



CLUTCH





SECTION F.

C L U T C H

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SECTION F.

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THE CLUTCH.

GENERAL DESCRIPTION.

The clutch, a Borg & Beck "Long" type, Model 10" CF, is of the single dry plate semi-centrifugal type, consisting of a driven plate assembly and a cover assembly. The Bentley reference number is GB-4421. The Bentley code number for the driven plate assembly is 270/1440.

1. Cover (pressed steel).
 2. Thrust spring (orange coloured).
 3. Insulator washer.
 4. Pressure plate.
 5. Release lever.
 6. Adjuster screw.
 7. Pin.
 8. Roller.
 9. Yoke.
 10. Spring washer.
 11. Setscrew.
 12. Needle bearing.
 13. Pin - release lever.
 14. Split pins.
 15. Facings.
 16. Disc.
 17. Splined hub.
 18. Driving spring.
 19. Spring retainer.
- } Driven
plate
assembly.

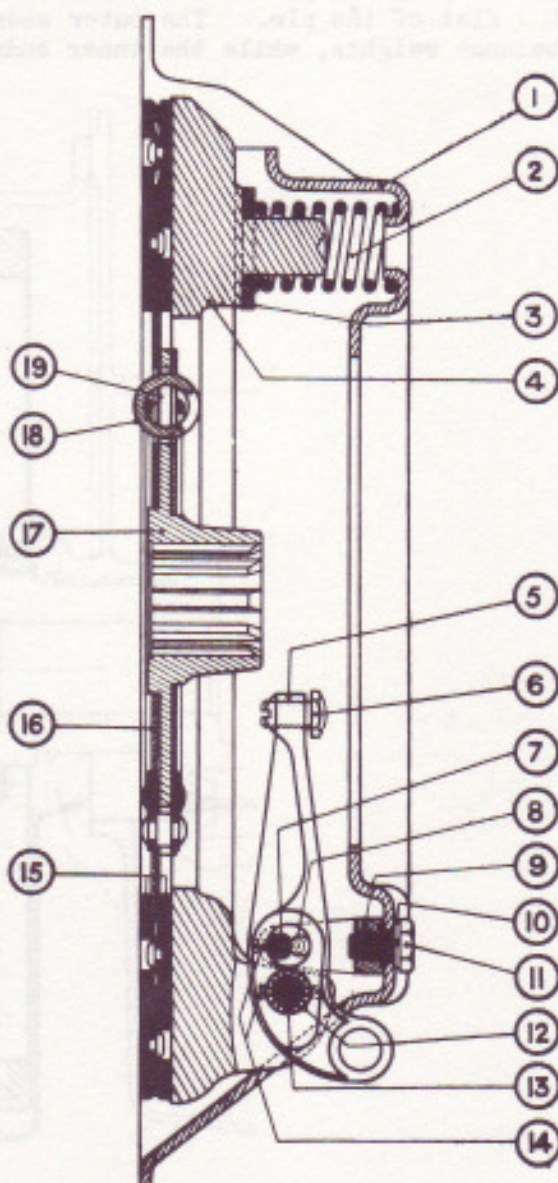


FIG. 1. SECTION THROUGH CLUTCH.



The driven plate assembly is of the flexible centre type in which the splined hub (17, Fig.1) is indirectly attached to the disc (16), and transmits the power and over-run through a number of driving springs (18) held in position by spring retainers (19). Two facings (15) are riveted to the disc.

The cover assembly consists of a pressed steel cover (1, Fig.1) and a cast iron pressure plate (4) loaded by nine thrust springs (2) which bed on insulator washers (3) positioned by projections formed on the pressure plate, three release levers (5) are mounted between forks formed on the pressure plate, and each lever is free to pivot on needle bearings (12) positioned by a release lever pin (13) which is secured by a split pin (14). Three release lever yokes (9) are assembled inside the cover and positioned by setscrews (11) and spring washers (10). Each yoke is forked, and the release lever is positioned in the fork by a pin (7) which bears on a roller (8) and is secured by a split pin (14). The pin is formed with a flat which registers with flats in the yoke and prevents the pin from turning, therefore the roller operates on the flat of the pin. The outer ends of the release levers are formed with balance weights, while the inner ends of the levers carry adjuster screws (6).

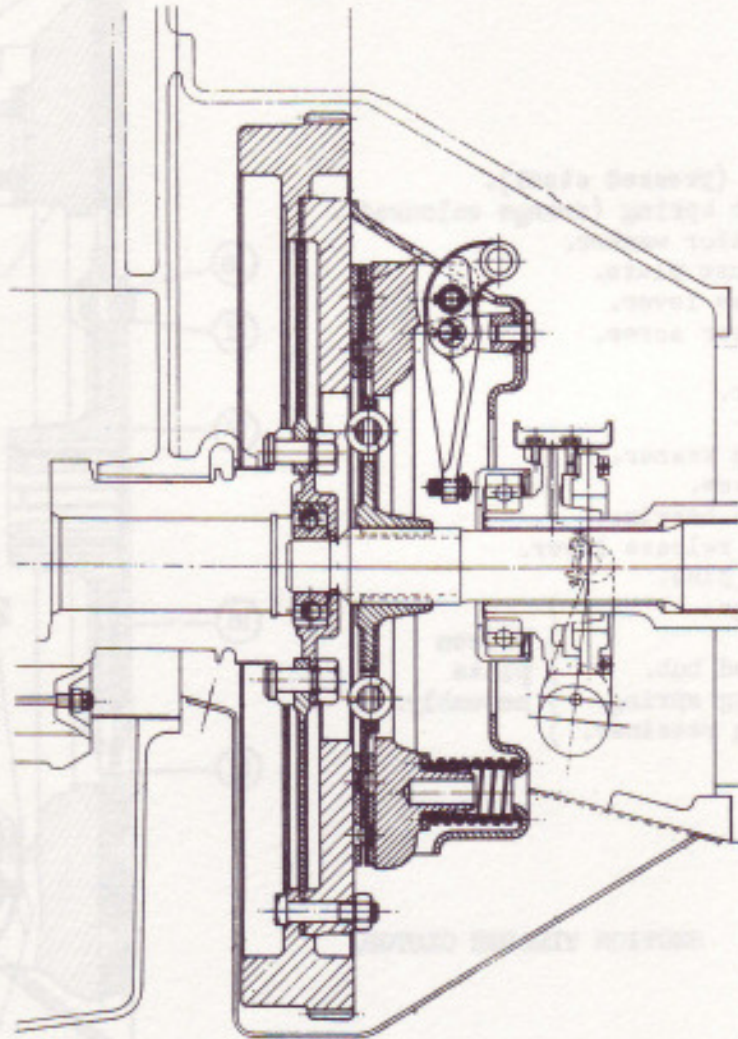


FIG. 2. SECTION THROUGH FLYWHEEL AND CLUTCH.



SERVICE FAULTS.

POSSIBLE CAUSES AND REMEDIES.

CLUTCH SLIP.

- Cause:
- (a) Insufficient free travel of the clutch pedal preventing full engagement of the clutch. If clutch slip is experienced at high engine R.P.M., it indicates that there is insufficient pedal clearance.
 - (b) Weak thrust springs (2, Fig.1). If excessive slip is allowed to occur, the heat generated may tend to soften the springs and add to the trouble, although a heat insulator washer (3, Fig.1) is interposed between each spring and the pressure plate.
 - (c) Worn out driven plate facings.
 - (d) Scored pressure plate (4, Fig 1) or scored friction plate (24, Fig.4) or both scored.

- Remedy:
- (a) Adjust the clutch pedal. Refer to appropriate paragraph of Sub-Section BF.3
 - (b) Fit a replacement unit (Cover Assembly) or new thrust springs to the correct specification whichever is the more readily available. The following is a specification of the springs to enable the condition of the existing springs to be determined:-
 - (i) Thrust spring colour - orange.
 - (ii) Assembled length - $1\frac{9}{16}$ " (39.7 mm).
 - (iii) Poundage of each spring when compressed to the assembled length - 130 to 140 lbs. (59 to 63.5 Kgs.)
 - (iv) Minimum serviceable poundage of each spring at the assembled length - 125 lbs. (56.7 Kgs.)

It should be noted where one or possibly two springs are below this figure and that the remainder are satisfactory, the total pressure may still be sufficient to prevent slip, but withdrawal of the pressure plate (4, Fig.1) may be uneven and give rise to shudder upon re-engagement. An accurate spring tester should be used when testing springs.
 - (c) Fit a new driven plate assembly.
 - (d) Reface in accordance with the instructions given in Sub-Section BF.3.



CLUTCH SHUDDER.

- Cause: (a) Resinous deposit on the facings caused by partially burnt oil.
 (b) Incorrect setting of the three adjusting screws (6, Fig.1) of the release levers.
 (c) Driving spring/s (18, Fig.1) of driven plate broken or weak thus reducing torsional flexibility of the driven plate.
 (d) Worn out driven plate facings.

- Remedy: (a) Refer to Sub-Section BF.3
 (b) Adjust the three adjusting screws. Refer to Sub-Section BF.3.
 (c) Fit a new driven plate assembly.
 (d) Fit a new driven plate assembly.

CLUTCH SPIN OR DRAG.

- Cause: (a) Too much free travel of the clutch pedal.
 (b) Insufficient total travel of the clutch pedal.
 (c) Incorrect setting of the three adjusting screws (6, Fig.1) of the release levers.
 (d) Distorted driven plate due to weight of gearbox being allowed to hang on clutch during erection after repairs.

- Remedy: (a) Adjust the clutch pedal. }
 (b) Adjust the clutch pedal. } Refer to appropriate paragraph of Sub-Section. BF.3.
 (c) Adjust the three adjusting screws. Refer to Sub-Section BF.3.
 (d) Fit a new driven plate assembly.

CLUTCH RATTLE.

Cause: Driving spring/s (18, Fig.1) of driven plate broken or weak.

Remedy: Fit a new driven plate assembly.

ABNORMAL FACING WEAR.

Cause: Usually produced by overloading (i.e. pulling trailers etc.) and by excessive slip when starting, associated with overloading.

Remedy: In the hands of the driver.



TO REMOVE, DISMANTLE AND RE-ASSEMBLE

CLUTCH.

The following description relates expressly to a chassis fitted with a Standard Saloon Body. The operations to expose the gearbox and clutch casing will probably differ on coachbuilt or special bodies, but the actual removal of the clutch will be the same.

TO EXPOSE GEARBOX AND CLUTCH CASING.

- (i) Drain coolant from cooling system - See Sub-Section BN.1
- (ii) Lock the master switch in the "OFF" position then disconnect the wires from the two terminals on the underside of the car heater. Disconnect the two hose connections from the heater, after slackening off the clips; great care being taken during this operation not to twist the pipes attached to the heater, as this may cause a leak.
- (iii) Remove the rear seat cushion.

Depress the adjuster catch and slide the left-hand front seat rearwards, a combined sliding and lifting movement will permit the seat to be detached from the runners and to be removed. Repeat for right-hand front seat.
- (iv) Remove loose carpets from front and rear floors, leaving centre portion attached to the large detachable floor panel. Release top end of leather gaiter surrounding change speed lever.

Place detached parts in a clean place and protect with a dust cover. Suitably cover interior of the car to prevent soiling.

- (v) Unscrew the twenty-two screws from metal toeboard and remove toeboard.

Unscrew the thirty-nine screws from large detachable floor panel and remove the panel. It can be easily slid through the front door if it is first lifted backwards over the change gear lever and then turned on one side.

It may be necessary to remove stainless steel strips securing draught welt along the bottom edge of the front door openings, before the detachable floor panel can be lifted out.

All the toeboard and floor panel screws fit into cage nuts.

- (vi) As a precautionary measure, disconnect positive cable from the battery.



TO REMOVE THE GEARBOX.

To carry out the following operations, place the car on a ramp or over a pit.

- (i) Drain all the oil from the gearbox, by removing drain plug. This operation is more easily performed when the gearbox is warm.
- (ii) Remove the two right-hand engine undershields.
- (iii) Disconnect speedometer drive cable from gearbox by unscrewing the knurled nut.
- (iv) Disconnect the flexible oil pipe from the rear end of gearbox by unscrewing the union nut.

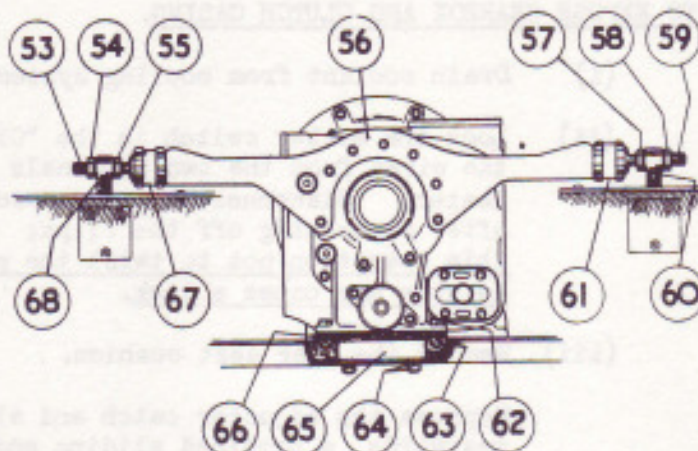


FIG. 3. ENGINE AND GEARBOX REAR SUPPORT.

- (v) Disconnect ball-joint of the oil damper control rod from the lever on the right-hand side of gearbox.
- (vi) Slacken back the inner nuts (55 and 57, Fig. 3), and remove torque reaction rubbers (61 and 67) from their retaining cups; then remove the torque bracket (56) from the rear of the gearbox by removing the seven nuts and spring washers.
- (vii) Remove the two nuts and spring washers (63), then remove bolts (62), fitted to the bottom and outermost holes in the gearbox rear end cover and support. Do not remove the nuts (64).
- (viii) Remove tie-bar complete with bracket and triangular packing piece from under the bracket, by removing the two nuts and spring washers securing it to the rear of the gearbox and also the three bolts securing the tie-bar bracket to the cruciform member. The nuts fitted to the tie-bar itself, must not be disturbed as this would upset the fore and aft position of the engine.
- (ix) Disconnect centre universal joint at the four bolt flange, and allow the rear propeller shaft to be lowered clear of the centre bearing.
- (x) Slacken back the screw of the propeller shaft centre bearing retaining strap (Jubilee type clip) a few turns.



- (xi) Disconnect front propeller shaft at the four bolt flange behind the gearbox, then slide the propeller shaft rearwards so that it is well clear of the gearbox.
- (xii) Uncouple change gear lever shaft (at its universal joint) from the selector lever shaft, by removing the four bolts; first marking the relationship of the flanges of the joint. Collect the spring.
- (xiii) Remove the selector lever shaft from the gearbox, as follows:-
 - (a) Remove top cover from gearbox.
 - (b) Remove the covers secured by three setscrews, then withdraw selector lever shaft complete, through the aperture in the side of the gearbox.
 - (c) Temporarily replace top cover, and cover up the aperture in the side of the gearbox to prevent the ingress of foreign matter.
- (xiv) Remove the two pull rods and drag links from the servo as described in Sub-Section BJ.5 paragraph, "To Remove the Servo from the Chassis" Next, push the rear end of the gearbox sideways for about half an inch towards the left-hand side of the chassis in order to give more clearance for the removal of the servo. Remove the central servo retaining setscrew, then, carefully pull the servo off its driving shaft, taking care not to damage the large phosphor bronze cover against the frame member. Remove the Ferodo sealing washer from the gearbox facing behind the servo.
- (xv) Before attempting to remove gearbox, the engine must be supported at a point immediately in front of the clutch casing, as gearbox rear mounting also supports the engine. To do this, place a jack under the rear end of the crankcase lower-half, interposing a wooden board between the lower-half and the jack in order to spread the load, and screw up the jack just sufficiently to take the load off the gearbox rear mounting.
- (xvi) Remove the two bolts from both ends of the gearbox support member which attach it to the frame cruciform. Then, remove support member taking care not to lose metal packing piece or pieces (66, Fig.3).
- (xvii) Remove the eight nuts and spring washers securing the gearbox to the clutch casing. Attach one end of a rope to the gearbox immediately behind the front flange, and the other end to the third motion shaft between the flange and the gearbox, taking care not to damage the damper control rod. Carefully draw the gearbox rearwards without tilting it in order to avoid distorting the clutch driven plate. When the first motion shaft is clear of the clutch casing, lower gearbox to the ground.



TO REMOVE THE CLUTCH FROM THE FLYWHEEL.

NOTE: It is not possible to remove the clutch casing from the engine with the engine in the frame, owing to the dashboard preventing it being lifted over the flywheel, therefore, it is necessary to extract the clutch itself from the casing.

- (i) Remove bottom cover from clutch casing, by removing the six nuts and spring washers. Do not disturb the small bolts which attach the felt strip to the cover, also take care not to distort the cover as this may cause it to foul the flywheel when replaced.
- (ii) Turn flywheel, until one of the three bolts (27, Fig.4), which retain the friction plate (24) to the flywheel (23), is at the lowest position. (Do not confuse these bolts with the six which

- 20. Flexible disc.
- 21. Crankshaft.
- 22. Bolts (12 off).
- 23. Flywheel.
- 24. Friction plate.
- 25. Housing - spigot bearing.
- 26. Spigot bearing.
- 27. Bolts (3 off).
- 'A' Oil Sealing Washer.

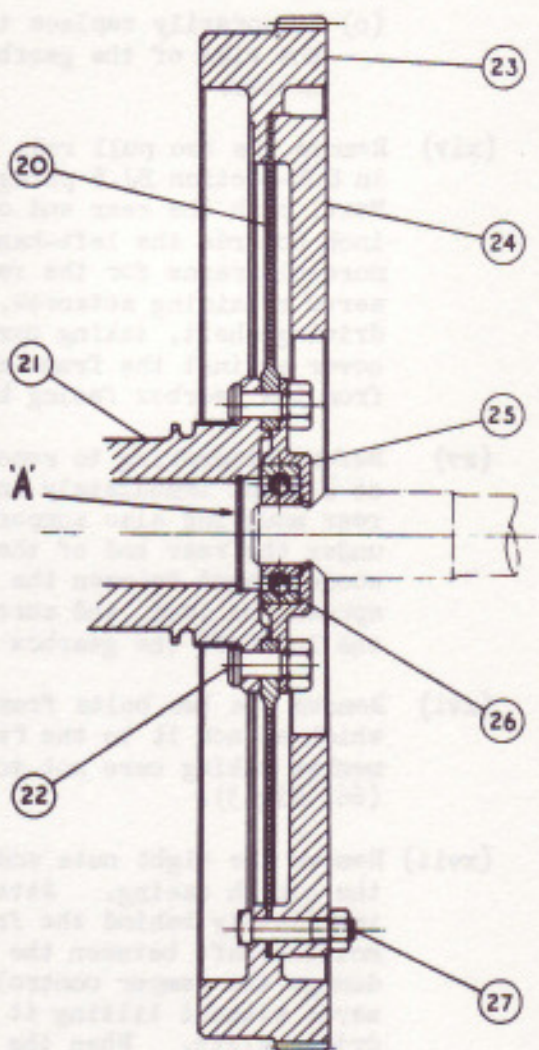


FIG. 4. SECTION THROUGH FLYWHEEL.



secure the clutch to the flywheel). It will be observed that the nuts of these three bolts are locked by centre punching. Remove the nut and the bolt, do not remove the remaining two nuts and bolts. This operation is necessary in order to provide the required withdrawal clearance when removing the clutch.

- (iii) Turn flywheel until two of the six nuts which retain the clutch to the flywheel are at their lowest position, and while these two nuts are being slackened back, insert and hold in position between the adjacent release lever (5, Fig.1) and the pressed steel cover (1), one of the special Borg and Beck 'L' shaped spacers. As the nuts are slackened back, this will cause the spacer to be nipped. Remove the nuts, spring washers and the two bolts. Turn the flywheel through 120° so as to expose two more nuts and repeat the above operations. Again turn the flywheel through another 120° and while holding the clutch, repeat the same operations.

In the event of the 'L' shaped spacers not being available, three suitably sized distance pieces such as a quarter inch nut, will suffice. Spacers or distance pieces are necessary in order to prevent the clutch coming too far back under the influence of the thrust springs (2) and jamming against the clutch operating cross shaft.

- (iv) While holding the clutch, turn the flywheel until the hole from which the bolt (27) was removed, is at its lowest position, and then remove the clutch (in a downwards direction) complete with driven plate.

INSPECTION OF CLUTCH FACINGS AFTER SERVICE.

The possibility of further use of the friction facings (15, Fig.1) of the driven plate assembly is sometimes raised, because they have a polished appearance after considerable service. It is natural to assume that a rough surface will give a higher frictional value against slipping, but this is not correct. The nature of a roughened surface is one of small hills and dales, but as the amount of useful friction for the purpose of taking up the drive is dependent upon the area in contact, a smooth surface is required to transmit a maximum of power.

A polished surface is a common experience, but it must not be confused with a glazed surface which is sometimes encountered due to conditions discussed in the following.

The ideal smooth or polished condition will provide proper contact, but a glazed surface may be due to a film or a condition introduced, which entirely alters the frictional value of the facings. These two conditions might be simply illustrated by the comparison between a polished wood and a varnished surface. In the former, the contact is still made by the original material, whereas in the latter instance, a film of dried varnish is interposed between the contact surfaces.

- (a) After the clutch has been in use for some little time, under perfect conditions, (i.e. without the presence of oil and with only that amount of slip which the clutch provides for under normal conditions) then the surface of the facings assume a polish, the facings are



then in a perfect condition. It will, however, be observed upon examination of the facings of a new driven plate assembly, that the finish (after the grinding process) of the surfaces, appears to be a little rough, which soon wears off.

- (b) Should oil in small quantities gain access to the clutch in such a manner as to come in contact with the facings, it will burn off, due to the heat generated by slip, which occurs under normal starting conditions. The burning off of this small amount of lubricant, has the effect of gradually darkening the facings, but, provided the polish on the facings remains, it has very little effect on clutch performance.
- (c) Should increased quantities of oil attain access to the facings, one or two conditions, or a combination of the two, may arise, depending upon the nature of the oil, etc.
 - (i) The oil may burn off and leave on the surface facings, a carbon deposit which assumes a high glaze and causes slip. This is a very definite though very thin deposit.
 - (ii) The oil may partially burn and leave a resinous deposit on the facings, which frequently produces a fierce clutch, and may also cause a "spinning" clutch due to a tendency of the facings to adhere to the flywheel friction plate or the pressure plate of the cover assembly.
 - (iii) There may be a combination of (i) and (ii) conditions, which is likely to produce a shudder during clutch engagement.
- (d) Still greater quantities of oil produce a blacked soaked appearance of the facings and the effect may be slip, or shudder in engagement, etc., according to the conditions.

If the conditions under (c) or (d) are experienced, a new driven plate assembly should be fitted, and the cause of the presence of oil removed (refer to Service Bulletin Nos. BB-32, BB-40, Section F, and BB-35 Section E) and the clutch and flywheel face thoroughly cleaned.

THE CLUTCH COVER ASSEMBLY.

The clutch cover assembly need not normally be dismantled for examination, since its comparatively simple mechanism can be inspected with the parts in position. The pressure plate should be free from deep scoring or surface cracks, and under perfect running conditions will have a polished surface. If scoring, distortion or surface cracks have occurred, the pressure plate should be refaced, or, a new assembly should be fitted if available.

The release lever assembly shows a certain amount of slackness, even when in a new condition, and this subject is covered more fully in paragraph "To Re-assemble Clutch Cover Assembly". If necessary, the thrust springs may be examined in accordance with the specification given in Sub-Section BF.2.



Reconditioning of the clutch cover assembly, which is supplied as a complete unit, is not usually undertaken except by the Manufacturers, and it is customary to fit a complete replacement and return the original for repair; if circumstances render this course impracticable, proceed as follows:-

TO DISMANTLE CLUTCH COVER ASSEMBLY.

- (i) Mark the following parts so that they can be re-assembled in the same relative positions to each other in order to preserve the balance:- Cover (1, Fig.1), pressure plate (4) and release levers (5).
- (ii) Place the cover assembly under a press with the pressure plate (4) resting on wooden blocks, so arranged that the cover is free to move downwards when pressure is applied.
- (iii) Place a wooden block across the top of the cover, resting on the spring bosses. then compress the cover, by means of the press, and, while holding it under compression, unscrew the setscrews (11) and collect the spring washers (10). Release pressure slowly to prevent the thrust springs (2) from flying out; remove cover and collect thrust springs and insulator washers (3) from the projections on the pressure plate.
- (iv) Extract the split pins (14), push out the pins (7 and 13), collect the yoke (9) and the roller (8). Remove the release lever (5) from the pressure plate (4) and push the needle bearings (12) out of the hole in the former. Dismantle remaining release levers from pressure plate in a similar manner.

TO RE-ASSEMBLE CLUTCH COVER ASSEMBLY.

Before assembly, thoroughly clean all parts and replace those which show appreciable wear. It will be found that there is a certain amount of slackness in each release lever assembly which is in order, providing there are no "flats" on the rollers of the needle bearing (12) and the pin (13). If the friction surface of the pressure plate (4) is scored, then it can be refaced as described in the appropriate paragraph.

The thrust springs (2) can be examined in accordance with the specification given in Sub-Section BF.2. A slight smear of high melting point grease, such as Duckham's HP.2295 or Keenol should be applied to the following parts during assembly. Drive lug sides on the pressure plate (4), bores and lands of release levers (5) and the full length of the rollers (8).

- (i) Place the roller (8) in the hole in the release lever (5) which is nearest to the adjusting screw (6) and pass the fork of the yoke (9) over the rollers. Insert the yoke pin (7) through the flats formed in the yoke fork and fit a new split pin (14).
- (ii) Using a small quantity of the same high melting point grease, assemble the needle bearings (12) in the other hole in the release lever. Position the lever between the lugs on the pressure plate so that the holes coincide, insert the release lever pin (13) and fit a new split pin (14). Ensure that the needle bearings are not displaced when fitting the release lever pin. Fit the



remaining levers in a similar manner ensuring that the markings coincide.

- (iii) Place the pressure plate on the blocks under the press and assemble an insulator washer (3) and a thrust spring (2) over each projection on the pressure plate.
- (iv) Lay the cover over the assembled parts, ensuring that the marks made on the cover coincide, and that the tops of the springs register correctly with the positioning lips inside the cover.
- (v) Place the wooden block across the cover, operate press, and guide the outer ends of the release levers through the holes in the cover.
- (vi) Screw the setscrews (11) through the cover into the yokes (9), ensuring that a spring washer (10) is under the head of each set-screw, and tighten securely. Release and compress the clutch a few times to ensure that the moving parts are operating correctly. Remove the clutch from the press. Refer to the following paragraph.

TO ADJUST THE THREE ADJUSTING SCREWS OF THE RELEASE LEVERS.

After the dismantling and re-assembling of a clutch cover, it will be necessary to check, and re-adjust, if required, the adjusting screws (6, Fig.1) on the inner ends of the three release levers (5), because satisfactory operation of this type of clutch is absolutely dependent on the accurate adjustment of these screws.

Due to the variation in the thickness of the facings (15, Fig.1) of the driven plate assembly, the only accurate method is to adjust the screws (6) while the pressure plate (4) is held parallel to the flywheel by using a Borg and Beck Lever Adjustment Gauge, (Fig.5). The thickness of the three flat machined lugs of the gauge should not be less than 0.327" (8.3 m/m) or more than 0.330" (8.38 m/m) thick, nor should the external diameter of the gauge be less than 8.400" (213.36 m/m).

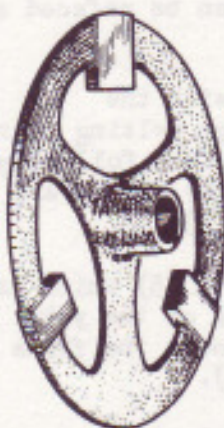


FIG. 5. BORG & BECK
LEVER ADJUSTMENT GAUGE.

During the initial build of a clutch, the three adjusting screws are adjusted so that the hemispherical head of each screw is 2.062" (52.38 m/m) + or - 0.030" (0.76 m/m) from the face of the friction plate (24, Fig.4) of the flywheel, with a maximum allowable difference in the height of the screws of less than 0.005" (0.127 m/m).

To adjust the screws, proceed as follows:-

- (i) Place the Borg & Beck Gauge, with its hub uppermost on a surface plate, then measure the height from the underside of the three flat machined lugs (i.e. from the surface plate) of the gauge to the top of the hub. Should the measurement for example be found to be 1.812" (46.02 m/m), then machine a distance piece 0.250" (6.35 m/m) thick x 1.400" (35.56 m/m) diameter, to bring this height up to 2.062" (52.38 m/m). Should it be found when



measuring the height to the top of the hub as described above, that it is less than 1.812" (46.02 mm), then a corresponding thicker distance piece will be required.

- (ii) Clean the joint face of the cover (1, Fig.1) and remove any burrs. Place the gauge plate centrally against the pressure plate (4) in the position normally occupied by the driven plate assembly, and then bolt the clutch cover assembly to a suitable plate having flat surfaces in which six holes have been drilled to correspond with the six holes in the cover. The plate should measure approximately 6.500" (12 mm) thick by about 13.000" (330 mm) square, having machined surfaces parallel to each other. The nuts of the six bolts should be tightened down one or two turns at a time by diagonal selection in order to avoid distorting or springing the pressed steel cover. Before the cover is tightened down, be sure the gauge is centred and the three flat machined lugs are directly under the release levers. To ensure that the cover has been squarely tightened down, a check should be made with a 0.0015" (0.038 mm) feeler between it and the plate.
- (iii) Place the machined distance piece on to the top of the hub of the gauge. A short straight edge or scale (approximately three inches long) can now be laid across the centre of the top of the distance piece. Check, and if necessary, adjust each screw in turn until they just touch the straight edge or scale. Should it be found, after adjustment of the screws, that the saw-cut in them does not line up with the slot in the release levers, then do not attempt to alter the setting of the screws. Lock them by peening metal from the levers into the saw-cut of each of the three screws.
- (iv) Replace the three Borg & Beck 'L' shaped spacers in position.

TO REFACE THE FRICTION PLATE OF THE FLYWHEEL AND THE PRESSURE PLATE OF THE CLUTCH COVER ASSEMBLY.

After a considerable mileage has been covered or should the clutch have been subjected to harsh treatment, the friction plate (24, Fig.4) and the pressure plate (4, Fig.1) of the cover assembly may be found to be scored, and there may also be evidence of contraction-cracks on the friction surface, i.e. small hair-line surface cracks.

It is permissible to regrind the friction surface of both the friction and the pressure plate to a depth not exceeding 0.010" (0.25 mm) on each plate. Remove the least amount of metal necessary to give a clean and highly polished finish. If the plates are only lightly scored, then they can be cleaned up in position by stoning.

TO REMOVE AND REFIT THE FRICTION PLATE OF THE FLYWHEEL.

It should be noted when re-assembling the friction plate to the flywheel, that one of the three holes in the friction plate, flexible disc (20, Fig.4) and the flywheel through which the bolts (27) are fitted, is offset by 1°, therefore there is no need to mark them for co-relation purposes.



- (i) Remove the remaining two bolts (27, Fig.4); before removing a bolt, turn the flywheel until the bolt is at its lowest position, but do not turn the engine until it has been removed, in order to prevent the possibility of the bolt head jamming against the clutch casing. Similar precautions must be taken when replacing the bolts.
- (ii) Remove friction plate from flywheel, leaving the latter suspended on the flexible disc (20). If necessary, the first few threads of the bolts can be cleaned up with a 0.3125" diameter 22 T.P.I. (R.H.) B.S.F. die. When re-assembling friction plate to flywheel, three new nuts should be fitted if necessary.
- (iii) Line up the 1° offset hole in the flywheel, flexible disc and the friction plate and refit two bolts (27), the third being refitted after the re-assembling of the clutch to the flywheel, the three nuts should then be fully tightened, and the bolts re-centre punched in two places to lock the nuts.

RE-ASSEMBLING THE CLUTCH TO THE FLYWHEEL AND CHECKING THE OIL FEED TO THE CLUTCH RELEASE BEARING.

- (i) Remove all traces of oil, grease or foreign matter from the flywheel, clutch, and the interior of the clutch casing. Do not touch the facings of the driven plate with greasy hands or allow any oil or grease to contact the facings.
- (ii) When fitting a new driven plate assembly, ascertain that it is a free sliding fit on the splines of the first motion shaft of the gearbox, in every position before assembling the clutch to the flywheel.
- (iii) Turn the flywheel until the hole from which one of the bolts (27, Fig.4) was removed, is at the lowest position.
- (iv) With a Borg & Beck 'L' shaped spacer (or distance piece) in position between each of the three release levers, and the pressed steel cover of the clutch, place the drivenplate assembly against the pressure plate (4, Fig.1) of the cover assembly with the short end of the splined hub, facing the flywheel.
- (v) Holding the driven plate in position against the clutch, lift the clutch up between the flywheel and the clutch operating shaft, and centralise the driven plate by inserting the splined aligning tool, No.1616/T1002 into the hub of it, and then into the spigot bearing fitted at the end of the crankshaft. If a dowel is fitted or if there are co-relation marks on the clutch, and the flywheel, line these up, and then secure the cover assembly to the flywheel with the six bolts, spring washers and nuts, tightening the latter by diagonal selection and removing the 'L' shaped spacers directly they become free during the tightening of the nuts.

Remove the aligning tool.



- (vi) Refit the bolt (27), tighten up the nut and centre punch the bolt in two places to lock the nut. Should the friction plate (24) have been removed, then tighten up the three nuts and lock by centre punching.
- (vii) Make sure that the oil feed pipe (28, Fig.6) to the oil trough of the clutch trunnion is correctly positioned, and check the rate of oil flow to the clutch release bearing in accordance with the instructions given in paragraph 3 of Service Bulletin No.BB-32 Section F.

- 28. Oil Feed Pipe.
- 29. Trough.
- 30. Setscrew.
- 31. Joint.
- 32. Clutch Release Bearing.
- 33. Housing.
- 34. Oil Retaining Ring.
- 35. Spring Ring.
- 36. Split Pin.
- 37. Trunnion.
- 38. Universal Ring.

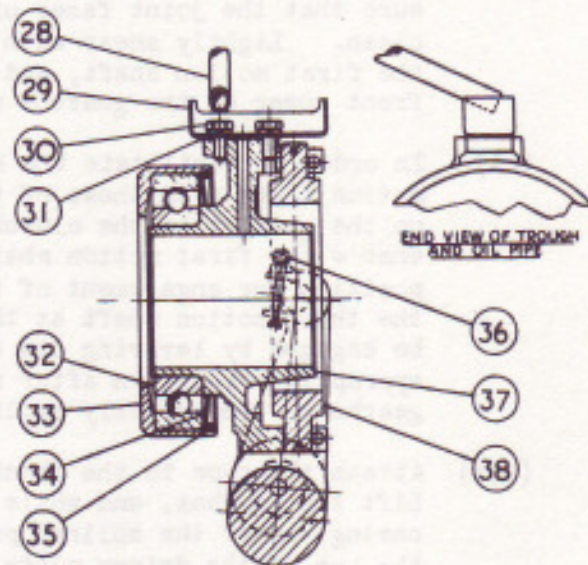


FIG. 6. SECTION THROUGH CLUTCH RELEASE BEARING AND TRUNNION.

TO FIT A NEW CLUTCH RELEASE BEARING TO THE TRUNNION.

In the event of a clutch release bearing becoming noisy, it should be replaced. Access to the bearing is obtained after the removal of the gearbox, but it is not necessary to remove the clutch.

- (i) Remove the two split pins (36, Fig.6) securing clutch trunnion assembly to the clutch operating shaft and remove the trunnion complete.
- (ii) Using an aluminium drift, remove the trunnion (37) from the ball bearing (32).
- (iii) Remove the spring ring (35) from the housing (33) and then remove the oil retaining ring (34).
- (iv) Remove the ball bearing from the housing and insert the new bearing, after cleaning all dismantled parts and making sure that the oil passage in the trunnion is clear.



- (v) The remainder of the re-assembling is the reverse of the dismantling operations. Fit two new split pins.
- (vi) After re-assembling, check the rate of oil flow to the release bearing in accordance with the instructions given in paragraph 3 of Service Bulletin No. BB-32 Section F.

TO REFIT THE GEARBOX.

- (i) Clean the gearbox externally including the front end, also make sure that the joint faces of the clutch casing and gearbox are clean. Lightly smear with engine oil the splined portion of the first motion shaft, and also the machined extension of the front cover of the gearbox upon which the trunnion slides.
- (ii) In order to facilitate the engagement of the splines of the first motion shaft with those of the clutch driven plate when offering up the gearbox to the clutch casing, engage a gear, this will enable the first motion shaft to be rotated to the correct position for engagement of the splines, by turning the flange on the third motion shaft at the rear of the gearbox. A gear can be engaged by levering one of the selector rods into the appropriate position after removal of the cover on the top of the gearbox. Temporarily replace cover after engaging gear.
- (iii) Attach the rope to the front and rear of the gearbox as before. Lift the gearbox, and while holding it square with the clutch casing, enter the splined portion of the first motion shaft into the hub of the driven plate and push the gearbox into position until the studs of the clutch casing protrude through the gearbox flange. It is important that this operation is carried out carefully, in order to avoid strain on the shaft and distortion of the driven plate assembly.

It will probably be necessary to fit the two lower nuts and spring washers, retaining the gearbox to the clutch casing, before the gearbox is pushed fully home. Fit the remaining six nuts and spring washers and progressively tighten up the eight nuts to secure.

- (iv) With the jack still in position under the engine, re-assemble the gearbox support member to the frame cruciform and secure with the four bolts. Replace the packing piece/s (66, Fig. 3) but do not fit the bolts (62) at this stage. Lower but do not remove the jack.
- (v) Refit the servo to the gearbox as described in Sub-Section BJ.5, paragraph "To Refit the Servo to the Gearbox". If additional clearance is required for fitting the servo, then move the rear of the gearbox about half an inch towards the left-hand side of the chassis.
- (vi) Raise the jack just sufficiently to take the weight off the gearbox rear support member, line up the gearbox and the packing piece/s (66) and fit the two bolts (62) and the nuts and washers (63). Ascertain that the heads of the two bolts are correctly



positioned, remove the jack and tighten up the two nuts with a box spanner.

- (vii) Remove the cover from the top of the gearbox and the temporary cover from the side of the gearbox. With a suitable lever, move the selector rod jaws into line in the neutral position.
- (viii) Re-assemble the selector lever shaft to the gearbox as follows:-

Clean the joint face of the gearbox and of the two aluminium covers which retain the selector lever shaft to the gearbox and smear the joint faces with a thin film of jointing compound. Line up the oil return holes of these two covers and refit the assembly to the gearbox observing that the selector lever fits into the jaws of the selector rods and also that the oil holes in the two covers are at the bottom. Secure with the three setscrews and spring washers. Replace the top cover.

- (ix) Place the short coiled spring in position between the ends of the selector lever shaft and the change gear lever shaft, line up the co-relation markings on the universal joint and couple together with the four bolts.
- (x) Re-couple the front propeller shaft to the gearbox.
- (xi) Re-couple the rear propeller shaft at the centre universal joint.
- (xii) Tighten up the screw of the propeller shaft centre bearing retaining strap (Jubilee type clip).
- (xiii) Place the tie-bar complete on the two studs at the rear end of the gearbox and then place the triangular packing piece between the rear tie-bar bracket and the cruciform and secure with the three bolts. Replace the nuts and spring washers to secure the front of the tie-bar to the gearbox.
- (xiv) Replace the torque bracket (56, Fig.3) on the rear of the gearbox and secure with the seven nuts and spring washers.
- (xv) Replace the torque reaction rubbers (61 and 67) with their recessed ends outermost, making sure that they are correctly located in the cups and then tighten up the inner nuts (55 and 57) to lock, holding the cups "square" while doing this. Do not disturb the outer nuts (54 and 58).

NOTE:- If the outer nuts have been disturbed, or if for any other reason it is desired to reset the adjustment of the torque rubbers, then proceed as follows:-

Fully slacken back the inner and outer nuts, correctly replace the rubbers, making sure that they are pressed



fully home in the cups. Now slacken back the inner nuts and retighten them finger tight, then holding the cups "square", tighten two more complete turns with a spanner, finally tighten the outer nuts to lock.

- (xvi) Reconnect the oil damper control rod to the lever on the right-hand side of the gearbox.
- (xvii) Reconnect the flexible oil pipe, (leading to the rear shock dampers), to the union on the rear of the gearbox.
- (xviii) Reconnect the speedometer drive cable to the gearbox.
- (xix) With the servo in position and the central servo retaining setscrew tightened up, refit the connections to the servo as described in Sub-Section BJ.5, paragraph, "Refitting the connections to the Servo". The adjustment of the servo motor should not have been effected by its removal from the gearbox, but it is advisable at this stage to check the adjustment in accordance with the instructions given in Sub-Section BJ.5 paragraph, "To adjust the Servo".
- (xx) Replace the two right-hand engine undershields.
- (xxi) With the oil drain plug tightened up, refill the gearbox up to the level mark on the dipstick. Approximately six pints of oil will be required. Use a first quality engine oil of viscosity S.A.E. 30 as instructed in the Owner's Handbook.
- (xxii) Reconnect the positive earthing wire to the battery and replace the cover.
- (xxiii) THOROUGHLY INSPECT that all nuts have been tightened up and that no split pins, locking plates and spring washers have been omitted - this applies particularly to the Servo and Brake connections.
- (xxiv) The re-assembling of the remaining items such as floorboards, carpets and seats, etc., is approximately the reverse of the dismantling instructions for "Exposing the Gearbox and Clutch Casing", but bearing in mind the following:-
 - (a) When replacing the electrical connections to the car heater, ensure that the orange coloured wire is connected to the terminal marked 'SW' on the heater and the black coloured wire, if fitted, connected to the 'E' terminal. Also make sure that the two rubber water pipes have been reconnected.
 - (b) Finally, refill the cooling system with the anti-freeze mixture removed, topping up as necessary.
- (xxv) Expel all air from the oil pressure pipe to each rear shock damper in accordance with the instructions given in Sub-Section BR-1, which will be found at the end of paragraph "To Refit a Rear Shock Damper".



TO ADJUST THE CLUTCH PEDAL.

As the driven plate facings wear, the pressure plate (4, Fig.1) moves closer to the flywheel and the weighted ends of the three release levers follow. This causes the inner ends of the release levers to travel further towards the gearbox and decrease the clearance between the levers and the clutch release bearing. The effect of this on the clutch pedal, is to decrease the clearance or free travel, which is the distance the clutch pedal can be moved down towards the pedal gap plate before the release bearing contacts the three release levers. Measure, and adjust if necessary, the free travel of the clutch pedal as follows

With the clutch pedal lever against its up-stop under the pedal gap plate, place the edge of a rule against the centre of the side of the pedal and the end of it against the dash. Depress the pedal by hand until the clutch release bearing just touches the three release levers of the clutch. Measure the free travel which should be $1\frac{1}{2}$ " (38 mm). A turnbuckle adjuster with a central spanning point is provided. Insufficient free travel of the clutch pedal can be one of the causes of clutch slip.

NOTE:- To obtain access to the clutch pedal adjusting mechanism, remove the rear half of the right-hand engine undershield and adjust as necessary from below.
