OVERDRIVE

The Laycock-de Normanville Overdrive unit gives an increase in propeller shaft speed of 24·67%, that is, it has a ratio of 0·802 : 1.

WORKING PRINCIPLES

At the top of Fig. 7, the unit is shown diagrammatically in direct drive. The cone clutch, which is fixed to an extension of the sunwheel, is held to the rear by spring pressure so that the inner friction band contacts the outside of the annulus. This locks the gear train, and the drive is transmitted directly through the uni-directional clutch. Any over-run or reverse torque is taken by the cone clutch.

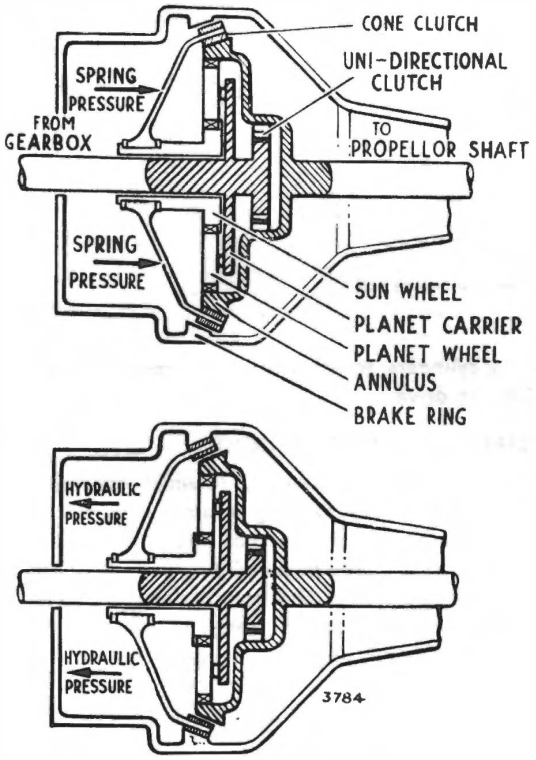

Fig. 7. *Diagrammatic sections*

The lower illustration in Fig. 7 shows the unit in overdrive. The cone clutch is held forward by hydraulic pressure so that the outer friction band of the clutch is locked to the stationary brake ring. As the cone clutch is splined to the sunwheel, the sunwheel is also held stationary. The planet carrier is splined to the input shaft, and is driven by it. The planet wheels are thus driven round the stationary sunwheel, and in so doing rotate the annulus and tail shaft at a speed greater than that of the input shaft.

THE HYDRAULIC SYSTEM (See Fig. 7)

A cam, keyed to the gearbox mainshaft, operates the plunger of a pump, which forces oil via its discharge valve, into the relief valve. The line pressure is kept constant by introducing a relief valve into the system.

From the pump, oil under pressure is passed to the operating cylinders via the operating valve

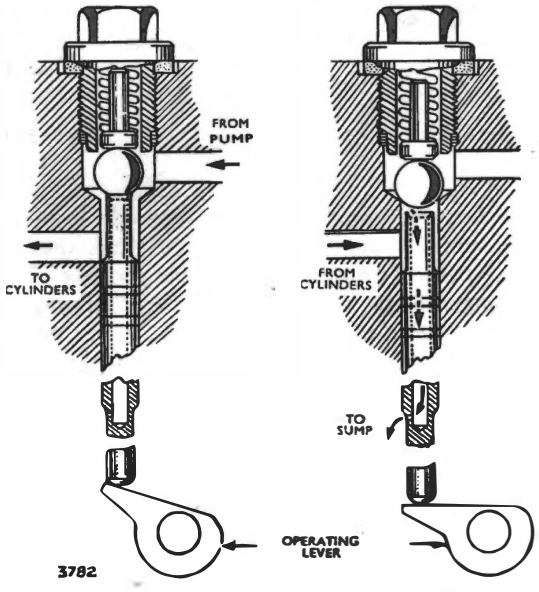

Fig. 8. *Operating valve*

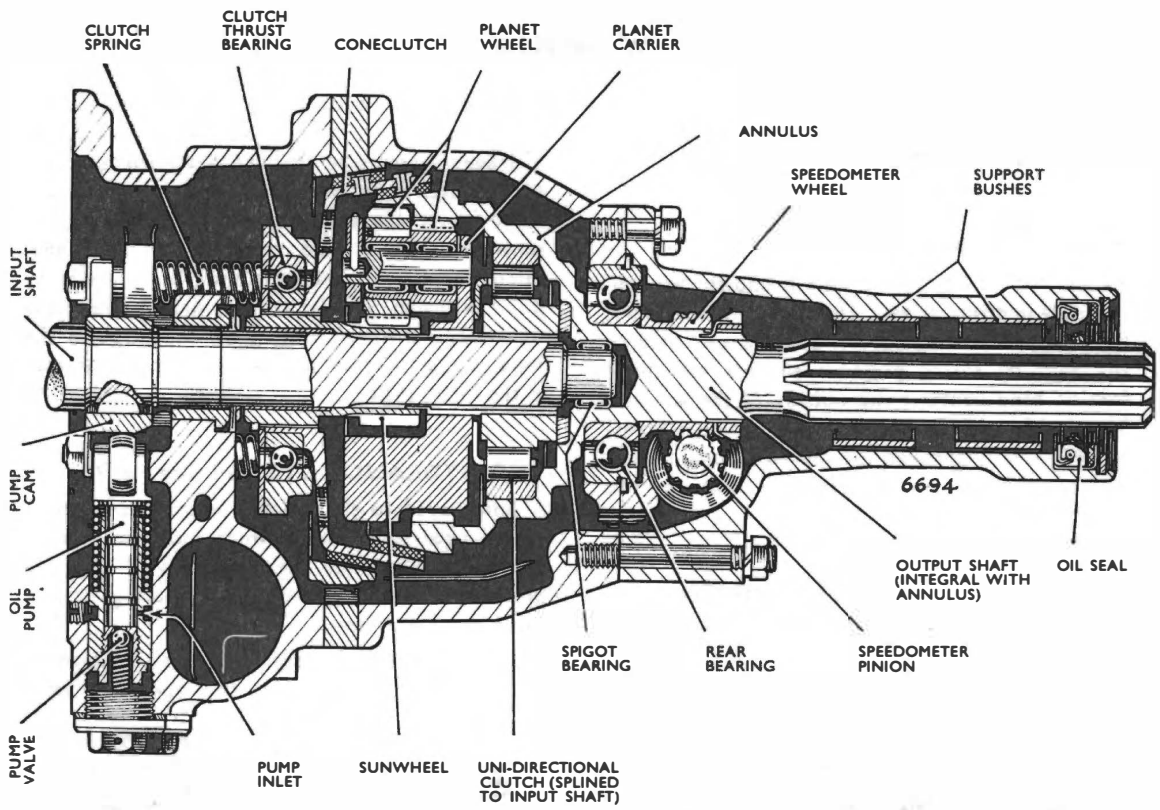

Fig. 9. *Sectional view of overdrive unit*

shown diagrammatically in Fig. 8. When the overdrive control is operated the valve is lifted, thus holding the ball off its seat against the pressure of the plunger spring. Oil then passes to the operating cylinders forcing the pistons forward. When the overdrive control is moved to the disengaged position, the spring plunger pushes the ball on to its seat, and the valve falls away from the ball. Oil from the cylinders then returns through the centre of the valve to the sump. Near the bottom of the valve is a small jet which slows down the emptying of the cylinders, to provide smooth re-engagement of direct drive.

CONTROL OF OVERDRIVE

The overdrive is actuated by a solenoid, controlled by a switch on the steering column. An isolator switch mounted in the gearbox top cover ensures that overdrive can be obtained only in third or top gear. Both these switches are connected in series with the operating coil of a relay, and the solenoid is energised through the relay contacts.

Self Cancelling Switch. (Fig. 13A)
When the overdrive switch is moved to the direct drive position, battery feed is applied to terminal W1, de-energising the relay coil. The contacts will open and the circuit to terminal C1 and the overdrive solenoid broken. Overdrive will disengage and the warning light will go out. The overdrive switch will return to the central position.
When the gear lever is moved out of the 3rd/4th gear position the gearbox switch will open and the circuit from the fuse unit broken. If overdrive had been engaged the relay coil will become de-energised, the contacts will open and overdrive will be disengaged. The warning light will go out. As the overdrive switch will have returned to the central position, it will be necessary to re-select overdrive, if required, after a gearchange is made from 2nd to 3rd gear. This ensures that overdrive is not engaged on changing from 2nd to 3rd gear.
A resistance in the lighting switch dims the warning light when the side lights are switched on. (Alpine III only).

LUBRICATION AND MAINTENANCE

The oil in the overdrive unit is common with that in the synchromesh gearbox and the level should be checked at the gearbox. To drain the gearbox and overdrive units, the gearbox and overdrive drain plugs must be removed.
Note:—*The overdrive drain plug is the one nearest the left side of the unit. The pump valve plug in the centre, and the relief valve plug on the right are wired together, and are not removed unless attention to valves is required.*
It is essential that the approved lubricant is used when refilling. Trouble may be experienced if some types of extreme pressure lubricants are used because the planets act as a centrifuge to separate the additives from the oil.
The combined capacity of synchromesh gearbox and overdrive units is 4 pints (4·4 American pints, 2·3 litres). If the units have been drained and refilled the oil level should be rechecked after the car has been run, since a certain amount of oil will be retained in the hydraulic system.
It must 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 case is opened. This applies to adding oil to the transmission and to servicing the unit. Any dirt or even lint from a wiping cloth that finds its way into a valve may cause serious difficulty. When the unit is dismantled for any service work the parts must be thoroughly cleaned and kept covered with an oily lintless cloth until reassembled. Similar care should be taken when handling the hydraulic valves, etc., since scratches or nicks might cause leakage on reassembly.

DIAGNOSIS OF FAULTS

When positioning the vehicle for the removal of the Overdrive, care must be taken that the vehicle is *NOT* brought to a halt by stalling in gear.
When transmitting torque in forward direct drive, the rollers of the unit directional clutch are forced towards the crest of the facets of the inner member, and if the vehicle is brought to a halt by stalling in gear, the rollers can lock in the drive position, thereby preventing the removal of the Overdrive unit.
If the overdrive unit does not operate properly, it is advisable first to check the level of oil and, if low, to top up with fresh oil and test the unit again before making any further investigations.
BEFORE COMMENCING ANY DISMANTLING OPERATIONS IT IS IMPERATIVE THAT THE OVERDRIVE SWITCH IS OPERATED TEN TO TWELVE TIMES WITH THE ENGINE STOPPED, IGNITION SWITCHED ON AND TOP GEAR ENGAGED TO RELEASE ANY HYDRAULIC PRESSURE FROM THE SYSTEM.
Faulty units should be checked for defects in the order listed below:

Overdrive does not engage

1. Insufficient oil in the gearbox.
2. Solenoid not operating due to fault in electrical system.
3. Control mechanism out of adjustment.
4. Insufficient hydraulic pressure due to leaks or faulty relief valve—Test pressure.
5. Leaking operating valve due to foreign matter on ball seat or broken valve spring.
6. Leaking pump non-return valve due to foreign matter on ball seat or broken valve spring.
7. Pump not working due to choked filter.
8. Damaged gears, bearings or shifting parts within the unit requiring removal and inspection of the assembly.

Overdrive does not release

IMPORTANT—This calls for immediate attention. Do not reverse car, as selection of reverse in overdrive can cause extensive damage.

1. Control mechanism out of adjustment or fault in electrical circuit.
2. Blocked restrictor jet in valve.
3. Sticking clutch.
4. Damaged parts within the unit necessitating removal and inspection of the assembly.

Clutch slip in overdrive

1. Insufficient oil in gearbox
2. Control mechanism out of adjustment.
3. Insufficient hydraulic pressure due to leaks, or foreign matter in valves.
4. Worn or carbonised clutch lining.

Clutch slip in reverse or freewheel condition on overrun

1. Control mechanism out of adjustment.
2. Blocked restrictor jet in valve.
3. Worn or carbonised clutch linings.
4. Insufficient pressure on clutch due to broken clutch springs.

Hydraulic knock

This knock occurs once per mainshaft revolution in direct drive and can be eliminated by relieving the hydraulic pressure in the direct drive position by scoring the operating valve ball seat in the casing as follows :—

Remove the operating valve as described on page 19.

Grind a screwdriver blade as shown in Fig. 10 and holding it centrally, give a *light* tap, indenting two grooves in the seating. Alternatively score the seating with a sharp pointed scriber (one score should be sufficient if deep enough).

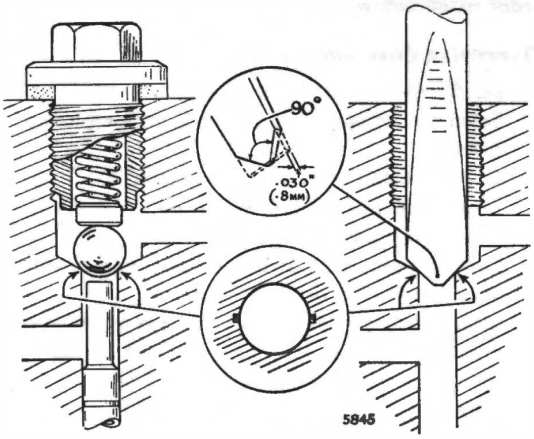

Fig. 10. *Scoring operating valve ball seat*

Remove Pump Valve, springs plug and replace with spring and plug Part No. 5039588.

It is essential that no foreign matter is allowed to enter the unit and that undue force is not used when striking the tool causing the operating valve bore to be belled out at the edge of the indents. If this occurs ream by hand the valve bore with a $\frac{1}{4}$" reamer, suitably greased, to clear the obstruction.

Re-assemble the removed components and test.

This does not apply after Laycock Nos. 3082, 3083.

ADJUSTMENT OF CONTROLS

The operation of the controls can be checked by means of the hole in the solenoid lever on the right-hand side of the unit, accessible from under the car after removal of the cover plate. The

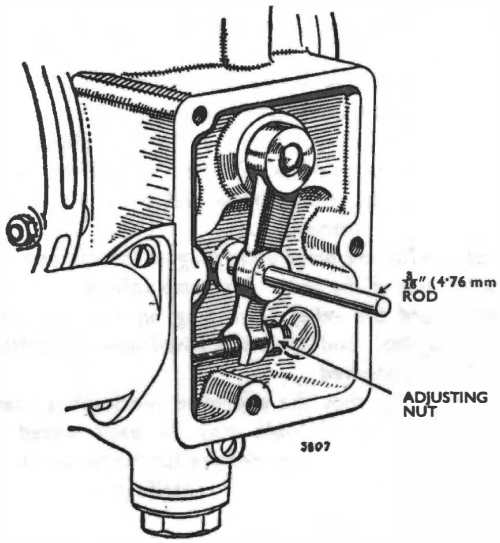

Fig. 11. *Checking setting lever position*

controls are operating correctly when a $\frac{3}{16}$" diameter rod can be passed through the hole in the solenoid lever into the hole in the overdrive casing (see Fig. 11) with ignition switched on, top gear engaged and the steering column switch in the overdrive position.

If the solenoid operates, but does not move the setting lever far enough to allow the rod to be

inserted, the solenoid plunger must be adjusted. Adjustment is effected by screwing the self-locking nut on the plunger in or out, with the plunger pushed into the solenoid as far as it will go. The solenoid spindle must be held against rotation by using a suitable spanner. All units have two milled flats on the spindle for spanner access. The fork on the solenoid lever should just contact the nut with the $\frac{3}{16}$" (4·76 mm.) rod in position.

Ensure that with the control in the overdrive position the setting rod can be inserted, and that the solenoid current does not exceed 2 amperes. If the current is maintained in the order of 15 to 17 amperes, it is an indication that the solenoid plunger is not moving far enough to switch from the operating to the holding coil, and the plunger must be readjusted. This is important, as high amperage will cause solenoid failure.

If the solenoid does not operate, the electrical circuits should be checked. Circuit diagrams are shown in Figs. 13, 13A and 14.

Overdrive Isolator Switch Adjustment

The isolator switch is mounted in the gearbox top cover. It is operated, that is to say closed, by an abutment on the selector lever safety latch when the latter moves into the third and top gear plane.

Correct adjustment is most important because:—

1. The switch must ensure engagement of overdrive when this is selected in third and top gears and must maintain the electrical circuit to keep overdrive "in".
2. The switch must ensure that Overdrive does NOT engage in first, second or reverse gears.

To Check Adjustment:—

1. Switch on the ignition but do not start the engine.
2. Move the overdrive facia switch to OVERDRIVE.
3. Engage third or top gear; the safety latch will move over to the left pressing on the switch plunger. The switch is then closed.
4. As the switch CLOSES a distinct "click" from the overdrive relay will be heard and the warning light will illuminate on later Alpine and Rapier cars.
5. Move the gear lever back into NEUTRAL and through the neutral "gate" towards first and second.
6. The isolator switch should OPEN as the lever is moved through the NEUTRAL "gate" denoted by a further audible "click" from the relay and the warning light going out on later Alpine and Rapier cars.
7. The isolator switch MUST be fully OPEN in the first and second speed range and will automatically be OPEN in the reverse range.
8. Engage first or second gear, operate the steering column switch and ensure that the overdrive relay and solenoid do not operate—denoting isolation of overdrive in first and second gears.
9. Road test to confirm correct adjustment—Overdrive will engage and remain engaged in third and top with steering column switch at Overdrive, and WILL NOT engage in first and second.

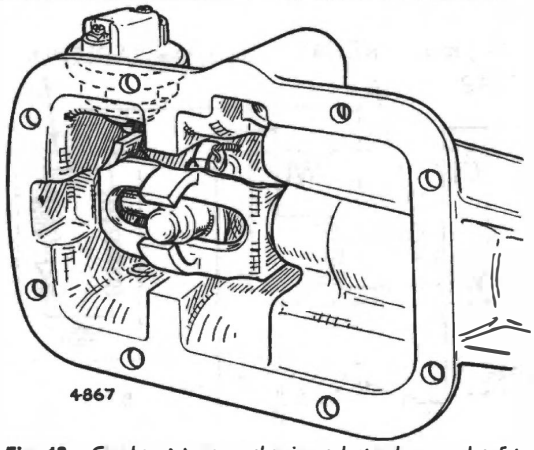

Fig. 12. *Gearbox top cover showing selector lever and safety latch with isolator switch abutment*

To Adjust:—

1. Remove rubber cover from switch and disconnect leads.
2. Unscrew switch from gearbox top cover and remove shims.
3. Screw switch up and down in top cover to obtain the setting previously described.
4. Measure with feelers the gap between the switch head and the top cover face.
5. Insert shims to the required thickness and tighten switch in top cover.
   The required shims are obtainable under the part number P.112524.
6. Check setting as described under "Isolator Switch—To check adjustment".

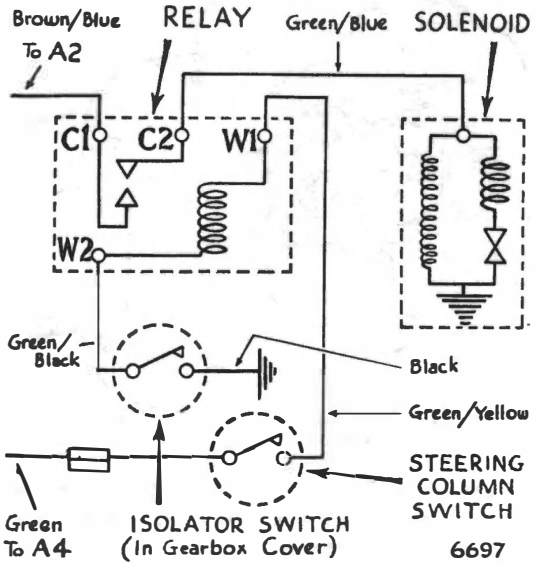

Fig. 13. *Circuit diagram Alpine I and II*

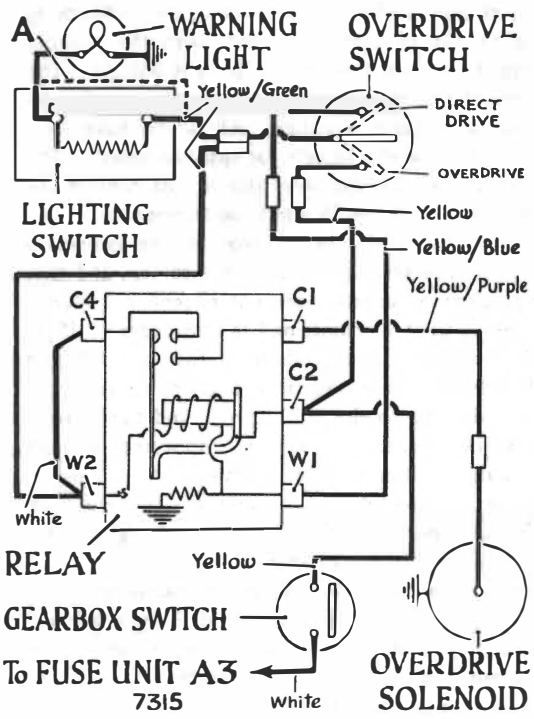

Fig. 13A. *Circuit diagram Self Cancelling Switch. (A Rapier and Alpine IV).*

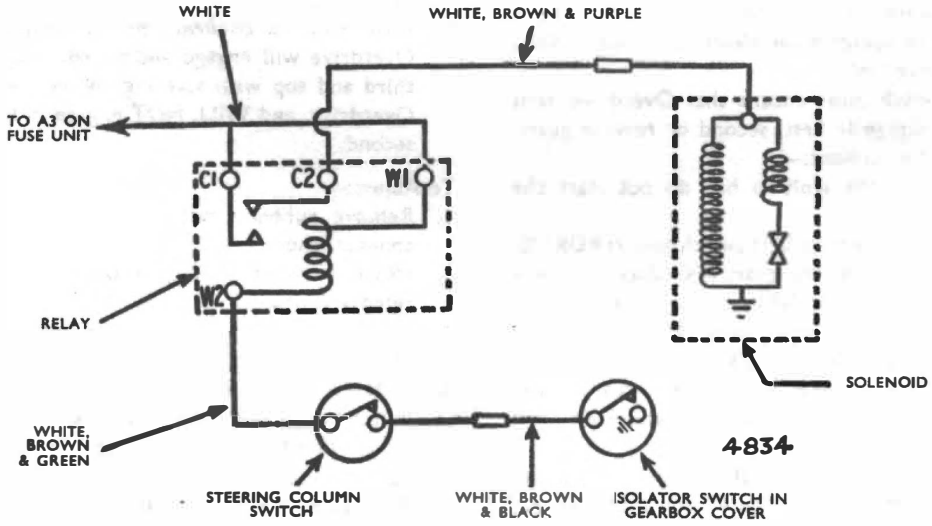

Fig. 14. *Circuit diagram (early Rapier)*

TESTING OIL PRESSURE

Release the hydraulic pressure as previously described.

Remove the operating valve plug and fit in its place the special adaptor (VLC. L.188). Use an oil pressure gauge reading to 800 lbs. per sq. in. (56·24 kgs. per sq. cm.) using a pipe union to fit the $\frac{1}{8}$" B.S.P. internal thread in the adaptor.

Jack up the rear wheels of the car, start the engine and engage top gear and overdrive with the engine ticking over slowly.

A pressure of 480—500 lbs. per sq. in. (approx.) (33·75—35·15 kgs. per sq. cm.) should be recorded.

THE OPERATING VALVE (See Fig. 8)

To gain access to the operating valve, remove the cover plate from the floor centre, on the driver's side. With the ignition on, top gear engaged and engine stopped, move the overdrive switch into and out of the overdrive position ten or twelve times to release hydraulic pressure.

Remove valve plug, take out plunger and spring and remove ball with a magnet.

The valve can be removed with a tapered piece of wood, but care must be exercised to avoid damage to the seating at the top 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.

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 check the relief valve and pump valve.

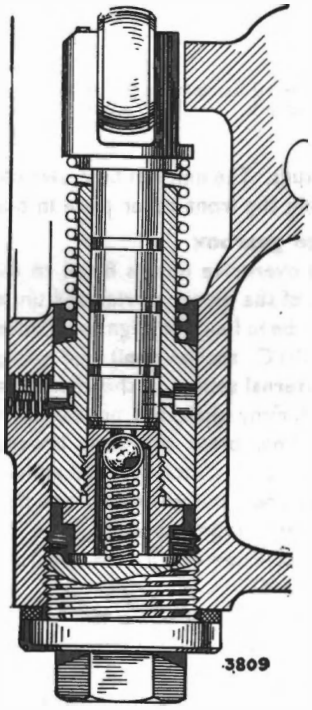

Fig. 15. *Oil pump and valve*

THE RELIEF VALVE

Access to the relief valve is gained through a plug in the bottom of the main casing (33 Fig. 19).

To dismantle

Release the hydraulic pressure as previously described. Remove the drain plug and drain off oil.

Remove the valve plug, this will release the valve spring and plunger (and ball on early units).

Remove the valve body.

Inspect the "O" ring, spring and plunger etc. for damage. The plunger (ball on early units) should be a sliding fit in the valve body.

THE PUMP VALVE (See Fig. 15)

Access to the pump valve is gained through the centre plug in the bottom of the main casing.

To dismantle

Proceed as follows:—

1. Release the hydraulic pressure as previously described. Remove the drain plug and drain off oil.

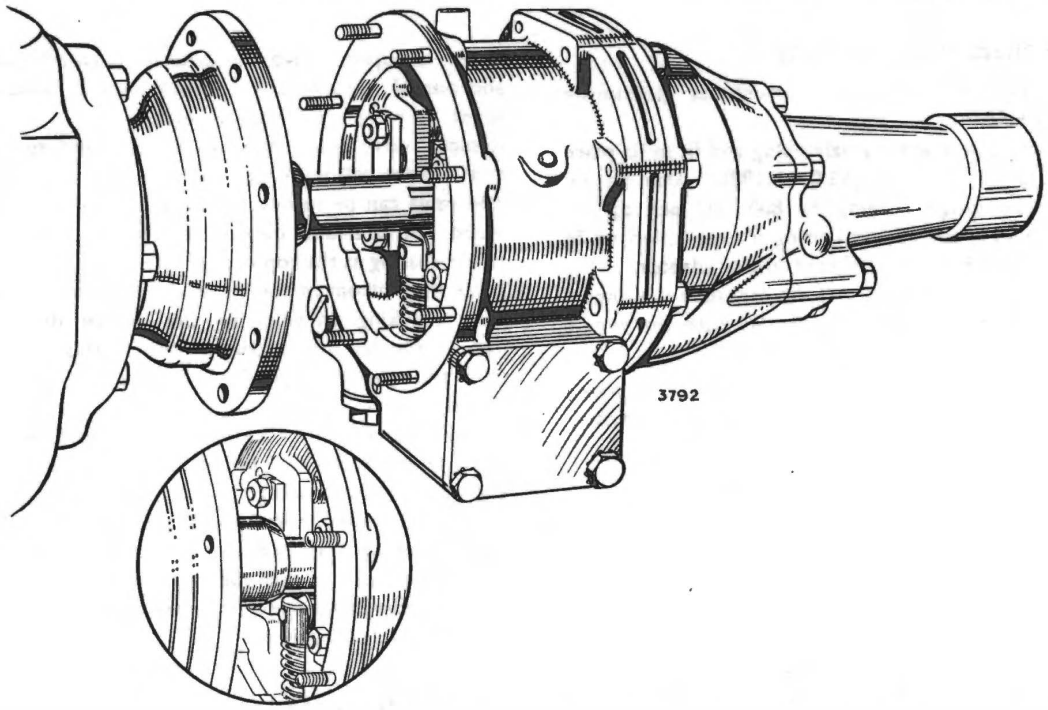

Fig. 16. *Overdrive ready for fitting to gearbox (Later units are fitted with an external balance pipe and a plug replaces the breather)*

2. Unscrew the valve cap and take out the spring and ball.

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.

GEARBOX AND OVERDRIVE UNITS

To remove

Alpine I, II

Remove engine-gearbox-overdrive unit as described in Section B—"Engine—To remove and refit".

Alpine III onwards. See "Gearbox—To remove and refit".

Rapier

See "Gearbox—To remove and refit".

OVERDRIVE UNIT

To remove from gearbox

The unit is split at the front cover plate (adaptor plate) which is attached to the front housing by eight $\frac{5}{16}$" studs. The unit can be drawn off the main shaft, leaving the front cover plate in position.

To refit to gearbox

Before the overdrive unit is fitted to the gearbox the splines of the planet carrier and uni-directional clutch must be in line. To align them, insert dummy mainshaft (VLC. special tool) and engage it first with the internal splines of the planet carrier.

Turn the dummy shaft and planet carrier and, at the same time, press the shaft inwards until it engages the roller clutch internal splines.

Turn the gearbox mainshaft to locate the cam with its highest point facing upwards. The lowest point will then coincide with the overdrive pump plunger (Fig. 16).

The two splines and the pump cam will now be lined up correctly, and it is most important that neither the gearbox mainshaft nor the overdrive coupling driver is turned until the unit is fitted to the gearbox. The edge of the cam facing the overdrive unit is

chamfered to enable the pump plunger to "ride" on to the cam as the overdrive and gearbox flanges come together.

SPECIAL TOOLS

A complete range of special tools are available for overhauling the Overdrive Unit.
They are obtainable from:—

Messrs. V. L. Churchill & Co. Ltd.,
Great South West Road,
Bedfont, Feltham,
Middlesex, England.

TO DISMANTLE

Assuming that the overdrive front cover has been retained on the gearbox as described, dismantle the overdrive unit in the following order, with the front end uppermost:—

Remove the operating valve, as described under the heading "The Operating Valve". This will allow air to enter the cylinders of the operating pistons and will thus facilitate removal of these pistons.

To remove the oil pump (rarely necessary) unscrew the valve seat in the valve orifice using VLC. Key L.213. Remove the body retaining screw. Screw VLC. Tool L.205 into the pump body and withdraw the body.

Remove 3 setscrews securing operating lever cover

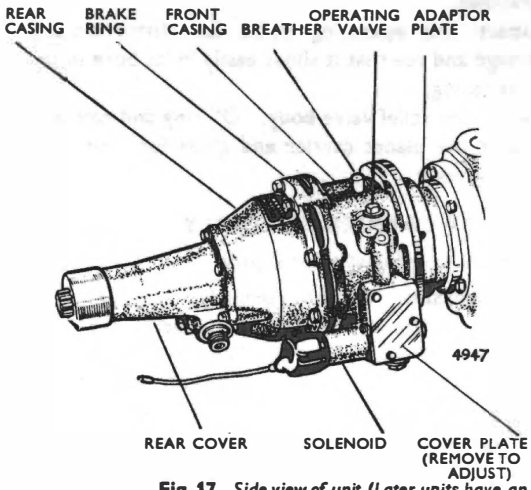

Fig. 17. *Side view of unit (Later units have an external balance pipe and a plug replaces the breather)*

assembly to the o/s of the unit (adjacent to solenoid). Remove cover.

Remove 2 screws securing solenoid to casing. Ease plunger out of operating lever yoke and remove solenoid.

Release the lockwashers securing the four ¼" nuts retaining the operating piston bridge pieces. Remove the nuts, lockwashers and bridge pieces and withdraw the operating pistons by gripping their spigots with pliers.

Disconnect the balance pipe, if fitted.

Loosen and progressively remove the eight ¼" nuts around the centre flange of the casing. This will gradually release the four clutch springs. Remove front half of casing complete with brake ring. Take the four clutch springs off their pegs on the thrust plate.

The brake ring is spigoted into each half and will normally come away with the front half of the casing. A few light taps with a mallet around its flange will remove the ring from the rear casing.

Lift out the clutch sliding member complete with the thrust bearing and sunwheel. If the cone clutch sticks in the brake ring, a light tap with a mallet on the rear end of the casing will free it.

Remove the sunwheel from the sliding cone clutch member by withdrawing the sunwheel circlip from its groove in the forward end of the sunwheel hub. Remove the thrust bearing and the thrust plate by removing the large circlip and pressing out the cone clutch hub from the thrust plate and bearing. Remove bearing from thrust plate assembly using VLC. Special Tool.

Remove planet carrier assembly. If necessary to remove roller clutch, first remove circlip and brass locating ring which is in an annular recess in front of the clutch.

Place fitting ring (VLC. Special Tool L.178) centrally over the front of the annulus and lift the inner member of the uni-directional clutch into it. This will ensure that the rollers do not fall out of the inner member. Remove the fitting ring and place the parts in a suitable container. Remove the spring ring, located between the hub and the cage.

Remove the bronze thrust washer fitted between the clutch inner member and the front face of the annulus.

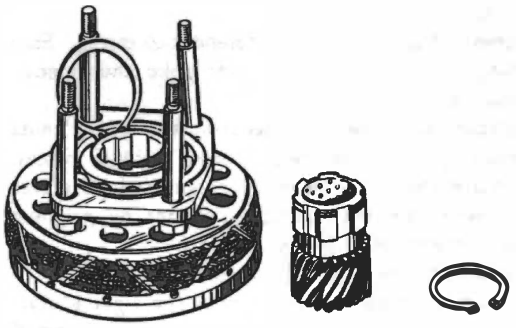

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Fig. 18. *Cone clutch and sunwheel details*

A caged needle roller bearing is fitted in the annulus centre spigot. If it is necessary to remove this, use VLC. Special Tool.

Remove the speedometer drive pinion and bush, located by one dowel screw.

Remove the rear oil seal (if necessary) by screwing the taper thread of the outer member of the VLC. special tool into it and tightening the centre bolt against the rear of the tail shaft.

To remove annulus, first remove tail shaft casing, then remove circlip around rear ball bearing and drive out annulus and rear bearing forwards.

To remove rear bearing disengage lockwasher and remove ring nut securing speedometer driving gear and rear bearing with the special spanner supplied by VLC. Remove gear. Using the VLC. special tool, draw off the ball bearing.

Inspection

When the unit has been dismantled, each part should be thoroughly cleaned and inspected to determine whether any parts should be replaced.

As a guide the planned new dimensions are given at the end of this section. Inspect the front casing for cracks, damage, etc. Examine the bores of the operating cylinders for scores and wear. Check for leaks from the plugged ends of the oil passages.

Examine the clutch sliding member assembly. Ensure that the clutch linings are not burned or worn. Inspect the bolts locating the clutch springs and bridge pieces and see that they are not distorted. Ensure that the ball bearing is in good condition and rotates freely.

Inspect the clutch springs for distortion or collapse.

Inspect the teeth of the gear train for damage. If the sunwheel 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 to the pitch line of the teeth.

Inspect the face of the sunwheel front thrust ring in the front casing. This should be renewed only if deeply scored, and it is only subjected to sunwheel rotation whilst overdrive is in course of selection.

Inspect the uni-directional clutch. See that the rollers are not chipped and that the inner and outer members of the clutch are free from damage. Make sure that the outer member is tight in the annulus. Ensure that the spring is free from distortion.

Inspect the ball race on the output shaft and see that there is no roughness when it is rotated slowly.

Examine the tail shaft sleeve (reverse spline) bushes.

Inspect the mainshaft splines for nicks and burrs. See that the oil holes are open and clean.

Inspect the oil pump for wear on the pump plunger and roller pin. Ensure that the plunger spring is not distorted. Inspect the valve seat and ball and make sure that they are free from nicks and scratches.

Inspect the operating valve for distortion and damage and see that it slides easily in its bore in the front casing.

Inspect the relief valve body, "O" ring and ball, etc.

Inspect the planet carrier and gears for tooth and bearing wear.

PLANET CARRIER ASSEMBLY

To remove planet wheel pins

This operation is not normally necessary, but should a pivot pin or planet wheel roller cage require renewing, adopt the following procedure:

Support the carrier on a suitable hollow abutment through which the pin will pass.

Using a suitable drift, drive the pin out, shearing the small Mills pin.

Temporarily replace the planet wheel pin and,

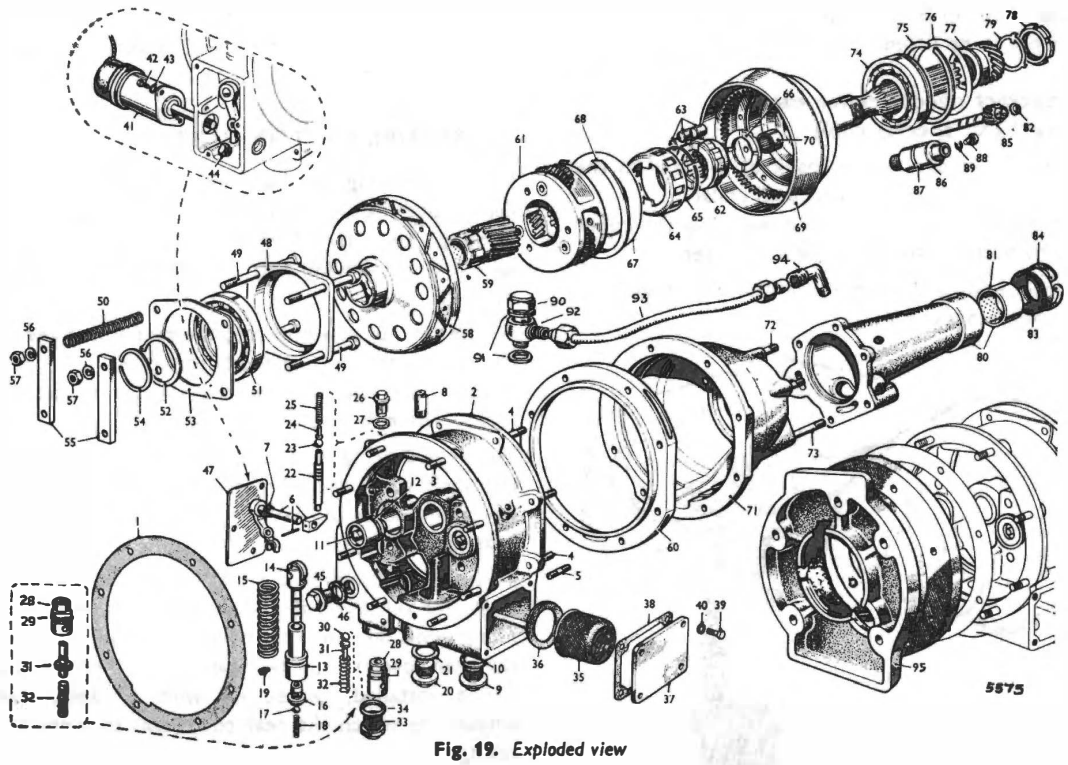

Fig. 19. *Exploded view*

1 Joint—Overdrive to gearbox adaptor.
2 Front casing.
3 Stud—Overdrive to gearbox adaptor.
4 Stud—Front casing to brake ring and rear casing.
5 Stud—Front casing to brake ring and rear casing.
6 Operating lever assembly.
7 Seating ring—Operating shaft.
8 Breather or plug.
9 Drain plug.
10 Drain plug washer.
11 Operating piston.
12 Piston ring (rubber).
13 Pump body.
14 Plunger.
15 Plunger spring.
16 Valve body.
17 Ball } Pump operating.
18 Spring }
19 Pump body retaining screw.
20 Cover plug } Pump.
21 Cover plug washer }
22 Operating valve.
23 Ball } Operating valve.
24 Plunger
25 Spring
26 Plug
27 Washer
28 Relief valve body.
29 Rubber ring } Relief valve.
30 Ball (Inset shows relief
31 Plunger valve assy. from
32 Spring Chassis Nos.
33 Plug Rapier B.3010530
34 Washer Alpine B.9009213
35 Filter.
36 Rubber joint—Filter.
37 Filter cover plate.
38 Filter cover plate gasket.
39 Set-screw securing filter cover plate.
40 Washer.
41 Solenoid and joint to casing.
42 Set-screw—Solenoid to casing.
43 Washer.
44 Nut—solenoid to valve lever.
45 Plug } Solenoid and valve
46 Washer } lever adjustment.
47 Valve lever cover.
48 Bearing housing.
49 Pin } Clutch release.
50 Spring
51 Bearing
52 Circlip
53 Retainer plate
54 Snap ring } Clutch release.
55 Bridge plate
56 Tab washer
57 Nut
58 Clutch cone.
59 Sunwheel.
60 Brake ring.
61 Planet carrier with wheels.
62 Ratchet } Free whee..
63 Rollers
64 Roller cage
65 Circlip
66 Thrust washer.
67 Retaining plate.
68 Circlip.
69 Annulus.
70 Mainshaft bearing.
71 Rear casing.
72 Stud—Rear casing to rear cover.
73 Stud—Rear casing to rear cover
74 Rear bearing.
75 Circlip.
76 Shim.
77 Speedometer wheel.
78 Locknut.
79 Tab-washer.
80 Rear cover.
81 Bush.
82 Thrust button, speedometer pinion.
83 Rear oil seal.
84 Circlip.
85 Speedometer pinion.
86 Bearing.
87 Oil seal.
88 Locking screw.
89 Washer.
90 Banjo bolts } Fitted from Chassis Nos. Rapier B.300S253 Alpine B.9005038
91 Washers.
92 Banjo union
93 Balance pipe
94 Elbow union
95 Gearbox adaptor.

using its small hole as a guide, drill out the broken end of the Mills pin in the carrier.

Note:—The drill size must be smaller than the new Mills pin to be fitted.

To extract needle roller cages (using VLC. special tool)

Secure the square ended shank of the tool in the vice and remove wing nut and all collars.
Slide the gear over the spindle and allow the roller cage to butt against the spindle shoulder.

Fit main body and wing nut and press the gear off the roller cages.

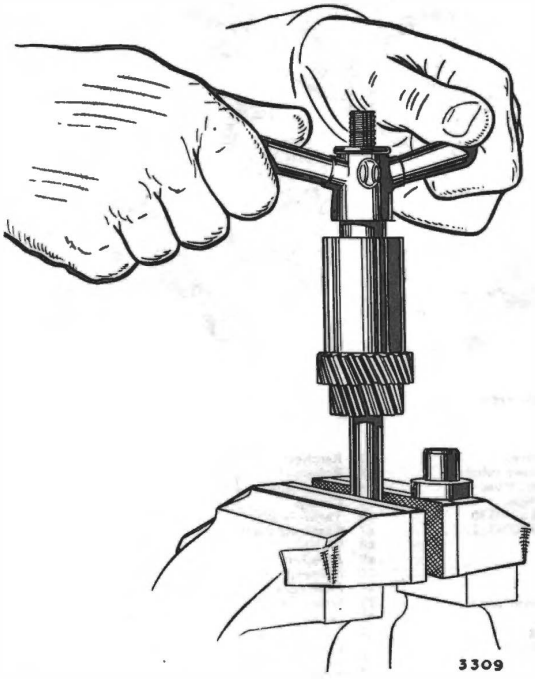

Fig. 20. *Removing roller cages*

To replace roller cages

Fit guide bush, flange downwards, over the shank of the tool. Place gear over guide bush followed by one roller cage, spacing collar and wing nut and press the cage right home.

Remove gear and collars, fit one collar, the gear inverted, second cage and collar. Screw second cage into position.

Treat each gear similarly and refit to the planet carrier, ensuring that the new Mills pins are a good driving fit in their holes.

REASSEMBLING THE UNIT

Fit rear bearing, circlip groove uppermost, over the output shaft, driving it into position against its locating shoulder behind the annulus. Fit speedometer driving gear, lockwasher and slotted nut.

Fit the annulus assembly into the rear casing and fit the circlip into the bearing outer track.
Ensure that the rear bearing circlip is located against the rear face of the casing.

The rear bearing is located at its rear end by the tail shaft cover assembly, and a shim is inserted into the recess of the cover to ensure that the bearing is trapped.

If a new bearing is fitted and it becomes necessary to assess the thickness of shims required, place two or more shims into the rear cover recess and offer up the rear cover to the rear casing with bearing and circlip installed, measuring with a feeler the amount by which the rear cover fails to meet the casing.

Remove the rear cover again, measuring the thickness of shims previously inserted, and subtract the gap already checked by feeler gauge from the thickness of the shims. This will assess the actual shimming required.

The rear cover can then be fitted and then the speedometer drive bush and pinion.

If the spigot roller bearing in the centre of the annulus is to be replaced, use VLC. special tool to insert bearing.

Assemble the spring into the roller cage of the unidirectional clutch. Fit the centre member into the cage and engage it on the other end of the spring.

Engage the slots in the inner member with the tongues on the roller cage and see that the spring rotates the cage to urge the rollers up the ramps of

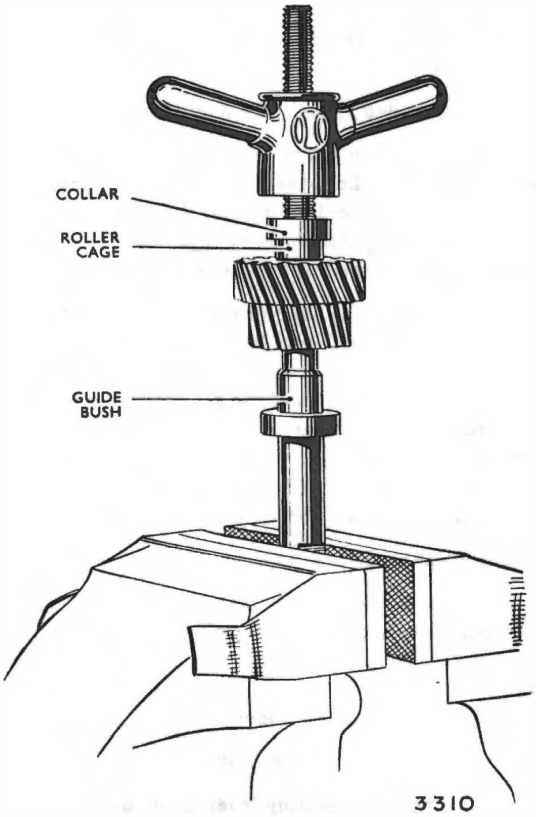

Fig. 21. *Fitting first cage*

the inner member. The cage is spring-loaded anti-clockwise when viewed from the front.
Place this assembly, front end downwards, into the fitting ring (VLC. L.178) and fit the rollers through the slots in the tool, turning the clutch clockwise. Replace the thrust washer and uni-directional clutch inner member with its rollers, cage and spring, using tool VLC. 178 to enter the rollers into the outer member.

Fit the brass protector ring into its groove in front of the roller clutch assembly. Fit circlip into recess to hold the brass ring in position.
Position the gears in the planet carrier by rotating each planet wheel until the etched line coincides with the etched line on the planet carrier.

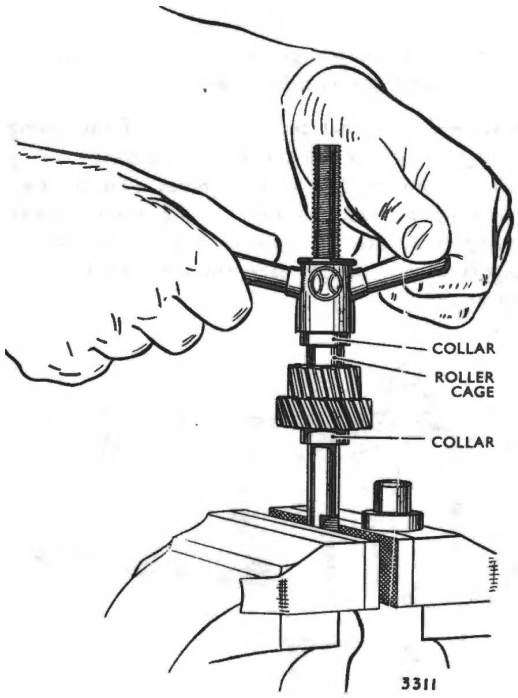

Fig. 22. *Fitting second cage*

Fit the planet carrier, pass the sunwheel splines into the open ends of the cone clutch member and fit the small circlip at the forward end of the sunwheel. Press the clutch bearing into the thrust plate, fit the 4 bolts of the thrust ring and then fit the clutch bearing assembly into the forward end of the cone clutch hub, securing the assembly in place by the large circlip on the hub. Fit the clutch assembly complete with sunwheel into the casing, engaging the sun and planet wheels. Fit the spacer plate over the bolts of the thrust ring bearing assembly and fit the 4 springs. Fit the front casing with the brake ring (large end of the taper towards the rear casing).

Carefully position the clutch ring bolts, which are shouldered, through the holes in the front casing. The clutch spring pressure will now be felt as the two halves of the casing go together, and it will be necessary to push the front half towards the rear

half, start the nuts on the studs, securing the two halves of the casing together and gradually tighten the nuts until the two faces meet.

Note.—Ensure that the two halves of the casing go together easily and check that the clutch spring bolts are not binding in their holes. Fit the two operating pistons, carefully easing their rubber sealing rings into the cylinder bores. The centre spigots of the pistons face towards the front of the unit.

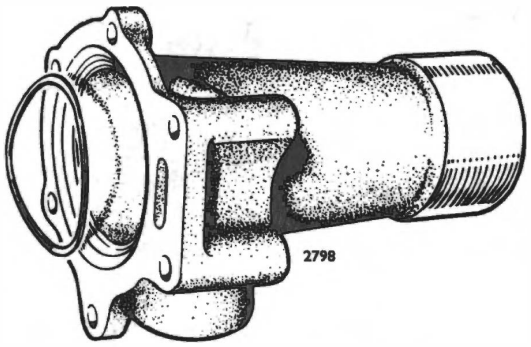

Fig. 23. *Rear cover and bearing shim*

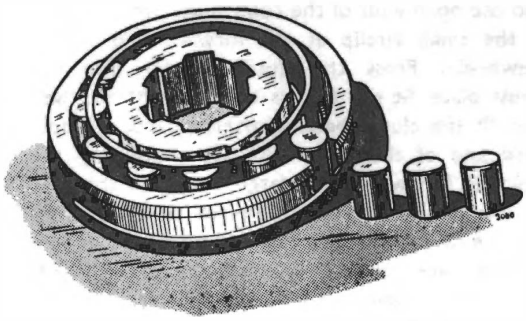

Fig. 24. *Assembling roller clutch*

If new "O" rings are fitted to the pistons, use VLC. special tool.

Fit the two bridge pieces, nuts and lockwashers.

Fit the solenoid plunger to the operating lever arm before installing the operating valve and spring; then fit the solenoid. Fit the operating valve assembly, ensuring that the lower operating plunger engages with the small cam on the operating shaft.

If the pump body has been removed (rarely necessary), insert its small end into the casing in the middle plug orifice at the bottom of the casing with the oil inlet port in the annular groove of the body facing towards its similar port in the main casing. Gently tap the body into position until the groove lines up with the grub screw hole at the bottom of the casing front face. Fit grub screw and tighten.

Fit pump valve, cap and washer.

Fit the relief valve assembly and plug in the right-hand bottom position of the casing and the drain plug in the left-hand bottom position. Fit and secure filter side cover plate. Insert the pump plunger and spring from above.

Fit the balance pipe. (Later Unit).

Do not yet fit the operating lever cover plate as it will be necessary to adjust the setting lever after finally fitting the unit to the car.

The assembly is now ready for fitting to the gear box unit.

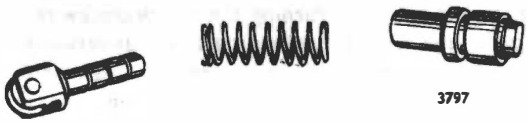

Fig. 25. *Oil pump components*

OVERDRIVE UNIT—DIMENSIONS AND TOLERANCES

Parts and Description	*Dimensions New*	*Clearance New*
Pump		
Plunger diameter	$\frac{3}{8}$"—·004" (9·525—·100)	
	—·0008" (—·020 mm.)	
Bore for plunger in pump body ...	$\frac{3}{8}$"+·0008" (9·525+·020)	+·0016" (+·040 mm.)
	—·0002" (—·005 mm.)	+·0002" (+·005 mm.)
Plunger spring fitted load at top of stroke	9 lbs. 7¼ ozs. (4·287 kgs.)	
Pump plunger spring free length ...	2" (51 mm.)	
Valve spring load	3·15 lbs. at $\frac{9}{16}$" long (1·428 kgs. at 14·29 mm.)	
Pin for roller	¼"±·00025" (6·350±·006 mm.)	
Bore for pin in roller	¼"+·002" (6·350+·050 mm.)	+·00225" (+·056 mm.)
	+·001" (+·025 mm.)	+·00075" (+·020 mm.)
Gearbox Mainshaft		
Shaft diameter at sunwheel bush ...	$\frac{7}{8}$"—·001" (22·225—·025)	
	—·002" (—·050 mm.)	
Sunwheel bush internal	·877" (22·276 mm.)	+·005" (+·127 mm.)
	·878" (22·301 mm.)	+·003" (+·076 mm.)
Shaft diameter at rear steady ...	$\frac{9}{16}$"+·0000" (14·288+·0000)	
	—·0005" (—·013 mm.)	
Torrington bearing	B·97	
Piston Bores		
Operating piston bore	$\frac{7}{8}$"±·0005" dia. (22·225±·013 mm.)	
Clutch		
Clutch movement, $\frac{1}{16}$" nominal (1·6 mm.) from direct to overdrive		
Clutch spring free length	1·667" (42·342 mm.)	

Relief valve — Summary of changes	**Introduction points**
1. Deep bore, 2" (50·8 mm.) long valve, $\frac{3}{16}$" (4·76 mm.) dia. ball.	First production to 32/1450/7781
2. Short bore, $1\frac{9}{32}$" (32·54 mm) long valve having $\frac{5}{16}$" (7·94 mm.) dia. spigot. $\frac{3}{16}$" (4·76 mm.) dia. ball ...	32/1450/7782 to 32/1536/1843
3. Short bore, $1\frac{7}{32}$" (31·0 mm.) long valve having $\frac{9}{16}$" (14·28 mm.) di . spigot. $\frac{3}{16}$" (4·76 mm.) dia. ball ...	32/1536/1844 to 25/3013/1965
4, As above with $\frac{5}{16}$" (7·94 mm.) dia. ball	Units from 25/3036 and 25/3037
5. As above with $\frac{5}{16}$" (7·94 mm.) dia. plunger	Units from 25/3046/1402 and 25/3047/3038
Relief valve spring free length ... 1·328" (33·73 mm.) 1·182" (30·02 mm.)	$\frac{3}{16}$" (4·76 mm.) dia. relief valve ball $\frac{5}{16}$" (7·94 mm.) dia. relief valve ball and plunger type relief valve.

NOTE. Short bore casings having ball type relief valve (Paras 2, 3 and 4) may be modified to the later plunger type relief valve (Para 5). The new valve and associated parts are available as a kit.

ADDITIONAL INFORMATION

Adjustment of controls

From late Series IV models onwards, the control is fitted with an adjustable stop pad. (See Fig. 26). Carry out all checks and adjustments, detailed on Page 16, as necessary.

When these are completed, release the locknut (A). Fig. 26.

With the $\frac{3}{16}$ in. (4.76 mm) dia. rod (B) in position and the adjusting nut (C) on the solenoid plunger (D) touching the fork (E), screw in the stop pad (F), until the inner face of the recess in the pad (F) makes contact with the end of the adjusting nut (C).

Then screw the stop pad (F) back three full turns.

When correctly set, the clearance between the end of the adjusting nut (C) and the inner face of the recess in the stop pad (F), should be .150 in (3.8 mm).

By following the method given here, the clearance is correct, without the need to take measurements.

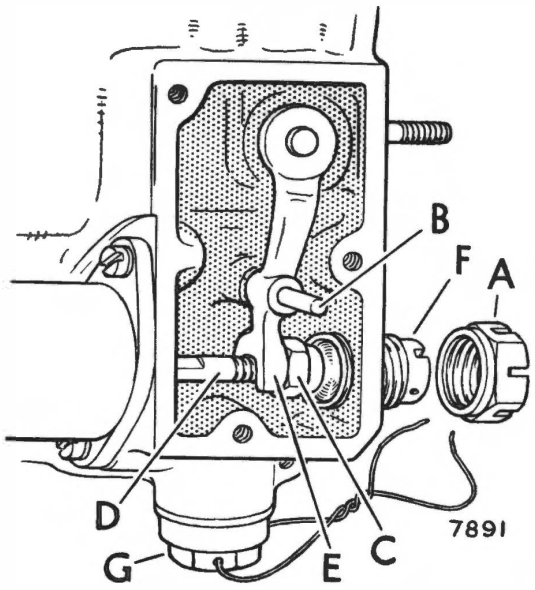

Fig. 26. *Stop pad adjustment*

Finally, tighten the locknut (A), and secure by wire-locking to the relief valve plug (G).