

semi-elliptic springs are connected to a transverse member of the frame by a transverse inverted spring of the semi-elliptic type, the middle of this spring being rigidly clamped to a bracket on the frame.

The full elliptic springs shown at J were once used for both the front and rear on some American cars. They gave great flexibility for a given overall length of spring, but they allowed a certain amount of side sway and fore-and-aft movement of the frame relatively to the axles.

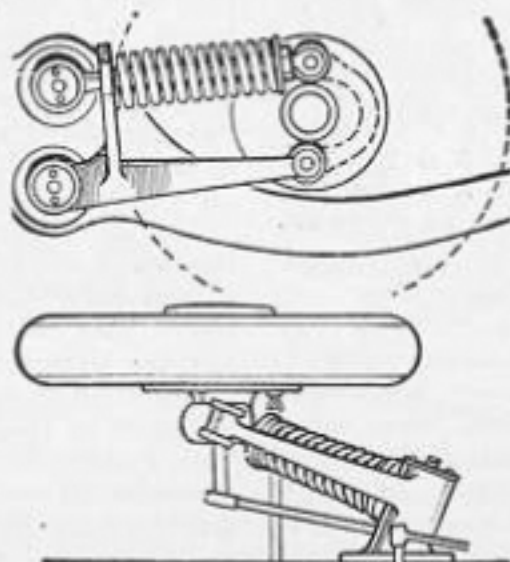
Two quarter-elliptic springs arranged one above the other, as shown at L, are pivoted at their free ends to a bracket on the axle and co-operate to resist the driving and braking torque.

The cantilever spring shown at M has a sliding connexion at its rear end with the axle which is positioned in a fore-and-aft direction by radius rods serving also to take the driving and braking torque. The spring has thus only to support the load and to resist side movements.

Transverse inverted semi-elliptic springs are shown applied to the front and rear axles at N and O respectively. In each case the middle of the spring is clamped to the frame so as to give lateral stability, while the ends are connected by short shackles to the axle so as to allow for the shortening and lengthening of the spring as it deflects. The shackles are made short

increasing friction, but neither of these methods has been used to any extent.

In the various types of independent wheel mounting both laminated leaf springs and coil springs are used. When the former are employed they are usually arranged transversely. Coil springs in several designs are enclosed and the layout embodies frictional or hydraulic shock absorbers. Some cars have suspension systems in which torsion bars or rods take the place of leaf or coil springs. The Citroën is a notable example of this type.



Spring System. Fig. 5. Two views of Gordon Armstrong independent system incorporating coil springs. Courtesy of "The Autocar"

SPRING WASHER.

Ordinary washers are replaced by spring washers to prevent slackening back of the nut when the parts are subjected to vibration. Spring washers of the single- and the double-twist type are employed, the former being used when a nut has to be more or less permanently locked in position with a spanner, and the latter where a thumb screw or milled nut is employed, such as on the terminals of

sparkling plugs or magnetos. With the double-twist type a smooth engagement is provided and friction only is relied upon to prevent backward rotation of the nut, but with the single pattern the corners are set up slightly so as to bite into the engaging face and offer a positive resistance to rotation of the nut in an anti-clockwise direction. Both types are made of good spring steel (see illustrations, page 475).

The single-twist spring washer cannot safely be used on soft metal such as aluminium without causing damage, since the surface area is small and the washer is liable to bed itself in.

Split pins are somewhat safer than spring washers and are used especially for locking nuts in more important parts such as the big ends and main bearings of a crankshaft. See Locking Washer.

Sprocket Wheel. See Chain Gearing; Chain Sprocket.

SQUARE ENGINE. When the stroke of the piston and the diameter of the cylinder are equal to one another, the engine is said to be square.

The R.A.C. or Treasury rating for taxation purposes in this country takes account only of cylinder diameter, and this is one reason why the stroke of the piston is nearly always made greater than the cylinder diameter. See Internal Combustion Engine; Treasury Rating.

S.S. CARS: RANGE OF FOUR MODELS

A British Make of Distinctive Design and First-class Performance

The S.S. is a comparative newcomer amongst cars now on the British market, but since its inception it has met with a marked and well-merited success. Produced originally as a sports vehicle combining high performance with comfort, it has been steadily developed so that the present cars are exceptionally fine examples of the type. The models now marketed are here fully described and maintenance notes (by arrangement with "The Autocar") are also given.



Spring System. Fig. 5. Typical half-elliptic spring applied to front axle. The rear anchorage and attachment to the axle beam are clearly shown.

so as to avoid excessive side play or swinging of the frame. In both cases the axles have to be stayed against forward and rearward movement by radius rods or a torque tube.

In the unusual arrangement shown at P a cantilever spring and a semi-elliptic spring share the weight of the rear part of the vehicle between them.

The springs may be covered by metallic or flexible gaiters which retain lubricant. In some cases very thin interleaves of zinc or other non-ferrous metal may be inserted between the steel leaves. This gives a fairly uniform degree of friction and prevents the rusting of the steel leaves on to one another. Flat ball cages have been arranged between the ends of the leaves to reduce friction, and insertions of frictional asbestos material have also been introduced in a similar manner with the object of

When the S.S. car was first manufactured it was really a modification of the Standard. The chassis was adapted to take special Swallow coachwork and various alterations were made to the engine to give an increased performance. The frame was underslung and the springing and steering were modified. As a result the finished production was extremely attractive both in appearance and its general behaviour on the road.

S.S. 1½-Litre. The present range of S.S. cars, known as the "Jaguar" series, consists of four models. The smallest of these is the 1½-litre and has a four-cylinder engine of 12 h.p. The dimensions are 69.5 mm. bore and 106 mm. stroke, and the cubic capacity is 1,608.5 c.c. The crankshaft runs on three bearings, and the camshaft is driven from the front end by a chain. Side-by-side valves are employed, these being actuated through harmonic cams, and the cylinder block is made of chromium iron. Light alloy is used in the construction of the connecting rods and the combustion chambers and the inlet and exhaust ports are carefully machined to give a good gas flow.

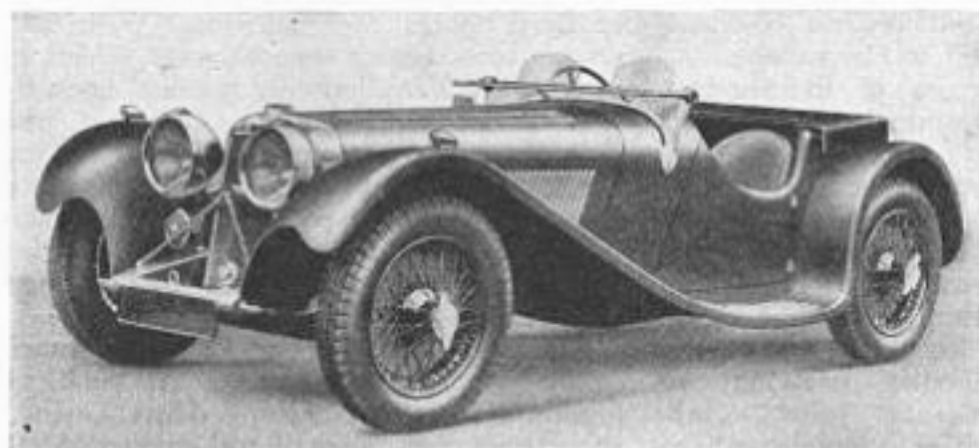
Carburation is by a Solex downdraught carburettor which receives its fuel supply from an eight-gallon rear tank by means of an A.C. mechanical pump. Ignition is provided by a coil-and-battery system and the lubrication arrangement incorporates the usual type of submerged gear pump.

From the engine the drive is taken by a dry single-plate clutch to a four-speed gear-box, the latter having synchro-mesh.

Box section girders are employed in the frame construction and there is a substantial cruciform which gives the necessary rigidity. Long, flat road springs of low periodicity form the suspension of the car, and these are controlled by Luvax hydraulic shock-absorbers. All the leaves are heavily coated with lead in order to prevent corrosion and the development of rust. Dunlop wire wheels of racing pattern are fitted as standard and there are Girling brakes with heavily ribbed alloy drums of 14 in. diameter. Light yet positive steering is a feature of this car, the gearing being of Burman-Douglas design, which works on the worm-and-nut principle.

S.S. 2½-Litre. The 2½-litre type is made in three forms—as a saloon, a tourer, and as a special two-seater, when it is known as the "100" model. The power unit—which is specially manufactured by the Standard Motor Company—has six cylinders with a bore of 73 mm. and a stroke of 106 mm., and the swept volume is 2,663 c.c. By R.A.C. rating the horse-power is 19.84 and the annual tax is £15. Overhead valves are used in this engine and they are operated by push-rods. The crankshaft is of very robust design and is carried on seven bearings.

The lubrication system has been very carefully designed with the oil supply maintained



S.S. A high power-weight ratio and an efficient engine enable this 2½-litre "Jaguar 100" to give an excellent performance. A speed of 60 m.p.h. is reached in under 12 seconds and the maximum speed approaches 100 m.p.h.

by a large-volume gear pump which is completely submerged. The sump is also of large capacity and it is heavily finned for cooling purposes. Cooling is thermosiphon assisted by an efficient centrifugal pump, and an automatic by-pass thermostat is embodied. The induction system is another special feature of the engine, and two S.U. automatic starting carburettors are incorporated in the arrangement. These are equipped with air-cleaners and are fed with fuel by an S.U. electric pump. The tank is fitted at the rear of the chassis and holds 14 gallons. Battery ignition is employed and the coil and distributor are conveniently located on the nearside of the engine where they are readily accessible. On the same side the ventilated dynamo is carried; it is belt driven from a pulley fitted to the front end of the crankshaft.

Transmission Details. Integral with the engine is the synchro-mesh gear-box. A dry single-plate clutch, a Hardy-Spicer propeller shaft and a semi-floating rear axle make up the rest of the transmission system. An ultra-low build is obtained by undersliding the frame at the rear and by dropping the side members aft of the front springing anchorages. These springs and those at the rear are of the semi-elliptic type and they are controlled by Luvax double-acting shock absorbers. Particular attention has been given to the brakes of this car; the shoes have Ferodo racing linings and the 15-inch drums are made of alloy, ground-finished and deeply finned for strength and cooling. The Girling system is employed, the shoes being rod-actuated.

The foregoing description applies to the chassis of the saloon type 2½-litre S.S. and in the main it also covers the specification of the tourer and the "100" model. The latter, however, being a super-sports machine, has somewhat higher gear ratios,

an 18-gallon fuel tank, and the wheelbase is 8 ft. 8 in. as against the 9 ft. 11 in. of the other models.

2½ - LITRE "JAGUAR." CARE AND MAINTENANCE. The care and maintenance of the 2½-litre "Jaguar" will now be dealt with, the information being

provided by "The Autocar."

In the case of a new car there are one or two important points to bear in mind. In the first place, the car should be driven at a moderate speed for the first 500 miles so that the engine does not exceed a speed of 2,500 r.p.m., and, secondly, the crankshaft is carried in seven bearings, and it takes at least 2,000 miles for the bearings to become properly run in so that the engine is free and can develop its maximum power. It is recommended that, at any rate during the early life of the engine, an upper cylinder lubricant and a running-in compound containing colloidal graphite should be employed.

Also, after the first 500 miles the oil should be drained from sump, gear-box and rear axle, as during the early life of the car a small amount of foreign matter is always liable to collect in the lubricant.

As regards engine lubrication one of the recommended lubricants should always be used, the oil filler being situated on the top of the valve cover. A dip-stick gauge is provided on the offside of the crankcase and this should be examined every 200 miles and fresh oil added to restore the level to the maximum mark.

Despite the fact that instructions are frequently given as to the correct manner in which the dip-stick should be used, cases often occur where it is obvious that the oil has not been maintained at the correct level. The car should be standing on level ground, and the engine should not be running. Withdraw the dip-stick, wipe it on a clean, non-fluffy rag, replace it, and again withdraw it, when the oil film on the end will indicate the correct level.

After the first 500 miles, and subsequently every 3,000 miles, the sump should be drained through the plug provided in the bottom. Do this when the engine comes in from a run, or start the engine up and

let it run at about 1,000 r.p.m. until it is thoroughly warm, as the oil will then flow out more readily and will carry any sediment with it. Before removing the drain plug have a large oil tray or other receptacle handy to receive the old oil, bearing in mind that the capacity of the sump is 2½ gallons. When all the oil has drained out give the engine a turn or two by hand so as to release the small amount of dirty oil which is retained in the oil pipes.

The careful owner may like to remove the sump after the first 500 miles, and subsequently every 10,000 miles, in order that it may be thoroughly cleaned out, and also the large filter which surrounds the oil pump, but at other times any remaining sediment in the sump may be washed out with flushing oil. Petrol or paraffin should, however, on no account be used to wash out the sump, unless it is first removed.

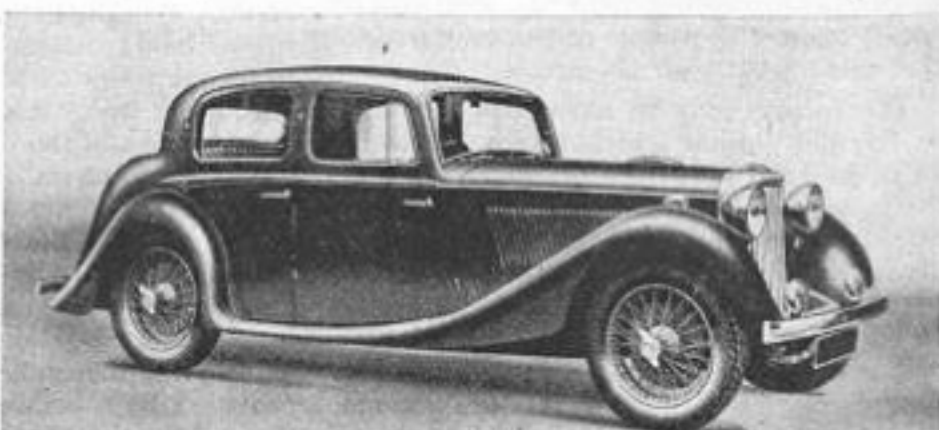
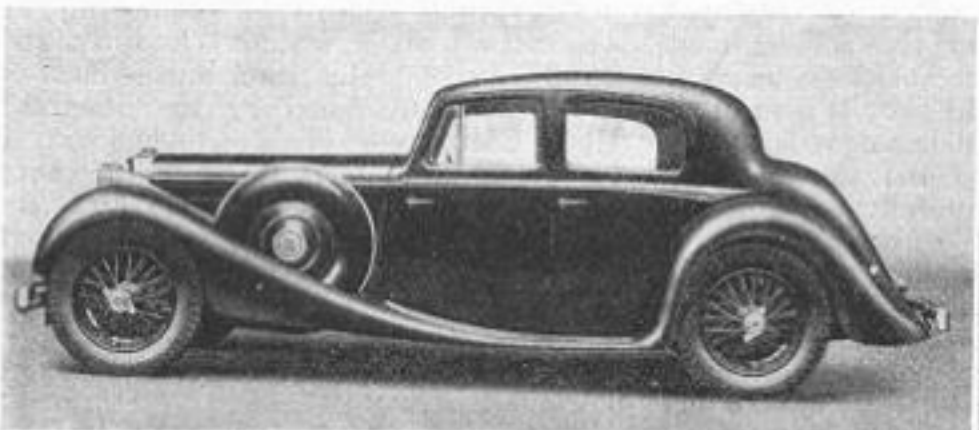
The sump is easily detached by packing pieces of wood beneath it to support it while the set screws which hold it to the cylinder block and crankcase casting are unscrewed. Care should be taken not to damage the washer between the sump and the main casting. The filter and the sump may be cleaned with petrol and a stiff paint brush, and should be allowed to dry before the sump is replaced. In tightening the set screws which hold the sump, work from side to side and diagonally, tightening the screws a little at a time so as to pull the sump up squarely on the crankcase and thus secure a good oil-tight joint.

After draining, and possibly cleaning the sump, see that the drain plug is replaced securely, as, should it come loose, all the oil in the engine might, of course, become lost quite rapidly, and before the driver was aware of it. Then refill the sump with 2½ gallons of fresh oil.

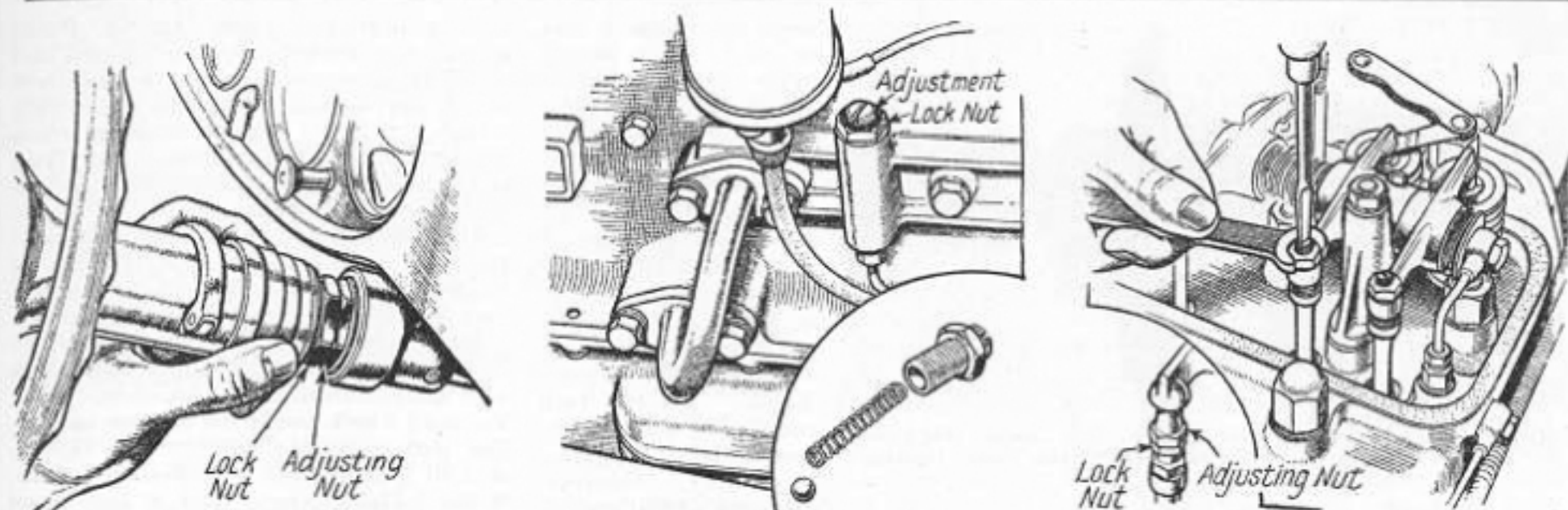
The oil is delivered under pressure to the various bearings and also to the shaft of the overhead valve rockers, and the pressure gauge on the instrument board advises the driver that the lubrication system is functioning correctly. When a normal running temperature is reached, this gauge should show a pressure of not less than 20 lb. per sq. in. at ordinary speeds, but much higher pressures may be recorded when the engine is cold, and a lower pressure may be shown when the engine is warm and running only at idling speeds.

Rocker Gear. Oil from the rocker shaft passes through oilways in the rockers and packed with wick; examination of the rocker gear after the engine has been running will show whether oil is reaching all the rockers properly.

If the oil is drained at the recommended intervals and not allowed to get dirty, it is



S.S. Left, the 1½-litre "Jaguar" in saloon form. The modern yet restrained lines of the coachwork make this model one of the most handsome cars on the road. Right, the 2½-litre saloon. The 1½ litre has a side-valve engine of 1,608.5 c.c. capacity and the R.A.C. rating is 12 h.p.



S.S. Three important points of adjustment on the 2½-litre "Jaguar." Left, how steering end play adjustment is disclosed by raising the telescopic cover located beneath the steering wheel. Centre, the construction and means of adjustment of the oil pressure relief valve located at the side of the engine. Right, how the valve clearances are obtained. An earlier type is shown in the inset.

Courtesy of "The Autocar"

unlikely that trouble will ever be experienced with the lubrication system, but should the engine be neglected and the oil become very dirty, it is possible that a particle of grit might interfere with the proper action of the oil pressure relief valve. This is situated on the crank case on the rearmost of the two plates which cover in the main oil gallery, and it consists of a spring-loaded valve with an adjusting screw secured by a lock nut to allow the spring pressure to be varied.

Oil Pressure. If the pressure fails the lock nut should be loosened and the adjusting screw withdrawn so that the spring and valve may be withdrawn and cleaned by washing in petrol. Replace the valve, then the spring, and, finally, the adjusting screw with its lock nut. The correct position of the adjusting screw must then be found, so that when the oil is warm a pressure of not less than 20 lb. per sq. in. is shown on the gauge at an engine speed of about 1,500 r.p.m. Turning the adjusting screw clockwise will increase the pressure.

There are one or two other points on the engine which require lubrication, and the distributor spindle bearing is provided with an oil cap through which two or three drops of oil should be inserted with an oilcan every 1,000 miles. Nipples are also provided on the hub of the fan and on the water pump, which should be given two or three strokes of the grease gun every 500 miles. The oilcan may be used for lubricating the small joints of the carburetter and ignition controls. Lubricators on the dynamo only need one or two drops of thin oil every 2,000 miles.

The mixture is supplied by two S.U. carburetters fed by an S.U. petrol pump. A gauze thimble is incorporated in the union of the float chamber of each carburetter, and there is also a filter attached to the hexagon plug in the bottom of the base of the fuel pump. If these filters are cleaned regularly, there should be no trouble with the fuel supply.

It is essential that the carburetter pistons carrying the tapered needle should rise and fall freely, and when the engine is not running a finger can be inserted through the air intake so that the piston can be lifted and allowed to fall. It should fall rapidly with a definite click as it reaches its lowest

position. If one of the pistons shows signs of sticking, it should be given two or three spots of thin oil through the oil cap nut.

The only adjustment likely to be necessary to the carburetter is for idling, and this should be made when the engine is hot. Screw up the jet-adjusting nut at the base of the jet as far as possible, which causes the mixture to be too weak. Then pull out the mixture control on the instrument board until the engine starts readily and idles regularly, when the jet-adjusting nut may be unscrewed until it contacts with the jet head. The two carburetters must be adjusted to give the same results, and then, while the engine is running, look through the air intakes so that the position of the pistons may be ascertained. When the carburetters are correctly synchronised the pistons should float at the same level, and the jet-adjusting nuts should be turned very slightly until the desired result is obtained.

So far as the ignition is concerned, the plugs recommended are Champion L10, and the points of all should be set to the same gap of .018 in. The distributor must be kept clean inside and the contact breaker points should always be clean and correctly set to the gauge provided.

Valve Clearances. The overhead valves should be checked every 3,000 miles. The correct clearance when the engine is hot is .006 in. for all valves, and on early models the adjustment is made by a nut and lock nut at the top of the push-rods, the clearance being measured between the valve stem and the end of the rocker arm. On later models a different form of adjustment is provided, the end of the rocker arm in contact with the push-rod having a screw secured by a lock nut.

Easy steering is largely a matter of lubrication of the various joints, but occasionally the tightness of the two bolts holding the steering box should be checked.

Adjustment is provided for the steering, but must be used with great care. End play in the steering column may be taken up by means of the adjustable ball race at the top of the column, the upper nut being a lock nut and the lower hexagon being the top of the ball race, which will, therefore, require to be turned clockwise very slightly, and then held in position while the lock nut is tightened.

Little attention is required by the transmission. The clutch does not require lubrication, and the only adjustment necessary is that for maintaining the free movement of the clutch pedal, which should be not less than $\frac{3}{8}$ in. measured at the pedal pad. There is a variation in the adjustment provided, as on the first models the adjustment was on the rod running from the pedal to the compensator lever, and this requires to be shortened to take up lost movement due to wear in the pins of the various joints, or lengthened if wear on the clutch should be greater than the lost movement due to wear in the pins, accordingly reducing pedal travel.

On later models both this rod and the rod from the compensator lever to the withdrawal shaft are adjustable for length, and the main adjustment should be made on the latter rod until the correct clearance of $\frac{1}{8}$ in. is obtained between the graphite release bearing and the release lever plate.

Gear-Box Filler. Access to the gear-box filler plug is provided through a hole in the moulded cover in the centre of the front compartment, and after the plug has been unscrewed by a box spanner it may be withdrawn by gripping it with a coin held in the thumb and finger of each hand. The dip-stick is attached to the filler plug and should be used, of course, in a precisely similar manner to the engine dip-stick to ascertain the oil level. It should be sufficient to do this at intervals of every 2,000 miles and to top up the box to the correct level with fresh oil.

After the first 500 miles the gear-box may be drained through the plug in the bottom and swilled out with flushing oil to remove any metallic particles.

STAFFORD. Staffordshire. Castle is a sham antique on site of older building; many old houses; S. Mary's and S. Chad's church; birthplace of Izaak Walton. See Birmingham District Motor Routes.

Stage Carriage. See Public Service Vehicle.

STAIGNE FORT. Kerry, I.F.S. Near Castlecove. Here is a noted round stone fort of great antiquity, the most perfect in the country. It is 114 ft. in diameter. See Cork District Motor Routes.

STAINDROP. Durham. 5 m. N.E. of Barnard Castle. 11-14th cent. church