

THREE LITRE BENTLEY

INSTRUCTION BOOK.

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Foreword.

THE THREE LITRE BENTLEY is a car which requires a minimum amount of attention to maintain it in an efficient condition. It is, however, very important that it should receive that small amount of attention which is necessary. This applies in particular to the lubrication of the chassis and it is strongly recommended that an Owner should, in his own interests, carefully follow the instructions contained in this booklet, and so maintain the car in a condition satisfactory to himself and to the Manufacturers. The Owner's attention is also specially called to page 14 where hints with regard to the treatment of a new car will be found.

Messrs. Bentley Motors Ltd. hope that Owners will never hesitate to communicate with the Service Department should they ever be in doubt with regard to any point concerning the upkeep and management of the car, or should they consider that it is in any way not performing as it should do.

The Company have such confidence in their product that they know that no owner need remain dissatisfied or disappointed.

The adjustments described at the latter end of the book include all those which may be undertaken outside the Service Department.

It is hoped that the perusal of these pages will prove of interest and will enable owners to acquire a general knowledge of the chassis, and so enable them to obtain the best results with regard to economy and enjoyable driving.

DESCRIPTION OF CHASSIS.

DETAILS IN BRIEF.

4 CYLINDERS: Cast *en bloc*.

BORE: 80 mm.

CAPACITY: 2996 CC.

STROKE: 149 mm.

R.A.C. RATING: 15.9.

TAX: £16.

WHEELBASE: Standard Model, 10ft. 10ins. Track, 4ft. 8ins.
Speed Model, 9ft. 9½ins.

Overall length: Standard 4-seater, 14ft. 10ins. Speed Model
4-seater, 14ft. 5ins.

WEIGHT OF CHASSIS WITH EQUIPMENT: Standard Chassis, 24¼ cwts.
Speed Chassis, 22¾ cwts.

WEIGHT LIMIT of complete car with
equipment as covered by
Guarantee. - - - Standard Chassis, 35 cwts.
Speed Chassis, 28½ cwts.

CAPACITY OF ENGINE SUMP: 2½ galls.

CAPACITY OF PETROL TANK: 11 galls.

WHEELS: Detachable wire, TYRES: Pirelli 820 x 120.
Rudge Whitworth.

ELECTRICAL EQUIPMENT: Smith's.

ENGINE LUBRICATION: Forced to main and big end bearings, splash
to pistons and gudgeon pins.

COOLING: Pump. MAGNETOS: 2 M.L.

CARBURETTOR: Standard Model, Smith-Bentley 5-jet.
Speed Model, Twin S.U.

PETROL FEED: Autovac. SPARKING PLUGS: 8 K.L.G.

CRANKSHAFT: 5 bearings. CAMSHAFT: Overhead 5 bearing.

VALVES: 4 per cylinder. PISTONS: Aluminium, 3 rings.

CLUTCH: Inverted cone. GEARBOX: 4 speeds and reverse.

DRIVE: Open propeller shaft. BACK AXLE: Spiral bevel.

BRAKES: Foot-brake on 4 wheels.
Hand-brake on rear wheels.

SPRINGS: Semi elliptic, underslung rear.

SPEEDOMETER: A.T. with positive drive from gear box.

INSTRUCTION BOOKS.

With each new chassis, the following Instruction Books, etc., are supplied:—

Bentley Instruction Book.

Carburettor Instruction Book.

Smith Electrical Equipment Instruction Book.

Rudge Whitworth Wheel Instruction Book.

Magneto Instruction Book.

Shock Absorber Instruction Book.

Autovac Instruction Book.

Proprietary articles such as dynamo, self-starter, speedometer, electrical horn, etc., do not come under the five years' Guarantee, though they are in most cases covered by their Manufacturer's one year Guarantee; should any of these instruments prove defective, the Service Department will forward a replacement on request. The defective instrument should not be tampered with, but must be returned to the Service Department, who will refer the matter to the Manufacturers.

ENGINE DETAILS.

The cylinders are cast *en bloc*, the cylinder head not being detachable. The block is of patented design and provides for ample water spaces round the combustion heads, valves, and sparking plugs. In each cylinder there are two exhaust and two inlet valves. They are tulip-shaped, their diameter is small, which combined with efficient cooling, enables them to function for a very great mileage without attention, and consequently they seldom require grinding in. The camshaft is mounted centrally along the top of the cylinder block, and runs in five plain phosphor bronze bearings. The valves are operated by rockers, mounted on two rods which are located parallel with, and on either side of the camshaft. The rockers have at one end a steel pad, which takes the lift of the cam, and at the other end a tappet screw, secured by a lock-nut; this screw bears on the end of the valve, and by means of it the tappet clearances are adjusted; the valve tip and the tappet screw are hardened to prevent wear. (In early engines the valves were fitted with detachable hardened caps.) There are two springs to each valve.

The valve gear and actuating mechanism are entirely enclosed in an oil-tight cover.

The crank-shaft is carried in five white metal bearings; it is prevented from moving endways by a double thrust ball race, housed behind the starting handle bearing. This ball race also takes the thrust imposed by the withdrawal of the clutch.

Aluminium pistons are fitted, having three rings at the top.

The camshaft drive is by means of spiral bevel gears and a vertical shaft from the front end of the crankshaft.

ENGINE OILING SYSTEM.

The oil supply is replenished through a filter on the nearside of the engine, the oil passing through a large cylindrical gauze. Before reaching the oil tank the oil has to pass through another gauze which is flat and of large area, and is located in the oil tank. To ascertain the quantity of oil in the tank, a dipstick is fitted and is to be found immediately underneath the filler. There are two marks on the dipstick, the higher, showing the oil level when the tank is full, and the lower, the level below which the oil should never be allowed to drop. The quantity of oil required to raise the level from the lower mark to the higher is approximately $1\frac{1}{2}$ gallons. When the tank is empty $2\frac{1}{2}$ gallons approximately are required to fill it to the top mark. When replenishing the tank, plenty of time should be allowed for the oil to filter through the two gauzes before withdrawing the dipstick in order to ascertain the amount in the tank. This precaution is particularly advisable when the weather is cold as the oil is then thick and filters slowly. The oil level should be tested before starting up in the morning so as to make certain that all oil in circulation has had time to drain back to the sump; the car should, of course, be standing on the level. Care should be taken not to overfill, as this will cause excessive oil consumption. The oil pump is situated at the bottom of the oil tank at the forward end. The pump is of the gear wheel type and is driven by a spindle rotated by worm gearing off the forward end of the crankshaft. Means are provided for adjusting the oil pressure which is controlled by a spring-loaded ball valve. (See p. 28 "Oil pressure adjustment.") On leaving the oil tank and before passing to the bearings the oil is forced through the cylindrical gauze filter. This is contained in a cylindrical casing mounted on the near side of the engine immediately behind the radiator. This filter is of large area so that it is only advisable to clean it about every 5,000 miles. (See p 28 "To clean oil filter.") On leaving the filter the oil passes through the side of the crank-chamber and is led by branching pipes to the five crankshaft bearings. Oilways are drilled in the crankshaft through which oil passes to the big-end bearings. It is then thrown, by centrifugal force, into the crank-chamber and so on to the cylinder walls, thus lubricating the pistons and gudgeon pins.

The camshaft has an oil passage throughout its length, oil is fed into this through the rear end bearing, the supply being delivered through a pipe taken off the delivery side of the filter. Thus the five camshaft bearings, cams, rockers and guides are lubricated. The overflow of oil from the overhead gear returns to the sump through the vertical shaft housing and two return pipes, situated between cylinders Nos. 1 and 2, and 3 and 4. Thence it drops to the sump through the large flat gauze filter mentioned above. All carbon and sediment is, therefore, trapped, and it will be noted that the oil is filtered before and after passing through the engine.

IGNITION.

Two Magnetos are fitted and two separate sets of sparking plugs, four being mounted on the exhaust side and four on the inlet side of the cylinder block. The magnetos are mounted on flanges on either side of the vertical shaft housing; they are driven at either end of a short cross shaft which in turn is driven off the vertical shaft. The magnetos are two separate units and are synchronised to spark simultaneously; they are controlled by separate switches. (See "To synchronise magnetos," page[—]). Apart from the extra reliability obtained by the fitting of two magnetos, it has been found that greater flexibility, acceleration, and decreased petrol consumption are obtained by their use. Independent magneto switches are fitted, and it is important that when the engine is running, they should both be switched on. The order of firing of the cylinders is 1, 3, 4, 2. No. 1 cylinder being nearest the radiator.

COOLING.

The water is circulated by a vane pump situated immediately behind the radiator, and mounted on the front portion of the vertical shaft housing. It is driven off the magneto cross shaft. The water is delivered through a distributor located inside the jacket plate on the inlet side of the engine. The temperature of the water in the cylinder block is kept constant and at an efficient working temperature by an automatic Thermostat. This is situated on the near-side front of the cylinder block. Its action is such that when the engine is cold the water circulation is short-circuited and does not pass through the radiator. The temperature therefore rises rapidly until it reaches approximately 75 deg. Centigrade; a valve in the Thermostat then opens and the radiator is brought into operation. It will, therefore, be realised that the engine warms up very quickly and always runs at an efficient temperature unaffected by that of the atmosphere.

DYNAMO.

The dynamo is mounted on the rear face of the dashboard. It is driven from the rear end of the camshaft, the connection being a short coupling and two Hardy fabric joints which allow for any relative movement between the dash and the engine. The dynamo acts as a flywheel on the camshaft, damping out torsional vibrations, and operates at half engine speed. It will be noted that it is mounted in a very accessible position. (NOTE: On 1922 chassis the dynamo was "geared up" to run at three times camshaft speed).

STARTER MOTOR.

The starter motor is housed in the crankcase casting on the near-side of the engine, and is held in position by a taper cotter-pin. The motor is therefore easily removed if for any reason this should become necessary. The engine is revolved by a Bendix pinion which engages with teeth machined on the periphery of the flywheel. Special note should be made that the worm of the Bendix should never be oiled, but should be periodically washed with petrol to remove any oil and grit that may have accumulated on it.

CLUTCH.

The clutch is of the inverted cone type. The cone is faced with Ferodo and drives through a ring secured to the flywheel by eight bolts. On the ring are tongues which cause the clutch to take up the drive smoothly, even though the clutch pedal may be suddenly released. When the clutch pedal is depressed, the clutch is disengaged by the pressure of two rollers on a thrust ball race. The mountings on which these rollers are carried are so compensated that the pressure exerted by them on the thrust race is always equal. This avoids any likelihood of undue wear on the clutch spigot or bush. The thrust of the clutch spring is taken by a thrust ball race at the front end of the spring inside the cone. Lubrication of the spigot and thrust ball race is effected by a wick lubricator which is screwed into the end of the crankshaft and is fed by the same supply as the main crankshaft bearings.

CLUTCH COUPLING.

The shaft connecting the clutch to the gearbox has a sliding splined joint at its front end and a Hardy disc coupling at its rear end. The shaft is hollow and an oil gun connection is provided through which it is loaded with oil which lubricates the *front coupling only*. (This Hardy coupling was only introduced in later 1923 Chassis.)

GEARBOX.

The gearbox has four speeds forward and a reverse. The change speed lever is on the driver's right. The gate is carried on an arm bolted to the gearbox; the change speed is, therefore, not affected by chassis whip and the gearbox, complete with gate and gear lever, can be easily removed from the chassis if necessary. Three point suspension is utilised and provision is made for obtaining correct alignment. The construction of the gear wheels and change speed mechanism is very substantial, and these parts will withstand very rough treatment without being damaged. It should be mentioned that the speedometer is driven from the gearbox.

The gearbox as fitted as Standard to the speed and standard chassis are not identical. The type "A" box as fitted to the speed model has a comparatively high 1st speed, and only a small difference in ratio between 2nd and 3rd and top. It is designed for use where only light sporting bodies are fitted and the highest road speed is required under various conditions. The type "B" box as fitted to the standard long chassis is, on the other hand, designed for use with a much heavier car, the 1st speed is low and is in the nature of an emergency gear and there are very much wider intervals between 2nd, 3rd and top. With this box, therefore, such high speeds on indirect gears cannot be attained as with the "A" box.

UNIVERSAL JOINTS AND PROPELLER SHAFT.

The universal joint coupling immediately behind the gearbox is of the star type, its parts being of very large dimensions. It is enclosed in a cover having an annular space round the propeller shaft. The propeller shaft is made of solid drawn steel tubing. An oil gun connection is fitted at its forward end. By means of it the shaft can be charged with oil which lubricates the pot-joint at its rear end.

The purpose of the pot-joint is to allow for the plunging action of the back axle when the car is travelling over an uneven road. It is composed of a crosshead fitted with phosphor-bronze blocks which move in slipper pieces, which are free to slide in steel guides. This joint is also fitted with an oiltight cover having an annular space round the propeller shaft. Just in front of this space and bolted round the shaft is a flange about 3 ins. in diameter; this is fitted in order to prevent grit and dust, etc., finding its way into the pot joint.

THE BACK AXLE.

The back axle is of the semi-floating type. The casing is made of two light steel pressings welded together and is immensely strong. The driving shafts have two bearings, at the outer end a roller bearing, and at the inner end a ball bearing, which is housed in the

differential casing. The hubs are secured to the shafts by a key and taper, the inner ends of the shafts being splined. The drive is by spiral bevel. The whole assembly of wheel and pinion and differential can be removed without disturbing the meshing.

The torque is taken by the rear springs, the front ends of which are anchored to the frame by shackle pins of large dimensions.

THE FRAME.

The frame and cross members are of special high grade steel. The construction is such that the engine and gear-box are not depended on to give additional strength. Tie bars are fitted between the front dumb-irons and also the rear dumb-irons in order to prevent twisting over bad roads.

ROAD SPRINGS.

The road springs are semi-elliptic, underslung at the rear, the front springs being mounted on top of the axle. When the car is fully laden the springs are very nearly flat. The shackle pins and bushes are of large diameter and are lubricated with oil. (See "Lubrication instructions," page 13). Spring gaiters are fitted as standard. The hanger bracket to which the rear end of the front spring is anchored incorporates a stop which makes it impossible for the front axle to come back when the front brakes are applied, should a breakage of the main spring leaf take place.

SHOCK ABSORBERS.

On the speed model, Hartford shock absorbers are fitted, and on the standard model D.N.'s. (For instructions with regard to these see p. 29, "Adjustments to shock absorbers.")

FRONT AXLE.

The front axle is a high-tensile steel stamping of "H" section, of ample strength to resist any strain that can be imposed upon it by the use of front wheel brakes. The steering stub axles have thrust ball races which take the weight of the car. The thrust race is protected by an oiltight aluminium dome. Lubrication is affected through an oilgun connection on the axle.

STEERING GEAR.

The steering is by worm and wheel, these parts being mounted on ball bearings. End movement of the steering column can be adjusted by means of a moveable sleeve. Means are provided for easily altering the rake of the column. (See "Steering, to alter rake of," page 31. To lubricate steering parts, see p. 13, "Lubrication instructions.")

PETROL SUPPLY.

The petrol tank, which has a capacity of 11 gallons, is carried at the rear of the chassis. A detachable gauze filter of large dimensions is supplied in the filler orifice. A two-way tap is fitted in the filler. The normal running position of the tap control is horizontal, *i.e.*, turned away from the filler; it will then be found that the engine runs dry of fuel with about two gallons remaining in the tank; on putting the tap control in the vertical position, *i.e.*, over the filler cap, these last two gallons can be utilised. (It should be realised the actual amount of the reserve supply depends on the camber of the road.) This is a simple method of ensuring a *reserve supply* of fuel which thus cannot unexpectedly run completely out without warning. The petrol tank has a drain plug, by removing which it can be completely emptied. The feed to the carburettor from the tank is by Autovac. The Autovac tank is mounted on the dash above the steering column. Mounted close to the Autovac is a filter through which the fuel passes before reaching the former. (For "Care of Autovac," see page 20.)

A tap is provided on the feed pipe between the autovac and the carburettor immediately underneath the former.

CARBURETTORS.

Twin S.U. Carburettors are fitted on the Speed Model chassis. They are of the horizontal type, having a common induction pipe. A rich mixture can be obtained, to make easy starting from cold, by means of the control in the centre of the switch plate on the instrument board. It is important, however, that once the engine is warmed up the control should be left in the extreme weak position, otherwise fuel consumption will be heavy and there is a chance of trouble being experienced from sooty plugs due to a too rich mixture. It is important that these carburettors should never be flooded, as owing to their position the excess of petrol may find its way into the cylinders and wash the oil film from the walls. (See pages 16 and 17)

A Smith Bentley 5-jet Carburettor is fitted to the Standard long chassis. This has four power jets, and a well-jet for slow running and starting. To obtain a rich mixture for starting a strangler is fitted, which cuts off the air supply to the well-jet. The strangler is controlled by a knob mounted centrally on the switch plate on the instrument board and is brought into operation when the knob is pushed right in towards the plate. The normal running position is half way out, where it is lightly held in position by a spring-loaded ball catch. The further the knob is pulled out the more the mixture is weakened. (See pages 16 & 17 .)

Two priming cocks are mounted on top of the induction pipe, which it may be desirable to use in very cold weather. It should be borne in mind, however, that difficult starting may be caused by too rich a mixture, almost to the same extent as by a too weak mixture. (See p. 16, "Hints on starting.")

BRAKES.

Four wheel brakes were introduced as standard about September, 1923, on all chassis. These brakes are of the mechanical type and are operated by the brake pedal. Independent brakes, on the rear drums only, are operated by the hand-brake lever.

A balance gear is fitted to ensure that the braking effort is distributed evenly on all four brake drums. This is mounted across the frame immediately behind the gearbox. Its design is simple, and a valuable feature is that friction is utilised to ensure that the brakes release together. When the balance gear has been correctly adjusted in the first place no further attention to it is required for a very great mileage. To take up wear only one adjustment is necessary, and that is to be found under the front floor boards to the rear of the lower end of the brake pedal. The adjustment for the hand-brake is on the outside of the chassis frame at the lower end of the brake lever.

ROAD WHEELS.

The wheels are detachable Rudge-Whitworth, secured by a locking ring. It should be remembered that to remove a locking ring, it is necessary to hammer it in the direction in which it would revolve when the car is going forward. (See "Care of road wheels," page [—].)

SILENCER.

In the Speed Model the exhaust gases pass through a single silencer in which are three baffles. These are mounted on four rods passing from end to end of the silencer.

In the Standard Model the exhaust gases pass through double expansion chambers, the tail pipe being fitted with a fish tail; thereby a silent exhaust with no back pressure is obtained. The exhaust system requires no attention.

GENERAL REMARKS ON LUBRICATION.

On reading through the lubrication instructions that follow, it will be realised that an extremely small amount of time is required to be spent on this work, general chassis lubrication being necessary only once in three months, or say every 2,500 miles. This is quite a large factor towards the popularity obtained by the car with owner drivers. It must, however, be understood that it is just as important with a Bentley as with any other make of car that lubrication should not be neglected. It should also be realised that though the instructions say that a certain part only requires lubrication every three months or every 2,500 miles, if it is found that that part shows signs, audible or otherwise, of lack of oil, it should be given the necessary attention. Lack of lubrication causes excessive and rapid wear, which is costly to the owner and unsatisfactory to the makers.

ENGINE LUBRICATION.

The oil supply to the engine is replenished through the filler on the near-side of the crank case. The oil tank is carried underneath the crank case and holds approximately $2\frac{1}{2}$ gallons. The level of oil in the tank is ascertained by a dip stick with a brass knob situated below the filler. On withdrawing the dip stick the oil level can be seen. (See page 5, under description of oiling system.) "Bentley Engine Oil" has been produced after experiment, and is most suitable for general use; it should be used whenever possible, but when unobtainable, Price's Huile de Luxe is the best substitute. Failing either of these oils, Price's "C," Castrol X.L., or Castrol "C" may be used; if, when touring, none of these oils can be purchased, an oil of equivalent viscosity such as Veedol Extra Heavy or Gargoyle Mobiloil "B.B." summer and "A" winter can be utilised.

It should, however, be borne in mind that a fairly thick oil suits the engine best and is most economical. The old oil in the engine should be replaced by fresh oil every 5,000 miles. (See instructions, page 29.) The screw down greaser, which is the means of lubricating the water pump spindle, should be filled with a heavy grease of any good brand whenever necessary. Lack of lubrication at this point may cause a drip of water through the greaser. The cylindrical oil filter should be cleaned every 5,000 miles. (See instructions, page 28.)

GEARBOX.

The level of oil in the gearbox should be examined every three months. To do this it is necessary to remove the cover. The oil should be up to, but never above, the centre of the lay or lower shaft. Equal parts of Price's Amber "B" gear oil and Bentley engine oil should be used, or alternately Gargoyle Mobiloil "C." The quantity of oil required to bring it to the correct level from empty is about three quarts.

BACK AXLE.

The oil level in the back axle should be examined every three months by removing the filler cap which will be found in the rear cover of the differential casing. The level should be about $\frac{3}{4}$ in. below the top of the filler. It is most important that the level should not be above this, as if it is the rear brakes may get oil on them which will destroy their efficiency. To fill the axle to the correct level from empty, 1 quart of oil is required. Equal parts of Price's amber "B" gear oil and Bentley engine oil should be used, or alternately Gargoyle Mobiloil "C."

STEERING BOX AND UNIVERSAL JOINTS.

The steering box should be examined every three months and, if necessary, replenished with Price's Belmoline "C" grease or a light grease of a similar nature. The universal joint at the front end of the propellor shaft behind the gearbox should be filled every three months, or every 2,500 miles. This is done by squirting oil in through the annular space in the centre of the cover and round the propeller shaft. This can be done with the help of the rigid nozzle supplied in the tool kit with the Tecalect oil-gun. In later chassis a Tecalect oiler is fitted in the universal joint covers to enable this to be done. Price's amber gear oil "B," or a gear oil of similar consistency should be used. When lubricating with a thick oil it is advisable to warm it so that it flows freely, as this apart from making the work easier, ensures that the oil reaches all the parts that require lubrication; it also has the effect of dissolving the old oil.

The pot joint at the rear end of the propeller shaft should be lubricated in the same manner as the forward universal joint, but in addition the hollow propeller shaft should be charged by means of the oil-gun nipple, fitted near its front end. The propeller shaft acts as a reservoir.

GENERAL CHASSIS LUBRICATION.

At the end of the instruction book, next to the back cover, will be found an oiling diagram, folded up, which shows all the points in the chassis where the oil-gun should be applied. These points require lubrication every three months, or every 2,500 miles, and engine oil should in each case be used. The following special points should be observed with regard to chassis lubrication. On either side of the rear axle, oil nipples are provided for lubricating the brake camshafts. These should be lubricated sparingly as the oil ways are connected with the rear axle casing, so that if too much is forced in, the level in the back axle casing is raised, which, as previously explained, is undesirable, owing to the probability of the oil getting through on to the brakes. The oil-way in this part is purposely constructed like this, as otherwise too much pressure of the oil-gun would *immediately* force the oil through into the brake

drums. The clutch shaft, on which an oil nipple is fitted, does not require a lot of oil as any surplus immediately leaks out, and when the engine is started up it splashes over the undershield, etc. The remaining oil points on the chassis should have oil forced in until it shows at the joints, indicating that the part to be lubricated is full. Engine oil should be used; it is advisable, but not essential, to warm the oil so that it penetrates to every part which should be lubricated. The oil-can should occasionally be used to lubricate any moving parts which are unsuitable for the use of the oil-gun, such as brake rod pins, carburettor, and magneto controls, clutch thrust rollers, starting handle, etc.

GENERAL HINTS WITH REGARD TO THE HANDLING OF THE CAR

The Three-Litre Bentley is remarkable in that, although it is a very fast car, it is extremely easy to handle and drive, either under touring conditions or in traffic. Even the inexperienced driver will soon find himself at ease when he takes the wheel, owing to the flexibility of the engine, the lightness of the steering, and the efficiency of the brakes. It should, however, be realised that the speed of the Bentley is very deceptive, and at first a close watch should be kept on the speedometer. Though all ordinary hills can be climbed on top, it is necessary, in order to obtain the best results as regards hill-climbing, to make use of the gearbox. This particularly applies to the Speed model which is higher geared than the Standard model, and from which a better performance as regards hill-climbing is expected. It cannot be too strongly emphasised that it is of the utmost importance that a car should not be driven hard when new. It is in the first 2,000 miles that a Bentley is made or marred. By this, it is meant that an owner who treats his car considerately at first, will have a smooth, powerful and silent engine, whereas the owner who continually puts his car through its paces, when the engine is still stiff, will be called upon to meet a repair bill many thousands of miles before the owner who treats his car carefully. By treating the car carefully is meant not indulging in high revs. on any gear for prolonged periods. A steady 40 miles per hour on top is not harmful, with perhaps occasional bursts of speed for short distances. In this connection it should be remembered that after an engine has been overhauled necessitating renewing or refitting the bearings, the car should be driven carefully for at least 500 miles, and when pistons only have been re-fitted, for 200 miles.

The brakes are very effective, but an owner who has not previously been accustomed to driving at high speeds should guard against over-confidence by reason of their efficiency. It is not intended in these pages to give detailed instructions as to how to drive, but a few hints with regard to gear changing may be found helpful. The Standard and Speed chassis have intermediate gears,

of which the ratios are different (this has already been explained under "Gear-box," p. 8). Taking the Standard chassis, the gear ratios are as follows:—

1st gear	...	...	...	16.2
2nd „	...	...	...	8.8
3rd „	...	...	...	6.5
Top „	...	...	...	4.23
Reverse	...	...	...	16.2

It is advisable to change from first to second directly the car is in motion and an appreciable pause must be made in neutral in order to get a silent change. The greater the speed of the car when making this change, the longer is the pause necessary. When changing from second to third only a short pause is necessary, whereas a longer pause is again required when changing from third to top. In each case matters are facilitated by double clutching, with, of course, the throttle in the closed position, the deceleration of the engine being greater than that of the clutch shaft. To change down it is necessary to double clutch, speeding up the engine when the gear is in the neutral position, according to the road speed of the car and the gear into which it is desired to change. This gear change will present no difficulties after the driver has become accustomed to the "feel" of the engine. Below is given a table of the speeds which it is safe to attain with the "B" box on the various gears; the engine revs. in each case being 3,000.

1st gear	...	...	...	18
2nd „	...	...	...	33
3rd „	...	...	...	46

It is, of course, understood that the car must have covered at least 2,000 miles before these engine revs. are indulged in. These ratios and speeds are calculated on the basis of the 4.23 back axle ratio, which is fitted as standard on the long chassis.

The ratios of the gears in the type "A" box, as fitted to the speed model, are as follows:—

1st gear	...	...	...	10.0
2nd „	...	...	...	6.18
3rd „	...	...	...	5.05
Top „	...	...	...	3.78
Reverse	...	...	...	10.0

The manner of making the change "up" on this box depends on whether a clutch stop is fitted. With this fitment it is possible to pull the gear lever through the gate very rapidly, the speed of change being dependent on the distance the clutch pedal is depressed, thus bringing the clutch stop into action more fiercely. Without a clutch stop it is necessary to pause in neutral from 1st to 2nd, 2nd to 3rd can be done without any pause, a pause again

being necessary between 3rd and top. In no case are such long pauses necessary as on the "B" box. Changing down it is required to double clutch with the exception of from 3rd to 2nd, when the gear lever can be pulled through very quickly, the clutch pedal being only very slightly depressed and the throttle being kept open, an amount depending on the speed of the car. The speeds which it is safe to attain on the various gears with the "A" box at engine revs. of 3,500 are given below, these being calculated on the basis of the 3.78 back axle ratio, which is fitted as standard on the speed model:—

1st speed	...	...	34 m.p.h.
2nd „	...	...	54 m.p.h.
3rd „	...	...	67 m.p.h.

Here, again, it must be understood that these speeds must only be indulged in after the car has done at least 2,000 miles.

It is hoped that the above hints will prove of some assistance to new owners, but it must be realised that it is only by practice that a driver can become really expert at handling his car.

On the standard chassis, which is fitted with the Smith-Bentley Carburettor, it is possible to effect considerable economy in fuel consumption by the intelligent use of the air control knob on the switch plate. This can be usually left in the full weak position under ordinary touring conditions. If, however, the car is being driven really hard, it is desirable to run with the knob in the normal position, as a weak mixture is not then advisable.

On the speed model, fitted with twin S.U. Carburettors, the mixture control should always be left in the full weak position, as this is the position in which maximum power is developed, the rich mixture being only necessary for starting and before the engine has warmed up.

It is advisable occasionally to test the magnetos and plugs in order to ascertain that they are functioning correctly by switching off each magneto switch alternately when the engine is pulling. By this means it can immediately be found whether all eight plugs are firing. The engine should always be run with both magnetos switched on; should one magneto cease to function, no harm will result from running on one magneto.

HINTS ON STARTING FROM COLD.

STANDARD CHASSIS WITH SMITH-BENTLEY CARBURETTOR. Put the throttle in the closed or slow running position, ignition lever three-quarters advanced, air control knob pushed fully in towards the plate on which it is mounted. Press the self-starter switch, and as the engine is being turned, gently dab the accelerator pedal with the

foot. If the engine does not fire in say, ten seconds, take the foot off the self-starter switch, and pause for a few seconds before depressing it again. The first time the engine fires it may kick back against the starter, owing to ignition being advanced. When this occurs the ignition should be retarded to about half-way or even further, until the engine fires in the correct direction. Directly the engine starts the ignition should be fully advanced and the hand throttle slightly open. The air control knob must then be pulled out until it is in the normal running position, where it is lightly held by a "spring and ball" catch. From cold, starting can be facilitated by depressing the clutch pedal, thus relieving the starter of the friction caused by the thick cold oil in the gear box. The engine should be allowed to warm up for two or three minutes before driving away. In very cold weather it may be found necessary to flood the carburettor, and also inject petrol through the priming cocks fitted on the induction pipe. It should, however, be realised that difficult starting can be caused by too rich a mixture, so that more than a teaspoonful of petrol should not be injected through the priming cocks.

SPEED CHASSIS FITTED WITH TWIN S.U. CARBURETTORS.—

Put the throttle in the closed or slow running position, ignition three-quarters advanced, the mixture control should be twisted a half to three-quarters of a turn towards the rich position. Depress the self-starter switch, and while the engine is being turned, gently dab the accelerator pedal with the foot. The first time the engine fires it may kick back against the starter, the ignition should then be retarded until the engine fires in the correct direction. When this occurs the ignition can be fully advanced and the throttle slightly opened. The mixture control should be put about one quarter turn rich until the engine has warmed up; it should then be put in the full weak or normal running position. Care should be taken with regard to this or trouble may be experienced with the sooting up of plugs. Twin S.U. Carburettors should *never* be flooded, as owing to the position in which they are mounted on the cylinder block an excess of petrol may find its way inside the cylinders and so wash the oil from the cylinder walls.

When starting by hand the ignition should never be more than one-quarter advanced, in order to avoid any risk of a back-fire.

FUEL.

It will be found that Benzole Mixture as sold ready mixed suits the engine admirably, and gives very satisfactory results. No. 1 petrol and Benzole, mixed in the proportion of three parts Petrol to one part Benzole is also satisfactory. If an owner prefers to do so, No. 1 petrol by itself may be used.

CAUTION. EXHAUST MANIFOLD.

This part is susceptible to fracture if the tail pipe at the rear of the silencer meets with a solid obstruction. A comparatively small jar, which might pass unnoticed by the occupants of the car is sufficient to cause the damage. This caution applies particularly to Speed models in which the tail pipe is carried lower than on the Standard model.

ACCIDENTS. OVERHAULS, Etc.

'The five years' Guarantee will immediately be cancelled if any repairs due to accident or overhauls to the chassis are carried out without the consent in writing, of the Company, being received before they are commenced. It is particularly important that no portion of the chassis should be heated and straightened in order to rectify accident damage. Owners are particularly requested to bear this caution in mind, as on a car capable of high speeds it is essential, from the point of view of the owner and manufacturer, that no risks should be taken. Adjustments as detailed in this Instruction Book may be carried out, but should an owner be in doubt with regard to any point he is earnestly requested to seek the advice of the Service Department.

BENTLEY SERVICE.

The Service Department is at all times pleased to hear from owners and to answer queries with regard to any point concerning the upkeep and management of the car. Communications should be addressed direct to the Service Department, Kingsbury Works, The Hyde, Hendon, N.W. A delay is caused by directing letters to either the Showrooms or the Works. Should an owner wish to bring his car in to the Service Dept. for work to be done, it is requested that he communicate with the Department beforehand in order to fix a date. Service will endeavour to suit the owner so far as possible, but an arrangement such as this is necessary in order to avoid congestion, and in order that the work may be put through expeditiously.

DON'T'S

DON'T race the engine when running free.

DON'T rev. the engine on any gear immediately after starting up. It may take several minutes for the oil to circulate throughout the system. This particularly applied if an engine has been standing idle for some days.

DON'T flood Twin S.U. Carburettors. Owing to their position you may get petrol in the cylinders and wash the oil off the walls.

DON'T drive *really hard* with the air control knob in full weak position. This applies only to the standard chassis with a Smith-Bentley Carburettor.

DON'T put any grease in rear hub caps and only a little in front ones.

DON'T overfill back axle.

DON'T forget to keep locking rings of detachable wheels tight, and *don't* use anything but a copper or hide hammer for tightening them.

DON'T forget that after a car has been washed, water may have got into the brake drums, rendering the brakes temporarily inefficient; two or three applications of the brakes will dry the water off.

DON'T forget that to undo a detachable wheel locking ring, the ring should always be hammered in the direction in which the wheel revolves when going forwards.

DON'T run with one magneto switched off except for testing.

DON'T run with the starting handle in the "down" position. It should always be left in the upright position, where it is automatically secured by a spring clip. When left in the down position the dogs on the end of the starting handle are liable to rub against those on the end of the crankshaft causing a "knocking" noise, which has on many occasions been mistaken for a big end knock.

DO

DO please write to the Service Department for advice if you are in doubt upon any point with regard to the upkeep and management of the car.

AUTOVAC.

Fuel is supplied to the carburettor by means of an Autovac, the system being such that the fuel is sucked from the tank at the rear of the chassis, the suction being obtained from the induction pipe. The Autovac is very reliable, and it is very exceptional for it to require any attention. It has been found in a few cases that very excessive petrol consumption, *i.e.*, in the neighbourhood of 12 to 14 miles to the gallon can be traced to the fact that a small valve is not seating properly, and is allowing petrol to be sucked into the induction pipe. Should this fault occur it can be traced by running the engine, then stopping it, and unscrewing the connection to the Autovac on top of the induction pipe. If the valve is leaking the inside of this pipe will be found to be wet with petrol. This fault can sometimes be remedied by giving the Autovac two or three sharp taps with a block of wood. If this is found to be of no avail it is not advisable to dismantle the Autovac, but to communicate with the Service Department, who will send a replacement as expeditiously as possible. There is a small drain cock on the underneath of the Autovac, which should be occasionally opened in order to drain away sediment and water which may have come through from the tank with the fuel. If there is much sediment in the Autovac, it will be found that this will not run out when the tap is opened, the tap being of small diameter and so getting blocked up. It can be cleared by inserting a wire or thin nail. Should an Autovac ever be dismantled it is most important to be careful not to damage the cork washer which makes the joint around the top. The whole action of the Autovac depends on this joint being air-tight.

CARE OF BATTERIES.

The batteries should be regularly filled once a fortnight with *distilled* water, which should just cover the top of the plates, which can be seen through the filler. Diluted acid should only be added when any of the electrolyte has been spilt. The specific gravity should be tested periodically to ascertain that the cells are properly charged. The main terminals on the top of the batteries should always be kept smeared with vaseline in order to avoid corrosion.

TO COMPENSATE 1922 AND 1923 BRAKES.

If one side or one shoe on the two-wheel brakes continually rubs on the drum, when the car is in motion, proceed as follows:—

With the help of the special hub extractors, having first removed the split pin and nut, remove the rear hubs, slacken off the brake, remove "pull-off" springs, and then the shoes. Next undo the pinch bolts which clamp the brake levers on to the brake camshafts. The brake camshafts operate the shoes, forcing them apart when the brake is applied. Remove the brake levers, taking care not to lose the keys for same, which are in the camshaft. Now make quite certain that the camshafts are quite free to rotate, not only together, but also one inside the other. If they are not free, remove them by pulling them out and ease them down with emery cloth. Having got the camshaft free, replace the levers, taking care not to have the outside lever too close to the inside lever, as if this happens they bind together on the bush separating them. Next assemble the shoes, and tighten the springs up equally. Replace the drums temporarily—chock the front wheels to avoid car falling off the jacks—run the engine, engage top gear and apply the brake (whichever one is being done first), until you can hear the brake lining in contact with the drum. If one side comes on first, remove drum and *tighten up* the springs about two turns on each spring; replace drums and run again. Whichever side comes on first indicates that the springs are weakest on that side. When screwing up the eye bolts, which hold the brake springs when starting to compensate the brakes, it is advisable to have about half the thread protruding through the nut, as this makes sure that there is sufficient tension on the spring at the start of operations to ensure the shoes coming away from the drums when the brake is released.

Whichever brake is being compensated the above remarks apply. *On no account should only one rear wheel be jacked up and engine run with a gear in mesh, as this procedure might cause damage to the rear axle.*

TO RECTIFY SCRAPING SOUND IN BRAKES WHEN CORNERING.

Generally this is caused by the dust cover which is over the inside of the brake drum rubbing on the brake drum itself. It should be eased back with a big screw driver or knocked back with a hammer.

TO ADJUST SMITH-BENTLEY CARBURETTOR.

To examine the jets on the Smith-Bentley Carburettor, disconnect the petrol pipe beneath the float chamber, underneath the arm which carries the float chamber will be found a nut. Undo this and the float chamber, complete with jet platform, can be dropped. The jets are numbered 1 to 4, these numbers being stamped on the jet platform. Between this group of four jets and the float chamber is another jet called the well jet, which supplies the petrol to the engine for slow running and starting. On starting the engine the jets come into action in succession.

After running 2,000 to 3,000 miles, the well-jet may probably be cut down without detrimentally affecting the running of the engine. Likewise Nos. 1 and 2 may be cut down, but whether smaller jets can be advantageously fitted can only be determined by experiment.

The Standard jet setting is:—

45	Well jet.
45	No. 1.
75	No. 2.
50	No. 3.
35	No. 4.

Try when cutting down:—

40	Well jet.
42	No. 1.
72	No. 2.
50	No. 3.
35	No. 4.

The dashpot is situated above the jets and can be removed, the jet block having been dropped, by undoing the four small nuts on the underside of the carburettor body. The dashpot rises up and down the port block, thereby uncovering the jets successively according to the engine revs. and the throttle opening.

The air control knob on the switch plate should be pushed in for starting from cold. This has the effect of giving a rich mixture, a cowl being raised round the well jet, cutting off the air supply. The

control knob should not be left in the rich position for longer than is absolutely necessary, as sooting up of the plugs will result. The control should be pulled out to the normal running position, it being located there by the spring loaded ball catch. After the engine has warmed up the control can be pulled further out. The best running position can only be decided by actual practice.

TWIN S.U. CARBURETTOR ADJUSTMENTS.

On this carburettor a tapered needle is held centrally in a piston whose up and down movement is controlled by the suction in the induction pipe. This tapered needle moves up and down in a jet, the position of which can be varied by a control mounted on the instrument board. The normal running position is when the control knob on the instrument board is turned as far as possible to the right, or in a clockwise direction. When starting from cold the control should be turned about half a revolution in an anti-clockwise direction. Directly the engine starts, it should be revolved about quarter of a turn towards the weak position, where it should be left until the engine has warmed up. It should then be turned to full weak and left there; the full weak position being that at which maximum power is developed.

It is most important that with this carburettor the control should not be in the rich position for longer than is absolutely necessary, as otherwise trouble is almost certain to be experienced from the plugs sooting up. On the right hand side of the carburettor, and carried at an angle, is a cylinder having three screws round the top and three round the base. To adjust the mixture remove the three latter screws and withdraw the cylinder complete with the dash pot, which is contained inside it, and the piston and taper needle below it. The needle is secured in the piston by a set screw; slack this back and push the needle further into the piston to make the mixture richer, and pull it out to weaken the mixture. A small movement of the needle of about $\frac{1}{64}$ th of an inch makes a considerable difference. This adjustment should only be carried out by a skilled mechanic. When replacing take care that the underneath face of the cylinder which bears on the carburettor body is free from grit, as the joint depends on the surface being clean and any leakage of air will completely upset the running of the engine. The piston which should always move up and down freely can be felt by placing one's finger in the air intake. A small oiler is provided in which five or six drops of thin sewing machine oil should be put once a week. When carrying out these adjustments the same alterations should be made to both carburettors. It is most important that S.U. Carburettors should

never be flooded when starting up. A sufficiently rich mixture can always be obtained by means of the dashboard control and flooding may result in petrol getting into the cylinders and washing the oil from the cylinder walls.

TO CHANGE A CLUTCH CONE AND RING.

These parts are always despatched by the Service Department ready for fitting, so that no "bedding in" is required.

Remove the clutch shaft complete. Remove the ring bolted to the flywheel (see Clutch Slip), withdraw the clutch cone from spigot. This is a job which requires a certain amount of care, in order that the spigot bearing may clear the clutch cross-shaft. When replacing, a block of wood should be placed between the withdrawal rollers and the end of the clutch spigot bearing, so as to take the thrust of the clutch spring, while the ring is being secured in position by means of the eight bolts already mentioned.

CLUTCH SLIP.

First make sure that there is about $\frac{1}{4}$ -in. clearance between the clutch pedal and the front floor boards at the point where the pedal comes through the boards. If the floor boards are pressing on the pedal when the clutch is home, slip is bound to develop. A new car should, in particular, be watched for this, as the Ferodo lining beds in after a little mileage, and consequently the pedal comes further back. If there is no clearance, remove the boards; at the base of the clutch pedal are two rollers, which bear against the clutch thrust race. These are mounted on eccentrics, and by undoing the nut and turning the eccentrics it is possible to give the pedal more clearance. The action of these rollers is compensated so that the thrust imposed by each is equal. Should the above not be the cause of the slip, wedge the clutch pedal out. On the outside flange of the flywheel are eight nuts which hold the clutch ring in position; undo these and draw the ring off. This then allows a clear view of the clutch lining; if greasy it should be washed off with petrol and then *roughed* up with a coarse file. If this does not rectify the trouble, please write to the Service Department.

CARE OF THE CLUTCH.

If the clutch is inclined to be fierce, push out the clutch, and with the end of a thin blade insert a little graphite grease between the clutch ring and the cone. In order to ensure it getting over the whole face of the clutch this should be done in three or four places.

If the clutch sticks and is hard to disengage, try squirting some petrol on to the face of the lining. If this does not cure the trouble write to the Service Department.

All lubrication to the clutch spigot bearing is automatically done by the engine.

TO RECTIFY NOISY CLUTCH WITHDRAWAL RACES ON 1922 CARS.

If on withdrawing the clutch a loud squeak is heard, this is due to the clutch withdrawal races being in need of lubrication. Engine oil should be applied by means of an oil can, the rollers being lubricated both on the outside and the inside.

TO DECARBONISE ENGINE.

This is a job which the Company insist on doing whenever possible. In any case the written consent of the Company must be obtained before the work is undertaken. If, on the other hand, an owner cannot send his car to our Service Department, then whenever possible one of our mechanics can do the work when he is in the neighbourhood. All we require is notification from the owner that he wishes the work done in this manner. If for any reason neither of these courses is practicable, the procedure is as follows:—

Remove water connections to radiator.

„ „ „ „ carburettor.

„ dynamo drive at rear end of camshaft.

„ leads from sparking plugs.

„ sparking plugs.

„ clip on vertical housing just above the magneto cross drive.

„ petrol pipe.

„ autovac.

„ horn.

„ cylinder holding down nuts.

Lift block.

To grind in valves:—

Remove camcase top cover.

„ bridge-piece which holds down the rockers.

„ camshaft.

„ valve springs. (See p. 32 “Changing a valve spring.”)

„ valve guides.

„ valves. (The valves cannot be removed before the guides have been taken out.)

NOTE.—To grind in valves it is necessary to make a special tool to hold them and grind from the top, as owing to their shape and the cylinder head they cannot be ground in with a screw driver from below.

On no account remove the lower half of the cam casing, which is integral with the upper half of the vertical shaft. When replacing the block, take care that the paper washer has all the necessary holes in it, the two most important ones being those centrally placed between Nos. 1 and 2 and between 3 and 4 cylinders. These holes are connected with the overhead gear, and drain the oil from there to the crankcase. When lifting and replacing the cylinder block the greatest care should be taken that the block is kept square.

TO ADJUST DYNAMO OUTPUT.

To increase the charging rate of the dynamo, remove the nickel-plated end cover. This will expose the brush gear, commutator and end bearing of the armature. Round the external circumference of the main body of the dynamo are nuts on studs which pass through slots. Undo these and rotate the brush gear in a clockwise direction to increase the output, and in the reverse direction to decrease. The maximum charging rate should never exceed 9 amps., or the dynamo and battery may be damaged.

TO CHANGE A DYNAMO.

The dynamo drive cover on which the spare sparking plugs are carried must first be removed. This is secured to the dash by 4 bolts. The flexible drive should then be disconnected and the dynamo can then be removed after undoing the 3 bolts securing it to the dash. Should a dynamo be returned to "Service" for repair or replacement, the driving dog should be removed and retained, as the new machine will be forwarded without this part.

TO FOCUS HEADLAMPS (LUCAS).

To remove the front glass on the headlamps unscrew the knurled knob at the back, the reflector and glass can then be drawn off in one piece. Hold the headlamp glass and rim in one hand and turn the reflector so that it comes away from its bayonet fixing. The bayonet fixing for the headlamp bulb has three positions, and the bulb should be tried in each of these to obtain the best results.

TO FOCUS HEADLAMPS (SMITH).

The front glass can be detached by unscrewing the *large* screw at the back of the lamp with a coin. The headlamps can be focussed without removing the front glass by merely turning the *small* screw at rear of lamp. These head lamps are carried on a spherical mounting which makes the aligning of them a simple matter, the slacking off of the nut under the lamp only being necessary. This may be found very advantageous when driving in fog.

TO REMOVE REAR HUBS.

Undo hub cap, remove the split-pin inside which passes through the castellated nut on the end of the axle shaft. Pull on hand-brake hard and remove nut in usual way, i.e., turn to left to undo. Then screw on to hub the hub drawer supplied in the kit. (NOTE.—This is double-ended, one for the off side and one for the near side.) Next screw in the set screw in the centre of the hub drawer, using a box spanner and long tommy bar. Give the set screw several hard taps to loosen the hub on the taper of the axle shaft. Immediately the hub is “started” on the taper, put the hand brake in the “off” position or damage will result to the plate behind the drum. NOTE.—When withdrawing the hub take care not to interfere with any axle adjustment. When replacing carefully clean the taper and smear with vaseline.

TO TIME IGNITION.

Turn the flywheel till No. 1 cylinder is on the firing stroke marked on the flywheel circumference, Mags. Nos. 1 and 4. Get this mark on top. Remove the distributor and make sure that the jump from the centre of the distributor is opposite the terminal from which the high tension lead goes to No. 1 Plug (No. 1 cylinder is nearest to the radiator). From this point onwards follow the instructions on “How to synchronise Magnetos,” p. [—]

TO ADJUST THE MAGNETOS.

On the M.L. Magnetos, as fitted as standard, the points should be set when fully open to .019" gap with the gauge on the magneto spanner, and once a fortnight the ring on which the contact breaker arm actuates should be smeared lightly with a little vaseline, as otherwise rapid wear may take place on the fibre pad, and also a high-pitched squeak may develop when the engine is running slowly.

The distributor, being of the “jump gap” type, requires no attention.

TO CHANGE A MAGNETO.

Remove the wires to the distributor. Remove the contact breaker and undo the three bolts which hold the magneto on to the aluminium vertical shaft housing. Rotate the flywheel so that the mark “Mag. 1 and 4” is on top. This is the only position of the crankshaft in which the magneto can be removed.

The driving dog or jaw engages with a laminated spring drive inside the casing. To remove the dog from the armature shaft undo the nut and draw it off its taper. Although there is a key-way cut in the magneto shaft, no key is fitted, the drive being taken by the taper. It is, therefore, essential when replacing the dog on changing

a magneto, that the nut is properly home. One or two settings of the dog may have to be tried before approximate correct timing is obtained with the three bolts registering in the centre of the slots. When doing this, bear in mind that re-synchronisation of both mags. is necessary, and that in order to get this it may be necessary to rotate the magneto either forward or backward. The ideal position when replacing a magneto, therefore, is to have the bolts nearly central in their slots so as to allow for movement either way. (To synchronise the magnetos, see page[—]). NOTE.—When ordering parts for magnetos it is essential to state whether these are for nearside or offside instruments; when returning a magneto for exchange or repair the driving dog should be removed.

TO ADJUST OIL PRESSURE.

Oil pressure should only be adjusted after the engine has been running an hour on the road, and the oil is thoroughly hot. The correct pressure is approximately:—

12 lbs. at 30 m.p.g. on top gear.

To adjust the pressure there is an adjusting plug at the front offside of the crankcase. Slack back the large lock nut which secures the plug and to *raise* the pressure, screw in the plug and vice versa. After adjusting make sure that the lock nut is properly tightened. Should the oil pressure drop unduly it is generally caused by dirt on the release valve itself inside the crankcase, and generally a turn of the adjusting plug will clear it. If, however, it does not, unscrew and remove the plug, and the spring which will be found behind it; start up the engine and the ball valve will immediately be blown out. Care should be taken to catch the ball either in the hand or a suitable receptacle. Stop the engine immediately after the ball has come out. Wash the parts in petrol and clean the ball seating in the crankcase with a "non-fluffy" rag. Replace parts and adjust oil pressure; screw the valve a good way home before starting up to make sure that oil pressure will materialise immediately.

TO CLEAN OIL FILTER.

The oil filter is mounted on the nearside of the engine immediately behind the radiator. To remove the cylindrical gauze undo the nut which secures the cap at the front end of the filter body. Remove the cap and pull out gauze and thoroughly wash with petrol. When replacing, take great care not to buckle the gauze and also to get the end of the gauze to register correctly on the inner end of the casing. The gauze should be cleaned out every 5,000 miles.

CHANGE OIL IN ENGINE.

Get engine thoroughly hot, *i.e.*, after a run of at least one hour. Jack up the back of the car as high as possible in order to make sure of draining the oil tank; remove plug from forward end of oil tank and allow tank to thoroughly drain. If a change is being made from Castrol "R," it is very important that the sump be washed out with paraffin poured in through the oil filler. Half-a-gallon of paraffin should be used, but the engine must not be run with the paraffin in the tank. Replace sump plug, lower the rear of the car and fill sump.

TO RECTIFY TENDENCY TO OVERHEAT.

A new engine naturally runs hotter than one which has been run in. With an engine which has a tendency to overheat first adjust the thermostat. (See p. 32 "To adjust thermostat.") After this make sure the tappets are in correct adjustment. See that the carburettor is not flooding thereby giving an over rich mixture, and, lastly, make sure that both magnetos are working correctly by switching off first one and then the others. If this does not cure the trouble, write our Service Department on the matter.

TO ADJUST D.N. SHOCK ABSORBERS.

These shock absorbers are of the oil type. To re-fill, remove the connecting link between the S.A. arm and spring anchorage, then remove the filling plug on top of the S.A. barrel, and pour in pure castor oil, at the same time working the arm up and down, as otherwise the S.A. will not be completely filled. When the body is full replace the plug. The adjustment is by means of a screw, secured by a lock nut situated on the lower portion of the face of the barrel. To adjust these shock absorbers see the D.N. instruction book supplied in the tool kit.

TO ADJUST HARTFORD SHOCK ABSORBERS.

The method of adjusting Hartford shock absorbers is by tightening or slackening off the big centre nut to which is attached a pointer. These shock absorbers can be tightened up more than one complete turn, and, therefore, if adjusting for the first time the best way is to turn the nut right back until it is just finger tight. This should bring the pointed opposite "O." The pointer should be

turned to No. 4, or for fast driving to 6. Both the front shock absorbers should be done in this way. The back shock absorbers should be adjusted as above, but should be set from 6 to 8 on the dial. To change a bush, remove the shock absorber and fit the bush so that it is a nice sliding fit on the pin. Oil should never be used on these bushes, as it causes the wood to swell.

TO CLEAN SPARKING PLUGS.

The plug which suits the Bentley engine best is the K.L.G. type J.1. Naturally, after running the points open out, it is therefore advisable to remove the plugs every 3,000 miles and set the points to the gauge on Mag. spanner or .019".

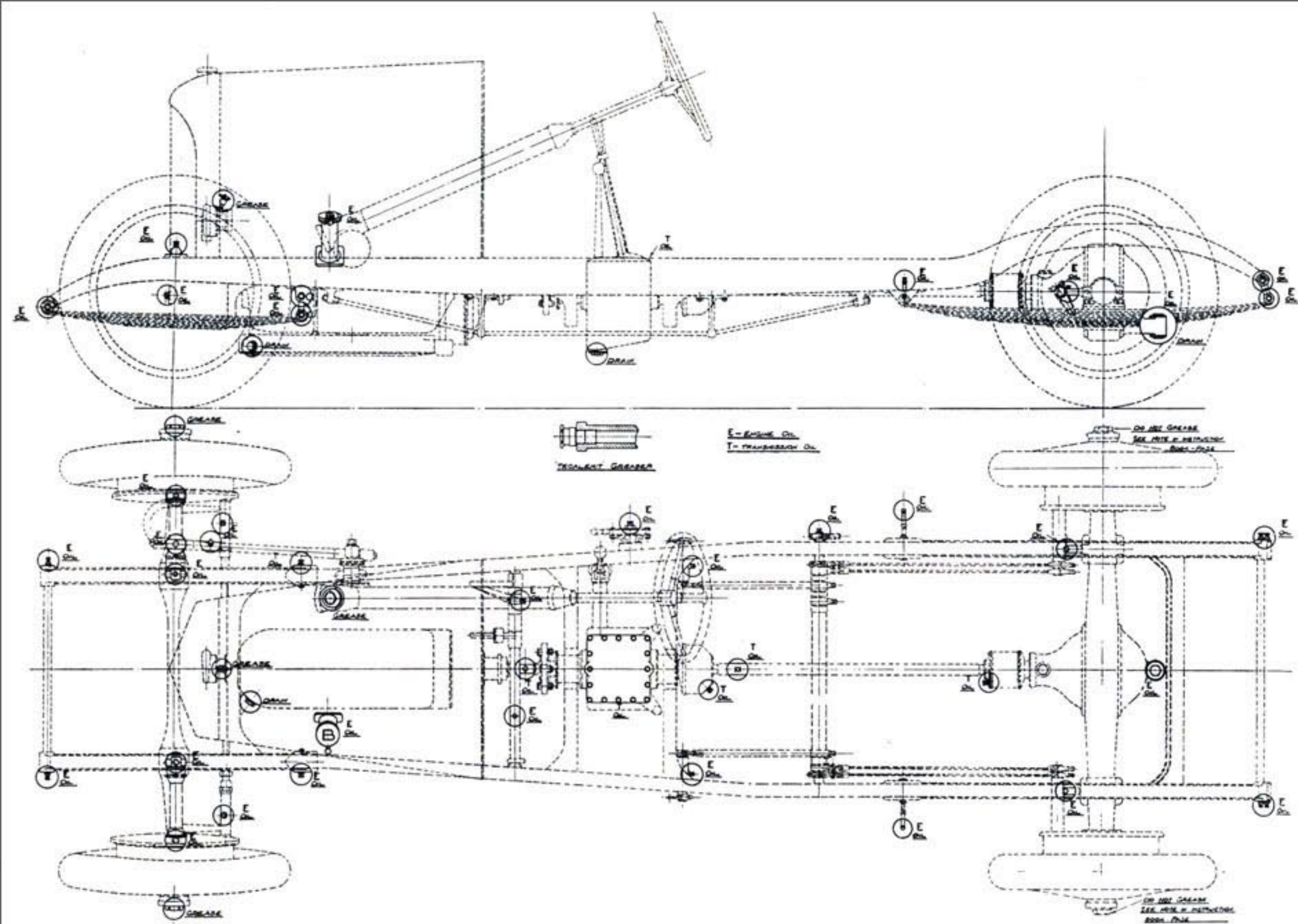
To clean the plugs unscrew the brass nut just above the main body of the plug; the whole of the inside of the plug then comes away and can be cleaned with a rag. The centre part or electrode of the plug can be replaced when worn out.

GREASING SPRINGS.

To grease the springs remove the gaiters and jack up the frame so that the axle hangs on the spring. Remove the "D" clips on No. 4 spring leaf and separate the leaves either by a special tool, which can be bought, or by inserting a screw driver into the gap between the leaves. Put some grease on a hack saw blade and smear it over the separated surfaces. When replacing the gaiter, smear the inside with grease, as this will work in between the leaves of the spring on the road and will also prevent rust. It is advisable only to do this work once a year.

TO RECTIFY NOISY SPRING SHACKLES.

When a car has done a considerable mileage a "clicking" sound may be set up when going round corners. This is due to side play in the rear shackles of the front springs. Steel shims can be obtained for taking up this wear. The method of doing this is as follows: Remove split pin from castellated nut on shackle bolt, remove nut, jack up frame of car so as to take weight off bolt, unscrew bolt and place a shim or flat washer in between the spring eye and the shackle, replace nut and split pin. The above method applies when shimming all shackles.



OILING DIAGRAM (CHASSIS WITH FRONT WHEEL BRAKES).

RECTIFYING LOW SPEED STEERING WOBBLE.

Make sure the track, *i.e.*, the alignment of the front wheels is correct. This distance from the inside of the front part of the front wheel (*i.e.*, from the rim and not the tyre) should be 3-16ths of an inch shorter than the distance between the inside of the rims at the rear of the front wheels. In other words the front wheels should point inwards 3-16th of an inch. Having checked this, proceed as follows:—

Jack up one front wheel and test for balance. If the wheel is heavier at one point, that point will naturally fall to the bottom. Opposite this heavy point bind the spoke of the wheel with strip lead, wound round the spoke tightly with the aid of pliers. Treat the other wheel in the same manner. It is of great importance to make certain that there is not any excessive play in the joints at either end of the fore and aft rod. (The fore and aft rod is the rod which connects the drop arm from the steering box to the stub axle arm.) These joints are spring loaded ball joints, and too much movement in these springs can be the cause of steering wobble. The maximum movement should be $\frac{1}{2}$ m.m. backwards and forwards in each joint. To reduce the movement it is only necessary to remove the split pins and caps at either end of the rod, unscrew the caps and insert a suitable number of washers behind the springs, afterwards replacing the caps and split pins. The joint can be tested for movement by gently turning the steering wheel to and fro and watching the ball joint.

TO ALTER RAKE OF STEERING.

On the driving side of the dashboard will be found the steering column support, with two slots cut in it through which are passed two bolts. Loosen these bolts and also the "pinch bolt" underneath the bracket, which allows the latter to slide up and down the column. Next on the steering drop arm side of the steering box are four nuts on studs which pass through slotted holes. Loosen these and drop or raise the column. If the position of the column is altered to any considerable extent, a wedge-shaped packing piece should be placed between the steering column bracket and the dash.

NOTE.—Altering the rake of the column necessitates the magneto controls being adjusted as follows: Set the hand lever fully advanced on top of the steering column. At the bottom of the latter is a short rod which is attached to a single lever on the magneto control cross rod. Undo the "pinch bolt" on this lever and push both magnetos fully advanced, then tighten up again. By this method it is impossible to interfere with the synchronisation of the magnetos.

TO ADJUST THERMOSTAT.

The thermostat is situated on the exhaust side of the engine at forward end of the copper water pipe, above the exhaust manifold. To adjust this, unscrew cover on which is a hexagonal boss. The valve, which is secured on its spindle by a split pin, will then be seen. Remove the split pin and to make the engine *run cooler* unscrew the valve three-quarters or a complete turn. Replace the split pin and cover. The correct working temperature of the engine is from 75° to 80°C, and the engine will under ordinary conditions consistently run at this temperature.

THROTTLE NOT CLOSING PROPERLY.

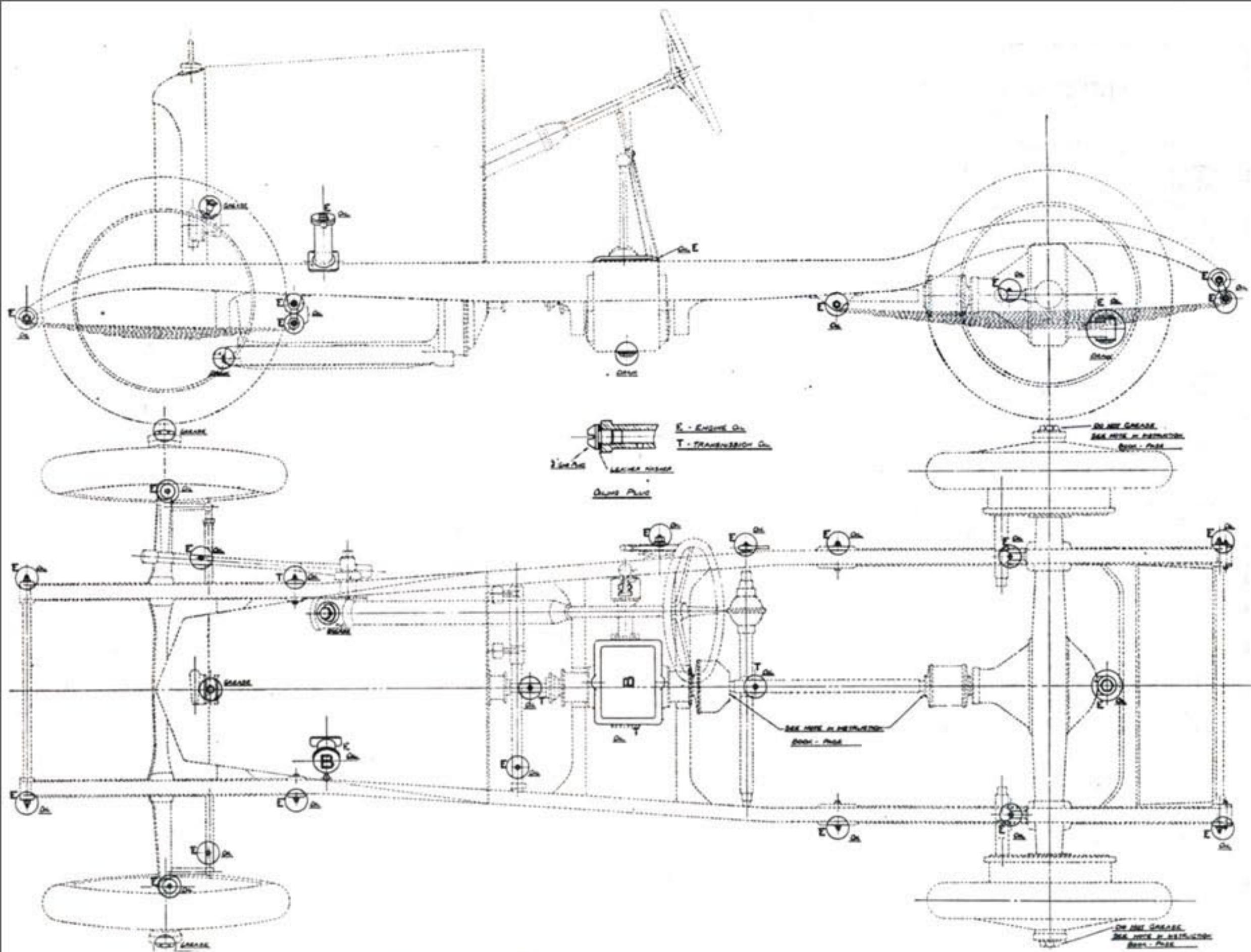
If it is found that when taking one's foot off the throttle, the engine still continues to race unless the accelerator is lifted up with the toe, examine all the carburettor control "U" clips and connections. A tight "U" clip would be sufficient to cause this trouble. Work the throttle by means of the hand control and lubricate the sleeve which slides on the hand control rod from the steering box. Also lubricate all "U" clips and joints.

TO ADJUST TAPPETS.

UP TO AND INCLUDING ENGINE No. 222.—Tappets should be adjusted when the engine is thoroughly warm. Turn flywheel till the line marked 1 and 4 is at the top. Get No. 1 cylinder on the firing stroke and set the tappets to .015". Then turn the engine till the mark 2 and 3 is at the top, i.e., half a revolution makes No. 3 ready for adjustment and after that No. 4. No. 1 cylinder is nearest the radiator. ENGINE No. 223 ONWARDS. Carry out above, but adjust inlet tappets to .004". Clearance and exhaust to .006" when hot. This adjustment should be carried out on a new car after 1,500 miles.

TO CHANGE A VALVE SPRING.

Remove the cover over the valve and the bridge piece holding the rockers in position. Remove the rocker rod together with the rockers. (When replacing take great care to tighten the bridge piece down evenly, otherwise it may fracture.)



OILING DIAGRAM (CHASSIS WITHOUT FRONT WHEEL BRAKES).