
ROLLS
ROYCE

Book of General and Technical Information Useful to Drivers and Owners of

Rolls-Royce Cars

40-50 H.P. SIX CYLINDERS

Liable to Alteration without Notice

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NOTE.

This book, together with a smaller one entitled "Instructions for Running Rolls-Royce Cars," is supplied with each Chassis. Further separate copies of either book may be obtained from Rolls-Royce, Ltd., at 15/- per copy for the large book, and 5/- per copy for the smaller book.

CONTENTS.

THE ROLLS-ROYCE SYSTEM OF PERIODIC INSPECTION.

Our interest in the Rolls-Royce Cars does not end at the moment when the owner pays for, and takes delivery of, the car. Our interest in the car never wanes. Our ambition is that every purchaser of a Rolls-Royce Car shall continue to be more than satisfied.

With this end in view, there are on the staff of Rolls-Royce, Ltd., experts whose sole duty it is to call, by appointment, on the owners or drivers of Rolls-Royce Cars, with a view to ascertaining whether they are satisfied with their cars.

A consultation between the owner or driver, or both, and one of these inspectors is invariably of benefit to users of Rolls-Royce Cars, and these visits have been highly appreciated in the past by both owners and drivers.

THE SECRET OF SUCCESSFUL RUNNING.

Before a Rolls-Royce Chassis is sold it is very carefully tested and adjusted by experts. It will run best if no attempt be made to interfere unnecessarily with adjustments.

An owner would do well to instruct his driver as follows:—

Lubricate effectively, in strict accordance with the advice given in this book, and do not neglect *any* part.

Use only those oils which are recommended by Rolls-Royce, Ltd., who have made prolonged and searching tests of oils. Considerable harm and expense may result from the use of unsuitable oils.

Inspect all parts regularly, but take care not to alter any adjustments unless really necessary.

The information in this book deals as fully as is practicable with every possible case which may arise, but if a Rolls-Royce Car be cared for regularly and properly, and not tampered with, reference to the book should seldom be necessary.

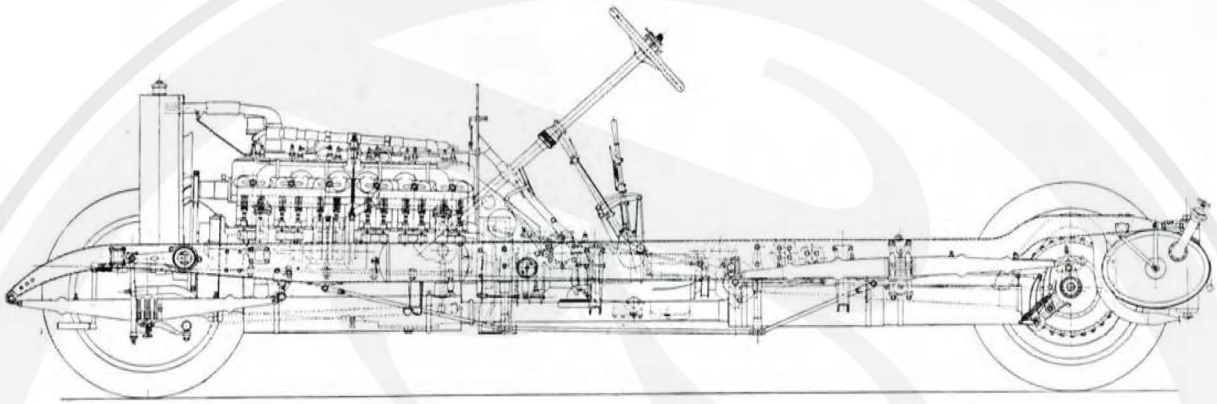


FIG. 1.

ELEVATION OF 40 50 H.P. 6-CYL. ROLLS-ROYCE CHASSIS.

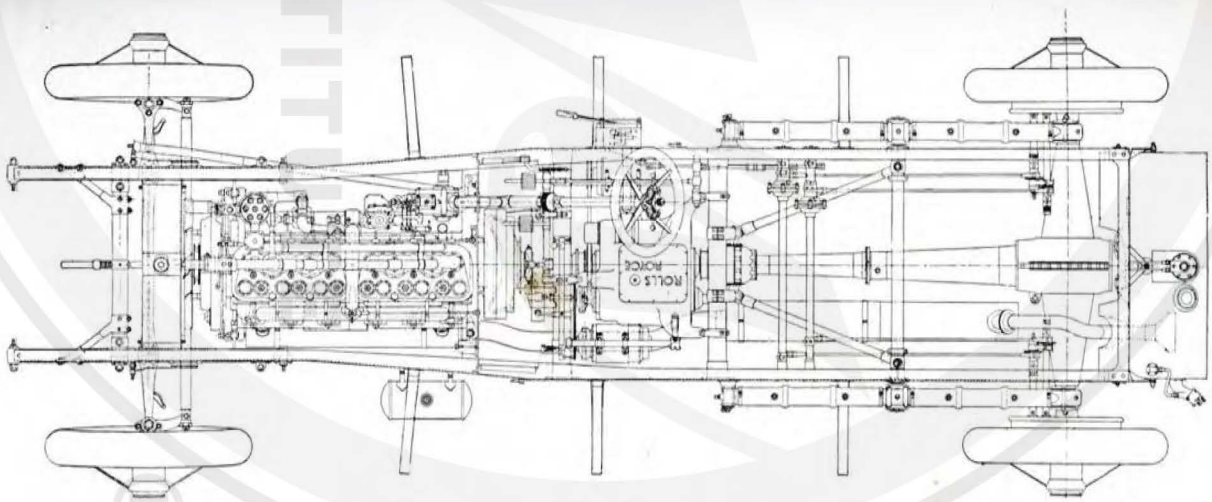


FIG. 2.

PLAN OF 40-50 H.P. 6-CYL. ROLLS-ROYCE CHASSIS.

CHAPTER I.

INSTRUCTIONS FOR STARTING, DRIVING, STOPPING, ETC.

STARTING THE ENGINE.

See that the gear lever is in the neutral position, the hand brake lever "on," and petrol tap on. Operate the hand pump until the pressure gauge registers about one pound. Retard the ignition fully by setting the control lever right back to "late," and fully close the throttle by moving the governor lever sharply to the bottom of its quadrant. Switch on both ignitions by turning the switch to position marked "**M** and **B**" (magneto and battery), and move the mixture control lever right over to "strong." A small high-velocity carburetter is provided on the induction pipe for starting purposes only, being controlled by a small lever on the instrument board. Turn this lever to the "Starting" position, and depress the button switch on the dash, when the electric starter motor will set the engine running. When the engine is running properly, the main throttle should be opened a little by moving the governor lever about one-third up its quadrant and the starting carburetter control turned to its "Running" position.

An exhaust heated jacket is provided around the carburetter throttle chamber, the jacket being supplied through a bye-pass pipe from the rear exhaust box. A butterfly throttle valve is arranged in the rear exhaust downtake between the jacket connection and the silencer, this throttle being so interconnected with the accelerator pedal that it is closed when the main throttle is closed, and opens as the latter is opened by depressing the accelerator pedal. Consequently, hot gases circulate freely around the throttle chamber immediately the

engine is started, and thereby render the car very quickly available for service even in the coldest weather. It is advisable, however, to allow the engine to run for a few minutes before taking the car on the road, during which time it should be noticed that the oil pressure is registering correctly.

In the event of its being necessary to use the starting handle, this should be pulled upwards by lifting it with the four fingers of the right hand without actually gripping it; this will prevent personal injury in the event of a backfire. On no account should the handle be pushed down to start.

Whether the engine is started by means of the electric starter or by hand, it is important that the ignition lever should be set right back to "late" before attempting to start the engine.

As soon as the engine starts, the ignition should be moderately advanced, and the governor lever set back until the engine runs as slowly as required.

The mixture control lever should be set in the middle of its range as soon as the engine is warm.

To start the engine "off the switch," the switch should be turned to the "**B**" or "**M** and **B**" position, and the ignition lever moved smartly from its full "advance" to its full "retard" position. The coil being of the non-trembler type, this will result in a quick break of the low-tension circuit and a spark in the cylinder which is on its firing stroke.

STARTING THE CAR.

With the engine warm, first push the clutch right out, gently move the gear lever into the first speed position, and then release the side brakes. The position of the governor lever now should be a quarter way up its quadrant, so that the engine is accelerated to about 300 or 400 revolutions per minute. Then, with the ignition control lever advanced to about a quarter of its range only, the clutch should be let gently in.

In starting the car do not run the engine too fast, remembering that the slower the engine speed the more

quietly will the car get away, and the less stress will there be on the transmission.

Care must be taken not to "grind" the gears; if the gears will not engage through the teeth being opposite to one another, the clutch pedal should be slightly lifted, and after pressing well down again, another attempt should be gently made. Do not jam the gears in. If a grinding noise is heard when bringing into gear (which is due to the wheels revolving), press the clutch pedal *well* down, which should stop them. If they still continue to revolve, there may be an excess of oil on the clutch (see Chapter III. on "Care of Clutch," *p.* 24), or possibly the small clutch pad requires attention (see "Clutch Pad," *p.* 28).

The clutch must always be let in gently, otherwise the engine may be stopped by the effort to suddenly move the load, and the mechanism and tyres may be strained and damaged.

If the clutch should slip, *i.e.*, fail to drive the car properly when "engaged," see Chapter III. on "Care of Clutch."

To change from the lowest gear to the next higher one, leave the control lever in its position of quarter-way up quadrant, and as soon as the car is moving steadily, push out the clutch and move the gear lever quietly into next gear position (this can be done quite slowly), then let in the clutch gently. The gears will engage without noise if the time between disengaging one gear and engaging the next is judged nicely; this should be such as will allow the primary shaft to drop in speed sufficiently to pick up the higher gear without grating the teeth. The governor will open the throttle automatically the requisite amount if the clutch is let in *gently*, so do not touch the accelerator pedal during these operations.

Having finally got the car running on the top gear (which, being the direct drive, should be used as soon as possible), the speed can be adjusted to suit the wish of the driver by using the foot accelerator pedal, the governor being set by placing the governor lever near its "slowest" position. Never depress the accelerator pedal with the clutch out or the gear lever in "neutral." The accelerator pedal should be released when turning a corner.

ECONOMICAL RUNNING.

The mixture control lever should be set a few notches weak, and the ignition lever should then be considerably advanced, when it will be found that the engine will pull fairly vigorously, even with this weak mixture. Care must be taken, however, not to weaken the mixture to too great an extent, or it will be necessary to run with a more open throttle, and thus more mixture will be used and the economy lost.

It should be understood that a weak mixture takes considerably longer to rise to its maximum pressure after ignition than a normal mixture, and it is for this reason that the ignition can be advanced so considerably under these conditions. If the mixture is weakened in this way to a reasonable extent, and the process not carried too far, then considerable economy will be effected, providing the ignition is suitably advanced.

It is necessary to bear in mind the amount of work the engine is required to do, and the above applies particularly to speeds of 30 miles an hour and over on fairly level roads and with reasonably light loads.

When running with a weak mixture care should be taken to retard the ignition at low speeds; the engine being particularly sensitive to the ignition under these conditions.

TO DESCEND A HILL.

The throttle may be closed by moving the governor lever right back (if the governor is already set for slow running, the throttle will close automatically when the speed of the car is much increased), so that the clutch being left "in," the engine may serve as a brake. The foot and hand brakes should then be applied gently and gradually, so that the speed is always kept well within control. Always put the brakes on at the top of the hill. Do not wait until the car is running fast downhill. Avoid jamming the brakes on suddenly. Changing to a lower gear should never be attempted while descending a hill unless the car has been nearly stopped.

If the car is on a decline (forwards) and the engine has stopped, it may be started by allowing the car to run slowly downhill (on "direct drive") and then gently letting the clutch in. Care should be taken to use *only* the "direct drive," as the use of any other gear may cause damage to the transmission.

TO ASCEND A HILL AND CHANGE TO A LOWER GEAR.

If a hill is too steep to be negotiated on "direct drive" and necessitates a lower gear, the driver should, immediately before withdrawing the clutch for changing gear, speed up the engine by means of the throttle-lever on the steering wheel to a speed equivalent to that at which it should run when the lower gear is engaged. Then, after "double clutching,"* the gear lever should be gently pushed into the gear required without loss of time, and the clutch allowed to go home gently.

A driver will soon know the correct position of the governor lever for a change of gear at various car speeds; for example, it is a simple matter to note that the best position of the governor lever is in the midway position when changing from direct to the next lower gear at about 18 miles per hour, and so on for other speeds.

It is found there is a tendency to keep on top gear longer than is advisable, owing to the pulling power of the engine at slow speeds. The speed of the car, when climbing a hill, should never be allowed to fall below 14 miles per hour in top gear.

To take advantage of the high power of the engine it is essential to keep up the engine speed, so that in making a fast ascent of a steep hill a change from top to the next lower gear should be made at not less than 20 miles per hour, and, better still, 25 or 28 miles per hour.

A change of gear should be made without any noise or shock whatever, otherwise the handling is wrong. In order to get the knack of gear-changing quickly and silently, it is useful to practise on the level.

Caution. Take care never to try to change gear or allow the gears to get "out of mesh" when the engine has stopped and the car is in motion; should this occur, wait till the car is almost at rest before touching the gear lever.

TO STOP THE CAR.—BRAKES.

In stopping the car (except in case of emergency), the throttle should be closed (by releasing accelerator pedal) well before arrival at destination, and the car allowed to slow down, so that little or no brake will be required. In

* By "double clutching" is meant that the clutch is momentarily let in to spin the gears directly the gear lever has been moved from one gear, and before it is moved to another.

fact, the brakes should be used as little as possible, and retained for emergencies. Similarly, the clutch should be withdrawn or the throttle closed in plenty of time before coming to a corner or traffic obstruction, so that a *gentle* application of the brake will stop the car completely if necessary.

The proper course, on desiring to slow down, is to do so by allowing the throttle to close; the engine will then retard the car without taking out the clutch (*i.e.*, use the engine as the first brake).

All brakes should be eased off as the car comes to rest (the hand brake put on again *after* the car is stationary); this will prevent any unpleasant jerk to the passengers and mechanism.

For long down grades, the engine may be left in gear (direct) and the throttle closed.

See notes elsewhere on lubrication and care of the brakes.

STEERING.

The steering of these cars is designed to have what is termed a "big lock," *i.e.*, the front wheels can be turned round to a considerable angle, which is extremely useful for turning round in narrow roads and confined spaces, but care must be taken never to use the "full lock"—or anywhere near it—when the car is travelling at any speed, but only when manœuvring in or out of a difficult place.

See notes elsewhere on the lubrication and care of the steering gear.

SIDE-SLIP.

On greasy surfaces the speed must at once be reduced to "very slow," for the brakes may be valueless to stop the car in case of an obstruction.

The safest rule on greasy surface is to drive as though you had no brakes, *i.e.*, in such a manner that if an obstruction presents itself the car will pull up of its own accord by merely withdrawing the clutch.

When you feel a tendency of the car to slip, immediately take the clutch out; do not apply the brake, which would probably cause a worse skid, but "correct" the side-slip by turning the front wheels in the direction towards which the *back* of the car is tending to skid; be careful to turn them straight again just as soon as the car straightens itself, or you may have a worse skid in the opposite direction. It is often the *second* skid that causes an accident owing to the driver having "corrected" the first without being prepared for a counterswing in the other direction worse than the first.

NOTES TO DRIVERS.

An owner may find it well to instruct his driver as follows:—

Collisions. Drivers are warned to inspect carefully the front dumb-irons, springs, wheels, and steering gear for damage, after even slight collisions. Damage to these parts may result in a serious accident when the car is again on the road.

Corners. Avoid taking bends or corners fast, as this puts a serious side strain on the wheels, body, etc., and causes *great wear and tear* to the tyres.

Carburation in Cold Weather. Under extremely cold climatic conditions it is advisable to do some or all of the running on the governor control lever and not to use the accelerator pedal save when maximum engine power is required. By this means a good flow of hot gases will pass through the carburetter throttle jacket owing to the fact that the governor, as it opens the main throttle, does not open the butterfly throttle valve located in the rear exhaust down-take pipe. On the other hand, the heat supplied to the carburetter can be reduced by utilising the accelerator pedal, the latter being interconnected with the exhaust throttle, which is thereby caused to open as the carburetter throttle is opened.

Risks. Avoid unnecessary risks, such as passing between other vehicles when there is only just room, as this often results in a sudden violent application of the brake being necessary, which causes wear on the tyres and unnecessary discomfort to the occupants.

Towns. When passing through towns and villages, the throttle should be nearly closed, *i.e.*, the governor lever placed near the "slow" position, so that (the accelerator pedal being "up") the engine will only just keep the car going at a slow speed.

Speed. Remember that owing to the silence of the car one is often driving at a much higher speed than one thinks.

Courtesy. Drive with the greatest consideration and courtesy for other users of the road, so that you may not earn a bad reputation.

Dust. Especially avoid driving fast. In dusty weather, where there are many pedestrians on the road, an occasional glance backwards will reveal the immense amount of annoyance and discomfort to others which such a practice causes.

Mud. In wet weather, when the road surface is uneven, the speed should be greatly reduced in populated parts, to avoid splashing people on the footpath.

High Curbs. Care should be taken when driving close to a high curb to avoid catching the projecting spokes of a wire wheel at **A**. See *Fig.* 3.

Tyres. Do not let the tyres get flabby, but pump them up occasionally. It is ruinous to the tyres to run on them if they are not well pumped up; too much pressure, however, may cause a burst, as well as discomfort to the occupants. (See *p.* 89.) Examine the surfaces of the tyres at stopping places and pull out any nails, flints, etc.; many punctures are thereby saved.

Ignition. It is recommended that both ignitions should always be used.

Auxiliary Oil. It is important to remember that, when the accelerator is depressed beyond a certain point, the auxiliary oiling device is brought into action; this fact would be utilized by a thoughtful driver by *depressing the pedal occasionally to its full extent after driving for some time on, say, ½ throttle* (*i.e.* without auxiliary oil).

Slow Running. Strengthen the mixture 2 or 3 notches, switch on battery only and retard. A strong mixture burns slowly, and if ignited late will give the minimum power, because the exhaust valve opens and releases the pressure while the gases are still burning. Keep the compression good (*as explained on p.* 121); attend to the valve tappets (*see p.* 122).

Extremely slow running may be obtained by increasing the spark gaps to ·035 in. or ·04 in., but this necessitates the plug points being kept particularly clean; if the engine is then found to mis-fire when the throttle is opened after running slowly, the gaps are too long, and should be shortened. See *p.* 53, *et seq.*

AFTER THE CAR HAS STOPPED.

The hand brake should be put firmly on, and the change gear lever brought to the neutral position before the driver leaves his seat. If the car will soon be required again, the engine should be stopped with the governor lever halfway up the quadrant (not more), by means of the switch, after

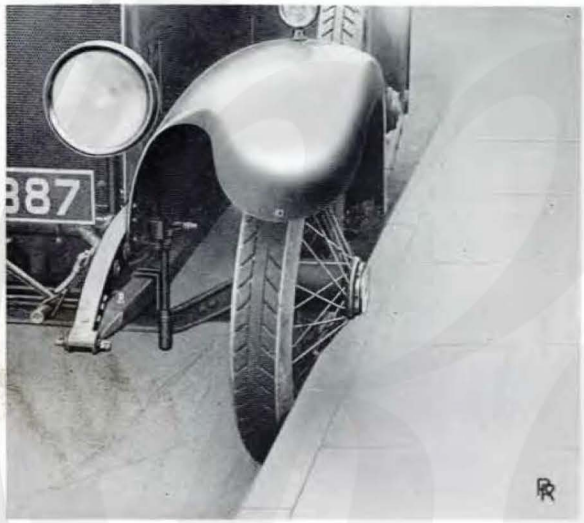


FIG. 3.

which the ignition should be put to the fully retarded position ready for the new start. The engine should not be "raced" and then switched off, as this will cause violent explosions in the silencer. If the car will not be used again immediately, turn off the main petrol supply tap.

CLEANING.

It is necessary to keep *every part* of the mechanism clean, not merely the parts which are easily accessible.

CHAPTER II.

LUBRICATION OF ENGINE.

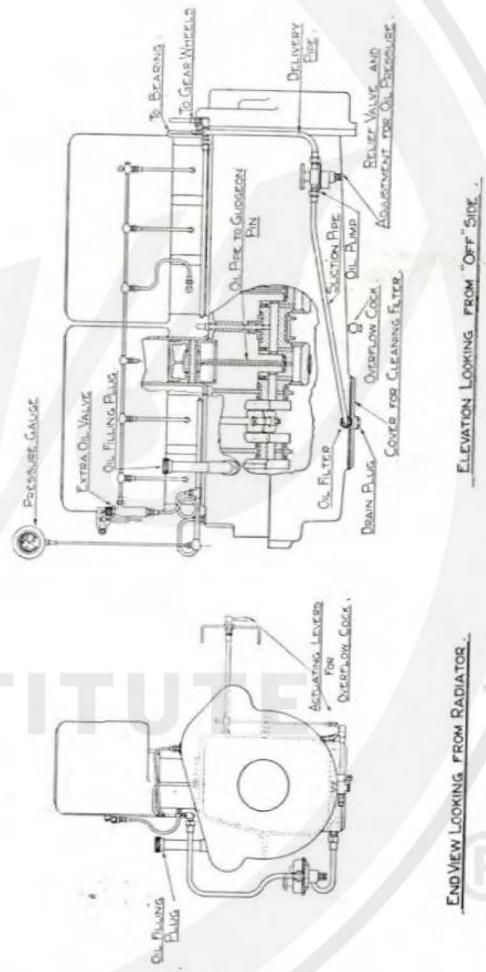


FIG. 4.

LUBRICATION SYSTEM OF ROLLS-ROYCE ENGINE.

LUBRICATION OF ENGINE.

The correct amount of oil to be contained by the oil-well of the engine is 1 gal., and that contained in the supply tank is $1\frac{3}{8}$ gals.

The engine should be oil-retaining, *i.e.*, there should be practically no waste or leakage noticeable. Any serious leak of oil should be attended to.

Notwithstanding the correct quantity of oil having been put into the engine, the driver must always be certain that

FIG. 5. THE ENGINE OIL PUMP, SHOWING DIRECTION OF OIL CIRCULATION.

the oil is *circulating* properly, otherwise (unlike "splash" lubrication) the oil in the well would be useless, for it would not reach the cranks. The proper circulation of the oil is denoted by the oil pressure gauge situated on the instrument board.

When the engine is running, this gauge should never indicate less than 3 lbs. or more than 20 lbs. per square inch.

The oil pump (*Fig.* 5) is provided with an automatic "by-pass" or relief valve, which governs the maximum pressure at which the pump circulates the oil; to alter this relief valve—and so adjust the pressure at which the oil should constantly circulate—there will be found a large

screw **G** just underneath the relief valve, checked by a lock-nut **H**; this screw should be screwed up or down as the pressure is required to be increased or diminished; when making this adjustment, have the engine running and watch the gauge. A special spanner is provided for this adjustment.

Do not touch the oil pressure regulator screw (**G**, *Fig.* 5), if it can possibly be avoided; this is very carefully adjusted by the makers, and it is most improbable that this is the part causing trouble—make sure that all the other parts are right first.

Fig. 6 shows the pump in pieces—relief valve **C**, valve seat **B**, valve spring **K**, square steel driving tube **J**, suction side **S**, delivery side **D**, body of pump **A**, adjusting screw **G**, and lock-nut **H**.

FIG. 6. ENGINE OIL PUMP DISMANTLED.

Fig. 5 shows how the pump should be fixed when in position; **D** is the delivery side (front of engine); **S** the suction side leading to base chamber; the arrows mark the direction of rotation and of oil circulation.

Do not cut the oil circulation pressure down low, but run with it as high as you can *without* causing smoke in the exhaust; there *should be* a slight smoke visible in the exhaust when first starting up the engine from cold, but there is something wrong if the exhaust *continuously* emits blue smoke with the oil pressure set below 7 lbs.

If the gauge shows signs of dropping back, the oil feed is failing, and should at once be attended to (try letting more oil into the engine); if the gauge drops to *zero*, the car must on no account be driven on (except in emergencies for a mile or two), otherwise the white-metal bearings may be destroyed.

Auxiliary Oil Valve and Filter.

In conjunction with the forced feed system just described, there is fitted an auxiliary oiling system by means of which an increased quantity of oil is delivered to the cylinders when the throttle is opened beyond a certain point. An oil valve and filter, fixed to the front face of the dashboard, is connected to the main oil supply from the pumps. When the accelerator pedal is depressed beyond a certain point, this valve is opened by a small lever interconnected with it, and the auxiliary oil is distributed direct to the cylinder walls by small pipes.

The cleaning and adjustment of this mechanism are described in operation 8, Appendix IV.

It is advisable, for much night work, to fit a small electric lamp over the pressure gauge.

Causes of Engine Lubrication Failure.

If the gauge begins to fluctuate considerably, or the oil pressure fails completely when the engine is running, the following are the probable causes:—

(1) Insufficient oil in the well of the engine.

(2) The filter or one of the oil pipes is choked up. (See operation 1, Appendix III.)

(3) The relief valve on the oil pump is being held open by some foreign substance deposited on the face; this valve can be easily taken out and cleaned.

(4) There is a leak somewhere in the oil system, probably in one of the pipes or unions. If the leak is on the "delivery" side of the pump, it will reveal itself by a slight flow of oil; but if it is on the "suction" side, the pump will be drawing in air, and the location of the leak will not be so easy; the short suction pipe **S** (*Fig.* 5) between the oil-well and the pump might be taken off and blown through to see if it is split anywhere or if the brazing of the unions has been cracked.

(5) The oil system wants "priming" owing to some part having been recently dismantled. (See operation 1, Appendix III.)

(6) The pressure gauge may be at fault. To test this, unscrew a union or priming plug, and estimate pressure by laying finger gently over opening.

(7) The pump is not working owing to some foreign substance getting into the wheels and jamming the pump; this will cause the square driving piece to "open out" (so designed to avoid breaking the pump), but will be difficult to detect without taking off the pump or pump cover. The square driving piece is a piece of steel tube, and can be easily replaced.

Should the oil pressure vary considerably with the speed of the engine, the oil is probably too thin; thin oil should be avoided.

When the accelerator pedal is depressed sufficiently to operate the auxiliary oil, the pressure gauge will drop a few pounds owing to the partial release of the pressure.

If the pressure fails only when the accelerator pedal is pressed well down, then it is the extra oil system that is at fault, and this should be carefully inspected for leaks.

So long as *some* pressure is showing on the gauge occasionally, the journey may be continued (but at slow speed) *if absolutely necessary*.

CHAPTER III.

CARE OF CLUTCH.

Clutch.

Periodically the clutch will require a little oil, which may be fed with a syringe on to the cone surface, as shown in *Fig.* 7 (the clutch pedal being depressed meanwhile). The oil should be introduced when the engine is running and the clutch shaft stationary.

The time which one charge or filling of oil will last will vary according to the amount of use the clutch has had, therefore it is advisable to examine the state of lubrication about once a week. This can be done by looking downwards through one of the large holes in the clutch cone. If the bottom of the inside of the clutch is dry, a small amount of engine oil should be fed with a syringe on to the

FIG. 7. OILING CLUTCH SURFACE.

surface of the cone—about an eggcup-full. If there is a small amount of free oil at the bottom, the lubrication is correct.

If the clutch is neglected or badly used it may squeak when being engaged. The cause of the squeak in most cases is due to a lack of oil in the fabric. To remedy this, engine oil should be applied whilst the engine is running, and the clutch pressed out of engagement.

After treating the clutch in this manner, it is advisable to prop it out overnight, thus permitting the oil to saturate the cotton fabric.

It is desirable to have ample oil in the clutch. With an excess of oil, however, a film of oil is maintained between the clutch lining and the flywheel, and the clutch will not readily stop revolving when the clutch pedal is depressed. Under these conditions changing gear is rendered difficult, and considerable damage may be done to the teeth of the gear wheels by attempts to engage them. This difficulty will be particularly noticeable when engaging the gears whilst the car is at rest.

Until there is this proof that the clutch contains an excess of oil, more and more oil may be added.

Any excess of oil in the clutch may be drained out by removing the plug **A** in the flywheel, or by means of a syringe, as shown in *Fig.* 8.

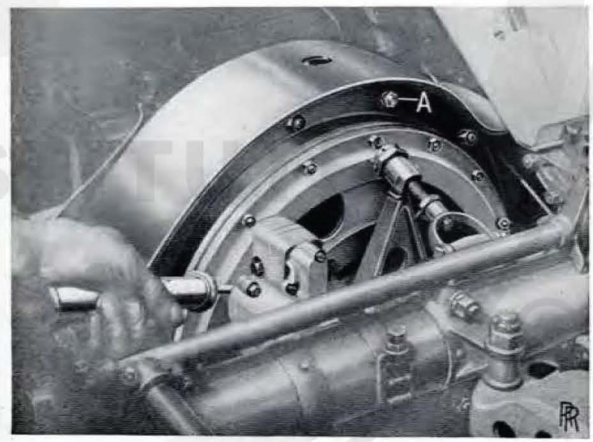


FIG. 8. SHOWING OIL DRAIN AND ALTERNATIVE METHOD OF WITHDRAWING SURPLUS OIL.

Should the clutch become over-oiled, though none has been applied by hand, it will probably be caused by leakage through the small valve on the end of the crankshaft. This valve, which is opened when the clutch pedal is fully depressed, allows oil from the crankshaft to feed the spigot, or clutch bearing. The valve may have stuck or may not close properly, owing to some foreign substance getting underneath the seat. The spindle which actuates the valve will be seen (**B**, in *Fig.* 9) projecting from the end of the clutch shaft when the coupling is removed.

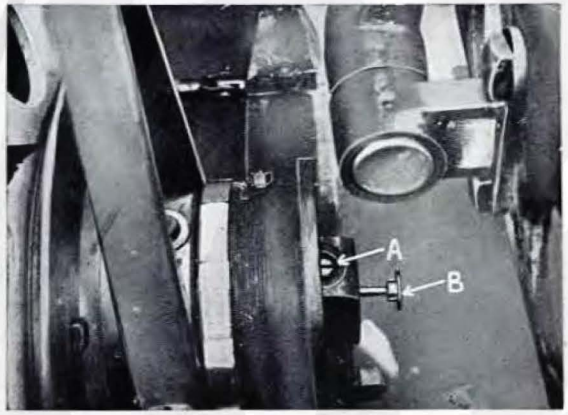


FIG. 9. SHOWING COUPLING REMOVED.

This spindle moves with the clutch, and is held in position by a grub-screw (**A**, in *Fig.* 9), which passes through the driving pin on which the square blocks are fitted. By unscrewing this grub-screw the spindle is free to move endways, and if pushed in towards the engine, will be found to come against a surface which gives to further pressure. This is the valve which opens when pressed, but is closed by means of a spring when pressure is released. This is a means of ascertaining if the valve has stuck. This action is, of course, carried on in a similar manner by depressing the clutch when the spindle is held in position with the grub-screw. To set this spindle, the clutch should be engaged and the spindle brought into position so as just to touch the valve (but not to open it). It should then be brought back $\frac{1}{16}$ inch, and locked by means of the grub-screw. This is the normal position, and should be increased or reduced as found suitable.

Fig. 10 shows the parts of this device; the spring **E** should be inserted (large end first) after the worsted plug **A**; fix valve **B** in seating **C**, and screw bodily into end of spigot.

Should there be anything wrong with the valve, it can be taken out and cleaned by dismantling the clutch. *Before* putting the clutch together, the engine should be run with the valve in place to test if the valve really shuts off the oil, *i.e.*, whether it is properly ground to an oil-tight joint. The worsted plug (**A**, *Fig.* 10), fitted at the crankshaft

FIG. 10. CLUTCH OIL VALVE DISMANTLED.

extension, is to prevent a too free supply of oil from flowing to the clutch, and to act as a filter to the oil. This plug should be as tight a fit as possible.

Care must be taken that the joint made between the valve seating and the end of the clutch spigot is oil-tight.

Note that the above oiling device is for oiling the clutch bearing only, not the clutch itself.

RÉSUMÉ.

Should a "slipping" clutch be experienced at any time, the following are the probable causes:—

(*a*) Too much oil (which can be drawn out with syringe (*Fig.* 8) or by removing the special plug in the flywheel, and running the engine for a while).

(*b*) The parts have worn out of adjustment, resulting in the pedal lever catching the floor-board or other

mechanism, having reached the limit of its stroke. This can be adjusted by shortening the link which is situated at the top end of the vertical levers, giving it a few complete turns. In case the fault cannot be remedied at the time, it is advisable to *change on to a lower gear* until the clutch cools or a place is reached where the necessary adjustment can be made.

(*c*) The clutch lining having worn until the coupling has no end-play, resulting in the coupling preventing the clutch spring forcing the clutch into the conical portion of the flywheel.

N.B.—It is most essential not to run the car with the clutch slipping, but to stop and attend to the *fault at once*, otherwise the lining may quickly be destroyed.

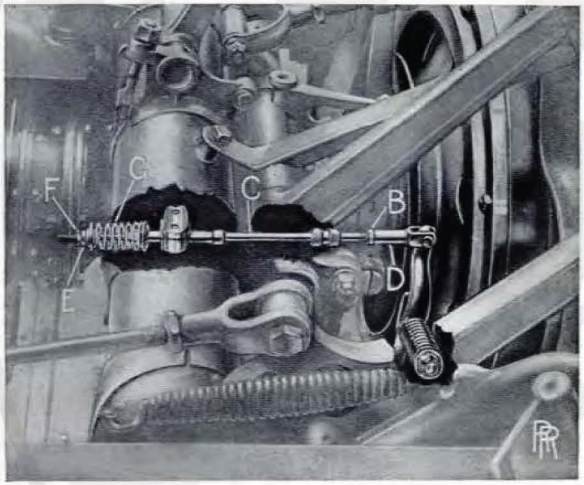


FIG. 11. ARRANGEMENT OF CLUTCH PAD.

CLUTCH PAD.

There is a small brake in the form of a fibre pad against which the clutch rubs when depressed. The object of this brake is to stop the clutch from revolving when "out," and so facilitate the changing of gears. It may at times require adjusting as the clutch wears further into engagement, *i.e.*, bringing nearer to the flange of the clutch on which it rubs. To do this, slack off the nut **B** (*Fig.* 11)

quite clear. Then screw the spindle **C** further into the jaw **D** until the fibre pad is $\frac{1}{32}$ inch clear of the flange; the nut **B** should then be screwed up again to lock it in position. The nuts retaining the spring have been carefully set, so that with the engine running at normal slow speeds and the car standing, the clutch ceases to revolve when depressed fully in 2 to 3 seconds. This adjustment gives the easiest change of gears. If the clutch is either over-lubricated or too dry, then this adjustment will be upset, and it will be necessary, in order to get the best results, to alter the tension in the spring **G** (*Fig.* 11); to effect this, ease the lock-nut **F** (*Fig.* 11), and by means of the nut **E** adjust the tension in this spring as required, and, on finding the correct setting, tighten the nut **F**.

CHAPTER IV.

ELECTRIC LIGHTING, STARTING & IGNITION SYSTEMS.

A. DESCRIPTION.

General.

The equipment comprises a dynamo, switchbox and junction box, a 12-volt 55-ampère-hour accumulator, an ammeter, a six-cylinder magneto, and the following items of Rolls-Royce manufacture:—A starter motor with electrically operated main switch and jaw clutch actuator; battery ignition, consisting of non-trembler ignition coil with ballast resistance, and combined low-tension make-and-break and high-tension distributor, the battery ignition being provided with a centrifugal device for automatically varying the timing; and combined magneto and battery ignition steering column switch.

The wiring diagram (*Fig.* 12) shows these units in their approximate relative position, with their electrical connections. Some of the internal connections of the switchbox are omitted, but are given in the connection diagram (*Fig.* 13). In these diagrams positive leads are coloured red, and negative black, it being assumed that all circuits are closed. All switching is done on the negative leads, except for the main starter motor current. An earth return on the chassis frame is utilised in the case of the ignition only, otherwise the whole system is insulated. This earth is made on the positive bar of the junction box on the front of the dash at **E** (*Fig.* 15, *p.* 33) and at the contact breaker under the battery ignition distributor.

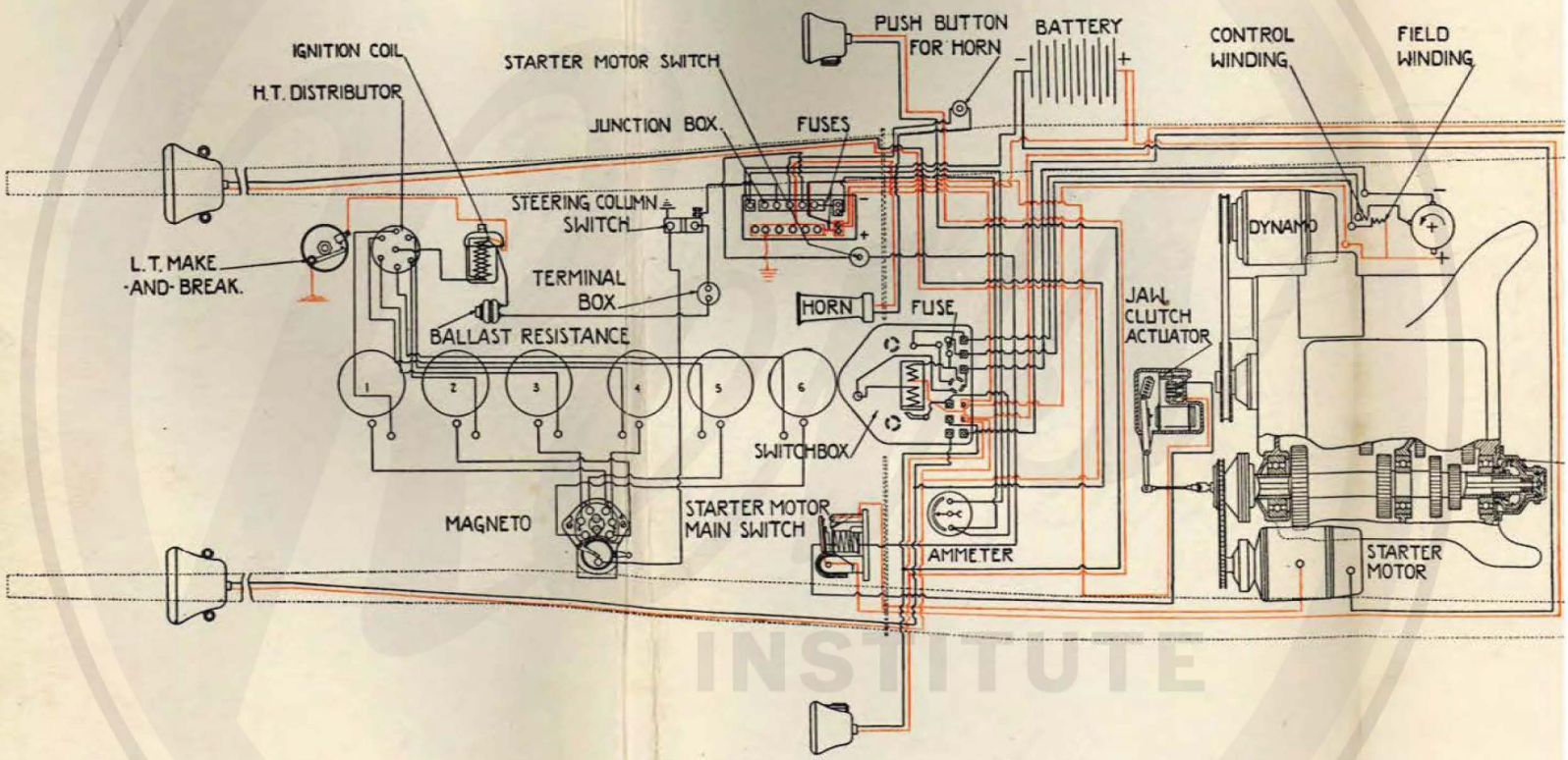
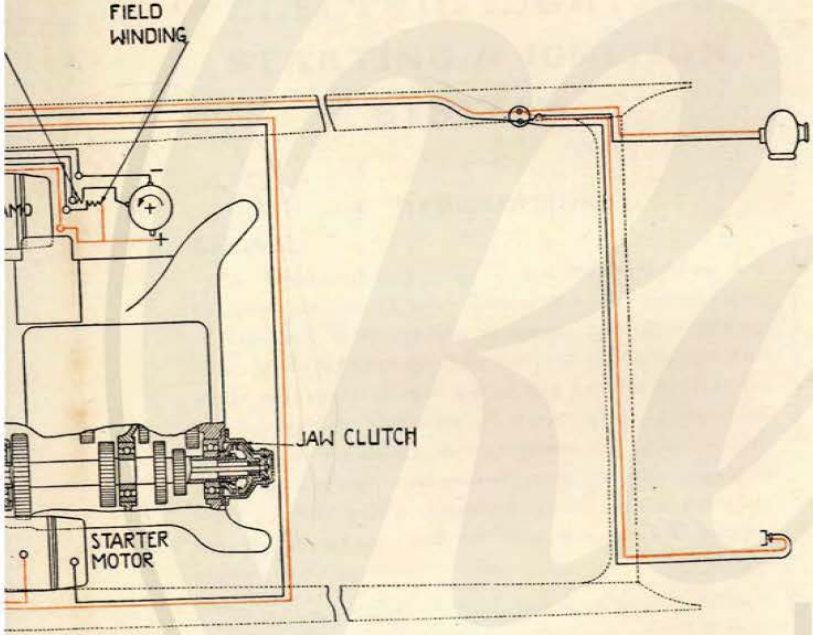


FIG. 12.

WIRING DIAGRAM OF ROLLS-ROYCE ELECTRIC LIGHTING, STARTING AND IGNITION SYSTEMS.



IGNITION SYSTEMS.

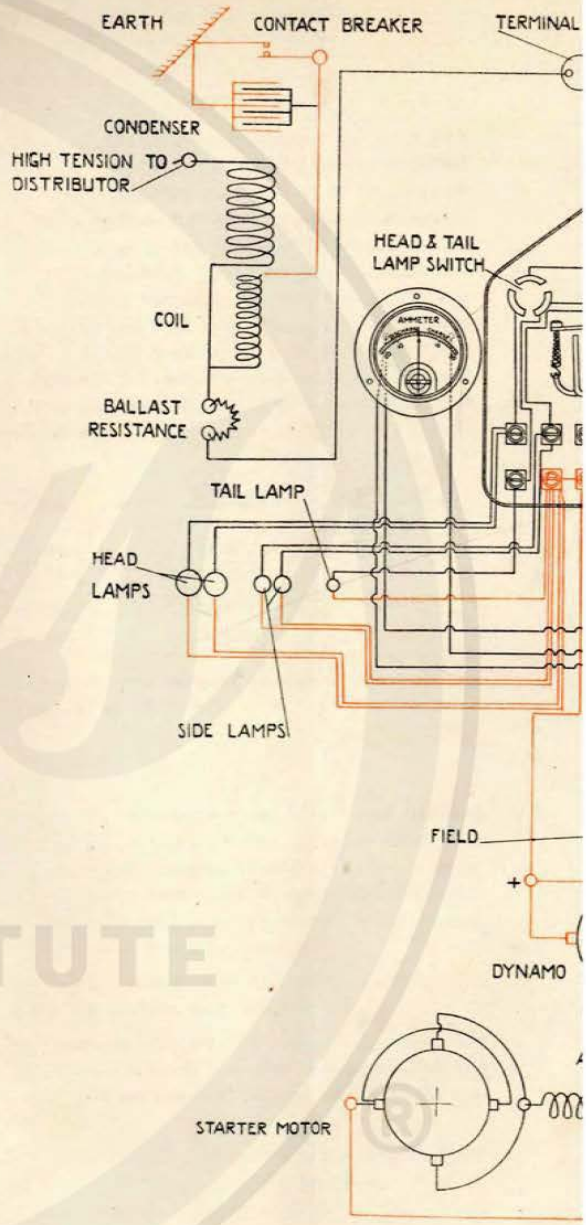


DIAGRAM OF E

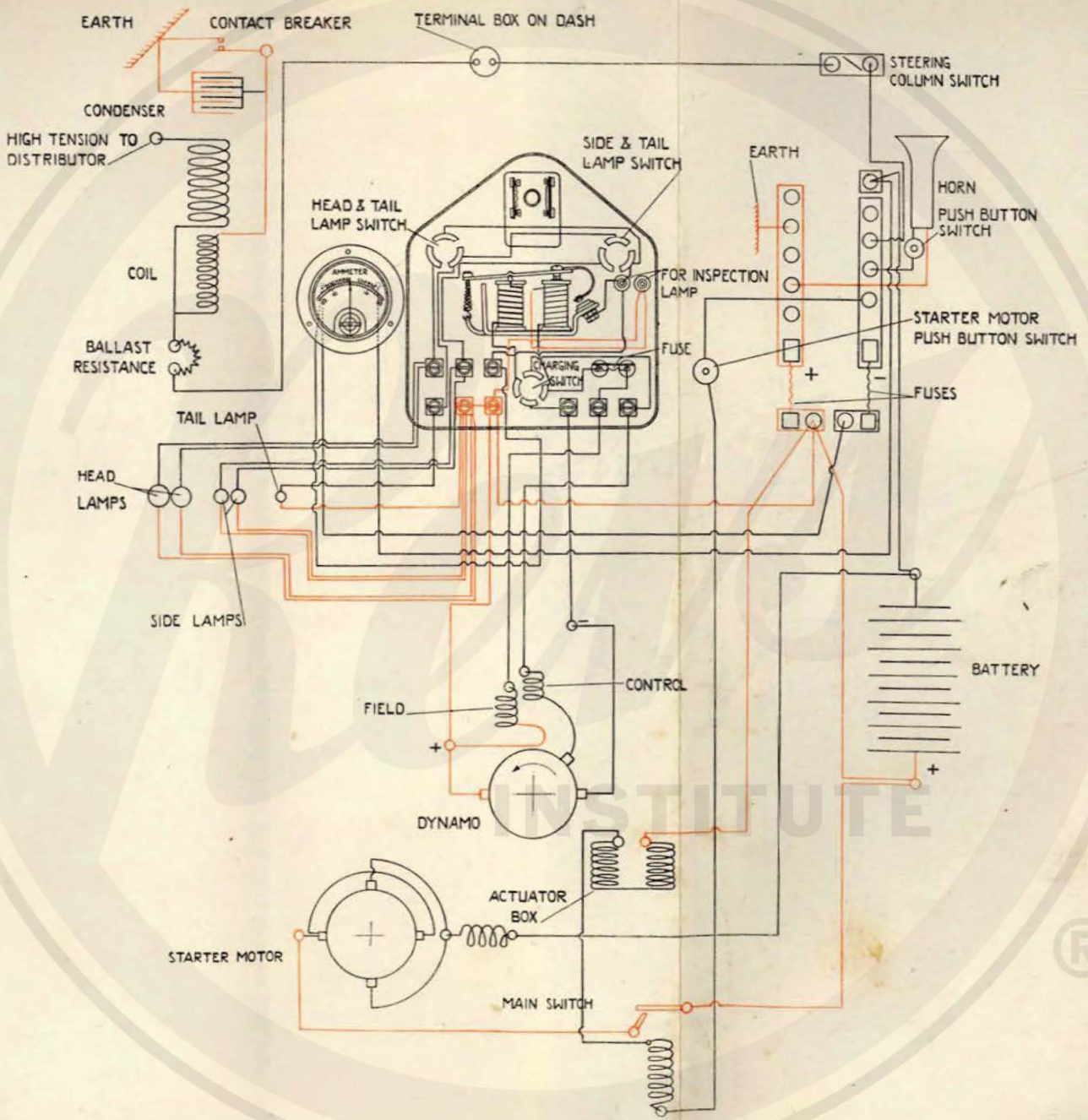


FIG. 13.

DIAGRAM OF ELECTRICAL CONNECTIONS.

Dynamo.

This is situated on the off-side of the gearbox and driven by a Whittle belt. It is of a type which, when connected to a battery, is so controlled as to cause it to generate a nearly constant current for wide variations of speed. Such control is effected by the addition to what is otherwise practically a plain shunt-wound dynamo, of a control brush, nearly mid-way between the main brushes, and a control winding on the field pole through which current from the control brush passes to a main brush. The arrangement involves the use of a four-lead cable between the dynamo and the switchbox. The actual leads are coloured as follows:—

Lead.	Colour.	Corresponding number on dynamo.
Positive	Red	1
Field	Black	2
Control	Green	3
Negative	White	4

An adjustment for the tension of the dynamo driving belt is provided at **A** (*Fig.* 14).

Switchbox.

This is situated on the instrument board, and contains the charging switch, lamp switches, dynamo field fuse, and automatic cut-out, also terminals for the dynamo, battery and lamp connections, and socket for an inspection lamp plug. One such plug is supplied with each chassis. The cover of this box is easily removable.

The internal and external connections of the switchbox are given in the connection diagram (*Fig.* 13).

The arrangement of lamp switches allows the use of the head and tail lamps without the side lamps, or the side and tail lamps without the head lamps, or all three sets of lamps, at will.

The operation of the charging switch connects the field, control and negative leads of the dynamo together and to the fixed contact of the cut-out through the series winding of the cut-out. The movable contact is in connection through the ammeter with the negative terminal of the

battery. The positive terminals of dynamo and battery are permanently connected together in this box.

In addition to the series winding which carries the main current, there is a shunt winding on the cut-out connected between the main positive and negative terminals of the dynamo. When the dynamo is run up with the charging switch on, current in this coil causes the automatic contact to be made. Subsequently, as the speed increases,

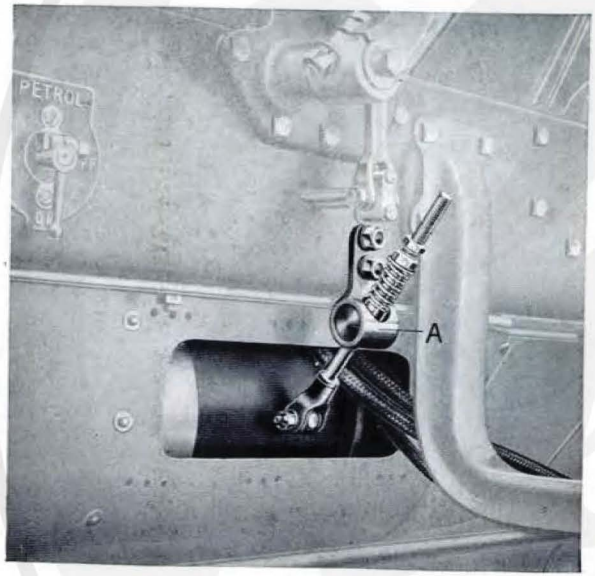


FIG. 14.
TENSIONING DEVICE FOR DYNAMO BELT.

the effect of the main current is added. When the dynamo slows down and its E.M.F. falls below that of the battery, the current reverses through the series coil and the effect of the shunt winding is neutralised, which allows the contacts to fall apart.

Junction Box.

This is fitted on the front off-side of the dash, and is shown with the cover removed in *Fig.* 15.

The positive and negative bars are shown at **P** and **N**. **E** is the earthing connection already referred to.

Each bar is connected to the battery through a 25-ampère fuse **F**, spare wire for which is provided on a small reel, **W**, within the box. A diagram of the wiring is secured within the cover of the box at **D**.

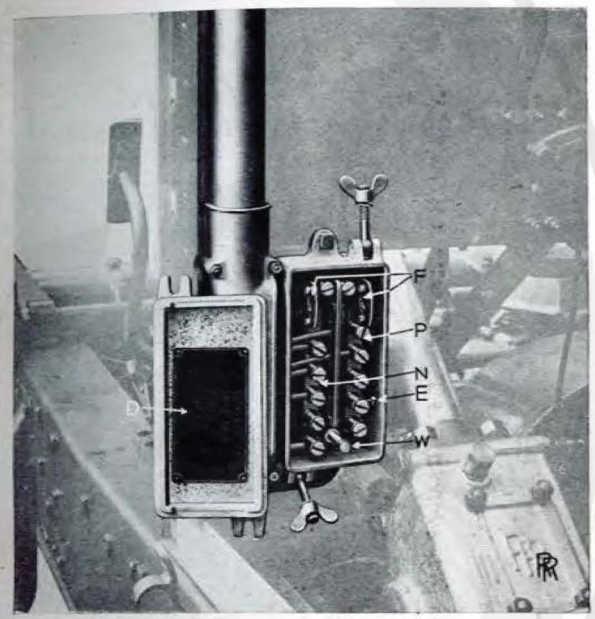


FIG. 15. JUNCTION BOX.

Connections from this box are taken to starter push-button, main switch and actuator box, also for Klaxon and battery ignition. The remaining terminals are available as spares.

Ammeter.

This is a moving coil, central zero, 20-ampère ammeter. Electrically it is so connected as to indicate all current passing in or out of the battery, except the heavy current for the starter motor, a needle deflection to the right indicating "charge," and left "discharge." Thus the

dynamo output is exactly indicated if no consuming apparatus be switched on; and if the dynamo be off, the current being consumed by lamps, etc., is shown. If dynamo and lamps be on, the reading gives the balance in or out of the battery.

Starter Motor.

The starter motor **M** is shown in *Fig.* 16. It is carried on a longitudinal tube **B**, and drives by a chain **C** the second or layshaft of the gearbox through the medium of a jaw clutch (*see* wiring diagram, *Fig.* 12). An epicyclic

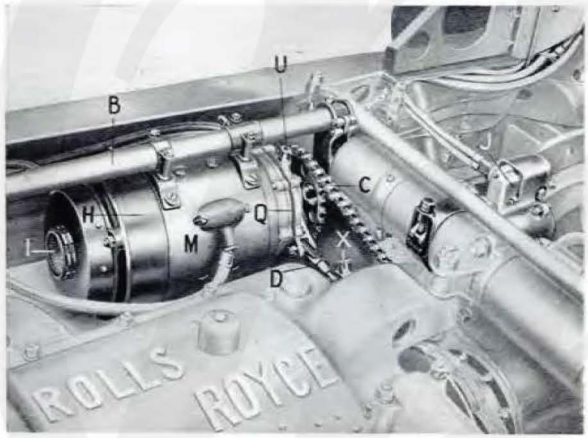


FIG. 16. STARTER MOTOR.

reduction gear at **Q** on the motor, together with another such gear on the gearbox, gives a total reduction between motor armature and engine crankshaft of 23·3 to 1. The chain-wheel on the layshaft is provided with a friction drive device for the purpose of protecting the motor and its gearing against damage in the event of a back-fire. An adjustment for the chain drive is provided at **D**.

Electrically Operated Main Switch and Jaw Clutch Actuator.

Operation of the push-button switch on the dash excites in series the electro-magnetic windings of the main switch and jaw clutch actuator **J** (*Figs.* 12, 16, 17, *and* 18).

The armature of the latter, when attracted, actuates the jaw clutch through a lever **L**, and a rod **T** (*Fig.* 18), running through the hollow layshaft. A spring toggle mechanism working on the lever ensures that the jaw clutch is either fully engaged or fully disengaged. The teeth of the clutch are backed off on their non-driving faces, ensuring their automatic disengagement when the engine starts and the push-button switch is released.

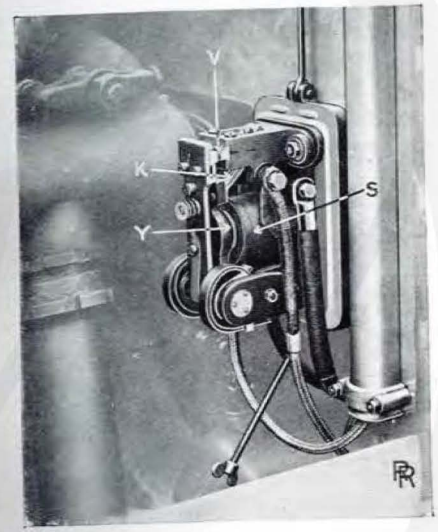


FIG. 17.
ELECTRO-MAGNETICALLY OPERATED MAIN SWITCH.

The main switch on the front of the dash is shown with cover removed in *Fig.* 17. The attraction of the electro-magnet **S** on its armature **Y** closes the main motor circuit through copper contacts **K**. Carbon contacts **V** are provided to take the break.

Battery Ignition.

The small non-trembler ignition coil is shown at **O**, in *Fig.* 19, and the ballast resistance at **R**. The function of the resistance is to limit the current taken by the coil

at slow speeds, or if the ignition switch should accidentally be left "on" when the engine is stopped. It also secures practical equality of intensity of secondary spark at all speeds.

The combined low-tension make-and-break and high-tension distributor is illustrated in *Fig.* 19 with the high-tension distributor cover removed. A condenser connected across the break is located in a pocket, **W**, in this apparatus. The insulated contact and the insulated side of the condenser are brought out to the insulated spring terminal to which the external low-tension connection is made. A small terminal box is provided on the dash to enable the battery ignition system to be disconnected from the supply of current.

Steering Column Switch.

The ignition switch at the base of the steering column, operated by the knurled nut in the centre of the steering wheel, really consists of two electrically independent switches. One of these earths the low-tension terminal of the magneto; the other makes or breaks the low-tension circuit of the battery ignition. There are four positions of this compound switch, giving each ignition "on" separately and both "on" and "off" together; and these being indicated thus:—**M**—magneto on, **B**—battery on, **M** and **B**—magneto on and battery on, and **O**—both off.

B. RUNNING INSTRUCTIONS.

Before disconnecting any part of the electrical system, it is very advisable, unless the battery itself be previously removed, to take out the two fuses from the junction box.

Never disconnect the battery whilst any charge or discharge current is passing.

Dynamo Bearings.

These should require little attention. When the chassis is overhauled, however, or the dynamo removed, they should be cleaned out and regreased with sufficient grease only to occupy the interstices between balls and cage. Any excess is only melted out by heat.

FIG. 18. JAW CLUTCH ACTUATOR.

On some dynamos there is provision for additional lubrication at the driving end in the form of a small oil-cup. Oil occasionally.

Dynamo Belt.

The belt should be kept adjusted gently tight. A reduction below 10 ampères in the charging current indicated by the ammeter when no lights or other apparatus are in use, may mean that such adjustment is necessary. On the other hand, a noisy belt drive or dynamo may mean that the belt is too tight.

Dynamo Brushes.

At intervals the dynamo end cover should be removed and the commutator and brushes inspected. Deposits of brush dust or moisture should be suitably removed. In the course of time the brushes may wear down, making it necessary to reset the spring pressure, which setting is provided for in three stages. When the amount of wear is such that the top of a brush has become flush with the top of its holder, the spring pressure should be set up to the second notch. When, further, the top of the brush has become lower than the top of its holder by half the possible amount, the second readjustment of spring pressure should be effected.

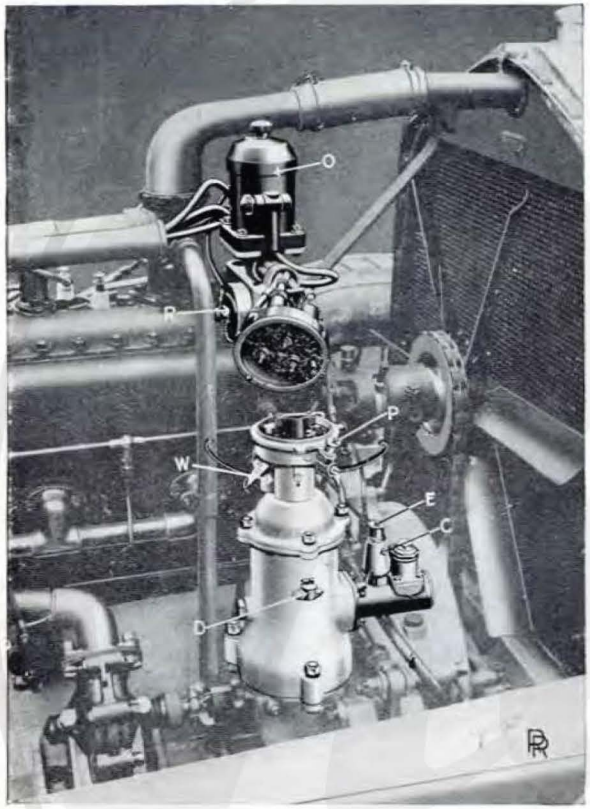


FIG. 19.

CONTACT BREAKER, DISTRIBUTOR AND COIL OF BATTERY IGNITION.

A spare set of brushes is provided with each chassis. Should it become necessary to fit these, it is important, by means of fine glass-paper drawn to and fro round the commutator, with its rough side in contact with the brush, to secure proper bedding. The dynamo should then be allowed to run light for several miles before supplying current.

Dynamo Connections.

When the disconnection of the dynamo cable connections to the dynamo terminals is to be effected, great care should be taken to ensure their correct replacement (*see p.* 31). The same remarks, of course, apply to disconnection of the dynamo cable at the switchbox.

When, for any reason, the dynamo is removed from the chassis, care should be taken that it is not replaced with reversed residual magnetic polarity, which may result from an electrical test such as running the dynamo as a motor with wrong connections from an independent battery.

Should the dynamo be thus replaced, though there is a probability of its being corrected by the chassis battery, there is danger in the process of the cut-out contacts being damaged by arcing at the points.

To be sure of avoiding this, on first running the engine, after the components have been replaced, the switchbox cover should be removed and the cut-out contacts held together by hand for a moment, during which the engine should be accelerated and the charging switch put on.

This will ensure the dynamo polarity in relation to the battery being made correct in the first instance, and eliminate the possibility of damage to the contacts.

Switchbox.

The function of the field fuse is to protect the dynamo against damage by overheating if it be run with the charging switch on and the battery disconnected from any cause, in which circumstances the field fuse will readily be melted. Special care should be taken that this fuse is gripped firmly in the fuse-holder, as a loose contact may cause the fuse to melt unnecessarily, or prevent the dynamo from exciting. Test the grip by gently pressing on the middle of the fuse wire with the end of a match-stick.

Should the ammeter not show any charging current with the charging switch on, lamps off, and dynamo running, confirm that the battery connections are sound by inspection and by trying the head lamps with the dynamo not running, and if any irregularity be found, first rectify this, then inspect the field fuse, and, if necessary,

replace with spare found in small container in switchbox. In the unlikely event of no charging now taking place, the fault must lie in the dynamo or dynamo connections, and it will be necessary carefully to inspect these. One cause of failure to charge would be the existence of an earth on field, negative, or control leads from switchbox to dynamo. (*See under* "Tracing an Earth," *p.* 44.)

The lighting of lamps or operation of any other part of the electrical system direct from the dynamo with battery, either intentionally or unintentionally disconnected, must be avoided. In these circumstances, the dynamo is protected by the field fuse from damage, but the lamps may be damaged by the over-voltage before the field fuse has had an opportunity of preventing this.

The automatic cut-out is set in the first instance by the makers, and should only be touched in exceptional circumstances. In the unlikely event of sparking and consequent pitting at the contacts, causing the cut-out to fail to break, and so allowing the battery to discharge through the dynamo, pull off charging switch immediately and inspect cut-out contacts. Such a failure will be quickly evident by the ammeter showing a large unexpected discharge current.

It may be necessary to clean the contacts with the aid of some fine glass-paper. After doing this, a very little vaseline may be placed on the surfaces which make contact.

If it be desired to use an inspection lamp, this may be connected to the plug provided with the switchbox. We recommend, under "Care of Battery," the use of another such plug for the purpose of charging the battery in position on the car from an external source.

Junction Box.

When occasion demands the replacement of a fuse in this box, spare wire will be found on the little reel inside the box, and care should be taken that the wire is straight in the fuse-holder and firmly gripped. Carefully inspect these fuses occasionally, and renew in the event of any irregularity.

The positive or right-hand fuse will be the more likely to become melted in service, as the permanent earth connection of the electrical system is effected on the bar supplied with current through this fuse. Failure of this

fuse indicates the occurrence of an earth upon some conductor (coloured black on diagrams) in direct connection with the negative terminal of the battery, or else a direct short circuit from bar to bar, which may take place in carelessly removing or replacing the cover. It is unlikely that the negative or left-hand fuse will go, but such would indicate an earth on the negative bar in the box, or in connections thereto, or again, a direct short circuit from bar to bar.

Failure of operation of battery ignition and Klaxon, without failure of starter, indicates melting of positive fuse, but the symptoms of failure of the negative fuse include the failure of electrical operation of starter.

The failure of either of these fuses will not interfere with the lighting or charging.

The spare terminals on the bars permit of the connection of additional apparatus, *e.g.*, body lighting, but the resulting additional drain on the system should be carefully taken into account and provided for by extra charging in the manner explained under "Care of Battery" (*p.* 45).

Such additional apparatus will, of course, be put out of action by the melting of *either* fuse.

Switchbox, Junction Box, and Ammeter Connections.

If at any time it be necessary to disconnect the wires from the switchbox, junction box, or ammeter terminals, great care should be taken to ensure their correct replacement. Further, it is very important that the wires coming from the switchbox be suitably supported inside the scuttle, to prevent the connections being strained. Should the ammeter connections be reversed in error, the charge and discharge indications of the ammeter will be reversed.

Starter Motor Lubrication.

A few drops of gear oil should be given at intervals to the reduction gear through the lubricator **U** (*Fig.* 16).

Starter Motor Chain Drive.

The driving chain **C** should be adjusted at **D** so as to be neither slack nor taut in any position. (*See Fig.* 16.)

Starter Motor Brushes.

Before dismantling any part of the starter motor, remove the two fuses from the junction box.

At intervals remove the cover **H** (*Fig.* 16), and inspect commutator and brushes. Deposits of brush dust should be suitably removed. Should faulty running of the motor develop which is not traceable to the battery, it is possibly due to faulty contact of the brushes on the commutator, which may in turn be due to want of freedom of the brushes in their holders. Such want of freedom is likely to result from excess of bearing grease having found its way to the brush-holder.

Ordinarily the brushes will last a very long time. A spare set is, however, provided with each chassis, and should it become necessary to utilise these, it is important, by means of fine glass-paper drawn to and fro round the commutator, with its rough side in contact with the brush, to secure proper bedding. After this, it is well to run the motor light on 6 volts for 15 minutes before replacing in the chassis.

Starter Motor Connections.

When replacing the starter motor in the chassis, it is important to be sure that clean and sound electrical connections of cable to motor are reobtained, owing to the heavy current which these have to carry.

Push-button Switch.

The push-button switch, like the main switch, has main copper contacts, and auxiliary carbon contacts which make first and break last, and serve to protect the copper contacts against sparking at break. In using the electric starter it is necessary to press the button well home, otherwise the whole current may have to flow through the carbon contacts, which will result in their deterioration. At the same time the main switch may be operated without the jaw-clutch actuator, when the starter motor will race without coming into gear.

Main Switch.

The copper and carbon contacts of the main switch should be inspected occasionally, as the carbon will very gradually become burnt away. It is very important that

the original condition of the main switch, in which the carbons make contact first and break last, be maintained, and for this purpose spare carbon contacts are supplied. To test this point, operate the switch by hand, applying the force direct to the armature lever carrying the copper contact, and not to the top lever carrying the carbon contact. This will allow the motor to run light without being put into gear, unless already in gear. Any flashing at the copper contacts will then indicate that the carbon contacts require renewal. Keep the switch on only momentarily. The copper contact surfaces should ordinarily be kept in a clean condition by the application of a very small amount of vaseline. Should they have become pitted or discoloured, however, they should be carefully treated with fine glass-paper, and re-vaselined. Should it be necessary to remove the main switch heavy current connections, it is very essential that these be correctly replaced, as otherwise the action of the system will be interfered with. It is also necessary to be sure that clean and sound electrical connections be reobtained, owing to the heavy current which these have to carry.

Battery Ignition Contact Breaker and Distributor.

It is desirable occasionally to touch up the platinum points of the low-tension make and break with a very fine file, but take great care not to remove platinum unnecessarily. In setting the points the maximum gap opening should be ·018″ to ·020″.

The low tension rocker may require lubrication at long intervals. The rocker arm should be removed, and a little grease smeared on the pivot pin.

The high tension distributor requires no attention beyond an occasional wiping of the interior with a clean dry rag.

Steering Column Switch.

The wires in connection with the three terminals of the steering column switch are correspondingly marked by means of coloured bands, to the terminals themselves. black representing the magneto earthing wire and terminal, and red the two battery ignition wires and terminals. The latter are mutually interchangeable without effect, but must not be interchanged with the magneto wire.

Battery Connections.

There are two pairs of cables connected to the battery terminals, one pair of these carrying the heavy current for the starter motor, and one pair all the other currents in or out of the battery. The correct action of the system is dependent upon their correct replacement.

The ferrules on the heavy current leads are marked "plus" and "minus" to correspond to the battery terminals. The ends of the finer cables are coloured red and white also, to correspond respectively to these terminals.

The necessary care must be taken to secure clean and sound electrical connections of cables to battery, particularly of the heavy current cables, which should go on first. To clean cable terminals use paraffin, not abrasives, and afterwards vaseline thoroughly. If corrosion has taken place, use a solution of ammonium carbonate in the first instance, applying this with a rag.

Magneto.

The Type E.O. 6 magneto is provided with oil holes, and two or three drops of oil should be added occasionally. Excess of oil must be carefully avoided, for it will interfere with the working of the magneto. Also it should be noticed that on these magnetos the contact breaker casing carrying the cams is not removable, access to the contact breaker being obtained by pulling off the end cover.

A gauge for setting the contacts is provided on the magneto spanner.

Should it be necessary to start the engine by hand on the magneto, particular care should be taken to fully retard the ignition before starting.

Tracing an Earth.

Some of the symptoms of the occurrence of an earth on the system were indicated in the paragraph on "Junction Box," *p.* 41.

If the earth is on a negative conductor, first find out if such earth only manifests itself by the melting of a fuse when a switch is on, *e.g.*, steering column, push-button, lamp-switch, or Klaxon button. In such a case the earth is on the connection beyond the switch in a direction electrically away from the negative pole of the battery.

Otherwise the earth must exist on a lead in permanent connection to the negative pole of the battery, and may be traced by disconnecting such leads in turn and watching for its disappearance. But it may, with the help of the wiring diagram, be judged, in the first instance, upon which side of the ammeter the lead containing the earth is electrically situated, by noting whether the ammeter is affected whilst the fuse is being melted.

An unintentional earth occurring on any conductor in direct connection with the positive side of the system will cause no immediate dislocation, but is undesirable. If suspected, remove positive fuse, when the horn and battery ignition should normally become inoperative. If such is not the case, an earth exists, and should be traced by disconnecting such leads in turn until horn and battery ignition are rendered inoperative with the positive fuse removed. The negative and control leads from dynamo to switchbox may be looked upon for this purpose as in direct connection with the positive side of the system. An earth on the field connection from dynamo to switchbox, although causing the dynamo to fail to excite, as described on *p.* 40, would not permit the battery ignition or the horn to be operated with the positive fuse removed, as the resistance of the field winding would limit the current. In order to trace, if necessary, this kind of earth, first see that all switches are off, and that the junction-box fuses are removed, then earth the negative junction-box terminal. A current of about three ampères indicated by the ammeter will show the existence of such an earth.

C. CARE OF BATTERY.

Initial Charge of Ebonite Battery Received Unfilled with Acid.

First examine the battery and see that all terminals and connections are properly greased to prevent corrosion. Slight corrosion may occur on the positive terminals of each cell and on the washers under the terminals in contact with the top of the battery. Examine such parts particularly, and if any uncertainty exists about the greasing of these, the washers and corresponding terminal nuts and connections should be removed and

given a bath in molten vaseline. When replacing, see that all terminal nuts are firmly screwed up.

Fill each cell carefully with *best* battery acid of density 1320 to ½" above the tops of the plates, taking care not to spill acid on the top of the battery. After filling, replace stoppers.

If it be necessary to prepare the acid electrolyte, take best brimstone sulphuric acid, free from contamination of iron or arsenic and having a density of 1835, and pour it slowly into distilled water in a leaden or non-metallic vessel, stirring meanwhile with a glass rod until a density of 1320 is secured when the mixture is quite cold. Never pour water into the acid, but always acid into water, and do this very slowly, in order to avoid an excessive rise of temperature. Allow the mixture to cool to below 80° F. before use.

Leave the battery overnight to allow the plates to soak, after which remove stoppers and restore the levels with distilled water *only*.

Now charge the battery at an ampère value equivalent to ⅔ of the normal charge rate as given on the label (*i.e.*, $\frac{2}{3} \times 4 = 2\frac{2}{3}$ ampères) for 96 hours at least, but in any case until all plates, both positives and negatives, gas freely. The charging rate may be reduced overnight, but the time extended accordingly. If the charge cannot be carried out in one period, an interval of rest should not exceed the immediately preceding period of charge at the specified rate, nor should it exceed 12 hours as a maximum. If, during the charge, the electrolyte temperature approaches 100° F., interrupt or reduce rate of charge, but extend time accordingly. (Never, during the life of the battery, allow this temperature to be exceeded.)

The first charge and all subsequent charges on batteries removed from the car should be carried out with the stoppers removed. The filler holes of some batteries will be found to be fitted with a loose ring, which turns through 90° with the stopper. The function of this ring is to take up a position in which it closes vent holes in the sides of the filler channel when the stopper is withdrawn, thus enabling topping up with distilled water to the correct level to be effected without overfilling, owing to air being locked in the space at the top of each cell round the filler channel. On any batteries fitted with such loose rings, it is therefore desirable, when these stoppers are removed for charging, to return these rings through the 90° during the charging process. In replacing the stoppers, care should be taken on all batteries that these are well turned after insertion to seal the joint and prevent escape of acid. At the same time communication between the air-space at the top of the battery and the vent itself is effected.

During this first charge watch the acid density in each cell, using a syringe hydrometer. The density should not be allowed to exceed 1290. If it does, withdraw some acid and replace with distilled water, allowing time for mixing. Ordinarily the acid in the hydrometer must be allowed to return to the cell from which it was drawn. In order to facilitate the use of a hydrometer when determining the density of the electrolyte, we list below the principal readings required :—

Density or Specific Gravity.	Twaddell's Hydrometer Degrees.	Baumé Degrees (approx.).
1150	30	19
1200	40	24
1225	45	27
1270	54	31
1280	56	31·5
1290	58	32
1320	64	35
1835	167	66

The first charge should not be considered complete until the densities have remained constant for five hours.

The battery should now be allowed to discharge through resistances or lamps to 10·8 volts (current passing) at the normal charge rate (4 ampères in the present case). Then recharge immediately at the same rate until all plates again gas freely (*i.e.*, for at least 15 hours).

The battery is then in a good condition for being placed on the car and connected up to the electrical system. It should be well packed in its box so that it cannot move, and the cable terminals should be greased before attachment.

Use of Charging Switch.

If the car is used in circumstances which require frequent use of the starter and lights, it will be found quite necessary to always keep the charging switch on when the engine is running. There is no need to switch

this off every time the engine is stopped, as the cut-out takes care of the switching operation, but it is advisable to switch off when leaving the car. If, however, the car is used for long, fast runs in the daytime, it may be better to switch off sometimes, if it be known that the battery is already in a fully charged condition. In these circumstances it is somewhat detrimental to continue charging for any time.

It is important that the battery be kept fully charged, but not overcharged. Overcharging in this way may cause the temperature limit of 100° F. to be exceeded, and the cells may suffer, due to evaporation from the electrolyte.

Care of Battery under Running Conditions.

The top of the battery should always be kept clean and, as far as possible, dry; attention should immediately be given to the least sign of corrosion occurring on the terminals. Keep the terminals and connections lightly greased, clean on their surfaces in contact and firmly screwed up (but do not use abrasives for cleaning, *e.g.*, file, emery-paper, sand-paper). (*See also under* "Battery Connections," *p.* 44.) Do not allow metal tools or other metal to short circuit across any terminals of the cells. Do not inspect the battery with the aid of a naked light, and on no account disconnect any of the battery terminals or connections when any charge or discharge current is passing, for such a course incurs serious risk of an explosion, destructive to one or more cells.

A useful adjunct in connection with keeping the top of the battery free from acid is a small sponge, which should be used in conjunction with a bowl of water to remove acid from the top of the battery. Use clean glass, earthenware, or leaden vessels for acid, but on no account use any other metal vessel. Do not "short" the battery to see if it is charged. See that vent-plug passages are kept clear.

A battery must never be allowed to continue discharging when the voltage of any cell has fallen below 1·8 (except momentarily for the purpose of tracing a faulty cell, as described on *p.* 50; or when desired to store or despatch battery unfilled, as described on *p.* 52).

Such a discharge may occur if there is an earth in the wiring system, or if the ignition switch be left on in error

and the primary platinum contacts happen to be left in contact. Always, when taking leave of the car, notice that the ammeter does not show any discharge current.

Inspection of Electrolyte.

The levels of electrolyte in the cells should be inspected frequently, and maintained to cover the plates by ½" by the frequent addition of distilled water. Use a syringe type hydrometer to take densities, which should be 1270 to 1290 for fully charged condition and after standing for an hour. If, in these circumstances, the densities are low, give a special charge if possible from an external source (*see p.* 50) at the normal charge rate (4 ampères for the battery provided), until the density has remained constant in every cell for 5 hours. If still below 1280, it is important to remove some electrolyte and replace with electrolyte of 1320 density, until the required increase is secured, after which again pass charging current for a short while. Unless acid has been lost by spilling, such replacement should *never* be required. As far as possible, arrange to make changes in the electrolyte just previous to charging.

Testing for Condition of Charge.

No voltmeter is provided on the electrical system, as this is not considered necessary. A small "Battery Indicator" is obtainable from Messrs. Lucas, complete with short length of flex and plug for insertion in the switchbox inspection lamp socket. This is a useful little instrument, and indicates directly the state of charge of the battery; but these indications must only be taken when head lamps are lit from the battery, with the charging switch off. The reading of such an instrument or voltmeter when the battery is on open circuit is quite a fallacious indication of the condition of the battery.

If the battery is in ordinarily good working order and care is taken to keep the densities, when in a fully charged condition, round about 1280, as already described, the state of charge of the battery will be very well indicated by density readings taken with the syringe hydrometer. If the readings are 1200 to 1225, the battery may be considered to be half discharged. If the readings are down to 1150, the battery must be considered in a completely discharged condition.

Failure of One Cell.

If the battery voltage, when lighting the head lamps, goes prematurely low, it may be due to one cell having become, through some minor fault, less good than the others. This is best ascertained by the use of a pocket voltmeter, with which each cell should be tested independently, whilst the head lamps are lighted, and the faulty cell located. Ordinarily it may be expected that all the six cells will work together in much the same condition. Any cell, however, which drops out of line with the others, should be carefully tended, and, if necessary, given separate treatment, it being quite easy, with the bolted-up connections, to remove a cell at any time. If the cell is past recovery, a new cell may be obtained in its place. It should be understood, however, that the necessity for such replacement is considered *most unlikely* if proper care be taken of the battery.

Charging in Garage from External Source.

A direct current is necessary, the positive pole of the supply being connected to the positive pole of the battery. If the supply be alternating, suitable rectifying apparatus must be used. The charging current must necessarily be supplied through a suitable switch and a variable resistance, or set of lamps, preferably carbon filament, suitably arranged to act as a variable resistance.

If the source of current be a direct current public supply main, then, before connecting up the battery for charging purposes, it should be confirmed that the resistance is in the main showing the higher potential to earth. For this purpose take a lamp of supply main voltage, earth one terminal to water pipes or gas pipes, and connect the other terminal in turn to each charging terminal. Then, with the minimum possible resistance in circuit, the lamp should light more brightly on that terminal supplied through the resistance. Otherwise the mains feeding the board require interchanging. In the absence of the necessary experience, an electrical expert should be consulted.

It is possible to charge the battery in position on the car, making use of a plug, as previously described, supplied by Messrs. Lucas, to fit the socket on the switchbox. This plug can only be inserted one way round. The connections of the other end of the flexible wire to which the plug is attached to the charging-board terminals must be made in

such a way as to cause the chassis ammeter to indicate "charge" when the current is switched "on." The chassis charging switch should be left "off."

Another method of securing correct direction of current is to place the plug pins in contact with pole-finding paper, and arrange that the polarity shown is in agreement with that at the plug socket, positive being on the right, but whichever way it is done, be certain that the direction is correct.

The number of lamps in circuit, or the variable resistance, must be suitably adjusted to allow of the flow of the required charging current, which should not exceed eight ampères, and should be reduced as the charge proceeds to about three ampères at the finish, when all plates should be gassing. Avoid overcharging the battery, either in quantity or time, except at "trickle" rate, as described below.

Charging in the garage from an external source, with the battery in position on the car, is recommended where conditions of running are such that a greater demand is made on the battery than can be replaced by the dynamo.

When a suitable direct current supply is available, we recommend in any case that it be made a rule always to leave the battery on charge at "trickle" rate (1 ampère or less) when the car is in the garage, as such a procedure will assist in keeping the battery in thorough condition.

Use of Starter.

Careless use of the starter will reduce the life of the battery. Careful use of the starter will make very little difference in its life as compared with the more ordinary lighting demands. If the battery is known to be in good condition and well up in its state of charge, the starter may be used for several times in immediate succession with the certain knowledge that the battery is not being appreciably injured, and will turn the engine easily. If at any time the starter appears sluggish in its action and such sluggishness is traceable to the battery, no attempt should be made to use the starter until the battery has had a thorough charge up again to the gassing condition.

Battery out of Commission.

If it is desired at any time to put the battery out of use, it is preferable to store the battery in a fully charged condition in a cool dry place, and give it a freshening

charge at half rate at least once a month until all plates gas freely, topping up with distilled water if necessary.

Despatch of Battery.

If the battery is to be despatched by rail any distance within the British Isles, first give it a full charge, then pack in a box so that the tops of the terminals are level with the top of the box. Then fix narrow strips of wood across the top, but leave spaces between the strips so that the tops of the cells are plainly visible.

Label the case "CONTAINS ACID, KEEP THIS SIDE UP," and despatch at owner's risk. Before putting the battery again into use, give it a freshening charge.

Battery Stored or Despatched Unfilled.

If it is not possible in storing the battery to give it the necessary freshening charges, or if the battery is to be despatched a long way, or if not desired to send it at owner's risk, the best procedure, which is not, however, as good as keeping the battery in a charged condition, is as follows:—

1. Fully charge the battery.
2. Empty out electrolyte and replace with pure distilled water.
3. Allow battery to discharge slowly through resistances until it shows about one volt per cell.
4. Remove all terminals and connections; clean, re-grease, and store or despatch separately.
5. Empty out water and allow battery to drain.
6. For storage, place in a cool dry place, with all vent-plugs well tightened up.
7. To put the battery again into commission, it should preferably be treated in the same way as a battery received unfilled (*p.* 45).

Ignition Control.

The ignition lever on the steering wheel controls both the magneto and battery ignitions, the latter through a part only of its total range. In addition, a centrifugal device is provided in the ignition tower which automatically advances and retards the battery ignition as the engine speed rises and falls. This does not, however, affect the magneto ignition, which is controlled only by hand, but owing to the pocketted position of the battery ignition plugs over the inlet valves as compared with the more open location of the magneto plugs in the "intermediate" position, it will be found that hand adjustment of the ignition is rarely necessary, except for starting purposes, when the lever should be fully retarded. Consequently, the ignition lever should be left about three-quarters advanced, and both ignitions used for all normal running conditions.

The battery ignition is useful for—

1. Starting the engine (when it is preferable to have both switched on).
2. Slow running in traffic.
3. Re-starting on the switch.
4. Investigating when anything is wrong.

Plugs.

The most frequent trouble with ignition is found in the plugs. This generally only affects one cylinder at a time, and therefore gives bad ignition generally (not always) at regular intervals, and *before* upsetting any other part of the ignition, which is probably working well, the defective plug should be changed and carefully tested.

In order to discover which plug, if any, is missing fire, run on one ignition at a time, and:—

(*a*) Switch off the current and feel the sparking plugs to ascertain if one is colder than the others. This would indicate that it had been missing fire. Or, if this method of detection fails:—

(*b*) "Short-circuit" each sparking plug in succession by connecting it by means of a screw-driver to some convenient metal-work on the engine; if the plug has been firing properly, this "short-circuiting" will reduce the speed of the engine by reason of the additional "mis-firing" thus caused; if it does not, then the plug being tested is probably the faulty one, and should be changed for another one known to be good (and clean), which should always be carried in readiness on the car.

Having discovered that a plug is at fault, proceed to examine same as described in operation 2, Appendix III. (*see p.* 116).

Missing Fire.

If there should be "missing-fire" with the battery ignition and the plugs are not at fault, the contact breaker should be looked at and carefully cleaned, as described in operation 10, Appendix III. (*see p.* 120).

Should the failure still continue on the battery ignition, proceed as follows:—

The usual signs that the mixture is too weak for the battery ignition are irregular firing or failure to fire at some particular speed (at which the carburation is weakest). These failures can generally be improved by advancing the ignition.

If the "missing-fire" is sometimes on all the cylinders and on both ignitions, then it is almost certainly a question of carburation (which is treated under the heading of "Carburation"); but should this failure take place with the magneto ignition only, the low-tension contact breaker on the magneto should be examined carefully. For details of parts needing attention, *see p.* 123.

If all these are found in good order, the earth wire, which leads to the switch intended to stop the ignition, should be examined, and can best be tested by disconnecting it entirely from the magneto, stopping the engine when desired by the throttle. If this does not locate the fault, then it may be something more serious inside the magneto, which should be taken off and returned to the makers.

NOTES CONCERNING IGNITION.

(1) The selection of ignition plugs is a very important matter. 90% of the plugs sold have faults which would lead drivers to use too rich a mixture to avoid the fault of missing fire when picking up from slow speeds with full throttle.

If the ignition plug is correct, it is almost unknown on the Rolls-Royce Cars for there to be any missing fire due to wrong carburation with the full throttle. The mixture is never so weak but that it will fire and give some slight power, but if it is very weak it will burn very slowly, and so cease to give any power, and may be still burning when the inlet valve opens, giving the familiar noise known as "popping in the carburetter."

Should there be any failing under this condition, which we term "full throttle picking up," the fault is ninety-nine times out of a hundred entirely with the ignition plug.

The trouble appears to be due to the points of the plug becoming imperceptibly oxidised, which increases the resistance to such a large amount, that, coupled with the full compression that occurs with a full throttle, the spark fails to jump between the points. The slightest rubbing

of the points with a knife, file, or piece of emery removes the fault for a certain length of time, but it only seems possible to avoid this fault by using multiple-pointed plugs with electrodes that keep cool. It occurs chiefly with weak mixtures, not with over-rich mixtures or excess of oil, under which condition the flame is deoxidising.

The result of the missing fire described is either the irritable knocking in the transmission, or, what is more frequent, the driver is induced to run with a much richer mixture than is necessary with correct plugs.

We would point out that the above refers particularly to *Full Load Missing Fire.*

In all cases the electrodes should be kept clean, especially with some makes of plugs, otherwise there is a tendency for the engine to misfire and run very irregularly when "throttled down."

(2) Missing fire under light loads or when running light may have many causes (see other paragraphs). At the same time, such bad running can very often be traced to an insufficiently wide gap in the ignition plugs, so that, although narrow gaps will cure the fault mentioned in paragraph 1, it is necessary for good sweet running under throttled conditions to have the gaps the maximum distance other conditions will allow.

(3) In paragraph 1 we mentioned what is called "popping in the carburetter," which is a very weak explosion taking place with weak mixtures burning slowly in the cylinder and the induction pipe.

Keep ignition well advanced.

A weak mixture or a throttled-down mixture should be ignited earlier than a full charge of the full strength.

Keep wires free from oil.

Keep all H.T. wires well protected from "earth," as neglect of this point is one of the most frequent causes of insulation failures.

Wires leading to plugs should not be "bunched," but separated as much as possible.

If the magneto will not switch off, see that the carbon button in the removable cover is making good contact with the head of the contact breaker locking screw.

RE-SETTING THE IGNITION.

Magneto Ignition.

When an engine does not pick up quickly and sweetly from slow speeds, it may be due to the ignition being too early, and if bringing the ignition to a late position does not cure it, the

magneto, if firing too early, should be adjusted later relative to the engine. The operations for this adjustment are as follows:—Remove the large nut screwed into the front of the timing wheel case, unscrew the nut on magneto drive shaft inside case about two turns; the magneto shaft can then be turned by hand the requisite amount. Tighten up the nut again, taking care that the adjustment is not disturbed. It is recommended that the timing of the magneto is not altered unnecessarily, as the adjustment is rather a delicate matter, and considerably influences the general running of the engine.

Especial care must be taken that the high-tension distributor is making contact with the No. 1 distributing plate when the No. 1 (front) piston is in the firing position. Correct timing can then be obtained by noting the *exact* moment when the low-tension platinum points *break* contact, which should be when the mark on the flywheel (corresponding to the crank pin) is ¼ inch before its central top position with the ignition lever fully retarded.

If at any time the magneto has to be removed, it will be necessary on replacing same to re-time it as described above, the teeth of the serrated drive shafts not being marked.

When removing the magneto, unscrew the front universal joint cover (right-hand thread) with the special spanner provided.

See that the number cut in the ebonite on each terminal corresponds with the figure marked at each magneto distributor terminal.

MAGNETO FAILING AT LOW SPEEDS.

If the magneto fails to effect proper ignition at slow speeds of the engine, it is probably due to:—

(*a*) The points on the sparking plugs being *too* far apart (*see p.* 116).

(*b*) The platinum contact on the magneto having burnt itself out of adjustment, and therefore not making contact for the right length of time.

(*c*) The magnets becoming demagnetised. This might be after three or four years' use. Test with screwdriver.

ELECTRICAL FAULT LOCATION.

In case of faulty operation, proceed to investigate as follows:—

(1) Prove battery and connections in order by trying head lamps.

(2) Failure of klaxon, battery ignition, or starter mechanism, may be due to blown fuse in junction box. Ascertain fuse wires in junction box to be firmly gripped (*pp.* 40 *and* 45).

If dynamo does not charge:—

(1) Examine driving belt for slackness (*p.* 37).

(2) Ascertain fuse in switchbox to be sound and firmly gripped. Test with match-stick (*p.* 39).

Repeated failure of properly fitted fuse indicates fault on system. Examine for dirty cut-out contacts.

If battery ignition fails or misses:—

(1) First confirm right condition of sparking plugs.

(2) Assure correct condition of contact breaker points and adjust to ·018″ to ·020″ maximum gap (*p.* 43).

(3) With ignition switched on, see by ammeter, while engine is cranked, that coil is taking current intermittently. If no current, test with pocket voltmeter availability of battery voltage on ballast resistance terminals then at coil terminals.

If starter motor fails to operate:—

(1) If motor turns without engine, examine friction clutch on front of gearbox (*p.* 34).

(2) If motor is sluggish or does not turn, examine commutator and brushes (*p.* 42).

If battery will not retain charge:—

(1) Ascertain that cut-out in switchbox does not stick (*p.* 40).

(2) Test each individual cell with pocket voltmeter (*p.* 50).

CHAPTER V.

CARBURATION.

Faulty Adjustment of Carburetters.

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, and the running and economy have been thereby rendered at fault.

We would like to draw attention to the fact that very great care is taken in accurately adjusting and setting each carburetter, and that we have installed at the works for this purpose scientific apparatus, which enables us to be certain that the carburetter setting is quite correct before the car leaves the works.

There is, therefore, 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.

Adjustment of Carburetters.

The ROLLS-ROYCE Carburetter is made with two jets, with their corresponding air passages. When the engine is running slowly, throttled down, only one jet (the right-hand smaller one) is open, and as the throttle is opened the second one automatically comes into action, and as the engine increases in speed the automatic supplementary air valve admits additional air. The whole arrangement is so constructed as to insure sufficiently vigorous suction at slow speeds and perfectly free passage of the gases at high speeds, and, at the same time, to keep the ratio between air and spirit constant.

The engine is not only more economical, but it also works more satisfactorily when the quantity of spirit is the smallest possible amount that will ignite promptly. The engine should therefore be run with the weakest possible mixture, and owing to the fact that the atmospheric conditions and motor spirits vary, we provide means of adjusting the quantity of spirit (through a certain range) from the steering column. This also enables the driver to test whether the carburation is correct.

Should it be found necessary, however, to dismantle the whole carburetter, the readjustment can be made quite easily by taking care that the small levers are clamped upon the regulating nuts when the screws are exactly level with the top of the nuts, and the marks on the nuts parallel with the dashboard regulator in the central position. If, however, some part has been broken or replaced so as to render useless this indication of the manufacturer's setting, then proceed as follows: Put the hand regulator in the central position and slack off the levers which are clamped to the milled nuts, screw the milled nuts round so that the cones controlled by these milled nuts just open the petrol spray, then make an attempt to start the engine by "flooding" or "priming" the induction pipe or both. As soon as you are able to get the engine to fire, make a rough adjustment as quickly as possible, so as to keep the engine running. Now throttle the engine down by putting the governor lever as low as possible, and proceed to regulate the slow-speed jet (right-hand one) until the engine runs steadily with the smallest amount of petrol, which means that the nut is screwed as far as possible in a right-handed direction (clockwise, looking at the top). In reducing this low-speed jet to the minimum, the engine may commence to "hunt" on the governor, which is an indication that the jet has been reduced too much. It should then slowly be increased by turning anti-clockwise until the engine runs steadily when warm with the smallest amount of petrol and at a reasonably slow speed. The screw on the lever can then be tightened.

Then proceed to adjust the high-speed jet as follows: Advance the ignition half-way up the quadrant, using both battery and magneto ignition, open the throttle wide by hand, and while the engine is running very fast with the throttle wide open, screw the milled nut clockwise until the engine shows definite signs of dropping in speed through getting insufficient petrol to ignite quickly.

Now proceed to tighten the bolt which clamps the lever on to the screw, and the car should then be taken on the road and the hand lever can be tried in various positions to test if the carburation can be made too weak by putting the lever in its extreme weak position, and if it cannot be made too weak to run at its fastest speed, then the high-speed jet can be reduced (say quarter of a turn at a time) until, upon testing, it is

found that the hand regulator will effectively reduce the petrol to below the minimum for best running.

It will be noticed that this adjustment of the high and low speed jets enables the carburetter to give a correct mixture at high and low speeds, and if it is found that the engine fails to run economically, or misses fire at high or low speeds, each jet can be separately regulated so as to correct any such fault.

Should it be necessary to dismantle the float chamber for cleaning or other purpose, it is well to note that before removing same from body of carburetter, the low-speed jet spindle must be taken out; otherwise, on replacing this part, the jet spindle may be damaged. This spindle is removed bodily with the flange after taking out the screws holding same.

THROTTLE VALVE.

With reference to the throttle valve, this should be capable of being completely closed by the governor after the engine has been raced with the foot accelerator. If this is not the case, the control of the engine is apt to be faulty at slow speeds. Also, if the throttle valve gets worn and is so slack as to allow the engine to draw any gas when it should be shut, firing in the silencer may occur after running downhill or upon closing the throttle after a fast run.

HEATING OF CARBURETTER.

Owing to the greatly reduced volatility of modern fuels, as compared with those at one time available, it has been found that water-jacketting of the carburetter or induction pipes is no longer sufficient to provide the heat necessary for good carburation within a reasonable time after starting up the engine. Exhaust heating has therefore been arranged for the throttle chamber of the Rolls-Royce carburetter in place of water heating, the jacket being supplied through a bye-pass pipe from the rear exhaust box. In order to ensure a good supply of hot gases to this jacket, there is arranged in the rear downtake pipe, *i.e.*, at a point situated between the jacket connection and the silencer, a butterfly throttle valve, which is closed when the main throttle is closed, and is so interconnected with the accelerator pedal that operation of the latter to open the main throttle also opens this exhaust throttle. Consequently, immediately the engine is started hot gases circulate freely around the throttle chamber and result in efficient vapourisation of the fuel.

CONSUMPTION.

On dry, level roads, a gallon of petrol should carry a car of average weight with an average load at reasonable touring speed a distance of about 14 miles; if the consumption is much inferior to this, the following points should be looked to:—The carburetter may give too rich a mixture and the jets may be reduced by the hand lever on the steering column, but no alteration should be made to the fixed adjustments on the carburetter; the timing of the ignition may be incorrect or the car may have been driven with the ignition lever too much retarded; the automatic air valve or piston in the carburetter may not be working freely; the float or needle valve may not be working freely, causing "flooding"; there may be a leak of air in one of the inlet pipes between the carburetter and cylinders; or there may be a leakage in the petrol system. (*See also* "Economical Running," *p.* 13.)

MISSING FIRE.

If this should occur and it is not traceable to any fault in the ignitions, there may be other causes:—

If the mixture is not properly adjusted, the engine may refuse to run on all the cylinders. Missing fire may therefore occur through faulty adjustment of the carburetter or when the piston of the automatic air-valve has stuck.

Missing fire may also occur owing to the sticking of exhaust valves. This can be temporarily corrected by removing the valve cap and turning the engine until the faulty valve is lifted from its seat; paraffin can then be squirted on to the valve stem and guide. The valve should be removed, when convenient, and the stem thoroughly cleaned and polished, and replaced, having first well rubbed in some graphite.

If at any time it should be found that, when the car has run a short distance with the throttle wide open, "firing" takes place in the carburetter, and there are other signs of petrol "starvation," it would be as well to carefully clean out all the petrol pipes and connections, as these are liable to become coated as time goes on.

If the engine will not run well at slow speeds, look to the induction pipe. This should be sound, and there should be no external leak between the throttle and the cylinders. This is best tested by disconnecting the priming pipe, closing the throttle, and blowing through the priming cock on the induction pipe. It is disastrous to the slow running of the engine if any air is drawn into the cylinders otherwise than through the carburetter. The priming cock or starting carburetter control, as the case may be, should always be turned to the "Running" position when the engine is running.

Missing at Low Speeds.

"Misfires" may be caused by faulty compression (*see under* "Compression," *p.* 121).

STARTING CARBURETTER.

A small auxiliary carburetter is provided for starting purposes only. This is arranged on the induction pipe and controlled from the instrument board. A small lever is mounted on the latter, its dial being marked "Starting" and "Running" to the left and right respectively. Petrol is drawn through a small pipe from the main carburetter float chamber and air through the holes around the starting carburetter. A spring-controlled piston in the latter is operated by engine suction, and regulates the air supply to suit the degree of this suction. The petrol supply can be adjusted by rotating the knurled screw at the top of the starting carburetter, which carries a taper jet needle. Screwing this down weakens the starting mixture, and, conversely, unscrewing it enriches the mixture. In the event of the adjustment having been upset for any reason, an initial or trial setting may be obtained by first lightly screwing the needle valve right down and then unscrewing it from 1½ to 3½ complete turns. The best setting must then be found experimentally, but it should be such that an engine speed of about 500 revolutions per minute can be maintained running on the starting carburetter alone, with the engine just warm. Under extremely cold climatic conditions the valve may be temporarily unscrewed half a turn further in order to start the engine.

On no account should a large screwdriver be used to turn the valve, as it would be possible by such means to damage the needle seating.

It is important to remember that this starting carburetter depends for its correct working upon absence of air-leaks in the induction system. Consequently, when in use for starting purposes, the main carburetter throttle must be entirely closed by moving the governor lever smartly to the bottom of its quadrant.

Under running conditions the control lever should always stand at the "Running" position.

PRESSURE FEED SYSTEM.

The Rolls-Royce pressure feed system is shown in *Fig.* 21. It includes:—

1. The usual hand pump (**A**).
2. A small pump (**B**) on the governor casing.
3. A pressure gauge (**D**).

The four-way cock **E** (*Fig.* 21) is arranged so that pressure may be applied by hand pump and by power pump; also, both may be coupled together. The lever, when turned vertically upwards, will release the pressure entirely from the system.

This cock is on the near side of the chassis, and under ordinary circumstances should be left in the "both pumps" position.

A small air pump is situated on the governor casing (*Fig.* 19), being driven by an eccentric from the vertical shaft driving the governor and distributor. The compression space of the pump is so proportioned that the pressure under which air is supplied to the petrol tank cannot exceed from two to three pounds. A part-sectional view of the pump is given in *Fig.* 20. At the outward extremity of its stroke the piston uncovers a port **D** in the cylinder wall, and air enters the cylinder through the filter gauze **G** and this port. On its inward stroke the piston covers this port and air at from two to three pounds pressure is delivered through the automatic delivery valve **V** to the casing **K**, from which connections are taken to the dash-board pressure gauge and to the petrol tank. The lift of the delivery valve **V** should not exceed about ·005". This may be regulated by means of the knurled screw **S** after the

cap **C** has been removed. The screw **S** should be screwed right down and then slacked back $\frac{1}{8}$ of a turn, which will allow the valve about ·005″ lift. The valve spring **P** should on no account be altered. The larger spring **L** is arranged to act as a locking device to the screw **S** through the medium of the nut **N**. The valve should be removed occasionally by unscrewing the

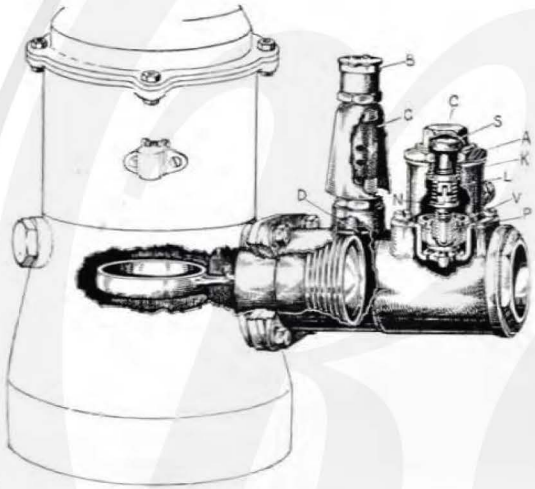


FIG. 20.

PART-SECTIONAL VIEW OF AIR PUMP ON GOVERNOR CASING.

cover **A**, and the valve and seating wiped with a piece of clean cloth. A lubricator **B** is arranged on the filter, and it is very important that the correct quantity of oil should be added to the pump. This should be from two to three drops of engine oil monthly or every two thousand miles. More or less oil than this will impair the working of the pump. Over lubrication, by reducing the compression space, causes the air pressure to be too high. The filter **G** can be removed for cleaning by unscrewing the lubricator **B**.

The filler is located on the "near" side of the tank (**M**, *Fig.* 21). Owing to the special construction of the cap, no tools are required to remove or replace it, this

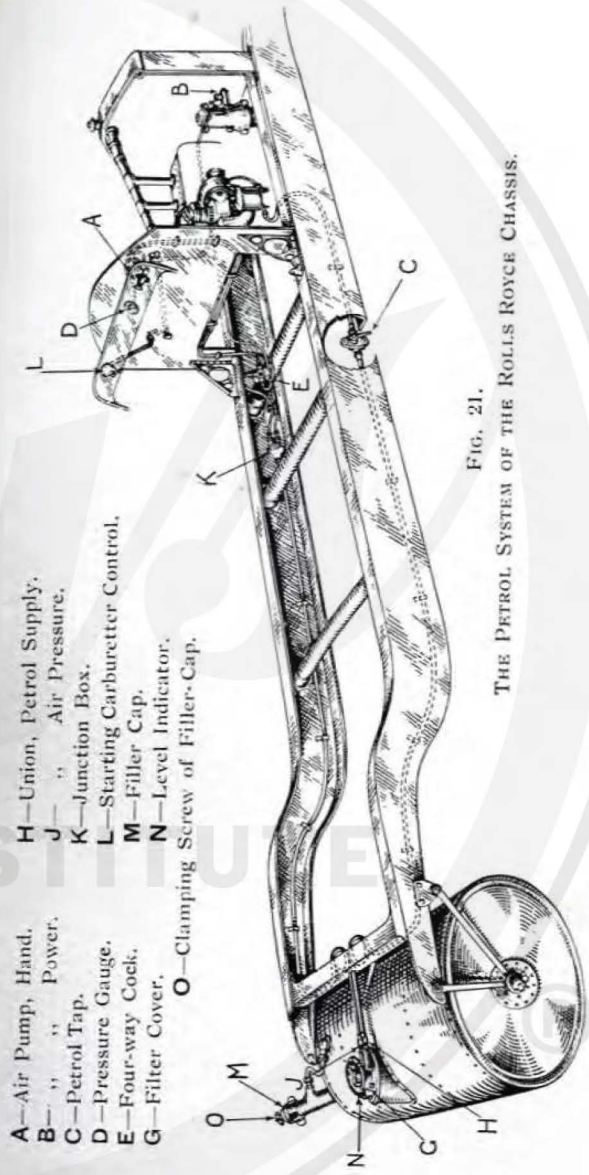


FIG. 21.

THE PETROL SYSTEM OF THE ROLLS ROYCE CHASSIS.

being done quite easily with the fingers. To remove the cap, thumb screw, **O**, should first be slackened a few turns, when it will be found that the cap itself can be unscrewed and removed with the fingers.

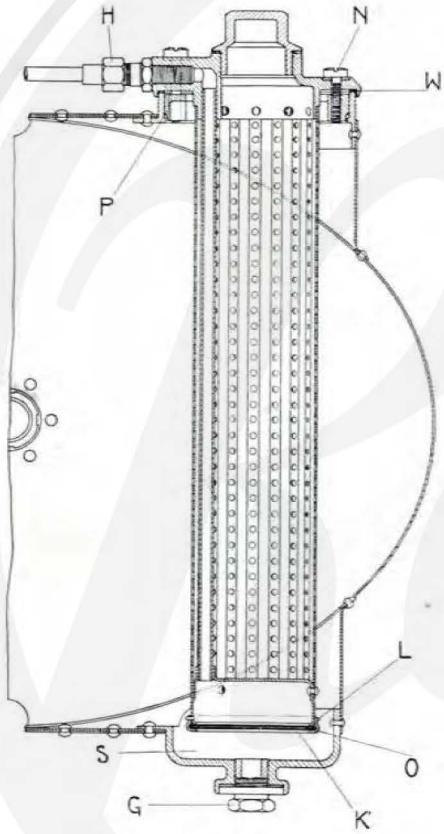


FIG. 22.
PETROL FILTER.

On no account should petrol be added to the tank without being passed through a proper filter funnel provided with a fine gauze.

When replacing the filler cap it should be noticed that the leather washer is intact, as a perfectly air-tight

joint must be made. The thumb screw, **O**, should first be released a few turns, and the cap then screwed on as far as possible with the fingers. Finally, thumb screw, **O**, should be screwed down tightly in order to ensure a perfect joint.

To get at the filter, which should be taken out and cleaned every six months, unscrew the two unions (**H**) and (**J**) (petrol supply and air pressure). *Figs.* 21 and 22. The six screws **N**, *Fig.* 22, should then be slackened *one* turn, when the whole cap can be unscrewed bodily by hand and the filter carrier removed.

The petrol feed filter, **K** (*Fig.* 22), should be carefully cleaned on the outside. It very seldom requires to be cleaned on the *inside*, but should this appear necessary it can be easily removed by taking out the locking wire, **L**, and unscrewing the retaining ring, **O**. If the filter is very dirty, it is advisable to drain out some of the petrol from the tank by removing the plug, **G**, and thereby flushing the sump, **S**, of sediment.

Care must be taken in replacing the filter carrier that the fibre washer (**W**, in *Fig.* 22) makes a good joint between the cap and the casing. To effect this it is essential that a small clearance be left between the screwed plug and the cap as shown at **P**, *Fig.* 22; but if the screws have been slackened one turn only, there will be no difficulty. To make a good joint it is only then necessary to tighten each screw a little, in turn, to provide an even pressure all round the cap.

NOTES.

Should the pressure fail, proceed as follows:—

Raise the pressure in the petrol tank by a few strokes of hand pump, then turn the handle of the four-way cock **E** (*Fig.* 21) to the position marked "Power Pump." If pressure still falls, turn the handle of the four-way cock to the position marked "Hand Pump"; this cuts off the power pump delivery valve and air filter.

If the trouble is not in any of these parts, try all the fittings of the petrol tank. A few drops of oil round the screw heads will enable the leakage to be detected.

The only remaining joints are the union on the pressure gauge and those in the junction box (**K**, *Fig.* 21) fitted in the "near" side member.

CHAPTER VI.

ROAD WHEELS.

To Remove the Detachable Wheel.

After jacking up the car, place the special wheel spanner in position on the large hub nut, and see that the locating levers are fitting into the groove provided for the purpose. The spanner in position is shown in *Fig.* 24, *p.* 70. Press the serrated locking plate **A** (*Fig.* 24, *p.* 70) out of engagement by means of the central adjusting screw **B** (the serrations can clearly be seen when out of engagement), slacken the hub nut several complete turns (this has a right-handed thread for all wheels). The wheel may then be withdrawn from the inner hub.

Fitting and Adjustment of Front Wheels.

To Remove the Inner Hub and Ball-bearings. First replace the grease plug **D** (*Fig.* 23) by the special screw **A**, as shown in *Fig.* 25, this screw being fitted with a nut **M** and thrust-piece **N**; press the locking plate **P** back about $\frac{3}{16}$ inch, compressing the spring **D**; the split locking ring **C** (*Fig.* 25) will then be relieved of the spring pressure, and may be removed from the groove in the hub. Slacken the nut **M** and then unscrew the stud **A**, allowing the locking plate to be pressed out of the hub by the large coil spring **D** (*Fig.* 25). This coil spring can then be removed. It will be noted that the inner end of this spring is bent, and fits into slots locking the grease retaining cap, as shown in *Fig.* 25. Remove the grease retaining cap **E** (which has a left-handed thread for the "off" side wheel and a right-handed thread for the "near" side wheel), take out the split pin and screw off the castellated nut on the end of the axle (this having a left-handed thread for the "near" side axle and a right-handed thread for the "off" side axle). The hub, together with the ball-bearings, may then be withdrawn from the axle.

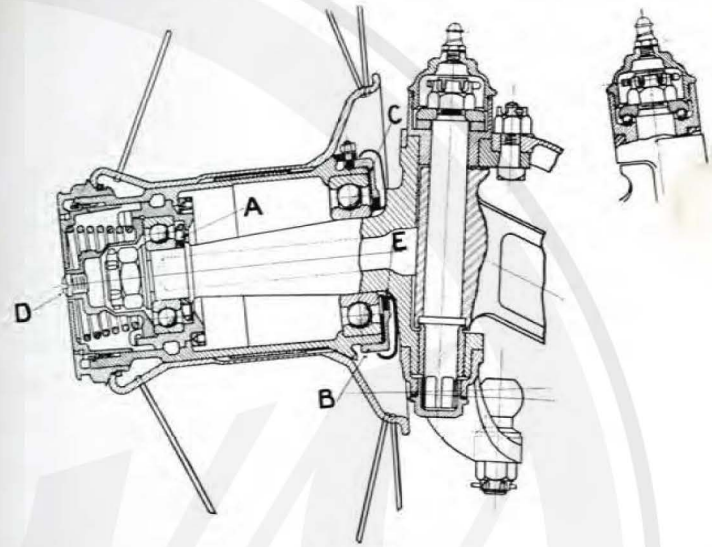


Fig. 23.
Front Hub Section.

To remove the ball-bearings, unscrew the large brass cap **B** (*Fig.* 23) (which has a left-handed thread for the "near" side wheel and a right-handed thread for the "off" side wheel); the locking plate provided for the purpose must be removed before this nut can be unscrewed, then remove the small ball-bearing, after which the larger one can be taken out.

The wheel hub is located axially by means of the outer, that is the smaller, ball-bearing, and consequently there is clearance between the larger ball-race and the end of the hub. It is useful to check this clearance by means of a straight-edge placed along the end of the hub. Care should be taken to replace the safety washer **A** (*Fig.* 23) in its proper position. The grease retaining cap should be filled with Hoffmann's ball-bearing grease.

It is always important to see that front-wheel hubs fit their axles without looseness or end play, as any excessive slackness at this point might cause a breakage through the shocks that would result.

Note.—The plain-thrust bearing shown in *Fig.* 23 is arranged on the "off" side pivot, that on the "near" side being a ball-thrust washer, as shown in the separate section of this part.

FIG. 24.
WHEEL HUB SPANNER IN POSITION.

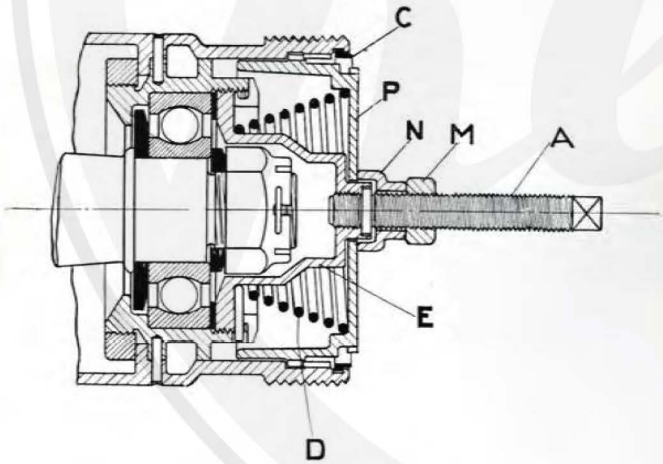


FIG. 25.
FRONT HUB SECTION, SHOWING METHOD OF REMOVING LOCKING RING.

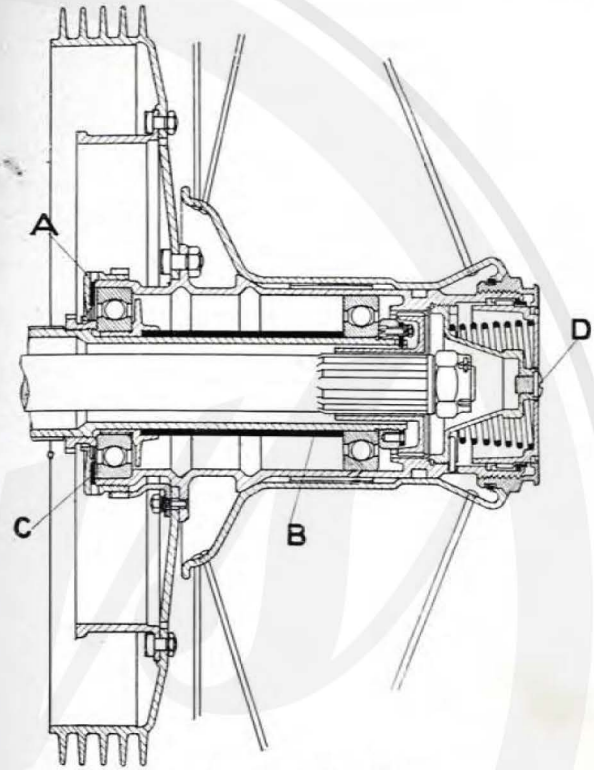


FIG. 26. REAR HUB SECTION.

Fitting and Adjustment of Rear Wheels.

TO REMOVE THE INNER HUB AND BALL-BEARINGS. The wheel having been removed, take out the grease plug **D** (*Fig.* 26, *p.* 71) and insert the special screw **A** (*Fig.* 27) in its place, and by means of the nut **M** (*Fig.* 27) press the serrated locking plate **B** back about $\frac{3}{16}$ inch. The split locking ring **C** will then be relieved of the spring pressure and may be removed from the groove in the hub. When this has been taken out of its groove the special screw **A** (*Fig.* 27) can be removed, allowing the serrated locking plate **B** to be pressed out of the hub by the large coil spring **D** (*Fig.* 27); this coil spring can then be removed. It will be noted that the inner end of the spring is bent and fits into a hole in the hub, locking

the grease retaining cap **E** (*Fig.* 27). The grease retaining cap **E** may now be unscrewed (this having a right-handed thread for the "near" side wheel and a left-handed thread for the "off" side wheel). Take out the split pin and screw off castellated nut from the end of the live axle. To slide off the driving dog **J** (*Figs.* 27 *and* 28), it is necessary to use a screwed rod **A** (*Fig.* 28), a tapped hole **F** (*Fig.* 27) being provided in the driving dog to accommodate this rod. Remove the three small nuts **G** (*Figs.* 27 *and* 28), take off the small washers, and also remove the large locking washer **H** (*Figs.* 27 *and* 28). Then insert the dowel pins of the special tube spanner **B** (*Fig.* 28) into the holes provided in the axle tube nut **K** (*Figs.* 27 *and* 28) (this nut having a left-handed thread for the "near" side wheel and a right-handed thread for the "off" side wheel). With this nut removed the hub is free and can be drawn off the axle, together with the ball-bearings.

To remove the ball-bearings it is necessary to unscrew the large brass cap **A** (*Fig.* 26) (left-handed thread for the "near" side wheel, right-handed thread for the "off" side wheel) from the inner end of the hub. Before this can be done the locking plate must be removed, which is held on by a special stud and nut. The ball-bearings, together with the distance piece **B** (*Fig.* 26), may then be removed, passing them through the inner end of the hub.

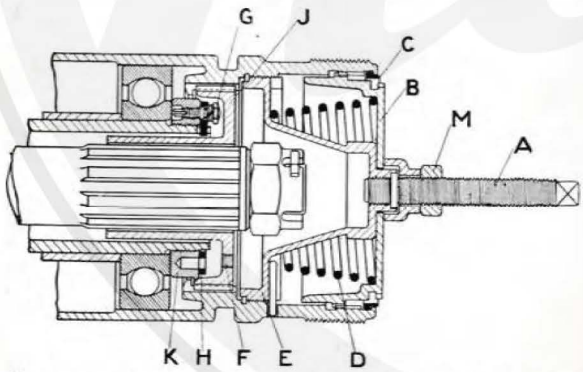


FIG. 27. REMOVAL OF AXLE TUBE NUT AND LOCKING RING FOR REAR HUB.

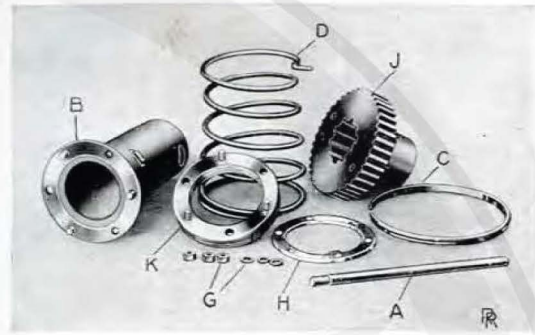


FIG. 28.
DETAILS OF REAR HUB.

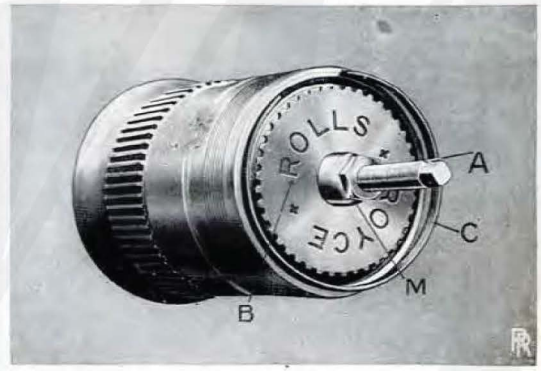


FIG. 29.
METHOD OF REMOVING HUB LOCKING RING.

TO REPLACE REAR WHEELS AND BEARINGS. Place the outer ball-bearing in position in the hub; next insert the distance piece **B** (*Fig.* 26), and replace the inner ball-bearing. This should be in a position so that when a "straight-edge" is placed across the end of the hub there is $\frac{1}{64}$ inch clearance between it (the "straight-edge") and the ball-bearing. The large brass cap **A** (*Fig.* 26) should then be screwed up tight (fibre washer **C**, *Fig.* 26, being in position), and locked with the locking plate provided for the purpose. The hub may then be mounted on the axle, care being taken to see that

the hub is properly "home," and then by means of the special spanner **B** (*Fig.* 28) screw the axle tube nut **K** (*Figs.* 27 *and* 28) into position (this latter having left-handed thread for the "near" side and right-handed thread for the "off" side hub). Screw this nut up so that the large locking washer **H** (*Figs.* 27 *and* 28) can be mounted in place with its tongue fitting into one of the slots in the axle tube. The small nuts and washers **G** may then be replaced. Slide the driving dog **J** into position on the live axle, and then the plain washer and castellated nut; screw up the latter to the shoulder on the shaft, not forgetting to "split-pin" same. Screw on the grease retaining cap **E** (*Fig.* 27) (which has a right-handed thread for the "near" side wheel and a left-handed thread for the "off" side wheel). See that this cap is filled with Hoffmann's ball-bearing grease before replacing. Replace the large coil spring and see that the bent portion fits into the hole in the inner hub. Place the other end of the spring inside large cap **B** (*Fig.* 27), and insert the special screw **A** (*Fig.* 27) in order to compress the spring by the nut **M**. The split locking ring **C** (*Figs.* 27 *and* 29) may then be fitted into its groove and the special screw **A** (*Fig.* 27) replaced by the small plug **D** (*Fig.* 26). The wheel may now be mounted in position on the hub, using only the special large wheel spanner to effect this.

Care of Wire Wheels.

Make sure that the wheel is right "home" and screwed up very tightly after changing. Never run with a wheel even slightly loose; this is disastrous to the driving dogs and screw threads. Check this periodically by rocking the wheel and tightening with a spanner if loose. These precautions are necessary, because it may occur that grit and dirt are gripped between the fitting surfaces when the wheel is replaced, and this dirt gradually grinds away, leaving the wheel loose.

Care should be taken when driving close to a high curb to avoid catching the projecting spokes. See illustration (*Fig.* 3, *p.* 18). Very serious damage may thus be done to the wheel.

CHAPTER VII.

SHOCK ABSORBERS.

Front Shock Absorbers.

The Rolls-Royce Front Shock Absorber effectually damps the violent oscillations of the road springs, and although the main features are of the orthodox pattern, some methods of construction are employed which make the apparatus far more durable than other shock absorbers of this type hitherto manufactured.

The Front Shock Absorber consists of a base (**A**)—see *Figs.* 30 and 31 on *pp.* 76 and 77—and a washer (**B**), which are keyed together. Between these parts a steel lever (**C**) is free to move. The steel lever (**C**) is kept out of contact with the metal portions (**A**) and (**B**) by means of two leather washers (**D**) and (**E**). The leather washers keep the damping effort exerted constant.

The pieces (**A**) and (**B**) are drawn together by means of a suitable spring (**F**) and (**G**). Thus the action of the spring and bolt, in connection with the base and washer (**B**), is to exert a pressure on the steel lever (**C**). The use of a spring to draw the portions together has several advantages; among them it should be noted that the Shock Absorber may wear a considerable time before making any appreciable difference to the length, and, therefore, the force exerted by the spring.

The spring should be adjusted by means of the nut (**H**) fixed on one end, so that a load of 25 to 30 lbs. may be hung on the end of the lever (**C**), without slip. The adjusting nut, which is split for locking purposes, is so shaped that it will take a standard spanner across its flats.

The Shock Absorber lever (**C**) is connected to the axle by means of an adjustable ball joint (**J**). By means of this joint it is possible to take up all the slack in the connection and thus render the Shock Absorber noiseless in action.

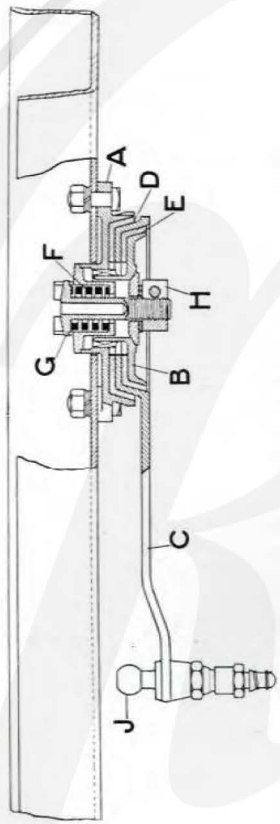


FIG. 30. ROLLS-ROYCE FRONT SHOCK ABSORBER.

These ball joints may be adjusted as follows:—

Release the check nut at the bottom and make sure that the adjusting nut thread is free; tighten the screw up until fairly tight, and then turn it backward for one-eighth of a turn; this will make both joints just "free" without being slack. The locking nut can then be tightened up, taking care not to disturb the adjustment.

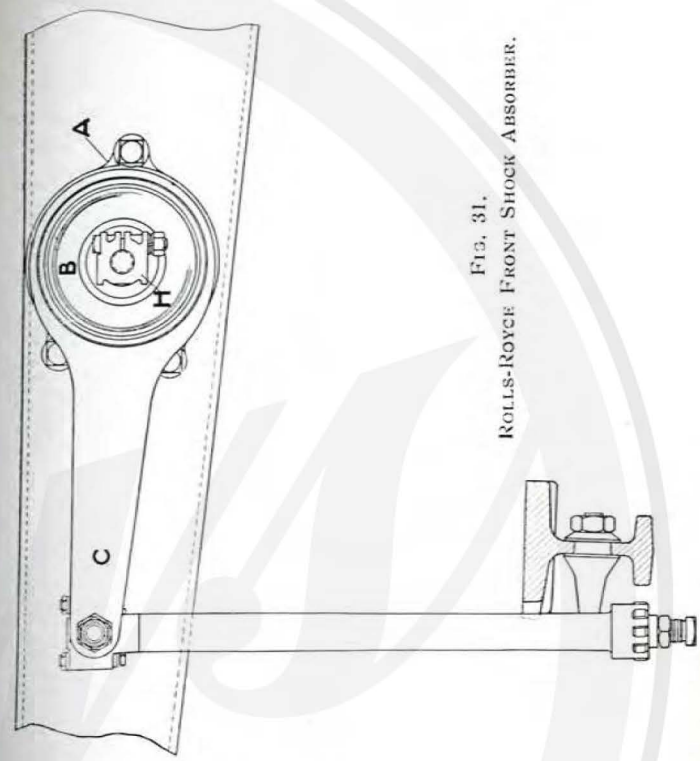


FIG. 31. ROLLS-ROYCE FRONT SHOCK ABSORBER.

Rear Shock Absorber.

Shock absorbers are also fitted between the rear axle and the frame, as shown in *Fig.* 32.

These are carefully set before the car leaves the makers, and should require no adjustment over long periods. The friction surfaces are of hard wood, as also are the bearing bushes of the connections to axle and frame, and none of these parts requires any lubrication.

If it becomes necessary for any reason to remove the adjusting nut (**A**, *Fig.* 32), the following points should be carefully observed, in order that the original adjustment may be restored. The nut (**A**) and pointer (**A'**) must be marked before removal, in order that they may be replaced in the same relative positions, and it should be observed that the pointer (**A'**) indicates "4" on the dial

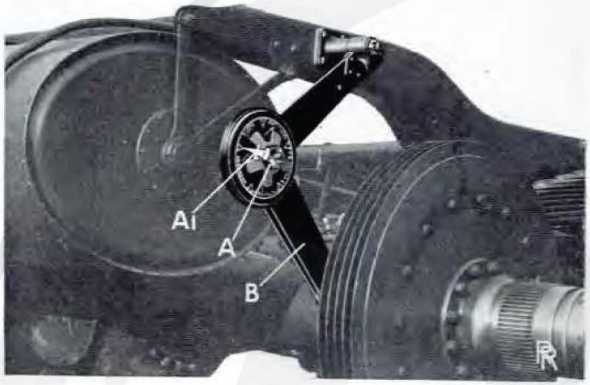


FIG. 32. REAR SHOCK ABSORBER.

when the latter is arranged with its "O" in line with the double arm (**B**) of the shock absorber. When unscrewing the nut (**A**), the number of complete turns necessary to remove it should be counted, and the same number of turns given when it is replaced.

In the event of the adjustment being upset and no record having been kept of the original setting, it will be necessary to disconnect the lower arm (**B**) from the axle. Nut **A** should then be screwed up until this arm will just support a weight of from 30 to 35 lbs., the dial plate being arranged, for convenience, with its zero in line with the lower arm, and the pointer fixed relative to the nut so that it indicates approximately the figure "4" when supporting the weight.

It is preferable, in order to avoid unnecessary loading of the shock absorber connections, to set the adjustment as light as possible. It should not exceed the value given, and if this is found to be too great for the weight of body and the load carried, it can be reduced by unscrewing the nut slightly.

CHAPTER VIII.

HINTS AND SUGGESTIONS.

Chattering noise at magneto. Overheating. Water circulation. Pump. Thermostat. Frost, precautions. Lifting off cylinders. Sticking piston rings. Repairs. Importance of careful lubrication. Squeaks. Rattles. Oil on rubber. Exhaust box. Mascots. Licenses. Registration. Fire. Insurance. Laying up of Cars. Tyre inflation.

"CHATTERING" OF MAGNETO.

Should an occasional chattering sound be heard to come from the magneto at certain speeds, it is probably caused by the small "brake" on the drive of the magneto requiring adjustment by means of the small thumb nut which controls the pressure on the shoes, or it may perhaps require lubrication.

OVERHEATING.

If water or much steam should be emitted from the radiator, the engine is becoming unduly hot, and should be stopped. The cause will probably be one of the following:—

(*a*) Fan belt too loose or broken. If the fan belt is too slack, it should be tightened. See operation 7, Appendix III. (*p*. 119).

(*b*) Insufficient water in the radiator.

(*c*) The water is not circulating properly through an obstruction, or the pump is being jammed.

(*d*) The lubrication of the engine has ceased, allowing the hot gases to pass the pistons.

(*e*) The car is being driven with the ignition too much retarded. The ignition should be "advanced" as far as possible without causing a knock or loss of power.

(*f*) The engine is drawing in and firing far too "rich" a mixture. The jet or jets should be reduced.

(*g*) Pre-ignitions are taking place.

(*h*) Water will be driven out of the radiator and will give the appearance of overheating, if the radiator be filled above the mark shown in *Fig*. 52.

(*i*) Too much "rust preventive" or other compound has been added to the water.

WATER CIRCULATION.

If there is any apparent failure of water circulation, which can be judged by the emission of steam and by a great difference in temperature between the upper and lower portions of the radiator, or by looking into the top of the radiator to see if the water is moving when the engine is running, the pump should be examined to see that the spindle of it is really revolving—that is, the driving shaft may be revolving and the pump may not be; if this is so, tighten the bolts which clip the coupling to the shaft.

In the event of the *pump* failing, the water will continue to circulate (though not so well) by "thermo-syphon" action, so that the journey may be continued if it is necessary, so long as the engine is not allowed to overheat.

WATER-PUMP.

In case of any obstruction (ice, pieces of metal, etc.) entering the pump so as to cause it to jamb, the driving shaft is so designed that the driving portion can slip on the circular portion of the pump-shaft instead of breaking it.

The gland of the pump should be screwed up when it shows signs of leaking.

THERMOSTAT.

It is important, under normal running conditions, that the temperature of the circulating water in the engine should be maintained between 85° C. and 90° C. When a thermometer is provided on the instrument board, the temperature of the water is clearly indicated. The thermostat, shown at **A** in *Fig.* 33, consists of a double valve operated by an alcohol-filled expansible vessel exposed to the water. When cold, this vessel is contracted, and one part of the valve closes communication between the upper water pipe and the radiator (cutting the latter out of action), and the other part opens a bye-pass leading from the top water pipe to the water pump inlet. When a temperature of about 75° C. has been attained in the cylinder water jackets, the alcohol-filled vessel expands. This tends to close the bye-pass pipe and opens the main water pipe to the radiator to an extent that maintains the water at a constant temperature of from 85° C. to 90° C.

FIG. 33. THERMOSTAT.

With an atmospheric temperature at freezing point and the engine only lightly loaded—as, for instance, when running down long hills—the water in the radiator is liable to freeze, being stagnant until the radiator valve opens. Hence it is desirable, when such conditions are likely to be met, to have blanking plates on the radiator. Two plates of different widths are provided, as illustrated in *Fig.* 34, where—

(*a*) Shows both plates fitted.
(*b*) Shows the wide plate only in use.
(*c*) Shows the narrow plate only in use.
(*d*) Shows both plates removed.

That combination of blanking plates should be utilised which covers the greatest area of radiator without allowing the water to boil.

The plates fit direct against the radiator under the bonnet, and are each held in position by four bolts, nuts, and washers. Before passing a bolt through the radiator the particular airway which is to be utilised should have inserted at either end one of the small fibre bushes provided. The leather washers supplied should be arranged against the front of the radiator under the heads of the special bolts, and the metal washers, nuts, and split-pins fitted at the back of the plate.

On removing a plate it may be necessary to clear the air-space of the radiator from mud and other obstruction. This should only be done with a stick of soft wood, and even then care must be taken to avoid damaging the radiator.

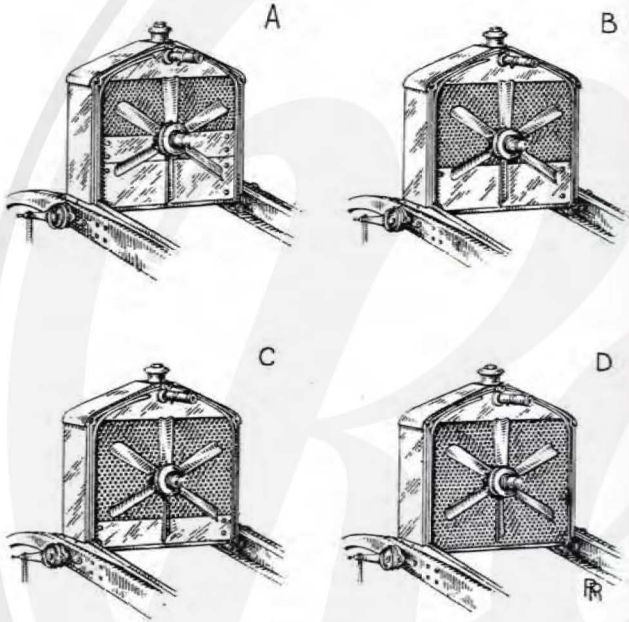


FIG. 34.
RADIATOR BLANKING PLATES.

FROST.

In very cold weather, the general rule should be to empty all the water out of the car when it is not in use, if it is to stand in a place where water may freeze. When the car is again required, *hot* water should be poured in to melt any ice there may be in the system, and *hot water should also be poured over the pump*, to melt the ice which may have "cemented" the interior blades. Be sure all is thawed *before turning the starting-handle*.

A suitable anti-freezing mixture may be prepared by adding 20% of denatured alcohol or methylated spirits to the water. This will lower the freezing point to about −12° C. As the proportion of alcohol will in time be reduced by evaporation, a mixture of half alcohol and half water should, under such circumstances, be used to make up losses in the radiator. If plain water only is used, and the climate is extremely cold, it is best to keep the engine running when exposed standing out-of-doors; it is also good practice to throw a rug over the radiator when the car is at rest. The fan belt may be dispensed with provided the water does not boil.

LIFTING OFF CYLINDERS.

It should be noted that if it is required to lift off the cylinders at any time, it is important that this should only be done by a skilled fitter, and the car should preferably be sent to the ROLLS-ROYCE Works for the purpose. Should, however, this be impossible, the following points should be noted in order to avoid straining the connecting rod and breaking the piston rings.

Dismantling. Remove all parts on the front of the dashboard that may possibly foul the rear cylinders when lifting. See that they are free in the holes of the cylinder studs, then lift steadily and squarely, so as to avoid breaking the piston rings.

Re-erecting. Fix the rear cylinders, first setting the pistons in the position indicated in *Fig.* 35. Cylinders should be slung by means of pulley blocks, care being taken before lowering to see that the crank chamber facing and the cylinder base are clean.

Lower the cylinders, keeping them in a state of motion to prevent the rings getting jammed.

The chief operator should be on the "near" side of the engine, and should guide the rings into the bores, the positions of the pistons being as illustrated, to enable them to be manipulated one after the other.

Take care that the flanges of the water pipes bed properly, and when fixing the cylinder nuts see that these are screwed down equally and with even pressure, there being a possibility of a broken base unless this is carefully done.

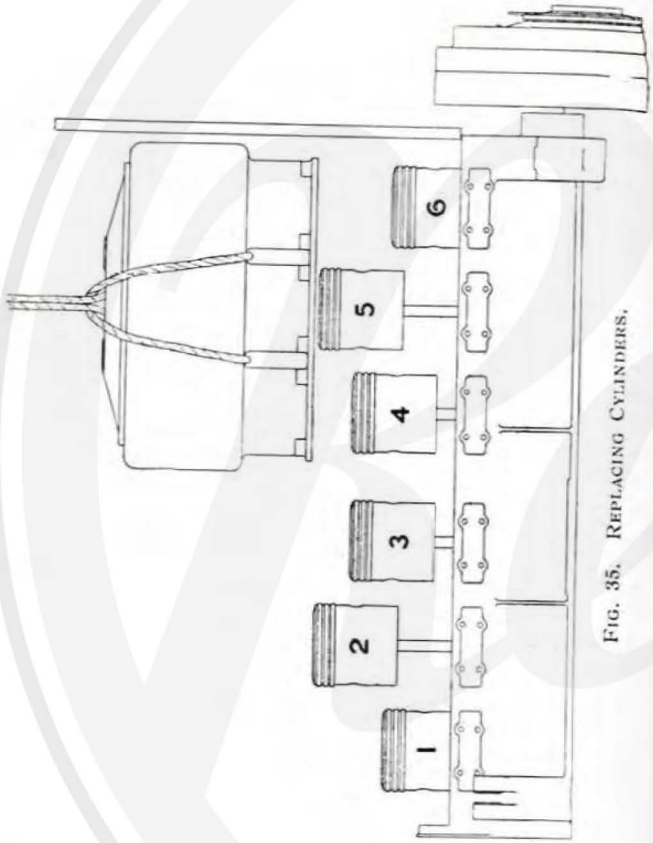


FIG. 35. REPLACING CYLINDERS.

STICKING PISTON RINGS.

After continual use, the engine may, possibly, become foul owing to over-lubrication, and this may cause a clapping noise in the cylinders, due to the piston rings sticking in the grooves.

This may be generally overcome by removing the screw (near No. 1 cylinder) which plugs up the end of the extra oil pipe, and squirting therein a syringe-full of paraffin.

The engine should be running "light" when this is done, and it should be noted that this operation does not in any way affect the pressure feed lubrication of the engine.

OTHER REPAIRS.

Should any repair be required at any time, and it is not possible to send the car to the ROLLS-ROYCE Works, you should (after receiving the Company's consent to get the repair carried out elsewhere) see that it is thoroughly well done by competent people, who have the necessary skilled labour and proper appliances. If it is necessary to replace any chassis parts only those parts should be used which have been obtained from Messrs. Rolls-Royce, Ltd.

It is economical that a car should be sent to its makers for dismantling and report at least once every 50,000 miles.

Should any of the pistons, piston pins, or connecting rods be taken apart at any time, care should be taken, when putting them together, to see that the pistons are replaced with the saw-cuts in the skirts on the same side of the cylinders as the valves.

LUBRICATION.

We wish to emphasise the importance of the proper and thorough lubrication of the whole car; it is disastrous if any parts are neglected altogether, and what is required is a careful man who will "get into his overalls" and study every moving part of the car.

Oil should be used liberally, but not in such a manner as to cause undue waste.

Use Price's Amber "A" in Gear-Box and Back Axle Casing; with this should be mixed 10% of Price's Motorine "C" in cold weather.

For the Engine, use Price's Motorine "C."

Use Price's Amber "A" in the Oil Gun.

For Graphite Grease, use Price's "Belgraphine."

For Ball-Bearings, use Hoffmann's Ball-Bearing Grease, manufactured by Alex. Duckham & Co., Ltd., Phœnix Wharf, Millwall, E.

Arrangements have been made whereby Rolls-Royce, Ltd., can supply promptly any quantity of the above oils (from one gallon cans to forty gallon barrels) at current retail prices, which include free delivery in London of any quantity. In the country, orders for five gallons and upwards are delivered free to the nearest railway station. Quotations will be submitted on application.

Castor or Lard Oil may be used in Back Axle Casings and Gear-Box if extra speed or power is desired.

SQUEAKS.

If a squeak develops which you have trouble in locating, look to the starting handle, the springs and shackles, and engine suspension joints.

RATTLES.

Rattles may occur if the spring clips inside the bonnet do not correctly grip the bonnet strips, if the shock absorber ball-joints are worn or have been adjusted too loosely, or the coupling between the clutch and the gear-box requires lubrication.

Vibrations of the brake pedal may occur if the brake ropes are slack. The brakes should be adjusted so that the ropes are at all times in tension.

OIL ON RUBBER.

Oil must be kept off all rubber goods, such as tyres, insulated wires, and rubber mats. Should any get on by accident, it should be thoroughly wiped off at once, and the part washed with soap and water.

EXHAUST BOX.

Care should be taken to see that the outlet on the silencer does not gradually become partially choked with mud, etc.

MASCOTS.

We disapprove of fitting heavy or cumbersome mascots on the radiator filler cap, as these have a tendency to fracture the joint between the filler cap body and the radiator tank.

A special mascot of a distinctive type, and one designed exclusively for use on Rolls-Royce cars, may be obtained from the makers on application at an extra cost.

CAR LICENSES.

The Inland Revenue License payable under the Finance Act, 1920, in respect of a 40/50 H.P. Rolls-Royce motor car which is privately owned, is £49. The information required for the License Form is as follows:—

Horse Power (Treasury Rating).	48·6.
The engine is an internal combustion engine.	
Manufacturer's name	Rolls-Royce, Ltd.
Description of car	40/50 Horse-Power.
Chassis type letter and number.	This will be found on an engraved plate on the dashboard.
Number of engine	This will be found on the front arm of the crank-case.
Year of manufacture of engine.	It is not necessary to state this, but the owner of a car of which the engine was constructed before January 1st, 1913, is entitled to repayment of 25% of the duty paid.
Number of cylinders having a single piston.	6.
Internal diameter of cylinders.	4½ ins.

FIRE.

Employees should frequently be warned of the great danger of fire from lighted matches or lamps which are brought near exposed petrol. It is surprising to note the extent to which smoking, striking and throwing down matches is permitted in garages, etc.

Owing to the extremely inflammable nature of petrol, the main petrol tap (situated outside the chassis frame on the right-hand side) should always be turned off when the car is left standing or is brought into a building, as in the event of the automatic float feed becoming jammed from any cause, the carburetter would flood and the petrol would flow out on to the floor or road. This is especially important when putting a car into a garage for the night a number of fires have occurred through neglect of this simple precaution.

Close Petrol Tap.

After taking over a new car, always familiarise yourself with the exact situation of the main petrol tap and with its "on" and "off" positions, so that in the event of fire the tap can be immediately closed without a moment's hesitation.

Care should be taken to see that the garage is well ventilated when running the engine to warm it up, and the mixture should be suitably weakened as the engine gets warmer.

INSURANCE.

We strongly recommend car owners to insure themselves against accidents; heavy claims are often obtained against motorists for accidental damage to a pedestrian or other road user caused in some cases through no fault of the motorist.

Particulars of good policies can be obtained from us.

LAYING UP OF CARS.

Before storing a car for any period, the following work should be carried out:—

(1) All water carefully drained from the cooling system.
(2) All petrol withdrawn from tank, filter and carburetter.
(3) All tyres should be removed from rims and placed together, with all other rubber articles (horn bulbs, mats, etc.), in a cool place away from the light.

(4) All accumulators should be charged once a month or the acid should be replaced with distilled water. (See Chapter IV., *p.* 52.)
(5) All bright parts should be cleaned and lightly smeared with oil.
(6) If a hood or cover is fitted, this should be left open and extended to avoid creasing or cracking the fabric. (See Chapter IX.)

INFLATION OF TYRES.

We recommend pressures of between 45 and 55 lbs. for open cars, and between 55 and 65 lbs. for closed cars, according to weight of complete car. The high pressures recommended and maintained in the past result in uncomfortable riding and early development of rattles in coachwork and chassis, with little, if any, increase in tyre mileage. Moderate tyre pressures are very necessary with tyres of cord foundation, which have now been adopted by the leading tyre manufacturers.

Drivers should note there is a considerable increase in the air pressure owing to rising temperature due to hot weather and fast driving.

Allowance should be made for this rise, which approximates to 1¼ lbs. for every 10° F. rise in temperature of the tyre.

CHAPTER IX.

HINTS ON PRESERVATION OF MOTOR BODIES.

1. A motor car should be kept in an airy, dry motor house, with a moderate amount of light, otherwise the colours will be destroyed.

2. There should be no communication between the stable and the motor house. The manure heap or pit should be avoided, as ammonia fumes are very injurious to both paint and upholstering.

3. A motor car should never under any circumstances be put away dirty. It will stain or spot unless care be taken to remove the mud before it dries on or as soon afterwards as possible.

4. The use of petrol with the water when washing a car is most detrimental to the varnish, especially when the varnish is soft.

5. When washing a motor car, keep it out of the sun, use plenty of water, and apply, when practicable, the hose or syringe, taking care that the water is not driven into the body to the injury of the lining. When forced water is not obtainable, use for the body a large soft sponge. This, when saturated, squeeze over the panels, and by the flow down of the water the dirt will soften and harmlessly run off. Then finish with a soft chamois leather and old silk handkerchief, but it is important that all grit should be removed from the panels before leathering off; a particularly careful man would have a second sponge to use for his panels, and would on no account wash the bonnet, wings, chassis, or wheels with the same sponge or leather as he uses for the panels.

6. The same remarks apply to the underwork and wheels. Never use a spoke brush, which, in conjunction with the grit from the road, acts like sandpaper on the varnish, scratching it and, of course, effectually removing all gloss. If persisted in it will rub off the varnish and paint down to the wood. Great attention should be paid to this point. Never allow water to dry itself on a motor car, as it will invariably leave stains.

7. Regarding the interior, when the trimming is of morocco, it should never be washed or even rubbed with a damp leather, as the dye of the skins is thereby loosened and comes off on the clothes of the occupants. When the upholstery is of cloth, a gentle rubbing with a soft brush is the best for cleaning it.

8. To remove stains or spots from the panels, a few drops of furniture polish reviver, or even linseed oil, on a dab made of woollen rags (using as little of the fluid as possible), will generally suffice. If the panels are very bad, nothing but a regular flatting-down and hand polishing, or even re-varnishing by the coachmaker, will be effectual.

9. In cleaning brass or silver, be careful not to smear upholstery or paint with the polish. Silver should be cleaned with the best plate powder; brass may be cleaned with liquid cleaners, but great discretion should be used in the sort employed.

10. Keep a small bottle of japan always handy to paint the treads and steps worn by the feet; lay it on as thin as possible. If the treads and steps are of rubber, they should be treated with pipeclay, which easily washes off.

11. As a general rule, a motor car retains its freshness better with moderate work than if standing for long periods in a motor house; the paint will not fade so quickly and the lustre of the varnish will be greater.

12. A driver should be careful not to load the inside of a car with oil cans, dirty bundles of odds and ends, or sharp-edged articles, as these do more damage to the coachwork and upholstery of a car in a few minutes than any amount of fair wear and tear. The driver should be equally careful to see that his hands and clothes are quite clean before touching the coachwork or upholstery of a car, as again much damage can be caused in a few minutes.

13. Such moving parts of the bodywork as locks, hinges, dovetails of doors, hoodstick joints, or the joints of cabriolet bodies, and windscreen joints should be lubricated occasionally to prevent wear and eliminate squeaks.

CHAPTER X.

STORAGE OF PETROL.

In view of the regulations issued by the Home Secretary on July 31st, 1907, and for the benefit of our clients who may not be versed on the subject, we are reproducing some of the principal points that must be observed. We are indebted to *The Autocar*, from which, with the kind permission of the Editor, we are making the following extracts. The original article was written by Mr. Douglas Leechman, Barrister-at-Law.

"A purveyor of petrol must have a license from the local authority even if he only wants to sell a little now and again and keeps the petrol principally for use in his own cars. A private owner may choose to apply for a license under special circumstances; but, as a rule, he will prefer to be free from the attentions of the local authority. What are the restrictions he must comply with under these circumstances?

Rules for the Owner who has no License.

"First, there must be a proper storehouse. This term means any room, building, coach-house, lean-to, or other place in which the petrol is kept. An open-air place of storage is included, if due precautions are taken to prevent unauthorised persons having access to the spirit. As a rule, it is not advisable to keep the petrol in such a place as a conservatory, as it should be carefully noticed that where the storehouse forms part of or is attached to another building, and the intervening partition or floor is of an unsubstantial or highly inflammable character, or even if it has an opening, *e.g.*, a door or window, in it, the storehouse will be deemed to include the whole building, which must not be used as a dwelling or as a place where persons assemble. This is a very important restriction, and it is emphasised by the regulations adding that the storehouse shall have a separate entrance from the open air, distinct from that of any dwelling or building in which persons assemble. Given such a storehouse, and it is thoroughly ventilated, sixty gallons of spirit may be kept in it, and no more. If one or more cars are in the same place, the petrol in their tanks must be counted in

reckoning the maximum of sixty gallons. If the owner has two or more storehouses, each fulfilling the requirements, he may keep any quantity up to the maximum in each; but if two or more of the storehouses are within twenty feet of each other, such two or more shall count as one only, so far as concerns the quantity of spirit to be kept therein.

"If any person keeps petrol in a storehouse which is within twenty feet of any other building (whether in his occupation or not), or of any timber stack or other inflammable goods not owned by him, he must give notice to the local authority, and must allow their officer to inspect the spirit at any reasonable time. The notice must be renewed in January of each year. This regulation does not apply to the petrol kept in the tank of the car.

Owner with or without License.

"If the private owner decides to proceed by license obtained from the local authority, under the Petroleum Act, 1871, he will not be subject to the foregoing regulations, as such, except as to the thorough ventilation of the storehouse. But, license or no license, he will be bound by the following regulations: The petrol must be kept, used, and conveyed in metal vessels calculated to withstand any ill-treatment short of gross negligence or extraordinary accident; and the vessels must be so constructed and maintained that no leakage of either liquid or vapour can take place therefrom. Every such vessel, not forming part of a car, when used for keeping or conveying petrol, shall bear the words, 'Petroleum spirit, highly inflammable,' conspicuously (not merely 'legibly,' as in the 1903 regulations) and indelibly stamped or marked on it, or on a metallic or enamelled label attached to it.

"The capacity of the vessels must not exceed two gallons each, unless, in the event of a license being obtained, the same prescribes a higher limitation.

"All the petrol and all dangerous vapours derived therefrom must be removed as far as practicable from any such vessel before any repairs are done to it. The filling or replenishing of a vessel with petrol must not be carried on, nor must the contents of the vessel be exposed in the presence of fire or any artificial light liable to ignite vapour rising from the spirit. Nor must such fire or artificial light be brought dangerously near to any vessel containing petrol.

"All due precautions must be taken to prevent accidents by fire and explosion, and to prevent unauthorised persons having access to the petrol, or to vessels which do contain, have contained, or are intended some day to contain petrol. Further, every person managing, or employed on, or in connection with any light locomotive, shall abstain, and shall prevent others, from committing any act tending to cause fire or explosion, and which is not reasonably necessary. This regulation and the first of the two new ones apply to persons who obtain licenses to keep petrol for sale, or partly for use and partly for sale. Otherwise such persons do not come under the regulations, but remain under the Petroleum Act, from which the regulations in most cases exempt the private owner.

"The two new regulations are as follows:—

(14) In the storehouse or in any place where a light locomotive is kept or is present, petroleum spirit shall not be used for the purpose of cleaning or lighting, or as a solvent or for any purpose other than as fuel for the engine of a light locomotive.

Provided that where due precaution is taken to prevent petroleum spirit from escaping into a sewer or drain, and provision made for disposing safely of any surplus petroleum spirit, and where no fire or naked light is present, quantities not exceeding one gill may be used for the cleaning of a light locomotive at a safe distance from any building, place of storage of inflammable goods, or much frequented highway, or for the repair of tyres, under suitable precautions.

This regulation shall apply to premises on which petroleum spirit is kept for the purpose of, or is being used on, light locomotives, whether such premises are licensed or not, unless the local authority see fit, in the case of licensed premises, to grant an exemption by a special term of the license.

(15) Petroleum shall not be allowed to escape into any inlet or drain communicating with a sewer.

"A gill, it will be remembered, is a quarter of a pint. As all the regulations apply to any petroleum which gives off an inflammable vapour at less than 73° Fahr., as well as to petrol itself, it will be no defence to say that the liquid used for cleaning the car or removing patches from air tubes, or for other purposes, was not really 'petroleum spirit.'

Owner with License.

"From what has been said before as to storehouses, it will be evident that there are many private owners whose garages do not comply with the requirements of a place wherein petrol may be kept under the regulations. Not only is he then prohibited from storing sixty gallons—he must not store any at all without a license from the local authority. They may or may not see fit to grant a license. If they do grant one, they may also grant requests to allow of petrol being stored in vessels of more than two gallons capacity each, and to allow of more than sixty gallons being kept in one storehouse. But these extensions are more likely to be desired by, say, a motor omnibus company than by an ordinary private owner. The local authority means the court of the Lord Mayor and Aldermen of the City of London, the London County Council, the Borough Council, or the District Council, as the case may be. The fee for a license is 5s. The license will be subject to all the regulations referred to as applicable in the lastly preceding section, and to such others as the local authority may prescribe, provided they are not inconsistent therewith.

"A breach of the regulations is punishable on summary conviction by a fine not exceeding £10; and persons storing petrol without a license where such is required are liable to a fine of not more than £20 a day."

CHAPTER XI.

DEMONSTRATION CLASS.

We desire to advise customers of our Demonstration Class which is maintained for the purpose of training drivers in the care, adjustment, and driving of a Rolls-Royce car. This class is only intended for men who have had experience in driving and maintenance of motor cars, and require special instruction in the care and handling of the Rolls-Royce car. It is also of great benefit to customers with old type Rolls-Royce cars who intend getting a new chassis, as all the wiring system and the new parts are carefully demonstrated to the pupils in the class.

It is pointed out that only those who are engaged to drive Rolls-Royce cars can be accepted for instruction. The course occupies two weeks, commencing every Monday morning and finishing on the following Saturday week at noon. The premises are very well equipped, and there are two cars for actual driving on the road, and on which gear-changing is practised. There is also a fine lecture room, in which there is a complete set of units of the chassis which are taken apart and demonstrated to the pupils. There is also a complete set of the wiring system laid out on a table, which makes it easier for the pupil to understand than if it was on a chassis. At the end of the course there is an examination, and customers are asked to allow their drivers to take part in this.

While undergoing tuition drivers are boarded and lodged on the premises, which are specially equipped for the purpose.

In order that pupils shall not miss any of the course, which commences on Monday morning, they are requested to report at "The Welcome," Alvaston, Derby, on the Sunday night previously.

On arrival at Derby Station, if the pupils take the tram to Alvaston, anybody there will show them where "The Welcome" is situated.

We shall be pleased to forward to customers, on request, forms giving further particulars of this class.

Owners may also attend this class. We shall be pleased to arrange for their instruction on receipt of notice to this effect. Suitable accommodation can be found at the Midland Hotel.

CHAPTER XII.

ROLLS-ROYCE SUCCESSES.

1904.

The first Rolls-Royce Car, a two-cylinder, was created.

The Commissioners of the PARIS SALON de l'Automobile awarded the Rolls-Royce a Special Medal and Diploma.

1905.

TOURIST TROPHY.

A 20-h.p. Rolls-Royce, driven by an amateur, gained second place; beat all other cars having vertical cylinders: 208½ miles.

Average speed 33¾ miles an hour;

petrol consumption, 24·8 miles per gallon.

4,000 MILES ROAD TRIAL.

In conjunction with the Royal Automobile Club Tyre Trials, the Rolls-Royce covered the 4,000 miles in 25 days.

Non-stop each day.

1906.

"BATTLE OF THE CYLINDERS."

Distance: 1,187 miles; marks given for hill-climbing, speed on level, changing of gears, fuel consumption, reliability, silence and absence of vibration. Six-cylinder Rolls-Royce *versus* a four-cylinder car of foreign make. Result: the six-cylinder Rolls-Royce

Won by 396 marks.

MONTE-CARLO TO LONDON (RECORD).

20-h.p. Rolls-Royce. May 10th and 11th, 1906. Driven by the Hon. C. S. Rolls from Monte-Carlo to Boulogne, 771 miles in 28 hours 14 minutes;

Equals 27·3 miles per hour, including all stops.

SCOTTISH RELIABILITY TRIALS.

June, 1906. 617½ miles; over mountainous roads in Scotland; non-stop, and the only six-cylinder car out of seven entries which

Completed the distance without a stop.

TOURIST TROPHY.

The Royal Automobile Club instituted this event with a view to determining the best all-round Touring Car in the world. The race was

Won by a Rolls-Royce

driven by the Hon. C. S. Rolls, distance 161½ miles,

Average speed 39·4 miles per hour,

fuel consumption over 25 miles per gallon. The course was winding and mountainous, and the weight of four persons was carried.

EMPIRE CITY TRACK, NEW YORK.

The Rolls-Royce, fitted with touring body,

Won the Five Miles Silver Trophy;

also made second fastest time in all classes.

1907.

ORMOND BEACH RACES.

The Rolls-Royce

Broke the Five Miles Record

for all petrol cars of 60 h.p. and under; time 4 mins. 52 secs.

WORLD'S INTERNATIONAL CHAMPIONSHIP.

The Rolls-Royce, competing against cars of far greater horse-power,

Won for Great Britain the Bronze Statue

for the World's International Touring Car Championship, Distance 20 miles; time 23 mins. 12 secs.

12 MILES GOLD MEDAL, FLORIDA.

Special Gold Medal offered for a twelve miles match between a 20-h.p. Rolls-Royce and a 30-h.p. American Car.

Winner, 20-h.p. Rolls-Royce;

time 13 mins. 12 secs.

SCOTTISH RELIABILITY TRIALS.

The Gold Medal for Class 7 was awarded to the Six-Cylinder Rolls-Royce.

NON-STOP RECORD.

A six-cylinder Rolls-Royce, under R.A.C. observation,

Covered 15,000 miles

with only one minute stop (for petrol tap), or 14,371 miles Non-stop Record, and no signs of wear to either engine, gears, or main bearings. "Two years' work in seven weeks."

Total distance equal to a journey round the world from London to within 200 miles of Ireland.

Cost of fuel, oil, and all work done on the car during this trial, including cost of making the car equal to new at the end of the trial, was £93 15s. 10d., or under £48 a year of 7,500 miles.

The R.A.C. Certificate further shows that a 40-50 h.p. Rolls-Royce can be run at under

£150 a year (of 7,500 miles),

including petrol, oil, tyres, and all repairs.

THE DEWAR TROPHY,

awarded annually by the Royal Automobile Club for the most meritorious long-distance performance in each year, was unanimously

Awarded to Rolls-Royce, Ltd.,

"in respect of the performance of the 40-50 h.p. Six-Cylinder Rolls-Royce car in its 15,000 miles Long Distance Trial."

1908.

BOMBAY-KHOLAPAR TRIAL

(620 miles). Annual Reliability Test of the Motor Union of Western India, February, 1908. Class V.

Won by the 40-50 h.p. Six-Cylinder Rolls-Royce

known as "The Pearl of the East," which covered the whole distance without an involuntary stop. The car used only ¾-gallon of oil for the 620 miles, which included climbing six mountain passes (The Ghats), having a total rise of 5,000 feet.

No tools or spares were carried, and the bonnet was locked throughout the trial, the keys being carried by the observer.

THE ROLLS-ROYCE IN INDIA.

In addition to being the winner of its class in the Bombay Trials, the Six-Cylinder Rolls-Royce was declared joint

Winner of the Mysore Cup.

This car has also, in India, secured a Silver Cup, Two Gold Medals, and Two Diplomas, and was awarded First Prize for Appearance at the Bombay Motor Show, 1908.

£1,000 CHALLENGE.

With a view to proving their statement that the Rolls-Royce is the Premier Car of its class in the world, Rolls-Royce, Ltd., issued a £1,000 Challenge for a 15,000 Miles Trial of Regularity, Efficiency, Durability, and Economy, against any other car coming within Class 9 of the R.A.C. Touring Standards. This challenge

Was not accepted.

THE 2,000 MILES TRIAL

of the Royal Automobile Club (Class K), Six-Cylinder Rolls-Royce won by 44 miles; fastest car in 10 out of 11 of the hill-climbs; the most economical car in petrol of any car in the trial, having made 40·98 ton-miles per gallon, namely, 20·1 miles per gallon throughout the trial, and lost less marks than any car in the trial of more than 21 h.p.

The above Trial included 20 miles of timed hill-climbs and a 200 miles race on a Brooklands Track.

1911.

TOP GEAR TEST FROM LONDON TO EDINBURGH AND BACK,

concluding with a Speed Test on Brooklands, a six-cylinder 40-50 h.p. Rolls-Royce Touring Car ran from London to Edinburgh and back on top gear, with a fuel consumption of

24·32 miles per gallon,

or 57·07 ton-miles per gallon, under R.A.C. observation. The run finished up at Brooklands, where

A speed of 78·26 miles per hour was made.

SPEED TEST AT BROOKLANDS.

A six-cylinder 40-50 h.p. Rolls-Royce car, fitted with a racing body, obtained a certificate from the B.A.R.C. for

A speed of 101·8 miles per hour,

over a distance of half-a-mile with a flying start.

1913.

THE GREAT AUSTRIAN ALPINE CONTEST.

The trial was run over a distance of 1,650 miles, including nineteen Alpine passes. The Rolls-Royce cars were admitted to be by far the

Fastest cars in the trial,

and clearly demonstrated this by leaving all the other competitors behind on the great hill-climbs. The tour lasted eight days, and

The Rolls-Royce Cars led throughout,

and arrived first at the end of each day's journey. Each car made a non-stop run, and each car was a

Winner of one or more prizes.

It is significant of the extraordinary cooling arrangement of the Rolls-Royce cars to note that, although the conditions of the contest made it permissible for competitors to fill their radiators every day, no water was added to the Rolls-Royce radiators throughout the whole trial, and the

original seals on the water tanks remained intact at the conclusion.

THE SPANISH GRAND PRIX.

A speed contest for fully equipped touring cars over a 200-mile course through the Guadarrama mountains, containing steep ascents and descents, and many dangerously sharp turns. The car having the highest speed on the hills and on the level, and the best petrol consumption, was to be declared the winner. Two Rolls-Royce cars were entered and

Gained first and third places.

The winning Rolls-Royce car completed the course at an

Average speed of 54 miles per hour.

1914.

THE SPANISH GRAND PRIX.

A speed contest, in the form of a hill-climb, held on about 20 kilometres (12½ miles) of mountain road, having an average gradient of 1 in 10 and a number of acute corners, which necessitated the speed being considerably moderated. The competition provided for three classes: for touring cars with open bodies, for cars with closed bodies, and for racing cars.

The event for closed cars was

Won by the Rolls-Royce,

fitted with a cabriolet body and all accessories, weighing in all 41 cwt. 89 lbs.,

At an average speed of 40·7 miles per hour,

and incidentally set up a new record for the hill for closed cars.

The car was awarded a gold medal by the R.A.C. of Spain. In the class for open cars, a Rolls-Royce also made a remarkable performance, inasmuch as it ascended the hill at an average speed of 45·7 miles per hour, thus beating many of the cars which were specially built for speed and including one car having an engine of 120 h.p.

THE GREAT AUSTRIAN ALPINE TEST.

This easily eclipsed in severity the contest of the previous year and constituted the severest trial on record. In a distance of 1,818 miles no less than 27 Alpine passes had to be negotiated, having a total combined height above sea-level of 105,646 feet, throughout which

The Rolls-Royce Car ran faultlessly and made a non-stop run.

There were 75 starters, amongst which there was only one Rolls-Royce. Four cars possessed engines considerably larger than that of the Rolls-Royce, as follows:—

1 Benz	having an engine of	10,100	cubic centimetres.
1 Benz	,, ,,	10,100	,, ,,
1 Benz	,, ,,	8,490	,, ,,
1 Graf and Stift	,,	8,490	,, ,,
1 Rolls-Royce	,,	7,410	,, ,,

The Rolls-Royce was easily the

Fastest Car in the Trial,

making the fastest time on the Katschberg and fastest time on the level in the speed test between Salzburg and Vienna. It was

The only English Car to lose no marks,

and was, in fact, the only high-powered car which maintained a perfect record throughout.

1921.

THE "COTE DU PHARE" HILL CLIMB, BIARRITZ.

The Post-war Rolls-Royce made fastest time at this event.

1st, ROLLS-ROYCE	24⅘	secs.
2nd, Vauxhall 38/90	27	,,
3rd, Hispano-Suiza, 6 cyl.	27⅘	,,
4th, Hispano-Suiza, 6 cyl.	28	,,
5th, Voisin	34	,,

The "Cote du Phare"—500 metres in length—includes three sharp turnings. The Rolls-Royce, starting from rest, climbed the hill in fastest time, and was travelling at the finish at the rate of

63¾ miles an hour.

APPENDIX I.

DAILY OPERATIONS.

LUBRICATION.

1 and 2. **Replenishing Crank Chamber.**

It is important that the correct level of oil should be maintained in the crankcase. This is indicated by a special overflow cock shown at **D** (*Fig.* 46, *p.* 114), fixed on the lower half of the crank chamber. The cock is operated by a small lever, which is located on the chassis frame on the "near" side of the car. It is closed when the lever hangs vertically downwards. This overflow cock indicates the normal height of the oil when the car is *level*.

When opening the cock, do not be deceived by a small amount of oil which may be in the cock itself. If oil does not flow out freely, this is an indication that the level is getting low, and more oil is required in the engine-well. If this is not added, and the level is allowed to fall lower, the pump will fail to maintain the circulation properly, and the gauge will indicate considerable variations of pressure.

When adding oil to the crankcase the overflow cock should be open, and normally the addition should be made through the crankcase breather by means of a funnel fitted with a gauze filter.

The oil contained in the tank fixed to the "near" side of the frame should be looked upon as a "reserve" supply to be used when facilities for adding oil through the breather and a filter funnel as described are not available. To admit oil to the engine from this tank, the tap below it should be turned on and the oil forced into the crank chamber by connecting the tyre pump to the filling plug and raising the pressure in the tank by three or four strokes of the pump, the overflow cock being open meanwhile. When oil begins to run out of the overflow cock (the car should be level, or this will not be a true indication), both the overflow cock and the

tap of the reserve oil tank should be turned off. The latter is off when at right angles to the pipe. (*For further information, see pp.* 20 *and* 114.)

OPERATIONS AND ADJUSTMENTS.

2. **Filling with Petrol.**

Petrol should only be poured into the petrol tank through a very fine wire gauze strainer—fine enough to stop water. Funnels wet with water must not be used for replenishing petrol tanks. No tools are required to remove the cap, **M**, *Fig.* 36, for filling. It is only necessary to release thumb screw, **O**, a few turns with the fingers when the cap can be easily unscrewed. When replacing the cap it should be screwed on as far as possible and finally tightened by means of the screw, **O**, to make an air-tight joint. The quantity of petrol in the tank can be seen by reference to the level indicator, **N**.

FIG. 36.

THE CORRECT WAY TO HOLD A PETROL CAN SO AS TO ALLOW A FREE INTAKE OF AIR AND A CLEAN FLOW OF PETROL.

Density.

The R-R carburetters are regulated for motor spirit, having an average specific gravity of ·710; when the car is taken abroad a slight alteration to the jets may be necessary to suit the foreign petrol, but this should be obtainable with the small lever on the steering column.

5. Filling with Water.

The radiator should not be filled higher than half-way across the return pipe, and the level should not be allowed to get much below this. The white line in *Fig.* 52 shows the correct level.

Use only soft water (preferably rain water).

A teaspoonful of "Incrusto" per gallon of water may be added to prevent scale and rust. This preparation is obtainable from the Anglo-Bosphorus Oil Co., Ltd., Bristol (mention for ROLLS-ROYCE car).

APPENDIX II.

EVERY 500 MILES, OR WEEKLY.

LUBRICATION.

3. Bevel Gear-box.

The back-axle casing should contain about 4½ pints of gear oil. The oil should be filled from the back filling plug (H, *Fig.* 49) until it runs out at this plug. When opening the filling hole, do not be deceived by a little congealed oil, or by froth, both of which may give the appearance of the box being full. Fill same quantities and at same times as the change gear-box, *i.e.*, ¼ to ½ a pint injected with a syringe every 500 miles, or once a week.

Before filling the bevel gear-box it is convenient, especially in cold weather, to warm the oil to make it flow easily. It is also best to fill the box when it is just warm, *i.e.*, when the car has just come in.

If too high a level of oil is allowed in either of the gear-boxes, waste and trouble will follow, as the violent agitation causes froth to form, and the bulk of the oil is so increased as to ooze out of the bearings and to get on to the brakes and tyres.

N.B.—Do not on any account use grease in the gear-boxes, as this would clog the oil passages.

Castor or Lard oil may be used in back axle casings and gear-box if extra speed or power is desired.

See that the drain pipes projecting from the rear brake brackets are not clogged with mud, or the brakes will become oiled and ineffective.

4. **Clutch Coupling.**

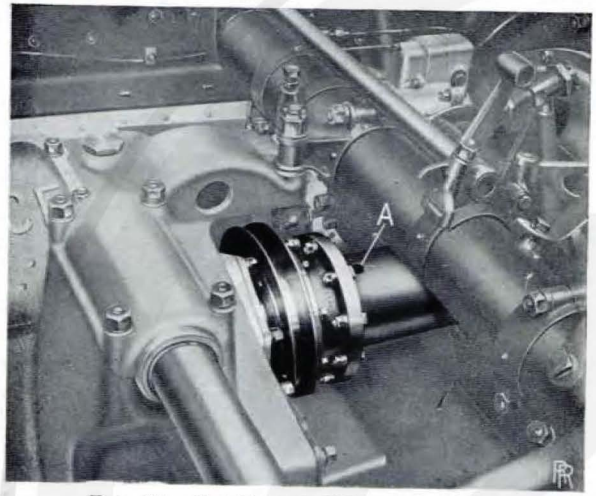


FIG. 37. OIL CLUTCH COUPLING AT **A**.

It is essential that this coupling should have a regular and sufficient supply of oil.

7. **Spring Shackles.**

The twelve oil-gun lubricators are shown in *Figs.* 38, 39, and 40. The oil gun should be filled with gear oil and

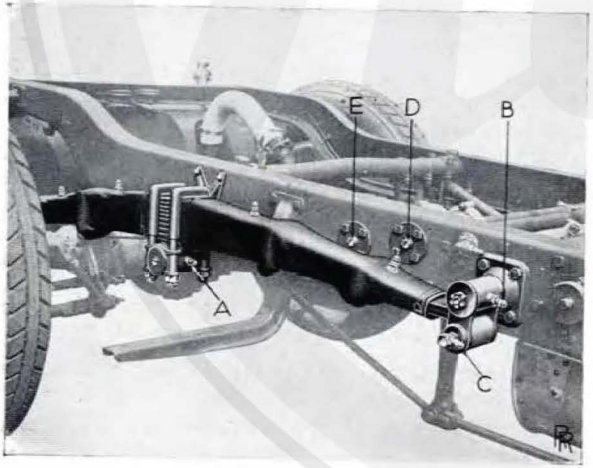


FIG. 38. LUBRICATE AT **A, B,** AND **C** (SAME ON OTHER SIDE).

screwed down until oil exudes from the ends of the bearings. The caps should then be replaced on the lubricators.

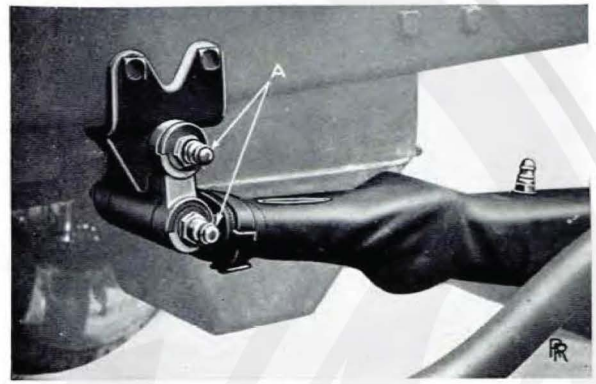


FIG. 39.

TWO LUBRICATORS **A** ON BACK OF "OFF" FRONT SPRING (SAME ON OTHER SIDE).

8. **Starting Handle.** Gear oil should be forced into lubricator **A**, *Fig.* 40, by means of the oil gun, and the lubricator cap replaced.

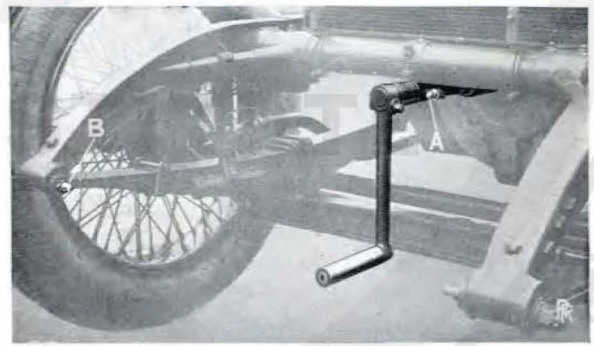


FIG. 40.

LUBRICATOR ON STARTING HANDLE AND "OFF" FRONT SPRING.

13. **Steering Box.**

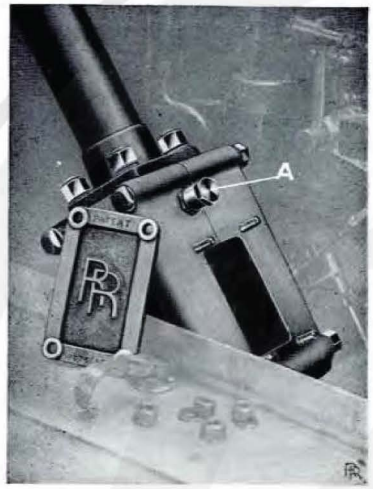


FIG. 41. STEERING BOX SHOWING OIL CUP **A**.

16. **Fan Bearing.**

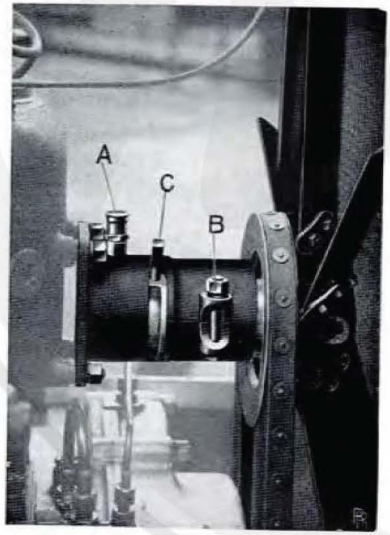


FIG. 42. LUBRICATE WITH GEAR OIL AT CUP **A**.

9-10. **Steering Pivots.** Careful attention should be paid to the lubrication of the steering pivots. In order that oil may reach the bearing surfaces of these, the axle should be jacked up during lubrication. The lower cap should be removed to drain out any water which may have accumulated, and afterwards filled with gear oil and replaced. Gear oil should then be freely injected through the upper lubricator by means of the oil gun, and the lubricator cap replaced.

18. **Governor.**

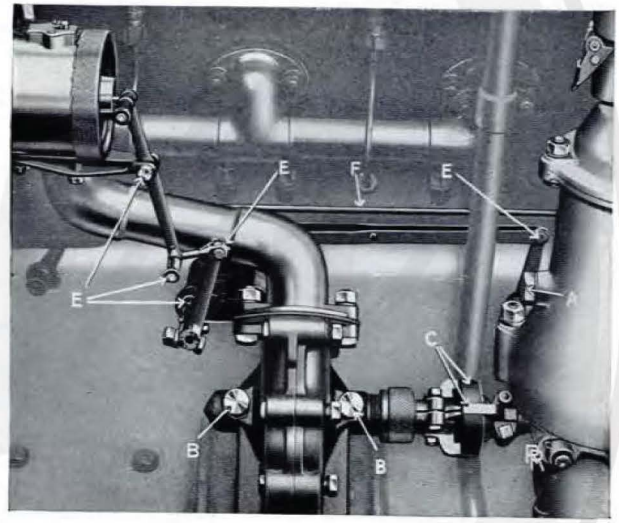


FIG. 43. **A** SHOWS PLUG-HOLE FOR GOVERNOR CASE.

19. **Water Pump.** The two cups, **B**, in *Fig.* 43, when filled with graphite grease, should be screwed *right* down, and the fibre disc in the bottom of each cup will make a water-tight joint.

22 to 24. **Control Mechanism.**

The driver, on first taking over a new Rolls-Royce car, should trace out the various movements and connections between the governor lever on the steering wheel, the accelerator pedal, the automatic governor, the exhaust throttle, and the throttle valve on the carburetter ; all these

are directly or indirectly connected together, and care should be taken to oil, every week, the numerous connecting links, pivots and pins carefully. The perfect governing of the engine, after the car has been in use for a long time, will largely depend upon careful attention to such details, which will avoid unnecessary wear and "play" in these parts. The same applies to the moving parts between the ignition lever on the steering wheel, the battery ignition distributor, and the magneto.

N.B.—These links should be quite free and should "float."

35. Front Shock Absorber Ball Joints.

When lubricating the front shock absorber ball joints by means of the oil gun, feel if any wear has taken place; adjust if necessary. (For method of adjustment, *see p.* 76.) Lubricate with engine oil the outside edges of the leather cones at points marked **E** and **D** in *Fig.* 30 (*p.* 76).

OPERATIONS AND ADJUSTMENTS.

2. High-Tension Distributor on Magneto.

Fig. 44 shows the cover of the magneto distributor removed for cleaning purposes. Electrical leakage in the high-tension distributor of either the battery ignition or magneto causes pre-ignitions, and can generally be cured by careful cleaning with a dry rag.

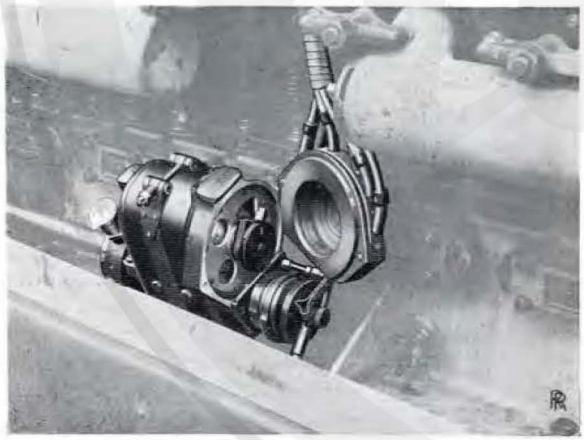


FIG. 44.
MAGNETO DISTRIBUTOR WITH COVER REMOVED.

Any defect with the distributor is generally manifest by pre-ignitions, whereas if the defect is with the low-tension contact breaker, it is manifest by mis-fires. When replacing the wires on the distributor of magneto, see that the figures or number of rings cut in the ebonite of each terminal corresponds with the figures on the distributor.

4. Carburetter Air Valve.

This can be removed by unscrewing the milled ring **A** and lifting off cap **B** with spring attached (*Fig.* 45).

The air valve **C** should be drawn out slowly and carefully, so as not to distort same or bend centre spindle.

It should be carefully wiped with a clean cloth, free from fluff; emery must not be used. Avoid any form of lubrication.

The cap carrying the spring should make an air-tight joint with dash-pot **D**.

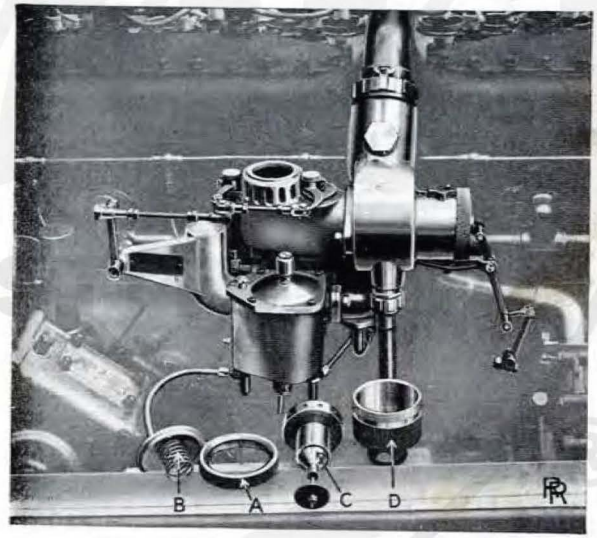


FIG. 45.
SHOWING AIR VALVE AND DASH-POT REMOVED.

APPENDIX III.

EVERY 2,000 MILES, OR MONTHLY.

LUBRICATION.

1. Oil-Well and Filter.

Unscrew with spanner the drain plug fixed in the centre of the cover of the oil-well **A** (*Fig.* 46), and let all oil out of the engine well or "sump": then take down and clean the cover **A**, the filter **B**, and suction pipe **C**.

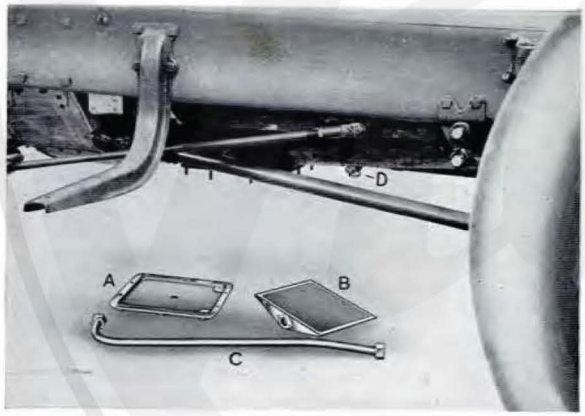


FIG. 46. SHOWING OIL-WELL AND FILTER.

To effectively clean the filter, paraffin should be violently squirted through it from the *inside* with a syringe. This removes dirt from the outside of the gauze. On no account should the filter be immersed and washed in paraffin, for such a course tends to work the foreign matter to the inside.

Then replace filter in the well loosely, *with gauze facing downward*, and refix the cover **A**, taking care to make a good joint (with good stout paper) on to the crank-chamber; then see that the unions of the oil pipes are screwed up tightly, and refill the well with a *fresh* charge of engine oil up to the overflow level. Care should be taken when replacing the cover not to damage the filter.

Whenever the oil-well, pipes, or pump are taken down for any purpose and put back again, special care should be taken when first starting the engine up (after refilling) to see that the pressure gauge reads correctly, for an "air lock" may form in the pump, which will prevent the flow of oil. Should this occur, the pipes should be "primed" by unscrewing one of the unions (*see Fig.* 47) leading from the trunk pipe to the crankshaft, and injecting oil therein by means of the oil-syringe. The unions can then be refixed and the engine started up again.

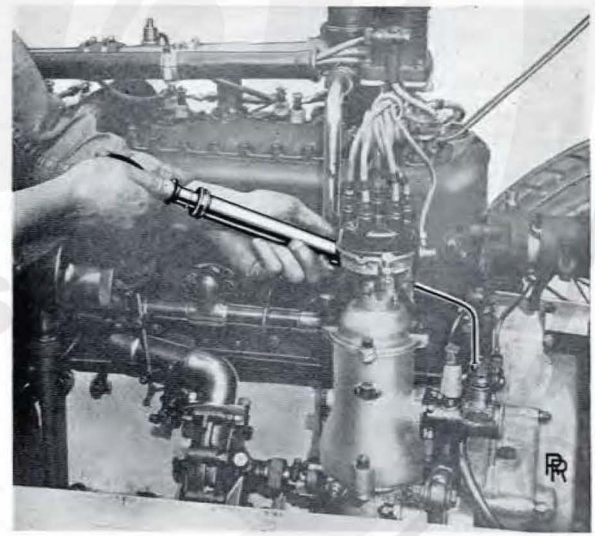


FIG. 47.

"PRIMING" THE OIL PIPES AFTER REFILLING.

4. Road Springs.

Gaiters provided with oil-gun lubricators are fitted on the springs, and gear oil should be injected by means of the oil gun, three or four turns being given on each lubricator.

It is essential that the surfaces of the spring-leaves in contact be kept well lubricated, as this affects vitally the easy riding of the chassis.

When readjusting the ball ends of the shock absorbers, see that these are neither so tight as to cause binding, nor too loose, which would set up an irritating rattle. (For correct method of adjustment, *see p.* 76.)

8. Brake Differential Gear Shafts.

Remove the plugs **D** and **E** (*Fig.* 38, *p.* 108) and inject a syringe-full of gear oil into each of the brake differential gear tubes, thus lubricating the bearings at each side of the frame.

OPERATIONS AND ADJUSTMENTS.

1. Accumulators. *(See "Care of Battery," p. 46.)*

2. Sparking Plugs.

In removing sparking plugs *always* use the special box spanner provided.

Examine each plug for faults:—

(1) The points should not be coated with oil (clean them in petrol).

(2) The insulation should not be wet, cracked, or coated with carbon.

(3) There should not be any sharp corners or "burrs" on inside end of the plug; these becoming incandescent would cause pre-ignitions.

(4) The gap at the points should be correct; these should be set to ·02" for magneto and ·03" for battery.

A special gauge is provided to ensure accurate setting.

(5) It should be noted that the battery plugs should be situated over the inlet valves, and the magneto plugs in what we call the "intermediate position." *(See further notes on p.* 53.)

5. Adjustment of Foot and Hand Brakes.

A convenient adjustment is provided for the foot brake on the off side of the frame at the hand-wheel **H** (*Fig.* 48). By means of this hand-wheel considerable wear on the brake shoes can be taken up before having recourse to altering the position of the brake levers on the back axle.

To adjust the foot brakes, first push the hand-wheel **H** in order to disengage its locking device, and then turn in a clock-wise direction until the brake ropes are tight and the pedal has resumed its normal position.

When all adjustment has been taken up in this manner, the hand-wheel **H** should be turned back again as far as it will go and use made of the adjustment which is provided on the brake shafts on the rear axle. Before altering this adjustment, the external parts of same should be cleaned

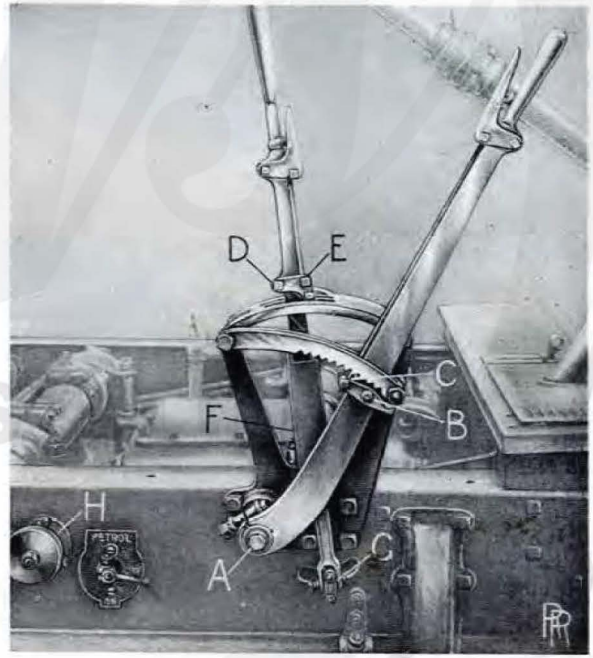


FIG. 48.
FOOT BRAKE ADJUSTMENT AT **H**.

down with paraffin in order to avoid the possibility of the mechanism becoming choked with foreign matter in the process of adjustment.

The method of adjustment here is similar both for the foot and hand brakes, except that the locking piece **D** (*Fig.* 49) on the foot-brake is situated about the middle of the shaft instead of at the end of the shaft, as in the case of the hand-brake. Remove the leather cover and slide back the locking piece **D**; this is fitted with an "**L**" slot, which engages with a pin, thus holding it clear. Slacken the nut **E** which holds the ratchet lever **F** in engagement with the part **G**. The actuating shaft (which is most conveniently held by a spanner on the boss **C**) should be moved one tooth forward, thus taking up the wear. On no account must the number of notches moved on the two ratchet levers in adjusting be unequal. Numbers 0, 1, 2, 3 are stamped on the edge of each disc to show clearly the exact amount the lever has been moved. Then tighten up nut **E** and release the piece **D** from the pin, taking care that the castellations on these parts are fully engaged (*Fig.* 49).

It is arranged that the ratchet lever **F** can only be adjusted three notches, and after moving up this adjustment one tooth, final adjustment may be made in the case of the foot-brake by means of the hand-wheel **H** already referred to. This may then again be utilised as wear occurs until it becomes necessary to alter the rear axle brake shaft adjustment another tooth, and so on until all three of the teeth have been taken up. In the case of the hand-brake, all adjustments should be made on the brake shafts on the rear axle, and it is advisable, when using this adjustment, to jack up one wheel. Then with the hand lever set one notch on its quadrant towards the "on" position, the brake should be so adjusted that it is possible to feel the brake just rubbing when the wheel is turned by hand.

It should be particularly noticed that the amount of adjustment provided as described on both brakes is sufficient for all purposes, and is so proportioned that when all is taken up it is a sign that the brake shoes require re-lining.

On no account should the lengths of the wire ropes be altered.

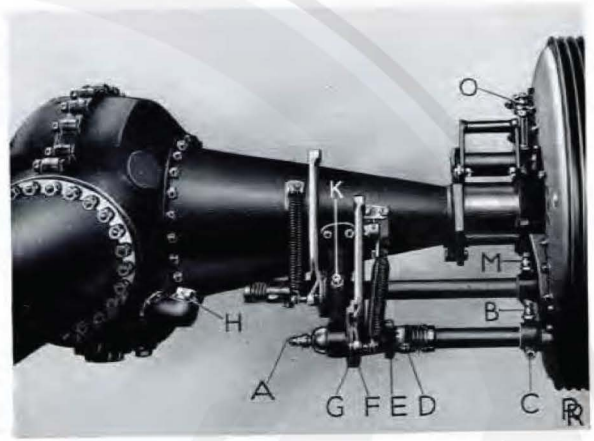


FIG. 49.
BRAKE ADJUSTMENT.

7. Treatment and Adjustment of Fan and Dynamo Belts.

The fan and dynamo belts should be removed by slackening their respective adjustments (*see Figs.* 14 and 42), then removing the ordinary wood screw holding the halves of the leather link together. The belt should be carefully scraped with a blunt knife, to remove particles of grit, etc., then the back of the belts (not the sides) should be slightly smeared with engine oil, the joints being worked to allow the oil to penetrate to the pins. Before replacing, the surplus oil should be removed by wiping with a dry rag. The tension of the belt should be noted for a few days after this treatment, and adjustment made if necessary. Adjustment of the fan belt is effected by loosening the clamping bolt **B** (*Fig.* 42) and turning the bracket which is mounted eccentrically by means of pin **C**, *then relocking*. A certain amount of longitudinal adjustment is provided in the fan bracket for lining up the two pulleys, and it should be noticed after adjustment of the belt, and before starting the engine, that the fan has not inadvertently been moved axially, so as to cause the blades to foul any part. Should the lever reach the end of the slot, the belt must be shortened. In the case of

the dynamo belt an adjustment is provided for this on the "off" side of the frame, as shown at **A** in *Fig.* 14. If either of the belts requires to be shortened, this may be done by removing in adjacent links the ordinary wood screws which fasten the halves of the links together. The screwdriver should be forced between the halves to open them, and the complete link removed (this includes the metal coupling).

V belts do not require to be really tight; they should be adjusted only gently tight.

8. Steering Gear.

This should be examined, particularly to see that the steering arms are tightly attached to the stub-axles, and that all bolts are secured with nuts and split pins, especially noticing that the nuts are tight and that the split pins are not worn through owing to a loose nut rubbing against them. The ball ends of the cross-steering rod can be adjusted when slack in the manner described in next paragraph.

Adjustment of Cross-steering Joints.

Release the check nut and make sure that the adjusting nut thread is free. Screw up the adjustment nut until fairly tight, then turn it backward for one-eighth of a turn; this will make it just free without being slack. The locking nut can then be tightened up, taking care not to disturb the adjustment.

Spring Clips.

Inspect the clips attaching springs to axles, and tighten the nuts if these are slack.

10. Low Tension Contact Breaker of Battery Ignition.

It is advisable to examine the platinum contacts of the battery ignition low-tension contact breaker and to touch these up with a very fine file *if necessary*, but care must be taken not to remove too much platinum. When closed these contacts should bed together truly and flat, and the maximum gap between them when open should be from ·018" to ·028".

APPENDIX IV.

EVERY 5,000 MILES, OR HALF-YEARLY.

OPERATIONS AND ADJUSTMENTS.

1. Compressions.

To secure regular firing, full power, good SLOW RUNNING, and to enable the engine to be started "off the switch," the compressions should be kept good. This can be tested by holding the starting handle against each compression. Poor compressions are generally caused by leaky valves or valve covers. A little oil poured around the latter makes a useful test. It is best to test one cylinder at a time by taking out an ignition plug from each of the five other cylinders.

In the case of the valve covers, and ignition plugs, the joints should be made with the special copper and asbestos washers; the faces on these washers should be kept clean and flat. These covers should be screwed up with the special key provided.

The bore of the cylinder should be of good surface and well lubricated in order to prevent gases leaking past the piston.

2. Cylinders.

These should be kept clean, and a periodical inspection made by taking out the valve covers and inserting a small electric lamp right into the cylinder. Note if there is sufficient lubrication. This is a means of ascertaining whether the engine is working with the right pressure of oil. It is essential that the cylinders should not run short of oil; but too much oil will clog the plugs, cause

smoke in the exhaust, and will eventually cause pre-ignition through excessive carbon deposit in the cylinders. (See *p.* 85, "Hints on Lifting off Cylinders.")

A sooty deposit, especially noticeable on the ignition plugs, is a sign of strong mixture.

3. Grinding Valves.

Experience would indicate that an examination should be made every 5,000 miles, the compressions being tested as indicated, care being taken that sparking plug and valve cover joints are quite tight. If the compression of any cylinder is found to be poor, the *exhaust* valve should be ground in first. To get at the valves, take off the bridges holding the exhaust chamber on and the pipe union underneath, then remove the exhaust chamber; take off valve covers; take out the valve cotter by lifting spring (with valve lifter), at the same time holding down the valve from the top; then push up and withdraw valve.

The valve should be ground in very lightly with a large screwdriver and *not* with a brace, lifting the valve occasionally with the stem and starting again in a fresh position. Use the finest emery powder and oil, finishing with emery flour and oil. *Never* use coarse emery. Occasionally wipe the valve clean and apply fresh emery and oil.

It is more economical to grind valves a little and often rather than to allow them to get into bad condition.

Whenever valves are removed the stems and guides should be thoroughly cleaned with paraffin, well polished, and some graphite rubbed in before replacing.

4. Tappets.

In all cases when the valves have been "ground in," or changed for any reason, attention should be paid to the tappets.

These should be adjusted (*Fig.* 50) so that the clearance between the tappet screw and the valve spindle is as small as possible, provided that the tappet screw does not hold the valve off its face when the engine is cold. The closer this setting the more silent will be the valve gear.

Any reasonable variation in this clearance does not affect the efficient running of the engine owing to alteration of the valve timing. A special feeler gauge is supplied, measuring ·002", and this should be inserted when the

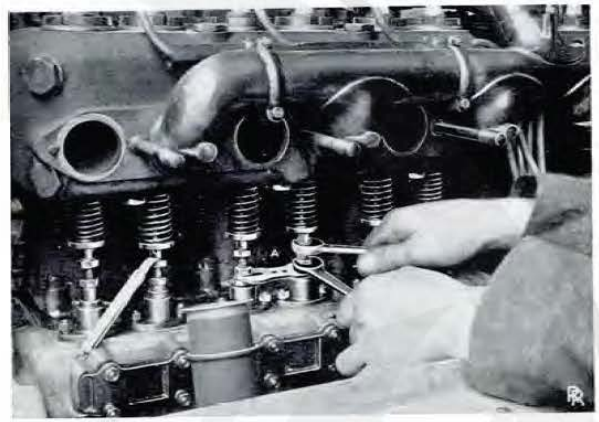


FIG. 50.

LOCKING THE TAPPET ADJUSTMENT, SHOWING FEELER GAUGE IN USE.

valve is shut. In order to obtain good SLOW RUNNING, attention should be given to all the valve tappets.

The adjustment is effected by means of a special locking spanner **A**, shown in position on *Fig.* 50. This prevents the tappet, on which the adjustment is being made, from turning.

5. Magneto Contact Breaker.

The low-tension contact maker on the magneto should be cleaned and examined carefully to see that the small lever carrying the platinum point is working *freely*, and that the platinum points are in good order and correctly set; these points should be carefully flattened if such an operation is necessary. (The small round cap must, of course, be slipped off first.) This setting is correct when the maximum break is such that the special gauge on the magneto spanner will *just* go in. It is good practice to carry a spare contact breaker for the magneto.

A defect with the low-tension contact breaker is generally manifest by mis-fires. *(See p.* 44 and 55 *for further notes regarding the Magneto.)*

6. Carburetter.

Shake the float **A** (*Fig.* 51) to discover if any petrol has leaked into it; if so, it should be returned to the makers or to a first-class tinsmith for correction.

Care should be taken when replacing the needle valve, **B**, and float to see that the guide screw engages with the slot in the balance weight of the needle valve before tightening up the cover.

7. The Water System.

The drain tap for the water system is situated just below the pump.

After the water has ceased to flow (the car being level), close this tap, *i.e.*, vertical position.

Re-fill with clean *soft* water (such as pure rain-water), always using a strainer.

The radiator should not be filled higher than the centre of the return pipe, neither should the level be allowed to get much below this. The white line in *Fig.* 52 shows the correct level.

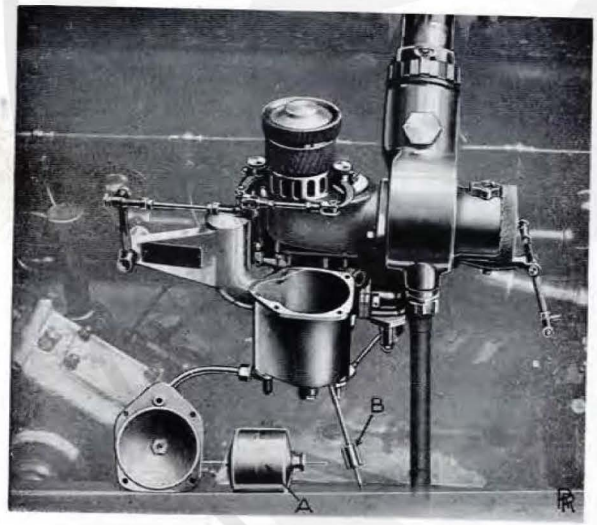


FIG. 51.
SHOWING FLOAT **A** AND NEEDLE VALVE **B** REMOVED FOR CLEANING.

Avoid using any metal rod or prong to clean the air-spaces of the radiator, as damage to the radiating tubes is sometimes caused by instruments of this kind.

If mud has collected in the air-spaces of the radiator, a soft wooden stick is the best instrument to use, and even this with care.

8. Auxiliary Oil Valve and Filter.

The auxiliary oil valve is on the front face of the dashboard, and can be cleaned by disconnecting the pipe **A** (*Fig.* 53) and unscrewing bottom nut **B**; this nut carries the gauze which forms the filter, which can then be conveniently cleaned. When replacing filter, make sure that the spring **H**, which holds the oil valve **F** to its seat, is in position.

The nipples fitted to the threaded unions which are screwed into cylinder walls should be removed and cleaned, and the pipes blown through.

If oil leaks past the valve stem **F**, the nut **K** should be screwed down *slightly*. Take care that it is not tightened sufficiently to hold the valve stem and prevent the spring from operating it.

The valve should be set to open when the accelerator pedal is depressed from $\frac{2}{3}$ to $\frac{3}{4}$ of its full travel.

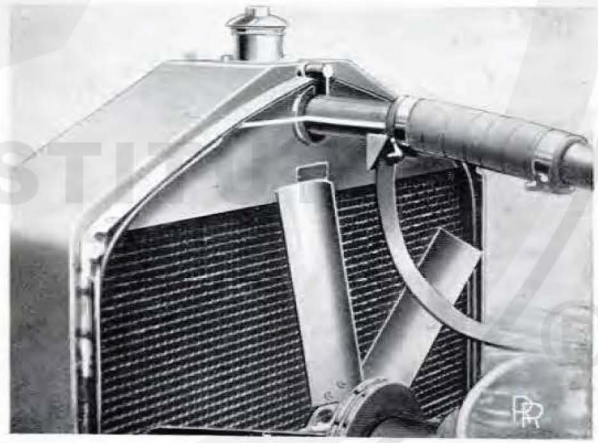


FIG. 52.
WHITE LINE SHOWS CORRECT WATER LEVEL.

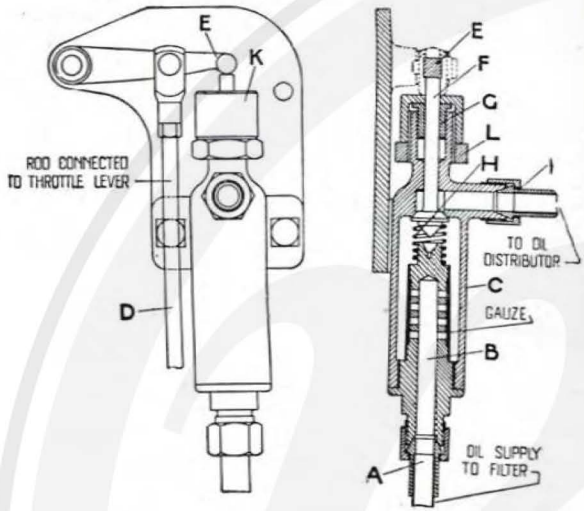


FIG. 53.
AUXILIARY OIL VALVE AND FILTER.

Loose Nuts.

It is a good plan to place the car over a pit and let a careful, skilled mechanic examine and test every nut, bolt and pin throughout the car in order to tighten up every one that has loosened at all.

APPENDIX V.

EVERY 50,000 MILES.

Should it be impossible to return the car to the makers for overhaul, it is most important that the work is put into the hands of really competent people who have the necessary skilled labour and proper appliances. A great deal of damage can be done to a car during overhaul by lack of knowledge and by carelessness. We consider this a point of great importance, and would impress upon owners the desirability of returning the car to our own Repair Shop, if this is in any way possible.

Index of Illustrations.

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