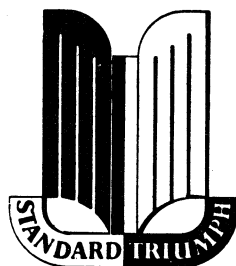


SERVICE
INSTRUCTION MANUAL

for the
LAYCOCK - DE - NORMANVILLE

OVERDRIVE UNIT
WITH
ELECTRICAL CONTROL



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COVENTRY ENGLAND

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FOREWORD

This Manual has been compiled with a view to familiarising our Agents and other Repairers, throughout the World, with the operation and repair of the Laycock de Normanville Overdrive Unit.

Whilst there have been few major changes in the Overdrive Unit itself, since it was first fitted to our vehicles, there have been alterations in the control mechanism. This Manual deals with the Electrical Control mechanism, currently fitted to the Standard Vanguard, Triumph Renown and Triumph TR2. Details of earlier control mechanisms are included in two previous publications entitled "Instructions for Fitting Laycock de Normanville Overdrive Unit" and supplied under Part Numbers 500955 and 501545 respectively, obtainable from our Spares Department.

Detailed overhaul instructions are given in this Manual mainly for the benefit of our Overseas Dealers who are unable to take advantage of our Replacement Unit Service. To further assist Overseas Dealers, who have to carry out their own repairs, a fully comprehensive stock of parts for the Overdrive Unit and its control mechanism are obtainable from our Spares Department.

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THE LAYCOCK DE NORMANVILLE OVERDRIVE UNIT

AS FITTED TO PRESENT PRODUCTION OF 20S., 20ST and TR2 MODELS

DESCRIPTION

The Laycock de Normanville Overdrive Unit fitted to the above models is electrically operated at the touch of an electric switch. This unit operates on second and top gears on the Vanguard and Renown range, but on top gear only on the Triumph TR2, which has a four-speed gearbox.

The electrically operated overdrive on the two upper gear ratios with the Three Speed Unit offers a number of improvements; an instantaneous gear change at the touch of the operating switch; a five-speed gearbox, namely first, second, overdrive second, top and overdrive top; a speed range in second gear of five to forty-five miles per hour and a cruising ratio, overdrive top, giving approximately 30 m.p.g. at 50 m.p.h.

In the case of the TR2, which has a four-speed gearbox, no useful purpose can be gained by overdriving any gear other than top, since the differential ratio of second to third and third to top is almost the same as that of the overdrive. No provision is made for overdriving any gear other than top gear, nor is it recommended.

The overdrive unit itself is fitted to the rear of the normal gearbox and takes the place of the normal rear extension on all models.

RATIOS :

		20S and 20ST Models. (6.00 × 16 tyres).				
		Top	2nd	1st	Rev.	
Ratios		1.00	1.67	3.54	4.11	
Overall						
Ratios		4.625	7.71	16.35	18.99	
When in						
O/Drive		3.6	6.00	—	—	
		TR2 (5.75 × 16 tyres).				
		Top	3rd	2nd	1st	Rev.
Ratios		1.00	1.325	2.00	3.38	4.28
Overall						
Ratios		3.7	4.9	7.4	12.5	15.8
When in						
O/Drive		3.03	—	—	—	—

THE PRINCIPLE (Fig. 1).

An epicyclic gear train is arranged to consist of a sun wheel (A), planet wheels (B), a planet wheel carrier (D) and an outer ring, the annulus (C).

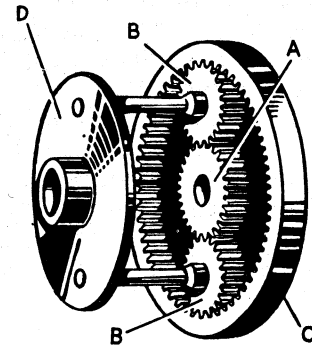


Fig. 1 Principle of an Epicyclic Gear.

If the planet carrier is rotated while the sun wheel is locked to the annulus the whole gear train will rotate as a solid unit giving a direct through drive. If on the other hand the sun wheel is locked to the casing preventing it from rotating and the planet carrier is rotated, the annulus will be overdriven at a higher speed than the planet carrier.

OPERATION

In addition to an epicyclic gear train similar to the one depicted in Fig. 1, there is also a hydraulic pump, a hydraulic accumulator or pressure storage chamber, a roller clutch and a sliding cone clutch. When in direct top gear (see Fig. 2) the overdrive is inoperative. The

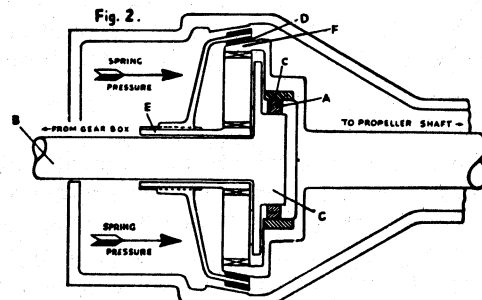


Fig. 2 Operation in Direct Drive.

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drive from the gearbox to the propeller shaft is taken through the rollers (A) from the gearbox main driving shaft (B) to the outer member of the uni-directional clutch (C), and so direct drive is transmitted. The roller clutch drives in one direction only, and therefore if the car were to over-run the engine, the rollers would be pushed down the inclined surfaces away from the annulus or output member and the drive broken, leaving the car without engine resistance to assist braking. This problem is overcome by means of a cone clutch (D). This clutch slides on the sun wheel splined extension (E) (Fig. 2) and it is pushed by springs to engage with the corresponding cone of the annulus (F). This, therefore, locks the sun wheel to the annulus. Between the annulus and the sun wheel are the planet wheels which are carried by the planet carrier (G) which is mounted on the driving shaft (B). The planet wheels are therefore also locked and resistance to over-run is provided by the engine through the gearbox and main drive shaft to the planet wheels.

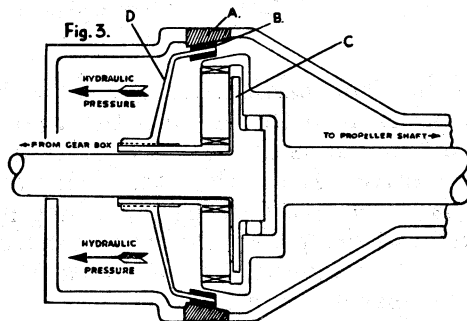


Fig. 3 Overdrive in operation.

When overdrive is engaged (Fig. 3) a valve in the unit is opened, applying hydraulic pressure from the pressure accumulator to two pistons which work in cylinders formed in the unit housing. These pistons exert pressure against the cone clutch member, overcoming the spring pressure and pushing the cone clutch (D) away from the annulus until the outer lining (B) presses against a conical brake ring (A) built into the main casing.

The sun wheel, which carries on its splined extension the cone clutch, is free to rotate on the driving shaft, therefore, when the cone clutch comes into contact with the brake ring, both cone clutch and sun wheel are brought to rest and held stationary.

The planet carrier (C), which is splined to the driving shaft, is driven round the stationary sun wheel so that the planets rotate and overdrive the annulus at a higher speed than the driving shaft. In overdrive, the outer member of the roller clutch over-runs the inner member. Engine braking is again provided by the cone clutch which holds the sun wheel from rotating in either direction.

CONSTRUCTION (Fig. 4)

The mainshaft of the gearbox is extended to form the input shaft (1) of the overdrive unit. This shaft carries first of all a cam (3) operating a plunger type hydraulic pump (39). The pump delivers oil through a non-return valve (36) to the accumulator cylinder (35), in which a piston (34) moves back against a compression spring (33) until the required pressure is reached when relief holes are uncovered. Further back on the shaft there is a freely rotatable sun wheel (17) in one piece with an externally splined sleeve. Immediately behind the sun wheel and splined to the shaft is the planet carrier (15) in which are mounted the three planet wheels (16). At the rear of the input shaft and also splined to it is the inner member (20) of the roller clutch. The outer member (18) of the roller clutch is carried in the annulus (32) which is in one piece with the output shaft (23). Mounted on the splined sleeve of the sun wheel is a double cone clutch member (11). The cone clutch member can slide upon the splined sleeve of the sun wheel so that the inner lining (14) can make contact with a corresponding cone on the annulus, alternatively the outer lining (12) can make contact with a cast iron brake ring (13) which forms part of the unit housing.

To the hub of the cone clutch member is secured a ball bearing (9) housed in a flanged thrust ring (10). This ring carries on its forward face eight pegs (7) acting as guides to eight compression springs (8) by which the cone clutch member is held against the annulus. The thrust ring also has attached to it four pins (5) which carry two bridge pieces (6) bearing against the pistons (2) operating in cylinders formed in the unit casing. The pistons can push in the opposite direction to the thrust of the springs and are connected through a valve to the pressure accumulator.

In direct gear the drive from the input shaft is through the rollers (19) of the roller

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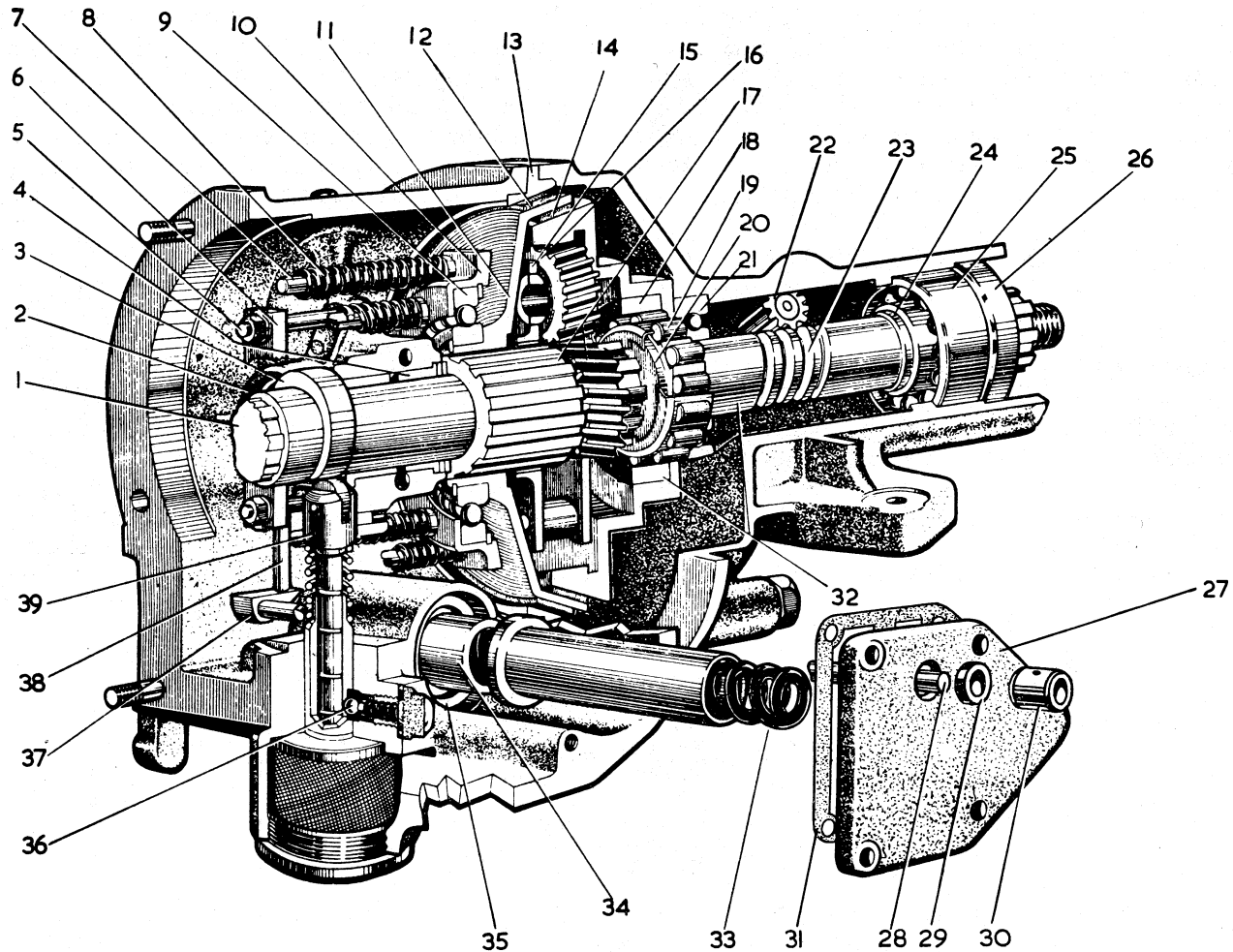


Fig. 4 Sectional View of the Overdrive Unit.

clutch which rise up the inclined faces of the inner member and become wedged between the inner and outer member of the clutch. The inner lining of the cone clutch is held locked by spring pressure against the annulus, so that the entire gear train rotates as a solid unit to prevent a free wheel condition and to handle reverse torque.

The change into overdrive is effected by operating a switch, which in turn actuates the solenoid. Whilst the plunger is drawn into a solenoid, this rotates the operating shaft (28) so that the cam lever (37) lifts the operating valve spindle (38) admitting oil from the pressure accumulator cylinder into the two cylinders in the unit casing, pushing the operating pistons (2) against the bridge piece (6). The cone clutch member now overcomes the eight clutch springs and slides forward along the splines of the sun

wheel extension, until the outer lining (12) contacts the stationary brake ring (13).

The oil immersed cone clutch comes smoothly to rest, together with the sun wheel, resulting in a perfectly smooth change into overdrive. During the brief period of time when the change into overdrive is taking place, the power continues to be transferred through the roller clutch until overdriving actually commences, so that the drive is without interruption and the change instantaneous. When changing from overdrive to direct drive the throttle may be kept open. The release of oil pressure from the operating cylinders is deliberately restricted so that the cone clutch takes about half a second to move over to the direct drive position. As soon as contact between the cone clutch and the brake ring is broken, the load on the engine is released, allowing the engine to speed up until

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the roller clutch ceases to be over-run and takes up the drive again. The change into normal is completed as the cone clutch contacts the annulus to prevent free-wheeling. When the throttle is closed the cone clutch is released from contact with the brake ring, and takes up the drive smoothly against the annulus.

THE ELECTRICAL CONTROL GEAR

(Fig. 5—Wiring Diagram)

The operating valve lever is lifted automatically by the plunger of an electric solenoid. The solenoid has two separate coil windings with an internal switch which is closed when the solenoid is not energised. The closing coil gives a powerful initial lift to open the valve, after which the internal switch opens, leaving the holding coil to continue holding the valve open. The current to operate the solenoid is taken from

body is a press-fit into the overdrive front casing, and is fed with oil from the sump of the casing through a fine mesh strainer. The oil is delivered through a non-return ball valve to the accumulator cylinder, in which a piston moves back against a powerful compression spring until the required pressure of 470—510 lbs. per sq. in. (32.9—35.7 kgs. per sq. cm.) in the case of the Vanguard and Renown, and 420—445 lbs. per sq. in. (29.4—31.1 kgs. per sq. cm.) in the case of the TR2 is reached, when relief holes are uncovered. From the relief holes the oil is led through drilled passages in the overdrive body to an annular groove between the two steady bushes for the gearbox shaft extension. Radial holes in the shaft collect the oil and deliver it along an axial drilling to other radial holes in the shaft, providing positive pressure-fed lubrication to the sun wheel, thrust washers, planet carriers and planet bearings. From the

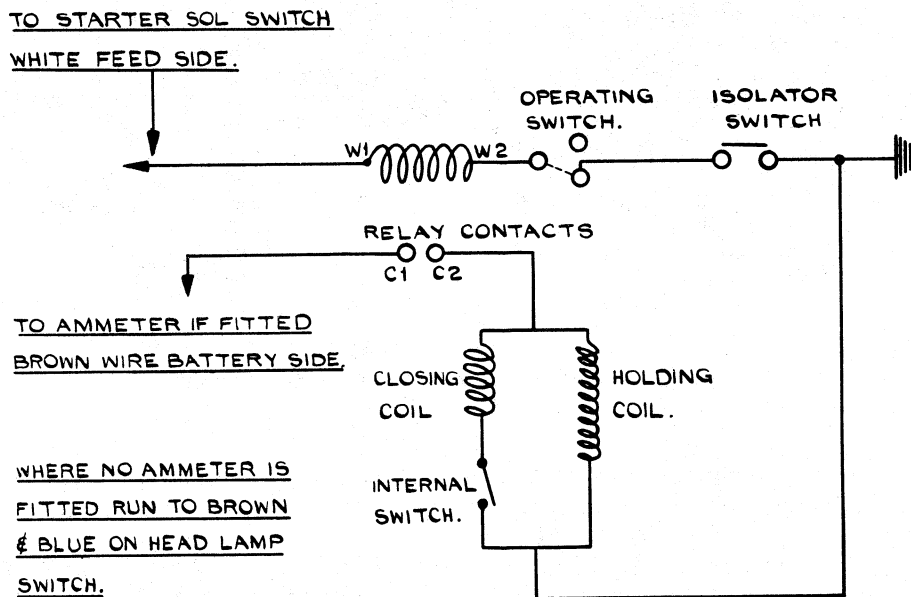


Fig. 5

Wiring diagram.

the starter solenoid switch, and the operating switch in the case of the Vanguard and Triumph Renown is situated on the steering column, but on the TR2, this switch is placed on the instrument panel. Incorporated in the circuit is an isolator switch, which limits the use of overdrive to top and second on the Vanguard and Renown, and to top gear only on the TR2.

THE HYDRAULIC SYSTEM

The hydraulic system is supplied with oil by a plunger type pump operated by a cam on the gearbox mainshaft extension. The pump

accumulator cylinder, oil under pressure is supplied to the operating valve chamber by way of a drilled passage in the unit casing. When the operating valve is lifted, the oil flows under pressure via another drilled passage to the two operating pistons which work in cylinders formed in the unit casing. When the operating valve is closed, the oil in the operating cylinders is returned to the sump.

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CARE AND LUBRICATION

The oil in the overdrive is common with that in the gearbox. The oil to use is ordinary mineral oil in the following grades :—

Normal summer climates — S.A.E.30
Normal winter climates — S.A.E.20

Under no circumstances should extreme pressure gear oils be used, because the centrifugal effect of the planets may separate some of the additives from the oil and cause sludging. The oil capacity of the gearbox and overdrive unit is as follows :—

Standard Vanguard
and
Triumph Renown — $3\frac{1}{2}$ pints (2 litres)
Triumph TR2 — $3\frac{1}{2}$ pints (2 litres)

The correct level must be carefully maintained. It will be necessary to remove the drain plugs from both gearbox and overdrive unit to

drain them, but refilling is done through the gearbox only.

Refill the gearbox with oil after draining and then drive the car a short distance, after which top up with oil because some of the oil will have been taken into the hydraulic system. Do not run the car with no oil in the unit because air may enter the hydraulic system.

Cleanliness is the keynote to satisfactory performance of any hydraulic system. The smallest amount of dirt or "fluff" from a wiping cloth which finds its way into a valve will cause a great deal of unnecessary difficulty. Pay particular attention to the clean condition of the oil used for filling, and carefully clean all around the filler plug each time before removing it. Regular attention to these small details will be rewarded by long and trouble-free service.

DIAGNOSIS AND RECTIFICATION OF FAULTS

Any faults in the overdrive or its control gear will become manifest in one or other of six symptoms. These six symptoms are given below, and each one is covered by a procedure for finding and rectifying the fault in the quickest possible time. The tests given are arranged in such an order as to avoid any unnecessary dismantling or removal of parts. As familiarity with the overdrive increases, almost any fault can be isolated and rectified within a short time.

Each of the tests given is based on the assumption that the previous tests have been satisfactorily carried out and that the unit has been working normally prior to the fault developing.

When a unit has been removed from the gearbox and replaced, other faults can occur due to wrong assembly, but these faults are given separately in the sections dealing with fitting, stripping and rebuilding of the overdrive.

I. OVERDRIVE DOES NOT ENGAGE

(i) Insufficient oil in the unit.

The gearbox must be filled to the level of the filler plug. Be sure to clean carefully around filler hole before removing plug.

(ii) Solenoid Lever not set correctly. See page 8.

(iii) Electrical Control Gear.

When the electrical components are functioning correctly, the solenoid can be heard to "click" in and out when the gear lever is in neutral, the ignition switched on and the overdrive switch moved to the on and off positions. (Except TR2. See below).

When the gear lever is moved into first or reverse (on all models except TR2), the circuit should become "dead," that is, no "clicking" of the solenoid should be heard when the ignition is switched on and the operating switch moved to the on and off positions. In the case of the TR2 the circuit becomes "alive" *only* when top gear is engaged.

The feed wires to "W1" and "C1" on the relay are NOT connected through any fuse for the following reason :—

Should the fuse blow when the engine is driven at peak revs. in overdrive second gear, the overdrive unit would immediately return to normal second gear. The car running at high speed would then turn the engine at speeds for which it was not designed, with consequent risk of damage to the connecting rods, valve gear, etc.

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(iv) Fault Locating. (See Fig. 5)

- (a) Check battery.
- (b) Check the "W1" terminal of the relay, which should be "alive" when the ignition is switched on. Check the "C1" terminal on the relay, which should always be "alive." Check the "C2" terminal on the relay, which should be "alive" only when the operating switch is in the overdrive position, the gearbox in neutral (top gear on TR2) and the ignition switched on. If "C2" remains "dead," connect "W2" to earth. If "C2" becomes "alive" then either the operating switch or the isolator switch is faulty. If "C2" remains "dead," then the relay is faulty and should be replaced. Remove the test wire from "W2" to earth.
- (c) If the switches are suspected, remove from the terminal of the isolator switch situated on the O/S of the gearbox (except TR2) the wire which is NOT earthed and connect it directly to earth. If "C2" becomes "alive" then the operating switch is satisfactory and the isolator switch is faulty and should be replaced.

If "C2" remains "dead" then the operating switch is faulty and should be replaced.

- (d) If, when "C2" is alive, the solenoid is too weak to move the lever its full travel (see valve adjustment), or sets up a continuous buzzing noise, or fails to operate at all, then it should be replaced by a new solenoid which has been weather-proofed or fitted with the latest type of rubber shroud.
- (v) **No Oil Pressure.**
If the unit still fails to operate and the operating valve is seating and lifting correctly, check that the oil pump is working. Jack up the rear wheels of the car, remove the operating valve plug and start the engine. **Before removing the plug it is very important to release all oil pressure from the system by operating the valve setting lever by hand about ten times.** Engage top gear with the engine

ticking over slowly and watch for oil being pumped into the valve chamber. If none appears, then the pump is not working, probably due to foreign matter on the seat of the non-return valve. A flow of oil into the operating valve chamber does not prove that the oil pressure is correct, a pressure of 470—510 lbs. per sq. in. (32.9—35.7 kgs. per sq. cm.) is required on the Vanguard and Renown, and 420—445 lbs. per sq. in. (29.4—31.1 kgs. per sq. cm.) is required on the TR2. An adapter is available and should be used to replace the operating valve plug in conjunction with an oil pressure gauge reading up to 800 lbs. per sq. in. (56.24 kgs. per sq. cm.) and suitable for screwing into the $\frac{1}{8}$ " B.S.P. thread in the mouth of the adapter. Low pressure indicates leakage. To remedy this fault, proceed as follows:—

- (a) Remove the drain plug (G) and drain off oil (Fig. 6).
- (b) In the case of the TR2, remove the cover from solenoid bracket.
- (c) Remove solenoid. On the Vanguard and Renown, remove solenoid from its mounting bracket, and on no account attempt to unscrew the two *RED* painted bolts holding the bracket at this stage.
- (d) Slacken off clamping bolt in solenoid lever and remove lever with the solenoid plunger attached.
- (e) Remove the distance collar.
- (f) The solenoid bracket is secured by two $\frac{5}{16}$ " (7.937 mm.) diameter studs and two $\frac{5}{16}$ " (7.937 mm.) diameter bolts, the head of the bolts are painted *RED*. **REMOVE THE NUTS FROM THE STUDS BEFORE TOUCHING THE BOLTS.** The two bolts should now be slackened off together, releasing the compression on the accumulator spring, which abuts the solenoid bracket.
- (g) The pump valve plug (F) can now be unscrewed with a box spanner, and the spring (D), plunger (C) and ball (B) removed (Fig. 6).

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After re-assembling it will be necessary to reset the solenoid lever, as described on page 8.

2. OVERDRIVE ON ALL GEARS

(i) Electrical Control Gear.

- (a) A dangerous condition can arise if that part of the circuit between "W2" (Fig. 5) on the relay to the non-earthed side of the isolator switch becomes accidentally earthed. Any earthing would bring in the overdrive on all gears including reverse.

Any attempt at reversing the car in overdrive would destroy the roller clutch built into the unit. If such a situation should occur, remove the wire from "W2" until the fault has been located and rectified.

- (b) Built into the relay are switch contacts which switch the heavy current to the solenoid when the solenoid coil is energised. Should these contacts stick "IN" then the overdrive would be operative on all gears including reverse. To check this, remove the wire from "W2" and check "C2." If "C2" is "alive" then the contacts are sticking in. Replace the relay.

- (c) If the solenoid plunger has corroded due to the entry of water into the solenoid, the plunger could stick "IN" causing overdrive on all gears. To check this, remove the wire from "C2" and by working the solenoid lever on the side of the gearbox, ensure that the plunger is working freely in and out of the solenoid. Should there be any tightness, ensure that the lever is not putting any side load on the actuating bolt, thereby jamming the plunger in the bore of the solenoid.

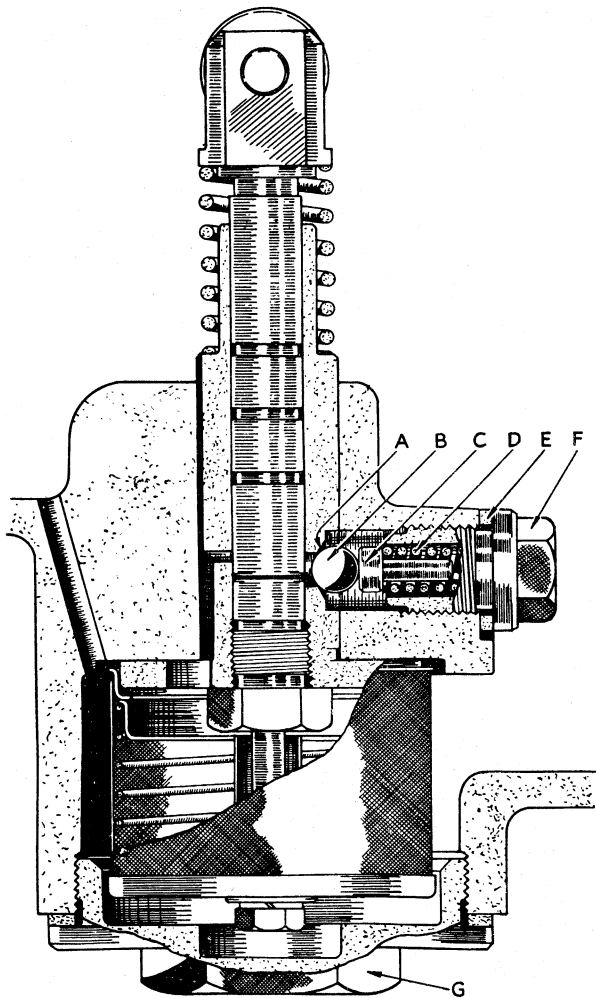


Fig. 6 The Oil Pump.

- (h) Clean the valve seat (A) and reseal the ball if necessary by gently tapping it on to its seat with a copper drift.

Re-assembly is the reverse of the above operations, but ensure that the valve plug is well tightened on to the soft copper washer (E) (Fig. 6) which should be replaced by a new one if damaged in any way.

Do not forget to replace the accumulator spring tube when re-assembling; failure to do so will result in the piston housing becoming displaced as soon as the unit is driven. Also ensure that the end of the accumulator spring engages on the short dowel at the rear of the solenoid bracket.

Should any tightness remain, remove the solenoid from the bracket and check the plunger for corrosion. Should any corrosion be apparent, replace the solenoid with one which has been weather-proofed or fitted with the latest type of rubber shroud.

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(ii) Solenoid Lever not set correctly.

(Fig. 7).

The solenoid lever, once set, should not normally require any further adjustment. Checking the setting of the lever takes only a few seconds and should be carried out at this point in case any initial "bedding down" has caused maladjustment. On the opposite side of the overdrive to the solenoid will be seen a valve setting lever (C) mounted on the end of the valve operating shaft (D). In the outer end of the lever is a

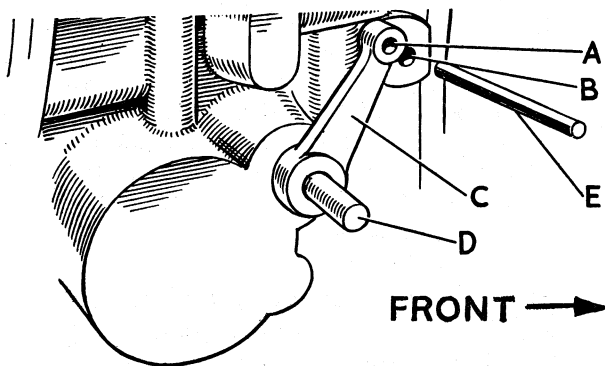


Fig. 7 Setting the Operating Valve.

$\frac{3}{16}$ " (4.7625 mm.) diameter hole (A), which must line up with a similar hole (B) in the overdrive casing when the lever is in the correct overdrive position.

To check this setting, switch on the ignition with the gear lever in the neutral position. Switch overdrive switch to the on position (top gear on TR2), this will then operate the solenoid and move the valve operating shaft to the overdrive position. The hole in the setting lever should now be in line with the hole in the overdrive casing and it should be possible to insert a $\frac{3}{16}$ " (4.7625 mm.) diameter pin or drill shank into the two holes. If the holes do not line up, the solenoid lever must be reset. Proceed as follows:—

- Remove the cover plate from the solenoid bracket in the case of the TR2. There is no cover plate on the Vanguard or Renown.
- Slacken off the clamping bolt (A) in the solenoid lever.

- Energise the solenoid as already described, and put a $\frac{3}{16}$ " (4.7625 mm.) diameter pin through the hole in the valve setting lever into the hole in the casing.
- Hold the solenoid lever (C) downwards so that it bears lightly against the head of the plunger bolt (D) and tighten the clamping bolt (A).

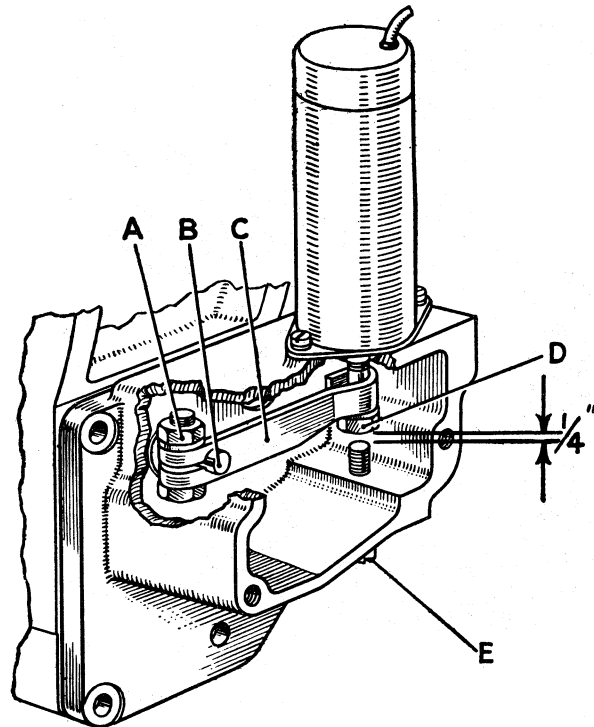


Fig. 8 Adjusting the Solenoid Lever.

Make sure that there is no end float in the valve operating shaft by pressing the valve setting lever and the solenoid lever inwards simultaneously when tightening the solenoid lever bolt. This expands the oil seals and prevents oil leakage.

- Remove the pin from the setting lever and operate the solenoid several times by use of the switch.
- Check that the hole in the valve setting lever corresponds with the hole in the casing by inserting the pin again. If the two holes do not quite line up, a

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fine adjustment can be made by screwing the solenoid plunger bolt (D) further in or out of the plunger. To adjust this bolt it will be necessary to remove and replace the split pin which secures the two parts.

- (g) After ensuring that the setting is correct replace the cover to the solenoid bracket.
- (h) The adjusting screw (E) is to prevent the plunger bolt from falling too low when the solenoid is not energised. The screw should be set to give $\frac{1}{4}$ " (6.35 mm.) clearance between the head of the plunger bolt and the end of the screw when the plunger is lifted.

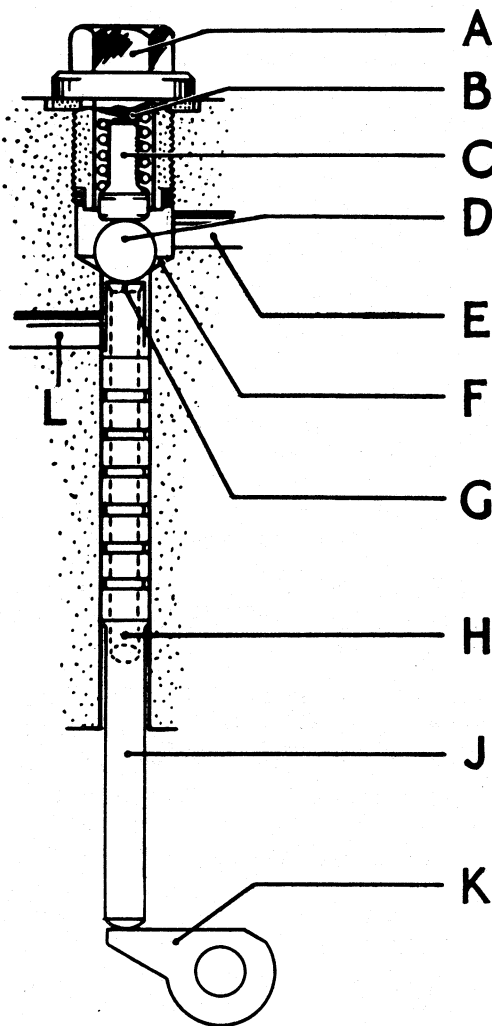


Fig. 9

The Operating Valve.

3. OVERDRIVE DOES NOT REMAIN ENGAGED

(i) Operating Valve leaking due to foreign matter on the Valve Seat.

The operating valve chamber (Fig. 9) is an enlargement at the top of a vertical hole in the overdrive casing. It is sealed with a screwed plug (A) and contains a spring (B) and plunger (C), which hold a steel ball (D) downwards against a seating (F), to prevent oil from circulating to the operating cylinders. The valve (J) is a hollow spindle sliding in the hole with a conical seating (G) for the steel ball in the top end. When the valve is lifted by the cam lever (K) it seats against the ball which is then lifted, admitting oil from the pressure accumulator via the drilled passage (E) to the passage (L) and into the operating cylinders, moving the pistons forward to engage the cone clutch.

When the valve is lowered, the ball is allowed to come on to its seating in the casing, cutting off the supply of oil from the accumulator.

Further lowering of the valve brings it out of contact with the steel ball, allowing the oil from the operating cylinders to return along passage (L) and down inside of the valve, to discharge through the small restrictor jet (H) into the sump of the overdrive body. The jet is of such a size that the cone clutch takes about half a second to move back under the influence of the clutch springs.

The operating valve plug is placed at the top right-hand side of the overdrive casing. If the previous checks have all been satisfactory, this plug should now be removed. **BEFORE REMOVING THE PLUG IT IS VERY IMPORTANT TO RELEASE ALL OIL PRESSURE FROM THE SYSTEM BY OPERATING THE VALVE SETTING LEVER BY HAND ABOUT TEN TIMES.** After removing the plug, spring and plunger, the steel ball will be seen in the bottom of the valve chamber, a small magnet will be found useful for removing the ball from the chamber. To remove the valve, a short length of wire, approximately $\frac{3}{32}$ " (2.3812 mm.) diameter

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should be inserted into the drilling in the centre of the valve, which can then be lifted out. Clean and examine the valve seats. If necessary, the ball seat (G) on the operating valve can be re-finished by gently grinding in a spare $\frac{5}{16}$ " (7.937 mm.) diameter steel ball, using a fine grade grinding paste. Do NOT use the actual ball from the unit for grinding in, and be sure to wash the valve seat clean before refitting it. If necessary, the ball should be reseated in the valve chamber by tapping it gently on to the seat (F), using a soft copper drift.

4. OVERDRIVE DOES NOT RELEASE

Important.

If this happens, do not try to move the car, because a transmission "lock" would occur in reverse and damage may result.

(i) Blocked Restrictor Jet in the Operating Valve.

A symptom of this is failure to get back into normal, or a slow return to normal drive as the oil slowly leaks out through the blocked jet. The cure is to remove the operating valve, as already described, and clear the jet.

(ii) Electric Control not operating correctly.

If the unit remains in overdrive after the ignition has been switched off, then the electrical circuit is not at fault. If, however, the unit cuts in and out with the ignition switch, a short circuit in the wiring or a faulty relay must be looked for (See 2. (i)).

(iii) Solenoid Lever not set correctly or Solenoid Plunger "sticking."

It is very unlikely that any maladjustment of the lever will develop to prevent overdrive from releasing. Make sure that there is $\frac{1}{4}$ " (6.35 mm.) clearance between the solenoid adjusting screw (E) (Fig. 8) and the head of the solenoid bolt when the plunger is lifted. The setting and working

of the valve setting lever should be checked as already described, and corrected if necessary.

(iv) Sticking Cone Clutch.

This fault has been known to occur as a result of heating up after a long run on a new unit, before the linings are fully bedded in. The clutch invariably releases itself when it has cooled down a little, or it can be released by giving the casing a sharp blow with a hide hammer over the brake ring between the body of the overdrive and the rear cover.

5. CLUTCH SLIP IN OVERDRIVE

(i) Insufficient oil in Gearbox.

The correct oil level must be maintained.

(ii) Solenoid Lever not set correctly.

Check the setting as already described.

(iii) Insufficient Hydraulic Pressure.

Probably due to foreign matter on the ball seat of the pump valve, or on the ball seating on the operating valve. Check the pressure with the adapter and gauge as already described, and clean and reseat valve if required.

(iv) Worn or burned Cone Clutch Outer Lining.

This is not experienced even after very large mileages unless the car has been driven for a long time in overdrive with the clutch slipping, due to causes (i), (ii) or (iii) given above. Removal of the unit and replacement of cone clutch member, would be necessary in this case.

6. CLUTCH SLIP IN REVERSE OR FREE WHEEL CONDITION ON OVERDRIVE

Blocked Restrictor Jet in Operating Valve causing sluggish return movement of the Cone Clutch.

Clean the restrictor jet as already described.

STRIPPING AND REBUILDING THE OVERDRIVE

The overdrive can only be removed from the gearbox by splitting at the adapter plate, leaving the plate attached to the gearbox. The nuts should be removed from the four short studs before touching those on the two long studs. Then these should be unscrewed simul-

taneously a few turns at a time to release the compression on the clutch return springs.

Operations 1 and 2 can be carried out without completely stripping the unit, they have been included in this section for convenience.

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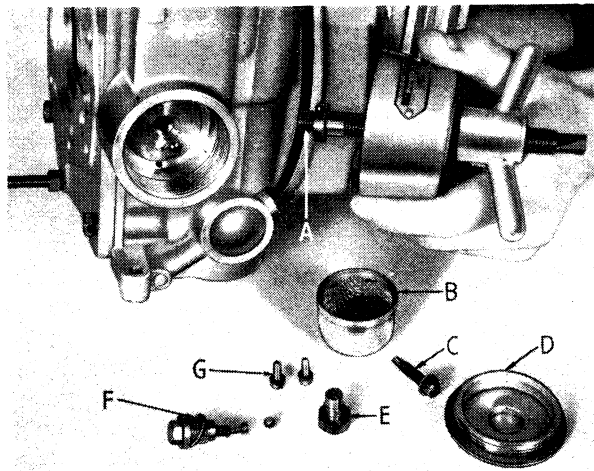


Fig. 10 Inserting the Oil Pump Extractor, Churchill Tool No. L 183.

I. Removing and Refitting the Oil Pump. (Fig. 10).

Remove the solenoid bracket as previously described and lift out the accumulator spring and tube to give access to the oil pump non-return valve. Remove oil pump non-return valve plug, spring, plunger and ball (F). Remove oil drain plug (D) and the oil strainer (B) which is held in place with the long bolt (C). Now take out the special screwed plug (E) and the two oil pump body screws (G).

Screw the short threaded end (A) of the extractor bolt into the oil pump body in place of the special screwed plug. Turn the wing nut on the long screwed end of the extractor bolt (A), drawing out the pump body (Fig. 11).

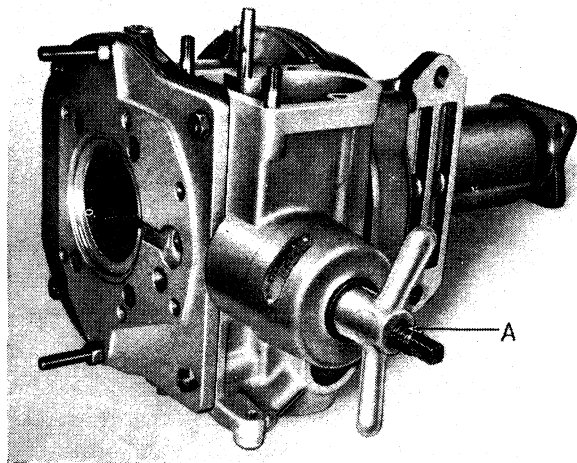


Fig. 11 Extracting the Oil Pump.

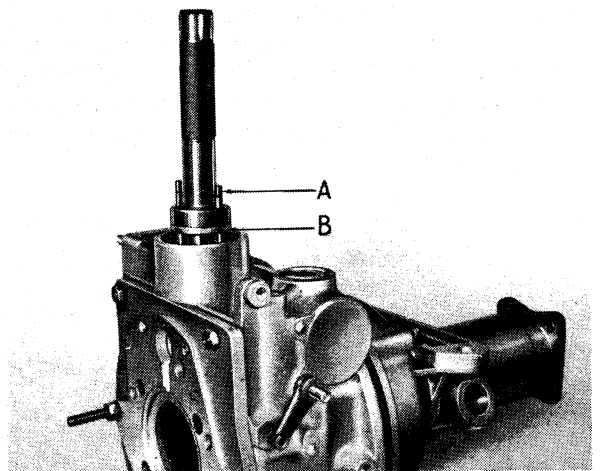


Fig. 12 Inserting the Oil Pump using Churchill Tool No. L 184.

To replace the oil pump body which is an interference fit in the casing, use two number 10 U.N.F. studs about 3" (7.5 cm.) long (A) as guides and drive the pump body (B) home with a suitable brass drift, or use the special tool which incorporates the two guides (Fig. 12).

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 casing.

2. Removing and Refitting the Operating Piston and its Housing.

Remove the solenoid bracket as previously described and lift out the accumulator spring and spring tube. The accumulator piston housing (B) is a push fit into the unit casing, and the oil tightness of the housing is ensured by the two rubber "O" rings (A).

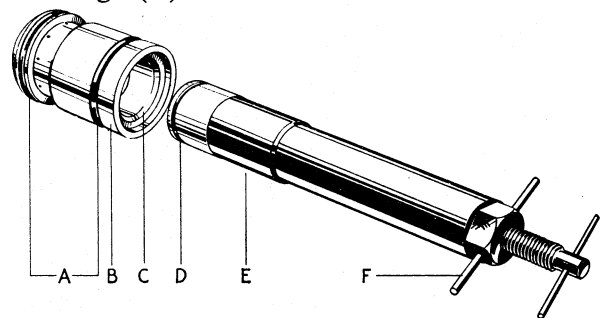


Fig. 13 Piston Housing and Extractor, Churchill Tool No. L 182.

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The housing can be extracted easily together with the piston by the use of the special tool (E) which fits into the bore of the housing and has a rubber "O" ring (D) which can be expanded by turning the tommy bar (F).

To use the extractor, first remove the operating valve plug "A" (Fig 9) to admit air to the rear of the housing, insert the nose of the extractor as far as it will go into the bore of the housing, tighten the tommy bar and pull (Fig. 14).

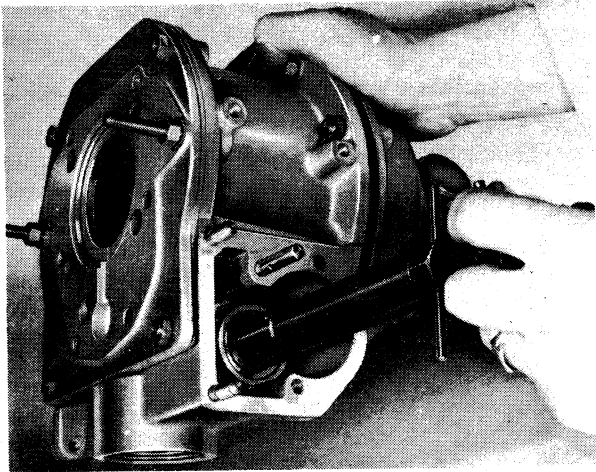


Fig. 14 Extracting the Piston Housing.

Examine the bore of the housing for signs of wear such as a ridge or scoring. This examination should be carried out without removing the piston from the housing.

The accumulator piston is fitted into the housing at the works with a special venturi tube, which ensures that the piston rings do not scrape the surface as they enter the aluminium housing. Replacement pistons are supplied already assembled in the housing. The piston should not be taken from the housing, but should this happen inadvertently do not put the piston back by pushing it into the rear end of the housing which has a conical recess (C) (Fig. 13), as this may result in the piston rings scraping the aluminium as they enter the housing. Instead, put the piston back from the front end of the housing, using a small piston ring clamp to compress the rings as the piston enters. A special venturi tube is now supplied by V. L. Churchill under Tool No. L 179.

Push the new piston and housing together into the casing by hand, using the accumulator spring tube (26) (Fig. 42), to push with. This will ensure that the piston does not blow out backwards as the housing goes in.

In the case of the TR2, where there is overdrive for top gear only, remove the solenoid bracket as previously described. Draw out the two accumulator springs (66 and 67) (Fig. 42). The piston has a $\frac{5}{16}$ " diameter N.F.2 tapped hole in its underside. A long bolt or length of screwed rod should be screwed into the piston in order to withdraw it. Assembly is the reverse procedure, and it is important to appreciate that correct fitting of the piston rings is of vital importance to the efficient working of the unit. Check that the rings are not gummed up due to use of an unsuitable lubricant, or have excessive clearance in the grooves.

3. Dismantling the Body and Gears.

At this point the front cover plate should have already been removed. Remove the clutch thrust springs and the two operating piston bridge pieces. Next remove the nuts from the six studs which hold the rear casing to the main casing and the two casings can then be pulled apart (Fig. 15).

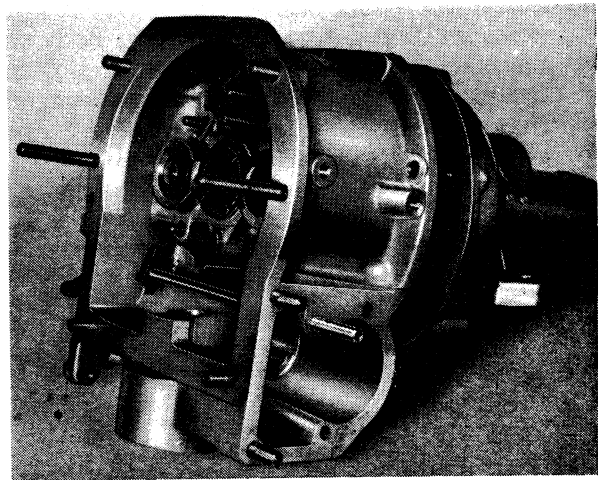


Fig. 15 Separating the Casing.

The sliding cone clutch sun wheel, planet carrier and roller clutch can now be lifted out in that order. To remove the annulus from the rear casing, grip the coupling flange in a vice and remove the large slotted nut from the end, also remove

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the speedometer pinion assembly. The annulus, which can now be drifted out easily from the rear, will take the front ball bearing with it and leave the rear ball bearing in the casing.

4. Inspection.

After the unit is dismantled and cleaned, each part should be thoroughly inspected to decide which parts should be replaced.

- (a) **Front Casing.** Examine for cracks or damage, oil leaks from the plugged ends of the oil passages or from the welch plug beneath the accumulator bore. Examine the bronze support bushes in the centre bore in which the mainshaft should be a close running fit. These bushes cannot be replaced in service since they have to be bored concentric to the casing after fitting. See that the cylinders which are bored in the casing for the operating pistons are free from scratches or scoring, and that the operating pistons and rings are not damaged.
- (b) **The Gear Train.** Inspect the teeth of the gear train for damage. Examine the bronze bush in the sun wheel which should be a close running fit on the mainshaft, and examine the planet wheels which should be a close running fit on the planet pinions. If the sun wheel or planet bushes are worn they cannot be replaced in service because they have to be bored true to the pitch line of the gear teeth. The gear train comprising sun wheel, planet carrier with planets and annulus is only supplied for service as a matched assembly to ensure quiet running, and care should be taken when dismantling units to keep gear trains in sets.
- (c) **The Mainshaft.** Inspect splines for wear or burrs, examine for signs of wear where the shaft runs in the bushes and sun wheel. See also that the oil holes are open and clean.
- (d) **Cone Clutch Sliding Member Assembly.** Examine the clutch linings for burning, wear or embedded foreign matter. The linings cannot be replaced in service because they have to be

ground accurately after riveting to the cone clutch member, which must be replaced if necessary. See also that the cone clutch slides freely on the splines of the sun wheel extension. Make sure that the pins for the clutch springs and bridge pieces are riveted tightly into the clutch thrust ring, and that the thrust ring ball bearing is in good condition.

- (e) **Clutch Springs.** Examine for distortion or collapse. Free length should be $4\frac{1}{2}$ " (11.5 cm.) outer springs, $4\frac{1}{4}$ " (10.8 cm.) inner springs. Replacement springs are supplied only in sets.
 - (f) **Roller Clutch.** See that the rollers are not chipped or damaged and that the inner and outer members of the roller clutch are not damaged. The outer member of the roller clutch cannot be replaced in service because it has to be ground concentric to the annulus after being fitted. See that the spring is not distorted or broken. Replacement rollers are supplied only in sets.
 - (g) **Ball Bearings.** See that the ball bearings for the annulus are in good condition and free from roughness when rotated slowly.
 - (h) **Thrust Washers.** Inspect for scoring of the steel or bronze.
 - (i) **Oil Pump.** Examine the pump for signs of wear. The pump plunger should be a close sliding hydraulic fit in the pump body, and the plunger roller should rotate freely on the roller pin with no slackness. Examine that the pump valve seat and ball are free from nicks and scratches.
 - (j) **Operating Valve.** See that the ball seating is free from nicks and scratches and the restrictor jet clear. Make sure that the valve slides freely in its bore in the front casing.
- ### 5. Re-assembling the Overdrive Unit.
- (a) First build up the tail case assembly; drive the front ball bearing on to the annulus and then press the annulus

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and bearing into the tail casing ; put the distance washer (24) (Fig. 4) on to the annulus shaft and press home the rear bearing (25) (Fig. 4). These distance washers are supplied in various thicknesses to suit the assembly. First of all try the same distance washers which were taken off when dismantling, even if a new annulus has been fitted the original distance washer will probably be suitable. Drive on the coupling flange and tighten the slotted nut. The end float of the annulus must now be measured, using either a dial indicator or by inserting feeler gauges between the annulus and a straight edge placed across the front face of the tail casing. The end float must be .005" to .010" (.127 to .254 mm.). It is very important that no preload should develop on the annulus bearings when the unit warms up in use. If the end float falls outside these limits, the nut and flange must be removed, the annulus driven out and a different spacing washer selected. When the end float is correct, remove the nut and flange and press home the oil seal (26) (Fig. 4) which is .006" (26 mm.) interference fit. The lip of the oil seal should face inwards.

- (b) Next prepare the main casing assembly in the following order :—Assemble the oil pump with valve, etc., the accumulator housing with piston, accumulator spring, tube and solenoid bracket, as already described. Next fit the two operating pistons, using a small piston ring clasp to assist assembly, or Churchill Tool No. L 179. The operating valve ball, plunger, spring and plug should now be fitted.

Finally drive home the cast-iron brake ring using a hide hammer (Fig. 16). The brake ring is spigoted to the main casing and is a light interference fit ; jointing composition should not be used.

- (c) Assemble the sliding clutch member. Press the ball bearing (B) into the housing in the thrust ring (A) and secure with the external circlip (D). The thrust ring and bearing is then

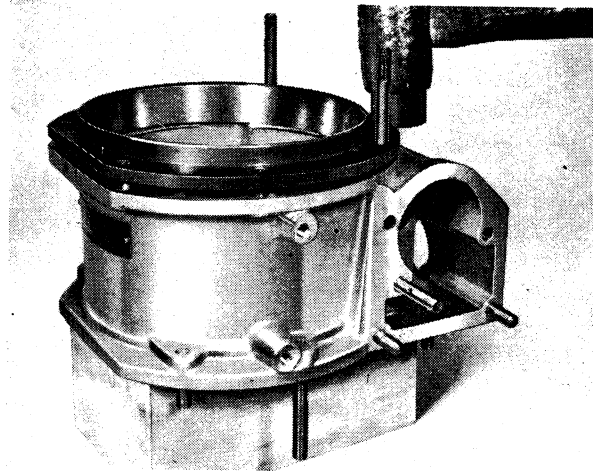


Fig. 16 Driving home the Brake Ring.

pressed on to the cone clutch member (C) and secured with the internal circlip (E) using suitable circlip pliers (Fig. 17).

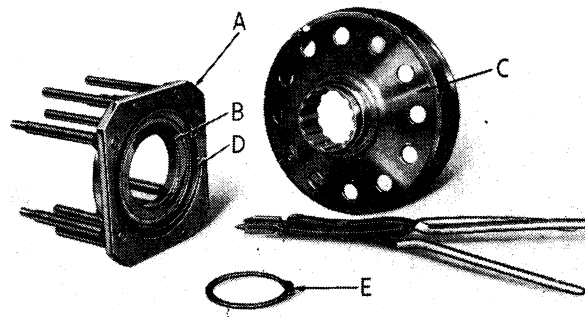


Fig. 17 Assembling the Sliding Member.

- (d) Assemble the roller clutch. This is quite easily done with the special assembly ring (Fig. 18). The roller clutch inner member (A), cage (B) and spring are put together, making sure that the spring is in the right way so as to cause the cage to urge the rollers up the inclined faces of the inner member. (See note on page 15).

The inner member with cage and spring is then placed into the assembly ring and the rollers (C) are pushed in through the slot in the rim of the ring (Fig. 19). The roller clutch can then be

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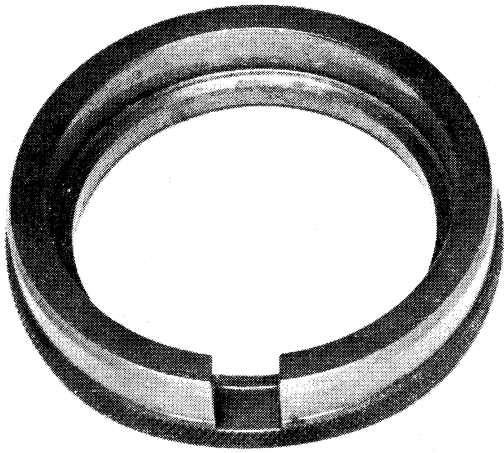


Fig. 18 Freewheel Assembly Ring, Churchill Tool No. L178.

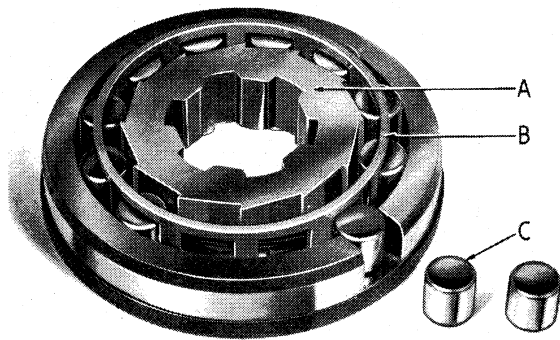


Fig. 19 Assembly of Roller Clutch.

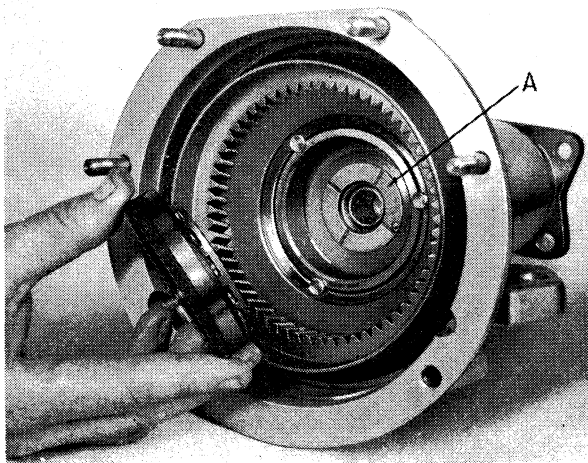


Fig. 20 Transferring Roller Clutch to Annulus.

transferred direct from the assembly ring to the annulus, remembering to put the bronze thrust washer (A) (Fig. 20) into position first (Figs. 20 and 21).

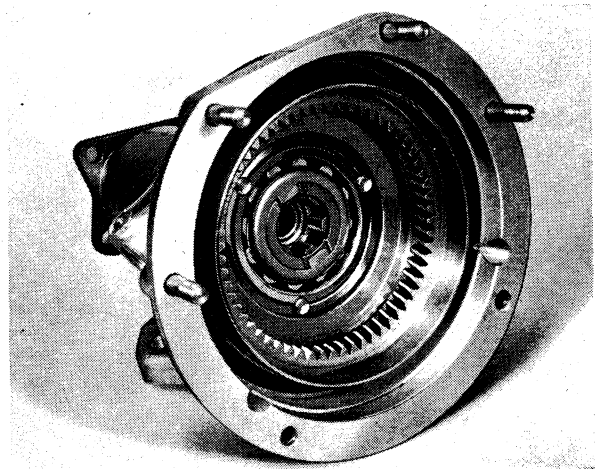


Fig. 21 Tail Casing with Roller Clutch assembled.

IMPORTANT NOTE

The assembly of the roller clutch as shown in this Manual covers all the Triumph Sports, Prefix No. 1275/, and Vanguard Overdrive Units which have prefix No. 1327/. Earlier Vanguards which have prefix No. 1287/ on the plate of the overdrive are fitted with the narrow roller clutch. Assembly of this unit differs slightly, as the lip on the outer cage is towards the rear of the unit, and a locating peg on the inner member locates in a corresponding hole in the planet carrier. It will be seen, therefore, that after assembling the rollers as in Fig. 19, it will be necessary to transfer the roller clutch into another ring, Churchill Tool No. L189, and then from this ring into the annulus. This will then ensure that the lip on the outer cage is to the rear, and the locating peg facing forward.

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- (e) Assembly of gear train. Erect the tail case assembly by securely gripping the mounting flange in a vice. Place the three thrust washers (38—2 off) and (54) (Fig. 42) for the rear of the sun wheel into position inside the planet carrier, with the steel thrust washer between the two bronze ones.

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 outward as shown in Fig. 22. The sun wheel

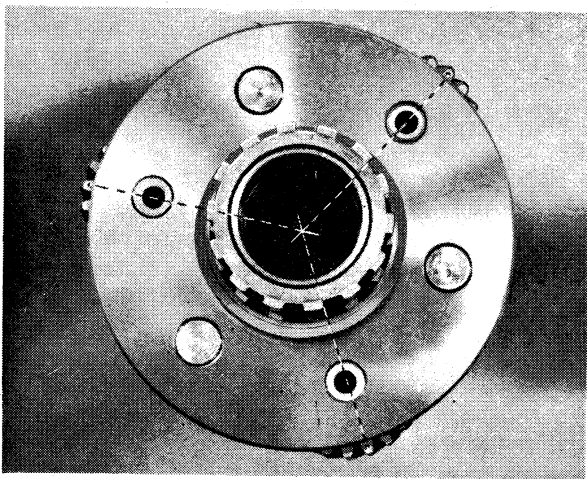


Fig. 22 Positioning the Marked Teeth on the Planet Wheels.

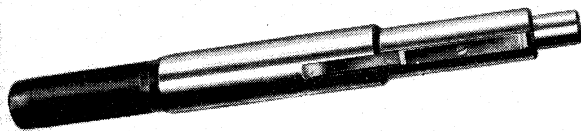


Fig. 23 Dummy Mainshaft, Churchill Tool No. L 185.

should now be inserted into the planet carrier and, with the punch marks still outward, the planet carrier should be placed into the annulus. The dummy shaft (Fig. 23) should now be inserted and left in place until rebuilding is completed (Fig. 24).

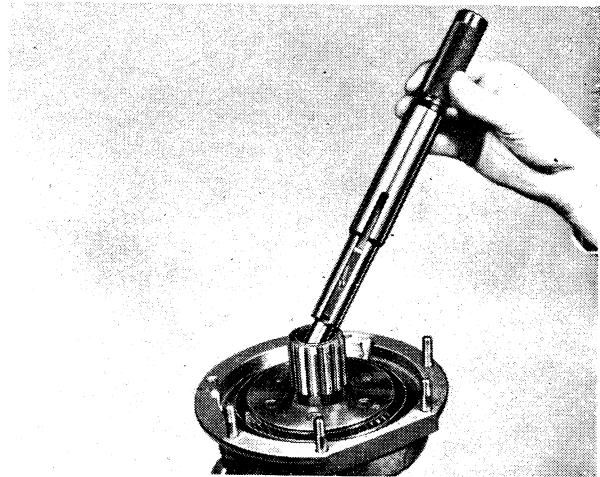


Fig. 24

Inserting the Dummy Mainshaft.

The next thing is to select a suitable adjustment washer to allow the correct amount of end float to the sun wheel. The steel thrust washer (B) (Fig. 25) which is fitted between the bronze thrust washer (C) (Fig. 25) and the central bush (4) (Fig. 4) in the main casing, serves also to make this adjustment and is supplied in various thicknesses to suit the assembly. Gauging the end float of the sun wheel can be done easily with ordinary feeler gauges as follows :—

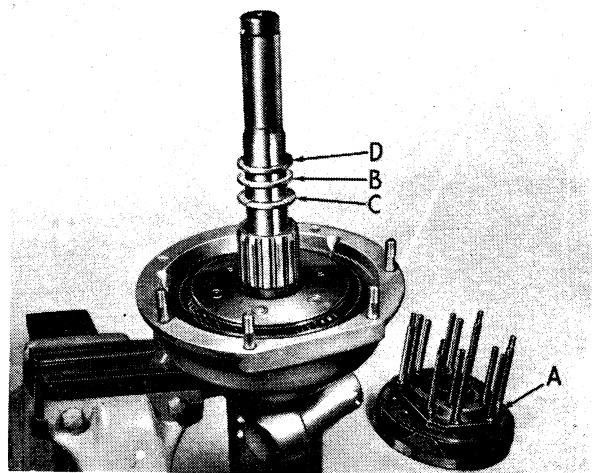


Fig. 25 Selecting a suitable Adjustment Washer to give the Sun Wheel End Float.

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Place the bronze washer (C) (Fig. 25) and the steel washer (B) (Fig. 25) in position at the front of the sun wheel. The cone clutch (A) (Fig. 25) should be left out while the thrust washer is being selected. Place the extra steel adjustment washer (D) of known thickness on top of the steel washer (B), and offer up the main casing assembly to the tail casing assembly. It will not go right down because of the extra washer, and the gap left between the two casings should be measured with feeler gauges (Fig. 26).

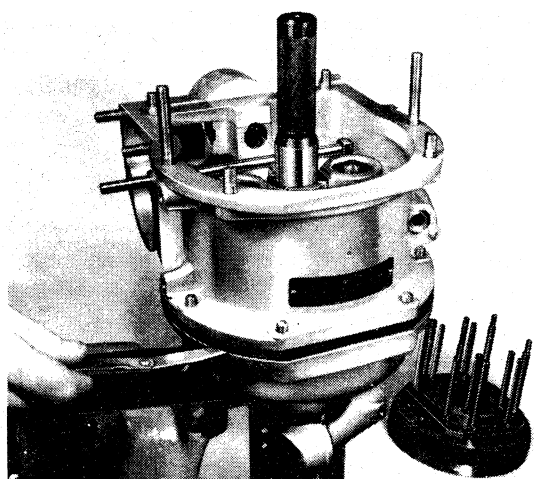


Fig. 26 Gauging the Sun Wheel End Float.

The width of the gap will be equal to the thickness of the extra washer less the amount of the sun wheel end float, for example, if the extra washer used is .078" (1.981 mm.) thick, and the measured gap between the casings is .062"

(1.575 mm.) then the end float of sun wheel with the particular thrust washer used will be:— .078" minus .062" equals .016" (1.981 mm. minus 1.575 mm. equals 406 mm.). The end float of the sun wheel must be between .014" and .020" (.355 mm. and .508 mm.). It is advisable when re-assembling a unit to first of all try the original thrust washer taken from the unit.

If the end float is found to be too much or too little, a suitable washer can readily be selected by calculation. These are supplied in various thicknesses.

As soon as the end float of the sun wheel is correct, re-assembly can quickly be completed. Separate the two casings, remove the extra thrust washer, fit the cone clutch assembly (A) (Fig. 25) in place, offer up the main casing to the tail casing, fit the nuts and spring washers on to the studs and tighten up evenly. The bridge pieces for the operating pistons should now be fixed in place and the clutch thrust springs placed in position on the pegs. Ensure that the eight springs are correctly located as shown in Fig. 34, that is, the long springs on the outside and the short springs nearer the centre. The dummy shaft should now be withdrawn and the unit is ready for fixing to the gearbox. If not required for immediate fixing to the gearbox the adapter plate or wooden cover should be fitted before putting the unit into store.

TO FIT OVERDRIVE TO VANGUARD MODEL

1. Remove the gearbox, leaving the engine in position. With Series II models there is a detachable portion at the rear of the normal detachable floor pressing, the removal of which, in addition to that of the main pressing, enables the gearbox to be removed and replaced without disturbing the clutch. The removal of the gearbox with earlier models necessitates the withdrawal of the clutch before the gearbox can be lifted upwards and over the floor of the car.
2. The gearbox should now be dismantled and the various gears and ball races examined

for possible damage. Any parts which are damaged or suspect in any way should be replaced. Where the vehicle, which is being converted to incorporate overdrive, has covered a mileage in excess of 10,000 miles, serious consideration should be given to the fitting of a reconditioned gearbox.

3. Remove the mainshaft ball race, if this has not already been done during normal dismantling work. The mainshaft originally fitted will be replaced by the special one supplied.

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4. Fit the baulk pin plate and ball race on the new mainshaft.
5. Gripping the mainshaft in the suitably protected jaws of a vice, assemble the gears on this shaft up to the main locating circlip, ensuring that the recess for this is free for its eventual entry by checking with half the circlip previously used (a new one will be required when re-assembling). When a new first or second mainshaft gear is to be fitted, ensure that .004"—.006" end float of the gears is permitted by the length of their bushes, when in their fitted positions. Having ensured that the synchro unit is perfectly free on the splines, check the overall float of the constant mesh assemblies, remove the second and first constant gears, but leaving their respective bushes in position with the hardened steel washer and half circlip. The end float can then be checked with a set of feeler gauges, as shown in Fig. 32. The correct float should lie between .007" and .012".
6. On the assumption that the oil transfer hole from the gearbox casing to the overdrive unit has yet to be drilled, fit the gearbox rear end packing and assemble adapter plate, supplied in the conversion pack, on to the gearbox casing securing the plate temporarily with the bolts provided.
7. Drill $\frac{5}{16}$ " diameter oil transfer hole indicated in Fig. 33 (it will already be drilled during normal manufacture with the later Series II models) concentrically through the hole in the adapter plate.
8. Where it has been found necessary to drill the oil transfer hole, the adapter plate and paper packing should now be removed and the casing and joint faces carefully cleaned.
9. Having first fitted the reverse pinion and ensured the condition of the countershaft gears, drop this latter assembly into the casing with a needle roller retainer tube inside it to position the needle rollers, with the front and rear thrust washers located by the tip of the countershaft and in grease, respectively. The countershaft gears should have an end float of .006"—.010" in their fitted position. If there is insufficient float the distance collar should be reduced. Where the end float is excessive a new distance washer and/or thrust washer should be fitted.
10. Having ensured the correct float in the countershaft gears, the countershaft should be driven out towards the front of the unit by the retainer tube, sufficiently to allow the countershaft gear assembly to fall to the bottom of the casing, whilst permitting the tip of the shaft to support the front thrust washer. The smaller rear washer remains located in grease. The retainer tube should be tapped a sufficient distance into the countershaft gear to locate the 24 needle rollers at each end whilst permitting the assembly to drop to the bottom of the casing.
11. Remove the mainshaft details remaining on the shaft with the exception of the ball race and baulk pin plate, and fit into the gearbox casing. Assemble mainshaft constant mesh gears on the shaft and install main locating circlip with the special sleeved tool.
12. Withdraw the gearbox mainshaft with the gears so far assembled, sufficiently towards the rear to enable the assembly to be tipped upwards, thus permitting second and top synchro unit to be fitted.
13. Tap mainshaft assembly into position and fit constant pinion.
14. Raise countershaft gear assembly and fit countershaft and complete re-assembly of the unit.
15. Fit adapter plate and locate packing on the gearbox casing with grease. Wire the heads of the six securing bolts, as shown in Fig. 33. The correct positioning of the wiring is important to ensure proper working clearance of the assembled overdrive unit.
16. Ensure that the eight springs in the overdrive unit are correctly located, as shown in Fig. 34. Previously these springs were identified by colouring—the outer ones being painted red and the inner, or shorter ones, blue. This method of identification is no longer necessary as the middle springs are appreciably shorter than those fitted at the top and bottom of the casing.
17. Fit the gearbox assembly to the overdrive unit, holding the latter in a vice as shown in Fig. 35. It is necessary to depress the pump plunger with a screwdriver whilst carrying

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out this operation, in order to allow the cam to pass over its roller on the pump plunger. The operating cam should be assembled on the gearbox mainshaft's splines so that the eccentric is offset from the ball race; this is obviously necessary to allow the cam to align with the pump roller. The driving plunger on the overdrive unit should be slowly revolved by hand, as the splines on the gearbox mainshaft approach those in the overdrive unit.

The forward ends of the six thrust springs having been located on their respective spigots, a nut and washer is fitted on the end of each of the long studs and the nuts tightened down evenly and progressively so as to pull the two units together. When the two faces are within 1" of each other, the pump plunger should be depressed with one screwdriver, whilst the cam is pushed along its splines with a second screwdriver into alignment with the roller on the plunger and both screwdrivers can then be withdrawn.

Continue tightening the gearbox down on the overdrive unit until it is possible to engage nuts on the threaded portion of the remaining studs. Fit nuts and washers and tighten all nuts home together progressively.

CAUTION. Do not use undue force in tightening the nuts on the long studs. There are two sets of splines in the overdrive unit and unless these are in line, it is impossible to tighten the overdrive unit home on to the adapter plate face.

The overdrive valve setting should now be checked.

FITTING THE SOLENOID AND BRACKET

1. Remove the collar on the valve operating shaft by withdrawing the cotter pin which is located on the N/S of the overdrive unit.
2. Remove the side cover plate by **FIRST REMOVING THE TWO NUTS** and then the two $\frac{5}{16}$ " diameter bolts, the heads of which are painted *RED*. The two bolts should be slackened off together, releasing the pressure on the accumulator spring.

3. After fitting the rubber grommet to the actuating bolt, screw this bolt into the solenoid plunger until the cotter pin hole is in mid-position in one of the slots of the plunger. Do not fit a cotter pin at this stage.
4. Fit the pressure plate over the grommet, and with two $\frac{3}{16}$ " diameter screws position on the solenoid bracket (Fig. 27).

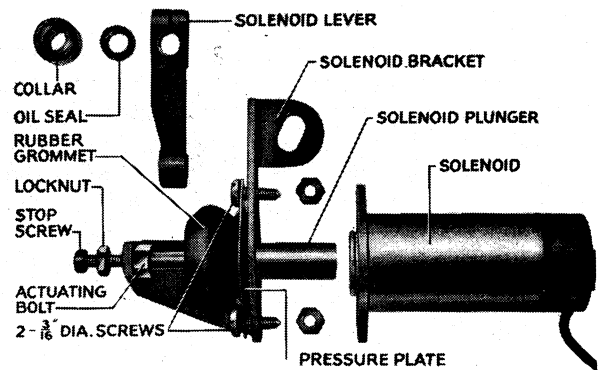


Fig. 27 Exploded view of Solenoid operating details.

5. Fit a paper joint treated with jointing compound and the solenoid over the plunger and over the two $\frac{3}{16}$ " diameter screws protruding through the solenoid bracket. Fit suitable nuts, spring washers and tighten up.
6. Fit the solenoid lever to the actuating bolt as shown in Fig. 28.

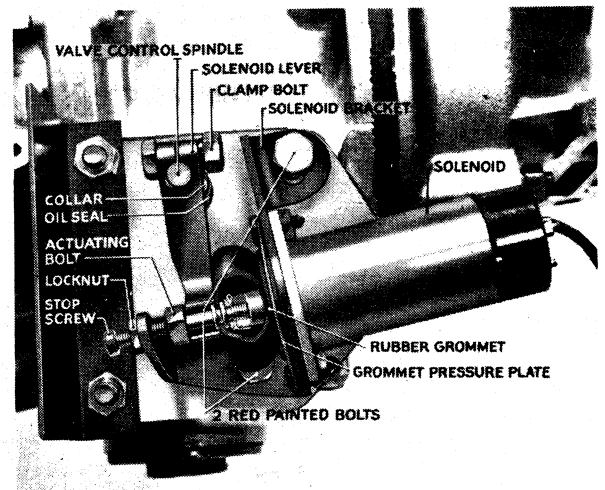


Fig. 28 Solenoid Operating Details in assembled form.

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7. After making sure that the paper joint is correctly placed and in good condition, locate the solenoid bracket assembly on the side plate by using the two red painted bolts, fit to the casting and at the same time, feed the oil seal, collar and solenoid lever on to the valve operating shaft. Tighten the bolts and fit a cotter pin to the collar.
8. Fit the stone guard to the two remaining studs and tighten the nuts.
9. On the right of the overdrive unit and pinned to the valve operating shaft, is a valve setting lever with a $\frac{3}{16}$ " diameter hole. In the casting adjacent to this lever is another $\frac{3}{16}$ " diameter hole. The valve setting lever should be rotated until the two $\frac{3}{16}$ " diameter holes coincide and then a $\frac{3}{16}$ " pin inserted through the lever into the casting, thus locking the operating shaft (Fig. 36).
10. Actuate the solenoid with a 12 volt battery and while the plunger is drawn into the solenoid, fit the clamping bolt and secure the lever to the operating shaft.
11. Remove the pin from the valve setting lever and disconnect the battery. Reconnect the battery and check the position of the valve setting lever again, which should permit the re-entry of the pin through the lever into the casting. If the holes do not coincide, note which way the lever should be moved and then remove the solenoid. Hold the plunger and screw the actuating bolt whichever way is necessary. Reassemble and repeat the check. When satisfied that the holes exactly correspond with the solenoid energised, remove the solenoid, fit the cotter pin to the actuating bolt and plunger and finally refit the solenoid.
12. Fit the actuating bolt stop screw and locknut (Fig. 28). By holding the operating lever against the head of the actuating bolt and moving the lever, a certain amount of free travel should be felt. Adjust the stop screw until this free travel is reduced to $\frac{1}{16}$ " when not in overdrive and then tighten the locknut. It is important that there should be lost movement at this point.

FITTING THE ISOLATOR SWITCH

(Fig. 29).

1. Disconnect the first and reverse cross-shaft from the gearbox flange. Unscrew the tapered locking bolt and remove the flange from the gearbox. Remove two $\frac{1}{4}$ " \times $\frac{3}{4}$ " A.C. bolts.
2. Fit the isolator switch to the bracket using two $\frac{1}{4}$ " \times $\frac{7}{8}$ " bolts to replace those previously removed. Replace flange and reconnect the cross-shaft.
3. Fit the isolator switch to the bracket and by using special packing washers, adjust the position of the switch until the plunger is depressed .1".
4. A wire should be run from one contact of the switch through a snap connector to the operating switch. The remaining contact should be earthed to the gearbox.

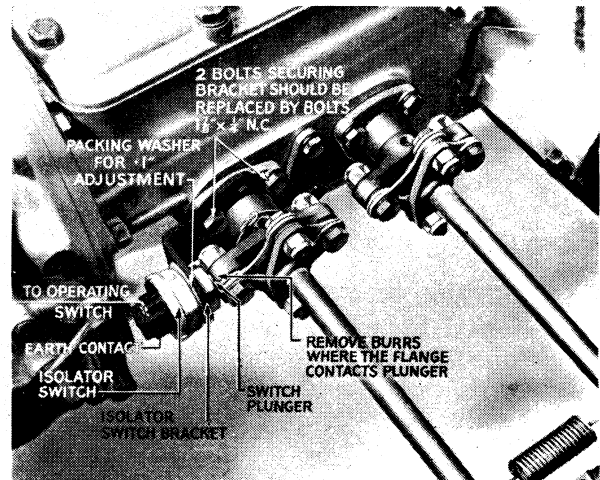


Fig. 29 Isolator Switch fitted to prevent engagement of Overdrive Control in "First" and "Reverse" Gears.

5. With the change speed lever in neutral position, the isolator switch contacts are closed and remain closed in either top or second gear position.

When first or reverse gears are selected the isolator switch contacts are opened, thus making it impossible to overdrive either of these gears.

NOTE

The correct operation of this isolator switch is most important as operation in reverse will seriously damage the unit.

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FITTING THE RELAY

1. Fit the relay to the relay bracket using two self-tapping screws. The bonnet hinges are secured to the body by three bolts to each hinge. The bottom bolt of the hinge nearest to the steering column is used to hold the relay and bracket inside the car (Fig. 30).

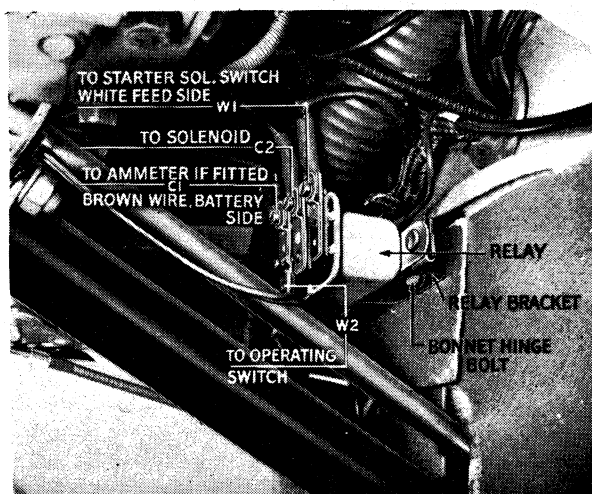


Fig. 30 Showing the positioning and wiring for the Relay.

2. From the hinge bolt remove the nut, fit the relay and bracket with the three connections uppermost. Refit the nut and tighten in this position.
3. The circuit shown in Figs. 5 and 41 shows the connections to be made to the relay.

FITTING THE OPERATION SWITCH

The operating switch is fitted between the gear change top clamp bracket and the underside of the steering wheel with the lever pointing in the opposite direction to the gear shift (see Fig. 31). It may be necessary to move the gear change mechanism lower down the steering column to accommodate the switch. One wire is fed through a snap connector to the isolator switch and the remaining wire should be connected to "W2" on the relay.

CAUTION

It is of the utmost importance that when changing from high speeds in overdrive second, the switch should NOT be moved and that the change should be from overdrive second to overdrive top and then the switch can be moved to normal top if desired. In changing down

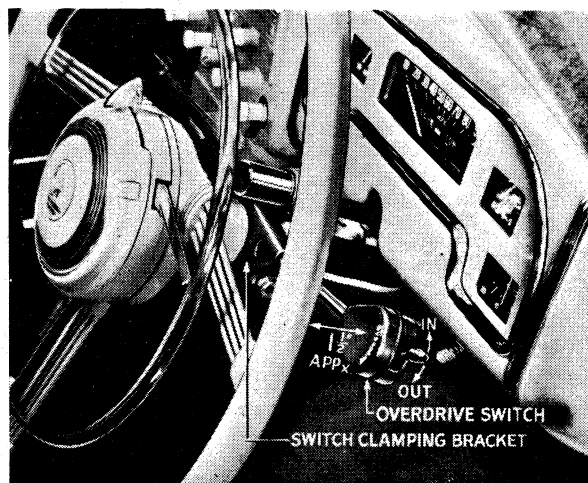


Fig. 31 Showing the assembled position of Control Switch.

from overdrive second to normal second, the road speed MUST NOT exceed 40 m.p.h.

NOTE

When fitting an overdrive to early Vanguard and Triumph cars, it is necessary to carry out slight alterations to the floor, toe-board and in some cases the chassis cross member. Details of these alterations are outlined in Overdrive Fitting Instructions, Part No. 500955, which may be obtained from our Spares Department. The necessary parts to enable Electrical Controlled Overdrive to be fitted are supplied in packs for the convenience of Agents. Two different packs are supplied. The first, under Part No. 501877, is to enable a car not previously fitted with Overdrive to be equipped with an electrically controlled unit and the second, Part No. 501878, to convert a car already fitted with a manually controlled Laycock De Normanville Unit. In the case of a conversion it is merely necessary to fit the "Baby" Accumulator and to discard the existing operating cable and control details on the overdrive unit itself (see The Standard Motor Co's. Publication, Part No. 501927). The existing normal gear changing mechanism will be retained as it is fitted, apart from slight modifications as detailed on instructions enclosed with each conversion kit.

IMPORTANT

Under no circumstances must an attempt be made to incorporate overdrive in second without fitting the "Baby" Accumulator. This is equally important when using a manually operated system.

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TO FIT OVERDRIVE UNIT TO TRIUMPH TR2.

I. DISMANTLING

Remove the detachable floor pressing from around the gearbox. Remove the four bolts connecting the propeller shaft to the gearbox flange. Disconnect the speedometer drive from the gearbox. Remove the bottom nuts of rear mounting and jack up engine sufficiently to allow removal of rear mounting. Remove the starter motor. Remove the clevis pin from the lever on the clutch withdrawal shaft.

Remove the bolts from around the bell housing and detach the gearbox from the engine.

The gearbox should now be dismantled and the various gears and ball races examined for possible damage. Any parts which are damaged or suspect in any way should be replaced.

Remove the mainshaft ball race, if this has not already been done during normal dismantling work. The mainshaft originally fitted will be replaced by the special one supplied.

2. ASSEMBLY OF GEARBOX

Proceed to re-assemble in the following sequence :—

- (a) Fit 1st and reverse idler pinion and shaft with the smaller gear pointing forward and the hole in the shaft in line with the securing bolt.
- (b) Fit the reverse selector fork and shaft with the tapered hole forward. Secure in position by fitting the tapered bolt and locknut.
- (c) With heavy grease, assemble the needle rollers into the 1st countershaft gear (24 each end) and slide in a needle retaining tube to retain the rollers during assembly.
- (d) With heavy grease, position the front thrust washer with the lip of the washer engaged with a recess in the gear case.
- (e) Slide the small, or 2nd speed gear, on to the 1st countershaft gear, following this by the 3rd speed gear with the boss pointing forward. Next slide on

the distance piece and finally the constant speed gear with the boss towards the distance piece.

- (f) Position the completed layshaft gear assembly in the bottom of the gear case and slide into position the rear thrust washer.
- (g) For checking purposes the layshaft should now be fitted. The countershaft gears should have an end float of .006"—.010" in their fitted position.
- (h) After checking, the layshaft should be removed by pushing the needle retaining tube into the countershaft gears and forcing the layshaft out, after which the gears should drop to the bottom of the gear casing.
- (i) Gripping the new mainshaft in the suitably protected jaws of a vice, assemble the gears on this shaft up to the main locating circlip, ensuring that the recess for this is free for its eventual entry by checking with half the circlip previously used (a new one will be required when re-assembling). When a new 2nd or 3rd mainshaft gear is to be fitted, ensure that .004"—.006" end float of the gears is permitted by the length of their bushes, when in their fitted position.

Having ensured that the synchro units are perfectly free on their splines, check the overall float of the constant mesh assemblies by removing the 2nd and 3rd speed constant gears, but leaving their respective bushes in position with the hardened steel washer and the half circlip.

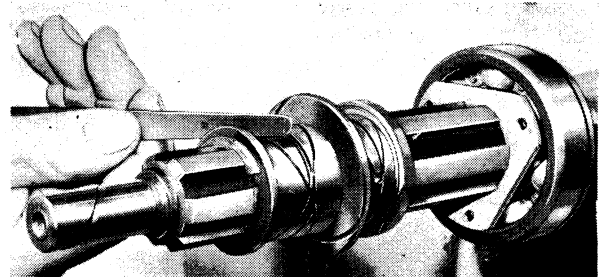


Fig. 32 Checking overall float of mainshaft bushes with feeler gauge.

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The end float can then be checked with a set of feeler gauges as shown in Fig. 32. The correct float should be between .007" and .012".

- (j) Remove the mainshaft details remaining on the shaft and begin the final assembly.
Fit the triangular shaped washer, ball race, distance washer and circlip.
Feed the shaft into the casing and assemble the 1st gear synchro unit, the hardened steel thrust washer which must be located on the splines, the 2nd constant gear with its bush, the 3rd constant gear with bush, the front hardened steel thrust washer and finally fit the main locating circlip with a special sleeved tool.
- (k) Withdraw the gearbox mainshaft, with the gears so far assembled, sufficiently towards the rear to enable the assembly to be tipped upwards, thus permitting the 3rd and top synchro unit to be fitted.
- (l) Tap the mainshaft assembly into position and fit the constant pinion assembly.
- (m) Raise the countershaft gear assembly and fit layshaft and complete the assembly of the unit.

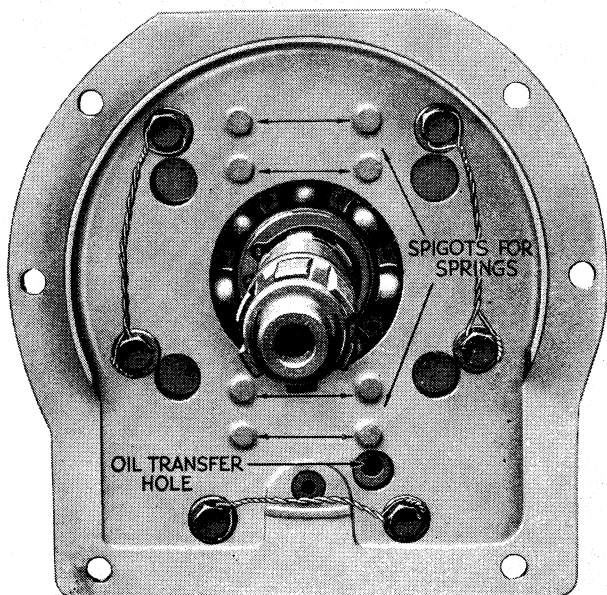


Fig. 33 Showing the oil transfer hole and method of wiring bolts. The Gearbox casing has to be drilled on early models whereas all present production are already drilled.

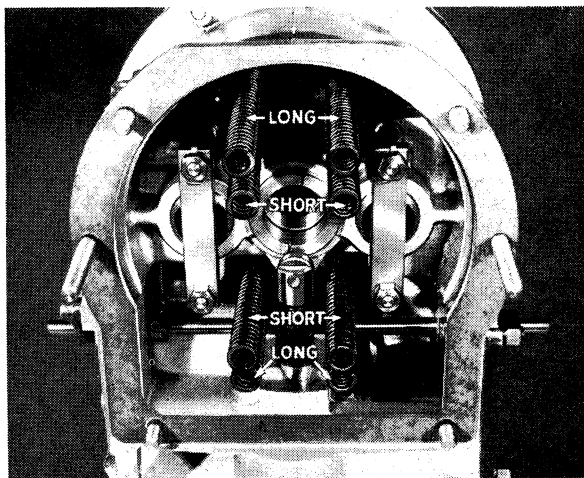


Fig. 34 Showing correct location of four springs.

3. FITTING THE OVERDRIVE UNIT

- (a) Locate the paper washer on the gearbox casing with grease, fit the overdrive adapter plate and wire the six securing bolts, as shown in Fig. 33. The correct positioning of the wiring is important to ensure proper working clearance for the assembled overdrive unit. Ensure that the oil transfer hole is free (see Fig. 33).
- (b) Ensure that the eight springs in the overdrive unit are correctly located, as shown in Fig. 34, that is, the long springs on the outside and the short springs nearer the centre.
- (c) After placing a paper joint on the adapter plate, fit the gearbox assembly

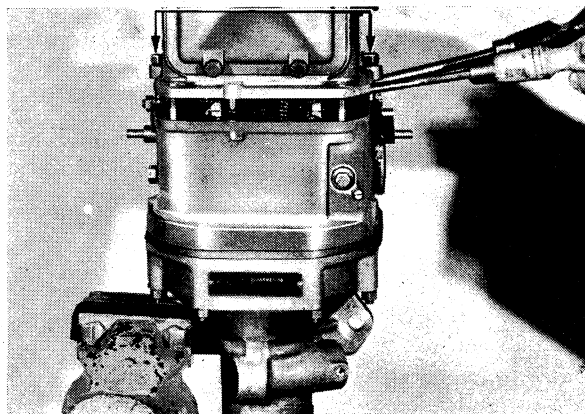


Fig. 35 Fitting Gearbox to Overdrive Unit. This operation is shown being carried out with a Vanguard unit.

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to the overdrive unit, holding the latter vertically in the vice as shown in Fig. 35. After engaging top gear, turn the constant pinion until the splines in the overdrive unit mesh with those of the mainshaft. The eight springs are now located on their spigots and a nut and washer fitted to each long stud.

These two nuts are now evenly tightened until the pump roller is nearing the pump driving cam. The driving cam should have been assembled on the gearbox mainshaft splines so that the least amount of eccentricity is nearest to the pump roller. It is necessary to depress the pump plunger with a screwdriver to allow the pump roller to pass over the cam. The nuts are now finally tightened.

CAUTION. Do not use undue force in tightening the nuts on the long studs. There are two sets of splines in the overdrive unit and unless these are in line, it is impossible to tighten the overdrive unit home on to the adapter plate face.

The overdrive valve setting should now be checked.

4. VALVE CHECKING

On the O/S of the overdrive unit and pinned to the valve operating shaft, is a valve setting lever with a $\frac{3}{16}$ " diameter hole. In the casting adjacent to this lever is another $\frac{3}{16}$ " diameter hole. Actuate the solenoid with a 12 volt battery and while the plunger is drawn into the solenoid, and if the valve adjustment is correct, it should be possible to insert a $\frac{3}{16}$ " diameter pin through the valve setting lever and into the casting (see Fig. 36).

If this is not possible then the valve must be re-adjusted in the following manner.

5. VALVE ADJUSTMENT

Remove the cover plate by unscrewing three cheese headed bolts. Slacken off the clamping bolt on the solenoid lever.

Rotate the valve setting lever until its $\frac{3}{16}$ " diameter hole coincides with the $\frac{3}{16}$ " diameter hole in the casting. Insert a $\frac{3}{16}$ " diameter pin through the hole in the

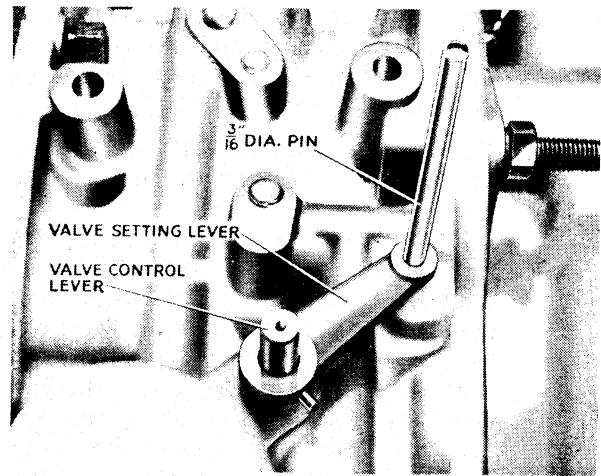


Fig. 36 Method of setting Valve Operating Levers.

setting lever and into the casting thus locking the valve operating shaft.

Actuate the solenoid with a 12 volt battery and while the plunger is drawn into the solenoid, tighten the clamping bolt on the solenoid lever and at the same time ensure that opposite end of the solenoid lever is against the head of the actuating bolt. Repeat the first check and if satisfactory, refit the cover plate (see Fig. 37).

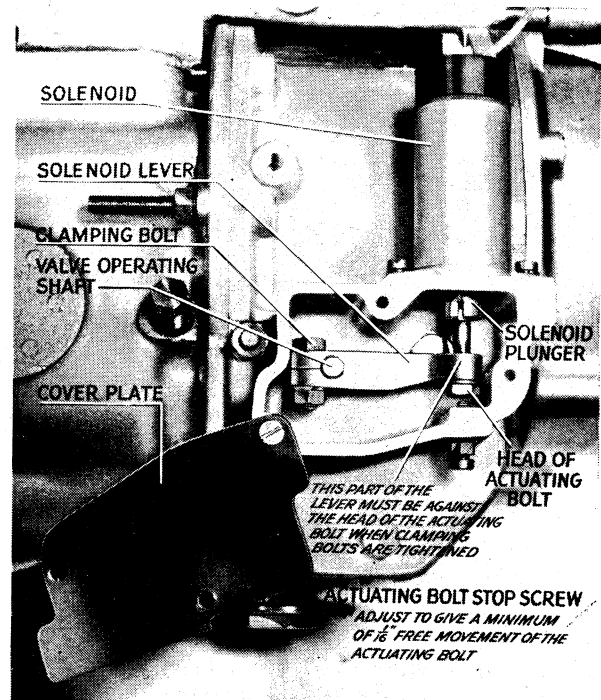


Fig. 37

Setting Solenoid Lever.

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6. FITTING THE ISOLATOR SWITCH

On the lid of the gearbox, and situated near the dipstick, is a plug with a 16 mm. dia. thread. This plug should be removed and replaced by an isolator switch type SS10/1, which is supplied (see Fig. 38).



Fig. 38 Showing the position of the Isolator Switch on the Gearbox Cover.

7. THE OPERATING SWITCH

L.H. Drive Cars. Two holes are pierced in the facia panel on the L.H. side of the speedometer and covered with fabric. The fabric should be pierced through the extreme L.H. hole and the operating switch fitted. The remaining hole is used for a heater switch when fitted.

R.H. Drive Cars. Two holes are pierced in the facia panel on the R.H. side of the speedometer and covered with fabric. The fabric should be pierced through the extreme R.H. hole and the operating switch fitted (see Fig. 39). The remaining hole is used for a heater switch when fitted.

The Relay. Reference to Fig. 40 shows the fitted position of the relay.

Wiring. The feed wire to the terminal marked "W1" on the relay is taken from

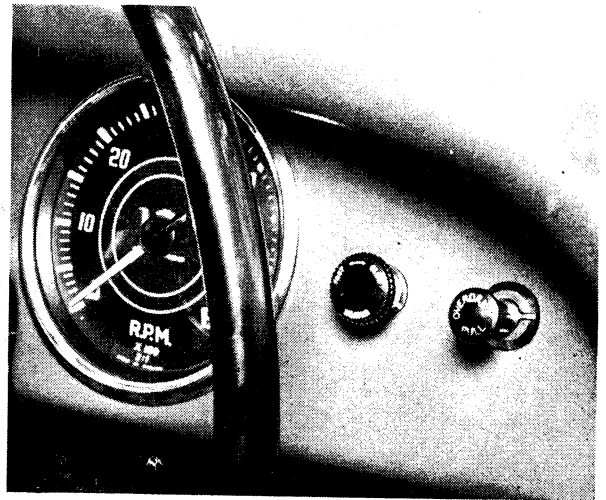


Fig. 39 Showing the position of the Overdrive Control.

the "live" side of the starter switch on the facia panel (see Fig. 41).

NOTE—The terminal on the starter switch is "live" only when the ignition is switched "ON."

A wire is connected from "W2" on the relay to a terminal of the operating switch on the facia panel. The remaining terminal

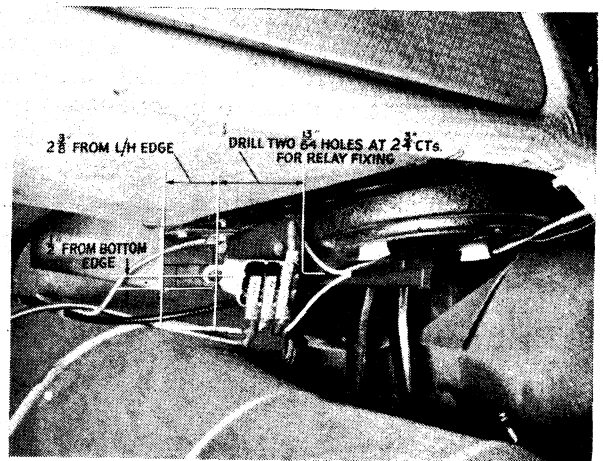


Fig. 40 Instructions for fitting the Relay Switch.

of the operating switch is connected through a snap connector to a terminal on the isolating switch situated on the gearbox lid. The remaining terminal of the isolating switch is earthed to one of the bolts securing

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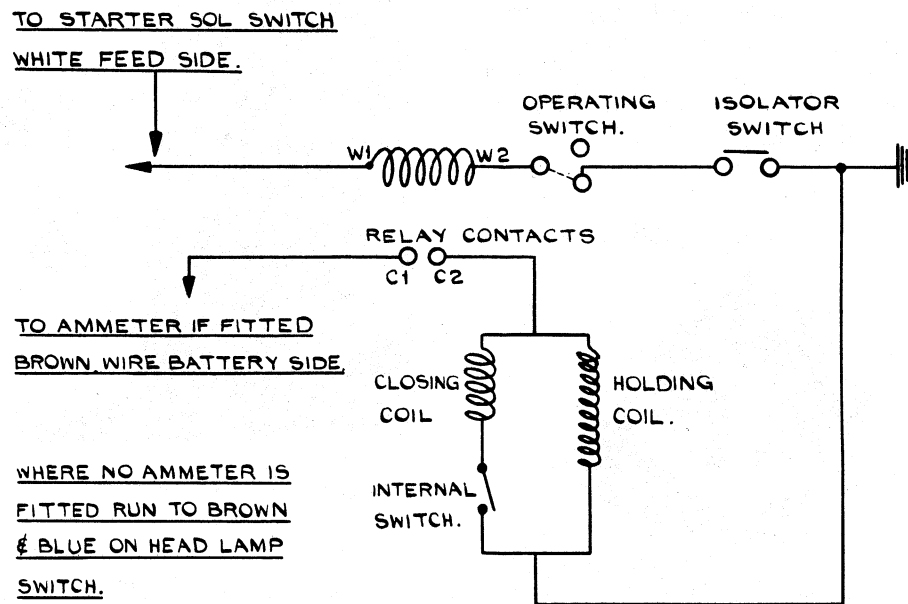


Fig. 41

Overdrive Control Circuit.

the gearbox lid. A second feed wire is connected from the negative side of the ammeter to "C1" on the relay.

To complete the wiring, a wire is connected from "C2" on the relay through a snap connector to the solenoid.

Built into the solenoid are two coils, a closing coil and a holding coil. These two coils are connected in parallel with an internal switch connected in series with the closing coil.

When the solenoid is energised, both coils are in circuit until the plunger reaches a pin which operates the internal switch. This

switch switches out the closing coil and allows the holding coil to remain in circuit. The closing current of 15 amperes is of a very short duration. The holding current should be less than one ampere. Fig. 41 shows the theoretical wiring diagram.

GENERAL. With a four-speed gearbox, no useful purpose can be gained by overdriving any gear other than top since the differential ratio of 2nd to 3rd and 3rd to top is almost the same as that of the overdrive. No provision is made for overdriving any gear other than top gear, nor is it recommended.

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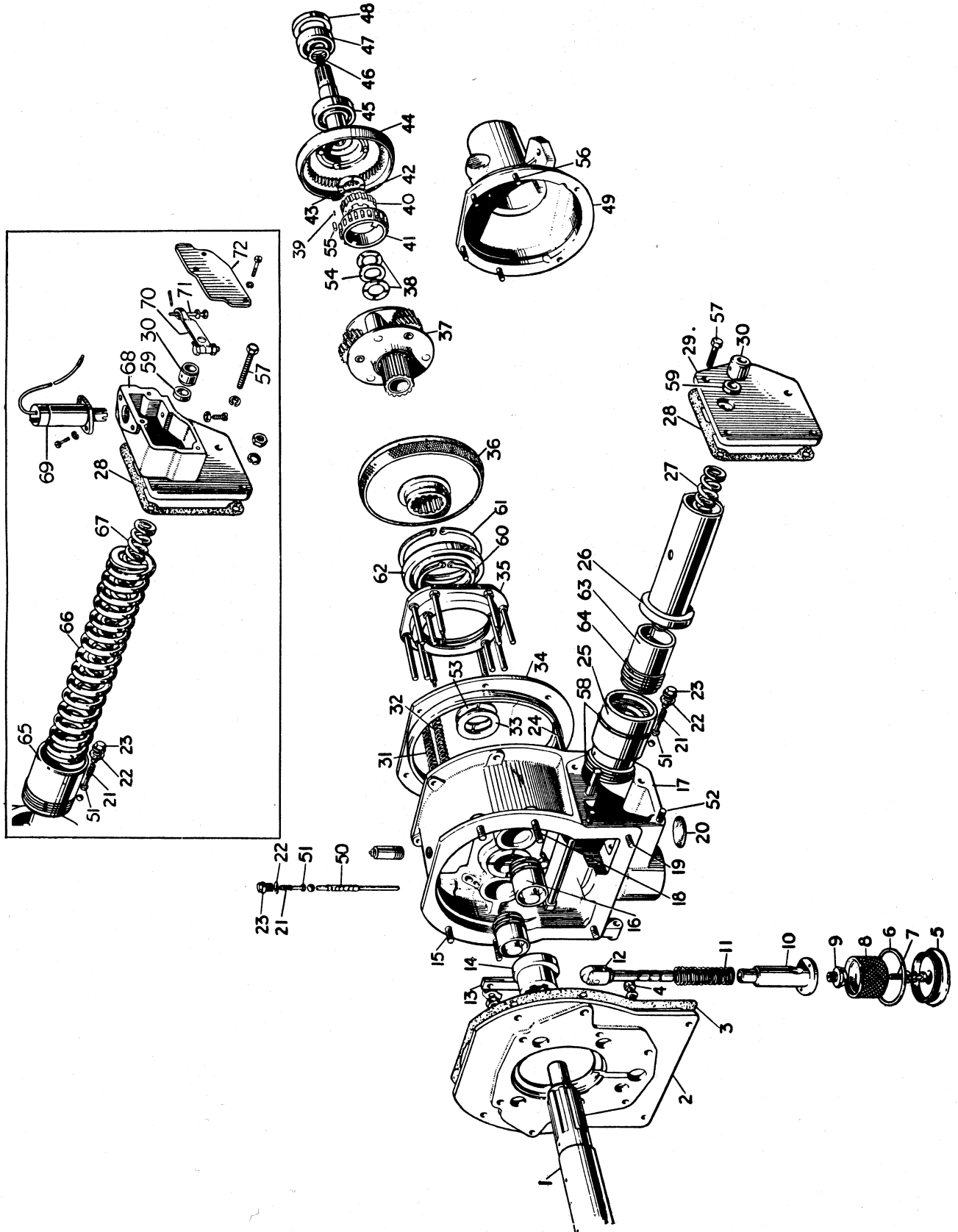


Fig. 42 The Overdrive in exploded form. Inset shows Accumulator Piston, Spring and Solenoid arrangement for the Triumph TR2.

NOTATION FOR FIG. 42

Ref. No.	Description	Ref. No.	Description
1.	Mainshaft.	37.	Planet Carrier, complete with Planet Wheels, Bearing, Shafts, etc.
2.	Adapter Plate.	38.	Thrust Washers.
3.	Paper Joint.	39.	Pin, Uni-directional Clutch to Cage.
4.	Bolt.	40.	Inner Member, Uni-directional Clutch.
5.	Drain Plug.	41.	Cage for Uni-directional Clutch.
6.	Fibre Washer.	42.	Spring for Uni-directional Clutch Cage.
7.	Bolt for Filter.	43.	Thrust Washer.
8.	Filter.	44.	Annulus Sub-assembly.
9.	Plug for Pump Body.	45.	Ball Bearing.
10.	Oil Pump Body.	46.	Spacing Washer.
11.	Pump Spring.	47.	Ball Bearing.
12.	Oil Pump Plunger Assembly.	48.	Oil Seal.
13.	Bridge Piece.	49.	Rear Casing Sub-assembly.
14.	Oil Pump Operating Cam.	50.	Operating Valve.
15.	Stud.	51.	Plunger for Ball.
16.	Operating Piston.	52.	Stud.
17.	Main Casting.	53.	Thrust Washer.
18.	Stud.	54.	Spacing Washer.
19.	Stud.	55.	Steel Roller.
20.	Welch Washer.	56.	Stud.
21.	Valve Spring.	57.	Setscrew.
22.	Copper Washer.	58.	Rubber "O" Ring.
23.	Valve Plug.	59.	Oil Seal.
24.	Stud.	60.	Seeger Circlip.
25.	Accumulator Piston Housing.	61.	Seeger Circlip.
26.	Accumulator Spring Tube.	62.	Ball Bearing.
27.	Accumulator Spring.	63.	Accumulator Piston.
28.	Joint Washer.	64.	Piston Ring.
29.	Side Cover.	65.	Accumulator Piston.
30.	Collar for Shaft.	66.	Accumulator Spring (Large).
31.	Clutch Springs (Long).	67.	Accumulator Spring (Small).
32.	Clutch Springs (Short).	68.	Solenoid Bracket and Side Cover Assembly.
33.	Spacing Washer.	69.	Operating Solenoid.
34.	Brake Ring.	70.	Solenoid Lever.
35.	Clutch Thrust Ring Assembly.	71.	Plunger Screw.
36.	Clutch Sliding Member.	72.	Cover Plate.

SPECIALISED TOOLS

The following tools are recommended for the dismantling and assembly of the Laycock de Normanville Overdrive Unit.

They are manufactured by Messrs. V. L. Churchill Ltd., 27-34, Walnut Tree Walk, London, S.E.11, to whom all enquiries should be addressed.

L.176. Drive Shaft Oil Seal Remover.
L.177. Drive Shaft Oil Seal Replacer.

L.181. Accumulator "O" Ring Fitting Tool.
L.182. Accumulator Piston Housing Remover.
L.183. Pump Barrel Remover.
L.184. Pump Barrel Replacer.
L.185. Dummy Drive Shaft.
L.186. Mainshaft Bearing Replacer.
L.188. Hydraulic Pressure Gauge.
L.189. Freewheel Assembly Ring.
L.178. Freewheel Transfer Ring.