

## SECTION Fa

### THE AUTOMATIC TRANSMISSION

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### GENERAL DESCRIPTION

The automatic transmission incorporates a three-element fluid torque converter with a maximum torque conversion ratio of 2 : 1 coupled to a bevel gear train which provides four forward gears and reverse.

Engine power is transmitted from the crankshaft converter output gear through an idler gear to the input gear which drives the bevel reduction gears in the gear train assembly.

The final drive is transmitted from a drive gear to a conventional-type differential unit (similar to that fitted to a synchromesh transmission unit), which in turn transmits engine power through two flange-type coupling drive shafts employing constant velocity joints to the road wheels.

The complete gear train assembly, including the reduction gear and differential units, runs parallel to, and below, the crankshaft and is housed in the transmission casing which serves also as the engine sump.

The system is controlled by a selector lever within a gated quadrant marked with seven positions, and mounted centrally on the floor of the car. The reverse, neutral, and drive positions are for normal automatic driving, with the first, second, third, and fourth positions used for manual operation or over-ride as required. This allows the system to be used as a fully automatic four-speed transmission, from rest to maximum speed with the gears changing automatically according to throttle position and load. If a lower gear is required to obtain greater acceleration, an instant full throttle position, i.e. 'kick-down' on the accelerator, immediately produces the change.

Complete manual control of all four forward gears by use of the selector lever provides rapid changes. However, it is very important that downward changes are effected at the correct road speeds otherwise serious damage may result to the automatic transmission unit. The second, third, and top gears provide engine braking whether driving automatic or manual; in first gear a free-wheel condition exists when decelerating. Manual selection to third or second gear gives engine braking and also allows the driver to stay in a particular lower gear to suit road conditions or when descending steep hills.

#### The hydraulic system

Oil is drawn from the transmission casing through the main gauze strainer and pick-up pipe by the main oil pump which has a high potential output and serves both the engine lubrication and transmission systems with a common oil supply. The oil passes through drillings in the cylinder block and a pipe to the external full-flow filter and thence to the valve block.

The valve block assembly controls pressures to the transmission. Separate valves control the converter and engine pressures. The oil passes from the valve block through a long connecting pipe to the converter stator unit. Three short interconnecting pipes take the necessary line pressure to each of the servos which control brake band operation in manual and automatic selector positions.

The power flow through the bevel reductions gear is coupled to the final drive gear pinion by means of two multi-disc clutch assemblies operated hydraulically in manual and the automatic selector positions.

In the event of tow-starting the engine, an auxiliary oil pump of low capacity is employed which is responsive to vehicle speed only; immediately the engine starts the main pump automatically takes over.

#### The governor system

The governor is driven by the auxiliary pump gears and is of the spring-loaded mechanical type, with its bobweights mounted on short links. A rod linkage transfers the movement to the governor valve incorporated in the valve block chest.

A spring-loaded rod connected to the carburetter provides an over-ride device. The spring tends to be compressed by accelerator pedal operation, and transfers this load by levers to the governor. The effect is to delay travel of the governor, which in turn delays gear shifts more as the accelerator is depressed.

#### The torque converter

This is fitted onto a taper on the rear of the crankshaft. Basically it comprises three elements, i.e. an impeller, a turbine, and a stator, but it is only serviced as a unit.

There is a continuous supply of oil circulating through the unit; this assists in dissipating the heat generated, and the out-flow passes through a low-pressure valve which maintains a 30 lb./sq. in. (2.1 kg./cm.<sup>2</sup>) pressure within the converter to improve efficiency.

#### The brake bands and servos

Three brake bands are used. One is for reverse and the others provide second and third speed reactions. The clamping load is applied by three hydraulic servos in a common casing.

#### The multi-disc clutches

For forward motion a single-piston multi-disc clutch carries the drive and is engaged at all times during forward motion of the car. This forward clutch unit is fitted on one side of the final drive pinion and on the other side is a top and reverse clutch assembly which has a tandem piston arrangement. This feature is necessary because the clutch is also engaged for reverse and since a greater torque capacity is required in this case both pistons are pressurized.

#### The valve block

This assembly is constructed of three sections, i.e. the lid, valve chest, and pipe chest.

A linkage arrangement locates the selector valve and this in turn is controlled by the selector rod, externally connected by cable to the gear selector lever in the car. The function of the various valves is as follows:

*The selector valve*, directs oil from the main supply to either the governor valve for automatic gear-shifting or alternatively to the appropriate clutch or servo for manual selection.

*The regulator valve* controls the main line pressure, a secondary piston on the valve boosts this pressure when reverse is selected.

*The governor valve* movement is controlled by the mechanical governor and it directs the oil flow to the appropriate clutch or servo for automatic gear-shifts.

*The relay valves* are used for shifts from second to third and third to top. They enable the clutch or servo required to be supplied either from the selector valve in 'manual' control or the governor valve in 'automatic'. In addition, pistons are fitted in front of the second and third relay valves to ensure that on up-shifts the engagement of the new ratio and release of the old occur simultaneously to prevent engine overspeeding between shifts. A relay valve is not required for the first gear as the torque reaction is controlled mechanically by a one-way clutch.

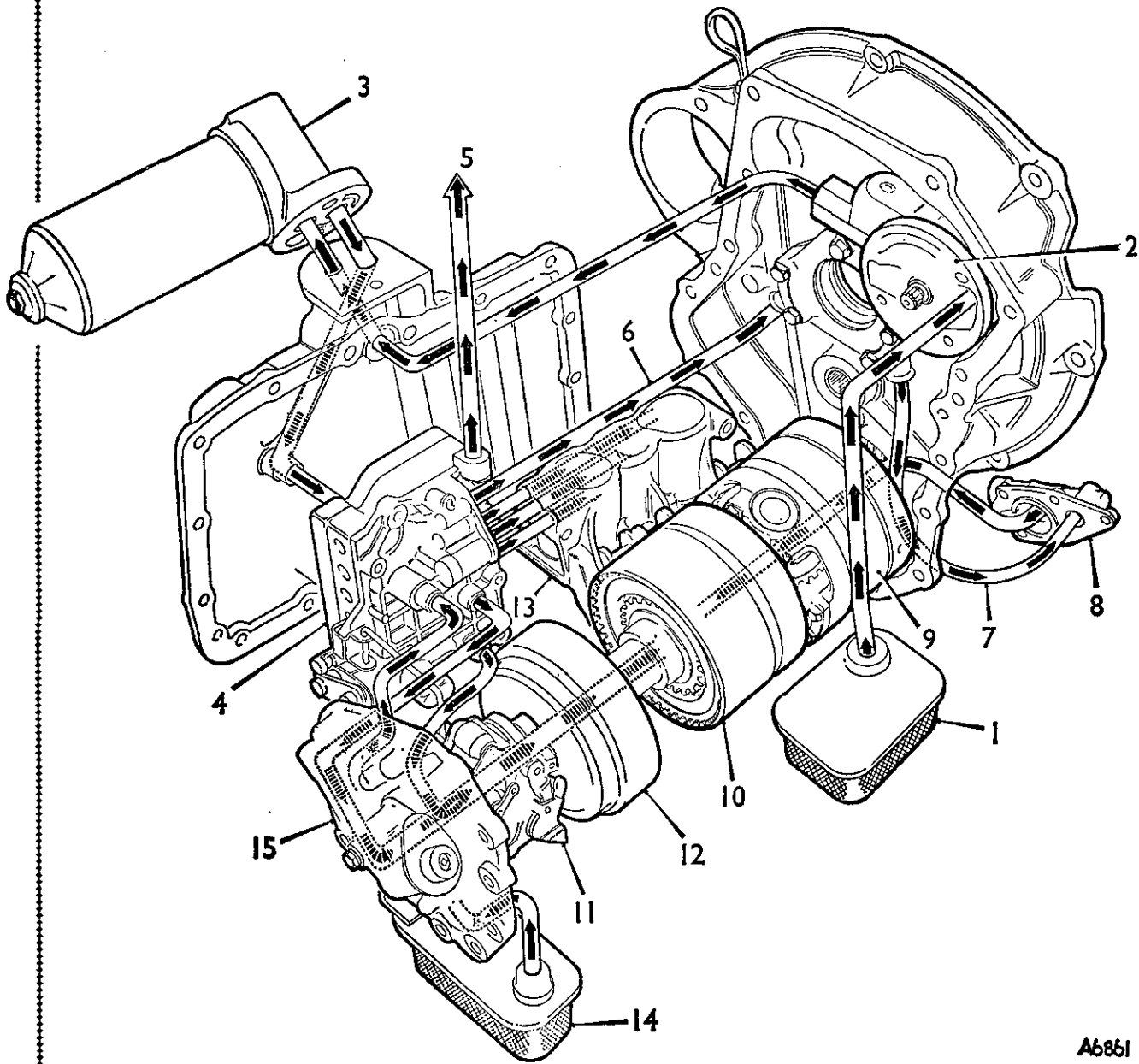
*The tow-start valve* short-circuits the auxiliary pump under all normal driving conditions but supplies the required line pressure for tow-starting. Immediately the engine starts the main pump automatically takes over.

#### **The low-pressure valve**

This valve controls the pressure in the converter to 30 lb./sq. in. (2.1 kg./cm.<sup>2</sup>). When the engine is stopped the valve is seated, preventing the converter draining. This avoids difficulties in checking the combined engine/transmission oil level and prevents a noisy and inefficient converter when restarting the engine.

#### **The auxiliary pump**

This unit is used for tow-starting. It is of limited capacity and is responsive to road speed only.



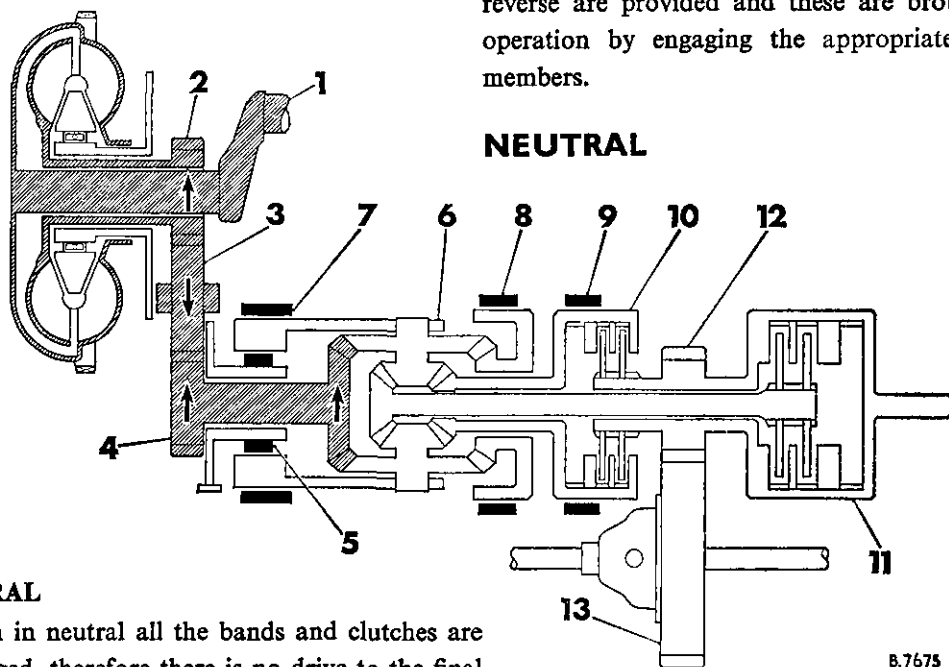
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*The components of the automatic transmission with the lubrication system and 'power flow' indicated by arrows to the various components*

- |                         |  |                                  |
|-------------------------|--|----------------------------------|
| 1. Main oil strainer.   | 6. Converter feed pipe.                  | 11. Governor.                    |
| 2. Oil pump.            | 7. Converter to low pressure valve feed. | 12. Forward clutch.              |
| 3. Oil filter assembly. | 8. Low pressure valve.                   | 13. Servo unit.                  |
| 4. Valve block.         | 9. Gear train.                           | 14. Auxiliary pump oil strainer. |
| 5. Engine oil feed.     | 10. Top and reverse clutch.              | 15. Auxiliary pump.              |

POWER FLOW DIAGRAMS (MECHANICAL)

The power flow diagrams indicate how the various ratios are obtained. Four speeds and reverse are provided and these are brought into operation by engaging the appropriate friction members.



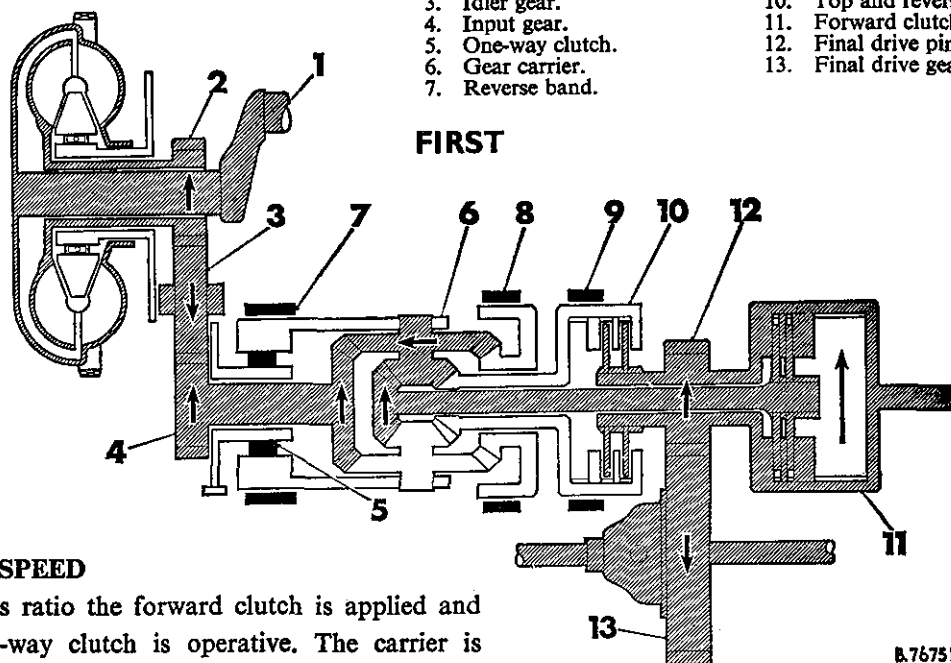
**NEUTRAL**

When in neutral all the bands and clutches are disengaged, therefore there is no drive to the final drive pinion.

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KEY TO COMPONENTS

- |                           |                             |
|---------------------------|-----------------------------|
| 1. Crankshaft             | 8. Third gear band.         |
| 2. Converter output gear. | 9. Second gear band.        |
| 3. Idler gear.            | 10. Top and reverse clutch. |
| 4. Input gear.            | 11. Forward clutch.         |
| 5. One-way clutch.        | 12. Final drive pinion.     |
| 6. Gear carrier.          | 13. Final drive gear.       |
| 7. Reverse band.          |                             |



**FIRST**

**FIRST SPEED**

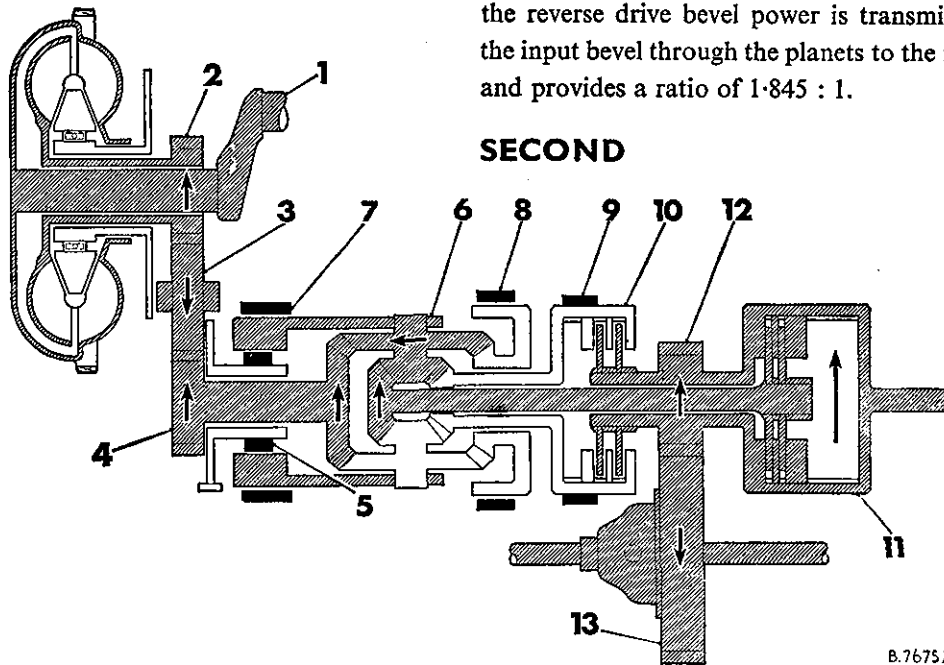
In this ratio the forward clutch is applied and the one-way clutch is operative. The carrier is stationary, its reaction being controlled by the one-way clutch. The input bevel drives the planet wheels and the planet pinions drive the forward output pinion and shaft. Thus power is transferred through the planet assemblies to the mainshaft, forward clutch, and the output gear, providing a ratio of 2.69 : 1.

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### POWER FLOW DIAGRAMS (MECHANICAL)

#### SECOND SPEED

As for all forward gears the forward clutch remains engaged, and in addition the second speed brake band applied. This controls the reaction which is imposed on the reverse drive bevel when in this ratio. With the planet cluster orbiting around the reverse drive bevel power is transmitted from the input bevel through the planets to the mainshaft and provides a ratio of 1.845 : 1.

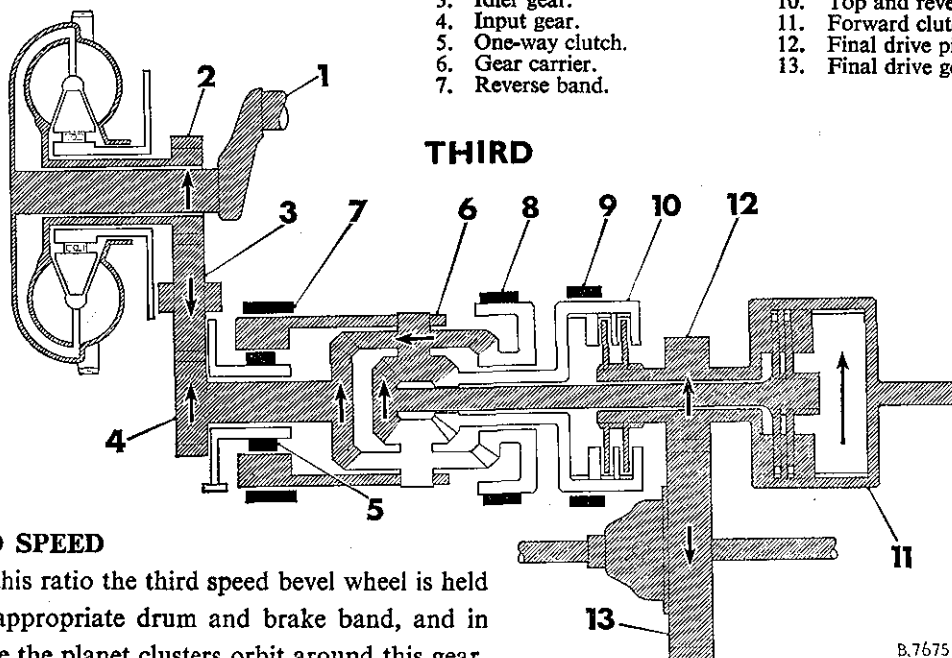


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#### KEY TO COMPONENTS

- |                           |                             |
|---------------------------|-----------------------------|
| 1. Crankshaft.            | 8. Third gear band.         |
| 2. Converter output gear. | 9. Second gear band.        |
| 3. Idler gear.            | 10. Top and reverse clutch. |
| 4. Input gear.            | 11. Forward clutch.         |
| 5. One-way clutch.        | 12. Final drive pinion.     |
| 6. Gear carrier.          | 13. Final drive gear.       |
| 7. Reverse band.          |                             |

#### THIRD



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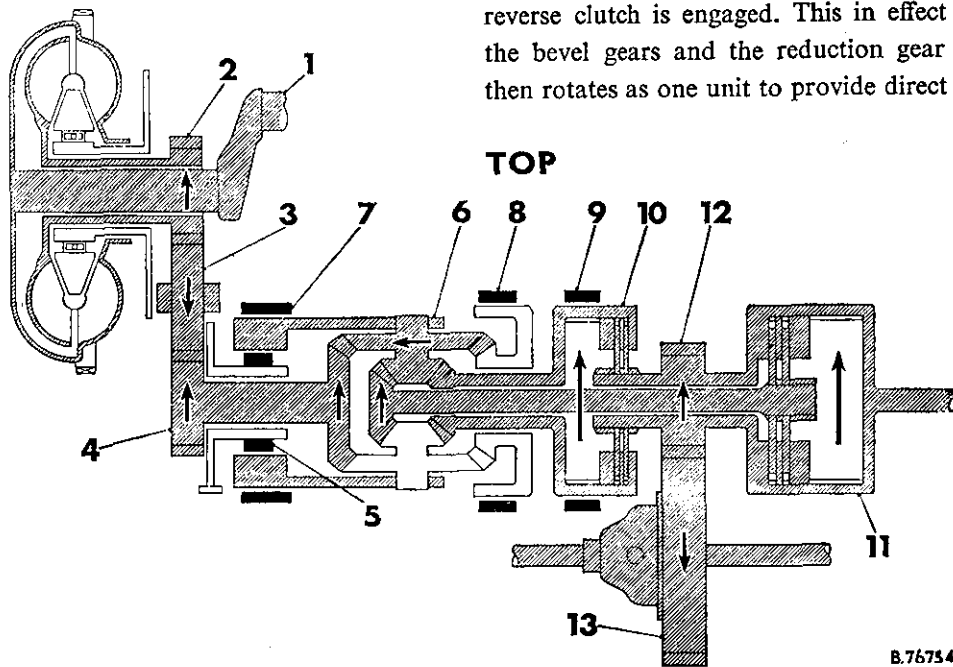
#### THIRD SPEED

For this ratio the third speed bevel wheel is held by its appropriate drum and brake band, and in this case the planet clusters orbit around this gear. Like second speed, power is transmitted from the input bevel through the planets to the mainshaft and in this case provides a ratio of 1.46 : 1.

POWER FLOW DIAGRAMS (MECHANICAL)

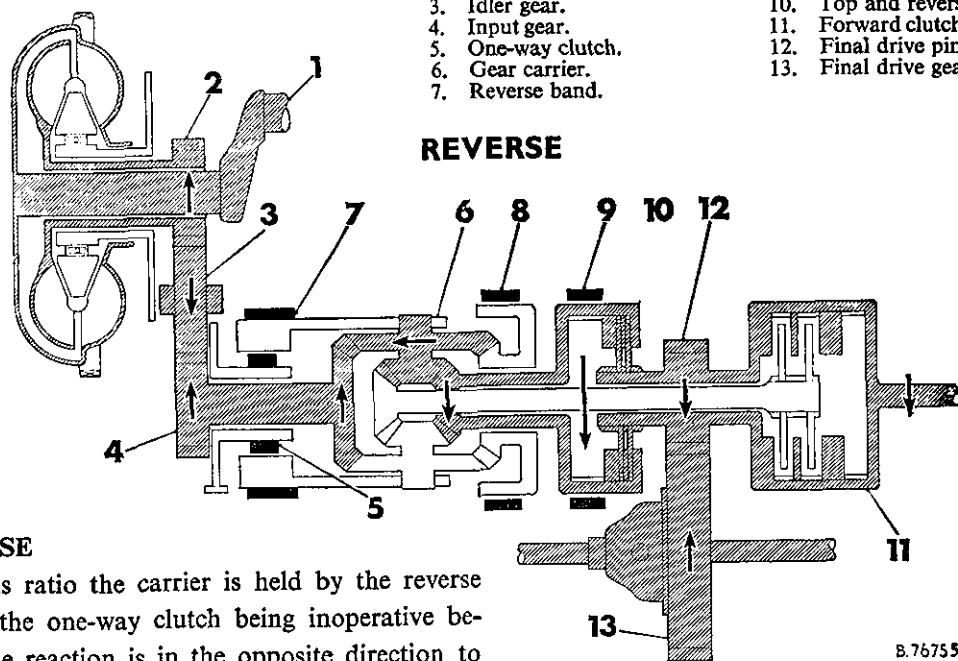
TOP SPEED

In addition to the forward clutch, the top and reverse clutch is engaged. This in effect locks up the bevel gears and the reduction gear assembly then rotates as one unit to provide direct drive.



KEY TO COMPONENTS

- |                           |                             |
|---------------------------|-----------------------------|
| 1. Crankshaft.            | 8. Third gear band.         |
| 2. Converter output gear. | 9. Second gear band.        |
| 3. Idler gear.            | 10. Top and reverse clutch. |
| 4. Input gear.            | 11. Forward clutch.         |
| 5. One-way clutch.        | 12. Final drive pinion.     |
| 6. Gear carrier.          | 13. Final drive gear.       |
| 7. Reverse band.          |                             |



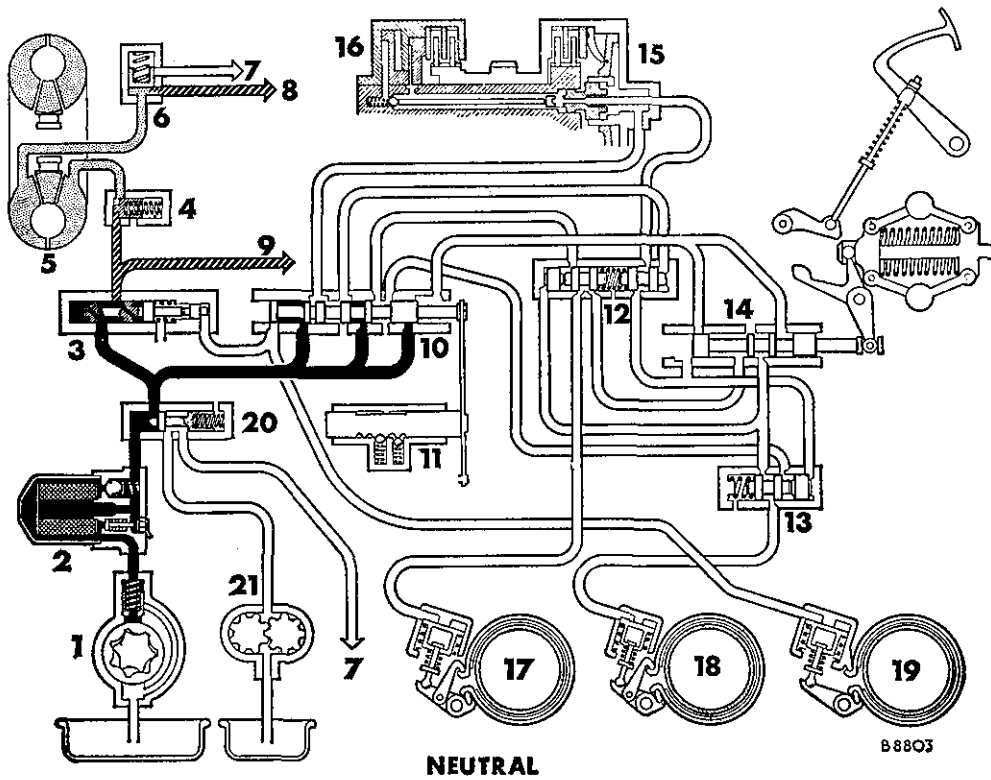
REVERSE

In this ratio the carrier is held by the reverse band—the one-way clutch being inoperative because the reaction is in the opposite direction to first speed).



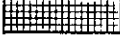

In addition the top and reverse clutch is engaged.

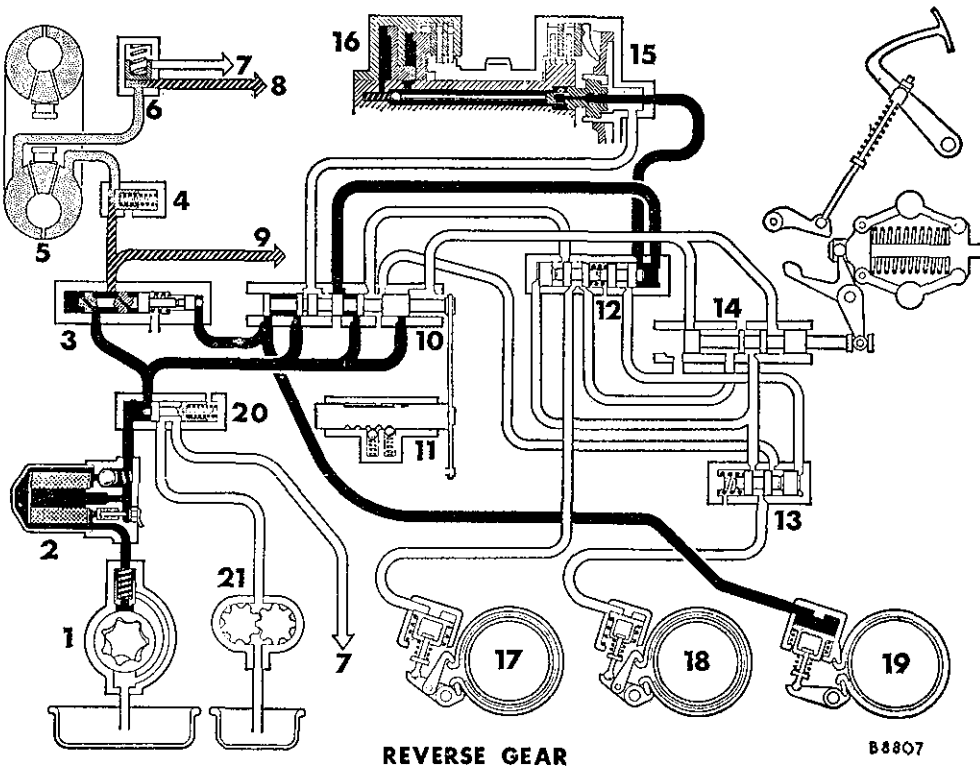
The input bevel wheel drives the planet wheel and the planet pinion drives the reverse drive gear. Thus power is transmitted through the planet assemblies to the top and reverse clutch and thence to the final drive pinion to provide a ratio of 2.69 : 1.

### LINE PRESSURE AND LUBRICATION DIAGRAMS



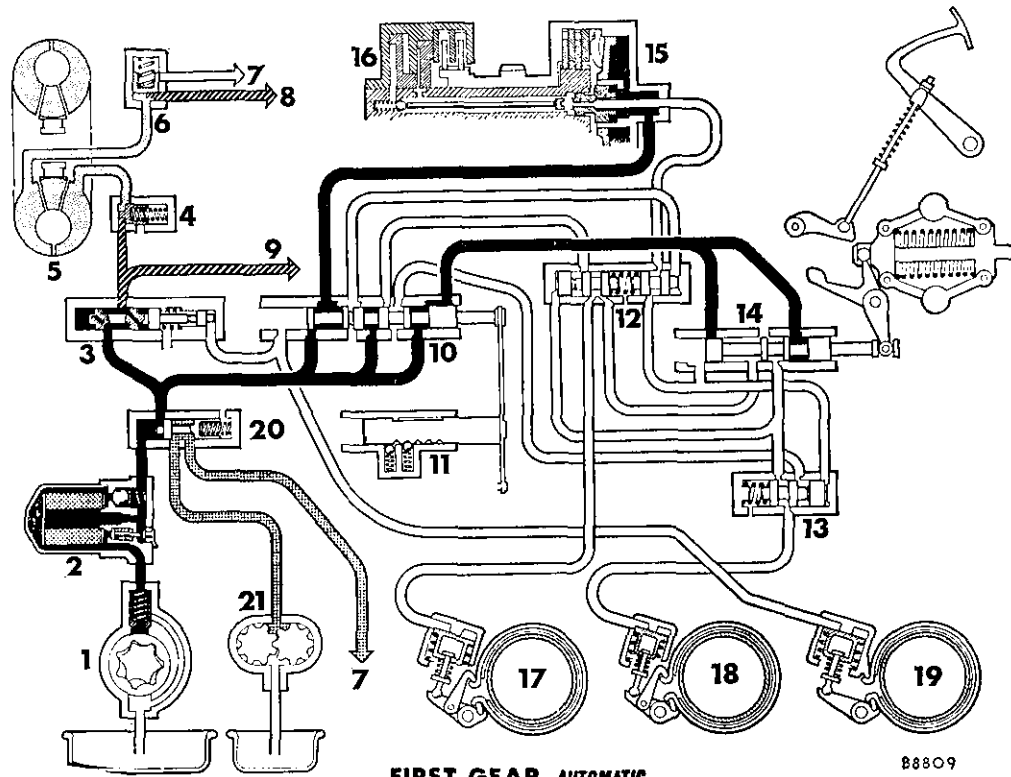
#### KEY TO DIAGRAM

- |                                     |                                 |  |
|-------------------------------------|---------------------------------|--|
| 1. Main oil pump.                   | 12. Second and top gear valves. |  Line pressure.      |
| 2. Oil filter.                      | 13. Third gear valve.           |  Lubrication.        |
| 3. Regulator valve.                 | 14. Governor valve.             |  Exhaust.            |
| 4. Engine lubrication relief valve. | 15. Forward clutch.             |  Converter pressure. |
| 5. Converter.                       | 16. Top and reverse clutch.     |  |
| 6. Low pressure valve.              | 17. Second gear brake band.     |  |
| 7. Engine lubrication.              | 18. Third gear brake band.      |  |
| 8. Gear train lubrication.          | 19. Reverse gear brake band.    |  |
| 9. Engine lubrication.              | 20. Tow start valve.            |  |
| 10. Selector valve.                 | 21. Auxiliary pump.             |  |
| 11. Selector valve detent.          |                                 |  |
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LINE PRESSURE AND LUBRICATION DIAGRAMS



FIRST GEAR *AUTOMATIC*

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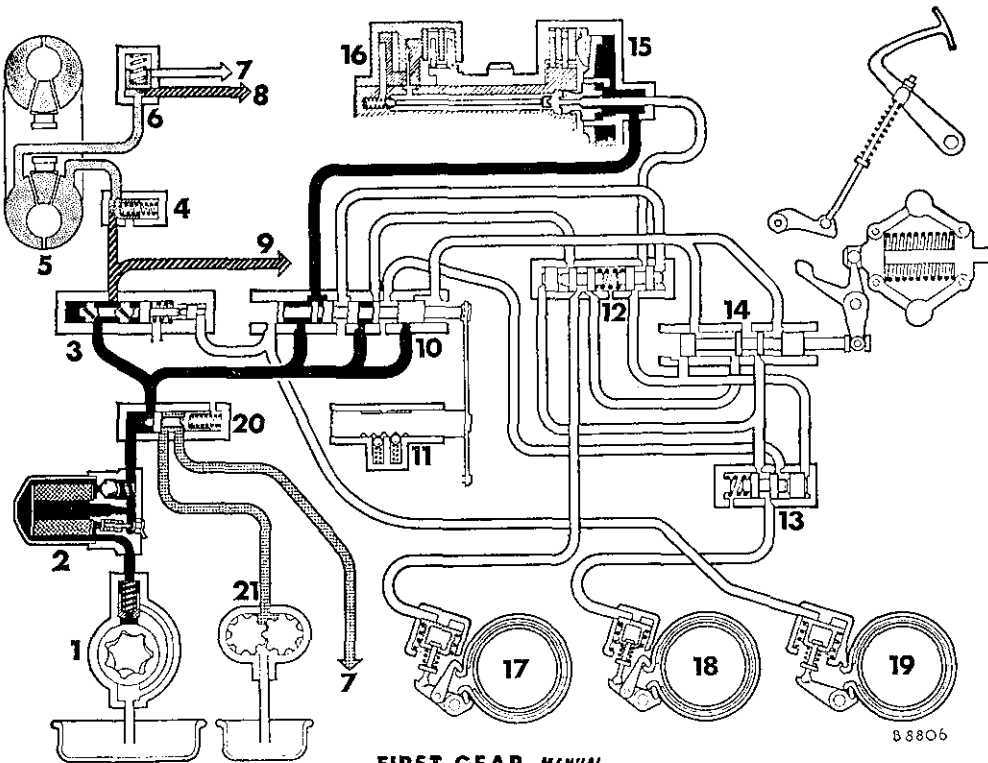
KEY TO DIAGRAM

- 1. Main oil pump.
- 2. Oil filter.
- 3. Regulator valve.
- 4. Engine lubrication relief valve.
- 5. Converter.
- 6. Low pressure valve.
- 7. Engine lubrication.
- 8. Gear train lubrication.
- 9. Engine lubrication.
- 10. Selector valve.
- 11. Selector valve detent.

- 12. Second and top gear valves.
- 13. Third gear valve.
- 14. Governor valve.
- 15. Forward clutch.
- 16. Top and reverse clutch.
- 17. Second gear brake band.
- 18. Third gear brake band.
- 19. Reverse gear brake band.
- 20. Tow start valve.
- 21. Auxiliary pump.

- Line pressure.
- Lubrication.
- Exhaust.
- Converter pressure

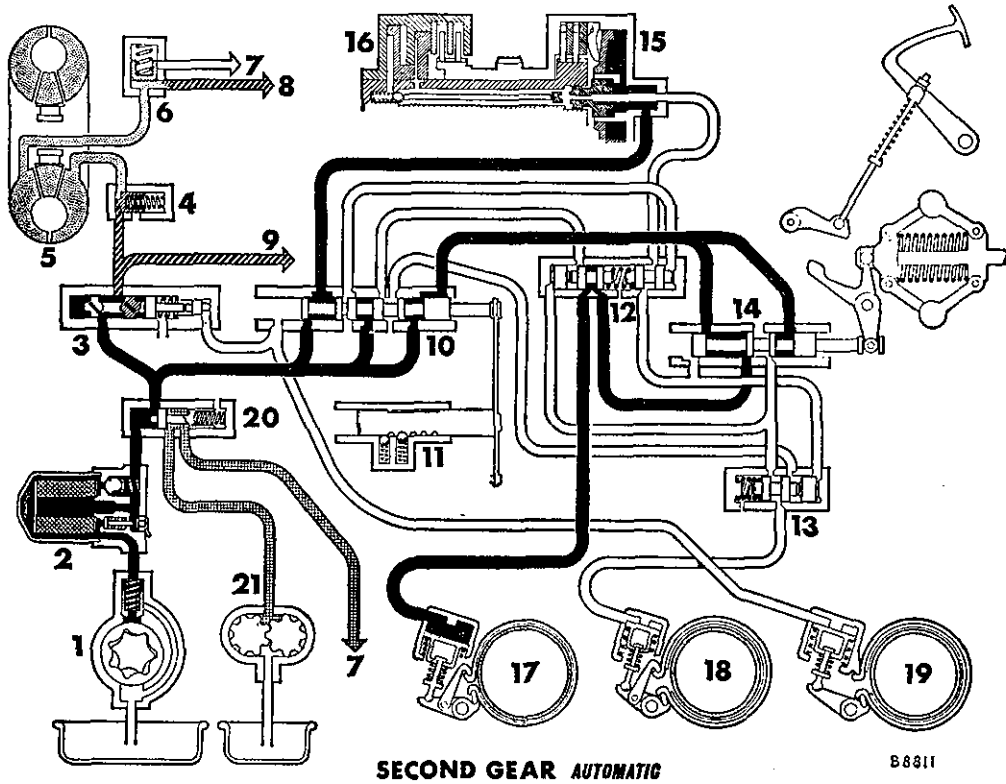
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FIRST GEAR *MANUAL*

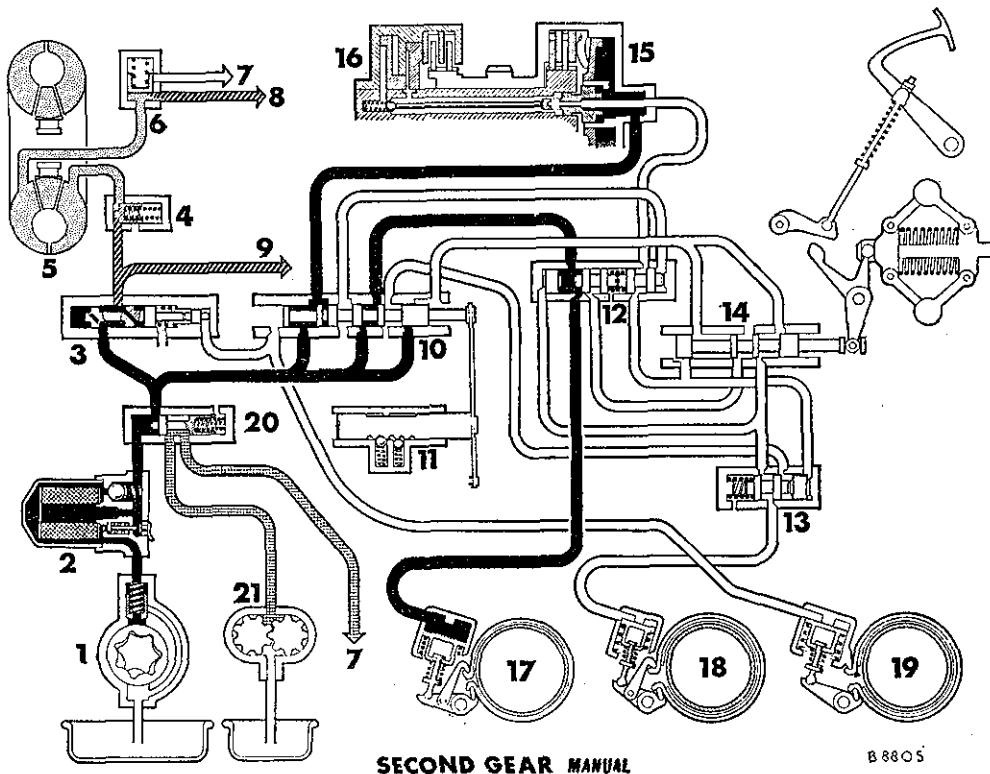
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### LINE PRESSURE AND LUBRICATION DIAGRAMS

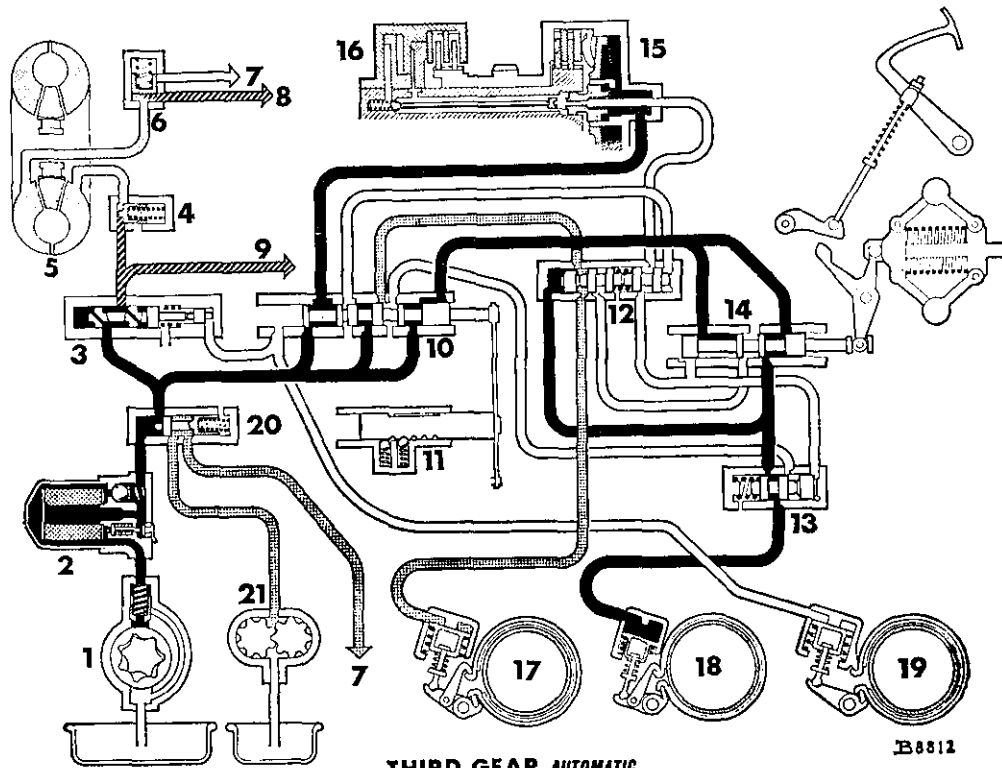


#### KEY TO DIAGRAM

- |                                     |                                 |                     |
|-------------------------------------|---------------------------------|---------------------|
| 1. Main oil pump.                   | 12. Second and top gear valves. | Line pressure.      |
| 2. Oil filter.                      | 13. Third gear valve.           | Lubrication.        |
| 3. Regulator valve.                 | 14. Governor valve.             | Exhaust.            |
| 4. Engine lubrication relief valve. | 15. Forward clutch.             | Converter pressure. |
| 5. Converter.                       | 16. Top and reverse clutch.     |                     |
| 6. Low pressure valve.              | 17. Second gear brake band.     |                     |
| 7. Engine lubrication.              | 18. Third gear brake band.      |                     |
| 8. Gear train lubrication.          | 19. Reverse gear brake band.    |                     |
| 9. Engine lubrication.              | 20. Tow start valve.            |                     |
| 10. Selector valve.                 | 21. Auxiliary pump.             |                     |
| 11. Selector valve detent.          |                                 |                     |
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LINE PRESSURE AND LUBRICATION DIAGRAMS



THIRD GEAR AUTOMATIC

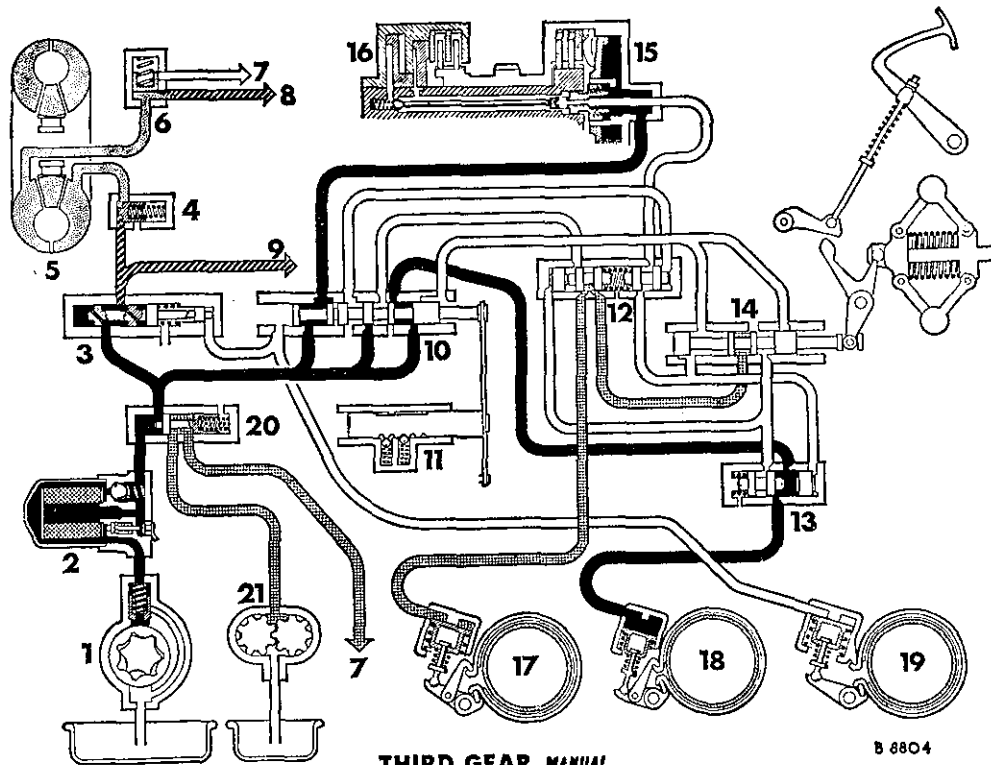
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KEY TO DIAGRAM

- |                                     |                                 |
|-------------------------------------|---------------------------------|
| 1. Main oil pump.                   | 12. Second and top gear valves. |
| 2. Oil filter.                      | 13. Third gear valve.           |
| 3. Regulator valve.                 | 14. Governor valve.             |
| 4. Engine lubrication relief valve. | 15. Forward clutch.             |
| 5. Converter.                       | 16. Top and reverse clutch.     |
| 6. Low pressure valve.              | 17. Second gear brake band.     |
| 7. Engine lubrication.              | 18. Third gear brake band.      |
| 8. Gear train lubrication.          | 19. Reverse gear brake band.    |
| 9. Engine lubrication.              | 20. Tow start valve.            |
| 10. Selector valve.                 | 21. Auxiliary pump.             |
| 11. Selector valve detent.          |                                 |

- |  |                     |
|--|---------------------|
|  | Line pressure.      |
|  | Lubrication.        |
|  | Exhaust.            |
|  | Converter pressure. |

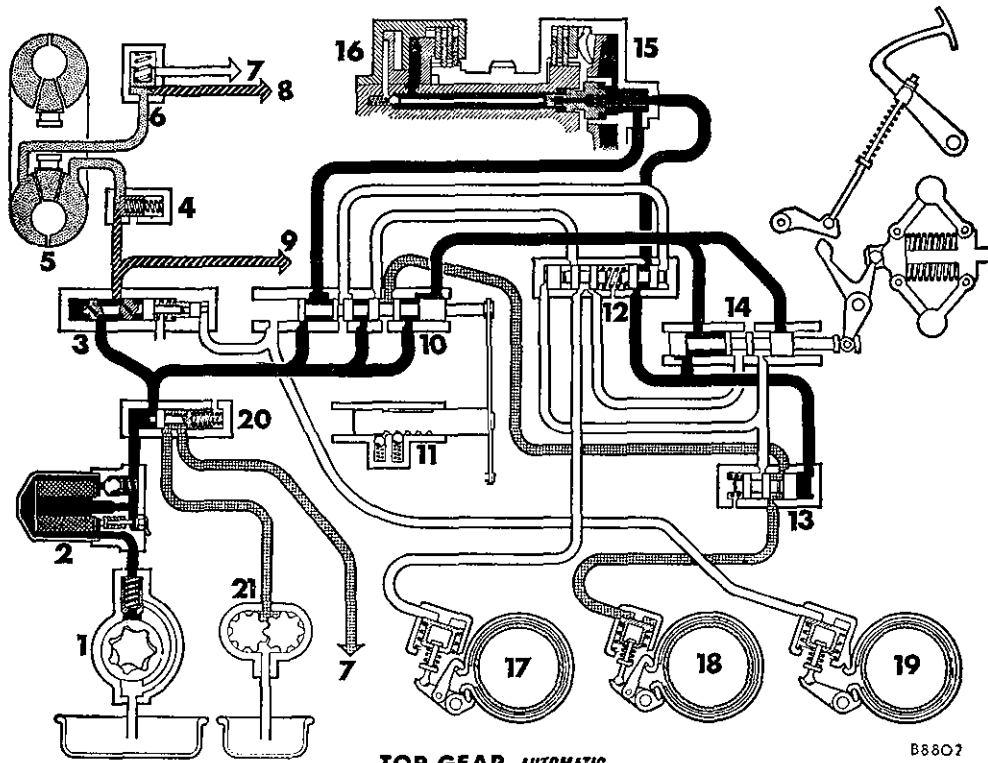
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THIRD GEAR MANUAL

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### LINE PRESSURE AND LUBRICATION DIAGRAMS



TOP GEAR AUTOMATIC

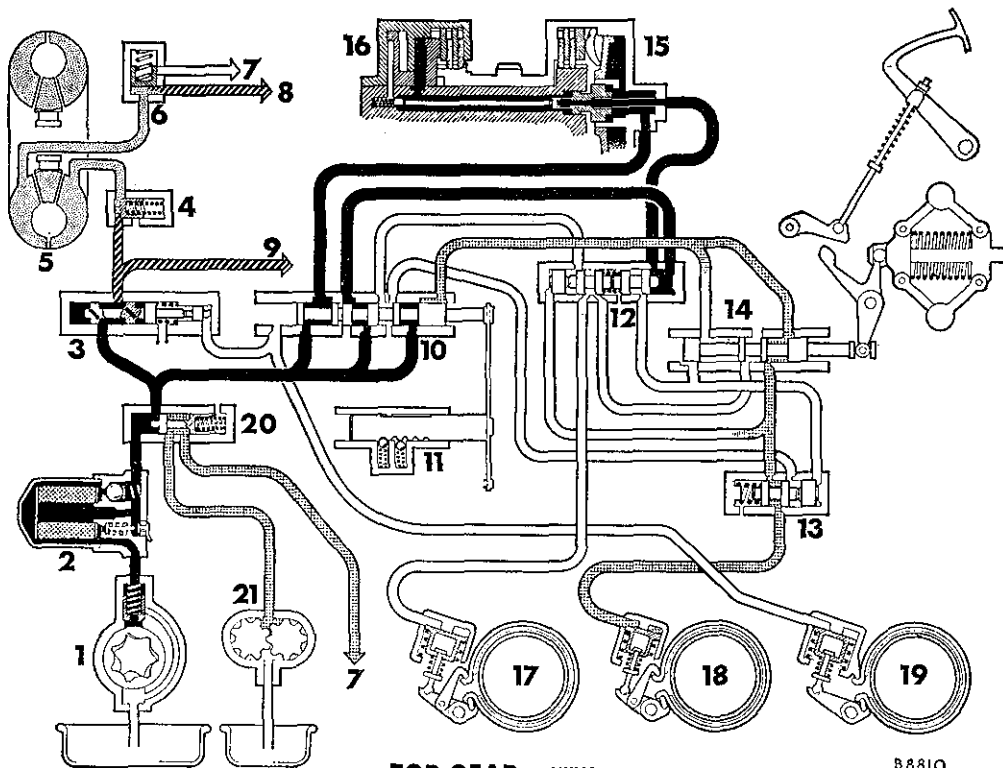
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#### KEY TO DIAGRAM

- |                                     |                                 |
|-------------------------------------|---------------------------------|
| 1. Main oil pump.                   | 12. Second and top gear valves. |
| 2. Oil filter.                      | 13. Third gear valve.           |
| 3. Regulator valve.                 | 14. Governor valve.             |
| 4. Engine lubrication relief valve. | 15. Forward clutch.             |
| 5. Converter                        | 16. Top and reverse clutch.     |
| 6. Low pressure valve.              | 17. Second gear brake band.     |
| 7. Engine lubrication.              | 18. Third gear brake band.      |
| 8. Gear train lubrication.          | 19. Reverse gear brake band.    |
| 9. Engine lubrication.              | 20. Tow start valve.            |
| 10. Selector valve.                 | 21. Auxiliary pump.             |
| 11. Selector valve detent.          |                                 |

- |  |                    |
|--|--------------------|
|  | Line pressure.     |
|  | Lubrication.       |
|  | Exhaust.           |
|  | Converter pressure |

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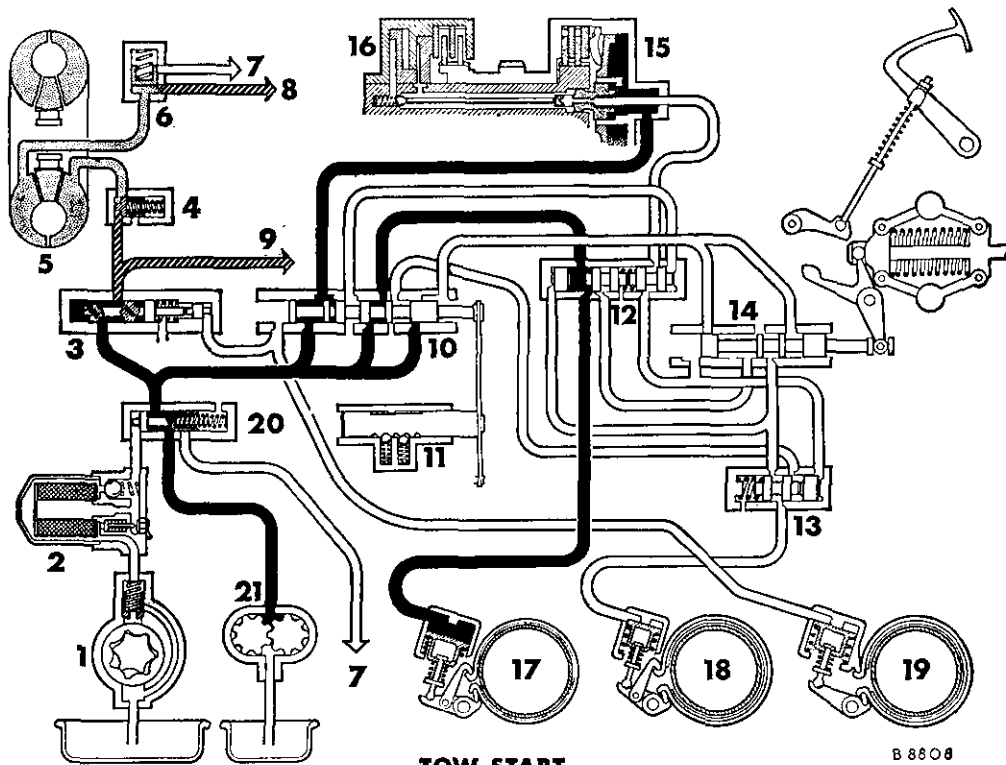


TOP GEAR MANUAL



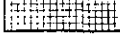

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THE AUTOMATIC TRANSMISSION

LINE PRESSURE AND LUBRICATION DIAGRAMS



KEY TO DIAGRAM

- |                                     |                                 |   |
|-------------------------------------|---------------------------------|---|
| 1. Main oil pump                    | 12. Second and top gear valves. |  Line pressure.      |
| 2. Oil filter.                      | 13. Third gear valve.           |  Lubrication.        |
| 3. Regulator valve.                 | 14. Governor valve.             |  Exhaust.            |
| 4. Engine lubrication relief valve. | 15. Forward clutch.             |  Converter pressure. |
| 5. Converter.                       | 16. Top and reverse clutch      |   |
| 6. Low pressure valve.              | 17. Second gear brake band.     |   |
| 7. Engine lubrication.              | 18. Third gear brake band.      |   |
| 8. Gear train lubrication.          | 19. Reverse gear brake band.    |   |
| 9. Engine lubrication.              | 20. Tow start valve.            |   |
| 10. Selector valve.                 | 21. Auxiliary pump.             |   |
| 11. Selector valve detent.          |                                 |   |

### Section Fa.1

#### FAULT DIAGNOSIS

##### Road test procedure

It is important to carry out a road test in all cases of suspected faults in order to confirm which component(s) of the automatic transmission are faulty or require adjustment.

In suspected cases of slip or poor acceleration a converter stall speed test should be carried out as detailed in Section Fa.2.

Check the performance in all seven selector positions as given below:

##### Neutral

Check that there is key start in this position only, and not in the drive positions.

##### Manual 1

Confirm that there is drive with NO engine braking.

##### Manual 2, 3, 4

Confirm that there is drive WITH engine braking.

##### Drive (automatic)

Check the speeds at which all up-and down-shifts are changing (these are detailed below on the 'CHANGE SPEED CHART').

##### Reverse

Confirm that there is drive WITH engine braking.

**NOTE.**—In suspected cases of faulty transmission gears and/or clutch units, a stall speed test should be carried out in all gears to determine which of the clutch units and/or brake bands are faulty. The mechanical power flow diagrams indicate the components in use for each gear. If there is slip in all gears a low oil pressure is indicated which should be confirmed by a pressure check as detailed in Section Fa.2.

CHANGE SPEED CHART

Selector Position	Throttle Position	Gear Shift	M.P.H.	Km.P.H.
'D'	Light	1-2	10-14	16-22
		2-3	15-19	24-30
		3-4	20-24	32-39
'D'	Kick-down	1-2	25-33	40-53
		2-3	37-45	60-72
		3-4	49-57	78-91
'D'	Kick-down	4-3	43-39	70-64
		3-2	35-31	56-50
		2-1	22-18	35-29
'D'	Closed (roll out)	4-3	20-16	32-26
		3-2	14-10	22-16
		2-1	8-4	12-6

FAULT DIAGNOSIS

<i>Faults</i>	<i>Diagnosis and Rectification Sequence</i>
Faulty gear selection, possibly with tie-up in 'D' position on kick-down .. .. .	1
Slip or no drive in forward gears .. .. .	2, 3
Slip in reverse .. .. .	4, 5, 6
Slip or no drive in all gears .. .. .	7, 8, 13, 20, 23
Difficult or bumpy selection and shifts possibly with squawk on selection and with lubrication warning light on or low gauge pressure .. .. .	7, 8, 9, 13, 20
Erratic automatic shifts .. .. .	7, 10
Incorrect shift speeds .. .. .	11
Excessive creep or engine stalls when selecting gear .. .. .	12
Unable to tow-start .. .. .	13, 14
Gear whine consistent with road speed but not in 'top' gear (4) .. .. .	15
Continual whine consistent with engine speed .. .. .	16
No drive in 'first' gear (1) automatic and manual .. .. .	17, 18
Slip or no drive in 'second' gear (2) automatic and manual .. .. .	19
No drive in 2, 3, or 4 positions manual but drives in these gears on automatic 'D' .. .. .	13
No drive in 2, 3, or 4 automatic 'D' positions, but drives in these gears on manual selection .. .. .	13
Poor acceleration .. .. .	21
Reduced maximum speed in all gears with severe converter overheating .. .. .	22

DIAGNOSIS AND RECTIFICATION CHART

1	Check gear change cable and selector rod adjustment (Section Fa.2).
2	Check the fitting of forward clutch feed pipe (Section Fa.3).
3	Check the forward clutch and/or the shaft rings (Section Fa.6).
4	Check the reverse gear band adjustment or remove the valve block and check the reverse servo feed pipe 'O' ring seals (Section Fa.4).
5	Remove the valve block and clean; regulator valve or reverse booster piston faulty (Section Fa.4).
6	Check the top and reverse clutch booster piston or shut-off valve (Section Fa.10).
7	Check engine/transmission oil level (Section Aa.1).
8	Carry out pressure check (Section Fa.2).
9	Check oil filter head 'O' ring seals or fitting of joint washer (Section Aa.2).
10	Remove and examine governor unit for sticking (Section Fa.5).
11	Check governor control rod adjustment (Section Fa.2).
12	Check carburetter adjustment—incorrect idle speed (Section Da.2).
13	Remove and clean valve block (Section Fa.4).
14	Check auxiliary pump, pipes, and seals (Section Fa.5).
15	Check gear train adjustment (Section Fa.7).
16	Check converter housing bush (Section Aa.4).
17	Check free-wheel support dowel bolt—sheared (Section Fa.3).
18	Check the one-way clutch unit (Section Fa.11).
19	Remove the valve block and check the servo feed pipe 'O' ring seals and check the second gear band adjustment (Section Fa.4).
20	Check main oil pump and flow valve, the supply and feed pipe seals, and main oil strainer seals (Sections Aa.8 and Fa.3).
21	Carry out stall speed check (Section Fa.2).
22	Change the torque converter unit (Section Aa.4).
23	Check the low pressure valve.

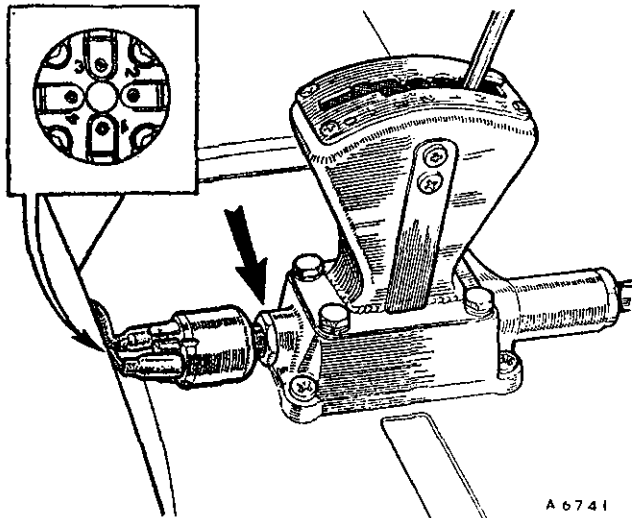


Fig. Fa.1

The inhibitor switch on the gear-change lever housing. Inset, the 1 and 3, 2 and 4 connections marked on the switch. The locking nut is indicated by an arrow

- (6) Verify that the starter operates only when the gear selector lever is in 'N', also that the reversing light (when fitted) operates only when 'R' is selected.

**NOTE.**—If the switch cannot be adjusted to operate correctly it must be renewed.

### Gear-change cable and selector rod

It is most important to carry out the adjustment procedure detailed below and refer to Fig. Fa.2.

### Adjustment

- (7) Pull back the rubber boot (1) and remove clevis pin (2). Ensure that the selector rod (3) is screwed in tightly and push it fully into the transmission case.

**NOTE.**—Never start the engine with the selector rod disconnected.

- (8) Refit the clevis pin (2) into the selector rod yoke (4) and check the measurement given in Fig. Fa.2; adjust if necessary.

## Section Fa.2

### ADJUSTMENTS

#### Inhibitor switch

The switch is located on the rear of the gear selector housing (Fig. Fa.1).

It has four terminals, two of which are connected through the ignition/starter circuit. This ensures that the engine will only start when the gear selector is in the 'N' position.

The switch terminals marked 2 and 4 are used in the ignition/starter circuit, and both the electrical leads are interchangeable to the 2 and 4 positions on the switch.

The terminals marked 1 and 3 are used for reversing light connections (when fitted).

Check the gear-change cable and selector rod adjustment before adjusting the inhibitor switch.

#### Adjustment

- (1) Select 'N'.
- (2) Disconnect the electrical connections from the switch.
- (3) Slacken the locknut and screw the switch in as far as possible.
- (4) Connect a test lamp or meter across the switch terminals 2 and 4. Screw the switch into the housing until the circuit is made and mark the switch body. Continue screwing in the switch and note the number of turns required until the circuit breaks. Remove the test equipment and unscrew the switch from the housing **half** the number of turns counted.
- (5) Tighten the locknut and refit the electrical leads to the appropriate terminals.

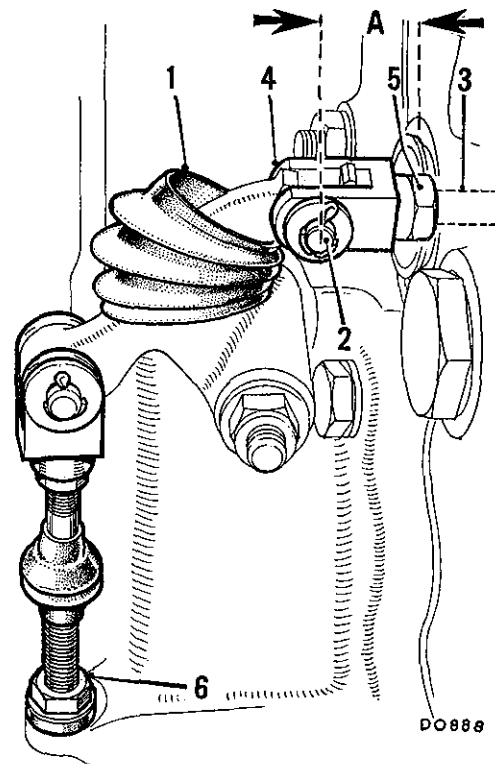


Fig. Fa.2

The gear-change cable and selector rod adjustment

- |                  |                               |
|------------------|-------------------------------|
| 1. Rubber boot.  | 4. Selector rod yoke.         |
| 2. Clevis pin.   | 5. Selector rod yoke locknut. |
| 3. Selector rod. | 6. Cable adjusting nuts.      |

Shown inset: the selector rod checking dimension.

A =  $\frac{3}{8}$  in. (20 mm.)



- (9) Slacken the locknut (5) behind the selector rod yoke and turn the yoke (4) until the correct measurement of  $\frac{3}{8}$  in. (20 mm.) is effected (see Fig. Fa.2). Tighten the locknut (5), ensuring that the yoke is set squarely to the bell-crank lever arm.
- (10) Select 'N' in the transmission unit by pulling the selector rod fully out and then pushing it back in one detent.  
The measurement 'A' in Fig. Fa.2 should now be 1.45 in. (37 mm.).
- (11) Select 'N' on the quadrant with the gear lever, and adjust the outer cable using the adjusting nuts (6) (see inset to Fig. Fa.2). The adjustment is correct when the clevis pin (2) can be easily refitted.

**NOTE.**—Ensure that the yoke ends on the selector cable and rod are square to the bell-crank lever, before reconnecting.

**Testing adjustment**

- (12) Apply the hand and foot brakes, and ensure that the starter operates only in the 'N' position; if this is not correct, adjust the inhibitor switch as detailed in items (1) to (6).
- (13) Start the engine, and move the gear lever to the 'R' position and check that reverse is engaged. Slowly move the lever back towards the 'N' position, checking that the gear is disengaged just before or as soon as the lever drops into the 'N' position on the quadrant. Repeat this procedure in the first gear '1' position. Re-adjust the outer cable slightly if necessary to obtain the above conditions.

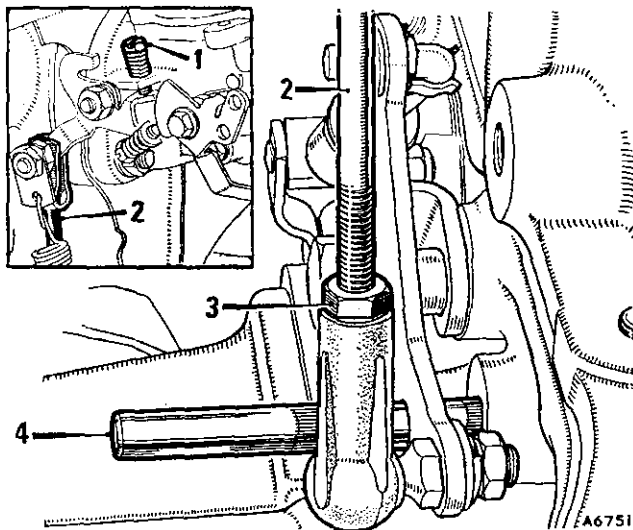


Fig. Fa.3

The governor control rod adjustment showing:

- |                               |  |
|-------------------------------|--|
| 1. Throttle adjustment screw. | 3. Locknut.                                  |
| 2. Governor control rod.      | 4. $\frac{1}{4}$ in. (6.4 mm.) diameter rod. |

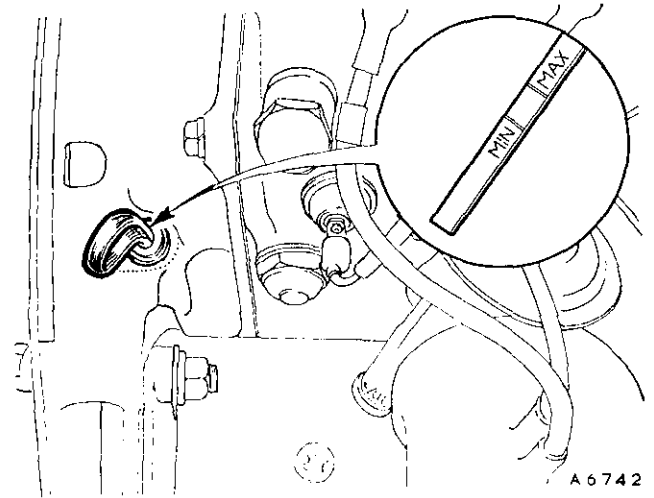


Fig. Fa.4

The oil level dipstick with the level markings shown inset

- (14) Ensure that all adjustment/locking nuts are tight and the clevis pins are secured. Pack the rubber boots with Duckham's Lammol grease. Refit the boots and the weather protection shield (if fitted).
- (15) Carry out a road test, checking the operation in each gear lever position.

**Governor control rod adjustment**

- (16) Run the engine to its normal working temperature.
- (17) Disconnect the governor control rod at the carburetter.
- (18) With the carburetter correctly tuned, adjust the throttle adjusting screw to give a tachometer reading of 650 r.p.m. at tickover.
- (19) Insert a  $\frac{1}{4}$  in. (6.4 mm.) diameter rod through the hole in the governor control rod bell-crank lever and into the hole in the transmission case (Fig. Fa.3).
- (20) Slacken the locknut (3) (Fig. Fa.3) and adjust the length of the rod to suit the carburetter linkage in the tick-over position.
- (21) Reconnect the governor control rod to the carburetter. Tighten the ball joint locknut and remove the checking rod from the bell-crank lever.

**Stall speed check**

- (22) Start and run the engine until it reaches its normal working temperature and check the oil level.
- (23) Connect a suitable tachometer or that of Service tool 18G 677 or 18G 677 Z (see Fig. Fa.5).

Service tool electrical connections:

18G 677—Green to ignition coil CB.

Red to battery positive.

Black to battery negative.

18G 677 Z—Red to ignition coil CB.

Black to earth connection.

- (24) Apply the hand and foot brakes, select any gear position except 'N' or 1, apply maximum throttle for not more than 10 seconds and note the tachometer reading. Compare the figure obtained with the chart below.

Model	R.P.M.	Condition	Rectification
848 c.c.	1,300-1,400	Satisfactory	Nil
998 c.c.	1,400-1,500	Satisfactory	Nil
	Under 1,000	Stator free wheel slip	Change torque converter
	Over 1,500	Transmission slip	Check transmission unit (see Road Test note)
848 c.c. and 998 c.c.	Under 1,300	Engine down for power	Check engine

- (25) Disconnect the tachometer.

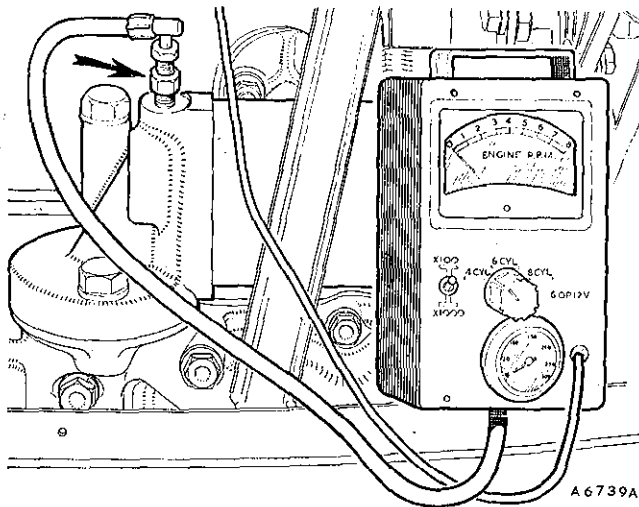


Fig. Fa.5

Checking the pressures and the stall speed with Service tool 18G 677 and adaptor 18G 677 C (arrowed)

### Pressure check

- (26) Check and top up the oil level (see Section Aa.1).
- (27) Remove the pressure point plug on the engine oil filter, fit Service tool adaptor 18G 677 C, and connect Service tool 18G 677 Z (see Fig. Fa. 5) or use pressure gauge (Service tool 17G 502 A with pipe and adaptor 18G 502 K).
- (28) Start and run the engine until the oil temperature is 80° C. (176° F.) (check with a thermometer inserted into the dipstick hole). Re-start and run the engine at 1000 r.p.m. and check the following approximate pressures:
- In all gear positions except 'R' a pressure of between 75 and 85 lb./sq. in. (5.3 and 6 kg./cm.<sup>2</sup>) should register on the gauge.
  - In 'R' the pressure should be between 115 and 125 lb./sq. in. (8 and 8.8 kg./cm.<sup>2</sup>).

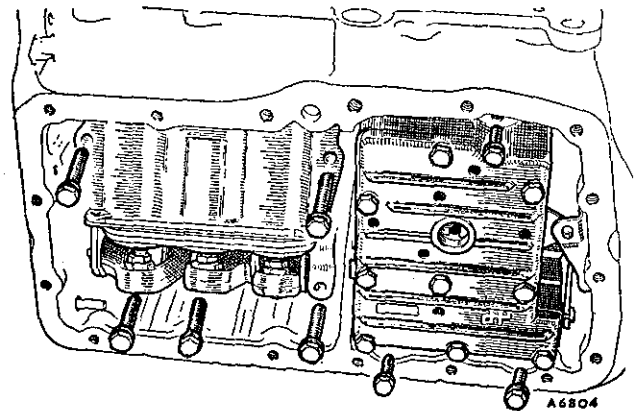


Fig. Fa.6

Removing the valve block and servo bolts

**NOTE.**—Should the approximate pressures given above not be obtainable, see Section Fa.1, 'FAULT DIAGNOSIS'.

- (29) Remove the pressure test equipment and refit the plug.

### Section Fa.3

#### TRANSMISSION UNIT

##### Dismantling

- Remove the engine and transmission from the car, see Section Aa.3.
- Remove the transmission from the engine as detailed in Section Aa.4 **only** if fitting a replacement engine, transmission case, or if it is necessary to remove the main oil strainer pick-up pipe and seals.
- Remove the converter and converter housing as detailed in Section Aa.4, items (1) to (11) and (13).

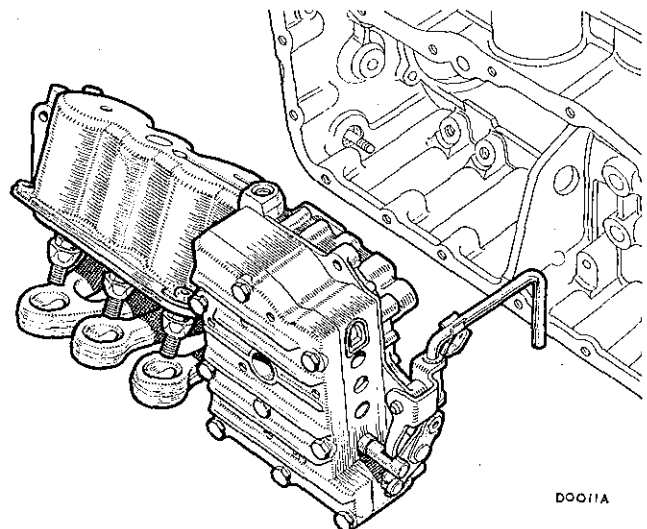


Fig. Fa.7

Removing the valve block and servo unit as an assembly

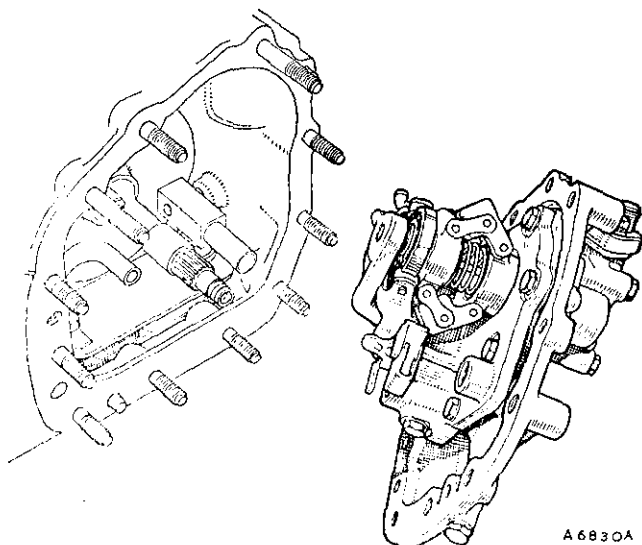


Fig. Fa.8

*Removing the auxiliary pump and governor assembly*

- (3) Unscrew and withdraw the gear selector rod and remove the front cover (the connecting bobbin is pressed into the later-type cover).
- (4) Remove the governor control assembly from the transmission case and fit Service tool 18G 1097 (see Fig. Fa.19).
- (5) Remove the securing nuts and pull the auxiliary pump and governor assembly from the transmission case.

**NOTE.**—For auxiliary pump and governor dismantling and reassembling see Section Fa.5.

- (6) Remove the dowel bolt and pull out the auxiliary pump filter outlet pipe.
- (7) Pull out the auxiliary pump outlet and the forward clutch apply pipes.

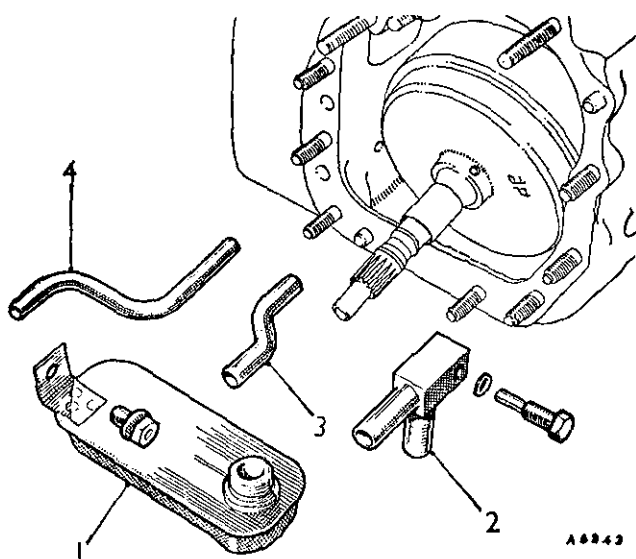


Fig. Fa.9

*Removing the auxiliary oil pump strainer (1) and pipe (2), with (3) the outlet pipe, and (4) the forward clutch apply pipe*

- (8) Remove the set screw and lift out the auxiliary pump filter.
- (9) Remove Service tool 18G 1097 and withdraw the forward clutch from the casing.

**NOTE.**—For forward clutch dismantling and reassembling see Section Fa.6.

- (10) Withdraw the forward output shaft and tap out the reverse shut-off valve. Insert the dummy output shaft Service tool 18G 1093 or 18G 1093 A.
- (11) Slacken off the servo band adjusters.
- (12) Remove the dowel bolt (Fig. Fa.11) and remove the gear train which includes the top and reverse clutch with its Torrington needle thrust bearing and steel washer, and the first gear free-wheel assembly.

**NOTE.**—For gear train dismantling and re-assembling see Section Fa.7.

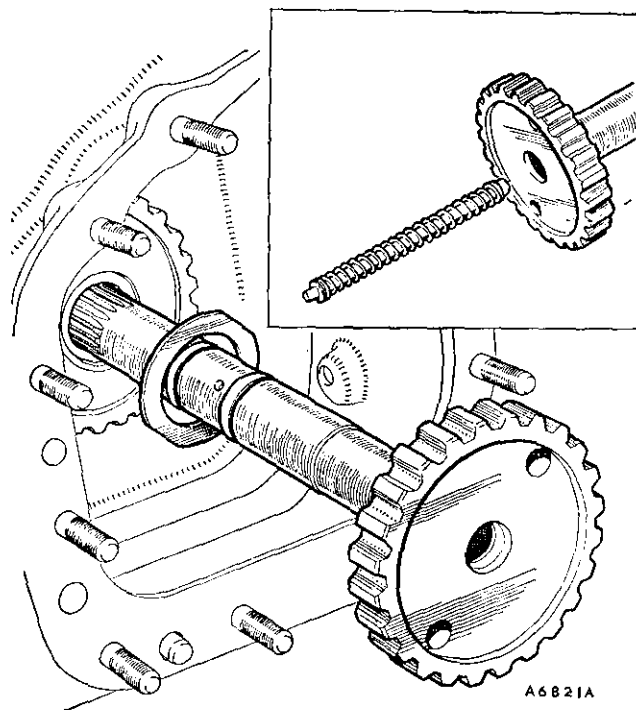


Fig. Fa.10

*The forward output shaft with (inset) the reverse shut-off valve*

- (13) Remove the valve block and servo unit securing bolts, and on later models unscrew and remove the engine oil feed pipe adaptor and withdraw the valve block connecting pipe through the adaptor hole. Depress the tops of the bands and unhook them from the servos and lift out the valve block and servo unit as an assembly (Fig. Fa.7).

**NOTE.**—For valve block dismantling and re-assembling see Section Fa.4. For servo unit dismantling and reassembling see Section Fa.8.

- (14) Remove the bands from the transmission case.

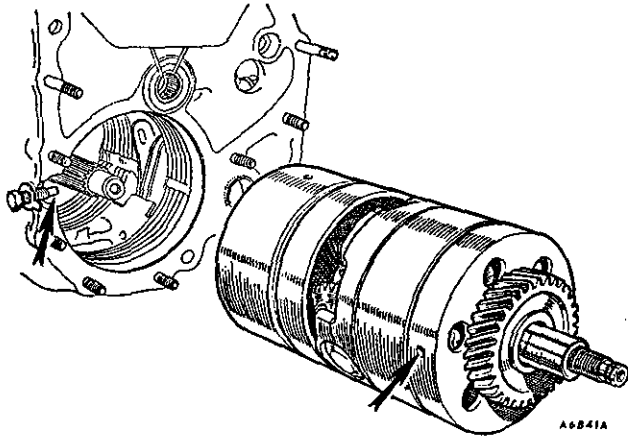


Fig. Fa. 11

Removing the gear train assembly. The arrows indicate the dowel bolt and its location in the free-wheel support

- (15) Remove the governor control assembly from the transmission case. Knock back the lock washers and remove the nuts from the differential housing and the differential end cover set screws. Remove the differential and housing assembly.

**NOTE.**—For differential dismantling and re-assembling see Section Fa.9.

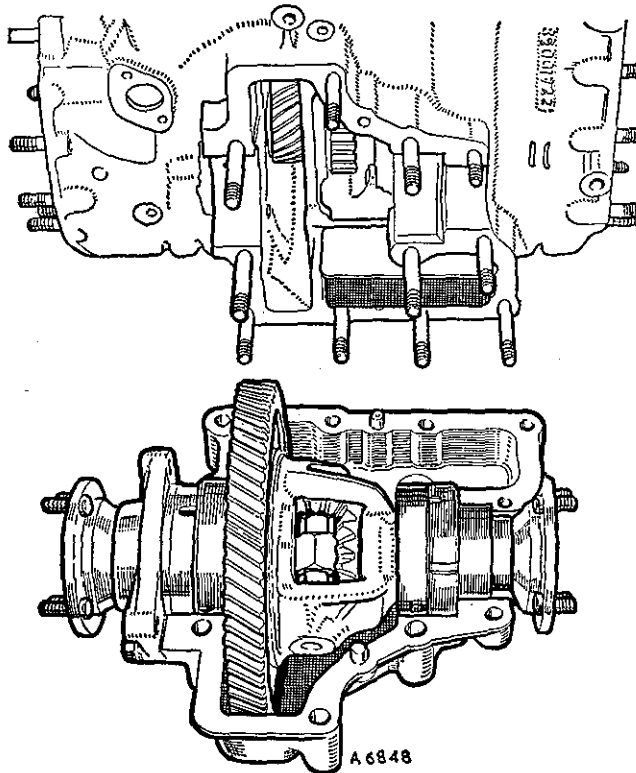


Fig. Fa.12

Removing the differential assembly

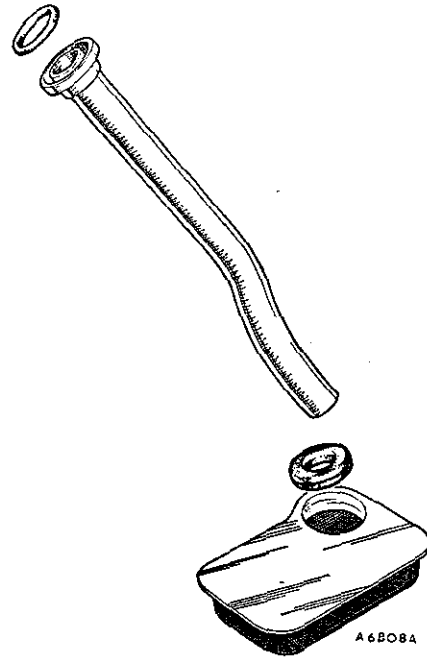


Fig. Fa.13

The main oil strainer, pick-up pipe and seals

- (16) Remove the main oil feed pipe and strainer (see item (2a)).
- (17) Knock back the lock washer on the nut on the forward clutch splines and use Service tool 18G 1095 to hold the top and reverse clutch hub (Fig. Fa.14) and remove the nut with 18G 1096 (Fig. Fa.15). Drift out the top and reverse clutch hub and lift out the piston assembly.

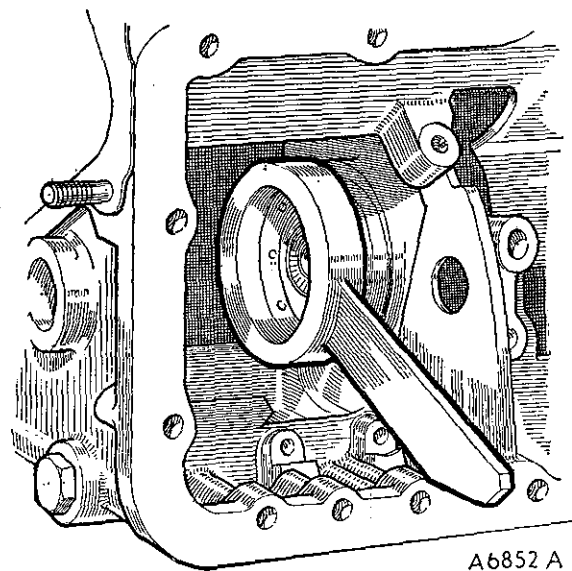


Fig. Fa.14

Using Service tool 18G 1095 to hold the top and reverse splines when removing the forward clutch hub nut

- (18) Remove both the bearings from the centre webs of the transmission case; each bearing must be drifted out on its outer race and from opposing sides of the webs.

**Reassembling the transmission unit**

Absolute cleanliness is essential, use fuel (petrol) or paraffin (kerosene) where necessary for cleaning. Dry the components with an air pressure line or use non-fluffy rag.

Clean all joint faces and fit new joint washers and oil seals.

After reassembly of each dismantled unit the complete transmission can now be rebuilt.

Lubricate all components with a recommended automatic transmission lubricant. This is particularly important when fitting new 'O' rings and seals.

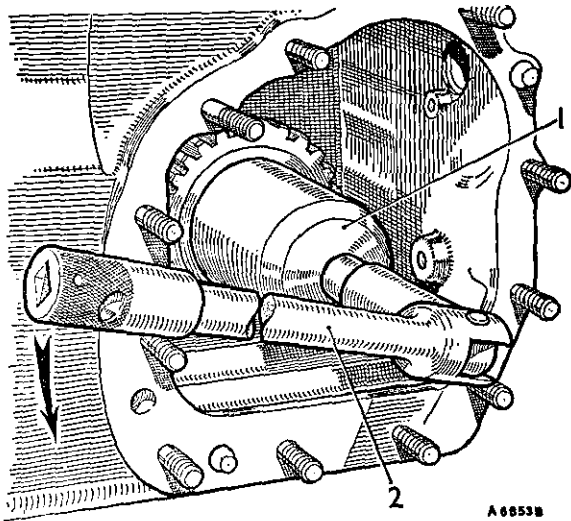


Fig. Fa.15

*Removing the forward clutch hub nut*

1. Service tool 18G 1096. 2. Socket handle.

- (19) Refit the top and reverse clutch hub bearings to the centre webs of the transmission casing. Drift each bearing on its outer cage into the web until the bearing register contacts the face of the web.
- (20) Refit the top and reverse clutch hub, together with the final drive gear pinion but without the selective washer. Lightly tighten the forward clutch hub nut until light friction is felt on the bearings when rotating the hub.
- (21) Check the gap existing between the final drive gear and the forward clutch hub bearing face.
- (22) Subtract .002 in. (.05 mm.) from the gap measurement and select a washer of this thickness from the range available.
- (23) Remove the hub and refit the assembly with the selected washer and with the chamfer on the final drive pinion facing the gear train (see Fig. Fa.16).

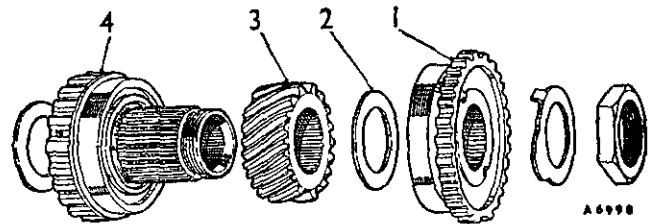
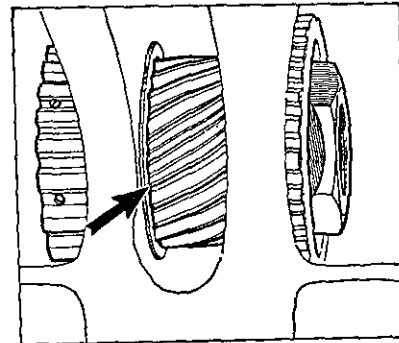


Fig. Fa.16

1. Forward clutch splines. 3. Final drive pinion.  
2. Selective thrust washer. 4. Top and reverse splines.  
Shown (inset) correctly assembled with the arrow indicating the chamfer on the pinion

- (24) Use Service tool 18G 1095 to hold the top and reverse clutch splines (see Fig. Fa.17) and tighten the forward clutch hub nut with Service tool 18G 1096 and 18G 592 (see Fig. Fa.18), to the torque figure given in 'GENERAL DATA'.
- (25) Check that there is light friction on the bearings when rotating the hub, i.e. the bearings should have a preload of .002 in. (.05 mm.).

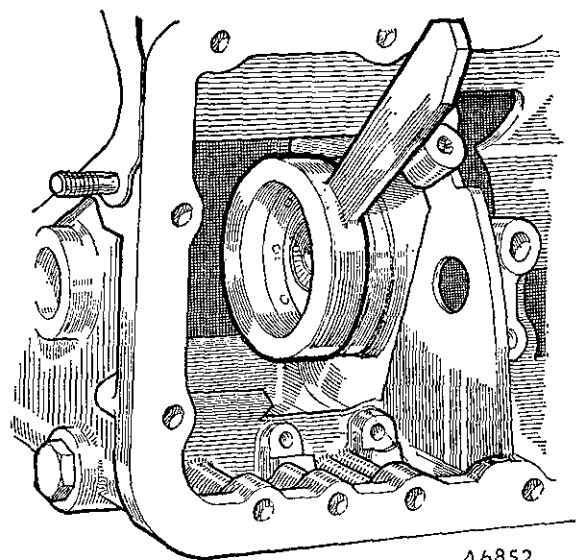


Fig. Fa.17

Using Service tool 18G 1095 to hold the top and reverse splines when tightening the forward clutch hub nut

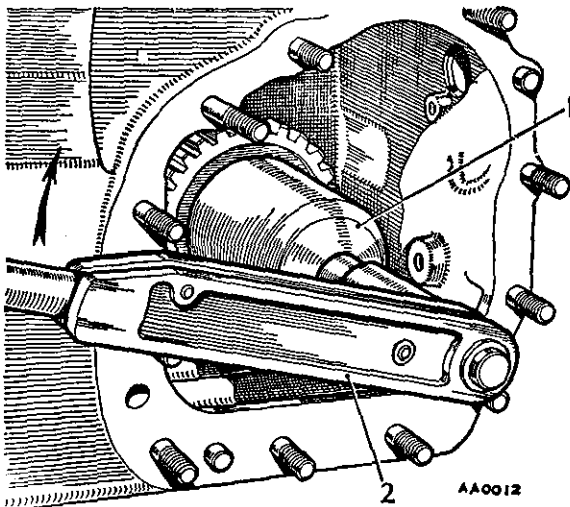


Fig. Fa.18

Tightening the forward clutch hub nut with Service tools 18G 1096 (1) and 18G 592 (2)

- (26) Tap up the locking washer.
- (27) Insert the forward output shaft with its bi-metal washer (see Fig. Fa.10) through the output gear assembly. Ensure that the reverse shut-off valve is located in the end of the shaft, and that the rings on the shaft are in good condition.
- (28) Position the plastic sleeve over the rings on the forward clutch shaft and refit the forward clutch unit. Fit Service tool 18G 1097 to retain the correct position of the forward clutch unit (see Fig. Fa.19).
- (29) Fit new seals to the three valve block bobbins and fit them into their locations in the transmission casing.

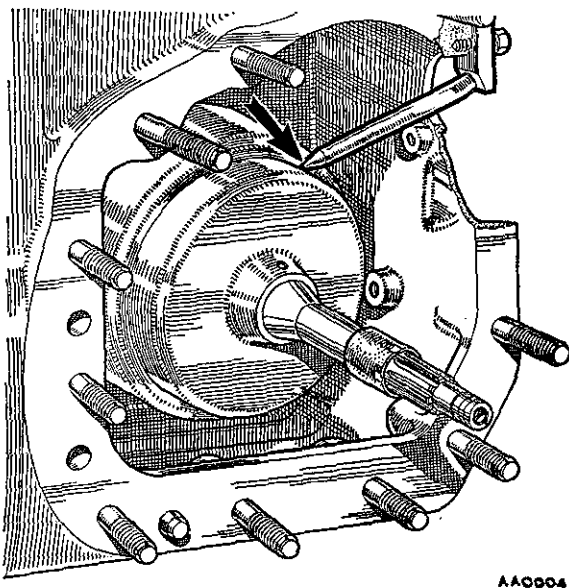


Fig. Fa.19

Holding the forward clutch in position with Service tool 18G 1097

- (30) Reassemble the valve block and servo unit as an assembly, fitting new seals to the inter-connecting pipes.
- (31) Refit the valve block and the servo unit as an assembly into the transmission case, ensuring correct location of the valve block with the bobbins in the case and that the governor linkage is positioned over the web in the transmission casing. Tighten the valve block and the servo unit securing bolts to the torque figure given in 'GENERAL DATA'.
- (32) Refit the second, third, and reverse gear bands into the transmission casing.
- (33) Locate the bands on the servo struts.

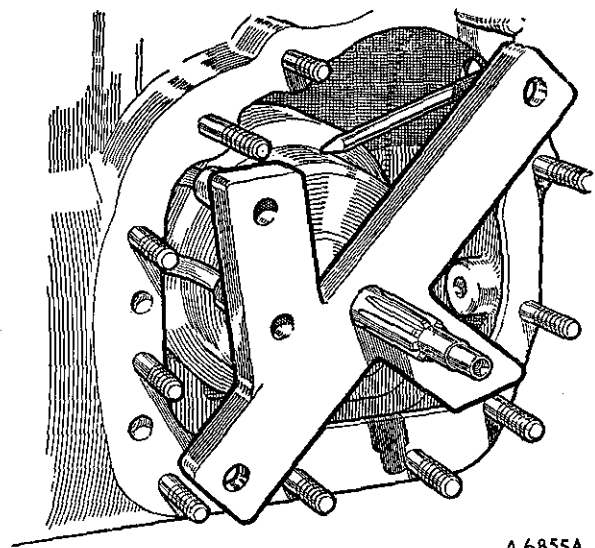


Fig. Fa.20

Using the positioning fixture Service tool 18G 1094 to ensure correct alignment of the pipes

- (34) Refit the forward clutch apply pipe into its location in the transmission casing.
- (35) Refit the auxiliary pump pick-up strainer and pipe; secure the pipe with the dowel bolt (fitted with a copper sealing washer). Refit and tighten the strainer securing screw.
- (36) Fit a new joint washer to the transmission casing. Fit Service tool 18G 1094 and align the pipes (Fig. Fa.20) and remove the tool.
- (37) Refit the auxiliary pump and governor assembly and engage the valve block linkage with the later-type governor unit as shown in Fig. Fa.21, also ensuring correct alignment with the oil pipes and the forward shaft. The plastic sleeve fitted over the rings on the shaft is for assembly purposes, and will become safely displaced along the forward clutch shaft. Tighten the securing nuts to the torque figure given in 'GENERAL DATA'.
- (38) Remove the forward clutch retainer—Service tool 18G 1097.

- (39) Refit the top and reverse clutch hub washer and the Torrington needle thrust bearing into position with grease.
- (40) Ensure that the top and reverse clutch friction plates are free to drop before refitting the gear train assembly into the transmission. Correctly position the second, third, and reverse gear bands in the case and refit the gear train, using hand pressure only to push it into position. Quick rotation of the input gear will assist in engaging the top and reverse clutch friction plates. When correctly reassembled the dowel bolt will engage easily in the freewheel support (Fig. Fa.11).
- (41) Refit the dowel bolt with a new lock washer.

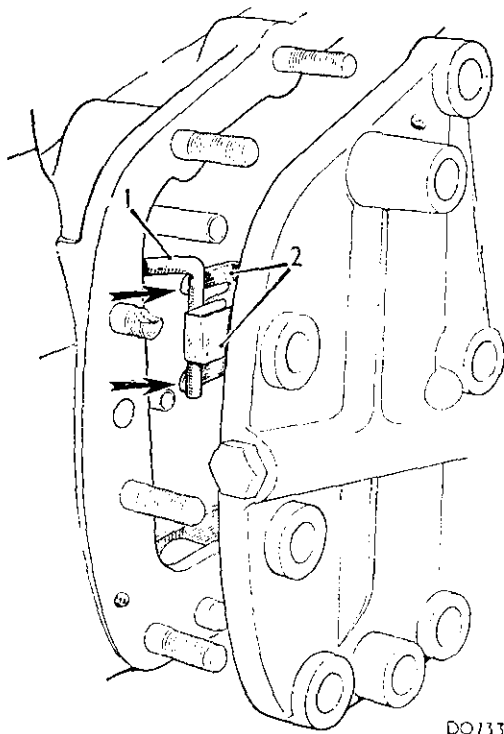


Fig. Fa.21

Engaging the valve block linkage (1) with the spring clip drive mechanism (2) of the later-type governor

- (42) Screw the gear change selector rod fully into the valve block linkage. Check and reset if necessary the selector rod adjustment (see Section Fa.2).
- (43) Adjust the second, third, and reverse servos (see Fig. Fa.23). Slacken the locknut (1) and the spherical adjuster (2) until each brake band (3) is in contact with the transmission casing stops (4). Adjust each adjuster (2) until the clearance 'A' is obtained, and tighten the locking nut (1).
- (44) Fit a new seal to the front cover bobbin, and refit the cover using a new joint washer. On early units the front cover connecting bobbin can be removed and requires two oil seals.

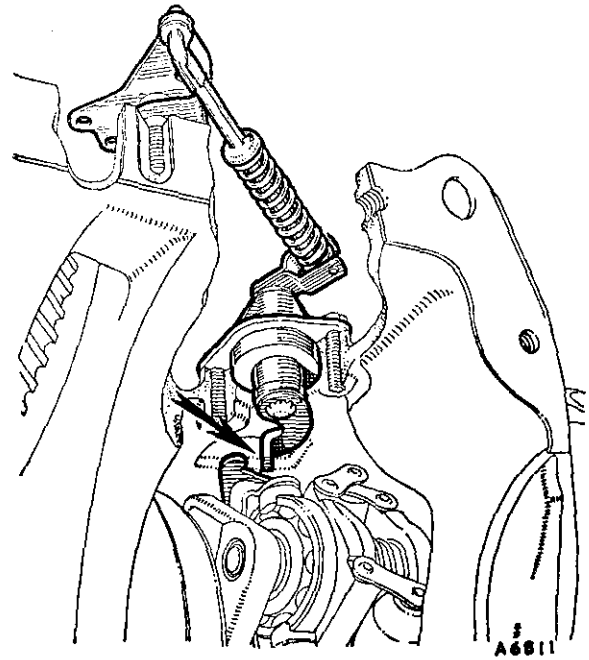


Fig. Fa.22

The correct position of the kick-down rod assembly

- (45) Refit the main oil strainer and pick-up pipe using new seals (if these items were removed), see item (2a).
- (46) Refit the differential assembly as detailed in Section Fa.9.
- (47) Refit the engine to the transmission as detailed in Section Aa.4 (if removed see item (2a)).
- (48) Refit the converter and components removed in item (2b).
- (49) Refit the engine/transmission unit to the car as detailed in Section Aa.3.

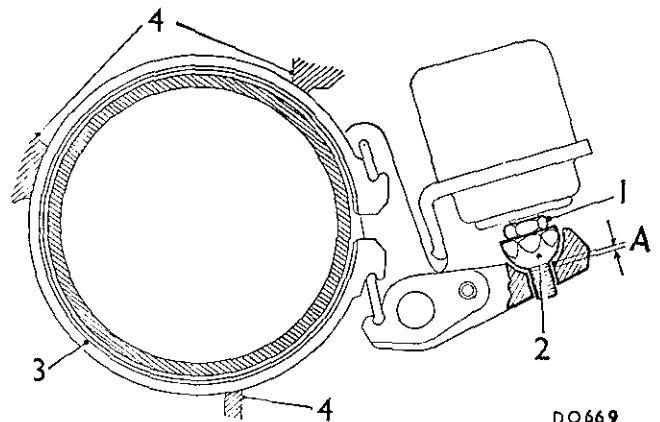


Fig. Fa.23

The servo unit band adjustment

A = .040 to .080 in. (1.02 to 2.03 mm.)

### Section Fa.4

#### VALVE BLOCK

##### Early models

The valve block can be removed from the transmission unit with the power unit *in situ* by removing the unit as three individual sections.

It is necessary to clean thoroughly the area around the transmission front cover before any dismantling is commenced. Absolute cleanliness is essential at all times and especially so whilst servicing this unit.

##### Later 848-c.c. and 998-c.c. models

The valve block assembly cannot be removed from the transmission unit with the power unit *in situ* but the lid and valve chest can be removed for dismantling and cleaning. If it is necessary to examine and/or fit new seals to the valve block/servo unit interconnecting pipes or to remove the pipe chest, it is necessary to remove the power unit from the car and remove the converter and housing (see items (25) to (32)).

##### Removing (early models)

- (1) Remove the front grille.
- (2) Remove the filter assembly as detailed in Section Aa.2.
- (3) Remove the engine oil feed pipe.
- (4) Drain the engine/transmission unit.
- (5) Remove the transmission front cover and valve block bobbin.
- (6) Place the gear selector lever in the 'R' position on the quadrant.

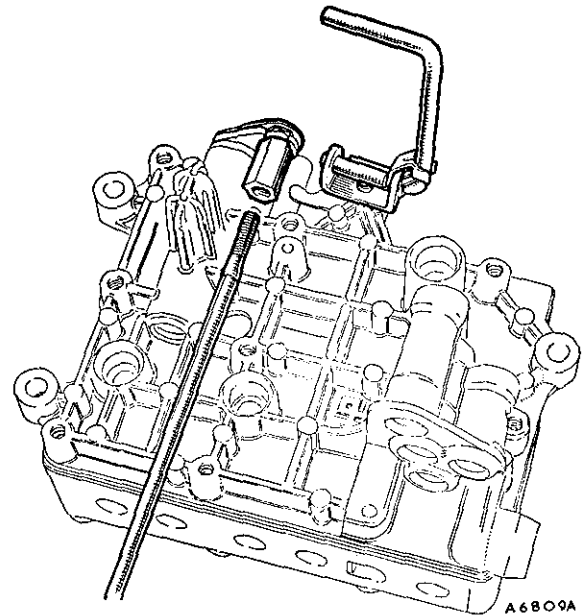


Fig. Fa.24

The gear selector rod and the governor valve linkage

- (7) Remove the bell-crank lever clevis pin. Unscrew and pull out the selector rod sufficiently to remove the valve block.
  - (8) Loosen the servo unit securing bolts.
  - (9) Remove the valve block assembly as individual components, i.e. the lid, valve chest, and finally (if necessary) the pipe chest (Fig. Fa.25).
- The valve block can only be removed as an assembly with the power unit removed from the car.

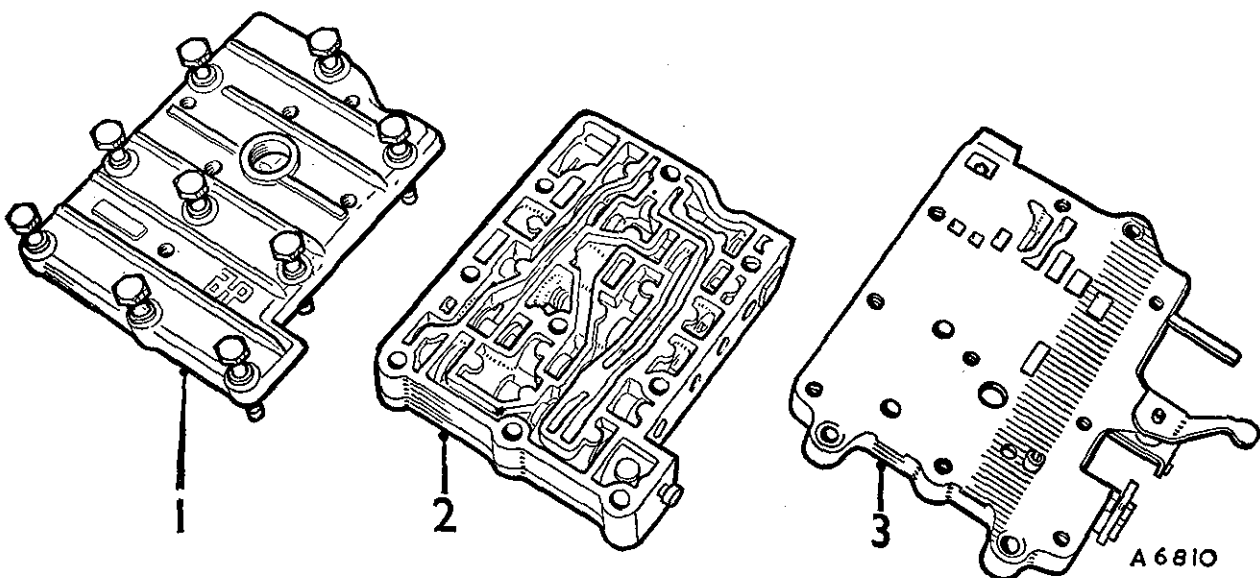


Fig. Fa.25

The valve block assembly

1. Lid.

2. Valve chest.

3. Pipe chest.



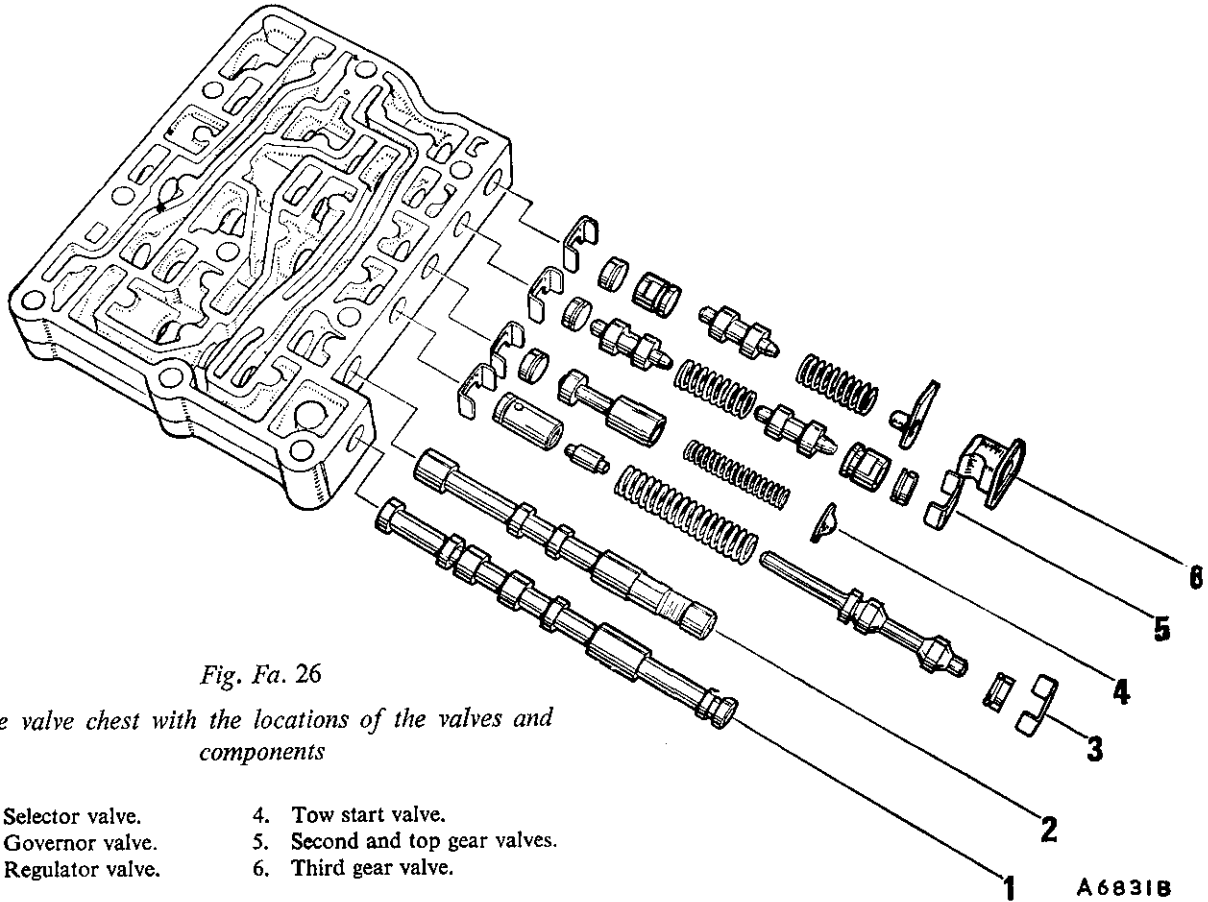


Fig. Fa. 26

The valve chest with the locations of the valves and components

- |                     |                                |
|---------------------|--------------------------------|
| 1. Selector valve.  | 4. Tow start valve.            |
| 2. Governor valve.  | 5. Second and top gear valves. |
| 3. Regulator valve. | 6. Third gear valve.           |

**VALVE CHEST ONLY—'POWER UNIT IN SITU'**

**Removing (later 848-c.c. and 998-c.c. models)**

- (10) Carry out items (1), (2), and (4).
- (11) Disconnect the engine oil feed pipe and remove the adaptor. Withdraw the valve block connecting pipe through the adaptor hole.
- (12) Remove the transmission front cover and manoeuvre the cover upwards and out through the grille aperture.
- (13) Remove the valve block lid and the valve chest.

**NOTE.**—Before dismantling the valve block it must be remembered that the valves are selected for each bore. It is of the utmost importance therefore to reassemble each valve into its original bore and position. Cleanliness is essential at all times.

**Dismantling**

- (14) Remove the lid and valve chest from the pipe chest (if removed as a unit), see Fig. Fa.25.
- (15) Remove the selector and governor valves.
- (16) Remove the 'C' clips and the plugs. Remove the regulator valve, spring, and reverse booster piston assembly.
- (17) Remove the 'C' clip and the plug. Remove the tow-start valve, spring, and spring retainer.

- (18) Remove the 'C' clips and the plugs. Remove the second and fourth gear valves, spring, and booster piston.
- (19) Remove the 'C' clip and tap out the plug. Remove the third gear valve booster piston, spring, spring retainer, and the plastic plug.

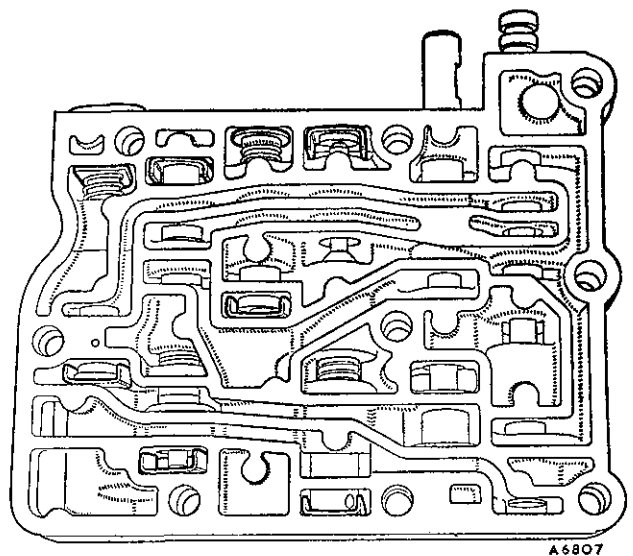


Fig. Fa.27

The valve chest with the 'C' clips correctly positioned

### Inspecting

Clean all parts thoroughly in clean fuel (petrol) or paraffin (kerosene) and dry off using an air pressure line.

Check for burrs on the valves and valve chest and for sticking valves. Place all components in automatic transmission oil before reassembling to the valve block.

### Reassembling

- (20) Reassemble each valve assembly in the reverse order of dismantling (see Fig. Fa.26). Check that the 'C' clips and plugs are correctly located in the valve chest (see Fig. Fa.27).

### Refitting

- (21) Refitting is a reversal of the removal procedure; take care to locate the selector valve with the linkage and the governor rod with the governor. The flat on the governor valve must face inwards. Tighten all securing bolts to the torque figures given in 'GENERAL DATA'.

- (22) Ensure that the new joint washer fitted to the filter head/transmission front cover is correctly fitted.  
 (23) Check and adjust if necessary the gear change cable and selector rod adjustment (see Section Fa.2).  
 (24) Refill the engine/transmission unit with the recommended oil to the 'MAX' mark on the dipstick (see Section Aa.1).

### VALVE BLOCK ASSEMBLY REPLACEMENT 'POWER UNIT REMOVED'

#### Removing (later 848-c.c. and 998-c.c. models)

- (25) Remove the engine/transmission unit from the car (Section Aa.3).  
 (26) Remove the converter cover, converter and converter housing as detailed in Section Aa.4, items (3) to (11).  
 (27) Carry out items (10) and (11) and remove the front cover.  
 (28) Remove all the servo unit securing bolts.  
 (29) Remove the bell-crank lever clevis pin. Unscrew and pull out the selector rod.  
 (30) Carry out operations (2) and (3) in Section Fa.5.

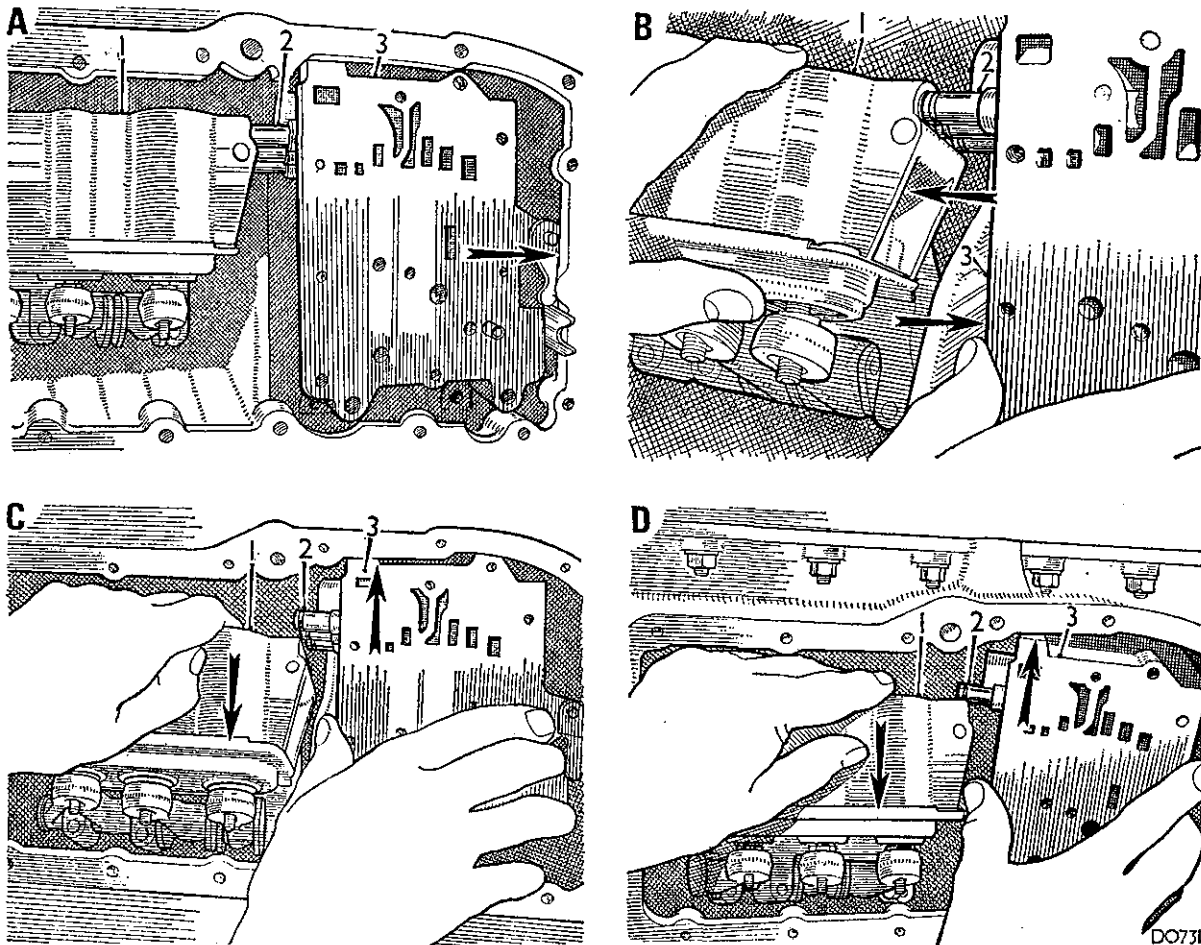


Fig. Fa.28

The removing and refitting sequence of the pipe chest section of the valve block

1. Servo unit.      2. Connecting pipes.      3. Pipe chest.

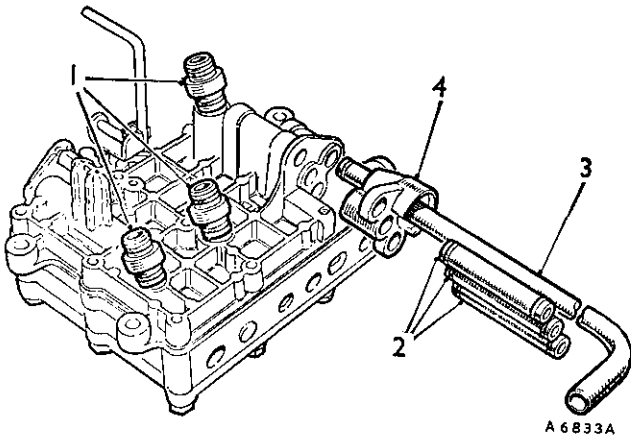


Fig. Fa.29

The valve block assembly showing

1. Three connecting bobbins.
2. Valve block to servo pipes.
3. Valve block to converter feed pipe.
4. Pipe assembly guide.

- (31) Remove the valve block lid and valve chest.
- (32) Remove the pipe chest as shown in the operation sequence in Fig. Fa.28 after pulling it outwards to release it from the bobbins and to disconnect the governor linkage.
- (33) Refer to Fig. Fa.28.
  - (a) Push the pipe chest fully against the casing.
  - (b) Move the servo unit in the opposite direction until the three pipes are clear of the servo unit.
  - (c) Pull the servo unit outwards and downwards; lift the pipe chest upwards and (when clear), move it so that the pipes are over the top of the servo and the regulator valve lever is clear of the transmission casing.
  - (d) Hold the servo unit down and withdraw the pipe chest after lifting the linkage over the web in the casing.

**Fitting replacement unit**

- (34) Remove the lid and valve chest from the pipe chest of the new unit. Refit these as individual components in the reverse order of the removing procedure, noting the following points:
- (35) Fit the three bobbins into their locations in the transmission case.
- (36) Assemble the three pipes into the pipe chest (together with the nylon guide) before refitting the unit to the transmission casing.
- (37) Carry out operation (21).
- (38) Position the plastic sleeve over the rings on the forward clutch shaft.
- (39) Carry out operations (36) to (38) in Section Fa.3.
- (40) The remainder is a reversal of the removal procedure.

**Section Fa.5**

**AUXILIARY PUMP AND GOVERNOR**

**Removing**

- (1) Remove the engine/transmission unit from the car as detailed in Section Aa.3.

- (2) Remove the governor control assembly from the transmission case and fit Service tool 18G 1097 (see Fig. Fa.19).
- (3) Remove the securing nuts and pull the auxiliary pump and governor assembly from the transmission case.

**Dismantling**

- (4) Remove the speedometer drive assembly.
- (5) Remove the set screws and bolt. Pull out the governor centre shaft, and lift away the governor assembly together with one of the auxiliary pump gears.
- (6) Remove the circlip, lift off the auxiliary pump gear, and remove the governor.
- (7) Lift out the governor bearing trunnions and washer.
- (8) Remove the second auxiliary pump gear from the auxiliary pump casing together with its bi-metal washer.

**Reassembling**

- (9) Reassemble the auxiliary pump gear with its bi-metal washer to the pump casing.
- (10) Refit the governor auxiliary pump gear and circlip. Ensure that both gears are seating correctly and will rotate freely after assembly.
- (11) Refit the governor assembly to the auxiliary pump and refit the centre shaft.
- (12) Use Service tool 18G 1106 to centralize the auxiliary pump and governor unit with the end cover, tighten the securing bolts to the torque figure given in 'GENERAL DATA' and remove the Service tool.
- (13) Refit the speedometer drive assembly, with a new joint washer.

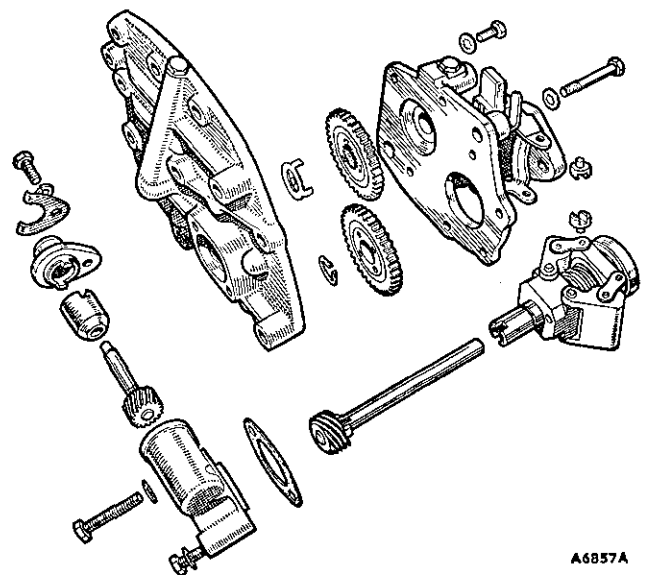
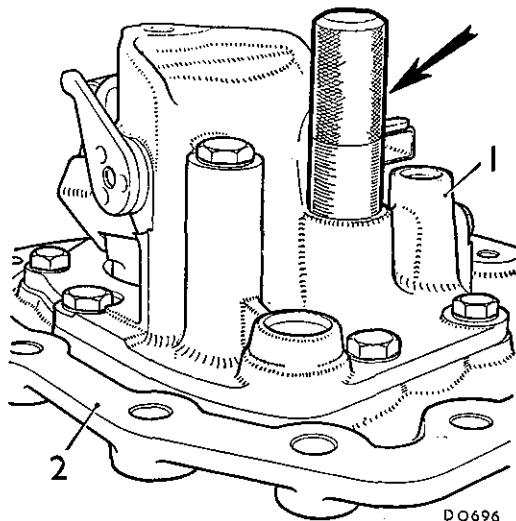


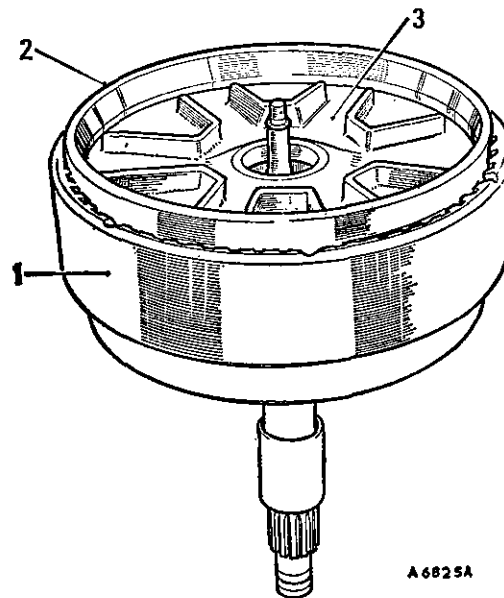
Fig. Fa.30

The speedometer drive and governor assembly components



**Fig. Fa.31**

Centralizing the pump and governor unit (1) with the end cover (2) using Service tool 18G 1106 (arrowed)



**Fig. Fa.32**

Fitting the forward clutch piston using Service tool 18G 1102

1. Forward clutch.
2. Service tool 18G 1102.
3. Forward clutch piston.

### Refitting

- (14) Carry out the instructions given in Section Fa.3, items (36) and (38).

**NOTE.** — See 'GENERAL DATA' for all torque figures.

## Section Fa.6

### FORWARD CLUTCH

Two types of clutch assembly are in use; the earlier type having 47 teeth is shown in Fig. Fa.34. This unit is now replaced by the 30-tooth clutch as shown in Fig. Fa.35. The two clutch assemblies are not interchangeable; when a replacement unit is required only the identical unit to that removed must be fitted.

### Removing

- (1) Carry out the operations given in Section Fa.3, items (1), and (5) to (9).

### Dismantling

- (2) Remove the circlip.

**NOTE.**—Mark the retainer plate and steel clutch plate to assist when reassembling.

- (3) Remove the retainer plate and clutch plates (two paper, one steel).
- (4) Lift out the piston return springs and pressure plate.
- (5) Remove the spring ring (if fitted) and toggles (see Fig. Fa.34).
- (6) Use an air pressure line to blow out the piston.
- (7) Remove the circlip and lift out the reverse shut-off valve.

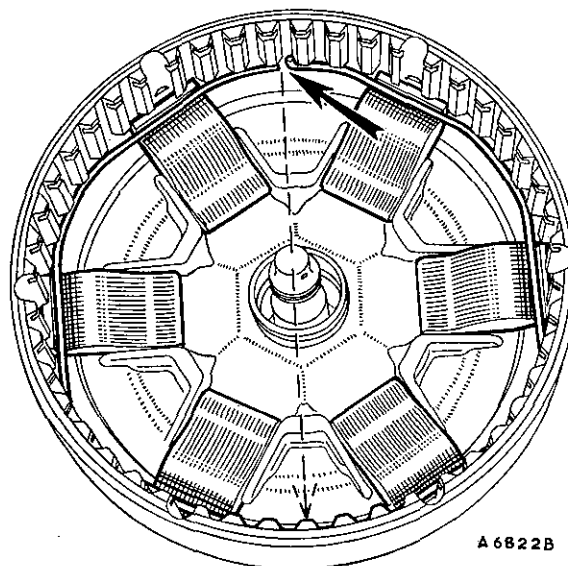
Fa.28

### Inspecting

Check all parts for wear and renew if necessary. Check the reverse shut-off valve oil seals and renew if necessary.

### Reassembling

- (8) Refit the reverse shut-off valve and fit a new circlip.



**Fig. Fa.33**

The fitted position of the toggles and spring ring (fitted to very early units). The arrow indicates location of spring ends exactly opposite the only five tooth section of the clutch unit

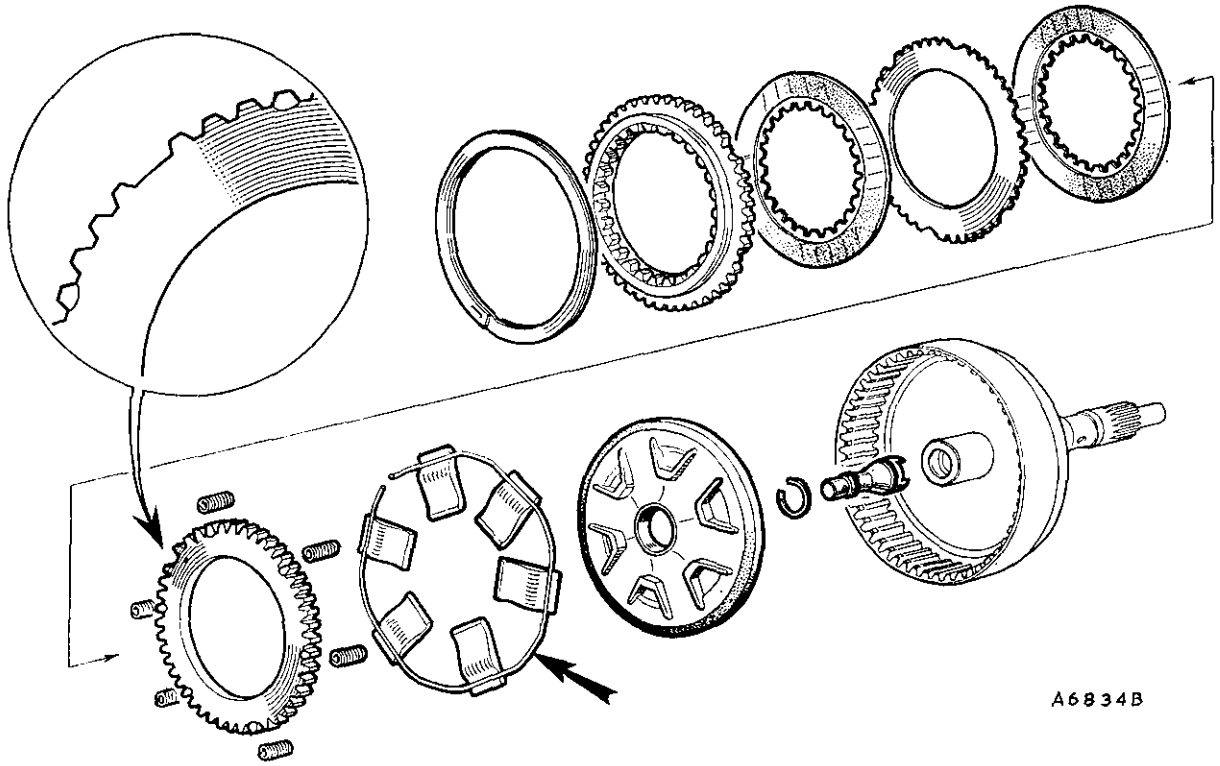


Fig. Fa.34

The early-type (47-tooth) forward clutch components. The arrow indicates the spring ring fitted to very early units only

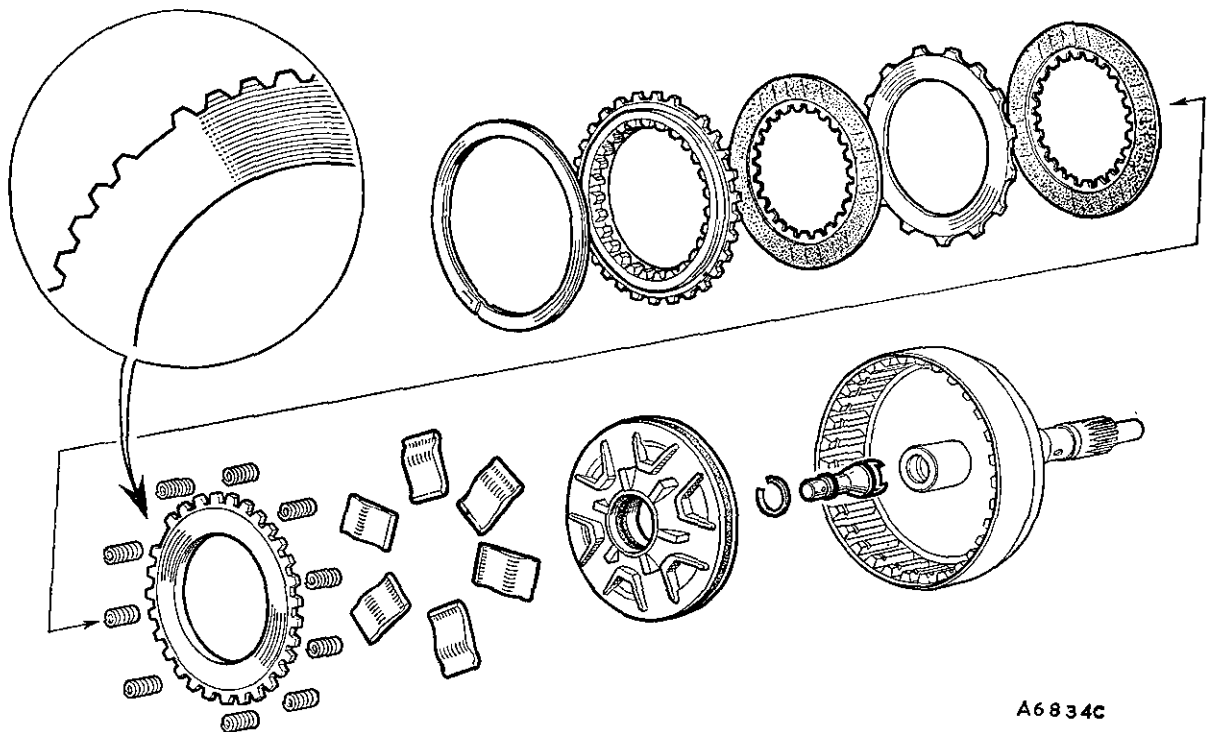


Fig. Fa.35

The (30-tooth) forward clutch components

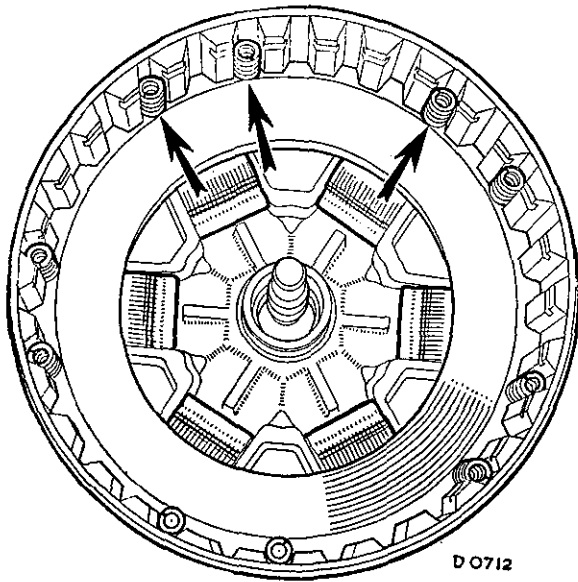


Fig. Fa.36

The fitted position of the toggles and springs of the 30-tooth clutch

- (9) Using Service tool 18G 1102, assemble the piston with the lips of the seal facing inwards and lubricated with transmission oil.
- (10) 47-tooth clutch. Assemble the toggles and spring ring (early units) with the ends of the spring ring located as shown in Fig. Fa.33, and with the cut-out tooth on the pressure plate in the relative position to the ends of the spring ring (Fig. Fa.34). Assemble the clutch plates and the piston return springs.
- (11) 30-tooth clutch. Assemble the toggles, pressure plate, and the piston return springs as shown in Fig. Fa.36. Refit the clutch plates and the retainer plate (see Fig. Fa.35).

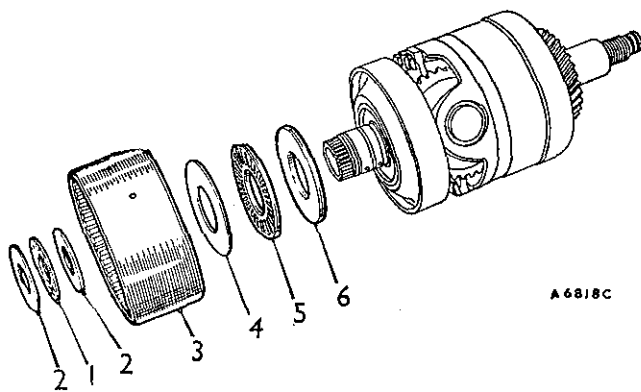


Fig. Fa.37

Removing the top and reverse clutch

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| 1. Torrington needle thrust bearing. | 4. Thrust washer.                    |
| 2. Thrust washers.                   | 5. Torrington needle thrust bearing. |
| 3. Top and reverse clutch.           | 6. Selective washer.                 |

Fa.30

- (12) Refit the retainer plate with its six recessed teeth positioned relative to the piston return springs.
- (13) Refit the circlip.

### Refitting

- (14) Carry out the operations given in Section Fa.3 items (28) and (34) to (38).
- (15) Refit the governor linkage.

### Section Fa.7

#### GEAR TRAIN

The gear train is accurately assembled with special equipment to obtain the correct backlash on the various gears and it is not possible to assemble this unit to factory standard without this special equipment. In the event of failure of any part of this unit a new complete gear train assembly must be fitted. The only washer in the gear train which can be renewed is the forward output gear bi-metal washer (8) (see Fig. Fa.42); this is not a selective size washer.

### Removing

- (1) Carry out the operations given in Section Fa.3, items (1) to (2b) and (12).

### Dismantling

- (2) Remove the top and reverse clutch.

**NOTE.**—For top and reverse clutch dismantling and reassembling see Section Fa.10.

- (3) Remove the thrust race and washers (Fig. Fa.37).

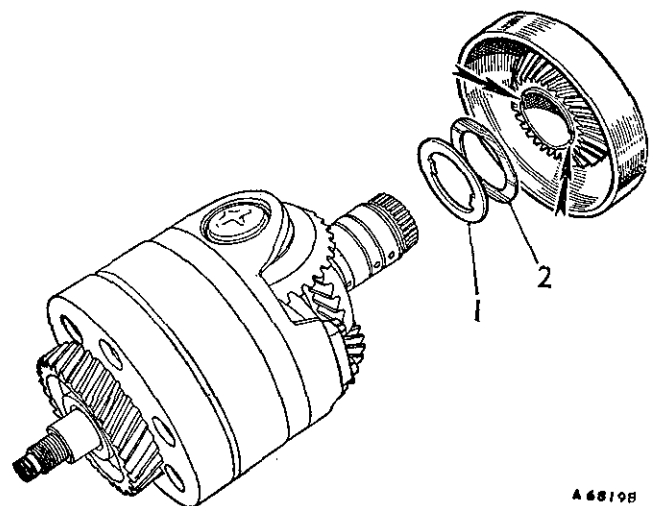


Fig. Fa.38

Removing the third speed reaction gear. The arrows indicate the bi-metal washer locations

- |                     |                      |
|---------------------|----------------------|
| 1. Bi-metal washer. | 2. Shim (if fitted). |
|---------------------|----------------------|

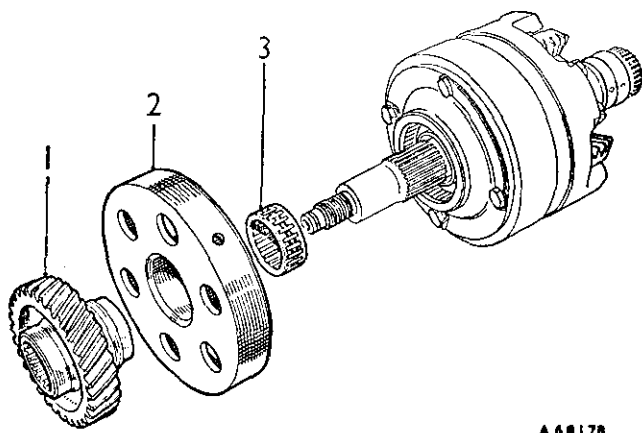


Fig. Fa.39

Removing the input gear (1), the first gear free-wheel reaction member (2), and the needle-roller bearing (3)

- (4) Remove the third gear reaction member together with its thrust washer and shim (if fitted) (Fig. Fa.38).
- (5) Remove the input gear, and pull off the first gear free-wheel reaction member and needle-roller bearing (Fig. Fa.39).
- (6) Knock back the lock washers and remove the first gear free-wheel housing set screws.
- (7) Pull out the first gear free-wheel assembly, input gear, Torrington thrust race, and washer (Fig. Fa.40).

NOTE.—For first gear free-wheel assembly dismantling and reassembling see Section Fa.11.

Dismantling of the gear train is necessary only if the forward output gear bi-metal washer is to be replaced.

- (8) To dismantle the early-type gear train assembly as shown in Fig. Fa.42, refer to items (16) to (19), with the reassembly sequence given in items (33) to (36).

Dismantling of the later gear train assembly is given below in items (9) to (15), with the reassembly sequence in items (20) to (32).

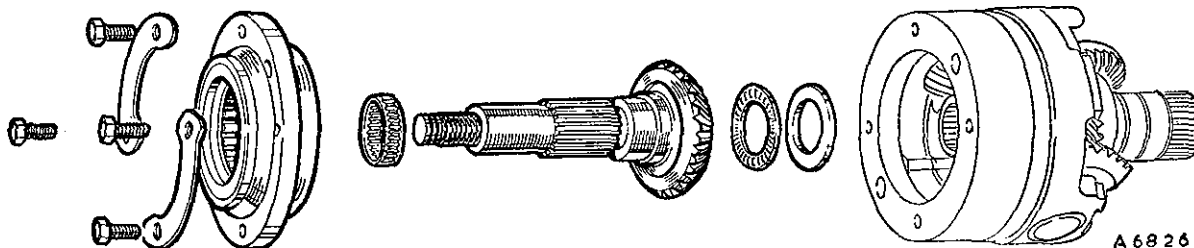


Fig. Fa.40

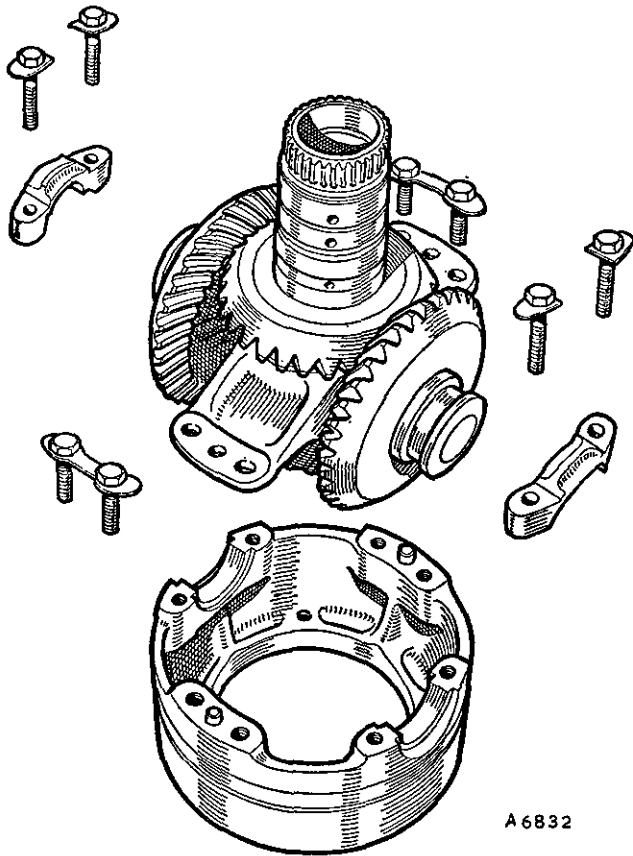
Removing the one-way clutch and the input gear with its Torrington needle thrust bearing and washer

**Dismantling gear train (later-type)**

- (9) Remove the spindle end cover circlips and covers; remove the small locking circlip and unscrew the spindle locking screws.
- (10) Hold the unit on its side until the locking ball rolls out from the hole in the planetary gear spindle. Repeat this operation on the other side.
- (11) Insert Service tool 18G 1093 A into the forward output gear and through the complete assembly to assist the dismantling procedure.
- (12) Screw the Service tool adaptor 18G 284 AJ into one of the planetary gear spindles and using Service tool 18G 284 pull the spindle from the gear. Repeat this operation with the other spindle and withdraw the needle-roller bearings.
- (13) Knock back the locking tabs and remove the strap securing bolts.
- (14) Ease the strap off the dowels and lift the complete assembly from the carrier.  
Retain the respective positions of each planetary gear thrust washer with the carrier.
- (15) Dismantle the assembly, ensuring that all components are retained in their respective positions for reassembly (see Fig. Fa.43).

**Dismantling gear train (early-type)**

- (16) Check the markings on the carrier and the bearing caps, i.e. marked NIL or with the letter 'O'. These are reference marks to fitting dimensions and the caps must be refitted in their original positions as indicated by the markings on reassembly of the unit.
- (17) Knock back the locking tabs and remove the bearing cap bolts and the strap securing bolts. Lift out the forward output gear, reverse output gear, and the pinions.
- (18) Lift off the thrust bearings, pinions, and thrust washers.
- (19) Lift off the forward output gear and thrust washer, the reverse output gear, thrust washer, and thrust race.



A 6832

Fig. Fa.41

Removing the forward and reverse output gears, and the planetary gears from the carrier

### Inspecting

Clean and examine all parts for wear. Fit a new bi-metal washer to the forward output gear if required and renew if necessary the Torrington needle-thrust races.

Fit new rubber seals and replace the locking plates.

**NOTE.**—Use petroleum jelly when reassembling to secure the various thrust washers and needle thrust races in position.

### Reassembling gear train (later-type)

(20) Assemble the forward output gear with its bi-metal washer and the .004 in. (.10 mm.) shim (if fitted) interposed between the bi-metal washer and the carrier (see Fig. Fa.44).

Assemble the reverse output gear with its Torrington needle thrust bearing and steel washer.

(21) Insert Service tool 18G 1093 A through the forward output gear and the assembly to ensure correct alignment.

(22) Check and reset the timing of the gear train (see Fig. Fa.45) by rotating the planetary gears until the timing marks are in alignment.

(23) Retain the timed position of the gear train and refit to the carrier ensuring that both timing marks align with the dowel surface of the carrier.

(24) Refit the planetary gear needle-roller bearings and tap in the spindles (with the hole on the centre of the spindle facing downwards).

(25) Insert a ball into each spindle and screw in the locking screws. Refit the locking screw circlips, end covers, and the cover circlips.

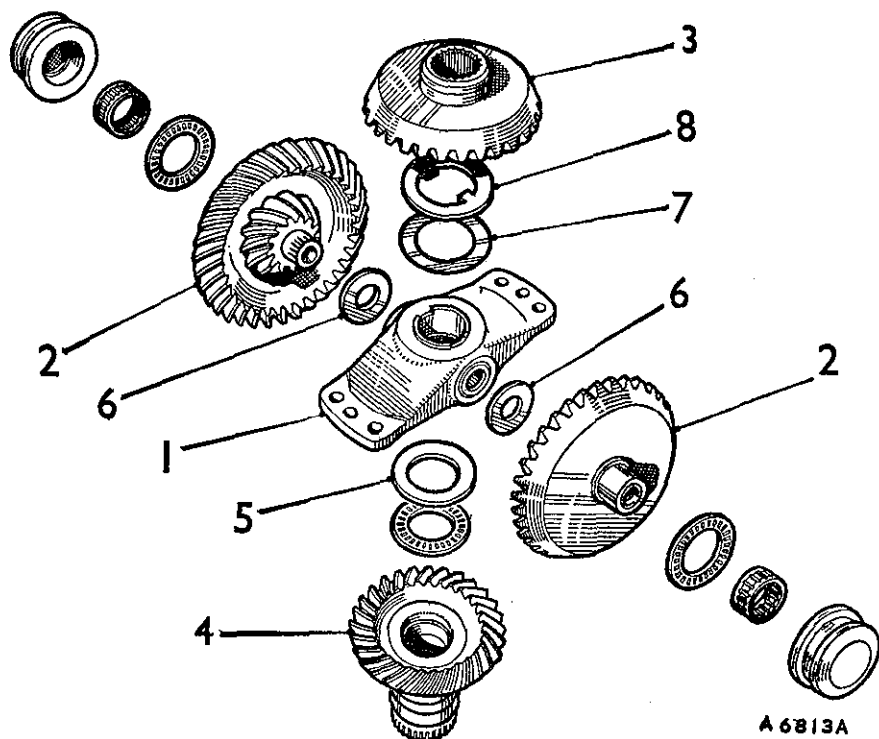


Fig. Fa.42

The early-type gear train completely dismantled

1. Gear carrier.
2. Planetary gears.
3. Forward output gear.
4. Reverse output gear.
5. Steel washer (reverse output gear).
6. Planetary gear washers.
7. Steel shim (forward output gear).
8. Bi-metal washer (forward output gear).

A 6813A



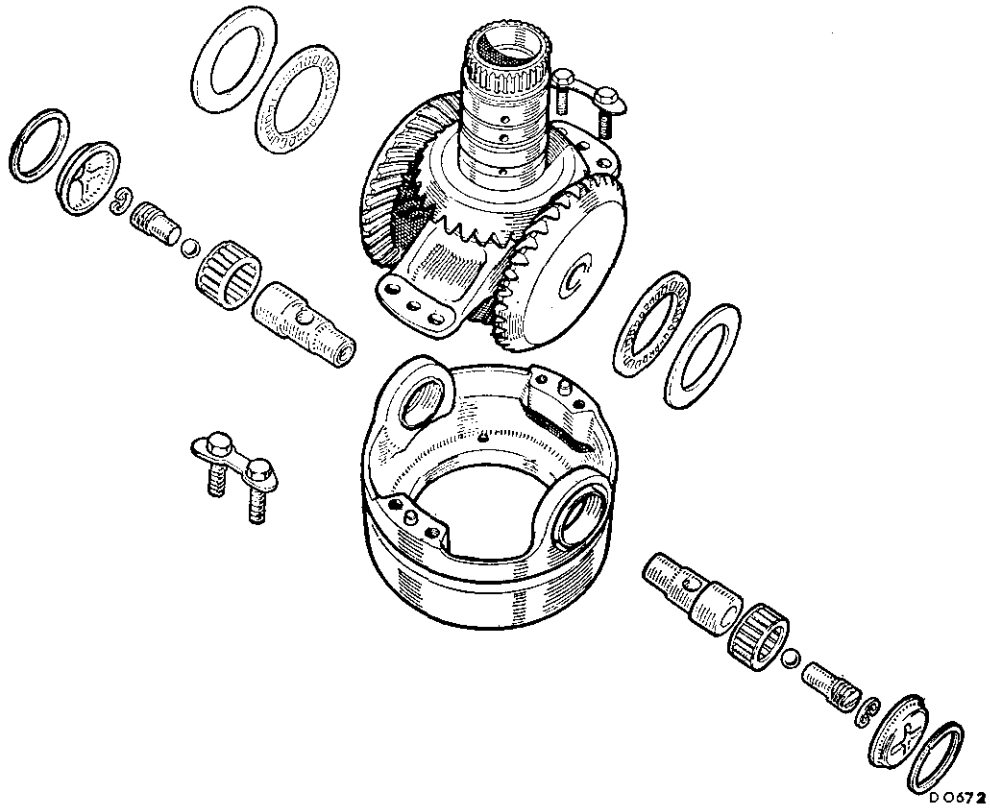
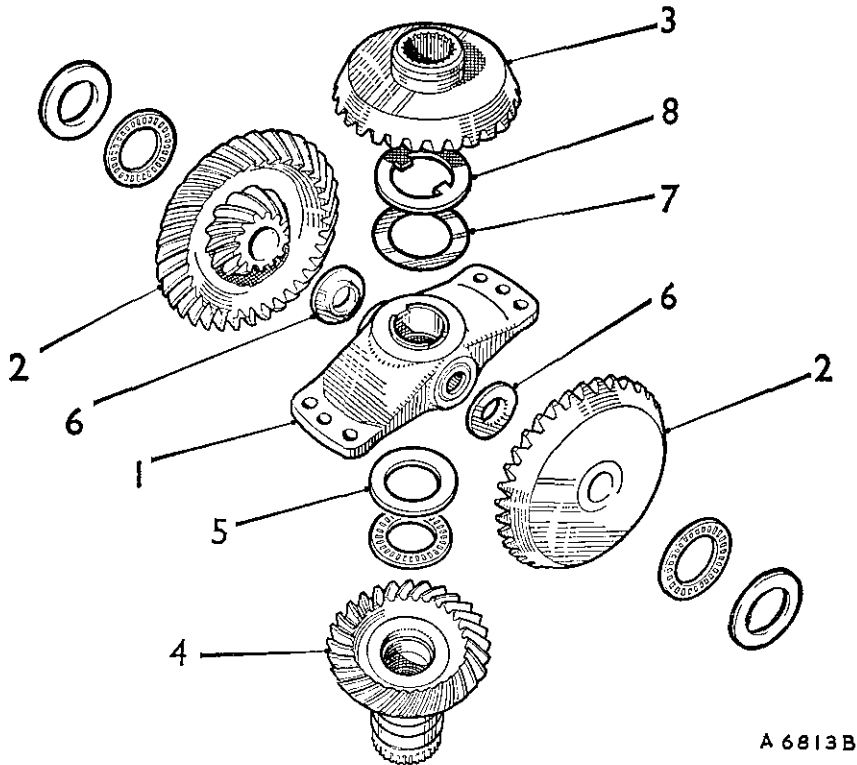


Fig. Fa.43

The later-type gear train, with the forward and reverse output gears and the planetary gears removed from the carrier



A 6813B

Fig. Fa.44

A dismantled view of the later-type gear train assembly

- |                         |   |
|-------------------------|---|
| 1. Gear carrier.        | 5. Steel washer (reverse output gear).    |
| 2. Planetary gears.     | 6. Planetary gear washers.                |
| 3. Forward output gear. | 7. Steel shim (forward output gear).      |
| 4. Reverse output gear. | 8. Bi-metal washer (forward output gear). |

- (26) Assemble the third speed reaction gear with its bi-metal washer fitted with the white metal face towards the reverse output gear (see Fig. Fa.46) and with the steel shim(s) located between the bi-metal washer and the gear.

Retain each washer and shim in position with petroleum jelly and refit the assembly to the gear train (see Fig. Fa.46).

- (27) Assemble the bevel input shaft with its Torrington needle thrust bearing and selective steel washer (see Fig. Fa.40).  
 (28) Refit the one-way clutch to the gear train housing (Fig. Fa.40), tighten the securing bolts, and tap up the locking plate tabs.  
 (29) Refit the free-wheel support.

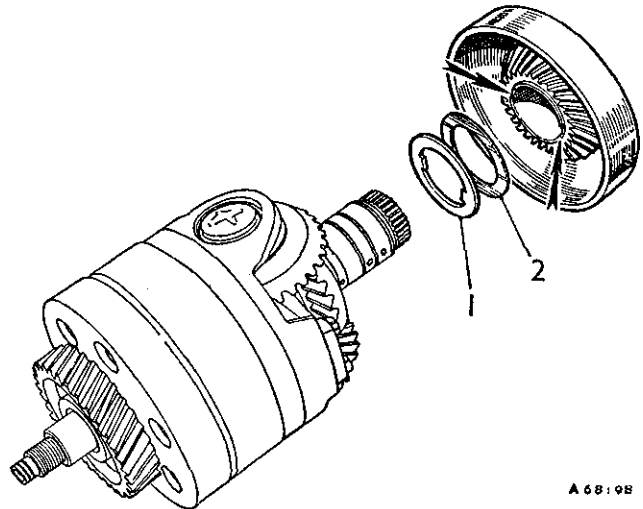


Fig. Fa.46

Refitting the third speed reaction gear with its bi-metal washer, locations indicated by arrows

1. Bi-metal washer.                      2. Shim (if fitted).

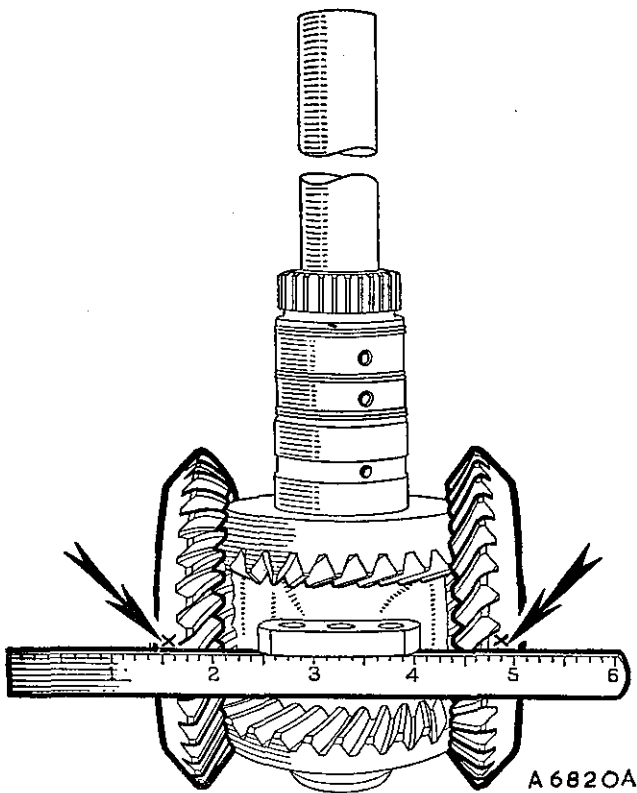


Fig. Fa.45

Timing the gear train

- (30) Refit the input gear and needle-roller bearing (see Fig. Fa.47).  
 (31) Refit the top and reverse clutch with its selective steel washer and Torrington needle thrust bearing onto the reverse output shaft (see Fig. Fa.48).  
 (32) Check across the splined end of the reverse output shaft and the adjacent face of the top and reverse clutch (Fig. Fa.49). Both faces must be exactly level with no gap, to ensure that the third speed reaction gear has no end-float and the correct backlash is maintained. If both faces are not level, remove and measure the thickness of the selective steel washer fitted in item (31) and fit the correct selective washer from the range available (see washer chart below).

Selective Washer Sizes	Part Nos.
·076 to ·078 in. (1·93 to 1·98 mm.)	22G 748
·072 to ·074 in. (1·83 to 1·88 mm.)	22G 749
·068 to ·070 in. (1·73 to 1·78 mm.)	22G 750
·064 to ·066 in. (1·63 to 1·68 mm.)	22G 751

### Reassembling gear train (early-type)

- (33) Carry out items (20) to (23) with the following exceptions: Refer to Fig. Fa.42, and use Service tool 18G 1093 when reassembling this early-type gear train.  
 (34) Refit the bearings caps to their respective positions (see markings) and using new locking plates, refit and tighten the bearing cap and carrier bolts to the torque figure given in 'GENERAL DATA'.

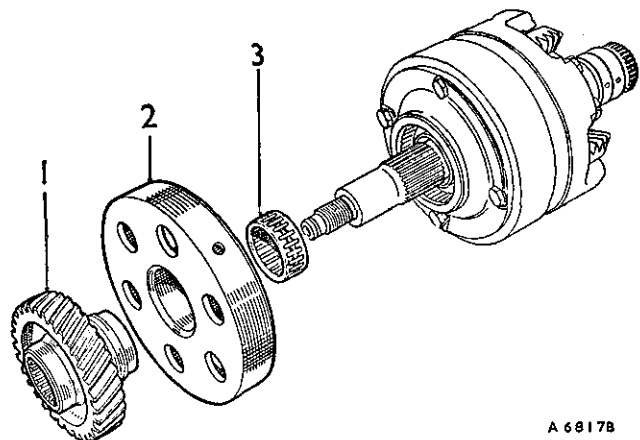


Fig. Fa.47

Refitting the input gear (1), the first gear free-wheel reaction member (2), and the needle-roller bearing (3)

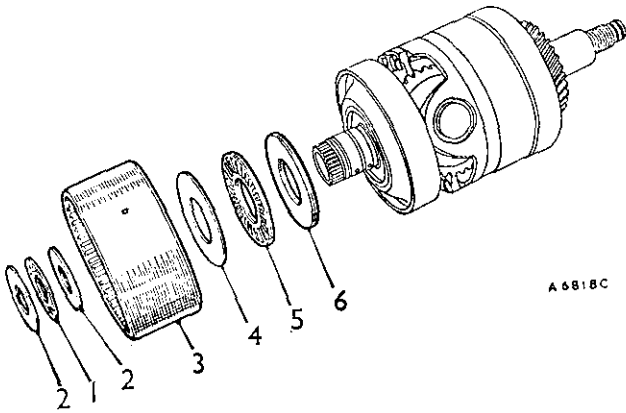


Fig. Fa.48

*Refitting the top and reverse clutch*

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| 1. Torrington needle thrust bearing. | 4. Thrust washer.                    |
| 2. Thrust washers.                   | 5. Torrington needle thrust bearing. |
| 3. Top and reverse clutch.           | 6. Selective washer.                 |

(35) Carry out items (26) to (31).

(36) Carry out item (32) and note the 'example' and selective washer chart below.

The selective washers for the early units are not interchangeable with those fitted to later units.

Example: If the selective washer fitted in operation (23) was .0365 in. (.93 mm.) thick and after checking there was a gap, fit the correct selective washer from the range available (see washer chart below).

Gap	Washer required
.000 to .0035 in. (.000 to .08 mm.)	.1185 in. (3 mm.)
.0035 to .0075 in. (.08 to .19 mm.)	.1135 in. (2.88 mm.)
.0075 to .0115 in. (.19 to .29 mm.)	.1095 in. (2.78 mm.)
.0115 to .0150 in. (.29 to .38 mm.)	.1055 in. (2.67 mm.)

**Refitting**

(37) Carry out the operations given in Section Fa.3, items (40) and (41). The remainder is a reversal of the removal procedure.

(38) Refit the power unit to the car as detailed in Section Aa.3.

**Section Fa.8**

**SERVO ASSEMBLY**

**Removing**

- (1) Carry out the operations given in Section Fa.3 items (1) to (13).
- (2) Remove the servo unit from the valve block assembly.

**Dismantling**

- (3) Remove the centre shaft and lift out the servo levers, reaction levers, washers, and struts.

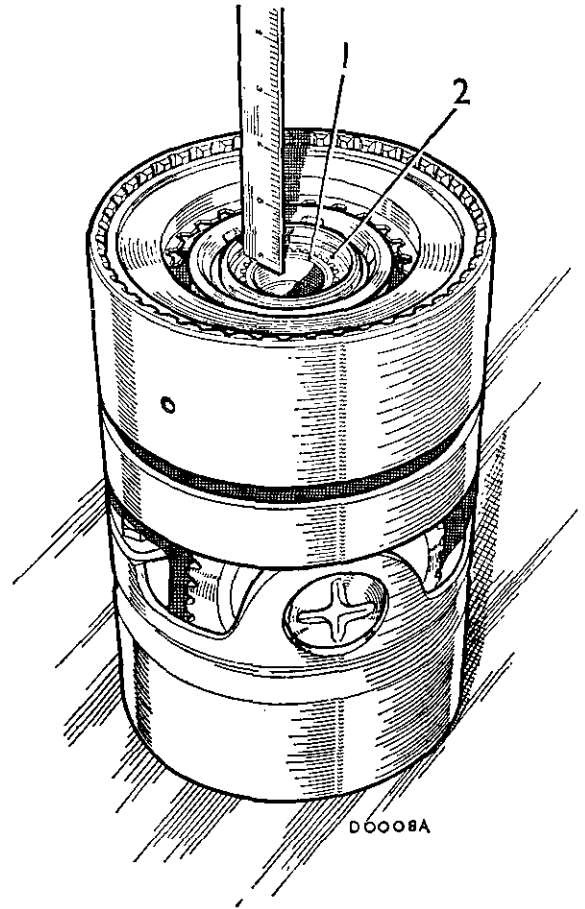


Fig. Fa.49

*Checking that the end of the reverse output shaft (1) is level with the internal face of the top and reverse clutch (2)*

- (4) Hold the servo cover and release the securing screws and the cover.
- (5) Lift out the springs and pistons.

**Inspecting**

Check all parts for wear and renew if necessary.

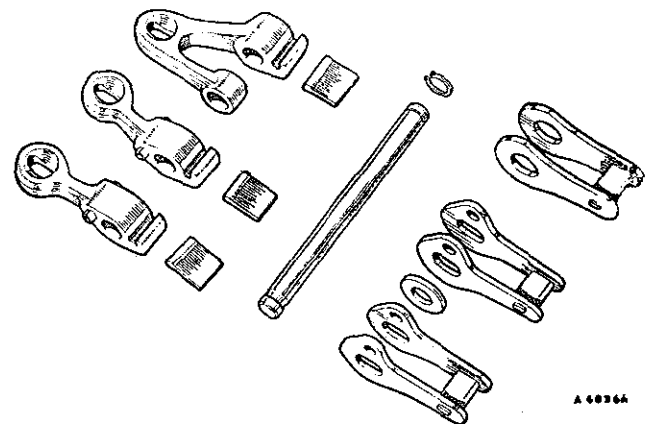
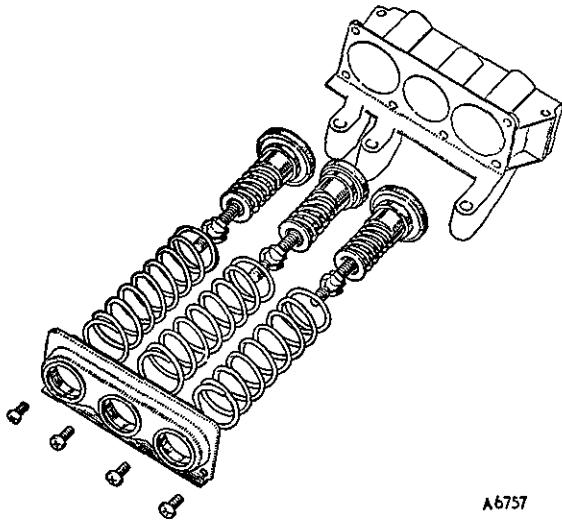


Fig. Fa.50

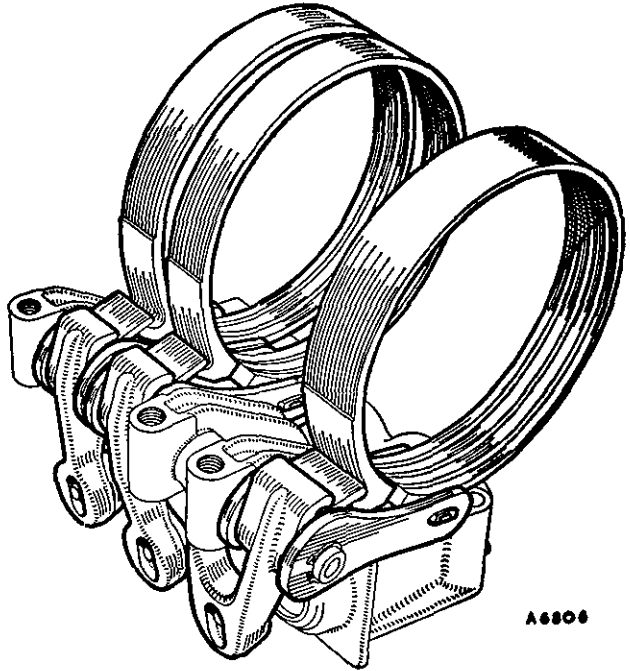
*The fitting relationship of the servo levers with the reaction levers and struts*



A6757

Fig. Fa.51

The servo unit components



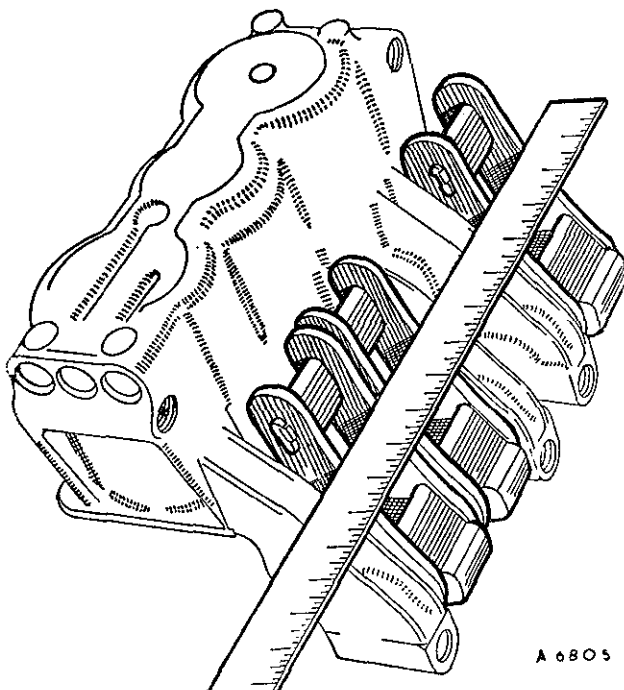
A6808

Fig. Fa.53

The brake band and struts correctly positioned

### Reassembling

- (6) Lubricate the seals and fit the pistons into the correct bores (lips of seals facing downwards).
- (7) Assemble the springs and cover.
- (8) Hold the cover in position and fit the drive screws.
- (9) Assemble the struts, washer(s), reaction levers, and servo levers in the reverse order of dismantling (Figs. Fa.50, 52 and 53).
- (10) Insert the centre shaft with the cutaway in the shaft correctly positioned.



A 6805

Fig. Fa.52

The correct fitted position of the servo reaction levers

Fa.36

### Refitting

- (11) Carry out the operations detailed in Section Fa.3, items (30) to (44), (48), and (49).

## Section Fa.9

### DIFFERENTIAL ASSEMBLY

#### Removing

- (1) Remove the engine and transmission from the car (see Section Aa.3).
- (2) Drain the engine/transmission unit.
- (3) Use Service tool 18G 1100 to hold the driving flanges and remove the centre securing bolts. Withdraw the flanges from the splined shafts.
- (4) Knock back the lock washers and remove the nuts from the final drive housing.
- (5) Remove the securing screws and pull the kick-down linkage assembly clear of the transmission case.
- (6) Remove the two set screws securing the end cover to the transmission, and remove the final drive and housing assembly (Fig. Fa.12).
- (7) Remove the remaining securing bolts from the end cover and remove the cover and the adjustment shims.

#### Dismantling

- (8) Remove the differential unit from its casing.
- (9) Withdraw the oil seal housing, remove the bearings using Service tool 18G 2.

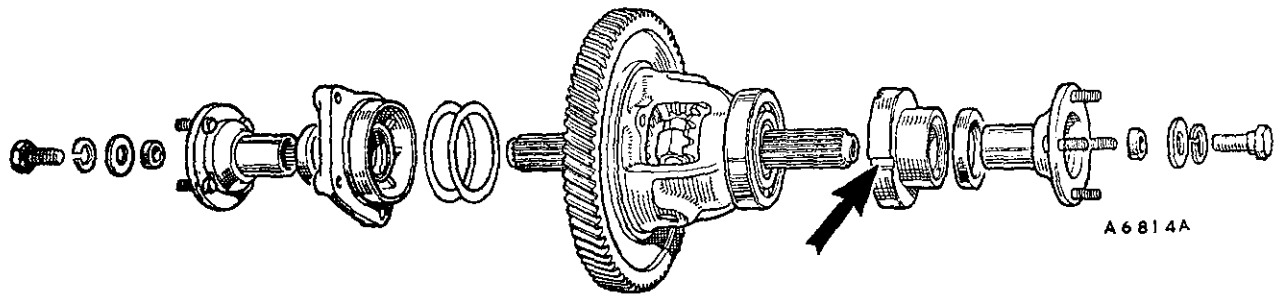


Fig. Fa.54

The differential components with the arrow indicating the alignment slot in the spacer

- (10) Knock back the locking plate tabs and remove the bolts securing the driving gear to the cage. Mark the gear and cage so that they can be refitted in their original positions.
- (11) Separate the driving gear from the cage and remove the differential gear and thrust washer from the driving gear.
- (12) Tap out the roll pin and remove both pinions and thrust washers, pinion spacer, and the other differential gear and thrust washer.

#### Inspection

Clean and examine the components for wear and fit new parts as necessary.

**NOTE.**—If any component has suffered damage with the result that swarf has been introduced into the lubricating system the automatic transmission must be removed (Section Aa.4) and dismantled as detailed in Section Fa.3.

This also applies if fitting a replacement drive gear pinion into the transmission unit.

Absolute cleanliness is essential.

#### Reassembling

- (13) Reassembly is a reversal of the dismantling procedure. Make sure that the differential gear thrust washers are refitted with their chamfered bores against the machined faces of the differential gears. Refit all components in their original positions.

#### Refitting

- (14) Refit the differential unit into the transmission case and push the assembly towards the converter, with the slot in the spacer in alignment with the dowel in the transmission case (Fig. Fa.54). Fit a new joint washer coated with Hylomar jointing compound. Ensure that the oil seal is pressed squarely against the face of the spacer and refit the differential housing, fit new locking plates, and lightly tighten the securing nuts.

#### Adjustment

- (15) Refit the end cover without a joint washer but with the original adjustment shims, tighten the cover bolts evenly and sufficiently only for the cover register to nip the bearing outer race; overtightening will distort the flange.

- (16) Take a feeler gauge measurement at varying positions between the side cover flange and the differential housing, any variations in measurement will indicate that the cover bolts are not evenly tightened. Adjust the cover bolts accordingly until identical measurements can be obtained. The compressed thickness of a new cover joint washer is .007 in. (.178 mm.) and the required preload on the bearings is .002 in. (.051 mm.). The correct gap is therefore .009 in. (.229 mm.), any deviation from this figure must be made up by adding or subtracting shims.

*Example:* If the feeler gauge measurement is .005 in. (.127 mm.), add a shim of .004 in. (.10 mm.) thickness between the bearing and the end cover.

- (17) Remove the end cover, fit shims as required, and refit the cover with a new joint washer coated with Hylomar jointing compound. Tighten the differential housing nuts and the cover bolts to the torque figures given in 'GENERAL DATA'. Tap up the locking plate tabs, except the nut which accepts the exhaust pipe bracket (fitted when the engine is in the car).
- (18) Lubricate the driving flange oil seal and refit the flanges making sure that the split collets are correctly located, inside the flanges. Fit new rubber seals to and refit the central securing bolts. Hold the flanges with Service tool 18G 1100 and tighten the flange bolts with Service tool 18G 372 to the torque figure given in 'GENERAL DATA'.
- (19) Refit the governor control linkage to the transmission case with a new washer. Ensure the lever is positioned correctly, relative to the governor (see Fig. Fa.22).
- (20) Carry out the 'Refitting' instructions given in Section Aa.3.

## Section Fa.10

### TOP AND REVERSE CLUTCH

#### Removing

- (1) Carry out the operations given in Section Fa.3, items (1), (2b), and (12).

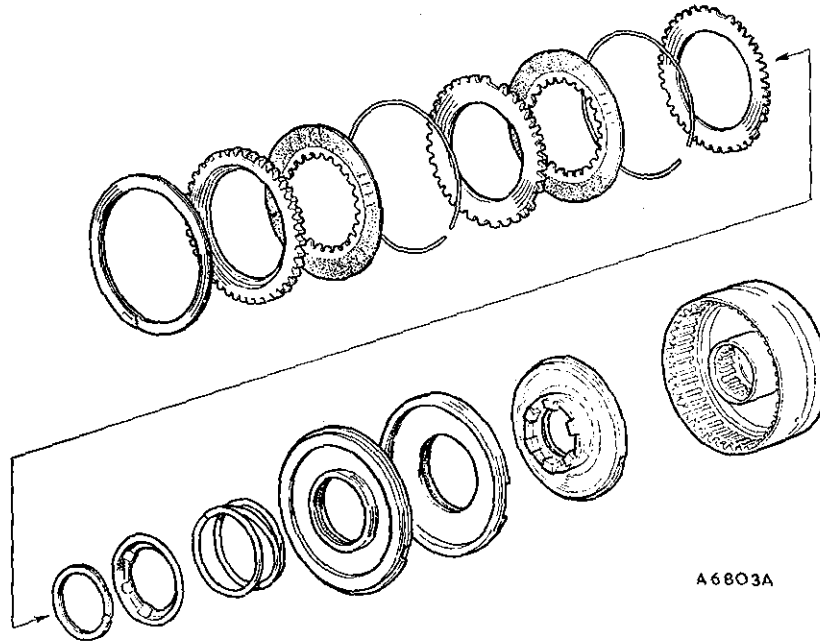


Fig. Fa.55

The top and reverse clutch components

- (2) Remove the top and reverse clutch from the gear train together with the Torrington needle thrust bearing and the steel washer.

### Dismantling

- (3) Remove the double spring circlip.
- (4) Remove the retainer plate.
- (5) Lift out the paper plate, spring ring, steel plate, paper plate, spring ring, and the thin steel plate.
- (6) Remove the circlip, spring retainer, and the piston return coil spring.
- (7) Lightly shock the assembly against a flat surface to remove the top gear piston and cylinder.
- (8) Refit the reverse (booster) piston into the bore, easing the piston ring into the bore with a screwdriver.
- (9) Fit Service tool 18G 1103 into the clutch unit and holding these together, lightly shock the assembly against a flat surface to remove the reverse booster piston.

### Inspecting

Check all parts for wear and renew if necessary. Renew the oil seals in the pistons. Check the piston ring gap which must be .016 to .020 in. (.4 mm. to .51 mm.), for both rings when fitted in their respective bores.

### Reassembling

- (10) Refit the reverse gear booster piston with the boss facing outwards, using Service tool 18G 1103 (see Fig. Fa.56).

- (11) Refit the top gear piston into its cylinder with the boss facing outwards.
- (12) Fit the top gear piston and cylinder into the clutch housing, with the cut-aways on the rear outer edge of the cylinder opposite the holes in the clutch housing.
- (13) Refit the top gear piston return spring, spring retainer, and circlip.

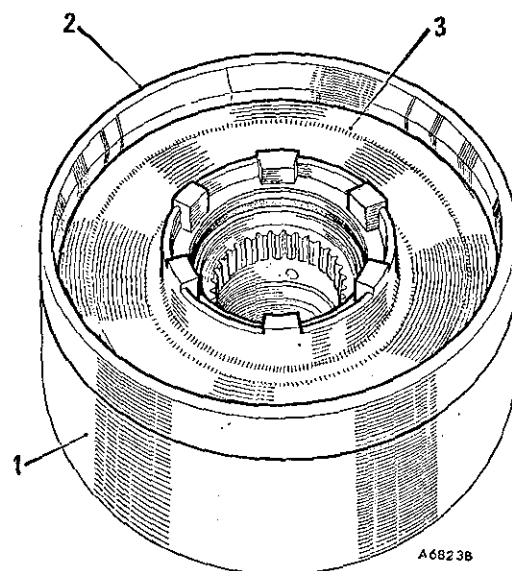


Fig. Fa.56

Using Service tool 18G 1103 (2) to remove or refit the reverse gear piston (3) to the top and reverse clutch unit (1)

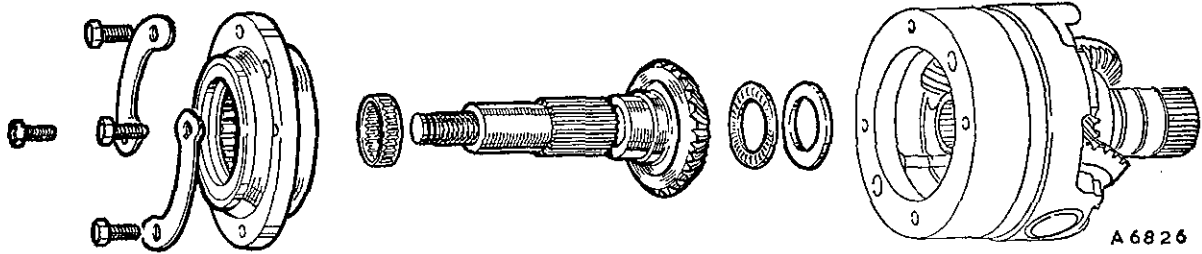


Fig. Fa.57

The one-way clutch removed from the gear train, with the input gear, bearings and thrust washer shown in assembly sequence

- (14) Refit the clutch plates, aligning the cutaway in the steel plates (thin steel, spring ring, paper, steel, spring ring, paper).
- (15) Refit the retainer plate and circlip.

**NOTE.**—Before refitting the clutch unit, ensure that the friction plates are free to drop.

**Refitting**

- (16) Carry out the operations given in Section Fa.7, items (31) and (32).
- (17) The remainder is a reversal of the removal procedure.

**Inspecting**

Check all parts for wear and renew if necessary.

**Reassembling**

- (6) Reassemble the thrust bearing, intermediate spring ring, first gear free-wheel (lip facing outwards, see Fig. Fa.59), spring ring, and refit the circlip.

**Refitting**

- (7) Refitting is a reversal of the removing procedure.

**Section Fa.11**

**FIRST GEAR FREE-WHEEL ASSEMBLY (ONE-WAY CLUTCH)**

**Removing**

- (1) Carry out the operation given in Section Fa.3, items (1), (2b), and (12).
- (2) Remove the first gear free-wheel reaction member.
- (3) Knock back the locking plate tabs and remove the retaining bolts and the first gear free-wheel (one-way clutch) from the housing.

**Dismantling**

- (4) Remove the circlip.
- (5) Lift out the spring ring, first gear free-wheel, intermediate spring ring, and thrust bearing (see Fig. Fa.58).

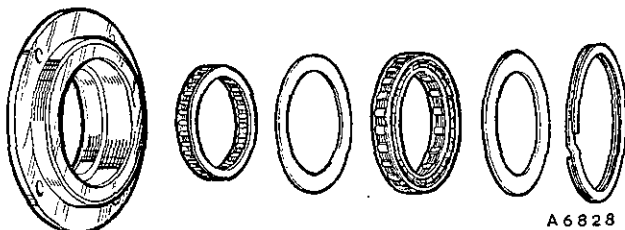


Fig. Fa.58

The components of the one-way clutch

**Section Fa.12**

**GEAR-CHANGE CABLE**

**Removing**

- (1) Remove the weather protection cover (if fitted) from the converter housing. Pull back the rubber sleeve and disconnect the gear-change cable by removing the clevis pin. Slacken the yoke clamp nut and remove the yoke, nut, rubber ferrules, and sleeve (see Fig. Fa.60). Remove the adjusting nuts from the outer cable and pull the cable clear of the transmission.
- (2) Release the cable clip from the floor panel.
- (3) Remove the front floor covering.
- (4) Disconnect the electrical leads from the inhibitor switch.

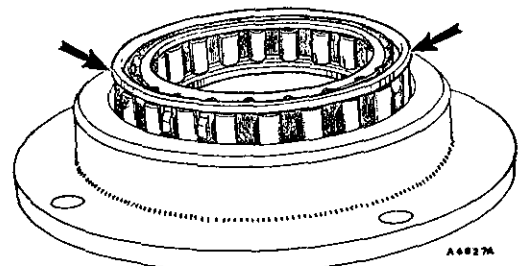


Fig. Fa.59

Fitting the one-way clutch with the lip (arrowed) correctly positioned, uppermost

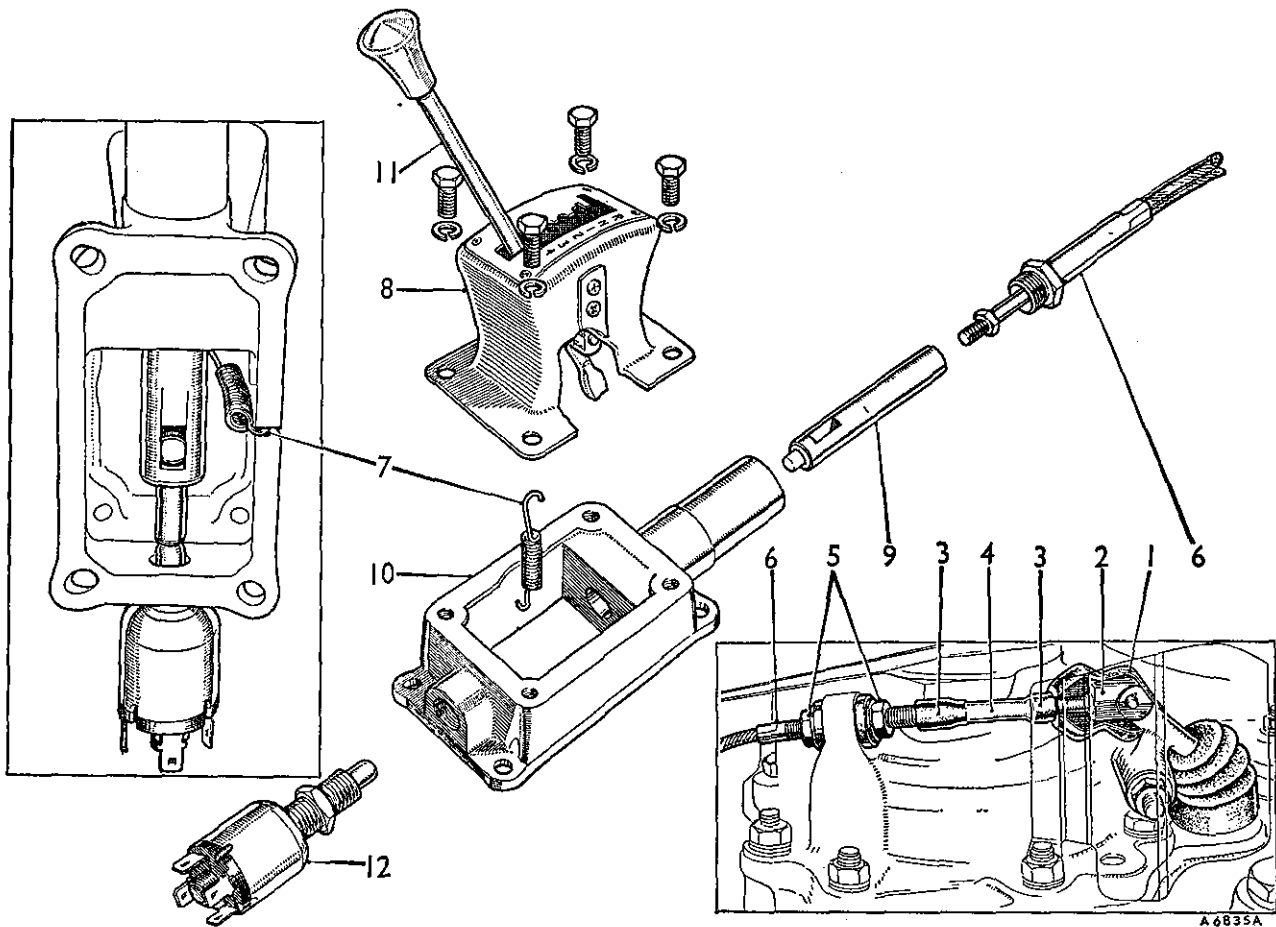


Fig. Fa.60

The gear-change housing and cable components. Insets show the reverse return spring location and the cable connections

- |                     |                           |                          |
|---------------------|---------------------------|--------------------------|
| 1. Rubber sleeve.   | 5. Cable adjusting nuts.  | 9. Lever plunger.        |
| 2. Yoke.            | 6. Cable.                 | 10. Gear-change housing. |
| 3. Rubber ferrules. | 7. Reverse return spring. | 11. Gear selector lever. |
| 4. Cable sleeve.    | 8. Quadrant.              | 12. Inhibitor switch.    |

(5) Remove the screws securing the gear change housing, carefully pull the cable through the rubber dust excluder, and remove the housing and cable assembly.

### Dismantling

- (6) Hold the assembly in a vice and remove the set screws securing the quadrant to the housing. Release the reverse return spring from the base of the housing and remove the quadrant and lever assembly.
- (7) Unscrew the cable securing nuts from the front of the housing, pull the cable from the housing and release it from the gear change lever plunger.

### Inspecting

- (8) Clean and inspect moving parts for wear.

### Reassembling

- (9) Lubricate all moving parts with grease.
- (10) Reassembly is a reversal of the dismantling procedure.

### Refitting

- (11) Refitting is a reversal of the removing procedure.
- (12) Adjust the inhibitor switch and the gear change cable and selector rod as detailed in Section Fa.2.



# SECTION G

## THE DRIVE SHAFTS

	<i>Section</i>
General description	
● Drive shaft:	
Removing .. .. .	G.1
Overhaul .. .. .	G.2
Coupling replacement .. .. .	G.3
Universal joint overhaul .. .. .	G.4 ●

## GENERAL DESCRIPTION

Each of the two drive shafts employed has two principle members incorporating a Hardy Spicer constant-velocity bell joint. The hemispherical interior of the bell joint and the exterior of the inner ball race have six grooves machined in line with the shaft axis, and a ball cage carrying six steel balls is interposed between the two. The steel balls engage the grooves of both members to key them together and at the same time allow the members to hinge freely upon each other.

The joint is packed with special grease and the unit is enclosed in a sealed rubber boot. The inner end of the drive shaft is splined and has a pre-lubricated sliding joint sealed with a rubber boot.

## Section G.1

## DRIVE SHAFTS

## Removing

● To remove the drive shaft assembly from the vehicle follow the removing instructions given for swivel hubs in Section K.2. ●

The constant-velocity bell joint may be removed from the drive shaft for replacement as a unit or to have a Service kit fitted. Under no circumstances must individual components be replaced in the bell joint assembly.

Should a rubber boot enclosing the joint be damaged with a consequent loss of lubricant, it is necessary to remove the joint from the shaft for dismantling and inspection of the components.

If a rubber boot is damaged in the workshop and dirt has not entered the joint, a new boot may be fitted after first repacking the joint with the recommended grease.

To fit a new boot the drive shaft must be removed from the vehicle.

## Constant-velocity (bell) joint

The bell joint can be removed from the drive shaft for dismantling and inspection of the components.

Service kits are available which include the required amount of lubricant to service a bell joint.

When servicing of the joint becomes necessary, the procedure given in Section G.2 must be followed.

## Sliding joint flange

On later models the sliding joint is repacked with  $\frac{3}{4}$  oz. (21 gm.) of Duckham's M.B. grease (BMC pack AKF 1457) and sealed with a rubber housing seal, early models were fitted with lubricating nipple. When servicing the sliding joint or fitting a new seal, refer to Section G.2.

G.2

## Section G.2

## DRIVE SHAFT OVERHAUL

## Dismantling the shaft assembly

- (1) Clean the shaft of road dirt and grease and mount the shaft centrally in a vice fitted with soft jaws.
- (2) Prise off the boot and housing seal clips or cut the soft iron wire, turn back the housing seal and slide off the joint flange. Remove the housing seal and the rubber boot, if they are worn or damaged, replacements must be fitted on reassembly.
- (3) The bell joint can only be dismantled after removal of the shaft; a round-section spring ring located in a deep groove in the extreme end of the shaft is expanded into the chamfered end of the inner race bore, and for shaft removal this must be contracted into the groove.
- (4) Hold the shaft and joint vertically, the bell joint downwards, and give the edge of the outer race a sharp tap with a soft faced mallet (see Fig. G.1). This should contract the spring ring so that the joint can be drawn off the shaft. It should not be necessary to use heavy blows for this operation.

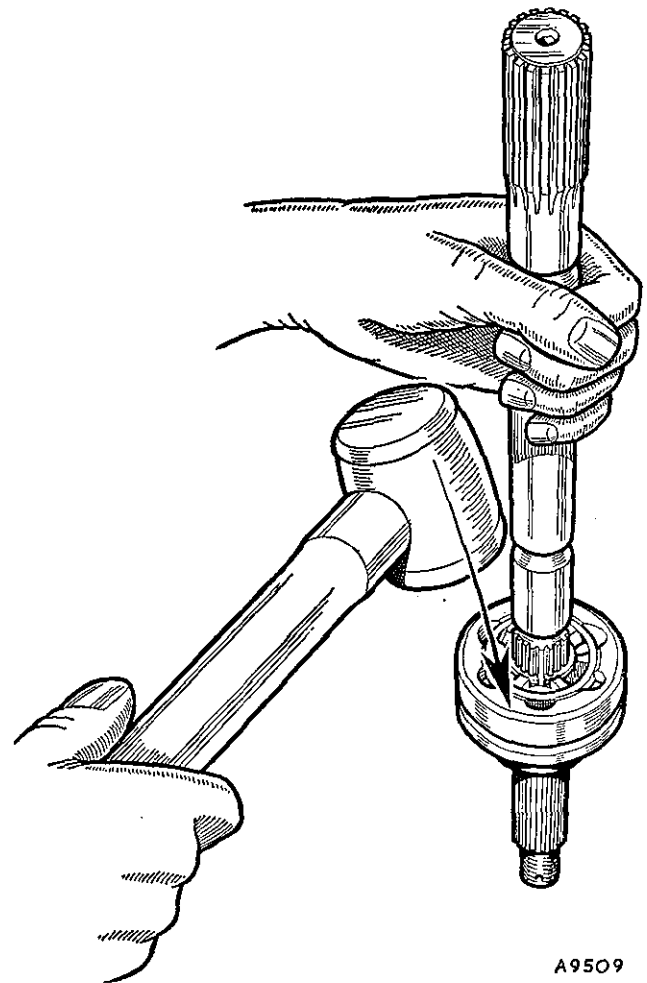


Fig. G.1

Drive the bell joint from the shaft at the point indicated

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