (50 and 47) (no spring is fitted if model is early '1953') and the 3-4 governor plug (46) into their respective bores, taking particular care when manoeuvring the latter into the larger of the two bores.

Fit the overspeed oil guide plate (52) into position and secure the already assembled overspeed valve unit (58) to the inner body.

Inner and front valve bodies — To assemble

Position the oil check ball valve (24) on its seating in the front valve body (27) and fit the spring (23) and cover plate (22). The valve seating will be found in the passage adjacent to the centre screw hole (see Fig. 52).

Insert the 3-2 detent plug (26) into its bore in the front body and fit the detent plug retaining plate (25); ensure that the plate covers the adjacent oil ports.

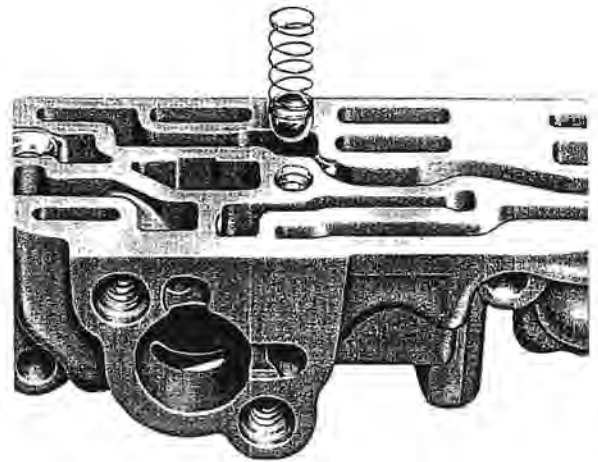


Fig. 52 Positioning oil check ball valve

Fit to the front body the T.V. regulator valve and spring (32 and 28), the 1-2 regulator plug (29), the 3-4 regulator plug (30) and the 4-3 shuttle valve (31). The 4-3 shuttle valve is fitted to cars from late 1953 onwards.

Hold the inner body (41) with the valve bores vertical and the radiused corner lowermost and to the right. Insert into their respective bores the 3-4 shift valve and spring (38 and 35), and if the control valve unit is a '1952' model the '3' range valve and spring, the 1-2 shift valve and spring (39 and 36) and the 2-3 shift valve, spring and guide pin (40, 34 and 37); the guide pin fits inside the spring, within the hollow stem of the valve.

Lay the inner and front bodies flat on the bench and position the front oil guide plate (33) against its mating face on the front body. Bring the assemblies together, ensuring that the 2-3 shift valve spring (34) engages with the 3-2 detent plug (26) and that the 1-2 shift valve spring (36) engages with the 1-2 regulator plug (29). Firmly hold the two assemblies together and fit and tighten the three securing screws.

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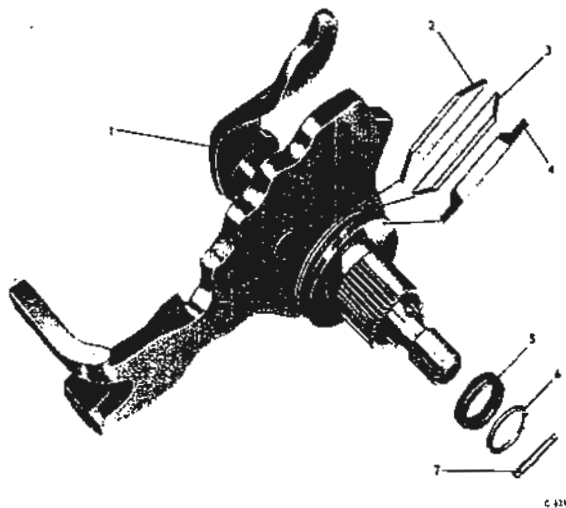


Fig. 53 Selector and throttle valve levers

- 1 THROTTLE VALVE LEVER
- 2 INNER WASHER
- 3 OUTER WASHER
- 4 RUBBER SEAL
- 5 SEALING WASHER
- 6 FLAT WASHER
- 7 RETAINING PIN

3-2 Timing valve body — To assemble

Insert the 3-2 timing valve, spring and retaining cap (44, 49 and 53) into the timing valve body (42). Depress the retaining cap against the tension of the spring and fit the retaining pin (54) into its oblique drilling in the timing valve body; release the cap.

Secure the timing valve body to the lower face of the inner body (41), ensuring that the oil ports are fully covered.

Outer valve body — To assemble

If the selector lever (5) and throttle valve lever (59) have been removed from the outer body (16), re-assemble them as shown in Figure 53; fit a new sealing ring (6) to the throttle lever shaft.

If the compensator plug (15) has been removed, refit it to its bore, using a rod fitted into the hole in the large end of the plug to assist in manoeuvring it into position. Fit the retaining pin (14) to its drilling in the outer valve body (16), ensuring that it passes across the valve bore to enter the socket at the far side and does not project above the joint face of the body.

Fit the compensator valve and spring (18 and 17) and the detent plug (20) into their bores in the outer body.

Position the compensator plate (19) against its mating face on the outer body (16), then fit and tighten the three securing screws.

Hold the outer body (16) with its valve bores vertical and the selector lever pivot lowermost and to the left. Using the free hand, insert into the centre lower bore as one assembly, the throttle valve (13) and the T valve and spring (10 and 11). Move them gently upwards until the throttle valve (13) butts against the detent plug (20). Turn over the outer body and insert the transition valve (12).

Set the throttle valve lever (59) against the protruding end of the throttle valve stem and hold the selector lever (5) clear of the throttle lever. Check that the throttle valve is home in its bore.

Fit the oil guide plate (4) and plunger body (3), ensuring that the tip of the throttle valve lever is entered into the slot in the plunger body. Secure the assembly with the three setscrews provided; ensure that the shortest screw of the three is fitted through the boss on the outer body (16), otherwise the selector plunger will not enter the housing during later assembly.

Rotate the selector lever (5) away from the plunger body and fit the detent plunger and spring (1 and 2) into their bore in the plunger body.

Insert the selector valve (9) up to the third land into its bore in the outer body (16), then rotate the selector lever (5) until the actuating pin on the lever engages between the top lands of the selector valve. Do not force the pin against the valve, otherwise the valve stem may bend. Depress the selector plunger (1) and further rotate the selector lever until the plunger engages in a notch. Release the plunger and check that the selector lever moves freely into each of the operating positions.

Fit the by-pass valve (43) to the cavity in the outer body (not '1952' model). Figure 54 shows the differences between the two models.

Check that the compensator plug retaining pin (14) is correctly fitted and does not protrude above the joint face of the outer body. Position the oil guide plate (21) on the outer body with its radiused corner towards the selector lever pivot. Align the plate with the aid of the four main setscrews and assemble the

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outer body and plate to the inner body. Leave the main setscrews in position until the two assembly screws have been tightened. Fit and tighten the two securing screws.

Control valve unit—To test

The control valve unit can be tested for correct operation using a special test rig, or by refitting it to the gearbox and carrying out a road test as described under 'Testing the change points' in Chapter 2.

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

To check the freedom of the 1-2 shift valve group, apply an air pressure of approximately 70 lb/sq. in. to the G1 passage as shown in Figure 55. On '1952' control valve units, air pressure applied to the G1 oil duct will move both 1-2 and 2-3 shift valves but only the 2-3 group on current models. The lower half of the control valve unit must be suitably blanked off to achieve this.

Movement of the 2-3 and 3-4 shift valve groups and of the overspeed valve can be checked by covering area '2', (see Fig. 55) and applying air pressure to the G2 oil duct. If difficulty is experienced in observing the movement of the overspeed valve, a piece of stiff wire inserted through the centre of the spring and allowed to rest on the valve will indicate when the valve moves.

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

Control valve unit—To fit

Before refitting the control valve unit, examine the mating faces of the unit and the gearbox casing for cleanliness.

Fit the governor oil delivery pipes into the bores in the parking brake bracket. Fit the parking brake pawl return spring in position over the G2 oil pipe, ensuring that the other end is hooked around the parking brake lever pin.

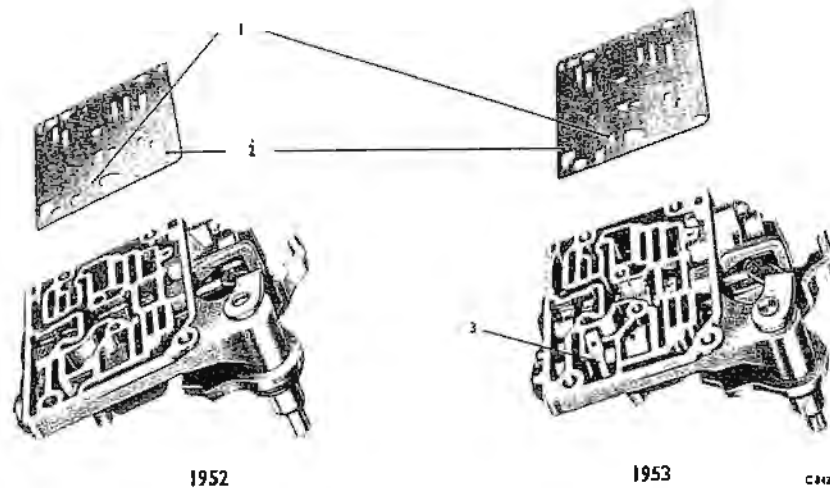


Fig. 54 Outer bodies, oil guide plates and by-pass valve

1 BLEED HOLE 2 OIL GUIDE PLATE 3 BY-PASS VALVE

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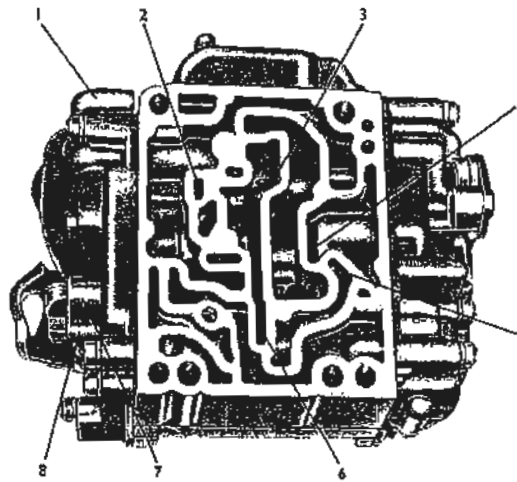


Fig. 55 Air pressure test points

- | | |
|---------------------------|-------------------|
| 1 OVERSPEED VALVE HOUSING | 5 G1 PASSAGE |
| 2 BLANKING AREA | 6 3-4 SHIFT GROUP |
| 3 2-3 SHIFT GROUP | 7 G2 OIL DUCT |
| 4 1-2 SHIFT GROUP | 8 G1 OIL DUCT |

Align the reverse clutch oil pipe and ensure that it is home in its bore.

Rotate the selector lever to a position where it will clear the parking brake lever during fitting of the control valve unit.

Engage the three oil pipes in the bores in the control valve unit. Fit the four securing setscrews and spring washers and tighten evenly to the torque loading figure given in the 'Summary of Repair Data'.

Fit the pressure control valve oil pipe into the holes in the control valve unit and the gearbox casing; the

short end of the pipe mates with the control valve unit. Gently tap the pipe home using a soft-faced mallet.

Ensure that the selector lever engages with the parking brake lever, also that the conical steel washers and the oil seal on the selector lever shaft are still in position.

Refit the side cover and sump as described in Section 3.

After fitting the control levers, the control settings should be checked before testing the operation of the gearbox as described in Chapter 2.

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SECTION 5 — PARKING BRAKE BRACKET

Parking brake bracket — To remove

The parking brake bracket and governor sleeve assembly can be removed from the gearbox only after removal of the side cover and the control valve unit. It is not necessary to remove the gearbox from the car for this operation.

Remove the side cover (see Section 3) and the control valve unit (see Section 4) then disengage the return spring from the pillar on the parking brake lever.

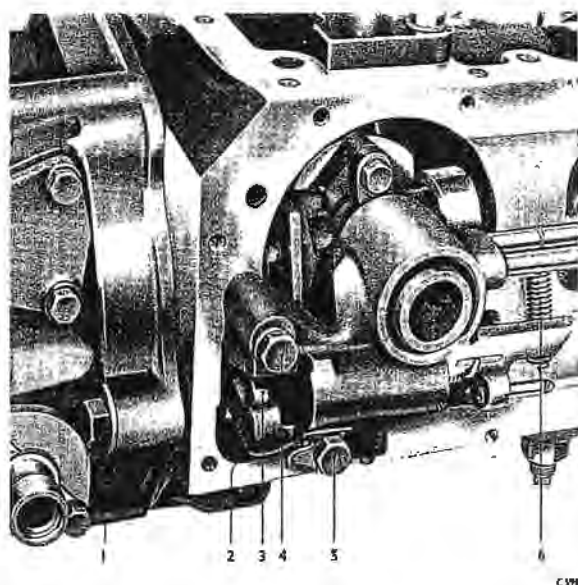


Fig. 56 Disconnecting points

- | | |
|-------------------------------------|-------------------------------------|
| 1 PARKING PAWL SCREW | 5 RETAINING SCREW AND TAB WASHER |
| 2 PARKING PAWL | 6 PARKING BRAKE LEVER RETURN SPRING |
| 3 PARKING PAWL ROLLER | |
| 4 RETAINING SCREW AND SPRING WASHER | |

The parking brake bracket disconnecting points are clearly shown in Figure 56.

Unlock the tab washer, then unscrew and withdraw the parking pawl support screw and washer. Remove the parking lever roller from its crank pin. The parking pawl will be left loose in the casing as it cannot be withdrawn until the parking bracket has been removed.

Unlock the front setscrew tab washer, then remove the two securing setscrews and washers securing the parking bracket. Withdraw the parking bracket and governor sleeve assembly from the governor tower. If difficulty is experienced, indicating that grooves have been worn in the governor sleeve bore, the sleeve can be freed by sharply pulling the assembly away from the tower.

Remove the parking pawl from the gearbox casing. It may be necessary to slightly rotate the output shaft to free the pawl from the brake annulus.

Parking brake bracket — To dismantle

The parking brake bracket assembly need not be dismantled unless the fault diagnosis described in Chapter 2 indicates faulty operation of the reverse or the parking blocker piston and this is confirmed by an air test (see Chapter 2).

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

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

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Parking brake bracket — To inspect

Clean all parts, paying particular attention to the oil passages and slots in the main casting; a small amount of sludge and metallic dust can be expected here. Use a compressed air line to clear the oil passages and the reverse clutch oil pipe.

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

Insert the oil sealing rings in their running position in the governor sleeve bore. Check the ring gaps with feeler gauges; if the gap is larger than that given in the 'Summary of Repair Data' renew the rings. If the new ring gaps are too wide, fit a new governor bracket.

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

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

Examine the roller and the crank pin for damage and for excessive wear.

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

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

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

Parking brake bracket — To assemble

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

Care must be taken to ensure that the pistons are fitted into the correct bores; the parking brake lever would be rendered inoperative by fouling the head of the parking blocker piston if the blocker piston were fitted in the wrong bore.

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

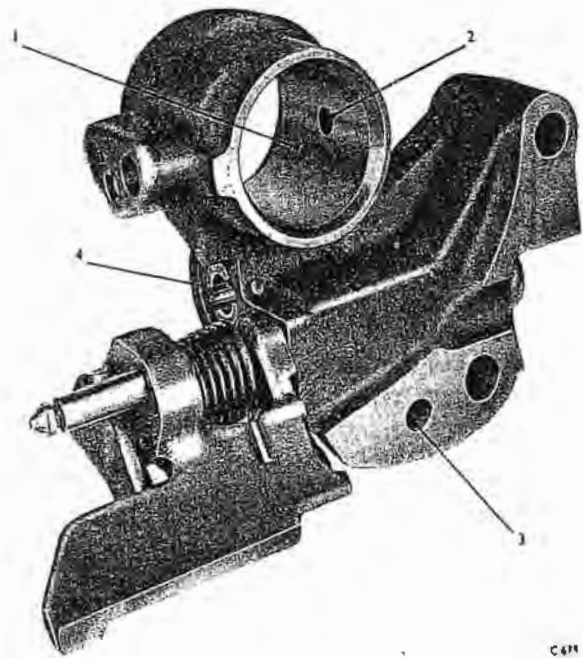


Fig. 57 Air pressure test points

- | | |
|--------------------------|---------------------------|
| 1 G1 OIL DUCT | 3 MAIN OIL PRESSURE INLET |
| 2 MAIN OIL PRESSURE DUCT | 4 REVERSE BLOCKER PISTON |

Parking brake bracket — To test

The parking and reverse blocker pistons should be tested for freedom of movement in their bores after assembly. Intermittent application of air pressure, at approximately 70lb/sq.in., to the points shown in Figure 57 should cause the pistons to move to and fro in their bores.

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

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

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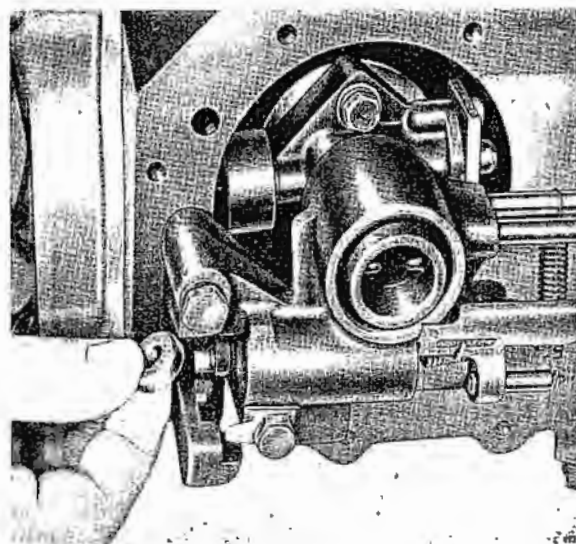


Fig. 58 Fitting parking pawl roller

Parking brake bracket — To fit

If the parking brake bracket has been renewed due to wear in the governor sleeve bore, the oil sealing rings must be removed from the governor tower and the gaps checked as described earlier in this Section. The 'run-out' of the governor tower should also be checked as described in Section 7.

Remove the parking pawl support screw if it has been refitted for location purposes, then position the parking pawl loosely in the gearbox casing. It may be necessary to slightly rotate the output shaft to allow the pawl to engage with the brake annulus gear.

Align the sealing ring gaps for ease of assembly and apply a light film of gearbox oil to the governor tower and rings. Slide the governor sleeve carefully over the rings. Fit the two securing setscrews with their locking washers, taking care to position the special washer on the setscrew adjacent to the parking blocker piston, so that the largest tab secures in position the blocker piston retaining pin. Screw in the setscrews until they are finger tight but do not lock them at this stage.

Lubricate the roller crank pin and fit the roller (see Fig. 58). Move the parking pawl into position and fit

the support screw complete with a new tab washer; this tab washer acts as an oil seal and must be in good condition. Tighten the support screw to the correct torque loading, but do not yet lock the screw by means of the tab washer.

Fit the reverse clutch oil pipe and the control valve unit, as described in Section 4, but do not yet fit the parking lever spring as this might interfere when aligning the governor sleeve.

Insert the governor sleeve alignment tool (RH329) into the annulus formed between the governor tower and the sleeve, if necessary lightly tap the sleeve to allow the tool to enter freely (see Fig. 59). Tighten the parking bracket setscrews to the correct torque loading shown in the 'Summary of Repair Data'; remove the tool and check that it has remained free. Check that the tool still enters freely when rotated to several positions.

Turn the gearbox output shaft to rotate the governor through a quarter of a turn, then again insert the alignment tool in several positions. Repeat this check at each quarter of a turn of the governor. If, at any point, the tool will not enter the annulus freely, slacken the parking bracket setscrews and again insert the tool to align the governor sleeve, then tighten the setscrews to the correct torque loading and repeat the complete check.

If difficulty is experienced in satisfactorily aligning the governor sleeve, slacken the securing setscrews securing the rear oil pump and governor and the parking brake bracket, then insert the aligning tool. Tighten the setscrews to the correct torque loading, then again carry out the complete check. The slight movement gained from the slackening of the rear pump and governor setscrews will probably be sufficient to allow correct alignment of the governor sleeve.

When the tool has entered freely into each of the four positions of the governor tower, lock the special tab washer to the parking bracket securing screw, ensuring that the largest tab is positioned to secure in position the parking blocker piston retaining pin.

Lock the parking pawl support screw by bending one tab against the screw head and two tabs against the rear casing.

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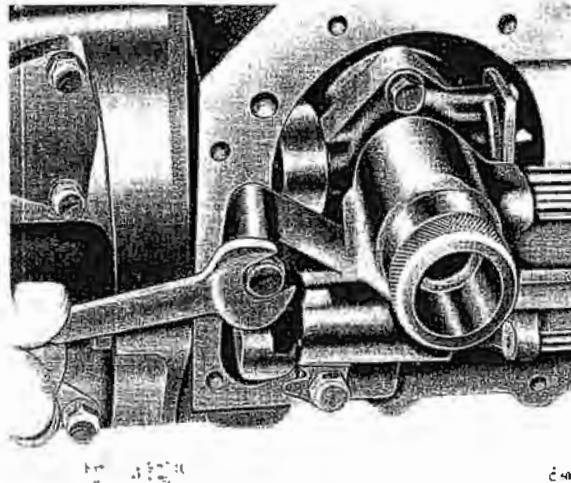


Fig. 59 Aligning governor and parking bracket

Fit the free end of the parking lever return spring over the pillar on the parking lever.

Move the selector lever to the reverse position to check that the parking pawl engages correctly in the

external teeth on the reverse annulus gear. If the pawl comes to rest on top of a tooth, slowly rotate the annulus gear to allow the pawl to snap into engagement under reverse selector spring tension.

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SECTION 6 — FRONT AND REAR SERVO UNITS

The front and rear servo units vary between different models of the gearbox. Identification of the various models and their interchangeability are as follows

From late 1953 onward the front servo unit is fitted with a light alloy valve body mounted externally on the servo body; the front band release cylinder is secured to the servo body by three setscrews. The rear servo is outwardly similar to earlier models but incorporates a drilled boss for the fitting of a compensator oil pressure pipe which connects with the front servo. These servo units can be fitted as a pair, with the compensator oil pressure pipe, to the early or late '1953' gearbox. The front servo can be fitted with an earlier rear servo not having a compensator oil pipe but the rear servo must not be fitted unless the compensator pipe and appropriate front servo are fitted also.

The early '1953' front and rear servo units are similar to the late '1953' units with the exception that compensator oil pipe bosses are not incorporated. These servo units cannot be fitted to the '1952' model gearbox.

The '1952' front servo unit incorporates the 4-3 timing valve, the quick-release valve and the rear pump non-return valve in the servo body to which the front band release cylinder is secured by two setscrews. The rear servo unit is outwardly identical to the early '1953' model. These servo units cannot be fitted to later boxes.

The servo units can be removed from the gearbox while it is installed in the car but the sump and filter must first be removed as described in Section 3.

Front and rear servos — To remove

The rear servo can be removed independently of the front servo, but as removal necessitates slackening the setscrews securing the front servo, instructions are given for removal of both servo units together. The front servo cannot be removed without removing the rear servo.

The disconnecting points are shown in Figure 60.

Slacken the front and rear band adjusting screw lock-nuts and unscrew the adjusting screws approximately five complete turns to release the pressure on the servo operating rods. Hook a piece of bent wire into the coils of the rear band release spring and secure it to prevent the spring from falling when the servo is removed.

Remove the governor oil delivery pipe, if necessary using light leverage near the ends of the pipe.

Slacken the setscrews securing both servo units to the gearbox casing; remove the compensator oil pipe, if fitted, front servo end first.

Remove the two setscrews securing the rear servo, carefully draw the rear servo away from the front servo, and withdraw the rear servo from the oil transfer pipe and from the gearbox. If the gearbox is installed in the car, care must be taken during this operation to support the rear servo and so avoid damage to the front servo and oil pipes. Remove the rear band release spring.

Support the front servo and remove the two securing setscrews. Push the rear oil pump discharge pipe as far as possible into the rear pump and carefully ease the front servo unit from the gearbox casing, turning it to disengage the rear oil pump discharge pipe and at the same time withdrawing it from the front oil pump delivery pipe.

If difficulty is experienced in disengaging the servo unit from the rear oil pump discharge pipe, slacken, and if necessary remove the front servo valve body. On '1952' gearboxes, slacken the setscrews securing the rear pump. If the valve body is to be detached from the front servo, remove the three securing screws, then slide the valve body toward the front and lift it from the servo body; retain the non-return valve spring and the ball.

If fault diagnosis has indicated that a servo unit might be defective, it should be checked as described under 'Front servo — To test' in order to ascertain which part is at fault before it is dismantled and inspected.

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Front servo unit — To dismantle

Hold the servo unit with the valve body (see Fig. 61) uppermost to prevent the 4-3 timing valve from falling out when the valve body is removed. Hold the valve body against spring pressure and remove the three securing screws. Slowly release the pressure and remove the non-return valve ball and spring as the bodies move apart. Tip the servo body and allow the 4-3 timing valve to slide from its bore.

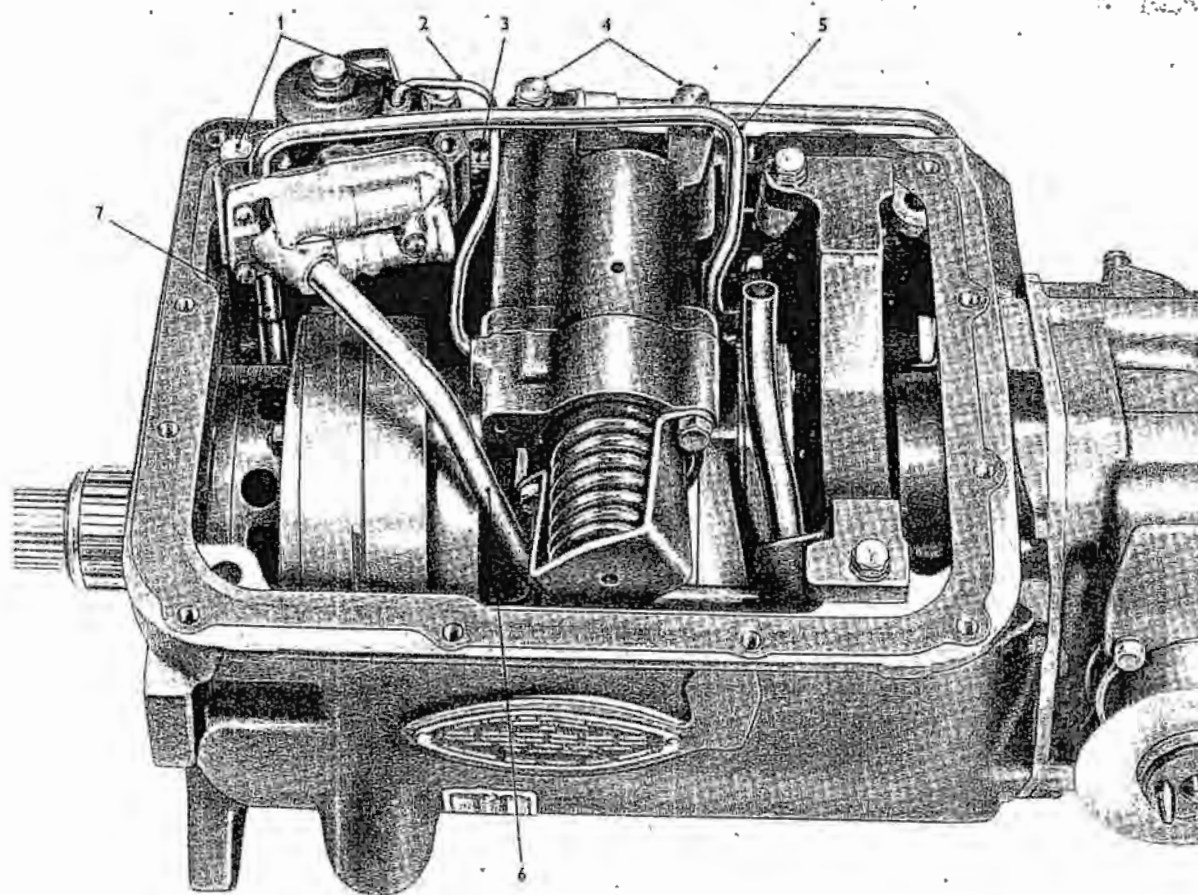
Depress the overrun valve retainer and withdraw the pin, retainer, spring and valve. If the retainer sticks in the bore, refit the valve body to the servo body, without the non-return valve and spring, then apply an air blast of approximately 70lb/sq.in. intermit-

tently to the band release oil duct (see Fig. 65); this will have the effect of hammering the retainer without damage to the component parts. Do not use leverage between the valve and the dividing walls in the face of the valve body casting.

Depress the exhaust valve spring, using a screwdriver edge through the slot in the retainer, then slide out the retainer. Withdraw the spring and valve.

To dismantle the remainder of the servo unit, remove the three screws securing the band release cylinder and withdraw the cylinder from the servo body. Withdraw the band release piston from the front band release cylinder.

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



C 605

Fig. 60 Disconnecting points

- | | | |
|-----------------------------------|-----------------------------------|--------------------------------------|
| 1 FRONT SERVO RETAINING SETSCREWS | 4 REAR SERVO RETAINING SET SCREWS | 6 REAR PUMP-TO-FRONT SERVO OIL PIPE |
| 2 COMPENSATOR PIPE | 5 GOVERNOR FEED OIL PIPE | 7 FRONT PUMP-TO-FRONT SERVO OIL PIPE |
| 3 OIL TRANSFER PIPE | | |

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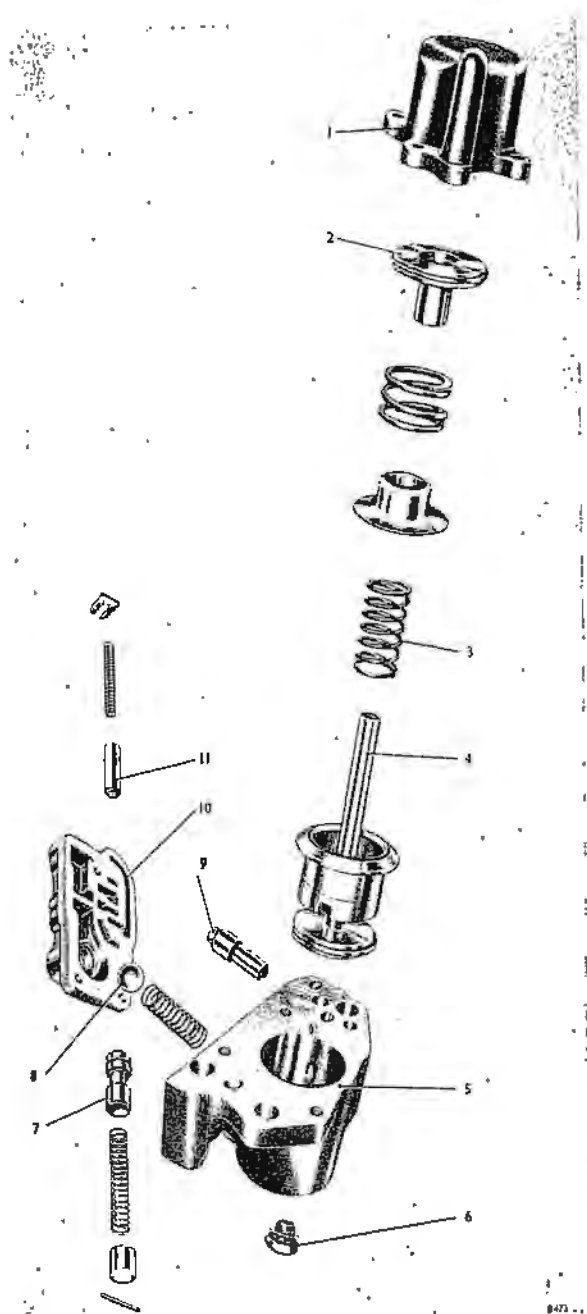


Fig. 61 Front servo—exploded

- | | |
|------------------------------|-------------------------|
| 1 BAND RELEASE CYLINDER | 6 BLANKING PLUG |
| 2 BAND RELEASE PISTON | 7 OVERRUN CONTROL VALVE |
| 3 APPLY PISTON RETURN SPRING | 8 NON-RETURN VALVE |
| 4 APPLY PISTON ASSEMBLY | 9 4-3 TIMING VALVE |
| 5 SERVO BODY | 10 VALVE BODY |
| | 11 LINE EXHAUST VALVE |

Withdraw the compensator and band apply piston assembly from the servo body, using a press tool and distance piece through the blanking plug orifice. The compensator and band apply piston assembly cannot be dismantled further.

If the gearbox has covered a considerable mileage, and new piston rings are available, remove the old rings from the pistons. If new rings are not available, or the gearbox has only covered a low mileage, the rings should be inspected as described in 'Front servo — To inspect'.

Dismantling of a '1952' front servo, described in the following paragraphs, is slightly different to the procedure for dismantling current models.

The component parts are illustrated in Figure 62 to which reference should be made when dismantling the unit.

Remove the two setscrews and washers securing the front band release cylinder to the servo body and withdraw the cylinder and spring.

Unscrew the blanking plug from the servo body and withdraw the piston assembly. If the piston assembly sleeve is tight in the body, it can either be drifted or pressed out using a soft metal drift through the blanking plug orifice; take care not to damage the orifice threads. The piston assembly cannot be dismantled further.

Unscrew the blanking plug and remove the retainer and 4-3 timing valve.

Cut the end off the quick-release valve retaining pin, extract the pin and withdraw the spring and valve.

Unscrew the non-return valve seat and remove the spring and ball.

Rear servo unit — To dismantle

Dismantling of the rear servo (see Fig. 63) is best attempted using the special tool (STD 6012) to compress and release the inner and outer band apply springs. Do not unscrew the two strap securing setscrews until the springs are held captive, otherwise damage to the servo, or personal injury, may result.

Fit the servo unit in position on the base pegs of the special tool (see Fig. 64) and screw down the compressor spindle until it enters through the hole in the strap and just meets the boss on the top of the compensator piston. Fit the 'U' section distance piece in position.

ROLLS-ROYCE AUTOMATIC GEARBOX

If tool (STD 6012) is not available and a press is to be used, place the servo operating lever in its normal position and use a packing piece under the lever to support the unit in a vertical position under the plunger. Lower the press plunger until it just meets the strap; do not lower further, otherwise the strap may become distorted.

Unscrew and remove the two securing setscrews, then release the springs gradually until they are fully extended. Remove the strap, outer spring, compensator piston and inner spring.

Withdraw the compensator/release piston and compensator/release cylinder from the servo cylinder and remove the exhaust valve and spring from the compensator/release cylinder. Using a suitable bar on the operating rod, push out the main piston and spring from the servo cylinder.

If it is necessary to remove the piston from the compensator and release cylinder, stand the assembly on end, captive spring uppermost, then using leverage under both sides of the coil, remove the spring from the operating rod. The lowermost coil will be damaged on its withdrawal from the groove — it should therefore be renewed on assembly. Withdraw the piston from the cylinder.

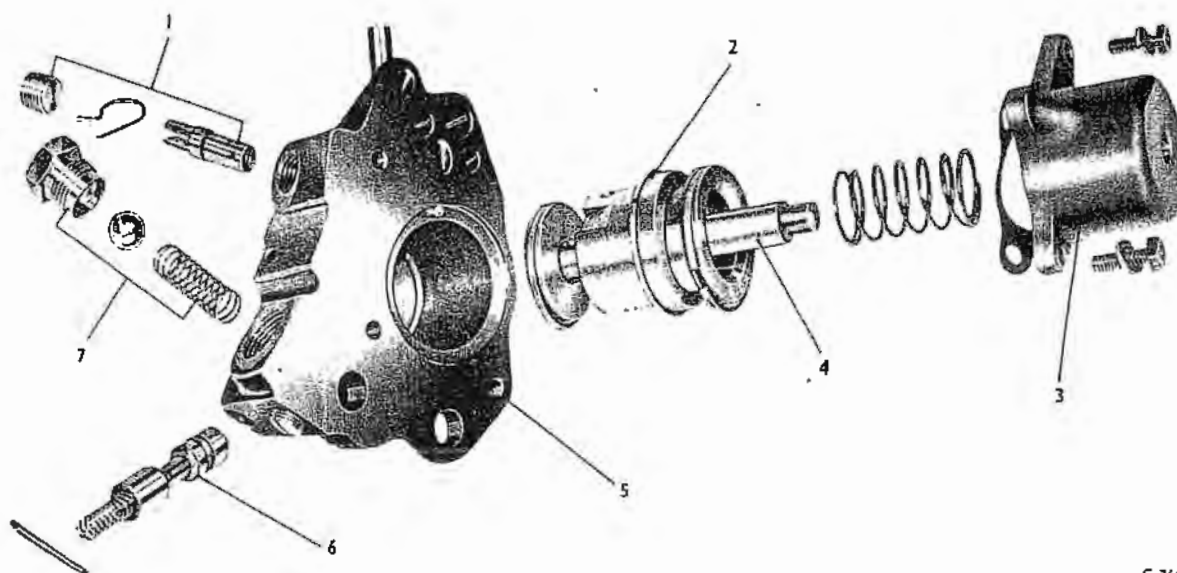
If the operating lever is to be removed, withdraw the split pin, slide out the pivot pin, remove the operating lever from the lugs and slide out the eighteen needle rollers.

If the gearbox has covered a considerable mileage and new piston rings are available, remove the old rings from the pistons. If new rings are not available or the gearbox has only covered a low mileage, the rings should be inspected as described in 'Rear servo—To inspect.'

All parts should be cleaned thoroughly before the inspection, using a brush, compressed air and filtered cleaning fluid.

Oil ducts and valve bores must be washed and blown through to remove any particles which could eventually reach the control valve unit and cause faulty operation of the gearbox. Ensure that the leak hole in the non-return ball valve seating in the front servo is free from dirt or sludge.

Do not remove piston rings, except when essential to facilitate cleaning of the grooves; careless handling of these rings can cause distortion. The piston ring inside the front servo compensator piston assembly cannot be removed, but every effort must be made to flush the compensator chamber by introducing cleaning fluid and moving the operating rod to and fro.



C 766

Fig. 62 Front servo—exploded (1952 cars)

- | | | |
|--------------------|----------------------|-----------------------|
| 1 4-3 TIMING VALVE | 3 CYLINDER COVER | 6 QUICK-RELEASE VALVE |
| 2 PISTON ASSEMBLY | 4 BAND OPERATING ROD | 7 NON-RETURN VALVE |
| | 5 FRONT SERVO BODY | |

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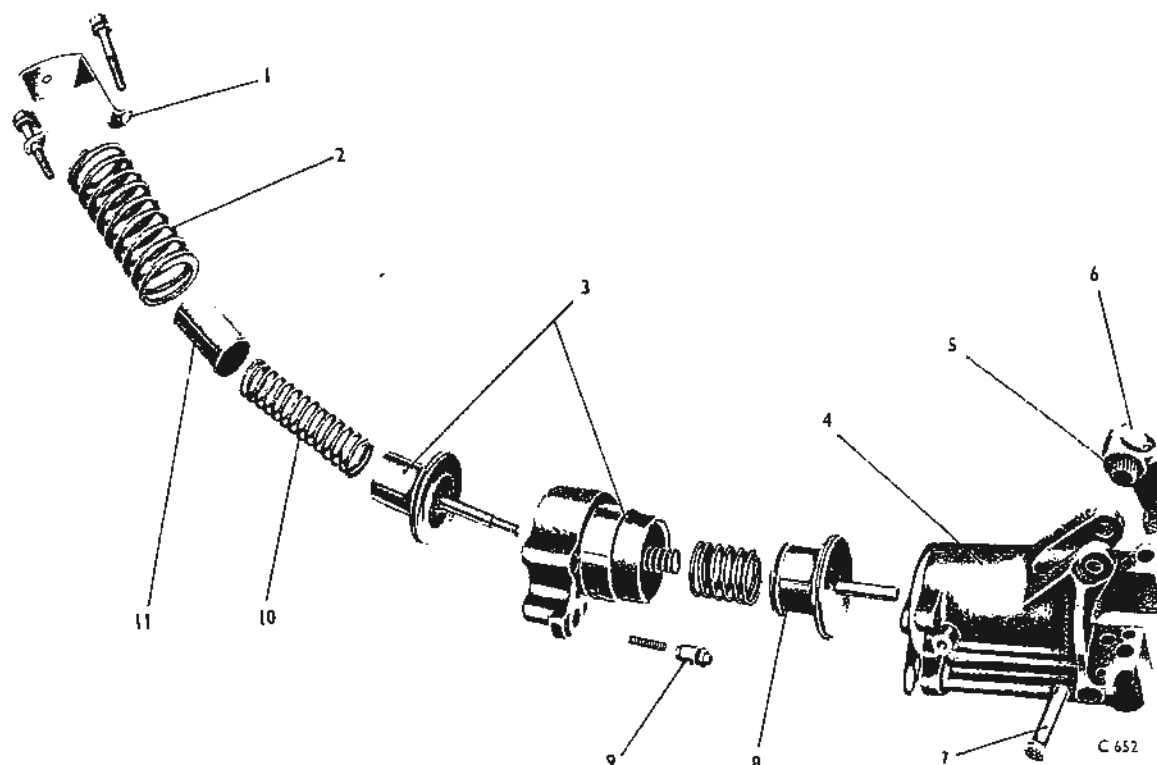


Fig. 63 Rear servo—exploded

- | | | |
|---|-------------------|-----------------------|
| 1 STRAP | 4 SERVO BODY | 8 BOOSTER PISTON |
| 2 OUTER SPRING | 5 NEEDLE ROLLERS | 9 EXHAUST VALVE |
| 3 COMPENSATOR AND
RELEASE PISTON AND
CYLINDER | 6 OPERATING LEVER | 10 COMPENSATOR SPRING |
| | 7 PIVOT PIN | 11 COMPENSATOR PISTON |

Clean all pipes and check them for kinking at the bends. Check the ends for damage and for fit in their respective bores.

Check all permanent plugs for security.

Examine all springs for distortion and screw threads for damage. Damaged screw threads can be cleaned out in the normal manner providing that the correct taps and dies are used. In the case of the two setscrews securing the compensator and release cylinder to the rear servo cylinder, due consideration should be given to the load imposed on the threads when the servo is acting under oil pressure.

Opportunity should be taken to check the condition of the band linings as far as possible while in position on the drums. The bands must not be pulled away from the drums, otherwise they may become distorted and contact area lost.

Front servo — To inspect

Examine the piston bores in the servo body and the front band release cylinder for signs of scoring or of 'pick-up'. Check that the dowel in the servo body has not become damaged. This dowel is a loose fit in the servo body and is easily removable.

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

Examine the piston assembly externally for scores and the piston rings (if the old ones are being re-fitted) for chipped edges and uneven contact. Hold the outer body of the assembly and move the operating rod backward and forward to check for freedom of action; a cushioned effect coupled with the characteristic scraping action of a piston ring should be felt.

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Check the face of the light alloy valve body for distortion, using a surface plate. Any distortion, particularly in the section between the main line oil passage and the overrun valve, will necessitate renewal.

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

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

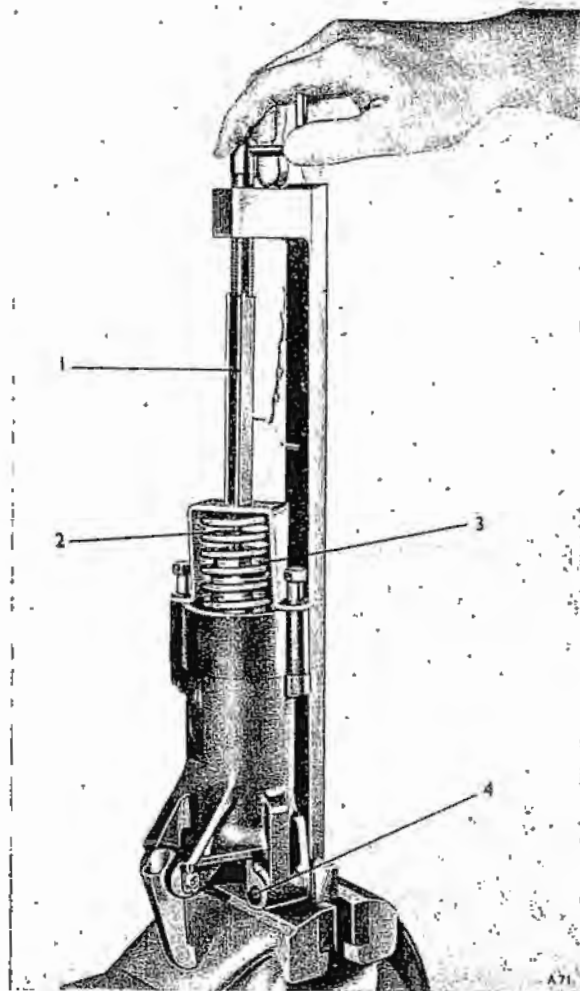


Fig. 64 Dismantling rear servo

- | | |
|-----------------------|-----------------------|
| 1. DISTANCE PIECE | 3. COMPENSATOR PISTON |
| 2. COMPRESSOR SPINDLE | 4. BASE PEG |

Rear servo — To inspect

The rear servo should be inspected in the same manner as the front servo with the addition of the following items.

Examine the spring retaining strap for cracks at the bends and for bending across the hole in the top section.

Examine the compensator and release piston internally and the compensator piston externally for scoring; examine both pistons for burrs on the rims of the open ends.

Examine the restrictor valve plate in the base of the compensator and release cylinder for security.

Examine the pivot pin and the bore of the band operating lever for wear and bedding of the needle rollers. Assemble the pivot pin and needle rollers in the bore and check for play. If wear or excessive play is apparent, renew the parts. Check the fit of the pivot pin in the lugs on the servo body.

Unserviceability of the following parts will necessitate renewal of the complete servo unit as these items are selectively fitted on initial assembly.

- Compensator/piston.
- Compensator/release piston.
- Compensator/release cylinder.
- Main piston.
- Servo cylinder.
- Exhaust valve.

Front and rear servos — To assemble

When assembling the servo units ensure that all parts are clean and oiled; do not fit sliding parts into dry bores. Refit any piston rings that have been removed. Fit new jointing where applicable but **do not** use jointing compound. Enter piston rings squarely to avoid scraping the cylinder walls.

Front servo — To assemble

If necessary, fit a new piston ring onto the band apply piston and fit the assembly into the bore of the servo body.

Align the dowel slot in the sleeve with the dowel in the servo body and push in as far as possible by hand; a press tool may be necessary to push the assembly

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fully home. The sleeve should fit the front servo body with an interference fit of 0.000 in. to 0.001 in.

If necessary, fit a new piston ring onto the band release piston, then fit the piston to the band release cylinder, using three 0.0015 in. feeler gauges to enter the piston ring over the steps in the bore.

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

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

Torque tighten the three securing setscrews.

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

Fit the overrun valve, spring, retainer and pin. Ensure that the end of the overrun valve retainer pin is below the surface, otherwise it will prevent the two faces from meeting and will permit oil leakage.

Fit the 4-3 timing valve to its bore in the servo body and ensure that it is below the surface, then fit the ball valve and spring and fit the valve body on to the servo body; secure with the three setscrews. Torque tighten the securing setscrews evenly to prevent distortion of the alloy body.

Assembly of the '1952' front servo is the reverse of dismantling and in most ways similar to the procedure described for current front servos. The following paragraphs give a few points which should be borne in mind when assembling.

The piston assembly should be pushed to the end of the bore to ensure that the operating rod is correctly aligned in the guide hole when fitting the release cylinder.

Align the dowel slot with the dowel pin before entering the piston assembly into the servo body. Enter the compensator sleeve squarely in the bore and press it in as far as possible by hand. If necessary use a press tool but avoid canting the sleeve, otherwise it may seize in the bore, or the piston ring may become wedged or broken.

Fit a new quick-release valve retainer pin and peen the head to secure.

Ensure that the 4-3 timing valve retainer spring is locked in position by spring action in the depression in the servo body.

Rear servo — To assemble

Assemble the needle rollers into the bore of the operating lever, retaining them in position with petroleum jelly, then fit the assembly to the servo body with the pivot pin. Lock the pivot pin in position with a split pin.

Fit the compensator and release piston in the cylinder. Stand the assembly on end, operating rod uppermost, then push the new spring, smallest coil first, on to the rod until it comes to rest in the groove. Fit the paper jointing in position on the end face.

Fit the spring in position in the bore of the main piston, ensuring that it is pressed into its housing, this should be an interference fit of 0.001 in.; slide the main piston into the servo cylinder. Assemble the exhaust valve spring into the hollow of the exhaust valve, then insert both into the bore of the compensator/release cylinder. Ensure that the spring is home in the smaller bore and that the valve is seated correctly over the spring; it is possible for the spring to become trapped by the rim of the valve. This can cause mal-functioning of the gearbox when moving from first gear, or when the selector lever is moved into range '2' with the engine running and the car stationary ('1952' model).

Lay the servo cylinder and the compensator and release cylinder assembly horizontally. Align the exhaust valve with the orifice in the servo body then bring them together, ensuring that the exhaust valve enters the orifice without trapping the paper joint.

Stand the assembly upright then fit the inner spring, compensator piston, outer spring, strap and setscrews.

Screw out the spindle and mount the servo on the base pegs of the special tool (STD 6012). Screw down the spindle through the hole in the strap and onto the boss on the compensator piston. Continue to screw down until the compensator piston is about to enter the bore of the release piston. Lift the outer spring and strap clear of the compensator piston. Carefully align the compensator piston in its bore then screw down the spindle until the piston is entered in the bore of the release piston. Compress the outer spring by hand until the distance piece can be fitted to the tool, then screw down the spring with the tool until the strap just meets the facing on the compensator cylinder. Fit and torque tighten the securing setscrews.

If assembling the rear servo under a press, care must be taken to ensure that the piston enters the bore squarely; the outer spring cannot be lifted to facilitate access as on the special tool.

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Servos — To test

The servo units can be tested functionally only by using a special test rig, or by refitting them to the gearbox and carrying out a road test as described in Chapter 2.

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

Front servo — To test

Apply air pressure to the band apply duct (see Fig. 65). The operating rod should move out to its fullest extent and the 4-3 timing valve should be heard and seen to move through the compensator pipe hole on top of the servo body. If the 4-3 valve does not move, shake the valve to the other end of its bore and repeat the check; this valve is not subject to spring pressure and therefore will not return once it has moved.

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

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

Air testing of '1952' front servo is somewhat different to the procedure described above and is as follows

Remove the blanking plug from the 4-3 timing valve bore, hold the servo with the bore uppermost, then apply air pressure to the band apply duct (see Fig. 65). This should move the servo piston and cause the operating rod to move out to its fullest extent and also lift the 4-3 timing valve, as seen through the blanking plug orifice. Refit and tighten the blanking plug.

Apply air pressure intermittently to the band release duct and observe to ensure that the exhaust valve moves to and fro across the exhaust port in the side of the casing adjacent to the non-return valve seating.

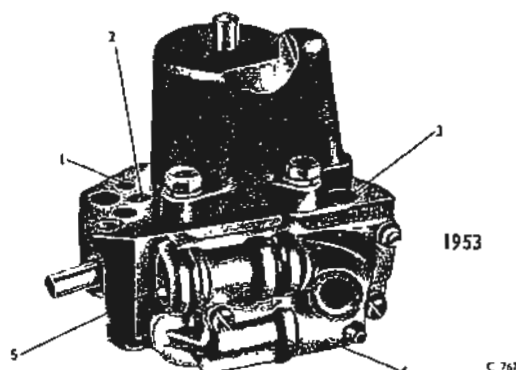
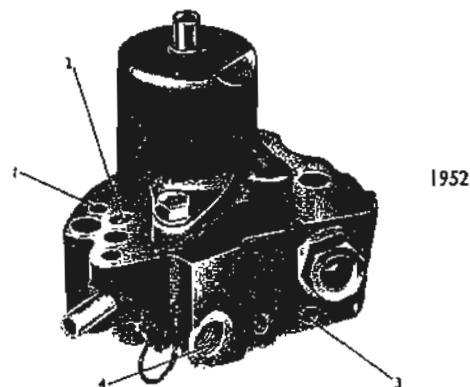


Fig. 65 Air pressure test—Front servos

1952 SERVO

- | | |
|----------------------|---------------------|
| 1. BAND APPLY DUCT | 3. EXHAUST PORT |
| 2. BAND RELEASE DUCT | 4. 4-3 TIMING VALVE |

1953 SERVO

- | | |
|-----------------------------|----------------------------------|
| 1. BAND APPLY DUCT | 4. OVERRUN CONTROL VALVE HOUSING |
| 2. BAND RELEASE DUCT | 5. EXHAUST VALVE HOUSING |
| 3. FRONT PUMP DELIVERY DUCT | |

Rear servo — To test

Apply air pressure to the band release oil duct (see Fig. 66); the operating rod should move into the servo cylinder.

Apply air intermittently to the 1-2 oil duct; the exhaust valve should be felt to move to and fro in its bore. A piece of stiff wire inserted through the pressure balance hole in the end of the exhaust valve bore will confirm this movement.

Front and rear servos — To fit

If the rear pump and governor securing bolts have been slackened during dismantling, tighten them and check the alignment of the governor sleeve as described in Section 5. This can be carried out without

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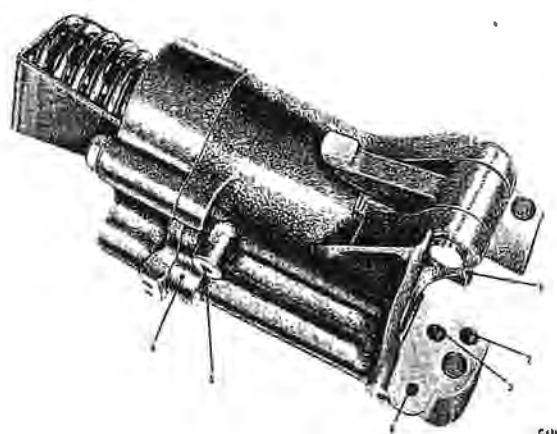


Fig. 66 Air pressure test—Rear servo

- | | |
|-------------------------|------------------------------|
| 1 OPERATING ROD | 5. COMPENSATOR OIL PIPE DUCT |
| 2 BAND RELEASE OIL DUCT | 6. EXHAUST VALVE HOUSING |
| 3 COMPENSATOR OIL DUCT | |
| 4 1-2 OIL DUCT | |

removing the control valve unit.

Fit the rear oil pump discharge pipe into the bore in the rear pump ensuring that it is fully home. Ensure that the front pump delivery pipe is fully home in the front pump.

Rotate the front drum band until the slot for the operating rod is in the correct position and the other end of the band is engaged with the adjusting screw. Engage the band operating rod in the band slot, then manoeuvre the servo unit into position, engaging the front pump delivery pipe and the rear pump discharge pipe in their respective bores. Do not fit the securing setscrews at this stage.

Fit the rear band release spring in the housing in the end of the rear band, using petroleum jelly to hold it temporarily in position. Engage the short end of the operating strut in the spring coil and tie the ends of the band together with a piece of wire, this will hold the spring in position during subsequent operations; the wire should be fixed in such a manner that it can be removed easily at a later stage. Rotate the band until it engages with the adjusting screw.

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

Push both servos to the face on the gearbox casing, then fit and evenly torque tighten the securing setscrews,

taking care that the front and rear pump pipes fully engage smoothly; the rear servo must be supported during this operation. Check that the band release spring is in the correct position, then remove the locking wire from the ends of the band ensuring that no wire is left in the gearbox.

Adjust the setting of the front and rear bands as described later in this Section.

Fit the compensator pressure pipe (if applicable) and the governor oil delivery pipe.

Fit the oil filter and sump as described in Section 3, then carry out a road test as described in Chapter 2,

Bands — To set

Setting of both bands must be carried out whenever a servo unit has been removed and may also be necessary to rectify faulty operation of the gearbox. The procedure is the same whether the gearbox is installed in the car or on the bench.

Front band — To set

The tools used for setting the front band are, spanner (RH 131), gauge (RH 671 for '1952' servos with a tapered thread) and gauge (UR 3144) — see Chapter 4 — Tools.

It is necessary to use the spanner, only if the gearbox is in position in the car. The outer box spanner fits on to the lock-nut and the inner adjusts the bands.

Unscrew the blanking plug from the front servo body and screw in the setting tool as shown in Figure 67. Turn the plunger nut by hand until the plunger makes contact with the servo piston. Turn the drum by hand in the opposite direction to normal rotation to centralize the band; using a spanner, screw in the plunger five complete turns. Check that the knurled washer cannot be rotated; if it is loose, slacken the band adjusting screw until the washer is gripped.

Hold the knurled washer of the tool as shown in Figure 67, then tighten the band adjusting screw until the washer just slips. Hold the adjusting screw to prevent it from turning, then tighten the lock-nut to the correct torque loading. Check that the tension on the knurled washer has not changed indicating that the setting has not altered.

Slacken the plunger nut more than five turns, to relieve the pressure on the screw thread in the servo body; unscrew the tool, then refit and tighten the blanking plug.

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Rear band — To set

The tools required for setting the rear band are, spanner (RH 131) and gauge (23789/G1002) — see Chapter 4 — Tools.

Remove the governor oil delivery pipe.

Check that there is a clearance between the end of the operating lever and the operating rod of the rear servo; if necessary, slacken the band adjusting screw. Turn the rear drum in the opposite direction to the normal rotation to centralize the band. To ensure that the band is centralized, hold a screwdriver against the riveted end of the band and shock it into position on the drum.

Hold the band setting gauge with the cut-away leg firmly against the spring end of the servo and the other end of the gauge resting on the servo operating rod, as shown in Figure 68.

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

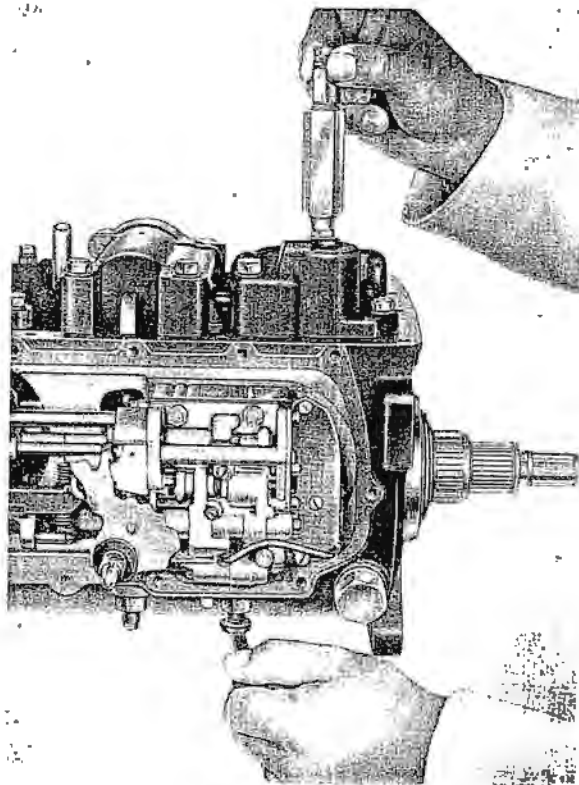


Fig. 67 Setting the front band

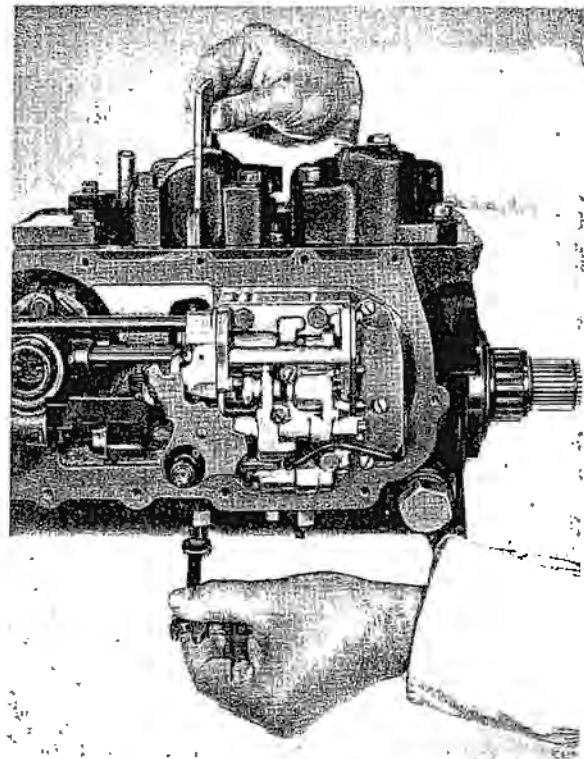


Fig. 68 Setting the rear band

and recommence the setting operation, which must always be carried out by adjusting the operating lever moving towards the gauge and not away from it. Firmly hold the adjusting screw and tighten the lock-nut to the correct torque loading. Check that the setting has not altered.

Refit the governor oil delivery pipe.

Gauge (UR 3144) — To check

Instances have occurred of the lock-nuts, which regulate the spring loading in tool (UR 3144), slackening off, resulting in inaccurate adjustment of the front band.

Remove the plunger assembly from its housing and check the length of the spring under a compression; this should be 1.160 in. \pm 0.003 in.

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

It is recommended that tool (UR 3144) should be frequently checked approximately every three to six months, depending on how often the tool is used.

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SECTION 7—REAR PUMP AND GOVERNOR

To remove the rear pump and governor, it is unnecessary to remove the gearbox from the car. Drain the oil as described in Chapter 2, then remove the following units

- Sump and side cover (see Section 3).
- Control valve unit (see Section 4).
- Parking brake bracket (see Section 5).
- Front and rear servo units (see Section 6).

If the governor only is to be removed, it is not

necessary to remove the two servo units.

Governor — To remove

Scribe correlation marks on the edge of the governor drive flange and the governor body to ensure correct assembly, then unscrew the two retaining setscrews and separate the governor assembly from its driving flange.

If the gearbox is removed from the car, hold the output shaft to prevent the governor from turning whilst the two setscrews are removed.

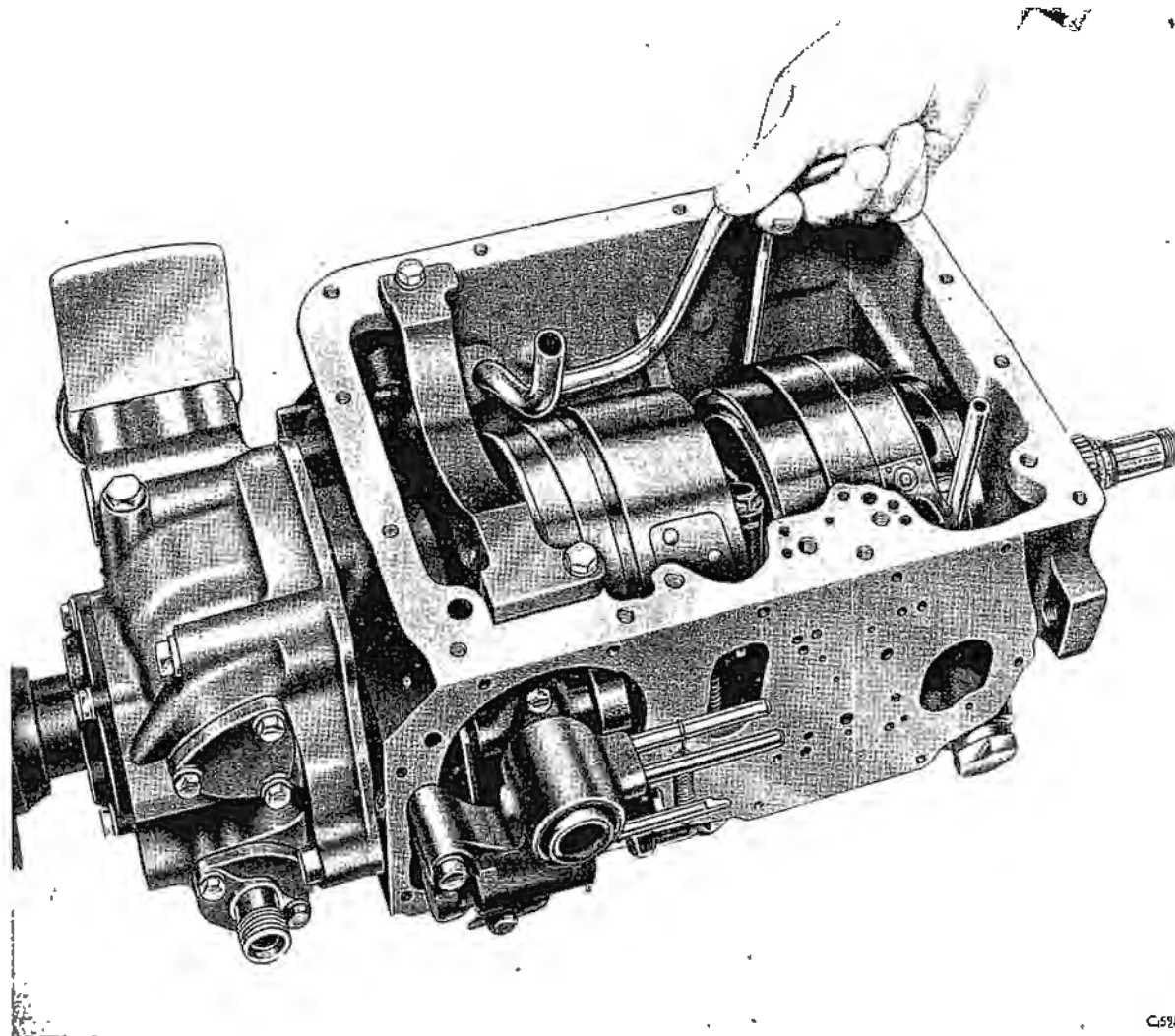


Fig. 69 Removing pump-to-front servo oil pipe

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Rear pump and governor — To remove

Withdraw the pump-to-front servo oil pipe as shown in Figure 69.

Rotate the output shaft until the large (G1) governor weight faces toward the front of the gearbox. Unscrew the two retaining setscrews and withdraw the pump and governor assembly from the gearbox, as shown in Figure 70.

Rear pump and governor — To dismantle

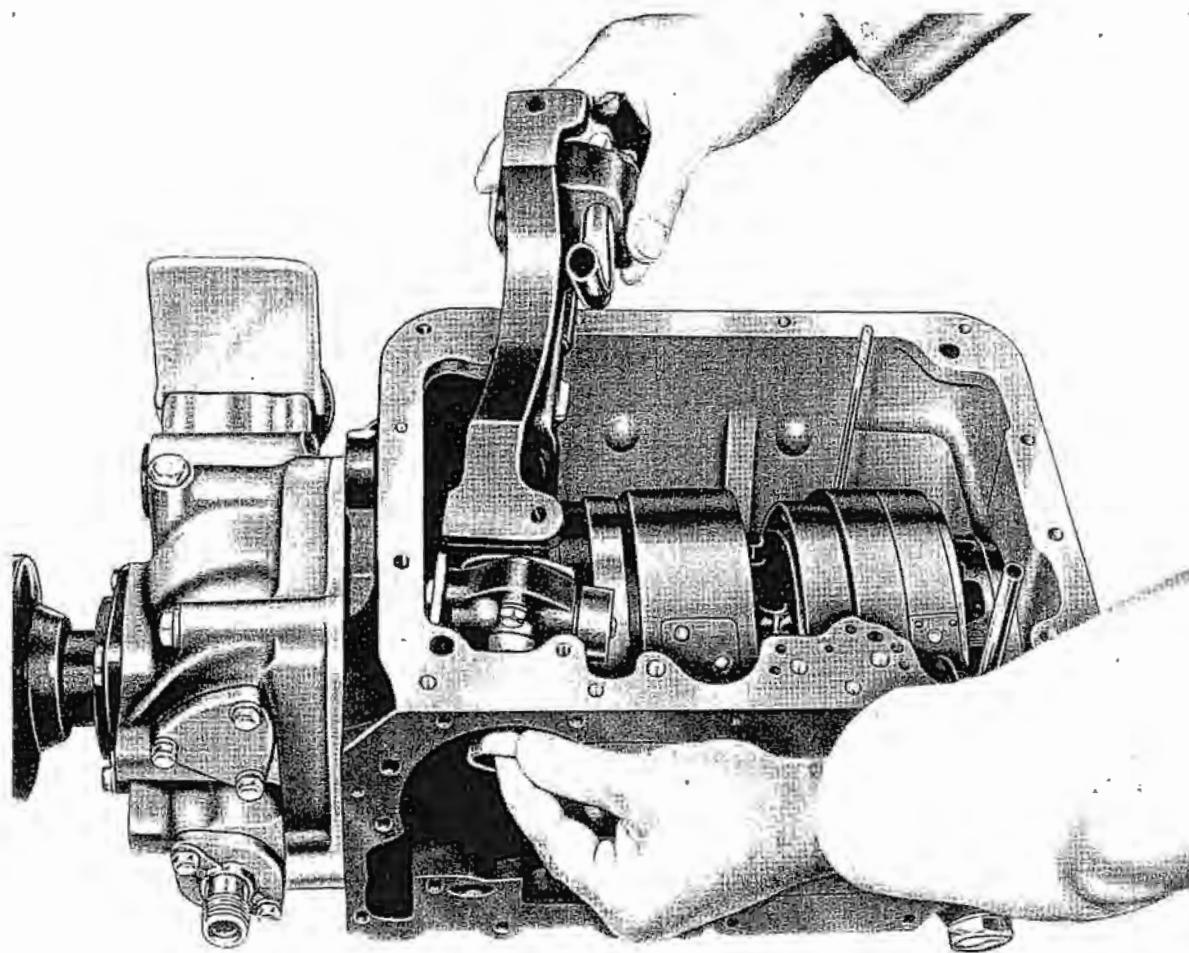
Dismantling of the governor and rear pump is limited to that described in the following paragraphs.

If wear or damage should necessitate the renewal of a part not covered by these dismantling instructions, either the pump or governor must be renewed as a unit.

When renewing a pump, the bronze driving gear on the output shaft must be examined for wear; if wear is considered excessive or the gears are noisy on a subsequent road test, renew the gear.

Governor — To dismantle

The only parts which can be removed from the governor assembly are the oil sealing rings, the G2 valve and sleeve and a hardened steel washer which is situated in the bottom of the G2 valve sleeve bore; this washer is not fitted on early gearboxes.



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Fig. 70 Removing rear pump and governor

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The G2 valve can be withdrawn from its sleeve after removing the retaining plate, as shown in Figure 71, but the oil sealing rings need not be removed unless they are worn or damaged.

If a G2 valve is unserviceable, a new G2 valve and sleeve assembly may be fitted, but if a G1 valve is unserviceable a new governor assembly must be fitted as neither G1 nor G2 weights should be removed.

Rear pump — To dismantle

Unscrew the four screws retaining the cover and lift off the pump cover. Withdraw the annulus gear by tilting the pump and gently shaking until the gear drops into the palm of the hand.

Rear pump and governor — To inspect

Clean all the components thoroughly, flush out the oilways with a suitable cleaning fluid and blow through with compressed air. Examine all parts for cracks and burrs.

Governor — To inspect

Check the mating faces of the governor and driving flange with engineers' blue; if either face is distorted, renew the complete assembly as the surfaces must not be scraped. Some early rear pumps are fitted with an aluminium drive flange and in this case both rear pump and governor should be renewed.

Wear of the governor tower is unlikely, but if signs of rubbing are evident, it should be inspected in conjunction with the bore of the parking brake bracket. Wear of this nature is usually caused by the tower running eccentrically. Details of the run-out check and methods of rectification are given under 'Governor — To fit.'

Check the oil seal rings for freedom or excessive clearance in their grooves; if the periphery of a ring appears to be worn, remove the ring, insert it into the bore of the parking brake bracket and check that the ring gap is within the limits given in the 'Summary of Repair Data' at the beginning of this Chapter.

Ensure that the G1 and G2 valves operate freely; they should be heard moving as the governor assembly is gently shaken from side to side.

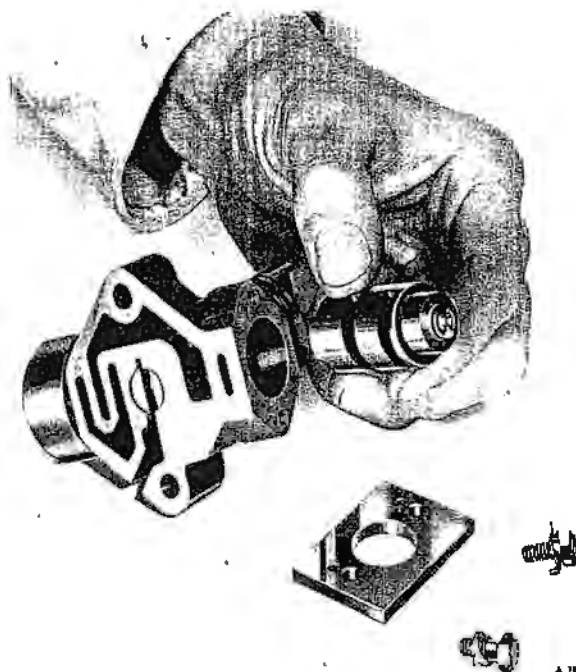


Fig. 71 Removing G2 valve and sleeve

Rear pump — To inspect

Check the governor driving flange and flexible drive retaining pins for security. Failure of the flexible drive is most unlikely, therefore the large amount of axial movement and the small radial movement between the steel driven gear and the flexible drive can be considered normal.

Early rear pumps are not fitted with a flexible drive, the oil pump skew gear being secured to the pump drive shaft by a pin. On some rear pumps the skew gear retaining pin is a sliding fit in the drive-shaft, but an interference fit in the gear. This allows the skew gear to move very slightly radially on the shaft and, providing this slight movement does not suggest that the pin has worn, the pump unit need not be renewed.

Check the mating faces of the pump cover and the pump body with engineers' blue. Small burrs may be removed, but the joint faces must not be scraped or lapped otherwise the machining marks may easily be eliminated.

Examine the annulus gear pocket and the pump cover for wear. If scoring in the pocket is severe and likely to affect the pump performance, renew the pump. If the oil pressure is found to be low during fault diagnosis tests, this should be used as a guide when assessing score damage.

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Inspect the gears for worn or damaged teeth and check the oil inlet pipe for security in the pump body.

Check the inside face of the crescent shaped segment for signs of fouling by the inner gear teeth. If scoring is heavy this is an indication of excessive wear in the drive-shaft bushes; in each case the pump should be renewed.

Rear pump and governor — To assemble

To assemble the rear pump and governor, reverse the procedure for dismantling ensuring that each part is lubricated with clean gearbox oil before being refitted.

The importance of cleanliness is emphasised, but rag should never be used owing to the danger of fluff entering the control system and fouling the valves. Attention is drawn to the special instructions contained in the introductory notes at the beginning of this Chapter, also the torque loading data and schedule of fits and clearances given in the 'Summary of Repair Data'.

Governor — To assemble

Refit the oil sealing rings to the governor tower, using the special tool as shown in Figure 72; if the rings are new, check the gaps by inserting the rings into the bore of the parking brake bracket, then check the clearance in the grooves of the tower.

Insert the steel washer (if fitted), G2 valve and sleeve into the governor body ensuring that the small recess



Fig. 72 Fitting governor oil sealing rings

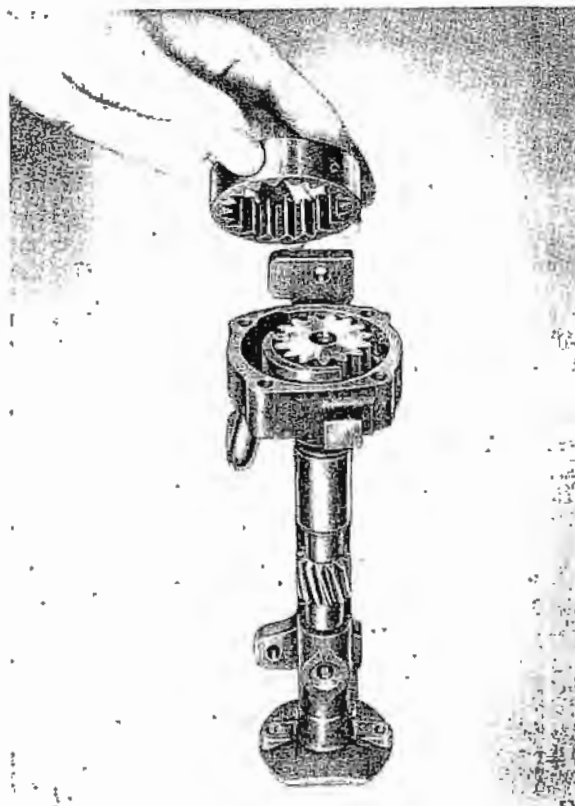


Fig. 73 Fitting annular gear

in the sleeve aligns with the slightly larger recess in the governor body. Refit the retaining plate, ensuring that the dowel in the plate lines up with the two recesses previously described. Fit the two setscrews and new tab washers; tighten the setscrews to the correct torque given in the 'Summary of Repair Data' and lock the tab washers.

Rear pump — To assemble

Assemble the rear pump reversing the procedure for dismantling noting the following points.

Ensure that the annular gear is correctly fitted with the chamfered edge toward the bottom of the annulus gear pocket as shown in Figure 73. Fit the pump cover and the four setscrews; torque tighten to the figure given in the 'Summary of Repair Data'.

Check that the drive-shaft end float is not less than 0.0005 in. or more than 0.0025 in. Pour some clean gearbox oil through the pump intake pipe then turn the gears to check for free rotation.

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Governor — To fit

Before fitting the governor body to the driving flange it must be checked for swash, using a dial test indicator as shown in Figure 74. Turn the pump shaft several times and check that the swash, if any, is within the limits given in the 'Summary of Repair Data'. If outside these limits, renew the pump and again check for swash.

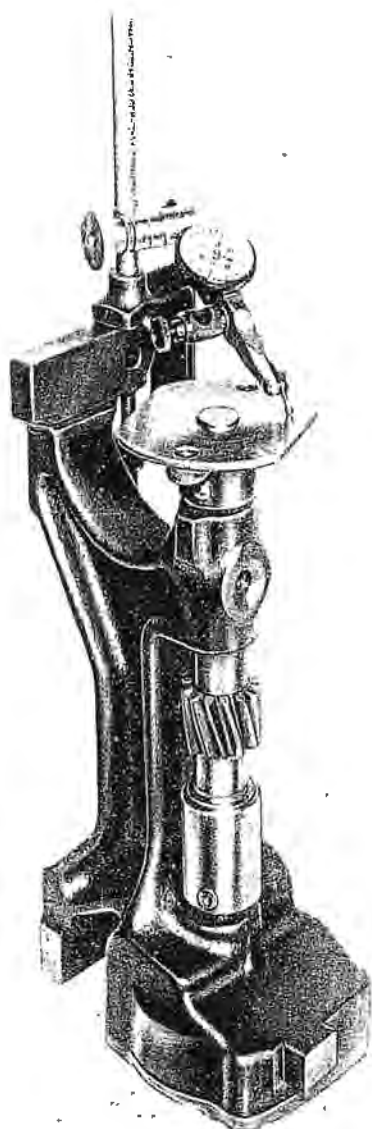


Fig. 74 Checking rear pump flange for swash

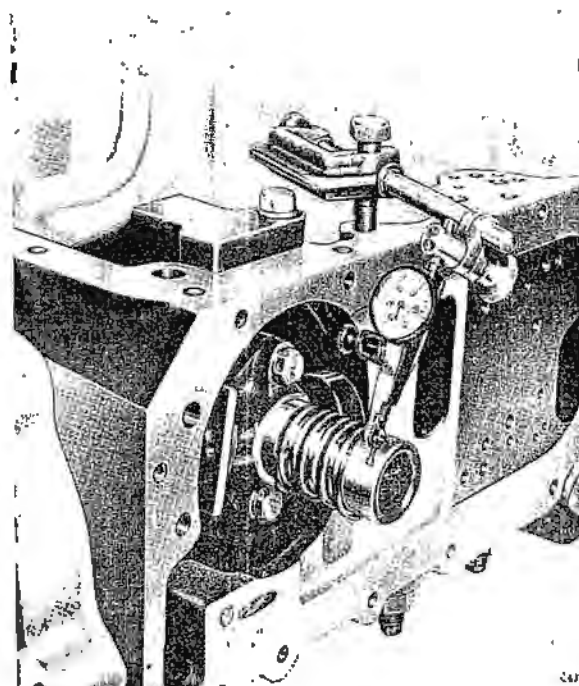


Fig. 75 Checking governor tower run-out

Mount the governor onto the driving flange and if neither of the units have been renewed, ensure that the correlation marks coincide; if a new unit is being fitted, it should be marked after the run-out check described later. Refit the two setscrews and tighten to the correct torque loading. Using a dial test indicator as shown in Figure 75, check the run-out of the governor tower as follows.

With the stem of the indicator contacting the tower approximately 0.250 in. from its outer end, rotate the shaft several times. If the total run-out exceeds the limits given in the Summary, remove the governor from its drive flange, turn it through 180 degrees and refit, then check again. If run-out is still excessive, fit a new governor and repeat the check. If this does not bring the run-out within the limits, the rear pump and the governor must be renewed.

After completing the check, again scribe the correlation marks on the governor and driving flange; refit the parking brake bracket (see Section 5), the control valve unit (see Section 4), the side cover and sump (see Section 3) then refill the gearbox with oil. Prime the ride control unit if fitted.

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Rear pump and governor — To fit

When both the rear pump and governor have been removed from the gearbox, the assembling and checking procedure is similar to that given under 'Governor — To fit'. It is, however, easier to check for swash and run-out before installing the combined assembly into the gearbox; in such cases the dial test indicator should be mounted onto the pump body.

After completing the checks, ensure that the mating surfaces of the gearbox and pump unit are free from burrs, especially around the setscrew holes, then, with the G1 weight facing the front of the gearbox fit the assembly, at the same time slightly rotating the governor to mesh the gears. Fit the two retaining set-

screws to the correct torque loading.

Refit the front and rear servo units (see Section 6), parking brake bracket (see Section 5), control valve unit (see Section 4) and side cover and sump (see Section 3). Fill with oil and prime the ride control unit if fitted.

Serviceability check

After overhaul or fault rectification, a road test should be carried out to ensure that the gearbox functions correctly, particular attention being paid to that part of the test which led to the diagnosis of the fault. Details of the tests concerned are given in Chapter 2.

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SECTION 8—PRESSURE CONTROL VALVE

Removal of the pressure control valve (see Fig. 76) can be carried out with the gearbox in the car and without the removal of any other parts.

To ensure that the inner parts do not fall out during removal the following procedure should be carefully carried out.

Using a suitable spanner unscrew the blanking plug taking care to restrain it under the pressure of the return spring. Before lifting out the blanking plug place a finger on to the return spring and lift out the complete unit.

The valves can then be shaken out of their bores.

Pressure control valve — To inspect

Thoroughly clean all parts, using a suitable cleaning fluid.

Examine the condition of the inner and outer rubber cushions and if they show any sign of deterioration or damage, remove and fit new ones, after first dipping them into clean gearbox oil.

Remove the oil seal ring and joint washer from the blanking plug then examine the threads for signs of 'picking-up' or damage; similarly examine the threads in the gearbox, then screw the plug into the gearbox to check for freedom.

Fit a new seal ring and joint washer, then assemble the unit using petroleum jelly to retain the plugs and damper spring in position while the unit is assembled to the gearbox. Torque tighten the plug to 40 lb.ft. to 50 lb.ft.

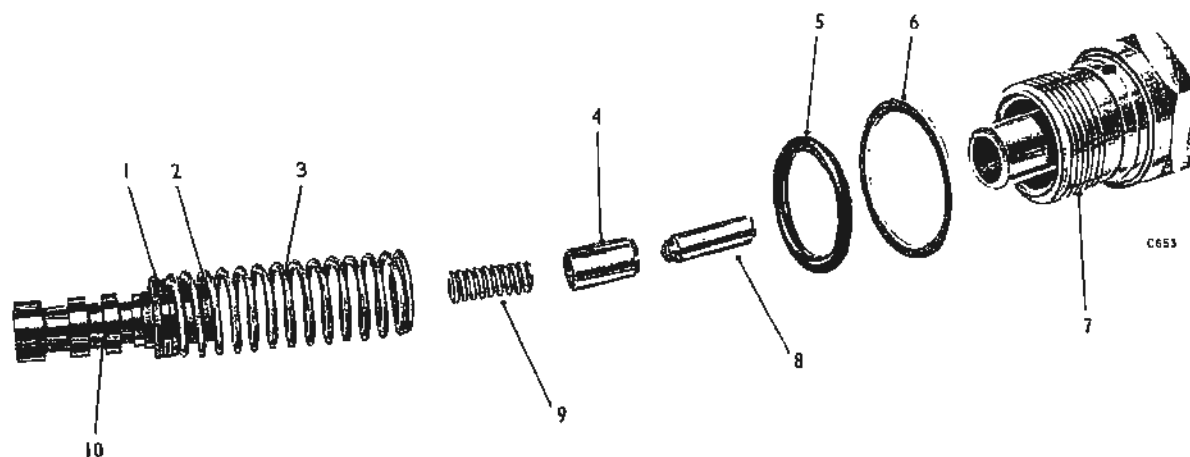


Fig. 76 Pressure control valve—exploded

- | | | | | |
|-----------------|------------------------|----------------|-----------------------|--------------------|
| 1 INNER CUSHION | 3 RETURN SPRING | 5 SEALING RING | 7 BLANKING PLUG | 9 DAMPER SPRING |
| 2 OUTER CUSHION | 4 REVERSE BOOSTER PLUG | 6 JOINT WASHER | 8 T.V. REGULATOR PLUG | 10 REGULATOR VALVE |

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SECTION 9—FRONT PUMP AND DRIVE-SHAFT

To remove the front pump and drive-shaft, first remove the gearbox from the car as described in Section 1 then remove the following units.

Fluid coupling (see Section 2).

Side cover, sump and filter (see Section 3).

Front and rear servo units (see Section 6).

Pressure control valve (see Section 8).

If required, the front pump can be removed from the gearbox without disturbing the drive-shaft, but for the purpose of overhaul it is easier to remove the shaft at this stage. Instructions covering removal, inspection and re-assembly are included in this Section.

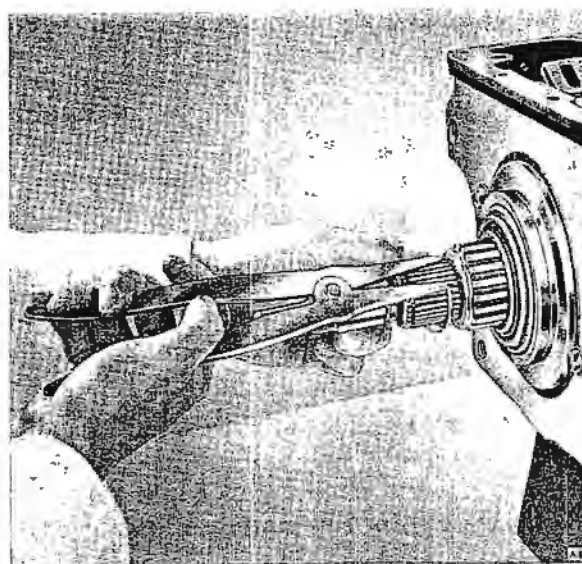


Fig. 78 Removing intermediate shaft snap ring

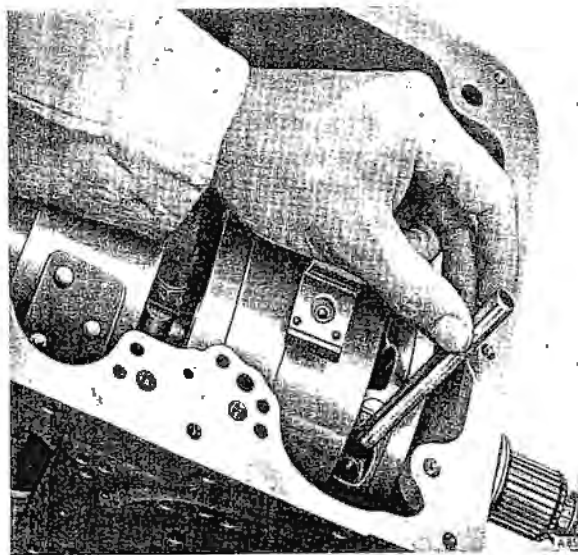


Fig. 77 Removing oil feed pipe

Front pump — To remove

Withdraw the pump-to-front servo oil feed pipe (see Fig. 77). Remove the pump-to-filter pipe.

Using spring ring pliers in the manner illustrated in Figure 78, remove the snap ring, steel backing washer and bronze thrust washer from the intermediate shaft; keep together and label them for easy identification on re-assembly.

Remove the two screws securing the front pump, then withdraw the dowel washer from its counterbore with the spring ring pliers. Taking care not to damage the drive-shaft bushes on the intermediate shaft splines, withdraw the pump together with the drive-shaft from the gearbox. It may be necessary to tap the rear face of the pump to free it initially, in which case a soft drift should be used.

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Remove and discard the pump-to-gearbox gasket. From the intermediate shaft, remove the bronze thrust washer and label it for identification.

The front pump should be dismantled only if suspected of faulty operation which cleaning will usually rectify. It may be preferable to change the complete unit rather than attempt rectification if rig test facilities are not available.

Front pump — To dismantle

Separate the pump from the drive-shaft by sliding one from the other.

Place the pump on the bench, front cover downward, then, using the holding tool shown in Figure 79, remove the four setscrews and washers. Lift the body from the front cover. If the body is held by the two dowels, gently tap the cover with a soft mallet; do not turn the cover over otherwise the pump parts will fall out and may be damaged.

Before lifting any of the parts, mark the exposed face of the pump rotor to ensure that it is fitted correctly on re-assembly. Do not use a scribe or punch for marking; an indelible pencil is recommended.

Remove the top inner vane ring, pump rotor, seven vanes and the lower inner vane ring, then lift out the slide after pushing it toward the priming springs as shown in Figure 80. Remove the two concentric priming springs; on early pumps only one single spring is fitted.

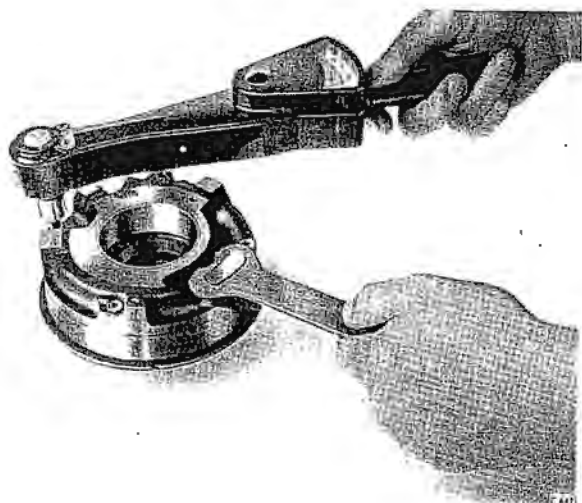


Fig. 79 Unscrewing body retaining screws



Fig. 80 Removing pump slide

Remove the relief valve from the pump body as shown in Figure 81. Depress the spring guide and withdraw the retaining pin. Relaxing the pressure on the spring, carefully remove the guide and spring; remove the valve with the spring ring pliers.

Remove and discard the oil seal ring from the oil intake pipe bore in the pump body.

Remove the piston-ring type oil seals from the pump cover.

The lip-type oil seal in the pump cover should not be removed unless renewal is necessary; the seal is a tight fit in its bore and removal may necessitate the use of a hammer and chisel.

If the lip-type seal has to be renewed on an early 'S2' front pump take careful note of the following paragraphs.

Early 'S2' front pumps are fitted with a seal identical to those fitted to 'S1' pumps, but on 'S2' pumps the seal is not pressed fully home in the pump cover recess. A modification provided for a washer interposed between the seal and the recess end face in order to more effectively control the position of the seal.

A further modification incorporated the re-positioning of the seal recess in order to obviate the necessity for a spacing washer.

Current cars are fitted with a new type of seal, (Part No. UG 4107) requiring a recess position similar to that of 'S1' pumps. No spacing washer is required and the seal is pressed fully home in the recess.

Seal (UG 4107) will be supplied as a replacement for fitting to all 'S' series cars but existing seals (UG 3670) may be used if in stock.

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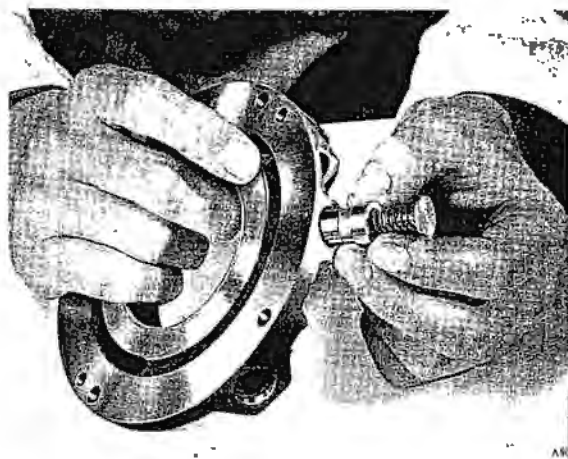


Fig. 81 Removing relief valve

Seal (UG 3670) — To fit

Remove the old seal by tapping it outward, taking care not to damage the adjacent machined faces.

Using a depth gauge or vernier caliper, measure dimensions 'A' and 'B' given in Figure 82. Subtract dimension 'B' from dimension 'A'. A reading between 0.355 in. and 0.400 in. indicates that the cover is not of the modified type and that a washer must be fitted; a reading between 0.415 in. and 0.450 in. indicates a modified pump, requiring no action.

Insert the washer, if fitted, into the recess (chamfered edge leading); apply a smear of jointing compound to the outer wall of the recess, lubricate the new seal with transmission fluid, then press the seal home in its bore.

Seal (UG 4107) — To fit

It will be necessary, in some cases, to carry out a machining operation on the pump cover in order to accommodate this seal. Identification of covers requiring machining is by the dimensional check outlined in the instructions for fitting the (UG 3670) seal. A dimension between 0.415 in. and 0.450 in. indicates that the cover must be machined to accept the seal. A dimension between 0.355 in. and 0.400 in. indicates that the cover will accept the seal without modification. Where a spacing washer has been fitted, this should be removed before refitting the new seal.

Pump cover — To modify

Extract the oil seal from the cover, then remove the front pump from the gearbox as previously described.

Machine the pump cover to increase by 0.050 in. the depth of the seal location bore (dimension 'B' Fig. 82). Thoroughly clean the cover to remove all swarf, then assemble the pump. Refit the pump to the gearbox.

Fit a new seal as described earlier in this Section.

Front pump — To inspect

Clean all parts thoroughly, taking care to remove any traces of sludge; flush out all oil passages with a suitable cleaning fluid. Using a piece of strong wire, check that the bleed holes and passages are clear, then blow them through with compressed air. Rag should not be used for cleaning purposes owing to the danger of fluff entering the control system and fouling the various valves.

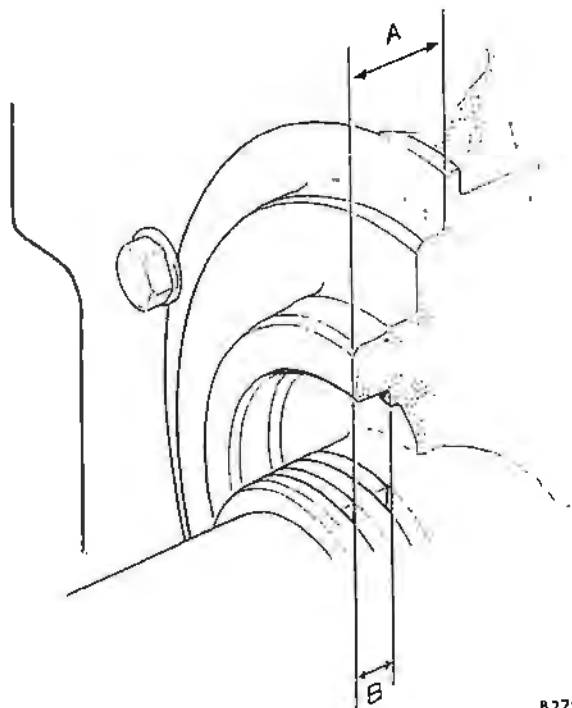


Fig. 82 Pump cover checking dimensions

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Examine all parts for cracks or damage and check all sliding surfaces for scores, burrs and roughness.

Check that the halves of the pump mate without a gap. Small burrs may be removed but the joint face must not be scraped or lapped.

Reference should be made to the Spares Schedule before renewing any distorted or damaged parts, as many of the components are selectively fitted after manufacture and must not be renewed separately.

Check that the dowels are secure in the front cover.

Ensure that the pump slide moves freely in the front cover and that the relief valve and regulator valve are free in their respective bores.

Examine the relief valve spring and the priming springs for damage and general condition; slight polishing of the coil outer diameter is permissible.

Check that the pump vanes are free in their slots.

Insert the oil rings into position in the torus cover neck, then check that the gap is within the limits given in the 'Summary of Repair Data.'

Inspect the drive-shaft bush in the pump body for heavy uneven wear, scores, flaking and security; slight wear of the bush is normal and can be disregarded. If wear or damage is excessive, the complete pump should be renewed as it is not advisable to fit a new body to an old cover.

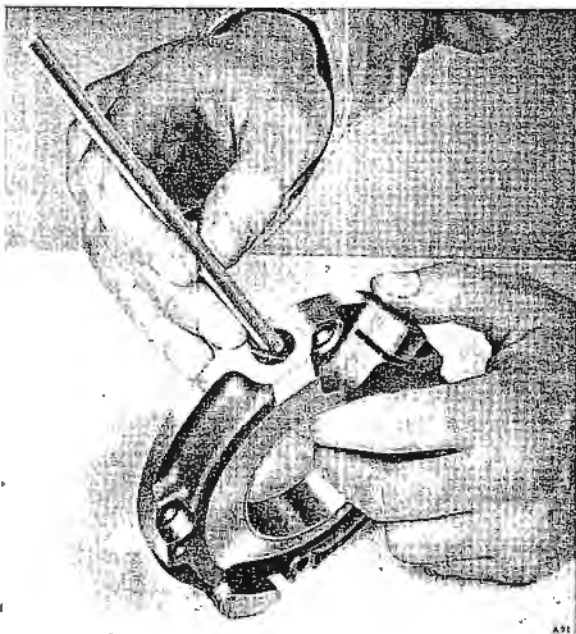


Fig. 83 Fitting intake pipe sealing ring

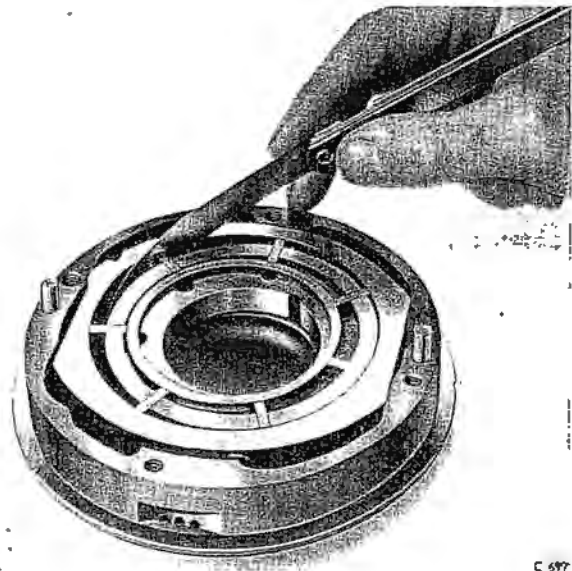


Fig. 84 Checking vane clearance

Check the key in the drive-shaft and the keyway in the pump rotor for burrs and wear.

Examine the drive-shaft splines for wear, the gear teeth for damage and the journal surface for scoring.

Check the two bushes in the shaft for security, scoring, flaking and uneven wear.

Examine the steel backing washer and bronze thrust washer for ridges or heavy scoring.

Front pump — To assemble

When all parts have been carefully inspected, cleaned and dried, lubricate all the moving parts with clean gearbox oil and rebuild the pump in the following order.

Fit a new intake pipe oil seal ring into the bore of the pump body as shown in Figure 83. Check that the ring is fitted correctly by entering and withdrawing the intake pipe, after ensuring that the end of the pipe has no sharp edges and is lightly smeared with gearbox oil.

Refit the relief valve with its spring guide and retaining pin.

Fit the pump slide, together with its two concentric priming springs, into the front cover; if a single spring was fitted originally, this should be discarded and a replacement pair fitted. Ensure that the outer spring is correctly located in the recesses of the pump cover and the slide, then check that the slide will move through its full stroke and return under spring pressure.

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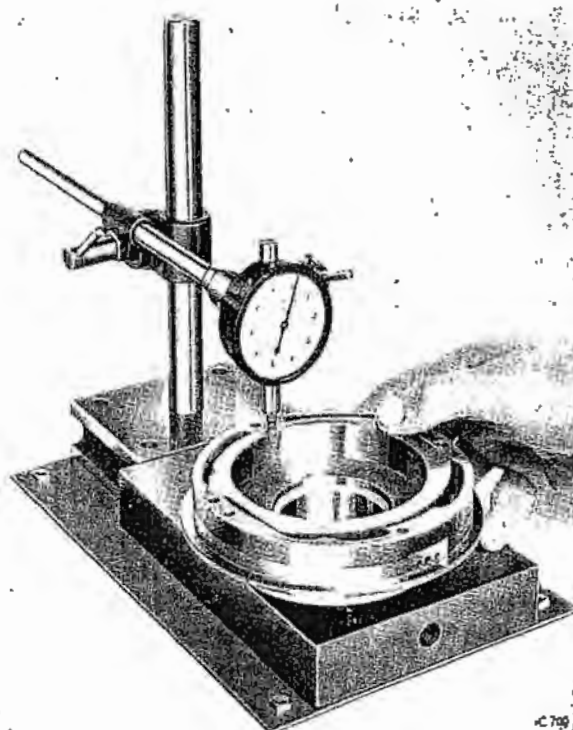


Fig. 85 Checking slide end clearance

Fit one of the vane rings and then the rotor with its marked face upward.

Fit the seven vanes and position them according to the wear pattern on the radiused ends; the edge polished along its length should contact the inner bore of the slide, the inside edge being polished only where contact is made with the vane rings.

Fit the second vane ring and ensure that the vanes are positioned correctly between the vane ring and the pump slide. Rotate the rotor several times to ensure freedom of movement.

If any of the vanes appear excessively loose, their diametrical clearance should be checked in the manner illustrated in Figure 84, to ascertain if it is within the limits given in the 'Summary of Repair Data.'

Check the end clearance between the slide and the pump body, using a dial test indicator as shown in Figure 85. The initial reading should be taken from the joint face, then the assembly moved so that the stem of the indicator runs on to the slide.

The difference in the two readings should coincide with the limits given in the 'Summary of Repair Data.' Check the end clearance of the rotor in the manner described in the previous paragraph.

Fit the pump body over the dowel pins in the front cover. Fit the four setscrews and washers, then, using the special tool shown in Figure 79, tighten the screws to the correct torque loading. Turn the rotor several times to check for freedom of movement, then by pushing against the internal bore of the rotor, ensure that the slide is free and the priming springs return it to the maximum delivery position.

Refit the oil seal rings into their grooves in the front cover. Fit a new lip-type seal if necessary.

Pour a little clean gearbox oil into the pump intake bore and turn the rotor several times to ensure thorough internal lubrication.

Front pump — To fit

Fit the bronze thrust washer over the intermediate shaft so that it is in position against the shoulder of the front planet carrier. After a liberal application of clean gearbox oil, slide the front drive gear over the intermediate shaft into the main casing, turning it slightly to mesh with the planet gears. During this operation care must be exercised to avoid damage to the bushes by the intermediate shaft splines.

Fit the bronze thrust washer and the steel backing washer over the intermediate shaft, then fit the snap ring using the special pliers.

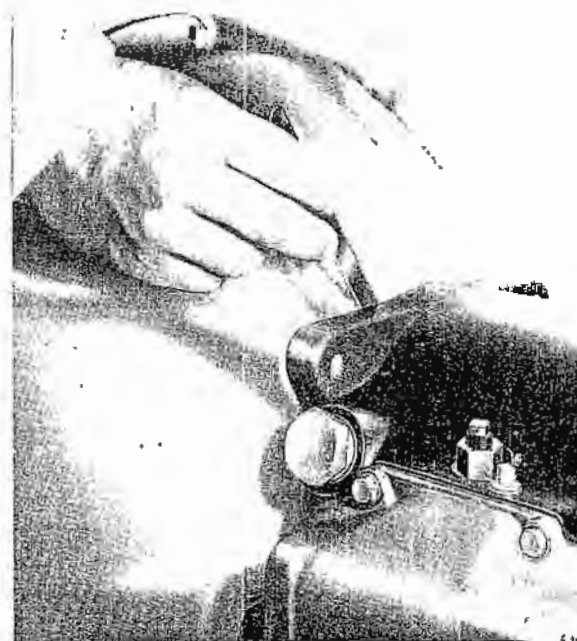


Fig. 86 Checking pump flange projection

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Fit a new gasket under the pump cover flange.

Before fitting the pump, lubricate the drive-shaft bush in the pump body with a liberal amount of clean gearbox oil. Align the drive-shaft key with the keyway in the pump and slide the pump body into position; the key should enter the keyway smoothly and easily.

Align the pump flange with the dowel washer location in the gearbox front face and insert the dowel washer. Fit the two retaining setscrews and tighten to the correct torque loading.

If a replacement pump has been fitted, the following check should be made to ensure the correct nip of the pump flange by the flywheel housing.

Check that the projection of the pump flange from the front face of the gearbox is within the limits given in the 'Summary of Repair Data'. This can be done with a straight edge and feeler gauges, or alternatively by refitting the bell housing, lightly tightening the retaining setscrews and measuring the gap between the housing and the gearbox face in the manner illustrated in Figure 86. If the clearance is incorrect, renew the gasket.

Fit the remaining assemblies in the following order.

Pressure control valve (see Section 8).

Front and rear servo units (see Section 6).

Side cover, sump and filter (see Section 3).

Fluid coupling (see Section 2).

Finally re-install the gearbox in the car as described in Section 1.

Oil pressure—To check

Fit an oil pressure gauge as described under 'Oil pressure test' in Chapter 2, then run the engine at idling speed and check the oil pressure. Select Reverse and again note the pressure. If the pump is working satisfactorily the pressure should not be less than 75 lb/sq.in.

Reverse pressure should not be less than that obtained in Neutral and is usually approximately 150 lb/sq.in. Finally, carry out a normal road test to ensure that all the components are functioning correctly. Details of change points and testing procedure are given in Chapter 2.

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SECTION 10—RIDE CONTROL UNIT

To remove the ride control unit it is unnecessary to remove the gearbox from the car or to drain the oil.

There are two types of ride control unit, both fitted to the gearbox in a similar manner, but they are not interchangeable due to the differences in internal design and the fitting of the drive-shaft key. When it becomes necessary to renew a part or a complete unit, reference should be made to the Spares Schedule for details concerning type, model and permissible interchangeability.

Ride control unit — To remove

Disconnect and remove the ride control operating lever complete with its bracket.

Disconnect the flexible outlet pipe and remove the two nuts and spring washers securing the suction pipe flange. If the gearbox is being dismantled for overhaul the suction pipe should be completely removed. On early gearboxes this pipe will have already been disconnected when removing the sump, but on later models the pipe must be disconnected at the two bolt flange where it passes through the side of the gearbox casing.

Remove the four setscrews securing the pump to the gearbox and withdraw the pump, disconnecting the suction pipe if not already removed. Care should be taken not to drop the drive key or pump gears during this operation.

Unscrew the two remaining setscrews retaining the intermediate plate; the plate will be forced out by the pressure of the three dished spring washers which preload the drive-shaft bearings. Remove the plate, distance piece and washers.

Ride control unit — To dismantle

Remove the ride control valve plunger assembly by unscrewing the retaining guide (see Fig. 87). Unscrew and remove the outlet adaptor from the opposite end; the ball valve and spring can then be removed from either end. It is unnecessary to dismantle the control valve plunger assembly further (see Fig. 88), unless damage and wear necessitates renewal; in such cases the retaining collar must be removed and a new one fitted during re-assembly.

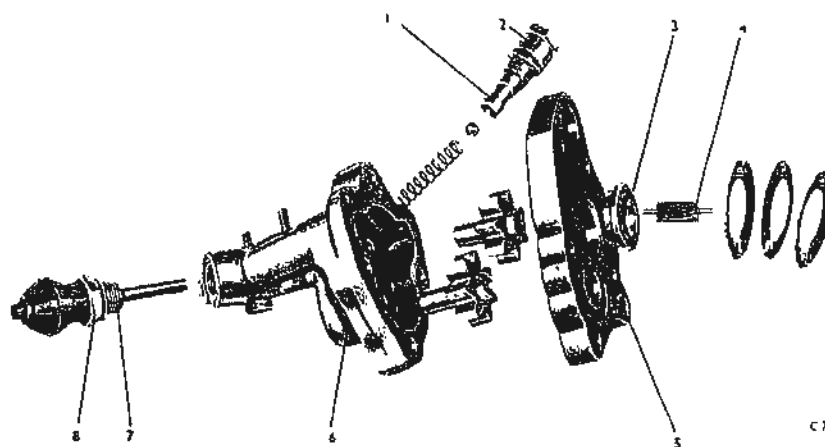


Fig. 87 Ride control unit—exploded

- | | | | |
|--------------------------|------------------|----------------------|--------------------------|
| 1 CONTROL VALVE ASSEMBLY | 3 DISTANCE PIECE | 5 INTERMEDIATE PLATE | 7 CONTROL VALVE ASSEMBLY |
| 2 OUTLET ADAPTOR | 4 DRIVING KEY | 6 PUMP CASING | 8 RETAINING GUIDE |

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Ride control unit — To inspect

Thoroughly clean all parts and remove all traces of jointing compound, using a suitable solvent.

Check all joint faces for burrs and damage marks. If the damage is slight, remove by light scraping, if excessive, renew the unit.

Examine the gear pockets for scoring and picking up. If severe, renew the pump body.

Check the gear teeth for damage and the gear shafts and driving dogs for wear. Renew any part which is badly worn or damaged.

Examine all alloy parts for cracks, especially in the vicinity of bolt holes and drillings.

Examine the drive key for wear and damage.

Inspect the control valve ball and seating for pitting and grooving.



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Fig. 88 Control valve plunger assembly—exploded

Check the bore size of the pump intake passage (see Fig. 89); if it is 0.250 in. it should be enlarged to 0.3437 in. as described in the following paragraph. The enlarging of this passage assists in preventing air locks.

Open out the bore with a 0.3125 in. drill, then drill to finish size with a 0.3437 in. drill. To enable the drill to enter the hole centrally it may be necessary to relieve the shoulder on the pump flange using a round file. Care must be taken to ensure that the drill does not penetrate too far beyond the end of the drilling, otherwise damage to the threads of the control valve nut may result. Clean off any swarf and blow out with compressed air.

Ride control unit — To assemble

Re-assemble the pump control valve, fitting the outlet adaptor first; followed by the ball, spring and plunger assembly from the opposite end in this order. New joint washers should be fitted under both the plunger retaining guide and the outlet adaptor.

Ride control unit — To fit

The following sequence of operations is necessary to ensure correct engagement of the driving key.

- 1 Temporarily refit the intermediate plate with the distance piece and dished spring washers as shown in Figure 90. Fully tighten both the securing setscrews.
- 2 Rotate the drive-shaft until the slot from the key is horizontal.
- 3 Insert the driving key, then press it fully home and measure the clearance between the end of the driving blade and the outer surface of the intermediate plate as shown in Figure 91.

This measurement should be between 0.020 in. and 0.040 in. If outside these limits, the outer face of the intermediate plate should be faced off accordingly or the plate renewed by one of suitable thickness (see Spares Schedule).

After the correct clearance is obtained remove the intermediate plate and lightly smear the gearbox joint face with jointing compound.

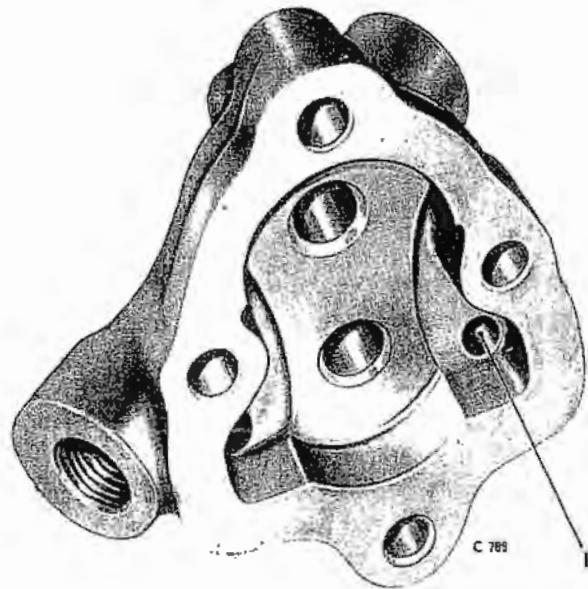


Fig. 89 Pump casing

1 INTAKE PASSAGE

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Refit the dished spring washers, using petroleum jelly to hold them in position. Fit the intermediate plate, together with the distance piece, then finger tighten the retaining setscrews. Care should be taken to ensure that the dished washers do not slip out of position and become trapped between the gearbox casing and the intermediate plate.

Lubricate the pump gears with clean gearbox fluid and refit them to the pump body, turning them so that the driving slot will mate with the key during assembly.

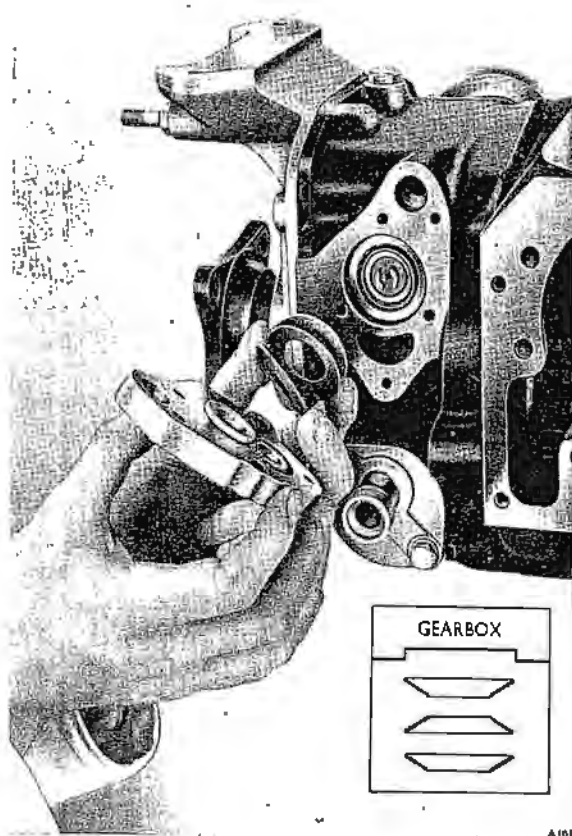


Fig. 90 Refitting intermediate plate

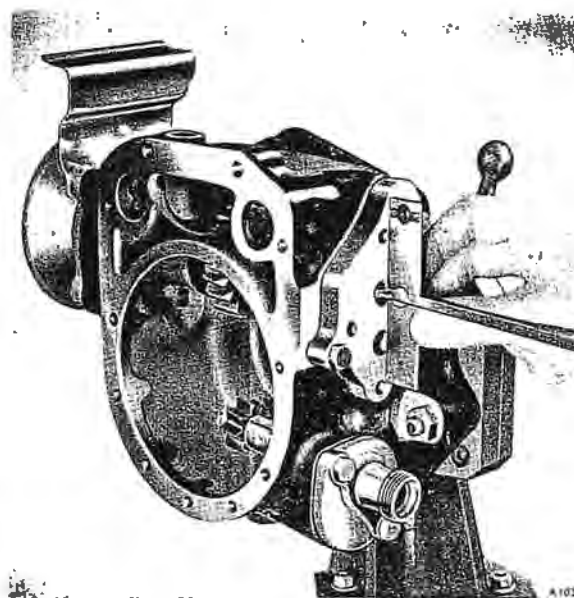


Fig. 91 Checking driving key clearance

Lightly smear the pump body joint face with jointing compound, then offer it into position, engaging the driving key and fitting the securing setscrews to finger tightness. Before finally tightening the setscrews, push the pump body toward the front of the gearbox as far as the clearance of the setscrew holes will permit. This method of positioning the pump is most important as it ensures a correct face seal between the gears and the intermediate plate.

Refit the sump-to-ride control pump oil pipe, and when in position check that the inlet end of the pipe projects one inch from the sump joint face. Reposition if necessary by bending the pipe.

Refit the ride control operating lever and bracket, also the flexible outlet pipe, ensuring that the latter is kept well clear of the exhaust pipe.

Finally, prime the pump as described in Chapter 2.

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SECTION 11 — SPEEDOMETER DRIVE

The speedometer drive (see Fig. 92) is secured to the gearbox rear extension by two setscrews; its removal is straightforward and no other gearbox units need be disturbed.

Several different types of speedometer drives are in use; when ordering spares, consult the Spares Schedule in order to obtain the correct item for a particular model.

The overhaul procedure for speedometer drives is quite simple and the same procedure can be followed for all models.

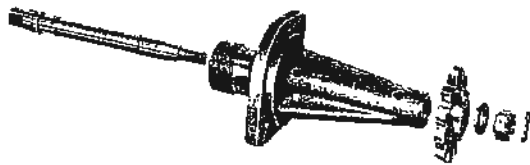


Fig. 92 Speedometer drive—exploded

Speedometer drive — To remove

Disconnect the speedometer cable by unscrewing the knurled nut at the gearbox end and withdraw the cable. If the speedometer drive is to be removed for a considerable length of time, mask the open end of the drive cable to exclude dust. Remove the two retaining setscrews and washers and withdraw the speedometer drive.

Speedometer drive — To dismantle

Before dismantling the unit, spin the shaft and check for any run out of the gear; if eccentric renew the shaft. Remove the split pin, castellated nut and washer, then drive out the shaft from its housing and off the gear, by giving it a sharp blow with a soft-headed mallet.

Speedometer drive — To inspect

Clean off the jointing compound from both joint faces and wash the dismantled parts with a suitable cleaning fluid. Examine the gear teeth for knocks and signs of excessive wear. Examine the squared end of the shaft for cracks and the threads on the housing for damage.

Speedometer drive — To assemble

Reverse the procedure for dismantling noting the following. Do not over-tighten the castellated nut before fitting a split pin. After assembly check that the shaft end float is within the limits given in the 'Summary of Repair Data'.

Speedometer drive — To fit

Smear jointing compound on the joint faces and refit the unit to the rear extension. Fit the setscrews and washers and connect the cable.

On some models the axis of the drive-shaft is eccentric to the flange and the speedometer drive should be fitted so that the offset boss is adjacent to the head of the parking brake pawl support screw.

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SECTION 12—ROAD WHEEL BRAKE SERVO DRIVE

It is unlikely that removal of the servo drive-shaft will be necessary, except during complete overhaul. It can be removed without disturbing the gearbox, after first removing the brake servo motor (see Section 1) and, the ride control unit, if fitted (see Section 10).

Servo drive — To remove

On cars not fitted with a ride control unit, remove the three setscrews and washers securing the servo drive blanking plate, then remove the blanking plate and the three spring washers.

The small tapered bearing outer race will remain in the extension casing.

On all cars, remove the four setscrews and washers securing the servo drive end cover and withdraw the cover; remove the large washer, if fitted, from the cover. The large tapered bearing outer race may remain in the casing, but this can be removed at the same time as the drive unit.

Using a soft punch, tap the small end of the shaft until the large bearing outer race is removed from the casing; the drive-shaft can then be removed. The small bearing outer race should be a push fit in its bore and may then be easily removed.



Fig. 93 Servo drive—exploded

Servo drive — To dismantle

Before dismantling the servo drive, examine the assembly as described under 'Servo drive — To inspect'; it is not advisable to remove any of the parts, except when they require renewing due to wear or damage.

Using a press or a suitable bearing extractor, withdraw the small tapered bearing; care must be taken to protect the ride pump driving lugs at the end of the shaft as they may easily become damaged.

Remove the circlip and slide off the washer, servo drive gear and distance sleeve (see Fig. 93).

Finally, press the large tapered bearing inner race off the shaft.

Servo drive — To inspect

After washing all the parts in a suitable cleaning fluid, examine the bronze gear teeth for signs of excessive wear or damage; wear will be shown by the teeth becoming ridged, thin and sharp.

Check the inner races of the tapered bearings for security on the shaft, the rollers for damage and the cages for cracks. Check the condition of the outer races and their respective housings for signs of excessive creep; also check the three dished spring washers for distortion or cracks.

Check the three driving pins, in the end of the shaft, for wear and security.

Check the condition of the oil seal in the end cover; if it needs renewing, tap out the seal with a hammer and soft drift, supporting the cover to avoid damaging the joint face.

If fitted, check the oil drain pipe for security in the end cover.

Servo drive — To assemble

Slide the large tapered bearing on to the shaft as far as it will go, then using a sleeve which will pass over the shaft and bear up against the inner race, press the bearing along the shaft until it is approximately 0.062 in. from the shoulder. Do not press the bearing any further otherwise it may bind on the shoulder bottom radius and make final positioning difficult.

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In the following order fit the sleeve, gear (plain portion towards the sleeve) abutment washer and circlip.

Position the small bearing onto the end of the shaft and mount the assembly on a press in the manner illustrated in Figure 94. Support the assembly by the outer race of the large bearing, then using a suitable sleeve, press against the inner race of the small bearing, until it abuts against its locating shoulder. Continue the pressure until the larger bearing has moved firmly up against the distance sleeve, securing the gear and abutment washer hard against the circlip.

Check that the sleeve cannot be turned by hand before removing the assembly from the press.

When fitting a new end cover oil seal, ensure that the seal lip faces toward the gearbox and that the seal is pressed fully home into its bore.

Servo drive — To fit

Before installing the drive-shaft assembly into the gearbox, lubricate the two bearings and drive gear with clean gearbox oil.

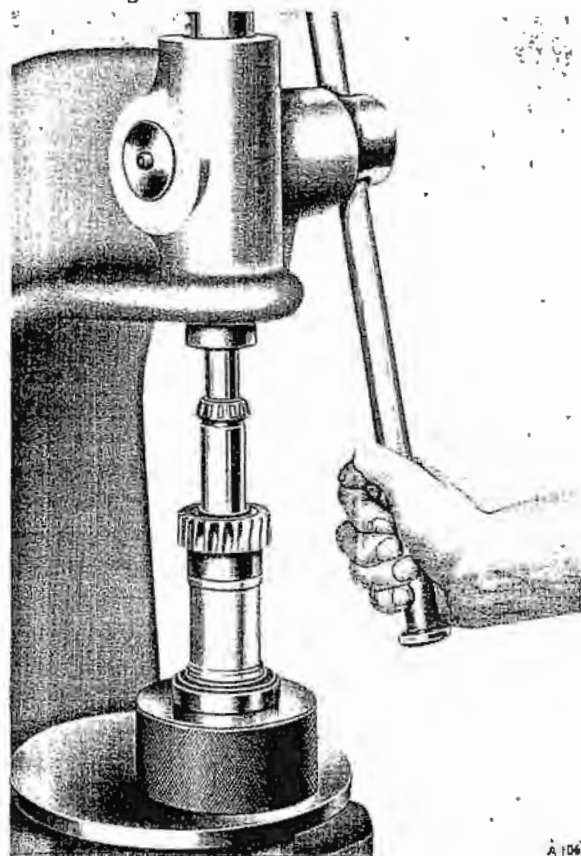


Fig. 94 Pressing bearing into position

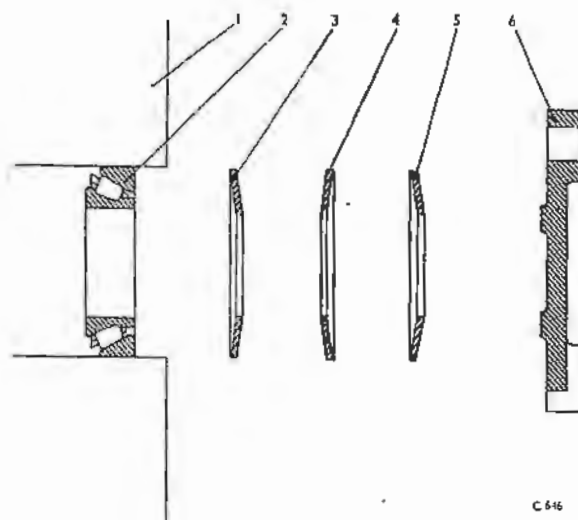


Fig. 95 Correct fitting of spring washers

- | | |
|-----------------------|------------------------|
| 1 GEARBOX CASING | 4 CENTRE DISHED WASHER |
| 2 SMALL TAPER BEARING | 5 OUTER DISHED WASHER |
| 3 INNER DISHED WASHER | 6 BLANKING PLATE |

Fit the small bearing outer race into its housing, leaving sufficient room for the three dished spring washers, which on 'S' series cars without the ride control unit, should then be fitted in the order shown in Figure 95. Coat the blanking plate with jointing compound and fit the plate; secure with the three setscrews and washers and tighten evenly.

Slide the shaft into the gearbox, carefully meshing the gear teeth, then fit the large bearing outer race into its housing.

Coat the joint face of the end cover with jointing compound, fit the large washer in the cover, then with the drain pipe to the bottom of the gearbox, fit it over the outer race by tapping it evenly with a soft-headed mallet. On cars not fitted with a ride control unit, the large washer and the oil drain pipe are not fitted.

Finally, evenly tighten the four setscrews and washers and check for freedom of rotation by turning the output shaft. It is emphasized that the four setscrews must be tightened evenly otherwise damage may occur as a result of the large bearing outer race cross binding in its bore.

Refit the brake servo motor as described in Section 1 and if fitted, the ride control unit as described in Section 10.

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SECTION 13 — REVERSE ASSEMBLY

The reverse assembly consists of the reverse epicyclic gears, rear extension casing and output shaft, also, for assembling and dismantling purposes, the mainshaft. Two different types of reverse assembly are fitted, the 'R' series cars and the 'S' series cars.

Differences between the two reverse assemblies are shown pictorially and are explained in the following paragraphs.

The '1952' and '1953' models are similar in appearance and in the sequence of assembling and dismantling.

The 'S' series assembly differs from the 'R' series in the shape of the extension casing, gearbox-to-chassis mounting bracket and propeller shaft coupling flange; also it is not fitted with a ride control oil pump.

The gearbox-to-chassis mounting bracket is deleted on 'S2' and 'S3' series cars.

The different models of rear extension are not interchangeable.

To remove the reverse assembly, remove the gearbox from the chassis, as described in Section 1, then remove the following units.

- Fluid coupling (see Section 2).
- Side cover, sunip and filter (see Section 3).
- Control valve unit (see Section 4).
- Parking brake bracket (see Section 5).
- Front and rear servo units (see Section 6).
- Rear pump and governor (see Section 7).
- Ride control unit, if fitted (see Section 10).
- Speedometer drive (see Section 11).
- Road wheel brake servo drive (see Section 12).

'S' series rear extension — To remove

During removal of the reverse assembly from the gearbox, also during subsequent dismantling, all thrust and adjusting washers should be labelled for easy identification when re-assembling.

After removal of the units previously mentioned, check the end float of the mainshaft as follows.

Remove the spring ring from the mainshaft, screw on the end float checking sleeve to its fullest extent, then mount a dial test indicator as shown in Figure 96.

Fit the wedge tool in position between the forward end of the oil delivery sleeve cap and the front drum and tap it lightly to take up the drum assembly end float.

Push the mainshaft rearward and set the indicator dial at zero.

Pull the shaft forward and note the reading.

Repeat this operation to ensure that a correct reading is obtained. If this is within the limits stated in the 'Summary of Repair Data', the existing adjusting washer can be retained provided that it is otherwise serviceable.

If the end float is incorrect, measure the thickness of the adjusting washer and select a new one to give the correct end float.

Fit a holding tool to the output flange as shown in Figure 97. Unlock and remove the output shaft nut, tab washer, abutment washer and end nip adjusting washer; withdraw the output flange.

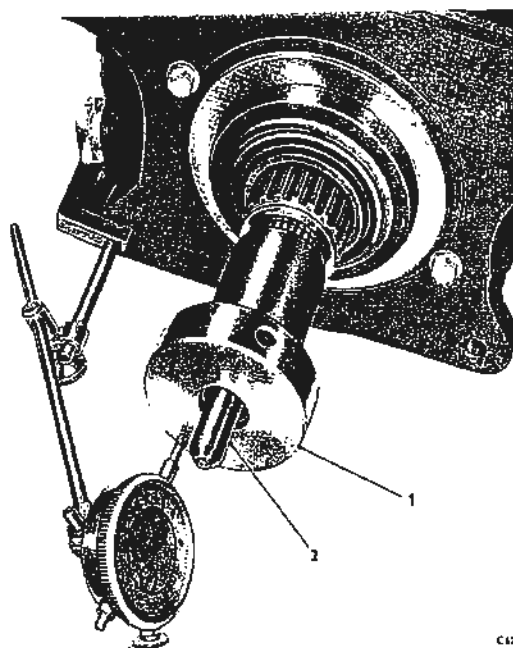


Fig. 96 Checking mainshaft end float

- 1 CENTRALISING SLEEVE
- 2 MAINSHAFT

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Hold the rear drum by applying the rear band with a suitable lever, then remove the six setscrews and washers which secure the driving flange to the rear drum.

Remove the blanking plug from the rear face of the extension casing to gain access to one of the securing setscrews. Remove the five setscrews and washers securing the extension (the parking pawl screw having already been removed).

Withdraw the reverse assembly from the gearbox casing, taking care to retain the stationary cone key, then remove the mainshaft and washers (see Fig. 98). If the reverse assembly sticks in the gearbox casing, tap the mainshaft with a soft-headed mallet to initiate movement.

Remove and discard the gasket.

Fit the rear clutch hub retainer.

'R' series rear extension — To remove

Check the mainshaft end float, remove the output flange, then remove the driving flange setscrews as already described for 'S' series cars.

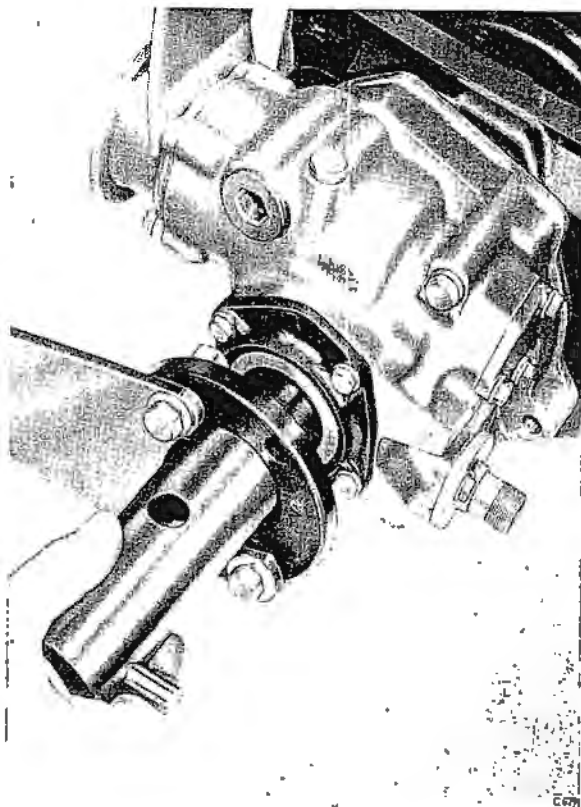


Fig. 97 Removing output flange securing nut



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Fig. 98 Mainshaft and washers

- | | |
|---------------------------------|-----------------|
| 1 END FLOAT ADJUSTING
WASHER | 3 THRUST WASHER |
| 2 SNAP RING | 4 OIL PASSAGES |

Remove the two long studs and the setscrews which secure the end cover to the rear extension casing.

If the torque reaction bracket has not been removed, this also should be removed. Using a soft-headed mallet, tap the end cover rearward from its spigot location in the extension casing; discard the joint.

If the rear oil seal is to be renewed, press it from its bore in the end cover.

Remove the five setscrews securing the extension casing to the gearbox; two of these will be found inside the extension casing. The parking pawl locating screw will have been removed earlier.

Withdraw the reverse assembly from the gearbox casing; retain the stationary cone locating key.

If the assembly sticks in the gearbox casing, a few sharp blows with a soft-headed mallet on the front end of the mainshaft will be sufficient to start the assembly moving.

Discard the joint between the extension casing and the gearbox casing.

Withdraw the mainshaft, also the thrust washers, located one each side of the mainshaft sun gear.

Fit the rear clutch hub retainer.

Rear extension — To dismantle

The sequence of dismantling the rear extension is basically the same for all models. Any differences will be pointed out in the following paragraphs. For 'S' series cars reference should be made to Figure 99 and for the earlier models to Figure 101.

Remove the setscrews securing the end cover and remove the cover ('S' series cars). To remove the output shaft, set up the extension casing flange on blocks, rear end uppermost, to give at least 4-500 in. clearance between the output shaft planet carrier and the bench.

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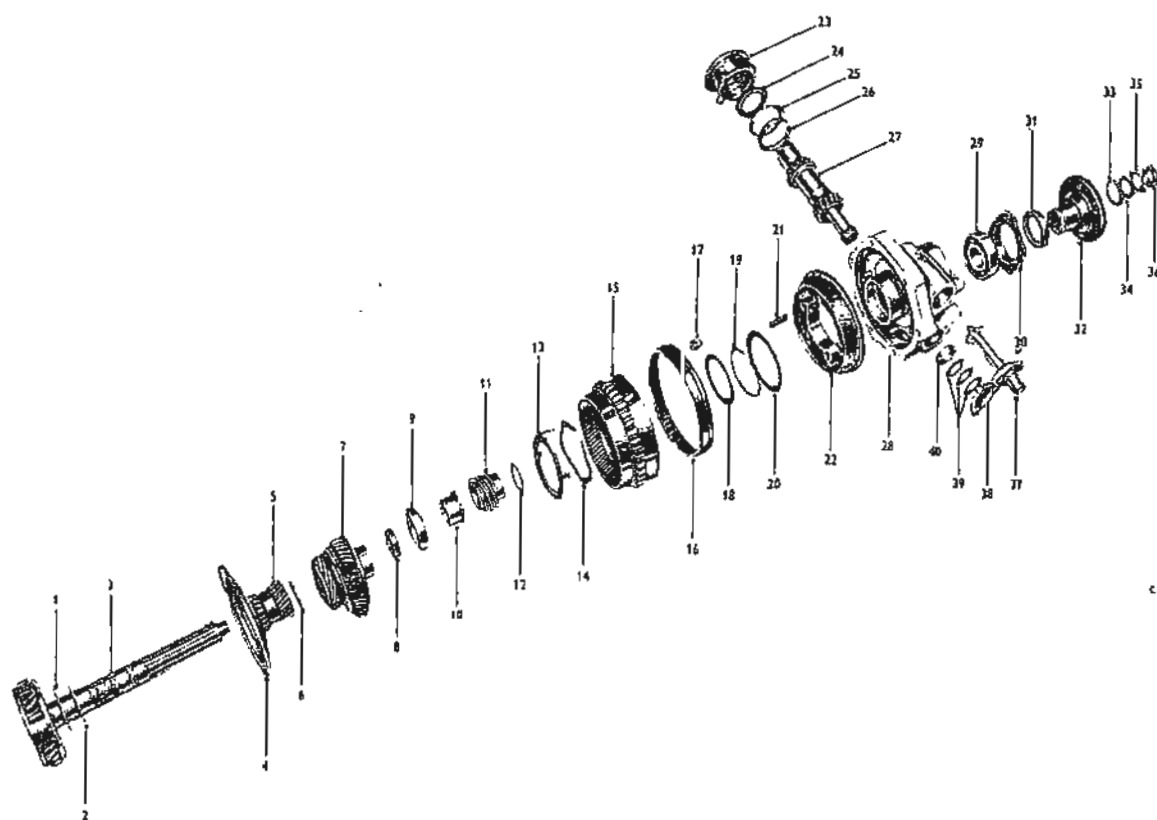


Fig. 99 Output shaft and reverse assembly — exploded

- | | | | |
|--------------------------|-------------------------|--------------------------|-----------------------------|
| 1 THRUST WASHER | 11 SERVO DRIVE GEAR | 21 CLUTCH RETURN SPRING | 31 OIL SEAL |
| 2 BACKING WASHER | 12 LOCATING WASHER | 22 REVERSE CLUTCH PISTON | 32 COUPLING FLANGE |
| 3 OUTPUT SHAFT | 13 RETAINER | 23 SERVO DRIVE END COVER | 33 NIP WASHER |
| 4 DRIVING FLANGE | 14 CUSHIONING RING | 24 OIL SEAL | 34 ABUTMENT WASHER |
| 5 REVERSE SUN GEAR | 15 REVERSE ANNULUS GEAR | 25 WASHER | 35 LOCK-WASHER |
| 6 SNAP RING | 16 STATIONARY CONE | 26 BEARING OUTER RACE | 36 NUT |
| 7 REVERSE PLANET CARRIER | 17 LOCATING KEY | 27 SERVO DRIVE | 37 SPEEDOMETER DRIVE |
| 8 SPACER | 18 THRUST WASHER | 28 EXTENSION CASING | 38 BLANKING PLATE |
| 9 FRONT BEARING | 19 SNAP RING | 29 REAR BEARING | 39 DISHED WASHERS |
| 10 DISTANCE SLEEVE | 20 RETAINER | 30 END COVER | 40 SMALL BEARING OUTER RACE |

Protect the output shaft threads then, using a press or a hammer and drift, drive the output shaft downward until the rear bearing becomes free on the shaft. Withdraw the rear extension casing and bearing, locating washer ('S' series cars only) and servo drive gear. On 'R' series cars drive the output shaft through the remainder of the assembly, and withdraw the distance sleeve from the casing.

On 'S' series cars fit a claw extractor and withdraw the front bearing and distance sleeve from the shaft.

Remove the thrust washer from the reverse annulus gear. Remove the annulus gear, distance piece and the reverse planet carrier from the output shaft, taking

care not to damage the soft metal bush in the annulus gear. Remove the snap ring from the output shaft and lift off the reverse sun gear and driving flange, thrust washer and backing washer.

With the annulus gear on the bench, outer stationary cone uppermost, expand and remove the stationary cone using snap ring pliers as shown in Figure 100. Avoid over expanding the cone as this may result in distortion. Turn over the annulus gear and remove the retainer and cushioning ring by slightly turning the retainer and withdrawing the lugs from their holes; early retainers have two lugs instead of four as on the later models.

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Fig. 100 Removing the outer clutch cone

Fit the clutch spring compressing tool to the extension as shown in Figure 102, ensuring that the gap in the spring ring is situated between two of the tool legs to facilitate removal.

Centralise the tool in the extension housing; on earlier rear extensions the tool is self-aligning. Screw down the tool nut until the clutch spring retaining washer is clear of the spring ring; remove the ring from the groove. Remove the tool and withdraw the retaining plate and six clutch springs.

Withdraw the inner cone clutch from the extension casing.

If difficulty is experienced in removing the clutch cone, place a hand over the extension casing to retain the piston, then apply air pressure of approximately 70 lb/sq.in. intermittently to the clutch apply duct as shown in Figure 103. This will lift the cone sufficiently to allow withdrawal from the casing; do not attempt to rotate the cone as it is located by dowels. Remove the clutch piston sealing rings.

On 'R' series cars remove the snap ring from the groove in the front bearing housing and tap out the bearing.

Rear extension — To inspect

Before inspection, all parts must be cleaned thoroughly using a suitable cleaning fluid, a brush and compressed air.

Examine the following for residual sludge. Gear teeth, external and internal splines, bores and sealing ring grooves and the mainshaft bearing housing at the front end of the output shaft.

The clutch apply duct in the extension casing and the oil passages at the rear end of the mainshaft must be blown through to ensure that they are free from obstruction.

Screw threads

Examine all screw threads, particularly any which were tight on removal; if necessary clean the threads.

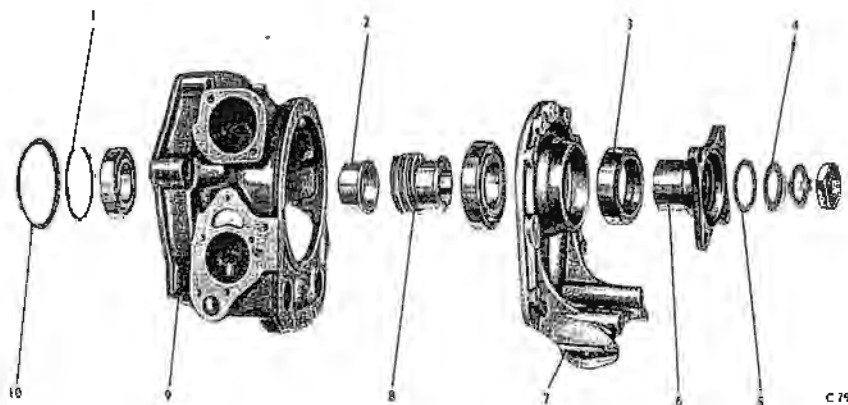


Fig. 101 Reverse assembly casing 1952/53 models

- | | | | | |
|-------------------|-------------------|-------------------|--------------------|------------------------------|
| 1 SNAP RING | 3 OIL SEAL | 5 NIP WASHER | 7 END COVER | 9 EXTENSION CASING |
| 2 DISTANCE SLEEVE | 4 ABUTMENT WASHER | 6 COUPLING FLANGE | 8 SERVO DRIVE GEAR | 10 REVERSE PISTON INNER SEAL |

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Gears

Examine all gear teeth for damage and wear. Examine the end thrust washers of the planet pinions for general condition.

Examine the planet pinion carriers around the pin bores for radial cracking, particularly across the narrowest sections, also check the pins for tightness in the bores; the pins are a press fit initially and should remain tight.

If any part of a planet pinion assembly is found to be unserviceable the complete assembly concerned must be renewed.

If any part of the reverse planet carrier is unserviceable, the complete assembly, including the rear pump driving gear, must be renewed; the pump driving gear is retained by a ball and snap ring and any attempt to remove it will render it unserviceable. The rear pump must be renewed complete with the reverse planet carrier; a worn gear must not be mated with a new gear in this instance.

The output shaft planet gear assembly, reverse sun gear and the reverse planet gear assembly may be changed independently of their mating gears.

Output shaft

Examine the bearing faces of the planet carrier, the shaft and the thrust and backing washers for scoring and for signs of uneven wear.

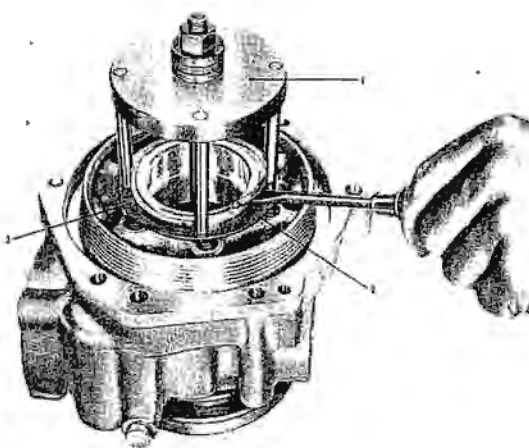


Fig. 102 Clutch spring compressing tool in position

1 COMPRESSING TOOL 2 SNAP RING 3 RETAINER

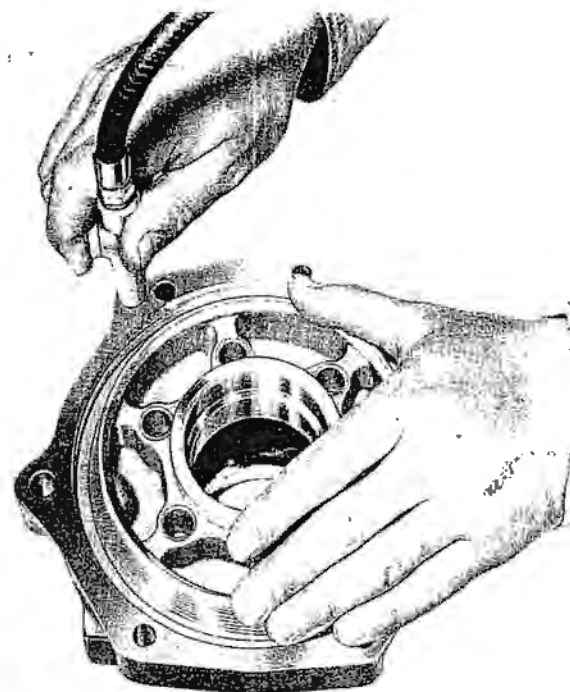


Fig. 103 Removing the inner clutch cone

Examine the mainshaft bronze bearing in the hollow end of the output shaft.

Check the splines for fretting and twisting which may indicate incipient failure.

If any part of the output shaft is found to be unserviceable, it must be changed as an assembly. The thrust and backing washers can, of course, be renewed independently if any doubt exists as to their serviceability.

Reverse sun gear and driving flange assembly

Check the driving flange and the thrust washer retainer for distortion; the retainer should be tight on the splines.

Examine the bronze bearing in the bore of the sun gear for scoring and uneven wear.

Any unserviceability will necessitate renewing the complete assembly.

The thrust washer retainer under the driving flange should not be disturbed as this is a press fit and jig-assembled.

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Reverse planet carrier

Check that the rear pump driving gear is tight on the mounting and examine the gear for excessive wear.

Examine the bearing surfaces of the extension and the cushioning ring for scoring and uneven wear.

If any part of the reverse planet carrier is unserviceable the complete assembly and the rear pump must be renewed, as explained under 'Gears'.

Reverse clutch assembly

Examine the following parts for scoring, rough surfaces, signs of overheating and uneven contact. The mating faces of the outer stationary clutch cone, the reverse annulus gear and the inner stationary clutch cone.

Examine the thrust washer and the bearing surface in the reverse annulus gear for scoring and uneven wear; also examine the soft metal lining in the annulus gear bore for scoring, cracking and for bad adhesion to the shell.

Check the clutch spring retainer for damage or distortion and the springs for collapsed coils. Check that all the springs are of the same length.

Examine the outer stationary clutch cone for cracking in the vicinity of the keyway.

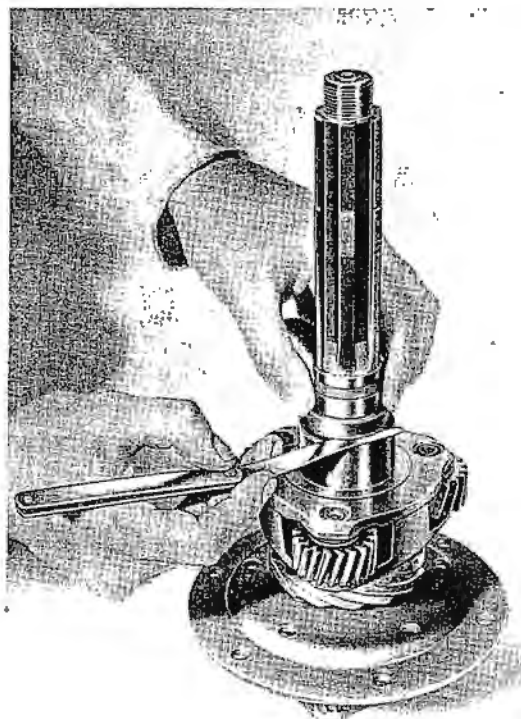
Examine the cushioning ring retainer for excessive wear on its bearing surface and for cracking at the bends of the lugs. Check that the cushioning ring has not lost its spring tension and become flattened during service.

Check the reverse clutch piston seals for loss of resilience and cracking. Any unserviceability of the reverse annulus gear, stationary clutch cone and the inner clutch cone will necessitate renewal of these parts as a complete assembly.

Two different reverse clutch assemblies are in service, one having an $1\frac{1}{2}^\circ$ cone angle and the other a $12\frac{1}{2}^\circ$ cone angle; these must be kept separate from each other. Other parts of the assembly can be renewed independently, but clutch springs should be renewed as a set.

Bearings and housing

Examine the front and rear ball bearings for wear and the outer races and their housings for signs of spinning; the outer race should be a light tap fit in the housing.



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Fig. 104 Checking reverse planet carrier end float

The bearings can be renewed independently of the shaft or extension casing providing that due regard is given to the condition of the housing and mountings.

Rear extension, worm gear and coupling

Examine the extension for cracks and other damage.

Examine the internal splines of the worm gear and coupling for signs of fretting or other damage; also examine the bore of the distance sleeve for burrs which might become detached during assembly.

Check the coupling bolt holes for elongation.

Check the oil seal rubbing diameter for signs of grooving or burrs.

Check the oil seal for loss of resilience and any damage to the sealing lip which would account for a leaking seal.

All items in this assembly may be renewed independently.

Rear extension — To assemble

Before assembling, all parts must be clean and should be lightly oiled with clean gearbox oil.

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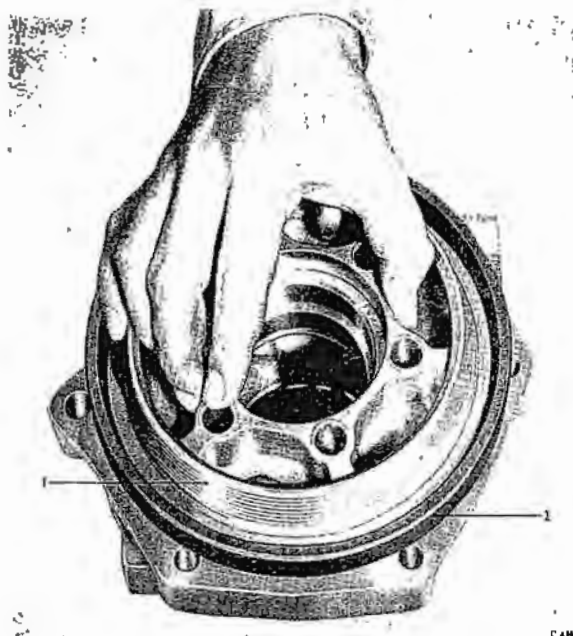


Fig. 105 Fitting inner clutch cone
1 CLUTCH CONE 2 GUIDE TOOL

New gaskets, oil seals and spring rings should be fitted where applicable; jointing compound must not be used except where stated.

Ensure that any new parts fitted are correct for the model concerned, particularly the reverse annulus gear thrust washer which is bronze for 'R' series cars and steel for 'S' series cars.

Stand the output shaft on end and assemble the thrust washer, backing washer and the driving flange and reverse sun gear, taking care not to damage the bronze bearing in the sun gear bore as it passes over the shaft splines.

Check that the washers are in the retainer on the underside of the driving flange, then fit the snap ring to the groove in the shaft. Rotate the sun gear assembly to ensure that it is free on the shaft. Fit the reverse planet carrier ensuring that the gears mesh correctly with the sun gear and check that it rotates freely.

Slide the distance piece in position on the shaft; on 'S' series cars, check the end float of the reverse planet carrier by holding the distance piece against the shoulder on the shaft and inserting a feeler blade between the distance piece and the planet carrier as shown in Figure 104. If the end float is not within the limits quoted in the 'Summary of Repair Data' the output shaft, or the reverse planet carrier, or both, must be renewed by selected parts.

Lightly smear the inner clutch cone outer seal with Mobilgrease M3 and expand the seal gently into its groove with the seal lip facing away from the conical end of the clutch cone. Grease the inner seal and fit it to the groove in the neck of the extension casing with the lip facing the bottom of the apply chamber. Ensure that both seals are fitted snugly into their grooves.

With the extension casing on the bench, apply chamber uppermost, fit the outer seal guide tool in position (see Fig. 105), ensuring that it is seated on the shoulder in the apply chamber. If a guide tool is not available, a narrow flexible strip of metal approximately 1.00 in. wide, of the correct length and free from burrs and jagged edges, should be inserted in the same manner as the tool.

Lower the inner cone squarely into the guide tool, seal first, then turn it to engage the four dowels. Push the cone into the chamber until it reaches the bottom, then remove the guide tool.

Do not try to force the piston into its chamber without the aid of a suitable guide, otherwise damage to the piston outer seal will almost certainly occur.

Fit the extension casing in position over the base of the clutch spring compressing tool and fit the six clutch springs into the sockets. Lay the clutch spring retainer plate and the spring ring in position on top of the springs and assemble the top portion of the tool ensuring that it is in a central position. Depress the retainer until the spring ring can be fitted into the groove. When the spring ring is in position, tap it into the groove to make sure it will not fly out when under pressure. Release the pressure and remove the tool.

Check the freedom of the piston in the apply chamber by applying an air pressure of approximately 70 lb/sq.in. to the clutch apply duct.

Hold the cone out by air pressure and check the seal for leakage indicated by the presence of grease bubbles. If leakage occurs fit a new seal.

Lubricate the outer stationary clutch cone and expand it into position on the reverse annulus gear, using snap ring pliers.

Care must be taken not to damage the inner face on the edge of the annulus gear during this operation. Do not over expand the cone owing to the risk of distortion and the subsequent loss of contact area.

Turn over the reverse annulus gear and fit the cushioning ring and retainer; if it has four lugs, rotate the retainer, to lock the lugs in their holes.

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Rear assembly — 'S' series — Final assembly

Final assembly of the 'S' series reverse assembly differs only slightly from the 'R' series assembly procedure.

The thickness of the servo drive gear locating washer must be assessed before fitting the output shaft as described later in this Section.

The reverse assembly can be assembled completely before being refitted to the gearbox if a bench fixture for holding the assembly is available. If a fixture is not available, assessment of the output shaft end nip washer and the final tightening and locking of the securing nut should be left until the assembly is bolted to the gearbox casing.

With the output shaft standing on its end, lower the reverse annulus gear over the shaft (cushioning ring retainer downward), until it meshes with the reverse planet carrier. Spin the reverse annulus several times to check for freedom of rotation.

Position the thrust washer in the reverse annulus gear and retain it with a smear of petroleum jelly.

Fit the front bearing into its housing in the extension casing, then lower the bearing and casing over the output shaft and press down the bearing until it abuts against the distance piece. During this operation the outer clutch cone must be guided into its spigot in the

extension casing, at the same time line up the keyway so that it is between the bottom two setscrew holes in the casing.

Fit the distance sleeve (flanged end uppermost) servo drive gear (worm gear end first), locating washer and rear bearing (see Fig. 106). The distance sleeve and inner race of the rear bearings are a tight fit on the shaft and should be pressed or driven into position.

Note If the distance piece, front bearing, distance sleeve or servo drive gear have been renewed, the length of the new part must be checked against the length of the discarded part and any difference allowed for in the locating washer, e.g. if a replacement gear was 0.005 in. shorter than the discarded one, the thickness of the locating washer must be increased by that amount.

The total length of spacer, bearing, sleeve, gear and adjusting washer should be 3.578 in. - 0.005 in.

A few early 'S' series gearboxes are fitted with a rear extension having a spacer, bearing, sleeve, gear and adjusting washer stack height of 3.607 in. - 0.005 in. To conform to current assembly figures, this height should be reduced to 3.578 in. - 0.005 in. by reducing the thickness of the spacing washer.

Fit the speedometer drive (see Section 11) and the servo drive (see Section 12) and check them for freedom of rotation.

If necessary, fit a new coupling oil seal in the end cover with the seal lip toward the bearing. Press in the seal squarely so that there will be no oil leak between the seal case and end cover.

Apply a thin coating of jointing compound to the face of the end cover and screw it to the extension casing.

Fit the output flange, applying a thin smear of oil where it passes through the seal. Check that the threads project approximately 0.500 in. above the base of the recess in the flange, indicating that the rear extension has been correctly assembled.

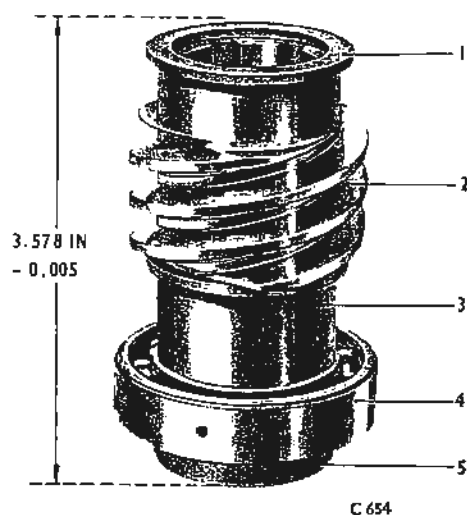


Fig. 106 Correct fitting of servo drive gear

- | | |
|--------------------|-------------------|
| 1 LOCATING WASHER | 3 DISTANCE SLEEVE |
| 2 SERVO DRIVE GEAR | 4 FRONT BEARING |
| | 5 DISTANCE PIECE |

Rear assembly — 'R' series — Final assembly

Stand the output shaft on the bench with the planet gears lowermost.

Fit the reverse annulus gear over the shaft (cushioning ring downward) until it meshes with the reverse

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planet carrier. Spin the reverse annulus several times to check for free rotation.

Position the thrust washer in the reverse annulus gear and retain it with petroleum jelly.

Fit the front bearing into its bore in the extension casing and retain it in position with the snap ring.

Lower the bearing and casing over the output shaft and press down the bearing until it abuts against the distance piece. During this operation, guide the outer clutch cone into its spigot in the extension casing, at the same time line up the keyway so that it lies between the bottom two setscrew holes in the casing.

Fit the distance sleeve (flanged end uppermost), servo drive gear (worm end first), finally the rear bearing (see Fig. 101).

The distance sleeve and bearing are a tight fit on the shaft and should be pressed or driven into position.

Fit the speedometer drive (see Section 11), and the servo drive (see Section 12) checking it for freedom of rotation.

The end cover and coupling flange cannot be fitted to this model until the reverse assembly is fitted to the gearbox.

Rear extension — To fit

Remove the clutch hub retaining plate, check that the clutch hub is engaged correctly in all the driving clutch plates as described in Section 14.

Fit a new gasket to the gearbox-to-rear extension face and retain it with petroleum jelly.

Fit the bronze adjusting washer to the recess in the front face of the output shaft and retain it with petroleum jelly.

Fit the mainshaft into the bearing in the output shaft. Ensure that the bronze thrust washer is in position in the rear clutch hub, then fit the mainshaft and rear extension to the gearbox casing. Check that the stationary outer cone key is aligned with the keyway in the gearbox casing. Fit the key then the parking pawl screw, to align the rear extension. Fit the remaining setscrews and tighten them to finger tightness.

Apply air pressure of approximately 70 lb/sq.in. to the reverse clutch apply hole in the gearbox casing (see Fig. 107). This will apply and centralise the reverse clutch assembly. With the air pressure still applied, tighten the setscrews evenly. Release the air pressure and torque tighten the setscrews to the correct loading; remove the parking pawl screw.

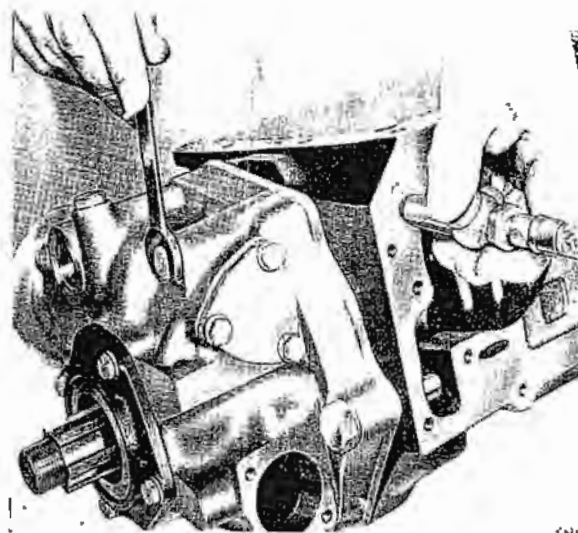


Fig. 107 Centralising reverse cone clutch

Align the driving flange holes and rear drum holes and fit the setscrews and washers; check the output shaft for freedom of rotation and the mainshaft for freedom of movement while the screws are being tightened progressively.

If the output shaft becomes stiff to turn, or locks, or the mainshaft cannot be moved, remove the rear extension and check that the rear clutch hub is home in the rear drum; also ensure that the mainshaft adjusting and thrust washers have not slipped from their respective recesses. If either of these washers have slipped and become trapped, it must be checked for damage or distortion and renewed if necessary.

If new clutch plates have been fitted to the front or rear drum a certain amount of stiffness may be encountered but it should still be possible to turn the output shaft by hand.

Check the end float of the mainshaft as described under 'Rear extension — To remove'. This is a routine assembly operation but may have to be carried out during investigations of stiffness as described in the previous paragraphs. Fit the mainshaft snap ring.

On 'S' series cars only, fit a new washer to the rear extension blanking plug; fit and tighten the plug.

On 'R' series cars, the extension casing end cover can then be fitted.

If necessary, fit a new coupling oil seal in the end cover with the seal lip toward the bearing; use a suitable dolly to ensure that the seal is fitted squarely.

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Fit a new joint between the extension casing and the end cover, then fit the end cover to the casing and secure it with the setscrews and studs.

Lubricate the seal with clean gearbox fluid.

Fit the coupling, assess the thickness of the end nip adjusting washer and fit the adjusting washer, clamping washer, tab washer and nut. Tighten the nut and lock by turning up the tabs.

Output shaft end nip — To adjust

The end nip of the output shaft is set to ensure that all components are locked in their relative positions on the shaft.

In addition to the standard parts, the following extra parts will be required for this operation.

A slave adjusting washer of known thickness between 0.040 in. and 0.060 in.

A packing washer approximately 0.100 in. thick and of the same bore as the adjusting washer.

After the coupling has been fitted, the slave washer and packing washer should be fitted into the recess in the coupling. Fit the clamping washer and nut, then tighten, until all end clearance has been taken up.

Remove the nut and packing washer and fit the clamping washer. Refit and tighten the nut.

Mount a dial test indicator to read off the coupling flange as shown in Figure 108. Push the coupling into the casing and set the indicator dial to zero. Pull the coupling out and note the reading. The thickness of the end nip adjusting washer is — Thickness of slave washer + d.t.i. reading + 0.004 in. to 0.010 in. (0.008 in. is used on initial build).

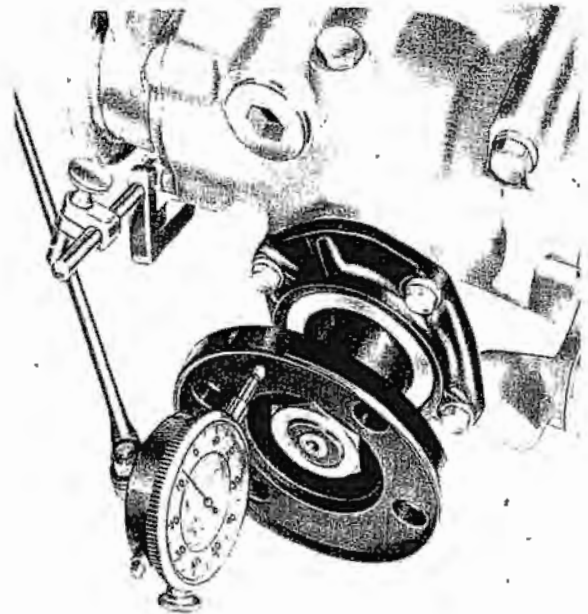


Fig. 108 Assessing thickness of end nip washer

Measure the thickness of the existing washer and if suitable and otherwise serviceable, refit it. If not suitable, select another to give the correct end nip.

Remove the nut, clamping washer and slave washer; fit the selected adjusting washer, clamping washer, tab washer and nut. Fit a holding tool to the coupling flange, tighten the nut and turn up the tabs. Remove the holding tool and refit the remaining units listed at the beginning of this Section.

The reverse unit can be tested for correct functioning, only by re-fitting the gearbox to the car and carrying out reverse and forward selection of gears as described in Chapter 2.

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SECTION 14 — DRUM ASSEMBLY

This Section covers the overhaul of the drum assembly which comprises the front and rear clutch units, the intermediate shaft, the oil delivery sleeve and the front and rear bands. Before this assembly can be removed, the gearbox must be removed from the car as described in Section 1 and the following units removed.

Fluid coupling (see Section 2).

Side cover, sump and filter (see Section 3).
Control valve unit (see Section 4).
Parking brake bracket and governor sleeve (see Section 5).
Servo units (see Section 6).
Rear pump and governor (see Section 7).
Pressure control valve (see Section 8).
Front pump and drive-shaft (see Section 9).
Reverse assembly (see Section 13).

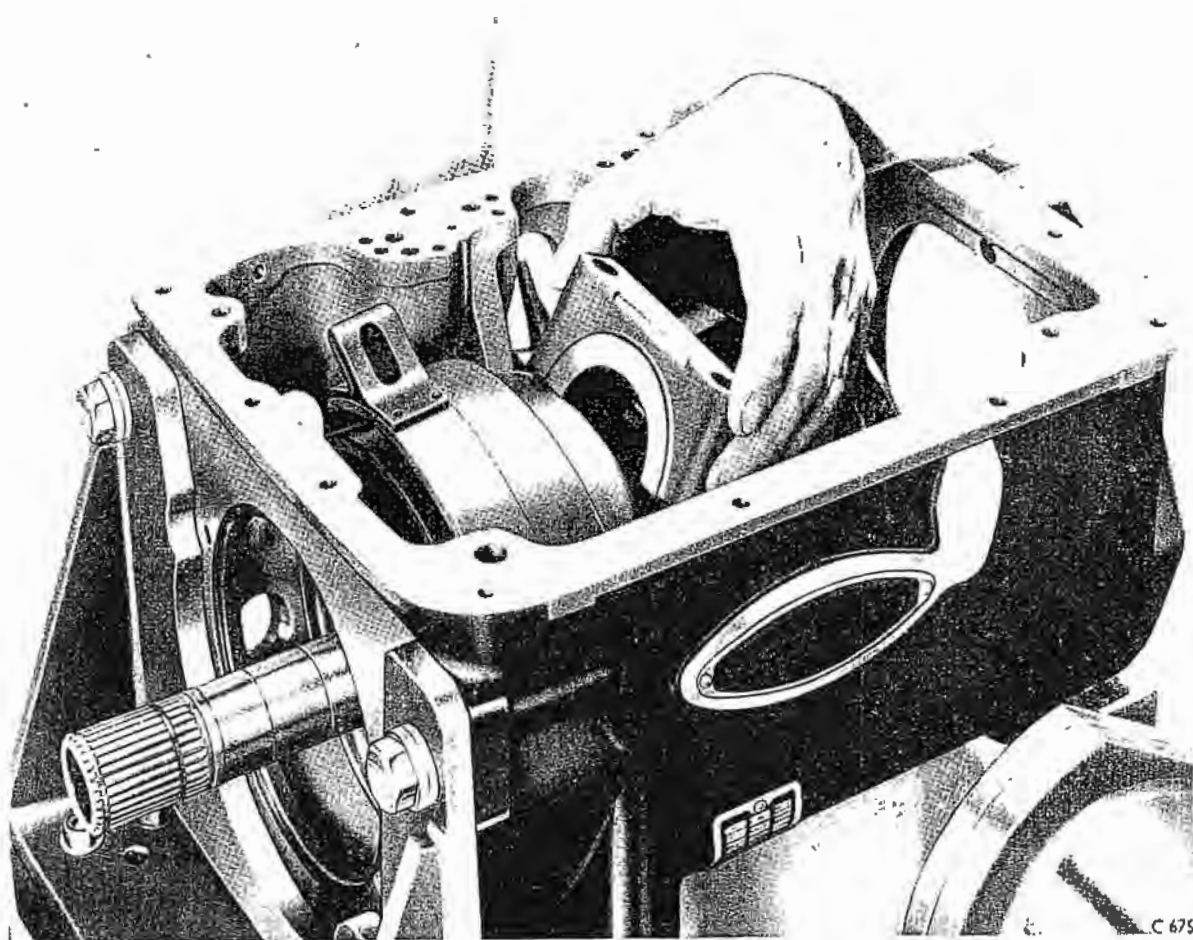


Fig. 109 Removing centre bearing cap

C 675

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Drum assembly — To remove

Turn back the tabs of the centre bearing cap lock-plate, unscrew the two retaining cap setscrews and withdraw the cap as shown in Figure 109. The drum assembly can then be lifted from the gearbox case, but care must be taken not to distort the bands as they are easily damaged. Turn both bands so that they are clear of their respective anchor pins. Lift the rear end of the shaft and steady the front end, gently easing the delivery sleeve out of its support. Hold the rear band on the rear drum and remove the drum assembly, leaving the front band in the casing.

Fit the assembly in the holding stand (see Chapter 4) then remove the front band from the casing.

Drum assembly — To dismantle

With the spring ring pliers, remove the snap ring retaining the rear hub as shown in Figure 110, then lift the rear drum assembly off the intermediate shaft.

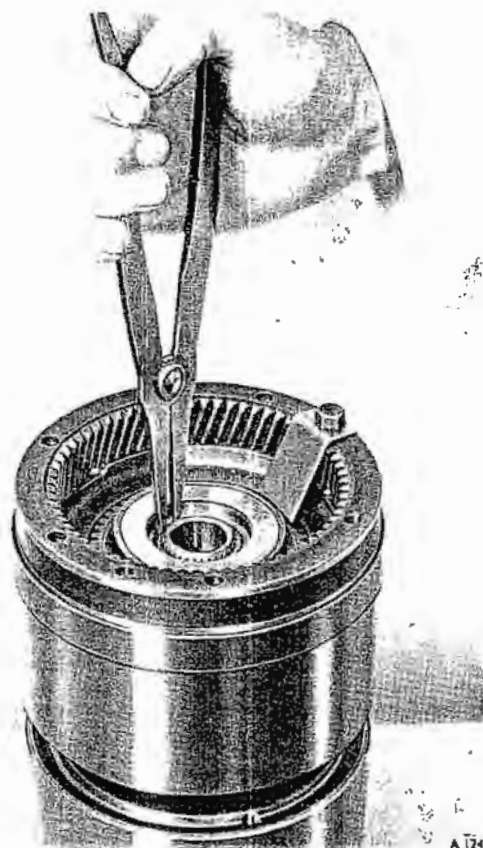


Fig. 110 Removing rear drum retaining ring

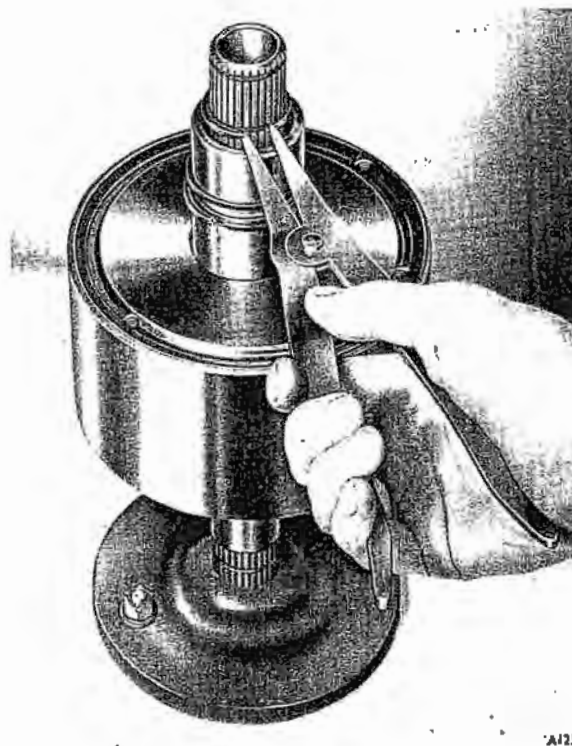


Fig. 111 Removing delivery sleeve retaining ring

Remove the thin steel thrust washer which is fitted between the snap ring, retaining the oil delivery sleeve and the rear clutch hub; this washer is not fitted to early gearboxes. The washer is fitted only to gearboxes having a modified rear clutch hub, the hub being counterbored to accept the washer.

Remove the snap ring retaining the oil delivery sleeve (see Fig. 111) and withdraw the sleeve.

Remove the front drum retaining ring (see Fig. 112) taking care not to scratch the surface of the intermediate shaft, then lift off the drum assembly. Withdraw the steel and the bronze thrust washers from the recess in the front drum and label them for identification.

Front drum — To dismantle

Position the front drum assembly in a suitable press and apply sufficient pressure to the clutch cover to enable the spring ring to be prised from its groove as shown in Figure 113. Remove the drum assembly from the press and separate the clutch cover from the drum by tapping the sun gear with a soft-headed mallet.

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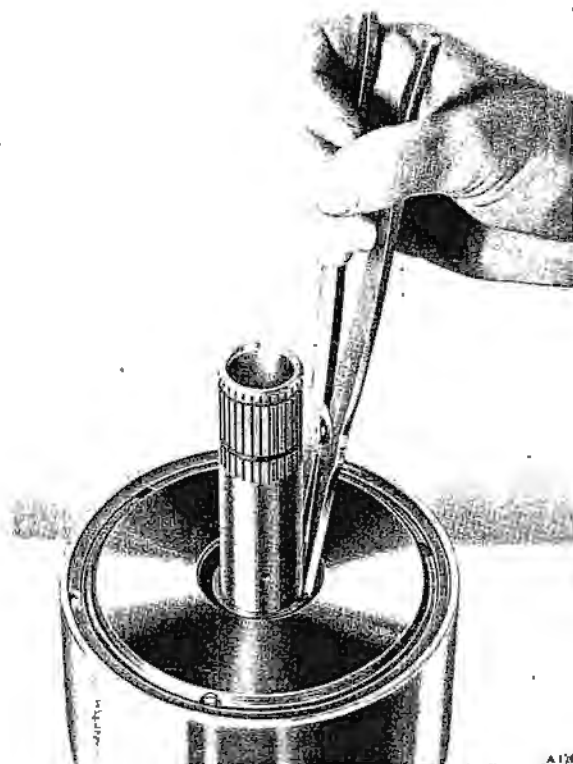


Fig. 112 Removing front drum retaining ring

Remove the six inner and outer clutch release springs, then lift out the complete pack of clutch plates; it is important that the plates are not separated prior to inspection.

Remove the clutch piston from its annular housing in the clutch cover, by tapping the sun gear sharply with a soft-headed mallet to shock it out of position.

Using a blunt screwdriver, remove and discard the oil seal rings and expanders from their respective grooves in the clutch piston and cover.

Rear drum — To dismantle

Remove the rear clutch hub retainer bracket (see Fig. 110) and withdraw the hub and bronze thrust washer; the dismantling procedure is then similar to that described for the front drum. The clutch release springs of this unit are fitted with small guide pins which should be removed with the springs.

The annulus gear is secured to the rear drum by two setscrews and should be removed only for renewal purposes.

Drum assembly — To inspect

With the exception of the pack of clutch plates, clean all parts thoroughly with a suitable cleaning fluid. The clutch plates should be inspected first, as described later in this Section.

Inspect all surfaces of the clutch drums for scores and grooves; only slight damage which can be removed by stoning is permissible. Check the clutch drive pins for security; if loose renew the drum.

Examine the gear teeth of the rear drum annulus gear and the intermediate shaft planet pinions. If damaged, check the gears with which they mesh and, if unserviceable, renew the particular unit or assembly.

Examine the splines of the clutch hubs and the intermediate shaft, for damage marks, burrs and excessive uneven wear, only damage which can be rectified by light stoning should be accepted. If any splines are chipped, the particular unit should be renewed.

Check the snap ring grooves of the intermediate shafts for burrs and ridges and the bearing surfaces for scores and scratches; smooth off with a stone if necessary.

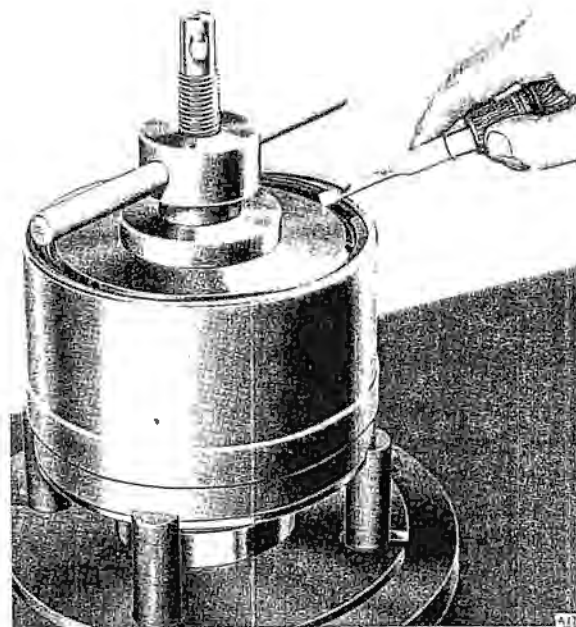


Fig. 113 Removing clutch cover retaining ring

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Fig. 114 Fitting expander and seal to clutch piston

Check the planet carrier and the outer diameter of the pinion thrust washers for cracks. Spin each planet gear to check for smooth running and check them for side play which may indicate worn needle rollers or loose planet retaining pins. The front planet assembly must be renewed as a unit should any of the components become unserviceable; dismantling is not permitted.

Inspect the clutch release springs for distortion and collapsed coils; slight wear indicated by brightness of the outer coil diameter is acceptable. Examine the guide pins of the rear clutch springs for distortion and burred ends; check that they are all of equal length.

Inspect the clutch pistons for scores, cracks or distortion and ensure that the seal grooves are perfectly clean.

Examine the piston bore of the clutch cover for scores and the intermediate shaft bushes for security, signs of picking up or heavy wear. Check the seal groove for cleanliness.

Inspect the oil delivery sleeve for scores; only damage which can be removed by light stoning is acceptable.

Check the rings for freedom in their grooves and ensure that the grooves are clean. It is not necessary to remove the rings unless damage necessitates renewal.

Check the centre bearing cap and dowel pin for burrs and damage marks; light damage may be removed by stoning. If the dowel pin is loose or damaged it should be renewed.

Ensure that the oil passages in the cap are clear, then carry out a leakage check between the case, cap and sleeve in the following manner.

Oil delivery sleeve — To check

Dip the sleeve into clean gearbox fluid, then refit it into the gearbox case, locating the cap dowel pin in one of the two holes in the sleeve instead of its correct location: this blanks off the casing oilways.

The cap must be fitted with the machined chamfer toward the front of the case and the setscrews tightened evenly to the correct loading. (If the sleeve can be rocked, it should be renewed). When air pressure is applied to the front and rear clutch passages, as shown for clutch testing in Figure 119, there should be no leakage between the sleeve, the case and the cap. In the case of a new oil delivery sleeve, slight leakage may be rectified by very careful dressing of the cap horns. Should this prove unsuccessful, the cap and casing must be renewed.

When the foregoing checks are satisfactory, remove the sleeve ready for re-assembly.

Having retained the clutch plates in the order in which they were fitted, it is now possible to inspect the surfaces of each plate in relation to that with which it mates. This is important as a rough surface of a driven plate may easily be the cause of excessive wear on the mating face of the composition drive plate.



Fig. 115 Fitting expander and seal to clutch cover

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At the clutch cover end of the pack it may be found that there are one or two extra steel plates. These 'spacing' plates should be labelled and kept separate from the other plates, as they are not hardened and vary in thickness.

Slight discolouration of the steel driven plates is acceptable, but heavy discolouration caused by excessive overheating may have upset the heat treatment and be the cause of future failure if the plate is not renewed. Check the driven plates for distortion using a surface plate, also ensure that the surface finish is smooth and polished.

The composition surfaces of the drive plates should be carefully checked for lifting, flaking and excessive wear. A plate will normally darken with use, but should it be almost black, or have a glazed look, indicating signs of burning, it must be renewed. If more than one plate is badly burnt, the complete set of plates should be renewed.

The surface contour of the drive plates is undulated; each plate should have six 'waves' which must not be less than 0.015 in. deep. This can be checked on a surface table by sliding a feeler gauge into the spaces so formed; if there is evidence of any other distortion the plate must be renewed.

Examine the drive plate serrations and the driven plate slots for burrs and signs of excessive wear. If necessary, remove any burrs, then check that the plates slide smoothly over their respective splines or driving pins.

Examine all thrust washers for cracks; if any washer is cracked, badly scored or excessively worn, it should be renewed and the respective mating surfaces inspected for burrs, scoring and sharp edges.

Examine the bands for loose rivets and worn linings; if the rivets are loose or the face of a lining is worn down to the grooves, or has started to lift from the steel band, the particular band assembly must be renewed. When inspecting bands, care must be taken not to distort them in any way as they are surface ground to fit the drums. If a lining is found to be badly impregnated with foreign matter, such as bronze caused by bush failure, it should be renewed.

Check the steel bands for distortion and cracks and the anchor ends for broken welds and worn sockets.

Check the rear band operating strut locating pin for security and the strut for play on the pin. If play is excessive or the pin is loose, renew the complete band assembly.

Check the snap rings for correct fitting in their grooves. If they are loose when in position on the intermediate shaft they should be renewed.

Check the fitting of the large spring rings in the clutch drums. The ring must be a snug fit in its groove; slight distortion necessitates the renewal of the rings.

Front clutch — To assemble

Fit a new seal and expander to the piston in the manner illustrated in Figure 114; care must be taken to ensure that the rubber is bedded well down into its groove and that the expander does not protrude beyond the bottom edge of the rubber seal.

In a similar manner fit a new seal and expander to the clutch cover. After initially inserting the expander and seal into the groove, a small wooden block should be fitted between the seal and the inner circumference of the cover (see Fig. 115). This will prevent the tendency for seal and expander to creep out of the groove during fitting. Remove the wooden block and check that the expander does not protrude below the seal.

The direction in which the protruding lip of the seal faces is important and must be fitted as shown in the respective illustrations (see Fig. 114 and Fig. 115).

With the seals correctly in position the piston may then be inserted into the cover after first smearing the rubber with 'Mobilgrease M3'. The lip of the outer seal should be initially introduced into the cover using the side of a blunt screwdriver drawn over the seal edge as shown in Figure 116; after which the two components can be manually pressed firmly together. Line up the square notches in the piston with the three holes in the cover.

Fit the intermediate shaft into the holding fixture, clutch hub uppermost. Fit the front drum over the shaft so that it rests on the planet gears with its driving pins pointing upward. Lubricate the surfaces of the clutch plates with clean gearbox fluid, then fit them, commencing with a composition drive plate and then a steel driven plate alternately until the complete pack is fitted.

Ensure that each composition plate slides freely over the clutch hub splines and that the steel plates are fitted with the square notches over the driving pins.

It should be noted that previously labelled spacing plates must be fitted last, but the thickness may have to be re-assessed as described later.

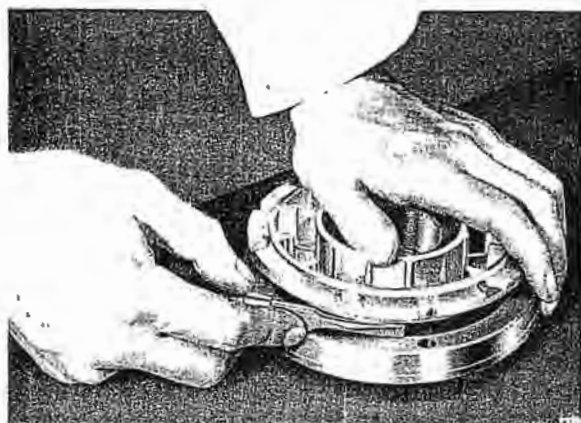


Fig. 116 Fitting piston to clutch cover

Fit the six pairs of clutch release springs into the locating holes formed by the plates, then fit the cover into the drum, sun gear first, making sure that the springs engage into the pockets of the clutch piston.

Remove the complete assembly from the intermediate shaft. Using a suitable press, apply sufficient pressure to the clutch cover to enable the spring ring to be refitted into its groove. Ensure that the ring beds firmly into its groove, then release the pressure.

After removing the assembly from the press, ensure that the outer shoulder of the clutch cover protrudes evenly through the inner circumference of the retaining ring; if necessary, lightly tap the cover into its correct position using a soft-headed mallet.

The assembly of the clutch plates should now be checked: this is best accomplished by placing the fingers on the teeth of the drive plates and lifting and turning the plates. When correct, the clearance should be just sufficient to allow free rotation without binding.

If the clutch is too free and end float can be felt, or if the plates are binding or solid, it will be necessary to alter accordingly the thickness of the spacing plate or plates.

These plates are supplied in various thicknesses (see Spares Schedule) and can be fitted singly or paired in any combination to give the correct clearance.

The total number of spacing plates fitted must not exceed two and they must not be fitted in any position other than between the clutch cover and the first steel 'driven' plate.

Rear clutch — To assemble

If previously removed, refit the annulus gear and tighten the setscrews evenly; before final tightening, tap the end face of the gear with a soft-headed mallet to ensure correct location.

Assembly of the remainder of the unit is then similar to that of the front unit, with the exception that there is no need to mount it on the intermediate shaft; it is, however, advisable to temporarily fit the clutch hub to ensure that the drive plates slide freely on the splines. It must be remembered that guide pins are fitted inside the clutch return springs in the rear clutch. After assembly, remove the hub, then check and adjust the clutch plate clearance in the same way as described for the front clutch.

Refit the hub together with the large bronze thrust washer. The washer should be coated with petroleum jelly to ensure that it is retained in the deep counterbore of the hub. Rotate the hub to engage the driving plate splines; when properly installed, the hub should be flush or slightly below the counterbore of the drum. Fit the hub retainer bracket using a reverse drive flange retaining setscrew.

Fit the drum assemblies to the shaft in the following order, using clean gearbox fluid liberally during assembly.

Fit the front drum over the shaft onto the hub, rotating it backward and forward until all the drive plates are correctly located.

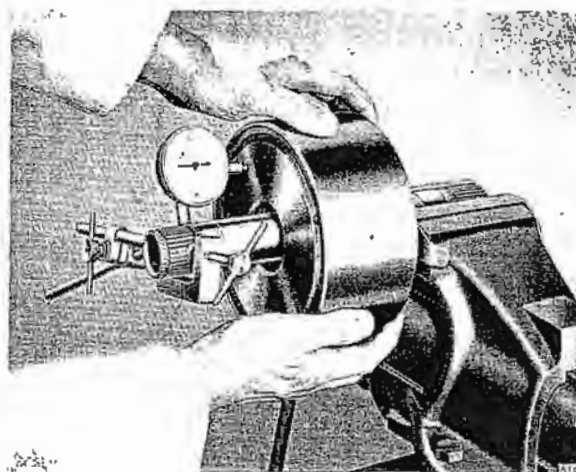


Fig. 117 Checking front drum end float

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Fit the following in the order mentioned, the bronze washer, the steel (selective) washer and the spring retaining ring. The selective washer may have to be renewed if, as a result of the following end float check the clearance is found to be outside the limits.

Remove the shaft and drum from the holding fixture and grip the shaft in a vice, using fibre clamps. With a dial test indicator mounted as shown in Figure 117, measure the end float of the drum assembly. If outside the limits given in the 'Summary of Repair Data' replace the steel thrust washer for one of suitable thickness, details of which are given in the Spares Schedule.

Refit the assembly in the holding stand, then using the ring compressing tool (see Chapter 4), fit the oil delivery sleeve, entering first, the end which has the rings nearest the end of the sleeve (see Fig. 118). If the sleeve is too tight to fit by hand, a soft-headed mallet may be used as shown in Figure 118; only light taps should be necessary. Push the sleeve fully home into the bore of the drum then fit the spring retaining ring; refit the thin steel thrust washer.

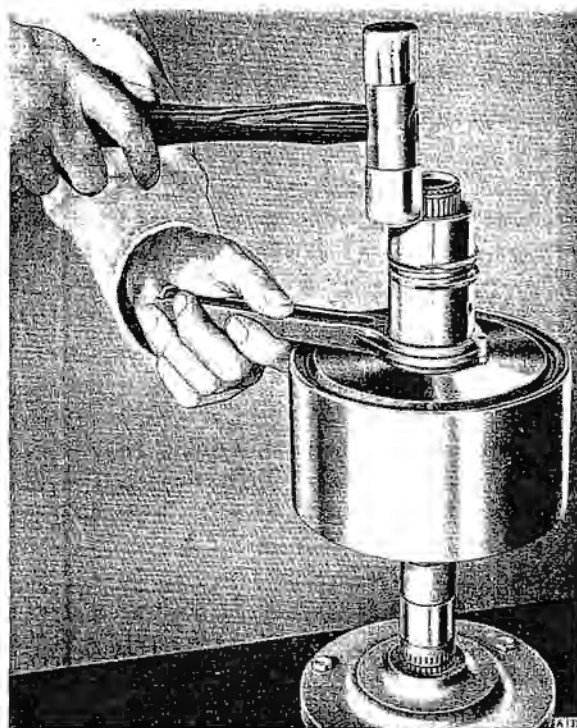


Fig. 118 Fitting oil delivery sleeve

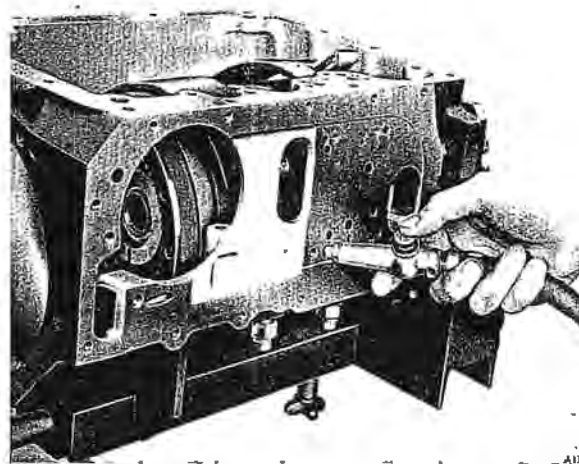


Fig. 119 Checking clutch operation

Fit the ring compressing tool over the two exposed rings on the oil delivery sleeve. Slide the rear drum over the shaft and lower it carefully onto the delivery sleeve; when fully home remove the compressing tool.

Fit the rear drum snap ring.

Drum assembly — To fit

Fit the bearing cap in position on the oil delivery sleeve (chamfer forward), making sure that the dowel locates positively in its correct hole.

Fit the front band into position in the gearbox, insert the shaft assembly through the band and while still tilted, slide the rear band onto its drum.

Before securing the bearing cap, ensure that the band anchorage ends are correctly located on their respective adjusting screws; fit the two bearing cap setscrews together with a new tab washer, then tighten evenly to the correct torque loading given in the 'Summary of Repair Data'.

Ensure that the drums revolve smoothly on the intermediate shaft, then check the action of the clutches by means of compressed air applied through the passages illustrated in Figure 119. Correct operation can be heard and felt. Thoroughly check for air leaks during this test.

Refit the remaining assemblies in the reverse order to that given for dismantling, then road test the gearbox as described in Chapter 2.

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SECTION 15 — GEARBOX CASING

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When all the units have been removed from the gearbox, as described in the foregoing sections, the only removable parts which remain are, the two band adjusting screws and the oil pressure test point blanking plug.

Removal of the adjusting screws and blanking plug is straightforward.

Clean the casing and passages with clean paraffin and compressed air.

Gearbox casing — To inspect

Check all joint faces for burrs; light damage can be removed by careful stoning. Similarly check the spigot bores in the front and rear ends of the case.

Inspect the screw threads of all tapped holes making sure that the top threads have not been pulled or damaged to an extent which might upset the joint face.

Check the fit of the band adjusting screws with the threads in the gearbox case; also check the threads of the lock-nuts and the oil pressure point blanking plug.

Examine the gearbox casing for cracks.

Check the fit of the centre bearing cap together with the oil delivery sleeve as described in Section 14.

Check the continuity and interconnection of the oil passages with air pressure. Strong wire may be used to clear a blocked passage but care must be taken not to raise any burrs at the end of the passages.

Check that the dipstick aperture is fitted with a water excluder.

Early gearboxes are not fitted with a water excluder and opportunity should be taken to fit one if the gearbox has been completely dismantled.

All new and replacement gearboxes will have a water excluder fitted.

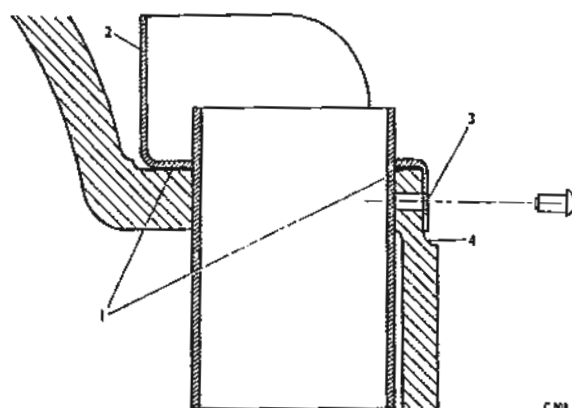


Fig. 120 Fitting water excluder

- | | |
|------------------------|------------------------------|
| 1 APPLY BOSTICK | 4 FILE HORIZONTAL FLAT 0.400 |
| 2 WATER EXCLUDER | IN. DEEP TO RECEIVE EX- |
| 3 DRILL 0.062 IN. DIA. | CLUDER LIP |

Water excluder — To fit

File a horizontal flat, approximately 0.400 in. deep, on the outside of the dipstick housing sufficiently wide to receive the right angled drilled location lip of the water excluder (see Fig. 120).

Remove the dipstick.

Clean around the area to which the water excluder is to be fitted.

Liberal coat with Bostick adhesive the bottom of the water excluder and the matching surface of the dipstick housing. Position the excluder over the dipstick sleeve, then using the location lip as a guide, drill a 0.062 in. diameter hole through the dipstick housing and guide sleeve for a hardened hammer drive screw (see also Fig. 120).

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If a water excluder is being fitted to a gearbox which is not completely dismantled, take care to ensure that no swarf enters the gearbox during the drilling procedure.

Ascertain that the excluder is firmly fixed, then drive in the hardened screw to secure the excluder.

Machine the face of the dipstick as shown in Figure 121 to allow 0.062 in. clearance for gearbox breathing. Clearly mark the top of the dipstick with **RED** paint to indicate that this has been carried out.

Ensure that the correct dipstick is fitted to the gearbox casing.

There are two methods of air breathing incorporated in the Automatic Gearbox, (a) through the four scoops machined in the dipstick guide sleeve, or (b) through the filter cap past the segment removed from the serrated washer.

It is of the utmost importance that the correct dipstick is fitted into its appropriate guide sleeve to permit adequate breathing. Incorrect matching may result in oil leakage or the ingress of water.

On some early 'SI' cars oil leaks may occur due to a pressure build up in the gearbox, especially after prolonged running at high speed.

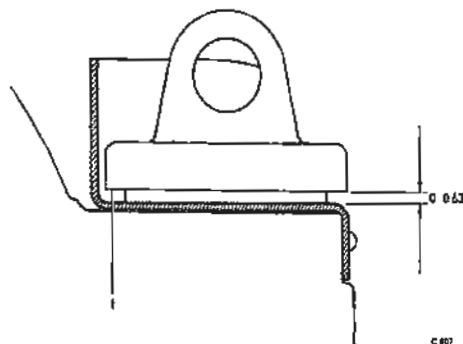
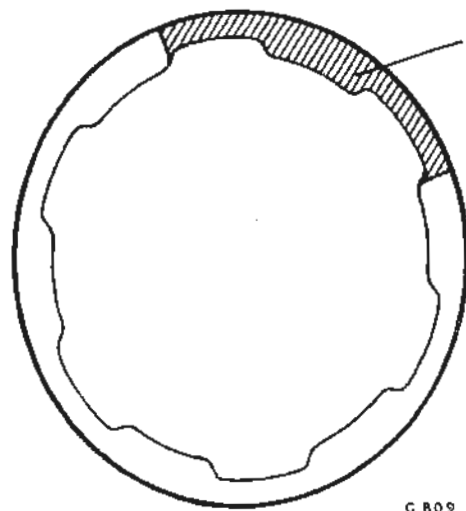


Fig. 121 Water excluder and dipstick

1 MACHINE THIS FACE ON THE DIPSTICK TO MAINTAIN 0.062 IN CLEARANCE



C 809

Fig. 122 Modified serrated washer

1 THIS SECTION TO BE CUT OUT AND REMOVED

This can be prevented by modifying the automatic gearbox oil breather and dipstick.

Remove the dipstick and dismantle it by removing the 'C' clip, spring ring or split pin, whichever is fitted. This will allow the retaining cap, copper mesh crimp and the serrated washer to be removed.

Cut the serrated washer and file the retaining cap as shown in Figure 122.

Thoroughly clean and remove all metal particles; re-assemble the components and refit the dipstick.

Note All modified dipsticks are fitted to unscalloped guide sleeves. All unmodified dipsticks are fitted to machine scalloped guide sleeves.

Screw the band adjusting screws into the case, refit the oil pressure check point blanking plug and tighten it to the correct torque loading given in the 'Summary of Repair Data'.

CHAPTER 4

TOOLS

CHAPTER 4

TOOLS

The following is a list of special tools for the servicing and overhauling of the Automatic Gearbox; these are recommended for use when carrying out repairs and adjustments.

General tools are not included as it is felt that these will be available locally.

Orders should be addressed to

ROLLS-ROYCE LIMITED

CREWE SERVICE DEPARTMENT

Pym's Lane, Crewe, Cheshire

Telephone: Crewe 55155

Telegrams: 'ROYCRU, CREWE'

Telex: 3621

LONDON SERVICE DEPARTMENT

Hythe Road, Willesden, London, N.W.10

Telephone: LADBroke 2444

Telegrams: 'SILVAGOST, WESPHONE, LONDON'

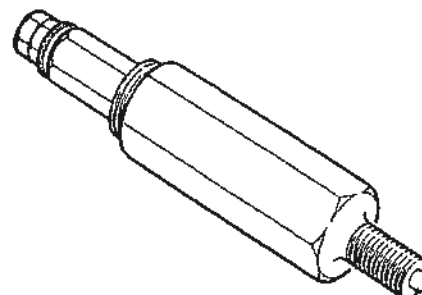
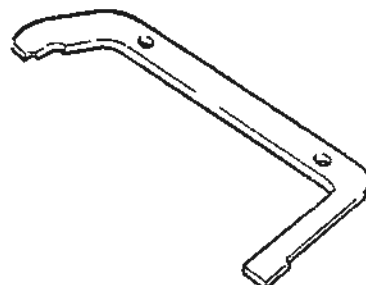
Telex: 25133

Bands

Part number

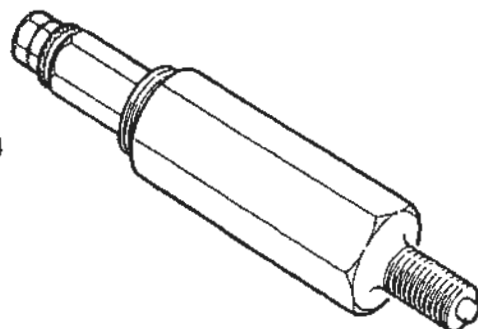
Gauge — Rear band setting 23789/G1002

Tool — Front band setting — Early 'R' type .. RH 671

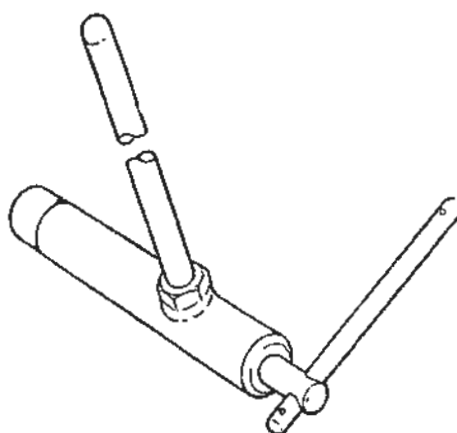


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Tool — Front band setting — 'R' and 'S' type .. UR 3144

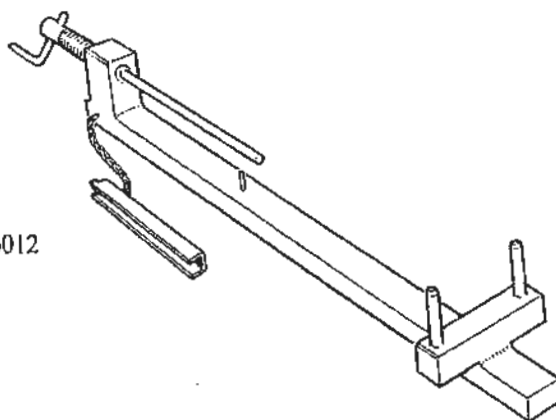


Tool — Band adjuster RH 131



Servos

Compressor — Rear servo spring STD 6012



Governor

Alignment gauge — Governor sleeve RH 329



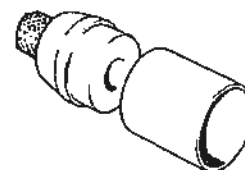
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Printed in England

SEPTEMBER 1963

TSD 2042

Assembly sleeve — Oil sealing ring 25937/T1002-5

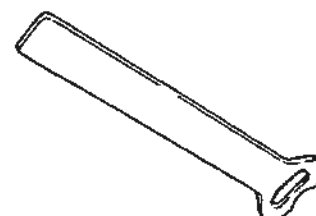


Front pump

Adaptor — Torque spanner 26225/T1002

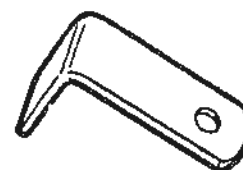


Holding tool — Front pump STD 6007



Rear clutch

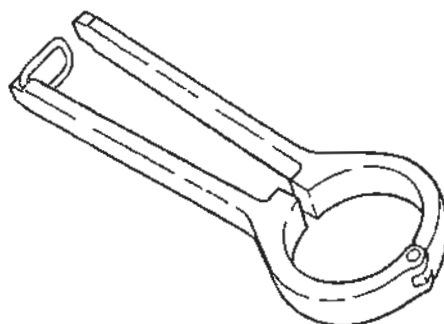
Hub retainer 23789/T1001



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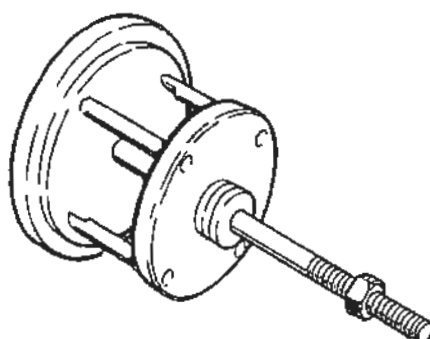
Oil delivery sleeve

Compressing tool — Oil delivery sleeve ring .. RH 186

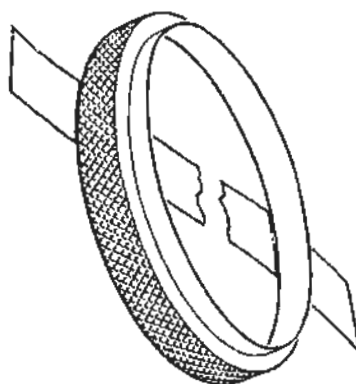


Reverse clutch

Compressing tool — Reverse clutch spring .. 23789/F1002

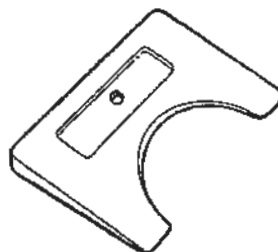


Installing tool — Piston to drum 23789/F1004



Drums

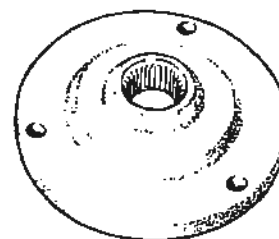
Spacer — Front drum STD 6010



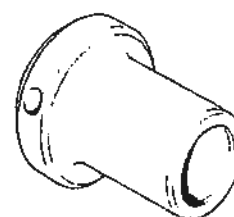
ROLLS-ROYCE AUTOMATIC GEARBOX

Shafts

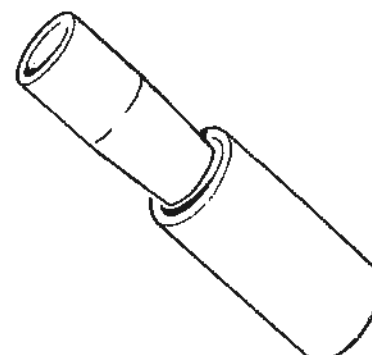
Holding fixture — Intermediate shaft RH 584



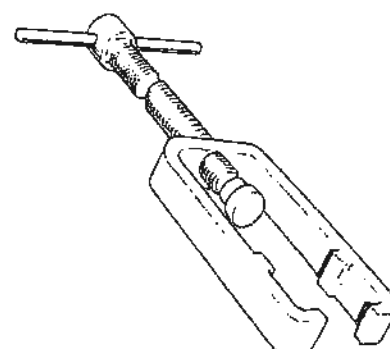
Checking sleeve — Mainshaft end float .. 23789/T1005



Assembly tool — Mainshaft snap ring .. RH 551

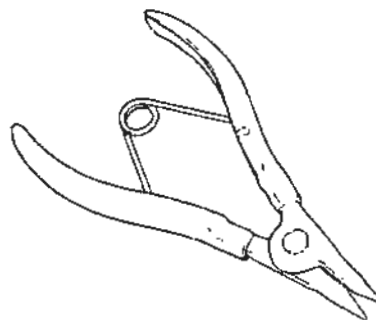


Extractor — Output shaft bearing 32794/T1001



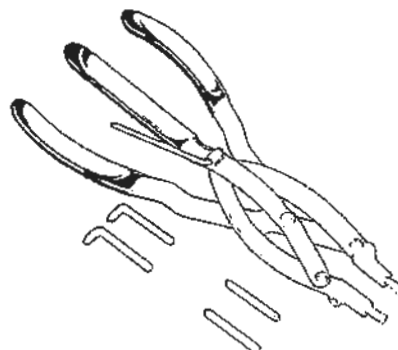
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Pliers — Circlip RH 166



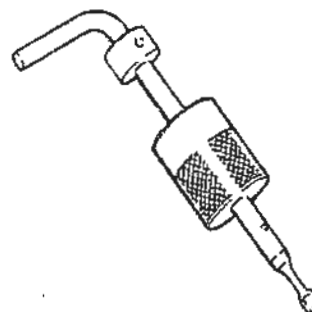
Pliers — 2-way — Snap ring RH 7674

(May be used for further applications
using the various nose pieces)



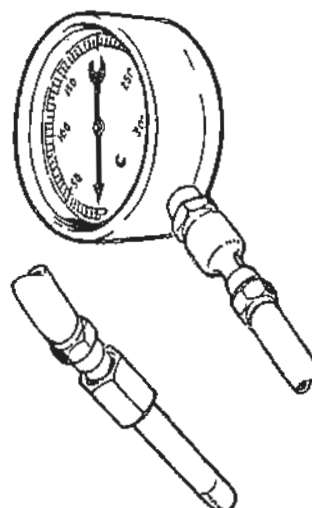
Casing

Extractor — Exhaust valve — Early 'R' type .. STD 6003



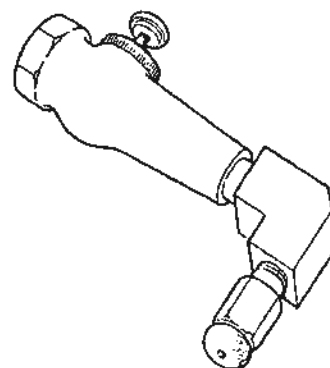
Pressure checks

Pressure gauge R 5244

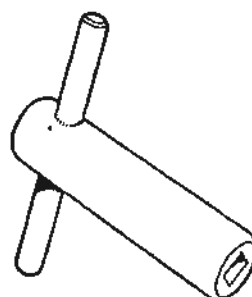


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Adaptor — Air checking R 5280

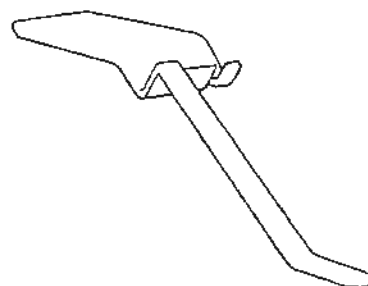


Spanner — Square holed — Blanking plug .. RH 412

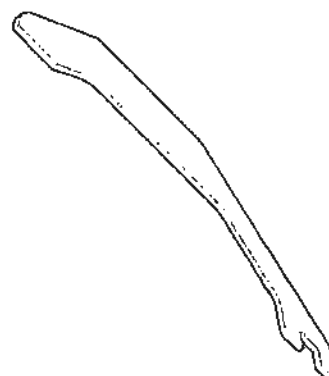


Controls

Gauge — Throttle linkage — 'R' type RH 581



Gauge — Throttle setting — 'R' type .. 24918 G1002



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Gauge — Throttle linkage — SI cars RH 407

