Advance Particulars of the

9 H.P. BELSIZE LIGHT CAR.

(Bradshaw Model.)

GENERAL. The car is an entirely new model on the most up-to-date lines. It is primarily a two-seater but the seat is wide enough to accommodate three normal persons, consequently there is no dickey seat, and the boot at the rear has ample accommodation for tyres, spares, etc., whilst the platform above this boot is arranged to carry plenty of luggage.

The wheelbase is 8 feet and the track is 46 inches, the overall length being 10 feet 9 inch and the overall width 4 feet 5 inch. The total weight of the car is less than 10 cwt., and the engine (which is of the latest "Bradshaw oil-cooled design") is larger than those normally fitted to cars of this type and size. This increased size of engine renders frequent recourse to the lower gears unnecessary. Side-by-side valves are incorporated, as well as a silent chain for the timing gears, so as to ensure the engine unit being very quiet in operation.

Three speeds and reverse gears are provided, and a new system of gear change is provided which makes it practically impossible for a bad gear change to be made, even by a novice.

The object in this design is to supply at a low price the most efficient light car suitable to the general public. It is not a racing car, although it has a sporting appearance and a very powerful engine. It will carry three people comfortably and it is almost entirely devoid of greasers and other similar items that require constant attention. It is an ideal ladies' car, as it is extremely light on all its controls. The gear and brake levers are on the right hand side, so as not to interfere with the body space, and it is fitted with a door of ample size.

An electric starter is provided as an extra, when required, and a lighting set (electric) is supplied with every car.

ENGINE. The engine is a "V" TWIN, having a bore of 85 mm. and a stroke of 114 mm. (Tax £9), cubic capacity 1,300 c.c. The engine, clutch, and gear box, are in one unit. The angle between the two cylinders is 90°, thereby obtaining practically perfect balance. The whole unit is completely enclosed and has no external working parts with the exception of the flywheel. It embodies the now well-known system of "Oil-cooling," to the designs of Granville Bradshaw, and patents have been applied for all over the World.

This entirely new system of cooling is remarkable for its efficiency and is considered to be a great advance on either air or water-cooling for petrol engines of all types. A description of this cooling system is given at the end.

The cylinders are sunk into the crankcase together with the whole of the valve gear, and this enables the engine to be made as quiet in its running as the best of water-cooled engines. All the engine parts are lubricated automatically and without attention, and any cylinder can be removed for examination or decarbonisation in three minutes.

BALANCE. The balance of this engine is equal to that of a good four-cylindered engine.

FAN FLYWHEEL. The flywheel is a steel casting which is attached to the front end of the crankshaft. It is formed with blades cast integrally, which blades constitute an efficiently designed centrifugal fan, and the whole of the crankcase and cylinder heads are totally enclosed and under a powerful air blast of 100 miles an hour. The upper covering is quickly detachable for access to the cylinders.

LUBRICATION. The lubrication is entirely automatic, with a simple indicator on the dashboard to show that the circulation is working and to tell when the oil level is low. The whole of the oil is carried in the crankcase sump and the gearbox, and is circulated under pressure throughout the whole engine unit, including the gearbox, and via the hollow crankshaft to the big end bearings, and thence to the tappet gearing.

The oil pump can be removed without disturbing the oil in the crankcase, and an efficient oil filter is situated in the base which can be removed by undoing two nuts.

PISTONS. The pistons are of aluminium alloy, expressly designed to conform with the requirements of oil-cooling. They are fitted with three rings and the one at the skirt is a specially chamfered one with arrangements for keeping down the oil. It should not be used in any other groove.

CONNECTING RODS. These are of the usual stamped "H" section and have large white metal bearings. These bearings are die cast, and can be easily replaced without the usual troublesome bedding in.

GEARBOX. The gearbox is cast integrally with the crankcase, but not as in ordinary unit construction.

Unit construction, as generally known, is advantageous from the manufacturer's point of view, and is a sound job from the driver's point of view, until some trouble or other arises, in which case it is most inaccessible, especially in any detail connected with the clutch.

Frequently the whole engine has to be removed from a car in order to inspect the clutch or fit a new clutch lining or spring. A similar trouble arises in order to replace a gear in the gearbox.

In the 9 H.P. BELSIZE however, all this is unnecessary as all the advantages of the unit construction are obtained with none of the usual disadvantages of inaccessibility.

CLUTCH. The plate clutch, as well as the internal parts of the gearbox, can all be removed in a few minutes. The clutch is situated at the back of the gearbox, but it RUNS AT ENGINE SPEED AS IN ORDINARY PRACTICE (Bradshaw's Patents). It is only necessary to remove three nuts from the cardan shaft universal joint and the whole of the clutch can be removed. Further, the gearbox parts can be extracted complete by removing the end cover. This carries the selector and all gears and gear shafts with it.

REVOLVING CLUTCH STOP. This advanced method of construction is still further advanced by the use of a powerful clutch stop, which is carried on a member that rotates with the cardan shaft (instead of stationary as in all other cars), and thus it is never possible for the clutch to slow down below cardan shaft speed, therefore, on all gears the variation of speed of the teeth is well within that permissible for easy changing, and when changing into top gear (the one mostly used) the speeds are identical and the gear change is silent every time (Bradshaw's Patents).

FRAME. The frame is of pressed steel channel of exceptionally deep section and is reinforced by heavy pressed steel crossmembers, three in number. The forward and intermediate ones carry the engine unit, and the rear one carries the rear universal joint for the cardan shaft and rear axle.

SPRINGING. All the springs are Quarter-elliptic and require no lubrication at any of their joints. The front springs are attached rigidly to both the chassis and the front axle, and each spring has two safety leaves. The rear springs are attached rigidly to the chassis and to the rear axle by means of hardened steel pins of large diameter running in oilless bushes which never need any attention and should not be lubricated.

The push of the drive on the car is taken through these springs.

STEERING. The steering is the last word in balance, lightness, self-centering, and absence of the backlash. The wheel can be turned from full lock to full lock whilst the car is standing still, and at 60 miles per hour on the road the car can be manoeuvred with ease by holding the wheel lightly between the thumb and finger. It is a steering which inspires the greatest confidence.

The steering gear consists of a large square thread operating inside a bronze nut combined with another thread to take the thrust in both directions. The whole of the steering is lubricated from the crankcase direct and as this oil is always thin it better lubricates all parts, needs no extra attention, and never becomes stiff in the winter time as do some steerings when lubricated with grease.

FRONT AXLE. The front axle is made from one heavy steel stamping of girder section. The steering heads are of exceptionally large size and have large bearings as this is an item which wears most rapidly on most light cars and gives considerable trouble. The vertical pin bearings are four inches in length and one inch in diameter, and the weight of the car is carried on large adjustable ball thrust bearings at the base of these pins.

REAR AXLE. The rear axle is a very light but strong construction of malleable castings and large diameter steel tubes. The drive is through spiral bevel wheels in order to obtain the silence of larger cars. The shafts are very strong in order to use larger bearings than are usually found even in heavier cars, and the torque is taken through the cardan shaft casing, the drive, as previously mentioned, being taken by the springs. This assists in preventing side sway at higher speeds.

BRAKES. The brakes are exceptionally large in size, and will run without adjustment for 8,000 miles. The internal diameter of the drums is 9ins. and the width of the shoes, 1½ins. One is operated by the hand lever on the right hand side and the other by the foot in the usual manner.

PETROL TANK. This is situated on the engine side of the dashboard, the feed to the carburettor is gravity and a large detachable filter which can be removed bodily for cleansing purposes is incorporated.

The capacity of the tank is six gallons and the filler cap is under the bonnet, thus preventing the petrol or benzol from being spilt over the paint or varnish.

RADIATOR. The radiator and bonnet are exceptionally high, and perfectly streamlined so as to give a very pleasing appearance, and the former is fitted with attractive strip metal grids instead of flat sheet metal punched with small holes.

CARBURETTOR. The carburettor is a 30 mm. Zenith horizontal, both foot and hand controls being provided. It is in a most accessible position.

IGNITION. The ignition is by means of a Magneto which is carried in an accessible position on the top of the gear box.

LIGHTING. The electric lighting is by a six volt dynamo set, having two head lamps with dimmer switch and a tail lamp.

ACCESSIBILITY is one of the most studied points in the whole design.

The 9 H.P. BELSIZE is essentially a car for the busy owner driver who has little time or inclination to tinker with his car. It is for the driver who expects it to function at any hour of the day or night, and who can only find time to oil up at a few rare intervals during the whole year. The whole of the engine, clutch and gearbox unit, as well as the automatically lubricated steering gear, are all under the bonnet. THERE IS NOTHING WHATEVER UNDER THE FLOORBOARDS, and even the universal joint behind the clutch and gearbox is accessible under the bonnet. The "first thing" under the bonnet is the oil filler cap, and this is used to fill up both gearbox and crank chamber. The rear axle will run for 5,000 miles with one fill up of grease and the front steering rods are provided with oil cups that carry a large quantity of engine oil, instead of the usual small greasers. The rest only requires the usual yearly "tour of inspection" and in case anything (even vital parts) require adjustment or spare parts, they can be fitted with unusual ease. Even a new piston ring or piston could be fitted without removing the engine, as also could a connecting rod, or big-end bearing, or the camshaft or any cam gearing or parts.

The whole of the rear axle can be removed in four minutes and should the engine unit require moving, it can be taken out complete with gearbox and clutch from under the bonnet, without interfering with the body or floor boards in any way.

PRICE. This is not yet definitely fixed, but it will be at such a figure as to compare favourably with the 8 H.P. and 10 H.P. Cars at present on the market.

THE COOLING OF THE 9 H.P. BELSIZE LIGHT CAR.

By Granville Bradshaw.

The "Bradshaw" method of "Oil-cooling" is now a well proved system. It is simplicity itself and it achieves all objects and advantages obtained by water-cooling as well as many more, and it at once removes all the great disadvantages that are found in the water-cooled engine.

It is quite as efficient in every way and in some cases much more efficient.

It removes the radiator, water pump, water jacket, etc., and by lightening the chassis saves petrol and tyres. It is, of course, much cheaper in manufacture than a water-cooled engine and completely prevents all overheating, cylinder distortion, boiling on hills, the worry and trouble of filling up the radiator, and wholly avoids the necessity of garage heating in winter as well as worry about frost when standing.

It renders any engine more accessible, a cylinder can be removed in a few minutes without draining off the water or breaking any troublesome water joints (especially as in water-cooled cylinders with detachable heads and gaskets), a cylinder can be removed single-handed and it prevents all carbonisation of the pistons in any way.

This system of "Oil-cooling" is simplicity itself, as it is only a scientific method of using the surfaces of the engine as a heat radiator combined with a method of conducting the heat of the interior of the engine to the crankcase and other parts by means of the oil which is inside the engine and which is primarily used for lubrication.

It is not generally known that it has been definitely proved that even in ordinary standard water-cooled engines in use in cars to-day the crankcase and the oil within it radiates much more heat than does the radiator proper.

This condition of affairs actually happens without any special means having been applied to secure the same, and when fins have been cast underneath the crankcase to "cool the oil" it has not been known that this cooling of the oil has had a much more beneficial effect upon cooling the engine than would have been an increase in the size of the radiator by 100%. When a water-cooled engine boils it is generally due to some small water passage very close to the valve pockets, which small passage cannot be kept below boiling point of water, therefore local boiling takes place and the water separates from the cylinder and allows the barrel to reach a higher temperature. Further, as can readily be seen in the case of a saucepan over a fire, that part of the saucepan which is in contact with the heat becomes coated inside with tiny bubbles, and these bubbles insulate the heat of the cylinder barrel from the cooling water, in which case not nearly so much heat is extracted by the radiator as has hitherto been imagined.

The writer has seen many cases in which the temperature of the cylinder barrel of a water-cooled engine is considerably higher than that of a corresponding air-cooled one.

Oil does not create bubbles at high cylinder temperature, neither does it separate from the metallic surfaces. The heat of the actual cylinder head is of much less consequence than is the heat of the piston, and yet water-cooling is designed only to cool the cylinder head and barrel, and the piston head is left to look after itself and to keep cool under high friction and insulated from the water by two thicknesses of metal and an oil film.

The Piston head is allowed to be excessively heated as can be seen by the fact that carbon is formed which requires a piston head temperature of about 900° fahr. and this increases as the carbon accumulates.

The Piston can only be kept down in temperature by some properly designed means of extracting the heat and passing it away. The cylinder barrel is only in contact with the heat of the explosion for a short part of the time whilst the piston is in contact for the whole of the stroke, therefore, that which can efficiently cool the piston can also cool the barrel. Konking on a hill in a water-cooled engine is in nearly all cases due to the inability of the design to avoid the piston overheating and becoming carbonised.

It can readily be seen that if SUFFICIENT oil is poured into the piston constantly it must keep down its temperature and fortunately the writer has found that by correct arrangement it only requires about 100% more oil in circulation than that normally used for lubrication purposes.

With such circulation of oil at a rapid rate combined with a design of crankcases which is suitable to the purpose the writer finds that it is easily possible to keep down the oil temperature to less than 180° fahr., and the pistons (of aluminium alloy) do not discolour (much less carbonise) EVEN AFTER FIFTY HOURS ON FULL LOAD ON THE TEST BENCH.

This shows a great saving in oil consumption as none can burn away and incidentally the oil is clear and fresh at the end of the run.

Enclosing all working items within the crankcase and by removing the metallic ring of the original air-cooled cylinder (the noise of the water-cooled cylinder is deadened by the water) by sinking it right down in the crankcase and bolting it by its head enables an oil-cooled engine to be made as quiet in operation as the best of water-cooled engines.

The proof of the pudding is, of course, in the eating, and a hard run on a 9 H.P. BELSIZE light car will satisfy the most critical mind that they can find no further use in water-cooling.

THE HIGHEST RECOMMENDATION FOR OIL COOLING.

In an issue of "The Autocar," dated 23rd April, 1921, the writer was asked to give his opinion as to the advantage of the "straight-eight" engine for use in the Grand Prix races as practically all cars entered were of this type. The reply was that probably the greatest advantage was one that nobody realized, i.e., they had crankcases with larger area per cylinder volume than had the others and, combined with the large oiling system which they probably had, it would assist them in cooling the cylinder barrel and piston to an extent that they could not realize.

In an issue of "The Autocar," 16th August, 1921, it states:- "THE WINNER (of the 1920 Grand Prix) ACTUALLY COVERED THE LAST TWO LAPS WITHOUT WATER AND BOYER'S DUESENBERG HAD VERY LITTLE WATER LEFT IN ITS RADIATOR..... IT IS OPEN TO DOUBT WHETHER ANY OTHER TYPE OF ENGINE COULD STAND SUCH TREATMENT."

That the most strenuous race in the world should have been won by oil-cooling is surely the best proof of the efficiency of this system.