



## Section F.1

### DESCRIPTION

The gearbox has four forward speeds and one reverse, and synchromesh is incorporated on second, third and top gears.

Top gear is a direct drive; third and second are in constant mesh; first and reverse are obtained by sliding spur pinions.

## Section F.2

### LUBRICATION

The gearbox oil level should be checked by the dipstick at the recommended mileage and topped up if necessary.

The filler plug, which incorporates the dipstick, is located beneath a rubber cover, and is accessible when the floor mat and rubber cover have been raised.

Drain plugs are provided in the base of the gearbox and overdrive. Ensure that the drain plugs are kept clean and do not forget to replace them after draining.

The capacity of the gearbox is given in "General Data".

## Section F.3

### REMOVAL AND REPLACEMENT

- (1) Turn the battery master switch, which is situated inside the luggage compartment, to the "off" position.
- (2) Inside the car remove the seat cushions and release the clips securing the padded arm rest to the central tunnel.
- (3) Unclip and roll back the carpet over the short gearbox tunnel to expose the twelve screws securing the tunnel to the body of the car. Unscrew the setscrews and remove the tunnel and its carpeting.
- (4) Unscrew the six setscrews, three on either side, which secure the carpet covered bulkhead and remove the bulkhead.
- (5) Using a suitable tool tap back the locking washer on the propeller shaft flange bolts and remove the bolts.
- (6) Unscrew the four setpins from the gearbox mounting brackets (see Fig. A.3, Section A), also unscrew the speedometer cable at its connection to the gearbox.

**Note.**—When an overdrive gearbox is fitted it will also be necessary to unclip the cable to the gearbox switch and release it at its terminal on the switch.

- (7) Working beneath the vehicle remove setpins (1) Fig. A.4, Section A, and unscrew the nuts (2) and (3) to release the stabiliser bar.
- (8) Detach the clutch slave cylinder from the gearbox bell housing by removing the two securing setpins. The slave cylinder push rod is released from the clutch operating lever by the removal of the securing clevis pin.
- (9) Remove the starter motor as described in Section N.
- (10) Place suitable supports underneath the gearbox bell housing and engine sump, and unscrew the nuts, bolts and setpins securing the bell housing to the engine backplate.
- (11) Withdraw the gearbox first motion shaft from the flywheel bearing and clutch by gently easing the gearbox rearwards.  
If the unit does not detach itself readily it will be necessary to raise the rear of the engine.
- (12) The replacement of the gearbox is a reversal of the removal procedure.

## Section F.4

### DISMANTLING

- (1) Remove the dipstick. Unscrew the breather from the overdrive unit, if fitted. Drain the oil from the gearbox and overdrive by removing the drain plug beneath each unit.
- (2) Unscrew the speedometer drive from the right-hand side of the rear extension.
- (3) Unscrew the seven short and one long bolt and remove the clutch housing.
- (4) Remove the three nuts threaded on studs mounted on the gear lever cup. With the removal of these nuts the cup may be withdrawn together with the three washers and three distance pieces located on the studs.
- (5) Withdraw the gear lever from the gearbox.
- (6) Unscrew the thirteen bolts securing the side cover to the gearbox housing and remove the cover; there are two dowels locating the cover. Take care not to lose the three selector balls and springs which will be released as the cover is withdrawn.
- (7) Unscrew the eight bolts and remove the rear extension.

**Note.**—For models fitted with overdrive.

Once the overdrive unit has been separated from the gearbox (see Section G.10), the removal of the

## GEARBOX

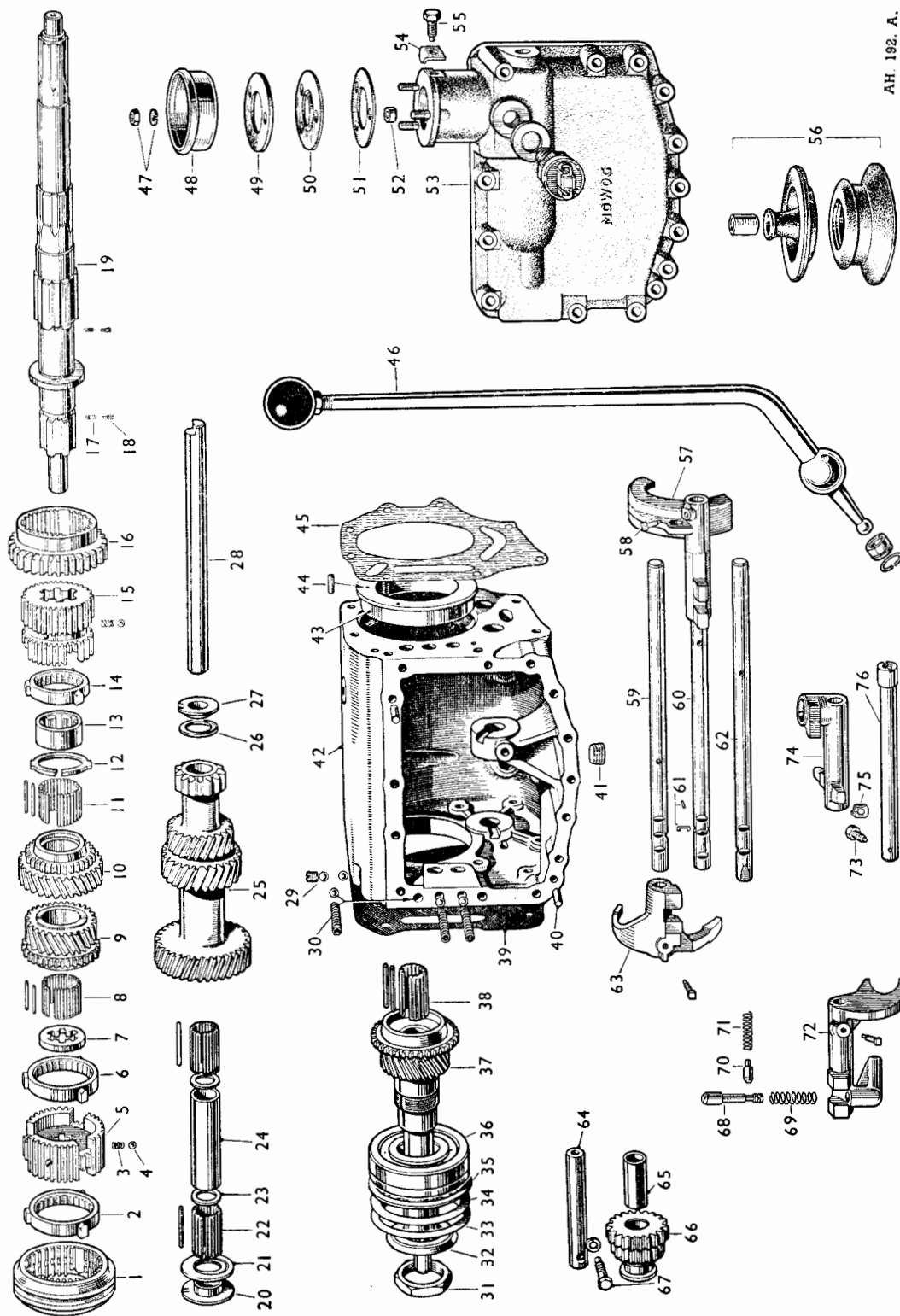


Fig. F.1. Components of the Gearbox.

AH. 192. A.

Fig. F.1. Components of the Gearbox.

- |                                    |                                 |                                   |
|------------------------------------|---------------------------------|-----------------------------------|
| 1. Synchronesh sleeve.             | 26. Washer.                     | 52. Distance piece.               |
| 2. Baulking ring.                  | 27. Thrust plate.               | 53. Side cover.                   |
| 3. Synchronizer spring.            | 28. Layshaft.                   | 54. Washer.                       |
| 4. Synchronizer ball.              | 29. Interlocking balls.         | 55. Gear lever locating screw.    |
| 5. 3rd and 4th speed synchronizer. | 30. Selector ball and spring.   | 56. Rubber dust covers.           |
| 6. Baulking ring.                  | 31. Bearing nut.                | 57. 1st and 2nd speed fork.       |
| 7. Locking plate.                  | 32. Bearing nut lockwasher.     | 58. Screw for fork.               |
| 8. Needle rollers.                 | 33. Bearing spring plate.       | 59. 3rd and 4th speed fork rod.   |
| 9. Third speed gear.               | 34. Bearing plate.              | 60. 1st and 2nd speed fork rod.   |
| 10. Second speed gear.             | 35. Bearing circlip.            | 61. Interlocking pin and rivet.   |
| 11. Needle rollers.                | 36. First motion shaft bearing. | 62. Reverse fork rod.             |
| 12. Gear washer.                   | 37. First motion shaft.         | 63. 3rd and 4th speed fork.       |
| 13. Locking plate.                 | 38. Needle rollers.             | 64. Reverse shaft.                |
| 14. Baulking ring.                 | 39. Joint washer.               | 65. Bush.                         |
| 15. 2nd speed synchronizer         | 40. Side cover dowel.           | 66. Reverse gear.                 |
| 16. First speed gear.              | 41. Drain plug.                 | 67. Locking screw.                |
| 17. Plunger spring.                | 42. Gearbox casing.             | 68. Selector plunger.             |
| 18. Gear plunger.                  | 43. Bearing housing.            | 69. Selector plunger spring.      |
| 19. Main shaft.                    | 44. Locating peg.               | 70. Detent plunger.               |
| 20. Thrust plate.                  | 45. Joint washer.               | 71. Detent plunger spring.        |
| 21. Thrust washer.                 | 46. Gear lever.                 | 72. Reverse fork.                 |
| 22. Needle rollers.                | 47. Nut and washer.             | 73. Control shaft locating screw. |
| 23. Washer, roller.                | 48. Cup.                        | 74. Locking washer.               |
| 24. Spacer, roller.                | 49. Rubber washer (thick).      | 75. Control shaft.                |
| 25. Laygear.                       | 50. Steel washer.               | 76. Control lever.                |
|                                    | 51. Rubber washer (thin).       |                                   |

adapter plate is accomplished by unscrewing the eight nuts in the recess in the adapter plate.

The overdrive pump cam should slide freely along the third motion shaft thus giving access to the circlip holding the distance piece to the rear adapter plate. Remove the circlip and slide the distance piece off the shaft. The adapter plate should now pull away from the gearbox, together with the rear main bearing. It may be necessary for one operator to hold the gearbox vertically by the adapter plate whilst a second operator taps the third motion shaft until the ball race in the adapter plate is free of the shaft.

- (8) Cut the locking wires and unscrew the fork retaining screws. Remove the shifter shafts and forks in the following order :—
  - (a) The reverse shaft and fork together with its selector and detent plungers and springs.
  - (b) Top gear shifter shaft only.
  - (c) First and second shaft and fork.
  - (d) Top gear fork.

Take care not to lose the two interlock balls, normally located one at each side of the centre shifter shaft, which will be released when the shaft is removed.

- (9) Unscrew the reverse shaft locating screw and push out the shaft; lift the gear from the box.
- (10) Tap out the layshaft and allow the gear to rest in the bottom of the box.
- (11) Withdraw the first motion shaft assembly; note that there are 16 spigot rollers.
- (12) Withdraw the mainshaft rearwards.
- (13) Lift out the layshaft gear and thrust washers.

## Section F.5

### DISMANTLING THE MAINSHAFT

- (1) Slide the top and third gear hub and interceptors from the forward end.
- (2) Depress the plunger locating the third gear locking plate, rotate the plate to line up the splines and slide it from the shaft. Extract the plunger and spring, and slide off the third speed gear and its 32 rollers.
- (3) Unscrew the main shaft nut; remove the nut, locking washer, speedometer drive gear, bearing with housing and distance collar.
- (4) Slide the first and second speed hub, second speed interceptor and first speed gear rearwards from the shaft; if the first speed gear is withdrawn from the hub, take care to hold the balls and springs located in holes in the hub.
- (5) Depress the second gear locking collar plunger and rotate the collar to line up the splines; slide the collar from the shaft and extract the two halves of the second gear washer, retaining the spring and plunger.
- (6) Withdraw the second speed gear and its 33 rollers from the shaft.
- (7) To dismantle the first motion shaft assembly, tap up the locking tab, unscrew the nut and remove the bearing.

**NOTE.**—The method of dismantling and reassembling the overdrive gearbox is the same as that described for the standard gearbox, with the exception that no speedometer drive gear or locking washer and nut is fitted.

### Section F.6

#### REASSEMBLY

##### Mainshaft

- (1) Smear the shaft with grease and assemble the 33 second speed gear rollers; slide the second gear into position.
- (2) Replace the plunger and spring. Fit the two halves of the second gear washer and slide the collar on to the splines. Depress the plunger and push the collar into position, locating the lugs of the washer in the cut-outs of the collar; rotate the collar to bring the splines out of line.
- (3) Replace the balls and springs in the second and first speed hub; depress the balls and slide the first speed gear on to the hub; refit the assembly to the shaft.
- (4) Refit the bearing distance collar, the bearing and housing, the speedometer drive gear key and gear, locking washer and nut. Tighten the nut and tap over the locking washer.
- (5) Fit the third gear and its 32 rollers to the shaft; replace the plunger and spring and the third speed locking plate; rotate the plate to bring the splines out of line.
- (6) Fit the balls and springs to the top and third speed hub and slide the striking dog into position on the hub.
- (7) Replace the hub, striking dog and interceptors on the shaft.

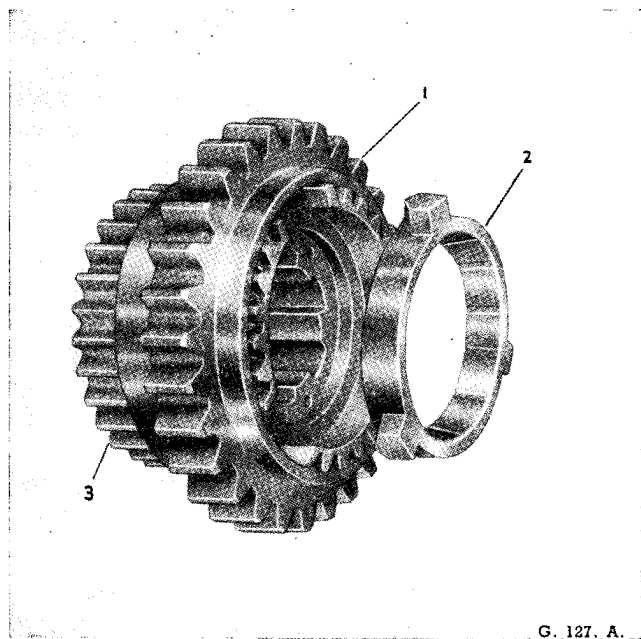


Fig. F.2. Assembling gear and synchronizer.

1. Gear. 2. Baulking ring. 3. Synchronizer.

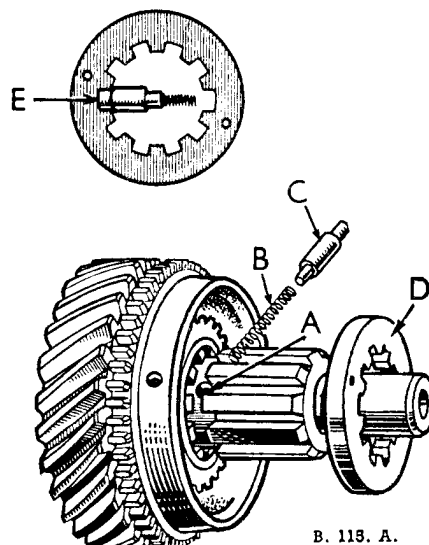


Fig. F.3. Securing the third motion shaft gears.

A. Hole for spring

B. Spring.

C. Location peg.

D. Locking washer.

E. Peg located in washer.

##### Layshaft

- (1) Fit the distance tube to the layshaft gear with a washer at each end of the tube.
- (2) Smear the rollers with grease and position them in the gear. Place the thrust washers and plates in position at each end of the gear.
- (3) To retain the rollers in position, a length of round bar of layshaft diameter and just long enough to hold the thrust washers and plates, should be inserted in the gear assembly.
- (4) Place the gear in the box and allow it to rest at the bottom.

##### Gearbox

- (1) Insert the mainshaft assembly from the rear of the box.
- (2) Position the first motion shaft rollers and the first motion shaft assembly in the box.
- (3) Lift the layshaft gear into position, locating the thrust washer tags in the grooves provided. Push the layshaft through the housing and gear, and withdraw the retaining bar as the shaft pushes it out of the gear. The cut-away portion of the shaft must be aligned to fit the groove in the bell housing provided to prevent the layshaft from turning.
- (4) Refit the reverse gear and shaft and tighten the setscrew. Place the top gear shifter fork in the box. Replace the first and second gear shifter fork and shaft.
- (5) Replace one interlock ball above the first and second shifter shaft and insert the top gear shifter shaft.

- (6) Position the remaining interlock ball, holding it with grease and refit the reverse fork and shaft together with its selector and detent plungers and springs.
- (7) Screw in the fork setscrews, tighten up and wire.
- (8) Bolt the rear extension into position, using a new gasket if necessary. Note that the plain bearing plate is fitted against the bearing.

**Note.**—For models fitted with overdrive :—

Slide the adapter plate, together with its bearing and paper joint washer, along the third motion shaft. Fit and tighten down the eight setpins securing the adapter plate to the gearbox.

Fit the distance piece which covers the space between the rear main bearing and the groove allocated for the circlip, and fix on the latter. Refit overdrive (see Section G.10).

- (9) Refit the selector balls to the holes in the gearbox housing and the springs in the holes in the side cover.
- (10) The gear lever together with its cup, washers and distance pieces may now be attached to the side cover. Ensure that the ball of the lever makes a good fit with its mating socket.

- (11) Refit the cover, fitting a new gasket as required. Observe that the top right-hand setpin is longer than the other twelve.
- (12) Refit the clutch housing with plain bearing plate against the bearing.  
Refit the speedometer drive, breather and dipstick.

## Section F.7

### MODIFIED GEARS

Commencing at engine number 11342, the gears were modified to increase their rigidity. In earlier versions of this modification the laygear was fitted with plain bushes, but this was later replaced by a layshaft assembly with needle roller bearings.

The modified gears are only interchangeable with earlier types in complete sets.

## SECTION G

### OVERDRIVE

(Series BN4)

Section No. G.1	Lubrication
Section No. G.2	Working description
Section No. G.3	Construction
Section No. G.4	Servicing in position
Section No. G.5	Guide to service diagnosis
Section No. G.6	Operating valve
Section No. G.7	Hydraulic system
Section No. G.8	Pump valve
Section No. G.9	Hydraulic pressure
Section No. G.10	Dismantling and reassembling unit
Section No. G.11	Overdrive relay system
Section No. G.12	Fault tracing

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## Section G.1

### LUBRICATION

The lubricating oil in the overdrive unit is common with that in the gearbox and the level should be checked with the gearbox dipstick.

It is essential that an approved lubricant be used when refilling. Trouble may be experienced if some types of extreme pressure lubricants are used because the planet gears act as a centrifuge to separate the additives from the oil.

Recommended lubricants are given in Section Q. It should be emphasised that any hydraulically controlled transmission must have clean oil at all times and great care must be taken to avoid the entry of dirt whenever any part of the casing is opened.

At the recommended milage check the oil level of the gearbox and overdrive and top up if necessary through the gearbox dipstick hole.

In addition to the normal drain plug fitted to the gearbox the overdrive unit incorporates a plug at its base which gives access to a filter.

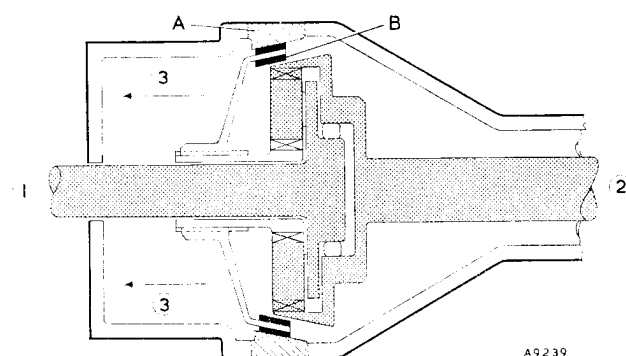
Occasionally remove the overdrive oil pump filter and clean the filter gauze by washing in petrol. The filter is accessible through the drain plug hole and is secured by a central set bolt.

Refilling of the complete system (gearbox and overdrive) is accomplished through the gearbox filler plug. The capacity of the combined gearbox and overdrive unit is  $6\frac{1}{4}$  pints (7.5 U.S. pints; 3.5 litres).

After draining,  $\frac{1}{4}$  pint of oil will remain in the overdrive hydraulic system, so that only 6 pints will be needed for refilling. If the overdrive has been dismantled the total of  $6\frac{1}{4}$  pints will be required.

After refilling the gearbox and overdrive with oil, recheck the level after the car has been run, as a certain

amount of oil will be retained in the hydraulic system of the overdrive unit.



1. From gearbox. 2. To propeller shaft.  
3. Spring pressure.

## Section G.2

### WORKING DESCRIPTION

The overdrive unit comprises a hydraulically controlled epicyclic gear housed in a casing which is directly attached to an extension at the rear of the gearbox.

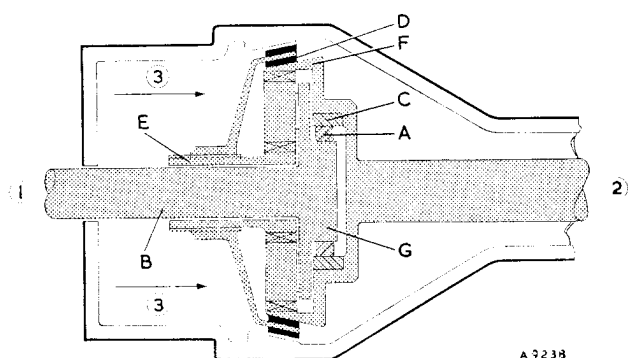
The synchromesh gearbox third motion shaft is extended and carries at its end the inner member of an uni-directional clutch (see Fig. G.1). The outer member of this clutch is carried in the combined annulus and output shaft.

Also mounted on the third motion shaft are the planet carrier G and a freely rotatable sun wheel. Splined to a forward extension E of the sun wheel and sliding thereon is a cone clutch member D, the inner lining of which engages the outside of the annulus F while the outer lining engages a cast-iron brake ring sandwiched between the front and rear parts of the unit housing.

A number of compression springs is used to hold the cone clutch in contact with the annulus, locking the sun wheel to the latter so that the entire gear train rotates as a solid unit, giving direct drive. In this condition the drive is taken through the uni-directional clutch, the cone clutch taking over-run and reverse torque, as without it there would be a free-wheel condition.

The spring pressure can be overcome through the medium of two pistons, working in cylinders formed in the unit housing, supplied with oil under pressure from a hydraulic accumulator. This hydraulic pressure causes the cone clutch to engage the stationary brake ring (A Fig. G.2) and bring the sun wheel to rest, allowing the annulus to over-run the uni-directional clutch and give an increased speed to the output shaft, i.e. "overdrive".

When changing from overdrive to direct gear, if the accelerator pedal is released (as in a change down for engine braking) the cone clutch, being oil immersed, takes up smoothly. If the accelerator pedal is not



1. From gearbox. 2. To propeller shaft.  
3. Hydraulic pressure.



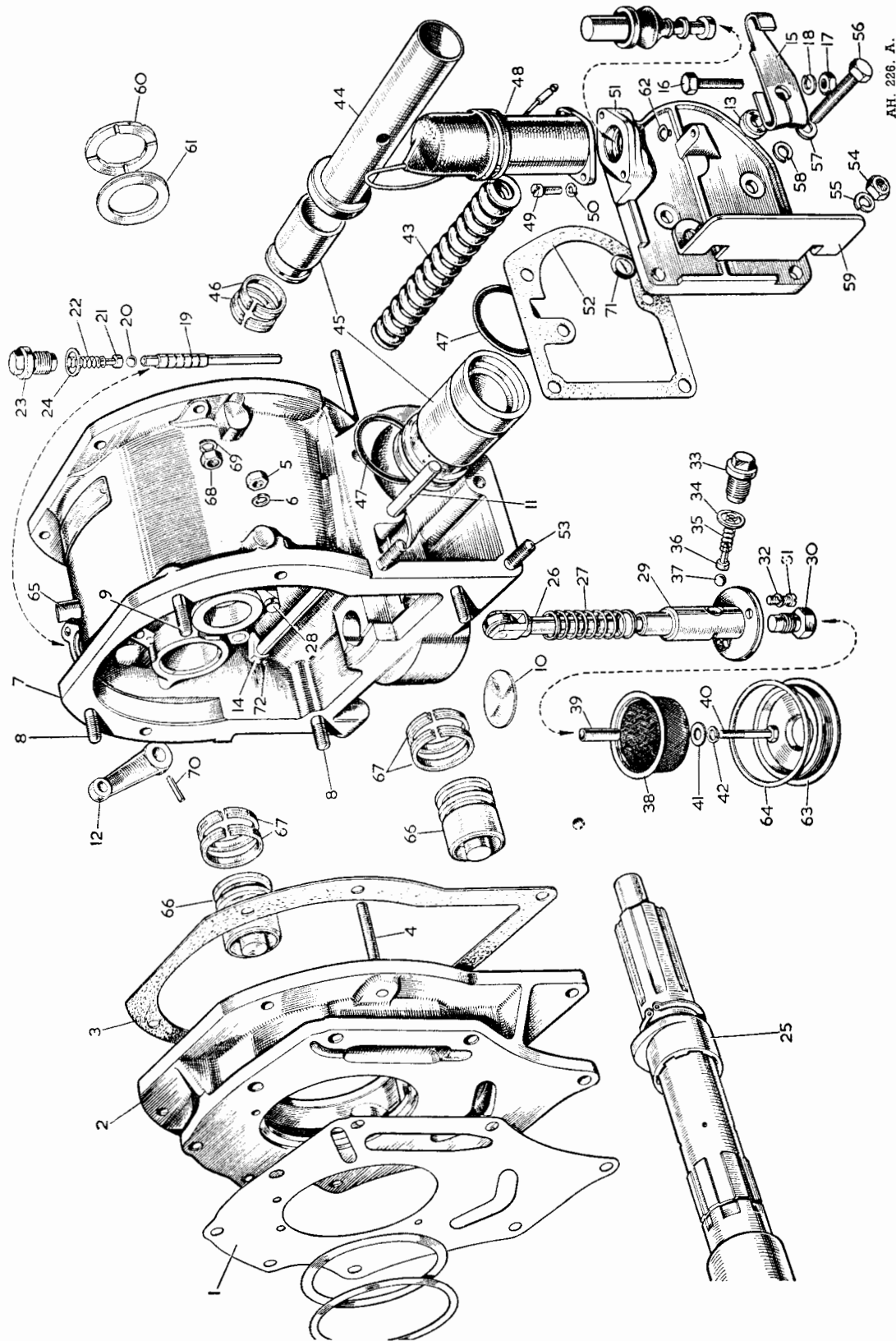


Fig. G.3. Components of overdrive front casing.

*Fig. G.3. Components of overdrive front casing.*

- |                            |                         |                             |                        |
|----------------------------|-------------------------|-----------------------------|------------------------|
| 1. Joint washer.           | 19. Valve push rod.     | 37. Ball valve.             | 55. Spring washer.     |
| 2. Adapter plate.          | 20. Ball valve.         | 38. Pump filter.            | 56. Setpin.            |
| 3. Joint washer.           | 21. Ball valve plunger. | 39. Distance piece.         | 57. Plain washer.      |
| 4. Locating stud.          | 22. Valve spring.       | 40. Filter bolt.            | 58. Spring washer.     |
| 5. Nut.                    | 23. Valve plug.         | 41. Plain washer.           | 59. Solenoid shield.   |
| 6. Spring washer.          | 24. Copper washer.      | 42. Spring washer.          | 60. Thrust washer.     |
| 7. Main casing.            | 25. Third motion shaft. | 43. Accumulator spring.     | 61. Spacing washer.    |
| 8. Stud.                   | 26. Pump plunger.       | 44. Distance tube.          | 62. Rubber stop.       |
| 9. Stud.                   | 27. Plunger spring.     | 45. Piston assembly.        | 63. Drain plug.        |
| 10. Welch plug.            | 28. Guide peg.          | 46. Piston rings.           | 64. Drain plug washer. |
| 11. Valve operating shaft. | 29. Pump body.          | 47. Rubber rings.           | 65. Breather.          |
| 12. Setting lever.         | 30. Pump body plug.     | 48. Solenoid unit.          | 66. Piston.            |
| 13. Collar.                | 31. Body screw.         | 49. Unit screw.             | 67. Piston rings.      |
| 14. Shaft cam.             | 32. Spring washer.      | 50. Spring washer.          | 68. Nut.               |
| 15. Solenoid lever.        | 33. Valve plug.         | 51. Solenoid lever housing. | 69. Spring washer.     |
| 16. Adjusting screw.       | 34. Plug washer.        | 52. Joint washer.           | 70. Cotter pin.        |
| 17. Nut.                   | 35. Valve spring.       | 53. Stud.                   | 71. Oil seal.          |
| 18. Washer.                | 36. Ball valve plunger. | 54. Nut.                    | 72. Peg.               |

released, when contact between the cone clutch and brake ring is broken, the unit still operates momentarily in its overdrive ratio as engine speed and road speed remain unchanged. But the load on the engine is released and it begins to accelerate, speeding up the sun wheel from rest until, just at the instant when its speed synchronises with the speed of the annulus, the whole unit revolves solidly and the uni-directional clutch takes up the drive once more. The movement of the cone clutch is deliberately slowed down so that the uni-directional clutch is driving before the cone clutch contacts, ensuring a perfectly self-synchronised change.

## Section G.3

### CONSTRUCTION

The third motion shaft of the synchromesh gearbox is extended to carry first a cam operating the oil pump and then a steady bearing with two opposed plain bushes carried in the front housing. Next is the sun wheel of the epicyclic gear carried on a Clevite bush, and beyond this the shaft is splined to take the planet carrier and uni-directional clutch. The end of the shaft is reduced and carried in a plain bush in the output shaft. The latter is supported in the rear housing by two ball bearings. The clutch member slides on the splines of the sun wheel extension to contact either the annulus or a cast iron brake ring forming part of the unit housing.

To the hub of the cone clutch member is secured a ball bearing housed in a flanged ring. This ring carries on its forward face a number of pegs acting as guides to compression springs by which the ring, and with it the clutch member, is held against the annulus. The springs prevent free-wheeling on over-run and are of sufficient strength to handle reverse torque. Also secured to the ring are four studs picking up two bridge pieces against which bear two pistons operating in cylinders formed in the unit housing. The cylinders are connected through a

valve to an accumulator in which pressure is maintained by the oil pump. The operating pistons are fitted with synthetic rubber sealing rings, and the accumulator piston with three piece cast iron rings.

When the valve is open, oil under pressure is admitted to the cylinders and pushes the pistons forward to engage the overdrive clutch. Closing the valve cuts off the supply of oil to the cylinders and allows it to escape. Under the influence of the springs the clutch member moves back to engage direct drive position. The escape of oil from the cylinders is deliberately restricted so that the clutch takes about half a second to move over.

The sun wheel and pinions are cyanide case-hardened and the annulus heat-treated. Gear teeth are helical. The pinions run on needle roller bearings on a case-hardened pin.

The outer ring of the uni-directional clutch is pressed into the annulus member. The clutch itself is of the caged roller type, loaded by a lock-type spring made of round wire.

The hydraulic system is supplied with oil by a plunger type pump operated by a cam on the gearbox third motion shaft. The pump body is pressed into the front housing and delivers oil through a non-return valve to the accumulator cylinder, in which a piston moves back against a compression spring until the required pressure is reached when relief holes are uncovered. From the relief holes the oil is led through drilled passages to an annular groove between the two steady bushes on the gearbox third motion shaft.

Radial holes in the shaft collect the oil and deliver it along an axial drilling to other radial holes in the shaft from which it is fed to the sun wheel bush, thrust washers, planet carrier and planet pins.

From the accumulator, oil under pressure is supplied to the operating valve chamber. This forms an enlargement at the top of a vertical bore and contains a ball

valve, the ball seating downwards thus preventing oil from circulating to the operating cylinders. The valve is a hollow spindle sliding in the bore, its top end reduced and carrying a seating for the ball, which is then lifted, admitting oil to the operating cylinders and moving the pistons forward to engage the overdrive clutch.

When the valve is lowered the ball is allowed to come on to its seating in the housing, cutting off pressure to the cylinders.

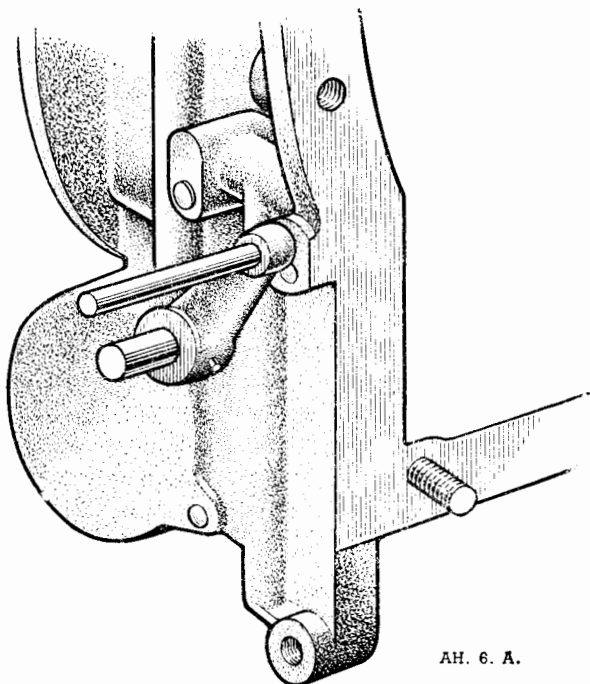


Fig. G.4. Valve setting lever.

Further movement of the valve brings it out of contact with the ball, allowing the oil from the cylinders to escape down the inside of the valve to discharge into the sump. The cone member then moves back under the influence of the clutch springs.

## Section G.4

### SERVICING IN POSITION

When the overdrive does not operate properly it is advisable first to check the level of oil and, if below the requisite level, top up with fresh oil and test the unit again before making any further investigations.

**Before commencing any dismantling operations it is important that the hydraulic pressure is released from the system. Do this by operating the overdrive 10 to 12 times.**

As the unit is fitted with a speed responsive control it will be found more convenient to carry out this operation by moving the valve setting lever manually.

G.4

## Section G.5

### GUIDE TO SERVICE DIAGNOSIS

#### Overdrive does not engage

- (1) Insufficient oil in unit.
- (2) Failure of switches or wiring (check solenoid operation visually).
- (3) Solenoid setting out of adjustment.
- (4) Insufficient hydraulic pressure due to pump non-return valve setting incorrectly (probably dirt on the seat).
- (5) Insufficient hydraulic pressure due to worn accumulator.
- (6) Damaged parts within the unit requiring removal and inspection of the assembly.

#### Overdrive does not release

- (1) Control mechanism out of adjustment.
- (2) Solenoid sticking.
- (3) Blocked restrictor jet in operating valve.
- (4) Solenoid setting out of adjustment.
- (5) Clutch sticking.

**NOTE:—Do not attempt to reverse the car: severe damage to the overdrive may result.**

#### Clutch slip in overdrive

- (1) Insufficient oil in unit.
- (2) Solenoid setting out of adjustment.
- (3) Insufficient hydraulic pressure due to pump non-return valve setting incorrectly.
- (4) Insufficient hydraulic pressure due to worn accumulator piston, worn accumulator housing, or leaking 'O' ring.
- (5) Operating valve seating incorrectly.
- (6) Worn or glazed clutch lining.

#### Clutch slip in reverse or free-wheel condition on overrun

- (1) Solenoid setting out of adjustment.
- (2) Blocked restrictor jet in operating valve.

## Section G.6

### OPERATING VALVE

Having gained access to the unit through the floor, unscrew the valve plug and remove the spring and plunger. The ball valve will then be seen inside the valve chamber. The ball should be lifted  $\frac{1}{32}$  in. (·8 mm.) off its seat when the overdrive control is operated.

As the unit is fitted with a speed responsive control the appropriate parts of the electrical circuit must be shorted out in order to operate the control.

If the ball does not lift by this amount the fault lies in the control mechanism. Located on the right-hand side of the unit and pivoting on the valve operating cross shaft, which passes right through the housing, is a valve setting lever. In its outer end is a  $\frac{3}{16}$  in. (4·7 mm.) diameter hole which corresponds with a similar

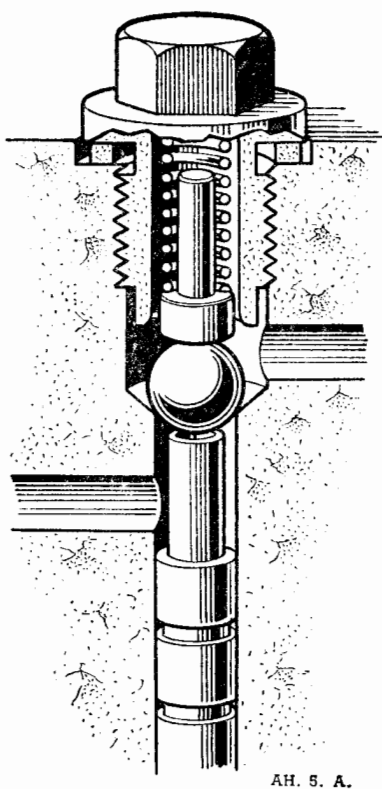


Fig. G.5. The operating valve.

hole in the housing when the unit is in "overdrive" (i.e. when the ball is lifted  $\frac{1}{32}$  in. (.8 mm.) off the valve seat).

If the two holes do not line up, adjust the control mechanism until a  $\frac{3}{16}$  in. (4.7 mm.) diameter rod can be inserted through the setting lever into the hole in the housing.

A small magnet will be found useful for removing the ball from the valve chamber. The valve can be withdrawn by inserting a length of  $\frac{1}{8}$  in. (3.2 mm.) welding rod, but care must be taken not to damage the ball seating at the end of the valve. Near the bottom of the valve will be seen a small hole breaking through to the centre drilling. This is the jet for restricting the exhaust of oil from the operating cylinders. Ensure that this jet is not choked.

## Section G.7

### HYDRAULIC SYSTEM

If the unit fails to operate and the ball valve is found to be seating and lifting correctly check that the pump is functioning.

Jack up the rear wheels of the car, then with the engine ticking over and the valve plug removed, engage top gear. Watch for oil being pumped into the valve chamber. If none appears then the pump is not functioning.

The pump (Fig. G.6) described above, is of the plunger type and delivers oil via a non-return valve to the accumulator. Possible sources of trouble are (1) failure of the non-return valve due to foreign matter on the seat or to a broken valve spring and (2) breakage of the spring holding the pump plunger in contact with the cam.

The pump is self priming, but failure to deliver oil after the system has been drained and refilled indicates that the air bleed is choked causing air to be trapped inside the pump.

In the unlikely event of this happening it will be necessary to remove the pump and clean the flat on the pump body and the bore of the casting into which it fits.

## Section G.8

### PUMP VALVE

Access to the pump valve is gained through a cover on the left-hand side of the unit. Proceed as follows:—

- (1) Remove drain plug and drain off oil.
- (2) Remove solenoid.
- (3) Slacken off clamping bolt in operating lever and remove lever, complete with solenoid plunger.
- (4) Remove distance collar from valve operating shaft.
- (5) The solenoid bracket is secured by two  $\frac{5}{16}$  in. (7.9 mm.) studs and two  $\frac{5}{16}$  in. diameter bolts,

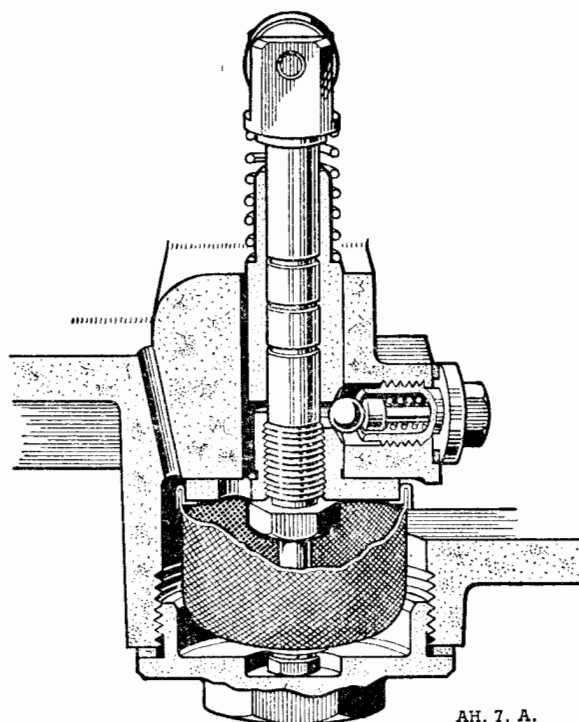
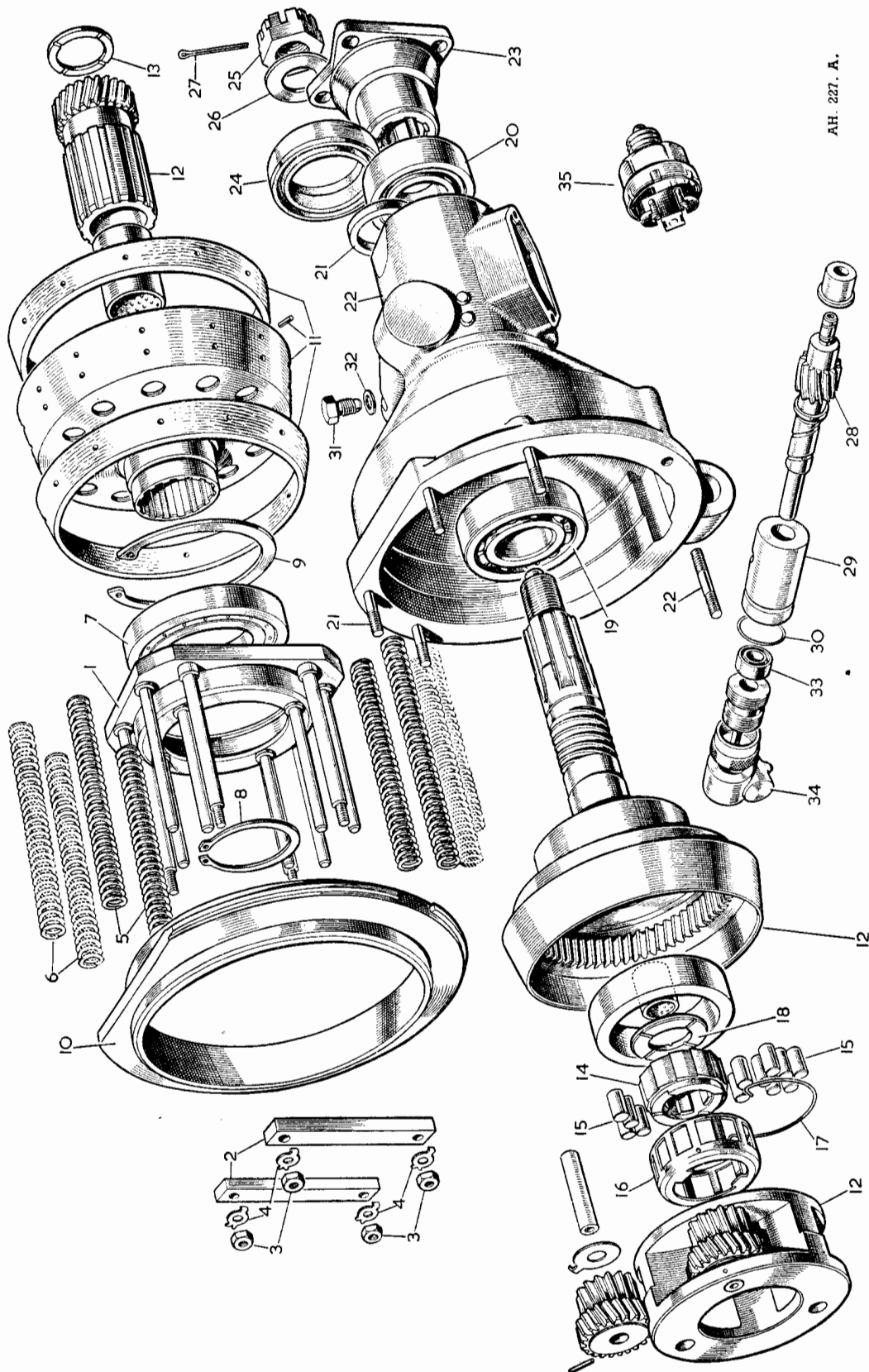


Fig. G.6. The pump in cut-away form.



AH. 227. A.

Fig. G.7. Components of overdrive rear casing

Fig. G.7. Components of overdrive rear casing.

- |                           |                             |                     |                          |
|---------------------------|-----------------------------|---------------------|--------------------------|
| 1. Clutch thrust ring.    | 10. Brake ring.             | 19. Inner bearing.  | 28. Speedometer spindle. |
| 2. Bridge pieces.         | 11. Clutch assembly.        | 20. Outer bearing.  | 29. Spindle sleeve.      |
| 3. Nuts.                  | 12. Sun wheel assembly.     | 22. Rear housing.   | 30. Washer.              |
| 4. Locking washers.       | 13. Thrust washer.          | 21. Spacing washer. | 31. Locking peg.         |
| 5. Clutch spring (long).  | 14. Uni-directional clutch. | 23. Driving flange. | 32. Washer.              |
| 6. Clutch spring (short). | 15. Rollers.                | 24. Oil seal.       | 33. Oil seal.            |
| 7. Front bearing.         | 16. Outer casing.           | 25. Flange nut.     | 34. Spindle adaptor.     |
| 8. Circlip (small).       | 17. Securing clip.          | 26. Washer.         | 35. Overdrive switch.    |
| 9. Circlip (large).       | 18. Thrust washer.          | 27. Split pin.      |                          |

the heads of which are painted red, **remove the nuts from the studs before touching the bolts.** This is **important.** The two bolts should now be slackened off together, releasing the tension on the accumulator spring.

(6) Remove the solenoid bracket.

(7) Unscrew the valve cap and take out the spring, plunger and ball.

Clean the valve ball and seat with non-lint rag. Reseat the ball by tapping it on its seat with a light hammer and drift. Reassembly is the reverse of the above operations. Ensure that the soft copper washer between the valve cap and pump housing is nipped up tightly to prevent oil leakage.

It will now be necessary to reset the valve operating lever. Proceed as follows :—

Before clamping up the valve operating shaft rotate the shaft until a  $\frac{3}{16}$  in. (4.7 mm.) diameter pin can be inserted through the valve setting lever on the offside of the unit into the corresponding hole in the casing. Leave the pin in position. Energise the solenoid by pulling off the snap connector at the solenoid terminal and connecting up with a short lead direct to the negative terminal of the battery. Check that the plunger travels the full extent of its stroke. Hold the solenoid lever lightly against the bottom shoulder on the solenoid plunger. Retighten the lever clamping bolt taking care that there is .008 to .010 in. (.20 to .25 mm.) end float in the cross shaft. Remove the locating pin from the setting lever. Operate the solenoid several times to check for correct working.

## To Dismantle the Pump

Proceed as follows :—

- (1) Remove the drain plug and drain off oil.
- (2) Remove pump valve as previously described.
- (3) Remove the filter after unscrewing the securing bolt.
- (4) Take out the two cheese head screws securing the pump body flange and extract the pump body. A special extractor tool (18G 183) is available for this purpose. This screws into the bottom of the pump body in the place of the screwed plug.

## Assembly of the Pump

Line up the pump body so that the inlet port and holes for securing screws register with the corresponding

holes in the housing, and tap the pump body home. Use service tool 18G 184.

The pump plunger is prevented from rotation when in position by a guide peg carried in the front casing. When assembling the pump the plunger should be inserted with the flat on its head facing the rear of the unit. It is possible to guide it past the guide peg by means of a screwdriver inserted through the side of the casting.

Replace the plug in the bottom of the pump body, ensuring that it is screwed home tightly.

## Section G.9

### HYDRAULIC PRESSURE

A working oil pressure of 470 to 490 lbs. per sq. in. (33.04 to 34.45 kg./cm.<sup>2</sup>) is required.

A hydraulic pressure gauge complete with fittings (Service Tool 18G251) is obtainable from B.M.C. Service Ltd.

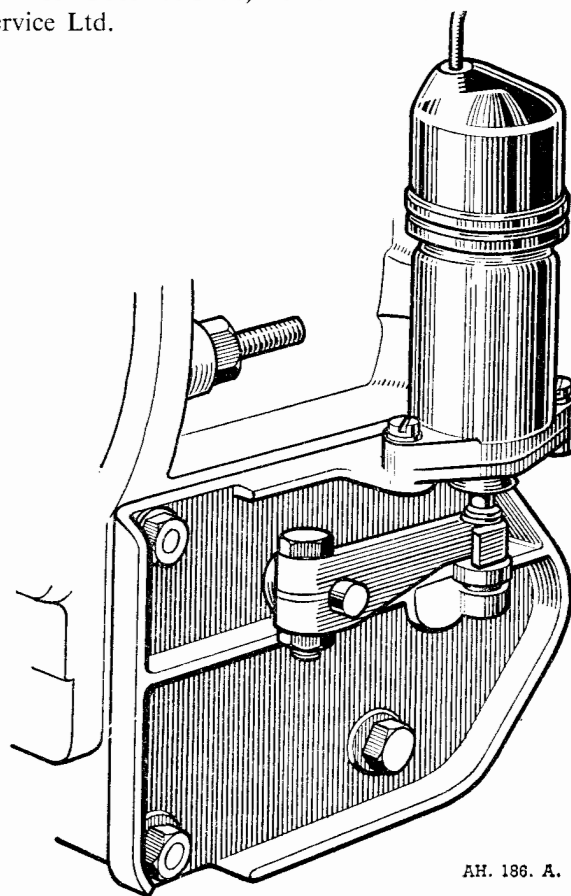


Fig. G.8. Showing the solenoid plunger bolt resting on the rubber stop

## Section G.10

## DISMANTLING AND REASSEMBLING UNIT

**Dismantling**

Should trouble arise necessitating dismantling of the unit to a degree further than has already been described, it will be necessary to remove the unit from the car.

Whilst it is possible to lift out the overdrive alone from the car, it is advised that the gearbox and overdrive be removed as a single unit. It is far easier to refit the overdrive to the gearbox when the assembly is on a bench as the extended third motion shaft must be lined up with the splines of the uni-directional clutch.

The unit is split at the adaptor plate which is attached to the front casing by six  $\frac{5}{16}$  in. (7.9 mm.) studs, two of which are extra long. The four nuts on the shorter studs should be removed before those on the longer ones are touched. The latter should be unscrewed together releasing the compression of the clutch springs. The unit can then be drawn off the mainshaft, leaving the adapter plate attached to the gearbox.

Remove the clutch springs from their pins. The two bridge pieces against which the operating pistons bear can now be removed. Each is secured by two  $\frac{1}{4}$  in. nuts locked by tab washers. Withdraw the two operating pistons.

As the adaptor plate is now separated from the unit the pump valve can be dismantled without removing the side cover (solenoid bracket) from the casing and there is no need to disturb the latter unless it is necessary to remove the accumulator piston and spring.

Remove the six  $\frac{5}{16}$  in. (7.9 mm.) nuts securing the two halves of the casing and separate them, removing the brake ring which is spigoted into the two pieces. Lift out the planet carrier assembly. Remove the clutch sliding member complete with the thrust ring and bearing, the sun wheel and thrust washers. Take out the inner member of the uni-directional clutch, the rollers, cage, etc.

If it is necessary to remove the planet gears from the carrier the three split pins securing the planet bearing shafts must be extracted before the latter can be knocked out to release the gears and needle roller bearings.

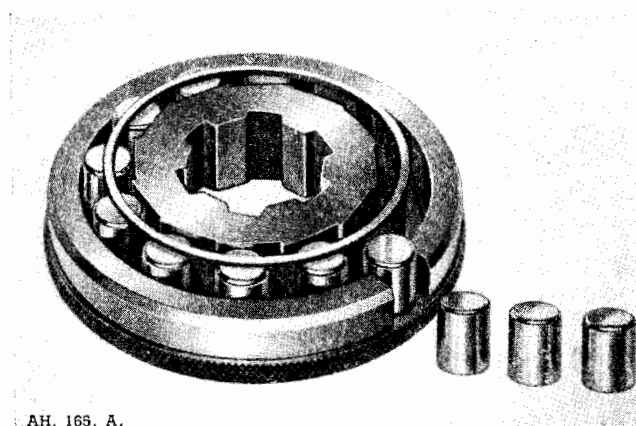
To remove the annulus, first take off the coupling flange at the rear of the unit, remove the speedometer gear, centrifugal switch, etc., and drive out the annulus from the back. The front bearing will come away on the shaft leaving the rear bearing in the casing.

**Inspection**

Each part should be thoroughly inspected after the unit is dismantled and cleaned to ensure which parts should be replaced. It is important to appreciate the difference between parts which are worn sufficiently to

affect the operation of the unit and those which are merely "worn in".

- (1) Inspect the front casing for cracks, damage, etc. Examine the bores of the operating cylinders and accumulator for scores and wear. Check for leaks from plugged ends of the oil passages. Ensure that the welch washer beneath the accumulator bore is tight and not leaking. Inspect the support bushes in the centre bore for wear and damage.
- (2) Examine the clutch sliding member assembly. Ensure that the clutch linings are not burned or worn. Inspect the pins for the clutch springs and bridge pieces and see that they are tight in the thrust ring and not distorted. Ensure that the ball bearing is in good condition and rotates freely. See that the sliding member slides easily on the splines of the sun wheel.



AH. 165. A.

Fig. G.9. Using tool 18G 178 for assembling the roller clutch.

- (3) Check the clutch springs for distortion or collapse.
- (4) Inspect the teeth of the gear train for damage. If the sun wheel bush is worn, the gear will have to be replaced since it is not possible to fit a new bush in service because it has to be bored true to the pitch line of the teeth.
- (5) Examine the steel and bronze thrust washers.
- (6) See that the rollers of the uni-directional clutch are not chipped and that the inner and outer members of the clutch are free from damage. Make sure that the member is tight in the annulus. Ensure that the spring is free from distortion.
- (7) Inspect the ball bearings on the output shaft and see that there is no roughness when they are rotated slowly.
- (8) Ensure that there are no nicks or burrs on the mainshaft splines and that the oil holes are open and clean.
- (9) Inspect the oil pump for wear on the pump plunger and roller pin. Ensure that the plunger



spring is not distorted. Its free length is 2 in. (5.08 cm.). Inspect the valve seat and ball and make sure that they are free from nicks and scratches.

- (10) Check the operating valve for distortion and damage and see that it slides easily in its bore in the front casing.

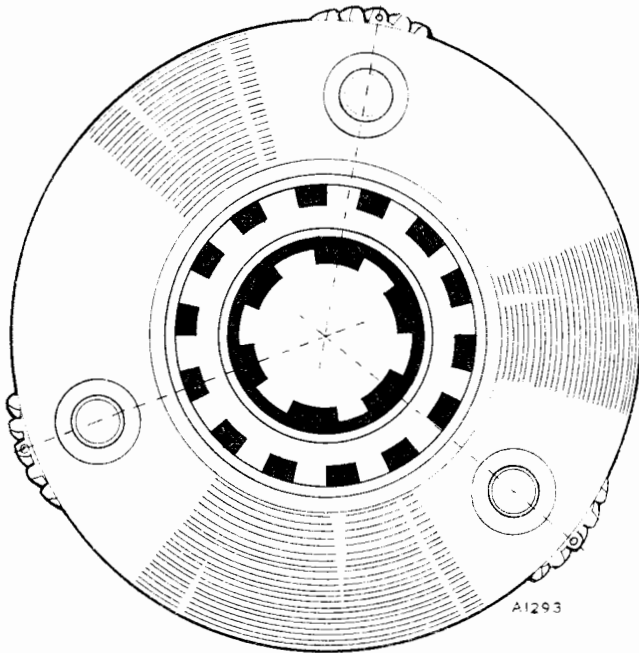


Fig. G.10. Before assembling the planet carrier to the sun wheel rotate the planet wheels until the punch marks are in the position shown.

### Reassembling the Unit

The unit can be reassembled after all the parts have been thoroughly cleaned and checked to ensure that none are damaged or worn.

Assemble the annulus into the rear casing, not forgetting the spacing washer which fits between a shoulder on the shaft and the rear ball bearing. This washer is available in different thicknesses for selective assembly and should allow no end float of the annulus (output shaft) and no pre-loading of the bearings.

Selective washers are available in the following sizes :—

- 146 in.  $\pm$  ·0005 in. (3.7 mm.  $\pm$  ·01)
- 151 in.  $\pm$  ·0005 in. (4.3 mm.  $\pm$  ·01)
- 156 in.  $\pm$  ·0005 in. (3.9 mm.  $\pm$  ·01)
- 160 in.  $\pm$  ·0005 in. (4.1 mm.  $\pm$  ·01)
- 161 in.  $\pm$  ·0005 in. (4.09 mm.  $\pm$  ·01)

Replace the thrust washer and uni-directional clutch inner member with its rollers and cage. The fixture (Fig. G.9) is for retaining the rollers in position when assembling the clutch. Ensure that the spring is fitted correctly so that the cage urges the rollers up the ramps on the inner member.

Fit the pump cam on to the gearbox mainshaft,

offer up the front housing to the cover plate and secure temporarily with two nuts. In order to determine the amount of end float of the sun wheel, which should be ·008 in. to ·014 in. (·20 mm. to ·35 mm.) an extra thrust washer of known thickness should be assembled with the two normally used in front of the sun wheel.

The gear train must be assembled in the following way so that the planet wheels will mesh with the sun wheel and at the same time allow their compound teeth to mesh correctly with the annulus. One tooth on each planet wheel is punch-marked, and the planet wheels must be turned in the carrier so that the punch marks are radially outwards as shown in Fig. G.10. With the planet wheels aligned in this way, fit the planet carrier over the sun wheel. The position of the planet wheels in relation to each other ensures that the second set of teeth on the planet wheels will mesh with the annulus teeth. Offer up the assembly to the annulus turning the planet carrier until the locating peg on the inner member of the uni-directional clutch enters the corresponding hole in the planet carrier. This lines up the splines in the two members.

Assemble the brake ring to the front casing then offer up the front and rear assemblies, leaving out the clutch sliding member with its springs, etc. The gap between the flanges of the brake ring and rear casing should be measured. This gap will be less than the thickness of the extra thrust washer by the amount of end float of the sun wheel. If this is between the limits specified the unit may be stripped down again and re-assembled without the extra thrust washer. The clutch sliding member bridge pieces, etc., must now be replaced. The compression of the springs is taken up on the two long studs between the front casing and adapter plate.

If the indicated end float is more, or less, than that required it must be adjusted by replacing the steel thrust washer at the front of the sun wheel by one of less or greater thickness, as required. Washers of varying thickness are stocked for this purpose.

Seven sizes are available, as follows :—

- 113 in. to ·114 in. (2.8 mm. to 2.9 mm.)
- 107 in. to ·108 in. (2.72 mm. to 2.74 mm.)
- 101 in. to ·102 in. (2.56 mm. to 2.59 mm.)
- 095 in. to ·096 in. (2.4 mm. to 2.44 mm.)
- 089 in. to ·090 in. (2.26 mm. to 2.28 mm.)
- 083 in. to ·084 in. (2.1 mm. to 2.13 mm.)
- 077 in. to ·078 in. (1.9 mm. to 1.98 mm.)

Care must be taken to ensure that the thrust washers at the front and rear of the sun wheel are replaced in their correct positions. At the front of the sun wheel the steel washer fits next to the head of the support bush in the housing and the bronze washer between the steel one and the sun wheel. At the rear, the steel washer is sandwiched between the two bronze washers.



Grip the mounting flange of the overdrive unit in a vice, so that the unit is upright, and insert a dummy shaft 18G 185 or a spare mainshaft if the dummy shaft is not available, so that the sun wheel and thrust washers, planet carrier and roller clutch line up with each other; a long thin screwdriver should be used to line by eye the

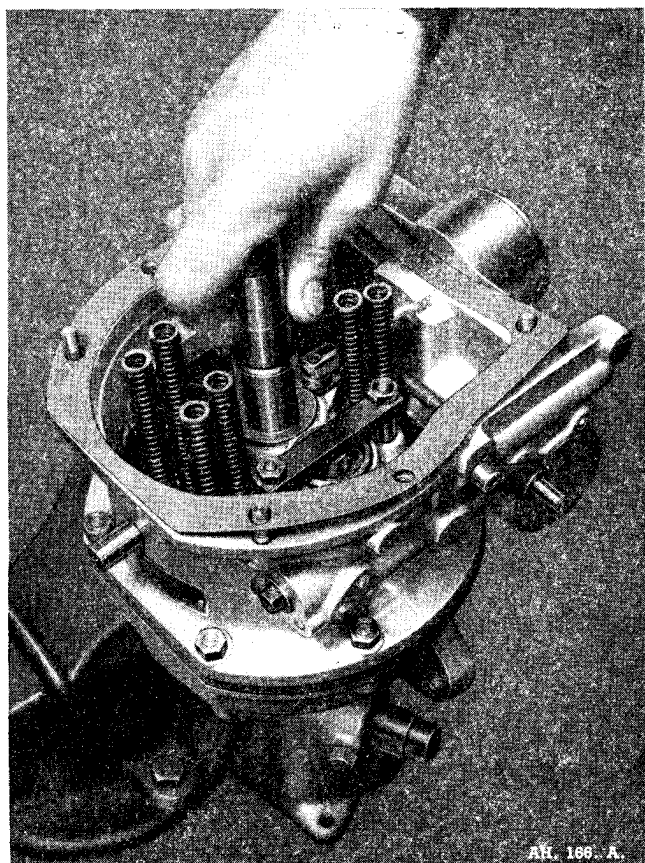


Fig. G.11. Centralising the gears with dummy mainshaft.

splines in the planet carrier and the roller clutch before inserting the dummy shaft. Gently turn the coupling flange to and fro while holding the dummy shaft, to assist in feeling the shaft into the splines of the planet carrier and roller clutch. Make sure that the dummy shaft has gone right into the spigot bush, checking this by using the screwdriver blade as a depth gauge.

Make quite sure that the clutch springs are in their correct positions—the  $4\frac{1}{4}$  in. (108 mm.) long springs are the inner ones, and the  $4\frac{1}{2}$  in. (115 mm.) ones are the outer. This is most important because if any of the springs are in the wrong position they will become “coil bound” when the adapter plate is in place and restrict the movement of the sliding clutch so that overdrive will not engage.

Place the oil pump operating cam in position on top of the centre bushing with the lowest part of the cam in contact with the oil pump plunger and also place the paper joint washer in position.

The gearbox, with top gear engaged, should now be lifted by hand on to the overdrive unit, carefully threading the mainshaft through the oil pump cam and into the centre bushing in the body of the overdrive unit. Gently turn the first motion shaft to and fro to assist in “feeling” the mainshaft into the splines of the planet carrier. When the mainshaft is sufficiently entered for the gearbox to come to rest against the clutch springs with the two long studs just protruding through the holes in the overdrive body, put the spring washers and nuts on to the end of the studs. Before commencing to tighten the nuts, use a long thin screwdriver to guide the ends of the clutch springs on to the short locating pegs which are cast into the face of the adapter plate—this is very important because if the springs are not properly located they may become “coil bound” and prevent overdrive engaging. Now commence simultaneously to tighten the nuts on the two long studs, compressing the clutch springs and drawing the gearbox and overdrive together evenly. As the gearbox and overdrive come together watch carefully to see the splines on the mainshaft enter the oil pump operating cam and that the cam remains properly engaged with the oil pump plunger. If the two units do not pull together easily with only the resistance of the clutch springs being felt as the two nuts are tightened, stop tightening immediately. Gently rotate the gearbox first motion shaft in a clockwise direction whilst holding the overdrive coupling flange stationary until the mainshaft is felt to enter the roller clutch. The tightening of the nuts on the two long studs can then be completed, and the nuts fitted and tightened on to the four short studs.

**NOTE:** The gearbox mainshaft should enter the overdrive easily, provided that the lining-up procedure previously described is carried out and the unit is not disturbed. If any difficulty is experienced it is probable that one of the components has become misaligned, and the gearbox should be removed and the overdrive re-aligned with the dummy shaft.

## Section G.11

### OVERDRIVE RELAY SYSTEM

#### Description

Engagement of overdrive is controlled electrically through a manually operated toggle switch. The circuit shown in Fig. G.11 includes the following components :

- (i) Relay, model SB40. An electro-magnetic switch used with item (ii) to enable an interlocking

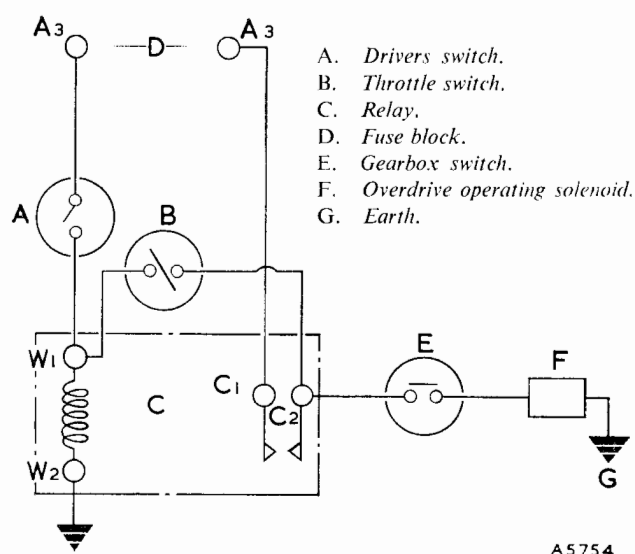


Fig. G.12. Wiring diagram for the overdrive electrical circuit

safeguard to be incorporated against changing out of overdrive with throttle closed.

- (ii) Throttle Switch, model RTS1. A lever-operated semi-rotary normally closed switch used in conjunction with item (i) to override the toggle switch under closed throttle conditions.
- (iii) Gear Switch, model SS10. A small plunger-operated switch allowing overdrive to be engaged only in the two highest forward-gear positions.
- (iv) Solenoid Unit, model TGS1. An electromagnetic actuator to engage overdrive mechanism by opening hydraulic control valve.

### Operation

When the toggle switch contacts are closed, current flows by way of the ignition switch and fuse unit supply terminal A3 to energize the relay operating coil. Closure of the relay contacts connects terminal A3 to the gear switch and, providing one of the two higher ratio gears is engaged, will energize the solenoid unit and effect a change from direct drive to overdrive.

Overdrive will be maintained until the solenoid unit is de-energized.

Change from overdrive to direct drive is effected either by selecting a low gear (when the gear switch contacts will open) or by turning the toggle switch to off with open throttle (when the relay contacts will open).

If effected with closed throttle, a change from overdrive to direct drive could result in a shock to the transmission. An interlocking circuit is therefore incorporated to override the toggle switch under closed throttle conditions. Under these conditions, the throttle

switch contacts provide an alternative supply circuit to the relay operating coil.

### Maintenance

Regular attention should be paid to wiring and connections. Damaged cabling must be replaced and loose terminals tightened, including the relay and solenoid unit earthing connections.

## Section G.12

### FAULT TRACING

#### The Solenoid Unit

With the engine stopped, neutral gear engaged, and the ignition switched on, disconnect the solenoid connection. Using a jumper lead, momentarily connect the solenoid to fuse unit supply terminal A3. The solenoid should be heard to operate. If no sound is heard, the solenoid is defective or incorrectly adjusted to the operating linkage. Remake the connection.

#### The Gear Switch

Engage top gear, depress the throttle pedal and momentarily connect relay terminal C2 to terminal A3. The solenoid should be heard to operate. If no sound is heard, the gear switch is defective. Re-engage neutral gear.

#### The Relay Coil

Momentarily connect relay terminal W1 to terminal A3. The relay should be heard to operate. If no sound is heard, the relay is defective.

#### The Toggle Switch

Operate the toggle switch. The relay should be heard to operate. If no sound is heard, the toggle switch is defective.

#### The Relay Contacts

With top gear engaged, toggle switch closed and throttle switch open, the solenoid should be heard to operate. If no sound is heard, the relay is defective.

#### The Throttle Switch

Engage top gear and close the toggle switch. Open the toggle switch and slowly depress the accelerator. The solenoid should be energized from zero to one-fifth throttle. If the solenoid is heard to release under one-fifth throttle, the throttle switch must be checked.

### Throttle switch adjustment

The setting of the throttle switch is critical and incorrect adjustment will result in the overdrive disengaging when the car slows down with the throttle closed, accompanied by a noticeable braking effect.

The switch will normally only require adjustment after the carburetter or accelerator controls have been adjusted. The method of switch checking and adjustment, is as follows.

Connect a low consumption test lamp (a 12 volt 2.2 watt fascia panel light bulb is suitable) between the top terminal "A" (Fig. G.13) and a convenient earthing point.

The bulb should light when the overdrive and the ignition are both switched on, and the gear lever is set in the third or top gear position.

When the overdrive is switched off, the bulb should remain alight with the throttle still closed.

Progressively open the throttle by means of the accelerator pedal until the light goes out. Check the position of the throttle opening when this occurs: it should be one-fifth open. This position of the throttle has been reached when a  $\frac{3}{16}$  in. (5 mm.) diameter rod can be just passed between the throttle stop screw and the stop lever on the HD type of carburetter, or when a feeler gauge of .048 in. (1.22 mm.) thickness can be inserted between the throttle stop screw and the stop on the H4 type of carburetter used on earlier engines.

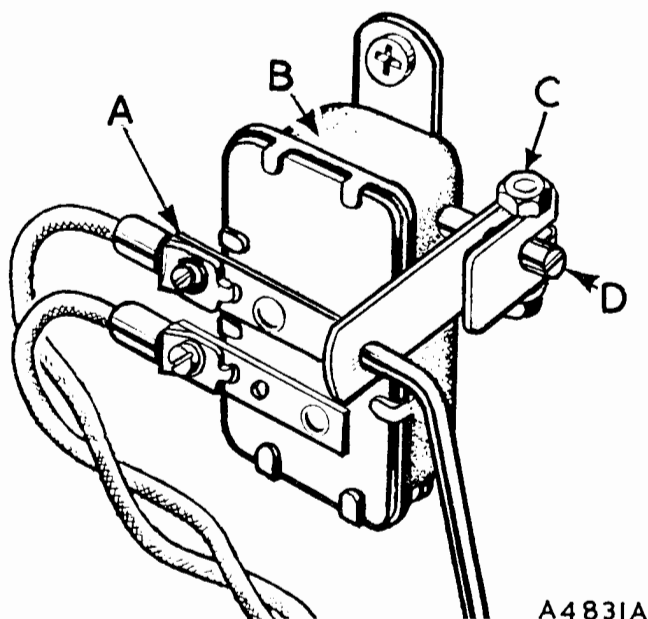


Fig. G.13. The overdrive throttle switch showing,

- |                     |                         |
|---------------------|-------------------------|
| A. Switch terminal. | C. Lever clamping bolt. |
| B. Switch body.     | D. Operating shaft.     |

If the switch requires adjustment, slacken the lever clamping bolt "C" (Fig. G.13) and turn the switch operating shaft "D" (Fig. G.13) with a screwdriver until the setting is correct: the end of the shaft is slotted for this purpose.

## SECTION GG

### OVERDRIVE

(Series BN6)

For details of the overdrive unit fitted to BN6 cars refer to  
Section G.

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**GGG**

# **SECTION GGG**

## **OVERDRIVE**

(Series BN7 and BT7)

Section No. GGG.1    Overdrive unit for BN7 and BT7 cars

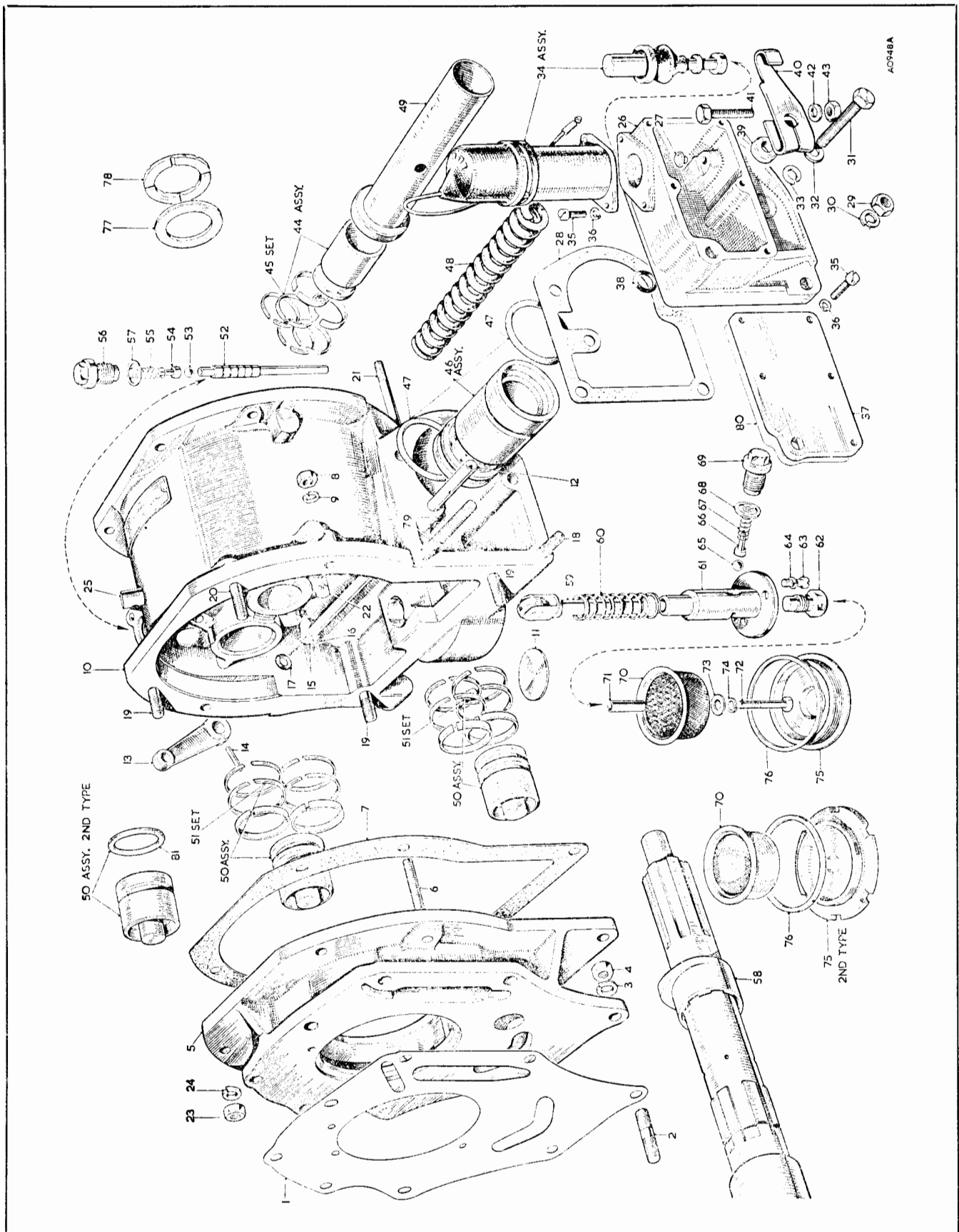
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## Section GGG.1

### OVERDRIVE UNIT FOR BN7 AND BT7 CARS

The overdrive units fitted to the BN7 and BT7 cars are basically similar to those described in Section G. The following changes have, however, been made:

- (1) A re-designed filter has been fitted and is retained in the body by a boss on the inside of the drain plug. The filter is accessible through the drain plug hole.
- (2) New operating pistons have been fitted with synthetic rubber sealing rings and the accumulator piston with three piece cast iron rings.
- (3) The pinions are fitted with needle roller bearings in lieu of "Clevite" bushes.
- (4) The outer ring of the uni-directional clutch is not riveted.
- (5) An additional selective washer  $0.160 \pm .0005$  in. thick is available.
- (6) A re-designed solenoid bracket and adapter plate has been fitted.



No.	Description	No.	Description	No.	Description
1.	Joint—overdrive unit.	28.	Joint—bracket to case.	55.	Spring for plunger.
2.	Stud—overdrive unit.	29.	Nut—bracket to casing.	56.	Plug for valve—screwed.
3.	Washer for stud (spring)	30.	Washer for nut (spring).	57.	Washer for plug.
4.	Nut for stud.	31.	Screw—bracket to casing.	58.	Can—oil pump.
5.	Plate—adaptor.	32.	Washer for screw.	59.	Plunger assembly—oil pump.
6.	Stud—adaptor to casing.	33.	Washer for screw (spring).	60.	Spring for plunger.
7.	Joint—adaptor to casing.	34.	Solenoid.	61.	Body—oil pump.
8.	Nut—plate stud to casing.	35.	Screw—solenoid to bracket.	62.	Plug for body—screwed.
9.	Washer for stud (spring)	36.	Washer for screw (spring).	63.	Screw—body to front casing.
10.	Casing—front.	37.	Plate—solenoid bracket cover.	64.	Washer for screw (spring).
11.	Plug.	38.	Seal, oil—valve operating shaft.	65.	Ball valve.
12.	Shaft—valve operating.	39.	Distance collar.	66.	Plunger, ball.
13.	Lever for shaft.	40.	Lever—solenoid.	67.	Spring for plunger.
14.	Pin—lever to shaft.	41.	Screw—lever to spindle.	68.	Washer for valve plug (copper).
15.	Can—valve operating.	42.	Washer for screw (spring).	69.	Plug—valve.
16.	Pin for can.	43.	Nut for screw.	70.	Strainer—oil pump.
17.	Seal for shaft.	44.	Piston assembly—accumulator.	71.	Distance tube for strainer.
18.	Stud for solenoid bracket.	45.	Ring—piston.	72.	Bolt for strainer.
19.	Stud for plate—long.	46.	Housing assembly—accumulator.	73.	Washer for bolt.
20.	Stud for plate—short.	47.	Ring, rubber.	74.	Washer for bolt (spring).
21.	Stud—front to rear casing.	48.	Spring—accumulator pressure.	75.	Plug—oil drain.
22.	Peg—oil pump plunger guide.	49.	Tube for spring.	76.	Washer for plug.
23.	Nut—front casing to adaptor plate.	50.	Piston—assembly—operating.	77.	Washer, steel.
24.	Washer for nut (spring).	51.	Ring, piston.	78.	Washer—phosphor bronze.
25.	Breather.	52.	Valve, operating.	79.	Stud for solenoid bracket.
26.	Bracket solenoid.	53.	Ball for valve.	80.	Joint for cover plate.
27.	Stop (rubber).	54.	Plunger, ball.	81.	Ring—piston.

Key to the overdrive front casing components.