

CLUTCH



SERVICE INSTRUCTION LEAFLET

ISSUED BY
ROLLS-ROYCE LIMITED

RR/F1.

SB/GS.1/SF

Subject :
CLUTCH - REPLACEMENT
TIMING MARKS
25/30 AND WRAITH

Date
of 2nd December, 1946
Issue

IMPORTANT

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The ignition and valve timing marks on the 25/30 H.P. and Wraith are stamped on the Borg and Beck clutch housing. It is therefore necessary whenever a complete new clutch is fitted to ensure that these markings are transferred to the new clutch in the same relative positions. This applies also to the tappet clearance figure required for checking valve timing.

In order to avoid possible confusion, all irrelevant marks should be erased by peening or filing.



SERVICE INSTRUCTION LEAFLET

ISSUED BY

ROLLS-ROYCE LIMITED

RR/F2

Subject :

CLUTCHES.
OVERHAUL, ADJUSTMENT AND GENERAL
MAINTENANCE. ALL TYPES.

Date
of
Issue

31st January, 195

SB/GF.1/SF.

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The clutches fitted to ALL Rolls-Royce cars, (excluding Silver Ghost series) are of the Single Dry Plate type. The earlier clutches were of Rolls-Royce design and manufacture, which were superseded by Borg and Beck assemblies of standard type, as follows:-

	<u>Rolls-Royce Clutch</u>	<u>Borg and Beck Clutch</u>
20 h.p.	All	None.
20/25 h.p.	To GTK-4.1	From GTK-4.2 inclusive
25/30 h.p.	None	All
Wraith	None	All
Phantom I	All	None
Phantom II	All	None
Phantom III	All	At 3-AZ-20 and onwards a "Cushion" type driven plate was used of Borg & Beck manufacture. At 3-CM-79 a "Long" type clutch plate was fitted, this became the standard replacement for all Phantom III cars.

DESCRIPTIVE INFORMATION

Prior to proceeding with the data covering overhaul and adjustment, the following brief description and diagrammatic sketches illustrating the individual characteristics and construction of each type of clutch are given.

ALL COMMUNICATIONS SHOULD BE ADDRESSED TO

ROLLS-ROYCE LIMITED, SERVICE STATION, HYTHE ROAD, WILLESDEN, LONDON, N.W.10

1. 20 h.p. & 20/25 h.p. Chassis to GTK-41 incl:

Fig. 1 illustrates the general design of the clutch fitted to all the chassis in the above mentioned ranges.

In this design the clutch plate is located between two clutch liners, both of which are riveted to carrier rings (A & B), the front ring being bolted to the flywheel face, while the rear ring constitutes the pressure plate, (B).

Four levers, (only one "C" is shown) are provided for clutch withdrawal purposes, their ends, or toes, being pressed inwards on operation of the clutch pedal by the sliding sleeve, (D) this being actuated through a ball thrust bearing and trunion.

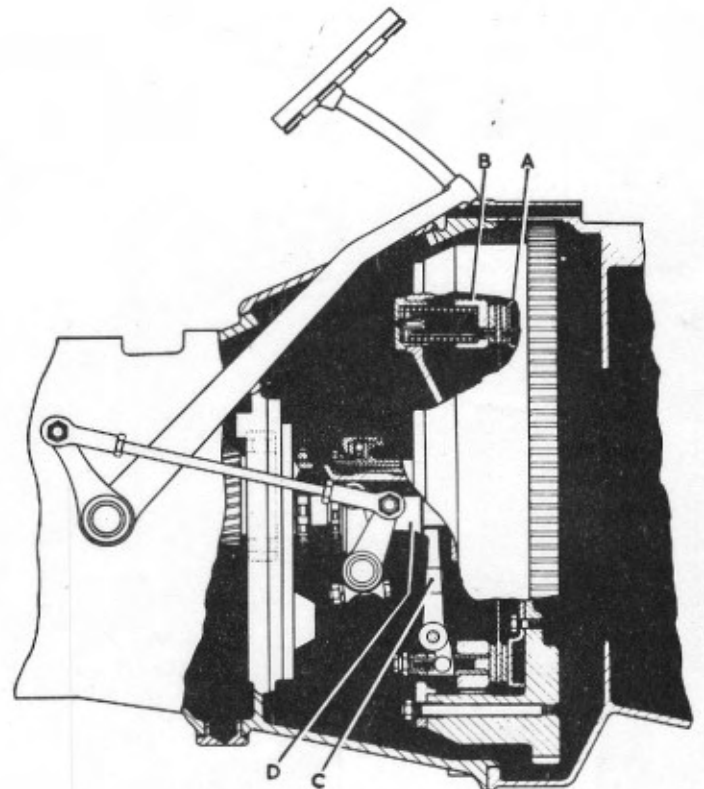


Fig. 1.

Two types of clutch plates were used during this production period, one being the rigid type and the other the Spring Drive type, shown in Fig.2. which was fitted only to 20/25 h.p. chassis between GXB-1 and GRF-41 inclusive.

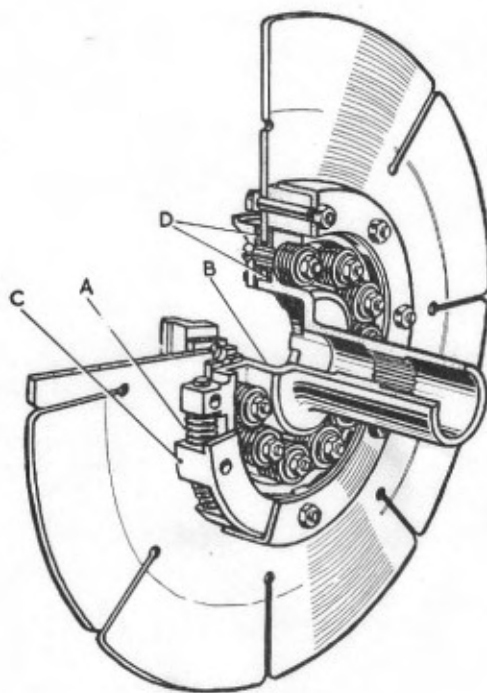


Fig. 2.

In this type the drive from the friction plate is transmitted to the driving shaft through the medium of the coil springs (A), these being set circumferentially between alternate dogs on the hub (B), and the ring (C), which is bolted to the plate itself. A damping device is incorporated within this spring drive section whereby the movement of the plate relative to the hub is controlled by means of the two spring loaded friction liners (D).

Both the Rigid and the Spring Drive type of clutch plates have alternate segments staggered to provide gradual engagement, the staggered segments being bent .025" (0.64 m/m.) towards the engine to assist full dis-engagement.

All plates have the words "To Engine" etched on this face as an aid to correct assembly.

11. Phantom 1.

Fig. 3. illustrates the type of clutch fitted to Phantom 1. chassis.

Early Phantom 1. chassis had the clutch fabrics riveted to the pressure ring and the flywheel face respectively. Commencing at Chassis No: 31-NC, however, all subsequent Phantom 1. chassis were fitted with a floating carrier ring to which the clutch fabric on the engine side of the clutch plate was riveted.

This ring (A), which is secured to the flywheel face for rotation purposes by the driving dowels (B), is spring loaded by means of four coil springs (C), in order to ensure a smooth take-up of the drive on engagement of the clutch.

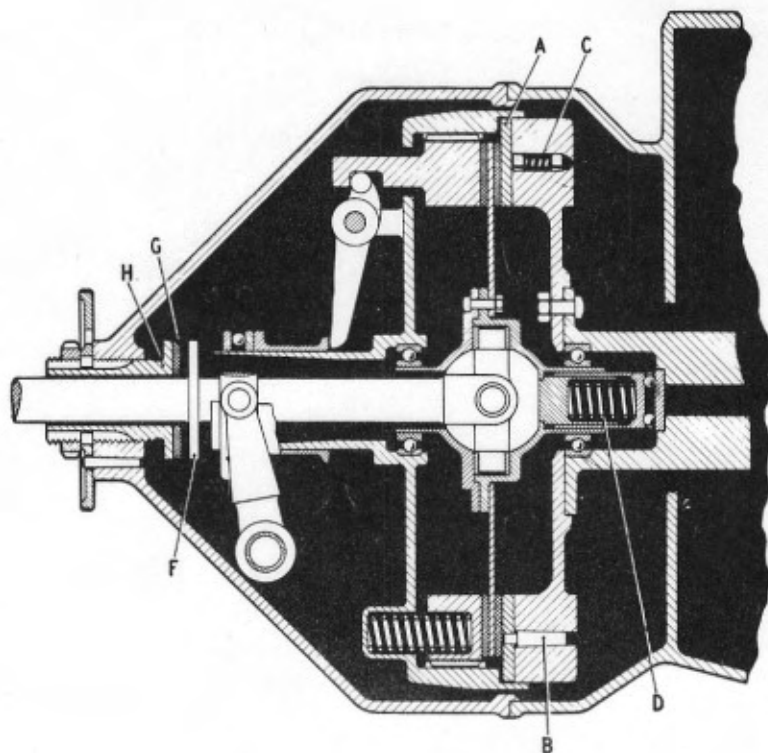


Fig. 3.

The clutch plate is accurately located relative to the friction linings by means of the two ball journals on either side of the hub, axial movement of the plate and hub being allowed for in the mounting of these bearings.

A special form of clutch stop, or brake, is provided, the pressure of which is predetermined and not directly affected by pressure on the clutch pedal. A coil spring (D), tends to push the clutch plate and shaft away from the engine when the clutch is withdrawn. A collar (F), on the clutch shaft is then caused to make contact with the friction ring (G), carried on an axially adjustable sleeve (H), fixed to the casing.

111. Phantom 11.

The diagrammatic sketch Fig.4. below illustrates the type of clutch fitted to Phantom 11. chassis.

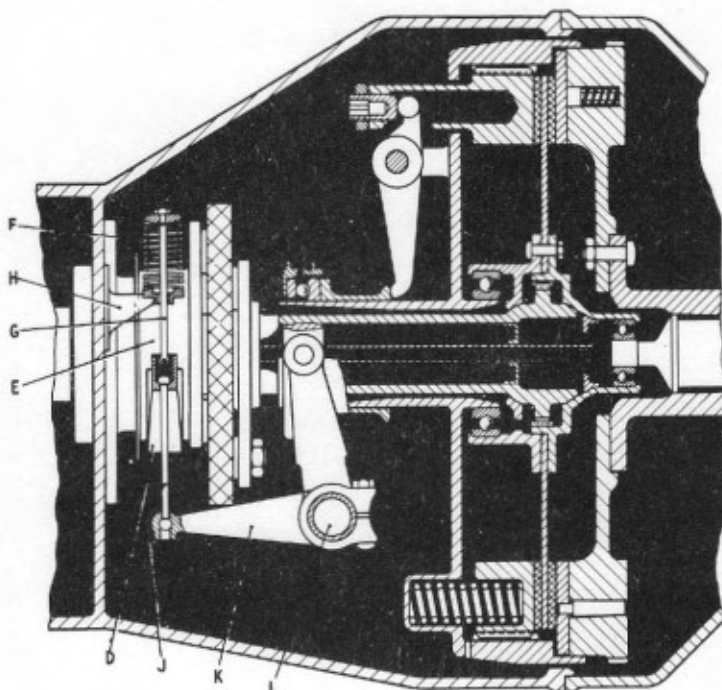


Fig. 4.

The Phantom 11. clutch is housed in an extension of the gearbox which is bolted to the crankcase.

Although these clutches correspond basically with those fitted to Phantom 1. chassis, certain minor differences exist, notably in the deletion of the coil spring at the spigot end of the clutch shaft, and the design of the clutch stop mechanism. With the introduction of the synchromesh gearbox at Chassis Number 46-MS, however, the clutch brake was deleted.

The Clutch brake comprises of a brake shoe (D), lined with friction fabric, which is pivoted to the clutch housing, and which is pressed into engagement with the drum (E), by the spring (F), and rod (G), this spring reacting against a bracket (H), which is secured to the front end of the gearbox. Normally with the clutch engaged, the shoe is held clear of the drum by the rod (J), and the lever (K), which is secured to the withdrawing shaft (L), by means of a pinch bolt. When the clutch pedal is depressed, the end of this lever is raised, and permits the spring to apply the brake shoe by means of the rod.

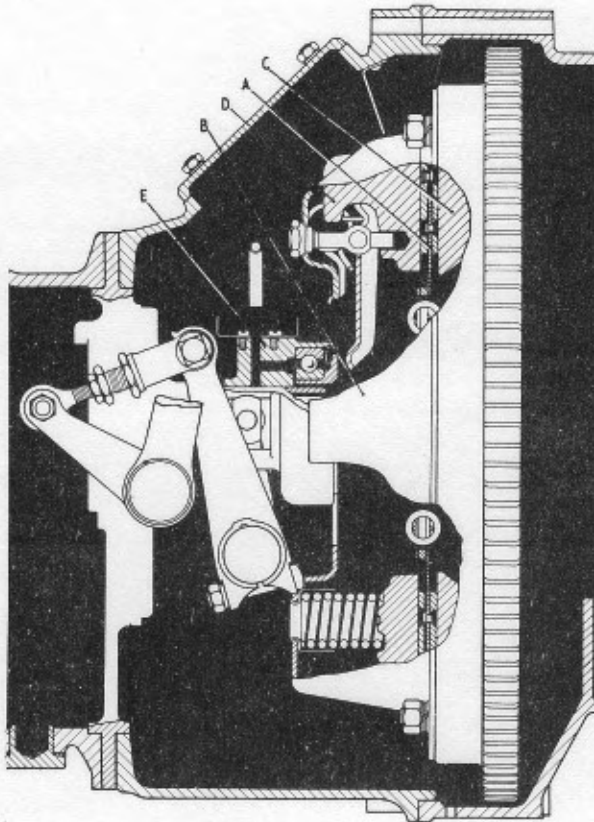
IV. 20/25 h.p. from GTK-42 incl: 25/30 h.p. and WraithBORG AND BECK CLUTCHES (11")

Fig. 5.

V. Phantom 111. Clutch.

All Phantom 111. chassis are fitted with a Rolls-Royce designed clutch, the driven plate being, however, either Borg and Beck, or the 13½" "Long" type which is shown in Fig.6, and now represents the correct replacement for all chassis.

In this the driven plate assembly (A), which is lined with friction fabric on both its faces, is interposed between the cover assembly (B), and the flywheel face, and is located in position by means of the splined clutch driving shaft. The cover assembly is secured to the flywheel flange by studs, the friction surfaces being provided by the pressure ring (C), and the flywheel face respectively, and the whole unit is enclosed in a casing made in two halves and bolted to the crankcase. Six release levers are provided for clutch withdrawal purposes, being pivoted on needle rollers, and actuated through a ball thrust race.

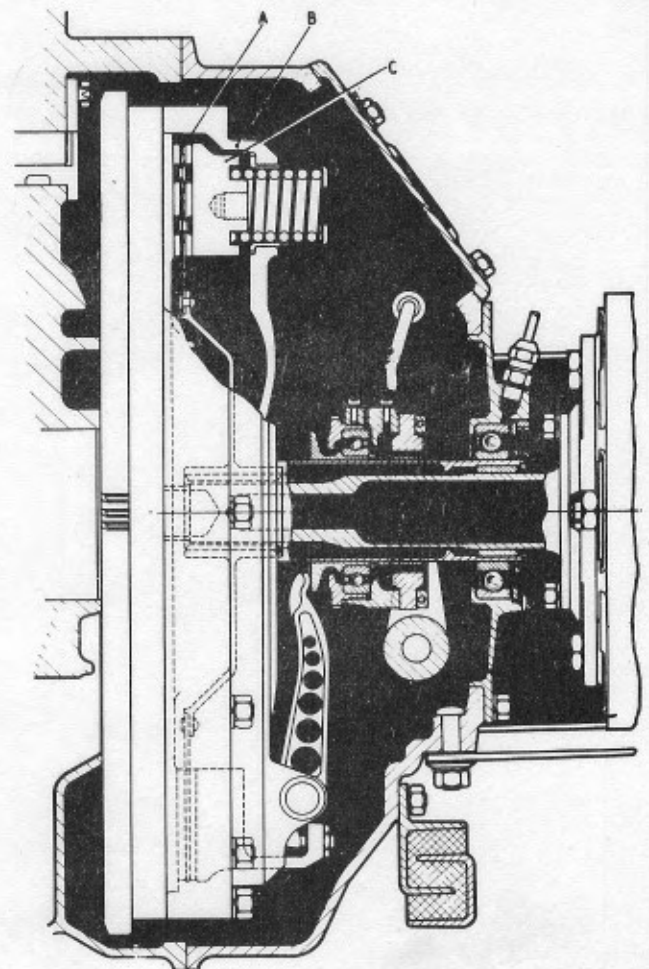


Fig. 6.

All chassis in the above mentioned ranges are fitted with the standard 11" Borg and Beck clutch illustrated in Fig.5.

In this type the driven plate (A), which is lined with friction fabric on both its faces, is interposed between the clutch cover assembly (B), and the flywheel face to which the cover assembly is bolted. The driven plate is located in position relative to the friction surfaces provided by the pressure ring (D), and the flywheel face (C), by means of the splined 1st. motion shaft on the gearbox. Four release levers are mounted on the clutch cover, and are pivoted on floating pins. The release levers are operated by the sliding trunnion (E), which is actuated by the withdrawal forks.

On "Wraith" cars the operating linkage is of the compensated type to allow for greater latitude of engine movement, and is more complex than is shown in the illustration.

CLUTCH ADJUSTMENT DURING SERVICE

Normally the clutches fitted to Rolls-Royce chassis require very little attention during service beyond the periodical adjustment to restore the free pedal travel which has been lost due to wear of the friction linings.

NORMAL RUNNING ADJUSTMENT can be effected at the link rod between the clutch pedal and the external operating lever. On some 20/25 h.p. models a limit to this adjustment is determined by the withdrawal sleeve fouling the front face of the gearbox ball race housing. A check must always be made for adequate clearance at this point with the clutch pedal lifted to the floorboard, after adjustment.

On earlier models the link rod is pegged and external adjustment should not be attempted.

On some models including all Phantom III chassis, and all chassis fitted with Borg and Beck clutches, the link rod is in the form of a turnbuckle with right and left hand thread.

WORKSHOP ADJUSTMENT on Rolls-Royce type clutches. At the time of overhaul and/or when the external adjustment is completed, adjustment should be effected at the toggle lever adjusting screws. On models with pegged linkage, the toggles provide the only adjustment.

The adjustment procedures and all relevant data appertaining to each type of clutch fitted will be found detailed in the following paragraphs.

ROLLS-ROYCE TYPE CLUTCHES

All 20 h.p. and 20/25 h.p. to GRF-41 inclusive.

Clutch adjustment on all above chassis should be effected at the toggle levers, the correct toggle adjustment being obtained when the toes of the levers are in light contact with the face of the withdrawal sleeve when this face is exactly 0.750" (19.05 mm.) from the rear face of the clutch cover plate. The best method of adjustment is to slacken off the four adjusting screws several turns, which will allow the withdrawal sleeve to approach the clutch cover face. One lever should then be adjusted by the screw until the gap between the withdrawal sleeve and clutch cover face is to the exact measurement. This is best determined by means of a small gauge measuring 0.750" (19.05 mm.). With the withdrawal sleeve held against this lever, the remaining levers should be adjusted up to the sleeve. A final check should then be made to ensure that all four levers made equal contact with the sleeve.

With the above adjustment carried out, the clutch pedal should have 3/8" to 1/2" (9.5 to 12.70 mm.) free lift to the floorboard (floorboard secured in position). In the event of this measurement being outside these limits, it would indicate that adjustment has been made at the link rod which should be reset.

20/25 h.p. Chassis GLG-1 to GTK-41 incl:

Periodical adjustment may be carried out at the turnbuckle (external linkage). At overhaul, toggle adjustment is necessary, as described previously, and the turnbuckle restored to the original setting by measurement of the free pedal lift. The dimensions for setting the toggle levers and the free pedal travel are the same as described for the preceding models.

ROLLS-ROYCE TYPE CLUTCHESPHANTOM I

All chassis are provided with toggle adjustment ONLY, which should be carried out as described previously under 20 h.p. The clearance between the front face of the withdrawal sleeve and the cover plate differs as follows:-

Chassis to 101-CL inclusive

0.950" (24.13 mm.)

Chassis 1-WR and onwards

0.900" (22.86 mm.)

It will be found more convenient for adjustment if gauges are made to these measurements.

With the above adjustment carried out, the clutch pedal should have $3/4$ " (19.05 mm.) free lift to the floorboard (floorboard secured in position). In the event of any large discrepancy from this measurement, it would indicate that adjustment had been made at the link rod, which should be re-set.

All Phantom I clutches incorporate a clutch stop (see Fig.3, Page 3.), the adjustment of which is best effected by trial and error.

In correct adjustment, the clutch plate should stop spinning with the clutch pedal fully depressed in 5 seconds or less.

A basic setting is obtained as follows:-

- (a) Unlock and screw back the serrated locknut located at the rear of the clutch housing sufficiently to permit the knurled ring to be moved clear of the retaining dowel.
- (b) Turn this ring back approximately $1/4$ of a full turn, i.e. in the same direction as the rotation of the engine, press it forward so that the dowel pin engages one of the holes drilled in its face, and lock in position by means of the serrated locknut.

This basic setting may be modified by moving the knurled ring a hole or two in either direction to obtain the shortest stopping time of the spinning member, this is best effected with a hot gearbox.

It should be noted that this type of clutch stop, in addition to applying friction braking to the spinning member, also acts as a location stop to position the driven plate an equal distance away from either friction surface when the clutch is fully disengaged. It will be seen that excessive adjustment in either direction from the basic setting will result in the spinning member making contact with one of the friction faces, and failure to stop.

PHANTOM II

Toggle adjustment on all Phantom II chassis is carried out as described previously under 20 h.p. The clearance between the front face of the withdrawal sleeve and cover plate is as follows:-

0.950" (24.13 mm.)

A gauge made to this dimension will facilitate adjustment.

With the above adjustment carried out, the clutch pedal should have $\frac{3}{4}$ " (19.05 mm.) free lift to the floorboard (floorboard secured in position). In the event of this measurement being outside these limits, it would indicate that adjustment has been made at the link rod which should be re-set.

Phantom II. Chassis 1-TA and onwards.

Periodical adjustment may be carried out at the turnbuckle (external linkage). At overhaul, toggle adjustment is necessary, as described previously, and the turnbuckle restored to the original setting by measurement of the free pedal lift.

The clutch brake (Fig.4. Page 4.) was fitted to all chassis BEFORE the introduction of the synchromesh gearbox at 46-MS., and requires little or no attention between chassis overhauls.

If the stopping time exceeds 5 seconds adjustment may be obtained by altering the angular setting of the lever (K) which is located on the withdrawal shaft (L). The pinch bolt securing the lever should be released, this will allow the spring to bring the clutch brake shoe into contact with the drum. The clutch pedal should now be depressed half way, and whilst held in this position, the pinch bolt should be retightened. On release of the pedal, the lever (K) will move the shoe away from the drum (a distance of approximately $\frac{3}{16}$ " measured at the end of the lever). Slight variations of this setting may be needed, but in all cases it is necessary that the friction lining of the brake shoe is clear of the drum when the clutch pedal is in its normal, at rest position.

PHANTOM III

Periodical adjustment may be carried out at the turnbuckle (external linkage). At overhaul, toggle adjustment may be necessary, and should be carried out as described previously under 20 h.p. The dimension between the face of the withdrawal sleeve and the flywheel cover should be 0.875" (22.2 mm.). (It should be noted that there are six operating levers.) At this time the turnbuckle should be restored to the original setting by measurement of the free pedal travel.

PHANTOM III (Continued)

The clutch pedal is held up against the floorboard by a tension coil spring, and the free movement is measured in a horizontal direction between the top of the pedal and the dashboard. This movement should be $3/4$ " (19.05 mm.) when the pedal is lightly depressed to where the withdrawal sleeve makes light contact with the operating levers. The aluminium pedal plate must be in position to measure this dimension.

In adjusting the toggles certain provisions are necessary, and are dealt with under "Clutch Overhaul".

BORG AND BECK TYPE CLUTCHES

20/25 h.p. (GTK-42 to GTK-53 incl.) ALL 25/30 h.p. ALL WRAITH CHASSIS

The above chassis were fitted with Borg and Beck clutch assemblies of standard type and are provided with turnbuckle adjustment for the regulation of free pedal travel.

The clutch pedal is held up against the floorboard by a tension coil spring, and the free movement is measured in a horizontal direction between the top of the pedal and the dashboard. This movement should be $3/4$ " to 1" (19.05 mm. to 25.40 mm.) when the pedal is lightly depressed to where the withdrawal sleeve makes light contact with the operating lever. The aluminium pedal plate must be in position to measure this dimension.

Toggle adjustment is only possible when new parts are fitted as described later under "Clutch Overhaul".

LUBRICATION OF THE CLUTCH MECHANISM

Lubrication of the various joints and bearings of the clutch mechanism, in addition to the hand lubrication of the external linkage joints common to all chassis, is essential for mechanical efficiency.

As, however, the points to be lubricated and the methods of lubrication vary, the essential information is given under the following detailed headings.

20 h.p. All Chassis. to GVO-10 inclusive

The clutches fitted to the above chassis are all hand lubricated, the points to be lubricated, quantity of lubricant required and the intervals between lubrication being as detailed below:-

- | | | |
|-----|-------------------------|--|
| (a) | Ball Thrust Bearings: | 3 to 4 drops of engine oil to be injected every 2,000 miles into the oil hole provided in the top of the clutch trunnion. |
| (b) | Clutch Spigot Ballrace: | ONLY 4 drops of engine oil to be injected every 5,000 miles into the oil hole provided in the clutch shaft. This oil hole will be found located just behind the clutch trunnion. |

LUBRICATION OF THE CLUTCH MECHANISM (Contd)20 h.p. All Chassis (contd.)

- (c) Clutch Withdrawal Shaft bearings: A few drops of engine oil to be injected every 1,000 miles into the open end of the shaft.
- (d) Toggle Lever Fulcrum Pins: 2 to 3 drops of engine oil every 2,000 miles.
- (e) Clutch Pedal Shaft Bearings: Gear oil to be injected into the lubricator by means of an oil gun every 1,500 miles until oil exudes from the ends of the pedal bosses.

20 h.p. from GVO-11 inclusive and
20/25 h.p. All Chassis to GTK - 41 incl:

The ball thrust bearing and the bearings of the clutch withdrawal shaft on all the clutches fitted to the above chassis are lubricated through the centralised chassis system.

The clutch spigot bearing, on the other hand, requires to be hand lubricated every 5,000 miles, the point of lubrication taking the form of a small oil hole in the clutch shaft just behind the clutch trunnion. To reach this point, the sliding sleeve on the clutch shaft will have to be rotated with the fingers until a slot appears on top, after which the engine will have to be cranked until the hole in the clutch shaft is visible through the slot. The amount of lubricant to be injected at this point should never exceed 4 drops from an oil can.

The toggle lever fulcrum pins should also be hand lubricated at the same time, each pin receiving 3 to 4 drops of engine oil from the oil can.

20/25 h.p. (GTK-42 to GTK-53 incl:) 25/30 h.p. and WRAITH

The withdrawal thrust ball race and all moving parts associated with this are lubricated on all these chassis through the centralised chassis system.

The clutch shaft spigot bearing on all these chassis is packed with grease on assembly and requires no further attention between chassis overhauls.

PHANTOM I. ALL CHASSIS

All Phantom I clutches are hand lubricated, the points to be lubricated, quantity of lubricant required and the intervals between lubrication being detailed as below:-

- (a) Ball Thrust Bearing and Inner End Bearing of the Clutch Withdrawal Shaft.) 3 to 4 drops of engine oil to be injected every 2,000 miles into the oil hole provided in the top of the clutch trunnion.
- (b) Withdrawal Shaft Outer Bearings:) A few drops of engine oil to be injected into the open end of the shaft every 2,000 miles.

PHANTOM I. ALL CHASSIS (Contd)

- | | | |
|-----|-------------------------------|---|
| (c) | Toggle Lever Fulcrum Pins; | 2 to 3 drops of engine oil every 2,000 miles. |
| (d) | Clutch Plate Universal Joint; | ONLY 4 drops of engine oil to be injected every 2,000 miles into the oil hole provided in the shaft just behind the adjustment for the clutch stop. |
| (e) | Clutch Pedal Shaft Bearings; | Inject gear oil by means of an oil gun into the lubricator every 1,500 miles until oil exudes from the ends of the pedal bosses. |

PHANTOM II. ALL CHASSIS

The centralised chassis lubrication system deals with the clutch withdrawal and pedal shaft bearings, and also the ball thrust race on all the clutches fitted to Phantom II chassis.

On certain of the earlier chassis prior to the introduction of the synchromesh gearbox, the flexible joint within the driven plate hub casing and the two clutch shaft supporting ball races will be found to be lubricated from the gearbox via a pipe running through the hollow shaft.

On the greater number of chassis both these ball races and the flexible joint will require to be periodically hand lubricated, oil being injected into a hole drilled in the clutch shaft just behind the clutch trunion. Only 4 drops of engine oil should be injected at this point every 5,000 miles.

The toggle lever fulcrum pins on all the clutches should also be lubricated at the same time, each pin receiving 3 to 4 drops of engine oil from an oil can.

PHANTOM III. ALL CHASSIS

The various bearings associated with the clutch shaft and withdrawal mechanism on all chassis are lubricated through the centralised chassis system.

The toggle levers, pivoting on needle rollers, are initially packed with grease, and require no attention between chassis overhauls.

CLUTCH OVERHAUL - ALL MODELS

It should be noted that in all cases, with the exception of the Phantom I and Phantom III chassis, the gearbox will have to be removed from the chassis before the clutch can be dismantled for overhaul.

The major components which will require to be either disconnected or removed prior to the removal of the gearbox are as follows:-

- | | | |
|-----|----------------------------|--|
| (a) | Undershield: | To be removed in all cases. |
| (b) | Propellor Shaft: | To be disconnected at the forward end only. (On those chassis where a damper is fitted, this must first be moved back clear of the coupling between the gearbox and propellor shaft. To disconnect this damper, remove the six 2 B.A. nuts around the hub. |
| (c) | Gear Change Mechanism: | Remove completely. (On those chassis where the road spring shock damper control box is fitted below the change speed mechanism, this must first be disconnected and removed before the gear change selector can be pulled out of the gearbox.) |
| (d) | Pedal Shaft. | If this is supported at one end in clutch casing, it must be removed. On the other hand if the shaft is supported on brackets only, it may be left in position. |
| (e) | Gearbox Rear Cross Member: | Remove sufficiently to enable the gearbox to be removed from the chassis. |
| (f) | Starter Motor. | Remove in all cases. |
| (g) | Servo Motor | Although not absolutely necessary, it is, however, recommended that this is removed from the gearbox, thus obviating the danger of paraffin finding its way on to the servo linings should the gearbox be washed down while out of the chassis. |

The dismantling, relining and reassembly procedures for the various types of clutches fitted will be found detailed under their respective headings below.

20 h.p. and 20/25 h.p. up to GTK-41 incl:

1. Remove the gearbox complete with the clutch trunnion and withdrawal sleeve.
2. Slacken off the clutch spring retaining caps to relieve the spring pressure.
3. Remove the back plate assembly securing nuts, and pull off the assembly complete with the driving sleeve and clutch plate.
4. Remove the inner friction liner plate securing nuts, and remove the plate from the flywheel face.
5. Remove the eight clutch springs, followed by the toggle levers, and drop out the pressure plate after suitably marking this to ensure correct re-assembly on the same serrations.
6. Remove the clutch plate hub securing bolts and separate. (In the case of the spring driven clutch plate all eight 2 B.A. nuts securing the driving ring to the clutch plate together with the twelve 2 B.A. nuts retaining the damping springs in the centre of the hub, must first be removed before the clutch plate can be separated from the sleeve as all these nuts will be found to be burred over, replacement bolts and nuts will be essential for reassembly.)

Re-Assembly of the Spring Drive Clutch Plate

The eight bolt holes in the clutch plate should be reamed out to size prior to actual assembly.

1. Lay the plate, engine side facing downwards, on the bench, and position a friction disc over its central hub. Place the driving sleeve, sleeve pointing upwards, on top of this friction disc, and coincide the twelve bolt holes located round the friction disc with the corresponding twelve holes in the centre of the driving sleeve flange.
2. Drop the driving ring into position, line up the eight bolt holes with those in the clutch plate, and insert a driving spring between each alternate set of driving dogs. Temporarily secure the driving ring and clutch plate in position by pushing two of the square headed 2 B.A. bolts through from the engine side of the plate, and tightening up the nuts. These should not be burred over.
3. Turn the assembly over, i.e. with the sleeve pointing downwards, and position the second friction disc on the engine side of the clutch plate. Line up the twelve holes with those previously lined up, and insert the twelve tubular bronze distance pieces, pushing these fully home and ensuring that they are flush at each end with the outside faces of the friction discs.

Re-Assembly of the Spring Drive Clutch Plate (contd)

4. Fit the driven plate in position over the second friction disc, coincide the twelve holes, and push the twelve countersunk headed 2 B.A. screws through, ensuring that these are fully home. Turn the assembly over again so that the sleeve points upwards, and fit the damping springs. Each spring should have a plain 2 B.A. washer fitted between the top of the spring and the securing nut, and the nut should be tightened down to its fullest extent, after which it should be lightly burred over.
5. Insert the remaining eight driving springs in position, carefully remove the two securing nuts, push the other six square headed 2 B.A. bolts through from the engine side of the clutch plate, replace the driving ring cover, and tighten down all the nuts lightly burring over.

Re-Lining

1. Drill out the existing rivets from the back of the liner plates, and strip off the linings.
2. Clean off the lining faces of both plates, and fit the replacement liners.
3. Fit the replacement clutch plate. The bolt holes on the replacement clutch plate will require reaming out, and particular care must be taken to see that, when assembled the face with the words "To Engine" etched on is to the front.

Re-Assembly & Initial Adjustment of the Toggle Levers

1. Refit the inner friction liner plate to the flywheel face.
2. Refit the pressure plate into the back plate assembly, ensuring that the assembling marks on both units coincide and that the plate slides freely on its serrations.
3. Refit the toggle levers into their respective pedestals, and replace the eight clutch springs, screwing down the retaining caps a few turns in each case.
4. Slide the driving sleeve and clutch plate into the back plate assembly, and lift the complete unit up to the flywheel. Line up the assembling marks, and fit the clutch unit on the studs.
5. Using a suitable arbor, centralise the clutch plate, and then tighten up all nuts.
6. Fully tighten down all the clutch spring retaining caps, and remove the arbor.
7. Except on 20 h.p. models where the clutch trunnion is not secured to the fork, the trunnion may remain in the fork in the gearbox bell housing, in these cases the withdrawal sleeve may be removed from the trunnion with the fingers and should be threaded on to the clutch cover spigot for the purpose of adjusting the toggle levers. These levers should be set to make equal contact with the face of the withdrawal sleeve when it is pressed forward with light finger pressure. The required measurement between the face of the withdrawal sleeve and the rear flywheel cover face being 0.750" (19.05 mm.). The withdrawal sleeve should then be refitted to the trunnion.

Re-Assembly & Initial Adjustment of the Toggle Levers (contd)

8. The gearbox should then be replaced and the bell housing bolts secured.
9. A check should be made for the free pedal travel, and the linkage re-set, as described previously.

20/25 h.p. (GTK-42 to 53 incl:) 25/30 h.p. & WRAITH. BORG & BECK

1. Remove the gearbox.
2. Remove the clutch unit, eight 3/8" nuts and spring washers.
3. Inspect the friction surfaces on both the flywheel and pressure plate. Should excessive scoring have taken place, the flywheel will require machining and the existing clutch unit returned to this Service Depot for replacement.

Clutch Plate Replacement

1. Check the replacement driven plate for freedom on the splines.
2. Centralise the driven plate by means of a locating arbor, line up the assembly marks on both the clutch unit and flywheel rim, and secure.

NOTE: In the event of a replacement clutch unit being fitted, all the relevant ignition and valve timing marks should be transferred to the new unit prior to assembly.

3. Remove the locating arbor and refit the gearbox.
4. The external adjusting link must be used to obtain the correct free movement of the pedal, as described earlier in this leaflet. (The release levers on all replacement Borg and Beck clutch units are correctly adjusted by the manufacturers).

IMPORTANT NOTE:

No provision is made in these clutches for subsequent adjustment due to wear or to incorrect assembly should the unit itself be dismantled, i.e. ALL parts not restored to their previous relative positions.

At the time of initial assembly and adjustment the four nuts and eyebolts ("E" Fig.5) which control the position of the operating levers, are drilled for split pins. Should further adjustment become essential for any reason, it would be necessary to fit new eyebolts to allow for the subsequent re-drilling.

Subject to the requirements of the preceding paragraph, adjustment of the operating levers may be corrected as follows:-

Clutch Plate Replacement (Contd)

1. The clutch unit should be secured to the flywheel by the full complement of nuts, with the Borg & Beck Lever Adjustment Gauge centred in the place of the driven plate.
2. Each lever should then be adjusted at the eyebolt nut until the withdrawal bearing surface of the lever is in line with the outer face of the boss on the gauge plate.

For accurate adjustment the gauge plate is essential. (Use of the driven plate could give misleading results due to varying thickness and compressibility of the cushioning.)

Should a gauge plate be unavailable, however, reasonable results may be obtained with the following procedure:-

1. The clutch unit should be bolted down to a face plate, with the driven plate centralised in position. (The full number of bolts must be used - 8).
2. Using a Dial Indicator Gauge, set each lever to a dimension of 1.820" + or - .0015" (46.23 mm. + or - .04 mm.) between the withdrawal bearing surface of the lever and the surface plate.

Phantom I. All Chassis

There is no necessity for the gearbox to be disturbed.

1. Disconnect the pedal connection.
2. Disconnect and remove the Hardy coupling between the gearbox and the clutch.
3. Unscrew the large serrated locknut, and slide the clutch brake adjusting ring backwards clear of the retaining dowel.
4. Remove all the outer ring of clutch casing nuts, together with the bolts holding the top and bottom halves together. The casing may now be split and each half removed separately.
5. Slacken off the clutch spring retaining caps, and then remove all the clutch back plate securing nuts.
6. Draw off the back plate assembly, complete with the clutch driving shaft, driven plate and pressure plate. (This is effected by inserting fully threaded 5/16" x 3/2" B.S.F. bolts into the four tapped holes seen equidistantly spaced round the circumference of the back plate, and screwing down evenly until the assembly is free. Care should be taken to ensure that the clutch disengagement spring, located at the spigot end of the driving shaft, is neither lost nor damaged.)
7. Slacken off the two retaining clamps securing the inner friction liner carrier plate to the flywheel face, and remove the plate. (NOTE: Care should be taken to ensure that the small springs and plungers recessed in the flywheel face behind this plate are not lost.)
8. Slide off the driving piece, and remove the circlip from the driving shaft.
9. Remove the clutch brake sleeve.

Phantom I. All Chassis (contd)

10. Remove the clutch brake.
11. Remove the small serrated washer and the clutch withdrawal trunnion. (Take care not to lose this washer as it acts as the distance piece for the clutch brake sleeve.)
12. Remove the four set screws and retaining clamps from the back plate assembly, and tap out the driven plate assembly complete with the driving shaft.
13. Remove the eight clutch springs and the four toggle levers, complete with their fulcrum pins and blocks. Mark the pressure plate in relation to the back plate assembly, and then remove.
14. Remove the driven plate assembly by undoing the eight nuts round the hub.

Relining

1. Drill out all the existing rivets, and remove the liners.
2. Clean up the faces of both the rings and fit the replacement liners.
3. Fit the replacement clutch plate, reaming out the bolt holes to suit, and ensuring that oil tight joints between the plate and the driving shaft boss are made by fitting Vellumoid washers of between 0.003" to 0.006" (0.08 to 0.15 mm.) working thickness.

Re-Assembly of Clutch

1. Line up the assembly marks on both the inner liner carrier plate and flywheel face, and refit the plate on the driving dowels. Secure in position by means of the two retaining clamps, ensuring that the tabs of the lock washers are turned up.
2. Coincide the assembly marks, and drop the pressure ring into position in the back plate unit. Check for freedom of movement.
3. Refit the toggle levers and blocks.
4. Slide in the clutch driving shaft, complete with the driven plate and tap into position by means of a wooden block.
5. Secure the driven plate in position by replacing the four setscrews and retaining pieces.
6. Replace the eight clutch springs and screw the retaining caps up a few turns each.
7. Replace the clutch withdrawal trunnion.
8. Replace the serrated distance washer.
9. Replace the clutch brake and then the clutch brake sleeve.

Re-Assembly of Clutch (contd)

10. Replace the circlip, and slide on the driving piece. (The "Arrow" seen etched on the outside of the driving piece barrel should coincide with the oil hole drilled in the shaft.)
11. Slide the clutch disengagement spring into the spigot end of the clutch shaft. (The brass body should be entered first, and grease is recommended for retaining this in position while assembling the clutch unit.)
12. Lift the complete unit up to the flywheel, line up all the relevant assembly marks and secure.
13. Tighten down all the clutch spring caps fully.
14. Replace the top and bottom halves of the clutch casing, ensuring that the clutch withdrawal fork operating pins are fully engaged with the withdrawal trunnion. Adjust the toggle levers to the recommended clearances, (see "Clutch Adjustment" earlier in this leaflet.)
15. Slide on the knurled clutch brake adjusting ring, recesses for the retaining dowel to the front, and lock in position by means of the large serrated locknut.
16. Replace the Hardy coupling.
17. Reconnect the clutch pedal to the withdrawal shaft operating lever.
18. Adjust the clutch brake in the manner described earlier in leaflet.

Phantom II. All Chassis

1. Remove the gearbox, complete with the clutch trunnion and sliding sleeve. (There is no necessity for the clutch brake to be disturbed in any way).
2. Relieve the clutch spring pressure by slackening off the retaining caps.
3. Remove the back plate assembly securing nuts, and draw off the unit complete with the driving sleeve and clutch plate. (This is effected by inserting four fully threaded 5/16" x 3.1/2" B.S.F. bolts, each complete with a nut, into the tappet holes which will be seen equidistantly spaced round the circumference of the back plate, and screwing these down evenly until the assembly is free.)
4. Remove the four special set bolts securing the inner liner plate to the flywheel face, and pull the plate off the driving dowels. This plate should be suitably marked prior to removal, to ensure re-assembly on the same dowels after relining, and care should be taken to see that the small springs and plungers recessed in the flywheel face behind the plate are neither lost nor damaged.

Phantom II. All Chassis (contd)

5. Remove the clamping pieces retaining the clutch plate within the back plate assembly, and knock out the driving sleeve and clutch plate, using a suitable block of wood for the purpose.
6. Remove the eight clutch springs and then the toggle levers. Slide the pressure plate out of the cover assembly, marking both to ensure re-assembly on the same serrations.
7. Remove the clutch plate by separating the hub casing on the driving sleeve. (If plain nuts are used, this will necessitate replacement bolts and nuts for re-assembly.)

Relining

1. Drill out the existing rivets from the rear of the liner plates, and strip off the linings.
2. Clean up the liner faces on both plates, and refit the replacement linings.
3. Fit the replacement clutch plate, reaming out the bolt holes to fit the replacement bolts, and ensuring oil tight joints on both sides of the plate by fitting Vellumoid washers of between 0.003" to 0.006" (0.08 to 0.15 mm.) working thickness.

Re-Assembly of Clutch and Initial Adjustment

1. Replace the small springs and plungers into their respective recesses in the flywheel face, line up the assembly marks and slide the inner liner plate on to its driving dowels. Ensure that this slides freely on the dowels, and then secure in position by the four special set bolts.
2. Refit the pressure plate into the back plate assembly, ensuring that the assembling marks on both units are coincident and that the plate slides freely on its serrations.
3. Refit the toggle levers to the pressure plate pedestals.
4. Slide in the clutch driving sleeve and plate assembly, and tap into position, using a suitable block of wood for the purpose.
5. Secure the clutch plate within the back plate assembly by re-fitting the retaining clamps.
6. Replace the eight clutch springs, and screw the retaining caps up a few turns each.
7. Lift the complete unit up to the flywheel, line up the assembly marks, and secure.
8. Tighten down the clutch spring retaining caps all the way.
9. Slide on the trunnion and refit the gearbox, securing all the bell housing bolts.
10. Adjust the toggle levers so that their inner ends, or toes, just make contact with the face of the withdrawal sleeve when this is exactly 0.950" (24.13 mm.) from the back of the cover plate.
11. Carry out the remainder of the re-assembly.
12. * A check should be made for the free pedal travel, and the linkage re-set, as described previously.

PHANTOM III. All Chassis

There is no necessity for the gearbox to be disturbed.

1. Remove the centre barrel running through the centre cruciform frame member. (Four bolts at each end.)
2. Remove the barrel from the Hardy coupling. (Six 5/16" B.S.F. nuts).
3. Remove the Hardy coupling by undoing the six 5/16" B.S.F. nuts on the driving flange on the engine side of the coupling. (Do NOT remove the large split pinned nuts.)
4. Remove the stay on the bottom half of the clutch casing.
5. Slide out the clutch driving shaft.
6. Disconnect the oil pipe and remove the clutch shaft ball race housing by undoing the ring of nuts round the steel plate at the rear of the casing.
7. Support the rear of the engine either on a trestle or a jack.
8. Remove the rear engine support bracket and silencer stay.
NOTE: Care should be exercised to see that the packing washers between the engine support bracket and the frame are not lost. It is recommended that these are tied to their respective holes in the engine support bracket after removal.
9. Disconnect the yoke from the clutch pedal, and remove the wing lever from the clutch withdrawal shaft. (It should be noted that this lever is keyed on to the shaft.)
10. Bring the clutch withdrawal forks to the rear, remove the two 5 B.A. setscrews, and remove the withdrawal trunion from the shaft.
11. Remove all the outer ring of clutch casing bolts, also those which hold the top and bottom halves together. The casing may now be split, and each half removed individually.
12. Provision for the compression of the clutch springs during dismantling is by means of three equally spaced holes in the pressure plate, tapped 1/2" B.S.F. These holes are drilled in the spigot bosses which locate the springs, and are accessible through the hexagon apertures in the relative clutch spring housings.

When the holes are located, three 1/2" x 3.1/2" fully threaded bolts, nuts and plain washers, are fitted by screwing the bolts home into the pressure plate with the nuts taken up to the boltheads. The nuts should then be screwed back into contact with the spring housing, with the washers interposed, and the pressure plate drawn back evenly until the spring tension is taken up.

PHANTOM III. All Chassis (contd)

13. The clutch cover retaining nuts should be removed and the complete clutch unit withdrawn from the flywheel. To assist this operation, three holes are provided, drilled and tapped, 5/16" B.S.F., equally spaced between the securing studs for the insertion of setscrews.
14. The clutch unit should then be placed on the bench and the spring pressures released evenly by the compression bolt nuts. The unit may then be dismantled as necessary.

Notes:

The clutch spring housings are screwed in from the INSIDE on the Phantom III clutch, and rarely require disturbing.

On some earlier models the holes (5/16" B.S.F.) mentioned in Para. 13, were not incorporated, and the necessary internal pressure to split the flywheel may be obtained by slackening off the compression rings at the three 1/2" nuts (Para.12).

Checking of Clutch Plate before Assembly

The correct replacement Driven Plate for all Phantom III chassis is the "LONG" type, 13 $\frac{1}{2}$ ". These plates are highly susceptible to damage in transit and by rough handling, and it is necessary that the following checks are carried out prior to fitting:-

1. The plate should be rotated between centres and checked for truth. The front (towards engine) face must not 'run out' more than .010" (0.25 mm.)
2. It is not possible to check the rear face in this manner, due to the distortion of the fabric by the cushion springs. It should be borne in mind, however, that the total withdrawal movement of the pressure plate is only 0.096" (assuming 1" (25.40 mm.) free pedal travel), and as the possible expansion of the cushion arrangement may be .070" (1.78 mm.) to permit a running clearance of .010" (0.25 mm.) minimum leaves a total permissible 'run out' of both faces of .016" (0.41 mm.) only.
3. When the plate is compressed the inner rivet heads pass into clearance holes in the opposing plates; it should be checked that fouling is not taking place at these points when the plate is under full compression.
4. The replacement clutch plate should also be checked for freedom of movement on the existing clutch shaft. It is essential that all the splines on both the shaft and the plate mate freely.

Re-Assembly of the Clutch

The "LONG" type clutch plate being thicker than those originally fitted, necessitates the fitting of a .070" (1.78 mm.) packing ring (G.84703) between the flywheel and back plate unit, and also the replacement of the existing clutch springs by others of greater free length, i.e. painted YELLOW.

1. Fit the replacement clutch springs (YELLOW) and pressure plate into the back plate unit.

Re-Assembly of the Clutch (contd)

2. Refit the six toggle levers.
3. Screw in the three compression bolts, and compress the springs.
4. Fit the replacement clutch plate into the back plate unit.
5. Position the packing ring on the flywheel, and fit the clutch unit on to the securing studs, but do not tighten up the nuts.
6. Centralise the clutch plate by means of the clutch shaft.
7. Tighten up all the clutch unit securing nuts.
8. Release the spring pressure by removing the compression bolts.
9. Slide trunnion on to the clutch shaft, and press down until the flange at the front end makes contact with the six toggle levers.
10. Adjust the toggle levers. (The clearance between the face of the clutch trunnion and the rear of the back plate unit should be exactly .875" (22.2 mm.) with the toggle toes just making contact.)
11. Refit the top and bottom halves of the clutch casing and secure.
12. Reconnect the clutch withdrawal arms.
13. Refit the wing lever on to the withdrawal shaft, and reconnect the yoke to the clutch pedal.
14. Refit the rear engine support bracket and silencer stay.
15. Refit the steel plate containing the clutch shaft ball race, and refit the oil pipe.
16. Refit the stay on the bottom half of the clutch casing.
17. Refit the Hardy coupling and both driving barrels.
18. A check should be made for the free pedal travel, and the linkage reset as described previously.

NOTE:

After fitting a new clutch plate to the Phantom III chassis, difficulty may be experienced in failure of the clutch to stop when disengaged. This can be avoided by:-

- (a) Careful attention to the truth of the Driven Plate as described previously.
- (b) Free movement of the clutch plate along the splines of the shaft.
- (c) Minimum amount of lost travel in the withdrawal linkage from Pedal.
- (d) Cleanliness and a small amount of lubrication in the Oilite Bush (D. Fig.6) at the rear end of the clutch shaft. (This bush which is mounted in the rear end of the flywheel cover extension, supports the clutch shaft and becomes a bearing when the clutch is disengaged.)