

MAINTENANCE INSTRUCTIONS

for

The
Unapproachable

Norton

REGD TRADE MARK

Motor Cycles

Price 1/6

NORTON MOTORS (1926) LTD.

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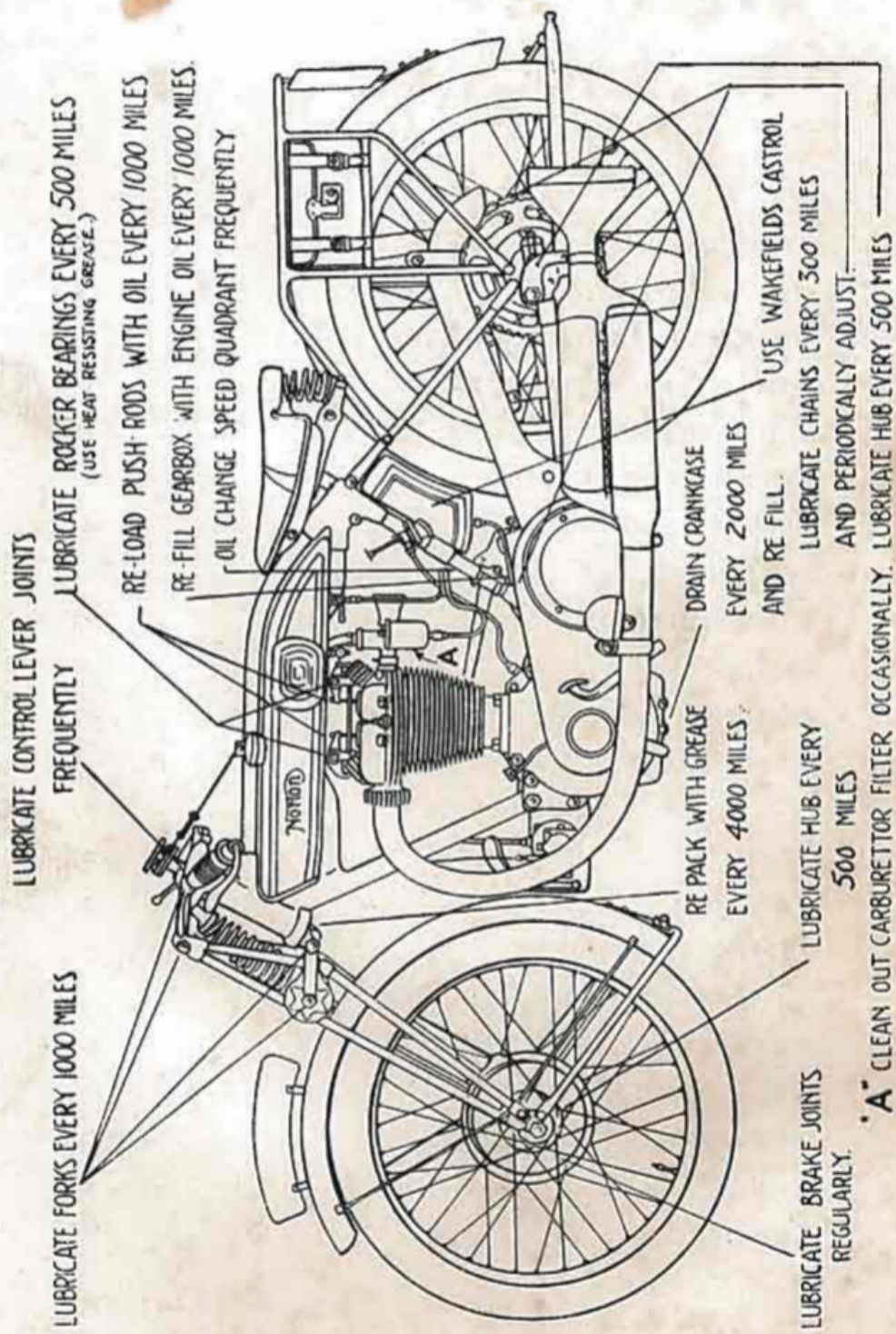
**MAINTENANCE
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LUBRICATE CONTROL LEVER JOINTS
FREQUENTLY

LUBRICATE FORKS EVERY 1000 MILES

LUBRICATE ROCKER BEARINGS EVERY 500 MILES
(USE HEAT RESISTING GREASE.)

RE-LOAD PUSH-RODS WITH OIL EVERY 1000 MILES

RE-FILL GEARBOX WITH ENGINE OIL EVERY 1000 MILES.

OIL CHANGE SPEED QUADRANT FREQUENTLY

RE PACK WITH GREASE
EVERY 4000 MILES

LUBRICATE HUB EVERY
500 MILES

LUBRICATE BRAKE JOINTS
REGULARLY.

DRAIN CRANKCASE
EVERY 2000 MILES
AND RE FILL.

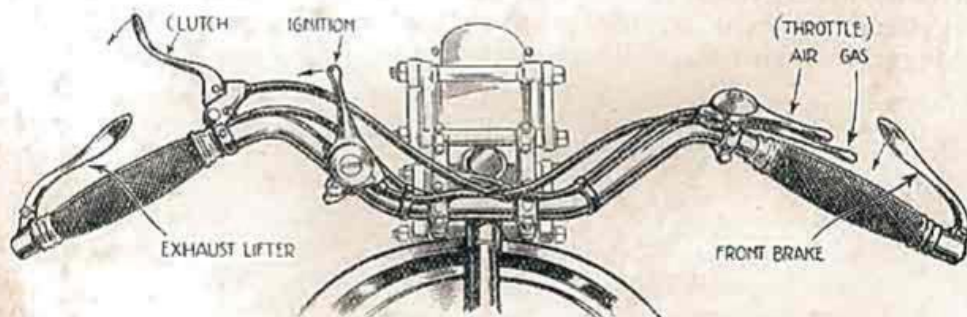
USE WAKEFIELDS CASTROL
LUBRICATE CHAINS EVERY 300 MILES
AND PERIODICALLY ADJUST.

A CLEAN OUT CARBURETTOR FILTER OCCASIONALLY. LUBRICATE HUB EVERY 500 MILES

INTRODUCTION

IN preparing these instructions we have omitted, for the first time in editing this booklet, the elementary details and preliminary information that perhaps is necessary for an absolute novice, in the assumption that the majority of riders of Norton machines are fully acquainted with the elementary details for efficient maintenance.

It must not be assumed from the foregoing that the details in this instruction booklet are essentially technical. In previous editions a number of pages have been appropriated for pointing out the importance of immediate adjustment, method of starting, proper method of driving, setting carburetter controls, method of freeing engine when cold, method of changing gear, and other elementary details which we consider is quite unnecessary information to the average Norton rider. Our services are, however, at all times available to give any information that may be required which will facilitate obtaining the maximum efficiency, and we invite Norton riders to enlist our aid whenever in doubt; our services will be freely and willingly placed at their disposal.



We now immediately proceed to one of the most important fundamental instructions, which is lubrication.

At the Works, Wakefield's Castrol oils exclusively are used with highly successful results. Castrol "XL" is suitable for touring purposes for all models. Castrol "R," however, should be used for racing, and is recommended both for the C.S.1 and E.S.2 models for general use. When changing grades of oil the crankcase should be drained and thoroughly rinsed before replenishing. Speedwell "Sans Egal," Nicol's Dragonfly Norton oil, or Price's "Motorine De Luxe" are also suitable lubricants; for speed work, however, Speedwell "White Ideal" or Nicol's Dragonfly R.A. should be used.

LUBRICATION

An engine will give good service for many thousands of miles if satisfactorily lubricated, but may be ruined in a day if this be neglected. Use only best grade oils.

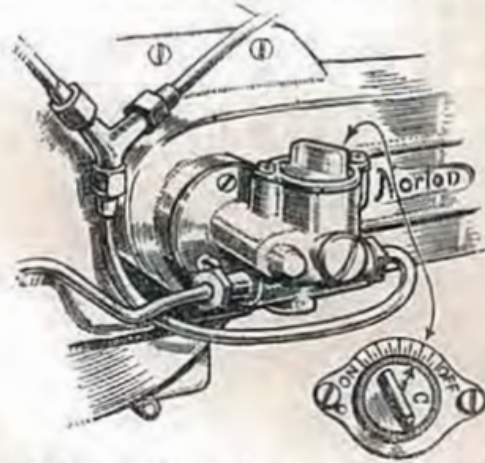
Refuse all others. Some garages supply the "just as good" sort from bulk, but disappointment and expense are almost certain to follow their use. One barrel only of cheap oil is sometimes kept, and recommended for everything from a traction engine to a two-stroke. Avoid such. Other than above, it is impossible to lay down any hard and fast rule for lubricating, the amount of oil depending entirely upon conditions, but be sure to give enough, it being safer to err on the generous side and over-lubricate (which necessitates more frequent cleaning of the engine or causes an oiled-up sparking plug) than to be too sparing of oil, which means frequent re-bushing, new piston rings, etc., etc., unsatisfactory running, and, finally, a ruined engine.

Quantity

The following is a brief description of the pump:—

Mechanical Oil Pump

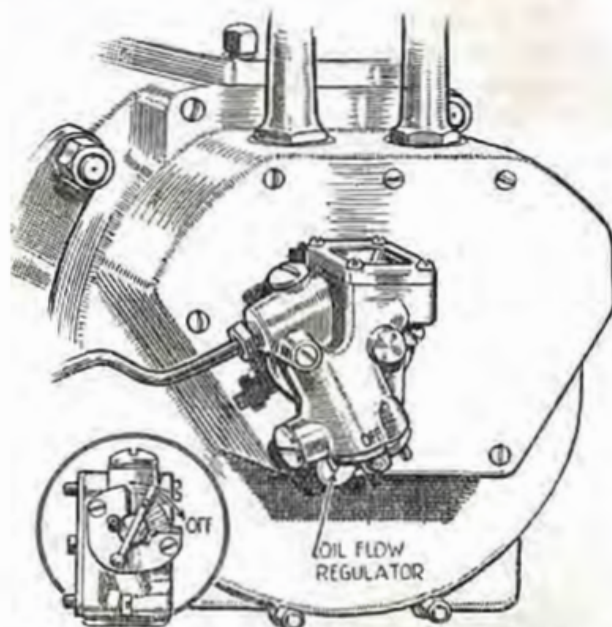
A Plunger is made to rotate and reciprocate in a sleeve by means of a lug, which forms part of the plunger. The lug moves in a fixed groove and slides up and down a slot in the sleeve. The rotary movement is imparted to the sleeve (and plunger) by means of a worm wheel (forming an integral part of the sleeve) and worm driven. Instead of ball valves, there is a slot or port in the rotating sleeve which registers with the supply port on the ascending stroke of the plunger and with the delivery port on the descending stroke.



The flow of oil is regulated by turning the block in which the cam groove is cut. This has the effect of altering the "timing" or phase of the plunger stroke in relating to the opening and closing of the supply and delivery ports; thereby adjustment is found, the two screws are tightened, and the serrations in the fixing plate are pressed on to those in the cam block, locking it firmly in position.

When machines are despatched from the Works the regulator is set to deliver approximately two-thirds of the maximum supply ; when the running-in period of approximately 500 miles is completed, this should be gradually reduced, until only a quarter of the maximum supply is delivered.

It is essential that the two small screws are tightened after the adjustment has been made ; the object of securing the indicator in this way is to prevent frivolous or accidental alteration of the adjustment.



Set oil pump to deliver approximately two-thirds of its maximum capacity for the first 500 miles, after which, reduce supply as it is found advisable. The best pump setting can be determined by experiment.

Mechanical Oil Pump with Sight Feed

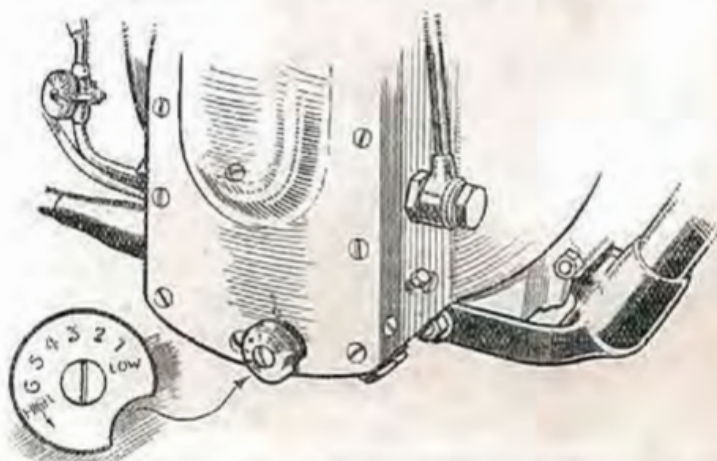
Where this type of pump is fitted oil is delivered to the timing panel and then enters the crankcase by way of two ports above the cam wheels. The timing gear, therefore, is submerged in oil.

Semi Automatic Hand Pump with Sight Feed

Oil is delivered to the engine with this pump by means of depressing the plunger. An internal spring is fitted in the barrel of the pump which returns the plunger to the upright position. It is at all times advisable to work on the drip feed principle that is adjusted by means of the indicator which is situated immediately over the sight feed portion of the lubricator. This should be set so that the pump should empty itself once every six or eight miles. Should the sight feed portion fill with oil it is an indication that the oil is not passing freely to the engine. This may be possibly due to air leaking from the sight chamber, in which case one of the hexagonal parts under the glass may require adjustment, or may be due to a stoppage in the supply pipe to the engine, in which case the parts should be dismantled and thoroughly cleaned.

Semi Automatic Pump without Sight Feed This type of pump delivers oil to the engine by depressing the plunger in exactly the same manner as the type with the sight feed incorporated, the only difference being that the passage of oil is through a pipe to the engine and does not pass through a sight feed. For general purposes a full charge of oil should be delivered to the engine approximately every six or eight miles. When riding against a strong head wind or maintaining a high average speed this should be increased accordingly.

Dry Sump System This lubricating system is of the constant circulation dry sump type, and consists of a modification of the usual dry sump system, differing from it in that the sump instead of being absolutely dry contains a certain adjustable depth of oil, into which the fly wheels dip.



The control tap leading from oil box to engine should be "OFF" when machine is left standing. Supply of oil to sump can be varied with this tap. The oil level adjuster marked "High and Low" regulates the level of oil in the sump. When adjuster is at "High" it is at the highest level, "Low" is the lowest level, the engine then receiving from splash a minimum quantity of oil.

For very fast work it will generally be found possible to use the maximum quantity with advantage, whilst for ordinary touring the centre position will possibly give the best results. If with this setting the engine still receives an excess of oil the hole in the adjuster should be moved one notch at a time if necessary to the lowest position.

This adjustable splash is additional to the big end and timing gear feed, and it is therefore impossible, even when the level is at a minimum, for the engine to run absolutely dry.

The pump is of the double acting plunger type. The upper end of the plunger draws oil from the tank and delivers it under pressure to the timing gear and big end bearing, from whence it is thrown by centrifugal force into the cylinder and piston. Surplus oil quickly drains to the sump, and is then drawn by the lower end of the plunger through the level regulator and returned to the

tank. The level of oil in the sump is controlled by the position of the return hole in the regulator. On later models the oil level regulator is situated on the exterior of the pump panel.

A filter, which should be occasionally removed and cleaned, is embodied in the oil feed union which is fitted at the base of the oil box. It is most conveniently removed when the oil tank is empty. To remove this, detach the oil feed pipe and unscrew the oil feed union by means of the large hexagonal flange attached to same, when the filter is readily detachable and can be easily cleaned.

To some of the early dry sump models an additional filter was incorporated in the base of the pump housing. It was found that this somewhat impeded the return of oil, is actually unnecessary, and to machines where this is fitted it should be removed, an adequate filter being embodied in the oil box.

Excessive supply of oil to the engine is traceable to oil syphoning from the oil box to the crankcase when the machine is left standing for any lengthy period. To overcome this, the combined control and feed regulator tap fitted to the oil pipe leading from the tank to the crankcase should be turned off. The regulator can also be used to control the oil feed to pump, this should be set to deliver approximately half or even less of the maximum supply; this can gradually be reduced or increased as is found advisable.

CAUTION

Do not forget to open regulator when machine is in use.

Lubrication of Cycle Parts

Use the grease gun provided in the equipment with Crimsangere.

DECARBONIZING

Side Valve Engine

First disconnect petrol pipe union at tank end. Loosen clip joining carburetter to cylinder. The carburetter can now be removed from engine.

To Remove Cylinder for Decarbonizing

To remove carburetter completely, without removing control levers, pull outer casing of Bowden cable until it comes out of recess in control lever body; the inner cable will then slip through slot cut in body, and the nipple can be slipped out of the circular recess in underside of air or throttle lever, as the case may be.

Next remove high tension cable and sparking plug. Then loosen valve caps, or remove same entirely, with special spanner provided in kit.

Remove compression tap with other end of spanner. To remove exhaust lifter cable, turn engine round until the exhaust valve is fully raised by tappet, then lift the long plated arm a little more by means of a tommy-bar or screw-driver slipped under the arm, and behind the oil pipe union on crankcase. Use screw-driver or tommy-bar as a lifter. The inner Bowden cable can then be slipped through the eye of valve lifter arm.

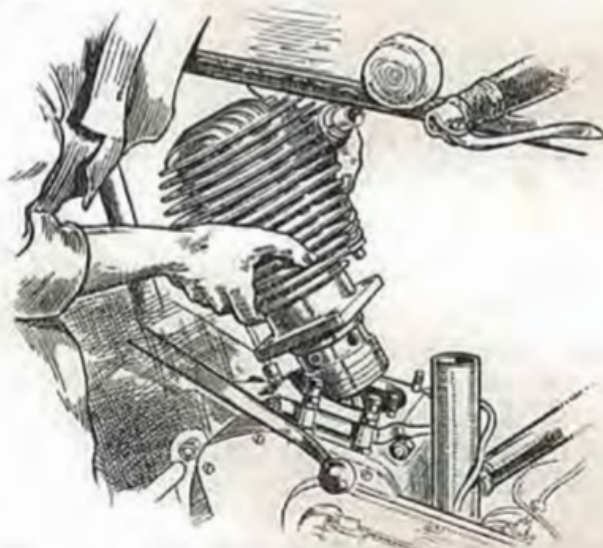
The Bowden adjuster should be screwed out of the cylinder with special spanner provided, and the cable slipped through slot in cylinder.

Remove oil pipe from crankcase union. It is not absolutely necessary to remove either oil pipe or silencer, but is recommended to avoid possibility of bending the connecting rod when removing the cylinder.

The valves are best removed whilst the cylinder is on the crankcase. We can supply a tool for this purpose, but no difficulty should be experienced in obtaining one from a local dealer. This should be placed so that the hook rests on the valve head. The lever portion should be placed under valve spring cup and the lever depressed; when the spring is lifted to its full extent, fix the ratchet arm in position.

Both hands are now free to remove the valve cotters. On Big 4 Machines and all side valve machines manufactured previous to 1923 a flat type valve cotter is fitted which may be removed from the valve with pliers. On all $3\frac{1}{2}$ -h.p. side valve models subsequent to 1923 split type valve cotters are fitted, and these may be easily removed with the fingers. Remove valve lifter tool, then slip screw-driver under base of the valve stem and lift; the valve can then be removed, as also can the spring.

Then remove the four nuts holding cylinder to crankcase, when the cylinder can be detached.



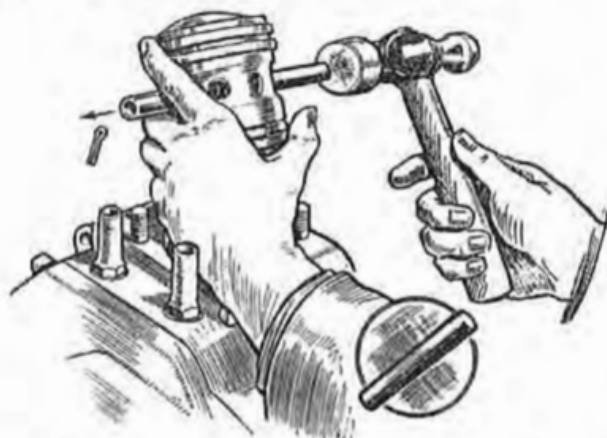
Stand astride the machine, lift the cylinder gently, tilting same backwards, then rotate through 180 deg. The connecting rod must be pointing to the rear of the machine. Assistance should be obtained to hold the piston and connecting rod, immediately prior to completely removing cylinder.

Stand astride the machine and lift the cylinder gently off crankcase; at the same time tilt it backwards, and then rotate cylinder through 180°, the valve chest then being on the opposite or left-hand side of the machine. See that the connecting rod is pointing to the rear of the machine.

Obtain assistance to hold the piston and connecting rod, and you will find the cylinder can easily be removed.

A clean cloth should be wrapped round the connecting rod and packed into the mouth of the crankcase. This prevents dirt entering the latter.

To remove cast-iron piston, proceed as follows : Remove cotter pin by closing ends with pliers and then withdraw. Next obtain a piece of rod slightly smaller in diameter than the gudgeon pin. Place this rod against end of gudgeon pin and tap gently with a hammer. **HOLD THE PISTON FIRMLY IN PALM OF LEFT HAND WHILST DOING THIS**, the rod being held between left forefinger and thumb.



GUDGEON PIN REMOVAL (For cast iron pistons only).

Withdraw split pin by closing ends, obtain a piece of rod slightly smaller in diameter than gudgeon pin, place rod against the end of gudgeon pin and gently tap with a hammer. The piston should be held firmly in the left hand whilst doing this, the rod being held by the left forefinger and thumb.

It is most important that particular care is taken to see that the connecting rod is not bent in the slightest degree during this operation, otherwise results may accrue which may be disastrous. If the connecting rod is bent the engine should be returned to the Works.

CAUTION

Be careful to note which side the split cotter is fitted (i.e., chain side or valve side), and which is front and back of piston, and be sure to re-assemble in the same way.

When re-assembling, push gudgeon pin into piston until it comes flush with inside of boss of piston ; slip piston over connecting rod, then tap gudgeon pin **GENTLY** in, making sure that the pin has entered the small end bush and that the key is entering key-slot cut in the piston. Re-fit split cotter and open the ends of same with a screw-driver.

While the piston and cylinder are off, pour about a pint of clean paraffin into the crankcase. This will remove dirty oil from the flywheels and crankcase, whilst you are decarbonizing.



Three thin strips of tin fitted in a manner as illustrated, facilitates piston ring removal. Slip these behind the rings over the ring gap, one at a time, and then equally space, when the rings are readily removable.

To remove piston rings three thin strips of tin should be cut, say $\frac{1}{2}$ in. wide by 2 in. long. These should be slipped behind the rings one at a time, via the ring gap, and then equally spaced out. The rings can then be removed easily.

CAUTION Remember which is top ring and which is bottom, and also the top and bottom of each ring, and replace in the same order.

All is now ready for a complete and thorough decarbonizing and valve grinding.

The above sounds very complicated and intricate, but we feel certain that if even the veriest novice undertakes this work as set out, he will be agreeably surprised at its simplicity.

Decarbonizing Thoroughness in decarbonizing well repays the labour expended. To clean the cylinder head the best tool is a long screw-driver, with which the carbon can be scraped and chipped from the head, great care being taken to see that the polished part of the cylinder bore is not scratched. A useful accessory for examining this part of the work is a cheap round pocket mirror supported on a strip of bent tin.

The hand can quite easily be inserted in the cylinder whilst using emery cloth. Quite an appreciable amount of carbon will be found on the walls of the valve chest.

The valve chest should also be scraped clean and polished with emery cloth. Another spot where carbon lodges is in the sweep where the cylinder bore merges into the valve chest. Special tools for removing this can quite easily be made by an amateur from a length of $\frac{1}{4}$ in. round or hexagon steel suitably bent, and ground.

The exhaust port should also be scraped and cleaned. Valve caps and compression tap should be cleaned and polished with

emery cloth. The piston head should be scraped with an old knife, and when clean polished with emery cloth. A lot of carbon is usually deposited on the INSIDE of the piston. It is most important that this should be removed. The screw-driver can be used for this till all carbon is scraped off the ribs, etc., inside piston.

Take care not to let screw-driver shank bump unnecessarily against piston skirt, or the latter may crack. Examine ring grooves for carbon. Should any be present, scrape out with an old knife. The rings should also be scraped at the back.

Wash piston and rings thoroughly in clean paraffin. Re-fit rings either by slipping them over the piston or with the three strips previously described.

Polish valve heads with fine or used emery cloth, and give valve stems a light rub with the cloth also. For grinding in the valves we recommend a good quality grinding paste or carborundum powder.

Do not grind valves unnecessarily, but see that all pit marks are removed from the valve face. Finish off with a fine powder. Wash cylinder, valve caps, compression tap, and valves and springs, etc., in clean paraffin, **TAKING GREAT CARE TO REMOVE ALL TRACES OF EMERY OR GRINDING POWDER.** Dry with a clean smooth cloth. All is now ready for re-assembling.

First drain dirty oil and paraffin from the crankcase by means of drain plug. Then pour in half a pint of clean oil, seeing that plenty of it runs down the connecting rod into the big end bearing. (See that drain plug is screwed in before pouring in this oil.) Also smear oil in small end bush.

Re-fit piston as per previous instructions. Rings should be spaced so that gap of top ring faces front, and gap of bottom ring faces rear. Smear piston thoroughly with oil and see that there is plenty behind the rings. Wipe top of piston clean.

The cylinder bore should be smeared with oil, and then re-fitted to crankcase. If paper joint is torn, fit a new joint. These can be obtained from the works on application. The paper washer should be smeared with seccotine or gold size.

If any difficulty is experienced in getting piston rings to enter cylinder, obtain assistance to hold the cylinder while the rings and piston are eased in. Screw down cylinder nuts, giving each a half turn alternatively.

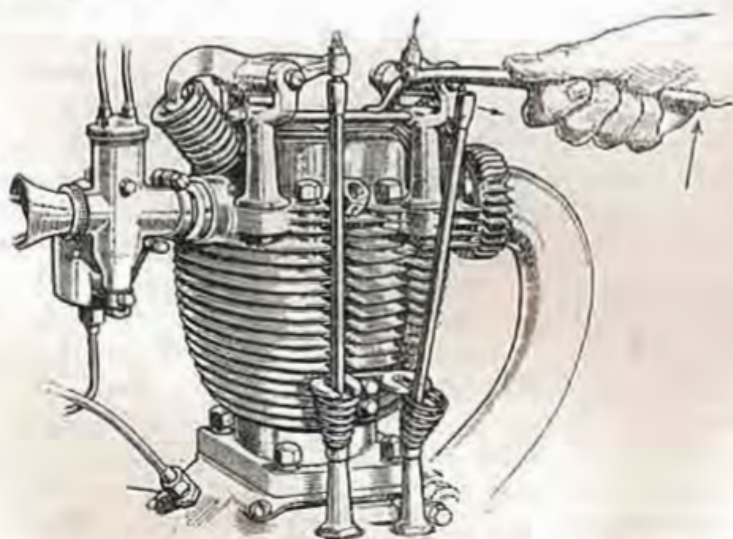
Re-fit valves, first smearing valve stems with a little oil. Fit compression tap and valve caps, if necessary fitting new copper-asbestos washers. Screw in sparking plug, re-fit exhaust lifter cable and the exhaust system. Attach oil pipe, carburetter, and high tension wire to plug. The work is now complete. Start engine and run gently until warm. Then check tappet clearances (.005 exhaust, .003 inlet), and check cylinder, holding down nuts for tightness.

If your engine is fitted with an aluminium piston, the same remarks apply, with the exception that the gudgeon pin is of the floating type. Take care to note which is front of piston and which way the gudgeon pin is removed, and replace in same way. Do not scrape head of piston with a tool, but remove carbon with fine emery cloth; finally polish up head with a clean rag soaked in paraffin.

O.H.V. Engine Push Rod Operated Many of the particulars given previously for models fitted with side-by-side valve engines will operate in the case of the O.H.V. model. Detach finned exhaust pipe locking ring, and swing the exhaust pipe away from the cylinder head.

To remove O.H.V. Head for Decarbonizing Remove petrol pipe, loosen clip joining carburettor to cylinder head, and remove carburettor. It is also possible to facilitate the removal of the head if the sparking plug and compression plug are first removed.

The next operation is to remove the push rods. This may be done by resting a screw-driver on the rocker standard distance piece tube and lifting the overhead rocker, where a straight pattern type of rocker is fitted. With the arched pattern rocker a cranked tommy-bar or lever should be used in a similar way. It is important to note that the push rods should not be forced too far outward, otherwise a broken tappet head may result. Force the push rod return spring downwards. This will then release the spring from the recess in the push rod return spring stop. By holding the tappet head down and pulling the push rod up, this may then be extracted.



A screwdriver for straight pattern rockers, and a cranked tommy bar or lever for arched rockers should be used for lifting the rocker for push rod removal. Push rods should not be forced outward, otherwise tappet head will be damaged.

**Model E.S. 2
Push Rods**

The push rod return springs are enclosed, the spring covers being screwed to the tappet guides. To remove the push rods, unscrew the spring covers and slide them up the push rods, which may then be withdrawn as instructions previously given. The push rod tops are loaded with oil, and after removal should be filled by means of a small cycle oil container or oil gun with very fine nozzle. A small hole is drilled in the circumference of the push rod top for this purpose. This oil channel is inter-connected with the oil way leading to the push rod bearing surface. Rubber oil retainers are fitted, and should be immediately replaced after filling the push rods, in order to prevent leakage of oil. This method provides adequate and constant lubrication of the push rod tops and rocker arm adjusting screws, so preventing wear.

Valve Clearance. TOURING ... Inlet, .003 in. Exhaust, .006 in.
Models C.S.1 and E.S.2 RACING ... Inlet, .005 in. Exhaust, .008 in.

It is always advisable to remember, when removing push rods, which is the inlet and exhaust. This will then avoid unnecessary re-adjustments when re-assembling. The cylinder head is bolted to the barrel by means of four special sleeve nuts. These should next be removed, when the complete head may be detached. For a gas-proof joint a good ground seating on the cylinder barrel and head is provided, and it is important that the seating of the head should not be scratched against the studs in the barrel.

**Removing
Cylinder Barrel
O.H.V.**

This is quite a simple operation. The instructions in regard to the renewal of cylinder for decarbonizing in the case of the side-by-side valve engine can here be usefully employed. Remove the four cylinder holding-down nuts at the base of the cylinder barrel, turn the fly-wheels round until the piston is at the bottom of the stroke (taking care to see that the barrel is kept perpendicular in order to avoid any strain on the connecting rod); the piston is then readily removed after removing the gudgeon pin.

It is essential that care is taken to see that the piston is marked, showing which is the front and rear. This should be replaced exactly as it is taken out; to use a colloquial expression, do not fit in "back to front."

**Removal of
Valves**

The valves should then be removed; a suitable tool is included in the kit with each machine. In the case of the straight type rockers the portion of the tool with the wing nut attached should be inserted in the sparking plug hole of the cylinder head. The wing nut should then be tightened down; the bridged portion of the tool should be placed over the valve-collar. The rocker arm should then be depressed by means of a tommy-bar against the rocker standard tie rod, when the valve spring will be compressed and the cotters and springs quite easily removed.

With the arched pattern type of rockers a similar type of tool is supplied, with the addition of a spring compressor. The portion of this tool with the wing nut is used in precisely the same way as in the case of the straight pattern rockers; the spring compressor should be inserted in the compression plug hole, and by placing the forked end over the valve-collar and tightening the nut, the valve spring will be compressed.

Removal and Adjustment of the Overhead Rocker

Detach the locknut on the rocker pin; unscrew pin, when the rocker should be lifted upwards. The rocker operates on a roller bearing made up of rollers in a special phosphor-bronze retaining cage.

Take care to see that the rollers are not lost in removal. A roller retaining washer is fitted each side to prevent these working out. The rocker standard itself is not likely to require attention, but should it be necessary to remove this a square tubular spanner will be required to remove attachment bolts.

Any end play in excess of .003 in. which may have developed in the rockers can be taken up by means of adjustment provided by the centre bolt. Slack off dome locknut at end of centre bolt, unscrew bolt say one quarter turn, and while holding bolt in this position tighten locknut. If excessive end play still exists, repeat the operation until same is removed. The rocker, however, must not bind on the bearing.

Cylinder Head

Care should be taken to see that ground joint of the head is not damaged. The method adopted at the Works of holding the head whilst decarbonizing is to fit a hexagon steel bar screwed at one end into the sparking plug hole. The cylinder head may then be held in a vice by means of the steel bar. If such a bar is not available, an old sparking plug makes a useful substitute. This will facilitate the operation considerably. Remove carbon from the top of the piston, both inside and outside. Clean the top of the piston with a piece of cotton waste, and polish with very fine emery. The skirt of the piston should not be touched. The valve stems may be cleaned with VERY FINE or worn emery cloth. Do not use coarse grinding compound for grinding valves in. A little fine paste smeared very lightly over the valve face is far better. We are unable to supply a special valve grinding tool for this operation, but a small hand vice which may be clamped over the valve stem will be found quite satisfactory. The head of the valve should be cleaned and polished, all deposit being removed. Care should be taken to avoid burring the valve stems, otherwise unnecessary wear will take place in the valve guide. The same remarks apply to the head itself. This should be polished with very fine or used emery cloth after the deposit has been removed. To re-fit the rocker standards and overhead gear the details given for the removal of these should be reversed. Re-fit the valves, first smearing a small quantity of oil on the stems, fit the star washer at the base of the valve guide, then the internal and external springs. It is important to see that

A GOOD HEAT RESISTING GREASE IS ESSENTIAL FOR OVERHEAD ROCKER LUBRICATION PRICES H.M.P. GREASE WILL BE FOUND QUITE SUITABLE FOR THIS PURPOSE.

the internal spring is located correctly on the washer at the base of the guide. Fit top spring collar and compress the spring and re-fit cotters. The rockers may now be re-fitted to the standard and with the head completely assembled, the cylinder head may be re-fitted to the barrel. IT IS IMPORTANT TO SEE THAT BOTH THE FACE OF THE CYLINDER BARREL AND THE CYLINDER HEAD ARE PERFECTLY CLEAN, and free from dust particles. These should not be cleaned with even fine emery, but just wiped over with a perfectly clean piece of cloth.

If either seatings have been damaged in removal of the head it will be necessary to re-grind these in, in the same manner as a valve would be. To grind in the cylinder head the four studs should be removed. This may be done by screwing two nuts to the studs, using one as a locknut against the other. The holes from which the studs have been taken should then be filled with grease, so that grinding compound is kept out of the threads. The head and barrel should then be rubbed together, similar to the grinding-in of valves. A good joint may be made between the head and the barrel by smearing a little seccotine on the faces.

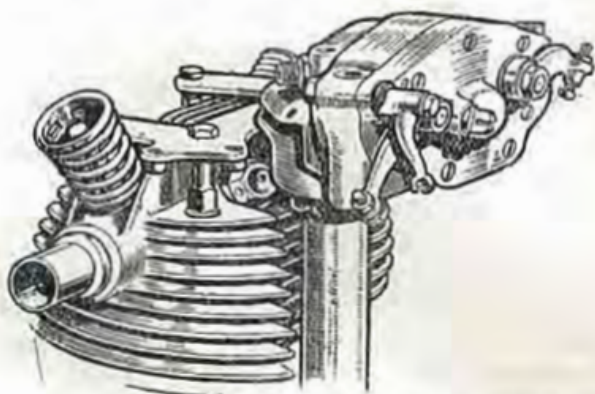
Re-fitting Piston and Re-Assembling The piston should then be fitted, taking care to see that this is replaced in the same position from which it was removed. Re-fit the barrel in the manner as indicated in the case of re-fitting the cylinder on the side-by-side valve engine. The base of the barrel should be smeared with a little gold size or seccotine. Paper washers should be used to ensure a perfectly oil-proof joint. It is important to see that the sleeve nuts holding the head to the barrel are tightened down evenly. Replace the sparking plug. The push rods may then be re-fitted. Should the push rods require re-adjustment, place spanner on the hexagon at the bottom end of the push rod, and with another spanner release the locknut at the top of the push rod; adjust the screw which is provided with flats for this purpose. When correct adjustment has been obtained, tighten nut. Where the arched type rocker gear is fitted, adjustment is made by means of the square-headed adjusting screw which is fitted to the rockers. Two spanners are supplied with the tool kit for the purpose of adjusting these, one fitting the small squared head of the rocker adjusting screw, and the other the locknut. Adjustment is obtained in exactly the same manner as with the straight pattern rocker.

Decarbonizing O.H.C. Engine, Model C.S.1 The procedure usually adopted for decarbonizing is applicable to the O.H.C. engine, with detailed instructions in following pages. Although this may appear a somewhat formidable procedure, actually it is very simple. In keeping with advance design, simplicity is the keynote of every operation necessary for the efficient maintenance of this machine.

The camshaft and cams of this engine, together with the cam rockers, are enclosed in an aluminium rocker box, which is secured

to the cylinder head by four bolts. The camshaft is driven through a hollow vertical shaft by bevel pinions mounted on splines.

For decarbonizing it is quite unnecessary to dismantle the rocker box or remove the cylinder barrel. Fittings such as exhaust pipe, cables and the oil pipe from sump to rocker box should be detached. In addition, remove the petrol tank which is secured by four bolts, the petrol pipe, petrol tap, and tank connecting pipe being first detached. The tank should be raised at the saddle end and withdrawn towards the saddle until the nose of the tank is clear of the handlebar clips. It is advisable to remove the top bevel gear inspection cover to ascertain the position of the bevel pinions. The one on the vertical shaft has on one tooth a distinguishing mark, whereas the pinion on the camshaft has two teeth distinguished. The engine sprocket should be revolved until the marking on the vertical shaft pinion coincides with the distinguishing marks of the camshaft bevel. This will enable the setting to be checked when the rocker box is remounted in position. The four bolts securing the rocker box should be withdrawn; it is also advisable to loosen the twelve cheese-headed screws which retain the crankcase and lower bevel panel cover. It is quite unnecessary to completely remove this, the object in loosening this panel cover is to remove pressure from the vertical shaft tube where this enters the case.



The Rocker Box with vertical shaft need not be dismantled entirely for cylinder head removal and decarbonizing. The four bolts securing Rocker Box should be removed, the twelve cheese headed screws of crankcase cover into which vertical shaft tube enters, should be loosened, but not removed. The Rocker Box with vertical shaft can be bodily raised $\frac{1}{2}$ in. to clear the nuts securing the Rocker Box platform, when the Rocker Box should be rotated through 180 deg. Care should be exercised in lifting the Rocker Box, only sufficient to clear Rocker Box platform nuts, otherwise the vertical shaft will be completely withdrawn.

If the rocker box, together with vertical shaft and housing, are now bodily raised approximately $\frac{1}{2}$ in. in order to clear the two nuts securing rocker box platform, and rotated through an angle of 180°, the top bevel inspection cover will face the cylinder head (See illustration). (Care should be taken in lifting the rocker box otherwise the splined vertical shaft, which is a sliding fit in the

lower bevel pinion, will be completely withdrawn, and consequently the valve timing disturbed; with care this can be avoided. Should this inadvertently happen, see illustration for re-setting timing.)

The four set screws holding rocker box platform should next be removed, when the cylinder head can be detached. Decarbonizing and grinding valves may now be proceeded with, and previous instructions dealing with this should be referred to. If it is desired to remove the cylinder barrel, the top one of the two nuts at the base of the cylinder should be unscrewed, when the securing rods which pass through the fins of the cylinder may be withdrawn. If there is a tendency for the lower and larger nut to turn during this operation, it should be held with a spanner. Having decarbonized and thoroughly cleaned the cylinder head, etc., the engine should be re-assembled and the parts re-fitted in the reverse order from which they were removed.

Note.—The compression plug must be fitted before the rocker box and vertical shaft are placed in position.

Rocker Box to Dismantle

The valve rocker arms are keyed to the tapered end of the cam rocker shafts and secured with a lock nut. The nuts should be removed when the rockers may be drawn from the shafts. Seven screws retain the rocker box cover in position and if removed together with the exhaust valve lifter lever and bolt, the cover is detachable. The cam rockers may be withdrawn from the phosphor bronze bushes, a replacement insert, if necessary, can be fitted to the original rocker arm at a very small cost.

In order to remove the camshaft, it is necessary to detach the top bevel pinion, which is keyed on to the shaft and secured by a lock nut. When the lock nut is removed, the pinion can be withdrawn. It will be noted that three keyways are cut in the pinion. It is essential to note which keyway was employed originally and refit in the same position. If a spacing washer is fitted behind the pinion care should be taken to refit this when re-assembling. The cams are a sliding fit on the camshaft and can readily be detached if a replacement should be found necessary.

Removing Engine from Frame

Should it be necessary to remove the complete engine unit, proceed as follows:—Remove carburetter, exhaust system, exhaust lifter cable, and high tension wire as for decarbonizing. Then remove front chain, unscrew nut attaching magneto support rod to the lug of front down tube. Detach the rod from the eye in the frame lug, and the magneto control cable. Then remove nuts from the front engine lug and gear bracket bolts on the sprocket side of the machine. Two tommy-bars or similar rods should be obtained to facilitate removing the bolts and for supporting the engine in the frame. The engine unit can now be lowered to the ground and removed to the bench.

**Removing Engine
from Frame.
Models C.S.1 and
E.S.2**

The engine unit complete with magneto *in situ* may be removed, it being quite unnecessary to dismantle the engine in any way. The instructions for decarbonizing should be referred to, as it is necessary to remove the exhaust pipe, carburettor cables and also the petrol tank, together with the chain-case secured by four bolts, also engine driving chain.

The footrest centre rod serves as a rear engine fixing bolt. Remove the nuts on either end of rod, and withdraw, when the footrest hangers with distance pieces will become detachable. The front engine plate should be completely detached by withdrawing the bolt which secures it to the frame, together with the two bolts which attach it to the crankcase. Three bolts now secure the engine to the frame, two in the frame cradle at the base of the crankcase, which should be withdrawn from the transmission side of the machine, and the third which passes through the combined magneto platform and rear engine plates; these removed, the engine can be taken from the frame. Take a firm hold of the engine and tilt in a forward direction until the magneto platform is clear of the lugs of the frame, lifting the engine out of the frame cradle from the transmission side of the machine.

**Dismantling
Engine**

We have previously dealt with removal of the cylinder and component parts, and also with removal of the complete engine unit from the frame. So far we have not interfered with the timing in any way. To dismantle the timing gear, proceed as follows:—

Remove magneto chain cover, magneto sprocket set screw, the sprocket fits on a taper shaft, a long screw-driver should be used to force this off. Remove the locknut of the camshaft sprocket (right-hand thread), when this may then be removed in precisely the same manner as the magneto sprocket.

Models previous to 1923 have the camshaft sprocket screwed to the exhaust camshaft, and secured by a locknut. With this removed the sprocket can be unscrewed (NOTE! LEFT-HAND THREAD); two holes are drilled for this purpose. In the Works a special tool is used for this, but it can be removed equally as well with a flat-nosed punch.

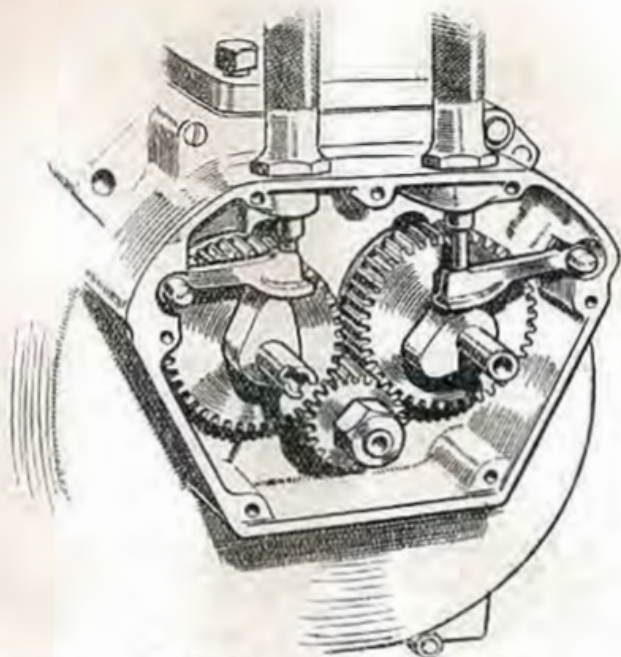
Next remove the seven panel cover screws. Note one is countersunk. This fits in the panel cover behind the magneto chain.

The cover should then be eased off, say $\frac{1}{4}$ in. A long screw-driver or other flat instrument should be inserted between the cover and the case to prevent the cams being removed. Then remove cover, which exposes the timing gear. Take out the rockers, taking note which is the inlet and which exhaust. One end of each shaft is ground plain, the other has a "centre" mark; the plain end of each shaft goes in the panel cover. The

cam wheels are not marked in any way, but, if doubtful of replacing them correctly, distinguishing marks can be made on both cams and timing pinion.

**Model E.S.2.
Timing Gear**

The cams fitted to this type of engine differ from the other push rod operated engine, insofar as they are not integral with cam wheels. The cams are screwed on to the shaft of the wheels; a right-hand thread is employed.



E.S.2 Model. TIMING GEAR.

The cams of this engine are not integral with the cam wheels, they are screwed to the shafts (right-hand thread). The push rod spring covers are screwed to the lappet guides, these should be removed before an attempt is made to detach push rods.

The cam wheels can now be withdrawn. The timing pinion is keyed on to the taper end of the main shaft and secured by a *left-hand thread* locknut; detach this in the manner indicated in the case of the engine shaft sprocket.

On models previous to 1923 the timing pinion is screwed to the main shaft (left-hand thread). This pinion controls the whole of the timing, and should not be disturbed unless absolutely necessary. To remove it a special tubular box spanner is necessary. These spanners can be supplied on application. There may be one or more packing washers behind the pinion, which should be re-fitted when assembling.

To remove the front chain sprocket remove nut and locknut from shaft. Find position of keyway in sprocket. Having done so, place end of punch or tommy-bar behind sprocket, bar to be vertically over keyway, e.g., at right angles to the main shaft. Give tommy-bar a sharp blow. This has the action of loosening

the key. A sprocket drawer, however, should be used if obtainable. The crankcase can now be completely dismantled.



A series of distinguishing marks indicating correct valve timing:—
Mark "A" on Mainshaft should point in a vertical direction with "B" on large bottom bevel, positioned on each side of "C," which will then be in line with "A" on Mainshaft. "D" on small bevel pinion should be positioned on each side "E." It is important that "F" is meshed with "E."

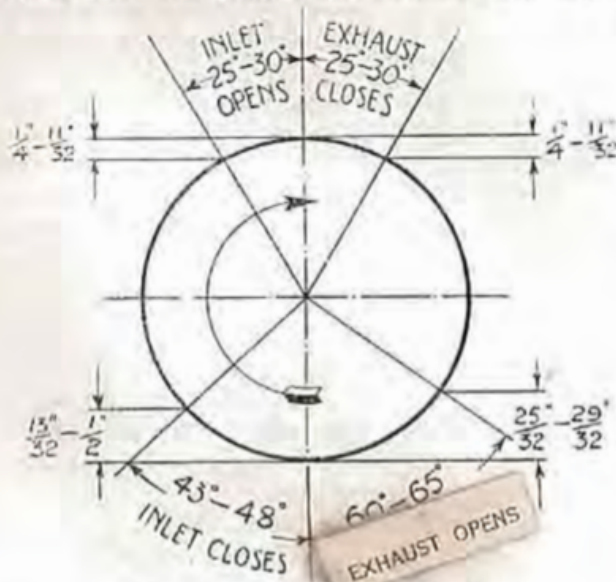
Should difficulty be experienced in parting the crankcase when all nuts and bolts are removed, grip one-half of the case in each hand at the mouth, and bump the case gently on the bench, at the same time pulling the case apart. This will invariably part the crankcase joint without difficulty. The flywheels and connecting rod should be put in a place of safety. Do not under any circumstances dismantle the flywheels. It is far better to return these to the Works if attention is necessary.

When re-assembling, the crankcase joint should be made with either gold size or seccotine. When re-fitting half-timing pinion, see that nut securing same is absolutely dead-tight.

1923 and Earlier Models. Re-assemble the engine complete, but leave the timing gear till last. With this order of assembling you will have the valves, etc., in position, and it only remains to insert the cams. The following is a very quick method of timing with reasonable accuracy.

Timing the Engine.
(Side by Side Valve Engines only)
Set the piston at the top of the stroke. Fit the inlet cam and the inlet rocker; the cam should be in such a position that it commences to lift the rocker, and therefore the tappet just a shade

before the piston reaches the top of its stroke. This can be tested by "rocking" the flywheels to and fro by means of chain sprocket. Then fit the exhaust cam and rocker so that the valve closes (i.e., the tappet becomes "free" and capable of rotation by the fingers) just after the piston has reached the top of its stroke.



E.S.2 Model. TIMING DIAGRAM.

As a check "rock" the engine sprocket to and fro, so that the piston comes to the top of its stroke and slightly down, when one valve should close and the other open.

**Timing Engine
(Side by Side Valve
Engine only). 1924-5
and subsequent
Models.**

**(For O.H.V. and
O.H.C. Models see
pages 21 and 22)**

In the case of some of the later 1924 models a different type of cam was fitted, marked "90." These cams are also fitted to all 1925 models. The practice of marking same "90," however, was discontinued during the 1925 season. For correctly timing these models, that is, models with the "90" cams, proceed exactly in the same way by setting the piston at the top of the stroke. Fit the inlet cam and the inlet rocker. The cam should be fitted in such a position that it commences to lift the rocker and tappet $\frac{3}{16}$ in. before the piston reaches the top of its stroke. Re-fit the exhaust cam and rocker so that the valve closes when the piston has reached $\frac{3}{16}$ in. after top dead centre.

During the 1926 season a different type of cam was standardised on all models, and these were marked "W.7."

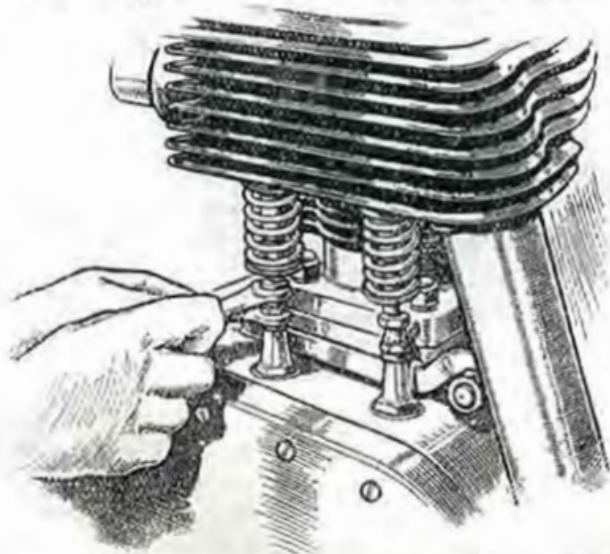
The method of timing the engine with the "W.7" type of cam wheel fitted is precisely the same as previous models. For correct timing see chart.

Finer Timing

To time really accurately, a timing stick is necessary. This can be made from a compression tap and 12 in. rule, which is marked in $\frac{1}{16}$ in. The movable

parts of the compression tap are removed, leaving just the body with a hole through it. A hacksaw cut is then made in the body into which the rule is fitted, and soldered into position. At the top of the rule and at right angles to it a nut is soldered on. The compression tap hole and the bore of the nut serve as guides for a sliding rod. To this rod an adjustable pointer is fixed. The wire terminal from a K.L.G. plug makes a useful and cheap pointer. The compression tap screws into the cylinder, and the sliding rod rests on the piston top. It is obvious that all up and down movements of the piston are communicated to the rod. The pointer will therefore register the amount of movement of the piston on the scale marked on the rule. This is such a simple and useful fitting that any owner will be well repaid by making one.

Adjustment of Tappets To adjust these for correct clearances, special spanners are provided in the tool kit. With one spanner on the hexagon of the tappet and the other on the hexagon of the tappet head, unscrew locknut until correct clearance (approximately .005 exhaust, .003 inlet) has been obtained. Then remove the spanner from the tappet stem and tighten the locknut against face of the tappet head.



For adjusting tappets use correct spanners provided in tool kit. One spanner should be fitted to the hexagon of the tappet and the other to the tappet head; loosen lock nut and adjust to give .003 inlet, .005 exhaust clearance, tighten lock nut against head of tappet. Valve clearance CS1 and ES2 Models. Inlet, .003 clearance; exhaust, .005 clearance.

IGNITION

With contact breaker fully advanced, the platinum points should be commencing to open: Big 4 $\frac{1}{4}$ in. and 3 $\frac{1}{2}$ h.p. (side valve engines only) $\frac{3}{16}$ in. before top dead centre on compression stroke.

Re-Assembling Replace panel cover, making joint with a little seccotine or gold size.

A little clean oil should be put on the cam shafts and rocker shafts before the cover is fitted.

Tappet clearance must be made after the timing gear cover is fitted, the cam shafts being then supported at both ends.

Secure camshaft sprocket on cam shaft by means of locknut.

Re-fit magneto chain and magneto sprocket, fixing same with setscrew, but do not tighten.

Place contact breaker cam case in the "fully-advanced" position.

Timing Magneto

Set the piston so that it is at the top of the compression stroke. To make sure it is on the compression stroke test both tappets; both should revolve freely. Insert a pencil or piece of wire through compression tap hole. Make a mark on the pencil or wire. Then measure carefully and place another mark $\frac{3}{16}$ in. above the first ($3\frac{1}{2}$ -h.p. engine) or $\frac{1}{4}$ in. above (Big 4). Rotate engine sprocket backwards until the top mark occupies the place previously held by the bottom mark, the piston having obviously descended $\frac{3}{16}$ in. (or $\frac{1}{4}$ in.), as the case may be, then set the contact breaker so that the points just commence to separate.

Note.—Accurate magneto timing is extremely important. Many riders imagine that by advancing their timing they will get more speed. This is a fallacy, and it only throws unfair loads on the engine, spoiling its flexibility, and eventually damaging it throughout.

Dismantling Engine O.H.C. Model C.S.1

We have already dealt with removal of cylinder head for decarbonizing. It will be recalled that for this operation the lower end of the vertical shaft was not entirely withdrawn. This should now be done. The crankcase panel cover should be detached by removing the twelve cheese-headed screws. Do not remove large screw in the centre of the panel cover or the oil lever adjuster. The lower vertical shaft bevel and self-aligning bearing are fitted in an aluminium housing; remove the two retaining pins which secure this to the crankcase. This is quite a separate unit. The bearing is secured in the housing by a suitable locking ring and should not be dismantled, except for renewal purposes, when it is advisable either to return this to the Works or to a firm of competent engineers.

The oil pump drive worm and worm wheel should then be removed.

On the main shaft the bevel pinion is keyed as also is the engine sprocket. Both are secured by a lock nut and should be removed. It is now possible to separate the crankcase by withdrawing the bolts. It is inadvisable to dismantle the flywheels. If a replacement big end bearing is necessary, it is advisable either to return the flywheels, together with the connecting rod, to the works, or to place the work in the hands of a competent repair works.

To re-set the valve timing revolve the fly-wheels until the mark A on the main shaft is pointing in a vertical direction with the marks B on the large bottom bevel which is fitted to the bottom of the vertical shaft positioned on each side of mark C. It is important that this setting is not disturbed in carrying out instructions which follow.

The mark C on the aluminium housing which carries the large bottom bevel, is now in line with the mark on the main shaft. Then take hold of rocker box and vertical shaft assembly, turn the vertical shaft until the mark D on the small bevel pinion fitted to the top of the vertical shaft is positioned between the two marks E on the large bevel pinion fitted to the cam shaft. With these wheels in this position insert bottom of vertical shaft into large bottom bevel and carefully note that the mark F on one of the splines at the bottom of the vertical shaft is meshed with mark G on the spline of the large bevel into which the vertical shaft fits. This is very clearly illustrated in the timing diagram.

Magneto Adjustment (C.A.V.) The magneto is remarkably reliable and should not cause any trouble. In case of failure repairs should be entrusted to a firm who specialise in this class of work or should be returned direct to the manufacturers.

ADJUSTMENT OF CONTACT BREAKER

The contact points only need adjustment at long intervals. To adjust, turn the engine slowly by hand until the points are seen to be fully opened, then slacken the locking nut and rotate the contact screw by its hexagon head until the gap between the contacts is set to the gauge on the magneto spanner. After adjustment tighten the locking nut.

HINTS FOR THE DETECTION AND REMEDY OF IGNITION FAULTS

Ascertain whether the plug or plug lead is at fault. If the high tension cable shows signs of deterioration, it should be renewed. If a spare plug is at hand, it may be substituted for the suspected one, or if it is merely the gap that is too large, it should be adjusted.

Should the engine refuse to fire, the following test should be made: Remove the sparking plug, lay it on its side on the cylinder and observe whether sparks occur at the points. If sparking does not take place, examine the contact breaker points to see that they are clean. Inspect the pickup and see that the carbon brush is making good contact with the slip ring.

TIMING

For Side Valve Models of 1923 and earlier manufacture.

Big 4.		3½ H.P.
Exhaust valve commences to open	$\frac{3}{4}$ "	$\frac{11}{16}$ " before bottom centre.
Exhaust Valve closes	$\frac{3}{2}$ "	$\frac{3}{16}$ " over top centre.
Inlet valve commences to open	$\frac{3}{2}$ "	$\frac{3}{16}$ " before top centre.
Inlet valve closes	$\frac{1}{2}$ "	$\frac{1}{16}$ " up compression stroke.

For Side Valve Engines, 1924 Models, where cams are marked 90, and 1925 Side Valve Models.

Big 4.		3½ H.P.
Exhaust valve commences to open	$\frac{7}{8}$ "	$\frac{7}{8}$ " before bottom centre.
Exhaust valve closes	$\frac{3}{2}$ "	$\frac{1}{16}$ " over top centre.
Inlet valve commences to open	$\frac{3}{2}$ "	$\frac{3}{16}$ " before top centre.
Inlet valve closes	$\frac{11}{16}$ "	$\frac{9}{16}$ " up compression stroke.

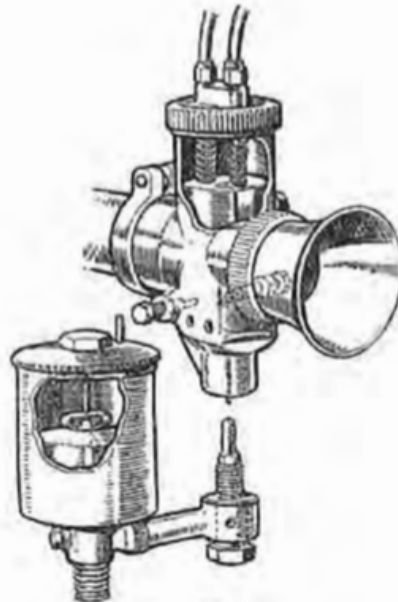
For 1926 and subsequent Models where cams are marked W7.

490 c.c. OHV and SV Models.		Big 4 and 588 c.c. OHV Models.
Exhaust valve commences to open	$\frac{8}{16}$ "	$\frac{7}{8}$ " before bottom centre.
Exhaust valve closes	$\frac{1}{4}$ "	$\frac{1}{16}$ " after top centre.
Inlet valve commences to open	$\frac{1}{4}$ "	$\frac{3}{16}$ " before top centre.
Inlet valve closes	$\frac{5}{16}$ "	$\frac{1}{2}$ " after bottom centre.

MAGNETO TIMING

With contact breaker fully advanced, points commence to open 490 O.H.V. $\frac{1}{2}$ in. 16 H. $\frac{3}{16}$ in., Big 4 $\frac{1}{4}$ in., 588 O.H.V. $\frac{3}{8}$ in. before top dead centre on compression stroke.

Carburettors (B. & B.) To get an easy start from cold:—Slightly flood float chamber, close air and throttle levers, retard ignition about half way, and kick engine over once or twice, then open throttle lever about $\frac{1}{4}$ in. and engine generally starts first kick. When engine is warm it is not necessary to flood.



Any slackness in the control wires should be taken up by unscrewing the adjusting bushes on spraying chamber cap, the throttle slide being set so that it just closes off, or, if preferred, it can be set slightly open so that engine ticks over idly with throttle lever closed right off.

If the engine has a tendency to stop when running slowly, it is generally an indication of a weak mixture, and the knurled air adjusting screw of pilot jet should be screwed in (clockwise) about a quarter turn, and the locknut tightened up again. If the engine does not fire regularly and black smoke comes from the exhaust, a rich mixture is indicated, and the knurled screw of pilot jet should be unscrewed (anti-clock) until the engine fires regularly.

It should be borne in mind that if there is an air leak in the induction system the engine can only function on the pilot jet with the throttle fully closed, and the leak, if of any magnitude, makes slow running impossible.

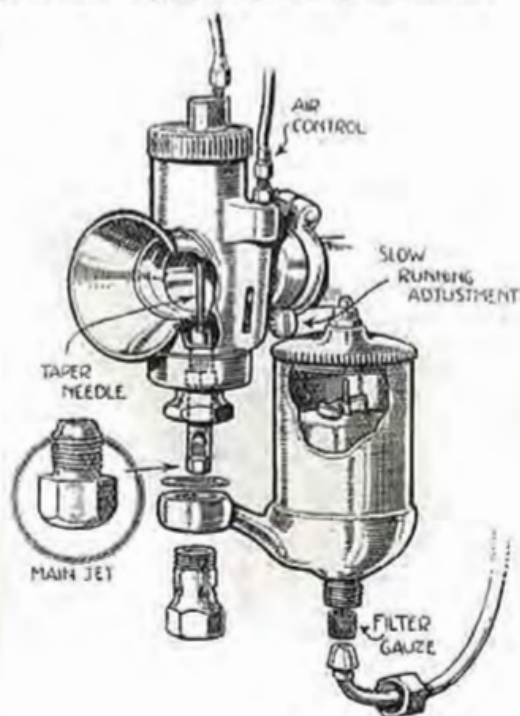
Any sign of weakness of opening up to approximately three-quarters throttle can be corrected by raising needle $1/16$ in. or $1/8$ in., and any richness by lowering taper needle a similar amount.

The main jet should be of such a size that it enables full air to be taken with full throttle when all-out on the level.

All pilot adjustments should be made with engine running and air lever on handle bar fully open.

A 190 jet is fitted as standard specification to this carburetter.

Particular attention should be paid to the adjustment of the taper needle; this should protrude $1\frac{1}{8}$ in. measured from the base of the slides. A 180 jet is fitted for Big 4 Models, and the taper needle should protrude $1\frac{1}{2}$ in. from base of slides.



Amac

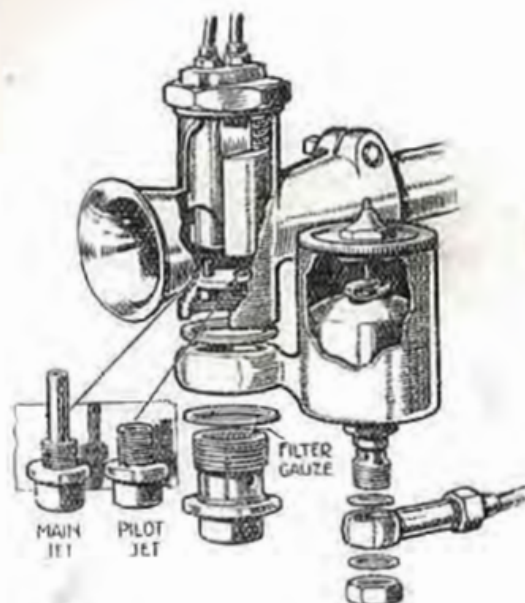
The quality of the mixture issuing from the Pilot Jet Outlet is controlled by means of the knurled cap on the Mixing Chamber side which regulates the amount of air admitted to the Pilot Jet.

To weaken the mixture turn the knurled cap anti-clockwise, and clockwise to enrich. This adjustment must be made gradually.

The approximate setting will be found between one half and one complete turn open, depending on the capacity of the engine.

Main Jet

This is of the submerged type, the petrol being broken up by means of a sprayer situated just above the petrol level. No. 37 main jet is fitted as standard specification.

**Binks****(C.S.1 & E.S.2)
Models**

This is a two jet type of carburettor; these consist of the PILOT JET, which works alone on first starting the engine, and gives easy starting and slow running; when the throttle is opened the MAIN JET, which is the longer of the two, comes into operation. The air lever operates a plunger situated over the main jet, and should be set to modify the mixture when the engine is cold.

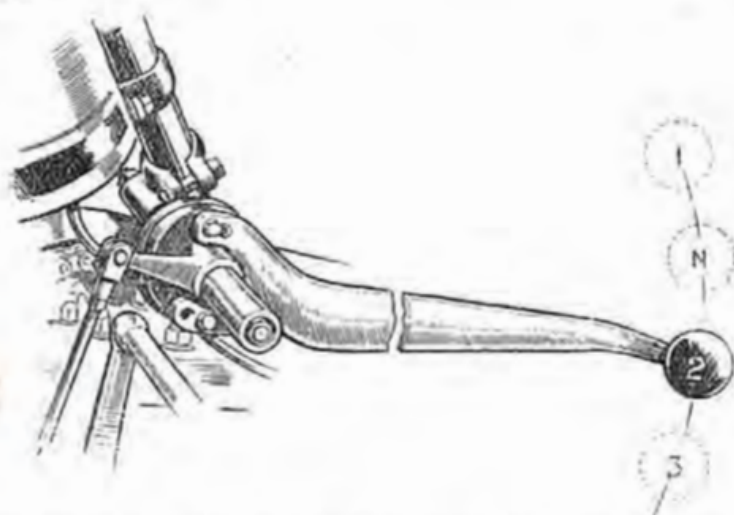
To tune the Binks two-jet carburettor, the engine MUST BE WARM, when it is easily tuned by the fitting of suitable jets. To remove the jets loosen the screw clamping the float chamber to the carburettor body; the jets may then be removed with the key provided, but care should be taken when re-fitting that they are screwed in firmly, but FINGER TIGHT.

STURMEY-ARCHER (NORTON TYPE)—C.S. Gearbox

Previous to 1926 the C.S. type was standardized; in 1926 this was replaced by the L.S. box. Later a different type of gearbox was employed, specially made for Norton Machines.

C.S. Gearbox previous to 1926

The clutch consists of a main body keyed to the gearbox axle, and eight other plates, 4 of which are coupled to the main body by spring boxes and studs.



GEARBOX CONTROL QUADRANT POSITIONS (L.S. TYPE CLUTCH).
Fitted to all late models, GS1 and ES2 Models.
1.—Low. N.—Neutral. 2nd.—Middle. 3rd.—Top.

Clutch

The clutch sprocket and the three plates are tongued; these are coupled to one another by tongues and grooves on the outer diameters.

The friction driving surfaces consist of plugs inserted in plates.

The whole clutch may be readily dismantled by removing spring box screws.

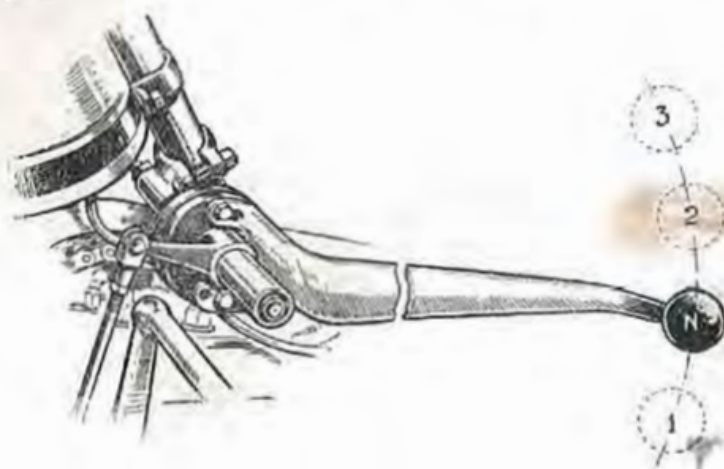
Adjust the Clutch

The wire stop screw should be adjusted until there is about $\frac{3}{16}$ in. to $\frac{1}{4}$ in. of idle movement in the clutch worm lever. It may be necessary to loosen the clutch worm lever from the worm to find a more convenient operating position. The only parts of the clutch liable to wear are the friction plates, which are easily replaced. The clutch should be adjusted immediately any sign of slipping is felt. Should oil get on the clutch, as may occur when newly assembled, this will cause slipping; to overcome, inject petrol. A sure sign of slipping is given by the clutch becoming very warm whilst driving.

When fitting up the control wire for the clutch, ease off the bends as much as possible to ensure long life and easy movement of the inner wire.

The Kick Starter The kick starter consists of a crank lever fastened by a taper cotter to a short shaft, which is machined out to receive a free wheel pawl. This communicates movement to a large gear wheel in mesh with a small pinion, mounted on a squared portion of the main axle. When the return spring brings the crank back to its normal vertical position, a projection on the free wheel pawl comes into engagement with a fixed cam mounted in the gearbox cover, and positively depresses the pawl out of action.

Gear Adjustment It is important to see that the gear control is kept properly adjusted, and this should be tested occasionally to see that it is correct. Before proceeding to adjust the control see that the nut of the rocking shaft behind the box is tight.



GEARBOX CONTROL QUADRANT POSITIONS. (O.S. TYPE CLUTCH.)
1.—Low. N.—Neutral. 2nd.—Middle. 3rd.—Top.

The adjustment of the gear is effected by removing the pin from the top connection on the end of the control rod, and giving the connection half a turn on the thread up or down to lengthen or shorten the control rod as required. When the gear is properly adjusted the control lever should move an equal amount either side of the neutral notch without engaging either the middle or low gears.

Lubrication Use Speedwell "Crimsangere Light," specially prepared for Sturmey Archer Gearboxes, supplied in 1 lb. tubes.

Do not lubricate the clutch, as this is designed to run dry.

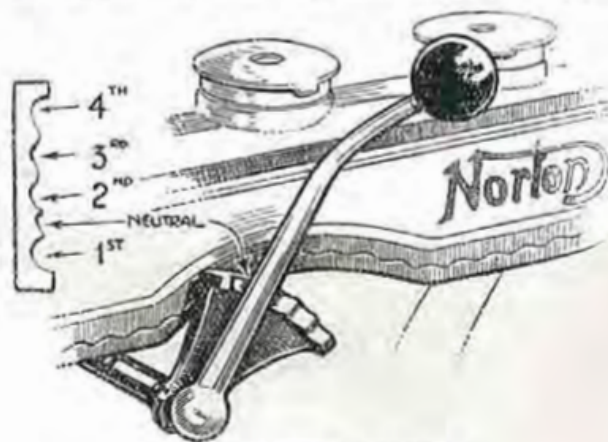
L.S. Type 3 Plate Clutch This clutch consists of a main body which fits on to the splined main shaft, and is secured by a nut. Should it be found necessary for any purpose to dismantle

the clutch, the end cap which takes the thrust of the push rod button should be removed by placing a tommy bar in slots provided, and tapping same sharply with a hammer. The clutch rod button may now be withdrawn. The shaft nut should then be removed, together with the spring cup washer. The clutch plates should be removed separately, also the sprocket and roller race.

When re-assembling particular care should be taken to replace the plates in the same order as they were removed. The back plate, which is a plain metal plate, the tongues on which are shallower than any other plate, should be replaced first, followed by the roller race and clutch sprocket. When fitting the former note that the roller retaining ring should be nearest the rear chain sprocket; if this is not replaced correctly it will not revolve freely or give a true bearing for the clutch sprocket.

Then fit the dished metal plate, followed by friction plate (i.e., fitted with inserts) a plain steel plate, and a further friction plate, and finally, the outer plate, with the projection which registers in the hole in the spring cup. The spring cup should then be placed in position, together with mainshaft washers. The spring, spring collar and retaining nut should then be fitted. The latter should be locked tight when the thrust button is in position, fix end cap and the clutch is complete.

Latest Type C.S. Gearbox The instructions for dismantling the early type C.S. box previously given are applicable to this type of box, and the instructions previously given in regard to the L.S. clutch are applicable to this type of clutch.



NORTON 4-SPEED GEARBOX.
1st.—Low gear. 4th.—Top gear.

CHAIN ADJUSTMENT

The chains should be periodically examined and adjusted. If enclosed in chain cases these can be examined through the inspection covers. Revolve rear wheel slowly with top gear in engagement, until the tightest place is ascertained in the front driving

chain. The adjustment should be such that there is about $\frac{1}{4}$ in. up and down movement possible. The rear chain should be tested in the same way. To adjust front chain loosen the four nuts holding gearbox to bracket. On the Big 4 and 17C Models a bolt is provided for drawing gearbox backwards. This should be turned until the chain is correctly adjusted, and the four nuts tightened up; the action of tightening these nuts may alter the adjustment of the chain. Should this be the case, adjust until correct.

On 1926 and subsequent 16H and O.H.V. models slacken the four nuts of the gearbox studs and adjust by turning the hexagon of the bolt mounted on the gear bracket. To slacken the chain turn in an anti-clockwise direction.

The rear chain is adjusted by loosening the rear wheel spindle nuts slightly, and turning nuts on adjuster bolts fitted to wheel spindle. Take care to give these each the same number of turns or the wheel will be thrown out of track. Then tighten up spindle nuts. Where an internal expanding brake hub is fitted, it is also necessary to loosen the nut attaching the brake anchor plate to lug of chain stay.

Chain Lubrication

Remove chains and soak in paraffin for a few hours. This will remove all dirt. Hang them up to let them drain thoroughly until dry. Then melt sufficient tallow to which has been added a couple of handfuls of flake graphite, in a tin, in which the chains should be placed, so that the mixture just covers them; allow the tallow to cool off and set, then remove chains and wipe off surplus lubricant. Speedwell "Crimsangere" also is suitable and much more convenient for chain lubrication. Rusty and stiff chains, besides being noisy, absorb an astonishing amount of power.

Front Chain Adjustment Models C.S.1 and E.S.2

The gearbox is housed in the frame and secured by two bolts, at the head and base. To adjust the front driving chain the nuts of both bolts should be slackened off. The design is such that the gearbox is pivoted on the lower bolt. An adjuster bolt is coupled to the top anchor lug of the gearbox at the rear. This should be turned clockwise if it is desired to slacken the tension of the front chain or anti-clockwise to tighten.

Having obtained the correct tension on the chain, the nuts of the two securing bolts should be tightened up. This method of mounting the gearbox provides instant and fine adjustment.

HEAD ADJUSTMENT

This should be such that it allows perfect freedom without up and down play. To test this stand astride the machine and grip bars. Lift the bars to ascertain if any movement is visible. Loosen nut on ball head clip, then tighten the large column nut.

REAR BRAKE ADJUSTMENT

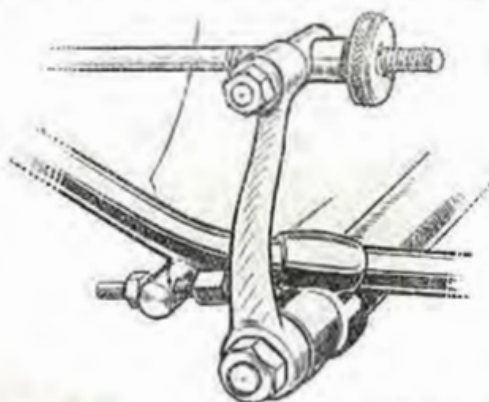
For Belt Drum Type Brake

This can be done at two points. The stud on which brake pad pivots slides in the brake anchor lug. To adjust the bottom end of brake block, loosen the locknut at the wheel end of brake rod, and by means of a hexagon spanner provided in the tool kit the brake rod may be turned until the correct adjustment is secured, the rod being screwed with left and right-hand threads.

For Internal Expanding Type Hub

Adjustment of the brake is made by loosening the locknut on the wheel end of the brake rod, when the brake rod may be turned until the correct adjustment is found, the rod being screwed with right and left-hand threads. It is important to see that the locknut is again tightened after adjustment of the rod.

REAR BRAKE ADJUSTMENT OF C.S.1 AND E.S.2 MODELS

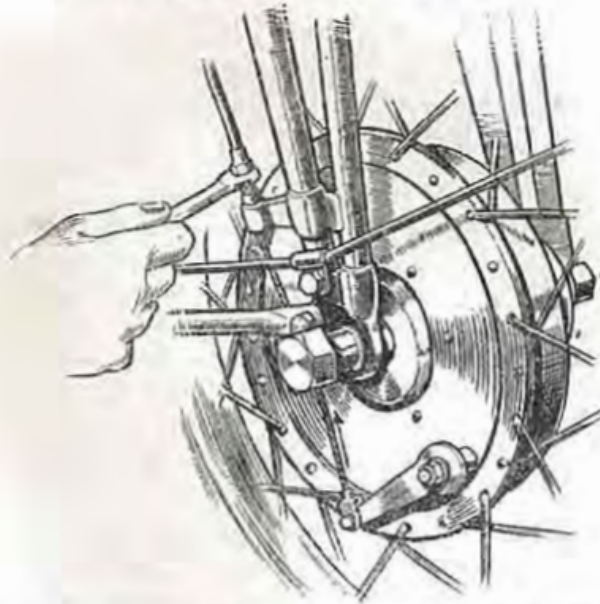


Turn milled nut in a clockwise direction to take up wear. To alter position of brake pedal pad, slack off milled nut and adjust stop to give required position of the pedal.

In addition to provision for taking up normal wear, an independent adjustment is provided for altering the angle of the brake pedal pad so that in all positions of the adjustable footrests the brake can be conveniently operated without removing the foot from the rests.

The milled nut at the gearbox end of the brake should be turned in a clockwise direction to take up wear. To alter the angle of the pad proceed as follows: Slack off the milled nut, loosen the brake pedal stop locknut, and adjust the stop to give the required position of the pedal, tighten the locknut, and then the milled nut until the brake is correctly adjusted.

FRONT WHEEL



To adjust, loosen lock nut with spanner provided in tool kit, remove slack from cable by means of adjuster, and re-tighten lock nut. To remove wheel, loosen spindle nuts after detaching cable "U" clip cotter and pin, ease slotted plate of brake anchor from stud brazed to fork. Lubricate cam pin every 500 miles.

Hub Adjustment Should the ball path or indentations be shown on the periphery of the cone, this is an indication that the bearings are too tightly adjusted.

The life of hub bearings can be considerably lengthened by care being paid to adjustment.

Three types of front hubs have been fitted; one has an ordinary adjustment by means of a flat on one of the cones; another type of hub has a knock-out spindle; both are plain type. In the case of the hub with the knock-out spindle the cones are screwed on to a hollow sleeve through which the spindle passes when one of the spindle nuts has been removed, this can be withdrawn and the wheel taken out. Only one cone of either type of hub is adjustable; the other fixed cone should always be locked up tight whether on spindle or hollow sleeve. The adjustable cone on all front wheels should be on the near or driving side of the machine.

FRONT INTERNAL EXPANDING BRAKE HUB

The cones of this hub require the same attention as the plain pattern. The brake drum and hub shell should never be detached;

when these leave our Works, same are trued up, and should it be found necessary at all to separate same this should be returned.

The linings of the brake are readily renewed, and can be supplied together with rivets for re-fitting. The method of detaching the brake lining is as follows: Loosen the two spindle nuts after having removed the cotter and pin by which the "U" clip is attached to the operating cam lever, ease the brake anchor plate, a slot in which engages a stud brazed to the forks; the wheel can then be detached. Remove off-side spindle nut and distance piece, when the plate and brake shoes complete may be removed. To remove the shoes turn the operating lever until the cam opens them to the fullest possible extent, and with a screw-driver or chisel under the centre of one shoe, i.e., between the brake plate itself and the shoe, ease the latter away from the plate until at right angles to it; shoes and springs can then be detached from both cam and pivot pin. The springs can then be detached, old linings removed and new ones fitted.

Adjustment of the operating mechanism of the brake is provided on the Bowden wire adjuster, which is fitted in a lug brazed to the forks. It is important to see that the linings before re-assembling are thoroughly clean, and unless new linings have been fitted it is always advisable to "rough up" with a file or rasp.

REAR WHEEL: RIM BRAKE TYPE

To adjust bearings, follow instructions given as in the case of the front wheel. Should new cups be required, return wheel, labelled and less tyre, a special tool being required for removing the old cups.

The cone is provided with serrations and locked in position with the chain adjuster which is also serrated.

Rear Internal Expanding Brake Hub

Three spindle nuts are provided—an outside nut on the brake drum side, an inside nut on the same side, and an outside nut on the transmission side. The nuts should be slackened in the order as mentioned, and it will be found that the spindle can then be turned by means of the squared end. To tighten the bearing, turn the spindle in an anti-clockwise direction, and to slacken in a clockwise direction. After adjustment it is important that the nuts are tightened in the reverse order from that mentioned previously. When tightening or slackening the outside nut on the transmission side of the machine it is necessary to hold the spindle by the squared end, to prevent this turning.

FORKS

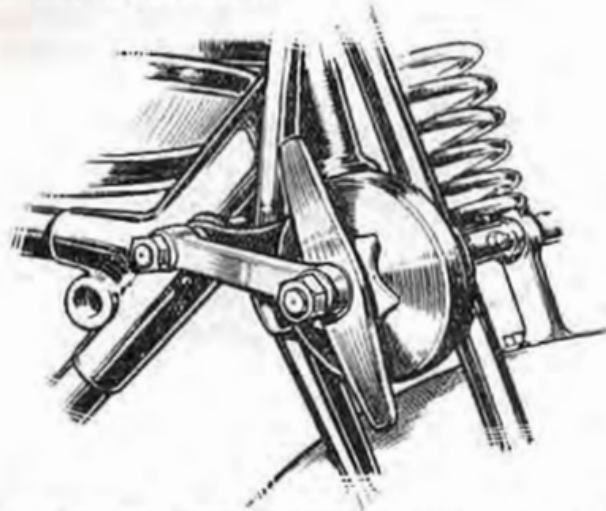
Norton-Webb Pattern

The forks are lubricated by means of grease nipples or oilers. Particular attention should be paid to lubrication. "Crimsangere" should be used with grease gun. Adjustment of the links is provided by the spindles, and any side-play which may develop may be taken up by slackening off all spindle nuts. The spindles should then be turned by means of the squared end provided, either clockwise or anti-clockwise as necessary.

Before an attempt is made to adjust the links, the shock absorbers should be completely slackened off. When the adjustment is complete up and down pressure should be applied to the handlebars to ascertain that the link faces are not binding.

Shock Absorbers

Adjustable shock absorbers are incorporated, which are entirely self-contained, and suspended from the link mechanism; the adjustment is entirely separate from the link adjustment.



BEFORE ADJUSTING SHOCK ABSORBERS, ascertain that fork links are correctly adjusted, i.e., end play between inner faces of fork links and girder member. Spring star washers hold the friction plates against discs, adjustment being obtained by varying the tension of the star washers, effected by tightening or slackening the hand adjusters.

It is advisable, before adjusting the shock absorbers, to ascertain that the links are correctly adjusted, so that practically all end play is taken up between the fork link faces and the girder cross members.

Adjustment

Spring star washers hold the friction or carrier plates against the friction discs, and adjustment is obtained by varying the tension of the star washers, this being effected by slackening or tightening the nuts which are fitted between the fork links and the star washers.

On later models these nuts are replaced by hand adjusters.

Steering Damper A steering damper is incorporated in Norton Webb Forks fitted to 1928 Models. Very little attention to this part is necessary; the friction plate consists of a metal ring to which friction inserts are fitted. The damper is very efficient and easily operated.

Norton-Druid Forks In order to take up any side play which may have developed with the H.W. pattern fork (oval section tubes), hardened steel washers should be inserted between the link and the face of the spindle housing.

In the case of the H.R.T. type of fork (round section tubes) which has been standardized on later models, adjustment is provided in the fork spindles. In order to take up any play the spindle nuts should be slackened off and the spindle turned by means of the hexagon head. When the adjustment is completed up and down pressure should be applied on the handlebars to ascertain that the links are not binding.

Steering Damper The later pattern H.R.T. fork has a steering damper incorporated; this is extremely efficient, and easy to operate, the adjusting wheel need only be turned approximately $\frac{1}{2}$ in. (in a clock-wise direction) to bring the damper into operation.

Shock Absorbers (where fitted) To adjust, slacken the locknut on the bottom front spindle and the locknut on the bottom rear spindle; if for higher speeds tighten by turning the front and rear spindles in a clock-wise direction by means of the hexagon heads, for normal speeds turn spindles in an anti-clockwise direction. BOTH spindles must be turned the same amount, then tighten up the lock nuts.

THE SIDECAR

The "Norton" sidecar is of particularly sturdy design, and when fitted to the machine is extremely rigid, unlike so many sidecars it is not prone to mal-alignment, once correctly fitted no further adjustment is necessary. Should, however, the sidecar be removed for any purpose, proceed to refit as follows: Place the sidecar in position, leaving all attachment nuts slack. The sidecar wheel should not run parallel with the machine wheels or there would be a tendency for the machine to constantly pull to the left. The sidecar wheel should run in toward the machine $\frac{3}{4}$ in.

Alignment is regulated by the clip lug at the bottom of the centre sidecar arm, which can be moved along the centre tube of the chassis to which it is attached, and the clip lug of the rear arm which slides along the rear tube of the chassis. To align correctly, two straight edges 6ft. long are necessary, which should be placed on the floor, one against the wheel rims of the machine,

the other against the wheel rim of the sidecar. Now measure the distance between the edges immediately in front of the front wheel and at the rear of the rear wheel, the distance between the edges should be $\frac{3}{4}$ in. less at the front than at the rear.

Lubricate sidecar wheel bearings and check adjustment as necessary.

If after reading the foregoing, every Norton owner feels capable of retaining the tune of his machine, our object will have been achieved. The notes are intended to be equally interesting to the novice and the "man who does his own repairs," and should the latter consider the detailed descriptions somewhat tedious we would ask him to bear in mind the dual purpose of the notes.

