INSTRUCTION BOOK

FOR

Velocette

Models

OV (250 c.c.) **MAC** (350 c.c.) **MSS** (500 c.c.)

PRICE 2/6 NETT.

VELOCE LIMITED
HALL GREEN WORKS
: York Road, Hall Green :
BIRMINGHAM, 28

TELEphone : SPRingfield 1145/6/7.
grams : "Veloce, Birmingham."

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INDEX.

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FOREWORD.

This Instruction Book has been prepared to supersede the separate Instruction Books issued previously to cover respectively the Models MOV, MAC and MSS. We have endeavoured to combine in it what we consider to be the best features of the 1939 editions with more extensive and detailed information relating to dismantling and re-assembling.

Whilst reference to earlier models has been made wherever possible it must be understood that the book caters in the main for current types and may therefore not apply in strict detail to some old machines still in commission. Should any point not be fully understood, however, we will gladly reply to any enquiries.

A careful study of the contents will be worth while and should help the owner (be he novice or expert) to maintain his machine in that state of efficiency which it is impossible to retain without attention to those simple but none the less important adjustments and lubrication details which are described in the following pages.

F50/2R.

SERVICE DEPARTMENT.

January, 1947.

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Taking Delivery.

As new motor cycles are not usually delivered to the Agents' Showrooms by road it is necessary to make certain before starting up the engine, or taking the machine over, that the fuel and oil tanks are filled and that there is the correct amount of oil in the gearbox. Also as the accumulator may not have been filled with electrolite (or charged) these details should be checked over and attended to as required.

The oil tank should be filled to about 1" of the top (*i.e.*, about 2" below the top face of the filler cap neck).

The gearbox is filled with ordinary engine oil through the opening in the end cover from which the plug marked "Oil" has first been removed. Also remove the level plug from the end cover (see Figs. 7A & 23) and pour in oil until it is seen to drain out of the level plug hole with the machine held upright.

When the flow ceases replace and tighten both plugs. Be very careful not to over-tighten the level plug or the cover may be damaged or the plug broken off.

Do not in any circumstances use anything except engine oil for gearbox lubrication. Grease or heavy gear oil may cause the bearings to run dry.

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THE CONTROLS (HAND).

Clutch Lever. The larger of the two levers on the left side of the handlebar when pulled right back until it touches the grip disengages (or frees) the clutch, disconnecting the drive between the engine and the gearbox.

It must not be operated to ease the engine by slipping the clutch instead of changing to a lower gear, or be held up in order to "free wheel." Keep the hand off the lever when driving normally and do not hold it up with the machine stationary, and the engine running, if held up in a traffic block. Select neutral position for the gears in such circumstances, and release the lever.

The control cable attached to this lever should move freely for at least $\frac{1}{8}$-in. before the pressure of the clutch springs is felt. This freedom will be likely to decrease with use, particularly on a new machine, or on one in which the clutch has been relined, particularly during the first few hundred miles' running.

Readjust *as soon as* this is noticed—as described on page 49.

Exhaust Valve Lifter. The smaller of the two levers on the left side of the handlebar. When pulled towards the rubber grip causes the exhaust valve in the engine to be held off its seating and relieves compression in the cylinder. Its use (as described fully later) is for starting up. In certain conditions it may be used when the machine is being ridden slowly with low gear engaged down exceptionally steep or difficult gradients in order to prevent the rear wheel locking on a loose surface. It is not used in normal driving on main or secondary roads.

Steering Damper Knob. In the centre immediately above the steering column. Turning clockwise brings the friction discs of the steering damper together and stiffens the operation of the steering column in the steering head. In nearly all normal riding should be set so that the column is quite free. Tighten the damper a little at a time and gradually to assist in "holding" the machine when travelling fast on rough roads. Overtightening will give rise to a slow rolling movement of the motor cycle, particularly at slow speeds. If slackened back too far the star spring below the knob may rattle slightly.

The Air Control Lever. A small lever clipped to the top of the handlebar on the right. Pull back towards the saddle to open the air valve. For details of use see page 6.

The Front Brake Lever. Similar in appearance to the clutch lever, but fitted on the right-hand side. When pulled towards the grip applies the brake in the front hub.

The Horn Button. Fitted to the left of the brake lever. Press to sound the horn.

The Throttle. Operated by turning the right-hand grip. Movement back towards the rider opens the throttle valve in the carburetter and under most conditions increases the speed of the engine (and, when the gears and clutch are engaged) the speed of the machine. Keep the throttle closed when starting up. Movement of the twist grip when starting (familiarly known as "shaking the bottle") will nearly always cause difficulty in starting.

Except on some early models there is no control for the ignition as on some other makes. The spark is advanced and retarded entirely automatically. On machines fitted with manual ignition control the lever is moved towards the rider to retard the spark.

FOOT CONTROLS.

Brake Pedal. Slightly ahead of the left footrest. Press down to apply the rear brake.

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†**Gear Pedal.** Ahead of the right footrest. Press down to engage a higher gear. Raise to get a lower gear. After each movement the lever must be allowed to regain its central position. Keep the foot off the pedal when driving and do not kick or "stamp down" the pedal. See also "Driving Instructions."

Footstarter. Behind right footrest. Footpiece swivels out of the way when not in use.

FUEL TAPS.

Situated underneath the fuel tank (one at each side) at the rear end. Must be shut off when the machine is left standing for more than a minute or so. The plungers work horizontally. To open, the hexagon knob (marked PUSH-ON) is pushed towards the body of the tap. To close, press the round milled knob (marked PUSH-OFF). Use only one tap and the other side will then act as a small reserve supply which is usually sufficient to run the machine about 3 to 4 miles. Either side may be used as the main supply. Always refuel as soon as possible after being forced to call upon the reserve and at once close the "reserve" tap again.

LIGHTING SWITCH.

Fitted to the top of the head lamp behind the Ammeter. The lever has four positions, indicated on the black moulding below the switch lever as follows:—OFF—CH.—The position for daylight running. H.—Headlamp bulb and tail lamp on. L.—Parking (dim) bulb on in headlamp and rear lamp on. The dipper switch for the headlamp bulb is at the right of the clutch lever.

INSTRUMENTS.

Ammeter. In the top of headlamp. Indicates the flow of current into or out of the battery. Discharge (outflow) indicated on left of dial. Charge (inflow) indicated on the right.

Speedometer. On the top right side of fork girder. Registers total mileage run and indicates speed.

CONTROL LEVERS.

These are all capable of being set on the handlebar in the best positions to suit any individual rider. A few moments spent in arranging their positions as desired are very well spent.

The levers are also adjustable for freedom of working. Air lever should be adjusted so that whilst free enough to operate without difficulty it does not shut back of its own accord when machine is in use. The centre screw or hexagon head controls this setting. Turn clockwise to tighten.

The adjustment of the other levers is by tightening or loosening the fulcrum pin after slacking off the small fulcrum pin lock nut. Set the fulcrum pins so that freedom without slackness is obtained, otherwise levers tend to vibrate and wear on fulcrum pins becomes excessive.

Oil all pivots and working parts from time to time.

† *This control is arranged to work the reverse way to that described on all pre-war models and on some machines produced for the War Office.*

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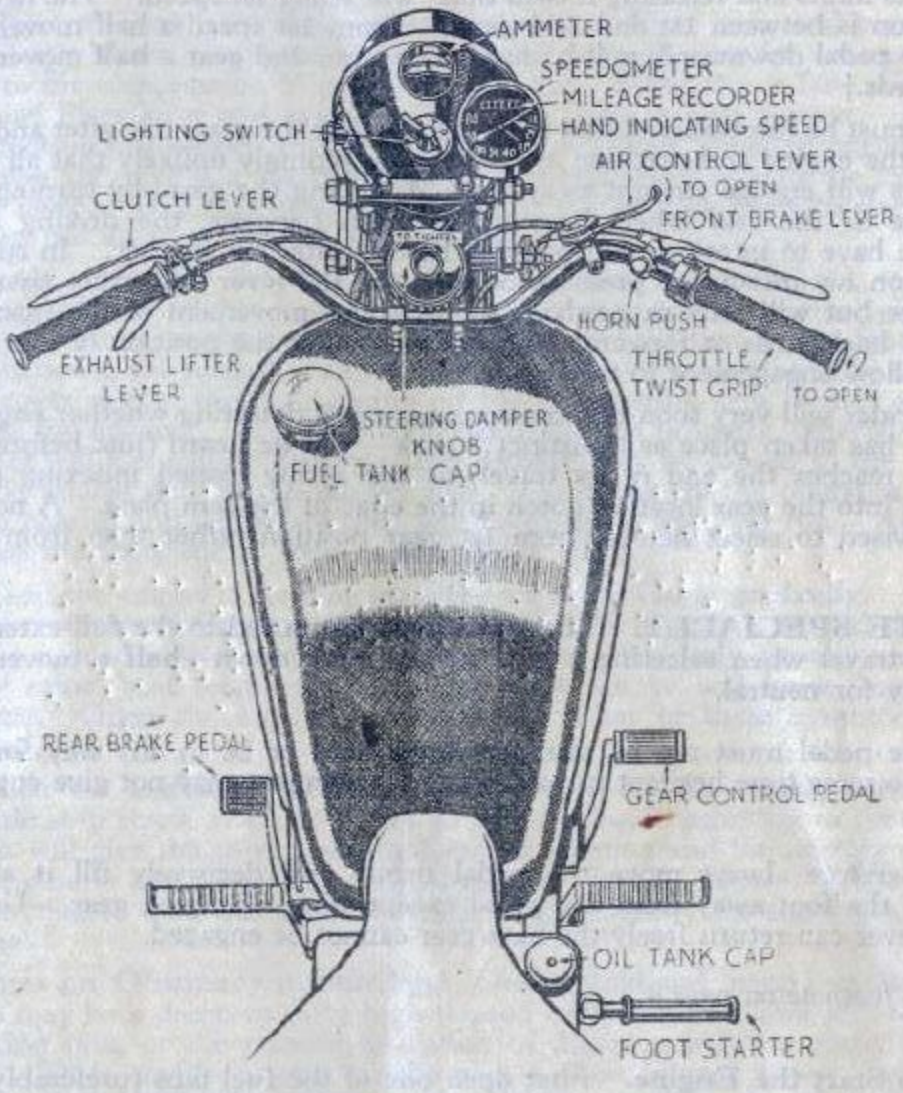
ARRANGEMENT OF CONTROLS



Always, before taking out the machine, or even starting the engine, make sure that it is ready for the road. See that there is a sufficient amount of fuel for the journey, and that there is enough oil in the oil tank and gearbox.

DRIVING INSTRUCTIONS.

Before attempting to start up the engine make sure that the gears are in neutral ("free engine") position. This can be found out by raising the clutch lever and pressing down on the foot-starter. If a gear is engaged the foot-starter will not go down freely but will cause the machine to run forward. To select neutral move gear pedal as required. The number of movements needed will depend on which gear is engaged, as the following explanation will show.

The gear control pedal operates a spring loaded spindle (in the gearbox) carrying the pawl which moves the cam plate one position at a time, and after each movement either up or down is returned to its central position. If 1st (low) gear is in engagement and the pedal is pressed down as far as it will go, 2nd gear will be selected. A second pressure downwards on the pedal will give 3rd gear, and a third movement down will give 4th (top) gear. From 4th gear position three successive lifts of the pedal (moving

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it to its limits and releasing it each time) will select 1st speed. The neutral position is between 1st and 2nd gears. From 1st speed a half movement of the pedal downwards will be needed or from 2nd gear a **half** movement upwards.†

It must be remembered that in trying to select the gears one after another with the engine and machine at rest it is exceedingly unlikely that all four speeds will engage straight away without moving the gears by turning the engine or the rear wheel because, as often happens, the driving dogs which have to interlock will possibly be opposite one another. In such a position no amount of pressure or force on the lever will cause them to engage but will only cause damage. A slight movement of the machine either backwards or forwards will, however, alter the position of the dogs and allow engagement to take place.

A rider will very soon become accustomed to detecting whether engagement has taken place as a distinct "click" will be heard (just before the lever reaches the end of its travel) as the spring loaded indexing pawl snaps into the gear location notch in the edge of the cam plate. A novice is advised to select neutral from 1st gear position rather than from 2nd gear.

NOTE SPECIALLY. The pedal must be moved to the full extent of its travel when selecting a gear either up or down—**half** a movement only for neutral.

The pedal must not be stamped down hard or be in any way forced. At the same time hesitant or half-hearted movement may not give engagement.

Therefore always move the pedal firmly and decisively till it stops. Keep the foot away from the pedal except when changing gear. Unless the lever can return freely the next gear cannot be engaged.

† *See footnote on page 4.*

To Start the Engine. First open one of the fuel taps (preferably the right-hand one) by pressing in the hexagon knob. Lean the machine sharply over to the right side for about 20 seconds to flood the carburetter or depress the "Tickler" on the carburetter. The "Tickler" is a small spring loaded button on the lid of the float chamber. After a few seconds, whichever method is used fuel will be seen to seep out through a small hole in the side of the mixing chamber body. As soon as this occurs release the "tickler" or return the machine to the vertical. Do not flood excessively when cold. **Do not flood at all when the engine is hot.**

Turn the small throttle stop screw clockwise till the lug on the screw touches the side of the mixing chamber body. This screw is fitted obliquely upwards in the side of the mixing chamber and has a small cross-bar in the head to provide a convenient grip for the fingers. It holds the throttle valve slightly open in the best position for starting. Shut off the twist grip fully and if engine is cold close the air control lever.* Now raise the exhaust valve by operating the small control lever on the handlebar. While holding this lever up press the footpiece of the starter slowly down. After a short distance the ratchet will be felt to engage the ratchet gear in the gear box when pressure should be continued to rotate the engine. When fully depressed release the footpiece, which will be returned to the top by its return spring. Repeat this operation a few times to fill the cylinder with combustible mixture, and to free the engine.

* *Set ignition lever about one-third advanced if old machine with manual control.*

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When this has been done release the exhaust lifter lever and press the footstarter down slowly as before. Resistance will now be encountered due to the compression of gas in the cylinder. When this is felt, raise the exhaust lifter lever and press the footpiece down a little further. Allow the footpiece to return to the top once more, move down to engage the ratchets and give it a sharp downward thrust without raising the exhaust lifter lever. This should rotate the engine fast enough for it to start. If it does not do so at the first attempt—Try again.

Notes on using the Footstarter. It is very important not to kick sharply and the ratchet must be allowed to engage properly before putting heavy pressure on the footpiece. It will be noticed that as the footpiece moves down, the ratchet is allowed to slide into the ratchet housing on the end cover due to the lug running off the disengaging cam formed at the end of the housing. It must be allowed to slide in properly, otherwise the ratchet will not engage properly, and damage may be caused to the teeth on the ratchet and on the ratchet gear. Do not hurry the operation—by being careful and deliberate time will be saved in the long run. Always release the footpiece as soon as the engine starts.

When the engine is running open the air control lever gradually. After a few moments the engine will accept the full air supply. Should the air not be opened soon enough the engine will fire irregularly, usually missing every other beat (eight stroking) and black smoke will issue from the silencer. Open the air fully immediately either of these symptoms is noticed.

When the engine is running regularly with full air supply turn the throttle stop screw as far as it will go anti-clockwise (stop lug to the rear) which will give the correct setting for slow running and for starting when the engine is hot. Generally speaking, the "fast" position of the stop screw (that is with the lug forward) is only necessary for starting a cold engine.

Notes on Obstinacy in Starting. During cold and damp weather the cause may be a damp or dirty high tension cable from the magneto to the sparking plug or the outside insulation of the plug may be coated with mud. This provides a path for the high tension current which "leaks" to "earth," diminishing the intensity of the spark at the plug points. Clean the affected parts with dry rag.

Over-rich Mixture caused by excessive flooding of the carburetter or of flooding when hot. Rectify by opening throttle and air controls fully and rotate engine sharply several times with the footstarter to clear the over-rich mixture. Close throttle, leave air control full open and try again. If still unsuccessful take out sparking plug and clean internal insulation and firing points; they will probably be "wet" with excess unvapourized fuel. Before replacing the sparking plug check the gap between the firing points (this should be .015") and reset if needed. Also rotate engine several times to clear out the rich mixture from the combustion chamber.

Provided the trouble is not of a more serious nature, necessitating workshop attention, the engine should start after this attention.

When the Engine is Cold always allow a few minutes to elapse after starting for the oil to circulate before running it up to high speed. A fairly fast tick-over is about right. The circulation of the oil may be checked by taking off the cap from the oil tank, when oil will be observed running back into the tank from the pipe inside the neck of the tank. See also page 25.

Starting Away. Having got the engine running, **push up the prop stand** on the left side of the machine. It folds backwards and upwards below the frame tube. This is very important. If left down it can be very dangerous.

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Free the clutch by gripping the clutch lever and pulling it back into contact with the handlebar grip.† Raise the gear pedal to engage first speed. The dogs should be felt or heard to engage. Release the pedal. If the dogs do not engage do not force the pedal but move the machine slightly backwards or forwards to alter the position of the dogs and try again. Alternatively, momentarily release the clutch lever with the gears in neutral and then make another attempt. **Never under any circumstances** move the gear pedal unless the clutch is freed first if the engine is running. Note specially that no amount of force will engage the dogs unless they are in such a position that they can interlock or mesh with one another. Having engaged first speed (low gear) by the upward movement of the control pedal release the clutch lever very gradually and at the same time open the throttle slightly when the drive will gradually be taken up and the machine will begin to move forward. When this occurs do not be in a hurry to release the clutch lever suddenly or the engine may stall, but continue to let it out slowly and at the same time increase the amount of throttle opening. Conversely, do not "race" the engine up to high speed without releasing the clutch lever. It cannot drive the machine at all until the clutch commences to grip. A good driver can always be picked out by his clutch work as he always "gets off the mark" with the minimum amount of fuss and noise and does not "race" the engine excessively.

When well under way and at about 15 m.p.h. on the level free the clutch again and slightly close the throttle, pause about a second and then press down the gear pedal firmly until it stops, release the clutch again as this is done and open the throttle gradually. Take the foot off the gear pedal allowing it to return to mid position. Change up to third speed at about 25 m.p.h. by repeating the process, and when a speed of 35 m.p.h. is reached, change into top.

To change to a lower gear the procedure is similar except that the throttle should be left open and the pedal moved upwards **as far as it will go.** Three upward movements in succession from top will bring the gears back to first speed.

Bear in mind that a little practice is required in order to become proficient. Remember that the throttle should be closed when changing to a higher gear and the change made slowly, whilst a change to a lower gear should be made quickly with the throttle open. Never look down when changing gear. Keep looking at the road ahead.

The road speeds quoted are for a fully run in engine and are right for all general riding. Special conditions, as when starting on a gradient, may make it necessary to reach a higher road speed before changing up as of necessity some speed is lost as a change is made and if made too early the machine may be running too slowly for the engine to pull away properly by the time the higher gear is engaged.

To stop, close the throttle, and as the machine slows to about 15 m.p.h. free the clutch. Raise the gear pedal fully and release it twice in succession, and then raise it half way slowly until the pawl is felt to click into the neutral notch. Apply the brakes and release the clutch lever gradually. Never release it suddenly before it is certain that neutral has been found. When the machine is stationary close the fuel tap if the machine is not to be driven away at once, and raise the exhaust lifter lever to stop the engine.

Running in a New Engine. A new machine requires to be driven with restraint until all working parts become thoroughly free or "bedded down" and will not give of its best until this has occurred and it is, as it is termed, "run in." It is a mistake to drive a new machine hard and give it too much "collar work" to do. Hard pulling ("slogging") on a large throttle opening uphill must be avoided, and liberal use should be made of the gearbox so as to ease the load on the engine and allow it to run as lightly loaded as possible. A high road speed is not injurious and can in fact be beneficial if the speed is reached without opening the throttle wide.

† *See footnote page 4.*

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and as this condition will often arise going down hill, we do not necessarily advise that the speed in top gear should be limited to any set speed. It has been found by experience that to run in a new engine at a fixed and regular speed is sometimes very unsatisfactory. Vary the speed as much as possible, but **always run the engine lightly loaded,** indulging in short, sharp bursts of speed occasionally. The speed and duration of these may be increased as the mileage reaches the 500 figure and after about 1,000 miles the engine should be properly run in.

GENERAL HINTS ON DRIVING.

Do not forget to raise the prop stand before driving away, and always use this stand whenever possible in preference to leaning the machine against walls or kerbstones.

See that the stand works freely. Lubricate the pivot if the stand is stiff.

Do not forget to open the air lever fully when running.

Do not race the engine unnecessarily or let the clutch in suddenly. This causes increased wear on the tyres, chains and transmission generally. Try to obtain a neat and smooth get-away.

Keep the feet clear of the brake and gear pedals when not actually braking or changing gear, and keep the hand off the clutch lever when it is not in use.

Drive as much as possible on the throttle, making the minimum use of the brakes.

Use both brakes in preference to the rear only.

Do not let the engine slog on a high gear. Change to a lower ratio in good time.

Do not kick or "stamp down" the gear pedal. Force is unnecessary.

Do not attempt to start with the throttle too far open.

Do not neglect essential adjustments, particularly the clutch adjustment.

Feel the footstarter ratchet engage before putting the full weight on the footpiece.

Do not under any circumstances tamper with the silencer. More noise may make the machine seem faster, but experience has shewn that alterations usually reduce the performance.

Always close fuel taps when leaving the machine for any length of time.

Tighten any loose nuts or bolts as soon as they are seen to need attention.

WEEKLY MAINTENANCE.

(Based on an assumed weekly mileage of 500.)

CONTROL CABLES. Lubricate all exposed ends of cables from oil can. Check all controls for freedom and see that nipples work freely in control levers. Remove any tight nipples from levers, ease, lubricate and refit.

Any cables showing signs of sticking within the outer casing must be detached from the levers and oil worked down into outer casing by feeding in oil from can and working casing up and down on inner cable whilst cable is held as upright as possible.

CONTROL LEVERS. Lubricate all moving parts of levers.

BRAKE CONTROLS. Lubricate felt washers behind front and rear cam levers, trunnions at front and rear ends of rear brake rod, felts and exposed portion of brake cable on front brake cam lever.

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STANDS.	Lubricate pivots of prop stand and rear stand, and rear stand securing clip pin on rear guard.
FOOTRESTS.	Lubricate pillion footrest pivots.
FRONT FORK SPINDLES.	Grease five nipples.
FOOTSTARTER.	Lubricate footpiece pivot.

PERIODIC MAINTENANCE.

OIL TANK.	Drain, clean feed filter, and re-fill to within 1-in. from top of tank (i.e., 2-ins. from top face of Filler neck) after every 2,000 miles running. On new or reconditioned engines this must be done after the first 500 miles and at 2,000 miles. At the same time clean suction filter plug and cylinder oil feed bolt. Remove crankcase drain plug, drain, and re-fit.
GEARBOX.	Every 5,000 miles drain completely. Remove level plug, re-fill with oil. When surplus oil is drained out re-fit level plug. On new or reconditioned gearboxes this must be done after the first 1,000 miles.
CLUTCH.	Check adjustment for free movement.
WHEEL BEARINGS.	These are packed with high melting-point grease during manufacture. Dismantle bearings and re-pack with grease every 10,000 miles.
SPEEDOMETER REDUCTION GEARBOX.	Grease every 1,000 miles. (Do not over-lubricate as excess grease may get on to the brake linings and reduce the efficiency of the brake).
GEAR LEVER PIVOT.	Grease every 1,000 miles. (MOV & MAC Models only.)
BRAKE CAM BEARING REAR.	Grease every 1,000 miles. (Do not over-lubricate as excess grease may get on the brake linings and reduce the efficiency of the brake).
STEERING COLUMN.	Grease every 2,000 miles.

Every 3,000 miles the following should receive attention :—

Test tension of front and rear, driving chains, re-adjust if required.

Clean out front chain case.

PERIODICAL ATTENTION. LUBRICATION.

The importance of efficient lubrication cannot be over-estimated. The use of cheap oils is false economy, and we only recommend the employment of those oils and greases which we have found from our own experience to be the most suitable for our machines.

It is specially recommended that towards the end of September the oil tank should be drained and should be refilled with one of the grades recommended for Winter use, the use of such a grade being continued throughout the Winter months. At the beginning of May the tank should again be drained out and one of the grades recommended for Summer lubrication employed.

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In the case of four stroke models the oil tanks and pipes should be cleaned out thoroughly and the contents of the tank should not at any time be kept in use for longer than 2,000 miles running. All old oil should be discarded after this distance has been run and the tank refilled with fresh oil. Instructions for changing the oil and cleaning the filters, etc., appear on other pages.

The identifying letters used by most oil firms denoting the different grades under which their oils are supplied are often imitated, and it is essential when ordering oil to specify the Brand as well as the Grade. As an additional precaution see that the oil is taken from branded cabinets or from sealed packages. See also that if oil is measured it is brought in a clean container.

The following high-grade lubricants are recommended :—

ENGINE LUBRICATION (SUMMER).

Triple Shell (Shell Mex & B.P. Ltd.).
Essolube "50" (Anglo-American Oil Co., Ltd.).
Price's Motorine "C" (Price's Lubricants Ltd.).
Vacuum Mobiloil "B.B." (Vacuum Oil Co., Ltd.).
Castrol "XXL" (C. C. Wakefield & Co., Ltd.).

ENGINE LUBRICATION (WINTER).

Castrol "XL" (C. C. Wakefield & Co., Ltd.).
Double Shell (Shell Mex & B.P. Ltd.).
Essolube "40" (Anglo-American Oil Co., Ltd.).
Price's Motorine "M" (Price's Lubricants Ltd.).
Vacuum Mobiloil "A" (Vacuum Oil Co., Ltd.).

FOR COMPETITION MACHINES the following are recommended for engine lubrication :—

Vacuum Mobiloil "D" (Vacuum Oil Co., Ltd.).
Castrol "Grand Prix" (C. C. Wakefield & Co., Ltd.).
Golden Shell (Shell Mex & B.P. Ltd.).
Essolube "Racer" (Anglo-American Oil Co., Ltd.).
Price's Motorine "B de Luxe" (Price's Lubricants Ltd.).

GEAR BOX LUBRICATION.

Use Summer Grade Engine Oil throughout.

HUB LUBRICATION.

Price's Belmoline "C" (Price's Lubricants Ltd.).
Mobilgrease No. 4 (Vacuum Oil Co., Ltd.).
Castrolease Heavy (C. C. Wakefield & Co., Ltd.).
Shell Retinax "CD" (Shell Mex & B.P. Ltd.).
Esso Grease (Anglo-American Oil Co., Ltd.).

FOR GREASE NIPPLES.

Esso Grease (Anglo-American Oil Co., Ltd.).
Price's Belmoline "C" (Price's Lubricants Ltd.).
Mobilgrease No. 2 (Vacuum Oil Co., Ltd.).
Castrolease Medium (C. C. Wakefield & Co., Ltd.).
Shell Retinax "CD" (Shell Mex & B.P. Ltd.).

FOR REAR CHAINS.

Shell Retinax "CD" (Shell Mex & B.P. Ltd.).
Esso Grease (Anglo-American Oil Co., Ltd.).
Price's Rangraphine (Price's Lubricants Ltd.).
Mobilgrease "No. 2" (Vacuum Oil Co., Ltd.).
Castrolease "G" (C. C. Wakefield & Co., Ltd.)

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ENGINE LUBRICATION SYSTEM.

Engine oil must be changed at intervals of 2,000 miles running. (After first 500 miles on new or overhauled engine.) To change proceed as follows :—

Drain oil tank by removing drain plug, below tank. Disconnect oil feed pipe from tank by undoing union nut and unscrew oil filter from tank. Clean filter in petrol. Refit filter and connect up oil feed pipe. Remove and clean suction filter plug (see below).

Loosen clip on top end of rubber hose between return union on crankcase and pipe on tank. Pull hose away from tank. Refill tank with fresh oil to within 1-in. from top of tank (i.e., 2-in. from top face of filter neck). Start engine—catch dirty oil (which will be returned up return pipe hose) in small tin. When return begins to run clean stop engine and refit hose. Tighten hose clip.

Notes re Above.—Never carry out the job in dusty surroundings. Always see that oil is poured into tank from clean measures and containers. (See Fig. 12.)

THE SUCTION FILTER.†

Remove filter plug every 2,000 miles by unscrewing from rear bottom corner of crankcase, using tubular sparking plug spanner through hole in bottom member of frame. Clean plug in petrol. See that red fibre washer is in order. Refit plug and tighten up fully. (See Fig. 9.)

THE CYLINDER OIL FEED.†

Every 2,000 miles remove bolt below cylinder base joint at rear on left side. Bolt is marked "jet" on head. Clean in petrol. See that small cross hole in the centre of bolt is clear. See that fibre washer below head is in order. Replace. Exercise great care in tightening so that bolt is not sheared off. (See Fig. 11.)

PERIODICAL ATTENTION. LUBRICATION (GEARBOX).

Every 2,000 miles top up to correct level.

The gearbox is lubricated with oil of the same grade as that which is used for the engine.

To fill, remove the filler and level plugs, see Fig. 7A. Pour in a small quantity of oil through the filler plug hole until it commences to run out of the level plug hole with the machine standing upright.

Allow the oil to run until the flow ceases and refit both plugs. If oil will run out of the level plug hole with the machine standing upright it is an indication that there is too much oil in the gearbox.

Too high a level will not prove detrimental, as the excess oil will only be likely to run into the primary chain cover, where it can of course do no harm. It cannot cause the clutch to slip if the catch is adjusted correctly. After a new machine has covered 500 miles it is desirable to drain the gearbox. The drain plug is at the rear of the housing at the bottom. To remove any sediment that may have collected in the bottom of the gearbox it may be flushed out with clean petrol. This must all be allowed to drain away before refilling with oil.

Screw in the drain plug after the gearbox has been drained and re-fill with oil as described above.

In normal service the gearbox oil should be changed about every 5,000 miles. No other attention is necessary.

Heavy gear oil or grease will not find its way to the various bearings in a satisfactory manner, and may involve some part running dry with the consequent risk of seizure. For this reason therefore, such lubricants must not be used.

† *These two refinements are not incorporated on early pre-war Models.*

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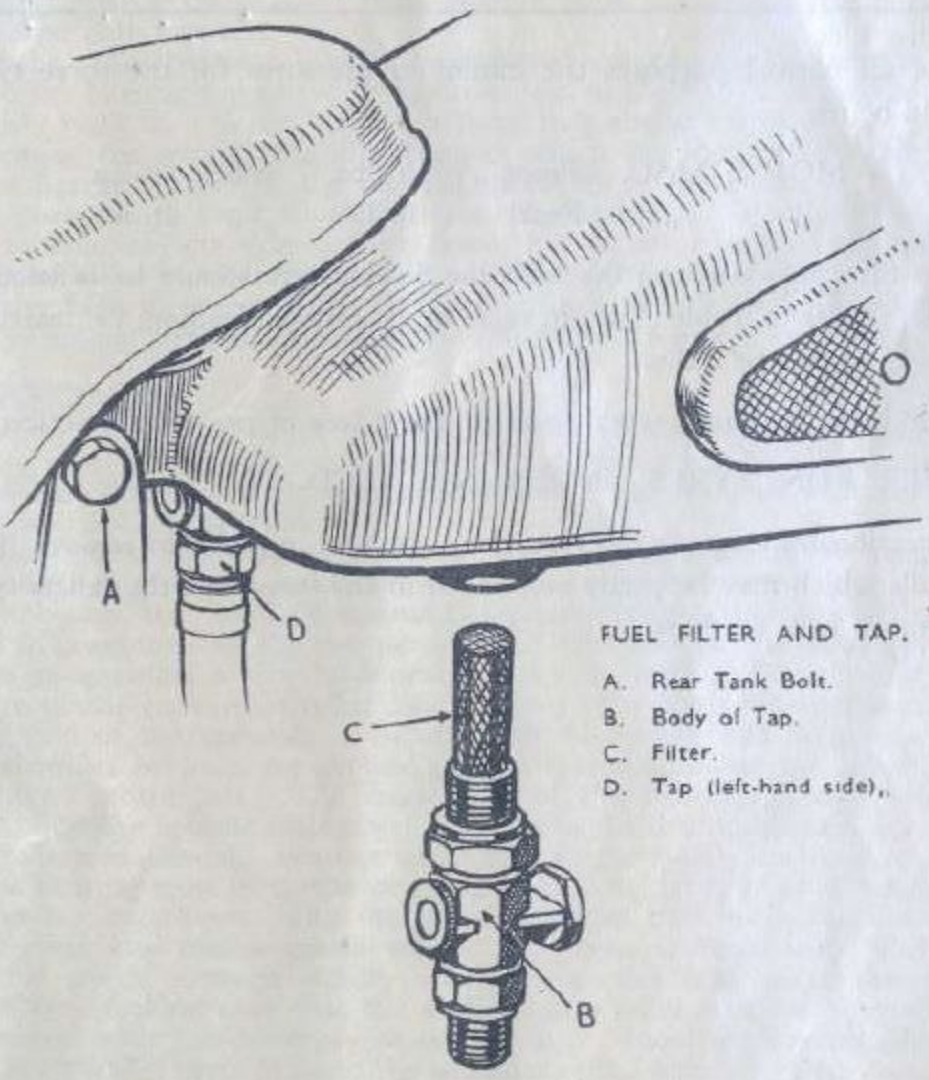
LUBRICATION OF FORK SPINDLES, BRAKE CAMS, NIPPLES AND CYCLE PARTS, Etc.

When using the grease gun bear in mind that it is better to lubricate a little and often rather than to neglect this attention for a considerable time and then over-lubricate. Under very wet or dirty conditions, lubrication of the various points should be carried out more liberally. Should it be found that for some reason or another grease will not enter a bearing but escapes between the grease gun nozzle and the nipple, this can usually be prevented by inserting a piece of clean rag between the nipple and the grease gun nozzle. The rag forms an effective seal and will usually prevent all leakage but will allow grease to pass freely into the nipple. Do not use heavier grades of grease than are specified as there is a danger that the various bearings and bushes may not receive a proper supply due to the grease choking the passages, etc.

FUEL FILTERS.

Two filters are fitted as a part of the fuel taps. To clean—drain fuel from tank into clean container. Unscrew both taps from tank. Clean filters in petrol. See that fibre washers on taps are in good order. Replace taps.



FUEL FILTER AND TAP.

A. Rear Tank Bolt.
B. Body of Tap.
C. Filter.
D. Tap (left-hand side).

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TYRE MAINTENANCE.

Minimum Inflation Pressures.	NOMINAL TYRE SECTION.					
	2.375"	2.75"	3.00"	3.25"	3.50"	4.00"
Lbs. per □ inch.	LOAD PER WHEEL IN LBS.					
16	120	140	160	200	280	360
18	140	160	180	240	320	400
20	160	180	200	280	350	430
24	185	210	240	350	400	500
28	210	250	300	400	450	—
32	240	280	350	440	500	—

For all normal purposes the minimum pressures for the three types should be :—

MOV & MAC.	Front ..	16-lbs.	MSS.	16-lbs.
" "	Rear ..	18-lbs.	"	16-lbs.

If a Sidecar is used on the MSS the Sidecar tyre should be inflated to 16-lbs. Refer to Table above in cases of exceptional loading, i.e., carrying a passenger on the Pillion.

Check the pressures weekly and inflate if loss of pressure is noticed.

NEVER RUN TYRES UNDER-INFLATED.

Occasionally examine the tyres for cuts, and in order to remove flints or nails which may be partly embedded in the treads, partly deflate tyres to remove nails or flints.

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REMOVAL OF FRONT WHEEL.

Raise the machine on to the rear stand. Loosen the front stand from the mudguard and raise the machine on to the front stand. Pull the brake lever towards the handlebar, grasp the casing of the control cable close to the lever and slip it out of the recess whilst at the same time releasing the lever. Slide the nipple out of the lever, detach all cable clips. Unscrew the hexagon nut at the lower end of the flexible speedometer drive and slip the flex out of engagement with the reduction gearbox. Loosen both spindle nuts, prise the washers out of the recesses in the outside of the fork ends, when the wheel will drop out and can be removed.

DISMANTLING FRONT WHEEL BEARINGS. (See Fig. 1.)

Take off both spindle nuts, and lift out the brake plate and shoes from the brake drum. By using two spanners working against each other, loosen the lock-nut on the left-hand end of the spindle and take this nut and the bearing adjustment nut off the spindle. Take off the dust cap. Using a punch made of brass, copper, or aluminium-alloy drive the spindle through the hub towards the brake drum. **In no circumstances must the spindle be driven out from the brake drum side** towards the left. The centre of the roller bearing on the right-hand side will come out with the spindle. The dust cap from the left-hand side of the hub is easily prised out of place and the centre part of the bearing can be taken out. Both bearing cups in the hub can now be repacked with grease.

If the roller bearings have to be renewed due to wear or damage, the old outer bearing rings have to be driven out of the hub in which they are a fairly tight fit. When removing them it is almost impossible to avoid scrapping the grease retaining washers which are inserted between the outer bearing rings and the internal shoulders in the barrel of the hub. If a punch is to hand which will just fit through the barrel of the hub the retainer on one side may be saved, but as one ring and one washer must be taken out before such a punch could be used it is usual simply to drive both rings out of place with an ordinary bar about $\frac{7}{16}$-in. diameter and 10-in. long, replacing both grease retainers with new ones on assembly.

REASSEMBLY.

When fitting new roller bearings (which are supplied comprising the centre race, rollers, cage, and outer ring) do not mix up the component parts—see that each centre race with rollers is fitted to run with the ring with which it was supplied.

Place one grease retainer in place—concave side outwards or towards the bearing, press the outer ring of the bearing firmly into the recess in the hub until it is hard up against the grease retainer, which it will then hold in position. Fit the two parts to the other side in a similar manner.

To re-assemble a vice is desirable but not essential. First slide the centre of the brake-side roller bearing up to the shoulder on the right-hand end of the spindle. A small collar or washer will be noticed at the shoulder between the ground part of the spindle and the larger unmachined centre part. The inner ring of the bearing presses against this. Slip the spindle into place from the brake drum side and see that the rollers fit into the bearing outer ring in the hub. The centre part of the bearing must of course be fitted so that the large ends of the taper rollers are outermost. Tap the inner dust cap back into the hub and wipe away any excess grease which may have squeezed out. Put on the flat inside distance washer. Follow up this with the brake plate and shoes, making sure that the small pinion on the reduction gearbox is meshed with the driving gear on the hub. Incidentally, this driving gear is a parallel press fit on to the shoulder of the hub. It is very seldom necessary to replace it, but it can be "prised" out of place using two large spanners packed up (with nuts of suitable thickness) from the back of the brake drum.

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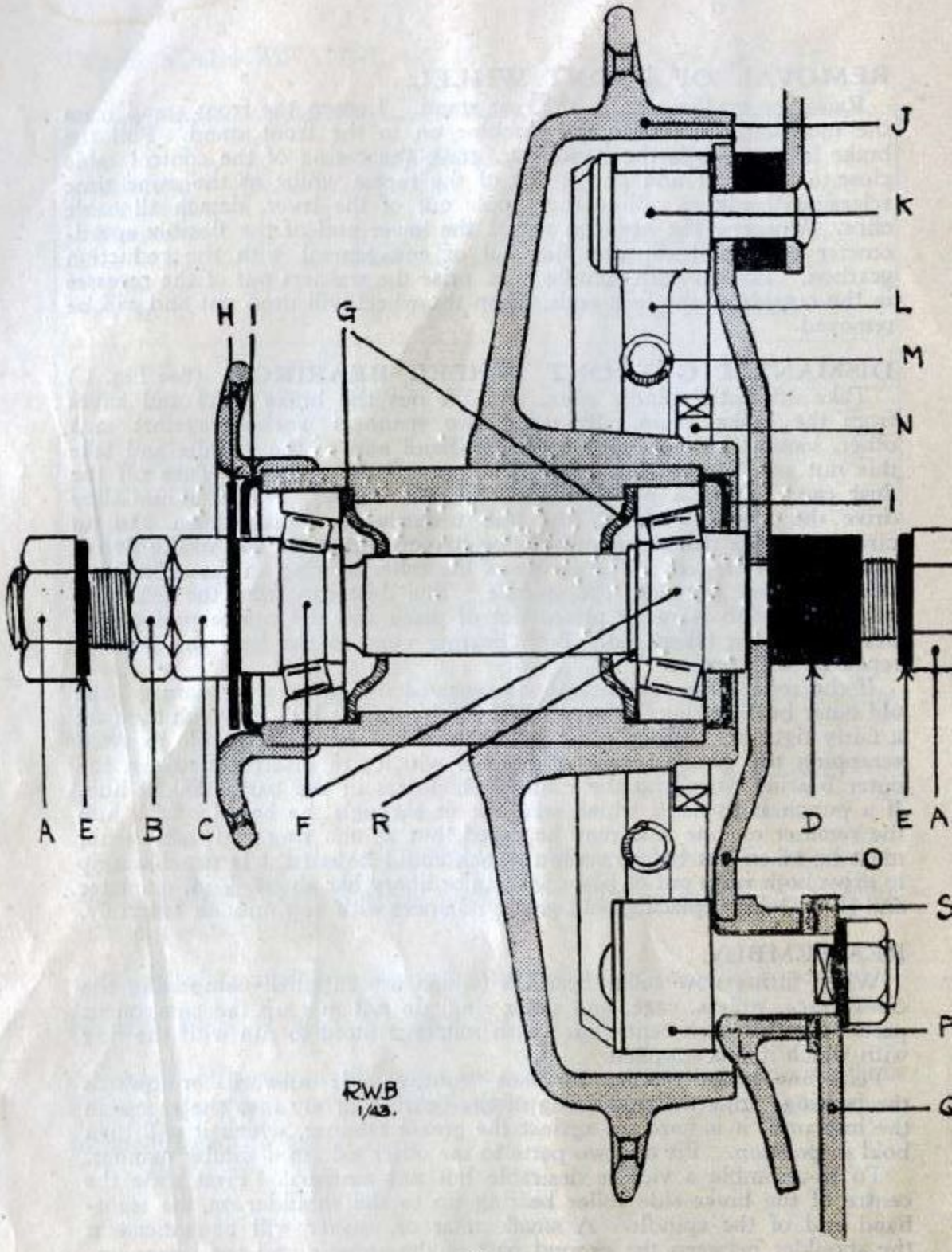

Fig. 1.

SECTION OF FRONT HUB AND BRAKE. (MOV and MAC Type) †

A. Spindle Nuts.
B. Lock Nut.
C. Bearing Adjusting Nut.
D. Brake Plate Distance Piece.
E. Spindle Nut Washers.
F. Wheel Bearings.
G. Grease Retaining Washers.
H. Outer Dust Washer.
I. Inner Dust Caps.
J. Brake Drum.
K. Brake Shoe Fulcrum Pin.
L. Brake Shoe.
M. Brake Shoe Spring.
N. Speedometer Drive Gear.
O. Brake Plate.
P. Brake Cam.
Q. Brake Cam Lever.
R. Bearing Seating Collar.
S. Brake Cam Felt Washer.

† *The MSS type hub is larger and differs slightly in detail.*

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Refit the tubular distance piece, spindle-nut and washer, and tighten down the nut to hold the brake plate lightly. Now hold the wheel (brake drum downwards) in a vice by gripping the spindle nut firmly between the jaws. Fit the roller bearing centre into the left-hand bearing ring and tap the inner dust cap into place. Place the flat dust washer in position and tighten down the adjusting nut **lightly** far enough to allow the wheel to turn freely with only a very slight amount of slackness (about $\frac{1}{64}$-in.) noticeable at the wheel rim in all positions. Fit the lock nut and screw it down lightly against the adjuster nut. The setting of the bearings is then near enough for the wheel to be re-fitted to the machine. To do this, slack off the spindle nut at the brake side enough to allow the spindle to slide up into the fork end and push the wheel up into place. See that the outside washers are snugly fitted into the recesses in the fork ends, the brake plate engaged with the lug on the fork girder, and tighten down both nuts. Check the adjustment. If incorrect, *i.e.*, wheel tight or excessively slack, see next section.

When correctly adjusted connect up the brake cable and adjust the brake (Fig. 2).

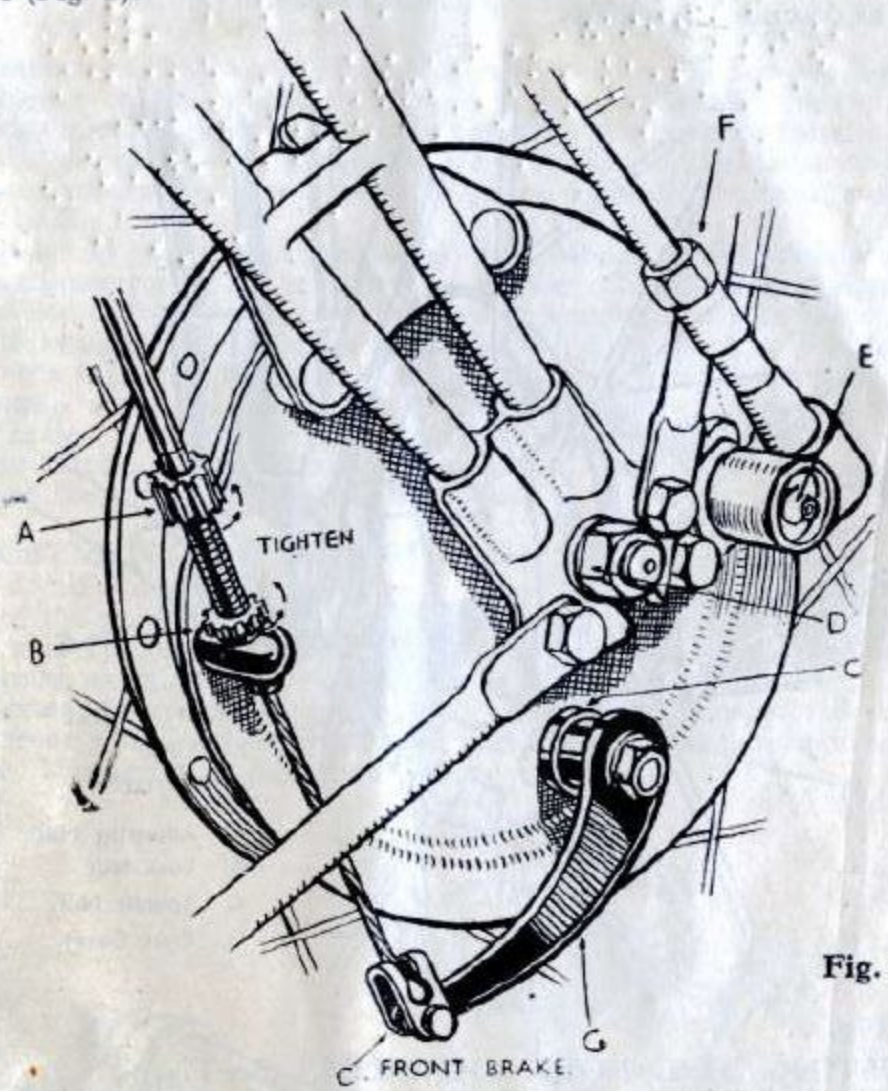

Fig. 2

FRONT BRAKE.

A. Adjuster.
B. Lock Nut.
C. Felt Washers (keep oily).
D. Spindle Nut.
E. Greaser for Reduction Gearbox.
F. Nut (securing flexible drive).
G. Cam Lever.

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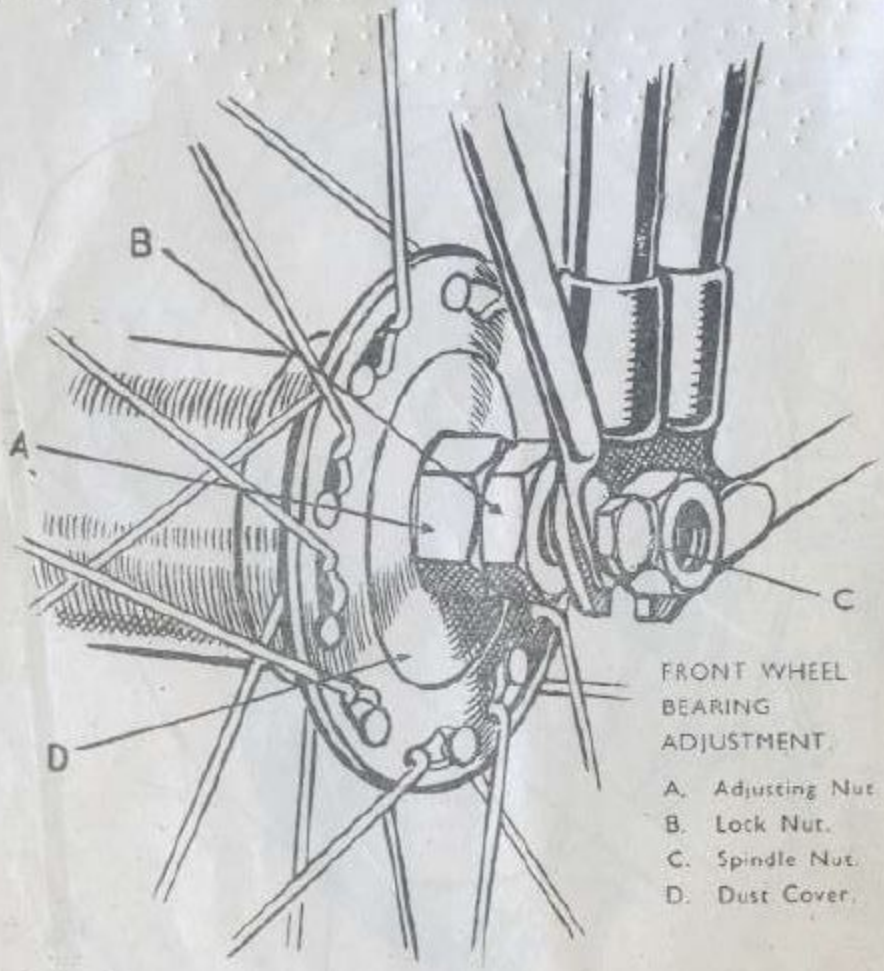
We advise that when dismantling the hub, or in fact any part of the machine, a careful note be made of the positions that the various nuts, washers and other parts occupy before removal. If they are systematically placed in order as taken off and their positions memorised, much time and trouble would be saved and there will not be any of those odd and unaccounted for " left over " parts when the job is done.

ADJUSTMENT OF FRONT WHEEL BEARINGS (See Fig. 3).

Should the wheel be too slack loosen the nearside spindle nut, slack back the lock nut slightly and tighten the adjusting nut until the play is nearly all taken up. Check with the wheel in several positions allowing not more than $\frac{1}{64}$-in. play at the wheel rim. Tighten the lock nut, being careful not to shift the adjusting nut. Tighten the spindle nut again and check adjustment once more.

If the bearings are too tight, proceed as above, but slack back the adjuster nut away from the head. Tap the brake drum over from the off-side, using a wood mallet or a block of wood until play is obtained. Then adjust as described previously.



FRONT WHEEL BEARING ADJUSTMENT.

A. Adjusting Nut.
B. Lock Nut.
C. Spindle Nut.
D. Dust Cover.

Fig. 3.

ADJUSTING THE FORK SPINDLES. (See Fig. 4.)

See that the adjustment of the shock absorber is slacked right off before checking or resetting the adjustment of the fork spindles.

The final adjustment of the spindles must allow perfect freedom of movement of the fork spindles with no noticeable end clearance between the inner faces of the links, the spacing washers, and the faces on the top-clip, column, and girder cross-members. If on checking the adjustment one spacing washer on each spindle can be turned with the finger and thumb and has no side tilt the adjustment of the particular spindle is correct. Adjustment is needed when the washers are loose and can tilt.

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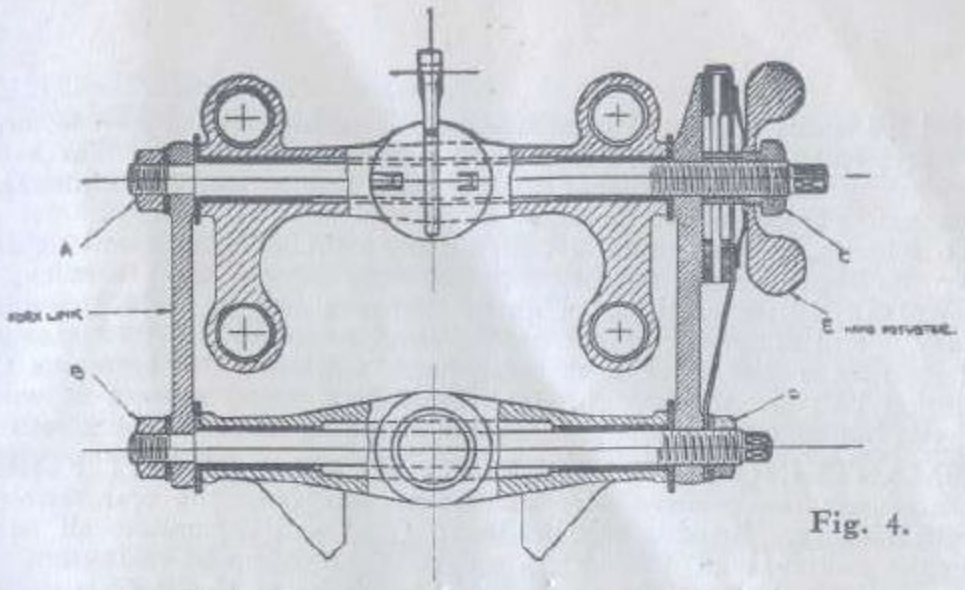


Fig. 4.

SECTION THROUGH BOTTOM SPINDLES OF FORK.
A, B, C and D. Spindle Nuts. E. Adjuster for S Absorber.

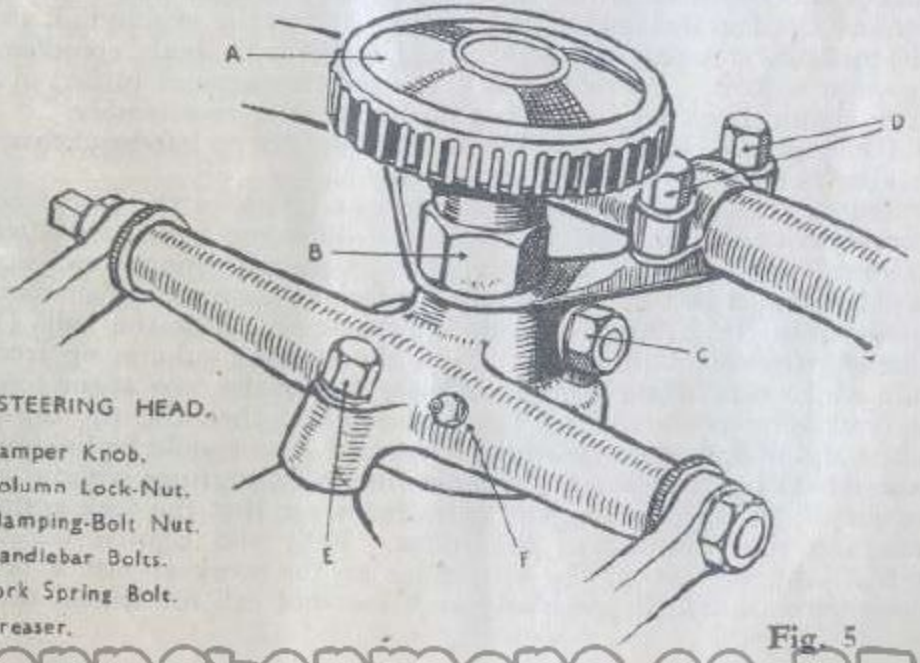
Reference to the illustration will show that the spindles are reduced in diameter on the nearside ends and fit into unthreaded holes in the nearside links into which they are secured by the nearside spindle nuts. The offside links and offside ends of the spindles are threaded so that the distance between the inner faces of the links is variable by turning a spindle in the links.

To take up play loosen the nut on the nearside of the spindle which needs adjustment, and then the nut on the offside. Grip the square offside end of the spindle with a moveable spanner and turn the spindle anti-clockwise slightly until the play is **nearly** all taken up. Tighten up both nuts fully and check as described above. If too tight loosen the nuts again and turn the spindle slightly clockwise. Tighten nuts and check again. All four spindles adjusted in a similar manner.

Early pattern forks have shock-absorbers at both sides. The spindles on these are adjusted in just the same way.

ADJUSTMENT OF STEERING HEAD. (See Fig. 5.)

To do this properly a stout box or tin will be needed to support the front of the machine to keep front wheel clear of the ground. Tighten shock absorber (on right-hand side of front fork) fully. This prevents fork spring extending fully when wheel is lifted clear of ground and prevents extended spring fouling head lug. Support machine on rear stand. Raise front wheel and have someone push stout box under front end of frame. Unscrew steering damper knob.



THE STEERING HEAD.

A. Damper Knob.
B. Column Lock-Nut.
C. Clamping-Bolt Nut.
D. Handlebar Bolts.
E. Fork Spring Bolt.
F. Greaser.

Fig. 5

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Feel for traces of play in head bearings by taking hold of fork towards the lower end of girder and alternately pushing and pulling. Check for freedom by turning handlebar to left and right. Correct adjustment gives perfect freedom with no play.

To take up, loosen clamping bolt nut on top clip of fork and tighten down the large hexagon nut below the steering damper knob (turn clockwise) about a quarter turn. Tighten clamping bolt and check results. If play is still noticeable repeat process until removed. If overtightened and steering is stiff, slack back the column nut, and after loosening the clamping bolt tap the top clip up from below, using a piece of wood between hammer and top clip. Tighten clamping bolt and check results.

DISMANTLING THE STEERING HEAD & FRONT FORK.

Disconnect the positive wire and horn cable from the rear terminal on the battery. Remove the headlamp front and disconnect all wires from the switch (Figs. 42 and 43). Take off the lamp by taking out the bolts securing the brackets to the fork. Disconnect the flexible speedometer drive from the reduction gearbox on the brake-plate (Fig. 2), and remove the speedometer.

As described on page 15, disconnect the front brake-cable from the lever on the handlebar.

Completely unscrew the steering damper knob and pull it up with the rod, star spring, and locating-plate. Remove the four bolts securing the handlebar to the top-clip of the fork, raise the handlebar out of position and pull back and rest it on the top of the fuel tank. At once refit the two half clips and four bolts to the top-clip in the positions they occupied originally.

Should any work be being undertaken to the fork take out the front wheel, after supporting the machine with a box or block of wood placed under the front end of the frame. Loosen the clamping bolt in the top clip and remove the steering-column lock-nut. Take out the bolt securing the top lug of the spring to the top-clip and tap the lug out of the taper. Tap the top-clip clear of the column and pull out the column from the steering head. Care must be taken to catch the balls from the lower head bearing. There should be nineteen in each race.

Should it be required to attend to the spindles or links of the fork only, there is of course no need to remove the fork. It is, however, not possible to take out one spindle separately, and two should always be removed together as follows (the procedure is the same for top or bottom spindles except that to remove the bottom ones it will also be necessary to take out the bolt securing the shock absorber plate to the girder) :—

Raise the front of the machine and support the frame at the front end, preferably so as to leave the front tyre just lightly resting on the ground. Take off both nuts from the nearside ends of the spindles, which are to be removed. Tap the link off the spindles. Tap the offside link away from the machine towards the right, and it will pull both spindles out of position with it. Provided that these spindles are not turned in the link they should need very little re-adjustment after re-assembly.

Each spindle bears in two bushes. There are no left-hand threads used in the construction of the fork assembly.

Before refitting the steering column and fork to the frame check the condition of the cups in the frame and the cones which are fitted to the column. Should there be the slightest signs of pitting, new cups, cones and balls must be fitted. To refit the fork to the machine, first smear stiff grease into the bearing cups in the frame and stick the balls (19, ¼-in. diameter in each) into place. Push the steering column up from below and whilst supporting it firmly in place put on the cone at the top and tap it down into position. Fit the dust-cap and then slip the top-clip into place and fit and screw down the lock-nut. This should be tightened down just far enough to leave the column free in its bearings without any trace of play. When checking the adjustment see that the fork spring is not catching the head-lug of the frame. Refit and tighten the clamping pin in the top-clip. The remainder of the work is just a reversal of operations described previously and does not call for special mention.

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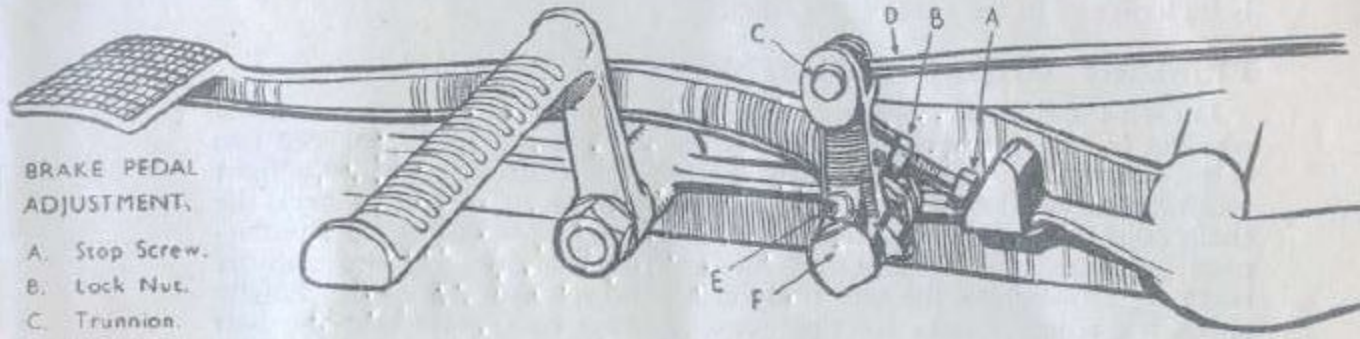
ADJUSTMENT OF BRAKES.

Front Brake. (See Fig. 2). The hand lever should not come up too close to the grip when the brake is fully applied, and as the brake wears it will be found that the lever will move further before full braking power is obtained. Adjustment is then necessary, and is carried out as follows :—Loosen the lock nut below the knurled head of the brake adjuster on the front brake plate, screw up the adjuster until the correct adjustment is obtained. It is best to have the adjustment set so that the lever is about a full inch away from the grip when the brake is fully applied. When correctly set tighten the lock nut. After adjusting raise the front wheel from the ground by supporting the machine on the front stand in order to make sure that the brake shoes are not fouling the drum when the lever is released. (The adjuster is on the fork girder on early types).



BRAKE PEDAL ADJUSTMENT.

A. Stop Screw.
B. Lock Nut.
C. Trunnion.
D. Brake Rod
E. Pedal Greaser
F. Pedal Pivot.

(MOV and MAC)
Fig. 6.

REAR BRAKE ADJUSTMENT

A. Adjusting Nut.
B. Cam Lever.
C. Trunnion.
D. End of Dummy Spindle.
E. Dummy Spindle Nut.
F. Greaser for Brake Cam.
G. Felt Washer (keep oily)

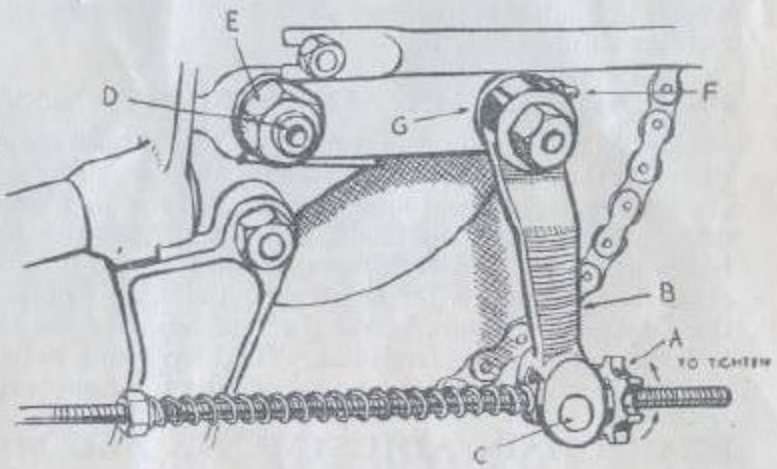


Fig. 7.

Rear Brake. (See Fig. 7). To re-adjust screw the knurled nut further up the brake rod at the rear end until the correct adjustment is obtained. The brake pedal on MOV and MAC machines may be adjusted for height to suit the rider's individual requirements by altering the setting of the brake pedal stop (see Fig. 6). See that it clears the footrest when the brake is fully applied. After adjusting brakes check wheels to see that brake shoes are not fouling.

ADJUSTMENT OF CHAINS.

Slack or incorrectly adjusted chains cause hard or snatchy running and excessive wear. The adjustment of both chains should be such that there is about ½-in. free up and down movement midway between the sprockets. Check the adjustment of the front chain through the inspection hole in the chain cover—never attempt to check with chains in motion—an elementary point which if forgotten may result in the loss of, or injury to, the fingers. Always check the adjustment in several places and allow the specified amount of freedom in the tightest place. The tension is nearly always found to vary slightly in different places as the sprockets are turned.

The primary chain is adjusted by moving the gearbox which is pivotally mounted and which in the case of the MOV and MAC models is mounted on a cross tube of the frame to which it is held by two halfclips. On the

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MSS model the gearbox is also pivotally mounted, but it is mounted on a bolt passing through the bottom of the housing, and the housing is held between the two rear engine plates. The driving load upon the rear chain always tends to pull back the gearbox and would tighten the front chain excessively if no positive means were provided to stop the gearbox "working" back. On the MOV and MAC models the top of the gearbox housing is provided with a shoulder through which passes a draw bolt secured to the left-hand rear engine plate, and on the MSS the draw bolt is fitted behind the rear of the two top gearbox fixing bolts and passes through an "eye" bolt fixed to the engine plate (see Fig. 7A). In each case two nuts are fitted on to the draw bolts by means of which it is possible to move the gearbox forward or backward on its mounting after the fixing clips, in the case of the models MOV and MAC are loosened or the fixing bolts loosened in the case of the MSS.

PRIMARY CHAIN ADJUSTMENT—MOV & MAC.

Loosen the four nuts securing the half clips underneath, and loosen the rear nut on the draw bolt or gearbox adjuster. Screw this back about two turns. Now screw the front nut back in the same direction until it is tight and tighten up the nuts underneath to hold the half clips. Check the chain adjustment. Should the chain be too tight, loosen the nuts underneath again and turn the front nut forward a little and follow it up with the rear nut. Re-tighten the nuts underneath and re-check the chain. Finally check the adjuster nuts for tightness. Always make sure that the bolt which holds the adjuster or draw bolt to the rear engine plate is kept fully tightened up.

PRIMARY CHAIN ADJUSTMENT—MSS.

Slacken the nuts on the three bolts which hold the gearbox into the engine plates, one at the bottom and two at the top. The adjusting nuts (Fig. 7A) are on the right-hand side of the machine just alongside the rear engine plate. To tighten the chain, screw the front nut forward along the draw bolt a little and then turn the rear nut forward until it is tight. Check the chain adjustment, after tightening the fixing bolts. If too tight, loosen the fixing bolts again, screw the rear adjuster nut slightly to the rear and follow it up with the front nut. Tighten fixing bolts and check the adjustment. Finally check the adjuster nuts for tightness.

REAR CHAIN ADJUSTMENT. ALL MODELS.

If slackness in the front chain is taken up it will be necessary to re-adjust the rear chain to compensate for the amount that it will have been slackened by the rearward movement of the gearbox.

To re-adjust the rear chain slacken the nut on the dummy spindle at the left-hand side frame fork end and slightly unscrew the detachable spindle which passes through the fork end of the frame on the right-hand side. On early models of the MOV and MAC types it is also necessary to slacken the rear brake plate anchor bolt (Fig. 27). On machines fitted with the early type integral hub and brake drum (non-detachable), slacken the nuts on both sides.

The wheel may be pushed to the rear to take up excess slackness in the chain by turning the chain adjusting screws each a little at a time clockwise after loosening the lock nuts which keep them secured in the frame fork ends. The heads of the adjusters and lock nuts are situated in the angle made between the saddle stay tubes (from fork end lugs to below saddle) and the chain stays (between fork end lugs and lower part of frame) (see Fig. 27). A convenient way to keep the rear wheel in correct alignment is to count the number of turns given to each screw and turn them an equal amount. Push the wheel forward so as to contact the dummy spindle and detachable spindle with the ends of the adjusters and hold it in this position when tightening the spindle and the nut on the opposite side.

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Check the adjustment of the chain, and if correct tighten the lock nuts on the adjusters and check the spindle and nut for tightness. Finally and most important, should the rear chain be taken off always be sure to refit the small spring clip on the chain connecting link carefully into the grooves in the link pins and make sure that the closed end of the spring clip faces forward in the direction of movement of the chain.

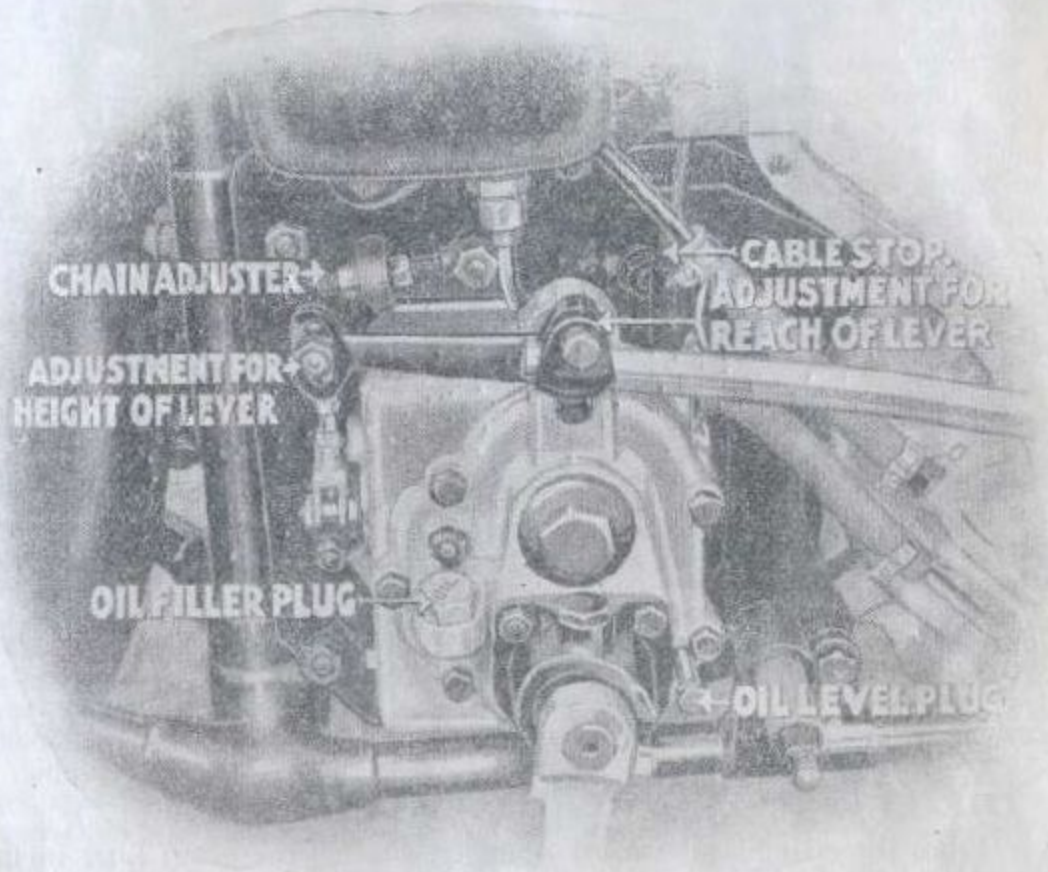

Fig. 7A.

The Gearbox (MSS Type) (The Gear Lever shown is an early type.)

LUBRICATION OF CHAINS.

The front chain is enclosed in a sheet metal cover and a small quantity of oil is put into the chain case before the machine is tested. The oil should be replenished at intervals of approximately 1,000 miles, more oil being poured in through the inspection plug hole in the front part of the primary cover. This inspection cap is approximately above the left-hand footrest. It is usually convenient to squirt oil over the chain from an oil can while the chain is moved forward by the starter.

The rear chain should be lubricated from an oil can from time to time, and occasionally should be removed and put into a bath of paraffin to allow the paraffin to penetrate into the interior of the chain joints and also brushed well to remove all external dirt. It should then be given another bath in fresh, clean paraffin, and after being well shaken should be hung up to drain. The chain is then ready to be lubricated before being refitted to the machine. This may be done by soaking it in a bath of warm, but not boiling, graphite grease or tallow. The grease or tallow must be warm enough to be quite fluid. After allowing the chain to remain in the bath from about 15 to 20 minutes, allow the bath to cool down until the contents almost set, and then remove the chain, wipe off excess grease and refit it.

When re-fitting the rear chain, make sure that the spring clip on the connecting link is fitted so that the closed end of the link faces forward in the direction of movement of the chain. This is important.

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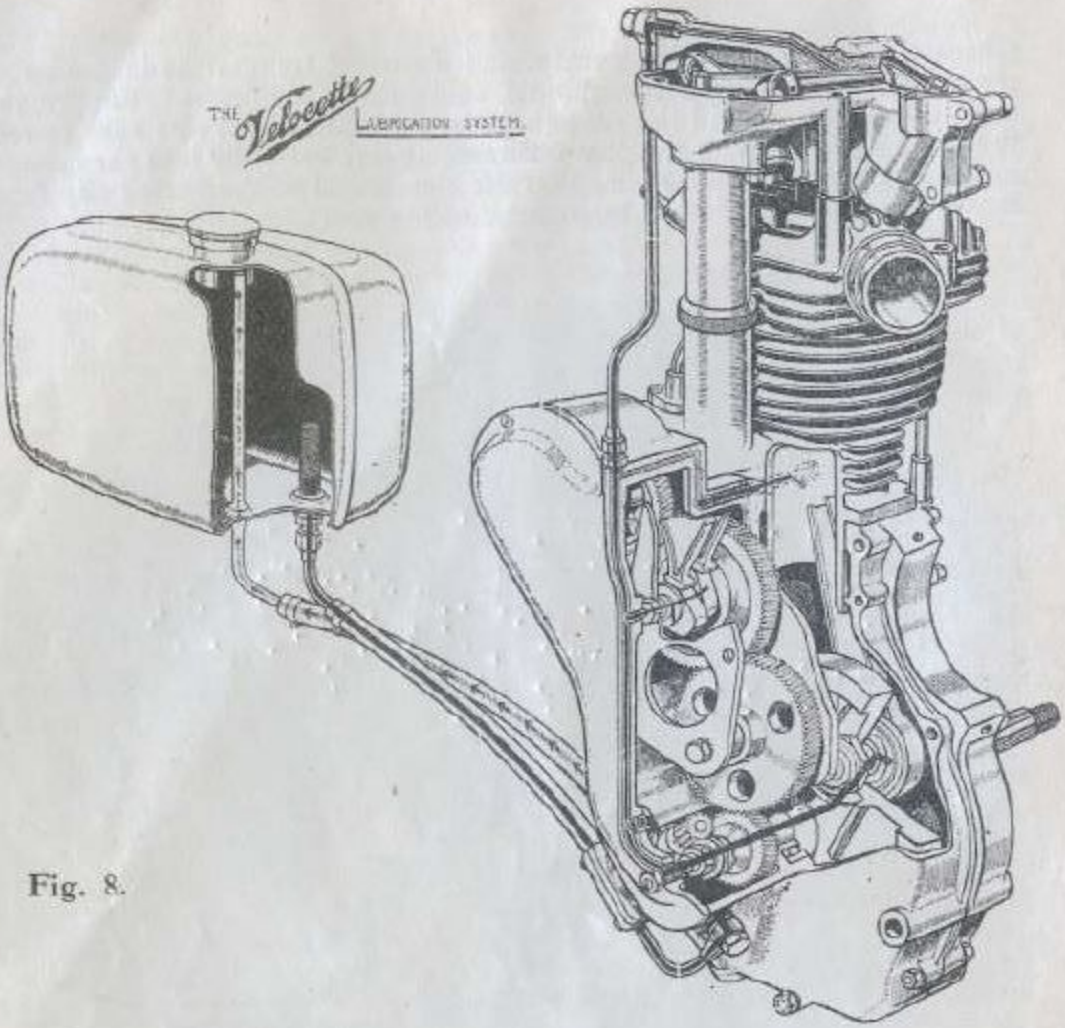

Fig. 8.

THE ENGINE LUBRICATION SYSTEM. (See Fig. 8.)

From the oil tank oil feeds by gravity through the gauze filter in the tank and the feed pipe to the oil pump situated in the lower part of the rear of the timing side crankcase. This pump is divided into two distinct parts—the upper part of gears acting as the feed pump and the lower pair as the return pump. Both sets of gears are fitted in the one pump-body and are driven from the crankshaft by a worm on the main-shaft which meshes with a skew gear on the spindle of the pump. In order that it shall never be possible for more oil to be fed into the engine than the return side of the pump would be capable of clearing from the sump, the return gears are almost double the width of the feed gears. Thus the return side is able to handle nearly double the amount which can be supplied to the engine.

The Illustration (Fig. 8) shows clearly the general arrangement of the lubrication system and should be referred to in conjunction with this explanation.

From the feed gears oil is fed out of the top of the pump into the passage drilled in the crankcase which leads obliquely upwards to the face of the timing-chest. Before reaching the end of this passage the oil has to pass a ¼-in. diameter steel ball which, when the pump is not working, is held against a seating in the oil passage by a light spring. The spring is held in position by a plug screwed down to a shoulder inside the mouth of the passage.† (See Fig. 10).

This arrangement is termed the check valve. Its purpose is to prevent any oil flowing into and thus flooding the engine when the machine is left standing.

† *A small steel plate pressed into the oil passage was used instead of the screwed plug up to* 1940.

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The timing cover which is secured to the face of the timing-chest acts as a distributor for the oil supply. A passage cored in the cover during casting registers with the mouth of the oil-passage in the crankcase and oil is thus fed into the passage in the cover.

By means of the passage in the cover oil is taken to an oil-jet (screwed into the cover) through which a supply passes into the hollow mainshaft and through a drilled hole to the crankpin, from which it issues from a hole in the centre of the roller track in the big-end. The revolving big-end dissipates the oil over the interior of the crankcase, lubricating the cylinder and piston and small end bearing. This oil ultimately drains to the bottom of the crankcase to be picked up by the return pump.

A second opening in the oil passage in the timing cover is arranged to fit over the end of the spindle carrying the cam-wheel and cams. The oil feeds along the hollow spindle and passes out through two holes in the spindle to oil holes in the cam-wheel bush and through holes in the cam faces. Lubrication is thus provided directly for the bearing and the cams and cam-followers.

† From the upper end of the passage oil is diverted through a drilling in the face of the timing cover into a drilled passage in the crankcase and to the rear of the cylinder wall. This supply has first to pass through a hollow bolt screwed into the crank case from the nearside. The head of this bolt is marked "jet." A small radial hole in the bolt allows sufficient oil to pass to the oil holes in the cylinder. (See Fig. 11.)

The remainder of the supply is taken by a pipe from the top of the timing cover to the rocker box. The top half of the rocker box is drilled to lead oil to the large oil grooves in the top bearing surfaces above the rockers.

These grooves being open at the push-rod ends of the bearings, the oil is free to run away down the push-rod cover into the timing-chest, where it lubricates the timing gears, etc. The crankshaft pinion dips into oil collected in the bottom of the timing-chest. The excess drains through a hole to the sump.

Lubrication of the intermediate-timing-gear bearing is provided from the spindle carrying the gear. The flange of this spindle (inside the crankcase) is drilled to communicate with a groove running the full length of the top of the spindle and a constant supply of oil runs into the oil hole and along the groove from the interior of the engine.

In addition to those parts which are lubricated directly from the pump, the valves and valve-guides receive adequate lubrication from oil which is collected in the valve spring covers.

In actual working conditions quite a lot of oil accumulates in the valve spring covers. The supply is restricted to some extent by the provision of two washers, one in each rocker, which are held in place by light springs attached to the tappet covers.

All oil which drains back to the sump is drawn away past a filter plug† (Fig. 9) by the return side of the pump which delivers it to the oil tank.

The correct working of the system can be checked by starting the engine and removing the cap from the oil tank. Oil will be noticed returning in an intermittent stream from the top of the pipe just inside the filler neck.

The fact that the return is irregular sometimes give rise to enquiry, but it is quite in order. On starting the engine the return may be almost constant for a few moments due to the amount of oil which has drained to the bottom of the crankcase whilst the engine was stationary, and until this surplus is cleared the return flow will exceed normal. During normal running, however, the return is somewhat intermittent, and mixed with bubbles of air due, partly to the fact that the return side of the pump has practically double the capacity of the feed side, and partly to variations in the amount of oil suspended in the crankcase due to engine speed. For example, upon sudden acceleration the return flow may cease for a time, but will of course resume at a greater rate upon the engine being slowed down.

† *Except on engines prior to M3472, MAC 5079 and MSS 3611.*

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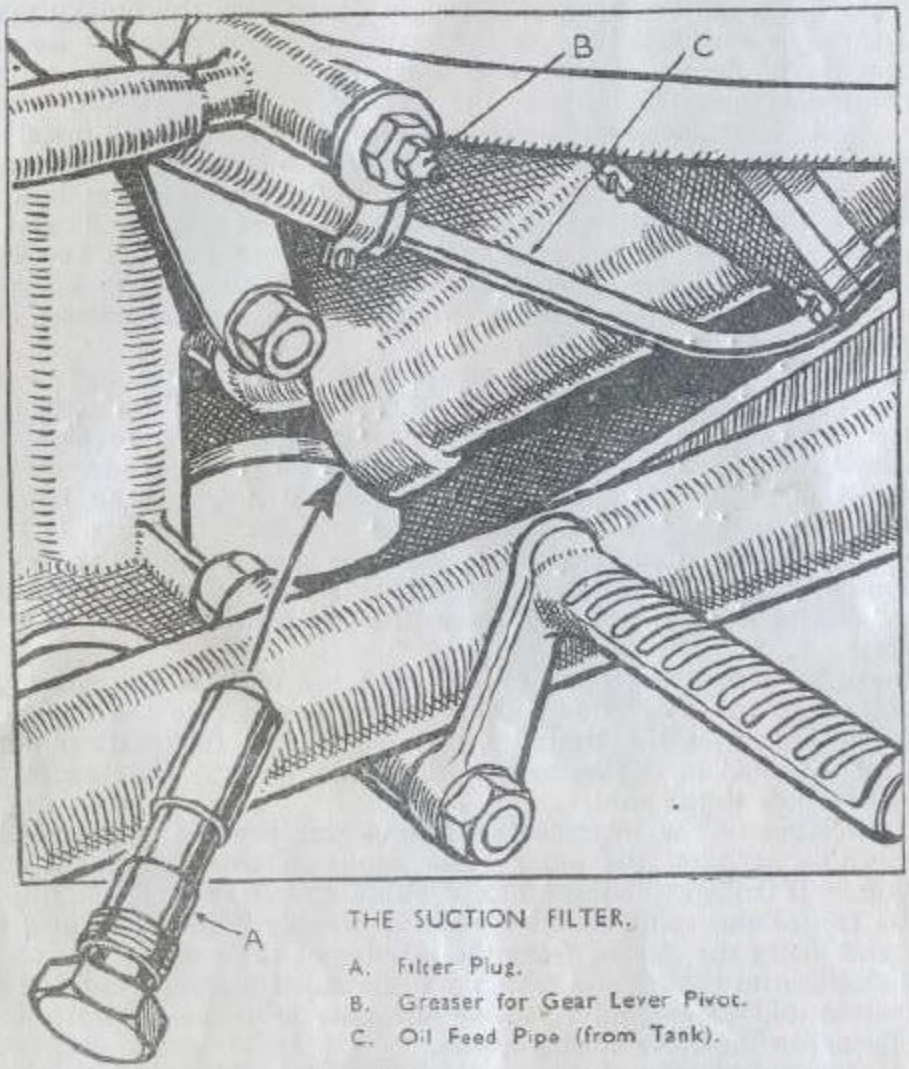
† THE SUCTION FILTER. (See Fig. 9.)

All oil has to pass this filter before reaching the return pump.

The head of the filter plug is situated at the bottom rear corner of the crankcase on the "off" or right-hand side of the machine, just below the rear engine bolt. It has a right-hand thread.



THE SUCTION FILTER.

A. Filter Plug.
B. Greaser for Gear Lever Pivot.
C. Oil Feed Pipe (from Tank).

Fig. 9

The body of the plug is machined to fit with a very small peripheral clearance from the bore in the crankcase in which it is fitted. The space whilst being ample to pass the oil will not permit anything to pass which could damage or lock the oil pump.

The plug may be unscrewed with the sparking plug spanner and should be removed occasionally for cleaning purposes, usually at intervals of approximately 2,000 miles running. If restricted or choked, excessive smoking at the exhaust will occur due to the return of oil to the tank being prevented, with consequent flooding of the crankcase.

When refitting see that the fibre washer is in place and the plug fully tightened. An air leak at this point will make impossible the proper working of the return side of the system.

THE CHECK VALVE. (See Fig. 10.)

Occasionally trouble is encountered with excessive smoking from the exhaust on starting, due to oil from the tank draining through into the crankcase when the engine is stationary owing to the check valve failing to close properly. The remedy is to remove the timing cover and reseat the ball. The valve consists of ¼-in. dia. steel ball held on a seating in the main oil passage above the oil pump by a light spring. The spring is

† *Except on engines prior to M3472, MAC 5079 and MSS 3611.*

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held by a plug, screwed into the mouth of the oil passage. It may be unscrewed with a screwdriver and should bring the spring with it. Engines built prior to 1940 have a small plate pressed into the oil-way instead of the screwed plug illustrated. This plate can be pulled out by using a small pair of pliers with narrow jaws.

The use of an engine oil of "heavier" grade than recommended, *i.e.*, a Summer Grade during the Winter, may also cause smoking on starting from cold in addition to making starting more difficult.

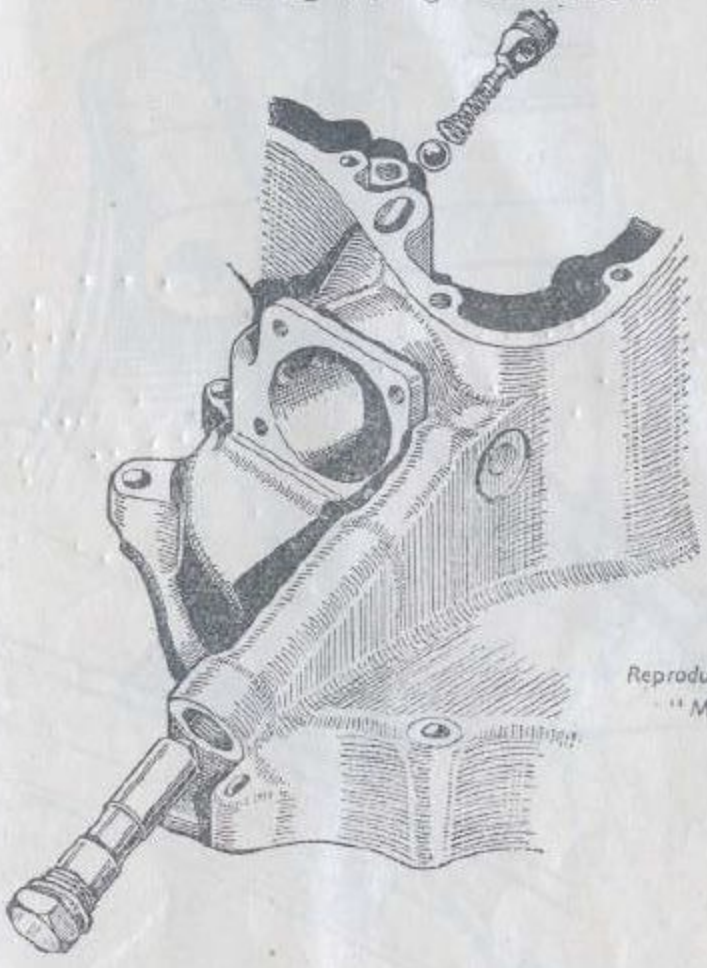

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Fig. 10

THE SUCTION FILTER AND CHECK VALVE.

(Shown removed from the crankcase.)

The passage into which the plug is fitted is readily visible as soon as the timing cover is taken off. The mouth is oval in shape, and its position is well shown in Fig. 10.

To reseat the ball insert a punch in the oil passage and **lightly** tap the ball once or twice against the seating. Before re-fitting the spring and plug, make sure that the former is in good condition and if there is any doubt about it, replace it with a new one.

When re-fitting the check valve plug, screw it down as far as it will go against the shoulder in the oil passage.

After re-fitting the check valve plug and the timing cover, start the engine before attaching the rocker box oil feed pipe to the union on the cover. Oil should be forced out of the union in a steady flow. If satisfactory, stop the engine and connect up the pipe. If no oil comes out see that the check valve spring is not jammed. Slightly ease back the check valve plug and test again.

THE CYLINDER OIL FEED.† (See Fig. 11.)

Remove bolt below cylinder base joint at rear on left side. Bolt is marked "jet" on head. Clean in petrol. See that small radial hole in the centre of bolt is clear. See that fibre washer below head is in order. Replace. Exercise great care in tightening so that bolt is not sheared off.

† *Except on engines prior to M3472, MAC 5079 and MSS 3611.*

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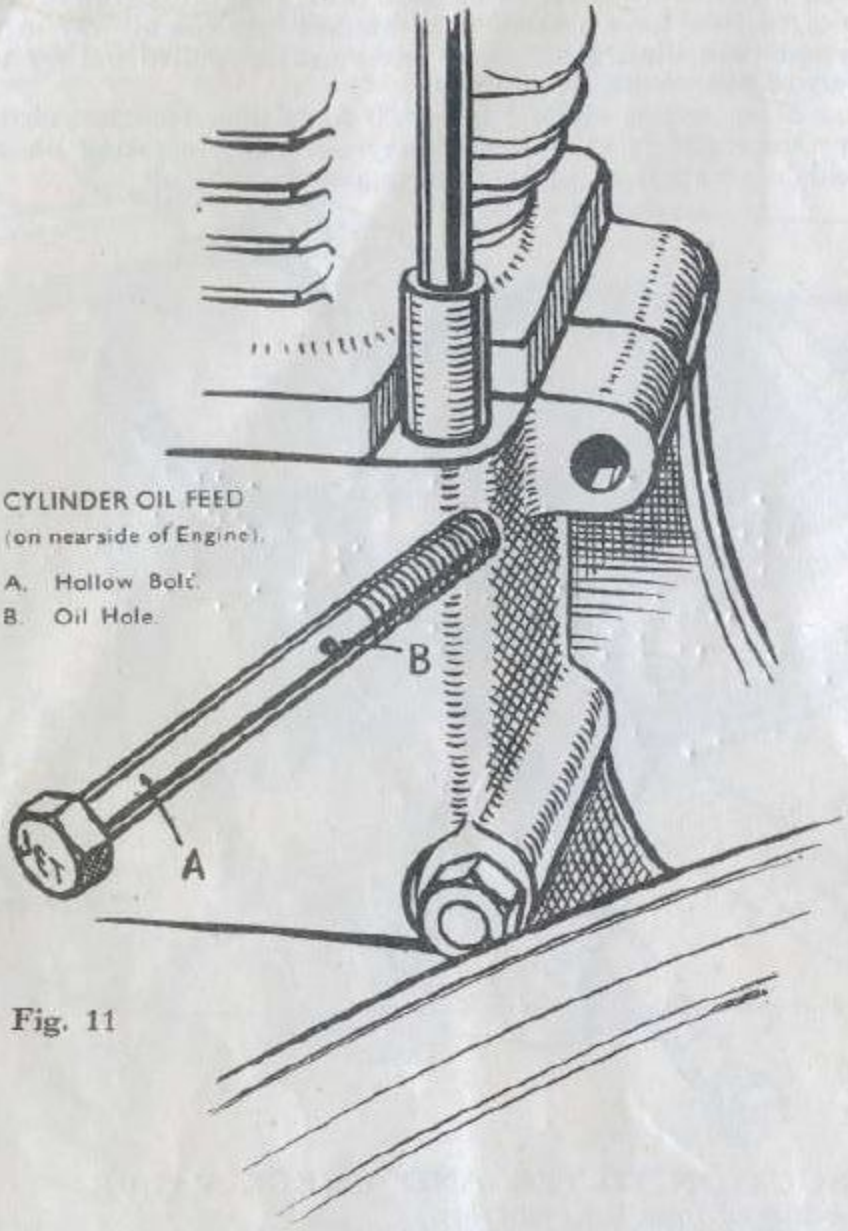

Fig. 11

ADJUSTMENT OF DYNAMO DRIVE BELT.

Take off belt cover by taking out bolt from centre of cover and nut securing cover to primary chain case. Loosen clamping bolt securing dynamo strap to crankcase in front of cylinder base. Turn dynamo slowly on crankcase being careful not to move it sideways and put pulleys out of line. The armature is eccentric to the body of the dynamo, so that rotation of the body varies the distance of the armature spindle from the crankshaft. When belt is just **taut** tighten clamping bolt.

Check alignment of belt. Replace cover.

REMOVAL OF OIL TANK. (See Fig. 12). MOV and MAC Models only.

To remove the oil tank for cleaning purposes it is necessary first of all to disconnect the clutch cable, and this is done in the following manner :—

Raise the handlebar clutch lever as when declutching when driving the machine ; grasp the outer casing of the clutch cable and release the handlebar lever, at the same time pull forward the outer casing so that it comes away from the socket of the lever.

The nipple can then be slipped out of the lever and the outer casing will slide up, enabling the cable stop to be taken out of the cable stop holder on the gearbox. (See Fig. 19).

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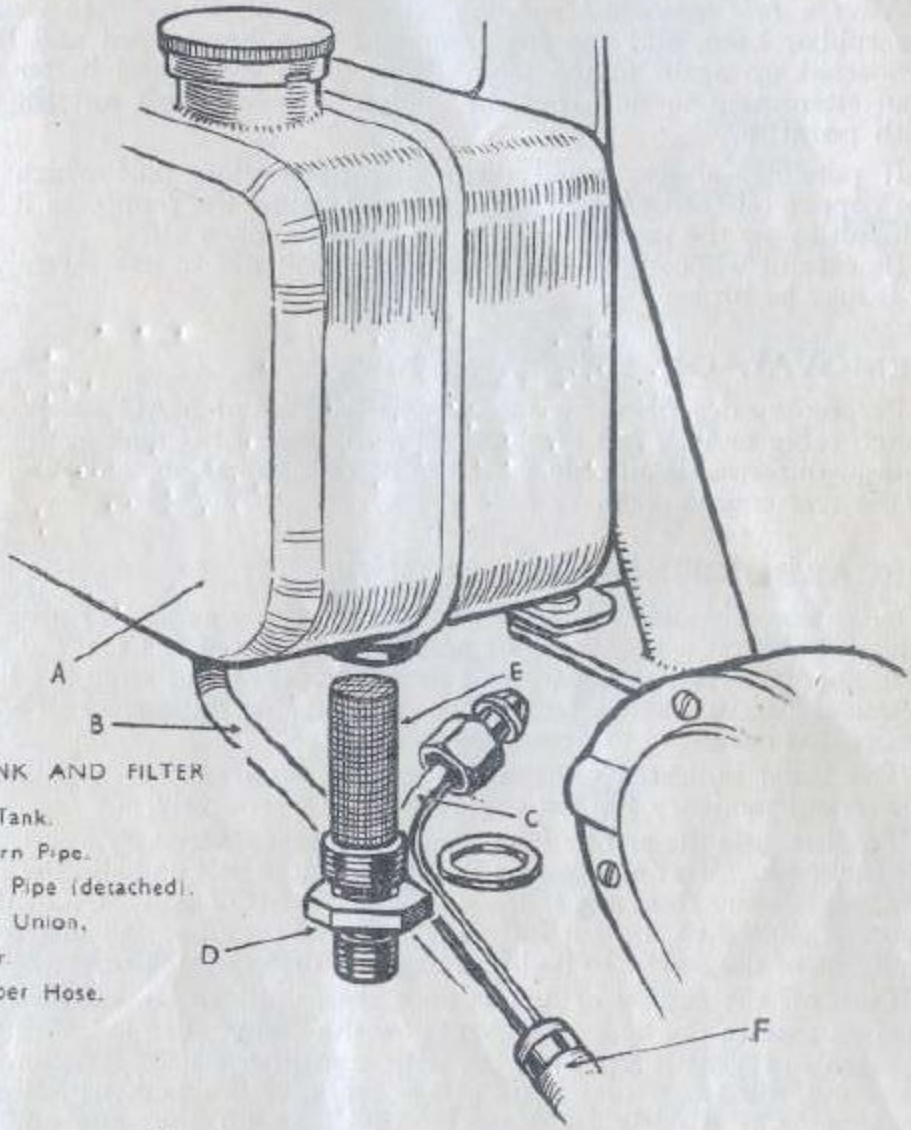
Screw out the cable holder, and slip this up out of place, and then disconnect the small cable nipple from the slotted connecting piece just inside the gearbox by sliding the cable sideways. The cable and casing



OIL TANK AND FILTER

A. Oil Tank.
B. Return Pipe.
C. Feed Pipe (detached).
D. Feed Union.
E. Filter.
F. Rubber Hose.

Fig. 12

will then easily draw upwards through the tube in the oil tank. Drain the tank by removing the drain plug or oil feed union.

The oil pipes should then be disconnected and finally the tank can be unbolted and removed.

It is held by one bolt at the top to the saddle lug of the frame, and at the bottom is secured to the battery platform by a nut which is screwed over a threaded boss surrounding the tube through which the clutch cable passes.

Note particularly before removing the oil pipes the position in which they are fitted so that they may be re-fitted in the correct way. (See Fig. 8).

The copper oil pipe which is attached to the oil tank by means of a union nut must be connected to the oil pipe which is secured to the crank-case by the hollow bolt.

The return hose is attached to the small black union above the oil pump and to the steel pipe on the tank.

This pipe is easily distinguishable from the feed pipe as it forms a part of the tank and is not detachable.

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In order to clear as much as possible of the dirty oil out of the engine it is best, after refilling the oil tank, to leave the return pipe hose disconnected and start up the engine. The dirty oil will be pumped up through the rubber hose and it can be caught in a suitable container and ultimately discarded.

After a few moments' running, clean oil will be seen to issue from the rubber hose, and the engine should then be stopped and the hose connected up again to the tank. This is an easier and better method than attempting to flush out the engine. **Never flush out the engine with paraffin.**

If possible, always avoid disturbing the hollow bolt which secures the copper oil feed pipe to the crankcase below the pump, as it may be difficult to get the pipe oil-tight again if this is taken off.

Be careful when tightening this hollow bolt not to use excessive force or it may be broken.

REMOVAL OF OIL TANK MSS.

Proceed as described for the Models MOV and MAC except that the clutch cable may be left in place. The fixings of the tank at the top and bottom differ in detail only. At the bottom an ear on the tank is bolted to the rear engine plate.

DECARBONISING THE ENGINE.

It is generally desirable to decarbonise the engine and to grind in the valves lightly on a new machine after it has covered the first 2,000 miles. It is not, however, necessary to repeat the process at anything like such frequent intervals and often a very considerable mileage can be covered before it is necessary to decarbonise again.

The usual indications that this work is required are—a falling off of power and tendency for the engine to pink excessively.

To dismantle the engine for decarbonising it is necessary first to remove the fuel tank. To do so loosen the front saddle bolt and slip the frame of the saddle away from the bolt. On Models MOV and MAC the saddle frame is slotted to allow it to be lifted out of position, and this will allow the front of the saddle to be lifted to make the rear tank bolt accessible.

Turn off the supply of fuel at both taps, undo the union nuts holding the fuel pipe to the taps. Do not allow the fuel pipe to twist. If a tap is not tight, prevent it from turning with a spanner on the hexagon section. Take out the two fixing bolts at the front of the tank with their steel washers. On Models MOV and MAC take off the nuts holding the small strap across the bottom of the tank at the front and remove the washers and strap. Loosen the nut from the rear bolt, push out the bolt to free tank. The tank is then free to come away.

Unscrew the ring holding the mixing chamber top to the mixing chamber of the carburetter, and pull out the throttle and air valves by the cables and tie them up out of the way to the top tube of the frame.

Take off the two nuts and remove the plain washers from the studs attaching the carburetter to the cylinder head and take off the carburetter and fuel pipe.

REMOVING ROCKER BOX.

It is now necessary to remove the rocker box.

This is done by unscrewing and removing the bolts securing the tappet covers to the side of the rocker box and top cover. Take off both covers, being careful not to drop and lose the small oil control washers which are fitted in the centres of the rockers and which are held in place there by the rocker thrust springs fixed to the covers.

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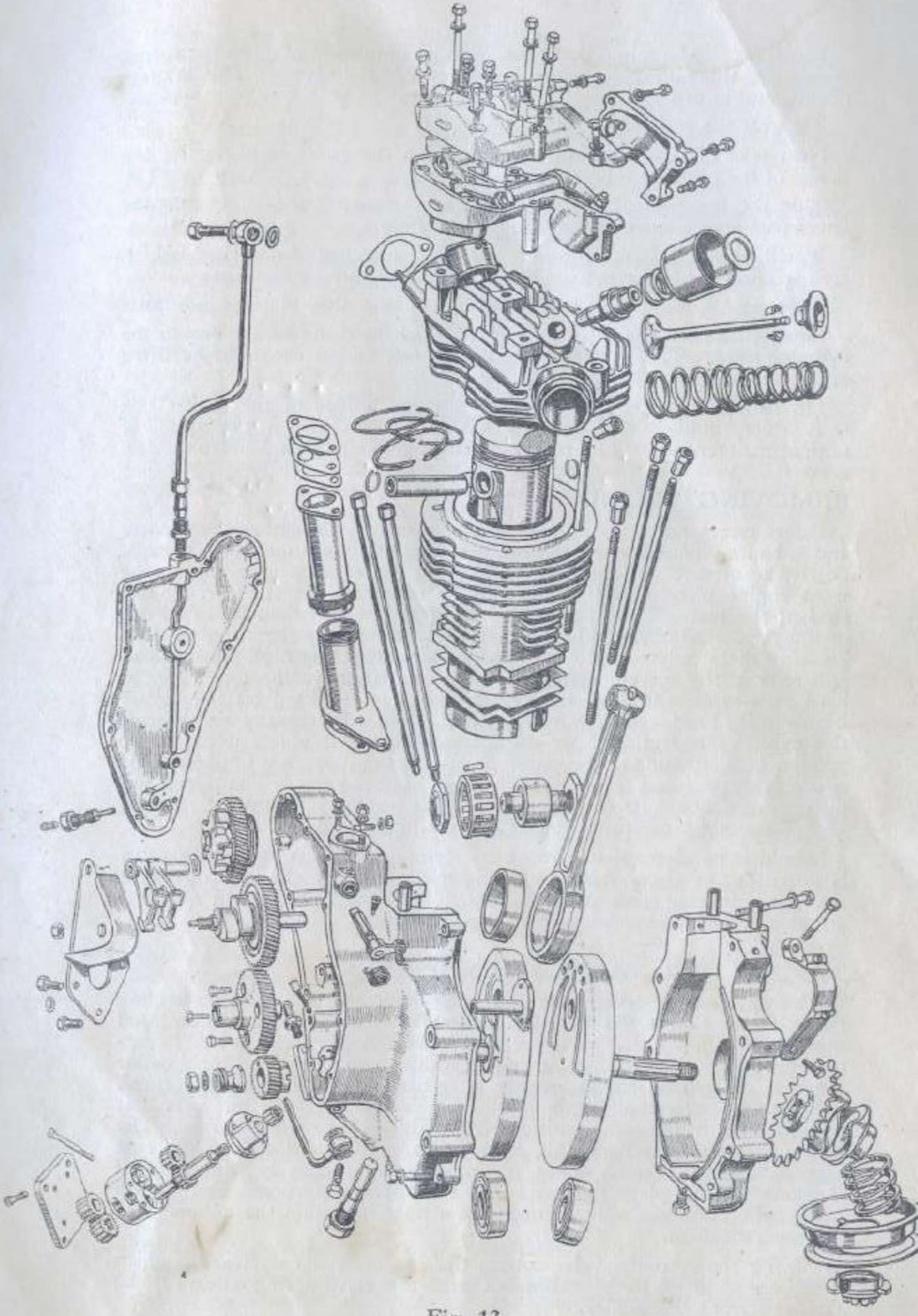

Fig. 13

"EXPLODED" VIEW OF ENGINE. MAC Type.

The Engines of the MOV and MSS Models are similar in design.

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It will usually be found that there is an accumulation of oil in the spring covers and this oil may overflow on removal of the covers. This is quite normal and in order.

Take off the rocker box oil feed pipe.

Next take off the nuts and washers from the studs securing the top flange of the pushrod tube to the rocker box.

Slide the top part of the pushrod cover down off the studs into the lower part after loosening the gland nut slightly.

It will be noticed that between the two paper packing washers which are used on the top flange joint there is a steel pushrod guide plate.

When the rocker box is taken off be sure that this plate is not lost.

Finally, take out the three long bolts which hold the rocker box to the cylinder head. This will free the rocker box and it can then be lifted off.

Do not take apart the top and bottom halves of the rocker box as it is very unlikely that this will ever have to be done in the course of normal maintenance. The rocker bearings give almost indefinite service.

REMOVING CYLINDER HEAD.

Before removing the cylinder head it is necessary to remove the silencer and exhaust pipe. Loosen the nut securing the clip around the exhaust port, take off the nut and washer securing the exhaust pipe clip to the front engine plate, and also take off the nut from the silencer support stud at the rear. The silencer and exhaust pipe can then be lifted out of the way. Detach cylinder head steady (if fitted) by removing the bolt securing the steady tube to the head. Disconnect the high tension lead and remove the sparking plug. Unscrew and remove the four cylinder head nuts—this will allow the cylinder head to be lifted off the barrel. No cylinder head gasket is now fitted.† **It is unnecessary to remove the cylinder barrel,** and we do not recommend it unless it has to be taken off for attention to the piston or piston rings, which is unlikely to be needed except after a considerable mileage has been run. The piston and piston rings should be disturbed as little as possible. Frequent removal and re-assembly sometimes causes heavy oil consumption.

Should it be essential to remove the cylinder barrel, however, this can be lifted out of place after unscrewing the four long cylinder studs from the four crankcase studs at the bottom. They can be held with a pair of grips or by locking two nuts on to the top ends.

TAKING OUT VALVES AND SPRINGS.

The valves are removed by compressing the valve springs whilst holding the valve head on to the seating so as to allow the split cotter to be lifted out of the hollow in the valve-spring-washer. A *Terry* " 250 c.c." compressor will suit. After removing keep the two halves of each cotter together. The odd halves are not interchangeable. The valve springs, valve-spring-covers and washers, etc., are interchangeable, but it is best to refit them in the same positions from which they were removed. The valves are also interchangeable on MOV and MAC Models. The best plan is to get two small boxes, marking them respectively " inlet " and " exhaust." and place the parts into the appropriate boxes as they are taken off. The inner valve springs are a tight fit within the outers. Do not separate them.

Having removed the valve-cotters the springs can be released, which will permit them to be taken out and the valve spring covers to be removed from the guides.

† *A gasket was only used on engines prior to M3472, MAC 5079 and MSS 3611.*

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It should be noted that inside each cover there is a plain steel washer which provides a seating for the bottom of the valve springs, and underneath each cover and between the cover and the guide there are two packing washers which should be renewed when re-assembling the engine.

The valves will pull out of the guides and should be thoroughly cleaned.

REFACING AND GRINDING IN VALVES, Etc.

Reface the seatings on a valve grinding machine equipped with a collett if such a machine is available. The seat angle is 45°.

An alternative method is to hold the stem carefully and as close to the head as possible in the chuck of a lathe or drilling machine, being careful not to mark the stem or otherwise damage it.

The valve head may then be cleaned and polished up with ordinary emery cloth, a fine grade being used for finishing purposes. It is desirable to true up the valve seats before grinding in the valves because although a valve is a comparatively cheap replacement it is necessary to avoid wearing the seats in the cylinder head by prolonged grinding as the head is expensive to replace.

To remove the carbon from the cylinder head it is best to use a scraper made from some soft metal such as brass. This will avoid scratching the surface of the head or damaging the valve seats. Scrape the carbon from the combustion space and from the exhaust port and finish off by cleaning up the ports with a coarse grade of emery cloth.

Avoid scratching the valve seats when doing so.

It is unlikely that the seatings in the cylinder head will require truing up with a cutter unless the machine has covered a considerable distance.
If recutting is needed see Page 38.

If the seats appear to be in reasonably good order, the valves should be lightly ground in. To grind in the valves, use a very fine emery powder mixed with oil or paraffin, or one of the numerous brands of valve grinding compounds. These compounds are sometimes put up in a double-ended tin, the coarse compound in one end and fine compound in the other. It is very seldom necessary to use the coarse variety on the valves. Use as little compound as possible smeared over the seating on the valve. Avoid getting any compound on to the stem or into the valve guide.

Slip the valve into position and hold the end of the stem near the cotter groove with a suitable holder which should be tightened on to the valve carefully to avoid damaging the stem or the edges of the cotter groove.

Rotate the valve backwards and forwards, maintaining the valve head in contact with the seating by pulling lightly on the stem. Lift the valve frequently from the seating to prevent the formation of concentric rings and bring it down into another position, recommencing the back and forward movement for a further period.

After a few minutes light grinding the holder should be removed and the valve taken out. The compound should be wiped off the valve and off the seating in the head. The seatings should be a light grey in appearance, free from marks or black pits. As soon as a light grey seating is obtained all round the seat of the valve and all round the seat in the head, the grinding-in operation is complete, and the other valve should then be tackled.

REFITTING VALVES AND SPRINGS.

Before re-assembling, wash the valves and cylinder head very carefully in clean paraffin and wipe dry. Be particularly careful to see that there are no traces of valve grinding compound on the valves, and particularly in the guides.

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Obtain four new packings and fit two in place over one of the valve guides. Place the valve spring cover in position and then fit the valve spring bottom washer in place over the valve guide inside the cover.

Put the valve springs into place, followed by the top washer, and after smearing the valve stem with lubricating oil, push the valve up into place, making sure that the stem comes through the top washer. The valve springs now have to be compressed again so that the two halves of the cotter may be refixed. If the insides of the cotters are lightly smeared with grease this will help to hold them to the stem whilst the valve springs are released again.

When compressing the valve springs either to remove or replace the valves be very careful to avoid damaging the spring-covers. If these are "burred" or set out of round it will not be possible to make the joints oil tight.

When fixing the cotters, make sure that the small lip on the cotter registers correctly with the groove in the stem of the valve.

If desired, a small quantity of jointing compound may be used on the asbestos washers, but this is not actually necessary. Jointing compound, however, is necessary for remaking the other joints on the engine (except the cylinder head joint, which will be dealt with later) and for this purpose we recommend Gasket Goo, which, after long experience we have found to be very satisfactory.

As an alternative jointing compound if Gasket Goo is not available, Seccotine is satisfactory.

CLEANING PISTON TOP.

To clean the carbon from the top of the piston, bring the piston to the top of the stroke. A soft metal scraper as previously recommended for the cylinder head is necessary to avoid scratching the piston crown.

Scrape the carbon away and clean the top of the piston as much as possible with rag. **Do not use emery cloth to clean the piston crown.** Should this be used small abrasive particles of emery would be sure to get down between the piston and the cylinder and would rapidly prove disastrous to the engine. To remove all traces of carbon which have worked down between the top of the piston and the barrel push the piston slightly down into the bore and wipe away the carbon. Should the cylinder barrel have been taken off, the piston can best be cleaned after removal from the engine, as there is then no risk of pieces of carbon dropping into the crankcase.

THE CYLINDER HEAD JOINT.

† No cylinder head gasket is now used.= The joint is made between the cylinder head and the barrel, these two parts being lapped together during original assembly, so that the surfaces are quite flat. **Do not attempt to prevent a leakage** by tightening the cylinder head nuts. In the unlikely event of this joint leaking, remove the head. It can be re-ground to the barrel without the slightest difficulty. It is better to take the cylinder off the engine, but the work can be carried out with the cylinder in position if the four long cylinder studs have previously been taken out.

If the work is done in this way, however, great care must be taken to make sure that no trace of the grinding compound which is used for lapping the head to the barrel is allowed to get down between the cylinder bore and piston, as owing to its abrasive nature it would naturally cause damage very quickly. To carry out the actual grinding-in operation, a small quantity of fine grinding compound mixed with oil should be smeared on the two lower faces on the top of the cylinder, and the head slipped into position on to the barrel and then rotated backwards and forwards in order to grind the surfaces together.

† *See Footnote, page 32.*

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It is desirable to raise the head slightly from time to time, and bring it down into another position in much the same manner as described previously to be adopted when grinding in the valves. Having completed the grinding, which should leave a smooth, grey surface on the cylinder and cylinder head, it is necessary to clean the faces carefully of all traces of compound.

Where "Tighten" is stated, remember that overtightening may cause serious damage through stripped threads or broken bolts and studs.

REFITTING THE CYLINDER HEAD.

When re-assembling the cylinder head do not use any jointing compound on the face joint.

The sparking plug should be fitted to the cylinder head and screwed down before the head is fitted to the barrel, otherwise any small pieces of dirt which may have collected in the sparking plug threads may be forced out of the plug hole into the combustion chamber and cause damage to the cylinder bore or the piston.

Screw down the four cylinder head nuts on the long studs until they are each in contact with the head, and then begin to tighten them down further, evenly, and in turn, that is to say, do not tighten one nut fully without touching the others DO NOT IN ANY CIRCUMSTANCES TIGHTEN THESE NUTS EXCESSIVELY. A good gastight joint is obtainable without forcing the nuts. The tension on the cylinder studs tends to increase as the engine heats up, and excessive tightening of the nuts in the first place may quite possibly involve serious damage to the engine.

REFITTING THE ROCKER BOX.

Assuming that the rocker box has not been taken apart, it is necessary only to scrape off carefully any traces of the old jointing compound from the surfaces to which the tappet covers are attached and around the inside of the recesses which fit against the steel valve spring covers.

The latter surfaces should then be smeared lightly with good jointing compound (Gasket Goo, Seccotine or Gold Size). The tops of the platforms on the cylinder head and the underside of the rocker box bosses which fit on to them should be cleaned, and the rocker box fitted into place. The centre bolt must be in place in its hole before the rocker box is placed in position, as it cannot be put in afterwards on account of the top frame tube.

Make sure before fitting the rocker box, however, that the pushrods are in position, together with the guide plate and paper packing washers (one on each side of the guide plate), and see that the pushrods are engaged properly with the top and bottom rockers. Tighten the three bolts evenly and firmly, but not excessively. The joint surfaces at the top of the pushrod cover can then be smeared with compound and re-assembled.

Next in order the tappet clearances should be dealt with. The method of re-setting and correct clearances are given later. Having adjusted the tappets correctly, which should be done with the engine cold, clean the faces of the tappet covers, both the flat surfaces and the curved joint surfaces being dealt with at the same time.

See that the oil control washers are in place in the centre bosses of the rockers, smear the joint surfaces of the tappet covers with compound as described above, and fit the covers into position carefully, slipping the bolts through the holes and tightening them up evenly and a little at a time.

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Care is necessary when dealing with these bolts not to overtighten them—they can be snapped off if excessive force is used.

Finally, refit the oil pipe to the timing cover and the rocker box, being careful not to overtighten the hollow bolt which secures the pipe to the rocker box cover.

Two fibre washers are used on this pipe, and one of these should be on either side of the banjo union.

ADJUSTMENT OF THE TAPPETS. (See Fig. 14).

The tappets must always be adjusted when the engine is cold, and when the piston is at top dead centre of compression stroke. Clearances as follows :—

MOV and MAC.	Inlet	.003-in.	Exhaust	.006-in.
MSS	,,	.005-in.	,,	.010-in.

(Different clearances are employed when checking the valve timing. See page 46).

One turn of the tappet gives ·038-in. variation in clearance (approx.)

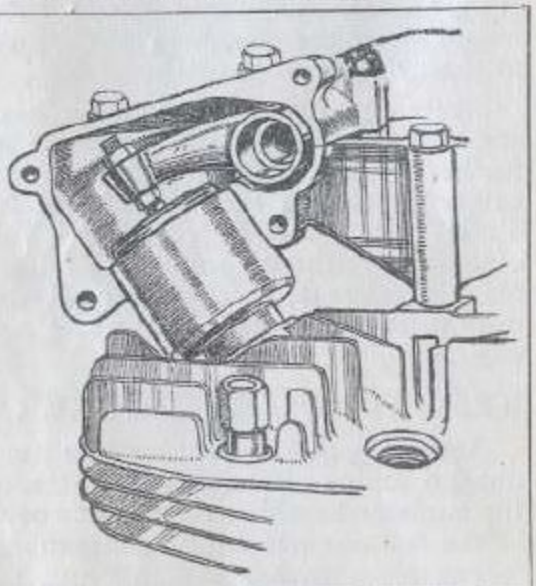

Fig. 14.
EXHAUST TAPPET COVER REMOVED.

With a new machine check and if necessary reset the clearances after the first 500 miles running. After this, attention should not be required during the periods between top overhauls, which are usually needed at about 8,000 mile intervals.

To make the adjustment, slacken off the locknut, which is screwed on to the tappet and is above the end of the rocker.

Then turn the hexagon tappet head, which is below the rocker, to the right, to increase the clearance, or to the left to reduce it.

Check the clearance with a clearance gauge and tighten the locknut whilst the tappet head is held with a second spanner. After tightening the locknuts check the clearances again to be sure that they have not been altered whilst tightening the locknut.

To find top dead centre of compression stroke, refer to paragraph "Checking the Valve Timing" (Page 46).

DISMANTLING THE ENGINE SHAFT SHOCK ABSORBER AND PRIMARY CHAIN.

Take off the dynamo-belt cover, loosen the clamping bolt in the dynamo-strap, turn the dynamo in its mounting until the belt is loose, and remove the belt. Remove the cover from the front end of the rear chain—it is held at the front end by a nut to a stud on the primary-chain cover. Lift the ear on the cover off the stud, at the same time pulling the cover forward out of the socket in the rear part of the chain-cover. Sometimes this is easier if the bolt holding the rear part of the cover to the mudguard valance is loosened first.

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Remove the split cotters from the nut securing the rear driving sprocket and from the nut on the engine-shaft. Loosen the nut on the gearshaft **slightly**. This nut is usually very tight, and the spanner will need driving round with a hammer or mallet, and the rear brake should be held on firmly while doing so to prevent the sprocket turning.

Next engage top gear and remove the nut from the engine-shaft. This nut will also require to be driven round to start it and the engine-shaft prevented from turning by holding the rear brake on. Both nuts unscrew anti-clockwise. Special spanners are provided in the tool kit for both these nuts, the pegged spanner (closed end) and the "Ring" spanner respectively.

Unscrew the nut right off the engine-shaft with the belt pulley flange and spring. Do not lose the plain washer which is used between the nut and the shoulder of the shaft. Now unscrew and remove the nut from the gearshaft, take off the plain washer behind it. Pull the sprocket off the shaft, and unhook it out of the chain.

Take out all screws from around the edge of the chain cover and on MOV and MAC machines remove the nut and washer from the stud below the inspection cap and halfway down the face of the cover. On MSS machines remove the single bolt securing the cover to the crankcase and take off the left-hand footrest and footrest square bar. Pull the outer half of the cover away from the inner part, being careful when separating them not to damage the joint-packing. A distance tube will be found between the two halves. This fits over the edges of the covers around the holes, through which the fixing stud or bolt passes. The purpose of the distance tube is to prevent oil leaking out, and to prevent the cover being crushed in when the fixing nut or bolt is tightened.

The sliding member or shock absorber clutch may now be pulled out off the engine shaft, but the sprocket and chain cannot be removed on account of the chain being of the "endless" type, this making it necessary to take off at the same time the chain wheel from the gearbox.

Remove the small grub screw and the locking plate from the flange of the sleeve-gear nut on the clutch.† It will be seen that the nut has four holes drilled in the flange and the peg-spanner is used to turn the nut.* Again it will almost certainly be necessary to start the nut (anti-clockwise) by driving round the spanner. Remove the nut and pull off the engine sprocket and whole of the clutch with the chain. To start the clutch out of position it may be necessary to lever the back plate away from the face of the gearbox. Be careful when the clutch is removed not to lose the three small thrust pins from the back plate.

After re-assembling note that the clutch will need re-adjustment. See page 49.

THE ENGINE—DISMANTLING AND RE-ASSEMBLING.

PRELIMINARY WORK—MOV and MAC MODELS ONLY.

Before removing the engine from the frame remove the fuel tank and primary chain and clutch (see sections dealing with these points). Disconnect the cables from the positive battery terminal (the rear one).

Remove the dynamo with the inner half of the belt-cover after loosening the dynamo strap and pulling out the single pin plug from the dynamo. Take off the inner half of the primary chain cover—held by four screws to the face of the gearbox. These screws are secured by locking wires. Cut these and use new wires when re-assembling.

Remove all bolts from the engine plates and disconnect the eye of the gearbox adjuster from the nearside rear engine-plate. Remove the engine from the frame.

† *Only on MAC and MSS Models after* 1940.
See page 56. *Fig.* 23c.

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THE ENGINE—DISMANTLING AND RE-ASSEMBLING—PRELIMINARY WORK. (MSS.)

Proceed as in the previous section, but do not remove the bolts securing the crank case to the rear engine plates as the engine and gearbox have to be removed together with the rear engine plates attached. The gearbox adjuster may also be left in position. Loosen the bolts securing the engine plates to the crank case and lift the entire engine and gearbox out of the frame. Finally separate the gearbox from the engine on the bench.

DISMANTLING CYLINDER AND PISTON.

Support the engine in a convenient position by gripping in a vice the front flange of the crankcase, supporting the rear of the engine from the bench by means of a steel bar bent to fit into one of the bolt holes and set to rest firmly on the bench. This takes a lot of the weight and prevents the engine sliding down in the vice.

Take off the rocker box and cylinder head as described on pages 30 and 32, remove the pushrods and guide plate and take off the pushrod tubes, top and bottom, by detaching from the crankcase. With the flat of the hands against the front and rear of the cylinder, push it sharply backwards and forwards alternately, exerting an upward pressure at the same time, to loosen the cylinder in the crankcase. When free, pull it up carefully off the piston. It is advisable to have an assistant to support the piston as it is freed from the cylinder, in order to avoid damage.

Make a note before removing the piston which side of the engine the slot for the removal of the circlip is situated, or mark the piston so that it is put back into the same position. On the MOV and MAC Models the larger of the two flat surfaces on the crown is below the exhaust valve.

Remove one of the circlips from the piston and drive out the gudgeon pin from the opposite side. A soft metal punch must be used against the end of the pin to prevent damage. An assistant is essential when driving out the pin, so that the piston is supported on the opposite side to avoid damaging the connecting rod by setting it out of line.

The pin is a light driving fit with the piston cold.

REMOVAL OF PISTON RINGS.

To remove the piston rings, gently expand the ends of the top piston ring away from the piston and insert three or four thin metal strips between the ring and the piston, sliding these round behind the ring until it is possible to slide the ring upwards over the piston crown. Take care not to spring the rings any more than is necessary to put the strips into place and to raise them out of the grooves as piston rings are rather brittle. This applies particularly to the slotted oil control ring. Some MSS engines have a "stepped" section scraper ring in the third groove from the top.

RE-CUTTING VALVE SEATS.

The seatings in the head can then be cleaned up by using a 45° cutter with a pilot $\frac{3}{16}$-in. diameter, 4-in. long. A $\frac{3}{8}$-in. pilot will be needed for the MSS exhaust guide.

After prolonged service, and repeated cutting, the seatings may become sunk well below the surrounding surface of the combustion chamber, and this condition lowers the efficiency of the engine. The ridge of metal around the seat then needs cutting away and the surface blending into the hemisphere of the combustion chamber, otherwise the valves will be masked and loss of power will result.

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The valve guides are detachable, and may be removed and new ones fitted with a double diameter soft punch or drift. The small end should be $\frac{5}{16}$-in. diameter for about 2-in., and the remainder $\frac{1}{2}$-in. diameter approximately 4-in. long. Drive out the guides from inside the ports, but do not remove them unless they are worn or damaged so as to need replacement.

INSPECTION OF CYLINDER AND PISTON RINGS.

The cylinder should now be inspected for condition of bore and piston rings. If the bore is worn badly or is scored, it will require re-boring and an oversize piston with rings. The original diameter of the bore is 2.677-in. in the case of MOV and MAC cylinders, and 3.189-in. on the MSS.

Re-boring is generally considered necessary when wear in excess of .008-in. has taken place, or the bore has become damaged or scored.

The rings when new, and when fitted to a new or re-bored cylinder have gap clearances as follows :—

MOV and MAC Compression rings	.010-in.
,, ,, ,, Scraper ring	.012-in.
MSS Compression rings	.018-in.
,, Slotted scraper ring	.016-in.
,, Stepped type scraper ring	.016-in.

Oversize pistons and rings are made in only two oversizes :—
plus .020-in. ($\frac{1}{2}$ mm) and plus .040-in. (1 mm)

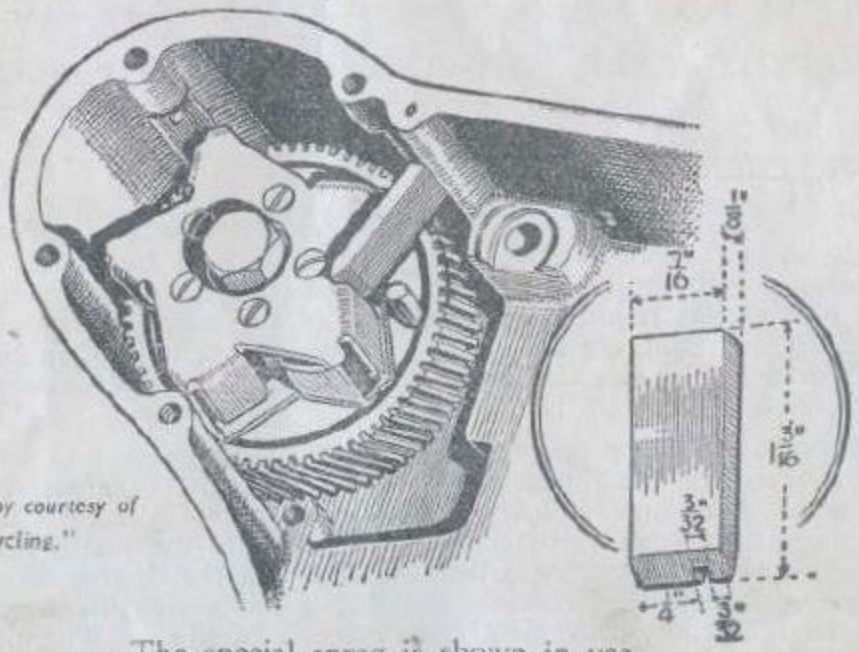
No intermediate sizes are used. It is not practicable to fit oversize rings to a worn cylinder, unless the cylinder is re-bored and the appropriate larger piston fitted.

REMOVAL OF AUTOMATIC TIMING UNIT. TIMING GEARS AND MAGNETO. (See Fig. 15).

The removal of the timing cover should now be undertaken. It will come away easily when the screws have been taken out. Never attempt to remove the cover by inserting a screwdriver as a wedge between the faces. This damages the faces and will cause oil leakage after re-assembly. If the cover has stuck to the joint packing, tap it carefully at several points round the edge to free it.

The following procedure applies also to engines with hand controlled ignition, except that no sprag need be used when removing the magneto gear.

Fig. 15



Reproduced by courtesy of "Motor Cycling."

The special sprag is shown in use.
(Inset—Sprag with dimensions).

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Having removed the cover, remove the automatic timing unit as follows: Sprag the centre of the unit against the inside of the timing case, using a small piece of steel bar which can easily be made. See the details given on the appended illustration. Loosen the hexagon nut in the centre. It will be found to tighten again shortly after becoming free. Continue turning it, when it will be found that the nut (which forms its own extractor) will withdraw the unit from the armature if the pressure on the spanner is maintained. The nut has a right-hand thread.

The use of the sprag is essential when removing the auto timing unit, otherwise one of the "ears" of the centre will foul the stop peg in the gear either bending the "ear" or loosening the peg. Either condition prevents proper working of the unit.

Take off the three fixing nuts securing the magneto flange to the crankcase and remove the magneto.

Access to the timing gears is obtained by taking off the strengthening plate, which is held by four bolts and one nut on the end of the cam-wheel spindle. The cam-wheel, intermediate gear and cam-follows may be pulled off their spindles by hand. Behind the cam-followers is a "Belleville" washer. Take care not to lose this, and be sure to replace it when re-assembling.

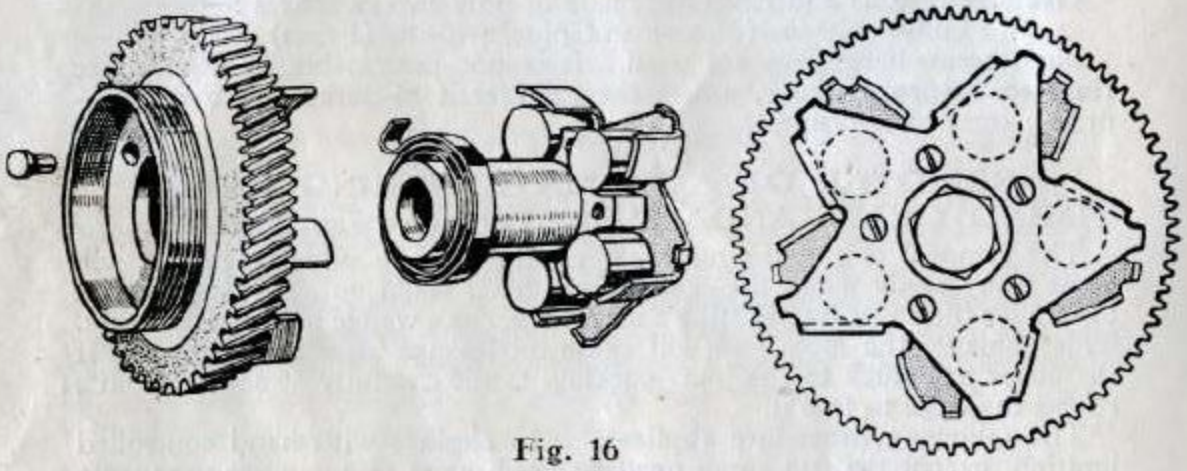

Fig. 16

The Automatic Timing Unit.

Left: Showing return spring. Right: In fully advanced position ("open")

(DO NOT TAKE THE UNIT APART—IT IS SELDOM NECESSARY).

THE OIL PUMP. (See Fig. 17).

The oil pump has to be taken out before the worm gear and crankshaft pinion can be removed. **It is essential to heat the crankcase** surrounding the pump before any attempt is made to tap it out. Remove the four screws holding the base-plate of the pump to the crankcase—heat up the crankcase by means of a blowlamp, and when hot tap out the pump from inside the timing case, using a soft drift. Avoid applying the drift to the end of the spindle.

To take the pump apart for inspection of the gears, take out the four screws securing the pump body and cover to the base plate. Pull the cover and body apart and the gears will lift out of place. It will usually be found unnecessary to take the spindle from the pump-cover but to do so, take off the pinion which meshes with the driving worm by unscrewing it carefully from the spindle, it has a right-hand thread, and can be held most conveniently with a pair of pliers. The pump gears should be a close fit in the body without end float.

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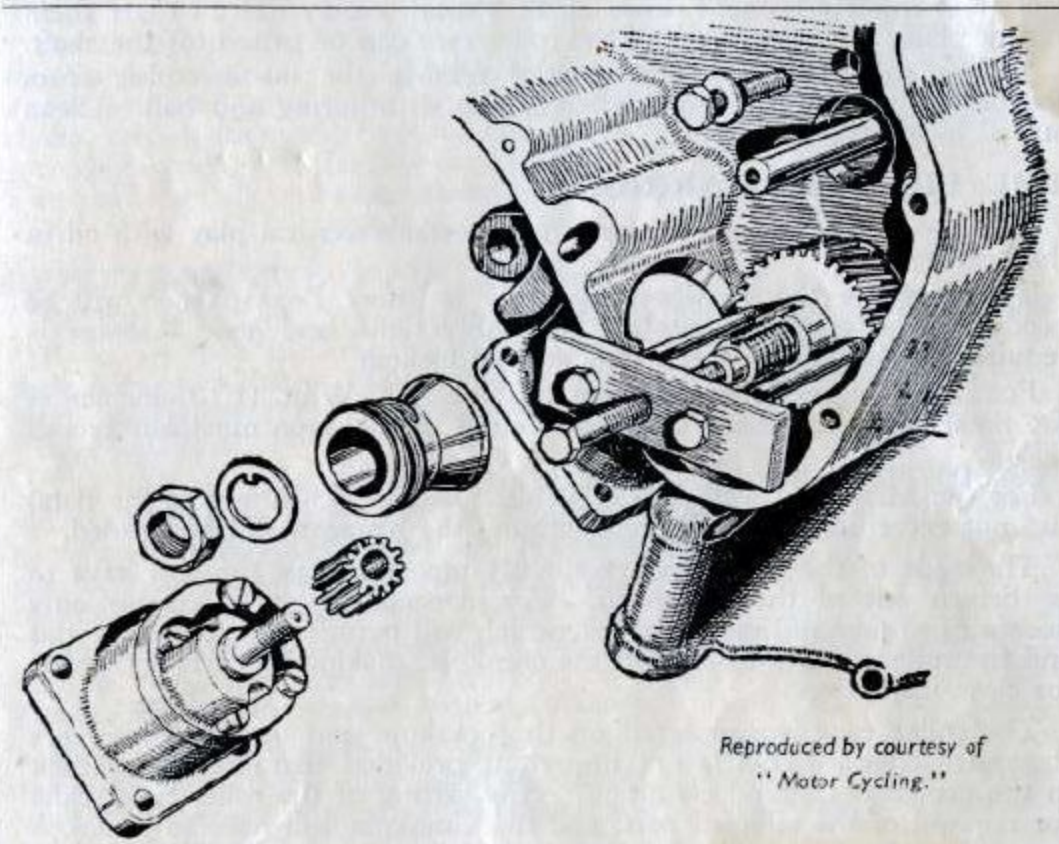
Should new gears be fitted it may be necessary carefully to lap them in by rotating the spindle a few times with a small quantity of abrasive. For this purpose, fine Turkey-Stone Powder should be mixed with oil and should be run through the pump. In no circumstances should ordinary grinding compound or emery be used. After lapping it is of the utmost importance to take the pump apart again and to clean all parts thoroughly to remove even the smallest trace of abrasive. Re-assemble the pump with clean oil on the gears. Heat the crankcase before attempting to refit the pump, which must be replaced the same way round as originally fitted.



Reproduced by courtesy of "Motor Cycling."

The Oil-pump is illustrated after removal, and with small driven pinion taken off. The Crankshaft Timing-pinion is about to be pulled off the shaft with the extractor.

Fig. 17.

EXTRACTING THE CRANKSHAFT TIMING-PINION.

(See Fig. 17.)

Removal of the pump permits the worm and crankshaft pinion to be taken off the mainshaft as follows : Remove the nut from the mainshaft —**left-hand thread**—and then the "tongued" washer. The worm may be prised off with two screwdrivers. A small puller will be needed for the removal of the pinion.

This is a simple tool made from a steel plate 2-in. × 1-in. × ¼-in. with two ¼-in. clearance holes (17/64-in.) drilled at 1 $\frac{3}{32}$-in. centres. Midway between these holes drill and tap a hole $\frac{5}{16}$-in. B.S.F. thread. Two ¼-in. diameter × 2½-in. long bolts should be reduced in diameter for ⅜-in. at the ends and threaded 2 B.A. The extractor bolt for the centre hole should measure $\frac{5}{16}$ × 2-in. threaded up to the head. The finished puller and method of use can be clearly seen from the accompanying sketch.

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SEPARATING THE CRANKCASE—REMOVAL OF MAIN-BEARINGS.

The separation of the two halves of the crankcase is quite straightforward and will be accomplished easily after taking out all securing studs and bolts including of course the hollow Cylinder oil-feed bolt on the nearside.

The Mainbearings—a roller race on the nearside and a ballrace on the offside on MOV and MAC engines—two roller races on the MSS—should be replaced if there is any trace of roughness or if any up and down-play can be detected. The ballrace and the outer ring of the roller race are readily removed without special tools if the crankcase is heated first, and smartly brought down on to a solid wood surface to jarr them out of place, the centre ring of the roller race can be prised off the shaft.

Whilst the Crankcase is separated remove the oil-filter-plug from the offside rear, and the check-valve plug with spring and ball. Clean out all oil passages.

THE BIG-END BEARING.

The connecting rod should have no detectable vertical play with oil in the bearing.

To dismantle the Flywheel assembly a heavy Box-Spanner will be needed. The crankpin nuts are invariably tight, and good leverage is required to shift them. The nuts are not locked.

For MOV big ends the spanner must be $\frac{5}{8}$-in. Whit. (1.101-in. across the flats) and the outside diameter around the hexagon must not exceed $1\frac{7}{16}$-in.

For the MAC and MSS a $\frac{3}{4}$-in. Whit. spanner (1.3-in. across the flats) and not exceeding $1\frac{3}{4}$-in. diameter around the hexagon will be needed.

The ends of the Crankpin are slightly taper and the pin will have to be driven out of the Flywheels. For inspection it is of course only necessary to take off one Flywheel, which will permit the connecting rod and the roller cage to be slid off the crankpin, making all parts accessible for close inspection.

The roller cage is supported on the crankpin and occasionally wears the outer edges. This is not important provided that the roller track in the centre is in good condition. Any pitting of the roller track calls for renewal of the affected part, and the Crankpin will have to be taken out of the other Flywheel.

The crankpin is made up of two parts* — a hardened steel sleeve being pressed on to a "soft" pin. Thus in the event of wear, the sleeve only may be renewed. These are made in the following diameters :—

	MOV.	MAC.	MSS.
Standard diameter ..	1.2492-in.	1.374-in.	1.4990-in.

REFITTING THE CRANKPIN.

This construction makes it necessary to tighten both Crankpin-nuts evenly when fitting, otherwise the sleeve might be moved on the pin. When re-assembling the pin or fitting a new one, tap the pin carefully into the Flywheel and tighten down the nut only far enough to pull the edge of the sleeve into light contact with the face of the Flywheel. Always make certain that the two faces are quite clean before fitting. It is immaterial which way round the pin is fitted, and as the sleeve is recessed at both sides there is no need to register any oil hole in the Crankpin with the oil-hole in the Flywheel. Before fitting, however, make sure that the oil passage through the timing-side Mainshaft to the inner face of the Flywheel is quite clear, and also see that there is no restriction in the oil hole in the Crank pin sleeve.

* *Except before 1939 when the pins were made in one piece.*

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Oversize rollers are also usually obtainable. The standard diameter is .1875-in., and there are two oversizes, .0002-in. and .0004-in. oversize respectively. In addition, should the hardened ring in the connecting rod be worn or pitted, this also must be renewed.

With the connecting rod mounted with rollers and cage in position on the Crankpin the slightest perceptible vertical play should be allowed with a dry bearing. Should there be slight stiffness this can usually be eliminated by carefully lapping out the ring in the rod or slightly polishing down the Crankpin sleeve.

LINING UP THE FLYWHEELS.

For lining up the Flywheels perfectly straightforward equipment is all that is required. The Flywheels should first be roughly lined up in the vice and then trued by placing the two Main-bearings on their shafts, resting these on V blocks 5-in. from the shaft centres to the base and 2⅜-in. apart, and then checking with a Dial-gauge on the Mainshafts. The Shafts are allowed a minimum out of truth figure of .001-in.

MAXIMUM

REFITTING THE MAIN BEARINGS.

NOTE SPECIALLY that the inner rings of the main bearings taper .001-in. per inch and must therefore be fitted the correct way round to their respective shafts. The "large" ends of the inner rings are always fitted adjacent to the Flywheel bosses, i.e., they are placed on the shafts "large end first."

The "large" ends will be found on inspection to have a pronounced radius, but as an extra check, "Hoffman" bearings have the maker's name and identification serial numbers stamped on the **opposite** side of the races so that when correctly fitted these marks should be outside and remote from the Flywheels.

Should an attempt be made to fit the bearings the wrong way round it will be found that they will hardly go on to the mainshafts at all when pressed lightly into position with the fingers.

Heat the Crankcase halves before fitting the timing side ballrace or the outer rings of the roller races by immersing each half in boiling water until it is hot enough to allow the bearing and the outer ring to be dropped into the housings.

Note that any packing shims used to control the end float on the flywheel assembly must be fitted into place before the bearings and see that the outer ring of the roller races are fitted with lip at the bottom of the housing, otherwise it will be impossible to slide the Crankcase into place owing to the rollers being unable to enter the outer rings.

REFITTING FLYWHEELS TO CRANKCASE.

As to the re-assembly of the Crankcase, no particular difficulty is likely to occur, but care is necessary to see that the Flywheel Assembly is set so that with perfect freedom when cold, there is no detectable sideplay.

The best method of doing this part of the work is first to fit the main bearings into the Crankcase, bolt the two halves of the Crankcase togethe (there is no joint packing used between them) and measure carefully the distance between the faces of the two inner rings of the bearings. Use an internal micrometer for this. Next measure the width across between the main Bearing-bosses on the Flywheels. Any difference between the two dimensions may be made up by placing shims behind the outer rings of the bearings. As far as possible pack each side equally to keep the Flywheel Assembly central in the Crankcase. The shims are stocked in three thicknesses, .0003-in., .0005-in. and .012-in.

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Further assembly is then quite straightforward to anyone who has taken the engine apart. It may be an advantage to note that joint packings must be used on the Pump-Base-Plate, the Timing Cover, the push-rod tube flanges (2 at top, 1 at bottom), the Cylinder base, the Valve Spring covers (2 each), and Carburetter. All other joints are metal to metal. Good jointing compound is necessary on all joints except the Cylinder head joint.

ADJUSTMENT OF INTERMEDIATE TIMING GEAR.

When refitting the timing gears note that the spindle carrying the Intermediate gear is integral with a flange inside the Crankcase, to which the flange is secured by three ¼-in. × 26T Bolts.

These bolts pass through $\frac{11}{32}$-in. holes, and as the Spindle has considerable freedom in the hole through which it passes, a certain amount of movement is provided for adjusting the mesh of the Intermediate gear with the Crankshaft Pinion and Camshaft wheel. This adjustment is set correctly at the Factory, and generally no alteration to the setting is needed, but should the necessity arise, the Spindle should be set so that the three gears mesh without noticeable backlash, but run with perfect freedom of rotation.

When new the spindle for the Intermediate gear is .561-in. in diameter, and a new bush should be bored out to .5625-in. The Camwheel spindle is .499-in. and the bush size should be .5-in. New bushes should be bored out in preference to reaming to ensure concentricity of the bearing with the gear teeth. These Timing gears should have end float not exceeding .0015-in. on their spindles. Check with feeler-gauge between end face of bush and strengthening plate.

Place the Crankshaft timing pinion in position on the mainshaft, engage it with the key and tap it up into place. Slide the pump driving worm into position, fit the tongued washer and screw up and tighten the left-hand thread retaining nut.

RE-ASSEMBLING THE PISTON AND CYLINDER.

(*Before re-assembling the cylinder, refer to paragraph re cylinder head joint*).

If the magneto has been removed refit it before fitting the Cylinder.

Before refitting the Cylinder barrel, check the connecting rod for alignment if there is any indication from inspection of the Piston that it is not quite true or there is any reason to suspect that it may have been distorted. To check the Connecting Rod for accuracy, obtain a mandrel of the same diameter as the gudgeon pin and not less than 5-in. long. Pass this through the smallend bush, set the Flywheels with the big-end at T.D.C. and verify by means of a surface gauge that the mandrel is parallel with the top machined face of the Crankcase and in line with the Crankshaft centre line. Examine the piston bosses to make sure that the small-end eye of the rod has had sufficient side clearance from the Piston, and has not been thrusting up against one of the bosses.

Tap the gudgeon pin into one of the piston bosses, so that it protrudes very slightly beyond the inside face of the boss. Slip the piston over the top of the connecting rod engaging the protruding end of the gudgeon pin in the small-end bush which should previously have been smeared with clean oil, and drive the gudgeon pin back into place, obtaining assistance when doing so to support the piston on the opposite side, as described in a previous section for the removal of the pistons. Also on MOV or MAC see that the larger of the two flat machined surfaces on the piston crown faces forward.

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Take care not to drive the gudgeon pin too far, and thus damage the piston boss on the other side by forcing it too hard against the circlip which is fitted. When the gudgeon pin is in position fit the other circlip into its groove, making sure that it is correctly seated.

Wipe the piston clean, fit the rings into position, space them so that the slots are approximately equidistant from one another around the circumference of the piston, and smear the skirt of the piston with clean oil.

If the packing washer on top of the crankcase has been taken off or broken, fit a new one into position over the spigot at the bottom of the cylinder.

Wipe the inside of the cylinder bore with clean rag, lightly smear it with clean engine oil and proceed to slide it over the piston, compressing the piston rings in turn with the fingers so as to enter them in the cylinder, which should then slide down easily into place.

It is an advantage if help is available, as an extra pair of hands are very useful during this part of the work. See that the cylinder is fitted the correct way round, the cutaway portion of the fins being of course behind the pushrod tubes. As the utmost cleanliness must be observed during the foregoing operations, it is advisable that the hands should be thoroughly wiped before carrying out this part of the work, as no dirt or foreign matter must be allowed to get on to the piston or cylinder bore, as this would be likely to cause damage. Also do not use "fluffy" rag.

RETIMING THE VALVES.

To re-time the valves bring the piston to T.D.C. and fit the Camwheel and Intermediate wheel on their respective spindles so that the marks etched at the edges of the gears coincide. It should be noted that although there are two marks on the Intermediate gear, it is possible immediately to find out which mark should match with the Camwheel, and which with the Crankshaft gear, as the marks are not diametrically opposite, and the longer section between the marks is always facing the front of the machine.

Note specially that once the Crankshaft has been turned the marks will no longer coincide again until the shaft has turned 93 complete turns. This is because the Intermediate gear has an odd number of teeth (a "hunting" gear) to distribute the wear evenly on the teeth. The actual numbers of teeth are: Crankshaft Pinion, 46; Intermediate gear, 93; Camwheel and Automatic Timing Unit, 92.†

When the Strengthening Plate has been refitted the Automatic Timing Unit may be replaced and the Ignition timing reset. Make sure that the Shakeproof washers have been refitted under the bolts securing the plate and that the bolts are properly tightened up.

RETIMING THE IGNITION.

The following procedure is also correct for engines with hand controlled ignition :—

Retime the Ignition as follows :—With the Piston within 4° of T.D.C. of the Compression stroke set the Contact-breaker Points to open with the Timing Unit fully retarded (closed), or if hand controlled set lever to full retard.

Should the Crankshaft have been moved from the position in which it was when the valve timing was set, the compression stroke may be determined by ascertaining the position of the cams. These will be pointing away from the Cam followers, and the bearing tips of the followers will be resting resting on the neutrals of both cams. In this connection refer also to Page 46.

† *Except on engines of pre-1936 make. Early types had 24 T. or 47 T. Crankshaft Pinions.*

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REFITTING THE OIL PUMP.

The oil-pump may now be re-fitted. Heat the Crankcase with blow-lamp adjacent to the Pump housing. Slip a new joint packing over the Pump on to the base plate and slide the Pump into place. Take care to engage the driving gear correctly with the worm and see that the screw holes in the base plate are exactly opposite the screw holes in the crankcase. Fit and tighten the four fixing screws. See Fig. 17 for correct position of pump for re-fitting.

CHECKING THE VALVE TIMING.

The following preliminary work is unnecessary if the engine is out of the machine.

Preliminary Work. On MAC and MSS Models remove the Fuel Tank. (See details, page 30).

Checking. Take out the sparking-plug and remove the cover from the dynamo belt. Fix a Timing Disc to the Crankshaft and a Pointer to some fixed part of the engine.

Rotate the Crankshaft slowly with the Footstarter until the Inlet-valve is seen to open and close.

Insert a spoke or a straight piece of stiff wire through the sparking-plug hole and then move the Crankshaft forward again VERY slowly until the piston is felt to reach its highest point in the Cylinder. By rocking the Crankshaft back and forward whilst holding the spoke or wire the top dead centre position is readily found.

DO NOT USE A SHORT PIECE OF WIRE—IT MAY BE DROPPED ACCIDENTALLY INTO THE CYLINDER.

Set the pointer to zero on the Timing disc.
For Cam M17/3. (Model MSS).

Reset BOTH tappet clearances to .025-in.
For MOV and MAC Cam M17 to .010-in. in and .015 ex.

With these clearances the timing should be :—

	MSS Cam No. M17/3.	MOV and MAC Cam No. M17.
Inlet opens -	30°	50° before Top dead-centre.
Inlet closes -	60°	60° after Bottom dead-centre.
Exhaust opens	60°	70° before Bottom dead-centre.
Exhaust closes	30°	40° after Top dead-centre.

The Inlet and Exhaust Cams are machined in one piece, so that should there be a marked variation in the reading from one Cam but the setting of the other be found correct the Cams and Cam-followers should be inspected for wear.

With new Cams and Cam-followers or those which are known to be in good condition it is sufficient to check only the Inlet opening position. If this is right the remainder of the setting follows automatically.

After checking be sure to reset the Tappets to the " running " clearances of .003-in. Inlet and .006-in. Exhaust for MOV and MAC and .005-in. Inlet and .010-in. Exhaust on MSS.

CHECKING THE IGNITION TIMING.

Important. Should it be necessary to alter the Ignition setting DO NOT ATTEMPT to loosen the nut securing the Automatic Timing-unit to the Magneto Armature before reading the instructions on page 39.

Preliminary Work. Remove the Contact-breaker Cover from the Magneto and rotate the Crankshaft with the Footstarter until the Contact-points are fully open.

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Check the gap with the gauge on the Magneto S[illegible] nd if not correct reset the adjustable point to give the right clearal posit[illegible]

Fix a Timing Disc and Pointer (as described in the l[illegible] section) after removing the Dynamo Belt-cover.

Open the Throttle and Air Controls fully.

Engage the Footstarter and rotate the Crankshaft until compression is felt in the Cylinder.

Release the Footstarter, and then remove the Sparking-plug.

Set the Piston to Top dead-centre and adjust the Pointer to zero on the Timing-disc (see previous section).

Move the Crankshaft BACK about 20°, and with the fingers separate the Contact-points. Place between the Points a small strip of Cigarette paper or paper of similar thickness (.001 to .0015-in.).

Release the Points on to the paper.

Checking. Rotate the Crankshaft forward very slowly whilst maintaining a light pull on the Cigarette paper.

If the timing is correct, the grip of the Points on the paper will cease when the Crankshaft is between 4° and zero.

If not correct loosen the Automatic Timing-unit from the Armature (see page 39) and reset it.

Should no Timing Disc be available the timing may be set to Top Dead Centre by checking by the Piston, **but in no circumstances** must the timing be set so that the spark occurs AFTER Top Dead Centre.

A Timing Disc can be made quite easily by marking out a card or metal disc in degrees by means of a Protractor.

Note.—The apparent lateness of the timing is because the Automatic Timing-unit is holding the Magneto into full retard. When the Engine is running the timing is automatically advanced the correct amount to suit the Engine speed.

THE CLUTCH, EXPLANATION OF WORKING, AND ADJUSTMENT.

Owing to the unconventional method used for adjusting the clutch, the following explanation should be read carefully in conjunction with Fig. 18. The clutch cable passes through a stop (C) and holder (D) in the top of the gear box, and is attached, inside the gear box housing, to a form of bell crank lever (F) by a connecting piece (E). The short arm of the bell crank lever bears against a ¼-in. diameter thrust pin (G) which passes through the wall of the gear box housing to emerge behind the clutch back plate, and bear against the clutch thrust cap (J). This cup is hinged to the outer wall of the gear box housing at a point opposite to the thrust pin, so that when the pin is forced out of the gear box by operating the clutch control the thrust cap opens away from the gear box housing like a door, towards the clutch back plate. The thrust bearing (H), which is self-aligning through its spherical contact with the cup, presses the three small diameter thrust pins (I) through the clutch back plate (K) on to the adjustable spring holder (M) which is screwed into the front plate, so forcing the plates to separate.

If the foregoing has been followed carefully, it will be apparent that any adjustment which may be needed is made by screwing the Spring-holder further into, or out of, the front clutch-plate as may be necessary.

In order that there shall be no load on the Thrust-bearing when the Clutch is driving, it is essential that some freedom exists between the thrust-bearing and the Thrust-pins, and this freedom is apparent at

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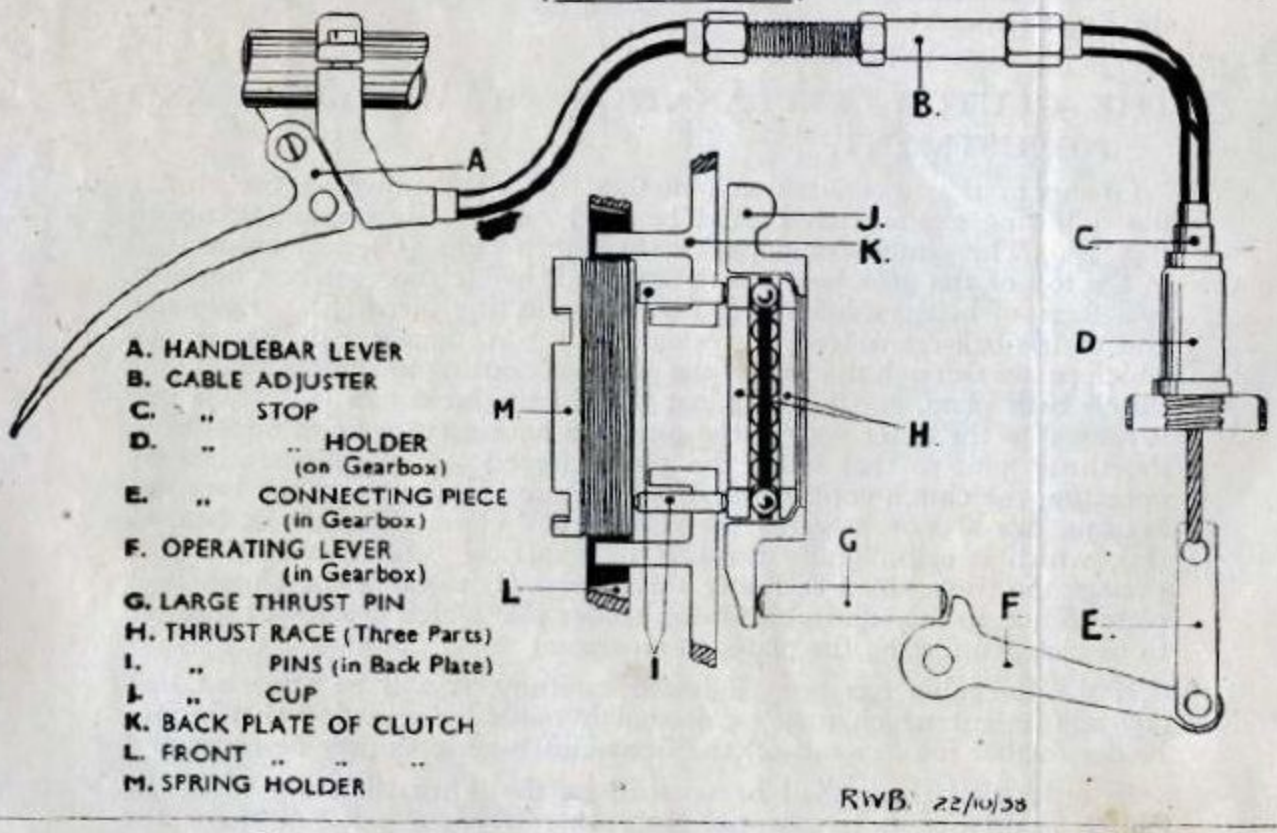
the handle oil-pump lever in the form of slack in the outer covering of the clutch adjacent cable. There should at all times be $\frac{3}{16}$-in. slack at this point when the lever is fully released. In other words, the rider should be able to pull back the lever quite freely until the inner cable has pulled out $\frac{3}{16}$-in. from the casing before the pressure of the clutch springs is felt. Never allow freedom to decrease below $\frac{1}{8}$-in.

After a machine has completed test, the clutch is re-adjusted so that there is the necessary amount of free movement in the clutch thrust bearing, and as the cable adjustment is correct, this free movement is indicated by free movement on the clutch cable at the handlebar end.

During the first hundred or so miles running with new clutch inserts these tend to "settle down," which permits the back and front Clutch-plates to close together very slightly. This, of course, gradually decreases the amount of freedom in the Thrust-bearing, and is indicated by a gradual reduction in the free movement on the cable. It is necessary, therefore, to keep a careful watch on the clutch lever, particularly when the machine is new, or after the clutch has been relined, so that as soon as the free movement is reduced to less than approximately $\frac{1}{8}$-in., the clutch spring holder should be re-adjusted **at once** in an anti-clockwise direction to restore the freedom in the operating mechanism. If this adjustment is not made when it becomes necessary, the gradual settling of the inserts allows all the play in the bearings to be taken up and ultimately the thrust cup is forced hard up to the face of the gearbox, and the thrust bearing is subject to a constant thrust load, which is not designed or intended to carry, the spring pressure on the friction surfaces inserts is correspondingly decreased, clutch slip occurs, and damage to the thrust pins and thrust bearing is almost bound to follow. Obviously, therefore, this adjustment (which contrary to the usual practice, is not made by means of the cable adjuster except in special circumstances) is one of considerable importance.

DIAGRAM OF CLUTCH OPERATING MECHANISM
(NOT TO SCALE)



Follow this Diagram when reading Page 47. **Fig. 18.**

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ADJUSTMENT OF CLUTCH.

Raise the machine on to the rear stand. Select neutral position of the gears.

To make the adjustment, take off the circular plate on the front part of the rear chain cover. A transfer on the plate indicates its purpose. It is held by two screws. Take from the tool kit the adjusting tool, a small steel rod ¼-in. in diameter with a flat at one end. This tool or peg should be pushed through the hole in the small rear driving-sprocket, so that the end with the flat can engage with one of the recesses in the Clutch Spring-holder. It may be necessary to turn the Sprocket a little either way if the hole is not exactly opposite a recess. Having engaged the peg with a recess, pull the rear wheel forward about a quarter of a turn to move the Sprocket. This turns the Spring-holder in the clutch front plate to restore the freedom in the operating mechanism. Freedom will be indicated by the appearance once more of free movement on the clutch cable. Should this not be enough, pull the wheel forward a little further. If it is too much, pull it slightly backwards until the correct adjustment ($\frac{3}{16}$-in. freedom) is obtained.

CLUTCH CABLE AND STOP

Sketch shows stop removed. Note that ⅛-in. freedom is absolute minimum permissible

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Fig. 19.

Should it happen that, owing to the adjustment having been neglected, the Clutch is in a badly slipping condition, or if the Spring-holder is a very tight fit in the outer or front Clutch-plate and will not turn without moving the plate with it, engage 2nd or 3rd gear before trying to turn the Sprocket. The differential action of the gears will then give the necessary relative movement between the spring holder and the front plate but it will be necessary now to move the wheel BACKWARDS to increase the free movement instead of forward, as was done when working with gears in neutral. If this point is remembered no trouble should be encountered.

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In the event of the **Clutch slipping when there is always free movement in the cable,** this usually shows that the thrust cup is hard up against the gearbox and that consequently there is no freedom in the clutch thrust bearing, the slackness being due to the Cable adjuster* itself (under the fuel tank) requiring taking up a trifle. In such a case the play in the cable should be taken up first and when this has been done and the lock-nut tightened on the adjuster, the Spring-holder should be turned anti-clockwise to restore the free movement in the thrust bearing. Generally, however, the cable does not require re-adjustment in normal use as it does not stretch, but the outer casing may settle down and compress slightly, which of course has the same effect.

The Cable-Adjuster is situated between two halves of the outer casing on the control cable, under the fuel tank.

The presence of oil, even in excess, in the chain cover and on the friction surfaces cannot cause the clutch to slip, provided that the adjustment of the clutch is correct.

CORRECTING CLUTCH ADJUSTMENT IF ORIGINAL SETTING IS LOST.

If for any reason the Clutch is not working properly, and it is not immediately clear in what way the adjustment is at fault, the best method of resetting the adjustment correctly is as follows :—Slacken off the Cable-Adjuster fully and slip the cable Nipple out of the Handle-bar Lever. See that the Clutch is in a slightly slipping condition by pressing down on the Footstarter as a test. If it is not slipping, turn the Spring-holder clockwise until the Clutch slips slightly on being tried. Now refix the Cable-nipple to the Lever and reset the Cable-Adjuster until there is just no free movement noticeable at the Handlebar-Lever. When this has been done, and the lock-nut on the adjuster has been tightened, screw back the Spring-holder anti-clockwise until the usual $\frac{3}{16}$-in. free movement on the cable is obtained. Should the Clutch then fail to work properly it will be necessary to dismantle it for a detailed examination, as the Thrust bearing or Inserts may require renewal.

ADJUSTMENT OF CLUTCH.

Fig. 20

The Sprocket is shown "broken away" to enable the adjusting tool to be seen engaged with the Spring-holder.

* *The adjuster is on the Gearbox on some early Models.*

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FITTING A NEW CLUTCH CABLE.

In order to fit a new clutch cable or outer casing, it will be necessary to take off the fuel tank as the cable is clipped to the top tube of the frame below the tank. This is described in the section dealing with decarbonisation. Pull up the clutch control lever, grasp the outer casing firmly just ahead of the lever socket and pull sharply towards the centre of the machine as the lever is smartly released, slipping the casing at the same time out of the recess in the lever socket. Remove the cable stop from the cable stop holder on top of the gearbox and unscrew the stop holder right out. Hold this up out of the way under the Oil tank and disconnect the small cable nipple from the slotted connecting piece just inside the gearbox by sliding the cable sideways. The cable and casing will then easily be drawn up through the tube in the oil tank, after which the nipple can be slipped out of the handle-bar lever.*

If a replacement cable is to hand with the casings, adjuster, and nipples already fitted up, it can be fitted straight away and the adjustment reset, but if a new cable is to be fitted to the original casings with the old adjuster, it must be well oiled or greased before being threaded through. Do not oil or grease the end to which the nipple is to be soldered, as this will make soldering difficult.

The approximate position in which to solder the nipple can usually be found by slipping the nipple into place up the wire, with the countersunk side of the hole away from the casing. Check off the position for it against the old wire. When the position has been decided hold the cable below the nipple with pliers, and bend the short end of the wire sharply against the nipple. Clean the wire and solder the nipple in place against the bend. Cut off the excess wire close to the nipple, and spread the strands of wire into the countersunk recess of the nipple. These strands can be lightly hammered down to spread them well. Heat up the solder again to ensure a good joint, and to fill the countersunk hollow in the nipple, and when cold trim off excess solder to allow the nipple to enter into the recess in the connecting piece.

Thread the cable assembly down through the oil tank* and slip the cable stop holder over the end. Slide the nipple sideways into the connecting piece, screw the stop holder into place and put the cable stop into position.

Adjust the clutch spring holder clockwise until the clutch is in a slightly slipping condition when checked by pressing down the Footstarter. See that the cable adjuster is screwed up to its limit to make it as "short" as possible. Connect the nipple and outer casing to the handle-bar lever. Set the cable-adjuster so that there is JUST no free movement perceptible at the handle-bar end and tighten the lock-nut on the adjuster. Screw the clutch spring holder anti-clockwise until free movement is restored in the cable, and lastly refit the Fuel tank. See also page 49, dealing with clutch adjustment, etc.

† DISMANTLING AND RE-ASSEMBLING THE CLUTCH. MAC and MSS.

Begin as described on page 36 for dismantling the engine-shaft shock absorber and remove the whole clutch from the sleeve gear. Do not lose the three small thrust pins from the back plate. The front plate will now lift off, exposing a steel plate fitted with friction inserts; remove this and the steel "dished" plate below it. Slide the chain wheel and ballrace off the centre of the back plate. The ballrace should remain in the chain wheel and is intended to be a light push fit on the centre. Only one steel plate and an "inserted" plate remain to be lifted off. The clutch inserts, of which there are 66, will not need renewal unless they are worn down flush with the steel, or are very loose in the holes. The ball race should run freely, and should be fairly tight in the chain-wheel. The inserts are of Ferodo on the MAC and MSS and cork on the MOV.

* *On the MSS the cable passes behind the oil tank.*

† *All Model MOV (and MAC machines supplied before* 1941) *have single plate cork-lined clutches. The method of dismantling is similar.*

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The removal of the clutch will have exposed the thrust bearing. This consists of three parts. First, a flat thrust ring, followed by a caged ball thrust bearing, and finally a thrust washer having a flat face to provide a bearing for the balls, and a convex face on the other side which seats in a concave surface in the thrust cup. The thrust cup need not normally be removed. See that the flat bearing surfaces are free from pitting, and that the balls are in good order. If needed, fit new parts, coating them with grease before fitting. The plain thrust ring may be reversed if worn on one side only, and will be quite satisfactory. The distance piece on the sleeve gear may be inspected, and if worn should be replaced. See that the brass cage of the ballrace is quite free upon it before assembling.

Refit the three parts of the thrust race in the following order : Spherical washer with convex face against the thrust cup, followed by the ball thrust, and finally the plain thrust ring. Coat all these parts with grease when fitting.

†To re-assemble the clutch lay the back plate, working surface upwards, on the bench. Place one of the " insert " plates in position, followed by one of the steel " dished " plates. The projections on the inside of this plate must be engaged in the notches in the back plate. Take up the chain wheel and see that the ballrace is free. Press a little grease into the race and turn it round once or twice to distribute the grease. Slide the chain wheel and race over the centre of the back plate and turn the chain wheel until the notches on the outside engage the projections on the " insert " plate underneath.

The second " dished " plate is now fitted with its projections facing upwards.

Place the second " insert " plate in position, making sure that its outer projections fit into the recesses in the chain wheel. Finally place the front plate in position. It is occasionally difficult to fit this at the first attempt, as it is not possible always to locate its recesses over the projections on the " dished " plate, which, of course, cannot be seen when the front plate is lowered into position. By manoeuvring the chainwheel backwards and forwards, however, it will usually drop into place after one or two attempts. Screw the Spring-holder into place if it has previously been taken out. Lift the whole Clutch, being careful to hold the back and front plates together firmly, and smear a little grease into the holes for the three Thrust-pins. Put the Thrust-pins into place—the grease will hold them. Engage Top gear (to prevent the Sleeve-gear slipping back into the Gearbox) and slide the Clutch into position on to the splines of the Sleeve-gear.

Fit the Clutch-springs, setting them in position so that the ground edges of the Springs are on the outside of the Holder. The Spring-holder must be screwed in until it contacts the ends of the three Thrust-pins. Provided the Sleeve-gear is pushed well up into its Ballrace, *i.e.*, has not been allowed to slip back into the Gearbox, the Sleeve-gear Nut can be started on the threads without having to compress the Springs.

Should the sleeve gear nut fail to engage the threads on the sleeve gear due to the latter having slipped back through the ballrace, remove the clutch and screw up the sleeve gear nut against the distance tube to draw it back. When the end of the thread is reached remove the nut and carefully fit the clutch back plate. Fit and tighten the nut again to draw the sleeve gear further through the back plate. Remove the nut and finally assemble the clutch.

Tighten the Sleeve-gear Nut tightly with the Peg-spanner, finishing by driving the Spanner round, and when tight refit the Locking-plate and Set-screw.

† *All MOV Models (and MAC machines supplied before 1941) have single plate cork-lined clutches. The method of assembly is similar.*

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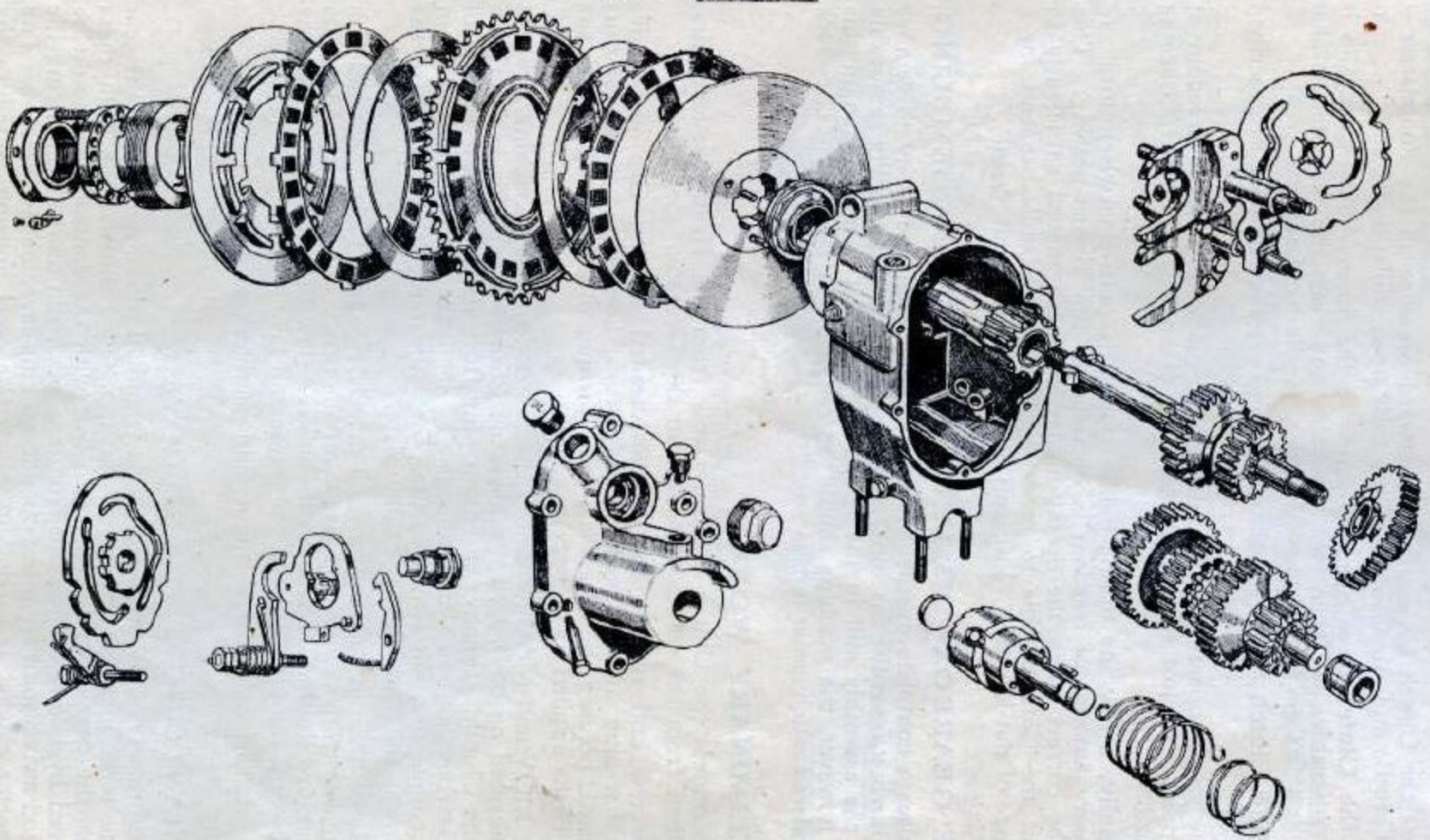

Fig. 21
"EXPLODED" VIEW OF MODEL GEARBOX AND CLUTCH (MAC).

NOTE.—The End Cover shown is a war-time part and differs from the actual Cover now fitted. The Clutch shown is identical to that used on the MSS. The MOV Models have single plate cork Clutches.

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Proceed to reset the adjustment as follows :—

Slack off the Cable-adjuster completely, and slip the Nipple out of the Lever on the Handle-bar.

Test the Clutch by exerting downward pressure on the Footstarter—the Throttle and Air Controls being fully open whilst doing so.

If the Clutch does not Slip screw in the Spring-holder until slip is just noticeable, and then refit the cable and reset the Adjuster so that there is JUST no free movement at the Handle-bar Lever.

If the Clutch Slips refit the Cable and set the Adjuster as described above.

The whole operating mechanism will thus now have no freedom at any point ; all lost motion having been taken up during the foregoing operations.

Finally, screw the Spring-holder outwards (anti-clockwise) until the necessary amount of freedom is obtained in the Thrust-bearing. This will be correct when the Spring-holder has been moved sufficiently to permit the Control-cable to move freely at the Handle-bar end for a distance of not less than -$\frac{1}{8}$in., and not more than about $\frac{3}{16}$-in.

THE GEARBOX—DISMANTLING AND RE-ASSEMBLING.

Unless a complete overhaul is needed there is no necessity to remove the Gearbox from the machine, as all internal parts are readily removable with the assembly still in the frame—if the work is undertaken in this way, however, the machine should be raised on to a trestle. The work is rendered much easier in this way.

PRELIMINARY WORK.

Disconnect the Clutch Control Cable from the Handlebar-lever first and then from the connecting-piece in the Gearbox. See Page 51.

Unscrew and remove the hexagon-headed Bearing Cap just above the Filler-plug in the Gearbox End-cover. Loosen the large nut thus disclosed, holding the Gearshaft from turning meanwhile by having the Rear Brake applied by an assistant.

On MOV and MAC to remove the gearbox from the machine, proceed as described on page 37, to remove the Primary Chain cover, the Chain and the Clutch. Remove the drain plug from the rear at the bottom of the Gearbox housing and drain out all oil. Take out the split-pin from and remove the bolt which secures the Adjuster-bolt at the top of the housing to the nearside rear engine-plate.

Take off the nut and washer from the Gear-control Pedal-pivot and pull the lever with the swivel and sleeve off the pivot. Unscrew the four nuts and remove the half-clips from the studs below the Gearbox. Raise the Gearbox off the cross tube of the frame and take it out of the machine.

On MSS Models remove engine and gearbox (see page 38).

DISMANTLING THE END-COVER.

The pre-war MOV and MAC Models and all MSS Models have the gear control lever in a bushed lug at the top. (See illustration). On these models the gear control lever and pivot with the control rod should be removed by taking off the nut from the pivot pin and disconnecting the gear rod swivel joint from the outside striking lever on the gearbox. The Footstarter ratchet is carried in a separate steel housing bolted to the cover. This housing may be removed before taking off the end cover or may be left attached as desired, but if attention is needed to the ratchet or return spring only, it is easier to take it off leaving the end cover in place.

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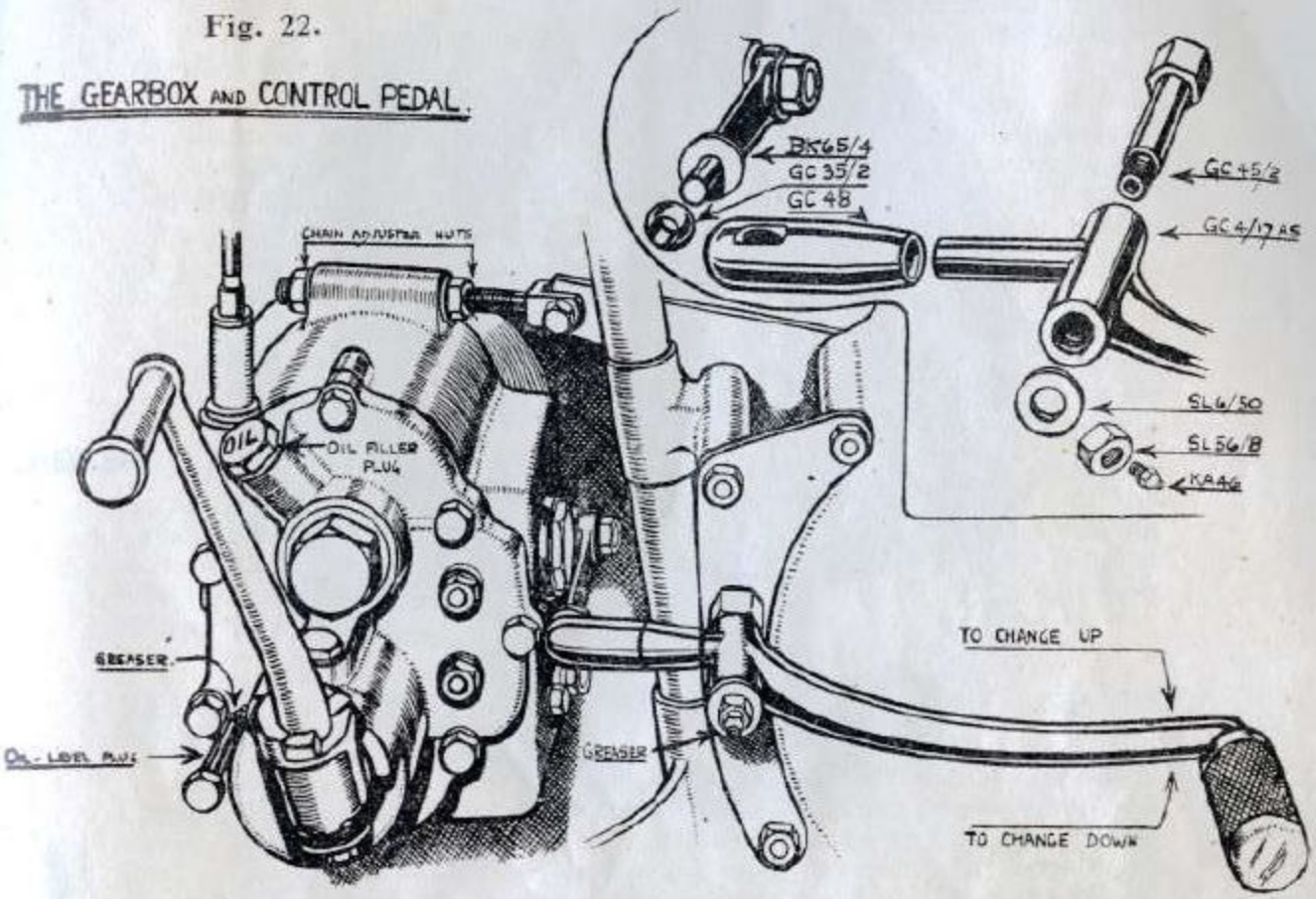
Fig. 22.



MOV and MAC MODEL GEAR CONTROL.

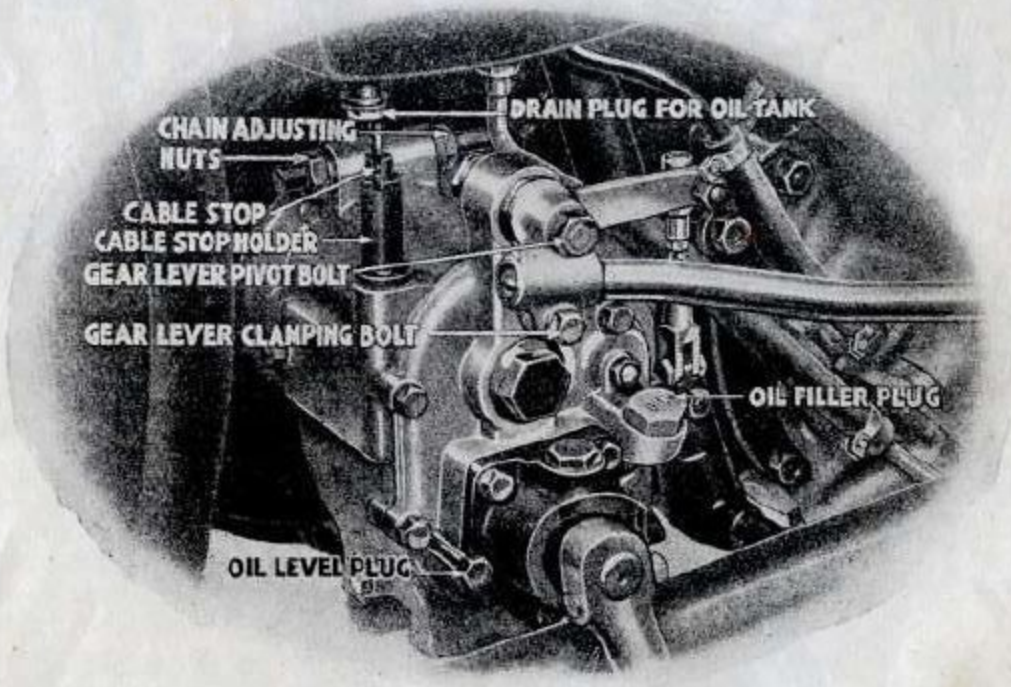


Fig. 23.

PRE-WAR MAC MODEL GEAR CONTROL.

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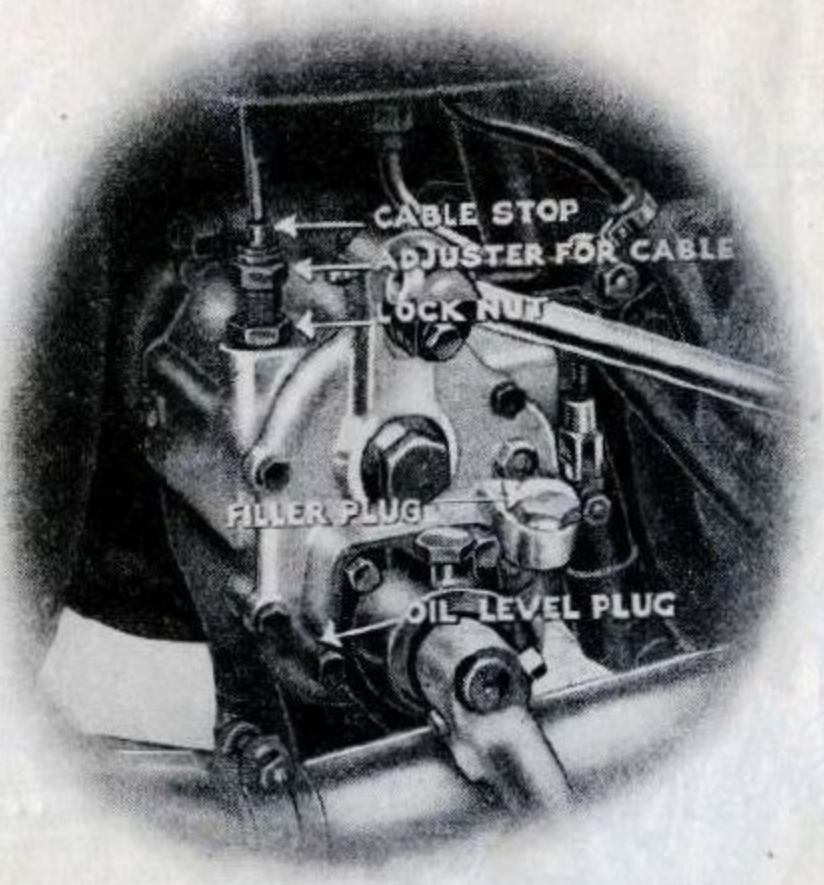

Fig. 23A.

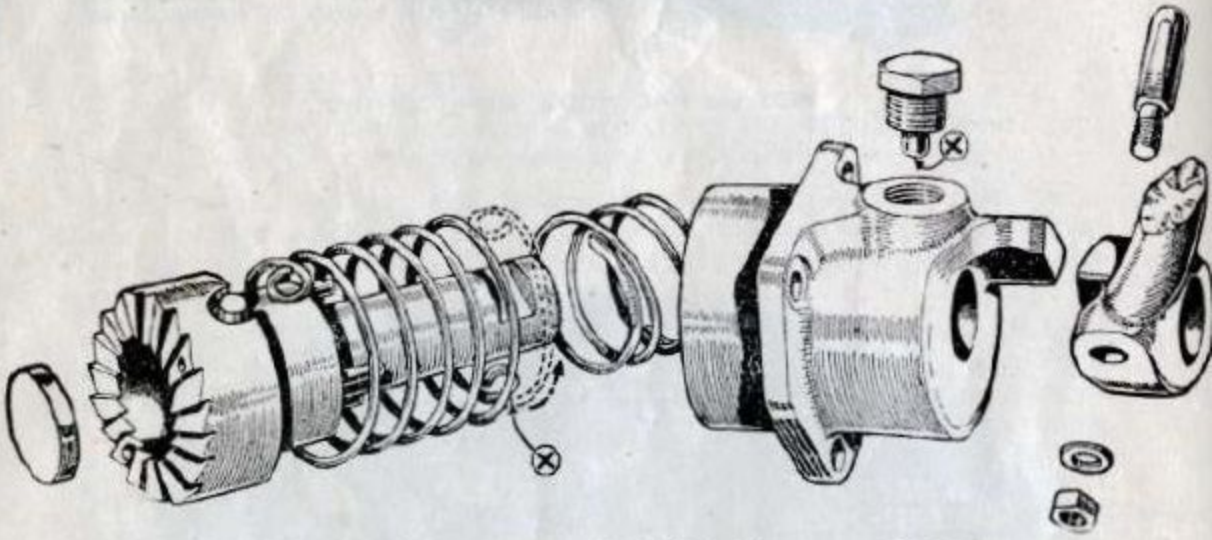

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Fig. 23B

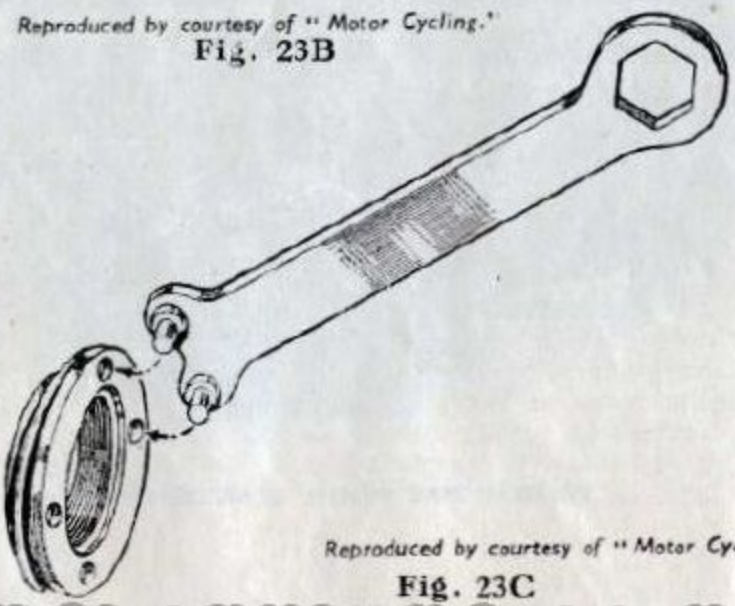

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Fig. 23C

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If the Footstarter mechanism does not need attention, the housing may be left in place fixed to the cover and the dismantling carried out as described below.

If the Footstarter Ratchet or Return spring are to be renewed, loosen the Anchor pin for the Return spring in the top of the Ratchet Housing on the cover, and take off the nut and washer from the cotter securing the Footstarter crank to the Ratchet before taking off the housing or the cover.

Remove the Oil-level-plug from the end cover. Now remove the nut from the end of the Gearshaft (previously loosened) and tap the shaft into the Gearbox about an inch.

Take out the bolts securing the End-cover to the housing, and the two nuts off the ends of the Selector-fork Pins. Pull off the cover with the Footstarter mechanism all in one. Attention to the Footstarter is dealt with on page 60.

Note that the end of the Layshaft is supported in the Footstarter-ratchet in a floating bush.† This bush may remain on the end of the Layshaft or come out with the Ratchet. In either case, be careful not to lose it or the Thrust-washer inside the hollow end of the Ratchet behind the floating bush. The bush should be a free fit on the Layshaft and in the Ratchet.

REMOVAL OF SELECTOR FORK RODS AND GEARS AND SHAFTS.

Take off the loose low-gear wheel from the end of the Gearshaft. Engage either second or third speed and draw out the two Selector-fork Pins. This is done by threading the nuts back on to the ends of the Pins. The Pins can then be levered out with the end of a Screwdriver or Tyre-lever under the nuts against a piece of material $\frac{3}{8}$-in. thick placed on the machined face of the Housing to act as a fulcrum. Pull out the Gearshaft from the Clutch side through the Sleeve-gear.

By twisting the upper Selector-fork so that the Operating-peg clears the cam track, the fork and the Double gear can be extracted. In a similar manner the Layshaft assembly and the lower Fork can be removed. This leaves only the Sleeve-gear, which can be tapped into the Housing through the large Ballrace.

SPECIAL NOTE.—On MSS Models with 17 T. Sleeve Gear and on other Models when close ratio (17-27) Gears are fitted, the Sleeve Gear has to be turned until a position is reached where the 16 T. Top Gear pick-up dogs do not mask the layshaft gear teeth, otherwise the layshaft gear cannot be withdrawn from mesh with the Sleeve Gear.

THE OPERATING MECHANISM. (Fig. 24).

It is exceedingly unlikely that any attention will be needed to this part of the Gearbox, as from experience over a period of several years we have found the parts comprising the internal Control-mechanism to be virtually non-wearing, and no case of a breakage occuring has ever been known.

Should the Cam plate have to be removed it may be taken out with the small centre piece on which it is fitted by first depressing the Indexing-pawl at the bottom. **Do not in any circumstances take the Cam-plate off the centre piece** before marking both parts, so that they may be re-assembled in the same relative positions and with the Cam plate facing the right way round (Fig. 24).

The remainder of the Mechanism is quite easily removed if need be, but should on no account be taken apart unnecessarily.

**Early types have a roller bearing.*

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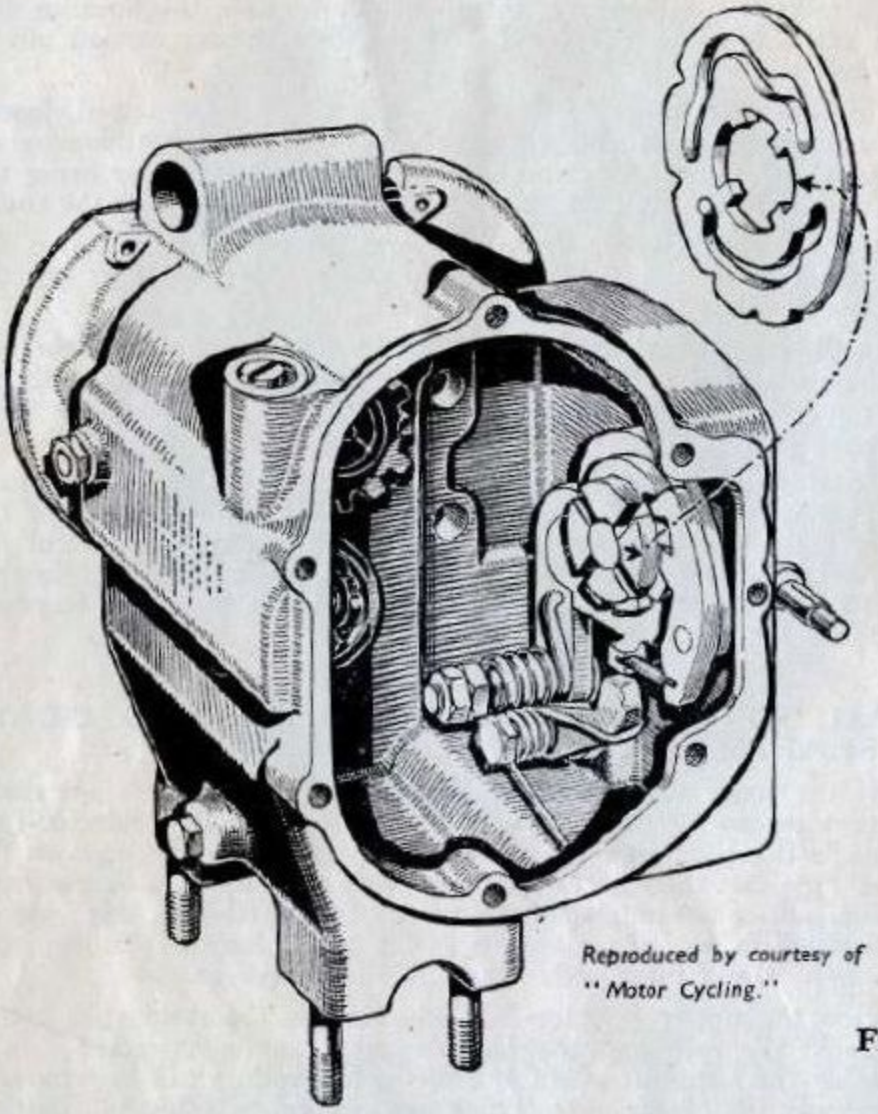

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Fig. 24

THE OPERATING MECHANISM AND CAM PLATE (MOV and MAC).

(Cam Plate shown removed).

REMOVAL OF CHAIN COVER, Etc.

If the Sleeve-gear Ballrace or the Ballrace shims are to be replaced or removed for inspection, the inner half of the Primary chain cover must be removed. Remove it as follows :—Cut the locking wires from the securing screws. Remove the screws. Pull off the cover and joint packing behind it. Unscrew and remove two small screws securing the wire clip to the face of the housing. Take off the clip and lift out the Thrust cup. When re-assembling note that new locking wire must invariably be used.

THE BEARINGS.

The condition of the large Sleeve-gear Ballrace and its Steel Shims can usually be verified without removal. Any sign of slackness or roughness in the bearing indicates that a replacement is needed. Inspect the shims (one at each side of the ballrace) to see that they are not worn or split. Pay particular attention to the inner one which may have been in contact with the Oil-thrower on the Sleeve-gear.

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To remove the large Ballrace it is necessary to take out the Retaining ring by unscrewing it out of the housing. It is provided with three slots to facilitate removal. If it is driven round with a punch it is essential to use one which is shaped properly to fit the slots, which will otherwise be damaged. Tap the bearing out when retaining ring and shim have been removed.

On refitting the Ballrace see that both shims are located as centrally as possible, so that the Distance piece for the Sleeve-gear does not foul when pulled up to the centre ring of the Ballrace. Also when the retaining ring has been screwed home fully the edge of the Housing must be " centre-popped " into the three notches around the outside.

The bearing for the Gearshaft in the end cover can be tapped out or into the cover with a drift $1\frac{1}{8}$-in. in diameter, 3-in. long, with a Pilot $\frac{1}{2}$-in. in diameter, $\frac{1}{2}$-in. long. The larger diameter should be recessed to a depth of $\frac{1}{16}$-in. round the pilot to a diameter of 1-in.

The Ballrace at the nearside end of the Layshaft can be driven out of its place into the Housing with a $\frac{7}{8}$-in. diameter drift 3-in. to 4-in. long, after knocking the Oil-retaining Cap outwards through the centre of the bearing with a $\frac{1}{2}$-in. diameter tommy bar. This Cap must be replaced after the ballrace or a new one has been inserted and the housing " centre-popped " to secure it. A drift $1\frac{1}{2}$-in. diameter, 5-in. long, with a $\frac{5}{8}$-in. diameter pilot $\frac{1}{2}$-in. long, recessed to a depth of $\frac{1}{16}$-in., and a diameter of $1\frac{1}{4}$-in. round the pilot is suitable for refitting the bearing.

Apart from the bush in the sleeve gear, all others are supplied so that they are the correct size when pressed into their wheels, but the need for their replacement is most unlikely. The sleeve gear bush which is pegged to the sleeve gear can be driven out with a $\frac{1}{16}$-in. diameter drift after the peg has been removed by drilling out with $\frac{1}{16}$-in. diameter drill. When replaced, it should be bored to give a clearance of .001-in. above the shaft diameter. A good fit is essential to obviate any side loads on the main-bearing and it is desirable to bore and not to ream the bush owing to the risk if reaming is resorted to of the bearing being made bell-mouthed—a cause of oil leakage. When boring see that bore is concentric with the ground outside ballrace seating.

THE LAYSHAFT ASSEMBLY. (See Fig. 25).

In order to remove the loose second and third speed gear wheels from the Layshaft it is necessary to remove the large Layshaft driven gear and the small ratchet gear respectively. The large Layshaft driven gear and the ratchet gear can be pressed or levered off the Layshaft. Note specially, however that a small thrust washer fits over the ends of the splines against the outside of the ratchet gear. Do not lose this. *Also note that on some MAC machines a spring circlip retains the ratchet gear in position in cases where a 16 tooth ratchet gear is used. It is important in such a case not to attempt to remove the ratchet gear before taking this circlip out of position.* It is however, necessary only to remove one of these gears, if only the sliding dog has to be replaced. The edges of the driving dogs on the second and third speed gears and upon the driving dog itself should be carefully inspected for wear as worn dogs may cause dis-engagement under load.

ASSEMBLY.

Re-assembly is the reverse procedure of dismantling. First the Sleeve gear is inserted from inside and pressed through the Ballrace, being careful first to slip the Oil thrower over the Sleeve gear with the concave face towards the gear teeth. Next the Cam-plate, etc., the Layshaft assembly and Gearshaft with its gears are refitted in that order. Care is, of course, necessary when replacing the Layshaft assembly and the Double gear to see that the pegs of the Selector forks are properly engaged with the groove or track in the Cam.

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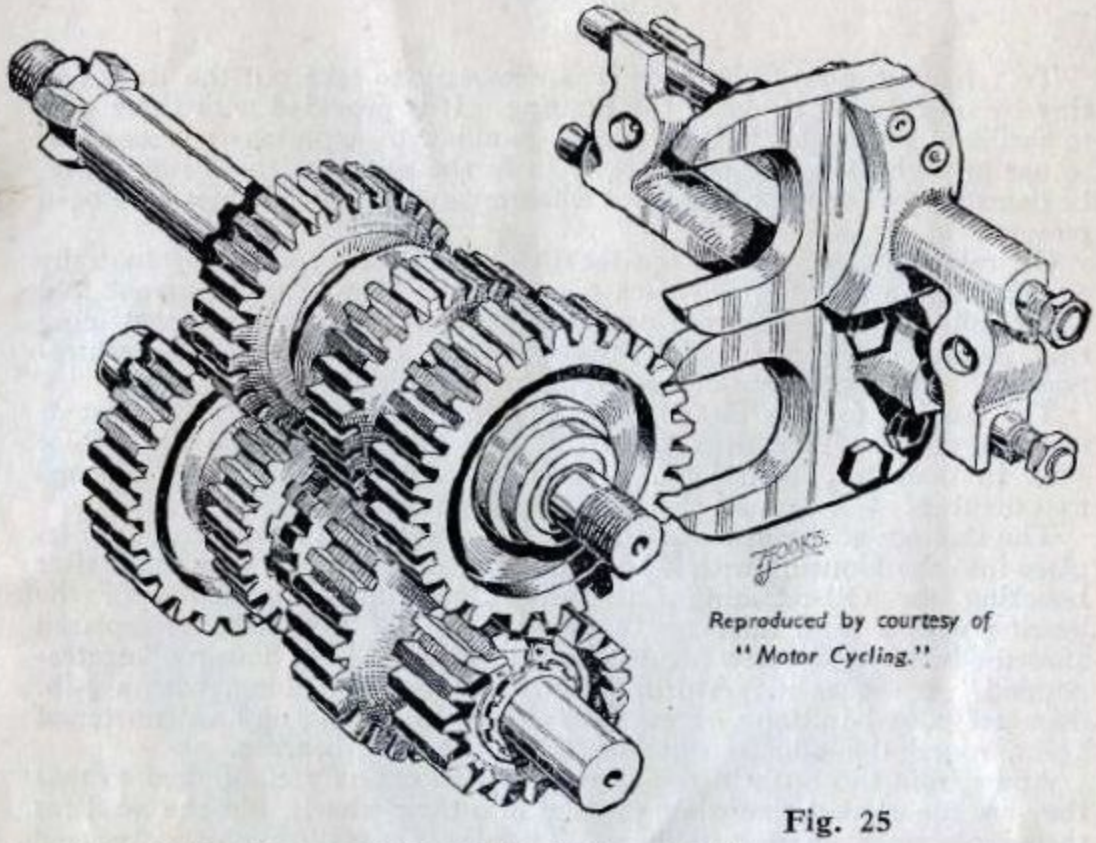

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Fig. 25

THE GEARS AND SELECTOR FORKS (MOV and MAC)
(IN CORRECT POSITIONS FOR RE-ASSEMBLING)

The position of the forks is inverted and to the rear of the gears on the MSS.

THE FOOTSTARTER.

A swivelling foot-piece pivots in the top of a crank attached to the ratchet, on some Models the whole crank swivels in a lug attached to the ratchet.

Notes on using the Footstarter. It is very important not to kick sharply and the ratchet must be allowed to engage properly before putting heavy pressure on the footpiece. It will be noticed that as the footpiece moves down, the ratchet is allowed to slide into the ratchet housing on the end cover due to the swivel lug running off the disengaging cam formed at the end of the housing. It must be allowed to slide in properly, otherwise the ratchet will not engage properly, and damage may be caused to the teeth on the ratchet and on the ratchet gear. Do not hurry the operation—by being careful and deliberate time will be saved in the long run. Always release the footpiece as soon as the engine starts.

In the unlikely event of the Footstarter failing to return correctly on NO ACCOUNT must the machine be run unless the Foot piece is returned by hand to the disengaged (upright) position and secured there if necessary.

Unless it is necessary to replace the Ratchet or Return spring do not dismantle the Swivel-lug or F/S crank from the end cover. If the Spring is broken and is to be renewed proceed as follows :—

The Footstarter Ratchet Housing should be removed separately, leaving the end cover in place (see page 57). Turn the F/S crank through 90° and drive out the cotter, pull it off from the end of the Ratchet and pull out the Ratchet and part of spring. When doing so take care not to lose the engaging-spring which fits inside the Return-spring or the three Rollers which operate through holes in the Ratchet against the

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loose Thrust washer. Take out the Anchor pin (already loosened, see "Dismantling the end cover") and remove the remainder of the Spring. Should the return spring be unbroken a slightly different procedure is necessary for removing the Ratchet as follows :—

Take off the Nut and Washer from the Cotter and remove the Anchor pin (only if the Return spring is to be changed) now obtain 2 nails about 2-in. long × $\frac{3}{16}$-in. in diameter (or slightly less) and cut off the heads, drive these into the bench $1\frac{19}{32}$-in. apart leaving them protruding about 1-in. Place the Ratchet Housing face downwards over the nails so that these enter the two breather holes which are drilled through the teeth of the Ratchet. Pull the housing round clockwise 90° against the tension of the spring and drive out the cotter. Release the housing, pull off the crank, and lift the Ratchet off the nails. Push the Ratchet through from the outside sufficiently to enable the loop of the Spring to be prised off the fixing lug on the Ratchet. When the Spring is unhooked push the Ratchet right out, the Return spring can now be withdrawn.

The Return spring is slightly larger in diameter in its free state than the housing to which it is fitted and to replace a spring the following directions must be followed.

First examine the 2 loops, the smaller loop engages the Anchor pin, the larger the Ratchet.† Push the end with the smaller loop into the housing so that when it is fully home the loop will be directly below the Anchor pin hole to permit the tip of the Anchor pin to fit into the loop.

With a screwdriver press the Spring into the Housing, working round it spirally coil by coil until only sufficient is left out to be slipped over the lug on the Ratchet. Refit the Anchor pin. Place the engaging spring and rollers (or Thrust pins) in position, sticking the Rollers with some grease. Note that there are 6 holes in the Ratchet, three of which act as breathers. It is essential to place the Rollers in those holes which are recessed right through into the parallel ground bearing surface inside the Ratchet.

Place the Ratchet in position, engage the loop of the Spring over the lug and push the Ratchet right home, place the housing face downwards again with the Ratchet over the nails. Push the crank into place on the end of the Ratchet and pull the housing round against the tension of the spring SUFFICIENTLY FAR ONLY to allow the cotter to be tapped through its hole across the flat on the Ratchet. The cotter must be fitted with the Threaded end facing the rear of the machine. Fit the Nut and Washer and tighten up. If a new Cotter is required file the flat if necessary so that when the Cotter has been driven fully home the head is flush with the surface of the Swivel-lug.‡

RE-FITTING THE END COVER.

The footstarter housing need not be fitted until after the end cover has been replaced. *Note specially that on MOV and MAC Models one of the end cover bolts is slightly shorter than the others, and it is essential that this be replaced in the correct position. It is used in the hole adjacent to the edge of the cam plate. If one of the longer bolts is used in this position it will foul the operating pawl and prevent the proper working of the gear operating mechanism.*

Place in position the layshaft thrust washer which fits over the ends of the splines protruding from the ratchet gear. *Note that in the case of some MAC Models a circlip is used to retain the ratchet gear—it is illustrated in Fig. 25. In such a case see that this circlip, which is only used when a small ratchet gear is fitted, is in position in its groove.* Place the end cover joint washer in position on the face of the end cover and push the end cover into position, working the ballrace over the end of the gearshaft. Put in and tighten all fixing bolts except the one at the very bottom. Re-fit the nut to the gearshaft, tighten the nut and then refit the cap. Fit and

† *See Fig. 23b.*

‡ *Do not in any circumstances fit a packing washer between the K/S housing and end cover. This is important.*

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tighten the nuts of the selector fork rods and the gearbox is then ready for the footstarter housing and ratchet, etc., to be fitted. ‡Place the hardened thrust washer into the bearing recess in the ratchet, smear the end of the layshaft with oil and slide the floating bush into place. *On some early machines a caged roller race is used in place of this bush.* It is necessary to see that the roller cage of this bearing is fitted so that the open end of the cage is remote from the ratchet gear. Smear the inside of the ratchet with oil and work the housing and ratchet into position over the bearing and tap it carefully into the end cover, finally securing it with the three fixing bolts. The gearbox is then ready for refitting to the frame.

REMOVAL AND REPLACEMENT OF REAR WHEEL.

REMOVAL.

Free the rear stand from the mudguard and raise the machine on to the stand. Always choose level ground, but if compelled to work on a slope, have the machine facing uphill, it is then unlikely to run forward off the stand when the wheel is out. Disconnect the rear lamp and detach the mudguard extension.

Loosen and take off the three nuts securing the wheel to the Brake-drum, unscrew and pull out the Spindle from the off-side. As it comes clear of the hub catch the distance piece, which is fitted between the hollow spindle of the hub and the Fork-end of the frame. Remove the wheel by lifting it off the studs and pulling it away to the rear.

REPLACEMENT.

Lift the wheel into place and fit the three wheel nuts to the studs on the Brake-drum. Place the distance piece in position inside the Fork-end of the Frame. See that the plain washer is in place under the head of the Spindle, screw in and tighten the Spindle fully.

Tighten the three wheel nuts fully and refit the mudguard extension.

NOTES ON ABOVE.

After running about twenty miles after replacing the Rear wheel, check and if necessary tighten the spindle and wheel nuts, in case any bedding down has occurred. On early MOV and MAC Models also check Brake Anchor Bolt for tightness. (See Illustration page 63).

Never lower the machine off the stand on to the wheel unless the Spindle is in position, and on no account remove this spindle unless the weight is taken off the wheel by placing the machine on the stand.

To change a rear Inner-tube it is not necessary to remove the wheel. The old tube can be removed and a new one fitted by removing the Spindle and distance piece.

REMOVAL OF REAR BRAKE.

Take out the Rear Wheel as previously described and on MOV and MAC Models disconnect the Torque-link from the Brake-plate or the Prop-stand Pivot, whichever is the more convenient.

On early MOV and MAC Models the Brake-plate is secured to the frame fork end lug by an anchor bolt which has to be removed to take out the Brake-plate. (*See Fig.* 27).

Loosen the large hexagon nut on the Dummy-spindle and slide the whole assembly out of the Fork-end of the frame.

By taking the nut right off the Dummy-spindle the Brake-plate and Brake-shoes will lift right out of the Drum. Be careful not to lose the distance tube which fits on the Dummy Spindle outside the Brake-plate.

‡ *See important foot note on previous page.*

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REMOVAL AND RE-FITTING OF REAR WHEEL.

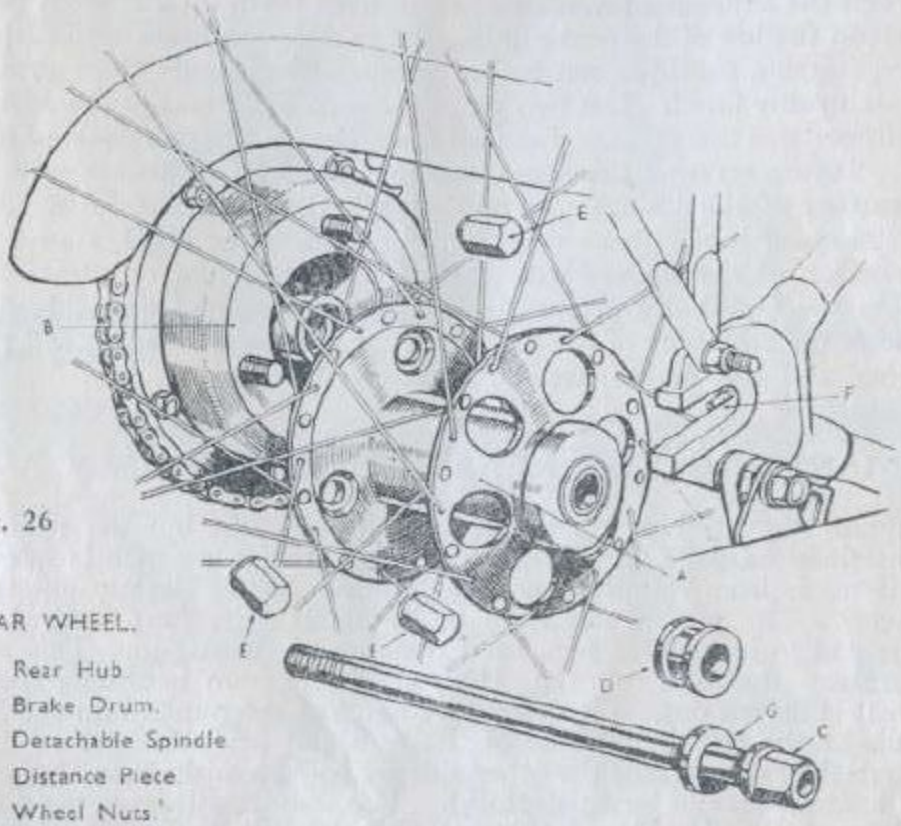

Fig. 26

REAR WHEEL.

A. Rear Hub
B. Brake Drum.
C. Detachable Spindle
D. Distance Piece
E. Wheel Nuts.
F. Tip of Chain Adjuster
G. Plain Washer.

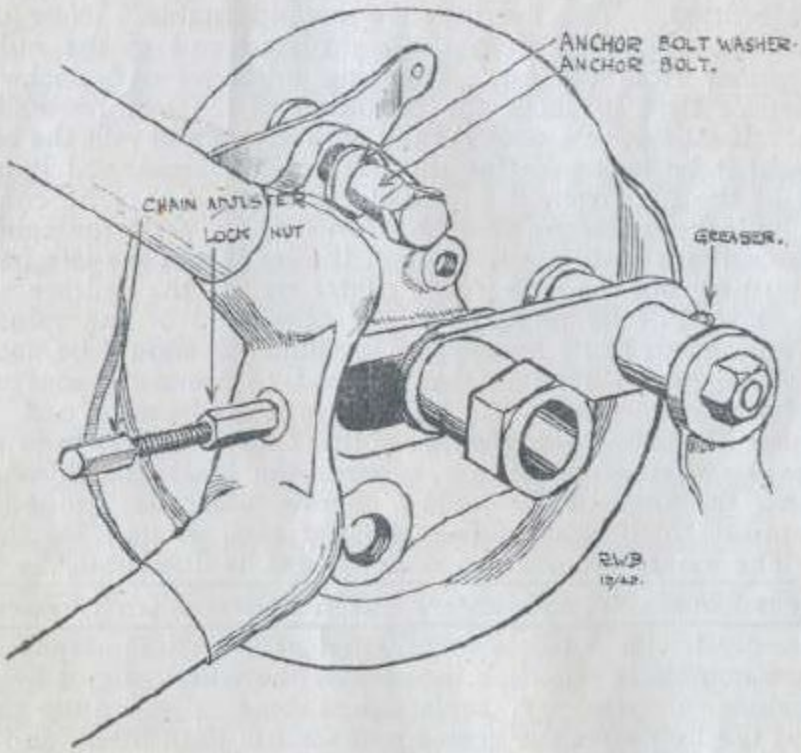

Fig. 28

REAR BRAKE ANCHORAGE (EARLY MOV and MAC Type).

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BRAKES.

When the adjustment available has all been taken up it is often possible to extend the life of the brake linings by packing the brake shoes from the cam. Suitable packings can be cut comparatively easily from sheet steel and are readily fitted. Cut two strips for each brake and fit them between the slipper and the shoes. Take off the shoes and fit one packing to each shoe. Before refitting the shoes, see that the rivet heads are well below the surface of the linings. If not—punch them down a little. Should new linings or replacement shoes with new linings be fitted, always smear the surface of the linings with the very slightest film of grease. This reduces the possibility of the drums becoming scored and ridged, and although the efficiency of the brakes will at first be affected, it will rapidly improve and the brakes become perfectly normal.

DISMANTLING THE REAR HUB BEARINGS.

Support the machine on the rear stand and take out the rear wheel as described on page 62. To remove the bearings a punch is necessary, and is made from round brass or aluminium bar of slightly under $\frac{7}{8}$-in. diameter. The punch will have to be about 9-in. long, turned down at one end to just under $\frac{3}{8}$-in. for a distance of about $\frac{1}{2}$-in. This is used to protect the end of the Hollow spindle from becoming damaged when it is driven out. Fit the reduced end of the punch into the hollow spindle at the right-hand side of the hub and drive the hollow spindle through the hub towards the other side by using a fairly heavy hammer (a 1-lb. hammer should be satisfactory). The spindle will leave the dust cap on the right-hand side and this can then be lifted off and the ballrace from the left-hand end of the hub will be forced out with the spindle and a small dust cap. This bearing, which will still be in place on the hollow spindle, can be cleaned and tested for wear. If any undue slackness is perceptible or if the bearing is felt to turn roughly, jerkily or stiffly, it should be replaced. If satisfactory it can be put aside until it is to be refitted. The bearings are not adjustable. Now unscrew the ballrace retaining ring from the right-hand end of the hub using the peg spanner from the kit. The ring unscrews anti-clockwise. It will be possible then to check the condition of the bearing whilst it is in position. If satisfactory, pack it fully with grease and refit the retaining ring. Should it be necessary for the bearing to be renewed it must be driven out of the hub from the opposite side and it may be convenient to use the hollow spindle for this job. To do this, press the spindle out of the other ballrace and pass it through the hub from the left hand end until it is pushed into the hole in the centre ring of the ballrace which is to be removed. Fit the punch into the other end of the spindle and drive the bearing out of its housing in the hub. It should be noted that behind each bearing a steel washer is used to prevent grease working into the hollow centre part of the hub where it can be of no use. Before refitting either of the bearings always see that these washers are in position (The concave surfaces are always towards the bearing). Also observe carefully that the ends of the hollow spindle which are ground to the correct diameter to fit the bearings are not each ground for the same distance. The longer ground end must always be fitted into the bearing on the right-hand side and enters the hub first when re-assembling. This apparently trivial detail is for all that of great importance because if the hollow spindle is put back incorrectly the wheel cannot be refitted to the machine properly. A replacement bearing can quite easily be pressed into the hub after the grease retainer has been fitted, and should then be packed full of grease. Now screw in the retaining ring and tighten fully.

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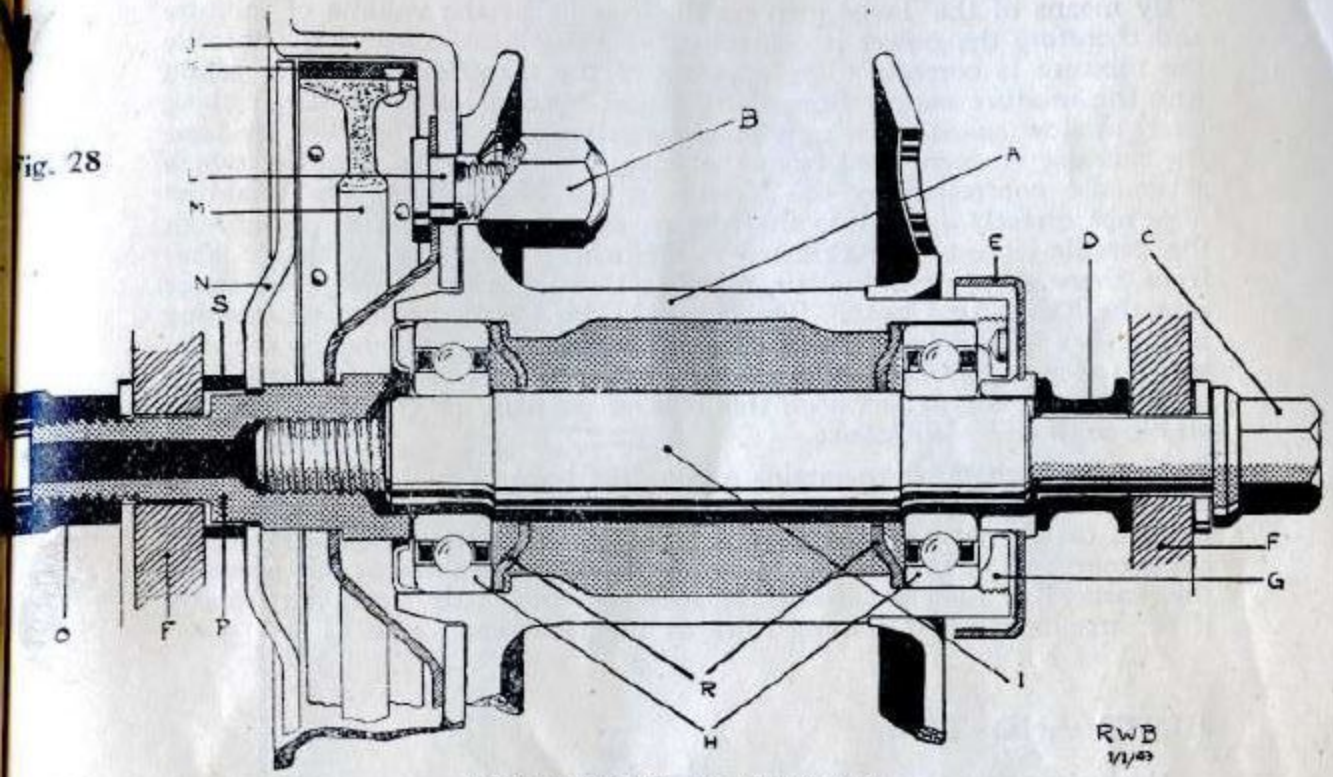
Fig. 28



ARRANGEMENT OF REAR HUB.

A. Hub Shell.	G. Ball Race Retaining Ring.	M. Brake Shoe.
B. Wheel Nuts.	H. Ball Races.	N. Brake Plate.
C. Detachable Spindle.	J. Hollow Spindle.	O. Dummy-Spindle Nut.
D. Distance Piece.	K. Brake Drum.	P. Dummy-Spindle.
E. Outer Dust Cap.	L. Brake Lining.	R. Grease Re-tainers.
F. Frame Fork Ends.		S. Brake Plate Distance Piece.

Refit the other bearing to the shorter ground end of the hollow spindle. put the other grease retainer into place in the hub, concave face outwards, and slip the spindle through, fitting the other end into the centre of the right-hand bearing. Drive the spindle through until it is fully home and the left-hand bearing is down in its housing in the hub. Pack well with grease and press in the small dust cap. Finally, tap the right-hand dust cap on to the end of the hollow spindle The wheel is then ready to put back into the frame.

THE CARBURETTER.
DESCRIPTION AND EXPLANATION OF WORKING.

The illustrations provided should be referred to for explanation of the text.

The purpose of the Carburetter is to atomise the correct amount of fuel with the air that is drawn into the engine and thus supply a correctly proportioned mixture at all engine speeds and all throttle settings. This is achieved by the selection of the correct size main jet, and main choke bore, in conjunction with the right adjustment or setting of the jet needle and the Pilot jet.

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By means of the Twist grip on the Handlebar the volume of mixture and therefore the power is controlled, and at all positions of the throttle the mixture is correct. The opening of the throttle brings into action first the mixture supply from the Pilot-jet System for idling (*i.e.*, ticking over) at slow speed, then as it progressively opens, via the Pilot By-pass, the mixture is augmented from the Main-jet, the earlier stages of which action are controlled by the Needle in the Needle-jet. The Main-jet does not directly spray into the Mixing-chamber, but discharges through the Needle-jet into the Primary Air Chamber, and the discharge goes from there as a rich, fuel-air mixture through the Primary Air-choke into the Main Air-Choke. This Primary Air-Choke has a compensating action. A separately operated mixture control is also provided by the Air-valve (operated from the handlebar) for use when starting from cold, and until the engine is warm, this control partially blocks the passage of air through the Main-choke.

The Float-chamber maintains a constant level of fuel at the jets, and cuts off the supply when the engine stops. It is however, always advisable to turn off the fuel at the taps if the machine is stopped for more than a few moments or is not likely to be needed for some time, as this prevents the wastage of fuel which may escape from the Carburteer, particularly if the machine is left leaning towards the right-hand side.

HINTS AND TIPS.

Always see that there is the minimum of backlash or lost motion in the Controls, so that the movement of the Air-lever or Twist grip immediately brings about the movement of the Air and Throttle-valves respectively. The adjustment is made by means of the adjusters on the top of the Mixing-chamber.* Screw the adjusters anti-clockwise to take up slackness. Also see that the control Cables are so arranged on the machine that any movement of the Handlebar does not affect the Carburetter.

Should it be suspected at any time that fuel is not reaching the Carburetter properly, the feed may be verified by detaching the pipe below the float chamber and momentarily turning on each tap in turn. Fuel should gush out if the pipe and taps are clear. A stoppage of the air vent hole in the fuel tank cap can cause an air lock in the tank and stop the flow. See that this hole is kept clear. Flooding may be due to a worn or bent Float-needle, or a leaky Float, but nearly all flooding with new machines is due to impurities (grit, fluff, etc.) from the tank—so clean out the Float-chamber periodically till the trouble ceases. Note that if the Carburetter is flooding with the engine stopped, the overflow from the main jet will not run into the engine but out of the carburetter through the small hole in the side of the Carburetter-body.

Erratic slow running is often caused by air leaks, so verify that the joint between the flange of the Carburetter and the Cylinder head is properly made and nuts tight Check for air leaks by putting a little oil round the edge of the joint packing. On machines which have run a considerable mileage a worn throttle may be responsible.

Banging (*i.e.*, explosions) in the Silencer may be caused by a choked Pilot-jet or to too weak a pilot mixture (through incorrect adjustment) when the throttle is closed or nearly closed—also it may be caused by too rich a pilot mixture or an air leak in the exhaust system. The reason in either case is that the mixture has not fired in the cylinder but has fired in the hot silencer or been ignited there by a incandescent particle of carbon from the exhaust port. If the banging happens when the throttle is fairly wide open it is more likely to be due to ignition. Remove the sparking plug, clean, adjust and refit.

**On pre-war Models throttle cable is adjusted differently* *(see Page 72).*

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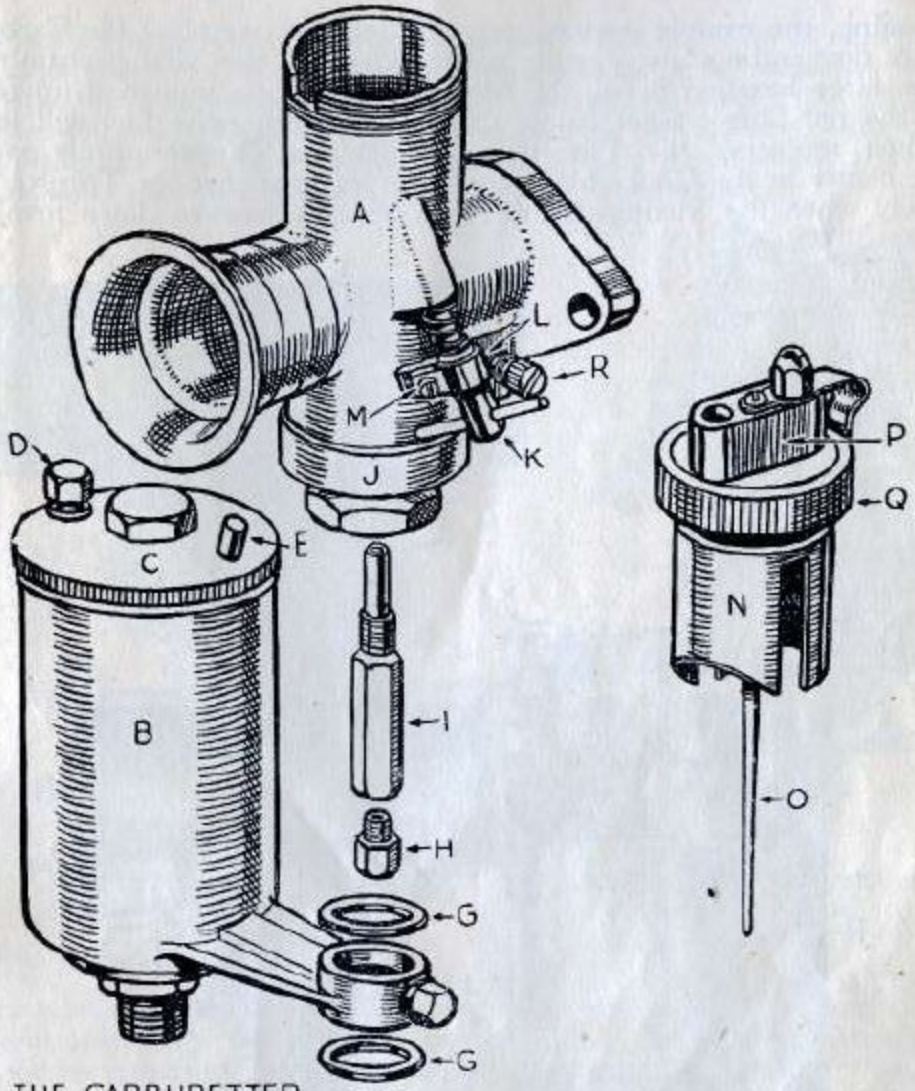

THE CARBURETTER

A. Mixing Chamber.
B. Float "
C. " " Lid.
D. Locking Screw.
E. Tickler.
F. Hollow Bolt.
G. Fibre Washers.
H. Main Jet.
I. Needle Jet.
J. Mixing Chamber Nut.
K. Throttle Stop Screw.
L. Stop Lug.
M. Clamping Screw.
N. Throttle Valve.
O. Jet Needle.
P. Mixing Chamber Top.
Q. Locking Ring.
R. Pilot Adjusting Screw.

Fig. 29

Bad Fuel Consumption may be due to flooding or leaking pipes and taps—also to a worn Float-needle Valve (if the machine is an old one), or else to a worn Needle-jet. This may be remedied or improved by lowering the needle in the Throttle-valve, but if it cannot be—then the only remedy is a new Needle-jet.

Usually when an Air Filter is fitted the main jet is of smaller size than would be used without a Filter, so that if the Air Filter is removed and the machine used without it, care must be taken not to overheat the engine due to too weak a mixture. Testing with the Air Valve will indicate if a larger Main-jet and higher Needle position are required.

Faulty running may not be due to Carburation. If the trouble cannot be remedied by making the mixture richer, or weaker with the Air-valve, and it is known that the fuel feed is good and the Carburetter is not

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flooding, the trouble is elsewhere. When re-assembling the Carburetter after dismantling, always note particularly that the Mixing-chamber Nut (the large hexagon below the Mixing chamber) is tightened up fully on to the red fibre washer below the Jet-block, otherwise fuel will leak up. When replacing the Throttle, see that the Throttle-needle goes into the centre in the Choke-block and once in, note that the Throttle works freely when the Mixing-chamber top Ring is screwed down firmly.

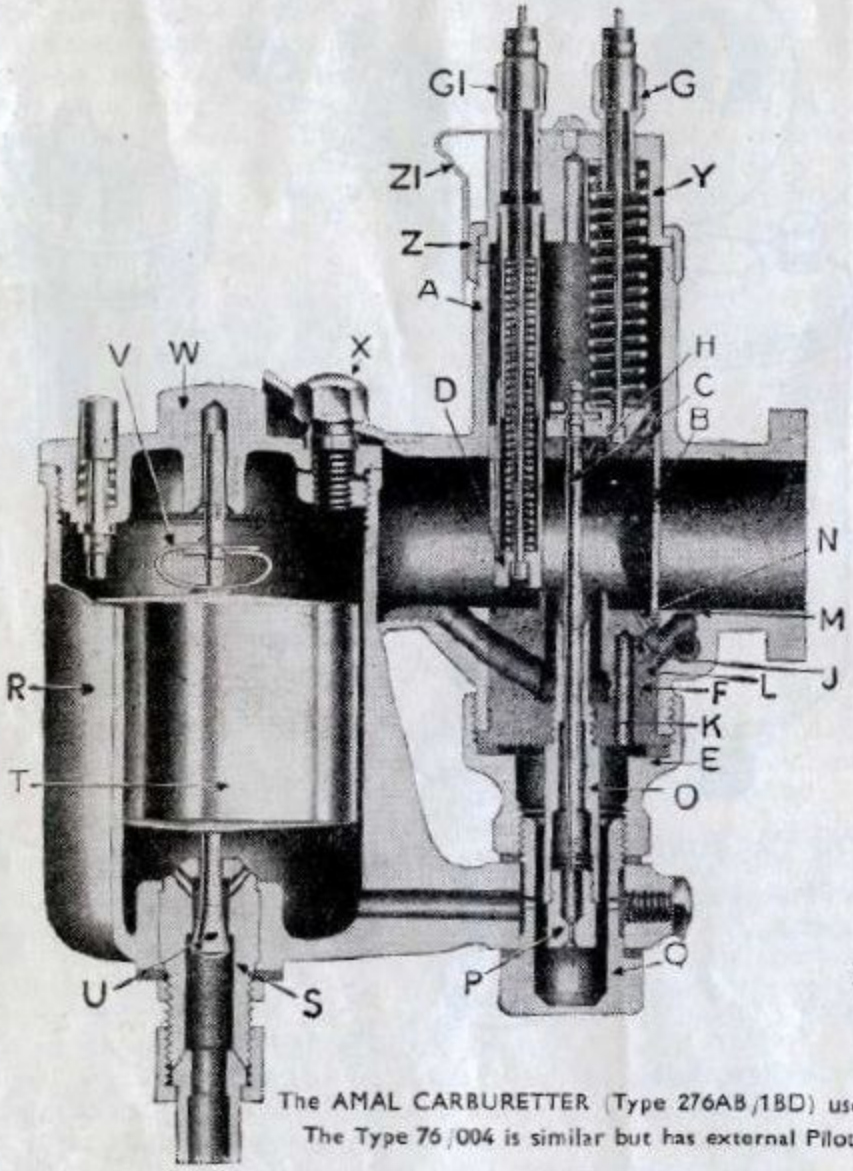

Fig. 30

The AMAL CARBURETTER (Type 276AB/1BD) used on MAC
The Type 76/004 is similar but has external Pilot air holes.

FLOAT CHAMBER LID.

To remove, first loosen the small hexagon head screw (X) (turn anti-clockwise), and unscrew lid by means of the large hexagon (W) in the centre (unscrew anti-clockwise). To remove the Float (T), pinch the spring bow (V) on top of the Float and pull Float up. When replacing slip the Float over the Needle (U) till the bow clocks into the needle groove. Select the correct groove and pinch the bow to allow the Needle to be engaged in the correct position. Take care always to avoid bending the needle.

THE THROTTLE STOP SCREW.

This should be set so that when it is turned with the stop lug facing back the throttle is held open sufficiently to keep the engine running slowly when the twist grip is shut off. On Velocette machines an adjustable stop lug is fitted in place of the lock nut illustrated, and the screw

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has a small cross bar to facilitate operation. The stop lug is held by a small clamping screw to the stop screw, and should be tightened up when the correct setting has been obtained. The stop screw is then available for obtaining the correct setting of the Throttle for starting from cold. This position is given by turning the stop screw until the stop lug is right forward. Keep the Twist-grip shut off when starting.

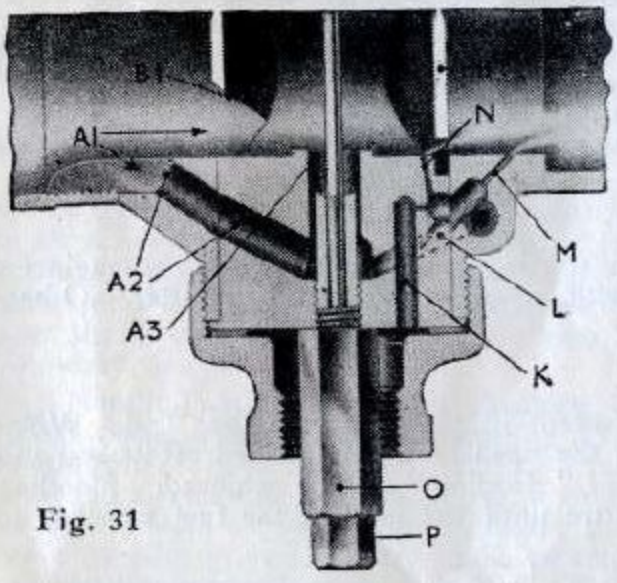

Fig. 31

SECTION THROUGH NEEDLE JET AND PILOT PASSAGE.

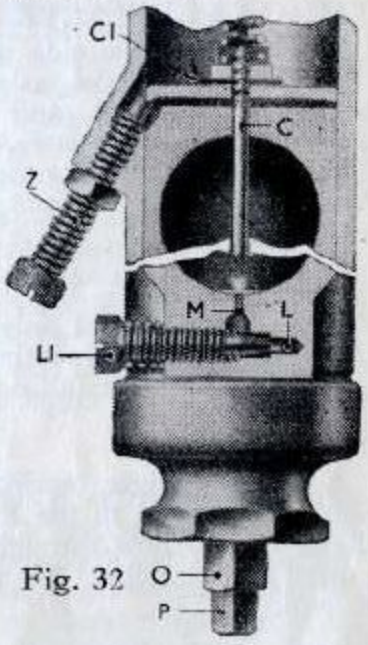

Fig. 32

SECTION THROUGH STOP SCREW AND PILOT JET.

PILOT AIR SCREW.

This screw regulates the strength of the mixture for ' idling " and for initial opening of the Throttle, by controlling the suction on the Pilot petrol Jet by metering the amount of air that mixes with the fuel. Usually it gives the correct mixture when set from 1½ to 2 turns out (anti-clockwise) from the fully screwed-in position.

MAIN JET.

The main jet (P) controls the fuel supply when the Throttle is more than three-quarters open, but at smaller openings, although the supply of fuel goes through the Main-Jet, the amount is diminished by the metering effect of the Needle (C) in the Needle-jet (O). Each jet is calibrated and numbered so that its exact discharge is known and two Jets of the same number are alike. Never ream out a Jet. Get another of the right size if a larger Jet is found to be necessary. This however is unlikely, to be required. The bigger the number on a Jet the bigger the Jet.

To get at the Main-jet, undo the Float chamber holding bolt (Q). The Jet is screwed into the bottom of the Needle-jet. If the jet is tight hold the Needle-jet carefully with a spanner whilst unscrewing the Main-jet.

NEEDLE AND NEEDLE JET.

The Needle (C) is attached to the Throttle-valve (B) and being taper, either allows more or less fuel to pass through the Needle-jet as The Throttle is opened or closed throughout the range, except when idling or at nearly full throttle. The Needle-jet is of a defined size and is only changed or altered from standard when using special fuels such as Alcohol.

The taper needle position in relation to the Throttle opening can be set according to the mixture required by fixing it to the Throttle-valve

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with the needle clip spring in a certain groove, thus either raising or lowering it. Raising the needle enriches the mixture and lowering it weakens the mixture at throttle openings from half to three-quarters open. Normally the clip-spring is set in the third groove from the top.

THROTTLE-VALVE CUT-AWAY.

The atmospheric side of the Throttle valve is cut away to influence the depression on the main fuel supply and thus gives a means of control between the Pilot and Needle-jet range of Throttle opening. The amount of cut-away is recorded by a number stamped on the top of the Throttle valve, viz. 6/4 means type 6 Throttle valve with No. 4 cut-away. A larger cut-away, say 5, gives a weaker mixture and 3 and 2 richer mixtures.

AIR VALVE.

(D). This is used only for starting and running when the engine is cold, and for experimenting with, when setting the Carburetter. Otherwise it is always set full open.

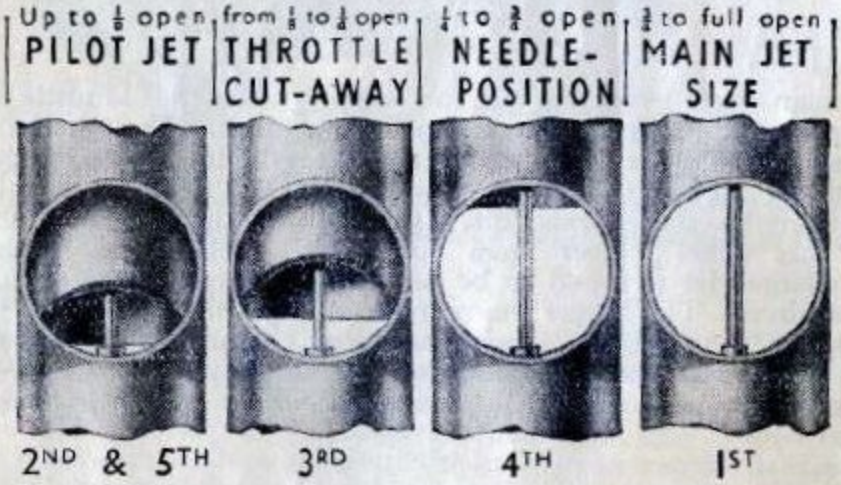
TICKLER.

A small plunger (spring loaded) in the Float-chamber Lid. When pressed down on to the float, the needle valve is pushed off its seat and allows fuel to flow through and " flooding " is thus achieved. Flooding temporarily enriches the mixture until the level of the fuel subsides to normal.

HOW TO SET AND ADJUST THE CARBURETTER.

Proceed in the following order only. By so doing you will not upset good results obtained. See Illustrations of various phases of Throttle opening. **Note.**—The Carburetter is automatic throughout the Throttle range—the Air Valve should always be wide open except when used for starting or until the engine has warmed up.

PHASES OF AMAL NEEDLE JET CARBURETTER
THROTTLE OPENINGS



SEQUENCE OF TUNING **Fig 33**

1st. Main Jet with Throttle in Position 1.

Test engine for full throttle. It may be found at full throttle that the power seems better with the Air-valve slightly closed. This indicates too small a main jet.

2nd. Pilot Jet with Throttle in Positions 2 and 5.

With engine idling too fast with Twist grip shut off and the Throttle shut down on to the stop screw : (1) Loosen stop lug and turn the stop

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screw down until the engine runs slower and begins to falter
the pilot air screw in or out to make the engine run regularly
(2) Now gently lower the Throttle stop screw until the engine
and just begins to falter, then lock the stop lug by means
clamping screw so that the lug is in contact with the side of
chamber to the rear of the stop screw. Now begin again t
pilot air screw to get the best slow running. If this second
makes the engine run too fast, go over the job a third time
lock up the stop lug tightly without disturbing the correct
the screw. Considerable time will be saved if a start is made
pilot air screw set between 1½ to 2 turns unscrewed from its full
position.

3rd. Throttle Cut-away with the Throttle in Position 3.

If as the Throttle is opened from the idling position, there is objectiona
spitting from the Carburetter, slightly enrich the pilot mixture by screwing
the air screw in about half a turn, but if this is not effective, screw it
back again and fit a Throttle valve with a smaller cut-away. If the
engine jerks under load at this throttle position and there is no spitting,
either the throttle needle is much too high or a larger throttle cut-away
is required to cure richness.

4th. Needle, with Throttle in Position 4.

The needle controls a wide range of Throttle opening and also the acceleration. Try the needle in as low a position as possible, viz., with the clip in a groove as near the top of the needle as possible, if acceleration is poor and with air valve partially closed the results are better, raise the needle by two grooves, if very much better, try lowering the needle by one groove and leave it where it is best. **Note.**—If the mixture is still too rich with the clip in the top groove—the needle jet probably requires replacement because of wear. The needle itself seldom wears out.

5th. Finally.

Go over the idling again for final touches.

CARBURETTER SETTINGS.

Model MOV.	Main Jet	120
	Needle Jet	4/061
	Needle No.	5/065
	Throttle valve No.	5/3
	Throttle needle clip setting—third groove	
Model MAC.	Main Jet	130
	Needle Jet	4/061
	Needle No.	6/065
	Throttle valve No.	6/3
	Throttle needle clip setting—third groove.	
Model MSS.	Main jet	180
	Needle jet	4/061
	Needle No.	6/065
	Throttle valve No.	6/4
	Throttle needle clip setting—third groove	

THROTTLE AND AIR CONTROL CABLES.

These should operate freely without lost movement, and normally need no attention except for periodical lubrication. The adjusters for the Air Control Cable and the Throttle Cable are situated in the mixing chamber top. They are indicated as G1 and G respectively on Fig. 30. Turn anti-clockwise to take up lost movement.

To oil the cables remove them from the handlebar lever and twist grip, and, from thick brown paper make small funnels the small ends of which should then be tied round the ends of the casings. Support the ends as high as possible and fill the paper funnels with thin oil and allow the cables to remain in this way over night, when the oil will penetrate down the inside of the casing.

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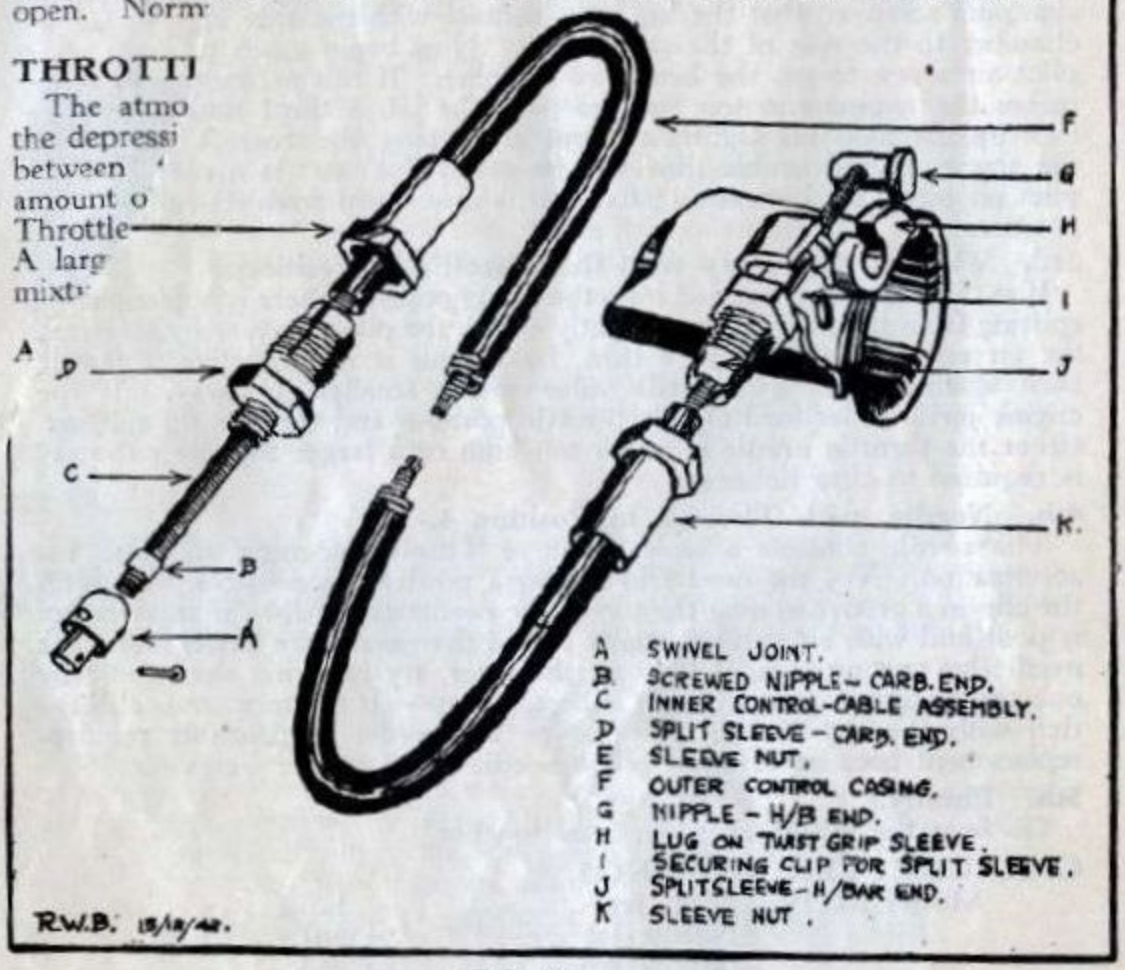

Fig. 34.

THROTTLE CABLE AND TWIST GRIP (PRE-WAR TYPE ONLY). Fig. 34.

The Throttle Valve is operated by a push-pull cable from the Twist Grip and no spring is used above the throttle valve. To adjust the cable, first see that with the Twist Grip in the closed position the Throttle Valve is down as far as it will go in the mixing chamber—set the throttle stop screw back. See Page 68. Slacken off the sleeve nut E (Fig. 34), using a second spanner to hold the hexagon of sleeve D to prevent this turning. Slide the outer casing up or down in the sleeve until correct adjustment is obtained, and tighten sleeve nut E. Be careful to hold the sleeve D with a second spanner, otherwise it may be twisted off.

The cable may be lubricated as described previously, or may be completely removed from the casing and smeared with oil.

To remove cable take off the clip I (Fig. 34) securing sleeve J to the lug on the handlebar, and slip the cable nipple out of the "ear" on the Twist-Grip Sleeve. Unscrew the ring Q (Fig. 29) from carburetter and draw out both throttle and air valves. Pull out the small pin securing the Swivel Joint A (Fig. 34) to the valve. Unscrew the Swivel Joint from the nipple B (Fig. 34) and pull out the cable.

The Twist-Grip can be pulled off the end of the handlebar when the clip is free and cable nipple removed. Do not lose the small rectangular friction pad which lies in a slot in the handlebar and which will be freed when the Twist-Grip is taken off. Should the Twist-Grip have been stiff clean the handlebar and smear with grease. When replacing slide up as far as the friction pad, depress the pad into the slot, and slide the Twist-Grip over it into place. Finally replace the clip and cable nipple.

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THE SPARKING PLUG. Detachable Types.

Some Models were fitted with KLG type 831 plugs, with m NS

WARNING.

The procedure detailed for plugs with Corundite insulat apply to any sparking plug which may be fitted, and whi insulation. Mica insulation will be ruined if the plug is e blasted or the insulation is cleaned with emery cloth. The in such plugs must only be cleaned by soaking in paraffin or petrol a with rag. The Corundite insulation can be cleaned on a sandblas but it is usually satisfactory to do so by hand. First unscrew th nut from the body so that the insulated centre electrode may be witho If the Corundite insulation is oily, first wash it in petrol or paraffin using fairly coarse emery cloth, remove the carbon deposit, then was again. The firing point of the centre electrode should be cleaned wit fine emery cloth.

The plug body should be scraped clean internally with a knife or wire brush and finally rinsed in petrol.

Lightly smear the internal washer with thin oil and verify that it is seating properly in the plug body before inserting the central electrode and re-assembling the plug. Care should be taken not to overtighten the gland nut when screwing up the body.

The gap should now be adjusted to .015-in.—.018-in. If the gap is too wide the necessary adjustment must be made by bending the earth point. The firing point of the central electrode must not be levered towards the earth points.

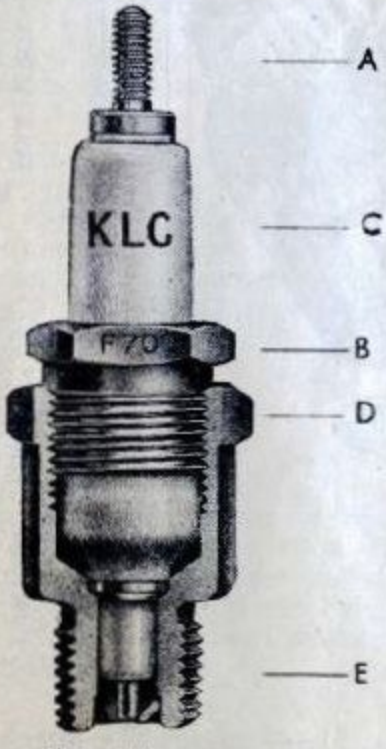

Fig. 35.

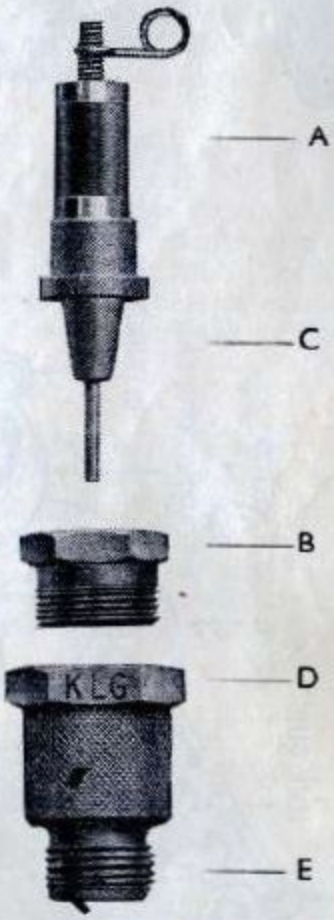

Fig. 36.

A. Top End of Centre Electrode.
C. Corundite Insulator.
B. Gland Nut.
D. Plug Body.
E. Thread to Fit Cylinder Head.

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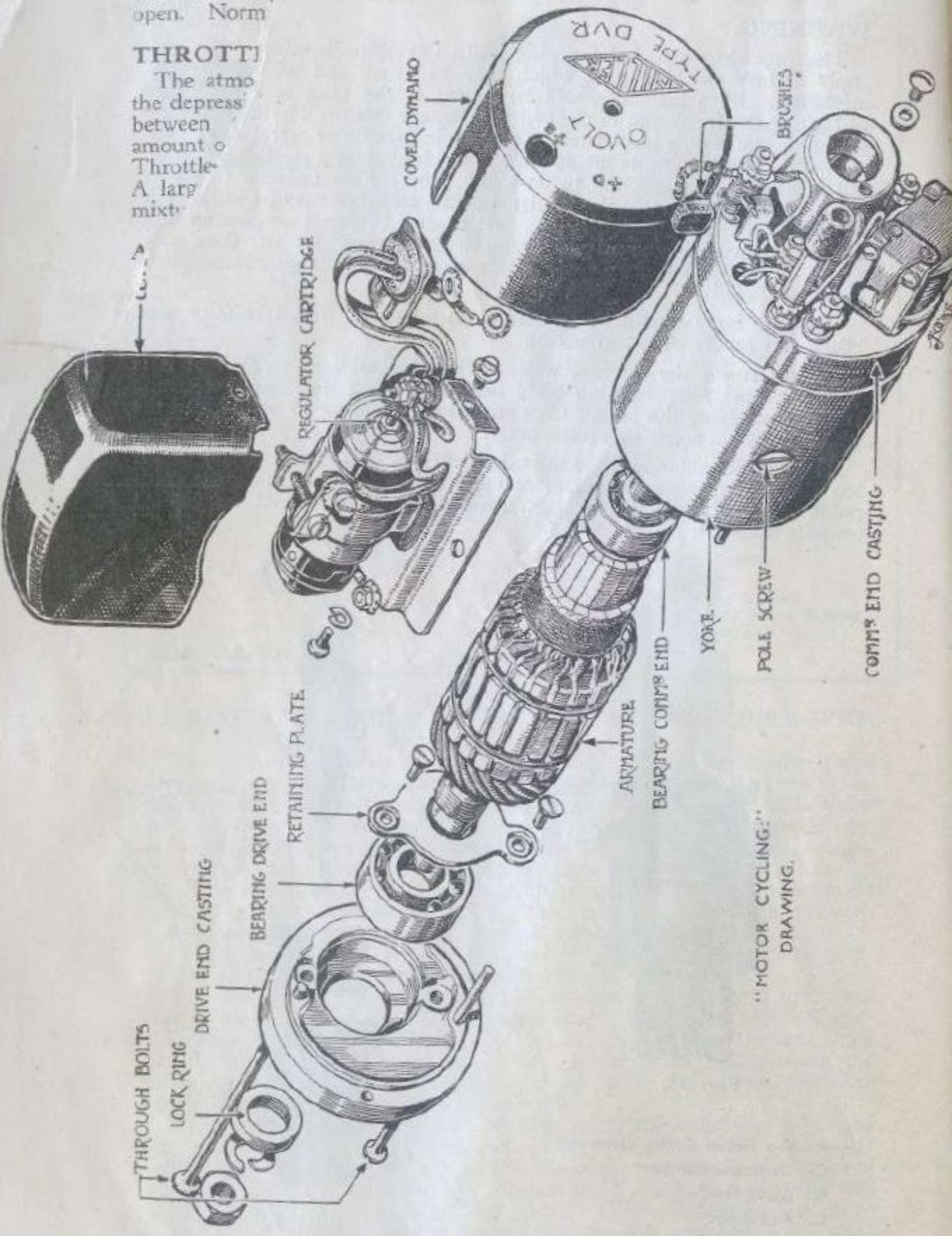
MILLER DYNAMO (Type DVR) Fig. 37



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MAINTENANCE INSTRUCTIONS

FOR THE

MILLER LIGHTING SET

FITTED TO

THE VELOCETTE

The following instructions apply to all Models, except that the wiring in the headlamp differs slightly. Reference to the respective wiring diagrams will explain fully.

CHARGING.

(i) **Dynamo. Type**, Miller DVR. (6 volt)

(ii) **Dynamo—Testing.**

Remove the cover securing screw, then remove cover, this exposes commutator end bracket as Fig. 38. Disconnect the three outside leads (Regulator and Head Lamp) from terminals D.B.S. Clip the negative lead of a good quality moving coil voltmeter, reading from 0-10 volts to a clean earthing point on the dynamo, and clip the positive lead to terminal "B."

Start engine and slowly increase its speed. If no reading is shown on the voltmeter then clip positive lead of voltmeter to terminal "D." If a reading is then shown the cut-out is at fault (try adjusting as instructions). If no reading, the fault is in the dynamo itself. On no account must the engine speed be increased during testing to such an extent that a reading of 8 volts is exceeded. If dynamo and cut-out are in order, re-connect the three leads to terminal D, B and S., and test regulator, para. (viii).

(iii) **Dynamo—Removal.**

Electrical breakdown of the dynamo is most unusual, and the unit should be tested as described above, Para. B. (ii) before assuming that removal is necessary. Take off belt cover by removing bolt from centre of cover and nut securing cover to primary chain case. Unscrew the dynamo clamping strap bolt about $\frac{5}{16}$-in. (do not completely remove bolt). Turn the dynamo in its mounting until the belt is loose, and remove the belt. Disconnect the three dynamo wires as described in Para. B (ii), and remove dynamo complete.

(iv) **Dynamo—Dismantling.**

Remove belt drive pulley from Armature shaft by taking off the nut and washer and drawing the pulley off the tapered end of the Armature shaft with a "Claw" extractor. Be careful when using the extractor not to damage the thin flanges of the pulley.

Remove brushes "A" and "X" (fig. 38) from their holders. Unscrew and remove the two long bolts securing both end castings of the dynamo yoke. The countersunk heads of these screws can be seen at the driving end.

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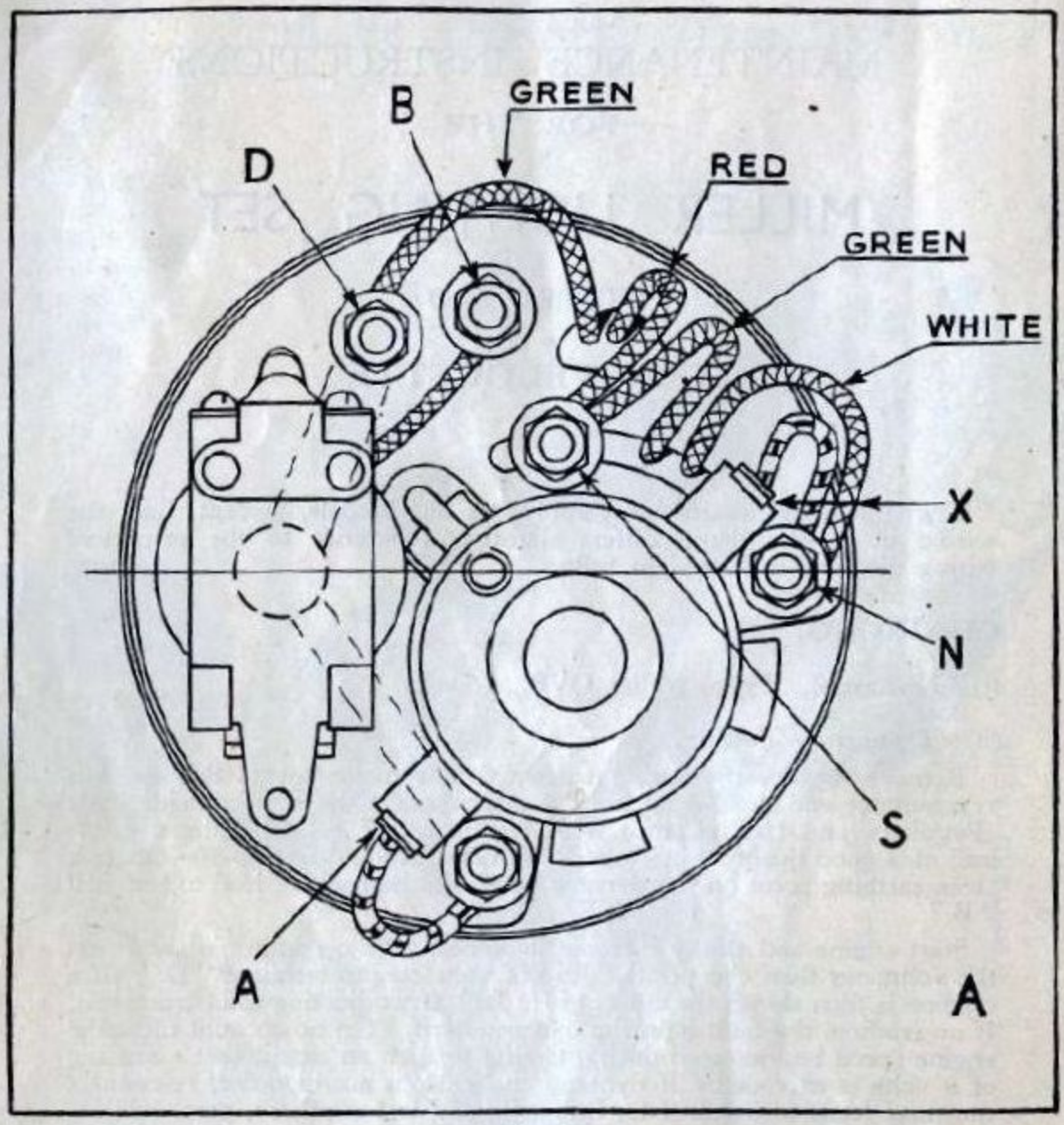

Fig. 38.

With the aid of a $\frac{3}{8}$-in. diameter metal punch and hammer, tap the armature spindle at the commutator end. As soon as the ball race at the commutator end is clear of the casting, the armature complete with driving end casting, can be withdrawn.

If it is necessary to remove the driving end casting from the armature spindle, first remove the pulley key from the spindle, then unscrew and remove the bearing lock ring, located on the armature shaft just behind the tapered portion. No attempt should be made to slacken this ring by knocking round with a punch. A special pin spanner should be used as shown in Fig. 39. If this spanner cannot be obtained, it can easily be made. The hardened pins are $\frac{3}{16}$ inches in diameter, with their centre $\frac{3}{4}$ inches apart. The inside diameter of the spanner where it fits around the armature shaft is $1\frac{7}{16}$ inches.

By rigidly supporting the bearing retaining plate which will be seen inside the driving end casting, the armature spindle may then be pressed out. Care should be taken not to damage the screwed portion of the shaft during this operation, nor should the centre hole be damaged or the shaft distorted in any way.

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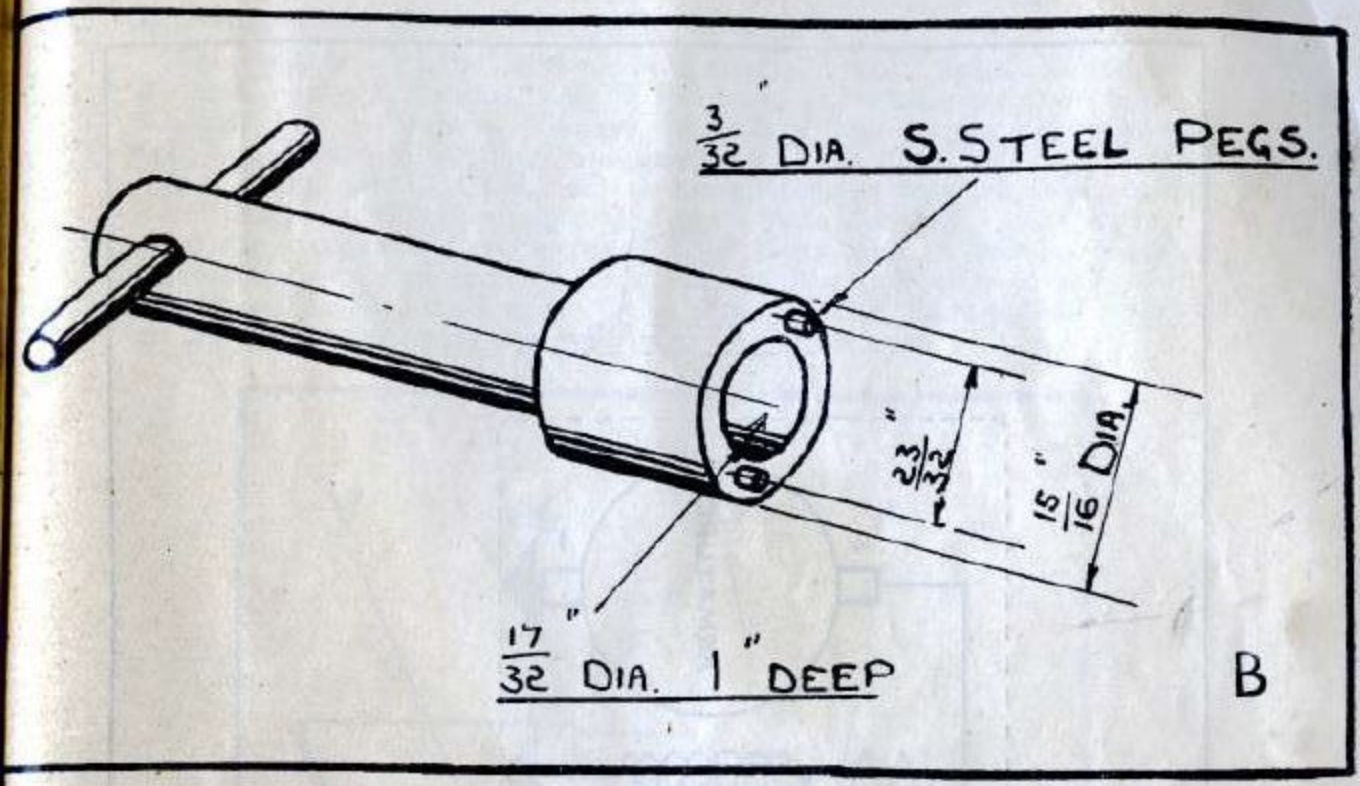

Fig. 39.

To remove the commutator end casting from the yoke, first disconnect at D, N and S, the four insulated leads, as seen in Fig. 38 (one each white and red and two green) which pass through the end casting to the field coil. The end casing can then be pulled away from the yoke, care being necessary to ensure that the four leads are not damaged in passing them through the accommodation slots in the end casting.

(v) Dynamo Commutator and Brushes.

Test and Repair. Check that the brushes are clean and move freely in their holders. If there is any stickiness, remove the brush and clean the sides with a cloth moistened with petrol, or by lightly polishing with fine glass paper. Always replace brushes in their original positions. Brushes which have been worn so that they do not bear firmly on the commutator, or which expose the embedded end of the flexible on the running face must be replaced. The commutator must be clean and free from traces of oil and dirt. When the dynamo has not been removed a dirty or blackened commutator can be cleaned by pressing a fine duster against it while the engine is slowly turned over. If the commutator is very dirty the duster should be moistened with petrol. (If required, the commutator micas should be undercut to a depth of approximately .025-in., but this operation can only be done after the Armature has been removed).

After fitting new brushes, they must be correctly bedded to ensure that they will make good contact with the commutator. To bed the brushes pass a thin strip of very fine glass paper between the commutator and each of the brushes, making sure that the smooth side of the paper rubs on the commutator, then pull the paper backwards and forwards for a few strokes, and then remove the paper. Wipe away any carbon or glass paper dust after the operation.

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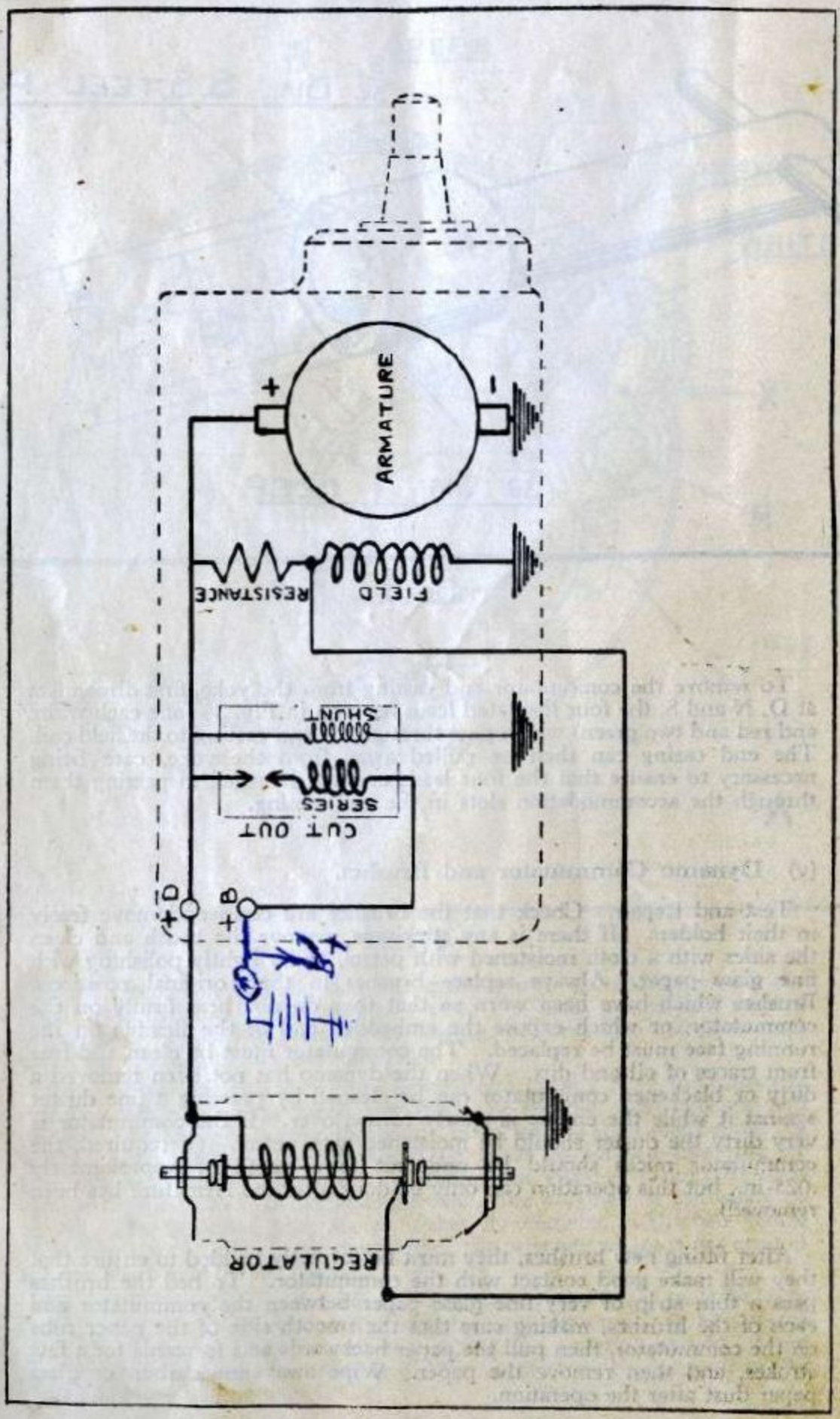

Fig. 40.

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Dynamo Field Coil.—Test and Repair.

The resistance of the field winding (red and white leads) should be 4 ohms. + or —.25 ohms., and of the resistance winding (green leads) 7 ohms. + or —.25 ohms. Megger test to earth and megger test between field and resistance windings should be not less than 100,000 ohms. When fitting new field coil, force yoke and pole on to a mandrill about 8-in. long, the diameter tapering from 1.767 inches to 1.773 inches. Grip the exposed end of the mandrill in a vice, and by using a robust screwdriver, the countersunk screw securing the pole shoe to the yoke can be screwed up dead tight. It is important that there should be no air gap between the pole shoe and inner face of the yoke.

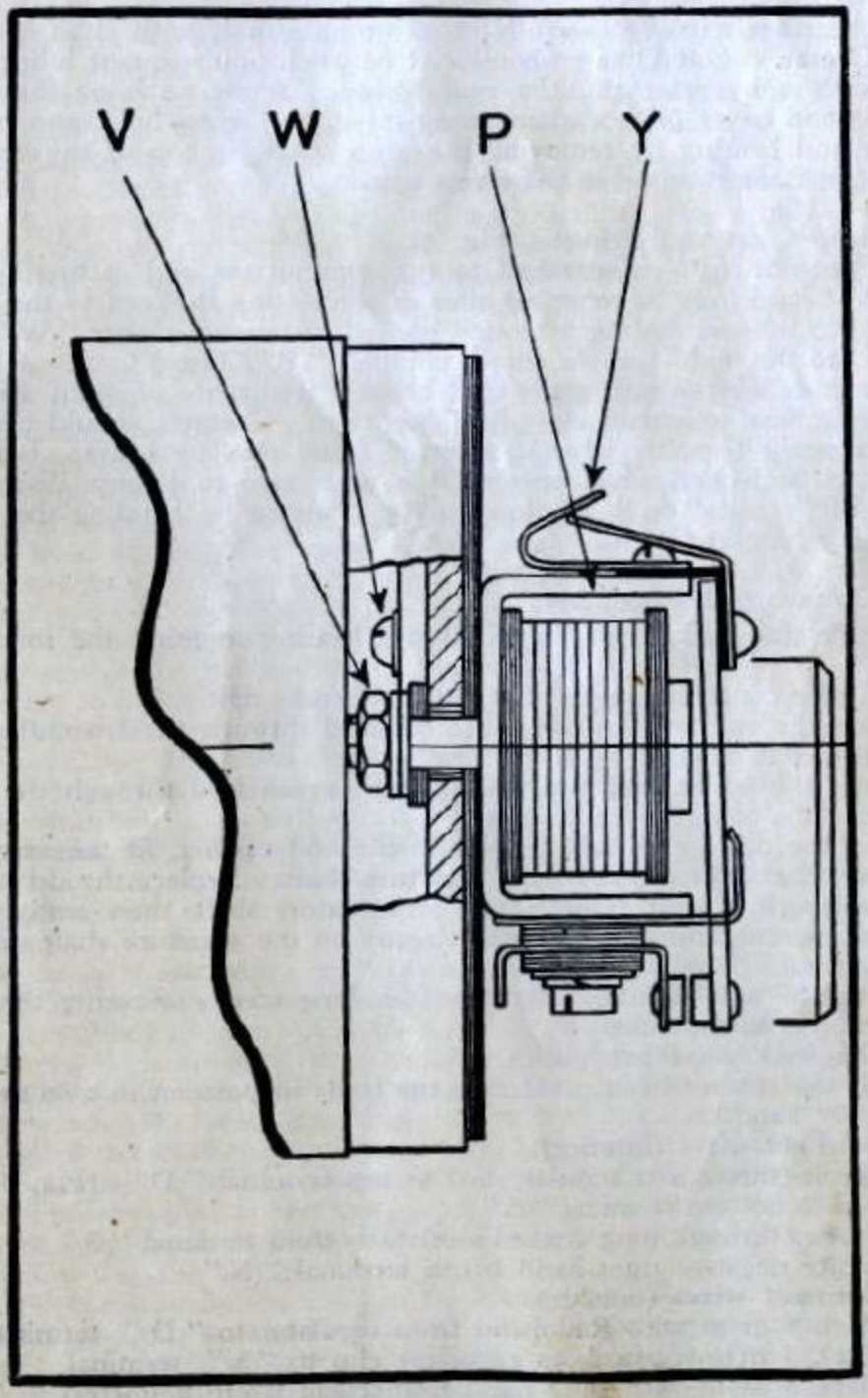

Fig. 41.
The Cut Out.

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Dynamo Armature.—Test and Repair.

The resistance of the Armature Coils measured between two adjacent commutator bars should be .2 ohms +or — .01 ohms. Megger test to earth should be not less than 100,000 ohms.

Dynamo Bearings.—Replacement and Lubrication.

The drive end bearing can be removed from the drive end casting by unscrewing the two small screws securing the bearing retaining plate, also the small grub screw on the outside boss. The bearing can then be tapped out. The commutator end bearing can be removed from the armature shaft by using a suitable extractor (it is not a very tight fit on the shaft).

Ball bearings must be carefully packed on assembly with High Melting Point Grease. Soft Grease should not be used. Subsequent lubrication in service is by removing the round-headed screw retaining the commutator end cover plate and inserting oil in the screw hole, and to the driving end bearing by removing the grub screw on top of the bearing housing and inserting oil in the screw hole.

Cut-Out.—Test and Adjust. Fig. 41.

The cut-out "P" is attached to the commutator end casting by one nut "V" and may be removed after disconnecting the lead to the earth retained to the end casting by round headed screw and washer "W," and the lead to the middle of the three terminals "B," Fig. 38.
Resistance of series winding .09 to .1 ohms. Resistance of shunt winding 55 to 56 ohms. Contact clearance $\frac{1}{32}$-inches. Contacts should close at approximately 6 volts, when a current from zero to $\frac{1}{4}$ amp. is being generated, and open when current falls from zero to $\frac{1}{2}$ amp. discharge. The "off" and "on" tension can be adjusted by bending the brass tensioning bracket (Y).

(vi) **Dynamo**—Re-assembly.

Reverse the procedure in Para. B (iv) bearing in mind the following points :—

(*a*) Fit the commutator end casting to the yoke first.
(*b*) Pass the red lead and the adjacent lead through the triangular slot in the end casting.
(*c*) Pass the white lead and the adjacent green lead through the long curved slot in the end casting.
(*d*) Fit the drive end ball bearing to the end casting, fit the assembly over the tapered end of the armature shaft. Replace the drive side bearing lock ring, tighten fully on armature shaft, then gently press the commutator end ball race already on the armature shaft into its housing.
(*e*) Replace and tighten fully the two long screws securing the end castings to the yoke.
(*f*) Replace key and belt pulley.
(*g*) Fit the rubber bush protecting the leads in position in commutator cover band.
(*h*) **Connect** wires (interior).
Green (through triangular slot) to top terminal "D" (Fig. 38).
Red to bottom terminal "S."
Green (through long curved slot) to bottom terminal "S."
White negative right-hand brush terminal "N."
(*i*) **Connect wires** (outside).
Black 5 m/m with Red band from regulator to "D" terminal.
Black 5 m/m plain from regulator clip to "S" terminal.
Black 5 m/m with Blue band from Head lamp (ammeter) to "B" terminal.
Replace brushes and fit dynamo to machine, afterwards fitting commutator end cover.

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(vii) **Regulator Type**—Miller CVI.

The regulator provides complete automatic control, so that the dynamo output varies according to the load on the battery, or its state of charge. Normally during daytime running, when the battery is in good condition, the dynamo gives only a trickle charge, so that ammeter readings will seldom exceed 1 or 2 amperes.

(viii) **Regulator**—Testing.

If, under normal running conditions, it is found that the battery is continually in a low stage of charge, or is being overcharged, and the test described in para. (ii) has established that the dynamo and cut-out are in order, the regulator may be tested by substitution if a replacement is available. It should be noted that it is quite safe to run the "Miller" dynamo without the regulator cartridge being fitted. When removed, and the dynamo leads left in place, that is, the one with the red identification sleeve connected to the base plate, and the other with the green identification sleeve, to the clip bolt, the dynamo gives a reduced output, with a maximum of approx. 3½ amps. It is therefore advisable to fit a replacement regulator as soon as possible.

To test whether the regulator is at fault, disconnect the battery positive lead, and connect a moving-coil voltmeter to the two regulator base terminals (positive and negative) start the engine and run at an equivalent speed of not less than 20 m.p.h. (approx. 1,000r.p.m.) If the regulator is in correct adjustment the voltmeter reading should be from 7.5 to 7.9 volts.

Regulator—To adjust.

If the voltmeter reading is below 7.5 volts over regulation is taking place, causing the battery to be continually in a low state of charge. If a spare regulator is not available, a **temporary** adjustment may be made by screwing out the negative contact screw (which is visible at the conical end of the regulator cartridge), two complete turns. Should the voltmeter reading be over 7.9 volts, which would cause overcharging, a temporary adjustment may be made by screwing out the positive contact screw at the other end not more than ¼ turn.

Note.—These adjustments will not give the correct voltage readings, but will enable the machine to be run with improved results until it is convenient to fit a replacement regulator.

Regulator—Remove and Replace.

The regulator is fitted to the strap which retains the dynamo in position —the cartridge being easily removed after removal of the cover. The pressed steel base and cartridge clip need not be removed unless broken.

(vix) **Ammeter.** Type—Miller /75V.

The Ammeter is retained to the headlamp shell by a metal bridge and two knurled nuts.

Ammeter. To Test.

With engine stationary, switch on the lights, the ammeter should indicate the equivalent lamp load, upon switching off, the needle should swing back freely to zero. If at fault replace as soon as possible.

Battery.—It is essential to give the battery regular attention, as upon its condition depends the efficiency of the lighting. At least once a month remove the vent plugs from the top of the battery and examine the level of the electrolyte. If necessary, add distilled water to bring the level above the tops of the plates but well short of the bottom of the vent plugs. This operation is best carried out just before commencing a journey when the agitation due to running and the gassing caused by charging will thoroughly mix the solution.

Should the machine be laid up for several months give the battery a small charge from a separate source of electrical energy about once a fortnight in order to obviate any permanent sulphation of the plates Do not remove the electrolyte from the battery and allow the plates to dry as certain chemical changes take place which result in loss of capacity. It is best to check the specific gravity of the electrolyte by means of a hydrometer as this gives a good indication of the state of charge of the battery.

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Specific gravity figures are :—1.285 to 1.300 fully charged, 1.210 half discharged, and 1.150 fully discharged. Never leave the battery in a discharged condition, and unless some long daylight runs are to be made, during which the battery can be charged, remove the battery from the machine and have it charged from an independent supply.

Always see that the connections are clean and tight and to prevent corrosion smear them with vaseline. Loose or dirty battery connections may cause burned out bulbs.

DIAGRAM OF WIRING (Non-Automatic).

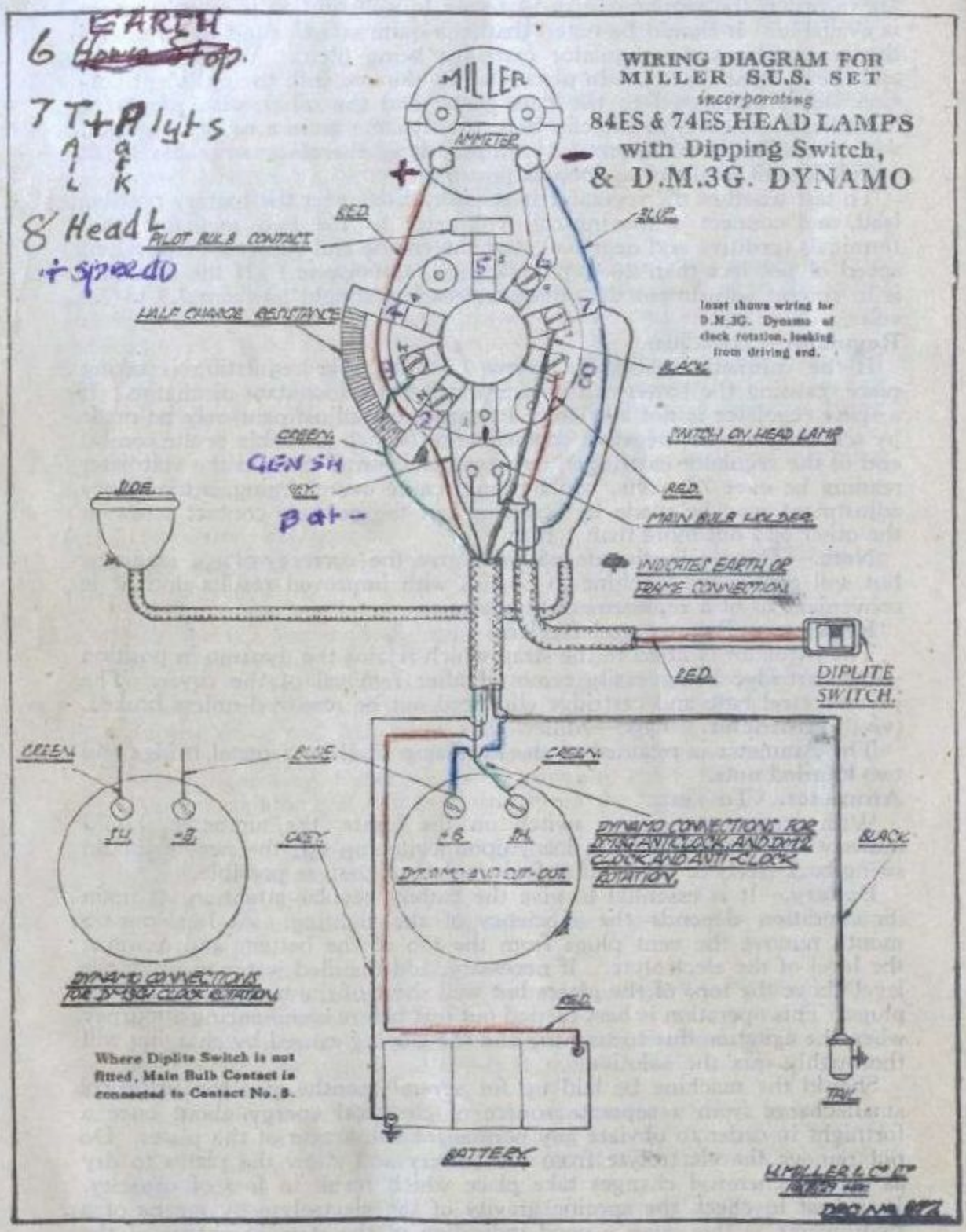

Fig. 42.

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DIAGRAM OF WIRING (Auto-Voltage Regulated).

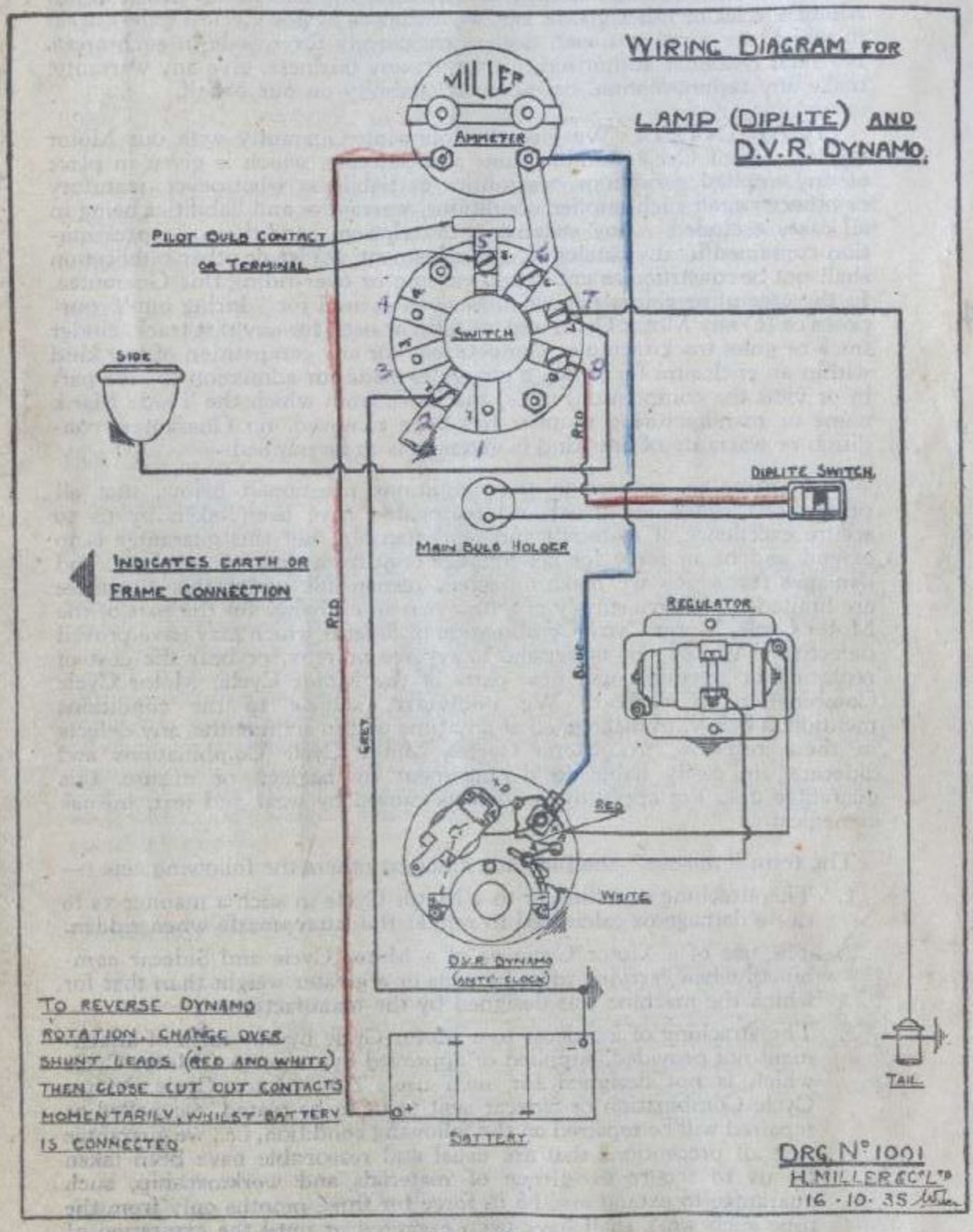

Fig. 43.

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GUARANTEE.

NOTICE. We do not appoint agents for the sale on our behalf of our Motor Cycles or other goods, but we assign to Motor Cycle Dealers areas in which we supply to such dealers exclusively for re-sale in such areas. No such Dealer is authorised to transact any business, give any warranty, make any representation, or incur any liability on our behalf.

GUARANTEE. We give the following Guarantee with our Motor Cycles, Motor Cycle Combinations and Sidecars, which is given in place of any implied conditions, warranties or liabilities whatsoever, statutory or otherwise, all such implied conditions, warranties and liabilities being in all cases excluded. Any statement, description, condition or representation contained in any catalogue, advertisement, leaflet or other publication shall not be construed as enlarging, varying or over-riding this Guarantee. In the case of machines (*a*) which have been used for "hiring out" purposes or (*b*) any Motor Cycle and or Sidecar used for any dirt track, cinder track or grass track racing or competitions (or any competition of any kind within an enclosure for which a charge is made for admission to take part in or view the competition) or (*c*) machines from which the Trade Mark, name or manufacturing number has been removed, no Guarantee, condition or warranty of any kind is given or is to be implied.

We guarantee, subject to the conditions mentioned below, that all precautions which are usual and reasonable have been taken by us to secure excellence of materials and workmanship, but this guarantee is to extend and be in force for six months only from date of purchase, and damages for which we make ourselves responsible under this guarantee are limited to the free supply of a new part in exchange for the part of the Motor Cycle, Motor Cycle Combination or Sidecar which may have proved defective. We do not undertake to replace or refix, or bear the cost of replacing or refixing, such new parts of the Motor Cycle, Motor Cycle Combination or Sidecar. We undertake, subject to the conditions mentioned below, to make good at any time within six months, any defects in these respects. As Motor Cycles, Motor Cycle Combinations and Sidecars are easily liable to derangement by neglect, or misuse, this guarantee does not apply to the defects caused by wear and tear, misuse or neglect.

The term "misuse" shall include amongst others the following acts :—

1. The attaching of a Sidecar to a Motor Cycle in such a manner as to cause damage or calculated to render the latter unsafe when ridden.
2. The use of a Motor Cycle or of a Motor Cycle and Sidecar combined, when carrying more persons or a greater weight than that for which the machine was designed by the manufacturers.
3. The attaching of a Sidecar to a Motor Cycle by any form of attachment not provided, supplied or approved by us, or to a Motor Cycle which is not designed for such use. Any Motor Cycle, Motor Cycle Combination or Sidecar sent to us to be plated, enamelled or repaired will be repaired on the following condition, i.e., we guarantee that all precautions that are usual and reasonable have been taken by us to secure excellence of materials and workmanship, such guarantee to extend and be in force for three months only from the time such work shall have been executed or until the expiration of the six months above referred to, and this guarantee is in lieu and in exclusion of any common law or statute, warranty or condition, and the damages recoverable are limited to the cost of any further work which may be necessary to amend and make good the work found to be defective.

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CONDITIONS OF GUARANTEE. If a defective part should be found in our Motor Cycles, Motor Cycle Combinations or Sidecars, or in any part supplied by way of exchange before referred to, it must be sent to us CARRIAGE PAID, and accompanied by an intimation from the owner that he desires to have it repaired or exchanged free of charge under our guarantee, and he must also furnish us at the same time with the number of the machine, the date of the purchase or the date when the alleged defective part was exchanged as the case may be.

Failing compliance with the above, such articles will lie here AT THE RISK OF THE OWNER, and this guarantee and any implied guarantee, warranty or condition shall not be enforceable.

We do not guarantee specialities such as tyres, saddles, chains, electrical equipment, lamps, etc., or any component parts supplied to the order of the purchaser differing from the standard specifications supplied with our Motor Cycles, Motor Cycle Combinations, Sidecars or otherwise.

NOTE.—We reserve the right to alter all Specifications and/or prices where necessary without notice.

INSTRUCTIONS FOR FIXING TRANSFERS.

When renovating a machine it is sometimes necessary to fix new Transfers to the tank, etc. Carefully clean the surface to which the Transfer is to be applied so that it is free from all dirt and grease. Apply a very thin coating of Gold Size or Transfer Varnish over the design of the transfer, avoiding overlapping the lettering as far as possible. Allow the transfer to stand until the Gold Size becomes "tacky" and then, with the thumb nail separate the thin paper from the thicker backing, at one corner only, and peel it off. Apply the transfer to the work, keeping it taut between the fingers and lightly press down with thumb. See that the transfer is well pressed down and free from creases and air bubbles. Allow to stand for about 10 minutes approximately, and then soak off the thin paper with cold water, when it will float off and leave the transfer. Wipe over with a rag soaked in clean paraffin. To preserve the transfer brush over with a light film of clear varnish, which may be applied when the transfer has dried.

CORRESPONDENCE WITH THE WORKS.

At the head of every letter written to us on the subject of a machine we advise that the engine number with serial letters should be quoted. The number and letters will be found stamped on the driving side of the crankcase just below the bottom flange of the cylinder. Police Registration Numbers are of no help since these are invariably allocated after delivery of the Motor Cycle from the Works. In all communications a really legible signature and the full address are necessary and important.

If a letter addressed to us is in reply to a letter received from us the letter reference, which will be found in the letter heading on the left-hand side, should be quoted so that the letter may be passed immediately to the individual dealing with the matter. Letters asking for advice and technical information should not contain orders for Spares or refer to other subjects. Owners should always order Spares from the nearest Velocette agent. Private owners cannot purchase Spares at Works.

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REPAIRS.

If it is desired to bring a Motor Cycle to the Works for attention it is absolutely essential that a definite appointment be arranged in writing with the Service Dept.

Testing and external examination can be done at almost any time and at very short notice, but if subsequently it is found necessary to carry out work the machine may have to take its turn with work already in progress at the time unless some definite arrangement to the contrary has been agreed upon by us.

All Motor Cycles or parts sent by rail for repair should be addressed to us and consigned to Hall Green Station, G.W.R., carriage paid, and must be labelled with sender's name and address (or parcel should contain a note giving this information). All parts must be securely packed and cylinders, heads, petrol tanks, etc., which are liable to damage, must be packed in strong wooden cases. Where goods are received insufficiently packed we supply suitable boxes which are charged extra. Complete machines should have movable equipment such as tools, inflators removed before despatch. A letter giving full instructions for repairs needed should be posted and should state date of despatch of goods. This letter must give the Serial Numbers of Engines or Gearboxes sent as units or, in the case of a Motor Cycle, the Registration Number and Engine Number. Any machines or parts received without instructions or other means of identifying sender will lie here at Owner's Risk and we shall be under no obligation in regard to them.

Attention is drawn to the fact that generally the demands upon our Repair Department are less during the Winter months than during the Summer period. In consequence we can deal with repairs more expeditiously during the Winter. This should be borne in mind when contemplating an overhaul.

ESTIMATES.

We are pleased to give estimates for repairs needed to any machines or parts sent to us if required and in such cases we do not commence repairs until such estimates are returned accepted. Such estimates are prepared as accurately as possible but may be subject to slight revision if, when repairs are actually in progress, it is found that additional parts are needed. In the event of an Estimate not being accepted a charge will be made for stripping and assembling. No guarantee is given with any repair if the Estimate is not accepted in full.

TERMS FOR REPAIRS.

Our terms for all repairs are as for spares (see spares lists) but carriage and packing is charged extra in all cases. Packing cases (when invoiced) will be credited if returned in good condition within seven days from date of despatch of goods. Parts removed and replaced with new ones will be disposed of at once unless instructions are received for their return at the same time as order. In cases where Estimates are submitted the old parts will be disposed of on acceptance of Estimate unless instructions are received otherwise. In cases of urgency parts may be sent per Railway C.O.D.* system at our discretion if instructions to the contrary are not received.

* Railway C.O.D. Services temporally suspended.

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CONDITIONS UNDER WHICH REPAIRS ARE UNDERTAKEN.

Unless appointments are made and confirmed beforehand we cannot undertake to start and complete repairs during one day. We will at any time arrange appointments on request. Whilst every reasonable care is taken, customers' machines and property are received, stored, and driven at customers' sole risk and we accept no responsibility for loss or damage arising from fire, accident, theft, or otherwise. Customers' wishes as to delivery will be adhered to as far as is practicable, but no responsibility can be accepted for delays in the carrying out of any repairs, or for the quality of, or delays in procuring, any replacements that are not of our manufacture.

When repairs are completed customers will be advised by post unless we are otherwise instructed.

HOURS OF BUSINESS :

9 a.m. to 12-30 p.m. and 2-0 p.m. to 5-0 p.m. Mondays to Fridays. Closed Saturdays.

Bank Holidays and Special Occasions excepted.

CLAIMS UNDER GUARANTEE.

Terms of the guarantee will be found upon another page.

Should it be becessary to claim for an alleged defective part it is essential that the original part is returned for examination in accordance with terms and conditions laid down and before any such claim can be considered. This does not mean that the machine must be laid up whilst the old part is being returned for examination and a new part may be ordered either through one of our appointed Agents or direct from us, and will in the latter case be sent per C.O.D. unless cash is received with order. The original part should then be returned to us suitably labelled with owner's name and address and the engine number, date of purchase and a brief statement of the circumstances of the case. If the claim is admitted a refund will be made of the cost of the parts if purchased direct from us or credit will be issued to the Agent if replacements were purchased in that way. In the latter circumstances the name and address of the Agent should be given when returning the parts.

Usually it is convenient to send either the original Invoice or Advice Note which accompanies the purchase of the replacement part. Should a claim be disallowed reasons will be given in detail for our decision. It should be borne in mind, however, that a claim is in no way prejudiced by the acceptance of an Invoice in the first place and every claim is treated individually and judged entirely upon merit and the result of the inspection of the original part.

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(I). B.T.H. TYPE KC1 FORM N.4. MAGNETO. L.H. ROTATION, FITTED WITH FORM Y5 AUTOMATIC TIMING DEVICE. (Used on both MAC and MAF Models.)

(II). Breaker Mechanism.
Lubrication.

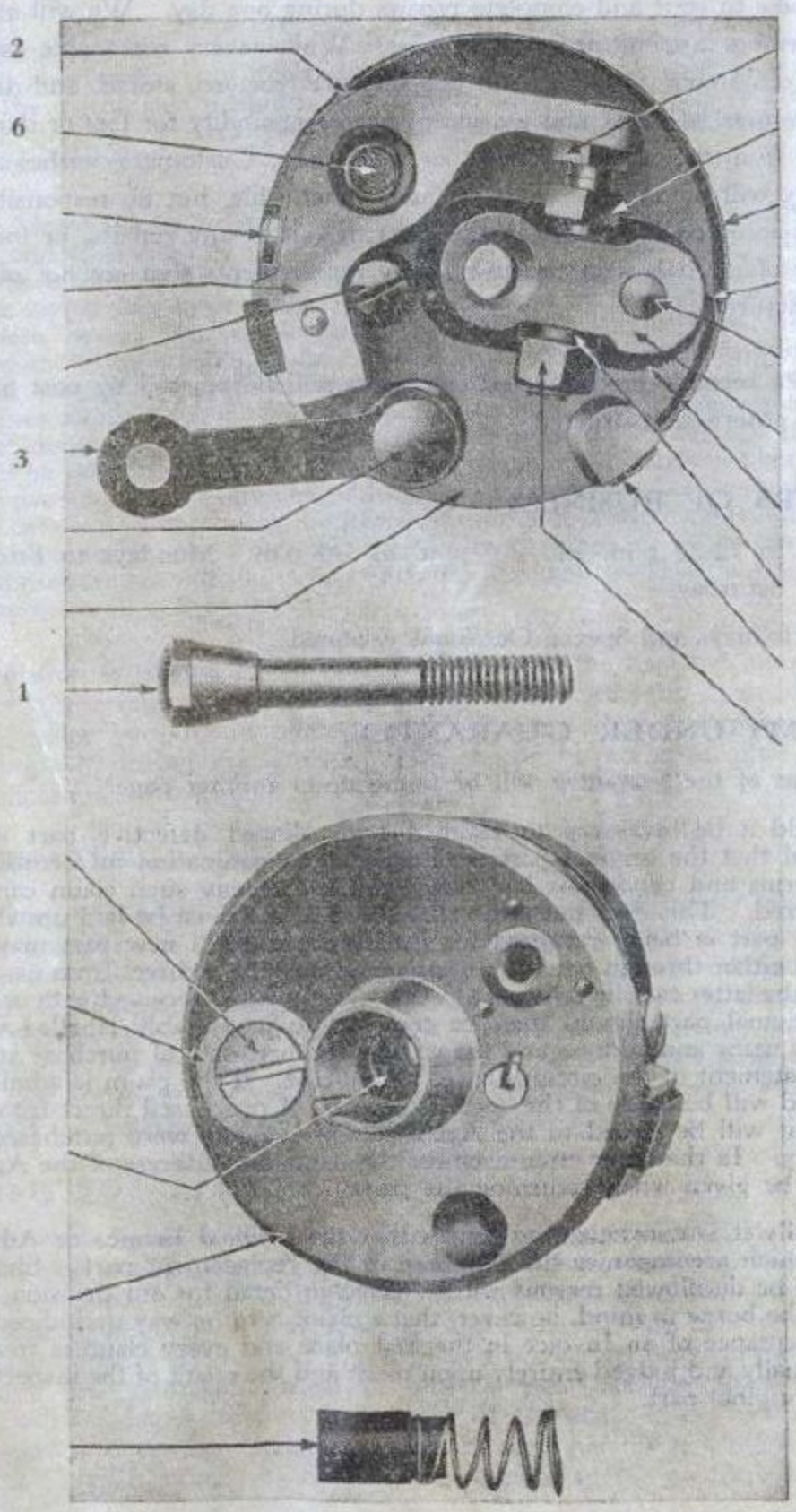

Fig. 44.

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The cam is lubricated by a felt wick in the bottom of the cam ring, which should be given one or two drops of light machine oil. The cam track should also be smeared with oil, but take care to wipe off all surplus oil, leaving only a light oil film on the cam track.

The contact lever bearing is more easily lubricated when the contact breaker is removed for cleaning as described below.

The contact breaker may be removed for cleaning by unscrewing the central hexagon-headed screw (1), and withdrawing the breaker. The contact lever (2) may then be lifted from its bearing bush by first raising and then moving to one side the check spring (3) which is located in the end of the bearing bush.

Care should be taken not to distort in any way the contact lever control spring (4). The points (5) may be cleaned with a very fine emery cloth, but under no circumstances should they be filed. Wipe away any dirt or metal dust with a petrol moistened cloth.

Before replacing the contact lever smear the bearing bush lightly with thin lubricating oil, wiping off any surplus. Also apply one drop to the wick (6) in the bearing bush.

IT IS OF THE UTMOST IMPORTANCE THAT THE POINTS BE KEPT ABSOLUTELY FREE FROM OIL.

Adjustment.

To check the contact setting turn the engine until the contacts are fully opened, and insert the 0.012-in. feeler gauge provided between the contact; the gauge should be a sliding fit. If there is any appreciable variation from the gauge, slacken the lock nut and turn the contact screw by its hexagon head until the gap is set to the gauge. Finally tighten the lock nut.

(III). **H.T. Cable.**

Should be 7 m/m in diameter. Other sizes such as 5 m/m and 9 m/m will not fit in the High-Tension Brush Holder. The cable must be replaced if the rubber insulation has perished or cracked.

(IV). **Pick-up.**

Periodically remove the pick-up or brush holder and wipe it with a cloth moistened with petrol, also see that the carbon brush moves freely in its holder. Before replacing the brush holder, insert the corner of a clean cloth in the aperture in the housing so that it bears against the slip-ring track and the flanges, at the same time turning the engine slowly.

(IX). **Dismantling.**

Total dismantling of the magneto should be rarely necessary, but instructions are given below in case this should be required.

(1). First remove contact breaker cover and contact breaker.

(2). The collector brush holder or pick-up should next be removed before any attempt is made to withdraw the armature from the housing.

(3). The contact end plate may now be removed by unscrewing the fixing screws and the contact breaker cover spring pillar.

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(4). The armature may then be withdrawn from the housing.

NOTE.—If the armature is actually withdrawn from the housing it will be necessary to re-magnetise the magnet after replacing the armature; unless a soft iron 'U' shaped and good fitting keeper is placed over the magnet poles before the armature is withdrawn.

(X). **Test and Repair.**

If the armature has been removed it should be examined for actual structural faults, such as bent or damaged shaft, cracked or broken slip-ring. Special equipment is required to check the winding and condenser and whilst a new condenser can be fitted, in the event of faults of this nature it is desirable to replace with a complete service armature.

Before re-assembling the magneto, carefully examine the bearings, which should be replaced if not in good condition. Special Extractors are required to remove the inner and outer races, and no attempt should be made to remove them by other means. If these extractors are not available, the complete magneto should be returned to the Makers for re-conditioning and a replacement fitted to the machine. When fitting new bearings the following points must be carefully watched :—

(*a*) The inner race must be square with the shaft, and pressed fully home.

(*b*) When fitting the inner race at the slip ring end, make sure the washers between the inner race and the slip rings are fitted concentrically, so that the flat washer does not ride on the spindle shoulder.

(*c*) The outer races are insulated from the housing and contact end-plate, with serrated fibre washers. It is important that this fibre washer is centrally located before being pressed home.

The bearings should be packed with a suitable High-Melting Point Grease before re-assembly.

(XI). **Re-assembling.**

When re-assembling, the armature should be set up with an end play of 0.002-in. This end play is adjusted by means of shims which are fitted between the magneto body and the contact breaker endplate.

When re-fitting the contact breaker great care should be taken to ensure that the key on the contact breaker base engages with the slot in the armature endplate.

B.T.H. FORM Y5 AUTOMATIC TIMING DEVICE.

Refer to Figs. 15 and 16.

The device is incorporated with the magneto driving gear and does not require any attention or adjustment.

Should it be necessary to remove the magneto, the automatic timing device can be removed by undoing the self-extracting nut on the end of the magneto spindle. (*Before removal refer to Pages 39 and 40*). After the nut loosens, it will almost immediately tighten again, and it is then that it commences to withdraw the gear and timing device from the tapered magneto spindle.

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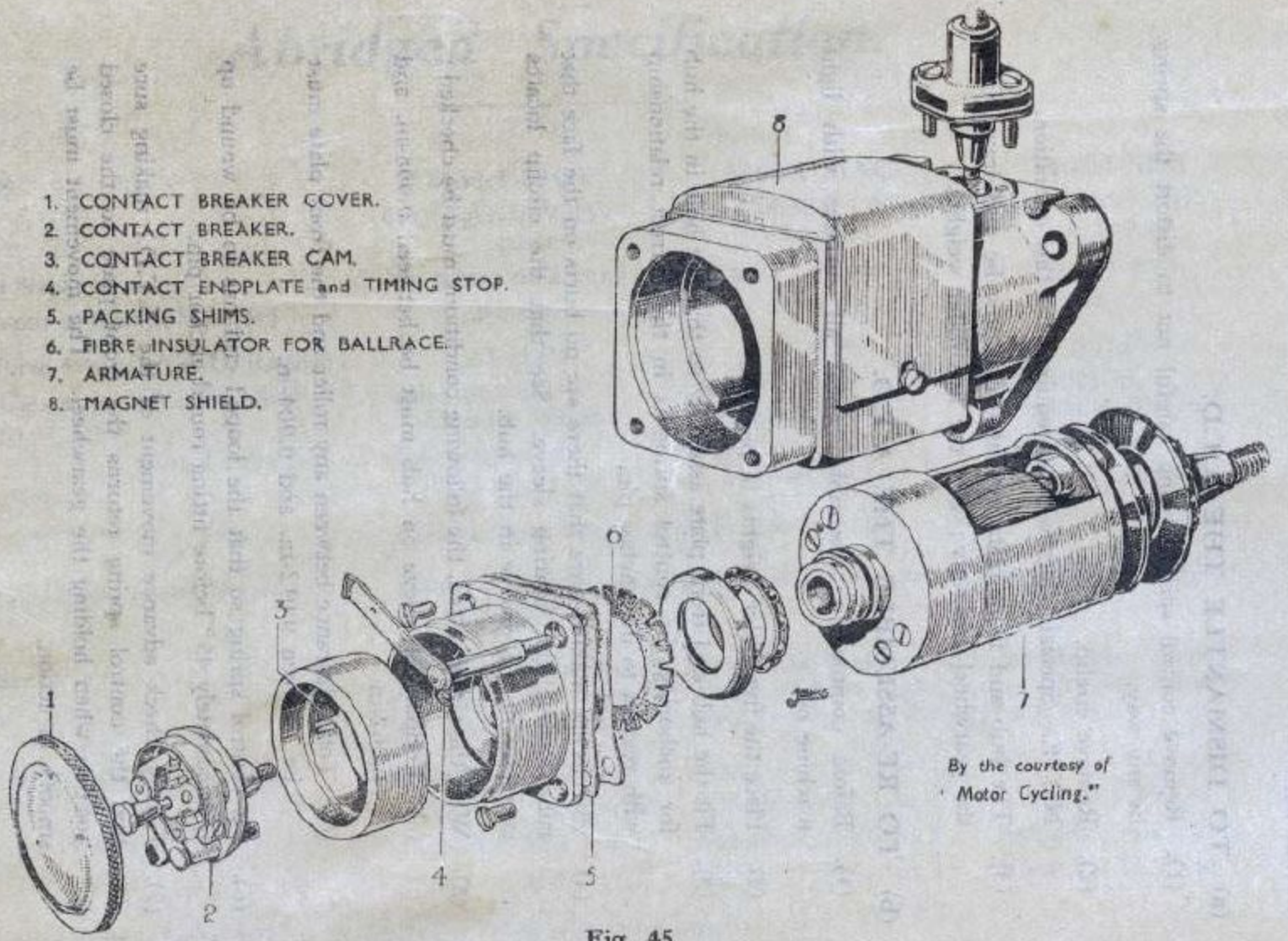
1. CONTACT BREAKER COVER.
2. CONTACT BREAKER.
3. CONTACT BREAKER CAM.
4. CONTACT ENDPLATE and TIMING STOP.
5. PACKING SHIMS.
6. FIBRE INSULATOR FOR BALLRACE.
7. ARMATURE.
8. MAGNET SHIELD.



By the courtesy of
"Motor Cycling."

Fig. 45

Should for any reason the gearwheel be damaged it will be necessary to replace the A.T.D. plate, gearwheel and bearing sleeve assembly complete. To effect this replacement the following procedure must be carried out :—

(a) TO DISMANTLE THE A.T.D.

(1). Remove control spring, being careful not to distort the spring in any way.

(2). Remove circlip.
NOTE.—Special pliers will be required for this operation.

(3). The hub and front plate assembly can now be withdrawn from the gearwheel assembly ; also the five roller weights.

(b) TO RE-ASSEMBLE THE A.T.D.

(1). Before commencing assembly, smear all surfaces with light machine oil.

(2). Place the five roller weights in position.

(3). Fit the hub and front plate assembly so that the hole in the hub for anchoring the control spring is in the correct relationship with respect to the anchor pin.

(4). Fit circlip, making sure that there are no burrs on the face that rubs against the bearing sleeve. See that the circlip locates correctly in the groove in the hub.

(5). With the circlip fitted, the following conditions must be checked :

(*a*) Endplay of sleeve on hub must be between 0.008-in. and 0.002-in.

(*b*) Total clearance between any roller and the front plate must be between 0.012-in. and 0.004-in.

(6). Fit control spring so that the looped end has to be wound up approximately 45° before fitting round anchor pin.

(7). Finally check advance movement of the A.T.D., making sure that the control spring returns the front plate to the closed position when holding the gearwheel. The movement must be smooth in action.

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Abridged Specification.

ENGINES.	Model MOV	Model MAC	Model MSS
Type	One Cylinder OHV—4 stroke	One Cylinder OHV—4 stroke	One Cylinder OHV—4 stroke
Bore and Stroke	68 mm. × 68 25 mm.	68 mm. × 96 mm	81 mm. × 96 mm.
Cubic Capacity (Swept Volume) ..	248 c.c.	349 c.c.	495 c.c.
Rated Horse-Power (A.C.U. Rating) ..	2.5 H.P.	3.5 H.P.	5 H.P.
Tappet Clearances (For Running) ..	Inlet .003-in. Exhaust .006-in.	Inlet .003-in. Exhaust .006-in.	Inlet .005-in. Exhaust .010-in.
,, ,, (For Timing) ..	Inlet .010-in. Exhaust .015-in.	Inlet .010-in. Exhaust .015-in.	Inlet .025-in. Exhaust .025-in.
	Clearances to be set when Engine is cold.		
Position of Engine Serial Number ..	Stamped (following the serial letters) on near side of Crankcase below Cylinder.		
Gearboxes	4 speeds. Operated by Right-hand Pedal on all three Models. Downward movement of Pedal engages higher gear. Pre-war Models and some war-time machines operate the opposite way.		
Ratios: With Standard Sprocket ..	Top: 6.35 to 1	Top: 5.5 to 1	Top: 4.9 to 1
	Third: 8.45 to 1	Third: 7.3 to 1	Third: 5.91 to 1
	Second: 11.1 to 1	Second: 9.6 to 1	Second: 7.76 to 1
	First: 16.1 to 1	First: 14 to 1	First: 11.25 to 1
Position of Gearbox Serial No. ..	Stamped on rear of housing.		

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ABRIDGED SPECIFICATION—*Continued.*

TANKS.	Fuel Capacity	2.75 gallons	11.35 litres	2.75 gallons	11.35 litres	3.5 gallons	15.9 litres
	Oil „	½ gall.	2.27 litres	½ gall.	2.27 litres	½ gall.	2.27 litres
Transmission.							
Primary Drive	—driver	19 teeth		22 teeth		23 teeth	
„ „	—driven	44 „		44 „		44 „	
Final „	—driver	19 „		19 „		Solo 18T. S/C. 16T.	
„ „	—driven	52 „		52 „		46 teeth	
Chains, Primary	—Pitch & Width ..	.5-in. × .305-in.		.5-in. × .305-in.		.5-in. × .305-in.	
„ „	—Roller Diameter..	.335-in.		.335-in.		.335-in.	
„ „	—No. of Pitches ..	74		75		68	
„ Rear	—Pitch & Width ..	.5-in. × .305-in.		.5-in. × .305-in.		.625-in. × .380-in.	
„ „	—Roller Diameter..	.335-in.		.335-in.		.4-in.	
„ „	—No. of Pitches ..	108		108		99	
Principal Dimensions:—							
Height to Top of Saddle		27.5-in.		27.5-in.		28-in.	
Wheel Base		52.25-in.		52.25-in.		55-in.	
Width over Handlebars		27.5-in.		27.5-in.		29-in.	
Wheels: Rims		WM2 × 19		WM2 × 19		WM3 × 19	
Tyres: Front		26-in. × 3.25-in.		26-in. × 3.25-in.		26-in. × 3.5-in.	
„ Rear..		26-in. × 3.25-in.		26-in. × 3.25-in.		27-in. × 4-in.	

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