GEARBOX AND OVERDRIVE

SECTION E

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GEARBOX

GENERAL DESCRIPTION

A four-speed gearbox is fitted having synchromesh on the upper three ratios. Of these, second and third employ helical gears, and are in constant mesh.

The synchronised gears are engaged by dog-clutches, whereas first has sliding gear engagement. Reverse is engaged by a sliding idler pinion. Top gear is direct drive.

The synchromesh is of baulking ring type. Spring-loaded shifting plates locate the baulking ring relative to the sliding sleeve. The baulking ring impinges on a cone machined on the gear.

Overdrive is available as factory fitted optional equipment. It is engaged by a switch mounted on the steering column and controlled by an isolator switch mounted in the gearbox top cover. The isolator switch permits engagement of overdrive in third and top gears only.

GEARBOX—To remove and refit (see Overdrive Section where applicable.)

Alpine

Place car on ramp or over a pit.
Disconnect positive lead from battery.
Drain radiator.
Drain gearbox. Replace plug.
Remove top water hose.
Remove floor cover and gear lever.
Disconnect throttle linkage.
Disconnect exhaust system from branch pipes and remove.
Place jack under rear of engine and detach rear cross-member from underframe.
Disconnect speedometer cable and hydraulic clutch pipe.
Remove lower bellhousing bolts.
Disconnect clutch slave cylinder from bellhousing.
Lower engine and remove gearbox crossmember.
Remove starter and upper bellhousing bolts.
Withdraw gearbox and bellhousing rearwards and downwards.

Rapier

Place the car on a ramp or over a pit.
Disconnect positive lead from battery.
Drain radiator.
Drain gearbox. Replace plug.
Undo clip and remove top hose.
Remove rocker cover. (It may be necessary to remove rocker shaft complete if heater is fitted).
Disconnect accelerator control linkage.
Remove engine rear lifting brackets.
Disconnect exhaust flange from manifold.
Disconnect front exhaust hanger bracket.
Remove propeller shaft rear coupling bolts, disconnect coupling and remove shaft rearwards.
Rapier IV. Unscrew gear-lever knob. Remove ashtray. From behind and above blower switch, remove wing nut fixing which retains upper edge of console to lower edge of facia. Remove single screw from ashtray aperture. Remove front and rear gearbox tunnel covers.
Jack up engine at rear.
Remove bolts securing engine rear mounting bracket to frame.
Disconnect speedometer cable.
Disconnect clutch slave cylinder from bellhousing.
Disconnect starter cable and remove starter motor.
Remove gear lever.
Disconnect wires from overdrive solenoid and gearbox isolator switch (if overdrive fitted).
Lower rear of engine.
Remove nuts and bolts securing bellhousing to engine.
Remove gearbox and bellhousing rearwards and downwards.
Reverse the above procedure for refitting.
Check oil level.
Bleed clutch hydraulic system. (See Section D, "Bleeding the System").
Check that the clutch is operating and adjusted correctly.

Note:—Do not in any way tilt the gearbox when removing or refitting, as a great strain is thus imposed on the clutch driven plate.

TOP COVER

To remove and refit

Remove oil level dipstick. (No dipstick is fitted to gearboxes with oil level/filler plug.)

Remove gearbox cover bolts and lift off main cover without damaging the paper joint.

Refitting is a reversal of the above, taking care to ensure that the internal change speed lever and its selector safety latch engage in the selector fork gaps.

Before finally tightening cover securing bolts, position main cover by tapping its edges with a mallet, in order to obtain unrestricted "swing" of the selector safety latch across the selector fork gaps.

To remove gear lever

Slide grommet up gear lever.

Remove four setscrews securing spring retaining cap to top cover casing.

Withdraw gear lever.

To dismantle and reassemble

Early Alpine (Fig. 1a)

Remove rubber boot from below the gear lever socket mounting.

Remove cover plate with reverse stop spring and plunger from the side of the gear lever mounting.

Remove 3 setscrews securing the lever spring retaining cap to the extension casting and take off the cap, spring and cupped washer. Lift out the gear lever. Note the spring-loaded ball at the lower end of the lever. This is positively located in its drilling to prevent dropping out during dismantling.

Release locking wire from the square headed bolt securing the internal shift lever to the remote control shaft. Remove the bolt and withdraw the shaft through the rear of the casing. This will also release the safety latch and spacing washers, one at each end of the latch.

To reassemble pass the remote control shaft into the cover from the rear.

Locate the safety latch spacing washers in position with grease, and hold the safety latch and internal shift lever in place whilst passing the shaft through the remaining parts.

Line up the holes in the shaft and internal shift lever, fit, tighten and relock the square headed bolt.

Ensure that the spring-loaded ball is in position in the lower end of the gear lever and fit the level, cupped washer, spring and cap.

Fit the reverse stop plunger, spring and cap.

Refit the rubber boot below the lever socket.

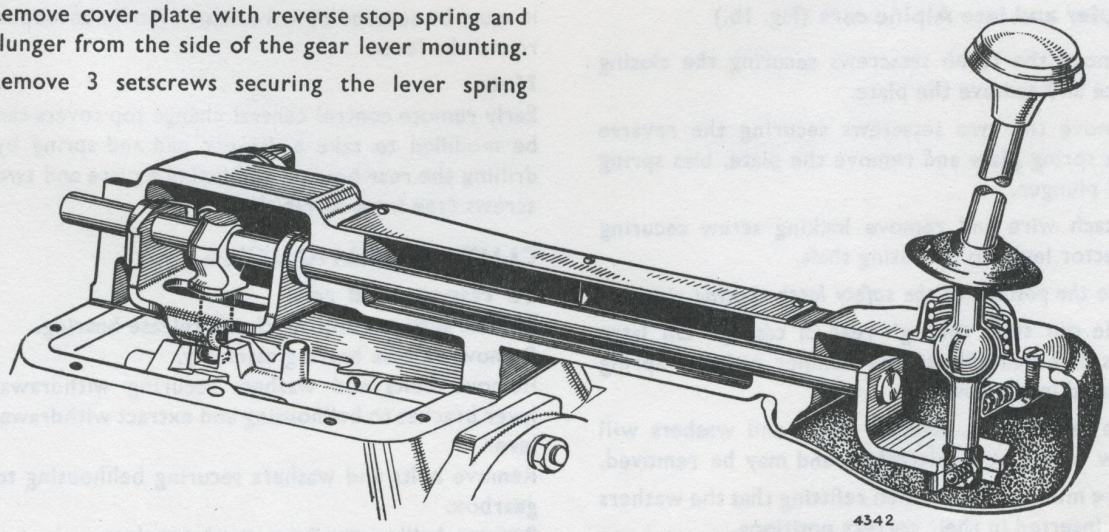
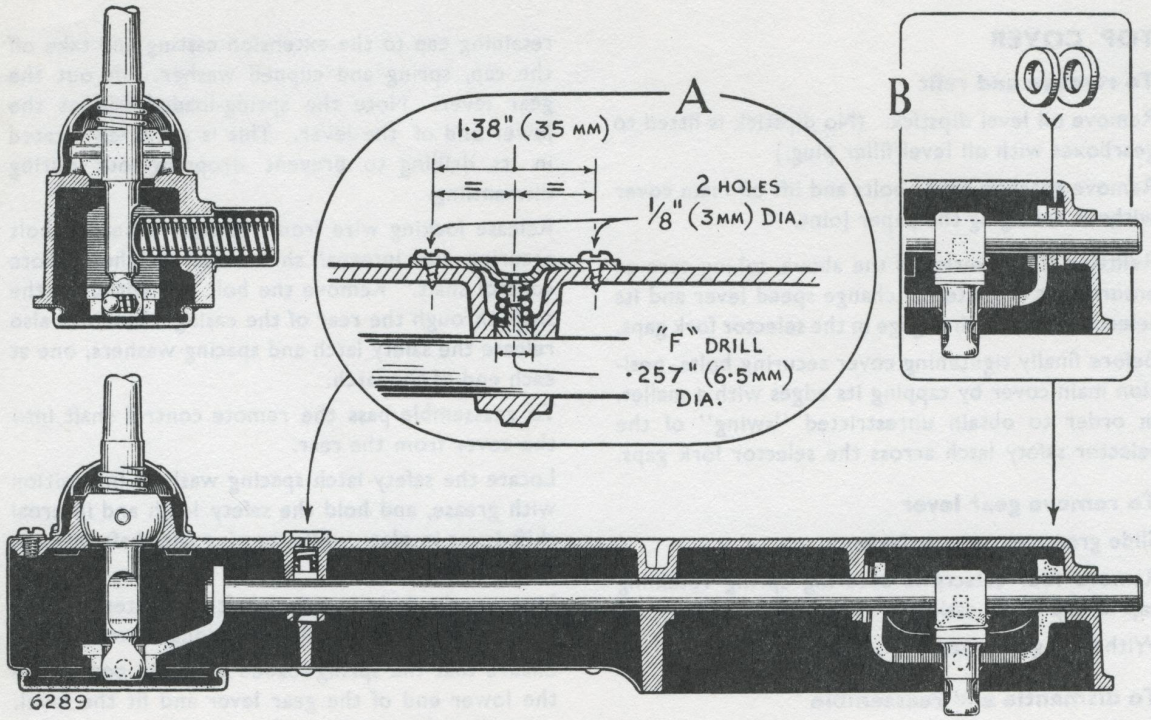


Fig. 1a. *Sectional view of top cover assembly, early Alpine cars*



A. DETAILS TO FIT DAMPER AND SPRING TO EARLY COVERS
B. SPACING WASHERS ON EARLY COVERS

Fig. 1b. *Sectional view of top cover Rapier and late Alpine*

Rapier and late Alpine cars (Fig. 1b.)

Remove the seven setscrews securing the closing plate and remove the plate.

Remove the two setscrews securing the reverse bias spring plate and remove the plate, bias spring and plunger.

Detach wire and remove locking screw securing selector lever to operating shaft.

Note the position of the safety latch spacing washers.

Slide out shaft through rear of casing. On later cars this will release the damper pad and spring located in the cover.

The safety latch, selector lever, and washers will now have become detached, and may be removed.

Care must be taken when refitting that the washers are inserted in their correct positions.

When the selector lever locking screw is refitted it must be secured by wire, which should be looped round the lever.

Note

Early remote control central change top covers can be modified to take a damper pad and spring by drilling the rear bearing and fitting a plate and two screws (see Inset A, Fig. 1b.)

CLUTCH BELLHOUSING

To remove and refit

Extract springs securing clutch release bearing.
Remove release bearing assembly.
Remove bolts and washers securing withdrawal lever bracket to bellhousing and extract withdrawal lever.
Remove bolts and washers securing bellhousing to gearbox.
Remove bellhousing from gearbox spigot.
Refitting is a reversal of the above instructions.

REAR COVER

To remove and refit

Remove speedometer pinion and bush.
Remove rear mounting plate (two bolts and one nut). Remove the remaining two bolts and washers securing rear cover to casing and remove cover.
Remove paper joint.

Refitting is a reversal of the above instructions.

If the rear bushes are worn or scored, a cover complete with finished bushes is available. Alternatively, if boring facilities are available, new bushes may be fitted and bored to 1·380/1·379″ (35·05/35·02 mm) within ·0015″ (·038 mm) total indicator reading at 90 deg. to the front face of the cover.

A strengthened cover with a circlip to retain the oil seal, and a propellor shaft with no dust shield are fitted to later cars. (To give interchangeability with the new rear cover, which supersedes the old, replacement shafts for early or later cars will not be fitted with a dust shield).

TOOLS FOR DISMANTLING AND REASSEMBLING GEARBOX

The dismantling and reassembling of the gearbox will be simplified by the use of the following tools, their uses being fully described in the ensuing instructions.

The first two tools can be made up to the dimensions given.

1. Dummy layshaft spindle $\frac{3}{4}$″ (19 mm.) diameter x $6\frac{1}{2}$″ (165·1 mm.) long—made up.
2. Dummy selector shaft $\frac{7}{16}$″ (11·1 mm.) diameter x 5″ (127 mm.).—3 required.
3. Selector shaft loading tester clamp. (Churchill No. R.G.62 or any suitable clamp to attach to the end of the selector shaft).
4. Circlip pliers V.L.C. 7065 ("C" and "A" points).
5. Socket spanner RG.317 for mainshaft front nut.

SELECTOR SHAFTS AND FORKS

To remove and refit (Figs. 2 and 3)

It is imperative that these are removed REARWARDS only. Use dummy selector shaft as described under "TOOLS".

Carefully tap out reverse selector shaft (64). Note the distance piece (66) at the rear of the selector fork.

Carefully tap out the 1st and 2nd and 3rd and 4th selector shaft (55 and 59).

Remove the selector forks.

Adjustment of axial load between 3rd and 4th selector shaft and fork

This operation should be carried out before assembling the 3rd and 4th speed selector shaft and fork into the gearbox; proceed as follows:—

Grip the 3rd and 4th speed selector fork in a vice; insert shim/s, spring and ball, then the selector shaft, depressing the ball by inserting a punch.

The axial load necessary to move the selector shaft groove across the ball in the fork should be 25 lbs (11·3 kg.) to 30 lbs. (13·6 kg.). This may be tested by means of a suitable spring balance, attached to the end of the selector shaft by a hand vice or the Churchill selector shaft loading tester VLC No. RG.62. Adjust axial load to the above figure by addition or removal of shims. As it will be necessary to detach the selector shaft from the fork in order to assemble to the gearbox it will be necessary to retain the adjusted ball and spring in the fork by means of a dummy selector shaft as previously described.

With the above exception, refitting is a reversal of the preceding instructions.

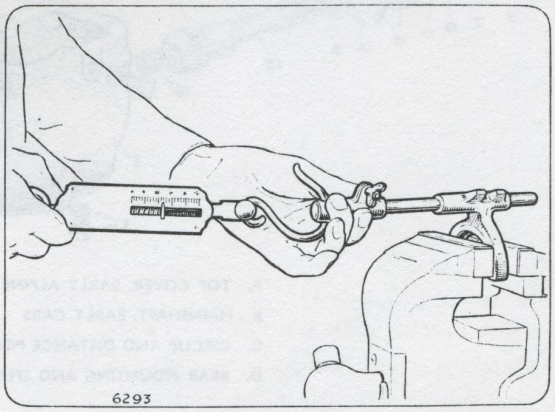
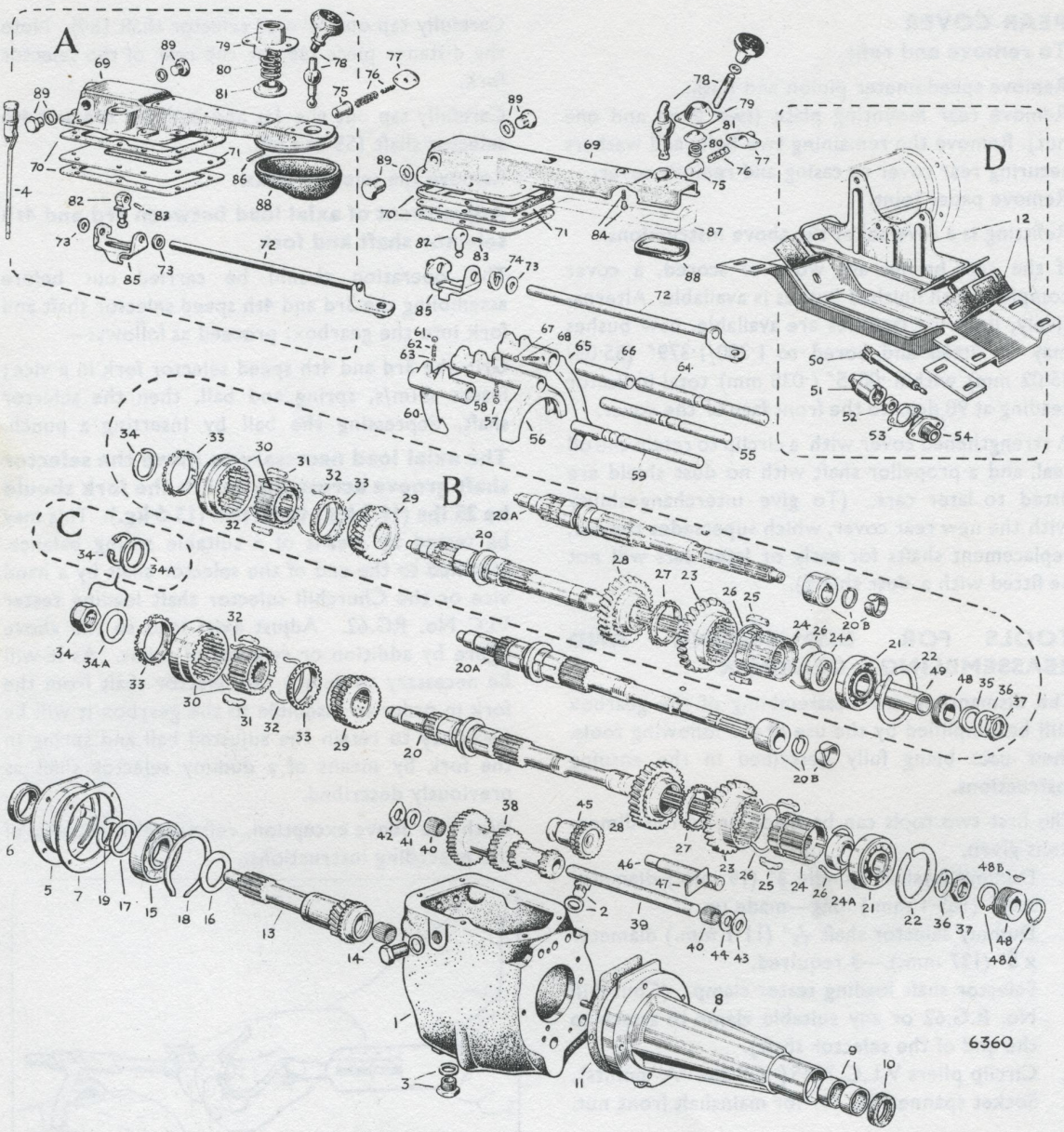


Fig. 2. *Checking of axial load of 3rd and 4th selector shaft and fork.*



A. TOP COVER, EARLY ALPINE
B. MAINSHAFT, EARLY CARS
C. CIRCLIP AND DISTANCE PIECE (SOME LATER MAINSHAFTS)
D. REAR MOUNTING AND SPEEDO DRIVE.

Fig. 3. *Exploded view of gearbox.*

FRONT COVER ASSEMBLY

To remove and refit (Fig. 3)

The front cover assembly can only be withdrawn after the layshaft cluster (38) has been lowered into the bottom of the gearbox casing (1).

Remove top and rear covers and selectors as previously described.

Remove the four securing setscrews from the front cover (5).

Remove setscrew and washer securing lock plate (47).

Remove lock plate by sliding it downwards.

Displace layshaft (39) by entering dummy layshaft from the front, pushing it rearwards until clear of the fixed thrust washer (43) so lowering the layshaft cluster assembly to the bottom of the casing.

It is essential that the layshaft spindle is entered and removed through the rear of the casing. The hole in the front of the casing is of smaller diameter than that in the rear, and incorrect removal and refitting will destroy the oil-sealing thereby obtained.

The front cover assembly should now be withdrawn from the casing.

Do not lose the needle rollers (14) from the main-shaft spigot bearing.

Remove the fourth speed baulking ring (33) from the synchrohub (30).

In order to maintain efficient functioning of the synchronising mechanism it is advisable to correlate each baulk ring to its mating cone by some form of identification, e.g., using a sharp instrument, scribe in a prominent position the numbers 2, 3 and 4 indicating second, third and fourth speeds.

When refitting the front cover assembly it is essential that the drain hole is placed in the six o'clock position, and a new paper joint fitted between the gearbox casing and the front cover.

To dismantle and reassemble (Figs. 3 and 4)

Remove circlip (18) securing bearing (15) in front cover (5).

Press stemwheel assembly, complete with bearing, out of front cover.

Remove circlip (19) securing bearing (15) and abutment washer (17) to stemwheel (13).

Press bearing off stemwheel.

Remove bearing shield (16). (Do not omit this on reassembly).

Remove oil seal. (This is a press fit in the cover).

Reassembly of the front cover assembly is a reversal of the preceding instructions with particular attention to the following points:—

The circlip (19) securing the bearing to the stem-wheel must always be renewed.

In this assembly a predetermined amount of float is provided for and is controlled by the class of fit of the members of the ball bearing.

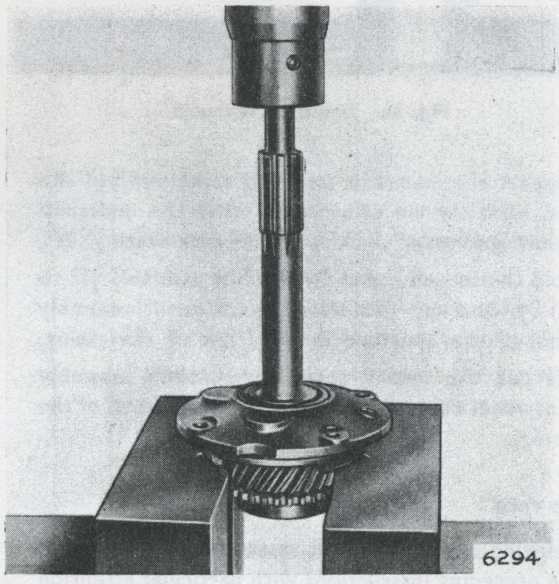


Fig. 4. *Pressing stem wheel out of cover*

MAINSHAFT ASSEMBLY

To remove (Figs. 3, 5a and 5b)

Remove top and rear covers, selectors and front, cover.

On early cars (inset B, Fig. 3) release lockwasher (36) and undo nut (37), securing bearing to shaft and remove distance piece (49) and speedo gear (48).

On later cars, the speedo securing circlips (48A), speedo gear and key (48 and 48B) must be removed before removal of the nut (37) and lockwasher (36).

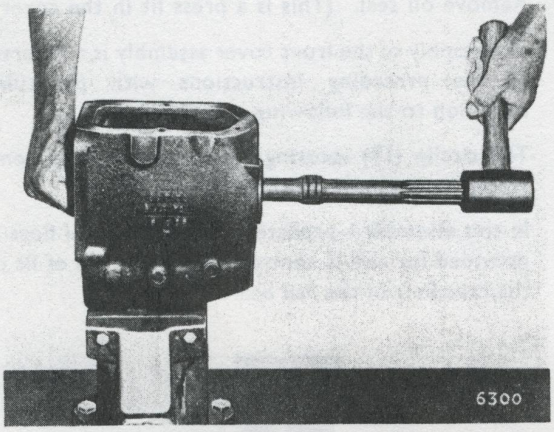


Fig. 5a. *Driving out mainshaft*

Support the mainshaft assembly at its forward end and, with the aid of a mallet, drive the mainshaft assembly forward until free of the rear bearing (21).

Hold the second speed synchrohub assembly (23 to 26) by hand and withdraw the mainshaft assembly through the aperture in the front of the casing.

Lift out the second speed synchrohub assembly and wheel through the aperture in the top of the casing.

To refit

Refitting of the mainshaft assembly is a reversal of the preceding instructions with particular attention to the following:—

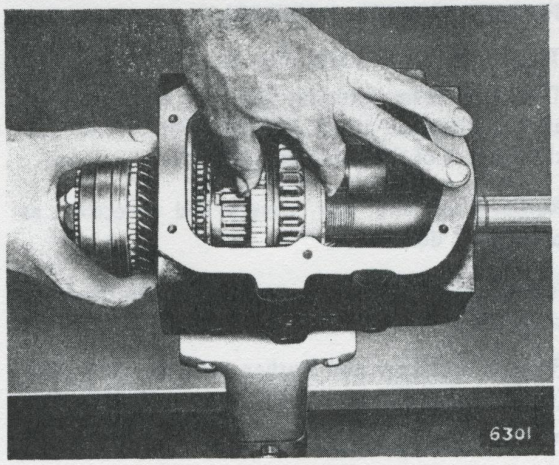


Fig. 5b. *Removing mainshaft*

Oil the inner surface of the second speed baulking ring (17) and secure it to its mating cone by light hand pressure in order to safeguard against the baulking ring floating and becoming trapped during the driving rearward of the mainshaft into the bearing.

During the driving in of the mainshaft to the rear bearing care must be taken to align the second speed shifting plates (25) with the slots in the second baulking ring (27); also the first speed wheel (23) and the 3rd and 4th speed sliding sleeve (30) should be retained in position on their respective hubs (24) and (30) by hand.

It is essential that the rear main bearing (21) is positioned so that it is held firmly against the second speed hub distance piece (24A).

To ensure this condition, place the gearbox on a press so that the bearing inner track rests on the base plate and the mainshaft passes through the V-notches. Place a protector sleeve over the stemwheel spigot and press the shaft through the bearing until the hub distance piece is securely held between the bearing and the second speed hub (see Fig. 6a).

To dismantle and reassemble (Figs. 3, 5c-5f)

Remove second speed wheel (28) and separate the baulk ring from the gear. Mark the baulk ring to ensure it is reassembled to the correct gear.

Secure mainshaft in vice, **using soft metal clamps.**

Remove front mainshaft circlip or nut (34).

Remove the third and fourth synchrohub (30) from mainshaft. (This is a press-fit).

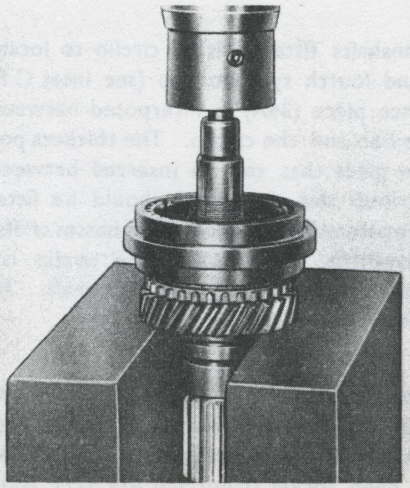


Fig. 5c. *Pressing of 3rd and 4th synchrohub*

Remove the third speed wheel (29) and separate the baulk ring from the gear. Mark the baulk ring to ensure that it is reassembled to the correct gear.

Remove the third and fourth sliding sleeve.

Remove three shifting plates (short) (31).

Remove two synchro circlips (32) from synchrohub.

Dismantle the second speed synchrohub as follows:—

Remove first speed wheel (23) from hub (24).

Detach the three long shifting plates (25).

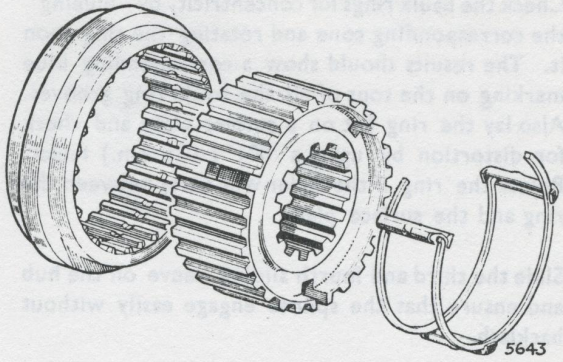


Fig. 5d. *Arrangement of 3rd and 4th speed synchrohub*

Remove the large shouldered distance piece (24A) from the rear end of the hub. The front and rear circlips (26) can then be withdrawn.

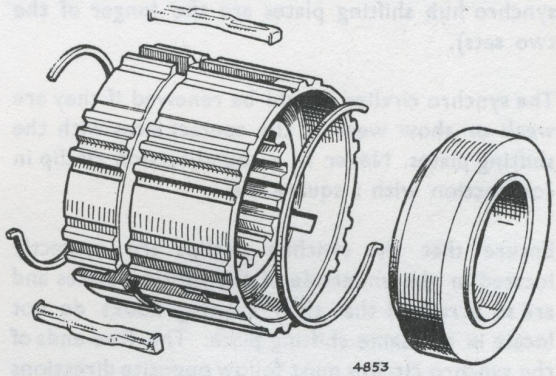


Fig. 5e. *Arrangement of 2nd speed synchrohub circlips*

Reassembly of the mainshaft is a reversal of the preceding instructions with particular attention to the following:—

Ensure that the dog teeth of the baulk rings are in a good condition and that the grooves in the tapered bore of the baulk rings are not worn and are clean.

The gear cone that receives the baulk ring must be free from glazing or ridging.

Check the baulk rings for concentricity by "blueing" the corresponding cone and rotating the ring upon it. The results should show a corresponding blue marking on the tops of all the baulk ring grooves. Also lay the ring flat on a surface plate and check for distortion by using a ·001" (·025 mm.) feeler. Reject the ring if the feeler will enter between the ring and the surface plate.

Slide the third and fourth sliding sleeve on the hub and ensure that the splines engage easily without backlash.

Check the condition of the chamfers on the sliding sleeve internal splines to ensure each face is flat and free from burrs.

Examine the shifting plates for wear particularly at the centre protrusion and check that in each set all three are the same length. (The second speed synchro hub shifting plates are the longer of the two sets).

The synchro circlips should be renewed if they are weak or show wear at the contact faces with the shifting plates. Never fit a round-section circlip in conjunction with a square one.

Ensure that the synchro circlips are correctly located in the underside of the shifting plates and are so arranged that their locating hooks do not locate in the same shifting plate. The free ends of the synchro circlips must follow opposite directions from one another in relation to their respective locating hooks. Reassemble the circlips so that one circlip passes across the underside of each of the three shifting plates and with the plain ends of the circlips pointing in opposite directions to each other.

The second speed synchro-hub circlips must be assembled in exactly the same way as for a third and fourth speed hub.

Test the baulking rings will slide freely within the sliding sleeve and the hub recess. Carry out this test with the sleeve assembled to the hub with the shifting plates and circlips in position.

End location of 3rd speed hub

On mainshafts fitted with a spring ring (34, inset B, Fig. 3) to locate the third and fourth synchro hub the thickest possible spring ring should be fitted by selective assembly of the five thicknesses of spring ring available. Ensure that the spring ring is fully located in the groove in the mainshaft. Always use a new spring ring.

On mainshafts fitted with a circlip to locate the third and fourth synchro hub (see inset C Fig. 3) a distance piece (34A) is interposed between the synchro hub and the circlip. The thickest possible distance piece that can be inserted between the synchro hub and the circlip should be fitted by selective assembly of the four thicknesses of distance piece available. Ensure that the circlip is fully located in the groove in the mainshaft. Always use a new circlip.

On later cars the third and fourth speed hub is secured by a nut and washer (1 and 2, Fig. 5f). Tighten the nut to a torque of 80 lb. ft. (11 kg. m. using a deep socket (Churchill RG 317) and with a suitable punch peen the flange of the nut into the indentation in the mainshaft (3, Fig. 5f). Always use a new nut on reassembly.

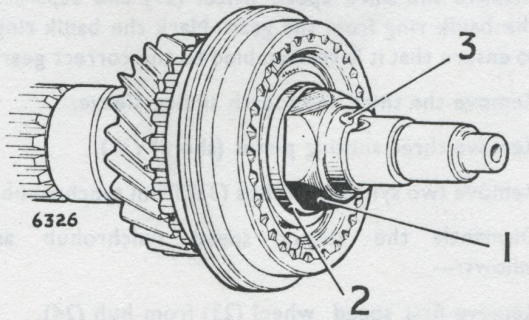


Fig. 5f. *Nut and washer securing 3rd and 4th speed synchro hub*

Poor Synchromesh

When a gearbox is stripped to rectify a complaint of this nature, the following items require particular attention:—

1. *Replacement baulk rings.* These must be thoroughly cleaned, paying special attention to the grooves in the cone faces. Check carefully for damage and burrs.

2. *Sliding sleeves and hubs.* Check for burrs, especially the edges of the shifting plate slots in the hub, and stone off if necessary. Offer up the baulk ring to the hub (without the sliding sleeve or shifting plates) and rotate. Any restriction between the limits imposed by the shifting plates will impair the operation of the synchro.

3. *Gear wheel synchro cones.* Examine the cone face. If annular ridges are found, change the wheel. Chech the new wheel for burrs.

4. *Reassembly.* Lap the new baulk ring to the synchro hub cone, using coarse metal polish.

LAYSHAFT ASSEMBLY

To remove and refit (mainshaft removed)

Extract the layshaft assembly complete with rollers (40, Fig. 3) abutment ring (41) and floating steel thrust washer (103) through the aperture in the front of the casing.

Remove the two bronze thrust washers (42) and (43).

Replacement is a reversal of the preceding operation with particular attention to the following:—

End float of the layshaft cluster between the thrust washers should be ·006in./·008in. (·152/·203 mm.). This clearance should be checked with the assembly in a dry condition and adjusted by selective assembly of floating thrust washer.

After insertion of needle rollers, place abutment ring in recess at the front of the cluster.

REVERSE WHEEL

To remove and refit (mainshaft and layshaft removed)

Withdraw rearwards, the reverse wheel spindle (46) from the casing.

Remove reverse wheel (45).

Replacement is a reversal of the preceding instructions.

REAR BEARING

To remove from casing

Support the gearbox on its face and press out the bearing. Should the bearing circlip (22, Fig. 1,) be removed from the bearing a new circlip must be fitted.

GEARBOX

To reassemble

During the assembly the following points must be borne in mind:—

Absolute cleanliness is essential.

Use a liberal supply of clean oil when assembling movable parts finally.

Check movable parts for freedom of movement.

Always fit new paper joints.

Seal gearbox casing at front end of layshaft spindle with a good brand of sealing compound.

All external setscrews must be dipped in a good quality non-setting jointing compound before assembling.

1. Fit reverse wheel and shaft into casing (gears to the rear).
2. With the aid of thick grease position the bronze layshaft thrust washers (large one to the front) in the casing.
3. See that there are twenty-seven needle rollers at each end of the layshaft cluster. Locate them with thick grease.
4. Fit abutment ring into the front of the cluster and lower cluster complete with dummy shaft into the casing, and then fit the rear floating steel thrust washer.
5. Pass the first and second synchrohub and second speed wheel assembly through the top of the casing with bevelled first speed teeth to the rear and enter the mainshaft through the front of the casing, passing its rear end through the first and second synchro assembly, and the bearing aperture in the casing.

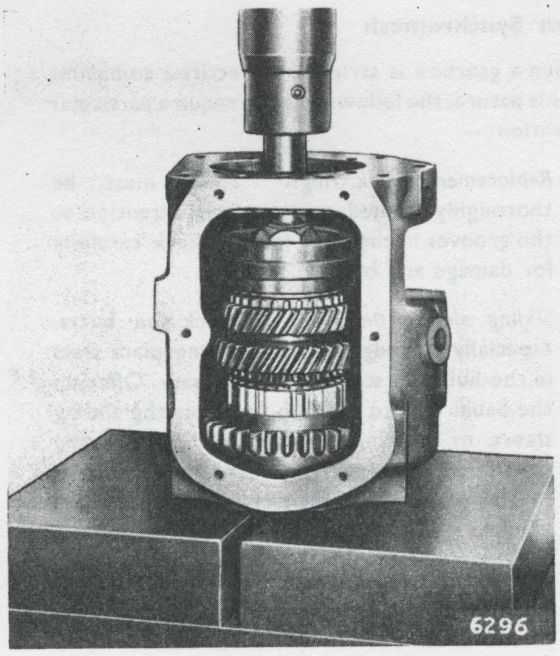


Fig. 6a. *Pressing mainshaft into rear bearing*

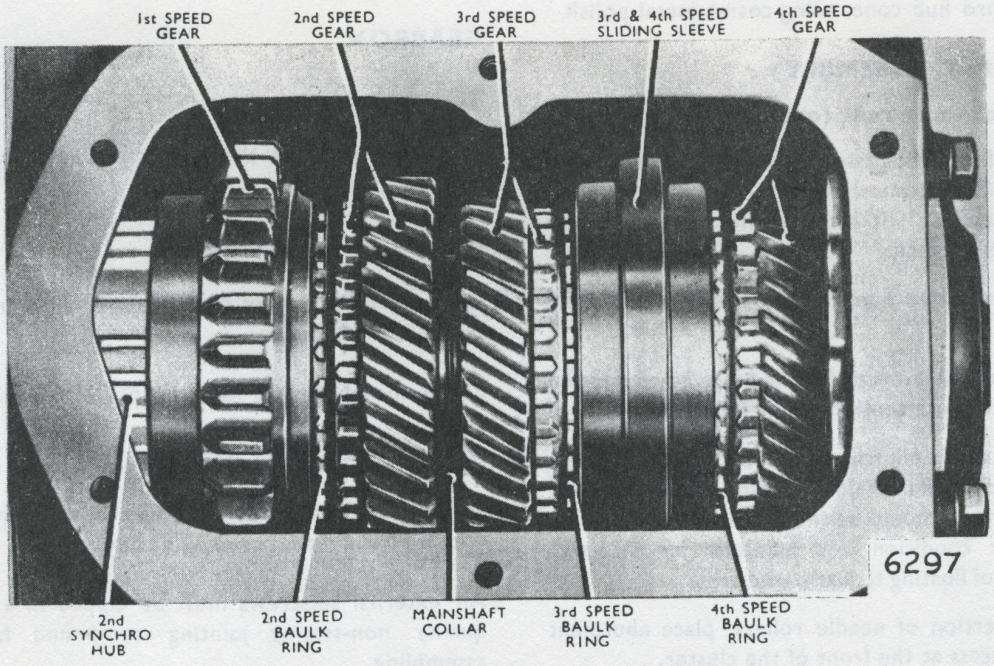


Fig. 6b. *Mainshaft assembled in the gearbox casing*

6. Fit the rear bearing and press it right home. On early cars (inset B Fig. 3) fit the spacer (49), speedometer gear (48), spacer (35), lockwasher and nut (36) and (37). On cars fitted with the later type mainshafts (Insets C and D, Fig. 3), fit the lockwasher and nut (36 and 37), speedo gear and circlips (48 and 48A).

7. Ensure that the twenty-seven needle rollers are in position in the stemwheel and then fit the front cover and stemwheel assembly with the drain hole in the six o'clock position.

8. Invert gearbox and insert layshaft spindle through rear of casing, ensuring that the thrust washers at each end are correctly positioned.

9. Fit layshaft and reverse spindle lock plate.

10. Place gearbox upright and fit third and top, first and second and reverse forks. Fit reverse distance piece and shaft with long end of shaft to the front. Fit first and second and third and top shafts.

11. Refit rear cover and check that shafts are free and that all gears can be selected.

12. Fit top cover, taking care to position it so that the internal selector lever moves freely across the slots in the forks.

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.

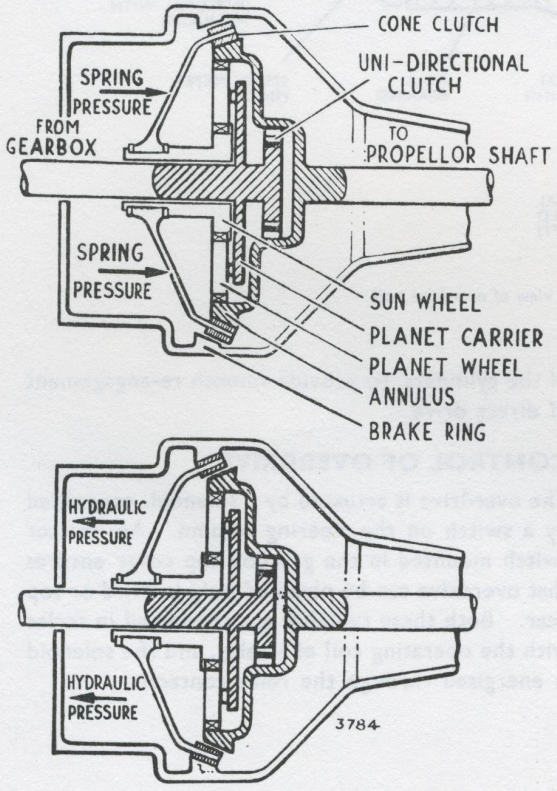


Fig. 7. *Diagrammatic sections*

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

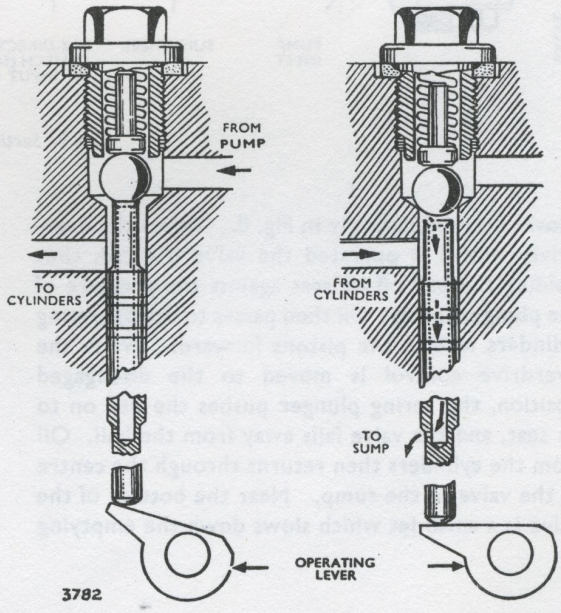


Fig. 8. *Operating valve*

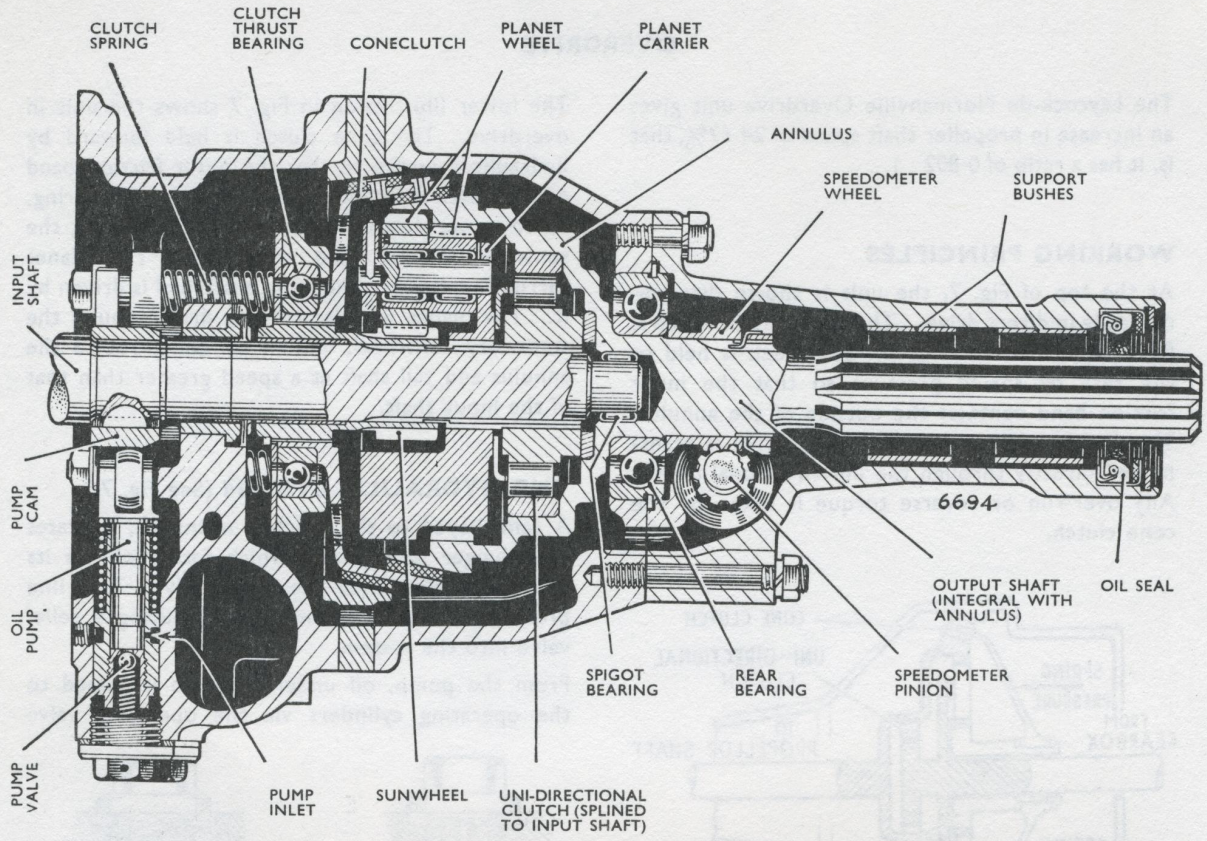


Fig. 9. *Sectional view of overdrive unit*

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).

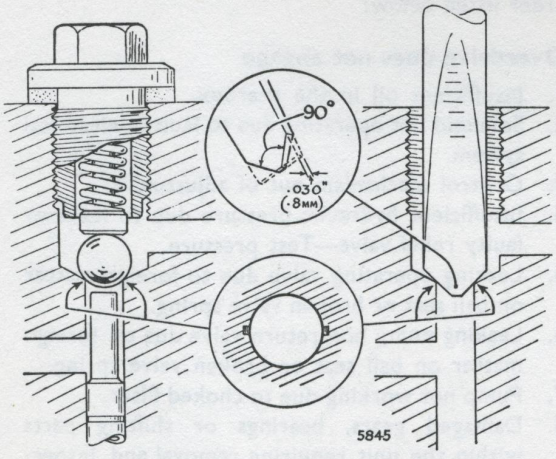


Fig. 10. *Scoring operating valve ball seat*

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 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.

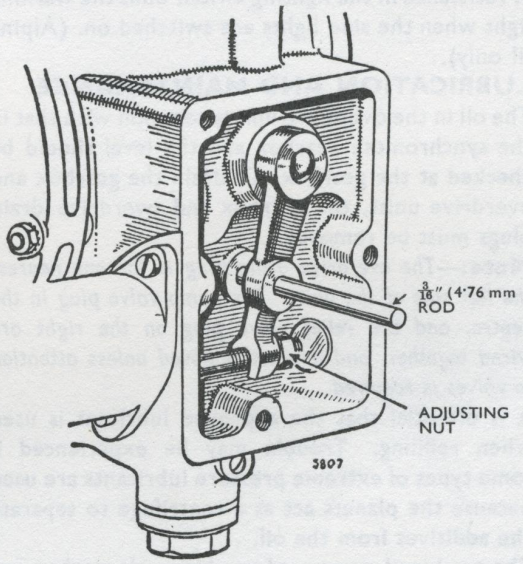


Fig. 11. *Checking setting lever position*

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.

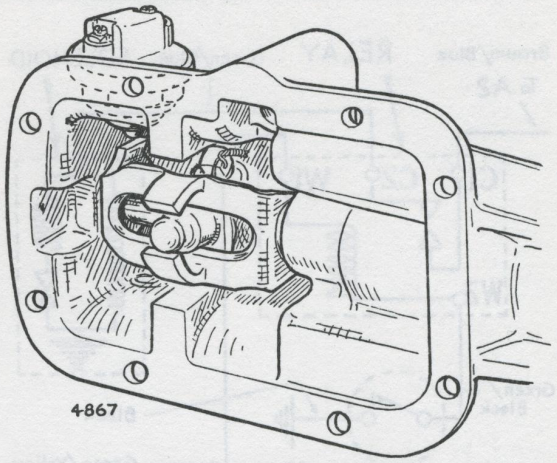


Fig. 12. *Gearbox top cover showing selector lever and safety latch with isolator switch abutment*

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".

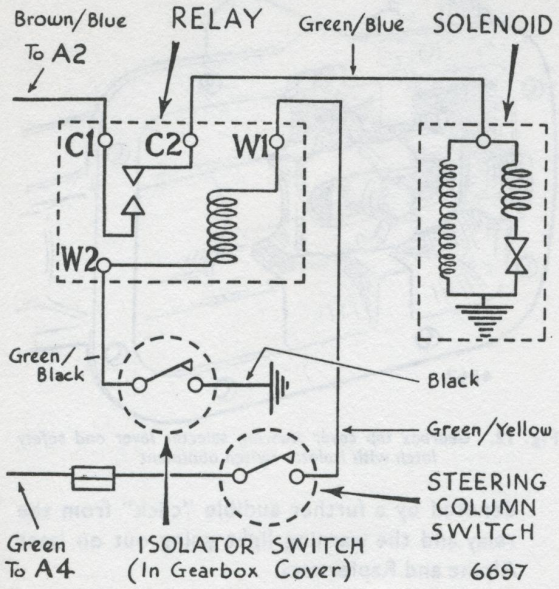


Fig. 13. *Circuit diagram Alpine I and II*

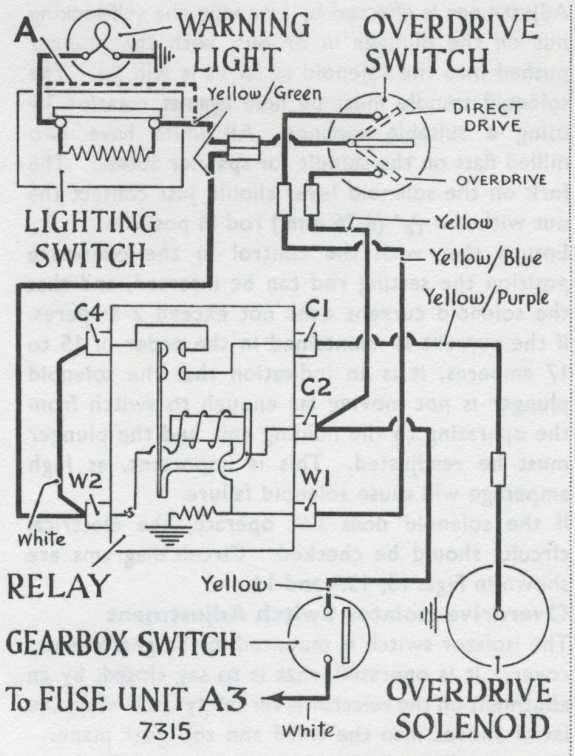


Fig. 13A. *Circuit diagram Self Cancelling Switch. (A Rapier and Alpine IV).*

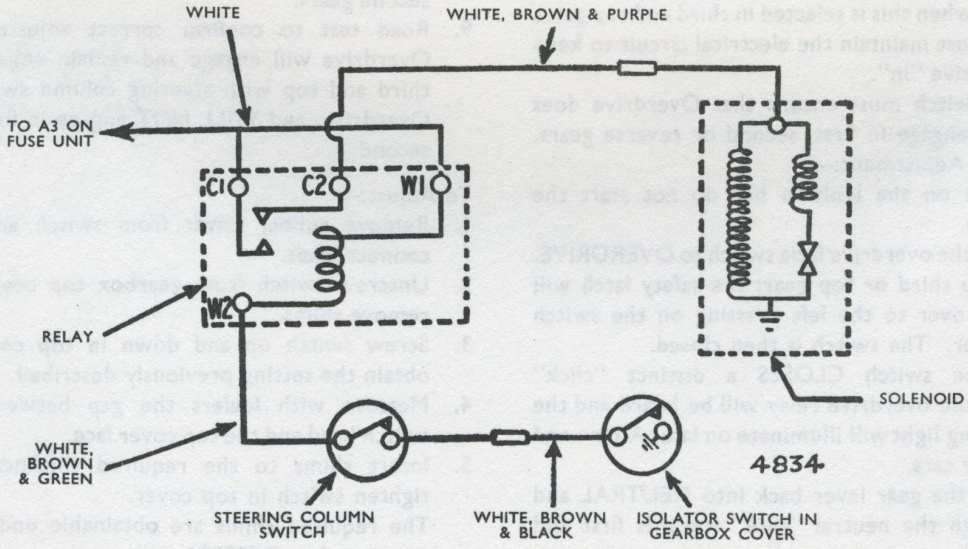


Fig. 14. *Circuit diagram (early Rapier)*

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.

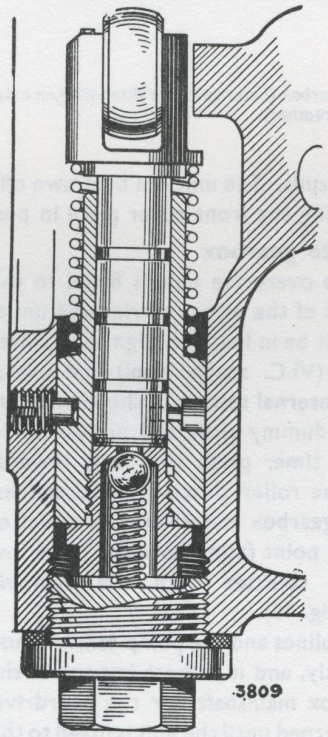


Fig. 15. *Oil pump and valve*

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.

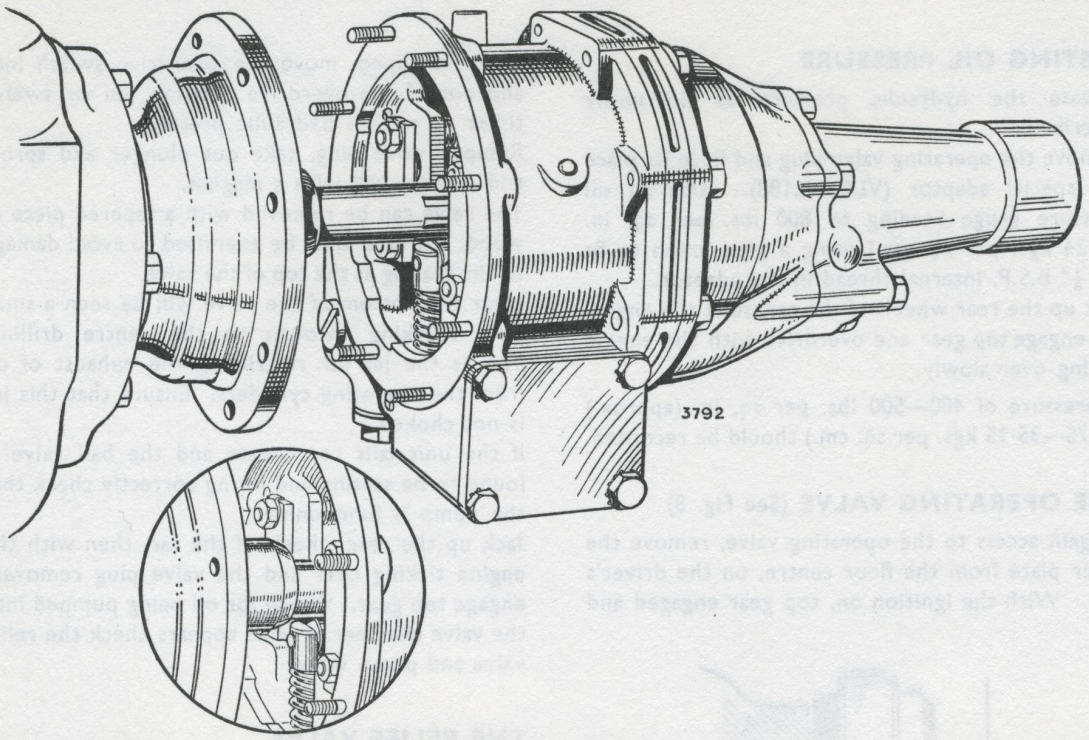


Fig. 16. *Overdrive ready for fitting to gearbox (Later units are fitted with an external balance pipe and a plug replaces the breather)*

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

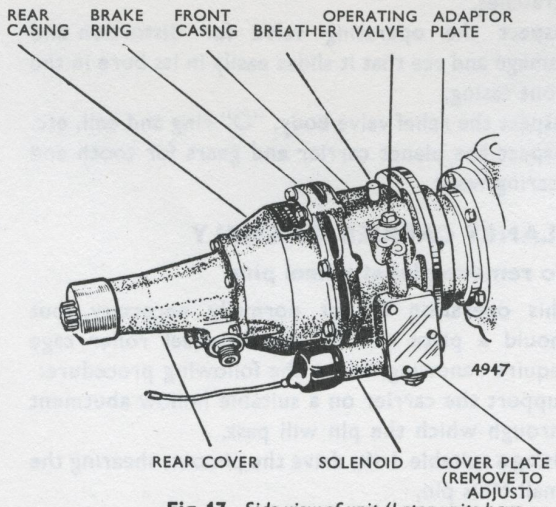


Fig. 17. *Side view of unit (Later units have an external balance pipe and a plug replaces the breather)*

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 $\frac{1}{4}$" 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 $\frac{1}{4}$" 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.

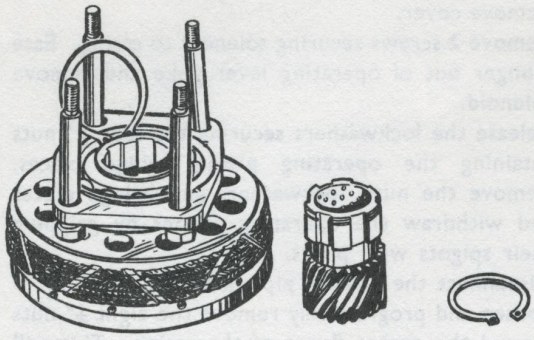


Fig. 18. *Cone clutch and sunwheel details*

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,

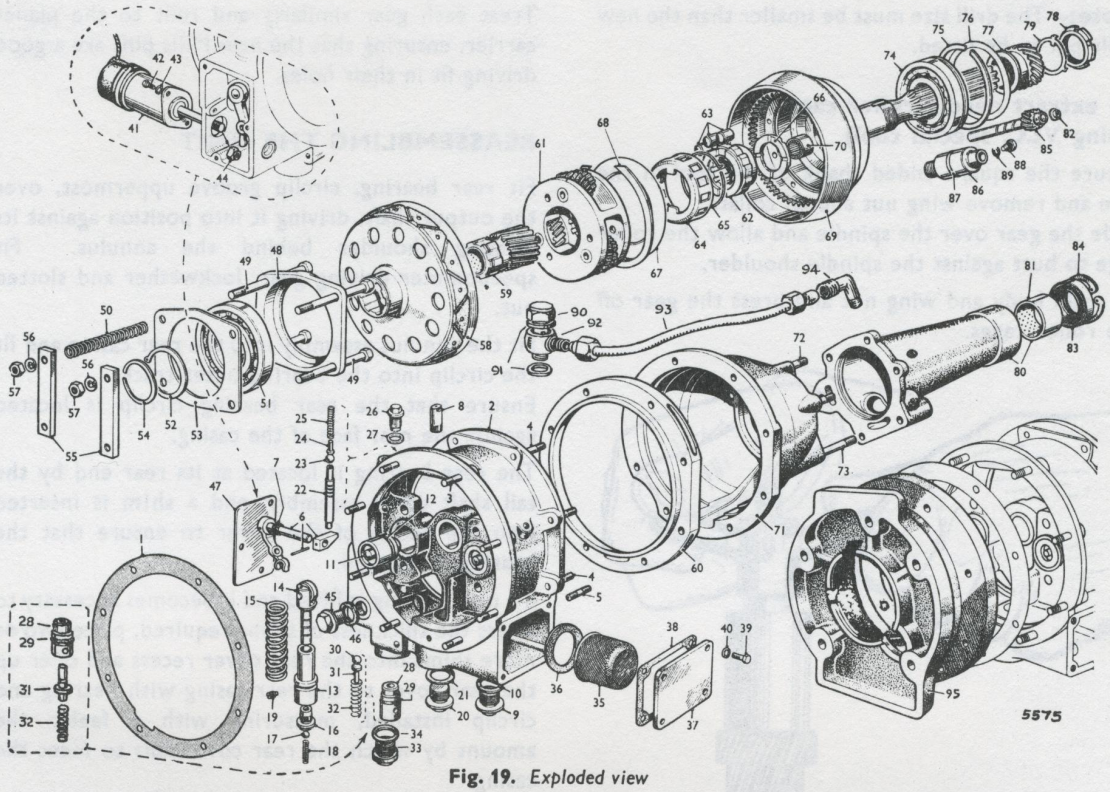


Fig. 19. *Exploded view*

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 }
24 Plunger }
25 Spring } Operating valve.
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 }
50 Spring }
51 Bearing } Clutch release.
52 Circlip }
53 Retainer plate }
54 Snap ring }
55 Bridge plate } Clutch release.
56 Tab washer }
57 Nut }
58 Clutch cone.
59 Sunwheel.
60 Brake ring.
61 Planet carrier with wheels.
62 Ratchet }
63 Rollers } Free wheel.
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 }
91 Washers. } Fitted from
92 Banjo union } Chassis Nos.
93 Balance pipe } Rapier B.3005253
94 Elbow union } Alpine B.9005038
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.

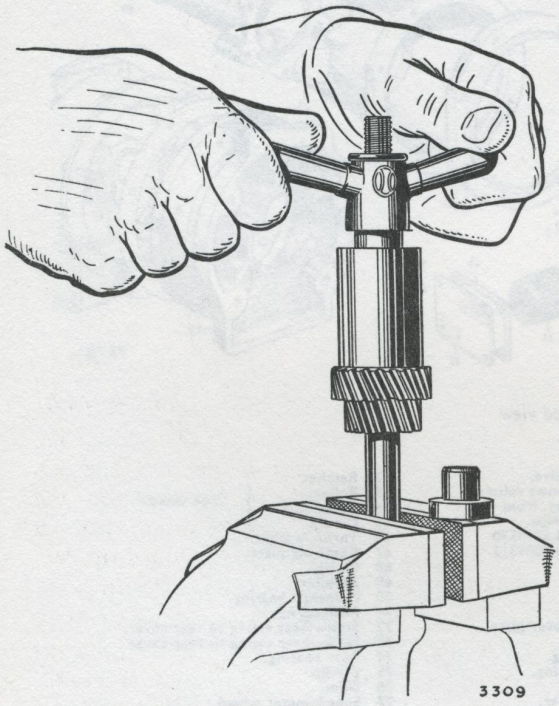


Fig. 20. *Removing roller cages*

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

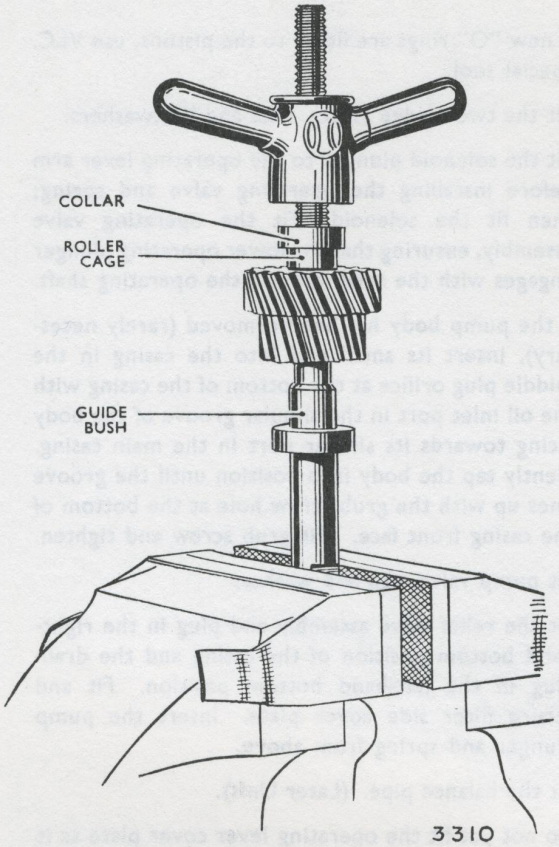


Fig. 21. *Fitting first cage*

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.

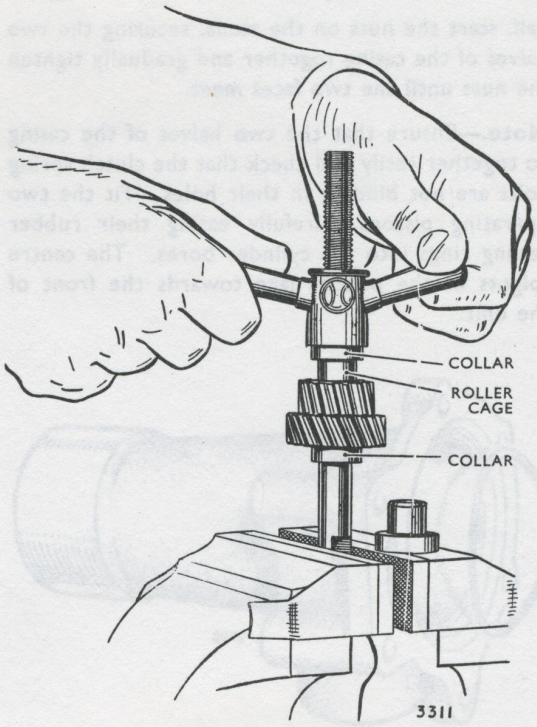


Fig. 22. *Fitting second cage*

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.

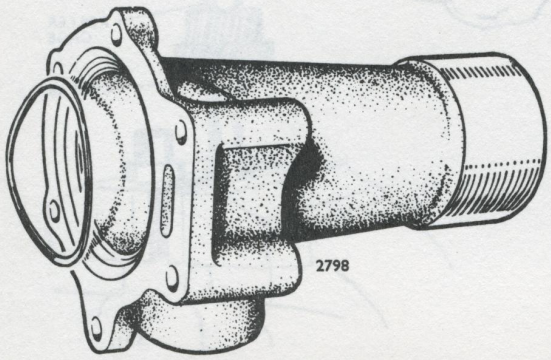


Fig. 23. *Rear cover and bearing shim*

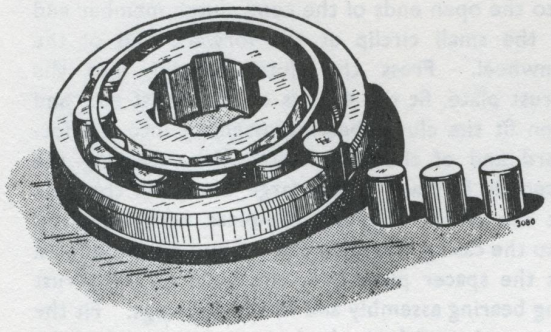


Fig. 24. *Assembling roller clutch*

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.

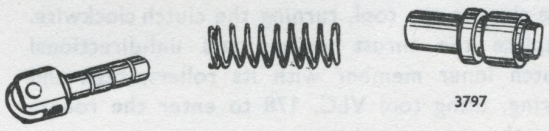


Fig. 25. *Oil pump components*

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. 7$\frac{1}{4}$ 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	$\frac{1}{4}$″±·00025″ (6·350±·006 mm.)	
Bore for pin in roller	$\frac{1}{4}$″+·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.

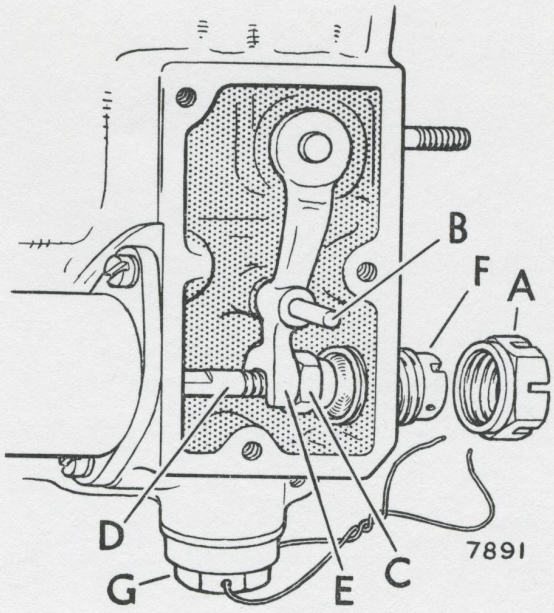


Fig. 26. *Stop pad adjustment*

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