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The New Book of the
MATCHLESS

1945 - 1950

W. C. HAYCRAFT

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PREFACE

AN earlier Pitman publication, *The Book of the Matchless*, dealt with 1931–3 machines and is now out of print. This new volume is a great improvement on the old, and fully covers all 1945–50 "Clubman" Matchless overhead-valve singles. The post-war Models G3/L and G80 are indeed beautiful precision jobs, with fine performance and the utmost reliability and stability.

They developed from, and are rather similar to, the famous military motor-cycles that emerged, to the tune of 80,000, from the factory at Plumstead Road, London, S.E.18, during World War II. Many of the military machines are now in private ownership and this handbook should be of assistance to owners both of military and of civilian models of similar design.

Spring frame versions of Models G3/L and G80 (known as G3/LS and G80/S) were introduced in 1949. Detailed information regarding the new spring frames is now available, and all other instructions in this book apply. The Competition Models G3/LC and G80C, and the 498 c.c. vertical twin Model G9, are *not* dealt with. The former, however, have engines similar to the standard O.H.V. engines.

In compiling the present volume, the author has aimed at producing a really helpful work of reference. The book is written in simple language, and is suitable both for experienced and for inexperienced riders.

Special attention has been paid to the illustrations, of which some have been specially taken. They deserve close scrutiny and convey what is sometimes difficult to express in words.

If you have never before handled a Matchless, turn direct to Chapter I, which deals with preliminaries, starting-up, and driving. Space does not permit of the legal aspects of driving being dealt with, and a complete novice should thoroughly digest the "Highway Code."

Chapters II to X inclusive contain all essential information on practical maintenance and overhaul that is likely to be required in order to keep in first-class condition a Matchless G3/L, G3/LS, G80, or G80S engine, machine, and equipment.

In conclusion, the author would like to thank the makers of the Matchless, Matchless Motor Cycles, for very kindly sanctioning the reproduction in this book of many drawings and for rendering other helpful assistance. This applies also to the manufacturers of various accessories, who have been most co-operative.

W. C. H.

CONTENTS

CHAPTER I

HANDLING A MATCHLESS

It is assumed that you are the proud owner of a brand new Matchless "Clubman" model (Fig. 1), resplendent in its untarnished coat of glistening chromium and black enamel, or that you are the owner of a good second-hand bargain.

It is also taken for granted that you have read your "Highway Code," have an elementary knowledge of motor-cycles, and understand the functioning of the engine and the various controls.

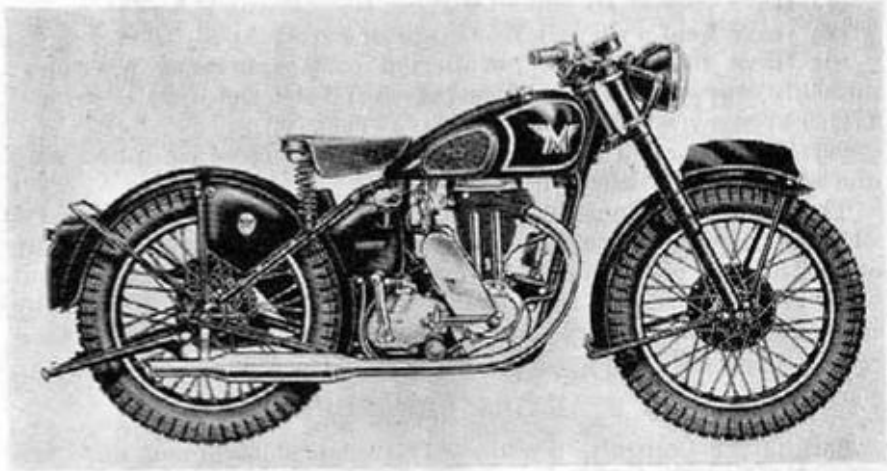

FIG. 1. A MACHINE WITH REAL FINISH AND HIGH PERFORMANCE—THE MODEL G3/L MATCHLESS

The 350 c.c. "Clubman" model illustrated is similar to the 500 c.c. Model G80, except for some minor differences (see page 107). The 1949 Models G3/LS and G80/S have a spring frame (see Fig. 7).

Getting on the Road. Before you can legally get on the road, you must attend to the following essential preliminaries—

(1) Insure against all *third-party* risks and obtain the vital "certificate of insurance." If you have a valuable machine, you are advised to take out full comprehensive insurance.

(2) Obtain the registration licence and registration book (Form R.F. I/2)[1], or renew the licence (Form R.F. I/A).

[1] The Matchless engine and frame numbers required on Form R.F. 1/2 will be found on the near-side of the crankcase and on the offside of the saddle lug (beneath the saddle) respectively. Models G3/L and G80 are taxed at £3 15s. per annum, with £1 5s. extra duty for a sidecar. (Where the standard petrol ration only is obtainable, the annual tax payable for the machine is reduced to half the normal rate.)

(3) Obtain a "provisional" or driving licence (Form D.L. 1A).

(4) Apply for Standard petrol ration at post office (produce log book). For Supplementary, complete Form R(M.S.) 2.

(5) Fit a reliable speedometer (see Fig. 6) if one is not fitted (not *essential* if machine registered prior to 1st Oct., 1937).

(6) If you carry a pillion-passenger, see that he or she sits *astride* a proper pillion seat securely *fixed* to the machine.

(7) If you are ineligible for an actual driving licence, attach "L" plates to the front and back of the machine.

All the official forms referred to above may be obtained from any large post office.

You are not eligible for a driving licence *unless* you have complied with one of these conditions—

(1) Have passed an official driving test (Form D.L. 26).

(2) Have held a driving licence prior to 1st April, 1934.

(3) Have held for the *full* period of its currency a twelve-monthly "provisional" licence between 18th October, 1940, and 17th February, 1947.

(4) Have reached the age of 16 years and have complied with one of the above three conditions.

The Matchless Controls. If you have never before handled a "Clubman" Matchless, you should, before attempting to start up or get on the road, familiarize yourself with the control lay-out shown in Fig. 2. Note that all handlebar controls are operated by *inward* movement.

STARTING PROCEDURE

Setting the Controls. First verify that replenishment has been attended to. The filler caps and controls are shown in Fig. 2, and oil tank and gearbox replenishment are dealt with on pages 29 and 35 respectively. Check that the gear-change pedal *is* in neutral (see Fig. 4). Then set the carburettor and ignition controls.

(1) Set the throttle so that it is slightly open by turning the twist-grip *inwards* about *one-sixth* of its total movement.

(2) Completely close the air control lever.

(3) Fully advance the ignition control by pulling it *inwards* to its *full extent*, and then retard it by about *two-fifths* of its total by pushing it *outwards*.

If the engine is already warm, open the throttle about a quarter and the air control lever half to three-quarters according to how warm the engine is.

To Free a Cold Engine. If the engine (especially a new one) is stone cold, it is generally advisable to free the piston before attempting to start up. Raise the exhaust valve lifter and kick the engine over smartly about three times.

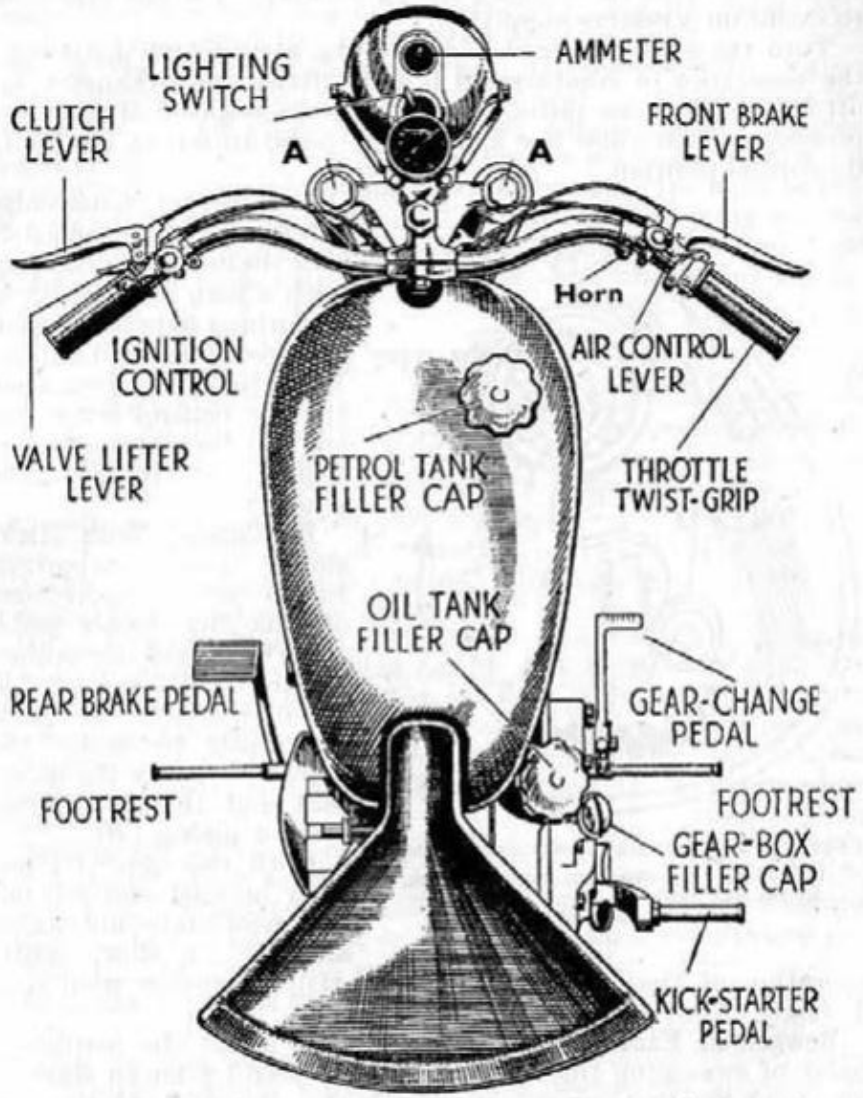

FIG. 2. THE NEAT CONTROL LAY-OUT ON THE "CLUBMAN" MATCHLESS
All controls, except the dipping switch (next to ignition control), are shown. The controls are adjustable for angle, but adjustment is seldom necessary except, perhaps, for the rear brake, gear change pedals, and footrests (1950) Remove the top bolts *A* to replenish the "Teledraulic" front forks.

To Effect a Quick Start. After setting the controls, depress the float chamber "tickler" momentarily, but do not flood the carburettor so that petrol drips from it. It is assumed that the petrol

has been turned on by using the *off-side* tap. Use the other one to maintain a reserve supply.

Turn the engine over slowly with the kick-starter pedal until the resistance of compression is felt. Raise the exhaust valve lifter and allow the piston just to pass the position of full compression. Then allow the kick-starter pedal to return almost to its normal position.

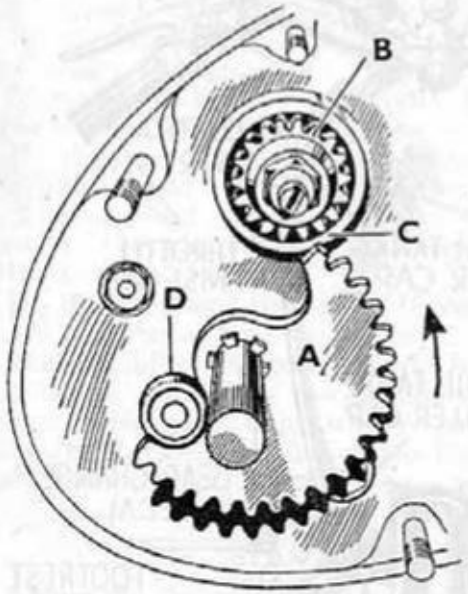

FIG. 3. THE KICK-STARTER MECHANISM
A, *B*, *C* show the quadrant, ratchet pinion, and the gap between them, respectively. *D* is the quadrant stop.

Release the exhaust valve lifter and simultaneously kick the engine over sharply with a long swinging kick. If nothing happens, repeat the procedure until it does! When the engine fires, open the air control lever and advance the ignition control to give even running on the pilot jet.

Be Careful With Kick-starter. It is very important not to exert excessive force on the kick-starter pedal (see Fig. 3) until the toothed quadrant (*A*) has moved in the direction of the arrow sufficiently to bridge the gap (*C*) between the quadrant and the kick-starter ratchet pinion (*B*).

Until the gap (*C*) has been bridged and full engagement has been obtained and felt, a slow, gentle operation of the kick-starter is essential to prevent wear and damage. *Never* use excessive force.

Beware of Excessive Flooding. Do not adopt the pernicious habit of swamping the carburettor with petrol prior to starting up. Such flooding incurs a grave risk of neat petrol entering the cylinder from the down-draught carburettor and destroying the vital oil film between the piston and cylinder.

Fire! In the rare and unlucky event of the carburettor catching fire, do not panic and dial 999! Instead, turn off the petrol, open the throttle wide, and kick the engine over sharply, with the exhaust valve lifter raised.

If Engine is Obstinate. If the engine refuses to start at the third kick, verify that petrol is reaching the float chamber by

depressing the tickler. When you are satisfied on this point, remove and carefully inspect the sparking plug (see page 57). Clean the plug, check its gap, and test it (see page 54).

Warm Up Engine Moderately Fast. Do not race the engine immediately after starting up from cold, as it takes some time for the oil to circulate properly. Too fast running also generates excessive heat. On the other hand, do not warm the engine up too slowly, or the pump will not work fast enough to circulate the oil properly and the combustion of a rather cold mixture will be incomplete, with the result that condensation on and corrosion of the cylinder walls may occur. Never allow the engine to idle for long.

ON THE ROAD

To Engage First Gear. Ease the Matchless off its rear stand, with the engine running and the gear-change lever pedal in neutral, sit astride the machine, and disengage the clutch by operating the handlebar lever (see Fig. 2). Raise the foot gear-change pedal *fully* with the instep of the foot and engage first (bottom) gear (see Fig. 4). Slight backward or forward movement of the machine often facilitates engagement. As soon as first gear is *felt* to engage, remove the instep from the pedal.

On a New Machine. If difficulty is experienced in engaging first gear, wait a few seconds before making another attempt. Initial difficulty in engaging first gear on a *new* machine usually cures itself quite soon, and sticking clutch plates can be rectified by stopping the engine and smartly kicking the engine over several times with the clutch fully disengaged and the exhaust valve lifter raised.

Moving Off. Having engaged first gear, move off by slowly releasing the clutch lever. As the machine gathers speed and the engine takes the full load, gradually increase the throttle opening by means of the twist-grip, so as to maintain a progressive rise in the speed of the engine and machine.

Changing Up (First to Second). As soon as your Matchless has reached a speed of about twelve m.p.h. in first gear, change up into second gear. Once again disengage the clutch, slightly close the throttle, pause a second, and then *depress* the gear-change pedal to its *full extent* with the toe, until second gear is *felt* to engage (see Fig. 4). Then engage the clutch and also remove the toe from the pedal to allow the pedal to return to its normal position.

Changing Up (to Third and Fourth). Progressively increase the throttle opening until about twenty m.p.h. is obtained. Now disengage the clutch, throttle down slightly, pause a second, and then smartly, but without force, *depress* the gear-change pedal fully until third gear is *felt* to engage (see Fig. 4). Engage the

clutch, remove the toe from the pedal, and throttle up to maintain a good road speed without any tendency for the engine to "knock." To change into fourth (i.e. top gear), repeat the procedure at approximately thirty m.p.h.

Changing Down (Fourth to Third). Throttle down to a normal speed for third gear. Disengage the clutch, throttle up slightly, pause a second, and *raise* the gear-change pedal to its *full extent* with the instep of the foot until third gear is *felt* to engage. Immediately afterwards engage the clutch, remove the toe from the

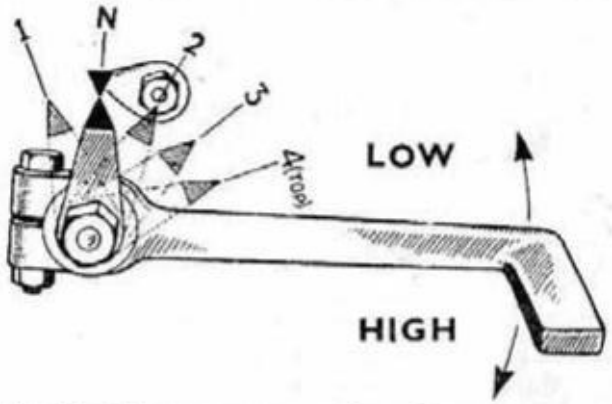

FIG. 4. THE FIVE POSITIONS OF THE FOOT GEAR-CHANGE INDICATOR
All changes up to a higher gear are made by *depressing* the pedal with the toe, and all changes down to a lower gear by *raising* the pedal with the instep. Internal springs return the pedal to the horizontal position after each gear change is made.

pedal, and throttle up to compensate for the increase in the speed of the engine relative to rear wheel speed.

Changing Down (to Second and First). The required procedure is similar to that just described for changing down from fourth to third gear. With the instep of the foot *raise* the gear-change pedal to its *full extent* during each gear change. Each full movement of the pedal engages the *next* gear in the gear change sequence as shown by the indicator in Fig. 4.

To change from fourth or third gear into first (bottom) gear, it is not *essential* to complete the full gear changing procedure for each intermediate gear, although this should be done when hill climbing. The method which can be used is to bring the machine to a crawl by means of the throttle and brakes, disengage the clutch, and then raise the gear-change pedal to its *full extent* —three or four times (in quick succession), according to whether top or third gear was previously engaged. Then engage the clutch and throttle up slightly.

Silence Is Golden. Noisy gear changing is bad for sensitive

ears, and worse still for the gearbox! Learn to change gear silently. Here are a few golden rules—

(1) Make full use of the four gear ratios provided. The gear-

FIG. 5. ALMOST AIRBORNE, BUT UNDER FULL CONTROL!
The surging power and exceptional stability of the "Clubman" Matchless are well depicted in the above snapshot. For competition events the "Winged" Matchless is a hot favourite.

change pedal always returns to the same position, but do not leave it there!

(2) Do not "bully" the machine up a steep incline in top gear.

(3) Change gear *before* your mount gets "hot and bothered."

(4) Use a nicely co-ordinated and almost simultaneous movement when operating the clutch, throttle, and gear-change pedal.

(5) Keep a steady pressure on the gear-change pedal *until the clutch is felt to engage*. At other times remove the foot.

(6) Do not race the engine in the lower gears to "impress the lads." They may like it (perhaps), but your engine will hate you!

(7) Be kind to the gearbox and give it its oil ration occasionally (see page 37).

Tackling Hills. Your Matchless will romp up gentle gradients, but maintain the engine r.p.m. high by making full use of the gearbox where necessary and *in good time*. On no account permit

FIG. 6. WATCH CAREFULLY THE SPEEDOMETER DURING RUNNING-IN, AND UNTIL YOU GAIN EXPERIENCE

It is advisable to keep within the speed ranges indicated until running-in is completed. A speedometer *must* be fitted and be accurate within ± 10 per cent. Above is the Smith trip-type instrument (obtainable with 80 or 120 m.p.h. dial) suitable for Matchless machines.

the engine to labour. Be liberal with the throttle opening, and do not retard the ignition control lever unless this is essential (to ward off a "knock"), as this reduces power output.

When descending steep hills, open the air lever wide and close the throttle. This will not only cool the engine, but it will enable engine compression to exert a powerful braking effect.

Use Both Brakes. Acquire the habit of using *both* brakes simultaneously, as this gives powerful braking with minimum and even wear of the brake linings and tyres.

Excessive and fierce brake application plays havoc with the tyres and transmission, and for this reason you should learn to *drive on the throttle* and use the brakes as little and as seldom as possible. Make use of engine compression as a brake when descending hills (see previous paragraph), but never use the clutch or exhaust valve lifter for controlling speed. This places a motor-cyclist beyond the pale.

Bringing Motor-cycle to a Halt. To effect a normal stop on the road, use the following procedure—

(1) Close the throttle by means of the twist-grip.

(2) Fully disengage the clutch.

(3) Apply *both* brakes simultaneously, increasing the hand and foot pressure as the brakes take effect.

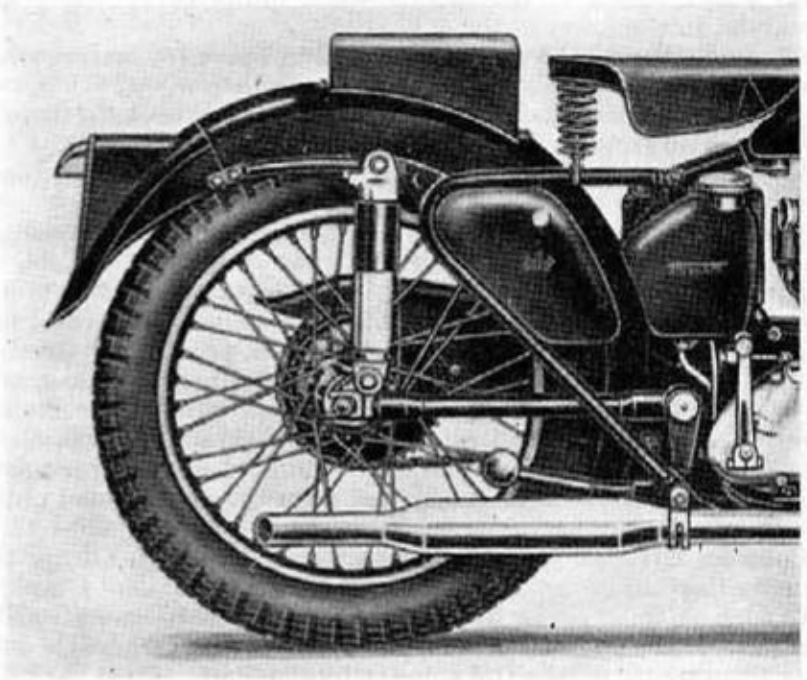

FIG. 7. DESIGNED FOR COMFORT—THE MATCHLESS SPRING FRAME ON 1949 MODELS G3/LS AND G80/S

Except for the provision of oil-damped rear springing, Models G3/LS and G80/S are identical to Models G3/L and G80 shown in Fig. 1. A similar spring frame is specified on the vertical twin Model G9 (see page 135). Two special competition models (G3/LC and G80C) are also available.

(4) Raise the gear-change pedal until "neutral" (see Fig. 4) is engaged. It may be necessary to operate the pedal several times in quick succession (see page 6).

(5) Engage the clutch by releasing the lever.

To Stop the Engine. After bringing the motor-cycle to a halt with the throttle closed (as far as the throttle stop permits), it is necessary only to raise the exhaust valve lifter for a few seconds in order to extinguish all signs of life. Before you leave your machine, turn off the petrol tap to prevent accidental flooding of the carburettor.

Nurse Your Engine for 500 Miles. After covering 500 miles it is not harmful to step up the speed of a *new* machine gradually, but refrain from using full throttle until about 2000 miles have been covered. A new Matchless must be properly run-in, or it may be permanently spoiled. Here is some sound advice—

(1) Don't even momentarily give the engine full throttle.

(2) Don't over-rev. the engine when idling or on the road, especially in the lower gears.

(3) Don't exceed the speeds indicated in Fig. 6 for first, second, third, and fourth gears, if you can possibly help it.

(4) Don't permit the engine to labour or "knock." Change down in good time.

(5) Don't run the engine with the machine stationary for more than a minute or two.

(6) Don't forget to keep the engine, gearbox, and machine correctly lubricated (see Chapter IV).

After the First 100-150 Miles. A certain amount of bedding-down occurs, and it is important to check the adjustment of the following: (*a*) tappets, (*b*) contact-breaker points, (*c*) steering head bearings, (*d*) primary and secondary chains, (*e*) brakes, and (*f*) wheel bearings. Consult the Index for appropriate instructions. Steering head bearing adjustment is very important, as slack bearings will suffer. After the initial bedding-down and necessary adjustments have been made, further adjustment is needed much less frequently.

Colloidal Graphite for Running-in. It is beneficial during the running-in period to mix *one pint* of Acheson's Colloidal Graphite with each *gallon of engine oil*. This benefits the valves and bearing surfaces. If the compound (obtainable from most garages) is used after running-in, reduce the amount by one half.

Removing Petrol Tank Filler Cap. Some riders find that the filler cap does not come away instantly. On Matchless machines, to release the filler cap quickly, depress it slightly, then turn it and withdraw the cap.

CHAPTER II

CARE OF YOUR TYRES

NEGLECT is probably responsible for about ninety per cent of all premature tyre failures, and it is not surprising that under some forms of ill treatment tyres quickly wear out. Modern tyres (see Fig. 8) are designed to give, and will give, excellent mileage if proper care is taken of them.

Correct tyre *inflation* and wheel *alinement* are the most vital matters to attend to, but other factors also affect the life of the tyres. The manner in which the machine is ridden, for instance, has an appreciable effect.

FIG. 8. SECTIONED MODERN TYRE (DUNLOP) AND RIM

Above is a wired-type cover (*A*) and the tube (*B*) fitted to a typical well-base rim (*C*). Note the non-stretchable beads (*D*) of steel wire resting on the shoulders of the rim (*C*).

Some Driving Don'ts. Below are some things which you should *not* do when driving—

(1) Forget to increase the pressure in the *rear* tyre (5–10 lb. per sq. in.) if you carry a pillion rider or heavy luggage.

(2) Brake too often or too fiercely.

(3) "Blind" over bad roads. The ability of even correctly inflated tyres to withstand concussion is limited.

(4) Use large throttle openings too often. Wear at 30 m.p.h. is nearly *half* that at 50 m.p.h.

(5) Indulge in stunt cornering, especially with a sidecar.

(6) Accelerate too fiercely, especially from a standstill.

(7) Run with smooth tyres. This invites skidding and also is illegal.

(8) Travel over water-bound macadam roads if concrete, asphalt, or tarmac surfaces are available.

(9) Permit oil, grease, or paraffin to remain on the tyres.

(10) Allow the machine to rest on the tyres for long with the machine motionless.

The Dunlop Valve. Internal details of the valve incorporated

on all Dunlop tubes are shown in Fig. 9. The valve core has a non-return valve to facilitate tyre inflation and checking the pressure. This forms an effective air seal, but nevertheless keep the valve cap screwed on tightly (hand tightening only). Dust or dirt collecting inside the valve stem is liable to interfere with the action of the inside check mechanism and cause leakage.

About once a year it is advisable to remove the valve core and renew it, if it is not in perfect condition. To remove a valve core for inspection, unscrew the valve cap and insert its slotted end

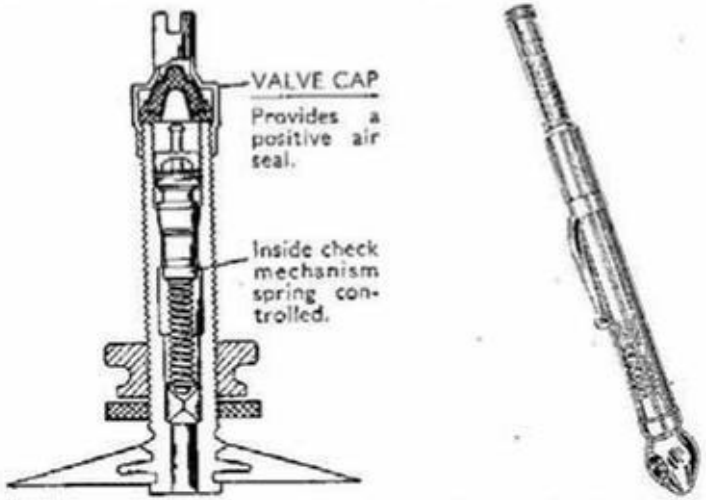

FIG. 9. SHOWING INTERNAL DETAILS OF DUNLOP VALVE (LEFT) AND DUNLOP PENCIL TYPE NO. 6 PRESSURE GAUGE (RIGHT)
A valve core key is incorporated in the end of the piston of the pressure gauge illustrated.
(*Dunlop Rubber Co. Ltd.*)

into the valve stem, using it as a screwdriver. If preferred, use the valve core key provided on most Dunlop-type pressure gauges.

Check Inflation Pressures Weekly. Even the best quality rubber is not entirely impervious to air leakage, and tyre inflation pressures slowly but surely decline in spite of the fact that the tyres and valves are in perfect condition. Therefore check the inflation pressures of both tyres weekly, not by "thumbing" the covers or kicking them, but by using a suitable pressure gauge. An excellent type gauge is shown in Fig. 9. By maintaining the inflation pressures correct, tyre deflection is reduced to the minimum, and maximum comfort, tyre life, and freedom from skidding are assured.

To check the inflation pressure of each tyre, remove the valve-cap and press the end of the gauge on to the open end of the tyre valve as shown in Fig. 10. This depresses the spring-loaded

plunger inside the valve and permits air to flow into the gauge and so to push up the piston, which is calibrated in lb. per sq. in. Note the exact pressure reading and compare this with the correct inflation pressure. If there is any appreciable discrepancy, pump-up the tyre as required until the pressure is shown to be correct.

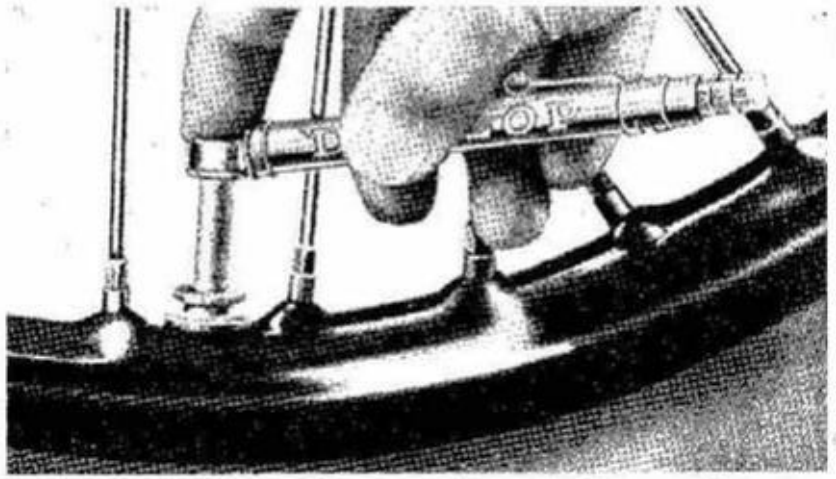

FIG. 10. THE ONLY SAFE METHOD OF CHECKING INFLATION PRESSURE
(*Dunlop Rubber Co. Ltd.*)

Correct Inflation Pressures. If you ride solo and are of normal weight, you should maintain the inflation pressures of the front and rear tyres at 17 lb. per sq. in. and 20 lb. per sq. in. respectively. If you are not of normal weight, carry heavy equipment, or a

MINIMUM TYRE INFLATION PRESSURES
(Showing load per tyre and recommended pressure in lb. per sq. in.)

Load	Pressure	Load	Pressure
200 lb.	16 lb.	350 lb.	24 lb.
240 lb.	18 lb.	400 lb.	28 lb.
280 lb.	20 lb.	440 lb.	32 lb.

pillion passenger, it is necessary to adjust the inflation pressures accordingly. Above are tabulated the correct minimum inflation pressures for specified loads per tyre.

The most satisfactory method of determining the correct inflation pressures required is to ride or take the machine to the nearest

weighbridge and check individually the fully-laden weight on the front and rear tyres. Then consult the above table for the front and rear correct minimum inflation pressures. A suitable weighbridge is to be found at most large railway stations and other transport concerns.

Checking Wheel Alinement (Solo). As has already been mentioned on page 11, rapid tyre wear is caused by the wheels not being in true alinement. To check the alinement on a solo Matchless, a straight-edge or a plain board (with one edge planed perfectly straight and square) about 6 ft. long, 4 in. wide, and 1 in. thick is required.

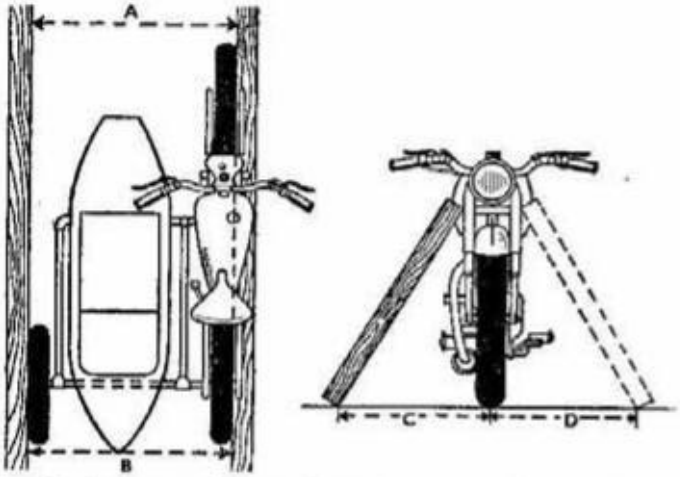

FIG. 11. CHECKING WHEEL ALINEMENT ON A SIDECAR OUTFIT
If alinement is correct, dimension *A* is about ⅛ in. less than dimension *B*, and dimension *C* equals dimension *D*.
(Dunlop Rubber Co. Ltd.)

Jack up the Matchless on its stand, with the front and rear wheels parallel to each other. Then check the wheel alinement by holding the straight-edge or board in contact with both tyres. It should contact the front and rear of each tyre if the wheels are correctly alined. If the wheels are out of alinement, rectify matters by means of the adjuster bolts screwed into the rear fork ends (see page 114).

Checking Wheel Alinement (Sidecar). Here two plain boards, about 6 ft. long, about 4 in. wide, and about 1 in. thick are required. Each board must have one true edge. In addition, a third board of similar type, but about 4 ft. long, is needed. When the above-mentioned boards are not in actual use they must

be kept quite flat to prevent warping, and care must be taken to avoid damaging their true edges.

Before checking the wheel alinement of a sidecar outfit, place the outfit on a smooth floor, preferably a concrete surface. Referring to Fig. 11, to check that all three wheels of the Matchless are running in track, place one of the long boards alongside the

FIG. 12. A DOUBLE CONCUSSION FRACTURE CAUSED BY INCORRECT INFLATION
Above is shown the inside part of a cover that has been badly damaged. Note the jagged edges that must have nipped the tube and probably caused a dangerous burst.
(Dunlop Rubber Co. Ltd.)

front and rear tyres of the motor-cycle and verify that the board contacts the front and rear of each tyre, as when checking alinement on a solo machine. Move the handlebars until the best contact is obtained.

Without disturbing the board placed alongside the motor-cycle tyres, place the second long board so that its true edge contacts the sidecar tyre, as illustrated in Fig. 11. Then, with a steel measuring tape, check dimensions *A* and *B*, with the tape as close to the tyres as practicable. To obtain the best results, dimension *A* should be about ⅜ in. less than dimension *B*. If the motor-cycle and sidecar wheels are dead parallel, there is a tendency for the sidecar outfit to pull towards the left.

Having checked the three wheels for alinement, verify that the motor-cycle itself is quite *vertical*. Referring to Fig. 11, take the 4 ft. board and rest it at a given point against the upper part of the "Teledraulic" front forks. Mark the floor where the edge of the board touches it. Then rest the board on the opposite side of the forks with its upper end in exactly the corresponding position and again mark the floor where the lower edge of the board touches. With the steel measuring tape, check dimensions *C* and *D*. If the machine is truly vertical, these two dimensions should be equal. If you have good binocular vision you should be able to verify that the machine is vertical by visual inspection, but it is safer to make a dimensional check.

The sidecar chassis fittings on a new Matchless outfit sometimes take a permanent "set," causing the motor-cycle to lean slightly towards the sidecar. This can be rectified by adjusting the attachment arms.

Examine Cover Treads Occasionally. It is a good plan occasionally to jack-up both wheels and carefully inspect the cover treads for cuts and small stones or flints which may be embedded in the rubber. The removal with a small pocket-knife of such stones or flints will often prevent punctures of the tubes occurring subsequently and perhaps in most inconvenient circumstances.

Fill up all small cuts with a suitable tyre-stopping compound, but if a deep cut is discovered it is advisable to remove the cover concerned and to get the cut vulcanized at a tyre service station or at a garage. This is the most satisfactory method of dealing with it.

Removing a Cover. To repair a puncture it is not absolutely essential to remove the wheel concerned, but wheel removal is advisable. This enables the tube to be kept clean and, if necessary, to be tested in water.

It is possible to remove a cover by using a single tyre lever (shown at 8 in Fig. 54), but many motor-cyclists prefer to use two. On no account use *long* tyre levers, and never forget that the wire type beads are *inextensible* (see Fig. 13). The procedure for removing a cover with two tyre levers is as follows—

(1) Remove the front or rear wheel (see pages 120-121).

(2) Remove the valve cap and the valve securing nut. Also completely deflate the tyre by removing the valve core or inside check mechanism (see Fig. 9).

(3) Push both tyre beads inwards off the rim seats.

(4) Insert a tyre lever close to the valve, and while pulling on the lever, push the beaded edge of the cover (diametrically opposite to the valve) into the well of the rim.

(5) Insert a second tyre lever about 2½ in. distant from the first one, and progressively prise the bead over the flange of the rim.

(6) Continue to remove the tyre cover with one lever, while retaining the detached portion of the bead with the second lever. The use of force should not be necessary.

(7) Push the stem of the valve upwards through the hole in the rim and carefully withdraw the tube. Place it in a safe position away from oil and dirt.

(8) Stand the cover upright, with the wheel in front.

(9) Insert from the front a tyre lever between the flange and

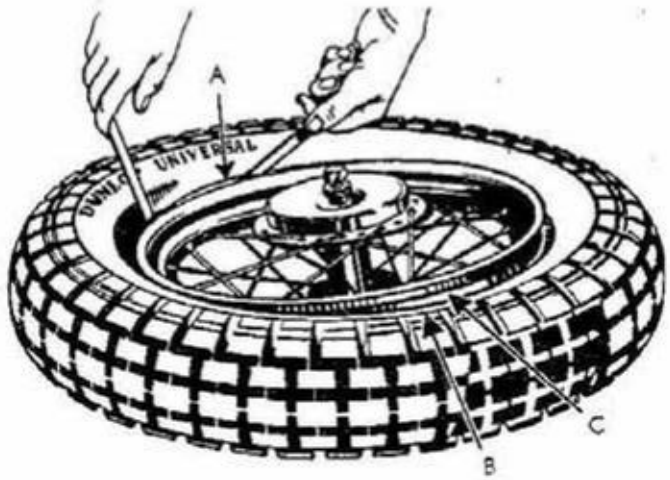

Fig. 13. Correct Method of Removing a Tyre Cover

Remember that tyre beads are inextensible and, before attempting to lever the cover bead at *A* over the flange of the wheel rim, ease the cover bead at *B* off the rim shoulder *C* down into the well.

(Dunlop Rubber Co. Ltd.)

the other bead, and carefully ease the cover back over the rim flange.

(10) If difficulty is experienced in completing the removal of a new cover, maintain the pressure on the bead by means of the tyre lever, and tap off the cover with a suitable mallet.

Repairing a Non-synthetic Tube. Thoroughly clean the rubber in the vicinity of the puncture, using fine sand-paper. Then rub off all traces of dust. Next select a suitable repair patch of the correct size. Preferably use an auto-vulcanizing patch, such as the Dunlop "Vulcafix." Detach its linen backing by stretching the rubber. The patch can be affixed to the tube with or without the application of solution.

Where solution is employed, use this on the *tube only* and do not affix the patch until the solution is tacky. If you do not use

solution, rub the prepared face of the patch with a cloth moistened with petrol. A brown deposit will thereby be transferred to the cloth and this deposit must be rubbed on the tube over the area where the patch is to be affixed. Repeat the above procedure and allow one minute for the patch and transferred deposit on the tube to dry. Now affix the patch to the tube and apply slight pressure round the edges. Automatic vulcanizing will occur. After repairing the puncture, rub some french chalk around and over the patch.

Fitting a Tyre Cover. The procedure for fitting a new wired-type cover or replacing a used one is as follows—

(1) Lay the wheel on the bench or floor and place the cover on top of it.

(2) Push the lower bead on one side well down into the well of the rim and, beginning diametrically opposite, ease as much as possible of the bead over the flange of the rim by hand pressure only. Prise the rest of the lower bead over the rim flange by means of a tyre lever. If care is taken, the use of a tyre lever should not be necessary.

(3) Replace the inside check mechanism in the tube valve and round out the tube slightly by gentle inflation. On no account distend the tube.

(4) Pass the valve through the hole in the rim and replace its securing nut. Screw the nut only about $\frac{1}{2}$ in. on the valve stem. Tuck the tube snugly into the cover and make sure that it is not twisted at any point.

(5) Begin to fit the second (top) bead of the cover by pushing it down into the well of the rim in a position diametrically opposite to the valve.

(6) Work the remainder of the second bead, on each side of the point where it was introduced, over the rim flange, fitting the part nearest to the valve last of all. Hand pressure should suffice, but it may be necessary to use a tyre lever for the last portion.

(7) Press the valve upwards in the rim hole to permit the beads to bed down properly, and then pull the valve back firmly into position.

(8) Slightly inflate the tube and verify that it is not "pinched" anywhere, especially near the valve.

(9) Pump up the tyre to about half its normal inflation pressure, spin the wheel and note whether the tread pattern runs evenly. Manipulate the cover by hand until this is the case, and then pump up to the normal inflation pressure (see page 13).

(10) Tighten firmly by hand the nut on the valve and replace the valve cap.

How to Store Tyres. Keep both tyres clear of the ground by means of the front and rear stands, maintain their inflation pressures correct (see page 13), and cover up the tyres to keep out the light.

Rubber deteriorates least rapidly when stored in a dark, cool, and damp place, such as a cellar. It is therefore best when storing tyres for a long period to remove the tubes, rubber rim bands, and covers from both wheels. Eliminate any traces of oil or grease and also dig out small stones and flints from the covers. If the place where you propose to store the tyres is not dark, wrap the tyres up thoroughly with several thicknesses of newspaper.

Hinged Tail Piece on 1950 Models. On the 1950 models a hinged tail piece is provided on the rear mudguard to facilitate rear wheel removal and tyre repairs. To remove this, it is only necessary to loosen four spigoted nuts and also disconnect the connector for the Lucas rear lamp lead (see page 143).

CHAPTER III

KEEPING BRAKES EFFICIENT

ANY motor-cycle used on the road with inefficient brakes is a lethal weapon. Always keep both brakes thoroughly efficient by adjusting them to give maximum braking power. This chapter tells you how to do it. The driving aspects of braking have already been referred to on page 11 in Chapter II.

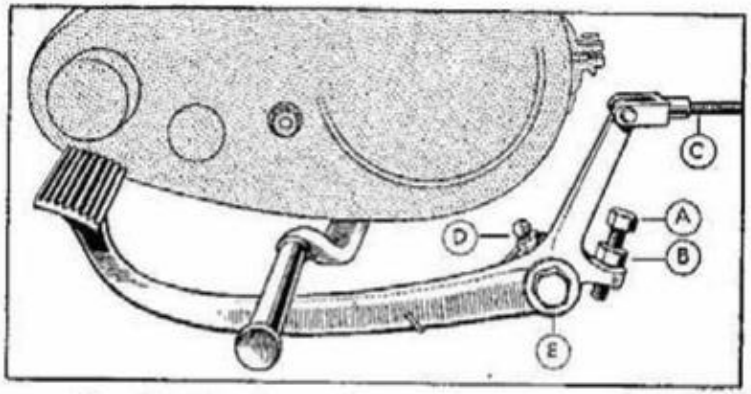

FIG. 14. THE SIMPLE BRAKE PEDAL ADJUSTMENT

A = Adjuster bolt (contacting frame)
B = Lock-nut for adjuster bolt
C = Rod to brake-shoe expander lever
D = Grease nipple
E = Pedal-securing nut

Matchless Brake Adjustments. On the "Clubman" models it is easy to keep the brakes highly efficient, because several means of adjustment are provided. It is possible to—

(1) Adjust the position of the rear brake pedal to suit individual requirements.

(2) Make a minor hand adjustment of both brakes.

(3) Effect a major adjustment of both brakes by means of the brake shoes.

To Adjust Brake Pedal Position. If the existing position of the rear brake pedal on your Matchless does not suit you it is possible to vary the pedal position within narrow limits (see Fig. 14) by means of the adjuster bolt (*A*) screwed into the heel of the pedal and secured by the lock-nut (*B*).

If it is desired to raise permanently the toe end of the pedal, *unscrew* the adjuster bolt (*A*) after first loosening the lock-nut (*B*). The best adjustment for normal purposes is to set the

adjuster bolt so that, with the foot clear of the pedal, the arm of the brake pedal just clears the support for the footrest.

Altering the position of the brake pedal necessarily moves the rear brake rod (*C*) and therefore makes it necessary to check and probably adjust the rear brake as described below.

Adjusting the Rear Brake. It is advisable to check the rear brake adjustment *weekly*. Except where considerable wear of the brake shoe linings has taken place, it is generally found that only a minor brake adjustment is called for. The adjustment is correct when the brake shoe linings are almost in contact with the rear brake drum when the pedal is in the "Off" position.

In order to make a minor rear brake adjustment, jack the Matchless up on its rear stand. Then to eliminate "lost motion," screw the knurled adjuster shown at (*A*) in Fig. 15 farther on to the brake rod until slight friction is felt between the brake linings and the brake drum when the rear wheel is spun with the gear-change lever in "neutral." Having obtained contact between the linings and drum, *unscrew* the adjuster nut (*A*) *two complete turns*.

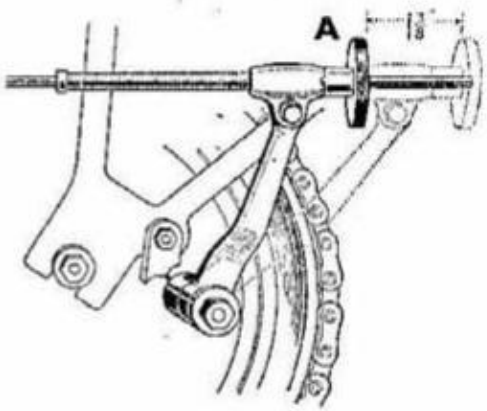

FIG. 15. HAND ADJUSTMENT OF REAR BRAKE (SHOWN EXHAUSTED)

The adjuster nut *A* is shown screwed fully on to the brake rod, and leverage is bad. Any further adjustment must be obtained by means of the shoes.

Where it is not possible to adjust the rear brake by means of the hand adjustment, owing to the condition shown in Fig. 15, recourse must be had to a major adjustment (by means of the brake shoes) as described on pages 22-23.

Adjusting the Front Brake. This adjustment, like that of the rear brake, should be checked *weekly*. The adjustment is right when the brake shoe linings are nearly in contact with the front brake drum when the handlebar lever is not operated. Unless considerable wear of the Ferodo linings, or of the cable control (or of both) develops, a minor hand adjustment should be sufficient. This is effected in the following manner—

Referring to Fig. 16, jack up the Matchless on both front and rear stands. Then *unscrew* the lock-nut (*B*) approximately *half a complete turn*. Now take up "lost motion" by unscrewing the knurled cable adjuster (*A*) until the brake shoe linings just contact the brake drum when the front wheel is spun by hand.

Finally, screw down the knurled adjuster (*A*) *two complete turns* and tighten the lock-nut securely.

If hand adjustment of the front brake is no longer possible owing to the condition shown in Fig. 16, a major adjustment must be made by means of the brake shoes as described below.

Brake Shoe Adjustment (1945–7 Models). To rectify loss of braking efficiency which cannot be rectified by means of the hand adjustment shown in Figs. 15, 16, it is necessary to effect a major adjustment of the thrust collar fitted to the tongue of each brake shoe. The adjustment is the same for the front and rear brakes, and details of the adjustable thrust collar are shown in Fig. 17. As may be seen, each thrust collar (7) has machined slots (5), (6), (8), of different depth.

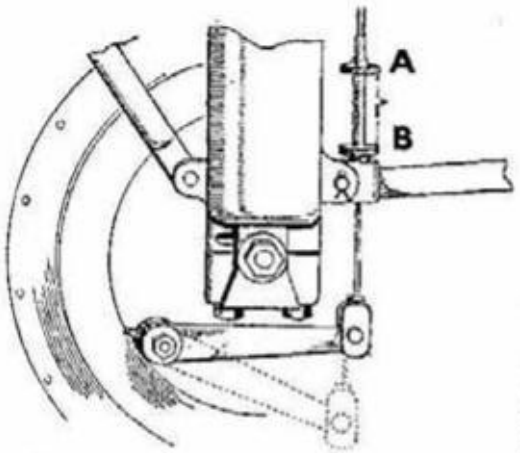

FIG. 16. HAND-ADJUSTMENT OF 1945–7 FRONT BRAKE (SHOWN EXHAUSTED)

With the hand-adjuster (*A*) screwed right out, no further adjustment is possible except by means of the brake shoes. Note the poor angle assumed by the shoe expander lever. On 1948–9 models the adjuster-nut and lock-nut are located higher up on the near-side "Teledraulic" fork leg.

Referring to Fig. 17, to effect a major brake adjustment it is necessary to remove each thrust collar from the tongue of its shoe and turn the collar so that the slot next less in depth engages the brake shoe (3) on replacing the shoe. Where the brake linings are badly worn, the two shallow slots (5) are suitable. If no wear of the brake linings has occurred, use the two deep slots (6). If only moderate wear of the linings is present, it is advisable to make use of the two medium depth slots (8). It should be noted that the tongue (4) enters the centre of the thrust collar (7).

Both brake shoes belonging to the *same* pair must be matched and it is essential to use the same depth slot when fitting each thrust collar to the tongue of the shoe before fitting the shoes to the front or rear brake cover plate.

Having effected a major brake adjustment (to offset loss of leverage or because further hand adjustment is impossible), slacken off the hand adjuster shown at (*A*) in Figs. 15 and 16, and proceed to adjust the front or rear brake (or both brakes) by means of the hand adjustment as described on page 21.

Brake Shoe Adjustment (1948-9 Models). Fig. 18 shows the improved deep-section brake shoe provided for the front and rear brakes on 1948–9 models. It will be observed that the thrust collar formerly provided has been replaced by a hardened thrust pin. This renders a major brake adjustment very simple. It is effected in the following manner.

Referring to Fig. 18, it is necessary only to remove the thrust

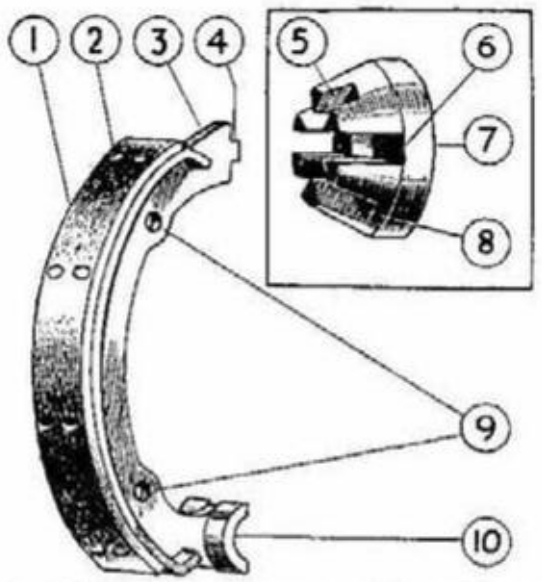

FIG. 17. SHOWING 1945–7 BRAKE SHOE WITH THRUST COLLAR ADJUSTMENT

1 = Ferodo lining
2 = Rivet (8 per set) for securing lining
3 = Brake shoe
4 = Brake shoe tongue
5 = One of two shallow slots
6 = One of two deep slots
7 = Adjustable thrust collar
8 = One of two medium depth slots
9 = Holes for shoe springs
10 = Heel of brake shoe

pin (1) from the brake shoe (3) and then fit a shim washer (2) beneath the hardened thrust pin. Two shim washers (Part No. STD–174) are contained in the tool kit of each new Matchless to permit of adjustment if and when necessary.

Having effected a major brake adjustment, slacken off the adjuster shown at (*A*) in Figs. 15 and 16, and then adjust the front and/or rear brake in the normal manner with the hand adjustment (see page 21).

Interchangeability of Brake Shoes. Although it is permissible to fit the rear brake shoes and associated parts to the front brake cover plate, this is not desirable without good reason. The two brake shoes fitted to the *same* brake cover plate are *not* interchangeable.

Positioning of Front Brake Cover Plate Important. The front brake cover plate is secured to the front wheel spindle with an internal and an external nut. A locating washer is fitted between the cover plate and the internal nut.

If the front wheel has been removed (see page 120), it is important, before replacing it in the "Teledraulic" front forks, to position the internal nut correctly. When the locating washer is

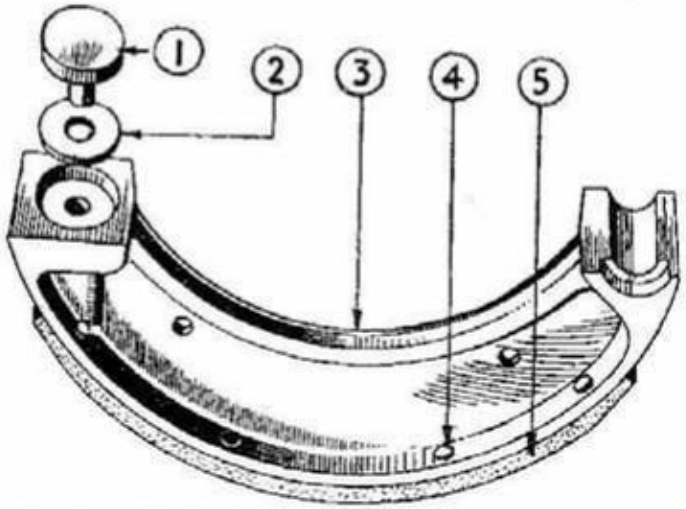

FIG. 18. SHOWING 1948–9 BRAKE SHOE WITH THRUST PIN ADJUSTMENT
1 = Hardened thrust pin
2 = Shim washer
3 = Brake shoe
4 = Rivet (8 per set) for securing lining
5 = Ferodo lining

fitted adjacent to it, the locating washer outer face must stand proud of the outer edge of the brake drum to the extent of $\frac{1}{16}$ in. A dimensional check should be made. Place a suitable straight-edge across the outer edge of the brake drum and then measure vertically the distance between this edge and the outer face of the locating washer. If the distance is less or greater than $\frac{1}{16}$ in., adjust the internal nut accordingly.

Fit the external nut so that its hexagonal side abuts the front brake cover plate.

Centralize the Brake Shoes. Where a front or rear brake cover plate has been removed and the shoe assembly dismantled or disturbed, it is advisable to centralize the two shoes in the brake drum during assembly. This ensures that equal pressure is exerted on the drum by *both* linings. Lack of centralizing is often accompanied by an irritating squeak occurring during brake application.

Centralize the brake shoes before replacing the front wheel, or, where the rear wheel is concerned, before tightening the nut

securing the brake cover plate (in situ) to the spindle of the wheel.

To effect centralizing, first loosen the nut securing the brake cover plate to the spindle of the wheel. Next increase the leverage of the shoe expander operating lever by slipping a box spanner over the lever. Exert pressure on the spanner to expand the shoes to their full extent and simultaneously tighten the nut on the spindle so as to secure the brake cover plate.

Slackness of Rear Brake Drum. Transmission harshness, and even wheel spoke fracture, may result from slackness of the nuts and bolts securing the integral brake drum and rear wheel sprocket to the hub of the wheel.

Removal of the rear brake drum and sprocket is seldom necessary, but when occasion is had to remove and dismantle a rear wheel, the securing bolts and nuts should be checked for tightness. As may be seen in Fig. 70, the drum and sprocket (25) are secured to the wheel hub by six bolts (11) and nuts (13). Beneath each nut is a locking washer (12). It is most important that all six locking washers are in position and this point should be checked during assembly.

The Front Brake Drum. On all 1945–7 Matchless machines the front brake drum is secured to the wheel hub by means of eight countersunk screws. On later models ten countersunk screws are provided. During the assembly of a wheel, check that these screws are done up firmly.

Care of Brakes During Storage. The best plan is to remove the brake shoes and smear the inside surfaces of the drums with petroleum jelly. The brake shoes, springs, expanders, levers, etc., can be stored in a suitable box after greasing all except the light alloy components. See that the fulcrum ends of the shoes and the thrust pins, or thrust collars, are well greased, and do not forget the shim washers, if fitted. Wrap up all parts in newspaper before placing them in a box.

1950 Brake Shoe Adjustment. The shoes have a thrust pin adjustment as shown in Fig. 18.

CHAPTER IV

LUBRICATING YOUR MATCHLESS

You would not deliberately ill-treat your Matchless by running it hard up against a brick wall with the throttle open, but you can be equally cruel to it by neglecting lubrication. This can cause the piston to run hard up against the cylinder walls and

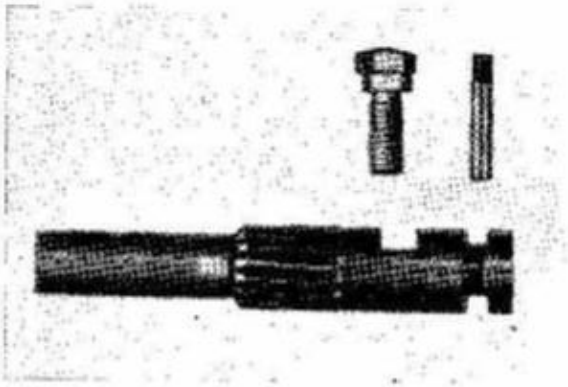

FIG. 19. THE OIL PUMP PLUNGER, GUIDE SCREW, AND PIN

For position of the pump on engine, see Fig. 20. Note that the hardened steel pin *must* fit inside the hollow guide screw with the relieved end (shown dark) *away* from the plunger.

cause metal-to-metal contact. The same applies to the numerous bearings.

THE DRY SUMP SYSTEM

The engine lubrication system on Matchless "Clubman" models is of the full dry sump (D.S.) type, where *all* oil in the engine and oil tank is kept in constant circulation while the engine is running. Its functioning is entirely automatic, but a little regular attention is *essential*.

The "Heart" of the D.S. System. The oil pump in the crankcase has a horizontal type steel plunger (Fig. 19) which combines rotary motion with reciprocating movement. Rotary motion is imparted to the plunger by a worm on the timing side engine main shaft. The reciprocating motion is obtained by the hardened pin in the hollow guide screw (see Fig. 19) engaging the profiled cam groove cut on the (larger) scavenge end of the plunger.

The profiled cam groove is designed so that the opening and closing of the two main ports, and a small auxiliary port, are

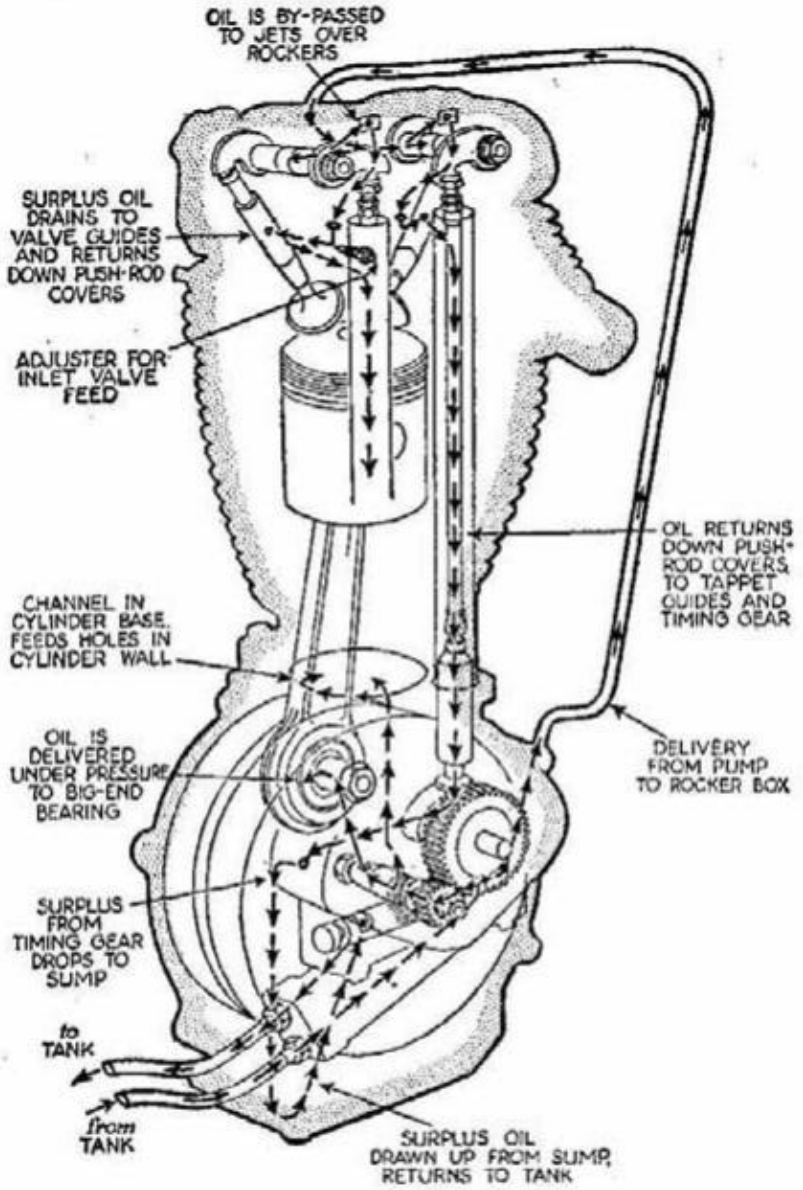

FIG. 20. DIAGRAM SHOWING HOW THE OIL CIRCULATES INSIDE THE MATCHLESS O.H.V. ENGINE

The above circulation diagram is applicable to all 1945 and later O.H.V. "Clubman" engines.

(*From "The Motor Cycle"*)

sychronized with the pumping impulses obtained by plunger reciprocation. The scavenge (rear) end of the plunger, which is totally enclosed in its housing by two end-caps, has a greater capacity than the delivery end, and in consequence it keeps the crankcase sump in a "dry" state, all oil being returned to the tank for further circulation.

Outline of Oil Circulation. Fig. 20 shows at a glance how the oil circulates in the Matchless engine with D.S. lubrication. The circulation of the oil in the tank (capacity: 3 pt., 1945–8; 4 pt., 1949) can be understood by referring to Fig. 21.

The delivery (front) end of the plunger shown in Fig. 19 feeds oil under pressure to the connecting-rod big-end bearing through a passage cut in the timing-side main shaft, flywheel, and crankpin. The piston and cylinder bore are lubricated by surplus oil splashed from the big-end bearing. Further provision for lubrication of the cylinder, however, is another pressure oil feed from the pump. The latter forces oil through a passage (equipped with ball valve control) in the crankcase to a circular channel in the cylinder base. The oil reaches the cylinder bore through a number of small holes drilled in the channel. Surplus oil automatically drains down into the sump of the crankcase.

The Matchless plunger pump also feeds a secondary oil supply to the timing gear and rocker-box. The supply to the timing gear is fed through a passage in the timing gear case. The oil collects in the timing-case until a pre-determined level is reached. As may be seen in Fig. 20, an external pipe connected to the front of the oil pump housing conveys the secondary oil supply direct to the rocker-box and push-rod ball ends.

The overhead inlet and exhaust valve rockers inside the rocker-box are thoroughly lubricated by means of jets above them, and the excess oil drains to and lubricates both valve guides. The oil supply to the guide for the inlet valve can be regulated by means of a needle-pointed screw adjuster. This oil supply adjustment is the only one provided on the Matchless D.S. lubrication system.

Surplus oil from the valve guides passes down the push-rod covers and the tappet guides and enters the timing-case. Here all engine oil, beyond that needed to keep the level at the predetermined height, drains down into the sump of the crankcase. The large capacity scavenge end of the plunger pump sucks up the oil collected in the sump from various parts of the engine and pumps it back via the upper pipe into the oil tank for filtering and further circulation.

Two Filters are Provided. To ensure that the oil in the D.S. lubrication system is kept clean, two filters are provided. A cut-away view of the Matchless oil tank showing the filters, and the

circulation of the oil inside the tank is shown in Fig. 21. As may be observed, a metal gauze strainer is incorporated in the delivery or feed pipe union. It should be noted that the sole object of this filter is to trap any dirt, pieces of fluff, etc., which may get into the oil tank while it is being replenished.

The main filter is a detachable fabric type. It comprises a long felt element contained within an upright tubular wire cage. As may be noticed in Fig. 21, all the engine oil returned by the scavenge end of the pump has to percolate through the felt element and wire cage which are supported by a cylindrical housing inside the tank. Very thorough filtering results.

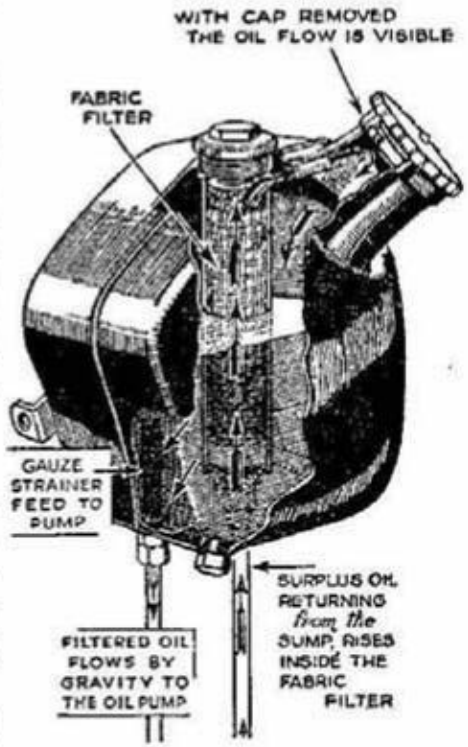

FIG. 21. OIL CIRCULATION AND FILTER ARRANGEMENT IN OIL TANK
Note the main fabric filter and gauze strainer. Observe also method of checking oil circulation.

LUBRICATING ENGINE

Always purchase engine oil in sealed containers or replenish from branded cabinets. Specify clearly the brand and grade which you require, and refuse firmly but politely the "just as good" type.

Suitable Brands and Grades of Engine Oil. To ensure easy starting, maximum performance and minimum wear, the safest policy is to use one of the brands and grades officially recommended by Matchless Motor Cycles. They recommend the use of one of the following engine oils—

(*a*) Castrol "Grand Prix" (summer) or "XXL" (winter).
(*b*) Mobiloil "D" (summer) or "BB" (winter).
(*c*) Triple Shell (summer) or Double Shell (winter).
(*d*) Price's Motorine "B" de luxe (summer) or Motorine "C" (winter). See also page 133.
(*e*) Essolube Racer (summer and winter).

It should be noted that the above recommendations are not tabulated in any priority order. It is for the rider to choose which brand he prefers. All the five mentioned are thoroughly sound.

Checking Level of Oil in Tank. Remove the filler cap and inspect the level of oil in the tank frequently. Always verify the level before setting out on a long run and top-up with suitable engine oil (see previous paragraph) if necessary. Sufficient oil must be kept circulating in order to ensure correct lubrication of the engine and its proper cooling.

If the oil level is below the half-full mark, top-up immediately, otherwise the oil in circulation is apt to become hot, dirty, and diluted. As far as possible maintain the level *above the half-full mark*, but do not permit the level to rise above 1 in. from the filler-cap orifice (see Fig. 21). This is important for the following reason.

On stopping the engine, no further pump action occurs, but the oil continues to drain into the sump from various parts of the engine. When the engine is subsequently started there is obviously surplus oil accumulated in the sump and this is immediately pumped back into the tank by the large-capacity scavenge end of the pump plunger. The effect is to cause a rise in the level of oil in the tank.

Verifying Oil Circulation. Verify the oil circulation before *every run*, immediately after starting up the engine from cold. Remove the oil tank filler-cap and observe the oil flow from the small spout (see Fig. 21) inside the filler-cap orifice. If no oil can be seen emerging from the spout, raise the exhaust valve lifter and stop the engine immediately.

The oil flow immediately after starting up the engine from cold should be *steady*. An erratic or weak flow is abnormal and requires investigation. After a brief period of warming up the engine, the surplus oil in the crankcase sump is disposed of, and thereafter the oil flow from the spout of the return pipe decreases somewhat and may become irregular. Some froth may be noticeable caused by the presence of air bubbles, but this is normal and can be disregarded, once the engine gets into its stride.

If you suddenly accelerate the engine and then close back the throttle, you may observe first a marked decline, or even cessation, of the oil flow and then a considerable increase in the flow.

No Oil Pump Adjustment Provided. The Matchless oil pump is capable of delivering the correct volume of oil to the engine at *all* throttle openings. Consequently there is no adjustment provided for the main oil supply. To ensure correct lubrication of the engine, however, it is essential to keep the two end-caps of the plunger housing quite airtight. Check the securing nuts periodically for tightness with a spanner. (See also page 33.)

Adjusting Oil Supply to Inlet Valve Stem. The adjuster for the oil supply to the inlet valve stem comprises a needle-pointed screw (Fig. 20) situated on the off-side of the cylinder head. If

the engine is mechanically sound, the normal setting of the adjuster screw is *half a complete turn from the fully closed position*. Once the correct setting has been obtained, it should not be necessary to interfere with the adjustment.

The adjuster screw is secured by a lock-nut, which prevents accidental alteration of the adjustment. To *increase* or decrease the oil supply to the inlet valve stem, the adjuster screw must be turned slightly *anti-clockwise* or clockwise respectively, after first loosening the lock-nut.

What symptoms indicate that an adjustment is called for? An excessive oil supply is denoted by blue smoke at the exhaust, high oil consumption, and a tendency for the sparking plug to oil-up and become dirty. An insufficient oil supply is indicated by the inlet valve stem developing a mouse-like squeak.

Lubrication of Exhaust Valve Stem. No adjustment is provided for the oil supply to the exhaust valve stem. The stem is automatically lubricated by oil fed through a channel drilled in the cylinder head. Surplus oil from the exhaust valve stem and from the stem of the inlet valve is by-passed back into the chamber responsible for lubricating the timing gears.

FIG. 22. GAUZE STRAINER INTEGRAL WITH FEED PIPE UNION

Changing the Oil. With a brand-new Matchless it is advisable to empty the oil tank and replenish it with fresh oil after covering 500 miles and again at 1000 miles. After this, change the oil once every 5000 miles.

Before draining the oil tank, make sure that your Matchless is level with both wheels on the ground or with both stands down. Then to drain the tank, place a suitable receptacle below the drain plug to catch the oil and unscrew the plug from the front lower edge of the tank. Be patient and allow the whole of the oil to drain away.

Having drained the oil tank, also remove the drain plug from the bottom of the crankcase sump (on the off-side), and permit any accumulation of oil to drain off. There will not be a large amount, but it is desirable to remove what there is. Finally, make sure that both drain plugs are replaced and firmly tightened.

Cleaning the Two Filters. Thorough and regular cleaning of the two filters in the oil tank (see Fig. 21) is most important and must never be overlooked. It is best to remove and clean the filters just before the oil is changed. Advice on removing the filters is given in subsequent paragraphs. As regards actual cleaning, this should be done thoroughly with petrol, but do not

attempt to remove the felt element of the large cartridge type filter from its tubular wire cage, and do not use a fluffy rag when cleaning the gauze strainer fitted to the union of the oil feed pipe (see Fig. 22).

Inspect the cork washer fitted below the hexagon cap of the fabric filter (Fig. 21) and renew the washer if it is not in perfect condition. Also examine the felt element very carefully. Fit a new element if its ends are at all distorted or perforated.

It should be observed that a choked gauze strainer can completely or partially starve the engine of oil, since it is integral with the feed pipe union and all oil entering the engine has to pass through it.

On the other hand, choking of the gauze strainer can be caused only through replenishing the tank with impure oil. The whole of the oil returned by the pump from the engine to the tank is effectively cleaned by means of the large fabric filter, assuming the felt element is sound.

If the felt element of the fabric filter is clogged up with impurities, excessive lubrication can occur owing to resistance offered to the returning oil, and the filter itself is likely to suffer damage owing to a local building up of pressure.

How to Remove Filter Element. On 1945–7 models, first raise the rear of the saddle after removing the two saddle spring securing bolts. On 1948–9 "Clubman" machines this is not necessary.

Unscrew and remove the hexagonal cap from the oil tank filler orifice. Next withdraw the dished washer and the filter spring. Then insert a finger inside the felt element and withdraw the filter element towards the rear. On 1948–9 models gently raise element while pressing inward and slightly backward. This will enable the top end of the filter element just to clear the inside of the saddle cover. Take great care not to kink or damage the element when withdrawing it.

The procedure for replacing the filter element is the reverse of that just described. On a 1945–7 model, where the rear of the saddle is assumed to have been raised, replace the saddle in its normal position and fit and securely tighten the two saddle spring securing bolts.

Removing Gauze Strainer. To remove the gauze strainer (Fig. 22) for cleaning after draining the oil tank, the following procedure is necessary. Disconnect the oil-feed pipe from the union screwed into the base of the oil tank by unscrewing the union nut from the pipe nearest the rear wheel. Spring the feed pipe away from the union and then unscrew the union and remove this complete with the integral strainer. To replace the gauze strainer, union, and feed pipe, reverse the above instructions.

If you Split the Crankcase. Should it be necessary for any reason

to separate the crankcase halves, it is essential to remove the pump plunger (Fig. 19) first. Failure to take this precaution will almost certainly result in damage being caused.

To Remove Oil Pump Plunger. Do not remove the oil pump plunger unnecessarily. If you must remove it, first drain the oil tank as described on page 31. Also unscrew the union nut securing the bottom end of the oil feed pipe from the pump housing to the rocker-box. Remove both end caps from the pump housing by undoing the hexagon-headed securing bolts.

Just below the pump housing in front of the rear cap is the all-important guide screw and pin. Remove these together (see Fig. 19), and push out from the front the pump plunger and withdraw it from the rear end of the pump housing.

To Replace Oil Pump Plunger. First make sure that the inside of the pump housing is clean, and also check that the plunger itself is clean internally and externally. Oil the plunger and gently push it into position. Its smaller end must enter the rear of the pump housing, and the guide screw must next be fitted. Before replacing the guide screw, make certain that the steel pin inside the hollow screw is fitted as indicated in Fig. 19, or serious damage may be caused to the teeth of the pump plunger.

After replacing the guide screw, and while slowly tightening it, move the pump plunger backwards and forwards until the end of the guide screw pin is felt to engage the profiled cam groove at the rear end of the plunger. When this happens, tighten the guide screw firmly, but on no account tighten before proper engagement is obtained, otherwise stripping of the teeth on the timing-side engine main shaft and of the teeth on the plunger is liable to take place.

Fit the pump housing front and rear end-caps and see that airtight joints are obtained. The two paper washers must be in perfect condition. Renew them if they are damaged in the slightest degree. Make certain when fitting the paper washer for the front-end cap that the small oil hole in the cap itself is not obstructed.

To Prevent Air Leaks at Pump Housing End-caps. It is advisable to apply some liquid jointing compound to one side of each paper washer. This side must be fitted in contact with the end-cap. To ensure an airtight joint at each end-cap, it is essential to see that the securing bolts are tightened down evenly and firmly. Tightening should always be effected in a diagonal order. Also occasionally check the delivery and return pipe union nuts for tightness.

Bearings of Lucas Magneto. The armature bearings of the Lucas magneto (type NI/3/AO); mounted on a platform behind the cylinder, require little attention. They are initially packed

with grease by the makers during assembly and further greasing should not be necessary for at least 10,000 miles. When re-greasing becomes necessary it is desirable to remove the magneto and return it to Joseph Lucas, Ltd. of Birmingham, 19, or to one of their service stations, for thorough servicing. No grease nipples are fitted, but the contact-breaker requires periodical oiling.

Lubricating Lucas Contact-breaker. The cam and tappet of the face-cam type contact-breaker (Fig. 23) require lubrication

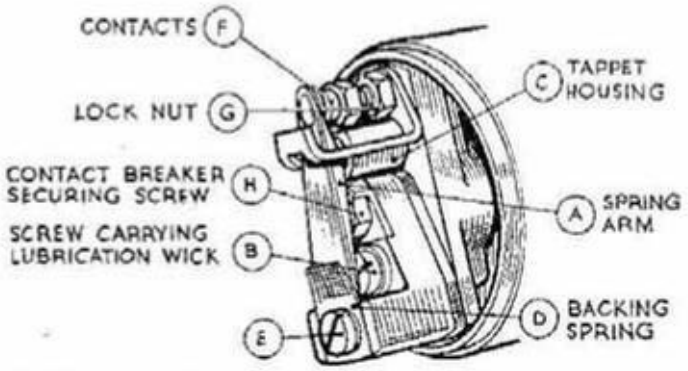

FIG. 23. FACE CAM CONTACT-BREAKER OF LUCAS MAGNETO SHOWN ASSEMBLED

This type of contact-breaker is provided on the magnetos of all 1945 and later Matchless machines. The various parts are shown dismantled in Fig. 24.

approximately every 5000 miles. In order to effect such lubrication, remove the complete contact-breaker as described below.

First release the spring blade and take off the contact-breaker cover. Now, referring to Figs 23 and 24, remove the screw (*E*) and the spring washer retaining the spring arm (*A*) to the body (*L*) of the contact-breaker, and detach the curved backing spring (*D*) and the spring arm (*A*). Next unscrew the screw (*B*) carrying the lubrication wick, and remove the insulating bush (fibre). Straighten the tab on the locking plate (*J*) situated behind the head of the contact-breaker securing screw (*H*), and with the spanner shown at (11) in Fig. 54 remove screw (*H*). Then lever off the contact-breaker body (*L*) from the armature shaft extension.

After completely removing the contact-breaker, saturate the wick, mounted in the core of the carrying screw (*B*), with a few drops of *thin machine oil*. Push from the contact-breaker body (*L*) the tappet (*K*) and wipe the tappet clean with a soft cloth. Smear a little thin machine oil on the tappet and replace it in the body.

To assemble the face-cam type contact-breaker, proceed in the

reverse order of dismantling. Make sure that the curved backing spring (*D*) is replaced so that the curved part is on the *outside* as illustrated.

Grease Magneto Chain Every 1000 Miles. The driving chain for the magneto is enclosed in a chain case on the off-side of the engine. It is not automatically lubricated like the dynamo chain, but relies for lubrication on grease packed inside the chain case. It is necessary to add grease about every 1000 miles by injecting

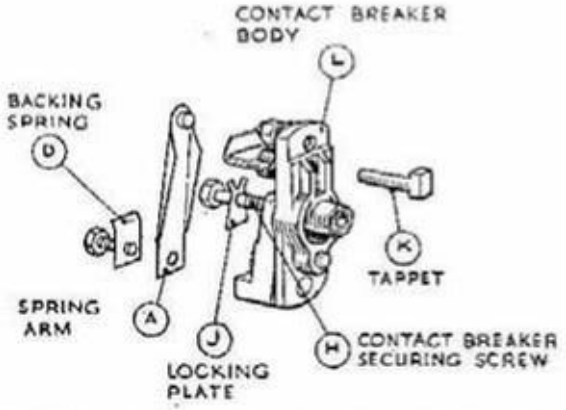

FIG. 24. FACE CAM CONTACT-BREAKER OF LUCAS MAGNETO SHOWN DISMANTLED

The same contact-breaker is shown assembled in Fig. 23.

a small quantity through the grease nipple provided on the chain-case cover for this purpose. Suitable greases are those recommended for the various cycle parts (see page 36).

LUBRICATING CYCLE PARTS

Bearings of Lucas Dynamo. The armature bearings of the Lucas (type E3AR/AOS/1) dynamo, like those of the Lucas magneto, are packed with grease by the makers on assembly and this should suffice for at least 10,000 miles running, until a complete engine overhaul is required, when the dynamo should be removed and returned to Joseph Lucas, Ltd., or to a Lucas service station for thorough cleaning, overhaul, and lubrication.

The Dynamo Driving Chain. The separate Lucas dynamo is chain-driven from the engine shaft by a chain which is completely enclosed in the oil-bath chain case containing the primary chain. Therefore, provided the oil-bath chain case is kept properly replenished, no individual attention to the dynamo chain is necessary. The replenishment of the oil-bath is dealt with on page 38.

Lubricating the Burman Gearbox. Matchless Motor Cycles advise the use of summer grade engine oil (see page 29) for the

four-speed heavyweight Burman gearbox on the 1948–9 "Clubman" machines. On 1945–7 machines, however, light grease is recommended for gearbox lubrication. On no account must *thick* grease be used. Suitable grease for 1945–7 gearboxes, and for lubricating various cycle parts by means of the grease nipples provided, are as follows—

(1) Castrolease "Medium."
(2) Mobilgrease No. 2.
(3) Shell "Retinax" Grease C.D.
(4) Price's Belmoline "C."
(5) Esso Grease.

WHEN AND WHERE TO LUBRICATE (KEY TO FIG. 25)

(1) *Oil Tank.* Inspect level of oil frequently. Maintain level above half-full mark, but not above 1 in. below filler orifice. Top-up as required with suitable engine oil. Check circulation prior to every run. Change oil every 5000 miles and clean fabric and gauze filters. (See pages 29 and 31.)

(2) *Oil Pump.* Adjustment is not provided, but keep the two end-caps of the plunger housing air-tight. (See page 30.)

(3) *Inlet Valve Stem.* Should excessive lubrication or valve squeak occur, regulate as required the needle-pointed adjuster screw located on the off-side of the cylinder head. (See page 30.)

(4) *Lucas Magneto.* Every 5000 miles remove face-cam contact-breaker and oil the cam and tappet. Return instrument at 10,000 miles for servicing. (See page 34.)

(5) *Magneto Chain.* Every 1000 miles inject a little grease into the chain case. (See page 35.)

(6) *Lucas Dynamo.* Return instrument for servicing at about 10,000 miles, or when a complete engine overhaul is required. (See page 35.)

(7) *Burman Gearbox.* Every 1000 miles inject about 2 oz. of light grease (1945–7 models), or 2 oz. of summer grade engine oil (1948–9 models). Flush out gearbox, change lubricant every 5000 miles. (See page 38.)

(8) *Oil-bath.* Verify level of oil every 500 miles and top-up, if necessary, to level of inspection cap orifice. Do not permit level to fall below $\frac{3}{16}$ in. from bottom edge of orifice. (See page 38.)

(9) *Secondary Chain.* Examine and if necessary oil chain, every 500 miles. Every 1000 and 2000 miles, in winter and summer respectively, remove, clean, and immerse chain in molten tallow. (See page 38.)

(10) *Wheel hubs.* Every 1000 miles inject some grease through hub nipples. (See page 39.)

(11) *Brakes.* Every 1000 miles grease the nipples in each expander bush. Grease rear brake pedal every 3000 miles.

Monthly oil the yoke end pins of rear brake, thread on rod, and front brake cable end. (See page 39.)

(12) *Steering Head.* Every 3000 miles grease both nipples. (See page 39.)

(13) *"Teledraulic" Front Forks.* Check hydraulic fluid content of each fork leg every 3000 miles (1945–7 models), or 5000 miles (1948–9 models). Top-up as required. (See pages 41–42, 144)

(14) *Control Levers.* Monthly oil the various handlebar levers. (See page 40.)

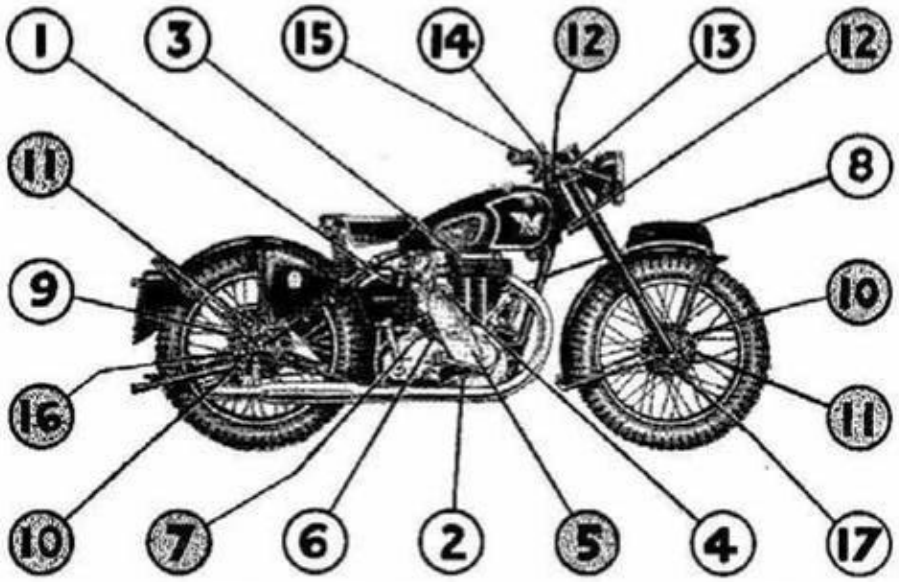

FIG. 25. WHEN AND WHERE TO LUBRICATE YOUR MATCHLESS
Apply the grease gun to points indicated by numerals in shaded circles. (For key to chart, see opposite).

(15) *Throttle Twist-grip.* Occasionally smear some grease on the handlebars below the twist-grip. (See page 40.)

(16) *Speedometer.* Monthly grease the speedometer gearbox. (See page 40.)

(17) *Stands.* Monthly oil the hinge bolts of both stands. (See page 40.)

Gearbox (*contd.*). Do not completely fill with engine oil or light grease. Under normal conditions it is sufficient to top-up with lubricant every 1000 miles by inserting 2 oz. of light grease or engine oil (1948–9 models) via the grease nipple on the kick-starter case or through the filler orifice. Excessive replenishment will result in leakage.

Changing Gearbox Lubricant. It is desirable after a considerable mileage (say every 5000 miles) to change the lubricant in the gearbox. The light grease or engine oil (1948–9 models) should be drained completely and the Burman gearbox flushed out with a suitable flushing oil and afterwards replenished with 1 lb. 14 oz. of grease (1945–7 boxes), or with 1 pint of engine oil (1948–9 boxes).

The screwed drain plug is located low down at the rear of the gearbox shell. Where a non-fluid lubricant (light grease) is used, it may be found somewhat difficult to drain the gearbox thoroughly by removing the drain plug only. The best plan here is to remove the foot-change cover and also the kick-starter case. Before replenishing the gearbox make sure that the drain plug is replaced and firmly tightened.

Replenishing Oil-bath Chain Case. Remove the inspection cap from the oil-bath chain case about every 500 miles and observe the level of oil. On no account must the oil level be permitted to fall below $\frac{3}{16}$ in. from the bottom edge of the inspection cap orifice, with the machine jacked up on the rear stand. The correct amount of oil is present when its surface is level with the orifice.

If the oil level is too low, some harshness in the primary transmission generally develops. Top-up the oil-bath chain case as required and when necessary, using one of the brands and grades of engine oils mentioned on page 29. Lubrication must not be neglected, for the oil-bath is responsible for lubricating: (*a*) the primary chain, (*b*) the dynamo chain, and (*c*) the engine shaft shock-absorber.

Oil-bath Inspection Cap Removal. To remove the cap, unscrew the retaining screw approximately *four turns*. Then slide the cap sideways until it is possible to slip the back plate through the orifice and remove the complete cap assembly.

To prevent the risk of the filler cap, or inspection cap, being lost while riding, it is important to centralize the cork washer before firmly tightening the knurled retaining screw. Do not forget this when replacing the inspection cap.

Secondary Chain Lubrication. About every 500 miles examine the condition of the secondary chain. If the chain is in a dry state, turn the rear wheel by hand and apply some engine oil with a suitable brush or rag. About every 1000 miles in winter, and every 2000 miles in summer, it is advisable to remove the chain from the sprockets and clean and lubricate it in the following manner—

(1) Clean the chain thoroughly with paraffin.

(2) Hang up the chain and allow to dry.

(3) Immerse the chain for about *five minutes* in a suitable receptacle containing molten tallow.

(4) Allow excessive molten tallow to drain off the chain.

Having lubricated the chain, fit it to the gearbox and rear wheel sprockets. It is permissible to lubricate the chain, using engine oil instead of molten tallow, but this substitute is not so good. Allow the chain to soak for an *hour or two* where engine oil is used.

Use of Grease Gun. Fig. 26 shows the standard type of grease gun (Part No. LTK20) recommended for Matchless machines and provided with the tool kit. The gun must be applied periodically to all grease nipples provided on the machine.

Suitable greases to use are those recommended on page 36 for the 1945–7 Burman gearbox. The grease gun must be charged so that the grease is on the *top* side of the piston. Special grease canisters are available with loose collars provided with holes. To charge the grease gun from one of these canisters, place the barrel of the gun over the hole in the central floating plate and press downwards firmly. Turn the grease gun and at the same time remove it from the floating plate. This should charge the grease gun so that the grease is flush with the top of the barrel. Having charged the grease gun, replace its screwed top cap. If no grease canister of the type referred to is available, charge the grease gun by hand, using a suitable lath or similar implement.

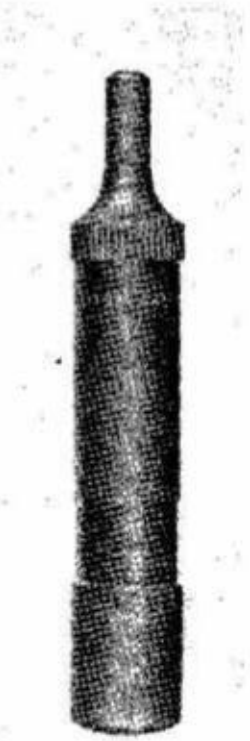

Fig. 26. Grease Gun Supplied with Matchless Motor-cycles

Wheel Hub Lubrication. On new machines the hubs of both wheels are packed with grease. To prevent mud and water entering the hubs, and to ensure correct lubrication, inject some grease through the nipple of each hub about every 1000 miles. Avoid excessive lubrication, or some of the grease may get on to the brake linings and impair the efficiency of the brakes.

The Steering Head. Apply the grease gun sparingly to the grease nipple in the head lug of the frame about every 3000 miles. Also grease the handlebar lug nipple at the same time.

Lubricating Front and Rear Brakes. Inject a little grease about every 1000 miles through the grease nipple provided on the brake cover plate for the expander bush. About every 3000 miles apply the grease gun to the nipple in the heel of the rear brake pedal (shown at (*D*) in Fig. 14).

Smear a few drops of engine oil *monthly* on the yoke end pins

at the front and rear ends of the rear brake rod. Do not forget the threaded portion of the rod to which the hand adjuster is fitted. Also remember the bottom end of the front brake cable.

Speedometer lubrication. To ensure smooth and efficient running, grease the speedometer gearbox about *once a month*. The gearbox is attached to the rear wheel spindle and the grease nipple is located on top of the speedometer gearbox. No further lubrication is required beyond the above-mentioned attention.

Lubricating Throttle Twist-grip. Stiffness sometimes develops and this spoils sensitive control of the throttle. To rectify stiffness is quite simple, and the following procedure should be adopted.

(1) Remove both the screws which retain the halves of the twist-grip body.

(2) Withdraw the twist-grip from the end of the handlebars.

(3) Smear some high-melting-point grease on the end of the handlebars.

(4) Smear some high-melting-point grease on the friction spring, and also on the drum on which the internal wire is wound.

(5) Replace the twist-grip on the end of the handlebars.

(6) Fit the two screws retaining the halves of the twist-grip and firmly tighten the screws.

The Handlebar Levers. It is advisable to smear a little engine oil *monthly* on all the moving parts of the handlebar levers. This will reduce friction and keep the controls responsive and easy to operate.

Lubricating Stand Fulcrum Bolts. Occasionally remove the stand fulcrum bolts, smear some engine oil on them, and replace. There are several small parts on the machine where only a little movement occurs. All such parts should be similarly lubricated. This will facilitate free movement and prevent rusting. The main parts of the Matchless requiring attention are indicated in the lubrication chart on page 37.

If a Sidecar is Fitted. Do not forget to lubricate the sidecar chassis. Several grease nipples are provided for the purpose.

Suitable Hydraulic Fluid for "Teledraulic" Forks. The 1945–7 "Teledraulic" front forks and 1948–9 type, modified and simplified internally, require no actual lubrication. It is necessary, however, occasionally to check the hydraulic fluid content of each fork leg (6½ oz. on 1945–7 forks, 10 oz. for 1948–9) and to top-up where necessary, as described in later paragraphs of this chapter. Below are specified suitable types of fluid for the Matchless hydraulic dampers—

(1) Wakefield's "Castrolite."
(2) Mobiloil "Arctic."
(3) Single Shell.
(4) Price's Motorine "E."
(5) Essolube "20."

To Check Level of Fluid in 1945–7 "Teledraulics." It is desirable to check the fluid level every 3000 miles. Position your Matchless so that it is resting on both wheels and is quite vertical. To maintain it in this position, insert packing beneath both footrests. Unscrew the two hexagon plugs shown at (*A*) in Fig. 2. Pull each plug (*A*) upwards to its maximum extent and thereby expose the fork damping rod attached to the plug.

By "pumping" action eject any hydraulic fluid trapped in the tubes above the damper valves. Work each plug and damping rod up and down several times. Pause for *two minutes* to permit ejected fluid to drain down to the main supply of damping fluid.

Remove the two fluid level plugs (shown at (50) in Fig. 69) and their fibre washers from the fork sliders. The plugs are situated just beneath the securing bolts for the front mudguard bridge. Some hydraulic fluid should just ooze from the holes for the fluid level plugs if the hydraulic fluid content of the forks is correct. Should no fluid be seen to ooze out from the holes, it is necessary to top-up each fork leg in the manner described below.

Topping-up Procedure (1945–7 "Teledraulics"). It is assumed that the two fluid level plugs are still removed. To top-up each leg of the "Teledraulic" front forks, the following procedure is required—

(1) Pour about two tablespoonfuls (equivalent to *one fluid ounce*) of hydraulic fluid down each fork leg inner tube (shown at (9) in Fig. 69) from the top end.

(2) Work the top plug (10) and attached damper rod (13) up and down several times.

(3) Wait for *two minutes* to allow hydraulic fluid to ooze from the fluid level hole.

(4) If no excess hydraulic fluid oozes from the fluid level hole, pour *another fluid ounce* of this medium down the inner tube of the fork leg.

(5) Having added further fluid, work the top plug and attached damper rod up and down several times, as previously. During all such "pumping" action, use the fingers only and make the upward strokes as sharply as possible.

(6) If still no fluid oozes from the fluid level plug hole, investigate the reason carefully and rectify any defect responsible.

(7) As soon as hydraulic fluid is observed to ooze out of the level plug hole, this indicates that the fluid content of the fork leg is correct, and the plugs can be replaced as referred to below.

(8) Replace the fluid level plug on the inner side of the fork leg slider. Do not forget to fit the fibre washer before tightening the plug with a screwdriver.

(9) Fit the plug to the top of the fork leg inner tube and firmly tighten with a spanner.

To Check Hydraulic Fluid Content (1948–9 "Teledraulics"). It is wise every 5000 miles to check the hydraulic fluid content of each front fork leg. Before beginning this check, it is necessary to see that your Matchless is quite vertical, with the front wheel raised clear of the floor. Remove the two hexagon-headed plugs shown at (*A*) in Fig. 2, from the tops of the fork leg inner tubes.

To determine the fluid content of each fork leg, remove the drain plug from the base of the fork leg slider and permit the hydraulic fluid to drain off into a graduated measuring flask or other vessel (graduated in fluid ounces). In normal circumstances 8–8½ fluid ounces of fluid will drain away in one operation.

Replace the drain plug in the base of the fork leg slider and subject the forks to shock and recoil action several times (i.e. work them up and down). Now remove the drain plug a second time and catch any further hydraulic fluid which may drain off into the graduated vessel already containing most of the fluid. It may be necessary to repeat the draining procedure (including working the forks up and down) three times to ensure that the maximum quantity of hydraulic fluid is drained off into the graduated vessel. Note the exact amount of fluid extracted. It is not possible to extract in this manner the whole content of each leg (10 fluid ounces), but the amount drained off and measured should total 9½ oz.

Topping-up Procedure (1948–9 "Teledraulics"). Checking hydraulic fluid content and topping-up the fork leg should be effected in one continuous operation. Deal with each fork leg separately. It is assumed that the fluid content of one leg has been ascertained. Then top-up as follows—

(1) If the total amount of hydraulic fluid extracted from the fork leg measures exactly 9½ fluid ounces, no topping-up is needed. If the amount is less than 9½ oz., add hydraulic fluid, of the type already in use, to the graduated vessel until the total fluid measures exactly 9½ oz.

(2) Replace the drain plug in the base of the fork leg slider.

(3) Pour the 9½ oz. of hydraulic fluid contained in the graduated vessel into the top of the fork inner tube.

(4) Verify that the fork leg is fully extended.

(5) Replace the hexagon-headed top plug (and washer), and firmly tighten the plug.

It is important to note that where 1948–9 "Teledraulic" front forks have been completely stripped down (necessarily incurring the removal of *all* hydraulic fluid), it is essential after assembly to top-up each fork leg with the full 10 oz., not 9½ oz. as mentioned above for the normal topping-up procedure.

CHAPTER V

CORRECT CARBURATION

Upon correct carburation, accompanied, of course, by a "fat" spark at the plug (see Chapter VI) depend the following: (*a*) good maximum speed with the throttle wide open, (*b*) lively acceleration without "flat spots" or misfiring, (*c*) ability to negotiate steep hills without overheating and "knocking," (*d*) economical running, (*e*) the maintenance of the engine in a cool and clean condition, (*f*) smooth slow-running, and (*g*) easy starting.

To obtain good performance, the mixture of air and atomized fuel entering the engine inlet port must *always* be kept in the right proportions (about 13 to 1). On the Matchless the responsibility for the "mixture" (to be taken once every two revs!) rests on an Amal carburettor.

The Amal Carburettor. The carburettor fitted as standard on Models G3/L and G/80 is a flange-fitted, vertical, needle-jet Amal, and its type No. is 76D/IJ and 89B/IAK respectively.

Control of the air slide is by means of a handlebar lever, and control of the throttle slide by a twist-grip (see Fig. 2). The action of the Amal carburettor is semi-automatic, the air control lever being closed only to facilitate starting. At all other times it is kept wide open. External adjuster screws are provided for slow-running and throttle stop adjustment. The essential details of the Amal carburettor are shown in Figs. 27 and 28, and below is an outline of how the carburettor functions.

ACTION OF AMAL CARBURETTOR

An understanding of the design and action of the Amal carburettor is desirable before considering its tuning and maintenance. Referring to Fig. 20 showing a sectional view of the Amal semi-automatic carburettor, *A* is the carburettor body or mixing chamber, the upper part of which has a throttle valve *B*, with taper needle *C* attached by the needle clip. The throttle valve regulates the quantity of mixture supplied to the engine. Passing through the throttle valve is the air valve *D*, independently operated and serving the purpose of obstructing the main air passage for starting and mixture regulation. Fixed to the underside of the mixing chamber by the union nut *E* is the jet block *F*, and interposed between them is a fibre washer to ensure a petrol-tight joint.

On the upper part of the block is the jet block barrel *H*, forming a clean through-way. Integral with the jet block is the pilot jet *J*, supplied through the passage *K*. The adjustable pilot air

intake *L* communicates with a chamber, from which issues the pilot outlet *M* and the by-pass *N*. A throttle stop (see Fig. 28)

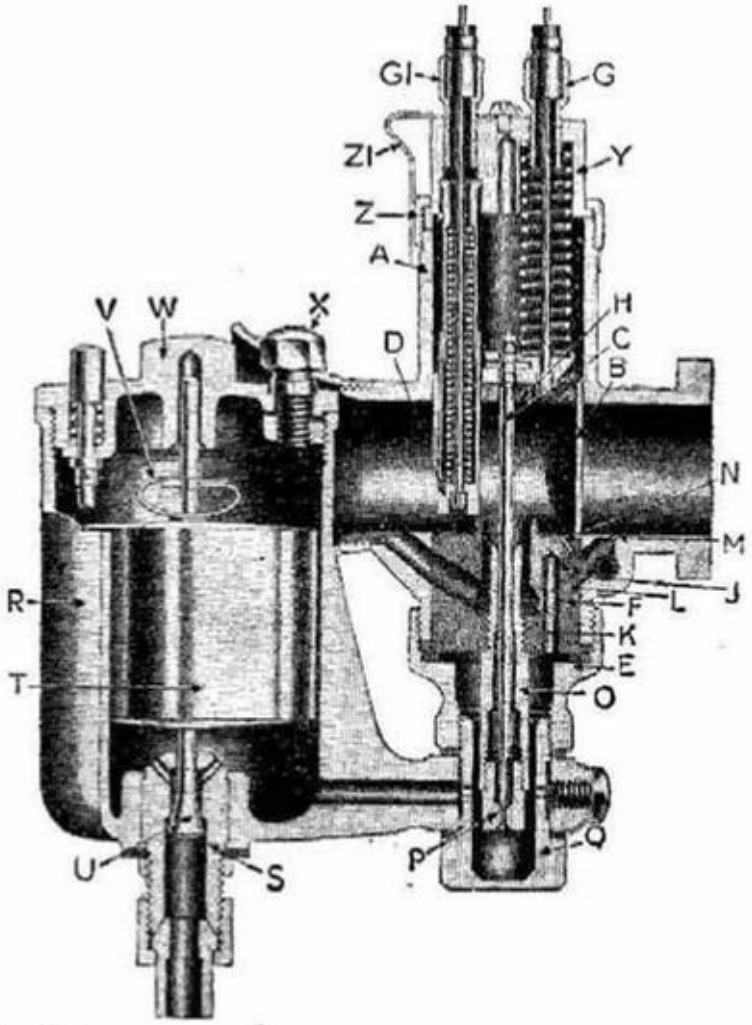

FIG. 27. SECTIONAL VIEW OF AMAL NEEDLE-JET SEMI-AUTOMATIC CARBURETTOR FITTED TO ALL "CLUBMAN" MODELS

is provided on the mixing chamber, by which the position of the throttle valve for tick-over is regulated independently of the cable adjustment.

The needle jet *O* is screwed in the underside of the jet block, and carries at its bottom end the main jet *P*. Both these jets are removable when the jet plug *Q*, which bolts the mixing chamber

and the float chamber together, is removed. The float chamber, which has bottom feed, consists of a cup *R* supplied with petrol by union *S*. It contains the float *T* and the needle valve *U* attached by the clip *V*. The float chamber cover *W* has a lock screw *X* for security.

The petrol tap having been turned on, petrol will flow past the needle valve *U* until the quantity of petrol in the chamber *R* is sufficient to raise the float *T*, when the needle valve *U* will prevent a further supply entering the float chamber until some in the chamber has already been used up by the engine. The float chamber having filled to its correct level, the fuel passes along the passages through the diagonal holes in the jet plug *Q*, when it will be in communication with the main jet *P* and the pilot feed hole *K*; the level in these jets being, obviously, the same as that maintained in the float chamber.

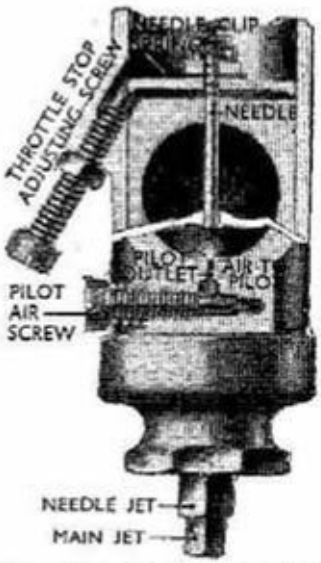

FIG. 28. THROTTLE STOP AND PILOT AIR SCREW

Imagine the throttle valve *B* very slightly open. As the piston descends, a partial vacuum is created in the carburettor, causing a rush of air through the pilot air hole *L* and drawing fuel from the pilot jet *J*. The mixture of air and fuel is admitted to the engine through the pilot outlet *M*. The quantity of mixture capable of being passed by the pilot outlet *M* is insufficient to run the engine. This mixture also carries excess of fuel. Consequently, before a combustible mixture is admitted, throttle valve *B* must be slightly raised, admitting a further supply of air from the main air intake.

The farther the throttle valve is opened, the less will be the depression on the outlet *M*, but, in turn, a higher depression will be created on the by-pass *N*, and the pilot mixture will flow from this passage as well as from the outlet *M*.

The mixture supplied by the pilot and by-pass system is supplemented at about one-eighth throttle by fuel from the main jet *P*, the throttle valve cut-away determining the mixture strength from here to one-quarter throttle. Proceeding up the throttle range, mixture control by the needle position occurs from one-quarter to three-quarters throttle, and from this point the main jet is the only regulation.

The air valve *D*, which is cable-operated on the two-lever carburettor, has the effect of obstructing the main through-way

and, in consequence, increasing the depression on the main jet, enriching the mixture. Two cable adjusters *G*, *G1*, are provided.

Throttle Stop Screw. The throttle stop adjusting screw (shown in Fig. 28) is normally adjusted so as to prop the throttle slide open sufficiently to enable the engine to tick-over when the throttle twist-grip is completely closed.

Pilot Air Screw. This controls the suction imposed on the pilot jet by metering the volume of air which mixes with the fuel. It controls the strength of the mixture for "idling" and also for initial throttle openings. On Matchless machines the air for the pilot jet is admitted externally.

Main Jet. This regulates the fuel supply at throttle openings exceeding three-quarters full open. At smaller openings of the throttle, the fuel supplied passes through the main jet, but the amount is decreased due to the needle in the needle jet having a metering effect. The main jet is screwed into the needle jet and can readily be detached after removing the jet plug shown at *Q* in Fig. 27. Referring to Fig. 28, to remove the main jet, hold the needle jet with one spanner, and with another unscrew the main jet.

Each Amal main jet is numbered and calibrated so that its precise discharge is known. It thus follows that any two main jets having the same number are identical in all respects. The larger the jet, the higher is its number. If a larger size jet is needed, on no account attempt to ream the existing jet, but obtain a new one of larger size.

Needle and Needle Jet. The needle is attached to and moves with the throttle slide. Being tapered, it therefore permits more or less fuel to pass through the needle jet as the throttle is opened or closed respectively. This applies throughout the range of throttle openings, except at nearly full throttle and when "idling." The needle jet is of a specified size, and normally it should not be changed except when going over to alcohol fuels.

As may be seen in Fig. 28, the position of the taper needle relative to the throttle opening can be adjusted according to the mixture required by securing the needle to the throttle with the needle spring clip in a particular groove, several of which are provided. Position No. 3, for example, means the third groove *from the top* At throttle openings from one-quarter to three-quarters open, raising the needle enriches the mixture, while lowering the needle weakens it.

Throttle Valve Cut-away. The throttle on the atmospheric side is cut-away, and this affects the depression on the main fuel supply. The cut-away provides a means of tuning between the pilot and needle jet range of throttle opening. The actual amount of cut-away is denoted by a number marked on the throttle slide. Thus 6/4 means a throttle type 6 with a No. 4 cut-away. A

throttle with a larger cut-away (say, 6/5) weakens the mixture. Conversely, a smaller cut-away enriches the mixture.

TUNING AMAL CARBURETTOR

All Matchless machines leave the Plumstead factory with their carburettors carefully tuned by experts, and it is generally undesirable to tamper with the maker's setting. Occasionally more power and better results can be obtained by using a slightly larger size main jet, or by effecting other adjustments. An adjustment should not be made, however, without *very* good reason.

Note the Exhaust. If carburation is correct, no trace of black smoke is visible at the exhaust. Combustion is complete and carbon formation almost non-existent. Also where the mixture is right, the exhaust flame is of a *whitish-blue* colour.

If the mixture tends to be weak, the colour of the exhaust flame is *light blue*. If, on the other hand, the mixture is excessively rich, the flame is of a characteristic *yellow* colour, and some *black* smoke is generally present. Note that the above references to exhaust flames imply exhaust flames as observed at an *open* exhaust port.

Is Mixture Weak? An excessively weak mixture is usually accompanied by (*a*) a generally sluggish engine, (*b*) some popping-back into the carburettor, (*c*) a tendency to overheat and "knock," (*d*) occasional misfiring, (*e*) bad slow-running, (*f*) some hesitation in picking-up, which is removed on closing the air lever slightly. A weak mixture, besides giving poor performance, is likely to burn the exhaust valve owing to slow combustion. Possible causes of a weak mixture are as follows—

(1) Air leakage caused by worn carburettor slides or a worn inlet valve guide.

(2) Air leakage due to a poor joint at the flange fixing of the carburettor.

(3) Incorrect tuning of the Amal carburettor.

(4) Badly adjusted or sticking carburettor controls.

(5) A stoppage in the fuel pipe to the float chamber.

(6) A sticking float chamber needle, or incorrect attachment of the float on the needle (rather unlikely).

(7) A choked jet or filter.

(8) Weak engine compression due to badly seating valves, or worn piston rings, worn cylinder, faulty cylinder head joint, etc.

(9) An air lock in the fuel supply system.

It is fairly easy by a process of elimination to check whether a weak mixture is caused by a fault other than incorrect carburettor adjustment. For instance, engine compression can be tested by operating the kick-starter with the air lever wide open.

Similarly, the state of the inlet valve can be determined by feeling whether it is slack in its guide. To check the fuel pipe, remove and blow through it. Normally it is unwise to meddle with the adjustment of the float chamber needle.

Is Mixture Rich? An excessively rich mixture, though sometimes providing good power at high speeds, is generally accompanied by (*a*) black smoke at the exhaust, (*b*) sluggish running, (*c*) heavy fuel consumption, (*d*) a tendency for eight-stroking,

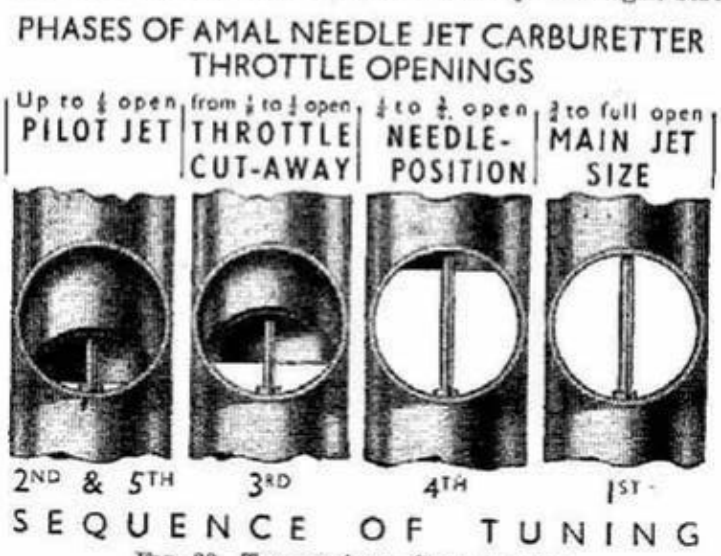

FIG. 29. TUNING AMAL CARBURETTOR

(*e*) some misfiring at moderate and low speeds, (*f*) a tendency for the engine to choke when the air lever is closed slightly, and (*g*) an engine which rapidly carbonizes, so causing a further decline in power output and an increasing tendency to "knock" under slight provocation. Possible causes for some or all of the above symptoms are enumerated below—

(1) "Flooding "of the carburettor due to a punctured float, a bent or worn float needle, a defective needle seating, grit between the needle and the valve seating, or to too high a level of fuel at the jet orifice (about $\frac{1}{16}$ in. below the orifice is normal).

(2) Badly adjusted or sticking carburettor controls.

(3) Incorrect Amal carburettor tuning.

Flooding of the carburettor can be dangerous (see page 4) and must be rectified at once. But do not mistake real flooding for a leaky union below the float chamber, caused through insufficient tightening of the union nut. A leakage of this kind is apt to cause a weak mixture rather than an over-rich one.

Tuning Procedure. Should the setting of the Amal carburettor not give entire satisfaction for particular requirements, there are four separate ways of rectifying matters as given herewith, and the adjustments should be made in this order: (*a*) Main jet ($\frac{3}{4}$ to full throttle); (*b*) pilot air adjustment (closed to $\frac{1}{8}$ throttle); (*c*) throttle valve cut-away on the air intake side ($\frac{1}{8}$ to $\frac{1}{4}$ throttle); and (*d*) needle position ($\frac{1}{4}$ to $\frac{3}{4}$ throttle). The diagram (Fig. 29) clearly indicates the part of the throttle range over which each adjustment is effective.

The Amal carburettor is throughout the throttle range entirely automatic, and the air lever should be kept wide open, except for starting and until the engine has warmed up properly. It is assumed that normal petrol is used for tuning, which should be done in the sequence described below. Throttle openings to be used in the five tuning operations are those indicated in Fig. 29. By following these tuning instructions (recommended by Messrs. Amal, Ltd.) you will be assured of obtaining the most satisfactory performance with maximum economy of fuel. For tuning purposes it is advisable to get your Matchless started up on a quiet road having a slight up gradient, so as to impose a small load on the engine.

1. Checking Size of Main Jet. Accelerate up to full throttle and carefully note the response of the engine to twist-grip action.

AMAL CARBURETTOR SETTINGS FOR 1945–50 SINGLES

Model	Carburettor	Main Jet	Taper Needle	Needle Position	Throttle Valve
350 c.c. O.H.V.	. 76D/IJ	150	T-6-Std.	3	6/4
500 c.c. O.H.V.	. 89B/IAK	180	T-29-Std.	2	29/4

Should power output appear better with the air lever very slightly closed or with the throttle not completely open, this indicates that the main jet is too small, and the next larger size should be tried. Similarly, if there is a tendency for the engine to run "heavily" on full throttle, this denotes that the main jet is too large and the next smaller size should be experimented with.[1]

If tuning for speed, be careful to choose a main jet of size sufficient to maintain the engine in a cool condition. Make a run at high speed, pull up, and stop the engine immediately. Remove

[1] Different size jets are obtainable from Matchless spares stockists, or from Messrs. Amal, Ltd., Holford Works, Perry Barr, Birmingham, 20.

the sparking plug and closely inspect it. If the business end of the plug is sooty, the mixture is too rich. Should the body be dry grey in colour, the mixture is on the weak side, and a larger size jet is required. With a properly proportioned mixture, the plug body should have a bright black appearance. Also, when running, observe the sound of the exhaust; it should be crisp and have no trace of "woolliness." Black smoke at the exhaust shows that the mixture is much too rich.

2. Pilot Jet Adjustment. Allow the engine to idle at an excessive speed, with the twist-grip closed and the throttle slide abutting the throttle stop screw. The ignition lever should be set to obtain the best slow running.

Loosen the nut on the throttle stop adjusting screw, and unscrew the latter until the engine slows up and begins to stall. Then screw the pilot air screw in or out as required to enable the engine to run regularly and faster.

Next, gently lower the throttle stop screw until the engine again begins to falter. Now lock the throttle stop adjusting screw with the lock-nut and commence to readjust the pilot air screw to obtain the optimum slow-running. Should this second adjustment cause the engine to tick-over at an excessive speed, repeat the adjustment a third time. When perfect slow-running has been obtained, tighten the lock-nut on the throttle stop screw without disturbing the position of the screw.

3. The Throttle Cut-away. Should appreciable spitting-back at the carburettor occur on accelerating from rest with the engine idling, stop the machine and slightly enrich the mixture by screwing the pilot air screw in approximately *half a turn.* If this does not effect the desired result, screw it back to its former position and fit a throttle slide having a smaller cut-away.

If there is no spitting-back but the engine jerks under load, this shows an over rich mixture, and the remedy is to fit a throttle slide with larger cut-away, or else to lower the throttle needle.

4. Position of Needle. The tapered needle influences a wide range of throttle openings and affects acceleration. Check performance with the needle in as low a position as possible, i.e. with the clip in the groove nearest the end of the needle. If acceleration of your Matchless declines, and improves by partially closing the air lever, raise the position of the needle by two grooves. If a marked improvement is thereby obtained, try the effect of lowering the needle, by one groove, and leave it in the position where the best performance is obtained.

It should be noted that if the mixture is still excessively rich with the needle clip in groove No. 1 (nearest the end), wear of the needle jet has probably occurred and renewal of the jet is called for. The needle itself is of stainless steel and wear does not take place, even after a big mileage.

5. Check over Idling Adjustment. Also make any final small adjustment which is required to obtain perfectly smooth tick-over, neither too fast nor too slow.

Pilot Jet Obstruction. If the pilot jet adjustment does not obtain the desired results and the engine will not idle nicely with the throttle almost closed, the air lever three-quarters open, and the ignition lever about two-thirds advanced, it is possible that the pilot jet is obstructed. The jet passage, actually a duct drilled in the jet block, is very small and can easily become choked.

To gain access to the pilot jet, remove the jet plug and the float chamber (see Fig. 27), and then detach the jet block by pushing it out of the mixing chamber. The pilot jet can then be cleared by means of a fine strand of wire.

If Slow-running is Bad. If it is found impossible to obtain good slow-running by making the pilot air adjustment as described in the second operation on page 50, it is probable that some defect other than carburation is responsible for preventing the engine running slowly at low revolutions. Air leaks are a possible cause which should be looked for (see page 47). Badly-seating valves will also weaken the mixture. Defects in the ignition system may also be responsible for poor tick-over. The sparking plug may be oily, or the points set too close (see page 57). Possibly the spark is excessively advanced or the contact-breaker needs attention (see page 64). Examine the slip ring for oil and see that the pick-up brush is bedding down and in good condition. Also examine the H.T. cable for signs of shorting.

If Consumption of Fuel is Excessive. If in spite of careful checking up on the tuning of the carburettor, high fuel consumption continues, it is likely that one or more of the under-mentioned causes is responsible for wastage of precious fuel. Late ignition timing will eat into your petrol supplies quickly. The same applies to poor engine compression due to badly fitting piston rings or valves. Also take into consideration the question of flooding due to a faulty float, air leakage at the joint between the carburettor and engine, weak valve springs. See that no wastage is caused by slack petrol pipe union nuts.

Adjusting Matchless Twist-grip. Adjustment should be such that the grip is free and easy to twist, but "stays put." The spring tension on the twist-grip rotating sleeve is regulated by a screw incorporated in one-half of the twist-grip body. To increase the tension, loosen the lock-nut and screw the screw into the body as required.

It is possible to move the complete twist-grip on the handlebars by slackening the two screws which clamp it in position.

The best position of the twist-grip is that which gives the cleanest and straightest path to the throttle cable between the handlebars and the under side of the petrol tank. Should a new cable have to be fitted, do not forget to grease it with a graphite lubricant.

MAINTENANCE OF AMAL CARBURETTOR

To ensure correct carburation it is advisable occasionally to remove the carburettor from the engine, strip it down completely, and then thoroughly clean it. It is a good plan to do this about every three months as described below.

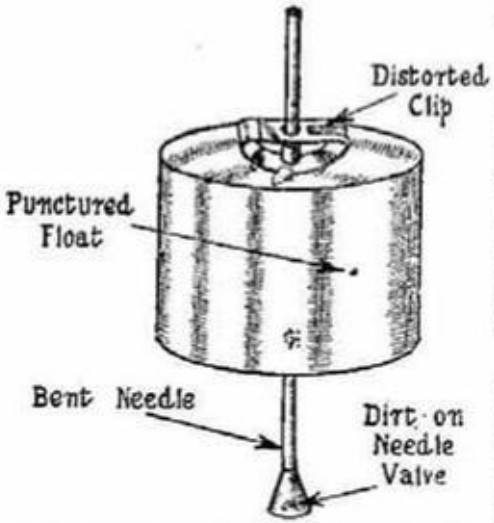

FIG. 30. IF PERSISTENT "FLOODING" OCCURS, LOOK FOR THESE DEFECTS

Stripping Down the Amal. First detach petrol feed pipe. Unscrew the jet plug *Q* (see Fig. 27) and remove float chamber complete. With box or set spanner, slacken the mixing chamber union nut *E*. Mixing chamber complete may now be removed from engine.

To remove chamber undo the two nuts holding the carburettor flange. Unscrew mixing chamber lock ring *Z* (held by clip *Z*1), and pull out throttle valve, needle, and air valve. Remove main jet *P* and needle jet *O*. Mixing chamber union nut *E* may then be removed and jet block completely pushed out. If this is obstinate, tap gently, using a wooden stump inside the mixing chamber. Unscrew float chamber cover *W*, after slackening lock screw *X*. Withdraw the float by pinching the clip *V* inwards, and pull gently upwards.

Cleaning Carburettor. Wash all components thoroughly clean with petrol. Pay special attention to the float chamber, and see that any impurities collected inside are removed completely.

Inspection of Components. If the Amal carburettor has been in continuous service for a considerable period, it is advisable to inspect the following components carefully—

(*a*) FLOAT CHAMBER. Scrutinize the float chamber components closely. Polish the valve part of the float needle by rotating the needle in its seat while pulling it vertically upwards. If a distinct shoulder is visible on the needle where it seats, renew the needle immediately. Examine the needle for signs of bending.

(*b*) THROTTLE VALVE. Test in mixing chamber, and if excessive play is present it is advisable to renew this without delay.

(*c*) THROTTLE NEEDLE CLIP. This part must securely grip needle. *Free rotation must not take place*, otherwise the needle groove will become worn and necessitate a new part being fitted. *Be sure to refit the clip in the same groove.*

(*d*) JET BLOCK. If trouble has been experienced with erratic "idling," ascertain by means of a fine bristle that the pilot jet *J* (see Fig. 27) is clear, and that the pilot outlet *M* in the mixing chamber is unobstructed.

To Assemble Carburettor. Referring to Fig. 27, refit jet block *F* with washer on underside, and screw on lightly mixing chamber union nut *E*. Screw in needle jet *O* and main jet *P*. Open air lever $\frac{7}{8}$ in., throttle lever half-way; grasp the air slide between the thumb and the finger; *make sure that the needle enters the central hole in the barrel H*. Slightly twist the throttle valve until it enters the barrel guide, when on pushing down the valves the air valve should enter its guide. If not, slightly move the mixing chamber *Y*, when the air valve will slide into place. Screw on mixing chamber lock ring *Z*. *No brute force is necessary.*

Attach carburettor to the cylinder, pushing right home, and examine washer if flange fitting. Insert the jet plug *Q*, and thoroughly tighten union nut *E* by means of a fixed spanner. Refit float and needle, holding the needle head against its seating by means of a pencil until the float and the clip *V* are slipped into position. Make sure that the clip enters the groove provided. Screw on the cover tightly and lock in position by means of the lock screw *X*. The float-chamber jet plug *Q* has one washer above the one beneath the lug. Screw the jet plug into mixing chamber and lock securely. Clean petrol pipe and filter if fitted and replace. It will be necessary to re-check the pilot setting if this has been disturbed.

Needle Jet Wear. The needle itself does *not* become worn. Should the mixture be still too rich with the clip in No. 1 groove (nearest the end), it is probable that the needle jet requires replacement due to wear. This is assuming that the carburettor has been correctly tuned and that no flooding is taking place.

When Laying-up Your Matchless. Drain off all petrol from the carburettor. If the period of "cold storage" is expected to be prolonged, it is advisable to drain the petrol tank and fill it to the brim with clean engine oil. On putting the machine into commission again, drain off the oil and make use of it.

Smear all bright steel parts of the carburettor, including the float chamber needle and throttle taper needle, with some vaseline. Lubricate the control cables thoroughly with engine oil and smear the levers themselves with petroleum jelly.

CHAPTER VI

PREVENTING IGNITION TROUBLE

MAGNETO ignition is provided on all Matchless "Clubman" models and the sole items comprising the ignition system are: (*a*) the sparking plug, (*b*) the magneto, and (*c*) the H.T. lead from the magneto to the plug. The purpose of this chapter is to tell you how to keep these three items effectively operational.

THE SPARKING PLUG

Suitable Type Plugs. If ignition trouble is to be avoided, it is essential to fit a good sparking plug of the correct type. Inferior plugs will not stand up to the high temperatures involved (about 1500 deg. Fahrenheit at insulation tip) and will not enable the engine to give its best performance.

The Matchless "Clubman" engines (G3/L and G/80) require 14 mm. sparking plugs with a ½ in. reach. Three very reliable and efficient makes of plugs are the Lodge, Champion, and K.L.G. These plugs (see Fig. 31) have "Sintox," improved "Ceramic," and "Corundite" insulation respectively. These excellent forms of insulation have been developed largely through the exacting requirements of plugs for combat aircraft. They are designed to withstand great heat, have high thermal conductivity, and are impervious to attack by fuel deposits. Where the above-mentioned sparking plugs are used, the correct types to fit are as specified below.

LODGE—Fit a three point, detachable type HI4, or a single-point, detachable type HI4S. The former is very suitable for the 1948–9 O.H.V. engines.

CHAMPION—Fit a single-point non-detachable type L–10 or L–IOS on 350 c.c. and 500 c.c. O.H.V. engines respectively.

K.L.G.—Fit a single-point, detachable type F70.

Sparking Plug Troubles. Most ignition trouble is caused by some sparking plug defect which can easily be remedied by cleaning and adjusting the plug, or renewing it where its condition is very bad. If the condition of the plug is such that *no* spark occurs, obviously the engine will refuse to start, or stops completely. If, on the other hand, its condition is such that only a weak spark is available, the result is a poor power output, some intermittent misfiring, irregular slow-running, and difficult starting.

Where a sparking plug is suspected to be at fault, remove it with (H.T. lead attached) and place it on the cylinder head with the terminal clear of the head. Then turn the engine over sharply

with the kick-starter and note whether the spark is good and regular. In broad daylight it is not very visible, but it should be possible to hear a distinct "click." An alternative method of testing the plug (without removing it) is to use a pencil-type neon-tube tester which indicates good sparks by violet coloured flashes.

If no spark, or only a weak spark, occurs at the plug points, and

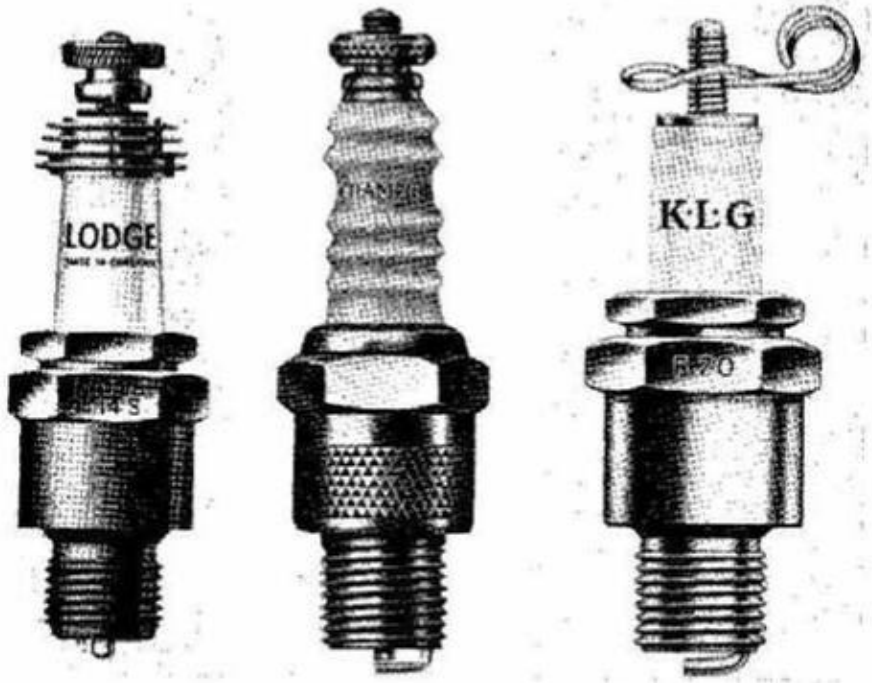

FIG. 31. ANY OF THESE PLUGS WILL GIVE GOOD RESULTS
From left to right are shown: the Lodge HI4S, the Champion L-10S, and the K.L.G. F70.

the H.T. current is O.K. at the plug end of the H.T. lead (see page 66), inspect the plug and give it a thorough overhaul. One or more of the faults dealt with in paragraphs (1) to (8) may be present, and the appropriate action must then be taken.

Colour of Plug Insulation. When a sparking plug is removed from the engine, the colour of its insulation should be noted. If the colour is *light brown*, the plug is probably running at the correct temperature. If on the other hand, the colour is *dull black* or *ashy white*, it is almost certain that the plug is subjected to insufficient or excessive heat respectively. An incorrect running

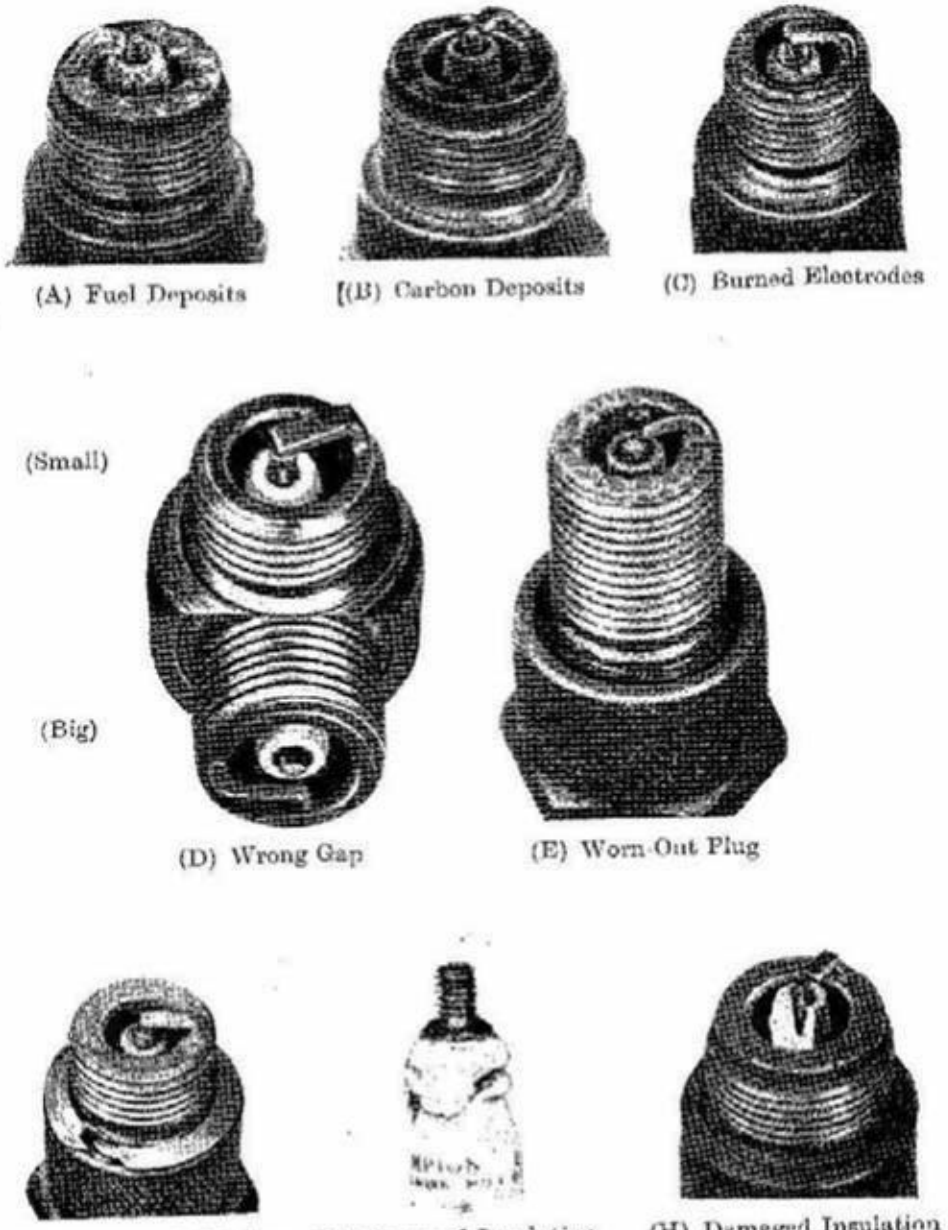

FIG. 32. LOOK FOR THESE FAULTS WHEN INSPECTING THE PLUG
(Champion Sparking Plug Co., Ltd.)

temperature may be associated with incorrect lubrication, carburation, or ignition.

1. Oiling-up. Inspect the plug for signs of oiling-up, usually accompanied by the presence of considerable carbon deposits. If the plug is dirty and moist with engine oil, thoroughly clean it. Where persistent oiling-up occurs at short intervals, the cause must be ascertained and rectified. Possible causes of the trouble are: an excessive oil supply to the inlet valve stem (see page 30); gummed-up, badly fitted, or worn piston rings; or a worn cylinder and/or piston. On a new engine some oiling-up of the plug (due to oil passing the rings) is quite normal during the running-in period. This cannot be rectified.

2. Fuel Deposits. During inspection of the plug, light-coloured fuel deposits of the type shown at *A* in Fig. 32 may be noticed. If you have been running on an "anti-knocking" fuel containing "lead" (not advised), the fuel deposits may be *yellowish* in colour. All fuel deposits are harmless unless accompanied by oiling-up or a generally bad condition of the plug. They should, however, be removed by thorough cleaning.

3. Carbon Deposits. Examine the plug carefully for carbon deposits, as these are likely to interfere with the correct functioning of the plug. Such deposits, where due to fouling by the mixture in the combustion chamber, are *dull black* and sooty as shown at *B* in Fig. 32, but where caused by oil fouling they are *shiny black*, hard and often wet. A combination may occur. Slight carbon deposits are found on most plugs at inspection, and they should be removed by cleaning the plug thoroughly.

A tendency for heavy carbon deposits to form quickly should be rectified by weakening the mixture (see page 48) if due to fouling by an over-rich mixture, or by taking steps to prevent oiling-up if caused by oil fouling. An incorrect gap at the plug points or contact-breaker may cause some misfiring, which expedites carbon formation. Therefore if considerable carbon deposits are present, check the gaps as described on pages 59 and 64.

4. Burned Electrodes. Inspect the electrodes of the plug. These may be in a badly burned condition as shown at *C* in Fig. 32. If they are, it is generally necessary to scrap the plug and fit a good heat-resisting plug of the type suited to the engine (see page 54).

Where burning of the electrodes is noticeable, verify that the mixture supplied by the carburettor is correct, and that the engine is not overheating for some reason. Also check that the gap of the new plug is not too small, as this tends to burn up the electrodes. Some blistering of the centre electrode insulation is often associated with burned electrodes.

5. Wrong Gap. When a plug is removed for inspection and cleaning, always check the gap between its points (or electrodes,

as they are correctly termed). A wrong gap as shown at *D* in Fig. 32 is detrimental to easy starting and good slow-running, and is likely to cause misfiring and indifferent general performance.

It should be noted that an excessive gap can impose an electrical stress on the magneto, caused by the generation of an excessive voltage. It may also induce a tendency for pre-ignition to occur, due to overheating of the tip of the centre electrode. Where the gap between the plug points is outside the limits 0·020 in.–0·025 in., effect the necessary adjustment as described on page 59.

6. Worn-out Plug. If the inspection of the plug shows it to be in the condition illustrated at *E* in Fig. 32, put it in the nearest dustbin, not in the cylinder head! Fit a new plug of good make and of the correct type (see page 54). A plug may be regarded as worn-out when carbon deposits have burned into the insulator surface and have crusted the inside of the plug body.

On a worn-out plug the electrodes are usually pitted, corroded and honeycombed to such an extent that efficient sparking is no longer possible. The spark ceases to jump the points and takes a short cut across the surface of the insulator—in other words a short circuit occurs.

7. Damaged Washer. Inspect the condition of the small copper washer fitted between the plug body and the cylinder head. This washer must be perfect, as it is responsible for maintaining compression. If there are any signs of "blowing" or if the washer is in the condition shown at *F* in Fig. 32, renew it forthwith.

When the plug is being tightened with a spanner, the copper washer often moves and does not assume a true concentric position, with the result that damage occurs. To prevent damage, slide the washer into its proper position before finally tightening-down the plug. If the washer has become flattened and hard, it loses its conductivity and should be renewed.

8. Damaged Insulation. The insulation of the modern plug will stand a lot of heat and ill-treatment, but it has its breaking point. Inspect the external insulation of the plug and also the insulation of the centre electrode for cracks and damage. If a fault is found it is advisable to renew the plug immediately.

Two typical examples of damaged insulation are shown in Fig. 32. That shown at *G* has been caused by careless application of a spanner during plug removal. It can be prevented by using only the box spanner shown at 6 in Fig. 54 when removing and fitting the plug. The type of damage shown at *H* can be caused by excessive overheating of the engine, or by making an attempt to bend the centre electrode instead of the outer electrode when re-gapping the sparking plug. Make sure that the plug insulation is quite clean, or shorting may occur. Also see that the plug terminal is secure when the plug is fitted.

Checking Gap at Plug Points. Although made of high grade alloy, the plug points gradually burn and wear away under chemical action, the intense heat of combustion, and ceaseless electrical discharges. Thus automatically the gap between the points gradually increases.

Remove the sparking plug about every 2500 miles (or whenever ignition trouble develops) for inspection, cleaning, and re-gapping

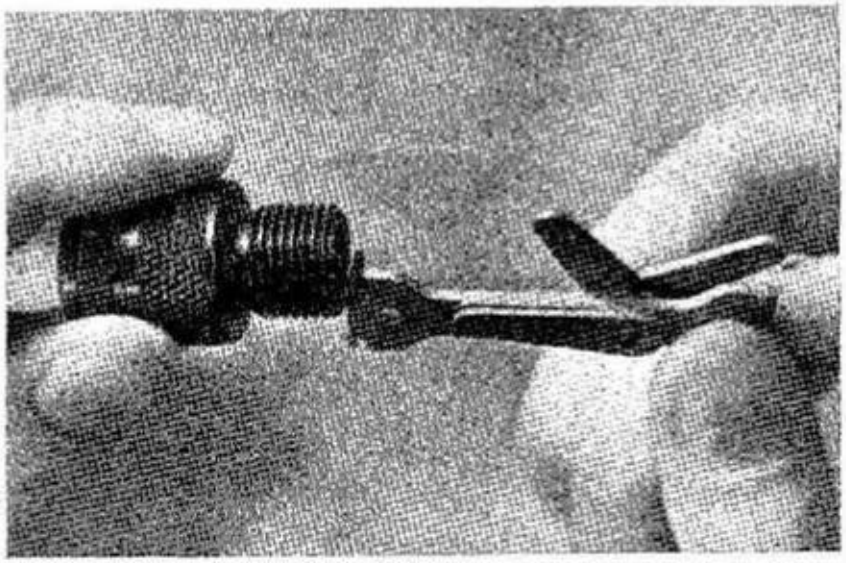

FIG. 33. ADJUSTING GAP OF A CHAMPION PLUG

The gap has been checked with the protruding "feeler" and found too big. It is shown being re-set by bending inwards the outer electrode by means of the notch in the body of the Champion combined feeler gauge and re-gapping tool.

(Champion Sparking Plug Co., Ltd.)

of the points where this is called for. Check the gap between the centre (insulated) electrode and the outer electrode(s) with a suitable feeler gauge such as can be obtained from the plug manufacturer[1] or from most accessory firms (see page 88). The correct gap is 0·018 in.–0·020 in.

If the plug gap is found to be incorrect, re-gap the plug *after* cleaning the plug and its electrodes (see page 60). When re-gapping the plug, be sure to *press* (not knock) inwards the *outer* electrode(s). On no account attempt to bend the centre electrode, or its insulation may look like that shown at *H* in Fig. 32!

Fig. 33 shows the "L"-shaped outer electrode of a Champion

[1] The makers of Lodge, Champion, and K.L.G. plugs are: Lodge Plugs, Ltd., Rugby; Champion Sparking Plug Co., Ltd., Feltham, Middlesex; and Smiths Motor Accessories, Ltd., Cricklewood Works, London, N.W.2.

sparking plug being pressed inwards by means of the Champion tool supplied for checking and adjusting the gap between the points.

Cleaning the Plug Quickly. If, on inspection, the sparking plug seems to be reasonably clean, it is sufficient to clean it quickly without taking it to pieces. Champion plugs as recommended for Matchless machines are not of the detachable type. Frequent quick cleaning of the plug is advised. Thorough cleaning (see below) can be undertaken at much longer intervals, unless, of course, some fault is causing carbon deposits to form rapidly. In this case the fault should be investigated.

To clean the sparking plug quickly, scrape the electrode points

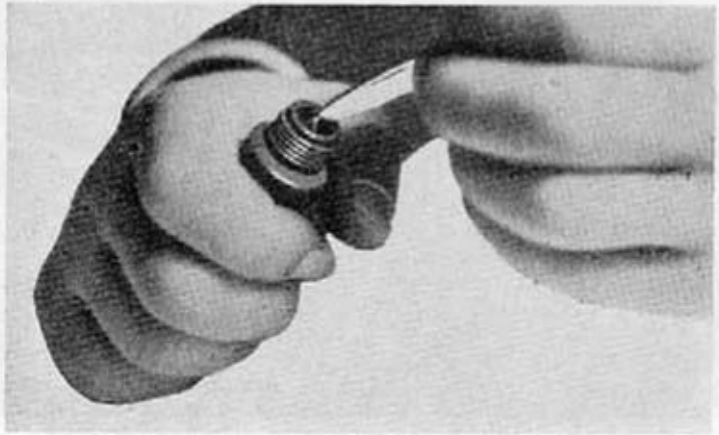

FIG. 34. QUICK CLEANING WITH A POCKET-KNIFE
A surprising improvement in engine performance is often obtained by brightening up the electrodes.

lightly with a sharp pocket-knife as shown in Fig. 34. It is inadvisable to do this, however, if by any chance the plug concerned has *platinum* alloy points (e.g. the Lodge HNP). A satisfactory method of cleaning the inside of the plug quickly is to use a proprietary plug-cleaner, a popular type of which comprises a metal reservoir containing loose steel wires and petrol.

To use the above-mentioned type of plug-cleaner, screw the plug into the reservoir and shake it vigorously. This action should remove all superficial carbon deposits. Wipe clean the outside of the plug with a rag moistened with petrol. If no plug-cleaner is available, use a suitable fine wire brush.

Cleaning the Plug Thoroughly (Lodge and K.L.G.). About every 2500 miles (or if trouble occurs) a detachable type plug should be dismantled, inspected and thoroughly cleaned. Fig. 35 shows a K.L.G. type F70 plug stripped for this purpose. To

dismantle the plug, hold the hexagon *A* of the plug body in a vice or spanner. If a vice is used, be careful not to squeeze the hexagon between the jaws. Then, with another spanner, unscrew the gland nut *B*. The insulated centre electrode *C* can now be detached.

An alternative and safer method of dismantling a detachable type sparking plug is to use the K.L.G. dismantling tool shown in Fig. 36. To dismantle a sparking plug with this tool, insert the plug upside down as illustrated, so that the hexagons of the gland nut and body of the plug engage the corresponding hexagons in the centres of the two discs of the tool. It will be found that the holes in the discs do not register exactly.

To loosen the gland nut of the plug with the K.L.G. tool, now

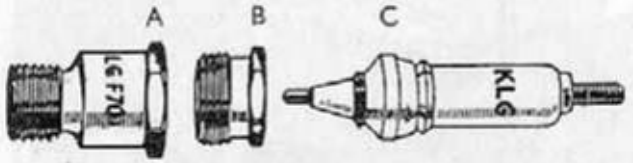

FIG. 35. DETACHABLE TYPE PLUG DISMANTLED FOR THOROUGH CLEANING

apply the tommy-bar (shown in the right hand) to the holes which are out of register, and lever the tommy-bar against the *fixed* disc. This will force the other disc round and thereby loosen the gland nut. To tighten the plug it is only necessary to lever the tommy-bar in the appropriate direction. The tool holder comprises a box spanner which can be used to remove or fit the plug in the engine.

Scrape off all carbon deposits from the metal parts with a small knife, and afterwards rinse the parts in petrol. Do not, however, attempt to scrape the "Sintox" or "Corundite" insulation used on Lodge and K.L.G. plugs respectively.

If the insulation is covered with soft carbon or oil, wash it thoroughly with petrol or paraffin. Afterwards remove all carbon deposits with fairly coarse emery cloth and again wash in petrol or paraffin. Polish the electrode points with some *fine* emery cloth, and reassemble the plug.

When assembling the plug, make sure that there is no grit or dirt lodged between the body of the plug and the insulator of the centre electrode. Also smear a little *thin* oil on the internal washer and make certain that the washer seats correctly, otherwise a gas-tight seal will not be obtained. Be very careful not to over-tighten the gland nut *B*. Afterwards, verify the gap at the plug points (see page 59).

Cleaning Champion Sparking Plugs. Champion sparking plugs suitable for Matchless engines are of the non-detachable type and cannot be dismantled and cleaned in the same manner as Lodge

and K.L.G. plugs just described. The same procedure, however, can be used for quick cleaning (see page 60).

With the engine in normal condition it should be sufficient to clean the plug thoroughly and inspect it about every 2500 miles. Undoubtedly the best method of thoroughly cleaning a Champion plug, is to take it to the nearest garage equipped with a Champion Service Unit. The plug can then be thoroughly cleaned of all deposits, washed, subjected to a high pressure air line, and after-

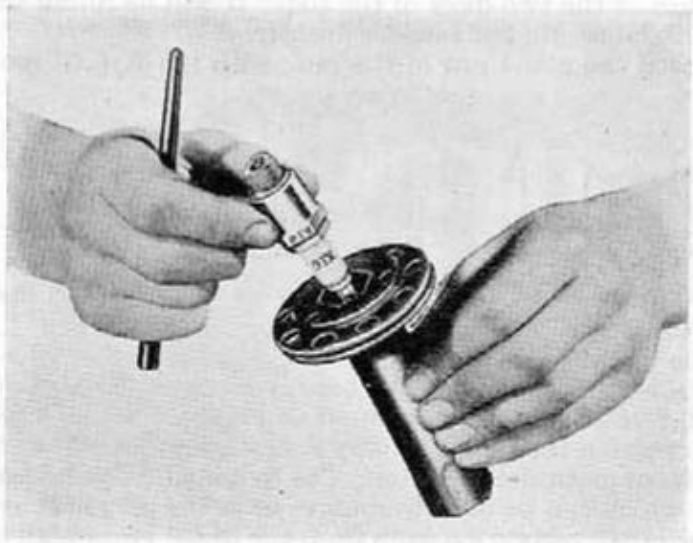

FIG. 36. USING K.L.G. TOOL TO DISMANTLE PLUG
The use of this convenient tool is explained in the text.

wards tested for sparking on the Champion machine at an air pressure of over 100 lb. per sq. in. The whole cleaning and testing procedure takes but a few minutes.

Should you decide to clean a non-detachable plug yourself, the simplest method is to remove the plug from the engine, pour petrol into the space between the plug body and the insulation of the centre electrode, and then set fire to the plug. Another method is to set fire to some oily rag and burn the plug clean. These two methods sound somewhat drastic, but in fact are not harmful to the plug and will effectively remove carbon deposits and oil from the insulator.

The use of a small wire brush will facilitate thorough cleaning. Wipe the outside and the tip of the insulator thoroughly clean. Also polish the electrodes with some *fine* emery cloth, after first removing all traces of carbon. Verify the plug gap (see page 59).

Replacing the Plug. Before fitting the sparking plug to the cylinder head, it is important to clean its threads thoroughly with a wire brush, as shown in Fig. 37. The object of doing this is not so much making the plug easier to screw home as obtaining maximum dissipation of heat when the plug is fitted (carbon is a bad conductor). Check that the copper washer is in perfect condition (see page 58).

When actually fitting the plug, screw it home as far as possible

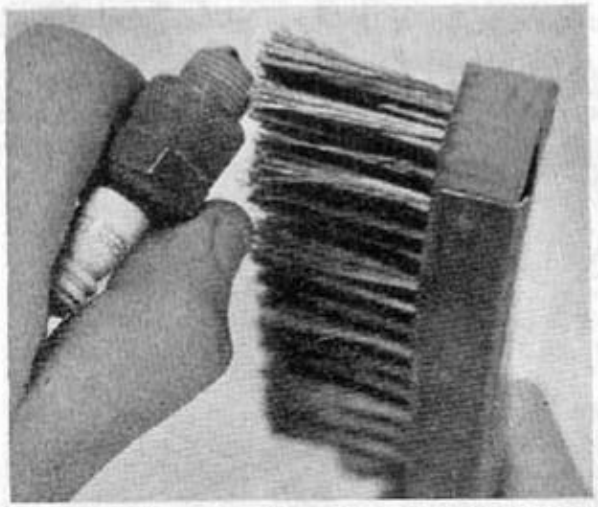

FIG. 37. BEFORE FITTING A PLUG, CLEAN ITS THREADS WITH A WIRE BRUSH
(Champion Sparking Plug Co., Ltd.)

by hand, and use the box spanner shown at (6) in Fig. 54 for final tightening only. Do not employ excessive force on the spanner, otherwise there is a risk of the copper washer becoming damaged. Continous excessive tightening flattens the washer and it becomes hard, with a consequent loss in heat dissipation. Similarly, under-tightening of the plug is apt to make the plug run hot and some "blowing" may occur between the plug body and the cylinder head. See that the H.T. lead is securely fixed to the plug by means of the terminal connector.

THE LUCAS MAGNETO

The "juice" (H.T. current) for the 14 mm. sparking plug is generated by a Lucas type. N.1., rotating-armature magneto with face-cam type contact-breaker. The instrument is mounted on an adjustable platform in a nicely protected position at the

rear of the cylinder and is chain-driven from a sprocket on the inlet camshaft. The drive is enclosed in a chain case formed by an extension of the crankcase.

Lubricating the Magneto and Its Drive. Instructions for lubricating the armature bearings of the Lucas magneto, the contact-

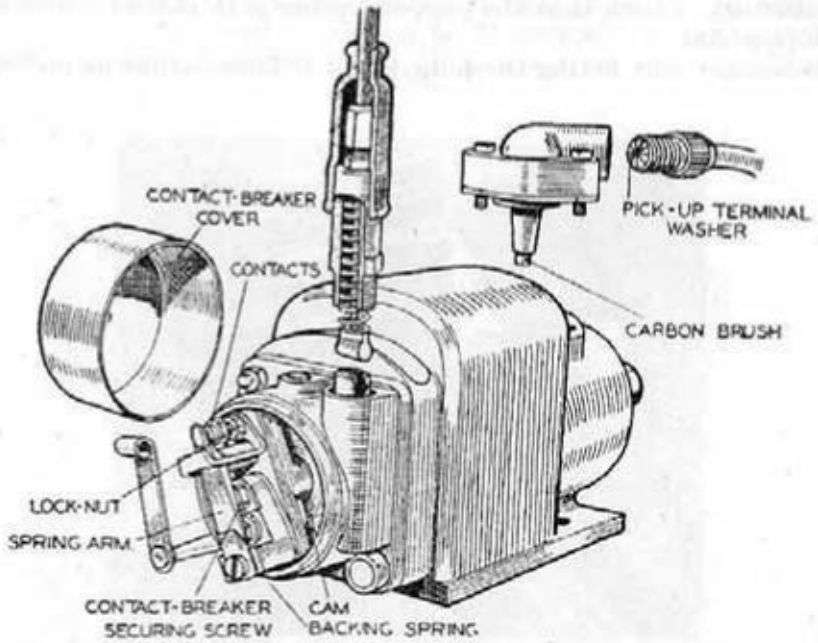

FIG. 38. SHOWING DETAILS OF LUCAS TYPE N.I. MAGNETO FITTED TO MATCHLESS MOTOR-CYCLES

In Fig. 24 is shown a view of the contact-breaker dismantled.

(Joseph Lucas, Ltd.)

breaker, and the magneto driving chain are given on pages 34–35 of Chapter IV.

Check Contact-breaker Gap Every 2000 Miles. Normally it should be sufficient to check the gap between the contacts of the contact-breaker about once every 2000 miles. Where the magneto or the contact-breaker is brand-new, however, some bedding-down occurs, and it is advisable to check the gap after covering 100 miles and again at 500 miles. An incorrect gap will adversely affect the functioning of the ignition system, and too large a gap will also advance the ignition timing. Always maintain the gap at 0·010 in.–0·012 in. The procedure for checking and adjusting the gap is as follows—

(1) Remove the contact-breaker cover and rotate the engine slowly forwards until the contacts of the contact-breaker are wide open (i.e. just before T.D.C. on the firing stroke).

(2) Insert the blade of the feeler gauge attached to the magneto spanner (shown at (11) in Fig. 54), between the contacts.

(3) If the feeler gauge *just* slides in without friction, the gap is correct and no adjustment is needed. If the gauge is a slack fit or the contacts have to be sprung to enable it to enter, adjust the gap as below.

(4) With the magneto spanner loosen the nut which secures the fixed contact screw (see Fig. 38) and then adjust this screw by means of its hexagon head until the correct gap is obtained between the fixed and movable contacts.

(5) Retighten the contact screw lock-nut and again check the gap. If correct, replace the contact-breaker cover.

From the foregoing it will be observed that checking the contact-breaker gap does not necessitate complete removal of the contact-breaker from the magneto. The same applies where cleaning is concerned.

Keep the Contact-breaker Clean. The contact-breaker, especially the contacts themselves, must *never* be permitted to get dirty or oily, otherwise ignition trouble will inevitably ensue, and the contacts will become burned and pitted. When checking the gap of the contact-breaker, *always* inspect the contacts closely, and if they need cleaning, do this *before* finally adjusting the gap.

If the contacts have a *grey, frosted* appearance, it can be reasonably assumed that they are fairly healthy. Should they be only slightly discoloured, clean both contacts with a cloth moistened with petrol. Where the contacts are pitted or blackened, they must be thoroughly cleaned with a fine carborundum stone, or if one not available, some *fine* emery cloth. Afterwards all metallic dust and dirt must be completely removed with a petrol-moistened cloth.

When cleaning and dressing the contacts, it is essential to remove the minimum amount of contact metal necessary to ensure: (*a*) brightness of the contacts, (*b*) parallelism of the contacts, (*c*) perfect smoothness and true faces. To ensure this, remove the spring arm (see Fig. 38) carrying the movable contact by withdrawing the fixing screw and spring washer. When replacing the arm, be sure to fit the small backing spring in its original position, with the curved portion facing *outwards* as shown in Fig. 38.

Renewing Cable for Spark Control. As may be seen in Fig. 38 slackness in the cable for advancing and retarding the spark can be rectified by means of the cable stop after pushing the rubber protector upwards and slackening the lock-nut. If, however, the cable frays, breaks, or stretches unduly, it is necessary to renew the cable in the following manner.

Do not attempt to remove the cam itself from its housing.

Remove the cable casing at the magneto by unscrewing the hexagon nut at its base. Draw fully upwards the Bowden cable and the attached plunger. This will cause the nipple into which the cable-end is soldered to rise above the top of the boss on the cam cage housing.

Slip the nipple sideways out of the hole in the plunger and completely detach the cable. Now thread the new cable through the casing and solder the nipple on to its end. Then slip the nipple sideways into the hole in the plunger and screw the casing home. Finally, make the necessary adjustment by means of the cable stop.

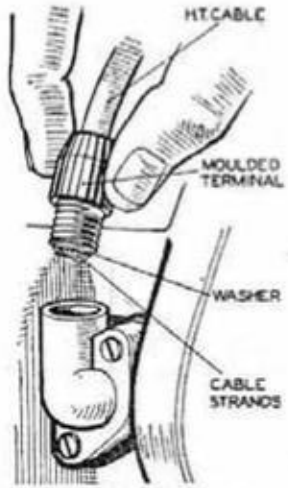

FIG. 39. FITTING H.T. CABLE TO MAGNETO PICK-UP
(Joseph Lucas, Ltd.)

Clean Slip-ring Occasionally. Misfiring and difficult starting are sometimes caused by moisture, oil, or dirt collecting on the slip-ring. About every 2000–3000 miles remove the H.T. pick-up (see Fig. 38) from the magneto and thoroughly clean the track and flanges of the slip-ring. The best way of doing this is to cover a pencil with a soft cloth and press this against the slip ring while slowly rotating the engine.

The H.T. Pick-up. When occasion is had to clean the slip-ring, also wipe the pick-up moulding and polish it with a fine, dry, cloth. Inspect the moulding for cracks and examine the carbon brush (see Fig. 38) and spring, but be careful not to stretch the spring. If the carbon brush is badly worn, renew it.

Before replacing the H.T. pick-up on the magneto, see that the carbon brush moves freely in its holder and beds down properly on the slip-ring. Good electrical contact is important.

To Renew H.T. Cable. On renewing an H.T. cable when the old cable has perished or cracked, always use 7 mm. rubber-covered ignition cable. Referring to Fig. 39, bare the end of the cable for about $\frac{1}{4}$ in. and thread the cable through the moulded terminal. Pass the wire through the bronze washer and then bend back the cable strands as illustrated. Finally, screw the moulded terminal into the magneto pick-up.

Testing H.T. Lead at Plug. If the engine is running well, obviously the lead is sound, but if the engine refuses to start, it is desirable to ascertain whether the H.T. current is reaching the plug end of the lead. Place the steel blade of a *wooden-handle* screwdriver in contact with the plug terminal and almost in contact with one of the cylinder fins. Kick the engine over smartly

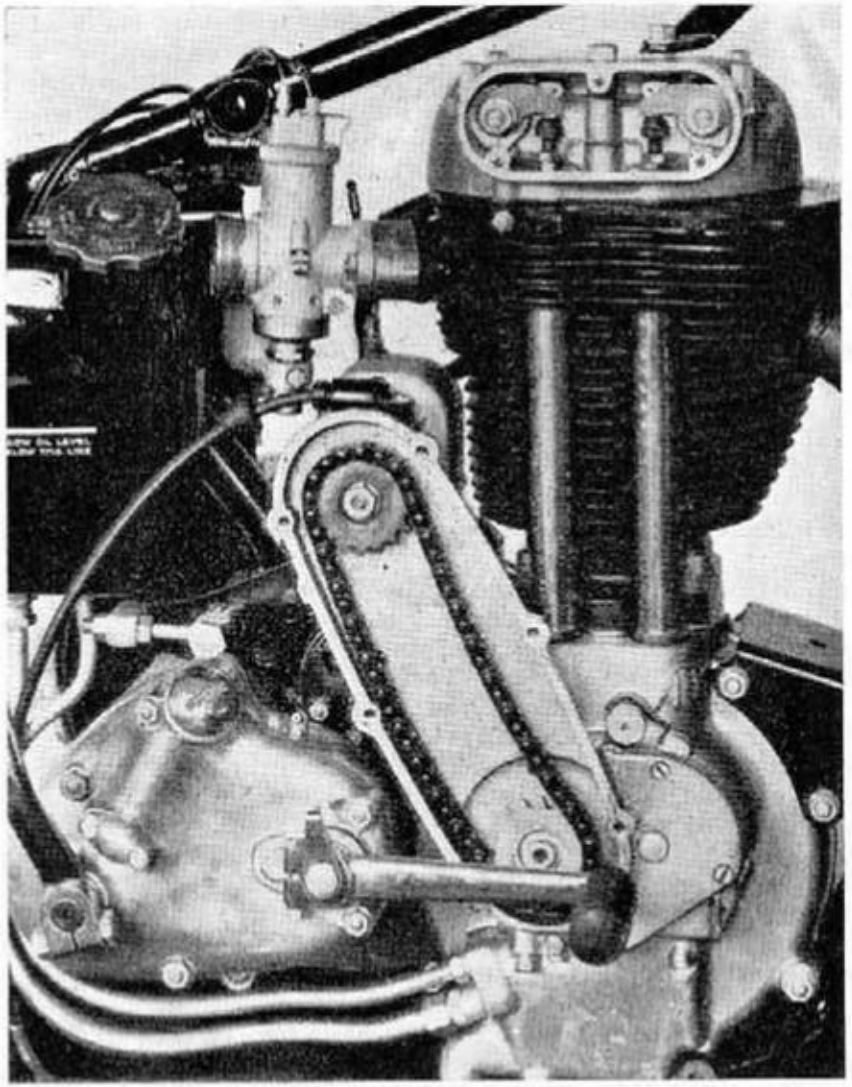

FIG. 40. MATCHLESS ENGINE WITH MAGNETO CHAIN CASE AND ROCKER-BOX COVERS REMOVED FOR CHECKING CHAIN TENSION AND MAGNETO TIMING

The chain shown is badly in need of adjustment. It is necessary to remove the rocker-box cover when checking the magneto timing in order to determine when both valves are closed.

(Chas. K. Bowers & Sons)

and note whether a "fat" spark occurs. If it does, the lead is sound, but if it does not, the lead or magneto is at fault.

Re-tensioning Magneto Chain. Occasionally (say about once a month) remove the cover from the magneto chain case and inspect the chain (see Fig. 40) for tension. Some stretching occurs, especially in a new chain, and where this is excessive it may spoil the exact ignition-timing and also accelerate wear of the chain and sprockets. Press the top chain run up and down (in its *tautest* position) midway between the magneto and camshaft sprockets. If the tension is correct, the *total* deflection should not exceed approximately $\frac{1}{4}$ in. If it is appreciably more or less, retension the chain as described below. Over tensioning may damage the magneto.

(1) Loosen the nuts on both bolts which support and secure the adjustable magneto platform.

(2) Insert the blade of a screwdriver beneath the front (slotted) end of the magneto platform and prise it upwards until the correct chain tension is obtained.

(3) Tighten firmly both nuts on the magneto platform securing bolts.

(4) Again check the tension of the driving chain.

(5) Grease the chain if necessary (see page 35) and fit the cover to the chain case. Do not use jointing compound. Tighten the various cover securing screws evenly.

Correct Magneto-timing is Vital. Incorrect magneto-timing can have a most detrimental effect on the engine, besides reducing its performance. A late timing will result in a "woolly" engine and a hot and noisy exhaust, with considerable overheating and inability to develop full power. An early timing, on the other hand, may result in the engine being powerful on the larger throttle openings, but it will have a nasty tendency to kick back when being started and it will "knock" readily under slight provocation. Worst of all, the engine will be subjected to some fuel detonation and stresses for which it is *not* designed.

Never attempt to improve on the maker's timing, which is such that *the contact-breaker contacts begin to open with the piston* $\frac{7}{16}$ *in. before T.D.C.* ($\frac{1}{2}$ *in. for* 1949) *on the compression stroke.* Sometimes it is necessary for some reason to remove the magneto or its driving chain. Where this is done, the magneto must be retimed. For this purpose it is desirable to have available the two following items—

(*a*) A stout screwdriver, or an old-type tyre lever with the end turned up.

(*b*) A metal rod of $\frac{1}{4}$ in. diameter and about $5\frac{1}{2}$ in. long.

1. Before Timing the Magneto. Remove the covers from (*a*) the contact-breaker, (*b*) the off-side of the rocker-box, and (*c*) the magneto chain-case. Also remove the sparking plug. Check that

the gap at the contact-breaker is correct (0·010 in.–0·012 in.) as described on page 64. It is also advisable to check that the magneto chain is correctly tensioned. The contact-breaker gap *must* be correct, as this affects the timing appreciably.

Loosen several turns the nut which secures the magneto-driving sprocket to the inlet camshaft, but do not take the nut right off. Then, with the stout screwdriver or old tyre lever referred to above, inserted behind the sprocket, lever the latter off the taper on the inlet camshaft. Rotate the engine forwards slowly until the position is at true T.D.C. with *both valves closed*, as described below.

2. Finding Exact Piston Position. Slip the $\frac{1}{4}$ in. diameter rod through the hole for the sparking plug. Then rotate the engine *forwards* slowly until it is felt that the piston is exactly at the top of its stroke. In this position no movement is imparted to the rod. Without moving the piston, mark the rod flush with the top of the sparking plug hole. Remove the rod and scratch another mark on it $\frac{7}{16}$ in. ($\frac{1}{2}$ in., 1949) above the first. Again insert the rod through the sparking plug hole and slowly turn the engine *backwards* by means of the rear wheel (with top gear engaged) until the upper of the two marks on the rod is flush with the top of the sparking plug hole.

3. Timing the Magneto "Break." With the piston still at $\frac{7}{16}$ in. or $\frac{1}{2}$ in. before T.D.C., advance the ignition control lever (see Fig. 2) on the handlebars *fully* by pulling it *inwards* to its maximim extent. Without moving the piston, rotate the sprocket secured to the magneto armature shaft (and the driving chain) *anti-clockwise*, viewed from the driving side, until the contacts of the contact-breaker are just beginning to open.

To determine the exact moment of the "break," slip a piece of tissue paper between the contacts and exert a gentle pull on the paper when the magneto sprocket is being slowly turned.

When the exact position of the "break" has been found, secure the sprocket to the inlet camshaft, being most careful not to permit the camshaft and/or armature to move while tightening the camshaft nut.

Finally check over the magneto timing again, verify the chain tension, grease the chain, if necessary, and replace the covers for the contact-breaker, rocker-box and magneto chain-case. Fit the sparking plug and you should be "all set."

TRACING IGNITION TROUBLE

Use Process of Elimination. If you are unable always to prevent ignition trouble, do not "guess" what the trouble is when it occurs. Hunt down the trouble by means of a logical process of elimination, except, of course, where it is obvious—which it seldom is!

Before deciding that ignition trouble is to blame for a partial or complete engine failure, it is advisable to ascertain that the engine is not running on a weak or excessively rich mixture (see page 47).

Carburation trouble is rather less likely than ignition trouble, but it can give rise to similar symptoms, such as misfiring, erratic running, poor slow-running, difficult starting, etc. If the petrol reaches the float chamber properly and the carburettor floods when the tickler is depressed, and there is no sound reason for thinking carburation to be at fault, check the ignition system as outlined below.

The diagnosis of trouble is often facilitated by noting the behaviour of the engine just before its failure, the onset of which may be gradual or sudden, and partial or complete. A complete failure is generally easier to diagnose than a partial one, because there must be something radically wrong (see accompanying table).

IGNITION FAULTS CAUSING PARTIAL OR COMPLETE ENGINE FAILURE

(The type of failure depends on the severity of the fault)

Observed Effect		Possible Cause
No spark or weak spark at plug	No spark or weak spark at H.T. lead	Contact-breaker oily Contacts dirty Contacts burned or pitted Contacts loose Contact-breaker gap wrong Sticking C.B. spring arm Sticking C.B. tappet Perished H.T. lead Damaged H.T. wire Damaged H.T. pick-up brush Carbon brush sticking Dirty or moist slip-ring Pick-up insulation faulty Magneto insulation faulty Magneto condenser "shorting" Loss of magnetism (magneto)
	Good spark at H.T. lead	Sparking plug wet Plug terminal loose Plug oiled up Plug carbonized Plug points burned Plug gap incorrect Plug worn out Damaged plug insulation Incorrect magneto timing[1]

[1] Incorrect magneto timing may be accompanied by a good spark at the sparking plug, but it occurs at the wrong time.

When checking the ignition system, use the following sequence—

(1) Test the H.T. lead at the sparking plug terminal (see page 66).

(2) If a "fat" spark occurs at the terminal end of the lead, test the plug itself (see page 54).

(3) If a weak spark, or no spark, occurs at the plug, inspect the sparking plug carefully for one of the faults shown in Fig. 32.

(4) Where the plug appears to be all right, examine the magneto contact-breaker (see page 65).

(5) Should the contact-breaker be clean and correctly adjusted, remove the H.T. pick-up from the magneto and inspect the pick-up, carbon brush, and slip-ring (see page 66).

(6) If the cause of the trouble still eludes you, check the timing of the magneto (see page 68).

(7) In the event of the magneto timing being dead right, reconsider the possibility of a carburation defect or the more remote possibility of a faulty magneto condenser, insulation, or loss of magnetism. Also take into account the mechanical condition of the engine. It is assumed that you have checked and if necessary adjusted the tappet clearances (see page 91).

Weatherproof Sparking Plugs. Ignition trouble in wet weather can sometimes be traced to moisture on the sparking plug terminal and external insulation causing a short. To prevent this, it is advisable to fit a weatherproof plug terminal to the existing sparking plug or to fit a watertight plug. Further information on this subject is included on page 133.

Storage of Ignition Equipment. It is advisable to remove the Lucas magneto from its platform and store it in a dry place indoors. Do not remove the sparking plug from the cylinder head, because it is essential to keep the inside of the combustion chamber and cylinder sealed to prevent corrosion.

CHAPTER VII

KEEPING THE LIGHTS BRIGHT

By attending to regular maintenance of the electrical equipment as described in this chapter, you should be able to avoid the inconvenience and danger of a sudden black-out of the lights when riding by night and the annoyance of a faltering horn and lights which are not as bright as they should be. The battery can never be neglected with impunity.

The Lucas Equipment. The equipment fitted to 1945 and later Matchless "Clubman" models is shown pictorially on page 83.

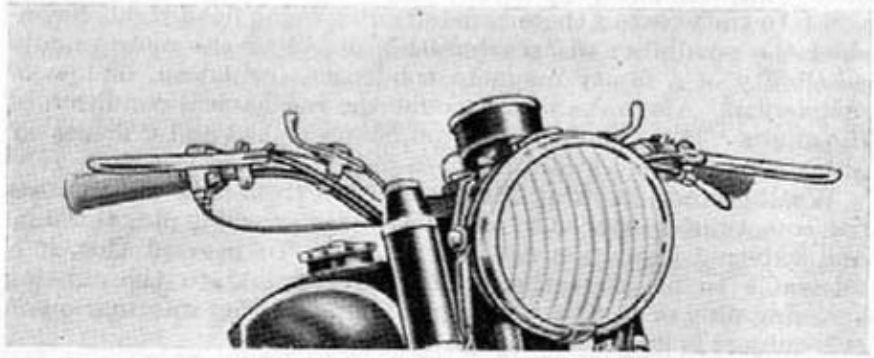

Fig. 41. Neat Mounting of Large Diameter Headlamp and Speedometer

The ignition system has already been dealt with in Chapter VI. The 1945–8 lamps comprise: a DU–42 headlamp, and panel with lighting switch and centre-zero CZ–27 ammeter; and a type WT203 rear lamp. The dipping switch (see page 3) for the double-filament headlamp main bulb is mounted on the handlebars. A powerful electric horn is fixed well forward above the front engine plates. See page 141 regarding 1949 lamps.

Current for the lamps and horn is supplied by a PUW–7E5 lead-acid battery, strapped to a platform below the saddle. The generator is an E3AR/AO5/I separate dynamo mounted on the rear engine plates and driven from the engine shaft by a chain enclosed by the primary chain-case.

Compensated voltage control (C.V.C.) takes care of charging, the type MCRI cut-out and regulator being mounted as a unit below the saddle.

MAINTENANCE OF LAMPS

Lighting Switch Positions. The lighting switch (see Fig. 2) on the

panel on top of 1945–9 headlamps causes the dynamo to charge in all three switch positions, which are as follows—

"OFF"—No lamps on.
"L"——Headlamp pilot bulb, and rear lamp, on.
"H"——Headlamp main bulb, and rear lamp, on.

Is Headlamp Alinement Correct? Incorrect headlamp alinement and/or an out-of-focus main bulb give reduced road illumination and are liable to dazzle other road users. Both faults are simply rectified.

To check the headlamp alinement, take your Matchless to a straight, level stretch of road, turn the lighting switch to the "H" position, and operate the dipping switch so that the main driving light is switched on. The beam of light should, if alinement is correct, be straight ahead and slightly below the horizontal. If the headlamp is mounted so that the beam of light is elevated or projects too much on the road, slacken the two side fixing-screws which secure the headlamp to its brackets and then tilt the headlamp slightly down or up until correct alinement is obtained. Afterwards tighten the two lamp fixing-screws firmly.

Is Headlamp Focused Correctly? On all new Matchless machines the double-filament main bulb is carefully focused to give the best illumination. Provided that genuine Lucas bulbs of the correct wattage and number are fitted as replacements, subsequent refocusing should not be necessary. Where a Lucas bulb is not available, or the focusing adjustment has been disturbed, it is necessary to re-focus. At the same time it is desirable to check the headlamp alinement as previously described.

The headlamp is correctly focused when the reflected rays of light are almost parallel and when the beam, projected upon a wall some distance from the machine, illuminates brightly a circular area of minimum diameter. The filament for the main driving light should be as near as possible to the focal point of the reflector in order to obtain a parallel beam. If the filament is positioned in front of the focal point, a converging beam (with dark centre portion) results. If, on the other hand, the filament is positioned behind the focal point, a diverging beam is obtained.

Both converging and diverging beams are highly undesirable as they illuminate the road poorly and are liable to dazzle other road users. Adjust the focus of the headlamp immediately if its beam is not uniform, is of short range, and has a dark centre. In order to focus the headlamp it is obviously necessary to move the main bulb backwards or forwards on the reflector axis according to whether the beam is converging or diverging respectively.

To Focus DU-42 Headlamp (1945-8). You should take your machine to a level stretch of road and focus the headlamp against a wall some distance (say 30–40 yards) from the machine. The

lamp front and reflector must first be removed. To do this, release the spring fixing clip (see Fig. 42) which secures the base of the lamp front and pull the latter outwards. As the lamp front and reflector come away together, free the top tag of the lamp front from the body of the lamp by lifting the lamp front slightly upwards.

The double-filament main bulb holder is adjustable in the plate fitted to the back of the reflector, and as may be seen in Fig. 42 there is a clamping clip for focusing adjustment. To focus the

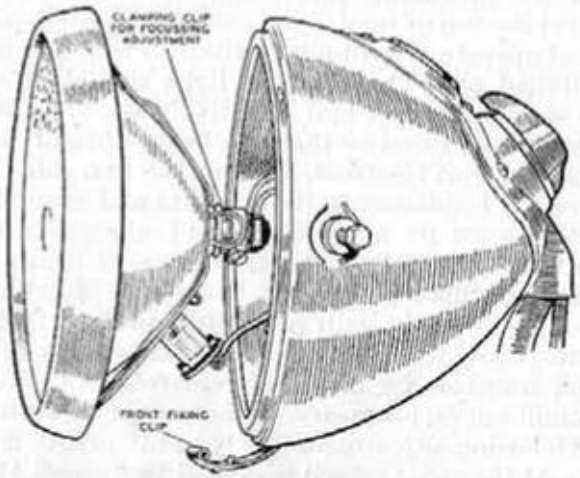

FIG. 42. FOCUSING ADJUSTMENT ON LUCAS DU-42 HEADLAMP
The lamp front and reflector are shown detached from the lamp body to reveal the clamping clip, which must be loosened to enable the bulb-holder to be moved for focusing.

bulb, loosen the clamping screw on the clip and push the bulb-holder in or out of the clamping clip as required. Several focusing adjustments may be needed. After making each adjustment, replace the lamp front and reflector and test the beam for focus (see earlier paragraph). When the correct focus is obtained, tighten the screw on the bulb-holder clamping clip firmly.

When fitting the lamp front and reflector, first locate the top tag in the slot of the lamp body and then press home the lamp front towards the body. Finally, fasten the lamp front by means of the spring fixing clip at the base of the lamp. See page 142.

Renewing Lamp Bulbs (1945-8). If a bulb "goes west," fit a bulb of the correct type. Most large garages and accessory dealers stock genuine Lucas bulbs, which are all specially tested to check that the filament is correctly positioned to give maximum results *with Lucas reflectors*. It is advisable not to wait till bulbs actually burn-out but to renew them after long service. This avoids the

risk of incorrect focusing caused by sagging of the filaments which sometimes occurs after extensive use.

Lucas bulbs have their metal caps marked with a number for identification purposes and it is important when renewing a bulb to see that it has the correct number on its cap. The number of the headlamp double-filament main bulb is 70; and that of the headlamp pilot, sidecar, and rear lamp bulbs, 200. The number 70 bulb is 6v., 24 W., S.B.C. The number 200 bulb is 6v., 3 W., S.B.C.

The headlamp main and pilot bulbs are fitted in holders attached to the plate secured to the rear of the reflector by two spring wires. To remove the plate, complete with the two holders and bulbs, it is only necessary to spring the two wires outwards until they are clear of the plate.

To remove the headlamp main bulb or pilot bulb from its holder, it is only necessary to release the bayonet fixing and withdraw the bulb.

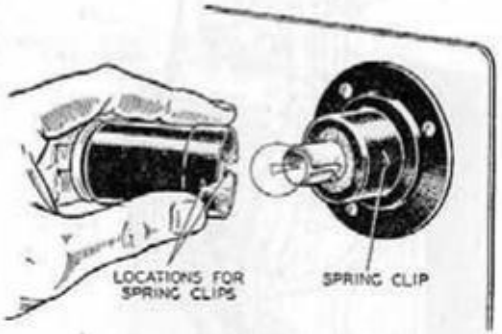

FIG. 43. LUCAS REAR LAMP (TYPE WT203)
The lamp shown is fitted to some post-war models, but later machines have the MT211 (page 143) or 467/1 type (page 142).

It is essential when fitting a new main bulb to see that it is the correct way round, i.e. with the dipped beam filament *above* the centre filament. The word "Top" is etched on Lucas main bulbs to indicate the correct position in the bulb holder. After fitting a new main bulb it is advisable to check the focus of the headlamp (see page 73). 1949 instructions are on page 142.

How to Remove Reflector (1945-8). Remove the four spring clips that secure the reflector and glass to the headlamp front and detach the reflector, the cork packing strip between the reflector and glass, and the glass itself.

To assemble the reflector and glass, the following procedure is necessary. First position the glass in the lamp front. Next, fit the cork packing strip to the reflector edge by pressing it into the pins which are integral with the lamp front. Then place the reflector assembly (complete with bulb holders) on top of the glass. Make sure that the top of the reflector registers with the top of the lamp front. Finally, replace the four spring clips so that they are about equally spaced.

The WT203 Rear Lamp (1945-8). The lamp body, with bulb holder, is secured to the rear number plate by means of three bolts with appropriate washers and nuts. To detach the portion of the

rear lamp housing the red glass, give it a *half-turn* to the left and then pull it outwards, as shown in Fig. 43. When replacing the outer portion of the lamp, engage the slots in the body of the lamp with the two spring clips on the body of the lamp, and push right home to effect full engagement. For 1949, see page 142.

Correct Method of Cleaning Lamps. Clean ebony black surfaces with a good type of car polish. Chromium-plated surfaces do not tarnish and should be wiped over with a damp cloth occasionally in order to remove dirt or dust. Care must be taken when handling a reflector not to scratch it accidentally, and *on no account must metal polish be used to clean it.*

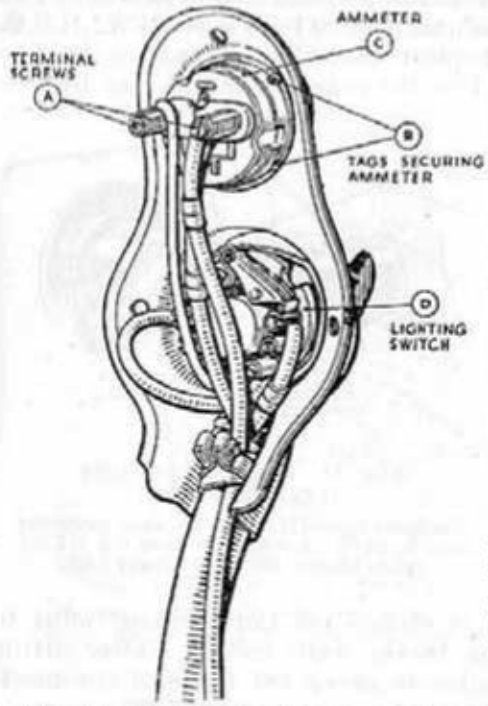

FIG. 44. AMMETER AND SWITCH PANEL REMOVED FROM LUCAS DU42 HEADLAMP

A fine colourless, and transparent covering is provided on all Lucas reflectors for protection purposes, and this covering can readily be cleaned without any risk of damaging the actual surface of the reflector. Polish the reflector covering lightly with a clean, dry, soft cloth or a chamois leather. No other treatment is desirable.

The Lucas CZ-27 Ammeter. This centre-zero instrument shows a charge on one side and a discharge on the other and is provided to give a reading of the amount of current flowing to or from the battery.

For instance, if the dynamo output is 3 amp. at a certain speed, and the pilot bulb and rear lamp are on, thereby absorbing, say, 1 amp., then 2 amp. remain for battery charging, and the ammeter will therefore indicate 2 amp.

At very low r.p.m. the ammeter reading is zero because the dynamo armature is not rotating fast enough to generate sufficient current to give a battery charge. (See also page 81.)

Removal of Ammeter. Should it be necessary for some reason to remove the ammeter on a Model G3/L or G80, this can readily be effected. Referring to Fig. 44, detach the panel from the top of the DU42 Lucas headlamp by unscrewing the three retaining

screws. Then unscrew the two ammeter terminal screws shown at *A* and disconnect the wires. Next bend back the four metal tags shown at *B*. When these have been dealt with, ammeter *C* can be removed bodily from the panel. Replace the ammeter, in the reverse order of removal. Do not touch switch *D*.

MAINTENANCE OF BATTERY (LEAD ACID)

Neglect of the battery quickly brings trouble, and correct attention in regard to its maintenance is *vitally* important. Upon it depends the lamps and horn.

Topping-up the Cells. Examine the acid level about every two weeks, and even more frequently in tropical climates. Unscrew the battery clamping screw and remove the battery. Then take off the battery lid and remove the three vent plugs. Inspect the hole in each vent plug and make certain that it is not obstructed. A choked vent plug hole will result in an increase of pressure in the cell owing to "gassing," and this may cause trouble.

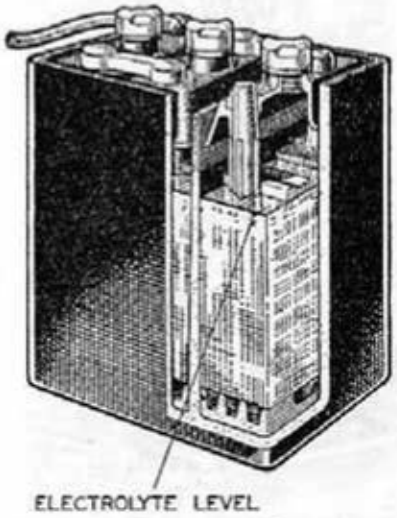

FIG. 45. KEEP THE ELECTROLYTE LEVEL WITH THE TOPS OF THE PLATE SEPARATORS

Wipe the top of the battery clean with a rag and also verify that the rubber washer fitted beneath each vent plug, to prevent leakage, is in position. After wiping the top of the battery, either destroy the rag or wash it thoroughly, using several changes of water. See that a supply of clean distilled water is to hand.

Be careful not to hold a naked light near the vents. If the level is below the tops of the separators, add *distilled* water[1] as required to bring the level correct (see Fig. 45). This should be done just before a charge run, as the agitation due to running and the gassing will thoroughly mix the solution. Acid must not be added to the electrolyte unless the solution has been spilled. If the solution has been spilled by accident, add diluted sulphuric acid of specific gravity equal to that in the cells.

Checking Specific Gravity. About once a month, hydrometer readings (specific gravity values) should be taken of the solution

[1] The distilled water, unlike the acid, is lost gradually by evaporation. Bottles of distilled water can be obtained from most garages and from chemists.

in each of the cells. The method of doing this is shown in Fig. 46. The Lucas hydrometer contains a graduated float which indicates the specific gravity of the battery cell from which a sample of electrolyte is taken.

After a sample has been taken and checked, it must, of course, be returned to the cell. The taking of S.G. readings with a hydrometer is the most efficient way of ascertaining the state of charge of the battery. The S.G. readings should be approximately the *same for all three cells*. Should the reading for one cell differ substantially from the readings for the others, probably some acid has been spilled or has leaked from the cell concerned. There is also a possibility of a short-circuit between the battery plates. In the latter case it will be necessary to return the battery to a Lucas Service Station for attention.

FIG. 46. USE LUCAS HYDROMETER TO CHECK SPECIFIC GRAVITY OF ELECTROLYTE

Under no circumstances must the battery be permitted to remain in a discharged condition for long, or serious deterioration will occur. After checking the S.G. readings and topping-up the cells, wipe the top of the battery and remove any spilled electrolyte or water; replace the three vent plugs and the battery lid. Then fit and tighten the battery clamping screw.

Battery Connexions. Always keep the battery connexions clean, free from corrosion, and tight, otherwise the ammeter readings will *not* indicate the true state of charge of the battery. To prevent corrosion they should be smeared with petroleum jelly.

Correct Readings. With Lucas batteries fitted to Matchless machines, the specific gravity readings at an acid temperature of approximately 60° F. should be: 1·280–1·300, battery fully charged; about 1·210 battery half discharged; below 1·150, battery fully discharged.

Never leave the battery in a discharged state for any appreciable period. A low state of charge often is caused through parking the machine for long periods with the lighting switch in the "L" position, unaccompanied by much daylight running. The remedy is, of course, to undertake more daylight running and to keep the switch in the "Off" position as much as possible until the battery regains its normal state of charge. If overcharging occurs, have the setting of the compensated voltage control unit checked.

MAINTENANCE OF DYNAMO

To Prevent "Shortings." Precautions are unnecessary for inspecting commutator, but on making adjustments to the wiring circuit, it is essential to take steps to prevent accidental "shorting." Disconnect the lead from the lighting switch to the battery *positive* terminal. Push back the rubber shield and then unscrew the cable connector. When doing this be sure that the cable does not make contact with any metal part of the frame, otherwise a "fat" spark will indicate that the battery *was* well charged! When reconnecting the lead, pull the rubber shield well over the connector.

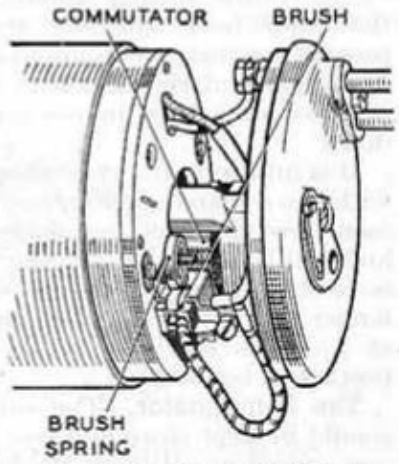

FIG. 47. COMMUTATOR END OF LUCAS DYNAMO
The metal cover is shown removed.

Lucas Servicing Advised. It is a good plan every 10,000 miles to entrust the dynamo to a Lucas service depot for dismantling, cleaning, servicing, and lubrication. Lubrication is referred to on page 35.

Inspection of Commutator and Brushgear. The Lucas E3AR/AO5/I dynamo will run satisfactorily for thousands of miles with scarcely any attention other than occasional inspection of the commutator and brushgear. It is advisable once a season, about every six months, to remove the metal cover from the dynamo and make a careful inspection.

The Commutator Brushes. The brushes must make good electrical contact with the commutator. They must be absolutely clean and able to move freely in their box-type holders, on holding back the retaining springs and gently pulling the leads and then releasing them. There must also be perfect contact between the brushes and the copper segments of the commutator; the brush faces in contact with the segments should be uniformly polished. Clean the brushes with a petrol-moistened cloth after removing them. To do this, pull back each brush-retaining spring (see Fig. 47) and remove the brush by pulling on its lead, being careful to see that the brush pressure spring is clear of the brush holder.

Examine the carbon brushes for wear and unevenness, and true them up if necessary. Generally it is best to replace the brushes *before* serious wear develops, as this prevents sparking, which

causes blackening of the commutator and an unsteady charging current.

If Lucas brushes become so badly worn that it is necessary to remove them, this can easily be done as follows: Release the eyelet on the brush lead by unscrewing the hexagonal nut or screw at the terminal; then, holding back the spring lever out of the way, withdraw the brush from its holder. Renew with genuine Lucas brushes.

The brush springs should be inspected occasionally to see that they have sufficient tension to keep the brushes firmly pressed against the commutator when the dynamo is running. It is particularly necessary to keep this in mind when the brushes have been in use a long time and are very much worn down.

It is unwise to insert brushes of a grade other than that supplied with the dynamo, or to change the tension springs. The arrangement provided has been made only after many years' experience, and will be found to give the best results and the longest life. It is really best when the brushes become so worn that they no longer bed down on the commutator, to have new brushes fitted at a Lucas service depot, as this ensures the brushes being properly "bedded."

The Commutator. The surface of the commutator segments should be kept clean and free from oil or brush dust, etc. Should any grease or oil work its way on to the commutator through over-lubrication, it will cause not only sparking, but, in addition, carbon and copper dust will collect in the grooves between the commutator segments.

The best way to clean the commutator is, without disconnecting any leads, to remove from its box-holder one of the main brushes and, inserting a fine duster, hold it, by means of a suitably-shaped piece of wood, against the commutator surface, causing the armature to be rotated at the same time. If the commutator has been neglected for long periods, it may need cleaning with fine glass-paper, but this is more difficult to do, and should not be necessary if it has received regular attention. The segments should be *dark bronze* and highly polished.

To Adjust Dynamo Chain. The tension of the dynamo chain which lies behind the primary chain (see Fig. 72) should be checked monthly, after removing the oil-bath chain case inspection cap (see page 38). Chain whip with the chain in its tautest position, mid-way between the sprockets, should be approximately $\frac{1}{2}$ in.

To make an eccentric adjustment for chain tension, first slacken the strap bolt clamping the dynamo in its housing. Then apply the spanner, shown at (5) in Fig. 54, to the flats cast on the dynamo end-plate, which is on the left-hand side of the dynamo.

Now rotate the dynamo *anti-clockwise* until correct chain tension is obtained. Afterwards retighten the strap bolt and again check the tension of the dynamo chain. If found to be correct, replace the inspection cap on the oil-bath chain case (see page 38).

Compensated Voltage Control (C.V.C.). All Matchless motorcycles incorporate compensated voltage control. The C.V.C. unit consists of a cut-out and voltage regulator unit neatly housed in a box beneath the saddle (bolted to battery carrier, 1949). The unit is connected between the dynamo and battery and sees to it that the battery is automatically charged the right amount

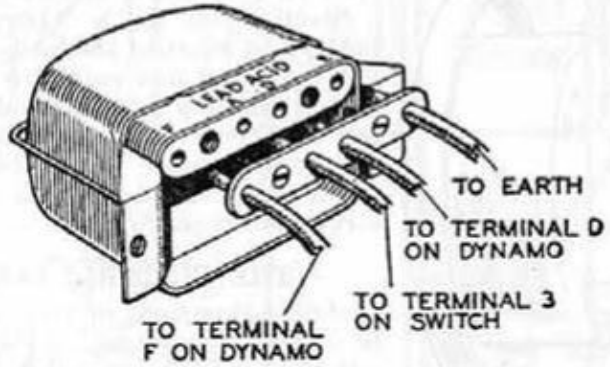

Fig. 48. Lucas Cut-out and Regulator Unit Connexions

by varying the dynamo output according to the state of charge of the battery and the load imposed on it.

Current is prevented from flowing back from the battery to the dynamo at low r.p.m. by means of the cut-out which opens. As soon as the r.p.m. rise high enough to enable the dynamo to charge the battery, the cut-out closes and completes the circuit.

In all three lighting switch positions (see page 73) the dynamo gives a controlled output and thus relieves you of responsibility in regard to charging. The regulator begins to operate when the dynamo voltage reaches about 7·3 volt. During daylight running with the battery well charged and the switch in the "Off" position, the dynamo gives only a trickle charge, and the ammeter reading is unlikely to exceed 1–2 amp. There is no danger of overcharging.

The regulator provides for an increase of dynamo output as soon as the lamps are switched on. The effect of switching the lamps on after a long run with the battery voltage high is often to cause a temporary discharge reading at the ammeter, but fairly soon the voltage falls and the regulator responds, thereby causing the output of the dynamo to balance the load of the lamps.

When the battery is in a discharged state, the regulator increases the dynamo output and restores the battery to its normal state of charge in the shortest possible time.

Do Not Tamper with C.V.C. Unit. The unit is sealed by the makers, as it does not need adjustment once it is correctly set. The only conceivable trouble is oxidizing or welding together of the contacts, owing to accidental crossing of the dynamo field and positive leads. Be careful if making wiring alterations. (see page 79). Referring to Fig. 48, make sure that the C.V.C. unit connexions are correct, tight, and that the insulation is sound.

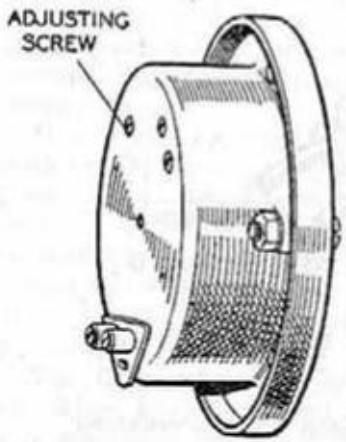

FIG. 49. ADJUSTMENT FOR TONE ON LUCAS HORN

Should you fit a "Lucas-Knife" battery in place of the lead-acid type, you must fit a new regulator to ensure a good charging rate with a discharged battery. You are advised to have the change-over made at a Lucas service depot and to visit a depot whenever any serious electrical fault develops.

THE ELECTRIC HORN

Careful adjustment of the Lucas horn is made at the works, and subsequent adjustment is rarely called for. Normally the horn should give long service without any attention whatsoever. The vibrating parts do, however, gradually wear and, after very considerable usage, some roughness and loss of tone may develop. This necessitates an adjustment being made.

To Adjust the Horn. Turn the adjusting screw shown in Fig. 49, with a small screwdriver *two or three notches*. Clockwise turning is generally required and the under side of the screw is serrated to facilitate adjustment. Now check the tone of the horn and repeat the adjustment if necessary. An excessive clockwise adjustment of the tone adjusting screw must not be made, otherwise it may be found that separation of the contacts does not occur, although the armature pulls in. On no account unscrew the nut securing the tone disc or tamper with any screws other than that just referred to.

After Adjusting the Horn. Note its current consumption recorded at the ammeter. With the horn correctly adjusted, this should not exceed 4–5 amp. While testing the horn, do not continue to depress the push switch if no sound is audible. Perhaps a faulty adjustment has resulted in the contacts failing to close, in which event no discharge is indicated at the ammeter.

If Horn Fails Completely or Partially. Do not immediately infer that the horn has broken down or needs adjustment. Possible causes of the trouble are: a loose fixing bolt; vibration of some adjacent part; a discharged battery; a loose connexion;

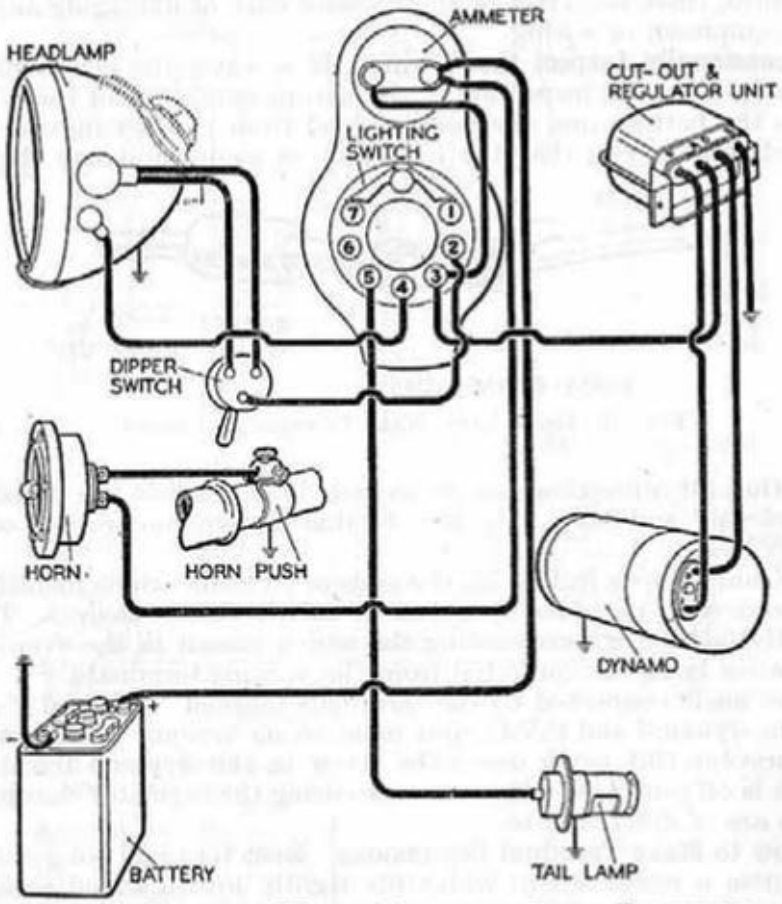

FIG. 50. PICTORIAL WIRING DIAGRAM OF LUCAS ELECTRICAL EQUIPMENT FITTED TO 1945 AND LATER MATCHLESS MACHINES

A wiring diagram showing the coloured sleeves used to identify the cables is shown on page 85.

(*Matchless Motor Cycles*)

a short circuit in the wiring; or a defective push switch. The last-mentioned may be occasioned through poor electrical contact due to corrosion.

THE WIRING CIRCUIT

No Fuse Provided. There is no fuse incorporated in the wiring circuit, which is purposely simplified, and capable of being understood by those with elementary electrical knowledge. A pictorial

view of the Lucas lighting equipment and the circuit is shown in Fig. 50, and a detailed wiring diagram showing the coloured sleevings is given on page 85. If care is taken to keep the various wires correctly connected, and to maintain the connexions clean and firm, there is no risk of an excessive current damaging any of the equipment or wiring.

Occasionally Inspect the Wiring. It is advisable occasionally to make a careful inspection of the wiring, especially of the wires from the battery and the positive lead from the dynamo to the switch panel. See that the insulation is sound and not chafed

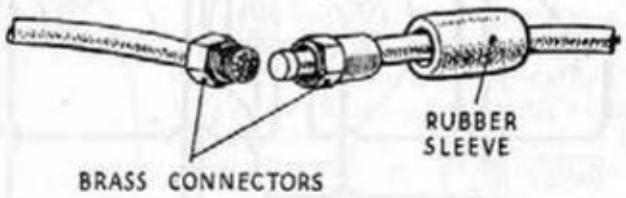

Fig. 51. Rear Lamp Wire Connexion (1945-8)

and that all connexions are clean and tight. Should the dynamo "pack up" suddenly, this may be due to dynamo trouble or a faulty lead.

As may be seen in Fig. 52, the ends of all leads can be identified for connexion purposes by means of their coloured sleeves. This greatly facilitates reconnecting the wiring circuit in the event of the wires being disconnected from the various terminals.

The leads connected to the terminals marked "*D*" and "*F*" on the dynamo and C.V.C. unit must on no account be reversed. To prevent this being done, the screw in the dynamo terminal block is off centre, and the screws securing the regulator clamping plate are of different size.

How to Make Terminal Connexions. Most terminal connexions comprise a metal sleeve which fits tightly into a metal socket. Where this type of connexion is provided, the method of making the connexion is as follows. First, withdraw the metal sleeve from the terminal socket. Then bare the end of the wire lead for about $\frac{3}{8}$ in. Having done this, pass the wire into the metal sleeve and afterwards turn back the wire strands so that they lie outside the sleeve. Finally, push the sleeve into the socket.

Connexions to Switch and C.V.C. Unit. In this case the wire is secured to a metal post by means of a binding screw. To connect, slacken the binding screw, bare the end of the wire for about $\frac{3}{16}$ in., push the wire through the slot in the side of the metal post, and tighten the binding screw.

Earth Wires. Connexions for the earth (and H.T.) wires consist of solid sleeve-type terminals with an eye at the extreme end. To

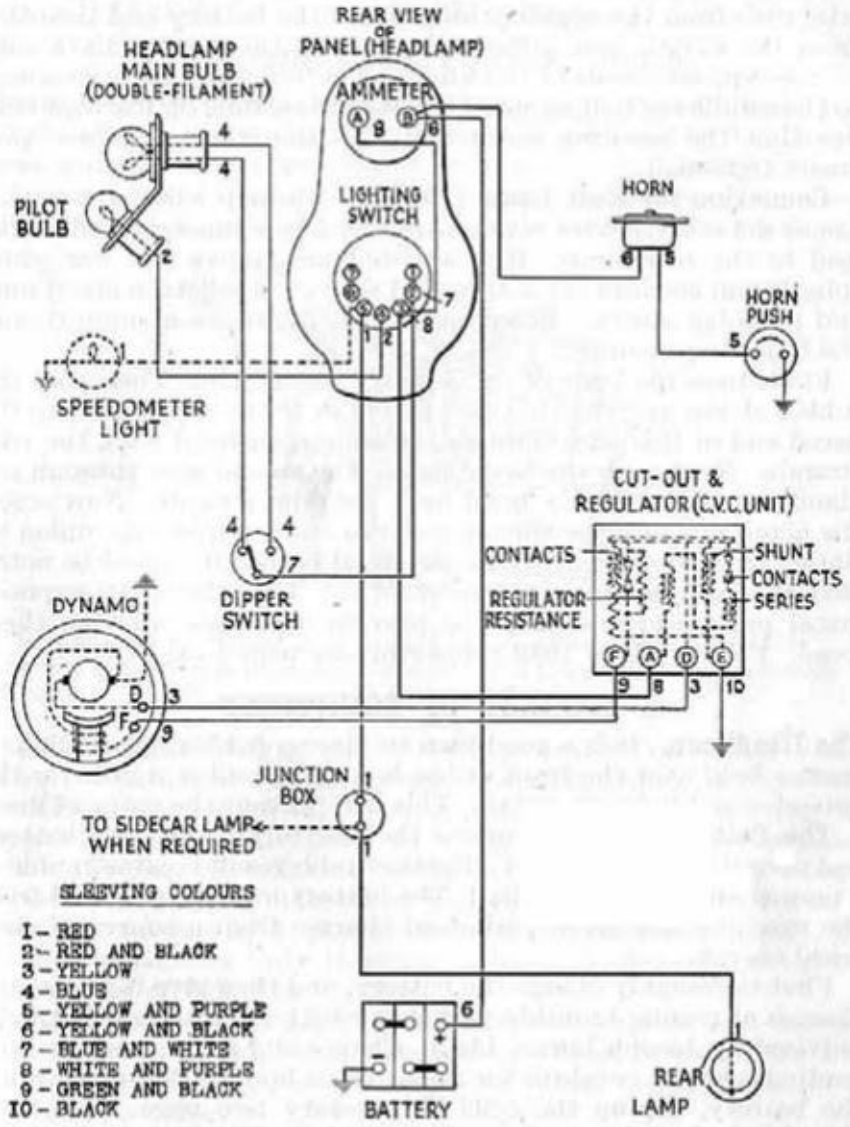

Fig. 52. Wiring Diagram of Lucas Electrical Equipment Fitted to 1945 and Later Matchless Machines
(*Joseph Lucas, Ltd.*)

effect a connexion, first bare the end of the wire for about $\frac{3}{8}$ in. Then slip the terminal over the wire so that the bared end fully enters the reduced core of the terminal. Afterwards flatten this

portion of the terminal either by hammering it or squeezing it in a vice.

The lighting system incorporates *two important earth wires*. One wire runs from the negative terminal of the battery and the other from the C.V.C. unit. The ends of both these wires have solid sleeve-type terminals of the kind just referred to and are secured to the saddle lug bolt situated beneath the saddle on the near side. See that the securing screw and also the connexions are kept firmly tightened.

Connexion for Rear Lamp (1945-8). To help wheel removal, a Lucas detachable wire connector (Fig. 51) is incorporated in the lead to the rear lamp. It is situated just above the rear wheel spindle and consists of: a threaded sleeve; a collet; a gland nut; and a rubber sleeve. Referring to Fig. 51, make a connexion in the following manner.

First, bare the ends of the wire for about ⅛ in. Then pass the rubber sleeve and the threaded sleeve over one wire, and slip the bared end of this wire through the collet and bend back the wire strands. Next push the bared end of the second wire through the gland nut and similarly bend back the wire strands. Now screw the gland nut into the threaded sleeve and complete the union by sliding the rubber sleeve over the metal parts. It should be noted that the rubber sleeve is important, as it insulates the exposed metal parts and also helps to prevent vibration working them loose. For details of 1949 connector, see page 143.

STORAGE OF EQUIPMENT

The Headlamp. It is a good plan to place a rubber bag, such as a sponge bag, over the front of the lamp and pull it right over the ammeter and lighting switch. This will prevent the entry of dust.

The Battery. Do not remove the electrolyte from the battery and permit the plates to dry. The inevitable result is catastrophic—a permanent loss of capacity! The battery must be removed from the machine and given periodical charges from a source of electrical energy.

First thoroughly charge the battery, and then give it freshening charges at regular monthly periods, or better still once a fortnight (advised by Joseph Lucas, Ltd.). Charge at ¾ amp. until the S.G. readings remain constant for about three hours. Before charging the battery, top-up the cells if necessary (see page 77). After charging is completed, clean the outside and top of the battery, smear the terminals with petroleum jelly, and then store the battery in a cool, dry, place.

The Dynamo. This needs to be stored away from dampness, and it is advisable to remove the instrument from your Matchless and store it indoors, together with the C.V.C. unit and horn.

CHAPTER VIII

ENGINE MAINTENANCE (1945-8)

Some aspects of engine maintenance have already been fully dealt with in the preceding chapters. Consequently this chapter contains only cross-references to such matters. Full instructions are given in respect of maintenance operations not previously covered. These include tappet adjustment, decarbonizing, valve-timing etc.

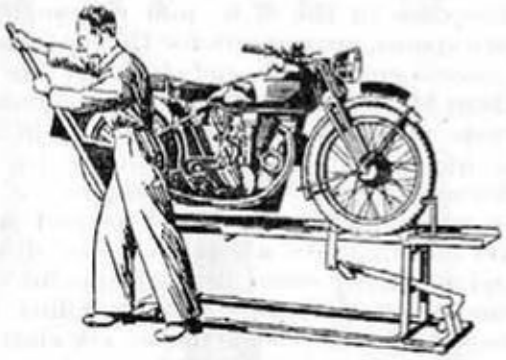

Fig. 53. An Excellent Repair Stand—the A.G.I. "Easilift"
The motor-cycle illustrated (not a Matchless) is being raised to a comfortable working height.

Maintenance in Comfort. Matchless owners who like to strip down and attend to their engines and machines in maximum comfort, without having to kneel, are reminded of an excellent repair stand now available at a reasonable price. The stand, shown in Fig. 53, is known as the A.G.I. "Easilift." It is hand-operated and with little effort will enable your Matchless to be raised to an accessible position and most convenient height. The stand, obtainable only through motor-cycle dealers, occupies a floor space of 7 ft. 6 in. × 18 in.

Have You a Spares List? A well illustrated Spares List covering all spares for Matchless engines and machines is obtainable from Matchless Motor Cycles of Plumstead Road, London, S.E.18. for 2s. 6d., post free.

Spares and Repairs. It is essential when you have occasion to forward or deliver parts to the manufacturers[1] (either for repair or as patterns) to attach to *each* part a label on which is written clearly your full name and address. To ensure quick attention,

[1] The Matchless Service and Repair Dept. is in Burrage Grove, Plumstead, London, S.E.18. See page 136 regarding Free Service Scheme.

all correspondence concerning spares and technical advice should be written on separate sheets.

Always quote the *complete* engine number or frame number, according to the nature of the part involved. The frame number will be found marked on the right-hand side of the seat lug below the saddle. The engine number (with letter prefix) will be found on the left-hand side of the crankcase.

In connexion with engine spares it is worth noting that the following five firms can meet most requirements: The Halford Cycle Co., Ltd.; Turners Stores; James Grose, Ltd.; Marble Arch Motor Supplies; and George Grose, Ltd. These firms have many branches in the U.K. and can supply carburettor spares, magneto spares, spare parts for the machine, tools, accessories, miscellaneous equipment, and clothing. See also page 136.

Necessary Items for Maintenance. For engine maintenance there are certain items which you *must* have handy in the lock-up or garage. These include: a can of paraffin for cleaning purposes; a stiff brush for scouring dirt off the crankcase; a tin of suitable engine oil (see page 29); a canister of grease; a small oil-can containing thin machine oil; a receptacle for oil when draining the oil tank and oil sump; some dishes or jars for washing engine parts in; some non-fluffy rags; valve grinding paste such as Richford's (coarse and fine); some fine emery cloth; a set of engine gaskets (see illustrated Spares List); some jointing compound; and some good hand cleanser, such as "Gre-solvent."

Tools for the Job. The Matchless tool kit, shown in Fig. 54, is adequate for any normal stripping down and assembly job and should prove sufficient for routine maintenance and overhaul. As may be seen in Fig. 54, thirteen serviceable tools are provided, not, of course, taking into account the grease-gun shown separately in Fig. 26. It is also necessary to obtain a suitable feeler gauge for checking the sparking plug gap (see page 59) and it is desirable to obtain a plug dismantling tool (see page 61), (except where Champion plugs are used); and a wire-brush type plug cleaner (see page 60).

Should you decide to undertake as much repair work as possible in addition to routine maintenance, stripping-down, and assembly, it is desirable to rig up a suitable bench, complete with vice, and to purchase some extra tools.

To begin, it is a good plan to buy a medium-weight hammer, a hand-drill and an assortment of twist-drills, a hacksaw, some large and small (smooth and rough) files, and a good soldering outfit for the repair of Bowden cables. Repair work is beyond the scope of this handbook, and you are not advised to tackle such work unless you have fair technical knowledge and skill in handling tools.

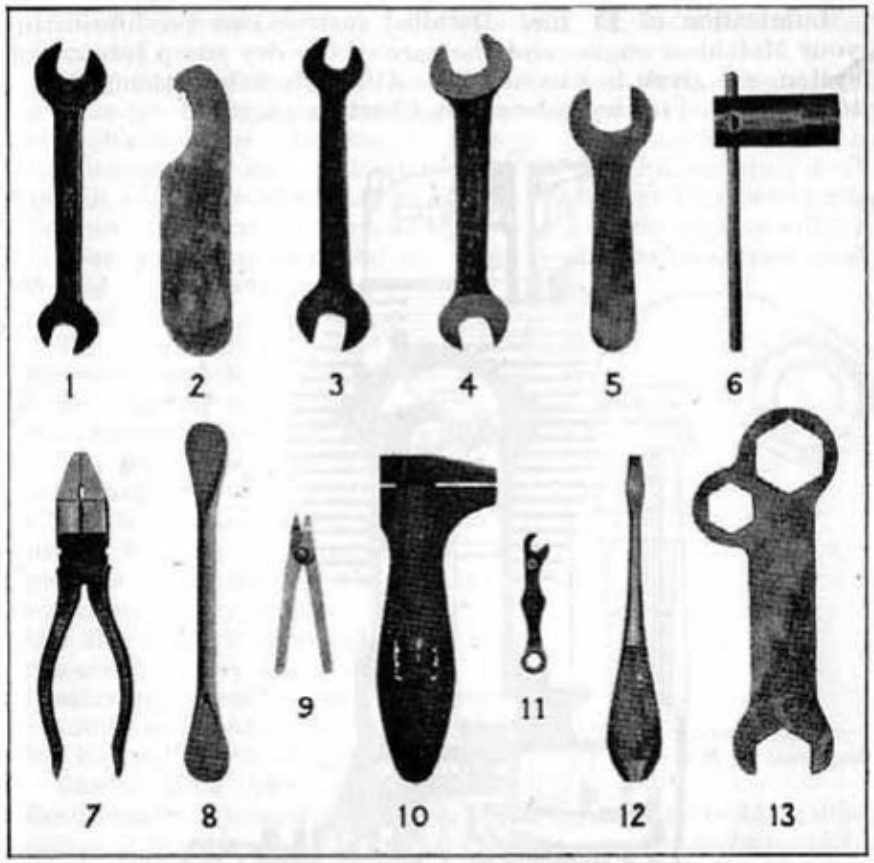

FIG. 54. THE 350 C.C., 500 C.C. MATCHLESS TOOL KIT

Each new machine is supplied with the tools illustrated, and with a grease gun and a tyre pump (see also page 88).

1 = Double-ended spanner ($\frac{7}{16}$ in. × $\frac{1}{4}$ in. Whit.)
2 = Spanner for hub-locking ring
3 = Double-ended spanner ($\frac{5}{8}$ in. × $\frac{1}{2}$ in. Whit.)
4 = Double-ended spanner ($\frac{7}{16}$ in. × $\frac{3}{8}$ in. Whit.)
5 = Spanner for dynamo
6 = Box spanner (with tommy-bar) for plug
7 = Pliers (with wire-cutter)
8 = Tyre lever
9 = Gudgeon-pin circlip pliers
10 = Adjustable spanner (King Dick)
11 = Magneto spanner and feeler gauge
12 = Screwdriver
13 = Triple spanner

ROUTINE MAINTENANCE

Earlier chapters of this handbook describe certain aspects of routine maintenance and adjustments, and this chapter contains appropriate chapter cross-references.

Lubrication of Engine. Detailed instructions on lubricating your Matchless engine and the care of the dry sump lubrication system are given in Chapter IV. Attend to lubrication points 1 to 5 indicated in the Lubrication Chart on page 37.

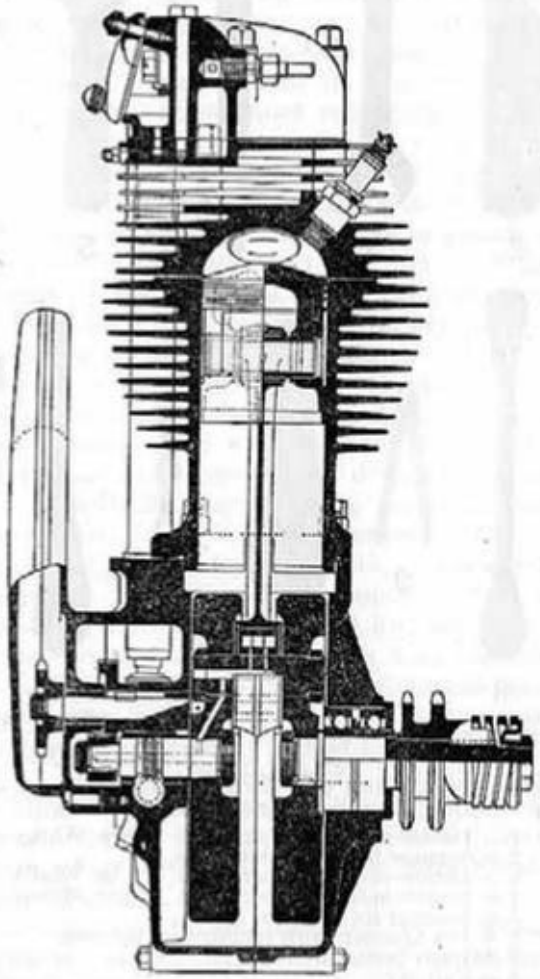

FIG. 55. SECTIONAL DIAGRAM OF MATCHLESS O.H.V. ENGINE
An exploded view of the flywheel and connecting-rod assembly is shown in Fig. 62.

The Amal Carburettor. For comprehensive advice on how to obtain and maintain correct carburation, refer to the instructions given in Chapter V.

The Ignition System. The maintenance required in order to prevent ignition trouble is fully discussed in Chapter VI. Note the useful plug illustrations in this chapter, and attend to

lubrication points 4 and 5 indicated in the Lubrication Chart on page 37.

Keep the Engine Clean. Keep your engine clean externally as well as internally. By so doing you enhance pride of ownership and obtain other advantages. Dirt is apt to mask defects and can accidentally enter the engine when it is being stripped down. It will also make rusting more likely. Rusted cylinder and cylinder head fins, besides being an eyesore, are detrimental to efficient dispersion of heat by radiation. They should be clean and black. On the Matchless they are stove-enamelled black.

To clean the cylinder and cylinder head fins, use a stiff brush dipped in paraffin. If the stove-enamelling has worn away, paint the fins with a good proprietary cylinder black. Clean the aluminium alloy and bright surfaces with rags and paraffin, assisted by brushes where necessary, and scour off the filth from the lower part of the crankcase by means of stiff brushes and paraffin. Thorough cleaning may take some time, but it is well worth while.

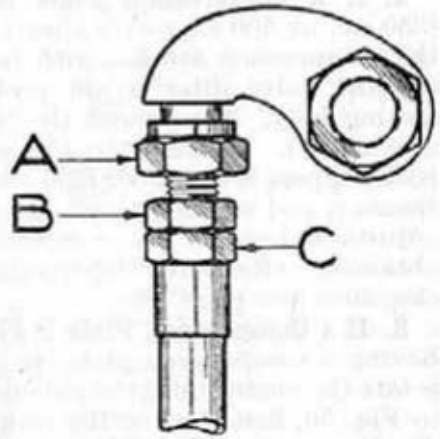

FIG. 56. TAPPET ADJUSTMENT ON 350 c.c., 500 c.c. O.H.V. ENGINES

Check Nuts for Tightness Occasionally. On a new Matchless where some initial bedding down occurs, it is advisable to check all external nuts and bolts for tightness fairly frequently. After the running-in period is completed, it is a good habit to check the external nuts regularly about *once a month*. It does not take long and the tools are provided in the tool kit. Pay special attention to the cylinder nuts, the nuts on the engine plates, and the union nuts for the pipe connexions.

ADJUSTING TAPPETS

This is another routine maintenance operation, and a very important one. Check and, if necessary, rectify the tappet adjustment about *once a month*. It is generally necessary to adjust both tappets about every 5000 miles. The adjustment must always be checked after decarbonizing the engine and grinding-in the valves. The need for tappet adjustment more frequently than about once every 5000 miles is generally due to some fault which should be investigated. It is of vital importance to keep the adjustment correct in order to prevent damage to the valves and to maintain high engine performance. See page 136 regarding 1949 engines.

The Adjustment. On Models G3/L and G80 the correct tappet clearance is *nil* with both valves closed and the engine *cold*. A clearance of *nil* implies that the push-rods are free to rotate without any appreciable up-and-down play.

Detach the cover from the off-side of the rocker-box (see Fig. 64) after removing the three retaining nuts and fibre washers. This exposes the inlet and exhaust tappet adjustment. As may be seen in Fig. 56, each push-rod has an adjustable head *A* secured by a lock-nut *B* to the top of the push-rod *C*.

1. If a Compression Plate is Not Fitted. Turn the engine (350 c.c. or 500 c.c.) over slowly until the piston is at T.D.C. on the compression stroke, with both valves closed. See that the exhaust valve lifter is not preventing the exhaust valve from seating fully. Then check the tappet clearance for both tappets (see above). Referring to Fig. 56, if an adjustment of either or both tappets is required, hold the top of the push-rod *C* with one spanner, and with another loosen the lock-nut *B*. Then screw the adjustable head *A* up or down until a tappet clearance of *nil* is obtained. Afterwards tighten the lock-nut *B* and again check the clearance (see page 136).

2. If a Compression Plate is Fitted. On 1945-8 500 c.c. engines having a compression plate, to adjust the tappet clearance, first rotate the engine until the exhaust valve lifts off its seat. Referring to Fig. 56, first slacken the lock-nut *B* on the exhaust push-rod *C*. Next rotate the engine until the inlet valve is lifted off its seat. Loosen the lock-nut *B* on the inlet push-rod *C*. Then screw the adjustable head *A* of the exhaust push-rod up or down as required to obtain a clearance of *nil*. Further rotate the engine until the exhaust valve is lifted off its seat. Now tighten the lock-nut *B* on the exhaust push-rod. Afterwards screw up or down as required the adjustable head *A* on the inlet push-rod *C* until tappet clearance is *nil*. Again rotate the engine until the inlet valve is raised, and tighten the lock-nut on the inlet push-rod.

3. After Tappet Adjustment. Turn the engine over until both valves are closed. Check that the push-rods are free to rotate without appreciable up-and-down movement. Fit the cover to the off-side of the rocker-box and replace the three retaining nuts. Make sure that the three fibre washers are also replaced beneath the nuts. When tightening the nuts, avoid using excessive pressure on the spanner. Such pressure is quite unnecessary, because a rubber fillet is incorporated at the rocker-box cover joint.

DECARBONIZING ENGINE

When is it Necessary? The exact period when the removal of carbon deposits from the piston and combustion chamber becomes necessary depends to some extent on (*a*) quality of the fuel used

and (*b*) the driving conditions. Under normal circumstances it is advisable to remove the cylinder head, decarbonize and, *if necessary*, grind-in the valves every 2500 *miles approximately*. If the engine develops a tendency to "knock" when accelerating quickly or hill-climbing, this indicates that the time for decarbonizing is due. Decarbonize a *new* engine at 1500 miles.

Every *alternate* decarbonizing it is advisable to remove the cylinder barrel and take off the piston in order that the piston rings may be inspected and the rings and their grooves cleaned.

FIG. 57. FUEL TANK FIXING BOLT ARRANGEMENT (1945–8)
The fixing bolt at the rear of the tank on the left-hand side has a hexagon head, and a metal washer is used instead of a thin rubber pad. See page 140.

Decarbonizing and grinding-in the valves is not difficult if you observe the following procedure.

1. Remove Fuel Tank. It is necessary to remove the fuel tank before detaching the rocker-box and cylinder head prior to decarbonizing, also when undertaking any major engine overhaul work. To remove the tank, turn both petrol taps to the "Off" position. Disconnect petrol pipe from *both taps*, using *two* spanners (hold taps when unscrewing nuts). Then sever the locking wires securing the four tank-fixing bolts (see Fig. 57). Now unscrew the four fixing bolts and ease the tank clear of the frame.

2. Remove Rocker-box (1945-8). After tank removal, the next step towards cylinder head removal is to take off the rocker-box and push-rods. First remove the three nuts retaining the cover to the off-side of the rocker-box. Also remove the three fibre washers beneath the nuts. Then take off the rocker-box

cover. Disconnect the upper union of the oil-feed pipe from the pump to the rocker-box. Now rotate the engine slowly until both inlet and exhaust valves are closed. On the 500 c.c. engine (Model G80), detach the steady between the engine and frame by removing the nut and washer from the rocker-box bolt extension and also the bolt from the frame clip.

With a suitable spanner, remove the seven bolts which secure the rocker-box to the cylinder head. Grip the rocker-box, tilt its right-hand upwards, and withdraw both push-rods. These should not be interchanged, and for this reason should be marked or placed so that they can subsequently be identified. Raise the front end of the rocker-box so as to clear the exhaust valve assembly and swing it round anti-clockwise to clear the frame tube. The rocker-box may now be lifted clear of the inlet valve assembly and removed from the engine. Be careful not to lose the hardened steel caps on the ends of the valve stems. These caps are most important. For 1949 engines, see page 137.

3. Remove Cylinder Head. Having removed the fuel tank and rocker-box as previously described, unscrew the sparking plug. Then proceed to remove, or partially remove, the exhaust system. Before this can be done (1945–6 350 c.c. engines) remove the right-hand side of the footrest rod. Remove the nut and washer on the right-hand side of the footrest rod and partially withdraw the footrest rod from the left-hand side. Now prise off the right-hand side footrest arm.

To remove the exhaust system, first remove the nuts and washers which secure the exhaust pipe and silencer to their stays. Then pull the exhaust pipe and silencer away from the stays, and pull the pipe downwards from the exhaust port in the cylinder head.

Remove the Amal carburettor by unscrewing the venturi air-intake (1945–8 models) and the two nuts securing the carburettor flange to the cylinder head. The carburettor may be allowed to rest on the saddle, and it is not necessary to disconnect the throttle and air controls.

Next remove the four bolts which retain the cylinder head to the cylinder barrel. If these are stiff, brush paraffin round their heads and allow to penetrate before again using the spanner. Lift the cylinder head from the cylinder barrel and simultaneously remove the push-rod cover tubes which come away with the cylinder head.

4. To Remove Cylinder Barrel. Rotate the engine so that the piston is near B.D.C. Next remove the four nuts which secure the cylinder barrel to the crankcase, and then gently draw the barrel off the piston. Steady the latter with one hand as the barrel is withdrawn, and take great care not to allow the piston to fall

sharply against the connecting-rod. After removing the cylinder barrel, cover the mouth of the crankcase with a clean rag.

5. Removing Piston. To remove the full-floating gudgeon-pin, it is only necessary to extract *one* circlip with the special pliers shown at (9) in Fig. 54. Push the gudgeon-pin out from the

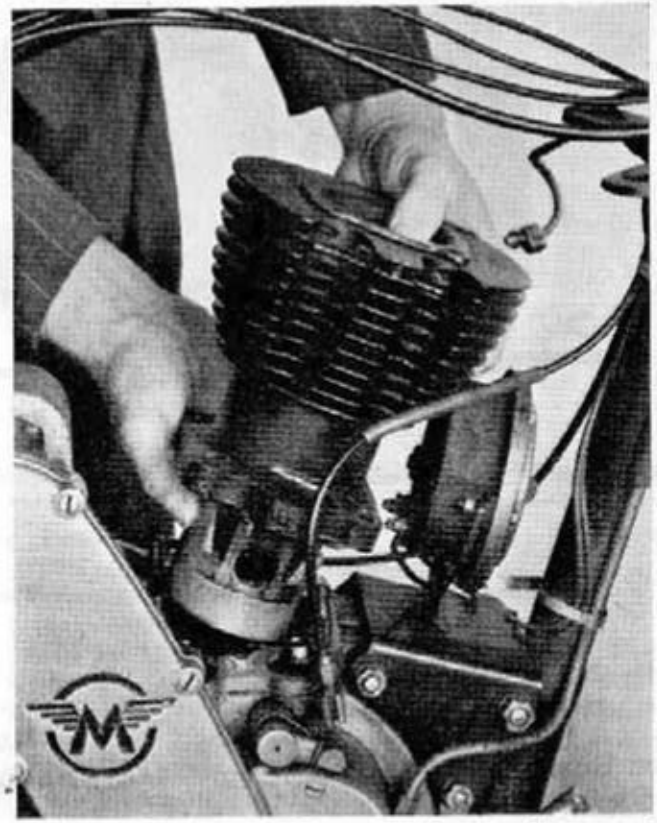

FIG. 58. CORRECT METHOD OF DRAWING OFF THE CYLINDER BARREL
Note how the piston is being steadied with one hand as the barrel is removed. The same method should be used for replacing the cylinder barrel.
(*Chas. K. Bowers & Sons*)

opposite side and remove the piston. The gudgeon-pin is an easy sliding fit in the piston bosses and the small-end bush. If the piston is not of the split-skirt type, shown in Fig. 59, scratch an "F" on the inside to indicate which is the front.

Matchless Piston Dimensions. For the benefit of more mechanically-minded readers who perhaps own workshop tools, including a micrometer, and may wish to check piston wear, the various diameters at different piston positions are given overleaf.

Normally a piston can be retained in service for very many thousands of miles; but eventually loss of compression and/or piston slap occurs due to wear of the piston, rings, and cylinder bore, especially the last-mentioned. Examine the cylinder bore

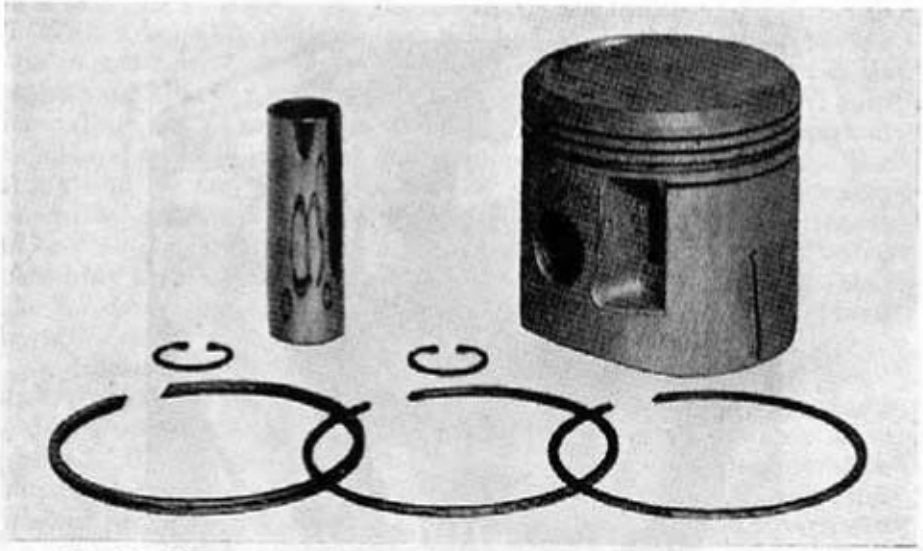

FIG. 59. MATCHLESS 500 C.C. PISTON, GUDGEON-PIN, CIRCLIPS, AND PISTON RINGS
Note the split in the "Lo-Ex" alloy piston skirt, and scraper ring left. (*Chas. K. Bowers & Sons*)

occasionally for longitudinal scores and circumferential ridges. Also inspect the piston for blackening of the skirt, scores, smearing, and other possible damage, particularly near the ring lands.

6. Piston Ring Removal. The piston rings should not be disturbed more frequently than once every *alternate* decarbonizing,

DIAMETERS OF MATCHLESS PISTONS (IN INCHES)

Position on Piston (New)	Diameter (350 c.c.)	(Diameter (500 c.c.)
Top Land	2·6872–2·6882	3·2140–3·2150
Second Land	2·6957–2·6967	3·2255–3·2265
Third Land	2·6957–2·6967	3·2185–3·2195
Top of Skirt (1945–7)	2·7127–2·7137	3·2430–3·2440
Bottom of Skirt (1945–7)	2·7138–2·7148	3·2441–3·2451
Top of Skirt (1948)	2·7162–2·7172	3·2475–3·2485
Bottom of Skirt (1948)	2·7167–2·7177	3·2480–3·2490
Top of Skirt (1949)	2·7167–2·7177	3·2480–3·2490
Bottom of Skirt (1949)	2·7172–2·7182	3·2485–3·2495

provided that engine compression remains good. The rings can be removed by "peeling off" with a small knife, but it is preferable to remove them with the aid of three strips of thin sheet metal (about ¼ in. wide) inserted beneath each ring as shown in Fig. 60.

The rings, being made of cast iron, cannot safely be sprung out wider than the piston crown diameter. If the rings are stuck with carbon, apply some paraffin. If this fails, use a proprietary ring removal tool.

7. Inspecting Piston Rings. Inspect the two compression rings and the scraper ring very carefully. To ensure good engine compression the piston rings must have good springiness, be free, but not slack in their grooves, have a polished surface all round, and have their gaps equally spaced and of the correct size.

If inspection reveals that the ring surfaces are bright all round, they are obviously making good circumferential contact with the cylinder bore and can be regarded as serviceable. If, on the other hand, the surfaces are discoloured or scorched at some points, contact is poor and it is desirable to reject the rings and fit new ones. The same applies where the rings are vertically slack in their grooves.

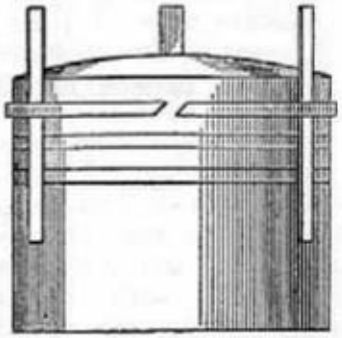

FIG. 60. THE SAFEST METHOD OF REMOVING PISTON RINGS

Clean the rings thoroughly on their inside faces, also the ends of the rings, and the slots in the scraper ring (see Fig. 59). Piston rings are made to very precise dimensions, and it is not generally practicable to fit oversize rings unless the piston is renewed also. Always fit genuine Matchless rings which are dimensionally correct.

8. Matchless Ring Dimensions. The width of the compression rings and the slotted scraper ring on all engines are $\frac{1}{16}$ in. and $\frac{1}{8}$ in. respectively. The normal ring gap is 0·006 in. to 0·008 in. and rings should be renewed when the gap exceeds 0·030 in. The normal clearance of each ring in its groove is 0·003 in.

After a considerable mileage, or if loss of compression occurs with the valves in good condition, check the gap of each piston ring. The best method of checking the gap is to push the ring squarely into the bore of the cylinder barrel with the aid of the piston and then check the gap between the ends of the ring with a feeler gauge. If the gap proves excessive, fit new Matchless rings (already "gapped"); if the gap is insufficient, remove some metal from *one* end of the ring to increase the gap to 0·006 in.

0·020 in. Oversize Piston and Rings Available. The engine manufacturers are able to supply a piston and rings which are 0·020 in.

oversize in diameter, but their fitting necessitates reboring the cylinder barrel bore to suit. A rebore is generally required when wear at the top of the bore reaches 0·008 in. On the 500 c.c. engine the diameter of the standard cylinder bore is 3·250 in. ± 0·005 in. On 350 c.c. engines it is 2·7187 in. ± 0·0005 in. When a rebore becomes necessary it is best to entrust this to the Plumstead factory. For charges, see Spares List.

9. To Remove Valves (1945-8). A valve spring compressor is not necessary. Lay the removed cylinder head on the bench or table and rest each valve head in turn on a small wooden block.

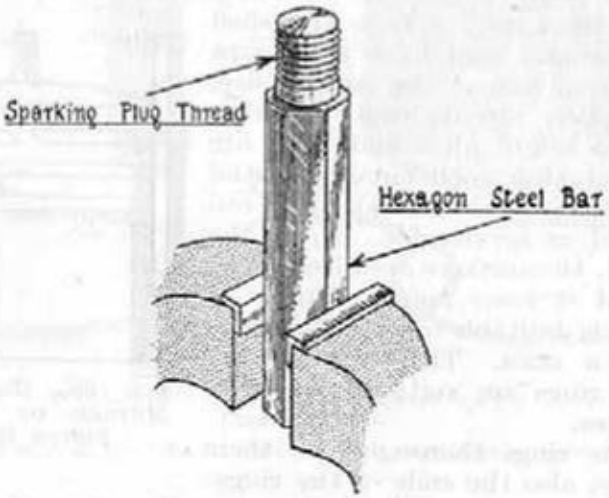

FIG. 61. A HOLDER THAT IS USEFUL WHEN DECARBONIZING THE CYLINDER HEAD

Then compress the duplex valve springs by exerting pressure on the *outer* collar until the split collet can be removed from the valve stem. It may be necessary to tap each collar sharply to free the split collet, as the latter is a taper fit in the collar. On the 500 c.c. engine the inlet and exhaust valves are of identical size, unlike those on the 350 c.c. engine, but valves must not be interchanged. To remove valves on 1949 engines, see page 137.

10. Scraping Off the Carbon. The best tool to use for scraping off the carbon deposits is an old (blunted) screwdriver, or a proprietary scraper (obtainable from most accessory dealers). For cleaning piston ring grooves a suitable scraper can be made up by fitting a handle to a piece of broken piston ring, or better still a proprietary tool can be obtained for the purpose. It is worth while decarbonizing *thoroughly*, as carbon deposits form less rapidly on smooth surfaces. Where deposits are found to be very

hard, the application of a little paraffin will facilitate their removal.

If the cylinder barrel has not been removed, scrape off all carbon from the piston crown, but *on no account use any abrasive.* Should this get between the piston and cylinder (as it probably would) your Matchless would rapidly go into a decline! Be very careful not to make any deep scratch marks on the comparatively soft surface of the light alloy piston. Scrape off all carbon from the inside of the combustion chamber. Do not forget to chip off and completely remove all carbon from the valve ports, the vicinity of the valves, the valve heads, and the sparking plug hole. It is permissible to use some *fine* emery cloth to polish up the combustion chamber surface, but if this is done the cylinder head must afterwards be very thoroughly cleaned and all trace of abrasive particles removed. Use a rag damped with paraffin. Do not touch the cylinder bore.

If the cylinder barrel *and* piston have been removed, it may be advisable to scrape carbon off the inside of the piston, but unless the deposits are thick, this should not be done. Remove all carbon from the piston crown, but *do not touch the skirt.* Any attempt to scrape the piston skirt may have disastrous results. The piston ring grooves, however, need attention. Clean these up thoroughly, but be very careful not to scrape the actual metal comprising the sides of the grooves. Make sure that the holes in the groove for the scraper ring (see Fig. 59) are unobstructed. The cleaning of piston rings is referred to on page 97. After decarbonizing is complete, clean all parts thoroughly with suitable clean rags and paraffin.

11. How to Grind-in the Valves. Although the engine manufacturers recommend that the valves be ground-in every time the engine is decarbonized, it should be understood that excessive valve grinding is not advisable as this is liable to cause the valves to become "pocketed," with a resultant loss of engine efficiency. If the valves are seating perfectly, leave them alone.

After removing the valves for grinding-in, clean both valve heads thoroughly and polish the valve stems with some fine emery cloth, using an up-and-down motion with the emery cloth held between the forefinger and thumb. Then proceed to grind-in each valve as described below, using a good grinding paste such as Richford's (obtainable in two grades, coarse and fine).

To grind-in a valve, lay the cylinder head down on the bench, with fins uppermost. Then smear the bevelled face of the valve with some grinding paste. If the valve face and seat are only slightly pitted, it should be sufficient to use a *fine* grade of paste only. Moderate pitting may necessitate the preliminary application of a coarse grade, and if the pitting is very severe, it may be

necessary to have the valve seats refaced with a cutter having a cutting angle of 45 degrees.

Insert the valve in its seat and oscillate the valve about a quarter of a turn backwards and forwards by means of the Matchless grinding tool. Maintain a slight pressure between the valve and its seat and lift the valve occasionally and turn it to a new position. Continue to grind in the valve until a continuous matt ring is present on both the valve seat and the valve. Generally one application of grinding paste is sufficient for the inlet valve, but the exhaust valve may require several applications to obtain good results.

12. After Grinding-in Valves. See that every trace of grinding paste is eradicated by cleaning the valves and the two seats with petrol and a clean rag. To ensure that the valve guides are free from damaging abrasive, it is advisable to draw a piece of clean rag through both guides.

13. To Check Valve Spring Length (1945-8). After much use the hard-pressed valve springs may weaken under the influence of heat, and thereby spoil the quick and positive action of the valves, which is so vital to high engine efficiency. The condition of the valve springs is reflected in their free length, which should be checked very occasionally with a small rule. On the 350 c.c. and 500 c.c. O.H.V. engines, the free length of inner and outer valve springs is $1\frac{1}{16}$ in. and $2\frac{1}{16}$ in. respectively[1]. Renew immediately any valve springs whose free length is found to be more than about $\frac{7}{32}$ in. below the free length dimensions quoted above.

14. To Replace Valves (1945-8). Clean the insides of both valve guides, smear some engine oil on the valve stems. Then fit the inlet and exhaust valves in their respective guides. On the 350 c.c. engine (Model G3/L) the inlet valve can immediately be recognized, as it has a larger diameter head than the exhaust valve. On the 500 c.c. engine (Model G80), however, the dimensions of both valves are identical, though the material differs. In this case, before fitting the valves, note the markings "IN" or "EX" on top of the inlet and exhaust valve stems respectively, above the grooves for the split collets.

Rest each valve head in turn on a small wooden block, and fit the duplex valve springs and collars. Compress the valve springs and then fit the split collet. A distance sleeve must be fitted next to the cylinder head under the lower collar for the exhaust valve springs, but this does not apply to the inlet valve. Make quite sure that both split collets are properly located. The two grooves machined in the bore of each split collet must *both* register with the corresponding rings on the valve stem, otherwise damage

[1] On 1948 engines the free length of the inner and outer valve springs is 2 in. and $2\frac{13}{64}$ in. respectively. 1949 engines have hairpin valve springs.

may result. Finally replace the hardened caps on the ends of the valve stems. Under no circumstances must these caps be omitted. Failure to replace them will cause wear and possibly actual damage through fouling of the oil lug on the rocker-box by the tappet adjuster head. See also page 138.

15. Replacing Piston Rings. If these have been removed, fit them in their grooves, which should first be oiled. The safest method of fitting the piston rings is to use three strips of thin

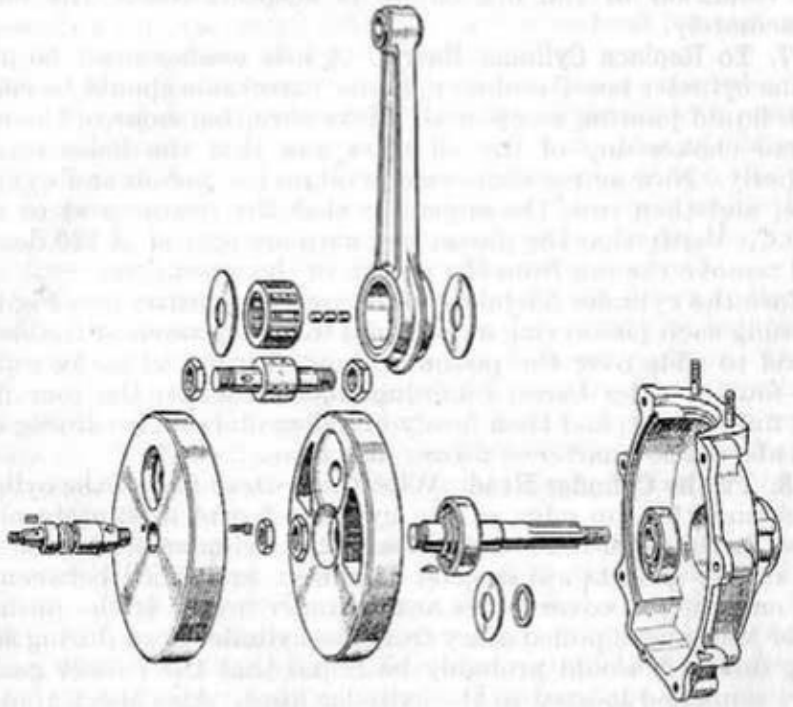

FIG. 62. SHOWING DETAILS OF MATCHLESS FLYWHEEL AND CONNECTING-ROD ASSEMBLY
(From "The Motor Cycle")

sheet metal, as illustrated in Fig. 60. Fit the (bottom) scraper ring first, and then the two compression rings. Space the ring gaps evenly, that is, at 120 degrees to each other. It is assumed that the ring gaps are within the permissible limits (see page 97). If new rings are fitted, these are correctly "gapped" by the makers and are ready for immediate use.

16. Replacing Piston. It is assumed that all parts are thoroughly clean and that the piston rings have been refitted. Smear some engine oil on the gudgeon-pin and then offer up the piston to the small-end of the connecting-rod. The piston must be replaced in

exactly the same position as before. If it is of the split skirt type (Fig. 59), the split itself must face to the *front* of the machine. This is essential.

Next insert the gudgeon-pin from the side from which the circlip has been removed. Centralize the gudgeon-pin, and with the small pliers, shown at (9) in Fig. 54, replace the circlip, using a rotary movement to ensure that it beds snugly into its groove. Perfect fitting of the circlip is essential to prevent damage. If the condition of the old circlip is suspect, renew the circlip immediately.

17. To Replace Cylinder Barrel. A *new* washer must be fitted to the cylinder base,[1] and its cylinder barrel side should be coated with liquid jointing compound. Make sure that none of the compound chokes any of the oil holes and that the holes register properly. Now smear some engine oil on the piston and cylinder bore, and then turn the engine so that the piston is at or near B.D.C. Verify that the piston ring gaps are spaced at 120 degrees and remove the rag from the mouth of the crankcase.

Ease the cylinder barrel carefully over the piston (see Fig. 58), pressing each piston ring as required into its groove to enable the barrel to slide over the piston without friction. Finally replace the four cylinder barrel retaining nuts. Tighten the four nuts, first finger-tight, and then firmly in a diagonal order, turning each nut about one-quarter of a turn at a time.

18. Fit the Cylinder Head. Wipe the bottom face of the cylinder head and the top edge of the cylinder barrel absolutely clean. Then fit the push-rod cover tubes to the cylinder head. See that the rubber gaskets are in good condition, and fitted between the top ends of the cover tubes and cylinder head. If the push-rod cover tubes were pulled away from the cylinder head during stripping down, it would probably be found that the rubber gaskets have remained located in the cylinder head. Also check that the metal washers are interposed between the top edges of the rubber gaskets and the recesses in the cylinder head.

Fit the cylinder head gasket on the top edge of the cylinder barrel. If the gasket is not in perfect condition, renew it. Also place the two rubber glands round the inlet and exhaust tappet guides. Then replace the cylinder head on the barrel, complete with push-rod cover tubes, and fit the four cylinder head retaining bolts. Each bolt must be fitted with a plain steel washer. Tighten each bolt a few turns and then gradually tighten all four, using a diagonal sequence to ensure an even pressure being exerted on the cylinder head.

19. Fit the Rocker-box (1945-8). Wipe the lower face of box

[1] On the 500 c.c. engine (Model G80) a compression plate is fitted as standard and a paper washer should be fitted on each side of it.

and the upper face of the cylinder head absolutely clean. Verify that the hardened steel caps *are* fitted to the ends of the inlet and exhaust valve stems. Then rotate the engine so that the piston is at or near T.D.C. on the compression stroke, with both tappets right down.

Place the special composition washer on the cylinder head face for the rocker-box, but before doing this inspect it carefully. Renew this washer if there is the slightest sign of damage. When fitting the composition washer, make sure that its small lip is concentric with the small hole in the cylinder head through which oil is fed to the stem of the inlet valve.

Now place the rear end of the rocker-box over the inlet valve assembly and swing it clockwise over the exhaust valve assembly until it is in the normal position. Next raise the offside of the rocker-box slightly and insert the two push-rods down the push-rod covers, being careful not to interchange the inlet and exhaust rods. Make certain that the push-rod ends engage the tops of the flat-base tappets and the overhead rocker arm ends.

Push the rocker-box right home and fit the seven rocker-box retaining bolts and plain steel washers. See that the bolt having a short head is fitted in the centre, right-hand position. On the 500 c.c. engine (Model G80) be careful to replace the bolt with the threaded extension (for the engine steady stay) in its correct position. Tighten all seven bolts lightly and then, using a diagonal sequence starting near the centre, firmly tighten them all, turning each nut a little at a time.

Connect the engine steady stay (500 c.c. only) to the rocker-box bolt with threaded extension, and fit the washer and nut. Bolt the other end of the steady to the clip on the frame down tube. Rotate the engine a few turns to enable all parts to bed home. Then with the appropriate spanner, check that all rocker-box retaining bolts are firmly tightened. Having done this, check the tappet clearances and adjust, if necessary. See also page 138.

20. Fit Pipe and Cover. Reconnect the oil-feed pipe from the pump to the rocker-box. Use two spanners when tightening the upper union, to prevent the union (screwed into the rocker-box) from turning. Fit a new rubber fillet to the rocker-box side cover if examination of the fillet shows deterioration. Then fit the rocker-box side cover to the rocker-box, and replace the three fibre washers and securing nuts. Tighten these nuts evenly, but not too tightly. The provision of a rubber fillet renders excessive tightening quite unnecessary.

21. Final Engine Assembly. Final reassembly, after decarbonizing, is completed by replacing the Amal carburettor, the sparking plug, the exhaust system, and the footrests. When fitting the Amal carburettor, it is important to obtain an absolutely

air-tight joint at the attachment flange. Renew the washer if not perfect, also the copper washer for the sparking plug.

22. Replace Fuel Tank. The fuel tank is secured to the frame by four fixing bolts and a number of rubber pads and metal washers. Details of a fixing bolt assembly are shown in Fig. 57, and the correct assembly order should be carefully noted.

To replace the fuel tank, first lay a metal washer on each of the

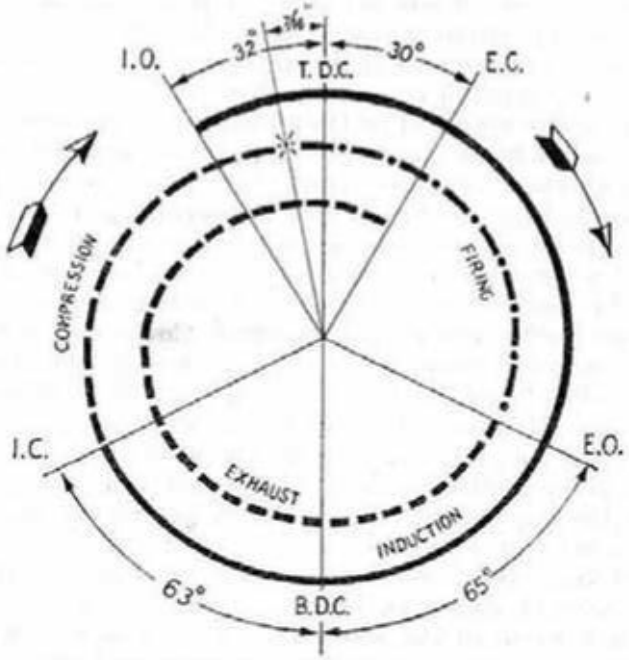

FIG. 63. MATCHLESS VALVE TIMING DIAGRAM

This diagram is applicable to all 1945 and later 350 c.c. and 500 c.c. engines. The ignition timing (full advance) is also shown (¼ in. B.T.D.C. for 1949).

four tank support brackets. Next place a *thick* rubber pad on to of each metal washer and position the fuel tank. It will be note that one of the four fixing bolts has a hexagon head. Fit a metal washer to this bolt and screw the latter into the rear tank location on the left-hand side. Fit *thin* rubber pads over the other three fixing bolts and fit the bolts.

Having fitted all four fixing bolts, screw the bolts home evenly until the rubber pads are slightly compressed. Do not screw the bolts right home, otherwise the tank will not be effectively insulated. Finally wire-lock the fixing bolts in pairs with 22 gauge wire, and replace the fuel pipe. When tightening the union nuts at the upper end of this pipe, hold the body of each tap with the adjustable spanner provided in the tool kit.

VALVE TIMING

The valve timing used on Matchless engines is the result of most careful calculation, experiment and design. Foolish indeed is the motor-cyclist who imagines that he can improve on this setting, which is shown in degrees of crankshaft rotation in Fig. 63.

After dismantling the timing gears it is necessary to re-time

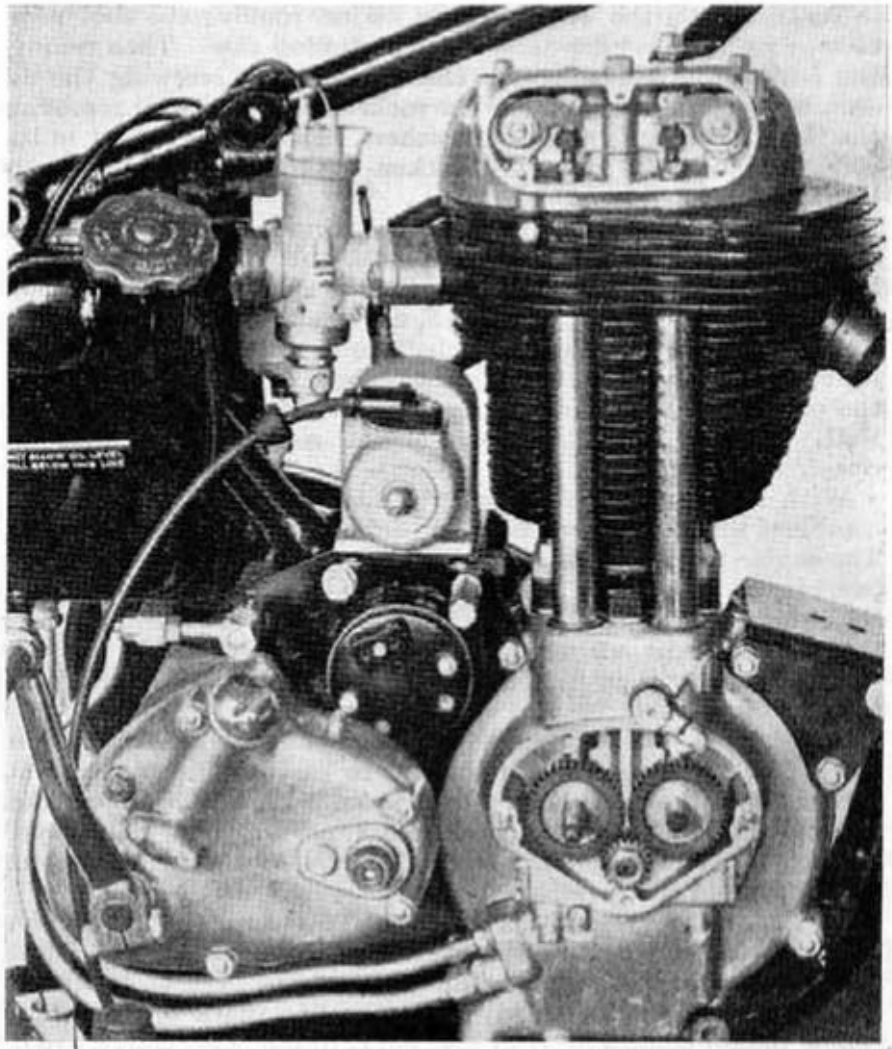

FIG. 64. MATCHLESS ENGINE WITH TIMING CASE AND ROCKER-BOX COVERS REMOVED, SHOWING TIMING GEARS AND TAPPET ADJUSTMENT

The correct alinement of the timing gears is shown in Fig. 65, and the procedure for adjusting the tappets is explained on page 91.

the valves, but this does not involve actual checking of the timing by attaching a degree disc to the crankshaft and measuring in degrees of crankshaft rotation the exact periods when the inlet valve opens and the exhaust valve closes. To avoid the necessity for doing this, the timing gears are marked with a line system of identification which makes correct replacement of the timing gears a simple operation.

To Dismantle the Timing Gears. First remove the foot gear-change pedal to render accessible the timing case. Then remove the cover from the magneto chain case by unscrewing the six securing screws. Also remove the rocker-box cover after removing the three fixing nuts and fibre washers. The engine is now in the condition shown in Fig. 40. Slacken the magneto driving chain if it is tight, as illustrated.

Unscrew the nut (R.H. thread) that secures the sprocket to the magneto armature spindle and remove this nut and the washer behind it. With a suitable tool, lever the sprocket off the spindle taper. Should the sprocket be stiff, use a suitable sprocket-drawer. Remove the magneto driving chain and withdraw the sprocket from the inlet camshaft in the same manner employed to withdraw the other sprocket. The securing nut for this sprocket also has a R.H. thread. Next turn the engine so that *both valves are closed*.

With a screwdriver, remove the five screws that secure the combined magneto chain-case and timing cover to the timing-case. The engine is now in the condition shown in Fig. 64, and the twin camwheel timing gear is exposed. Before completely removing the timing-case cover, hold the two camwheels in position in case they should come adrift when the cover is lifted clear. The two camwheels may then be removed by pulling the camshafts from their bearings.

Generally it is unnecessary to remove the small engine pinion, but if for some reason you decide to extract the pinion, you should undo the nut (L.H. thread) and with a suitable extractor pull the pinion off the crankshaft taper to which it is keyed (one key). To assemble the timing gears, use the procedure for dismantling in the reverse order.

To Ensure that Timing is Correct. To ensure that the valve timing is correct, it is necessary to use the following procedure when assembling the timing gears—

(1) Turn the engine slowly until the line mark on the small engine pinion (shown at *D* in Fig. 65) is in line with the centre of the bush for the inlet camshaft. The bush concerned is the *rear* one.

(2) Fit the inlet camshaft so that the line mark on the camwheel registers with the line mark on the small engine pinion *D* as shown in the right-hand illustration.

(3) Turn the engine slowly *forward* until the line mark on the small engine pinion *D* is in line with the centre of the bush for the exhaust camshaft (the front bush).

(4) Fit the exhaust camshaft so that the line mark on the camwheel registers with the line mark on the engine pinion as shown in the left-hand illustration.

If both camwheels are alined in accordance with the above procedure, the valve timing *must* be correct, provided that the timing-gear teeth have not become excessively worn, in which case it is time that the engine and machine are completely overhauled. It is advisable after assembling the timing gears to check

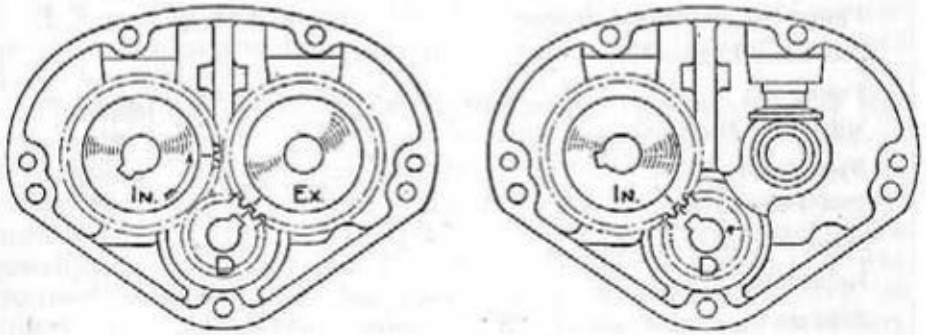

FIG. 65. HOW TO ALINE THE TIMING GEAR MARKS

Fit the inlet camwheel as shown in the right-hand sketch. Then turn engine forwards, and fit the exhaust camwheel as shown in the left-hand sketch.

that the tappet adjustment (see page 91) is correct, as this affects the valve timing to a small extent. Also check the magneto chain tension (see page 68).

Checking by Degree Method. If for any reason you make an actual check on the valve timing by attaching a degree disc to the crankshaft, it is essential *before* starting to check the timing to adjust both tappet clearances to 0·016 in. with the piston at T.D.C. on the compression stroke.

A Rough Check on Timing. It will be noticed from the valve timing diagram (Fig. 63) that the inlet valve opens 32 deg. before T.D.C. and the exhaust valve closes 30 deg. after T.D.C. There are, in fact, only 2 deg. difference between the I.O. and the E.C. Accordingly a rough check on the valve timing can be made by "rocking" the engine about the T.D.C. position an equal amount either side. It should be noticed that as one valve opens the other closes, and vice versa.

Engine Data. On Model G3/L the bore and stroke of the engine are 69 mm. × 93 mm., giving a cubic capacity of 347 c.c. The compression ratio (1945-9) is 6·3 to 1.

On Model G80 the bore and stroke are 82·5 mm. × 93 mm.,

giving a cubic capacity of 498 c.c. The compression ratio with compression plate (fitted as standard) is 5·97 to 1. With no compression plate fitted, the C.R. is 7·24 to 1. Both the O.H.V. push-rod operated engines have "Lo-ex" alloy pistons, triple-row roller big-end bearings, and two-piece crankpins. See page 140.

MEMORANDA

Phone No. of Matchless Motor Cycles ..... Woolwich 1223
Nearest Matchless Spares .....
Phone No., Matchless Spares .....
Matchless Engine No. .....
Frame No. ..... see page 88
Mileage of Machine .....
New Piston Fitted .....
New Piston Rings .....
Major Replacements .....
Rebushing .....
Rebores .....
Complete Overhauls .....
Decarbonizing .....
Grinding-in Valves .....
.....
.....

COMPLETE OVERHAUL

After a very big mileage has been covered and the engine begins to show signs of wear and tear, indicated by falling off in performance and some mechanical noise, it is advisable to submit the engine to a complete overhaul. This can best be undertaken by the makers or, if you are sufficiently skilled, by yourself as far as the stripping down and renewal of certain parts are concerned.

Some repair jobs *must* be undertaken by the makers or by skilled mechanics with good equipment. The engine should be removed from the frame, completely stripped-down, and all parts inspected, and renewals or repairs effected where called for.

Points to Note. During the complete overhaul and inspection, clean all parts thoroughly as they are removed. The magneto and

carburettor must be closely examined. As regards the engine itself, if air leaks or poor compression exist, look for the causes.

All bearings, especially the small- and big-end bearings, must be inspected for slackness and damage, and an inspection must be made of the cylinder bore, "Lo-ex" alloy piston, piston rings, gudgeon-pin, valves, valve seats, valve guides, split collets, valve springs, valve collars, overhead rockers, tappets, end caps, push-rods, tappet guides, timing gears, cams, oil pump, magneto drive, pipes, tank filters, etc. To sum up, *everything* should be examined, including the engine controls.

If You Split Crankcase. On no account forget to remove the oil pump plunger first (see page 32), otherwise damage will probably occur.

Flywheel and Connecting-rod Assembly. The overhaul of this assembly is best undertaken by Matchless Motor Cycles at Plumstead, unless you are a skilled mechanic and have adequate tools for the job. Alining the flywheels is a skilled operation and necessitates a jig or a dial indicator. You can perhaps renew the small-end bush, but as the bush contracts when pressed in to the connecting-rod, a reaming operation is therefore required to obtain a good fit for the gudgeon-pin. Actual repair work is very different from ordinary maintenance, with which this book is concerned.

Oversize Rollers for Crankpin. Crankpin rollers 0·001 in. oversize are obtainable, but must be fitted by skilled mechanics only, as it is usually necessary to "lap" the big-end journals and liners to obtain a precision fit.

STORING ENGINE

The Carburettor and Magneto. Deal with these as described at the end of Chapters V and VI respectively.

Clean the Lubrication System. Take a short run on your machine to warm up the engine and then change the oil and clean both filters as described on page 31. Now disconnect the return pipe from the pump to the oil tank and run the engine for a short period. This will force out the dirty oil, which can be collected in a tray or tin. Re-connect the return pipe when the oil issues in a clean condition. Also stop the engine. Finally, top-up the oil tank to the maximum permitted level (see page 30).

Seal the Combustion Chamber. To prevent internal corrosion, which may have a most damaging effect on the cylinder bore, valve seats, etc., it is essential to seal the combustion chamber in such a way that no moisture can get inside. If the valves or their seats are slightly pitted, grind them in. Then turn the engine so that both valves are completely closed. Tighten down the

sparking plug securely and see that its copper washer is sound before doing so.

While the engine is not being run, the oil tends to drain down the cylinder surface and this loss must be countered.

Occasionally remove the sparking plug and pour in enough clean engine oil to cover the piston. Then kick the engine over smartly (do not start it) many times so as to cause the pump to force the oil under pressure to the bearings, and to splash-lubricate the cylinder bore thoroughly.

CHAPTER IX

MAINTENANCE OF CYCLE PARTS (1945-8)

ALTHOUGH engine-maintenance is vital, do not neglect the tyres and the lighting system, and pay due regard to the correct lubrication and adjustment of the cycle parts. This chapter includes *all* essential maintenance instructions, and advice on dismantling and assembling.

Spares and Repairs. Note the advice given at the beginning of Chapter VIII concerning the Spares List, forwarding of parts to the makers, and large accessory firms. See also page 136.

Items Necessary for Maintenance. It is desirable to have the following items available: a can of paraffin, a stiff brush, a tin of *summer grade* engine oil, a canister of light grease (see pages 29 and 36), a tin of hydraulic fluid and a flask graduated in fluid oz. (see page 42), a tyre pressure gauge, a hydrometer, and a receptacle for draining the gearbox.

For cleaning purposes the following are also needed: some jars or dishes, some non-fluffy rags, two chamois leathers, a sponge and pail (if no hose is available), some soft dusters, a tin of wax polish, and a tin of suitable polish for the chromium.

Tools Required. The Matchless tool kit shown in Fig. 54 (excluding engine maintenance tools 6, 9, 11) are sufficient for all routine maintenance, stripping down and assembly, but it is desirable to buy a chain rivet extractor and a box of spare chain links. If you are in the mood to tackle repair work as well as maintenance, consider the extra tools suggested on page 88.

ROUTINE MAINTENANCE

Some routine maintenance operations are described in detail in earlier chapters of this handbook and suitable cross-references to these chapters are included in this chapter.

The Tyres. For detailed instructions on the care of tyres, see appropriate paragraphs in Chapter II.

The Lighting System. Keep the lights bright by attending to lamp, battery, and dynamo maintenance as described in Chapter VII.

Lubrication of Cycle Parts. This is fully explained in Chapter IV. Attend to the lubrication points indicated at 6 to 17 in the Lubrication Chart on page 37. Apply the grease gun regularly to those points indicated by numbers in shaded circles. Gearbox replenishment is needed every 1000 miles. See also page 38.

Keep the Machine Clean. If the enamelled and chromium-plated parts are neglected, the machine will soon become shabby-looking, and serious rusting may occur. On no account leave your Matchless soaking wet over-night. If you have not time for thorough cleaning in wet weather, grease the machine all over before using it. When cleaning the machine, use a stiff brush and paraffin for removing filth from the lower part of the gearbox.

Cleaning Enamelled Parts. Never try to remove caked mud by attempting to brush or rub it off when dry. Instead, carefully soak it off by means of a hose. When doing this, be careful not to direct the stream of water on to vital and vulnerable components such as the carburettor, dynamo, and magneto. If no hose is available, soak off the mud with a pail of water and a sponge. After removing all mud and dirt, dry the enamelled parts with a chamois leather, and afterwards polish the surfaces with soft dusters and some suitable wax polish, or a good proprietary polish.

How to Clean Chromium. On no account use ordinary liquid metal polish or paste to clean any of the chromium-plated parts. Such cleaners generally contain oleic acid which attacks the chromium. It is permissible, however, to clean the surfaces occasionally with some special chromium cleaning compound. To remove tarnish (salt deposits), it is advisable to clean the surfaces regularly with a damp chamois leather and afterwards polish them with a soft duster.

During Winter. It is a good plan to apply with a soft cloth to all chromium-plated surfaces one or other of the preparations on the market that help to render chromium-plate impervious to moisture—and so to reduce tarnishing. See also page 140.

Maintenance of "Teledraulic" Front Forks. Apart from checking the level of the hydraulic fluid occasionally (pages 41–42) and topping-up if necessary, no attention is called for. No adjustment is necessary and all working parts are automatically lubricated by means of the hydraulic damping fluid. Unless damage has been accidentally sustained, the "Teledraulic" front forks (see Fig. 69) should normally not require to be dismantled. However, after a very big mileage (say, 20,000 miles) the oil seal and paper washer in each fork leg, shown at (49) and (21) respectively in Fig. 69, may require attention. The same applies to the leather and fibre washers.

Having regard to the negligible attention normally required in respect of the "Teledraulic" front forks, the author has not included in this handbook detailed instructions for their stripping down and subsequent assembly. Those who on rare occasions require such information should refer to the appropriate instructions given in the instruction book issued with each new Matchless machine, or else contact the manufacturers.

Keep Nuts and Bolts Tight. Occasionally check all external nuts and bolts for tightness. See notes on page 91 concerning this.

VARIOUS ADJUSTMENTS

Saddle Adjustment. On the 1948 Matchless machines an adjustment is incorporated at the bottom ends of the saddle mounting springs. It is worth experimenting with the nut adjustment until the most comfortable saddle position is obtained (see page 141).

Maintenance of Burman Gearbox. Apart from attending to lubrication as described on page 35 of Chapter IV, the gearbox

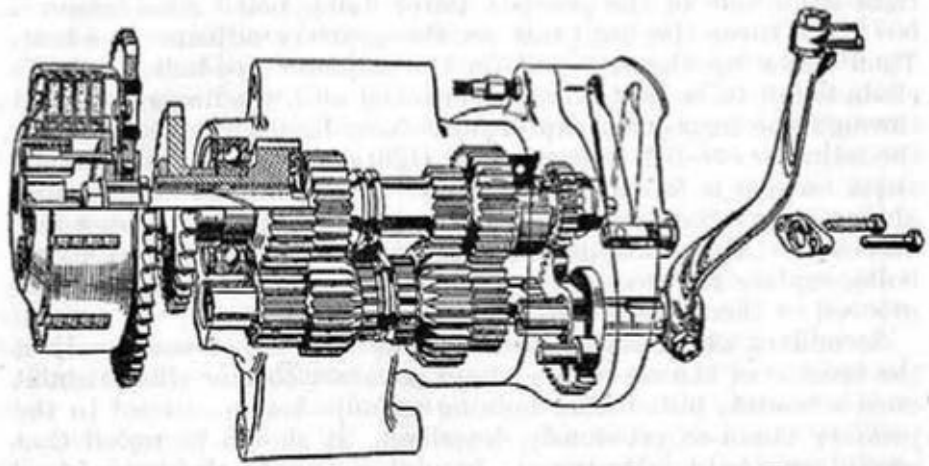

FIG 66. CUT-AWAY VIEW SHOWING INTERNAL DETAILS OF BURMAN FOUR-SPEED GEARBOX AND MULTI-PLATE CLUTCH

itself needs no attention for thousands of miles. After a very big mileage it may need stripping-down and thoroughly overhauling. The gearbox (Fig. 66) is best returned to the makers for this work.

Handlebar Adjustment. The handlebars on all 1945–9 Matchless models are adjustable for angle to suit individual requirements. On 1945–7 models loosen the two nuts which secure the handlebars to the "Teledraulic" front forks and then adjust handlebars as required. On 1948–9 models loosen the four nuts on the studs of the box-type clamp provided at the rear of the aluminium alloy head lug, and then adjust the bars for angle. After making the adjustment, be sure to retighten firmly the two or four securing nuts.

Adjusting Brakes. Full instructions on how to keep the front and rear brakes efficient by making minor and major adjustments are given in Chapter III.

To Adjust Primary Chain. The tension of the primary chain (see Fig. 72) should be checked about *once a month* and, if necessary, adjusted. Adjustment of the primary chain must always be

effected *before* that of the secondary chain, as it alters the tension of the secondary chain automatically.

To check the primary chain adjustment, place the machine on the rear stand and remove the inspection cap from the oil-bath chain case (see page 38). Then with the fingers check the chain whip (total up-and-down movement) mid-way between the two sprockets, with the chain in its tightest position. The whip should be approximately $\frac{3}{8}$ in.

If an adjustment is needed, slacken: (*a*) the nut on the right-hand side of the gearbox upper fixing bolt; (*b*) the nut on the right-hand side of the gearbox lower fixing bolt. Also loosen a few (2–3) turns the front nut on the gearbox adjuster eye-bolt. Then screw up the rear nut on the adjuster eye-bolt until the chain is felt to be quite taut, as checked with the fingers inserted through the inspection cap orifice. Now loosen the rear nut on the adjuster eye-bolt and carefully tighten the front nut until the chain tension is found to be correct. To obtain the best results, always overtighten first and then slacken back in the manner just described. Afterwards tighten the nuts on both gearbox fixing bolts, replace the inspection cap on the oil-bath chain case, and proceed to check the tension of the secondary chain.

Secondary Chain Adjustment. Check and, if necessary, adjust the tension of the secondary chain (gearbox to rear wheel) about once a month, but, before making an adjustment, attend to the primary chain as previously described. It should be noted that secondary chain adjustment, involving sliding the rear wheel bodily in the slotted fork ends, generally necessitates an adjustment of the rear brake being made, and care must be taken not to upset wheel alinement. Chain adjustment is correct when the chain, in its most taut position, has a whip mid-way between the sprockets of $\frac{3}{8}$ in. to $\frac{1}{2}$ in. See also page 144.

To tighten the secondary chain, first jack up the machine on the rear stand. Then loosen the nuts on the rear wheel spindle. Also slacken 2–3 turns the nuts on the two chain adjuster bolts which are screwed into the front of the fork ends. Then progressively and *uniformly* screw both adjuster bolts farther into the fork ends until the tension of the chain is correct. It is vitally important to screw both adjuster bolts into the fork ends exactly the same amount, otherwise wheel alinement (see page 14) will be upset, and this will necessitate a further adjustment being made. Having obtained the correct chain tension without upsetting wheel alinement, tighten the nuts on the rear wheel spindle and again verify the chain tension. Finally tighten the lock-nuts on the chain adjusters and also ascertain whether the rear brake is in need of adjustment (see page 21).

Adjusting Dynamo Chain. The tension of the chain which drives the dynamo (see Fig. 72) should be checked *monthly* and adjusted if necessary in accordance with the instructions given on page 80 of Chapter VII. It is not necessary to remove the oil-bath chain case cover as shown in Fig. 72.

Transmission Harshness. If harshness in the transmission develops, immediately check the level of oil in the oil-bath chain case. Provided the oil level is maintained correct, proper lubrication of the faces of the two cams of the shock-absorber (see Fig. 72) fitted to the engine shaft is ensured. Top up the oil level, using engine oil, as required (see page 29). If harshness continues, remove the outer half of the oil-bath chain case, and dismantle and lubricate the components of the shock-absorber. (See also page 127.)

When assembling the engine shaft shock-absorber, fit the components in this order: (*a*) the spring collar, which is a sliding fit on the driving side flywheel main shaft and lies between the ball bearing of this shaft and the engine sprocket; (*b*) the engine sprocket, which is integral with the dynamo driving sprocket; (*c*) the shock-absorber cam which overrides the engine sprocket cam under the influence of the engine impulses; (*d*) the shock-absorber spring; (*e*) the cap washer, which retains the shock-absorber spring; (*f*) the sleeve lock-nut, which must be firmly tightened against the driving side flywheel main shaft.

Burman Clutch Adjustment. Fig. 67 shows a cut-away sectional view of the assembled clutch and operating mechanism which is completely enclosed in the gearbox casing, as may be seen in Fig. 66. It should be noted that on the 500 c.c. model the clutch has five friction insert plates, whereas on the 350 c.c. model there are only four, as illustrated. Details of the clutch-operating lever and its fulcrum adjustment are clearly shown in Fig. 68.

Why Necessary. From a glance at Fig. 67 it will be readily apparent that wear of the fabric inserts in the friction plates gradually causes the clutch plates to close up towards each other, with the result that the effective length of the clutch thrust rod (inside the hollow gearbox mainshaft) is increased. The clutch cable, however, tends to stretch with repeated use of the clutch lever and thereby to some extent neutralizes the effect of clutch insert wear. Clutch slip must be avoided at all costs, as it causes damage and overheating, and spoils performance. Sometimes it is due to incorrect adjustment of the clutch springs (see page 117), but generally it is due to insufficient free movement in the clutch operating mechanism. Referring to Fig. 68, there must always be about $\frac{1}{32}$ in. clearance (with the clutch plates engaged) between the short steel plunger *B* and nose of the operating lever *C*. Periodically inspect and, if necessary, rectify the adjustment.

Two Adjustments. Two means of adjustment are provided, according to whether it is necessary to effect a minor or major

adjustment. It is fairly easy to determine by feel the approximate amount of free movement in the clutch control by noting when resistance is met with as the handlebar lever is brought into use.

To Effect Minor Adjustment. If wear of the friction inserts is such that only a minor adjustment is called for, loosen the locking

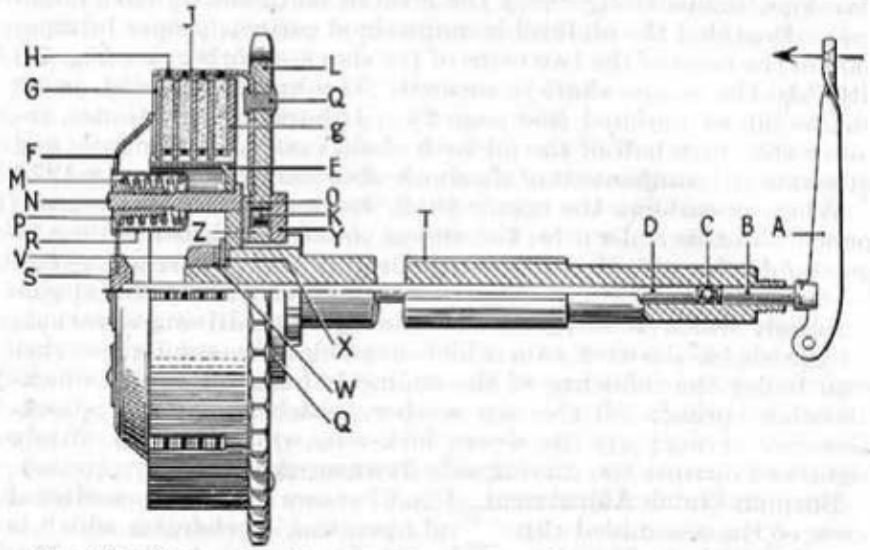

FIG. 67. DETAILS OF BURMAN MULTI-PLATE CLUTCH AND OPERATING MECHANISM

A = Clutch operating lever
B = Short steel plunger
C = Steel ball
D = Long thrust rod
E = Clutch centre
F = Spring pressure plate
G,g = Steel plain plates
H = Friction insert plates
J = Clutch case
K = Roller bearing rollers (24)
L = Clutch sprocket
M = Clutch spring (one of four)
N = Stud for spring adjustment nut
O = Washer (thin) retaining roller bearing
P = Spring adjustment nut
Q = Rivet
R = Spring cup (one of four)
S = Pressure plate boss
T = Gearbox mainshaft
V = Nut retaining clutch centre
W = Spring washer
X = Plain washer
Y = Washer (thick) retaining roller bearing
Z = Roller bearing ring

nut on the Bowden cable adjuster, which is screwed into the rear of the kick-starter housing (see Fig. 66). Then unscrew or screw up a few turns the cable adjuster, according to whether it is desired to decrease or increase the effective length of the control cable respectively. Decreasing the effective length of the cable does, of course, reduce the clearance (see Fig. 68) between the short steel plunger *B* and the nose of the operating lever *C*. After making the required adjustment, retighten the locking nut on the cable adjuster.

To Effect Major Adjustment. If wear of the friction inserts is such that it is impossible to obtain correct adjustment of the

clutch operating mechanism by means of the minor (cable) adjustment just described, a major adjustment is called for. This entails altering the effective position of the fulcrum pin (for the clutch-operating lever) in the kick-starter case.

Referring to Fig. 68, to effect a major adjustment, first remove the two screws *H* with a suitable screwdriver, and detach the cap *G*. Then proceed to adjust the sleeve nut *F* with an open-ended spanner until there is a clearance of about $\frac{1}{32}$ in. between

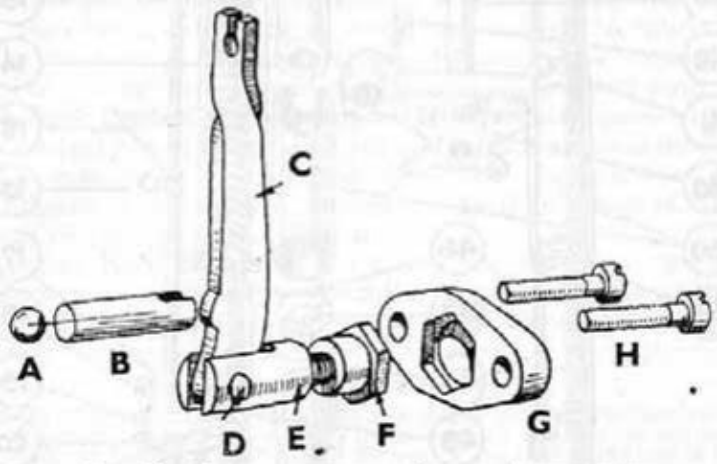

FIG. 68. CLUTCH-OPERATING LEVER ADJUSTMENT

The operating lever fork (*E*) slides in the kick-starter cover case, and its position is determined by the sleeve nut (*F*) locked by the cap (*G*) secured to the outside of the cover by the two screws (*H*).

A = Steel ball
B = Short steel plunger
C = Operating lever
D = Fulcrum pin
E = Fork for operating lever
F = Sleeve nut
G = Cap for sleeve nut
H = Cap securing screws

the short steel plunger *B* and the nose of the operating lever *C*. To increase or decrease the clearance, turn the sleeve nut *F* clockwise or anti-clockwise respectively. Normally a sleeve nut adjustment of one or two turns suffices to obtain the correct clearance. Finally, lock the sleeve nut by replacing the cap *G* and the two securing screws *H*.

Adjusting Clutch Springs. Clutch slip which persists in spite of the operating mechanism and cable being in correct adjustment may take place because the adjustment of the clutch springs requires attention. Before this can be done, it is necessary to remove the outer half of the oil-bath chain case, as described on page 127.

To make an adjustment, screw home *half a complete turn* each of the four adjustment nuts (shown at *P* in Fig. 67). Then make a careful test to ascertain whether the clutch still slips. If it does,

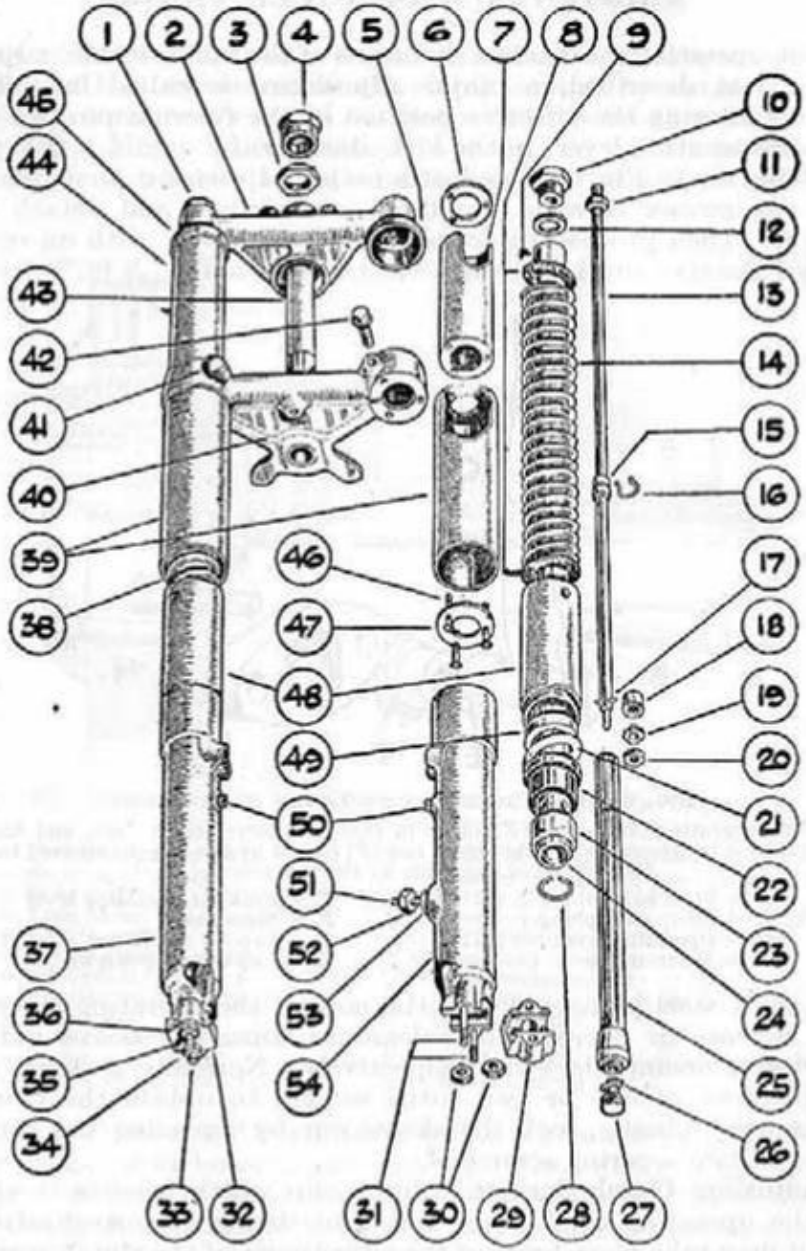

FIG. 69. SHOWING STEERING HEAD ADJUSTMENT AND DETAILS OF 1945–7 "TELEDRAULIC" FRONT FORKS

All numbered parts are named in the key on page 119

(From "Motor Cycling")

screw home a further half turn each adjustment nut, being most careful to adjust each nut exactly the same amount. It should be noted that the standard adjustment for spring tension is to tighten fully all four adjustment nuts and then to slacken back each nut *four complete turns*. The most suitable tool for tightening the clutch spring adjustment nuts is an old and broad screwdriver, slotted on the engaging edge.

Should it be necessary to screw the four adjustment nuts fully or almost home in order to eliminate clutch slip, this indicates that the clutch springs have weakened and/or the fabric inserts in the friction plates are excessively worn and require to be renewed. 1950 500 c.c. models have five adjustment nuts.

No Gear Control Adjustment. With the foot-operated type of gear control (provided on all 1945 and later Matchless models) the gear-change lever is mounted direct on the gearbox and no adjustment is necessary or included. An illustration of the gear-change pedal is shown in Fig. 4.

Steering Head Bearings. On a new machine some initial bedding occurs during the first 100 miles running, and the adjustment of the steering head should be checked when this mileage has

KEY TO FIG. 69

On the 1948 and later forks a light alloy shuttle secured to the inner tube (9) above the bush (23) replaces the damper rod (13), the damper tube (25) and the damper valve (18). The cone is also fixed to the base of the fork slider (54)

1 = Top plug
2 = Handlebar lug
3 = Steering-head adjusting nut
4 = Lock-nut for adjusting nut (3)
5 = Top cover tube cap
6 = Locating plate (threaded) for top cover tube (7)
7 = Top cover tube
8 = Leather seating washers for compression spring (14)
9 = Fixed (inner) tube
10 = Top plug
11 = Damper rod lock-nut
12 = Steel washer for top bolt
13 = Damper rod
14 = Fork compression spring
15 = Plunger sleeve
16 = Clip retaining sleeve (15) to tube (25)
17 = Stop-pin for valve (18)
18 = Damper valve
19 = Damper valve seat
20 = Lock-nut for damper valve
21 = Paper washer for oil seal
22 = Bakelite guide bush
23 = Bottom steel bush
24 = Bottom of fixed (inner) tube
25 = Damper tube
26 = Fibre washer for bolt (27)
27 = Damper tube anchor-bolt
28 = Circlip for securing bottom stee bush (23) to tube (24)
29 = Cap securing front wheel spindle
30 = Nuts retaining cap (29) to fork slider (54)
31 = Stud securing cap (29)
32 = Cap securing front wheel spindle
33 = Stud retaining cap (32)
34 = Nut retaining cap (32) to fork slider (37)
35 = Stud securing cap (32)
36 = Nut retaining cap (32) to fork slider (37)
37 = Fork slider (off-side)
38 = Fork compression spring
39 = Bottom cover tube
40 = Fork crown
41 = Fork crown pinch-bolt
42 = Fork crown pinch-bolt
43 = Steering-head stem
44 = Top cover tube
45 = Top cover tube cap
46 = Locating plate retaining screw
47 = Locating plate (plain holes) for bottom cover tube (39)
48 = Slider extension
49 = Oil seal
50 = Oil level plug
51 = Anchorage stud for front brake cover plate
52 = Nut for anchorage stud (51)
53 = Steel washer for anchorage stud (51)
54 = Fork slider (near-side)

been completed. Subsequently it is only necessary to check the steering head adjustment about once a month.

The ball bearing races of the steering head have spherical seats and are of the self-alining type. Thus they are not designed to fit snugly in the handlebar clip and steering head lugs. Both races in the head lug and the race in the handlebar clip lug are of identical type, but the ball race for the fork crown (the lowest of the four races) is not identical to the other three races.

To Check Steering Head Adjustment. Jack up the front of the machine by placing a box beneath the engine so as to take the weight off the front wheel. Then exert hand pressure upwards from the extreme ends of the handlebars. There should be no appreciable shake present and the steering head must be quite free to turn. If some shake is detected, adjust the steering head forthwith as described below.

To Adjust Steering Head. Referring to Fig. 69, the following is the correct procedure for adjusting the steering head. It is assumed that the front wheel is quite clear of the ground. Loosen the two pinch-bolts (41) and (42) in fork crown. On 1948–9 models slacken the nuts on the two studs (replacing pinch-bolts). Next slacken the domed lock-nut (4) at the top of the steering column. Having slackened the lock-nut, screw down very gradually the adjusting nut (3) for the steering head stem. This adjusting nut is located immediately below the lock-nut (4) and should be turned with the spanner shown at (13) in Fig. 54. While tightening the adjusting nut, test for steering head slackness by placing the fingers over the gap between the top frame lug and the handlebar lug, while simultaneously exerting upward pressure on the front edge of the front mudguard.

Tighten the adjusting nut (3) until the steering head is free to turn without perceptible up-and-down play. Afterwards tighten the domed lock-nut (4) and the two pinch-bolts (41) and (42) in the fork crown (tighten stud nuts on 1948–9 models). Finally withdraw the box or other packing from beneath the engine.

DISMANTLING AND ASSEMBLING

To Remove Front Wheel. Referring to Fig. 69, jack the machine up on the front *and* rear stands. Disconnect the yoke end of the front brake cable from the brake expander lever by removing the split pin and retaining pin. Slacken, but do not actually remove, the nut (52) which secures the front brake cover plate to the left-hand fork slider (54). The split pin securing the nut need not be disturbed. On 1948–9 models, slacken both anchorage screws instead. Next loosen the nut on the left-hand side of the front wheel spindle.

Remove the four nuts (30), (34), (36) which clamp the fork

slider caps (29) to the "Teledraulic" fork sliders. Detach both caps and place them aside separately, so that they may later be replaced exactly as prior to removal. These caps must *not* be interchanged. Then disengage the front brake cover plate from the anchorage stud (51) fitted to the left-hand fork slider on 1945–7 models and permit the front wheel to slide out of the fork ends.

Replacing Front Wheel. Referring to Fig. 69, hold the left-hand fork slider cap (29) under the location on the front wheel spindle, and offer up the front wheel assembly and cap so as to engage the cap with its two retaining studs (31). Simultaneously engage the slot in the front brake cover plate with the anchorage stud (51) in the left-hand fork slider (54). On 1948-9 models engage with two anchorage bolts. Fit the two nuts (30) securing the left-hand fork slider cap (and wheel spindle) and tighten the nuts lightly. Then fit the right-hand fork slider cap and tighten lightly the cap securing nuts (34) and (36). Make sure that the caps have not been interchanged and are fitted exactly as before.

Tighten lightly the nut on the left-hand side of the front wheel spindle. Then firmly and evenly tighten the four nuts which secure the two fork slider caps (and wheel spindle). Verify that the gaps, fore and aft, between each cap and the end of the fork slider are *exactly* equal. Ensuring that these gaps are equal is most important. Now firmly tighten the nut on the left-hand side of the front wheel spindle. Finally replace and tighten the nut (52) on the brake anchorage stud (51), and split-pin the nut. On 1948–9 models tighten firmly the two anchorage bolts.

To Remove Rear Wheel. Jack the machine up on the rear stand. Disconnect the lead for the rear lamp at the connexion (see Figs. 51 and 78) close to the rear wheel spindle. Next unscrew the gland nut on the speedometer driving cable. Also detach the spring link on the secondary chain, separate the ends, and allow the chain to hang clear of the rear wheel sprocket, but engaging with the small sprocket on the gearbox mainshaft. Remove the knurled adjusting nut from the rear brake rod.

Next detach the rear portion of the rear mudguard. To do this, first remove the two nuts which secure the rear portion to the front portion. Also remove the nut and washer from the bolt securing the mudguard side bridge and tool-box stay to the tubular stay. Next slacken about four turns the two nuts which secure the rear mudguard side stays to their studs. Then remove the rear portion of the rear mudguard, complete with stays. To disengage the top fixing bolt, it is advisable to spring the tool-box outwards (on 1945-8 models) as required.

Now slacken the nuts on both sides of the rear wheel solid spindle (see Fig. 70), passing through the hollow spindle, and carefully remove the rear wheel assembly from the fork ends.

To enable the assembly to clear the brake cover plate anchor bolt, tilt the wheel slightly and then withdraw to the rear.

Replacing Rear Wheel. Replace the rear wheel assembly, using the reverse order and procedure employed for removal. Note that it is important, prior to finally tightening the nuts on

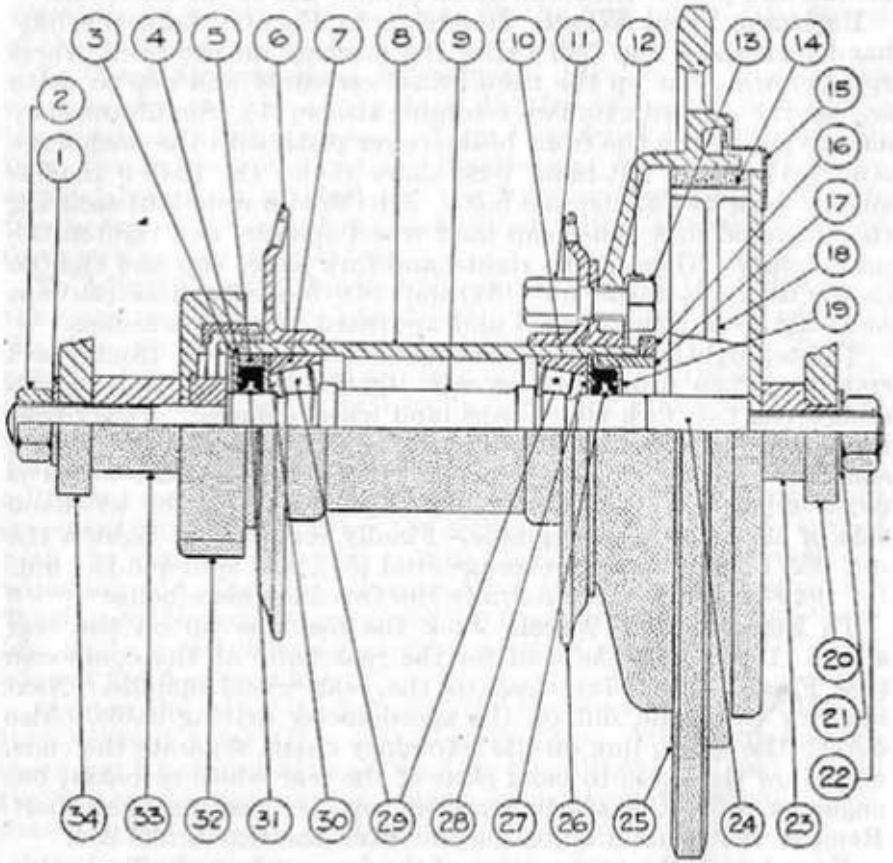

FIG. 70. REAR HUB ASSEMBLY SHOWN PARTLY SECTIONED

The front hub assembly (see also Fig. 71) is similar, but a single solid spindle (with one nut on the near-side) is used instead of the hollow spindle shown above, which has an internal solid spindle fitted with two nuts.

the ends of the wheel spindle, to position the speedometer gearbox (shown at (32) in Fig. 70) correctly. Positioning must be such as to permit of the gearbox driving cable being properly fitted.

After Replacing Rear Wheel. It is advisable, especially if the chain adjuster bolts have been disturbed, to check the alinement of the front and rear wheels. This can be done by stretching a piece of string taut across both wheels, about 4 in. from, and parallel with, the ground. The string should contact each tyre

on both sides of the wheel hub. A preferable method is to use a straight-edge or else a plain board, as described on page 14.

If the wheels are found not to be in true alinement, or the tension of the secondary chain needs adjusting, or both, rectify matters by means of the adjuster bolts screwed into the fork ends, as instructed on page 114. When making an adjustment, be

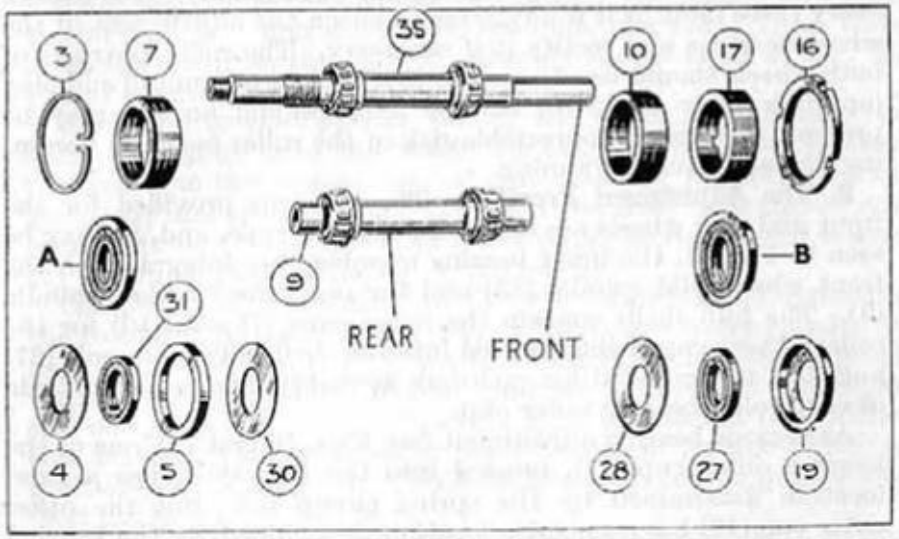

FIG. 71. WHEEL-BEARING COMPONENTS

The wheel spindles are the only different parts. The solid inner spindle for the rear hub is not shown. The bearing adjusting ring (17) is fitted on the *threaded* side of the hub. At *A* and *B* are shown the felt oil seals, pressed into the spacing collar (5) and the dished cup (19) respectively. The assemblies (*A*) and (*B*) are fitted on the outside of the fixed and movable bearing outer cups (7) and (10) respectively.

KEY TO FIGS. 70 AND 71

1 = Washer on solid spindle
2 = Nut securing solid spindle in rear fork end
3 = Spring circlip
4 = Oil seal retaining ring
5 = Spacing collar round oil seal
6 = Wheel hub flange (R.H.)
7 = Roller-bearing outer cup
8 = Hub shell
9 = Hollow outer spindle
10 = Roller-bearing outer cup
11 = Sprocket securing bolt
12 = Locking washer for sprocket and brake drum securing nut
13 = Sprocket and brake drum securing nut
14 = Brake lining
15 = Rear brake cover plate
16 = Locking ring for bearing adjusting ring
17 = Bearing adjusting ring
18 = Brake shoe
19 = Dished cup for oil seal
20 = Frame fork end (L.H.)
21 = Washer on solid spindle
22 = Nut securing solid spindle in rear fork end
23 = Spacer between brake cover plate and fork end
24 = Spacer inside brake cover plate
25 = Rear sprocket and brake drum
26 = Wheel hub flange (L.H.)
27 = Oil seal
28 = Oil seal retaining ring
29 = Taper rollers
30 = Oil seal retaining ring
31 = Oil seal
32 = Gearbox for speedometer drive
33 = Spacer between gearbox and fork end
34 = Frame fork end (R.H.)
35 = Front wheel spindle (solid)

careful to screw both adjuster bolts into the fork ends *exactly the same amount*. Having obtained correct wheel alinement and secondary chain tension by altering the position of the rear wheel, verify the adjustment of the rear brake which is likely to need attention. Instructions for effecting rear brake adjustment are included in Chapter III.

1. Check Wheel Bearing Adjustment Occasionally. About once every three months it is advisable to check the adjustment of the wheel bearings and rectify it if necessary. The roller bearings of both wheels should be adjusted so that a slight amount of end play (approximately 0·002 in.) can be felt. Should no end play be present, there is an appreciable risk of the roller bearings becoming damaged during running.

2. The Adjustment Provided. The bearings provided for the front and rear wheels are of the taper roller type, and, as may be seen in Fig. 71, the inner bearing members are integral with the front wheel solid spindle (35) and the rear wheel hollow spindle (9). The hub shells contain the outer cups (7) and (10) for the rollers, these cups being pressed into the shells. Two oil seals (27) and (31) are provided for each hub assembly, one on the outside of each roller bearing outer cup.

As regards bearing adjustment (see Figs. 70 and 71), one of the bearing outer cups (7), pressed into the hub shell, has a fixed location determined by the spring circlip (3). But the other outer cup (10) has a movable location determined by the bearing adjusting ring (17) on the side opposite the circlip. This adjusting ring abuts the outer cup (10) and enables the end play to be adjusted by moving the outer cup. The adjustment is then secured by the locking ring (16).

3. To Adjust the Roller Bearings. To adjust the rear wheel bearings, it is necessary to remove the wheel from the machine (see page 121), but if dealing with a front wheel its removal is not necessary. Bearing adjustment is effected on the left-hand or right-hand side, according to whether the wheel concerned is rear or front respectively.

Referring to Figs. 70 and 71, to adjust the roller bearings of a front or rear wheel, loosen the locking ring (16) for the bearing adjusting ring (17). Next tighten the bearing adjusting ring until *all* play has been eliminated. Then slacken off the adjusting ring exactly *one-half turn*. This should give about 0·002 in. end play. Finally retighten the locking ring (16), taking care to see that the adjusting ring does not move in the process.

Dismantling Wheel Bearings. The following procedure applies to front or rear bearings. Having detached the wheel from the machine in accordance with the appropriate instructions on pages 120 and 121, remove the brake cover plate, complete with brake shoe assembly. If dealing with a rear wheel, remove the solid inner spindle and also the small gearbox for the speedometer drive.

Now, referring to Figs. 70 and 71, loosen the locking ring (16) for the bearing adjusting ring (17) and completely unscrew the adjusting ring. Remove the adjusting ring together with the locking ring. Then remove in this order: the dished cup (19); the oil seal (27); and the oil seal retaining ring (28). These three members comprise the oil seal assembly shown at *B* in Fig. 71, plus the retaining ring.

Reverting to the opposite side of the wheel hub, extract the spring circlip (3) from just inside the hub end, and then proceed to remove in this order: the oil seal retaining ring (4); the oil seal (31); the spacing collar (5) round the seal; and the oil seal retaining ring (30). These four items comprise the oil seal assembly shown at *A*, plus the two retaining rings.

Complete the dismantling of the wheel bearings by removing the front wheel solid spindle (35), or the hollow outer spindle (9) from the rear wheel hub. Press from the wheel hub shell (do *not* hammer out) the wheel spindle, complete with rollers and cages, and one outer cup (7) or (10). This may be effected from either end, leaving one bearing outer cup (it does not matter which) in position in the hub shell. This remaining cup can be pressed out later if desired.

To Assemble Wheel Bearings. Before commencing to fit the front or rear roller bearings and hub spindle, clean all parts thoroughly, including the inside of the wheel hub shell.

Referring to Figs. 70 and 71, press the roller bearing outer cup (7) into the *unthreaded* end of the hub shell. The cups (7) and (10) are interchangeable and are tapered axially. On assembly the *thinner* edge of the cup must always face *inwards*. When pressing the outer cup into the hub shell, check that the cup is absolutely square to the shell, and exert pressure until there is a clearance of not less than $\frac{9}{32}$ in. from its outer edge to the inside edge of the groove cut in the hub for the spring circlip (3).

Now take the oil seal retaining ring (30) and insert this into the *unthreaded* end of the hub so that it abuts the outer edge of the outer cup (7). Press the oil seal (31), interchangeable with the oil seal (27), into the collar (5) and replace assembly *A* so that it is in contact with the oil seal retaining ring (30), previously fitted. Now fit the second oil seal retaining ring (4) next to the oil seal assembly *A*. The oil seal retaining rings (4), (28), (30) are interchangeable and comprise plain steel washers. Secure the oil seal and retaining rings in position by replacing the spring circlip (3) in its groove. Check that it beds down properly. Then from the opposite (threaded) end of the hub shell, force back the

bearing outer cup (7) until the oil seal and retaining ring assembly is hard up against the spring circlip (3).

Next insert into the *threaded* end of the hub, the front wheel solid spindle (35) or the hollow outer spindle (9), if dealing with a rear wheel. The spindle concerned must be fitted, complete with rollers and cages. See that none of the rollers is missing, and be most careful to introduce the correct end of the spindle first. With a front wheel, this is the *threaded* end, and with a rear wheel the *shorter* end.

Press into the *threaded* end of the hub shell the roller bearing outer cup (10). This outer cup is, as has previously been stated, interchangeable with the outer cup (7), and care must again be taken to ensure that the thinner edge of the cup is on the inside, so as to provide about $\frac{1}{16}$ in. play in the bearings. Replace the oil seal retaining ring (28) so that it abuts the bearing outer cup (10) already pressed into the threaded end of the hub shell. Fit the oil seal (27) into the dished cup (19) and then insert the oil seal assembly *B* so as to contact the oil seal retaining ring (28). The oil seal face must face *inwards*.

Screw the bearing adjusting ring (17) into the *threaded* end of the hub shell and screw the locking ring (16) on to the adjusting ring. Then adjust the roller bearings as described on page 124, to give about 0·002 in. play. Afterwards lock the adjusting ring by means of the spanner shown at (2) in Fig. 54, applied to the locking ring.

With the grease gun inject two fluid ounces of grease (see page 36) into the hub and finally replace the Matchless brake cover plate, complete with shoes, springs, etc. If assembling a rear wheel hub, replace the gearbox for the speedometer drive, and also the solid inner spindle. The wheel should now be ready for assembly to the motor cycle, as described on pages 122–123.

Removing Oil Tank and Battery Carrier. Before removing the oil tank and battery carrier, drain the oil tank (see page 31) and disconnect the positive and negative leads from the battery. Also unscrew the battery clamping screw and remove the battery from its carrier.

Unscrew and withdraw the countersunk-headed screw holding the bottom of the battery carrier to the stay for the rear chain guard. Next disconnect from the bottom of the oil tank the oil delivery pipe, also the oil return pipe. Take off (1945–8) the venturi air intake from carburettor and remove the securing bolt on the right-hand side of the oil tank. See also page 141.

Remove the bolt which secures the oil tank stay to the rear mudguard. Be careful not to lose the spacer and washer provided on this bolt. Now remove the two nuts and washers which secure the oil tank and battery carrier to the two frame studs. The oil tank and battery carrier should then be detached from the

machine. To facilitate their removal, give each a slight circular motion so as to disengage the studs brazed to the frame.

To Replace Oil Tank and Battery Carrier. Position the oil tank and battery carrier on the two fixing studs, and then reconnect the delivery and return oil pipes. Now proceed to complete the assembly in the reverse order of dismantling (previously described). Should the two oil pipes have been completely removed, reconnect the pump ends of the pipes *before* dealing with the unions at the tank end.

Concerning the Stands. Occasionally it may be necessary to remove one or more of the three stands, and a few points concerning their assembly are worth noting. To prevent loss, see that the $\frac{7}{16}$ in. locking nut on the hinge bolt for the prop stand is firmly tightened. The hinge bolt has a slotted head to enable it to be screwed into the stand jaw. Check that all components are quite clean before they are fitted.

As regards the front stand (which should never be used alone), it should be observed that the fixing bolt on the left-hand side is larger than the bolt used on the right-hand side. Split-pin both locking nuts on assembly. Do not drag stand beyond the *vertical* when using it.

When fitting the rear stand, make sure that the plain steel washer for each of the two fixing bolts is fitted beneath the bolt head, *not below the nut*.

Clutch Cable Removal. Should complete removal of the clutch cable be necessary, first remove the oil filler cap from the cover of the kick-starter case. Next screw fully home the Bowden cable adjuster on the back of the case. Now disconnect the clutch cable from the operating lever (shown at *C* in Fig. 68). This can be done through the oil filler cap orifice. Then unscrew completely the clutch cable adjuster and disconnect the cable from the handlebar lever. The cable is now free to be removed from the machine. Pull it away from the lower end and carefully ease it from the various frame attachment clips.

To Replace Clutch Cable. Proceed in the reverse order of removal, and finally check and, if necessary, adjust the clutch operation as described on page 116.

1. Removal of Outer Half of Oil-bath Chain Case. Place a suitable receptacle beneath the oil-bath to receive the oil as it runs out. Next disconnect the front connexion of the rear brake rod. Also unscrew the battery clamping screw and remove the battery from its carrier. Now remove the screw which binds the metal band at the rear of the oil-bath chain case, and detach the band. When doing this it may be necessary to prise up the battery carrier. Take off the rubber oil sealing band, and remove the nut and plain washer from the bolt projecting from the centre of the

chain case. Finally withdraw the outer half of the chain case. This exposes the primary chain, clutch, dynamo chain, and engine shaft shock-absorber (see Fig. 72).

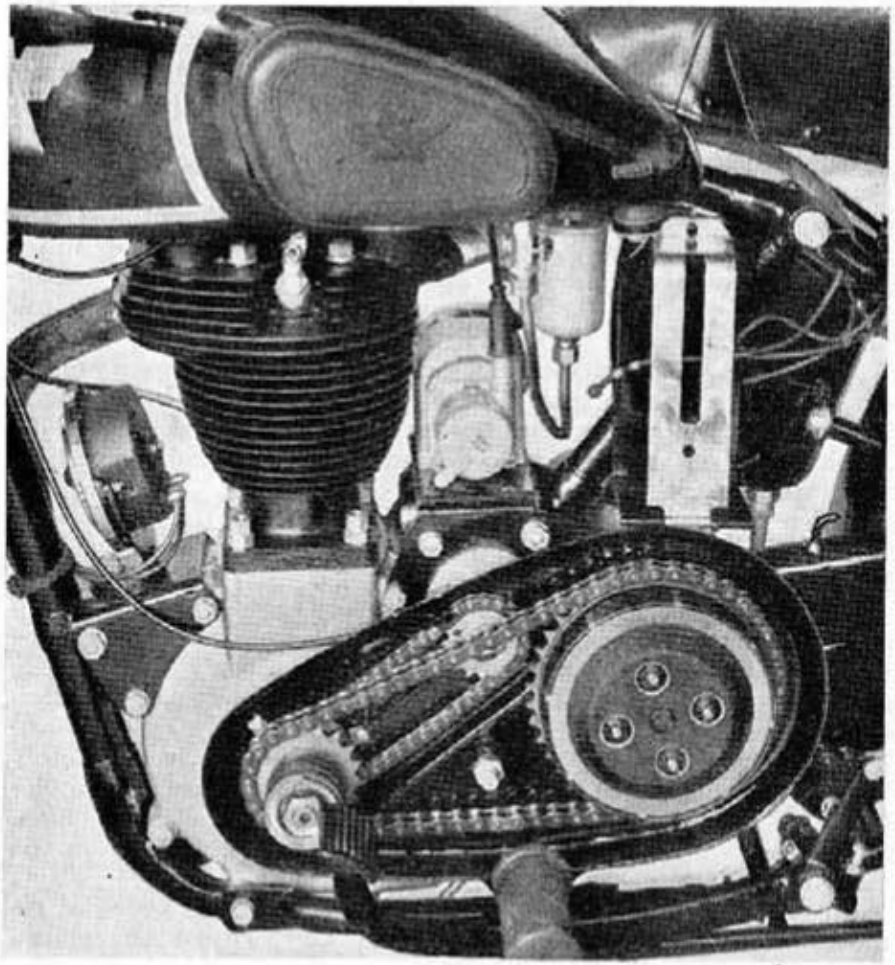

FIG. 72. MATCHLESS WITH OIL-BATH CHAIN CASE, OUTER HALF REMOVED

This view shows the engine shaft shock-absorber, the primary chain, the clutch, and the dynamo driving chain.

(Chas. K. Bowers & Sons)

2. To Remove Primary Chain and Clutch Assembly. First remove the nut retaining the engine sprocket (and integral dynamo-driving sprocket). This is facilitated by engaging top gear and applying the rear brake. Referring to Fig. 67, remove by

unscrewing uniformly the four spring adjustment nuts *P* and withdraw the clutch spring pressure plate *F*, complete with the four springs and spring cups *R*. Now remove the spring link from the primary chain and take the chain off the sprockets.

With top gear still engaged, again apply the rear brake and, referring to Fig. 67, unscrew the nut *V* retaining the clutch centre *E* to the gearbox mainshaft *T*. Remove the spring washer *W* and the plain washer *X* situated on the mainshaft behind the retaining nut. The entire clutch assembly may now be removed.

Withdraw the clutch assembly bodily by pulling it away from the gearbox mainshaft. The use of an extractor is generally quite unnecessary, as the clutch centre is a sliding fit on the mainshaft, but avoid losing any of the twenty-four clutch-bearing rollers which become free to move endwise when the clutch centre and sprocket assembly (including the roller bearing retaining washers) is withdrawn from the mainshaft.

3. Removal of Dynamo Chain and Back Half of Chain Case. To remove the dynamo chain, first remove the spring locking ring from the nut retaining the sprocket on the dynamo armature. Also detach the locking washer which surrounds the nut. With the spanner, shown at (5) in Fig. 54, applied to the two flats on the back of the dynamo sprocket, hold the sprocket and unscrew the dynamo sprocket retaining nut. With a suitable extractor tool withdraw the dynamo sprocket from the armature. Now remove in one operation the dynamo sprocket, "endless" dynamo chain, and the engine shaft shock-absorber.

To remove the back half of the oil-bath chain case, straighten the tabs on the locking washers beneath the three bolts which retain the back half of the chain case to the crankcase boss. Then remove the bolts. Also remove the bolt beneath the battery carrier. This bolt has a long head and secures the rear chain guard to the oil-bath chain case. Finally remove the nut from the centre fixing bolt, also the spacer behind it, and take off the back half of the oil-bath chain case.

4. To Replace Back Half of Chain Case. Smear some liquid jointing compound on the crankcase boss face. Verify that the spacer (between the left-hand engine plate and the oil-bath chain case) is fitted to the centre fixing bolt. On Model G80 the spacer is slightly shorter ($\frac{5}{64}$ in.) than on Model G3/L. Now replace the back half of the chain case.

Fit beneath the battery carrier the bolt with the long head. Tighten this bolt, which secures the rear chain guard, lightly. Now fit the three locking washers and bolts securing the oil-bath chain case half to the crankcase boss. Tighten these three bolts firmly and lock their tab-washers by turning up the tabs. Next

fit the $\frac{7}{8}$ in. long spacer (provided inside the chain case) to the centre fixing bolt and replace the fixing bolt nut. Tighten this nut fully, and also the long-headed bolt which secures the rear chain guard to the oil-bath chain case.

5. Replacing Dynamo Sprocket, Chain, and Clutch Sprocket. Check that the key for the dynamo sprocket is in position on the armature location. Also verify that the spacing collar (between the crankcase ball bearing and the back of the engine sprocket) is replaced on the engine driving side mainshaft. Next engage the dynamo driving chain with the teeth of the dynamo driving sprocket (the smaller sprocket behind, and integral with, the engine sprocket) and the sprocket which fits on the dynamo armature. In one simultaneous operation replace the two sprockets (and chain) on the engine mainshaft and dynamo armature. Then replace the plain washer and sprocket retaining nut on the dynamo armature. Tighten the nut finger-tight only.

While preventing the dynamo armature from turning by applying the spanner, shown at (5) in Fig. 54, to the flats on the back of the sprocket, tighten the dynamo sprocket retaining nut firmly. Replace the locking washer for the retaining nut, also the locking ring. Make sure that the latter beds down properly in the nut groove. Finally replace the cam of the engine shaft shock-absorber, the spring, cap washer, and retaining nut. At this stage the retaining nut should not be fully tightened (see paragraph 8).

6. Replacing Clutch Centre and Clutch Sprocket. Referring to Fig. 67, fit the roller bearing retaining washer *Y* on the gearbox mainshaft. This is the thicker of the two retaining washers. Next replace the roller bearing ring *Z* on the mainshaft and with thick grease position the twenty-four rollers *K* on the bearing ring. Replace the clutch sprocket *L* over the rollers.

Next fit to the gearbox mainshaft the washer *O* retaining the roller bearing. This is the thinner of the two retaining washers. Then fit the clutch centre *E* to the splined end of the mainshaft and push home. Afterwards replace in this order: the plain washer *X*; the spring washer *W*, and the nut *V* retaining the clutch centre. This nut should not yet be fully tightened (see paragraph 7).

7. Replacing Primary Chain and Locking Clutch Centre. Replace the primary chain on the two sprockets, being careful that the spring link is correctly fitted (see Fig. 73). Now fit the nut which retains the clutch centre to the mainshaft of the gearbox. When tightening this nut, engage fourth gear and apply the rear brake to prevent the mainshaft turning.

8. Fitting Clutch Plates and Springs. Referring to Fig. 67, slide into position in the clutch case *J* attached to the clutch sprocket *L* the thickest of the steel plain plates *g*. Make certain that the recessed part of the steel plate faces *towards* the clutch centre *E* and overhangs its flange.

Next slide into position one of the clutch friction insert plates *H*. Then fit a steel plain plate, followed by another friction insert plate, and so on, alternately, until the complete set of plates has been fitted. It should be noted that Model G3/L has five steel plain plates and four friction insert plates, whereas on Model G80 the number is six and five respectively.

Now insert the four spring cups *R* into the spring pressure plate *F* and offer up the pressure plate to the assembly. Fit the four clutch springs *M* and retain the springs in place by screwing the four adjustment nuts *P* on to the studs *N*. Tighten each nut a few turns as fitted, and then fully tighten in a uniform manner all four nuts. Afterwards slacken back each adjustment nut *four complete turns*. This is the standard spring adjustment (see page 119).

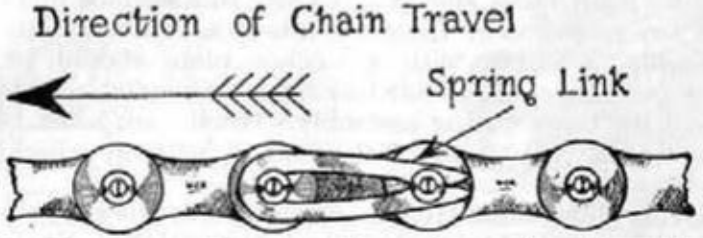

FIG. 73. ALWAYS REPLACE A CHAIN SPRING LINK LIKE THIS
The open end must always face the direction of chain movement.

Fully tighten the engine shaft shock-absorber retaining nut. When doing this, engage top gear and apply the rear brake to prevent the engine from turning. Finally check the adjustment of the primary and dynamo chains as described on pages 113–114.

9. Replacing Outer Half of Oil-bath Chain Case. It is necessary first to make sure that the faces of both halves of the chain case are quite clean and undamaged. The face of the outer half must be smeared with some liquid jointing compound. Remove the knurled adjusting nut from the rear brake rod and depress the pedal to its full extent. Then replace the outer half of the chain case.

Replace the plain washer and nut on the centre fixing bolt and tighten the nut with a suitable spanner. Make quite sure that both halves of the chain case *exactly register* before the nut is firmly tightened. Check that the metal and rubber bands are undamaged and quite clean. Then apply some liquid jointing compound to the edge of the oil-bath chain case.

Press the rubber band in place so that the free ends abut at the rear of the chain case. Now replace the metal band. Begin

at the front end of the chain case and draw the two free ends together by hand and replace the binding screw. Tighten this screw firmly, and then replace the brake rod adjusting nut and adjust the rear brake as required (see page 21).

Permit the jointing compound to set properly, and afterwards remove the inspection cap from the chain case and replenish with engine oil (see page 29) to the correct level. Finally replace the inspection cap.

10. Leakage from Oil-bath. Should oil leakage be detected after replacing and replenishing the oil-bath chain case, this may be due to one or both faces of the case being damaged or distorted. Both faces should fit closely to a surface plate and, if there is any suspicion of distortion due to accidental impact prior to assembly, a check with a surface plate should be made. Another possible cause of oil leakage is imperfect registering of the two joint faces during assembly. Great care must be taken to ensure *exact* registering of the halves, without which an oil-tight oil-bath is unobtainable.

Removing Rear Chain Guard. First remove the rear wheel and chain sprocket assembly[1] as described on page 121. Next remove the bolt which secures the front, top end of the rear chain guard to the oil-bath chain case. After this, remove the bolt which secures the front, bottom end of the rear chain guard to the frame, also the bolt securing the rear, top end of the chain guard to the frame. Then withdraw the chain guard.

STORING MACHINE

The Controls. Slacken off any which are in tension, and smear all levers with petroleum jelly.

The Exhaust System. Verify that no water is collected inside the exhaust pipe or silencer.

The Transmission. Slacken off the clutch spring adjuster nuts shown at *P* in Fig. 67. Drain and replenish the oil-bath chain case. Clean and thoroughly grease the secondary chain.

The "Teledraulic" Front Forks. Insert some packing beneath the crankcase to remove the load from the internal springs.

Clean and Grease Everything. Clean the whole machine, remove any rusting, touch up enamel if necessary, and smear the machine over with petroleum jelly. Apply the grease gun to all points indicated by shaded circles in Fig. 25. Polish the saddle with furniture polish and cover up the machine with a water-proof sheet.

[1] On 1949 and later models it is only necessary to remove the rear portion of the rear mudguard.

CHAPTER X

GENERAL MAINTENANCE (1949 ON)

New Price's Engine Oils. During 1949 Messrs. Price's Lubricants, Ltd., introduced a new type of engine oil known as Price's Energol. This oil supersedes the earlier Motorine type. On page 29 Price's Motorine "B" de Luxe and "C" are recommended

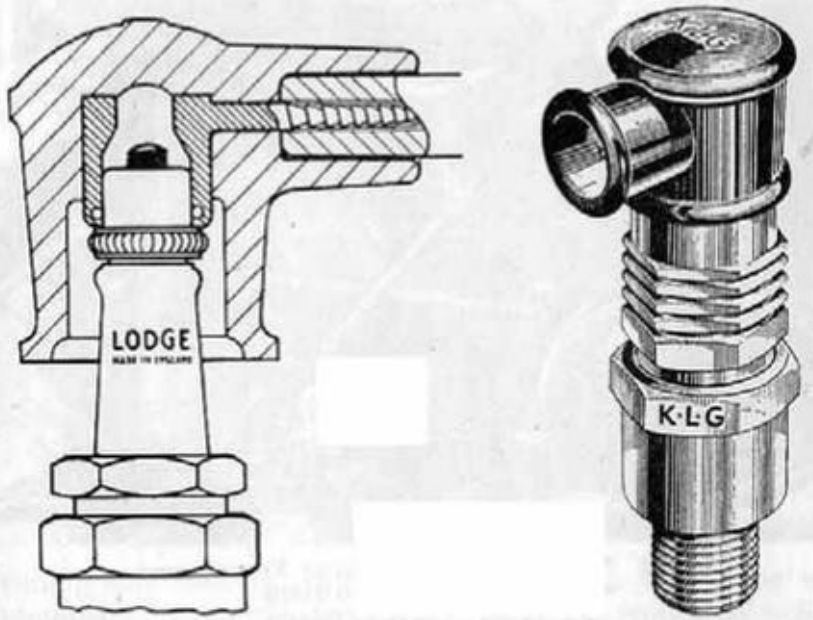

FIG. 74. SHOWING (*left*) LODGE WEATHERPROOF SPARKING PLUG TERMINAL AND (*right*) K.L.G. WATERTIGHT PLUG

for use in summer and winter respectively. The corresponding Energol grades are SAE 60 and SAE 40 respectively. This applies to all Matchless 350 c.c. and 500 c.c. Singles.

Weatherproof Terminals and Sparking Plugs. For all-weather riding it is a good plan to fit a weatherproof terminal to your sparking plug or else fit a watertight plug. A sectional view of the Lodge weatherproof terminal is shown in Fig. 74 (left-hand illustration). This terminal is weatherproof, shock-proof, quickly detachable, and costs only 1s. 6d. A K.L.G. weatherproof terminal which clips on to a K.L.G. plug and completely covers the top insulation is obtainable for 2s.

For those who are about to renew plugs, it is worth drawing attention to the new range of K.L.G. detachable watertight

sparking plugs. These plugs have a moulded terminal protector, a steel sleeve for protecting the insulation, heat dispersion fins, and a body of rust-resisting steel.

The K.L.G. watertight plug shown in Fig. 74 (right-hand illustration) costs 8s. 6d. and is obtainable with an 18 mm. or 14 mm. thread to suit most engines. This type of K.L.G. plug is identified by the prefix letter "W." The watertight counterpart

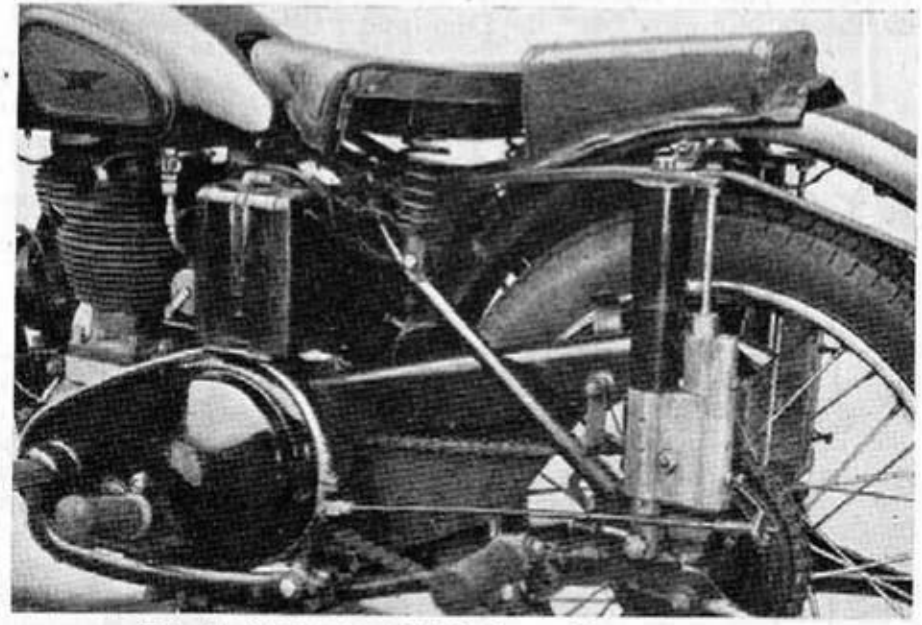

FIG. 75. MATCHLESS O.H.V. SINGLE FITTED WITH SIDDAWAY SPRING HEEL
(From "The Motor Cycle")

of the K.L.G. single-point detachable plug, referred to on page 54, is therefore WF70.

Do You Want Rear Springing? If you do, you can have it for £15, inclusive of *all* fittings and without special tools or frame alterations being needed to fit it yourself.

An efficient spring heel conversion set (see Fig. 75) incorporating powerful compression springs with hydraulic damping has been designed and is marketed by Mr. Geoffrey Siddaway, of the Grantham Motor Cycle Depot, 5 Chapel Street, Grantham, Lincs.

The Siddaway conversion set can be fitted to all 1945–8 single-cylinder O.H.V. models.

If you are considering buying a brand-new 1949 or later Matchless and desire rear springing, it is a good plan to purchase a 350 c.c. Model G3/LS or a 500 c.c. Model G80/S. Both these

mounts incorporate the excellent new Matchless spring frame (see Fig. 7) which is specified also on the 500 c.c. "Super Clubman" vertical twin, Model G9. The Matchless spring frame is of the duplex cradle type with pivot-type oil damped "Teledraulic" rear springing giving a total movement of 3 in. It should be noted that it is *not* possible to embody the Matchless rear springing arrangement on pre-1949 models.

An Attractive Vertical Twin. In 1949 Matchless Motor Cycles introduced to the home market is a most attractive vertical twin,

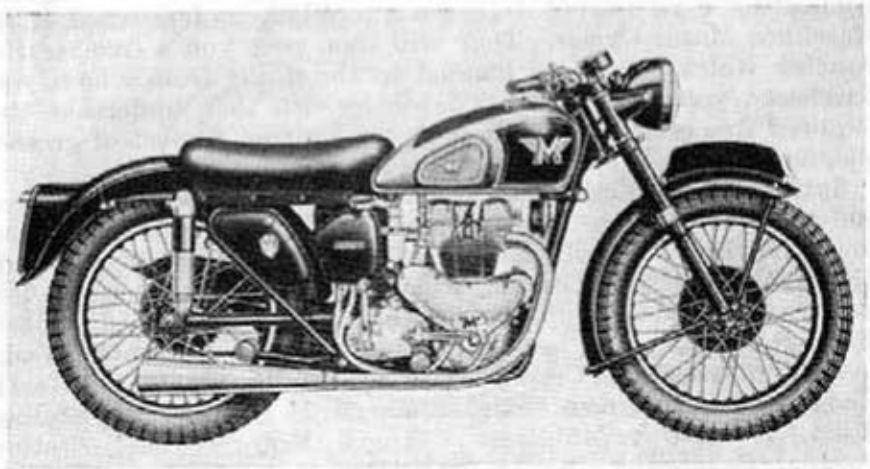

FIG. 76. THE MATCHLESS 498 C.C. "SUPER CLUBMAN" VERTICAL TWIN WITH MATCHLESS SPRING FRAME MODEL G9

a timing side view of which is shown in Fig. 76. Those who contemplate joining the twin-cylinder brigade would do well to meditate on the merits of this "Super Clubman," Model G9. In this edition only a brief reference to a few interesting features of the machine can be made, and it has not been found possible to include general maintenance instructions.

The 498 c.c. vertical twin engine has a bore and stroke of 66 mm. × 72·8 mm., giving a cubic capacity of 498 c.c. Separate cylinders are fitted and these are of light alloy with shrunk-in valve seats. The rocker posts are integral with the cylinder heads and valve clearance adjustment is by means of an eccentric adjustment of the rocker spindles.

Other features of the engine include the use of a sturdy three-bearing crankshaft, light alloy connecting rods with Vandervell big-end bearings, split skirt pistons of the wire-wound type, a twin-gear oil pump of large capacity, and duralumin push-rods.

The vertical twin engine is installed in a duplex cradle frame

with oil damped "Teledraulic" rear springing of the same type as used on Models G3/LS and G80/S. The luxurious general specification includes an Amal carburettor, gear-driven Lucas magneto and dynamo, a three gallon fuel tank, four-speed gearbox, 7½ in. brakes, and "Teledraulic" front forks.

Matchless Free Service Scheme. Owners of brand-new mounts are reminded that they are eligible for one free service and inspection at 500 miles, or at the latest three months after taking delivery.

To avail yourself of the Matchless free service scheme, sign the application card provided in your tool-box and forward it to Matchless Motor Cycles. They will then post you a free service voucher which should be handed to the *dealer* from whom you purchased your Matchless. The dealer will then undertake the required free service, making a charge only in respect of grease, oils, and materials used.

Spares and Repairs. Among firms which stock Matchless spares and also undertake repairs and reconditioning may be mentioned the following: R.A.F. Motors, 73 and 125–7 Falcon Road, Clapham Junction, London, S.W.11; Stanley's Motors, 7–8 Bulstrode Parade, Hounslow Central; S. A. Coles, Ltd., 364–8 High Road, Leyton, London, E.10.; Smith & Double, Ltd., 1–4 Mildmay Parade, Cranbrook Road, Ilford; Blay's, 192 Heath Road and 38 The Green, Twickenham; J. M. S. Miller, 289 Staines Road, Hounslow, Middlesex; Angus Motor Cycles, Station Parade, Sevenoaks, Kent; and Bryants, 25–27 and 72–74 Shortmead Street, Biggleswade, Beds.

ENGINE MAINTENANCE (1949 ONWARDS)

The engine maintenance instructions given in Chapter VIII apply to the single-cylinder O.H.V. 350 c.c., 500 c.c. engines fitted to the 1949 and later Matchless Models G3/L, G3/LS, G80, and G80/S. But some additional, and in some instances superseding, instructions are included in this chapter.

Suitable cross-references to maintenance matters dealt with in this chapter are given in Chapter VIII. It is therefore advisable to read this earlier chapter first and refer to the supplementary instructions in this chapter as required.

Tools for the Job. The tool kit referred to on page 88 and illustrated in Fig. 54 is provided also for 1949 and later 350 c.c., 500 c.c. single-cylinder O.H.V. engines. The kit, however, contains an additional double-ended spanner (Part No. 3263) and an extra tyre lever (Part No. W40/G3/TK29).

Adjusting Tappets. Follow closely the instructions for tappet adjustment given on pages 91–92, but disregard paragraph 2. Note that valve stem end caps are *not* fitted to 1949 and later singles. On 1945–8 engines with valve stem end caps it is important to see that the end caps are never omitted for the reason stated on page 101.

Decarbonizing Engine. The detailed dismantling, decarbonizing, valve grinding, and assembling instructions given on pages 92–104 apply to 1949 and later engines, except where otherwise stated. Engines made subsequent to 1948 include: a new rocker-box, hairpin valve springs, and a modified fuel tank fixing bolt arrangement. Appropriate instructions in respect of these altered components are given below.

To Remove Rocker-box. First remove the fuel tank as described

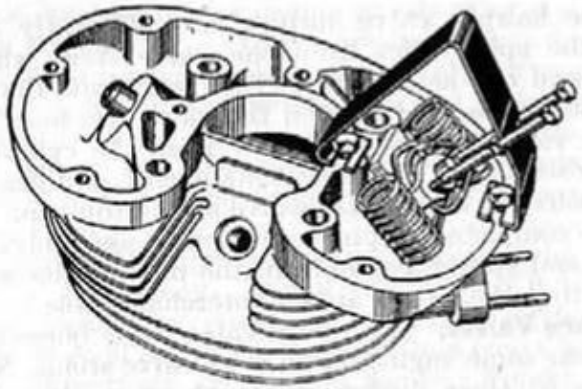

FIG. 77. MATCHLESS VALVE SPRING COMPRESSOR FITTED TO 1949 O.H.V. CYLINDER HEAD TO COMPRESS HAIRPIN VALVE SPRINGS

on page 93, paragraph 1. Next remove the three nuts and fibre washers securing the cover to the off-side of the rocker-box, and detach the rocker-box cover. Disconnect the external pipe which feeds oil to the rocker-box. Then turn the engine over slowly until both valves are completely closed.

On the 500 c.c. engine (Model G80 or G80/S) remove the engine steady bracket. To do this, remove the nuts and washers from the rocker-box extensions and also the bolt from the frame clip. Now remove the nine bolts which secure the rocker-box to the cylinder head. Also disconnect the exhaust valve lifter control cable. Then tilt the off-side of the rocker-box *upwards* and withdraw the inlet and exhaust push-rods. These push-rods must not be interchanged and it is advisable to mark them or place them such that they can be readily identified. After removing the two push-rods, lift off the rocker-box from the cylinder head.

To Remove Valves. Hairpin type valve springs are fitted to all 1949 and later 350 c.c. and 500 c.c. O.H.V. single-cylinder engines, and to remove the valves it is necessary to use the special Matchless valve spring compressor provided for the purpose.

This tool is not included in the tool kit, but is obtainable for 4s. 3d. from a Matchless dealer or from one of the firms mentioned on page 136. The part no. of the compressor is O14605 and that of the two attachment bolts supplied with it 41–G3L–M38.

After removing the cylinder head (see page 94) attach the slotted end of the Matchless valve spring compressor to the cylinder head by means of the two short attachment bolts as shown in Fig. 77. Then compress the hairpin valve springs provided for each valve by screwing in *evenly* the two long bolts of the compressor. Two countersunk depressions on the valve spring top cap engage the reduced diameter ends of the two long bolts.

When the hairpin valve springs are sufficiently compressed, withdraw the split collet from the valve stem which has no detachable end cap as hitherto. Then withdraw the valve from the combustion chamber. When the valve has been withdrawn, remove the valve spring compressor from the cylinder head by slackening each of the two long bolts evenly and gradually until these two bolts are clear of the valve spring top cap. Afterwards remove the complete hairpin valve spring assembly. Deal with each valve and spring assembly in the manner described above. Remember that the valves are *not* interchangeable.

To Replace Valves. Clean both valve guide bores with a clean rag and smear some engine oil on each valve stem. Next replace both valves in their guides. Note the remarks on page 100 (paragraph 14) regarding their correct identification. Place some packing beneath each valve head with the cylinder head resting upright on the bench.

Replace each hairpin valve spring assembly. See that the dowel pin on the valve spring block (to which the prong ends of the hairpin valve springs are attached) beds into the hole in the valve guide boss.

If for some reason the valve springs are detached from their fixing block, it is essential to make sure that on assembly the spring with the narrow spaced prong is entered into the block from the *chamfered* end.

Compress the hairpin valve springs by fitting the Matchless spring compressor tool as shown in Fig. 77 and then tightening the two long bolts *evenly*. Now replace each split collet on the valve stem. Be sure that it is correctly located. The split collet has two grooves machined in the bore and these must register with the *two* rings on the valve stem. Damage will probably be caused if the split collet is fitted so that only one groove engages one valve stem ring. Finally remove the valve spring compressor by loosening the two long bolts and lifting it off the cylinder head.

Replacing Rocker-box. Clean very carefully the lower face of the rocker-box and the upper face of the cylinder head. Next slowly turn the engine until the piston is at T.D.C. with both tappets right down. Inspect the cylinder head composition washer (renew if not perfect), and lay the washer on the cylinder head.

Position the rocker-box and then raise slightly the off-side of the box to permit of the two long push-rods being inserted in their original positions. Now fit the *nine* rocker-box securing bolts. Note that the bolt with the short head goes in the centre right-hand position, while on 500 c.c. engines (Models G80, G80/S) the bolts having the threaded extensions go one on each side of the central short-headed bolt. Tighten in a diagonal order and evenly all nine rocker-box securing bolts.

On 500 c.c. engines fit the engine steady stay and then rotate the engine a few times so as to be sure that the various parts bed right down. Now reconnect the exhaust valve lifter control.

Reconnect the rocker-box oil feed pipe and when tightening the union nut which screws into the rocker-box, use *two* spanners to prevent the union from turning when the nut is being tightened. Check the inlet and exhaust tappet clearances (see page 91) and adjust if necessary.

Examine closely the rubber fillet on the cover which fits on the off-side of the rocker-box. Renew this fillet if it is not sound. Replace the rocker-box cover and see that a fibre washer is placed beneath each of the three rocker-box cover securing nuts. Tighten the three nuts evenly and firmly. Finally replace the fuel tank as described in the next paragraph.

Replacing Fuel Tank. On 1949 and later Matchless O.H.V. singles the arrangement of the fuel tank fixing bolts (see Fig. 78) is somewhat different to the arrangement employed on 1945–8 machines which is illustrated in Fig. 57. Referring to Fig. 78, to replace the fuel tank, use the following procedure—

(1) Lay one of the twelve metal washers (*B*) on the end of each fuel tank support bracket.

(2) Lay one of the four thick rubber pads (*A*) on top of each metal washer.

(3) Place a metal washer (*B*) on top of each thick rubber pad.

(4) Carefully position the fuel tank.

(5) Slip one of the four thin rubber pads (*C*) over each of the four tank fixing bolts (*D*). Then slip a metal washer (*B*) over each bolt. All 1950 bolts have hexagon heads.

(6) Insert all four tank fixing bolts, complete with thin rubber pads and metal washers (also sleeves, 1950 models).

(7) Tighten *evenly* all four tank fixing bolts until the rubber pads are just *slightly* compressed. Do *not* fully tighten the bolts.

(8) Wire-lock the four tank fixing bolts. It is convenient to interlace them in pairs, using 22 gauge copper wire.

(9) Reconnect the petrol pipes, and use *two* spanners when tightening the union nuts.

Engine Data. The technical data given on pages 107–108 for the 1945–8 O.H.V. Models G3/L and G80 apply to the 1949 and later O.H.V. Models G3/L, G3/LS, and G80, G80/S, except in regard to the compression ratios.

On Models G3/L, G3/LS the C.R. is 6·4 to 1. On Models G80, G80/S the C.R. is 6·2 to 1 with compression plate fitted, and 7·47 to 1 where no compression plate is fitted.

FIG. 78. FUEL TANK FIXING BOLT ARRANGEMENT (1949 MODELS)
Note that you must fit a metal washer above and below each tank support bracket, and also between each thick rubber pad and the base of the tank.

MAINTENANCE OF CYCLE PARTS (1949 ONWARDS)

The detailed maintenance instructions given in Chapter IX apply to the 1949 and later O.H.V. Models G3/L, G3/LS, G80, and G80/S, but the following additional hints (to which cross-references are made in Chapter IX) should be noted.

Preservation of Chromium Plating. On page 112 reference is made to preparations for rendering chromium plating less susceptible to tarnishing during the winter. It may be mentioned that Messrs. Matchless Motor Cycles recommend the use of "Tekall," a product of 20th Century Finishes, Ltd., of 175–177 Kirkgate, Wakefield. This effective preparation is obtainable in ½ pt. and 1 pt. tins at most garages. A soft rag soaked in "Tekall" should be wiped over the chromium-plated parts. This will leave an almost invisible film which is impervious to moisture.

Saddle Adjustment. On the 1949 and later O.H.V. singles an adjustment for the saddle is provided at the rear and front. You are advised to experiment until you obtain the best adjustment to suit your own particular physique.

To make an adjustment at the rear of the saddle, alter the position of the lower spring fixing nuts on the screwed studs to which the springs are attached. To make an adjustment at the front, remove the fuel tank and experiment with the three evenly spaced positions for the hinge bolt.

Removing Oil Tank and Battery Carrier. The instructions given on pages 126–127 apply to machines manufactured later than 1948, but in the second paragraph the words "Take off (1945–8) the venturi air intake from carburettor and remove the securing bolt on the right-hand side of the oil tank" should read for 1949 onwards "Disconnect the C.V.C. (compensated voltage control) unit from the battery carrier (secured by two bolts)."

"Teledraulic" Rear Springing. On Models G3/LS and G80/S with oil-damped "Teledraulic" rear springing (Fig. 7) suitable hydraulic fluids to use in each of the two damping tubes are those mentioned on page 40 for the "Teledraulic" front forks. The fluid content per side is 50 c.c. Further information is given on page 144.

MAINTENANCE OF LAMPS (1949 ONWARDS)

The advice given on pages 72–76 for the Lucas lamps applies to 1949 and later equipment, except where the instructions are specifically dated 1945–8. The maintenance hints given in the remaining paragraphs of this chapter apply to equipment fitted subsequent to 1948, and cross-references to these hints are included in the earlier instructions.

Lucas Lamps (1949 Onwards). On 1949 and later Models G3/L, G3/LS, G80, and G80/S the lamps provided are a Lucas type SSU700P headlamp, and a Lucas type 467/1 rear lamp. The remaining components of the lighting system (dynamo, C.V.C. unit, battery, horn, etc.) are unaltered, and appropriate instructions are included in Chapter VII.

The large diameter Lucas type SSU700P headlamp differs somewhat from the DU–42 headlamp hitherto used. It has a fluted domed glass at the front, and a panel on top houses the CZ–27 ammeter, cable harness, and lighting switch. Switch positions are as described on pages 72–73, and the dipping switch for the double-filament main bulb is mounted on the handlebars adjacent to the ignition control. The pilot bulb (same as used for

rear lamp) is mounted *outside* the reflector, a small round window being provided in the reflector for illumination.

To Focus SSU700P Headlamp (1949 Onwards). Focusing should be effected on a level stretch of road with the headlamp beam directed against a wall some 30–40 yards distant from the machine. Note the general remarks on page 73 concerning focusing, and see that the headlamp is alined correctly (page 78).

To remove the lamp front, loosen the screw on top of the headlamp body, withdraw the rim outward from the top, and as the lamp front emerges, raise it a little in order to free the lower tag from the shell of the headlamp. The double-filament main bulb is adjustable in its holder and has a clamp tightened by one screw. To focus the main bulb, loosen this screw and push the bulb holder inwards or outwards until the correct focus is obtained. Afterwards firmly retighten the screw which clamps the bulb holder. Next engage the lower tag on the lamp rim with the small slit in the lamp shell and carefully force the top of the rim back into the lamp shell. Finally retighten the screw on the top of the lamp body.

Renewing Lamp Bulbs. Always fit *genuine* Lucas bulbs when occasion is had to renew them, and do not defer renewal until actual bulb failure occurs (see page 74). To remove the cap which carries the bulbs, depress one of the two spring plungers which secure the cap to the reflector and tilt the cap bodily. When replacing the bulb holder, engage the bulb carrier cap in the position at which the pilot bulb is against the small window in the reflector.

When fitting a double-filament main bulb, see that it is fitted with the dipped beam filament *above* the centre filament. Lucas main bulbs have the word "TOP" etched to indicate the correct position in the bulb holder. Check the main bulb for focus after renewing it.

Correct Bulb Replacements. The correct main bulb to fit in the SSU700P headlamp is a 6v., 24W., No. 168 double-filament type. The correct pilot and rear lamp bulb is a 6v., 3 W., M.B.C. No. 988 bulb. Both types of bulb have a bayonet fixing.

To Remove and Replace Reflector and Glass. To remove the reflector and glass assembly from the lamp rim, detach the five spring clips which are spaced evenly round the rim, and withdraw the assembly. When replacing the reflector and glass, lay the assembly on the rim, being careful to engage the block on the reflector back with the forked bracket on the rim. Then replace the five spring clips which secure the assembly.

The 467/1 Rear Lamp. The Lucas rear lamp body, complete with bulb holder, is secured on 1949 and later models to the rear

number plate by means of two nuts and spring washers. To remove the cover securing the red glass, loosen the captive screw which secures it, and withdraw the cover. If the bulb requires to be renewed, fit a 6v., 3 W., No. 988 bulb.

To facilitate rear wheel removal, a quickly detachable connector

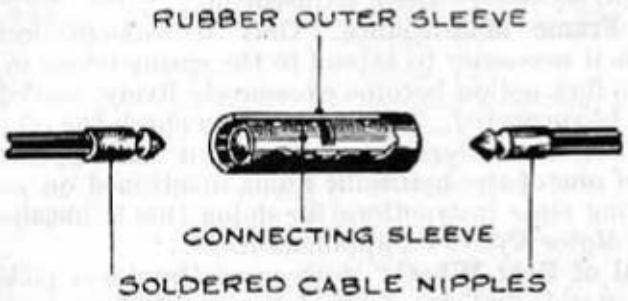

Fig. 79. Lucas Quickly Detachable Connector for Rear Lamp Lead (1949 Onwards)

is embodied in the lead to the rear lamp. This connector (see Fig. 79) comprises: (*a*) two tubular sleeves which are soldered to the cable ends; (*b*) a split ferrule into which the tubular sleeves

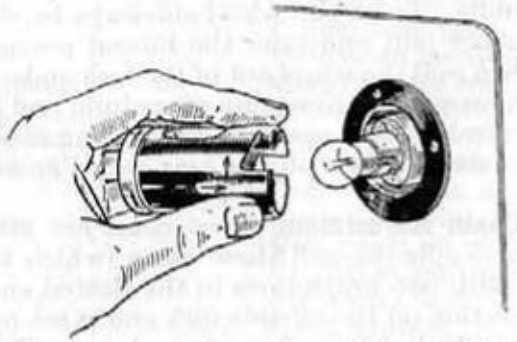

Fig. 80. Lucas Rear Lamp (Type MT211)
Fit the cover as indicated by the two arrows.

are a push-in snap fit; and (*c*) a rubber outer sleeve which covers the whole of the lead connector.

The MT211 Rear Lamp. This rear lamp, of Lucas design, is secured to the rear number plate of some 1948–9 models by means of a three-bolt fixing. To remove the cover carrying the red glass, push in and turn in an *anti-clockwise* direction. To replace the cover (see Fig. 80), locate the slots in the front portion over the retaining pegs in the lamp body, push inwards, and turn in an *anti-clockwise* direction.

SPRING FRAME MODELS (1949 ONWARDS)

The foregoing maintenance instructions for the 1949 Models G3/L and G80 apply also to the 1949 and later Models G3/LS and G80/S with "Teledraulic" rear wheel springing, except in regard to the following: (1) spring frame maintenance, (2) rear wheel removal, (3) secondary chain adjustment.

Spring Frame Maintenance. Only if leakage occurs (very unlikely) is it necessary to attend to the spring frame in any way. Should the fork action become excessively lively, loss of damping oil should be suspected. The remedy is to check the oil content of each fork leg and afterwards replenish it with 1¾ fluid ounces (50 c.c.) of one of the hydraulic fluids mentioned on page 40. A leaflet giving clear instructions for doing this is obtainable from Matchless Motor Cycles on application.

Removal of Rear Wheel. With your Matchless jacked up on its centre stand, disconnect the following: (1) the rear nut and bolt from each tubular member forming the hinged portion of the rear mudguard; (2) the clips securing the rear lamp cable to the edge of the rear mudguard; (3) the speedometer cable (unscrew gland nut); (4) the rear brake rod; (5) the rear chain (allow to hang on gearbox sprocket after removing spring clip).

Now slacken *three* complete turns the two external nuts on the rear wheel spindle. Twist the wheel sideways to clear the brake cover plate anchor bolt and raise the hinged portion of the rear mudguard. Then pull the wheel out of the fork ends. On replacing the rear wheel, reverse the foregoing procedure, and be careful not to impose any strain on the speedometer driving cable. Make sure that both the external nuts on the rear wheel spindle are firmly retightened.

Secondary Chain Adjustment. Two cams are attached to the rear wheel centre spindle, and these cams (which turn together) are in contact with two projections in the slotted ends of the rear fork. The projection on the off-side fork end is set by the makers, and its position is locked by means of a lock-nut. This adjustment ensures perfect front and rear wheel alinement.

To tension the secondary chain, with the machine on its centre stand, loosen the external nut on the near-side of the rear wheel spindle. Now push the wheel forward so that both fork spindle cams are in contact with the projections on the rear fork ends. Then with an adjustable spanner (Part No. LTK-12) applied to the hexagon body of the near-side cam, adjust the chain tension until there is 1½ in. total chain whip midway between the sprockets with the chain in its tautest position. This whip gives approximately ½ in. whip (normal) with the machine off its stand and the rider seated on the saddle. Finally retighten the nut on the near-side, while holding the wheel and cam in position.

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