Maintenance Manual and Instruction Book

FOR

THE UNAPPROACHABLE

Norton

REGD. TRADE MARK

MOTOR CYCLE

Models No. 19, ES2 and 50

NORTON MOTORS LIMITED
BRACEBRIDGE STREET, BIRMINGHAM, 6
ENGLAND

Maintenance Manual and Instruction Book

FOR

THE UNAPPROACHABLE

Norton
REGD. TRADE MARK

MOTOR CYCLE

Models No. 19, ES2 and 50

NORTON MOTORS LIMITED

BRACEBRIDGE STREET, BIRMINGHAM, 6, ENGLAND

Telephone:
ASTon Cross 3711 (P.B.X.)

Telegrams:
"Nortomo, Birmingham."

INDEX

DATA

	19S	ES2	50
Cubic Capacity	596 cc.	490 cc.	348 cc.
Bore	82 mm.	79 mm.	71 mm.
Stroke	113 mm.	100 mm.	88 mm.
Compression Ratio ...	6.4	7.1	7·3
Sparking Plug	KLG FE80 Three Point		
	Lodge 2HLN	Champion NA8	
Ignition Timing			
Before T.D.C. fully advanced	11/16"	5/8"	11/16"
Magneto points gap ...	.012"	.012"	.012"
Plug points gap	.022"	.022"	.022"
Valve Timing			
Inlet opens before top	11/32"	5/16"	11/32"
Exhaust closes after top	11/32"	5/16"	11/32"
Tappet Clearance cold			
Inlet	PUSH RODS FREE TO ROTATE WITHOUT		
Exhaust	UP AND DOWN MOVEMENT		
Amal Carburetter			
Type—Monobloc ...	376/17	376/17	376/19
Main Jet	270	270	210
Throttle Valve	376/4	376/4	376/3½
Needle position	3	3	2
Pilot Jet	30	30	30
Engine Sprocket			
Solo	21	20	18
Sidecar	18		
Gear Ratios			
Solo	4.52, 5.47	4.75, 5.75	5.28, 6.38
	8, 13.4	8.4, 14.2	9.34, 15.67
Sidecar	5.28, 6.38		
	9.34, 15.67		
Petrol Tank Capacity ...		3¼ galls. approx.	
Oil Tank Capacity ...		4 pints approx.	
Tyre size—front ...		3.25 × 19	
Tyre size—rear ...		3.25 × 19	
Tyre pressure—rear ...	25	23	23
Tyre pressure—front ...	22 s/car	20	20

INTRODUCTION

In preparing these instructions the elementary details and preliminary information that may be necessary to the absolute novice have been omitted, on the assumption that the majority of NORTON owners are already acquainted with the elementary details of starting, driving and maintenance. In connection with the latter we would stress the advisability of cultivating the habit of routine cleaning, lubrication, examination and adjustment of your machine. By this means many minor annoyances will be avoided and major breakdowns averted, and you will acquire the pride of ownership which marks the true enthusiast.

Below is a plan view of the machine with all controls clearly indicated. A short study of this will familiarize you with the position and function of each control. Without wishing to become elementary a description of the best method of ensuring an easy start may not be inappropriate. With the petrol turned on, the air lever partly closed and the ignition lever in about its middle position, slightly flood the carburetter until petrol seeps (not drips) from the bottom of the carburetter mixing chamber and very slightly open the throttle. Depress the kickstarter until the resistance of compression is felt, raise the exhaust valve lifter and depress the kickstarter a further two or three inches. Release the exhaust valve lifter and allow the kickstarter to return to its normal position. Give a long swinging kick on the starter, carrying it as far round as possible. With the controls correctly set the engine should now start up.

When taking over a new machine it is only necessary to add petrol and oil to the respective tanks before use; the lubrication points having received the necessary greasing at the Works. It is advisable, however, to see that the steering damper is slackened off and adjusted to your particular requirements.

New machines should not be driven at more than 35 miles per hour for the first 500 miles in top gear or a corresponding slower speed in the lower gears. Avoid "over-revving" and slogging or labouring of the engine. It is advisable during the running in period not to open the throttle more than ¼ to ⅓. The use of running-in compound during the initial stages

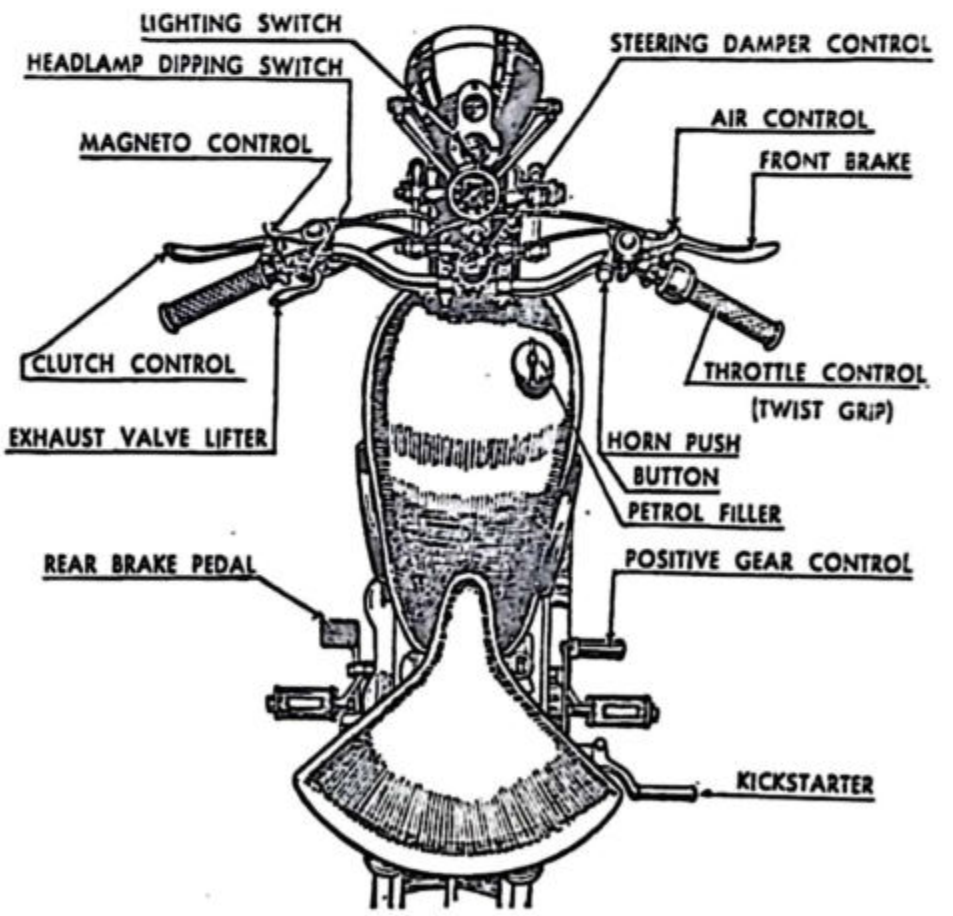


Fig 1. Plan of machine showing controls.

of the engine's life is strongly recommended. The compound, several brands of which are available may be obtained from all NORTON agents, contains "colloidal graphite," which forms a graphoid surface on all working surfaces of the engine and greatly assists in preserving their high quality finish. The compound should be mixed with the lubricating oil in the proportion of one pint to each gallon during the running-in, but if its use is continued after this period only half the quantity should be used.

Under all usual circumstances when the machine is travelling at 25 miles per hour or over the air lever should be fully open and the ignition fully advanced, and only during starting or when the engine shows a tendency to pink should the ignition be retarded. Remember that these are high efficiency engines which give of their best when running at relatively high revolutions, and do not be afraid to change into a lower gear at the first signs of labouring. We would stress that the highest possible use should be made of the gearbox, which is quite capable of withstanding all the loads likely to be imposed on it by normal usage.

At the end of this book will be found a trouble tracing chart, reference to which will greatly facilitate the locating and rectifying of any but the most unusual troubles which may be likely to cause an involuntary stop.

CLEANING

Before attempting to polish the enamel on any part of the machine, all traces of grit adhering to the various components should be washed off, preferably with a reasonably high pressure hose. Polish the enamel periodically with a good quality wax polish. Note that chromium plating is not impervious to rust and should be wiped down when possible, after being in the rain. Wash off any road grit and clean with one of the chromium polishes available from any garage. Do NOT use ordinary metal polish.

LUBRICATION

At the Works, Wakefield Castrol Oils have been used for many year's exclusively with highly successful results; the correct grades for the models dealt with in this book being:—

WAKEFIELD CASTROL XXL, for Summer use.
WAKEFIELD CASTROL XL, for Winter use.

Other very suitable oils for NORTON machines are:—

SHELL X-100-40 or B.P. ENERGOL S.A.E. 40 for Summer use.
SHELL X-100-30 or B.P. ENERGOL S.A.E. 30 for Winter use.
MOBILOIL "BB" for Summer use.
MOBILOIL "A" for Winter use.

These oils should be used in the engine and gearbox.

For oilbath chaincase use Wakefield's "Castrolite." Shell X-100-20, Price's Energol S.A.E. 20, or Mobiloil Arctic.

All bearings not automatically lubricated are fitted with nipples for grease gun lubrication, and a good quality grease, such as Wakefield Castrolease Heavy, B.P. Energrease C3, Shell Retinax or Mobiloil Hub Grease should be used at these points.

Below is a lubrication chart indicating the approximate periods at which the various lubrication points should receive attention. If the chart is adhered to, excessive wear will not occur at any of the moving parts, the life of the machine will be prolonged and its performance considerably enhanced.

NOTE.—On a new machine, drain and flush out oil tank after 500 miles. Remove crankcase drain plug and allow to drain. Remove level indicator plug from oilbath chaincase and fill to this level.

LUBRICATION CHART

Period.	*Location*	*Lubricant.*	*Period.*	*Location*	*Lubricant.*
Every 200 miles.	Oil tank, top up... ...	Oil.	Every 2,000 miles.	Brake pedal	Grease.
Every 1,000 miles.				Brake shoe cams ... (sparingly)	Grease.
				Brake rod jaw joints ...	Oil.
	Control cables	Oil.		Speedometer driving box	Grease.
	Control levers	Oil.		Drain and refill oil tank	Oil.
	Brake cable "U" clip ...	Oil.		Steering head races ...	Grease.
	Rear chain	Grease.	Every 5,000 miles.	Gearbox, drain and refill	Oil.
	Gearbox, top up... ...	Oil.			
	Oil bath, top up... ...	Oil.		Commutator end bracket	Oil.
				Telescopic forks	See para. 70
			Every 10,000 miles.	Oil bath, drain and refill	Oil.

THE ENGINE

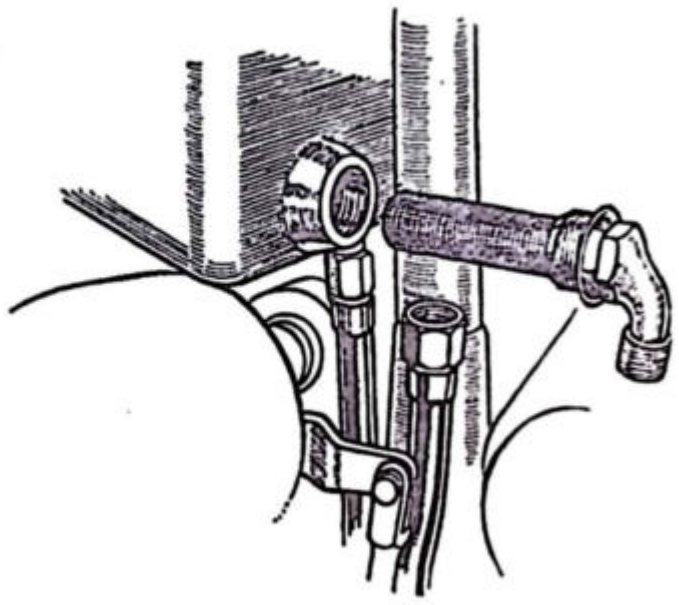
1. ENGINE, LUBRICATION SYSTEM.

This is of the dry sump type. The oil flows from the oil tank to the pump by gravity, assisted by suction from the feed side of the oil pump, through the gears, and is forced under pressure to various parts of the engine, drains to the lowest part of the crankcase—that is the sludge trap—and by suction from the return side of the pump is lifted back to the oil tank.

2. THE FILTER

The only filter in the oil system is of the gauze type and is fitted to the feed side of the oil circuit, attached to the adaptor screwed into the oil tank, to which the feed pipe is connected.

Clean filter, when oil tank is drained, every 2,000 miles.



Oil Tank Filter (Fig. 2).

3. ENGINE OIL PUMP.

This is of the gear type. The pump contains two pairs of gears, one on the feed side and the other on the return side.

The gears on the return side are twice the width of those on the feed, having twice the pumping capacity. This ensures that the crankcase is free from oil when the engine is running.

To check the return of the oil to the tank, remove the oil filler cap. The oil return pipe can then be seen. After the engine has been running for a few minutes, the oil return flow will be spasmodic, due to the greater capacity of the return gears.

4. OIL LEVEL.

The oil level in the oil tank should not be above three-quarters and not below half.

If the level is above the three-quarter mark when the engine is running, the pressure built up in the oil tank by the oil return side of the pump will force the surplus oil through the air release pipe on to the road.

Always run engine for a few minutes before checking oil level. It is possible when an engine has been idle for any length of time for the oil to syphon through the return gears to the sump.

When this happens, all the oil is returned to the tank in the first few minutes that the engine is running.

When the oil level is below the half full mark there is such a small quantity of oil that it tends to over-heat.

5. THE CIRCULATION OF THE OIL.

The oil is forced from the pump,

1. To the rear wall of the cylinder.
2. To the big-end bearing.
3. To the pressure control valve.

1. The oil passes through the timing panel to the mouth of the crankcase, through the base of the cylinder, up the cylinder wall and feeds the rear of the cylinder and piston.

2. The oil passes down the timing panel through the big end restriction jet, along the timing shaft, up the flywheel and is sprayed on to the roller big-end.

3. The oil pressure control valve is a spring-loaded ball, and acts as a safety valve, in the oil circuit. When the pressure of the oil lifts the ball from its seat, the oil passes the ball and is sprayed upon the timing gears. When the engine is assembled at the Works, the valve ball spring adjusting screw is screwed home and released 1½ threads. This is the only adjustment in the oiling system and it is not advisable to remove the ball from the valve unless it is suspected that the ball is sticking or not seating.

From the cylinder the oil drains down the sides of the crankcase and is picked up by ducts and carried to the main bearings and the timing gear bearings.

The oil collects in the timing case to such a level that the oil pump pinion is immersed,

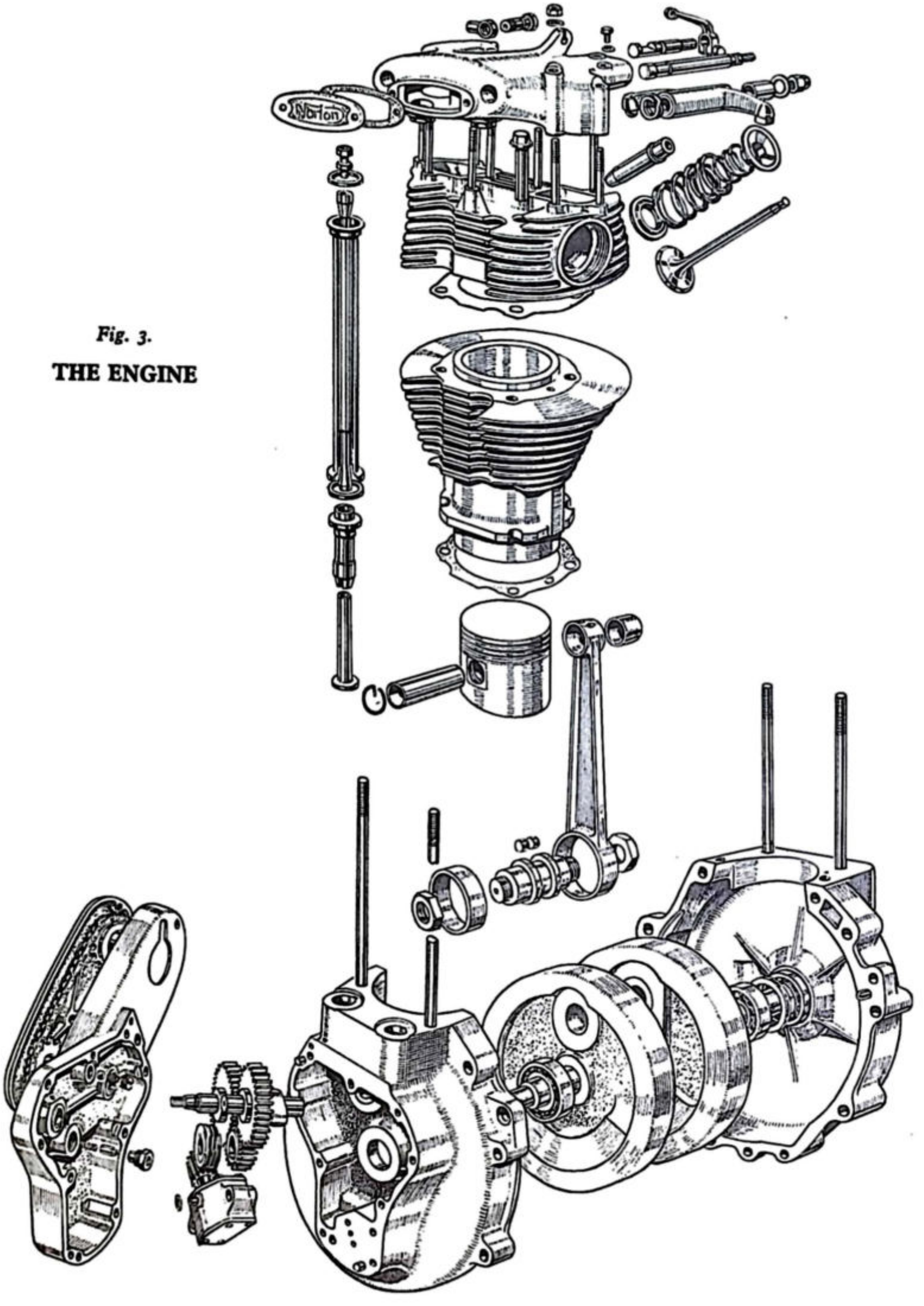


Fig. 3.

THE ENGINE

carrying oil to the half-time pinion and the timing gears.

A further timed breather is incorporated in the driving side mainshaft and releases pressure through a small hole in the underside of the mainshaft bearing boss.

A lead is taken from the oil return pipe to a banjo fitting on the rocker box, feeding oil to the rocker shafts and ball ends. Surplus oil returns down the pushrod cover tubes to the crankcase. Excess oil from the O.H.V. valve spring chambers drains back through drilled holes in the cylinder head and barrel.

Oil is fed to the magdyno chain by passing through the inlet cam spindle bush into the chain case. Any excess of oil accumulated in the case, drains through the breather pipe.

Crankcase pressure is released by a valve on the driving side of the crankcase and oil mist is fed to the rear chain.

All the oil drains to the base of the crankcase to the sludge-trap, is picked up by the suction of the return side of the pump and returned to the tank.

The oil-way from the sludge-trap is situated so that any foreign matter is left in the trap. This leaves the case when the crankcase drain plug is removed and the oil drained.

MAINTENANCE OF ENGINE

DECARBONISING

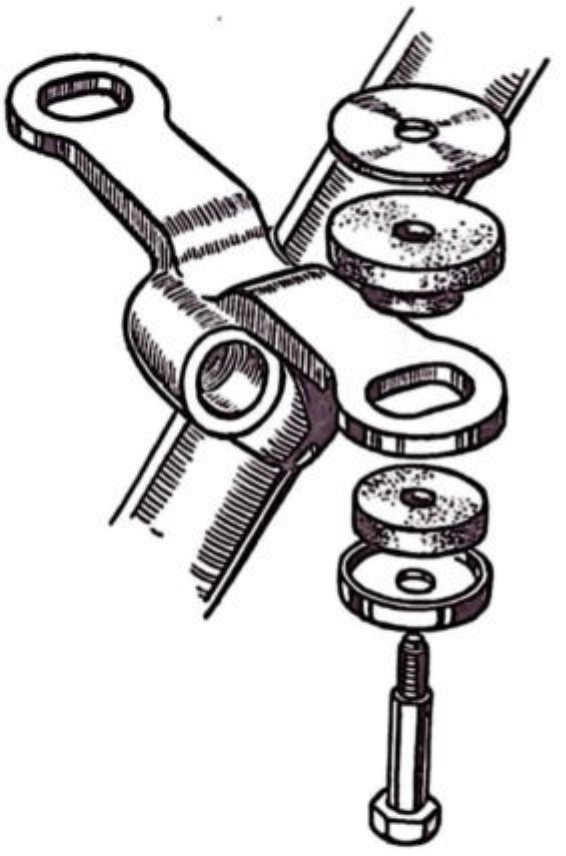
6. REMOVAL OF PETROL TANK.

It is not necessary to drain tank, but make sure that the petrol tap levers are in the " Off " position, that is, with the round end of the lever pressed in.

Disconnect petrol pipes from taps. Use two spanners, holding the union nut with one, and the tap union with the other.

Remove the four bolts and washers, and the tank is free from the frame.

Four shouldered rubber washers and steel washers should be on the tank brackets.



The order in which the washers for the tank mounting should be placed. (Fig. 4)

7. FITTING OF TANK.

Place the four shouldered rubber washers on the frame tank brackets, with the steel washers above.

Place tank in position and fit cupped steel and rubber washers on to the tank bolts. (Fig. 4).

Fit bolts to tank and tighten down evenly.

Ensure that the tank is clear of the frame.

Fit petrol pipes, using the two spanners as when removing.

8. REMOVAL OF CARBON.

Scrape carbon from top of piston and cylinder head.

Both are of the alloy type and care must be taken not to damage them.

Place an old piston ring at the top of the bore, and resting on top of the piston. It will prevent the carbon being removed at the edge of the piston and end of the bore.

After an engine has been used for any considerable time, wear in the bore and the rings takes place, allowing a small amount of oil to pass.

The carbon on the piston edge and the top of the bore acts as an oil seal and if removed, engine may use a little more oil until carbon is re-formed.

The carbon deposit in the valve ports and valve spring compartment cannot be removed unless the valves are removed.

Valves need NOT be removed at every de-carbonisation.

9. REMOVAL OF ROCKER BOX, CYLINDER HEAD AND CYLINDER BARREL.

It is not possible to remove the rocker box only whilst the engine is in the frame but the cylinder head and box must be removed as a unit.

Remove carburetter attached to induction stub by two bolts. Remove exhaust pipe or complete exhaust system in one piece. Disconnect oil feed pipe and exhaust valve lifter cable from rocker box. Check that both valves are seated and remove sparking plug.

Unscrew the four cylinder head nuts, lift the head clear of the barrel spigot and obtain assistance to hold the push rods and cover tubes whilst withdrawing the head from the other side.

Make sure that the rubber and composition washers from the ends of the push rod cover tubes are not lost and remember to keep the inlet and exhaust push rods separate for re-fitment.

Remove the nine nuts holding the rocker box to the cylinder head and withdraw the box from the studs. This will enable the head nuts to be withdrawn.

Revolve engine till piston is at the bottom of stroke and remove cylinder barrel (this need not be done at every decarbonisation as piston top can be cleaned with barrel in position.

Cover crankcase mouth with rag to prevent ingress of dirt or foreign matter.

10. REMOVAL OF VALVES FROM CYLINDER HEAD.

Compress valve springs with a suitable type of valve compressor.

When springs are compressed the valve cotters will fall from the valve stems.

Remove valve compressor.

Remove valves.

Remove valve springs and collars from valve spring compartment.

Remove carbon from underside of valve heads.

DO NOT POLISH VALVE STEMS.

Check valve stems in guides; if free, do not touch guides, unless they are badly worn.

If guides and valves show no signs of excessive wear, re-grind valve seats.

Always grind the seats when new valves are fitted.

11. GRINDING OF VALVE SEATS.

Use as little grinding compound as possible.

Place valve in guide and grind lightly, using a screwdriver or hand vice.

Do not revolve valve a complete turn, but oscillate, frequently raising valve from seat and placing in a different position.

Do not over-grind valve seats (a wide seat is not necessary).

When seat is ground sufficiently, that is, when the marks of the grinding make a complete ring on the seat and on the valve, remove all signs of grinding paste from seat, valve and valve pockets.

If the valves or the seats are badly burnt or pitted, it may be impossible to obtain a perfect seat by grinding. The seat will then have to be re-cut, and the valves re-faced, or new valves fitted.

12. FITTING OF VALVES.

Thoroughly clean valves, seats, and valve pockets. Fit valve springs and collars. Lubricate valve stems.

Fit valves into guides, compress valve springs, and fit cotters.

If the valve cotters are greased with a thick grease, the grease will hold the cotters in place until the springs are released.

13. REMOVING AND RE-FITTING OF VALVE GUIDES.

Valve guides are a driving fit in the cylinder barrel or head.

To remove, tap out with a double diameter drift.

Use the drift to replace or fit new ones.

Seats must be trued-up with cutter after refitting of guides, to ensure that the guides and seats are in alignment.

14. FITTING OF CYLINDER BARREL, CYLINDER HEAD AND ROCKER BOX.

Position piston rings so that gaps are equally spaced.

Lubricate rings, barrel and piston, and rotate engine till piston is near top of stroke.

Fit paper washer to crankcase mouth, ensuring that cylinder oil feed hole is unobstructed.

Fit barrel over piston and slide right home.

Clean faces of rocker box and head and smear with jointing compound. Having placed the cylinder head nuts in position, push rocker box home on head and fit all nine nuts and washers. These are probably better tightened when head is fitted to engine.

Clean head joint faces and fit aluminium gasket. Obtain assistance to hold push rods and covers in position whilst fitting head. Ensure composition washers correctly positioned at top and rubber washers at bottom of push rod cover tubes and fit head nuts tightening them down evenly.

Re-fit remaining components, remove inspection cover and check push rod adjustment —no clearance but pushrods free to rotate.

15. DISMANTLING & RE-ASSEMBLY OF ROCKER BOX.

Whilst rocker box is removed it may be necessary to remove the rockers for examination or re-bushing. Remove the inspection cover and the rocker spindle nuts and washers, and with a soft punch against the threaded end, drift the spindles out of position.

The rockers with their washers and shims may be extracted from the box.

Remove the exhaust valve lifter by first removing the small securing screw, when the lifter may be withdrawn.

The rocker bushes are a press fit in the rockers and may be pressed or drawn out as shown in fig. 5.

Rocker ball ends and pads requiring renewing may be drifted out with a punch.

Press in new rocker ends, ensuring that the hole in the shank of the ball end is lined up with the oil hole in the rocker arm.

New rocker bushes may be pressed in or drawn into position by reversing the method of extraction illustrated.

New bushes should be reamed with 9/16" dia. reamer after fitting.

The re-assembly of the rockers in the box may require a little patience. Fig. 3 shows clearly the position of the various parts. Note that the steel shims on either side of the spring washers are identical, the thrust washer at the opposite end being much thicker.

Obtain a bar slightly smaller than the large spindle hole and having a lead on one end. Insert this into the hole far enough to allow the shims and spring washer to be placed over it. Carefully thread the rocker into position (it may be necessary to slightly withdraw the bar to get the rocker right home), centralise the washers as nearly as possible, remove bar and insert spindle, having previously smeared it with oil.

Using soft punch tap spindle part way through rocker.

Compress spring washer by means of screwdriver inserted into push rod hole and bearing on rocker arm and place thrust washer in position; the pressure of the spring washer will hold it until the spindle is knocked further home.

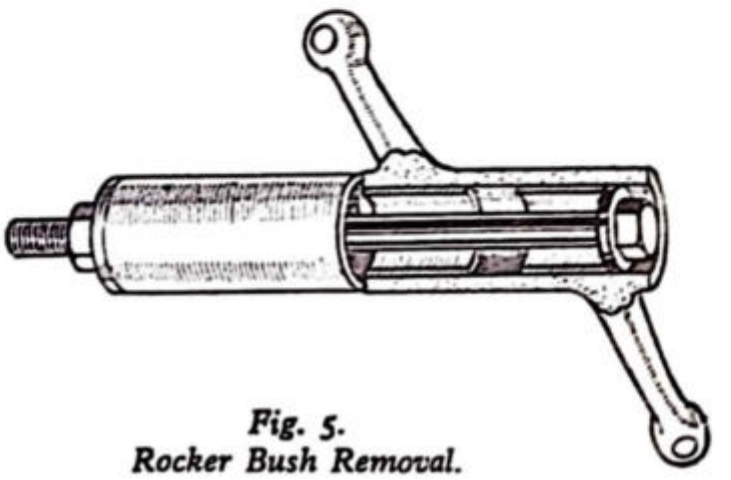


Fig. 5.
Rocker Bush Removal.

It is unlikely that the washer will be in true alignment with the spindle and will, therefore, be pinched between the rocker box and the shoulder on the spindle when the latter is tapped further into position. To release the washer tap the opposite end of the spindle once only.

Re-insert the screwdriver and again compress the spring washer. This will enable the thrust washer to be persuaded to drop over that part of the spindle on which it fits.

Insert tin strip or end of steel rule between rocker box and thrust washer, tap spindle fully home, remove tin strip, ensure that rocker is free to move, fit copper washer and dome nut and tighten.

16. TO ADJUST PUSH RODS.

Release the middle hexagon—the locking nut—by placing one spanner on the bottom

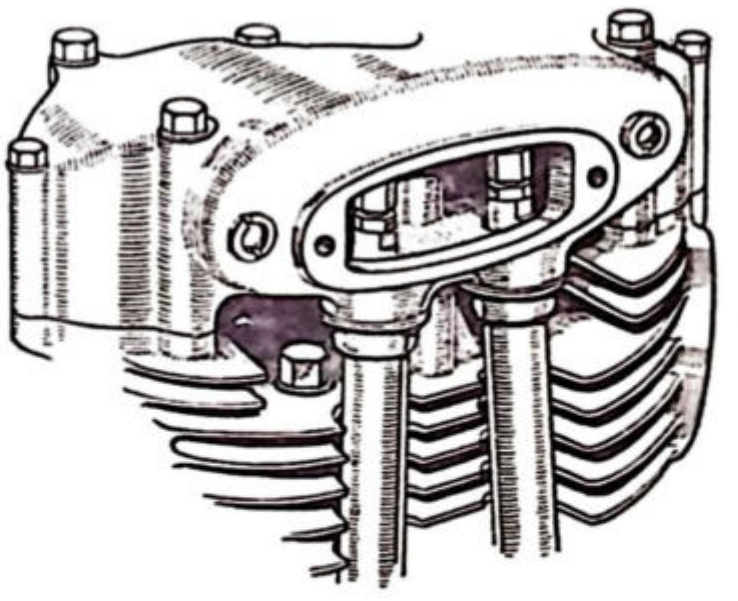


Fig. 6.
O.H.V. Push Rod Adjustment.

hexagon—the tappet stem or push rod—and the second on the locking nut.

Turn the top hexagon—the tappet head or push rod adjuster—in the desired direction, and when the correct clearance is obtained, tighten locking nut.

Check clearance after tightening locking nut.

17. REMOVAL OF PISTON AND RINGS.

Remove cylinder barrel (Para. 9).

Remove one circlip and the gudgeon pin.

Gudgeon pin is a running fit in the piston and small end bush.

Mark piston to ensure it is fitted the same way when replacing.

Remove rings from piston.

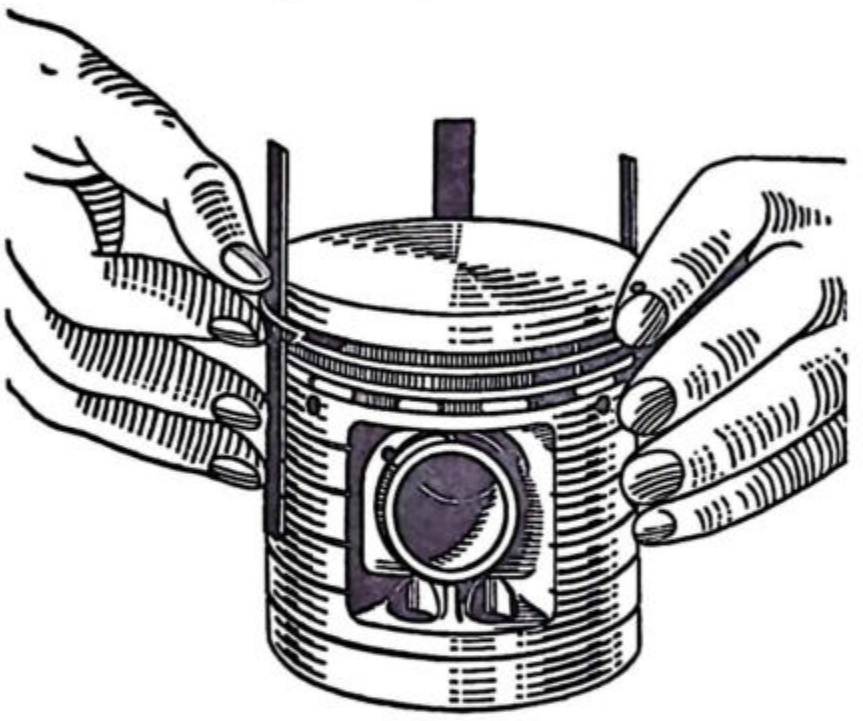


Fig. 7.

Place three thin metal strips approximately ½" wide and 2" long, behind the rings equally spaced and the rings may be readily removed. (Fig. 8.)

If it is decided not to fit new rings, it is not advisable to remove the carbon from the back of the ring or the bottom of the ring groove.

If it is decided to fit new rings, the grooves in the piston should be thoroughly cleaned. A portion of a broken hack-saw blade is an ideal tool for the job.

When the grooves have been cleaned, check the new ring for size in the grooves.

There should be a side clearance of .002".

Check rings in the cylinder bore for the correct width of gap.

Place ring in bore, push ring down bore, using the piston as a guide.

The ring gap should be:

Compression ring ... .012"—.016".
Scraper ... ... .005"

Check gap with feeler gauge.

18. REFITTING PISTON.

Fit rings to piston.

Fit piston to connecting rod with the piston in the same position as before dismantling.

Fit circlip. It is advisable to always replace circlip and fit a new one.

Fit cylinder barrel (Para. 14).

19. REMOVING AND FITTING OF SMALL END BUSH.

If when the cylinder barrel and piston are removed it is found that the small end bush is worn it should be renewed.

Bush must be withdrawn from connecting rod.

Obtain a bolt at least twice the length of the bush, place a washer at the head of the bolt with an outside diameter less than the bush. Place bolt in bush.

Over the screwed end of the bolt place a piece of tubing longer than the bush, with an inside diameter slightly larger than the outside of the bush.

Fit nut to bolt and tighten. As nut is tightened, the bush will be drawn from the rod.

Care must be taken so that no strain is taken by the rod.

Fit new bush in the same manner.

Before fitting bush to rod, the inside diameter should be reamed to the size of the pin, as when fitted in the rod the bush will compress, leaving sufficient metal for true-ing with the reamer. If this is not done, too much metal will need to be taken away with the reamer.

Drill oil-holes in the bush before reaming to size.

The gudgeon pin should be a running fit in the small-end and the piston.

20. REMOVAL OF TIMING PANEL.

Remove magdyno chain cover held by three cheese headed screws.

Remove sprockets with chain in position. If difficulty is experienced a withdrawing tool should be obtained. The cam spindle sprocket is held by taper and key; the magdyno shaft is not keyed.

Remove panel screws and note that the top three are shorter than the bottom three. Two countersunk screws are inside the mag. chain case.

When withdrawing the panel see that the big end feed jet is not lost and that any shims fitted to the cam spindles remain in position.

Remove big end feed jet spring.

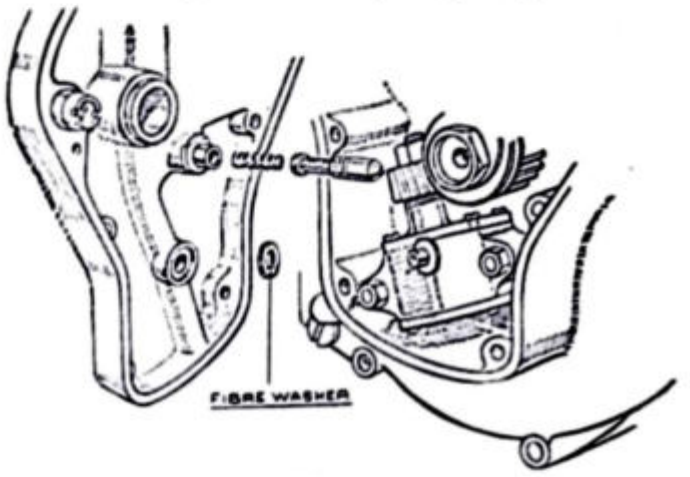


Fig. 8.

21. FITTING TIMING PANEL.

Clean the edges of the timing chest and the panel.

Smear the edges with gold-size or jointing compound.

Check fibre washer on the oil pump nipple, connecting pump to panel.

Place panel in position and the washer should prevent the edges of the panel meeting the case by 1/32". This ensures that when the panel pins are tightened, the washer is compressed, making an oil-tight joint.

Fit spring and jet in jet holder.

Fit panel and panel screws and tighten down evenly.

22. IGNITION TIMING.

Place chain and sprocket in position and tighten cam wheel sprocket nut only.

Place gearbox change-speed lever in top gear position.

Advance ignition fully.

Rotate engine by turning the rear wheel, until both valves are closed and the piston is at the top of its stroke.

The position of the piston can be ascertained by placing a thin rod into the cylinder, via the sparking plug hole.

Hold rule on the top of the piston and take the reading of the rule as it leaves the cylinder.

Turn the rear wheel backwards still holding the rule on top of the piston till the rule shows the correct figure. (See data sheet.)

Remove magdyno contact breaker cover.

Turn contact breaker in clockwise direction till the points open.

Insert thin feeler gauge or thin piece of paper, between the points.

Turn the contact breaker in an anti-clockwise direction till the points hold the feeler.

Turn contact breaker in a clockwise direction till the feeler is just free, that is when the points have just commenced to open.

Place a tube over the end of the shaft and sharply tap tube, forcing sprocket on to the taper of the shaft.

Tighten down nut carefully, so as not to turn the shaft.

When nut is tightened down, check timing.

Fit contact breaker cover.

Fit magdyno chain cover.

Fit sparking plug.

23. REMOVING TIMING GEARS, OIL PUMP, AND TAPPETS.

Remove timing panel (Para. 20), timing gears and oil pump are now visible.

Remove oil pump nuts and withdraw oil pump from studs.

Remove oil pump worm, LEFT HAND thread.

Timing gears may now be removed ensuring that any shims fitted to either end of the spindles are not lost.

Withdraw pinion from timing shaft using, if necessary, a sprocket drawer.

Unless absolutely necessary the tappets should not be removed as it is necessary to remove the tappet guides before the tappets may be withdrawn. The tappet guides are pressed into the crankcase and may be extracted by means of a sprocket drawer.

The inlet and exhaust tappets should not be interchanged.

24. FITTING TAPPETS, TIMING GEAR AND OIL PUMP.

If new timing gears have been fitted then they will need checking and re-shimming for end float. When fully home in the case the side of the gear should be clear of the boss carrying the pressure release valve. Shims should be added until this condition is obtained.

Fit timing cover, pull and push on inlet cam spindle and shim up till end float is just perceptible.

End float on exhaust cam spindle can only be properly checked when crankcase halves are separated.

Tappets must be entered into tappet guides from inside timing chest before the guides are pressed into position.

This necessitates a tubular drift to finally force the guides home.

Tappet guides are located radially by a peg in top of crankcase, which fits into a hole in tappet guide collar. Hole and peg should be as nearly in alignment as possible before pressing or tapping the guide into position.

Fit half-time pinion to mainshaft and rotate engine till crankpin is on T.D.C.

Fit cam gears, meshing the marked teeth with the appropriate markings on the pinion.

Fit and tighten oil pump worm, LEFT HAND thread, using punch or peg spanner.

Fit oil pump, ensuring that both faces are quite clean and using a minimum of jointing compound to avoid the oil holes becoming obstructed.

Check fibre washer on oil pump nipple and fit timing panel (Para. 21).

Time magneto (Para. 22).

25. OIL PUMP.

The oil pump is of the gear type. It is not advisable to dismantle it.

When pump is removed from timing chest, test for play in the spindle by pulling and pushing the worm wheel.

Revolve spindle and place fingers on the oil holes and the action of the gears should be felt if the pump is in good condition.

When revolving pump, any foreign matter obstructing the gears will be felt. Wash out with paraffin.

26. OIL CONTROL VALVE.

This is fitted in a boss on the inside of the timing panel. It is an assembly of a ball, spring and adjusting screw. The adjustment is set at the works and should not need any attention.

The control valve acts as a safety valve in the oil circuit. When the oil is cold, the oil pressure in the circuit tends to become excessively high, but the excess of pressure lifts the ball from its seat, allowing the oil to spray on to the timing gears.

If for any reason this is dismantled, the order of assembly is—ball, spring and adjuster nut.

Tighten the nut home and then screw out one and a half turns and lock with centre punch.

27. REMOVAL AND FITTING OF MAGDYNO.

The removal of the magdyno is simplified if the timing panel is removed.

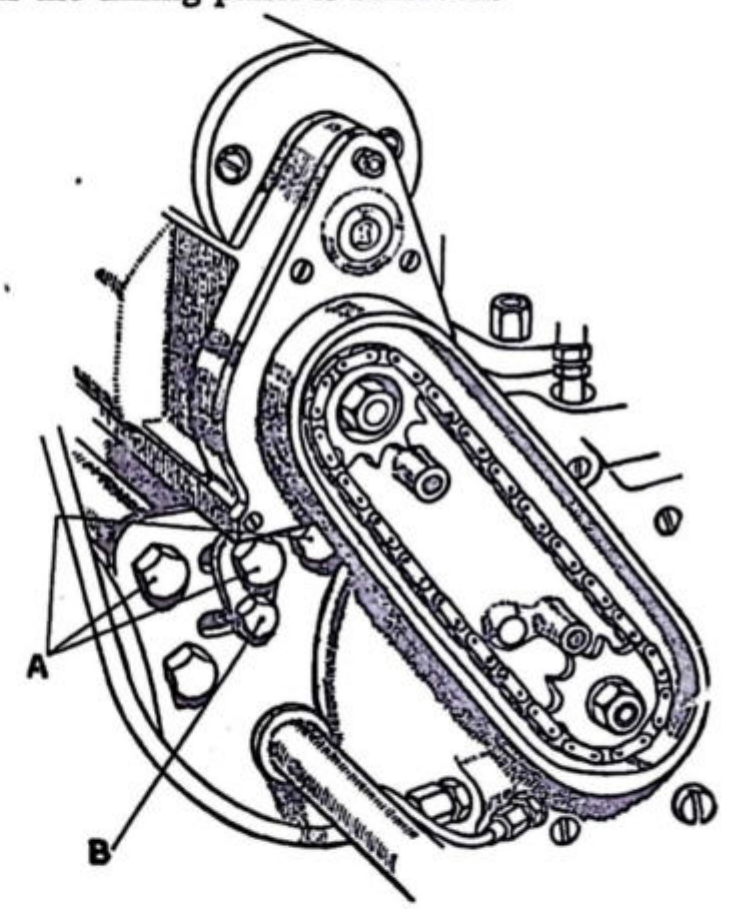


Fig. 9.

Remove timing panel (Para. 20).

Remove leads from dynamo (3.), and high tension lead from sparking plug.

Remove the locking bolt marked "B" in Fig. 10.

Remove the centre bolt of the three marked "A."

Ease the nuts off the outside bolts marked "A."

Magdyno can now be removed.

Replace in the reverse order.

Do not tighten the bolts until the panel is refitted and the chain adjusted.

With the bolts slack, the magdyno can be moved in the desired direction, to correct the chain adjustment.

28. EXAMINATION OF THE ROLLER BIG END.

With the cylinder removed, the big-end can be examined for wear.

Rotate the flywheels until the big-end is in the topmost position.

Hold connecting rod with both hands, pull and push, and any up and down play can be felt.

DO NOT USE SIDE PRESSURE.

Do not mistake side float for end play.

A small amount of rock is of no importance.

If any appreciable up and down movement is present a new crankpin bearing is necessary. The dismantling of the flywheels and fitting of crankpin is a skilled job requiring equipment not normally available to the average rider. The flywheel assembly should be returned to the works for this replacement.

29. REMOVING ENGINE FROM FRAME.

Remove the tank (para. 6), magdyno (para. 27) and exhaust valve lifter cable.

Remove carburetter, which may be left suspended from cables, remove exhaust pipe and silencer, a "C" spanner is supplied in tool kit to fit exhaust pipe locking ring on O.H.V. model.

Remove clip bolts and nuts, and silencer bolt, and the pipe and silencer can be removed as one unit.

Remove oil pipes from the crankcase. If the oil has not been drained from the oil tank, plug the end of the feed pipe.

Remove oil bath, engine sprocket, and clutch. (Para. 36.)

Remove front and rear engine plates completely. Remove engine cradle bolts and lift engine clear of frame.

30. PARTING OF THE CRANKCASE HALVES.

Remove crankcase drain plug and drain any oil that may be in the sump.

Remove cylinder barrel (Para. 9), piston (Para. 17), timing gear and oil pump (Para. 25).

Remove key from driving shaft.

Remove all the crankcase bolts and stud nuts, also the cheese headed screws from sump.

Crankcase halves can now be parted. Remove timing side first.

If leverage is necessary, revolve flywheels until the crankpin is at the mouth of the case, place a lever against the crankpin nut and lever outwards.

To remove the driving side of the case, lift the half of the case with the flywheels and lightly drop the end of the driving shaft on to a block of hard wood, when the case should leave the shaft.

31. REMOVAL OF BEARINGS FROM CRANKCASE.

It should be possible to remove the bearings from the case by tapping a shaft through the bearings, the shaft having a diameter slightly larger than the engine shaft, but small enough to pass through the bearing, should be bearing be tight in the case, without damage.

If the bearings are too tight in the housing to be removed by this method, the case should be heated round the bearing housings, when they should drop out.

Do not heat case sufficiently to destroy the temper of the bearings and do not use a concentrated flame.

32. FITTINGS OF BEARINGS TO CRANKCASE.

Test bearings, to be a sliding fit on shafts.

Press the ball bearing lightly in to the driving side of the case.

Fit the spacing washer next to the ball bearing.

Press the roller bearing lightly in to driving side of the case.

33. ASSEMBLY OF CRANKCASE.

Fit flywheels into case, and fit and tighten all bolts.

Test for side float in the flywheels, there should be .005".

If the float is excessive, remove wheels from case.

Fit pen steel washers to the engine and timing shafts to take up the excess of float.

Fit the same thickness of washers on each shaft, keeping the wheels central in the case.

Check side float.

If the side float is correct, check connecting rod for being central in case.

There is side float in the big-end.

Place fingers on the bottom of the connecting rod and push rod towards the timing side of the case.

Measure the distance from the end of the small-end bush to the side of the crankcase mouth on the timing side.

Push rod to driving side of case and take the same measurement, from the driving side.

The two measurements should be within 1/64" of each other.

Rod can be lined up by transferring the pen steel washers on the driving and timing shafts to whichever side needs them, to obtain the correct alignment.

When the correct alignment is obtained, remove wheels from case.

Lubricate main bearings and big-end.

Smear the two edges of the case with gold-size or jointing compound.

Fit wheels into the case and tighten all bolts and nuts.

Fit timing gears (Para. 24), and panel (Para. 21).

34. FITTING ENGINE TO FRAME.

Fitting of the engine to the frame should present no difficulty.

Lift engine into cradle and insert the two cradle bolts.

Starting at rear engine plates fit all bolts loosely, working finally to the front engine plate bolt.

Tighten all nuts.

Fit clutch, oil bath, etc.

Fit and time magdyno.

35. REMOVING AND FITTING OF TIMING GEAR BUSHES.

When engine is dismantled it may be found that the timing gear bushes require replacement. This is not a job to be undertaken by the average owner. The timing cover and half crankcase should be despatched to our service department.

THE TRANSMISSION

36. REMOVAL OF OIL BATH.

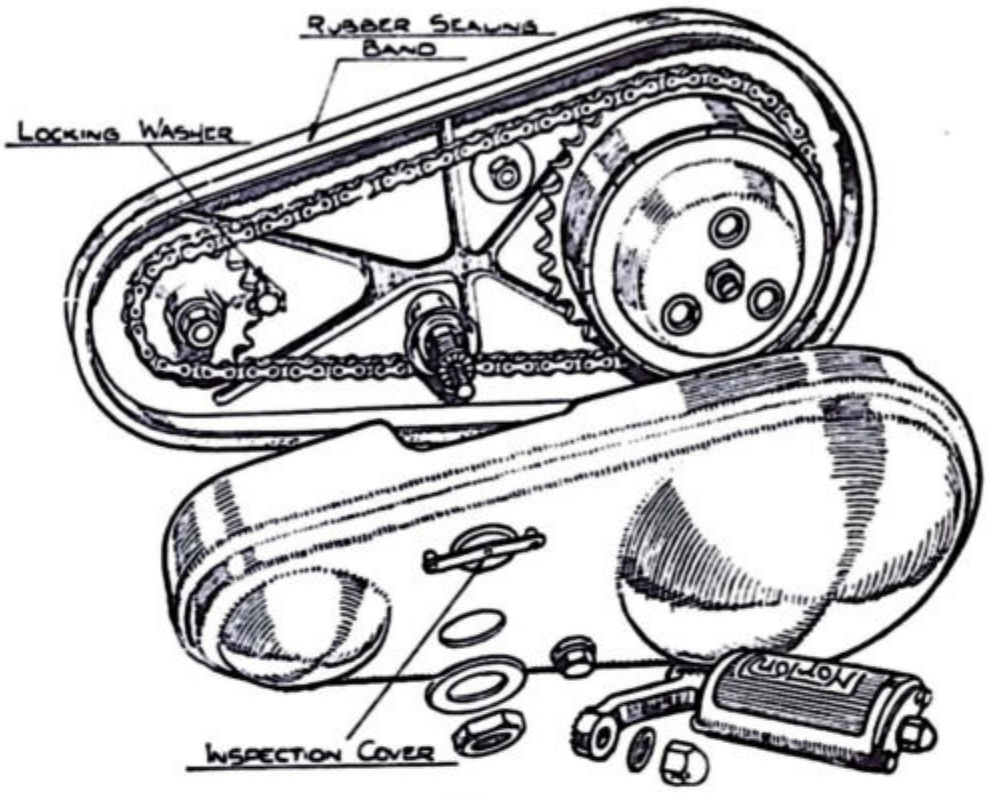


Fig. 10.

Remove the footrests, footrest rod and brake pedal.

Remove the large nut holding the outer portion of the oil bath, and remove the outer portion.

Remove clutch spring screws, springs and cups (three of each), clutch outer plate, clutch thrust pin, and clutch retaining nut.

Engage low gear and obtain assistance to hold the rear wheel while the nut is being removed.

Remove clutch body.

A special tool may be obtained for this purpose if necessary.

Remove engine sprocket (a claw-type extractor will remove this), and engine sprocket, clutch and chain can be removed together.

Remove rear portion of oil bath, held to the crankcase by bolt, to the engine plate by a nut, to the rear chain guard by a bolt, and by a nut on the gear box pivot bolt.

37. FITTING OF OIL BATH.

Assemble in the reverse order.

Examine rubber washer fitted round the flange of the inner portion. This must be in a good condition to retain the oil in the case.

Fill oil bath with oil to the level of the plug near the bottom of the outer portion of the oil bath.

38. CLUTCH—TO DISMANTLE.

Remove outer portion of the oil bath, and clutch. (Para. 36.)

A steel band is pressed round the clutch sprocket to prevent an excess of oil entering the clutch plates.

The plates can be removed with the band in position, but it must be removed to examine the driving slots in the sprocket.

Remove circlip holding clutch plates on to the body.

Remove plates.

There are six plain steel plates, and five steel plates with Ferodo inserts.

Remove clutch sprocket.

Place an old gearbox main axle (if available) in a vice with the splined end above the jaws, and fit body to axle.

Remove the three screws holding the front cover plate.

Remove the cover plate, and the clutch shock absorber rubbers. (Fig 11.)

A large "C" spanner is needed to remove the rubbers. This is placed over the body

and engaged in the splines, and the large rubbers compressed while the small ones are removed.

The handle of the spanner should be of such a length that the load can be taken by the user's thigh, allowing both hands to be free to remove the rubbers.

A substitute for a "C" spanner can be made by fixing a handle to an old plain steel clutch plate.

Compress large rubbers and remove the small.

A small sharp-pointed tool is necessary to remove the rubbers, as after use they adhere to the body.

Large rubbers are easily removed, after the small have been withdrawn.

Remove body from axle and replace in the reverse position.

Remove the three stud nuts on the back cover plate.

Back plate, roller race, back cover and body can be separated.

39. EXAMINATION OF CLUTCH PARTS.

Examine clutch inserts. They should be "proud" of the plate.

Fitting of separate inserts to a plate is not advisable, as the new inserts would be "proud" of the remainder and take all the drive on the plate in which it had been fitted.

It is advisable, if possible, to replace plates with either new or reconditioned ones.

If all the new inserts are fitted to a plate, ensure that the inserts are level and flat and all contact the steel plates, taking their share of the drive.

Examine the drive on the plates for wear.

The plates with the inserts, drive on the outside diameter, and the plain steel, on the inside.

The splines on the body and the plain steel plates driven by the body rarely show any sign of wear.

The tongues on the plates with inserts, driving the sprocket, may show signs of wear and they may have "cut" in to the driven part of the sprocket.

This wear obstructs the free movement of the plates when the clutch is operated.

This can be rectified by filing or grinding the tongues on the plates square. Also the edge of the driven part of the sprocket.

The only effect this will have on the clutch is a slight amount of "back-lash" when the clutch is engaged or disengaged.

Examine plain steel plates for any roughness. The back plate sometimes develops this fault.

Examine the roller race, rollers and the cage.

Examine the back cover plate face for wear by the clutch body centre.

Examine clutch shock absorber rubbers. They may have become soft or cracked.

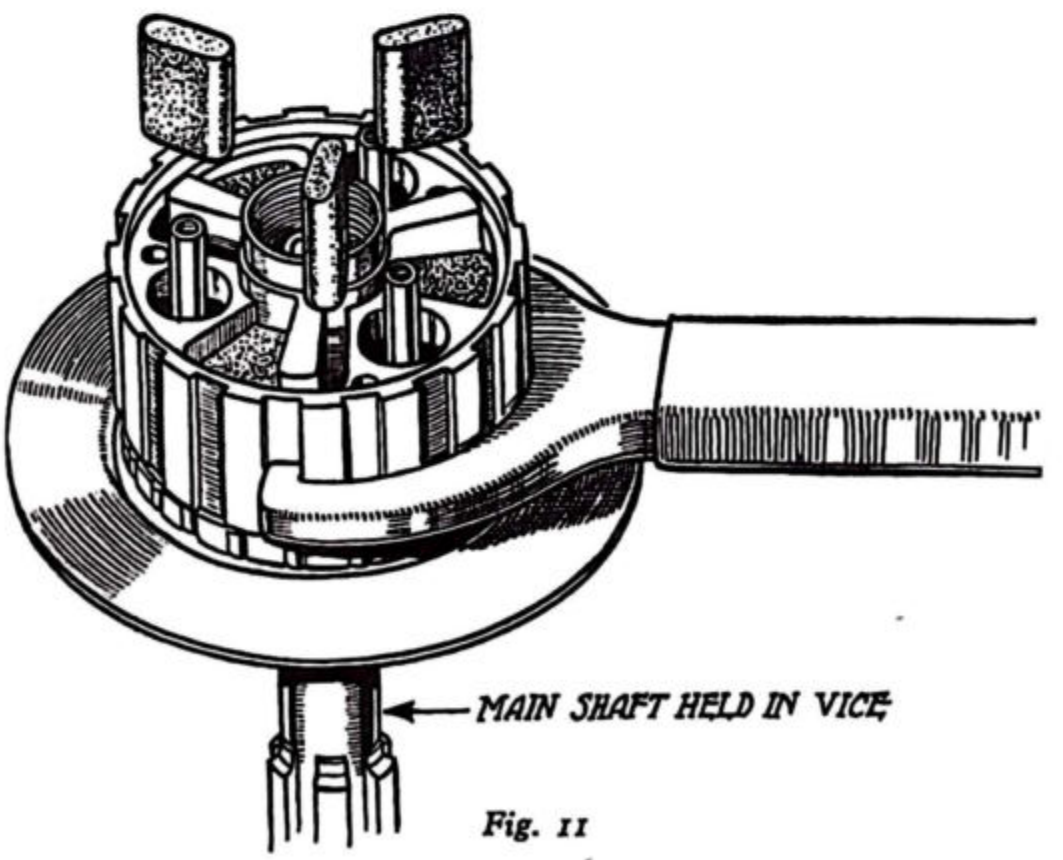


Fig. 11

40. ASSEMBLY OF CLUTCH.

Fit clutch body back cover plate to body, ensuring that the holes in the cover plate are in line with the holes in the body, and the spring studs an easy fit.

Fit clutch body centre and fit clutch large shock absorber rubbers in the position to take the drive.

Compress the rubbers in position and fit the small ones.

Fit body front cover and tighten screws.

Fit roller race on to the back cover plate, fit clutch back plate, and spring studs, fit stud nut and tighten. Lock nuts with a centre punch.

Test roller race for freeness on its track.

Fit steel band on to the sprocket. This should not be tight enough to distort the sprocket.

Check all the clutch plates in the sprocket and on body for freeness.

Fit sprocket to body. Revolve sprocket on race to check free movement.

Fit plates to sprocket and body. Order of fitting is—plain steel, inserts, plain, etc.

It will be noticed on examination that the plates are slightly bevelled on the one edge. Fit the bevelled edge towards the sprocket.

Revolve sprocket, ensuring that the plates are free.

Fit circlip, retaining the plates, and fit clutch to Gearbox axle.

Fit clutch thrust pin, clutch outer plate spring cups, springs, and spring pins. Tighten right home.

Fit oil bath outer portion. (Para. 37.)

THE GEARBOX

41. REMOVAL FROM FRAME.

Remove kick starter crank, gear indicator and gear lever.

Remove outer cover held by seven cheese head screws and release the clutch cable from the operating arm by rotating the worm with a large screwdriver.

Remove cable adjuster from inner cover.

Remove oil bath, clutch and engine sprocket. (Para. 36.)

Remove rear portion of oil bath (Para. 36), rear chain guard and rear chain.

Remove nut and adjuster bolt from the off-side of the gear box top bolt and extract the bolt from the nearside.

Remove prop stand spring and nut from the offside of the gear box bottom bolt, remove the nut and tap out the bolt.

The whole box may now be swung round in an anti-clockwise direction and lifted out of the frame on the offside.

42. FITTING TO FRAME.

Reverse the order of removal operations, leaving the top and bottom bolts slack until the primary chain has been correctly tensioned ($\frac{1}{4}/\frac{3}{8}$in. up and down movement) by means of the adjuster on the offside of the machine. Remember that any adjustment of the primary chain will affect the rear chain.

43. CLUTCH WORM LEVER, ADJUSTMENT.

When further adjustment of the clutch cable is impossible or brings the clutch worm lever into an unsuitable position, further adjustment may be obtained at the clutch worm lever accessible through the oval cover attached to the gearbox outer cover by two screws. This oval cover also forms an out-rigger bearing for the clutch worm and is a good fit in the outer cover. Should it be difficult to remove after the screws have been withdrawn, it should be tapped round until the ends stand away from the outer cover and thus provide two lips beneath which suitable levers may be inserted, but care should be taken to avoid overstraining the small cover. After slackening the cable adjuster right down, the lever may be rotated on the shank of the worm by releasing the pinch bolt and holding the shank by means of the slot machined across its end, whilst rotating the lever in an anti-clockwise direction until it is about 45° below the horizontal. Re-adjust the cable as necessary and check that when the clutch is withdrawn the angle between the cable and the worm lever is approximately a right angle.

44. OUTER COVER, REMOVAL AND FITTING.

Remove the kick starter crank by releasing its pinch bolt and pulling off the crank.

Remove gear indicator by unscrewing the centre bolt from the positive spindle.

Remove the gear change lever by unscrewing the pinch bolt and pulling off the lever.

Remove the seven cheese headed screws holding the cover in position and withdraw the cover carefully in order to avoid tearing the paper washer fitted to this joint. If the joint is difficult to break, there is a point at either end which overhangs the inner cover to which careful punching may be applied.

No difficulty should be experienced when refitting, the coverscrews should all be just pinched down and finally tightened in opposite pairs.

Some oil will have been lost due to the cover removal and should be replenished through the clutch worm inspection hole until oil begins to drip from the level plug hole normally plugged by the square headed level plug situated to the rear of and on the same level as the kick starter crank.

45. POSITIVE FOOT CHANGE, DISMANTLING.

With the outer cover removed the positive foot change mechanism becomes accessible. To dismantle, remove the two nuts securing the U section outer plate and withdraw the plate followed by the lever return spring, pawl carrier and ratchet plate. Note that there is a spacing shim fitted behind the latter. It is unlikely that the cam plate secured behind the shoulders of the two studs which carry the assembly will ever need removal, but the procedure is obvious.

46. POSITIVE FOOT CHANGE, ASSEMBLY.

Examine all parts for wear likely to result in lost movement, particularly the spindle bushes in both covers, the ends of the pawls and the pawl pin; obtain any replacements necessary and re-assemble, checking first that the two studs are quite secure and placing the spacing shim on the short shaft of the ratchet plate. Remember to insert the knuckle pin visible through the aperture in the inner cover into the hole in the ratchet plate arm whilst the ratchet plate is being fitted. Spread the pawls to enter the ratchet teeth whilst pushing home the pawl carrier.

47. INNER COVER, REMOVAL.

Screw the clutch cable adjuster as far down as possible, and with a large screwdriver and movable spanner, rotate the clutch worm lever in a clockwise direction till the cable nipple is clear of the lever. and withdraw the cable from its slot in the lever. Unscrew the adjuster and the cable is completely disconnected from the gearbox.

Remove the eight nuts securing the cover and withdraw it from the studs, being careful not to tear the paper washer fitted to the joint. The cover will bring with it the kick starter, crank, clutch worm and fittings and the mainshaft bearing.

48. INNER COVER, FITTING.

Thoroughly clean the joint faces and apply a little jointing compound to each face, place the paper washer in position over the studs and against the gearbox face. Fit the cover into position. It will probably be necessary to press the kick starter pawl into its recess in the kick starter crank before the cover can be pushed right home. Fit the eight securing nuts and washers and just pinch each one, finally tightening the nuts in opposite pairs. Refit the clutch cable and adjust as described in para. 43.

49. INNER COVER, DISMANTLING.

The dismantling of the footchange mechanism having already been dealt with, only the clutch operating mechanism and kick starter remain.. The clutch worm may be completely unscrewed from its nut and with the nut removed from the cover, the main shaft bearing may be drifted out. The hardened roller in the end of the clutch worm which rubs on the clutch thrust rod may also be drifted out and a replacement fitted if necessary. Lever off the cupped pressing which covers the kick starter return spring and remove the spring, when the kick starter axle complete may be withdrawn from its bush. This will enable the pawl pin, pawl, plunger and spring to be removed. If the nose of the pawl is badly worn or chipped, it should be renewed.

It is unlikely that the kick starter bush will ever require renewal, but it may be drifted out if necessary.

50. INNER COVER, ASSEMBLING.

Examine the kick starter cam and stop pieces riveted into the cover. They should never need renewing, but may have worked loose and require re-riveting.

Press the kick starter axle bush and mainshaft bush into the cover and screw home the clutch worm nut. Fit kick starter pawl, plunger and spring to kick starter axle. Remaining parts may be fitted now or after the cover is fitted to the gearbox.

When fitting the kick starter return spring, its free end which locates in one of the slots

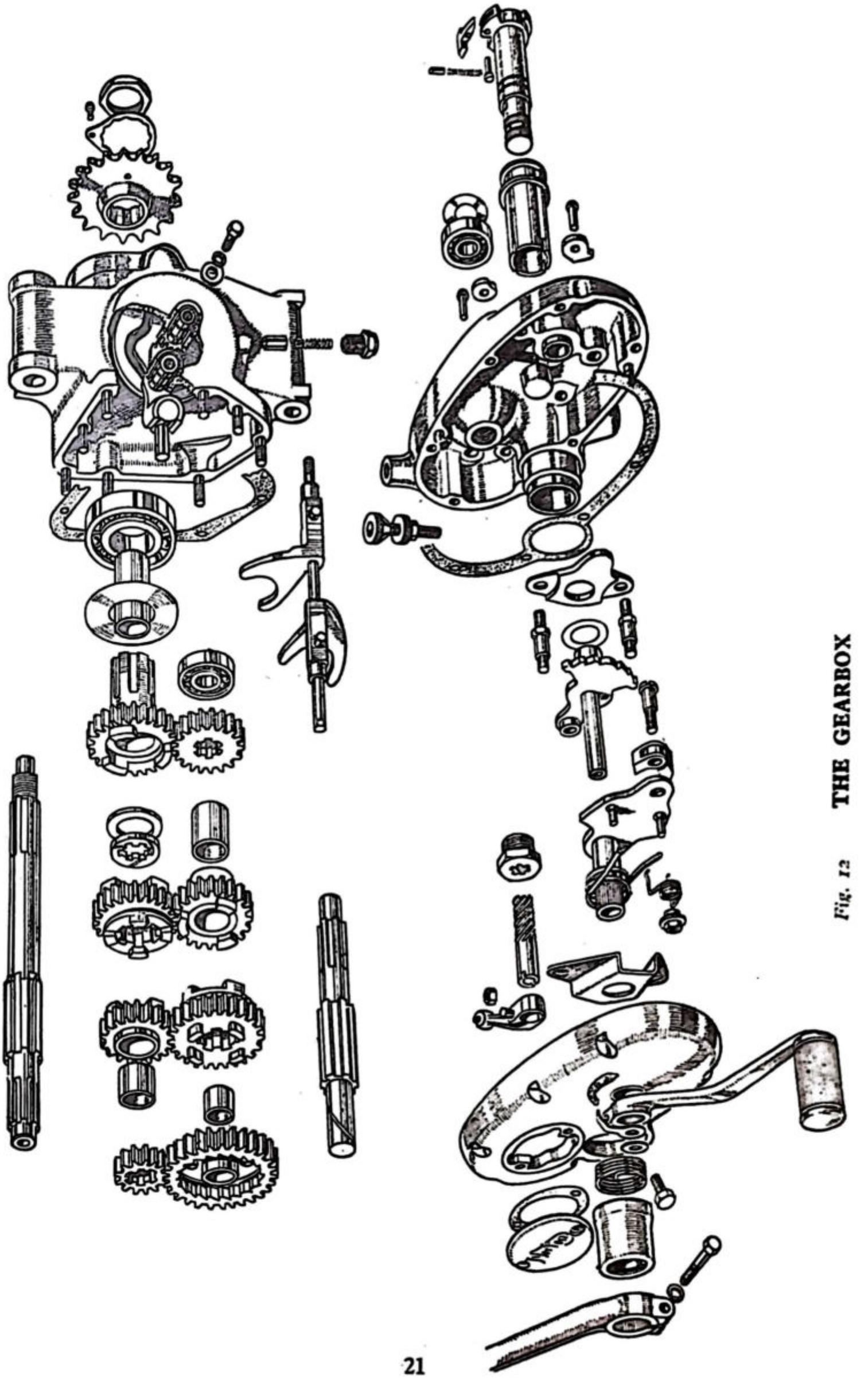


Fig. 12 **THE GEARBOX**

in the bush should be forced round into the second or third slot beyond its free position.

51. REMOVAL OF GEARS.

If the clutch has been removed, it will be necessary to fit a short length of tubing over the end of the main axle and hold it in place with a clutch nut to retain the axle in position whilst the gears are being removed.

Remove end cover. (Paras. 44 and 47).

Remove the low gear and kick starter wheel the large gear on the layshaft which has a bronze bush pressed into its centre.

Remove the small wheel from the end of the main axle.

Remove the mainshaft second gear; this is fitted with a fully floating bush. Unscrew the striker fork shaft by means of the two flats machined on its outer end and remove it together with the layshaft second gear and the striker fork.

Remove the tubular distance piece or clutch and withdraw the main axle together with the third gear and striker fork.

The bore of the main gear wheel, which still remains in position, carries 13 rollers which should be retained in position by inserting a roll of stiff paper in place of the main axle now removed. The axle will bring with it the bronze clutch thrust washer which should be examined, and if there are no grooves visible across the face which rubs on the main gear wheel, it should be renewed. Withdraw the layshaft and the two remaining gears, which will expose the outer race of the layshaft roller bearing in the far end of the box. The inner race with rollers and cage will most probably come away with the layshaft. The outer race may be removed by gently heating the case and dropping it—joint face downwards on the bench or a wooden block.

Remove axle sprocket nut which has a left hand thread and is held with a locking washer and screw, and withdraw the main gearwheel. If the gearbox is in the frame and the rear chain in position, obtain assistance to hold the rear wheel whilst the nut is being removed.

If the gearbox is removed from the frame, the sprocket may be held by passing a length of old chain around it and holding the ends in a vice.

Examine the steel roller retaining washer and if it is badly scored or worn down, it should be renewed. The main gear wheel bearing may be drifted from the shell. Remember that there is a pen steel washer fitted either side of this bearing.

52. REMOVAL OF CAM PLATE.

Remove the domed hexagon nut from beneath the forward side of the gearbox. This contains the cam plate indexing plunger which will drop out when the nut is removed.

Remove the two bolts fitted with spring and plain washers visible on the forward side of the gearbox shell. These secure the cam plate and cam plate quadrant, both of which may be pushed through into the box when the bolts are removed. Both cam plate and quadrant are carried in a bronze bush. It is unlikely that these bushes will ever require renewing, but they may be readily pressed or drifted out should the necessity arise.

53. FITTING CAM PLATE.

Place the quadrant in position and secure it with its bolt and washers. Place the cam plate in position so that one of the end grooves in its circumference is across the centre of the indexing plunger hole in the gearbox shell and meshing its gear with the last tooth but one on the quadrant, ensuring that the correct end of the quadrant rack is being used. Assemble the positive mechanism on to the inner cover (Para. 50). Place cover in position and correct quadrant lever to ratchet by means knuckle pin. (Para 46).

Set positive footchange to top gear and check that the indexing plunger groove lies in the correct position to mesh with the indexing plunger when fitted. Withdraw cam plate and re-mesh as necessary until the correct position is obtained when the cam plate bolts and washers should be fitted and tightened. Fit indexing plunger, spring and plunger bush.

54. FITTING GEARS INTO GEARBOX.

Drop pen steel washer (the smaller of the two) into the bottom of the bearing housing before pressing in the bearing. Fit main gear wheel bearing and layshaft bearing outer race.

Fit rollers (13) to main gear wheel smearing the assembly with grease, and insert the paper tube to retain the rollers.

Fit large pen steel washer over the shank of the main gear wheel, press the wheel home in its bearing, fit gearbox axle sprocket, tighten the nut, fit locking washer and pin.

Fit bronze clutch thrust washer to main axle so that the face having the three oil grooves will be against the main gear wheel. Carefully remove the paper tube from the main gear and insert main axle into position.

Fit distance tube in place of clutch and add clutch nut.

Fit third gear wheel (20 teeth) and top gear wheel (18 teeth) to layshaft and fit inner race with rollers and cage to end of the shaft. Grease the rollers and fit shaft into box.

Set the cam plate into the second gear position, i.e., with indexing plunger in the groove next to the shallow neutral groove.

Fit striking fork to mainshaft third gear (22 teeth) and fit gear to main axle, meshing it with the layshaft gear already in position.

Fit the second fork to the layshaft second gear (24 teeth) and fit the second gear with the fork to the layshaft. The pegs on the striking forks fit into the cam plate slots.

With the gearbox in the frame, little trouble will be experienced in holding the first fork in position. Fit the first fork in position and hold with a screw driver or similar tool whilst the second is placed in position.

Fit striking fork shaft and screw into the case.

Fit the remaining gears.

Fit end cover (Para. 44).

Remove tubular distance piece from clutch end of mainshaft. Remember to finally refill with oil to the level plug. (Para. 44).

WHEELS AND HUBS

55. FRONT WHEEL, REMOVAL.

Place machine on centre stand. Detach brake cable from cam lever and cable adjuster from brake plate. Remove spindle nut from off-side of spindle. Slacken pinch bolt in near side fork end. Take the weight of the wheel in the left hand and withdraw the spindle by means of a tommy bar placed through the hole in the head of the spindle.

56. FRONT WHEEL, FITTING.

Re-assemble in the reverse order. Insert spindle from near side. Lock pinch bolt in near side fork end after tightening the spindle nut.

57. REAR WHEEL, REMOVAL.

With machine on centre stand, disconnect tail and stop lamp leads by pulling the cable either side of the rubber covered snap connection behind the number plate. Remove the end bolt from each side lifting handle, which will enable the hinged end of the mudguard to be lifted when the wheel is removed.

Disconnect speedometer driving cable.

Remove the three rubber plugs from the end of the hub and with suitable box spanner, unscrew the sleeve nuts then exposed.

Remove wheel spindle and distance piece and draw wheel off its studs.

This method of wheel removal leaves the chain and brake drum in position.

To remove wheel complete with brake drum, disconnect rear chain and remove chainguard. Remove brake rod adjusting nut, disconnect brake torque arm from frame and disconnect speedometer drive. Release wheel spindle and nut from near side stub axle, enabling wheel to be slid along the adjusting slots and removed.

58. REAR WHEEL, REFITTING.

Reverse dismantling operations. Fit spring link to chain with closed end of spring facing direction of travel, ensure chain adjuster plates correctly seated and when all is tightened, check rear chain for correct tension. There should be $\frac{1}{4}$" slack midway between the sprockets with the weight of the machine on the wheels. Adjust rear brake as necessary.

59. REAR HUB, DISMANTLING.

Remove rear wheel (Para. 62). Remove locking ring, felt washer and distance piece from plain side of hub.

Drift out inner sleeve, it will bring with it the single row bearing.

Using a suitable punch, knock out the bearing in the brake side of the hub, together with the peened in washer, felt washer and pen steel washer.

60. REAR HUB, RE-ASSEMBLING.

Pack bearing with grease, wiping off surplus.

Fit single row bearing to screwed side of hub, fit inner sleeve with the long end into the single row bearing.

Fit distance piece, felt washer and locking ring and tighten.

Press double row bearing into position on opposite side of hub, followed by the pen steel washer and dished washer. Lightly rivet the dished washer into position.

61. FRONT HUB, DISMANTLING.

Remove front wheel (Para. 60.)

Remove brake plate.

Remove locking ring, felt washer and distance piece from opposite side of hub.

With suitable punch knock the bearing in the brake side further into the hub until the single row bearing drops clear.

Remove distance tube.

From this side of the hub drift out the remaining bearing, together with the peened in washer, felt washer and pen steel washer.

62. FRONT HUB, RE-ASSEMBLING.

Pack bearings with grease.

Press single row bearing into position followed by the distance piece (with collar against the bearing), felt washer and locking ring which can be tightenend up.

Insert distance tube through brake side of hub, ensuring that it is right home against the bearing just fitted.

Press double row bearing into position.

Fit pen steel washer and felt washer.

Lightly rivet the remaining washer into its recess.

BRAKES

63. DISMANTLING OF THE BRAKES.

Remove brake plate from the drum.

Remove brake lever return spring from the lever.

Remove nut and washer from the cam spindle.

Remove brake lever.

Remove cam and spindle from bush in the brake plate.

Tap the end of the spindle lightly until the cam is clear of the shoes.

Remove brake shoe return springs.

Remove the small pin from the end of each pivot pin and lift off the pivotpin tie plate.

Remove the brake shoes.

Cam spindle bush can be removed from the plate after removing the nut holding bush to the plate.

64. ASSEMBLY OF BRAKES.

Fit cam spindle bush to plate.

Fit brake shoes. Smear a little oil on the pivot pins.

Fit ONE shoe to pivot pin.

Fit spring to the shoe fitted to the pin near pin.

Hold second shoe near to the one fitted and fit the spring, stretch the spring and fit second shoe to pivot pin.

Fit second spring to both shoes.

Fit cam spindle to plate. Hold shoes apart with screwdriver or similar tool and allow cam to pass the ends of the shoes.

Fit tie plate over shoulders on pivot pins, fit and tighten both pins.

FRONT FORKS

65. MAINTENANCE.

Replenish damping oil at approximately 5,000 mile intervals.

Remove hexagon headed filler plug from top of each fork leg. Remove drain plug from each fork end. Allow oil to drain out and operate the forks a time or two to eject the last drops.

Replace drain plugs.

Re-fill each leg with a measured ¼ pint of Wakefield's Castrolite, Shell X-100-20, B.P. Energol S.A.E. 20 or Mobiloil Arctic.

Work the forks a few times to remove any air-locks.

Replace filler plugs.

66. STEERING HEAD ADJUSTMENT.

Place a wooden block or box under the engine cradle of sufficient height to raise the front wheel clear of the ground. Place thumb of left hand on the joint between the steering head of the frame and the fork head clip.

Attempt to lift the forks with the right hand. Any movement at the head races will be readily felt.

To adjust, slacken the steering column locking nut AND THE PINCH BOLT NUT clamping each leg into the fork crown.

Adjust by means of the nut situated on the steering column below the head clip, until all play is removed, but the forks are still free to rotate on the head races.

Re-tighten the steering column locking nut and the pinch bolts.

67. REMOVAL OF FRONT FORKS FROM FRAME.

This may be carried out either with or without the front wheel and mudguard in position.

Remove switch panel from headlamp.

Detach steering damper arm from frame.

Detach speedometer driving and lighting cables from speedometer head.

Remove all cables from the handlebar levers, remove handlebars.

Slacken off steering damper completely, remove steering column locking nut complete with damper knob and rod.

Remove oil filler plugs and speedometer panel.

Remove head clip and head race adjusting nut.

Withdraw forks carefully to avoid losing any head race balls.

Take care to avoid spilling any damping oil from the fork legs. If any oil is lost it will be necessary to replenish as instructed. (Para. 65)

68. FITTING OF FORKS TO THE FRAME.

Examine head races and balls (17 per race).

Races are pressed into their housings and may readily be knocked out for renewal.

Note that the races fitted in the frame embody a small hole to allow the entry of grease.

Liberally grease the track in the race fitted to the bottom of the steering column and the top frame race. Place 17 balls in position in each and carefully insert the column through the frame.

Place the top race and dust cover in position and screw the adjusting nut down the column until the hexagon is finger tight against the top race.

Refit the head clip and speedometer panel, the column locking nut loosely and the filler plugs which should be tightened up.

Adjust the head races. (Para. 66.)

Refit all remaining parts and check that all bolts and nuts have been tightened.

69. FORK LEG, DISMANTLING.

This may be carried out with the forks in position, but before commencing the work it is advisable to obtain from our Service Department a "pull through" to facilitate removal and replacement of the main tube.

Remove front wheel. (Para. 55.)

Remove front mudguard.

Remove oil filler and drain plugs from top and bottom of fork leg and allow oil to drain off.

Slacken the pinch bolt in the crown lug.

Fork end, complete with bottom cover, springs and main tube may be withdrawn.

If difficulty is encountered the "pull-though" already mentioned should be screwed into the top of the main tube which can then be tapped out with a mallet.

Remove from the main tube the top leather washer (this may have stuck to the inside of the upper cover) and main spring.

Remove the bottom cover, held to the fork end by two screws.

Remove leather washer.

Remove locking ring from top of fork end. Withdraw fork end from main tube.

The remaining components may now be removed from the main tube.

70. FORK LEG, ASSEMBLY.

Thoroughly clean all components and obtain any necessary renewals.

Attach the bottom bush to the main tube by means of the securing nut.

Place fork end in position on the main tube.

Fit shouldered bush into fork end followed by the super oil seal, the side with exposed spring being uppermost.

Screw home the locking ring and tighten sufficiently to be secure without distorting the case of the super oil seal.

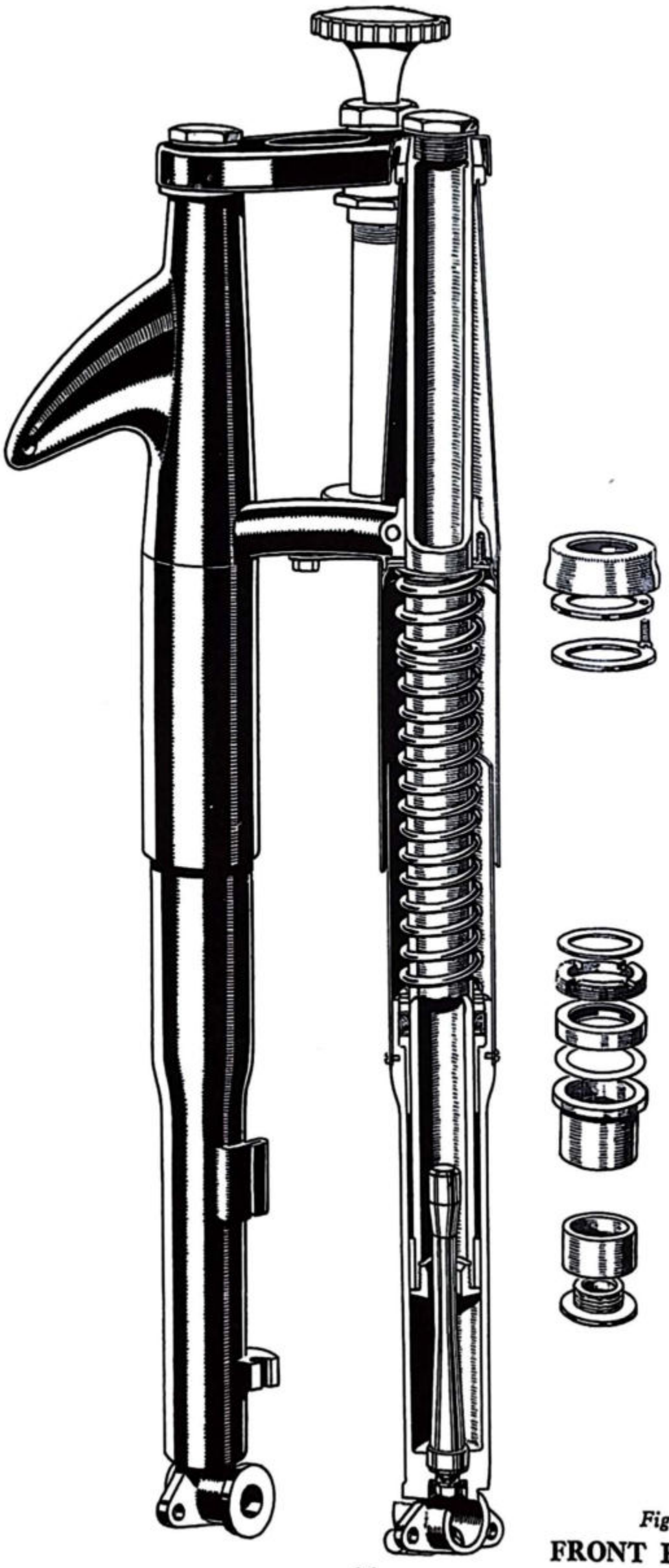


Fig. 15
FRONT FORKS

Fit the smaller of the two leather washers over the locking ring followed by the main spring and the remaining leather washer.

Fit bottom cover and securing screws.

Screw " pull through " into top end of main tube and pass through crown lug and head clip.

Draw into position by means of Tommy Bar inserted across the " pull through," and temporarily tighten the pinch bolt in the crown lug.

Remove " Pull-through."

Fit filler plug to main tube and slacken pinch bolt. Lock main tube in position with filler plug. Re-tighten pinch bolt.

Fit drain plug to fork end.

Remove filler plug.

Replenish with oil. (Para. 65.)

REAR SPRINGING

71. SWINGING ARM REMOVAL AND DISMANTLING.

As there is neither adjustment nor lubrication necessary to the swinging arm pivot, no periodic maintenance is necessary, but the time may arrive when it becomes necessary to dismantle the assembly, possibly to renew the silentbloc bushes.

Remove rear wheel (Para. 57). Remove shock absorber units by removing the bolts securing the top and bottom members to the frame and swinging arm respectively. Remove the pivot bolt by first removing the oil bath chaincase outer portion and the clutch (Paras. 36 and 38), removing the nut at the offside end of the pivot bolt and drifting the bolt right out of position, enabling the swinging arm to be withdrawn.

The silentbloc bushes are pressed into the cross tube of the swinging arm and may be knocked out of position, preferably using a drift only slightly smaller than the bore of the cross tube but longer than the hole in the outer sleeve of the silentbloc. Soaking in release oil may assist in the removal of over-tight bearings.

72. RE-ASSEMBLY AND RE-FITTING SWINGING ARM.

Press or drift one new bush into swinging arm until its outer sleeve is flush with the end of the cross tube. Insert distance piece from opposite side and press home the other bush. Place swinging arm in position, ensuring that the brackets for attaching the shock absorber are on the top side, re-fit pivot bolt and nut and tighten.

73. REAR SUSPENSION UNITS.

These fittings embody quite complicated oil damping arrangements which are carefully set to provide the correct suspension characteristics for your machine. They are sealed and are virtually leakproof and should NOT BE INTERFERED WITH. In the unlikely event of any attention being necessary, their removal is quite simple and straightforward and they should be taken to your usual Norton dealer or to the nearest Norton distributor.

No attempt whatever should be made by the normal rider to dismantle, drain or re-fill these units.

HANDLEBAR FITTINGS

74. IGNITION AND AIR CONTROL LEVERS.

The ignition and air control levers are shown in Fig. 17 in the position which they should be assembled, having first greased both sides of the lever.

After fitting the adjusting nut it should be tightened to give the required tension.

To remove the control cables from the lever, open the lever as far as possible, hold the outer cable, and as the lever is closed, pull the outer cable from the lever body.

Remove nipple from the lever.

To fit the cables, fit nipple into the lever, close the lever, pull the outer cable away from the lever and fit the cable to the lever body.

75. CLUTCH AND FRONT BRAKE CONTROL LEVERS.

The clutch and front brake controls are so

simple as to require no instructions for their dismantling or assembly.

The pivot bolts have shoulders machined on them, allowing the nuts on the bolts to be tightened while allowing clearance for easy movement of the lever.

To remove the clutch cable from the lever, turn the clutch operating arm on the clutch worm by other means than the cable, and the nipple can be removed from the arm, and inner and outer cables can be removed from the lever.

Fig. 16.
TWIST GRIP.

Fig 17.
IGNITION AND AIR CONTROL.

To remove the brake cable from the lever, remove the split cotter and pin holding the "U" clip to the brake arm, and the inner and outer cables can be removed from the lever.

Re-assemble in the reverse order.

76. EXHAUST LIFTER LEVER.

The arrangement of the exhaust lifter lever is similar to the clutch and brake, only smaller.

To remove the cables from the lever, turn the operating arm on the exhaust lifter by other means than the cable and remove the inner cable from the arm. Remove the nipple on the other end of the cable from the lever and the nipple will pass through the large hole in the lever body.

When re-assembling, the cables must be fitted to the lever first.

77. TWIST GRIP.

The twist grip assembly is shown in Fig. 17.

To assemble the twist grip, grease the portion of the handlebar where the grip works.

Fit the sleeve to the bar.

Grease the drum on the sleeve.

Fit spring and adjuster bolt and nut to the bottom half clip.

Thread the cable through the hole in the half clip.

Fit the nipple to the drum on the sleeve.

(Sufficient length of cable can be obtained by lifting the throttle slide and holding in position by a piece of soft wood placed in the air intake.)

Fit the top half clip.

Adjust the tightness of the grip with the adjusting screw and lock in the desired position.

Dismantle in the reverse order.

AMAL CARBURETTER

78. DISMANTLING OF CARBURETTER.

The easiest way to remove the carburetter is to turn both petrol taps off and disconnect feed pipe from carburetter, remove the two nuts securing carburetter flange and unscrew the knurled ring immediately below where the control cables enter the top of the mixing chamber body so that the slides may be withdrawn, either before or after the carburetter is removed. The air and throttle valves may be left on the cables unless it is desired to change or renew the cables or valves.

The throttle valve needle may be removed or adjusted for position by removal of the spring clip at the top of the slide.

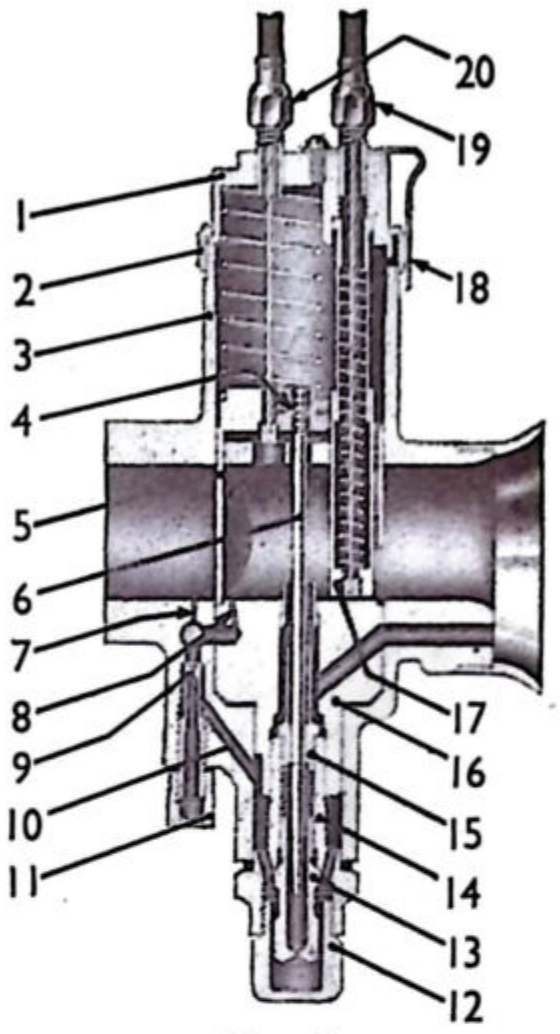


Fig. 18
Diagrammatic section through Mixing Chamber

1—Mixing Chamber Top
2—Mixing Chamber Cap
3—Carburetter Body
4—Jet Needle Clip
5—Throttle Valve
6—Jet Needle
7—Pilot Outlet
8—Pilot by-pass
9—Pilot Jet
10—Petrol feed to pilot jet
11—Pilot Jet Cover Nut
12—Main Jet Cover
13—Main Jet
14—Jet Holder
15—Needle Jet
16—Jet Block
17—Air Valve
18—Mixing Chamber Cap Spring
19—Cable Adjuster (Air)
20—Cable Adjuster (Throttle)
21—Tickler.
23—Banjo.
29—Pilot Air Adjusting Screw.
30—Throttle Adjusting Screw.

Remove the float chamber cover by removing the three screws securing it, and withdraw the hinged float, this will enable the nylon needle which controls the flow of fuel to be withdrawn and cleaned.

Removal of the nut at the base of mixing chamber gives access to the main jet which may be unscrewed from the jet holder which also carries the needle jet, accessible by removal of jet holder. Removal of these parts enables the jet block to be pushed or tapped out through the large end of the mixing chamber body when the jet block locating screw has been removed. This screw lies to the left of and slightly below the pilot air adjuster which is the horizontal milled headed screw equipped with restricting spring.

79. RE-ASSEMBLY OF CARBURETTER.

Re-assembly should present no difficulty but the following points should be watched. The washer fitted to the stub of the jet block should be in good condition, also the one fitted to the needle jet holder. When fitting throttle valve ensure that taper needle really enters the centre hole in the jet block, and that throttle works freely when mixing chamber top cap be fitted and secured. Fit float with narrow side of hinge uppermost and ensure that side cover washer and body are clean and undamaged to obtain a petrol tight joint.

80. CARBURETTER TUNING.

There are four distinct phases of tuning and each must be handled separately to obtain best results for any particular set of conditions.

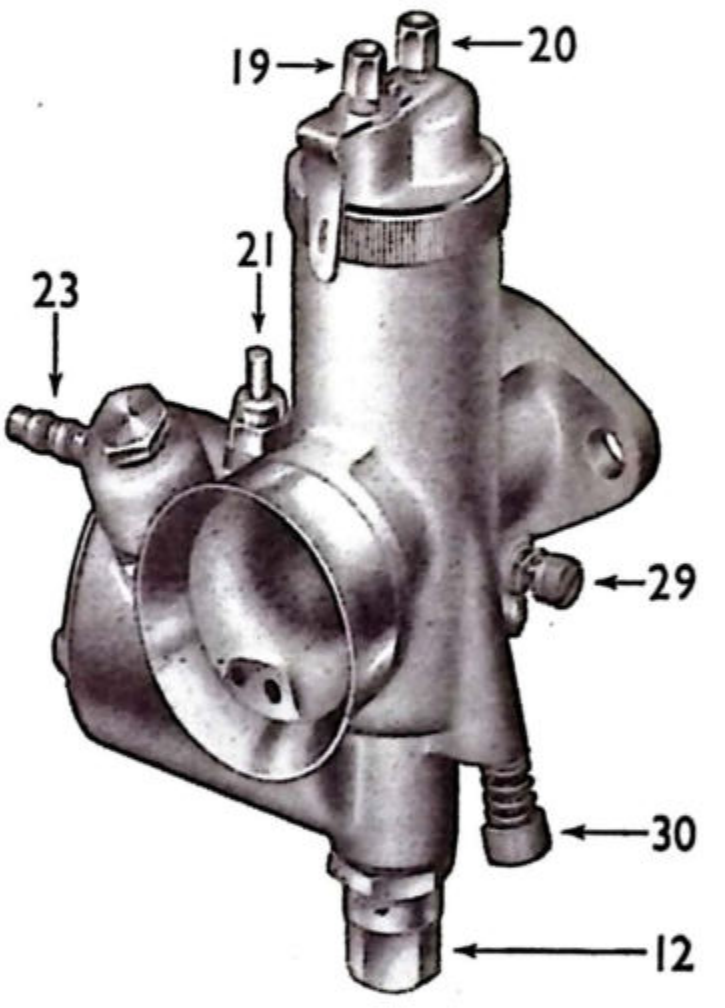


Fig. 19
General view of Carburetter

For all these positions the air valve should be fully open, the engine should be at its normal working temperature, and the machine should be driven on a slight up gradient to ensure engine pulling whole time.

1st MAIN JET.

This jet controls the fuel supply when the throttle is more than ¼ open. With the throttle fully open and the engine pulling hard,

slightly close the air lever when there should be a slight falling off of speed indicating a reasonably correct mixture. If maximum speed is obtained before the throttle is fully open, then a larger main jet is required; similarly if there is an increase in speed with the air lever slightly closed.

2nd SLOW RUNNING.

Having fixed the main jet, set the throttle adjusting screw to provide a fairly fast idling with the twist grip in the fully closed position and the ignition (where manually controlled) set for best slow running. Screw out the throttle adjusting screw until the engine begins to falter; now adjust the pilot air screw in or out as necessary to make the engine run evenly and faster. Lower the throttle adjusting screw further to reduce engine speed until a position of the pilot air screw is found at which the engine runs evenly and steadily on the smallest throttle opening.

3rd THROTTLE VALVE CUTAWAY.

With the throttle valve about a ¼ open (marking the twist grip if necessary in order to readily find this position whilst riding) note whether there is any spitting (indicating weakness) or jerky running under load (indicating richness). In the former event try screwing in the pilot air screw slightly and if this is ineffective, a throttle valve having less cutaway, i.e., stamped with a lower number and the reverse for jerky running.

4th THROTTLE VALVE NEEDLE.

With the throttle about ¾ open and the needle in a low position try the machine for acceleration. If results are poor and partially closing the lever provides improved conditions, raise the needle a notch or two until the best position is found.

5th RE-CHECK IDLING.

To ensure that subsequent adjustments have not upset the condition.

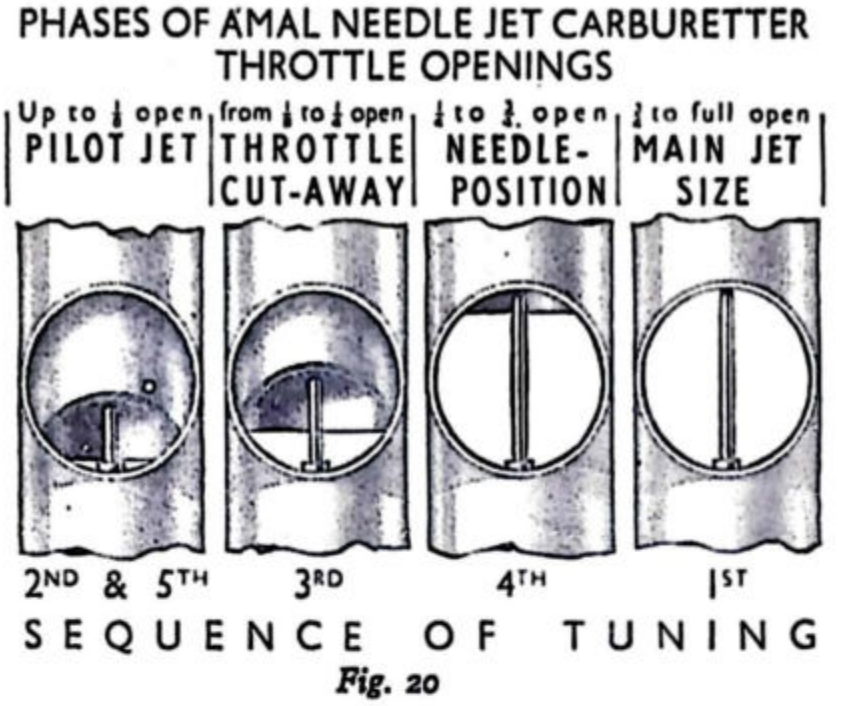


Fig. 20

81. MAINTENANCE.

Clean periodically by dismantling and washing in clean petrol, cleaning out all holes by blowing. Whilst dismantled examine throttle valve needle and float needle for wear and all fibre washers, renewing as necessary. Check that throttle valve is not unduly worn in the mixing chamber body.

82. RICH MIXTURE.

Indicated by black exhaust smoke, excessive soot on plug, lumpy running, petrol blown back from air intake.

Assuming that carburation has previously been satisfactory, suspect:—flooding due to punctured float, dirt on float needle seating or worn needle or seat. Worn throttle valve needle or needle jet, air cleaner choked.

83. WEAK MIXTURE.

Indicated by spitting back, poor acceleration, overheating, erratic slow running or improved performance with air lever partly shut.

Again assuming carburetter has been correctly set, suspect:—fuel blockage, either main supply or within carburetter. Worn inlet valve guide, air leaks at engine carburetter connection, worn throttle valve, loose jets.

LEGSHIELDS

84.

A standard set of these Legshield fittings comprises:—

2 Legshield Blades.
2 Legshield Blade Brackets.
2 Legshield Blade Brackets Back Plates.
4 ¼" pins and nuts for above.
1 Horn Bracket extension plate with ⅜" pin and nut.

1 7/16" dia. rod 24½" long with nuts.
1 7/16" dia. rod 23.7/16" long with nuts.
1 Distance tube 13⅛" long.
1 Distance tube 6⅞" long.
1 Distance tube 5⅞" long.
2 Distance tubes 1.7/16" long.
4 Distance tubes 3⅜" long.
2 Legshield Attachment brackets for tank platform.
2 Thin tank rubbers.

85. FITTING INSTRUCTIONS

Remove the front petrol tank bolts and slacken the rear bolts.

Remove the front tank platform top rubbers and replace with the thin rubbers supplied.

Over the rubbers place the attachment brackets so that the arm with the 7/16" hole points downwards and is to the rear of the tank bolt. Place the plain steel washers from under the tank over the brackets and insert the front tank bolts through the middle of the three holes in the attachment brackets but do not tighten up.

Place the 13⅛" distance tube between the legs of the attachment brackets, insert the longer of the 7/16" dia. rods and in each end place a 1.7/16" distance tube.

Remove crankcase engine plate bolt carrying the horn and insert in its place the remaining 7/16" rod. Attach the extension bracket to the horn and place in position on the left hand side of the rod.

Fit the 5⅛" distance tube next to the horn and the 6⅞" tube on the opposite side.

Fit the legshield brackets loosely to the rods with the deep valance on the inside, nearest the engine.

Fit the securing rod nuts. Tighten all nuts and bolts.

TYRES

86. MAINTENANCE.

Always keep tyres at the correct pressures, (see data page at front of book). Remove any stones which may be embedded in the tread. Replace valve dust cap if lost.

87. REMOVAL

Deflate tube by removing valve cap and core. Remove rim nut and security bolt nut if security bolt fitted. Push the beads of the cover down into the well of the rim at a point opposite to the valve. Insert a small tyre lever between the bead and the rim near to the valve. Ease the bead off the rim using a second lever inserted a short distance away. Repeat until one bead is free of the rim. Remove security bolt and tube, and remove the second bead in a similar manner.

88. FITTING.

Fit rim band. Dust tube, beads and rim with French chalk. Slightly inflate tube and place within cover on top of wheel with valve in line with hole in rim. Fit the underneath bead by hand, completing the operation with levers. Thread valve and stem of security bolt through appropriate holes. Fit second bead starting opposite valve. See that security bolt and tube are not being pinched between cover and rim. Inflate. Fit rim nut and security bolt nut. Adjust pressures to manufacturers recommendation and fit dust cap.

ELECTRICAL SECTION

89. ESSENTIAL MAINTENANCE.

Battery. Inspect the battery regularly and keep acid level to the top of the separators by adding distilled water.

UNLESS YOU DO THIS YOUR BATTERY WILL QUICKLY DETERIORATE.

Wiring. Keep all connections and terminals tight. See that the cables are clear of moving part.

Dynamo. Keep brushes and commutator clean. (Para. 96).

Magneto. Keep contact breaker clean. If necessary polish the contacts with fine

carborundum stone or emery cloth and afterwards wipe with cloth moistened with petrol. (Para. 92). Occasionally check contact breaker opening (using gauge on ignition spanner). (Para. 91).

Replace high-tension cable if it becomes worn or perished.

Head Lamp. Focus head lamp after fitting new bulb. (Para. 101).

Ignition

90. LUBRICATION.

The cam is lubricated by a wick, contained in the contact breaker base, which must be given a few drops of thin machine oil about every 2,500 miles.

To get at the wick, remove the spring arm carrying the moving contact and withdraw the screw carrying the wick. (Fig. 21)

When replacing the contact breaker components see that the small backing spring is fitted immediately under the securing screw and spring washer, and that the bent portion faces outwards.

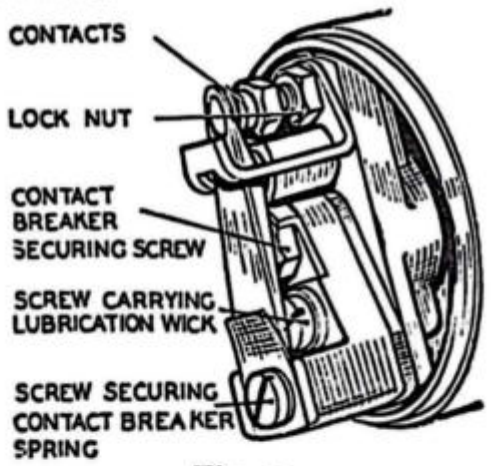


Fig. 21

91. CONTACT BREAKER—ADJUSTMENT.

After dismantling the contact breaker in order to lubricate, the contact setting should be checked.

Turn the engine until the contacts are fully opened and insert the gauge provided, .010 inch—.012 inch thickness, between the contacts.

The gauge should be a sliding fit.

If there is an appreciable variation from the gauge, slacken the lock nut and turn the contact screw by its hexagon head until the gap is set to the gauge.

Tighten the lock nut.

92. CONTACT BREAKER—CLEANING.

Remove the contact breaker cover and examine the contacts.

If they are dirty, they must be cleaned by polishing with a very fine carborundum stone or very fine emery cloth; afterwards wipe away any dirt or metal dust with a petrol-moistened cloth.

Cleaning of the contacts is made easier if the spring arm carrying the moving contact is removed as described in paragraph 90.

Examine the spring arm of the contact breaker and wipe away any rust.

Adjust as described in paragraph 91.

93. H.T. CABLE.

Should be 7 m/m. in diameter, rubber covered ignition cable.

The cable must be replaced if the rubber insulation has perished or shows cracks and becomes brittle.

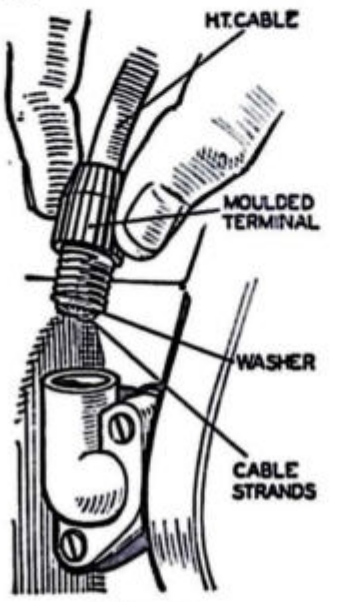


Fig. 22

To fit the new cable to the pick-up terminal, thread the knurled moulded nut over the lead, bare the cable for about ¼ inch, thread the wire through the metal washer removed from the old cable and bend back the strands.

Finally, screw the nut into its terminal.

94. PICK-UP.

Examine the pick-up or high tension terminal (magneto end).

See that the carbon brush moves freely in its holder, being careful not to stretch the brush spring unduly.

While the pick-up is removed, clean the slip ring track and flanges by holding a soft cloth on the ring while the engine is slowly turned by hand.

95. SPARKING PLUG.

Clean periodically by dismantling and removing all the carbon from the electrodes.

Scrape inside of plug body clean of carbon, re-assemble and set gap at .018"—.022".

Lighting and Accessories

96. DYNAMO—INSPECTION OF COMMUTATOR & BRUSHGEAR.

About once every six months remove the dynamo cover for inspection of commutator and brushes.

The brushes must make firm contact with the commutator. The brushes are held in boxes by means of springs; move the brush to see that it is free to slide in its holder. If it sticks remove it and clean with a cloth moistened with petrol. Care must be taken to replace the brushes in their original position, otherwise they will not bed properly on the commutator. If, after long service, the brushes have become worn to such an extent that they will not bear properly on the commutator, they must be replaced. Always use genuine Lucas brushes. Brushes should be fitted by a Service Agent.

Now examine the commutator. It should be free from any trace of oil or dirt and should have a highly polished appearance. Clean a dirty or blackened commutator by pressing a fine dry cloth against it while the engine is slowly turned over by hand. If the commutator is very dirty, moisten the cloth with petrol.

97. LUBRICATION.

The bearings in the dynamo are packed with grease during assembly and will last until it is necessary for the dynamo to undergo a complete overhaul.

98. CUT-OUT AND REGULATOR UNIT.

This unit (Fig 23) which is housed inside the tool box, consists of the cut-out which is an automatic switch to prevent discharge of the battery when the dynamo is not charging, and the voltage regulator which controls the output of the dynamo. With a fully charged battery the dynamo is only permitted to pass a small charge to the battery, whilst with a fully discharged battery a heavy charge is passed in order to boost up the battery rapidly. Both components are accurately set and should not be tampered with or adjusted.

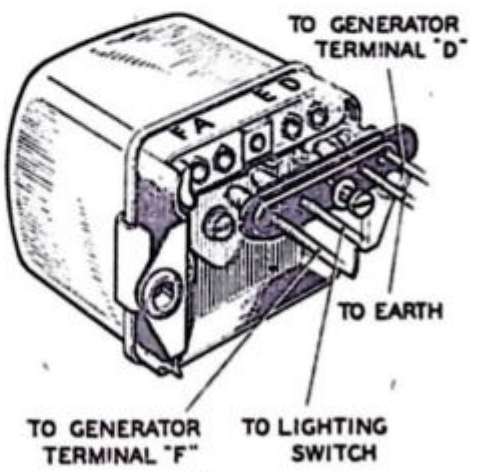


Fig. 23

99. AMMETER.

Fitted in the switch panel of the head lamp, this instrument indicates when the current is being taken from the battery in a greater quantity than is being fed to the battery (discharge).

It also shows when the dynamo is charging and hence by means of the regulator the state of charge of the battery.

100. BATTERY.

When examining a battery, do not hold naked lights near the vents as there is a danger of igniting the gas coming from the plates.

Remove the vent plugs and see that the ventilating holes in each are quite clear.

Remove any dirt by means of a bent wire.

A clogged vent plug will cause the pressure in the cell to increase, due to the gases given off during charging, and this may cause damage.

Make sure that the rubber washer is fitted under each vent plug, otherwise the electrolyte may leak.

Battery—Topping-up.

About once a month, remove the battery lid, unscrew the filler caps and pour a small quantity of distilled water into each of the cells to bring the acid level with tops of the separators.

Acid must not be added to the battery unless some is accidentally spilled.

Should this happen, the loss must be made good with acid diluted to the same specific gravity as the acid in the cells.

This should be measured by means of a hydrometer.

Checking Battery condition.

The state of charge of the battery should be examined by taking hydrometer readings of the specific gravity of the acid in the cells.

The specific gravity reading and their indications are as follows:—

1.280—1.300. Battery fully charged.
About—1.210. Battery about half discharged.
Below—1.150. Battery fully discharged.

These figures are given assuming the temperature of the acid is about 60° F.

Each reading should be approximately the same.

If one cell gives a reading very different from the rest, it may be that the acid has been spilled or has leaked from this particular cell, or there may be a short circuit between the plates.

This will necessitate its return to a Repair Depot for rectification.

Wipe the top of the battery to remove all dirt and water.

Note.

Do not leave the battery in a discharged condition for any length of time.

If a motor cycle is to be out of use, the battery must first be fully charged, and afterwards given a refreshing charge about every two weeks.

Earthing Connections.

Before disconnecting the battery, note which terminal is connected to the machine and reconnect accordingly.

Charging.

If the previous tests indicate that the battery is merely discharged, and if the acid level is correct, the battery must be recharged from an external supply.

101. HEADLAMP.

The headlamp incorporates a Lucas Light Unit which embodies a "pre-focus" bulb ensuring a correct beam without any necessity for focussing.

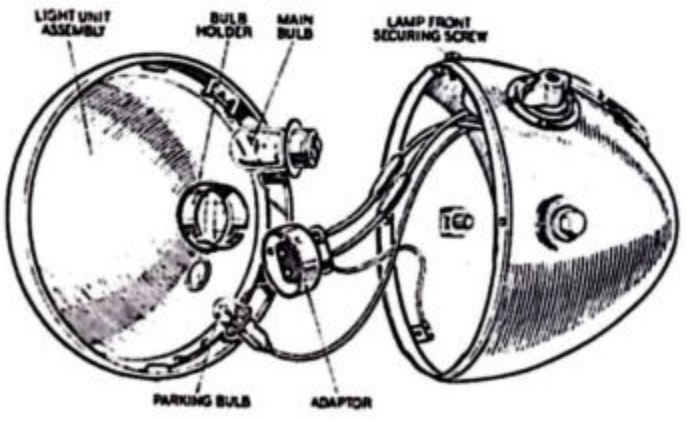


Fig. 24
Light Unit—bulb removal

Setting.

Check the setting of the lamp. Stand the machine about 25ft. from a light coloured wall and adjust the headlamp position until the main driving beam is projected straight ahead and parallel to the ground, the centre of the beam being the same height as the headlamp centre.

Bulb Replacement.

To remove the headlamp front, slacken the screw at the top of the lamp and lift off the front rim complete with light unit assembly. The pilot bulb is carried in a small metal plate in the base of the lamp body. The plate must be slid out in order to replace the bulb. To replace "pre-focus" bulbs, twist the back shell in the centre of the reflector back in an anti-clockwise direction and pull off. The bulb may now be removed from the rear of the reflector. Place the correct bulb in the holder, engage the projectors on the inside of the back shell with the slots in the bulb holder, press home and twist in a clockwise direction. To replace headlamp front, locate the bottom of the light unit assembly in the lamp body, press into position and tighten locking screw.

Note.

It is important that only genuine Lucas bulbs should be used as replacements in order to ensure accuracy and correct focussing.

Main bulb Lucas No. 312 6 volt 30/24 watt.

Pilot bulb Lucas No. 988 6 volt 3 watt.

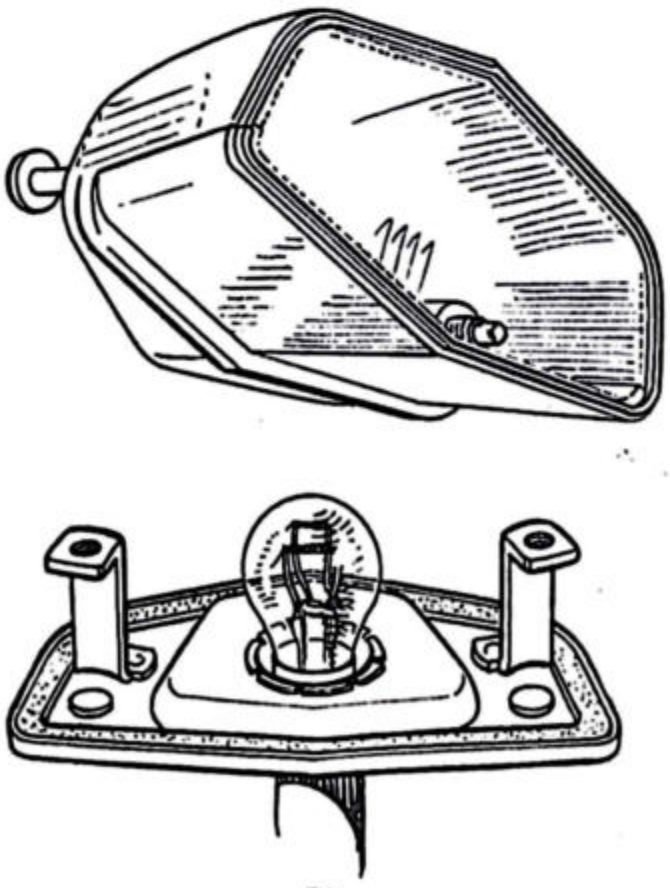


Fig. 25
Tail, Stop and Number Plate Lamp

103. CABLES.

Before making any alterations to the wiring or removing the switch from the headlamp, disconnect the negative lead at the battery to avoid the danger of short circuits.

The lead, about 1 foot long, from the negative battery terminal, is connected to the lead from the switch by means of a brass connector.

The connector is insulated by a rubber sleeve, which must be pushed back to allow the connector to be unscrewed.

Do not allow the brass connector to touch any metal part of the engine as this will short circuit the battery.

When connecting up again, pull the rubber sleeve over the connector.

104. LIGHTING SWITCH.

All leads to the headlamp are taken direct to the switch, which, together with the ammeter, is incorporated in a small panel.

The panel can be removed when the three fixing screws are withdrawn.

The ends of all the cables are identified by means of coloured sleevings.

105. HORN.

Electric horns are adjusted to give their best performance before leaving the works and will give a long period of service without any attention.

If the horn becomes uncertain in action, or does not vibrate, it has not necessarily broken down.

The trouble may be due to a discharged battery or a loose connection, or short circuit in the wiring of the horn.

The performance of the horn may be upset by the fixing bolt working loose, or by the vibration of some part adjacent to the horn.

To check this, remove the horn from its mounting, hold it firmly in the hand by its bracket, and press the push.

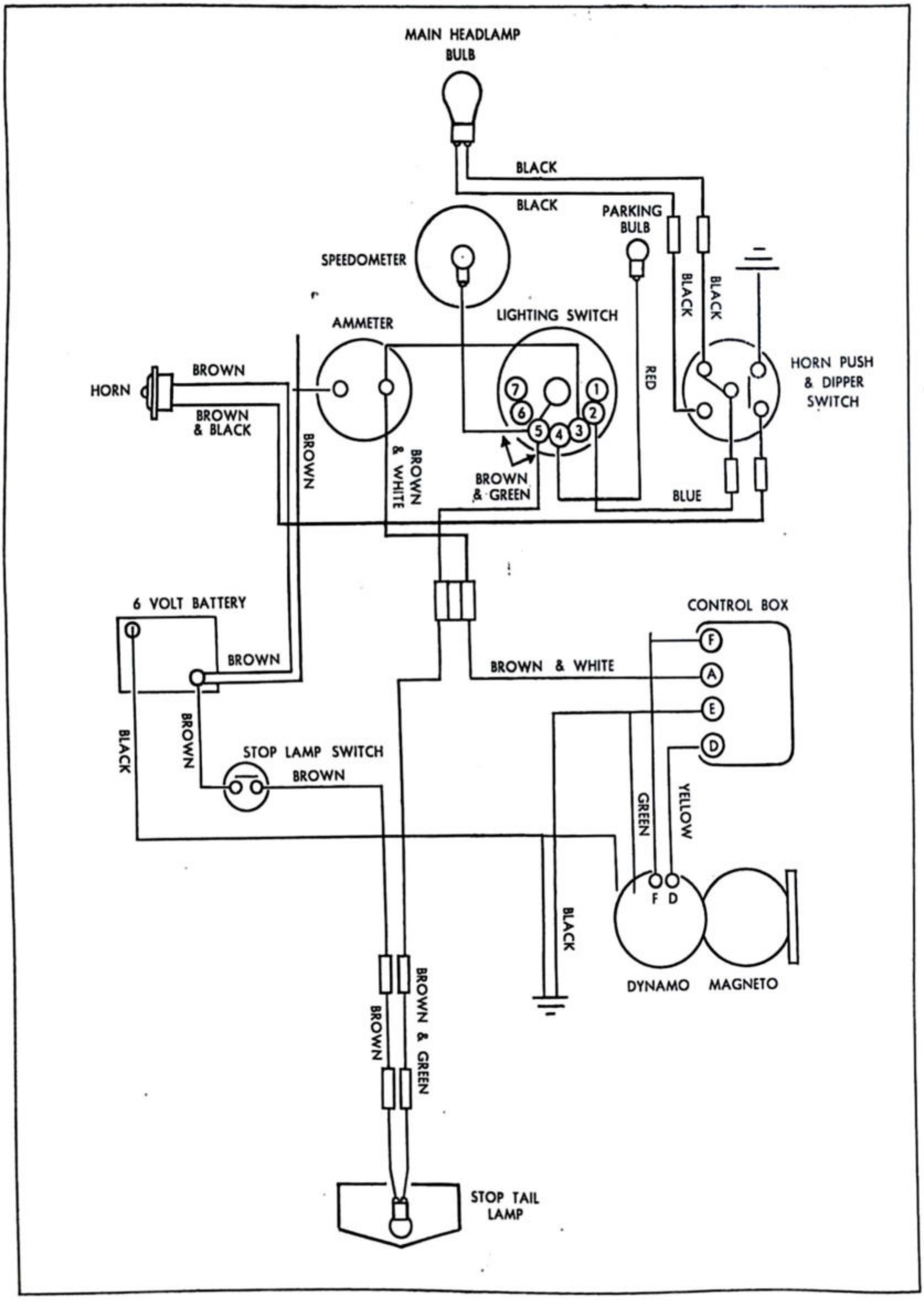
If the note is still unsatisfactory, the horn may require adjustment and should be taken to a Lucas Service Station.

102.* TAIL, STOP AND NUMBER PLATE LAMP.

This lamp is equipped with a double filament bulb; one 3 watt filament to provide rear light and number plate illumination, and and 18 watt filament controlled by the action of the rear brake.

To obtain access to the bulb, remove the two screws securing the plastic cover and lift off the cover. The bulb holder has staggered slots to ensure correct fitting. The correct bulb is Lucas No. 352 6 volt 3/18 watt.

WIRING DIAGRAM FOR ELECTRICAL EQUIPMENT



LOCATING AND RECTIFYING POSSIBLE TROUBLES

TROUBLE	*POSSIBLE CAUSES.*	*REMEDY*
Failure to Start.	Faulty plug. Faulty H.T. lead. Contact breaker points dirty or out of adjustment.	Remove plug, place plug body in contact with cylinder, revolve engine. If blue spark of fair intensity occurs, plug and ignition O.K.
	Pick-up brush worn or broken. Slip ring oily.	If no spark, change plug, and if still no spark, remove plug from H.T. lead, hold end of lead $\frac{1}{8}$" from cylinder and revolve engine. In the event of there being still no spark, examine contact breaker points and check their gap. Examine pick-up brush and clean slip ring.
	Failure of petrol to reach mixing chamber.	Ensure that petrol is flowing down feed pipes. Clean carburetter.
	Broken Throttle Wire.	Ensure that throttle slide rises as twist grip is revolved.
Erratic Slow Running.	Pilot adjustment requires re-setting.	With throttle about $\frac{1}{8}$" open and air closed, adjust pilot screw until good idling is obtained.
	Worn inlet valve guide.	Remove valve spring and test valve for side play in guide.
	Faulty valve seats.	Examine and re-grind as necessary.
Loss of Power.	No tappet clearance.	Check and re-set as required.
	Exhaust valve lifter holding valve off seat.	Ensure that there is some movement in cable before lever begins to lift valve.
	Front chain too tight.	Adjust.
	Loose carbon wedged on valve seat.	Can usually be removed by kicking engine over a few times.
	Broken piston rings.	Examine and replace as required.
Excessive Oil Consumption.	If accompanied by black smoke from exhaust, broken piston rings, worn rings or barrel.	Examine and make necessary replacements.
	Oil pump not returning.	With engine running an intermittent stream of oil should be seen upon opening oil tank filler cap.
	If unaccompanied by exhaust smoke, faulty oil pump timing cover connection.	Ensure that the necessary pressure is generated between timing cover and oil pump nipple fibre washers as instructed in para 21.
Engine Runs Harshly.	Mag. chain too tight.	Adjust as in para. 27.
Engine Cuts Out at Large Throttle Openings.	Dirt in carburetter.	Clean and re-adjust.

LOCATING AND RECTIFYING POSSIBLE TROUBLES

TROUBLE	*POSSIBLE CAUSES.*	*REMEDY*
Inefficient Brakes. (Front or Rear)	Grease on lining.	Examine and wash in petrol. Do not wash in paraffin.
	Tightness in mechanism.	Make sure that cam is free in its bearing and pedal not binding on spindle due to mud.
Slipping Clutch.	Cable adjusted too tightly.	Re-adjust cable until there is some movement on handle-bar lever before clutch operates.
	Inner cable too long. Clutch worm lever fouling gear box casing.	Shorten and re-adjust.
	Oil on plates (usually caused by overfilling oil bath.	Dismantle clutch plates and wash in petrol.
	Tightness in operating mechanism.	Examine, clean and free off as necessary.
Clutch Hard to Free	Clutch cable adjuster screwed right out, clutch worm lever not at correct angle, and therefore not having a straight pull.	Re-set clutch worm lever to give straight pull. Shorten inner cable and re-adjust.
Failure to Effect Gear-Changing.	Over revving especially from 1st to 2nd.	
Gear Changing Accompanied by Excessive Noise.	Slack rear chain.	Adjust as necessary.
Failure of Footchange Lever to Return to Normal Position.	Broken hairpin return spring.	Remove positive mechanism cover and front plate. Examine spring, renew as required.
Steering Rolls or Wanders.	Loose head adjustment.	
Twist Grip Closes if Released.	Tension requires adjusting.	Screw in adjuster one or two turns.
Steering appears Tight on Corners.	Steering damper binding, caused by bent frame anchor bracket.	Remove anchor bracket and re-set to correct angle.