Cleaning the Air Valve. The air valve and cylinder should be removed every 2,000 miles, and carefully wiped with a piece of clean dry cloth, as directed on page 130.

No oil should be used on the valve or its cylinder.

It is advisable when replacing these parts to re-fit the cylinder to the carburetter without the air valve, the latter being replaced afterwards.

Care should be taken when replacing the cylinder **D** to see that the metal washer **D2** is in position, and its joint faces are perfectly clean.

It must be emphasised that great care is necessary when handling these parts, as they have been machined to fit very accurately, and any slight distortion is liable to impair the working of the carburetter.

Faulty Adjustment of Carburetter. Examination of cars which have been in the hands of users has shown that in some cases the setting of the carburetters has been altered, with detriment to the running and economy.

There is no reason why carburetters should require readjusting, unless some new parts are supplied and fitted to the carburetter, or some alterations made to the engine.

Particular attention is drawn to the fact that great care is taken in accurately adjusting and setting the carburetter, the makers having installed at their works for this purpose scientific apparatus which enables them to be certain the carburetter setting is quite correct before the car leaves the works.

Users are therefore cautioned against interference with the makers' setting.

Setting of the Jets. If the adjustment of the jet needles has been upset for any reason, it can be restored in the following manner :—

With the mixture control lever jet half-way along its quadrant and the clamping screws **J1** and **J2** (Fig. 16) of the jet needle levers slack, each of the knurled nuts **K** and **W** should be turned until the line filed across them registers with the line across the end of the

corresponding screwed spindle, the end of the spindle being at the same time flush with the end of the nut.

The clamping screws **J1** and **J2** should then be tightened, and the makers' setting will have been restored.

If, owing to damaged and replaced parts, it becomes necessary to re-set the jets with no guide in the form of the markings referred to, it is strongly recommended that the makers should be consulted, and this work not attempted without their advice or assistance.

In the event, however, of circumstances rendering such a course impossible, or very inconvenient, proceed as follows :—

With the mixture control lever set half-way along its quadrant and the clamping screw **J1** slack, the knurled nut **W** should be turned in a clockwise direction until its lower side just commences to lift away from the facing against which it normally rests.

The low-speed jet will now be fully closed, the tapered part of the needle resting on the mouth of the stand pipe.

A preliminary setting can then be obtained by rotating the nut **W** in an anti-clockwise direction through approximately one complete turn. The clamping screw **J1** should then be tightened.

In the case of the high-speed jet it is not practicable to obtain a preliminary setting in this way because the tapered portion of the high-speed jet needle is arranged to pass freely inside the bore of its stand pipe. This is done in order to protect these parts from damage which otherwise might result if the nut **K** were turned to force the taper of the jet needle into the stand pipe.

Consequently, no visible indication is available to show precisely when the high-speed jet is fully closed, and it will be necessary to discover its approximate position by running the engine.

It will be possible to start up the engine after setting the low-speed jet needle as described, and this should now be done, the mixture control lever being set half-way along its quadrant.

If, when the throttle is opened moderately by means of the lever on the steering wheel, the engine pops back through the carburetter, and possibly stops, the mixture is too weak, and if black smoke comes from the exhaust, and the engine misses fire and perhaps stops, the mixture is too rich.

To weaken the high-speed jet setting, the screw **J2** should be released and nut **K** turned in a clockwise direction ; and to strengthen it, nut **K** must be turned in an anti-clockwise direction.

Having arrived at a preliminary setting for the high-speed jet in this way, and with the mixture control lever again set half-way along its quadrant, the throttle should be opened by means of the lever on the steering wheel until a speed is reached at which the automatic piston valve is on the point of lifting but has not actually lifted. Movement of this can be observed by looking through the air ports in the carburetter.

The clamping screw **J1** of the low-speed jet needle should then be slackened, and the knurled nut turned in a clockwise direction until the engine speed becomes slightly reduced.

The clamping screw should then be tightened, and the mixture control lever moved first over to **Strong** and then to **Weak.** If in *both* of these positions the engine hesitates, or even possibly stops in the **Weak** position, then the adjustment of this jet is fairly correct.

To test the high-speed jet setting, the accelerator pedal should be depressed momentarily, and the lever again tried in both its extreme positions. In either position a distinct loss of power should be experienced. If these variations do not occur, or occur in only one of the extreme settings of mixture strength, the settings should be varied accordingly by slackening the clamping screw and turning the high-speed knurled nut in a clockwise or anti-clockwise direction, according as the mixture requires weakening or strengthening respectively.

The foregoing will only provide an approximate or trial setting.

When the car is taken on the road for final adjustment, the driver should bear in mind that the high-speed jet comes into operation at about four miles per hour on top gear on the level. Consequently, any sign of too rich or too weak a mixture below this speed is an indication that the low-speed jet requires adjustment.

At speeds above four miles per hour, the high-speed jet has an increasing influence over the mixture.

The best all-round setting of the jets is one in which movement of the mixture control lever to either of its extreme positions will, at

any speed, cause a distinct loss of power and possibly miss-firing. Steady running and good power at all speeds should be obtained with the lever set half-way on its quadrant.

Mixture Control. It will be readily gathered from the preceding notes that a considerable and very useful range of mixture strength is within the driver's control under running conditions.

Utilised in a proper manner, very economical running can be obtained.

When starting the engine from cold, especially in cold weather, the mixture lever should be moved over to **Strong** before changing from the starting to the main carburetter.

As the engine warms up, it will be found that the lever can be moved towards the half-way position, until, with a well-warmed engine and normal touring conditions, it can be taken a few notches towards **Weak.**

A weak mixture burns more slowly than a normal one, and to get the best power from such a mixture, the ignition needs to be well advanced. Consequently, the most economical running is obtained when the ignition lever is fully advanced and the mixture control set as far towards **Weak** as the conditions allow without seriously reducing the power available.

If, on the other hand, weakening of the mixture is carried too far, then, apart from the probability of miss-firing and popping in the carburetter, similar road conditions will call for a bigger throttle opening, and the economy desired be thereby nullified.

Slow Running. The best slow running will be obtained with the mixture control set two or three notches **Strong.** If difficulty is experienced in getting the engine to run slowly, this may be due to the flow of fuel past the low-speed jet needle being restricted by the presence of foreign matter.

To remove this, the jet needle should be raised with the fingers by lifting knurled nut, **W** (Fig. 16), and the throttle simultaneously opened to race the engine momentarily.

If this effects a cure, it would be advisable to clean the fuel strainers and filter, as these are probably dirty (see page 46).

The trouble may also be due to sticking of the carburetter air valve (see page 52), or to faulty tappet adjustment (see page 40).

Starting Carburetter. A special auxiliary jet and expanding choke tube is incorporated in the carburetter for starting purposes only.

This jet can be regulated by means of the knurled screw **M** (Fig. 16), which carries a taper needle running into the jet. Turning this screw in a clockwise direction reduces the jet opening, and in an anti-clockwise direction increases it.

Should occasion arise to re-set this jet adjustment, the screw should be turned with the fingers in a clockwise direction until it is felt that the needle is entirely closing the jet. It should then be rotated in the opposite direction for about one-and-a-half complete turns. This will give a setting at which the engine can be started. Then, with the engine running, the screw may be turned to weaken or strengthen the mixture slightly as may be required.

It is important that the setting of the needle valve should not be such as to provide an over-rich mixture. Although an average setting is one-and-a-half turns from the closed position as stated, this may be reduced to one-and-a-quarter turns in warm weather. On the other hand, in very cold weather, it may be increased to one-and-three-quarter turns, but must be again reduced when the weather becomes warm.

Adjustment of the starting carburetter should only be performed when the engine is cold.

The variable choke or throat of this small carburetter consists of a suction-operated piston, which is lifted against gravity and automatically adjusts the choke area to suit the engine speed.

Access to this throat is obtained by unscrewing the cap **N**, which may then be lifted out with the jet needle. It is advisable occasionally to remove and carefully wipe the piston, but no oil should be used on it.

As the successful working of this small carburetter is dependent

on an air-tight induction system, it is essential that the main throttle should be fully closed when starting the engine.

When changing over to the main carburetter, the throttle should be moderately opened and the starting carburetter lever turned to the **Off** position, where it should always remain, except for starting. If the engine hesitates and tends to stop, the starting carburetter should be opened again and the main throttle closed until the temperature conditions of the engine are suitable for steady running on the main carburetter.

Cases have arisen of piston seizure which have been traced to excessive use of the starting carburetter. It should be appreciated that the object of the starting carburetter is to facilitate starting when the engine is quite cold, the mixture it provides under such conditions being on the rich side. Consequently, excessive use of the starting carburetter, or its use with a hot engine, is liable to cause liquid fuel to be drawn into the cylinders and wash away the engine oil.

Further, if used with a hot engine, starting may be difficult, due to the over-rich mixture.

The starting carburetter should not be used for more than half a minute before changing over to the main carburetter, and not used at all with a hot engine, in which circumstances starting will be found quite easy on the main carburetter only.

Float Feed Mechanism. The float chamber should be cleaned out every 5,000 miles, as directed on page 132, by unscrewing the cover **O**, after raising the catch **O1**, and removing the float **P**, Fig. 17. The interior of the float chamber should be wiped out with a piece of clean, damp wash-leather.

No provision is made for flooding the carburetter by agitating the float needle, as this is never necessary.

If flooding occurs, it is probably due to foreign matter having lodged on the needle valve seating, and steps should be taken accordingly.

Crankcase Breather Pipe to Carburetter. In order to reduce the emission of oil fumes from the engine, a pipe is carried from the crankcase to the carburetter air inlet.

This pipe is shown removed at **R** in Fig. 17.

A small gauze, **R1**, is arranged between the pipe flange and the carburetter, which in course of time may require cleaning. It should be removed and cleaned every 10,000 miles, as directed on page 133.

Dismantling the Carburetter. Normally it should not be necessary to dismantle the carburetter to a further extent than that already mentioned. On the other hand, it sometimes occurs that the jet needles become sticky in operation, due to sediment and impurities in the fuel, and the correct functioning of the carburetter is impaired.

Under such circumstances the carburetter should be removed bodily from the engine for dismantling.

The plugs below both jet needles should then be removed and cleaned of sediment. At the same time it should be ascertained that the spring plunger below the high-speed jet needle is working quite freely. The upward pressure of this spring is relied upon to open the high-speed jet, and its freedom of movement is therefore of great importance.

After removing the air valve and its chamber, two countersunk set-screws near the low-speed jet needle should be unscrewed. The jet needle can then be carefully lifted out.

The high-speed jet needle is removed by taking out the pin from the jaw at the lower end of control rod **T** (Fig. 16) and unscrewing the two countersunk set-screws which secure the bearing of the operating lever to the side of the carburetter. The jet needle may then be lifted out.

It is advisable to clean both jet needles carefully in paraffin. The jets themselves should also be cleaned out by using a small wooden stick and a piece of rag soaked in paraffin.

There should be no need to separate the two parts of the carburetter body, but if this be done, it is of vital importance to remove the air valve and its chamber first of all, and also the low-speed jet needle. The latter will almost certainly be damaged if left in position when the carburetter body is divided.

WARNING.—On no account should the engine be kept running for any appreciable period with the car in a closed garage. There is then a grave danger of people in the garage being asphyxiated owing to the presence of poisonous gases in the exhaust.

Consequently, particular care should be taken always to fling the garage doors wide open before starting the engine.

CHAPTER IV.

Care and Adjustment of the Four-Wheel Brakes.

General Description — Possible Variations — Adjustments — Adjustment of Rear Brakes—Adjustment of Front Brakes—Adjustment of the Servo—Lubrication—Oil on Brakes—Use and Abuse of the Brakes.

General Description. The Rolls-Royce four-wheel braking system comprises a servo motor of the dry, disc-clutch type which is equally effective for backward movement of the car as for forward movement. Further, even should the servo be out of action, the rear pedal-operated brakes still provide a reasonable braking capacity by direct action.

Pressure on the pedal applies the rear brakes direct in the usual manner and also engages the servo, but does not directly operate the front brakes, this being done only by the servo. The effect of the latter is distributed between the front and rear brakes, being therefore added to the direct pedal effort in the case of the rear brakes. With the leverages provided, this results in only about one-third of the total braking being imposed on the front wheels, which, in combination with the fact that—when the car is moving forwards—greater weight is thrown upon the front axle during braking, renders it very improbable that the front wheels can ever be locked.

The equalising of the servo pull to front and rear brakes respectively is effected by a special "T"-shaped balancing lever. A separate equaliser is provided for both pairs of front and rear brakes to ensure even braking on both sides of the car.

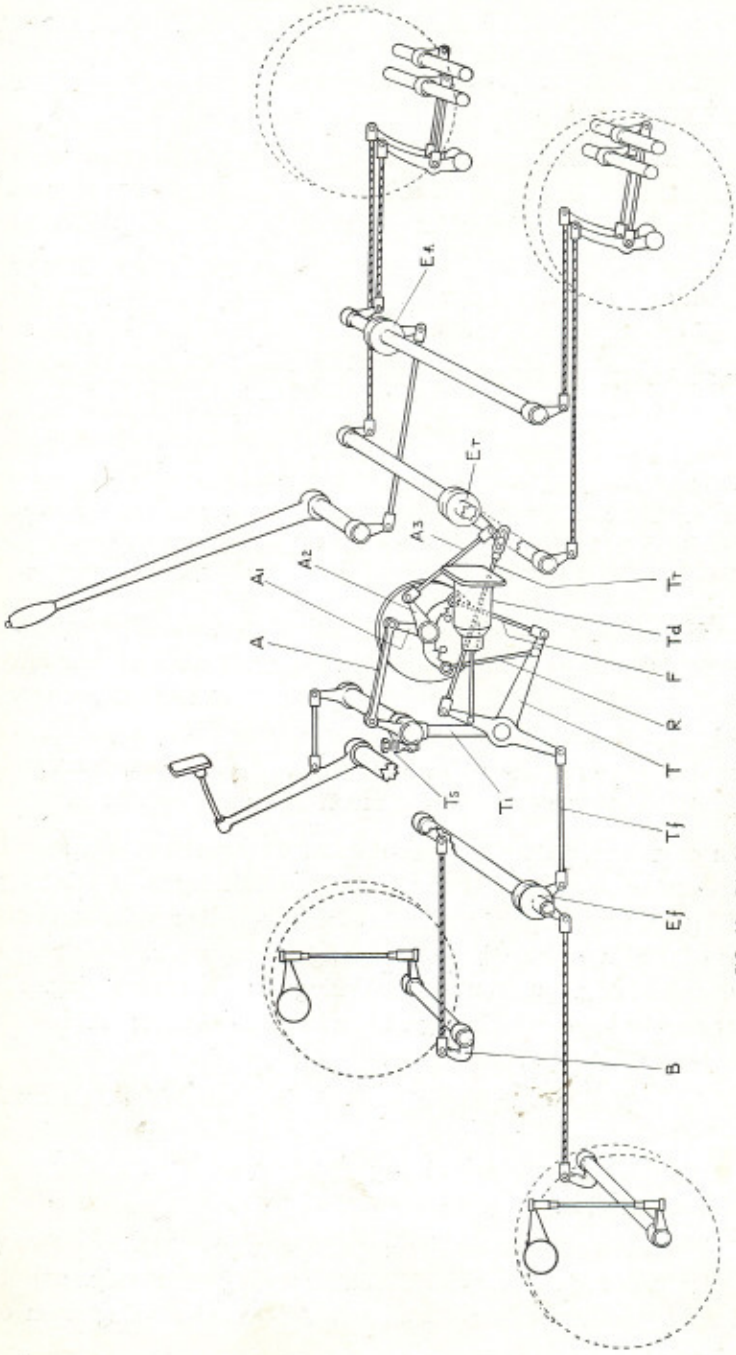

FIG. 18. DIAGRAM OF ROLLS-ROYCE FOUR-WHEEL BRAKE SYSTEM.

A diagrammatic representation of the whole system is shown in Fig. 18, a more detailed view of the servo and its connections being given in Fig. 21.

A shaft operated by the pedal passes through the gearbox, and on the near-side extremity of this shaft is mounted a lever coupled by the links **A** with a lever **A1** on the servo motor shaft. The lever **A1** has inclined teeth or cams formed on the face of its boss, these teeth engaging similar teeth formed on the boss of another lever, **A2**. From the latter a rod **A3** actuates the rear brakes through the medium of the equaliser **Er**.

The driven member of the servo carries two stops engaging one or other of the two levers mounted freely on the shaft. From each of these levers coupling rods, **F** and **R**, are carried to the " T "-shaped balancing lever **T**, rod **F** operating the brakes from the servo when the car is moving forwards, and rod **R** when it is moving backwards.

From the balancing lever **T**, rod **Tr** operates the rear brakes through the equaliser **Er**, its connection to the latter consisting of a slotted fork, which permits direct operation of the rear brakes by the pedal when the car is standing without affecting the servo or the front brakes. The other arm of balancing lever **T** is coupled by a link **Tf** to the front brake equaliser **Ef**, from which ropes are carried to the levers **B** mounted on the front axle.

In order to prevent noisy contact of the front brake shoes with their drums, the suspension link **T1** of the balancing lever **T** is hinged to the gearbox through a friction device, which damps the free movement of the link. For this purpose the link is provided with a split boss, which is tightened on to the bearing by a bolt and spring. The latter may be seen at **Ts** in Figs. 18 and 21. The setting of this spring should be not altered.

Noisy release of the servo levers is prevented by a pneumatic damper, **Td**, coupled to lever, **T**. The damper only acts in one direction, a non-return valve being used to eliminate damping as the brakes are applied.

Initial movement of the foot pedal engages the servo through the medium of two star-shaped buffer springs, **Z1** (Fig. 21), the inclined teeth on the bosses of levers **A1** and **A2** riding upon one

another and tending to separate the two levers. Further movement of the pedal causes both levers to move together, and actuates the rear brakes in the ordinary way.

These movements occur whether the car is standing or moving forwards or backwards, and result in the rear brakes being applied immediately the pedal is operated without any lag for the servo to take up its duty.

The degree of braking available without the servo assistance enables a driver to shunt the car in awkward places with perfect assurance that his brakes will respond without delay to the pedal movement.

When the car is running, in either direction, the servo actuates the front brakes and also adds its effort to the direct pedal effort on the rear brakes, operating through the medium of the "T"-shaped balancing lever, the long arm of which is pulled upwards by one or other of the coupling rods depending on the direction of movement of the car.

The hand brake operates on an entirely independent set of shoes working in the rear wheel brake drums, a similar type of equaliser (**E**h, Fig. 18) being employed. In order to avoid choking up of the ratchet teeth by grit, small stones or other foreign objects, the teeth are arranged pointing downwards.

To release the ratchet pawl, the button on the extremity of the hand lever should be depressed.

Possible Variations. As already mentioned, the leverages are so proportioned that of the total braking effort about two-thirds goes to the rear brakes, and the remaining one-third to the front.

This distribution though independent within reasonable limits of any maladjustment on the part of the user, depends, nevertheless, upon the condition of the brakes themselves. For instance, if oil should reach the rear brakes, and so reduce their co-efficient of friction, a greater proportion of the braking would be thrown upon the front wheels, which is not desirable.

Conversely, if the front shoes become oily, the balance of distribution will be upset in the other direction.

It is therefore very necessary that oil should be kept from the brake surfaces, particularly in the case of the rear brakes.

Precautions to be observed in this connection are :—

(a) Periodically and regularly to check that the oil escape holes in the brake covers are clear.

(b) To fill the axle box only when it is warm after running, and to warm the oil before pouring it in.

Adjustments. The only points in the system where any adjustment is provided or is necessary are the following :—

(1) Rear Brakes	..	The threaded rods coupled to the cam operating levers below the ends of the rear axle.
(2) Front Brakes	..	A serrated adjustment on the cam operating shafts.
(3) Servo	.. ..	A serrated adjusting nut on the end of the servo shaft.

These adjustments are dealt with in detail in the succeeding paragraphs.

It is very important to observe that under no circumstances should adjustment be attempted at any other points, for instance, by altering the lengths of other brake rods or any of the ropes. These are all carefully determined during the erection of the chassis, with a view to utilising to the best advantage the lengths of the various levers, taking into consideration the total movement of such levers from the time when the brakes are new until the facings are completely worn out.

Any alterations to the lengths of these rods or ropes will virtually shorten the lengths of some of the levers, and will interfere with the correct functioning of the system.

Adjustment of Rear Brakes. The state of adjustment of the rear brakes—both foot and hand-operated—should be tested by reference to movement of the brake cables necessary to take up the clearance between shoes and drums, or to the movement at the ends of the levers on the axle to which the cables are connected. For this purpose the cable should be pulled or the lever operated by hand and the movement measured. This movement should never be

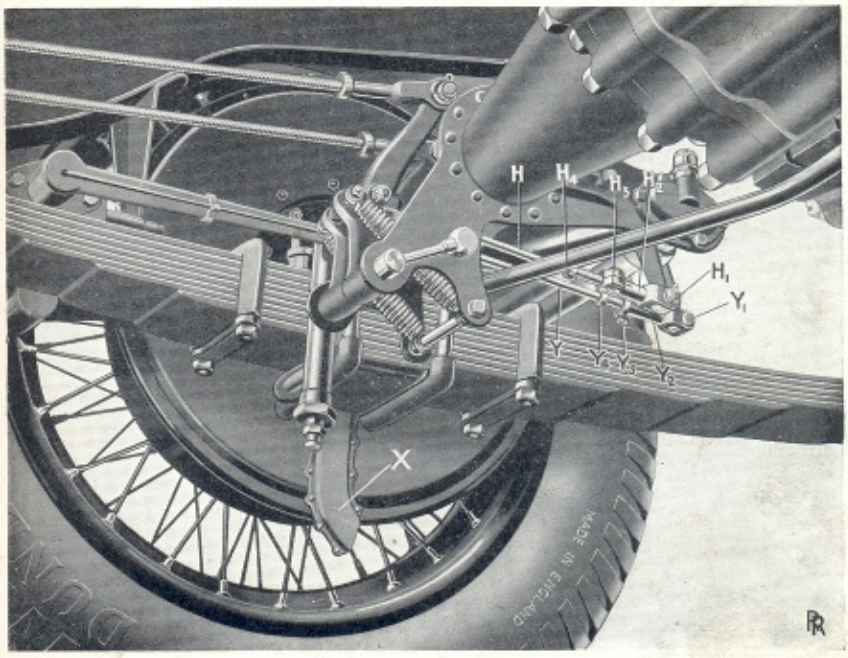

FIG. 19. REAR WHEEL BRAKE ADJUSTMENT.
(Viewed from Below.)

less than 1" for both the foot and hand brakes, but there is no need to adjust the brakes unless it exceeds 1½" for the foot brake, or 1¾" for the hand brake.

The method of adjustment is similar for both hand-operated and rear foot-operated brakes, and is illustrated above. This is a view looking from the underside of the axle.

The outside rods, **Y**, actuate the foot brake shoes, and adjustment is effected by removing the pin **Y1** from the jaw **Y2**, this pin being secured by a collar and split cotter, slackening the small nut **Y3**, and screwing the jaw further on to the rod **Y**, to an extent depending on the amount of adjustment required.

The amount of adjustment made to both these rods should usually be the same. A convenient method of checking this is to measure the distance between the collar **Y4** and the jaw **Y2**.

Before replacing the pins Y1 in the jaws, attention should be turned to adjustment of the hand brake, if any is required.

All adjustment for the hand brake is made on the inside rod H and the corresponding rod at the other end of the axle.

The adjustment is effected in a similar manner to that of the foot brake, but it should be noticed that the pin H1 of the hand brake jaw H2 cannot be removed until jaw Y2 is disconnected.

Care should be taken that the collar, which fits the pin of each jaw, is in position before fitting the split cotter.

The adjustment of both brakes should be checked finally by measuring the travel of the cable, as already described, when the cable or lever is moved from the off position to a point where the shoes just touch the drums.

After replacing the pins and their collars, split cotters should be fitted to these, and the small nuts, H3 and Y3, tightened up.

The amount of adjustment provided is so proportioned that when all has been utilised (jaws H2 and Y2 being against the collars H4 and Y4 respectively), it is a sign that the brake shoes require re-covering, and the makers should be consulted.

On no account should further adjustment be attempted, as, for instance, by shortening the brake ropes or interfering with adjustments within the brake drums. Such a course might result in serious injury to the drums and shoes.

Adjustment of Front Brakes. It should be borne in mind that pedal travel is no indication as to the front brake adjustment, because these are entirely servo operated and their adjustment will not influence the pedal travel.

The only indication that they require adjustment (apart from an observed decrease in the front braking) is excessive movement at the end of the levers Lf, Fig. 20. When lightly depressed by hand the movement at the end of this lever, for correct adjustment, should be about $\frac{9}{16}$". It should not exceed $\frac{7}{8}$".

When this figure is exceeded adjustment is imperative.

It is effected as follows :—

Remove the split cotter of the castellated nut J1, and unscrew the latter. The cover J may then be removed, exposing the serrated adjustment. As this cover also acts as a locking piece, it will be found

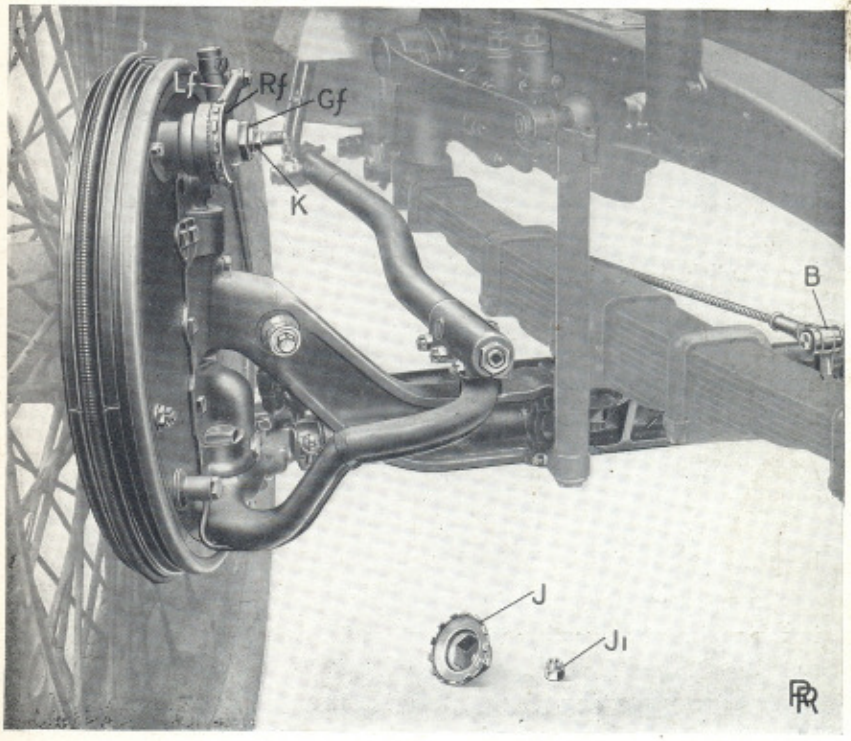

FIG. 20. FRONT WHEEL BRAKE ADJUSTMENT.

convenient to mark the position of engagement of its teeth with those on the member Rf before removing it.

The nut Gf should be unscrewed sufficiently to permit the serrated member Rf to be moved clear of similar serrations on the lever Lf. These two sets of teeth are marked respectively with an arrow and figures 0, 1, 2, 3, 4 and 5. If the brakes are being adjusted for the first time the arrow will point to 0.

Having noted the relative positions of these serrated parts, they may be disengaged by tapping the lever Lf away from the wheel,

carrying with it the serrated member **Rf**. While holding the latter in the hand, the lever should then be tapped towards the wheel again, when the serrations will be disengaged.

The cam operating shaft, and with it member **Rf**, should next be turned by means of a spanner on the hexagon **K** of the shaft until the parts can be re-engaged one serration further towards the on position of the cam operating shaft than before; that is, after the first adjustment the arrow will point to 1.

Finally, re-tighten the nut **Ff**, re-fit the cover **J**, which also acts as a locking piece for this nut, and replace the castellated nut **J1**, fitting a split cotter to the latter.

If any difficulty is experienced in getting the teeth of cover **J** to engage with those on member **Rf**, the cover should be rotated slightly and tried in different positions.

The brake clearances should be tested again after adjustment by measuring the movement of levers **Lf**, as described. This movement must not be less than $\frac{3}{16}$", otherwise the brakes may drag.

Usually it will be necessary to adjust each front brake a like amount.

It should be observed that when the five teeth of adjustment have been utilised, this is an indication that the shoes require new facings.

On no account should further adjustment be attempted by, for instance, interfering with the lengths of any of the brake rods or ropes.

Apart from testing for the need of adjustment of the front brakes, it is important to test from time to time that the shafts and joints on the axle are free by pushing down the levers **Lf** with the hand, or by moving levers **B** similarly.

The mechanism should feel free, and be returned sharply to the off position by the pull-off springs.

If any tightness is found, the cause must be investigated and removed, otherwise there is a danger of the brakes dragging and becoming damaged.

Adjustment of the Servo. The servo is of the dry, disc-clutch type, and should run 20,000 miles without the need of any adjustment.

If adjustment is necessary, it is effected by screwing up the nut **Z** (Fig. 21).

This nut is locked by 25 rounded serrations formed on its face, which engage similar serrations on a washer, which is secured against rotation relative to the shaft. The depth of these serrations is carefully proportioned to give the correct clearance of the servo, the nut being turned so that the teeth lightly ride over each other and engage again.

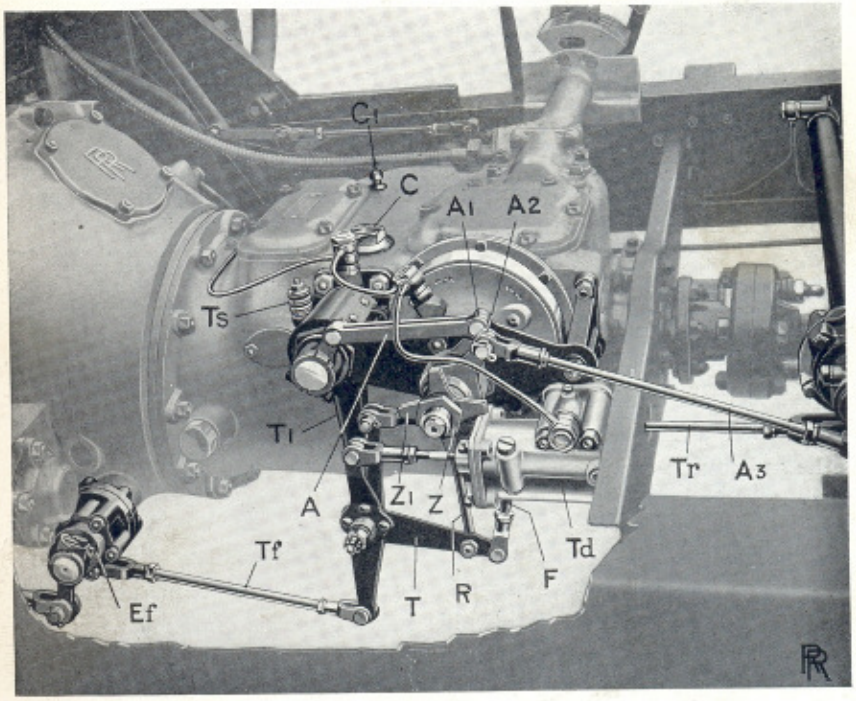

FIG. 21. THE SERVO MOTOR AND ITS CONNECTIONS.

On no account should force be used in this operation, as such treatment would nullify the object of the teeth, namely, to ensure the correct clearance with very little trouble.

After effecting adjustment in this way, care should be taken to see that the serrations are in proper engagement.