# TRIUMPH

# HERALD 1200, 12/50, VITESSE AND SPITFIRE

# WORKSHOP MANUAL



## GROUP 2

*Comprising :*

# TRIUMPH

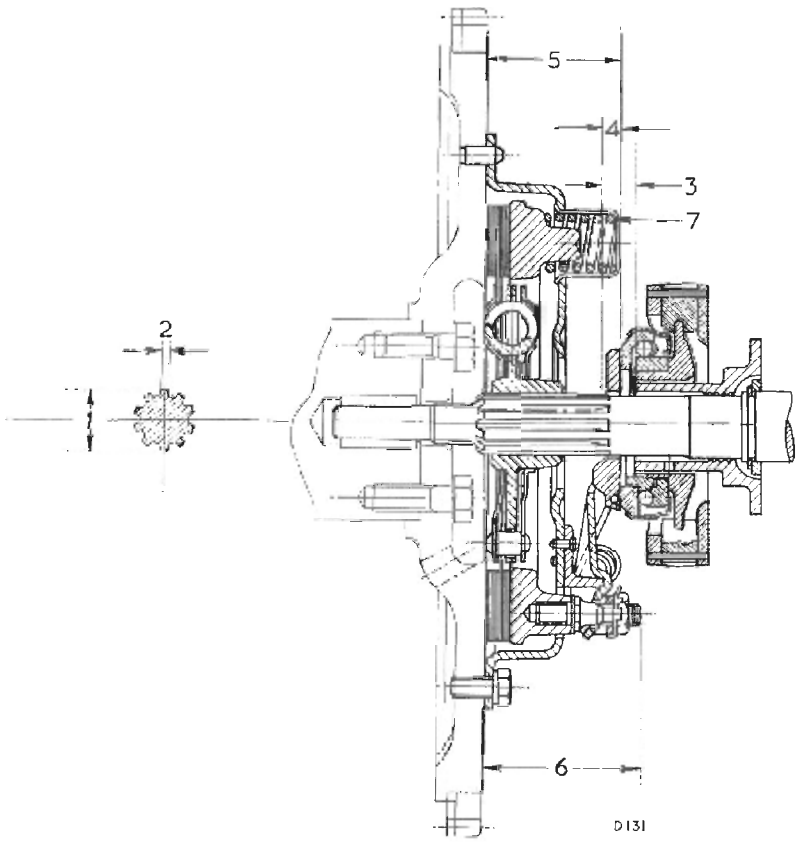
# HERALD 1200, 12/50, VITESSE

# and

# SPITFIRE MODELS

GROUP 2

CONTENTS




## CLUTCH DATA

| | |
|---|---|
| TYPE | 6A "Single Dry Plate" |
| OPERATION | Hydraulic |
| ADJUSTMENT | Self adjusting |
| DRIVEN PLATE | Belleville washer type, cushioned by white/light green springs |
| FACINGS | Mintex M19 |
| 1. Spline diameter O/D | 0·871″/0·873″ (22·12/22·17 mm.) |
| 2. Splines | 0·875″ (22·22 mm.) × 10 SAE splines |
| 3. Maximum travel available | 0·27″ (6·86 mm.) |
| 4. Minimum travel to release | 0·24″ (6·09 mm.) |
| 5. Release lever plate height | 1·83″ (46·48 mm.) using 0·305″ (7·797 mm.) gauge plate in place of driven plate |
| 6. Maximum height of adjusters | 2·22″ (56·39 mm.) at full release |
| 7. Thrust springs — 3 Dark Blue | 90/100 lbs. (40·82/45·36 kgs.) |
| 6 Red | 75/85 lbs. (34/38·5 kgs.) |

Fig. 1. Sectional view of the clutch (*Herald* 1200, 12,50 and Spitfire)

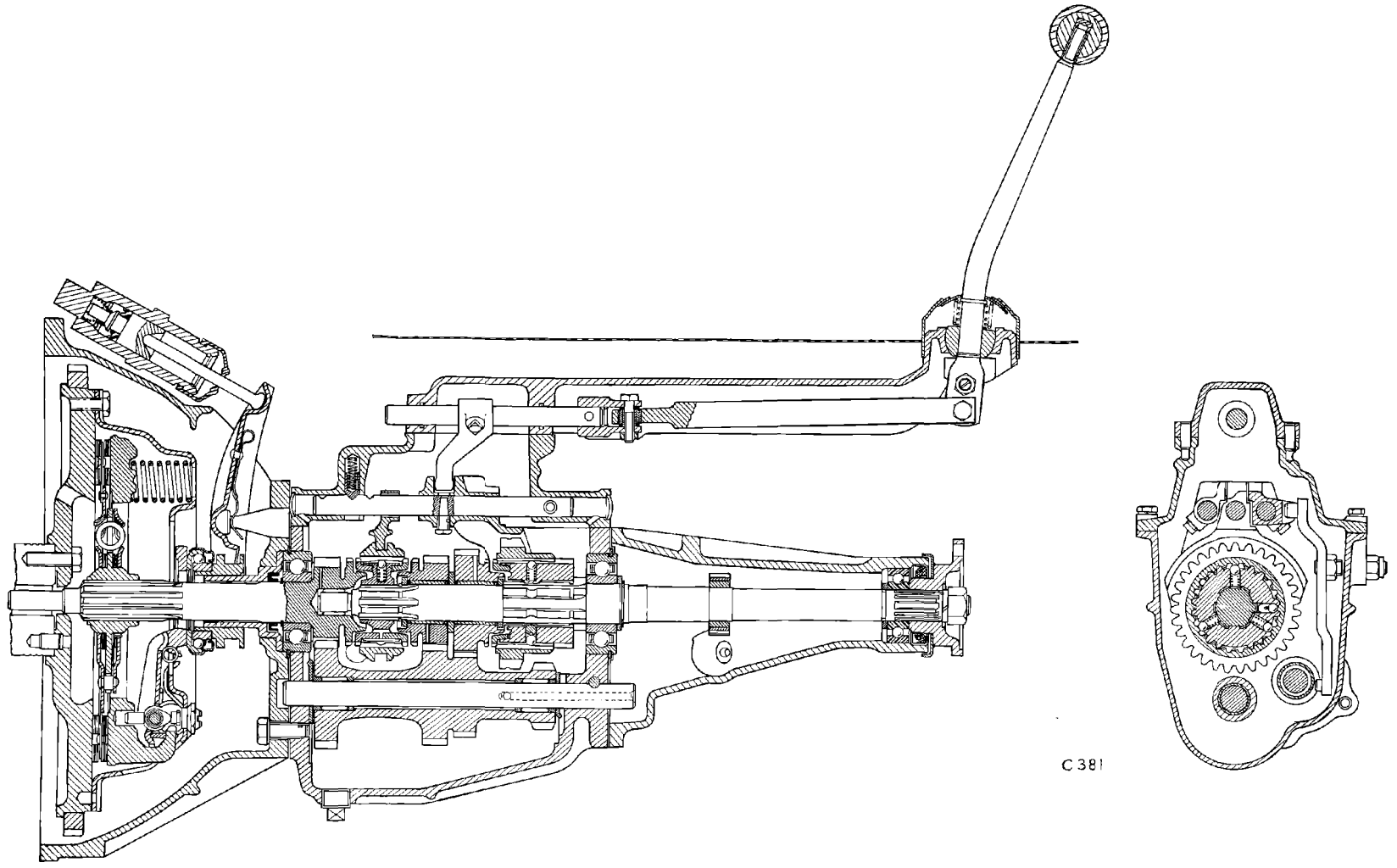
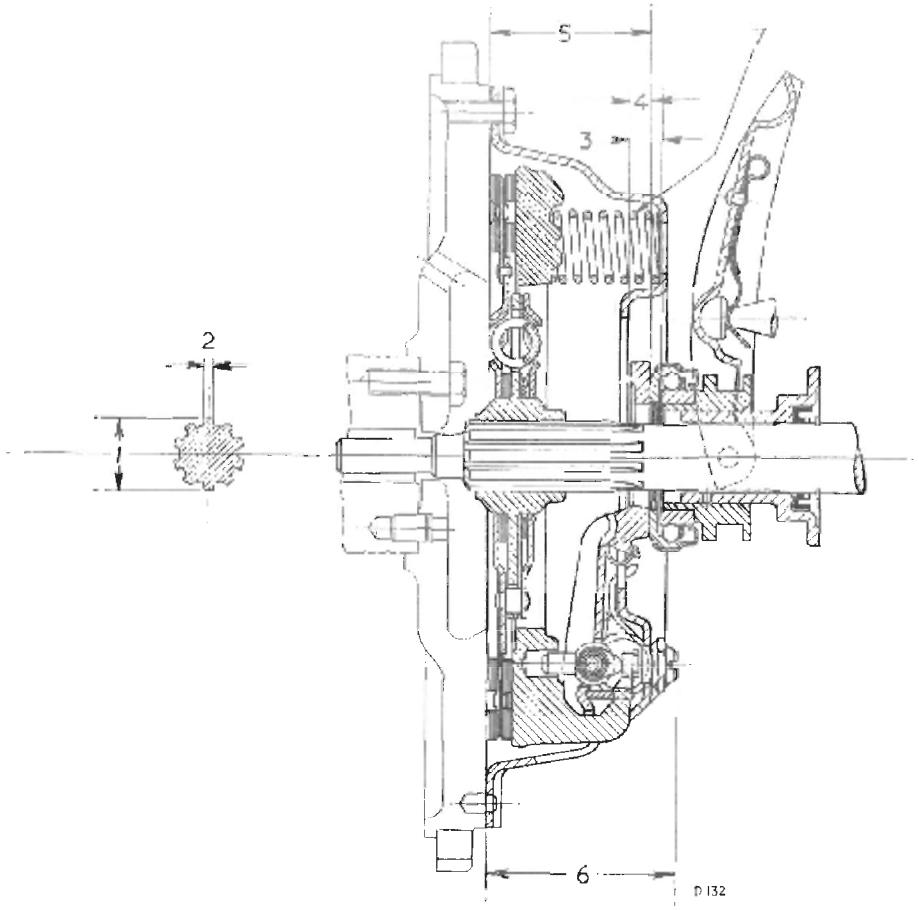



Fig. 2. Section of clutch (Vitesse) and gearbox unit. The gearbox is identical for the Herald 1200, 12/50, Vitesse and Spitfire




## CLUTCH DATA

| | |
|---|---|
| TYPE | 8A6 "Single Dry Plate" |
| OPERATION | Hydraulic |
| ADJUSTMENT | Self adjusting |
| DRIVEN PLATE | Belleville washer type, cushioned by white/light green springs |
| FACINGS | Wound yarn (RY2) |
| 1. Spline diameter (O/D) | 0·996″/0·998″ (25·3/25·35 mm.) |
| 2. Splines | 1·00″ (25·4 mm.) × 10 SAE splines |
| 3. Maximum travel available | 0·42″ (10·67 mm.) |
| 4. Minimum travel to release | 0·37″ (9·4 mm.) |
| 5. Release lever plate height | 2·18″ (53·54 mm.) using a 0·33″ (8·38 mm.) gauge plate in place of driven plate |
| 6. Maximum height of adjusters | 2·70″ (68·58 mm.) |
| 7. Thrust springs — 6 Light Grey | 195/205 lbs. (88·45/92·98 kgs.) |

**Fig. 3. Sectional view of the clutch (Vitesse)**

## MASTER CYLINDER OPERATION

**A. Clutch Driving Condition**

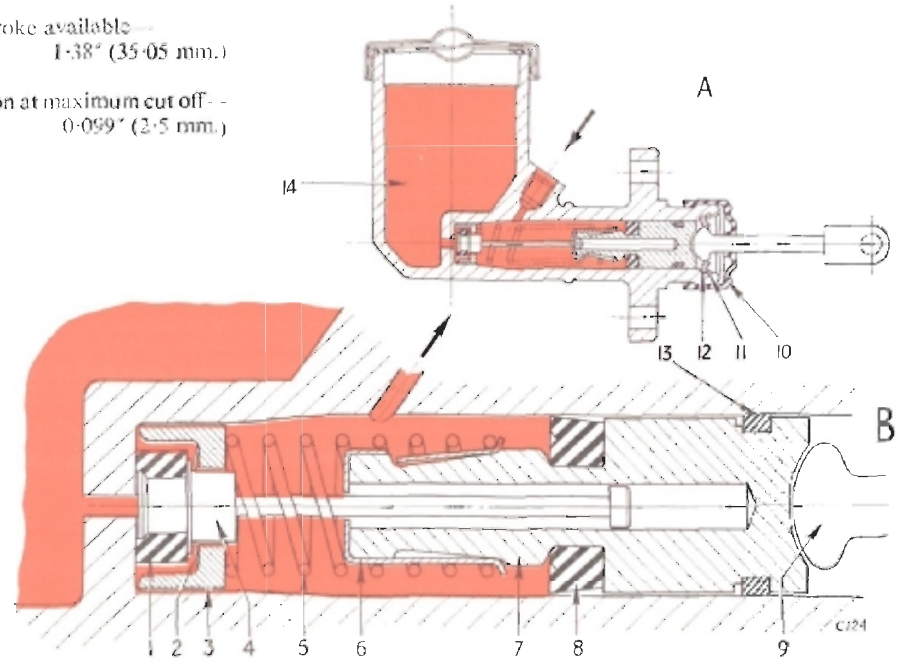
When the clutch pedal is released, the push rod (9) is returned to its stop (12) by the pedal return spring. This permits the plunger (7) to move rearwards under pressure of the spring (5). The flange on the end of the valve shank (4) contacts the spring retainer (6) and as the plunger continues to move rearwards, the valve shank (4) lifts the seal (1) from its seat on the end of the cylinder bore and compresses the spring (2). Hydraulic fluid can then flow past the three-legged distance piece (3) and seal (1) either to or from the reservoir.

**B. Clutch Released Condition**

Initial movement of the push rod (9) and plunger (7) releases the valve shank (4) and permits the spring (2) to press the valve shank (4) and seat (1) against its seat. This cuts off communication between the cylinder and reservoir. Continued movement of the plunger displaces fluid through the hydraulic pipelines and releases the clutch.

Maximum stroke available — 1·38″ (35·05 mm.)

Stroke position at maximum cut off — 0·099″ (2·5 mm.)




| | | |
|---|---|---|
| 1 Valve seal | 6 Spring retainer | 11 Circlip |
| 2 Spring (valve seal) | 7 Plunger | 12 Push rod stop |
| 3 Distance piece | 8 Plunger seal | 13 Plunger seal |
| 4 Valve shank | 9 Push rod | 14 Fluid reservoir |
| 5 Plunger return spring | 10 Dust cover | |

Fig. 4. Section through clutch master cylinder

## CLUTCH MASTER CYLINDER

**To Remove** (Fig. 5)

Proceed as follows:—

1. Empty the master cylinder through the clutch slave cylinder bleed nipple.
2. Pull back the rubber dust excluder.
3. Withdraw the clevis pin securing the push rod to the pedal.
4. Uncouple the hydraulic pipeline from the master cylinder.
5. Remove the bolts (16) from the master cylinder mounting flange and withdraw the unit from the bulkhead.

NOTE : Extreme cleanliness is essential when dealing with any part of the hydraulic system. Component parts should be cleaned in hydraulic fluid or alcohol.

**To Dismantle** (Fig. 6)

1. Remove the circlip (11) and the push rod stop (12) and push rod (9).
2. Withdraw the plunger (7) and recuperation valve assembly (19) from the cylinder bore.
3. Using a small screwdriver, lift the tag on the spring retainer (6) over the flanged end of the plunger (7) and detach the recuperating valve assembly.
4. Release the valve shank (4) from the spring retainer (6) by manoeuvring the flange on the stem through the eccentrically positioned hole in the end face of the spring retainer. The spring (5), distance piece (3) and spring (2) may now be withdrawn from the valve shank (4).
5. Remove the valve seal (1) from the shank (4) by carefully easing it off with the fingers.
6. Similarly, detach the rubber seals (8) and (13) from the piston grooves.

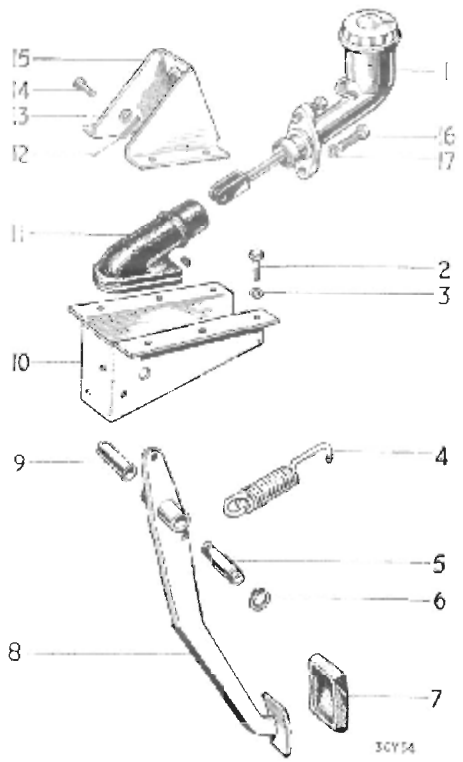
**To Re-assemble**

Reverse the dismantling procedure and note the following:—

1. When fitting the rubber seals, apply hydraulic fluid to ease their entry into the bore of the cylinder and ensure that their lips face forward.
2. Avoid trapping the spring (2) between the valve shank locating shoulder and the distance piece (3). The washer must be fitted with its domed side adjacent to the valve shank face.

**To Refit**

Reverse the removal operations, refill with hydraulic fluid and bleed the system as described on page 2·106.




| | | | |
|---|---|---|---|
| 1 | Master cylinder | 10 | Pedal bracket |
| 2 | Bolt | 11 | Rubber dust excluder |
| 3 | Spring washer | 12 | Split pin |
| 4 | Return spring | 13 | Plain washer |
| 5 | Pivot pin | 14 | Clevis pin |
| 6 | Circlip | 15 | Master cylinder bracket |
| 7 | Pedal rubber | 16 | Bolt |
| 8 | Pedal | 17 | Spring washer |
| 9 | Pedal pivot bush | | |

**Fig. 5. Exploded clutch pedal and bracket assembly**

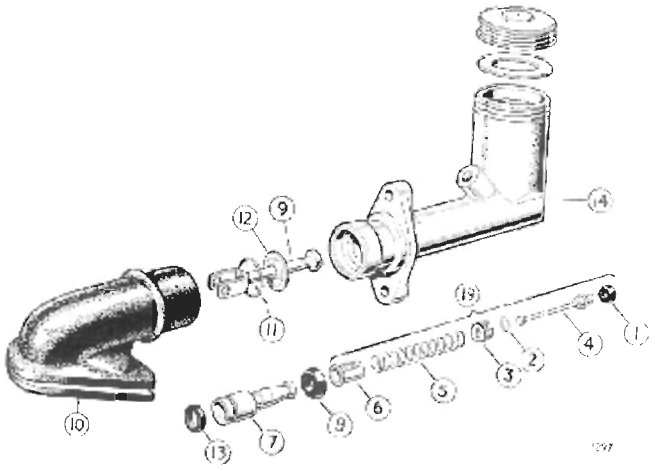



**Fig. 6. Exploded clutch master cylinder**
**Annotations are given under Fig. 4.**

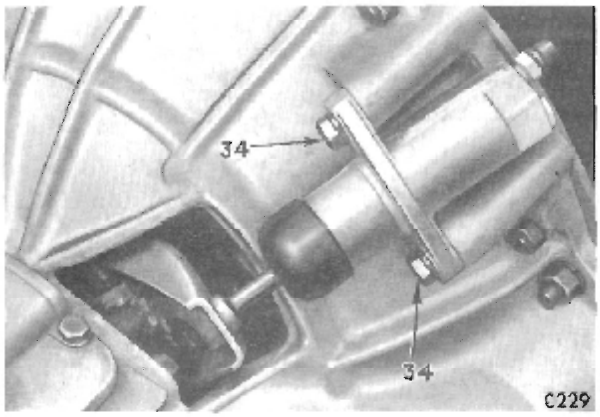



Fig. 7. Location of clutch slave cylinder (Vitesse)

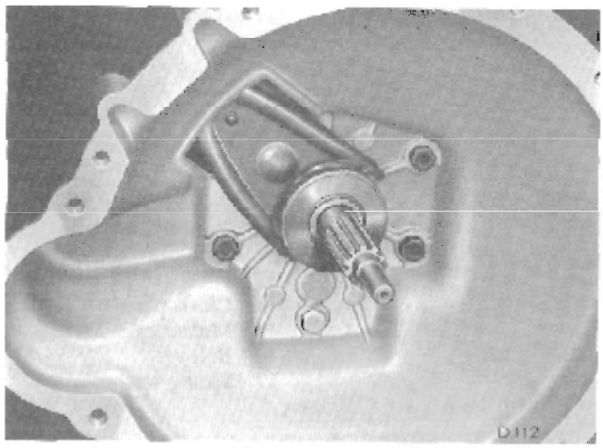



Fig. 8. Clutch release bearing (Vitesse)

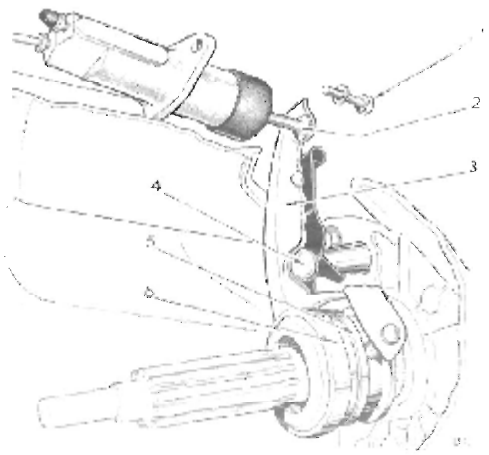



Fig. 9. Clutch release lever attachment (Vitesse)

## SLAVE CYLINDER (Fig. 12)

**To Remove**

Drain the hydraulic system by attaching a tube to the bleed nipple (25) and pumping the clutch pedal. Remove the tube and disconnect the hydraulic feed pipe (26).

Release the slave cylinder by removing the bolt/s (34).

**To Refit**

Reverse the removal procedure, ensuring that the push rod is correctly engaged in the piston cup. Re-connect the hydraulic feed pipe, refill and bleed the system.

**To Dismantle**

Remove the cover (32), circlip (31) and shake out the piston (30) and spring (28). Detach the seal (29) from the piston.

**To Re-assemble**

Lubricate the components with hydraulic fluid and assemble the seal (29) to the piston (30), placing the sealing lip towards the closed end of the cylinder (27). Insert the spring (28) and piston (30) into the cylinder bore. Spring the circlip (31) into position and re-attach the rubber cover (32).

**Bleeding the Hydraulic System**

The presence of air in the system will prevent the proper functioning of the clutch and will necessitate bleeding to expel the air.

During the bleeding operation, keep the reservoir topped-up with new brake fluid and ensure that the level does not fall below half full. If the reservoir is allowed to empty, air will be drawn into the system, necessitating re-bleeding.

With the aid of a second operator, bleed the system as follows:—

Wipe the bleed nipple clean, attach a length of rubber tubing to the nipple and allow the end of the tube to hang in a glass jar partly filled with brake fluid.

Unscrew the bleed nipple about a quarter turn, and, giving fast full strokes with a slight pause between each stroke, pump the clutch pedal until the clutch fluid entering the glass container is free from air bubbles.

IMPORTANT. Ensure that the piston returns to its maximum travel at the end of each stroke. A sticking piston will be obvious from the feel of the pedal.

Finish with a few slightly faster applications of the pedal, using the bottom half of the stroke, until it is apparent that all air has been excluded. Close the bleed screw during the last pedal application, or with the pedal fully depressed,

## CLUTCH RELEASE BEARING

**To Remove**

Referring to Fig. 11 for Herald 1200, 12/50 and Spitfire vehicles:— drive the pin (17) from the clutch housing and remove the operating lever (22). Drive out the pins (20) and release the bearing sleeve (15) by extracting the plugs (16). Withdraw the bearing (14) from the sleeve.

Referring to Fig. 9 for Vitesse vehicles:— remove the slave cylinder attachment bolts (1) and move the push rod (2) clear of the release lever (3). Unclip the lever from its spherical pivot pin (4), withdraw the bearing sleeve (5) and take off the bearing (6).

**To Refit**

Reverse the removal procedure.

## CLUTCH

**Removal**

Remove the gearbox as described on page 2·205. Progressively unscrew the clutch attachment setscrews and detach the cover assembly and driven plate from the flywheel face.

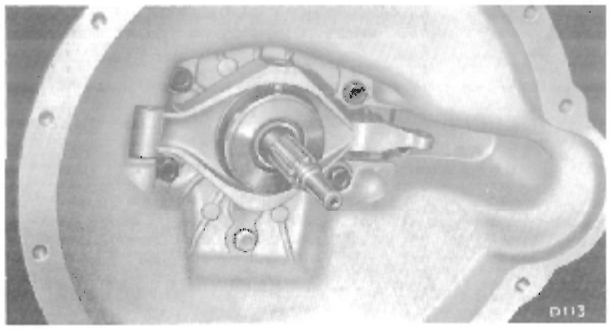


Fig. 10. Clutch release bearing and operating lever (Herald 1200, 12/50 and Spitfire)

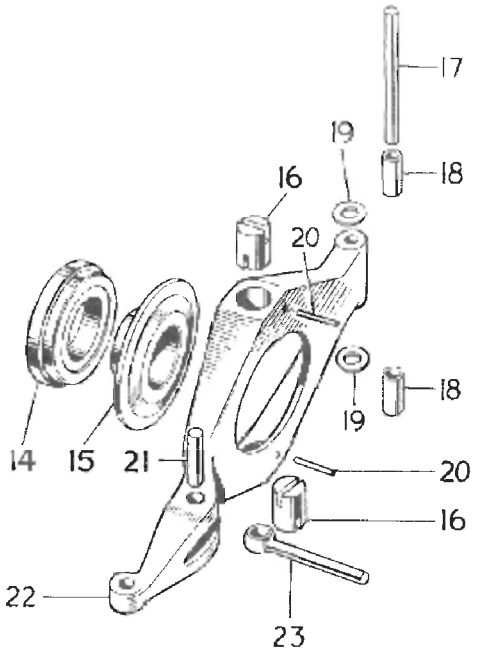



Fig. 11. Exploded operating lever assembly (Herald 1200, 12/50 and Spitfire)

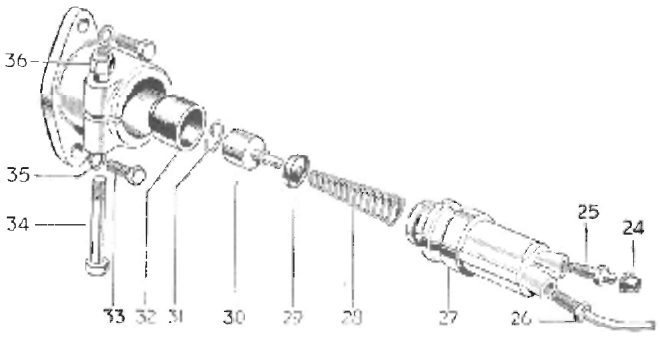
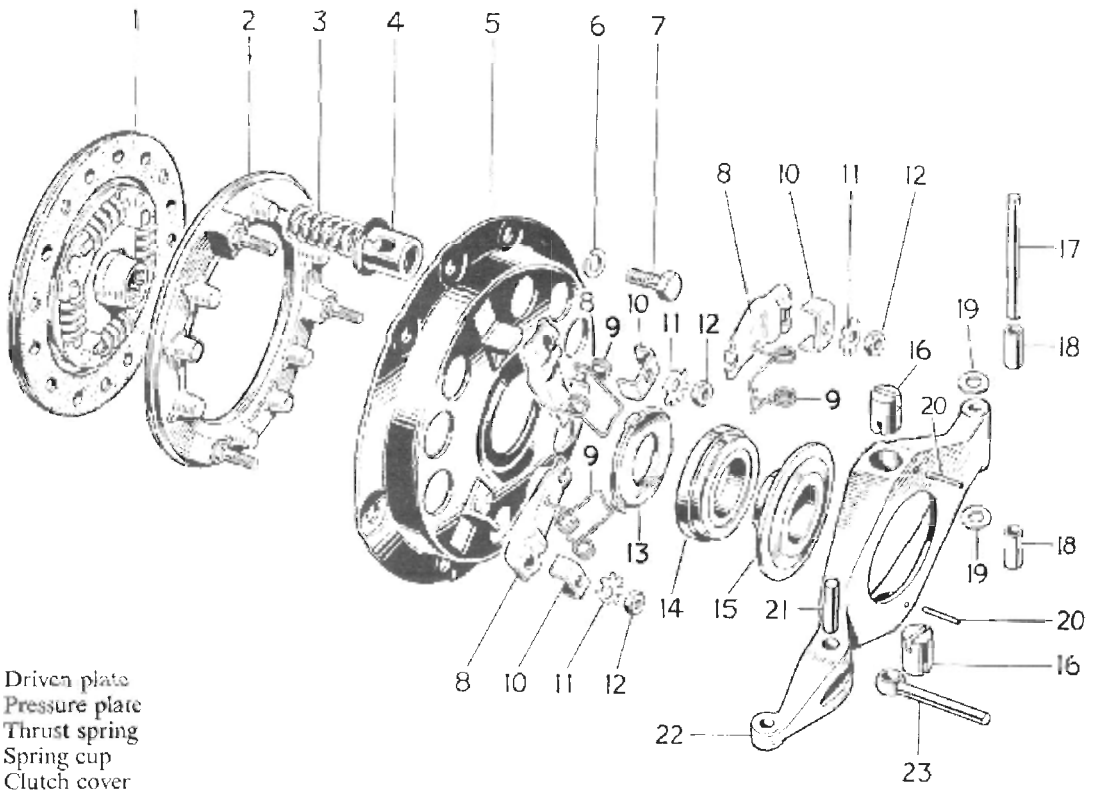



Fig. 12. Exploded slave cylinder details




1 Driven plate
2 Pressure plate
3 Thrust spring
4 Spring cup
5 Clutch cover
6 Spring washer
7 Setscrew
8 Toggle
9 Retaining spring
10 Bridge piece
11 Lockplate
12 Adjusting nut
13 Release lever plate
14 Release bearing
15 Bearing carrier
16 Thrust plugs
17 Hinge pin
18 Bush
19 Spacer washer
20 Lockpin
21 Push rod pin
22 Operating lever
23 Push rod

Fig. 13. Exploded clutch unit (Herald 1200, 12/50 and Spitfire)

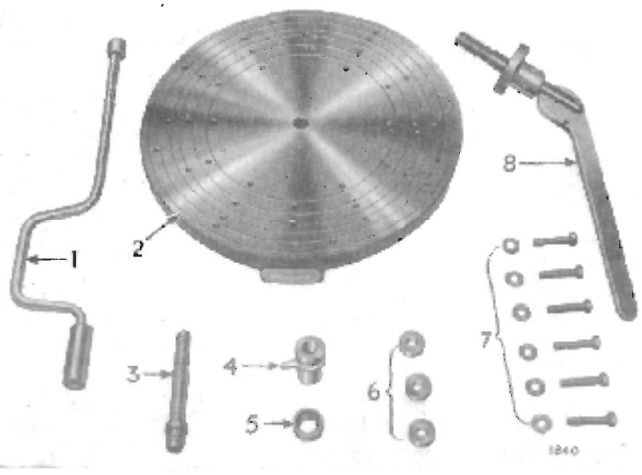
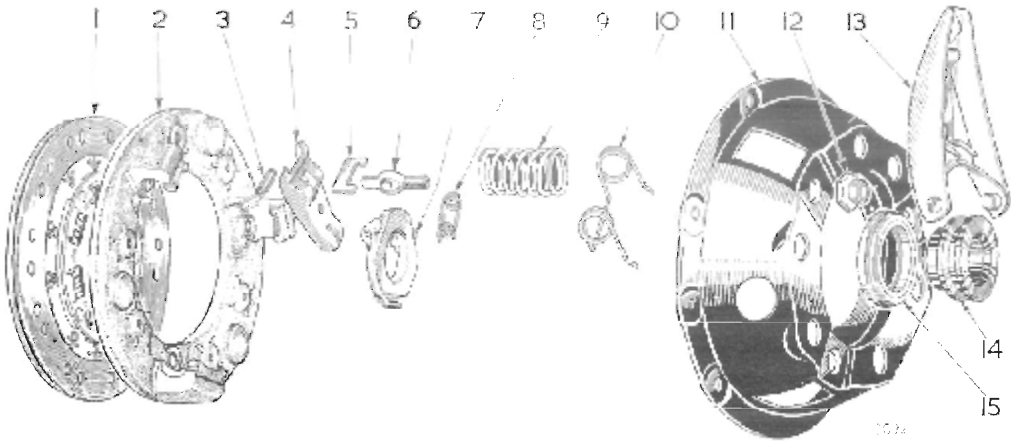



Fig. 14. Clutch assembly fixture No. 99A

### Dismantling (Fig. 14)

The Churchill clutch assembly fixture No. 99A is recommended for servicing the clutch units fitted to the Herald 1200, 12/50, Spitfire and Vitesse models. The method of dismantling is as follows:—

1. Position the spacers (6) on the baseplate and place the clutch unit over the spacers, with the release levers as near as possible over the spacers.
2. Mark the pressure plate, cover and toggles to facilitate re-assembling them to their original positions. Fit the operating handle (8) to the baseplate, and clamp the clutch unit by levering the handle. Secure the unit to the baseplate with six setscrews (7). Remove the operating handle.
3. Referring to Fig. 13, hold the release lever plate (13) down and detach the retaining springs (9). Remove the release lever plate.




1 Driven plate
2 Pressure plate
3 Toggle pin
4 Toggle
5 Strut
6 Eyebolt
7 Release lever plate
8 Release plate retainer spring
9 Thrust spring
10 Anti-rattle spring
11 Clutch cover
12 Adjusting nut
13 Operating lever
14 Bearing sleeve
15 Release bearing

**Fig. 15. Exploded clutch unit (Vitesse)**

4. Continue to dismantle the clutch as follows: -

(a) HERALD 1200, 12/50 AND SPITFIRE (Fig. 13)
Release the lockplates (11) and remove the nuts (12), lockplates (11), bridge pieces (10) and toggle levers (8). Progressively slacken the setscrews retaining the cover to the baseplate and lift off the cover (5), retainers (4), springs (9) and pressure plate (2).

(b) VITESSE (Fig. 15)
Break the staking on the adjusting nuts (12) and remove them. Progressively release the baseplate setscrews and detach the cover (11), toggle levers (4), eyebolts (6), pins (3), struts (5) and springs (9). Detach the pressure plate (2).

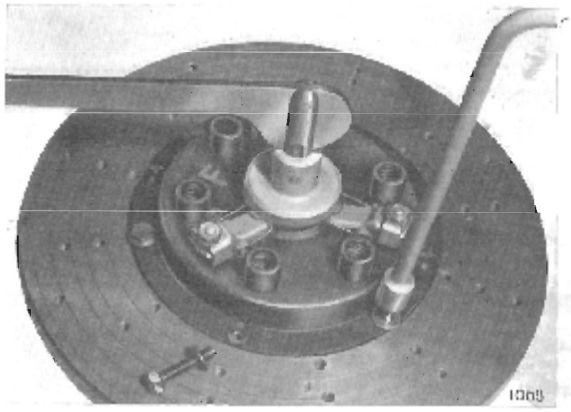


**Fig. 16 Attaching clutch unit to Churchill fixture (Herald and Spitfire).**

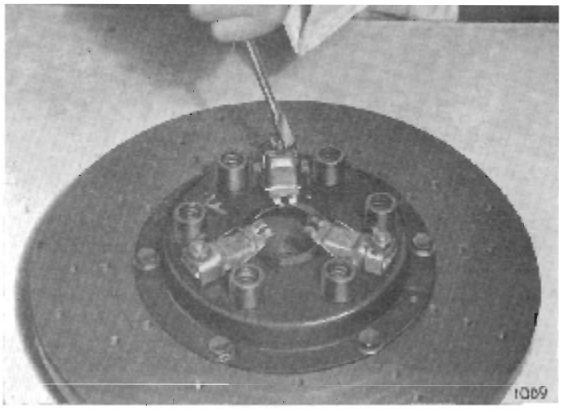


**Fig. 17 Releasing lockplates (Herald and Spitfire).**

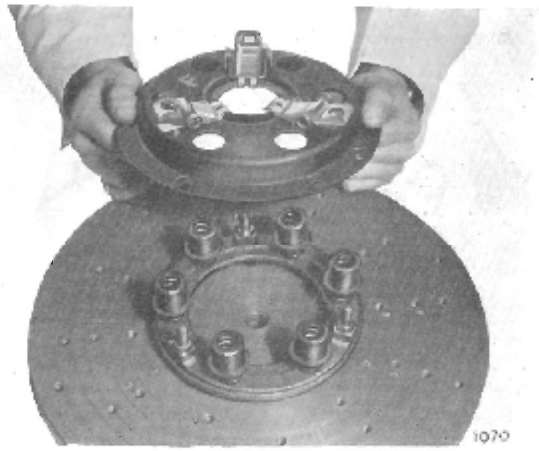


Fig. 18. Removing clutch cover assembly (Herald and Spitfire)

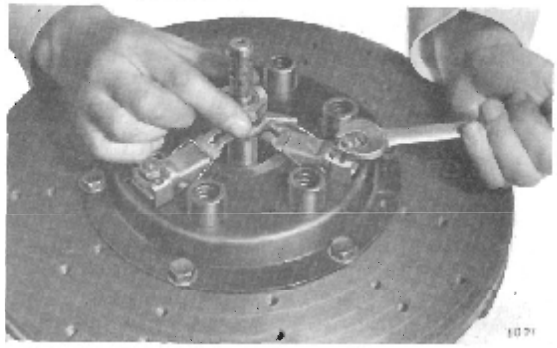


Fig. 19. Adjusting toggle height (Herald and Spitfire)

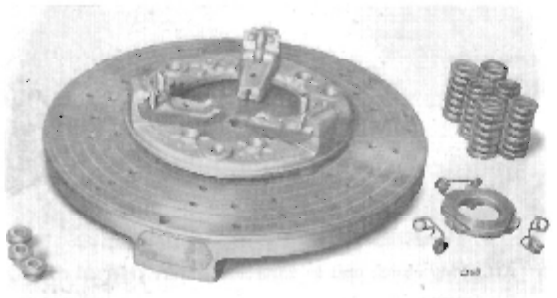


Fig. 20. Assembling toggles to pressure plate (Herald and Spitfire)

Fig. 21. Gauge finger fitted prior to adjusting toggle height (Vitesse)

**Re-assembly**

(a) HERALD 1200, 12/50 AND SPITFIRE

Position the pressure plate (2) on the baseplate, with the distance pieces positioned under the lever fulcrum studs. Fit the springs (3), cups (4) and cover (5). Tighten the cover down to the baseplate.

Assemble the toggle levers (8), bridge pieces (10), lockplates (11) and nuts (12). Fit the gauge finger (4), Fig. 14, with adaptor No. 5 and adjust the nuts (12) until the gauge finger just contacts the ends of each lever (8), Fig. 19. Remove the gauge and stud, fit the operating lever and operate the clutch a few times. Refit the stud and gauge, re-check the lever height and adjust if necessary. When correctly adjusted, bend up the lock-plates (11) against the nuts (12). Fit the release plate (13) and secure it with the springs (9). Check the run-out of the release plate with a clock gauge as shown on Fig. 23. This must not exceed 0·015" (0·38 mm.). If satisfactory, remove the clutch from the baseplate.

(b) VITESSE

Position the pressure plate (2) on the baseplate with the distance pieces positioned under the lever fulcrum studs. Assemble the pressure plate (2), springs (9), eyebolts (6), pins (3), studs (5), toggles (4), anti-rattle springs (10) and fit the cover (11). Secure the cover to the baseplate with setscrews and fit the nuts (12) to the eyebolt threads (6).

Adjust the toggle height as described under "Adjustment" and fit the release plate (7) and springs (8). Check the run-out of the release plate with a clock gauge (Fig. 23). This must not exceed 0·015" (0·38 mm.). If satisfactory, remove the clutch from the baseplate.

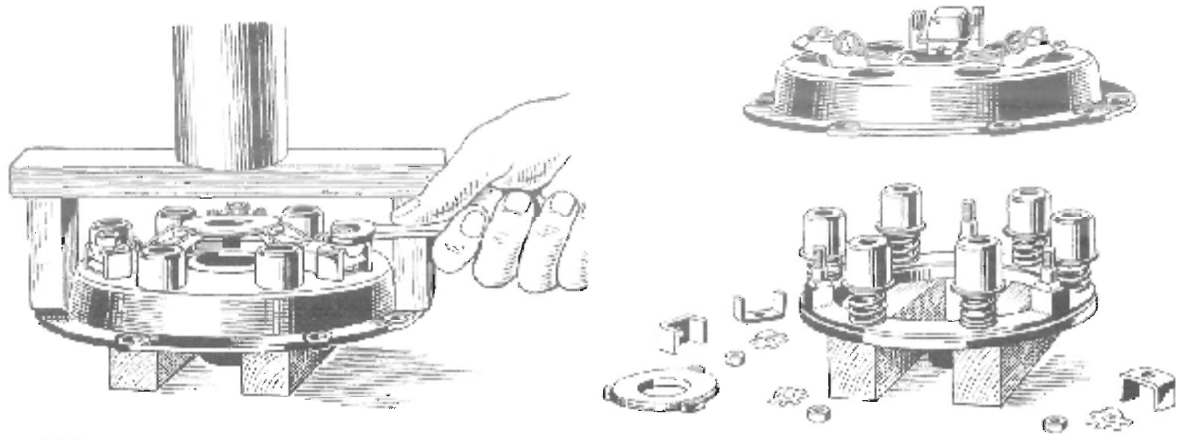


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Fig. 22. Using a press and wood blocks as an alternative to Churchill fixture No. 99A

### Refitting the Clutch Unit

Check the clutch driven plate for run-out by mounting it on a mandrel between lathe centres and rotating it slowly whilst the plunger of a dial indicator bears against the outside face of the friction lining.

The maximum run-out must not exceed 0·035" (0·23 mm.). Prise the plate in the required direction until the run-out is within specified limits.

Check the flywheel clutch face for satisfactory condition, and refit the clutch unit as follows:-

With the longer boss of the splined hub towards the gearbox, offer the driven plate up to the flywheel and centralise it by using a special shaft which fits the splined bore of the hub and locates in a bush at the rear of the crankshaft. A discarded input shaft sawn off to suit can be conveniently used for this purpose.

Locate the cover assembly over the two dowels and secure the cover pressing by evenly tightening the setscrews to the correct torque. Remove the centralising shaft.

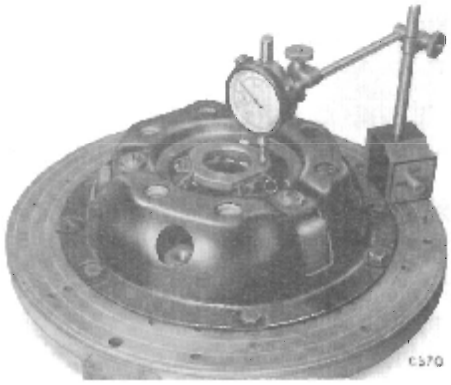

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Fig. 23. Using a dial gauge to check run-out of release plate

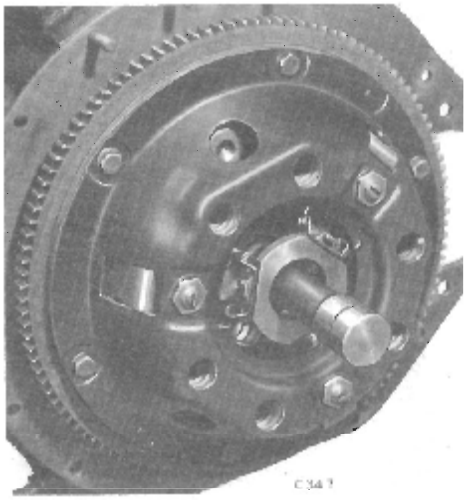

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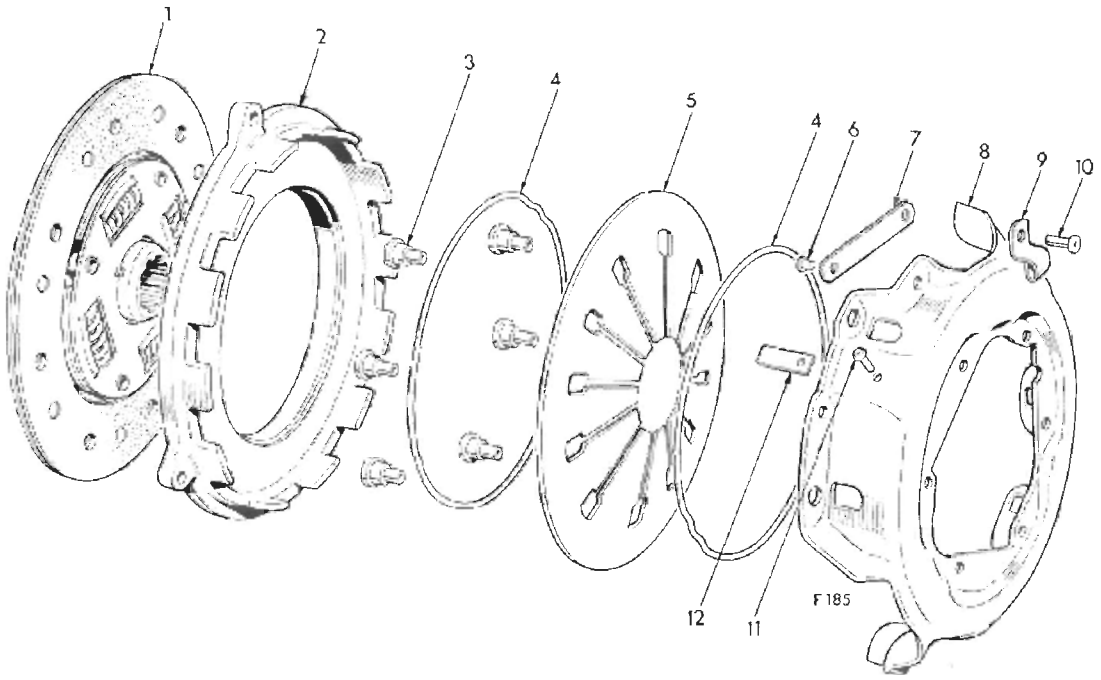
Fig. 24. Centralizing the clutch driven plate




1 Driven plate
2 Pressure plate
3 Rivet
4 Fulcrum ring
5 Diaphragm spring
6 Rivet
7 Drive strap
8 Cover pressing
9 Retaining clip
10 Rivet
11 Rivet
12 Balance weight

Fig. 25. Clutch details

## SPITFIRE MK. II

### CLUTCH UNIT

The diaphragm spring clutch unit fitted to the Spitfire Mk. II must not be dismantled for any reason.

Should any fault develop in the unit, a complete replacement assembly must be fitted.

## DIMENSIONS AND TOLERANCES

| PARTS AND DESCRIPTION | DIMENSIONS NEW ins. | DIMENSIONS NEW mm. | CLEARANCE NEW ins. | CLEARANCE NEW mm. | REMARKS |
|---|---|---|---|---|---|
| **Input Shaft** | | | | | |
| Input shaft spigot bush. Length .. | 1·06 | 26·924 | | | |
| Bore in crankshaft .. .. .. | 0·754 | 19·1516 | 0·002 | 0·0508 | |
| | 0·753 | 19·1262 | 0·0005 | 0·0127 | |
| Number of splines .. .. .. | 10 | | | | |
| Dia. of journal for front ball race .. | 1·0005 | 25·4127 | —0·0008 | —0·0103 | |
| | 1·0001 | 25·4025 | —0·0001 | —0·0025 | |
| Input shaft spigot race ball dia. .. | 0·688 | 17·475 | | | Torrington needle roller bearing. |
| | 0·687 | 17·449 | | | Press fit in bore. |
| **Mainshaft** | | | | | |
| Spigot dia. .. .. .. .. | 0·5000 | 12·7 | | | Runs in Torrington needle roller bearing. |
| | 0·4995 | 12·6873 | | | |
| 2nd/3rd gear bush journal dia. .. | 0·8738 | 22·1945 | 0·0027 | 0·0686 | |
| | 0·8733 | 22·1818 | 0·0012 | 0·0305 | |
| Centre ball race journal dia. .. .. | 1·0004 | 25·4101 | +0·0002 | 0·0051 | Transition fit |
| | 1·0000 | 25·4 | —0·0002 | —0·0051 | |
| Mainshaft 2nd/3rd gear circlip groove width .. .. .. .. | 0·079 | 2·0066 | 0·010 | 0·254 | |
| | 0·076 | 1·9304 | 0·004 | 0·1016 | |
| Mainshaft 2nd/3rd gear circlip groove bottom dia. .. .. .. | 0·795 | 20·193 | | | |
| | 0·790 | 20·0660 | | | |
| Mainshaft length between front end of 1st gear splines and front face of 2nd/3rd gear circlip groove .. | 2·609 | 66·2686 | | | |
| | 2·607 | 66·2178 | | | |
| Mainshaft rear ball race journal dia. .. | 0·7504 | 19·067 | 0·0006 | 0·0152 | |
| | 0·7501 | 19·055 | 0·0001 | 0·0025 | |
| **Mainshaft Gears and Bushes** | | | | | |
| 3rd speed gear—I.D. .. .. .. | 1·0945 | 27·8003 | 0·0037 | 0·0940 | |
| | 1·0935 | 27·7749 | 0·0007 | 0·0178 | |
| Width of hub between thrust faces .. | 0·996 | 25·2984 | | | |
| | 0·998 | 25·3492 | | | |
| 3rd speed bush—I.D. .. .. .. | 0·876 | 22·2504 | 0·0027 | 0·0686 | |
| | 0·875 | 22·2250 | 0·0012 | 0·0305 | |
| 3rd speed bush—O.D. .. .. | 1·0928 | 27·7571 | 0·0037 | 0·0940 | |
| | 1·0908 | 27·7063 | 0·0007 | 0·0178 | |
| Length of bush .. .. .. | 1·002 | 25·4508 | 0·002 | 0·0508 | End float of gear on bush. |
| | 1·000 | 25·4 | 0·006 | 0·1524 | |
| 2nd speed gear—I.D. .. .. | 1·0945 | 27·8003 | 0·0027 | 0·0686 | |
| | 1·0935 | 27·7749 | 0·0012 | 0·0305 | |
| Width of hub between thrust faces .. | 1·121 | 28·4734 | | | |
| | 1·123 | 28·5242 | | | |
| 2nd speed bush—I.D. .. .. | 0·876 | 22·2504 | 0·0027 | 0·0686 | |
| | 0·875 | 22·2250 | 0·0012 | 0·0305 | |
| 2nd speed bush—O.D. .. .. | 1·0928 | 27·7571 | —0·0037 | —0·0940 | |
| | 1·0908 | 27·7063 | —0·0007 | —0·0178 | |

*The minus sign indicates an interference fit*

GEARBOX — DIMENSIONS AND TOLERANCES — continued

| PARTS AND DESCRIPTION | DIMENSIONS NEW ins. | DIMENSIONS NEW mm. | CLEARANCE NEW ins. | CLEARANCE NEW mm. | REMARKS |
|---|---|---|---|---|---|
| HERALD 1200, 12/50 & SPITFIRE | | | | | |
| Countershaft gear cluster bore—both ends | 0·7815 | 19·85 | | | |
| | 0·7805 | 19·825 | | | |
| Depth of bore (rear) | 1·53 | 38·862 | | | |
| Depth of bore (front) | 1·44 | 36·576 | | | |
| VITESSE | | | | | |
| Countershaft gear cluster bore– both ends | 0·8434 | 21·3224 | | | |
| | 0·8439 | 21·4351 | | | |
| Depth of bore (rear) | 1·025 | 26·035 | | | |
| Depth of bore (front) | 0·962 | 24·4348 | | | |
| **Clutch Release Bearing Details** | | | | | |
| O.D. front cover extension | 1·249 | 31·725 | ·0045 | ·1143 | |
| | 1·247 | 21·675 | 0·0015 | 0·0381 | |
| Release bearing sleeve I.D. | 1·2515 | 31·788 | 0·0035 | 0·0889 | |
| | 1·2505 | 31·7627 | 0·0015 | 0·0381 | |
| Release bearing sleeve journal O.D. | 1·5007 | 38·1177 | 0·0012 | 0·03048 | |
| | 1·5002 | 38·1051 | 0·0002 | 0·00508 | |
| Clutch release bearing I.D. | 1·500 | 38·1 | 0·0012 | 0·03048 | |
| | 1·4995 | 38·0873 | 0·0002 | 0·00508 | |
| Clutch release bearing—O.D. | 2·625 | 66·675 | | | |
| —Length | 0·670 | 17·018 | | | |
| **Ball and Needle Roller Bearing Details** | | | 0·0035 | 0·0889 | |
| Front and centre ball races— | | | | | |
| Hoffman MS. 10K.—O.D. | 2·4995 | 63·487 | Nil | Nil | |
| | 2·4990 | 63·475 | ·001 | ·0254 | |
| I.D. | 1·0002 | 25·405 | ·0008 | ·02032 | |
| | 0·9997 | 25·392 | ·0001 | ·00254 | Transition fit. |
| Mainshaft spigot bearing | | | | | |
| Torrington needle roller No. B.810 : | | | | | |
| I.D. | 0·5 | 12·7 | | | |
| O.D. | 0·6875 | 17·4625 | | | |
| Length | 0·625 | 15·875 | | | Stamped end must face outwards. |
| Depth of press fit into constant pinion shaft end face | 0·47 | 11·938 | | | |
| Rear extension ballrace | | | | | |
| Hoffman LS.8—O.D. | 1·8747 | 47·617 | −0·001 | −0·0254 | |
| | 1·8742 | 47·605 | −0·000 | −0·0000 | |
| —I.D. | 0·7502 | 19·055 | −0·0006 | −0·0152 | |
| | 0·7498 | 19·045 | −0·000 | −0·0025 | |

GEARBOX — DIMENSIONS AND TOLERANCES — continued

| PARTS AND DESCRIPTION | DIMENSIONS NEW ins. | DIMENSIONS NEW mm. | CLEARANCE NEW ins. | CLEARANCE NEW mm. | REMARKS |
|---|---|---|---|---|---|
| **Mainshaft Gears and Bushes—continued** | | | | | |
| Length of bush | 1·127 | 28·6258 | 0·002 | 0·0508 | End float of gear on bush. |
| | 1·125 | 28·575 | 0·006 | 0·1524 | |
| 2nd/3rd gear thrust washer | 0·154 | 3·9116 | | | |
| | 0·152 | 3·8608 | | | |
| 2nd gear thrust washer | 0·124 | 3·1496 | | | |
| | 0·122 | 3·0988 | | | |
| 3rd gear circlip washer | 0·124 | 3·1496 | | | |
| | 0·122 | 3·0988 | | | |
| 2nd/3rd gear mainshaft circlip thickness | 0·072 | 1·8288 | 0·010 | 0·254 | |
| | 0·069 | 1·7526 | 0·004 | 0·1016 | |
| 2nd/3rd mainshaft circlip—I.D. | 0·79 | 20·066 | | | |
| 2nd/3rd mainshaft circlip—O.D. | 0·94 | 23·876 | | | |
| Mainshaft maximum permissible end float of 2nd/3rd gears and bushes, thrust washers and circlip on mainshaft | 0·004 | 0·1016 | 0·012 | 0·3048 | Recommended end float 0·004" to 0·010" (0·1016 to 0·254 mm.). Obtain if necessary by selective assembly of components. |
| | 0·019 | 0·4824 | 0·004 | 0·1016 | |
| Hub width between thrust faces | 0·849 | 21·5646 | | | |
| | 0·839 | 21·3106 | | | |
| **Reverse Gear** | | | | | |
| Pinion—I.D. bush | 0·6580 | 16·7132 | 0·003 | 0·0762 | |
| | 0·6573 | 16·6954 | 0·0018 | 0·04572 | |
| Reverse gear spindle—Main dia. | 0·6555 | 16·6497 | 0·003 | 0·0762 | |
| | 0·6550 | 16·6370 | 0·0018 | 0·04572 | |
| End dia. | 0·5618 | 14·2697 | 0·0015 | 0·0381 | |
| | 0·5613 | 14·2570 | 0·0002 | 0·0051 | |
| **Countershaft and Gears** | | | | | |
| Countershaft O.D. | 0·6555 | 16·6497 | 0·003 | 0·0762 | |
| | 0·6550 | 16·6370 | 0·018 | 0·0457 | |
| Countershaft –Length | 8·75 | 222·25 | | | |
| Countershaft bushes—Length | 1·385 | 35·18 | | | |
| | 1·365 | 34·67 | | | |
| I.D. Bushes—Countershaft gears | 0·6580 | 16·713 | 0·003 | 0·0762 | |
| | 0·6573 | 16·6954 | 0·018 | 0·0457 | |
| Distance between end thrust faces | 5·971 | 151·6634 | | | |
| | 5·969 | 151·6126 | | | |
| Thickness of front thrust washer | 0·125 | 3·175 | | | |
| | 0·123 | 3·1242 | | | |
| Thickness of rear thrust washer | 0·068 | 1·7272 | | | |
| | 0·066 | 1·6764 | | | |
| Thickness of rear rotating thrust washer | 0·0665 | 1·6891 | | | |
| | 0·0635 | 1·6129 | | | |
| Overall permissible end float | | | 0·0125 | 0·3125 | Obtain if necessary by selective assembly of thrust washers. |
| | | | 0·0015 | 0·0381 | |

# EXPLODED ARRANGEMENT OF GEARBOX DETAILS

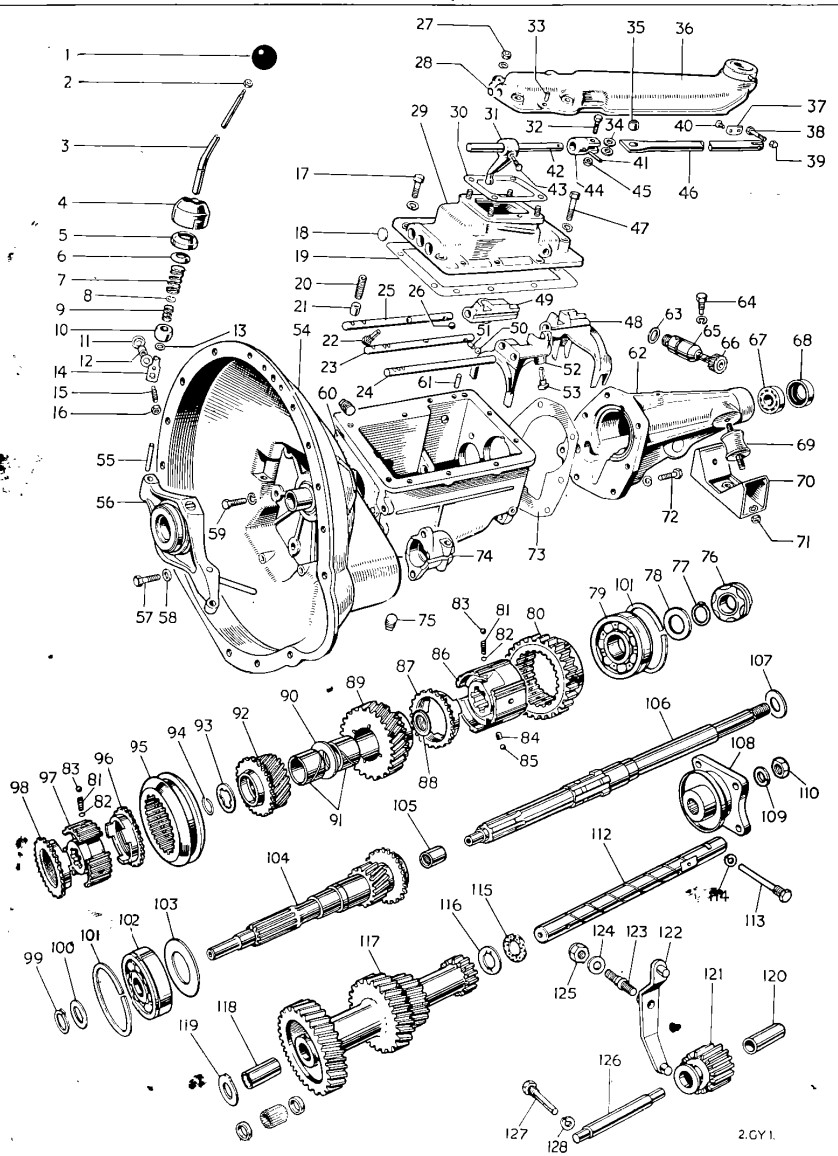



Fig. 1. Exploded Arrangement of Gearbox Details

**Key to Fig. 1**

1 Knob
2 Locknut
3 Gear change lever
4 Cover
5 Shield
6 Plate
7 Spring
8 Circlip
9 Spring
10 Nylon sphere
11 Stepped nylon washer
12 Bush
13 Washer
14 Lever end
15 Reverse stop pin
16 Locknut
17 Bolt
18 Welch plug
19 Gasket
20 Spring
21 Plunger
22 Taper locking pin
23 1st/2nd selector shaft
24 3rd/top selector shaft
25 Reverse selector shaft
26 Interlock ball
27 Nut
28 Rubber "O" ring
29 Top cover
30 Gasket
31 Selector ball-end
32 Bolt
33 Dowel
34 Washer
35 Bonded rubber bush
36 Gear change extension
37 Reverse stop
38 Bolt
39 Nyloc nut
40 Screw
41 Mills pin
42 Remote control shaft (front)
43 Taper locking pin
44 Fork
45 Nut
46 Remote control shaft (rear)
47 Bolt
48 1st/2nd selector fork
49 Reverse selector
50 Interlock ball
51 Interlock plunger
52 Top/3rd selector fork
53 Taper locking pin
54 Clutch housing
55 Pin
56 Clutch release mechanism
57 Wedgelock bolt
58 Plain washer
59 Bolt
60 Gasket
61 Dowel
62 Rear extension
63 Rubber "O" ring
64 Peg bolt
65 Speedo drive gear housing
66 Speedo drive gear
67 Extension ball race
68 Oil seal
69 Gearbox mounting rubber
70 Mounting bracket
71 Nut
72 Bolt
73 Gasket
74 Clutch slave cylinder bracket
75 Sump plug
76 Speedo driving gear
77 Circlip
78 Distance washer
79 Ball race
80 1st speed gear
81 Spring
82 Shim
83 Synchromesh ball
84 Plunger
85 Ball
86 2nd speed synchro hub
87 2nd speed synchro cup
88 Thrust washer
89 2nd speed mainshaft gear
90 Thrust washer
91 Bushes
92 3rd speed mainshaft gear
93 Thrust washer
94 Circlip
95 3rd/top synchro sleeve
96 3rd speed synchro cup
97 3rd/top inner synchro hub
98 Top synchro cup
99 Circlip
100 Distance washer
101 Circlip
102 Ball race
103 Oil deflector
104 Input shaft
105 Torrington needle roller bearing
106 Mainshaft
107 Distance washer
108 Driving flange
109 Spring washer
110 Nut
112 Countershaft
113 Peg bolt
114 Spring Washer
115 Rear fixed thrust washer
116 Rear rotating thrust washer
117 Countershaft gear cluster
118 Countershaft bush
119 Front fixed thrust washer (Vitesse has needle rollers and retaining rings)
120 Reverse gear bush
121 Reverse gear
122 Reverse gear actuator
123 Actuator pivot
124 Plain washer
125 Nyloc nut
126 Reverse gear shaft
127 Reverse shaft retaining bolt.
128 Spring washer

## GEARBOX REMOVAL

### To Remove Gearbox Leaving Engine in Position

Raise the vehicle on a ramp or support it on axle stands. Disconnect the battery, drain the gearbox and remove the front seats and carpets.

Referring to Fig. 2, release the casting (2), fitted only to the Spitfire, by removing the bolts (1) and (3) and by detaching the tachometer drive cable from the instrument.

The following instructions are common to all models:—

Remove the gear lever knob and grommet (4).

Release the gearbox cover (7) by removing the fasteners (5), and (6) and three screws on the engine side of the bulkhead.

Remove the attachments (8), withdraw the slave cylinder (9) and allow it to hang on its pipe (10).

Take out the bolts (11) and completely remove the propeller shaft.

Release the front exhaust pipe from the manifold and clutch housing.

Remove the starter motor and release the speedo drive (12) from the gearbox extension.

Remove the nuts (13), lift off gear change extension (14) and fit a cardboard cover to prevent the entry of foreign matter.

Remove the nuts (15), jack up under the sump until the gearbox extension clears the mounting bracket and take off the mountings (16).

Remove the clutch housing flange attachments (17) and withdraw the gearbox.

### To Refit

Reverse the removal procedure.

IMPORTANT: Do not allow the gearbox to hang on the clutch spigot shaft whilst fitting it to the engine.

Refill the gearbox with oil.

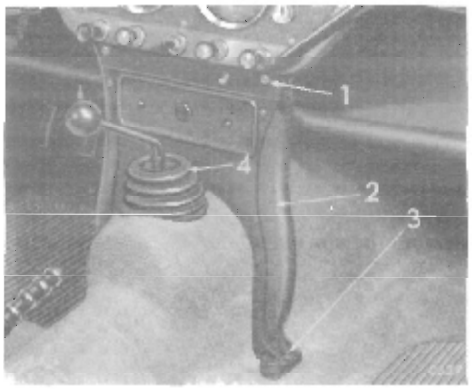



Fig. 2. Spitfire facia support attachments

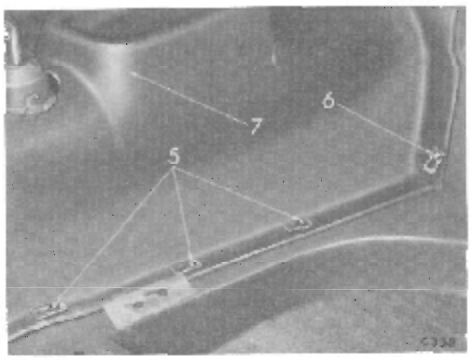



Fig. 3. Gearbox cover fixings

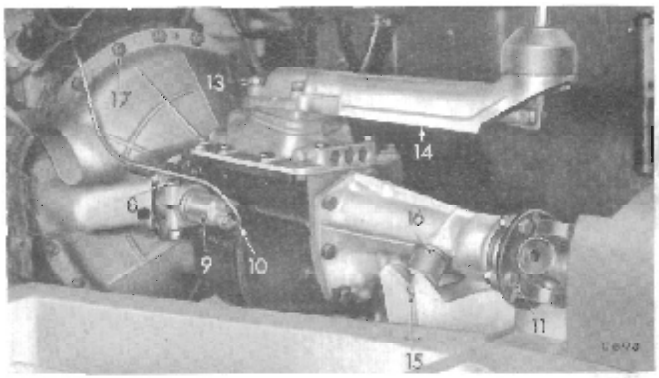



Fig. 4. Herald 1200, 12/50 and Spitfire gearbox attachments

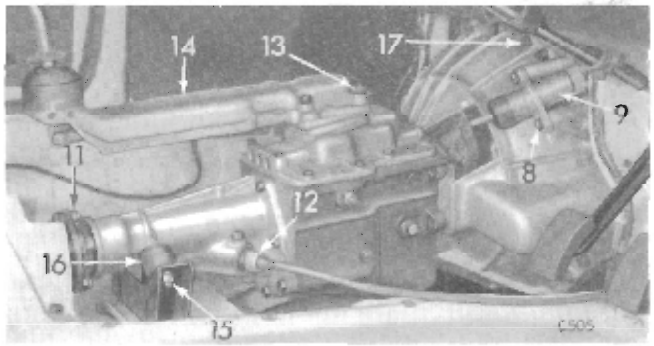



Fig. 5. Vitesse gearbox attachments

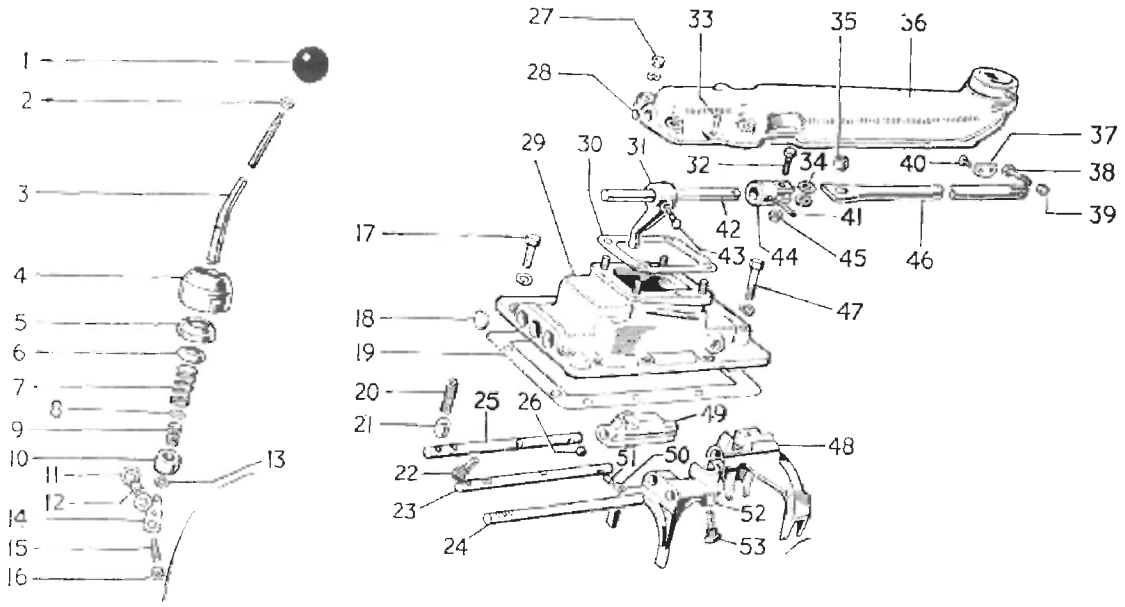



Fig. 6. Exploded top cover details

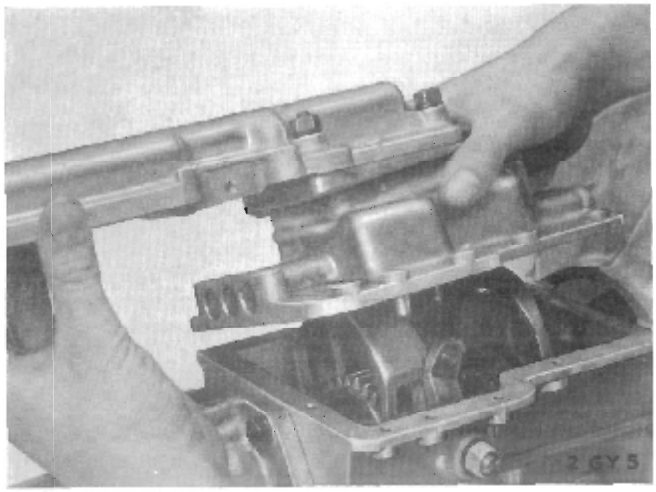



Fig. 7. Removing top cover

## DISMANTLING OPERATIONS

**Top Cover**

Withdraw the bolts (17), (47) lift off the top cover (29) and joint washer (19).

Remove the nuts (27) and the spring washers then lift off the extension (36) and the paper joint (30).

Remove the Nyloc nut (39) and bolt (38), releasing the shaft (46) from the gear change lever (3). Remove gear lever knob (1) by releasing locknut (2) and unscrewing knob.

Release cap (4) as shown on Fig. 9. Lift the lever assembly out of the extension and remove the cups (5) and (6), together with the outer spring (7).

Remove the snap ring (8) from the gear lever and detach the inner spring (9) and Nylon sphere (10). Detach the reverse stop plate (37) by removing the two countersunk screws (40). Unscrew reverse stop bolt (15) from gear lever.

Remove the threaded taper locking pin (43) and withdraw the shaft (42) from the extension casing (36) and selector (31).

Remove the rubber 'O' rings from the extension casing bore (Fig. 11).

Detach the locknut (45) and unscrew the pivot bolt (32) from the coupling fork (44). Withdraw the shaft (46) from the coupling, together with fibre washers (34).

Detach the coupling fork from shaft (42) by drifting out the hollow spring steel pin (41).

Dismantle the selector shaft and fork assemblies by driving out the Welch plugs (18) with a $\frac{1}{8}$" (3·17 mm.) dia. pin punch as shown in Fig. 10 ensuring that the selector shafts are clear.

Remove the threaded tapered locking pins (53) and (22) from the selector shafts and forks.

Push the selector shaft (25) out of the cover, followed by items (23) and (24). Remove the two interlock balls (26), (50), plunger (51), three selector plungers (21) and three springs (20).

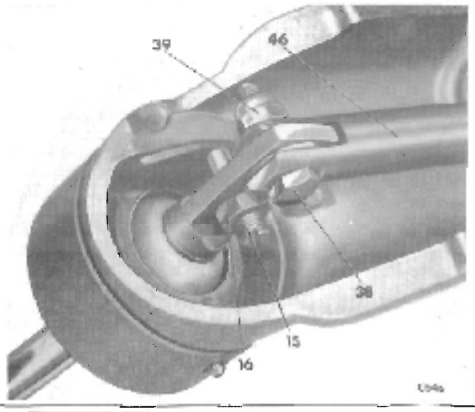



*Fig. 8.* Control shaft to gearlever attachment details

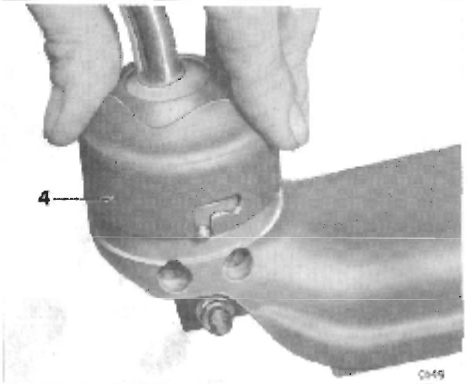



**Fig. 9.** Turning the cover to release the gearlever assembly

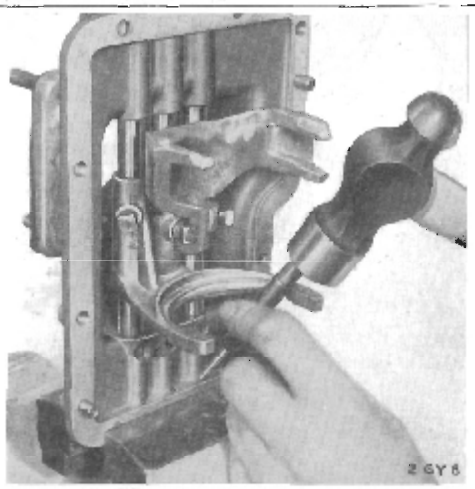



**Fig. 10.** Removing selector shaft welch plugs

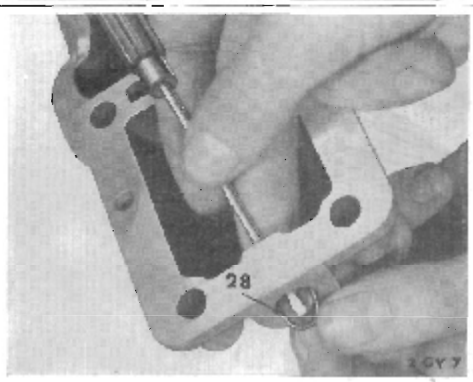



**Fig. 11.** Removing rubber 'O' ring from extension

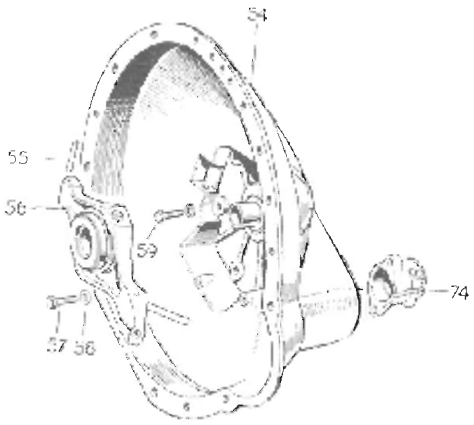
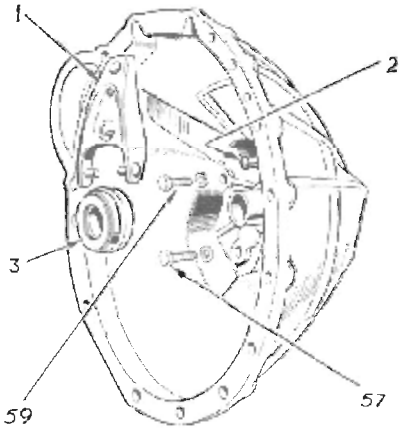



Fig. 13.




**Clutch Housing**

HERALD 1200, 12/50 AND SPITFIRE

Drift out the pivot pin (55) from the clutch housing (54) and remove the operating lever assembly (56). Release the clutch housing by removing the slave cylinder bracket (74), four bolts (59) and one Wedgelock bolt (57).

VITESSE

Unclip the release lever pressing (1) from the pivot ball (2) and remove the lever and bearing (3). Remove the bolts (59) and (57) to release the clutch housing.

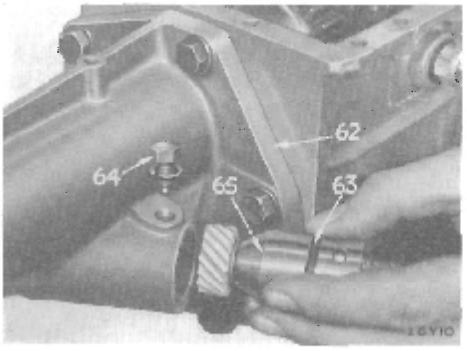



Fig. 14. Withdrawing speedometer driving pinion

**Rear Extension**

Remove the nut (110), and spring washer (109) and withdraw the driving flange (108) from the mainshaft (106).

Withdraw six bolts (72) and one longer bolt securing the extension (62) to the gearbox. Remove the extension by lightly tapping the mounting lugs with a hide-faced hammer. Remove the paper joint washer (73) and distance washer (107) from the mainshaft.

Remove the peg bolt (64) and withdraw the housing (65) from the extension (62). Remove the gear and shaft from the housing and detach the rubber 'O' ring.

Eject the ball race (67) and oil seal (68) from the extension.

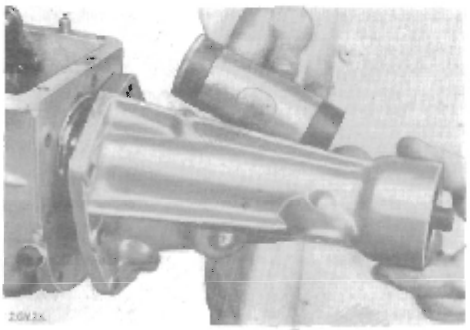


Fig. 15. Removing rear extension

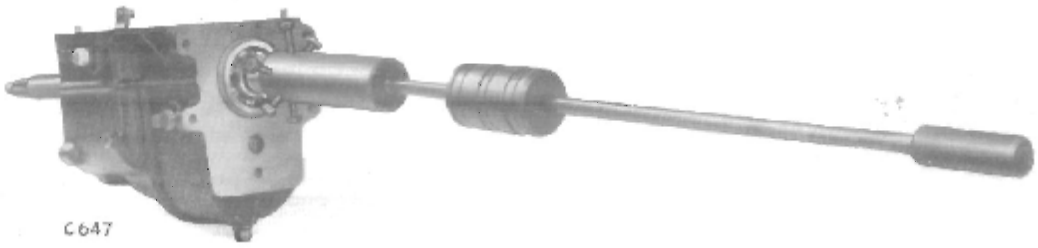



Fig. 16. Using Churchill main tool 4235A with adaptor S.4235A-2 to remove input shaft assembly

**Countershaft**

HERALD 1200, 12/50 AND SPITFIRE

Extract the countershaft locating bolt (113) and eject the countershaft (112), permitting the countershaft gear cluster to drop clear of the mainshaft gear.

VITESSE

Eject the countershaft and retain the needle roller bearings by inserting a length of rod 0·655″ (16·64 mm.) dia. × 5·5″ (139·7 mm.) long.

**Input Shaft**

Utilizing Churchill tool as shown in Fig. 16, withdraw the input shaft assembly from the gearbox.

Remove the two circlips (99), (101), the distance washer (100), then place in a press and extract the ball race (102) and oil deflector (103), Fig. 18.

**Mainshaft and Gears**

Using a hollow drift, drive the mainshaft (106) rearwards, as shown on Fig. 20, until the rear ball race (79) is clear of its housing.

Tilt the mainshaft assembly (Fig. 19) and extract the synchro unit (92), (95) and the synchro cups (96) and (98).

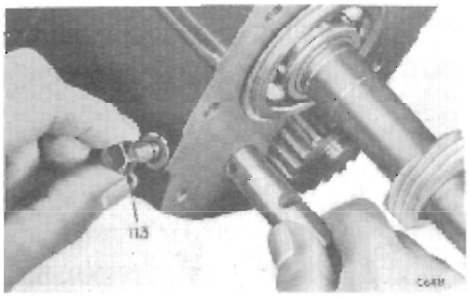



Fig. 7. Withdrawing the layshaft

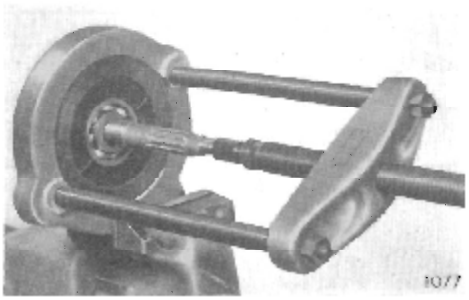


Fig. 18. Using Churchill press and adaptors to remove input shaft bearing

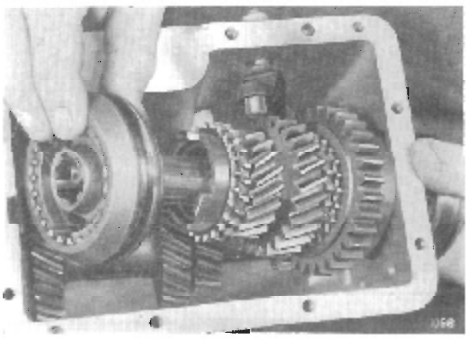


Fig. 19. Tilting the mainshaft and removing synchro unit

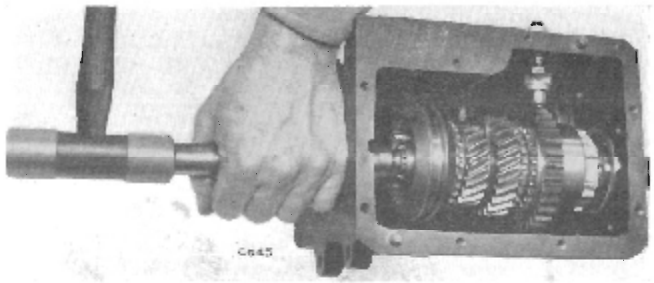
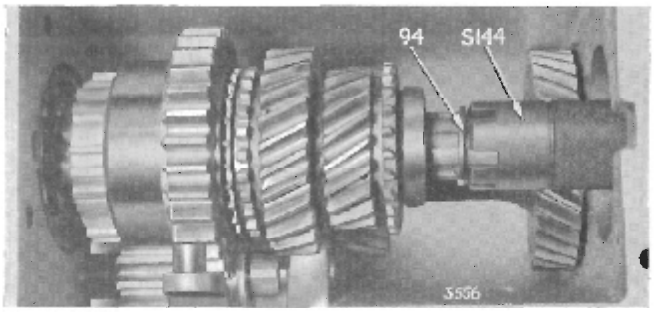
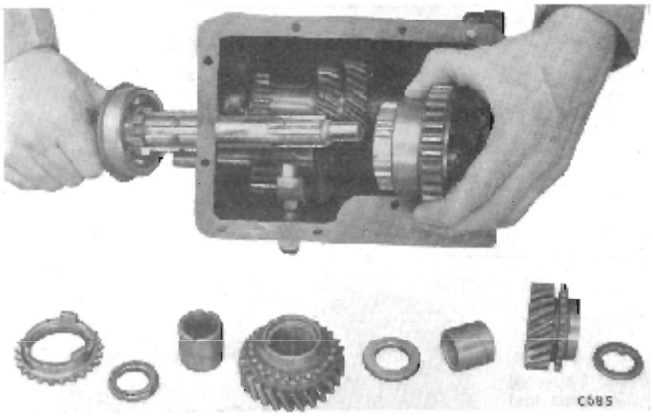



Fig. 20. Driving the mainshaft rearwards to allow the shaft to be tilted



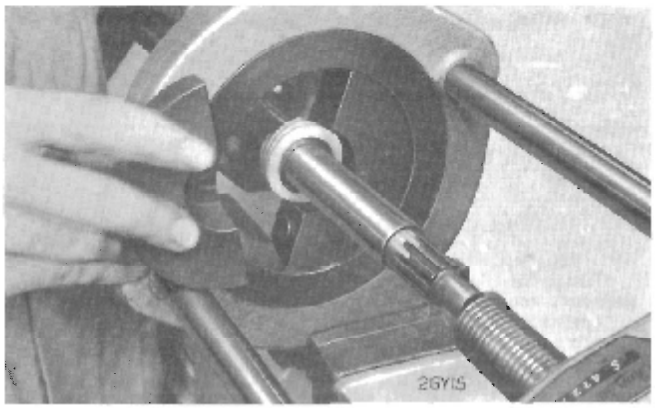

Re-position the mainshaft and, using a special extractor, remove the circlip (94).

**Fig. 21. Using Churchill tool S.144 to remove mainshaft circlip**



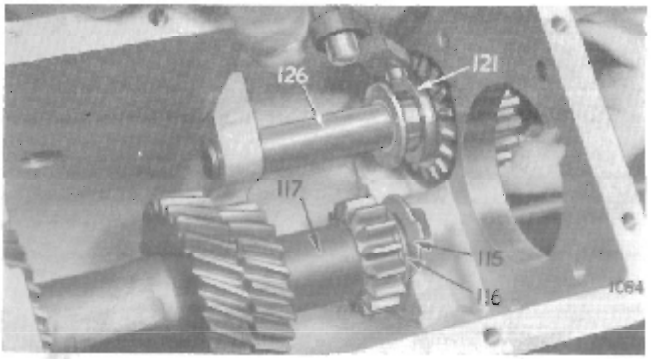

Again drive the mainshaft rearwards and as this is now being finally withdrawn remove the mainshaft details as they are released from the shaft.

**Fig. 22. Removing mainshaft details**




Completely dismantle the mainshaft by removing the nylon speedo driving gear (76), the circlips (77) and (101), distance washer (78) and ball race (79).

**Fig. 23. Using Churchill press and adaptors to remove speedometer driving gear**




Eject the reverse idler gear (121) rearwards. Remove the dowel bolt (127) and withdraw the reverse idler gear shaft (126).

Remove the rear thrust washer (115) and, after lifting the gear cluster (117) from the casing, remove the front thrust washer (119) and the rear rotating thrust washer (116).

**Fig. 24. Ejecting the reverse pinion**

Drift out worn countershaft bushes and fit new ones.

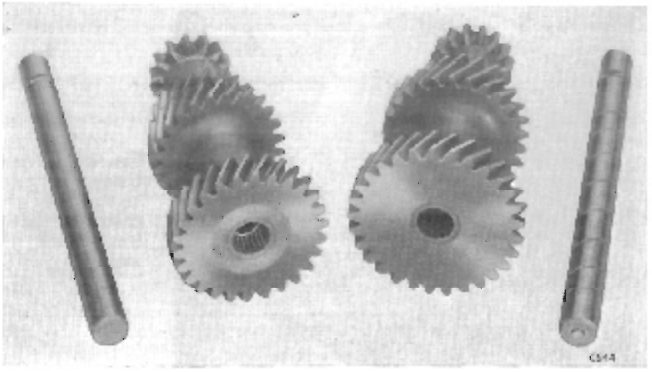


**Fig. 25. Showing (left) the Torrington needle roller bearings fitted to Vitesse countershaft and (right) the bushes fitted to Herald 1200 and Spitfire.**

Complete the dismantling of the transmission case by unscrewing the nut (125) and removing the operating lever (122) and pivot pin (123).

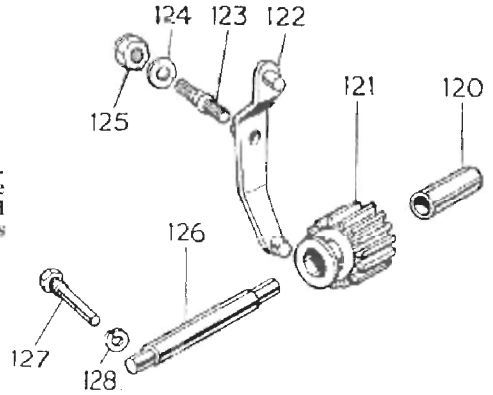



**Fig. 26. Reverse pinion and lever details**

Both synchro units are dismantled by withdrawing their outer synchro sleeves. It should be noted that spring-loaded balls are retained by these sleeves and to prevent losing any balls or springs it is advisable to cover each unit with clean rag whilst withdrawing its sliding member.

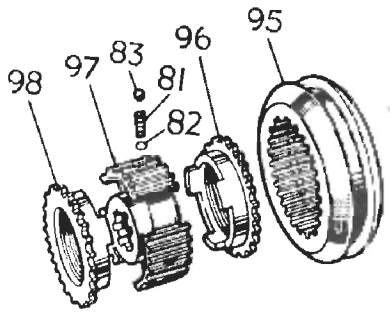



**Fig. 27. Dismantled "Top" and "Third" synchro unit**

In addition to the synchro balls and springs fitted to the second speed synchro unit, this is also provided with an interlock plunger and ball.

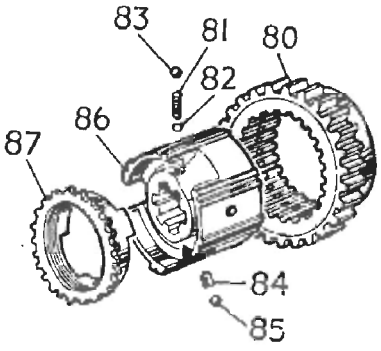



**Fig. 28. Dismantled second gear synchro unit**

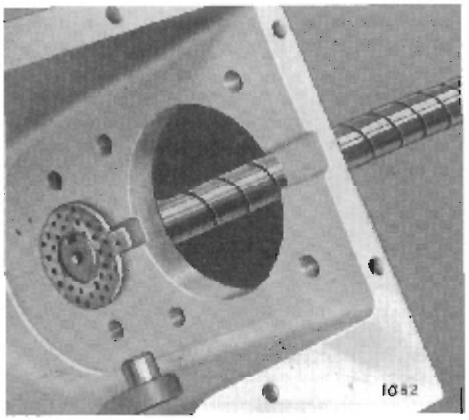



Fig. 29. Using the layshaft to centralise the front thrust washer

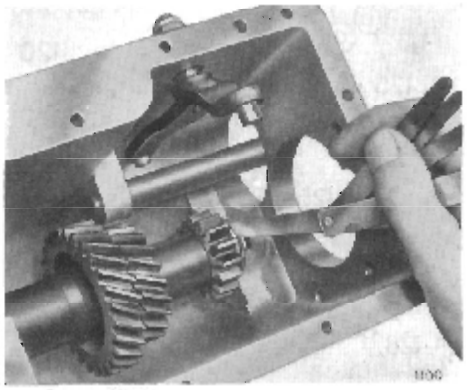


Fig. 30. Using feeler gauges to measure countershaft end float

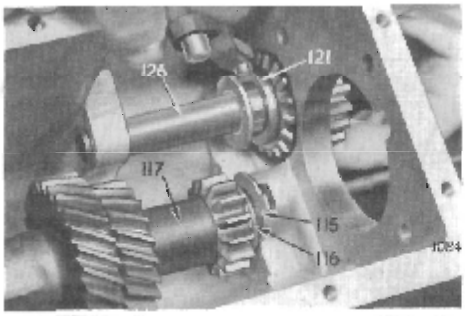



Fig. 31. Inserting reverse pinion

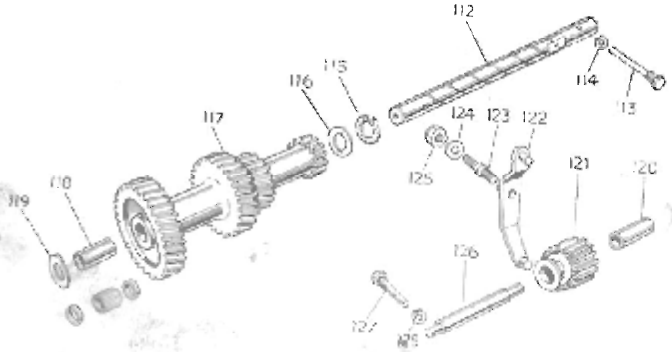



Fig. 32. Exploded countershaft and reverse pinion details

## ASSEMBLY OPERATIONS

Having thoroughly cleaned and carefully examined the gearbox components, renew all defective and doubtful items and proceed to re-assemble them as follows:

### Countershaft

Using heavy grease to support it, smear the steel face of the front countershaft thrust washer (119) and locate this in the gearcase, placing the bronze face towards the gear with its tag in the recess provided. Centralise the washer by inserting the rear end of the countershaft (112) through the gearcase as shown on Fig. 29.

Attach the rear rotating thrust washer (116) in a similar manner, engaging its tags in the rear slotted face of the countershaft gear cluster, then lower the assembly into the casing.

Push the gear cluster towards the front thrust washer until this is nipped, then having smeared the rear thrust washer (115) with grease, insert this between the casing and the rotating thrust washer (116) and correctly position its tag in the recess provided.

To enable the countershaft gear end-float to be measured, it will now be necessary to align the thrust washers and the gear cluster with appropriate holes in the gearbox, then install the countershaft (112).

Using feeler gauges inserted between the rear fixed thrust washer (115) and the adjacent rotating washer (116) measure the gear end-float as shown on Fig. 30.

Although permissible limits of 0·0015″ to 0·0125″ (0·04 to 0·31 mm.) are quoted on page 2·203, an end-float of 0·006″ (0·15 mm.) is recommended. Adjust by selective assembly of available thrust washers. If it is necessary to reduce the thickness of any thrust washer, DO NOT REMOVE METAL FROM THE BRONZE FACE.

Eject the countershaft (112) allowing the gear cluster to drop to permit installation of the mainshaft assembly.

### Reverse Idler Gear

Screw the pivot pin (123) into the reverse idler gear selector lever (122) until a thread protrudes through the attached boss on the lever, then assemble this in the gearcase and secure it with a nut (125) and plain washer (124).

Position the reverse idler gear shaft into the casing and, having aligned its locating hole, secure the shaft by inserting the locking pin (127) with lock washer (128) and tightening.

Slide the reverse idler gear (121) over the shaft and engage its annular groove with the pin attached to the lower end of the operating lever (122) as shown on Fig. 31.

Synchro Units

1. Assemble synchro springs (81), balls (83) and shims (82) to the 3rd/Top synchro hub (97). Fit the outer sleeve (95).
2. Repeat with 2nd synchro unit.
3. Test axial release load which should be:
   3rd/Top: 19/21 lbs. (8·618/9·525 kg.);
   2nd: 19/21 lbs. (8·618/9·525 kg.).

NOTE: If the actual release loads differ from those specified, adjust the number of shims beneath each synchro spring to give the correct loading.

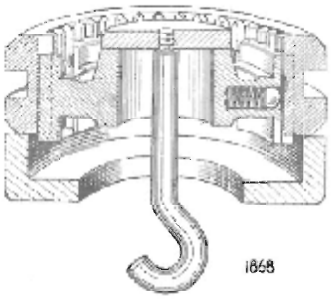



Fig. 33. Checking Top/3rd synchro release load. A spring balance is attached to the hook and the pull pressure increased to the point of release

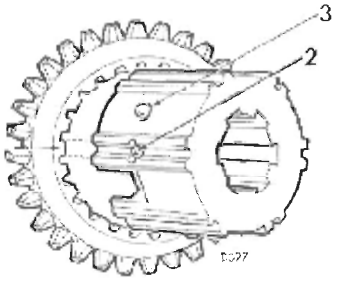



Fig. 34. Second speed synchro unit, showing "master" spline (1), the interlock ball (2) and the synchro ball (3)

**2nd and 3rd Mainshaft Gear End Float on Bushes**

Measure the end float of each gear on its respective bush as shown on Fig. 35. This should be 0·002" to 0·006" (0·05 to 0·1524 mm.). Fit a new bush to increase float; decrease float by reducing bush length.

CAUTION: Reduced bush length will increase end float of bushes on mainshaft.

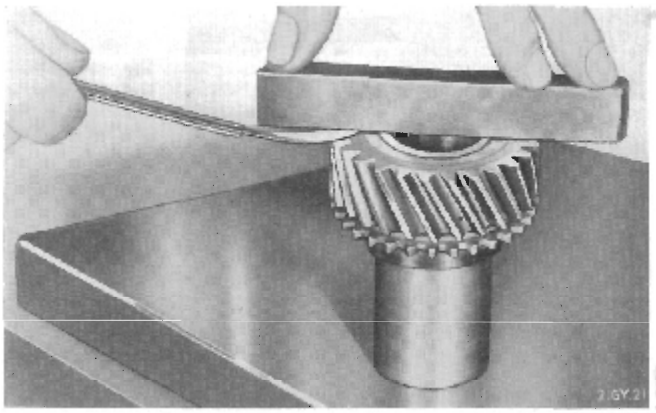


Fig. 35. Measuring gear end-float

**Overall End Float of Bushes (Mainshaft)**

Assemble the thrust washer (88), bush (91), washer (90), bush (91) and thrust washer (93) to the mainshaft. Secure the assembly with a discarded half-circlip (94) and measure the total end float of the bushes and thrust washers on the mainshaft. If necessary, adjust the end float by selective use of thrust washers to give 0·004" to 0·010" (0·1016 to 0·254 mm.).

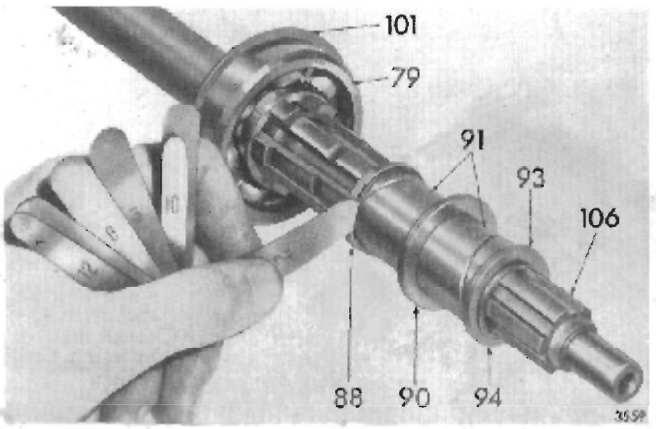



Fig. 36. Measuring overall bush end-float

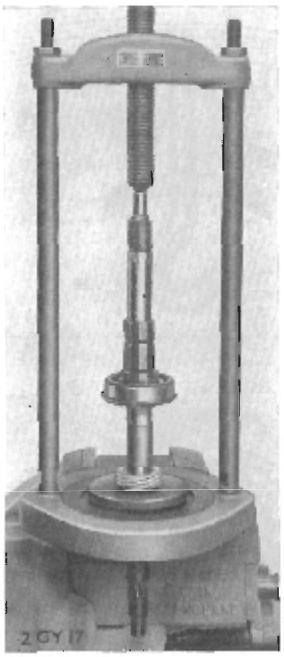


Fig. 38. Refitting the speedometer drive gear.

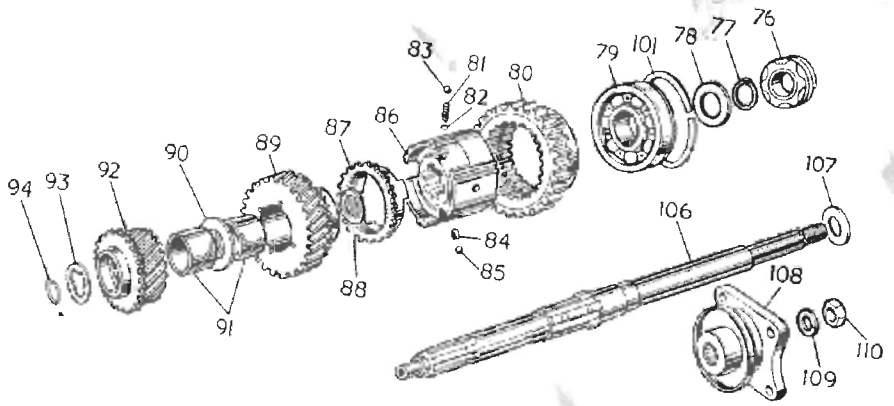



Fig. 37. Exploded mainshaft details

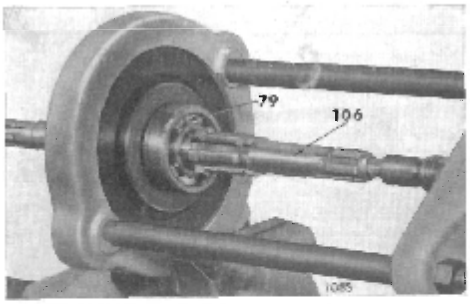



Fig. 39. Refitting the mainshaft bearing

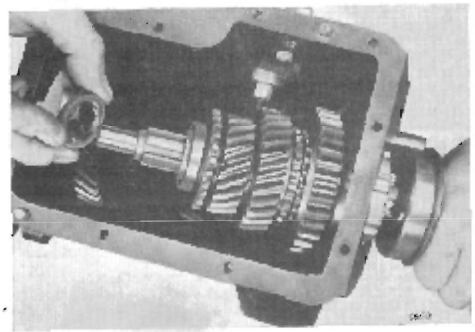


Fig. 40. Assembling the thrust washer with its scrolled face towards the gears

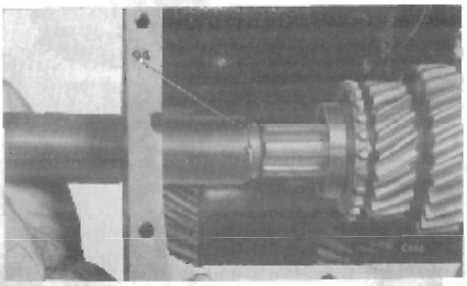



Fig. 41. Using Churchill tool S.145 to install the mainshaft circlip

### Mainshaft Assembly

Placing the circlip groove to the rear, press the ball race (79) on the mainshaft (106), followed by the distance washer (78) and the Seeger circlip (77), which must be correctly located in the mainshaft groove.

Next press the speedo drive gear (76) on to the mainshaft as shown on Fig. 38 and spring the large circlip (101) into the ball race groove.

Pass the mainshaft through the gearbox and, holding it as shown on Fig. 40, thread the mainshaft components on to the shaft in this order:—

1. Second gear synchro unit assembly with gear portion forward (make sure that the interlock plug (82) and ball (83) are correctly located in this unit).
2. Second speed synchro cup (make sure that the three lugs locate in the synchro hub).
3. Rear thrust washer (88) with its scrolled face forward.
4. Second speed gear (89) and bush (91).
5. Centre thrust washer (90).
6. Third speed gear (92) and bush (91).
7. Front thrust washer (93) with its scrolled face rearward.

Utilising a special tool as shown on Fig. 41 install the circlip (94). Placing the longer boss of the inner synchro member forwards, slide the "top and third" synchro unit with baulk rings attached over the mainshaft and complete the installation by driving the rear ball race into its housing.

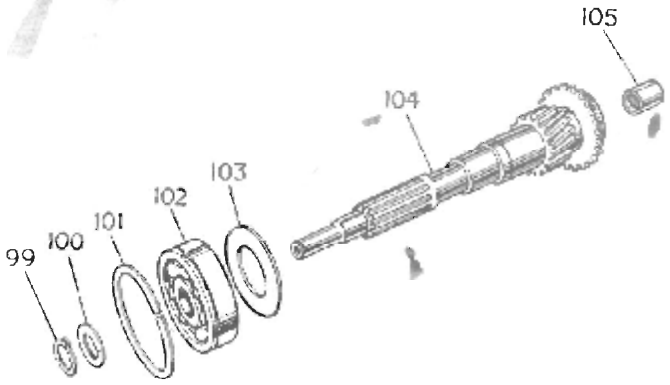



Fig. 42. Exploded input shaft details

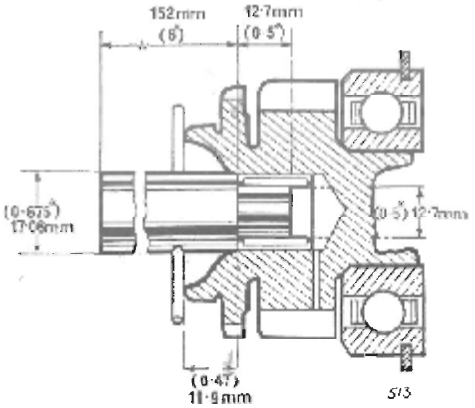



Fig. 43. Details of drift used for driving the needle bearing into the pinion

### Input Shaft

Removal of the needle roller bearing (105) is not possible and necessitates replacement of the input shaft (104). Use a special drift, detailed on Fig. 43, to ensure that the new bearing is positioned at the correct depth.

Smear the oil deflector plate (103) with grease and place it over the spigot on the input shaft. Avoiding any disturbance of this plate, press the ball race (102) on to the shaft as shown on Fig. 44. Secure the ball race by fitting the distance washer (100) and the circlip (99) ensuring that the latter is correctly located in its annular groove in the shaft.

Having installed the large circlip (101) on the ball race outer member and placed the "top" synchro cup (93) over its cone on the input shaft, offer up the assembly and as the ball race is being driven into its housing, simultaneously locate the baulk-ring lugs in their respective slots in the synchro hub as shown on Fig. 45.

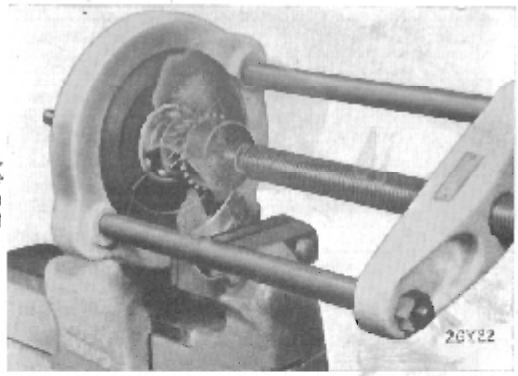



Fig. 44. Pressing the ball race onto the input shaft

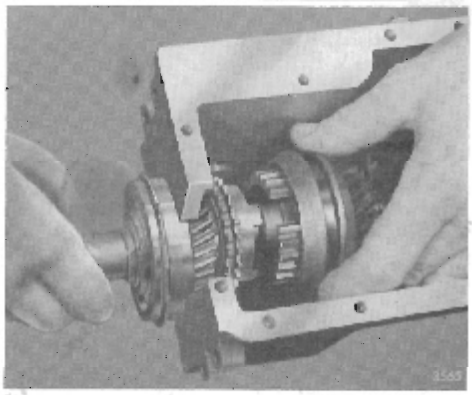


Fig. 45. Installing the input shaft assembly

### Countershaft

Align the thrust washers and countershaft gear cluster by pushing a 0·655" (16·64 mm.) dia. rod, having a short taper on one end, through the gearbox and countershaft assembly. Then eject this tool with the actual countershaft, taking care to maintain contact between the two shafts whilst the former is being driven out. Secure the shaft by aligning the lock pin holes and inserting the lock pin (113) with the lock washer (114).

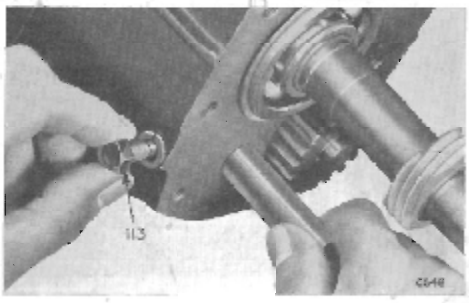



Fig. 46. Installing the layshaft and locking pin


Fig. 47. Fitting the rear oil seal

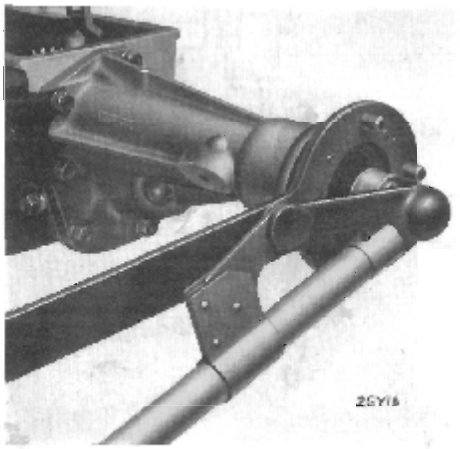



Fig. 48. Using a torque wrench to tighten the driving flange nut

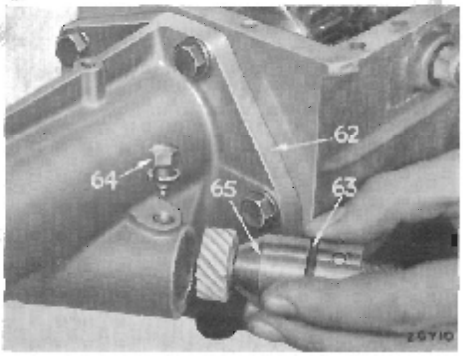



Fig. 49. Inserting the speedometer drive pinion

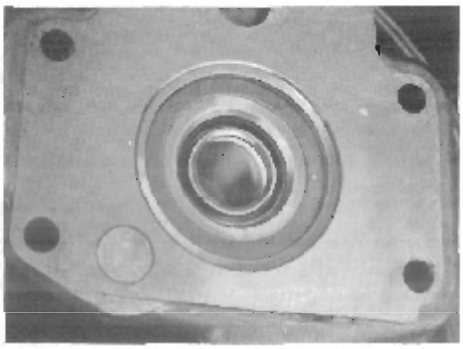


Fig. 50. Position of front cover oil seal (Vitesse)

**Rear Extension**

Drive the ball race (67) into its bore in the rear end of the housing, followed by the oil seal (68) with the sealing lip facing forward (see Fig. 47).

Lubricate the speedometer drive shaft and insert this into its housing (65). Renew the rubber 'O' ring (63) if it is torn or perished.

Insert the drive gear assembly into the rear extension, aligning the location hole with the corresponding hole in the extension. Insert and tighten the peg bolt (64) and spring washer as shown in Fig. 49.

Feed the distance washer (107) over the end of the mainshaft and, after smearing the joint washer (73) with grease, locate this on the rear face of the gearbox.

Using a hollow drift to drive the rear ball race over the mainshaft, install the extension and fit the securing setscrews (72) with lockwashers.

Fit the driving flange (108), spring washer (109) and nut (110), tightening the latter to the correct torque.

**Front Cover Oil Seal** (VITESSE)

If necessary, extract the front cover oil seal and drive in new seal, with its sealing lip facing the rear of the gearbox, into the recess in the clutch housing.

Coat the paper joint washer (60) with grease, then assemble the washer and clutch housing (54) to the gearbox. In the case of the Vitesse, protect the oil seal by wrapping the input shaft clutch splines with adhesive tape. Secure the cover with one wedge-lock bolt (57), plain washer (58) and 4 bolts (59) with spring washers.

**Re-Assembly**

To re-assemble the clutch housing and clutch release mechanism, reverse the removal sequence and note the following:—

To prevent oil leakage, fit a new copper plated steel washer (58) beneath the lower bolt (57).

**Top Cover**

Having inserted the plungers and springs into the cover (Fig. 51) slide the "third and top" selector shaft (24) into the front end of the cover (29) whilst feeding the shaft into position, press down on the selector plunger, thus enabling the shaft to pass over it and through the appropriate selector fork. Continue to insert the shaft until its middle indent registers with the plunger, *i.e.*, the neutral position.

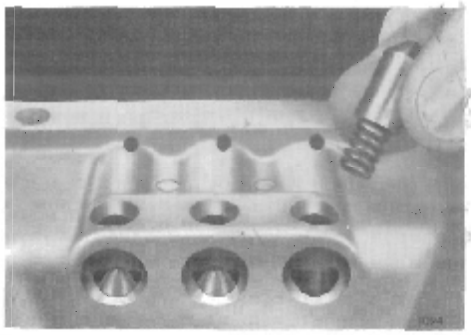


Fig. 51. Fitting selector plunger and spring to top cover

Repeat the procedure with the "reverse" shaft (25) and selector (49) until this also has reached the neutral position.

Insert the interlock plunger (51) into the "first and second" speed shaft (23) and assemble this and its selector fork (48) into the cover by adopting a similar procedure, except that this shaft also passes through the "third and top" selector fork.

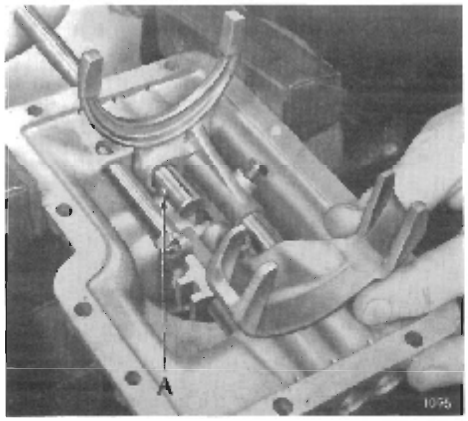



Fig. 52. Inserting 1st/2nd speed selector shaft showing interlock plunger at position (a)

Before the shaft (23) has been pushed to its neutral position, insert the two interlock balls (50) and (26) into the transverse bore connecting the shaft bores at the rear of the casting as shown on Fig. 53 then push the shaft further into the cover until its selector plunger registers with the middle indent, and the interlock balls and plunger are retained by the shafts.

Secure the forks and reverse selector by inserting threaded tapered locking pins. Using sealing compound around the edges of the welch plugs (18) drift these into the ends of the selector shaft bores.

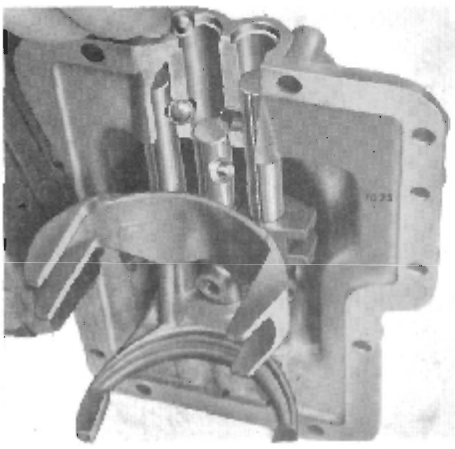


Fig. 53. Lid cut away to show interlock plunger and balls

Ensure that all selectors and gears are in their neutral position, then place the joint washer and top cover assembly over the two dowels on the gearbox. Secure these items with setscrews and lockwashers, placing the longer ones at the rear.

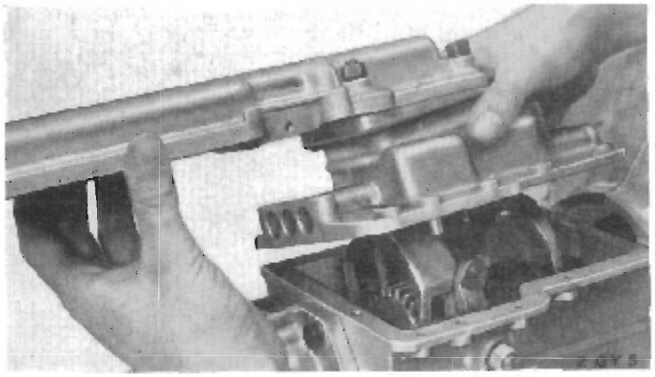


Fig. 54. Fitting top cover assembly to gearbox

## DIMENSIONS, CLEARANCES AND SPECIAL TOOLS

| | Dimensions New | | Clearances New | |
|---|---|---|---|---|
| **Pump** | ins. | mm. | ins. | mm. |
| Plunger diameter | ·3742 | 9·504 | ·0002 | ·005 |
| | ·3746 | 9·514 | ·0016 | ·041 |
| Pump body bore | ·3748 | 9·52 | ·0002 | ·005 |
| | ·3758 | 9·545 | ·0016 | ·041 |
| Pin for roller diameter | ·2497 | 6·342 | ·0007 | ·018 |
| | ·2502 | 6·355 | ·0022 | ·056 |
| Roller bore diameter | ·251 | 6·375 | ·0007 | ·018 |
| | ·252 | 6·4 | ·0022 | ·056 |
| **Pump Roller Bush** | | | | |
| Outside diameter of bush | ·3736 | 9·49 | ·0005 | ·013 |
| | ·3745 | 9·512 | ·0023 | ·058 |
| Inside diameter of roller | ·375 | 9·525 | ·0005 | ·013 |
| | ·3759 | 9·548 | ·0023 | ·058 |
| Inside diameter of bush | ·251 | 6·375 | ·0007 | ·018 |
| | ·2518 | 6·396 | ·002 | ·051 |
| Outside diameter of pin | ·2497 | 6·342 | ·0007 | ·018 |
| | ·2502 | 6·355 | ·002 | ·051 |
| **Relief Valve** | | | | |
| Relief valve plunger diameter | ·3122 | 7·93 | ·0002 | ·005 |
| | ·3127 | 7·942 | ·0013 | ·033 |
| Relief valve body bore diameter | ·3129 | 7·958 | ·0002 | ·005 |
| | ·3135 | 7·963 | ·0013 | ·033 |
| Operating piston diameter | ·8735 | 22·187 | ·0003 | ·008 |
| | ·8742 | 22·205 | ·002 | ·051 |
| Operating piston bores | ·8745 | 22·212 | ·0003 | ·008 |
| | ·8755 | 22·237 | ·002 | ·051 |
| Operating valve diameter | ·2494 | 6·335 | ·0003 | ·008 |
| | ·2497 | 6·342 | ·0012 | ·03 |
| Operating valve bore | ·25 | 6·35 | ·0003 | ·008 |
| | ·2506 | 6·365 | ·0012 | ·03 |
| **Gearbox Mainshaft** | | | | |
| Diameter at hub bush | ·9236 | 23·46 | ·004 | ·102 |
| | ·9244 | 23·48 | ·006 | ·152 |
| Bush internal diameter | ·9284 | 23·581 | ·004 | ·102 |
| | ·9296 | 23·612 | ·006 | ·152 |
| Diameter at sunwheel | ·873 | 22·174 | ·003 | ·076 |
| | ·874 | 22·2 | ·005 | ·127 |
| Inside diameter of sunwheel bush | ·877 | 22·276 | ·003 | ·076 |
| | ·878 | 22·301 | ·005 | ·127 |
| Diameter at steady bearing | ·562 | 14·275 | | |
| | ·5625 | 14·287 | | |
| Planet pin diameter: 0·802 to 1 ratio (25%) | ·4372 | 11·105 | | |
| | ·4375 | 11·112 | | |
| **Miscellaneous** | | | | |
| Clutch movement from direct to overdrive | ·04 | 1·016 | | |
| | ·06 | 1·524 | | |
| Hydraulic operation pressure | 510 – 530 lbs/sq. in. (35·853 – 37·259 kg/cm.) | | | |
| Ratio | 25% | | | |

## SPECIAL TOOLS

| | |
|---|---|
| L.178 | Assembly ring for uni-directional clutch |
| L.201 | Dummy mainshaft |
| L.202 | Annulus tail shaft remover and replacer (use with hand press RG.4221B) |
| L.203 | Planet gear needle bearing remover and replacer |
| L.204 | Tail shaft oil seal remover adaptors (use with main tool 7657) |
| L.205 | Oil pump body remover adaptor |
| L.183A | Oil pump body remover (main tool) |
| L.183A2 | Oil pump body remover adaptor |
| L.206A | Pump body replacer |
| L.207 | Operating piston "O" ring fitting tool |
| L.208 | Annulus spigot bearing remover |
| L.209 | Annulus spigot bearing replacer |
| L.210A | Clutch thrust ring bearing remover adaptor (use with adjustable puller No. 55) |
| L.211 | Tailshaft bearing nut wrench |
| L.212 | Tailshaft oil seal replacer |
| L.213 | Oil pump body key |
| L.214 | Speeds drive gear and bearing remover |
| L.215 | Clutch thrust ring bearing replacer |
| 7657 | Oil seal remover (main tool) |
| RG.4221B | Handpress |
| S.4221A | Handpress |
| No. 55 | Adjustable puller |
| L.252 | Operating piston remover |

## LAYCOCK DE NORMANVILLE OVERDRIVE

The overdrive is an additional gear unit, mounted on the rear face of the gearbox in place of the normal extension. When in operation, the unit provides a higher overall gear ratio than is available with the standard transmission. Reduced engine speed, resulting from the higher ratio, will reduce fuel consumption, increase engine life, and ensure greater driving comfort, providing the unit is used correctly.

The overdrive is operated by an electrical solenoid, controlled by a switch mounted on the steering column. An inhibitor switch, fitted in the electrical circuit, prevents engagement of overdrive in reverse, first and second gears.

| | | |
|---|---|---|
| Suggested minimum engagement speeds are: | Top gear | 40 m.p.h. |
| | Third gear | 30 m.p.h. |
| Maximum disengagement speeds are: | Top gear | At driver's discretion. |
| | Third gear | 70 m.p.h. |

Disengagement of the overdrive at a speed higher than stated may cause damage from "over-revving".

### WORKING PRINCIPLES

**Overdrive Gears**

The epicyclic gear train of the unit consists of a central sungear, meshing with three planet gears which in turn mesh with an internally toothed annulus.

**Overdrive Disengaged** (Fig. 1)

A cone clutch (A), mounted on the externally splined extension of the sungear (G) is spring-loaded, by four clutch springs (L), via a thrust ring (K) and bearing (M), against the annulus (E) thus locking the gear train and permitting over-run and reverse torque to be transmitted.

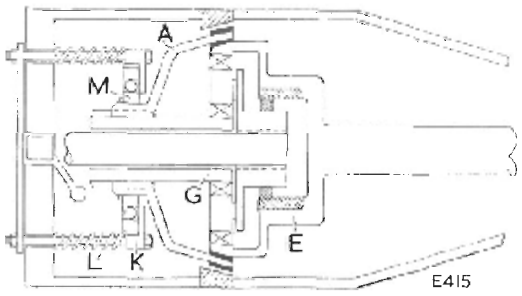



Fig. 1. Overdrive disengaged

**Overdrive Engaged** (Fig. 2)

When overdrive is selected, two hydraulically operated pistons (I) acting against bridge pieces (J), move forward and, overcoming the spring pressure, cause the cone clutch (A) to engage the brake ring (B) with sufficient load to hold the sungear (G) at rest. The planet carrier (D) can now rotate with the input shaft (H) causing the planet gears (F) to rotate about their own axis to drive the annulus at a faster speed than the input shaft, this being allowed by the free-wheeling action of the uni-directional clutch (C).

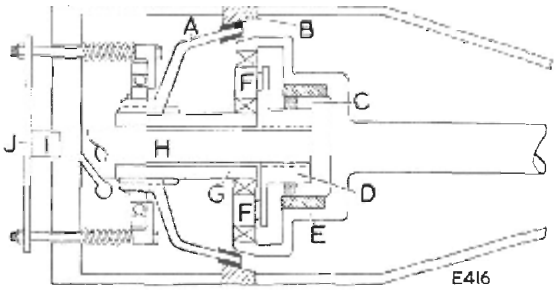



Fig. 2. Overdrive engaged

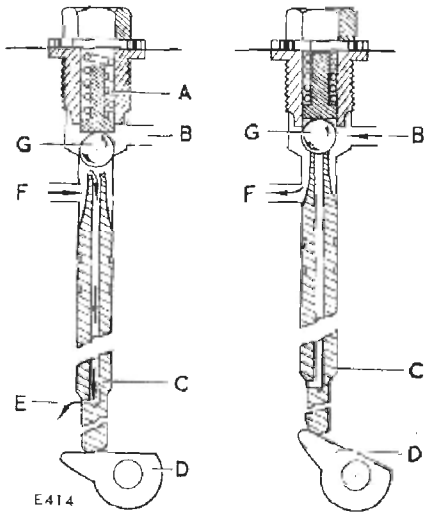
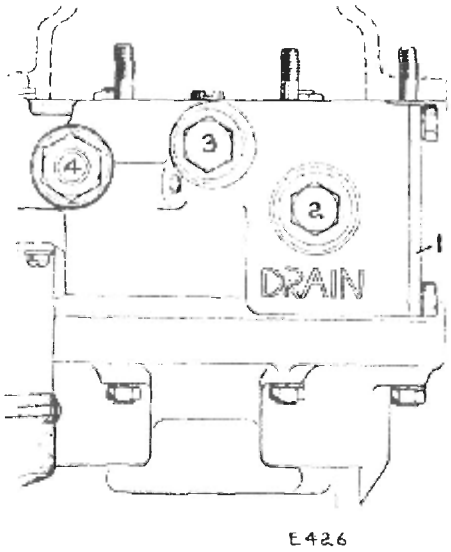



Fig. 3. Operating valve




1 Filter cover plate
2 Drain plug
3 Non-return valve plug
4 Relief valve plug

Fig. 4. Front casing viewed from underneath

## HYDRAULIC SYSTEM

Hydraulic pressure is developed by a plunger pump, cam operated, from the input shaft. The pump draws oil through a wire mesh filter and delivers it to the operating valve. A relief valve, incorporated in the system, controls the working pressure.

**Operating Valve** (Fig. 3)

In direct drive position, the ball valve (G) is seated in the casing thereby isolating the supply (B) from the operating cylinders (F).

When overdrive is selected, a solenoid causes cam (D) to rotate lifting the ball from its seat in the casing, and sealing the top of the valve, thus directing oil under pressure from port (B) to the operating cylinders (F).

When the valve is returned to the direct drive position, oil from the operating cylinders is exhausted down the hollow valve stem through the restrictor (E).

## LUBRICATION

Being interconnected, the gearbox and overdrive unit have a common oil level, indicated by a plug on the side of the gearbox. When draining the oil, remove the overdrive unit drain plug and gearbox drain plug. Access to the gauze filter, which must be removed and cleaned prior to refilling with oil, is effected by removing plate (1) (Fig. 4) retained by four setscrews.

Spill oil, from the relief valve, is diverted through drilled passages to a bush in the front casing, then into the mainshaft and along a central drilling to the rear bearing in the annulus. From the bearing, oil is passed, due to centrifugal force, through the uni-directional clutch to an oil thrower, from which it is picked up by a catcher on the planet carrier and then to the planet gears via the hollow bearing pins.

NOTE : All gearbox and overdrive units fitted to new cars are filled with a special oil, formulated to give all necessary protection to new gears. Under normal circumstances, this oil should not be changed, but may be topped up with any of the approved oils. If a new unit is fitted, or parts of an existing unit are renewed, the unit should be replenished with new special oil, supplied with a new unit, or ordered separately from the Spares Division.

Should difficulty be experienced in obtaining the special oil, use one of the approved lubricants listed on page 74. ON NO ACCOUNT SHOULD ANTI-FRICTION ADDITIVES BE PUT INTO THE OIL.

After refilling the gearbox and running the car for a short distance, re-check and top up the oil level to replace the oil which has been distributed around the hydraulic system. Always use clean oil and take great care to prevent the entry of foreign matter when any part of the casing is opened.

## SERVICING

### The Operating Valve

Access to the valve plug, on top of the unit, is gained by removal of the gearbox cover (page 2·205, Fig. 3). Operate the solenoid several times to release the hydraulic pressure. Unscrew the valve plug and, with the aid of a small magnet, remove the spring, plunger and valve. Taking great care to avoid damage to the valve seat, remove the operating valve, by inserting a length of stiff wire down its centre and drawing it up. Ensure that the small hole at the bottom of the valve, breaking through to the central drilling, is not choked. This hole provides a passage for oil exhausted from the operating cylinders when the valve is moved to the "direct drive" position.

If necessary the ball can be reseated as follows:

Place the ball on a block of wood, position the seat of the valve on the ball and give the valve a sharp gentle tap. Clean the valve seat in the casing, locate the ball on its seat and gently tap the ball using a copper drift. Tapping the ball too hard will close the mouth of the valve seat and prevent valve re-assembly.

### Adjustment of Solenoid Operating Lever

The operating valve, referred to above, is raised by a cam pinned on a transverse shaft. A solenoid-operated lever is attached to the opposite end of the shaft (Fig. 6).

Remove the cover plate from the solenoid housing, move the operating lever until a ⅜" (4·762 mm.) setting pin, pushed through the hole in the lever aligns with a hole in the casing. With the solenoid energised, screw the adjusting nut until it just contacts the operating lever. Remove the setting pin and de-energise the solenoid. Energise the solenoid and re-check the alignment of the holes.

Check that the current consumption is approximately 2 amps. A reading of 20 amps. indicates that the solenoid plunger is not moving far enough to switch from the solenoid operating coil to the holding coil of the solenoid and the operating lever must be re-adjusted.

CONTINUOUS HIGH CURRENT WILL CAUSE PREMATURE SOLENOID FAILURE.

With the solenoid de-energised, re-align the setting holes and insert the setting pin. Hold the solenoid plunger against the blanking plug (Fig. 7) and check that dimension "A" is ·150" to ·155" (3·81 to 3·937 mm.). Obtain this dimension by varying the thickness of the washer between the blanking plug and the casing, as necessary.

If an adjustable type of solenoid stop is fitted, proceed as follows:—

With the solenoid de-energised, re-align the setting holes and insert the setting pin. Hold the solenoid plunger against the adjustable stop, then adjust the stop until, with the plunger hard up

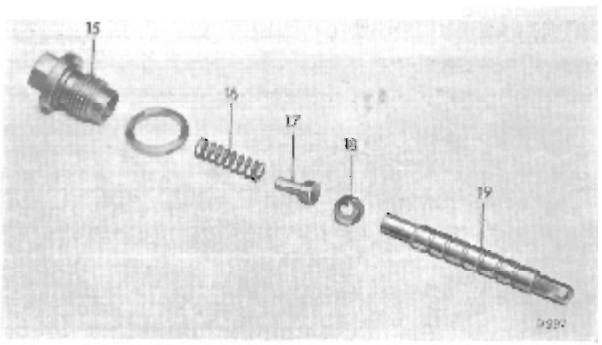
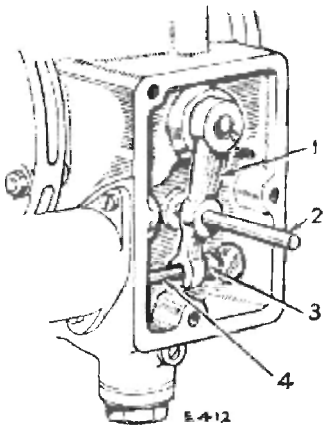



Fig. 5. Operating valve components




1 Operating lever
2 Setting pin
3 Adjusting nut
4 Solenoid plunger

Fig. 6. Adjustment of operating lever

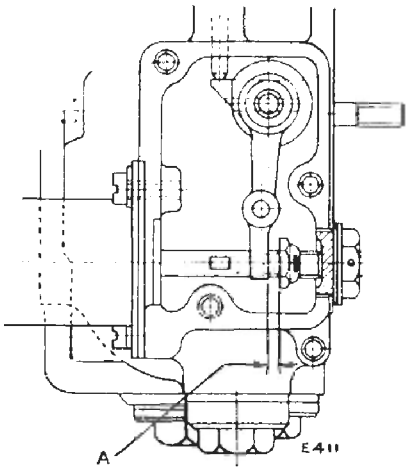



Fig. 7. Dimensional checks

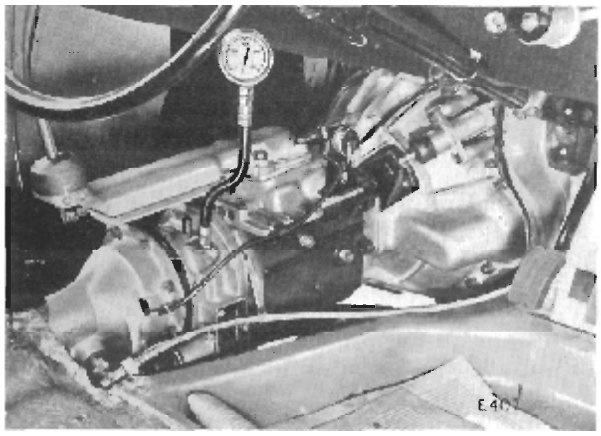


Fig. 8. Testing oil pressure

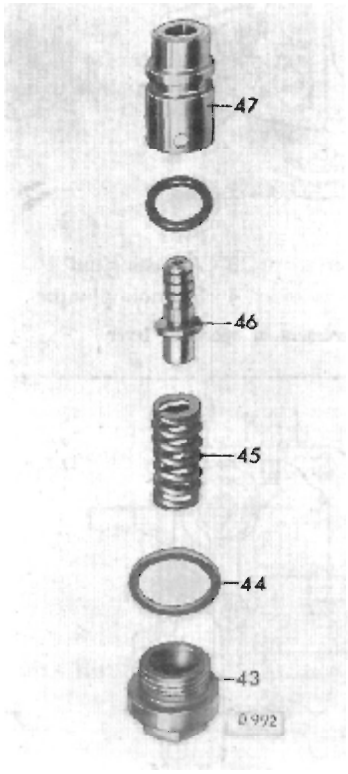



Fig. 9. Relief valve components

against the stop there is a gap of ·150" to ·155" (3·81 to 3·937 mm.) between the fork of the lever and the nut. When this gap has been obtained, tighten the locknut against the solenoid bracket until one of the slots in the locknut is in alignment with the drilled hole in the stop then secure with locking wire.

### Testing Oil Pressure

Release the hydraulic pressure by switching on the ignition, engaging top gear and operating the overdrive switch several times, remove the operating valve plug and replace it with the hydraulic test equipment (Churchill Tool L.188).

Jack up the rear wheels of the car securely, start the engine and run up to about 20 m.p.h. on the speedometer. Check the hydraulic pressure in overdrive. See page 2·301.

Lack of pressure when overdrive is selected may indicate that the pump non-return valve requires cleaning and re-seating and/or the relief valve and filter cleaning.

### Relief Valve

Access to the relief valve is gained by removing the plug at the bottom of the front casing adjacent to the solenoid housing cover plate. Remove the spring. The relief valve body can be withdrawn by inserting a length of stiff wire, shaped into a hook form, into the hole in the side of the body and pulling out.

The relief valve plunger can then be pushed out of the relief valve body.

### Pump — Functional Check

To check that the pump is working, jack up the rear wheels of the car securely, remove the operating valve plug and start the engine. Engage top gear and with the engine running slowly, watch for oil being pumped into the valve chamber. If none appears the pump is not functioning and its non-return valve should be cleaned and re-seated. To re-seat FIRST REMOVE the valve body using Tool No. L.213, then, after cleaning, tap the ball sharply onto its seat. A flow of oil does not necessarily indicate that the hydraulic pressure is correct.

### Sticking Clutch

If overdrive cannot be disengaged after carrying out the procedure outlined on page 2·305, the fault may result from a sticking cone clutch. This condition is more likely to occur on a new unit, due to insufficient "bedding in" of the clutch, than on a unit which has been in service for some time.

The clutch can usually be freed by giving the brake ring several sharp blows with a hide mallet from underneath when the car is on a hoist.

### The Electrical Circuit

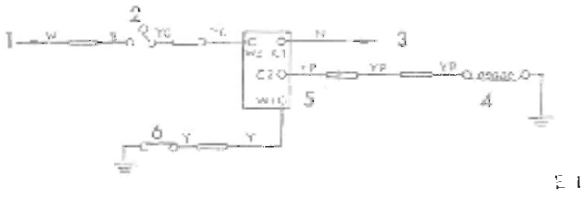
Because many operational failures are due to corroded terminals and faulty wiring, check the wiring and connections before dismantling any part of the overdrive unit.

Good earth connections are essential on all earthed components. This applies particularly to the solenoid because of the heavy current passed momentarily each time the overdrive is engaged.

Incorrect adjustment of the solenoid, resulting in failure of the main winding contact to open, may cause damage to the solenoid and relay.

If the overdrive fails to operate after checking all the electrical connections, refer to Fig. 10, and proceed as follows:

1. Switch on the ignition and engage top gear. Set the column control switch (1) to overdrive position. Check that the battery voltage is present at terminals C.1 and W.2.
2. Short out the terminals on C.1 and C.2 on the relay unit (3). If the solenoid (4) operates then the relay unit, column switch and gearbox isolator switch are suspect. Remove short circuiting link from between terminals C.1 and C.2.
3. Earth terminal W.1 on the relay unit. If the overdrive solenoid operates, then the gearbox isolator switch is suspect. If the relay unit does not operate, renew the relay unit.
4. Earth the yellow/green cable on the switch. If the solenoid operates, renew the control switch.




1 To SW on coil
2 Overdrive switch
3 To No. 1 on ignition switch
4 Solenoid
5 Relay
6 Gearbox isolator switch

**Fig. 10. Overdrive circuit**

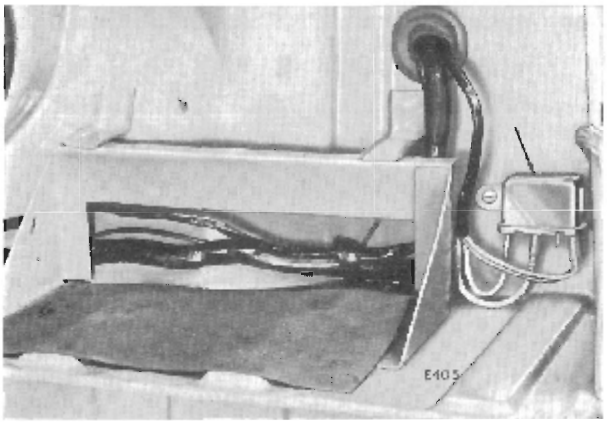



**Fig. 11. Location of relay**

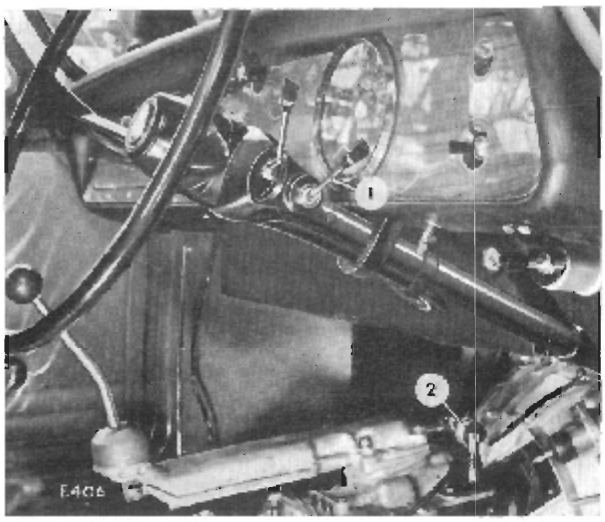



**Fig. 12. Location of (1) overdrive switch, (2) gearbox isolator switch**

## OVERDRIVE REMOVAL

Remove the eight nuts securing the unit to the gearbox adaptor plate. Break the connector adjacent to the solenoid valve and withdraw the units.

## EXPLODED ARRANGEMENT OF OVERDRIVE UNIT

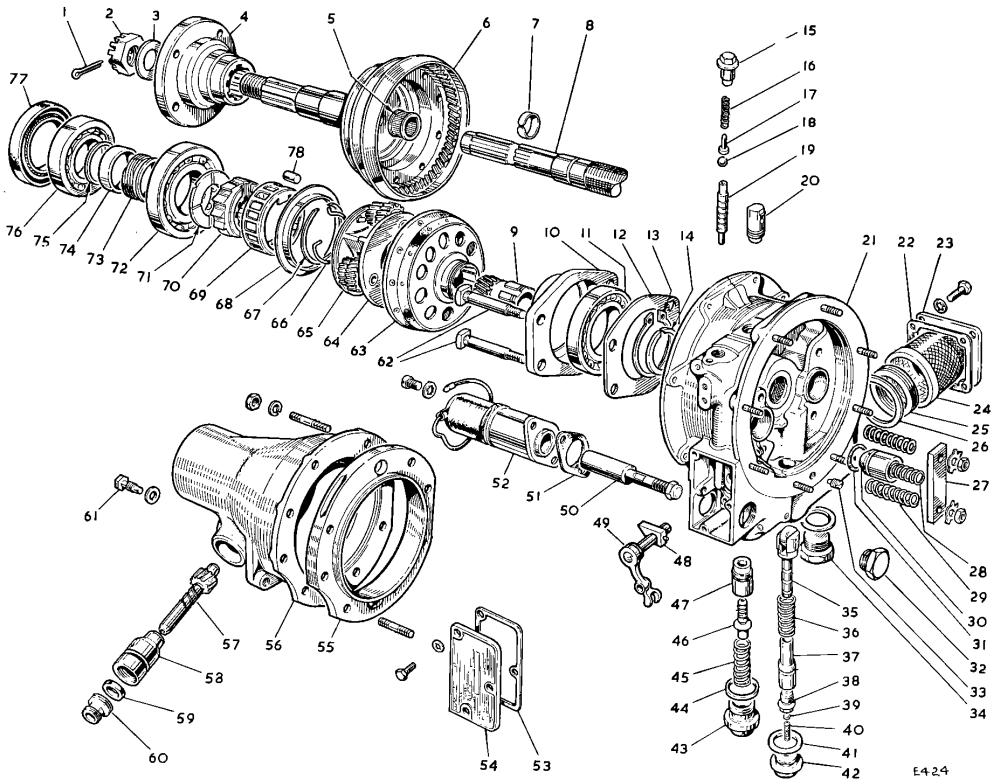



Fig. 13. Overdrive unit

## KEY TO FIG. 13

| | | | | | |
|---|---|---|---|---|---|
| 1 | Split pin | 27 | Bridge piece | 53 | Gasket |
| 2 | Nut | 28 | Bias spring | 54 | Cover plate |
| 3 | Washer | 29 | Clutch return spring | 55 | Brake ring |
| 4 | Coupling flange | 30 | Piston | 56 | Rear casing |
| 5 | Needle bearing | 31 | Piston 'O' ring | 57 | Speedometer pinion |
| 6 | Annulus | 32 | Plug | 58 | Speedometer pinion bush |
| 7 | Spring | 33 | Pump locating screw | 59 | Seal |
| 8 | Main shaft | 34 | Plug | 60 | Screwed end |
| 9 | Sungear | 35 | Pump plunger | 61 | Locating screw |
| 10 | Thrust ring | 36 | Return spring | 62 | Bolts |
| 11 | Thrust bearing | 37 | Pump body | 63 | Cone clutch |
| 12 | Retaining plate | 38 | Non-return valve body | 64 | Planet carrier assembly |
| 13 | Circlip | 39 | Ball | 65 | Planet gear |
| 14 | Circlip | 40 | Spring | 66 | Spring |
| 15 | Plug | 41 | Washer | 67 | Circlip |
| 16 | Spring | 42 | Plug | 68 | Oil thrower |
| 17 | Plunger | 43 | Plug | 69 | Cage |
| 18 | Ball | 44 | Washer | 70 | Inner member |
| 19 | Operating valve | 45 | Spring | 71 | Thrust washer |
| 20 | Lubrication bush | 46 | Relief valve plunger | 72 | Front bearing |
| 21 | Front casing | 47 | Relief valve body | 73 | Speedometer drive gear |
| 22 | Gasket | 48 | Cam | 74 | Distance piece |
| 23 | Cover plate | 49 | Operating lever | 75 | Spacer |
| 24 | Filter | 50 | Solenoid plunger | 76 | Rear bearing |
| 25 | Magnetic rings | 51 | Gasket | 77 | Oil seal |
| 26 | Rubber/Steel washer | 52 | Solenoid | 78 | Roller |

## DISMANTLING (Fig. 13)

To prevent damage or faulty operation resulting from the inclusion of foreign matter, scrupulous cleanliness must be observed during all service operations. Prepare a clean area in which to lay out the dismantled unit and clean containers to receive the smaller parts.

With the front casing uppermost, secure the unit in suitably protected vice jaws. Release the tab washers securing the four bridge piece retaining nuts, remove the nuts, washers, bridge pieces (27) and, from the operating piston bores, remove the bias springs (28).

Loosen the two solenoid securing screws to prevent the rubber solenoid cover fouling during front casing removal.

Progressively loosen, to ensure gradual release of the clutch spring loading, the eight nuts securing the front casing (21) and brake ring (51) to the rear casing (56). Remove the nuts, spring washers and lift off the front casing. If the brake ring remains with the rear casing, tap gently to remove.

Remove the four clutch return springs (29) and withdraw the clutch sliding member complete with thrust bearing (11), thrust ring (10), retaining plate (12) and sungear (9).

### Operating Valve and Relief Valve

Remove as detailed on pages 2·305 and 2·306 respectively.

### Pump

IMPORTANT: Remove the pump locating screw (33) before extracting the pump body.

Remove the pump plug (42), non-return valve spring (40) and ball (39), and the pump locating screw (33), see note above. Unscrew the non-return valve body (38) using tool L.213. Using tools L.183A, L.183A2 and adaptor L.205, extract the pump body as follows (Fig. 14):—

Screw the spindle into the pump body, position the adaptor against the casing and screw the wing nut down.

### Filter

Remove the cover plate (23), retained by four setscrews and withdraw the filter (24), three magnetic rings (25), and the rubber/steel bonded sealing washer (26).

### Operating Pistons

Withdraw the operating pistons (30) from their respective housings using tool L.252.

### Sliding Clutch Member

Remove the sungear retaining circlip (14) from its groove in the sungear extension and withdraw the sungear (9).

Remove the thrust bearing retaining plate (12), bearing circlip (13) from its groove on the cone clutch hub and press the hub from the bearing (11) and thrust ring (10). Extract the bearing from the thrust ring using tool L.210A.

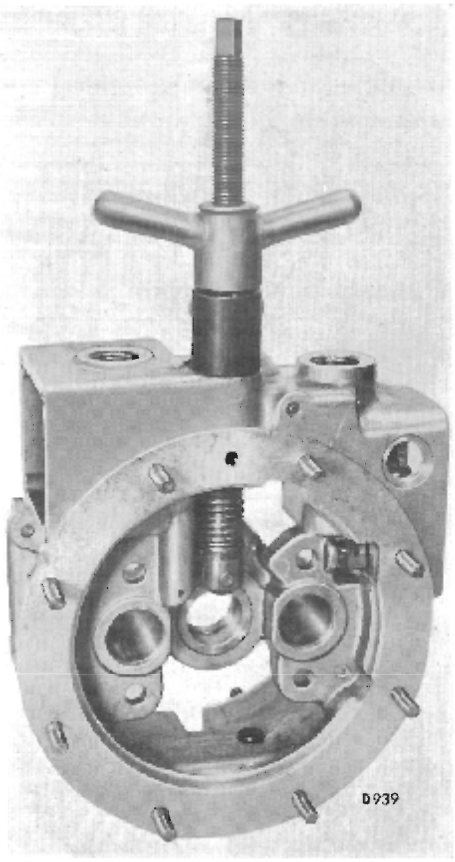



Fig. 14. Extracting pump body

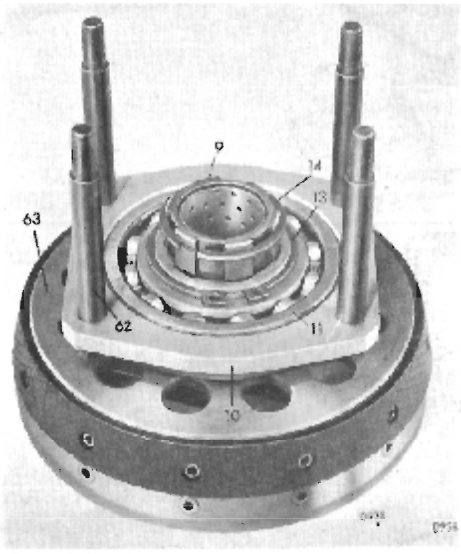



Fig. 15. Clutch sliding member assembly

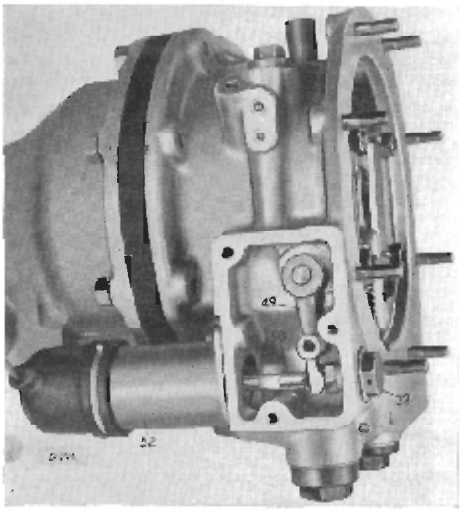


Fig. 16. View of unit from right-hand side showing solenoid cover removed

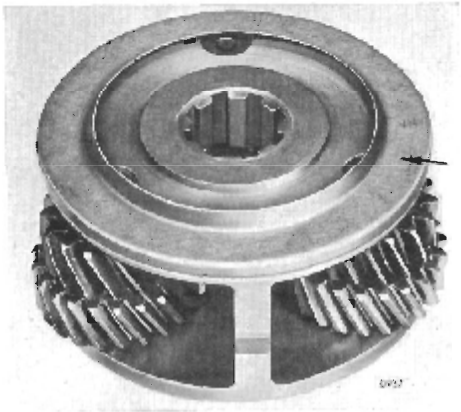


Fig. 17. Planet carrier assembly and oil pick-up ring

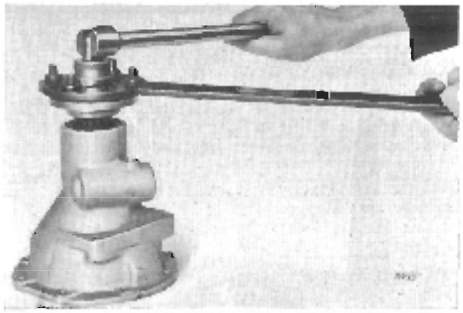


Fig. 18. Removal of coupling flange nut

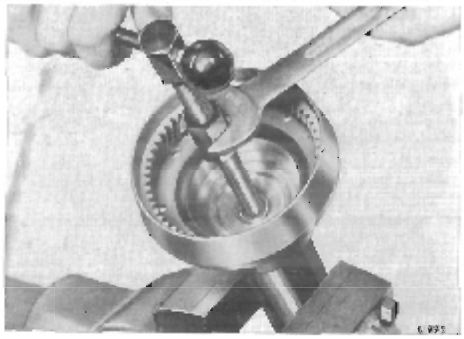


Fig. 19. Removing needle bearing from annulus

**Solenoid**

Remove the cover plate (54), retained by four setscrews, blanking plug (32), and unscrew the adjusting nut. Unscrew the two solenoid retaining screws and remove the solenoid (52) and plunger (50).

**Planet Carrier Assembly**

Inspect the gear teeth for damage and wear and check for excessive movement indicating needle bearing or retaining pin wear.

If necessary, renew the complete carrier assembly (64).

**Annulus, Removal from Rear Casing**

Remove the speedometer bush locating screw (61) and, to avoid damage to threads, use tool L.214 to extract speedometer drive bush (58) and pinion (57) from the rear casing.

Remove the split pin (1) and nut (2) securing the coupling flange (4) and press the annulus forward out of the rear case (56). The rear bearing (76) and oil seal (77) will remain in situ while the front bearing (72), speedometer drive gear (73), distance piece (74) and spacer washer (75) will be withdrawn with the annulus.

Remove circlip (67) and brass oil thrower ring (68) and withdraw the uni-directional clutch from the annulus.

The needle bearing (5) in the centre of the annulus may be withdrawn using tool L.208 as follows:—

Withdraw the central bolt from the tool and locate the outer part of the tool inside the bearing, ensuring the four tangs register behind it. Insert the central bolt and screw against the annulus.

Tap out the oil seal and rear bearing from the rear casing.

## RE-ASSEMBLY (Fig. 13)

Renew gaskets, "O" rings, seals and tab washers, as necessary, during re-assembly operations.

### Operating Valve

Locate the operating valve (19) within its orifice in the front casing and check that its hemispherical end abuts the flat of the operating cam (48). Position the steel ball (18), plunger (17) and spring (16) and secure with blanking plug (15).

### Relief Valve

Insert the relief valve plunger (46) in the relief valve body and locate the assembly within its orifice at the base of the front casing. Insert the spring (45), locating it on the boss of the plunger, and secure with the relief valve blanking plug (43).

### Pump

Assemble the pump plunger (35), spring (36) and body (37) and locate the assembly within its orifice in the front casing, locating the flat of the plunger roller fork against the thrust button situated below the centre bush. Press the pump body home, using tool L.206A, until the annular groove in the pump body is in alignment with the locating screw orifice. Insert the dowelled locating screw and tighten, ensuring that the dowel locates in the groove.

Screw in the non-return valve body (38), using tool L.213, position the ball (39) and spring (40) in the body and fit the retaining plug, ensuring that the spring locates correctly in the plug recess.

### Filter

Position the three magnetic rings (25) in the mouth of the filter (24) and the bonded steel/rubber sealing ring (26) in the filter housing with its steel face against the casing.

Locate the filter in its housing, open end against the rubber surface of the bonded washer, fit the cover plate (23) and secure with the four retaining setscrews. Fit the drain plug (34).

### Operating Pistons

Replace the pistons with the open end of the piston bore facing forward, carefully easing the sealing rings into the cylinder bores.

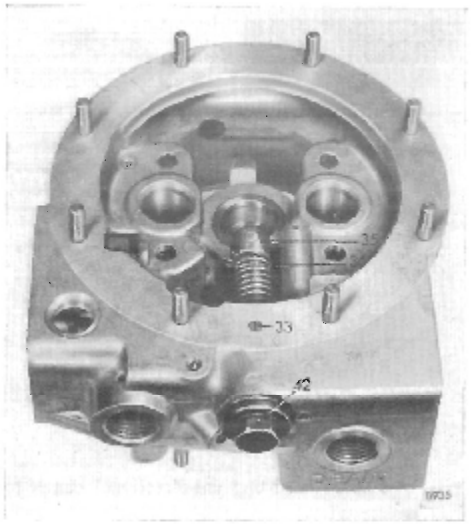



Fig. 20. View of front casing showing pump installed

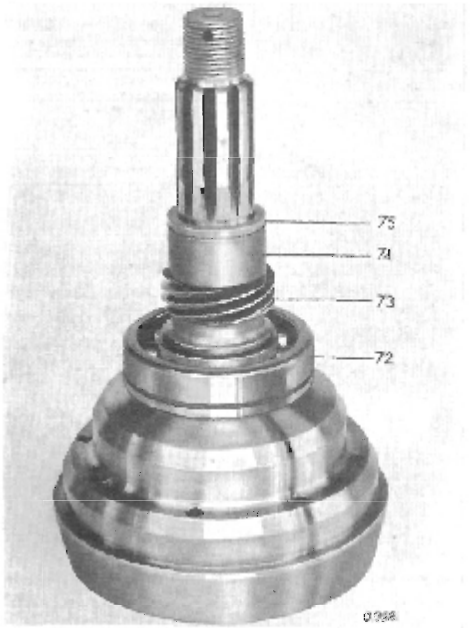



Fig. 21. Annulus prior to fitting to rear casing

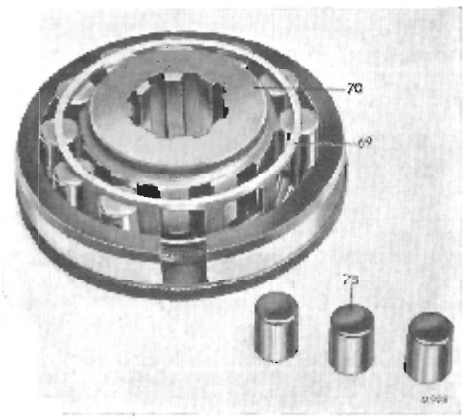



Fig. 22. Fitting rollers to uni-directional clutch

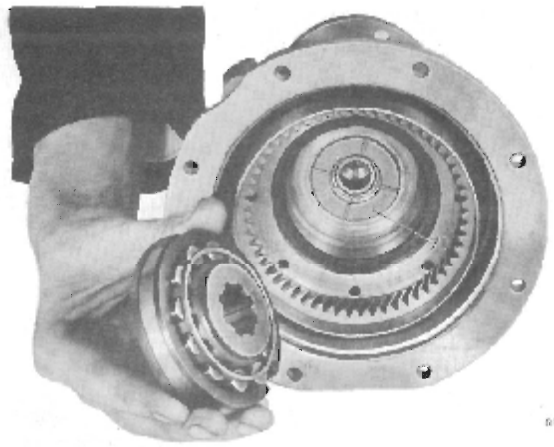


Fig. 23. Fitting uni-directional clutch to annulus

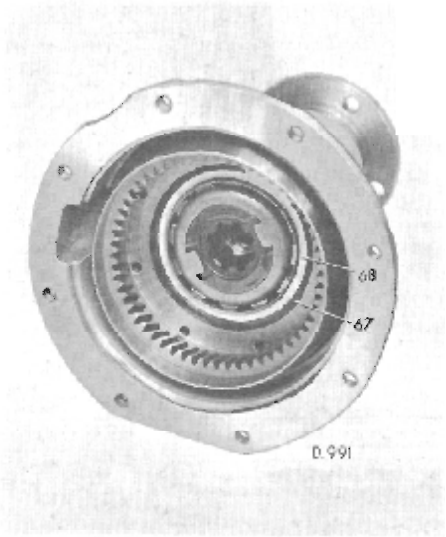



Fig. 24. Uni-directional clutch in position

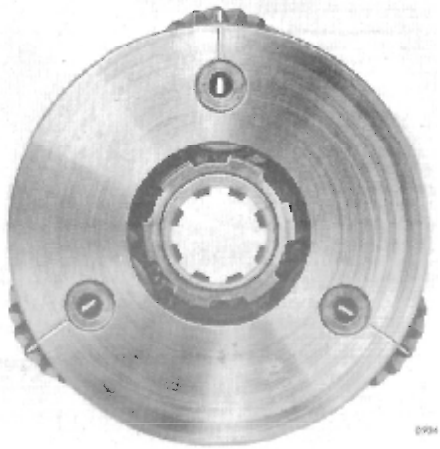


Fig. 25. Planet gear alignment

**Annulus and Rear Casing**

Locate the front bearing (72) over the annulus tail shaft and press into position against the locating shoulder at the rear of the annulus.

Position the speedometer drive gear (73), distance piece (74), and, if fitted, the spacing washer (75) on the tail shaft. Fit the assembly to the rear casing.

NOTE : Where new parts have been fitted, make a dimensional check between the distance piece and abutment shoulder for the rear bearing. Fit spacing washers, as required, to give a ·005" to ·010" (·1270 to ·254 mm.) end float between the rear bearing and the casing.

Press the rear bearing (76) on the tail shaft and into the rear casing simultaneously. Fit the oil seal (77) using tool L.212.

Press the rear coupling flange (4) on the tail shaft, locate the washer (3) and secure with nut (2) and split pin (1).

Insert the speedometer drive pinion (57) and bush (58) turning the annulus as necessary to engage the gear. Align the bush and casing holes and fit the dowelled locating screw (61).

Insert the needle bearing (5) in the centre of the annulus using Tool L.209.

Fit the spring (66) in the roller cage (69) of the uni-directional clutch, engaging one end in the cage. Insert the inner member (70), engaging the opposite end of the spring, and ensure that the slots of the inner member engage the tongues of the cage.

Place the assembly, front face down, in the assembly tool L.178 (Fig. 22) and fit the rollers. Check that the spring rotates the cage to drive the rollers up the inclined faces of the inner member.

Refit the thrust washer (71) and uni-directional clutch (Fig. 23) transferring the clutch direct from the assembly tool. Fit the brass oil thrower ring (68) and secure with circlip (67).

**Planet Gears**

Rotate the gears until the ETCHED lines on the gear and carrier coincide (Fig. 25). NOTE: On one of the three gears the etched line occurs on the same tooth as the centre pop mark. Insert the sungear and recheck the etched lines for alignment. Position the assembly within the annulus and remove the sungear.

**Clutch Sliding Member**

Press the thrust bearing (11) into the thrust ring and fit the four bolts ensuring the heads are correctly positioned. Press the assembly on the cone clutch hub and secure with circlip (13). Fit the retaining plate (12).

Insert the sungear (9) in the splined bore of the cone clutch and secure with circlip (14). Locate the assembly within the annulus and fit the four clutch return springs (29).

**Front Case to Rear Case**

Position the brake ring, both faces coated with suitable jointing compound, on the rear face of the front case, ensuring the kidney-shaped slot in the brake ring is located at the bottom (Fig. 26).

Fit the front casing to the rear casing. Clutch spring pressure will now be felt and it will be necessary to exert a slight pressure to bring the two casings together sufficiently to start the nuts. Tighten diametrically opposed nuts until the two faces meet.

Locate the bias springs (28) within the piston bores, fit the bridge pieces (27) and secure with nuts and tab washers.

Position the solenoid plunger (50) in the fork of the operating lever (49) and screw on the adjusting nut, replace the solenoid and secure with the two setscrews. Adjust as detailed on page 2·305 and, on completion, refit cover plate (54) and blanking plug (32).

**Refitting Overdrive to Gearbox**

Align the splines of the planet carrier and uni-directional clutch using a long screwdriver. Check the alignment by inserting dummy mainshaft (Tool No. L.201) (Fig. 27).

ROTATE THE GEARBOX MAINSHAFT AND POSITION THE PUMP OPERATING CAM WITH ITS HIGHEST POINT UPPERMOST. Engage first gear to retain this position. Check that the spring clip (7) is correctly located in its groove on the mainshaft and does not protrude above the splines.

NOTE : It is essential that rotation of gearbox mainshaft and overdrive coupling flange is avoided until the unit is fitted to the gearbox.

Remove the dummy mainshaft and fit the unit to the gearbox, secure with spring washers and nuts. Reconnect the solenoid cable.

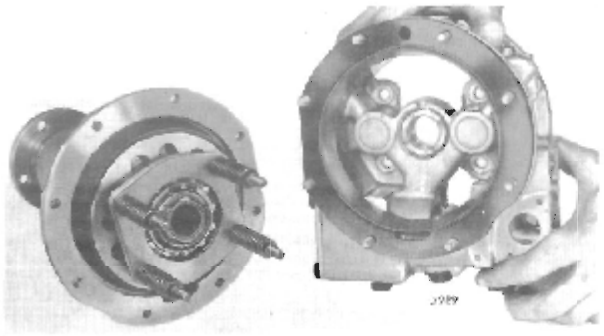


Fig. 26. Offering front case to rear case

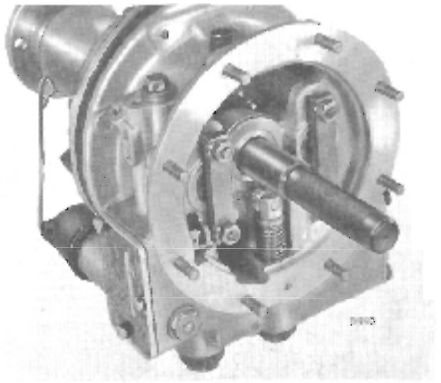


Fig. 27. Alignment check using Tool No. L.201

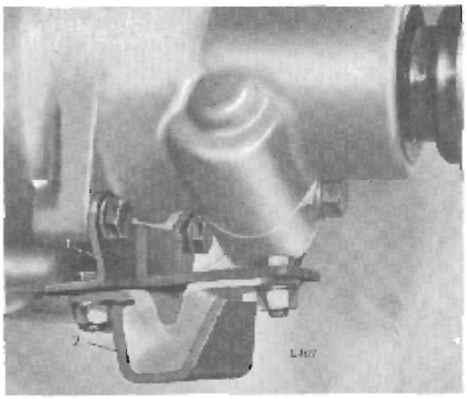


Fig. 28. Overdrive support bracket (1) and flexible mounting (2)

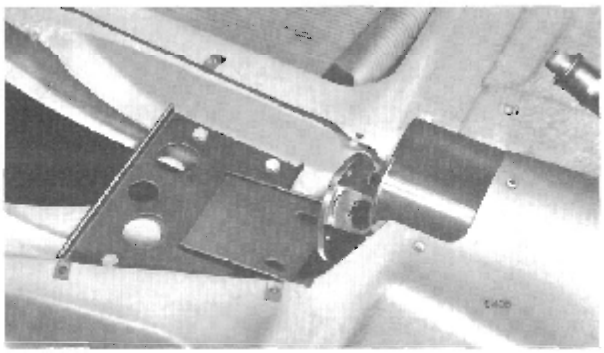
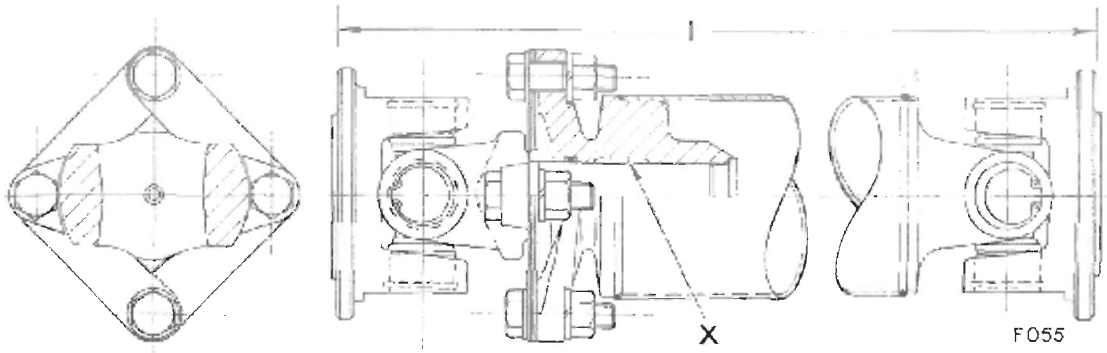


Fig. 29. Overdrive mounting platform




**X — Grease as specified below**

**Fig. 1. Strap drive propeller shaft**

| VEHICLE AND STANDARD-TRIUMPH PART NUMBER | OVERALL LENGTH CLOSED— DIMENSION (1) ins. | cms. | EXTENSION— DIMENSION (2) ins. | cms. |
|---|---|---|---|---|
| **Herald 1200 and 12/50 206275** | | | | |
| 207410 (BRD) .. .. .. | 50·250 | 127·64 | Zero | |
| *208033 (Hardy Spicer)* .. .. | 50·130 | 127·33 | | |
| 212549 (BRD Strap drive) .. | | | | |
| **Vitesse 208942** .. .. .. | 47·110 | 119·66 | 1·68 | 4·27 |
| (BRD Ordinary sliding spline) .. | 46·990 | 119·35 | 1·58 | 4·02 |
| **Vitesse with overdrive 208338** .. | 43·650 | 110·87 | 1·68 | 4·27 |
| (BRD ordinary sliding spline) .. | 43·530 | 110·57 | 1·58 | 4·02 |
| **Spitfire 210508** | | | | |
| (Frictionless BRD) .. .. | 41·375 | 105·09 | 0·50 | 1·27 |
| **Spitfire with overdrive 210985** | | | | |
| (Frictionless BRD) .. .. | 38·00 | 96·52 | 0·50 | 1·27 |

For lubricating the rollers in the bearing cups (3), Fig. 8, use Shell Dentax 250 or Retinax A, or equivalent. Lubricate at "X", Fig. 1, with this grease, when assembling.

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For lubricating splines, sliding and frictionless, use Duckham's grease Grade No. Q5648 or Rocol Molytone 320, or equivalent.

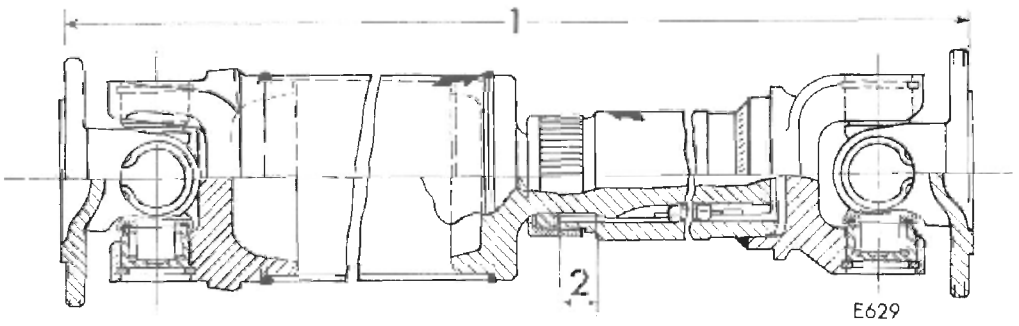



Fig. 2. Frictionless shaft sectioned

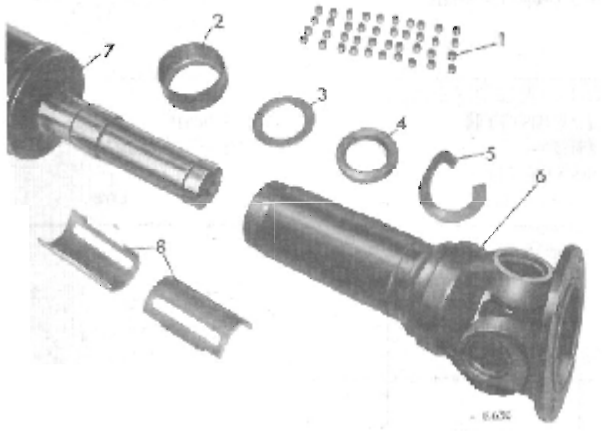



Fig. 3. Telescopic section exploded

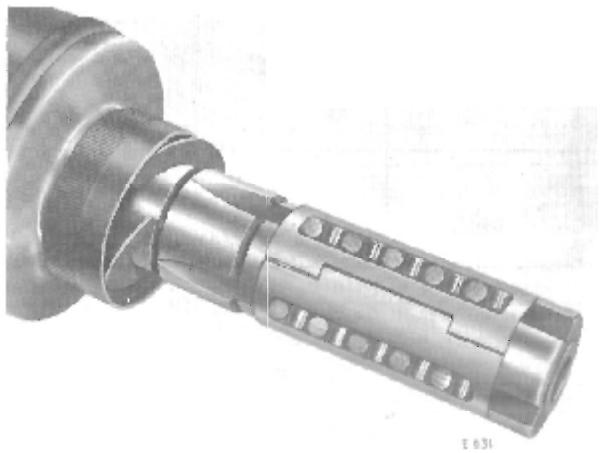


Fig. 4. Arrangement of rollers

Key to Fig. 3

| | | | |
|---|---|---|---|
| 1 | Rollers | 5 | Stop washer |
| 2 | Dust cap | 6 | Sliding yoke |
| 3 | Washer | 7 | Shaft |
| 4 | Felt ring | 8 | Restrainers |

## FRICTIONLESS PROPELLER SHAFT

### Dismantling

Unscrew the dust cap (2), carefully slide off the yoke (6), collect forty rollers (1) and remove the restrainers (8). Remove the split stop washer (5), felt sealing ring (4), washer (3) and dust cap (2).

### Assembling

Fit the dust cap (2) and the washer (3). Before fitting the new felt sealing ring (4), soak it in clean engine oil. Fit the split washer (5), and use pliers to make it flat again.

Fill the four grooves along the shaft (7) with the grease specified on page 2·401. Fit the roller end-travel restrainers (8), and through their slots stick ten rollers into each groove as shown in Fig. 4.

Align the arrows on the shaft (7) and the yoke (6) so that the front and rear yokes are in the same plane. Very carefully slide on the yoke (6), ensuring that all rollers remain correctly positioned within the restrainer slots. Screw the dust cap (2) securely on to the yoke (6).

See page 2·403 for universal joint servicing.

## PROPELLER SHAFT

Herald 1200 and 12/50 models are fitted with propeller shafts having a needle bearing universal joint at each end and no telescopic section, whilst propeller shafts fitted to Vitesse and Spitfire models incorporate a telescopic section at the front end.

### To Remove

Raise the vehicle on stands or a ramp.

Remove the carpet and gearbox cover as described on page 2-205.

Remove the bolts and nyloc nuts securing the propeller shaft flanges to the gearbox and rear axle unit.

Detach the propeller shaft.

On Herald and Spitfire models, it may be necessary to lever the engine/gearbox unit forward to disengage the propeller shaft from the gearbox and axle driving flanges.

### To Refit

Reverse the removal procedure, using new nyloc nuts if the original nuts can be screwed on to the bolts with finger pressure.

### To Dismantle

**Universal Joints** (Fig. 8)

Individual parts of the needle roller bearing assemblies should not be renewed. If necessary, fit a new set of bearing parts, comprising:—

Spider, oil seals, retainers, needle bearing assemblies and retaining rings.

Remove the circlips (2). If the circlips cannot readily be removed from the yokes, remove paint from the holes and tap the end of the bearing cup, thus relieving pressure on the circlip.

Support the forked end of the shaft as shown (Fig. 6) and by striking the flange with a soft mallet, drive out the needle bearing cup until it is sufficiently exposed to be removed with a pair of grips. Reverse the shaft and extract the opposite cup in a similar manner.
Remove the seals (4, Fig. 8).

Support the two exposed trunnions of the spider on wooden blocks (Fig. 7) and, by striking the radiused portion of the forked end of the shaft, drive out the needle bearing cup until it is sufficiently exposed to be removed. Repeat the operations to remove the remaining cup. Remove the spider from the forked end of the shaft.

Dismantle the universal joint at the opposite end in a similar manner.

Fig. 5. Removing a circlip

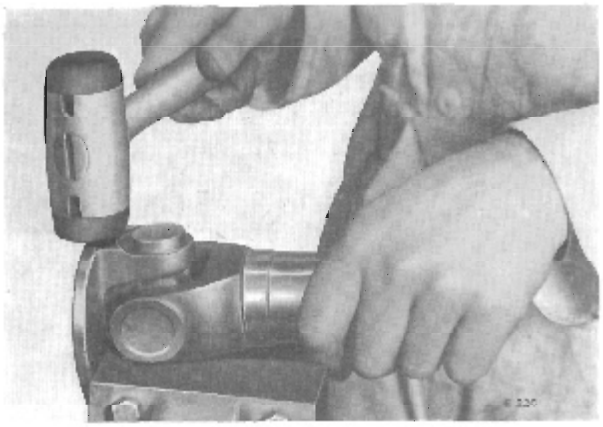


Fig. 6. Removing a bearing cup from the flange

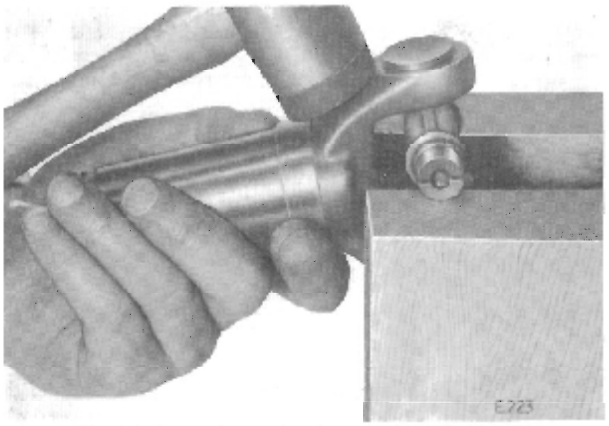
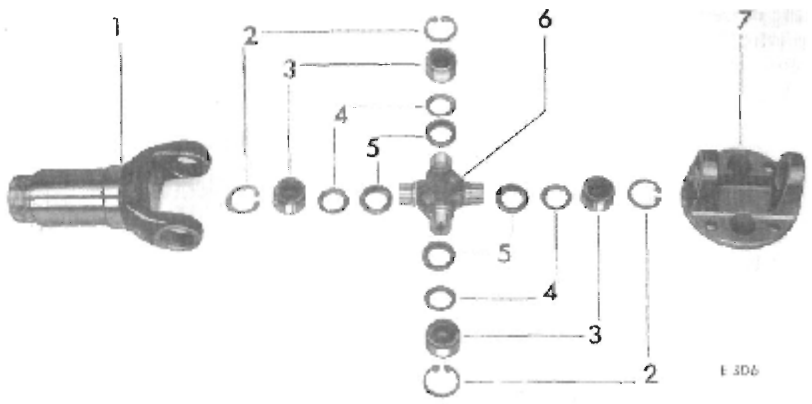


Fig. 7. Removing a bearing cup from the shaft




1 Sliding yoke
2 Circlips
3 Bearing cups
4 Seals
5 Retainers
6 Spider
7 Flange

Fig. 8. Universal coupling details

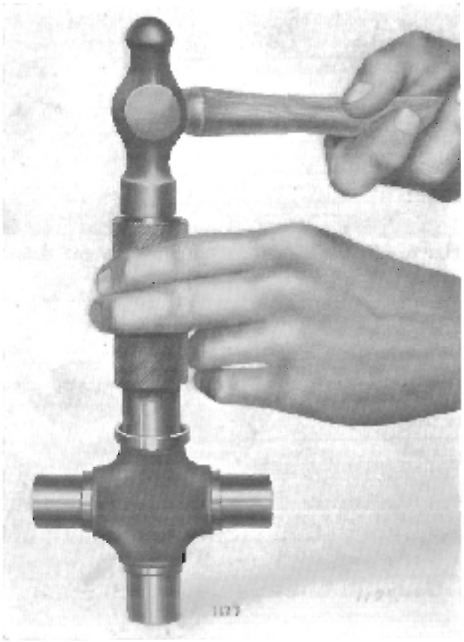


Fig. 9. Fitting spider journal seal retainer

**To Re-assemble**

Apply jointing compound to the journal shoulders on the new spider. Fit the oil seal retainers over the trunnions using a tubular drift (Fig. 9).

Smear the spider journals and the seal retainers with the grease recommended on page 2·401. Coat the inside of the races with this grease to retain the needle rollers, then one-third fill with grease.

Fit the oil seals.

Insert the spider into the flange yoke, ensuring that **the lubricator boss is fitted away from the yoke.** Using a soft-nosed drift, about $\frac{1}{32}$ in. (·8 mm.) smaller in diameter than the hole in the yoke, tap the bearing into position. It is essential that the bearing races are a light drive fit in the yoke trunnions.

Repeat this operation with the remaining bearings and retain them with the circlips (2).

Re-assemble the opposite end universal joint by repeating the above procedure.