TURBO HYDRA-MATIC TRANSMISSION

GM 400

WORKSHOP MANUAL

ROLLS-ROYCE SILVER SHADOW

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THE QUEEN'S AWARD TO INDUSTRY

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INTRODUCTION

The purpose of this Manual is to provide those responsible for the maintenance and overhaul of the GM 400 Transmission with information on proved methods of servicing.

The manual is copiously illustrated and gives a general description of the transmission as well as complete information on dismantling procedure, inspection and assembly.

A separate Chapter is devoted to servicing procedures and, included in this Chapter is a Fault Diagnosis which will assist Service Personnel in the speedy location of faults in the transmission.

Also included in the Manual is a list of special tools which have been designed to simplify the servicing and overhauling of the transmission.

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 It is advisable to endorse the superseded information, thus ensuring that the latest procedure only will be followed.

Service Personnel at Rolls-Royce Inc. and Rolls-Royce of Canada. Ltd. are always prepared to answer queries or give advice on individual servicing problems but it will assist them if inquiries are accompanied by the serial number of the transmission and the chassis number of the car.

Rolls-Royce policy is one of continuous engineering improvement and the right is reserved to revise the contents of this Publication without prior notice.

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GM 400

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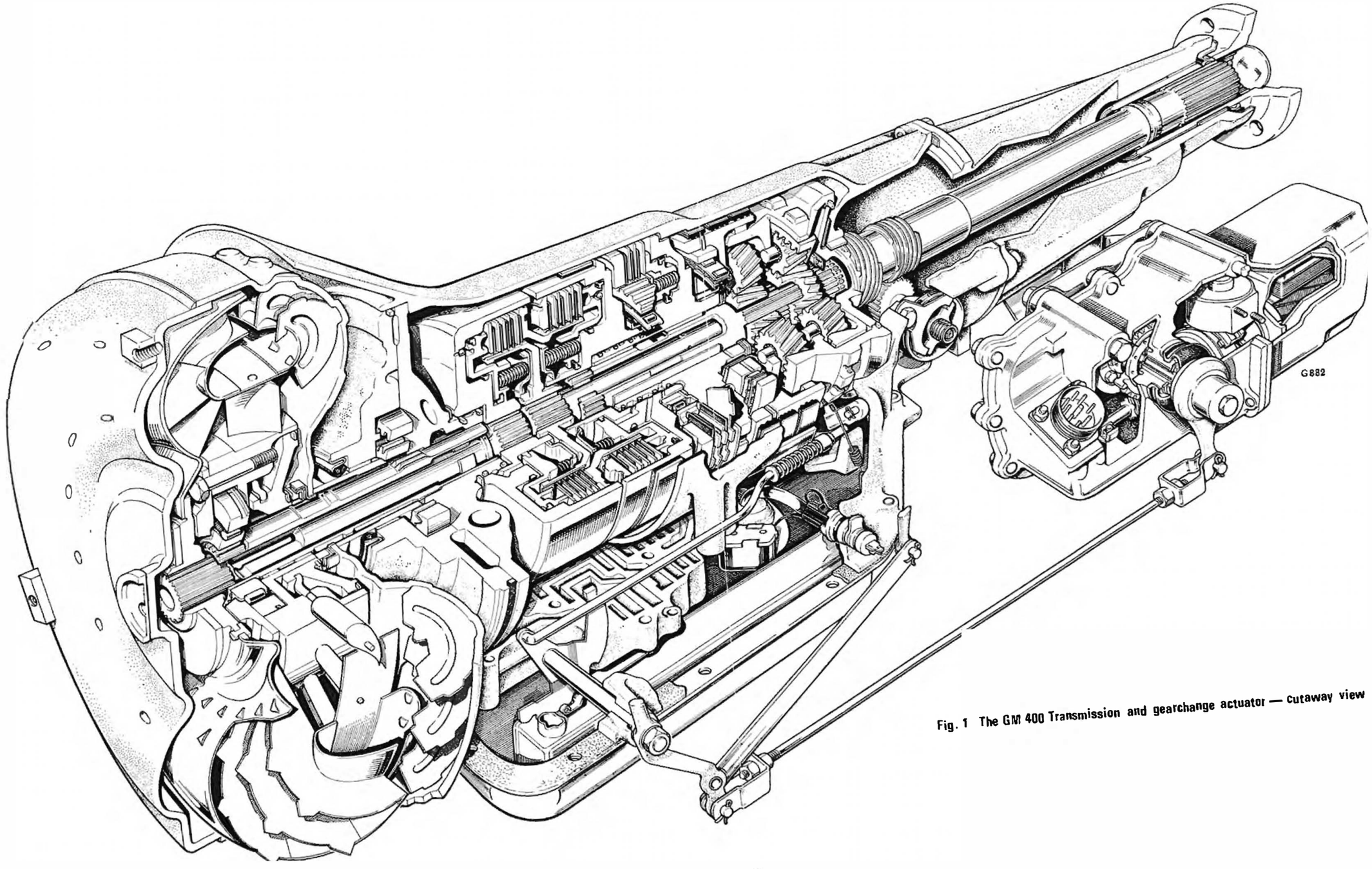

Fig. 1 The GM 400 Transmission and gearchange actuator — cutaway view

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CHAPTER 1
DESCRIPTION

Section 1
General Description

General

The GM 400 Turbo Hydra-Matic Transmission (see Fig. 1) is a fully automatic unit, consisting primarily of a three-element hydraulic torque converter and a compound planetary gear train. Three multiple-disc clutches, two sprag units and two friction bands provide the elements which are required to obtain the desired functions of the gear train.

The GM 400 Turbo Hydra-Matic Transmission can be identified by a name plate, fitted to the right-hand side of the transmission, toward the centre of the case. The serial number is prefixed by the letters RR and the year in numerals.

The torque converter, clutches and sprags connect the engine to the gears with the aid of pressurised transmission fluid. Three forward gears and Reverse are provided. When necessary, the torque converter will supplement the gears by multiplying engine torque.

The torque converter is of welded steel construction and cannot be dismantled. The unit is made up of two vaned sections which face each other across a fluid filled housing. The pump half of the converter is connected to the engine and the turbine half is connected to the transmission.

When the engine is running, the converter pump rotates, throwing fluid against the turbine, causing the turbine also to rotate. The fluid then returns to the pump in a circular flow and continues this cycle as long as the engine is running.

The converter also has a smaller vaned section, called a stator, which directs the fluid back to the pump through smaller openings at greater speed. The speeded-up fluid imparts additional force to the engine driven converter pump, thus multiplying engine torque. The angle of the stator blades can be made to vary to one of two positions; maximum (high) angle or minimum (low) angle.

High stator angle means a greater redirection of the fluid, increased engine speed and a good torque multiplication for maximum performance. At engine idle it reduces the efficiency of the converter, thus reducing the tendency of the car to 'creep'.

Low angle will give a more efficient converter, the effect being similar to that of an ordinary fluid coupling.

A hydraulic system pressurised by an internal-external gear type of pump provides the working pressure required to operate the friction elements and automatic controls.

The external control connections to the transmission are:

An electric gearchange actuator and a system of rods and levers. The actuator responds to an electrical signal from a switch on the steering column, then moves the gearchange lever on the transmission to the required position.

Engine vacuum – to operate a vacuum modulator unit.

12 volt electrical signals – to operate electrical detent and stator solenoids.

Gear or torque ratios of the transmission are as follows.

First	–	2·5 : 1 gear ratio
Second	–	1·5 : 1 gear ratio
Third	–	1·0 : 1 gear ratio
Reverse	–	2·0 : 1 gear ratio

Each gear ratio can be multiplied by as much as two, depending upon the slip speed of the converter pump and turbine.

A vacuum modulator is used to automatically sense engine torque input to the transmission. The vacuum modulator transmits this signal to the pressure regulator which controls main line pressure, so that all the torque requirements of the transmission are met and the correct gearchange spacing is obtained at all throttle openings.

The detent solenoid is activated by a micro switch adjacent to the carburetters. When the engine throttle is opened sufficiently the micro switch is closed by the engine controls, the solenoid is activated and a down-

change will occur at speeds below 70 m.p.h. (113 km.p.h.). At lower speeds a down-change will occur at lesser throttle openings without the aid of the micro switch or the solenoid.

The stator solenoid is activated by signals from two micro switches, both fitted in a similar position to the detent switch. One micro switch causes the solenoid to change the stator blade angle, from high to low angle, as soon as the throttle is 'cracked' open. The other micro switch causes the blade angle to change, from low to high angle, at approximately 45° of throttle opening.

The transmission fluid heat exchanger is secured to to the bell housing bottom cover, at the front of the transmission sump (see Fig. 2). The transmission is cooled by directing fluid from the converter to the heat exchanger. The cooled fluid then returns to the transmission to feed the lubricating system. Coolant from the rear of 'A' bank cylinder head is fed to the heat exchanger, it then flows via the heater return pipe to the radiator bottom tank.

The fluid system incorporates an intake pipe and strainer assembly. An internal by-pass permits increased flow during cold operation when the oil is heavier.

The transmission quadrant has six selector positions (see Fig. 3), which enable the driver to control the operation of the transmission under varying driving conditions. The six selector positions appear on the quadrant in the following sequence, from left to right; 'P' – Park, 'R' – Reverse, 'N' – Neutral, 'D' – Drive, 'I' – Intermediate and 'L' – Low. The engine can be started in the Park and Neutral positions only.

'P' – Park position positively locks the output shaft to the transmission case by means of a locking pawl and prevents the car from rolling either backward or forward when parked on a steep incline.

'R' – Reverse enables the car to operate in a reverse direction.

'N' – Neutral enables the engine to be started and run without the car moving.

'D' – Drive is used for all normal driving conditions and maximum economy. Drive range has three gear ratios from starting to direct drive. Forced down-changes are available for safe and rapid overtaking, by fully depressing the accelerator pedal.

'I' – Intermediate adds new performance for congested traffic conditions or hilly terrain. This range has the same starting ratio as 'D', but prevents the transmission from changing above second gear. Acceleration is retained when extra performance is required,

Fig. 2 Heat exchanger system

1 COOLANT FROM HEAT EXCHANGER TO CYLINDER HEAD
2 TRANSMISSION FLUID FROM HEAT EXCHANGER
3 TRANSMISSION FLUID TO HEAT EXCHANGER
4 HEAT EXCHANGER
5 COOLANT FROM HEAT EXCHANGER TO COOLANT PUMP

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also, the engine can be used to assist braking in this Range.

'L' – Low range permits operation at a lower gear ratio, and should be used when maximum torque multiplication is required or, when descending a steep gradient. When the selector lever is moved from Drive to Low at normal road speeds, the transmission will change to second gear and remain in second gear until the speed of the car is reduced to the normal 2–1 down-change speed. The transmission will thenchange down to first gear and remain in first gear regardless of car speed or engine revolutions, until the selector lever is moved into either the Drive or the Intermediate position.

Hydraulic system

Pressure control

The transmission is controlled automatically by a hydraulic system. Hydraulic pressure is supplied by the transmission oil pump, which is engine driven.

Main line oil pressure is controlled by a pressure regulator valve train which is located in the pump, and by the vacuum modulator which is connected to engine vacuum.

The pressure regulator controls main line oil pressure automatically, in response to a pressure signal from a modulator valve, in such a manner that the torque requirements of the transmission clutches are met and correct gearchange spacing is obtained at all throttle openings.

To control line pressure, a modulator pressure is used. This pressure varies in the same manner as torque input to the transmission. Since the torque input to the clutches is the product of engine torque and converter ratio, modulator pressure must compensate for changes in either or both of these.

To meet these requirements, modulator pressure is regulated by engine vacuum, which is an indicator of engine torque and carburetter throttle opening. It will decrease as the car speed increases to compensate for the changing converter torque ratio.

Vacuum modulator assembly

The engine vacuum signal is provided by the vacuum modulator which comprises an evacuated metal bellows, a diaphragm and a spring. These are so arranged that the bellows and spring apply a force that acts on the modulator valve so that it increases modulator pressure. Engine vacuum and a spring oppose the bellows and spring to control modulator pressure.

To reduce the effect of altitude on change points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

Governor assembly

The speed of the car is signalled to the transmission by a governor which is driven by the transmission output shaft. The governor is comprised basically of a valve body, a regulator valve and flyweights.

Centrifugal force causes the flyweights to act on the valve. The valve then regulates a pressure signal which increases with road speed.

Governor pressure acts on the modulator valve to cause modulator pressure to decrease as the speed of the car increases.

Operation of valves and hydraulic control units

Line pressure regulator

The line pressure regulator valve regulates line pressure according to pump speed and engine torque.

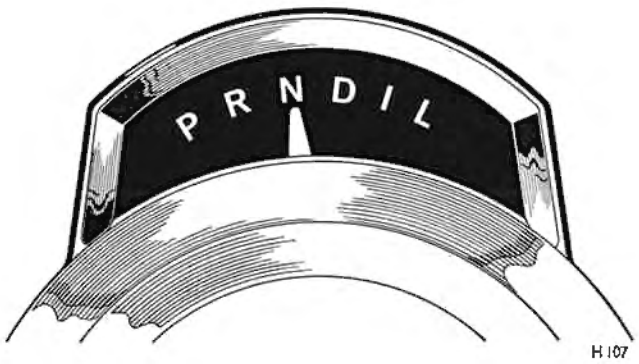

Fig. 3 Gear range selector quadrant

Manual valve

The manual valve extablishes the range in which the transmission is to be operated as selected by the driver through the selector switch and the gear-change actuator.

Governor assembly

The governor assembly generates an oil pressure that is sensitive to the speed of the car and which increases as the car speed increases.

Governor pressure is used to control the change points and to regulate modulator pressure.

Vacuum modulator valve

The vacuum modulator valve provides modulator pressure which senses engine torque and car speed. It is used to vary the change points, according to throttle

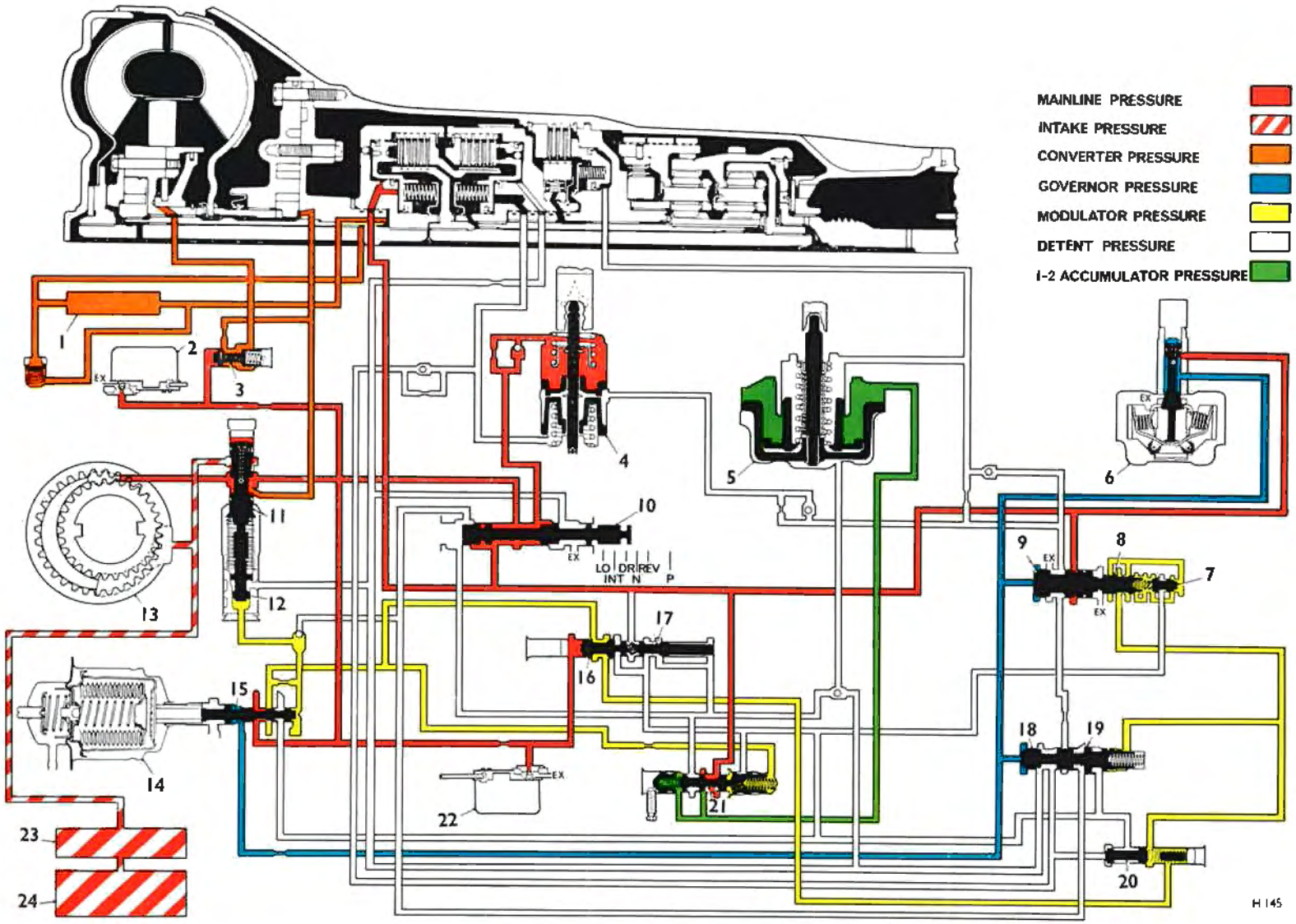

Fig. 4 Drive range — 1st gear

1 HEAT EXCHANGER	**5** REAR SERVO	**9** 1-2 VALVE	**13** PUMP	**17** REGULATOR VALVE	**21** 1-2 ACCUMULATOR VALVE
2 STATOR SOLENOID	**6** GOVERNOR ASSEMBLY	**10** MANUAL VALVE	**14** VACUUM MODULATOR	**18** 2-3 VALVE	**22** DETENT SOLENOID
3 STATOR VALVE	**7** REGULATOR PLUG	**11** PRESSURE REGULATOR	**15** MODULATOR VALVE	**19** 2-3 MODULATOR VALVE	**23** OIL STRAINER
4 FRONT SERVO	**8** 1-2 DETENT VALVE	**12** BOOST VALVE	**16** DETENT VALVE	**20** 3-2 VALVE	**24** SUMP

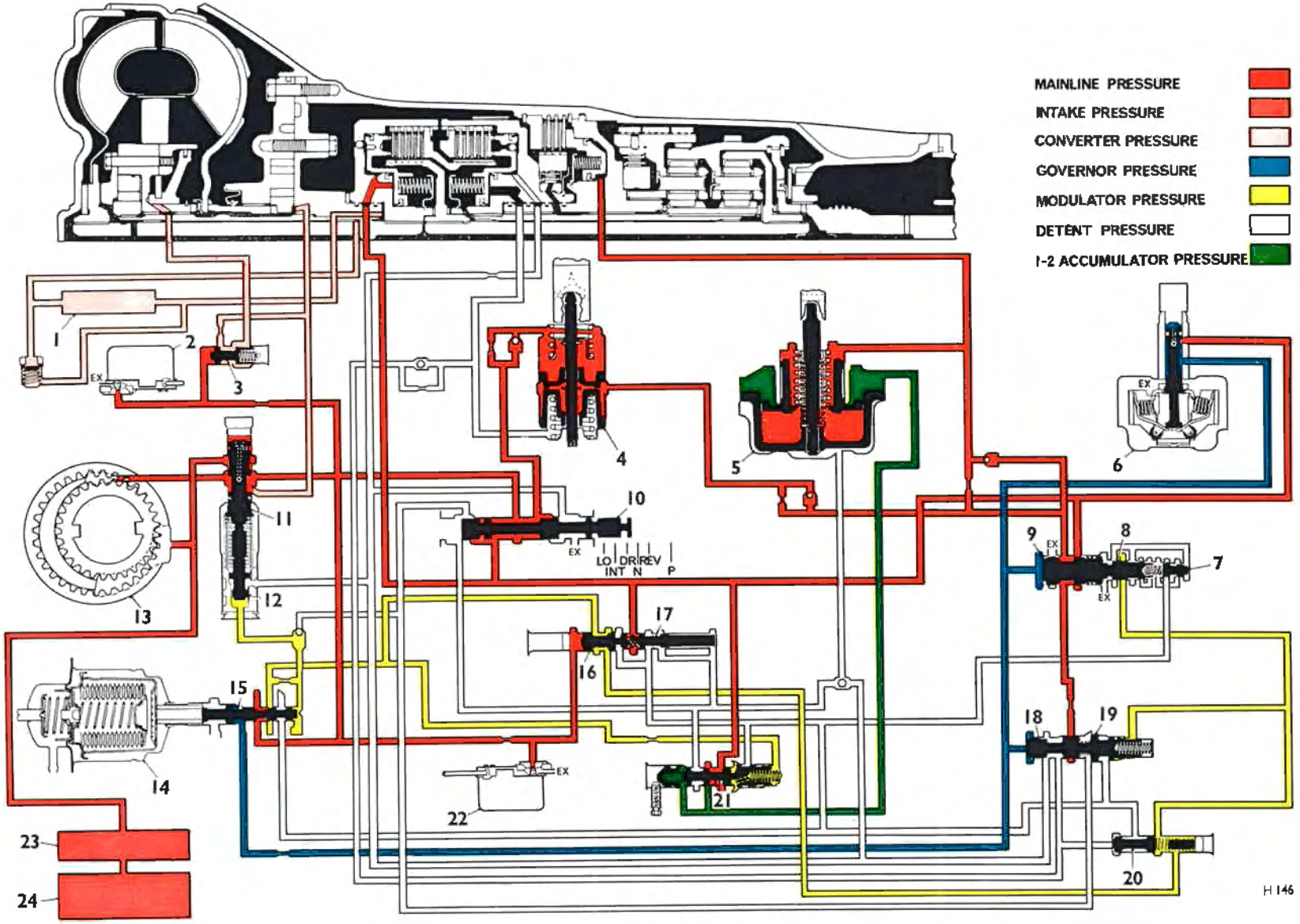

Fig. 5 Drive range — 2nd gear

1 HEAT EXCHANGER	**5** REAR SERVO	**9** 1-2 VALVE	**13** PUMP	**17** REGULATOR VALVE	**21** 1-2 ACCUMULATOR VALVE
2 STATOR SOLENOID	**6** GOVERNOR ASSEMBLY	**10** MANUAL VALVE	**14** VACUUM MODULATOR	**18** 2-3 VALVE	**22** DETENT SOLENOID
3 STATOR VALVE	**7** REGULATOR PLUG	**11** PRESSURE REGULATOR	**15** MODULATOR VALVE	**19** 2-3 MODULATOR VALVE	**23** OIL STRAINER
4 FRONT SERVO	**8** 1-2 DETENT VALVE	**12** BOOST VALVE	**16** DETENT VALVE	**20** 3-2 VALVE	**24** SUMP

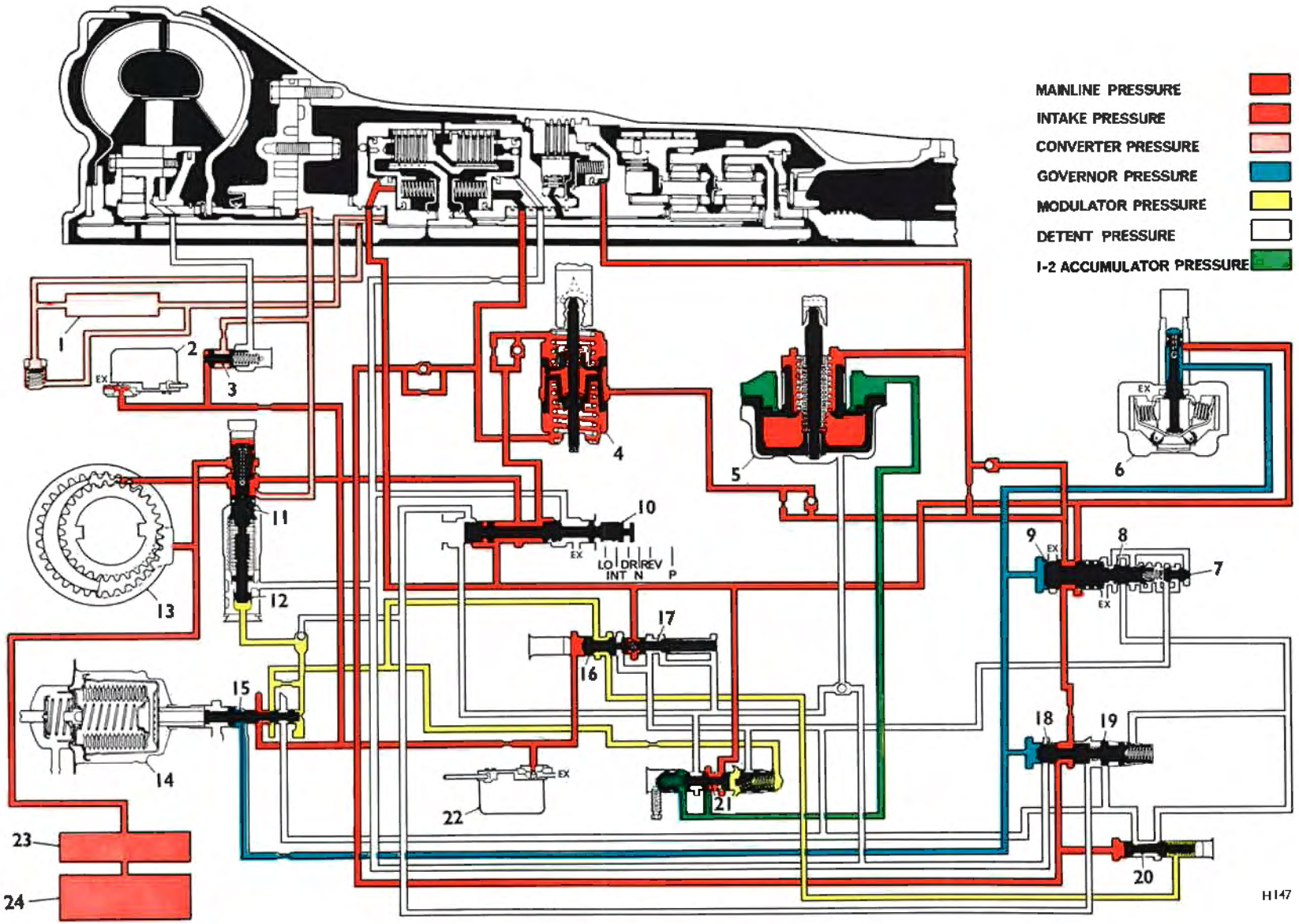

Fig. 6 Drive range — 3rd gear

1 HEAT EXCHANGER
2 STATOR SOLENOID
3 STATOR VALVE
4 FRONT SERVO
5 REAR SERVO
6 GOVERNOR ASSEMBLY
7 REGULATOR PLUG
8 1-2 DETENT VALVE
9 1-2 VALVE
10 MANUAL VALVE
11 PRESSURE REGULATOR
12 BOOST VALVE
13 PUMP
14 VACUUM MODULATOR
15 MODULATOR VALVE
16 DETENT VALVE
17 REGULATOR VALVE
18 2-3 VALVE
19 2-3 MODULATOR VALVE
20 3-2 VALVE
21 1-2 ACCUMULATOR VALVE
22 DETENT SOLENOID
23 OIL STRAINER
24 SUMP

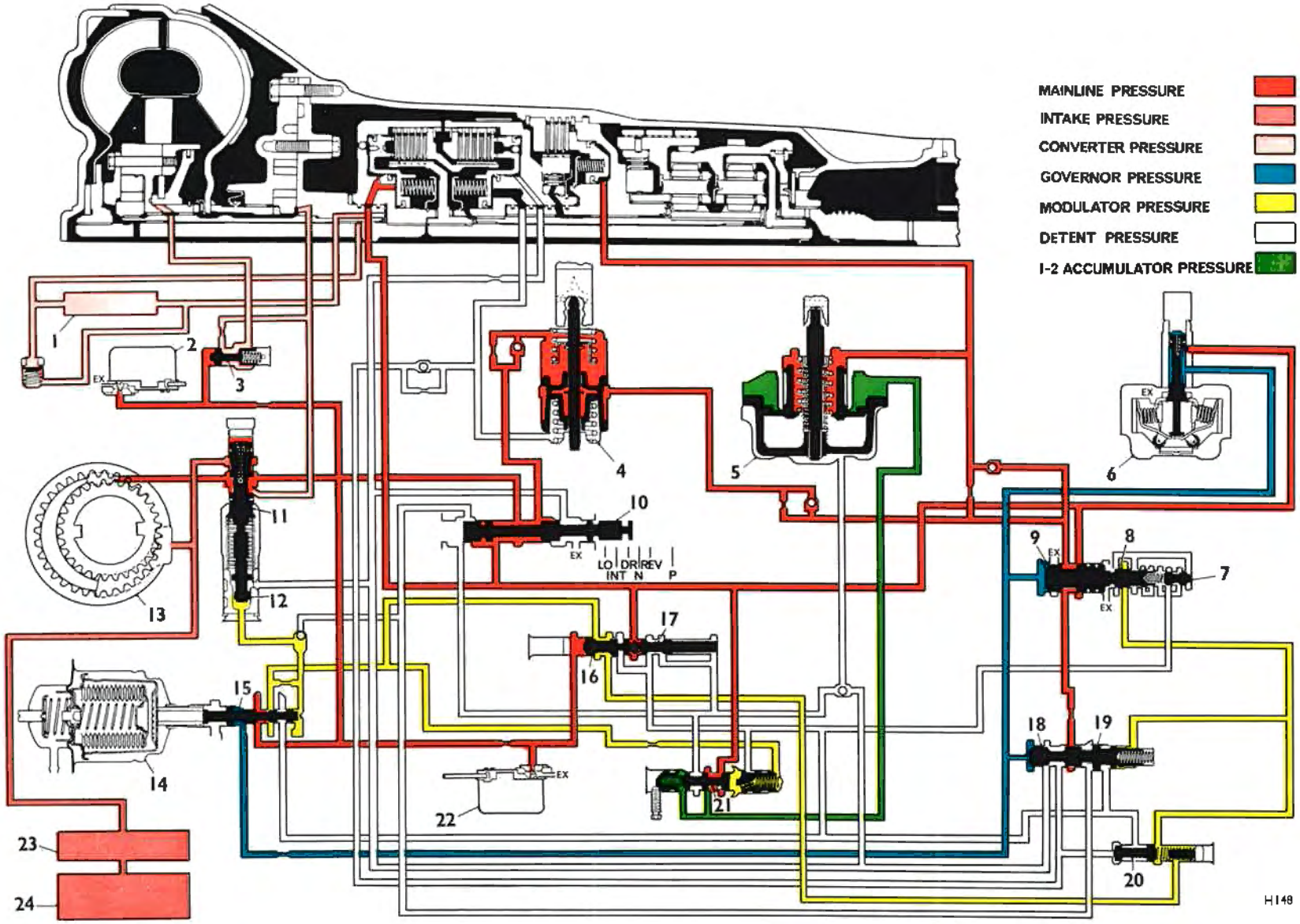

Fig. 7 Part throttle down-changes

1 HEAT EXCHANGER	**5** REAR SERVO	**9** 1-2 VALVE	**13** PUMP	**17** REGULATOR VALVE	**21** 1-2 ACCUMULATOR VALVE
2 STATOR SOLENOID	**6** GOVERNOR ASSEMBLY	**10** MANUAL VALVE	**14** VACUUM MODULATOR	**18** 2-3 VALVE	**22** DETENT SOLENOID
3 STATOR VALVE	**7** REGULATOR PLUG	**11** PRESSURE REGULATOR	**15** MODULATOR VALVE	**19** 2-3 MODULATOR VALVE	**23** OIL STRAINER
4 FRONT SERVO	**8** 1-2 DETENT VALVE	**12** BOOST VALVE	**16** DETENT VALVE	**20** 3-2 VALVE	**24** SUMP

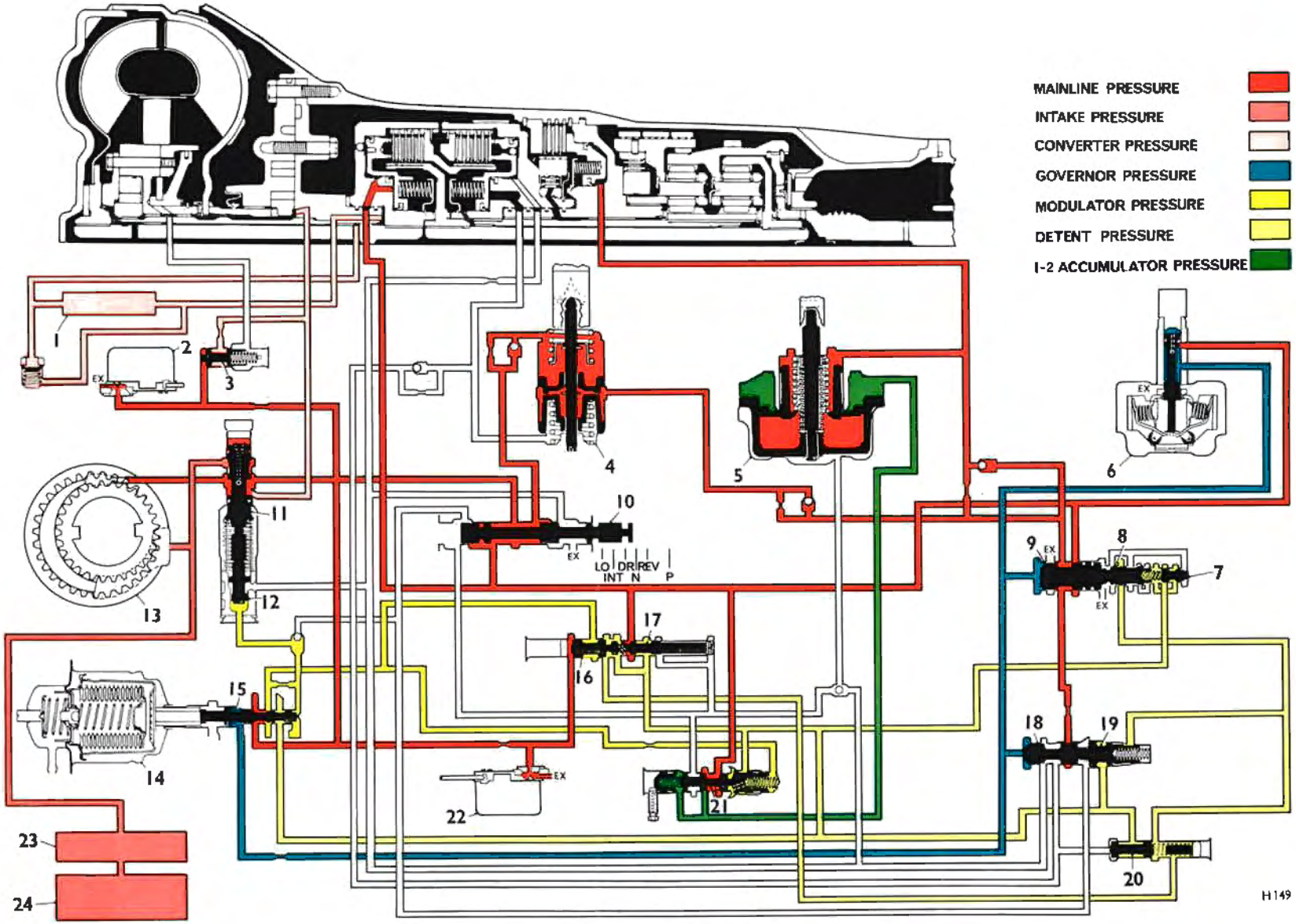

Fig. 8 Detent down-change

1 HEAT EXCHANGER
2 STATOR SOLENOID
3 STATOR VALVE
4 FRONT SERVO
5 REAR SERVO
6 GOVERNOR ASSEMBLY
7 REGULATOR PLUG
8 1-2 DETENT VALVE
9 1-2 VALVE
10 MANUAL VALVE
11 PRESSURE REGULATOR
12 BOOST VALVE
13 PUMP
14 VACUUM MODULATOR
15 MODULATOR VALVE
16 DETENT VALVE
17 REGULATOR VALVE
18 2-3 VALVE
19 2-3 MODULATOR VALVE
20 3-2 VALVE
21 1-2 ACCUMULATOR VALVE
22 DETENT SOLENOID
23 OIL STRAINER
24 SUMP

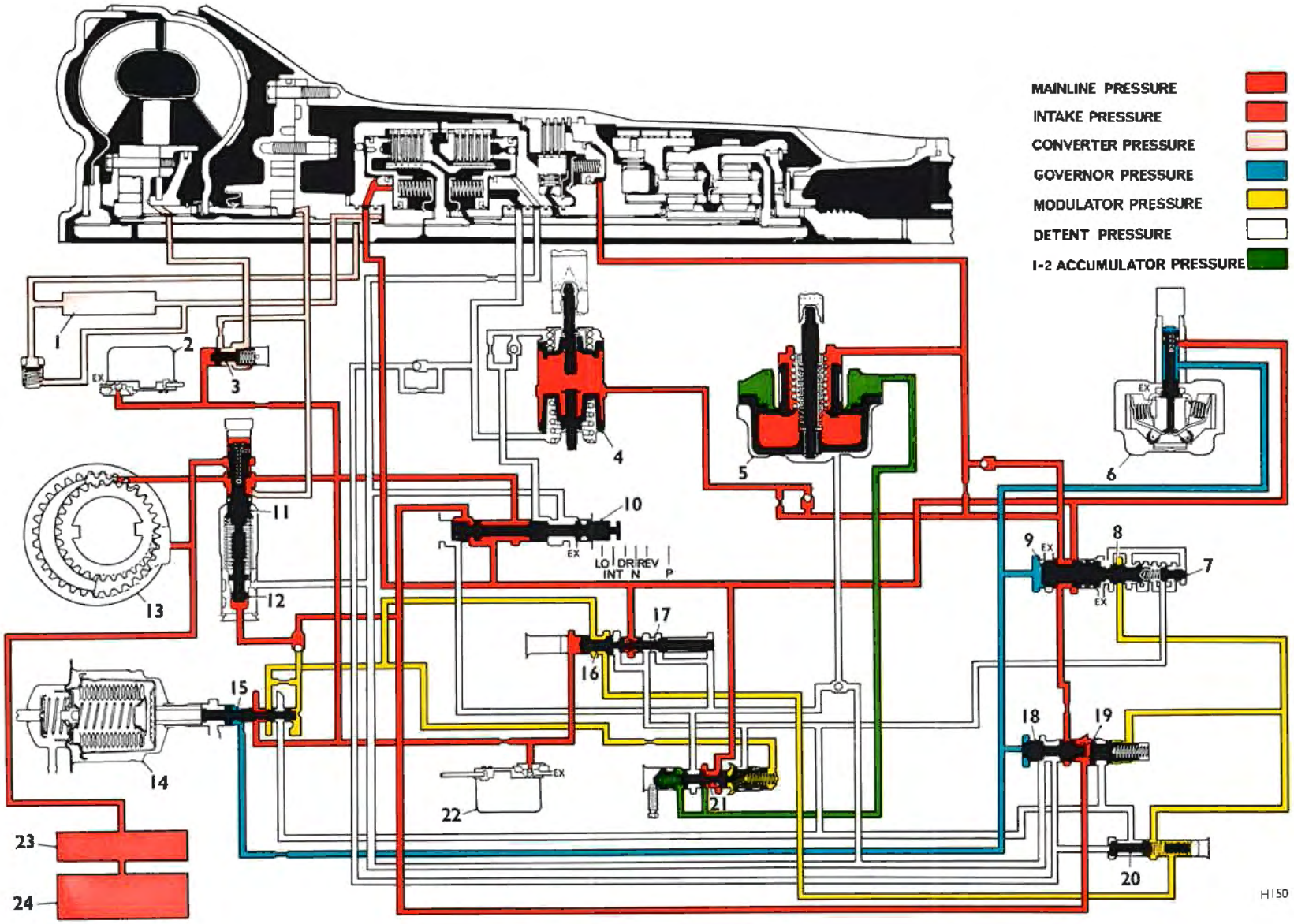

Fig. 9 Intermediate range — 2nd gear

1 HEAT EXCHANGER	**5** REAR SERVO	**9** 1-2 VALVE	**13** PUMP	**17** REGULATOR VALVE	**21** 1-2 ACCUMULATOR VALVE
2 STATOR SOLENOID	**6** GOVERNOR ASSEMBLY	**10** MANUAL VALVE	**14** VACUUM MODULATOR	**18** 2-3 VALVE	**22** DETENT SOLENOID
3 STATOR VALVE	**7** REGULATOR PLUG	**11** PRESSURE REGULATOR	**15** MODULATOR VALVE	**19** 2-3 MODULATOR VALVE	**23** OIL STRAINER
4 FRONT SERVO	**8** 1-2 DETENT VALVE	**12** BOOST VALVE	**16** DETENT VALVE	**20** 3-2 VALVE	**24** SUMP

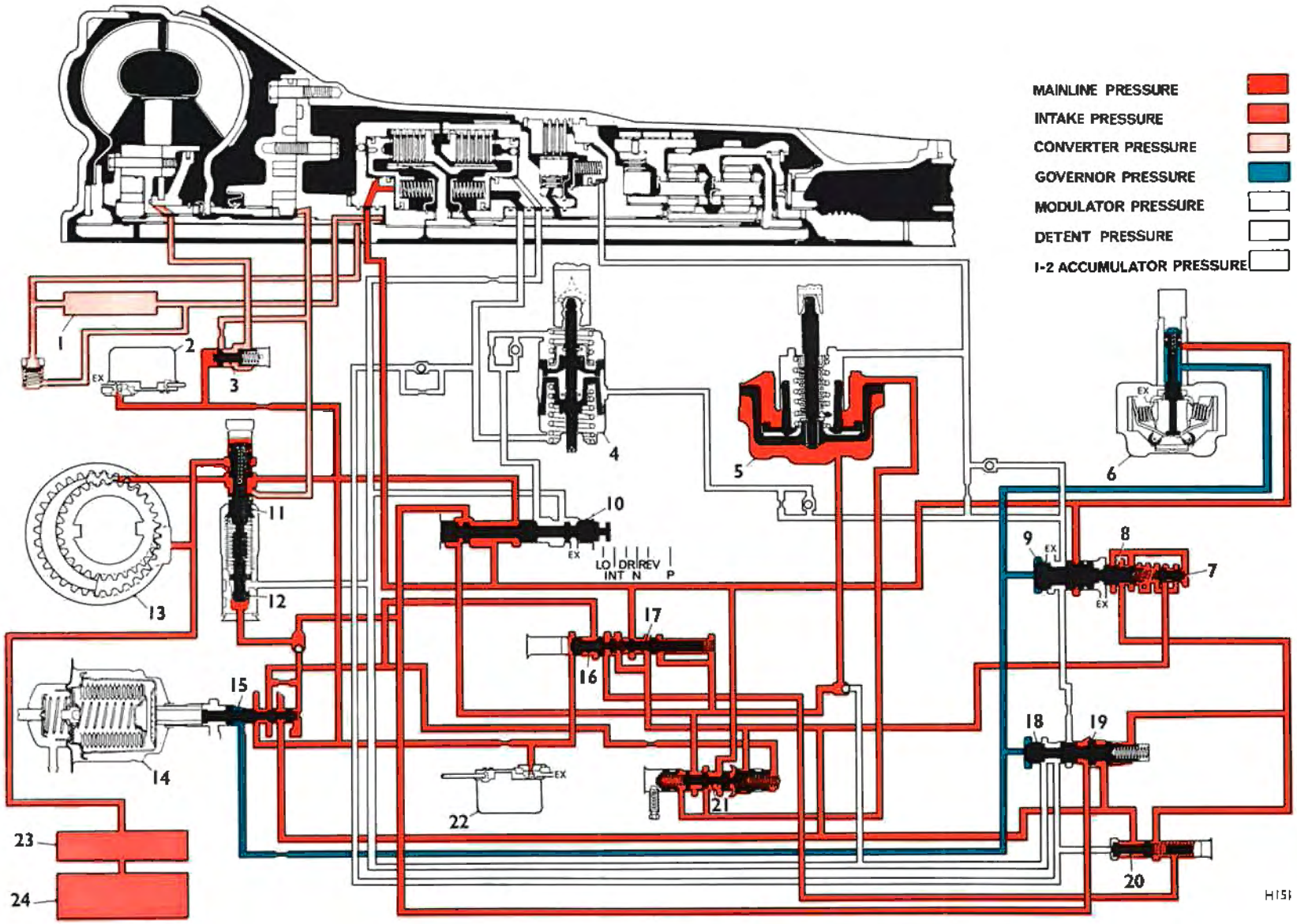

Fig. 10 Low range — 1st gear

1 HEAT EXCHANGER	**5** REAR SERVO	**9** 1-2 VALVE	**13** PUMP	**17** REGULATOR VALVE	**21** 1-2 ACCUMULATOR VALVE
2 STATOR SOLENOID	**6** GOVERNOR ASSEMBLY	**10** MANUAL VALVE	**14** VACUUM MODULATOR	**18** 2-3 VALVE	**22** DETENT SOLENOID
3 STATOR VALVE	**7** REGULATOR PLUG	**11** PRESSURE REGULATOR	**15** MODULATOR VALVE	**19** 2-3 MODULATOR VALVE	**23** OIL STRAINER
4 FRONT SERVO	**8** 1-2 DETENT VALVE	**12** BOOST VALVE	**16** DETENT VALVE	**20** 3-2 VALVE	**24** SUMP

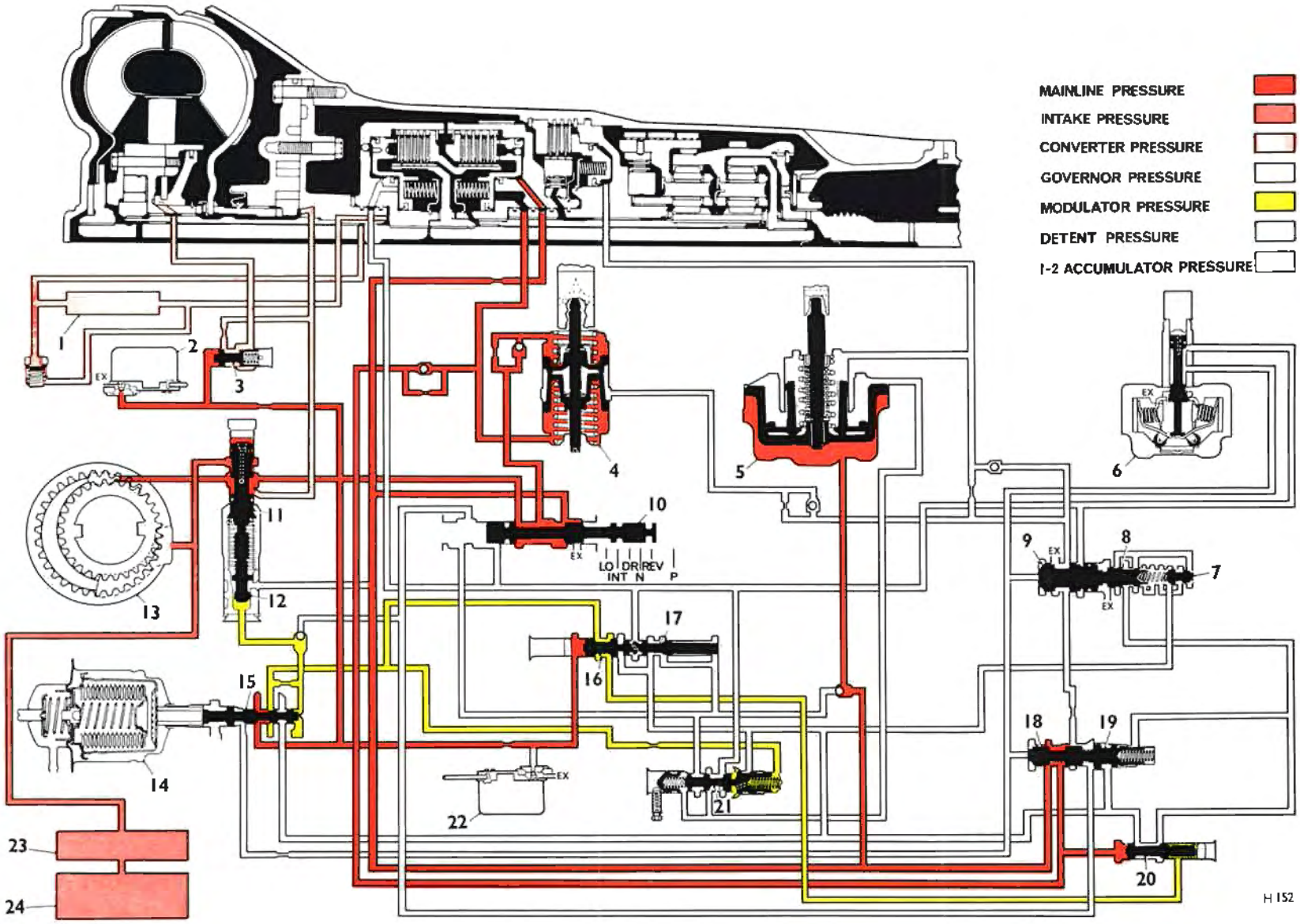

Fig. 11 Reverse

1 HEAT EXCHANGER	**5** REAR SERVO	**9** 1-2 VALVE	**13** PUMP	**17** REGULATOR VALVE	**21** 1-2 ACCUMULATOR VALVE
2 STATOR SOLENOID	**6** GOVERNOR ASSEMBLY	**10** MANUAL VALVE	**14** VACUUM MODULATOR	**18** 2-3 VALVE	**22** DETENT SOLENOID
3 STATOR VALVE	**7** REGULATOR PLUG	**11** PRESSURE REGULATOR	**15** MODULATOR VALVE	**19** 2-3 MODULATOR VALVE	**23** OIL STRAINER
4 FRONT SERVO	**8** 1-2 DETENT VALVE	**12** BOOST VALVE	**16** DETENT VALVE	**20** 3-2 VALVE	**24** SUMP

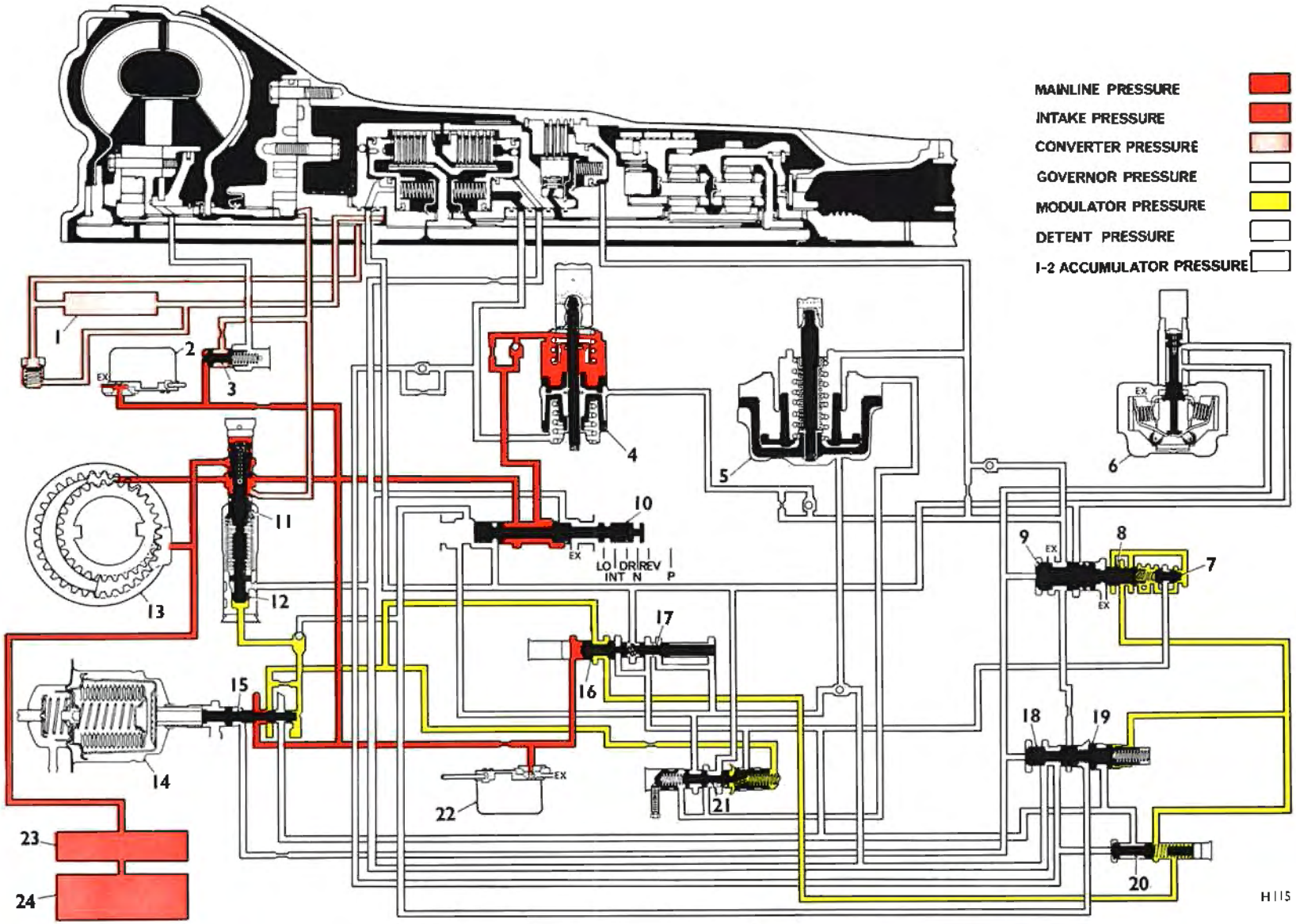

Fig. 12 Neutral — engine running

1 HEAT EXCHANGER	**5** REAR SERVO	**9** 1-2 VALVE	**13** PUMP	**17** REGULATOR VALVE	**21** 1-2 ACCUMULATOR VALVE
2 STATOR SOLENOID	**6** GOVERNOR ASSEMBLY	**10** MANUAL VALVE	**14** VACUUM MODULATOR	**18** 2-3 VALVE	**22** DETENT SOLENOID
3 STATOR VALVE	**7** REGULATOR PLUG	**11** PRESSURE REGULATOR	**15** MODULATOR VALVE	**19** 2-3 MODULATOR VALVE	**23** OIL STRAINER
4 FRONT SERVO	**8** 1-2 DETENT VALVE	**12** BOOST VALVE	**16** DETENT VALVE	**20** 3-2 VALVE	**24** SUMP

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opening, by opposing governor oil on the shift valves and also to raise line pressure proportional to engine torque.

1-2 shift valve

This valve controls the speeds at which the 1–2 and 2–1 changes occur.

1-2 regulator valve

The 1–2 regulator valve regulates modulator pressure to a proportional pressure, and tends to hold the 1–2 shift valve in the down-change position.

1-2 detent valve

The 1–2 detent valve senses regulated modulator pressure which tends to hold the 1–2 shift valve in the 2own-change position and provides an area for detent dressure for 2–1 detent changes.

p-3 shift valve

This valve controls the speeds at which the 2–3 and 3–2 changes occur.

2-3 modulator valve

The 2–3 modulator valve is sensitive to modulator pressure and applies a variable force on the 2–3 shift valve which tends to hold the 2–3 shift valve in the down-change position.

3-2 valve

The 3–2 valve prevents modulator pressure from acting on the shift valves after the direct clutch has been applied. This allows fairly heavy throttle operation in third gear without effecting a down-change. In third gear, detent pressure or modulator pressure above 92 lb/sq.in. (6,5 kg/sq.cm.) can be directed to the shift valves to provide the necessary force to effect the down-change.

1-2 accumulator valve

The 1–2 accumulator valve is sensitive to modulator oil and regulates drive oil to a proportionally lesser value. The pressure increases as modulator pressure increases and is used to control the engagement of the intermediate clutch.

Detent valve

The detent valve moves when line oil is exhausted from the end of the valve when the detent solenoid is energised. As a result, detent oil is directed to the 1–2 and 2–3 modulator valves and allows the detent regulator valve to regulate.

Detent regulator valve

When the detent valve moves, the detent regulator is freed and allows drive oil to enter the detent passage at a regulated pressure of 70 lb/sq.in. (4,9 kg/sq.cm.). Detent oil will flow also into the modulator passages which lead to the shift valves. Low oil moves the detent regulator to accept drive oil, allowing drive oil to enter the modulator and detent passages.

Stator valve

The stator valve moves when line oil at the end of the valve is exhausted as the stator solenoid is energised. This exhausts oil from the variable pitch stator piston and changes the angle of the blades from low to high. When the stator solenoid is not energised, converter oil is directed to the stator piston and low angle is obtained.

Rear servo and accumulator assembly

The rear servo applies the rear band for engine braking in Low range 1st. gear. It also applies the rear band in Reverse to hold the reaction carrier to provide the reverse gear ratio.

During the 1–2 up-change in Drive and Intermediate ranges the servo acts as an accumulator for the intermediate clutch oil to provide a smooth up-change.

Front servo

The front servo applies the 2nd. overrun band to provide engine braking in 2nd. gear in Low and Intermediate ranges. It is used also as an accumulator for direct clutch oil during the application of the direct clutch and, in conjunction with a series of check balls which control orifices, is part of the timing for the release of the direct clutch.

To prevent the application of the 2nd. overrun band in Neutral, Drive or Reverse, oil is directed from the manual valve to the release side of the servo piston.

In 'D' range, the servo release oil from the manual valve is used to charge the servo in preparation for the application of the direct clutch.

Direct clutch oil is directed to the front servo accumulator piston where spring force, plus direct clutch pressure, stroke the piston up against the force of servo release oil. This lowers the clutch apply pressure for a smooth engagement.

The release of the direct clutch and the exhausting of the front servo accumulator is slowed down by three check balls and three orifices. This permits a tsmooth return of the drive load to the intermediae sprag and also allows the engine r.p.m. to increase during a detent 3–2 down-change in preparation for the lower gear ratio, which results in a smooth change and better acceleration.

The position of the shift valves in each range and gear, and the various oil passages which are used are shown in Figures 4 to 12. The operation of the valves when each gear is selected is described in the following paragraphs.

Drive and Intermediate — First gear

Power flow

Forward clutch – applied. Direct clutch – released.

Intermediate clutch – released. Low sprag – effective. Front band – released. Intermediate sprag – ineffective. Rear band – released.

With the selector lever in either Drive or Intermediate range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear clockwise. (Converter torque ratio is approximately 2 : 1 at stall).

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear anti-clockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2·5 : 1. Reaction of the front pinions against the front internal gear is taken by reaction carrier and sprag assembly to the transmission case. (Approximate stall ratio – 5 : 1).

Oil flow

When the selector lever is moved to either Drive or Intermediate position, the manual valve is repositioned to allow line pressure to enter the drive circuit. Drive oil then flows to the following (see Fig. 4):

Forward clutch
1–2 shift valve
Governor assembly
1–2 accumulator valve
Detent regulator valve

Basic control

Drive oil is directed to the forward clutch where it acts on two areas of the clutch piston to apply the forward clutch. The first, or inner area, is fed through an unrestricted passage. The outer area is fed through an orifice to ensure a smooth change from Park, Neutral and Reverse to Drive.

Drive oil at the governor assembly is regulated to a variable pressure. This pressure increases with car speed and acts against the ends of the 1–2 and 2–3 shift valves and an area on the modulator valve.

Drive oil is regulated also to another variable pressure at the 1–2 accumulator valve. This pressure is controlled by modulator oil and is directed to the rear servo. 1–2 accumulator oil at the rear servo acts on the accumulator piston.

Stator blade angle

When at idle, the stator blades are at high angle (stator solenoid activated). This is true also under heavy throttle operation due to the second stator solenoid being activated.

At light or medium throttle (as shown), the second solenoid is not activated. Line pressure moves the stator valve against its spring, allowing converter oil to act on the stator piston positioning the blades at low angle.

Summary

The converter is filled and the stator blades are at high or low angle, depending upon throttle position. The forward clutch is applied. The transmission is in first gear.

Drive — Second gear

Power flow

Forward clutch – applied. Direct clutch – released. Intermediate clutch – applied. Low sprag – ineffective. Front band – released. Intermediate sprag – effective. Rear band – released.

In second gear the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against anti-clockwise rotation. Turbine torque through the forward clutch is then applied clockwise through the mainshaft to the rear internal gear.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1·5 : 1.

Oil flow

As the car speed and the governor pressure increases, the force of governor oil acting on the 1–2 shift valve will overcome the force of re-regulated modulator oil pressure. This allows the 1–2 shift valve to open, permitting drive oil to enter the intermediate clutch passage.

Intermediate clutch oil from the 1–2 shift valve is directed to the following (see Fig. 5):

Intermediate clutch
Rear servo
Front servo and accumulator pistons
2–3 shift valve

Basic control

Intermediate clutch oil from the 1–2 shift valve seats a one-way check ball and flows through an orifice to the intermediate clutch piston to apply the intermediate clutch. At the same time, intermediate clutch oil moves the accumulator piston against the 1–2 accumulator oil and accumulator spring to maintain lower pressure in the clutch during a 1–2 shift for a smooth clutch application. Intermediate clutch oil seats a second one-way check ball and flows to the front servo and accumulator pistons. Intermediate clutch oil is also directed to a land of the 2–3 shift valve.

Summary

The forward and intermediate clutches are applied. The transmission is in second gear.

Drive — Third gear

Power flow

Forward clutch – applied. Direct clutch – applied.

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Intermediate clutch – applied. Low sprag – ineffective. Front band – released. Intermediate sprag – ineffecitve. Rear band – released.

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

Oil flow

As car speed and governor pressure increase, the force of governor oil acting on the 2–3 shift valve overcomes the force of 2–3 shift valve spring and modulator oil. This allows the 2–3 shift valve to move, feeding intermediate clutch oil to the direct clutch passage.

Direct clutch oil from the 2–3 shift valve is directed to the following (see Fig. 6):

Direct clutch
Front accumulator piston
3–2 valve

Basic control

Direct clutch oil from the 2–3 shift valve flows past a one-way check valve to the inner area of the direct clutch piston to apply the direct clutch. Simultaneously, direct clutch oil is fed to the front accumulator piston. Pressure of the direct clutch oil, combined with the accumulator spring, moves the accumulator and servo pistons against servo oil. This acts as an accumulator for a smooth direct clutch application.

Direct clutch oil is supplied also to the 3–2 valve to move the valve against modulator pressure. This cuts off modulator oil to the 1–2 regulator and 2–3 modulator valves and allows the transmission to utilize the torque multiplying characteristics of the variable pitch converter.

Stator blade angle

The degree of converter torque multiplication is dependent upon the angle of the stator blades which is controlled by the stator solenoid. When activated, line oil acting on the solenoid and stator valve is exhausted at the solenoid. The stator valve spring will move the stator valve cutting off converter oil to the stator piston. Converter charge pressure will move the stator piston, positioning the stator blades at high angle.

Summary

The forward, intermediate and direct clutches are applied. The transmission is in third gear (direct drive).

Part throttle down-change

Power flow

Forward clutch – applied. Direct clutch – released. Intermediate clutch – applied. Low sprag – ineffective. Front band – released. Intermediate sprag – effective. Rear band – released.

In second gear, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against anti-clockwise rotation. Turbine torque through the forward clutch is then applied clockwise through the mainshaft to the rear internal gear.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1·5 : 1.

Oil flow

A part throttle 3–2 down-change can be accomplished below approximately 33 m.p.h. (53 km.p.h.) by depressing the accelerator far enough to raise modulator pressure to approximately 92 lb/sq.in. (6,5 kg/sq.cm.). Modulator pressure and the 3–2 valve spring will move the 3–2 valve against direct clutch oil and allow modulator oil to act on the 2–3 modulator valve. This moves the 2–3 valve train against governor oil and changes the transmission to second gear (see Fig. 7).

Detent down-change

Power flow

Forward clutch – applied. Direct clutch – released. Intermediate clutch – applied. Low sprag – ineffective. Front band – released. Intermediate sprag – effective. Rear band – released.

In second gear, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against anti-clockwise rotation. Turbine torque through the forward clutch is then applied clockwise through the mainshaft to the rear internal gear.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1·5 : 1.

Oil flow

While operating at speeds below approximately 70 m.p.h. (113 km.p.h.) a forced or detent 3–2 down-change is possible by depressing the accelerator pedal so that the kick-down button is depressed. This engages the switch at the carburetter and actuates the detent solenoid. The detent solenoid opens an orifice that allows line oil at the detent valve to be exhausted, thus permitting the detent regulator valve to operate. Line oil acting on the detent valve and solenoid is supplied by a small orifice.

Drive oil on the detent regulator valve is then regulated to a pressure of approximately 70 lb/sq.in. (4,9

kg/sq.cm.) and called detent oil. Detent oil is then routed to the following (see Fig. 8):

Modulator passage
1–2 regulator valve
2–3 modulator valve
3–2 valve
1–2 primary accumulator valve
Vacuum modulator valve

Detent oil in the modulator passage and at the 2–3 modulator valve will close the 2–3 shift valve, changing the transmission to second gear.

A detent 2–1 down-change can also be accomplished below approximately 20 m.p.h. (32 km.p.h.) because detent oil is directed to the 1–2 regulator valve. This allows detent oil to act on the 1–2 regulator, and 1–2 detent valve to close the 1–2 shift valve, changing the transmission to first gear.

To ensure clutch durability during 1–2 up-changes under detent conditions, detent oil is directed to the 1–2 accumulator primary valve to increase 1–2 accumulator oil pressure acting on the rear servo accumulator piston.

Detent oil is directed also to the modulator valve to prevent modulator pressure from regulating below 70 lb/sq.in. (4,9 kg/sq.cm.) at high speeds or at high altitudes.

Intermediate — Second gear

Power flow

Forward clutch – applied. Direct clutch – released. Intermediate clutch – applied. Low sprag – ineffective. Front band – applied. Intermediate sprag – effective. Rear band – released.

In second gear, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against anti-clockwise rotation. Turbine torque through the forward clutch is now applied clockwise through the mainshaft to the rear internal gear.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1·5 : 1.

In second gear, engine braking is provided by the front band as it holds the sun gear fixed. Without the band applied, the sun gear would overrun the intermediate sprag.

Oil flow

When the selector lever is in Intermediate, intermediate oil from the manual valve is directed to the following: (see Fig. 9).

Pressure boost valve
2–3 shift valve

Intermediate oil at the boost valve will increase line pressure to 150 lb/sq.in. (10,5 kg/sq.cm.). This increased intermediate oil pressure at the 2–3 shift valve will close the 2–3 shift valve, regardless of car speed.

For engine braking the front band is applied by exhausting servo oil at the manual valve. This allows intermediate clutch oil, acting on the servo piston, to move the piston and apply the front band. Once the transmission is in second gear – Intermediate, it cannot change to third gear regardless of car speed.

Summary

The forward and intermediate clutches and front band are applied. The transmission is in second gear – Intermediate.

Low range — First gear

Power flow

Forward clutch – applied. Direct clutch – released. Intermediate clutch – released. Low sprag – effective. Front band – released. Intermediate sprag ineffective. Rear band – applied.

With the selector lever in Low range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear clockwise. (Converter torque ratio is approximately 2·0 : 1 at stall).

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear anti-clockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier and output shaft clockwise in a reduction ratio of approximately 2·5 : 1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and sprag assembly to the transmission case. (Total stall ratio is approximately 5 : 1).

Downhill or overrun braking is provided in Low range by applying the rear band as this prevents the reaction carrier from overrunning the Low sprag.

Oil flow

Maximum downhill braking can be attained at speeds below 40 m.p.h. (64 km.p.h.) with the selector lever in Low position as this directs Low oil from the manual valve to the following: (see Fig. 10).

Rear servo
1–2 accumulator valve
Detent regulator valve

Basic control

Low oil flows past a ball check to the apply side of the rear servo piston and to the 1–2 accumulator valve to raise the 1–2 accumulator oil to line pressure for a smooth band application.

Low oil acts on the detent regulator valve. Combined with the detent spring, Low oil holds the detent

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valve against line oil acting on the detent valve, causing drive oil to flow through the detent regulator valve into the detent and modulator passages. Modulator and detent oil at line pressure acting on the 1–2 regulator and 1–2 detent valve overcomes governor oil on the 1–2 shift valve at any vehicle speed below approximately 40 m.p.h. (64 km.p.h.) and the transmission will change to first gear.

In first gear – Low range, the transmission cannot up-change to second gear regardless of car or engine speed.

Summary

The forward clutch and rear band are applied. The transmission is in first gear – Low range.

Reverse

Power flow

Forward clutch – released. Direct clutch – applied. Intermediate clutch – released. Low sprag – ineffective. Front band – released. Intermediate sprag – ineffective. Rear band – applied.

In Reverse, the direct clutch is applied to direct turbine torque to the sun gear shaft and sun gear. The rear band is also applied, holding the reaction carrier.

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

Oil flow

When the selector lever is moved to the Reverse position, the manual valve is repositioned to allow oil at line pressure to enter the reverse circuit. Reverse oil then flows to the following (see Fig. 11):

Direct clutch
2–3 shift valve
Rear servo piston
Pressure boost valve

Basic control

Reverse oil from the manual valve flows to the large area of the direct clutch piston and to the 2–3 shift valve. From the 2–3 shift valve, it enters the direct clutch passage and is directed to the small area of the direct clutch piston to apply the direct clutch.

Reverse oil flows to the rear servo and acts on the servo piston to apply the rear band. Reverse oil acts also on the pressure boost valve to boost line pressure.

Summary

The direct clutch and the rear band are applied. The transmission is in Reverse.

Park or Neutral — Engine running

Power flow

Forward clutch – released. Direct clutch – released. Intermediate clutch – released. Low sprag – ineffective. Front band – released. Intermediate sprag – ineffective. Rear band – released.

In Neutral or Park no bands or clutches are applied, therefore no power is transmitted.

Oil flow

Whenever the engine is running at idle with the selector lever in 'P' or 'N', oil from the pump is directed to the following (see Fig. 12):

Pressure relief valve	Manual valve
Torque converter	Detent valve
Oil cooler	Detent solenoid
Oil cooler by-pass valve	Vacuum modulator valve
Lubrication system	Front servo (Neutral only)
Stator valve	Stator solenoid and valve.

Cooling and lubrication

Oil flows from the pump to the pressure regulator valve which regulates pump pressure. When the pump output exceeds the demand of line pressure, oil from the pressure regulator is directed to the transmission heat exchanger by-pass valve. Oil from the heat exchanger is directed to the transmission lubrication system.

The heat exchanger by-pass valve permits oil to be fed directly from the converter to the lubrication circuits if the heat exchanger becomes restricted.

Line pressure acts on the following:

Manual valve
Detent valve
Detent solenoid
Modulator valve
Stator valve
Stator solenoid

Line pressure at the modulator valve is regulated to a pressure called modulator oil, which acts on the pressure boost valve, 1–2 accumulator and primary valves, and passes through the detent valve and the 3–2 valve to the 1–2 and 2–3 valve trains.

Stator blade angle

Line oil at the stator valve and stator solenoid is exhausted through an orifice at the solenoid, when the solenoid is activated at engine idle speeds. This allows the stator valve spring to move the stator valve, cutting off converter oil and allowing stator oil to exhaust. Converter pressure then positions the stator blades at high angle.

Summary

The torque converter is filled, stator blades are at high angle and all clutches and bands are released. The transmission is in Neutral.

CHAPTER 2

SERVICING

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CHAPTER 2
SERVICING

Section 1
Periodic Maintenance

Fluid level — To check

General

Car attitude and fluid temperature are particularly important when checking the fluid level on a Turbo Hydra-Matic Transmission. Careful attention to the following procedure is necessary in order to determine the actual fluid level.

Fluid recommendations

Whenever fluid is added, use only a Type 'A' Transmission Fluid, designated AQ/ATF, followed by three

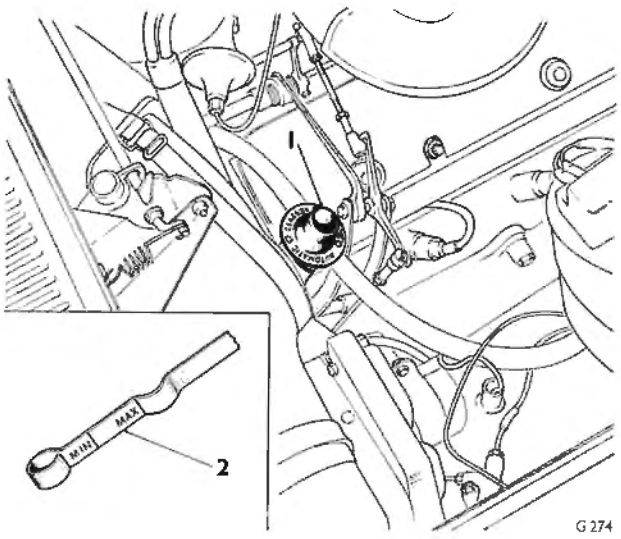

Fig. 13 Transmission dipstick

1 DIPSTICK
2 MINIMUM AND MAXIMUM FLUID LEVEL MARKS

or four numerals and the suffix letter 'A'. Only a fluid bearing the suffix letter 'A' in its designation should be used, as this indicates a superior grade of transmission fluid. The following is a list of recommended fluids.

General Motors	..	Hydra-Matic Fluid AQ ATF Type A Suffix A
B.P.	.. ..	ATF Type A Suffix A
Castrol	.. ..	Castrol TQ Type A Suffix A
Esso	.. ..	Esso Automatic Transmission Fluid Type A Suffix A
Mobil	.. ..	Mobilfluid 200 Type A Suffix A
Shell	.. ..	Donax T6 Type A Suffix A

The transmission dipstick and filler tube are situated on the right-hand side of the engine and are easily accessible when the bonnet is raised (see Fig. 13).

The transmission sump should be drained every 12,000 miles (20000 km.) or 12 months, whichever occurs first. Fresh fluid should be added to maintain the correct level on the dipstick (see Fig. 14).

The fluid intake system incorporates an intake pipe and strainer assembly. This assembly should be renewed after the first 24,000 miles (40000 km.) or two years, whichever occurs first. In the event of a major failure in the transmission, the strainer must be renewed.

To check and add fluid

The level of the transmission fluid should be checked at every engine oil change. The full 'MAX' and low 'MIN' marks on the dipstick are approximately $\frac{7}{8}$ pint (Imp.), 1 pint (U.S.), 0,45 litre apart and should be used to determine the correct fluid level at the normal operating temperature of 170°F. (76·7°C.). Careful attention to transmission fluid temperature is necessary because the correct fluid level at low operating temperatures will be below the 'MIN' mark on the dipstick (see Fig. 14), and the correct fluid level at higher operating temperatures will rise above the 'MAX' mark. Fluid level must always be checked when the car is on an even, level surface and with the engine running to ensure that the converter is full. To determine the correct fluid level proceed as follows.

Run the car on the road for approximately 20 minutes. This will ensure that the transmission has reached normal operating temperature. Stop the car.

Allow the engine to idle slowly and check the fluid level.

With the engine running, add fluid as required to bring it to the correct level (see Fig. 14).

To drain the sump and renew the intake pipe and strainer assembly

Run the car onto a ramp or over an inspection pit.

Place a clean container, minimum capacity 5 pints (Imp.) 6 pints (U.S.) 2,8 litres under the sleeve nut which secures the filler tube to the side of the sump.

Slacken the clips which secure the filler tube. Slacken the sleeve nut at the base of the tube and allow the fluid to drain into the container.

Remove the dipstick and filler tube from the sump.

Remove the sump; discard the gasket.

Drain the remainder of the fluid from the sump. Examine the residue for signs of wear in the transmission then wash the sump in clean paraffin (kerosene). Thoroughly dry the sump with clean compressed air.

Remove the intake pipe and strainer; discard the 'O' ring.

Fit a new 'O' ring into the intake pipe bore in the transmission case then fit the new intake pipe and strainer.

Fit the sump, using a new gasket. Torque tighten the setscrews to 12 lb.ft.(1,66 kgm.).

Fit the oil filler tube, positioning the clips before tightening the sleeve nut.

Add 5 pints (Imp.) 6 pints (U.S.) 2,8 litres of fresh clean transmission fluid through the filler tube.

Note When draining the sump and **not** renewing the intake pipe and strainer, add only $3\frac{1}{8}$ pints (Imp.) 4 pints (U.S.) 1,9 litres of fluid.

Run the engine at a fast idle for approximately 90 seconds with the selector lever in 'P' position.

Reduce the engine speed to slow idle and check the fluid level. This should be approximately 1.80in. **below** the 'MAX' mark when the transmission is cold (20°C., 68°F.).

Caution **Do not overfill** as foaming may occur when the fluid warms up. If the fluid level is too low, especially when cold, complete loss of drive may result after quick stops. Extremely low fluid levels will result in damage to the transmission.

To fill a dry transmission unit

The fluid capacity of a Turbo Hydra-Matic Transmission, including the torque converter, is approximately $18\frac{3}{8}$ pints (Imp.) $22\frac{1}{2}$ pints (U.S.) 10,6 litres, but the correct level is determined by the marks on the dipstick rather than by the quantity of fluid added. It is important that the correct level be maintained. When the transmission has been overhauled and a complete fill is required, including the torque converter, proceed as follows.

Pour approximately $11\frac{1}{2}$ pints (Imp.) 14 pints (U.S.) 6,5 litres through the filler tube.

Run the engine at a fast idle for approximately 90 seconds with the selector lever in 'P' position.

Reduce the engine speed to slow idle and check the fluid level. This should be approximately 1.80 in. **below** the 'MAX' mark when the transmission is cold (20°C., 68°F.)

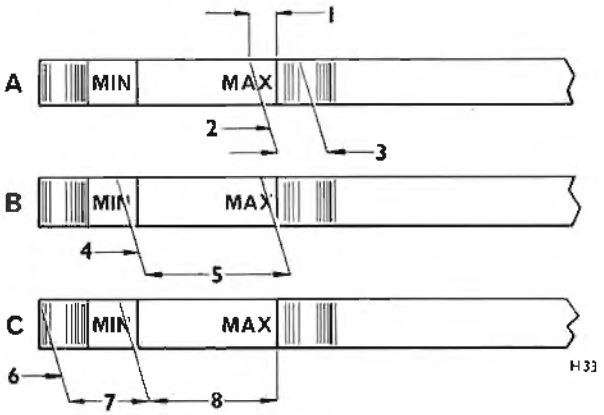

Fig. 14 Transmission fluid level showing correct fluid level range

A AT EXTREME OPERATING TEMPERATURE 210°F. to 250°F. (98.9°C. to 121°C.)
1 $\frac{1}{8}$ in. (3,2 mm.)
2 1 PINT (0,57 LITRE) LOW (APPROX.)
3 13/64 in. (5,2 mm.)
B AT NORMAL OPERATING TEMPERATURE 140°F. to 170°F. (60°C. to 76.7°C.)
4 1 PINT (0,57 LITRE) LOW (APPROX.)
5 13/16 in. (20,6 mm.)
C AT LOW OPERATING TEMPERATURE 80°F. to 110°F. (26.7°C. to 43.3°C.)
6 $\frac{1}{2}$ PINT (0,28 LITRE) LOW (APPROX.)
7 27/64 in. (10,7 mm.)
8 25/32 in. (19,8 mm.)

To check for leaks

Whenever the transmission has been dismantled, completely or partially, the following procedure must be observed to minimise the possibility of fluid leakage.

Always fit new gaskets and 'O' ring seals.

Use a small amount of petroleum jelly to hold a gasket in position during assembly. Do not use a sealing compound (e.g. Wellseal) with a gasket.

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Ensure that the composition cork and paper gaskets are not wrinkled or creased when fitted. Ensure that gaskets have not shrunk or stretched during storage.

Ensure that square-sectioned 'O' rings are correctly fitted and are not twisted.

Ensure that all mating faces are clean and free from burrs and damage.

Possible leakage points

When examining the transmission for leaks, determine whether the fluid originates from the transmission or the engine. The original factory fill fluid in the transmission is formulated with a red aniline dye to assist in locating the source of leakage. If the colour of the dye cannot be detected in the transmission fluid, add a red aniline dye preparation to the fluid. Red dye appearing in the leaking fluid will positively identify the source of the leak.

If the fluid is known to be leaking from the transmission, examine the following areas.

Front end

It will be necessary to remove the bell housing bottom cover and the lower front cover plate in order to examine the transmission for leakage at the front end.

To correct a leak at the front end, the transmission will have to be removed from the car.

If the pump oil seal is suspected of leaking fluid, ensure that the seal has been correctly fitted and is not damaged.

When fitting a new seal (see Section 12 Chapter 3) ensure that the seal bore in the case is clean and that the seal garter spring is fitted. Examine the finish on the converter neck and the bearing surface in the pump body.

Examine for damage the pump square-sectioned 'O' ring and the gasket.

Ensure that the 'O' rings on the pump securing setscrews are correctly fitted and are not damaged.

Examine the torque converter for leakage (see Section 3, Chapter 3).

Rear extension

Examine for damage the rear extension lip-type seal. Examine the finish on the sliding coupling.

Ensure that the square-sectioned 'O' ring at the front of the rear extension has been correctly fitted and is not damaged.

Note On later transmissions, the 'O' ring is superseded by a gasket, fitted between the joint faces.

Check the securing setscrews for correct torque tightness.

Examine the housing for cracks or porosity.

Transmission case

Examine the speedometer drive 'O' ring and lip-type seal. Ensure that the securing setscrew is torque tightened.

Examine the governor cover gasket. Ensure that the setscrews are torque tightened.

Examine for damage the detent and stator connector 'O' ring.

Examine for damage the parking pawl shaft 'O' ring.

Examine for damage the manual shaft 'O' ring.

Examine for damage the vacuum modulator 'O' ring. Ensure that the retaining setscrew is torque tightened.

Examine the vacuum modulator for possible damage to the diaphragm.

Note If the transmission is found to be consistently low on fluid, check the modulator to make certain that there is no split in the diaphragm. Apply suction to the vacuum tube and check for leaks. A split diaphragm would allow transmission fluid to be drawn into the engine induction manifold and vacuum line. This condition can usually be detected because the exhaust will be excessively smoky due to the transmission fluid being added to the combustion mixture.

Examine the sump gasket. Check the torque tightness of the securing setscrews.

Check the torque tightness of the main line pressure tapping plug.

Examine the breather pipe for damage.

Ensure that the transmission has not been overfilled.

Check for coolant in the transmission fluid.

Examine the case for cracks or porosity.

Heat exchanger connections

Ensure that the heat exchanger transmission fluid pipes are correctly fitted and are not damaged. Ensure that the nuts are tight.

Dipstick and filler tube

Examine the flared end of the dipstick and filler tube for cracks or damage. Examine the spherical seat in the sump. Ensure that the sleeve nut is tightened sufficiently to nip the tube securely to the sump.

Internal leaks

It will be necessary to remove the sump in order to determine the source of internal leaks.

Check the governor pipes for security and damage.

Examine the rear servo cover gasket for damage. Ensure that the square-sectioned 'O' ring is fitted correctly and is not damaged. Torque tighten the cover securing setscrews.

Examine the control valve unit assembly and oil guide plate gaskets. Check the torque tightness of the unit securing setscrews.

Examine the solenoid gaskets for damage. Check the

torque tightness of the solenoid securing setscrews.

Examine the intake pipe 'O' ring for damage.

Control joints — To lubricate

During initial assembly, the clevis pins in the manual control linkage are lubricated with Rocol 265 grease and should be similarly treated whenever they are removed.

The emergency (Get-You-Home) lever pivots on an Oilite bush and should not require lubrication.

When a car is being serviced, the opportunity should be taken to check the controls for correct operation and to lubricate all the control joints with a few drops of light oil.

Manual shaft — To lubricate

As part of the normal controls maintenance procedure, it is recommended that the manual shaft be lubricated with a few drops of oil at the point where it enters the transmission case.

If a manual shaft shield is fitted, the shaft should not require lubrication.

Section 2
Testing

Before road testing the car to check the functioning of the transmission, carry out the following checks.

Check the fluid level and top-up, if necessary.

Ensure that the engine and transmission are at normal operating temperature (170°F. or 76·7°C.).

Ensure that the gearchange actuator is operating satisfactorily.

Check the manual linkage and adjust, if necessary (see Section 4 of this Chapter).

Check the operation of the detent and stator switches and adjust, if necessary (see Section 4 of this Chapter).

If the oil pressure is to be checked, fit a gauge. The car can then be road tested, using all the selector ranges. Note when any operating faults occur. Check the gearchange pattern as follows.

Gearchange pattern check

Drive range

Select 'D' range, then accelerate the car from standstill. A 1–2 and a 2–3 up-change should occur at all throttle openings.

Note The change points will vary according to throttle opening.

As the speed of the car decreases to a stop, the 3–2 and the 2–1 down-changes should occur.

Intermediate range

Select 'I' range, then accelerate the car from standstill. A 1–2 up-change should occur at all throttle openings. A 2–3 up-change cannot be obtained in this Range. The 1–2 up-change point will vary according to throttle opening.

As the speed of the car decreases to a stop, the 2–1 down-change should occur.

Low range

Select 'L' range. No up-change should occur in this Range, regardless of throttle opening.

2nd. gear overrun braking

Select 'D' range. When a speed of approximately 35 m.p.h. (56 km.p.h.) has been reached, move the selector lever to the 'I' range position; the transmission should change down to 2nd. gear. An increase in the speed of the engine as well as an engine braking effect should be observed. Line pressure should change from 70 lb/sq.in. (4,9 kg/sq.cm.) to approximately 150 lb/sq.in. (10,5 kg/sq.cm.).

1st. gear — downhill or overrun engine braking

Select 'I' range. When the speed of the car is approximately 30 m.p.h. (48 km.p.h.) – not exceeding 40 m.p.h.(64 km.p.h.) – and at constant throttle, move the selector to 'L' range. An increase in engine r.p.m. and a braking effect should be noticed as the downchaneg occurs.

Stator angle change — above 40° throttle opening

Select 'I' range. Accelerate in 2nd. gear on a slight incline. A change in stator angle should be felt.

Note If the stator change cannot be felt, check the operation of the solenoid and micro switches with the test box as described in Section 4 – Controls.

Oil pressure — To check

Before attempting to check oil pressure or to road test the car, always ensure that the level of fluid in the transmission is correct (see Section 1, Chapter 2).

The pressure can be checked with the transmission in the car by using an oil pressure gauge coupled to the main line tapping in the left-hand side of the transmission case.

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Clean any dirt from around the line pressure plug; remove the plug.

Fit adaptor RH.7914 into the main line tapping; tighten the adaptor.

Screw a pressure gauge, 0 lb/sq.in. to 300 lb/sq.in. (0 kg/sq.cm. to 21,1 kg/sq.cm.) onto the adaptor then position the gauge so that it can be seen from the driver's seat. This can be achieved by removing the carpet from the driver's side then removing the rubber plug from the side of the transmission tunnel. Run the gauge pipe through the hole then couple it to the adaptor (see Fig. 15). Ensure that the gauge pipe does not interfere with the gearchange linkage.

Drive the car until the transmission has reached normal operating temperature 170°F. (76·7°C.).

Check the fluid level and correct, if necessary.

The following checks may be carried out during road test.

Engine idle pressure check

Select 'D' range then drive the car at approximately 30 m.p.h. (48 km.p.h.) with the throttle eased back. The line pressure should be 70 lb/sq.in. (4,9 kg/sq.cm.). Select 'I' range then drive the car to obtain a steady road load, speed 25 m.p.h. (40 km.p.h.). Line pressure should be 150 lb/sq.in. plus or minus 5 lb/sq.in. (10,5 kg/sq.cm. plus or minus 0,35 kg/sq.cm.).

Full throttle pressure check

Jack up the rear of the car then rest it on blocks so that the rear wheels are clear of the ground.

Disconnect the vacuum line at the induction manifold. Blank off the orifice in the manifold. Run the engine at a fast idle (700 r.p.m. to 1000 r.p.m.) in Neutral. The oil pressure should be 145 lb/sq.in. (10,2 kg/sq.cm.).

Repeat the procedure in Reverse. Reverse pressure should be 150 lb/sq.in. plus or minus 5 lb/sq.in. (10,5 kg/sq.cm. plus or minus 0,35 kg/sq.cm.).

Connect the vacuum pipe.

If either the idle pressure or full pressure check was low, examine the modulator for a loose securing screw, collapsed bellows or a sticking modulator valve.

Also check the pressure regulator valve for signs of sticking, a plugged orifice or a collapsed spring. Examine the regulator boost valve for signs of sticking.

If either the idle or full pressure check is high, check the vacuum line and the modulator for leaks or a sticking valve.

Also check the pressure regulator valve and boost valve for sticking.

Towing

Cars which are fitted with the GM 400 transmission cannot be started by pushing the car.

If the engine cannot be started by the starter motor, the car should be towed to the nearest service station.

If the transmission, propeller shaft, final drive unit and drive-shafts are serviceable, the car may be towed, in Neutral (N) at speeds of up to 45 m.p.h. (72 km.p.h.) for distances of up to 50 miles (80 kilometres).

When higher towing speeds, or extended mileage is necessary, it is recommended that the propeller shaft be disconnected or the rear wheels raised clear of the road.

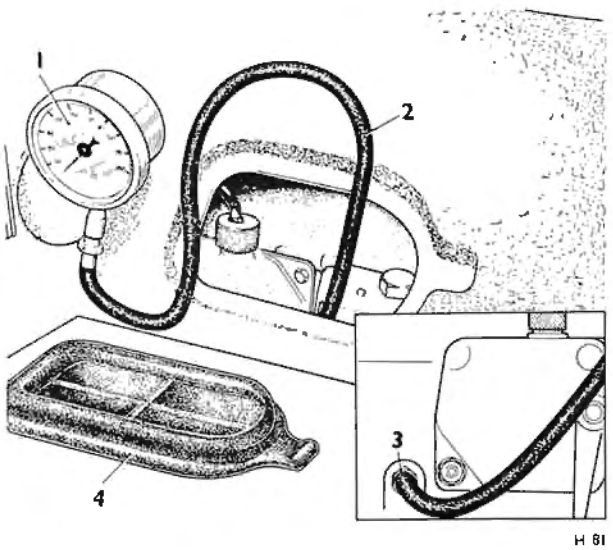

Fig. 15 Checking the oil pressure

1 OIL PRESSURE GAUGE
2 GAUGE PIPE
3 PIPE ADAPTOR (RH7914)
4 RUBBER COVER

Before towing, check the fluid level in the transmission. The level must be **above** the MAX mark on the dipstick when the engine is **not running.** The car must always be towed with the transmission in Neutral.

If it is necessary to raise either the front or the rear part of the car when towing, the wheels should be raised so that they just clear the ground. When towing with the rear wheels raised, secure the steering wheel with the front road wheels in the 'straight ahead' position.

Section 3
Fault Diagnosis

Introduction

Accurate diagnosis of transmission problems begins with a thorough understanding of normal transmission operation. In particular, knowing which units are involved in the various speeds and gears is essential so that the specific unit or fluid flow path can be isolated and investigated further.

The following diagnosis table lists the various diagnosis operations in the sequence in which they are to be performed.

Following the chart will, in most cases, correct the condition without having to remove the transmission from the car.

The instructions must be followed in exact sequence as any deviation will result in incorrect diagnosis.

The following sequence of tests may help to simplify the diagnosis of defects and should be performed first.

1 Check fluid level.
2 Warm up engine and transmission.
3 Check manual controls.
4 Check detent and stator switches.
5 Road test car.

Note If possible, test the car with the Customer as a passenger. It is possible that the condition which the Customer requires correcting is a normal function of the transmission, thus, unnecessary work can be avoided.

DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	ACTION
1 No drive in Drive range.	1 Insufficient fluid in transmission.	1 Top-up to the correct level on the dipstick. Look for excessive leaks. Examine the modulator for a leaking diaphragm.
	2 Low oil pressure.	2 Check for a damaged or missing 'O' ring in oil strainer bore. Check for a blocked oil strainer. Check regulator valve. Remove transmission, check welding at neck of torque converter. Remove and examine the oil pump.
	3 Car battery flat making actuator inoperable.	3 Fit new battery. Also check the thermal cut-out in the fuse box.
	4 Manual linkage incorrectly adjusted or disconnected.	4 Correctly adjust the manual controls.
	5 Loose or faulty control valve unit.	5 Check the torque tightness of the securing setscrews. Ensure that the manual valve is connected. Remove and overhaul the unit, if necessary.
	6 Slipping forward clutch.	6 Remove the transmission. Remove the forward clutch. Check the following items. (*a*) Missing or broken oil seal ring. (*b*) Leaking inner or outer piston seal. (*c*) Sticking check ball. (*d*) Worn clutch plates.
	7 Incorrectly fitted sprag or inoperative sprag (sprags turned over).	7 Remove and dismantle the transmission. Overhaul the rear sprag assembly.
	8 Oil seal rings (pump feed-to-forward clutch) missing or broken. Leak in circuit or pump-to-case gasket damaged or incorrectly fitted.	8 Remove the transmission. Remove the pump. Check the seals and gaskets. Renew as required.
2 1–2 up-change at full throttle only.	1 Defective or sticking detent micro switch.	1 Check the micro switch. Listen for the solenoid to operate.
	2 Faulty or incorrectly fitted solenoid.	2 Test the solenoid and renew, if necessary. If the solenoid operates but the 1–2 up-change is unobtainable, check the solenoid for: (*a*) Loose securing setscrews.

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DIAGNOSIS — continued

SYMPTOM	POSSIBLE CAUSE	ACTION
1-2 up-change at full throttle only—continued.		(*b*) Missing or incorrectly fitted solenoid gasket. (*c*) Blocked solenoid orifice.
	3 Heavy internal leak.	3 Check the case for internal leaks, blocked oilways or missing plugs.
3 No 1–2 up-change below 20 m.p.h. (32 km.p.h.).	1 The two leads to the case connector incorrectly fitted.	1 Correctly connect the stator and detent solenoid leads as described in Chap. 2, Sect. 4 – Controls.
4 Only first speed obtainable. No 1–2 up-change.	1 Detent solenoid failing to operate due to faulty micro switch.	1 Check the micro switch. Listen for the solenoid to operate.
	2 Faulty or incorrectly fitted solenoid.	2 Test the solenoid and renew, if necessary. If the solenoid operates but the change point is unobtainable, check the solenoid for: (*a*) Loose securing setscrews. (*b*) Missing or incorrectly fitted solenoid gasket. (*c*) Blocked solenoid orifice.
	3 Sticking governor valve.	3 Remove the governor. Free the valve, or renew the unit, if necessary.
	4 Loose or faulty control valve unit.	4 Check the torque tightness of the securing setscrews. If necessary, remove and overhaul the control valve unit. Look for a sticking 1–2 valve train.
	5 Slipping intermediate clutch due to worn piston seals or worn clutch plates.	5 Remove the transmission. Overhaul the intermediate clutch.
	6 Centre support securing screw not tight.	6 Remove the control valve unit. Torque tighten the setscrew.
	7 Heavy internal leak.	7 Check the case for internal leaks, blocked oilways or missing plugs.
5 First and second speeds only. No 2–3 up-change.	1 Detent solenoid failing to operate due to a faulty micro switch.	1 Check the micro switch. Listen for the solenoid to operate.
	2 Detent solenoid sticking in the open position. This would give detent up-changes only. The 2–3 up-change would occur at a very fast speed and may not be noticed.	2 If the solenoid will operate when the micro switch is operated, check for slack setscrews, incorrectly fitted gasket or a blocked orifice. If not, check the electrical connections or renew the solenoid, if necessary.
	3 Sticking governor valve.	3 Remove the governor. Free the valve or renew the unit, as necessary.
	4 Sticking 2–3 shift valve train. Damaged or incorrectly fitted gaskets between the control valve unit, oil guide plate and case.	4 Remove the control valve unit. Check for a sticking valve in the 2–3 train. Valves should be free to fall in the bore under their own weight. Check the gaskets and renew, if necessary.
	5 Slipping direct clutch due to leaking piston seals, missing or sticking piston check ball, broken oil sealing rings on the centre support, worn clutch plates, or a slack centre support setscrew.	5 Remove the transmission and overhaul the direct clutch assembly.
6 Drive in Neutral.	1 Manual linkage incorrectly adjusted.	1 Correctly adjust the manual linkage.
	2 Forward clutch will not release. **Note** This condition will also cause no Reverse.	2 Remove the transmission and overhaul the forward clutch. Air test before fitting it to the transmission.
7 No drive in Reverse or slips in Reverse.	1 Insufficient fluid in the transmission.	1 Top-up to the correct level on the dipstick.
	2 Manual linkage incorrectly adjusted.	2 Correctly adjust the linkage.
	3 Low oil pressure.	3 Check the vacuum modulator. Check the modulator valve for freedom of movement. Look for a restriction in the oil strainer or a leak at the intake pipe. Check the regulator valve and the boost valve for freedom of movement.

DIAGNOSIS — continued

SYMPTOM	POSSIBLE CAUSE	ACTION
No drive in Reverse or slips in Reverse—continued	4 Control valve body gaskets damaged or incorrectly fitted. Note Other faults will be indicated by this.	4 Remove the control valve unit and fit new gaskets, if necessary.
	5 Low/Reverse check ball missing from case. Note This will also cause no overrun braking in Low range.	5 Remove the control valve unit and check the position of all the check balls (see Fig. 79).
	6 2–3 valve train sticking open. Note This will cause a 1–3 up-change in Drive range.	6 Remove the control valve unit. Check the 2–3 train for freedom of movement.
	7 Reverse feed passage blocked.	7 Remove the transmission from the car. Check the continuity of the reverse passages (see Fig. 17).
	8 Damaged rear servo piston seal. Short band apply pin. Note A short band apply pin will also give no overrun braking or 'slippy' overrun braking in Low range.	8 Remove the rear servo. Check the piston seal. Check for a correct band apply pin.
	9 Forward clutch will not release. Note This will also cause drive in Neutral.	9 Remove the transmission. Overhaul the forward clutch.
	10 Damaged direct clutch outer seal. Burned clutch plates. Sticking check ball in piston.	10 Remove the transmission. Overhaul the direct clutch assembly. Check for a sticking check ball if the plates are burned.
	11 Reverse or Low band worn or damaged.	11 Examine the band for burned or loose linings, damaged anchor or apply pins or a broken band.
8 Slipping in all ranges or slips when starting.	1 Insufficient fluid in the transmission.	1 Top-up to the correct level on the dipstick.
	2 Low oil pressure.	2 Check the vacuum modulator. Check the modulator valve for freedom of movement. Look for a restriction in the oil strainer or a leak at the intake pipe. Check the regulator valve and the boost valve for freedom of movement.
	3 Slipping forward and direct clutches.	3 Remove the transmission. Examine the clutch plates. If the plates are burned try to determine the cause e.g. ensure check balls are free, check clutch return springs, check oil passages.
	4 Low sprag incorrectly fitted or sprags turned over.	4 Remove the transmission and dismantle. Overhaul the rear sprag assembly.
	5 Internal leak.	5 Check the case for internal leaks, blocked oilways or missing plugs.
9 Slips – 1–2 up-change.	1 Insufficient fluid in the transmission.	1 Top-up to the correct level on the dipstick.
	2 Low oil pressure.	2 Check the vacuum modulator. Ensure that the vacuum modulator is free in its bore. Ensure that the pressure regulator valve is not sticking.
	3 Sticking 1–2 valve train or a porous valve body or case.	3 Remove the control valve unit. Check the 1–2 shift valve train for freedom of movement. Check the body for porosity in the vicinity of the 1–2 shift valve.
	4 Damaged oil seal ring in the rear accumulator or damaged accumulator bore in the case.	4 Remove and examine the rear servo. Examine the accumulator bore and clean up, if possible.
	5 Damaged front accumulator oil seal ring.	5 Remove the front servo and examine. Fit a new oil seal ring, if necessary.
	6 Damaged intermediate clutch piston seals or burned clutch plates. Slack centre support securing setscrew.	6 Remove the transmission. Check the piston seals and clutch plates and renew, if necessary. Check the tightness of the centre support securing setscrew.

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DIAGNOSIS — continued

SYMPTOM	POSSIBLE CAUSE	ACTION
Slips - 1-2 up-change - continued	7 Leaking intermediate clutch plug or porosity between channels.	7 Remove and dismantle the transmission. Check the case for porosity and ensure that the plugs are secure.
10 Rough 1–2 up-change.	1 Insufficient fluid in the transmission.	1 Top-up to the correct mark on the dipstick.
	2 Slack setscrews in control valve unit, sluggish or sticking 1–2 shift valve train or gaskets incorrectly fitted.	2 Remove the control valve unit, check the 1–2 shift valve train. Ensure that the gaskets are correctly fitted. Torque tighten the securing setscrews.
	3 Damaged oil seal rings in the rear servo accumulator. Piston sticking. Broken spring or a damaged piston bore.	3 Remove the rear servo and overhaul.
	4 Intermediate clutch check ball missing or not seating. Porosity between channels.	4 Remove the control valve unit. Ensure that the check ball is serviceable. Check the case for porosity.
11 Slipping 2–3 up-change.	1 Insufficient fluid in the transmission.	1 Top-up to the correct mark on the dipstick.
	2 Low oil pressure.	2 Check the vacuum modulator. Ensure that the modulator valve is free in its bore. Ensure that the pressure regulator valve is not sticking. Remove the transmission and check the pump-to-case gasket.
	3 Leak at accumulator piston pin.	3 Remove the control valve unit and check the accumulator piston pin for a leak at the swaged end.
	4 Leaking direct clutch piston seals. Damaged case centre support oil seal rings. Excessive leak between the tower and the bush.	4 Remove the transmission and overhaul the direct clutch. Examine the centre support. Renew the rings or the support as required.
	5 Porous case.	5 Remove and dismantle the transmission. Check the case for porosity.
12 Rough 2–3 up-change.	1 High oil pressure.	1 Check the vacuum modulator. Ensure that the valve is free in its bore. Examine the pressure regulator valve and bush.
	2 Broken spring in front accumulator or sticking accumulator piston.	2 Remove the control valve unit and overhaul the front servo.
13 No engine braking in Intermediate range – second gear.	1 Leaking or broken oil seal rings, or scored bores in the front servo and front accumulator.	1 Remove the control valve unit and overhaul the front servo.
	2 Front band broken or burned (check for cause). Band not engaging on anchor pin and/or servo pin.	2 Remove the transmission. Examine the front band and associated components. Renew if necessary.
14 No engine braking in Low range – first gear.	1 Low/Reverse check ball missing.	1 Remove the control valve unit and ensure that all the check balls have been correctly fitted.
	2 Damaged oil seal ring, ring bore or piston in front servo. Servo apply oil leaking. Incorrect band apply pin.	2 Remove and overhaul the rear servo (correct pin length is important).
	3 Rear band broken, burned (check cause) or not engaging on anchor pins or servo pins.	3 Remove the transmission and examine the rear band and associated parts. Renew, if necessary.
15 No part throttle down-change.	1 Low oil pressure (other symptoms may be apparent).	1 Check the vacuum modulator. Ensure that the modulator valve is free in its bore. Ensure that the pressure regulator valve is not sticking.
	2 3–2 valve sticking or broken spring.	2 Remove the control valve unit and check the 3–2 valve and spring.
16 No detent down-changes.	1 Faulty detent micro switch or incorrectly adjusted controls.	1 Check the operation of the detent micro switch on the engine. Ensure that the switch is actuated correctly by the controls.
	2 Inoperative solenoid.	2 Actuate the detent micro switch and listen for the solenoid to operate. Check the circuit for continuity. Check the connections.

DIAGNOSIS — continued

SYMPTOM	POSSIBLE CAUSE	ACTION
No detent down-changes - continued	3 Sticking detent valve train.	3 Remove the control valve unit and examine the detent valve and spring.
17 Low or high change points.	1 Incorrect oil pressure.	1 Check the modulator vacuum line connections at the engine and transmission ends. Check the modulator valve and the pressure regulator valve train.
	2 Detent solenoid sticking open, slack securing setscrews or missing gasket (will also cause delayed changes).	2 Examine the detent solenoid. Check the gasket and the securing setscrews.
	3 Governor valve sticking, feed holes restricted. Pipes damaged or incorrectly fitted.	3 Remove the governor and examine the valve. Check the pipes.
	4 Sticking valves in the control valve unit.	4 Remove the control valve unit. Check the detent valve train, the 3–2 valve train and the 1–2 valve train. Check the 1–2 regulator valve (if this valve is sticking it will cause a constant 1–2 up-change point regardless of throttle opening). Check the gaskets and the spacer plate for correct fitting and check for blocked holes.
	5 Intermediate plug leaking or porous case.	5 Remove and dismantle the transmission. Check the plug and the case.
18 Car will not hold in Park position.	1 Manual linkage incorrectly adjusted.	1 Correctly adjust the manual linkage.
	2 Defective parking brake lever and actuator assembly. Parking pawl broken or inoperative.	2 Check the parking brake mechanism for correct operation. Check the chamfer on the actuator sleeve rod.
19 No convertor stator angle change.	1 Micro switch inoperative.	1 Check the micro switches on the engine. Listen for the solenoid to operate. Ensure that the throttle controls are correctly adjusted to operate both micro switches.
	2 Sticking stator valve train in the pump.	2 Remove the transmission and the pump. Check the stator valve train.
	3 Disconnected or earthed leads.	3 Check the stator solenoid circuit for continuity. Also ensure that the leads are in good condition and have good connections.
	4 Blocked or restricted feed to the stator.	4 Ensure that the feed hole in the stator shaft is clear.
	5 Converter by-pass valve broken or not fitted.	5 Examine the by-pass valve on the pump. Renew the valve, if necessary.
	6 Damaged oil seal ring on the turbine shaft. Shaft ring lands excessively worn.	6 Check the oil seal rings on the turbine shaft, also the ring lands.
	7 Stator orifice plug blocked.	7 Check that the plug orifice is clear.
	8 Defective converter assembly.	8 Pressure check the converter or renew if necessary.
20 Noisy transmission.	1 Pump noise.	1 Check for high or low oil pressure. Check for cavitation due to a blocked strainer, damaged 'O' ring, porosity in the intake system or coolant in the fluid. Remove the the transmission and pump. Check for pump gears incorrectly assembled, damaged gears or gears rubbing on the pump crescent.
	2 Gear noise – first gear, Drive range.	2 Ensure that the transmission has no metal-to-metal contact with the body. Remove the transmission and examine the planetary gear set for wear.
	3 Clutch application noisy during Neutral-to-Drive and Park-to-Drive.	3 Remove the transmission. Check the forward clutch.
	4 Noisy application during 1–2 up-change in Intermediate and Drive ranges.	4 Check the intermediate clutch plates.
	5 Noisy application during 2–3 up-change in Drive range, Neutral–to–Reverse and Park–to–Reverse.	5 Check the direct clutch plates.

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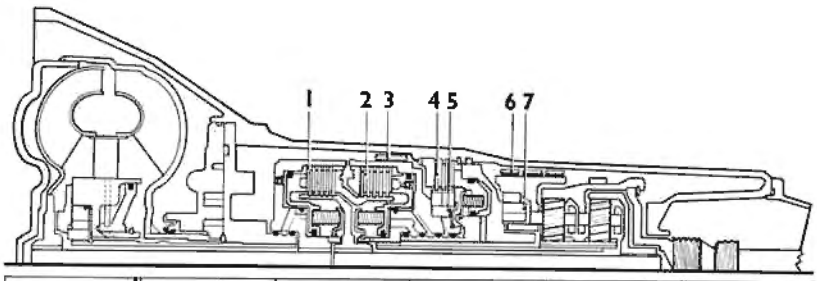
For additional information in diagnosing the faults which may occur in a Turbo Hydra-Matic Transmission, a chart showing the application of bands and clutches in the various drive ranges is shown in Figure 16. Transmission fluid passages are shown in Figures 17 and 18.



SELECTOR POSITION	Park–Neut:	Drive 1 2 3	Intermediate 1 2	Lo 1 2	Reverse
PUMP PRESSURE	70 – 160	70–160 70–160 70–160	175 – 175	175 – 175	100 – 230
FORWARD CLUTCH	OFF	ON ON ON	ON – ON	ON – ON	OFF
DIRECT CLUTCH	OFF	OFF OFF ON	OFF – OFF	OFF – OFF	ON
2nd OVERRUN BAND	OFF	OFF OFF OFF	OFF – ON	OFF – ON	OFF
INT: CLUTCH	OFF	OFF ON ON	OFF – ON	OFF – ON	OFF
INT: SPRAG	OFF	OFF ON OFF	OFF – ON	OFF – ON	OFF
REAR SPRAG	OFF	ON OFF OFF	ON – OFF	ON – OFF	OFF
REVERSE BAND	OFF	OFF OFF OFF	OFF – OFF	ON – OFF	ON

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Fig. 16 Band, sprag and clutch application chart

1 FORWARD CLUTCH
2 DIRECT CLUTCH
3 SECOND OVERRUN (FRONT) BAND
4 INTERMEDIATE CLUTCH
5 INTERMEDIATE SPRAG
6 REVERSE (REAR) BAND
7 REAR SPRAG

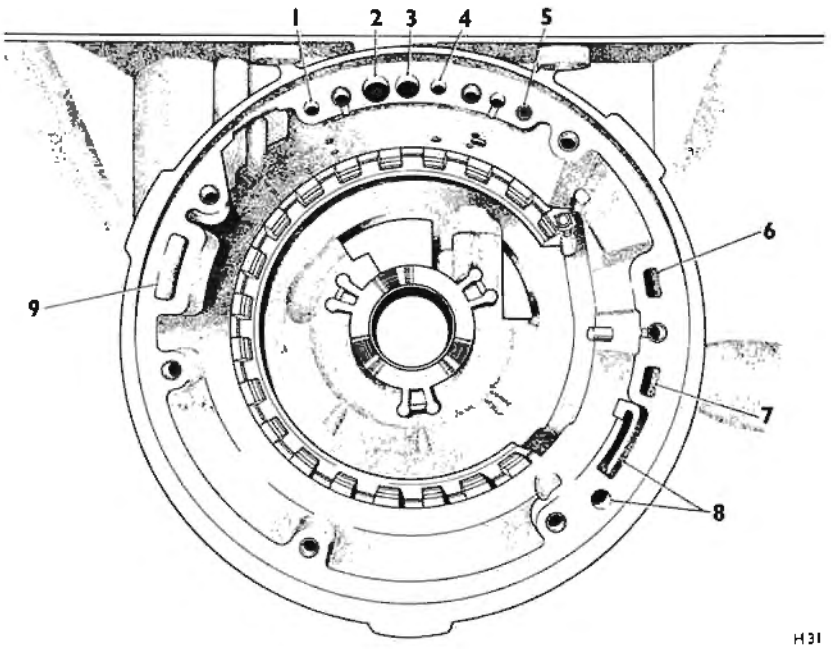

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Fig. 17 Transmission case fluid passages — front view

1 REVERSE
2 LINE
3 DRIVE
4 MODULATOR
5 STATOR SIGNAL
6 TO HEAT EXCHANGER
7 HEAT EXCHANGER RETURN
8 VENTS
9 PUMP INTAKE

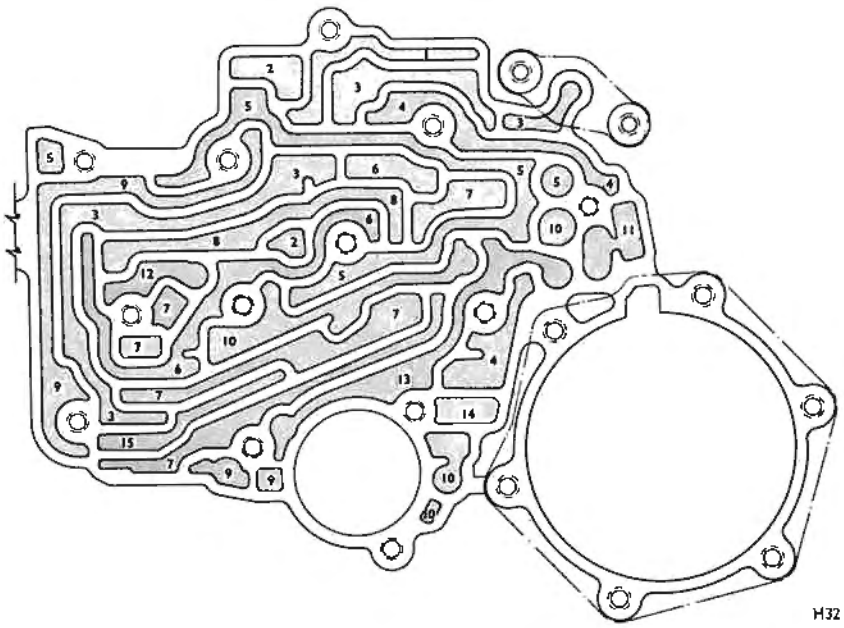

Fig. 18 Transmission case fluid passages — bottom view

1 INTERMEDIATE OIL
2 EXHAUST
3 LINE PRESSURE OIL
4 LO OIL
5 REVERSE OIL
6 DETENT OIL
7 MODULATOR OIL
8 DRIVE RANGE OIL
9 SERVO OIL
10 INTERMEDIATE CLUTCH OIL
11 REVERSE/LO OIL
12 MODULATOR/INTERMEDIATE OIL
13 DIRECT CLUTCH OIL
14 1-2 ACCUMULATOR OIL
15 GOVERNOR OIL

Section 4
Controls

Introduction

It is recommended that the controls be checked before a car is road tested. If any symptoms exhibited during a road test are shown by fault diagnosis to be attributable to controls, another check should be made before proceeding further.

Before altering transmission controls, ensure that the engine controls (throttle and choke) have been correctly adjusted and are operating freely.

Manual linkage — To adjust

Remove the split pin and clevis pin from the gearchange operating rod at the actuator end.

Select 'P' on the selector. Push the lower end of the gearchange lever fully forward ('P' position).

Connect the gearchange operating rod; fit the clevis pin but not the split pin.

Measure the gap between the neutral start and height switch lever and the adjacent pillar; the gap should measure 0·050 in. (1,27 mm.). If necessary adjust the jaw to obtain the required gap. Ensure that there is still clearance when the 3° overrun on the actuator, beyond the Park position, is used up.

Select 'L' on the actuator then select 'P'. Adjust the operating rod so that the clevis pin will slide into the jaw and through the lever.

Select each of the gear positions in turn, and at each position, ensure that the clevis pin will slide easily into the jaw.

Again, check that the pin will slide easily into the jaw when 'L' is selected after 'P' and when 'P' is selected immediately after 'L'.

If, in any position, the pin will not pass through the jaw and lever, adjust the length of the rod and use up the elongated hole in the jaw.

Finally, lubricate the clevis pin, fit the pin and secure it with a new split pin.

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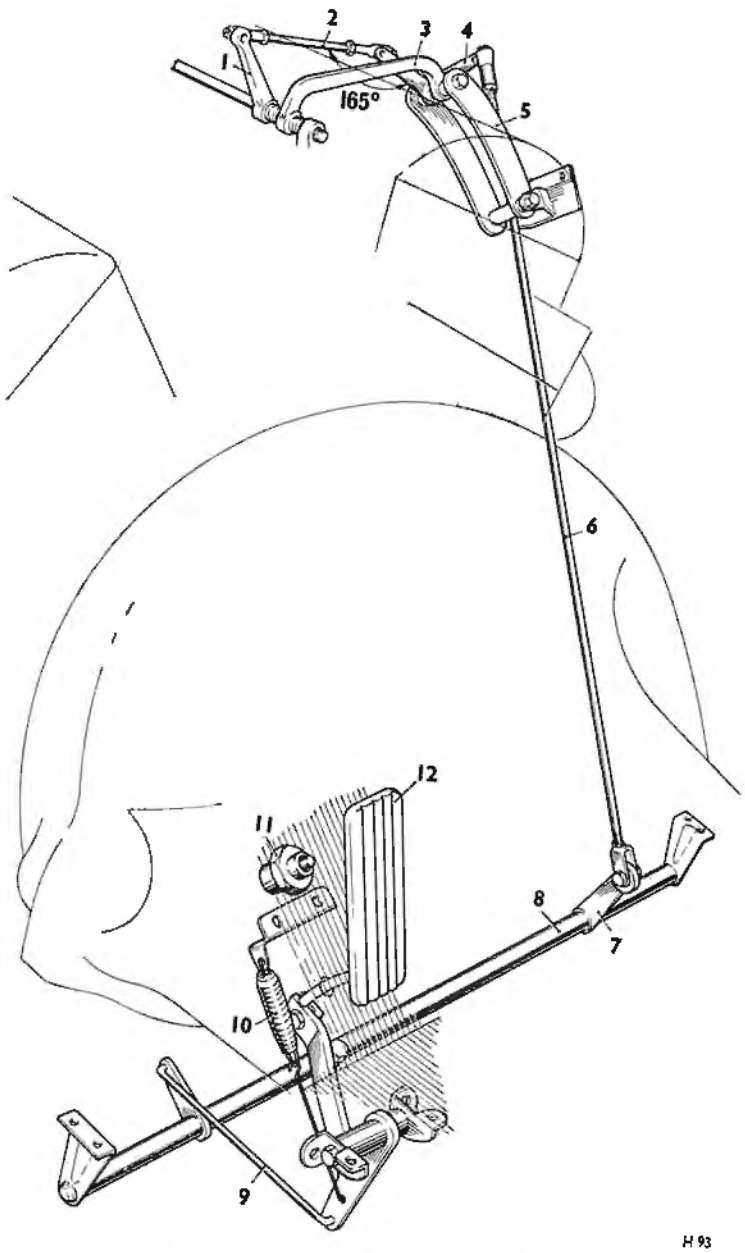

Fig. 19 Throttle controls

1 LEVER—'A' BANK CONTROL SHAFT
2 CONTROL ROD—'A' BANK CONTROL SHAFT TO FULCRUM LEVER
3 TIE ROD
4 FULCRUM LEVER
5 COMPENSATOR LINK
6 CONTROL ROD—ACCELERATOR CROSS-SHAFT TO FULCRUM LEVER
7 LEVER—ACCELERATOR CROSS-SHAFT
8 CROSS-SHAFT
9 CONNECTING ROD
10 PULL-OFF SPRING
11 KICK-DOWN BUTTON AND PEDAL STOP
12 ACCELERATOR PEDAL

Neutral start and height control switches — To adjust

The neutral start and height control switches are housed in an aluminium case, fitted to the left-hand side of the transmission. The switches are actuated whenever Neutral or Park is selected. This enables the engine to be started either in Neutral or Park and also sets the height control to **fast** levelling.

To adjust the switches, proceed as follows.

Disconnect the white and red lead at the starter relay. The relay is fitted to the compensating linkage bracket at the rear of the engine compartment, at the right-hand side.

Unclip the rubber retainer then remove the left-hand valance plug from the socket. The plug and socket are secured to the valance, directly below the hydraulic system reservoir.

Connect a lamp and battery between the white/red lead and the white/black lead in the plug.

When either Neutral or Park is selected, the lamp should light.

Select Reverse and Drive. Ensure that the lamp does

not light in either of these positions.

If necessary, adjust the switch actuating rod to obtain the correct lever position. Ensure that the 0·050 in. (1,27 mm.) clearance is maintained between the lever and the pedestal.

Remove the lamp and battery then connect the leads.

Accelerator pedal linkage — To adjust

Before attempting to set the control switches, ensure that the accelerator pedal and engine throttle controls are correctly adjusted. Check the setting of the controls as follows, referring to Figure 19 for identification of the rods and levers.

Check the length of rod (2) which connects the vertical lever on 'A' bank cylinder head cross-shaft to the fulcrum lever (4). Initially it should be set at $1\frac{15}{16}$ in. (50 mm.) between the inside faces of the ball joint lock-nuts.

Disconnect at the ball joint, the rod (6) which connects the fulcrum lever and the accelerator cross-shaft lever (7).

Check that the included angle made by rod (2) and the fulcrum lever (4) is approximately 165°, with the engine throttle in closed position. If necessary, adjust rod (2) to obtain this angle, then connect the rod.

Slacken the lock-nut on the accelerator lever stop bolt; screw in the stop bolt to allow the pedal to be pulled back by the spring. The pedal movement will be limited by the rubber boot under the toe board.

Measure the length of the fulcrum lever-to-pedal cross-shaft lever rod between the ball joint and clevis pin hole centres. The distance should be approximately $21\frac{1}{2}$ in. (54,6 cm.). If necessary, adjust the rod, then connect the ball joint; secure the pinch bolt.

Check to ensure that full throttle is obtainable. If necessary, adjust the kick-down stop so that full throttle is just obtainable.

Adjust the accelerator pedal lever stop-bolt so that, with the throttles closed, the head of the bolt just touches the stop on the underbody.

Note Set the stop bolt length when the engine is cold. The throttles may not completely close when cold if the stop is adjusted with a hot engine. Ensure that the choke is in the 'hot engine' position, i.e. fast idle cam inoperative.

Ensure that the fulcrum lever and the rod (2) cannot toggle over when the accelerator pedal is released quickly. Shorten rod (6) to cure this condition.

Finally, ensure that all the linkages and levers operate freely and are adequately lubricated.

Transmission control switches — To adjust

General

The stator and detent solenoids in the transmission are actuated by three micro switches which are in turn actuated by the engine throttle controls.

The damper and micro switch assembly signals a change in stator blade angle. High angle is signalled when the throttle is closed, and low angle is signalled when the throttles are just off the closed throttle stop.

The damper part of the assembly ensures that the throttles close slowly over the last few degrees of travel.

A second micro switch actuates the stator solenoid also. This switch is operated by a cam on the manifold shaft lever and re-introduces the stator blade high angle at approximately 45 degrees of throttle opening.

The third micro switch actuates the detent solenoid. This switch is operated at nearly full throttle by the 2 B.A. setscrew in the manifold shaft lever and signals a kick-down gearchange.

Assuming that the engine throttle controls have been correctly set, and the choke and slow running controls are correct, proceed to adjust the micro switches as follows.

Damper and switch assembly

Disconnect the air ducting at the choke body end and move the ducting clear of the switches.

Disconnect the yellow lead from the switch at its Lucar connector.

Connect one side of a test lamp to the yellow lead and the other side to earth.

Switch on the ignition.

Ensure that the fast idle cam is in the hot idling position i.e. choke fully open.

Slacken the two $\frac{5}{16}$ in. U.N.F. nuts on the switch mounting spindle (see Fig. 20). Adjust the position of the switch and damper assembly so that the test lamp lights just before the throttle closes completely, and extinguishes when the throttle is just clear of its off-stop. Tighten the nuts in this position.

Note The damper slows down the throttle during the last few degrees of movement as it is closing.

Allow time for the throttle to rest on its off-stop when determining the throttle closed position.

Switch off the ignition, remove the lamp and connect the yellow lead.

Stator micro switch

The stator micro switch is non-adjustable. It can be checked for correct operation by connecting a test lamp and checking to see if the lamp lights when the switch is contacted by the cam on the lever, with the ignition switched on.

Kick-down micro switch

Disconnect the white/purple lead from the kick-down micro switch.

Connect one side of a test lamp to the white/purple

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lead on the switch and the other side to earth.

Switch on the ignition.

Slacken the lock-nut on the 2 B.A. setscrew in the manifold lever shaft.

Adjust the 2 B.A. setscrew in the lever so that the test lamp lights when the lever is 0·025 in. (0,63 mm.) from the full throttle stop. Whilst carrying out this adjustment, ensure that the micro switch has some over-travel when the lever is contacting the full throttle stop.

Tighten the 2 B.A. lock-nut.

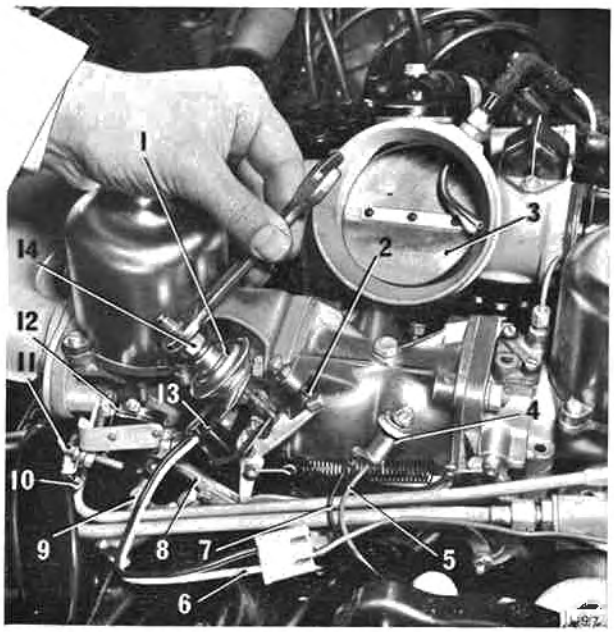

Fig. 20 Adjusting the damper and switch

1 THROTTLE DAMPER
2 THROTTLE OFF-STOP
3 CHOKE BUTTERFLY
4 TEST BULB HOLDER
5 TEST BULB LEAD
6 YELLOW LEAD
7 TEST BULB EARTH LEAD
8 STATOR SOLENOID SWITCH ACTUATING CAM
9 DETENT SOLENOID SWITCH ACTUATING SCREW
10 DETENT SOLENOID MICRO SWITCH
11 THROTTLE STOP SCREW
12 STATOR SOLENOID SWITCH
13 STATOR SOLENOID SWITCH (CLOSED THROTTLE)
14 ADJUSTING NUT

Connect the air ducting.

Adjust the under-pedal kick-down button and full throttle stop so that the button must be depressed before kick-down is obtained. This should be done as follows.

Kick-down button — To adjust

Remove the floor covering from the toe board on the driver's side of the car. The kick-down button can be seen beneath the accelerator pedal.

Slacken the large lock-nut, then adjust the body by screwing it up or down as required; tighten the lock-nut.

When setting the kick-down, care must be taken not to confuse part throttle down-changes and stator changes with the forced down-change (kick-down).

If, when adjusting the kick-down button, its position is such that it is in danger of being hidden by the carpet, an improvement can be made by shortening the rod (6). This will throw the pedal further away from the toe board, thus allowing the kick-down button to be raised. The accelerator lever stop-bolt will have to be adjusted to suit.

Ensure that the closed throttle condition is still available.

Stator and detent solenoid circuits — To check

The stator and detent solenoids can be checked for correct operation whilst the car is being driven on the road. This will enable the tester to determine whether or not the stator is changing its angle and also whether kick-down is obtainable at full throttle.

Stator solenoid — To check

Disconnect the white/brown lead from the Lucar connector on the solenoid case connector in the left-hand side of the transmission.

Connect a 12 volt test lamp between the lead and the connector. Position the test lamp so that it is vislbe from the driver's seat.

Drive the car and observe the test lamp.

The test lamp should light when the ignition is switched on, and remain so until the accelerator pedal is moved sufficiently to 'crack' the throttles, then become extinguished above this speed.

At approximately 45 degrees of throttle opening the test lamp should again be illuminated and remain so regardless of any further throttle opening.

If the test lamp fails to light, check the solenoid micro switch and controls for correct operation, and the circuit for continuity.

The solenoid itself can be checked by using a lamp and battery. Touch the solenoid case with one lead and the connector with the other lead; the lamp should light.

Remove the test lamp and connect the stator lead.

Detent solenoid — To check

Disconnect the white/green lead from the case Lucar connector.

Note On early cars the detent lead is white/purple.

Connect a test lamp between the lead and the connector.

Drive the car in Drive range – third gear at a speed below approximately 70 m.p.h. (113 km.p.h.).

Depress the accelerator pedal so that the detent button on the toe board is felt. Press the pedal further

to move the button. The lamp should light as the solenoid enforces the down-change.

If the lamp does not light, check the micro switch and the controls for correct operation, also check the circuit for continuity. The solenoid can be checked in a similar manner to the stator solenoid. Check the detent lead inside the transmission case.

Checking controls with test box RH 7932

If actuator test box RH 7932 is available it can be used to check both the stator and detent solenoids as well as selecting the gear range positions. Proceed as follows.

Remove the stator and detent leads from the case connector, then position the test box where it can be seen by the driver.

Fit the stator and detent leads from the test box to the Lucar connections on the case connector. Ensure that the leads are correctly positioned.

Fit the transmission detent and solenoid leads onto the pick-a-back connectors on the test box leads.

Remove the multi-pin plug from the electric gear-change actuator and fit the plug from the test box in its place.

Pick up a positive power supply from the facia of the car (an old cigar lighter suitably wired would suffice) and connect it to the inlet side of the test box.

The transmission will then be isolated from the selector switch on the column and all the selector positions can be obtained by selecting the appropriate range as shown by the marked dial on the test box cover.

Drive the car and check the selection of the gear ranges and the operation of the stator and detent solenoids by observing the lamps on the test box.

The gearchange actuator can be checked by inserting the test box between the actuator and the feed from the multi-pin plug. The car multi-pin plug must be fitted to the test box, and the test box plug fitted to the actuator.

By operating the switch on the box and observing the lamps, the actuator can be operated and checked for correct operation.

Section 5
Removal of Units

Removable units — Transmission in car

The following units can be removed from the transmission without the transmission being removed from the car.

The removal procedure for all the units is described in the appropriate Section in Chapter 3, with the exception of the pressure regulator valve, details of which are included in this Section.

Gearchange actuator (see Section 1).

Neutral start and height control switches (see Section 1).

Vacuum modulator and valve (see Section 4).

Governor assembly (see Section 5).

Speedometer drive (see Section 6).

Sump, strainer and intake pipe (see Section 7).

Control valve unit (see Section 8).

Rear servo (see Section 9).

Detent solenoid, connector, control valve spacer and front servo (see Section 10).

Rear extension (see Section 11).

Control rods, levers and parking linkage (see Section 13).

Pressure regulator valve — To remove (Transmission in car)

Run the car onto a ramp or over an inspection pit.

Remove the sump as described in Section 7.

Withdraw the intake pipe and strainer assembly.

Remove and discard the intake pipe 'O' ring.

Remove the setscrew which secures the detent roller spring; remove the spring and roller.

Slacken the lock-nut which secures the detent lever to the manual shaft.

Remove the manual shaft pin from the case.

Remove the gearchange lever from the manual shaft.

Prise the detent lever from the manual shaft then remove the parking actuator rod and detent lever. Ensure that the manual valve does not slide out of its bore in the control valve unit.

Push the manual shaft through the bore in the case in order to gain access to the pressure regulator valve bore.

Using a screwdriver or a steel rod, push the regulator boost valve sleeve against the pressure regulator spring (see Fig. 21).

Caution The pressure regulator spring is under extreme pressure and will force the valve sleeve out

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of its bore when the circlip is removed unless the sleeve is firmly held.

Continue to exert pressure on the valve sleeve then remove the circlip. Gradually relax the pressure on the valve sleeve until the spring pressure is released.

Carefully remove the regulator boost valve sleeve and valve, then withdraw the regulator spring.

Take care not to drop the valves, as they will fall out if they are not held.

Remove the pressure regulator valve and spring retainer. Remove the spacers (if fitted).

Pressure regulator valve — To fit

Before fitting, wash and examine all parts as described in Section 12.

Fit the spring retainer onto the pressure regulator spring. Fit any spacers which were previously removed.

Fit the pressure regulator valve onto the spring, stem end first.

Fit the boost valve into the sleeve with the valve stem outward then hold together all the parts so that the pressure regulator spring is against the valve sleeve.

Fit the complete assembly into the pressure regulator valve bore, taking care that the parts do not fall during the operation.

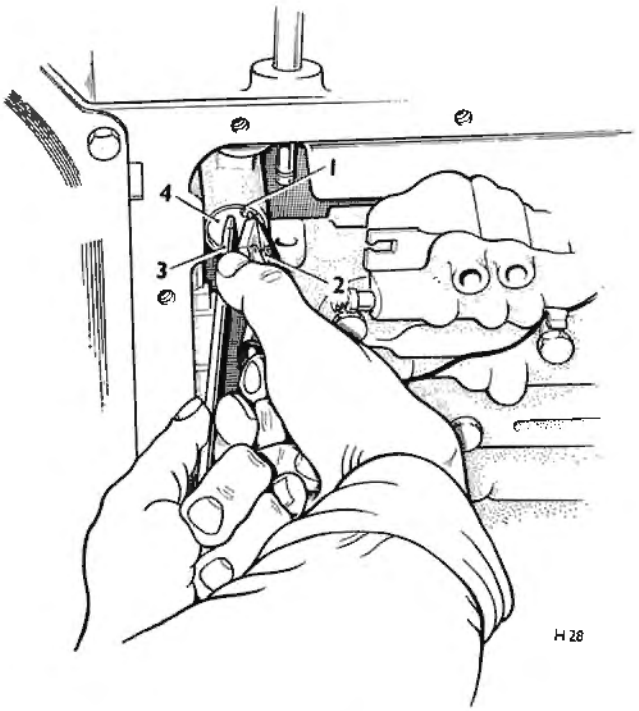

Fig. 21 Removing the pressure regulator valve

1 CIRCLIP
2 CIRCLIP PLIERS
3 ROD
4 SLEEVE

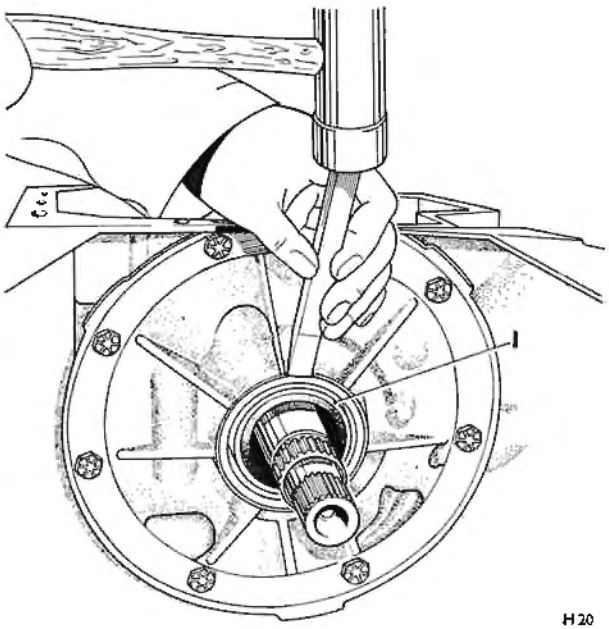

Fig. 22 Removing the pump oil seal

1 OIL SEAL

Using a screwdriver or a steel rod, push the regulator boost valve sleeve against the regulator spring pressure until the end of the sleeve has passed beyond the circlip groove. Fit the circlip then relax the pressure on the sleeve.

Note To facilitate fitting the circlip, encircle it around the screwdriver or steel rod, compress the circlip, then push it upward into the groove in the valve bore.

Fit the parking actuator rod and the detent lever, ensuring that the rod plunger is under the parking brake bracket and over the parking pawl.

Slide the manual shaft into the case and through the detent lever.

Fit the gearchange lever.

Fit the lock-nut onto the manual shaft. Torque tighten the nut to 18 lb.ft. (2,5 kgm.).

Ensure that the manual valve is engaging with the pin on the detent lever.

Retain the manual shaft with the pin. Straighten the pin to lock it in position.

Fit the detent spring and roller assembly; torque tighten the setscrew.

Fit the intake pipe and strainer assembly and the sump as described in Section 7.

Top-up the transmission with an approved fluid as required.

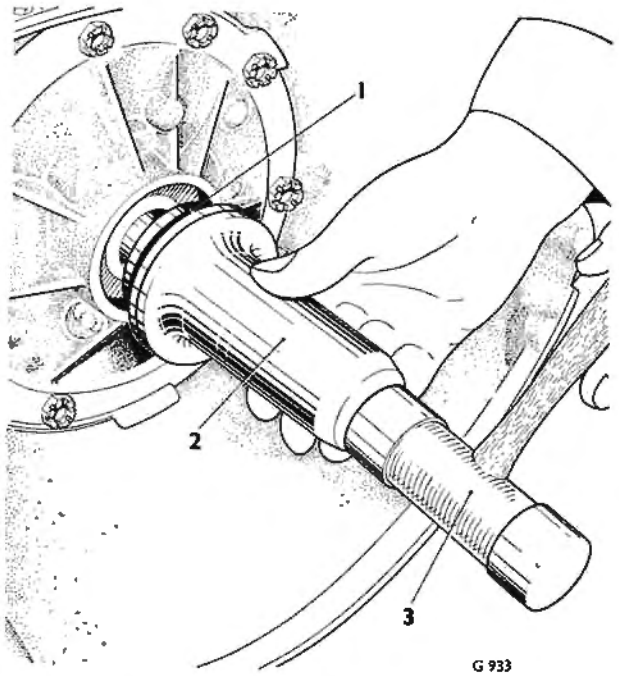

Fig. 23 Fitting the pump oil seal

1 OIL SEAL
2 SEAL FITTING TOOL
3 MALLET

Oil pump seal — To renew

Remove the transmission from the car (see Section 2, Chapter 3).

Carefully drive the point of a chisel under the lip of the seal then prise the seal out of the pump body (see Fig. 22).

Before fitting a new seal, ensure that the body bore is clean and free from burrs and that the garter ring is on the seal. Check the finish of the converter neck and the bearing surface in the pump body.

Lightly smear the outer edge of the seal case with 'Wellseal' then fit the seal to the pump using tool J–21359 as shown in Figure 23.

Fit the transmission to the car (see Section 2, Chapter 3).

CHAPTER 3

OVERHAUL

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CHAPTER 3
OVERHAUL
Section 1
Gear Change Actutator and Neutral Start and Height Control Switches

Description

The electric gearchange actuator (see Fig. 24) is mounted on a bracket secured to the transmission rear extension and is connected by levers and rods to the gearchange lever and to the neutral start and height control switches on the left-hand side of the transmission.

A 12 volt, series wound motor, is secured to the rearmost part of the actuator casing and is enclosed by a cover. Both the cover and the actuator casing are magnesium castings.

The motor is able to rotate in both directions, reversal being obtained by employing a double-wound field coil. The windings are of equal resistance, and one winding or the other is energised according to the gearchange selector position. A reset button which neutralises a thermal cut-out is located in the main fuse box on the bulkhead.

The drive from the motor is transmitted to a worm shaft via a flexible coupling. The worm shaft drives a worm gear which is rivetted to a shaft onto which the operating lever is fitted.

A drum is pinned onto the worm shaft, the drum itself forming part of the flexible drive. A solenoid operated brake acts on the drum periphery to arrest lever travel when a particular gear has been obtained.

Eight phosphor-bronze spring contacts are rivetted to a laminated bakelite base plate which is secured to the actuator casing. The spring contacts operate against a silver plated slip ring assembly which is screwed to the worm wheel. Also secured to the base plate is a dual relay arrangement, the contacts of which are normally open.

The actuator casing is vented to atmosphere but all joints and electrical connections on the casing are fully waterproofed.

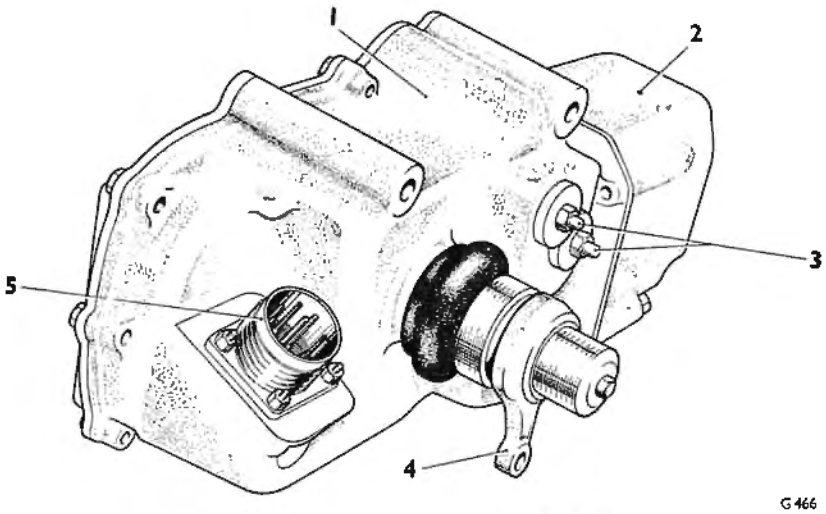

Fig. 24 Electric gearchange actuator

1 ACTUATOR CASING **2** MOTOR COVER **3** SOLENOID SECURING NUTS **4** ACTUATING LEVER **5** PLUG SOCKET

A rod, which extends rearward from the gearchange lever, is connected to a lever which is pinned to the neutral start and height control switch operating shaft. A cam is brazed onto the inner end of the shaft and actuates two micro switches, which are secured to the switch housing. The housing and wire connections are fully waterproofed and the whole assembly can be removed easily from the transmission without disconnecting the leads.

Operation

When the ignition is switched on and the selector lever on the steering column is moved to one of the gear range positions, current is allowed to flow to the actuator motor via a relay.

The motor rotates and turns the worm shaft through the flexible coupling. As the worm gear rotates, the

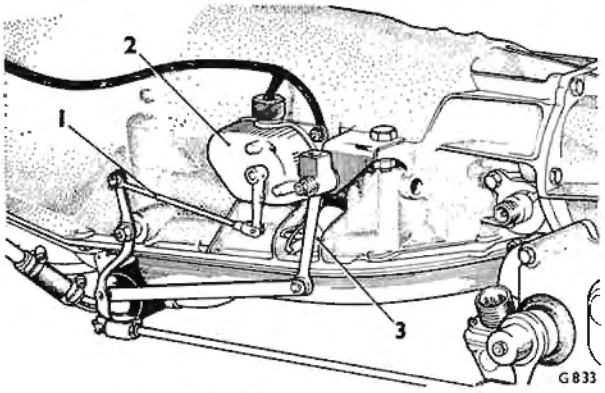

Fig. 25 Detent and stator solenoid connections

1 LINK ROD
2 MICRO SWITCH CASING
3 DETENT AND STATOR SOLENOID CONNECTIONS

slip ring which is secured to the worm gear also rotates until an insulated slot in the slip ring is aligned with the live contact. When this position is reached, the current is cut off and the motor ceases to rotate. Immediately the current ceases to flow, the brake, which is held off by the energised solenoid, is applied to the drum thus positively holding the shaft and lever in the required position.

As soon as the lever on the steering column is moved to another position, the solenoid is again energised, the brake is released and the motor will turn the actuating lever to the selected position.

The electric actuator is wired so that should the driver stop the car in a gear range other than Park then switch off the ignition, he can still lock the transmission by moving the selector lever on the steering column to the parking 'P' position.

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

The neutral start switch is actuated only when the transmission is in Neutral or Park; the engine cannot be started until the micro switch is in its operating position. Also actuated when in Neutral or Park is the height control switch which selects fast levelling whilst the car is stationary (for information concerning the operation of the levelling switch see Chapter G – Section 18 – Solenoid valve – T.S.D. 2205 Workshop Manual).

Gearchange electric actuator — To remove

Should the electric gearchange actuator fail to operate it should be noted that the system includes a thermal cut-out. This device prevents the motor from being overloaded should the gearchange linkage become obstructed and as a result, gives the impression of actuator failure.

Before removing the actuator, ensure that the controls are free and adequately lubricated, also that the actuator electrical system is cool enough for the thermal cut-out to permit the motor to operate. Press the reset button in the main fuse box to reset the cut-out.

It is recommended that the easiest and quickest method of dealing with actuator failure, is by substituting the faulty actuator for a service exchange unit. If a service exchange unit is not obtainable but adequate repair facilities are available, proceed as follows.

Disconnect the negative lead from the battery situated in the luggage compartment.

Remove the split pin and clevis pin from the actuating lever on the electric actuator; disconnect the rod from the lever.

Unscrew and remove the 'multi-pin' plug.

Disconnect the breather pipe from the governor cover plate and the actuator side cover.

Remove the three bolts which secure the actuator to the rear extension bracket then remove the actuator.

Neutral start and height control switches — To remove

Remove the split pin and clevis pin which secures the link rod to the switch actuating lever; disconnect the link rod.

Disconnect the two leads at the Lucar connections on the detent and stator solenoid case connector; note the position of the leads to ensure correct assembly (see Fig. 25).

Remove the two bolts which secure the switch cover

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to the bracket on the left-hand side of the transmission; remove the cover.

Note Before the switches can be removed from the car, the switch assembly must be partially dismantled and the leads disconnected (see Neutral start and height control switches — To dismantle).

Gearchange electric actuator — To dismantle

Unscrew the setscrew in the centre of the actuating lever cover then remove the cover.

Using spring compressing tool (RH 7843) compress the coil spring sufficiently to enable the hardened steel pin to be removed; drive out the pin.

Remove the spring compressing tool then withdraw the operating lever, spring and spring retaining cup from the shaft.

Remove the nuts and washers which secure the side cover to the main casing; remove the cover.

Note The cover gasket is sealed initially with jointing compound on both sides, as a result, the cover may not be easily removable. Use a hardwood wedge to loosen the cover. Do **not** use a screwdriver between the joint faces in an effort to remove the cover as this may cause damage to the joint faces and destroy the waterproofing effect. Discard the gasket.

Disconnect the motor feed to the relays.

Disconnect the leads from the motor earth and solenoid feed.

Remove the four nuts which secure the motor cover to the main casing; remove the cover.

The gasket is sealed with jointing compound and care should be taken when removing the cover.

Discard the gasket.

Withdraw the motor from the four long studs. The motor is secured to a mounting plate and this will be removed with the motor. Remove the rubber grommet and withdraw the leads.

Discard the gasket.

Remove the coupling dog from the motor output shaft.

Remove the flexible rubber coupling from the brake drum.

Remove the nuts and washers which secure the motor to its mounting plate. Remove the motor from the mounting plate, withdraw the leads from the grommet and through the hole in the plate.

Remove the nuts and washers which secure the plug leads to the connection on the insulated base plate; detach the leads from the connections.

Unscrew the nuts and washers which secure the plug assembly to the actuator casing. Remove the plug and withdraw the leads from the casing; retain the rubber gasket which fits between the casing and the plug.

Remove the nuts and washers which secure the insulated base plate to the main casing. Carefully lift the base plate from the studs.

Note Care should be exercised when handling the baseplate assembly to avoid damaging the relays and contacts.

Using tool (RH 7841) remove the roll pin which secures the brake drum to the worm shaft. Push the pin through the drum and shaft until it can be removed; discard the pin.

Remove the drum from the worm shaft. It will be necessary to hold the brake shoe away from the drum whilst the drum is being removed.

Mark the top of the brake shoe in pencil to facilitate correct assembly.

Unscrew the dome nuts which secure the brake solenoid assembly to the main casing; remove the cup washers and the rubber washers. Remove the assembly from the casing. Secure the brake shoe assembly and spring to the solenoid with adhesive tape to retain them as a unit.

Remove the circlip and washers from the outer side of the seal which fits over the actuator casing and around the output shaft; remove the seal.

Remove the circlip which locates the output shaft and slip ring assembly in the main casing then remove the washer.

Withdraw the slip ring and shaft from the bush in the actuator casing; remove the washer from the shoulder behind the slip ring.

Remove the circlip which locates the worm shaft and bearings in the actuator casing. Remove the adjusting washer and label it to ensure that the correct washer is fitted during assembly.

Gently tap the worm shaft and the bearings from the casing. The bearings are a push fit in the casing bores and no difficulty should be experienced when removing them.

It is recommended that no further dismantling of the actuator be attempted. If necessary, the following components should be renewed as separate assemblies, the base plate, plug, brake shoe, solenoid, brake solenoid and the output shaft and slip ring. The motor should be renewed as an assembly also although it may be dismantled for inspection as follows.

Gearchange actuator motor — To dismantle

Unscrew and withdraw the two through-bolts.

Remove the end covers.

Withdraw the armature from the drive end. Retain the shim washers which fit between the shoulder on

the drive end of the armature shaft and the drive end bush.

Note the side and the position of each brush to ensure correct assembly then remove the brushes, taking care not to stretch excessively the brush tension spring.

Should the pole piece require removal, mark the pole piece and the two retaining screws so that they can be fitted in their original positions.

Neutral start and height control switches — To dismantle

If the transmission has been removed from the car, the switch cover will have been removed from the transmission but it will still be connected to the car by leads. Dismantle the switches in the same way as described for dismantling the switches when the transmission is in position in the car.

To dismantle the neutral start and height control switches, proceed as follows.

Remove the four screws which secure the cover to the casing.

Remove the cover and discard the joint. The gasket is sealed with jointing compound on both sides during initial assembly and this may make separation of the cover and casing difficult. Do **not** use a screwdriver blade between the joint faces otherwise the waterproofing may be impaired.

Unscrew the knurled nut at the top of the cover.

Unscrew the two 6 B.A. screws which secure the micro switches to the casing.

Remove the switches and separator, disconnect the leads, then remove the leads and rubber grommet from the casing.

It should not be necessary to remove the operating cam and shaft which is secured in the casing by the lever. The lever is positioned and secured on the shaft by a roll pin.

Gearchange electric actuator — To inspect

Examine the magnesium casing for cracks or other damage. Ensure that the joint faces are clean and free from burrs.

Wash the gearchange operating lever, spring and covers in clean paraffin then examine them for general wear.

Ensure that the breather pipe is clear and free from damage.

Examine the driving dog slot for excessive wear, also the mating shaft on the drive end of the motor armature shaft. The dog should be an easy sliding fit on the shaft but without excessive side play.

Examine the rubber coupling for signs of deterioration.

Examine the general condition of the plug assembly. Ensure that no strands of wire are broken where they enter the pins. In the event of the plug being considered unserviceable, it is recommended that the whole assembly be renewed, rather than an individual connection. Special crimping tools and 'Cannon' insert tools are required for assembly purposes and unless these are available the work should not be attempted.

Examine the eight spring contacts for security on the insulated base.

Care must be exercised when handling the assembled base plate so that the contacts and the relays are not damaged in any way.

Check the height of the contacts from the base plate. The contact point should be approximately 0·485 in. (12,3 mm.) from the contact (lower) side of the base. If excessive wear has occurred on the contact points the base assembly should be renewed.

If the dual relay assembly is faulty, it is recommended that a new assembly be fitted rather than attempt rectification. The relays are precision units and are accurately set to give the correct operating times. The spring-loaded adjusting screw is set during the initial build of the relay and the setting should not be altered.

Ensure that the terminals and the terminal blocks are secure on the insulated base.

Examine the brake drum for scoring or damage. The brake drum should be a push fit on the worm shaft. If the drum is slack on the shaft, examine the drum bore and the shaft for signs of fretting.

Remove the adhesive tape from the brake shoe and solenoid assembly.

Ensure that the assembled plunger and brake shoe will slide freely into the solenoid.

If either the brake shoe assembly or the solenoid is unserviceable they should not be renewed separately. The components are tested as one complete assembly during initial build and must remain as such, unless equipment is available that will enable separate assemblies to be tested and 'paired' (see Dimensional Data at the end of this Section).

Examine the brake linings for wear.

Examine the general condition of the wiring.

If the components are satisfactory, retain them with adhesive tape until they are required for final assembly.

Check the tightness of the four 5 B.A. screws which secure the slip ring assembly to the shaft.

Ensure that a 0·025 in. (0,64 mm.) air gap exists on each side of the silver plated segments which are secured to the slip ring.

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Ensure that the edges of the slip ring around the air gap are free from burrs.

Examine the slip ring face for signs of tracking. This should not normally occur but, if signs of tracking are found, the slip ring assembly must be renewed.

Examine the teeth on the worm gear and the worm for damage or uneven wear.

Examine the ball bearing bores in the main casing for signs of fretting. The bearing should be a light push fit in the casing. Reject the casing if the push fit cannot be obtained.

Examine for wear the bush which supports the output shaft. The shaft should be a running fit in the bush, without excessive clearance i.e. the shaft should not rock in the bush (see Dimensional Data at the end of this Section).

Gearchange actuator motor — To inspect

Under normal operating conditions the gearchange actuator motor should need no attention. The porous bronze bearings are impregnated with oil and the brushes are carbon copper.

Details of motor tests and performance are given in 'Dimensional Data' at the end of this Section.

Neutral start and height control switches — To inspect

Examine the switch casing for damage to the joint faces.

Ensure that between 0·005 in. and 0·010 in. (0,13 mm. and 0,25 mm.) end float exists between the casing and the operating cam.

Gearchange actuator motor — To assemble

Assemble the gearchange actuator motor as follows (see Fig. 26).

Fit the pole pieces and the two self-tapping screws, ensuring that the marks made during dismantling are correlated.

Fit the brushgear assembly, ensuring that the brushes are fitted in their original position. Take care not to overstretch the brush tension springs. Ensure that the brush arms pivot freely on the terminal plate locations.

Lightly smear the armature shaft with Shell Turbo 41 oil, taking care to prevent any oil from reaching the commutator.

Fit the armature.

Fit the shim(s) to the drive end of the armature shaft.

Fit the end covers and secure them with the through-bolts.

Check the end float of the armature. The end float should be between 0·002 in. and 0·012 in. (0,05 mm. and 0,30 mm.). If the end float does not conform to these figures remove the drive end bracket and adjust the shim(s) to suit.

Gearchange electric actuator — To assemble

Wash the bearings and shaft assembly in clean paraffin (kerosene) then dry them with compressed air.

Lightly lubricate the bearings with Esso Beacon grease.

Ensure that the actuator casing is clean and dry, then fit the shaft and bearings. Do not use force to fit

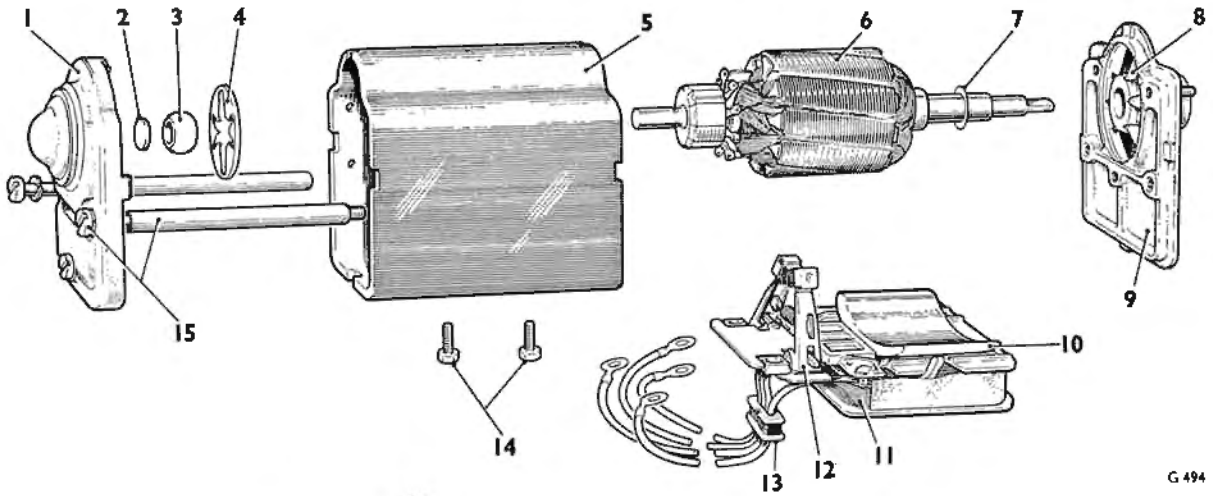

Fig. 26 Gearchange actuator motor — exploded

1 COMMUTATOR END BRACKET
2 THRUST PAD
3 SELF-ALIGNING BEARING
4 BEARING RETAINER
5 YOKE
6 ARMATURE
7 SHIM
8 BEARING RETAINER
9 DRIVE END BRACKET
10 POLE PIECE
11 FIELD COIL
12 BRUSH GEAR
13 GROMMET
14 POLE PIECE SECURING SCREWS
15 THROUGH-BOLTS AND INSULATORS

the bearings to the casing.

Fit the adjusting washer and the circlip.

Mount a dial test indicator so that the plunger rests on the end of the worm shaft (see Fig. 27).

Using a slave output shaft and gear, move the worm shaft backward and forward, noting the clock reading. If necessary, adjust the washer to give an end float of between 0·002 in. and 0·005 in. (0,05 mm. and 0,13 mm.). It should be appreciated that the bearings must be no more than a light push fit in the casing to achieve this end float (see Dimensional Data at the end of this Section).

Ensure that both the output shaft and the porous bronze bush are clean; **do not wipe the bush with a degreasing agent.**

Lightly lubricate the shaft with Shell Tonna E oil. Fit a washer over the shaft then fit the shaft into the bush in the casing.

Fit a washer over the end of the output shaft then fit the circlip.

Lightly lubricate the nylon worm gear with Esso Beacon grease.

Fit the rubber seal to the casing. A light smear of Esso Beacon grease applied to the inside of the seal will make this operation easier.

Fit the remaining washer and circlip to the shaft.

Ensure that the worm shaft will turn freely.

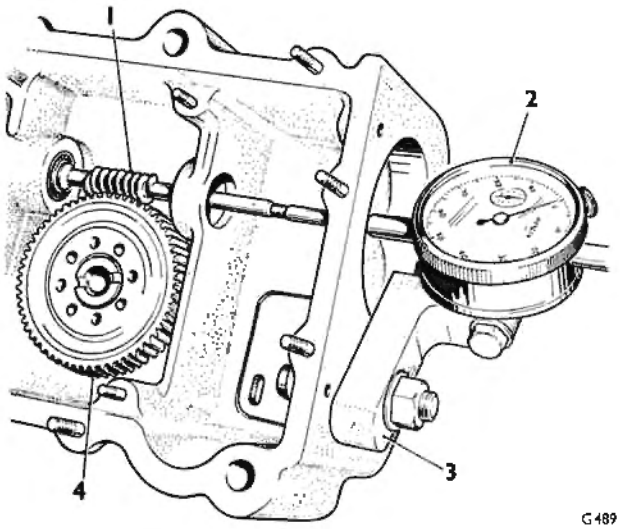

Fig. 27 Checking worm shaft end float

1 WORM SHAFT
2 DIAL INDICATOR GAUGE
3 GAUGE ARM
4 SLAVE GEAR

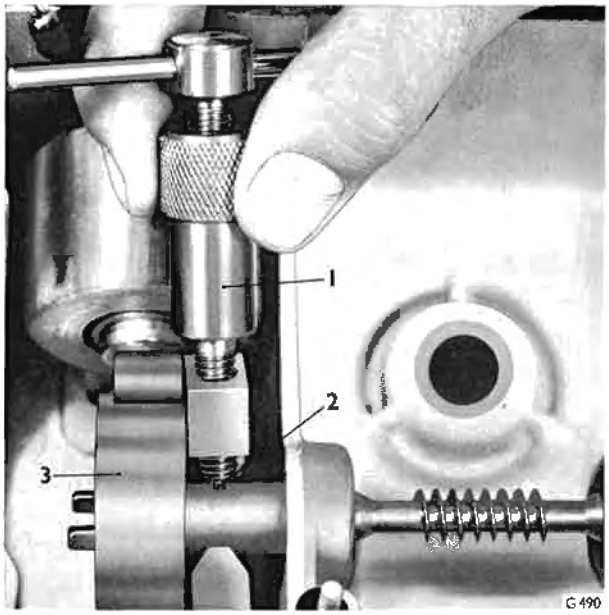

Fig. 28 Fitting the brake drum roll pin

1 TOOL
2 ROLL PIN
3 BRAKE DRUM

Rotate the output shaft until the open circuit sections are parallel with the worm shaft.

Note If the open circuits are at 90° to the worm shaft, the actuator will not operate when switched on initially.

Ensure that the pencil mark on the brake shoe is at the top.

Remove the adhesive tape from the brake shoe and solenoid assembly.

Fit the assembly into the actuator casing.

Fit the seal washers, cup washers and dome nuts. **Do not** tighten the nuts at this stage.

Push down the brake drum onto the worm shaft until the pin holes are aligned. If either the drum or the shaft is a new component, ensure that the drum can be pushed onto the shaft, otherwise it will be difficult to align the holes. It will be necessary to hold the brake shoe in, against spring pressure, whilst the drum is fitted.

Fit a new roll pin to the shaft and drum, using tool (RH 7841) as shown in Figure 28.

Remove the tool, ensuring that the pin protrudes equally on each side.

The brake should be set in relation to the brake drum and solenoid as follows.

Obtain a smooth strip of soft metal e.g. aluminium, 0·048 in. (1,22 mm.) thick, $\frac{3}{4}$ in. (19,0 mm.) wide and

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bend it into a half circle, 1 in. (25,4 mm.) radius.

Slide the metal onto the outside of the drum.

Push the solenoid assembly in the direction of the brake drum until the brake shoe abuts the metal strip (see Fig. 29). Tighten the two dome nuts. Remove the metal strip. When the solenoid is operated, the plunger will then travel a distance of 0·035 in. (0,89 mm.).

Fit the insulated base plate with the eight contacts and the relays. Care should be taken with this operation so that the settings of the relays and the position of the contacts are not disturbed. Evenly tighten the four 3 B.A. nuts.

Ensure that a gap of approximately 0·050 in. (1,3 mm.) exists between each contact. The slip ring and contacts can be seen through the motor mounting orifice.

View the contacts through the gaps in the contact plate and ensure that the contacts touch the slip ring centrally, between the outside diameter of the slip ring and the outer perimeter of the rivet heads. There should be a clearance of approximately $\frac{1}{16}$ in. (1,6 mm.) on each side (see Fig. 30).

Fit the rubber gasket to the plug assembly mounting face on the actuator casing.

Fit the plug assembly, ensuring that the two largest pins are lowermost. It is advisable to contain the leads with adhesive tape before attempting to thread them through the casing and the contact assembly.

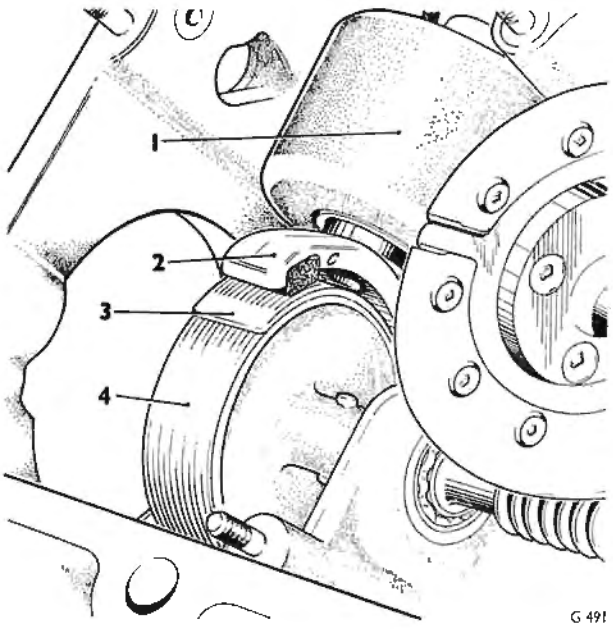

Fig. 29 Setting the solenoid brake

1 SOLENOID **3** SPACER
2 BRAKE SHOE **4** BRAKE DRUM

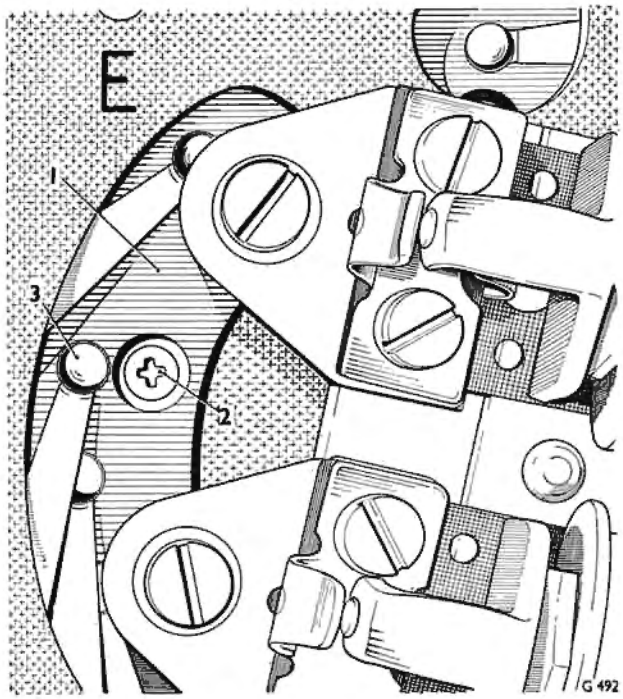

Fig. 30 Checking contact position

1 SLIP RING **2** SECURING SCREW **3** CONTACT

Remove the tape, then run all the leads to their respective connections (see Fig. 31).

Fit the nuts and washers then tighten them, starting at the one furthest away from the plug and progressing toward the plug.

Caution Do not fit any nuts which are tight on the threads of the studs in the terminal blocks. If a tight nut is fitted there is a danger that the terminal screw will turn and the terminal block will become loose, resulting in a loose connection between contact and screw. If in doubt about the firmness of a contact, remove the base plate and tighten the terminal screw.

Secure the actuator motor to its mounting plate studs with the three 2 B.A. half nuts and spring washers.

Feed the motor supply leads through the bore of the mounting plate, then through the grommet. The longer end of the grommet fits into the casing.

Ensure that the rear face of the actuator casing and the front face of the mounting plate are clean and free from burrs, then apply a thin coat of Wellseal to the faces.

Fit a new gasket to the rear face.

Fit the flexible coupling onto the brake drum.

Fit the coupling dog onto the drive end of the motor armature shaft.

Fit the motor onto the four long studs.

Feed the leads through to the actuator casing, at the same time position the grommet.

Push the motor forward, align the driving dog with the rubber coupling, then push the motor fully home. Ensure that the rubber grommet fits correctly into its recess in the casing and has not become trapped.

Ensure that the rear face of the mounting plate and the joint face of the motor cover are clean and free from burrs.

Apply a thin smear of Wellseal to the faces, fit a new gasket to the mounting plate then fit the motor cover.

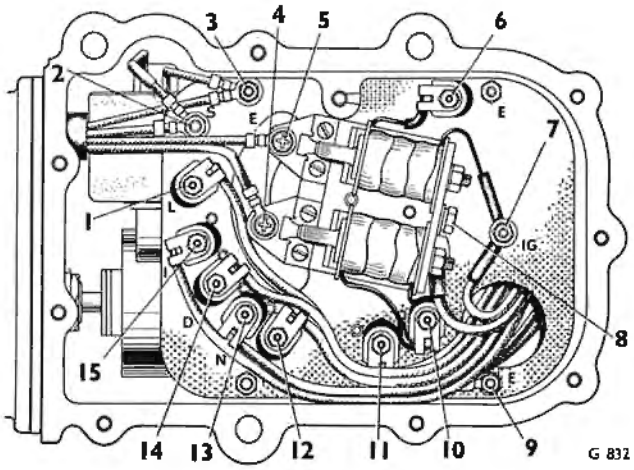

Fig. 31 Wire connections

1 BLACK/WHITE FROM PLUG TO TERMINAL L
2 GREEN FROM BOTH SOLENOID AND MOTOR TO TERMINAL S
3 BLACK FROM SOLENOID, AND BLACK/GREEN FROM MOTOR, TO TERMINAL E
4 RED/GREEN FROM MOTOR TO F1 RELAY TERMINAL
5 BLUE/GREEN FROM MOTOR TO F2 RELAY TERMINAL
6 BLACK FROM RELAY COIL MOTOR END TO TERMINAL F2
7 BLACK FROM RELAY COIL PLUG END, AND GREEN/BLACK FROM PLUG TO TERMINAL IG
8 BROWN/BLACK FROM PLUG TO RELAY POSITIVE FEED TERMINAL
9 BLACK FROM PLUG, AND RED FROM RELAY COIL PLUG END TO TERMINAL E
10 RED FROM RELAY COIL MOTOR END TO TERMINAL F1
11 BLACK/BROWN FROM PLUG TO TERMINAL P
12 BLACK/RED FROM PLUG TO TERMINAL R
13 BLACK/BLUE FROM PLUG TO TERMINAL N
14 BLACK/GREEN FROM PLUG TO TERMINAL D
15 BLACK/YELLOW FROM PLUG TO TERMINAL I

Fit and tighten the four 2 B.A. nuts and washers.

Connect the motor feed and the solenoid feed leads (see Fig. 31). Fit the solenoid leads first with the lead ends to the eyelets lowermost.

Fit the motor earth and the solenoid connection with the lead to the eyelet uppermost.

Fit the motor feed leads to the relays.

Examine all connections to ensure that they are all correctly connected.

Ensure that the slip ring is positioned with the open circuit sections parallel with the worm shaft, as described earlier.

Ensure that the joint faces of the actuator casing and the cover are clean and free from burrs.

Apply a thin smear of Wellseal to both faces then fit a new gasket to the casing.

Fit the cover and secure it with the eight 2 B.A. nuts and washers.

Fit the spring retaining cup onto the output shaft.

Liberally apply Rocol M 204 G Ragosine to the inside of the cup and to the output shaft.

Smear both ends of the spring with the same lubricant then fit the spring over the shaft and into the cup.

Lubricate the spring housing in the lever then fit the lever to the shaft with the lever pointing downward.

Smear the detent face of the lever, again using Rocol M 204 G Ragosine.

Using tool No. (RH 7843) compress the spring then fit the hardened steel pin.

Coat the inside of the cover with the same lubricant, then fit the cover and secure it with a setscrew.

To test the lever to ensure that the torque required to make the lever slip is correct, proceed as follows.

Operate the lever at least three times in each direction to relieve any initial stiffness.

Fit a spring balance to the lever, with one end of the spring balance located in the clevis pin hole in the end of the lever.

Move the lever forward until it slips; note the reading on the spring balance.

Move the lever in the opposite direction, again noting the reading. The lever should slip at a load of between 60 lb. and 75 lb. (27,2 kg. and 34 kg.).

If the load required to move the lever does not comply with the figures quoted, check the spring poundage (see Dimensional Data at the end of this Section) then renew either the spring or the lever to obtain the correct slipping load.

If rig testing facilities are available, test the actuator to the specification given in 'Dimensional Data' at the end of this Section.

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Neutral start and height control switch — To assemble

Ensure that the lever and cam assembly is free to rotate.

Examine the cork seal and should it require renewal, press out the roll pin using tool No. (RH 7841), remove the lever and washer, then renew the seal. Fit the lever using a new roll pin.

If the cam and shaft assembly has been removed from the casing, lubricate the shaft with Rocol M 204 G Ragosine when fitting the shaft to the casing.

Feed the leads into the casing then connect them to the micro switches as shown in Figure 32.

Fit the miscro switches and separator to the casing. The insulated separator fits between the two switches.

When the cam actuates the switches, ensure that a gap of 0·050 in. (1,27 mm.) exists between the flat on lever and the stop on the cover.

Draw the rubber sealing plug down the loom until it fits into the tapered bore in the casing. Tighten the knurled nut.

Ensure that the joint faces of the casing and cover are clean and free from burrs then apply a thin smear of Wellseal to both faces.

Fit a new gasket to the casing then secure the cover, using four 3 B.A. screws.

Gearchange electric actuator — To fit

Fit the actuator to the rear extension of the transmission. Torque tighten the bolts.

Fit the 'multi-pin' plug and tighten the knurled nut.

Fit the breather pipe to the actuator cover and to the top rearmost setscrew of the governor cover plate.

Neutral start and height control switch — To fit

Fit the switch to the bracket on the side of the transmission. Torque tighten the nuts.

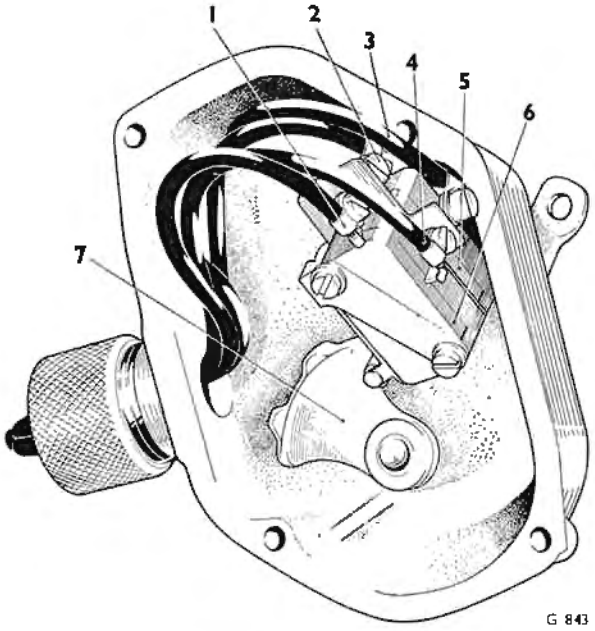

Fig. 32 Micro switch connections

1 RED/WHITE LEAD
2 GREEN/BLACK LEAD
3 GREEN LEAD
4 WHITE/BLACK LEAD
5 HEIGHT CONTROL SWITCH
6 NEUTRAL START SWITCH
7 ACTUATING CAM

Connect the control rods to both units, then adjust the controls as described in Section 4 – Controls – Chapter 2 – Servicing.

Fit the leads to the Lucar connections on the detent and stator solenoid connection.

DIMENSIONAL DATA FOR SECTION 1 — GEARCHANGE ACTUATOR AND NEUTRAL START AND HEIGHT CONTROL SWITCHES

DESCRIPTION	DIMENSION		PERMISSIBLE WORN DIMENSION	REMARKS
Output shaft bearing bush i/d.	0·6273 in. (15,932 mm.	— 0·001 in. — 0,025 mm.)	———	The bush is oil impregnated phosphor bronze and should not be cleaned with a degreasing agent.
Output shaft o/d.	0·6245 in. (15,863 mm.	— 0·0005 in. — 0,013 mm.)	———	———
Clearance.	0·0018 in. (0,045 mm.	to 0·0033 in. to 0,083 mm.)	———	———

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Dimensional Data—continued			
Front bearing bore — actuator casing.	0·7480 in. + 0·0005 in. (19,0 mm. + 0,013 mm.)	——	——
Front bearing o/d.	0,7480 in. — 0·0004 in. (19,0 mm. — 0,010 mm.)	——	——
Clearance.	0·000 in. to 0·0009 in. (0,00 mm. to 0,023 mm.)	——	——
Rear bearing bore — actuator casing.	0·7497 in. + 0·0005 in. (19,041 mm. + 0,013 mm.)	——	——
Rear bearing o/d.	0·7497 in. — 0·0004 in. (19,041 mm.) — 0,010 mm.)	——	——
Clearance.	0·000 in. to 0·0009 in. (0,00 mm. to 0,023 mm.)	——	——
Front bearing i/d.	0·2362 in. — 0·0004 in. (6 mm. — 0,010 mm.)	——	——
Worm shaft front bearing diameter.	0·2363 in. — 0·0005 in. (6,001 mm. — 0,013 mm.)	——	——
Interference or clearance.	0·0005 in. tight to 0·0004 in. clear (0,013 mm. tight to 0,010 mm. clear)	——	——
Rear bearing i/d.	0·250 in. + 0·0002 in. (6,35 mm. + 0,005 mm.)	——	——
Worm shaft rear bearing diameter.	0·250 in. — 0·0005 in. (6,35 mm. — 0,013 mm.)	——	——
Interference or clearance.	0·0002 in. tight to 0·0007 in. clear (0,005 mm. tight to 0,018 mm. clear)	——	——
Brake drum — shaft diameter.	0·2485 in. + 0·0005 in. (6,312 mm. + 0,013 mm.)	——	——
Wormshaft — drum diameter.	0·2485 in. — 0·0005 in. (6,312 mm. — 0,013 mm.)	——	——
Interference or clearance.	0·000 in. tight to 0·001 in. clear (0,000 mm. tight to 0,025 mm. clear)	——	——
Worm gears backlash.	0·002 in. to 0·007 in. (0,05 mm. to 0,18 mm.)	——	——
Worm shaft end float.	0·002 in. to 0·005 in. (0,05 mm. to 0,13 mm.)	0·005 in. (0,13 mm.)	Adjust end float by selecting suitable adjusting washer.
Motor armature end float.	0·002 in. to 0·012 in. (0,05 mm. to 0,03 mm.)	0·012 in. (0,03 mm.)	Adjust end float by selecting suitable adjusting washer.
Pressure of brushes on commutator.	4·4 oz. to 5·6 oz. (125 g. to 160 g.)	——	Renew spring or brushes to maintain pressure.
Solenoid brake spring — free length.	1·287 in. (approx.) (32,69 mm.) (approx.)	——	——
Load required to compress spring to a length of 1·045 in. (26,55 mm.).	6 lb. 8 oz. to 7 lb. (2,95 kg. to 3,18 kg.)	——	——
Operating spring free length.	1·00 in. (approx.) (25,4 mm.) (approx.)	——	——
Load required to compress spring to a length of 0·70 in. (17,8 mm.)	100 lb. (45,4 kg.)	——	——
2 B.A. half nuts — motor to mounting plate.	Torque tighten to between 30 lb.in. and 36 lb.in. (0,34 kgm. and 0,41 kgm.)	——	——

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DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Dimensional Data—continued			
Remainder of 2 B.A. nuts.	Torque tighten to between 48 lb.in. and 60 lb.in. (0,55 kgm. and 0,69 kgm.)	——	——
Pole piece screws.	Torque tighten to between 6 lb.ft. and 8 lb.ft. (0,83 kgm. and 1,11 kgm.)	——	——
Bolts — actuator to rear extension.	Torque tighten to between 16 lb.ft. and 18 lb.ft. (2,21 kgm. and 2,49 kgm.)	——	——

ACTUATOR MOTOR TEST DATA

Nominal operating voltage	12.
Torque developed in either direction of armature rotation at 20°C. with a 0·9 ohm solenoid brake load connected in shunt with the armature	40 oz.in. at 200 r.p.m. (min.) at 16·5 amp. (max.) and 20 oz.in. at 700 r.p.m. (min.) at 14·5 amp. (max.)

Test voltage must be measured at the motor flags lead terminals. Motor must be mounted with the field pole mounting screws uppermost for all performance tests.

Field coil resistance per winding	0·26 ohm to 0·3 ohm.
Resistance of armature winding (measured between adjacent commutator bars)	0·16 ohm. to 0·19 ohm.

SOLENOID TEST DATA

Voltage required to withdraw plunger against spring loading from a set distance of 0·075 in. (1,91 mm.)	5·0 volts (max.)
Voltage required to hold plunger back against spring pressure	1·0 volts (min.)

Note When the plunger and solenoid assembly has been satisfactorily tested the components should be kept together and fitted as a complete unit.

ACTUATOR TEST DATA

Voltage required to operate actuator — temperature range 70°C. to minus 17·8°C.	9 volts (min.)
Time taken to rotate a 2 in. (50,8 mm.) lever through 80° 15′ with a torque of 15·0 lb.in. (0,17 kgm.) applied to the lever	1·5 seconds (max.)

With 9 volts applied at the motor and an ambient temperature of 20°C. the stall torque on the end of the lever must be 40 lb.in. (0,46 kgm.).

With 12 volts applied at the motor and an ambient temperature of 20°C. the stall torque on the end of the lever must be 70 lb.in. (0,81 kgm.).

With 12 volts applied to the motor and 10 lb.in. (0,12 kgm.) load applied to the lever the actuator must select to within 3° of the correct position.

With 14 volts applied at the motor and no load on the lever, the actuator must not 'hunt' between selector positions. It is permissible for the lever to move slightly past a selected position then return to that position before halting. It is not permissible for the actuator lever to move forward and backward past the selected position before finally halting in the position required.

DUAL RELAY TEST DATA

Contact gap	0·020 in. to 0·025 in. (0,51 mm. to 0,64 mm.)
Core gap (contacts open)	0·030 in. to 0·035 in. (0,76 mm. to 0,89 mm.)
Contact pressure (closed)	5·1 oz. to 6·8 oz. (145 g. to 195 g.)
Cut-in volts	4 volts to 9 volts
Drop-off volts	2·5 volts (min.)
Relay winding resistance	17 ohms. to 19 ohms. (at 20°C.)

The volt drop across the contacts should not exceed 100 milli-volts when a current of 10 amps. is flowing through them, and the relay coil is supplied with a nominal 12 volts.

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Section 2
Transmission — To Remove and Fit

Transmission — To remove

Drive the car onto a ramp or over a pit; this is necessary to enable the transmission to be lowered when it is disconnected from the engine.

Chock both front wheels and one of the rear wheels to prevent the car from moving.

Jack up the other rear wheel to enable the propeller shaft to be rotated when the hand brake is released. Select 'N' to ensure that the transmission is not locked in the Park position.

Disconnect the negative lead from the battery.

Remove the hand brake spring from the operating lever and the body.

Remove the split pin and clevis pin from the pivot point in the end of the hand brake operating lever.

Remove the setscrews which secure the centre section cross-member on which the hand brake operating and balance levers are mounted. Move the centre section cross-member away from the transmission and suitably support the member to avoid 'kinking' the hand brake cables.

Disconnect the speedometer cable. Mask the end of the cable to exclude dust and dirt.

Unclip the wiring harness from the transmission dipstick filler tube, then remove the setscrew which secures the tube to the rear of 'A' bank cylinder head. Figure 33 shows the transmission disconnecting points viewed from the off-side.

Place a clean container, minimum capacity 4 pints (Imp.), 4·8 pints (U.S.), 2,3 litres, under the sleeve nut which secures the filler tube to the side of the sump. Slacken the nut and allow the oil to drain.

Remove the dipstick and filler tube.

Blank off the tapped hole in the sump to prevent any

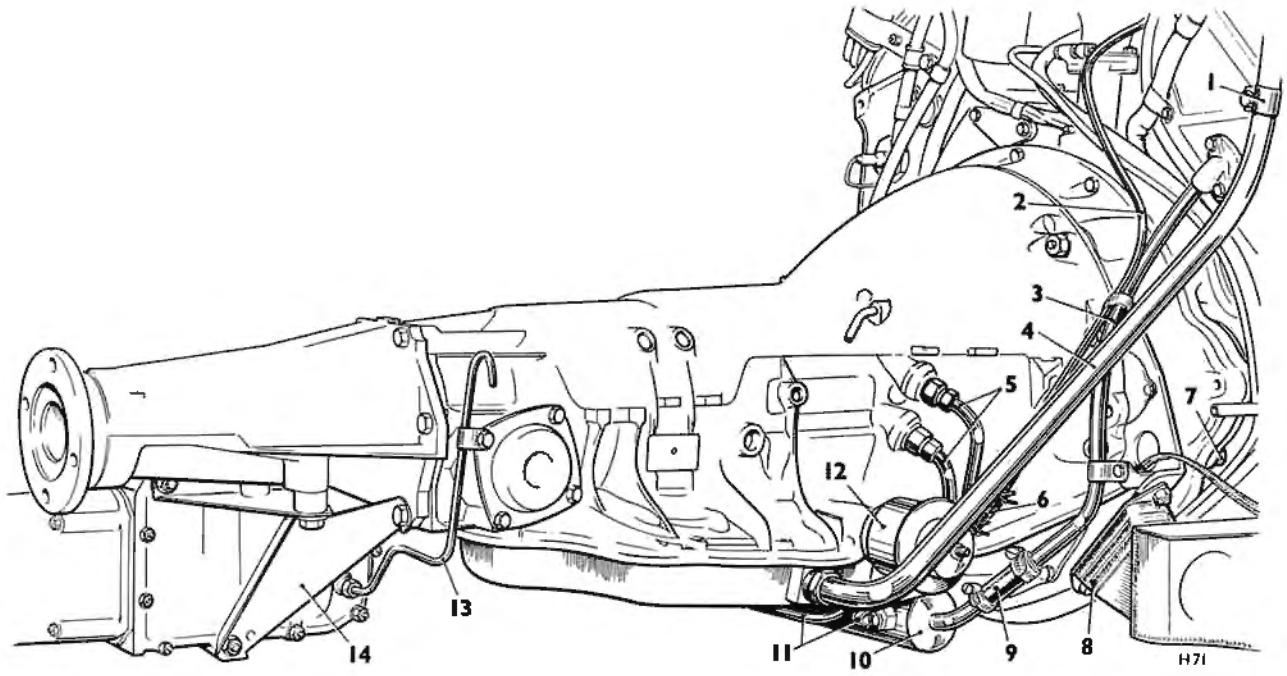

Fig. 33 Transmission disconnecting points — off-side

1 DIPSTICK AND FILLER TUBE CLIP
2 VACUUM PIPE
3 COOLANT FEED PIPE TO HEAT EXCHANGER
4 DIPSTICK AND FILLER TUBE
5 TRANSMISSIO6 FLUID FEED AND RETURN PIPES
6 VACUUM PIPE CONNECTION
7 STARTER MOTOR BOTTOM BOLT
8 RIGHT-HAND FLEXIBLE MOUNT
9 COOLANT PIPE CONNECTION
10 HEAT EXCHANGER
11 TRANSMISSION FLUID PIPES (HEAT EXCHANGER END)
12 VACUUM MODULATOR
13 ELECTRIC ACTUATOR BREATHER PIPE
14 ACTUATOR MOUNTING BRACKET

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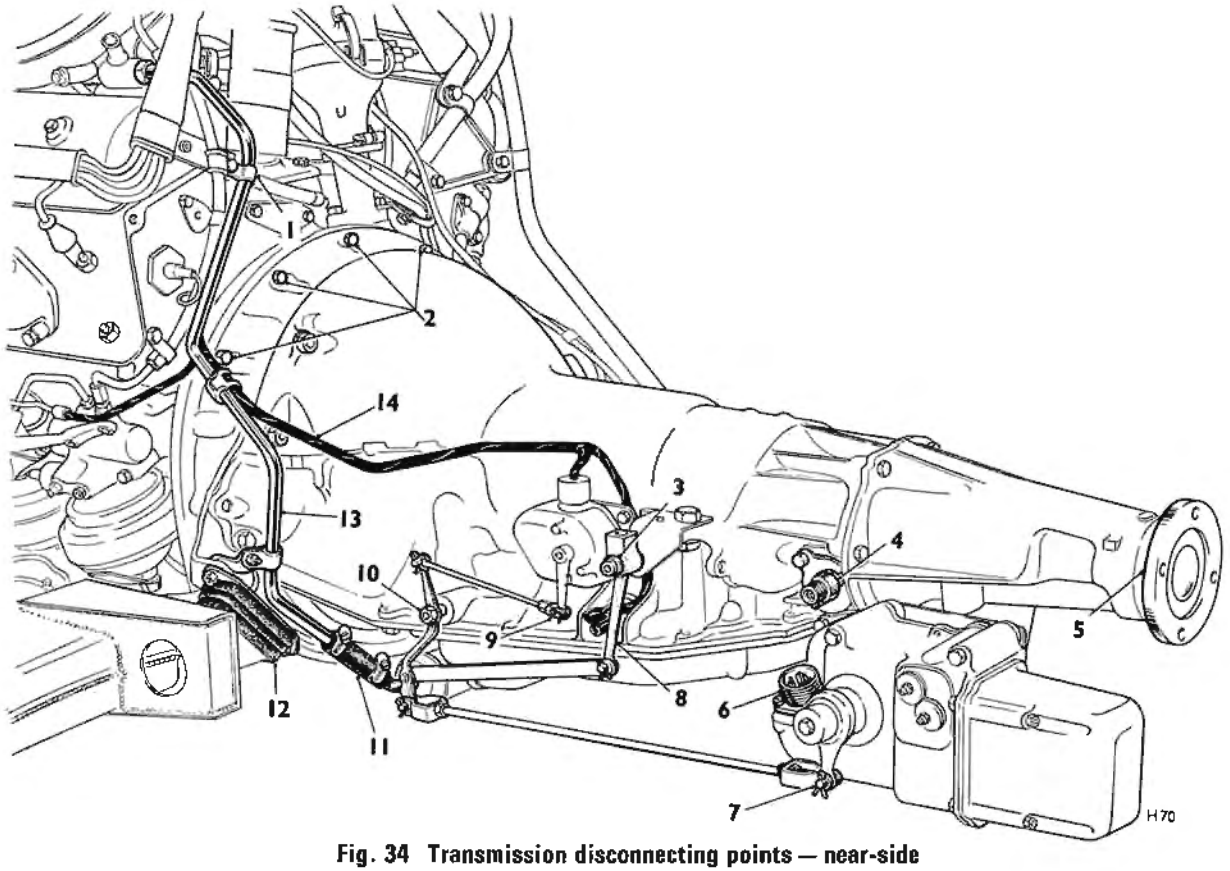

Fig. 34 Transmission disconnecting points — near-side

1 COOLANT RETURN PIPE CLIP
2 TRANSMISSION TOP SECURING SETSCREWS
3 EMERGENCY (GET-YOU-HOME) LEVER
4 SPEEDOMETER DRIVE
5 COUPLING FLANGE
6 JACK PLUG SOCKET
7 ACTUATOR LEVER CLEVIS PIN
8 DETENT AND STATOR LEAD CONNECTORS
9 MICRO SWITCH LEVER CLEVIS PIN
10 GEARCHANGE LEVER LOCK-NUT
11 HEAT EXCHANGER COOLING CONNECTION
12 NEAR-SIDE FLEXIBLE MOUNT
13 HEAT EXCHANGER COOLANT RETURN PIPE
14 MICRO SWITCH AND SOLENOID LEADS

remaining oil from running out as the transmission is being removed.

Unscrew the multi-pin plug retaining ring and withdraw the plug from its socket on the gearchange actuator. Mask the plug and the socket to prevent the ingress of dust and dirt.

Remove the setscrew which retains the actuator breather pipe to the transmission casing. Remove the pipe from the actuator.

Remove the split pin and clevis pin from the gearchange actuator lever.

Remove the split pin and clevis pin which secures the micro switch operating rod to the switch lever.

Remove the emergency (Get-You-Home) lever retaining nut and heavy washer.

Remove the lock-nut which retains the gearchange operating lever on the manual shaft.

Prise off the gearchange operating lever from the shaft then remove all the manual controls.

Remove the three bolts which secure the actuator to the rear extension; remove the actuator.

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

Slacken the four bolts at the front of the propeller shaft. Remove three of the bolts and the remaining bolt from the rear flange, allowing the shaft to rest on the rear cross-member.

Remove the bolt from the front flange, lower the front end of the shaft then remove the shaft by drawing it forward and downward.

Drain the engine coolant into a clean container.

Disconnect the two short rubber hoses, one on each side of the heat exchanger.

Note There will be a small quantity of coolant in the heat exchanger and associated pipes which will not drain until the rubber hoses are disconnected.

Remove the rod which connects the accelerator

pedal lever to the cross-shaft lever.

Disconnect the throttle operating rod at the compensating linkage. Raise the bonnet to gain access to the linkage.

Note The rod should be disconnected at the compensating linkage rather than at the cross-shaft. This will prevent damage to the rod whilst the transmission is being either removed or fitted.

Remove the four setscrews which secure the accelerator cross-shaft brackets to the underside of the body; remove the brackets, shaft, levers and rods.

Disconnect the heat exchanger coolant feed pipe at the rear of 'A' bank cylinder head.

Remove the clips and bolts which secure the coolant pipe to the transmission and the vacuum pipe; remove the coolant pipe.

Disconnect the near-side heat exchanger coolant return pipe at the junction above 'B' bank rocker cover. Figure 34 shows the transmission disconnecting points viewed from the near-side.

Unclip the wiring harness, remove the setscrews which secure the heat exchanger coolant return pipe to the rear of 'B' bank cylinder head, then remove the nut, bolt and washer which secures the heat exchanger return pipe to the engine rear mounting foot. Remove the heat exchanger return pipe.

Disconnect the vacuum modulator pipe at the modulator end and at the induction manifold; remove the pipe. Mask the open ends at the manifold and the modulator.

Disconnect and remove the heat exchanger transmission fluid pipes; these are located on the off-side of the transmission case.

Remove the four setscrews which secure the heat exchanger to the bell housing bottom cover; remove the heat exchanger. Mask the openings in the heat exchanger and the transmission.

Remove the nuts and washers which secure the neutral start and height control switches to the transmission mounted bracket on the left-hand side of the transmission.

Remove the two Lucar terminals from the detent and stator solenoid connector; note the colour of the leads to ensure that they are correctly connected when the transmission is later fitted to the car.

Tie the switch and lead assembly to a convenient point, clear of the transmission so that it will not be damaged.

Disconnect the starter motor leads.

Remove the starter motor securing setscrews.

Note The top setscrew has a special head and is fitted from the rear of the bell housing. Access to the screw is through a hole in the toeboard.

Remove the starter motor. Retain the spacer(s) fitted between the starter motor flange and the crankcase face.

Remove the setscrews which secure the front cover plate and the bell housing bottom cover; remove the plate and the cover.

Remove the setscrews which secure the engine flexplate to the torque converter.

Caution Carefully turn the torque converter until the setscrews can be reached. Do not lever on the flex-plate or starter ring or they may become damaged.

On early cars, the transmission is secured to the adaptor plate by through-bolts and, as a result, the adaptor plate must be removed with the transmission, In this instance proceed as follows.

Position a jack under the rear of the engine sump. Ensure that the load is spread evenly by placing a piece of wood between the sump and the head of the jack. Raise the jack to take the weight of the engine and transmission.

Remove any dirt from around the mounting brackets then scribe correlation marks on the transmission mounting feet and on the sub-frame around the mounting brackets. This will enable the transmission to be correctly positioned when it is fitted.

Support the transmission with the aid of a trolley jack and extension, using a suitable platform to fit around the transmission sump.

Remove the bolts which secure the rubber mounts to the transmission.

Remove the setscrews which secure the bracket to the sub-frame. Remove the mounting brackets and rubber mounts.

Unscrew the eight setscrews which secure the transmission to the engine. It may be necessary to lower the engine and transmission slightly to gain access to some of the setscrews; the uppermost setscrews can be reached from the engine compartment.

Note It may not be possible to remove all the setscrews completely owing to the close proximity of adjacent components, but the setscrews may be unscrewed sufficiently to clear their mating threads without having to withdraw the transmission. **Do not** remove the five large nuts and one setscrew which secure the transmission to the adaptor.

Carefully move the transmission toward the rear of the car, disengaging the adaptor from the engine crankcase. The adaptor is dowelled to the crankcase.

On later cars the transmission is secured to the adaptor plate by setscrews, and can be removed from the car whilst leaving the adaptor and the mounting plate in position.

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Support the transmission with the aid of a trolley jack and extension, using a suitable platform to fit around the transmission sump.

Unscrew the five $\frac{7}{16}$ in. dia. setscrews which secure the transmission to the adaptor.

Carefully move the transmission toward the rear of the car until the dowels in the transmission are clear of the mounting plate.

The remaining procedure is applicable to all cars.

Fit the retaining clamp J–21366 to prevent the converter from becoming disengaged from the transmission.

Caution The retaining clamp must be used, otherwise the converter may fall as the transmission is being removed.

Lower the jack until the transmission clears the body then remove the transmission from the car.

Remove the retaining clamp then withdraw the converter.

Caution A converter with oil weighs approximately 50 lb. (22,7 kg.). Handle it carefully.

If work is to be done on the transmission, fit it to the holding fixture J–8763–20 as shown in Figure 35.

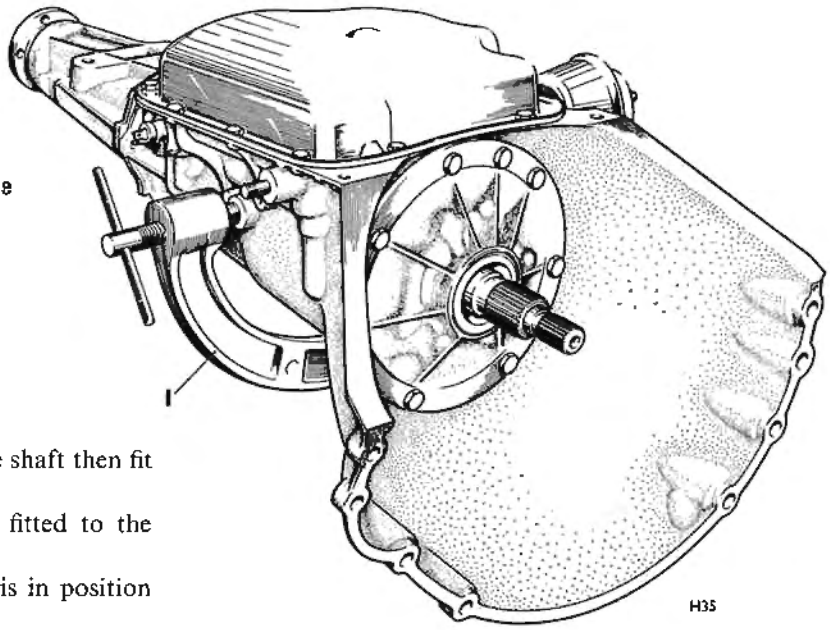

Fig. 35 Transmission in holding fixture

1 HOLDING FIXTURE

Transmission — To fit

Fit the torque converter onto the turbine shaft then fit the retaining clamp.

Fit the transmission onto the cradle fitted to the trolley jack.

Raise the jack until the transmission is in position then remove the retaining clamp.

On early cars ensure that the mating faces of the transmission adaptor and the engine crankcase are clean and free from damage.

Note It is advisable to fit setscrews into those holes which are difficult to reach when the transmission is finally positioned.

Align the dowels in the adaptor with the dowel holes in the crankcase then push the transmission forward.

Fit the setscrews and torque tighten them to the standard figures shown in the torque tightening table.

On later cars ensure that the mating faces of the transmission and the mounting plate are clean and free from damage.

Align the dowels in the transmission case with the holes in the mounting plate then push the transmission forward.

Fit the setscrews and torque tighten them.

The following procedure must be carefully observed when securing the torque converter to the engine flex-plate.

Rotate the converter until two of the three weld nuts on the converter line up with two bolt holes in the flex-plate.

Position the converter so that the weld nuts are flush with the flex-plate. Ensure that the converter is not tilted and that the pilot in the centre of the converter is correctly seated in the crankshaft.

Fit two setscrews from the front of the flex-plate and torque tighten them to 28 lb.ft. (3,9 kgm.).

Note The two bolts must be tightened at this stage to ensure that the converter is correctly aligned with the flex-plate and crankshaft.

Insert a screwdriver or pinch bar under one of the converter weld nuts. Rotate the converter until the third setscrew can be fitted. Torque tighten the setscrew to 28 lb.ft. (3,9 kgm.). **Do not** lever on the starter ring when rotating the converter.

If the adaptor and mounting plate have been removed raise the transmission slightly higher than its normal position and fit the mounting brackets and rubber mounts. Before tightening the brackets to the

sub-frame and the transmission, ensure that the correlation marks, which were scribed during removal, are aligned.

Ensure that the earthing lead is fitted to the top bolt on the right-hand mounting foot.

Remove the jack from beneath the engine sump.

Torque tighten the mounting setscrews and bolts, to the standard figures.

Remove the trolley jack.

Fit the front cover plate and the bell housing bottom cover.

Fit the starter motor; do not forget to fit the spacer(s) if removed (see Section M 4, Chapter M of T.S.D. 2205 – Workshop Manual).

Fit the neutral start and height control switches.

Connect the stator and detent leads to the case connector. The white and brown lead goes to the stator terminal (top, horizontal) and the white and green lead to the detent terminal (side, vertical).

Note On some early cars the detent lead is purple and white.

Fit the heat exchanger to the transmission bottom cover.

Remove the blanks then fit the heat exchanger transmission fluid pipes.

Fit the modulator vacuum pipe.

Fit the heat exchanger coolant feed and return pipes.

Fit the accelerator cross-shaft and bracket assembly.

Fit the throttle operating rod. Fit a new split pin at the lower end. Ensure that the upper end is lubricated.

Ensure that the throttle opens fully and returns when the pedal is released.

Fit the propeller shaft.

Fit the gearchange actuator.

Fit the gearchange levers and rods. Lubricate the clevis pins and fit new split pins. Torque tighten the gearchange operating lever lock-nut to 18 lb.ft. (2,49 kgm.). Check the manual controls as described in Chapter 2 – Section 4.

Remove the masking from the multi-pin plug and socket. Fit the plug and tighten the nut.

Fit the breather pipe.

Fit the oil filler tube and the dipstick.

Remove the masking from the speedometer cable; connect the cable.

Fit the centre section cross-member; torque tighten the setscrews.

Fit the hand brake operating lever. Lubricate the clevis pin and fit a new split pin. Fit the return spring.

Connect the battery.

Lower the car onto the road wheels.

Replenish the coolant system.

Fill the transmission with fluid as described in Chapter 2 – Servicing.

Road test the car to ensure that the transmission functions correctly.

Section 3
Torque Converter

Description

The torque converter serves two primary functions. It acts as a fluid coupling to transmit engine torque smoothly to the transmission, it also multiplies the engine torque when additional performance is required.

The torque converter comprises three basic elements; a pump, a turbine and a stator (see Fig. 36).

The converter cover is welded to the pump to seal all three members in an oil filled housing. An engine driven flex-plate bolts directly onto the converter cover so that the converter pump is mechanically connected to the engine and turns whenever the engine rotates.

Operation

When the engine is running and the converter pump is rotating, oil is picked up at the centre of the pump and discharged at the rim, between the pump blades. The pump shell and blades are designed so that the oil leaves the pump rotating clockwise, toward the turbine blades. As the oil strikes the turbine blades, it causes the turbine to rotate.

When the engine is idling, the converter pump rotates slowly and the force of oil is not sufficient to rotate the turbine with any efficiency. This situation enables the car to stand in gear with the engine slowly idling. As the engine throttle is opened, the pump speed increases and the force of oil striking the turbine causes it to transmit torque to the gear train. After the oil has imparted its force to the turbine, the oil follows the contour of the turbine shell and blades, leaving the centre of the turbine, and rotating anti-clockwise.

Because the turbine member has absorbed the force required to reverse the direction of the clockwise rotating oil it now has greater torque than is being

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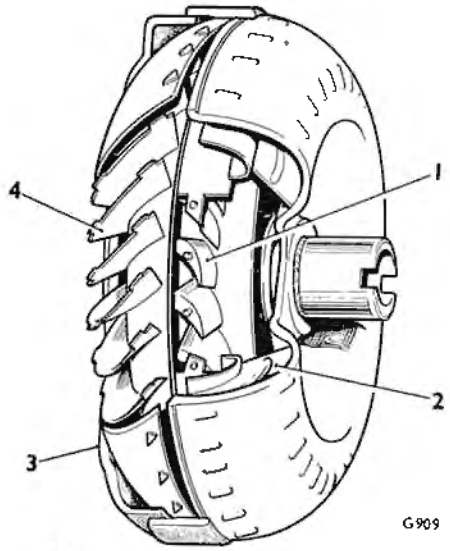

Fig. 36 Torque converter — cutaway view

1 VARIABLE ANGLE STATOR
2 PUMP
3 CONVERTER COVER
4 TURBINE

delivered by the engine.

To prevent the anti-clockwise spinning oil from striking the pump blades at an angle that would hinder its rotation, a stator assembly is interposed between the pump and the turbine. The purpose of the stator is to redirect the oil returning from the turbine so that its direction is altered to suit that of the pump (see Fig. 37); the energy of the oil is then used to assist the engine in turning the pump. This increases the force

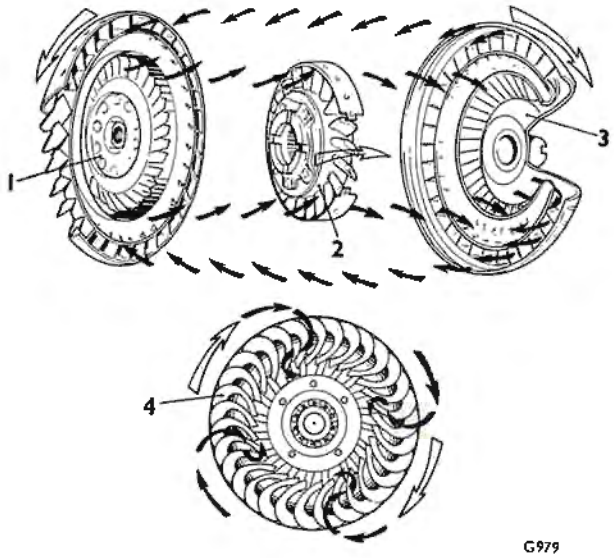

Fig. 37 Fluid flow with stator active

1 TURBINE
2 STATOR
3 PUMP
4 STATOR AND TURBINE

of the oil driving the turbine and, as a result, multiplies the torque.

The force of oil flowing from the turbine to the stator blades tends to rotate the stator anti-clockwise, but a sprag clutch, on which the stator is mounted, prevents this.

To further increase the performance and torque multiplication of the converter, the stator blades are made to alter their angle. Low angle provides more efficient converter operation throughout most of the operating range of the transmission. High angle causes the converter to become less efficient when the engine

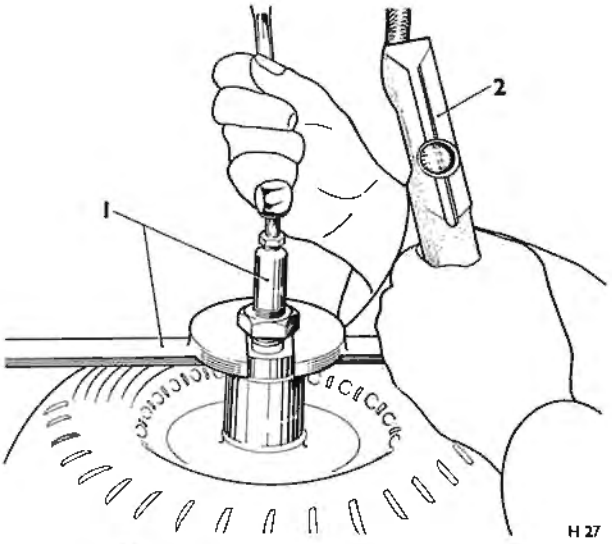

Fig. 38 Torque converter leak testing fixture

1 CONVERTER LEAK TEST FIXTURE
2 PRESSURE GAUGE

is idling and so prevents 'creep' when the car is standing in gear. At larger throttle openings with higher engine speeds, the high angle provides a greater redirection of oil returning to the converter pump. This results in increased engine speed and torque multiplication to assure maximum performance.

As both turbine and car speeds increase, the direction of the oil leaving the turbine changes. The oil flows clockwise against the rear side of the stator vanes. If the stator was fixed, the flow of oil would be impeded, but the sprag clutch allows the stator to rotate on its shaft. Once the stator becomes inactive there is no further torque multiplication and the converter functions as a fluid coupling at a ratio of 1 : 1.

Torque converter — To remove

Remove the transmission as described in the preceding Section.

Position a drip tray underneath the converter.

Remove the converter retaining clamp from the bell housing end of the transmission casing; remove the converter.

Caution The converter and oil weigh approximately 50 lb. (22,7 kg.) and care should be taken when removing it to ensure that it is not dropped or damaged.

Torque converter — To inspect

Examine the converter for signs of damage.

Examine the bush in the neck of the variable pitch stator for signs of wear.

Examine the neck of the converter for wear.

Examine the pump drive slots for wear.

Torque converter — To leak test

To enable the torque converter to be leak tested, fixture J–21369 will be required (see Section 17 – Workshop tools).

Fit the valve portion of the fixture into the neck of the converter; unscrew the large hexagonal nut.

Fit the fixture band crosswise onto the converter so that the slotted plate fits around the valve and under the nut (see Fig. 38). Tighten the nut to expand the 'O' ring so that a good seal is obtained.

Apply compressed air to the valve in the top of the tool at between 80 lb/sq.in. and 100 lb/sq.in. (5,6 kgm/sq.cm. and 7,0 kgm/sq.cm.).

Immerse the converter in water, noting any sign of bubbles which would indicate a leak. Remove the converter from the water. Renew the converter if a leak is evident.

Depress the valve stem to release the air pressure; remove the leak test fixture.

Caution Ensure that the pressure is released before removing the fixture, otherwise the valve may blow out during removal.

Torque converter — To fit

If the torque converter has been leak tested, ensure that all traces of water have been removed.

Fit the converter to the transmission, ensuring that the driving slots engage with the tangs in the transmission oil pump.

Fit the converter retaining plate.

Section 4
Vacuum Modulator and Valve

Description

The vacuum modulator is secured to the right-hand side of the transmission case and is connected by a pipe to the engine induction system. The modulator consists of a metal case which encloses an evacuated metal bellows, a diaphragm and springs. These are

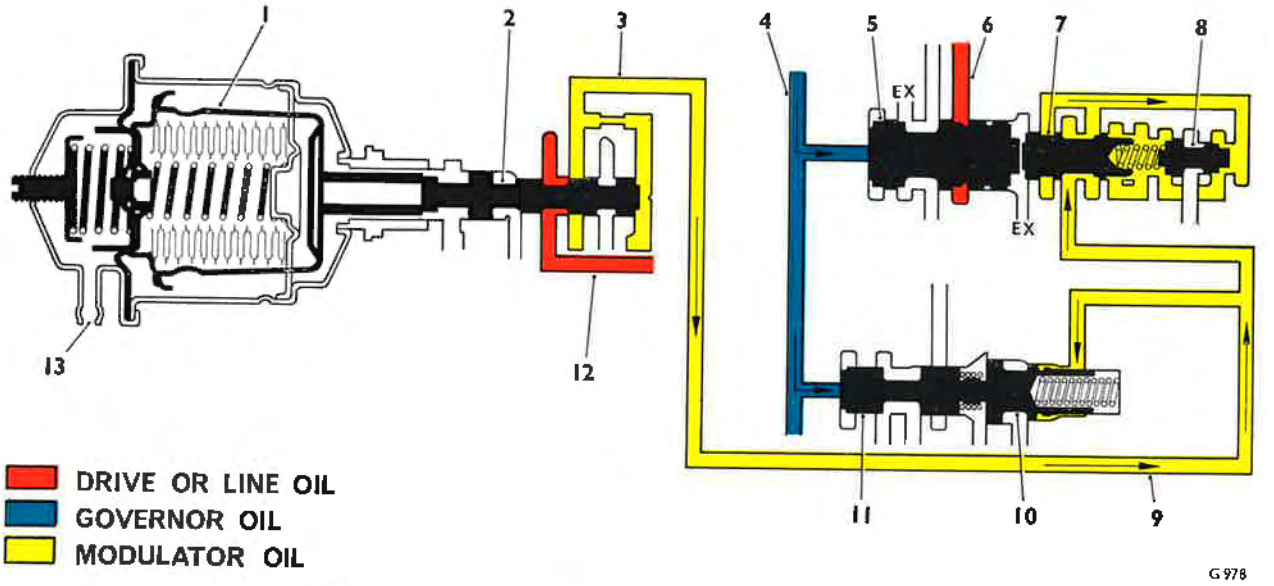

Fig. 39 Vacuum modulator and valve showing modulator pressure

1 VACUUM MODULATOR
2 MODULATOR VALVE
3 MODULATOR OIL
4 GOVERNOR OIL
5 1-2 VALVE
6 DRIVE OIL
7 1-2 DETENT VALVE
8 REGULATOR VALVE
9 MODULATOR OIL
10 2-3 MODULATOR VALVE
11 2-3 VALVE
12 LINE OIL
13 VACUUM CONNECTION

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arranged so that when fitted, the bellows and one spring apply a force that acts on the modulator valve to increase modulator pressure. Engine vacuum and another spring act in the opposite direction to decrease modulator pressure.

Operation

Modulator pressure is directed to the 1–2 regulator valve which regulates modulator pressure to a lesser pressure which is proportional to modulator pressure. This tends to keep the 1–2 shift valve in the closed or down-change position. Modulator pressure is directed also to the 2–3 modulator valve to apply a variable pressure proportional to modulator pressure. This tends to hold the 2–3 shift valve in the closed, or down-change position. As a result, the gear change points can be delayed to take place at higher road speeds with heavy throttle application (see Fig. 39).

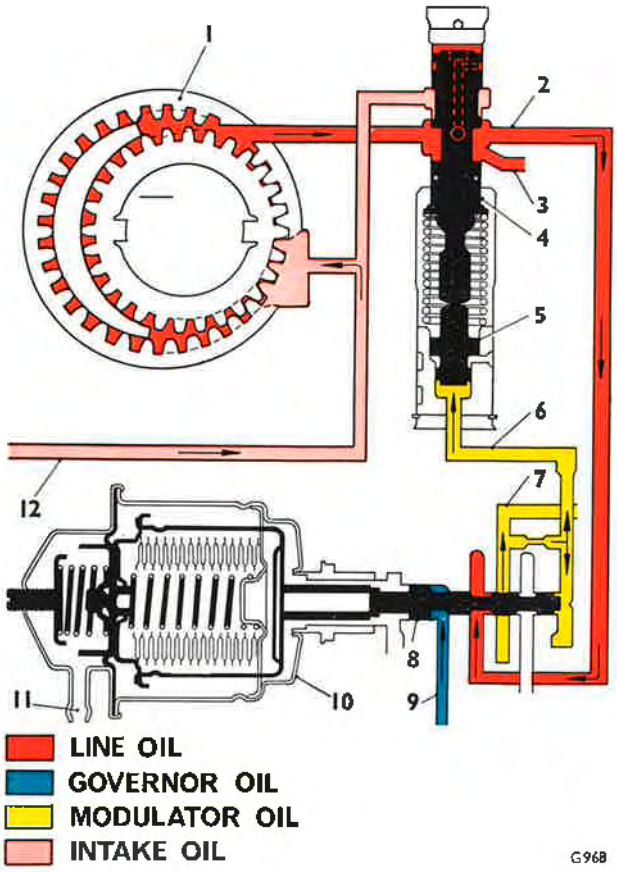

Fig. 40 Vacuum modulator and valve showing line pressure control

1 OIL PUMP
2 LINE OIL
3 CONVERTER OIL
4 PRESSURE REGULATOR OIL
5 BOOST VALVE
6 MODULATOR OIL
7 MODULATOR OIL 1-2 ACCUMULATOR VALVE
8 MODULATOR VALVE
9 GOVERNOR OIL
10 VACUUM MODULATOR
11 VACUUM CONNECTION
12 INTAKE OIL

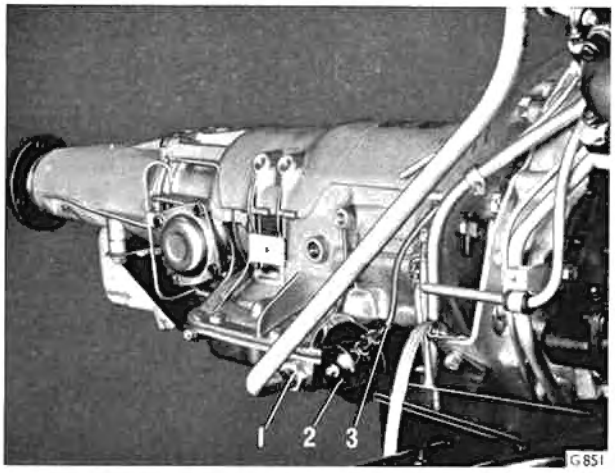

Fig. 41 Vacuum modulator and vacuum pipe

1 OIL FILLER TUBE SECURING NUT
2 VACUUM MODULATOR
3 VACUUM PIPE

Main line oil pressure is controlled in Drive range so that it will vary with torque input to the transmission. Since torque input is a product of engine torque and converter ratio, modulator pressure is directed to a pressure regulator boost valve, to adjust main line (pump) pressure for changes in either engine torque or converter ratio (see Fig. 40).

To regulate modulator pressure and in turn, line pressure, with the converter torque ratio that decreases as car speed increases, governor pressure is directed to the modulator valve to reduce modulator pressure with increases in car speed. In this way, line pressure is regulated to vary with torque input to the transmission for smooth changes with sufficient capacity for both heavy and light acceleration.

Vacuum modulator and valve — To remove

The vacuum modulator can be removed from the transmission without removing the transmission from the car. The following instructions apply whether or not the transmission has been removed.

Place a drip tray beneath the vacuum modulator.

Disconnect the vacuum pipe at the modulator end if the transmission is in the car (see Fig. 41).

Remove the setscrew and retainer which secure the modulator to the transmission.

Remove the modulator and 'O' ring; discard the 'O' ring.

Remove the modulator valve from the transmission case.

Vacuum modulator and valve — To inspect

Examine the vacuum modulator for signs of distortion.

Examine the 'O' ring seat for damage.

Apply suction to the vacuum tube on the modulator and check for leakage.

Examine the modulator valve for scores or damage. Ensure that the valve will move freely in its bore in the case.

Examine the modulator for damaged bellows. The modulator plunger is under approximately 16 lb. (7,3 kg.) pressure. If the bellows is damaged, very little pressure will be applied to the plunger.

Vacuum modulator and valve — To fit

Fit the valve into the bore in the case with the stem outward.

Fit a new 'O' ring to the modulator.

Fit the modulator to the case with the vacuum pipe connection toward the front of the car, approximately 45° from the vertical.

Fit the retainer with the curved side of the tangs facing the transmission.

Fit the retaining setscrew and torque tighten it to 18 lb.ft. (2,5 kgm.).

Connect the vacuum pipe.

Section 5
Governor Assembly

Description

The governor assembly (see Fig. 42) fits into the rear of the transmission casing on the right-hand side and is driven by a gear on the transmission output shaft.

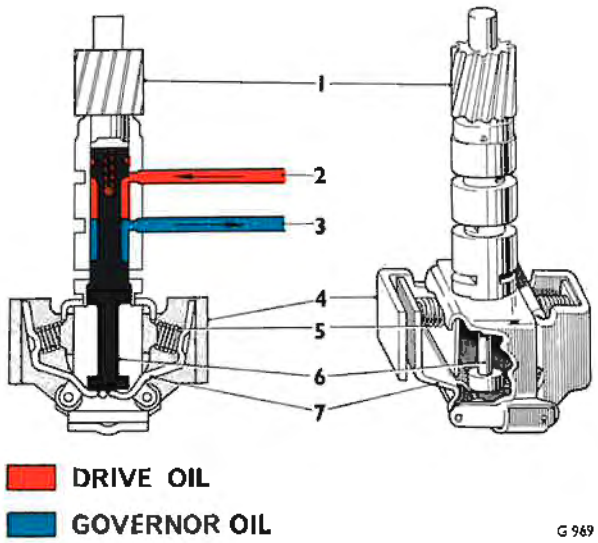

Fig. 42 Governor assembly

1 DRIVEN GEAR
2 DRIVE OIL
3 GOVERNOR OIL
4 PRIMARY WEIGHT
5 SPRING
6 VALVE
7 SECONDARY WEIGHT

The car speed signal for an automatic gearchange is supplied by this governor.

The assembly comprises a regulating valve, two primary weights, two secondary weights, secondary springs, body and driven gear. The weights are arranged so that only the secondary weights act on the valve. The primary weights contribute to the secondary weights through the secondary springs.

Operation

Slight changes in output shaft r.p.m. at low speeds result in small governor pressure changes.

The primary weights add heavy force to the secondary weights to obtain greater changes in pressure as road speed and output shaft r.p.m. increase. As the primary weights move out at higher car speeds they reach a stop and no longer become effective. From this point, the secondary weights and springs only are used to apply pressure on the governor valve.

Drive oil pressure is fed to the governor where it is regulated by the governor and gives an oil pressure that is proportional to car road speed.

To initiate the gear change from first to second, governor oil pressure is directed to the end of the 1–2 shift valve where it acts against spring pressure which is holding the valve in the down-change (closed) position (see Fig. 43).

As the car road speed, and subsequently the governor oil pressure increases sufficiently to overcome the spring resistance, the 1–2 shift valve train moves,

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allowing drive oil to flow into the intermediate clutch passage and through an orifice to apply the intermediate clutch. This makes the intermediate sprag effective which moves the transmission into second gear. Further increases in road speed and governor pressure will cause the transmission to change into third gear when governor pressure overcomes the 2–3 shift valve spring pressure.

Governor pressure is directed also to the modulator valve to regulate modulator pressure as described in the previous Section.

Governor assembly — To remove

The governor assembly can be removed from the transmission whether the transmission is fitted to the car or not.

Position a drip tray beneath the governor cover plate.

Remove the four setscrews which secure the plate to the case; remove the plate and discard the gasket.

Withdraw the governor assembly from the case (see Fig. 44).

Governor assembly — To dismantle

All the governor assembly components, with the exception of the driven gear, are selectively assembled and each assembly is calibrated. Therefore, it is recommended that should the governor assembly become unserviceable, it be renewed as an assembly. If the driven gear is damaged, it should be renewed separately.

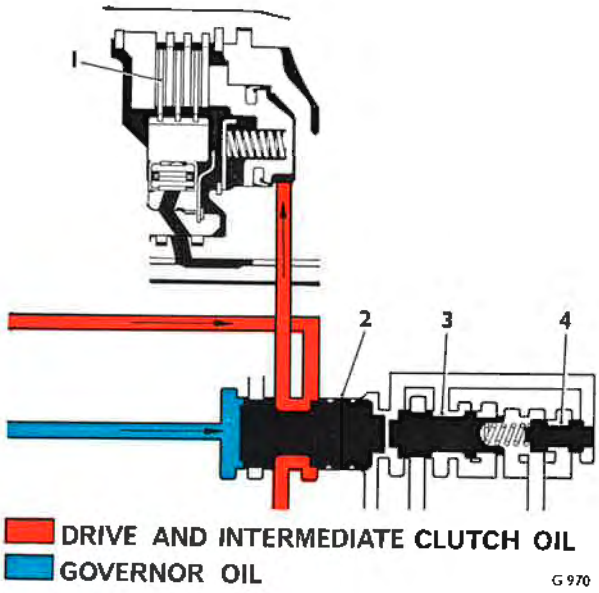

Fig. 43 Governor oil acting on the 1-2 shift valve

1 INTERMEDIATE CLUTCH **3** 1-2 DETENT VALVE
2 1-2 VALVE **4** REGULATOR VALVE

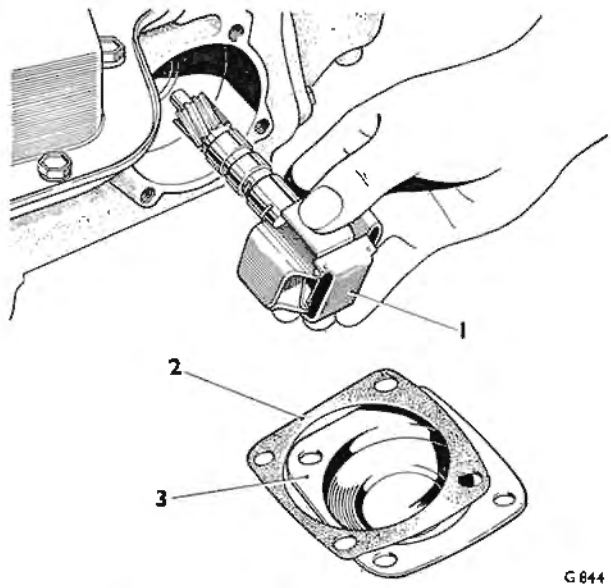

Fig. 44 Removing the governor assembly

1 GOVERNOR **2** GASKET **3** COVER PLATE

It is necessary to dismantle the governor assembly in order to renew the driven gear. Dismantling may be necessary also to thoroughly clean the governor should dirt cause it to malfunction. In such cases proceed as follows.

Cut off one end of each of the governor weight retaining pins. Remove the pins, thrust cap, governor weights and springs (see Fig. 45). The weights are interchangeable and need not be marked for identification.

Carefully remove the governor valve from the sleeve.

Governor assembly — To inspect

Wash all the components in clean paraffin (kerosene) then dry them with compressed air.

Examine the governor sleeve for scores or burrs.

Ensure that the governor sleeve will slide freely into its bore in the transmission casing.

Examine the valve for scores and burrs.

Ensure that the valve will slide freely in the governor sleeve bore.

Examine the driven gear for damage. Ensure that the gear is secure on the shaft.

Examine the springs for damage or distortion.

Ensure that the weights operate freely in their retainers.

Check the valve opening at inlet and exhaust; the minimum is 0·020 in. (0,508 mm.).

Governor driven gear — To renew

Drive out the gear retaining pin using a hammer and drift.

Support the governor sleeve on two $\frac{3}{16}$ in. (4,76 mm.) thick plates inserted in the exhaust slots in the sleeve.

Position the plates on the bed of a press with provision for the gear to pass through, then, using a long drift, press the gear out of the sleeve.

Thoroughly clean the governor sleeve to remove any swarf which may be present from the original gear assembly operation.

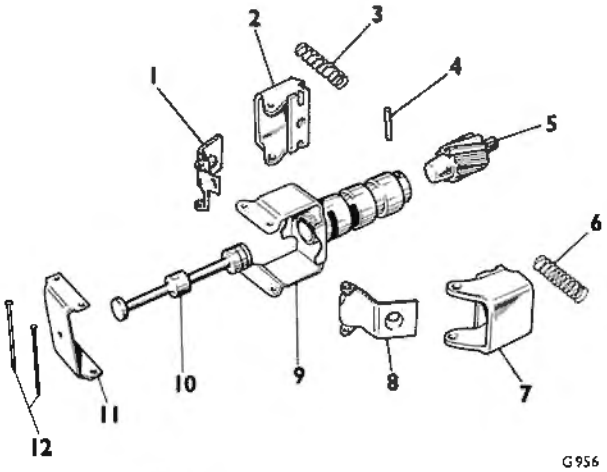

Fig. 45 Governor assembly — exploded

1 SPRING RETAINER (SECONDARY WEIGHT)
2 WEIGHT
3 WEIGHT SPRING
4 GEAR RETAINING PIN
5 DRIVEN GEAR
6 WEIGHT SPRING
7 WEIGHT
8 SPRING RETAINER (SECONDARY WEIGHT)
9 SLEEVE AND CARRIER ASSEMBLY
10 VALVE
11 THRUST CAP
12 RETAINING PINS

Note Ensure that the new gear is the correct one for the transmission casing in which it is to be fitted. A later type of casing incorporates a steady pin which locates the governor driven gear (see Parts List).

Support the governor sleeve on the two $\frac{3}{16}$ in. (4,76 mm.) plates.

Position the new gear in the sleeve then, using a suitable drift, press the gear into the sleeve until it is nearly seated. Carefully remove any swarf which may have shaved off the gear hub, then, press the gear down until it abuts the sleeve.

Mark the position of a new hole on the sleeve at 90° to the original hole then, using a drill of 0·187 in. (4,76 mm.) diameter, drill a new hole through the sleeve and gear.

Fit the gear retaining pin.

Thoroughly wash the gear and sleeve assembly in clean paraffin (kerosene) and dry with compressed air.

Governor assembly — To assemble

Lightly oil the valve then fit it into the governor sleeve.

Fit the governor weights, springs and thrust cap onto the governor sleeve.

Align the pin holes in the thrust cap, governor weight assemblies and governor sleeve.

Fit new pins and crimp both ends of the pins.

Ensure that the governor weights are free to operate on the pins.

Governor assembly — To fit

Lightly lubricate the governor sleeve and gear then fit the governor assembly into the transmission case.

Fit the cover, together with a new gasket.

Fit the four setscrews and torque tighten them to 18 lb.ft. (2,5 kgm.).

Section 6
Speedometer Drive

Description

The speedometer drive (see Fig. 46) is secured to the left-hand side of the transmission main casing by a setscrew and retainer. It is driven by a gear on the transmission output shaft at a ratio of 43 : 19.

Speedometer drive — To remove

To disconnect the speedometer cable unscrew the knurled nut at the transmission end then withdraw the cable. If the speedometer drive is to be removed for any length of time, mask the open end of the drive cable to prevent the ingress of dust and dirt.

Remove the setscrew and retainer then withdraw the speedometer drive; discard the 'O' ring.

Speedometer drive — To dismantle

Hold the gear between soft jaws in a vice.

Remove the split pin then remove the nut and washer securing the gear to the drive-shaft.

Tap the gear off the shaft using a soft-headed mallet.

Utilizing the two machined flats on the oil seal housing, hold the housing in soft jaws in a vice then unscrew the halves of the assembly.

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Withdraw the drive-shaft.

Speedometer drive — To inspect

Wash all the dismantled parts in clean paraffin (kerosene).

Examine the gear teeth for damage or excessive wear.

Examine the squared end of the shaft for cracking.

Examine the threads on the oil seal retainer for damage.

If the oil seal is to be renewed it should be pressed out of the housing using a suitable drift.

Examine the drive-shaft for burrs or sharp edges which may damage the oil seal during assembly.

Speedometer drive — To assemble

To assemble the speedometer drive, reverse the procedure given for dismantling, noting the following points.

Torque tighten the castellated nut to 8 lb.ft. (1,1 kgm.) then take the nut to the nearest split pin hole. Do not slacken the nut to correlate the hole and slot. Fit a new split pin.

Lightly lubricate the drive-shaft before passing it through the oil seal.

Ensure that the body and the seal housing are screwed tightly together.

Check the drive-shaft end float; there should be a minimum of 0·015 in. (0,396 mm.).

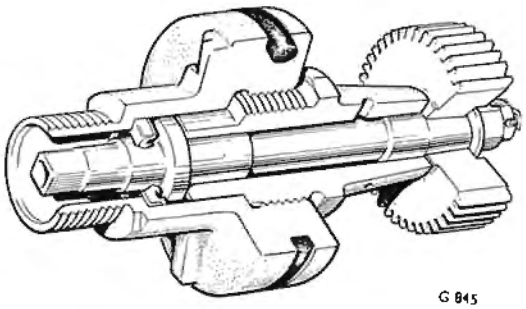

Fig. 46 Speedometer drive

Speedometer drive — To fit

Fit a new 'O' ring to the groove in the speedometer drive housing.

Lightly lubricate the 'O' ring to ease the fitting of the speedometer drive; fit the drive to the case.

Fit the retainer and setscrew. Torque tighten the setscrew to 18 lb.ft. (2,49 kgm.).

Connect the speedometer drive cable.

DIMENSIONAL DATA FOR SECTION 6 SPEEDOMETER DRIVE

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Drive-shaft end float.	0·015 in. (0,38 mm.) minimum	——	——
Gears backlash.	0·008 in. to 0·014 in. (0,20 mm. to 0,35 mm.)	——	——
Castellated nut — gear to shaft.	Torque tighten to 8 lb.ft. (1,11 kgm.)	——	Take nut to next split pin hole.
Setscrew — speedometer housing retainer to casing.	Torque tighten to 18 lb.ft. (2,49 kgm.)	——	——

Section 7
Sump, Strainer and Intake Pipe

Strainer and intake pipe — To remove

The strainer and intake pipe assembly may be removed from the transmission whether the transmission is fitted to the car or not.

The following procedure should be adopted, assuming that the transmission is fitted to the car.

Position a clean container under the dipstick tube nut where it enters the sump. The capacity of the container should be 4 pints (Imp.), 4,8 pints (U.S), 2,27 litres minimum.

Slacken the setscrews in the clips at the top of the dipstick tube.

Unscrew the sleeve nut at the bottom of the tube then pull the tube clear of the sump; allow the oil to

drain.

Remove the heat exchanger fluid pipes (see Fig. 47). Blank off the feed and return holes in the case and the heat exchanger.

Remove the four setscrews which secure the heat exchanger to the bottom cover of the torque converter.

Push the heat exchanger clear of the sump and secure it temporarily to obtain access to the setscrews securing the front of the sump.

Remove the thirteen setscrews securing the sump.

Lower the sump and drain the remaining oil; discard the gasket.

Lift out the strainer and intake pipe assembly (see Fig. 48).

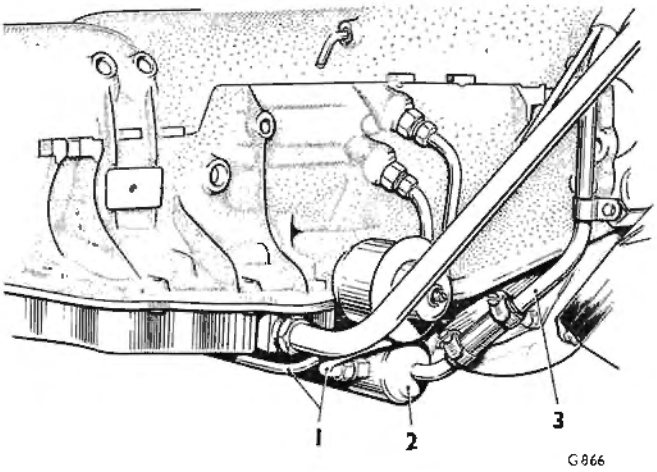

Fig. 47 Heat exchanger fluid pipes

1 TRANSMISSION FLUID PIPES **2** HEAT EXCHANGER
3 COOLANT PIPE

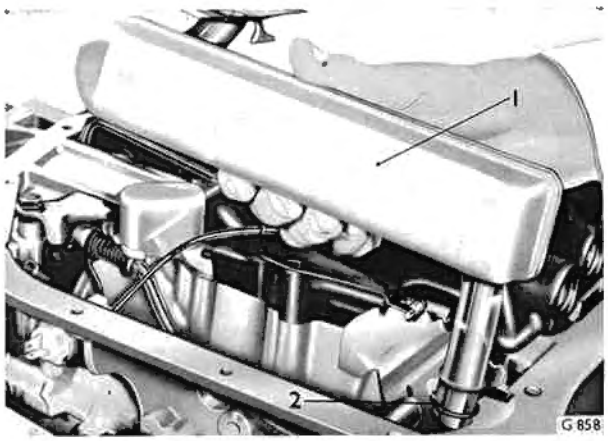

Fig. 48 Removing the strainer and intake pipe assembly

1 STRAINER AND INTAKE PIPE ASSEMBLY **2** 'O' RING

Remove and discard the intake pipe 'O' ring.

Note In cases where the transmission has failed, the strainer and intake pipe must be renewed.

Strainer and intake pipe — To fit

Fit a new 'O' ring into the intake pipe bore in the transmission case.

Lightly lubricate the 'O' ring then fit the strainer and intake pipe assembly.

Ensure that the sump is clean then fit the sump, using a new gasket.

Fit the setscrews to secure the sump; torque tighten them to 12 lb.ft. (1,66 kgm.).

Fit the heat exchanger and pipes, ensuring that the ends of the pipes and the sleeve nut threads are clean and free from dirt.

Fit the dipstick tube; tighten the sleeve nut and the two clip securing setscrews.

Section 8
Control Valve Unit

Description

The control valve unit comprises a cast iron body containing various shift valves and regulator valves which control the gear changes and the timing and spacing of the changes. The unit is secured to an oil guide plate on the bottom face of the transmission.

Operation

Drive range

When the selector lever on the steering column is moved to 'D', the actuator moves the manual valve, by way of levers and rods, to allow main line oil pressure to be delivered to the forward clutch (see Fig. 49). With the forward clutch applied, mechanical connection between the turbine shaft and the mainshaft is provided. The Low sprag assembly becomes effective as the result of power flow through the compound planetary gear arrangement and the transmission will be in first gear.

As the speed of the car increases, first gear is no longer suitable and an up-change to second is required.

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To initiate the change from first to second, governor pressure (see Section 5 – Governor assembly) is directed to the end of the 1–2 shift valve. As the car speed increases, governor pressure moves the valve to allow drive oil to apply the intermediate clutch (see Fig. 43 in Section 5). This makes the intermediate sprag effective and the transmission changes into second gear.

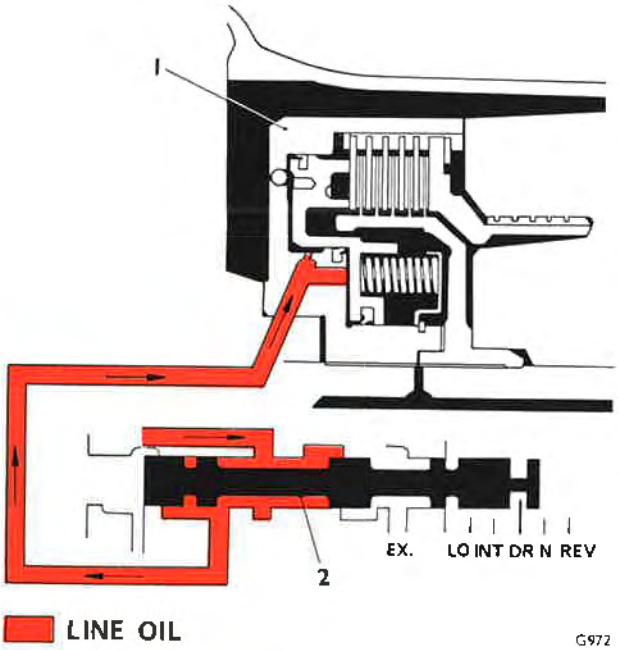

Fig. 49 Manual valve and forward clutch

1 FORWARD CLUTCH **2** MANUAL VALVE

The change to third gear is controlled by the 2–3 shift valve. The operation of the 2–3 shift valve is similar to that of the 1–2 shift valve. Springs acting on the valve tend to hold the valve closed against governor pressure. When the speed of the car is sufficient, the 2–3 shift valve opens and allows intermediate clutch oil to apply the direct clutch. The transmission then moves into third (top) gear. Oil pressure to the direct clutch piston is applied only to a small inner area of the piston in third gear.

Down-change

When the accelerator pedal is released and the car is allowed to decelerate to a stop, the down-changes will occur automatically as the valve springs overcome the diminishing governor pressure.

Delayed up-changes

If the hydraulic system was as basic as previously described, the gear change points would always occur at the same road speeds. When accelerating under heavy loads or when maximum performance is required, it is desirable to have the change points occurring at higher road speeds. To achieve this, a modulator valve is used (see Section 4 – Vacuum modulator and valve).

Clutch application control

To introduce gearchange 'feel', and to ensure long clutch plate life, the clutch apply pressure is regulated to suit throttle application (see Fig. 50). The intermediate clutch is controlled according to throttle opening as follows.

Line pressure is varied by the modulator.

A 1–2 accumulator valve train provides a variable accumulator pressure to cushion clutch apply. The 1–2

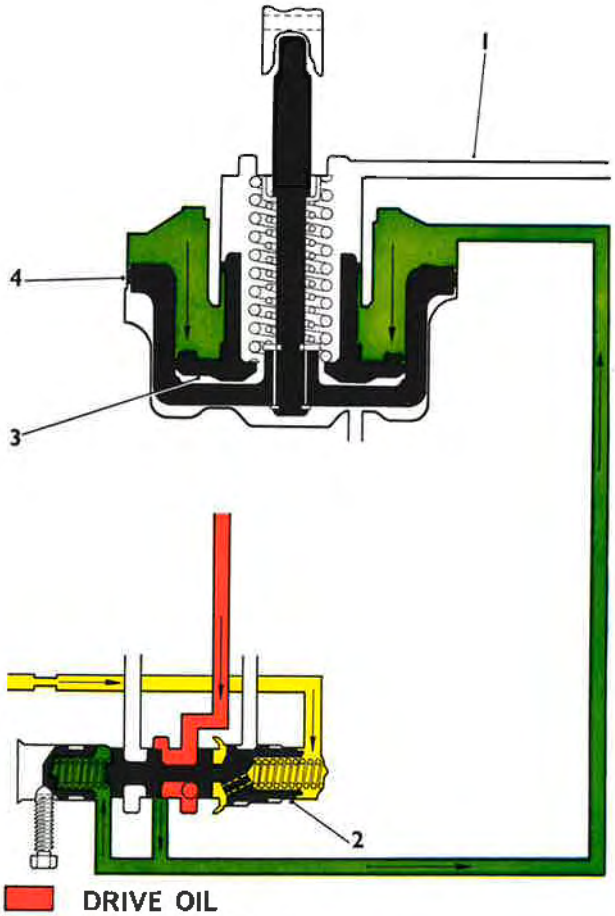

Fig. 50 Accumulator piston stroked prior to 1-2 up-change

1 INTERMEDIATE CLUTCH PASSAGE **3** ACCUMULATOR PISTON
2 1-2 ACCUMULATOR VALVE **4** SERVO PISTON

accumulator valve train is supplied with drive oil and is controlled by modulator pressure. During light throttle application, drive oil is reduced to a low accumulator pressure. During heavy throttle applications, accumulator pressure approaches full main pressure. Accumulator pressure is made to act on one side of the rear accumulator piston in the rear servo (see Section 9 – Rear servo). In first gear, the accumulator piston is stroked to its lower position to prepare it for the change to second gear.

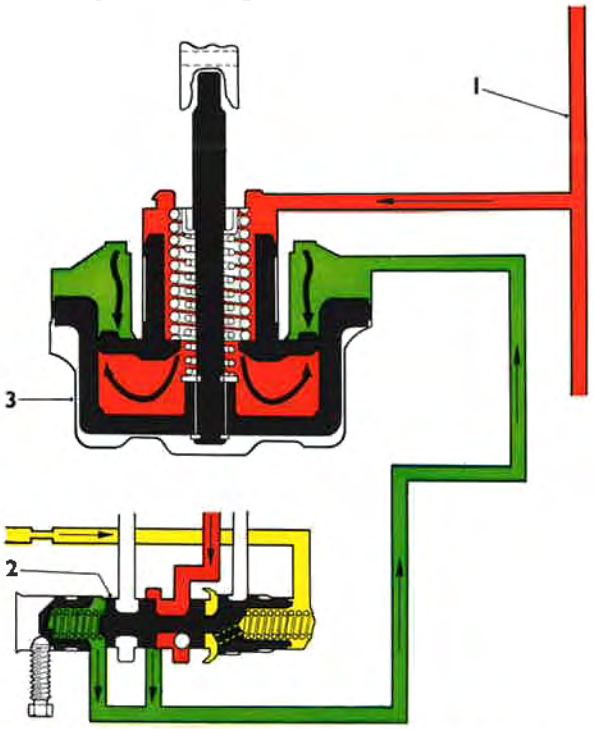

Fig. 51 Accumulator cushioning intermediate clutch application

1 INTERMEDIATE CLUTCH OIL **2** 1-2 ACCUMULATOR VALVE
3 REAR SERVO

When the 1–2 shift valve opens, intermediate clutch apply oil is also directed to the rear servo accumulator piston, stroking the piston against the 1–2 accumulator oil and the accumulator spring (see Fig. 51). This action absorbs a small amount of the intermediate clutch apply oil and permits the clutch apply time and pressure to be controlled for the correct gear change feel.

The direct clutch apply rate is controlled by the front accumulator piston. Located in the control valve assembly, it is part of the front accumulator and servo

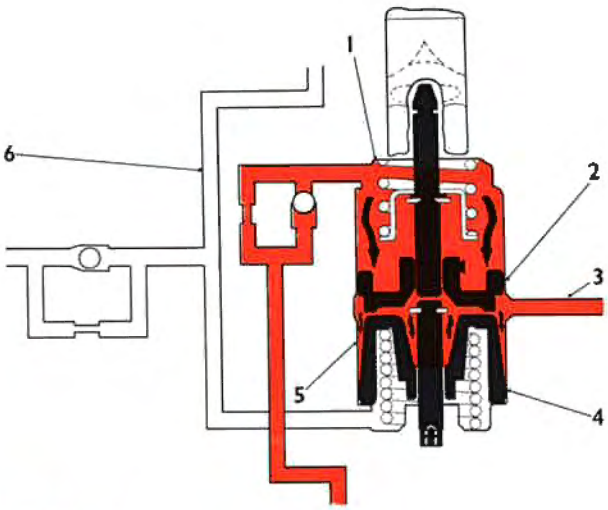

Fig. 52 Front accumulator piston stroked prior to 2-3 up-change

1 TRANSMISSION CASE **4** ACCUMULATOR PISTON
2 SERVO PISTON **5** VALVE BODY
3 INTERMEDIATE CLUTCH OIL **6** DIRECT CLUTCH OIL PASSAGE

piston system (see Fig. 52). In 'D' range, second gear, the accumulator is stroked against the accumulator spring by servo oil. Because servo oil is main line pressure and varies with throttle opening, the pressure in the accumulator is varied according to throttle opening.

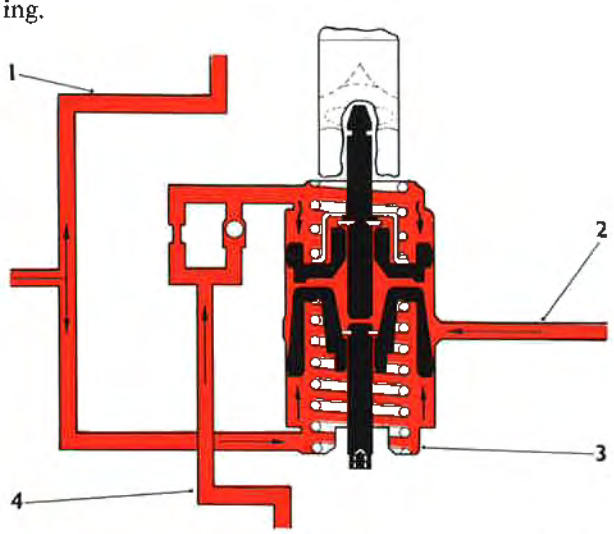

Fig. 53 Front accumulator piston cushioning direct clutch application

1 DIRECT CLUTCH OIL **3** ACCUMULATOR HOUSING
2 INTERMEDIATE CLUTCH OIL **4** SERVO OIL

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When the 2–3 shift valve opens, direct clutch oil flows to the direct clutch and the front accumulator piston (see Fig. 53). Direct clutch pressure rises so that the force from it, plus the accumulator spring force, overcomes the force from the servo pressure and moves the accumulator piston to the stop on the accumulator piston pin. This in turn strokes the servo piston the same amount, allowing it to just contact the band apply washer on the servo pin. However, it will not move the pin or apply the band. The stroking of the accumulator piston absorbs an amount of direct clutch oil and permits the direct clutch to apply at a controlled rate for a smooth 2–3 change.

3-2 valve operation

To take full advantage of the torque converter's ability to multiply torque when required, a 3–2 valve is used. This valve permits the accelerator to be depressed for moderate acceleration at low speeds in third gear without causing the transmission to change down. This allows the torque converter to sense the changes in engine speed and thus provide additional converter ratio for improved performance.

The 3–2 valve system is such that it will permit a 3–2 down-change during moderate to heavy acceleration when modulator pressure reaches approximately 108 lb/sq.in. (7,59 kg/sq.cm.) (see Fig. 54). Modulated oil pressure, plus spring pressure, will move the 3–2 valve against the force of direct clutch oil allowing modulator pressure to be directed to the shift valve trains. Modulator oil can then close the 2–3 valve train against governor pressure causing the part throttle 3–2 down-change.

Forced down-change (kick-down)

At road speeds below approximately 70 m.p.h. (113 km.p.h.) a detent (forced) down-change can be obtained by depressing the accelerator pedal. When the accelerator pedal is fully depressed, the detent valve train takes over from the modulator as the change-point controller.

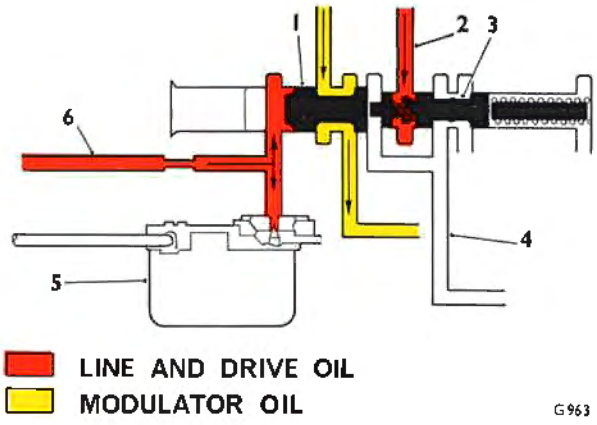

Fig. 55 Detent valve closed

1 DETENT VALVE
2 DRIVE OIL
3 DETENT REGULATOR VALVE
4 DETENT OIL PASSAGE
5 DETENT SOLENOID
6 LINE OIL

Main line oil is fed through a small orifice to one end of the detent valve. During normal operation, the port at the orifice end of the valve is sealed by the needle valve in the detent solenoid assembly. Line pressure thus holds the detent valve in an inoperative or normal position (see Fig. 55).

When the throttle is wide open, an electric micro switch on the carburettor is closed, energising the detent solenoid. This opens an exhaust port at the solenoid causing a pressure drop on the end of the detent valve. The detent valve is moved by the detent valve regulator valve spring and allows the detent regulator to regulate detent oil to a fixed pressure of approximately 70 lb/sq.in. (4,92 kg/sq.cm.).

When the detent valve moves, detent oil is allowed to flow into both the modulator and the detent oil passages to the shift valve trains. The points at which up-changes will then occur is controlled by detent

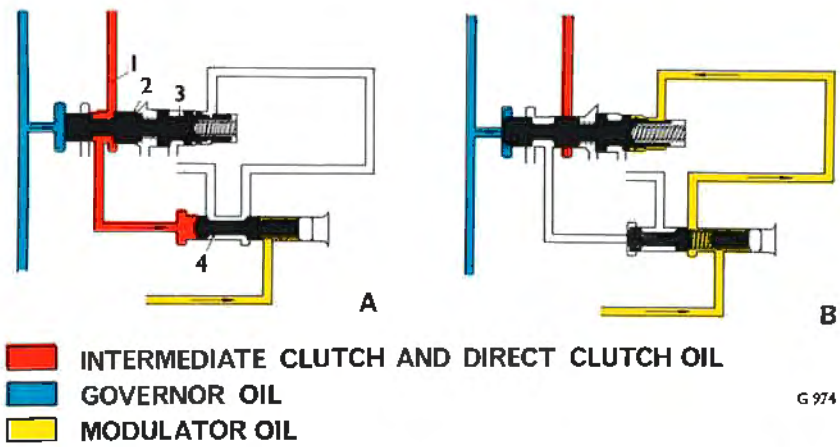

Fig. 54 Part throttle down-change

1 INTERMEDIATE CLUTCH OIL
2 2-3 VALVE
3 2-3 MODULATOR VALVE
4 3-2 VALVE
A VALVES IN 3rd GEAR POSITON, MODULATOR PRESSURE BELOW APPROXIMATELY 108 lb/sq.in. (7,6 kg/sq.cm.)
B PART THROTTLE DOWN-CHANGE, VALVES IN 2nd GEAR POSITION, MODULATOR PRESSURE ABOVE 108 lb/sq.in. (7,6 kg/sq.cm.)

pressure in the modulator passages. Detent down-changes are controlled by detent pressure in the detent passages. These change points are fixed at relatively high speeds by the constant oil pressure.

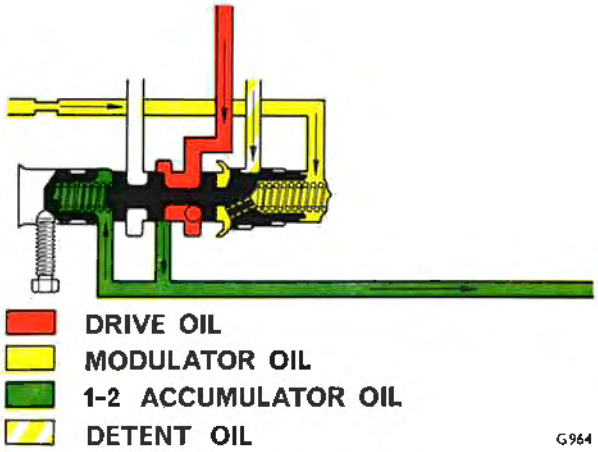

Fig. 56 1-2 accumulator valve

Detent pressure directed to the 1–2 regulator valve makes a detent 2–1 change available at car speeds below approximately 20 m.p.h. (32 km.p.h.).

To preserve the clutch linings during 1–2 up-changes under full throttle conditions, detent oil is directed to the 1–2 accumulator valve to increase 1-2 accumulator pressure (see Fig. 56).

Detent oil is also directed to the modulator valve to prevent modulator pressure from falling below 70 lb/sq.in. (4,92 kg/sq.cm.). This prevents main line pressure from falling below approximately 105 lb/sq.in. (7,38 kg/sq.cm.) regardless of altitude or car speed.

Intermediate range

When the selector lever is moved to the Intermediate 'I' position, the manual valve is moved to uncover a passage which will allow intermediate range oil to act on the 2–3 shift valve. Intermediate oil pressure on the 2–3 shift valve will cause the valve to move and the transmission will change down, regardless of car speeds (see Fig. 57).

To provide overrun engine braking, the front band is applied by the front servo. Intermediate clutch oil flows to the apply side of the servo piston. An orifice is incorporated in the flow path to ensure a smooth piston movement and band application. Intermediate range oil is directed to a check ball which allows the oil to enter the modulator passage leading to the pressure regulator boost valve. The resultant increase of pressure on the end of the boost valve raises main line pressure to 150 lb/sq.in. (10,55 kg/sq.cm.) and

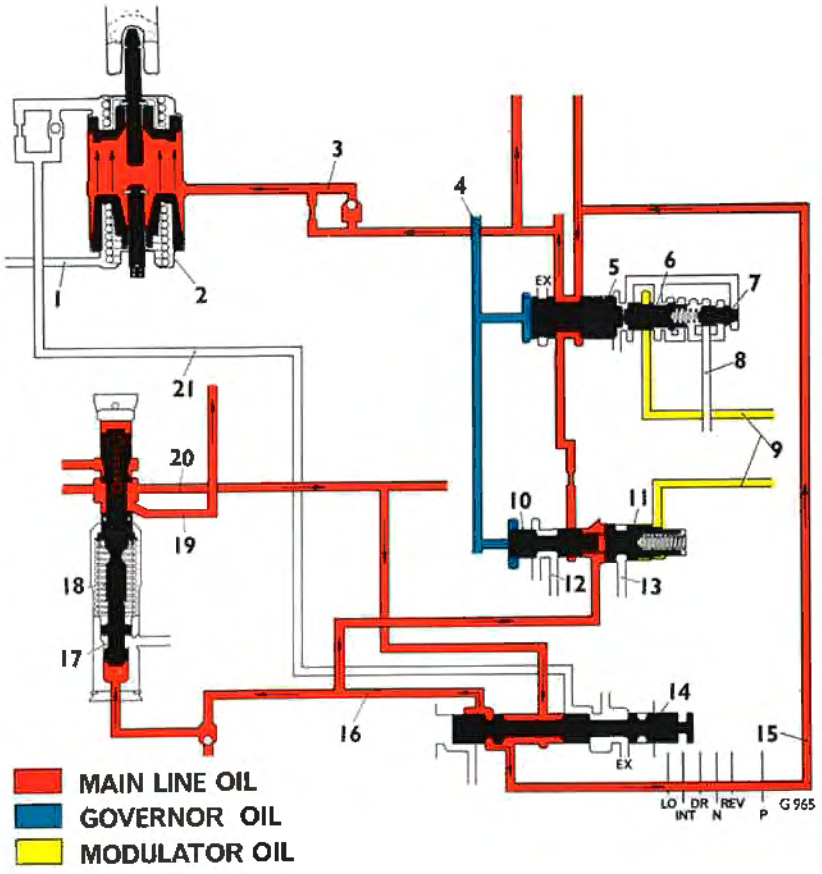

Fig. 57 Valves — intermediate range, 2nd gear

1 DIRECT CLUTCH PASSAGE
2 ACCUMULATOR PISTON
3 INTERMEDIATE CLUTCH OIL
4 GOVERNOR OIL
5 1-2 VALVE
6 1-2 DETENT VALVE
7 REGULATOR VALVE
8 DETENT PASSAGE
9 MODULATOR OIL
10 2-3 VALVE
11 2-3 MODULATOR VALVE
12 DIRECT CLUTCH PASSAGE
13 DETENT PASSAGE
14 MANUAL VALVE
15 DRIVE OIL
16 INTERMEDIATE OIL
17 BOOST VALVE
18 PRESSURE REGULATOR VALVE
19 CONVERTER OIL
20 LINE OIL
21 SERVO OIL PASSAGE

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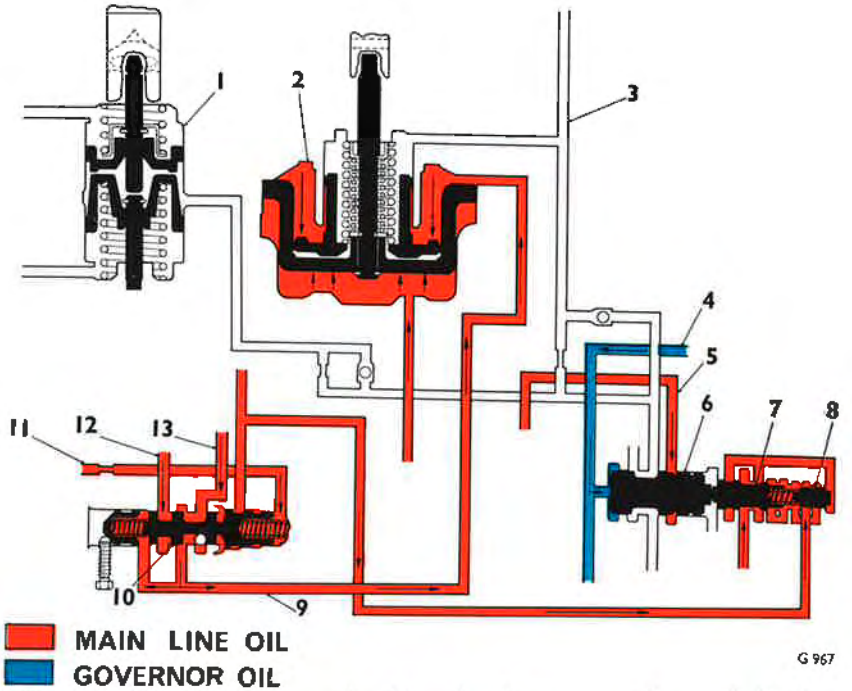
provides sufficient holding forces for overrun engine braking.

Low range

When the selector lever is moved to the Low 'L' range position, the manual valve is moved to allow Low range oil to flow to the detent regulator valve and spacer pin. The spring behind the regulator valve then moves the regulator and detent valves to the opposite end of the valve bore. Low range oil then prevents the regulator valve from regulating and drive oil passes through the hole in the regulator valve into the detent and modulator passages at a Low range pressure of 150 lb/sq.in. (10,55 kg/sq.cm.). As a result of this, the 1–2 shift valve will move to cause a down-change at road speeds below approximately 40 m.p.h (64 km.p.h.) and will prevent an up-change, regardless of the speed of the car.

Fig. 58 Low range 1st gear — rear band applied

1 FRONT SERVO
2 REAR SERVO
3 INTERMEDIATE CLUTCH PASSAGE
4 GOVERNOR OIL
5 DRIVE OIL
6 1-2 VALVE
7 1-2 DETENT VALVE
8 REGULATOR VALVE
9 1-2 ACCUMULATOR OIL
10 1-2 ACCUMULATOR VALVE
11 MODULATOR OIL
12 LOW OIL
13 DRIVE OIL



When the 1–2 shift valve closes, the exhausting intermediate clutch oil lifts two check balls off their seats to enable the front band and the intermediate clutch to release quickly (see Fig. 58).

To provide overrun engine braking, the rear band is applied by directing Low range oil pressure to the rear servo.

Low range oil is directed to the 1-2 accumulator valve during Low range operation to raise 1–2 accumulator pressure to line pressure. This increased pressure, directed to the rear servo accumulator piston, resists servo apply pressure and slows down the application of the rear band to enable a smooth change to be obtained during manual change to Low range, first gear, or for a 2–1 change in Low range.

Reverse

When Reverse 'R' is selected, the manual valve is moved to allow Drive, Intermediate, and Low range oil to be exhausted, and allows main line oil to enter the reverse passages (see Fig. 59). Reverse oil pressure is directed from the manual valve to the large outer area of the direct clutch piston and to the 2–3 shift valve where it enters the direct clutch exhaust port. Reverse oil then flows past the 2–3 shift valve, which is in the down-change position, and enters the third gear direct clutch apply passage. This passage directs reverse oil pressure to the small inner area of the direct clutch piston. With oil pressure on both inner and outer positions of the piston, the clutch applies. Reverse oil pressure is directed also to a check ball which allows oil to enter the same passage to the rear servo apply piston that Low range oil occupied in Low range; this applies the rear band. To ensure adequate oil pressure for the torque requirements in Reverse, reverse oil pressure is directed to the pressure boost valve which increases line pressure to a maximum of approximately 260 lb/sq.in. (18,28 kg/sq.cm.).

Control valve unit — To remove

The control valve unit may be removed with the transmission in position in the car. The oil must be drained and the sump removed to gain access to the control valve unit.

Unscrew the setscrew which secures the detent spring and roller assembly. Remove the spring and roller assembly.

Remove the twelve setscrews which secure the con-

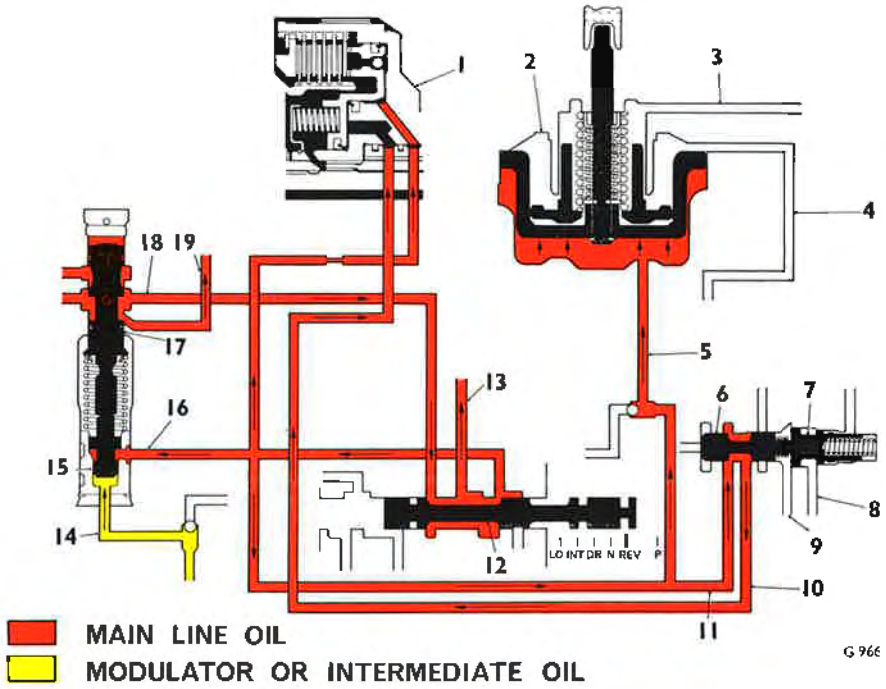


Fig. 59 Reverse — rear band applied

1 DIRECT CLUTCH (APPLIED)
2 REAR SERVO (APPLIED)
3 INTERMEDIATE CLUTCH OIL PASSAGE
4 1-2 ACCUMULATOR OIL PASSAGE
5 REVERSE OIL
6 2-3 VALVE
7 2-3 MODULATOR VALVE
8 DETENT OIL PASSAGE
9 INTERMEDIATE OIL PASSAGE
10 DIRECT CLUTCH OIL
11 REVERSE OIL
12 MANUAL VALVE
13 SERVO OIL
14 MODULATOR OIL
15 BOOST VALVE
16 REVERSE OIL
17 PRESSURE REGULATOR
18 LINE OIL
19 CONVERTER OIL

trol valve unit to the transmission case; remove the clips but leave them attached to the lead. Do not remove the solenoid securing screws.

Note On later models, the number of setscrew holes in the control valve unit was reduced by two, whilst the holes in the transmission case, spacer plate and gasket remain the same. When renewing a control valve unit, all the setscrew holes in the control valve unit must be used.

Remove the control valve unit, together with the two governor pipes (see Fig. 60).

Caution Ensure that the manual valve does not slide out of its bore. Take care to retain the front servo piston should it come out with the control valve assembly.

Withdraw the governor pipes from the control valve assembly; the pipes are interchangeable and need not be marked for identification.

Note If the transmission is to be dismantled further, remove the stator connector from its connection in the case, then remove the detent (short) lead from the stator connector (see Fig. 77 in Section 10).

Control valve unit — To dismantle

Hold the control valve unit with the cored passages uppermost, and the accumulator piston bore to the front as shown in Figure 61.

Remove the manual valve from its bore.

Fit the control valve accumulator installing tool (J–21885) onto the accumulator piston. Compress the piston and remove the 'E' ring container. Remove the accumulator control valve and spring.

Remove the retaining pin, 1–2 bushing, 1–2 regulator valve and spring from the upper right-hand bore.

Remove the 1–2 detent valve and the 1–2 valve.

Remove the retaining pin, 2–3 valve spring, 2–3

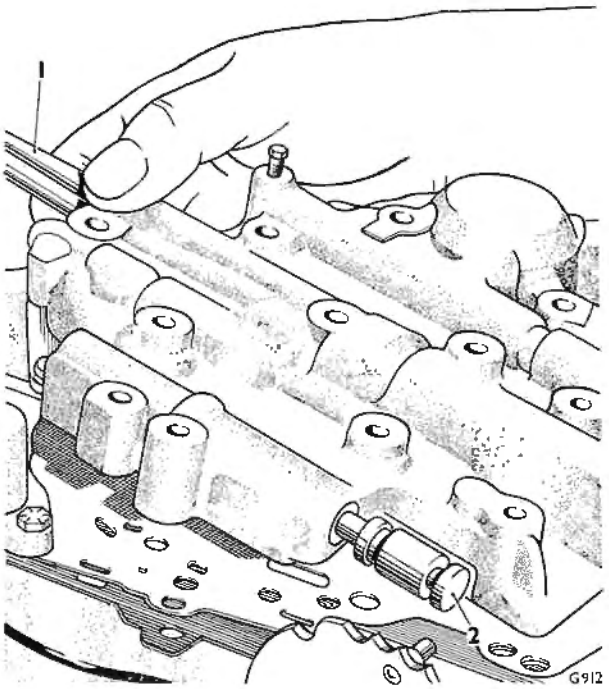


Fig. 60 Removing the control valve unit

1 GOVERNOR PIPES 2 MANUAL VALVE

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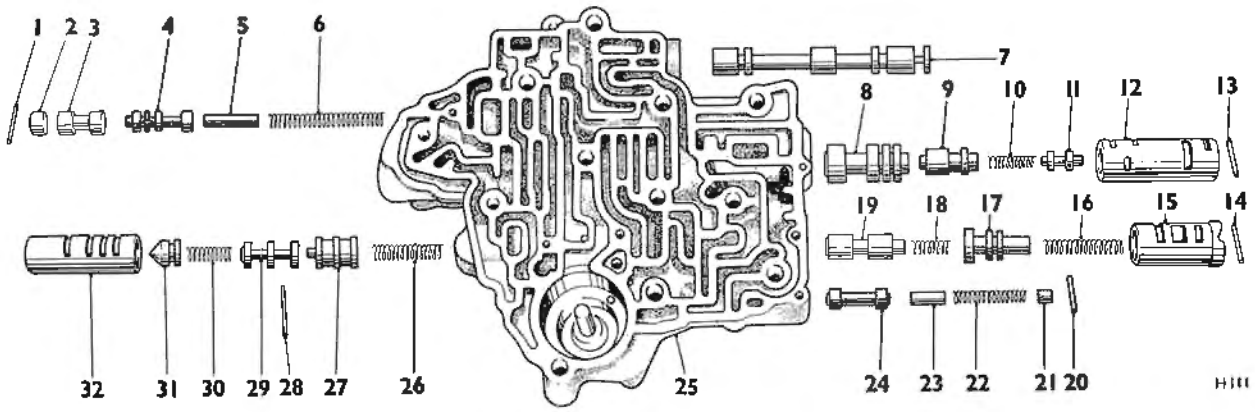

Fig. 61 Control valve unit — exploded

1 RETAINING PIN	**9** 1-2 DETENT VALVE	**17** 2-3 MODULATOR VALVE	**25** VALVE BODY
2 BORE PLUG	**10** 1-2 REGULATOR SPRING	**18** 2-3 INTERMEDIATE SPRING	**26** PRIMARY SPRING
3 DETENT VALVE	**11** 1-2 REGULATOR VALVE	**19** 2-3 VALVE	**27** PRIMARY 1-2 ACCUMULATOR VALVE
4 DETENT REGULATOR	**12** 1-2 SLEEVE	**20** RETAINING PIN	**28** RETAINING PIN
5 SPACER	**13** RETAINING PIN	**21** BORE PLUG	**29** 1-2 ACCUMULATOR VALVE
6 DETENT SPRING	**14** RETAINING PIN	**22** 3-2 SPRING	**30** SECONDARY SPRING
7 MANUAL VALVE	**15** 2-3 SLEEVE	**23** SPACER	**31** BORE PLUG
8 1-2 VALVE	**16** 2-3 VALVE SPRING	**24** 3-2 VALVE	**32** 1-2 ACCUMULATOR SLEEVE

bushing, 2–3 modulator valve and the 2–3 intermediate spring from the middle right-hand bore.

Remove the 2–3 shift valve.

Remove the retaining pin, bore plug, 3–2 spring and spacer and the 3–2 valve from the lower bore.

Remove the retaining pin and bore plug from the upper left-hand bore, adjacent to the manual valve bore. Use an extractor to remove the pin from the back face of the valve.

Remove the detent valve, detent regulator valve spring and the spacer.

Ensure that the 1–2 accumulator valve in the remaining bore is free, by moving the valve against the spring.

Note The small adjusting screw on the outside of the 1–2 accumulator valve bore regulates accumulator valve pressure. Do not disturb the adjusting screw unless it is necessary to remove the valve to free it in the bore.

If it is necessary to remove the screw, its **exact** position must be determined before removal, using a 1 in. to 2 in. (2,5 cm. to 5,0 cm.) micrometer.

After removing any burrs, measure from the screw head to the machined surface of the valve body (see Fig. 62). Note the measurement.

Remove the adjusting screw.

Remove the 1–2 accumulator valve retaining pin from the machined surface of the valve body; remove the plug.

Remove the 1–2 accumulator sleeve, secondary spring and valve.

Remove the primary 1–2 accumulator valve and spring.

Control valve unit — To inspect

Wash in Trichlorethylene, the control valve unit body, valves and the remainder of the parts. Do not allow

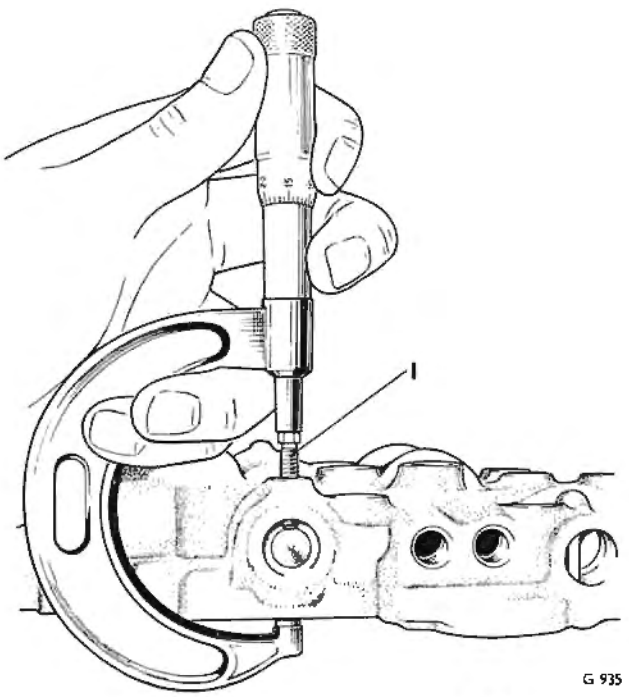

Fig. 62 Measuring the adjusting screw

1 ADJUSTING SCREW

the valves to knock together as this may cause burrs, or damage to the shoulders of the valves.

Examine all valves and sleeves to ensure that they are free from dirt. Any burrs should be carefully removed with a fine stone, or crocus paper slightly moistened with oil. Do not round-off the shoulders of the valves.

When satisfactory, wash the parts and lightly smear all valves and bushings with clean transmission fluid.

All valves and bushes should be tested in their individual bores to ensure that free movement is obtainable. The valves should fall under their own weight, with perhaps a slight tapping of the valve body to assist them. During these checks, ensure that the valves and valve bores are not in any way damaged.

The manual valve is the only valve that can be renewed separately. If other valves are damaged or defective, a new control valve unit must be fitted.

Examine the valve body for cracks or scored bores. Ensure that the cored face is free from damage.

Examine all springs for collapsed or distorted coils.

Control valve unit — To assemble

Before commencing assembly, ensure that all springs can be positively identified, otherwise the transmission will not function correctly. Refer to Figure 61 during assembly procedure.

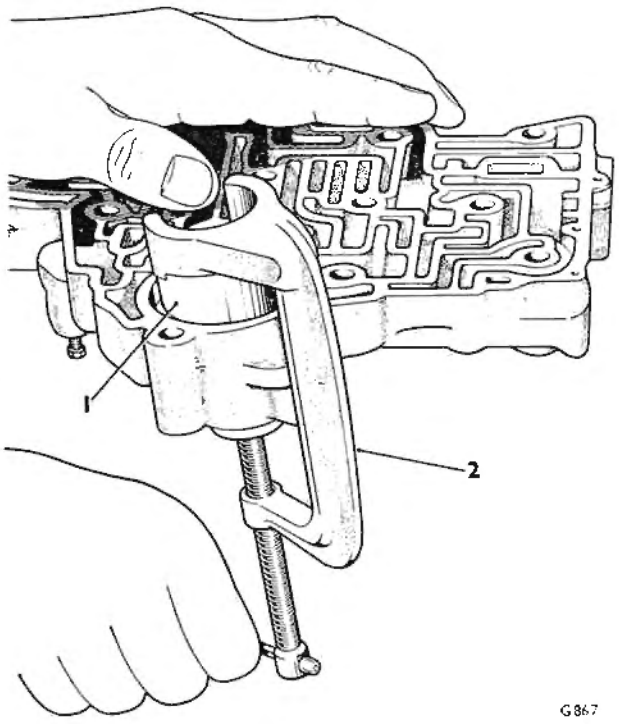

Fig. 63 Fitting the accumulator and spring

1 ACCUMULATOR PISTON **2** INSERTING TOOL

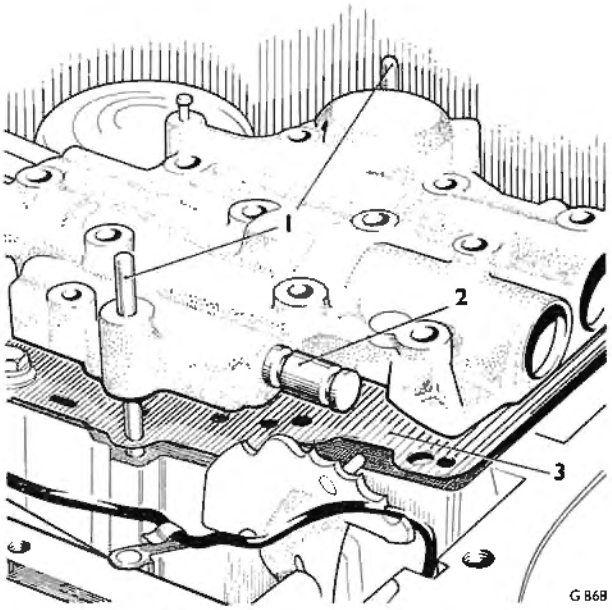

Fig. 64 Fitting the control valve unit

1 GUIDE PINS **2** MANUAL VALVE **3** GASKET

Lightly lubricate all parts with clean transmission fluid before assembly.

Fit the front accumulator spring and piston into the valve body.

Fit the valve body accumulator installing tool (J–21885). Align the piston and spring with the bore then compress the spring and piston (see Fig. 63). Secure the piston with the 'E' ring retainer.

If the 1–2 accumulator valve train has been removed, fit the 1–2 primary spring into the primary 1–2 accumulator valve.

Fit the valve and spring into the lower left-hand bore, spring first. Use a retaining pin as a retractor to hold the valve in its operating position.

Fit the 1–2 accumulator valve (wide land first) into the 1–2 accumulator sleeve.

Fit the 1–2 accumulator sleeve into its bore.

Fit the retaining pin.

Fit the 1–2 accumulator valve secondary spring and the 1–2 accumulator plug into the sleeve.

Fit the adjusting screw to conform to its original micrometer measurement.

Fit the detent spring and spacer into the next left-hand bore above. Compress the spring and hold it with a small screwdriver.

Fit the detent regulator valve, wide land first.

Fit the detent valve, small land first.

Fit the bore plug with the hole facing the outside then fit the retaining pin. Remove the screwdriver.

Fit the 3–2 valve into the lower right-hand bore.

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Fit the 3–2 spring, spacer, bore plug with the hole facing the outside, and the retaining pin.

Fit the 2–3 shift valve, with the stem facing the outside, in the next right-hand bore above.

Fit the 2–3 intermediate spring.

Fit the 2–3 modulator valve into the sleeve, then fit both parts into the valve bore.

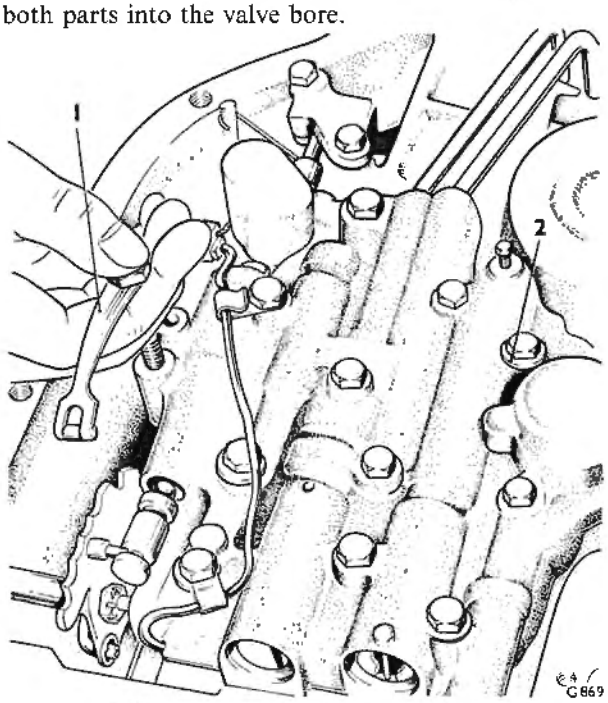

Fig. 65 Fitting the detent spring and roller
1 DETENT SPRING **2** WASHER

Fit the 2–3 valve spring and the retaining pin.

Fit into the next right-hand bore above, the 1–2 shift valve – small diameter first – then fit the 1–2 spring.

Fit the 1–2 regulator valve, spring and detent valve into the sleeve. Align the spring in the bore of the detent valve. Fit the parts into the valve bore.

Push in the sleeve against spring pressure then fit the retaining pin.

Fit the manual valve with the detent pin groove to the right-hand side (outmost).

Control valve unit — To fit

Fit the governor pipes to the control valve unit.

Using two guide pins screwed into the casing, fit the control valve unit into position (see Fig. 64). Ensure that the gasket and oil guide plate (spacer) are correctly positioned.

Note Ensure that the manual valve is correctly located by the pin on the detent lever.

Remove the guide pins and fit the control valve unit securing setscrews; do not fit the detent spring and roller securing screw.

Torque tighten the securing screws to 8 lb.ft. (1,1 kgm.).

Ensure that the stator lead is secured to the clips.

Fit the detent spring and roller assembly (see Fig. 65); fit the securing screw and torque tighten it to 8 lb.ft. (1,1 kgm.).

Fit the short (detent) lead to the stator connector (if it was removed) then fit the connector to the case.

Section 9
Rear Servo

Description

The rear servo comprises an assembly of pistons and springs, and fits onto the bottom face of the transmission casing, adjacent to the control valve unit. It is secured to the casing by six setscrews. The purpose of the servo is to act as an accumulator to absorb an amount of intermediate clutch oil, thus cushioning the application of the clutch, also to apply the rear friction band in Low range and Reverse.

Operation

Drive — Intermediate — first gear

In first gear, Drive and Intermediate ranges, 1–2 accumulator oil is directed to the rear servo accumulator piston in preparation for the 1–2 up-change.

Drive — Intermediate — second gear

Intermediate clutch apply oil is directed to the rear servo accumulator piston, stroking the piston against

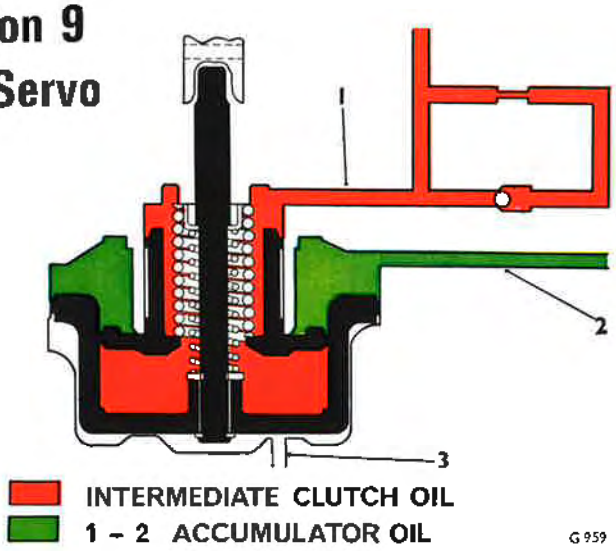

Fig. 66 Drive and intermediate — 2nd gear
1 INTERMEDIATE CLUTCH OIL **2** 1-2 ACCUMULATOR OIL
3 REVERSE OR LOW OIL

the 1–2 accumulator oil and the accumulator spring (see Fig. 66). This action absorbs an amount of intermediate clutch apply oil and permits the intermediate clutch to apply at reduced pressure for a smooth 1–2 up-change.

Low range — first gear

Overrun engine braking in Low range – first gear is provided by the rear servo which applies the rear band and prevents the reaction carrier from rotating clockwise (see Fig. 67).

The 1–2 accumulator oil is directed to the accumulator piston which attempts to prevent application of the servo. Low range oil is directed to the servo piston which, because it has a larger area, applies the rear band. Because 1–2 oil is present and is opposing the movement of the piston, the pressure applying the rear band is reduced. This provides a smooth band application.

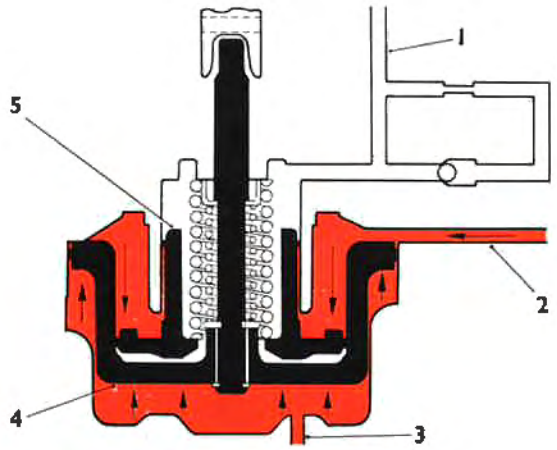

Fig. 67 Low range — 1st gear

1 TO INTERMEDIATE CLUTCH **4** REAR SERVO PISTON (APPLYING)
2 1-2 ACCUMULATOR OIL **5** ACCUMULATOR PISTON
3 LOW RANGE OIL (RESISTING SERVO PISTON)

Low range — second gear

In second gear the rear band is released. Intermediate clutch oil is directed to the release side of the servo piston which, with line oil in the 1–2 accumulator oil passage, balances out the Low range oil on the apply side of the servo piston (see Fig. 68). The servo release spring then strokes the servo piston to the band release position.

Reverse

In Reverse, the rear band is applied to hold the reaction carrier. Reverse oil is directed to the servo piston to apply the band (see Fig. 69). To ensure that the rear band will hold the reaction carrier for the reverse gear ratio, line pressure is increased. No other oil is present

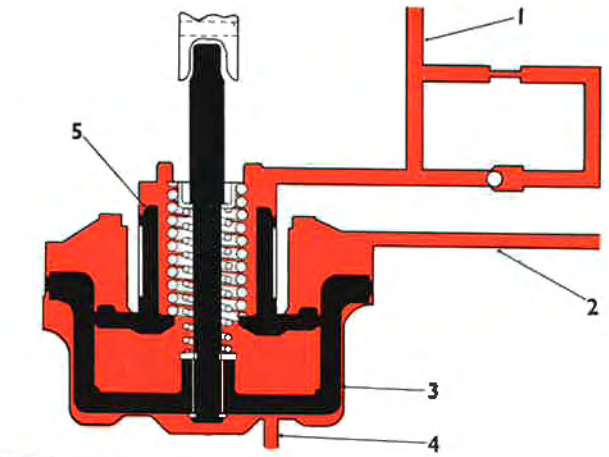

Fig. 68 Low range — 2nd gear

1 TO INTERMEDIATE CLUTCH **3** SERVO PISTON
2 1-2 ACCUMULATOR OIL **4** LOW RANGE OIL
5 ACCUMULATOR PISTON

in the servo to resist the movement of the servo piston.

Rear servo — To remove

The rear servo can be removed whether the transmission is removed from the car or not.

Remove the sump (see Section 7).

Remove the control valve unit (see Section 8).

Remove the six setscrews which secure the servo cover to the transmission casing. Remove the cover and discard the gasket.

Remove the servo unit from the casing (see Fig. 70).

Remove the servo accumulator spring.

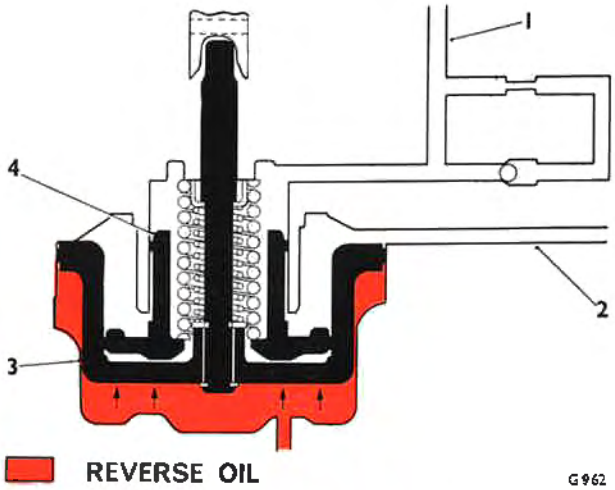

Fig. 69 Rear servo in Reverse position

1 TO INTERMEDIATE CLUTCH **3** REAR SERVO PISTON (APPLYING)
2 1-2 ACCUMULATOR PASSAGE **4** ACCUMULATOR PISTON

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To ensure that the rear band is correctly adjusted when the rear servo is fitted, the apply pin must be checked as follows.

Rear band apply pin — To select

Fit the band apply pin selector gauge (J–21370) onto the bottom face of the transmission casing. The gauge must fit over the rear servo bore with the hexagonal nut on the side of the gauge facing the parking brake linkage, and the smaller diameter end of the gauge pin (J–21370–5) in the servo pin bore (see Fig. 71).

Secure the gauge with two suitable setscrews e.g. rear servo cover screws; torque tighten the screws to 18 lb.ft. (2,49 kgm.).

Ensure that the stepped gauge pin moves freely in the tool and in the servo pin bore. The stepped side of the pin must face the front of the transmission case.

Band apply pins are available in three sizes as shown in the following chart.

IDENTIFICATION	LENGTH
Three rings	Long
Two rings	Medium
One ring	Short

The identification ring is located on the band lug end of the pin. Selecting the correct pin is the equivalent of adjusting the rear band.

To determine the correct size pin to use, apply 25 lb.ft. (3,46 kgm.) to the hexagonal nut on the side of the gauge (see Fig. 71). This will cause the lever on top of the gauge to depress the stepped gauge pin into the servo pin bore, simulating the actual operation of the servo. Note the relationship between the steps on the gauge pin and the machined surface on the top of the gauge.

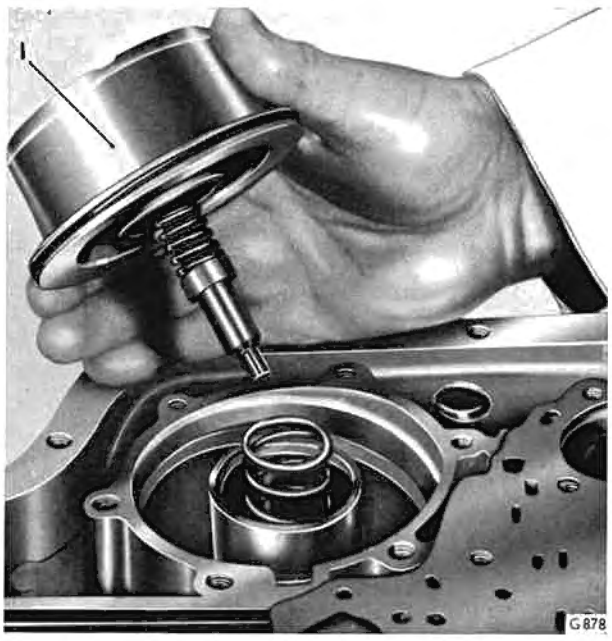

Fig. 70 Removing the rear servo

1 REAR SERVO

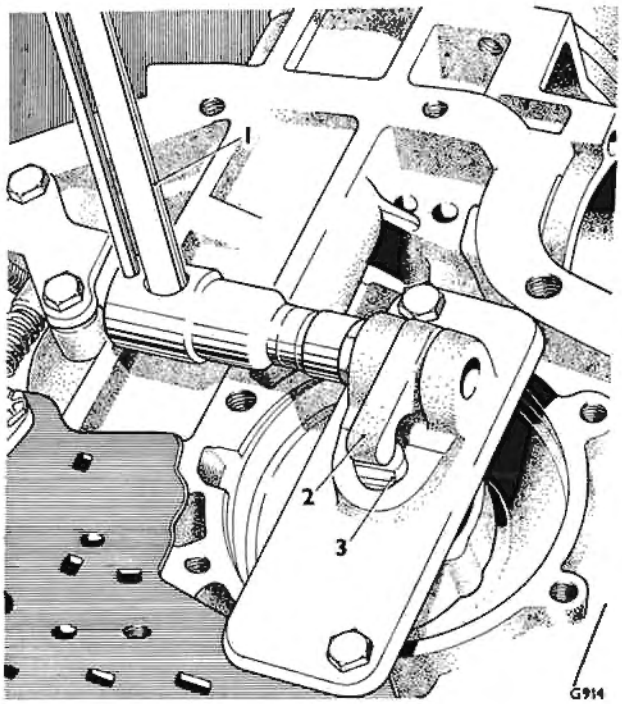

Fig. 71 Selecting the band apply pin

1 TORQUE SPANNER **2** GAUGE **3** GAUGE PIN

If the machined surface on top of the gauge is level with, or even above the upper step on the gauge pin, a long (3 rings) pin is required.

If the machined surface on top of the gauge is between the upper and lower steps on the gauge pin, a medium pin (2 rings) is required.

If the machined surface on top of the gauge is level with, or below the lower step on the gauge pin, a short (1 ring) pin is required.

If a new pin is required, make a note of the size of the required pin, then remove the gauge from the transmission.

Rear servo — To dismantle

Remove the rear accumulator piston from the rear servo piston (see Fig. 72).

Remove the 'E' ring which retains the rear servo piston on the band apply pin.

Remove the rear servo piston and the seal from the band apply pin.

Remove the washer, spring and retainer.

Rear servo — To inspect

Check the fit of the oil sealing rings in the accumulator piston. The rings should be free to turn in the grooves with a maximum clearance of 0·003 in. (0,076 mm.).

Fit the accumulator piston lower oil sealing ring into its bore in the casing and check the ring-to-bore fit.

Check the fit of the band apply pin in each piston.

Examine the band apply pin for scores, cracks or the opening of drilled passages.

Examine the accumulator piston for an open bleed passage.

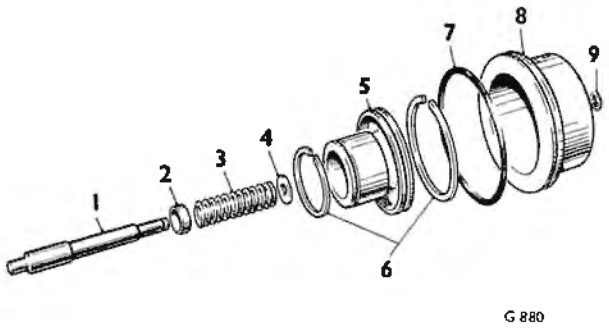

Fig. 72 Rear servo and accumulator — exploded

1 SERVO PIN
2 SPRING RETAINER
3 SERVO SPRING
4 WASHER
5 ACCUMULATOR PISTON
6 OIL SEALING RINGS
7 SERVO OIL SEAL
8 SERVO PISTON
9 'E' RING

Ensure that the pin is the correct size as determined by the check under heading 'Rear band apply pin – To check'.

Rear servo — To assemble

Fit the spring retainer (open end first), spring and washer onto the band apply pin.

Fit the servo piston onto the pin and secure it with the 'E' ring.

If necessary, fit a new oil seal ring onto the servo piston.

If they were removed for cleaning purposes, fit the oil sealing rings onto the accumulator piston.

Fit the accumulator piston into the servo piston.

Rear servo — To fit

Using clean transmission fluid, lightly lubricate the inner and outer rear servo bores in the transmission casing.

Fit the servo accumulator spring into the servo inner bore.

Note Before fitting the rear servo to the casing, ensure that the rear band apply lug is aligned with the servo pin bore in the transmission casing. If the lug is not aligned, the servo will not apply the rear band.

Position the rear sevo assembly in the transmission casing.

Using hand pressure, push the servo into the transmission casing, ensuring that the servo piston sealing ring is correctly seated in the bore.

Fit a new gasket and fit the cover.

Torque tighten the six setscrews to 18 lb.ft. (2,49 kgm.).

Section 10
Detent Solenoid, Connector, Control Valve Spacer and Front Servo

Description

The detent solenoid is secured to the lower face of the transmission casing and is connected by a lead to a connector on the left-hand side of the transmission. When the solenoid receives a signal from a micro switch at full throttle (kick-down button depressed) a needle valve is caused to move and an exhaust port is opened behind the detent valve. This allows the detent valve spring to move the detent valve and allow oil at high pressure to be fed to the shift valves to oppose governor pressure (see Forced down-change – kick-down – in Section 8 – Control valve unit).

The control valve spacer fits between the control valve unit and the transmission casing and forms part of the hydraulic system which contains restrictors and check balls.

The front servo is an assembly of pistons and springs, similar to the rear servo. It fits partly in the transmission casing and partly in the control valve unit. The servo applies the front band in Intermediate range – second gear and Low range – second gear, to provide engine braking. It is used also as an accumulator for

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the application of the direct clutch and, in conjunction with the check balls and orifices, is part of the timing for the release of the direct clutch.

Front servo operation

Drive range — first gear

In Drive range, servo oil from the manual valve charges the accumulator by stroking both the accumulator piston and the servo piston against the accumulator spring. This prepares the accumulator for the controlled application of the direct clutch during the 2–3 up-change. The charging of the accumulator in Drive range, first gear, also makes it possible to have a controlled 1–3 let-up change as the accumulator is prepared in first gear for direct clutch application.

Servo oil and the servo release spring prevent the application of the band in second gear – Drive range, when intermediate clutch apply oil is directed between the servo and accumulator pistons. Servo oil is also present in Reverse and Neutral.

Drive range — second gear

In Drive range – first and second gears, the accumulator is charged with servo oil (see Fig. 73). In second gear, intermediate clutch oil is fed between the servo and accumulator pistons but does not force them apart. This is because the force of the servo oil which holds the piston down is equal to the intermediate clutch oil pressure.

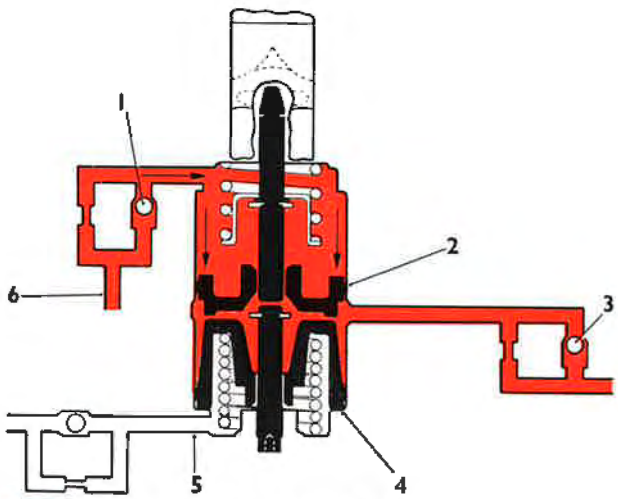

Fig. 73 Drive ranger — 2nd gear

1 CHECK BALL (SEATED)
2 SERVO PISTON
3 INTERMEDIATE CLUTCH OIL CHECK BALL (SEATED)
4 ACCUMULATOR PISTON
5 DIRECT CLUTCH PASSAGE
6 SERVO OIL

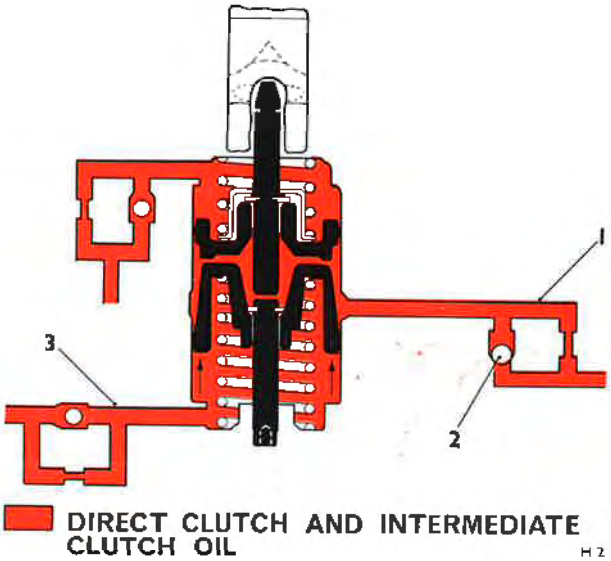

Fig. 74 Drive range — 3rd gear

1 INTERMEDIATE CLUTCH OIL
2 CHECK BALL
3 DIRECT CLUTCH OIL

Drive range — third gear

When the direct clutch is applied, intermediate clutch oil pressure increases. This increased pressure, plus the accumulator spring, overcomes the servo oil pressure and the accumulator piston is moved until it reaches the stop on the pin (see Fig. 74). As the accumulator piston moves, it abuts the servo piston which moves a corresponding distance, until it contacts a washer on the servo pin; it will not, however, move any further and the front band will not be applied.

As the accumulator piston moves, an amount of direct clutch oil is absorbed and this permits the direct clutch to apply at a controlled rate for a smooth 2–3 up-change.

Drive range — 3-2

The release of the direct clutch is controlled by the front servo, two orifices and two check balls. This allows the driving load to be transferred smoothly to the intermediate sprag.

The controlled release pressure allows the engine to increase its r.p.m. to suit the lower gear ratio of second gear during detent down-changes, resulting in a smooth change with better acceleration.

During the stroking of the servo and accumulator pistons, servo oil seats a check ball and the oil must pass through a restrictor. This slows down the stroking of the pistons (see Fig. 75).

The exhausting oil from the accumulator and the

direct clutch seats another check ball and the oil is forced to flow through an orifice. This controls the clutch pressure during direct clutch release.

Intermediate range — second gear

During a manual 3–2 down-change, intermediate clutch oil from the 1–2 shift valve seats a check ball and flows through an orifice to apply the front band (see Fig. 76). The oil which applies the band is controlled also by the stroking of the accumulator piston which is resisted by the accumulator spring and the restricted exhaust of direct clutch oil.

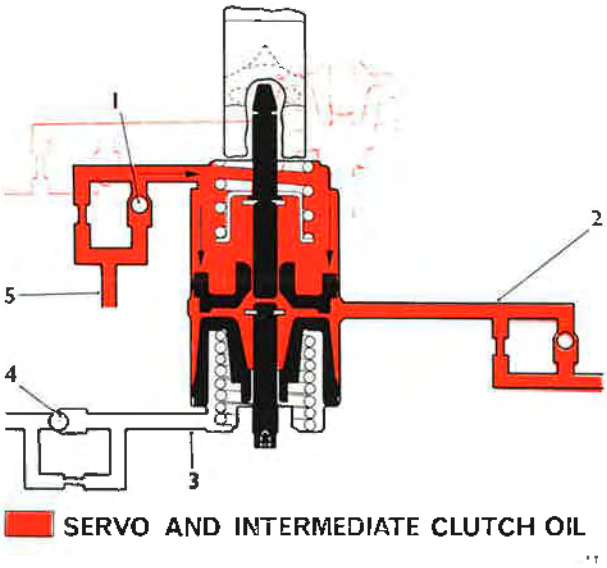

Fig. 75 Drive range 3-2

1 CHECK BALL (SEATED)
2 INTERMEDIATE CLUTCH OIL
3 DIRECT CLUTCH PASSAGE
4 CHECK BALL (SEATED)
5 SERVO OIL

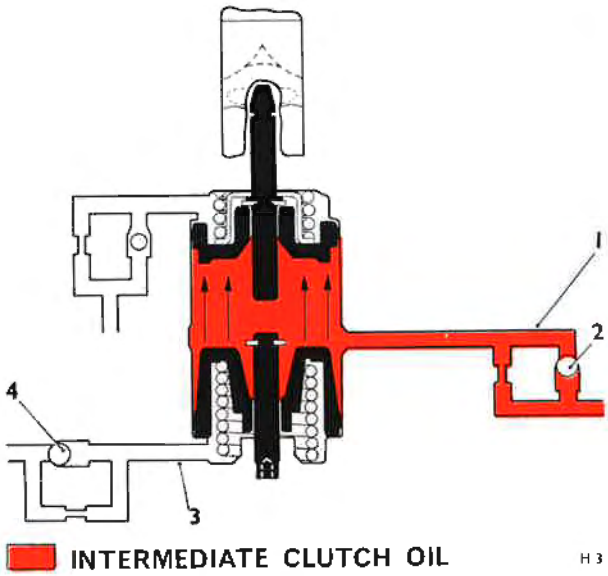

Fig. 76 Intermediate range — 2nd gear

1 INTERMEDIATE CLUTCH OIL
2 CHECK BALL
3 DIRECT CLUTCH PASSAGE
4 CHECK BALL

Detent solenoid, connector, control valve spacer and front servo — To remove

The units may be removed from the transmission whether the transmission is removed from the car or not.

Drain the transmission fluid and remove the sump.

Remove the control valve unit and governor pipes (see Section 8 – Control valve unit).

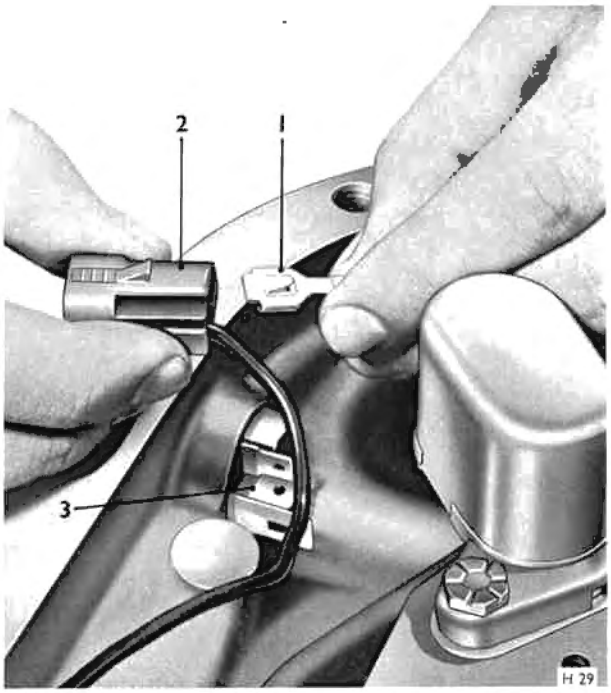

Fig. 77 Removing the detent solenoid lead

1 DETENT SOLENOID TERMINAL
2 STATOR CONNECTOR
3 CASE CONNECTOR

Disconnect the solenoid leads from the connector terminals (see Fig. 77).

Compress the tabs on the connector and remove the connector and 'O' ring from the casing; discard the 'O' ring.

Remove the two setscrews which secure the detent solenoid. Remove the solenoid and gasket.

Remove the control valve spacer plate and gasket.

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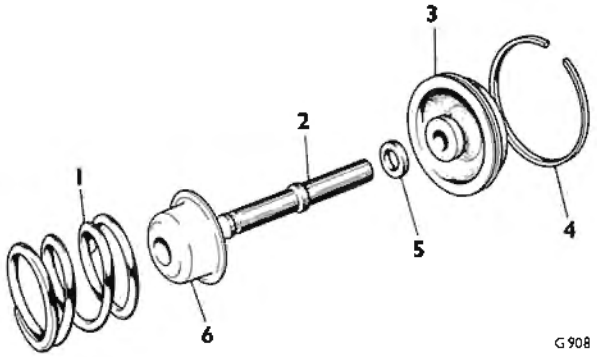

Fig. 78 Front servo — exploded

1 SERVO SPRING
2 SERVO PIN
3 SERVO PISTON
4 OIL SEAL RING
5 WASHER
6 SPRING RETAINER

Note If the last operation is being carried out with the transmission in the car, lower the control valve spacer plate in a level plane so that the check balls do not fall out. Remove the check balls from the spacer plate.

Remove the six check balls from the cored passages in the transmission case.

Lift the front servo piston, washer, pin, retainer and spring from the transmission case. An exploded view of the front servo is shown in Figure 78.

Front servo — To inspect

Examine the servo pin for damage.

Examine for damage the oil seal ring groove in the piston. Ensure that the ring is free in the groove.

Examine the piston for cracks and other damage.

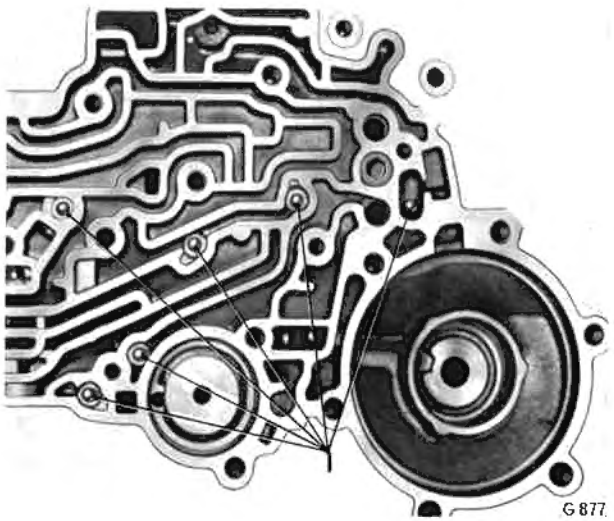

Fig. 79 Location of check balls

1 CHECK BALLS

Check the fit of the servo pin in the piston.

Detent solenoid, connector, control valve spacer and front servo — To fit

Fit the front servo spring and retainer into the bore of the transmission casing.

Fit the flat washer onto the front servo pin on the end opposite to the taper.

Fit the pin into the casing so that the tapered end contacts the forward band.

Fit the piston ring to the piston if it was removed.

Fit the piston onto the band apply pin so that the number on the shoulder of the piston faces toward the sump.

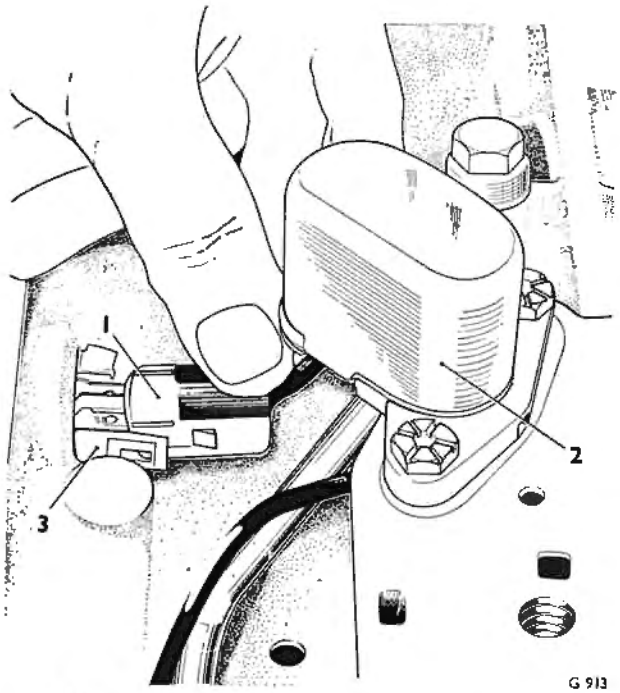

Fig. 80 Fitting the stator connector to the case sleeve connector

1 STATOR AND DETENT CONNECTOR
2 DETENT SOLENOID
3 CASE CONNECTOR SLEEVE

Check the piston for freedom of movement by pushing it against the spring.

Fit the six check balls into the ball seat pockets in the transmission casing (see Fig. 79).

Note If the operation is being performed with the transmission in the car, fit the check balls into the ball seat pockets on the spacer plate.

Fit the case-to-spacer gasket (gasket with an extension for the detent solenoid).

Fit the control valve spacer.

Fit the control valve-to-spacer gasket (gasket with slot).

Fit the detent solenoid gasket.

Fit the detent solenoid assembly with the connector facing the outer edge of the casing. Fit the securing setscrews but do not tighten them.

Fit a new 'O' ring onto the solenoid connector.

Fit the connector with the lock tabs pointing into the casing.

Bend up the locating tabs on the side of the casing.

Fit the solenoid and stator leads to the connector terminals (see Fig. 80).

Fit the control valve unit as described in Section 8 then tighten the two solenoid securing setscrews to 12 lb.ft. (1,66 kgm.).

Section 11
Rear Extension

Rear extension — To remove

This Section describes the procedure for removal of the rear extension when the transmission is fitted to the car.

The procedure is the same when the transmission is removed from the car except that the gearchange actuator and the propeller shaft will have been removed.

Remove the gearchange electric actuator as described in Section 1 of this Chapter.

Remove the propeller shaft as described in Section F 2, Chapter F of T.S.D. 2205 – Workshop Manual.

Place a drip tray beneath the rear extension.

Remove the coupling flange by withdrawing it from the output shaft.

Remove the six setscrews which secure the rear extension to the transmission casing.

Slide the rear extension rearward and downward until it clears the output shaft.

Caution Make certain that the output shaft splines do not damage the oil seal in the end of the rear extension.

Remove and discard the square section 'O' ring or gasket, whichever is fitted, from the rear extension.

Rear extension — To inspect

Examine the rear extension for cracks or damage.

Examine the bush for excessive wear or damage.

Examine the oil seal for damage.

If a new oil seal is to be fitted, push out the old seal using a suitable drift.

Ensure that the bore in which the seal fits is clean and free from damage and that the seal drain-back port is not obstructed.

Lightly smear with Wellseal the outer edge of the new seal then, drive in the seal using Tool J–5154.

Ensure that the rear face of the transmission casing and the front face of the extension are clean and free from burrs.

Rear extension — To fit

Fit a new square sectioned 'O' ring or a gasket, whichever was removed, onto the extension housing.

Carefully fit the extension casing over the output shaft until the extension abuts the rear of the transmission casing. Ensure that the splines on the output shaft do not touch the oil seal in the end of the extension casing otherwise the seal lip may be damaged.

Fit the six setscrews and torque tighten them to 23 lb.ft. (3,18 kgm.).

Fit the coupling flange.

Fit the propeller shaft (see Section F2 – Chapter F – T.S.D. 2205 – Workshop Manual).

Fit the electric actuator (see Section 1 of this Chapter).

Section 12
Oil Pump

Description

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

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Operation

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

As the gears turn, the oil is carried in pockets formed by the gear teeth, past a crescent shaped projection of the pump. Beyond the crescent, the gear teeth move closer together causing the oil to be squeezed out at pressure from between the teeth. At this point the oil is delivered through the pump outlet to the pressure system (see Fig. 81).

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

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

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

As pressure continues to increase, the pressure regulator valve moves to expose a port which directs excess oil to the suction side of the pump. The pressure regulator valve is spring-balanced to regulate line pressure at approximately 70 lb/sq.in. (4,9 kg/sq.cm.).

Oil pump — To remove

Remove the transmission from the car (see Section 2).

Remove the sump and oil strainer (see Section 7).

Remove the stator solenoid lead from the connector in the transmission casing. Remove the lead from the clips.

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

Remove one of the screws securing the oil pump also the 'O' ring, at either the 11 o'clock or 5 o'clock position.

Fit slide hammer J–8001 into the pump in the tapped hole from which the setscrew was removed.

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

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

Set the dial indicator to zero.

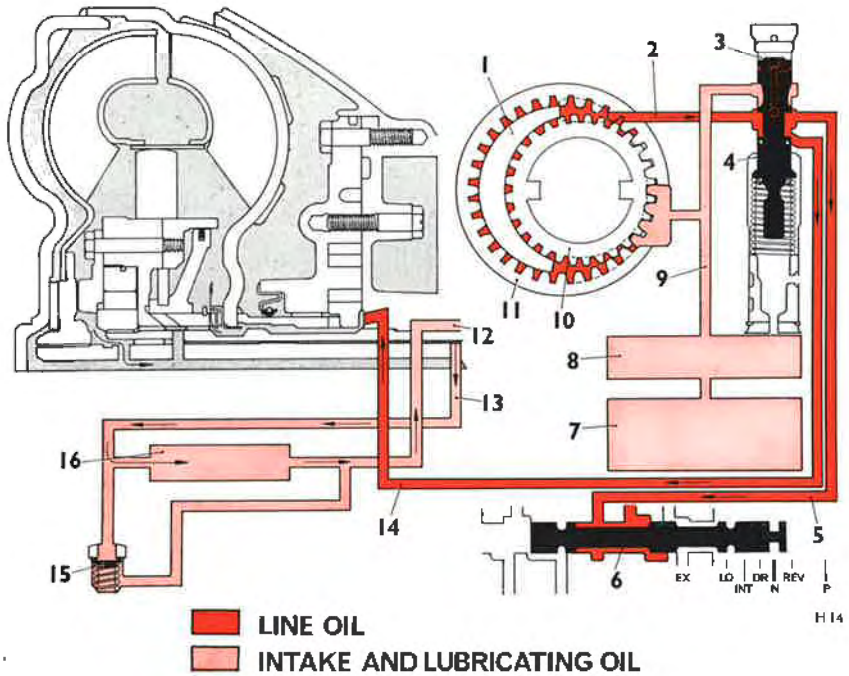

Fig. 81 Oil pump and pressure regulating system

1 PUMP CRESCENT
2 PUMP OUTLET
3 LINE PRESSURE OIL
4 PRESSURE REGULATOR VALVE
5 LINE PRESSURE OIL
6 MANUAL VALVE
7 TRANSMISSION SUMP
8 STRAINER ASSEMBLY
9 PUMP INTAKE
10 DRIVE GEAR
11 DRIVEN GEAR
12 LUBRICATING OIL
13 CONVERTER RETURN
14 CONVERTER OIL
15 HEAT EXCHANGER BY-PASS VALVE
16 HEAT EXCHANGER

Pull the turbine shaft forward as shown in Figure 82.

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

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

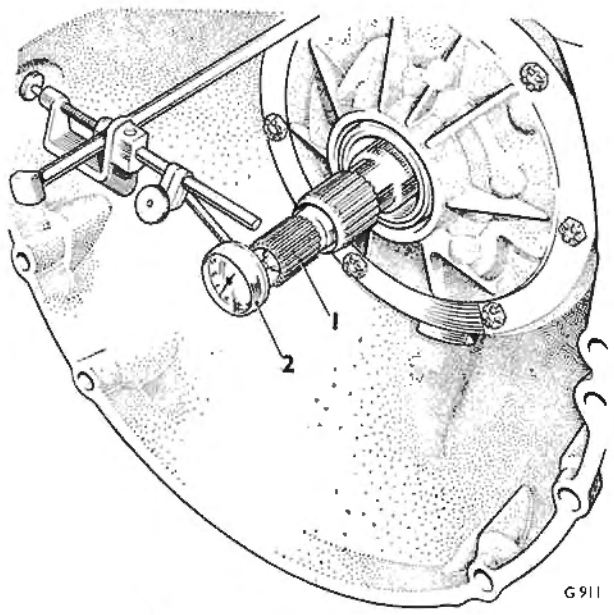

Fig. 82 Checking the front unit end float

1 TURBINE SHAFT **2** DIAL TEST INDICATOR

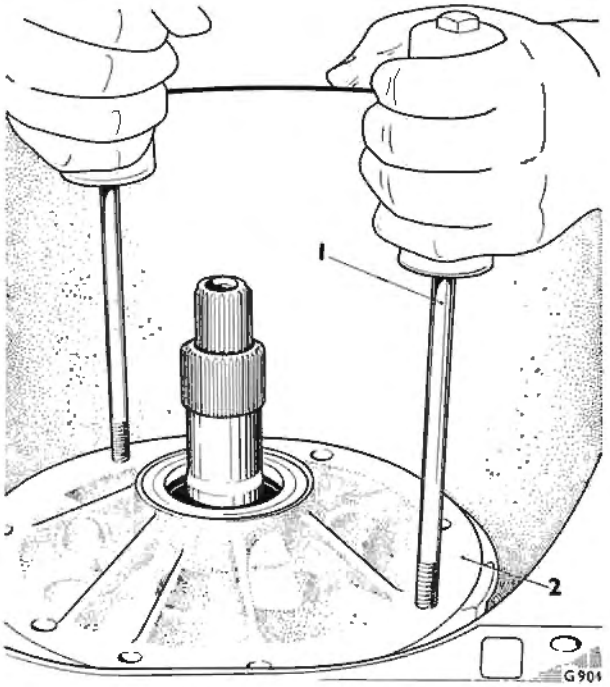

Fig. 83 Removing the oil pump

1 SLIDE HAMMER **2** OIL PUMP

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

Remove the dial indicator gauge. Do not remove the slide hammer at this stage.

Proceed with the removal of the oil pump as follows.

Remove the seven remaining setscrews securing the pump.

Fit slide hammer J–6125, with a $\frac{3}{8}$ in. × 16 threaded adaptor, into the other threaded hole in the pump body.

Remove the pump from the casing by driving it outward using the slide hammers (see Fig. 83).

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

Remove the slide hammers from the pump.

Remove and discard the square sectioned 'O' ring and the gasket.

Oil pump — To dismantle

Using adaptor J–21364 in the rear unit holding fixture J–6116, fit the pump into the holding fixture with the stator shaft pointing downward. Take care not to damage the shaft.

Remove the stator solenoid from the pump cover; discard the gasket.

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Compress the regulator boost valve, against spring pressure, then remove the circlip (see Fig. 84).

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

Remove the regulator boost valve sleeve and valve.

Remove the pressure regulator spring.

Remove the regulator valve, spring retainer and spacer or spacers (if fitted).

Remove the five setscrews which secure the pump cover to the pump body; separate the cover and body; note that the setscrews are of differing lengths.

Mark the driving and driven gears to facilitate correct assembly. Do not use a scriber or a punch; an indelible pencil is recommended.

Remove the gears from the pump body as shown in Figure 85.

Remove the retaining pin and the plug from the end of the regulator bore.

Remove the stator valve retaining pin; remove the stator valve and spring.

Remove the two oil rings from the pump cover.

Remove the fibre adjusting washer.

Remove the converter return check valve from the by-pass assembly.

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

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

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

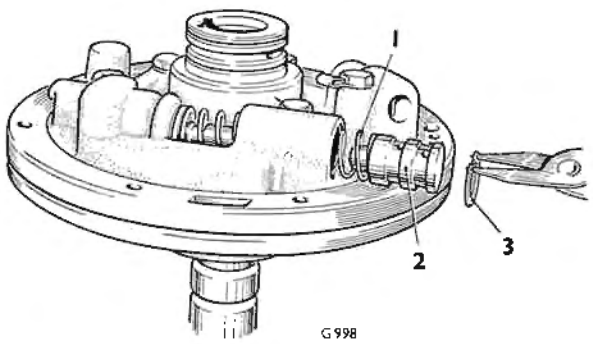

Fig. 84 Removing the regulator valve retaining circlip

1 REGULATOR VALVE SPRING
2 BOOST VALVE SLEEVE
3 CIRCLIP

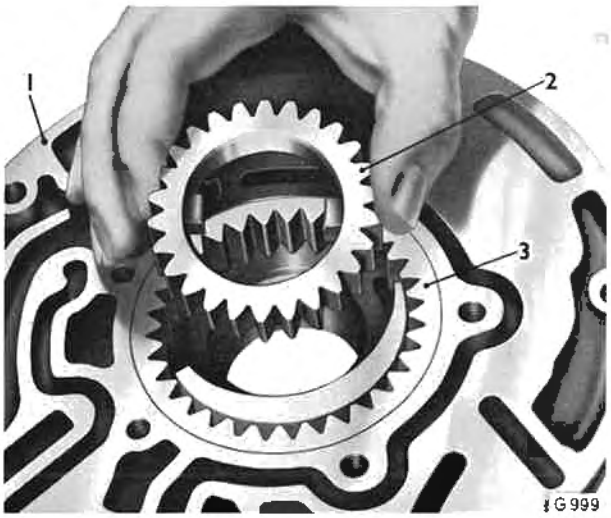

Fig. 85 Removing the pump gears

1 PUMP BODY
2 DRIVING GEAR (TANGS UPPERMOST)
3 DRIVEN GEAR

Using pump by-pass valve seat remover J–21361, in conjunction with slide hammer J–6125 and the $\frac{3}{8}$ in. × 16 threaded adaptor, fit the removal tool into the valve seat and drive upward on the slide hammer (see Fig. 86); remove and discard the valve seat.

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

Remove the by-pass valve and spring.

If the pump oil seal requires renewal, drive out the seal with a hammer and chisel (see Fig. 22 in Chapter 2). Take care not to damage the pump cover, especially the seal bore diameter.

Oil pump — To inspect

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

Examine the gear pockets and the crescent for scoring or other damage.

Fit the gears into the pump body then check the end clearance as shown in Figure 87. The clearance should be between 0·0008 in. and 0·0015 in.(0,0203 mm. and 0,0381 mm.).

Examine the face of the pump body for scores or burrs.

Examine the oil passages for blockages and porosity.

Examine the threads into which the cover securing setscrews fit.

Examine the pump body face for overall flatness.

Examine the bush for scores or burrs.

Examine the set screw 'O' rings for damage; renew if necessary.

Examine the pump cover face for overall flatness.

Examine the stator valve bore and the pressure regulator valve bore for scores or dirt (see exploded view in Figure 88).

Ensure that all the oil passages are clear and are not interconnected due to porosity.

Examine for scores or damage the face against which the pump gears rotate.

Examine the stator shaft for damaged splines or scored bushes.

Examine the oil ring grooves for damage or wear.

Examine the heat exchanger by-pass valve for free operation and good sealing qualities.

Examine for damage the face against which the selective washer fits.

Fit the oil sealing rings into their bore in the forward clutch housing and check for slack or badly fitting rings.

Ensure that the pressure regulator and the boost valve will move freely in their bores.

Oil pump — To assemble

Fit the oil pump driving and driven gears into the pump body with the alignment marks and tangs uppermost.

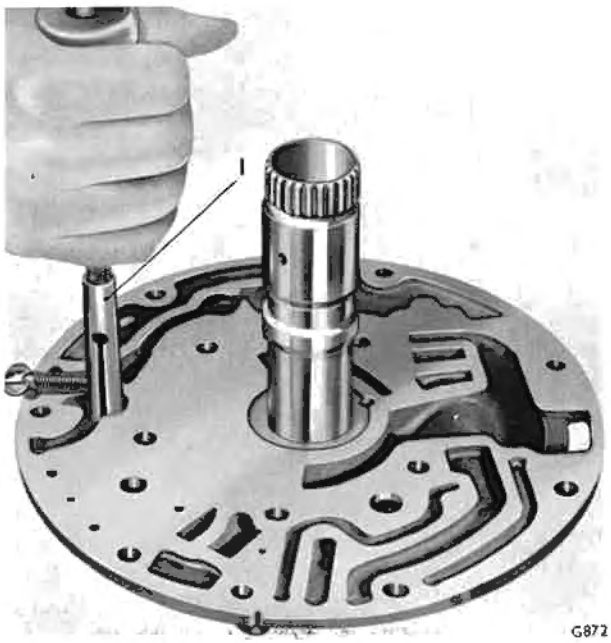

Fig. 86 Removing the by-pass valve seat

1 BY-PASS VALVE SEAT EXTRACTOR

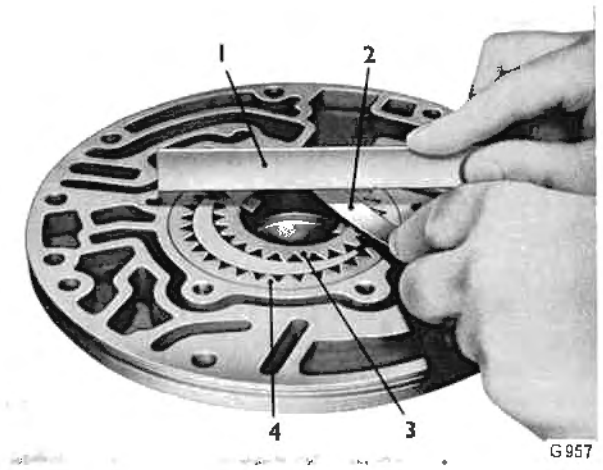

Fig. 87 Checking gear end clearance

1 STRAIGHT EDGE
2 FEELER GAUGE
3 INNER (DRIVING) GEAR
4 OUTER (DRIVEN) GEAR

Fit the pressure regulator spring spacer or spacers, if any were removed, then fit the retainer and spring into the bore.

Lightly lubricate the pressure regulator valve with clean transmission fluid then fit the valve into the opposite end of the bore, stem end first.

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

Retain the sleeve with the circlip.

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

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

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

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

Fit the oil rings.

If previously removed, fit the heat exchanger by-pass valve spring (large end first), valve and valve seat; lightly lubricate the valve. Use the pump by-pass valve fitting tool J–21360 to fit the valve seat (see Fig. 89).

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

Fit the pump body into the rear unit holding fixture J–6116, with the stator shaft pointing downward. Take care not to scratch or damage the shaft.

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

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

Fit the pump body and cover alignment band J–21368 around the pump assembly. Tighten the wing nut on the band to align the cover with the body (see Fig. 90).

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

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

If necessary, fit a new pump oil seal using seal installing tool J–21359.

Fit the stator solenoid. Tighten the securing setscrews to 12 lb.ft. (1,66 kgm.).

Fit the stator wire to the clip.

Oil pump — To fit

Fit a new gasket to the oil pump, retaining it with petroleum jelly. Align the holes in the gasket with the

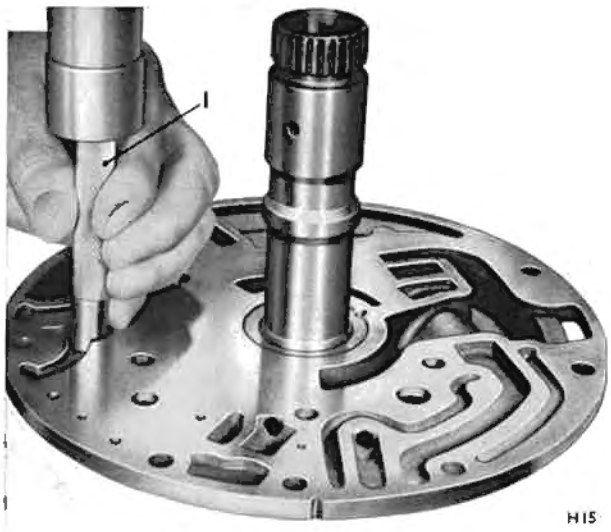

Fig. 89 Fitting the by-pass valve seat

1 PUNCH

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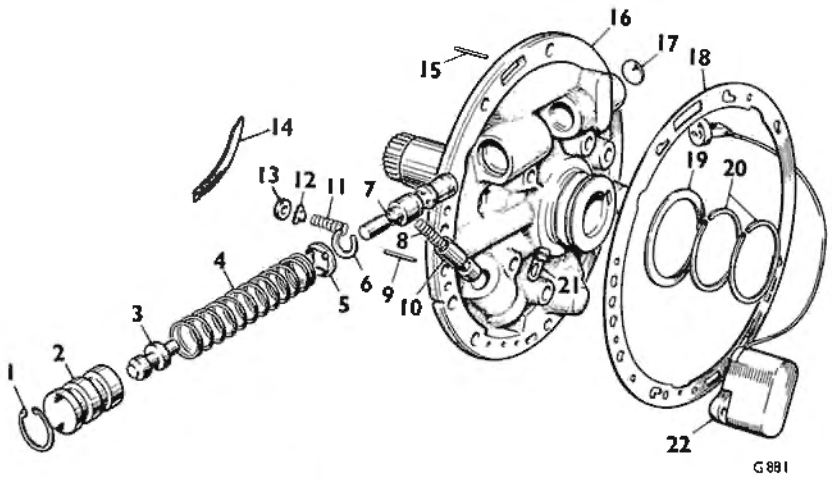

Fig. 88 Pump cover — exploded

1 SNAP RING
2 SLEEVE
3 BOOST VALVE
4 PRESSURE REGULATOR SPRING
5 SPRING RETAINER
6 SPACER
7 PRESSURE REGULATOR VALVE
8 STATOR VALVE SPRING
9 RETAINING PIN
10 STATOR VALVE
11 HEAT EXCHANGER BY-PASS SPRING
12 HEAT EXCHANGER BY-PASS VALVE
13 HEAT EXCHANGER BY-PASS VALVE SEAT
14 CONVERTER OUT-CHECK VALVE
15 RETAINING PIN
16 PUMP COVER
17 BORE PLUG
18 GASKET
19 SELECTIVE WASHER
20 OIL SEALING RINGS
21 WIRE RETAINING CLIP
22 STATOR SOLENOID

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corresponding holes in the pump cover.

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

Fit two $\frac{5}{16}$ in. × 18 slide hammer bolts J–6125, through two opposite threaded holes in the pump assembly. The bolts will serve as guide pins when the pump is being fitted to the casing.

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

Feed the stator connector and lead through the hole in the casing adjacent to the pressure regulator (see Fig. 91).

Fit the pump assembly into the transmission casing.

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

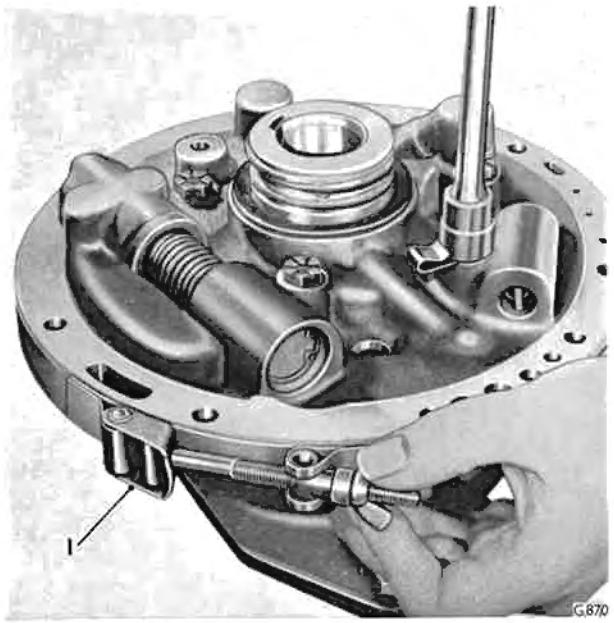

Fig. 90 Aligning the pump cover with the pump body

1 ALIGNMENT BAND

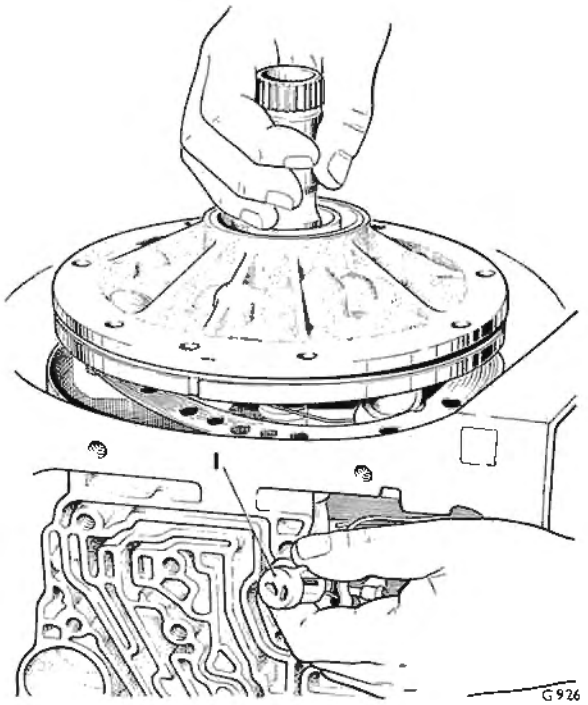

Fig. 91 Fitting the oil pump

1 STATOR SOLENOID CONNECTOR

Remove the guide bolts, but leave out one securing screw at either the 5 o'clock or 11 o'clock position so that the front unit end float can be rechecked. Torque tighten the setscrews to 18 lb.ft. (2,49 kgm.).

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

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

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

Fit the remainder of the units (see Section 7).

Section 13
Control Rods, Levers and Parking Linkage

Description

The control rods, levers and parking linkage consist of an assembly of levers and rods which are operated by the electric gearchange actuator; some are fitted to the transmission interior and some externally. The inside detent lever is connected to the manual control valve

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in the control valve unit and is retained in the desired position by a spring-loaded detent roller.

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

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

Operation

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

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

In the unlikely event of actuator failure it is possible for the driver to select the desired gear range from inside the car by operating the Get-You-Home lever. A hole in the top of the lever accepts the tapered end of the tyre lever thus enabling the Get-You-Home lever to be moved. By removing the rubber cover from the driver's side of the transmission tunnel, access to the lever will be obtained. The Get-You-Home lever, when moved, will operate the gearchange operating lever in a similar manner to that of the electric actuator.

Control rods, levers and parking linkage — To remove

The units may be removed from the transmission whether or not the transmission has been removed from the car. If the transmission has not been removed, drain and remove the sump as described in Section 7.

If the gearchange electric actuator and the neutral start and height control switches have not been removed, disconnect the gearchange operating rod and the switch operating rod by removing the split pins and clevis pins from the levers at each end; remove the rods.

Remove the split pin and clevis pin which secures the link rod to the Get-You-Home lever.

Remove the nut and clamping washer which retains the Get-You-Home lever to its pivot pin; remove the lever.

Remove the lock-nut which retains the gearchange operating lever to the manual shaft; remove the lever. On some early units a shield may be fitted to exclude moisture and dirt from between the shaft and shaft

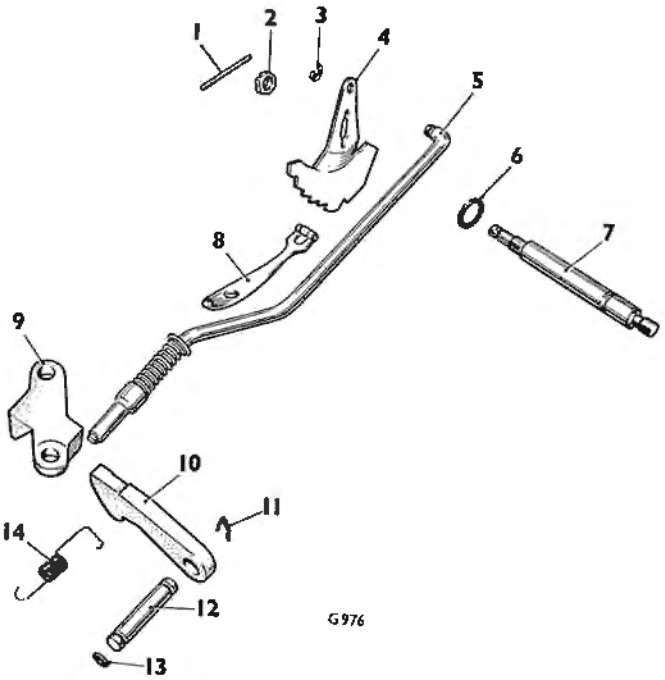

Fig. 92 Manual and parking linkage — exploded

1 RETAINING PIN	**8** DETENT ROLLER AND SPRING
2 LOCK-NUT	**9** PARKING BRAKE BRACKET
3 'E' RING	**10** PARKING PAWL
4 INSIDE DETENT LEVER	**11** SPRING RETAINER
5 PARKING BRAKE ACTUATING ROD	**12** PARKING PAWL SHAFT
6 MANUAL SHAFT SEAL	**13** OIL SEAL
7 MANUAL SHAFT	**14** PAWL RETURN SPRING

bore in the case; remove the shield from the shaft.

Remove the setscrew which secures the detent spring and roller assembly to the control valve unit; remove the detent spring assembly. Refer to Figure 92 for an exploded view of the internal parts.

Remove the pin which secures the manual shaft to the case.

Slacken the lock-nut which secures the inside detent lever to the manual shaft.

Prise the inside detent lever from the manual shaft then remove the lock-nut.

Remove the parking brake actuating rod, detent lever and manual shaft from the case; discard the 'O' ring if fitted.

Remove the detent lever retaining ring ('E' ring) then remove the lever from the rod.

Remove the setscrews securing the parking brake bracket; remove the bracket.

Remove the parking pawl return spring.

Remove the spring clip from the parking pawl shaft; remove the parking pawl and the shaft.

Remove and discard the 'O' ring from the parking pawl shaft.

Control rods, levers and parking linkage — To inspect

Wash all parts in clean paraffin (kerosene) then dry them with compressed air.

Examine the gearchange operating rod for signs of bending.

Examine the jaws for cracks or damage.

Examine the link rod for signs of bending.

Examine the switch actuating rod for cracks or signs of bending.

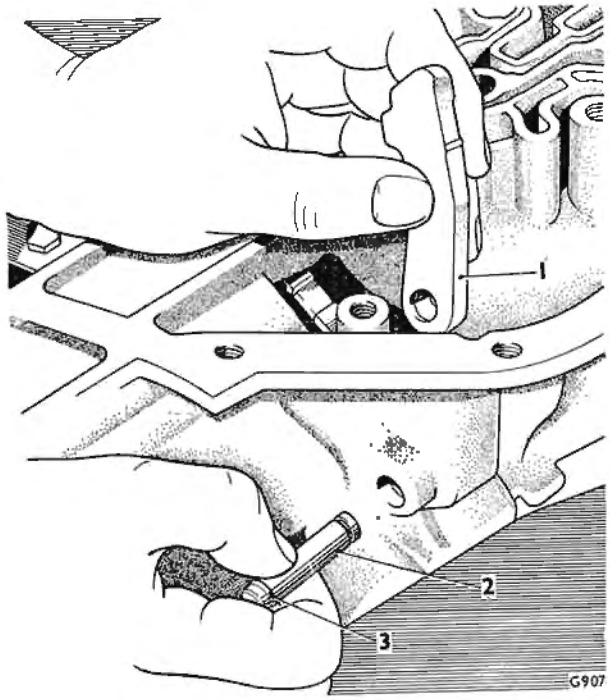

Fig. 93 Fitting the parking pawl and shaft

1 PARKING PAWL 2 SHAFT 3 'O' RING

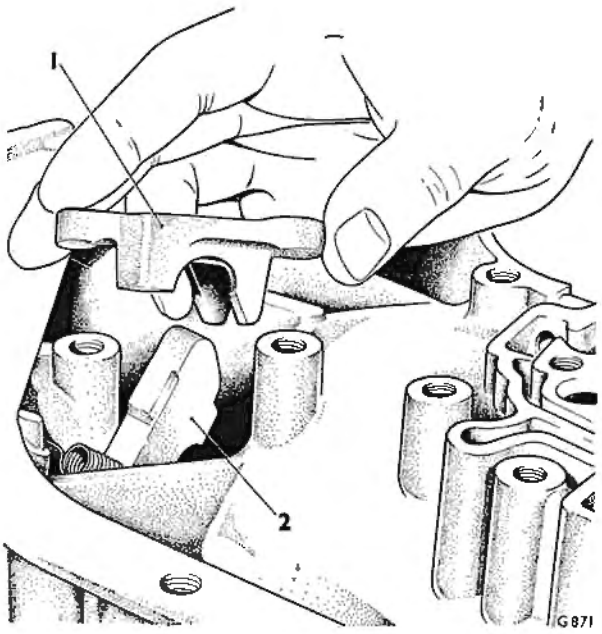

Fig. 94 Fitting the parking pawl bracket

1 PARKING PAWL BRACKET 2 PARKING BRAKE PAWL

Examine the Get-You-Home lever, gearchange operating lever and the gearchange actuator lever for damage and wear in the clevis pin bores.

Examine the Oilite bushes in the Get-You-Home lever for excessive wear.

Ensure that the pin is securely riveted in the gearchange operating lever.

Examine the parking actuator rod for cracks, damaged snap ring groove or broken spring retaining lugs.

Examine the actuator spring for distortion or damage. Ensure that the actuator fits freely on the actuator rod.

Examine the parking pawl for cracks or excessive wear.

Examine the manual shaft for damaged threads or shaft roughness at the gearchange operating lever end.

Examine the inside detent lever for cracks or a loose pin.

Examine the parking pawl shaft for damaged oil seal or retaining clip grooves.

Examine the parking pawl return spring for distortion or damaged ends.

Examine the parking pawl bracket for cracks or excessive wear.

Examine the detent spring and roller assembly for cracks or damage.

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Control rods, levers and parking linkage — To fit

Fit a new 'O' ring onto the parking pawl shaft.

Fit the parking pawl with the tooth toward the centre of the transmission then fit the parking pawl shaft (see Fig. 93).

Fit the parking pawl shaft retaining clip.

Fit the parking pawl return spring with the squared end hooked around the pawl.

Fit the parking pawl bracket so that the ends fit one each side of the pawl (see Fig. 94). Fit the securing setscrews and torque tighten them to 18 lb.ft. (2,49 kgm.).

Fit a new 'O' ring onto the manual shaft.

Fit the actuator rod into the inside detent lever from the side opposite to the pin; retain the rod with the 'E' ring.

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

Lubricate the manual shaft around the area occupied by the 'O' ring with Shell Retinax A grease. Fit the shaft into the case and through the detent lever (see Fig. 95).

Fit the lock-nut onto the manual shaft then torque tighten the nut to 18 lb.ft. (2,49 kgm.).

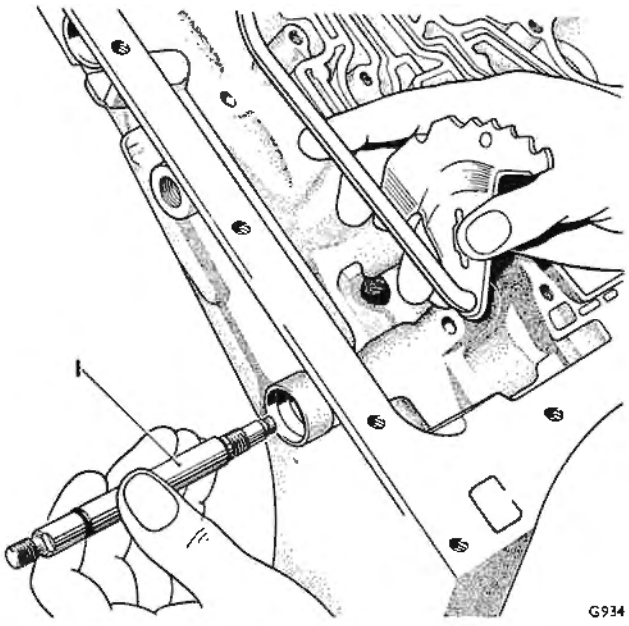

Fig. 95 Fitting the manual shaft

1 MANUAL SHAFT

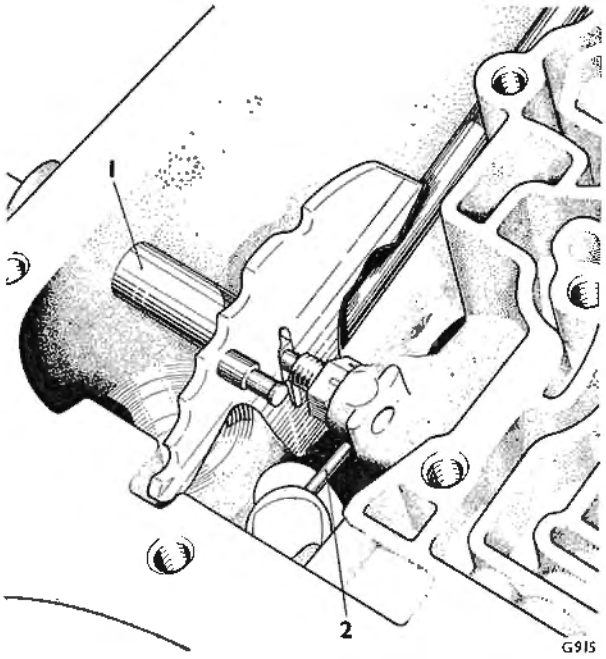

Fig. 96 Fitting the manual shaft retaining pin

1 MANUAL SHAFT **2** RETAINING PIN

Fit the retaining pin into the transmission casing, aligning it with the groove in the manual shaft (see Fig. 96).

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

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

Fit the gearchange operating lever to the manual shaft with the cranked side lowermost and away from the transmission. Fit the lock-nut and tighten it to 18 lb.ft. (2,49 kgm.).

Fit the Get-You-Home lever. Fit the clamping washer and nut; torque tighten the nut to between 8 lb.ft. and 10 lb.ft. (1,11 kgm. and 1,39 kgm.).

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

If the length of either the gearchange operating rod or the switch operating rod has been altered, adjust them as described in Section 4 – Controls – Chapter 2 – Servicing.

Fit the sump (see Section 7).

Section 14
Turbine Shaft, Forward and Direct Clutches, Sun Gear Shaft and Front Band

Description

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

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

The direct clutch is similar in construction to the forward clutch (see Fig. 97).

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

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

Operation

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

Whenever the direct clutch is applied, drive from the forward clutch is divided and follows two different paths to the gear unit (see Section 15).

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

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

An illustrated summary of the power flow through the transmission is given in Section 15 of this Chapter.

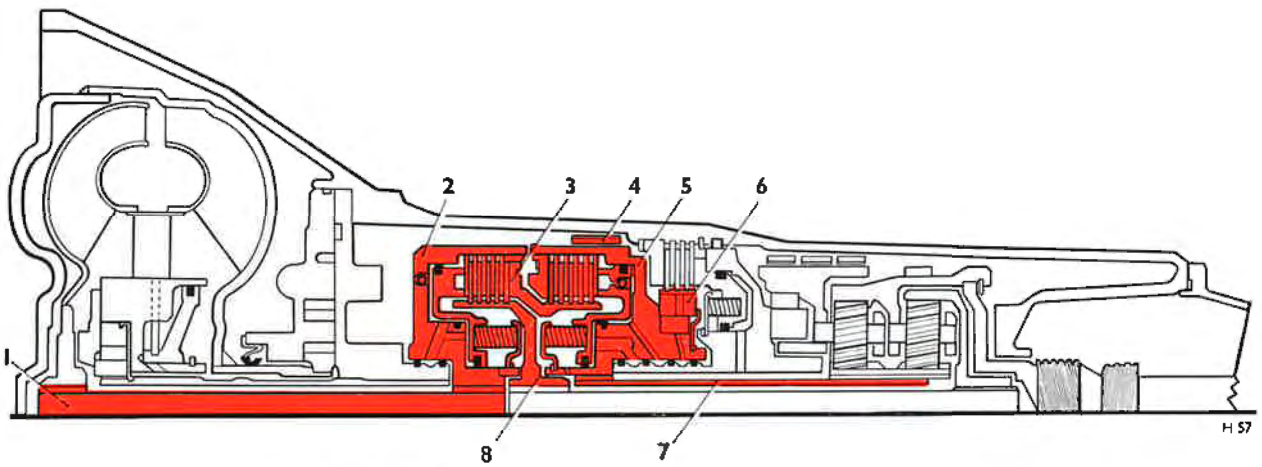

Fig. 97 Sectioned view of transmission showing forward and direct clutches

1 TURBINE SHAFT
2 FORWARD CLUTCH DRUM
3 DIRECT CLUTCH HUB
4 SECOND OVERRUN (FRONT) BAND
5 DIRECT CLUTCH DRUM
6 INTERMEDIATE SPRAG
7 SUN GEAR SHAFT
8 FORWARD CLUTCH HUB

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

Remove the transmission from the car as described in Section 2 of this Chapter.

Remove the oil pump (see Section 12).

Withdraw the turbine shaft and the forward clutch from the transmission (see Fig. 98).

Remove the thrust washer from between the forward clutch hub and the direct clutch housing; the washer may have come out with the forward clutch.

Withdraw the direct clutch and intermediate sprag assembly (see Fig. 99). The sun gear shaft may come out with the direct clutch assembly.

Remove the sun gear shaft if not previously removed.

Remove the front band.

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

Rear unit end float — To check

Remove the transmission rear extension housing (see Section 11).

Fit speedometer gear extractor bolt J-21797, or a similar suitable bolt into one of the holes in the end of the transmission case.

Mount a dial test indicator onto the bolt so that the indicator stem registers with the end of the output shaft (see Fig. 100).

Set the dial indicator to zero.

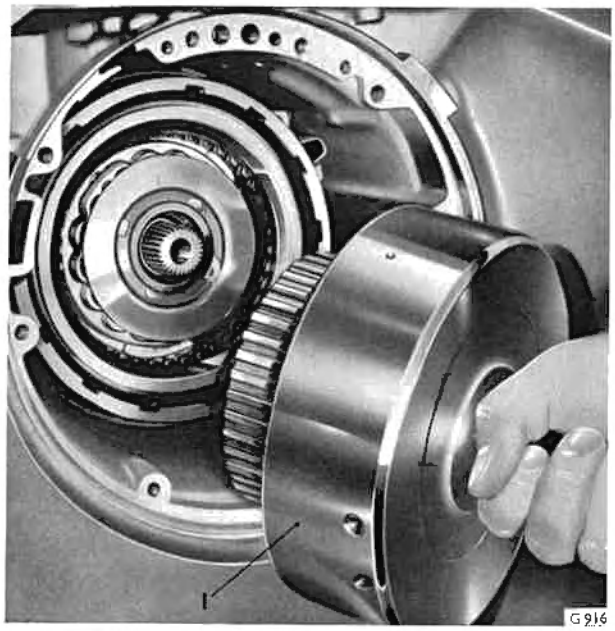


Fig. 98 Removing the forward clutch assembly

1 FORWARD CLUTCH ASSEMBLY

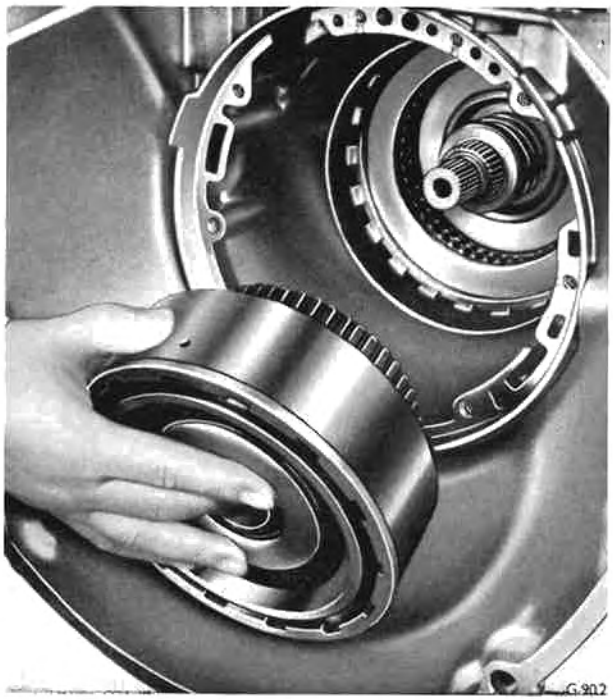


Fig. 99 Removing the direct clutch and intermediate sprag assembly

Move the output shaft to and fro, noting the indicator reading to enable the correct end float adjusting washer to be used when the transmission is assembled. The end float should be between 0·003 in. and 0·019 in. (0,076 mm. and 0,483 mm.).

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

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

THICKNESS	IDENTIFICATION NOTCH
0·078 in. to 0·082 in. (1,981 mm. to 2,083 mm.)	None
0·086 in. to 0·090 in. (2,184 mm. to 2,286 mm.)	On side of 1 tab
0·094 in. to 0·098 in. (2,388 mm. to 2,489 mm.)	On side of 2 tabs
0·102 in. to 0·106 in. (2,591 mm. to 2,692 mm.)	On end of 1 tab
0·110 in. to 0·114 in. (2,794 mm. to 2,896 mm.)	On end of 2 tabs
0·118 in. to 0·122 in. (2,997 mm. to 3,099 mm.)	On end of 3 tabs

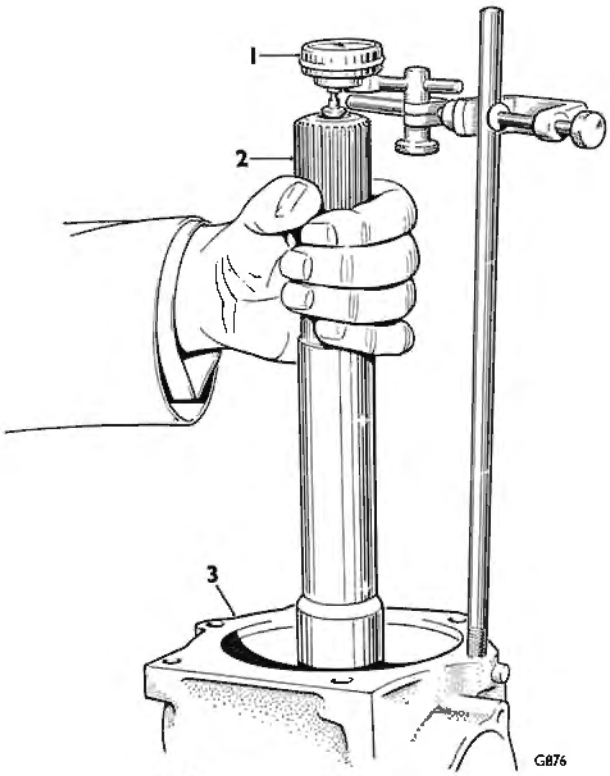


Fig. 100 Checking rear unit and float

1 DIAL INDICATOR GAUGE 2 OUTPUT SHAFT
3 TRANSMISSION CASE

Forward clutch and turbine shaft — To dismantle

With adaptor J–21364 in the rear unit holding fixture J–6116, fit the forward clutch assembly into the holding fixture with the turbine shaft lowermost; take care not to damage the shaft.

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

Remove the forward clutch hub. Remove the thrust washers, one from each side of the hub. An exploded view of the forward clutch is given in Figure 101.

Remove five composition and five steel clutch plates.

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

Using clutch spring compressor J–4670 in conjunction with adaptor J–21664, compress the clutch return springs until the retaining snap ring is accessible. Remove the snap ring (see Fig. 102).

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

Remove the piston from the clutch drum (see Fig. 103).

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

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

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

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

Using a suitable dolly, press the turbine shaft out of the forward clutch housing.

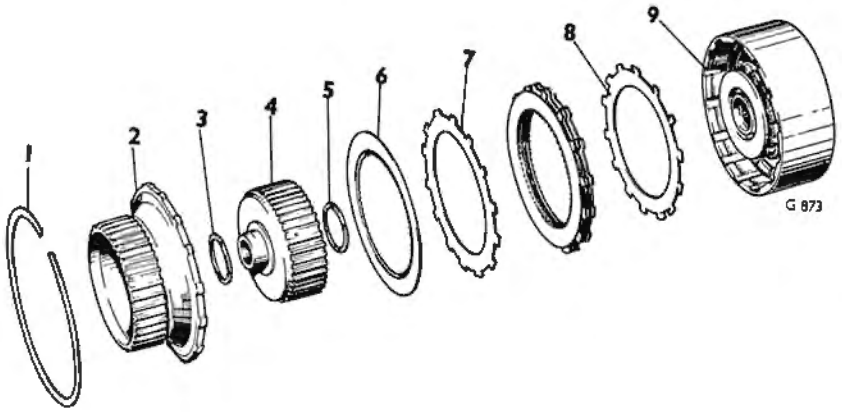
Forward clutch and turbine shaft — To inspect

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

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

Fig. 101 Forward clutch and forward and direct clutch hubs — exploded

1 SNAP RING
2 DIRECT CLUTCH HUB
3 THRUST WASHER
4 FORWARD CLUTCH HUB
5 THRUST WASHER
6 COMPOSITION PLATE
7 FLAT STEEL PLATE
8 WAVED STEEL PLATE
9 FORWARD CLUTCH ASSEMBLY



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

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

Examine the piston for cracks.

Examine the clutch drum for wear, scoring and cracks. Ensure that the oil passages are clear.

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

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

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

Examine the bush journals for damage.

Forward clutch and turbine shaft — To assemble

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

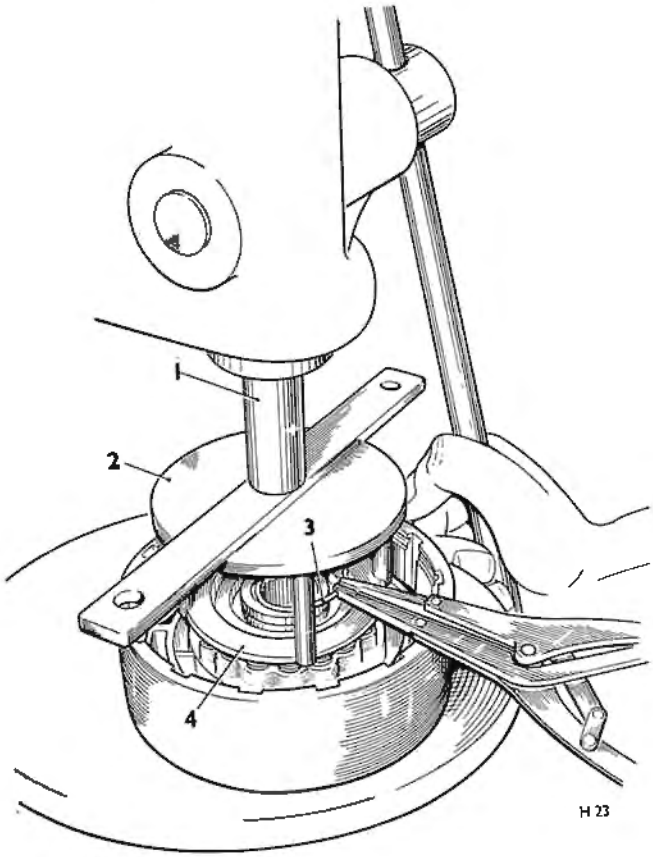

Fig. 102 Removing and fitting the forward clutch housing snap ring

1 PRESS RAM
2 CLUTCH SPRING COMPRESSOR
3 SNAP RING
4 ADAPTOR

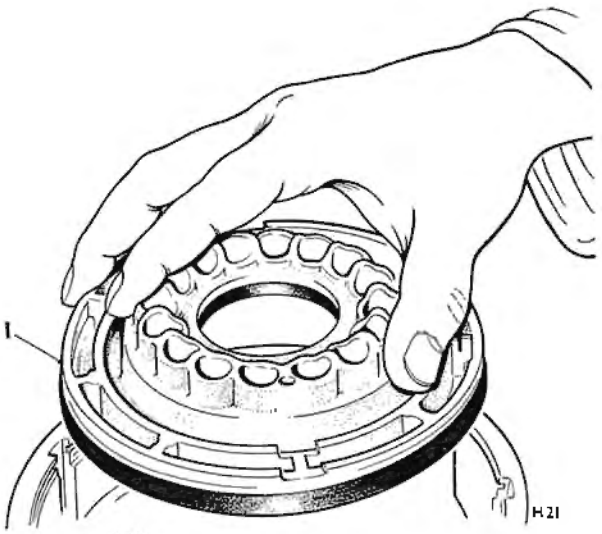

Fig. 103 Removing the forward clutch piston

1 CLUTCH PISTON

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

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

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

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

Lubricate new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the piston with petroleum jelly then fit the seals with the seal lip facing away from the return spring pockets.

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

Fit the forward and direct clutch inner seal protector J–21362 over the forward clutch hub.

Fit the clutch piston inside the forward and direct clutch piston installing tool J–21409 then fit the assembly into the forward clutch housing (see Fig. 104).

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

Fit the sixteen clutch release springs (blue) into the spring pockets in the clutch piston.

Note The forward clutch release springs are blue in colour and must not be interchanged with the black coloured springs used in the direct clutch piston.

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

Position the spring retainer on the springs,

Using clutch spring compressor J–4670 in conjunction with adaptor J–21664, compress the springs ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then release the tension on the springs. Remove the tools.

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

Remove the forward clutch from the press then fit it to the holding fixture J–6116 with the turbine shaft lowermost; take care not to damage the shaft.

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

Fit the forward clutch hub to the forward clutch housing.

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

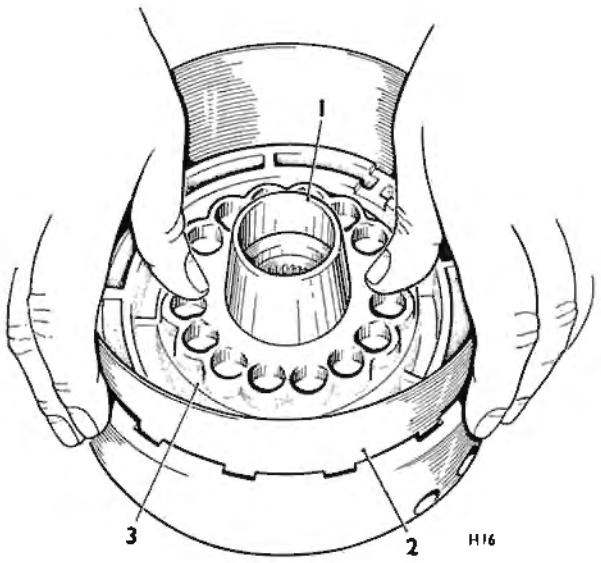

Fig. 104 Fitting the forward clutch piston

1 SEAL PROTECTOR **2** PISTON FITTING TOOL
3 FORWARD CLUTCH PISTON

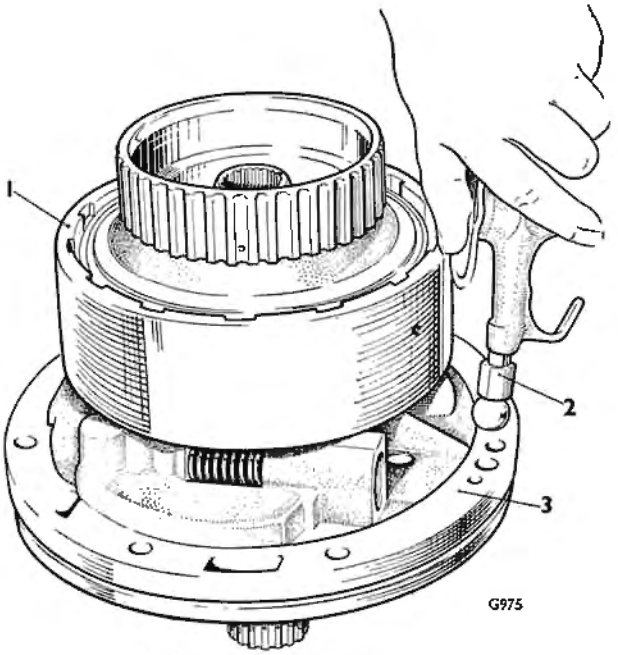

Fig. 105 Air testing the forward clutch

1 FORWARD CLUTCH ASSEMBLY **2** AIR LINE NOZZLE
3 OIL PUMP

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

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

Fit the forward clutch assembly onto the oil pump delivery sleeve then check clutch operation by applying air pressure at approximately 70 lb/sq.in. (4,92 kg/sq.cm.) through the forward clutch apply passage in the pump (see Fig. 105). The clutch should be heard and felt to apply.

Direct clutch and intermediate sprag assembly — To dismantle

Remove the snap ring which retains the sprag retainer; remove the retainer (see exploded view in Figure 106).

Remove the sprag outer race and bushes then withdraw the sprag assembly from the outer race.

Turn the unit over then remove the large snap ring which retains the direct clutch back plate in the clutch housing; remove the back plate.

Remove the five composition plates and the five steel plates (see exploded view of direct clutch in Figure 107).

Using clutch spring compressor J–4670 in conjunction with rear clutch spring compressor J–6129 and adaptor J–21664, compress the clutch return springs

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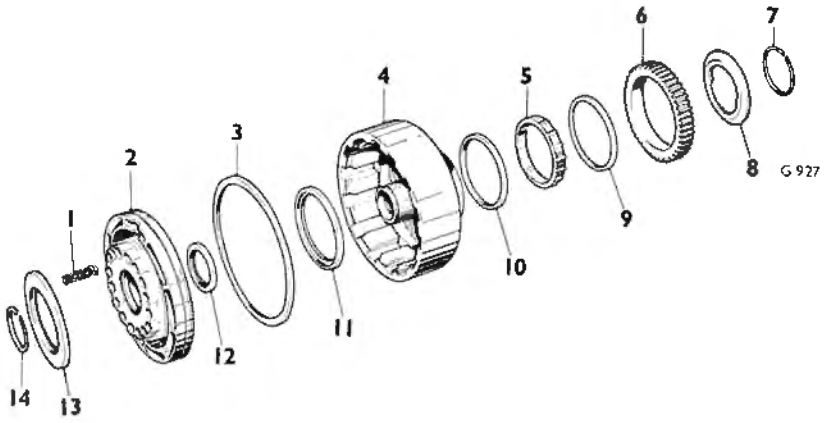

Fig. 106 Direct clutch and intermediate sprag assembly — exploded

1 PISTON RELEASE SPRING (16)
2 DIRECT CLUTCH PISTON
3 PISTON OUTER SEAL
4 DIRECT CLUTCH DRUM AND SPRAG INNER RACE
5 SPRAG ASSEMBLY
6 SPRAG OUTER RACE
7 SNAP RING
8 SPRAG RETAINER
9 SPRAG BUSH
10 SPRAG BUSH
11 PISTON CENTRE SEAL
12 PISTON INNER SEAL
13 CLUTCH SPRING RETAINER
14 SNAP RING

and remove the snap ring (see Fig. 108).

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

Withdraw the direct clutch piston from the clutch drum.

Remove and discard the piston inner and outer seals.

Remove and discard the piston centre seal from the direct clutch drum.

Direct clutch, sun gear shaft and intermediate sprag assembly — To inspect

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

Examine the sprag assembly for loose sprags.

Examine the sprag bushes for wear or distortion.

Examine the inner and outer races for scratches or wear.

Examine the clutch drum for cracks, ensure that the oilways are clear and look for excessive wear on the clutch plate driving lugs.

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

Examine the back plate for scratches or other damage.

Examine the sun gear shaft for cracks. Examine the splines for damage, examine the bushes for scoring and the ground bush journals for damage. Ensure that the oil feed hole is clear.

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

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

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

Direct clutch and intermediate sprag assembly — To assemble

Lubricate new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in

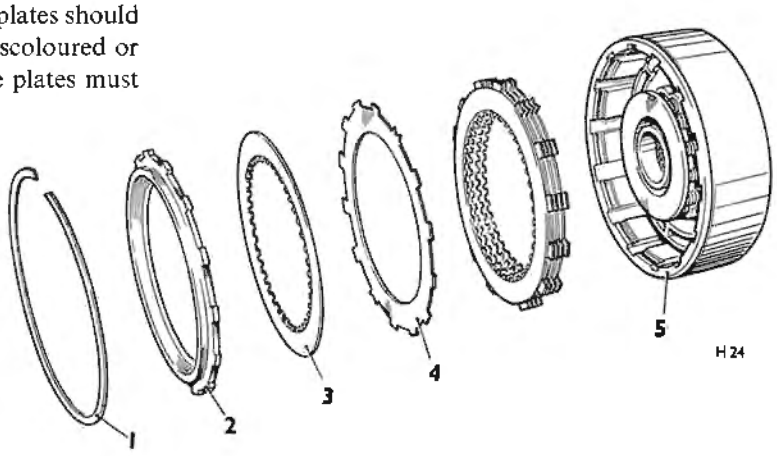

Fig. 107 Direct clutch — exploded

1 SNAP RING
2 BACK PLATE
3 COMPOSITION PLATE
4 STEEL PLATE
5 DIRECT DRUM AND PISTON ASSEMBLY

the direct clutch piston then fit the seals with the lips facing away from the spring pockets.

Lubricate a new centre seal with clean transmission fluid. Lubricate the seal groove in the direct clutch housing then fit the seal with the lip uppermost.

Fit the forward and direct clutch inner seal protector J–21362 over the direct clutch hub.

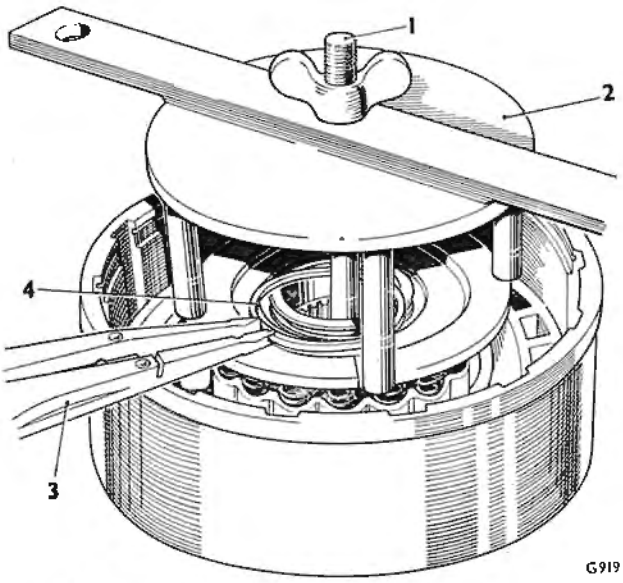

Fig. 108 Removing and fitting the direct clutch housing snap ring

1 SPRING COMPRESSING TOOL
2 CLUTCH SPRING COMPRESSOR (SEATED ON ADAPTOR)
3 SNAP RING PLIERS
4 SNAP RING

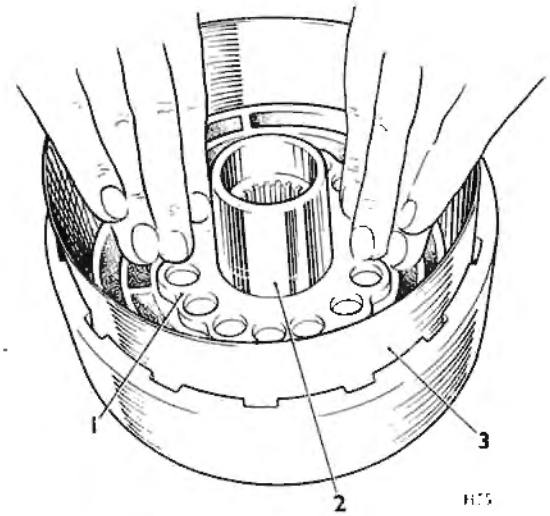

Fig. 109 Fitting the direct clutch piston

1 DIRECT CLUTCH PISTON **2** INNER SEAL PROTECTOR
3 OUTER SEAL PROTECTOR

Fit the clutch piston inside the forward and direct clutch piston installing tool J–21409. Fit the assembly into the direct clutch housing (see Fig. 109).

Fit the piston by turning it clockwise as it is pushed down.

Fit the sixteen clutch release springs (black) into the spring pockets in the clutch piston.

Note The direct clutch release springs are black in colour and are not interchangeable with the blue coloured springs in the forward clutch piston.

Position the spring retainer over the springs.

Using clutch spring compressor J–4670, rear clutch

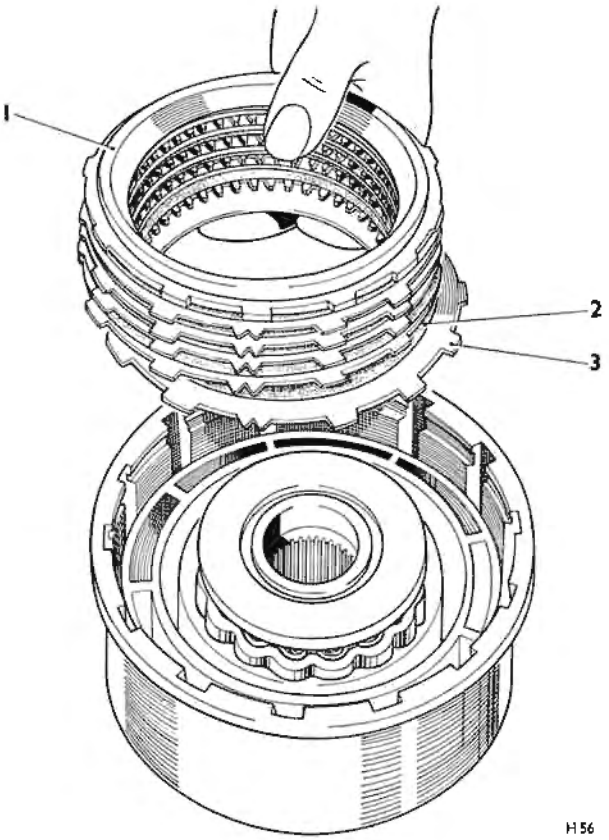

Fig. 110 Fitting the direct clutch plates

1 BACK PLATE **2** COMPOSITION PLATE (5)
3 STEEL PLATE (5)

spring compressor J–6129 and adaptor J–21664, compress the springs, ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then remove the tools.

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

Lubricate the five steel plates and the five composition plates with clean transmission fluid then fit the

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plates into the clutch drum. Commence with a steel plate then continue with alternate steel plates and composition plates, finishing with a composition plate. The notches in the steel plates must be aligned and fitted into the same slot in the drum (see Fig. 110).

Fit the direct clutch back plate over the clutch plates then fit the large snap ring.

Turn the clutch drum over then fit one sprag bush, cupped side uppermost, around the sprag inner race.

Lightly lubricate the sprag assembly with clean transmission fluid then fit the sprag into the outer race.

With the ridge on the inner cage of the sprag lowermost, fit the sprag and outer race onto the inner race with a clockwise turning motion.

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

Fit the other sprag bush, cupped side down, over the sprag assembly.

Fit the sprag retainer and the snap ring.

Fit the direct clutch assembly onto the centre support then air test the direct clutch to ensure that it operates correctly (see Fig. 111). Use an air pressure of approximately 70 lb/sq.in. (4,92 kg/sq.cm.).

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

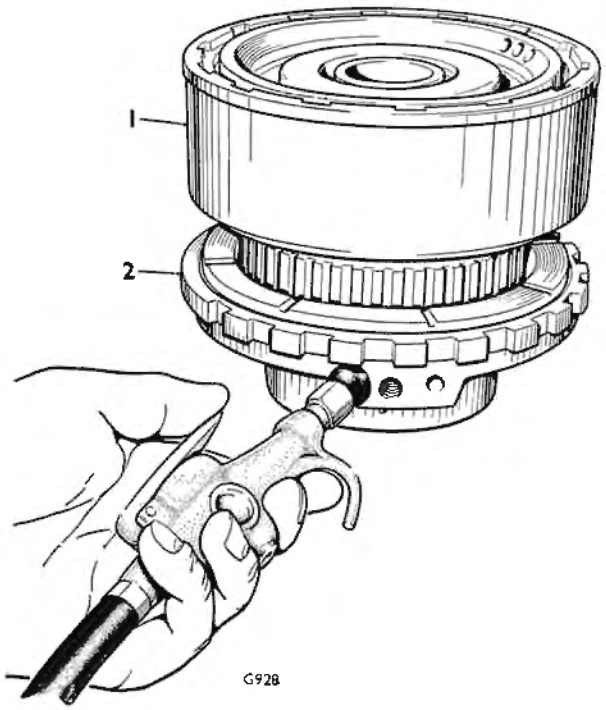

Fig. 111 Air testing the direct clutch

1 DIRECT CLUTCH ASSEMBLY **2** CENTRE SUPPORT ASSEMBLY

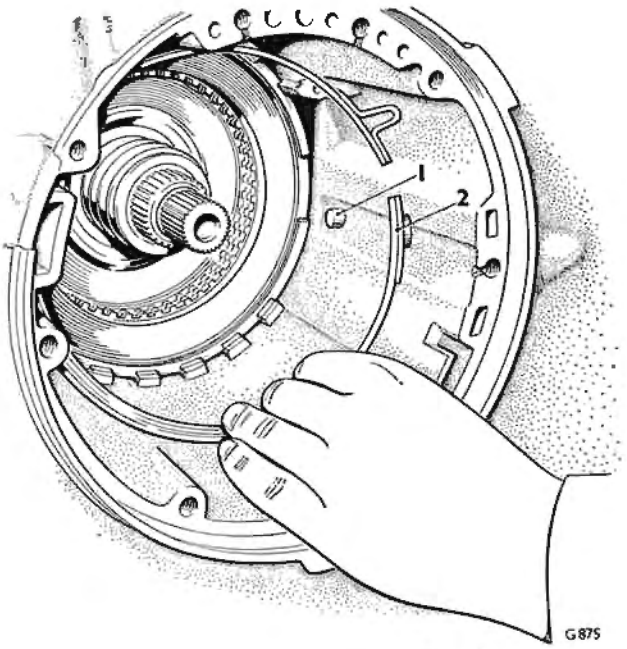

Fig. 112 Fitting the front band

1 ANCHOR PIN **2** FRONT BAND

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

Fit the front band so that the band anchor hole fits over the band anchor pin and the band apply lug faces the servo hole (see Fig. 112).

Fit the sun gear shaft with the longer splined end innermost.

Fit the direct clutch housing and intermediate sprag assembly onto the centre support as follows.

Ensure that the ends of the oil sealing rings on the centre support are interlocked, and that the rings are lubricated. Carefully slide the direct clutch drum onto the centre support sleeve, at the same time, engage the drum internal splines with the splines on the sun gear shaft. Ensure that the clutch drum hub 'bottoms' on the sun gear shaft and that the splines on the forward end of the sun gear shaft are flush with the splines in the direct clutch drum.

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

Fit the bronze thrust washer onto the forward clutch hub; retain the washer in position with petroleum jelly.

Position the transmission horizontally in the transmission holding fixture then fit the forward clutch assembly and the turbine shaft. Ensure that the end of the mainshaft fully enters into the forward clutch hub. It will be necessary to rotate the clutch drum to allow the direct clutch driving hub to line up with the clutch plates in the direct clutch. When the forward clutch is correctly seated it should be approximately $1\frac{1}{4}$ in. (3,175 cm.) from the oil pump face in the transmission casing.

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

Fit the oil pump as described in Section 12 of this Chapter.

Section 15
Intermediate Clutch, Gear Unit, Centre Support and Reaction Carrier

Description

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

The compound planetary gear unit consists of an internal gear, which is splined onto the mainshaft, an output planet carrier and pinions, an output shaft which is mechanically connected to the output carrier, and a sun gear which is splined onto the mainshaft (see Fig. 113).

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

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

Operation

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

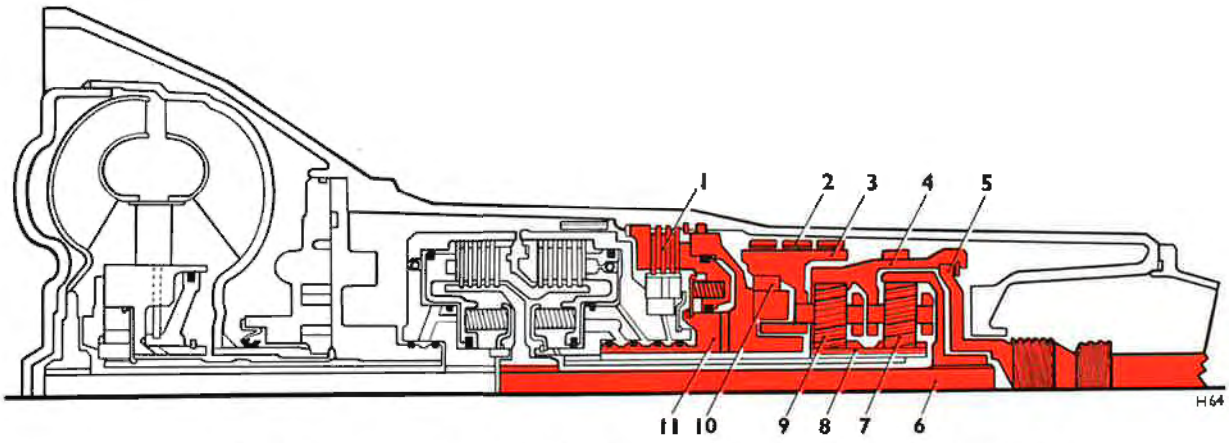

Fig. 113 Sectioned view of the transmission showing the intermediate clutch and gear unit

1 INTERMEDIATE CLUTCH
2 REAR BAND
3 REACTION CARRIER
4 OUTPUT CARRIER
5 OUTPUT SHAFT DRIVING FLANGE
6 MAINSHAFT
7 REAR PLANET PINION
8 SUN GEAR
9 FRONT PLANET PINION
10 REAR SPRAG
11 CENTRE SUPPORT

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Summary of power flow

Neutral — engine running

Forward clutch released, direct clutch released, intermediate clutch released, low sprag ineffective, front band released, intermediate sprag ineffective, rear band released.

In Neutral, all clutches and bands are released; therefore no power is transmitted from the torque converter turbine to the planetary gear train or output shaft (see Fig. 114).

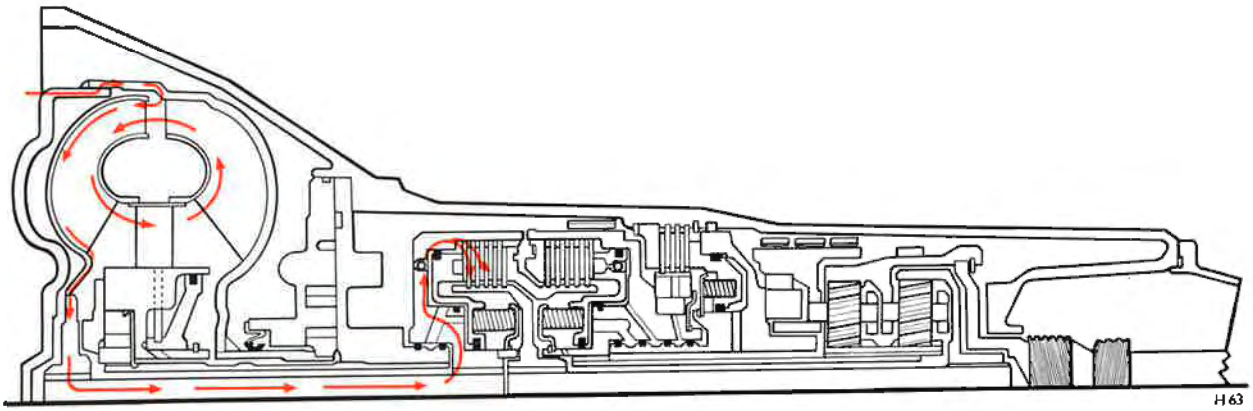

Fig. 114 Neutral — engine running

Drive range — first gear

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

With the selector in Drive range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear clockwise. Clockwise motion of the rear internal gear causes the pinions to turn clockwise, driving the sun gear anticlockwise. In turn, the sun gear drives the front pinions clockwise, driving the front internal gear, output carrier and output shaft clockwise at a reduction of approxmately 2·5 : 1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and Low sprag assembly to the transmission case (see Fig. 115). (The approximate stall ratio equals 5 : 1).

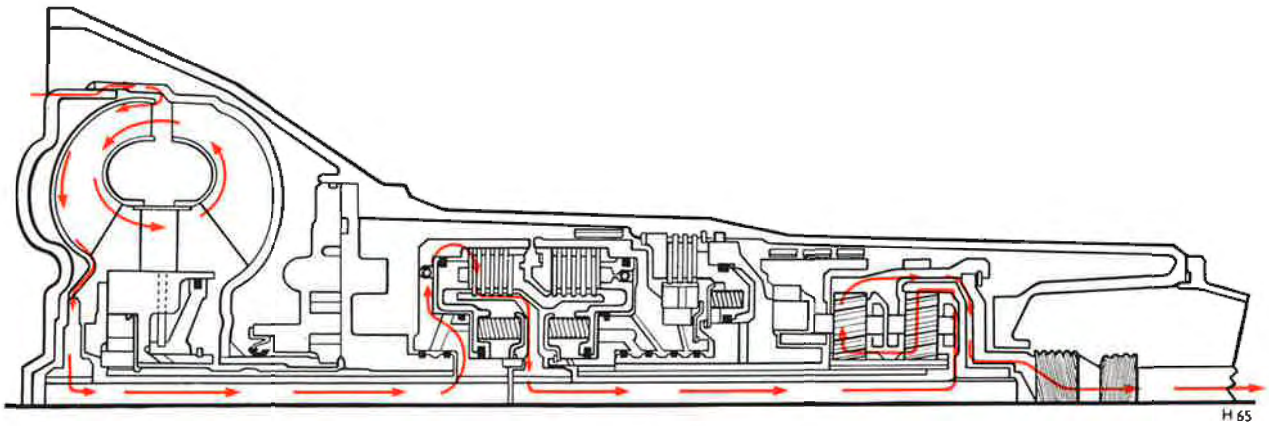

Fig. 115 Drive range 1st gear

Drive range — second gear

Forward clutch applied, direct clutch released, intermediate clutch applied, low sprag ineffective (overrunning), front band released, intermediate sprag effective, rear band released.

In second gear, the intermediate clutch is applied to

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allow the intermediate sprag to hold the sun gear against anti-clockwise rotation. Turbine torque, through the forward clutch, is applied clockwise through the mainshaft, to the rear internal gear. Clockwise rotation of the rear internal gear turns the pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise at a 1·5 : 1 ratio (see Fig. 116).

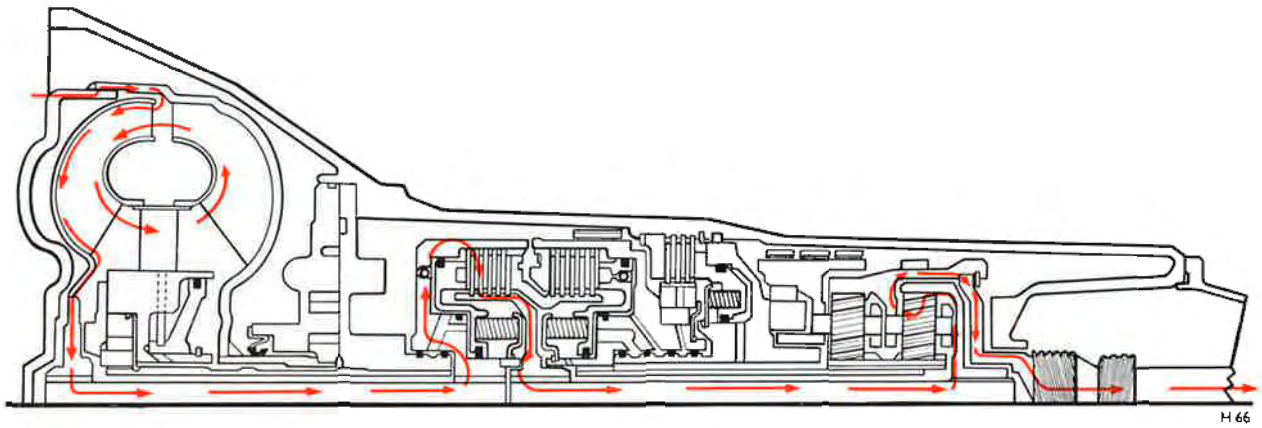

Fig. 116 Drive range 2nd gear

Drive range — third gear

Forward clutch applied, direct clutch applied, intermediate clutch applied, low sprag ineffective (over-running), front band released, intermediate sprag ineffective (over-running), rear band released.

In direct drive, engine torque is transmitted to the converter, then through the forward clutch to the mainshaft and the rear internal gear (see Fig. 117). Because the direct clutch is applied, some power is transmitted also to the sun gear shaft and the sun gear. Since both the sun gear and the internal gears are now turning at the same speed, the planetary gear set is essentially locked and turns as one unit in direct drive (ratio 1 : 1).

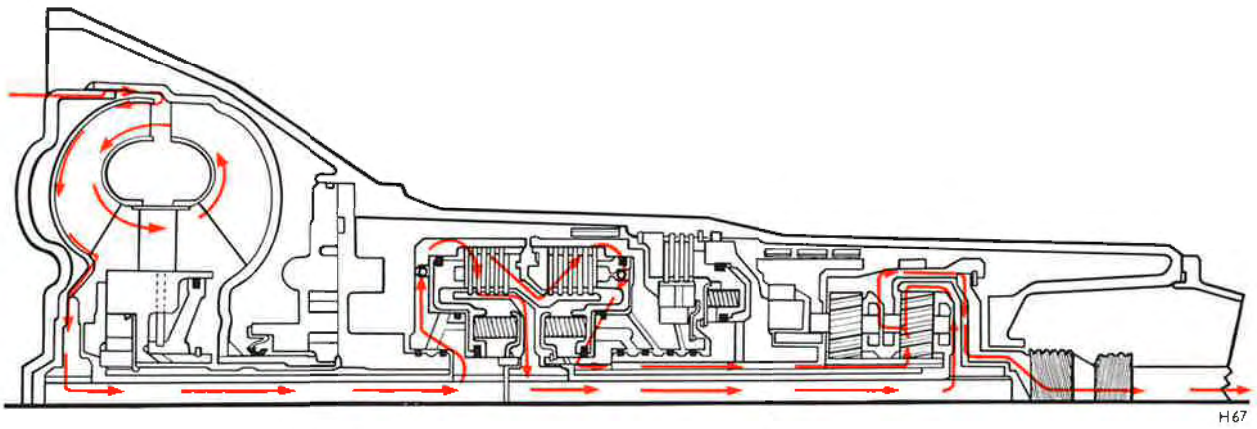

Fig. 117 Drive range 3rd gear

Reverse

Forward clutch released, direct clutch applied, intermediate clutch released, low sprag ineffective, front band released, intermediate sprag ineffective (over-running), rear band applied.

In Reverse, the direct clutch is applied to transmit turbine torque from the forward clutch drum to the sun gear shaft and sun gear (see Fig. 118). The rear band is applied; this prevents the reaction carrier from turning clockwise. Clockwise torque to the sun gear causes the front pinions and front internal gear to turn anti-clockwise in reduction. The front internal gear is directly connected to the output shaft, thus providing the reverse output gear ratio of approximately 2 : 1. The reverse torque multiplication at stall (converter and gear ratios) is approximately 4 : 1.

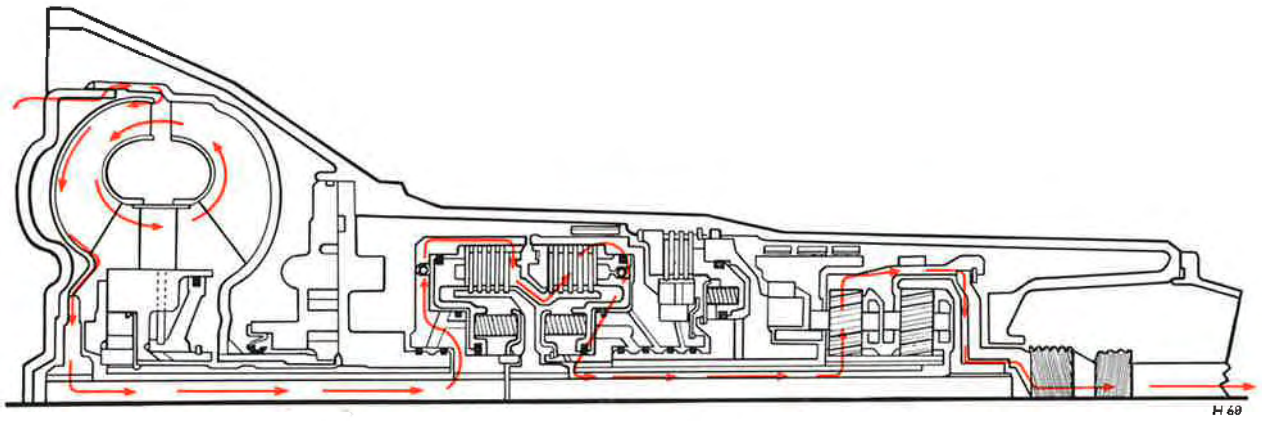

Fig. 118 Reverse

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

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

Remove the following units.

Sump, strainer and intake pipe assembly (see Section 7).

Control valve unit (see Section 8).

Rear servo (see Section 9).

Control valve spacer, check balls and front servo (see Section 10).

Oil pump (see Section 12).

Turbine shaft, forward clutch, direct clutch, sun gear shaft and front band (see Section 14).

Remove the centre support bolt from the transmission case. This is the socket-headed cap screw located in the lower face of the transmission case at the rear of the control valve unit oil passages.

Remove the snap ring which secures the intermediate clutch back plate.

Remove the back plate then withdraw the three composition plates and the three steel plates.

Using a pair of long-nose pliers remove the snap ring which retains the centre support in the case.

Fit tool J-21795 onto the end of the mainshaft so that the tangs engage in the groove in the shaft. Tighten the screw on the tool to secure the tool on the shaft and to prevent movement of the rearmost sprag during the removal of the gear unit.

Obtain a length of tube of suitable diameter which will fit over the output shaft and can be used as a handle. This will prevent damage to the case bush when removing the gear unit, centre support and reaction carrier.

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

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

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

Remove the output shaft thrust washer from either the output shaft or the case.

Using adaptor J-21364 in the rear unit holding fixture J-6116, fit the gear unit assembly into the holding fixture with the mainshaft pointing upward (see Fig. 119); remove the tool J-21795.

Withdraw the centre support assembly from the reaction carrier (see Fig. 120).

Remove the bronze thrust washer and centre support race.

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

Remove the reaction carrier and sprag assembly from the output carrier (see Fig. 121); remove the sprag assembly from the reaction carrier.

Remove the rear unit adjusting washer from the transmission case.

Remove the rear band assembly. To facilitate removal, rotate the band lugs away from the pins and pull the band assembly out of the transmission case.

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Centre support and intermediate clutch piston — To dismantle

Remove the four oil seal rings from the centre support (see the exploded view in Fig. 122); discard the rings.

Using clutch spring compressor J–4670 and rear clutch spring compressor J–6129, compress the springs then remove the snap ring (see Fig. 123).

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

Remove the intermediate clutch piston from the centre support.

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

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

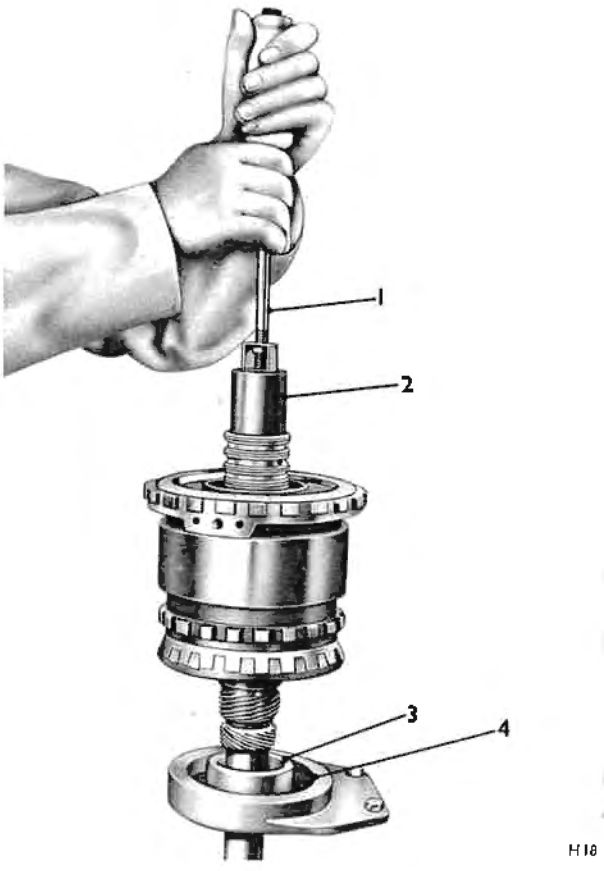

Fig. 119 Fitting the gear unit into the holding fixture

1 SLIDE HAMMER
2 GEAR ASSEMBLY REMOVAL AND FITTING ADAPTOR
3 ADAPTOR
4 HOLDING FIXTURE

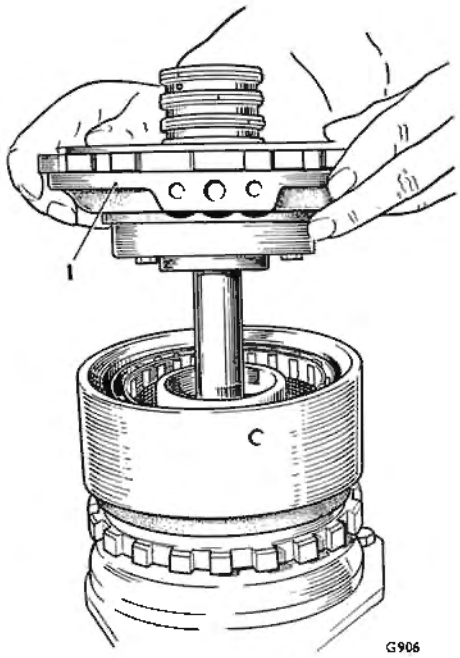

Fig. 120 Removing the centre support assembly

1 CENTRE SUPPORT

Centre support and intermediate clutch piston — To inspect

Wash all parts in clean paraffin (kerosene) then dry with compressed air.

Examine the sprag inner race for scratches and indentations. Ensure that the lubrication hole is clear.

Examine the bush for scoring or wear.

Ensure that the oil ring grooves are clean and are not damaged.

Air test the lubrication passages to ensure that they are clear and are not interconnected.

Examine the piston bore in the centre support for scratches or damage.

Examine the piston seal grooves for damage and ensure that they are clean.

Examine the piston for cracks or porosity.

Examine the springs for collapsed coils or signs of distortion. Check the spring length against that of a new spring before deciding whether to renew a set of springs.

Centre support and intermediate clutch piston — To assemble

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

Fit the intermediate clutch inner seal protector J–21363 over the centre support hub.

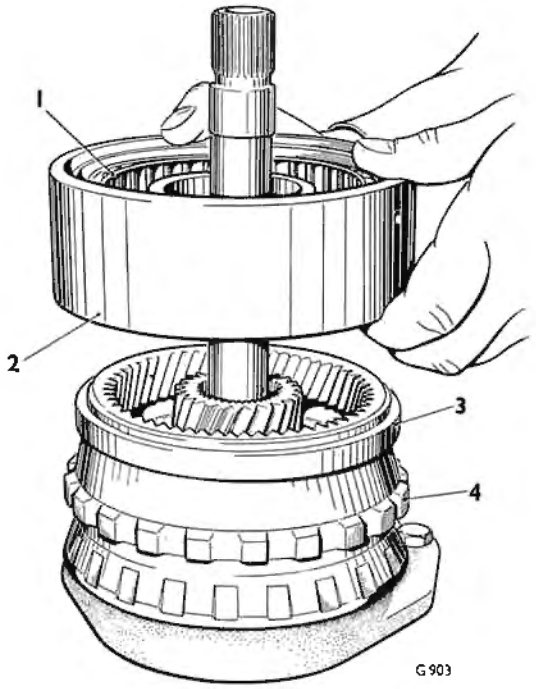

Fig. 121 Removing the reaction carrier and rear sprag assembly

1 SPRAG ASSEMBLY
2 REACTION CARRIER
3 GEAR RING
4 OUTPUT CARRIER

Fit the intermediate clutch piston as shown in Figure 124.

Fit the twelve clutch release springs into the pockets in the clutch piston.

Position the spring retainer centrally over the springs.

Using clutch spring compressor J–4670 in conjunction with rear clutch spring compressor J–6129 compress the spring retainer, ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then remove the tools.

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

Air test the operation of the intermediate clutch piston. Apply an air pressure of approximately 70 lb/sq.in. (4,92 kg/sq.cm.) through the centre oil feed hole to actuate the clutch piston (see Fig. 125); the piston should be heard and felt to move.

Gear unit — To dismantle

Using adaptor J–21364 in rear unit holding fixture J–6116, fit the gear unit into the holding fixture with the output shaft pointing downward. An exploded view of the gear unit is shown in Figure 126.

Remove the centre support-to-sun gear races and thrust bearing. The outer race may have been removed with the centre support.

Remove the sun gear from the output carrier assembly.

Invert the gear unit in the holding fixture so that the mainshaft is pointing downward.

Remove the snap ring which retains the output shaft in the output carrier; remove the output shaft.

Remove the thrust bearing and races from the rear internal gear.

Withdraw the rear internal gear and mainshaft from the output carrier; remove the thrust bearing and races from the inner face of the rear internal gear.

Remove the circlip from the end of the mainshaft then remove the rear internal gear.

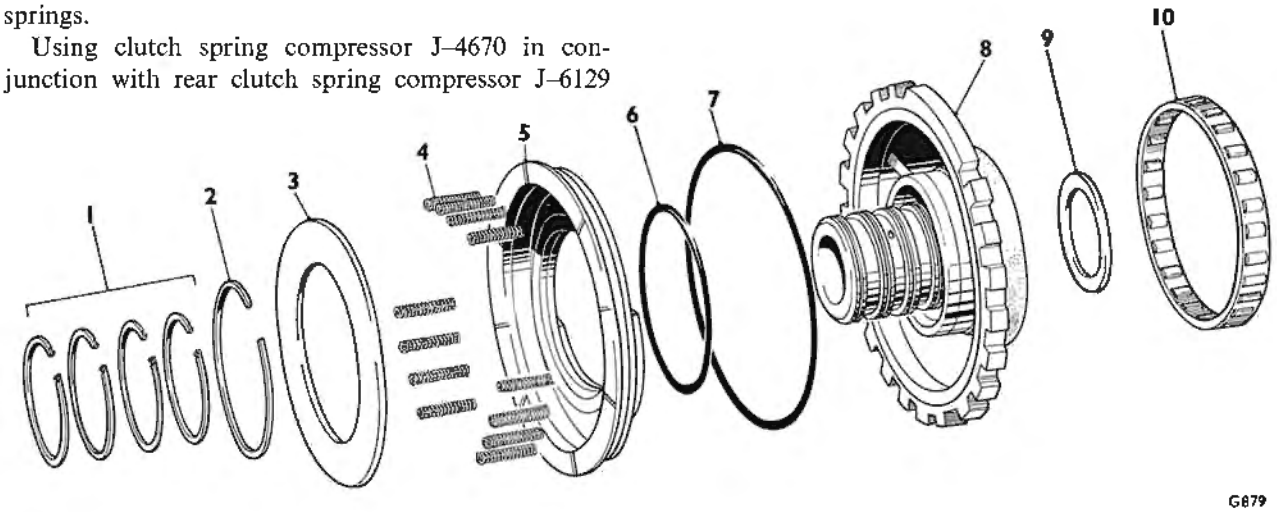

Fig. 122 Centre support — exploded

1 OIL SEAL RINGS
2 SNAP RING
3 INTERMEDIATE CLUTCH SPRING RETAINER
4 INTERMEDIATE CLUTCH SEAL RELEASE SPRINGS
5 INTERMEDIATE CLUTCH PISTON
6 INTERMEDIATE CLUTCH INNER SEAL
7 INTERMEDIATE CLUTCH OUTER SEAL
8 CENTRE SUPPORT ASSEMBLY
9 CENTRE SUPPORT THRUST WASHER
10 LO CLUTCH SPRAG ASSEMBLY

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Remove the output carrier from the holding fixture.

Output shaft — To inspect

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

Examine the bearing and thrust washer faces for damage.

Examine the governor drive gear for rough or damaged teeth.

Examine the splines for damage.

Check the orificed cup plug in the lubrication passage. Ensure that the orifice is clear.

Examine the driving teeth for damage.

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

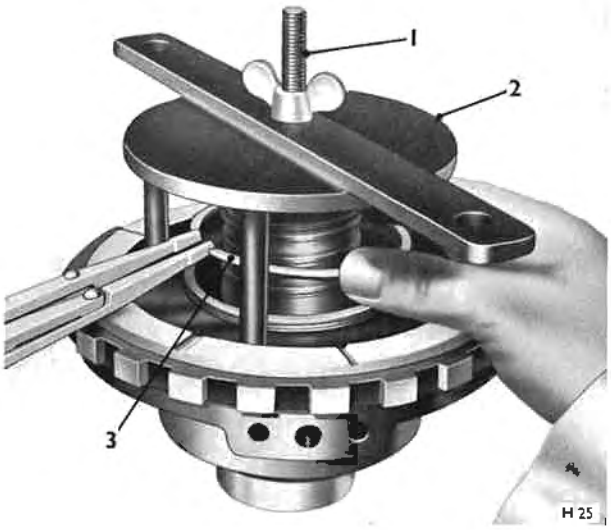

Fig. 123 Removing and fitting the intermediate clutch piston snap ring

1 REAR CLUTCH SPRING COMPRESSOR
2 CLUTCH SPRING COMPRESSOR
3 SNAP RING

Speedometer drive gear — To renew

Fit the speedometer drive gear removal tool J-21427, with extractor J-8433, to the output shaft. Fit the speedometer drive gear removal bolts J-21797 onto the output shaft so that the extractor bolts align with the end of the shaft, and the curved plate of the extractor tool is under the front face of the drive gear.

Tighten the extractor centre screw (see Fig. 127), withdrawing the gear until it is free on the output shaft; remove the tools and the gear from the shaft.

Ensure that the new drive gear is clean and free from burrs.

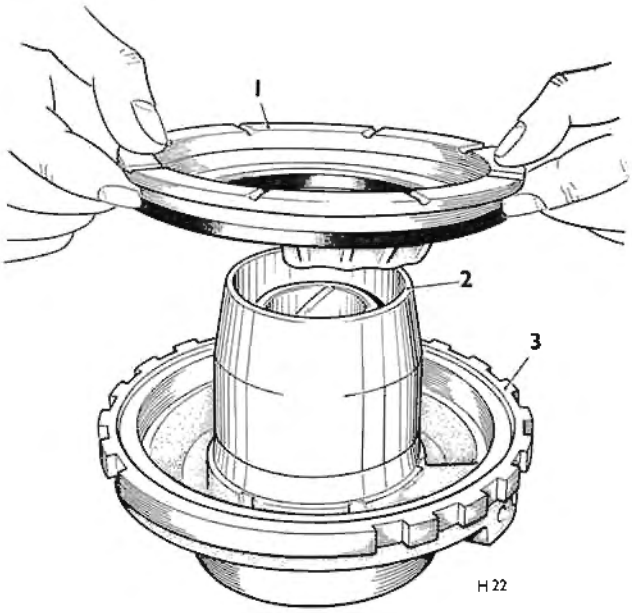

Fig. 124 Fitting the intermediate clutch piston

1 INTERMEDIATE CLUTCH PISTON **2** GUIDE SLEEVE
3 CENTRE SUPPORT

Lightly lubricate the bore of the gear then fit it over the output shaft.

Support the output shaft then drive the gear into position using a suitable length of tube and a mallet.

Caution Use a tube which fits closely over the output shaft. The ends of the tube must be square with the bore. Ensure that the end of the tube which

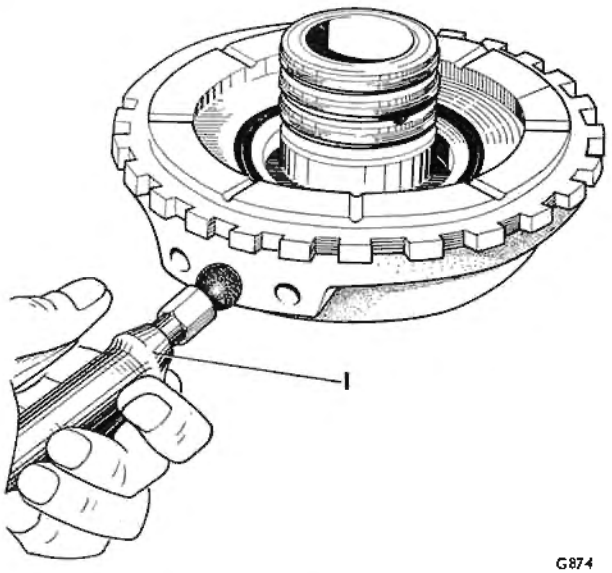

Fig. 125 Air testing the intermediate clutch

1 AIR LINE NOZZLE

contacts the gear is smooth and free from burrs.

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

Drive the gear down the shaft until the distance from the rear face of the gear to the end of the output shaft measures 15 in. (38,1 cm.) (see Fig. 128).

Mainshaft — To inspect

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

Examine the shaft for cracks or distortion.

Examine the splines for damage.

Examine the ground journals for scratches or damage.

Examine the snap ring groove for damage.

Examine the orificed cup plug in the end of the mainshaft. Ensure that the orifice is clear.

Rear internal gear and sun gear — To inspect

Wash the rear internal gear and the sun gear in clean paraffin (kerosene) then dry with compressed air.

Examine all the gear teeth for wear or damage.

Examine the splines for damage.

Examine the gears for cracks.

Ensure that the lubrication hole in the sun gear is clear.

Output carrier assembly — To inspect

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

Examine the front internal gear for damaged teeth.

Examine the pinion gears for damage, rough bearings or excessive side movement.

Check the end float of the pinions with the aid of a feeler gauge (see Fig. 129). The end float should be between 0·009 in. and 0·024 in. (0,228 mm. and 0,610 mm.).

Examine the parking gear lugs for cracks or damage.

Examine for damage the splines which drive the output shaft.

Examine the front internal gear ring for flaking or cracks.

Reaction carrier assembly — To inspect

Examine the surface on which the rear band applies, for signs of burning or scoring.

Examine the sprag outer race for scoring or wear.

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

Examine the thrust washer surfaces for signs of scoring or wear.

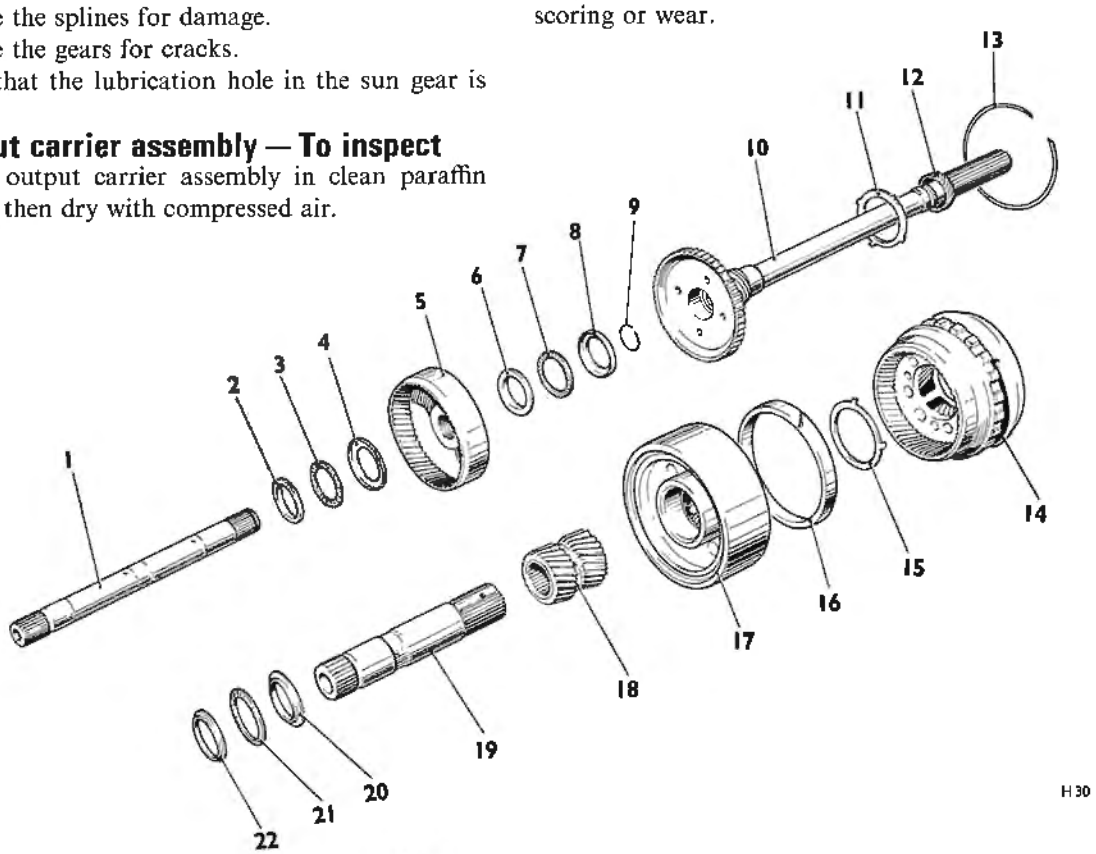

Fig. 126 Gear unit — exploded

1 MAINSHAFT
2 I/D FLANGED RACE
3 THRUST BEARING
4 O/D FLANGED RACE
5 REAR INTERNAL GEAR
6 I/D FLANGED RACE
7 THRUST BEARING
8 O/D FLANGED RACE
9 SNAP RING
10 OUTPUT SHAFT
11 FLANGED THRUST WASHER
12 SPEEDOMETER DRIVE GEAR
13 SNAP RING
14 OUTPUT CARRIER ASSEMBLY
15 THRUST WASHER
16 FRONT INTERNAL GEAR RING
17 REACTION CARRIER ASSEMBLY
18 SUN GEAR
19 SUN GEAR SHAFT
20 I/D FLANGED RACE
21 THRUST BEARING
22 I/D FLANGED RACE

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Examine the bush for damage. If the bush is damaged, the carrier must be renewed.

Examine the pinion gears for damage, rough bearings, or excessive side movement.

Check the pinion end float. This should be between 0·009 in. and 0·024 in. (0,228 mm. and 0,610 mm.).

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

Should the pinion gears need renewing, proceed as follows.

Support the carrier assembly on its **front** face.

Using a tapered punch, drive or press the pinions

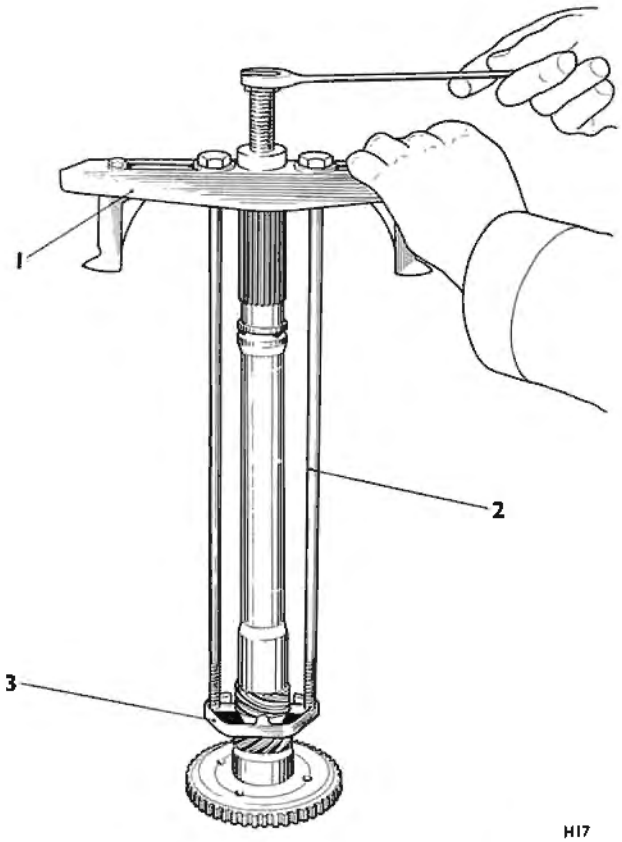

Fig. 127 Removing the speedometer driving gear

1 PULLEY REMOVER **2** REMOVAL BOLTS
3 DRIVE GEAR EXTRACTOR

out of the carrier.

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

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

Ensure that the new gears are clean and free from burrs then fit nineteen needle bearings into each pinion

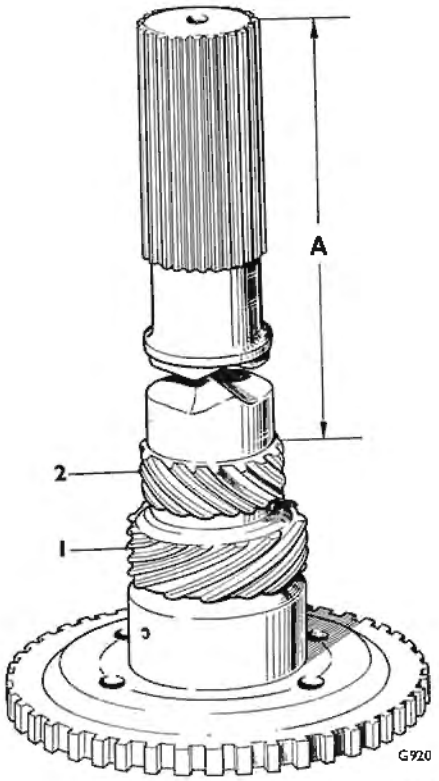

Fig. 128 Speedometer driving gear — fitted

1 GOVERNOR DRIVING GEAR **2** SPEEDOMETER DRIVING GEAR
A 15 in. (38,1 cm.)

gear. Use petroleum jelly to retain the bearings and use a pinion pin as a guide when fitting the bearings.

Fit a bronze and a steel thrust washer on each side of the pinion gear with the steel washer next to the

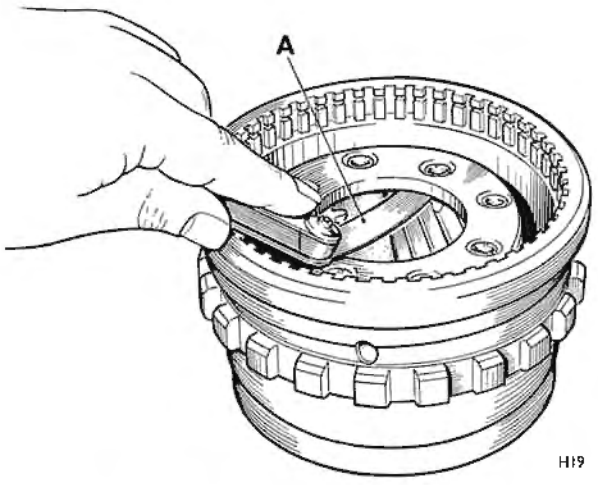

Fig. 129 Checking output carrier pinion end float

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

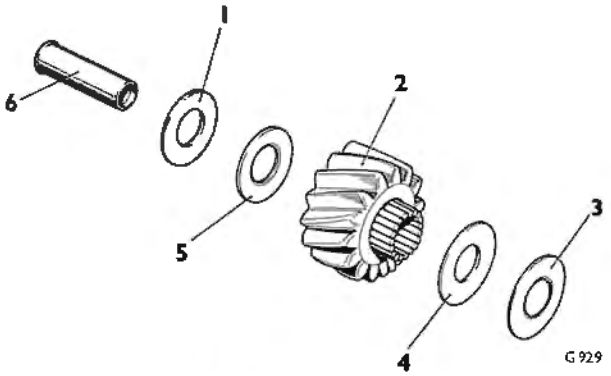

Fig. 130 Planet pinion gear — exploded

1 BRONZE WASHER
2 PLANET PINION
3 BRONZE WASHER
4 STEEL WASHER
5 STEEL WASHER
6 PINION PIN

gear (see exploded view in Fig. 130). Hold the washers in place with a smear of petroleum jelly.

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

Drive a new pinion pin into position from the front, rotating the pinion whilst the pin is being driven in. Ensure that the headed end of the pin is flush or below the face of the carrier.

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

Support the carrier with the head of the pin resting on the punch then, using a chisel with a radiused end stake the opposite end of the pin in three places (see Fig. 131).

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

Repeat the fitting procedure for the remaining pins.

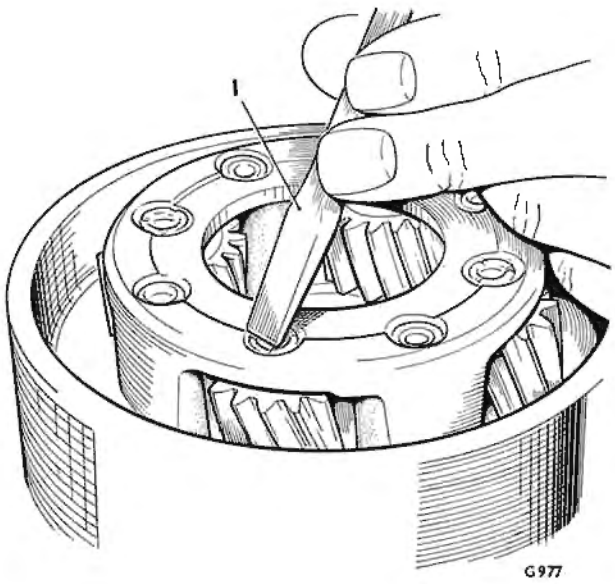

Fig. 131 Staking a pinion pin

1 BLUNT CHISEL

Rear sprag assembly — To inspect

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

Examine the sprag for damaged members.

Examine the sprag cage and retaining spring for damage.

Clutch plates and rear band — To inspect

Examine the condition of the composition plates. Check that the composition material has not lifted or flaked. If the plates are black, burned or shiny they should be renewed.

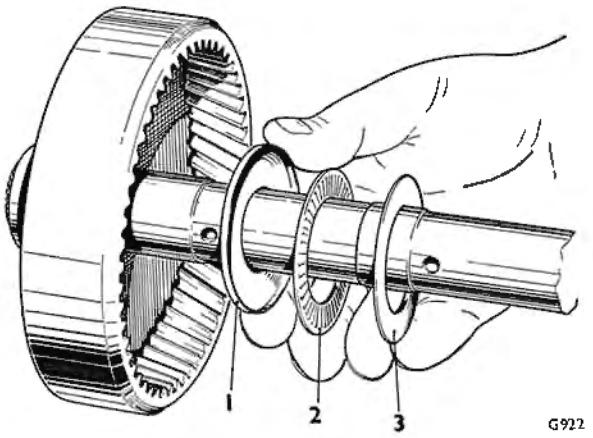

Fig. 132 Fitting races and thrust bearings to inner face of rear internal gear

1 O/D FLANGED RACE 2 THRUST BEARING 3 I/D FLANGED RACE

Examine the condition of the reaction (steel) plates. Check for scores or damage. The plates are normally matt grey in colour. If they are burned or distorted they must be renewed.

Examine the rear band for cracks or distortion. Examine the ends of the band for damage at the anchor lugs and the apply lug. Examine the lining for cracks, flaking and burning. Ensure that the lining is secured to the band.

Gear unit and centre support — To assemble

Ensure that all parts are clean. Lightly lubricate with clean transmission fluid all bushes, journals, gears, bearings and sprag races.

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Fit the rear internal gear onto the mainshaft, circlip groove end; fit the circlip.

Fit the races and thrust bearing onto the inner face of the rear internal gear, retaining them with a smear of petroleum jelly. Fit the large diameter race first with the flange uppermost (see Fig. 132). Fit the thrust bearing into the race. Fit the smaller diameter race over the bearing with the inner flange toward the bearing.

Ensure that the pinion gears are adequately lubricated then fit the output carrier onto the mainshaft so that the pinion gears mesh with the rear internal gear.

Fit the assembly into the rear unit holding fixture J–6116 with the mainshaft pointing downward. Take care not to damage the shaft.

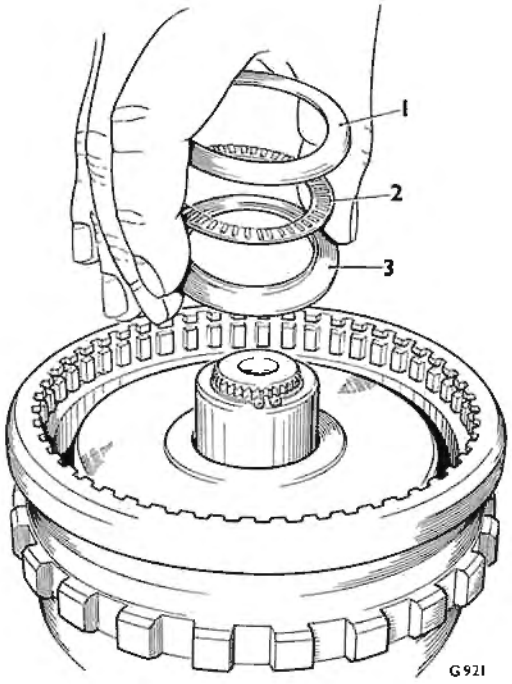

Fig. 133 Fitting races and thrust bearings to outer face of rear internal gear

1 O/D FLANGED RACE **2** THRUST BEARING
3 I/D FLANGED RACE

Fit the races and thrust bearing onto the outer face of the rear internal gear, retaining them with a smear of petroleum jelly. The small diameter (flanged I/D) race must be fitted first with the flange uppermost (see Fig. 133). Fit the thrust bearing into the race. Fit the large diameter (flanged O/D) race against the bearing with the flange cup over the bearing.

Fit the output shaft into the output carrier and fit the snap ring with the chamfer uppermost.

Invert the assembly in the holding fixture so that the output shaft points downward.

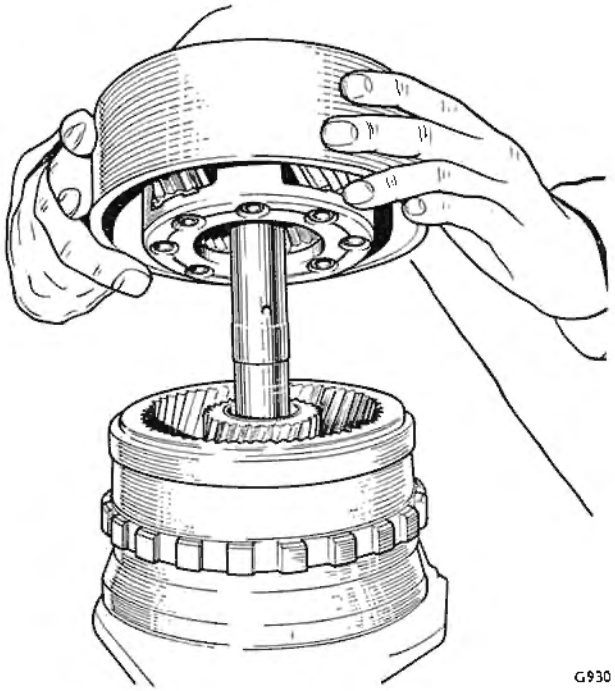

Fig. 134 Fitting the reaction carrier to the output carrier

Smear the tab side of the thrust washer with petroleum jelly then fit the washer into the output carrier so that the bent tabs engage in the tab pockets.

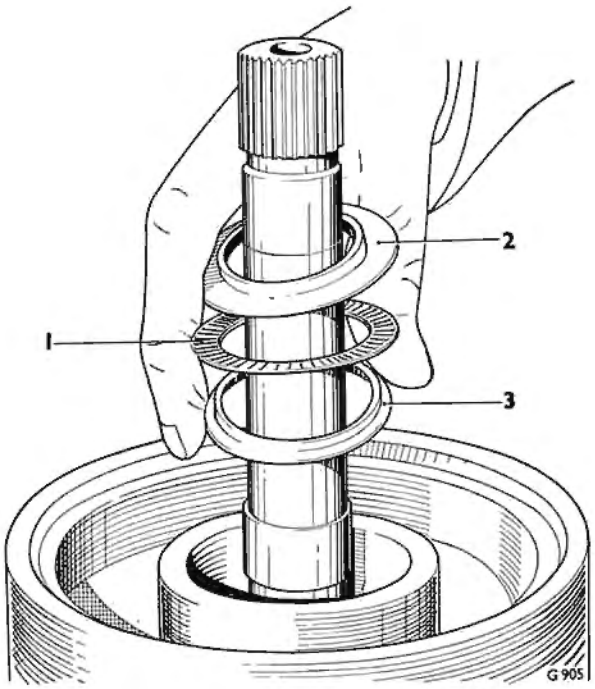

Fig. 135 Fitting races and thrust bearings to the sun gear

1 THRUST BEARING **2** I/D FLANGED RACE **3** I/D FLANGED RACE

Fit the sun gear; ensure that the end with the chamfered inside diameter faces down.

Fit the sun gear shaft with the longer of the splined ends lowermost.

Fit the ring over the output carrier.

Ensure that the reaction carrier pinion gears are adequately lubricated then fit the reaction carrier onto the output carrier as shown in Figure 134; mesh the pinion gears with the front internal gear.

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

Fit the thrust bearing onto the race.

Smear the small diameter race with petroleum jelly then fit the race onto the centre support with the flange uppermost as shown in Figure 135.

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

Using the rear sprag fitting tool J–21367, fit the rear sprag assembly onto the centre support inner race with the bronze drag strip uppermost (see Fig. 136).

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

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

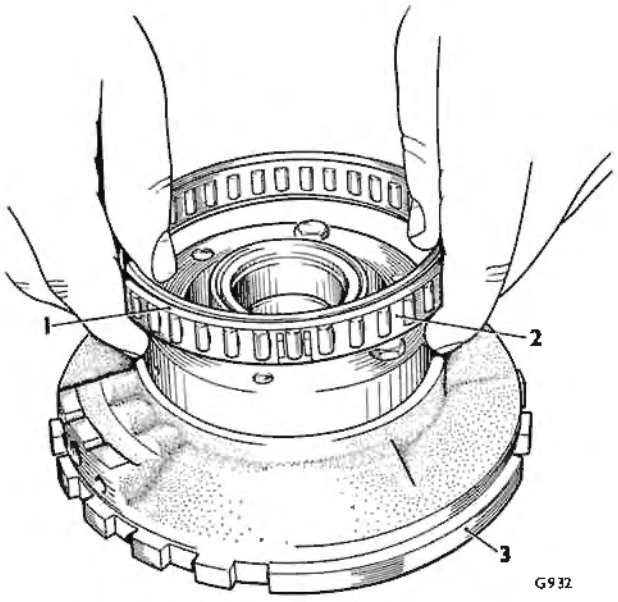

Fig. 136 Fitting the rear sprag to the centre support

1 SPRAG RIDGE UPPERMOST **2** SPRAG ASSEMBLY
3 CENTRE SUPPORT ASSEMBLY

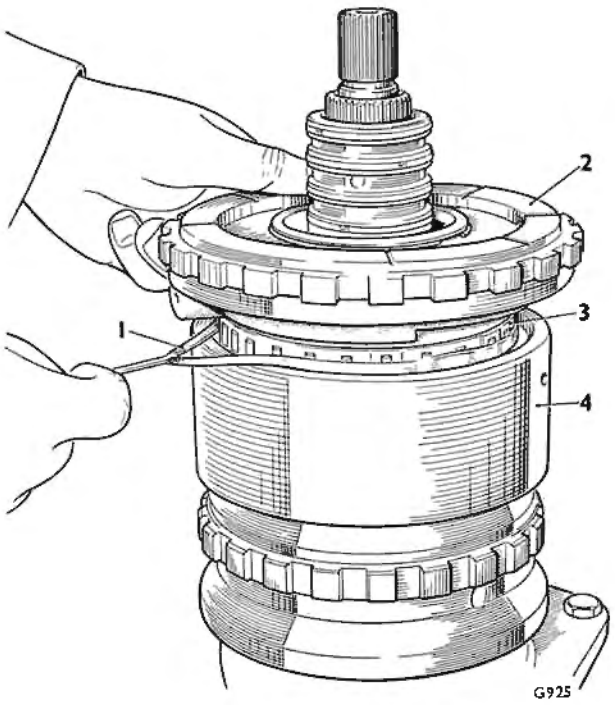

Fig. 137 Fitting the centre support to the reaction carrier

1 RUBBER BAND **3** SPRAG
2 CENTRAL SUPPORT **4** REACTION CARRIER

Fit a strong rubber band around the outside diameter of the sprag assembly to hold the sprags in place. Start the sprag assembly into the outer race, ensuring that all the sprags are inside the outer race. When this is done, cut or stretch the rubber band to remove it (see Fig. 137) then complete the procedure by pressing on the centre support.

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

Fit the tool J–21365 onto the end of the mainshaft so that the tangs engage the groove in the shaft. Tighten the screw on the tool to secure the tool on the shaft and to prevent movement of the rear sprag when the gear unit assembly is fitted.

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

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

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

Fit the rear band assembly into the transmission case so that the band lugs engage with the anchor pins (see Fig. 138).

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Fit the previously selected rear unit adjusting washer (see 'Rear unit end float – To check', in Section 14 of this Chapter) into the slots provided inside the rear of the transmission case; retain the washer with a smear of petroleum jelly.

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

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

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

Fit the gear unit with the centre support and the reaction carrier. Align the slots then carefully guide the assembly horizontally into the transmission case.

Position the transmission vertically with the front end of the case uppermost. Remove tool J–21365.

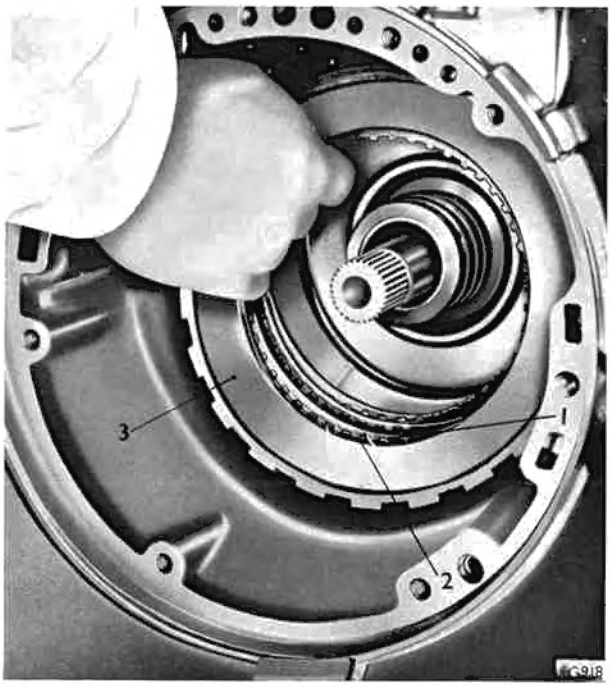

Fig. 139 Fitting the intermediate clutch plates

1 STEEL PLATE (3) **2** COMPOSITION PLATE (3) **3** BACK PLATE

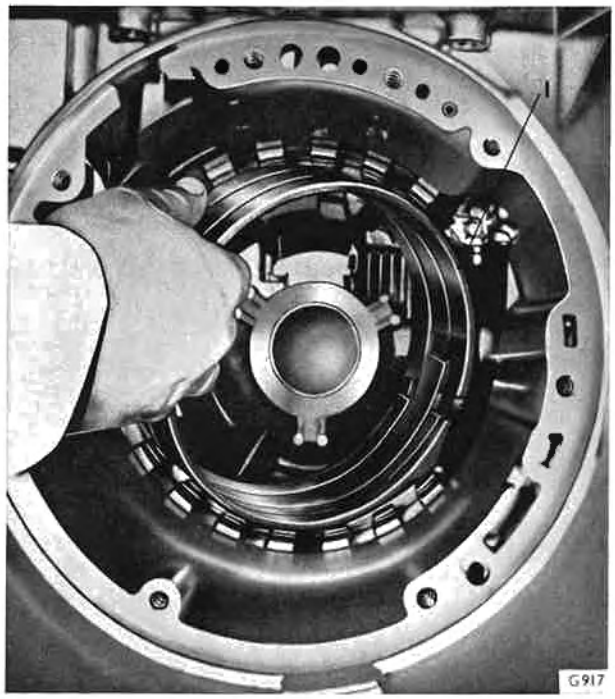

Fig. 138 Fitting the rear band

1 REAR BAND

Lubricate the centre support retaining snap ring with clean transmission fluid then fit the snap ring into the transmission case with the bevelled side uppermost; position the gap adjacent to the front band anchor pin. Expand the snap ring until the centre support is against the shoulder of the case.

Fit the centre support-to-case locating screw (small screw) into the case until it abuts the centre support. Tighten the screw to 5 lb.ft. (0,7 kgm.).

Lubricate the tapped hole in the centre support with clean transmission fluid then fit the centre support securing screw through the case and into the centre support. Torque tighten the screw to 23 lb.ft. (3,18 kgm.).

Remove the locating screw.

Lubricate the three steel and three composition clutch plates with clean transmission fluid then fit the clutch plates. Commence with a steel plate then fit alternate composition and steel plates, finishing with a composition plate (see Fig. 139).

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

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

Recheck the rear unit end float.

Section 16
Transmission Case

Description

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

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

Transmission case — To inspect

When the transmission has been completely dismantled, the case should be thoroughly washed in clean paraffin (kerosene) then dried with compressed air.

Ensure that all the oil passages are flushed out. Take care not to raise burrs on the ends of the passages.

Examine the case for cracks and porosity.

Ensure that the oilways are not interconnected.

Ensure that the band anchor pins are secure.

Examine all threaded holes; ensure that the threads are not damaged.

Examine the intermediate clutch plate lugs for damage or brinelling.

Examine the snap ring grooves for damage.

Examine the governor assembly bore for scratches or scoring.

Examine the modulator valve bore for scoring or damage.

Ensure that the cupped plug is secure in the case and that it is sealing efficiently.

Section 17
Workshop Tools

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

TOOL No.	TITLE	DESCRIPTION
J–21409	Forward and direct clutch piston fitting tool.	This tool enables the forward and direct clutch piston outer seal to enter the clutch drum easily and without damage to the seal.
J–21427	Speedometer drive gear removal tool.	This tool, when used in conjunction with J–21797 and J–8433 enables the speedometer driving gear to be removed from the output shaft.
J–21797	Speedometer drive gear removal bolt (2 off).	See previous description.
J–8433	Pulley extractor.	See previous description.
J–21795	Gear assembly removal and fitting adaptor.	This tool must be used whenever the gear assembly is removed or fitted. It fits onto the end of the mainshaft and when the centre screw is tightened, prevents the rear sprag from moving.
J–8763	Transmission holding fixture.	This fixture accepts the transmission case and, when used in conjunction with base J–3289–20, enables the transmission to be dismantled and assembled at a workable height and in the most convenient position.
J–3289–20	Base — holding fixture.	See previous description.
J–21359	Pump oil seal inserting tool.	This tool facilitates the fitting of the oil pump seal with the pump either fitted to or removed from the transmission.
J–21368	Pump body and cover alignment band.	This band ensures accurate alignment between the pump cover and the body whilst the securing setscrews are tightened.
J–21363	Intermediate clutch inner seal protector.	The seal protector fits over the centre support hub and ensures that the intermediate clutch piston inner seal is not damaged as the piston is fitted.

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Workshop Tools — continued

TOOL No.	TITLE	DESCRIPTION
J–21360	Pump by-pass valve seat fitting tool.	This tool is a punch which should be used when fitting a new by-pass valve seat.
J–21370	Band apply pin selector gauge (use J–21370–5 pin).	This gauge must be used, in conjunction with pin J–21370, to select the correct band apply pin in the rear servo.
J–21367	Rear sprag fitting tool.	This tool fits over the hub of the centre support and abuts the sprag inner race. The tool must be used when fitting the sprag to guard against damage to the soft bronze drag strips on the sprag itself.
J–21366	Converter retaining clamp.	This is a clamp which bolts onto the front face of the transmission case and prevents the torque converter from moving whilst the transmission is being handled.
J–21362	Forward and direct clutch inner seal protector.	This tool fits over the hub of the forward clutch and the direct clutch and protects the piston inner seal whilst the piston is being fitted.
J–21361	Pump by-pass valve seat remover.	When used in conjunction with slide hammer J–6125, this tool will extract the by-pass valve seat from the oil pump.
J–21664	Clutch spring compressor adaptor.	This adaptor, when used in conjunction with J–4670 — clutch spring compressor — facilitates the compressing of both the forward and direct clutch springs. The tool should be used when removing or fitting the clutch spring retainer snap ring.
J–4670	Clutch spring compressor.	See previous description.
RH 7674	Circlip and snap ring pliers.	By utilising the various nose pieces this tool can be used for the removal and fitting of the various circlip and snap rings in the transmission and electric actuator.
J–21885	Control valve accumulator piston fitting tool.	This tool is in the form of a clamp and facilitates the fitting of the accumulator spring and piston.
J–21369	Converter leak test fixture.	This fixture can be fitted to the neck of the torque converter and, when air pressure is applied to the valve, enables the converter to be pressure tested to check for leaks.
J–6125	Slide hammer assemblies.	The slide hammers have various uses when overhauling the transmission and are recommended when removing the oil pump.
J–5154	Rear extension oil seal fitting tool.	This tool should be used to fit a new oil seal to the rear extension. It can be used to fit a seal when the transmission is fitted to the car.
J–21364	Rear unit holding fixture adaptor.	This adaptor, when used in conjunction with rear unit holding fixture J–6116 will hold the rear unit whilst it is being dismantled or assembled.
J–6116	Rear unit holding fixture.	See previous description.
R 5244	Oil pressure gauge.	When coupled to the transmission main line oil feed, the gauge enables the oil pressure to be checked with the car either stationary or moving during a road test.
J–6129	Rear clutch spring compressor.	When used in conjunction with tools J–4670 — compressor and J–21664 — adaptor the tool will facilitate the removal and fitting of the direct clutch housing snap ring.
RH 7841	Roll pin insertion and extraction tool.	The roll pin can be easily fitted to and removed from the brake drum and worm shaft with the aid of this tool.
RH 7843	Compressor — actuating lever spring.	This tool fits onto the electric gearchange actuator and will compress the actuating lever spring to facilitate removal of the retaining pin.
RH 7914	Adaptor — main line oil pressure tapping to gauge.	The adaptor screws into the main line blanking plug orifice in the left-hand side of the transmission and accepts the oil pressure gauge pipe.
RH 7932	Gearbox actuator test box.	This test box, when connected to the actuator and the car's electrical supply, enables both the actuator and the column change switch to be tested independently. The box can be used as an aid to fault diagnosis as well as independent means of operating the actuator when setting the transmission controls.

Section 18
Torque Tightening Figures

General

To ensure that the correct torque tightening figures are obtained when fitting **plated** parts, all burrs and foreign matter must be removed from the abutment faces of the nuts, bolts, washers and components.

The threads, and nut and bolt abutment faces of **non-plated** parts should be smeared with clean transmission fluid before fitting.

Torque spanners should be periodically checked to ensure that they are giving the correct reading.

COMPONENT	THREAD SIZE	LB.FT.	KGM.
Setscrew — solenoid to case	¼ in. dia. × 20	12	1,7
Setscrew — control valve unit to case	¼ in. dia. × 20	8	1,1
Setscrew — control valve unit to case	5/16 in. dia. × 18	8	1,1
Line pressure plug	⅛ in. dia. pipe	10	1,4
Setscrew — pump body to cover	5/16 in. dia. × 18	18	2,5
Setscrew — pump to case	5/16 in. dia. × 18	18	2,5
Setscrew — rear servo cover to case	5/16 in. dia. × 18	18	2,5
Setscrew — governor cover to case	5/16 in. dia. × 18	18	2,5
Setscrew — parking pawl bracket to case	5/16 in. dia. × 18	18	2,5
Setscrew — vacuum modulator retainer to case	5/16 in. dia. × 18	18	2,5
Setscrew — speedometer driven gear to case	5/16 in. dia. × 18	18	2,5
Nut — speedometer drive-shaft	¼ in. dia. × 28	10	1,4
Setscrew — sump to case	5/16 in. dia. × 18	12	1,7
Setscrew — rear extension to case	⅜ in. dia. × 16	23	3,2
Nut — manual shaft to detent lever	⅜ in. dia. × 24	18	2,5
Nut — gearchange lever to manual shaft	⅜ in. dia. × 24	18	2,5
Setscrew — case to centre support	⅜ in. dia. × 16	23	3,2
Setscrew — engine flex-plate to torque converter	⅜ in. dia. × 16	28	3,9
Setscrew — transmission case to engine	5/16 in. dia. × 24	18	2,5
Setscrew — front cover to crankcase	¼ in. dia. × 28	10	1,4
Setscrew — adaptor to front cover	2 B.A. × 31·4 (0·185 in.)	5	0,7
Setscrew — bell housing to adaptor plate	7/16 in. dia. × 20	45	6,2
Setscrew — crankcase to adaptor plate	⅜ in. dia. × 24	32	4,4
Setscrew — mounting plate to adaptor	5/16 in. dia. × 24	18	2,5
Setscrew — bottom cover to heat exchanger	¼ in. dia. × 28	10	1,4
Adaptor — heat exchanger pipe to case	⅜ in. dia. × 18	35	4,8
Bolt — transmission mounting plate to flexible mount	5/16 in. dia. × 24	18	2,5
Setscrew — actuator mounting bracket to rear extension	7/16 in. dia. × 20	45	6,2
Bolts — actuator to mounting bracket	5/16 in. dia. × 24	18	2,5

CHAPTER 4

SERVICE BULLETINS

ROLLS-ROYCE SILVER SHADOW
AND BENTLEY T SERIES

SERVICE BULLETIN
TORQUE CONVERTER TRANSMISSION

No. SY/GM1
Circulation - All Distributors
and Retailers

FOR INFORMATION

VACUUM MODULATOR ASSEMBLY DIAGNOSIS PROCEDURE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the Torque converter transmission unit.

DESCRIPTION

After thorough investigation of vacuum modulators which have been returned as defective, it has been found that over 50% were serviceable. For this reason, the following procedure is recommended for checking Torque converter transmission vacuum modulators in Service before renewal is accomplished.

PROCEDURE

1. Vacuum diaphragm leak check

   Insert a pipe cleaner into the vacuum connector pipe, as far as possible, and check for the presence of transmission fluid. If fluid is found, renew the modulator.

   Note Petrol or water vapour may settle in the vacuum side of the modulator. If this is found without the presence of transmission fluid the modulator should not be renewed

2. Atmospheric leak check

   Apply a liberal coating of a soap bubble solution to the vacuum connector pipe seam, the crimped upper housing-to-lower housing seam and the threaded screw seal (see Fig.1). Using a short piece of rubber tube, apply air pressure to the vacuum pipe by blowing into the tube and observe the modulator for leaks. If bubbles appear - indicating a leak - renew the modulator.

Continued...

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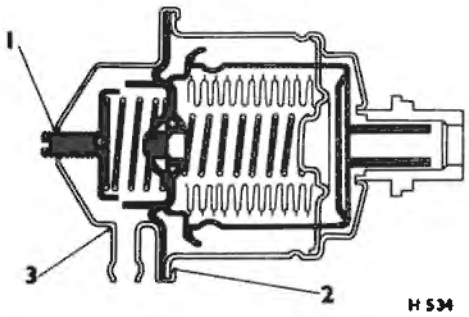
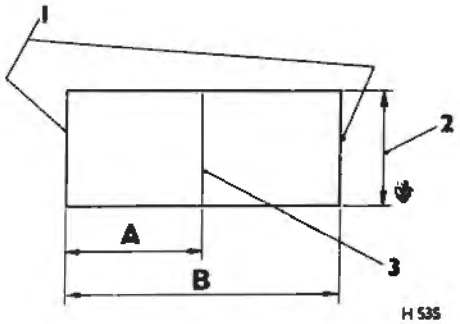


Fig.1 Possible sources of leakage

1 THREADED SCREW SEAL
2 UPPER HOUSING-TO-LOWER HOUSING SEAL
3 VACUUM CONNECTOR PIPE SEAM

Fig.2 Comparison gauge

1 ENDS TO BE SQUARE WITHIN 1/64 in. (0,397 mm.)
2 ROUND OR FLAT BAR BETWEEN 13/32 in. (10,32 mm.) AND 3/8 in. (9,5 mm.) IN WIDTH
3 SCRIBED CENTRE LINE
A 1/2 in. (12,7 mm.)
B 1 in. (25,4 mm.)



Note Do not use any method other than lung power when applying air pressure, as pressures in excess of 6 lb/sq.in. (0,42 kg/sq.cm.) may damage the modulator.

3. Bellows comparison check

Using a locally manufactured comparison gauge as shown in Figure 2, compare the load of a modulator which is known to be serviceable with that of the suspect modulator. Proceed as follows.

Continued...

(a) Fit the serviceable modulator onto either end of the gauge.
(b) Fit the suspect modulator onto the other end of the gauge.
(c) Holding the modulators in a horizontal position, move them towards each other, under pressure, until the end of either modulator sleeve just touches the line in the centre of the gauge. The gap between the centre line and the end of the modulator sleeve opposite should be 1/16 in. (1,6 mm.) or less. If the distance is greater than this amount, the suspect modulator should be renewed.

4. Sleeve alignment check

Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity. If the sleeve is concentric with the body, and the plunger is free, the modulator is acceptable.

Once the modulator has passed all of the foregoing tests it can be considered serviceable.

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Circulation - All No Distributors
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FOR INFORMATION

TORQUE CONVERTER TRANSMISSION DELAYED UP-CHANGE DIAGNOSIS

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the Torque converter transmission unit

GENERAL

There are several known causes of delayed up-changes or 'No up-change' in the above transmission. This diagnosis aid will help in finding the cause quickly with a minimum of labour.

PROCEDURE

A. Disconnect the electrical connection from the transmission and the car. If normal up-changes occur, the problem is in the detent switch or wiring. If the car still has delayed up-changes proceed as in paragraph B.

B. Connect a vacuum gauge to the lower end of the vacuum modulator pipe and check for normal vacuum. If vacuum is low or not present, check for restrictions in the line or external leaks in the vacuum system. Correct the problem then road test the car. If the problem still exists proceed as in paragraph C.

C. Connect a line pressure gauge and check the transmission fluid pressure in Drive range, with engine speed at approximately 1000 r.p.m. Pressure should be between 65 lb/sq.in. and 75 lb/sq.in. (4,57 kg/sq.cm. and 5,27 kg/sq.cm.).

Note Normal line pressure in Drive range with the car stationary should vary from approximately 65 lb/sq.in. (4,57 kg/sq.cm.) at idle to 150 lb/sq.in. (10,55 kg/sq.cm.) at full throttle. The pressure increases as engine vacuum decreases.

If the pressure is approximately 95 lb/sq.in. to 110 lb/sq.in. (6,68 kg/sq.cm. to 7,73 kg/sq.cm.) the problem is in the transmission detent system. If pressure is approximately 135 lb/sq.in. to 150 lb/sq.in. (9,49 kg/sq.cm. to 10,55 kg/sq.cm.) refer to paragraph D. If the line pressure was normal, refer to paragraph E, otherwise check the following items in the detent (kick-down system).

Continued...

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1. Detent solenoid (in transmission) loose or defective.

2. Solenoid feed orifice blocked. This is the 0.034 in. (0,86 mm.) dia. hole in the valve body spacer plate, nearest to the detent solenoid. An incorrectly fitted gasket could block the hole.

3. Detent valve spacer pin either short or missing. The pin should be 1.221 in. to 1.215 in. (31,01 mm. to 30,86 mm.) in length.

4. Detent valve bore plug pushed in too far and tilted. The plug should be seated against the retaining pin.

5. Detent valve bore plug undersize or eccentric, causing an excessive leak at the detent valve.

D. If line pressure in Drive range at 1000 r.p.m. is between 135 lb/sq.in. and 150 lb/sq.in. (9,49 kg/sq.cm. and 10,55 kg/sq.cm.) with good vacuum at the modulator, the modulator valve and the pressure regulator components should be checked.

E. If line pressure was normal (see paragraph C) the governor assembly should be removed and checked for freedom of operation and for the presence of dirt. The bleed orifice in the centre of the governor valve should be examined to ensure that it is not blocked.

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SERVICE BULLETIN
TORQUE CONVERTER TRANSMISSION

No. SY/GM 3
Circulation - All Distributor and Retailer

CATEGORY C

PINION GEAR, PINION WASHER, PINION PIN AND NEEDLE BEARING ROLLER CHANGE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with Torque converter transmission units

DESCRIPTION

The internal diameter of the pinion gears and pinion washers and the outside diameter of the pinion pins and needle bearing rollers are larger for the 1968 Model transmissions, except for some early 1968 Model transmissions built at the beginning of production. Prior to this change a production trial run of transmissions were built with these parts in both the reaction and output carriers of late 1967 Model transmissions. In addition a quantity of transmissions were built with these parts in only the output carrier of late 1967 Models.

PROCEDURE

If service replacement is required for the pinion gears in 1967-68 Model transmissions, it will be necessary to press one pinion pin out and measure the outside diameter for size. If the size is 0.3928 in. - 0.3930 in. (0,997 cm. - 0,998 cm.), use Service Package, Pinion Replacement, Part No. GM 8623951. If the size is 0.4340 in. - 0.4342 in. (1,102 cm. to 1,103 cm.), use Service Package, Pinion Replacement, Part No. GM 8625913.

Note When measuring the outside diameter of the pin, measure near the end.

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

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CATEGORY C

CORRECT USAGE AND INSTALLATION OF THE CENTRE SUPPORT TO CASE AND INTERMEDIATE CLUTCH BACKING PLATE TO CASE SNAP RINGS

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with Torque converter transmission units

DESCRIPTION

There have been reports concerning incorrect usage and/or incorrect installation of the subject parts, resulting in field failures after overhaul of the transmission. As a result of these failures, perhaps a review of the correct usage and installation of these snap rings would be worthwhile.

One side of the centre support snap ring is bevelled and one side is flat. Whereas, both sides of the intermediate clutch snap ring are flat.

PROCEDURE

CENTRE SUPPORT TO CASE SNAP RING

Use the bevelled snap ring. Install with the flat side to the centre support and locating gap adjacent to the band anchor pin (see Fig. 1).

INTERMEDIATE CLUTCH BACKING PLATE TO CASE SNAP RING

Use the flat snap ring. Install the snap ring with the gap opposite the band anchor pin (see Fig. 1).

Continued...

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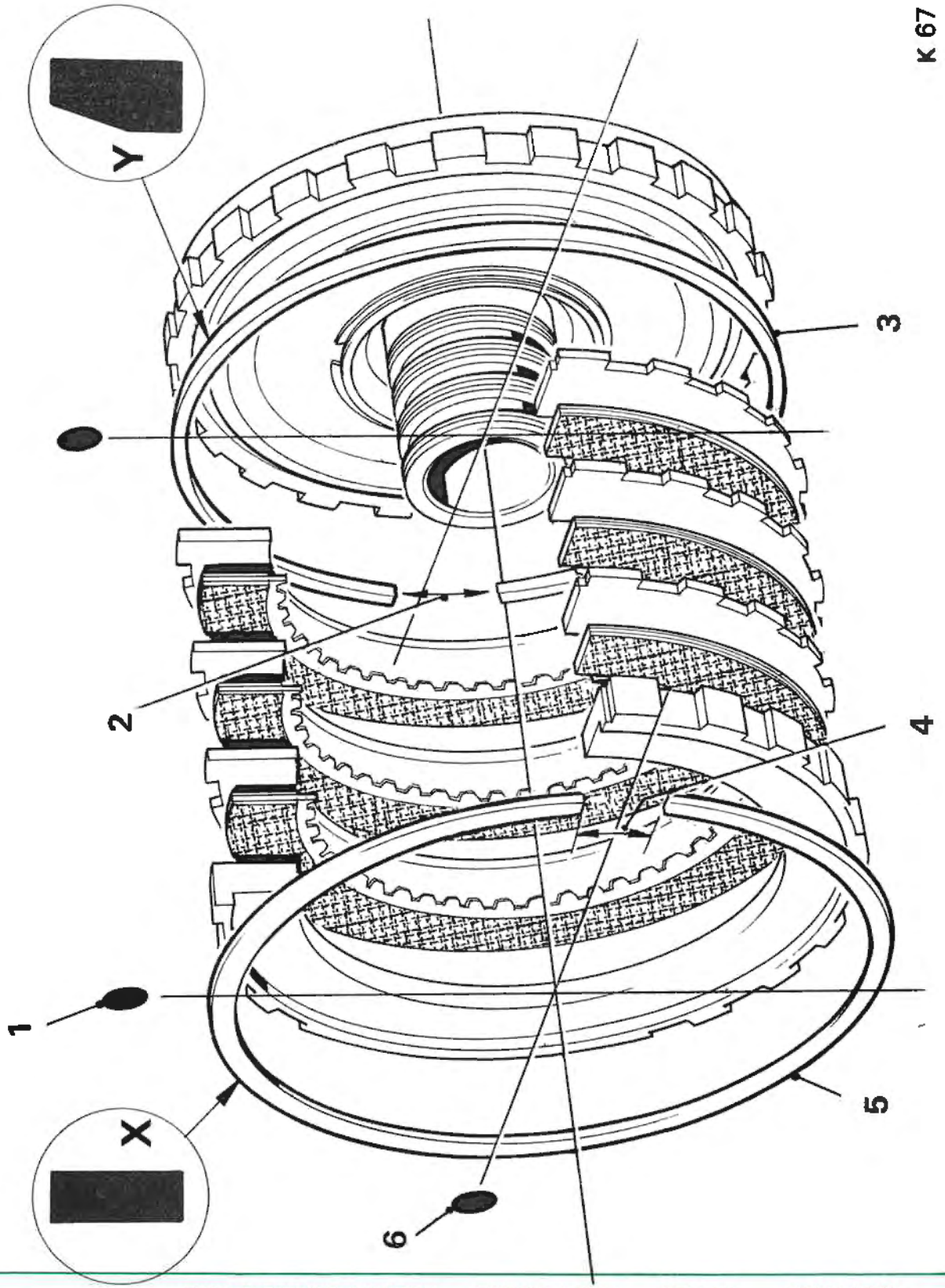

Fig.1 Centre support (Key on Page 3)

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Key to Fig. 1

1 TOP OF TRANSMISSION CASING
2 GAP IN CENTRE SUPPORT TO CASE SNAP RING
3 CENTRE SUPPORT TO CASE SNAP RING
4 GAP IN INTERMEDIATE CLUTCH BACKING PLATE TO CASE SNAP RING
5 INTERMEDIATE CLUTCH BACKING PLATE TO CASE SNAP RING
6 BAND ANCHOR SIDE

INSETS

X SECTION THROUGH INTERMEDIATE CLUTCH BACKING PLATE TO CASE SNAP RING
Y SECTION THROUGH CENTRE SUPPORT TO CASE SNAP RING

No. SY/GM5
Circulation - All Distributors
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CATEGORY C

OIL STRAINER ASSEMBLY USAGE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque converter transmission unit

DESCRIPTION

Reports indicate that the first type strainer assembly with the integral intake pipe and shroud, Part Number GM 5579822, has been installed in transmissions with the later type sump, Part Number GM 8625766.

The late sump does not have the configuration to accommodate the first type strainer assembly. Use of the first type strainer assembly with the second type sump will result in low or erratic oil pressure and pump cavitation noise caused by the restricted intake to the strainer assembly because of the oil sump configuration. A transmission failure will result from this incorrect combination of sump and strainer assembly.

The first type oil sump is not deep enough to accommodate the flat second type strainer assembly; and if their installation as a combination is attempted, the strainer assembly will be crushed.

PROCEDURE

When service replacement of the strainer assembly and/or oil sump is required, they must be used in the following combinations.

COMBINATION 1 - Use the first type strainer, Part Number GM 5579822, with the first type sump, Part Number GM 8623778.

COMBINATION 2 - Use the second type strainer assembly, Part Number GM 6437741, and intake pipe assembly, Part Number GM 8625428, with the second type oil sump, Part Number GM 8625766.

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No. SY/GM6
Circulation - All Distributors
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CATEGORY C

CENTRE SUPPORT LOCATING PROCEDURE AND SERVICE TOOL

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque converter transmission unit

DESCRIPTION

A change in the manufacturing of the transmission case is being made which will eliminate the threaded hole used for locating the centre support. The new service procedure to locate the centre support while tightening the locking bolt, requires a new service tool, which may also be used on all past Torque converter transmissions.

MATERIAL

The tool can be made of 0.375 in. (0,95 cm.) diameter, cold roll steel or from a screw driver with a 0.375 in. (0,95 cm.) dia. shank. The stock should be approximately 12.0 in. (30,5 cm.) long.

DIMENSIONS

1. Grind the stock to a blunt point, tapering it 0.875 in. (2,22 cm.) from the end of the bar to a 0.375 in. (0,95 cm.) dia. at the end.

2. Bend the bar to a 45^{o} angle 2.50 in. (6,35 cm.) from the pointed end. See Figure 1 for specifications.

PROCEDURE

The correct usage of the tool is as follows:

Place the centre support locating tool into the case direct clutch passage, with the handle of the tool pointing to the right as viewed from the front of the transmission and parallel to the bell housing mounting face (see Fig.1).

Continued...

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Apply pressure downward on the tool handle which will tend to rotate the centre support anti-clockwise as viewed from the front of the transmission. While holding the centre support firmly anti-clockwise against the case splines, torque the case to centre support bolt to 20 - 25 ft.lbs. (2,80 Kgm. - 3,50 Kgm.).

CAUTION: When using the locating tool, care should be taken not to raise burrs on the case valve body mounting face.

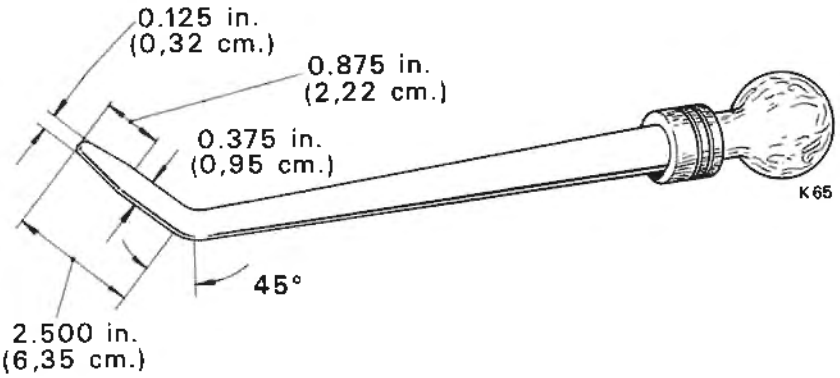

Fig.1 Centre support tool

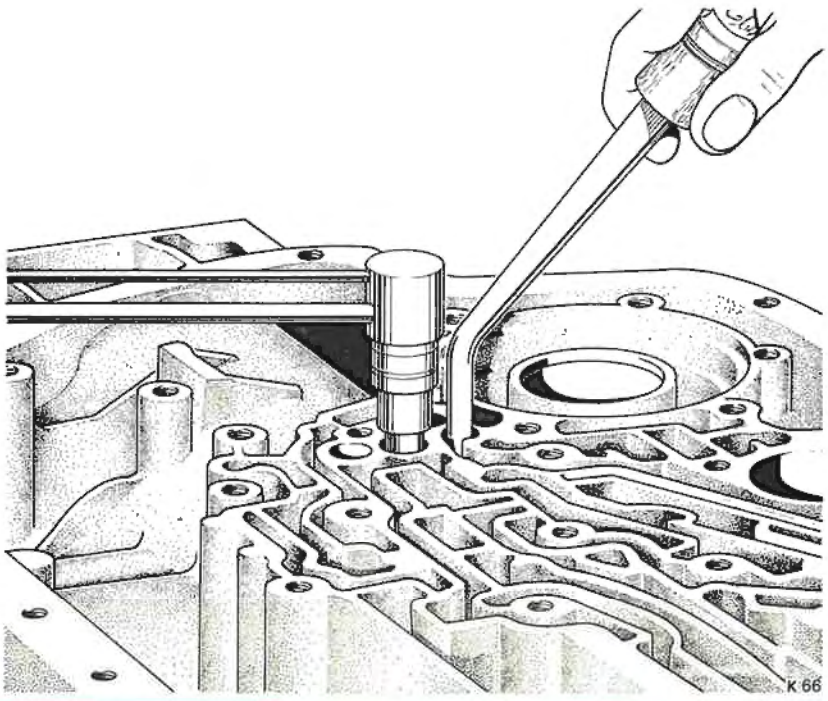

Fig.2 Centre support tool in position

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CATEGORY C

DIFFICULTY WHEN REMOVING THE GOVERNOR ASSEMBLY FROM CASE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque converter transmission unit

DESCRIPTION

A recent change in the manufacturing of the transmission case has eliminated the shoulder at the bottom of the governor pipe holes. Because of this change, it is possible to force the governor pipes deep enough into the case to enter the governor bore and bind or lock the governor in the bore of the case, so that difficulty will be encountered when removing the governor assembly.

PROCEDURE

If difficulty is encountered, the following steps should be followed:

1. Remove oil sump.

2. Withdraw governor pipes enough (approximately 0.125 in. (0,32 cm.)) to free the governor assembly.

3. Remove governor assembly.

With the governor pipes installed in the valve body assembly and the case, the distance between the case face and the pipes must be approximately 0.250 in. (0,64 cm.). This distance can be checked by using a 0.250 in. (0,64 cm.) rod as a gauge between the case face and pipes about 1.00 in. (2,54 cm.) from the right angle bend of the pipes. If this distance is maintained, the pipes will not cause interference with the governor assembly.

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CATEGORY C

TORQUE CONVERTER TRANSMISSION ACTUATOR BREATHER PIPE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars produced after chassis numbers SRX 3254 - Standard cars, and CRH 3399 - Coachbuilt cars fitted with the Torque converter transmission unit

DESCRIPTION

Cars produced after the above chassis numbers have been fitted with a transmission actuator incorporating a modified breather pipe.

This modified breather system comprises a flexible tube which is fitted to the open end of the existing steel breather pipe, the other end being connected into the centre cross-member by an adaptor.

The purpose of this Service Bulletin is to inform Distributors, Retailers and Service Personnel that when refitting a transmission actuator to a car with a modified breather pipe, it is essential that the flexible tube is reconnected to the adaptor in the cross-member and not allowed to hang free.

This modification is not retrospective and the existing breather pipe on early cars should not be modified.

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ROLLS-ROYCE SILVER SHADOW
AND BENTLEY T SERIES

SERVICE BULLETIN
TORQUE CONVERTER TRANSMISSION

No. SY/GM 8
ADDENDUMM
Circulation - All Distributors
and Retailers

CATEGORY C

TORQUE CONVERTER TRANSMISSION ACTUATOR BREATHER PIPE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars produced prior to chassis numbers SRX 3254 - Standard cars, and CRH 3399 - Coachbuilt cars fitted with the Torque converter transmission unit.

DESCRIPTION

Should a transmission actuator fitted with a flexible breather pipe be received from Rolls-Royce Ltd., it should not be fitted to a car produced before the above chassis numbers until the flexible plastic breather pipe has been removed and discarded.

No. SY/GM9
Circulation - All Distributors
and Retailers

CATEGORY C

NEW OIL PUMP COVER AND NEW OIL PUMP BODY

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque converter Fixed Stator transmission unit

DESCRIPTION

A new oil pump cover, Casting Part No. GM 8626176 (Type 2), and a new oil pump body, Casting Part No. GM 8626121 (Type 3) have been released to production (see Figs. 1 and 2).

The serial numbers and build date codes will be forwarded when available.

PROCEDURE

If Service replacement of the oil pump cover and/or oil pump body is required, they must be used in the following combinations.

Combination 1 - Oil pump cover, type 1 may be used with oil pump body types 1, 2 or 3.

Combination 2 - Oil pump cover, type 2 may only be used with oil pump body type 3 due to the changes in the oil passages.

	TYPE 1 Cover Part No.	TYPE 2 Cover Part No.	TYPES 1 & 2 Body Part No.	TYPE 3 Body Part No.
Combination 1	GM 8624982	-	GM 8624981 (Both bodies have same No.)	GM 8625954
Combination 2	-	GM 8625955	-	GM 8625954

Either combination may be used to service Torque converter Fixed Stator transmissions.

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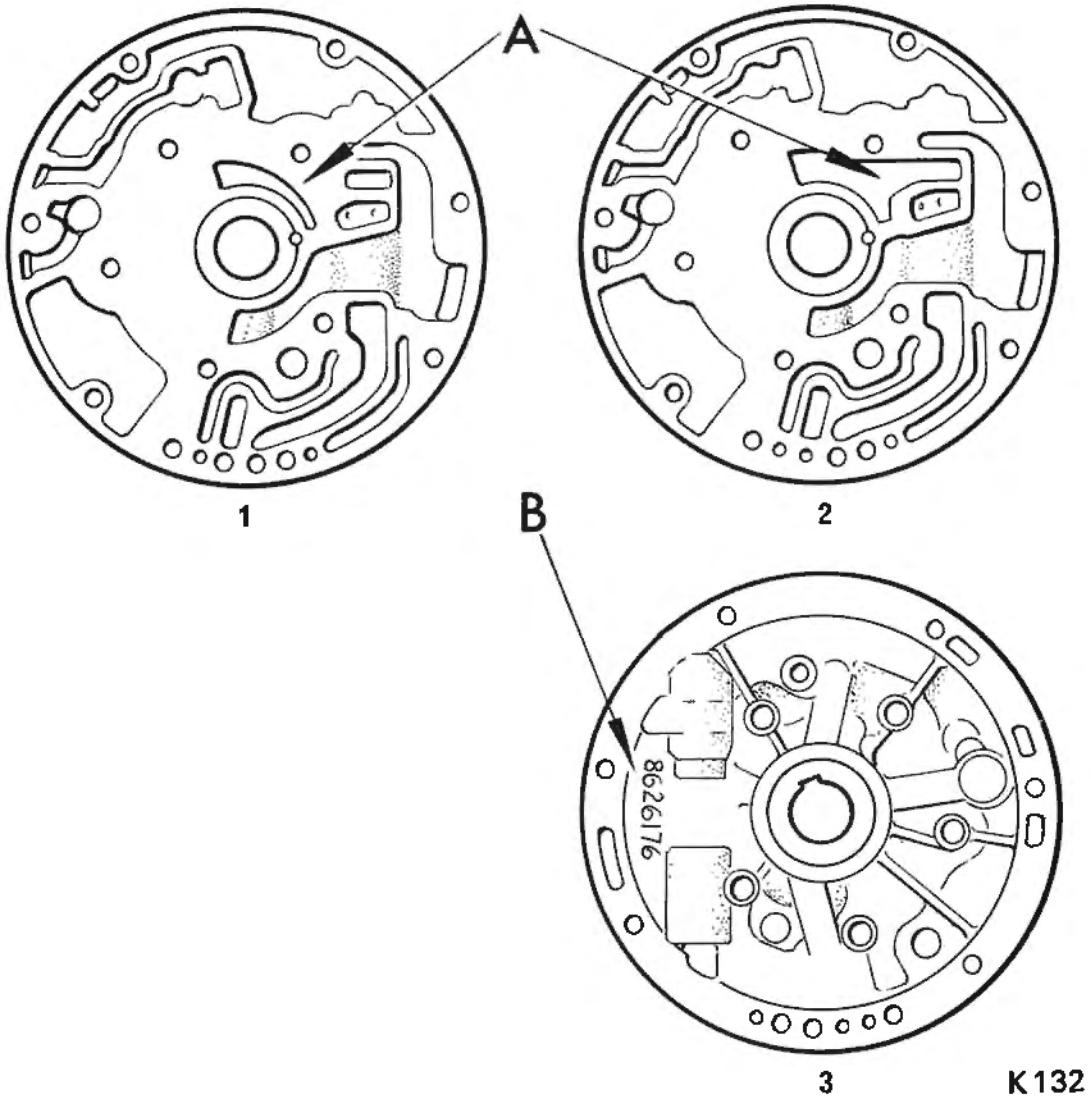

Fig.1 Oil pump cover

1 OIL PUMP COVER TYPE 1
2 OIL PUMP COVER TYPE 2
3 OIL PUMP COVER TYPE 2 (OPPOSITE SIDE)
A NOTE DIFFERENCES IN OIL PASSAGES
B IDENTIFICATION NUMBER

Continued...

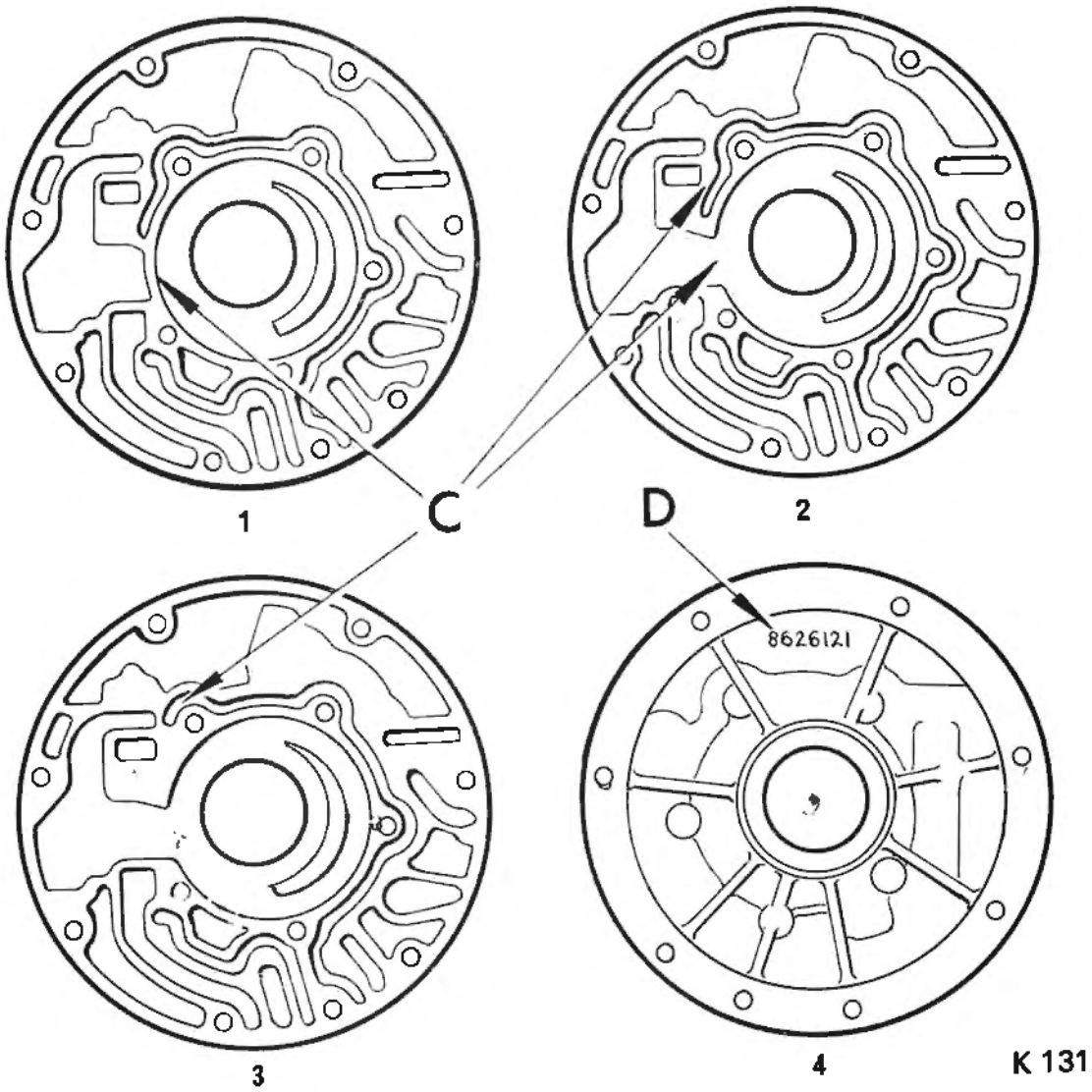

Fig.2 Oil pump body

1 OIL PUMP BODY TYPE 1
2 OIL PUMP BODY TYPE 2
3 OIL PUMP BODY TYPE 3
4 OIL PUMP BODY TYPE 3 (OPPOSITE SIDE)
C NOTE DIFFERENCES IN OIL PASSAGES
D IDENTIFICATION NUMBER

No. SY/GM10
Circulation - All Distributors
and Retailers

CATEGORY C

OIL PUMP ASSEMBLY, GEAR END CLEARANCE REVISION

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque converter transmission unit.

DESCRIPTION

Recent tests of the Oil Pump Assembly have resulted in a revision of the specification for the oil pump body face to gear end face clearance.

The original information as given in Chapter 3 Section 12 of the Torque Converter Transmission Workshop Manual T.S.D. 2271, under 'Oil pump - To inspect' states that the clearance should be between .0008 in. and .0015 in. (0,02 mm. and 0,038 mm.). This clearance has now been revised and states that the gear end clearance should be between .0008 in. and .0035 in. (0,02 mm. and 0,089 mm.).

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ROLLS-ROYCE SILVER SHADOW
AND BENTLEY T SERIES

SERVICE BULLETIN
TORQUE CONVERTER TRANSMISSION

No. SY/GM11
Circulation - All Distributors
and Retailers

CATEGORY C

OIL STRAINER REPLACEMENT

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque converter transmission unit

DESCRIPTION

When a major overhaul of a Torque converter transmission is being undertaken, and the oil sump is found to contain foreign matter such as clutch plate material or excessive metal particles, the oil strainer assembly must be renewed.

The late 1967 and 1968 type Oil Strainer Assembly, Part number GM 6437741, is a full flow design and does not have a by-pass valve. When this strainer becomes contaminated it will restrict the oil intake to the transmission oil pump resulting in faulty operation of the transmission. The faults likely to be noticed in the transmission are a noisy oil pump due to cavitation, plus slipping, intermittent or complete loss of drive.

The Service Recommendations for periodic maintenance, as given in Chapter 2 Section 1 of the Torque converter transmission Workshop Manual T.S.D. 2271, should always be observed for oil changes and oil strainer replacement.

No. SY/GM12
Circulation - All Distributors
and Retailers

CATEGORY C

GOVERNOR OVERHAUL

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque converter transmission unit

DESCRIPTION

Service report indicate that many governor assemblies are being replaced without being cleaned sufficiently. The procedure for Cleaning and Inspection of the governor is detailed in Chapter 3, Section 5 of the Torque converter transmission Workshop Manual T.S.D. 2271 under 'Governor assembly - To inspect'. This Service Bulletin may help Service Personnel to recall the correct procedure for dismantling and inspecting the governor.

PROCEDURE

1. Cut off one end of each governor weight retaining pin, and remove the pins, thrust cap, weights and springs.

2. Remove the governor valve from the sleeve, taking care not to damage the valve or sleeve.

3. Wash all parts in clean paraffin (kerosene), dry with compressed air and blow out all passages.

4. Inspect governor sleeve for burrs or seizure.

5. Check that the valve will slide freely in the governor sleeve bore.

6. Examine the driven gear for damage and check that it is secure on the shaft.

7. Examine the governor springs and weights for damage or distortion.

The governor driven gear may be serviced separately from the governor assembly as outlined below.

1. Drive out the governor gear retaining pin, using a small punch.

Continued...

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2. Support the governor sleeve on two 3/16 in. (4,76 mm.) thick plates inserted in the exhaust slots of the governor sleeve. Position the plates on the bed of a press with provision for the gear to pass through and press the gear out of the sleeve.

3. Thoroughly clean the governor sleeve to remove any foreign matter.

Note Before fitting ensure that the new gear is the correct one for the transmission casing to which it is to be fitted by reference to the current Parts List.

4. Again support the sleeve on the two 3/16 in. (4,76 mm.) metal plates through the exhaust ports, position the new gear in the sleeve, and using a suitable drift, press the gear into the sleeve, but do not press it fully into the seating. Carefully remove any swarf which may have shaved off the gear hub before pressing the gear fully down to abut the sleeve. Check again and remove any swarf that may have shaved off the gear hub.

5. Mark the position of a new hole on the sleeve at 90^{o} to the original hole, and using a .187 in. (4,76 mm.) diameter drill, drill a new hole through the gear and sleeve.

6. Fit the gear retaining pin.

7. Thoroughly wash the gear and sleeve assembly in clean paraffin (kerosene) and dry with compressed air.

8. Assemble the governor as detailed under 'Governor assembly - To assemble' - Chapter 3, Section 5 of the Torque converter transmission Workshop Manual T.S.D. 2271.

9. Ensure that the governor weights are free to operate on the pins. With the governor weights fully extended hold the assembly by the driven gear in an inverted position. The inlet port must open a minimum of .020 in. (.508 mm.). When the weights are moved inward, the valve must move downward and open the exhaust port a minimum of .020 in. (.508 mm.).

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SERVICE BULLETIN
TORQUE CONVERTER TRANSMISSION

No. SY/GM 13
Circulation - All Distributors and Retailers, Left-hand drive countries

CATEGORY C

APPROVED LUBRICANTS - TORQUE CONVERTER TRANSMISSIONS

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the torque converter transmission.

DESCRIPTION

The following fluids are approved for use in the torque converter transmission for both refill and top-up purposes.

1. Mobil ATF. 220 (Dexron 10104)

2. Regent Texamatic (Dexron 10101)

3. Castrol TQ Dexron (R)

It is ESSENTIAL that only fluids bearing the type name 'Dexron' are used.

Printed in England

ROLLS-ROYCE SILVER SHADOW
AND BENTLEY T SERIES

SERVICE BULLETIN
TORQUE CONVERTER TRANSMISSION

No. SY/GM14

Circulation - All Distributors and Retailers, Right-hand drive countries.

CATEGORY C

APPROVED LUBRICANTS - TORQUE CONVERTER TRANSMISSION

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the torque converter transmission.

DESCRIPTION

All the 1968 torque converter transmissions fitted to the above cars are equipped with a fixed-stator torque converter instead of a variable stator converter.

These transmissions are now beginning to appear in service and it is ESSENTIAL that they are refilled and topped up with one of the transmission fluids listed below.

1. Mobil ATF 220 (Dexron 10104)

2. Regent Texamatic (Dexron 10101)

3. Castrol TQ Dexron (R)

The 1968 torque converter transmission can be identified from within the engine compartment by the coloured ring around the transmission dipstick filler cap.

1966 and 1967 transmissions have yellow or black bands.

1968 transmissions have blue bands.

It should be noted that the 'Dexron' transmission fluids can be used in all the torque converter transmissions and it is recommended that Distributors and Retailers stock only these oils for use in these transmissions. If however, large stocks of the Type A Suffix A oils noted in the Torque converter transmission Workshop Manual T.S.D. 2271 are held, then these may be used up in the 1966 and 1967 variable stator transmissions.

ROLLS-ROYCE LIMITED, PYM'S LANE, CREWE, ENGLAND

SB/BP 1.8.68. SECTION GM

Printed in England

No. SY/GM 15
Circulation - All Distribut
and Retail

CATEGORY C

IDENTIFICATION AND CORRECT USAGE OF FORWARD AND DIRECT STEEL CLUTCH PLATES

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the 1967 and 1968 variable and fixed stator torque converter transmissions.

DESCRIPTION

There have been reported forward and/or direct clutch failures after overhaul of a torque converter transmission due to the incorrect usage of the flat steel clutch plates.

The direct clutch in all 1967 and 1968 variable and fixed stator torque converter transmissions uses the flat steel clutch plate 0.0915 in. (2,32 mm.) thick, part number GM 8625197.

The forward clutch in all 1967 and 1968 variable and fixed stator torque converter transmissions uses the flat steel clutch plate 0.0775 in. (1,97 mm.) thick, part number GM 8623849.

The forward and direct clutches each have one of the waved steel clutch plates 0.0605 in. (1,54 mm.) thick, part number GM 8623851.

The shape and number of teeth on the flat steel clutch plates, part numbers GM 8623849 and GM 8625197, and the waved steel clutch plate, part number GM 8623851 have been revised.

The revised plates have four teeth shortened (two pairs diametrically opposite) and two teeth omitted (singly diametrically opposite). For Service use the revised plates are interchangeable with the early type plates of the same number.

IDENTIFICATION (See attached illustration)

The early type flat steel clutch plate, part number GM 8623849 has no identification, but the later type is identified by a 'V' notch on one tooth.

Continued...

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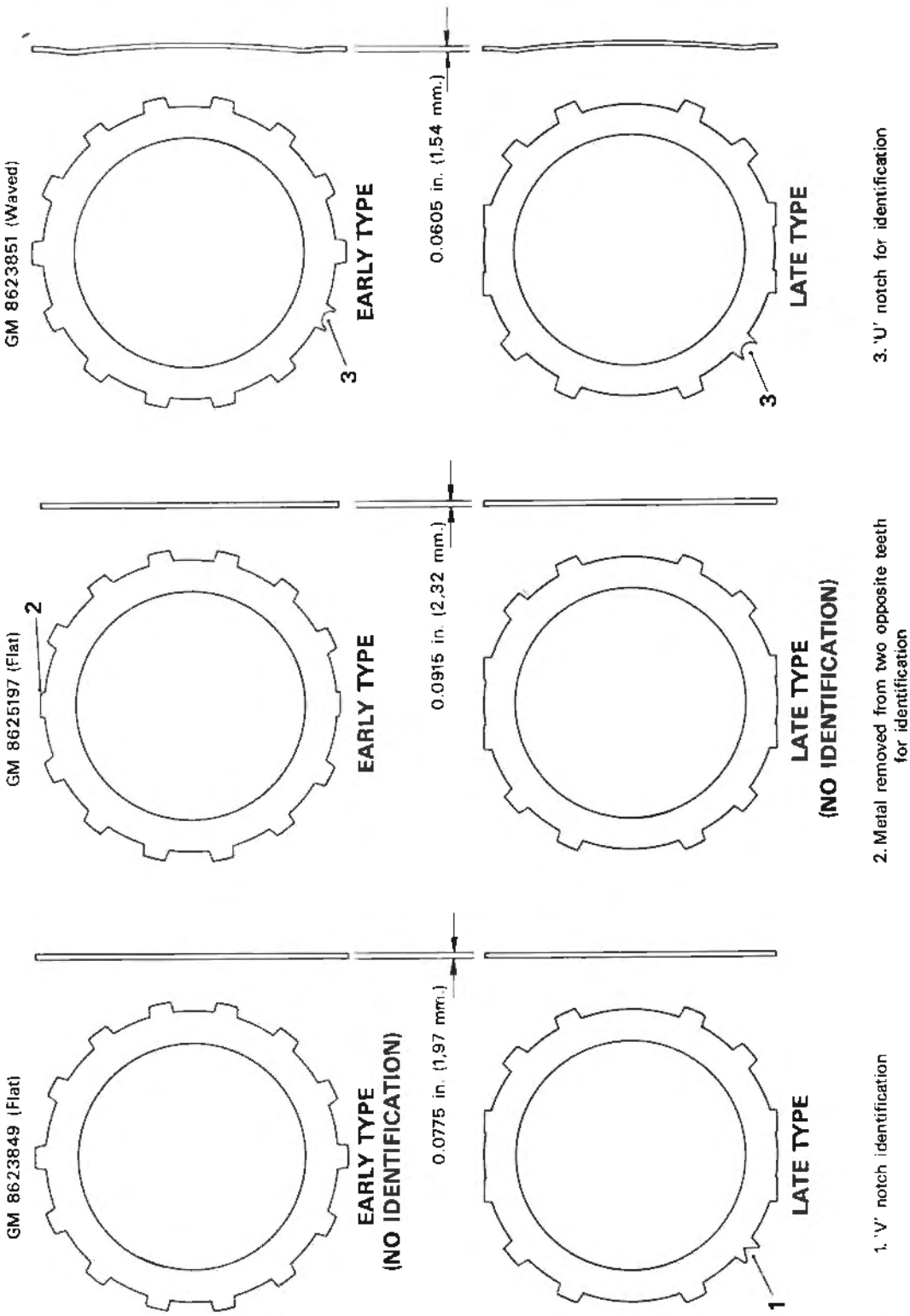
GM 8623851 (Waved)
EARLY TYPE
0.0605 in. (1,54 mm.)
LATE TYPE
3
3
3. 'U' notch for identification
GM 8625197 (Flat)
2
EARLY TYPE
0.0915 in. (2,32 mm.)
LATE TYPE
(NO IDENTIFICATION)
2. Metal removed from two opposite teeth for identification
GM 8623849 (Flat)
EARLY TYPE
(NO IDENTIFICATION)
0.0775 in. (1,97 mm.)
LATE TYPE
1
1. 'V' notch identification

Continued...

The early type flat steel clutch plate, part number GM 8625197 is identified by two diametrically opposite short teeth, but the later type does not have any identification.

The early and later type waved steel clutch plate, part number GM 8623851 have the same identification, which is a 'U' notch on one tooth.

Printed in England

No. SY/GM16
Circulation-All Distributor
and Retailer

CATEGORY C

TRANSMISSION REAR EXTENSION AND SEAL

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the torque converter transmission.

DESCRIPTION

On the above cars produced up to 1967 and fitted with the torque converter transmission, a square section sealing ring was used to form a seal between the transmission case and the rear extension. The sealing ring was accommodated in a machined groove in the front face of the rear extension (see Fig. 1).

Torque converter transmissions fitted to later cars were produced without the machined groove in the rear extension face and a paper gasket was used to form a seal between the transmission case and rear extension (see Fig. 2).

The purpose of this Service Bulletin is to inform Distributors and Retailers, that in Service either type of rear extension may be used with a torque converter transmission. Also, the paper gasket can be used with either the early type or late type rear extension.

However, any stock of the square section sealing ring should be used up with the early type rear extension.

Continued...

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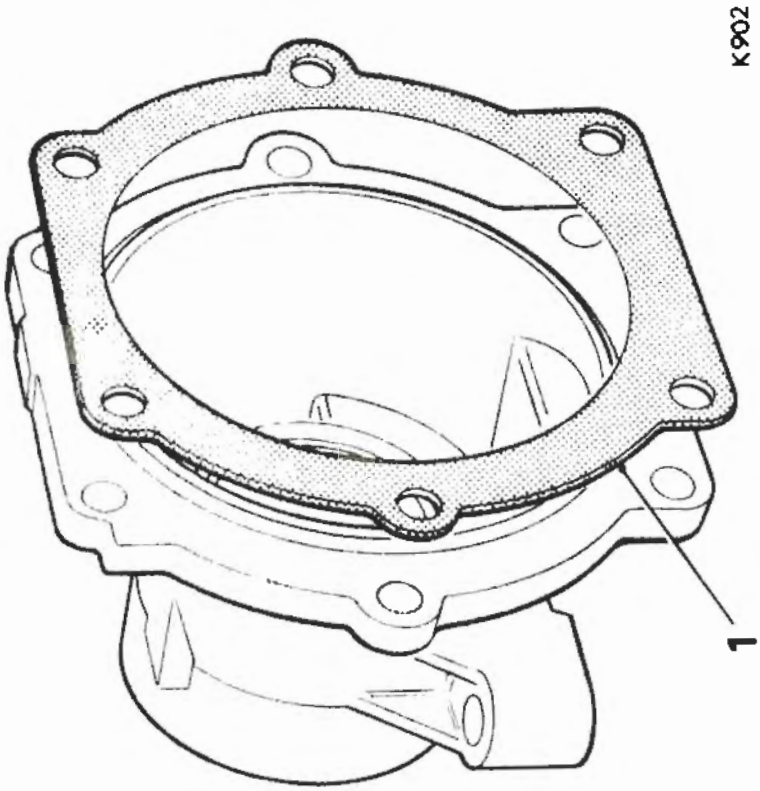

FIG. 2 LATEST TYPE REAR EXTENSION

1 Paper gasket (Part No. GM 8624709)

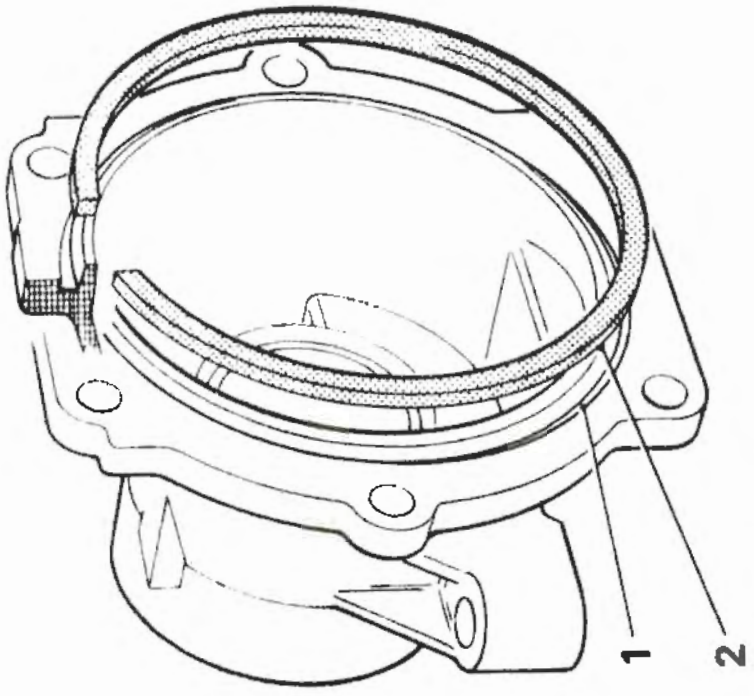

FIG. 1 **EARLY TYPE** REAR EXTENSION

1 Machined groove
2 Square section sealing ring (Part No. GM 8623216)

No. SY/GM 17
Circulation - All Distributors
and Retailers

CATEGORY C

ORIFICE CUP PLUG OMITTED FROM MAINSHAFT

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the torque converter transmission.

DESCRIPTION

The torque converter transmission is now being built with the orifice cup plug omitted from the mainshaft. This improves the flow of the lubricant.

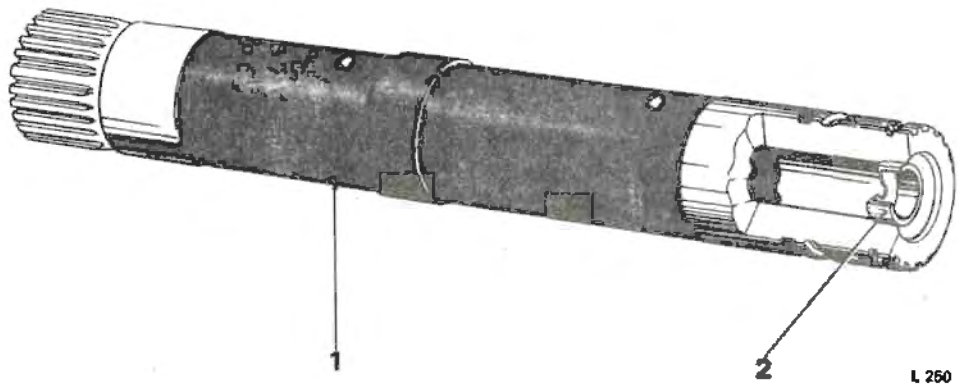

Fig.1 Mainshaft and plug assembly

1 Mainshaft
2 Orifice cup plug

Continued...

PROCEDURE

When a transmission is being overhauled and the mainshaft is removed, adopt the following procedure:

1. If the mainshaft contains an orifice cup plug, it should be removed and discarded (see Fig. 1). To remove the plug a rod ¼ in. diameter x 12 in. long (6,35 mm. x 30,48 cm.) should be used.

2. Before fitting a new mainshaft ensure that the orifice cup plug has been removed.

No. SY/GM18
Circulation - All Distributors
and Retailers

CATEGORY C

AUTOMATIC TRANSMISSION FLUIDS

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars.

DESCRIPTION

During the past year the major oil companies have started to market two new automatic transmission fluids and these fluids are now generally available.

One fluid is made to a General Motors specification and has a registered trade name of "Dexron". The fluids made to this specification noted in Service Bulletin SY/GM 14 and SY/RRT2 are approved for use in Rolls-Royce Silver Shadow and Bentley T Series cars as described in the Service Bulletins.

The second fluid is made to the Ford M2X-33F specification and this fluid, usually denoted by an 'F' prefix, must on no account be used in gearboxes fitted to Rolls-Royce and Bentley cars.

It is the responsibility of the Parts or Warehousing Manager to ensure that the correct gearbox fluids are supplied for use in Rolls-Royce and Bentley cars.

No. SY/GM19
Circulation - All Distributors
and Retailers

CATEGORY C

CONTROL VALVE ASSEMBLY BODY CASTING

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the Torque Converter Transmission.

DESCRIPTION

Control valve assemblies supplied for service replacements may be found to have the latest type body casting. When the latest type body casting is used, a pipe plug is fitted in a tapped hole in the casting adjacent to the front accumulator pocket. (see Fig. 1).

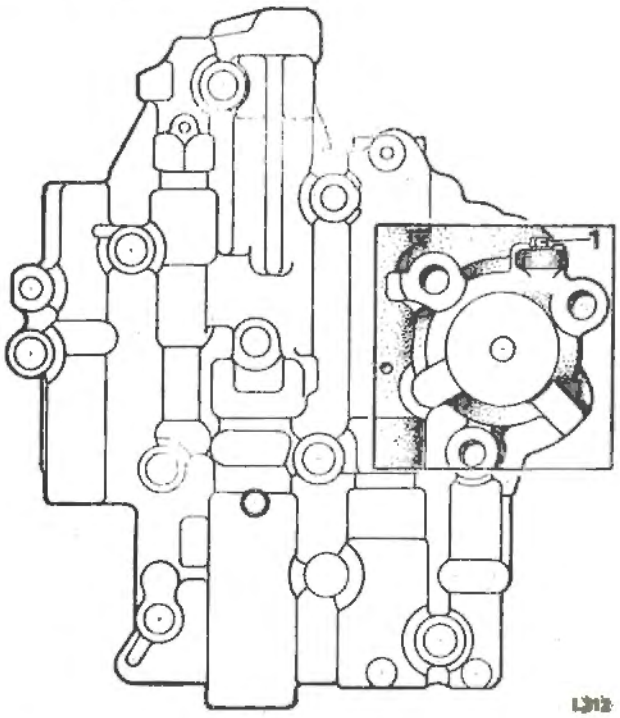

Fig.1 Control valve assembly

1. Pipe plug installed in body casting.

Continued...

It is important that the plug should remain securely tightened in position. If the control valve assembly is used with the plug omitted, the direct clutch will slip, causing it to burn, during third gear and reverse operation.

NOTE Service replacement control valve assemblies for 1970 Torque Converter Transmission units, are also built with a plug fitted in the body casing. If such a control valve is to be fitted to a 1970 transmission unit having a pressure switch, the plug should be removed and the switch securely fitted.

When the pressure switch is not used, the plug must remain securely fitted in the body casting.

No. SY/GM20
Circulation - All Distributors
and Retailers

CATEGORY C

CORRECT INSTALLATION PROCEDURE FOR CENTRE SUPPORT TO CASE SPACER AND BEVELLED SNAP RINGS

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the Torque Converter Transmission.

DESCRIPTION

Service reports indicate that occasionally when Torque Converter Transmissions have been overhauled, the centre support to case spacer has been fitted to the incorrect location in the transmission casing.

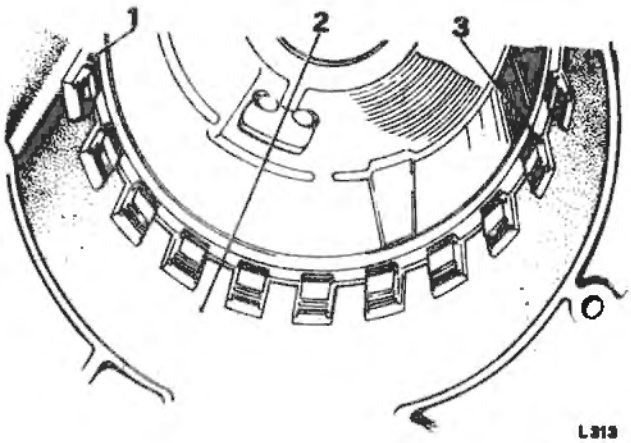

Fig. 1 Transmission case

1. Spacer ring groove
2. Transmission casing
3. Bevelled snap ring groove.

Continued...

The correct installation of the centre support to case spacer and the bevelled snap ring are clearly illustrated in Figures 1 and 2.

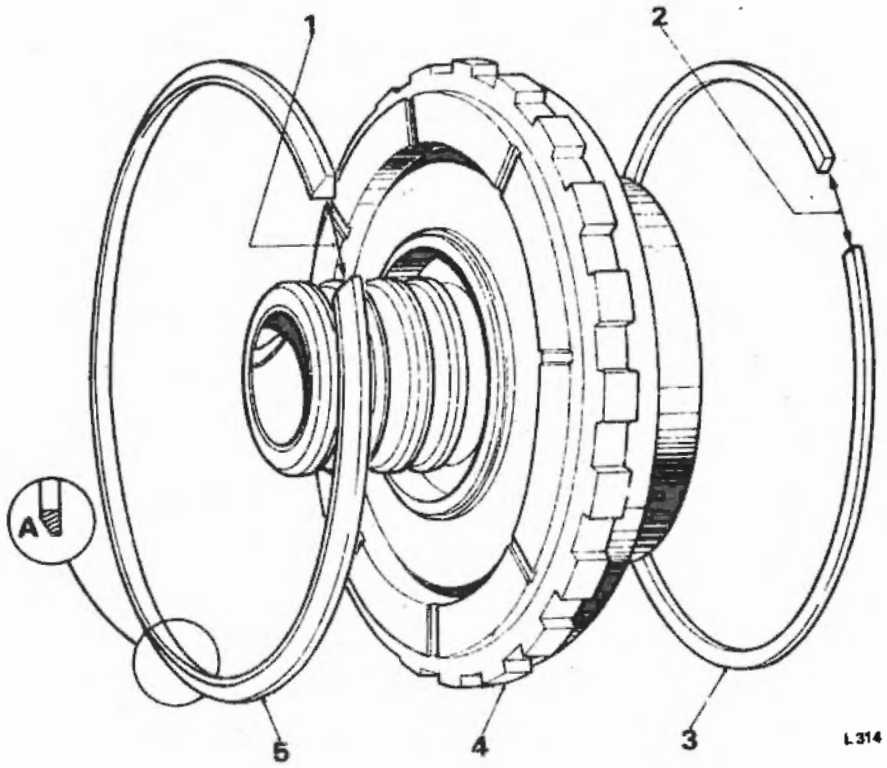

Fig. 2 Centre support

1. Snap ring gap (located in non-splined area of case).
2. Spacer ring gap (located in non-splined area of case).
3. Flat spacer ring.
4. Centre support.
5. Bevelled snap ring.

A. Flat side of snap ring to abut centre support.

Continued...

PROCEDURE

The following instructions must always be adhered to when fitting the centre support to case spacer ring and the bevelled snap ring.

1. Fit the 0.040 in. (1,014 mm.) thick flat spacer ring into the case to abut the shoulder at the bottom of the case spline (see Fig. 1).

2. Fit the centre support to case bevelled snap ring in the groove shown in Figure 1, to retain the centre support. The flat side of the snap ring should abut the centre support.

No. SY/GM21
ıtion - All Distributors
and Retailers

CATEGORY C

'TEFLON' CENTRE SUPPORT OIL SEAL RING

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the Torque Converter Transmission.

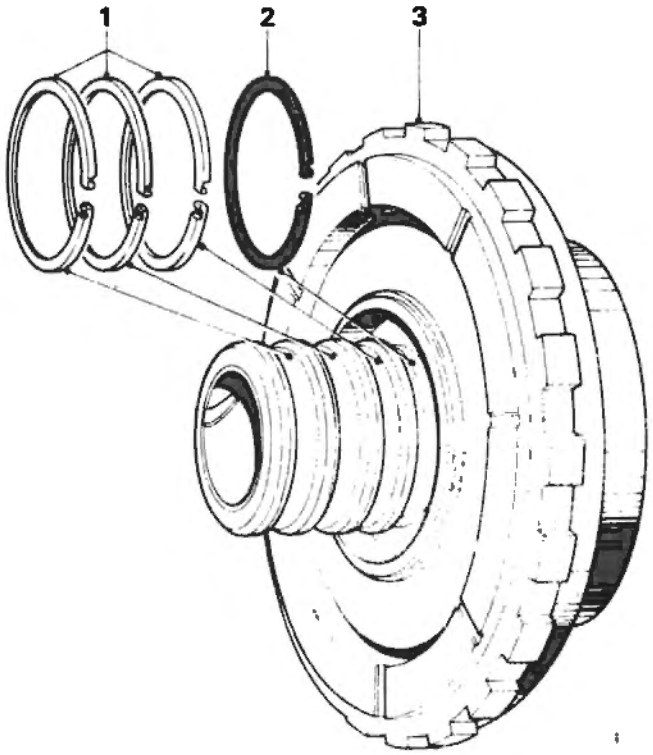

Fig. 1. Centre support

1. Cast iron oil seal ring
2. Teflon oil seal ring
3. Centre support

Continued...

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DESCRIPTION

The 1970 Torque Converter Transmission is now being built with a Teflon oil seal ring in the ring groove at the base of the centre support tower (see Fig. 1). The Teflon oil seal ring may be any colour such as white, tan, brown etc.

The Teflon oil seal ring is fitted to Torque Converter Transmission serial number 70-RR-2106 and all subsequent numbers.

SPARE PARTS INFORMATION

If replacement of the Teflon oil seal ring becomes necessary, it is permissible to fit the cast iron centre support oil seal ring, Part Number GM 8623148.

Printed in England

No. SY/GM22
Circulation - All Distributors
and Retailers

CATEGORY C

OMISSION OF CONTROL VALVE ASSEMBLY TO SPACER GASKET

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque Converter Transmission.

DESCRIPTION

Tests show that the control valve assembly to spacer plate gasket, part number GM 8623561, is not required in the Torque Converter Transmission. As a result, the Torque Converter Transmission, from serial number 70 RR 2346 onwards, is built without the gasket.

The deletion of the gasket does not necessitate any changes to the control valve assembly, spacer plate, case assembly or other related parts. Therefore, if the control valve assembly is removed from a Torque Converter Transmission, and is found to contain the gasket, the gasket may be omitted when fitting the control valve assembly.

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Printed in England 14.5.70

SECTION GM.

FORWARD AND DIRECT CLUTCH HOUSINGS CENTRE SEAL

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque Converter Transmission.

DESCRIPTION

Since mid - 1969 the Torque Converter Transmission has been built with the forward and direct clutch housings having a centre seal with optional and interchangeable lip constructions. The centre seal may either have a long or short length lip (see Fig. 1).

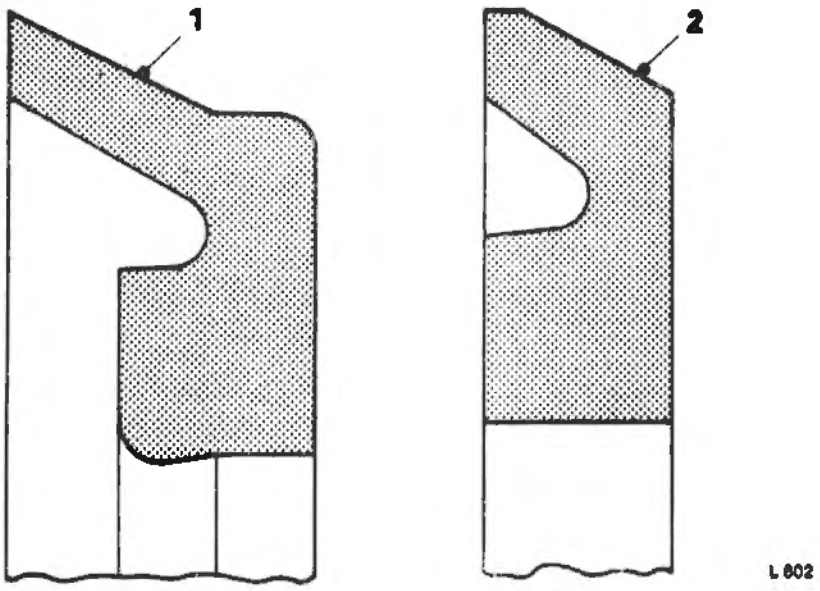

Fig. 1 Optional centre seal lip construction

1. Long length lip
2. Short length lip

The optional lip constructions of the centre seal are completely interchangeable when overhauling the Torque Converter Transmission.

No SY/GM24
Circulation - All Distributors
and Retailers

CATEGORY C

CENTRE SUPPORT AND INTERMEDIATE CLUTCH SNAP RINGS

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque Converter Transmission.

DESCRIPTION

Since the issue of Service Bulletin SY/GM20 it is still found that some failures of the Torque Converter Transmission particularly after overhaul, are the result of interchanging the centre support retaining snap ring with the intermediate clutch backing plate retaining snap ring.

CENTRE SUPPORT SNAP RING

In Figure 1 it can be seen that the centre support to case snap ring has one bevelled side and one flat side. The snap ring groove in the case has one tapered side to accommodate the bevelled ring.

The centre support bevelled snap ring must be installed with the flat side towards the centre support and with the ring gap adjacent to the band anchor pin.

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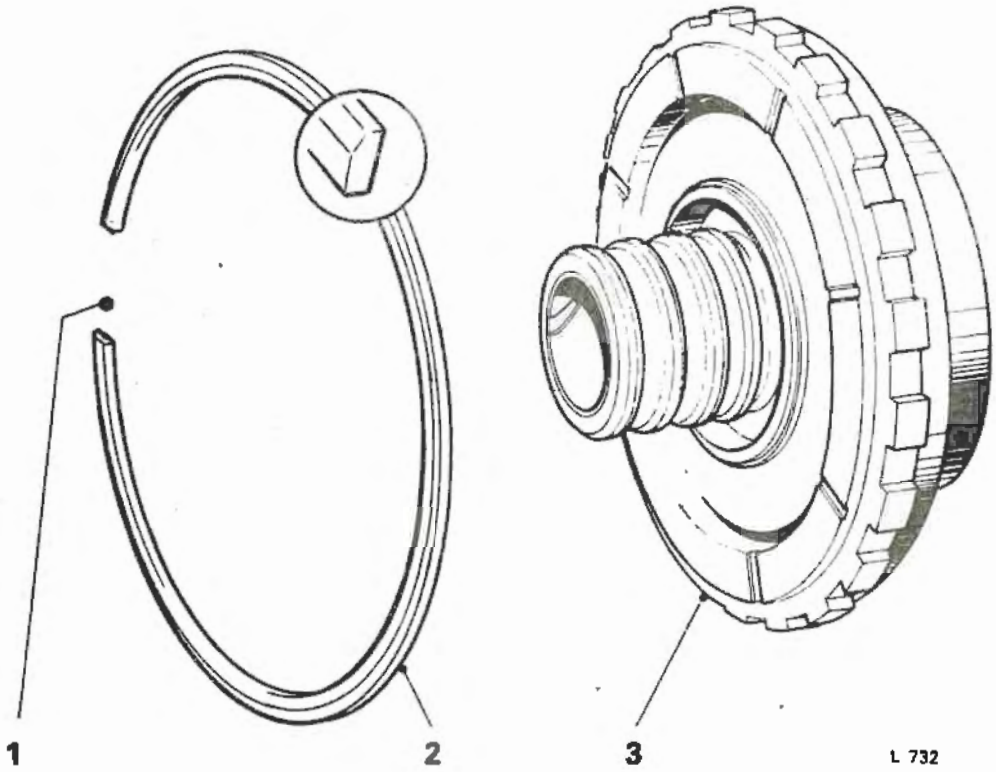

Fig. 1 Centre support and snap ring

Inset shows cross section of centre support snap ring (flat side of this snap ring towards the centre support)

1. Snap ring gap, to be positioned on the band anchor side of the case.
2. Centre support to case snap ring.
3. Centre support.

Continued...

INTERMEDIATE CLUTCH SNAP RING

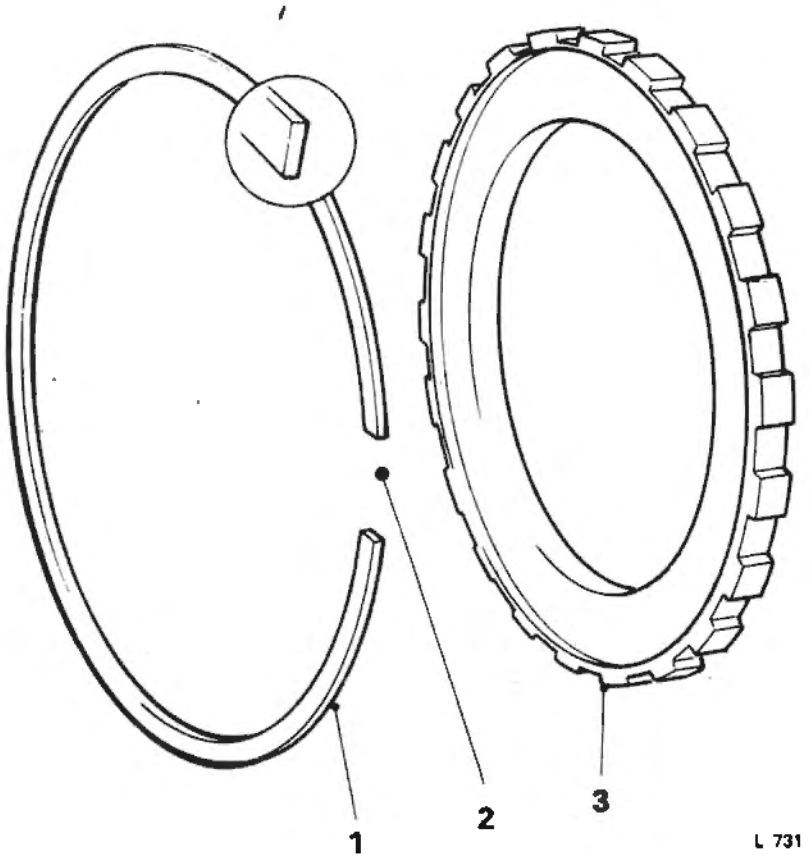

Fig. 2 Intermediate clutch backing plate and snap ring

Inset shows cross section of intermediate clutch backing plate snap ring (both sides of this snap ring are flat).

1. Intermediate clutch snap ring
2. Snap ring gap to be positioned on the opposite side to the band anchor pin.
3. Intermediate clutch backing plate.

Continued...

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The intermediate clutch backing plate to case snap ring is flat on both sides and the snap ring groove in the case has straight sides to accommodate the flat sides of the snap ring.

This flat sided snap ring must be installed in its correct position with the ring gap on the opposite side to the band anchor pin as shown in Figure 2.

It must be noted that the bevelled centre support to case snap ring will not seat properly in the straight sided intermediate clutch snap ring groove and if installed in the incorrect groove, will become dislodged during operation. This frequently results in a breakage of the spline in the case, from the snap ring groove forward, and consequently a transmission failure.

SERVICE BULLETIN
TORQUE CONVERTER TRANSMISSION

No. SY/GM25
Circulation - All Distributors
and Retailers

CATEGORY C

'TEFLON' OIL SEAL RINGS FITTED TO THE FRONT SERVO PISTON AND FRONT ACCUMULATOR PISTON

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque Converter Transmission - Serial No. 70-RR-2626 and onwards.

DESCRIPTION

During the latter part of the 1970 model year, Torque Converter Transmissions will be produced with 'Teflon' oil sealing rings fitted to the front servo piston and front accumulator piston.

Service personnel overhauling these transmissions will notice that the 'Teflon' rings allow the front servo piston and front accumulator piston to slide very freely in their bores. The free fit of the rings in the bores is a normal characteristic of these 'Teflon' rings and does not indicate leakage during operation.

The 'Teflon' rings should only be replaced if they show signs of damage or if evidence of leakage during operation exists.

If new rings are required, fit the current GM.8623131 aluminium (front servo) and GM.8623653 cast iron (front accumulator) service rings.

To remove a 'Teflon' ring pierce it with a sharp object such as a scriber and pull it out of the groove.

Note Take care not to scratch the piston groove.

If the control valve assembly is removed from a transmission installed in a vehicle and the transmission bears the above referenced or later serial number, the front servo piston and related parts may fall from the case because of the normal freeness of the 'Teflon' ring.

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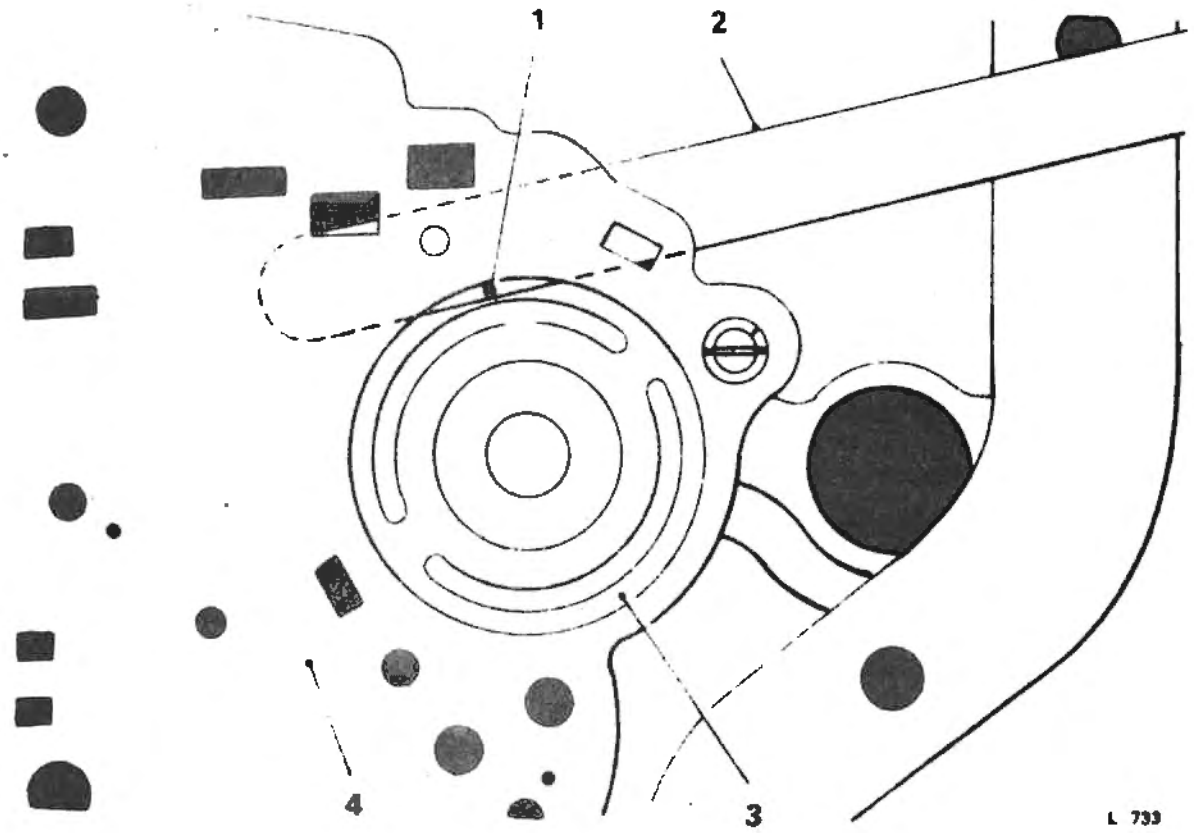

Fig. 1 Method of temporarily holding front servo piston in position (Transmission installed in a vehicle).

1. Locate feeler gauge in this position, allowing accumulator piston to enter the front servo piston before the feeler gauge is withdrawn.
2. Feeler gauge.
3. Front servo piston.
4. Spacer plate.

Continued...

When fitting a front servo piston with a 'Teflon' ring, into a transmission installed in a vehicle, the following procedure should be adopted.

1. Fit the front servo piston and related parts into position as described in Section 10 - Workshop Manual T.S.D. 2271.

2. With the front servo piston and related parts (see Fig. 78 Section 10 - Workshop Manual T.S.D. 2271) held in position by hand, place a length of clean 0.020 in. (0,0508 cm.) feeler gauge across the front servo piston between the spacer plate and case as illustrated in Figure 1. This is to hold the front servo piston in position long enough for the accumulator piston to enter the front servo piston.

3. Continue to assemble the components as described in the Workshop Manual.

Note Withdraw the feeler gauge before tightening any valve body bolts.

SECTION GM

Circulation - All Distributors and Retailers
Date: 24.8.70

Bulletin No. SY/GM26
Sheet No. 1

CATEGORY C

TRANSMISSION NOISE IN FIRST, SECOND AND/OR REVERSE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque Converter Transmission.

DESCRIPTION

During the past few months it has become increasingly evident that some additional information is required for diagnosis of transmission noise. This bulletin is intended to supplement the information which has been published in the Workshop Manual and covers only one part of the total noise diagnosis procedure.

Under the following conditions a noise which has been described as a high pitched buzz, a subdued siren sound, a grinding sound and gear noise has been reported.

1. Loudest in 'Reverse' and 'First Gear' during acceleration.

2. Barely noticeable in 'Second Gear' during acceleration.

3. No noise in 'Third Gear', 'Neutral' or 'Park'.

When a Torque Converter Transmission is dismantled for the purpose of correcting a noise fitting the above descriptions, particular attention should be given to the inspection of the roller thrust bearings and their races within the gear unit.

If a close inspection of the gears does not reveal any defects, it is possible that a pitted bearing roller, as shown in Figure 1, or a rough and pitted bearing race, as shown in Figure 2, could be the cause of the noise. Very often these defects are overlooked and the noise is still present after the gears within the unit have been replaced.

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SECTION GM

Circulation - All Distributors and Retailers

Bulletin No. SY/GM26

Date: 24.8.70

Sheet No. 2

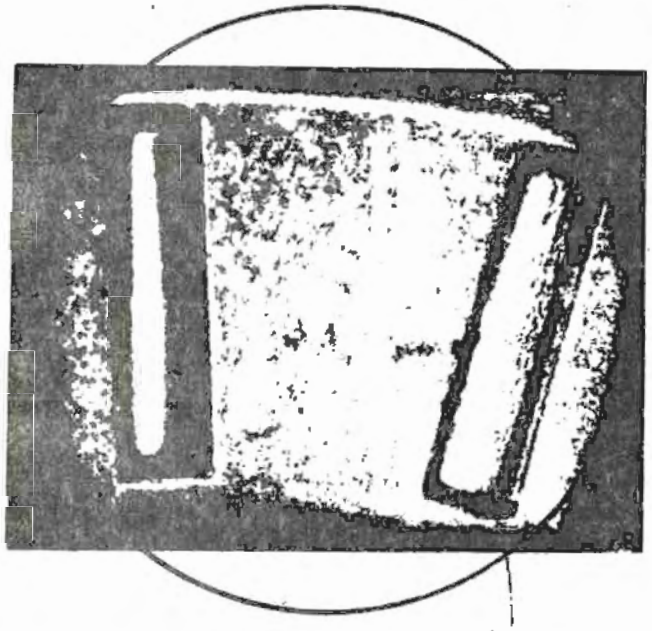

Fig. 1 Pitted bearing roller

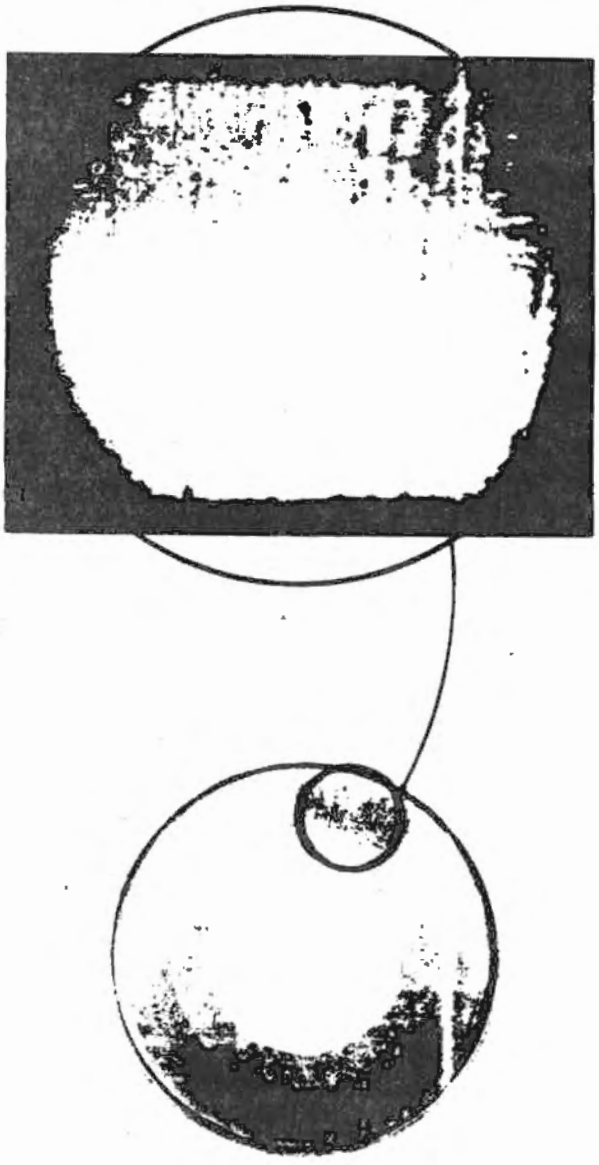

Fig. 2 Pitted bearing race

A most important step in the procedure to eliminate this particular noise is the cleaning and thorough drying of the thrust roller bearings and their races. An oily or wet film can easily cover the defects shown in Figures 1 and 2 and make them almost impossible to detect.

Note If pitting or roughness, as shown in Figures 1 and 2, is apparent on any thrust bearing roller or thrust race, the parts must be replaced.

SECTION GM

Circulation - All Distributors and Retailers

Bulletin No. SY/GM27

Date: 25.8.70.

Sheet No. 1

CATEGORY C

INSPECTION AND CORRECTION PROCEDURE FOR CONVERTER AND CASE ASSEMBLIES - TORQUE CONVERTER TRANSMISSIONS

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T series cars fitted with the Torque Converter Transmission.

DESCRIPTION

The converter and case assemblies returned to Rolls-Royce Limited are thoroughly inspected when received. This inspection indicates two points of interest which are as follows.

1. Some of the converters and case assemblies returned, were in a good condition and therefore should not have been changed by the service personnel.

2. Some of the parts returned could have been repaired by service personnel.

Some examples of conditions or problems which could have been repaired or corrected by service personnel are listed below.

1. Converters believed to cause a leak.

2. Converters believed to cause a vibration.

3. Converters with stripped converter bolt holes.

4. Case assemblies with minor porosity.

5. Car assemblies without an intermediate clutch cup plug.

6. Case fretting or peening on shoulder at the bottom of the case splines.

7. Case bushing worn or damaged.

8. Case assemblies with stripped bolt holes.

The attached sheets contain 'Inspection and Correction Procedures for the Torque Converter Transmission - Converter and Case Assemblies.' These procedures give practical methods to be followed when correcting converter and case assembly problems.

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INSPECTION AND CORRECTION PROCEDURE FOR THE TORQUE CONVERTER TRANSMISSION - CONVERTERS AND CASE ASSEMBLIES

CONVERTER ASSEMBLY

CONDITION	INSPECTION OR CHECKING PROCEDURE	CORRECTION
Leaks	1. Use procedure to pressure test under water (See Page 5). 2. Inspect converter hub surfaces for signs of scoring or wear that can damage seal.	1. Fit a new converter if it leaks. 2. Repair converter hub with crocus cloth if practical, or fit new components.
Vibration	1. Isolate cause of vibration by disconnecting other engine driven components, one at a time. 2. Inspect converter for loss of balance weight, or broken converter to crankshaft pilot.	1. Change position of converter on flex-plate 120° at a time to cancel out engine and converter unbalance condition. 2. Fit a new converter if balance weight is off or pilot is broken.
Noisy or Slips (Most converter noise occurs under slight throttle in 'Drive' with brakes applied).	1. Be sure noise is not caused by loose flex-plate to converter bolts, a cracked flex-plate (Engine to case dowel pins missing can result in a cracked flex-plate), a broken converter pilot or other engine components that are vibrating. 2. Inspect the converter internally for damage to the roller bearing, thrust races and roller clutch. (a) The thrust roller bearing and thrust races can be checked by viewing them when looking into the converter neck or feeling through the opening to make sure they are not cracked, broken or incorrectly positioned. (See Fig. 1).	1. Fit a new converter if it is damaged, or if the end play clearance is greater than 0.050 in. (1,27 mm.) (Refer to Page 5.). 2. Fit a new converter if it is damaged, or if the end play clearance is greater than 0.050 in. (1,27 mm.) (Refer to Page 5).

Continued...

CONDITION	INSPECTION OR CHECKING PROCEDURE	CORRECTION
Noisy or Slips (Continued)	(b) The roller clutch function can be checked by placing a finger into the converter neck and, with side pressure against the spline, turning the stator race. The race should turn fairly free in a clockwise direction and not turn in the anti-clockwise direction.	
	3. Inspect for excessive end play (See Page 5).	3. Fit a new converter if it is damaged, or if the end play clearance is greater than 0.050 in. (1,27 mm.).
	4. If fluid converter appears full of 'aluminium paint', converter is damaged internally.	4. Fit a new converter.
Stripped Converter Bolt Holes	1. Inspect for cause, such as damaged bolt threads.	1. Heli-Coil the damaged bolt holes. (See Page 12).
Note	Do not change the converter if a failure in some other part of the transmission has resulted in the converter containing dark discoloured fluid. The full flow filter used in the transmission is designed to remove all harmful residue from failures (other than converter or pump failures), before the oil is pumped into the converter. This transmission has used the full flow filter, Part Number GM 6437741 since late 1967.	Correct transmission problem and change fluid and filter.
	Important If cause of failure was transmission fluid contaminated by anti-freeze, replace the converter.	

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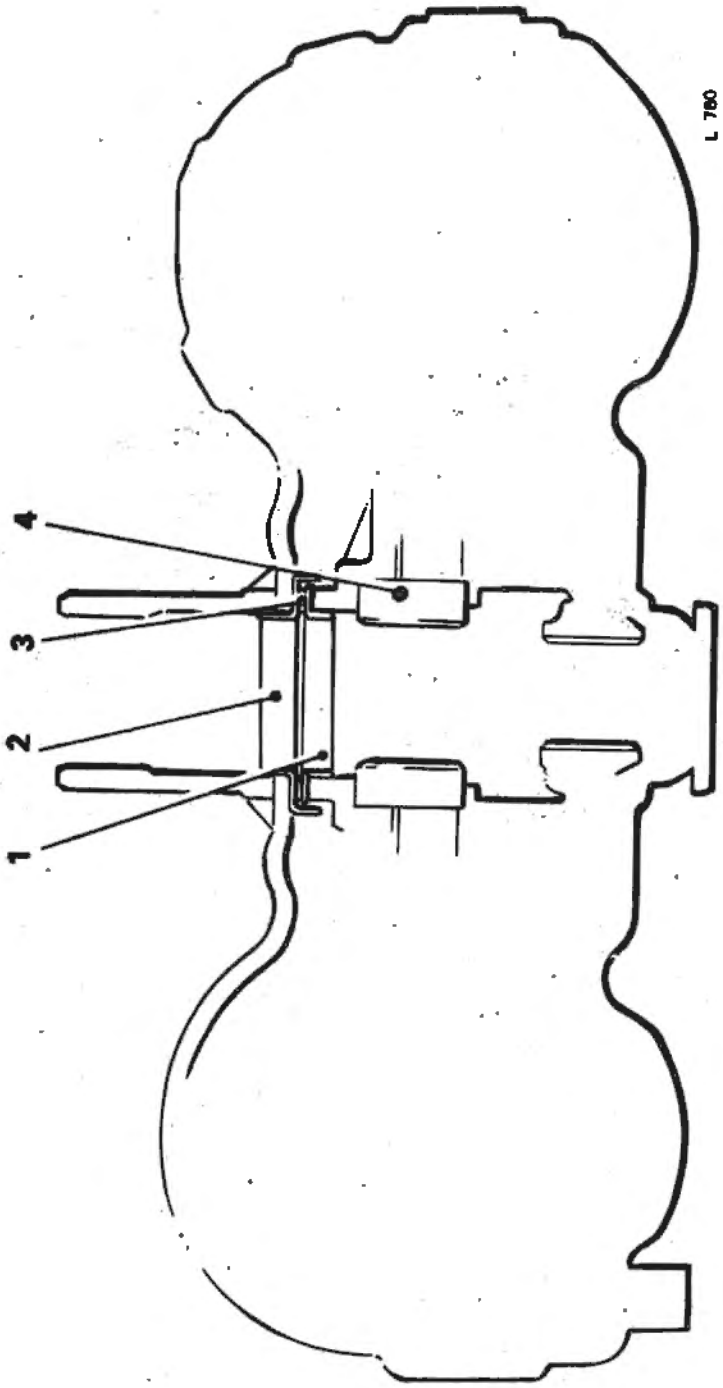

Fig. 1 Converter assembly

1. Thrust race (L)
2. Thrust race (Z)
3. Thrust roller bearing
4. Roller clutch stator race.

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To check converter for leaks

1. Install Tool J-21369 and tighten.
2. Fill converter with air (See Fig. 2), to 80 lb/sq.in. (5,625 kg/sq.cm.).
3. Submerge in water and check for leaks.

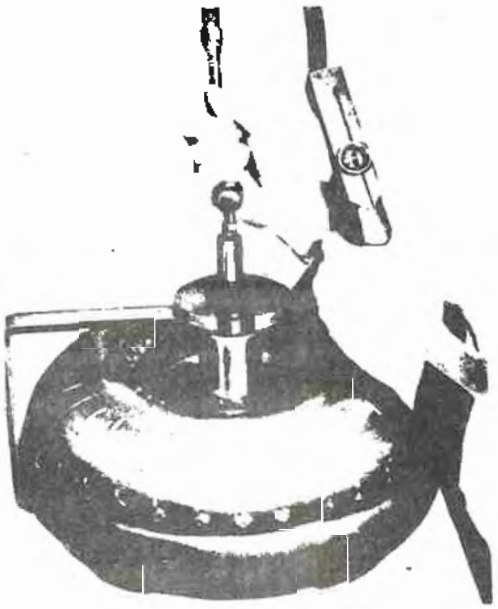

Fig. 2 Testing Converter for leaks

To check converter end clearance

1. Fully release collet end of Tool J-21371-8.

2. Install collet end of Tool J-21371-8 into converter hub until it bottoms (See A, Fig. 3); then tighten its cap nut to 5 lb. ft. (0,691 kg.m.).

3. Install tool J-21371-3 and tighten hexagon nut to 3 lb.ft. (0,415 kg.m.) (See B, Fig. 3).

4. Install Dial Indicator J-8001 and set it at 'Zero', while its plunger rests on the cap nut of Tool J-21371-8 (See B, Fig. 3).

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5. Loosen hexagon nut while holding cap nut stationary. With the hexagon nut loosened and holding tool J-21371-3 firmly against converter hub, the reading obtained on the Dial Indicator will be the converter end clearance. End clearance should be less than 0.050 in. (1,27 mm.). If it is 0.050 in. (1,27 mm.) or greater, a new converter must be fitted.

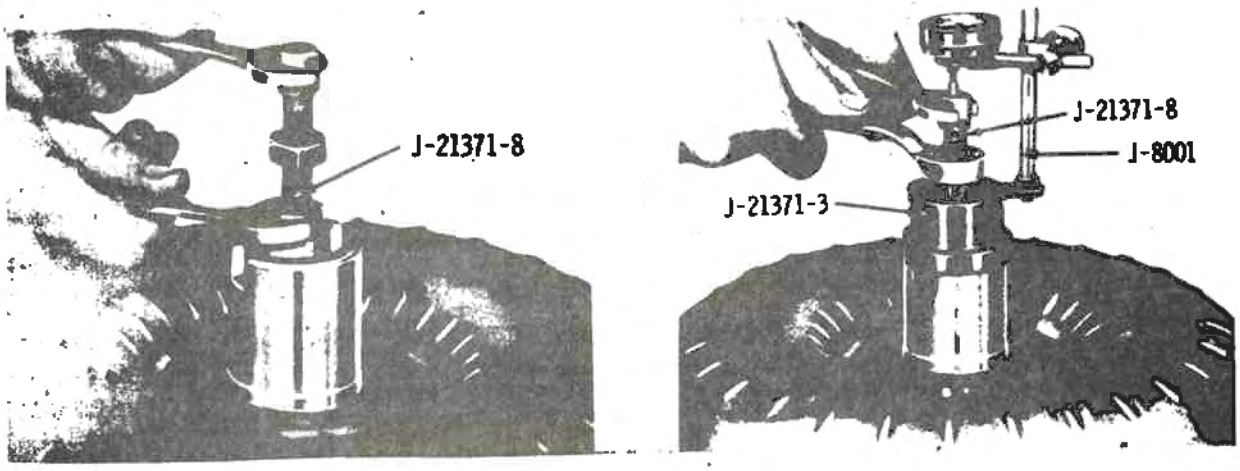

Fig. 3 Checking converter end clearance

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CASE ASSEMBLY

CONDITION	INSPECTION OR CHECKING PROCEDURE	CORRECTION
	IMPORTANT: If the case assembly requires replacement and it contains the centre support requiring the centre support-to-case spacer, make sure this spacer is removed from the old case and reinstalled in the new case.	
Leaks		
External	1. Determine exact source of leak, using black light or other methods.	1. Use recommended Epoxy repair procedure for minor porosity (not cracks) leaks. (See Page 9).
Internal	1. Inspect for internal porosity or cross channel leaks in valve body face passages. The use of thinner to aid in diagnosis may be helpful.	1. Fit a new case if porosity is found.
	2. Inspect for porosity or defects in modulator valve bore, case intake bore, pump case face, etc.	2. Fit a new case if porosity is found.
	3. Inspect for missing or loose intermediate clutch cup plug. (See illustration, Page 10, for location).	3. Fit a new cup plug (See Page 9).
Broken		
External	1. External damage is generally caused by handling, road hazard or other problems such as converter to flex-plate bolts coming out or propeller shaft universal joint failures.	1. Determine cause of failure, correct it and fit a new case.

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CONDITION	INSPECTION OR CHECKING PROCEDURE	CORRECTION
Internal	If internal case snap ring grooves are broken, it is caused by. 1. Installing snap rings and/or spacer incorrectly. (see Page 10).	1. Fit a new case and assemble snap rings in proper location.
	2. High oil pressure causing excessive forces.	2. Correct cause of high pressure - usually the cause is found in the pressure regulator valve system - and replace case.
Case fretting or peening on the shoulder at the bottom of the case splines.	1. If visual inspection of the case at the bottom of the splined area shows evidence of more than very slight peening, the correction package should be installed. Changing the transmission case for this condition is <u>not</u> recommended.	1. Install Centre Support Service Package, Part No. GM 8625990.
Scored, Worn or damaged, Case Bushing.	1. Inspect case bushing for severe scoring or wear. Also check lubrication grooves.	1. Fit a new Case Bushing. (See Page 11).
Stripped Bolt Holes	1. Inspect for cause such as damaged bolt threads.	1. Heli-Coil the damaged bolt hole. (See Page 12).

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Epoxy repair procedure for minor porosity as follows.

1. Road test car to bring transmission fluid to operating temperature - approximately 82°C. (180°F.)

2. Raise car on hoist or jack stand, engine running with driving wheels free to turn and locate source of oil leak. Check for leaks with transmission in 'Low' and 'Intermediate' ranges. (Use of a mirror is helpful in locating leaks).

3. Stop the engine and thoroughly clean area to be repaired with cleaning solvent and a brush; then air dry. (A clean, dry soldering acid brush may be used to clean the area and also to apply the epoxy cement).

4. Following the instructions of the manufacturer, mix a sufficient amount of epoxy cement, 3M-Scotch Weld-2216 or equivalent such as part number 1360016 (Z), to make the repair.

   Note Observe manufacturer's cautions in handling.

5. While transmission is still hot, apply epoxy cement to the area to be repaired. Be sure the area to be repaired is completely covered.

6. If 3M-Scotch Weld-2216 is used, allow one hour to cure before starting engine. If 1360016 (Z) epoxy is used, allow three hours to cure before starting engine.

7. Road test vehicle to bring transmission fluid to operating temperature of 82°C. (180°F.) and recheck transmission for leaks.

Intermediate Clutch plug fitting procedure

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

2. Make sure intermediate clutch cup plug hole is free of foreign material such as dirt, small particles of metal, etc.

3. Place intermediate clutch plug, Part Number GM 8611710 into hole, open end out.

4. Drive plug until flush or slightly below top of hole, using a 0.375 in. (9,525 mm.) diameter rod 10.00 in. (25,40 cm.) long.

   Note Make certain the rod used is large enough to locate on the lip edge of the plug (not the bottom of the plug).

5. Stake plug securely in case.

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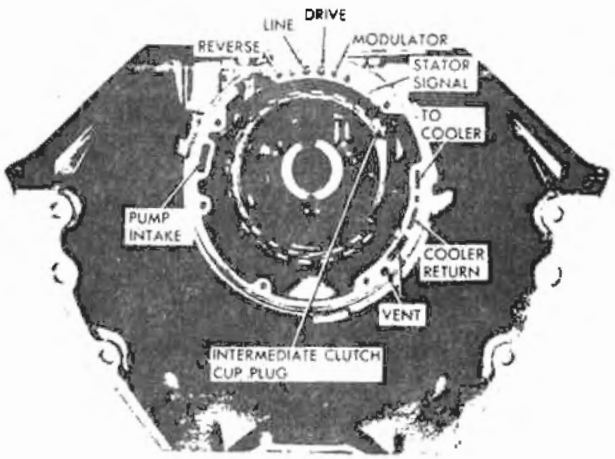

Fig. 4 View of case

Fitting the snap rings and/or spacer (See Service Bulletin SY/GM24).

Note Special care must be taken when fitting the snap rings and/or spacer.

1. Both sides of the centre support-to-case spacer are flat, and it is 0.040 in. (1,016 mm.) thick. If a transmission contains this spacer, it must be installed against the shoulder at the bottom of the case splines; and the gap must be located adjacent to the band anchor pin. (See Fig. 5.)

2. One side of the centre support-to case snap ring is bevelled and one side is flat. It must be installed with the bevelled side up (flat side against the centre support), and the gap must be located adjacent to the band anchor pin.

3. Both sides of the intermediate clutch backing plate-to-case snap ring are flat, and it is 0.093 in.(2,362 mm.) thick. It must be installed with the gap opposite the band anchor pin.

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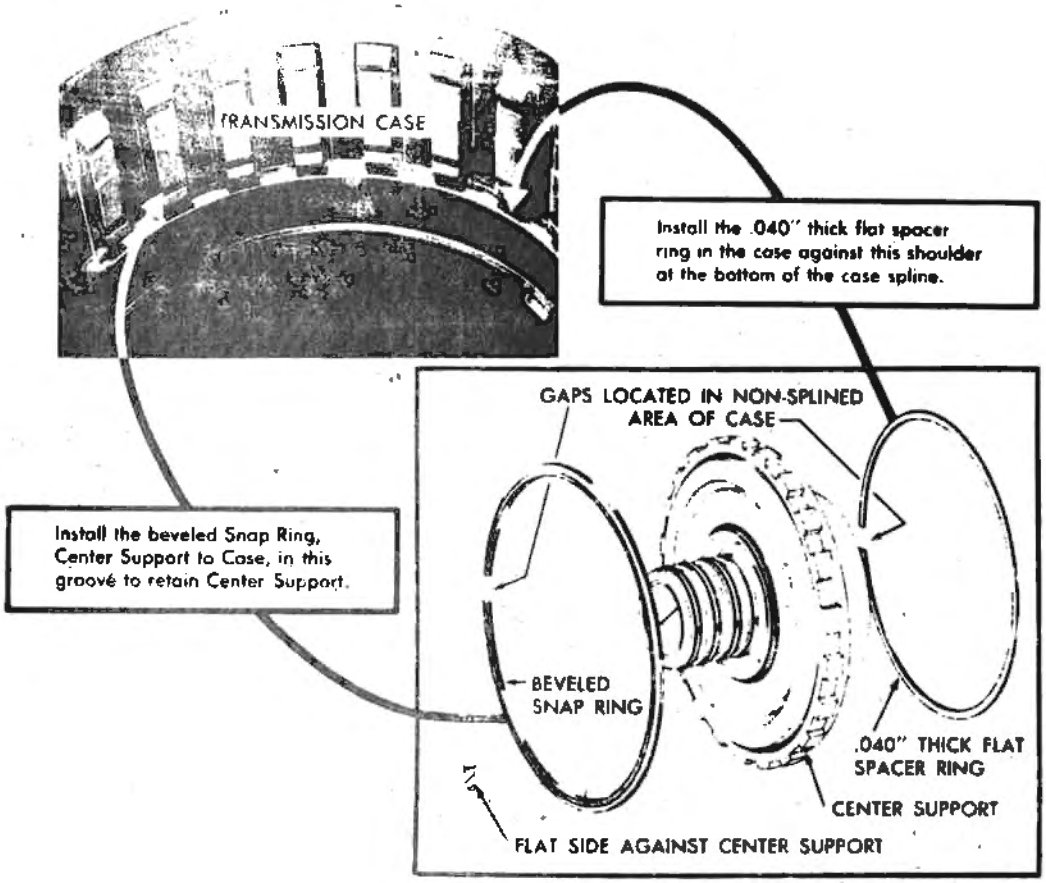

Fig. 5 Fitting the snap rings and/or spacer

Case Bushing Fitting Procedure.

REMOVE - With case properly supported, using tool J-21465-8, with driver handle J-8092, (or J-8400-1) remove bush.

REPLACE- Using tool J-21465-8, adaptor ring J-21465-9, driver handle J-8092, and extension J-21465-13, with lube passage facing front of transmission case, press/drive new bush(GM.8623941) into case until 0.040 in. (1,016 mm.) to 0.055 in. (1,307 mm.) above selective thrust washer face, as shown in illustration on Page 12. Stake bushing with tool J-21465-10. Stake marks to be in bush lubrication grooves.

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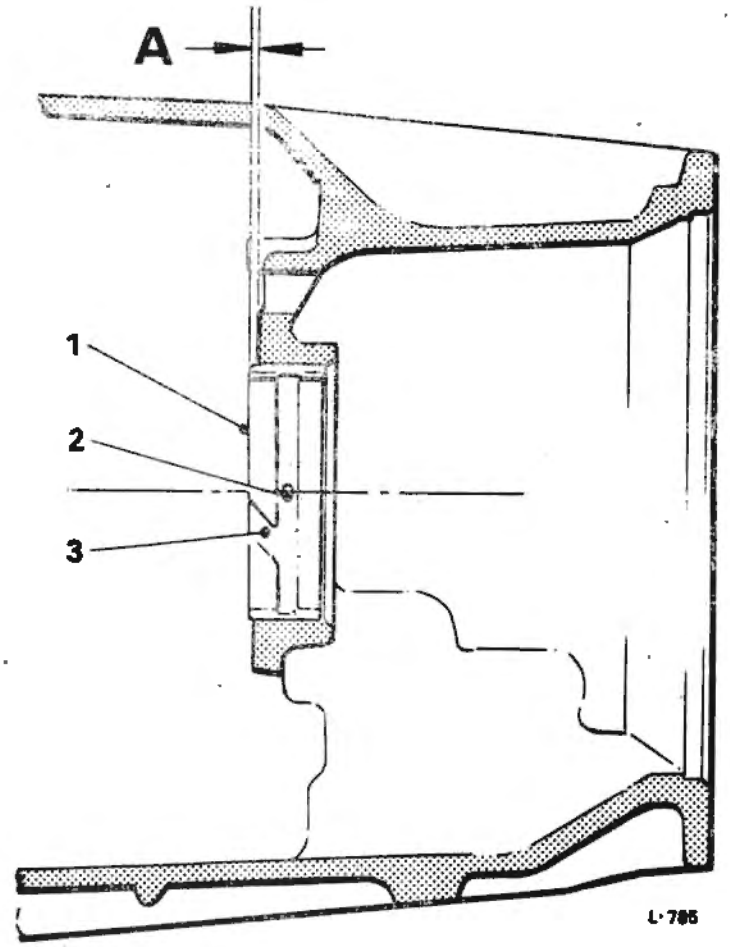

Fig. 6 Fitting a new case bush

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

Heli-Coil procedure as follows

1. Refer to Pages 14 and 15 for correct drill sizes, tap sizes etc.

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2. Shield the area around the hole to be heli-coiled to contain any small particles of metal.

3. Drill out the old threads and clean any small particles of metal from hole.

Note Drill only to the depth of the original hole. When drilling hole A-4 (See Fig. 7), the drill may go through to the inside of the case, and located just beyond this hole are the intermediate clutch splines. If the hole goes through, the burr must be removed from the clutch splines.

4. Tap the hole with the heli-coil tap.

5. Install the standard insert (STI) heli-coil.

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

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HELI-COIL INFORMATION FOR TORQUE CONVERTER TRANSMISSION

Transmission Out of Vehicle and Partially or Completely Dismantled.

LOCATION	HOLE NO.	DRILL SIZE	TAP SIZE	HELI-COIL SIZE
Pump to Case	All	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC
Valve Body to Case	A-1 through A-4 (See Page 16)	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC
Valve Body to Case	A-5 and A-6 (See Page 16)	0.266 in. (6,747 mm.)	1/4-20 UNC-2B	1/4-20 STI-NC
Converter To Flex-Plate	All	0.391 in. (9,922 mm.)	3/8-16 UNC-2B	3/8-16 STI-NC

Transmission in Vehicle and Partially Dismantled.

LOCATION	HOLE NO.	DRILL SIZE	TAP SIZE	HELI-COIL SIZE
Case Extension to Case	All	0.391 in. (9,922 mm.)	3/8-16 UNC-2B	3/8-16 STI-NC
Governor Cover to Case	All	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC
Modulator Retainer to Case	-	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC

Continued...

LOCATION	HOLE NO.	DRILL SIZE	TAP SIZE	HELI-COIL SIZE
Speedometer Driven Gear Assembly to Case	-	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC
Oil Pan to Case	All	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC
Rear Servo Cover to Case	All	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC
Parking Brake Bracket to Case	All	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC
Valve Body to Case	A-7 through A-10 (See Page 16)	0.328 in. (8,334 mm.)	5/16-18 UNC-2B	5/16-18 STI-NC
Valve Body to Case	A-11 (See Page 16)	0.266 in. (6,747 mm.)	1/4-20 UNC-2B	1/4-20 STI-NC
Solenoid to Case	A-12 and A-13) (See Page 16)	0.266 in. (6,747 mm.)	1/4-20 UNC-2B	1/4-20 STI-NC

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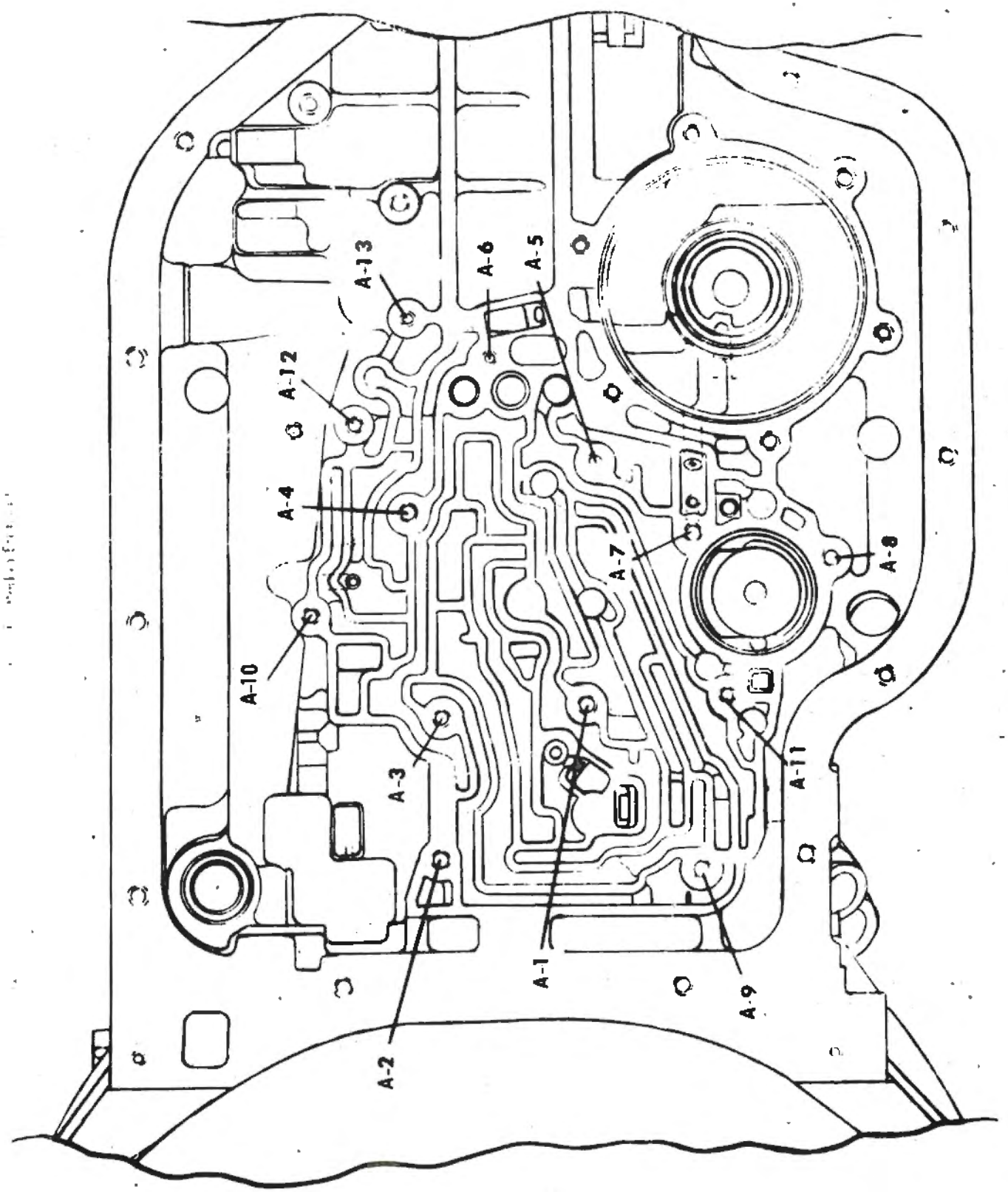

Fig. 7 View of underside of case

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Sheet No. 1

CATEGORY C

GASKET-CONTROL VALVE ASSEMBLY TO SPACER PLATE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the Torque Converter Transmission.

DESCRIPTION

Two reports have recently been received from different sources, of Torque Converter Transmissions having erratic gear change patterns with high oil pressures.

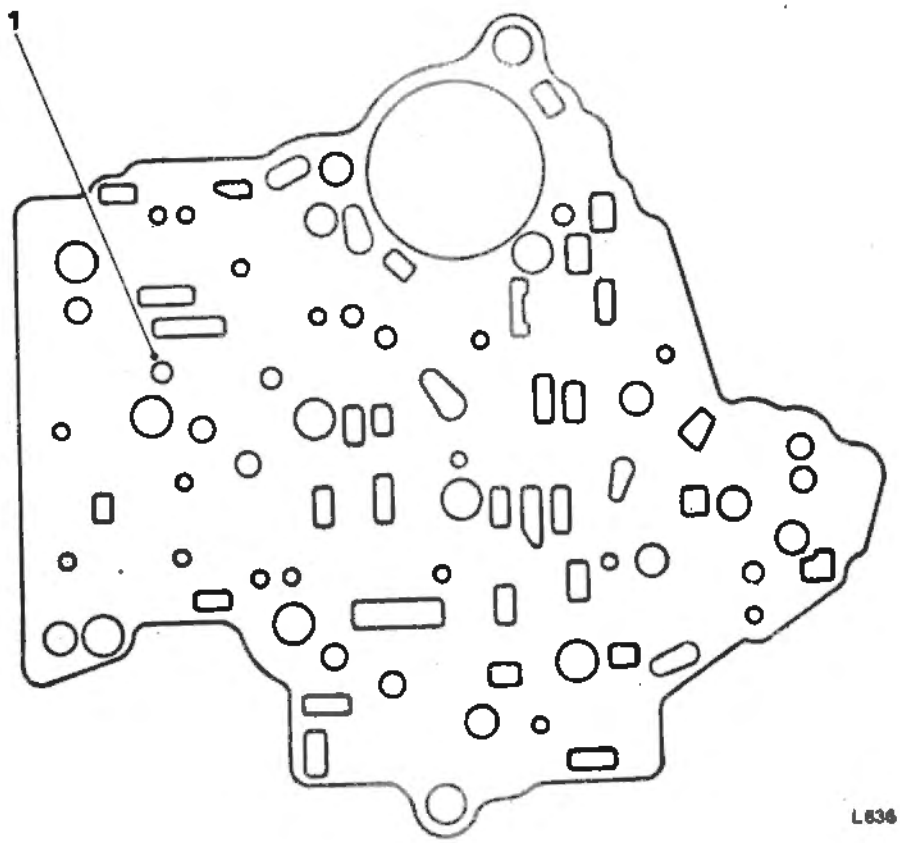

Fig. 1 Control valve assembly to spacer plate gasket

1. Position of missing hole in gasket.

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In both cases, the problem was finally traced to a defective control valve assembly to spacer gasket which had been fitted during service operations. The defective gasket was part of a service kit that was not a genuine service part.

The defect in the gasket is that the oil feed hole to the modulator valve is omitted (see Fig. 1).

In the first instance, a complete transmission was changed after several weeks had been spent attempting to locate the problem and in the second, a period of eight weeks elapsed before the defective part was found.

To prevent a possible repetition of this problem, it is suggested that the information contained in this Service Bulletin and Service Bulletin SY/GM22 be circulated to all service personnel.

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CATEGORY C

PUMP COVER AND PUMP BODY CASTING PART NUMBER CHANGE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley T Series cars fitted with the Torque Converter Transmission (Fixed Stator).

DESCRIPTION

Since the issue of Service Bulletin SY/GM9 additional information has become available regarding oil pump covers and bodies.

The serial number of the first transmission manufactured with the following oil pump cover and body is RR-68-1895.

Oil Pump Cover	GM.8626176
Oil Pump Body	GM.8626121

Subsequent changes to the part number have taken place as follows.

Casting	1st CHANGE	2nd CHANGE	CURRENT
Oil Pump Cover	GM.8626176	GM.8626174	GM.8626896
Oil Pump Body	GM.8626121	GM.8626121	GM.8626895

When servicing the Torque Converter Transmission (Fixed Stator) the service Pump Cover Assembly GM 8625955 which incorporates one of the three castings GM.8626176, GM.8626174 or GM.8626896 must be used ONLY with the Pump Body Assembly GM.8625954 incorporating one of the two castings GM.8626121 or GM.8626895.

SERVICE BULLETIN
TORQUE CONVERTER TRANSMISSION

No SY/GM30

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CATEGORY C

APPLICABLE TO: All Rolls-Royce Silver Shadow and Bentley T Series cars

REAR ACCUMULATOR PISTON CONTAINING 'TEFLON' OIL SEAL RING

DESCRIPTION

The 1971 Torque Converter Transmission are now being built with a new (2nd type) rear accumulator piston containing a 'Teflon' oil seal ring in the large diameter ring groove (see Figure 1). This piston can be identified by the number 8627200 cast in the piston. The 2nd type piston large diameter ring groove is machined shallower than the 1st type piston which used an aluminium ring. Therefore, the 'Teflon' ring is not interchangeable with the aluminium ring. The small diameter ring groove and oil seal ring have not been changed.

The first transmission serial number of transmissions containing the 2nd type piston and 'Teflon' oil seal ring is given on page 2.

As an assembly, with the correct rings installed, the 1st and 2nd type rear accumulator pistons are interchangeable.

The following parts are serviced:

DESCRIPTION		PART NUMBER
Rear Accumulator Piston	(1st Type)	8623669
Aluminium Oil Seal Ring	(Large Dia.)	8623672
Aluminium Oil Seal Ring	(Small Dia.)	8623671
'Teflon' Oil Seal Ring	(Large Dia.)	8627153

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The first transmission serial number of transmissions containing the new (2nd type) rear accumulator piston and teflon ring is as follows:

Torque Converter Transmission Serial No. 71-RR-1287

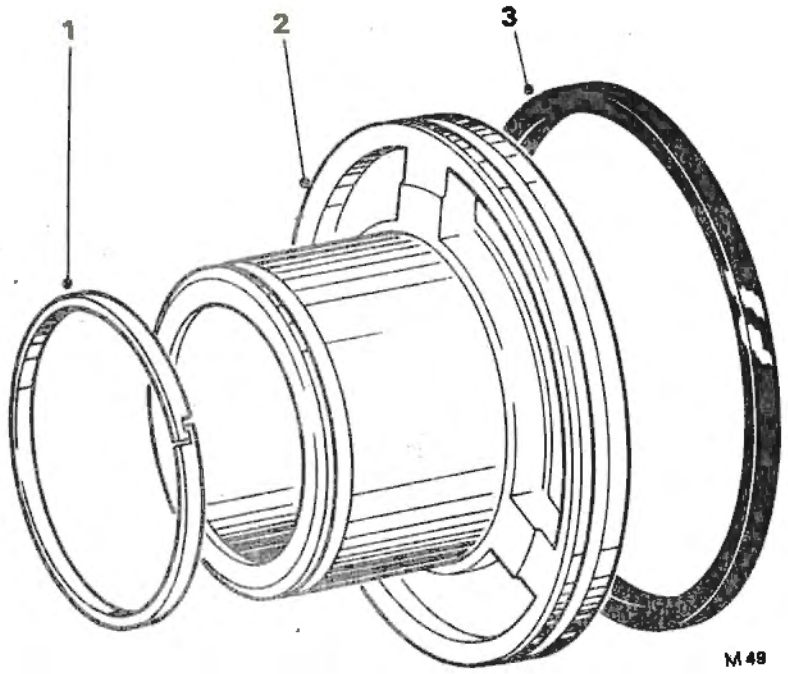

Figure 1 Accummulator piston 'Teflon' seal

1. Aluminium oil seal
2. Rear accumulator piston
3. 'Teflon' oil seal

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CATEGORY C

THE GEARBOX ACTUATOR

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Bentley 'T' Series cars.

DESCRIPTION

Allegedly defective gearbox electric actuators removed from cars in service have been subsequently found to operate correctly, indicating that the complexity of this particular electrical circuit can lead to problems being mis-diagnosed and actuators being removed needlessly. In addition, many of the actuators removed could have been reconditioned and then refitted to the car.

This Service Bulletin has therefore, been issued to assist in the diagnosis of problems in the actuator circuit; to advise how the actuator can be reconditioned and to provide a test procedure that can be applied following reconditioning. Should a customer complain about the electric gearchange circuit, the following tests should be carried out to ascertain if the complaint arises from the actuator or the associated circuit. Should these tests show that the associated circuit is operating correctly, the actuator should be reconditioned, tested and refitted as described in the following procedure.

After fitting the actuator to the car, the breather pipe should be inspected. If the metal breather pipe terminates at the side of the gearbox the breather pipe should be extended by fitting a length of plastic tube to the metal pipe, terminating the tube in the cross-member at the rear of the gearbox. This will help in preventing water entering the actuator via the breather pipe.

NOTE The test procedures are designed to prove if the cause for complaint is due to a faulty component within the gearbox actuator, or to a fault elsewhere in the gearchange circuit.

The test is designed to discover whether the pins of the actuator loom socket receive the correct electrical signal in sequence, as dictated by the position of the gearchange lever.

If the test shows that voltage is only available at the correct pins in all gear lever positions, this will normally indicate a fault within the actuator.

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To carry out these tests, a suitable voltmeter is required.

PROCEDURE

1. Ensure that the gearchange thermal cut-out switch on the distribution board (fuse panel) has not cut-out. This can be done by depressing the Red button. The position of the button will not change whether the switch has tripped or not, however a tripped switch will click on pressing the button.

2. Ensure that fuse number 12 is intact.

3. Disconnect the low tension wire from the distributor and turn the ignition switch to the 'on' position.

3a. Slightly loosen the actuator loom socket and recheck the actuator function. This will reveal any poor contact which may exist between the plug and socket.

4. Unscrew and withdraw the loom socket from the plug of the gearchange actuator.

5. Move the gear range lever to the 'Reverse' position and check that all the pins of the loom socket are of the correct polarity or are neutral, as indicated in Figure 1.

NOTE

Each pin in the socket is identified by a letter which is moulded in the rubber body adjacent to each pin.

6. Carry out the above operation in each of the gear range lever position, checking each pin in turn with the information given in Figure 1.

7. Switch off the ignition and ensure that pin number G of the actuator socket is now neutral.

8. Reconnect the socket to the actuator and refit the distributor low tension cable.

NOTE

If an incorrect reading is obtained during any of the above tests, this will indicate that the gearchange circuit is probably at fault and not the actuator. The correct procedure would then be to locate and correct the fault in the circuit and then repeat the test sequence.

Continued....

It should be noted that the voltage readings obtained must not be more than 0.25 Volts less than the battery voltage. However, if the test sequence does not reveal a discrepancy, then the fault must be either inside the gearbox actuator or in the gearbox and neutral start switch linkage. Before removing the actuator the gearbox linkage should be disconnected from the actuator output lever and checked for excessive stiffness.

The gearbox linkage should move into any gear when a load of approximately 10 lb. (4,53 kg.) is applied to the disconnected rod. However, on Four Speed Automatic Gearboxes a load of 20 lb. (9,07 kg.) is required to select Reverse.

If the linkage operation is satisfactory then it will be necessary to remove, recondition and test the actuator as described in this Service Bulletin.

RECONDITIONING PROCEDURE

The reconditioning procedure for these actuators is detailed in Section 3 - Chapter 1 of the relevant Gearbox Workshop Manual.

TEST PROCEDURE FOR RECONDITIONED ACTUATOR

1. Disconnect the earth cable from the battery negative terminal, or from the boot quick release terminal when fitted.

2. Connect an ammeter capable of reading at least 20 Amps. between the battery negative terminal and the loose end of the earth cable.

3. Ensure that all accessories such as the rear window demister and blower motors are switched off and then switch on the ignition. Note the reading shown on the ammeter.

4. Move the gearlever between 'Neutral' and 'Reverse' gear positions and check that the extra reading on the ammeter caused by the operation of the actuator does not exceed 10 Amps.

5. Check that the actuator moves smoothly and quietly to each position selected and that the output lever stops in the correct position and does not 'hunt' about that position more than once before finally stopping.

6. Remove the ammeter and connect the battery negative cable.

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Gear Range Lever		R	N	4	3	2	4 Speed Automatic Transmission.
Position	P	R	N	D	I	L	Torque Converter Transmission.
Socket Pin No.							General Notes.
A	N	N	Pos	N	N	N	
B	Pos	N	N	N	N	N	This pin is connected only on cars fitted with Torque Coverter Transmission.
C	N	N	N	Pos	N	N	
D	N	N	N	N	Pos	N	
E	N	N	N	N	N	Pos	
F	N	Pos	N	N	N	N	
G	Neg	Neg	Neg	Neg	Neg	Neg	This pin is Negative when the ignition is ON, and Neutral when the ignition is OFF.
H	Pos	Pos	Pos	Pos	Pos	Pos	This pin is directly connected to the thermal cut-out switch.
I	Neg	Neg	Neg	Neg	Neg	Neg	This pin is fixed to the valance earth point.

Key.

Pos. Common with the battery positive terminal.

Neg. Common with the battery negative terminal.

N. Neutral - no connection to either battery terminal.

Figure 1 - Test chart

Continued....

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PARTS REQUIRED

Cars fitted with Torque Converter Transmission

RH 2529	Service Kit	1 off	
RH 2542	Breather Kit	1 off	- only required for cars produced prior to SRX 3254

Cars fitted with Four Speed Automatic Gearbox

RH 2530	Service Kit	1 off	
RH 2542	Breather Kit	1 off	- only required for cars produced prior to SRX 3254

TIME ALLOWED

For reconditioning actuators from either of the above gearboxes - 4.75 HOURS.

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PARTS REQUIRED

Cars fitted with Torque Converter Transmission

RH 2529	Service Kit	1 off
RH 2523	Breather Kit	1 off

Cars fitted with Four Speed Automatic Gearbox

RH 2530	Service Kit	1 off
RH 2522	Breather Kit	1 off

TIME ALLOWED

For reconditioning actuators from either of the above gearboxes - 4.75 HOURS.

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FRONT SERVO & ACCUMULATOR PARTS CAUTION

The front accumulator piston, front servo piston and related parts are new for 1971. Individual parts of the 1971 assemblies are not interchangeable with past model parts.

Incorrect combinations of these parts may result in:

1. Loss of front band apply and/or band failure.
2. Direct clutch failure.

Identification and comparison of the 1965-1970 Front Accumulator and Servo Parts versus the 1971 parts are as shown on the attached illustration and as follows:

Identifying 1965 through 1970 and 1971 Components

1965 - 1970 Components	1971 Components
8623652 - Piston Front Accumulator Cast Aluminium Flat Surface	8626883 - Piston, Front Accumulator - Cast Aluminium - Has three raised pads
8623649 - Piston, Front Servo - Cast Aluminium - Has two raised pads	8626878 - Piston, Front Servo - Steel, flat surface
8623362 - Washer, Front Servo Piston Spring, Retainer	8626884 - 'C' Ring, Front Servo Piston, Spring retainer
8623651 - Pin, Front Servo Piston - Has a shoulder	8626879 - Pin Front Servo Piston - Has a groove
8623704 - Retainer, Front Servo Spring - Cupped area has a straight side	8626881 - Retainer, Front Servo Spring - Cupped area has a tapered side

Continued...

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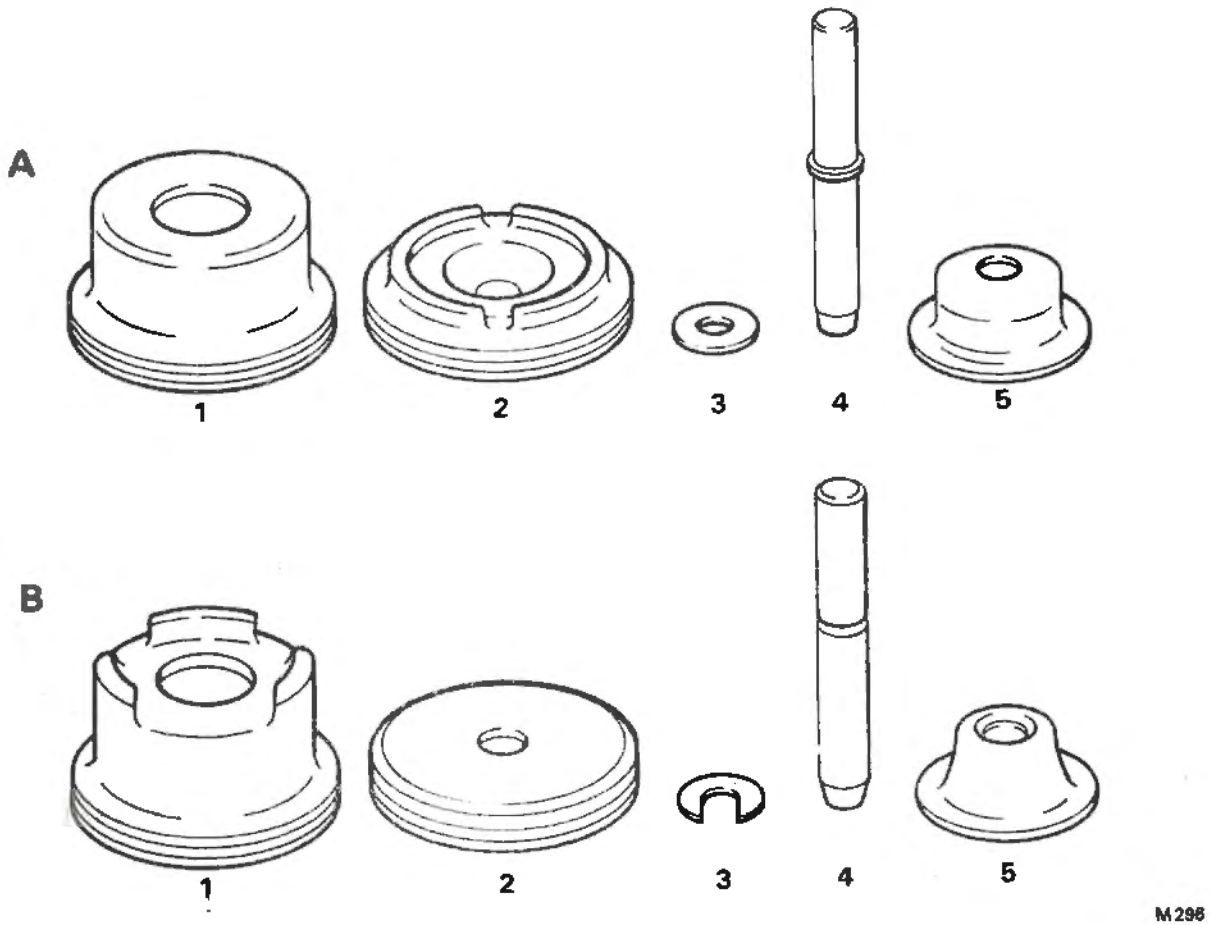

Fig.1 - Component changes

A 1965 through to 1970 components
1 Accumulator piston
2 Servo piston
3 Washer - front servo piston
4 Pin front servo piston
5 Retainer front servo spring

B 1971 components
1 Accumulator piston
2 Servo piston
3 'C' ring - front servo piston
4 Pin - front servo piston
5 Retainer - front servo spring

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NEW SUN GEAR SHAFT AND SUN GEAR

A new design mating spline has been released for the sun gear and sun gear shaft assembly in the Turbo Hydra-matic 400 and 425 transmissions. (See Fig. 1).

The new design sun gear shaft assembly has a full compliment of splines and the old sun gear will not assemble to it.

The new design sun gear will assemble to either the new or old sun gear shaft assembly.

Some production transmissions were built with the combination of the old design sun gear shaft assembly and the new design sun gear.

The old design sun gear shaft assembly, Part No. 8623177, will continue to be serviced and be released for all Turbo Hydra-matic 400 and 425 transmissions.

The new design sun gear, Part No. 8626807, will be released for service for all Turbo Hydra-matic 400 transmissions.

The new design sun gear Part No. 8626808, will be released for all Turbo Hydra-matic 425 transmissions.

Existing service stock of the old design sun gears, Part No. 8623182, Turbo Hydra-matic 400 and Part No. 8625035, Turbo Hydra-matic 425 should be depleted on transmissions built prior to this design change.

The starting serial numbers of transmissions built with the new sun gear shaft are as follows:

ROLLS-ROYCE TRANS. SERIAL NO.
RR-71-1287

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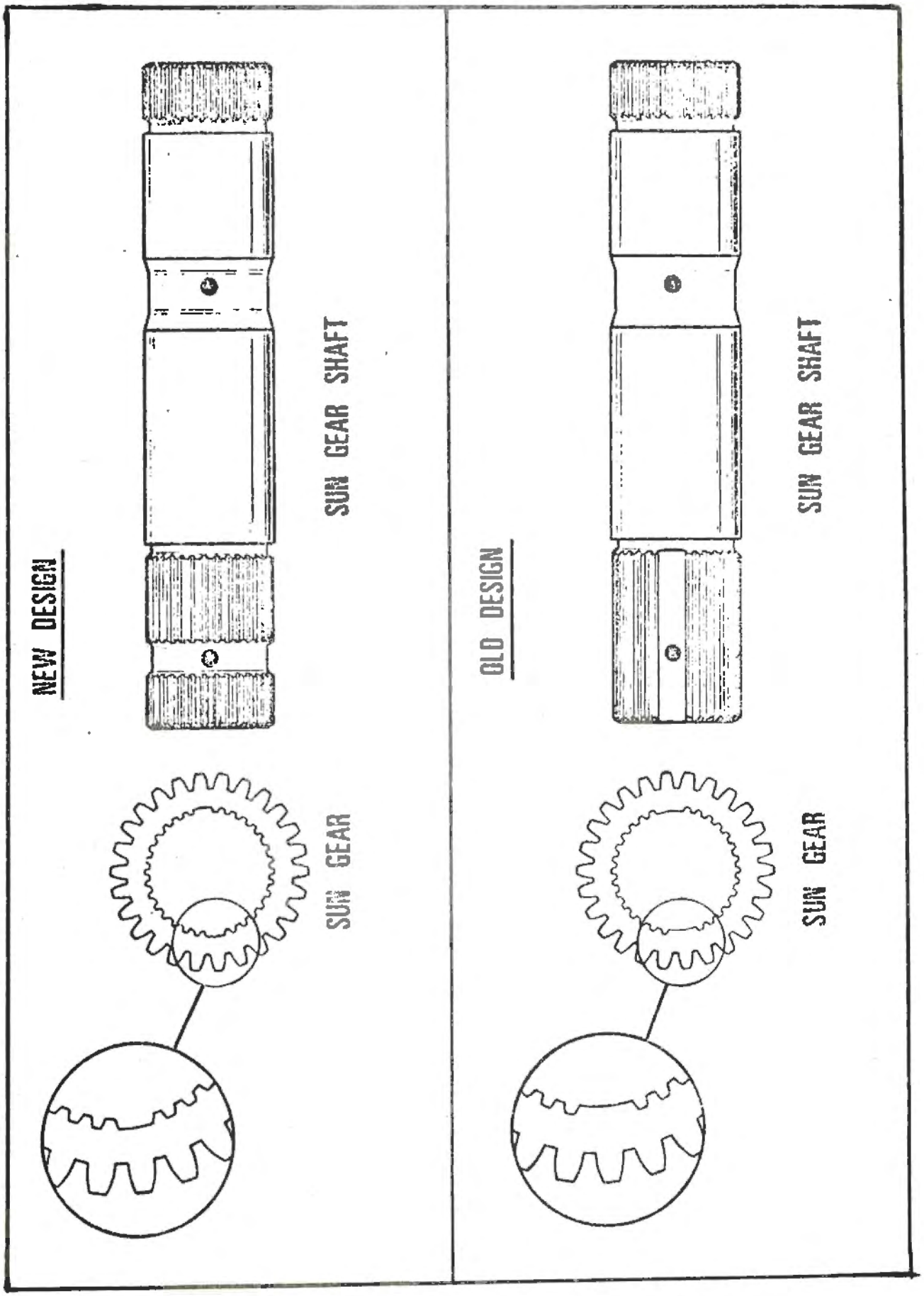

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CATEGORY C

CONTROL VALVE ASSEMBLY TO SPACER PLATE GASKET REINSTATED

APPLICABLE TO

All Rolls-Royce Silver Shadow and Corniche cars, and all Bentley T Series and Corniche cars.

DESCRIPTION

The Control Valve Assembly to Spacer Plate Gasket, Part No. 8623561, has been reinstated in the Torque Convertor Transmission both for Production and Service use.

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CATEGORY C

TCS SWITCH LEAD WIRE ASSEMBLY ROUTING - GM400

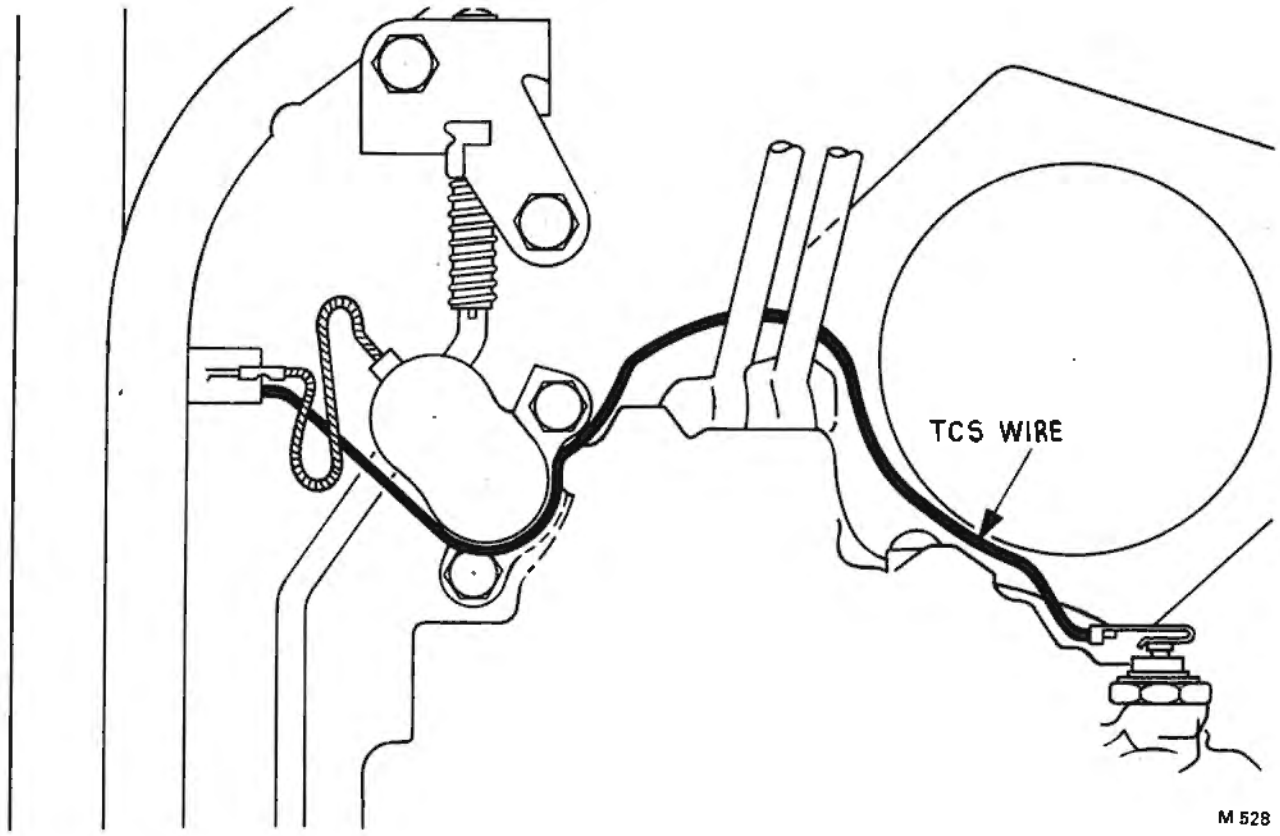
APPLICABLE TO:

All Rolls-Royce Silver Shadow and Corniche cars, and all Bentley T Series and Corniche cars fitted with the Torque Converter Transmission.

DESCRIPTION

The electric wire clip used to hold the TCS wire in place has been cancelled for production. The TCS wire is now routed from the case electrical connector around the solenoid assembly and under the governor pipes to the pressure switch. See illustration.

For Service, the electric wire clip may be discarded if the wire is routed as instructed.



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CATEGORY C

THE PERMANENT MAGNET MOTOR GEARBOX ACTUATOR

APPLICABLE TO:

Rolls-Royce Silver Shadow and Corniche cars, and all Bentley T Series and Corniche cars produced after Car Serial Number 9000.

DESCRIPTION

All cars produced after the above Car Serial Numbers are fitted with a gearbox actuator having a permanent magnet motor. This new actuator can be identified by the round motor housing, as opposed to the flat sided housing of earlier motors.

Service Bulletin SY/GM31 contains a Fault Diagnosis for the earlier type of actuator and the purpose of this Service Bulletin is to detail a Test Procedure and a Re-conditioning Procedure for the new actuator.

These gearbox actuators contain a series of cams which operate micro-switches. These switches fulfil the functions of the neutral start switch, the fast levelling switch and the Park anti-theft switch. In view of this, the test procedures for the actuator and for the switch circuits have been segregated in the interests of clarification.

A Theoretical Wiring diagram of the gearbox actuator and associated circuits is shown in Figure 1.

TEST PROCEDURE FOR MICRO-SWITCH CIRCUITS

Before conducting these tests ensure that fuse number 11 and 12 are intact and switch the ignition on. Battery voltage should now be available at pin 'T' of the loom socket.

'Park' anti-theft switch circuit

1. Using a suitable length of cable connect pin 'P' of the actuator loom socket to earth. This action should produce an audible 'click' as the anti-theft relay at the rear of the switchbox operates.

Continued...

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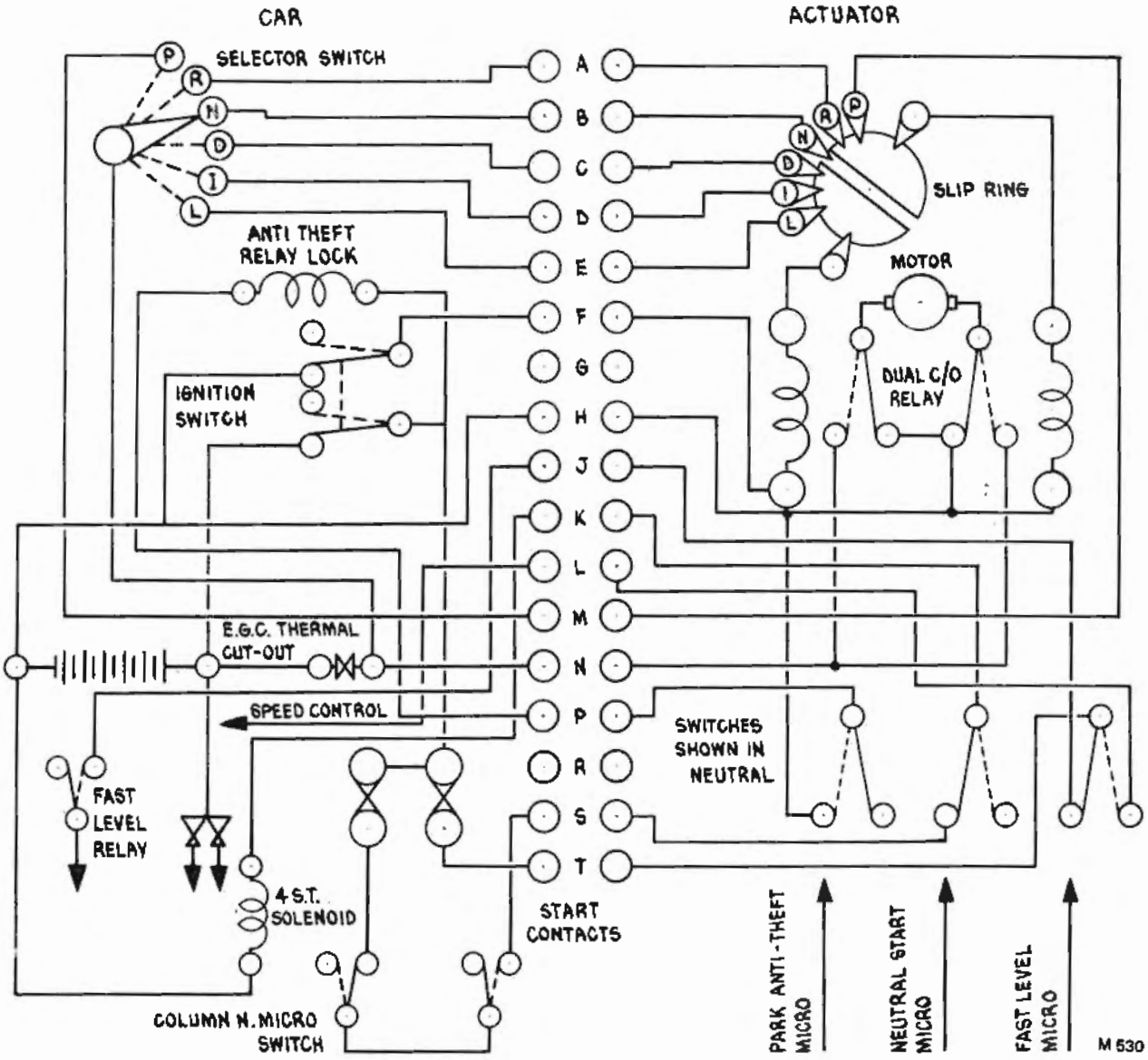

Fig.1 Theoretical Wiring Diagram

Continued...

'Neutral' start switch circuit

1. Place the gear range selector lever in the 'Neutral' position.

2. Check that each time the ignition key is turned to the 'Start' position, battery voltage appears at pin 'S' of the loom socket.

3. Repeat the above operation with the gear range selector lever in the 'Park' position.

4. Disconnect the thin Brown cable from the 'Lucar' connector of the starter motor solenoid.

5. Using a suitable length of cable connect pins 'S' and 'K' together. The starter relay on the longeron should now operate each time the ignition key is turned to the 'Start' position.

6. Fit the Brown cable back to the starter motor solenoid.

Fast level switch circuit

1. Using a suitable length of cable connect pins 'T' and 'J' together. This action should cause the fast levelling solenoid to operate.

Note If a fault is discovered in the switch circuits during any of the above tests, the fault should be traced and rectified; then the test repeated.

If no fault is found in the switch circuits this would indicate that the actual switches in the gearbox actuator are in need of adjustment or renewal.

The procedure for renewal and/or adjustment of these switches is contained in Figure 2 of this Service Bulletin.

TEST PROCEDURE FOR ACTUATOR

1. Ensure that the gearchange thermal cut-out switch on the distribution board (fuse panel) has not cut-out. This can be done by depressing the red button on the thermal cut-out switch.

2. Disconnect the low tension cable from the distributor and turn the ignition switch to the 'On' position.

3. Slightly loosen the actuator loom socket and re-check the actuator function. This will reveal any poor contact which may exist between the plug and the socket.

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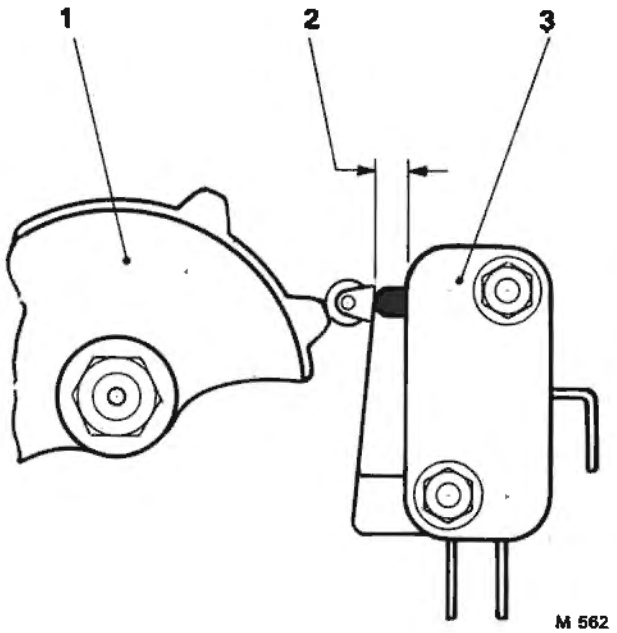

Fig.2 Adjustment of micro-switches

1. Cam
2. Gap 0.020 in. (0,51 mm.)
3. Micro-switch

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Gear Lever Position	P	R	N	D	I	L	General Information Notes
Socket Pin No.							
A	N	Pos	N	N	N	N	
B	N	N	Pos	N	N	N	
C	N	N	N	Pos	N	N	
D	N	N	N	N	Pos	N	
E	N	N	N	N	N	Pos	
F	Neg	Neg	Neg	Neg	Neg	Neg	This pin is Neg. when ignition is switched ON and Neutral when ignition is OFF.
H	Neg	Neg	Neg	Neg	Neg	Neg	This pin is permanently connected to earth.
M	Pos	N	N	N	N	N	
N	Pos	Pos	Pos	Pos	Pos	Pos	This pin is connected to the thermal cut-out switch.

Key.

Pos. Common with the battery Positive terminal.

Neg. Common with the battery Negative terminal.

N. Neutral - no connection to either terminal.

Fig. 3 - Test chart

Continued...

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4. Unscrew and withdraw the loom socket from the plug of the gearbox actuator.

5. Move the gear range selector lever to the 'Park' position and check that the pins of the actuator loom socket are of the correct polarity or are neutral as indicated in Figure 3.

Note Each pin in the socket is identified by a letter which is moulded into the rubber body adjacent to each pin.

6. Carry out the above operation in each of the gear range selector lever position, checking each pin in turn with the information given in Figure 3.

7. Switch off the ignition and ensure that pin 'F' is now neutral.

8. Connect the socket to the actuator and fit the distributor low tension cable.

Note If an incorrect reading is obtained during any of the above tests, this will indicate that the gearchange circuit is at fault and not the actuator. The correct procedure would then be to locate and correct the fault in the circuit and then repeat the test sequence.

It should also be noted that the voltage readings obtained must not be more than 0.5 Volt less than the battery voltage.

However, if the test sequence does not reveal a fault then the problem must be caused by a fault within the gearbox actuator.

Before removing the actuator however, the gearbox linkage should be disconnected from the actuator output lever and checked for excessive stiffness. The gearbox linkage should move into any gear when a load of approximately 10 lbs. (4,53 kg.) is applies to the disconnected rod.

If the linkage operation is satisfactory then it will be necessary to remove, re-condition and test the actuator as described in this Service Bulletin.

Continued...

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RE-CONDITIONING PROCEDURE

It should be noted that there are differences between the actuators fitted to cars equipped with Automatic Speed Control and those that are not. The differences are in the type and terminations of the micro-switches and in one of the cables to the height control switch.

1. Disconnect the gearbox linkage, the actuator loom plug and breather pipe; then remove the actuator from the car.

2. Remove the eight 2B.A. nuts and washers and carefully withdraw the side casing.

3. Remove the 0.250 in. (6,35 mm.) nut and washer and withdraw the cam noting the relative position between the cam and the output lever.

4. Disconnect all terminals on the contact plate, the dual relay and the micro-switches.

5. Remove the four 3B.A. nuts and withdraw the contact plate. It should be noted that on early actuators, two of the four studs are sleeved and these sleeves should be removed together with the contact plate.

6. Remove the nuts and bolts which secure the micro-switches and the dual relay to the contact plate. Discard the micro-switches, relay and contact plate.

7. Slacken the clamping bolt and remove the output lever.

8. Remove the washer and rubber boot; discard the boot.

9. Remove the circlip and thrust washer.

10. Withdraw the slip ring and gear assembly from the actuator case.

11. Remove and discard the contact segments from the slip ring.

12. Remove the three 0.250 in. (6,35 mm.) setscrews from the side of the actuator casing and carefully remove the motor assembly and drive collars. Remove the sealing ring from the actuator case.

13. Remove the internal circlip holding the bearing into the case and push the wormshaft and bearings out of the casing.

14. Remove the loom socket from the actuator casing.

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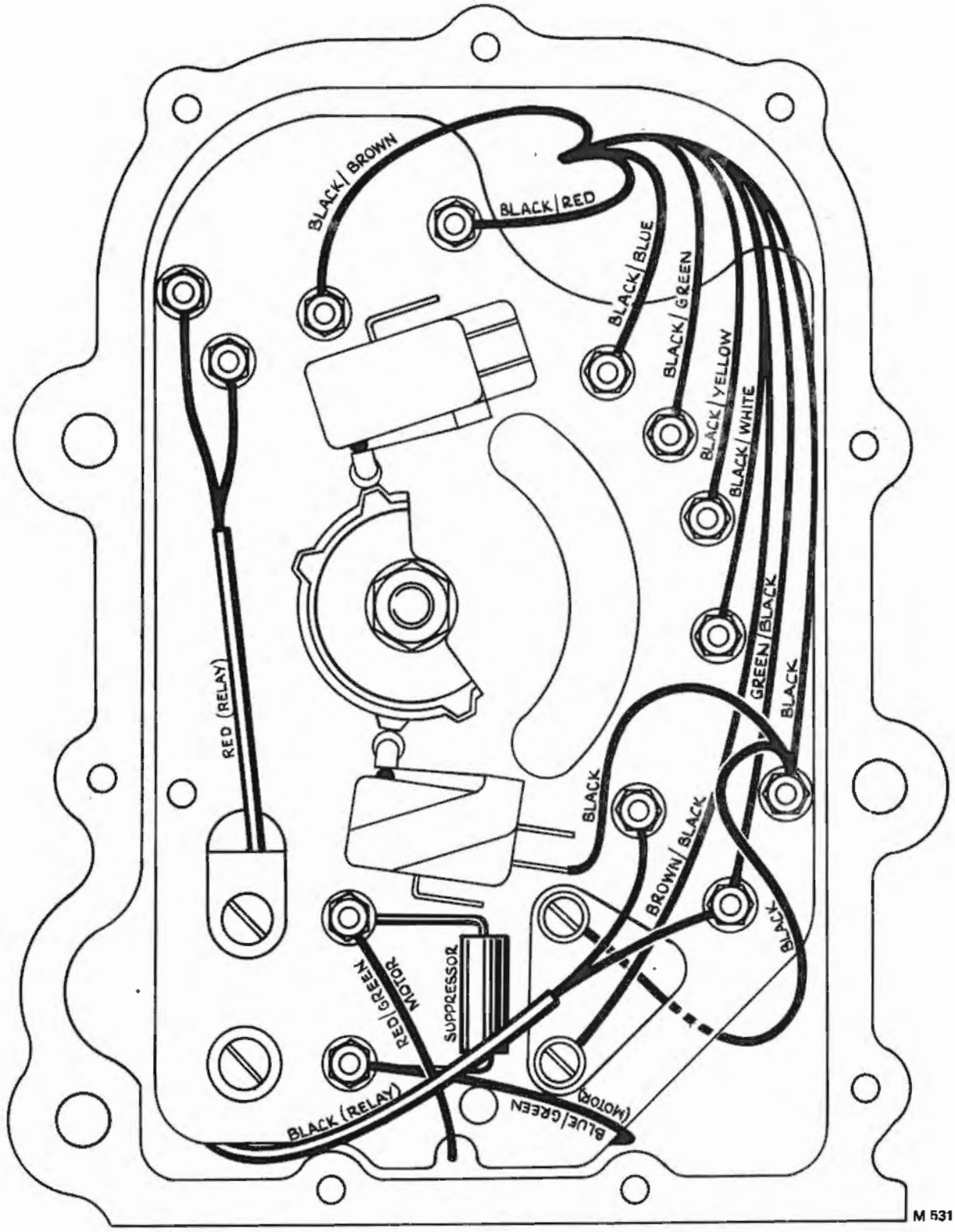

Fig.4 Connections to Contact Plate Assembly

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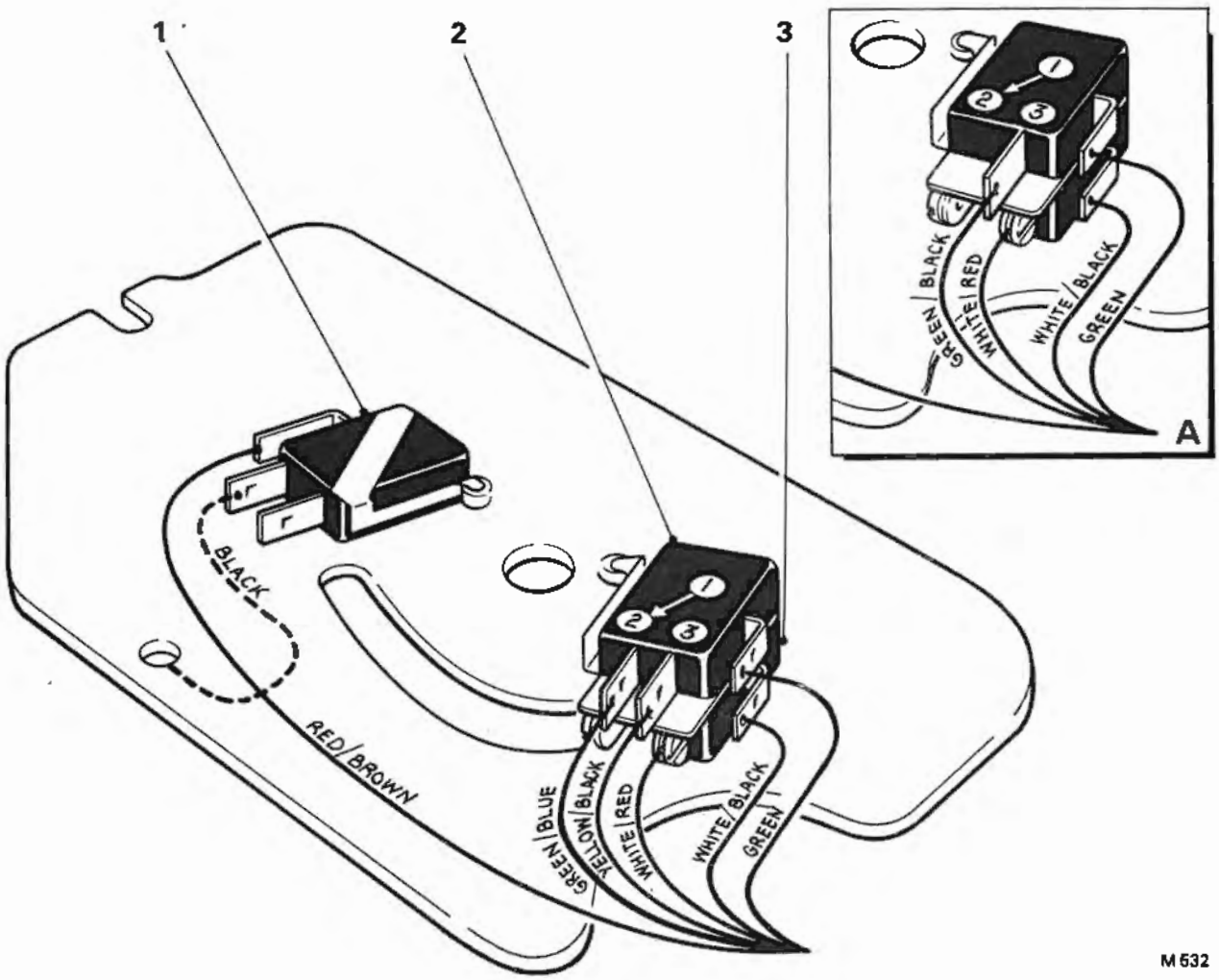

Fig. 5 Micro-switch connections

Inset A Connections for Automatic Speed Control cars

1. 'Park' micro-switch
2. Height control switch
3. Neutral start switch

Continued...

Note It will now be necessary to inspect and prepare certain components for re-use. These are as follows:

Actuator socket and cable assembly

Inspect the cables where they enter the pins of the plug. Ensure that no corrosion exists and that none of the individual cable strands have broken.

Actuator casing

Inspect all the sealing faces and the actuator casing and the side cover. Remove all traces of sealing joint and sealing compound.

Wormwheel

Inspect the wormwheel for abnormal wear of the teeth.

Wormshaft bearings

Inspect the bearings for undue wear or signs of roughness when rotated.

15. Remove the output shaft bearing from the actuator casing and press in the new bearing provided. The bearing should be fitted such that it is slightly proud on both the inside and outside of the casing.

Note This bearing is an oil retaining type and should not be soaked in any solvent.

16. Fit the wormshaft bearings to the wormshaft ensuring that the bearings are adequately lubricated with Esso Beacon grease.

17. Assemble the wormshaft and bearings into the actuator case. The bearings must be a slide fit in the casing bores. Adjust the end float of the wormshaft to between 0.002 in. and 0.005 in. (0,005 mm. and 0,012 mm.) using a suitable thickness of packing washer. Fit the circlip.

18. Fit new contact segments to the slip ring. Ensure that the edges of the segments are free of burrs.

19. Fit the slip ring and gear assembly into the main bush checking that the shaft is a slide fit in the bush. Lubricate the gear teeth with Esso Beacon grease. Use only the minimum amount of grease as any excess is liable to be thrown off.

Continued...

20. Fit the thrust washer and circlip to the output shaft.

21. Fit the rubber gaiter, washer and output lever to the shaft, noting the orientation of the output lever.

22. Check that the wormshaft can rotate freely. Rotate the wormshaft until the open circuit sections of the slip ring are at 90^{o} to the wormshaft and the flat side of the 'O' section of the output shaft inner end is uppermost.

23. Fit the splined collar and coupling onto the wormshaft.

24. Fit the new sealing ring provided to the groove in the case and pass the motor cables through the hole.

25. Mate the splined collar on the motor shaft with the nylon coupling.

26. Fit the three 0.250 in. (6,35 mm.) motor mounting bolts.

27. Check that the wormshaft is free to rotate.

28. Fit the dual relay provided to the new contact assembly and check the tightness of the 5B.A. terminal screws on the contact assembly.

Note This dual relay is a precision component and its internal settings can easily be upset by maltreatment.

29. Loosely fit the micro-switches to the contact plate assembly ensuring that the spring washers are fitted under the heads of the long 6B.A. screws in the slotted holes or under the nuts adjacent to the contact plate in the plain holes.

30. Loosely fit the contact plate assembly into the casing locating the sleeves, if fitted, on the studs and taking care not to damage the relay assembly and guiding the motor feed wires between the casing and the indentation in the contact base plate.

31. Fit the four 3B.A. nuts and washers to the contact plate and connect the motor feed cables and the suppressor across the relay mounting bolts as shown in Figure 4. All slack in the motor cables should be taken up by rotating the eyelets about the terminal posts.

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ACTUATOR SOCKET CONNECTIONS

SOCKET PIN NUMBER	CABLE COLOUR	DESTINATION
A	Black/red	to terminal R on contact plate
B	Black/blue	to terminal N on contact plate
C	Black/green	to terminal D on contact plate
D	Black/yellow	to terminal I on contact plate
E	Black/white	to terminal L on contact plate
F	Green/black	to 'ignition' terminal on the contact plate
G	THIS PIN IS NOT USED	
H	Black	to 'Earth' terminal of contact plate
J	Yellow/black	to normally open contact of fast level switch
K	White/red	to normally open position of neutral start switch
L	Green/blue	to normally closed position of fast levelling switch
M	Black/brown	to terminal P on contact plate
N	Brown/black	to normally open positions of dual relay
P	Red/brown	to pole position of park anti-thief switch
R	THIS PIN IS NOT USED	
S	White/black	to pole position of neutral start switch
T	Green	to pole position of fast levelling switch

Note On the pre-automatic speed control type of actuator the Yellow/black wire is replaced by a Green/black one and the Green/blue wire is deleted.

Continued...

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33. View the layout of the contacts onto the slip ring through the elongated hole in the contact plate and ensure that there is a minimum of 0.50 in. (1,27 mm.) between adjacent contacts as well as being approximately 0.062 in. (1,58 mm.) from either the edge of the segments or the countersinkings for the retaining screws.

34. Fit the rubber gasket and the socket assembly, guiding the cables through the casing and the aperture in the contact plate. The socket should be fitted so that the locating tong adjacent to pin A is uppermost on the sloping mounting face of the casing.

35. Fit all cables to their respective connections in accordance with Figs.1, 4 and 5. The longer cables to the contact plate should be fitted first, followed by the shorter cables and finally the micro-switch and relay connection. If the actuator involved was fitted with black micro-switches it will be necessary to suitably alter the cable connections to suit the new grey micro-switches provided. It is helpful to sort out the wires into their respective positions before attachment. It should be noted that when making connections to the 5B.A. terminal screws on the contact plate extreme care should be used when fitting the terminal securing nuts as if these are tight the first nut on the terminal will be loosened resulting in a poor connection.

36. Fit the actuator onto the gearbox mounting bracket and refit the loom plug to the actuator.

37. Remove the low tension cable from the ignition distributor; switch on the ignition and check that the actuator will select all six gear stations correctly.

38. Move the gear selector lever to 'D' and fit the micro-switch cam to the actuator output shaft. When tightening the 0.250 in. (6,35 mm.) nut, the torque reaction should be taken by gripping the output lever such that the tightening force is not absorbed by the nylon teeth of the wormwheel.

39. Move the gear range selector lever to the 'Park' position.

40. Locate the two micro-switches adjacent to the actuator socket (neutral start and fast levelling switches). Move the switches towards the peak of the cam until the switch plungers are in the centre of the peak and are depressed to within 0.020 in. (0,51 mm.) of the switch body as shown in Figure 5. When both switches are in the correct position, tighten the mounting bolts.

Continued...

41. Repeat this procedure on the left-hand micro-switch which operates the 'Park' anti-thief device.

42. Select 'Reverse' gear and check that all three switches are clear of the cams.

43. Select 'Neutral' and ensure that the right-hand pair of switch plungers are correctly depressed and that the right-hand micro-switch is clear of the cam.

44. Switch off the ignition and fit the distributor low tension cable.

45. Remove the actuator from the car and fit the casing side cover, painting both sides of the new gasket provided with a suitable jointing compound. Fit the actuator to the gearbox, connecting the loom plug and the actuator linkage.

TEST AFTER RE-CONDITIONING

1. Disconnect the earth cable from the battery.

2. Connect an ammeter capable of reading at least 15 amps between the battery negative terminal and the loose end of the earth cable.

3. Ensure that all accessories such as the rear window demister and blower motors are switched off and then switch on the ignition. Note the reading shown on the ammeter.

4. Move the gear range selector lever progressively through each gear position and check that the extra reading on the ammeter caused by the operation of the actuator does not exceed 7.50 amps.

5. Check that the actuator moves smoothly and quietly to each position selected and that the output lever stops in the correct position and does not 'hunt' about that position before finally stopping.

6. Remove the ammeter and reconnect the battery negative cable.

PARTS REQUIRED FOR RE-CONDITIONING

RH 2534	Actuator kit	1 off

TIME ALLOWED

For removal, re-conditioning, replacement and testing - 4 hours.

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CATEGORY C

GOVERNOR LUBRICATION

APPLICABLE TO:

All Rolls-Royce Silver Shadow, Bentley 'T' Series and all Rolls-Royce and Bentley Corniche cars fitted with Torque Converter Transmission having a serial number after 72 RR 2268.

DESCRIPTION

All transmissions produced prior to the above serial numbers were fitted with an output shaft having an axial lubrication passage which takes lubricant to a point rearwards of the speedometer drive gear. From this point the lubricant would pass through a radial drilling to the governor sleeve, thereby providing lubrication for the governor.

On transmissions produced after serial number 72 RR 2268 the governor lubrication is provided by a flat on the governor sleeve which allows oil to pass to the moving parts of the governor. The output shaft of these transmissions is not provided with any lubricating passages.

In view of these changes it is most important that the new shaft without the oil passage and the governor with the lubrication flat are used only on later transmissions.

Fitting the incorrect part may result in damage due to lack of lubrication.

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CATEGORY C

THE GEARBOX ACTUATOR

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Corniche cars and all Bentley 'T' Series and Corniche cars.

DESCRIPTION:

In the past there have been a number of internal alterations to the gearbox actuator and as there are no external means of identification it is possible that confusion may arise in identifying the various types of actuators.

This Service Bulletin is therefore intended to provide definite identification of each actuator type, to indicate which cars the various types will fit, and where applicable to detail slight changes which will enable one type to replace another.

The chart on the following pages gives details on application of actuators.

For checking and reconditioning procedures - Service Bulletins SY/GM31 and SY/GM38 should be consulted.

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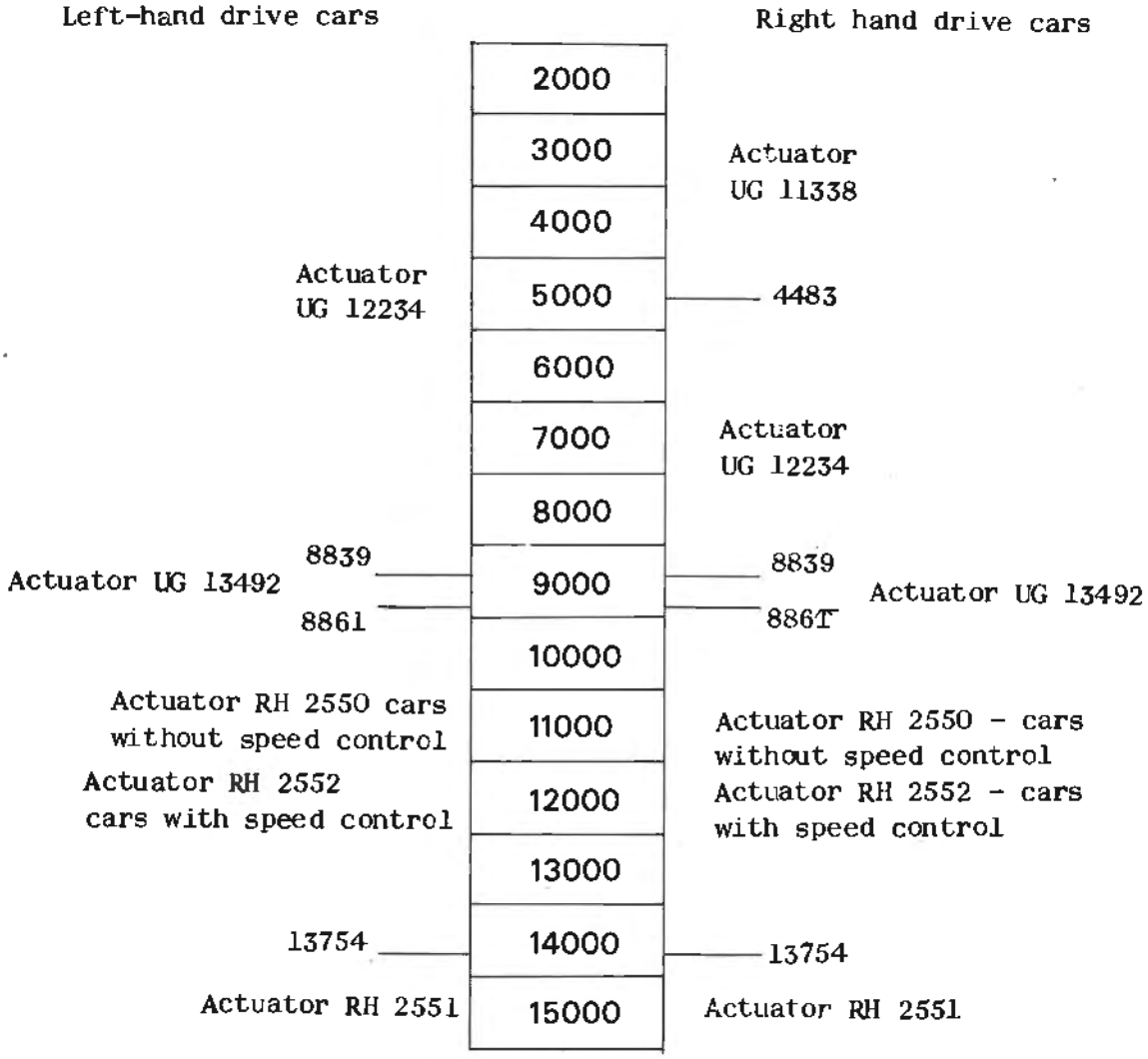
ACTUATOR APPLICATION CHART



NOTE:

On no account should an RH 2550 actuator be fitted to any car which is equipped with speed control or Kangol seat belts.

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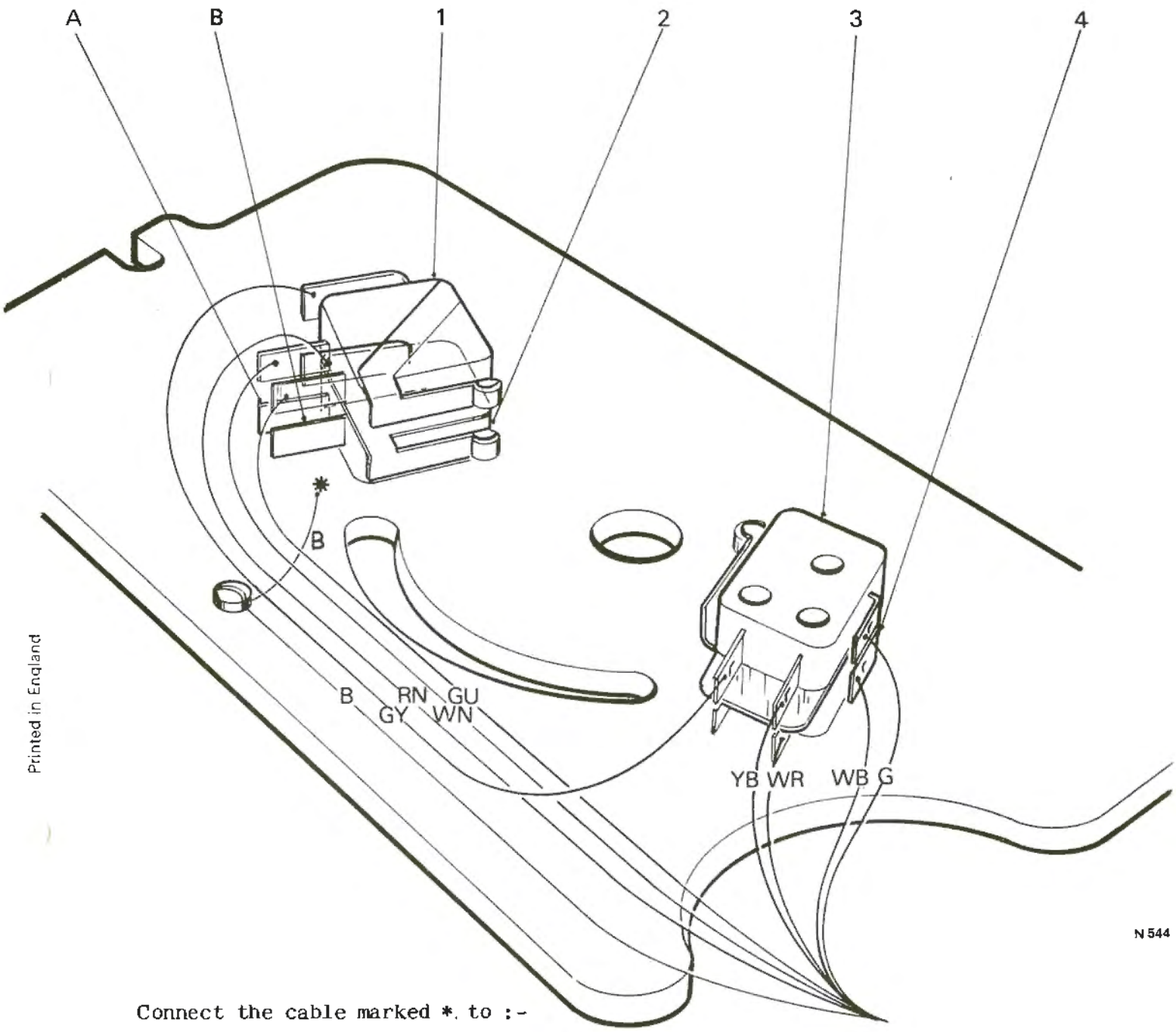

Connect the cable marked *. to :-

Terminal B on cars after SRH 13754
Terminal A on cars before SRH 13754

See text for full range of car serial numbers.

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ACTUATOR INTERCHANGEABILITY

Whilst the chart gives the correct actuator part number for each different car specification, in a number of cases interchangeability can be effected quite simply.

Details are as follows :-

1. Actuator RH 2552 can also be used on any car produced between car serial numbers 8861 and 13754 which were originally fitted with actuator RH 2550. Fitting RH 2552 will mean that the new actuator will have a speed control switch that is surplus to requirements, and in all other details the actuators are identical.

2. Actuator RH 2551 is fitted to all cars after SRH 13754. It should be noted that this car serial number is only an approximate number, the full list of numbers being as follows :-

   All Standard saloons - left and right-hand drive - SRH 13754 onwards.

   Coachbuilt saloons for North America - CRA 13459 onwards.

   Coachbuilt saloons other than for North America - CRH 13984.

   Convertible cars for North America - DRA 13413 onwards.

   Convertible cars other than for North America - DRH 13861 onwards.

   Long Wheelbase cars for North America - LRA 13921 onwards.

   Long Wheelbase cars other than for North America LRX 13973 onwards.

   Actuator RH 2551 can also be fitted to any car produced between car serial number 8861 and 13754 providing that a simple alteration to the internal wiring is effected.

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The alteration consists of :-

1. Remove the side cover plate from the actuator.

2. Locate the park anti-theft micro switch which is the one bolted directly to the base plate and carries a Black cable and a Red/Brown cable, as shown in Fig.1.

3. Remove the Black cable from the switch terminal and connect it to the remaining empty terminal of the same switch.

4. Replace the actuator side cover plate using a new gasket, part number UG 11279.

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CATEGORY C

GEARBOX IDENTIFICATION

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Corniche cars and all Bentley 'T' Series and Corniche cars fitted with 1973 Emission Control systems and produced after the following car serial numbers :-

SRB 14954 DRB 14991

CRB 15052 LRB 15056

DESCRIPTION:

The torque converter gearboxes are identified by a nameplate which is rivetted to the right-hand side of the gearbox casing. On this nameplate is the year of manufacture followed by the letters 'RR' and an individual gearbox serial number.

The gearboxes fitted to cars produced after the above car serial numbers are equipped with modulator valves which are internally different from those previously used. To denote this change the letters stamped on the gearbox identification plate have been changed from R.R. to R.S. The Rolls-Royce part number of the gearbox assembly has also been changed and is now UG 13822.

It is important that only gearboxes having the letters R.S. on the identification plate are fitted to cars produced after the above car serial numbers. It should also be noted that these later gearbox assemblies or their modulator valves, must not be fitted to earlier cars or the transmission gearchange pattern will be affected.

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CATEGORY C

GEARBOX IDENTIFICATION

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Corniche cars.

All Bentley 'T' Series and Corniche cars.

DESCRIPTION:

The torque converter gearboxes fitted to the above cars are identified by a nameplate which is rivetted to the right-hand side of the gearbox casing. On this nameplate is the year of manufacture followed by the letters R.R. and an individual gearbox serial number.

The gearboxes fitted to all cars equipped with 1973 Emission Control systems produced after car serial numbers:

SRB 14954 DRB 14991

CRB 15052 LRB 15056

are fitted with a modulator valve which is internally different from those previously used. To denote this change, the letters stamped on the gearbox identification plate have been changed from R.R. to R.S. The part number of the new modulator valve is 3027842.

The modulator fitted to cars not equipped with Emission Control systems remains unchanged - the part number being 8625976.

The new gearbox assembly, part number UG 13832 can be fitted to both cars not having Emission Control systems and earlier cars, providing that the modulator is replaced by the one from the displaced gearbox and the instructions given in Spares Information Sheets 4.G.41 and 4.G.48 are carried out as required.

It is important that all cars equipped with 1973 Emission Control systems are fitted with the new modulator.

Fitting the incorrect type of modulator valve to any car will result in the transmission gearchange pattern being affected.

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CATEGORY C

THE GEARBOX ACTUATOR BREATHER PIPE

APPLICABLE TO:

All Rolls-Royce Silver Shadow and Corniche cars and all Bentley 'T' Series and Corniche cars produced after the following car serial numbers

SRH 15279	DRB 15204
CRH 15205	LRB 15265

DESCRIPTION:

In order to improve the ventilation of the gearbox actuator, the material and point of termination of the breather pipe have been changed.

The new breather pipe terminates in the lower skin of the drive-shaft tunnel as opposed to the old breather pipe which terminated in the crossmember at the rear of the gearbox. This new arrangement allows the actuator to breathe into the dry atmosphere of the passenger compartment of the car.

The material of the breather pipe has been changed from the white soft plastic of the old pipe to a black rubber material.

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