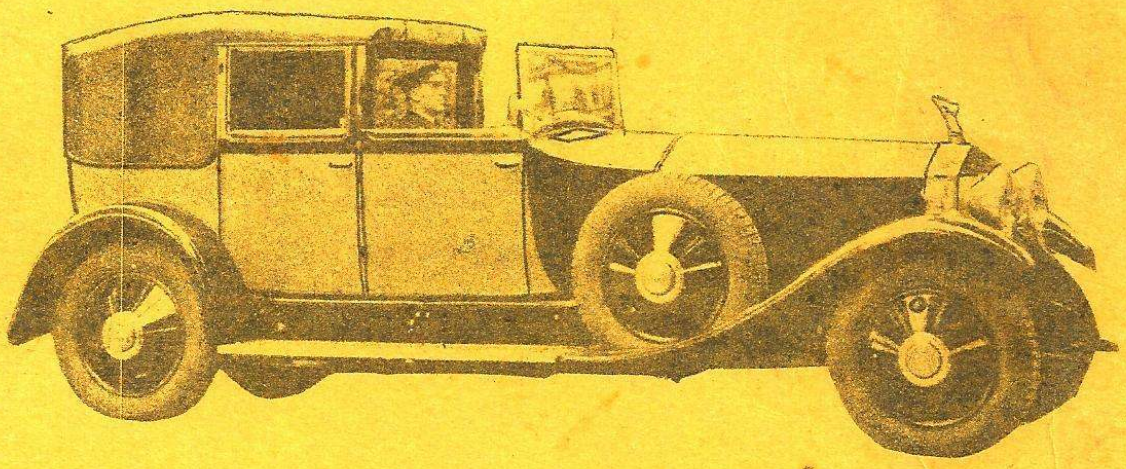
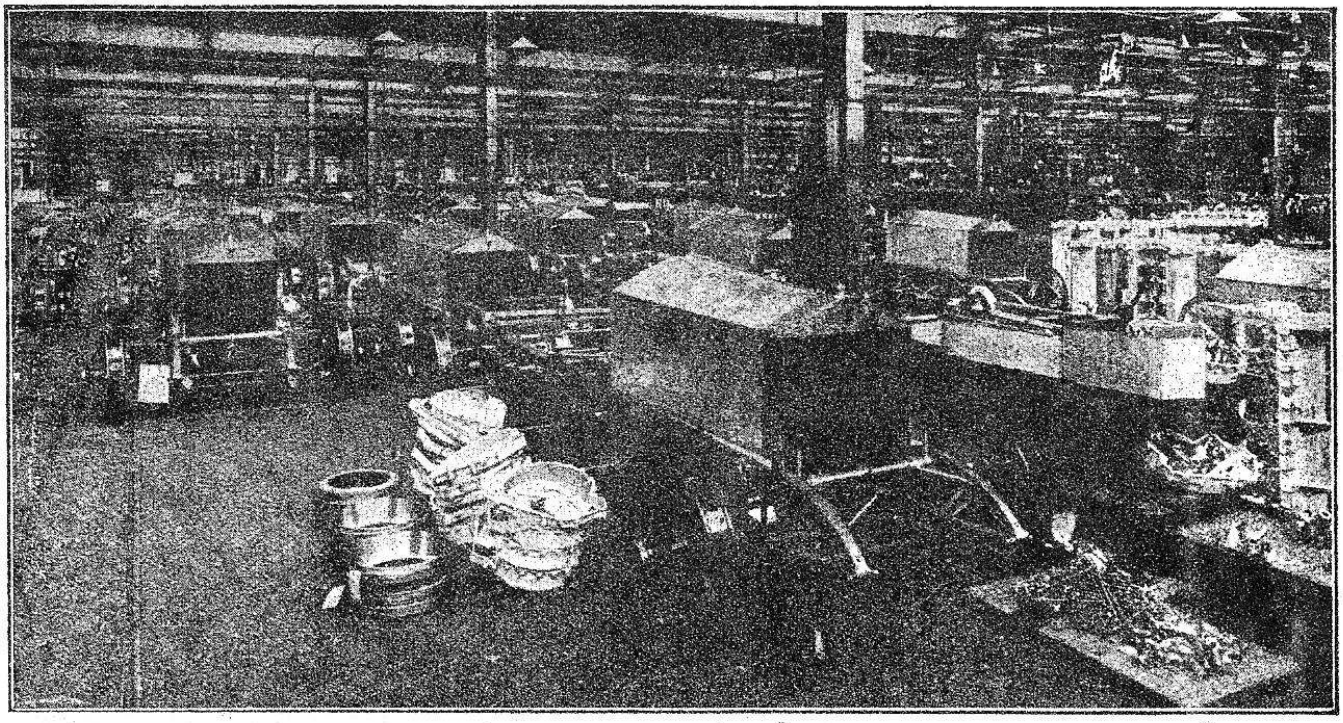


ROLLS-ROYCE

IN THE TWENTIES

SECRETS OF THE ROLLS-ROYCE.

Behind the Scenes at the Famous Derby Works. A Wonderful Series of Tests and Remarkable Attention to Detail.



A view of the assembling shop of the Rolls-Royce works at Derby.

THE Rolls-Royce car has attained such a world-wide reputation for general excellence that a peep behind the scenes in order to learn how this quality is maintained is worth describing.

Mere output is a secondary consideration at the Derby works. Excellence is their principal aim. To a casual observer, after an inspection of the methods employed in building and testing the car and its units, it seems extraordinary that any cars ever find their way to customers. The amount of testing, fitting, assembling, re-testing, stripping, and re-fitting that goes on is simply stupendous.

The inspection alone has been trebled since the Armistice. At first the amount of rejected parts rose to an alarming degree, but the lesson was soon learnt, and things have now settled down.

Constant Search for Improvement.

There is no such thing as finality in the design of this car. The search for improvement is always going on. A man may spend a fortnight designing a small bolt, but if this bolt gives ultimate and lasting satisfaction, the time has been well spent. The bolt might have been designed in five minutes and proved eventually wrong or capable of improvement, in which case it might have cost more than the well-thought-out bolt which took a fortnight to produce.

It has been said that the Rolls-Royce car is too full of small parts and general mechanism, but the company's answer to this criticism is that provided you do not realize the presence of the mechanism under the bonnet—in other words, that it does its duty without attention—it does not matter of how many pieces it is composed.

As an example of the infinite pains taken to ensure perfection, one may take the case of the back axle. Several cars are kept specially for running in axles. After the road run the axles are taken down and skilled mechanics go over the teeth one by one, cutting, grinding, and scraping until they are satisfied. Then the axle goes on to a test bench and is tested for noise. It may have to be taken down again and returned to the "dentists" to have its teeth improved, or it may pass its test, in which case it will be fitted in a chassis. The chassis must pass a 50 mile road test, and be perfect in every part. If one part is not up to the standard, the fault is corrected and the chassis has to go through its 50 mile run again. If another fault develops, the same routine is gone over until the 50 mile test is completed. Then follows a shorter road test, when the car is driven by the chief expert of the running department.

Bench Chassis Tests Under Load.

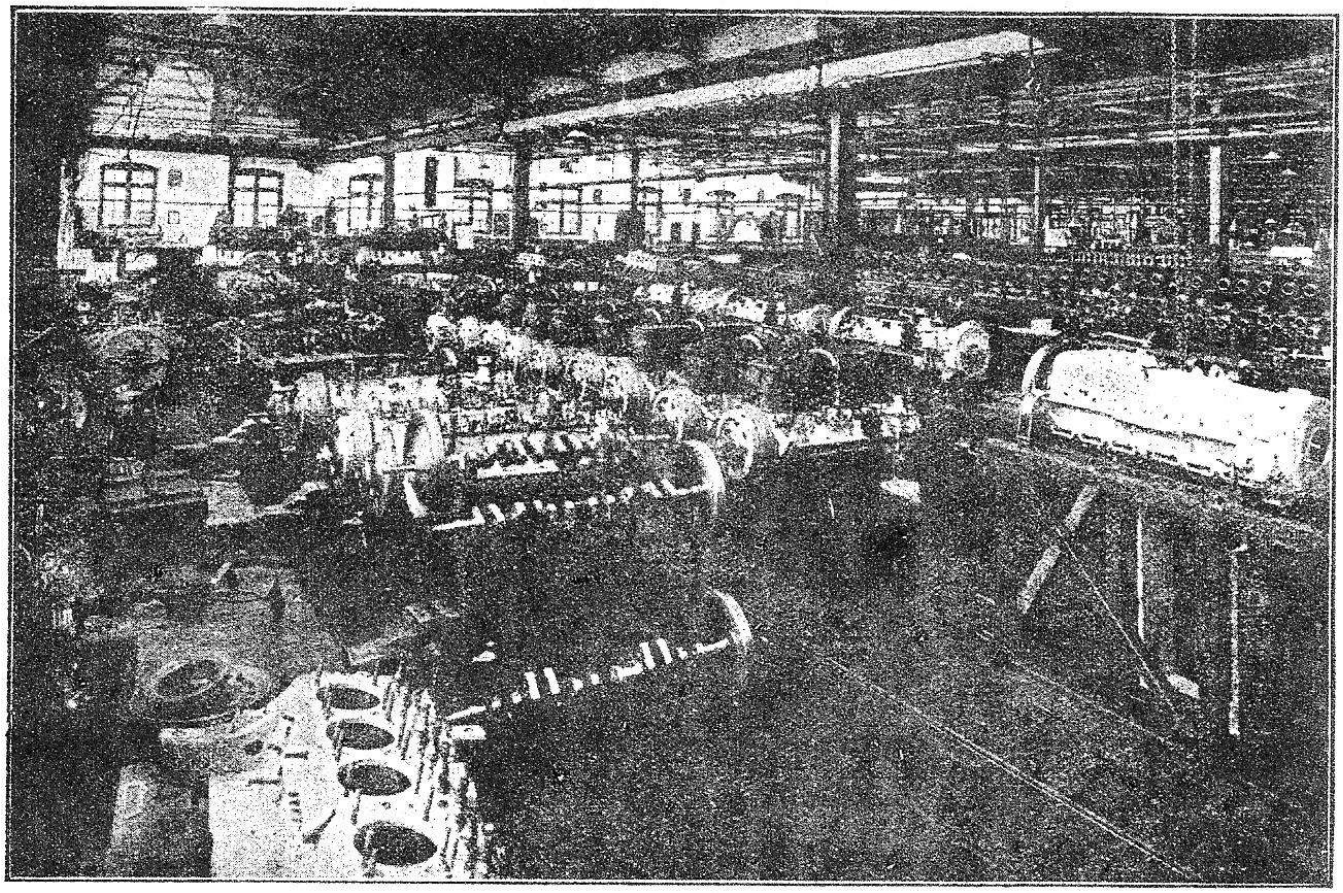
But this is by no means all that the chassis has to face. Each part and each unit has already received most rigid inspection and undergone prolonged tests suited to the work it will be called upon to perform. The whole chassis is tested on the bench under load in addition to the road test, the road wheels driving a dynamometer direct whilst the engine is run for four hours at full throttle.

Before this, however, the engine has undergone its running tests, during which the timing wheels are "run in," a special liquid being employed in order to render them dead silent. The engine is then stripped and inspected, after which it proceeds to undergo its eight hours' dynamometer

SECRETS OF THE ROLLS-ROYCE.—Contd.

test. Here the petrol, oil, and water consumption are noted and compared with the standard performance, the revolutions and horse-power developed also being observed.

In the same way the gearbox has to be subjected to prolonged tests for silence. The "dentists" are at work tuning up the teeth all day long, the amount of hand work put into the gearboxes and back axles in order to ensure perfection being simply astonishing. Indeed, to so fine a pitch of silence has the mechanism as a whole been reduced that it is now said that the contact breaker of the magneto is the noisiest part of the car. So soon as one part has been quietened, the noise of another—hitherto inaudible—makes itself heard, and so the work begins all over again.



In the engine assembly shop. Note the large number of engines going through.

Fine Limits of Springing.

The springing of the car is adjusted to such fine limits that customers have to state the exact weight of the body to be fitted and the number, weight and positions of passengers and equipment that they intend to carry. Each wheel is weighed separately with its correct load and the camber of the spring is measured. The off side front spring is adjusted differently to the near front spring, as the extra weight of the driver, and possibly the spare wheel or two, has to be accounted for on that side. On the front wheels a 25 lb. error either way is allowed, and on the back a 50 lb. error.

The experience gained in the manufacture of aero engines has resulted in improvements in manufacturing processes that were undreamed of before the war. Complicated machining and operations can now be performed which were considered impossible six years ago. In the case of materials and in the organization and inspection, much war-time learning has been incorporated in the manufacture of the cars. The employment of the aluminium piston is a notable example of the use of the new materials made possible by war-time experience.

There is probably more hand work in the Rolls-Royce car than in any other. Each car is treated as an independent unit. Parts are made to fit each other, piston to cylinder, gearwheel to gearwheel, and so on. The finest gauges in the world cannot approach this method for accuracy, although it is admitted that such a system means limited output and interferes to some small extent with interchangeability of parts, but the car when complete is as perfect as man can make it.

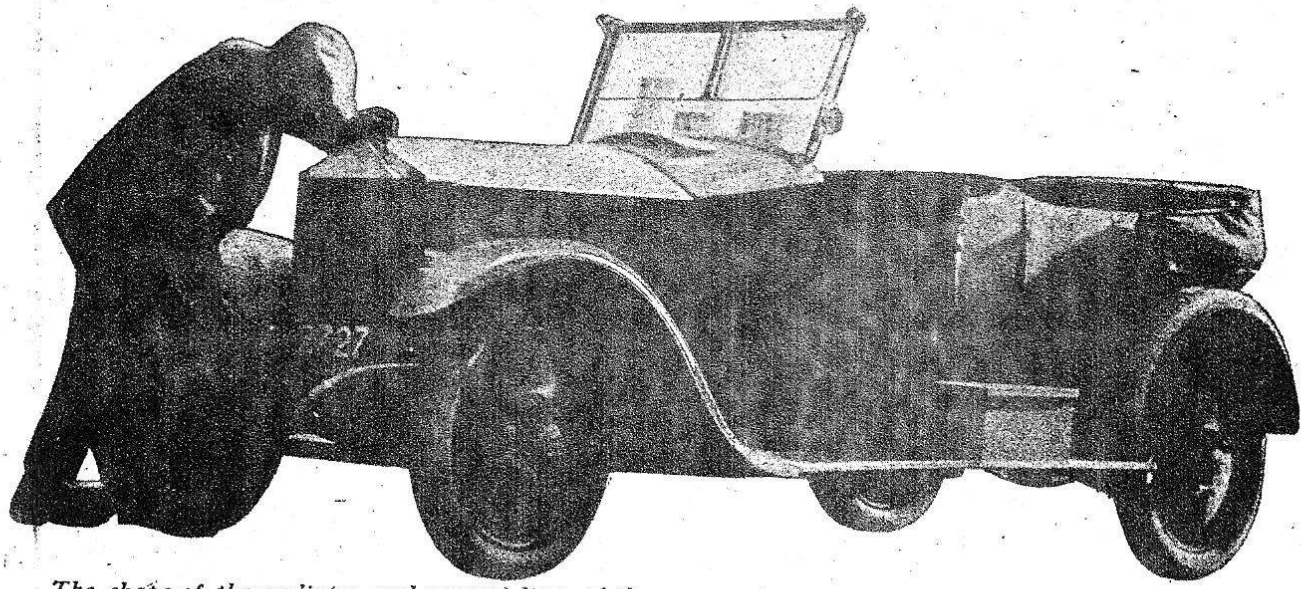
The spirit of the works, the spirit which it took Mr. Royce years of patient training to inculcate into his assistants, still lives. The idea of trying to make "the best only," apart from the spirit of making something "that is good enough," is what has made the Rolls-Royce reputation.

The place is a striking contrast to those works in which mass production is the great cry. That band of mechanics spending their lives patiently hand-grinding gearwheels to ensure silence is the keynote to the intense care of detail and love of accuracy that permeate the place.

To the patriotic motorist there is great satisfaction in the knowledge of the existence of a firm whose first aim is to maintain a spotless reputation for British engineering.

A MYSTERY CAR.

Is it an Experimental 20 h.p. Rolls-Royce?



The shape of the radiator and general lines of the car are in many ways suggestive of its make. By comparison with the height of the man at the starting handle its size can be judged.

FOR some time past it has been rumoured in motoring circles that Roll-Royce, Ltd., are contemplating the production of a model smaller than their present well-known 40-50 h.p. car, which has been their standard type for some considerable time. A concern with a name which is held in such high esteem as Rolls-Royce, Ltd., do not embark upon a new venture without taking all steps to ensure that their production shall be in every way satisfactory, and already several different models have, we understand, been undergoing strenuous road tests for some time.

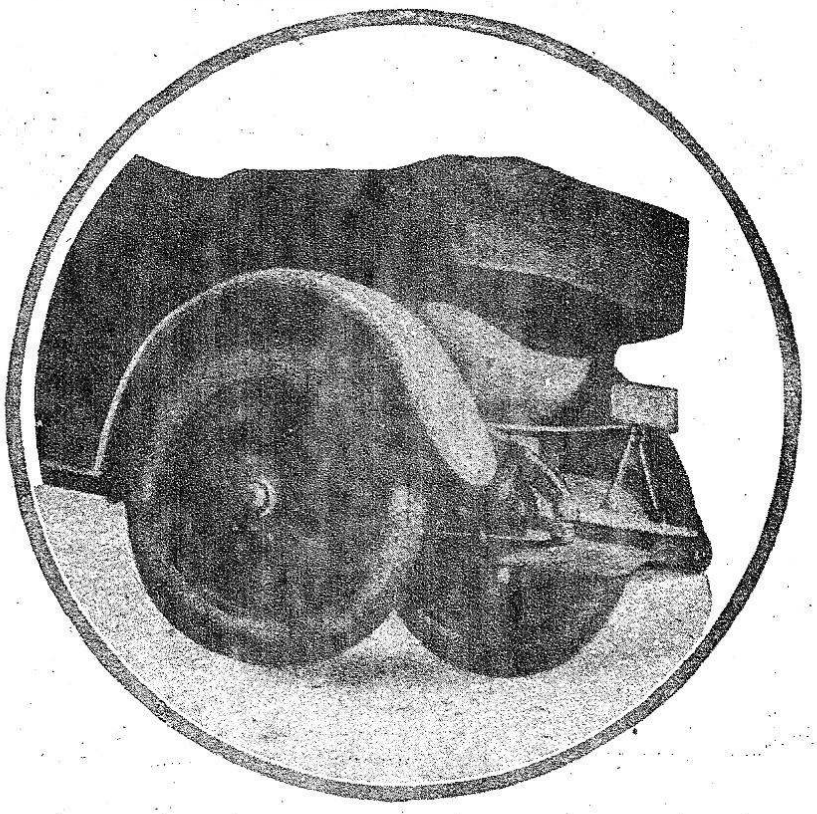
In the Sussex district a 20 h.p. car has been seen which bears certain characteristics of radiator shape and control which might lead to the supposition that it was a 20 h.p. Rolls-Royce. The power of the engine is given on the taxation disc, and the following details are observable:—The car is rated at 20.1 h.p. and has a four-cylinder engine, semi-elliptic springs front and rear (the standard Rolls-Royce has cantilever rear springs), and the body is a luxurious four-seater built by Mulliner.

The front axle bears a striking resemblance to that of the 40-50 h.p. Rolls-Royce and, as there are two brake rods running to each of the back wheels, presumably both hand and foot brakes are on the back axle.

The standard Rolls-Royce has a mixture control on the steering wheel, and this car also has a device of a similar nature. Central control is fitted, the gear lever working in a ball gate. The hand brake, too, is centrally situated.

Although this car has been seen on the road for some considerable time, its mere existence does not necessarily mean that this model is certain to be put into production at Derby. If there is any truth in certain rumours, it is but one of several models of different horse-powers which have been turned out for experimental purposes, and have been subjected to many strenuous tests.

We can assure our readers that when the policy of Messrs. Rolls-Royce is definitely settled they will have full notification of the fact in these columns, but that at the present time no final decision has been arrived at, and, therefore, inquiries will not lead to any tangible result.



A rear view, showing the semi-elliptic springs, disc wheels and large petrol tank.

The New 20 h.p. Rolls-Royce.

Striking Departure from Practice of 15 Years.

A Chassis of a Not Unusual Layout, but Incorporating Several Interesting Refinements, Priced at £1,100.

WHEN a concern that has built up a world-wide reputation on one policy decides to alter that policy after fifteen years' steadfast adherence to it, more than passing interest is attached to the change. The 40-50 h.p. Rolls-Royce chassis has been produced in numbers from year to year without its design having been altered in more than detail, and the suddenly announced introduction of an entirely new 20 h.p. chassis, to be sold alongside the older type, has naturally created no small stir in automobile circles.

We publish herewith the first complete, independent, and authoritative description of this new car, incorporating our own impressions of the chassis, together with carefully prepared illustrations, after a minute examination of all the detail features.

The existence of this smaller Rolls-Royce has been known to *The Motor* for some considerable time; in fact, we published photographs of a 20 h.p. Rolls-Royce car when it was in its experimental and test stages over a year ago. We are also able to give some general indications as to the performance of the car on the road.

CONDENSED SPECIFICATION.

Engine 21.6 h.p. (R.A.C.) six-cylinder, 3 ins. by 4½ ins. (3,150 c.c.). Unit construction, 3-point suspension, monobloc and detachable head, overhead valves, push rods. Battery ignition.

Single dry-plate clutch.

Three-speed gearbox, central levers.

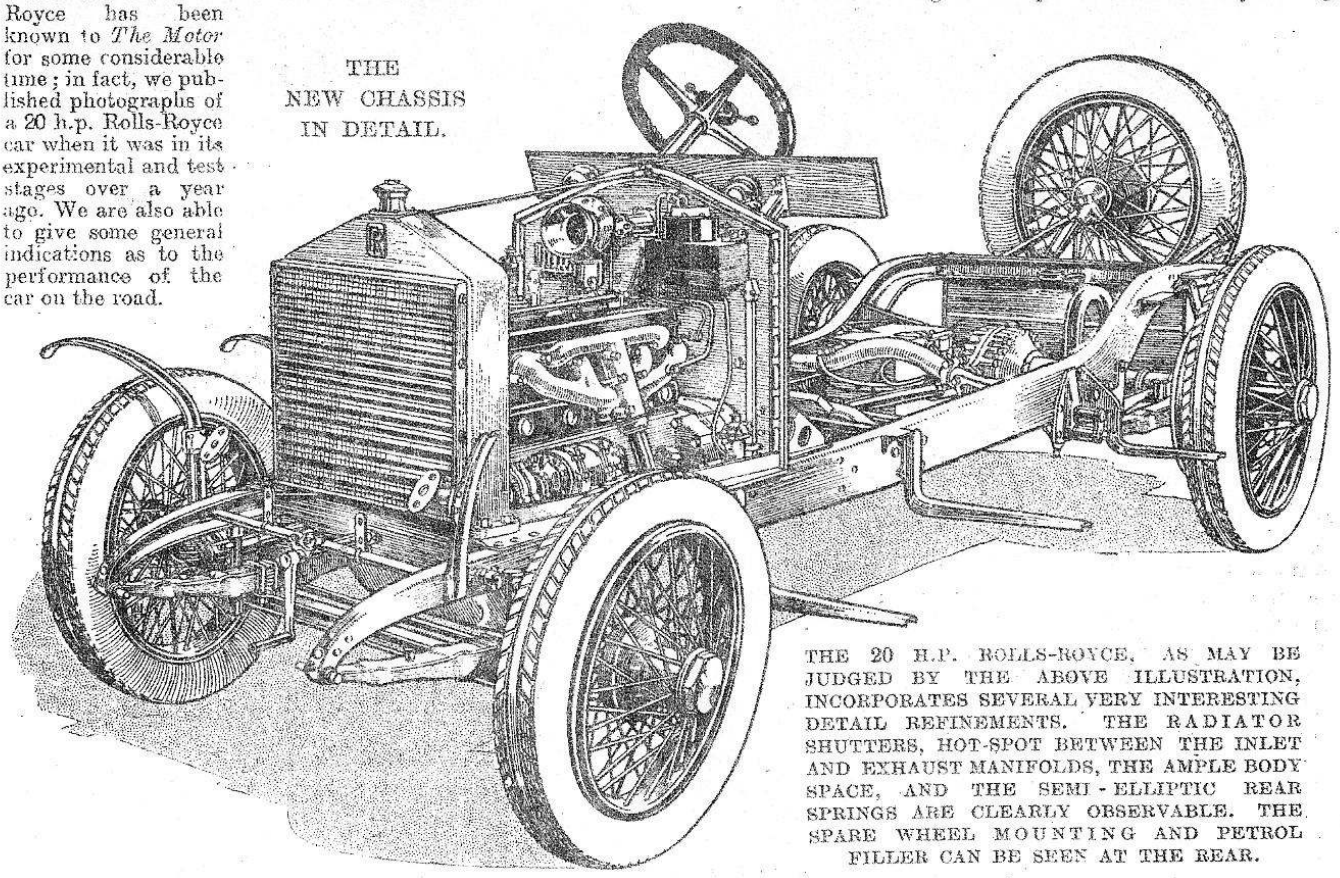
Back axle spiral bevel. Road wheels mounted completely on axle tubes—both brakes on rear wheels.

Road springs semi-elliptic—front and rear.

Wheelbase, 129 ins.; track, 54 ins.; road wheels 32 by 4½ Dunlop detachable wire. Petrol tank capacity 14 gals., vacuum feed. Chassis weight, complete with tyres and battery, 2,020 lb.

Price £1,100 (chassis).

THE NEW CHASSIS IN DETAIL.



THE 20 H.P. ROLLS-ROYCE, AS MAY BE JUDGED BY THE ABOVE ILLUSTRATION, INCORPORATES SEVERAL VERY INTERESTING DETAIL REFINEMENTS. THE RADIATOR SHUTTERS, HOT-SPOT BETWEEN THE INLET AND EXHAUST MANIFOLDS, THE AMPLE BODY SPACE, AND THE SEMI-ELLIPTIC REAR SPRINGS ARE CLEARLY OBSERVABLE. THE SPARE WHEEL MOUNTING AND PETROL FILLER CAN BE SEEN AT THE REAR.

In writing of this new 20 h.p. Rolls-Royce as a smaller car some qualification is needed. It is in no sense a "small" car, as is usually understood, its appearance being large and imposing; it is only when one sees it alongside the 40-50 h.p. model that one appreciates the difference in size. The new chassis has a wheelbase of 10 ft. 9 ins., which is well above the average, and the body space is very large when compared with the overall length of the car, an arrangement made possible by the compactness of the new engine.

The chassis takes roomy, six-seater limousine coachwork without any suggestion of disproportion, and in its appearance the bold upstanding lines usually associated with cars of this make are maintained and well harmonized. The chassis price is £1,100.

The outstanding features of this new Rolls-Royce chassis are its overhead-valved engine, centrally controlled three-speed gearbox, semi-elliptic rear springs, and the unit construction of engine, clutch, and gearbox. All these represent a total break away from previous Rolls-Royce practice. The remainder of the car reflects the 40-50 h.p. chassis in general layout, although, naturally, differences in several other details are observable. For instance, on the 20 h.p. car one ignition system (battery) only is provided, the mixture control is on the dash instead of on the steering wheel, there is no cut-out on the silencer and no auxiliary oil tank is fitted, all of which features are prominent on the 40-50 h.p. model.

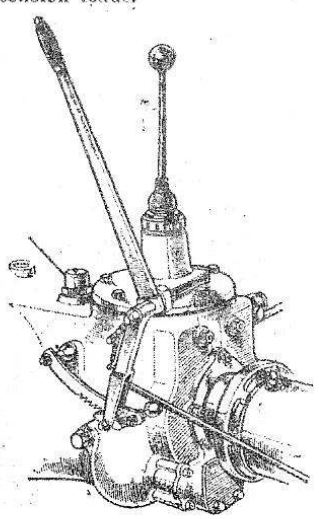
Dealing first of all with the power unit, the 20 h.p. Rolls-Royce engine is of the monobloc detachable-headed overhead-valve type, built up in a unit with a single-plate dry clutch and gearbox, the three components, however, being separate in so far as lubrication is concerned. The cast-iron cylinder block is made separately from the crankcase; on its near side it incorporates vertical tunnels, through which run the push rods to the overhead valves; on the off side the casting is left open and the water jacketing completed by means of flat plates fixed by studs, this arrangement allowing for proper distribution of the metal in the process of casting.

The detachable head is also a single, close-grained iron casting, the joint between it and the cylinder block being made by a copper-asbestos gasket, water passages being provided adjacent to the bores of all cylinders instead of the one single connection that is employed by some manufacturers of this type of engine.

The overhead-valve rocker gear is mounted on the detachable head, and is in turn covered by an easily-removable

The 20 h.p. Rolls-Royce Chassis Details.

casing normally held in position by three milled nuts. This casing carries the ignition coil—which is well out of the way of oil, heat and moisture in this position—and also tubes through which run the high-tension leads.



THE CENTRALLY CONTROLLED THREE-SPEED GEARBOX AND THE INVERTED HAND-BRAKE RATCHET.

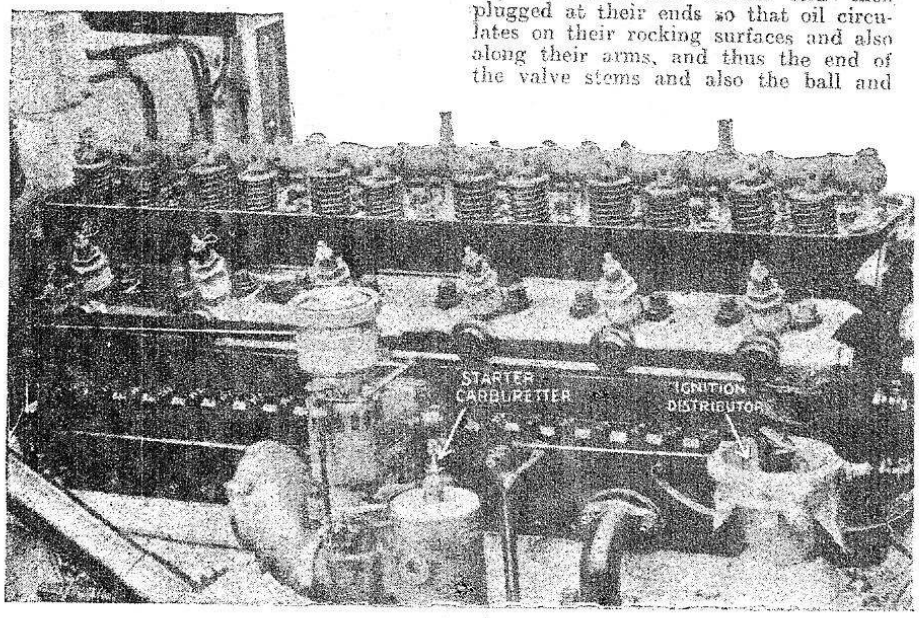
On the near side of the cylinder block are mounted the external inlet and exhaust manifolds. Mixture from the carburetter, which is mounted on the off side of the engine, runs through a passage cast in the cylinder block into the inlet manifold, and almost immediately comes into contact with a hot-spot due to heat—a commendable feature.

As to the disposition of the various components, the gear-driven dynamo is spigoted into the timing case on the near side, the vertical distributor for the ignition system and the centrifugal water pump being driven in tandem on the off side. The camshaft is on the near side, being, of course, enclosed in the crankcase.

The Internal Parts.

The internal parts of this engine are particularly interesting. At the outset it may be mentioned that it is a high-efficiency unit capable of giving off well over 50 b.h.p.; its compression ratio is 4.6 to 1, and it has a useful speed range of between 150 r.p.m. and 3,500 r.p.m., speeds which approximate to 3 m.p.h. and 65 m.p.h. on top gear. The crankshaft, which has hollow crankpins, is mounted on seven white-metal bearings to ensure rigidity, and is provided at its forward end with a vibration damper of the usual Rolls-Royce plate type. The whole of the timing gear is of helical-toothed pinions. The camshaft is also rigidly mounted in multiple bearings to prevent whip.

The valve gear is of outstanding interest, and, in view of recent controversy pro and con overhead valves, its layout should be considered in conjunction with the lubrication system. The sump holds a gallon of oil, this lubricant being circulated under pressure by an immersed pump to the main bearings, a branch lead serving to feed the valve and timing gear. An external oil pipe runs to the hollow shaft upon which are mounted the rockers of the overhead-valve gear. These rockers are drilled and then plugged at their ends so that oil circulates on their rocking surfaces and also along their arms, and thus the end of the valve stems and also the ball and



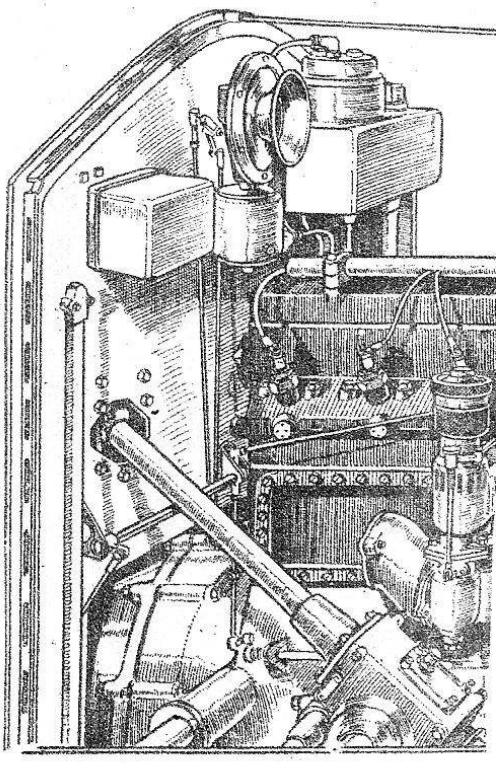
WITH ITS SPARKING PLUGS SET AT AN ANGLE IN THE ALMOST SPHERICALLY SHAPED COMBUSTION HEAD, THE NEW ROLLS-ROYCE ENGINE IS EQUIPPED WITH OVERHEAD PUSH-ROD OPERATED VALVES. OBSERVE THE MODIFIED R.R. CARBURETTER AND THE AUTO-CONTROLLED IGNITION DISTRIBUTOR.

that is formed by a surface joint between the junctions of the inlet and exhaust branch leads. This joint is intended never to be broken. The manifolds are specially treated to prevent them from assuming a rusty external appearance

D16

socket joints between the tops of the push rods and the ends of the rockers are supplied with lubricant under pressure. To some extent, therefore, an oil-cushioning effect is obtained, making for silence.

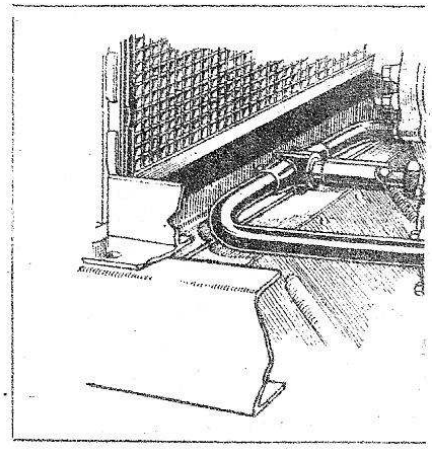
An interesting feature in connection with the Rolls-Royce valve gear is the fact that the valve clearance adjustment is provided on the *tappets* instead of on the rockers, access to this adjustment being afforded by two detachable plates on the near side of the cylinder block casting. It is observable that the push rods are very slender in section, and the whole valve gear is light, although, of



T..E OFF SIDE OF THE 20 H.P. ROLL TYPICAL ROLLS-ROYCE PRACTICE IS S CHASSIS. WITH A BORE AND STROK RANGE TO OVER 3,500

course, adequately strong, preventing any floating of the valves at high engine speeds. The normal valve clearance is three-thousandths of an inch, and the valve lift is five-sixteenths of an inch.

It may here be mentioned that the valve seats in the cylinder head are water cooled to prevent distortion, and, in order to prevent the oil, which naturally is present on the upper side of the detachable head, from finding its way down the valve stems, felt washers are fitted

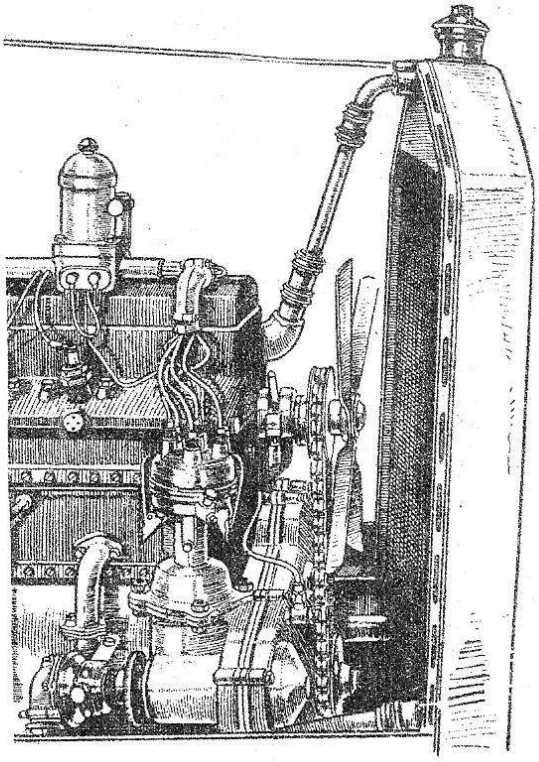


HOW THE ENGINE IS MOUNTED U-TYPE TUBULAR FRONT SUPPO FLEX

THE CAPTIONS AND ILLUSTRATIONS ON THE RIGHT HAND SIDE OF THE PAGE CONTINUED ON PAGE 28.

inside the valve springs, these latter being fixed by the ordinary cone and cup method.

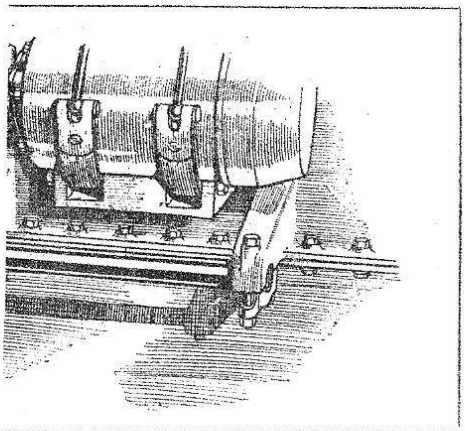
Turning now to the pistons, these are of aluminium, and carry three rings above the gudgeon pins, and their skirts are also split to prevent slap at low speeds when cold. The gudgeon pins are pinned into the pistons, and are lubricated under pressure. One of the



NGINE. IT IS PLAINLY APPARENT THAT REFLECTED IN THE FINISH OF THE NEW X 4½ IN. THE 20 H.P. UNIT HAS A SPEED) DEVELOPS OVER 50 B.H.P.

piston rings acts as a scraper, and we understand that the oil consumption of the new Rolls-Royce engine is particularly light. The overall engine layout is notable in that it provides for a combustion-head shape that is in keeping with the latest ideals, the head being almost circular in plan, slightly curved in section, and the points of the K.L.G. sparking plugs, which are inserted at an angle, are close to the inlet ports.

The unit incorporates several small



CHASSIS, THE SKETCH SHOWING THE EE-POINT ATTACHMENT, PREVENTING ROVIDED.

Points About the New Engine Explained.

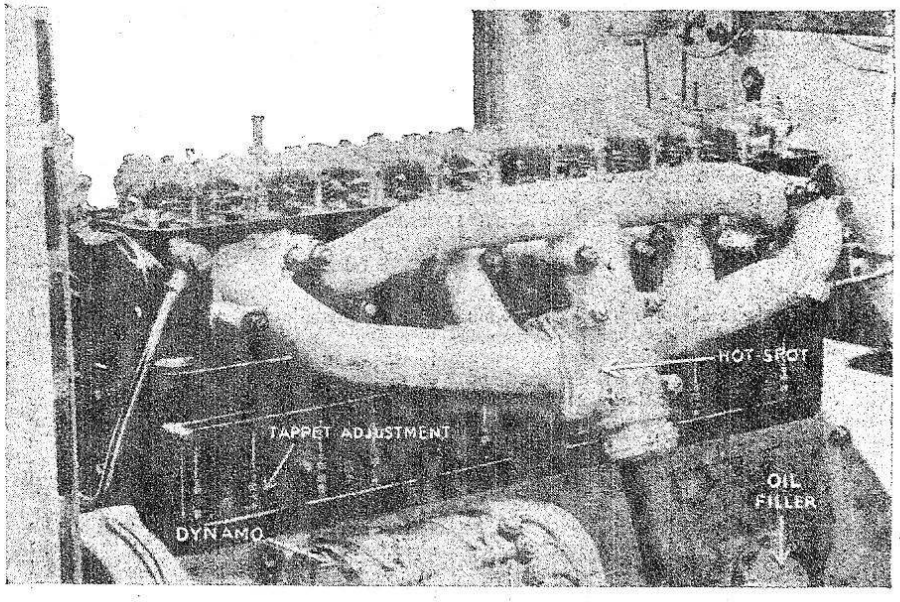
but important details that are worthy of more than passing comment, particularly as regards the carburation and ignition. The carburetter is a modified pattern of that which is fitted to the 40-50 h.p. Rolls-Royce, the controlling piston being vertical instead of horizontal. It has two adjustable jets controlled from the dashboard, and it also is provided with what is fundamentally a separate carburetter for starting. When the main butterfly throttle is shut and the small lever on the dash is turned, this carburetter is put into communication with the induction pipe, and provides a supply of rich but properly vaporized mixture that is calculated to ensure an easy start from dead cold.

Auto-controlled Ignition.

The governor-controlled throttle, which is such an outstanding feature of the 40-50 h.p. Rolls-Royce, is not fitted.

Particularly interesting is the fact that the crankcase is connected up by a half-inch bore pipe to the main air inlet, so that crankcase fumes are absorbed by the engine, preventing them from reaching the passengers in the car; at the same time, to some slight extent upper cylinder lubrication is provided.

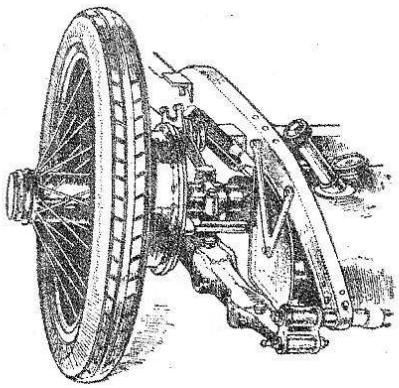
The ignition system is by battery and coil only, and undoubtedly the choice of this feature by such a well-known designer as Mr. F. H. Royce will go far towards popularizing it in this country. The distributor is provided with a spark advance and retard range of 35 degrees from the steering wheel control, but, additionally, it is centrifugally controlled so that no matter in what position the



ADJUSTMENT OF VALVE CLEARANCE ON THE NEW ROLLS-ROYCE IS EFFECTED AT THE HEAD OF THE TAPPET AND NOT ON THE ROCKER, AS IS MORE USUALLY THE CASE ON THIS TYPE OF ENGINE. OBSERVE THE HOT-SPOT BETWEEN THE EXHAUST AND INLET MANIFOLDS, THE MOUNTING OF THE POSITIVELY DRIVEN DYNAMO, AND THE OIL-FILLER.

ignition advance and retard lever may be placed, a self-adjusting 12-degree advance and retard is automatically afforded, according to the speed of the engine. This is a very clever feature, and makes for elasticity of performance which is independent almost of the skill of the driver.

As regards the cooling system, 3½ gallons of water are contained in the system, and radiator shutters will probably be fitted as standard, either hand or thermostatically controlled. The four-bladed fan has its shaft spring loaded, so that the Whittle driving belt is always in correct tension, and a thermometer is provided on the dashboard, its temperature-indicating tube being fitted to the



A REAR VIEW OF THE SEMI-ELLIPTIC REAR SPRINGS, WHICH SHOWS ALSO THE ASBESTOS PADDED BRAKE DRUMS, PETROL TANK FILLER, ITS GAUGE, AND THE PROGRESSIVE SHOCK ABSORBER.

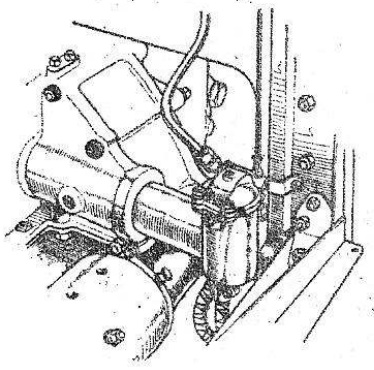
rear end of the cylinder block, so that it is the actual heat of the water in the cylinder jackets that is indicated and not that of the radiator. The shutters as at present fitted are controlled from the dash, and are of the horizontal slit type.

The dynamo is arranged so that it gives a big output of current at low speeds, gradually decreasing as the r.p.m. mount up, so that overcharging

THE 20 h.p. ROLLS-ROYCE.—Contd.

of the batteries is prevented when on tour, and an adequate supply of current is maintained in town. The six-volt accumulators, it may be mentioned, are slung inside the chassis at the rear, all the wiring is run through aluminium tubes wherever possible, and it is of the single-pole type, this making for sturdier construction and less likelihood of short circuits. The starter motor, which, like the rest of the electrical equipment, is of Rolls-Royce manufacture, is fitted low down on the near side of the crankcase, its pinion engaging with teeth cut on the flywheel—another departure from previous Rolls-Royce practice. This pinion, incidentally, has an overhang bearing which prevents whip and the development of noise.

The starter-controlling switch is very ingenious. Mounted on the near side of the chassis, at the bottom of the dashboard, is what appears to be a vertical aluminium tube about 4 ins. long. This is kept filled with oil. The contact surfaces for the starting current are mounted inside it and are thus immersed in oil, which prevents sparking and prevents any danger of fire. The switch itself is operated by a neat pedal situated on the floorboards, where it is not quite so well out of the way of the passenger's feet, perhaps, as it might be.



THE OIL-IMMERSED STARTER SWITCH IS A NOVEL FEATURE. NOTE ALSO THE STARTER MOTOR MOUNTING.

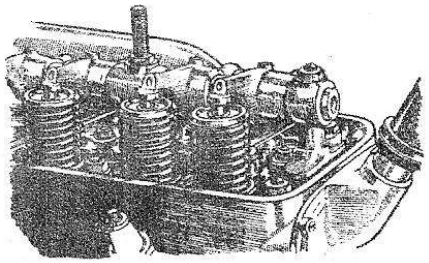
The Transmission.

From the engine the drive is taken to the gearbox through a clutch which consists of a single steel plate, working "dry," between two Ferodo-lined surfaces. This is very light in action, and as the inertia of the clutch shaft is small, gear-changing should be particularly easy and delicate. The gearbox is mainly notable for its compactness. It holds half a gallon of oil, the layshaft being mounted underneath the mainshaft and all the bearings are particularly well arranged to provide the utmost stiffness, so that both long life and silence should be assured.

The centrally situated gear lever, incidentally a feature which one frankly did not expect to find on a Rolls-Royce, is provided with an invisible gate and an interlocking device which ensures that two gears cannot be meshed at once, and it works in the reverse manner to that of most centrally controlled three-speed cars, first gear being towards the driver and back, second being across the gate and forward, and top speed back to the left. There is no stop to prevent the reverse gear teeth being unintentionally kissed.

The mounting of the power unit in the chassis is very ingenious. At the front of the engine there is a neat U-shaped sub-frame made up of tubes. This is connected to the chassis through a central bearing on the front cross-member and is bolted to two arms on each side of the engine. At the rear two tubes extend horizontally from the aluminium flywheel casing and are coupled by socket joints to the chassis side-members. Thus perfect three-point suspension of the engine is obtained, absolutely preventing any possibility of trouble through whatever chassis flexion may take place on very bad roads.

Three standard back axle ratios are provided, the normal one giving 4.28 to 1 on top, 6.98 to 1 on second, 13.57 to 1 on first, and 18.40 to 1 on reverse. This is with a gear reduction of 14 to 60 on the final drive and represents the ratio suitable for an open four-seater. With standard tyres this gives 22-23 m.p.h. at 1,000 r.p.m. of the engine.

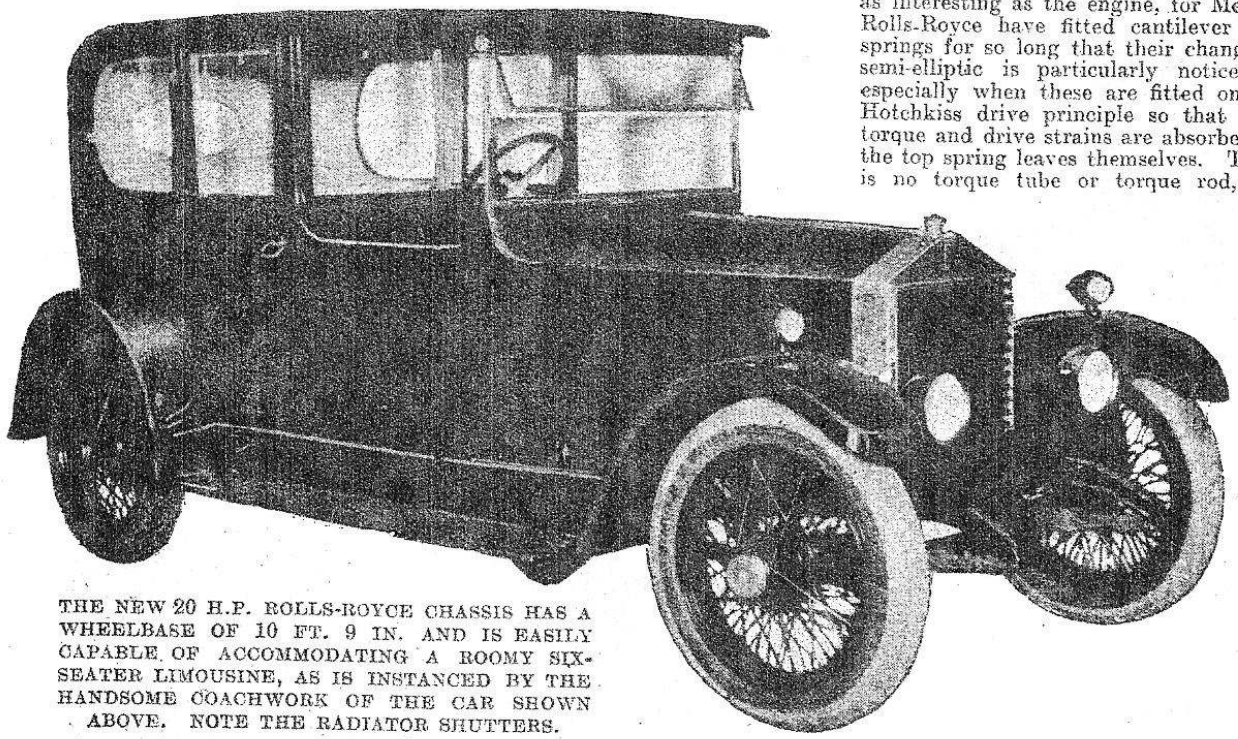


THE OVERHEAD-VALVE ROCKERS; FORCED-FEED LUBRICATION IS PROVIDED VIA THE ROCKER SHAFT.

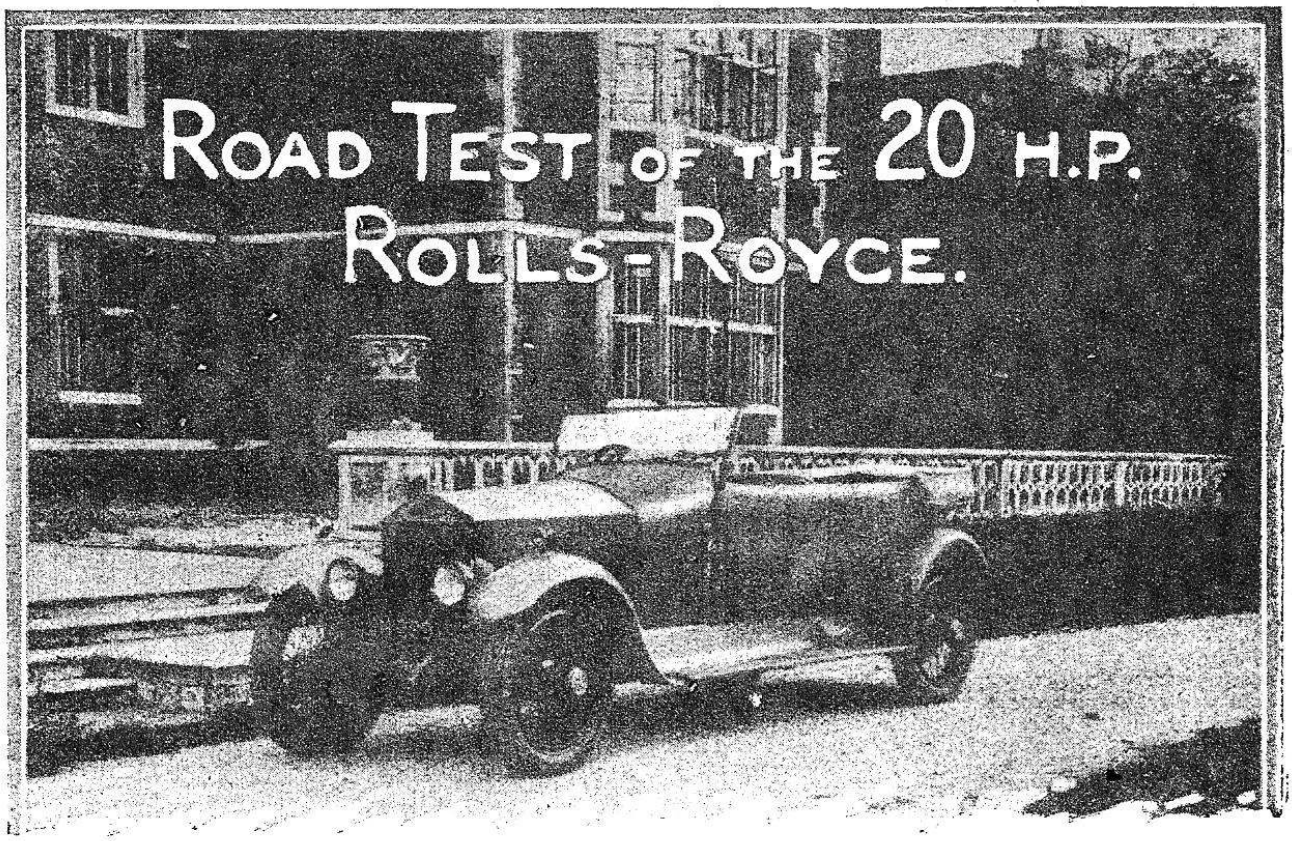
Undoubtedly the rear portion of the new 20 h.p. Rolls-Royce chassis is fully as interesting as the engine, for Messrs. Rolls-Royce have fitted cantilever rear springs for so long that their change to semi-elliptic is particularly noticeable, especially when these are fitted on the Hotchkiss drive principle so that both torque and drive strains are absorbed by the top spring leaves themselves. There is no torque tube or torque rod, the hollow propeller shaft being exposed; it is provided with sliding block universals at each end.

The rear springs are long and are arranged so that they lie almost flat when under load; they are under-shackled at their rear ends and are slung underneath the axle. Particular care apparently has been taken to ensure that the unsprung weight of the back axle is as low as is possible. Thus the differential casing is of aluminium, the axle tubes being of steel, and the axle is, of course, of the full-floating type. The outside casing is braced by a rod running between the spring pads and underneath the differential casing.

Both brakes, which are cable-operated through the well-known Rolls-Royce differential-type compensating gear, are situated side by side in wide and unribbed drums on the back wheels, the shoes being aluminium lined with Ferodo. It has for some considerable time past been the aim of designers to obtain really silent brakes, and Messrs. Rolls-Royce, Ltd., have adopted the system of bolting



THE NEW 20 H.P. ROLLS-ROYCE CHASSIS HAS A WHEELBASE OF 10 FT. 9 IN. AND IS EASILY CAPABLE OF ACCOMMODATING A ROOMY SIX-SEATER LIMOUSINE, AS IS INSTANCED BY THE HANDSOME COACHWORK OF THE CAR SHOWN ABOVE. NOTE THE RADIATOR SHUTTERS.



ROAD TEST OF THE 20 H.P. ROLLS-ROYCE.

Liveliness, Quietness, and Marked Road-holding Propensities Characterize the Latest Production of Famous Manufacturers.

EVERY make of car seems to possess certain characteristics in its performance that distinguish it from other marques. This inbred trait, as it may well be termed, will often be found in a whole series of models ranging from an 8 h.p. car up to the 40 h.p. super-chassis made by the same concern, and the new 20 h.p. Rolls-Royce provides a strikingly good instance of this fact.

Our first—almost involuntary—remark after we had ridden in the car for no more than 100 yds. was to the effect that it was certainly a Rolls-Royce. From that much may be deduced. Those who are conversant with the behaviour of the 40-50 h.p. model will realize that the reproduction of its more prominent characteristics in a smaller chassis is no mean achievement. It is the equivalent of saying that the new 20 h.p. Rolls-Royce is particularly silent, well sprung, and is endowed with that peculiar verve and response that are the prerogative of only the best cars.

In order to give our readers an authoritative impression of the behaviour of this very interesting car on the road it would be well for them to accompany us in spirit on the run which we were privileged to undertake with the demonstration car, which run, incidentally, was the first time any member of the Press had travelled any distance in the new 20 h.p. Rolls-Royce.

First, then, as regards appearance. The four-seater open coachwork which was fitted to this particular chassis had good external lines, except for the fact that the harmonization between the bonnet and the dash was not quite so nice as it might have been, a somewhat bulky effect when seen in a three-quarter front aspect being produced. The body sides are high and the seats low, and on sitting in the car one receives the impression that ample protection is afforded, particularly in the rear seats, where there was, in point of fact, rather more leg-room than was available in the forward compartment. To be perfectly frank, the distance between the back of the driving seat cushion and the pedals was not sufficient for a tall man, while there was none too much width for two full-grown adults sitting abreast. This latter feature is entirely due to the fact that the body sides are much higher than is usually the case, and it must be clearly understood that the coachwork to which we refer was one of the first bodies to be fitted on the 20 h.p. Rolls-Royce chassis, and may be regarded, therefore, in the light of an experimental production. We have no doubt that the faults of which we speak will be remedied.

With the radiator thermometer on the dashboard showing 60 degrees C.—that is, with the water-jackets normally cold, —the engine started up with almost surprising celerity immediately the starter motor pedal switch was depressed. It at once became apparent that the Rolls-Royce differs from the average run of cars. Instead of the noisy grinding of gears, such as is usually encountered when a starter motor is put into action, there was a faint "cluck" as the current was switched on, and after that no sound until the engine fired. The 20 h.p. Rolls-Royce is a two-gear car. One can start from a standstill with absurd smoothness on second speed, and during the whole time that we were in the car first gear was not engaged. The clutch is particularly smooth; the engine is dead quiet. There is not even a hiss of air through the carburetter to give indication of its action, and even when the bonnet is opened the only component that may be said to give off any audible sound at all is the large four-blade fan. Normally, a fan is regarded as being the quietest accessory, and it gives some idea of the silence of the new Rolls-Royce engine when one says that an air draught no fiercer than that to be encountered on other cars was distinctly audible.

This silence is retained throughout the whole of the engine speeds. There is no valve clatter, and, in fact, the engine might be replaced by a smoothly running electrical motor for all the notification one receives of the fact that it is an internal-combustion engine.

It is rather difficult to reconcile oneself to the idea of a central gear control on a Rolls-Royce. From the driver's point of view it is certainly not so convenient as the normally situated gear lever, while it gives the passenger a sense of having his accommodation cramped, by the fact that his knees are apt to touch the brake or gear levers, and, subconsciously almost, he feels duty-bound to move his rather limbs whenever the driver changes gear.

Admittedly this trait is not so apparent as it might be on the new Rolls-

CONDENSED SPECIFICATION.

***Engine:** Six-cylinder, bore, 3 ins.; stroke, 4½ ins.; 3,150 c.c. Treasury rating, 21.6 h.p. Unit construction, overhead valves.*

***Gearbox:** Three speeds, central control.*

***Suspension:** Semi-elliptic springs front and rear.*

***Brakes:** Operating on rear wheels.*

***Petrol Consumption:** 22 m.p.g.*

***Price:** Four-seater touring car, £1,595.*

MANUFACTURERS: Rolls-Royce, Ltd., 14-15, Conduit Street, London, W.1, and Derby.

THE 20 H.P. ROLLS-ROYCE ON THE ROAD.—Contd.

Royce, for gear changing is exceptionally infrequent.

As we stated when we first fully described the car, the new Rolls-Royce has an exceptionally high power-weight ratio, and this, coupled with the smooth, decisive power delivered by the engine at comparatively low rates of revolutions, makes the car exceptionally lively.

There is perhaps no better test for the qualities of a car than driving through streets that are filled with loose traffic. Acceleration is of paramount importance, as are good brakes, and in both these respects the new Rolls-Royce is particularly fine. On top gear it takes precisely 10⅘ secs. to accelerate from 10 m.p.h. to 30 m.p.h. on the level. Any motorist can compare this with the performance of his own car, which will give him some idea of the powerful surge forward that is the result of opening the throttle on the 20 h.p. Rolls-Royce. Between 20 m.p.h. and 40 m.p.h. acceleration is even better, and the great feature of the car is that the engine responds instantly throughout its whole range, and seems to propel the car without the slightest effort.

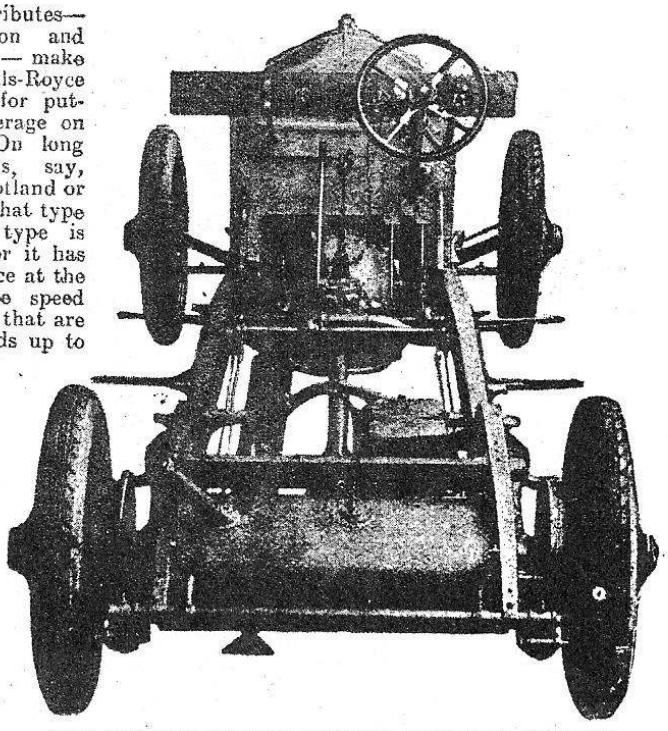
Then as to the suspension. It has been suggested that it was retrogressive policy on the part of the manufacturers to fit semi-elliptic rear springs to their new model. Whatever may be the theoretical considerations that can be brought forward in favour of the retention of cantilever rear springs, we have no hesitation in saying that, in practice, the semi-elliptic rear springing of the 20 h.p. model could not easily be bettered. The springs appear to be very supple at low speeds, and one can traverse really bad stretches of tramlined stone setts without their presence being in any way noticeable.

The test of good springing is whether the wheels will hold the road when they are heavily braked, and this is perhaps the most remarkable feature of the new Rolls-Royce. Dead silent in action, the rear brakes are exceptionally powerful, and their progressive action frankly was so good that it was almost disturbing for us, accustomed to ordinary brakes, to be a passenger in the car until we had grown to realize what remarkable stopping power they possess.

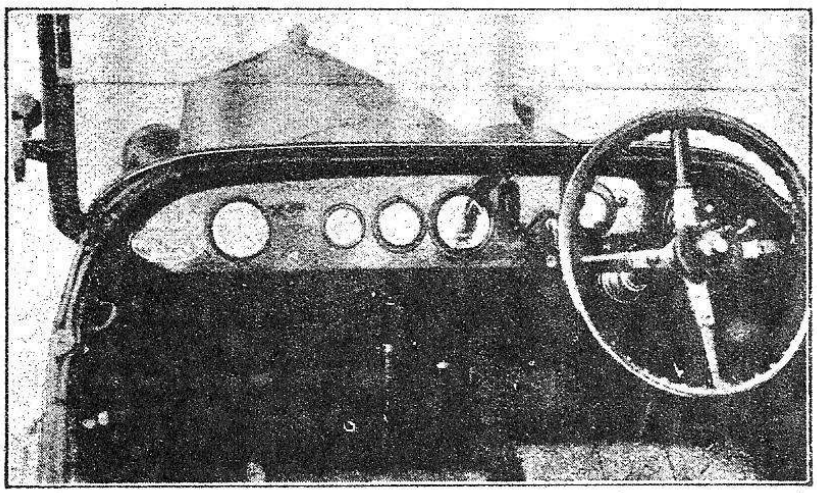
These two attributes—quick acceleration and rapid retardation — make the 20 h.p. Rolls-Royce very good indeed for putting up a fast average on ordinary roads. On long journeys — such as, say, from London to Scotland or on other routes of that type —the 40-50 h.p. type is naturally faster, for it has a better performance at the higher end of the speed scale, but on roads that are good only for speeds up to 50 m.p.h., the 20 h.p. model seems to do everything that could be desired; and, what is more, its performance throughout is characterized by refinement in operation that is, perhaps, peculiar to this make of car.

The petrol consumption is in the neighbourhood of 22 m.p.g., and the oil consumption is correspondingly low. Slow running on top gear is excellent, and one can confidently get out of the car and walk alongside it while it is moving on its direct ratio. Pick-up from this low speed up to 55 m.p.h. is clean, progressive, and, as we have stated, very rapid. The steering is light and sensitive, and it may here be mentioned for the benefit of those who deplore the substitution of a three-speed gearbox for one which provides four ratios, that the driver does not normally miss the extra gear on the 20 h.p. model, for its flexibility on top gear almost counterbalances the omission. When one realizes that on top gear the 20 h.p. Rolls-Royce will climb a half-mile rise of 1 in 7 at 23 m.p.h., one obtains a true idea of the remarkable torque that the engine delivers at low speeds. In every respect, except that of the comfort of the particular coachwork we tried and, as we have said, the central gear control, the new Rolls-Royce is fully up to the standard that has been achieved by its predecessors.

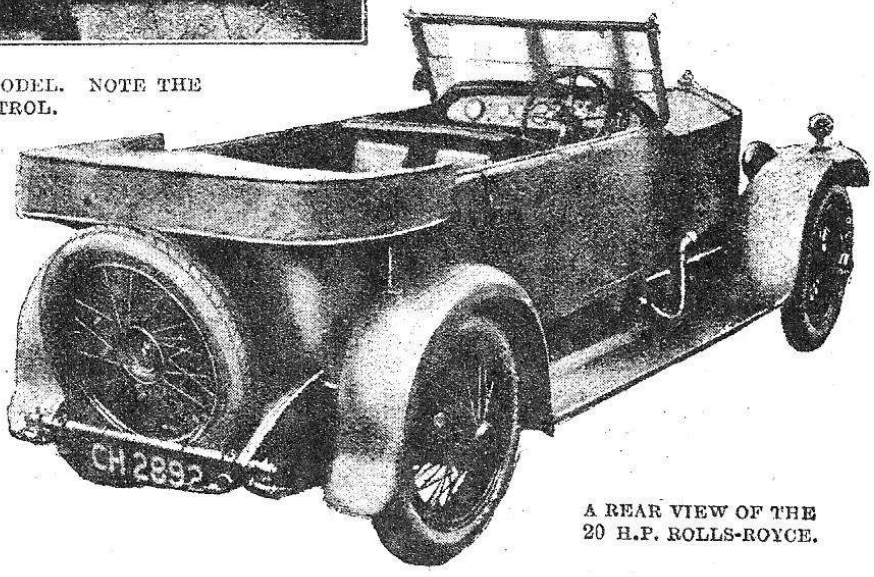
A gratifying number of orders for the car have been received, we understand, from well-known motorists.



THE LAY-OUT OF THE CHASSIS, WHICH IS REMARKABLE FOR MANY EXCELLENT DETAILS.



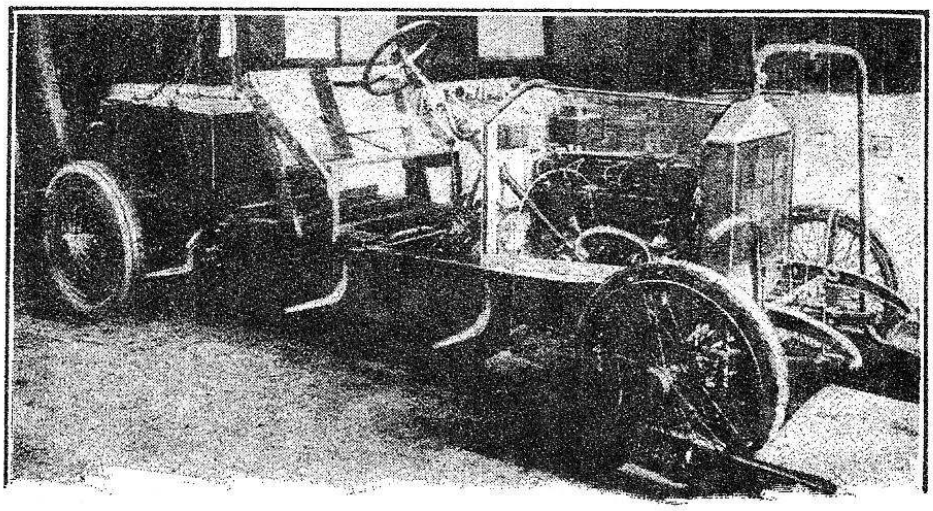
THE DASH-BOARD OF THE 20 H.P. MODEL. NOTE THE RADIATOR SHUTTER CONTROL.



A REAR VIEW OF THE 20 H.P. ROLLS-ROYCE.

TESTING THE 20 H.P. ROLLS-ROYCE.

A Process which Accounts for One-third of the Labour Costs from Raw Material to Finished Chassis.



A power test delivered at the road wheels. All Rolls-Royce chassis are first tested on the dynamometer in this way before the road stage commences.

RARELY indeed has a new car aroused such interest as the 20 h.p. Rolls-Royce, as the correspondence columns of *The Autocar* have shown since the particulars of the design were first announced. Criticism has been levelled at certain features of the chassis by many motorists of experience, and as hotly refuted by as many others, but even the most carping critic has been willing to admit that, as an engineering production, it is worthy to rank with its famous relative, the 40-50 h.p. That this should be conceded for an entirely new model is in itself a testimony to the care expended in the production of the car.

Testing as a Science.

At the present time the output from the Rolls-Royce works at Derby is ten to fifteen per week of the new 20 h.p. chassis, and about eight to twelve of the 40-50 h.p. model, the two cars being produced simultaneously in the same shops, and the same meticulous care and accuracy being expended in the selection and testing of material, the inspection during manufacture, and the testing of the various components and the completed chassis. The inspection and testing are, indeed, a veritable science, and they account for about one-third of the total labour charges on a chassis.

Inspection During Production.

Naturally the more rigid an inspection and testing system the greater will be the percentage of scrap, so that the remaining castings or stampings may in a manner be considered to be worth more than their face value. In machining the various components it is likely that hidden defects may from time to time be discovered, so that it is essential that any such defect be detected before more valuable time and labour be wasted. Accordingly, after every machining process comes an inspection ere the component passes on to the next machine.

Very fine limits in machining and grinding are adhered to; for example, the crankshaft pins and journals are ground to within one-thousandth part of an inch, while no bearing is allowed to be more than two-tenths of a thousandth out of parallel. If, therefore, a crankshaft were ground beyond this limit it would be scrapped, although it had already passed through about fifteen processes and was practically completed. Gudgeon pins are ground to a limit of one-and-a-half-tenths of a thousandth, and according to the importance of a component so is the accuracy insisted upon.

Care with the Engine.

When the engine and gear box unit is erected, it is tested over a period of many hours, the power developed and fuel consumed at various speeds being measured and recorded. When the test has been completed the unit is dismantled to the smallest component and minutely examined. Every working part is carefully tried for size to see that no undue wear has taken place, while a thorough examination is made of all parts to see that no faults have developed during the proceedings.

In a similar manner the gear box is tested under power, and, in order that the conditions of test shall be identical with the normal running conditions, the testing rig takes the form of a part of a chassis. An engine supplies the power, and a brake can be applied so that every gear can be tested under load.

The same method is adopted in testing rear axles, so that actual running conditions may be reproduced; for example, the engine is speeded up and retarded in order to show acceleration effects and "overrunning" peculiarities.

The Chassis Try-out.

The chassis, having been assembled from these carefully tested components, is tested as a whole on a dynamometer. The front wheels are secured in chocks, and the rear wheels rest on rollers, which they drive and by which the power developed may be measured. This is a power test only, before the chassis goes on its road test. The 20 h.p. model has to develop a minimum of 52 h.p. at 3,000 r.p.m., giving a petrol consumption of 22-24 m.p.g., and an oil consumption of 1,000-1,500 m.p.g.

On the Road.

On the road test a minimum mileage of 150 has to be covered on a set course, but frequently this is extended to 300 miles, or even more, as slight defects are detected by the skilled drivers during the driving period and are rectified.

Naturally, the same process of constant inspection and searching trial is applied to the larger models, and it is undoubtedly this, coupled with the careful selection of material and the accuracy of manufacturing processes, which have resulted in the name of Rolls-Royce being a synonym for excellence.

The Charm of the 20 h.p. Rolls-Royce.

Further Experiences with One of the World's Most Interesting Cars.

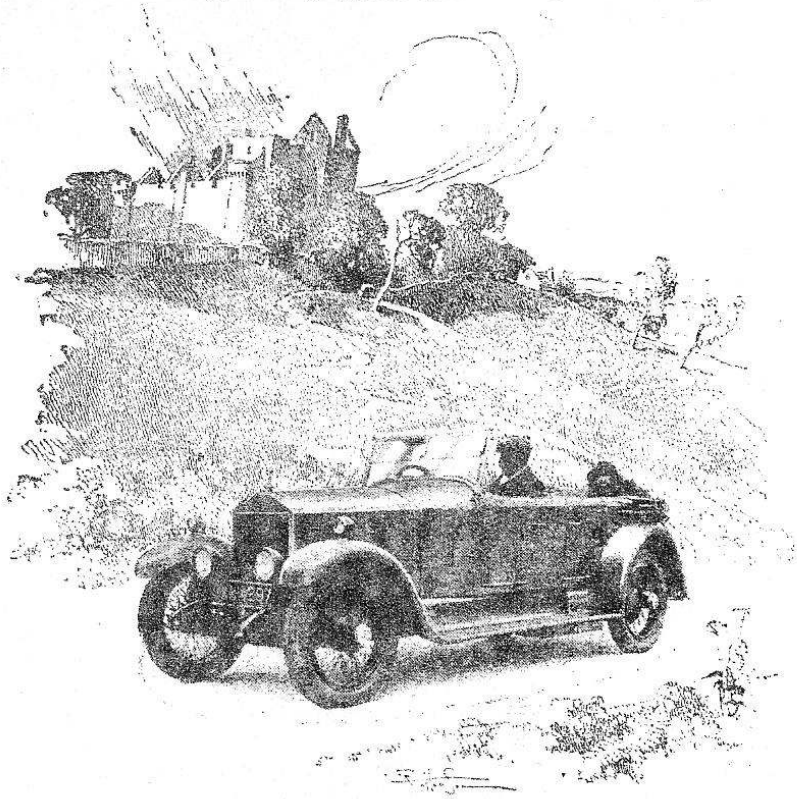
IT is now some seven months since we first had an opportunity of driving the 20 h.p. Rolls-Royce on the open road (see description in *The Motor*, October 24th, 1922). No car has ever created more interest at its inception than did this production of a famous concern, and in response to questions from a number of readers who are desirous of ascertaining information with regard to its wearing qualities and the general performance of the production chassis on the road, we recently took an opportunity of trying out what can well be termed a standard model of this famous marque. Actually, the car, upon which we drove some 300 miles, had, we understand, 700 miles to its credit.

The first models of a new type are sometimes made in the "tool-room" of the factory, and differ appreciably from those which eventually find their way into the hands of the average owner; but, in so far as our memory serves, the production-type 20 h.p. Rolls-Royce not only comes up to, but, if anything, exceeds in quality and performance, the original model produced.

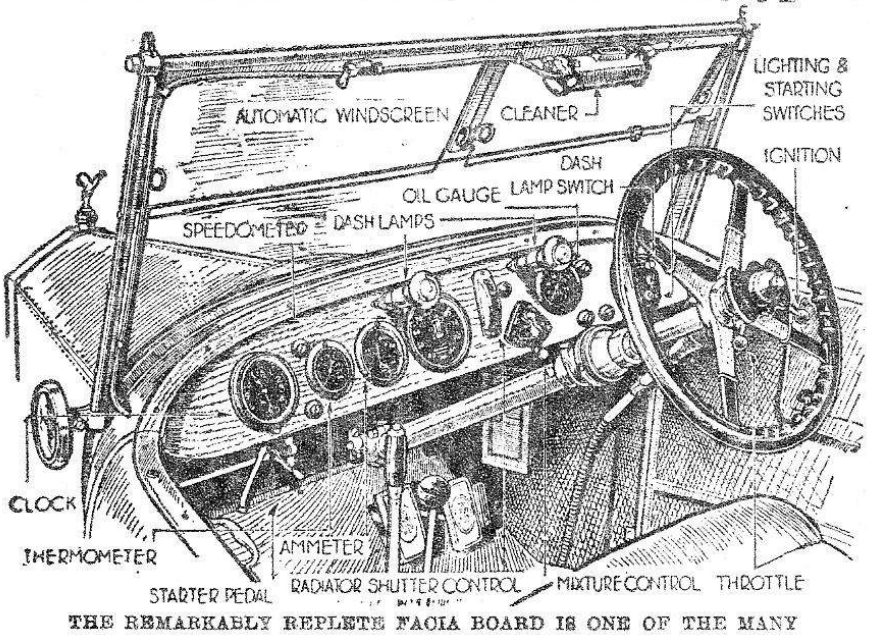
There is an indefinable sense of charm attached to the car. It would require a great deal of space and considerable repetition of what we have already said to deal with all the good features of the 20 h.p. Rolls-Royce, and we can now only summarize. Three characteristics are outstanding. One is responsiveness, the other quietness, and a third is a distinct sense of breeding that accompanies its every action.

There is a silkiness about the suspension and an elasticity of the engine that need experiencing before they can be believed. On top gear the speed range is from 4 m.p.h. to 62 m.p.h. on the level, and throughout this range the car responds to the accelerator pedal as though the engine, instead of being what is known as an internal-combustion unit, were a virile, tightly wound spring which releases its power to the touch. There is no vibration, not even a hum, and it is only on an engine of this type that the experienced motorist can tolerate a really well-silenced exhaust, for there are no external noises that obtrude themselves on his notice even on a long run.

The average speed obtainable on this 20 h.p. model is almost as good as that which can be obtained on a larger Rolls-Royce, for, thanks to a high power-to-weight ratio its pickup is very rapid indeed, and enables one to observe all the courtesies of the road and yet leave a satisfactory mileage behind one's back axle in the course of a day's run. Ample lock, beautiful brakes, and finger-light steering all go to attain this end.



THE APPEARANCE OF THE 20 H.P. ROLLS-ROYCE IS EQUALLY AS REFINED AS ITS ROAD PERFORMANCE.



THE REMARKABLY REPLETE FACIA BOARD IS ONE OF THE MANY INTERESTING FEATURES.

A considerable number of questions have been asked concerning the question of central gear control, but on both of the occasions that we have had the pleasure of driving this model we can justly state that no inconvenience has been noticeable on this score, although, perhaps, the position of the side brake necessitates the driver leaning forward rather more than should be necessary.

It is not a simple matter to express in mere words how good this car really is, but to any of those who might be doubtful as to the capabilities of the 20 h.p. Rolls-Royce, we can only say quite frankly that they should try it for themselves. We ourselves find that it is in all respects a very charming car indeed, and one that makes us proud that it is of English manufacture. The makers' address is 15, Conduit Street, London, W.1.

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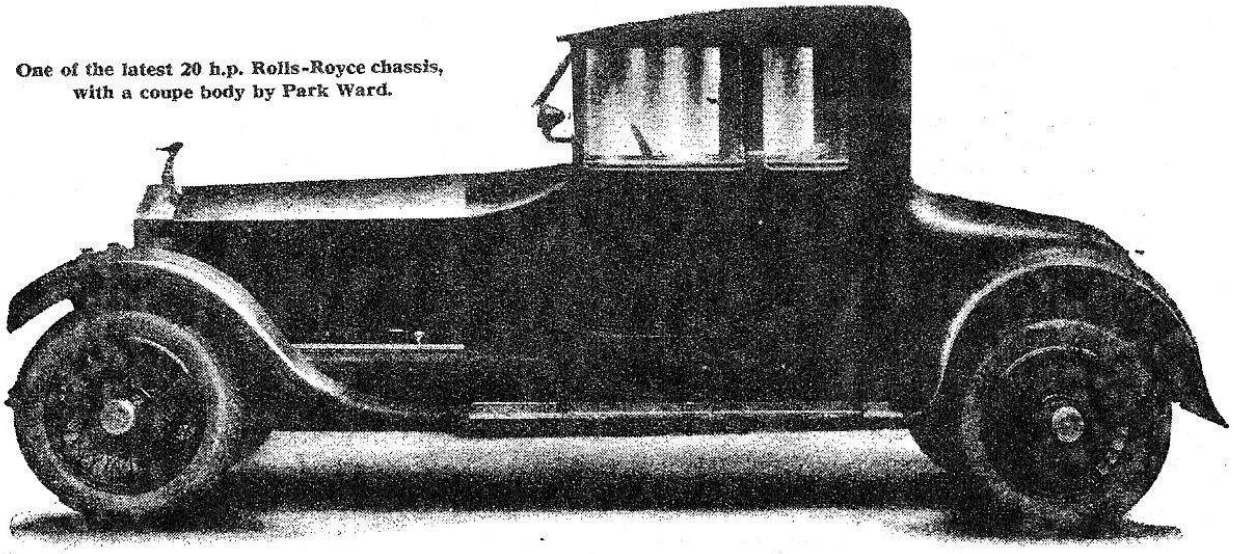
The 20 h.p. Rolls-Royce on the Road.

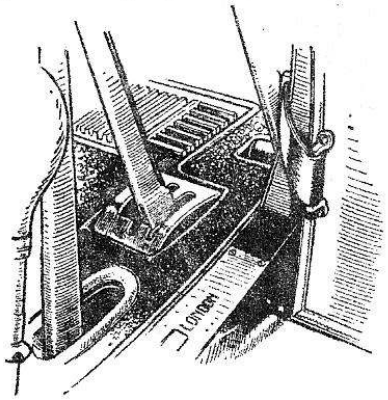
A Very Refined and Silent Car.



One of the latest 20 h.p. Rolls-Royce chassis, with a coupe body by Park Ward.

THE 20 h.p. Rolls-Royce with four-speed gearbox, front-wheel brakes and right-hand control has now been on the market for just about a year, and has earned a well-deserved popularity for the manner in which it gives the same silent running, the same comfort, and the same satisfaction in use as the famous 40-50 h.p. model, combined with a greater economy of operation. The tax on the smaller model is only £22 per annum, while a petrol consumption of approximately 21 m.p.g. is obtained by most private owners.

We were able to make a trial run in the 20 h.p. model, and thus satisfy ourselves that the performance is all that the average motorist can desire in a vehicle of its type. The six-cylinder engine, which has a capacity of a little over three litres, is so quiet that even with the car stationary it is literally impossible to tell if the engine is running without a glance to see if the oil gauge is registering or if the ammeter needle is flickering. There is a complete absence of any noises, however faint, in the chassis or bodywork, top-gear flexibility has been brought to the well-known Rolls-Royce pitch of development, and springing is excellent. Except for the fact that owing to the lower power output of the engine there is not the same liveliness, nor the same acceleration as is obtained from the New Phantom model, the 20 h.p. chassis seems to possess all the qualities of its bigger brother.



The gear and brake levers are well placed on the right-hand side.

CONDENSED SPECIFICATION.

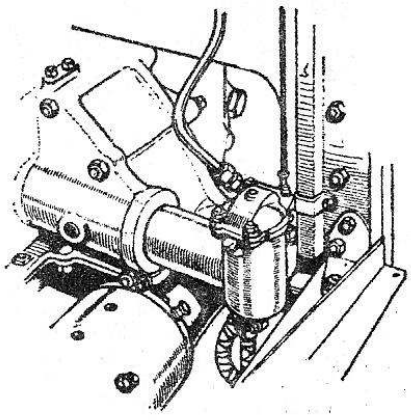
ENGINE: 6-cylinder, overhead valves, 3 in. bore, 4½ in. stroke (3,150 c.c.). Treasury rating 21·6 h.p. Tax £22. Starting carburetter.
CLUTCH: Single dry plate.
GEARBOX: In unit with engine, four speeds and reverse, right-hand control.
BRAKES: Rolls-Royce six-brake system. Brakes on all wheels operated from servo-motor on gearbox. Hand lever on right.
SUSPENSION: Semi-elliptic springs front and rear.
DIMENSIONS: Wheelbase, 129 ins.; track, 56 ins.; overall length, 178 ins.
WHEELS AND TYRES: Wire detachable, with 32×4½ straight-sided Dunlop cord tyres.
PRICE: Chassis, £1,100 (£85 extra for F.W.B.).
MANUFACTURERS: Rolls-Royce Ltd., 14-15, Conduit Street, W.1.

Speed with Silence.

Under favourable running conditions the 20 h.p. open touring car is capable of a maximum speed of 60 m.p.h. Moreover, the engine will throttle down so that the car will proceed at a crawl on top gear. At 30 m.p.h. the engine is as inaudible as when ticking over, while it may be said to be equally quiet at 45 m.p.h. on top gear, at which speed the car is pleasant to handle and has an attractive feeling of power in reserve.

For all ordinary running, including the negotiation of dense traffic and the average hilly or tortuous road, top gear only is used. There is never any need to change down either for a right-angle corner or when accelerating away on hills of the 1-in-15 variety. However, the man who does not disdain to use his gearbox will find that a quick drop into third speed will enable the car to surge forward in an impressive manner and practically the same silence that characterizes the top-gear running.

Starting on the level or a slight uphill gradient, third gear is normally used, a change into top being made within the first few yards. A slight pause is required when changing up, while silent changes down may be made without the need for double declutching at low speeds. The gearbox, which is a model of quietness, has a singularly easy change, and a very faint click is the only sign that a gear change has not been quite accurately timed.



The all-enclosed starter mechanism ensures reliable and efficient starting.

The clutch, which is of the single dry-plate type with Ferodo and steel surfaces, is very smooth, so that it is really not necessary to accelerate the engine when moving away from a standstill.

Steering is very light, and acts on the worm-and-nut principle, the

THE 20 h.p. ROLLS-ROYCE.—Contd.

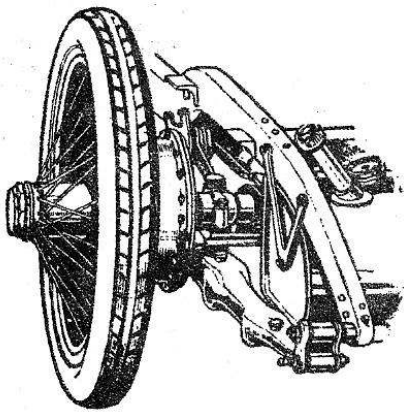
ignition and throttle controls, according to usual Rolls-Royce practice, being placed above the steering wheel.

Smooth Four-wheel Brakes.

As regards the brakes, these are similar to those fitted to the 40-50 h.p. new Phantom chassis, which are servo-operated from the gearbox. Only a very light pressure is required fully to apply the brakes, which we found very safe and steady even on the most slippery surfaces. There was, it is true, a slight tendency for the car to slide sideways on a very greasy surface if the brakes were applied when the driver was not holding the wheel, but this may have been due to the presence of water in the drums, as the car had only been washed shortly before the commencement of the test.

The springing, as one would expect on any model produced by Rolls-Royce, Ltd., is good, no shocks reaching the occupants of the car even when traversing extremely rough and pot-holey surfaces. The road-holding is very good, and the very light and accurate steering makes the car a pleasure to handle even when the roads are wet and treacherous, as they were on the occasion of our test.

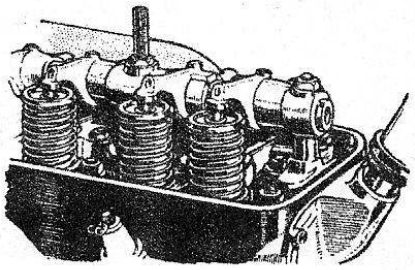
The great point to remember is that the standard of workmanship



The half-elliptic rear springs and petrol filler and gauge.

of the 20 h.p. Rolls-Royce is exactly the same as that of the other models of this famous marque, and the performance, while being thoroughly satisfactory now, is likely to be exactly the same in a number of years' time. The car is well suited to the needs of the owner-driver, because it requires very little attention to keep it in perfect condition, the high cost of the car being due to the scrupulous care with which every part is manufactured and the very extensive tests which all complete chassis have to undergo.

Having dealt with the general running of the car, we may pass on to one or two points of special interest in this most recent model. The four-speed gearbox is rather shorter than the three-speed box originally fitted to this chassis, as the result of successful efforts on the part of the designers to save weight and space by keeping the new box as small as possible. The driving shafts are thus kept very short, and, as they are supported by a third intermediate ball bearing, the spigot bearing is relieved of much of its load in the case of the third motion shaft, and the box is not only very quiet when new, but maintains its silence throughout a number of years' hard wear. Naturally, the



The overhead-valve rockers are lubricated by forced feed through a hollow rocker shaft.

great flexibility of the engine allows top gear to be used for all ordinary running in average country, so that the intermediate ratios are subjected, in any case, to very little wear. At the same time, in order to resist wear and maintain smooth and silent operation, the working faces of all the gear-wheel teeth are ground after hardening.

Well-chosen Gear Ratios.

The ratios are sensibly arranged, the top gear being the same as in the case of the three-speed gearbox. The third and second speed ratios are, however, a little above and a little below the original middle gear, while bottom gear is slightly lower than previously. The close ratio box naturally makes for easier gear changing, at all speeds, while it enables the best engine speed to be maintained on long climbs, such as are met with, for example, in the Alps.

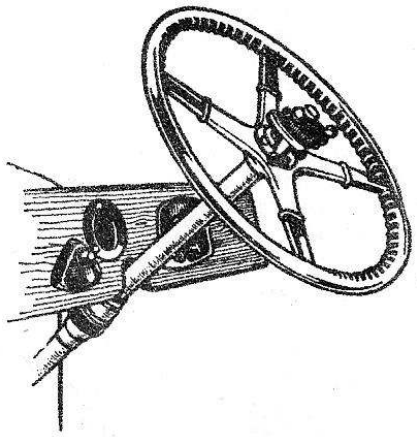
The very compact design of the new four-speed gearbox results from the arrangement of the sliding first and second-speed gear wheels on the layshaft, while the third and fourth sliding members are on the third motion shaft. Another good point is that the reverse gear is entirely disengaged when not in use, and consequently does not waste power by churning the oil. The reverse gear consists of two gear wheels of different diameters, one of which meshes with the third gear wheel fixed to the layshaft, while the other engages with the first-speed gear wheel on the third motion shaft, one pair of gears being arranged to be engaged slightly before the other, in order to make engagement easy. The layshaft is disposed below the main shaft, the gear wheel upon it thus distributing the oil throughout the box without the necessity for the lubricant to be maintained at such a height that there may be a possibility of oil leakage from the bearings.

Right-hand Change Preferred.

Taken as a whole, British motorists may be said to be very conservative, and although, for reasons of production, central control has enjoyed a considerable vogue in this country, it cannot be said to have been really popular; consequently most motorists will prefer the right-hand gear and brake levers which are a feature of the four-speed 20 h.p. Rolls-Royce. The gate, which has very narrow slots, is free from the catches which characterize the larger model. The movement of the gear lever is small, while both it and the brake lever are well placed and comfortable to the touch.

Hand-controlled radiator shutters enable the driver of a 20 h.p. Rolls-Royce to keep his engine running at the most efficient temperature. The advantage which these shutters possess over those which are automatically controlled by a thermostat is that, if it be desired to stop for an hour or two when the engine is thoroughly warm, the shutters may be closed and the water maintained as nearly as possible at the same temperature.

A radiator thermometer, accurately calibrated in degrees Centigrade, is among the dashboard in-



The throttle and ignition controls are mounted above the wheel, as on the 40-50 h.p. model, but the mixture control is on the dash.

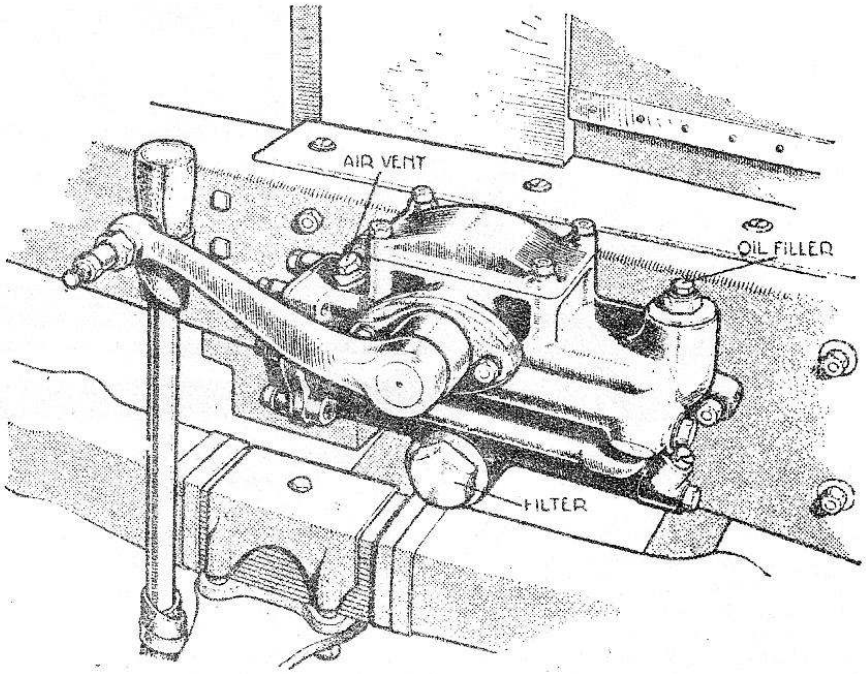
struments, so that the driver can at any time see whether the engine is at its most efficient temperature. In the course of a run at moderate speeds we found it best to maintain the water temperature at about 80 degrees Centigrade.

Summed up, the 20 h.p. Rolls-Royce may be regarded as representing the best British practice and as possessing an unusual refinement and silence of running. Its control calls for no effort, while it is economical to maintain, not only as regards running costs alone, but also because of the very slight depreciation even in prolonged use.

Modified Rolls-Royce Suspension System.

Interesting Design of Hydraulic Shock Absorber Now Fitted to the Front Axles of Both Models.

AFTER having built their 20 h.p. and 40-50 h.p. chassis in practically unchanged form for some considerable time, Rolls-Royce, Ltd., have decided upon the fitting of their own patented type of hydraulic shock damper to the front axle while retaining frictional shock absorbers to the rear axle. At the same time it is announced that the 40-50 h.p. New Phantom chassis can now be obtained with Dunlop low-pressure tyres of 6.75-in. section as an optional extra in place of the straight-sided type normally fitted, while 5.25-in. section low-pressure tyres are now standardized on the 20 h.p. chassis.



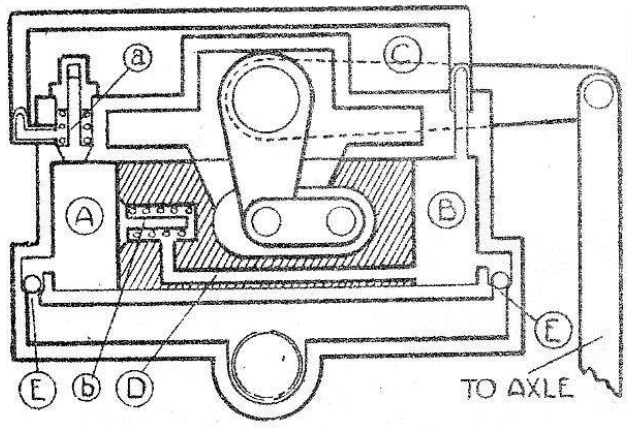
The new Rolls-Royce hydraulic shock absorber as fitted to a 40-50 h.p. New Phantom chassis. The casing is bolted to the frame and contains a double-ended plunger which reciprocates when the axle moves up and down.

Double-acting Principle.

As has been the case for some considerable time, Hartford shock absorbers are a standard fitting at the rear end of the 40-50 h.p. chassis. The new hydraulic damper, of which two are now fitted at the front end, is of neat and compact design and is so arranged as to be double-acting; that is to say, it provides a check upon unduly rapid motion both when the springs are being deflected and when they are rebounding.

The damper consists of a casing, roughly cylindrical in form, which is bolted to the side member of the frame and contains a double-ended plunger. This plunger is made hollow at the centre and is there fitted with a link coupled to a bell-crank lever which is connected to the front axle through the medium of a rod.

The principle upon which the damper operates can best be understood by reference to the diagrammatic sectional view which we reproduce, although it will be understood that this does not show a number of refinements which are incorporated in the design. Of the compression spaces left at each end of the plunger, which are filled with oil, that which is marked A on the diagram works at a high oil pressure and that which is marked B works at a lower pressure.



A diagram explanatory of the principle of operation; in moving to and fro the plunger forces oil through ducts and valves, so providing hydraulic damping. Automatic replenishment of oil from a reservoir is a feature. (See text.)

When the road spring rebounds and the axle moves away from the frame the plunger is forced towards the left, displacing oil from the space (A) and, vice versa, movements of the axle towards the frame (corresponding to deflections of the road spring) cause the plunger to move to the right and diminish the space (B). Owing to the differing pressures allowed for by the valves and transfer passages a bigger checking effect is obtained when the spring rebounds than is the case when the spring is deflected.

When the plunger moves to the left the oil displaced from the space (A) is forced through the automatic spring-controlled poppet valve (a) and passes through the duct (C) to the low-pressure space (B) on the other side of the plunger. While this action is taking place the poppet valve (b) is kept closed by the pressure of the oil. On the reverse stroke, when the plunger moves to the left, this valve (b) opens and allows the transfer of oil to take place from the space (B) to the space (A) through a hole (D) drilled in the plunger.

Interesting Refinements.

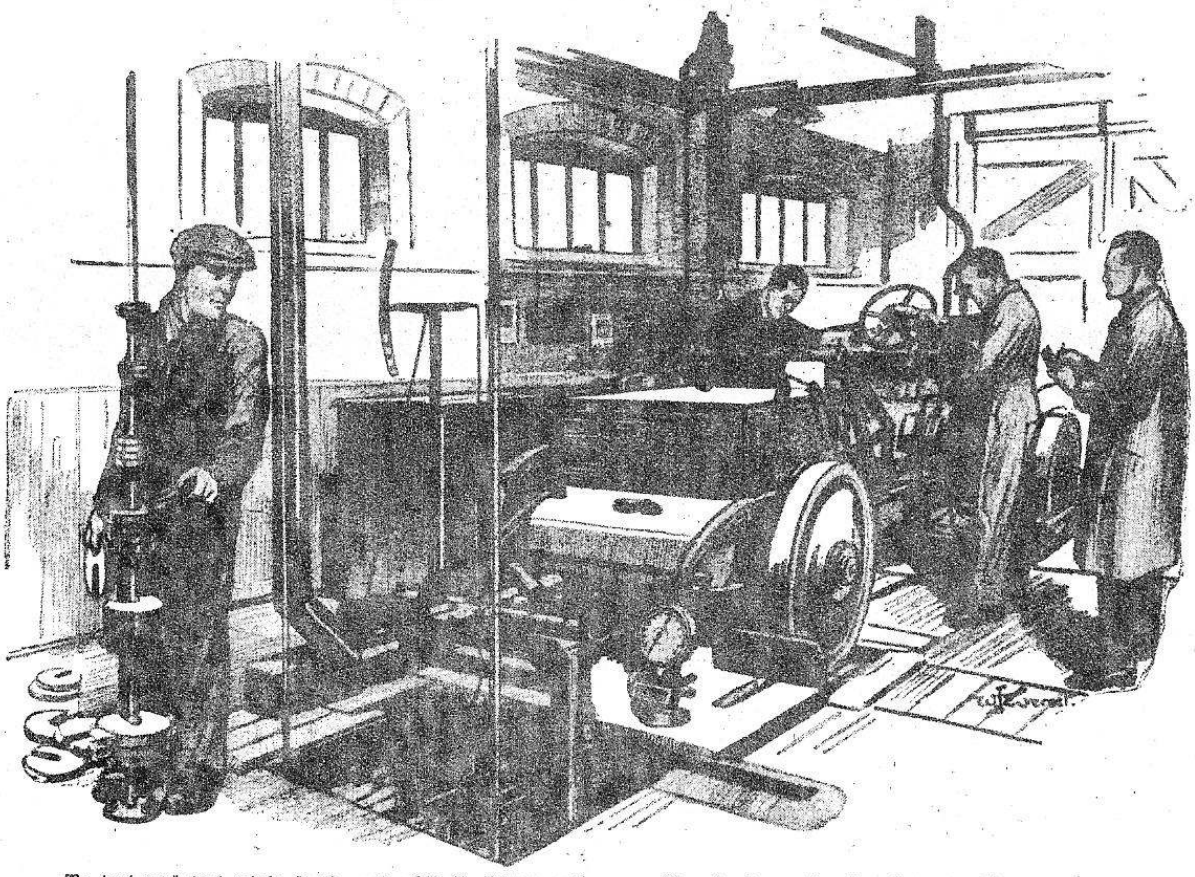
As regards the refinements previously mentioned, which have not been fully shown on the diagram in order to make matters clear, the most important consists of a method for ejecting air from the damper which might otherwise collect and interfere with the correct functioning of the device. The air will naturally tend to collect at the highest point, and here a special release valve is provided through which it is expelled when the plunger moves to the right.

Two non-return ball valves (E, E) are fitted near to the base of the cylindrical casing—one at each end—and these communicate with the end spaces (A and B) and with a filter leading to an oil reservoir. These valves only operate if suction be created in the end spaces (A and B) through loss of oil from the damper, and then move to allow a further supply to be drawn in. As is the case with all components used in Rolls-Royce cars, this new damper has undergone severe and prolonged testing before being adopted.

B24

WHY A ROLLS-ROYCE is A ROLLS-ROYCE!

A Works in Which Almost Every Chassis Component is Made. Methods of Manufacture Which Have Created a World-wide Reputation for Excellence



To test and test again is the rule of Rolls-Royce engineers. Here is shown the chassis test, with rear wheels carrying special solid tyres resting on dynamometer drums, which is equivalent to 100 road miles at full load. This follows individual tests of the engine, gearbox, rear axle, etc., and precedes prolonged road trials.

WHENEVER a manufactured article or mechanism transcends ordinary standards of excellence, curiosity is aroused as to why this should be the case. In the world of motoring an outstanding example is the Rolls-Royce chassis, and around it have grown up many legends—some based on fact, others fictitious—concerning the methods of production employed at the Derby works.

It is in these methods that one must search for the secrets which account for the fact that a Rolls-Royce *is* a Rolls-Royce; i.e., that it maintains, year by year, so high a standard of excellence that its claim to special distinction goes unchallenged everywhere. Our exclusive road test reports have shown that the road performances of Phantom II and of the 20-25 h.p. model are exceedingly good, and our recent descriptions of these chassis showed them to be designed on modern lines. There are, however, other cars that can travel as fast and the specifications of which include a six-cylinder overhead-valve engine, four-forward-speed gearbox, semi-elliptic springing and four-wheel brakes.

Superlative Care.

The two features in which the Rolls-Royce car excels are a wonderful refinement in running (which includes, of course, silence and smoothness) and a superlative care in construction, which results in extraordinary longevity. After giving due credit to the genius of Mr. F. H. Royce, who controls the entire design of the chassis from his secluded country home near Chichester, where he has a devoted staff of draughtsmen and mechanics, one must pay homage to a system of car manufacture which, in respect of the skilled craftsmen employed, the attention paid to details and the meticulous routine employed for testing and retesting the product at every stage, is surely unrivalled anywhere.

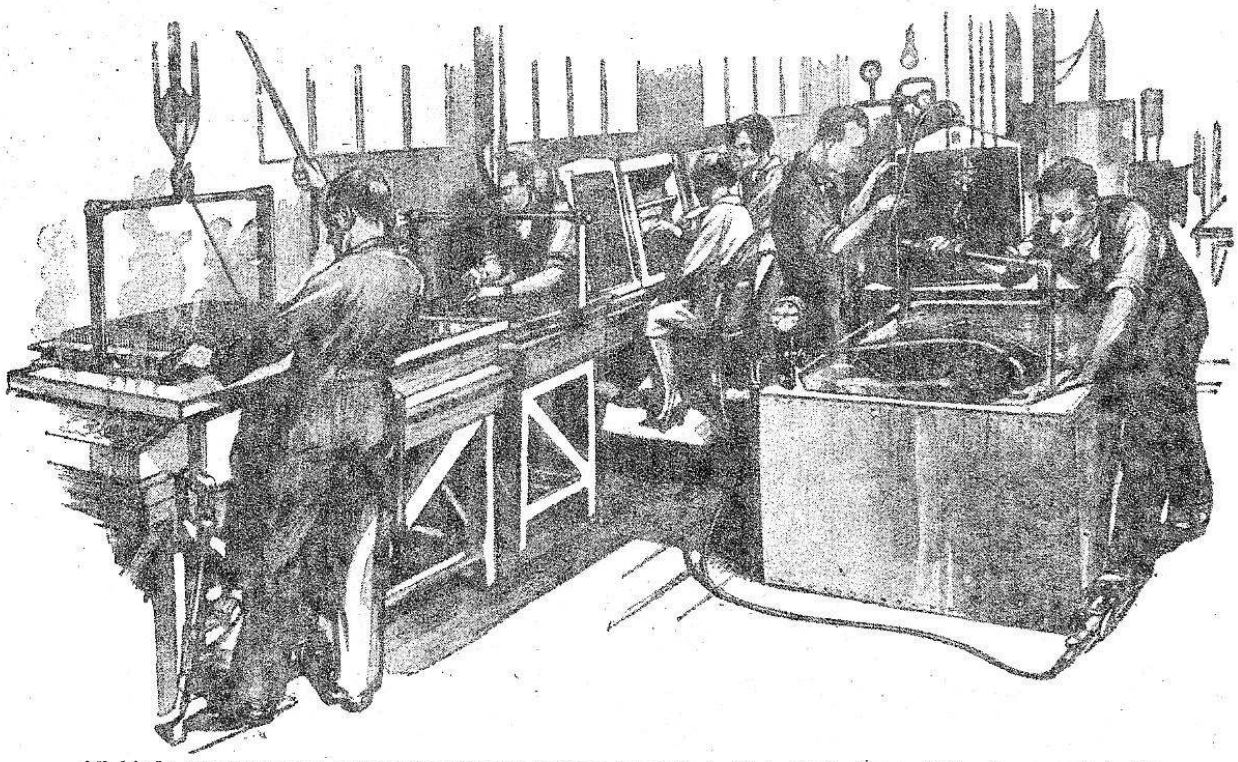
In this article we are privileged to lift the veil behind which the work of the remarkable Rolls-Royce factory at Derby is ordinarily carried on. This factory consists of single-story buildings, clean, airy and well-lighted, which cover 14 acres of ground and in which the two types of chassis and the Rolls-Royce aero engines are made.

To anyone accustomed to visiting motorcar factories, in which many of the components are "bought in" in finished form, the scope of the processes undertaken at these Derby works is literally amazing. Thus there are large foundries where intricate work in bronze, aluminium and cast-iron is carried out by expert metallurgists, there is a special department for the manufacture of forgings such as those required for the connecting rods, steering arms etc., there is a "works within the works" entirely devoted to making

WHY A ROLLS-ROYCE *IS* A ROLLS-ROYCE—Contd.

dynamos, starter motors, coils and other electrical gear, and even the bolts and nuts required are made on the premises.

The very important process of heat-treating crankshafts, gears, valves, etc., is carried out in a separate department, and here an unusual process, not often seen, is the tempering of the side members of the chassis frame. It is worth mentioning, in passing, that every connecting rod, steering arm or similar forged part of importance carries a test-piece, which is cut off and tested after heat treatment; in most factories only one part in a batch would be so tested. The distinctive radiator is also built up on the premises and embodies over 8,000 brass tubes soldered in a bath; it is subsequently tested under both air and water pressure before being built into a shell of nickel-silver.

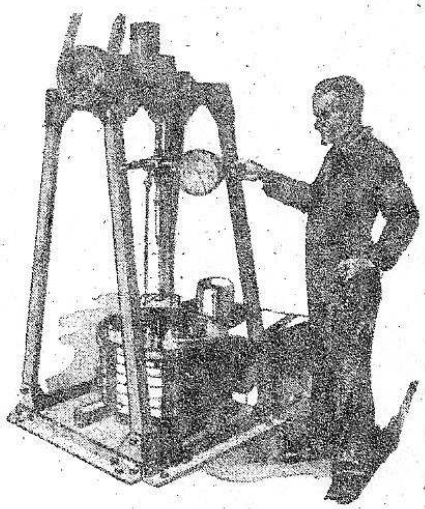


All kinds of components ordinarily "bought in" are specially built by Rolls-Royce, Ltd. An example is the radiator. The girls in the background range 8,000 brass tubes in a frame; these are soldered together to form the core (left) and are then tested for leaks (right).

Maintaining a High Standard.

All these specialized manufacturing processes are carried on, in addition to the more customary work of making the engine, transmission, etc., for one good and sufficient reason, viz., so high is the standard of excellence which the Rolls-Royce engineers have set themselves to maintain that they are obliged to assume entire control over the design and manufacture of every possible component. This can be achieved only by making them in the factory itself. One example will suffice to show the success of this unusual policy; so highly are Rolls-Royce methods in aluminium founding esteemed that their advice on this tricky subject is often sought by outside concerns.

In addition to the wide scope of the work undertaken, a feature of the Rolls-Royce factory which impresses the visitor is the extensive use made of jigs and fixtures, i.e., contrivances attached to machine tools which ensure standardization of the product. Such contrivances are ordinarily employed for the purpose of facilitating quantity production, but at Derby the aim is to ensure accuracy and interchangeability. Consequently, although (as we shall describe) a very considerable amount of hand work is put into each chassis by skilled craftsmen, it is erroneous to suppose that any individual differences are permitted. Should an accident occur to a car and necessitate fitting a spare part, this will drop into place when received as accurately as on any mass-production job.



On this machine the steering worm and nut are "run in" for hours until the friction, measured by the balance, reaches a certain minimum.

Having dealt with some salient features of the works, we will turn to some of the interesting stages through which each chassis passes on its way to completion. Commencing with the frame, this differs from ordinary practice in that all important connections, such as those joining the cross-members to the side members, are effected by means of bolts and nuts fitted to accurately reamed holes, rivets being used only for light brackets and similar lightly loaded parts.

Plated Road Springs.

The semi-elliptic road springs are not made at Derby, but upon arrival each is completely dismantled and all the leaves are polished and are then plated so as to render them rust-proof. Axles are also polished all over before being painted, the idea being to facilitate the job of inspectors who look for flaws in the metal; nothing is left to chance.

WHY A ROLLS-ROYCE *IS* A ROLLS-ROYCE—Contd.

Making the Gears Silent.

The machine-shop processes employed in the manufacture of the working parts follow the best modern practice; all straight-toothed gears, for example, are profile-ground on special machines after heat treatment, and cylinder bores are finished by honing. Gears with spiral teeth, such as the final-drive bevels, the timing wheels, and the constant-mesh wheels in the gearbox cannot be profile-ground on a machine, and, consequently, are mounted in pairs on special fixtures, which enable them to be run together under a stream of liquid abrasive.

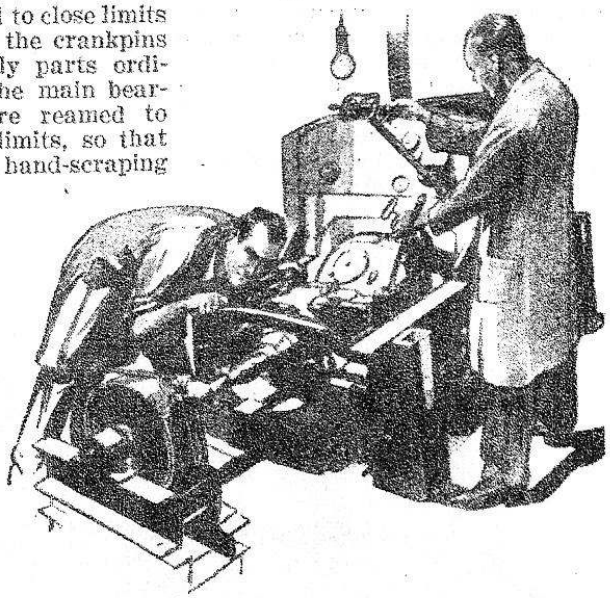
This process necessitates a high degree of skill on the part of the operator, because, if overdone, the tooth profiles are ruined. The idea is simply to allow all tool marks or other slight irregularities to be smoothed away and, if necessary, it is followed by hand-treatment with light abrasives, known as "stoning."

The pistons, which are of aluminium and have slit skirts, are specially ground to a slight oval, so that they make close contact with the cylinder walls on a plane at right angles to the gudgeon pin, but have a liberal clearance around the gudgeon-pin bosses. Consequently, there is room for expansion with heat, but piston slap is prevented.

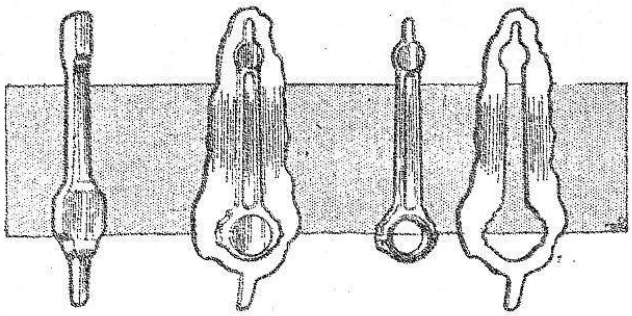
The crankshaft is ground all over—a simple statement, but just think of the care and labour which it implies! Every part of the webs is highly finished to close limits of size in addition to the crankpins and journals—the only parts ordinarily so treated. The main bearings and big-ends are reamed to within equally close limits, so that "bedding down" by hand-scraping is almost eliminated.

We found that we could turn a newly assembled engine quite readily by hand, as, owing to this system of close limits, it is not necessary that the parts should all be put together very tightly.

The inside of the engine presents as beautiful an appearance as the outside; the inner surface of the aluminium crankcase, for example, is smooth, scrupulously clean,



Silence, please! All gearboxes are tested individually on each gear, under load. Motive power is supplied by a Rolls-Royce engine so as to reproduce road conditions.



Stages in the production of a connecting-rod forging: (left) roughly shaped under a hammer. (Centre) first drop-forging process between dies. (Right) Final drop-forging process, in which the "flash" is trimmed off.

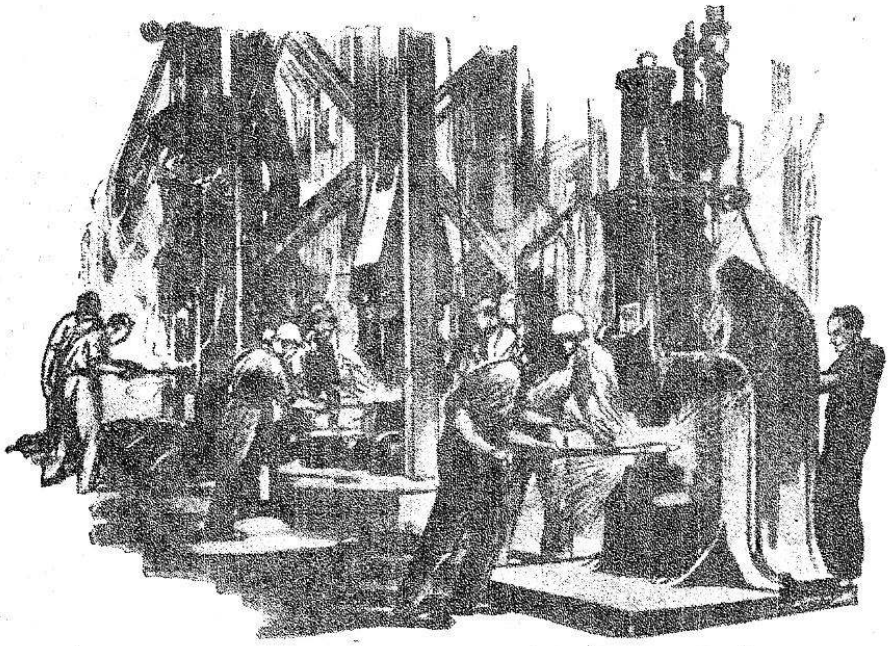
and treated with linse oil. And how these engin last! We saw one stripp in the repair shops whi had been at work on t road ever since it left t works in 1910. It w years since it had last be taken down, but there w not an atom of shake to felt in the big-ends.

The steering mechanis is a beautiful job and co sists of a worm working a nut which is lined wi white metal. These par are lapped together ensure smooth operation in a ve ingenious machine which, by osc lating the worm, causes the load nut to run first up and then dow This process is continued for hou until the friction, tested by balance, is reduced to a specifi minimum.

Testing the Engine.

Testing has been brought to a fi art at Derby, no trouble bei spared; it is applied first to in vidual components and then to t complete chassis. The engine, aft assembly, is run in gently under own power, using town gas, for thr hours at 400 r.p.m. and for a furth hour at higher speeds. There is oil in the sump during this perio lubricant being circulated through special cooling and filtering pla which removes all sludge, so th the oil-ways and bearings are co pletely freed from any deposits metal particles such as are bou to collect during assembly a which might damage the bearings

The engine next passes on to a te



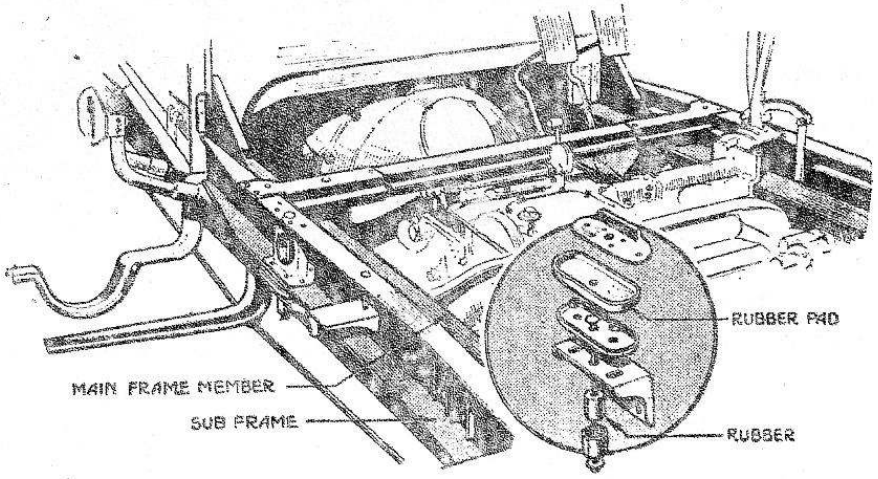
All the moderate-sized forgings required are produced in the Derby works. This view shows the section of forging shops which is devoted to making connecting rods.

WHY A ROLLS-ROYCE *IS* A ROLLS-ROYCE—Contd.

bench on which it is coupled to a Froude brake, where it does six hours under load at various speeds, the final test here consisting of a full throttle trial from 500 r.p.m. to 3,000 r.p.m. by stages. A high standard of performance is rigorously maintained.

In the meantime, other components are being tested. The complete gearbox, for example, is driven on all its gears in a special "noise detecting" department, and here there is an interesting example of thoroughness. Instead of driving the box by a belt or an electric motor in the usual way, a six-cylinder Rolls-Royce engine is employed, so that the gears are subjected to exactly the same torque fluctuations as they will experience in an actual car.

A similar process is applied to each complete rear axle, and in this case the ends of the half-shafts are coupled to heavy flywheels which correspond in their effects to the momentum of a car. The tester can therefore emulate all kinds of road conditions very closely indeed.



The final stage: The body is built on a steel sub-frame which is usually sent to the coachbuilder in advance. Subsequently body and sub-frame can readily be dropped on to the chassis. The anchorages (inset) embody insulators.

An engine, gearbox and rear axle which have been tested individually are next built into the chassis, and this then undergoes a prolonged test (equivalent to 100 miles on the road) with the rear wheels mounted on drums coupled to dynamometers, which absorb and record the power transmitted. Readings are taken on each of the four gears at speeds ranging from 500 r.p.m. to 3,000 r.p.m. by increments of 250 r.p.m.

Needless to say, such a remarkable degree of thoroughness in testing is altogether unusual, and one might be forgiven for supposing that after such an arduous upbringing a chassis might be regarded as fully fledged and ready to take wing to the coachbuilder. Instead of this, the trials already described form but a preliminary to still more rigorous tests on the road.

Extensive Road Tests.

First of all, the chassis goes out with an open body for general tests and adjustments, following which a special noise-amplifying box body is bolted on to it and an expert in silence takes the wheel. This body is of cubical shape, so that it magnifies any vestige of noise.

Such tests and adjustments may take days, or even weeks, to complete. When they are brought to a satisfactory conclusion the production department has finished with the chassis and it is handed over to an acceptance department, not controlled in any way by the production staff, which has the task of judging whether the job is up to standard. In order to decide this vital point, further road tests are made, so that before it leaves the works, in addition to bench tests, a Rolls-Royce chassis covers at least 300 miles on the road and is fully run-in in readiness for service.

The final stage before delivery consists of bouncing the chassis on its springs when loaded by weights to an extent representing the body, passengers and luggage which it w eventually have to carry. Followi this, it is sent to the coachbuilde usually by rail. The bodywor incidentally, is carried on a speci steel sub-frame mounted on rubb which has the advantage that t body maker can be constructing saloon, limousine or whatever it m be upon this sub-frame, whilst t chassis destined to carry it is a proaching completion at the work

One more stage remains, this bei a trial of the complete job on t road by a Rolls-Royce inspect before it is delivered from t coachbuilder to the eventual own Later on, its life and condition ar as is well know kept under o servation by i spectors e ployed by Roll Royce, Ltd., wh travel from di trict to distri and whose se vices are free placed at t command owners and a greatly appr ciated.

In attemptir a consecuti story of the wa a chassis is a sembled ar tested we hav inevitably had omit many oper tions of interes but many more pages of this journ would have to be absorbed befo even an outline of all the work ca ried on at this factory could given. One could, for example, d scribe the many unique process employed in making parts such the hydraulic shock absorbers, t silencer, the petrol tank, and t heavily plated steering colum Brief though it is, however, th account should suffice to show th the refinement and longevity whic form the quintessence of Rolls-Roy attributes result from a unique cor bination of designing skill, lengt experience and an almost supe human care in manufacture.

INGENIOUS BULB HORN OPERATED BY A PLUNGER

IT would hardly appear that such a simple instrument as a bulb horn was open to much improvement, but a Midland manufacturer of motor accessories has evolved an interesting variation of this popular type of warning signal. The modifications made concern the bulb end of the instrument only, the horn and reed being quite normal. The bulb is enclosed in a brass casing, and pressure is applied to it by means of a plunger, one end of which is concave, where it comes into contact with the rubber and the other convex to receive the palm of the user's hand. It is claimed that, as the bulb is protected from the atmosphere, it is almost unbreakable, and that the plunging device places an even pressure all over the bulb with a resulting instantaneous and powerful blast. A single twist horn, suitable for use on private cars, is listed at 25s., whilst the bulb adaptation c be purchased separately, to screw on an existing horn, for 12s. 6d. A more e pensive pattern of the through-dash ty with a double-twist horn is priced 47s. 6d. The makers are Messr Barratt, Wakefield and Co., 16 Lozells Road, Birmingham, and t London agents are Messrs. Thomas Headland, Pearman Street, Westminst Bridge Road, London, S.W.2.