THE
SIX CYLINDER
BENTLEY
INSTRUCTION BOOK

Instruction Book No. *Chassis No.*

BENTLEY MOTORS Ltd.

Showrooms :

POLLEN HOUSE, CORK ST., LONDON, W. 1

Telephone - - Regent 6911 (2 lines)

Telegraphic Address Benmotlim, Phone, London

Works & Regiftered Offices :

OXGATE LANE, EDGWARE RD. CRICKLEWOOD, N.W.2

Telephone Willesden 2140 (4 lines)

Service Department :

KINGSBURY LANE, THE HYDE, HENDON, N.W. 9

Telephone Hendon 1660 (4 lines)

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Price 21/-

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LIST OF ILLUSTRATIONS.

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FOREWORD

This Book is arranged so that all the essential information and instructions necessary to maintain the car in an efficient condition are contained in the first three chapters. The remaining chapters contain more detailed information which it is hoped will prove of interest to most owners and which will more than repay perusal.

The design of the 'SIX' Bentley incorporates all those features of the 'Three Litre' model which have assisted the latter to achieve its popularity as an ideal car for the owner-driver, and therefore a minimum amount of attention is required to maintain it.

Where so little attention is called for at comparatively infrequent intervals, there is always the chance that the few essentials will be neglected, which, in a car of this type, will inevitably lead to renewals which are expensive to the owner and a source of no satisfaction to the manufacturers, and it is, therefore, of great importance that this book should be carefully read and the instructions followed.

Messrs. Bentley Motors, Limited, hope that should an owner have, at any time, a query concerning the upkeep and management of his car, the answer to which is not to be found in these pages, he will not hesitate to communicate with the Service Department. The same request is made, should an owner be in any way dissatisfied with the performance of his car, as the Company have such confidence in their product that they know there is no reason for any owner to remain disappointed.

The adjustments described in this book include all those minor adjustments which may be undertaken without reference to the Service Department. The Service Department must, however, be consulted and their permission obtained, before any more important adjustment is attempted, as useful advice can always be given and it may even be considered that the matter is of such importance as to warrant the visit of an expert.

It is hoped that the perusal of these pages will prove of interest and will be the means of enabling an owner to get the best out of his car, both as regards economy and enjoyable driving.

SERVICE

Bentley Motors Ltd., Service Department, is situated at KINGSBURY WORKS, KINGSBURY LANE, HENDON, N.W.9, *(see Sketch, page 100)*, to which address all communications with regard to the upkeep and running of a car and orders for spare parts should be sent. It should be realised that addressing communications to the Works or to the Showrooms may entail a delay in replying. The telegraphic address is '*Benmotlim, Phone, London.*'

The Service Department is at all times pleased to hear from owners and to advise them regarding any point concerning their cars about which they may be in doubt. When an owner wishes to send his car in for work to be done, it is necessary that he should only do so by appointment, as otherwise it is possible that the Department will not be in a position to accept the car and at any rate a delay in putting the work in hand will result. Should, however, anything in the nature of a breakdown occur interfering with the use of the car, the Department will always take immediate action with a view to rectifying the defect.

Highly skilled representatives of the Firm are continually visiting owners in various districts of the country, carrying out adjustments and giving advice; it is, however, not the Firm's policy to visit all owners in rotation but only those owners who have requested that a visit should be paid them. It is hoped that this point will be borne in mind so that a visit will not be expected without a request being made.

THE FIVE YEARS' GUARANTEE

Every "SIX" Bentley Chassis is covered by a FIVE YEARS' Guarantee, a signed Guarantee Form being issued to every owner.

The Terms of the Guarantee are as follows :

IN Consideration of.....
agreeing to purchase from.....
Chassis No.....*Engine No*.....*which is sold subject only to and with the benefit of the following express warranty which shall exclude all conditions warranties and liabilities whatsoever whether statutory or otherwise which might exist but for this provision Messrs.*

BENTLEY MOTORS LIMITED

agree with him to supply new or repair free of charge any part of such Chassis other than proprietary articles such as electrical fittings, lamps, shock absorbers, detachable wheels, or other such accessories or fittings, that may fail on or before the.....*day of*.....19....., *owing to defective materials or faulty workmanship provided the defective part is returned to their works at Cricklewood, carriage paid, with the claim for repair or replacement, or the Chassis is delivered at such works free of expense.*

IT must, however, be understood that this Guarantee in no way affects such repairs or renewals as may be occasioned by fair wear and tear.

All rights or liability shall immediately be forfeited or cancelled if:

(a) *The Chassis is used for racing or other competition work without the written permission of the Company, or*
(b) *The Chassis is used for hire purpose of any description, or*
(c) *Any repair is done to the Chassis by any person, firm or company, other than Bentley Motors Limited, without their written consent.*

THE benefit of this agreement is not transferable except with the consent of the Company, and anyone desiring such transfer may obtain it by sending the Car at his expense to the above Works for inspection and by subsequently placing an order for any repairs and adjustments that the Company may consider necessary. After these repairs have been completed the Company will transfer the Guarantee, on payment of a fee of £5, which does not include the charge for any repairs or adjustments.

For and on behalf of BENTLEY MOTORS LIMITED

.....

Director.

3 Oxgate Lane, Cricklewood, N.W. 2.....19.....

PROPRIETARY ARTICLES.

Proprietary articles such as are included in the electrical equipment, the Shock Absorbers, Magnetos, etc., are not included in the Company's Five Years Guarantee, though they are in most instances covered by their manufacturer's one year Guarantee.

REPLACEMENTS.

In the event of the failure of any proprietary article included in the standard equipment of the chassis, the instrument must not be tampered with, but the Service Department should be informed and a replacement instrument will be forwarded. After this has been fitted the defective instrument must be returned to the Service Department who will take up the matter of repairs with the makers; should the instrument be taken apart or tampered with, the makers may refuse to accept responsibility for the defect and any benefit under the Guarantee may be lost.

INVOICING OF REPLACEMENTS.

All replacements issued by the Service Department are invoiced in the ordinary course of business routine. In the case of an instrument which is not under Guarantee, a credit will be passed when the defective one has been returned, and the maker's charge for repair has been ascertained. When an instrument or part is claimed under Guarantee a Claim Form obtainable, from the Service Department, must be filled up and sent in.

ADJUSTMENTS.

Particular attention is drawn to Clause (*c*) of the Guarantee. By this it is meant that only running adjustments such as are described in the pages of this book may be carried out without first obtaining the permission in writing of the Company. On no account may any seal be broken in order to make an adjustment without permission and advice being obtained, except it is found essential to do so under unusual circumstances, such as when touring abroad and time is not available to communicate with the Company, who must be informed at the first possible opportunity that such an adjustment has been effected.

ACCIDENTS.

When an accident is incurred in which the chassis is damaged it is essential that a report on the damage should be sent to the Company in order that they may decide the nature of the repairs necessary and also whether the car should be returned to them for the work to be done. It is of the utmost importance that, should any steering parts, or the front axle be damaged, none of these parts be heated and straightened. It must be realised that the car is capable of very high speeds over the worst roads so that any negligence with regard to this matter might lead to a serious accident.

DESCRIPTION OF CHASSIS.

Details in Brief.

ENGINE.—Six cylinders, cast 'en bloc,' fixed cylinder head. 100mm. bore by 140 mm. stroke. Cub. Cap. 6.597 cc. R.A.C. rating 37.2 H.P. Tax £38. Oil capacity of sump 3 galls. Lubrication by pressure to main and big end bearings and overhead gear, splash to pistons and gudgeon pins. Cooling by pump circulation and fan. Two M.L. Magnetos. Special Smith Bentley Carburettor. Autovac Petrol Feed. 12 K.L.G. Sparking plugs, Type J1. Crankshaft, eight bearings. Camshaft, eight bearings. Four overhead valves per cylinder. Aluminium B.H.B. pistons.

WHEELBASE, 12 ft. 6 in. Overall length, 16 ft. 7 in. Weight of chassis with equipment, 3724 lbs.

WHEELBASE, 11 ft. Overall length, 15 ft. 1 in. Weight of chassis with equipment, 3668 lbs.

TRACK.—4 ft. 8 in.

FUEL.—Capacity of tank, 19 gallons.

ROAD WHEELS.—Rudge-Whitworth detachable wire.

TYRES.—Dunlop, semi-balloon, 33 by 6.75 ins.

CLUTCH.—Single plate type, dry.

GEAR-BOX.—Four speeds forward and a reverse.

BRAKES.—Foot-brake mechanically operated on all four wheels. Hand brake, separate shoes on rear wheels only.

ROAD SPRINGS.—Front and Rear, semi-elliptic.

BACK AXLE.—Spiral bevel gears. Underslung.

SPEEDOMETER.—Positively driven from gear-box.

ELECTRICAL EQUIPMENT.—Specially designed and manufactured by Messrs. Smith & Sons (M.A.). Cricklewood.

BATTERIES.—Specially designed and manufactured by Messrs. Peto & Radford.

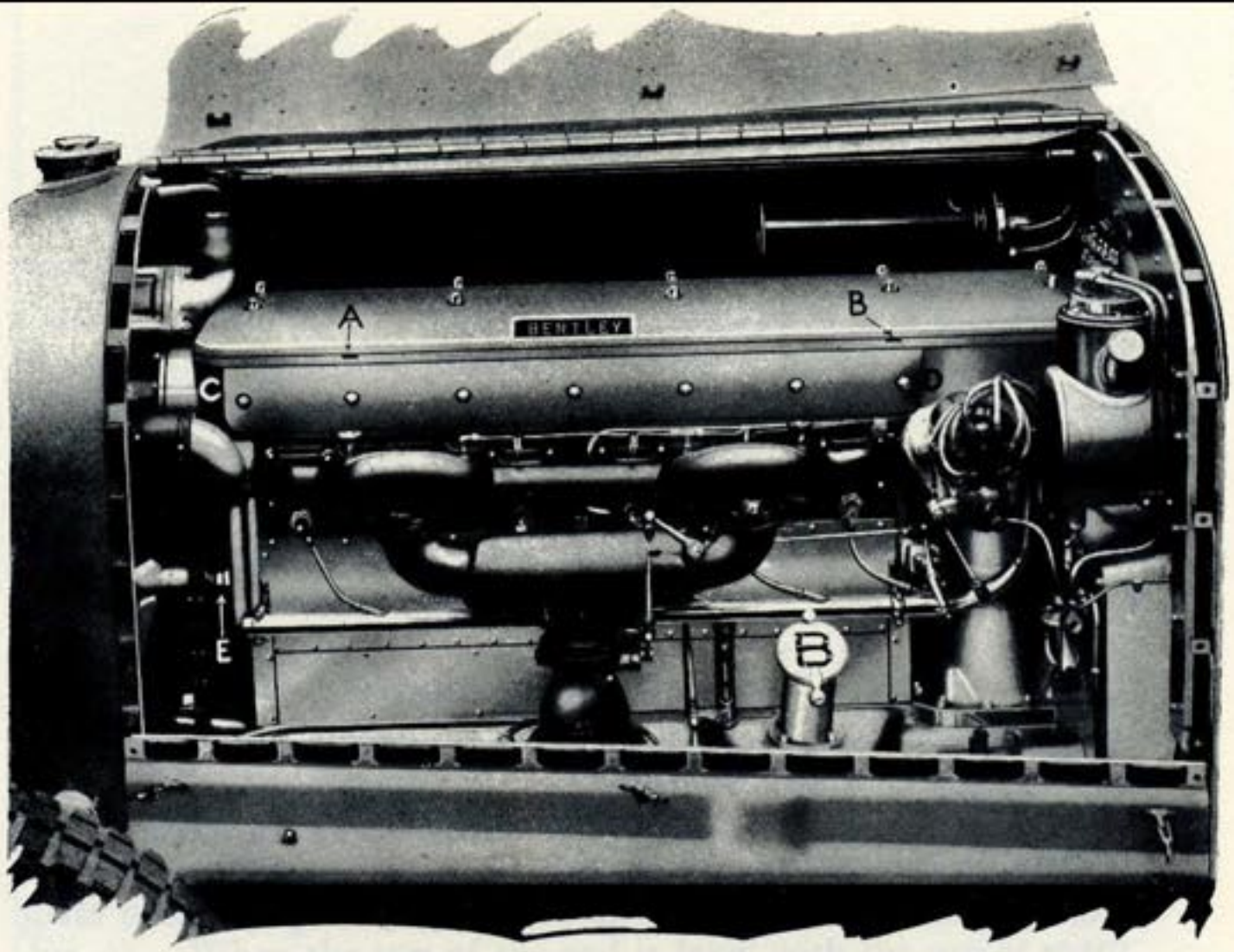


Fig. 1. NEARSIDE VIEW OF ENGINE.

Note the ten nuts on top of the camcase cover and the seven nuts on the side plate all of which must be removed in order to adjust the tappets. At points (A) and (B) are provided means for inserting a screw-driver to lever up the cover should it have stuck, similar points (C) and (D) being provided at the ends of the side plate. The fan belt adjustment lock nut is shewn at (E).

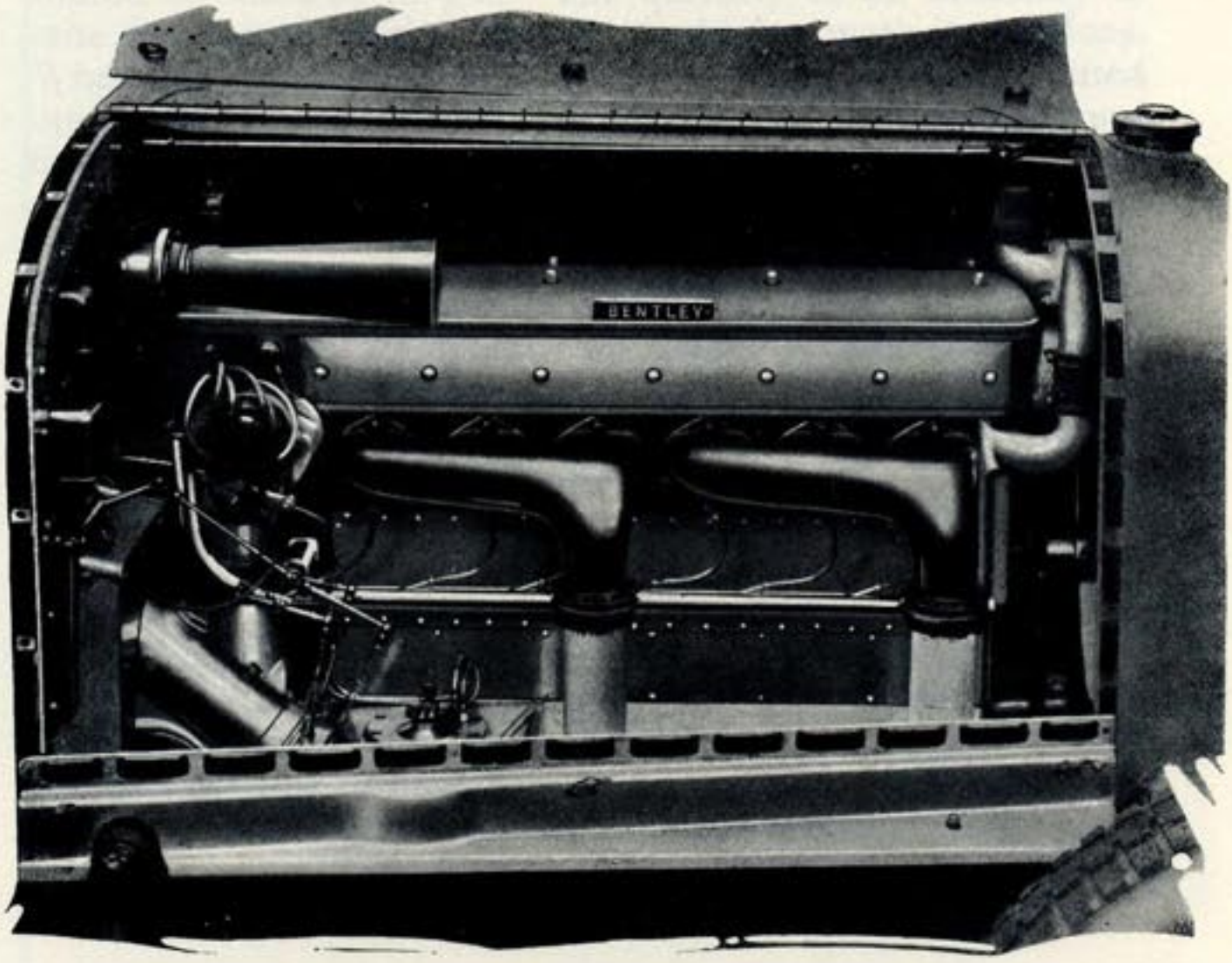


Fig. 2. OFFSIDE VIEW OF ENGINE.

CHAPTER I.

Oil Level. Water Level. Starting the engine. Ki-gass Petrol Injector. Summary of starting procedure. Driving. Change Speed Gate. Clutch Stop. Changing Gear. Caution in driving. Brakes. Water on Brakes. Oil pressure. Testing Magnetos. Care of new engine. Maximum engine revs. Adjustments on new car. Frost. Wheel discs.

STARTING THE ENGINE AND HINTS ON HANDLING.

INSPECT OIL LEVEL.

First ascertain that there is the correct level of oil in the engine. The oil level indicator will be found on the near side of the engine close to the oil filler. The gauge is of the float and rod type, the position of the rod being observed through a cylindrical glass tube in a plated container on which are two marks. (*See Fig.* 3). When the top of the rod is level with the upper mark the sump is full and contains 3 gallons; it must not be filled further than this. When the top of the rod is level with the lower mark, the oil in the sump is at the lowest level that it should be allowed to get. The quantity of oil necessary to raise the float from the lower to the higher mark is 2 gallons. When it is found necessary to replenish the oil it must be poured into the engine through the filler with the cylindrical gauze filter in position. (*See Fig.* 3). Bentley Engine Oil is recommended. (*See page* 20).

INSPECT WATER LEVEL.

Unscrew the radiator cap and if necessary replenish to the correct level which is 3 inches below the lip of the filler. There is no object in filling higher than this as the water will merely flush out of the radiator as it gets hot.

INSPECT QUANTITY OF FUEL.

The amount of fuel in the tank can be ascertained by means of the "Telegauge" Petrol Indicator which is fitted as standard. (*See page* 58). The engine runs best on National Benzole Mixture or a mixture of Benzole and Petrol in the proportion of one part benzole to three parts petrol. If desired No. 1 Petrol only may be used, but mixture is recommended.

STARTING THE ENGINE.

Normally the engine will start from cold on the self starter, but, if a new engine is unduly stiff, it is advisable to assist the work of the starter motor by using the starting handle; this however is only called for if the starter motor "labours," which would cause undue strain on the batteries. The procedure of starting the engine is as follows:—The fuel is first turned on by means of the larger of the two taps immediately underneath the Autovac on the near side of the dash (*see Fig.* 3), and both magneto switches are put in the "on" position as indicated on the switch plate. To make starting easy even in the coldest weather a Ki-Gass Petrol Injector is fitted. This consists of a plunger pump fitted in the instrument board with pipes connecting it to the top of the induction pipe and to the main fuel supply of the carburettor. (*See Fig.* 3). The pump plunger on being unscrewed and withdrawn, draws a pumpful of fuel from the main fuel supply pipe, and on being pushed in the fuel is forced in a vaporised form into the induction pipe in two places. This plunger is withdrawn and pushed in three times and then SCREWED HOME; this is very important, as if left unscrewed, neat fuel will be drawn into the induction pipe through the Ki-gass connections immediately the engine starts, thus making the mixture over-rich. The throttle is put in the closed position. The ignition control is fully retarded and the mixture control put over to full rich. The self-starter switch is then pressed when an almost instantaneous start may be expected. If the engine does not fire immediately the ignition should be slightly advanced. The best position of the ignition control varies slightly on different engines but can soon be found by experiment. If after starting, the engine tends to stop, another charge of the Ki-gass pump should be given, taking care to screw the plunger home afterwards. Directly the engine fires the accelerator pedal is lightly dabbed and the ignition advanced. After a few seconds the throttle can be slightly opened, the mixture control put in the midwayposition and the engine left to run at medium speed (about 500 revs.) for a few minutes, in order to warm up and also to allow the oil to circulate. It is most important to realise that it may take three or four minutes for the oil to circulate throughout the system, particularly if the weather is very cold and the engine has been idle for a few days. Great harm may be done by running the engine at high revolutions before it has warmed up, so that too much importance cannot be paid to this point.

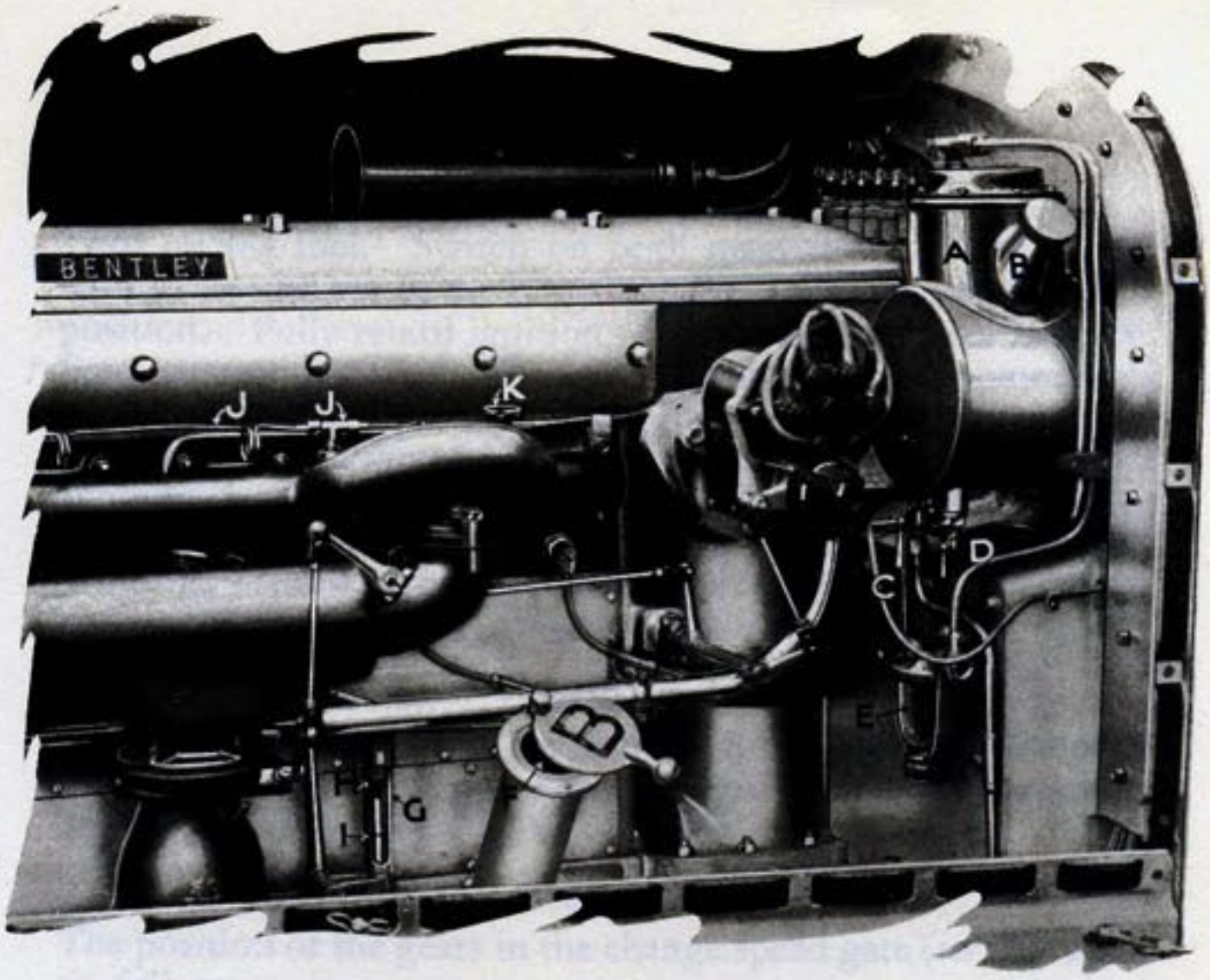


Fig. 3. AUTOVAC FUEL FILTER OIL FILLER AND LEVEL INDICATOR.
Autovac (A). Autovac filler (B). Fuel tap (C). Autovac drain tap (D). Filter (E). Oil Filler with cover partly to one side, shewing filter (F). Oil level indicator shewing float rod (G). Top oil level mark (H). Bottom oil level mark (H). Bottom oil level mark (I). Ki-gass connection to induction manifold (J). Priming tap (K).

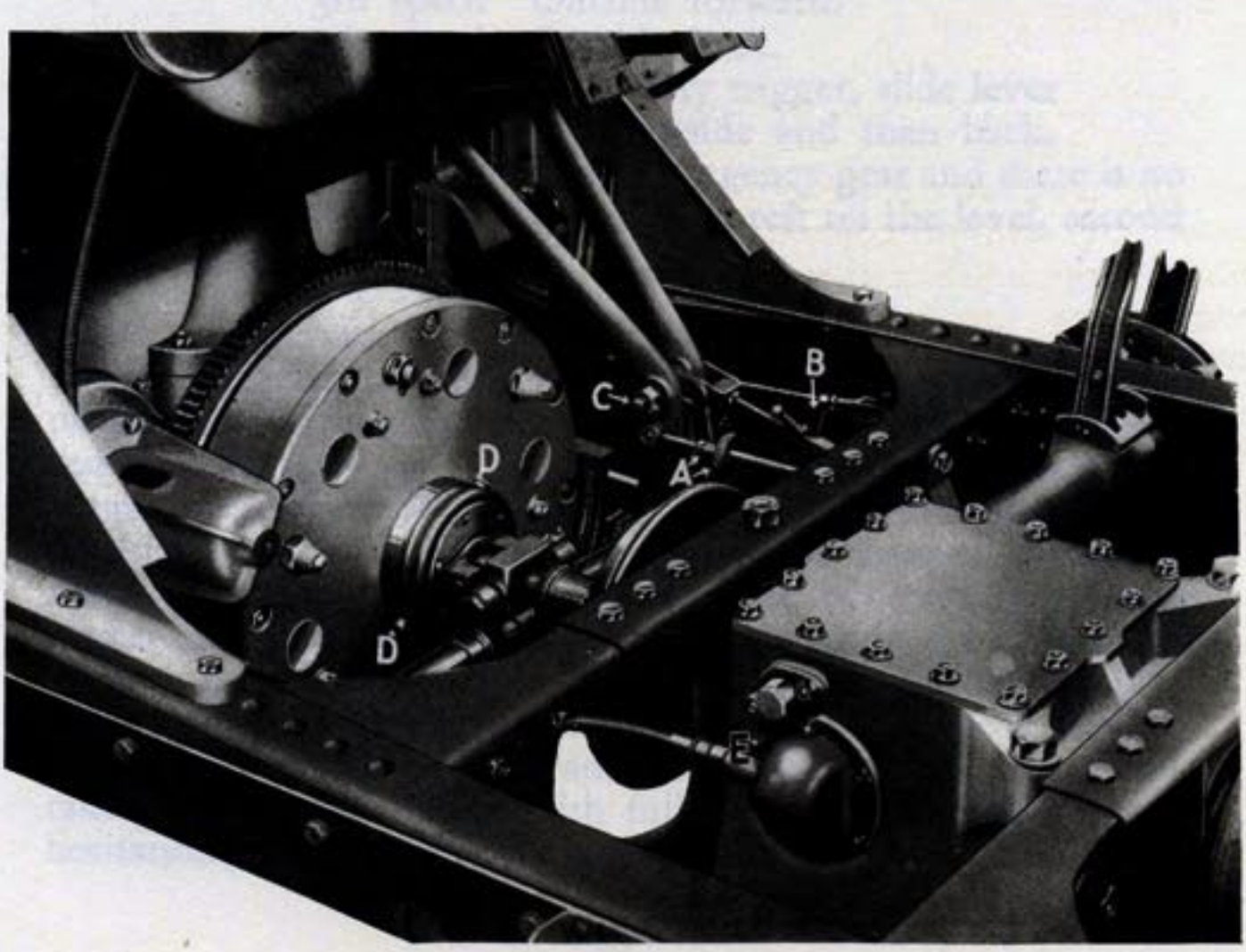


Fig. 4. GEAR BOX CLUTCH, SPEEDOMETER DRIVE, ETC.
Clutch stop adjustment shewing knurled hand wheel and locknut (A). Foot brake hand adjustment (B). Clutch pedal adjustment (C). Oiling nipples clutch thrust bearing sleeve (D). Speedometer drive and cable (E).

STARTING PROCEDURE IN BRIEF.

Summarised the starting procedure is as follows :—

Turn on the fuel. Switch on both magnetos. Prime engine with three plunges of the Ki-gass pump. Put throttle in closed position. Fully retard ignition. Put mixture control full rich. Press starter switch. If engine does not fire immediately slightly advance ignition. On firing gently dab accelerator. Give another charge of Ki-gass if engine tends to stop. After running for a few seconds slightly open throttle to about 500 r.p.m. (*see previous page*). Put mixture control in the midway position. Allow engine at least 3 or 4 minutes to warm up.

Don't forget to screw Ki-Gass plunger home after use.

DRIVING.

It is not intended in this book to give detailed instructions to drive a car, but only to give hints and tips which may be useful in driving efficiently the " SIX " Bentley in particular.

CHANGE SPEED GATE.

The position of the gears in the change speed gate (*see Fig.* 13) is as follows :—

1st speed	Inside forward.
2nd speed	Inside back.
3rd speed	Outside forward.
4th speed	Outside back.
Reverse.	Lift safety trigger, slide lever to outside and then back.

First speed is in the nature of an emergency gear and there is no necessity to use it when starting from rest on the level, second speed being quite suitable.

CLUTCH STOP.

A clutch stop with a simple adjustment is fitted so that the degree of fierceness of the stop can be quickly adjusted to suit individual requirements (*see page* 27). Upon this adjustment depends the length of the pause necessary with the gear level in neutral, when changing " up," in order to obtain a silent change. With the standard adjustment an appreciable pause is necessary and the higher the speed at which the change is made the longer the pause. It will, however, be found that owing to the flexibility of the engine, top speed can be engaged when the car is moving at only 3 or 4 miles an hour, and from this speed the engine will take up the drive, even with full throttle opening, without hesitation and with perfect smoothness.

CHANGING DOWN.

The performance of the " SIX " Bentley on top gear is such that there is seldom any necessity to change into a lower gear. When doing so, however, it is necessary to " double declutch " in order to make a silent change. The clutch is disengaged, the gear lever moved into neutral, the clutch re-engaged at the same moment the accelerator is dabbed, which has the effect of speeding up the clutch shaft, the clutch again disengaged and the gear lever moved into the lower gear. No difficulty will be experienced in accomplishing this after a little practice and the driver has become accustomed to the feel of the engine, but only practice can make perfect. The amount which the engine must be accelerated with the gear lever in neutral depends on the road speed of the car and the ratio of the lower gear which it is desired to change down to.

IGNITION CONTROL.

To obtain the best results, intelligent use of the ignition lever must be made; this should be fully retarded when the engine is under load up to 20 m.p.h., and even when running light the acceleration will be better at low engine speeds with the ignition thus.

CAUTION NECESSARY.

By reason of the engine's smoothness and silence and rapid acceleration, great care should be exercised until the driver is accustomed to the car and it should be driven with a watchful eye on the speedometer.

BRAKES.

The footbrake operates on the four wheels and the handbrake on the rear wheels only. They are powerful in action, but owing to the deceptive speed of the car and the ease with which it rides. over-confidence in the use of them must be guarded against,

WARNING Re Brakes.

After a car has been washed and water may have penetrated the brake drums the brakes will partly lose their efficiency ; it is, therefore, important, when starting out, to apply the brakes two or three times in order to dry the water off the linings.

OIL PRESSURE.

The correct engine oil pressure as shewn by the gauge on the instrument board should be not less than 20 lbs. at 40 miles per

hour or 15 lbs. at 30 miles per hour, after the car has been on the road for about an hour and the oil is thoroughly hot. The pressure will be considerably greater than this when the oil is cold. (*For adjustment of oil pressure, see page* 29).

TESTING MAGNETOS.

The two magnetos fire independent sets of sparking plugs and are synchronised to fire simultaneously. They have independent switches, and occasionally, they should be tested to make certain that they are both firing regularly and that all sparking plugs are in order. When running at about 15 miles an hour on top speed with the engine pulling against a slight gradient, both magneto switches being on, the magnetos should be switched off alternately, when it will immediately be felt, by the irregularity of the engine, if either magneto or any plug is misfiring. Care must be taken that both magnetos are not switched off at the same moment, as immediately either or both are again switched on, an explosion in the silencer will be caused due to the unburnt gases which have passed into it and the silencer may be damaged. Ordinarily the engine must always be run with both magnetos in operation as running one of these instruments switched off will damage it, and the plugs operated by that instrument may get sooted up. If, however, one magneto should fail, the engine can run on the other until a replacement can be obtained.

CAREFUL USE OF NEW ENGINE.

In common with other cars it is most important that the " SIX " Bentley should not be driven hard when new and before the engine has done sufficient mileage to work off its stiffness. Care with regard to this cannot be emphasised too strongly. An owner who treats his car considerately for the first 1,000 miles will have a much better and smoother engine than the owner who drives his car hard when the engine is still stiff, and the latter will probably be called upon to meet a repair bill many thousands of miles before the former. For the first 1,000 miles not more than 50 miles per hour on top gear should be indulged in except perhaps for short bursts and the car must not be driven really hard until it has done 2,000 miles. It will not develop its true performance until it has done 7,000 or 8,000 miles and will be found even to be improving after this.

MAXIMUM ENGINE REVS.

An engine is liable to be damaged if it is run above a certain limit on revs. per minute. This limit depends upon the design and in

the " SIX " Bentley it is 3,200 r.p.m. on indirect gears and 3,500 r.p.m. on top gear. On page 18 will be found a table of gear ratios for the various back axle ratios which are fitted as standard and also revolution charts from which can be read the road speed for the various gears and any particular axle ratio. The road speed corresponding to the maximum engine revs. for each gear having been determined it is only necessary to watch the speedometer to ensure that too high revs. are not being indulged in. This of course only refers to those cars on which a revolution counter is not fitted. It must be understood that this limit of revs. applies to an engine that is " run in " and not to one which is still stiff.

ADJUSTMENTS ON A NEW CAR.

It is particularly requested that after a new car has done about 2,000 miles it should be submitted to the Service Department in order that minor adjustments may be carried out. After an engine has been on the road for a little time the various parts settle down and minor adjustments can be carried out with advantage, adjustments which will not again be necessary for many thousands of miles. The car should only be sent in to the Service Department by appointment, in order to avoid disappointment and delay.

FROST.

During periods of severe frost when the car is kept in an unheated garage it is important to drain the water from the engine. To do this the two plugs underneath the radiator must be unscrewed and the water having drained, away the small cock on the aluminium water jacket plate on the front of the cylinder block must be opened.

DISC WHEELS.

When a car is fitted with discs to the wheels, it is important not to drive too close to high curbs as the discs will rub against the edge of the curb and be damaged. A good hint to prevent discs developing creaks and becoming rusty is to place an oily rag inside the wheel before the outer disc is fitted.

CHAPTER II.

System of chassis lubrication. Recommended oils. Touring abroad. Engine lubrication. Gear box lubrication. Back axle lubrication. Tecalemit system. Chassis lubrication. Brake camshafts. Spring shackles and steering parts. Clutch thrust sleeve. Front and rear hubs. Greasers. Magnetos. Vibration damper. Fan. Summary.

PERIODICAL LUBRICATION AND ATTENTION.

On reading through this chapter it will be realised that only a very small amount of time has to be spent on lubrication, general chassis lubrication being required only once in three months or every 2,500 miles. If, however, any part of the chassis shows obvious signs—audible or otherwise—of lack of oil, it must be given the necessary attention immediately, though this will not be likely if the instructions are carried out at the specified intervals. It should be realised that lack of lubrication causes excessive and rapid wear which is costly to the owner and unsatisfactory to the manufacturers.

SYSTEM OF CHASSIS LUBRICATION.

The chassis is designed for lubrication with oil, grease only being used for lubricating the water pump spindle and both ends of the dynamo armature spindle. Tecalemit nipples are fitted to all the oiling points, so that, with the Tecalemit gun, lubrication can be carried out quickly and cleanly. The gun forces oil at high pressure so that undue force in its use is not desirable. The Lubrication Chart included at the end of this book shows the grade of oil to be employed in the various oiling points. Chassis lubrication, as a whole, need only be carried out every three months or every 2,500 miles, the various parts, being designed so as to form reservoirs which carry sufficient oil for lubrication over such a period.

RECOMMENDED OILS.

Bentley Engine Oil, prepared by Messrs. Prices Patent Candle Co., is recommended for use in the engine, Summer Grade and Winter Grade for the respective seasons. Orders for this oil should be sent direct to the Service Department, the price being 7s. 9d. per gallon in one gallon tins, and 6s. 3d. per gallon in 5

or 10 gallon drums, delivery free in the United Kingdom. If this oil is unobtainable, the following oils are suitable :—

Prices Huile de Luxe, Summer and Winter Grades.
Castrol X.L. Summer and Winter Grades.
Triple Shell.
Mobiloil BB. Summer and A. Winter.
Veedol, extra heavy.
Filtrate, extra heavy.

Oils of different brands should not be mixed, except in emergencies; if mixed, an early opportunity must be taken of changing the oil in the engine. Other well-known brands may be used if desired, but the Service Department's approval must first be obtained and their advice asked concerning the correct Grade.

TOURING ABROAD.

When touring abroad great care must be exercised that only oil in *sealed tins* is put into the engine. This is a very important point. Mobiloil, Shell Oil and Veedol are obtainable in most places on the Continent, but should an unknown brand have to be used it should be borne in mind that a fairly heavy oil suits the engine best.

ENGINE LUBRICATION.

The oil level gauge (*see Fig.* 3 *and page* 12) must be looked at daily and the oil replenished to the correct level, care being taken never to allow the level to get below the lower mark on the gauge. Replenishment should be made after the engine has been at rest for some time so that the oil in circulation will have had time to return to the sump. When the engine is running there is approximately half a gallon in circulation so that the level as shewn by the gauge will rise a distance corresponding to this amount after the oil has drained back. The gauze in the filler must always be in position when refilling. Engines vary somewhat in oil consumption but 1,000 miles per gallon may be expected.

GEARBOX LUBRICATION.

The level of oil in the Gear Box must be examined every three months or every 2,500 miles. To do this it is necessary to remove the cover as no inspection plate is provided. (*See Fig.* 13). The oil should be level with the centre of the lay, or lower, shaft. It must not be above this level. To replenish, one part of Prices' Amber " B " gear oil and two parts of engine oil is

the correct mixture. Other gear oil of similar consistency may be used if desired. A plug is fitted for draining the gear box. On a new car this should be done after the first three months, after which it need only be done about every 10,000 miles. To facilitate draining, it should be done after the car has just come in from a run, as the oil is then thin and drains easily.

BACK AXLE LUBRICATION.

The oil level in the rear axle must be examined every three months or every 2,500 miles. For this purpose it is necessary to remove the plug on the goose-neck filler on the near side front of the axle casing banjo (*see Fig.* 14.) With the car standing on level ground the correct level of oil is half an inch below the top of the filler. Only engine oil must be used for replenishing. After the first three months the oil should be drained out by removing the plug at the bottom of the goose neck filler. After this, draining out need only be done about every 10,000 miles. It is of great importance that the axle should not be filled above the correct level, as should this be done, there is a likelihood of oil getting through the axle on to the brakes which will destroy their efficiency, and if it is left on the liners for any length of time it will necessitate the liners being renewed.

TECALEMIT LUBRICATION SYSTEM.

Tecalemit nipples are fitted to all oiling points throughout the chassis, so that, with the oil gun provided, lubrication can be carried out quickly and cleanly.

The correct method of using the oil-gun is to unscrew and remove the cover in which the screw-plunger is mounted; withdraw the plunger from the pump body. Screw the plunger as far back into the cover as it will go until the piston with the leather cup is right back in the cover. It is necessary to do this so as to avoid any likelihood of damage to the leather when replacing the cover on the pump. The pump body can then be filled with oil and the cover replaced. In the connection end of the pump is a spring loaded ball valve which will prevent oil leaking out of the pump except under pressure. The pump can therefore safely be carried, when charged, in the tool box. The top of the oiling nipples are hexagonal and the pump is slid on, the slotted portion of the connection engaging the top of the nipple. When the plunger is screwed into the pump, oil is forced into the part to be lubricated at high pressure, so that

much force need not be applied. Before disconnecting the gun from the nipple the plunger should be screwed back two or three turns to release the pressure in the gun, otherwise, on disconnecting, oil will gush out.

GENERAL CHASSIS LUBRICATION.

The lubrication of the chassis is straightforward if the oiling chart is followed. Each oiling point is marked either "E" or "T", indicating engine oil or transmission oil. By the latter is meant a mixture of Prices' Amber "B" oil or gear oil of similar consistency and engine oil in equal parts, with the exception of the gear box which has one part gear oil to two parts engine oil. Universal joint nipples are fitted on the universal joints at both ends of the propeller shaft through which the joints can be charged. (*See Figs.* 14 *and* 17). If too much oil is put in through these, the oil will overflow out of the annular space between the joint cover and the propeller shaft. This need not cause any concern as sufficient oil always remains for efficient lubrication.

A nipple is also fitted near the front end of the propeller shaft (*see Fig.* 17), which acts as a reservoir lubricating the rear joint only. These two joints, the gear box and clutch thrust sleeve are the only parts which are lubricated with transmission oil, all the remaining points having engine oil. Grease must on no account be used.

BRAKE CAMSHAFTS.

Fig. 14 shows a brake camshaft oiling nipple. Much oil must not be forced into these as the oilways have a direct connection with the back axle, consequently any surplus will tend to overfill this part. The oilways are specifically designed thus, as otherwise, too much pressure would force the oil in to the brake drums and so on to the brake liners, destroying their efficiency.

SPRING SHACKLES AND STEERING PARTS.

When lubricating the shackles and steering parts oil should be forced in until it exudes, showing that the oil has penetrated right through. Engine oil is used for these parts. The stub axles are designed with an air vent, so that oil exudes when it has reached the highest point in the stub axle pins.

CLUTCH THRUST SLEEVE.

Two oiling nipples are fitted on the gunmetal clutch thrust bearing sleeve. (*See Fig.* 4). Either of these oilers may be

SUMMARY OF CHASSIS LUBRICATION INSTRUCTIONS.

Part.	Lubricant.	Remarks.
GEAR BOX	One part gear to two parts engine oil.	*Fill to centre of lay shaft*
BACK AXLE	Engine oil.	*Fill to half-inch below lip of filler.*
PROPELLER SHAFT JOINTS.	Transmission oil.	
PROPELLER SHAFT	Ditto	*Acts as reservoir for rear joint.*
STEERING BOX	Engine oil.	
BRAKE CAM-SHAFTS (Rear).	Engine Oil.	*Do not over-lubricate.*
SPRING SHACKLES Etc.	Engine Oil.	*Lubricate till oil exudes.*
PERROT SHAFTS	Transmission Oil.	*Force oil until it is felt exuding into leather stockings.*
CLUTCH THRUST SLEEVE.	Transmission Oil.	*Lubricate sparingly every* 5,000 *miles.*
WATER PUMP	Grease.	*Turn greaser every* 500 *miles.*
FRONT HUBS	Grease.	*No attention required.*
REAR HUBS	Ditto	*Ditto*
DYNAMO	Heavy Grease. (Prices' H.M.P.)	*Turn greaser every* 2000 *miles.*
MAGNETOS	Machine Oil.	*Do not over-lubricate.*

CHAPTER III.

Adjusting foot brake. Adjusting hand brake. Clutch pedal adjustment. Clutch stop adjustment. Cleaning oil filter. Changing oil in engine. Cleaning oil pump strainer. Adjusting oil pressure. Loss of oil pressure. Cleaning petrol filter. Flooding carburettor. Reserve fuel supply. Choked carburettor jet. Engine controls. Adjusting fan belt. Road wheels. Shock absorbers. Tool kit. Batteries. "Dont's."

MINOR RUNNING ADJUSTMENTS AND HINTS.

In this chapter instructions are given for carrying out such minor adjustments as the driver of a "SIX" Bentley may be called upon to do from time to time in the ordinary course of running. It does not include instructions for the more skilled jobs such as adjusting tappets and synchronising magnetos, etc., which are included in another part of the instruction book and which are only necessary at comparatively infrequent intervals.

ADJUSTING FOOT BRAKE.

To take up the wear in the foot brake a single adjustment is provided under the front floorboards at the bottom of the brake pedal. (*See Fig.* 4). The lock nut is slacked back, *i.e.*, towards the front of the car and the butterfly nut screwed in a similar direction. After adjustment the lock nut must be screwed up. The normal adjustment is for the brakes to come into operation after the pedal has been depressed not less than 1 inch. If adjusted up closer than this the front brake on the inside of the lock when the wheels are fully locked over will bind slightly.

ADJUSTING HAND BRAKE.

The adjustment for taking up wear in the hand brake is situated at the lower end of the brake lever. (*See Fig.* 13). The butterfly nut is screwed in a clockwise direction and is automatically located in position every half revolution. The standard adjustment is for the brake to be hard on when the lever is vertical.

CLUTCH PEDAL ADJUSTMENT.

There is a straightforward adjustment for the clutch pedal. (*See Fig.* 4). It should be so adjusted that there is not less than an inch of movement between the pedal and the floor-boards when the clutch is engaged. Attention should occasionally be given to this point.

CLUTCH STOP ADJUSTMENT.

The clutch stop can be adjusted to suit individual requirements and to take up wear. The hexagonal lock nut (*see Fig.* 4) is slacked back and the knurled hand wheel is screwed in a clockwise direction to make the clutch stop fiercer in action. This adjuster wheel should not, however, be forced as it cannot be turned more than a certain distance. Ample range of adjustment is provided for. As issued from the Works the clutch stop is adjusted to be light in action.

CLEANING OIL FILTER.

The oil filter is mounted on the flange of the crank case on the offside of the engine (*see Fig.* 10). On a new engine the filter should be cleaned after the first 1,000 miles after which it need only be cleaned every 5,000 miles as the gauze is of ample size. The gauze is very simply removed and replaced. The hexagonal nut is unscrewed, then the steel cap is removed, disclosing the gauze which can be withdrawn. To clean, it should be washed in petrol with a brush. When replacing care must be taken that the joint washers are replaced and that the nut is screwed tight otherwise an oil leak will result. (*See Fig.* 5).

CHANGING OIL IN ENGINE.

The oil consumption of individual engines varies to some extent. When the consumption is over 1,000 miles per gallon, a gallon of oil should be drawn off from the sump every 1,000 miles, through the plug in the side of the sump (*see Fig.* 6), and a gallon of new oil poured in. The sump should be completely emptied and refilled with new oil every 5,000 miles, and after the first 2,000 miles on a new engine.

To enable the sump to be drained two plugs are fitted (*see Fig.* 6). The plug on the side of the sump should first be removed, when the oil has ceased to drain through this there will still be a small quantity left in the sump. To drain the remainder, the plug in the oil pump strainer cover must be unscrewed. The oil coming through this plug hole passes through the oil pump strainer, hence the desirability of draining the greater part of the oil out through the other plug hole first. The sump, being empty, a gallon of paraffin should be poured in through the oil filler and allowed to drain out. The engine must never be turned when there is paraffin in the sump. The plugs can then be replaced and fresh oil poured in to the correct level as shewn on the indicator.

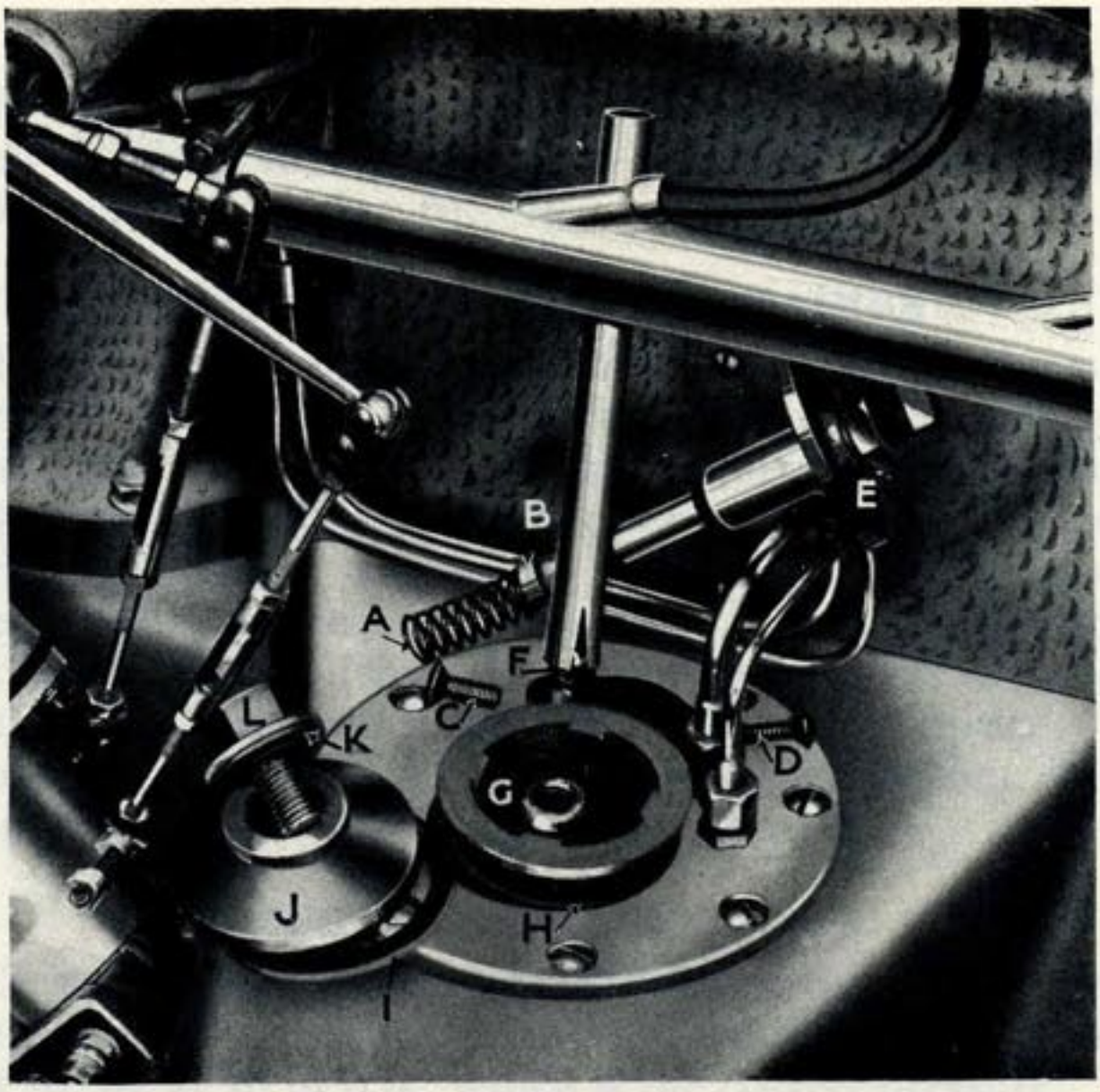


Fig. 5. OIL FILTER PARTLY REMOVED AND OIL PRESSURE RELIEF BALL REMOVED.

Note the oil pressure relief spring (A) on the end of the plug (B) removed by unscrewing the two screws (C and D), securing the flange (E). The ball valve (F) is shewn in the end of the tool supplied in the kit for the purpose of removing it. The oil filter (G) is shewn partly withdrawn. Note the washer (H) underneath the flange of the gauze, and the washer (I) under the cover (J); there is also a washer (K) between the bolt (L) and the cover.

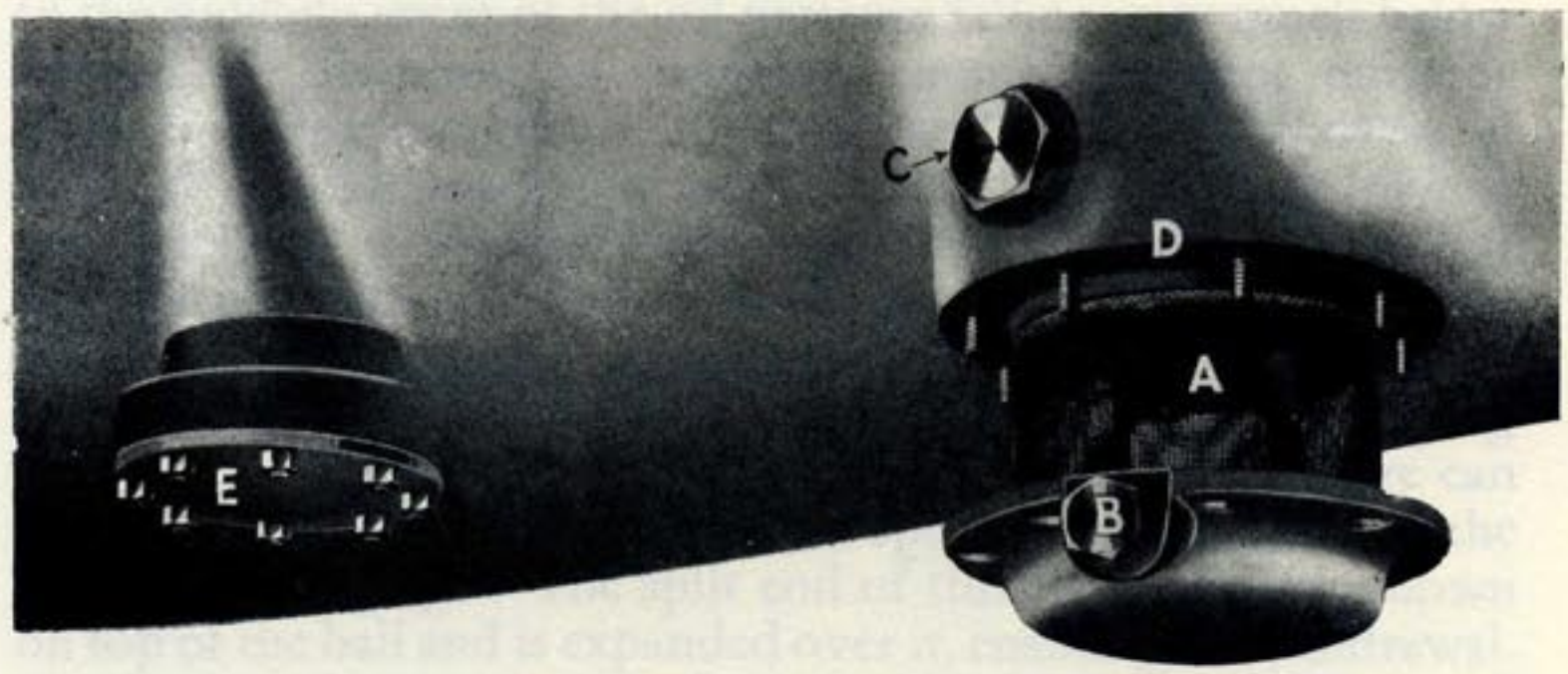


Fig. 6. BASE OF SUMP, SHEWING OIL PUMP STRAINER PARTLY REMOVED.

Strainer (A). Strainer drain plug (B). Sump drain plug (C). Paper washer (D). Oil level float chamber cover (E)

In early engines the drain plugs mentioned above were not fitted, so that to drain the sump it is necessary to remove the oil pump filter cover (*see Fig.* 6).

CLEANING OIL PUMP STRAINER.

The oil pump situated in the bottom of the sump at the rear end is surrounded by a gauze through which all oil delivered by the pump is drawn. (*See Fig.* 6). This strainer should be cleaned every 5,000 miles. The gunmetal cover of the strainer is secured by eight nuts which should be unscrewed when the cover complete with gauze can be removed. The act of doing this will drain all the oil from the sump, so in order to avoid a sudden rush of oil, the sump should first be emptied. (*See page* 27). Care must be taken that the paper washer between the pump cover and the sump is not damaged.

ADJUSTING OIL PRESSURE.

After the engine oil has been in use for some time, or in very hot weather, it may be found that the oil pressure drops below 15 lbs. per sq. in. at 30 m.p.h., which is the correct pressure. This can be easily adjusted. The adjusting plug is mounted on the flange of the crankcase on the off-side of the engine close to the oil filter. (*See Fig.* 10). The lock nut is slacked back and the plug screwed downwards (*i.e.*, clockwise) to increase the pressure and upwards to decrease it. This adjustment should only be made when the oil is hot after the car has been on the road not less than an hour. When the oil is cold the pressure will always be higher than normal.

RECTIFYING LOSS OF OIL PRESSURE.

In the unlikely event of the oil pressure falling very much below normal, or disappearing altogether, immediate steps must be taken to rectify the matter; the cause will be either a choked oil filter (*to clean see page* 27), or a choked oil pump strainer (*to clean see above*), or a foreign body under the oil pressure release ball valve, which is the most likely cause. To remedy this the oil pressure adjusting plug (*see Fig.* 10) must be removed by unscrewing the two screws securing the flange, the flange, plug lock nut, and spring coming away as a unit ; the ball valve can then be withdrawn by means of the special tool provided in the tool kit (*see Fig.* 5). The split end of this tool is pressed down on top of the ball and is expanded over it, enabling its withdrawal. The ball seating must then be cleaned. This can be done by wrapping a piece of non-fluffy rag round the end of the tool for

removing the ball and rotating it backwards and forwards on the seating. The ball is then replaced, also the spring and plug.

TO CLEAN PETROL FILTER.

A Zenith petrol filter is fitted and is mounted on the front side of the dash underneath the Autovac. (*See Fig.* 3). It should be cleaned every 2,500 miles. To do this the knurled nut underneath the filter is unscrewed and the stirrup supporting the filter cup pulled forward, the cup at the same time being removed. The filter consists of a large number of laminations or thin discs, every disc having small ridges on one face which separate them, one from the other, an infinitesimal amount, sufficient to allow fuel to pass between them, but not enough to allow any foreign matter to pass. The discs are clamped together by the pressure of a plate and a small knurled nut. This nut should be slacked back as far as it will go, the discs can then be separated and cleaned, the knurled nut then being screwed up. clamping the plates together again, and the cup being replaced, having first cleaned the sediment out of it. In the top of the filter is an air release knob to dispose of an air lock in the filter should one be experienced. The knob should be unscrewed as far as it will go until the air has escaped, the tap under the Autovac controlling the fuel supply being on. The release knob must then be screwed down tightly.
(*To clean Limpid petrol filter see page* 35a.)

TO CLEAN STRAINER IN CARBURETTOR.

A gauze strainer is fitted in the carburettor beneath the float chamber. This should be cleaned about every 2,500 miles. To do this the feed pipe to the float chamber must be disconnected, and then the nipple, on to which the connection screws, must be unscrewed. The strainer can then be withdrawn and cleaned in petrol with a brush. When replacing, care must be taken that the end with the dowel peg is inserted first, as if it is inserted incorrectly, the gauze will be crushed when the nipple is screwed up. (*See Fig.* 12).

FLOODING CARBURETTOR.

A flooding carburettor may be caused by :—

(1) Punctured float.
(2) Sticking float needle.
(3) Foreign matter on needle seating.

(1) To ascertain whether this is the cause of the trouble the float chamber cover must be removed and the float lifted out, then by

shaking the latter it can be found whether there is fuel inside it. If this is the case another float should be obtained as soon as possible, a temporary repair being made by drilling a hole in the float enabling the fuel to drain out and then soldering the hole. By holding the float in hot water any punctures can be found, as bubbles will come out as the air inside heats and expands. Any Garage would be able to carry out a repair of this nature satisfactorily.

(2) This is unlikely to be the cause of the trouble except on an old carburettor where a ridge may have formed on the taper of the needle and the toggles may be worn. The matter can be attended to by any mechanic.

(3) This is the most likely cause of the trouble and can frequently be rectified by gently twisting the needle on its seating. If this fails the needle and float should be removed and the needle seating and float chamber cleaned.

RESERVE FUEL SUPPLY.

The petrol tank holds 19 gallons. A two-way tap is fitted in the tank filler which enables the last three gallons to be used as a reserve supply. The normal running position of the tap is in the horizontal position, *i.e.*, turned away from the filler towards the near side of the car. When in this position the engine will run dry of petrol with approximately three gallons remaining in the tank and by bringing the tap to the vertical position (*i.e.*, over the filler) the remaining three gallons can be utilised. (*See Fig.* 16). This is a simple means of ensuring that the engine cannot run completely short of fuel without due warning. Owing to the fact that when the tap is in the normal position the fuel is not sucked from the bottom of the tank, it is advisable to run occasionally with the tap in the reserve position as otherwise, if it is only utilised at very infrequent intervals, water and sediment may have accumulated in the tank which would be liable to cause a stoppage in the supply. By using it, fairly frequently, the small amount of foreign matter will be trapped by the filter and will not be sufficient to cause trouble.

CHOKED CARBURETTOR JET.

It is most unusual for this trouble to occur, but should it do so, the jets are easily accessible. (*See Fig.* 12). The fuel pipe connection underneath the float chamber must be disconnected, then the nut which is underneath the jet platform must be unscrewed. The jet platform is connected by an arm with

the float-chamber and is integral with it. On removing this nut with the special spanner in the kit, the jet platform with the jets and the float chamber can be dropped and removed. The opposite end of the special spanner fits the hexagonal portion of the jets, so that they can be easily removed and examined. The symptoms of a choked jet depend on the jet affected. If No. 1 is blocked it will be found that the engine will start up, but will only run slowly for a few seconds, and will stop immediately the throttle is opened, the engine only running on the well jet. If Nos. 2, 3 or 4 are choked, there will be loss of power on opening the throttle and probably popping in the carburettor. When any jet is removed it is essential that it must be put back in the correct position in the platform, the positions being numbered.

ENGINE CONTROLS.

The "U" clips and balls of the carburettor controls should occasionally be oiled with a few drops of oil from an oil can. They should be moveable but without end play or float. If they get stiff or are too tightly adjusted they are liable to prevent the throttle coming back to the slow running position.

ADJUSTING FAN BELT.

The fan revolves on a spindle eccentrically mounted in the front of the cylinder block. A lock nut holds the eccentric in position. The tension of the Whittle belt can be adjusted by slacking back the lock nut and turning the eccentric, afterwards tightening the nut. A special spanner for the lock nut is included in the tool kit. It should be noted that a too tightly adjusted belt will be noisy.

ROAD WHEELS.

Every three months the road wheels should be removed and the splines and outside of the hubs greased. This is important, as if neglected it may lead to difficulty in withdrawing a wheel, when necessary on the road, and also may cause a creaking noise, which is difficult to locate. To unscrew a locking ring it must always be hammered in the direction in which the wheel revolves when the car is going forward. A copper hammer is supplied for this in the tool kit; a steel hammer must never be used, as it mutilates the ring and there is also a danger of fracturing the latter. After a wheel has been removed the locking ring should be further tightened up after the car has done about 30 or 40 miles

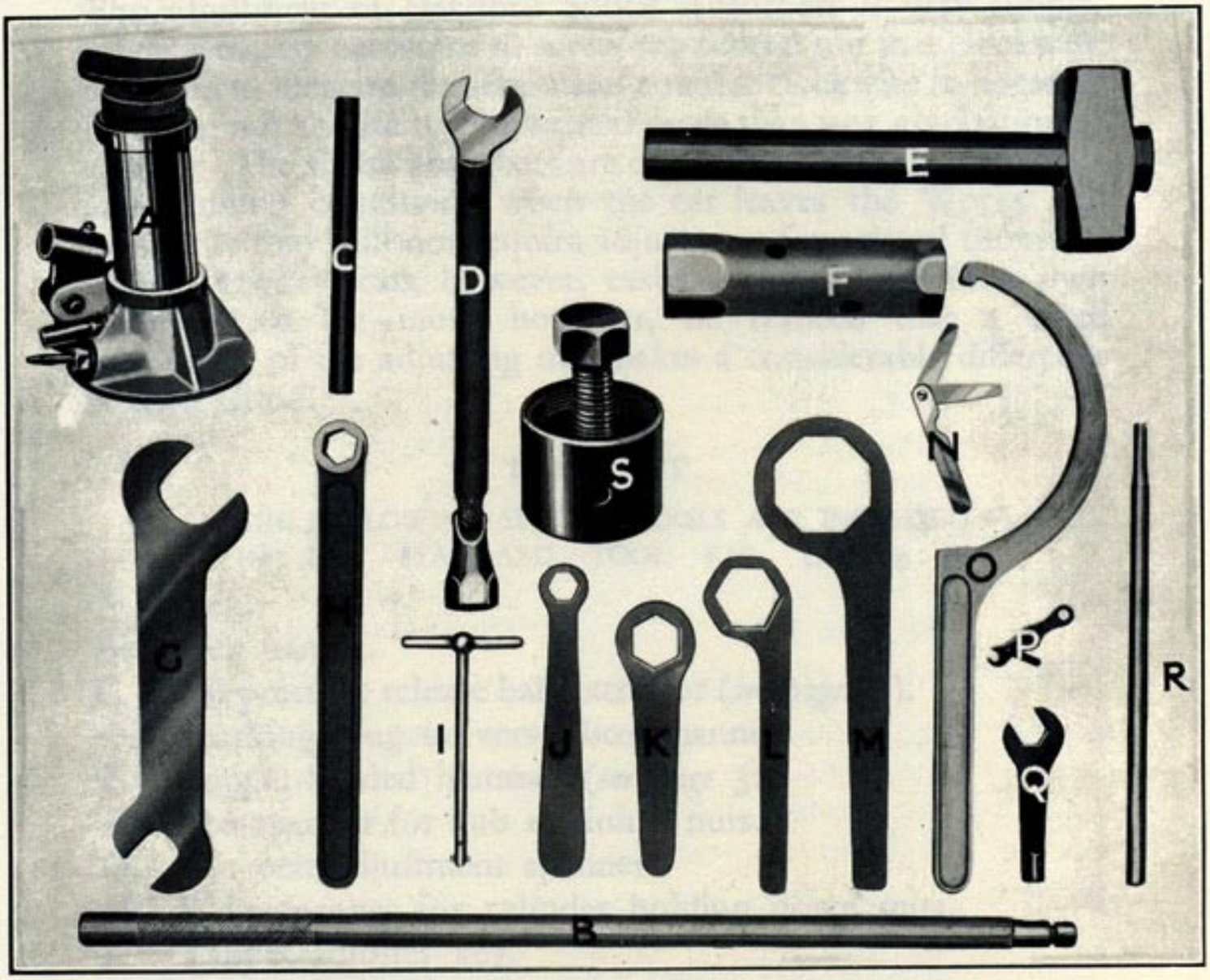


Fig. 7. SPECIAL TOOLS SUPPLIED IN KIT.

Jack (A). Jack handle (B). Oil pressure release ball extractor (C). Sparking plug spanner (D). Copper hammer (E). Hub retaining nut box spanner (F). Fan belt adjustment spanner (G). Cylinder holding down spanner (H). Tappet Key (I). Tappet lock nut spanner (J). Sump drain plug spanner (K). Back axle oil plug spanner and petrol tank drain plug spanner (L). Hub cap spanner (M). Feeler gauges, tappet (N). "C" spanner, coupling rod tunnel ring (O). Magneto spanner (P). Carburettor spanner (Q). Tommy bar (R). Hub extractor (S).

All locking rings should occasionally be tested to ensure that they are tight, as a loose ring allows the wheal to move on the hub, causing wear on the splines.

ADJUSTING SHOCK ABSORBERS.

The adjustment of Hartford Shock Absorbers is very simple, it being merely necessary to screw the central nut in a clockwise direction to increase the action and counter clockwise to decrease it. The nut should not be turned more than one graduation at a time. The shock absorbers are correctly set for average loads and running conditions when the car leaves the Works and ordinarily they will not require adjustment for several thousand miles. Owners can, however, easily adjust to suit their own requirements. It must, however, be realised that a small movement of the adjusting nut makes a considerable difference to their action.

TOOL KIT.

THE FOLLOWING SPECIAL TOOLS ARE INCLUDED IN THE STANDARD TOOL KIT. (*See Fig.* 7).

A. Jack.
B. Jack handle.
C. Oil pressure release ball extractor (*see page* 29).
D. Sparking plug universal box spanner.
E. Copper-headed hammer (*see page* 32).
F. Box spanner for hub retaining nuts.
G. Fan belt adjustment spanner.
H. Ring spanner for cylinder holding down nuts.
I. Tappet adjuster key.
J. Tappet lock nut spanner.
K. Sump drain plug ring spanner.
L. Ring spanner for rear axle filler cap and petrol tank drain plug.
M. Hub cap spanner.
N. .006 and .004 feeler gauge (*see page* 88).
O. " C " spanner for coupling rod tunnel ring.
P. Magneto spanner.
Q. Carburettor jet spanner.
R. Tommy bar.
S. Hub withdrawer.

BATTERIES.

The batteries consist of two six volts units connected in series to give a 12 volt supply. The efficiency of the whole electrical system depends upon them being in proper condition and they should be inspected not less than once a fortnight, the electrolite being replenished with *distilled* water until the top of the plates are covered. (*For further information with regard to their upkeep, see page 77*).

DON'T

DON'T race the engine when running free.

DON'T drive the engine at high revs. on any gear immediately after starting up from cold. It takes several minutes for the oil to circulate throughout the engine. This particularly applies if the engine has been lying idle for some days.

DON'T drive really hard with the mixture control in the full weak position, as this has a tendency to make the engine run hot.

DON'T forget to screw the Ki-Gass plunger home after use.

DON'T put any grease in the rear hubs and only a little in the front hubs, should the latter have been dismantled.

DON'T overfill the back axle.

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

DON'T forget that to remove a detachable wheel locking ring, the ring must always be hammered in the direction in which the wheel revolves when going forward.

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

DON'T forget that the speed of the car is very deceptive so that until accustomed to the feel of the car a careful eye should be kept on the speedometer.

DO

DO please write to the Service Department if in doubt about any point with regard to the upkeep and management of the car.

Six Cylinder chassis which were first produced were fitted with the "Limpid" petrol filter. To clean this the hexagonal nut on top of the filter is unscrewed and the white metal cap and glass container removed. The gauze can then be withdrawn and cleaned in petrol with a brush. When replacing the felt washer must not be forgotten, nor the fibre washer between the nut and the cap. Periodically the knurled drain plug should be removed to drain away any sediment and water. A small red float is included in the filter. This float sinks in petrol or mixture, but floats in water and is intended to act as an indicator showing the presence of water in the fuel. It cannot, however, be entirely depended upon as the action of Benzol destroys its efficiency after a time.

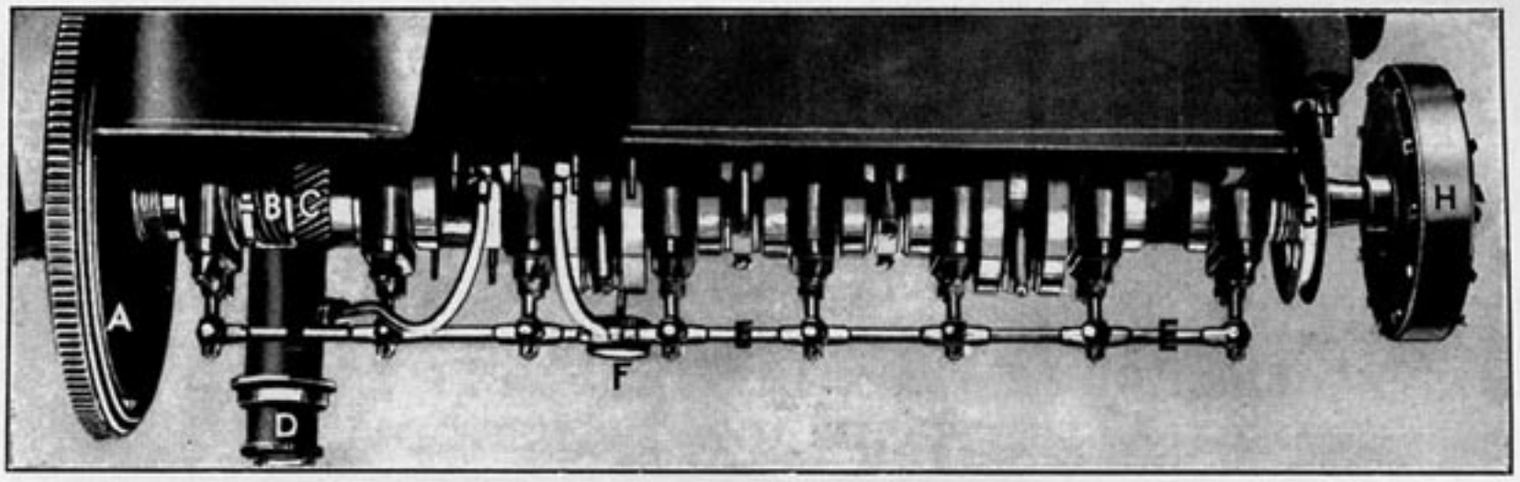


Fig. 8. CRANKCASE WITH LOWER HALF REMOVED.
Flywheel (A). Oil Pump drive (B). Coupling rod drive (C). Oil pump (D). Oil delivery pipe to main bearings (E). Oil level indicator float (F). Fan belt pulley (G). Vibration damper (H).

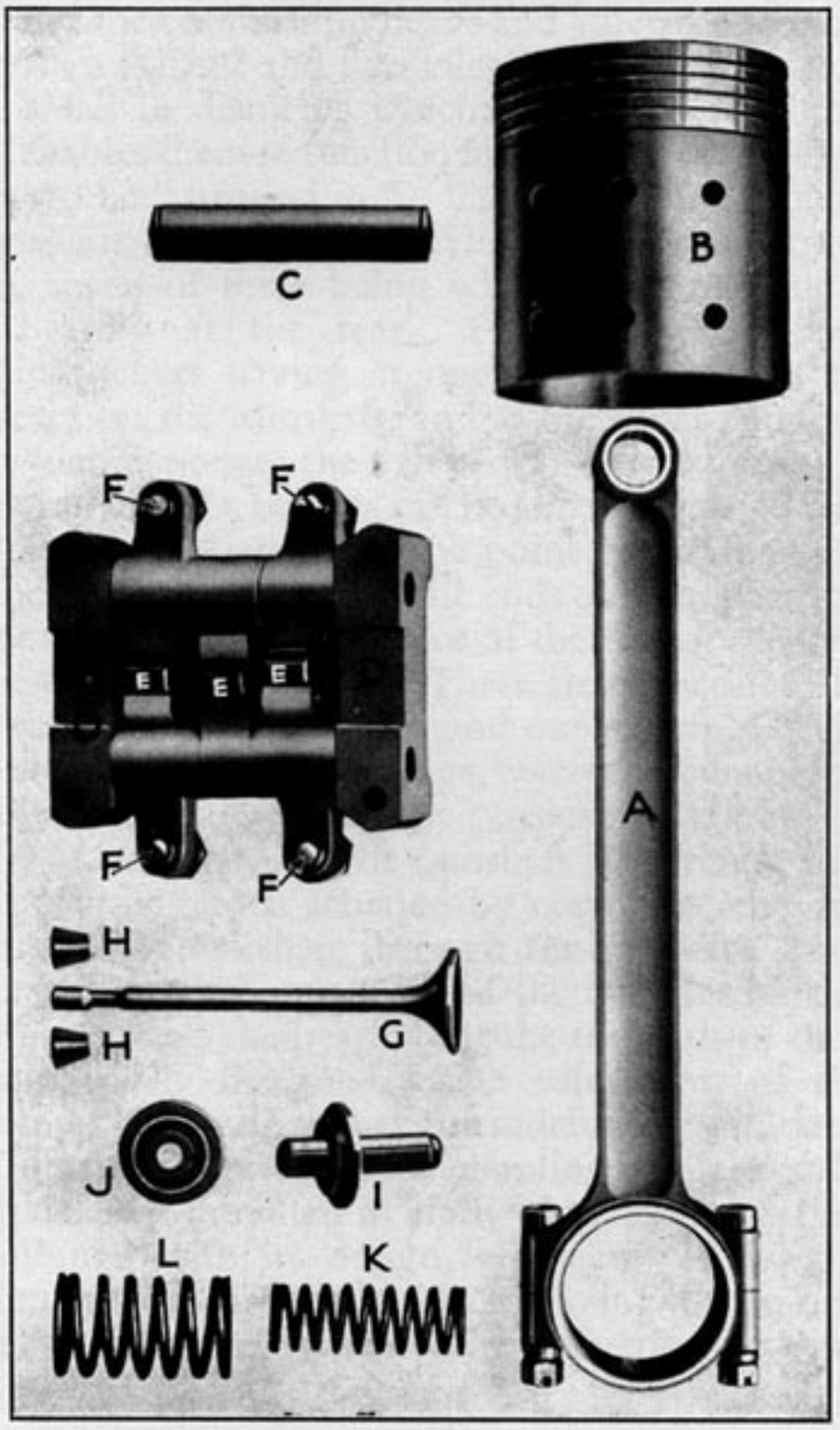


Fig. 9. VALVE PARTS, CONNECTING ROD, PISTON, ETC.
Connecting rod (A). Piston (B). Gudgeon pin (C). Rocker cap (D). Rocker roller (E). Ball end of tappet screw (F). Valve (G). Cone pieces (H). Valve guide (I). Valve collar (J). Inner valve spring (K). Outer valve spring (L).

CHAPTER IV.

Engine Details. Lubrication System. Cooling System. Ignition. Carburettor. Action of Carburettor. Care of Carburettor. Jet Settings. Fuel Feed System. Autovac. Exhaust System.

DESCRIPTION OF ENGINE. LUBRICATION, FUEL, COOLING AND IGNITION SYSTEMS.

ENGINE DETAILS.

The cylinders are cast "*en bloc,*" the cylinder heads not being detachable. The design is patented and provides for ample water space round the combustion heads and valves. In each cylinder there are two exhaust and two inlet valves, they are tulip-shaped and are small in diameter which, combined with the efficient cooling, enables them to function for a very great mileage without requiring to be " ground in." The single camshaft is mounted centrally along the top of the cylinder block and runs in eight bearings, seven of these being white metal and one phosphor bronze bearing at the rear. The valves are operated by duralumin rockers having at one end a hardened steel roller which bears on the camshaft, and at the other end a ball-ended tappet, which depresses the valve. The tappet screw is secured by a lock nut and the tappets can be simply adjusted (*see page* 89). The ball ends are flattened at the point where they bear on the valves and are free to rotate in the ends of the tappet screws, thus always bearing on the full surface of the end of the valve. The tip of the valve is hardened. There are two concentric springs to each valve, termed the inner and outer springs. The rockers are mounted in six aluminium caps, each cap being independently removable, and also serving the purpose of holding down the camshaft. (*See Fig.* 9). The camshaft is driven at the rear end by three coupling rods actuated by eccentrics, the drive being taken from the crankshaft through timing gears. In order to allow for the vertical expansion of the cylinder block and cam casing, due to heat, the bearings at the top ends of the coupling rods are specially designed. The adjustment of these must never be interfered with as they run indefinitely without attention. The bearings at both ends of the coupling rods are of duralumin. The crankshaft is mounted in eight white metal bearings, which fact, combined with its design, eliminates all whip. B.H.B. aluminium pistons are fitted, each having three rings and a scraper ring, all at the crown. The gudgeon pins float both in

the piston bosses and in the little end bushes, which are of aluminium. The big end bearings have no brasses, the white metal being secured direct into the connecting rod end, thus keeping down weight. Three point suspension is utilised for the engine.

The drive to the camshaft is taken off the rear end of the crankshaft, the coupling rods being contained in a cylindrical tunnel. A vibration damper is mounted at the front end of the crankshaft. The oil pump, which is of the gear wheel type, is carried in the bottom of the sump and is driven through a vertical shaft by skew gearing off the rear end of the crankshaft. The flywheel consists of a thin disc having teeth machined in its periphery in which the Bendix pinion of the self-starter engages. Two independent magnetos are fitted and are carried on flange mountings on either side of the engine ; they are driven by a skew gear mounted on the rear end of the camshaft. The magnetos are synchronised to fire simultaneously, two sets of sparking plugs being fitted. The plug fitted as standard is the K.L.G. type J.I. The water pump is mounted high up behind the radiator, and is driven off the front end of the camshaft. A Smith-Bentley five-jet carburettor is fitted, both this and the induction manifold being water heated. Two priming cocks are mounted on top of the induction manifold, but these need not normally be used, as a Ki-Gass primer (*see page* 13), is fitted as standard, thereby an easy start from cold being ensured. The carburettor is fitted on the near side of the engine (*see Fig.* 1). On the off side are the exhaust manifolds. These consist of two independent sets of branch pipes and manifolds and two exhaust pipes leading into the front expansion chamber, the three front cylinders being served by one set and the three rear cylinders by the other set. (*See Fig.* 2).

On the near side of the engine will be found the oil filler which contains a gauze filter, and just to one side of it the oil level indicator which shows the amount of oil in the sump. (*See Fig.* 3). In the flange of the crank case on the offside are the oil filter and the oil pressure adjusting plug. (*See Fig.* 10). The dynamo is carried on a flange mounting on the rear side of the dash and is driven, through two flexible joints off the rear end of the camshaft, at half engine speed.

A fan is fitted, its spindle being eccentrically mounted on the front end of the cylinder block. It is driven by a Whittle belt and a pulley on the crank shaft. A thermostat controlling the temperature of the water in the cylinder block is housed in the water pump casing ; this requires no attention. The starter

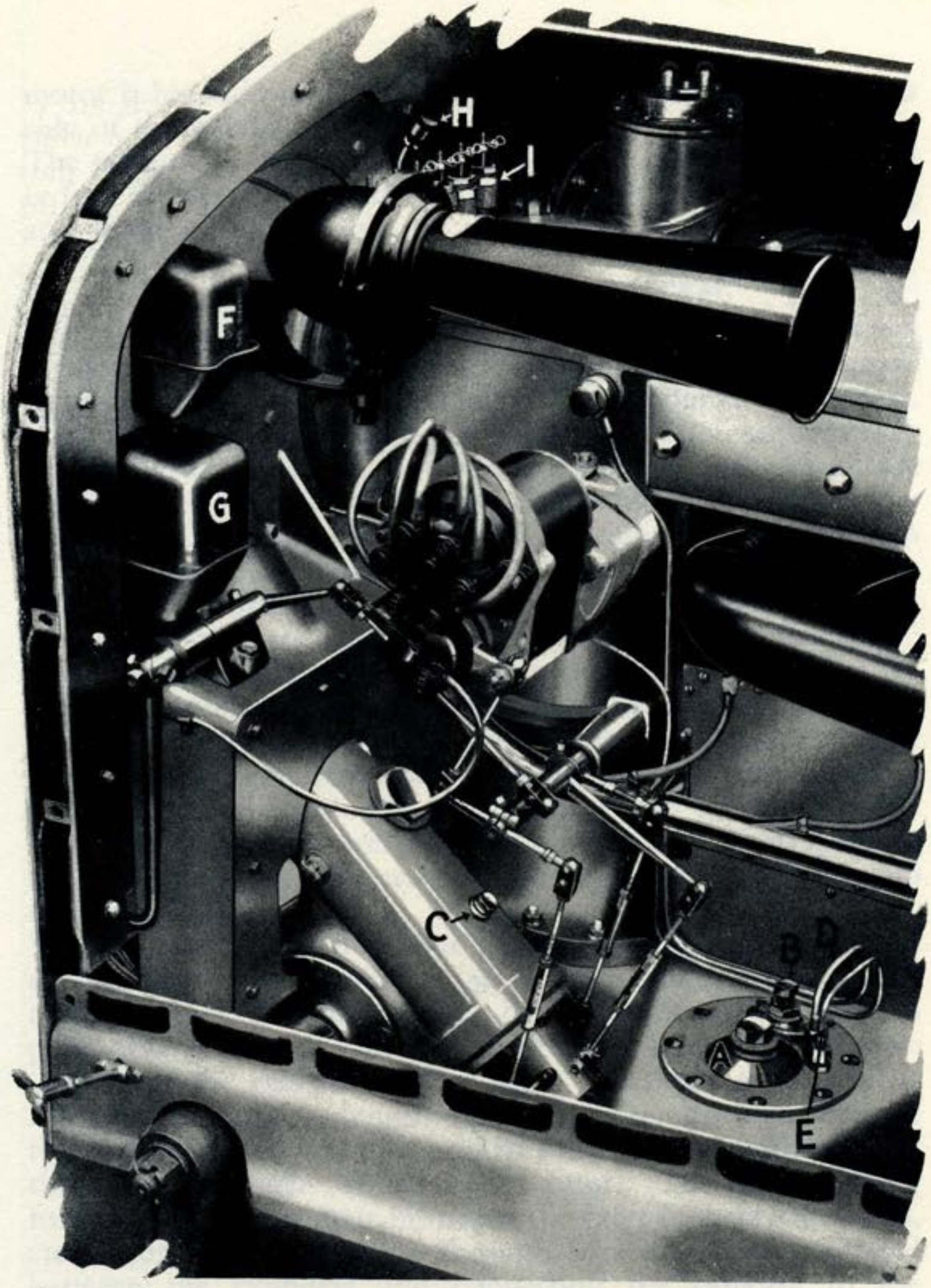


Fig. 10. CARBURETTOR CONTROLS, OIL FILTER AND PRESSURE ADJUSTING PLUG.

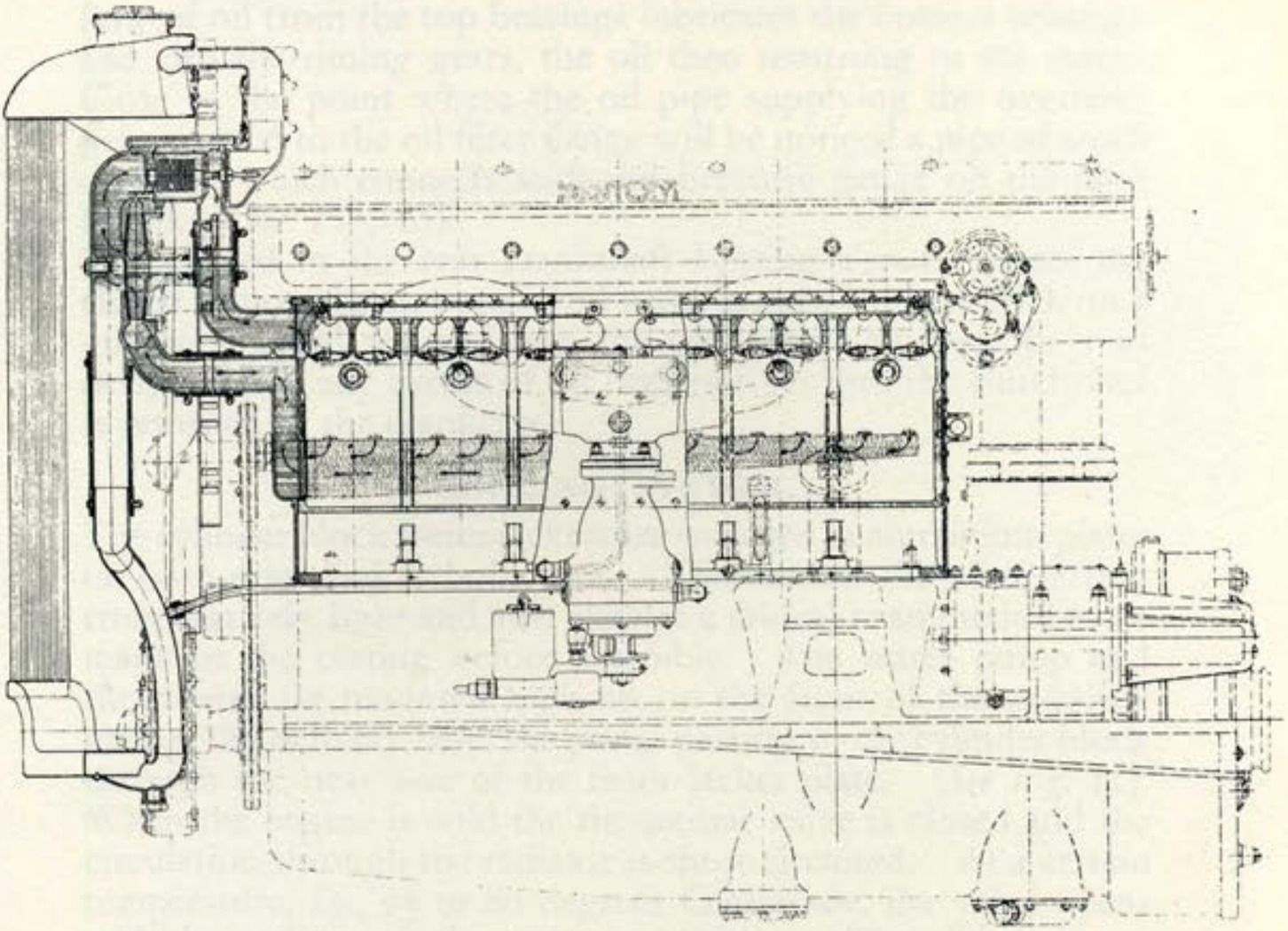
Shewing the correct angles of the magneto and carburettor controls. Also oil filter (A). Oil pressure adjustment plug (B). Oiling nipple for steering box (C). Oil lead to overhead gear (D). Oil lead to pressure gauge (E). Dynamo cut-out (F). Distribution box (G). Greaser for front end or dynamo (H). Spare sparking plugs in carrier (I).

motor is housed in the aluminium crankcase casting on the near side of the engine.
The radiator is mounted on trunnions with rubber bushes, and is free to swivel forwards and backwards without incurring any strain. (*See Fig.* 15).

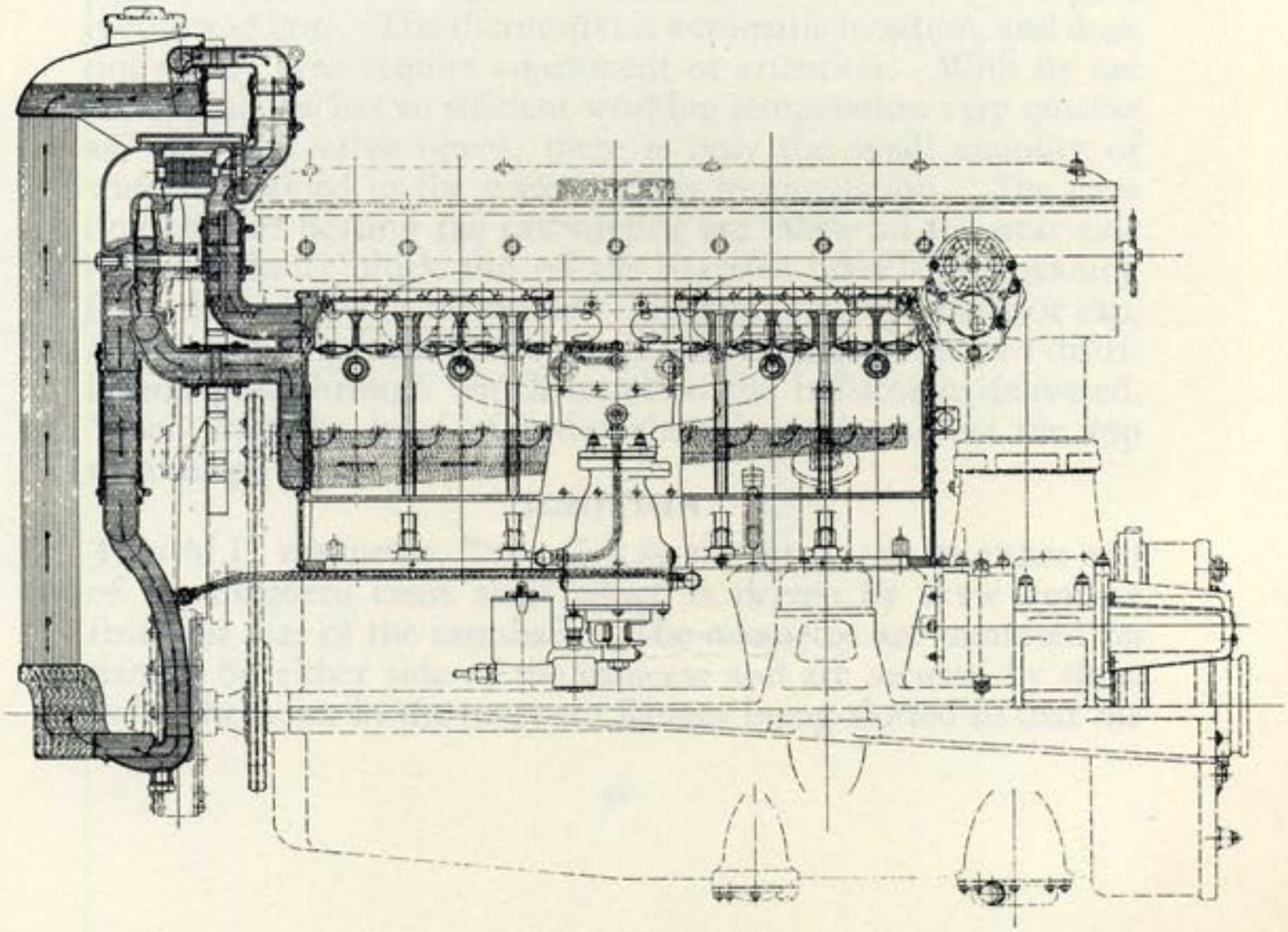
ENGINE LUBRICATION SYSTEM.

The oil pump, of the gear wheel type, is situated in the bottom of the sump at the rear end; it is surrounded by a large gauze strainer, through which all oil sucked by the pump has to pass. (*See Fig.* 6). From the pump, the oil is forced to another cylindrical filter of fine mesh, mounted in the flange of the crankcase on the offside. This filter is easily removable for cleaning. (*See page* 27). On being forced through the filter the oil is led both to the crankshaft bearings and to the overhead gear. To lubricate the former the oil is led back into the crankcase and through a pipe carried underneath and parallel to the crankshaft; a lead is taken off this pipe to each main bearing. (*See Fig.* 8). It will be noted therefore that each main bearing has a separate feed and is pressure fed. The crank shaft is drilled so that each big end bearing is fed from its corresponding main bearing. After passing through the main and big end bearings the oil is flung off and lubricates by splash the cylinder walls, pistons, and gudgeon pins, afterwards dropping back into the sump through a baffle plate.
The oil lead to the overhead gear is taken from the top of the oil filter body on the flange of the crankcase, and is led to the side of the camcase (*see Fig.* 10), wherein two branch pipes will be found. One of these pipes leads to the centre bearing of the camshaft. The latter is hollow, so that oil is forced throughout its length, lubricating each camshaft bearing through holes drilled in the camshaft and also the cams themselves through small holes drilled in the cams. The oil, on being forced out of the camshaft, lubricates the valve rockers and rollers, etc., returning to the sump through four drain pipes situated between the cylinders and connecting the camcase to the crankcase. The other branch pipe, mentioned above, is led to the rear bearing of the coupling drive passing immediately over the three eccentrics operating the coupling rods for the camshaft drive. In the top halves of these coupling rod bearings are recesses, and the oil pipe which supplies the rear bearing just mentioned has three small oil jets in its underside. The oil is forced through these jets and is caught in the recesses, thus lubricating the top coupling rod bearings. The lower bearings

HOT AND COLD WATER DIAGRAMS.



WATER SYSTEM, COLD.



WATER SYSTEM, HOT.

of the coupling rods are constructed similarly, so that the overflow of oil from the top bearings lubricates the bottom bearings and also the timing gears, the oil then returning to the sump. Close to the point where the oil pipe supplying the overhead gear is fitted to the oil filter flange will be noticed a pipe of small diameter which connects with the pressure gauge on the facia board. (*See Fig.* 10).

The oil fed to the rear crankshaft bearing also lubricates the clutch spigot, the amount of oil being controlled by a wick on a gunmetal spool screwed into the end of the spigot. It is so designed that any excess of oil does not get into the clutch, but is returned to the crankcase.

COOLING SYSTEM.

The cylinder block water jackets are enclosed in aluminium plates on both sides and at both ends. This makes the construction comparatively light and also enables a critical examination to be made of the casting before assembly. The water pump and thermostat are mounted high up on the front of the camshaft casing, the delivery from the pump passing to the cylinder block through the near side of the front jacket plate. (*See Fig.* 11). When the engine is cold the thermostat valve is closed and the circulation through the radiator is short-circuited. At a certain temperature, *i.e.*, 75 to 80 degrees Centigrade, the valve opens and the radiator is brought into action. The diagrams on page 41 clearly show the circulation of water when the engine is cold and hot. The thermostat is automatic in action, and does not at any time require adjustment or attention. With its use the engine reaches an efficient working temperature very quickly as, until the valve opens, there is only the small quantity of water contained in the water jackets in circulation. The connections for heating the carburettor are taken off the near side of the cylinder block and off the nearside branch pipe leading from the radiator to the pump. On removing the radiator cap, a horizontal pipe will be seen inside the radiator; this is a distribution pipe through which water to the radiator is delivered. When cold the level of water should not be above the top of this pipe.

IGNITION.

Two M.L. magnetos, Type G.R.6, are fitted, one at either end of the magneto cross shaft which is driven by skew gearing from the rear of the camshaft. The magnetos are mounted on flanges on either side of the camcase and are secured by three bolts, the holes in the magneto flanges being slotted so that the

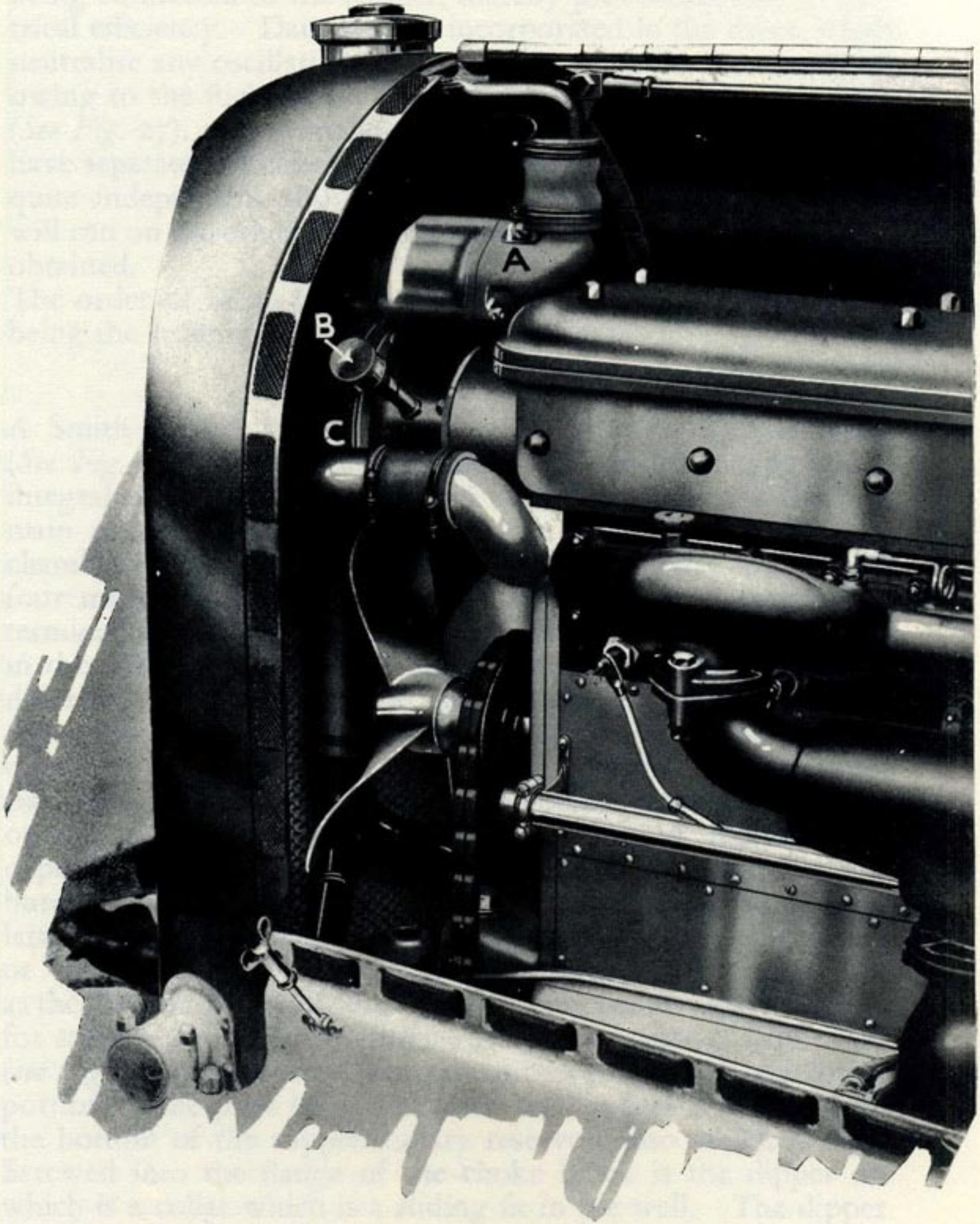


Fig. 11. WATER PUMP, THERMOSTAT AND FAN.
Thermostat (A) Pump spindle greaser (B). Pump (C).

instruments can be rotated to simplify synchronisation. (*See page* 92). Between the magnetos and the camcase is a distance-piece forming an air gap which prevents the heat of the engine being conducted to the former, thereby preventing loss of electrical efficiency. Dampers are incorporated in the drive, which neutralise any oscillation that might be set up in the cross-shaft owing to the flick of the magnetos particularly at slow speeds. (*See Fig.* 27). Each magneto fires a separate set of plugs, and have separate switches on the facia board. They are, therefore, quite independent and should one instrument fail the engine will run on the other until a repair can be made, or a replacement obtained.

The order of firing of the cylinders is 1, 4, 2, 6, 3, 5. No. 1 being the front cylinder.

CARBURETTOR.

A Smith Bentley five jet carburettor Type 50 BVS is fitted. (*See Fig.* 12). The float chamber is of the usual type and is integral with the jet platform on which are mounted the four main jets. On the arm between the platform and the float chamber the well, or slow running jet, is mounted. Each of the four main jets projects into a separate choke and each choke terminates at its upper end in a separate port opening radially in the circumference of the choke block, each port being at a different height. Over the circular choke block a dash pot slides, thus forming the automatic device for controlling the operation of the jets. The ports overlap, so that as the dashpot rises, each port begins to be uncovered before the port previously opened is completely clear. The position of the dash-pot depends on the volume of mixture passing through the carburettor and is independent of the throttle opening so that the latter can be fully opened at any engine speed without choking or " popping back." These main jets only come into operation as the throttle is opened, the well jet giving the necessary mixture for starting and slow running. This jet consists of a pilot jet (*see Fig.* 12), which screws into the nickel-plated well, the lower portion of the pilot being extended so that fuel is drawn from the bottom of the supplementary reservoir into which it dips. Screwed into the flange of the choke block is the dipper on which is a collar which is a sliding fit in the well. The dipper is hollow and the end fits over the top of the pilot jet. Three holes are drilled through the dipper just above the collar. On the underside of the body of the carburettor is a groove which is carried round one quarter of its circumference, and

connects with a passage carried up the carburettor body and ending in two small outlets into the throttle barrel. The butterfly throttle is of special design, and when in the shut position, the upper of these two outlets is half covered and the lower completely covered. There is a paper washer between the choke block flange and the carburettor body; this must always be in good condition as otherwise an air leak may develop which will upset the slow-running. A shroud is fitted over the well, controlled by the mixture control lever on the steering column. When the control is in the full rich position the shroud is raised, cutting off all air from the pilot jet and giving a very rich mixture for starting from cold. The carburettor is tuned to give maximum power and means are provided to give greater economy in fuel consumption when circumstances demand it. Four holes are drilled in the lower part of the choke block immediately over the tops of the jets. A rotary sleeve is fitted over this part of the block, also having holes drilled, which, by rotating the sleeve, can be brought to correspond with the holes in the block. This sleeve is controlled by the mixture control on the steering column, and in the normal position the holes in the block are covered by the sleeve. On moving the control to the weak position, (the normal position being central), the holes in the sleeve are brought to correspond with those in the block, allowing air to pass through, which decreases the suction on the jets. It must be realised that in the full weak position the mixture is very materially weakened and the engine will run several degrees hotter, particularly if driven hard; therefore, the engine should only be run on full weak mixture under favourable conditions.

On each side of the carburettor body, high up near the flange will be found a set screw secured by a lock-nut; these must never be interfered with, as they are for regulating the height to which the dash pot can rise. The slow running position of the throttle, and also its maximum opening, are regulated by adjusting the set screws secured by lock nuts bearing on projections on the boss at the end of the throttle spindle. Care must be taken that all nuts and screws are kept tight. The carburettor is water heated as also is the induction pipe. If at any time the water system has been drained, there is a possibility of an air lock in the carburettor water jacket on refilling. Therefore after the engine has warmed up the carburettor should be felt, and if it is cold, the top water connection on the carburettor must be slacked back until hot water appears, after which it must be tightened up.

ACTION OF CARBURETTOR.

When the throttle is in the starting and slow running position it is very slightly open. When the engine is turned over the suction comes on the upper of the two holes, referred to above, connecting through passages in the carburettor body to the well jet. Starting from cold the shroud round the well jet should be raised by putting the mixture control in the rich position. This cuts off all air to the well jet so that neat fuel would be sucked through into the induction pipe with a small proportion of air due to the throttle not being completely closed. The engine having run for, say, two minutes, the mixture control is put in the normal running position; this allows air to be sucked through the holes above the collar on the dipper, the air mixing with the fuel drawn through the pilot jet. The mixture then passes through the groove on the underside of the carburettor body and up through the passage at the side of the body to the hole in the carburettor body. On the throttle being opened, rich mixture is momentarily drawn through both holes in the barrel, and the increased velocity of air acts on No. 1 jet, the dash pot simultaneously rising and uncovering No. 2 jet, the well jet ceasing to operate; No. 2 jet is a large one to give rapid acceleration. As the throttle opening and engine revs. increase, Nos. 3 and 4 jets come into action; these are progressively smaller jets, so making the mixture weaker at high engine revs. From this it will be seen that the carburettor provides a correct mixture for the varying requirements of the engine, viz.:

1. A strong mixture for starting up only.
2. A normal mixture for slow running.
3. A sufficiently strong mixture for rapid acceleration.
4. A progressively weakening mixture as the engine speed increases.

Conversely, as the engine speed falls when hill climbing, the strength of the mixture automatically increases as the dash pot falls gradually closing the ports controlling the weaker mixture supplied by Nos. 3 and 4 jets, and causing increased suction on Nos. 1 and 2 jets.

If at any time the jets are removed, it is important that they should be put back in their correct position, the jet numbers being marked on the platform. The jets themselves are numbered according to their size, the numbers indicating the number of cubic centimetres of petrol passed per minute with the suction of a six-inch head of petrol.

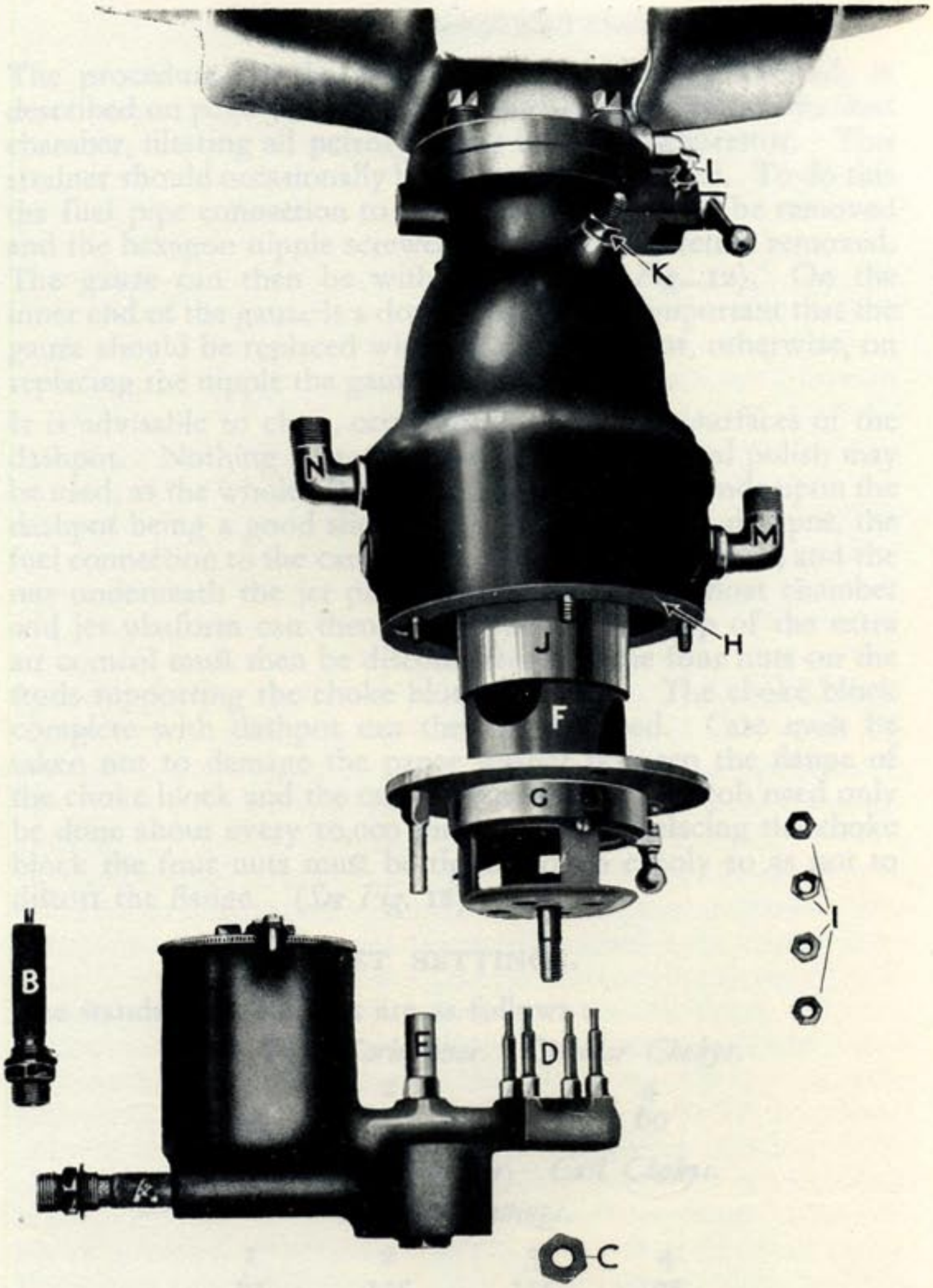


Fig. 12. CARBURETTOR PARTLY DISMANTLED.
Strainer partly removed (A). Strainer removed shewing dowel peg (B). Nut securing jet platform (C). Power jets (D). Well or starting jet (E). Port block (F). Extra air sleeve (G). Paper washer (H). Nuts securing port block (I). Dash pot (J). Setscrew adjusting travel of dash pot (not to be touched) (K). Slow running adjustment (L). Water pipe connections (M & N).

CARE OF CARBURETTOR.

The procedure, in the event of a jet becoming choked, is described on page 31. A gauze strainer is fitted beneath the float chamber, filtering all petrol passing into the carburettor. This strainer should occasionally be removed and cleaned. To do this the fuel pipe connection to the float chamber must be removed and the hexagon nipple screwed into the carburettor removed. The gauze can then be withdrawn. (*See Fig.* 12). On the inner end of the gauze is a dowel peg and it is important that the gauze should be replaced with the right end first, otherwise, on replacing the nipple the gauze will be crumpled.

It is advisable to clean, occasionally, the sliding surfaces of the dashpot. Nothing more abrasive than liquid metal polish may be used, as the whole action of the carburettor depends upon the dashpot being a good sliding fit. To remove the dashpot, the fuel connection to the carburettor must be disconnected, and the nut underneath the jet platform unscrewed, the float chamber and jet platform can then be dropped. The clip of the extra air control must then be disconnected and the four nuts on the studs supporting the choke block removed. The choke block complete with dashpot can then be dropped. Care must be taken not to damage the paper washer between the flange of the choke block and the carburettor body. This job need only be done about every 10,000 miles. When replacing the choke block the four nuts must be tightened up evenly so as not to distort the flange. (*See Fig.* 12).

JET SETTINGS.

The standard jet settings are as follows:

"B" Type Carburettor. Circular Chokes.

1	2	3	4
50	120	75	60

"C" Type Carburettor. Cast Chokes.

Approx. Settings.

1	2	3	4
65	135	115	75
60	140	115	75
65	140	120	80

Pilot Jets to suit.

Before altering a jet setting the Service Department should be asked for advice, the existing setting being given.

FUEL FEED SYSTEM.

The feed of fuel to the engine is by Autovac. There is a nineteen gallon tank at the rear of the chassis, approximately three gallons of this is held in reserve, and is controlled by a two-way tap fitted in the filler. (*See page* 31). The Autovac is fitted in a small tank of one gallon capacity, and is mounted on the near side of the dash, the cylindrical portion of the tank passing through the latter. In the unlikely event of the Autovac failing, a filler with a screw cap is fitted, so that the tank itself can be filled from an outside source in case of necessity. Underneath the tank a drain tap is provided, this should occasionally be opened to allow any sediment or water to escape. The tap being of small diameter it is possible that if there is much foreign matter it will not flow and to free it it will be necessary to insert a wire or thin nail. A filter is fitted on the pipe between the Autovac and the carburettor and is mounted on the dash. (*See page* 30). A tap to control the supply of fuel to the carburettor is under the Autovac tank. There are two connections to the top of the Autovac, one being from the main tank at the rear of the chassis and the other to the top of the induction manifold, whereby the necessary suction to operate it is obtained. (*See Fig.* 3).

The action of the Autovac is as follows. It is divided into two chambers, the inner or vacuum chamber being the instrument itself and the outer chamber being the reserve tank from which the carburettor is fed and into which the inner chamber empties itself. Communication between the two chambers is by a drop valve at the base of the inner chamber. The upper or inner chamber being connected with the induction manifold, a partial vacuum is created in it, thus closing the drop valve and drawing up fuel from the main tank at the rear of the chassis. As the upper chamber fills a float rises, and when it reaches a certain height, two valves are operated, one cutting off the suction, the other admitting air and destroying the vacuum, the drop valve thereby falling and allowing the fuel to fall into the outer chamber. This being open to the atmosphere, the fuel flows to the carburettor by gravity. As the float falls with the outflow of fuel, the suction valve closes and the operation of drawing in fuel is repeated. The float used is patented, and is self-draining. The float stem is hollow, having a hole inside and outside the body of the float. Any fuel entering the float is automatically evacuated through the stem during the suction period : during the period of atmospheric pressure air flows in, enabling the float to function as when air-tight.

The Autovac is very reliable in action and it is very exceptional for it to require any attention. Very excessive fuel consumption may be traced to the fact that the suction valve on top of the instrument is not closing properly and is allowing fuel to be sucked straight through into the induction pipe. Should this fault occur it can be traced by disconnecting the suction pipe on top of the induction manifold immediately after the engine has stopped running, when, if fuel is being sucked through, the pipe will be found to be wet. This can sometimes be remedied by giving the top of the Autovac a few sharp taps with a piece of wood. If this is found to be of no avail it is not advisable to dismantle the Autovac, but the Service Department should be communicated with, and a replacement instrument will be sent. If at any time it is found necessary to dismantle the Autovac great care must be taken that the cork washers round the top are not damaged, as the whole action depends upon there being an air tight joint at this point.

EXHAUST SYSTEM.

The exhaust system consists of two separate manifolds, each serving three cylinders, two exhaust pipes leading to an expansion chamber, which is divided into two, a connecting pipe between the expansion chamber and the silencer, a tail pipe from the silencer to the rear of the chassis.

The expansion chamber being divided into two portions by a division about its centre, the front three cylinders exhaust into one portion and the rear three cylinders into the other. The gases from the front half pass down a tube brought through the centre of the rear half and so in to the connecting pipe. The gases from the rear portion pass into the connecting pipe through holes in an annular ring round the pipe leading from the front half. The gases then pass through the connecting pipe at the end of which is a pepper box into the silencer. The latter has two baffles with holes drilled in them. The tail pipe is connected to the side of the silencer and is swept up over the axle and terminates in an open pipe. The whole system, not including the manifolds, is lagged with asbestos, the expansion chamber connecting pipe and silencer having metal sheeting over the asbestos. This system requires no attention and gives a very quiet exhaust with a complete absence of drumming in closed bodies. The brackets supporting the system from the cross members of the frame are so designed as to allow for the expansion of the parts due to heat. (*See Fig.* 14).

CHAPTER V.

Clutch. Clutch stop. Clutch shaft. Gear box. Back axle. Universal joints. Propeller shaft. Steering gear. Frame. Road springs. Fuel tank. Brakes. Shock absorbers.

CLUTCH. GEAR BOX. BACK AXLE. TRANSMISSION. FRAME. ROAD SPRINGS.

DESCRIPTION OF CLUTCH.

The clutch is of the single plate type, having a central duralumin disc, rivetted on each side of which is a Halo ring having cork inserts. The clutch runs in a dry condition, and its action is as follows: the driven friction plate having a Halo ring on each side, is flexibly mounted by means of two Hardy discs on the spider at the end on the clutch shaft, which connects the clutch with the gear-box. The end of the clutch shaft is recessed and is supported by a self-aligning ball bearing mounted on the end of the clutch spigot, which is an integral part of the crankshaft. A metal driving friction plate, which takes the pressure of the six powerful coiled springs, is located by, and slides on, three driving pins fitted in the clutch cover and secured by three nuts and tab washers, on the outside of the cover. Located in cups in the cover are the six clutch springs which bear on the driving plate. Three clutch withdrawal levers are pivotted on brackets bolted to the inside of the cover. The lower ends of these bear against the thrust bearing housing, and the upper ends are forked, the friction plate withdrawal pins passing through the forks. The inner ends of the pins have shoulders which take the pressure of the friction plate, the other ends passing through the clutch cover; an adjusting nut is screwed on to these ends, the nuts having an extension which passes through and slides in the clutch cover, the ends of the extension butting against the forks of the withdrawal levers. A ball bearing is fitted in the outer end of the thrust bearing housing; into this is fitted the thrust ring which takes the pressure of the withdrawal forks on the clutch pedal cross shaft operated by the clutch pedal. This fork is so compensated that each arm must bear with equal pressure on the thrust ring so that there is no tendency to throw the clutch out of alignment. When the clutch is engaged the driven disc on which the Halo is mounted is clamped between the metal driving disc and the face of the flywheel. When the clutch pedal is pressed the fork on the cross shaft bears against

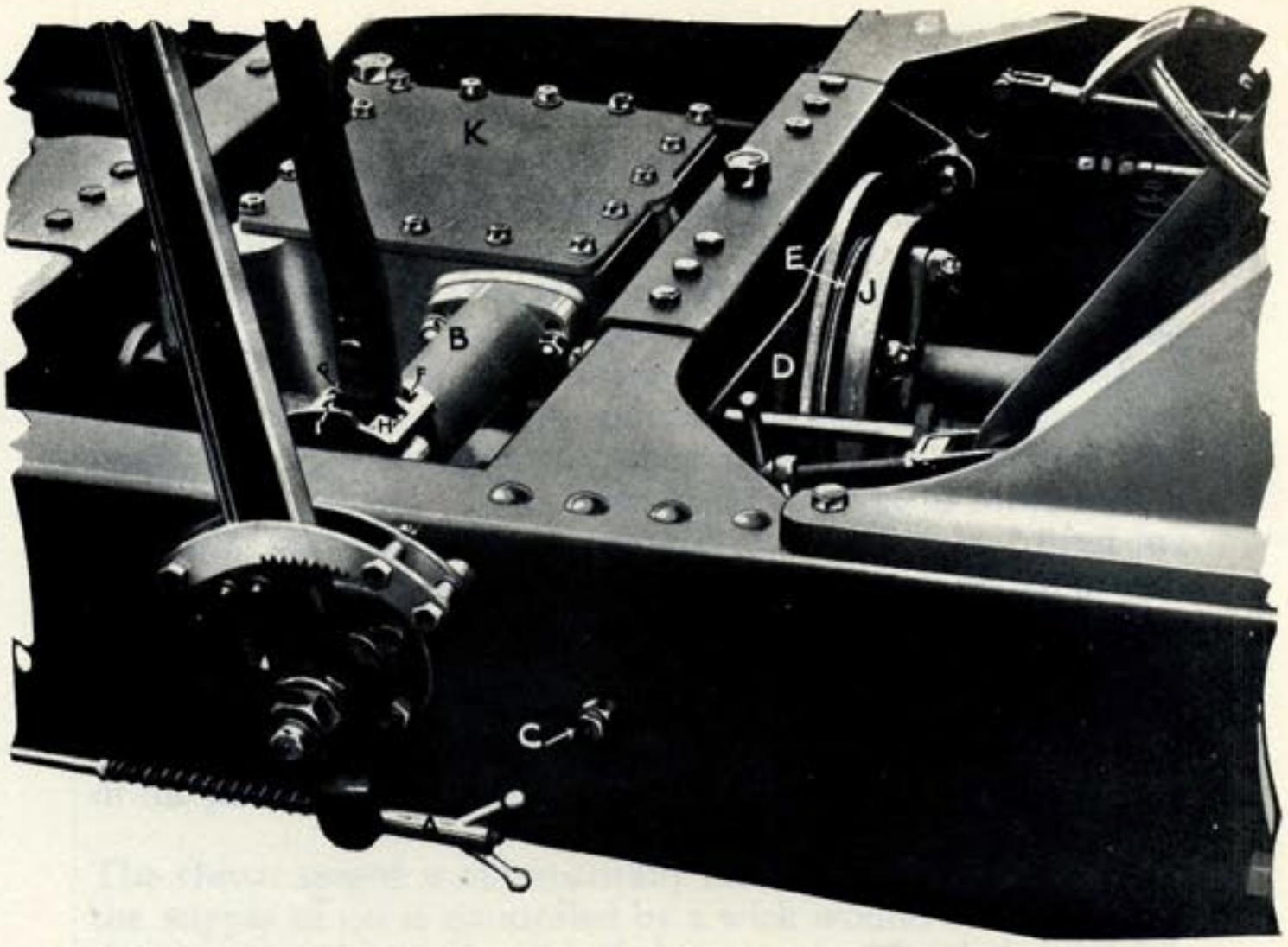


Fig. 13. CLUTCH STOP, CHANGE SPEED ARM AND HAND BRAKE ADJUSTMENT.
Hand brake adjustment (A). Change speed gate arm, shewing slots whereby angle of change speed lever can be adjusted (B). (This adjustment may not be carried out except by an expert.) Oil nipple for lubricating part of brake gear (C). Clutch stop friction pad (D) and ring (E). Position of speeds in gate : 1st (F), 2nd (G), 3rd (H), Top (I). Hardy disc coupling (J). Gearbox cover (K).

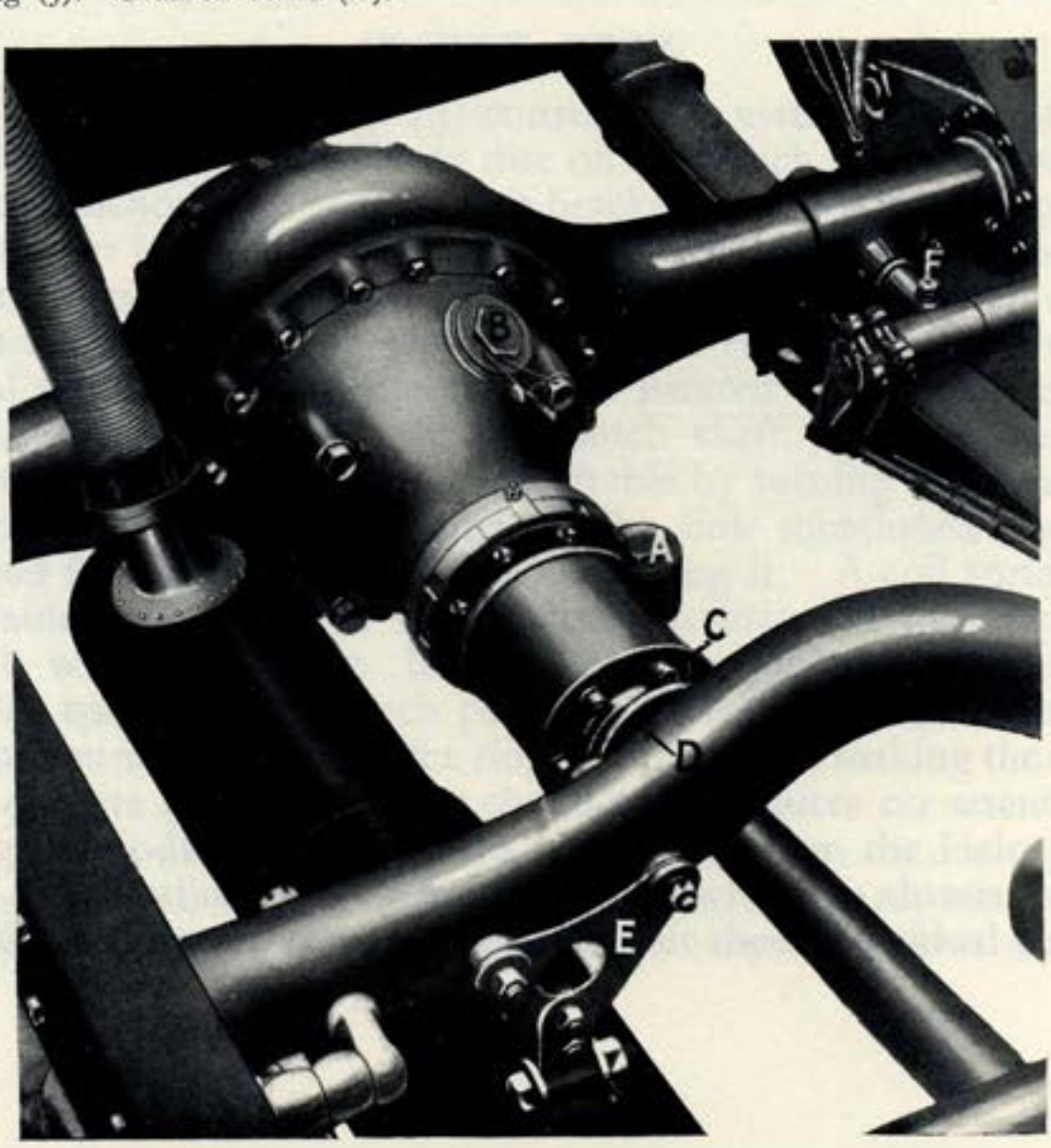


Fig. 14. REAR AXLE CASING AND BRAKE CAMSHAFT, REAR UNIVERSAL JOINT OILING POINTS, Back axle filler (A). Inspection plug with seal (B). Pot joint oiling nipple (C). Protecting flange (D). Flexible silencer bracket (E). Brake camshaft oiling nipple (F).

the thrust ring, the pressure being transmitted through the bearing to the bearing housing, the ends of the three clutch withdrawal arms resting against the end of the housing are forced forwards and the forks at the other ends are forced back, bringing with them the withdrawal pins and the metal driving plate, thus releasing the pressure on the driven plate. Two oiling nipples are fitted in the gunmetal outer cover of the thrust housing. Two are fitted for convenience, but only one need actually be utilised. The clutch thrust bearing is lubricated at this point and only a small quantity of oil must be forced in; if too much oil is used there is a chance of it penetrating into the clutch housing and causing clutch slip. The clutch requires no other attention, and no adjustment may be carried out without advice being obtained first. This does not, of course, apply to the clutch pedal adjustment for altering the position of the pedal, which is quite straightforward. (*See page* 26).

The clutch spigot is automatically lubricated from the engine; the supply of oil is controlled by a wick wound on a gunmetal spool, screwed into the end of the spigot. The design is such that any surplus oil drains back into the crankcase and does not get into the clutch housing.

CLUTCH STOP.

The clutch stop (*see Fig.* 13) consists of a metal ring, mounted on the rear side of the Hardy disc on the clutch shaft. A spring plate is anchored at one end to a bracket on the front nose piece of the gear box. The other end is connected by a link to a point on the clutch pedal arm, a few inches from its lower end. Mounted on the spring plate is a pad of Halo. As the clutch pedal is pushed forward this pad is pressed against the metal ring, acting as a brake on the clutch shaft. The degree of fierceness of the stop is easily adjustable by turning the knurled handwheel, which forms part of the link mentioned above, having first loosened the lock nut securing it. A coil spring is contained in the barrel which is an extension of the knurled hand wheel, and the link expands against the pressure of this spring as the clutch pedal is pushed forward, increasing the pressure of the pad on the ring. This avoids making the stop too definite in action. The clutch stop requires no attention, except periodical adjustment to take up wear on the Halo pad. The stop is adjusted to be light in action when the chassis leaves the Works, but drivers can adjust to suit their individual tastes.

CLUTCH SHAFT.

A Hardy disc joint is fitted to the rear end of the clutch shaft by means of a splined connection. The front end runs on a ball bearing at the end of the clutch spigot and has mounted on it the driven plate of the clutch.

GEAR BOX.

The gear box is mounted on three point suspension. The front anchorage can be adjusted for height, so as to obtain correct alignment with the engine. The change speed lever and gate are a unit with the gear box the former being carried on an extension bolted to the side of the gear box. These parts can therefore be lifted from the frame together and the change speed cannot be affected by any distortion of the frame. (*See Fig.* 13). There are four speeds forward and a reverse, the position of the gear level in the gate for the various gears being described on page 15. The main and lay shafts are very substantial in diameter, eliminating whip, and the gears themselves are of ample size. The selector gear is also strong enough to withstand misuse. Ball bearings are used throughout and the lay shaft bearings can be adjusted to obtain correct meshing of the gears. On no account may any adjustment be attempted on the gears or selector gear as this work can only be carried out satisfactorily by an expert, and great harm may be done by incorrect adjustment. The speedometer is driven from the gear box, the drive being mounted on the near side. (*See Fig.* 4). It can be removed as a unit. The drive is taken off the third speed sliding gear on the main shaft. It is automatically lubricated from the gear box and no attention is necessary. The correct level of oil in the box is to half way up the lay or lower shaft. (*See page* 21). To examine the level it is necessary to remove the lid of the box. A drain plug is provided.

BACK AXLE.

The back axle is of the semi-floating type, the casing consisting of two steel pressings welded together. The driving shafts have two bearings ; at the outer end an adjustable Timken roller bearing, and at the inner end, a ball bearing housed in the differential casing. The wheel hubs are secured to the shafts by a key on a taper, the inner ends of the shafts having splines, which fit into the differential gears. The hubs can be withdrawn without altering the adjustment of the Timken bearings, and it is most important that these should not be adjusted except by an expert. With the axle shafts removed, the differential and back

axle nose piece can be withdrawn without disturbing the adjustment of the gears. The thrusts of the crown wheel and pinion are taken by double thrust ball races, housed in the differential casing and nose piece respectively. The differential casing and crown wheel run in two ball bearings. On the nearside top of the nose piece is a plug which is sealed before the chassis leaves the works. (*See Fig.* 14). This plug is for inspecting the crown wheel and pinion, and must not be removed; it has nothing to do with the lubrication of the axle. The four star wheels of the differential are enclosed in an aluminium cage, and the whole construction of the back axle is very rigid. The goose neck for examining and replenishing the oil is fitted on the near side front of the nosepiece. (*For instructions with regard to lubrication, see page* 22.)

UNIVERSAL JOINTS AND PROPELLER SHAFT.

The propeller shaft is made of weldless steel tubing. Being hollow, it is designed to act as an oil reservoir for the rear universal or pot joint. (*See page* 23). The universal joint at the front end of the propeller shaft, immediately behind the gear box, is of the star type, and is of large dimensions, eliminating rapid wear. The joint is enclosed in an aluminium cover, leaving an annular space round the propeller shaft. An oiling nipple is fitted on the cover. (*For lubrication instructions, see page* 23). At the rear end of the propeller shaft is the pot joint, which is a universal joint designed to allow for the plunging action of the shaft, owing to the rise and fall of the axle. It consists of a cross head pin fitted in the end of the propeller shaft, the former being fitted with two phosphor bronze blocks which move in slipper pieces free to slide fore and aft in steel guides. In order to prevent grit and dust finding its way into the joint through the annular space round the shaft, a guard is fitted, consisting of a flange about 3 inches in diameter, bolted on the shaft a few inches in front of the joint. (*See Fig.* 14). An oiling nipple is fitted to the cover through which the joint can be charged in addition to the shaft acting as an oil reservoir. If either of the propeller shaft joints are over-oiled, oil will leak out through the annular spaces, but enough oil will always be retained for efficient lubrication.

STEERING GEAR.

The steering is by worm and sector, the former being mounted on two ball bearings and the latter being mounted on the steering

shaft which has a plain bearing. Adjustments are provided for taking up the lift in the steering column, meshing the worm and sector, taking up end float in the sector shaft, and altering the rake of the steering column. It is important that none of these adjustments should be tampered with, without the permission and advice of the Service Department, as the adjustments are very delicate, and improper adjustment may cause costly damage to the worm and segment apart from the fact that the delicacy of the steering will be destroyed. The rake of the column cannot be altered without the meshing of the worm and segment being disturbed, therefore any alteration of rake must not be attempted. The large plug on the steering box covers the adjustment for taking up lift in the steering column, and is not for lubrication. A Tecalemit nipple is fitted for the latter purpose. (*See Fig.* 10). The steering box is oiltight. The steering column, about half up its length, is supported by a bracket from the dash and rotates in a ball bearing. The control tubes operating the mixture, throttle, and ignition controls pass down the centre of the steering column, and terminals for the electric horn, the button of which is in the centre of the steering wheel, are clipped to the lower end of the steering box. The drop arm is keyed to the outer end of the sector shaft, the fore and aft rod connecting the drop arm by means of two spring loaded ball joints to the stub axle arm. The track rod connects the two stub axles, similar joints being utilised. Both the fore and aft rod and the track rod, being hollow, are utilised as reservoirs for keeping lubricated the joints at either end of them. The track rod is easily adjustable for length, so that the track of the front wheels can be set, the correct setting being for the wheels to be pointing inwards three-sixteenths of an inch, the measurement being taken from the rim of the wheels. The stub axles are mounted on swivel pins held in tapers in bosses at either end of the front axle. The pins therefore are fixed and the stub axles swivel on them, plain bearings being utilised for these and for the thrust bearings at the top end of the pins.

The action of the steering will be found to be very light, in spite of the large size of the tyres used, and no road shocks are transmitted to the steering wheel.

FRAME.

The side members of the frame are of deep section, and are very strong, chassis whip being thereby almost completely eliminated. The frame carries four press steel cross members and one large

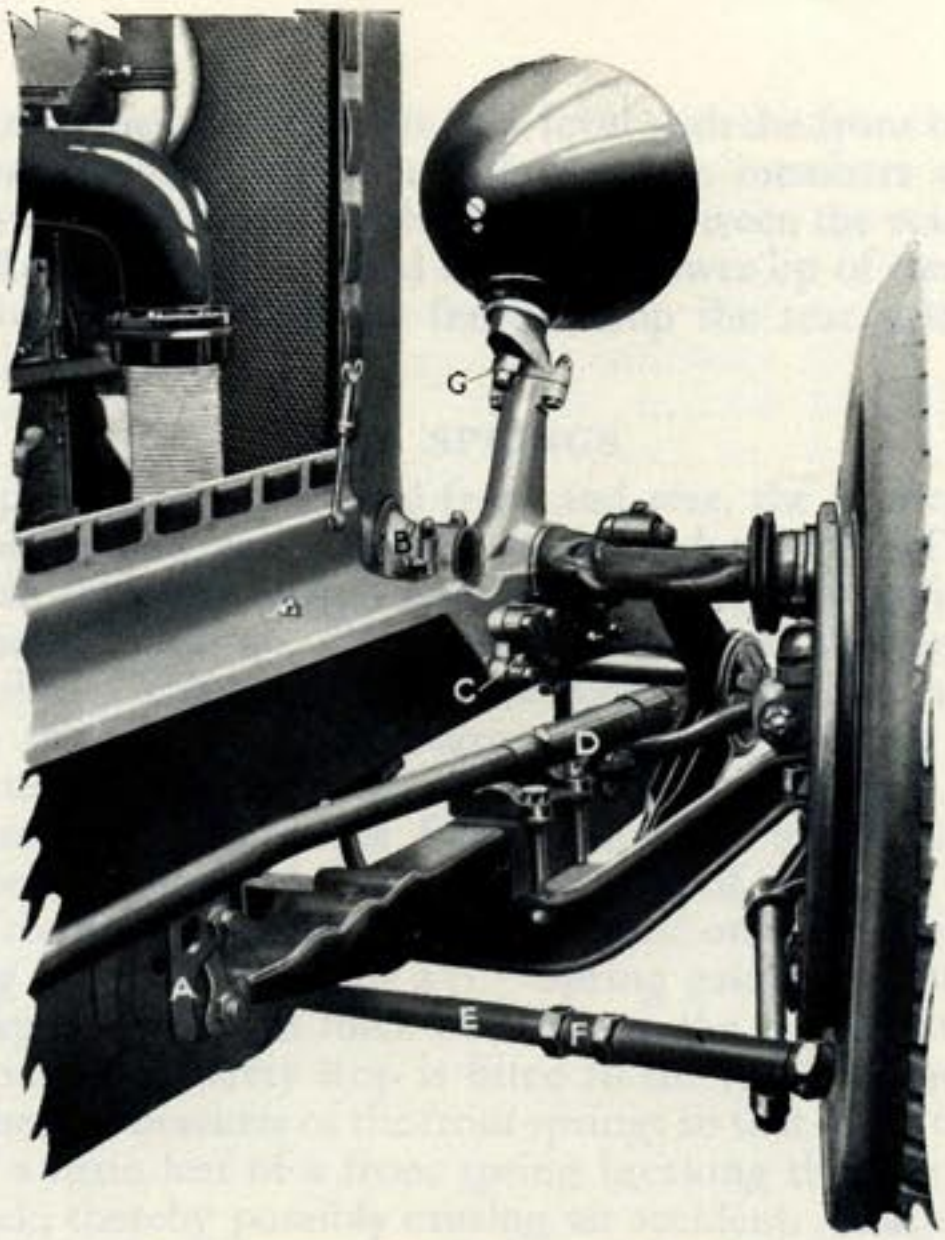


Fig. 15. OFFSIDE FRONT OF CHASSIS.
Front spring stop (A). Radiator trunnion (B). Wing iron bracket (C). Fore and aft rod (D). Track rod (E), shewing lock nut (G) securing adjustment for length. Head lamp can be swivelled by slacking back the nut (G).

Fig. 16. REAR OF CHASSIS.
Two-way tap (A) in reserve position (normal running position is horizontal). Telegage (B). Tail lamp lead for continental use (C). Number plate brackets (D). Spring gaiter oiling nipple (E).

tubular cross member which is on a level with the front brackets of the rear springs. Auxiliary tubular cross members are also fitted between the front dumb irons and between the rear dumb irons. Rubber pads are fitted under the lower lip of the frame, to take the shock, should the frame bump the rear axle under abnormal conditions.

ROAD SPRINGS.

Semi-elliptic springs are fitted front and rear, the former being on top of the axle and the latter being underslung. They are Woodhead Patented Design and have damping leaves fitted on top of the main leaves. They are strong, but at the same time very flexible. The front ends have solid eyes and are attached direct to the frame brackets, large diameter phosphor bronze bushes and shackle blots being used. The rear ends of the springs are shackled to the frame, the same sized bolts and bushes being employed. The front ends of the rear springs transmit the drive. Oiling nipples are fitted on the shackle bolts (*for oiling instructions, see page* 23). Spring gaiters are fitted and can be replenished with thick oil through the nipples fitted for this purpose. A safety stop is fitted to the frame immediately behind the rear brackets of the front springs so that in the unlikely event of a main leaf of a front spring breaking the axle cannot come back, thereby possibly causing an accident. Each spring is secured to the axle pad by four nickel steel bolts, the nuts being split pinned.

FUEL TANK.

The tank is mounted on trunnions and is carried between the rear dumb irons. (*See Fig.* 16). Its capacity is 19 gallons. Baffles are fitted to prevent the fuel surging from one side to the other. There is a drain plug, incorporated with which is a large gauze filter, which enables the contents to be completely drained away, and there is also a small plug which should occasionally be removed to allow water and sediment to drain out. A form of petrol gauge named the " Telegauge," is fitted as standard in the centre of the rear face of the tank. The dial of this instrument is fitted into a recess in the tank and it is removed without in any way affecting the tank or having to drain out any fuel. Therefore, should the gauge get damaged and have to be repaired, it can be removed with the minimum inconvenience. The gauge is magnetic in operation ; there is a float in the tank, the float being connected through gearing to a magnet which in turn controls the needle of the dial. The face of the dial is

filled with glycerine so as to damp out oscillations of the needle. This gauge is very reliable and accurate, and its readings are accepted as correct by the French Customs and Octroi authorities, after it has been sealed by them; it is so arranged that this can be done. This is a point worth bearing in mind when touring on the continent, as considerable time can be saved. In the filler of the tank is a two-way tap by the use of which a reserve supply of about three gallons of fuel can be brought into use. (*For the method of using this tap, see page* 31.) The action of this is quite simple. When the tap handle is in the horizontal position, *i.e.*, away from the filler, fuel is drawn through a pipe which terminates about 3 inches from the bottom of the tank; therefore, when the fuel drops to this level the pipe sucks air and the engine runs out of fuel; when the tap is put in the vertical position over the filler, this pipe is cut off, and the fuel is sucked through a second pipe which extends to the bottom of the tank, thereby utilising the remaining three gallons. A gauze filter of large dimensions is fitted in the filler.

BRAKES.

The four wheel brakes are pedal operated and the hand lever operates separate shoes on the rear wheels only. The former brakes are a slightly modified form of those brakes which have proved to be so satisfactory on the "Three Litre" model. They are entirely mechanical in operation and there is only the one adjustment at the lower end of the pedal for taking up wear. Once they are correctly compensated they will run for very long periods without any attention, except this one adjustment. A balance gear is fitted across the frame behind the gear box; this ensures that the braking effort is evenly distributed between all four brake drums. (*See Fig.* 17). It consists of a hollow shaft mounted on spherical bearings and carrying three complete compensators. Each of these consists of two arms, through the top ends of which passes the cross tube. The sides of the arms are kept in contact with a distance piece by bolts having Thackeray washers at both ends, so that there is friction between the arms, but not sufficient to prevent movement between them; the relative movement of the two arms is controlled by a whiffletree or balance arm, so that as one moves forward the other moves backwards. The whole compensator shaft is centralised in the frame by springs fitted at either end. The compensator on the offside end of the shaft balances the braking action between the offside front brake and the offside rear brake. The compensator on the near side of the shaft balances the action

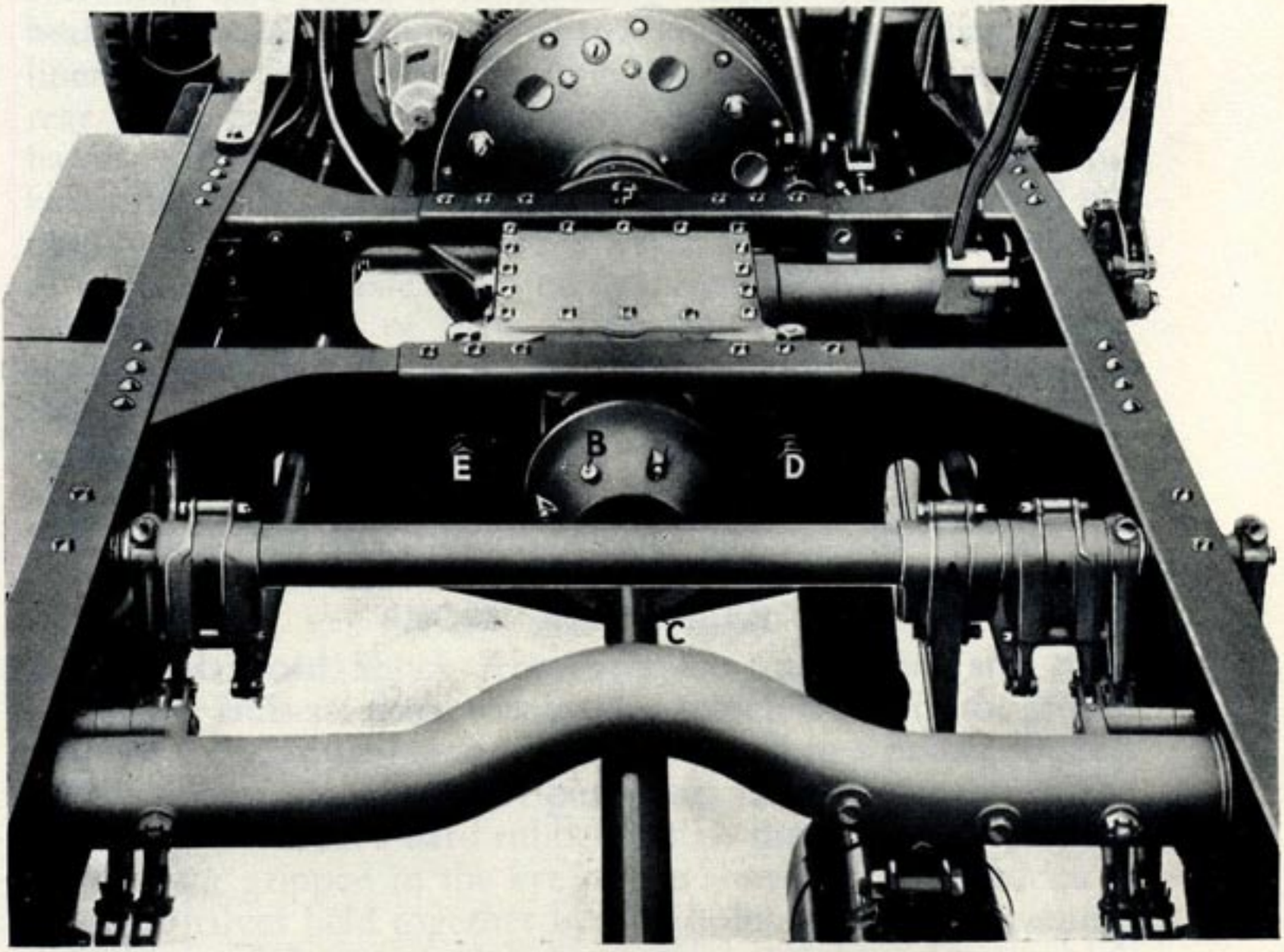


Fig. 17. CENTRAL VIEW OF CHASSIS LOOKING FORWARDS. Four wheel brake compensating gear (A). Oiling nipple for front universal joint (B). Oiling nipple for charging propeller shaft (C). Gear box suspension bolts (D.E.F.)

between the nearside front brake and the near side rear brake. The centre compensator balances the action between the near side front and near side rear brake, as one unit, and the offside front and offside rear brake, as one unit. Thus the brakes are compensated in pairs and as a whole. Through the centre of the hollow compensator shaft passes another shaft on which are mounted the arms which actuate the handbrake which acts on the rear drums only. This brake is not compensated. (*For instructions with regard to compensating brakes, see page* 93). The brake shoes are of aluminium and are lined with Halo. The liners on the front shoes are larger in area than those on the rear. The cam actuating the front shoes is operated by a shaft having a star type universal joint at both ends, the inner end being mounted on a bracket on the top lip of the frame, and the design is such that allowance is made for the plunging action of the shaft as the axle rises and falls over a rough road and for varying conditions of load. Two pull-off springs are fitted between each pair of rear shoes, the method employed allowing the tension of the springs to be adjusted, though this is not ordinarily necessary, unless the shoes have been removed. (*See Fig.* 26). The front shoes have a fulcrum pin at their lower ends, and have therefore only one pull-off spring.

SHOCK ABSORBERS.

Duplex Hartford Shock Absorbers are fitted front and rear. The lower ends are fitted to a bracket which is part of the saddle plate of the road springs and the upper end to a bracket bolted to the side of the frame. A pin passes through the eye of the shock absorber and a hard rubber bush is fitted over the pin, the bush being gripped in the eye of the shock absorber which is made in halves held together by two bolts. All the swivelling movement of the shock absorber is taken by the rubber, which does not move in the eye or on the pin. There is, therefore, no wear in these parts and they remain free from rattle indefinitely. The shock absorbers require no attention, except occasional adjustment to make up for wear in the friction discs. (*To adjust, see page* 34).

CHAPTER VI.

INSTRUCTIONS FOR THE CARE AND MAINTENANCE OF M.L. MAGNETOS, TYPE G.R.6

Manufacturers :

THE M.L. MAGNETO SYNDICATE, LTD.

VICTORIA WORKS, COVENTRY

Adequate arrangements for Service on M-L Magnetos have been made at the following Service Stations, where all necessary spare parts can be obtained :

Manufacturer's Service Stations :

HOME.

London and South Eastern Counties :

S. SMITH & SONS (M.A.) LTD.
179-185, GREAT PORTLAND STREET, W. 1
CENTRAL WORKS, CRICKLEWOOD, N.W. 2
Telephone : Willesden 2335 (7 lines)

Midland Counties :

M-L MAGNETO SYNDICATE, LTD.
WEST ORCHARD, COVENTRY
Telephone: Coventry 1008 and 1009

North of England :

S. SMITH & SONS (M.A.) LTD.
233, DEANSGATE, MANCHESTER
Telephone : Central 13

Scotland :

G. M. SMITH,
19, WEST REGENT STREET, GLASGOW
Telephone: Douglas 1063

Irish Free State :

S. SMITH & SONS (M.A.) LTD.
7 & 8, CITY QUAY, DUBLIN

COLONIAL.

Australia :

SMITH, SONS & REES, LTD.
30-32, WENTWORTH AVENUE, SYDNEY, N.S.W.
Telephone : City 7318 and 4708
and FLINDERS STREET, MELBOURNE
Telephone: Central 10178 and 919

Messrs. BUTLER BROS.
CHARLOTTE STREET, BRISBANE

New Zealand :

TEAGLE SMITH & SONS, LTD.
276-278 WAKEFIELD STREET, WELLINGTON
Telephone : 21-973

South Africa :

M. W. CURTIS & CO.,
40 FIELD STREET, DURBAN
Telephone : No. 779

Messrs.. LOGAN & BEHR
13 GREENMARKET SQUARE, CAPE TOWN

M.L. MAGNETOS, TYPE G.R.6.

Two M.L. Magnetos are fitted as standard. These are driven one at either end of the same cross shaft. They are quite independent and are synchronised to fire simultaneously. They fire separate sets of plugs, one set on the exhaust and the other on the inlet side. The rotation of the offside instrument is clockwise and of the nearside anti-clockwise. The magnetos are of the stationary armature type, the magnets revolving and the windings being stationary. This type of instrument has several advantages, particularly when applied to a six-cylinder engine. The high tension winding and condenser are stationary, there is no slip ring and pick-up, and the contact breaker not revolving, it is not subject to centrifugal force. The only revolving portion of the latter is a small cam.

The distributor being of the jump spark type, there are no carbon brushes and no rubbing contacts in either high or low tension circuit, with the exception of a small brush on the axis of the distributor rotor where the rubbing speed is negligible.

The magnetos are flange mounted and are secured by three bolts on extensions of the aluminium cam casing. A distance piece, with holes for ventilation, is fitted, so that the heat of the engine is not conducted to the instruments, while it also serves to prevent any possibility of oil being forced along the spindle and on to the windings.

CARE AND MAINTENANCE.

The magnetos are designed to reduce the necessity for attention to the minimum and must not be interfered with or dismantled unnecessarily. A little periodical care of the Ignition System generally is, however, advisable, and may be summed up in the three words : Cleanliness, Adjustment, and Lubrication.

As regards cleanliness, while dirt, wet and oil will not hurt the exterior of the magnetos and are not likely to penetrate to the interior, they may, if allowed to collect on the distributor and high tension cables, cause leakage and give rise to difficult starting and irregular slow-running. These parts should, therefore, be kept clean and dry, and the cables should be renewed when the rubber shows signs of cracking and perishing. The contact breaker points should be examined periodically, and cleaned if necessary. These are not likely to get dirty unless subject to the action of oil or petrol vapour and unnecessary cleaning should be avoided. Any sign of rust on the

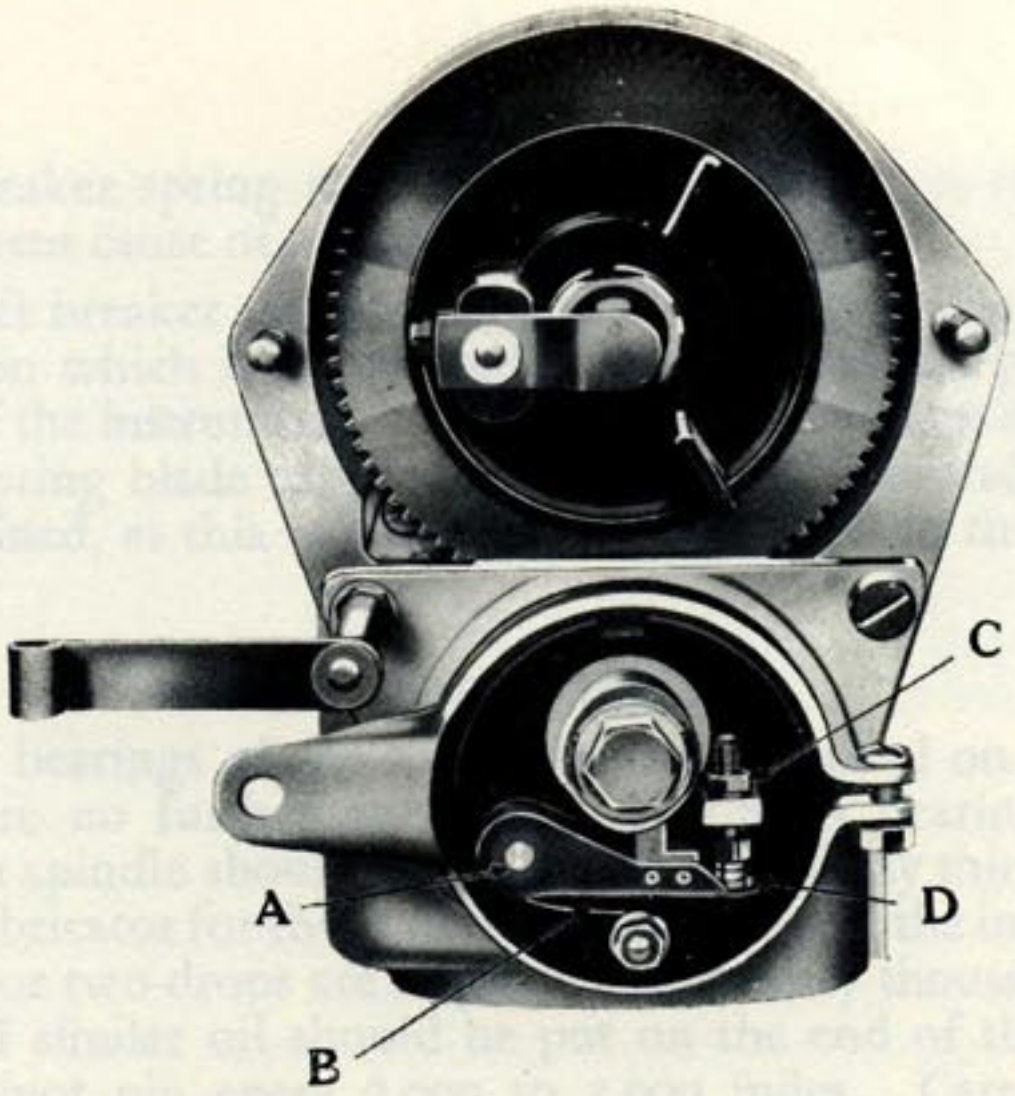


Fig. 18. M.L. MAGNETO, TYPE G.R.6.
Oil at Lubricator (not seen in Photo) 1 or 2 spots only every 1,000 miles. (A) Pivot, oil every 2,000 miles. (B) Main spring, don't let it get rusty. (C) Tighten firmly after adjusting points. (D) Contact points, adjust to gauge.

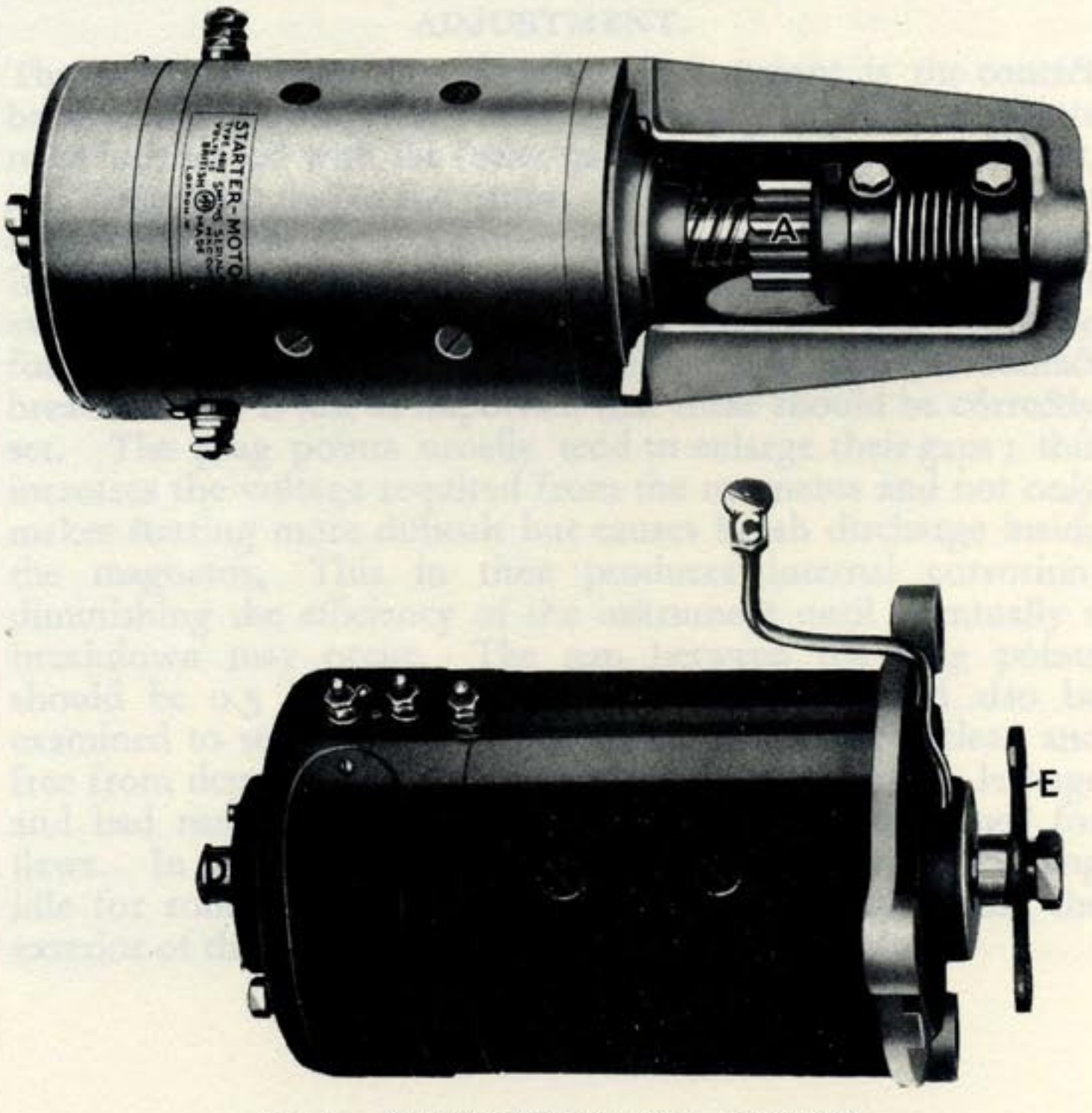


Fig. 19. SELF STARTER AND DYNAMO.
Bendix pinion (A). Greasers (C & D). Coupling (E).

contact breaker spring must be checked at once, as this is the most frequent cause of a broken spring.

The contact breaker can be removed by merely drawing it from the boss on which it is pivotted, and in a direction parallel to the axis of the instrument. Care must be taken when doing this that the spring blade exposed on removing the contact breaker is not strained, as this would cause a bad contact in the primary circuit.

LUBRICATION.

The main bearings of the rotor are grease packed on assembly and require no further attention. The plain bearing on the distributor spindle should be lubricated with fairly thin machine oil. A lubricator for this will be found on top of the instrument. Only one or two drops are required about every thousand miles. A drop of similar oil should be put on the end of the contact breaker pivot pin every 2,000 to 3,000 miles. Care must be taken that no oil gets on the contact breaker points. Do not over lubricate. (*See Fig.* 18).

ADJUSTMENT.

The only part requiring occasional adjustment is the contact breaker and this only very seldom. The gap between the points must be checked with the feeler gauge on the magneto spanner, and if incorrect, set to the gauge. After adjusting be careful to make certain that the lock-nut on the long contact screw is tight. It is advisable to check the magnetos for synchronisation about every 5,000 miles (*see page* 92). The sparking plugs will be found to require adjustment more frequently than the contact breaker and it is just as important that these should be correctly set. The plug points usually tend to enlarge their gaps ; this increases the voltage required from the magnetos and not only makes starting more difficult but causes brush discharge inside the magnetos. This in time produces internal corrosion, diminishing the efficiency of the instrument until eventually a breakdown may occur. The gap between the plug points should be 0.5 mm. or .019 in. The plugs should also be examined to see that the surface of the insulation is clean and free from deposits of soot, oil, etc., as these may cause leakage and bad running, and the insulation should be examined for flaws. In damp weather, when the engine has been standing idle for some time, starting may be facilitated by wiping the exterior of the plugs with a dry rag to remove moisture.

TROUBLES AND REMEDIES.

If the small attentions asked for above are given it is unlikely that any trouble will be experienced with the magnetos, so that should misfiring or irregular running be experienced the high tension leads and plugs and the carburettor should be examined before deciding that the magnetos are at fault. It must not be assumed that because a plug sparks satisfactorily when out of the cylinder that it will do so when under compression, so that the only satisfactory test for a plug is comparison with one which it is known is in proper order.

It is generally possible to differentiate between a fault in a magneto and one in the rest of the system by holding the end of a high tension lead about one sixty-fourth of an inch from the plug terminal while the engine is running slowly, or while it is being turned by the starter or by hand, and if a regular bright spark is seen the magneto is certainly not at fault.

Should this test point to the instrument being defective the contact breaker should first be examined. The points must open the correct distance under the cam, and the flat spring which retains the breaker inspection cover in place must press firmly and definitely on its seating. If these appear to be in order, remove the contact breaker and examine carefully. The points must be clean and the rocker arm move freely without any symptoms of sticking. The spring blade in the body of the magneto must make good contact with the brass segment at the back of the contact breaker moulding. A definite effort should be required when replacing the contact breaker to press the segment over the rounded end of the blade, and the blade should be deflected back at least one-sixteenth inch from its free position when it is resting on the segment.

If the fault is not discovered in carrying out the above, it must lie internally in the instrument in the winding or condenser. In this case the magneto must not be further dismantled, but the Service Department must be communicated with and a replacement instrument will be sent, or alternatively one of the manufacturers' Service Depots, as set out on page 62, should be applied to.

GUARANTEE.

The magnetos being proprietary goods are not covered by the Five Years' Guarantee on the Chassis, but Messrs. The M.L. Magneto Syndicate give a two years' guarantee in respect of them. The two years commencing from the date shewn on the

guarantee form in respect of the chassis and from which the Five Years' Guarantee commences. It is, therefore, particularly important that, if the benefit of this guarantee is expected in the event of a failure, the magneto should not be tampered with but should be returned untouched. A label should be attached to the instrument, giving the name and address of the sender, and the driving dog, etc., on the spindle, must be removed (*see page* 90), as the replacement instrument will be sent out without one fitted. Attention to these details will avoid delay and disappointment. Instructions for changing a Magneto will be found on page 90.

THE SMITH STARTING AND LIGHTING SYSTEM, CARE AND MAINTENANCE INSTRUCTIONS.

Manufacturers :

S. SMITH & SONS (M.A.) LTD.

CRICKLEWOOD WORKS, LONDON, N.W. 2

Telephone : Willesden 2335-6-7

Telegrams : Speedofac, Phone, London

Show Rooms :

SPEEDOMETER HOUSE,

179/185 GREAT PORTLAND STREET, LONDON, W.1

Telephone : Langham 2323

Telegrams : Speedomet, Telew, London

HOME SERVICE DEPOTS.

Midland Service Depot :

122 ALMA STREET, BIRMINGHAM

Northern Service Depot :

233 DEANSGATE, MANCHESTER

Scottish Service Depot :

19 WEST REGENT STREET, GLASGOW

Irish Senvice Depot :

39 DONEGAL STREET, BELFAST

FOREIGN AND COLONIAL BRANCHES.

PARIS, MILAN, CAPE TOWN, JOHANNESBURG, DURBAN, MELBOURNE, PORT ELIZABETH, SYDNEY, ADELAIDE, WELLINGTON, BANGKOK AND SOURABAYA

AGENCIES IN ALL COUNTRIES

THE SMITH STARTING & LIGHTING SYSTEM.

In this chapter a detailed description of the principal components is given, together with hints on troubles and how to locate and rectify them.

Special attention is drawn to the section on battery maintenance. Ninety per cent. of the more serious troubles can be traced to neglect of the battery, which is the heart of the system and the only component which requires frequent and regular attention. These instructions should, therefore, be carefully read, and if they are carried out the equipment may be relied upon to give efficient Service at all times.

The Starting and Lighting System consists of the following components : *Dynamo, Starter Motor, Battery, Bezel Lighting Switch, Cut-out, Dynamo Switch, Junction Box, Lamps and Wiring.* (*See Figs.* 19 and 20).

DYNAMO generates electricity for charging the battery.

STARTER MOTOR turns the engine until it runs under its own power.

BATTERY stores the electricity generated by the dynamo. It supplies the current for the starter motor, lamps and electrical accessories.

LIGHTING SWITCH controls the head, side and tail lamps, and by means of the ammeter, incorporated in it, indicates the correct working of the system.

STARTING SWITCH controls the starter motor circuit and is used when starting the engine only.

CUT-OUT automatically closes and opens the main charging circuit between the dynamo and the battery, when the voltage of the former is reached or falls below its proper value.

DYNAMO SWITCH enables the dynamo to be switched " On " or " Off " charge as required.

JUNCTION BOX provides fuses and convenient terminals for additional accessories. This is also termed the Distribution or Chassis box.

LAMPS consist of two headlamps, two side lamps, and a tail lamp and are controlled by the bezel lighting switch.

WIRING provides the necessary circuits whereby current is carried between the various components from the battery. For the tail lamp duplicate wiring is fitted so that this lamp can be carried on the nearside for continental use.

DYNAMO.

The Smith Patent Constant Current Dynamo is designed to ensure that the current output shall be limited to the correct amount and shall remain constant over a wide range of speed. This regulation is electro-magnetic and entirely automatic; it depends on armature reactions only, no vibrators or other complicated devices being utilised.

The steel magnet frame is cylindrical, and is ground on the inner surface to ensure a perfect magnetic joint between the frame and the pole pieces, which are secured in position with set screws.

The brush boxes are mounted on the commutator end housing. The brushes are held in position by springs and can be readily removed for inspection or renewal.

The driving end plate carries the ball bearing for the driven end of the armature shaft.

The laminations of the armature are built up on a steel shaft ground all over. The coils are impregnated with a special insulating varnish, under the vacuum and pressure system, which makes them impervious to moisture and unaffected by heat.

The commutator is made of hard drawn copper bars, insulated with mica. When assembled it is ground in position on the armature shaft.

The dynamo is provided with three terminals, one marked 3C being the main positive terminal; the second, marked 2C, being the field terminal; and the third, marked 1C, being the main negative terminal.

THE STARTER MOTOR.

The starter is a 4-pole series wound motor designed to develop ample power and a high starting torque with a minimum current consumption for the power developed. The drive is by means of the Bendix automatic pinion, which engages with teeth machined on the periphery of the fly wheel. The construction of this pinion is shewn in the illustration (*see Fig.* 19); briefly it consists of a steel sleeve having a triple worm or thread, mounted on the armature shaft, and connected to it through a stiff coil spring attached to a collar, keyed and pinned to the shaft. A hardened steel pinion having a corresponding internal thread is mounted on the sleeve, which is provided with stops at each end to limit the travel of the pinion. The pinion has an unbalanced weight which gives it inertia. Through the side of the weight a small hardened steel plunger is fitted, which is pressed

by a light spring on to the top of the thread on the steel sleeve. The object of this is to prevent the pinion from working along the worm due to vibration, and touching the flywheel when the starter is not in use. The drive is of the inboard type in which the pinion moves towards the motor.

OPERATION OF STARTER MOTOR.

When the starter switch is pressed the armature begins to revolve, causing the screw threaded sleeve to rotate also: the pinion which is weighted on one side lags on the screw thread by reason of its inertia, and therefore commences to move endways along the sleeve until it meshes with the teeth on the flywheel and continues to move until it butts against the stop collar, when it commences to rotate with the sleeve and so turns the flywheel. The spring acts as a cushion, and absorbs the shock of engagement; also should the teeth when meshing not register properly the spring allows sufficient flexibility for engagement to be effected, without damage to the teeth occurring. When the engine starts firing the speed of the flywheel causes the pinion to rotate faster than the threaded sleeve, causing it to travel endways out of mesh, and the unbalanced weight of the pinion holds it out of mesh until the armature comes to rest, thus completing the sequence of operations.

THE STORAGE BATTERY.

The batteries consist of two six volt units connected together in series. They are designed to withstand continual charging for long periods and also to provide the heavy discharge required for starting the engine. The plates used are thin and give the maximum capacity for the minimum size and weight. Wood separators which prevent frothing are used. The cells are made of a strong moulded material, and are securely fixed in a stout wooden case.

THE BEZEL SWITCHBOARD.

The switch is operated by turning the outer knurled bezel in the direction shewn by the arrows on the dial, the various positions being clearly indicated. The following controls are provided :—

ALL OFF
SIDE (and tail) LAMPS
ALL ON

A centre zero ammeter is mounted in the centre of the dial and registers the charge and discharge current indicating the correct working of the system.

THE DYNAMO SWITCH.

The dynamo switch is mounted on the switch plate together with the magneto switches. By means of it the dynamo can be put "on" or "off" charge. It is of the quick break type.

CUT-OUT.

The cut-out or circuit breaker operates as an automatic switch between the dynamo and the battery. Its sole purpose is to connect the dynamo to the battery as soon as the speed of the former is sufficient to enable it to charge the latter, and to open the circuit when the engine stops or slows down below the generating speed of the machine, thus preventing the battery from discharging back through the dynamo. The cut-out is of the magnetic type and is reliable under all conditions. It consists of an electro magnet with a spring controlled armature which carries the brushes for closing the electrical circuit. The magnet has two windings, one of many turns of fine wire, called the shunt winding, and the other consisting of a few turns of thick wire, called the series winding.

The shunt winding is connected directly across the main dynamo terminals, and when current is generated it energizes the magnet which attracts the armature when sufficient voltage is generated, and thus closes the main circuit through the series coils to the battery.

When the speed of the dynamo, and consequently the voltage drops below the charging value, the reverse current from the battery, flowing in the series winding neutralises the effect of the shunt winding, releases the armature and thus opens the circuit between the dynamo and the battery.

A fuse is provided on the cut-out base, which is connected in the dynamo field circuit and its object is to protect the machine against damage due to an accidental open circuit, or faulty connection between the dynamo and the battery. A spare reel of fuse wire is supplied to enable replacements to be made quickly when required (*see Fig.* 20). It is essential that no fuse wire except that provided should be used.

STARTER SWITCH.

The function of the starter switch is to complete the circuit between the battery and the starter motor. It is mounted on the instrument board for use by hand pressure and is fitted with a strong spring to secure a quick and certain release when the pressure is removed.

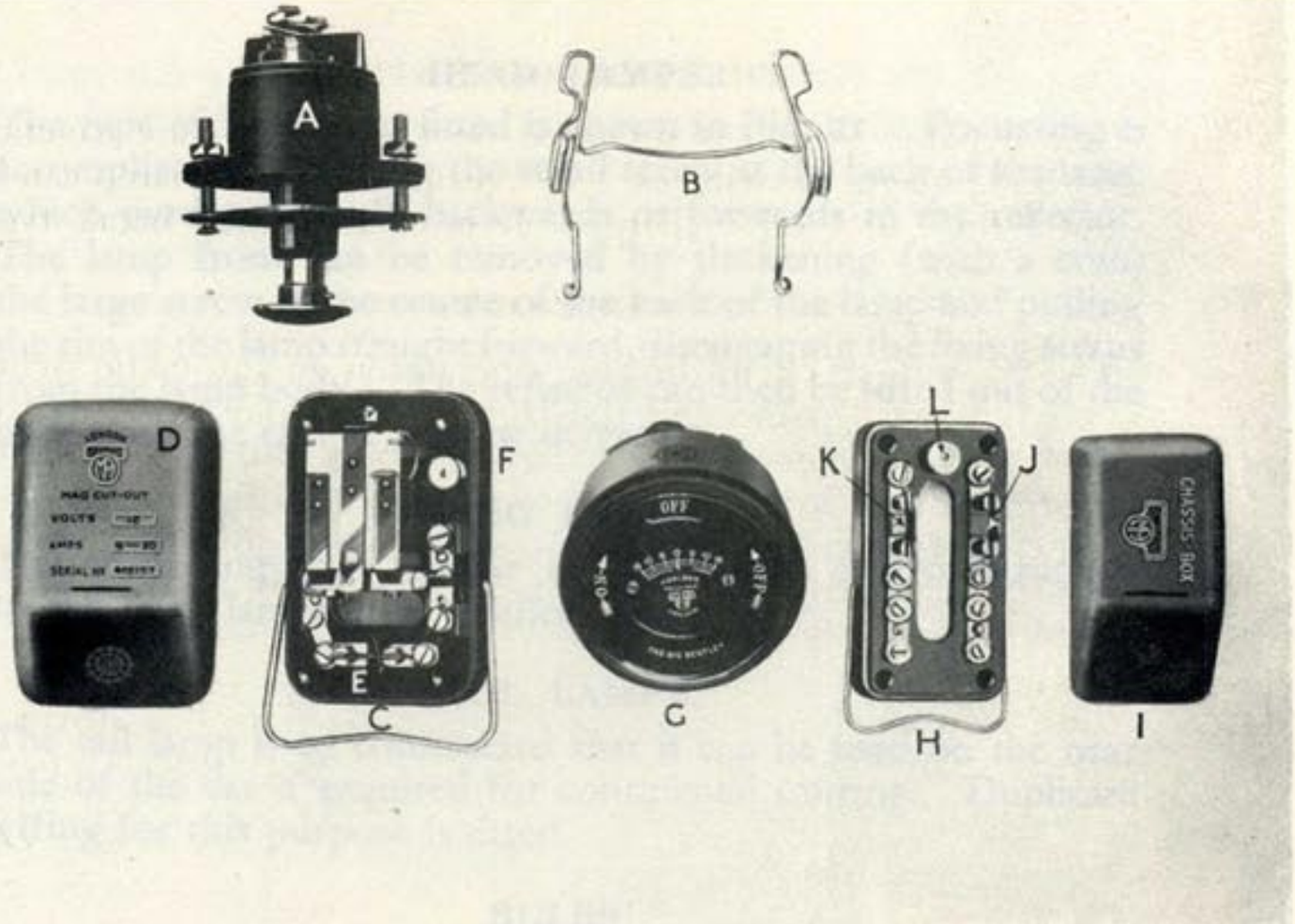


Fig. 20 ELECTRICAL EQUIPMENT.
Starter switch (A). Retaining clip for bezel switch (B). Dynamo cut-out and cover (C & D). Cut-out fuze (E). Reel of fuze wire (F). Bezel switch with amperemeter (G). Distributor box and cover (H & I). Accessory fuzes (J & K). Reel of fuze wire (L).

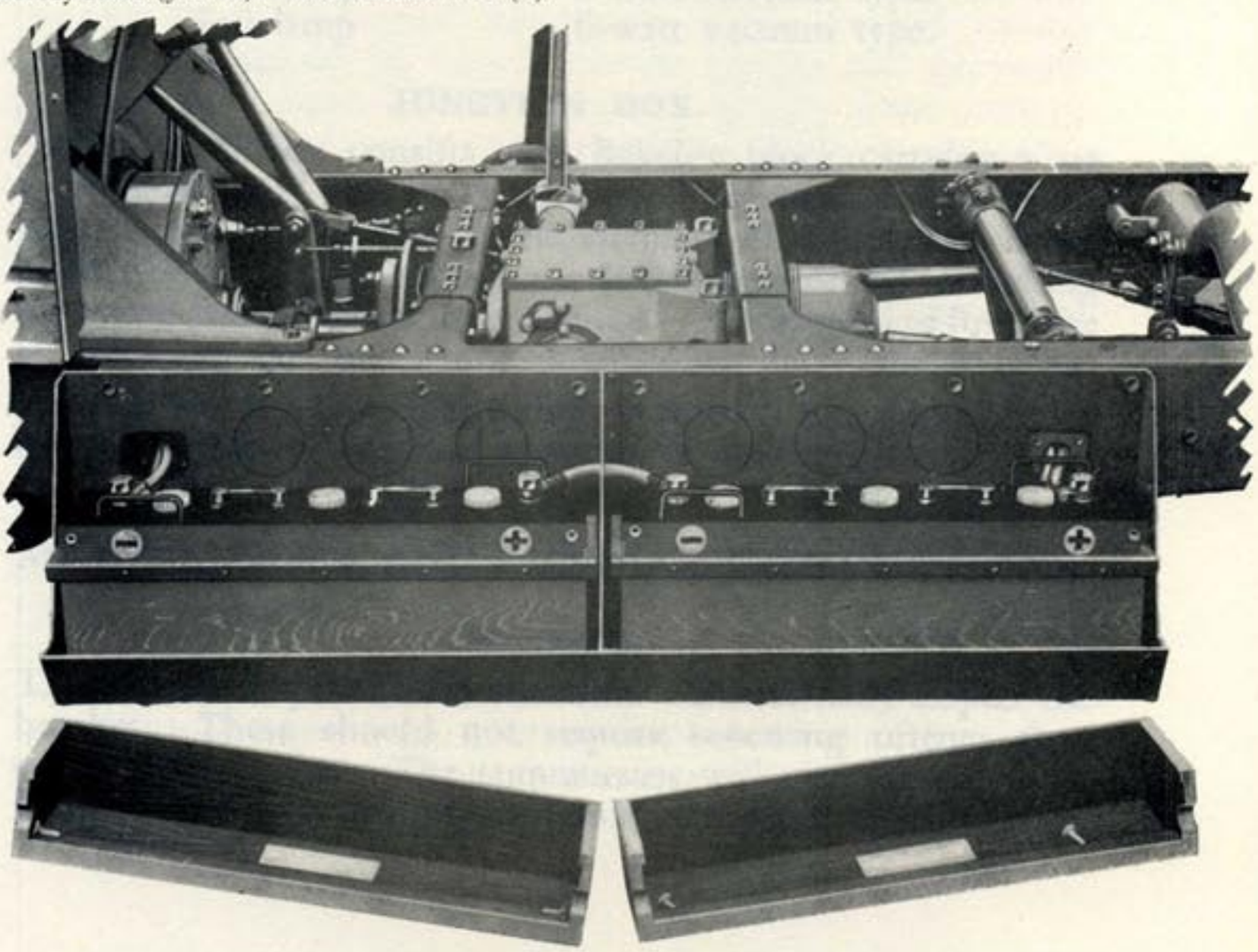


Fig. 22. BATTERIES IN POSITION IN CRADLES WITH COVERS REMOVED.

HEAD LAMPS.

The type of head lamp fitted is shewn in Fig. 21. Focussing is accomplished by turning the small screw at the back of the lamp which moves the bulb backwards or forwards in the reflector. The lamp front can be removed by slackening (with a coin) the large screw in the centre of the back of the lamp and pulling the rim of the lamp straight forward, disengaging the fixing straps from the lamp body. The reflector can then be lifted out of the body with the end of a screw driver.

WING LAMPS.

The wing lamps are similar in appearance and construction to the head lamps only smaller.

TAIL LAMPS.

The tail lamp is so constructed that it can be used on the near side of the car if required for continental touring. Duplicate wiring for this purpose is fitted.

BULBS.

The following bulbs are recommended :—

Head lamps	24 watt gas-filled.
Side lamps	6-watt vacuum type.
Tail lamp	6-watt vacuum type.

JUNCTION BOX.

The junction box consists of a Bakelite block carrying a set of terminals and two fuses, to protect the battery against any short-circuits or defects in the auxiliary circuits, such as the electric horn, interior lights, etc. It may be used for connecting up any additional accessories required. A spare reel of fuse wire is provided and the whole is protected by a metal cover.

SPECIAL NOTE.—If a cigar lighter is fitted it may be necessary to replace the existing fuse with one of heavier gauge.

MAINTENANCE AND RUNNING INSTRUCTIONS.

DYNAMO.

The dynamo requires little attention. Occasionally inspect the brushes. These should not require renewing oftener than every 10,000 miles. The commutator will wear almost indefinitely, but if dirty or rough it should be wiped over with a clean

rag, and the surface may be smoothed with very fine sand or carborundum paper, but on no account may emery cloth be used for this purpose. The greasers fitted at either end of the armature shaft should be given a turn about every 1,000 miles (*see Fig.* 19). Do not over-lubricate. The best grease for this purpose is Prices' H.M.P.

STARTER MOTOR.

The starter motor, being only used occasionally and for very short periods, requires practically no attention, though as a precaution, an occasional inspection should be made of the commutator and brushes to see that the former is clean and in good condition and that the latter are free in their holders.

BENDIX DRIVE.

The worm of the Bendix drive must always be kept clean. It must never be oiled, but should be cleaned occasionally with a rag dipped in petrol.

DYNAMO SWITCH.

The dynamo or charging switch is connected in the field circuit, when this circuit is closed the dynamo charges the battery, but when it is broken the dynamo ceases to generate. Normally the battery should always be on charge and the dynamo need only be switched "OFF" when touring long distances, or under special conditions when the starter and lights are seldom used. So-called overcharging does no harm if the battery is properly cared for. On the other hand under-charging is most detrimental to the plates and is the cause of most battery troubles.

CUT-OUT BOX.

The cut-out does not require attention. It is carefully adjusted in the first instance and must not be tampered with. Only the wire supplied may be used for the field fuse. This is a most important point. Failing this wire, only wire which blows at 3 amps may be employed. The employment of heavier gauge wire may lead to serious damage to the dynamo. The wire must be stretched between the two contact strips on the fuse holder and carefully pressed down towards the bottom edge. When replacing the fuse holder the fuse wire must be properly gripped by the spring contacts.

Fig. 21. HEAD LAMP.

with rim partly removed. Screw to be turned to release rim (A). Focussing screw (B). Nut securing lamp to bracket (C).

STORAGE BATTERY.

The Battery (*see Fig.* 22) is the heart of the electrical system, and it is essential that it should receive proper care and attention. It must be inspected at regular intervals, at least once a fortnight, or more often if the car is in constant use. If the following instructions are conscientiously carried out, the life of the battery will be prolonged and the reliability and efficiency of the system ensured.

TESTING THE BATTERY.

The condition of the battery can best be determined by means of a Hydrometer, the most convenient form being the Hydrometer Syringe. The purpose of the instrument is to test the specific gravity of the electrolyte or fluid in the battery. Each cell should be tested, and fully charged, they should have a specific gravity of about 1.25 : if below 1.15 the battery is practically exhausted, and should immediately be charged up either by running the car or from an outside source. On no account should the starter motor be used until the gravity is restored to at least 1.20. The specific gravity of the various cells will seldom be exactly the same, but the difference should not be very marked. If the gravity in one cell is much lower than in the others, it will probably indicate that that particular cell is not in good order. Should any cell require more frequent filling than any of the others, a leaky jar is indicated and the battery should be sent for repair.

If the battery is not in use for some considerable time it should be fully charged, and to keep it in good condition it should be given a freshening charge every four or six weeks. When a battery is again put into use after a period of idleness, it must be given a thorough charge.

The solution or electrolyte must always be kept above the top of the plates, and if below thus, pure distilled water, only, may be added until the tops of the plates are covered. This must be done regularly. If some of the solution has been accidentally spilled, the loss must be made good by adding dilute acid, and the specific gravity must be tested with a hydrometer. Loss through evaporation must be made good only by adding distilled water. The battery and the box must be kept clean and dry ; any spilt acid should be soaked up with blotting paper or a rag moistened with ammonia water. The terminals and connections must be kept coated with vaseline or grease.

TEST BY VOLTMETER.

An approximate guide to the condition of a battery can be given by means of a voltmeter. When testing by this means, take a reading with all lamps switched on ; this gives the voltage with a load on the battery. Voltage readings taken when the battery is on open circuit are valueless, as the battery may be practically discharged and yet indicate the normal voltage, except when a cell is out of order. A fully charged 12-volt battery should read from 12 to 13 volts when on load, and even with the full lighting load the voltage should not be below 12 volts. If the voltage when on load is below 12 volts it will indicate the battery is low and it should never be allowed to be below 11 volts without being given a thorough charge. When testing individual cells they should indicate 2.5 volts when fully charged on open circuit, and 1.8 volts when practically discharged. The voltmeter must, therefore, be used with intelligence and only a high-class instrument employed, as otherwise it is of doubtful accuracy.

The voltmeter will quickly indicate a faulty cell as this will show either a very low reading, or if there is a short between the plates, no reading at all.

Before coming to any definite decision with regard to the state of a cell a hydrometer test should be taken to confirm the conclusions arrived at by the voltmeter test.

A good substitute for the voltmeter is to use a lamp and note whether it glows bright or dull. After a little observation, the lights on the car will indicate fairly accurately the condition of the battery.

It must be remembered that an exhausted battery may easily show the normal voltage on open circuit, but will be incapable of supplying any current, and it is for this reason that when testing by voltmeter, it is necessary to allow the battery to discharge through a load such as a couple of the lamps on the car.

BATTERY REPAIRS.

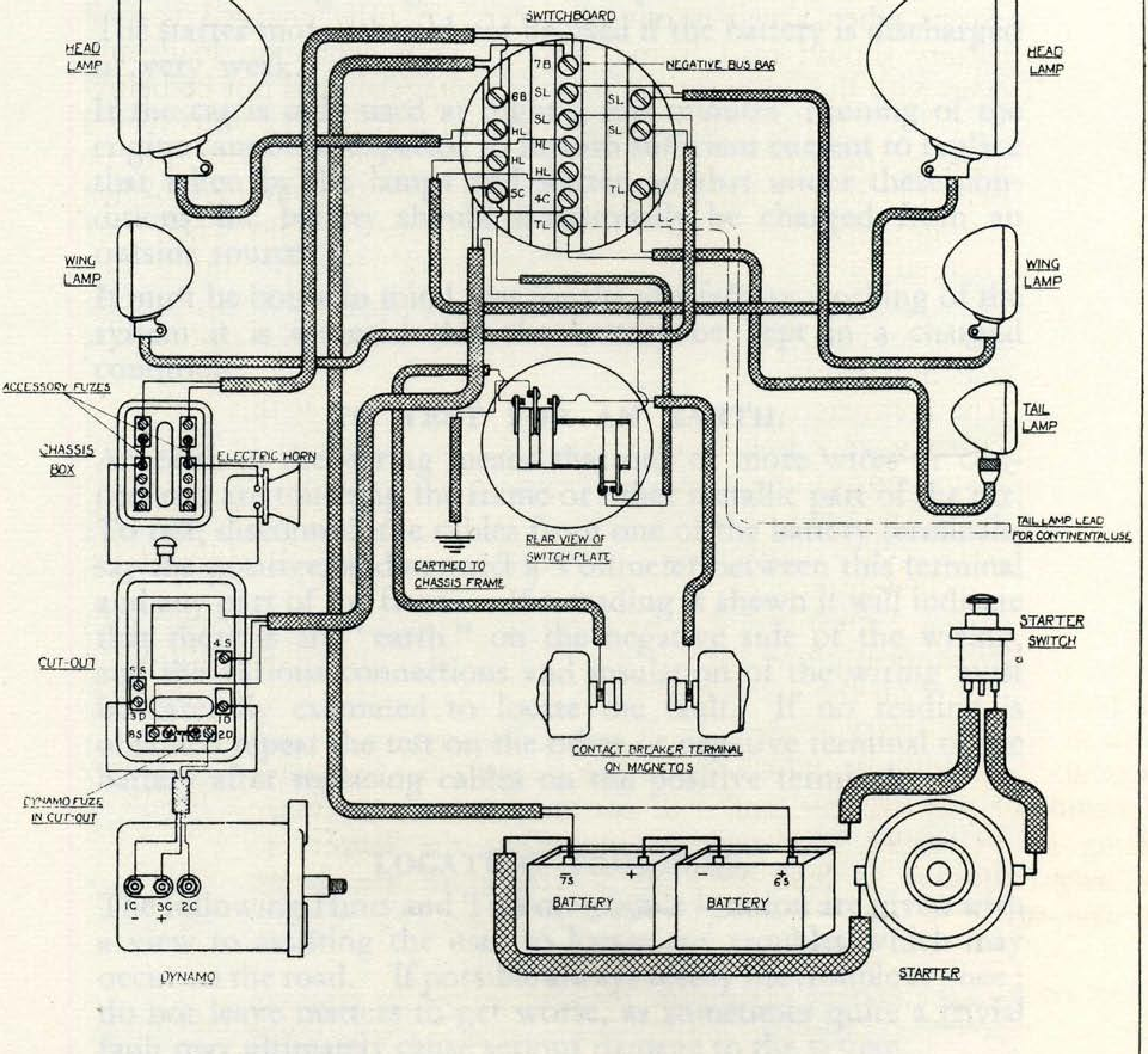
When returning a battery for repairs the acid should be emptied out, but under no circumstances whatever may the cells be filled with water.

WARNING.

On no account may the engine be run when the battery has been removed or disconnected, unless the field fuse which is in the cut-out box has been removed. If this precaution is not taken the field fuse will blow or the dynamo or lamps will be burnt out.

WIRING DIAGRAM.

THE SMITH STARTING & LIGHTING SYSTEM
WIRING DIAGRAM FOR BENTLEY MOTORS
SIX CYLINDER CAR



TR | CH | OR | APP

WIRING DIAGRAM
FOR SIX CYL BENTLEY CAR

S SMITH & SONS (M.A.) LTD
CENTRAL WORKS
CRICKLEWOOD LONDON

X.14763

DATE - 28 9 26

WIRING INSTRUCTIONS

CIRCUIT	TERMINALS TO BE CONNECTED	TYPE & SIZE OF CABLE USED	
DYNAMO TO CUT-OUT	1C TO 1D 2C 2D 3C · 3D	35/012 14/012 35/012	TRIPLE 2-35/012 & 1-14/012
CUT-OUT TO SWITCHBOARD & DYNAMO SWITCH	4S TO 4C 5S · 5C 8S TO DYNAMO SWITCH	35/012 35/012 14/012	TRIPLE 2-35/012 & 1-14/012
SWITCHBOARD TO DYNAMO SWITCH	5C TO DYNAMO SWITCH	14/012	SINGLE 14/012
SWITCHBOARD TO BATTERY	6B TO 6S 7B · 7S	35/012 35/012	TWIN 2 - 35/012
SWITCHBOARD TO CHASSIS BOX	6B TO CHASSIS BOX 7B TO CHASSIS BOX	35/012 35/012	TWIN 2 - 35/012

REMARKS

ALL LAMPS ARE CONNECTED DIRECT TO THE SWITCHBOARD TO THEIR CORRESPONDING TERMINALS WHICH ARE PLAINLY MARKED USE - TWIN CABLE 2-14/012

THE STARTER MOTOR IS DIRECTLY CONNECTED TO THE BATTERY THROUGH THE STARTER SWITCH, WHICH MUST BE IN THE POSITIVE CIRCUIT, USE - SINGLE CABLE 37/036

THE CONNECTIONS ON SWITCHBOARD & SWITCH PLATE ARE SHOWN AS LOOKING AT BACK OF INSTRUMENTS.

THE MAGNETO'S ARE CONNECTED WITH 4 m/m DIA RUBBER COVERED LOW TENSION CABLE 14/012.

THE TWO BATTERIES ARE CONNECTED TO SUIT BY MESSRS BENTLEY MOTORS

Details of the wiring of the chassis are given in the diagram (*see page 79*).

Do not abuse the system by unnecessarily frequent use of the self-starter, nor on any account use it to run the car along the road. Every operation of the starter motor represents a considerable drain on the battery, which it will require several miles of running along the road to replace.

The starter motor should not be used if the battery is discharged or very weak.

If the car is only used at night a few minutes' running of the engine cannot be expected to furnish sufficient current to replace that taken by the lamps and starter, so that under these conditions the battery should occasionally be charged from an outside source.

It must be borne in mind that for the satisfactory working of the system it is essential that the battery be kept in a charged condition.

TO TEST FOR AN EARTH.

An earth in the wiring means that one or more wires or connections are touching the frame or other metallic part of the car. To test, disconnect the cables from one of the battery terminals, say the positive, and connect a Voltmeter between this terminal and any part of the frame. If a reading is shewn it will indicate that there is an "earth" on the negative side of the wiring, and the various connections and insulation of the wiring must be carefully examined to locate the fault. If no reading is obtained repeat the test on the other or negative terminal of the battery after replacing cables on the positive terminal.

LOCATING TROUBLES.

The following Hints and Tips on trouble location are given with a view to assisting the user to locate any troubles which may occur on the road. If possible always rectify the trouble at once; do not leave matters to get worse, as sometimes quite a trivial fault may ultimately cause serious damage to the system.

SYMPTOM.	PROBABLE CAUSE.
AMMETER DOES NOT INDICATE CHARGING CURRENT.	*Field fuse blown indicating either a faulty or broken connection between dynamo and battery. Carefully trace all connections and locate fault before replacing fuse.*

SYMPTOM.	PROBABLE CAUSE.
ALL LIGHTS FAIL.	*Broken or bad connection between switchboard and battery.*
LIGHTS DROP TO DULL RED.	*Discharged battery or short circuit in the wiring system. To locate the latter, disconnect each lamp cable on switchboard in turn; when the remaining lights glow brightly the faulty cable has been located. It is advisable to switch the lights off whilst disconnecting the cables, and only switch on when ready to test.* *Carefully examine the faulty cable; also the lamp adaptor, and do not replace until the fault has been rectified.*
AMMETER DOES NOT REGISTER THOUGH FIELD FUSE HAS NOT BLOWN.	*Dynamo out of order; examine brushes and see that they are quite free in their holders.*
AMMETER REGISTERS CURRENT WHEN CAR IS STATIONARY AND ENGINE NOT RUNNING.	*This is of rare occurrence and may be due to two causes:* (1) *Cut-out out of order.* (2) *A short circuit between the dynamo negative and battery negative terminals.* *To locate, disconnect cable from terminal 3D on cut-out and note whether the ammeter needle returns to zero; if when replaced current is again registered examine for possible short between terminals 1D and 4S, also see that the armature of cut-out is not sticking.* *If the trouble cannot be remedied, have cut-out returned for inspection and repair if necessary.*
BULBS GLOW VERY BRIGHT OR BURN OUT.	*Broken or faulty connections between dynamo and battery; the field fuse will also probably blow.* *Switch dynamo OFF, examine battery connections and do not charge again until fault has been remedied.*
BULBS DULL OR NOT UP TO NORMAL WHEN DYNAMO IS NOT RUNNING.	*Battery discharged; use lamps sparingly and do not use starter motor until battery has been recharged.*

SYMPTON.	PROBABLE CAUSE.
ONE OR MORE LAMPS WILL NOT LIGHT.	*Bulbs defective or worn out; try new bulbs, or examine for faulty contacts in bulb holder and adapter, also examine lamp connections on switchboard.*
LIGHTS FLICKER.	*Loose connection in lamp wires or adaptors, or loose connection on battery.*
STARTER MOTOR TURNS ENGINE VERY SLOWLY.	*Battery almost discharged or engine very stiff. Do not use starter motor until battery is properly charged. Also examine starter cable connections on battery and starter switch.*
STARTER MOTOR DOES NOT ROTATE.	*Battery entirely discharged, either through excessive use of starter motor or short circuit. Test battery, also examine starter motor connections.*
STARTER MOTOR ROTATES BUT DOES NOT ROTATE ENGINE.	*Screwed sleeve of Bendix drive dirty or gummed with oil, etc. To remedy, clean with brush dipped in petrol and see that the pinion is quite free.*
BATTERY DOES NOT HOLD CHARGE OR IS ALWAYS WEAK.	*Defective cell or level of solution very low. Battery may be worn out or Specific gravity of the electrolyte low. Test with hydrometer. The car may not be run enough for the dynamo to charge the battery and replace the current taken from it. To remedy, run car and do not use lights or starter motor until battery is properly charged again.*

SPECIAL NOTE.

DO NOT INTERFERE with the adjustment of the dynamo or cut-out. The dynamo is set to give its correct output at the Factory and needs no further alteration at any time. The cut-out is also carefully adjusted, and the adjusting screws are sealed. If any fault is suspected in any of the apparatus have it carefully examined by a competent electrician, or return for inspection either direct to the Service Department or to one of Messrs. S. Smith & Sons (M.A.) Ltd. depots (*see page* 68).

CHAPTER VIII.

Advantages of Wired on Type. Inflation. Cuts. Acceleration and Braking. Rapid Tread Wear. Fitting and Removing.

THE CARE AND MAINTENANCE OF TYRES.

TYRES.

Dunlop tyres of the Wired type are fitted as standard, the size being 33 by 6.75 Balloon. The rims are of the well-base type. The adoption of these tyres and rims secures to the user many advantages, amongst which are those inherent to the wired type as a tyre. The chief of these advantages are :—

SAFETY.

The edges of the cover embody inextensible rings of wire by which means it is ensured that tyres do not in any way depend for their secure hold on the rim upon the presence or absence of air within them.

COMFORT.

The tyres, whether Balloon or Medium Pressure, can be successfully used without sacrifice of durability at appreciably lower pressures than is the case in respect of so-called High Pressure tyres.

MILEAGE.

The wonderful toughness of the tread compound with its high abrasive value and cut-resisting properties ensures an extremely slow rate of wear.

STABILITY.

The design and relative widths of tyres and rims ensure maximum stability at the inflation pressure appropriate to the load.

FREEDOM FROM MANY FORMS OF PREMATURE FAILURE.

The type of tyre and rim and the method of attachment give complete freedom from many forms of trouble fundamentally associated with other types of tyre.

CARE OF TYRES.

INFLATION.

The importance of suiting the inflation pressure to the load cannot be exaggerated in respect of any form of pneumatic tyre. In respect of those which come within the Low Pressure category the extra comfort given entails rather more care than in respect of High Pressure tyres for the reason that there is no margin for indifference or neglect. All users are urged to take steps to ensure that the tyres are continuously inflated to the makers' recommended pressures. In respect of the 33 by 6.75 Balloon tyres the pressures should be :—

For the front tyres, 30 lbs. per sq. inch.

For the rear tyres, 32lbs. per sq. inch.

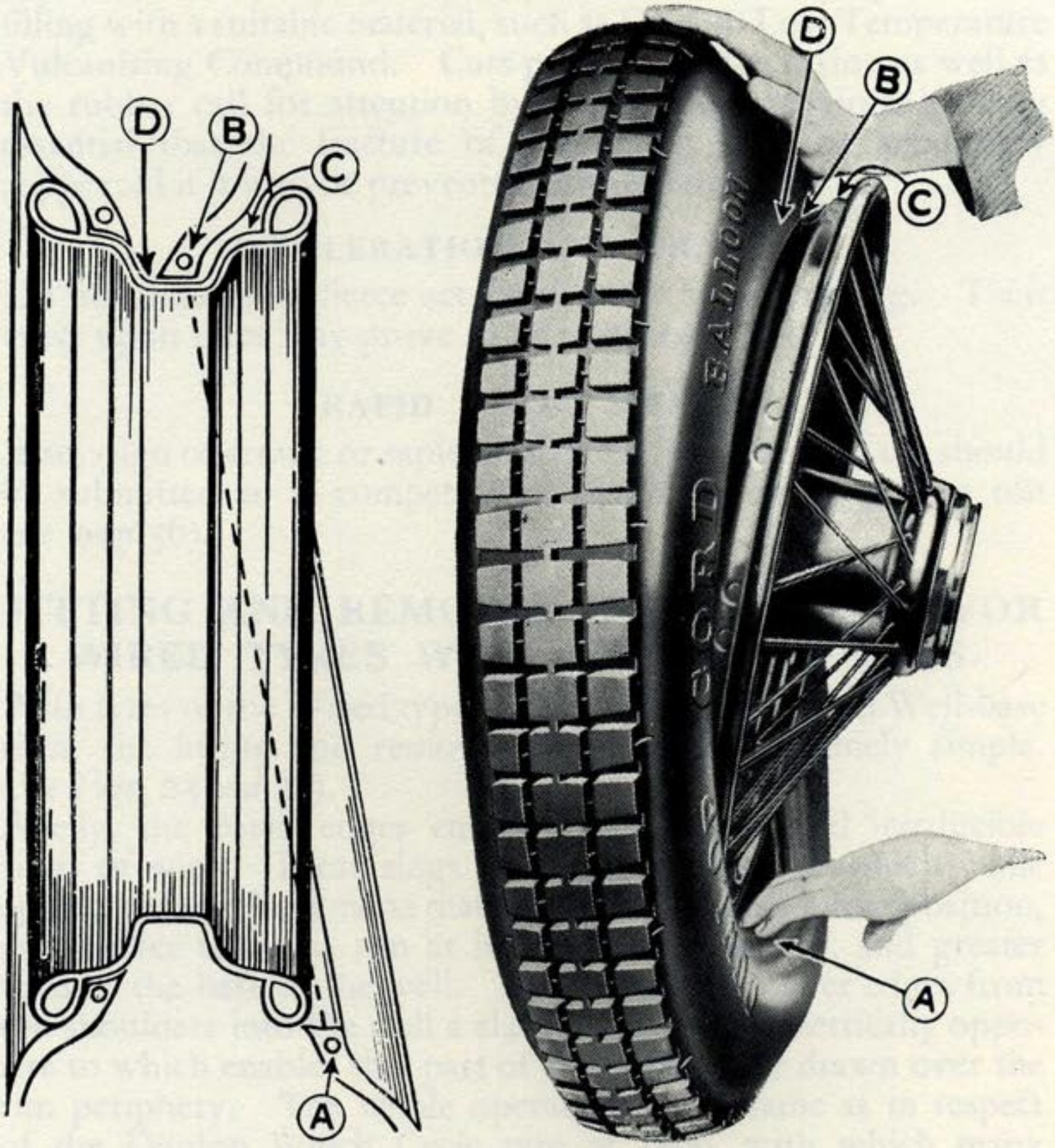
The pressure should be tested regularly by means of a gauge applied to the valve, and any loss restored. Much harm results from permitting the pressures to fall so low that undue flexing of the cover walls can occur. It can be safely said that care in respect of inflation pressure will prolong the tyre's life by many miles.

Many motorists, when testing their tyres, neglect the one carried as a spare. This is a mistake, and tends to outweigh any advantages which may be derived from carrying a fifth wheel. It will be appreciated that unless this is available for putting into service whenever required, its usefulness ceases to exist. It should be in a fit state of repair for immediate use, and inflated to a pressure suitable for use on the rear axle. If it is required to be used on a front wheel the pressure can be quite easily adjusted.

Do not be guided by the appearance of the tyres as to whether they require attention in respect of inflation. If they are neglected until they look unduly slack it is almost certain that irreparable damage has already been caused.

It is important to remember that the pneumatic principle, as applied to a tyre, consists in the employment of a column of compressed air of suitable volume and at suitable pressure to meet the load conditions which apply, and that the tyre is designed by the makers to deal with such load conditions at the particular inflation pressure recommended. If these recommendations are disregarded it is almost certain that complete satisfaction will not be obtained.

A pneumatic tyre with half its air may be compared to a bridge with only half its supports.



Figs. 23 & 24. METHOD OF FITTING AND REMOVING A TYRE.

The slack (A) is formed by pushing the cover edge (D) from the shoulder of the wheel (C) into the well (B).

CUTS.

Do not neglect cuts. The damaging effect upon the casing of water and road matter is such as may make it necessary to take a tyre out of service which would otherwise have been fit for many thousands of miles. All rubber cuts, except merely superficial ones, should be attended to immediately by means of filling with a suitable material, such as Dunlop Low Temperature Vulcanising Compound. Cuts penetrating the casing as well as the rubber call for attention by a competent repairer, it being essential that the fracture of the casing shall be adequately supported if it is to be prevented from extending.

ACCELERATION AND BRAKING.

Do not indulge in fierce acceleration or harsh braking. Their effect upon tyres may prove to be very costly.

RAPID TREAD WEAR.

If any sign of erratic or rapid tread wear is noticed the car should be submitted to a competent mechanic for an alignment test (*see page* 56).

FITTING AND REMOVAL INSTRUCTIONS FOR WIRED TYRES WITH WELL-BASE RIMS.

With tyres of the Wired type used in conjunction with Well-base rims, the fitting and removal methods are extremely simple. (*See Figs.* 23 *and* 24).

Briefly, the cover edges embody inextensible and irreducible rings of wire. These rings have a circumference which while approximately the same as that of the rim at the shoulder position, are smaller than the rim at its extreme periphery, and greater than at the base of the well. By pushing the cover edges from the shoulders into the well a slack is formed diametrically opposite to which enables that part of the cover to be drawn over the rim periphery. The whole operation is the same as in respect of the Dunlop Welch Cycle tyre of 1890, with which many motorists are quite familiar. The accompanying illustrations and instructions should make it easy for one who is quite unaccustomed to tyre fitting to place in position or remove a tyre quite easily at the first time of essaying the task.

TO FIT TYRE.

Push one edge of the cover over the edge of the rim. It will go quite easily if it is seen that the part of the edge first put on is pushed right down into the rim base.

Very slightly inflate the inner tube—do not distend it—place it in the cover, with valve through hole in rim. Commence to fit second edge of cover at a point diametrically opposite the valve, by placing it over the rim and pushing down into the base of the rim. A small lever may be used for the last few inches, but is not essential. On no account use large levers. Force is unnecessary, and may damage the cover edges.
Whilst inflating see that the edges of the cover are seated evenly round the rim.

TO REMOVE TYRE.

First completely deflate by removing all valve parts, and push the tyre edges into the base of the rim at part diametrically opposite valve, then lift the cover edges near the valve over the rim edge. A small lever may be used, but is not essential. No force is required to do this, but the edges of the cover opposite the valve must be in the base of the rim.

SPECIAL NOTE:

Do not use force—do not attempt to stretch the wire edges of the cover over the rim edge; they are inextensible. Fitting or removing will be found quite easy, without any forcing, if the wire edges of the cover are carefully adjusted into the rim base. The Dunlop Rubber Company includes in its organisation an expert technical staff possessing a knowledge and experience of tyre and wheel problems which is unique. In the elucidation of tyre and wheel problems it is prepared to place the whole of its resources at the disposal of any motorist who cares to apply to the Service Dept. either at Fort Dunlop, Birmingham, or any of its depots.

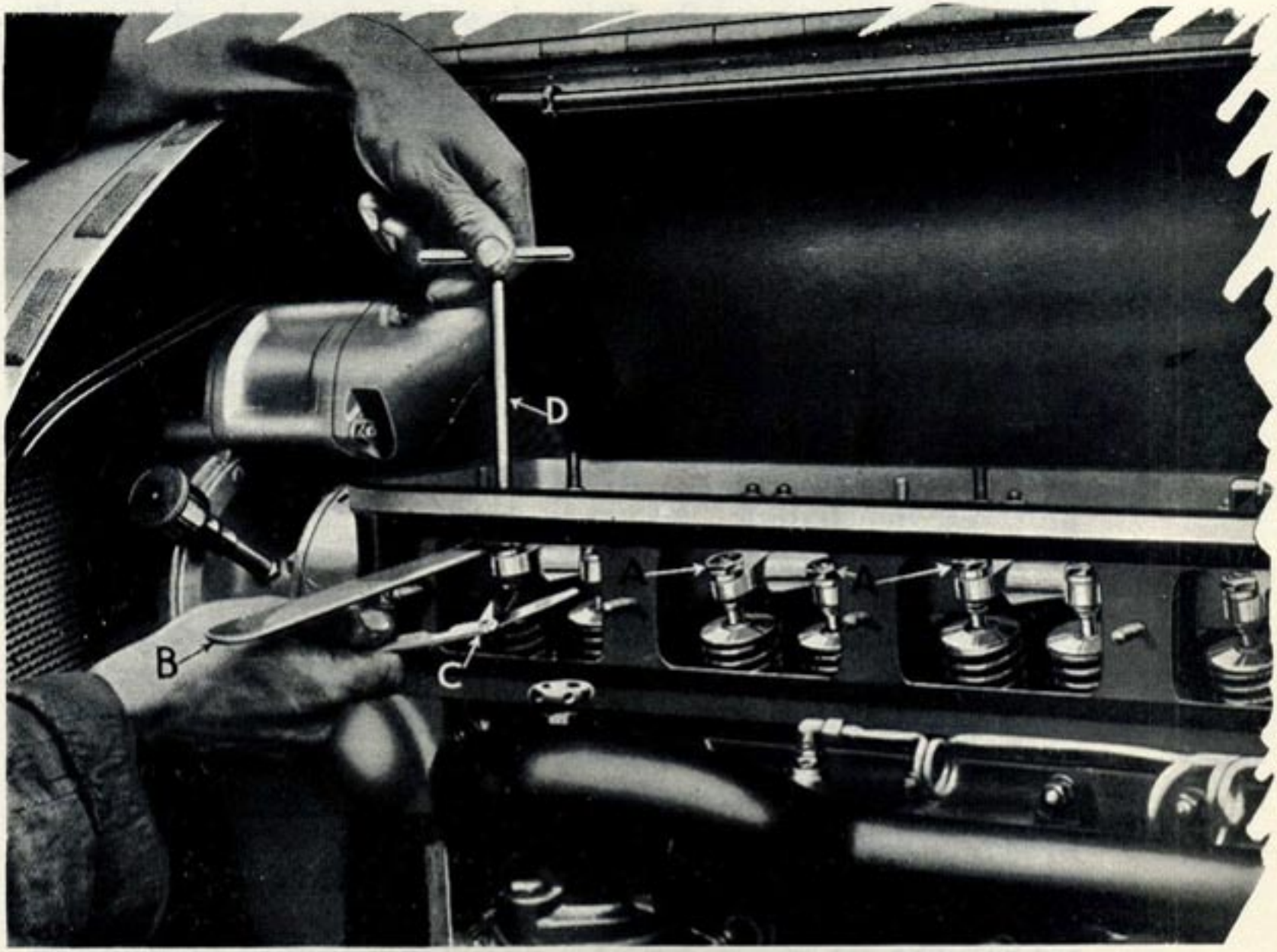


Fig. 25. METHOD OF ADJUSTING TAPPETS.

The tappet lock-nut (A) is first slacked back with the ring spanner (B). The feeler gauge (C) is inserted between the tappet ball-end and the valve tip. The key (D) is inserted in the top of the tappet screw which can then be adjusted to the correct clearance (*see page* 89).

CHAPTER IX.

To adjust tappets. Changing a Magneto. Synchronising magnetos. Changing a dynamo. Adjusting and compensating brakes.

ADJUSTMENTS.

In this chapter detailed descriptions of various jobs are given. These jobs do not require the skill of an expert and can be carried out without in any way affecting the Guarantee on the chassis and no difficulty should be experienced if the instructions are carefully followed.

TO ADJUST TAPPETS.

The design of the overhead gear is such that the tappets seldom require attention, but should a noisy tappet be suspected the method of adjusting is as follows (*see Figs.* 1 *and* 25) :

The aluminium cam case cover is held in position by 10 stainless steel nuts which must be unscrewed. The cover can then be lifted off ; should it have stuck, it can be " started " by inserting a screw driver into the four recesses provided for the purpose and gently levering it up. Care must be taken not to damage the cork washer which makes the joint between the cover and the cam case. The two aluminium side plates each secured by 7 nuts can then be removed in a similar manner. Each tappet screw is secured by a lock nut, to fit which a ring spanner is supplied in the tool kit together with a key which fits into the end of the tappet screw, thereby affording means of adjusting the clearance between the ball end of the tappet screw and the end of the valve stem. Before commencing adjustment, the engine must be thoroughly hot. As the tappets are adjusted for each individual cylinder, that cylinder must be at top dead centre on the firing stroke, this position being marked on the flywheel. For instance, when adjusting for No. 1 cylinder, the marks T.D.C.1 and 6 on the flywheel must be in line with the centre of the cylinder block, the actual cylinder which is on the firing stroke being ascertained by inspecting the position of the magneto distributor (*see Fig.* 28). The correct clearances are .004 inches on the inlet side, and .006 inches on the exhaust side. Feeler gauges of these thicknesses are supplied in the tool kit. After adjusting and tightening up the lock nut the clearance should be finally checked. It must be realised that the ball ends of

the tappet screws are free to rotate so that care must be exercised when adjusting that the flats on the balls bear on the valve stems. No trouble is likely to be experienced in this respect unless for any reason the tappet screws are slacked back considerably, as it is not until this is done that the balls could rotate sufficiently for the flats to become uppermost. When replacing the side plates and cover, the nuts must be tightened up evenly and in no circumstances must any jointing material be used apart from the washers.

Should a squeak develop in the overhead gear after the engine has been idle for a considerable period, it is probably due to a dry or rusty tappet screw ball and it is these parts which should be investigated with a view to curing the trouble, though the noise will automatically wear off.

CHANGING A MAGNETO.

In the event of a magneto proving defective and the fault not being curable without taking the instrument apart, a replacement instrument should be obtained from the Service Department or from one of the Maker's Service Stations (*see page* 62). The procedure of changing a magneto is as follows :

Disconnect the advance and retard control, and the sparking plug leads. Turn the flywheel so that T.D.C. 1 and 6 are uppermost. No. 1 cylinder should be on the firing stroke which can be ascertained by inspecting the magneto distributor, No. 1 terminal on the distributor cover being the centre forward one (*see Fig.* 28). Unscrew the nuts on the three bolts on the magneto flange and remove the bolts. The magneto can then be withdrawn, complete with the distance piece and anti-vibrator. (*See Fig.* 27). The latter parts will have to be fitted to the replacement instrument. To do this the nut on the spindle must be slackened, then with the dog held in a vice the nut (which is now loose on the spindle) must be given two or three hard taps with a copper drift which will have the effect of loosening the dog on the taper of the armature spindle, and then having completely unscrewed the nut, the dog, anti-vibrator and distance piece can be removed as a unit. The object in not removing the nut completely in the first instance is to prevent the screw threads at the end of the spindle being damaged by hammering, and it also prevents the instrument falling when the dog has been started on the taper. It will be noticed that there is a keyway cut in the taper of the spindle, but no use is made of this, the magneto

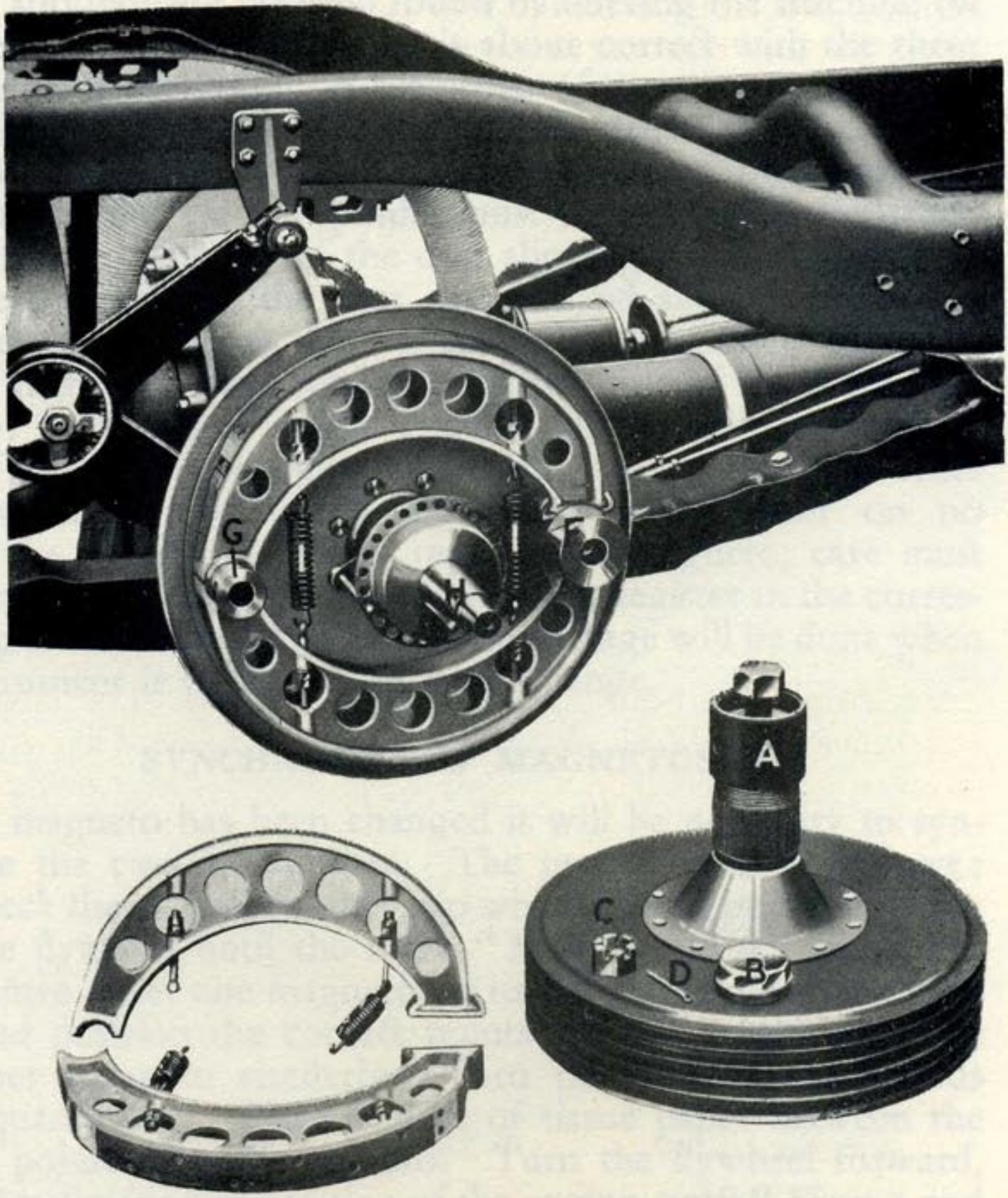


Fig. 26. REAR HUB WITHDRAWN AND ONE PAIR OF BRAKE SHOES REMOVED.

Hub with hub extractor in position (A). Axle cap (B). Axle nut (C). Split pin for axle nut (D). One pair of shoes removed showing brake liner (E). Brake cam (F). Brake pivot pin (G). Axle shaft and key (H). Brake " pull-off " springs (I).

drive being taken by the taper only. When fitting the dog to the replacement instrument, it should first be put on hand tight and the approximate position found by offering the machine on to its flange so that the timing is about correct with the three securing bolts registering in the centre of their slots. This will allow sufficient movement of the magneto forward or backward to obtain accurate synchronisation. Having obtained this position, the nut on the spindle must be thoroughly tightened to avoid any possibility of the dog slipping on the taper. It must be realised that the near side and off side magnetos are not interchangeable as their direction of rotation is different, hence the importance of stating for which side of the engine the magneto is required when another instrument is ordered. There is a castellated split pinned nut on the magneto cross drive housing, just behind the flange which must on no account be touched. When replacing a magneto, care must be taken that the slots of the anti-vibrator register in the corresponding slots in the sleeve, otherwise damage will be done when the instrument is tightened up to the flange.

SYNCHRONISING MAGNETOS.

After a magneto has been changed it will be necessary to synchronise the two instruments. The procedure is as follows: First check the contact breaker gap which should be .012 inches; turn the flywheel until the mark "Mags 1 and 6" are at top dead centre. Set one magneto on its flange so that in the fully advanced position the contact points are just separating. Set the other magneto similarly. Turn the flywheel backwards about quarter rev. Place a piece of tissue paper between the contact points of each magneto. Turn the flywheel forward, *i.e.*, in the direction of rotation of the engine, until "Mags 1 and 6" are again on top. The two pieces of paper should be released simultaneously—if not any slight variation can be rectified by rotating one magneto on its flange. The magneto controls must be so adjusted that both instruments are fully advanced when the mark "Mags 1 and 6" are at top dead centre. Though in the factory the magnetos are synchronised electrically the above method is quite simple and gives very accurate results.

CHANGING A DYNAMO.

Should a dynamo prove defective and it cannot be rectified by inspection and simple adjustment (*see page* 80), it is advisable to ask for a replacement instrument in order that the defective one

may be returned to the makers for repair without it first having been opened up. The method of removing a dynamo is as follows :

Remove the muff or insulator which covers the rear side of the dash and dynamo. This is secured to the dash by bolts. (*See Fig.* 29). Then remove the dynamo drive cover on which the spare sparking plugs are carried. This is secured to the front side of the dash by eight bolts. It is horse-shoe in shape and the bolts having been removed it must be twisted through quarter of a circle and then slid sideways towards the offside in order to remove it. The front Hardy disc joint must then be disconnected ; two bolts will have to be removed, the wire securing the nuts having been withdrawn. The screws of the clip securing the greaser pipe to the front end of the dynamo must be slacked back and the pipe withdrawn. Then remove the 11 bolts which secure the plate on which the dynamo is mounted to the rear side of the dash. The plate will come away with the dynamo attached by means of three bolts. The replacement dynamo must be mounted on the plate and the Hardy disc drive transferred, after which the method of remounting is the reverse of that described above.

COMPENSATING AND ADJUSTING FOUR-WHEEL BRAKES.

(1) Raise all four road wheels clear of ground by jacking up on wooden blocks under front axle and rear spring saddle plates.

(2) Disconnect the four footbrake pull rods at the wheel ends and see that all four road wheels revolve quite freely. The hand brakes lever should be in the " off " position against the " stop."

(3) Set compensator levers parallel, with the aid of a short tommy bar, until the quarter inch clamping bolts are central in slots. This also applies to the central compensator with the long single lever ; the two halves of this compensator should be set parallel bringing the clamping bolts central in slots.

(4) Remove split pins from compensator clamping bolts and tighten nuts dead tight to put compensators out of action.

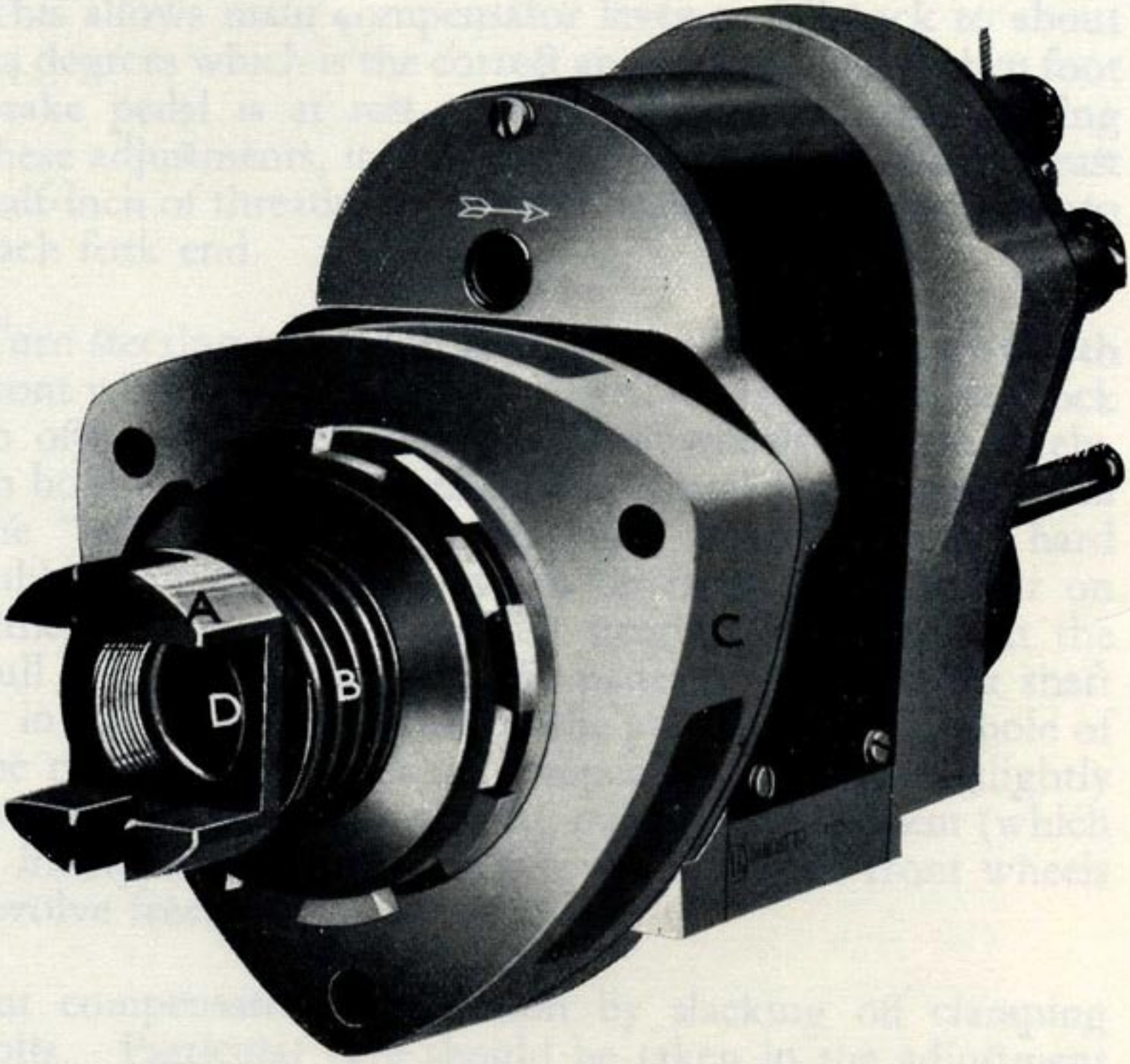


Fig. 27. MAGNETO AS REMOVED FROM ENGINE.

Driving dog (A). Anti-vibrator (B). Distance piece (C). Nut securing dog on taper (D).

(5) Adjust main adjustment (when pedal is back on the floor board) so that main compensator lever lays at approximately 12 degrees from the vertical; then connect all brake rods and adjust so that all wheels can be just rotated by hand and so that it requires the same amount of energy, to rotate each wheel. At this point slack off main adjuster so that foot brake pedal has 1 inch to 1½ inch free travel, *i.e.*, from the foot board to the moment the brake comes into operation. This allows main compensator lever to fall back to about 14 degrees which is the correct angle of this lever when foot brake pedal is at rest against footboard. After making these adjustments, it is important to be certain that at least half-inch of threaded end of pull rods remains screwed into each fork end.

(6) Turn steering wheel full lock to nearside and see that both front wheels revolve freely. Turn steering wheel full lock to offside and see that both front wheels revolve freely. In both positions of steering wheel brake pedal must be in the "off" position, against pedal board. Should hard rubbing or binding of brakes on front wheels occur on either offside or nearside full steering lock, see that the pull rod connecting the brake pedal to compensator shaft is in top hole of the two on the pedal and the top hole of the two on long lever on compensator shaft, and slightly increase pedal travel by letting out hand adjustment (which is incorporated in this pull rod) until both front wheels revolve freely on either lock.

(7) Put compensators into action by slacking off clamping bolts. Particular care should be taken in the adjustment of these bolts. The two bolts on the centre compensator should be tightened until the spring washers under nut and bolt heads are only just fully compressed. The bolts on each outer compensator should be tightened half a turn more than bolts on the centre compensator.

(8) Replace all split pits, tighten all lock nuts, tighten locking lever on hand ajustment, lower car to ground by jacks.

NOTE.—Periodical cleaning and lubrication of brake gear, including all pull rod fork ends, with occasional checking of compensator clamping bolts, will ensure faultless braking action over long periods.

CHAPTER X.

NOTES ON BUILDING AND MOUNTING BODIES TO SIX CYLINDER BENTLEY CHASSIS.

These notes are for the guidance of owners and coachbuilders, and it is most important that the points to which attention is drawn should be carefully observed.

The correct Bentley Motors blue prints must be obtained. The blue prints referred to are :—

B.57 for the 11ft. 0in. chassis.
B.52 „ „ 12ft. 0in. „
B.60 „ „ 12ft. 6in. „
B.59 Steering position—short column.
B.63 „ „ —long „
B.53 Fouling points.

MOUNTING BODY TO CHASSIS.

(1) Felt strip at least quarter inch thick must be placed between the body and the chassis frame.

(2) The scuttle must not be rigidly fixed to the dash, but must be of the floating type : should scuttle bolts be used, care must be taken that they do not interfere with the electric wiring.

(3) Care should be taken that no woodwork on the front scuttle arch fouls or interferes with the movement of the accelerator pedal, or driver's foot when operating same. The arch should not protrude inwards more than the aluminium dash at right side of pedal.

(4) The batteries must be mounted in the trays supplied and fitted to the chassis as shown on the drawing. The lids must be a tight fit on the batteries to prevent the ingress of water or mud and great care must be exercised that the running board does not interfere with this. It is not recommended that the batteries should be fitted between the frame members.

CONSTRUCTION DETAILS AND CLEARANCES.

(5) Front wings and valances must allow for full lock in steering, and for the rise and fall of the front wheels in that position. The front wings must be at the height above the frame shown in the blue print for various tyre and wheel sizes.

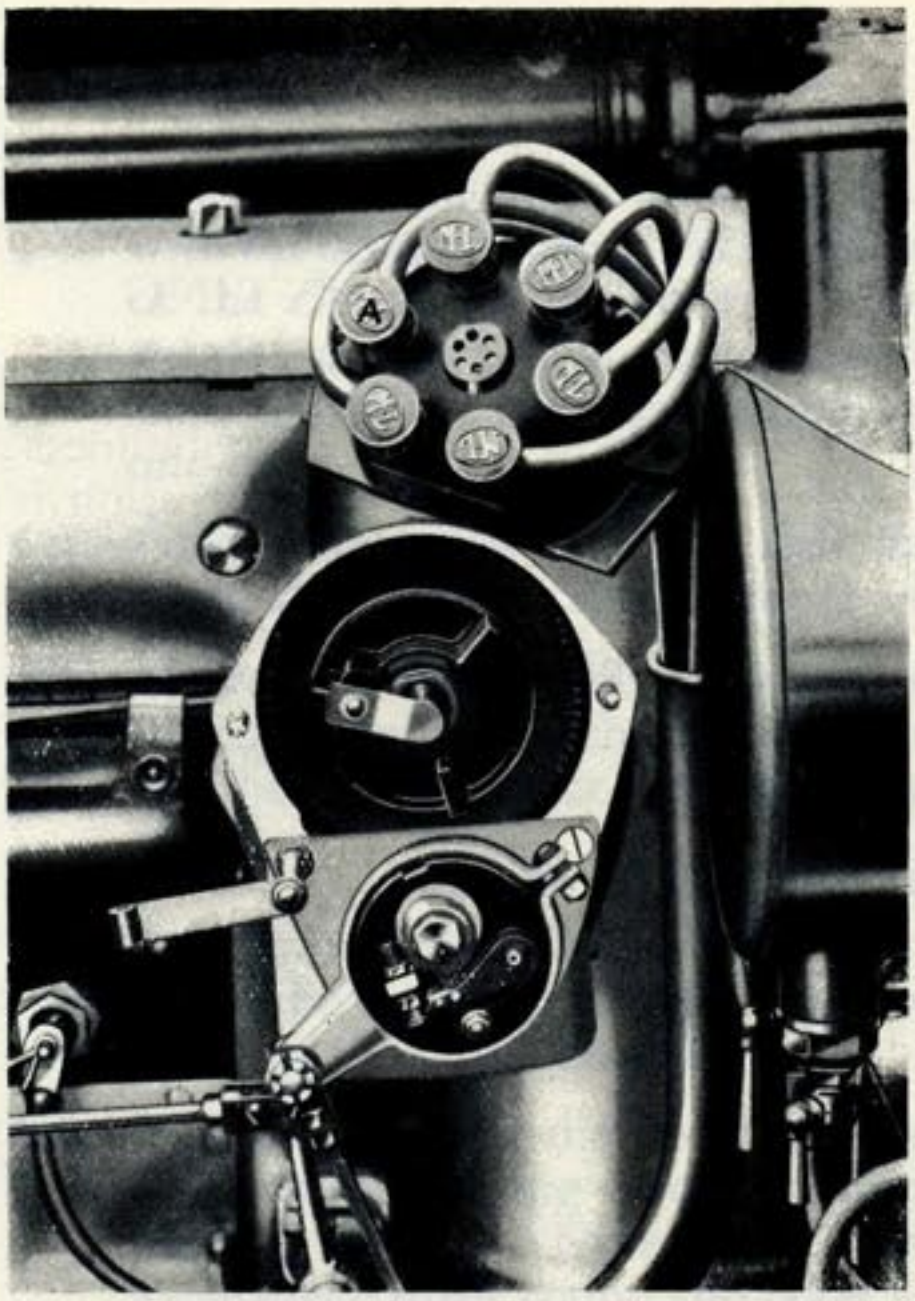


Fig. 28.

NEARSIDE MAGNETO.

With distributor and contact breaker covers removed. No. 1 cylinder is at top dead centre on the firing stroke with the ignition full advanced. (A) shows the H.T. lead to No. 1 cylinder.

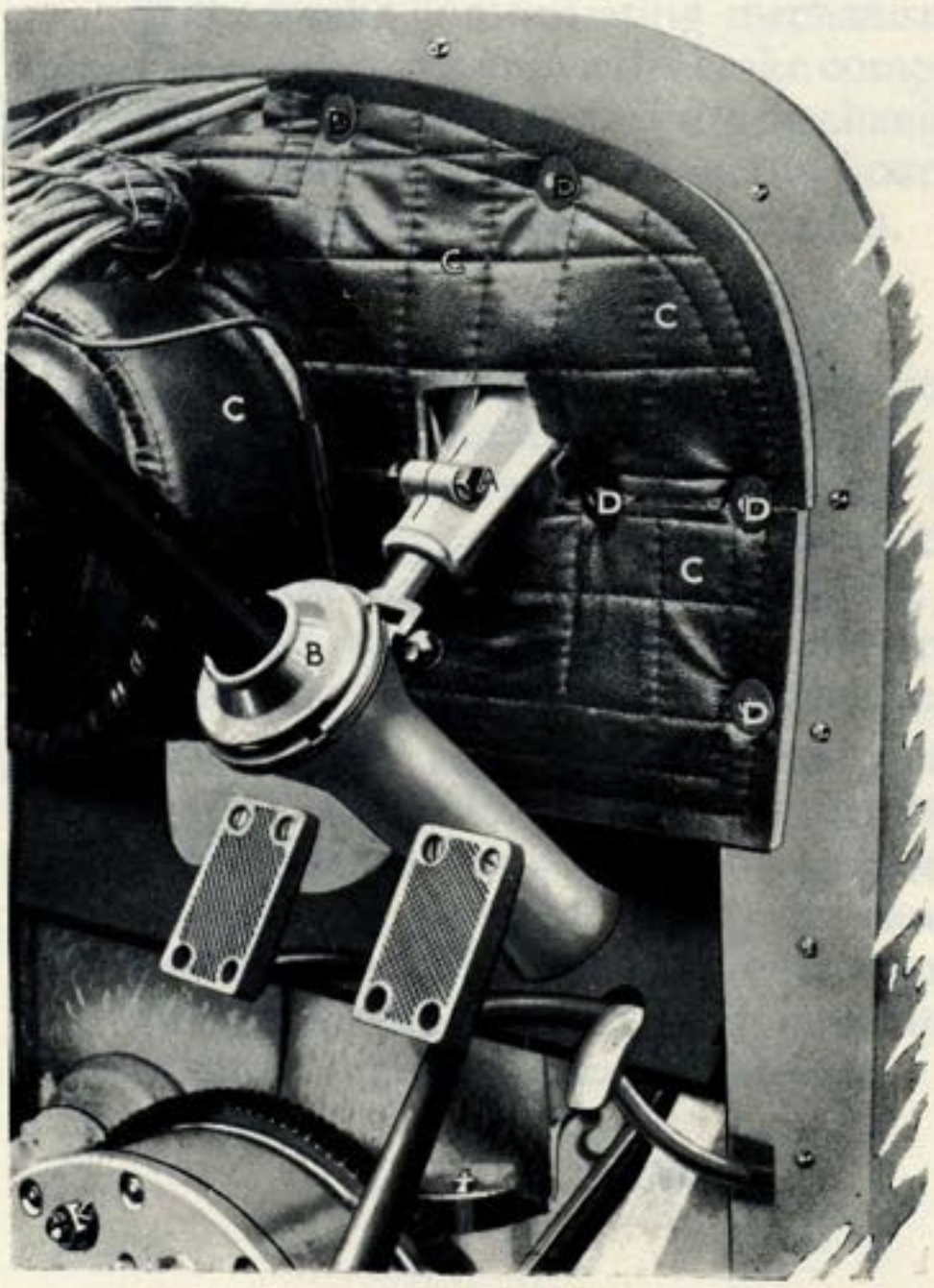


Fig. 29.

STEERING COLUMN AND OFFSIDE OF DASH.

Adjustable bracket (A) (this may never be adjusted except by a qualified Service representative). Steering column bearing (B). Dash-board insulator (C). Bolts securing insulator to dash (D).

(6) The instrument board must not be so low as to interfere with the driver's knees, making allowance for the operation of the clutch and brake pedals, and it should clear the steering column by at least three-eighths inch on either side, and allow steering column to be raised or lowered one inch.

(7) Great care must be taken that the floorboards do not touch the tubular cross member of the frame.

(8) Clearance must be allowed round all Tecalemit greasers, bearing in mind that the connection at the end of the grease gun has to *slide* over the hexagonal head of the greaser.

FRONT WHEEL BRAKES.

(9) The running boards when brought into the chassis frame should be cut away to allow for brake adjustment and the travel of the hand brake lever.

(10) It is essential that the floorboards should amply clear the brake compensating mechanism and allow this to move perfectly freely. Note that as the brakes wear the mechanism turns round and takes up a fresh position, and it is not sufficient to only allow clearance for the position of the brake compensating mechanism as it is when new. The floorboards above the brake compensating mechanism must be moveable so that the mechanism can be inspected, and when fixed in position the boards should clear the mechanism by at least quarter inch.

GENERAL NOTES.

(11) All floorboards throughout must be lined with felt, secured with flat aluminium strips and screws. The boards should be made of hardwood, close fitting and must be locked down securely so that at high speeds they do not blow up. The body must be so framed that the pedal boards can be removed when required, and the framing of the body must clear the gearbox so that it can be readily dismounted.

(12) The driver's seat should be cut away to allow for the change speed lever to take up the reverse position, consideration being given for a short driver. The front seats, when separate, must not touch, as this makes movement difficult, and the near front seat should be cut away at the side next to the door as much as is practicable, in order to facilitate entry and exit.

(13) Front seats should be well raked to provide support for occupants' legs, and the back of the seats should be raked and properly shaped to support back.

(14) The back seats should be as low as possible to give a comfortable seating position. Asbestos sheeting must be put between the board on which the rear cushion rests and the tail pipe, as the clearance between these is small.

(15) It is advisable that the body be panelled in aluminium.

(16) The floorboards must be made to clear the gear lever in all positions. This should be particularly watched in the case of the reverse position.

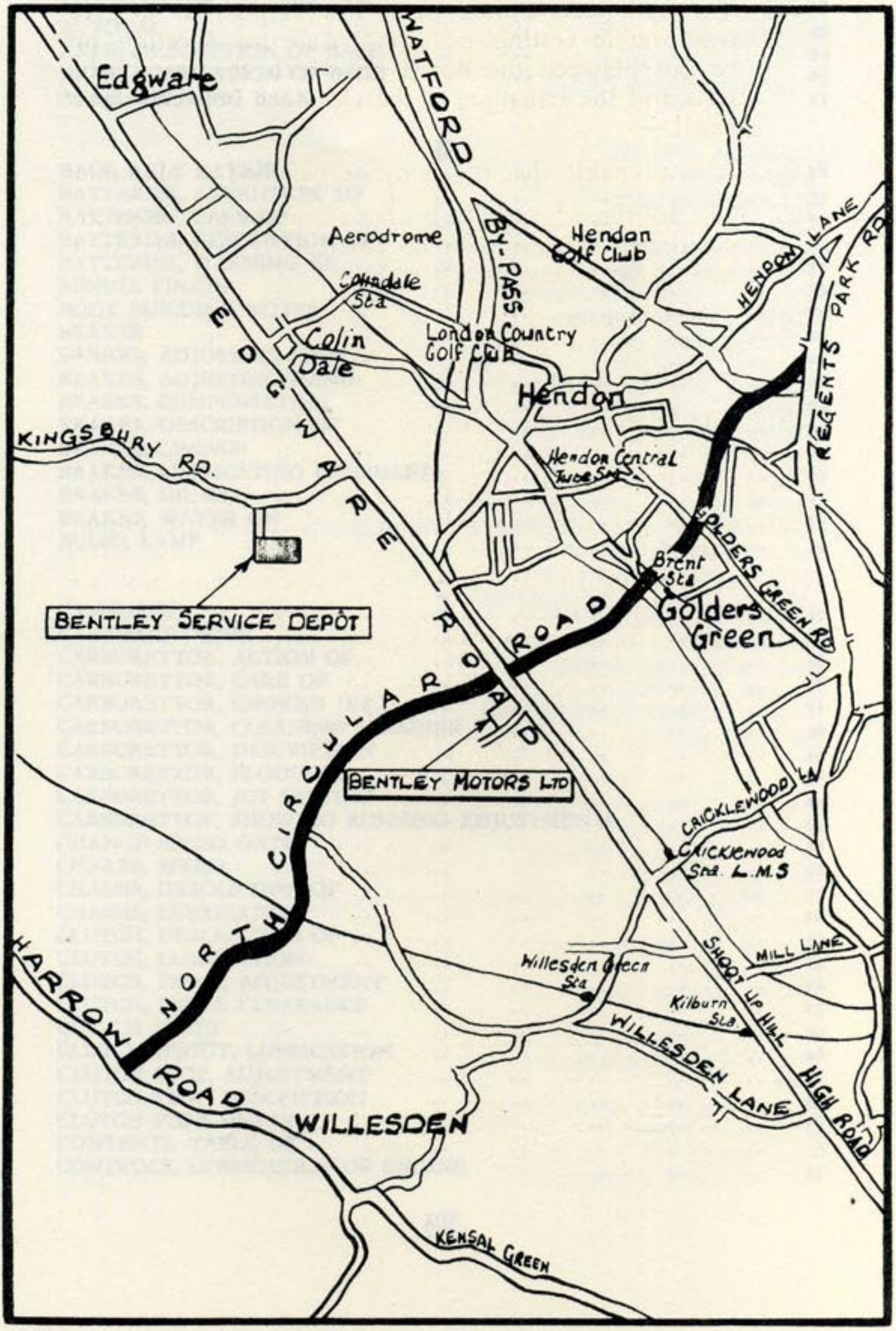
(17) The change speed gate should be covered before the body-work is commenced to avoid screws, wood, etc., getting into the gate and causing obstruction.

(18) The bonnet hinge, which is plated, must not be painted, and the hinge pin should be thoroughly cleaned and oiled after the bonnet has been painted.

(19) On no account may the rake of the steering column be altered, except by one of the Company's representatives, as in doing so the adjustment in the steering box is inevitably disturbed, and unless correctly re-adjusted the delicacy of the steering is interfered with.

SKETCH MAP SHOWING LOCATION OF SERVICE DEPARTMENT

Scale: 1 mile = 1 inch



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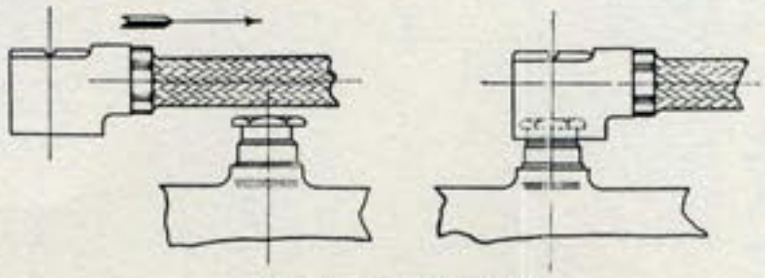
OILING DIAGRAM.



TECALEMIT GREASER

E—ENGINE OIL

T—TRANSMISSION OIL

GREASE

(SEE INSTRUCTIONS)

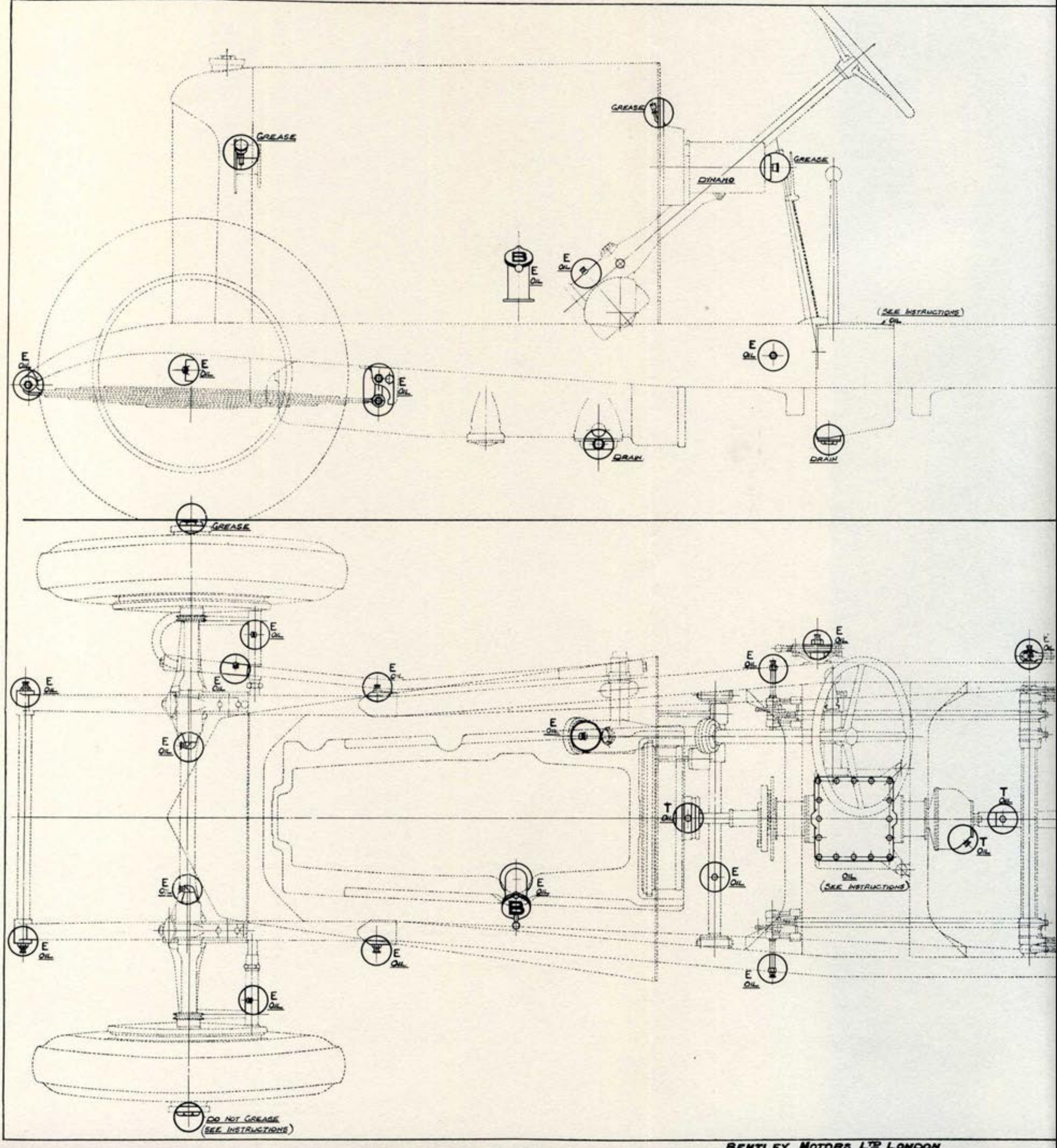
OIL

DRAIN

DO NOT GREASE

BENTLEY MOTORS LTD LONDON

OILING DIAGRAM



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used, two being fitted only for convenience. It is most important that this part should be lubricated only very sparingly and with transmission oil every 5,000 miles, not more frequently. Any excess of oil may find its way into the clutch housing, which will cause the clutch to slip.

FRONT AND REAR HUBS.

The front hubs are packed with grease at the Works and will run indefinitely without further lubrication. No grease may be put in the rear hubs, no lubrication being required.

GREASERS.

There is one greaser on the engine and two on the dynamo. The former is on the water pump to grease the pump spindle. This should be filled with heavy grease and given a turn about every 500 miles. The greasers on the dynamo are for greasing the armature spindle bearings. One is to be found on the engine side of the dash inside the bonnet, the other is mounted on the rear end of the dynamo. These should be packed with heavy grease and given a turn every 2,000 miles. Price's H.M.P. grease is the most suitable.

MAGNETOS.

The main bearings of the rotor are packed with grease and require no attention. The plain bearing on the distributor spindle should be lubricated with machine oil for which purpose a ball-valve oiler is fitted on top of the instrument. Give two drops every 1,000 miles or so; do not overlubricate. A spot of thin oil should be placed on the end of the contact breaker pivot pin about every 2,500 miles. Oil must not be allowed to get on the contact points. (*See Fig.* 18).

VIBRATION DAMPER.

The vibration damper is fitted at the front end of the crankshaft. It is filled with oil and only requires attention at very long intervals. If an owner requires to replenish this part the Service department should be communicated with and special oil will be supplied. It is important that only this special oil be used.

FAN.

No means are provided for lubricating the fan as this is packed with grease on assembly and no further attention is necessary for an indefinite period.