



Price 7/6 net.

INSTRUCTION MANUAL FOR THE WOLSELEY 16/45 H.P. SIX-CYLINDER CAR.



WOLSELEY MOTORS LIMITED

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INTRODUCTION.

This Manual has been compiled to provide owners of the Wolseley 16/45 h.p. car with the necessary information for the proper care and maintenance of the car.

The first part of this book contains all the necessary instructions for the ordinary running and driving of the car, while the Appendix deals with running adjustments and maintenance of the various component parts.

It has been assumed that the reader has some knowledge of the working and control of motor cars, but if he is a novice we should recommend him to obtain and study one of the excellent handbooks published by the motor press.

The owner of a "Wolseley" naturally desires to get the best out of his car, and to do this it is well worth while to spend a few minutes every week in giving the car the small amount of attention required.

The car is very carefully tested and adjusted before leaving the Works, and the owner will be well advised to avoid interference with the adjustment without good cause.

It is not advisable to drive the new car at high speeds on direct or indirect gears at first, for although the car has been thoroughly tested it takes some time for the moving parts to become properly bedded down. We suggest, therefore, that the car should not be driven at a speed of more than 30 miles per hour for the first 500 miles or so.

We have endeavoured, by the liberal use of illustrations, to make the instructions as simple and clear as possible; at the same time we realise that there may be occasions when the owner finds himself in some difficulty. We are always pleased to give such cases our special attention, and to reply as fully as possible to any queries our customers may raise.

WOLSELEY MOTORS LTD.

The clutch, brake, and accelerator pedals can be very easily adjusted both as to reach and height. The adjusting nuts are



SHOWING PEDAL ADJUSTMENT & ALSO BRAKE ADJUSTING NUT.

accessibly placed under the bonnet, and to make the adjustment it is only necessary to loosen the nut and slide the pedal in or out, or up or down, as required.

Starting the Engine.—First of all turn on the petrol. The petrol cock is under the "Autovac" on the pipe leading to the carburetter, and should be turned downwards to the "on" position.

Upon sitting in the driver's seat, a small knob will be seen on the instrument board within easy reach of the driver's left hand. This is the hand throttle control knob, and is for controlling the low running or idling speed of the engine. Set this knob with the pointer at about the third or fourth notch from the left. It may be observed here that the position may vary slightly with different cars, but once set it need seldom be altered, except perhaps for different climatic conditions, *e.g.*, the setting may require slight alteration for winter and summer running.

Pull out the carburetter jet control knob to the "starting from cold" position. The function performed by this knob is fully explained on page 50.

The ignition control lever is situated at the centre of the steering wheel. Set this at the retarded position as shown. The B.T.H. magneto is provided with an automatic timing device which is dealt with more fully on page 8.



SHOWING AUTOVAC, GREASE GUN ETC.

The next thing to do is to switch on the ignition by turning the switch lever to point to "M" on the switchboard.

Moving from Rest.—Depress the clutch pedal to its fullest extent and after waiting a few seconds, push the change speed lever to the left and forward into the first speed slot in the gate.



SHOWING PEDALS AND CHANGE SPEED LEVER.

The hand brake lever should now be released and the clutch gently engaged by raising the toes of the left foot while keeping the heel on the floorboard. At the same time the accelerator pedal should be gradually depressed with the right foot, to speed up the engine.

Second Speed.—When the car has gained some speed, say 5 to 6 miles per hour, the change to second gear should be made as follows:—

Depress the clutch pedal and at the same time release the pressure on the accelerator pedal. The change speed lever should then be pulled back into the opposite slot.

Note.—No force should be used in making this change. Let in the clutch gently and accelerate the engine as before.

Third and Top Gear.—The change from second to third and third to top speed should be made when a speed of about 10 miles per hour and 20 miles per hour respectively has been reached.

The same procedure should be followed as when changing from first to second, with the exception that the change speed lever must of course be moved into the slot in the gate corresponding to the gear required.

When moving from rest on a level road or slightly falling gradient it is permissible to start in second speed, in which case the instructions here given should be read accordingly.

Changing Down.—When changing down from top to third, third to second, or second to first speed, depress the clutch pedal, but in this case the accelerator pedal must be kept pressed down. The change speed lever should be moved into the neutral position, and the clutch pedal released. After pausing momentarily for the engine to gain speed, depress the clutch pedal again, move the change speed lever into the next lower speed, and release the clutch pedal.

It should perhaps be made clear that the hand control does not affect the range of the automatic device, but only extends the range of advance obtainable from the magneto. For example, if you are driving at 50 miles per hour the hand control should be advanced to correspond, but for speeds below 35 miles per hour the hand control should be in the retarded position.

Stopping the Car.—The car is fitted with four-wheel brakes which will bring the car to rest quickly in an emergency. For ordinary use they should be used with discretion. The brakes should never be applied so hard that the wheels are locked, because not only does this cause excessive wear of the tyres, but the braking capacity is considerably reduced.

To stop the car, decelerate, declutch and apply the brake gently. When the car has stopped, put the hand brake hard on, the change speed lever into neutral, release the clutch pedal and switch off the ignition.

Descending Steep Hills.—When approaching a very steep hill the car should be slowed down and a low gear engaged **before the descent is begun.** If the foot is then taken off the accelerator pedal and the clutch left in engagement the engine will act as the main brake, leaving the hand and foot brakes as additional braking power.

Electrical Equipment.—Having now discussed briefly the controls necessary for driving the car, we may draw attention to the electrical switchboard which is placed in the centre of the instrument board.

The switchboard contains all the parts necessary for controlling the various circuits. The cover is easily removable, being held in position under spring tension by the switch levers, which in turn are secured by their centre screws.

We will confine ourselves here to the operation of the switches and the function of the ammeter, referring the reader for a more detailed discussion of the electrical equipment to appendix ii.

Switches.-Both switches have three positions.

THE LEFT HAND SWITCH :---

- (1) "Off "-Dynamo and magneto off.
- (2) "M."—Magneto switched on; from which position the engine can be started.—The dynamo, however, is still switched off.
- (3) "D."-Dynamo charging and magneto on.

Luggage Grille.—The carrying capacity of the luggage grille is 80 lbs. This weight should not be exceeded, as the effect of excessive overhanging load is to set up severe strain on the rear end of the chassis.

When opening the grille the butterfly nut should be screwed back to its utmost limit to clear the recess in the grille frame.





ABOVE.-GRILLE FULLY OPEN.

TOP RIGHT.—GRILLE HALF OPEN, SUITABLE FOR SMALL CASE.

BOTTOM RIGHT .- GRILLE CLOSED.



Side Curtains.—These are of the rigid type and may be erected to form side screens for the protection of the front and rear passengers, whether the hood is raised or not.

When the hood is down, the rear curtains are placed in a slightly angular position to clear the hood sticks. This position can also be used when the hood is up, for ventilation, if desired.

When the side curtains are not in use they should be packed away behind the rear seat squab. Linen sheets are provided to protect the celluloid against scratching, and one of these sheets should be alternated between each two curtains when packing.

Ordinary liquid metal polish will be found very effective in removing from the celluloid panels light scratches or places dulled by friction. **Raising and Lowering the Hood.**—The photographs illustrate clearly the procedure to be adopted when raising the hood, but special attention is drawn to the following points :—

If none of the side curtains are in position on the car no special precautions are necessary and the hood can be raised or lowered with the greatest ease.

On the other hand, if the curtains are erected, it is necessary for the rear curtains to be removed when raising or lowering the hood, and in addition when raising the hood all the doors should be opened so that the curtains are entirely clear of the hood.

The method of lowering the hood is to unscrew from the screen and, standing on the offside of the car, push up the front hood stick. The hood will then automatically close, but it should be let down carefully and not allowed to fall with a bang. Straighten out the folds neatly and strap down securely to prevent chafing, afterwards fitting the hood cover.



METHOD OF STRAPPING DOWN THE HOOD.

frequently (say every 200 miles) in order to maintain it at the level of the upper mark on the dip rod.

The discerning owner will soon become familiar with the approximate consumption of oil and he may then with advantage, instead of filling up when the oil gets low, entirely drain off the old oil when the level falls to the lower mark on the dip rod and then fill up to the proper level with fresh oil. 1¹/₄ gallons will be required for this purpose. After doing this the strainer should also be filled up with oil.

The adoption of this procedure will prevent the continuous circulation throughout the engine of attenuated oil containing abraded metal particles and carbon which gather in suspension, and will reduce the wear of the moving parts to the minimum.

The oil drain plug on the side of the crankcase is specially made to fit the handle of the jack, so that draining the oil is a very easy matter.



REMOVING OIL DRAIN PLUG FROM CRANKCASE.

When the new car has run about 500 miles the crankcase should be drained and then replenished with fresh oil, as with a new engine the oil becomes dirty somewhat more quickly than afterwards, due to the bedding down of the working parts.

While on the subject of engine lubrication, mention should be made of the oil strainer. This is on the opposite side of the engine to the oil filler. All the oil in the engine passes through the strainer on its way to the pump and in the interior of the removable gauze all foreign matter is trapped. In the oil hole in the cylinder head leading to the camshaft bearings is a small rod to restrict the oil supply, which should be withdrawn and cleaned about every 1,000 miles.

Oil Pressure Gauge.—The oil pressure gauge will enable the owner to detect any irregularity in the engine oil supply.

Loss of pressure may be due to lack of oil in the crankcase sump, a choked strainer, or a leaking union, or possibly the strainer cover is not making an air-tight joint. There is one other possible cause of loss of pressure, but the chance of this arising is extremely remote. This is the sticking up of the oil relief valve (illustrated on p. 16). If this is in default it should be taken out and cleaned.

Excessive pressure may be caused by obstruction in the delivery pipes or oil-ways of the engine. If such is the case they should be cleaned out with paraffin.

The Grease Gun.—Grease gun connections are fitted to all those parts of the chassis which require grease lubrication. These connections are all very accessible and it only takes a few minutes to replenish them.

The question will arise in the mind of the owner. How often is replenishment necessary? The answer to this depends largely upon the use made of the car. If the car is taken out every day it will obviously require more attention than if it is only used at longer intervals.

The owner who uses his car every day should make a practice of greasing up every week, while those who use their cars less frequently will not find it necessary to do this so often.

The best advice we can offer is to add a little often ; the grease will then always be fresh and clean and will go in easily, while if the job is neglected, not only will serious wear take place, but it will be found much harder to force in the new grease.

About one turn of the gun at a time is sufficient, although at the spring shackles it is a good plan to force in the grease until all the dirty grease exudes from the ends, when it can be wiped off.



GREASING THE CHASSIS WITH THE GREASE GUN.

Gear Box and Rear Axle.—The gear box and rear axle are lubricated with Wolseley Filtrate Gear Oil. As both these components are fitted with oil retainers there is little possibility of any leakage of oil and they therefore do not require replenishment at frequent intervals.

It is advisable, when the car is delivered, to inspect the oil level to make certain that it is up to the top of the filler hole in both the gear box and rear axle, and to make it up if necessary.

After this the car can be run about a thousand miles without any further attention to this being necessary.

When the car has run this distance you should drain off the oil by removing the respective plugs from underneath and swill out the casings with paraffin, afterwards filling up to the top of the filler holes with fresh oil. The best time to drain off the oil is immediately after a run, when the oil is warm and will flow more easily. Repeat this procedure at intervals of two thousand miles.

Car Springs.—The springs are protected by leather gaiters. These are fitted with oil gun connections and lubricant should be injected as necessary, say every two or three thousand miles, with the special syringe supplied with the tool kit. Use a thin oil— **Wolseley Disc Clutch Oil** is eminently suitable.

RADIATOR AND COOLING SYSTEM.

The water in the radiator will not normally evaporate very quickly, but it should be added to as found necessary.

It is important that the radiator should be filled only with clean rain water which has previously been thoroughly strained. Do not use hard water under any circumstances, as the use of such water results in a deposit of lime or magnesia, which reduces the efficiency of the cooling system.

While the engine is warming up, after filling the radiator with cold water, a certain amount of water will run down the overflow pipe, owing to the expansion of the water on being heated, but this overflow will cease as soon as the engine reaches its normal working temperature.

Flushing out System.—It is advisable, about every six months, to flush out the cooling system. This should be done when the engine is warm. Drain off the water by turning on the cock on

TYRES.

The tyres are such an important item in the upkeep of a car that they should receive very careful attention, in order that the best service shall be secured from them. In the first place, it is very necessary to see that all tyres are fully inflated to the correct pressure. The following are the tyre maker's pressures for our 16/45-h.p. cars, which are fitted with Dunlop Tyres 4_{4}^{3} in. section for 21in. rims.

	Open Cars	Closed Cars	
Front	34tb. per sq. in.	351b. per sq. in.	
Rear	431b. per sq. in.	451b. per sq. in.	

To Remove Tyre.—First completely deflate by removing all valve parts, and push the tyre edges into the base of rim at part



You cannot pull the tyre edge at "A" over the rim edge until the tyre edge at "B" is pushel off the rim shoulder "C" down into the well "D," then tyre edge at "A" comes over the rim easily.

Remember the tyre edges are inextensible—force will only damage the tyre and cannot stretch the edge. diametrically opposite valve, then lift the cover edges near the valve over the rim edge. The small lever which is supplied with the car may be used, but it 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.

To Fit Tyre.-Push one edge of the cover over the edge of the rim It will go quite easily if you see 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 cover, with valve through hole (Take care that valve, in rim. which is fitted on side of tube, is on right side of 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.

The small lever may be used for the last few inches but it is not essential. On no account use large levers. Force is unnecessary and may damage the cover edges. For cleaning nickel-plating the best silver polish should be used, ordinary metal polish being too abrasive.

Do not attempt to polish the lamp reflectors with metal polish. If it becomes necessary to clean them, use rouge and chamois leather with care, as the highly-polished surface is easily damaged.

Use only soap and water for cleaning hoods, and ordinary liquid metal polish for celluloid lights.

Hints for Cars in Regular Service.—The following hints may be found useful where a car is in regular service, assuming a daily run of about 100 miles—

Daily. Fill up fuel tank.

Fill up radiator if necessary.

Check oil level in crankcase with dip stick.

- Weekly. Lubricate the chassis parts with the grease gun and oil can.
 - Oil bonnet hinges, bonnet catches, door locks and hinges, and hood joints.

Test compressions.

Monthly.

Lubricate magneto. (See page 20.)

Remove and clean oil and petrol strainers.

Examine front hub to see if adjustment of bearings is required.

Examine and clean magneto contact breaker.

Remove wheels and clean and oil brake joints.

Lubricate the hubs with "Wolseley" Filtrate Solidified Oil.

Check level of oil in gear-box and rear axle.

Drain off engine oil and replenish with fresh supply.

Adjust tappets if necessary.

APPENDIX.

The following portion of the book deals more in detail with the necessary running adjustments and maintenance of the various component parts of the car.

INSTITUTE

Foot Brake Adjustment.—The normal adjustment is made by the hand nut which is connected to the pedal and is easily accessible upon lifting the bonnet (see illustration, page 5). This adjusts all four foot brakes at the same time. When all the available adjustment there has been utilised, turn back the hand nut and take up whatever is necessary to bring the brakes into correct adjustment with the individual adjusting nuts at the ends of the cables near each wheel. This should be done by turning the four nuts the same amount each. The hand nut on the pedal will now become available for further adjustment. Always adjust the brakes with the front wheels in the "straight ahead" position.

If you desire at any time to check the foot brakes for balance, jack up both axles and rest them on blocks. Obtain the assistance of another person to depress the pedal and try to turn each wheel while the pressure is maintained. If they all show equal resistance to motion they are in balance, but if one can be turned while the others can not, it will be necessary to adjust it separately by means of its own adjusting nut.

It may so happen that both wheels on the one side are out of balance with those on the opposite side, owing to the fact that the front and rear foot brakes on each side of the car are operated by one piece of cable which extends from one end of the car to the other, and if so they should be adjusted accordingly.



Showing Adjustment Nuts for the Hand Brakes and the Adjustment Nuts for Equalising or Balancing the Rear Foot Brakes.

engine (except when at the top and bottom). No useful purpose will be served by turning the bush the other way, and if this is done the oil supply to the cam will be stopped.



The clearance should be checked occasionally with the feeler gauge provided in the kit. The gauge is .003in. (three thousandths of an inch) thick and should just slide through between the rocker and the top of the valve stem when the engine is cold.

When checking the valve clearance the peak of the cam operating that particular valve should be vertically upwards.

If the clearance is too great the tappets will be noisy, while if it is insufficient the valve cannot close. The engine should be turned by hand when it is hot, two or three times a week, to check compressions; if these are unequal perhaps one or more of the tappets are too close, in which case there will be a serious loss of power in the engine and, in the case of the exhaust valves especially, the head of the valve will rapidly burn away.

To adjust the tappets, loosen the lock nut, turn the bush until the clearance is correct, and tighten up the lock nut, afterwards checking the clearance again.

A thin copper washer is placed under the lock nut to prevent the nut working loose.

Sparking Plugs.—The sparking plugs should be taken out and cleaned by washing with petrol about every three or four thousand miles, and the gap between the electrodes checked and re-adjusted if necessary. The gap should be between $\cdot 015$ in. and $\cdot 018$ in.

One of the most apparent effects of fouled sparking plugs is difficult starting.

Magneto.—The contact breaker cover should be removed from time to time to see if the contact points are clean and free from oil, and also to check the distance between the points when separated by the action of the cam. to be adopted with these is to unscrew them as far as possible and then lift the head until it reaches the nuts. If the head is then packed up temporarily the nuts can be unscrewed right off the studs.

The head may be stuck down firmly, but it can be easily loosened by smartly rapping in two or three places with a mallet, or a hammer with a piece of wood interposed.

Take care not to damage the copper-asbestos jointing washer when lifting the head.

The surface of the combustion chamber and the top of the pistons, and the joint faces of the cylinder and head, must be thoroughly scraped and cleaned. Do not use a file for this purpose. While the cylinder head is off, examine the valves and seats. If these exhibit a pitted surface they should be ground in, according to the instructions on page 39.

Replacing the Cylinder Head.—If the old joint has not been damaged it may be used again, but it is advisable to have a new one ready in case of accident. Dress the joint on both sides with gold-size or par-boiled linseed oil and replace it carefully on the studs. Then put on the cylinder head and fasten down evenly by tightening each nut a little at a time, not forgetting to put on the nuts which were removed with the head partly lifted, before fastening down. Screw on all nuts finger tight and then finally tighten down in the sequence indicated in the illustration of the top of the cylinder head.



ORDER OF TIGHTENING CYLINDER HEAD NUTS.

The alignment of the vertical shaft should be checked during and after tightening down the cylinder head, as although two of the studs are dowel studs, careless or irregular tightening of the nuts may slightly distort the head and upset the alignment. Try for alignment of the vertical shaft (with the wide slots in the two portions of the shaft opposite) by sliding up the coupling to connect the top portion of the shaft. If the coupling slides up easily the shafts are in line, but if not it will be necessary to loosen the nuts again and tighten them more carefully. Repeated tightening of the nuts is necessary to ensure a perfect joint. The correct timing of the valves depends solely on the form of the cam and the relation of the gear wheels, and cannot be altered by the owner to any advantage.

Valve Grinding.—Should the valves require grinding in, this operation should be carried out as follows :—

Remove the cylinder head (see page 36). Remove the cam shaft, when the rockers can be swung out of the way. Release the valve springs by removing the cotters from above the spring cups and lift out the valves. The valves should then be smeared with a suitable grinding paste and ground to their seats by means of a screwdriver or brace and bit. When "grinding-in" only slight pressure is necessary. A suitable paste is put up in convenient tins, which we can supply to order.

While "grinding-in" the valve should be frequently lifted and moved round at the same time, so that the seating may be ground quite true all over. A light spring under the valve head will be found to be of some assistance.

After this operation the valves and seats must be thoroughly cleaned with a material which does not leave fluff. Do not swill with petrol or paraffin, as it is liable to wash the grinding material into the working parts.

In the event of a new valve being fitted, it will, of course, be necessary to grind it to its seat.

After grinding the valves the tappet clearance will require adjustment.

Valve Timing Gear.—The valve timing gear is designed to permit of easy dismantling without disturbing other parts. The method of disconnecting the vertical shaft for the removal of the cylinder head has been described on page 36.

If it is desired to remove the gear case, which contains the drive



DYNAMO AND MAGNETO DRIVE.

for the dynamo and magneto, proceed as follows :---

Remove the dynamo and magneto from their respective mountings. (Do not remove the dynamo cradle or difficulty may be experienced in obtaining the correct alignment again.) Loosen the clip and teleParticular care must be taken when reassembling the timing gear to see that all packing shims are replaced in their correct positions.

Fan Belt Adjustment.—To adjust the fan belt, loosen the clamping nut and turn the projecting part of the fan spindle until the belt is just tight. The belt should not be adjusted too tightly, or excessive load will be put on the bearings. It should be possible to turn the fan by hand when the belt is correctly adjusted.

Clutch.—The clutch is of the single dry plate type, having a light steel driven member which is gripped between two fabric facings. (See illustration on next page).

The clutch itself does not require any lubrication, and no attempt should be made to put oil or grease on the clutch facings. A grease gun connection is provided for the thrust bearing. This connection projects through the cover of the clutch and flywheel housing and is therefore very accessible after lifting the front floorboard. Do not force in an excessive amount of grease—add a little often. One complete turn of the grease gun is sufficient for 1,000 miles.

The fulcrum pins of the three clutch operating levers should be oiled about every 1,000 miles, as if these become dry or rusty they are liable to stick and cause the clutch to slip. A few spots of oil on the felt washers, allowed to soak in, will be sufficient.

Oil holes are provided in the clutch pedal bearings, access to which is obtained by removing the cover from the flywheel housing.

Important.—The adjustment of the three clutch operating levers (A) with relation to the bearing housing (B) should be checked from time to time; more frequently when the car is new. Lack of attention at this point will cause the clutch to slip and the fabric will then be rapidly worn away.

The clearance (C) between the ends of the levers and the face of the bearing housing gradually becomes less as the clutch fabric wears away and it is very important to see that the clearance referred to is never allowed to become less than 1/32 inch.

To check the clearance, insert a gauge between the tips of the levers and the face of the bearing housing (" C " in the illustration). Any clean piece of strip metal will do for a gauge of a thickness not less than 1/32 inch or more than 1/16 inch.

If the clearance is less than 1/32 inch the three clutch operating levers (A) must be adjusted by means of the screws (D), which should be screwed outwards after loosening the lock nuts (E).

The nuts on the universal joint spiders should be tested periodically for possible slackness.

Rear Axle.—The rear axle drive is by spiral bevel gear. All the driving gears and bearings in the middle of the axle are lubricated by the oil in the centre casing.

Timken adjustable taper roller bearings are fitted throughout the rear axle, but adjustment of these should not be required for many thousands of miles, and when such adjustment becomes necessary it should be done by a competent repairer

The bearings "A" of the pinion are adjusted by means of the nut "B," which is normally held fast by the lock nut "C."

The bearings "D" of the crown wheel and differential gear are adjusted with the slotted nuts "E." Access to these is obtained by removal of the rear cover of the axle. Great care must be taken that the endwise location of the crown wheel with relation to the pinion is not upset by unequal adjustment, or else the gears will become very noisy through being forced too far into, or out of, mesh. The correct amount of backlash between the teeth of the gears is between four and five thousandths of an inch.

It is essential when adjusting Timken bearings **not to leave** the bearings too tight, or when the temperature of the parts rises during running the bearings may be damaged.

Rear Wheel Bearings.—It will be observed from the illustration that the rear wheel bearings "G" are not lubricated by the oil from the centre of the axle owing to the interposition of an oil retaining device "H." The method of lubrication is by **Wolseley Filtrate Solidified Oil**, which is applied by filling the hub cap and screwing it on. The grease passes along a channel as shown and thus reaches the bearings.

Do not force in an excessive amount of grease or some may escape and get on the brakes. The hub cap should be emptied of grease finally to allow room for the expansion of the remainder.

The bearings are adjusted with the nut "K," which is normally locked by the washer "L," secured by the bolt "M." It is necessary to remove the hub before adjustment can be made. A hub withdrawer can be supplied to order.

Front Axle.—The front axle is a steel drop forging, carrying the swivel pins in bronze bearings, with ball thrust bearings to take the weight of the car. These bearings are lubricated with the grease gun and a film of lubricant should always appear outside the swivel pin bearings. End play in the steering column may be eliminated by loosening the locking bolt "A" and screwing up the bearing "B" (see illustration on page 49). Do not screw this up too tight but just enough to take out the end play and yet leave the steering column free to rotate easily. This should be tested with the front wheels jacked up clear of the ground. After adjustment, tighten up the locking bolt again but do not overstrain this or it will cause the steering to become stiff.

Backlash in the steering gear-that is, movement of the steering wheel without a corresponding movement of the front wheelsmay be brought about by two things, of which wear in the worm and wheel is one, and wear in the various joints of the steering links the other. The latter will not cause any trouble until the ball joints are worn out as they are spring loaded and the springs will keep the ball cups up to their work. If any looseness of these joints ultimately develops, the balls and cups should be renewed. Backlash in the teeth of the worm and wheel may be detected by careful rotational oscillation of the steering wheel. If the movement of the steering wheel is excessive, before the steering lever "C" begins to move, it may be necessary to bring into use a new set of teeth of the steering worm. It should be explained that in the ordinary way slightly less than one third of the teeth of the worm wheel are being used and there are, therefore, more than two thirds of the teeth left without wear. Before going any. further, however, first see if there is any appreciable end movement of the worm wheel shaft "D." (This can be seen when the steering wheel is turned backwards and forwards.) If so, this should be eliminated by adjustment of the thrust screw "F." Do not make this very tight or the steering will be stiff.

If the backlash is still excessive a new third of the worm wheel may be brought into use as follows :—

Take out the centre screw "G," loosen the clamping bolt "H," and withdraw the steering lever "C" from the shaft. Turn the steering wheel three complete turns and then replace the steering lever. The backlash will now, in all probability, be about half an inch at the rim of the steering wheel, which is the correct amount. If it is more than this it may be reduced by adjustment of the eccentric sleeve "J," which carries the worm wheel shaft, in the following manner :—

Take out the screw "K" and by turning the sleeve "J" the worm wheel can be made to enter more deeply into mesh with the worm until all excessive backlash is eliminated. It may not be possible to replace the screw "K" in the same hole from which it was taken, but three holes are provided to give a fine adjustment and the most convenient one should be used.



10-1

SECTIONAL VIEW OF STEERING COLUMN.

49



SECTIONAL VIEW OF CARBURETTER.

in the correct order (refer to the diagram of the jet parts). When the jet has been refitted into the carburetter, make sure that the piston is perfectly free, if it is not, slacken off the large nut and re-tighten. It may be necessary to do this several times before the piston is free.

(3) Float Chamber Flooding.—This can be seen by the fuel flowing over the float chamber and dripping from the air inlet, and is generally caused by grit between the float chamber needle and its seating. To remedy this, turn off the fuel, remove the float chamber lid and carefully clean out the chamber, paying special attention to the needle seat. After replacing the lid turn on the fuel and twist the needle round a few times on its seating. Do not grind the needle or its seating.

Other causes of erratic running are as follows-

Plug Points—being too far apart, causing misfiring and popping in the carburetter when the engine is at full throttle, pulling hard on hills, also difficult starting from cold.

Oily Plugs—causing bad starting and misfiring.

Sticky Valves or Faulty Tappet Adjustment—causing misfiring and popping in exhaust and through carburetter.

Bad Joint-between the carburetter and the engine.

Worn Inlet Valves or Guides—causing bad starting and engine will not idle well.

Blockage or Air Lock in Petrol Pipe.—causing carburetter to give symptoms of weak mixture, *i.e.*, lack of power and popping back through air inlet. This can be tested by removing float chamber lid and float from carburetter to see if there is free flow through the fuel passage in the bottom of the float chamber. If air bubbles come through an air lock is the trouble and it is generally due to shortage of fuel in the tank.

Adjustment for Idling.—The correct needle is fitted before the car leaves the Works ; the only adjustment is the setting for idling.

No adjustment should be attempted before the engine has attained its normal running temperature.

Adjust in the following manner—First screw up as far as possible the jet adjusting screw which will be found at the base of the jet and push in the jet control knob. In this position the mixture will probably be found to be too weak. It should be enriched gradually by pulling out the jet control knob on the dash until the correct idling mixture has been obtained. The jet adjusting screw should then be unscrewed until the base of this nut comes into contact with the jet head. The "Autovac" should require no attention other than flushing with clean fuel every two or three months, and keeping all the connections tight.

To flush out, first open the drain-cock (this opens in an upward direction); if no fuel runs out, the cock may be stopped up by sediment, but can be cleared with a piece of wire.

Unscrew the nut Y on the top of the "Autovac" which holds the clamp in position, remove the clamp and take out the fuel supply connection Z, after first disconnecting the pipe. This connection, being a push fit, can be readily removed by tapping gently and twisting round in any direction.

On removing the elbow (see Fig. 2, page 56) the filter will be exposed. Remove this and clean. Then thoroughly wash out the tank with clean fuel through the hole normally covered by the filter. Replace the filter and elbow, pushing the latter well down to ensure an airtight joint, and then replace the clamp, seeing that it bears evenly on all three joints. Do not overtighten the retaining nut.

Hints with regard to failure or irregularity of the "Autovac." —Should any trouble be experienced, it will most probably be of such a nature that it can be rectified very easily if the following hints are studied :—

"Autovac" fails to operate after the car has been standing idle for some length of time (say two or three weeks.)—Fill the carburetter float chamber with fuel and start the engine. By the time this fuel is used up, the "Autovac" will have started to operate normally.

"Autovac" fails to deliver fuel or the delivery is irregular.— Remove the carburetter float chamber cover and, if no flow of fuel is visible—

- (1) Ascertain if the main tank contains any fuel.
- (2) See that the fuel tap between the "Autovac" and the carburetter is turned on.
- (3) Make sure that the vent in the main tank at the rear is free, also the vent on the "Autovac." (This is important.)
- (4) See that all connections are airtight, especially those on the pipe running from the top of the "Autovac" to the induction pipe.
- (5) Give the "Autovac" a few light blows with the clenched fist in order to dislodge any grit which may be holding the drop valve off its seating. Do not use any violence, however.

- (6) Inspect the filter on the main fuel supply elbow.
- (7) Disconnect the pipe from the base of the "Autovac" to the carburetter and see that it is not stopped up.

Put the throttle in the **closed** position and turn the engine a few revolutions with the starter.

If the desired effect is not now obtained, either the main fuel pipe is stopped up or there is some failure of the internal mechanism. The second of these occurrences will necessitate opening the "Autovac" (see paragraph "Dismantling the 'Autovac'").

It is easy to ascertain if the main supply pipe is stopped up by disconnecting from the "Autovac" and blowing down it.

Fuel is drawn into the Induction Pipe.

The symptoms are that black smoke issues from the exhaust pipe, engine chokes and stops, and fuel pours from the carburetter air inlet.

This is very unlikely to occur and can only be caused by one of the three following reasons—

- Vent on top of the "Autovac" is completely stopped up. Clear the vent and completely drain the "Autovac" before restarting the engine.
- (2) Interior mechanism is sticking or defective, and is not allowing the vacuum valve to close. This will necessitate opening the tank.
- (3) Float fuel logged.

If the car is stranded, however, a temporary expedient is as follows :—

Disconnect the fuel pipe to the main tank and proceed until the "Autovac" runs dry; recouple the pipe until the "Autovac" fills, disconnect again, and continue thus until garage is reached.

Do not put pressure in the main tank. If the main tank air vent becomes restricted or choked, the suction of the engine will cave in the walls of the tank.

Dismantling the "Autovac."

- (1) Disconnect both of the pipes running to the top of the "Autovac."
- (2) Unscrew the small holding down screws and remove the top, gently prising it off with a blunt knife or screwdriver, and taking care not to break the cork gasket or jointing ring.

II.-Electrical Equipment.

MAGNETO.

Maintenance in Service.—Owners are recommended to examine the magneto periodically (say every 4,000 to 5,000 miles) and to carry out the following instructions. A little attention of this kind will ensure that the magneto is always rendering the best possible service.

(1) Lubrication.—Do not lubricate the magneto too frequently (see page 20). The platinum points of the contact breaker must be kept absolutely free from oil. This is of the utmost importance, because any oil on the contacts becomes oxidised and prevents good electrical contact between the platinum points when closed. The current from the magneto may be reduced considerably from this cause and may cause misfiring.

(2) Distributor and Brush Holder.—Remove the distributor and clean the inside of it with a cloth moistened with petrol. Any dust or foreign matter that may accumulate inside the distributor is liable to cause leakage, the symptoms of which are misfiring and poor starting.

In a similar manner wipe the surface of the brush holder, particularly between the safety gap electrodes.

(3) Slip-Ring and Collector Brush Holder.—Remove the aluminium dust cover at the driving end of the magneto and take out the collector brush holder, which is secured to the top of the main housing by two screws and, with a cloth dipped in petrol, wipe off any dust from the cone of the collector brush holder. Do not unnecessarily remove the carbon brush from the collector moulding.

Clean the flanges of the slip-ring in a similar manner. This can be done by **lightly** pressing one corner of the cloth between the slip-ring flanges and slowly turning the engine crankshaft.

. 2

(4) **Contact Breaker.**—The contact breaker is readily accessible by removing the cover and can be withdrawn from the magneto after unscrewing the centre fixing screw.

Examine the contacts, and if these are dirty the surface of each contact should be cleaned with a piece of very fine emery cloth or paper, care being taken to remove any emery dust with a cloth. in line with the mark on the flywheel housing, on the stroke when both valves of No. 1 cylinder are closed (*i.e.*, compression stroke).

The spindle of the magneto should be rotated, with the timing lever in the fully retarded position, until the distributor electrode is opposite No. 1 segment on the distributor and the contacts are just opening.

It should be noted that the direction of rotation of the magneto spindle is clockwise, looking on the driving end (as indicated by the arrow), and that the distributor electrode, when viewed from the distributor end, also rotates in a clockwise direction.



MAGNETO SETTING

FLYWHEEL MARKS.

E.-Distributor Electrode.

TIMING THE MAGNETO TO THE ENGINE.

Both the engine and magneto are now in the firing position for fully retarded ignition and the magneto coupling should be connected and the magneto strapped down.

The coupling is of the vernier type and a fine setting can be made by adjusting the rubber centre piece until the projections on each side are in line with the recesses in the two halves of the coupling.

After connecting, the setting should be checked to ensure that no movement has taken place.

The cables to the sparking plugs should be connected as shown on the diagram on page 63.



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The cut-out does not switch off the dynamo when the battery is fully charged, and no such automatic device is provided.

Fuse.—Only one fuse is provided; it prevents damage being done in the case of accidental short circuits. If the ammeter behaves irregularly inspect the fuse.

Occasionally examine the switchbox in order to ascertain that the fuse is held tightly in its position in the holder. A loose fuse in its holder, or a loose fuse clip will cause intermittent or no output from the dynamo.

If it becomes necessary to replace the fuse wire, it is essential that it is pushed down the fuse clip as far as possible, as otherwise it may not be gripped tightly when replaced in position. A carton of spare fuse wire cut to the correct length will be found above the left-hand switch.

Should it be found that the fuse is continually blowing, do not add two or three strands to prevent this occurring, but have the equipment thoroughly overhauled to find out the cause.

Battery.—It is absolutely essential, for the efficient working of the electrical equipment, that the battery is kept in good condition. The care of the battery may be summed up in the following rules :—

- (1) Add nothing but pure distilled water to the cells, and do this often enough to keep the plates always covered.
- (2) Take frequent specific gravity readings with the hydrometer (see below).
- (3) Give the battery a special charge whenever the gravity readings are below 1.150.
- (4) Keep the battery clean, and the filling plugs and connections tight.

Adding Water.—The electrolyte consists of pure sulphuric acid diluted to the correct specific gravity with pure distilled water. The water evaporates from the electrolyte, and it is necessary therefore to add water from time to time to make up the level to ‡in. above the top of the plates. This should be done once a month, because if the plates are exposed for any length of time they may be very seriously damaged.

The cells need replenishing with water more frequently in the summer than in winter.

Testing the Specific Gravity.—The specific gravity of the electrolyte is ascertained by means of a hydrometer of the syringe type. To use this instrument enough electrolyte is drawn up

the ignition, you turn the engine a few times with the starting handle, which will be found secured in clips on the dashboard. The reason for this is that in cold weather the oil on the pistons becomes stiff, and if the electric starter is used before the preliminary turning by hand, a great strain is put upon the battery in overcoming the initial stiffness of the engine. No great effort need be expended in doing this as it is not necessary to turn the engine quickly; it is sufficient to engage the starting handle at the bottom and pull up two or three times. Lady drivers will not usually find this is beyond their capacity.

Batteries Shipped Abroad.—On cars despatched abroad, the battery is sent dry and uncharged, and before being put into service the cells must be filled with electrolyte and given a long charge. The results obtained from the battery depend largely upon this initial charge, and it is therefore necessary that the following instructions are carried out in detail—

(1) Remove the filling plugs and fill the cells to about §in. above the top edge of the plates with pure brimstone sulphuric acid which has been previously diluted with pure distilled water to the specific gravity of 1.225 at 60 deg. F. (1.215 in tropical climates).

The proportion is roughly one part of acid to four parts of water by volume.

It is important in mixing to pour the water into the vessel first, adding the acid slowly and stirring thoroughly to assist diffusion. A mixing vessel made of glass, glazed earthenware or lead should be employed, and a glass rod used for stirring the solution.

The mixture must be allowed to cool to approximately atmospheric temperature before use (should not exceed 90 deg. F. as a maximum).

After filling, the battery may, with advantage, be allowed to stand for a period not exceeding 12 hours before charging.

It is not essential, however, to soak the plates in this way, and no harm will result if the battery is put on charge immediately after being filled with acid, provided that the temperature does not rise above 100° F. In tropical climates the temperature of cells can be kept down by lowering the charging rate by 25 per cent., and allowing a period of rest after 12 hours' charging.

No dry or uncharged accumulator should be filled with acid solution unless the charge be commenced within the period of time indicated above. three notches, and then move the lamp on its adjustable mounting until the best illumination is obtained.

The front rim of the lamp is secured by means of a bayonet fixing, and to remove, hold the sides of the lamp with the fingers, press the rim evenly with the thumb and palms of the hands, then rotate to the left as far as possible, when the front can be withdrawn. This method prevents undue strain on the lampmounting.

The reflectors should not be touched unless tarnished. Then clean carefully with a fine chamois leather and rouge wet with petrol, as the highly-polished surface is easily damaged.

Fault Location.—The following tables will assist owners to trace any faults in the electrical equipment—

Lights Fault Finding Table.



III.-Care of the Coachwork.

Care of Varnish and Paintwork.—You should never put the . car away in a dirty condition if you desire to preserve its appearance for the longest possible period.

Nowadays, with many tar-sprayed roads, the mud contains chemicals which will quickly destroy the lustre of the varnish if allowed to dry on.

When washing down with a hose the water should be allowed to flow on plentifully before using the sponge. Do not use a strong jet of water. If a hose is not used, the water should be squeezed from a sponge in a liberal manner and allowed to flow down the panels, etc., before washing over with the sponge.

Do not wipe the car over with a dry cloth before washing, even if it is only dusty, as the dust is abrasive and will scratch the surface.

After washing down thoroughly with the hose and sponge, wipe off all the spots of water with a clean chamois leather, which should be kept for this purpose alone.

Do not use petrol, benzole, or paraffin for cleaning coachwork it will crack the varnish.

Spots of tar may be very effectively removed with butter after the car has been washed and dried. Apply the butter thinly to the affected parts, let it stand overnight, and afterwards wipe off carefully with a soft cloth.

When the car is at rest it is an advantage for it to be kept in the shade, as the heat of the sun has an injurious effect on the paintwork and tyres. If the car is left standing for any length of time in bright sunlight there is a serious risk of the polished instrument board (and the facia strips in the case of Saloon Cars) becoming blistered.

Hoods.—When cleaning hoods use only soap and water. The hood should never be lowered when it is wet, and neither should it be left folded when the car is not in use.

When the hood is lowered, the fabric should be folded neatly and not be allowed to lie bunched up. The hood should be securely strapped down to prevent chafing.

INDEX.

Ammeter				10
" Autovac " Fu	nel Fe	ed.	÷ .	54
Axle, Front				45
Axle, Rear	•••		••	45
Battery, Care o	f		24,	65
Battery, Charge	ing Pe	eriod		10
Brakes			22,	32
			4	
Carburetter		4.		50
Care of Car, Ge	neral	Hints		25
Care of Coachw	ork			71
Clutch				41
Curtains, Side				11
Decarbonising				36
Dimmer Switch		/		10
Dynamo			•	62
Electrical Equi	9	,62		
Electrical Fault	-findi	ng Tabl	es 69	,70
Fan Belt Adjus	tmen	t		41
Fuel Supply				22
Gear Box .				43
Gear Changing				7
Grease Gun				17
Guarantee	-			29
				_
Hills, Descendi	ng Ste	eep		9
Hood Raising and Lowering				13

Ignition Control				8
Insurance				29
Lamps				68
Lubrication				14
Luggage Grille				11
Magneto			35,	59
			100	
Oil Pressure Ga	uge			17
Pedals, Adjustn	nent of			4
Propeller Shaft				43
Radiator and Co	ooling S	System		21
Road Springs				48
Seats, Adjustme	ent of F	ront		4
Side Curtains				11
Silencer		••	••.	48
Spare Parts		•••		29
Sparking Plugs	••			35
Starter				64
Starting the En	gine		5,	50
Steering Gear			•••	46
Storage	•••	•••		28
Table of Consei				
Table of Capaci	ties		••	30
Tyres			•••	23
Valve Grinding				39
Valve Tappet A	djustm	ent		34
Valve Timing G	ear			39
Washing the Ca	r		24,	71