June, 1948 Price 5/-

WORKSHOP MAINTENANCE MANUAL

FOR THE

ROYAL ENFIELD

350 c.c. O.H.V.

MOTOR CYCLES

MODELS WD/CO and WD/CO/B

THE ENFIELD CYCLE COMPANY LTD.

HEAD OFFICE AND WORKS: REDDITCH, WORCS.

Telegrams:
" Cycles, Phone, Redditch."

Telephone:
Redditch, 121 (8 lines).

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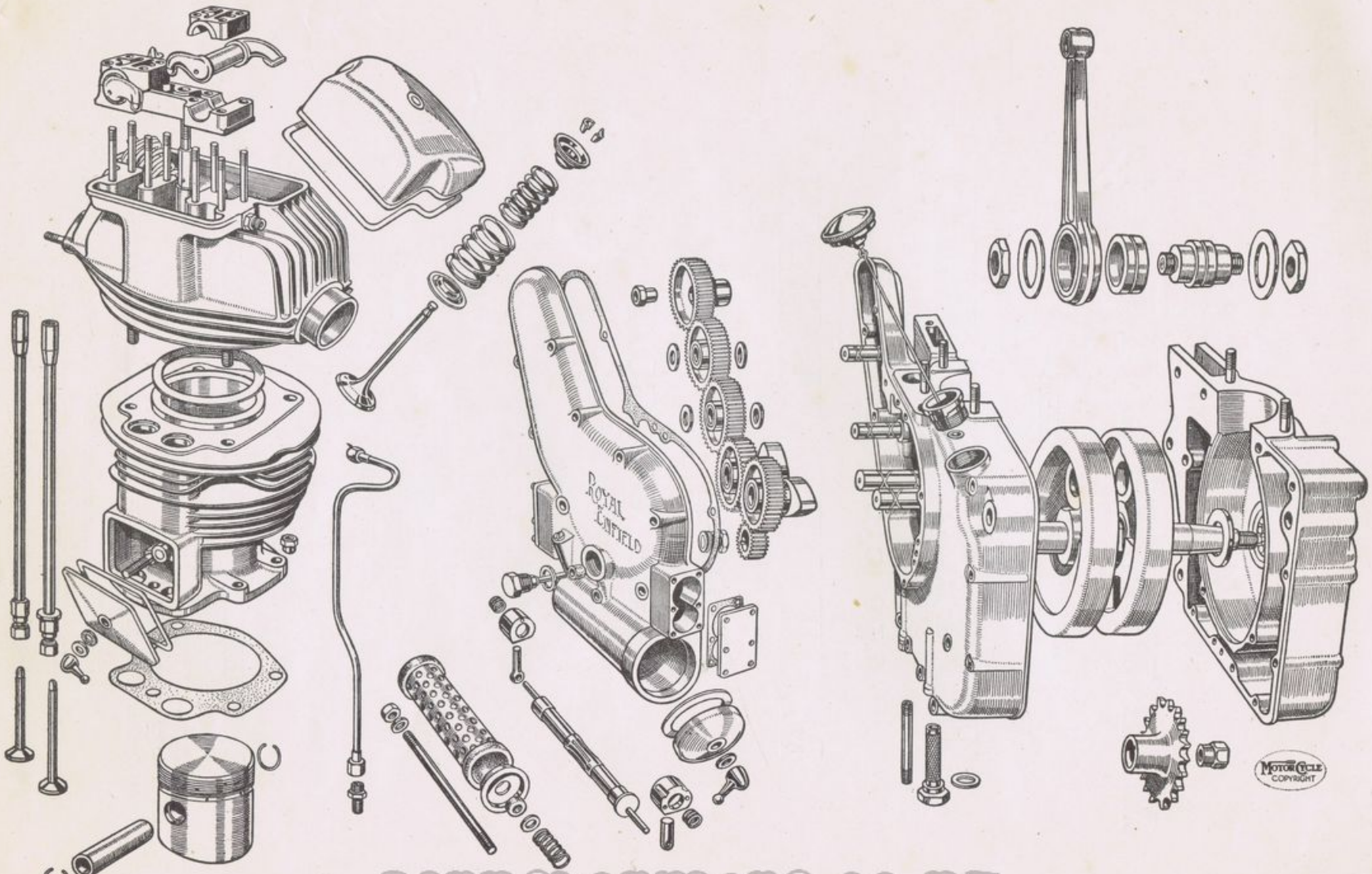


EXPLODED VIEW OF ENGINE

(Frontispiece)

CONTENTS

SUPPLEMENT FOR BURMAN GEAR BOX 41—49.

LIST OF ILLUSTRATIONS

ILLUSTRATIONS IN SUPPLEMENT.

PERIODICAL ATTENTIONS

EVERY 2,000 MILES

Drain engine oil from tank and engine sump when warm, i.e., after a run, and refill. **See Para. 26.** On new and reconditioned engines this operation must be carried out after the first 500 miles.

Rear Chain. Remove for cleaning and attention. **See Para. 34**

EVERY 5,000 MILES

Engine Oil Filter. A new felt element must be fitted. **See Para. 26.**

Gear Box. Drain when warm, i.e., after a run and refill to correct level. **See Para. 31.** Drain plug is underneath gearbox.

Chain Case. Drain chain case by unscrewing left foot rest nut and pulling off foot rest and outer half of chain case. Clean thoroughly, taking care not to allow oil to reach rubber sealing band. Refit and fill up to level of overflow plug. **See Para 34.**

Magdyno. Insert a few drops of light machine oil in the lubricator in the end cap of the dynamo.

Magneto. The wick lubricating the contact breaker face cam should be recharged with lubricant. **See Para. 54.**

Steering Head. The steering head races should be dismantled and reassembled with fresh grease.

Brakes. These should be dismantled, cleaned and have the operating cams greased. **See Para. 42.**

DATA

ROYAL ENFIELD 350 c.c. O.H.V. MOTOR CYCLE

ENGINE.

Cubic Capacity	346 c.c.
Stroke	90 m.m.
Bore	70 m.m. (2·751 in. ± ·00025 in.)

(Rebore to ·015 in. when wear exceeds ·008 in. and again to ·030 in. after further ·008 in. wear.)

Compression Ratio	5¾ to 1
Piston Dia. — Bottom of Skirt — Fore and Aft	2·748in. ± ·00025 in.
Piston Dia. — Bottom of Skirt — Sides	2·740in. ± ·00025 in.
Piston Dia. — Top of Skirt — Fore and Aft	2·745 in. ± ·00025 in.
Piston Dia. — Top of Skirt — Sides	2·737in. ± ·00025 in.
Piston Dia. — Top Lands	2·7285 in. ± ·0005 in.
Piston Ring Dimensions — Width—Plain Rings	1/16 in.
Scraper Ring	5/32 in.
Radial Thickness	·119 in. ± ·004 in.
Gap when in unworn cyl.	·011 in. to ·015 in.
Clearance in grooves	·003 in.
Oversize Pistons and Rings available	·015 in. and ·030 in.
Piston Boss Internal Diameter	·7500 in.—·7495 in.
Gudgeon Pin Diameter	·7500 in.—·7495 in.
Small End Bush Internal Diameter (fine bored or reamered after fitting)	·7507 in.—·7505 in.
Big End Bush Internal diameter (ground after fitting)	1·625 in. ± ·00025 in.
Crank Pin Diameter	1·249 in.—1·24875 in.
Main Bearing Outer Race inside diameter (before fitting)	1·3752 in.—1·3750 in.
Timing Side Bush inside diameter (reamered after fitting)	·877 in.—·875 in.
Driving Side Shaft Diameter	·8750 in.—·8745 in.
Timing Side Shaft Diameter	·8750 in.—·8745 in.
Roller Diameter	·2500 in.—·2490 in.

(Graded to nearest ·0001 in. and selective assembly used.)

Rocker Bearing inside diameter	·6255 in.—·6250 in.
Rocker Diameter	·6240 in.—·6235 in.
Valve Guide inside diameter (before fitting)	·3447 in.—·3437 in.
Valve Stem Diameter—Inlet	·3435 in.—·3425 in.
Valve Stem Diameter—Exhaust	·3415 in.—·3405 in.
Valve Tappet Clearance (with cold engine) Inlet	·002 in.
Valve Tappet Clearance (with cold engine) Exhaust	·004 in.

Valve Timing at ·005 in. tappet clearance—

Exhaust	opens	75° before b.d.c.
„	closes	35° after t.d.c.
Inlet	opens	30° before t.d.c.
„	closes	60° after b.d.c.

Valve Spring Free Length (outer and inner)	1¾ in.

(Renew valve spring when free length is reduced by ⅛ in.)

Cam Bush inside diameter (reamered after fitting)	·6255 in.—·6250 in.
Idler Pinion Bush inside diameter (reamered after fitting)	·502 in.—·501 in.
Cam Spindle	·6245 in.—·6235 in.
Idler Pinion Spindle	·49925 in.—·49825 in.

TRANSMISSION.

Sprockets—Engine	19 T ½ in. P. × ·305 in. W.
Sprockets—Clutch	42 T. ½ in. P. × ·305 in. W.
Sprockets—Countershaft	18 T. ⅝ in. P. × ·380 in. W.
Sprockets—Rear Wheel	46 T. ⅝ in. P. × ·380 in. W.
Chains—Front	74 pitches ½ in. P. × ·305 in. W.
Chains—Rear	89 pitches ⅝ in. P. × ·380 in. W.
Chain Adjustment—Front	¼ in. slack.
Chain Adjustment—Rear	½ in. slack.
Gear Ratios —First	18·6 to 1
Gear Ratios —Second	11·2 to 1
Gear Ratios —Third	7·9 to 1
Gear Ratios —Top	5·65 to 1
Clutch Thrust Rod Length	long part 9⅜ in. short part 1⅞ in.
Clearance in Clutch Control	1/16 in.

Gear Box Ball Bearings—

Large—Internal Dia.	30 m.m.	SKF 6206
Large—External Dia.	62 m.m.	SKF 6206
Large—Width	16 m.m.	SKF 6206
Small—Internal Dia.	⅝ in.	SKF RMS 5
Small—External Dia.	1 13/16 in.	SKF RMS 5
Small—Width	⅝ in.	SKF RMS 5

Gear Box Layshaft Bearings (reamered after fitting)—Left side—Internal Dia.	1·001 in.—1·000 in.
Gear Box Layshaft Bearings (reamered after fitting)—Right side—Internal Dia.	·7195 in.—·7185 in.
Kickstarter Shaft Bearing Internal Dia.	1·1255 in.—1·1250 in.

FRAME AND WHEELS.

Wheel Hub Ball Races—

Front—Internal Diameter	12 m.m.	SKF 6301
Front—External Diameter	37 m.m.	SKF 6301
Front—Width	12 m.m.	SKF 6301
Rear—Internal Diameter	⅝ in.	SKF RMS 5
Rear—External Diameter	1 13/16 in.	SKF RMS 5
Rear—Width	⅝ in.	SKF RMS 5

Wheel Rim Size	W.M. 2–19in. for 3·25—19 in. Tyre.

Front and rear rims interchangeable.

Wheel Spokes—

Front, near side	6½ in. long	All 8—10g. butted. Screwed ·140 in. dia. × 40 T.P.I.
Front, off side	8¾ in. long	All 8—10g. butted. Screwed ·140 in. dia. × 40 T.P.I.
Rear, near side	7¾ in. long	All 8—10g. butted. Screwed ·140 in. dia. × 40 T.P.I.
Rear, off side	8½ in. long	All 8—10g. butted. Screwed ·140 in. dia. × 40 T.P.I.

Spoke lengths measured under head.

Cush Drive, allowable free movement at wheel rim when rear brake is on	½ in. to 1 in.
Steering Head Balls	¼ in. dia. 38 to set (19 each race).

DATA—continued

CARBURETTOR.

Type and Number	Amal. 276 AC/1A.
Main Jet Size	130.
Throttle Valve	6/4

Taper Needle located by clip in third notch from top.

IGNITION.

Contact Breaker Maximum opening	·012 in.
Ignition Setting	$\frac{3}{8}$ in. before t.d.c. = 34° advance.
Sparking Plug—Size	14 m.m. $\frac{1}{2}$ in. reach.
Type	Lodge C.14 Sintox. or Champion L.10S.
Gap Setting	·018 in. to ·020 in.

GENERAL.

Petrol Tank Capacity	$2\frac{3}{4}$ gallons (including $\frac{1}{4}$ gallon reserve).
Oil Tank Capacity	4 pints.
Gear Box Capacity	$\frac{3}{4}$ pint.

TOOLS SUPPLIED WITH MACHINE

TOOL ROLL AND CONTENTS

No. per Set	Part No.	Description.
1	29044	Double-ended Spanner—Engineers' Patt. ($\frac{1}{4}$″ × $\frac{5}{16}$″ Whit.)
1	2976	,, ,, ,, ($\frac{3}{8}$″ × $\frac{7}{16}$″ Whit.)
1	24092	,, ,, ,, (·380″ × ·343″ hex. —also ·380″ sq.)
2	24096	,, ,, ,, ($\frac{3}{16}$″ × $\frac{1}{4}$″ Whit.).
1	28976	Tubular Spanner ($\frac{1}{4}$″ Whit.). (For Cylinder base nuts).
1	16594	,, ,, ($\frac{9}{16}$″ Whit.).
1	21166	,, ,, ($\frac{7}{16}$″ ,,).
1	24094	,, ,, ($\frac{11}{16}$″ ,,).
1	29043	,, ,, ($\frac{3}{16}$″ ,,).
1	24097	,, ,, ($\frac{5}{16}$″ × $\frac{3}{8}$″ Whit.).
1	29042	Tommy Bar (Bent).

No. per Set	Part No.	Description.
1	28996	Swivel Pin and Chain Adjuster Spanner (to fit $\frac{5}{16}$″ square).
1	16008	Magneto Spanner (·255″ × ·283″ hex. with ·012″ feeler).
1	29101	Pump Cover Pin Spanner (·255″ hex. with ·018″ feeler).
1	4272	Tyre Lever (cranked type).
2	4272A	,, Levers (spoon type).
1	3482	Screwdriver, 6″, wire.
1	14835	Extractor Nut (Dynamo Pinion).
1	16014	Grease Gun.
1	16007	Tool Roll (with strap—less tools).
4	25861	Hallite Washers for Push Rod Tubes.

SUPPLEMENTARY KIT

1	27528	Oil Can.
1	27389	,, Funnel.
1	27575	Pliers, 7″.
1	27574	Adjustable Spanner, 7″.
1	27576	Screwdriver, 6″.
1	27388	Chain Rivet Extractor.
1	27387	Tyre Repair Outfit.
1	29382	Box of Spare Links ($\frac{5}{8}$″ pitch chain).
1	27383	Packet of insulating Tape.
2	27386	Leather Straps.

ENGINE

DECARBONISING.

1. Removal of Cylinder Head.

Decarbonising will normally be necessary approximately every 2,000 miles and can be carried out without removal of the engine from the frame.

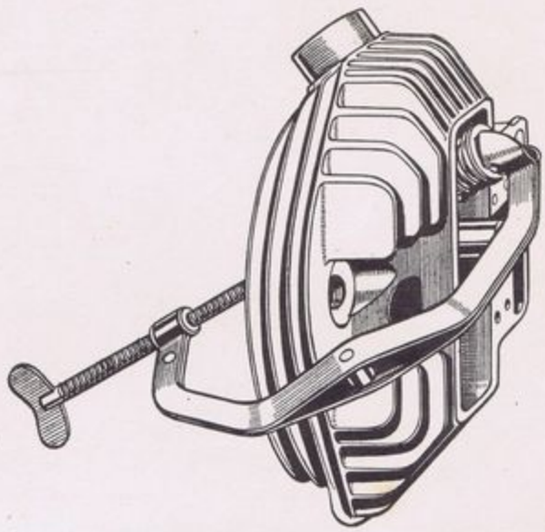
First remove the petrol pipe and the four bolts underneath the tank which secure it to the brackets and remove the tank. (If necessary the front saddle attachment bolt must be removed.) Next remove the cover over the valve gear, the carburettor, exhaust pipe and silencer. Remove the rocker bearing caps and rockers and lift the push rods out of their tubes (if the collar on the exhaust push rod will not clear the joint between the cylinder head and the barrel, leave this rod in position until after the head has been lifted off). The cylinder head can then be lifted off after unscrewing the four nuts which secure it to the cylinder.

2. Removal of Cylinder and Piston.

While it is not strictly necessary to remove the cylinder barrel and piston, this should preferably be done so that the condition of the piston, rings and big-end bearing can be examined. To remove the cylinder barrel after removal of the head, unscrew the **five** cylinder base nuts (the fifth nut is inside the tappet chest between the two tappets), disconnect the exhaust lifter cable from the handlebar lever, place the piston at the bottom of its stroke and lift the barrel off. To remove the piston, push out the gudgeon pin, after removal of the wire retaining clips with a suitable tool (such as the tang end of a small file) and lift the piston off the rod. Mark the piston so as to ensure reassembling the same way round.

3. Removal of Valves.

To remove the valves from the cylinder head, first lift off the hardened end caps from the valve stems. If these have stuck, they can be removed by compressing the spring slightly and gripping the end cap in a vice (see Fig. 1). Then compress the valve springs with a suitable compressor, lift out the split conical collars and release the springs, when the valve can be withdrawn. Fig. 2 shows a Terry compressor in use, Fig. 3 a special type suitable for a large workshop. Keep the split conical collars and the top spring collars paired up with their respective valves and replace in the same positions when reassembling.

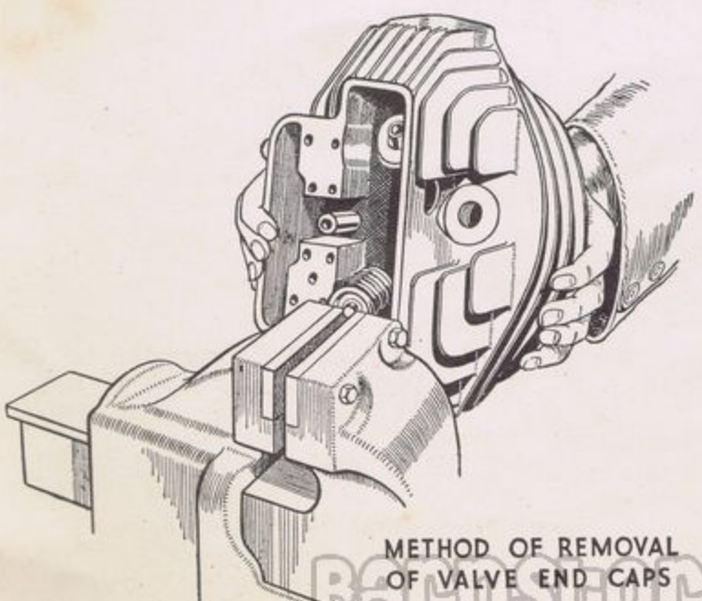


USE OF TERRY TYPE VALVE SPRING COMPRESSOR.

Fig. 2

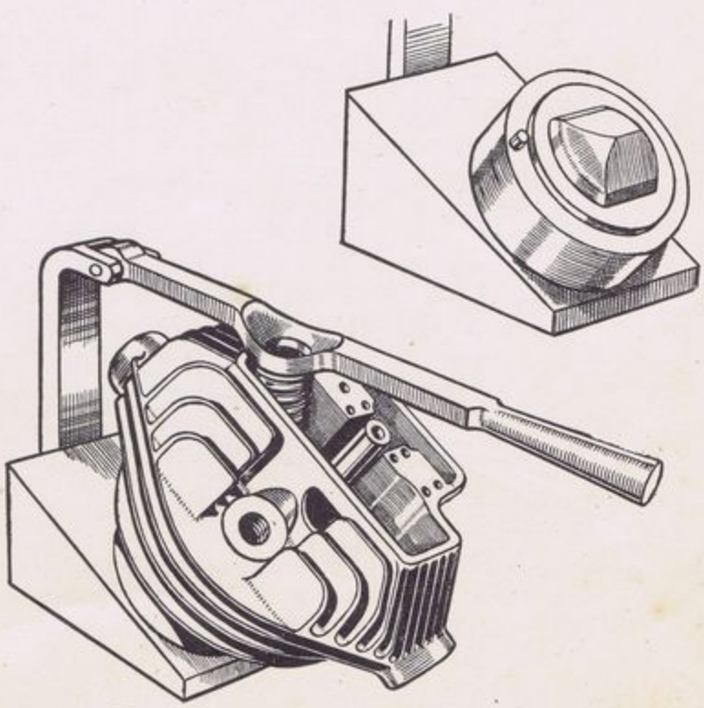
4. Removal of Carbon.

Remove carbon from the valves, ports and combustion chamber by scraping or by immersion in a solution of 4 ozs. of commercial potash to a gallon of water. Carefully remove the piston rings. Remove carbon from the ring grooves and the top of the piston by carefully scraping, taking care not to dig into the aluminium. **On no account allow potash solution to come into contact with an aluminium piston.**



METHOD OF REMOVAL OF VALVE END CAPS

Fig. 1



BENCH TYPE VALVE SPRING COMPRESSOR.

Fig. 3

5. Piston and Rings.

If the piston rings are in good condition they can be replaced, taking care to fit them in their original grooves and the same way up. If the rings show brown or black patches on their working faces or if their gaps when in position in the barrel are more than $\frac{1}{16}$ in. new rings should be fitted. The correct gap for new rings is ·011—·015 in. The gap should be measured in the least worn part of the cylinder which will be found to be at the extreme top or bottom of the bore.

The original size of the cylinder bore is 2·751 in. If the wear at any point in the bore exceeds ·008—·010 in. the cylinder should be rebored and an oversize piston fitted. Piston sizes available are ·015 in. and ·030 in. oversize. The original diameter of the piston skirt, measured fore and aft, is 2·748 in. at the bottom and 2·745 in. at the top. Diameters parallel to the gudgeon pin are ·008 in. less. The original side clearance between the piston rings and the grooves is ·003 in. If the piston skirt or the grooves show ·005 in. wear the piston should be replaced.

6. Big End Bearing.

While the piston is removed examine the condition of the big-end. This should have about ·010—·020 in. side play and it will be possible to rock the connecting rod slightly. The big-end is a plain bearing and has an original clearance of approximately ·003 in. which is rather more than is usual with a roller bearing. If, however, **definite** up and down play can be felt the engine should be stripped further to have the big-end renewed.

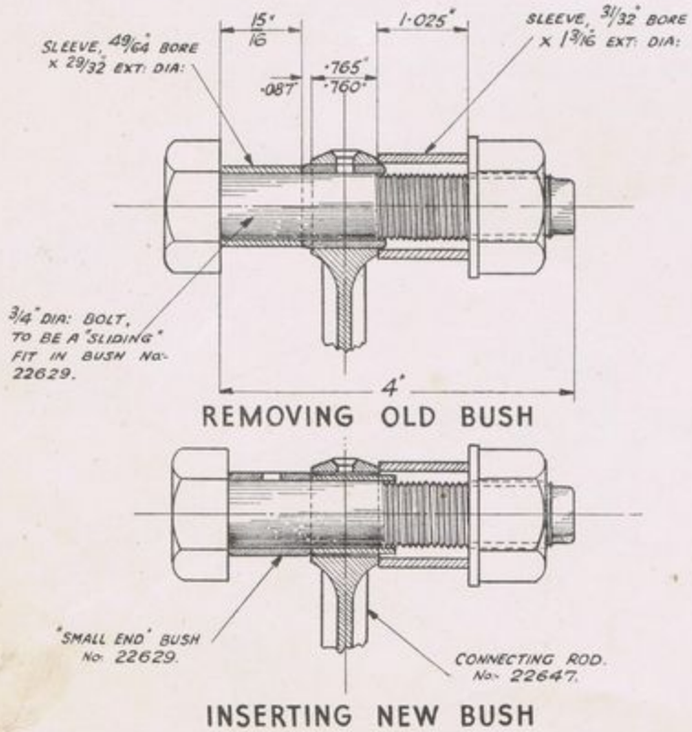
7. Small End Bearing.

The gudgeon pin should be a push fit in the piston (when cold) and a free working fit (·001 in. clearance) in the small end bush. The small end bush can be renewed if worn, using a draw bolt as shown in Fig. 4, both for withdrawing the old bush and fitting the new one. After fitting, the bush must be reamered, the size to suit a new gudgeon pin being ·7507—·7505 in.

8. Valves, Springs and Guides.

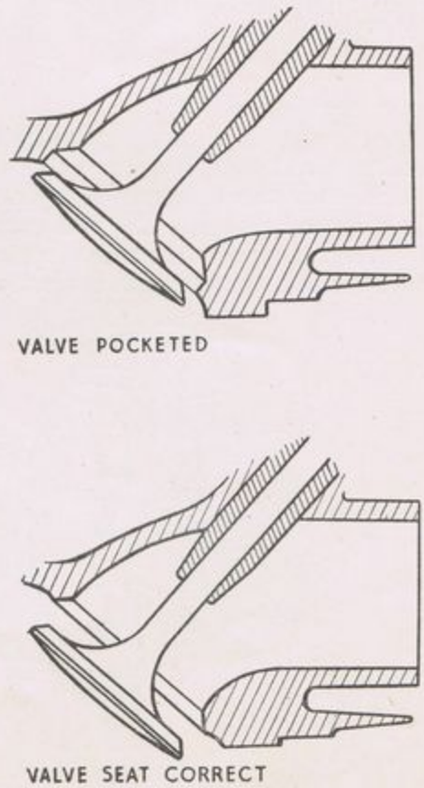
Wear on the valve stems can be seen on examination and if a definite step has formed the valves should be renewed. Test the valve guides for wear by trying the fit of a new valve in them. Both valves should be quite free, but the exhaust valve has ·002 in. more clearance than the inlet valve. The guides are removed by knocking or pressing them out from inside the head using a drift $\frac{9}{16}$ in. maximum diameter with one end reduced to $\frac{21}{64}$ in. diameter, supporting the head on a tube $\frac{13}{16}$ in. inside diameter 2 ins. long slipped over the collar on the guide. The same drift can be used for fitting the new guide. Check the length of the valve springs which are originally $1\frac{3}{4}$ ins. for both outer and inner springs. If these have closed more than $\frac{1}{8}$ in. they should be renewed.

Before replacing the valves they must be ground on to their seats. If good faces are not formed with a reasonable amount of grinding the seats must be cut with a cutter (included angle 90°) and the valve refaced in a Universal Grinder, or if this is not available by spinning in a chuck and holding a strip of emery cloth on the back of a file at 45° to the valve stem. Do not attempt to form good seats by an excessive amount of grinding. This will cause pocketing which restricts the flow of the gases (see Fig. 5). If a pocket has already been formed this must be removed by cutting with a valve seat cutter larger in diameter than the valve



TOOL FOR REMOVING OLD AND INSERTING NEW BUSH IN SMALL END OF CONNECTING ROD

Fig. 4



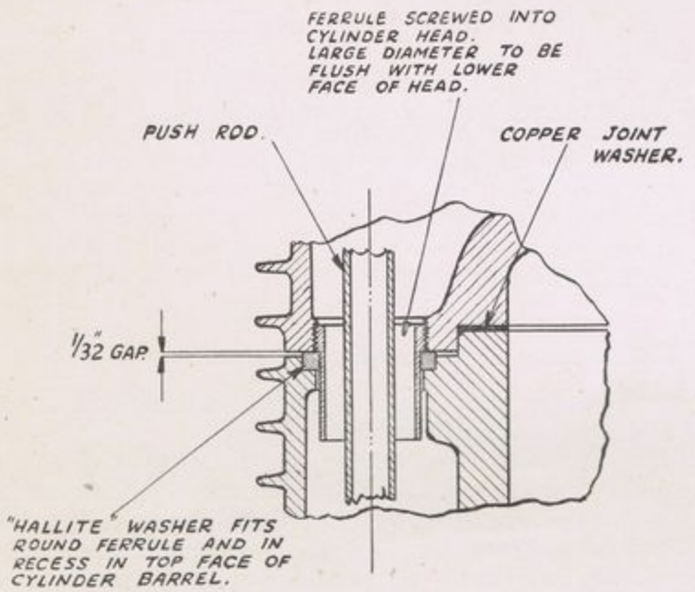
CORRECT AND INCORRECT CUTTING OF VALVE SEATS

Fig. 5

head. Do not interchange the inlet and exhaust valves, as there is a difference of ·002 in. in the stem diameter.

9. Reassembly of Engine after Decarbonising.

When reassembling the engine, take great care to have all parts perfectly clean and put clean oil on the piston, particularly round the rings. The cylinder base joint must be made with a paper washer which must have a small hole in it registering with the oil feed to the back of the cylinder. The cylinder head joint may be made with the old copper washer which, however, should preferably be annealed by heating to red



DETAIL OF JOINTS IN PUSH ROD ENCLOSURE TUBES

Fig. 6

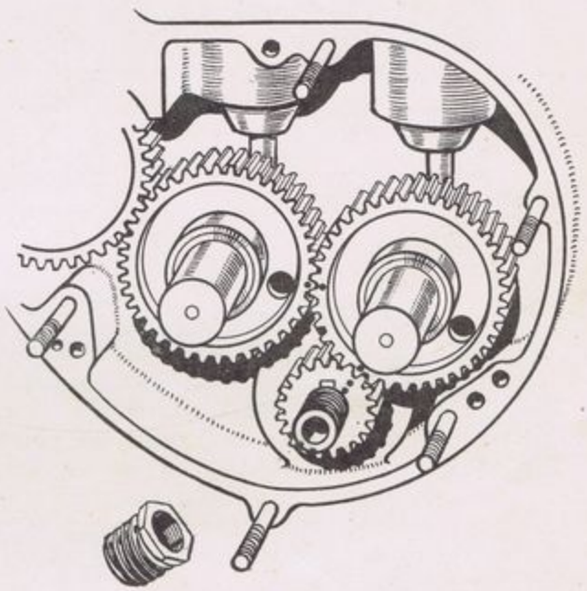
heat then quenching. New Hallite washers painted with gold size or shellac should be fitted to make the joints in the push rod enclosure tubes (see Fig. 6). When tightening down the cylinder base nuts, work diagonally from one to another to ensure pulling the base down dead level. When tightening down the cylinder head nuts put pressure first of all on the two at the push rod side of the engine so as to ensure compressing the push rod enclosure tube washers thoroughly and bringing even pressure on the copper head gasket. When replacing the valve rockers and caps put a little oil on each rocker and make sure that the rocker is free after the cap has been tightened down. If necessary, a sharp tap on the end of the rocker will usually free it. Excessive play in the rocker bearings can be taken up by grinding a little metal from the lower face of the hardened cap. Very little grinding is required and not more than ·001 in. should be taken off at a time. When replacing the rocker box cover, a new joint washer should be used.

The cylinder head and base nuts should be checked again for tightness, after the engine has been run long enough to get it thoroughly warm.

TIMING GEAR.

10. Valve Timing.

Access to the timing gear is obtained by removal of the timing cover after unscrewing the nine nuts securing it. About half a pint of oil will run out of the timing case. The cam wheels and magdyno drive idler pinions can now be pulled off their spindles, having first turned the engine so that both valves are closed. Correct timing is obtained when the tooth on the exhaust cam wheel having two dots on it meshes with the space having two dots on the small timing pinion, while at the same time the tooth having one dot on the inlet timing wheel meshes with the space having one dot on the exhaust timing wheel (see Fig. 7). In case the two dots



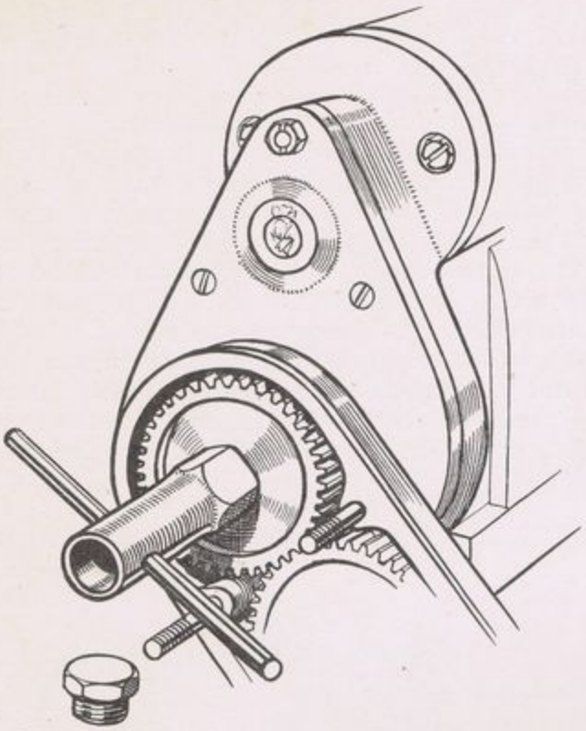
VALVE TIMING MARKS

Fig. 7

on the small timing pinion are covered by one corner of the hexagon on the oil pump driving worm, note that when the piston is at the top of the compression stroke, the single dots on the timing wheels lie on the line joining the centres of the two cam spindles. When replacing the magdyno drive idler pinions note that there is a hardened steel washer on either side of each pinion and that the deeper boss on the pinion is outwards. If the cam wheels have thin shims on either side take care to replace these on the same spindles.

11. Magneto Timing.

The magneto timing is not marked and must be set as follows :—Unscrew the nut which holds the timing pinion on to the magdyno shaft. Then screw the pinion extractor (supplied in the tool kit) into the centre of the timing pinion, thus loosening it from its taper (see Fig. 8). Remove the extractor, set the engine so that the piston is at the top of its compression stroke (seen by removal of the cylinder head or gauged by means of a narrow rule or timing stick passed through the sparking plug hole), see that the contact points open to the correct

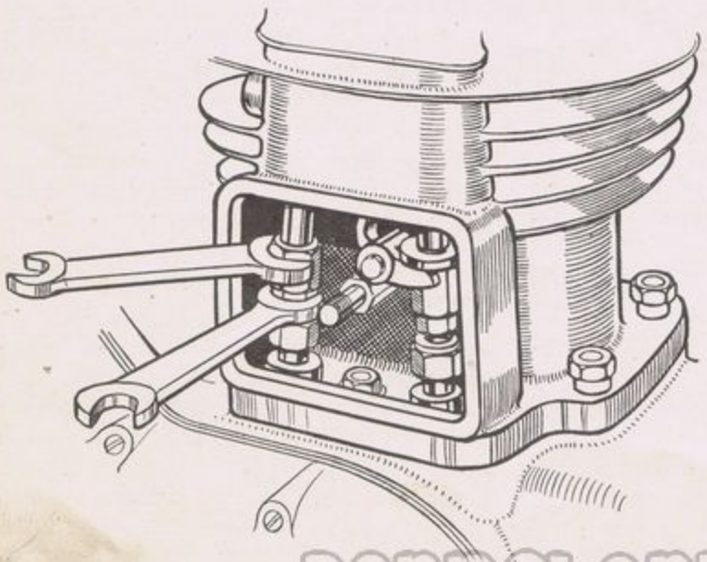


LOOSENING MAGNETO PINION

Fig. 8

figure of ·012 in., set the magneto control to full advance turn the engine backwards until the piston has descended $\frac{3}{8}$ in. and turn the contact breaker forwards (clockwise viewed from contact breaker end) until the points are just about to open. With the engine and contact breaker in these positions, tap the timing pinion lightly on to its taper and lock by means of the timing pinion nut. Check the timing after tightening the nut to make sure that it has not moved.

When replacing the timing cover rotate the engine so as to ensure easy engagement of the worm gears which drive the oil pumps. It is important to use a timing cover joint washer of the correct material and thickness. Make sure also that the cork oil seal which fits inside the pump driving worm is in good condition.



ADJUSTING TAPPETS

Fig. 9

12. Tappet Adjustment.

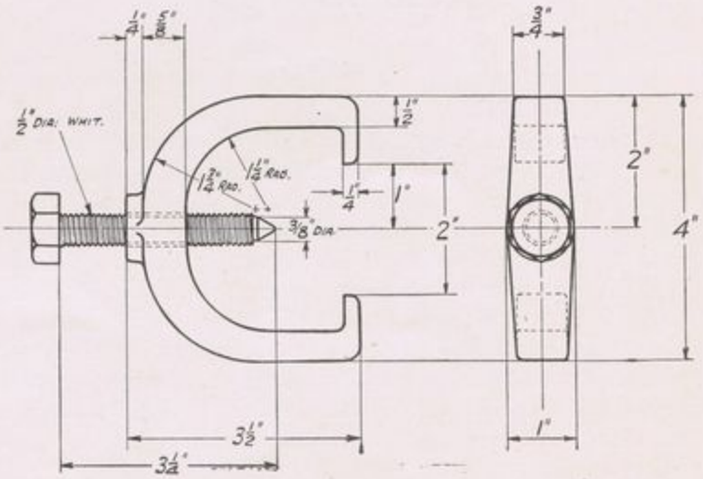
Access to the tappet adjustment is obtained by removing the inspection cover from the side of the cylinder. The exhaust tappet should have ·004 in. clearance; the inlet ·002 in., when the engine is cold. Owing to the ball and socket joint at the bottom of the push rods it is not possible to use feelers at these points. To check the clearance accurately the rocker box cover must be removed and the feelers applied between the ends of the valve stems and the rockers. With a little experience, however, the correct tappet clearance can be obtained by feel, the inlet push rod being just free while the exhaust has perceptible up and down clearance.

To make the adjustment (see Fig. 9) hold the push rod bottom end (top hexagon) and the locknut (middle hexagon). Unlock by turning the locknut to the left and make the adjustment by screwing the push rod cup (bottom hexagon) to the left to take up clearance or to the right to give more clearance, at the same time holding the push rod bottom end. Finally, lock up the locknut against the push rod end and check the clearance after finally tightening the locknut.

COMPLETE OVERHAUL.

13. Removal of Engine from Frame.

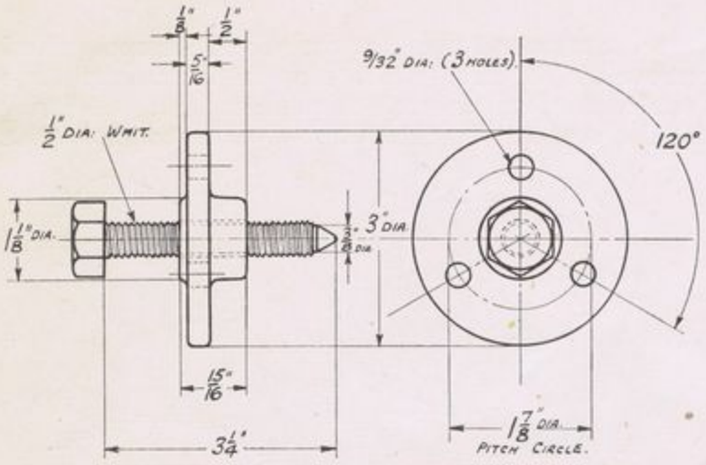
To remove the engine from the frame, first take off the petrol tank, carburettor, exhaust pipe and silencer. Next remove the left footrest and the outer half of the primary chain case, taking care to allow as little oil as possible to come in contact with the rubber sealing band. Unscrew the nut securing the engine sprocket; disconnect the front chain and withdraw the engine sprocket from its taper, using an extractor similar to that shown in Fig. 10. Dismantle the clutch (see



ENGINE SPROCKET EXTRACTOR

Fig. 10

Para. 32) and unscrew the main clutch securing nut (placing the machine in top gear and putting on the brake to prevent the mainshaft turning). Withdraw the clutch centre from its splines by means of an extractor as shown in Fig. 11. Now remove the rear chain,



CLUTCH CENTRE EXTRACTOR
Fig. 11

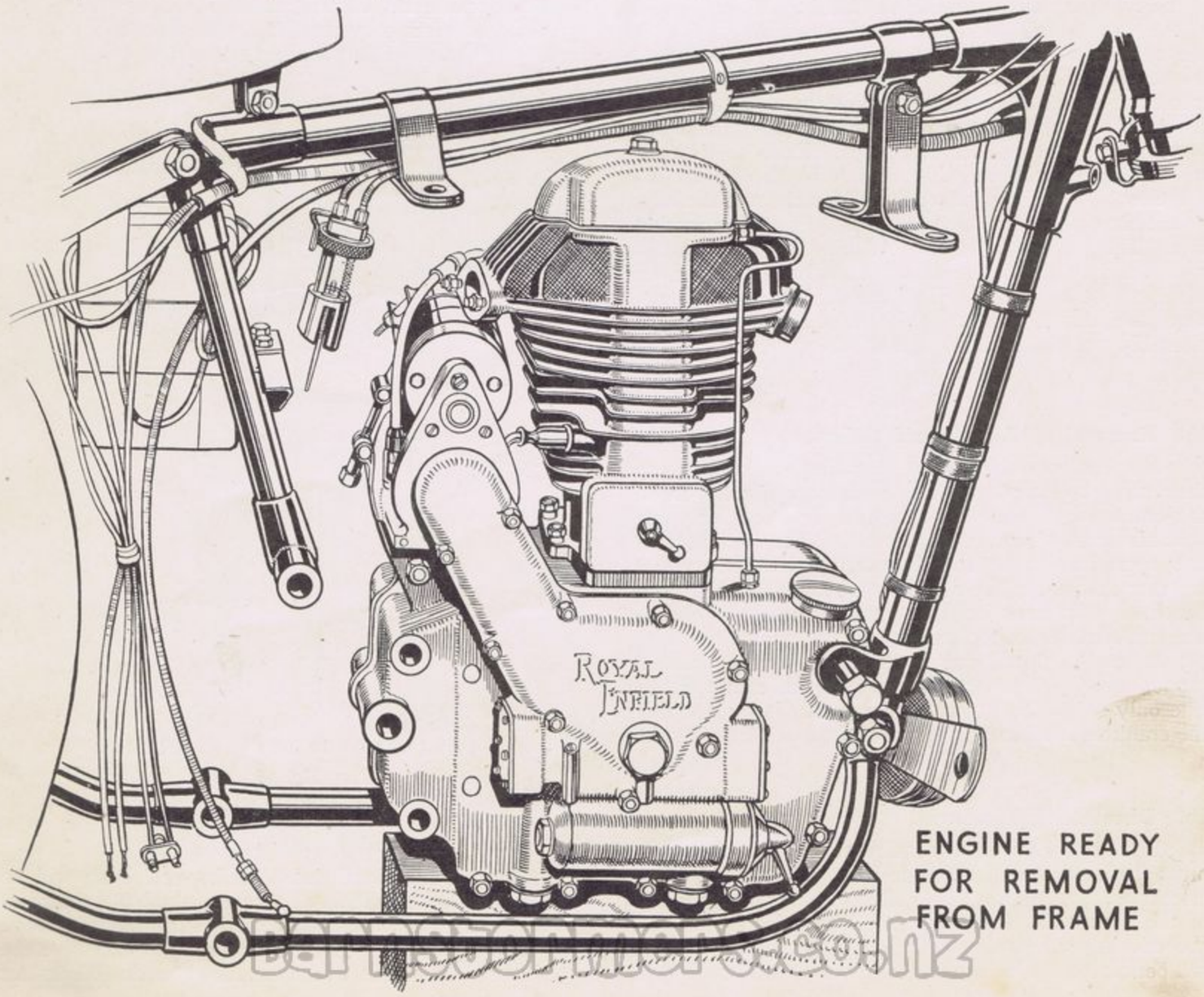
footrest rod, inner half of the primary chain case and the leads to the dynamo ; also the clutch, exhaust lifter and magneto control wires from the handlebars. Remove the top gearbox attachment stud (by unscrewing the nut at the chain case end and knocking out towards the opposite end) and the bottom stud ; also the studs securing the crankcase to the engine plates and the studs and distance pieces securing the engine plates to the bottom of the seat tube of the frame, and to the chain-stays and cradle tubes. Remove both the engine plates and the gearbox. Take the weight of the engine and remove the stud securing the front of the crankcase to the bottom of the down tube of the frame and lift the engine out in a backwards direction. Fig. 12 shows the machine with the engine ready to lift out after removal of the front attachment stud.

Note.

In the case of machines having frame numbers 19827-24826 and 25038-30037 upwards, the frames of which are fitted with tank tubes, it is necessary to remove the front as well as the rear engine plates. The engine can then be removed out to one side.

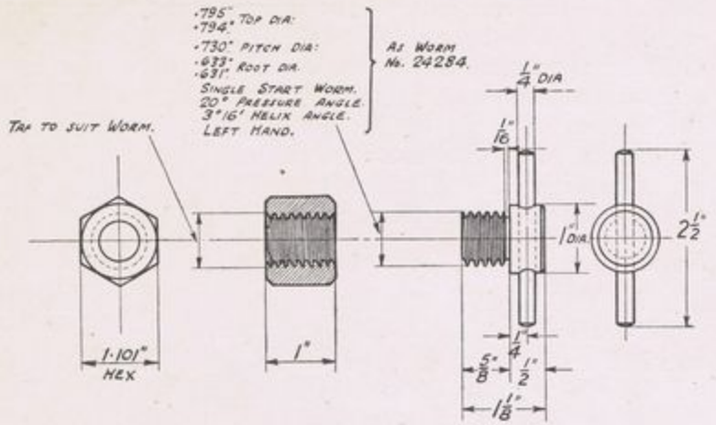
14. Dismantling the Crankcase.

To dismantle the engine, remove the cylinder head, cylinder and timing gear as described in Paras. 1, 2 and 10. Now unscrew the oil pump driving worm, which has a left-hand thread. This can be unscrewed by means of a thin spanner, a small lathe carrier or preferably by using the special tool shown in Fig. 13. The small timing pinion has not sufficient clearance behind it to allow an extractor to be used and must be knocked off its taper by driving a blunt chisel between the back of the pinion and



ENGINE READY FOR REMOVAL FROM FRAME

Fig. 12



PUMP WORM EXTRACTOR

Fig. 13

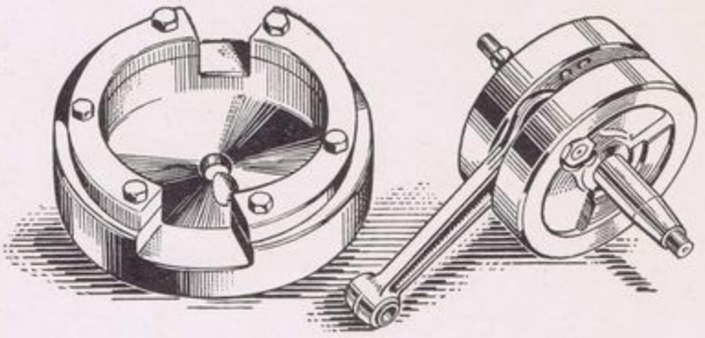
the bronze oil sealing bush behind it, taking care not to damage the bush. Remove the paper cylinder base joint washer and the magdyno pinion (see Para. 11), loosen the strap securing the magdyno and remove this ; also the timing pinion key and engine sprocket key. Next unscrew the two $\frac{5}{16}$ in. nuts just below the magdyno (one each side of the case), the $\frac{5}{16}$ in. nut below the front of the cylinder on the left side and the nuts from one end of the two $\frac{5}{16}$ in. studs passing through the case near the bottom. Then remove the nuts from one end of the seven $\frac{1}{4}$ in. studs which hold the two halves of the crankcase together. Before parting the two halves of the case, as much oil as possible should be drained out by removal of the two oil filter plugs. Even so, a small amount of oil will probably be left in the case. To prevent this running over the work bench, rest the case on the timing side in a clean tray and lift off the driving side. The joint will require breaking by a sharp tap with a soft mallet, after which the driving side can be lifted off quite easily. Lift the driving side rollers, cages and thrust washer off the shaft and the flywheel assembly out of the timing side of the case.

15. Removal of Tappets and Guides.

If the tappet stems, feet or guides are badly worn they must be renewed. The guides are a press fit in the crankcase and can be removed by knocking them upwards with a hammer and drift. The first part of this operation can be done by placing the drift against the tappet foot but for the last part a slightly bent and flattened drift must be used against the lower end of the guide itself. After removal of the guides the inlet tappet can be lifted out but to remove the exhaust tappet it is necessary to knock out the cam spindle. The only satisfactory way of doing this is by dividing the crankcase and knocking out the spindle from inside.

16. Dismantling Flywheels.

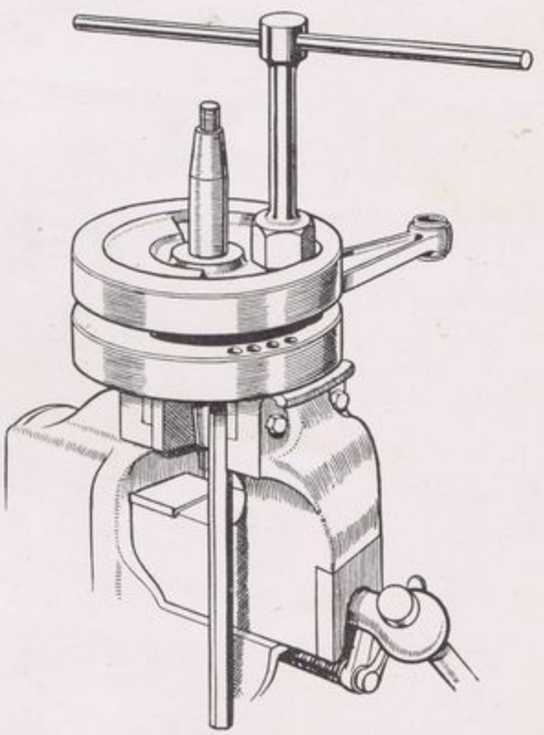
If the big-end bearing requires renewal the flywheels must be separated. To do this use the flywheel assembling jig (Fig. 14) if available, otherwise grip one of the mainshafts in a vice fitted with lead jaws and prevent the wheels from turning by inserting a stout rod between the vice and the edge of the balance weight on the lower wheel (see Fig. 15). From the upper wheel remove the set screw which prevents the crankpin nut from turning and unscrew this nut, using a well-fitting tubular spanner for this purpose. The crankpin is a



FLYWHEEL ASSEMBLY JIG

Fig. 14

press fit in the flywheel and to drive it out the upper wheel must be supported. For this purpose two pieces of channel iron may be used (see Fig. 16). The pin can then either be pressed out or knocked out using a heavy hammer and a stout brass or aluminium drift. Lift the connecting rod floating bush and thrust washers off the crankpin. If the crankpin requires renewal, grip the remaining flywheel in a vice, remove the other crankpin nut and drive the pin out of the wheel.

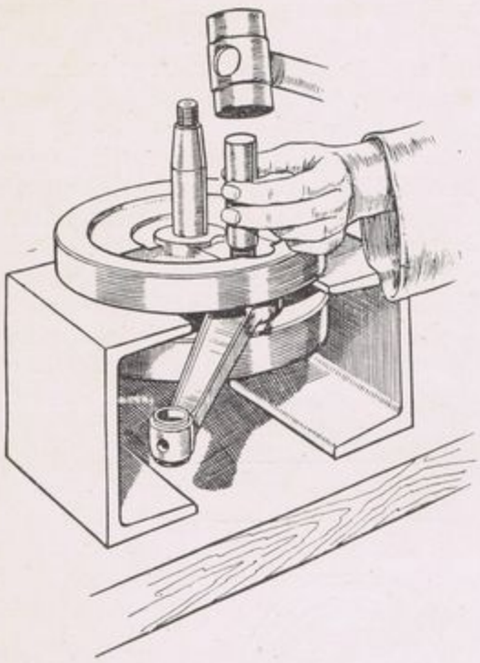


DISMANTLING FLYWHEELS IN VICE

Fig. 15

17. Connecting Rod.

Wear in the hardened steel big-end bush will be shown by the formation of a ridge round the centre of the bearing surface corresponding with the oil groove in the white metal bush. If this wear is excessive the rod should be replaced and returned to the Works for



SEPARATING FLYWHEELS

Fig. 16

reconditioning unless facilities are available for grinding the bush in position in the rod, in which case the old bush should be pressed out and an unground one fitted, this being subsequently ground out to 1·625 in. ±·00025 in. The practice of fitting new ready-ground big-end bushes is not recommended as it is difficult to ensure roundness of the bore if this is done.

Worn small-end bushes can be pressed or drawn out using the drawer shown in Fig. 4. The new bush should be reamered to ·7507—·7505 in.

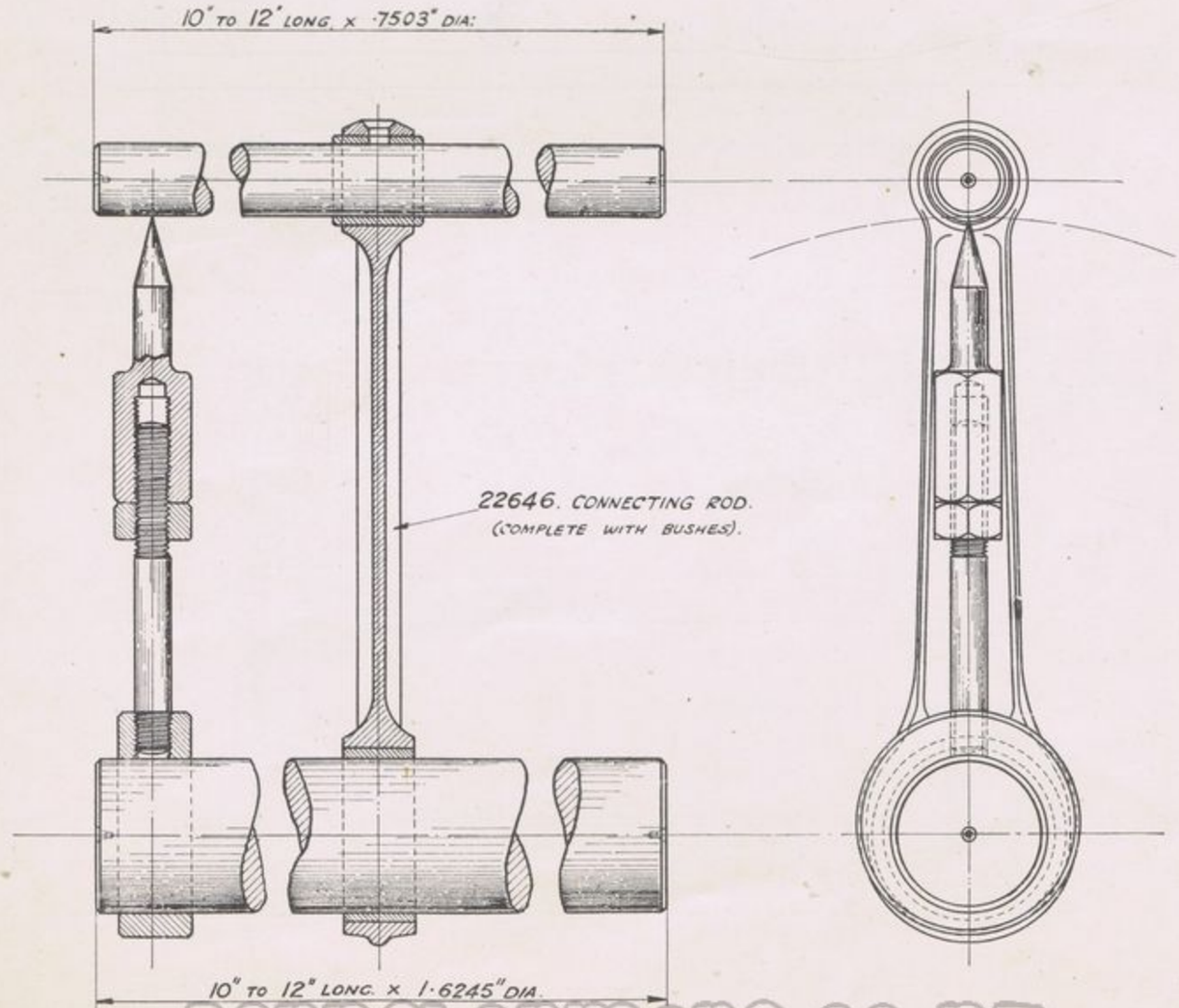
Before refitting the connecting rod it should be checked for freedom from bend or twist using the fixtures shown in Figs. 17 and 18.

18. Removal of and Replacing Mainshafts.

The driving and timing side shafts are held in to their respective flywheels by means of tapers and keys and are easily removed after unscrewing the nuts which secure them. Note the oil release valve in the end of the timing side shaft (see Para. 23). The hollow grub screw securing this must be screwed up tight and the end of the shaft centre punched to prevent the screw coming undone.

19. Reassembly of Flywheels.

Always fit the crankpin into the timing side flywheel first and make sure that the oil hole in the pin registers with the oil passage drilled in the web of the flywheel. The best check on this is to pour oil down the timing side shaft and see that it runs out at the centre of the pin. The small grub screw in the centre of the

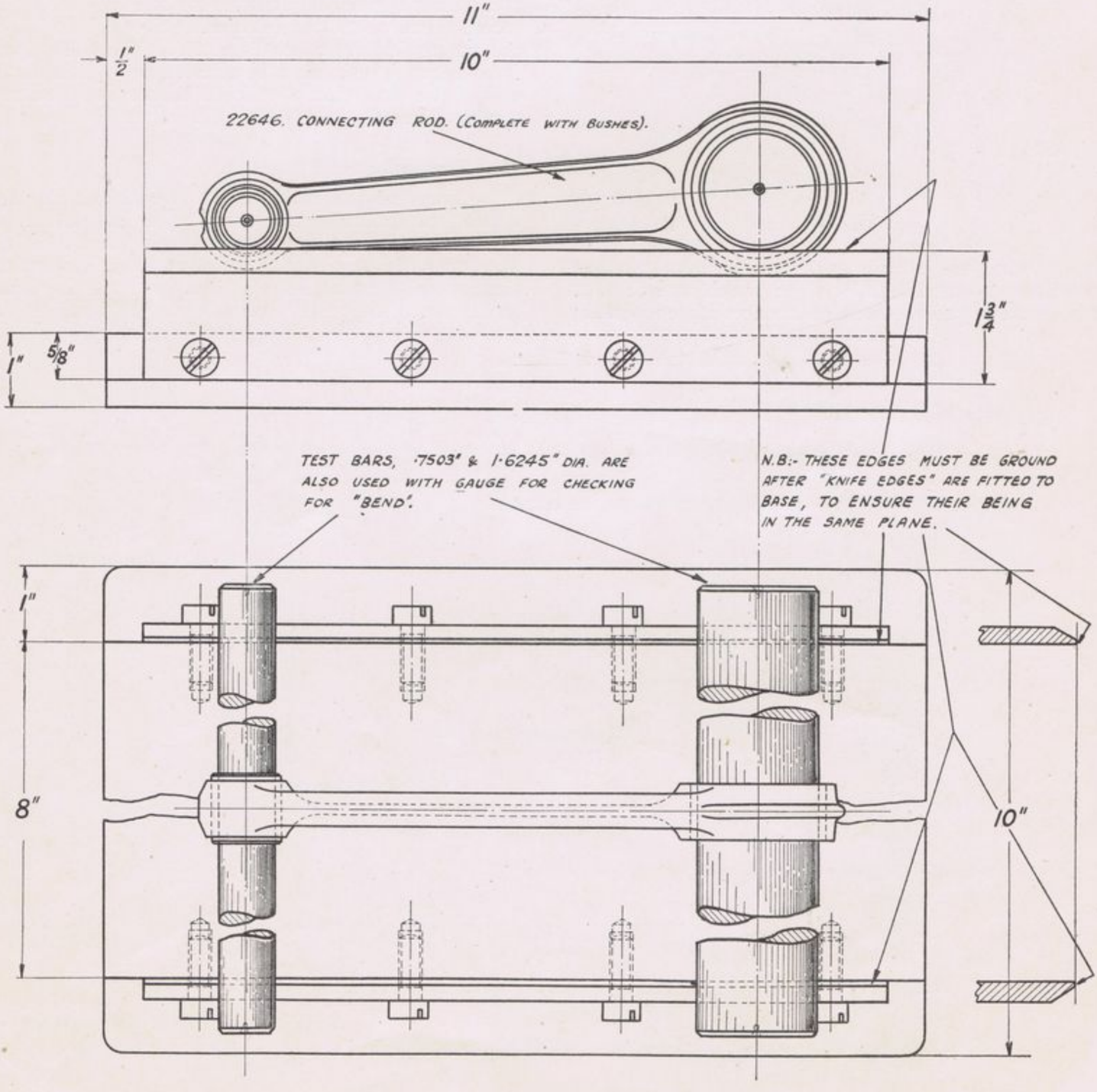


TEST BARS AND GAUGE FOR CHECKING CONNECTING ROD FOR 'BEND."

Fig. 17

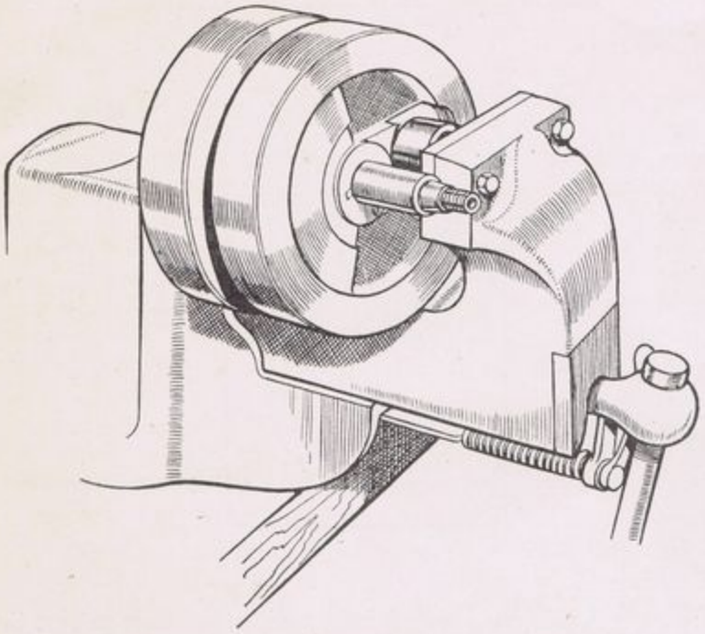
pin must be screwed tight and centre-punched to make sure that it does not come out. Note the hardened steel thrust washers either side of the centre portion of the crankpin. The white metal lined big-end bearing bushes must be handled with great care when fitting. The white metal is soft and easily damaged and the bush is a close fit both on the pin and in the rod so that it must be kept absolutely square otherwise it will jam and the white metal faces will be damaged. Once this bush is correctly fitted it will outlast a roller bearing provided it is always adequately lubricated.

The driving side flywheel can be assembled on to the timing side wheel and crankpin either under a press or between the jaws of a vice, using a short piece of tube between the faces of each flywheel and the vice jaws (see Fig. 19). When assembling the flywheels, line them up as closely as possible by means of a straight edge placed against the rim of the wheels at 90° either side of the crankpin. To tighten the crankpin nuts, use either the assembly jig shown in Fig. 14 or grip one of the mainshafts in a vice, using lead jaws, and place a stout metal bar against the edge of the balance weight of the lower wheel so as to prevent the wheels from turning (see Fig. 15). After the wheels have been assembled and the crankpin nuts tightened they must be trued up by placing the whole assembly between centres and checking the truth of the shafts with a dial micrometer (clock gauge). The shafts must run true



"KNIFE EDGES" FOR TESTING CONNECTING ROD FOR "TWIST"

Fig. 18



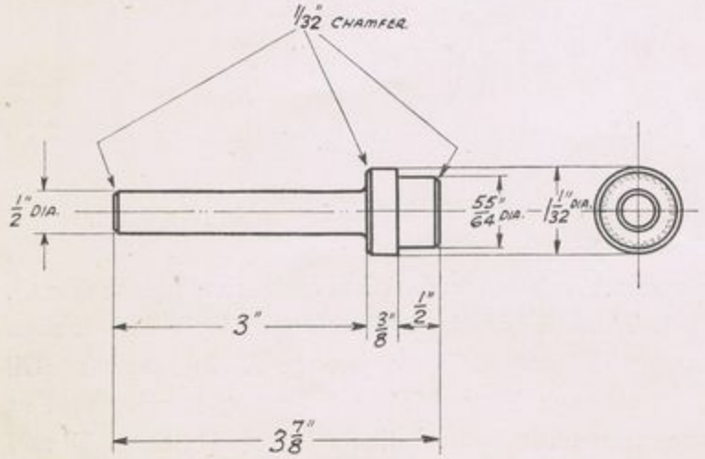
ASSEMBLING FLYWHEELS IN VICE

Fig. 19

to within ·001 in. Note that it is the truth of the shafts which is important, the rims and sides of the wheel do not really matter and may run out ·005 or ·010 in. When finally tightened up and trued, make sure that the big-end bearing has ·010—·020 in. side play.

20. Removal of Crankcase Main Bearings.

The bearing race can be removed from the timing side of the case by pressing it out by means of the bronze oil sealing bush. To do this, support the half case on a tubular block having an inside diameter of $1\frac{7}{8}$ in., then press the oil sealing bush right through, using a drift as shown in Fig. 20. This will bring out the main bearing



DRIFT FOR REMOVING TIMING SIDE BUSH & ROLLER RACE

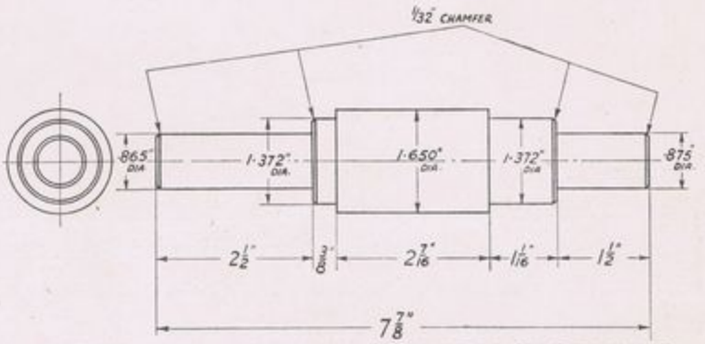
Fig. 20

race and the thrust washer between the bush and the race. The thrust washer will probably be damaged in the process so that a new one will be necessary.

To remove the main bearing race from the driving side of the case, the half case should be inverted over a lighted gas ring until the heat loosens the race so that it falls out on tapping the case.

21. Replacing Crankcase Main Bearings.

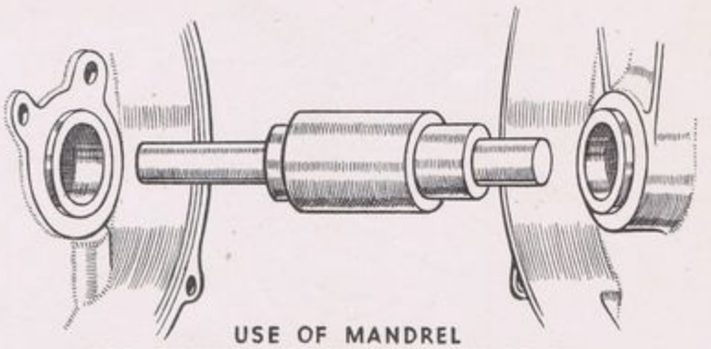
In order to ensure that the timing and driving side main bearing races are in line a mandrel such as is shown in Fig. 21 should be used. The races are inserted about



MANDREL FOR FITTING CRANKCASE MAIN BEARINGS

Fig. 21

half way into their housings and the case assembled with the mandrel in position in the bearings (see Fig. 22). Application of pressure to each end of the mandrel in turn will then force the races home and at the same time ensure that the two races are in line.

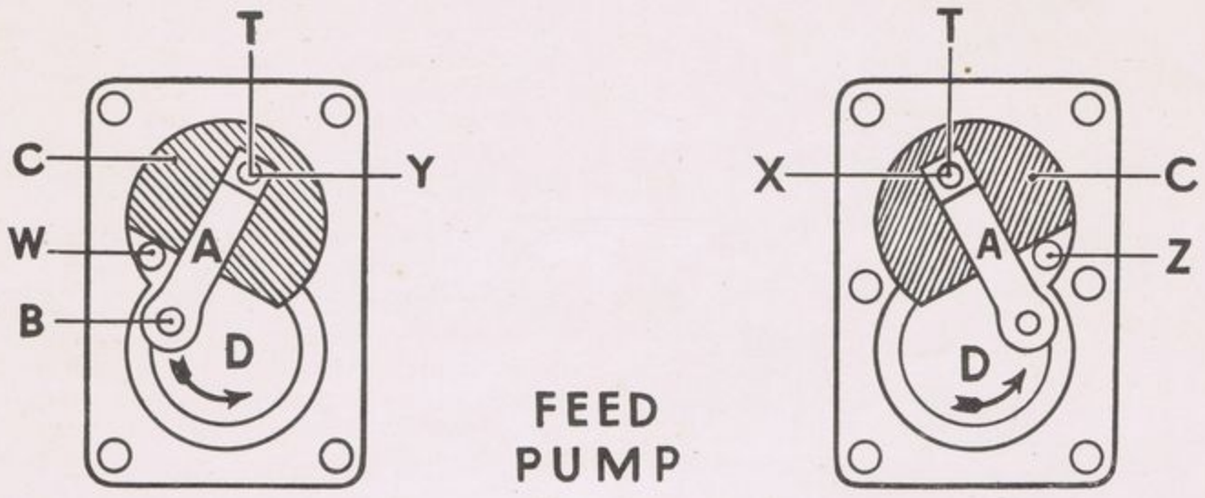


USE OF MANDREL
FOR FITTING CRANKCASE MAIN BEARINGS

Fig. 22

22. Reassembly of Crankcase.

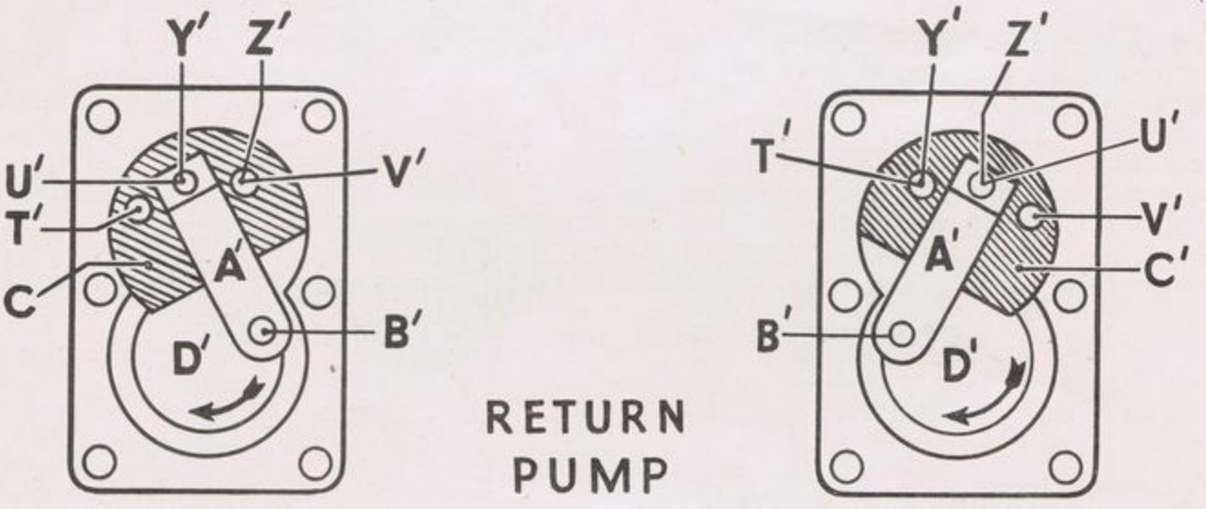
Proceed in the opposite order to that employed in dismantling the case. Make sure that all parts are perfectly clean before reassembling. Put clean oil on the shafts and roller bearings. The joint face between the two halves of the case must be made with gold size, shellac or a similar jointing compound. Before fitting the driving side of the case make sure that the magdyno strap is in position over its studs. When assembled, check for end float in the mainshaft, which should be from ·005—·015 in. If necessary the amount of end float must be adjusted by using main bearing thrust washers of different thicknesses.



Position 1.
Plunger A is being drawn out of cylindrical hole in disc C by action of peg B on shaft D. Port T in disc C registers with suction passage Y in housing. Delivery passage W in housing is uncovered. Oil flows through Y and T to fill pump cylinder and at same time oil in housing is forced through W to cylinder wall.

Position 2.
Plunger A is being pushed into cylindrical hole in disc C. Port T in disc registers with delivery passage X. Suction passage Z is uncovered. Oil is pushed through T and X to big-end bearing and at same time oil flows into housing through Port Z.

Fig. 23



Position 1.
Plunger A′ is being drawn out of cylindrical hole in disc C′. Ports U′ and V′ in disc register respectively with suction passage Y′ and delivery passage Z′ in housing. Oil flows through Y′ and U′ to fill pump cylinder and at same time oil in housing is forced through V′ and Z′ to delivery passage.

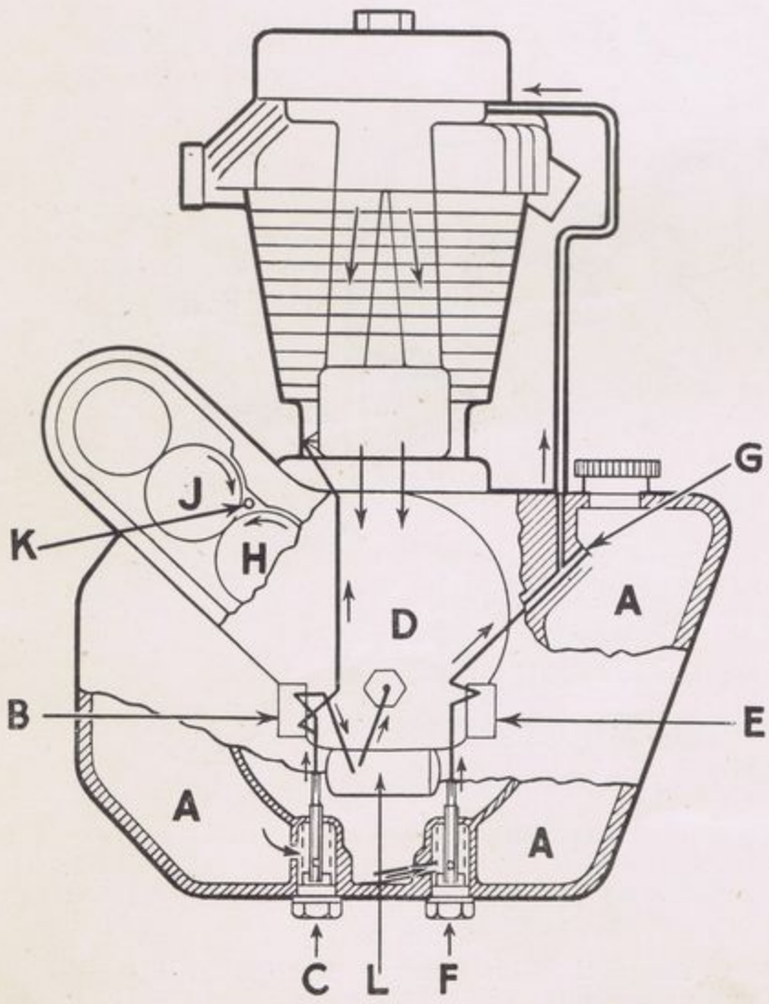
Position 2.
Plunger A′ is being pushed into cylindrical hole in disc C′. Ports T′ and U′ in disc register respectively with suction passage Y′ and delivery passage Z′ in housing. Oil flows through Y′ and T′ to fill pump housing and at same time oil in pump cylinder is forced through U′ and Z′ to delivery passage.

Fig. 24

LUBRICATION SYSTEM.

23. Principle of Operation.

The lubrication system is of the true dry sump circulating type. The fact that the oil tank is formed in the crankcase casting does not affect the principle of operation, which is identical with that on machines employing a separate oil tank with connecting pipes. **The oil tank should, therefore, be kept full to within two inches of the top, as opposed to a car or lorry engine, in which the level of oil must be kept well below the crankshaft.** The circulation of the oil is controlled by the feed and return pumps which are mounted in the timing cover and driven by a cross shaft and worm gearing from the timing side shaft. The feed pump is at the rear of the cover and the return pump at the front. Both pumps are of the oscillating cylinder type and are double-acting, the space in the pump housing being used to form a secondary cylinder which gives a delivery stroke when the main cylinder is on the suction stroke and vice versa. The operation of these pumps will be clearly understood on reference to Figs. 23 and 24. The paths through which the oil circulates are shown

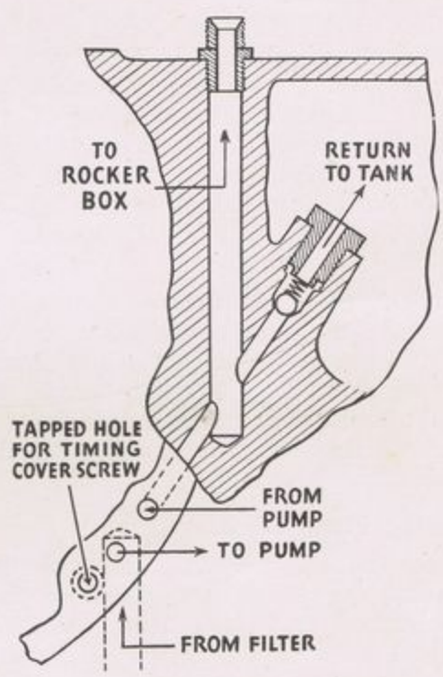


OIL CIRCULATION DIAGRAM

Fig. 25

diagrammatically in Fig. 25. The primary side of the feed pump B draws oil from the tank A through the gauze filter C and delivers it through the felt oil cleaner L to the oil feed nozzle D, pointing down the timing side shaft, from which it is forced to the big-end bearing, leakage back into the timing gear being prevented by a cork oil seal. A release valve at the inner end of the timing shaft prevents excessive pressure developing when the oil is cold. This valve is designed to lift at 30—40 lbs. per sq. in. pressure.

At the same time the secondary side of the feed pumps draws oil from the tank A through the gauze filter C and delivers it to the back of the cylinder. The oil from both the cylinder and the big-end is splashed round the engine by the flywheels and lubricates the piston, main bearings and small end, finally collecting in the two small wells or sumps at the bottom of the flywheel chamber. From these sumps, both primary and secondary sides of the return pump E draw oil through the second gauze filter F and return it to the tank A through the oil return passage G. The ball valve in this passage (see Fig. 26) by-passes part of the



BALL VALVE IN OIL RETURN PASSAGE

Fig. 26

return oil up the external pipe to the overhead rocker casing, from which it runs down the push-rod enclosure tubes and through grooves in the tappet guides to the timing case which is sealed off from the flywheel chamber. When the oil reaches a sufficient level in the timing case the two gear wheels H and J, which are partially shrouded so as to form a gear pump, pick it up and return it through the hole K to the rear portion of the oil tank. Thus, positive lubrication is provided for the big-end bearing, cylinder, overhead rockers and timing gear and the whole of the oil, apart from losses, is collected and returned to the oil tank.

24. Reasons for Excessive Consumption.

The rate of circulation is approximately 1 gallon of oil every 20 miles so that to obtain a consumption figure of 2,000 m.p.g., the amount of oil lost must not exceed 1 per cent. of that circulated through the engine. The only loss of oil from an engine in good condition occurs past the piston rings. As cylinder wear occurs

the rate of loss past the rings will increase, so that the oil consumption in a well worn engine may increase to 800—1,000 m.p.g. If the oil consumption is heavier than this (or is heavier than 1,500—2,000 m.p.g. in an engine having a cylinder and piston in good condition) the cause of the excessive loss of oil should be examined. The following are the most likely causes :—

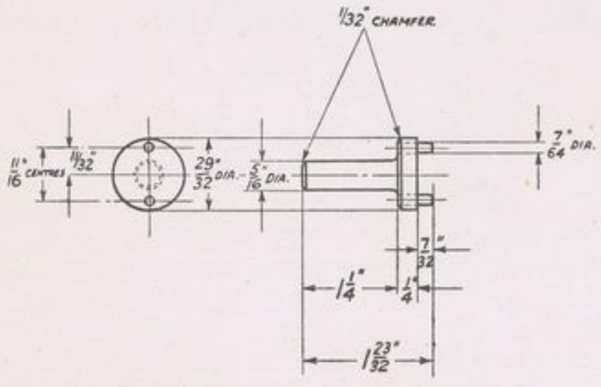
1. External oil leaks which may occur at any of the joint faces and are cured by remaking the joint.*
2. A partial obstruction in either suction or delivery passages leading to and from the return pump.
3. An air leak on the suction side of the return pump. Such a leak can occur at the washer beneath the front gauze filter, at the timing cover joint face where the suction passage crosses it, at the seating of the return pump disc in its housing or between the return pump plunger and its cylinder.

The effect of any defect in the return pump system is to allow oil to accumulate in the flywheel chamber and to escape past the driving side main bearing and through the crankcase breather which is situated behind the primary chain case. Any excessive amount of oil leaking at this point should therefore immediately suggest a defect in the return system. (Note that a certain amount of oily vapour will normally be blown out of the crankcase breather.)

To test the fit of the return pump plunger in its cylinder, remove the pump cover plate and lift out the pump disc and plunger. The fit of the plunger can be tested by placing a finger over the middle hole in the lower face of the disc and pulling the plunger out quickly. The plunger should be a good enough fit in the cylinder to spring back when released.

25. Replacing Pump Discs.

If the underside of the pump disc or the face against which it works shows signs of dirt or scoring, the disc should be relapped on to its seating, using fine pumice powder and oil or metal polish. Fig. 27 shows a suitable tool for lapping the disc. This can be held in the chuck of a brace. If a new disc is fitted it will be found that the top surface is completely circular. After lapping the disc the flat face up the side must be continued right to the top, otherwise the driving pin on the end of the cross shaft will foul the disc. Examine the lower face of the return pump disc for signs of it having been lifted off its seating by endways movement of the driving shaft and, if necessary, file a little extra clearance at the corner of the disc where the shaft may foul it.



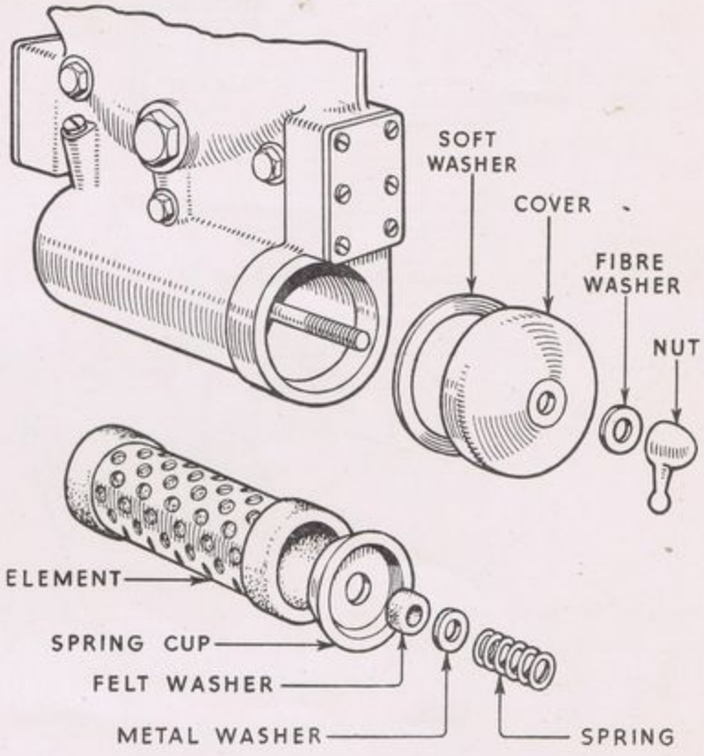
TOOL FOR LAPPING PUMP DISCS
Fig. 27

When fitting a new feed pump disc, make sure that it never simultaneously covers both the ports W and Z (see Fig. 23). If necessary, file a little more off the flat up the side of the disc to ensure this.

When replacing either pump disc make quite sure that there is no dirt between the lower face and the housing and see that the small coil spring is in position between the top of the disc and the pump cover plate. The joint beneath the cover plate must be air- and oil-tight.

26. Draining the System.

To drain all oil out of the engine remove the filter plugs C and F (Fig. 25) and the feed plug D (Fig. 25) leaning the machine to the right to empty the timing case. Remove also the felt element from the oil filter L (see Fig. 28 for details).



DETAIL OF FELT OIL CLEANER
Fig. 28

The oil should be changed after the first 500 miles and subsequently every 2,000 miles. All filters must be cleaned whenever the oil is changed and the felt filter element replaced every 5,000 miles.

Note.—After replacing the felt filter element allow the engine to tick over gently for five minutes to replace the oil in the filter housing. The big-end does not receive any oil until this has been done.

After draining the timing case the oil level in the tank will sink rapidly until the oil level in the timing case has been made up to normal.

***NOTE.**—Excessive oil leaks from the push rod enclosure tube joints, tappet chest, exhaust valve lifter adjusting bush or the back of the timing cover, may be due to too much oil being pumped to the rocker gear. This can be checked by replacing the external pipe leading to the rocker gear by a pipe connected to a sensitive pressure gauge, which should record a pressure of about 2 lbs. per sq. in. when the engine is running. To reduce the head of oil, fit a washer beneath the head of brass plug securing the ball valve spring (see Fig. 26). To increase the head of oil, remove any washers already fitted or remove the plug and spring, stretch the latter and replace.

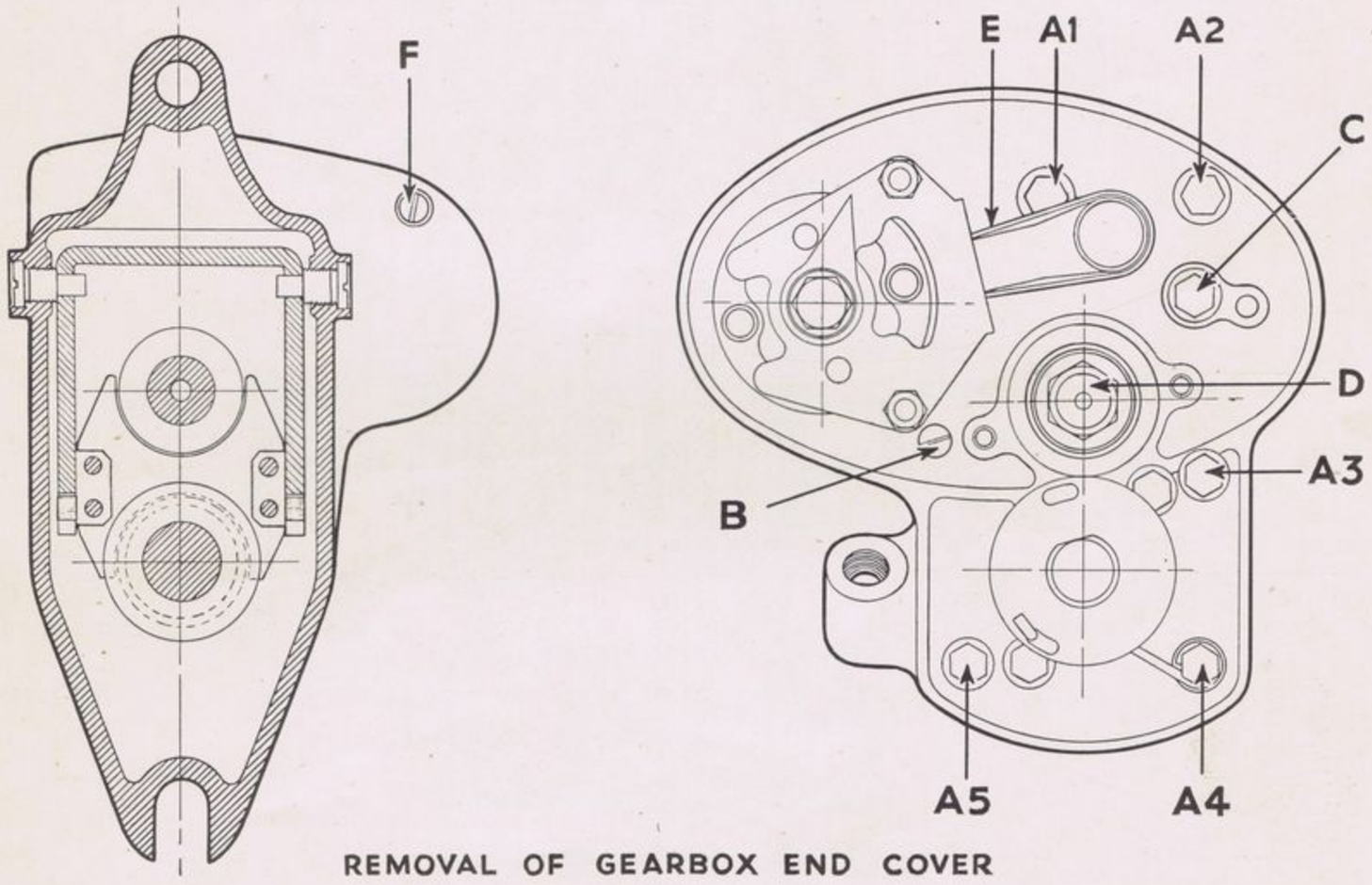
TRANSMISSION

GEAR BOX.

27. Removal of Gearbox from Frame.

The method of removal of the gearbox from the frame is described in Para. 13.

All operations on the gearbox can, however, be performed with the box in the frame except the removal of the inside operator fork and the bearings in the gearbox shell. To remove the mainshaft, however, it is necessary to take off the outer half of the primary chain case, dismantle the clutch and withdraw the clutch centre. To remove the final drive sleeve and layshaft it is necessary to remove both halves of the primary chain case and the countershaft sprocket. Having done this, it may be thought preferable to remove the gearbox from the frame.



REMOVAL OF GEARBOX END COVER

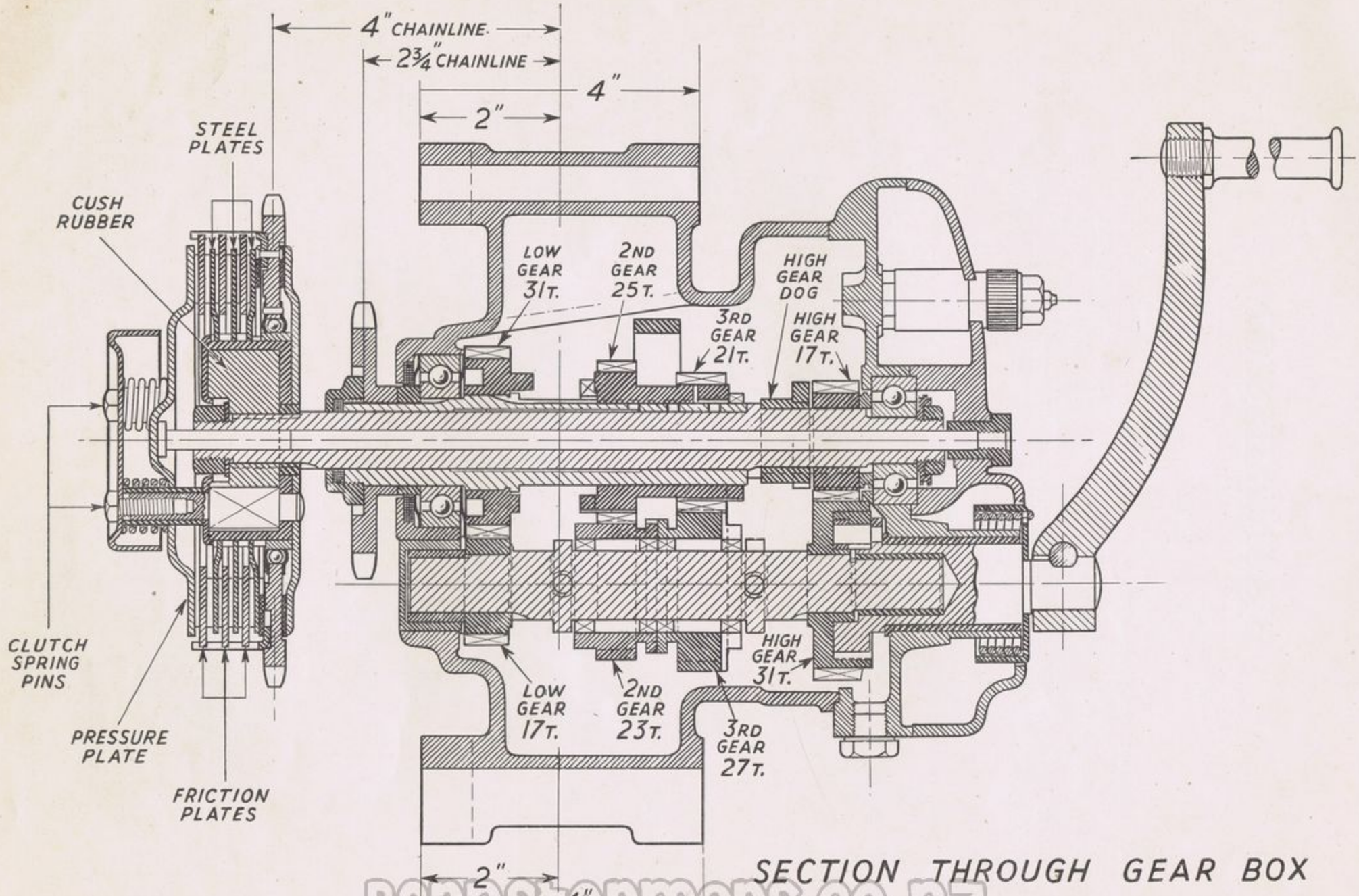
Fig. 29

28. Removal of Gears and Shafts.

To dismantle the box, first remove the kickstarter crank, the nut securing the gear indicator pointer and the gear operating lever. Then remove the four screws which secure the cover over the gear operating mechanism and lift this cover away. Disconnect the clutch control (if in machine) hinge the lever back, and lift out the clutch adjusting screw and sleeve.

The end cover can then be removed from the gearbox after undoing the five hexagon headed bolts A (see Fig. 29), the screws B and F, the operator locating plunger spring box C, and the mainshaft bearing nut D. (This nut has a left-hand thread). There is no need to disturb the foot change ratchet mechanism when removing this cover as access to the bolt A1 can be obtained by removal of the return spring E. The kickstarter mechanism will come away with the cover, leaving the mainshaft, layshaft and final drive sleeve located in the gearbox.

If it is required to remove the mainshaft, this can now be drawn straight out after removal of the clutch (see Paras. 13 and 32) which, however, should be done before taking off the gearbox end cover. The mainshaft high gear pinion and dog will come away with the shaft (see Fig. 30).



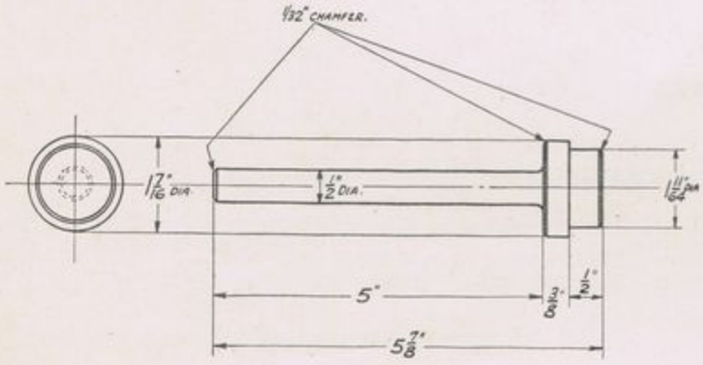
SECTION THROUGH GEAR BOX

Fig. 30

To remove the layshaft and final drive sleeve, the countershaft sprocket must first be removed. This, of course, necessitates removal of the inner half of the chain case if the box is still in the frame. The countershaft sprocket nut should be undone before removal of the gearbox end cover. Having removed the clutch, countershaft sprocket, end cover and mainshaft, the final drive sleeve and layshaft can be drawn out of the box.

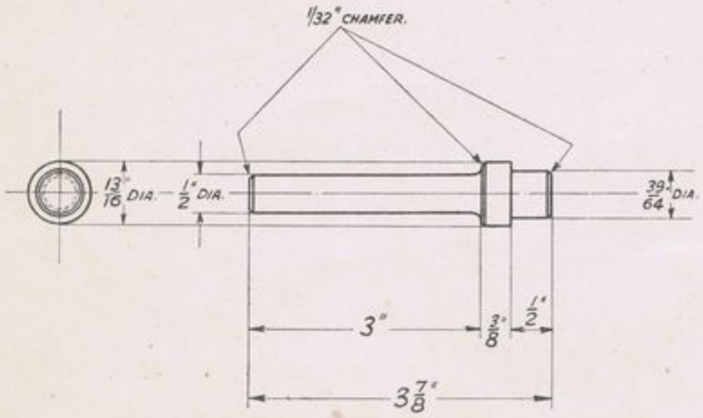
29. Removal of Ball Races.

The mainshaft ball bearings can be removed from the box and the cover by means of the drifts shown in Figs. 31 and 32, while the drifts shown in Figs. 33 and 34 are suitable for refitting these bearings. Note the felt washer in the recess behind the larger mainshaft bearing and the dished pen steel washer between the bearing and the felt washer. The second dished pen steel washer (having the smaller central hole) fits on the other side of the mainshaft bearing and is nipped between the inner face of the bearing and the shoulder on the final drive sleeve. Note that both pen steel washers have their raised centre portions facing towards the clutch and countershaft sprocket.



DRIFT FOR REMOVING GEARBOX BALL RACE

Fig. 31

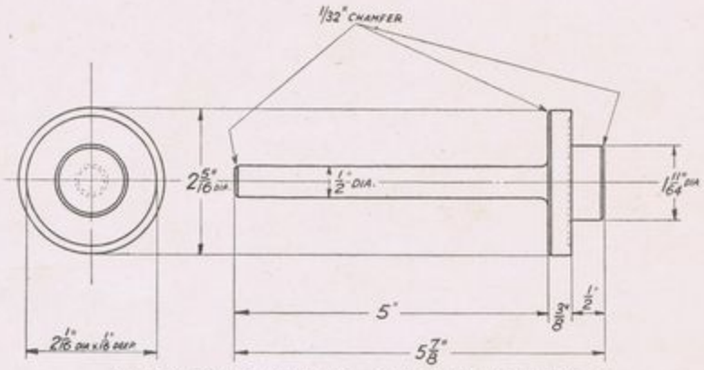


DRIFT FOR REMOVING GEARBOX COVER BALL RACE

Fig. 32

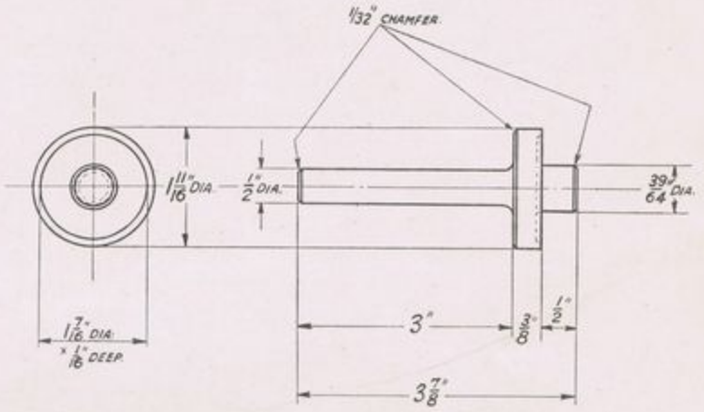
30. Foot Change Ratchet Mechanism.

Fig. 35 shows this mechanism dismantled. Note the slots in the adjuster plate which allow this to pivot after loosening the pins which secure it. If the plate is incorrectly adjusted, it may be found that, after moving



DRIFT FOR REFITTING GEARBOX BALL RACE

Fig. 33



DRIFT FOR REFITTING GEARBOX COVER BALL RACE

Fig. 34

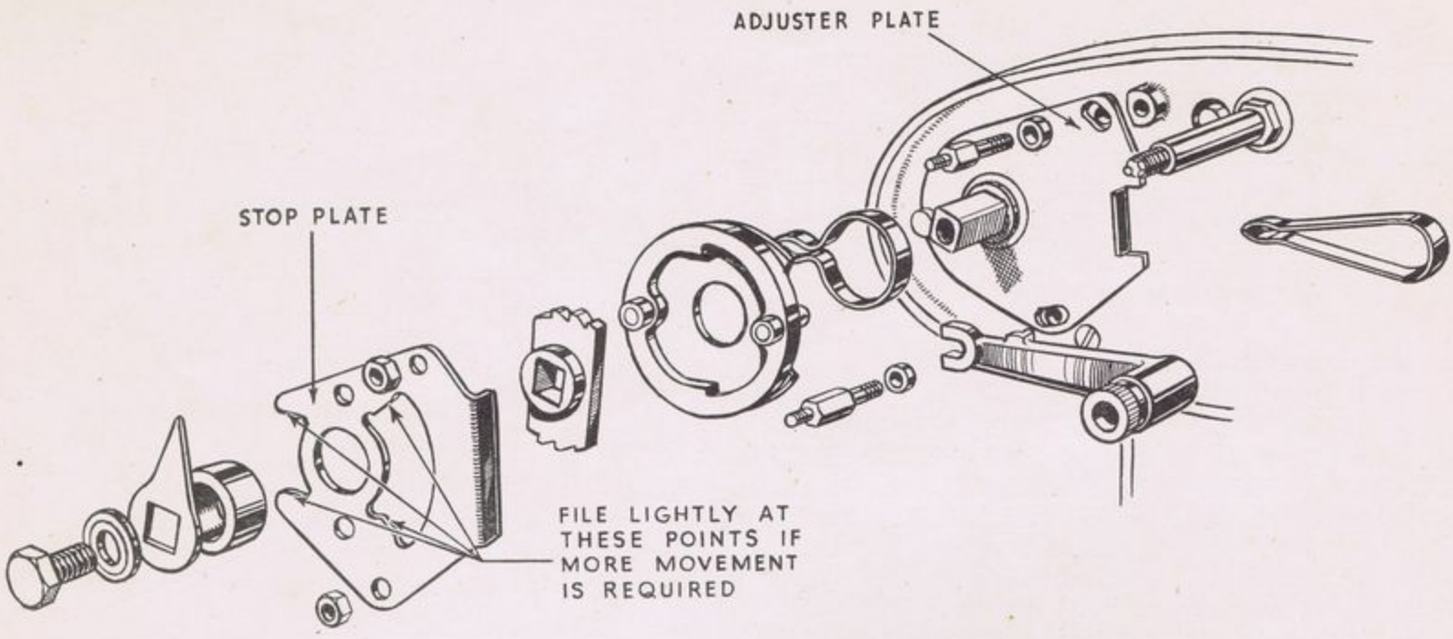
from top to third or bottom to second gear, the outer ratchets do not engage the teeth on the inner ratchets correctly. When the adjuster plate is correctly adjusted, the movement of the gear lever necessary to engage the ratchet teeth will be approximately the same in either direction.

If the gears do not engage properly, ascertain whether they require a little more movement or whether too much movement is given so that a hard kick goes right through second or third gear into neutral. If more movement is required, this can be obtained by filing the stop plate very slightly at the points indicated. If too much movement is already present a new stop plate must be fitted to give less movement.

31. Reassembling the Gearbox.

No difficulty should be experienced with this but the following points should be noted :—

1. If the mainshaft high gear pinion and dog have been removed, make sure that the dog is replaced the right way round (see Fig. 30). If this dog is reversed, third and top gear can be engaged simultaneously—with disastrous results.
2. When reassembling make sure that the trunnions on the operator fork engage with the slots in the inside operator.
3. See that the mainshaft is pushed right home. (It may tighten in the felt washer inside the countershaft nut.)



DETAIL OF FOOT GEAR CHANGE

Fig. 35

4. The layshaft high gear and kickstarter pinion should be assembled on the layshaft and the kickstarter shaft and ratchet assembled into it before fitting the end cover. Do not forget the washer between the layshaft high gear and kickstarter pinion and the kickstarter shaft.
5. See that the kickstarter shaft is in the working position (cotter flat to left when facing end cover) otherwise the cover will not go home.
6. The joint between the gearbox case and the end cover should be made with gold size, shellac or a similar jointing compound.
7. Note the oil retaining "scrolls" either side of the ball bearing in the cover.

Make sure that all parts are clean on assembly. For use in normal climates it is preferable to pack the recesses in the gearbox housing with soft grease and then top up to the level of the filler plug with gear oil. The oil will be found to run into the box more easily if the engine is started up and allowed to tick over, so as to rotate the gears and shafts. **On no account must heavy yellow grease be used in these boxes.**

CLUTCH.

32. Dismantling and Reassembly of Clutch.

The construction of the clutch is shown in Fig. 30. To dismantle the clutch plates unscrew the three spring pins and lift away the springs, pressure plate, cover over cush rubbers, friction plates and steel plates. To remove the clutch sprocket from the centre, spring off the large circlip which secures it. To remove the clutch centre, unscrew the attachment nut and withdraw the centre from the mainshaft using the extractor shown in Fig. 11.

When reassembling the clutch note that two of the steel plates are dished and the third one is flat. The correct order of assembly is clearly shown in Fig. 30. Do not forget to replace the cush rubber retaining cover before fitting the pressure plate. Make sure that the three distance tubes inside the springs pass through the holes in the pressure plate. Tighten the spring pins as far as they will go. If the clutch lifts unevenly the probable reason is that one of the springs has taken a set, in which case a new set of springs should be fitted.

33. Adjustment of Clutch Control.

It is essential that the clutch control has about $\frac{1}{16}$ in. free movement. To adjust, disconnect the control wire from the lever M, on the gearbox (see Fig. 36).

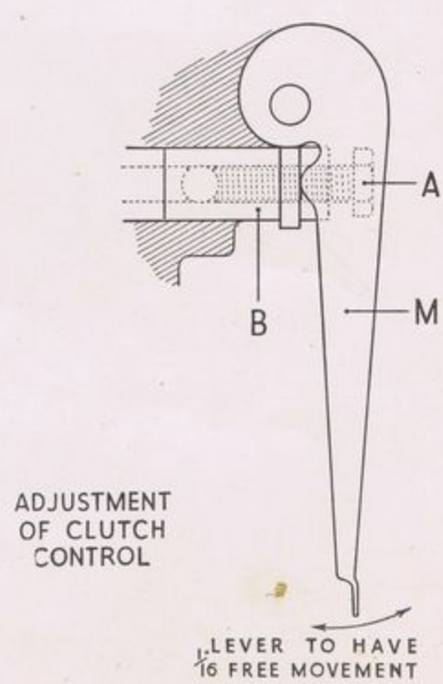


Fig. 36

Hinge the lever back and adjust by means of the screw A, holding the sleeve B to prevent it turning. Turn the screw A to the left to give more clearance to the control wire; to the right to take up clearance.

CHAINS.

34. Lubrication.

The front chain is lubricated by filling the oilbath case with engine oil up to the level of the overflow plug.

The rear chain should be lubricated regularly by the driver, but if it is dry or dirty must be removed, thoroughly washed in paraffin and soaked in engine oil or preferably in melted grease to which a little graphite has been added.

35. Tensioning.

The front chain should have approximately $\frac{1}{4}$ in. free movement up and down ; the rear chain about $\frac{1}{2}$ in. If the tension varies in different parts of the chain, adjust to the above figures at the tightest point.

To adjust the front chain, loosen the nuts on the studs which hold the gearbox to the engine plates, unscrew the central push bolt between the plates and lever the gearbox backwards until the tension is correct. This can be gauged through the inspection hole in the chaincase. After the chain has been correctly tensioned, securely tighten up the nuts on the gearbox attachment studs and screw up the central push bolt, until it bears hard against the upper lug on the gearbox, and tighten the locknut. The purpose of this push bolt is to prevent the gearbox moving backwards owing to the pull of the rear chain, which is greater than that of the front one.

To tension the rear chain, loosen the wheel spindle nuts and adjust by means of the adjuster screws in each fork end. Take care to turn each adjuster equally, otherwise the wheel will be thrown out of alignment.

36. Limits of Wear.

A chain is considered to be worn out when its length under load is 2 per cent. longer than the length of a new chain of the same type and same number of links. For the primary chain this means an increase in length of $\frac{3}{4}$ in. and for the final drive chain of $1\frac{1}{8}$ in. When measuring chains for wear, the load applied should be 28 lbs. for the $\frac{1}{2}$ in. pitch primary chain and 42—44 lbs. for the $\frac{5}{8}$ in. pitch final drive chain.

37. Removal, Repair and Replacement.

Both chains are fitted with spring links to facilitate removal. The springs can be removed with the fingers or with the aid of a pair of pliers.

If it is required to replace any of the links in a chain (as, for example, in the unlikely event of a roller or rollers having broken), two adjacent rivets passing through the same outer plate must be removed. To do this, use a rivet extractor or support the chain on two small nuts ($\frac{1}{4}$ in. or $\frac{3}{16}$ in. diameter) and drive the rivets out with a small punch. When replacing rivetted links, support the under side of the chain on a flat piece of steel and drive the outer plate over the rivets by means of a hollow punch (or small nut) applied over each rivet in turn. Hammer the ends of the rivets over lightly, taking care not to distort the outer plate so as to cause a tight joint. **Never join together new and badly worn lengths of chain.**

When replacing the chains make sure that the open ends of the spring connecting links point away from the direction of travel. The back half of the connecting link is easily inserted in the rear chain if the ends of the chain are brought together on the rear sprocket. In the case of the front chain, however, the connecting link must be inserted in the straight run of the chain as there is insufficient clearance behind the sprockets to allow the link to be inserted. It will be found that the link can be inserted much more readily if the ends of the chain are pulled together by a pair of round-nosed pliers or similar tool, or by a loop of fine string.

WHEELS

38. Removal and Replacement.

To remove the front wheel, place the machine on **both** stands (never use the front stand alone), disconnect the speedometer cable and brake control at the hub end, unscrew the wheel spindle nuts and spring the forks slightly open, when the wheel will drop out.

To remove the rear wheel, place the machine on the rear stand, loosen the four nuts which attach the mudguard and carrier assembly to the back stays, swing up the two stays from the front of the carrier to the back stays, disconnect the tail lamp lead and lift away the whole assembly of mudguard, carrier, pillion seat and panniers (if fitted). Now remove the rear chain and the wing nut from the brake rod, disconnect one end of the brake anchor strap, loosen the spindle nuts and pull the wheel out of the slotted fork ends.

Note :—To change an inner tube it is not necessary to remove the wheel. Remove the mudguard and carrier assembly as described above, then unscrew the right hand spindle nut and pull out the short length of spindle to which it is attached. Spring the forks slightly and slide out the distance piece between the hub and the right hand fork end. This will leave a gap through which the inner tube can be passed. Punctures whose positions are known can be repaired by removing the affected portion of the tube after removal of the mudguard and carrier as described above.

When replacing the front wheel make sure that the sleeve portion of the nuts enters correctly in the recess in the fork end, also that the slot in the anchor plate engages the anchor pin.

When replacing the rear wheel make sure that the wheel is pushed right up against the chain adjusters. Do not forget to couple up the brake anchor strap and adjust the brake correctly.

39. Tyres.

The tyres should be examined carefully for cuts and excessive or uneven wear ; also for signs of under inflation such as cracked side walls or damaged fabric.

When removing the tyre always start close to the valve and security bolt and see that the edge of the cover at the other side of the wheel is well down into the well in the rim. When replacing the tyre, fit the part by the valve and security bolt last. If the correct method of fitting and removal of the tyre is adopted, it will be found that the covers can be manipulated quite easily with the small levers in the tool kit.

40. Rims.

Rims which are running slightly out of truth can be trued up by tensioning the spokes, but if the rims are badly buckled, twisted or dented they must either be straightened or new ones fitted. Buckled rims cannot be trued without tightening some of the spokes excessively.

41. Spokes.

Examine the wheel for broken or loose spokes and replace or tighten. Loose spokes are liable to break owing to the load coming on them suddenly as the wheel revolves. Loose or broken spokes throw an undue strain on the other spokes in their vicinity.

42. Brakes.

The brake drums and linings require cleaning from time to time to ensure that there is direct contact between the lining and the drum. The presence of oil, grease, moisture, mud or even dry dust will impair the efficiency of the brake. To dismantle the brake, remove the wheel from the machine, remove the left-hand spindle nut completely and unscrew the distance piece which fits on the spindle between the inside of the fork end and the brake cover plate. The cover plate can then be lifted off complete with the operating cam and lever and shoes. Remove the two tension springs between the brake shoes and lift the shoes away. If it is required to remove the operating cam the nut which secures the operating lever to the cam spindle must be undone and the lever withdrawn from the splines on the spindle.

The colour of the linings varies from deep yellow to dark brown according to the severity with which they have been used and the temperature at which they have been running. **Their appearance should be polished.** Do not " rough up " the linings with a file in order to remove the normal polished surface. The removal of this merely shortens the life of the lining. The presence of grease or mud will probably be shown by dull black streaks on the linings. The best way to remove these is to scrape them off with a knife or hacksaw blade, then to reassemble the brake and run the machine for a short period in second or third gear with each brake in turn hard on. This will burn out the last traces of grease and will be found to restore the efficiency of the brake once the linings have cooled down. Alternatively grease can be burnt out of the linings with the aid of a blow lamp. Washing the linings with petrol usually results in washing the grease into them and is not recommended.

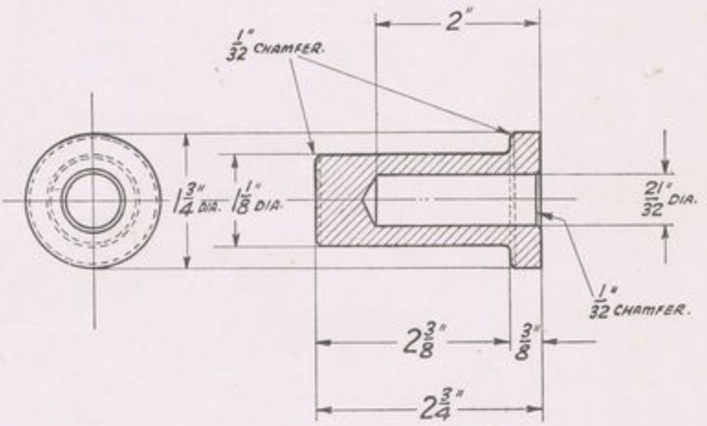
If new linings are necessary, make sure that those fitted are the correct size and type. The lining material for both brakes is Ferodo B.Z. and the dimensions for the rear wheel are 7 in. diameter by 1 in. wide, by $\frac{1}{4}$ in. thick and for the front wheel 6 in. diameter by 1 in. wide, by $\frac{1}{4}$ in. thick. When fitting new linings, rivet up the rivets at the ends of the linings last, so as to avoid buckling the lining.

If new linings are fitted it may be found that one goes into operation before the other. This may give either a very fierce brake or an ineffective one, according to which lining operates first. The shoes can be centralised by loosening the pins and nuts which secure the cam bush to the brake torque plate, then applying the brake and tightening the cam bush securing pins.

The brake cam, cam bearing and the pivot pin should be lightly smeared with grease before reassembling the brake, if this has been dismantled for cleaning or any other purpose.

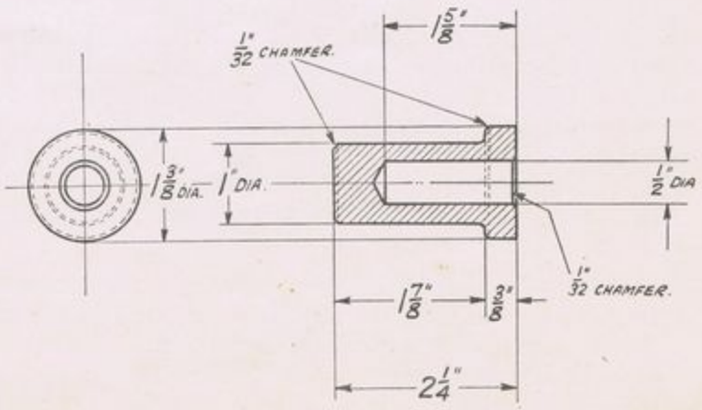
43. Wheel Bearings.

The wheel bearings should be examined and repacked with grease if necessary. The bearings are non-adjustable and if showing an excessive amount of play must be replaced. To remove the bearings, unscrew all nuts from the spindle, then drive the spindle out by hitting either end with a mallet. This will bring out one bearing with the spindle. Remove this bearing from the spindle and use the spindle to drive the other bearing out of the hub. The drifts shown in Figs. 37 and 38 will be found suitable for refitting the new bearings to the hubs, two of each type being required. The inner faces of the bearings should bear against the shoulders on the spindle just before the outer races bottom in the recesses in the hub barrel. If this is not the case excessive strain will be placed on the balls when the bearing retaining nut and nut securing the brake cover plate are tightened up. If the bearing shows signs of tightening when these nuts are screwed home a thin shim should be fitted on the spindle behind one of the bearings.



DRIFT FOR REFITTING REAR HUB BEARINGS

Fig. 37



DRIFT FOR REFITTING FRONT HUB BEARINGS

Fig. 38

44. Cush Drive Rubbers.

The condition of the cush drive rubbers in the rear wheel can be gauged by placing the machine on the rear stand, applying the rear brake and trying to turn the wheel by pulling on the tyre or rim. If there is more than one inch free movement of the tyre (half-inch if machine is to be used across country), the rubbers should be examined. Access to the rubbers is obtained by removing the wheel and the brake cover plate, then unscrewing the three Simmonds nuts at the back of the brake drum and knocking out the three shouldered pins which secure the cush drive lock ring, after which the combined sprocket and brake drum can be lifted off the hub barrel thus exposing the six rubber blocks. After fitting new blocks before replacing the sprocket, smear some grease on the protruding end of the hub barrel and also on the back surface of the cush drive lock ring. The sprocket will enter the spaces between the rubber blocks more readily if the latter are dusted liberally with French chalk or smeared with soft soap. With this type of cush drive it will probably be found best to lie the blocks flat in the hub shell, not to tilt them as is recommended for the smaller cush drive fitted to the Royal Enfield Side-valve Model WD/C.

FRAME AND FORK

45. Alignment of Wheels.

The only way to make sure that the wheels are in alignment is to check one against the other. Frames and forks are set when built so as to ensure that the centre of the two wheel spindles, the centre line of the engine attachment lugs and the head lug, all lie in the same plane. Individual points along the frame tubes, however, are not checked and the wheel cannot, therefore, be accurately lined up by ensuring that it is central between the chainstays or backstays. Neither can it be assumed that the wheel will be in line when it is pushed hard against the front end of the slots in the rear fork ends.

Wheel alignment can be checked by using a straight-edge if one is available. Wooden straight-edges, however, are liable to warp and are, therefore, not reliable. The best way to check the alignment of the wheels is to use a piece of fine string. This should be tied to one spoke of the rear wheel, taken round the tyre, brought towards the front of the machine and pulled taut with the front end some inches away from the front wheel. The string should then be brought slowly in towards the front wheel, keeping it taut and watching carefully to see when it touches the front portion of the rear tyre. It should just come on to the rear tyre at two points simultaneously with touching the front tyre at two points, assuming that the front wheel is pointing straight ahead. Check the setting by testing with string in the same way along the other side of the machine.

The above method checks only the alignment of the lower portions of the two wheels. If the frame is twisted or the forks are bent, it is possible that the lower portion of the wheels will be in alignment while the upper portion is not. Any serious twist can be seen by looking along the machine to make sure that both wheels lie in the same plane. In case of doubt this can be checked by using the string near the top of the wheels, after removal of the mudguards, battery, toolboxes and engine cylinder.

If the wheels are in alignment and the frame is not twisted or bent the rear chain should also be in alignment. This can be checked by looking along it with the chainguard removed. If the chain has been run out of alignment it will show definite indications on the sides of the sprocket teeth and on the inner faces of the chain links. If the wheels cannot be lined up without throwing the chain out of alignment, the probable cause is that the rear portion of the frame is bent.

46. Adjustment of Fork Links.

Side play on the front fork swivel pins should be eliminated as far as possible without interfering with the free movement of the forks. The two bottom fork spindles have right- and left-hand threads and screw into the bottom links. To adjust these, first remove the shock absorber hand nuts and star washers, taking care not to lose the small springs and plungers inside the hand nuts (see Fig. 39). Then loosen the locknuts on the fork spindles. The nuts on the right-hand side of the machine have left-hand threads. Adjust the links by turning the spindles by means of the squares on their ends in a clockwise direction (viewed from the left-hand side of the machine) to give more side clearance or in an anti-clockwise direction to take up clearance.

The two top spindles have threads only on the left-hand side of the machine. To adjust these, loosen the locknuts and turn the spindles by means of their hexagon heads in a clockwise direction (viewed from the right-hand side of the machine) to take up clearance or anti-clockwise to give more clearance. Check the adjustment after tightening the locknuts and make sure that the forks work perfectly freely. A little side play is preferable to excessive friction. Any necessary damping action is provided by the hand-operated shock absorbers, which must be replaced after adjusting the fork swivel pins. Note that the adjusting nut on the right-hand side of the machine has a left-hand thread, and that both adjusting nuts are tightened by turning their tops towards the rider when in the saddle. **Very little damping action is required for main road work and the adjustment of the shock absorbers should be left so that it is easy to move the star washers with the thumb.**

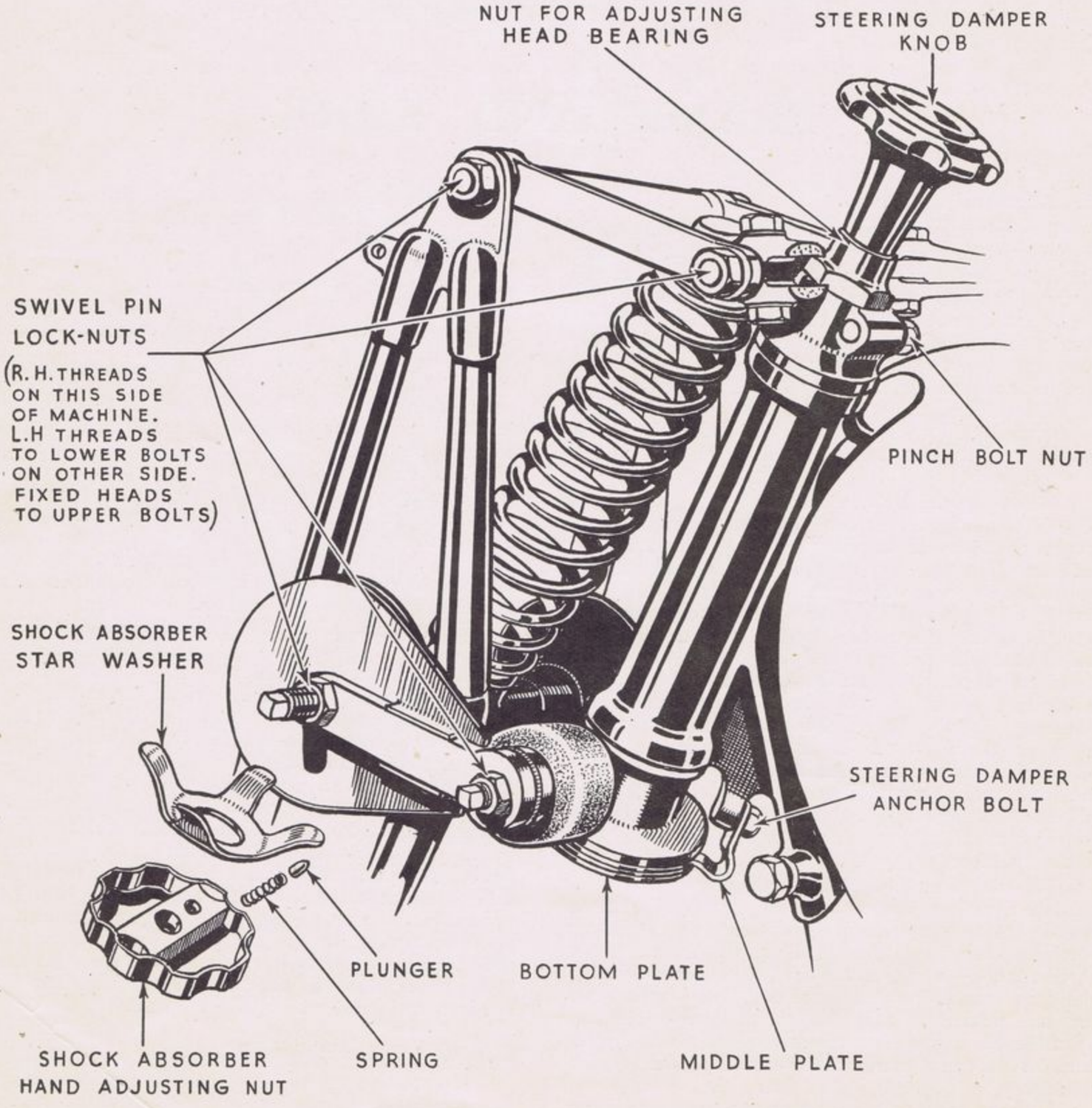
47. Worn Swivel Pins or Bushes.

If excessive up and down play is present in any of the swivel pins the pin and/or bush should be renewed. All four swivel pins work in renewable bronze bushes housed in the forks, steering stem or ball head clip. To remove the two lower swivel pins, first unscrew the shock absorber hand adjuster knobs and star washers, then the locknuts and turn each swivel pin in turn in a clockwise direction (when viewed from the left-hand side

of the machine) until the fork links become unscrewed from the threads on the swivel pins. When replacing the swivel pins, screw the links on to the front pin an equal distance at each side before starting the threads on the back pin. Make sure that the shock absorber friction discs and metal plates are correctly fitted over the boss on the bottom front fork lug.

48. Adjustment of Steering Head.

To check for play in the steering head, the weight must be taken off the front wheel by placing a suitable box beneath the engine crankcase. Play can then be felt by trying to move the lower end of the forks backwards and forwards. To distinguish between play in the steering head and in the fork swivel pin bearings, place



DETAIL OF FORK AND STEERING HEAD ADJUSTMENTS

Fig. 39

one finger across the head races just beneath the ball head clip. The steering head should be adjusted so as to have the minimum of play in it, while, at the same time, the fork must swing easily to either side when the handlebars are given a slight tap. To adjust the head bearing, first unscrew the steering damper knob, then loosen the nut on the pinch bolt through the ball head clip (see Fig. 39), and adjust the head bearing by means of the large nut on top of the ball head clip. Remove as much play as possible without interfering with the free movement of the steering head. **Do not forget to tighten the pinch bolt nut.** This takes the strain off the threads in the top adjusting nut and failure to tighten the pinch bolt may cause the threads in the adjusting nut to strip, with serious consequences.

49. Dismantling and Reassembling Steering Head.

To dismantle the steering head, take the weight off the front of the machine by supporting the crankcase on a suitable box, then remove the steering damper knob and anchor bolt (see Fig. 39). Next remove the head bearing adjusting nut, loosen the pinch bolt nut (see Fig. 39) and drive the projecting end of the steering stem through the ball head clip. Lift the ball head clip away in a forward direction and withdraw the front forks complete, with steering stem, from the lower end of the head lug.

When replacing the steering stem and forks, assemble the lower head race on to the steering stem with clean grease round the balls. Note that there are only 19 balls in each race. Do not attempt to fit an extra ball. Insert the steering stem upwards through the head lug, place the upper ball race in position and knock the ball head clip down on to it, then screw down the head bearing adjusting nut until the adjustment is correct and lock up the pinch bolt nut.

50. Steering Damper.

If the steering is found to bind even when a little play is present in the head bearing, the probability is that the steering damper is not freeing properly. To check this, remove the $\frac{1}{4}$ in. diameter bolt which attaches the middle plate of the steering damper to the head lug on the frame (see Fig. 39). This puts the damper completely out of action and if the steering now becomes free this is an indication that the damper was previously binding. In order to ensure that the damper frees properly, the middle plate and the bottom plate must both be parallel with the turned face on the bottom of the steering stem. To ensure this, loosen the $\frac{1}{4}$ in. bolt securing the middle plate to the head lug; also the second $\frac{1}{4}$ in. bolt securing the bottom plate to the steering stem. Both these pins pass through slotted lugs on the plates and the plates can be tapped up or down as required in order to bring them parallel with the lower face of the steering stem. Lock up the two $\frac{1}{4}$ in. bolts tightly, with the bottom and middle plates and the steering damper in such a position that the damper is perfectly free. Binding of the damper causes bad steering at low speeds and it is more important to ensure that the damper comes perfectly free than for it to be capable of locking the steering tightly. Damping of the steering of this machine is required only at very high speeds or across country and then only light damping is required.

CARBURETTOR

(AMAL Type 276 A.C./1A)

51. Adjusting Slow Running.

To set the carburettor so that the engine ticks over slowly, proceed as follows:—Start up the engine and set to run on a small throttle opening with the air fully open and ignition about half retarded. Screw up the throttle stop adjusting screw (see Fig. 40) until the engine begins to speed up. Now close twist grip completely and make sure that there is slack in the control cable, if necessary adjusting by means of screwed adjusting bush on top of the carburettor mixing chamber. Next unscrew throttle stop adjusting screw gradually until the engine is running as slowly as possible consistent with steady, even firing. Next adjust pilot air screw in or out until the engine speed is its maximum for the given throttle and ignition settings. If the speed is now too high, unscrew throttle stop adjusting screw further and, if necessary, correct adjustment of pilot air screw. When the best settings have been found, lock up locknut on throttle stop adjusting screw and screw up throttle cable adjusting bush on top of mixing chamber until all but a little slack is taken out of the control wire.

52. Dismantling Carburettor.

The construction of the carburettor is clearly shown in Fig. 40. Carburettors should be dismantled from time to time in order to clean out accumulations of silt from the bottom of the float chamber, float chamber holding bolt, etc. If it is necessary to remove the jet block from the mixing chamber, great care should be taken in doing this as the jet block is easily distorted. When replacing the float make sure that the spring clip engages correctly with the groove in the fuel needle.

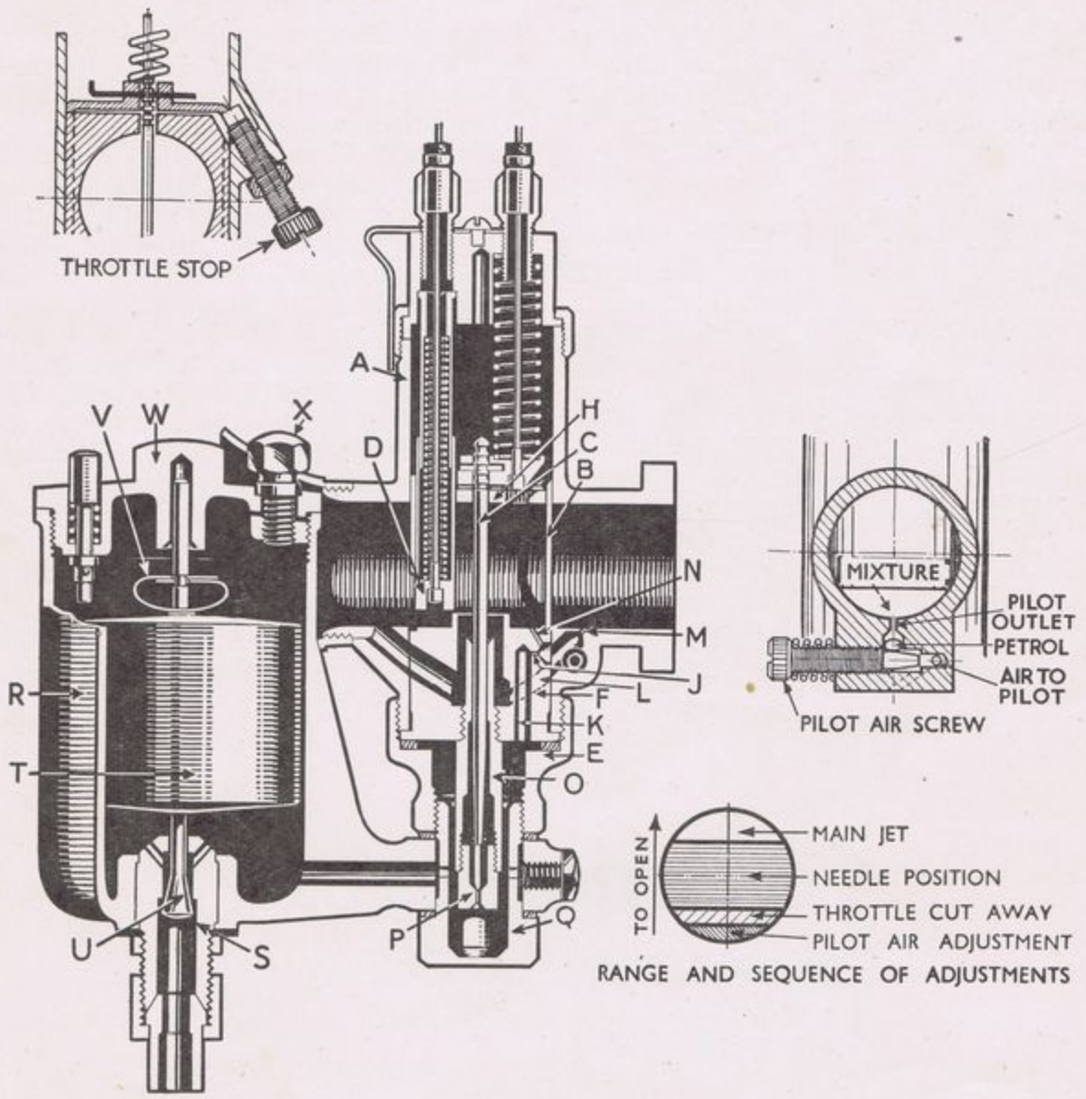
53. Causes of High Petrol Consumption.

If the petrol consumption is excessive, first look for leaks either from the carburettor, petrol pipe, petrol taps or tank. If coloured petrol is in use this will readily indicate the presence of any small leaks which otherwise might pass unnoticed. If the petrol system is free from leaks, carefully set the pilot adjusting screw as described

in Para. 51 to give the correct mixture when idling. Running with the pilot adjusting screw too far in is a common cause of excessive petrol consumption. If the consumption is still heavy, try the effect of lowering the taper needle in the throttle slide by one notch. Do not fit a smaller main jet as this will not affect consumption except when driving on nearly full throttle and may make the mixture too weak at large throttle openings, thus causing overheating.

The standard setting for this carburettor is as follows :—

Main Jet No. 130.
Throttle Valve 6/4.
Needle clip in middle groove.



A MIXING CHAMBER
B THROTTLE VALVE
C THROTTLE NEEDLE
D AIR VALVE
E MIXING CHAMBER UNION NUT
F JET BLOCK
H JET BLOCK BARREL
J PILOT HOLE
K PILOT FEED HOLE
L PILOT AIR HOLE
M PILOT OUTLET
N BY-PASS
O NEEDLE JET
P MAIN JET
Q HOLDING BOLT
R FLOAT CHAMBER
S NEEDLE SEATING
T FLOAT
U NEEDLE VALVE
V SPRING CLIP
W FLOAT CHAMBER TOP
X FLOAT CHAMBER LOCK SCREW

SECTION OF AMAL CARBURETTOR

Fig. 40

LIGHTING AND IGNITION SYSTEM

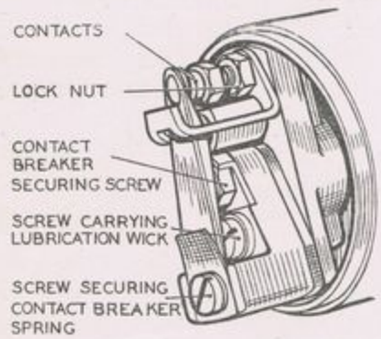
MAGNETO (LUCAS Magdyno Model MO1-4, Type L1 or Model MO1-6, Type L1).

54. Lubrication of Contact Breaker Mechanism.

The cam is lubricated by a wick contained in the contact breaker base, which must be given a few drops of thin machine oil. To get at the wick, remove the spring arm carrying the moving contact and withdraw the screw carrying the wick. At the same time remove the tappet which operates the contact breaker spring, and lightly smear with thin machine oil ; when replacing, see that the small backing spring is fitted immediately under the securing screw and spring washer and that the bent portion faces outward. See Fig. 41.

55. Cleaning Contact Breaker.

Remove the contact breaker cover and examine the contacts. If they are dirty, they must be cleaned by polishing with a 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 above.



CONTACT BREAKER MECHANISM, COVER REMOVED

Fig. 41

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

56. Adjustment of Contact Breaker.

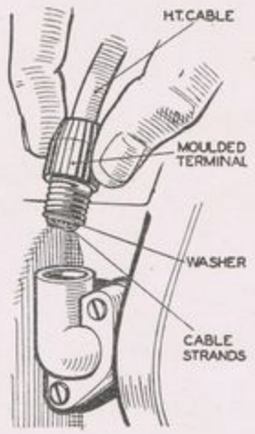
To check the contact setting, turn the engine until the contacts are fully opened and insert the gauge provided on the magneto spanner, ·012 in.—·015 in., between the contacts ; if the setting is correct, the gauge should be a sliding fit. If there is an appreciable variation from the gauge, slacken the lock nut and turn the contact screw by its hexagon head, until the gap is set to the gauge. Finally tighten the lock nut.

57. H.T. Cable.

This should be 7 m.m. in diameter. Other sizes, such as 5 m.m. and 9 m.m. will not fit in the immobilizer and suppressor. The cable must be replaced if the rubber insulation has perished or shows cracks and has become brittle.

58. H.T. 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



PICK-UP, MOULDED NUT REMOVED TO SHOW METHOD OF MAKING CONNECTION

Fig. 42

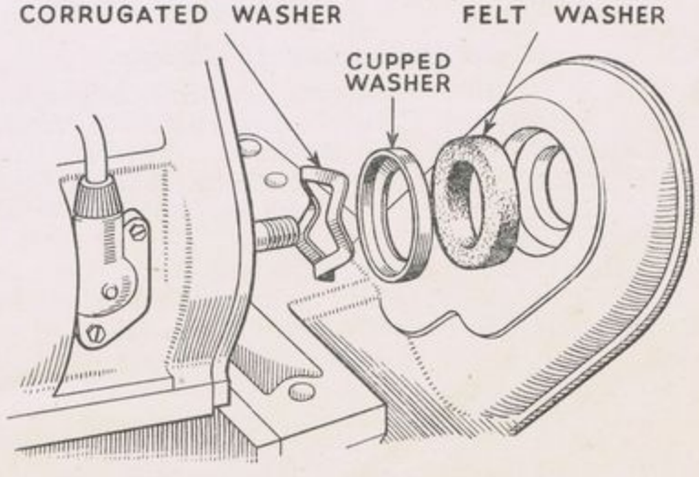
the ring while the engine is slowly turned by hand. To fit new cable (see Fig. 42) thread the knurled moulded nut over the lead, bare the cable for about $\frac{1}{4}$ in., thread the wire through the metal washer removed from the old cable, and bend back the strands. Finally screw the nut into its terminal.

59. Suppressor and Immobilizer.

Check for cracks in insulation, check for positive contacts of H.T. wire ; always disconnect lead at spark plug end before unscrewing immobilizer. See that lead is arranged so that immobilizer is clear of metal parts of machine.

60. Magneto Drive.

The magneto drive is by gears enclosed in the engine timing case. These are automatically lubricated and require no attention or adjustment.

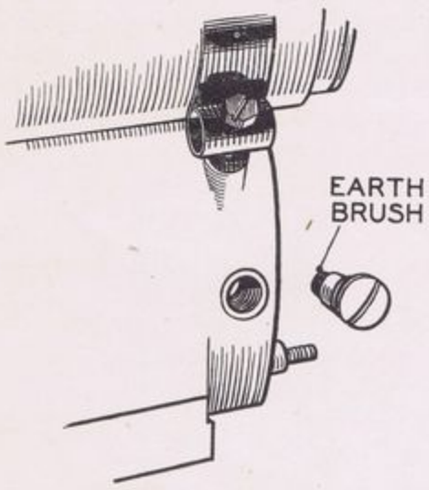


ASSEMBLY OF FELT GLAND FOR MAGDYNO SPINDLE

Fig. 43

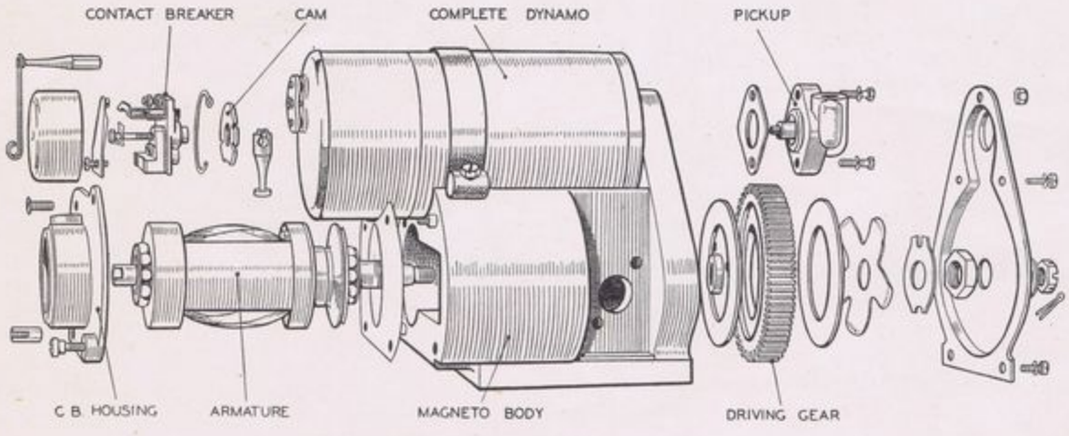
61. Timing Ignition.

The ignition timing should be such that the contact breaker points are just about to open when the piston is



DETAIL OF MAGNETO EARTH BRUSH
Fig. 44

$\frac{3}{32}$ in. before the top of the compression stroke, the control being fully advanced. This is equivalent to 34° advance. For details of the method of altering the timing, see Para. 11.



EXPLODED VIEW OF MAGNETO
Fig. 45

62. Removal and Replacement of Magdyno.

To remove the complete magdyno first take off the timing gear cover (see Para. 10), then remove the driving pinion (see Para. 11). Next loosen the nut tensioning the magdyno securing strap, lift the magdyno until the dowel pins in the base are clear and withdraw the instrument endways.

When replacing the magdyno note the correct order of assembly of the oil retaining gland at the back of the timing case. This is clearly shown in Fig. 43.

63. Slipping Clutch.

A shock absorbing drive is incorporated in the larger of the two gears which take the drive from the magneto shaft to the dynamo. This considerably relieves the peak loading on the teeth of the driving gear and gives a far longer life. The drive is taken from the gear centre, which is keyed to the magneto shaft, through the fabric gear which is held against the gear centre under the pressure of a star shaped spring, to the pinion on the dynamo shaft. The effect of a violent overload is to cause the fabric gear to slip relative to the gear centre and so prevents shock from being transmitted to the fabric gear.

64. Dismantling the Magneto.

First remove earth brush and high tension pick-up : Then proceed as follows :—

(1) **Drive End.**

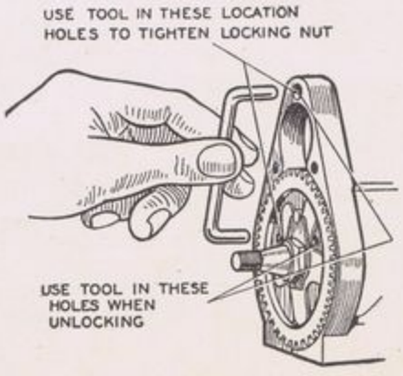
Remove dynamo.
Take off driving end cover by unscrewing four countersunk screws. Unscrew large nut in centre of driving gear (the wheel may be locked by using the gear fitting tool as illustrated in Fig. 46). Remove locking washer, clutch spring and gear wheel complete with friction plate.

(2) **Contact Breaker End.**

Take off contact breaker cover.
Unscrew contact breaker plate retaining screw —note position of the small backing spring, i.e., immediately under the securing screw and spring washer, with the bent portion facing outwards.

Knock back locking tags on contact breaker centre screw. Take out centre screw when contact breaker may be removed, by levering off evenly with the aid of two screwdrivers.

The cam plate is now exposed and can be removed when the copper spring ring is levered out with a screwdriver. Take care when doing this that the ring does not fly, also note position of the Bowden control plunger and the slots in the face cam.



USE OF JIG FOR MAGNETO SLIPPING CLUTCH
Fig. 46

Observe that the cam is fitted with its flat side towards the armature of the machine.

The contact breaker end shield can now be removed if the fixing screws, pillar and spring and earthing terminal nut are unscrewed.

Take out armature by tapping with a soft drift from the drive end.

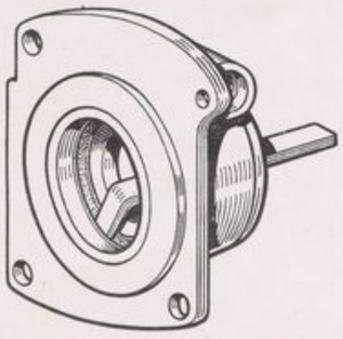
Care should be taken not to allow the yoke to come in close contact with any iron filings as the magnets which are die-cast within the body will attract these, and cause the armature to bind.

65. Test and Repair of Magneto.

When the armature has been removed it should be examined for actual structural faults, such as cracked or bent shafts. Any flaw in the winding needs special equipment to detect.* In the absence of this some idea of the condition can be obtained with the aid of a battery.

Screw the contact breaker retaining screw into the end of the armature shaft. Connect one pole of a 2-volt cell to this with an ammeter in series. Connect the other pole of the battery to the core of the armature. The ammeter will then record the current taken by the primary turns—this should be approximately 3 amperes. To check the secondary winding, connect a piece of H.T. cable to the brass insert of the slipring and hold the other end a little away from the armature core. If the lead from the battery which was connected to the core is then flashed quickly on and off the core, a high tension spark should occur between the H.T. cable and the core.

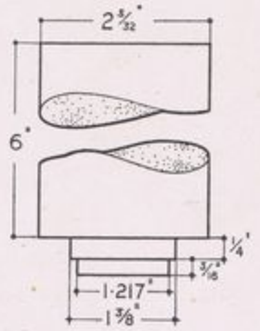
No spark between these points indicates that there is a fault either in the armature windings or the condenser and a replacement should be fitted.



TOOL FOR REMOVING ARMATURE BEARING

Fig. 47

It is important that the two ball bearings which support the armature are in good condition. If they are packed on assembly with a grease such as a suitable high-melting point grease they will stand an almost unlimited amount of normal wear, but if they start to fail due to a bent shaft or other cause they must be replaced. They can be removed with a tool as shown in Fig. 47, and they should be replaced with a pressure of 250 lbs. At the works this is done in a hydraulic press, but in case of emergency they can be driven in with a mandrel made to the dimensions shown in Fig. 48. The serrated fibre washer fits behind the race to prevent any electric current attacking the surface of the bearings.

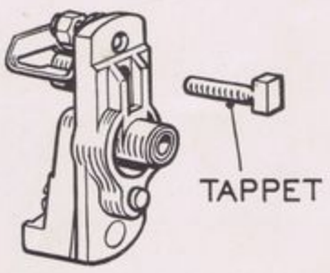


MANDREL FOR REPLACING ARMATURE BEARINGS

Fig. 48

66. Reassembly of Magneto.

Thoroughly wash out cages and balls and dry. Re-pack with high melting point grease. Refit armature and contact breaker end plate, taking care that the distance shims are in position. Check armature for endplay. Armature should revolve easily when turned by hand, with not more than ·003 in. endplay.

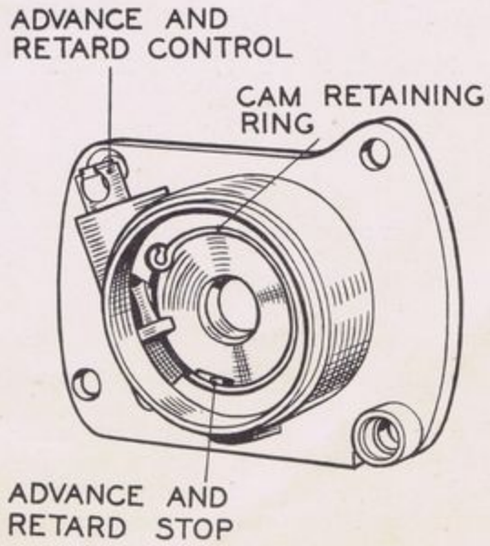


CONTACT BREAKER BODY AND TAPPET

Fig. 49

Adjust by adding or leaving off shims under contact breaker end plate until correct.

Fit cam in position with Bowden control plunger in its correct slot and secure with spring circlip. See Fig. 50.



CONTACT BREAKER END PLATE

Fig. 50

* *i.e., an ohmeter. The resistance of the secondary winding measured between the slip ring and earth should be* approximately 4,000 *ohms. If the resistance is considerably greater or less than this figure, the secondary winding may be considered to be faulty.*

Examine fibre 'tappet.' See that it slides freely without having sideplay. See Fig. 49.

Moisten cam lubricating wick with oil. Fit contact breaker in position on horseshoe shaft location on end of armature shaft. Make sure the fibre heel of the contact breaker tappet is located correctly in its guides. See Fig. 49.

Fit centre screw with locking plate. Tighten and lock by bending up tags of locking plate.

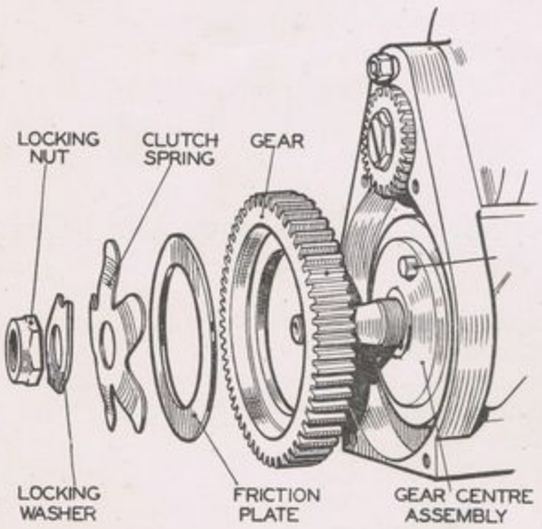
Refit spring contact arm with backing spring in its correct position.

Turn armature till points are fully open and adjust the gap to ·012 in. with feeler gauges.

Tighten lock nut at foot of contact screw. Re-check gap setting.

67. Reassembling and Testing Slipping Clutch.

Key the gear centre assembly to the magneto shaft. Place the gear in position on the centre with bevelled edge inwards. Insert the friction plate in the recess in the gear. Thread the spring over the shaft and arrange so that the locating pin on the centre is positioned between two fingers of the spring.



MAGNETO SLIPPING CLUTCH

Fig. 51

Thread the locking washer over the spindle and locate on the pin as was done with the spring.

Screw the locking nut on the spindle with hexagon towards the gear. Tighten nut dead tight, using the gear locking tool as previously illustrated. See Fig. 46.

Test for slip in the following manner :

With gear locked, slip must not occur, with a pressure of less than 4 lbs. applied at the end of a horizontal lever 1ft. long secured to the spindle. Slip must occur at a pressure of less than 10 lbs.

If slip occurs at less than 4 lbs. a new spring must be fitted.

When the spring pressure has been satisfactorily tested, lock the securing nut by bending over one of the tags of the locking washer.

Refit dynamo and pack gears with high melting point grease.

Fit driving end cover in position with paper gasket correctly located.

Replace H.T. pick-up, checking carbon brush to see that it is free to move in its holder and examine cork gasket for cracks.

Refit earth brush.

SPARKING PLUG.

Type : Lodge H.14 Sintox or Champion L.10S (14 m.m. thread, standard ½ in. reach).

68 Dismantling, Cleaning and Setting.

If the plug is oiled or carboned up it should be taken apart and thoroughly cleaned internally. To dismantle the plug, hold the gland nut (smaller hexagon) in a vice and unscrew the body of the plug by means of a tube spanner or ring spanner. Take care not to lose the metal sealing washer which makes the joint between the insulator and the body of the plug.

Carefully remove all oil and carbon from the internal insulation and inside the plug body. Re-assemble the plug and tighten securely so as to ensure gas tightness.

Carefully reset the gap between the plug points to ·018 in. taking care to set the side points and **never to bend the central electrode.** A gauge ·018 in. thick will be found on the small spanner supplied for tightening the oil pump cover screws.

Note.—In the case of replacement plugs which may be of the non-detachable type, the only satisfactory way of cleaning is by sand blasting. This, however, must never be done to plugs having mica insulation.

69. Testing.

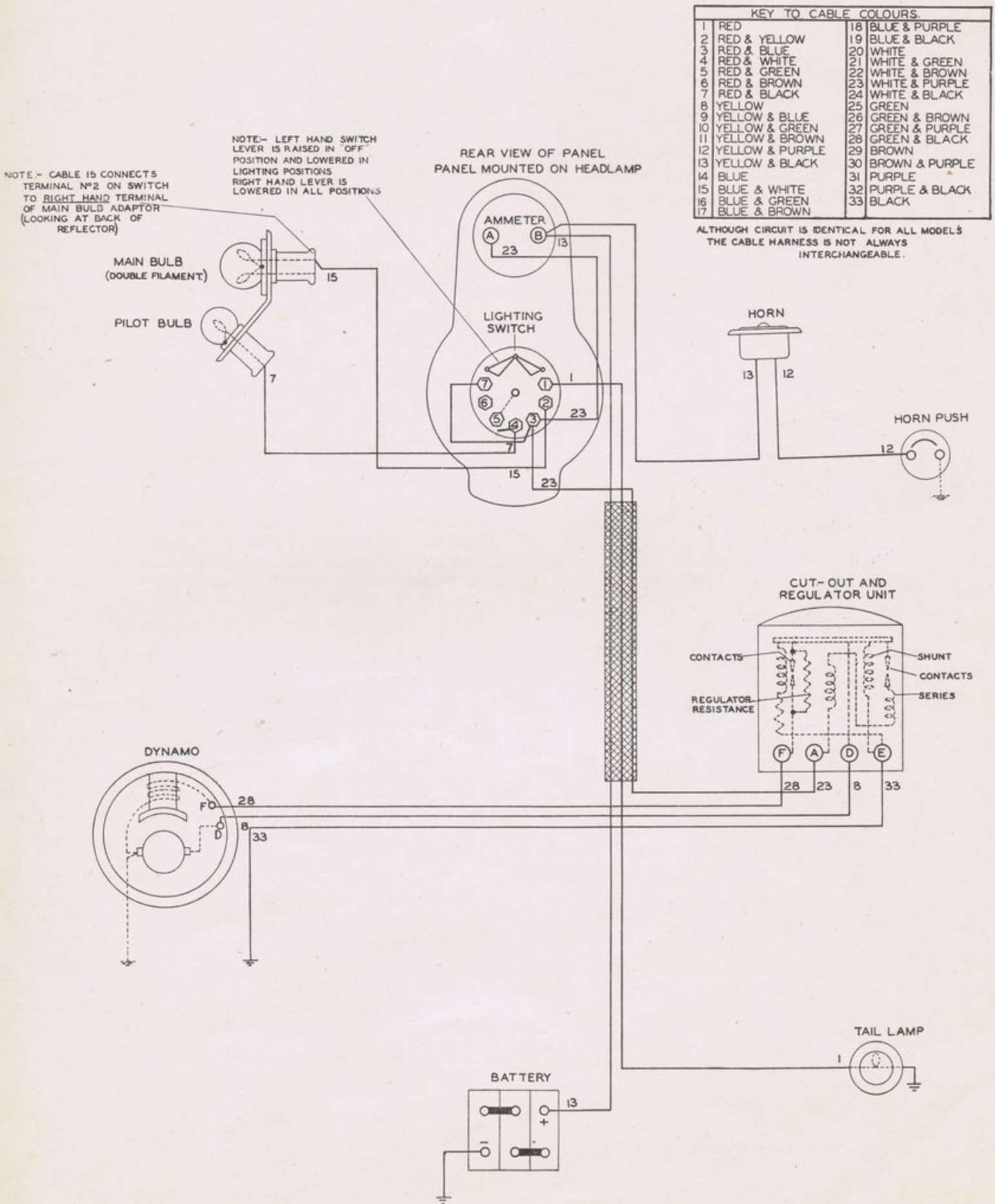
The only satisfactory test for a plug is its ability to fire under pressure. This requires the use of special apparatus consisting of a pressure chamber (with a small glass window) into which the plug can be screwed and a source of high tension current.

A plug in good condition with its points set to ·018 in. should fire at 10,000 volts when subject to a pressure of 40 lbs. per sq. in.

CHARGING CIRCUIT.

70. Testing.

With compensated voltage control equipment, the reading on the ammeter will show only one or two amperes charge during daytime running when the battery is fully charged.



WIRING DIAGRAM

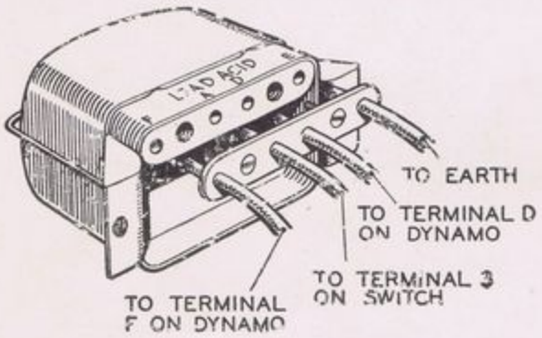
Fig. 52

It is most important that the main dynamo and field leads are not interchanged either internally or externally at the dynamo or at the voltage control box. If the ammeter does not show a charge when the engine is running at a fair speed, test as follows :—

Remove dynamo leads from terminals " D " and " F." Bridge the two terminals and, with the engine running at a fast tick-over speed, connect a voltmeter between the link joining terminals " D " and " F " and the yoke of the dynamo. Speed up engine slightly when voltage should rise with speed.

If the dynamo proves to be in order, reconnect leads at the dynamo.

Next disconnect leads to " D and " F " terminals at the voltage regulator. Join these wires together and test with voltmeter connected between them and a good earth on the machine. If the voltage rises with speed then the leads from the dynamo to regulator are in order.



CONNECTIONS TO VOLTAGE REGULATOR

Fig. 53

At this stage test the battery and connections with voltmeter :—

(1) Test between positive and negative battery terminals. Reading should be 6 to 7 volts.

(2) Test between positive battery and frame of motor cycle. No reading indicates bad earth or broken earth wire from battery to frame.

(3) With engine running at charging speed, turn front wheel through full lock, to stress cables, and check for fractures under insulation.

Assuming that components and wiring so far tested have proved to be in order, now test the control box and the remaining cables.

Remove the lead from terminal " A " at control box.

With voltmeter, test between this lead and earth. If a reading is obtained, the wiring from the battery to this point is in order and the fault lies in the cutout and regulator unit.

If no reading, connect voltmeter between terminal No. 3 on headlamp switch, and earth, when a reading will indicate there is an open circuit in wire between regulator and switch.

If no reading, test first between terminal " A " at ammeter and earth, and then terminal " B " and earth. A voltmeter reading at terminal " A " but not terminal 3 indicates a break in the link between ammeter and switchbox.

No reading at terminal " A " but a reading at terminal " B " indicates that the ammeter is open circuited.

No reading at terminal " B " indicates either a broken wire between terminal " B " and battery or bad battery connections.

DYNAMO.

(Lucas Type E. 3.H.M.).

71. Removal.

To remove the dynamo from the magneto portion of the Magdyno, unscrew from the driving end plate the securing nut and slacken the two screws in the clamping band. The dynamo can then be drawn away from its mounting.

72. Dismantling.

Bend back the tab washer from over the screw securing the driving pinion and remove the screw. Withdraw the pinion by means of an extractor. Lift the two brushes from their holders and unscrew the two through bolts securing the driving end bracket to the yoke. Withdraw the end bracket complete with armature. The armature can be removed from the end bracket by means of a hand press.

73. Cleaning Commutator and Brushes.

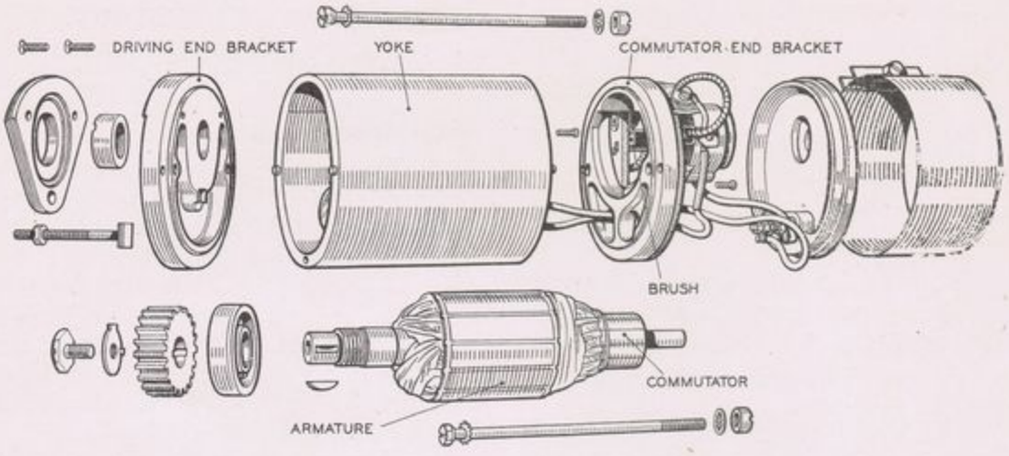
About every 10,000 miles, remove the metal cover band in order to inspect the commutator and brushgear. Check that the brushes are clean and move freely in their holders. If there is any stickiness, remove the brush and clean the sides with a cloth moistened with petrol, or by lightly polishing with fine glass paper. Always replace brushes in their original positions. Brushes which have worn so that they do not bear firmly on the commutator, or which expose the embedded end of the flex on the running face, must be replaced.

The commutator must be clean and free from traces of oil or dirt. Clean a dirty or blackened commutator by pressing a fine duster against it while the engine is slowly turned over. If the commutator is very dirty, the duster should be moistened with petrol.

74. Method of Making Connection to Dynamo or Regulator Terminals.

To make a connection to the dynamo or regulator terminals, slacken the fixing screw on the terminal block and remove the clamping plate.

Withdraw the metal sleeve in each terminal. Pass about 1in. of cable through the holes in the clamping plate and bare the ends for $\frac{3}{8}$ in. Fit the metal sleeves over the cables, bend back the wire over the sleeves and push them well home into their terminals. Finally screw down the clamping plate. The leads connected to the " D " and " F " terminals of the dynamo or regulator units must not be reversed. To prevent this occurring the screw in the dynamo terminal block is off-centre and the screws which secure the regulator terminal clamping plate are of different sizes.



EXPLODED VIEW OF DYNAMO

Fig. 54

75. Treatment of Badly Worn Commutator.

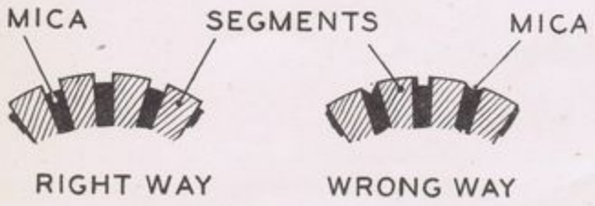
To remedy a badly worn commutator it will be necessary first to remove the armature from the dynamo. (See dismantling, Para. 72).

Mount the armature complete with the end bracket in a lathe, rotate at high speed and take a light cut with a very sharp tool. Do not remove more metal than is necessary. Polish the commutator with very fine glass paper. Now undercut the mica insulation between the commutator segments to a depth of $\frac{1}{32}$in. below the surface of the segments. A hacksaw blade, ground down until it is only slightly thicker than the mica forms a suitable tool. Draw this backwards and forwards along the mica until it is undercut to the proper depth. See Fig. 55.

76. Sticking Brushes.

Test by holding back the brush spring and moving the brush in its holder. If the brush tends to stick, remove it and clean with petrol.

Check spring tension as shown in Fig. 56. Correct tension is 10—15 ozs.

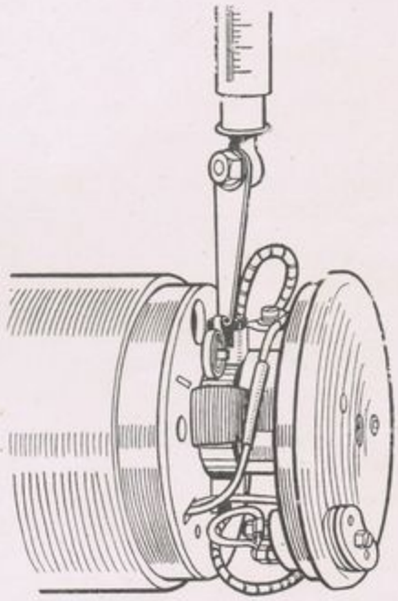


UNDERCUTTING MICA

Fig. 55

77. Worn Brushes.

Brushes which have worn to such an extent that they do not bear properly on the commutator must be replaced. Remove machine from engine and withdraw dynamo cover band. Remove screw securing eyelet on end of brush lead. Hold back brush spring and remove brush from its holder. Place new brush in holder and gently lower the spring. Secure eyelet on end of brush lead in original position.

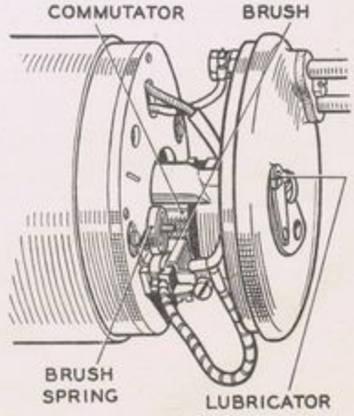


TESTING BRUSH SPRINGS FOR TENSION

Fig. 56

78. Test and Replacement of Field Coil.

The fitting of the field coil requires the use of a pole expander. If one is not available, do not attempt to replace the coil. When fitting a new field coil, take care to tighten the pole shoe fixing screw to the fullest extent.



COMMUTATOR AND BRUSH GEAR

Fig. 57

79. Test of Armature.

The testing of the armature requires the use of a volt drop test or " growler." If these are not available, check by substitution.

80. Special attention required if water has entered Dynamo.

(1) Check fibre wedges located in armature core slots. These may have swollen and become proud of the core. Cut level with sharp knife.

(2) Thoroughly dry out field coils and brushgear.

(3) Remove drive end ballrace. Wash out and if no excessive wear or roughness is apparent, re-pack with high melting point grease.

81. Reassembly of Dynamo.

(1) Pack drive end bearing with high melting point grease. Refit bearing retaining plate.

(2) Fit armature into drive end bearing and secure by screwing the retaining ring up tightly.

(3) Pass coil leads through slot provided on commutator end bracket insulating plate.

(4) Fit commutator end bracket in position on dowel pins.

(5) Lightly smear commutator end of armature shaft with oil and fit armature and drive end bracket into the yoke.

(6) Refit through bolts with cupped washers under drive end and flat spring washers under commutator end.

(7) Fit brushes into boxes and connect up brush tags with lead to " D " terminal and lead from " F " under their appropriate screws. The brushes are pre-formed and do not need bedding to the commutator.

(8) Reconnect wires to terminals " D " and " F " on bakelite cover, making **absolutely sure** that the correct wires are fitted to the respective terminals.

(9) To test—run the dynamo as a motor by connecting the + terminal of a 6 volt Battery to the " D " terminal of the dynamo and the − terminal of the battery to the dynamo yoke. Bridge terminals " D " and " F " with a piece of wire. The dynamo should then commence to rotate slowly.

Remove the link at " F " terminal when an increase in the speed should be observed. Reconnection of the link between " F " and " D " should slow down the speed again.

(10) Refit cover band, taking particular care to see that the top half overlaps the bottom and the cork gasket is correctly in place. Ascertain from the position of the magdyno which side faces the rear of the motor cycle and bring join in band to this side. This procedure is most important to prevent water entering dynamo.

REGULATOR AND CUTOUT.

(Lucas Model MCR1, Type L33).

82. Description.

The regulator provides complete automatic control causing the dynamo to give an output which varies according to the load on the battery or its state of charge. Normally, during daytime running, when the battery is in good condition, the dynamo gives only a trickle charge, so that ammeter readings will seldom exceed 1 or 2 amperes. If, under normal running conditions, it is found that the battery is continually in a low state of charge, or is being overcharged, then the regulator should be adjusted.

Always check that the " D " lead (yellow) and " F " lead (green and black) between the regulator and battery are connected to their correct terminals at both ends.

83. Adjustment.

The checking and adjustment of the regulator necessitates the use of a moving coil voltmeter having a full scale reading of approximately 12 volts.

To check the setting, disconnect the cable from the " A " terminal of the regulator and connect the voltmeter between the " D " terminal of the regulator or the regulator frame and some metal part of the engine.

Start the engine and increase the speed until the voltmeter needle " flicks " and then steadies. This reading should occur between the following limits :—

At 30°F. between 7·9 and 8·3 volts.
At 60°F. between 7·8 and 8·2 volts.
At 90°F. between 7·7 and 8·1 volts.

If the voltage at which the reading becomes steady occurs outside the limits the regulator must be adjusted.

Stop the engine, release the locknut holding the adjusting screw (see Fig. 58) and turn the screw in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the adjustment screw a fraction of a turn and then tighten the locknut.

When adjusting, do not run the engine up to more than half throttle as while the dynamo is on open circuit it will build up to a high voltage if run at high speed and so a false voltmeter reading will be obtained.

84. Cleaning Contacts.

After a long period of service, it may be found necessary to clean the vibrating contacts of the regulator. These are accessible if the top screw carrying the fixed contact is removed and the bottom screw slackened to enable the fixed contact to be swung outwards. The contacts should then be cleaned by polishing with a fine carborundum stone.

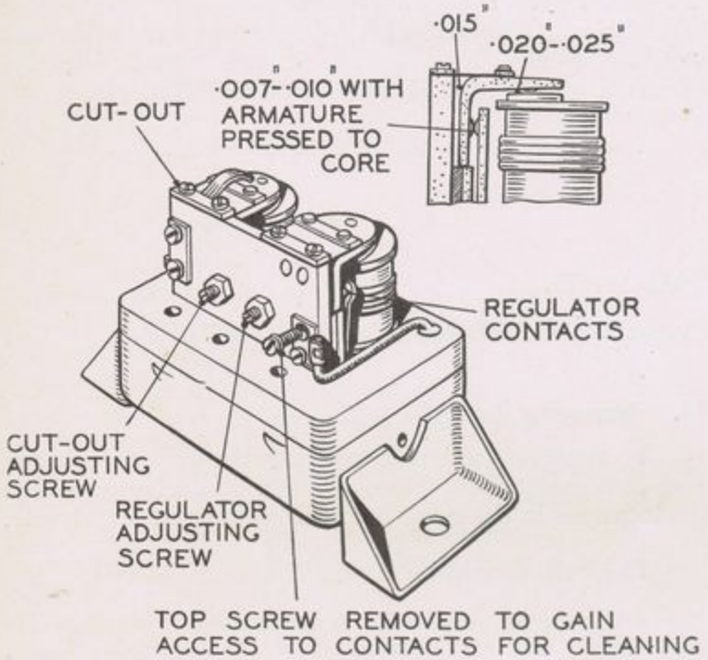
85. Mechanical Setting.

The contacts are accurately set during assembly and normally should not be disturbed. In the event of it becoming necessary to reset the contacts, however, the following procedure should be adopted :—

Insert ·015 in. feeler gauge between the back of the armature and the regulator frame.

Insert ·020 in. — ·025 in. feeler gauge between the top of the bobbin core and the underside of the movable armature (not under the stop rivet).

Press the armature back against the regulator frame and down on to the bobbin core, with the feeler gauges in position and secure the armature by tightening the two fixing screws. Adjust the gap between the regulator contacts when the armature is pressed down on to the bobbin, to between ·007 in. and ·010 in. This is done by inserting or removing packing shims at the back of the fixed contact. After completing the mechanical setting, the electrical setting of the regulator must be checked. See Para. 83.



VOLTAGE REGULATOR ADJUSTMENTS

Fig. 58

86. Adjustment of Cut-Out.

If, after adjusting the voltage regulator and reconnecting the wire to the " A " terminal, no charge is registered on the ammeter, check the cut-out contact points. See that these are clean and making good contact when closed. Set the voltage at which the points close to 6·2—6·6 volts, adjusting in a similar manner to the Voltage Regulator (see Para. 83) but using the cut-out adjusting screw.

87. Regulators for use with NIFE Batteries.

A special regulator marked NiFe is supplied for use with these batteries. If a NiFe battery is substituted for the lead acid type a new regulator must be fitted.

AMMETER. (Lucas Type CZ27).

88. Removal and Replacement.

Take out the three screws from the panel on the headlamp and remove the panel. Unscrew the ammeter terminal nuts and lift off the cable eyelets. Bend back the four metal tags securing the ammeter and remove the ammeter from the panel.

89. Ammeter Faults.

Check for faults in ammeter by substitution.

BATTERY. (Lucas Type PUW7E-5).

90. Topping Up.

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 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.

Pour a small quantity of **distilled** water into each of the cells to bring the acid level with the 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.

91. Checking Conditions.

First ascertain that the battery is a lead acid type and not a NiFe (nickel-cadmium alkaline) type, as the same hydrometer must not be used to take readings on both types of battery. 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 readings 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.

92. Cleaning.

Wipe the top of the battery to remove all dirt or 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.

93. Earthing Connections.

See that the lead from the negative terminal of the battery is securely connected to the cycle frame or other suitable earth.

94. 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. Charge the battery with a constant current of 1·2 amperes until the specific gravity of the electrolyte in the cells remains constant.

If the battery does not respond to a freshening charge it must be put through what is known as a " cycle."

First charge as described above for a period of 10 hours and then discharge at the rate of 1·2 amperes. The time taken to discharge should be 7–8 hours. If the battery discharges in a shorter time, repeat the charging and discharging cycle. If the efficiency of the battery is not improved by this process there is probably an internal fault and the battery should be replaced.

HEADLAMP. (Lucas Type DU42).

95. Removing Lamp Front and Reflector.

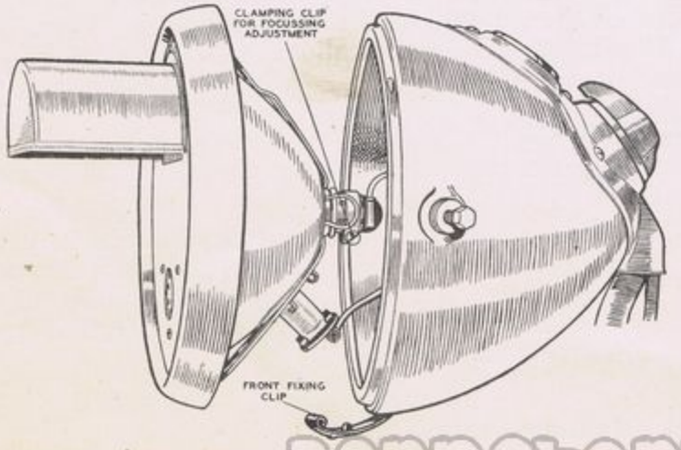
To remove the lamp front and reflector press back the fixing clip at the bottom of the lamp. When replacing the front locate the top of the rim first, then press on at the bottom and secure by means of the fixing clip.

To remove the bulb holder, press back the securing springs.

96. Setting and Focussing.

The lamp must be set to ensure that the beam is projected below the horizontal.

To obtain the best driving light the bulb should be correctly focussed in the reflector. To adjust the position of the bulb, remove the lamp front and reflector and slacken the screw on the clamping clip at the back of the reflector. Slide the bulb holder backwards or forwards until the best lighting is obtained and finally tighten the clamping screw.



HEADLAMP—REFLECTOR PARTIALLY REMOVED

Fig. 59

97. Cleaning.

Care must be taken, when handling the reflector to prevent it from becoming finger marked. It can, however, be cleaned by polishing with a fine chamois leather. Metal polishes must not be used.

98. Bulbs.

The main bulb should be 6 volt, 24 watt, double-filament type. If the filament in use burns out, reverse the bulb in its holder, thus bringing the other filament into operation. Re-focus the lamp to obtain the best results from the altered position of the filament.

The pilot bulb is 6 volt, 3 watt S.B.C.

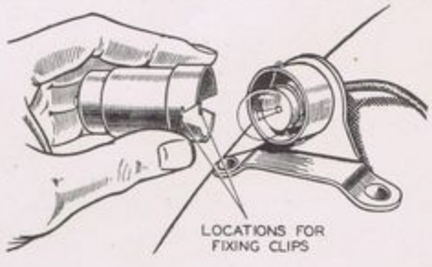
TAIL LAMP.

(Lucas Type L-WD-MCT1 or L-WD-MCT1A).

99. Removing Lamp.

To remove the cover carrying the red glass, twist and pull away from base. When replacing, position the locations in the cover over the spring and push home.

The bulb should be 6 volt, 3 watt, S.B.C.



TAIL LAMP—CAP REMOVED

Fig. 60

CABLES.

100. Positive Lead to Battery.

Before making any alterations to the wiring or removing the switch from the headlamp, disconnect the positive lead at the battery to avoid the danger of short circuits. The lead from the positive 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 machine as this will short circuit the battery. When connecting up again, pull the rubber sleeve over the connector.

LIGHTING SWITCH. (Lucas Type U39).

101. Method of Making Connections.

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. The colour scheme and the diagram of connections are shown in the wiring diagram (see Fig. 52). When making connections to the switch, bare the end of the cable for about $\frac{3}{8}$ in., twist the wire strands together and turn back about $\frac{1}{8}$ in. so as to form a small ball. Remove the grub screw from the appropriate terminal and insert the wire so that the ball fits in the terminal post. Now replace and tighten the grub screw ; this will compress the ball to make a good electrical connection.

ELECTRIC HORN.

(Lucas Type HF 1235 or Miller Type 21E).

102. General.

The horn is adjusted at the Works to give its best performance and will give a long period of service without any attention.

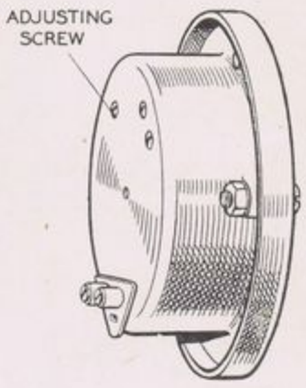
If a horn becomes uncertain in its action, giving only a choking sound, or does not vibrate, it does not follow that it has broken down. First ascertain that the trouble is not due to some outside source, e.g., a discharged battery or a loose connection or short circuit in the wiring of the horn. It is also possible for the performance of the horn to be upset by the fixing bolt working loose. This can be ascertained by removing the horn from its mounting, holding it firmly in the hand and operating the push.

If the note is still unsatisfactory, the horn may require adjustment.

103. Method of Adjusting.

The adjustment of a horn does not alter the characteristics of the note, but takes up wear of vibrating parts which if not corrected, results in loss of power or roughness of tone.

If the horn is used repeatedly when badly out of adjustment, due usually to unsuccessful attempts at adjustment, the horn may become damaged, due to the excessive current which it will take. When testing, do not continue to operate the push if the horn does not sound. If, when the push is operated, the horn does not take any current (indicated by an ammeter connected in series with the horn), it is possible that the horn has been adjusted so that its contact breaker is permanently open.



ELECTRIC HORN

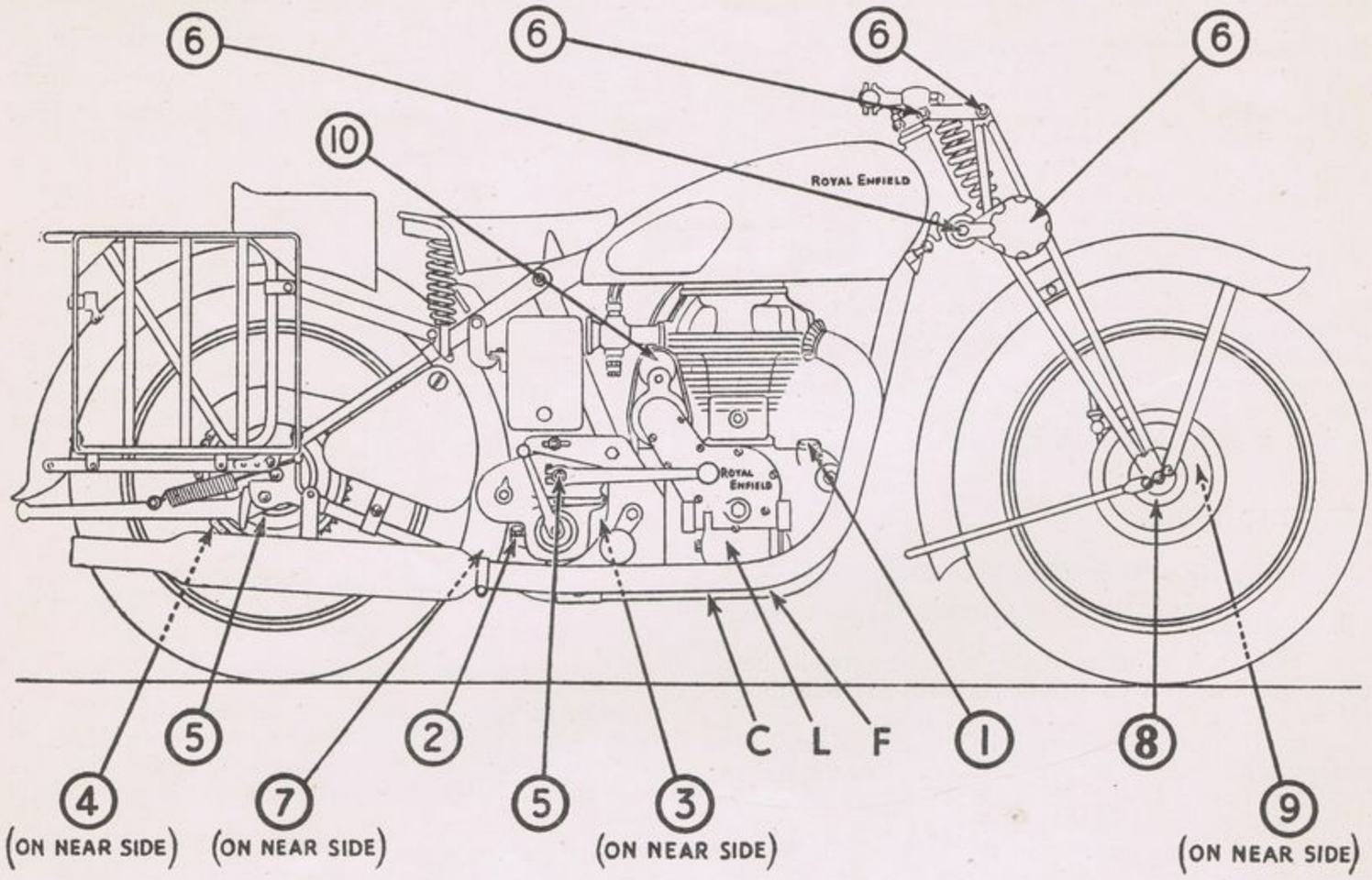
Fig. 61

After adjusting, note the current consumption. A horn may give a good note yet be out of adjustment and taking an excessive current. When adjusting, do not attempt to unscrew the nut securing the tone disc or any other screws in the horn.

The adjustment is made by turning the adjustment screw (Fig. 61) usually in a clockwise direction. The underside of the screw is serrated and the screw must not be turned for more than 2 or 3 notches before retesting. If the adjustment screw is turned too far in a clockwise direction, a point will occur at which the armature pulls in but does not separate the contacts.

The current when the horn is adjusted to give its best performance must not exceed 4 amperes.

LUBRICATION CHART



MOTOR CYCLE, SOLO, ROYAL ENFIELD, MODELS WD/CO and WD/CO/B, 350 c.c. O.H.V.

Location No.	Part	Lubricant
1	ENGINE TOP UP (Capacity 4 pints)	Castrol Grand Prix (or XXL).* Golden Shell † (or Triple Shell).*
2	GEAR BOX TOP UP (Capacities : Standard Box, ¾ pint ... / Burman Box, 1⅓ pint ...)	Mobiloil D ‡ (or B.B.).* Essolube Racer § (or 50).*
3	CHAIN CASE TOP UP	Motorine B de Luxe (or C).*
4	REAR CHAIN	Engine Oil or Grease.
5	GEAR CONTROL PIVOT (Kickstarter Pivot on Burman Gear Box)	Castrolease (Medium). Mobilgrease (No. 2).
6	FORK SWIVEL PINS (6 points)	Shell Retinax C.D. Esso Grease. **
7	BRAKE PEDAL PIVOT	Belmoline D.
8	WHEEL HUBS	Castrolease (Heavy). Mobilgrease (No. 4). Shell Retinax R.B. Grease.
9	SPEEDOMETER DRIVE	Esso Grease. ** Belmoline C.
10	MAGDYNO LUBRICATOR	Light Machine Oil.
	OIL CAN LUBRICATION Control levers and exposed ends of control cables.	Engine Oil.

* The oils shown in brackets are recommended for use in very cold weather or at any time when special motorcycle oils are not available.

** Known in some countries as Esso Cup Grease.

† " " " " Shell X100 (S.A.E.60).

‡ " " " " Mobiloil B.

§ " " " " Essolube 60.

SUPPLEMENT

FOR

ROYAL ENFIELD 350 c.c. O.H.V. MODEL WD/CO/B FITTED WITH BURMAN GEARBOX

Contract No. 294/c/13870

Frame and Engine Nos. 14001—17000 inclusive

CLUTCH.

104. Dismantling, Reassembling and Adjustment of Control.

Machines having frame numbers 14001—15050 inclusive are fitted with clutches identical with that described in paragraphs 32 and 33 (page 22) and illustrated in Fig. 30 (page 20) of the main portion of this book. Later machines have a similar clutch with a solid centre instead of the cush drive centre. This is illustrated in Fig. 62 and the methods of dismantling and assembling the clutch and adjustment of the clutch control are exactly the same as for the clutch fitted to the standard gearbox.

GEARBOX.

105. Method of Operation.

The method of operating the foot control lever is precisely the same as with the standard gearbox, i.e., the lever is moved downwards when making upward changes and upwards when making downward changes. The internal construction of the gearbox is, however, completely different and is shown in Fig. 66.

The mainshaft (3) runs in the 32 T. driving gear (12) and carries on its splined centre portion the mainshaft sliding gear (13), which has a gear at each end. The mainshaft third gear (15) runs free on the mainshaft.

The layshaft (36) carries the layshaft third gear (29) and layshaft small gear (34) or constant mesh gear on splined portions at each end of the layshaft. The layshaft first gear (30) and second gear (33) run free on the shaft while the layshaft clutch (31) is free to slide on the splined centre portion of the shaft.

The gears are engaged by endways movement of either the mainshaft sliding gear or the layshaft clutch which are controlled by operating forks actuated by a camshaft which is operated by the footchange mechanism.

The illustration shows the gears in the neutral position. Rotation of the mainshaft causes rotation of the mainshaft sliding gear and the first and second gear pinions on the layshaft. As, however, these are free to rotate on the layshaft there is no drive through the gearbox.

To obtain first gear the layshaft clutch is moved to the right so that the external teeth on it engage with the internal teeth in the layshaft first gear, thus clutching the gear to the layshaft. Rotation of the mainshaft now causes rotation of the layshaft through the mainshaft sliding gear, layshaft first gear and layshaft clutch. In turn, this causes rotation of the driving gear through the layshaft small gear.

To obtain second gear the layshaft clutch is moved to the left, thus clutching the layshaft second gear to the shaft so that rotation of the mainshaft causes rotation of the driving gear, through the second gears, the layshaft and the layshaft small gear.

To obtain third gear the layshaft clutch is returned to its central position, thus freeing both the first and second layshaft gears on the shaft and the mainshaft sliding gear is moved to the right so that the teeth on the smaller end of it engage with the internal teeth in the mainshaft third gear, thus clutching it to the mainshaft. Rotation of the mainshaft now drives the layshaft through the third gears and in turn drives the driving gear through the layshaft small gear.

To obtain top gear the mainshaft sliding gear is moved to the left so that the teeth on the larger end of it engage with the internal teeth in the driving gear, thus clutching the mainshaft direct to the driving gear.

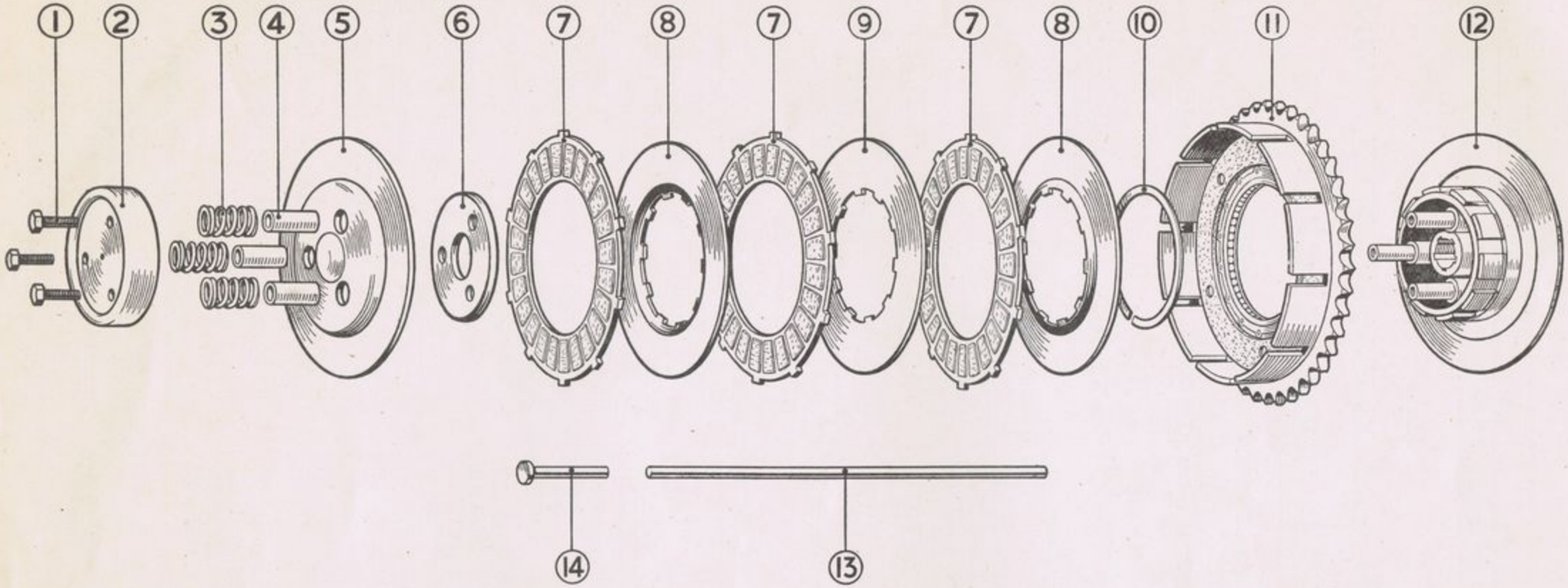
The clutch is mounted directly on the mainshaft and the driving sprocket is attached to the splined end of the driving gear. Thus connection between the mainshaft and the driving gear either direct or through one of the gear trains causes the rear wheel to be rotated by the engine at a speed depending on the gear ratio which is in use.

The kickstarter is operated by means of a quadrant which, on depressing the kickstart lever, engages with a ratchet pinion on the end of the mainshaft.

106. Removal of Gearbox from Frame.

The gearbox is removed from the frame in the same way as the standard box (see paragraph 13, page 10 in the main portion of this book).

All operations on the gearbox can, however, be carried out with the box in position.



EXPLODED VIEW OF CLUTCH

(1) Spring Screw.
(2) Cap.
(3) Spring.
(4) Distance Tube.
(5) Front Plate.
(6) Clutch Centre Retaining Ring.
(7) Plate with Inserts.
(8) Intermediate Plate, dished.
(9) Intermediate Plate, flat.
(10) Retaining Spring.
(11) Sprocket and Drum Assembly.
(12) Clutch Centre and Backplate Assembly.
(13) Clutch Rod.
(14) Clutch Operating Pad.

Fig. 62

107. Dismantling the Gearbox (if in the machine).
See Fig. 66.

Operate the foot control until the gears are in the top gear position. Disconnect the clutch control cable from the clutch lever on the gearbox, unscrew the six nuts which secure the kickstart case cover and withdraw this cover complete with the kickstarter and foot control mechanisms.

Unscrew (R.H. thread) the mainshaft nut (22) at the same time applying pressure to the rear brake pedal. This will effectively prevent the mainshaft from turning provided that top gear has been engaged as suggested above and that the rear chain has not been removed. Remove the kickstart driving ratchet (21), ratchet pinion (20) and spring (19), together with the bush inside the spring.

Now remove the outer half of the primary chaincase, dismantle and remove the clutch and withdraw the clutch centre from the mainshaft (see paragraphs 32 and 13 in the main portion of this book). Remove the inner half of the primary chaincase and unscrew the driving gear nut (1) after bending back the tabs on the lock washer (2). Remove the rear chain, driving sprocket (4) and spacing collar (5). The mainshaft can now be pulled out of the gearbox towards the left-hand side of the machine.

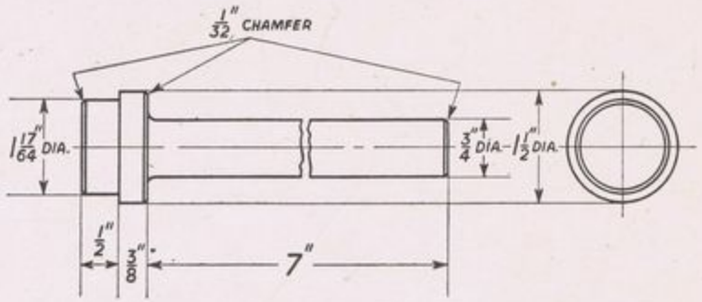
Note.—*It is not necessary to disturb the driving gear nut unless it is required to replace the driving sprocket, driving gear, bearing or gland felt washer.*

Unscrew the five nuts which secure the kickstart case to the gearbox shell and remove the kickstart case and the paper washer which makes the joint between it and the gearbox shell. The mainshaft third gear (15) can now be lifted away, but before attempting to remove the rest of the gears it is essential to unscrew the screwdriver slotted plug (see Fig. 69, No. 7) underneath the front of the gearbox at the kickstarter end. After removal of this and the spring (see Fig. 69, No. 5) above it, the entire assembly of camshaft, operating forks, mainshaft sliding gear and layshaft complete with gears and layshaft clutch, can be withdrawn from the gearbox.

Push the driving gear into the gearbox from which it can be taken away.

108. Removal of Ball Bearings and Layshaft Bearings.

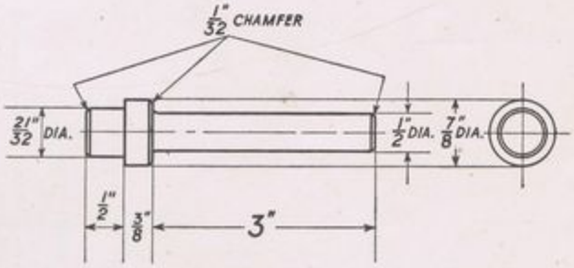
To remove the driving gear bearing (11) first remove the retaining ring (6) and lift away the outer driving gear gland washer (7), felt washer (8) and inner gland washer (10). Then remove the driving gear bearing location ring (9), after which the bearing can be pushed out from inside the box using a drift as shown in Fig. 63.



DRIFT FOR REMOVING DRIVING GEAR BEARING

Fig. 63

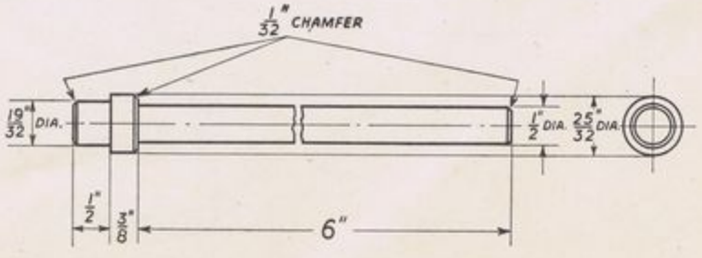
To remove the mainshaft ball bearing from the kickstart case remove the bearing retaining ring (18) and washer (17) after which the bearing can be pushed out from inside the case using a drift as shown in Fig. 64.



DRIFT FOR REMOVING MAINSHAFT BALL BEARING

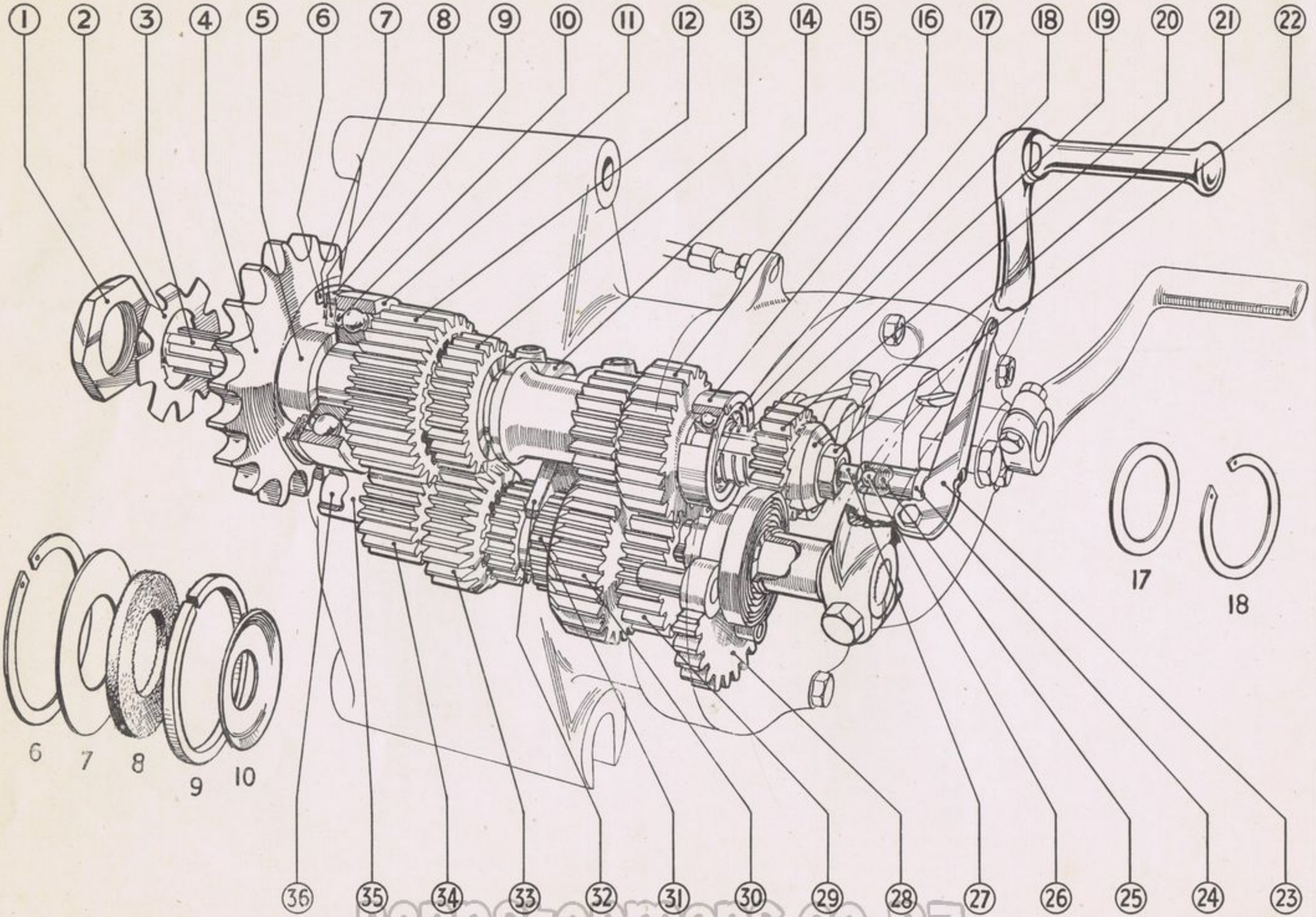
Fig. 64

The layshaft bush in the kickstart case can be removed by means of a drift as shown in Fig. 65. The layshaft bush in the gearbox shell can be removed by means of the same drift, after removal of the steel cap which blanks off the end of the bush. This cap can be driven out from inside the gearbox by means of a suitable drift.



DRIFT FOR REMOVING OR REFITTING GEARBOX LAYSHAFT BUSHES

Fig. 65



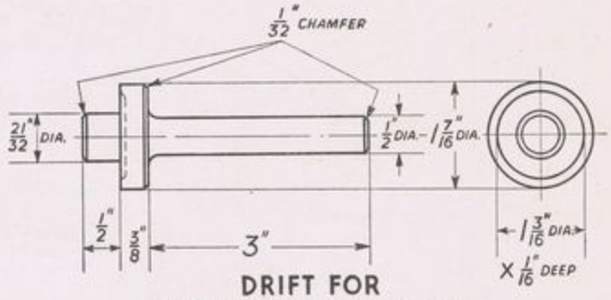
BURMAN GEAR BOX

(1) Driving Gear Nut.
(2) Driving Gear Nut Locking Washer.
(3) Mainshaft.
(4) Driving Sprocket.
(5) Sprocket Spacing Collar.
(6) Retaining Ring.
(7) Driving Gear Gland Washer (Outer).
(8) Driving Gear Gland Felt Washer.
(9) Driving Gear Bearing Location Ring.
(10) Driving Gear Gland Washer (Inner).
(11) Driving Gear Ball Bearing.
(12) Driving Gear, 32 T.
(13) Mainshaft Sliding Gear, 23—18 T.
(14) Operating Fork (Mainshaft.)
(15) 3rd Gear, Mainshaft, 29 T.
(16) Mainshaft Ball Bearing.
(17) Mainshaft Bearing Washer.
(18) Mainshaft Bearing Retaining Ring.
(19) Ratchet Pinion Spring.
(20) Ratchet Pinion.
(21) Driving Ratchet.
(22) Mainshaft Nut (kickstarter end).
(23) Clutch Operation Lever.
(24) Clutch Adjusting Operating Sleeve.
(25) Clutch Adjuster Screw.
(26) Steel Ball, $\frac{1}{4}$in.
(27) Clutch Rod.
(28) Kickstart Quadrant.
(29) 3rd Gear, Layshaft, 21 T.
(30) 1st Gear, Layshaft, 32 T.
(31) Layshaft Clutch.
(32) Operating Fork, Layshaft.
(33) 2nd Gear, Layshaft, 27 T.
(34) Small Gear, Layshaft, 18 T.
(35) Layshaft Bush.
(36) Layshaft.

Fig. 66

109. Reassembling the Gearbox.

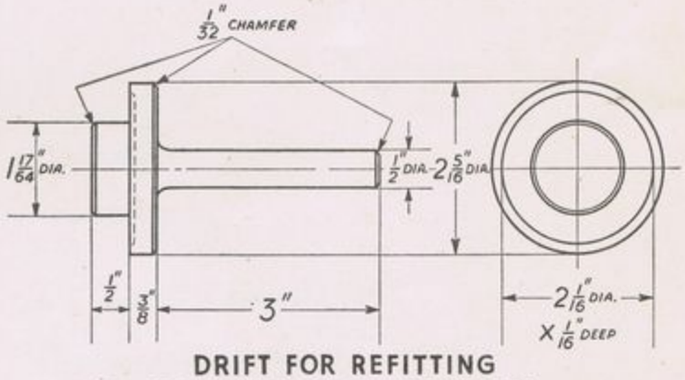
The drift shown in Fig. 65 is also suitable for inserting new layshaft bushes. Suitable drifts for inserting the ball bearings are shown in Figs. 67 and 68.



DRIFT FOR REFITTING MAINSHAFT BALL BEARING

Fig. 67

No difficulty should be experienced in reassembling the gearbox, the procedure, in general, being the reverse to that employed in dismantling it. The following points should, however, be noted :—

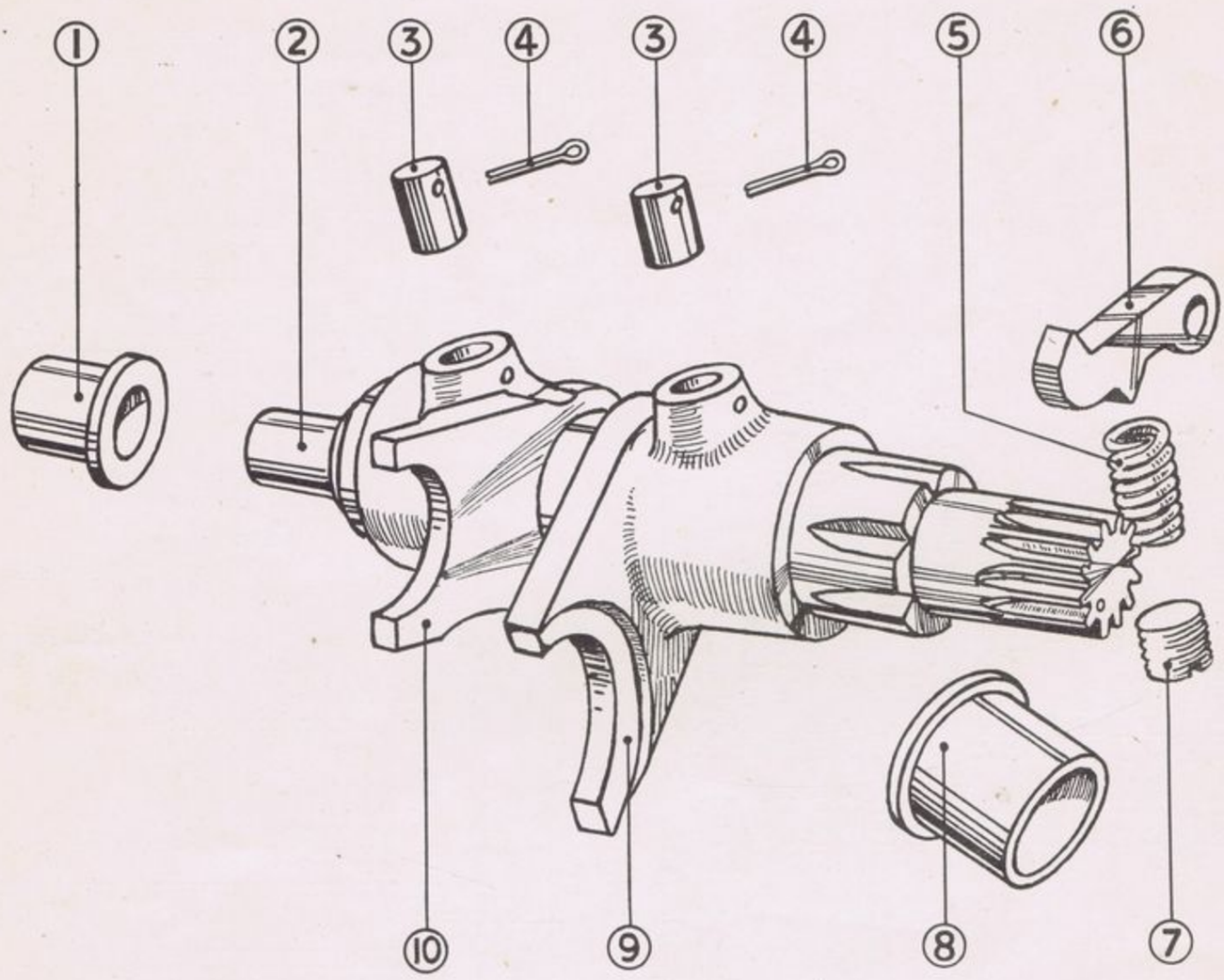


DRIFT FOR REFITTING DRIVING GEAR BEARING

Fig. 68

(*a*) When assembling the layshaft gears on the shaft, make sure that they are in the correct order. Note that the layshaft small gear (18 teeth) is wider than the layshaft third gear (21 teeth) and that the splines at one end of the layshaft are correspondingly longer. The layshaft second gear (27 teeth) is fitted next to the small gear and the first gear (32 teeth) next to the third gear pinion.

(*b*) Assemble the layshaft and gears, camshaft with operating forks and mainshaft sliding gear in a cluster before assembling these into the gearbox. When doing this note that, if the layshaft small gear is to the left, the pinion on the end of the camshaft must be to the right and the small end of the mainshaft sliding gear must also be to the right. The small operating fork engages with the mainshaft sliding gear, the larger one with the layshaft clutch.



EXPLODED VIEW OF CAMSHAFT

(1) Camshaft Bush, Shell.
(2) Camshaft.
(3) Operating Peg (Camshaft).
(4) Operating Peg Cotter.
(5) Pawl Spring.
(6) Pawl.
(7) Pawl Spring Plug.
(8) Camshaft Bush, Kickstart Case.
(9) Operating Fork (Layshaft).
(10) Operating Fork (Mainshaft).

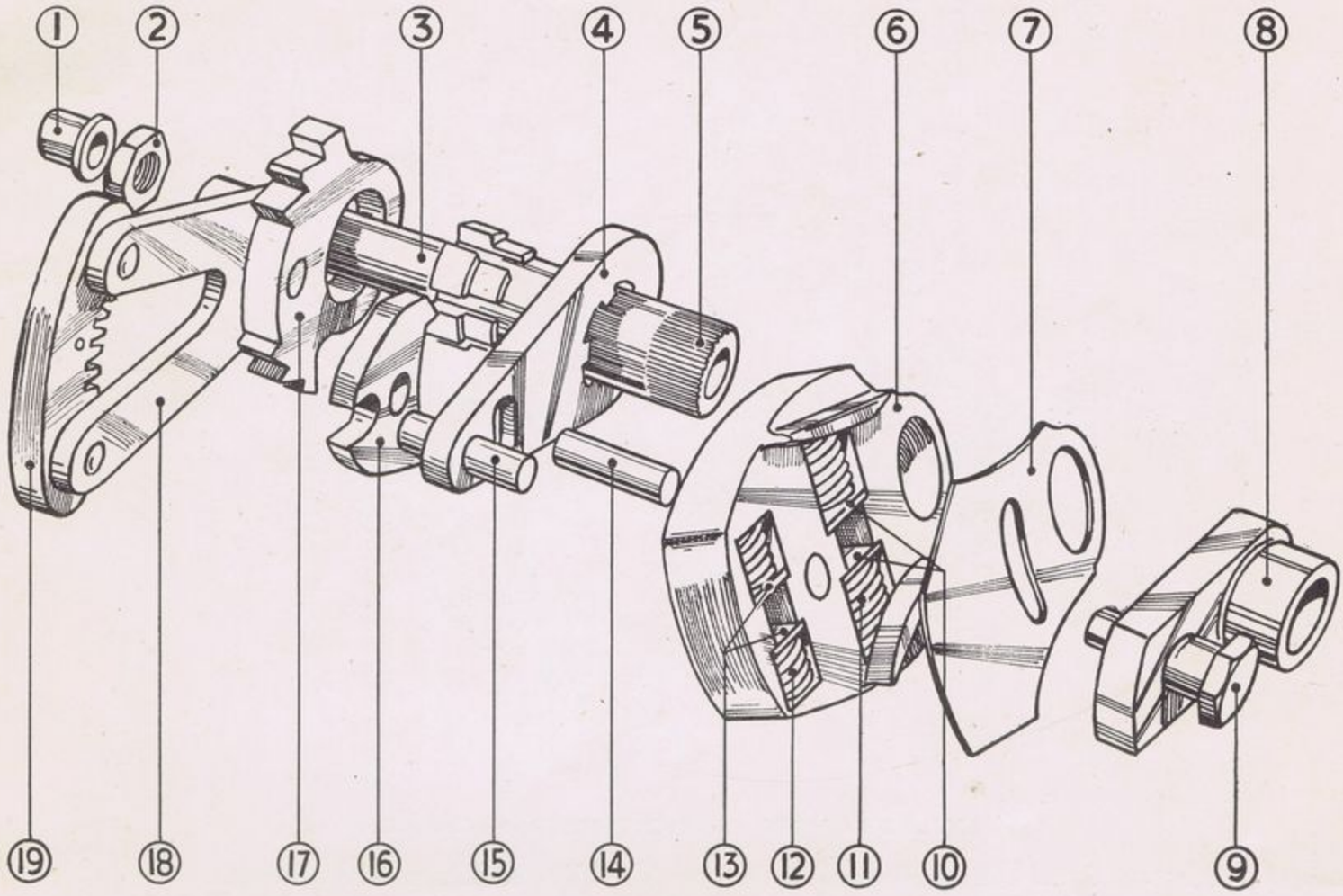
Fig. 69

(*c*) When assembling the toothed ratchet of the gear control mechanism with the gear on the end of the cam, see that the marked teeth are assembled together otherwise the gears will not be in correct register. Whilst it is quite possible to reassemble the foot control mechanism in one complete unit with the kickstart case cover, it will probably be found simpler to assemble first the ratchet, control sector quadrant, gear sector and sector spindle into the kickstart case and the foot control lever bush, control bush bolt, spring box and springs, control quadrant, ratchet sleeve, pawl, pawl operating peg and pawl spindle into the kickstart case cover.

Make sure that the pawl is put back the same way round as it was originally fitted as it may not engage correctly if reversed.

(*d*) Before replacing the kickstart case cover make sure that the end of the kickstart spring is anchored on to its pin and wind up the spring 1½ to 2 turns by means of the kickstart lever. The kickstart quadrant must be in such a position that it engages with the ratchet pinion while the cover is being pushed home.

The spring must not close up solid when the kickstarter is operated, but at the same time must have sufficient tension to hold the pedal firmly in the normal upright position. If the spring has insufficient tension or closes up solid, adjust by removing the inner end from the kickstart spindle boss and refitting one or two notches further round as required.



EXPLODED VIEW OF FOOT CHANGE MECHANISM

(1) Sector Spindle Bush.
(2) Sector Spindle Nut, $\frac{7}{16}$ in.
(3) Sector Spindle.
(4) Control Quadrant.
(5) Ratchet Sleeve.
(6) Spring Box.
(7) Spring Box Cover Plate.
(8) Foot Control Lever Bush.
(9) Control Bush Bolt.
(10) Main Spring Plate.
(11) Main Spring.
(12) Pawl Spring.
(13) Pawl Spring Plate.
(14) Pawl Operating Peg.
(15) Pawl Spindle.
(16) Footchange Pawl.
(17) Ratchet.
(18) Control Sector Quadrant.
(19) Gear Sector.

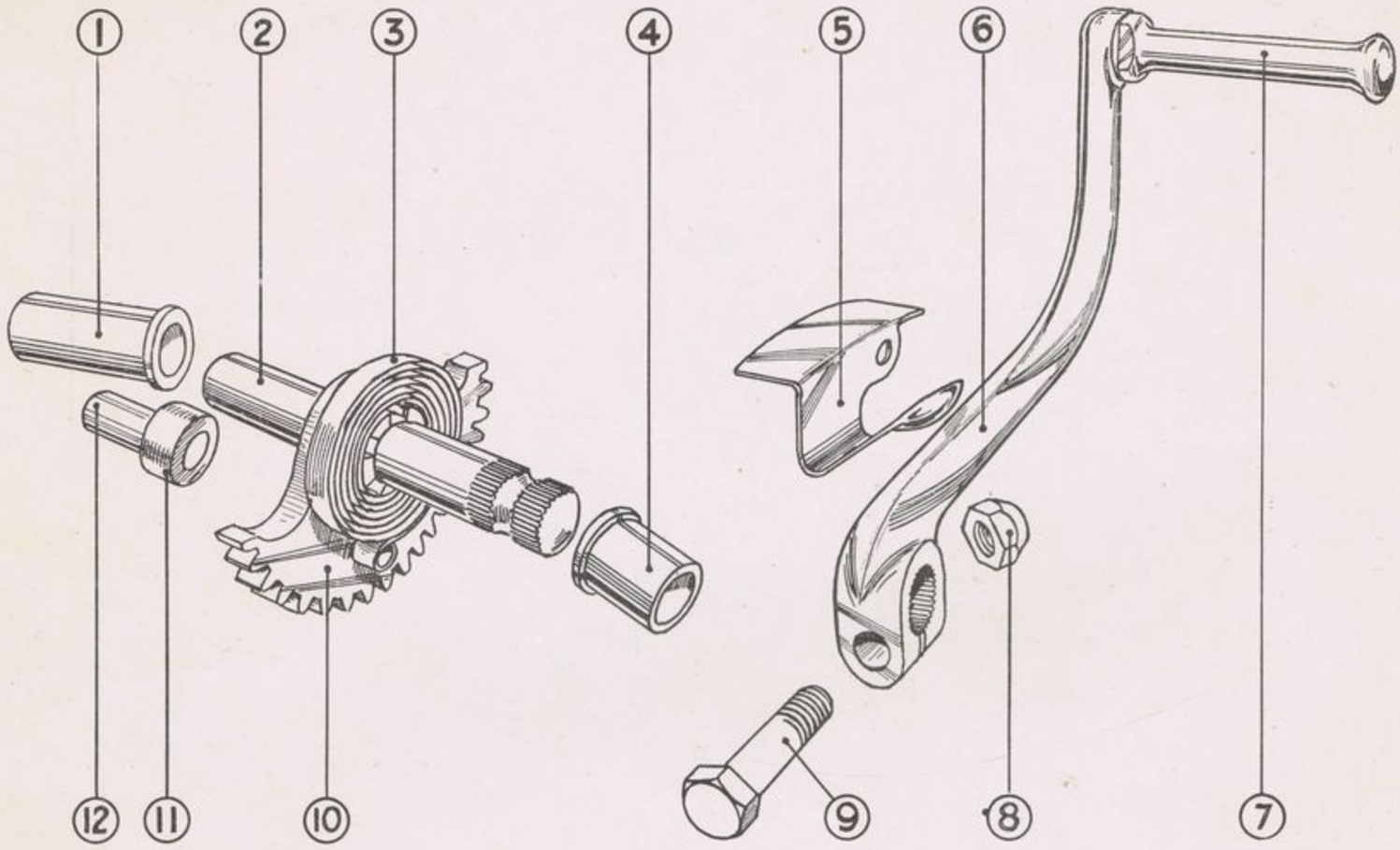
Fig. 70

110. Camshaft.

The camshaft is shown in Fig. 69. If it is required to remove one of the operating forks the operating peg must first be withdrawn after removal of the split cotter which secures it. When refitting the forks, note that the one with the small forked end is fitted at the end of the camshaft furthest from the operating gear. Note also that the operating forks are assembled with their forked ends next to each other. When replacing the operating pegs make sure that they are the correct way round as they are chamfered to clear the inside of the gearbox casing.

111. Foot Change Mechanism.

This mechanism, though apparently complicated, is actually quite simple in operation. The details of the mechanism are shown in Fig. 70. The foot control lever is mounted on the ratchet sleeve (5) and movement of the lever turns the ratchet sleeve and with it the control quadrant (4). During the first part of the movement the pawl spindle (15) tips the footchange pawl (16) until it engages in one of the teeth in the ratchet (17). At the same time one of the pawl springs (12) in the spring box (6) is compressed. Further movement of the ratchet sleeve (5) and control quadrant



EXPLODED VIEW OF KICKSTARTER MECHANISM

(1) Kickstart Spindle Bush (Inner).
(2) Kickstart Spindle.
(3) Kickstart Spring.
(4) Kickstart Spindle Bush
(5) Kickstart Lever Spring Clip.
(6) Kickstart Lever.
(7) Kickstart Lever Pedal.
(8) Kickstart Lever $\frac{5}{16}$ in. Bolt Nut.
(9) Kickstart Lever $\frac{5}{16}$ in. Bolt.
(10) Kickstart Quadrant.
(11) Kickstart Stop Peg Rubber with Sleeve.
(12) Kickstart Stop Peg.

Fig. 71

(4) causes the ratchet (17) to move, carrying with it the control sector quadrant (18) and gear sector (19) which thus turns the gear on the end of the camshaft (see Fig. 69). At the same time the spring box (6) itself pivots, compressing one of the main springs (11) until further movement of the control lever is prevented by one of the stops formed on the spring box. On releasing the control lever the springs in the spring box return the box, control quadrant and pawl to their normal positions, but movement of the ratchet, control sector quadrant, gear sector and camshaft is prevented by the gear indexing pawl which engages with grooves cut in the camshaft (Fig. 69). Thus on the return of the pedal the pawl (16) slides over one of the ratchet teeth and is ready to pick up the next tooth when the control lever is operated again.

The sector spindle (3) moves with the control sector quadrant (18) and carries on its outer end the gear indicator, the position of which thus indicates which gear is engaged. Note that this gear indicator is in line with the small fixed indicator when the gears are in neutral.

112. Kickstarter Mechanism.

This is shown in Fig. 71. Operation of the lever (6) rotates the quadrant (10) which engages with the ratchet pinion (20 in Fig. 66) and rotates the engine through the driving ratchet, mainshaft, clutch and primary chain. When the engine starts, the ratchet pinion over-runs the driving ratchet until the kickstart lever is returned to its normal position, when the quadrant disengages from the ratchet pinion and allows the pinion to rotate with the mainshaft and driving ratchet.

It is important to make sure that the kickstart lever is returned fully home so that the quadrant is disengaged from the ratchet pinion, otherwise the latter may seize on the mainshaft and do a considerable amount of damage. If the kickstart spring is broken or weak, pick the lever up by hand and place it in position so that the kickstart lever spring clip (5) will hold it in place. Early boxes were not fitted with this spring clip, but should have been modified in service.

When operating the kickstart lever, ease the quadrant into engagement with the ratchet pinion by operating the lever slowly with the clutch lifted.

If the quadrant jams on engagement do **not** try to force it, but engage second gear and rock the machine **backwards** with the exhaust lifter raised. This will disengage the quadrant from the ratchet pinion.

113. Dismantling and Reassembling Gearbox when Removed from Frame.

The method of doing this is exactly the same as when the box is in the frame but some difficulty may be experienced in preventing the mainshaft and driving gear from rotating when undoing or tightening up the nuts which secure the clutch centre and ratchet pinion to the mainshaft and the nut which secures the driving sprocket to the driving gear.

Perhaps the simplest way of holding these is to make a chain grip by attaching a length of rear driving chain to a steel rod and then to wrap the chain round the driving sprocket, which will be prevented from turning by holding the rod. If the gear control is placed in the top gear position, holding the driving sprocket will also prevent the mainshaft from turning.

114. Lubrication.

After assembly pack the gearbox half-full with Castrolease (Medium), Mobilgrease (No. 2), Shell Retinax C.D., *Esso Grease or Belmoline D.

*Known in some countries as Esso Cup Grease.

DATA

The following items of data shown under the heading TRANSMISSION, on page 5 in the main section of this book, require revision to suit the Burman gearbox :—

Chains—Front	75 pitches ½ in. P. × ·305 in. W.
Rear	89 pitches ⅜ in. P. × ·380 in. W.
Gear Ratios —First	17·85 to 1.
Second	11·75 to 1.
Third	7·23 to 1.
Top	5·65 to 1.
Clutch Thrust Rod Length –	long part 9 7/16 in.
	short part 1⅞ in.
Clearance in Clutch Control	1/16 in.
Gearbox Ball Bearings —	
Large—Internal Dia.	1 9/32 in. (SKF 6206 with inner race bored out.)
External Dia.	62 m.m.
Width	16 m.m.
Small—Internal Dia.	17 m.m. (SKF 6203)
External Dia.	40 m.m.
Width	12 m.m.
Gearbox Layshaft Bearings —	
(Compo. bushes, must not be reamered)	
Internal Dia. after fitting	·6115 in.
Oil Capacity	1½ pints.

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