WORKSHOP MAINTENANCE MANUAL

FOR THE

Royal Enfield

'Made like a Gun'

736 c.c. "INTERCEPTOR"

MOTOR CYCLE

TRADE MARK

'MADE LIKE A GUN'

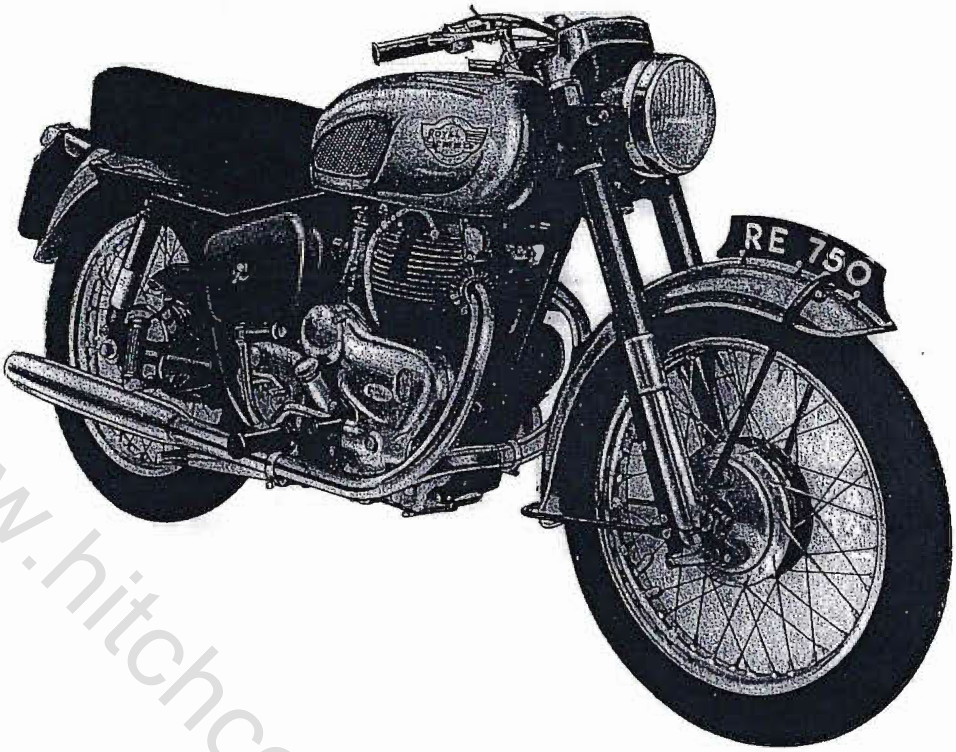
THE ENFIELD CYCLE COMPANY LIMITED

HEAD OFFICE AND WORKS:

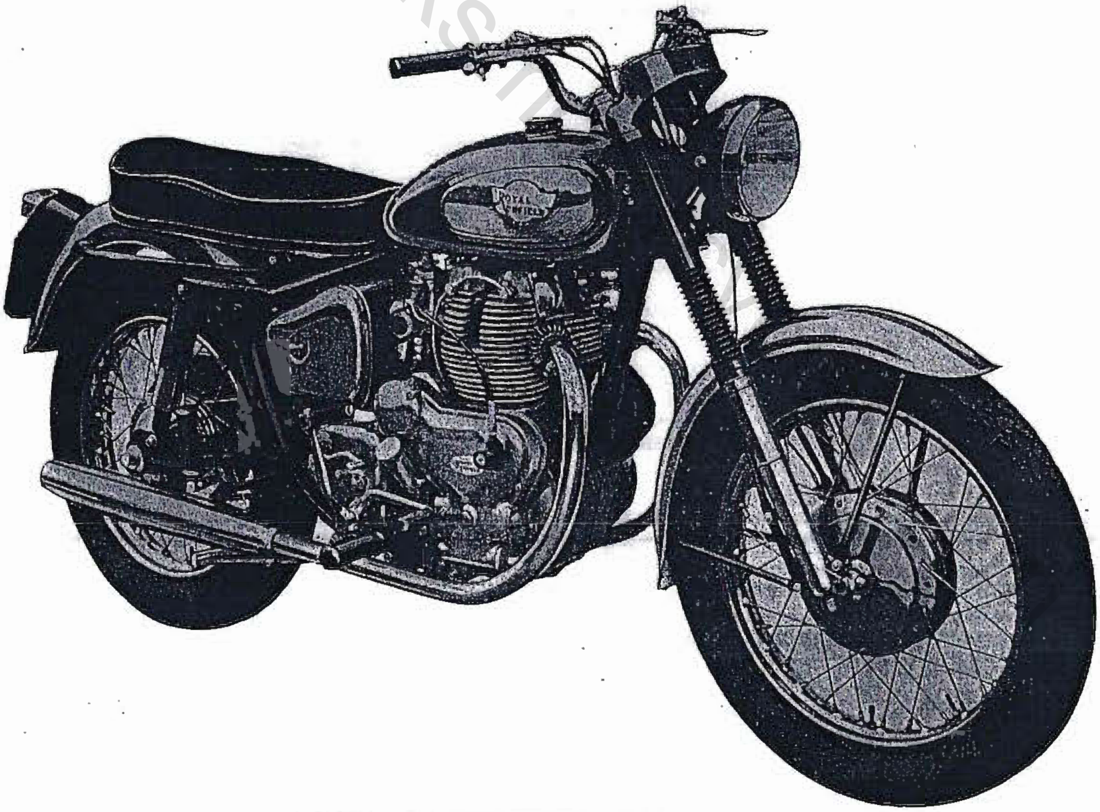
REDDITCH, WORCESTERSHIRE, ENGLAND

Telephone :
Redditch 4222 (9 lines)
S.T.D. RE9. 4222

Telegrams :
"Cycles, Redditch"



1965 "INTERCEPTOR" U.K. MODEL



1965 T.T. "INTERCEPTOR" U.S.A. MODEL

(Frontispiece)

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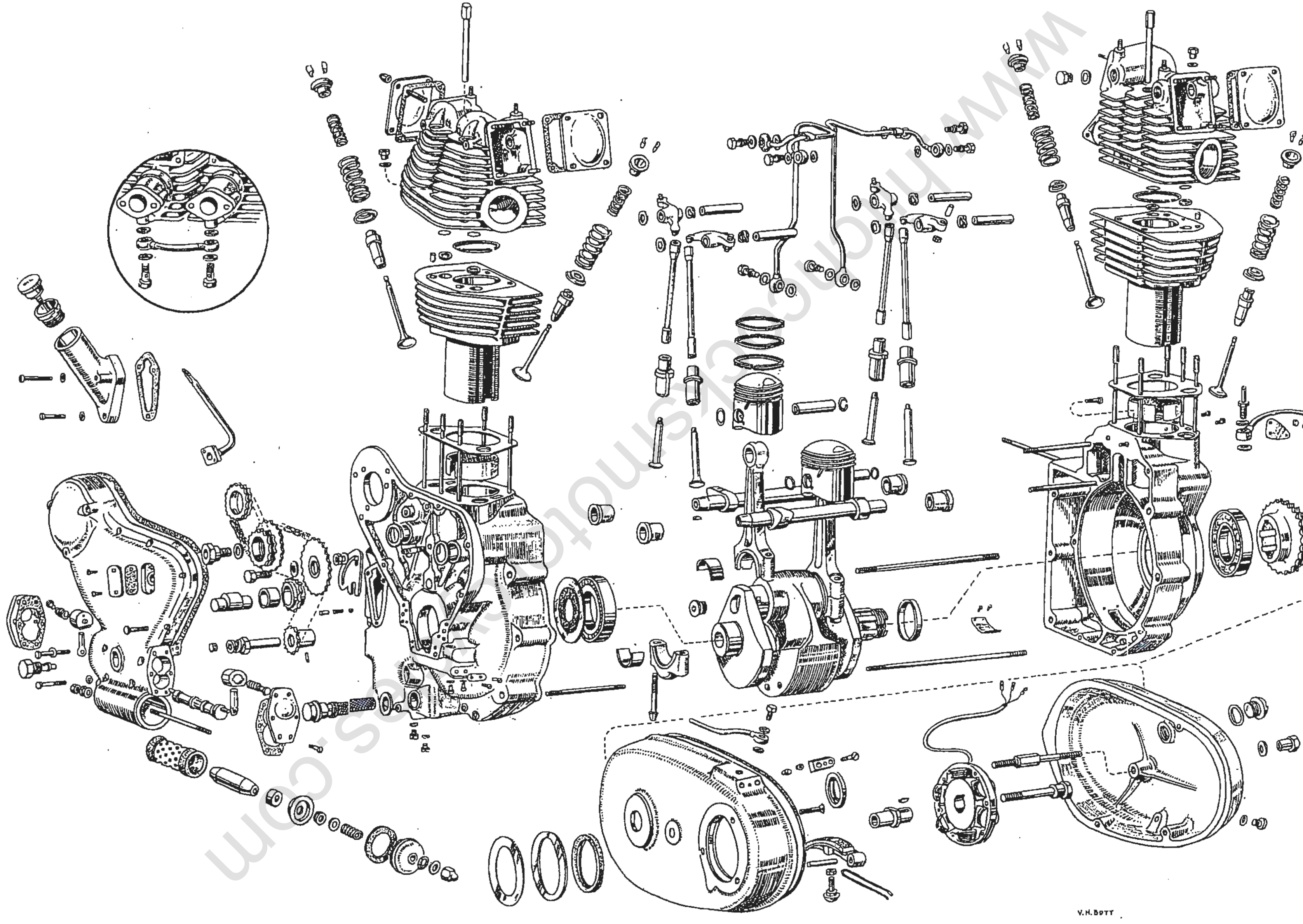


EXPLODED VIEW OF "INTERCEPTOR" ENGINE 1965-6

Fig. 1

Technical Data

"Interceptor" Engine

Cubic Capacity		736 c.c.
Stroke	Nominal	93 mm.
Bore	Nominal	71 mm.
	Actual	70·92 mm./2·792 in.

Rebore to ·020 in. oversize when wear exceeds ·0065 in.

Compression Ratio	8 to 1 or 7$\frac{1}{4}$ to 1
Piston Diameter—	
Bottom of Skirt—	
Fore and Aft	2·788 in.
Top Lands	2·7635 in.

Skirt is tapered and oval turned.

Piston Rings—	
Width—Plain Rings	·0625/·0635 in.
Single Scraper Ring ...	·1550/·1560 in.
Double Scraper Rings	·0781/·0776 in.
Radial Thickness	2·883/3·085 mm.
Gap when in unworn Cylinder ...	·015/·020 in.
Clearance in grooves	·001/·003 in.

Renew Piston Rings when gap exceeds $\frac{1}{16}$ in.

Oversize Pistons and Rings available	+·020 in.
Piston Boss Internal Diameter ...	·7498/·7500 in.
Gudgeon Pin Diameter	·7498/·7500 in.
Con. Rod Small End Internal Diameter	·7507/·7505 in.
Big End Internal Diameter Con. Rod	2·0190/2·0185 in.
Big End Internal Dia. Bearing Shells	1·8750/1·8755 in.*
Crank Pin Diameter, Timing Side ...	1·8744/1·8740 in.
Crank Pin Diameter, Driving Side ...	1·8741/1·8737 in.
Driving Side Main Ball Bearing—	
Type	Hoffman 145 or R and M—LJ45
Outside Diameter	85 mm.
Inside Diameter	45 mm.
Width	19 mm.
Timing Side Main Roller Bearing—	
Type	Hoffman R145 or R and M—LR45
Outside Diameter	85 mm.
Inside Diameter	45 mm.
Width	19 mm.
Rocker Inside Diameter	·5627/·5622 in.
Rocker Bearing Inside Diameter ...	·5622/·5617 in.
Rocker Spindle Diameter	·5617/·5615 in.
Inlet Valve Stem Diameter	·3430/·3425 in.
Exhaust Valve Stem Diameter ...	·3410/·3405 in.
Valve Guide Internal Diameter ...	·3437/·3447 in.
Valve Guide External Diameter ...	·6275/·6270 in.
Valve Guide Hole in Cylinder Head Dia.	·625/·626 in.
Tappet Stem Diameter	·3743/·3740 in.
Tappet Guide Internal Diameter ...	·3755/·3745 in.
Tappet Guide External Diameter ...	1·0125/1·0130 in.
Tappet Guide Hole in Crankcase Dia.	1·011/1·010 in.

Tappet Clearance with cold engine—

Inlet	Nil	Normal running
Exhaust	Nil	
Inlet	Nil	Continuous high-speed running
Exhaust	·005″	

*Assumes ·0005 in. "stretch" of eye of rod and cap due to interference fit of bearing shells.

Valve Spring Free Length—		
Inner		1$\frac{1}{2}$ in.
Outer		1$\frac{11}{16}$ in.

(Renew when reduced by $\frac{1}{16}$ in.)

Valve Timing with ·012 in. clearance. See Page 11

Camshaft Bearing External Diameter	·9095/·9085 in.
Camshaft Bearing Internal Diameter (Bored in position in crankcase.)	·7505/·7495 in.

Cam Lift—		
Exhaust	Sports—·328 in.	Std.—·3125 in.
Inlet	Sports—·344 in.	Std.—·3125 in.
Valve Lift (approx.)—		
Exhaust	Sports—·328 in.	Std.—·3125 in.
Inlet	Sports—·344 in.	Std.—·3125 in.

Timing Sprocket	12 Teeth
Camshaft Sprockets	24 Teeth
Magneto Sprocket	19 Teeth
Timing Chain—Type ...	Single No. 110038 endless
Length	66 Pitches
Width	·225 in.
Pitch	·375 in.
Roller	·250 in.
Magneto Chain—Type ...	Duplex No. 114500 endless
Length	44 Pitches
Width	8·64 mm.
Pitch	8 mm.
Roller	5 mm.
Magneto Speed	Half Engine Speed
Points	·015 in.
Timing—Advanced ...	$\frac{11}{32}$ in. before T.D.C. (32°)
Engine Sprocket	29 Teeth
Clutch Sprocket	56 Teeth
Final Drive Sprocket	21 or 20 Teeth
Primary Chain—Type ...	Duplex No. 114038 endless
Length	92 Pitches
Width	·628 in.
Pitch	·375 in.
Roller	·250 in.
Feed Oil Pump—Speed	1/6 Engine Speed
Piston Diameter ...	·24975/·24950 in.
Stroke length ...	·5 in.
Return Oil Pump—Speed	1/6 Engine Speed
Piston Diameter	·375/·3755 in.
Stroke length ...	·5 in.

Sparking Plug—Lodge 2HLN. Champion N5 or NA8, or KLG FE.75, Autolite AE2. For high speed running over long distances, use Lodge 3HLN, Champion N3 or NA10, or KLG FE.100, Autolite AE 901.

Diameter	14 mm.
Reach	$\frac{3}{4}$ in.
Gap	·018/·022 in.

Engine Specification

1. Engine

The engine is an even-firing vertical twin-cylinder, having separate cylinders and heads and fully enclosed pressure-lubricated overhead valve gear. It has a dry sump lubrication with the oil tank integral with the crankcase and a massive one-piece high-strength spheroidal graphite cast iron crankshaft.

2. Cylinder Heads

The cylinder heads are die-cast from light aluminium alloy with ample finning to ensure adequate cooling. The exhaust pipe inserts are cast-in and the valve inserts are of austenitic iron and are shrunk in so that they are replaceable. The large capacity induction ports are streamlined and blended to the valve seatings.

3. Cylinders

The separate cast-iron cylinders have a nominal bore of 71 mm, the stroke being 93 mm. The cubic capacity of the engine is 736 c.c. The cylinder heads are located on the cylinders by hollow dowels and the joint between head and barrel is made by a split, triangular section steel ring which seats on a chamfer at the top end of the cylinder barrel and stands about ·005 in. proud of the joint face. The push rod tunnels are sealed by washers of special heat and oil resistant rubber bonded to metal and fitting in recesses in the cylinder head.

4. Pistons

The pistons are made of low expansion aluminium alloy, heat treated and form ground taper and oval. Standard and low compression pistons are available, the former having approximately $\frac{1}{2}$ in. dome and the latter about $\frac{5}{16}$ in. Each piston carries two compression rings, of which the top one is chrome plated. Standard compression pistons are fitted with a special dual oil control ring. Low compression pistons use a single slotted type ring.

Compression ratios are as follows:—

Standard Pistons, No compression plate—$8\frac{1}{2}$ to 1.
Standard Pistons, 1 compression plate—8 to 1.
Standard Pistons, 2 compression plates—$7\frac{1}{2}$ to 1.
Low Compression Pistons, no plate—$7\frac{1}{4}$ to 1.
Low Compression Pistons, 1 plate—6·9 to 1.
Low Compression Pistons, 2 plates—6·6 to 1.

5. Connecting Rods

The connecting rods are produced from stampings of Hiduminium RR56 light alloy. The little end bearings are of alloy direct on to the gudgeon pin. In case of wear after long service the little end can be bored out and fitted with a bush, but this is rarely necessary.

The big end bearings consist of white-metalled steel liners which are renewable. The detachable bearing caps are bolted to the connecting rods by means of high tensile socket screws, the heads of which are drilled for wiring.

6. Crankcase

The combined crankcase and oil tank is die-cast from light alloy in two halves, being split vertically.

7. Crankshaft and Flywheel

The crankshaft is cast in one piece, integral with the massive central flywheel, from high quality spheroidal graphitic cast iron. The total weight is approximately 24 lbs., and all crankshafts are dynamically balanced.

The main journals are ground, and the big end journals are ground and hand lapped. The main journal on the drive side is drilled through its centre for the crankcase breather.

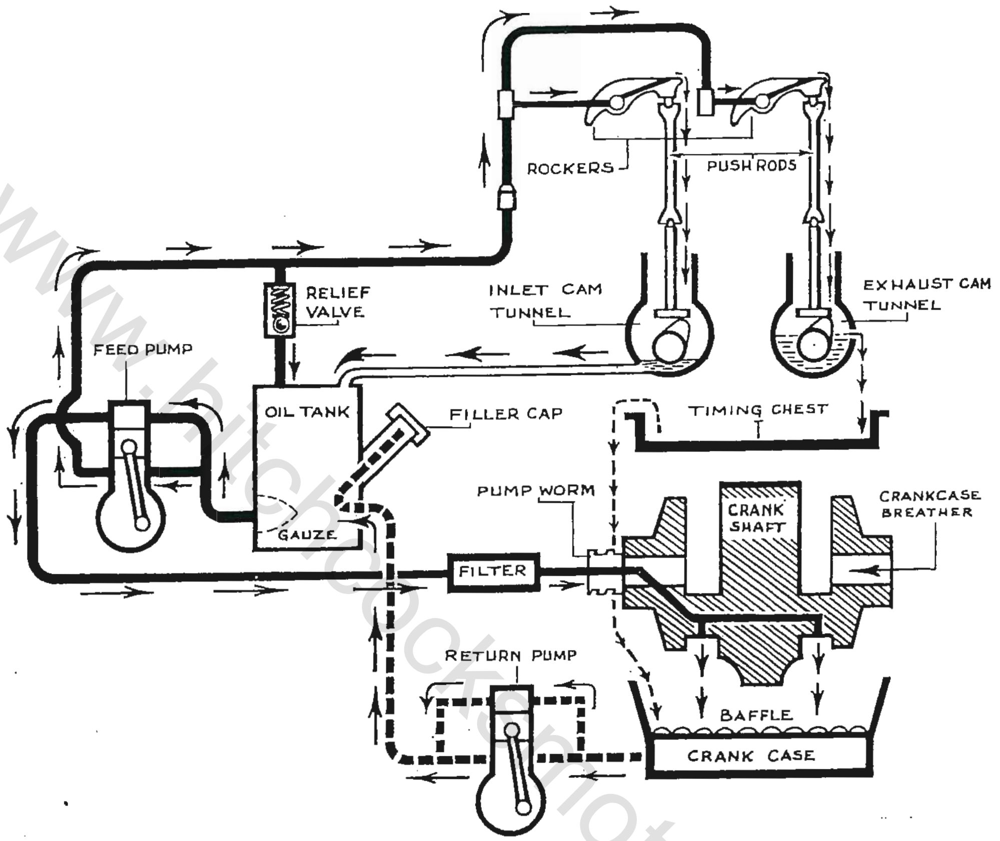
8. Main Bearings

Heavy duty bearings are provided for the crankshaft, the driving side being ball and the timing side roller.

9. Camshafts

The camshafts are machined from drop forged steel stampings with the cams and bearings hardened and ground. The cam profiles are produced to give racing performance and, in order to obtain the maximum efficiency, the usual silencing ramps are omitted. Alternative camshafts with quietening ramps are available for riders who are prepared to sacrifice a little performance in the interests of mechanical silence. These were fitted to the earlier engines.

The camshafts are located in the crankcase and



LUBRICATION SYSTEM. Diagrammatic Arrangement
Fig. 2

run in bronze bushes. The bushes on the nearside are pressed into detachable housings which are bolted to the driving side crankcase. This enables the camshafts to be changed, if so desired for tuning purposes, without the necessity of dismantling the crankcase.

10. Valves

The inlet valves are machined from stampings of special Silicon-Chrome Valve Steel and the exhaust valves are of High-Nickel-Chromium-Tungsten Valve Steel with the stems Stellite-tipped.

11. Valve Gear

The valves are operated from the camshaft by means of large, flat-based, guided tappets, tubular alloy push rods with induction hardened steel ends and overhead rockers. Two compression springs are fitted to each valve secured by Bullock Type split collets locking in high strength aluminium collars. The springs are specially designed to give a variable rate on compression.

12. Timing Drive

The camshafts are located in the crankcase, running in bronze bushes. They are driven by an endless chain from the timing sprocket on the crankshaft and the tightness of the chain can be adjusted by means of the chain tensioner in the timing chest.

The magneto is driven by a separate endless chain from the rear camshaft sprocket in the timing chest. The tension of this chain is adjusted by moving the magneto fixing bolts in their slotted holes.

A special slotted bolt securing the front camshaft sprocket provides a drive to a tachometer if this is required. This drive can be fixed to an aperture provided in the timing cover, which is otherwise covered by a small plate.

13. Ignition and Lighting System

The ignition is supplied from a Lucas K2F magneto and the lighting and other electrical circuits from a 6- or 12-volt battery which is charged through a rectifier from a Lucas alternator.

The alternator is housed in the primary chaincase, the permanent magnet rotor being mounted on the end of the crankshaft and the six coil stator fixed to the back of the chaincase. When a 12-volt battery is used the "Zener Diode" regulation system is employed. This ensures maximum charge rate when the battery voltage is low, cutting down to a trickle charge as the voltage rises.

The magneto is chain-driven from the inlet camshaft at half engine speed and the timing is hand controlled from a lever on the handlebar on the earlier models, while later models have an automatic centrifugal control incorporated in the magneto sprocket.

14. Carburetters

Twin Amal Monobloc carburetters with a bore of $1\frac{3}{16}$ in. are fitted as standard. On the earlier models only the left-hand carburetter contained a float chamber, the right-hand instrument being fed by a short flexible connecting tube joining the two jet holders. Later, carburetters with right-hand float chambers became available and were used on the right-hand side of the machine with the standard left-hand float chamber on the left.

15. Air Filter

Provision is made for housing twin 5 in. diameter Vokes Micro-Vee felt and gauze dry filters in a compartment of the toolbox, but the use of these may reduce the maximum speed slightly.

16. Lubrication System

Lubrication is by the Royal Enfield Dry Sump system which is entirely automatic and positive in action. The oil tank is integral with the crankcase, ensuring the full rate of circulation immediately the engine is started and rapid heating of the oil in cold weather.

There are two positively driven piston type oil pumps running at $\frac{1}{8}$ engine speed, one at the rear of the timing cover for pumping oil to the bearings under pressure and the other at the front for returning the oil from the crankcase to the tank. The return pump has a capacity approximately double that of the feed pump which ensures that oil does not accumulate in the crankcase.

The oil from the big ends drains into the bottom of the crankcase and is prevented by a baffle from being drawn up by the flywheel.

The oil from the rocker bearings is squirted through a small hole in each rocker on to the top ends of the push rods. It then flows down the push rod tunnels into the cam tunnels, where it lubricates the cams and tappets. Oil from the rear (inlet) cam tunnel is then returned direct to the oil tank through a drilled passage. Oil from the front (exhaust) cam tunnel overflows into the timing chest, where it lubricates the timing chains and then drains to the sump beneath the baffle plate at the bottom of the crankcase.

Both pumps are double acting, the primary side of the feed pump supplying the big ends and the secondary side the rockers and valve gear. Both sides of the return pump combine to pump oil back to the tank from the sumps at the bottom of the crankcase.

A spring loaded relief valve controls the pressure of the oil to the valve rocker gear which is through external pipes.

A gauze strainer is provided for the feed oil leaving the tank and there is a large capacity felt filter in the feed to the big ends. An aluminium cylinder is fitted over the fixing stud inside the filter element to reduce the volume of oil required to fill the filter after it has been dismantled for cleaning and to ensure the rapid flow of oil to the big ends.

A small circular magnet is also fitted over the fixing stud inside the oil filter for the purpose of collecting any ferrous particles which may be suspended in the oil.

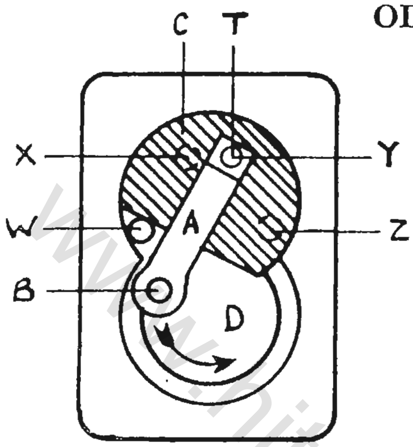
17. Breather

Two separate breathers are fitted to ventilate the crankcase. The driving end of the crankshaft is drilled through, allowing the engine to breath into the primary chain case which is itself vented by means of a banjo union and a copper pipe running along the top. The second breather consists of drilled passages in the wall of the driving side of the crankcase. These communicate with the breather body situated on the crankcase wall just below the L.H. cylinder base. From here the gases are taken by a copper pipe to a union on top of the oil tank and thence by another pipe to the rear chain. The purpose of the connection to the oil tank is twofold. First it allows any surplus oil carried over to drain back into the tank. Secondly, it provides a vent to permit the escape of pressure which would otherwise build up in the tank due to the difference in the capacities of the feed and return pumps. Both the drilled main shaft and the side breather body contain non-return disc valves which prevent air being drawn into the crankcase on the up-stroke of the pistons and thus tend to produce a partial vacuum in the case. Excessive pressure in the case, as shown by oil leaks, may be the result of one of these discs becoming stuck.

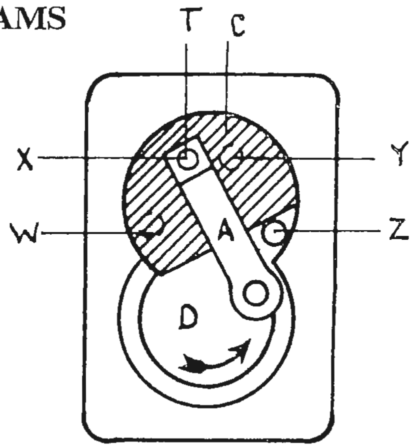
18. Gearbox

The gearbox is bolted on to the back of the crankcase and has four speeds, which are foot controlled, and a patented neutral finder. All gears are in constant mesh, changes being effected by robust dog clutches. (See Subsection 64).

OIL PUMP DIAGRAMS



FEED PUMP
POSITION 1



FEED PUMP
POSITION 2

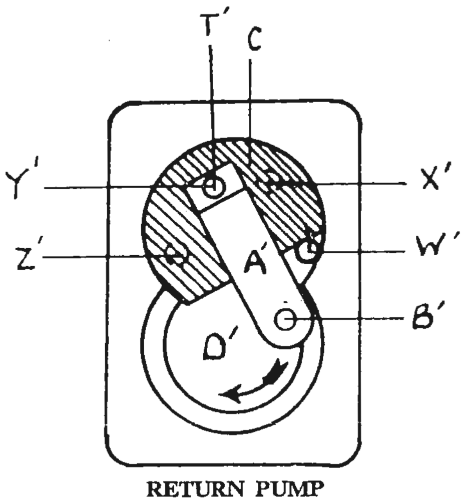
Fig. 3A

The ports in the housing are connected as follows :—

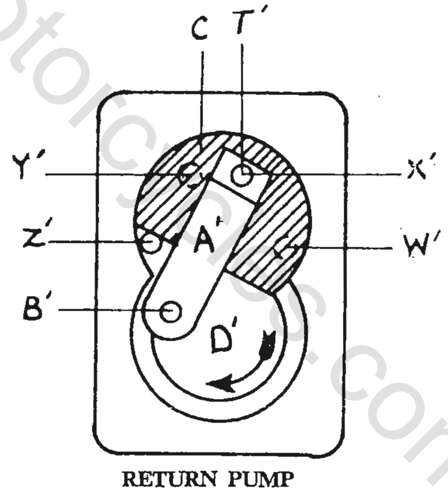
W — delivery to rocker gear.
X — delivery to big ends.
Y — suction from oil tank.
Z — suction from oil tank.

Position 1. The plunger A is being drawn out of the cylinder hole in the disc C by the action of the peg B on the shaft D. The port T in the disc C registers with the suction port Y in the housing, so that oil is drawn into the cylinder from the oil tank. At the same time the delivery port W in the housing is uncovered and oil below the disc in the housing is forced through W to the rocker Gear.

Position 2. The plunger A is being pushed into the cylinder hole in the disc C. The port T in the disc now registers with the delivery port X in the housing, so that oil is forced out of the cylinder to the big ends. At the same time the suction port Z in the housing is uncovered and oil is drawn into the housing below the disc from the oil tank.



RETURN PUMP
POSITION 1



RETURN PUMP
POSITION 2

Fig. 3B

The ports in the housing are connected as follows :—

W′ — delivery to oil tank.
X′ — delivery to oil tank.
Y′ — suction from crankcase.
Z′ — suction from crankcase.

Position 1. The plunger A′ is being drawn out of the cylinder hole in the disc C′ by the action of the peg B′ on the shaft D′. The port T′ in the disc C′ registers with the suction port Y′ in the housing, so that oil is drawn into the cylinder from the crankcase sump. At the same time the delivery port W′ in the housing is uncovered and oil below the disc in the housing is forced through W′ back to the oil tank.

Position 2. The plunger A′ is being pushed into the cylinder hole in the disc C′. The port T′ in the disc now registers with the delivery port X′ in the housing, so that oil is forced out of the cylinder back to the oil tank. At the same time the suction port Z′ in the housing is uncovered and oil is drawn into the housing below the disc from the crankcase sump.

The standard gear ratios with 20T and 21T sprockets are as follows:—

		20T	21T
Bottom Gear	...	12·32	11·75
Second Gear	...	8·16	7·8
Third Gear ...	...	6·51	5·72
Top Gear ...	...	4·44	4·22

19. Clutch

The clutch has six pressure plates and five friction plates, including the sprocket which is lined on both sides with friction material. On earlier models this was a moulded material riveted on but later models employ a bonded cork based material. The four loose friction plates on the later clutches use the same cork based material bonded on. In earlier clutches the two inside plates had inserts of moulded material which, though it would stand more heat was more liable to slip if an excess of oil reached the friction surfaces.

A description of the operating mechanism is given in Subsection 63.

Service Operations with Engine in Frame

20. Removal of the Timing Cover

First place a tray under the engine to catch the oil which will escape when the cover is removed. Remove the timing side exhaust pipe. Remove the oil filler neck by taking out the three screws fixing it to the crankcase. Remove the timing cover fixing screws. Draw off the timing cover, tapping it lightly if necessary.

In refitting the cover, insert the two long screws through the cover to locate the gasket. See that the thrust washer is on the chain tensioner sprocket spindle and that the neoprene seal is in position on the oil feed plug. If the seal or plug is damaged a new one of either should be fitted. The seal is Part No. 42114 and the plug is Part No. 42113.

The refitting of the cover will be facilitated if the engine is turned gently forwards while the cover is being put into place. This will help the engagement of the pump worm with the pump spindle and prevent damage to the gears.

Always fill the filter with clean oil before refitting the timing cover and always take great care not to damage the gasket where the section is narrow.

To verify that the oil pumps are working after replacing the timing cover, start the engine and slacken the feed plug between the oil pumps. The return oil pump can be checked by removing the oil filler cap so that the oil return pipe can be seen. It may take several minutes for all the oil passages to fill and the oil to commence circulating. The feed to the rockers can be observed by removing the rocker-box covers, when oil will be seen flowing down the surface of the push rods.

21. Valve Timing

The camshaft sprockets are keyed to the camshafts so that the valve timing can only be incorrect if the timing chain is incorrectly fitted.

The correct setting is obtained with the marks stamped on the camshaft sprockets facing each other inwards on the centre line and the mark on the crankshaft sprocket pointing vertically downwards. (See Fig. 4.) If it is necessary to remove the sprockets see Subsections 43 and 44.

Remember that all three timing sprocket fixing bolts have **Left-Hand Threads.** While tightening the camshaft bolts the sprockets should be held.

The table on page 11 shows the characteristics of three alternative camshaft and sprocket arrangements which are available. The choice between these depends on whether the owner wants (1) good torque and speed with good mechanical silence or (2) maximum torque up to 80 m.p.h. or (3) maximum flat-out speed. When checking opening and closing points do not expect precise agreement with the figures quoted. The figures obtained when checking will depend largely on the method used to decide when the valve opens or closes also, if using a dial gauge, whether this is reading the movement of the tappet or spring collar. It must be remembered, too, that the precise timing of each valve depends on the accurate position of *four* keyways and on whether the timing chain is new or worn. The figures in the table are intended as a guide to which cams are fitted and enable a check to be made that the timing marks are correctly lined up. If opening and closing points on the same shaft are early or late by about 30° the sprocket is fitted one tooth wrong

22. Tappet Adjustment

The tappet clearance is adjusted by means of a screw in the outer end of the rocker. Access to the adjusting screws is obtained by removing the covers of the rocker boxes.

The inlet should be set so that the rocker is just binding, the exhaust so that it is just free. For

Ref.	Camshaft	Inlet Sprocket	APPROXIMATE TIMING AT ·012 in. CLEARANCE				Remarks
			EX. opens B.B.D.C.	EX. closes A.T.D.C.	IN. opens B.T.D.C.	IN. closes A.B.D.C.	
1	EX. 32705 IN. 32705 (Standard)	36140	82°	35°	35°	82°	Cams have quietening ramps. Least mechanical noise. Good torque and speed.
2	EX. 35345 IN. 35344 (Sports)	36140	77°	35°	37°	60°	Better torque than (1). Same maximum speed. Noisier.
3	EX. 35345 IN. 35344 (Sports)	45207 (Marked "A")	77°	35°	22°	75°	Torque as (1) up to 80 m.p.h. Better than (1) or (2) above 90 m.p.h. Noisier than (1)

continuous high speed work, however, give the exhaust ·005 in. clearance. These figures are for a COLD engine.

To adjust the clearance, loosen the locknut beneath the rocker arm, turn the screw and retighten the locknut.

The adjustment of each valve should be made with the corresponding valve in the other cylinder fully open. This ensures that the tappet is on the neutral portion of the cam.

If the heads of the adjusting screws are worn they should be replaced.

23. Removal of the Camshafts

Remove the timing cover (Subsection 20).

Remove the camshaft sprockets (Subsection 44).

Remove the three screws holding each of the camshaft bearing housings.*

Compress the valve springs and withdraw the camshafts. It is necessary to rotate the camshafts slightly while withdrawing them in order that the cams will pass through the shaped hole in the crankcase.

When replacing the camshafts compress the valve springs and hold the tappets clear of the cams. If the rocker adjusting screws are screwed right back, it is not necessary to compress the valve springs.

24. Ignition Timing

To set the ignition timing, first remove the timing cover (Subsection 20) and then remove the magneto sprocket nut and withdraw the sprocket, using Special Tool No. 14835 in the case of the earlier engines fitted with manual ignition control.

When automatic control is fitted no special extractor is required. Merely unscrew the centre sleeve nut which secures the auto. advance coupling to the magneto and keep on unscrewing, when the coupling will be drawn off its shaft.

Set the contact points to ·012/·015 in. when fully opened. If they are worn or pitted a new set should be fitted. (See Fig. 20, Subsection 80, for illustration of contact breaker.)

Remove both sparking plugs and set the pistons $\frac{5}{16}$ in.—$\frac{11}{32}$ in. (31° to 32°) before top dead centre. Note which piston is on the compression stroke (both valves closed) and which is on the exhaust stroke (exhaust valve open).

Fit the magneto chain and sprocket, or auto. advance coupling, and tighten the nut finger tight. Set the ignition control in the fully advanced position (manual control) or, in the case of engines fitted with automatic advance, rotate the two halves of the coupling relatively to each other against the springs and hold them in this position with a piece of wire. Now rotate the magneto armature forwards (anti-clockwise looking at the contact breaker) until the points just commence to open as indicated by the fact that it is *just* possible to withdraw a piece of *thin* tissue paper from them. Tap the magneto sprocket or auto. advance coupling on to the tapered end of the magneto shaft and tighten the centre sleeve nut.

Now rotate the engine through one revolution and check the timing on the other contact breaker cam. The H.T. pick-up nearest to the contact points when they are in the open position is the "live" one and the H.T. lead from this must be connected to the sparking plug in the cylinder which is on the compression stroke. Do not forget to remove the wire holding the auto. advance coupling.

Note.—To check the timing (as opposed to resetting it) set the pistons $\frac{11}{32}$ in. before t.d.c.

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*From engine No. YB16573 onwards the fitting of detachable crankshaft bearing housings was discontinued. To remove the camshafts from these engines it is necessary to separate the two halves of the crankcase. See Subsections 55, 56 and 57.

with the ignition retarded. Now advance the timing either by the manual control (when fitted) or by rotating the contact breaker arm anti-clockwise (auto. advance). The points should just open in the full advance position.

25. Primary Chain Adjustment

The tension of the primary chain can be checked through the inspection cover in the primary chain case and, should it require adjustment, access to the adjuster is gained by removing the chain case cover, which is held in position by a single nut. Before removing the nut, place a tray under the engine to catch the oil from the chaincase.

Beneath the bottom run of the chain is a curved slipper on which the chain rests and which may be raised or lowered by turning the adjusting screw after having first slackened the locknut.

A rubber button is fitted to the end of the adjusting screw to prevent the transmission of chain noise to the chaincase and this is held against the chaincase by a hairpin spring, which prevents it from bouncing.

Do not adjust the chain to be dead tight but rotate the engine slowly and, while doing so, test the tension of the top run of the chain by pressing it up and down with the fingers. Adjust the tension so that there is ¼ in. up and down movement at the tightest spot.

Re-tighten the locknut on the adjusting screw, replace the chain cover and replenish with oil to the height of the level plug.

26. Timing Chain Adjustment

Before adjusting the tension of the timing chain, turn the engine until the chain is in its tightest position, checking the chain between all sprockets.

Adjust the tension so that there is ¼ in. movement of the chain.

The tension of the timing chain is altered by moving the quadrant after slackening the nut A which secures it (see Fig. 4). This rotates the eccentric spindle on which the chain tensioner jockey sprocket is mounted. Tightening of the chain is effected by moving the quadrant to the left.

It is imperative that the quadrant is fitted the right way round and that the eccentric spindle is fitted correctly in the quadrant fork. If the chain tightens when the quadrant is moved to the right, the tensioner has been wrongly assembled and may cause damage to the quadrant (see Fig. 5).

In making the adjustment, care must be taken to see that any backlash in the quadrant is taken up in the "tightening" direction, i.e. do not make the chain too tight and then move the quadrant back slightly, but tighten the chain progressively until the correct tension is obtained and then lock the quadrant. If the chain becomes too tight during adjustment, slacken it right back and make the adjustment again.

If the chain is too slack it may give rise to a loud noise which can be mistaken for a faulty bearing. If it is too tight the result will be a high pitched howl. If such noises are heard, therefore, first check the adjustment of the timing chain.

27. Magneto Chain Adjustment

To adjust the magneto chain tension, remove the timing cover (see Subsection 20), slacken the three magneto fixing nuts, slide the magneto back until the chain has about $\frac{3}{16}$ in. up and down movement, then tighten the fixing nuts.

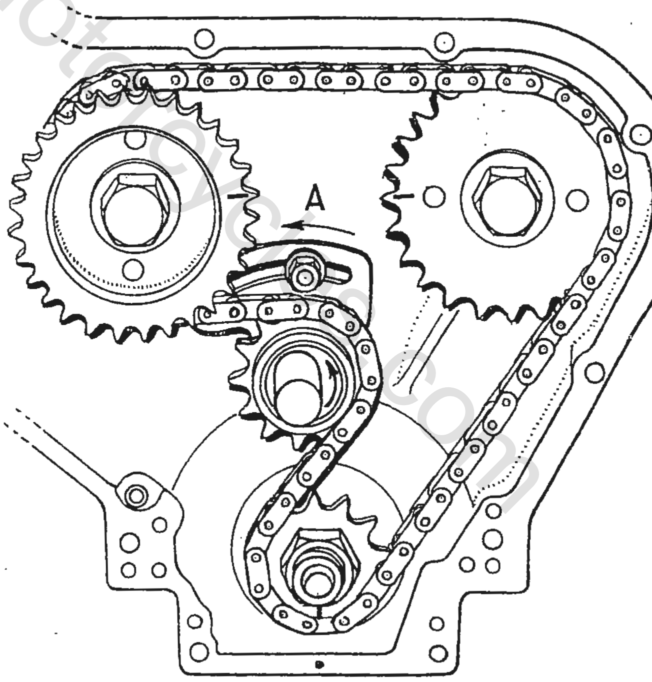
28. Removal of the Dual Seat and Rear Mudguard

Disconnect the leads to the rear lamp by pulling out the plugs in the connectors near the tool box.

Loosen the two nuts on either side of the seat attaching the mudguard carrier to the frame and lift the seat, mudguard and carrier off together.

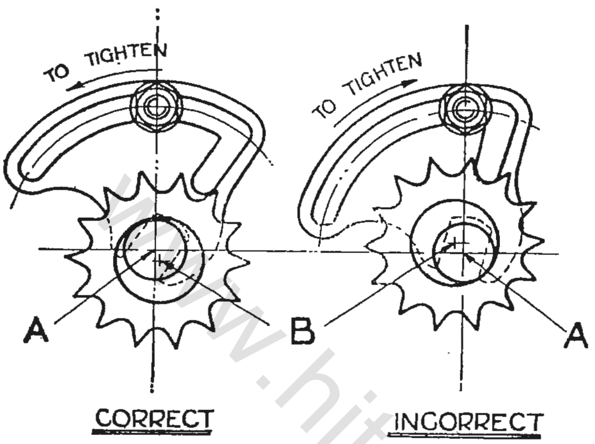
29. Removal of the Petrol Tank

The petrol tank is rubber mounted front and rear. The front attachment is by means of a horizontal stud passing through a rubber sleeve



TIMING CHAIN ADJUSTMENT SHOWING TIMING MARKS

Fig. 4



TIMING CHAIN ADJUSTMENT

Fig. 5

housed in a lug across the frame immediately behind the steering head. The rear fixing on the 4¼ gallon tank is by means of a transverse clamp and two bolts which pull the tank down on to rubber blocks above and beneath the top tube. On the smaller capacity tanks used in the U.S.A. a rubber lined metal clip is used secured by two ¼ in. diameter bolts and nuts.

To remove the tank, first disconnect the petrol pipes, then remove the nut from one end of the front attachment stud and knock out the stud. Then unscrew the nuts or bolts securing the rear end of the tank and lift it away, taking care not to damage the paintwork on top at the front end where it may come into contact with the handlebar clamp. It is preferable to remove the dual seat and rear mudguard before attempting to lift the tank.

30. Removal and Refitting of the Cylinder Head

First remove the petrol tank and petrol pipe. (Subsection 29.)

The dual seat may also be removed if desired. (Subsection 28.)

Remove head steady brackets.

Disconnect the oil pipes and plug leads.

Remove the exhaust pipes and carburetter(s), also the induction manifold on single carburetter models.

Remove the rocker box covers.

Turn the engine until both valves in one head are closed.

Remove the five cylinder head nuts from the head, hit it smartly with a hide mallet beneath the exhaust and inlet ports (not the fins) and lift it off.

Turn the engine through one revolution and repeat with the other head.

When replacing the heads, see that the dowels are in position in the cylinder barrels and that the push rods are the right way up (shallow cups upwards).

See that the taper section "Cross" sealing ring and its seatings are perfectly clean and that the rubber seals for the push rod tunnels are in good condition and correctly fitted. With the head upside down on the bench drop the packing shim into the recess first, then the seal with the metal side downwards. A little jointing compound should be applied to both sides of the "Cross" sealing ring and the rubber push rod tunnel seals.

Lower the cylinder heads over the push rods making sure that the rockers locate in the cups.

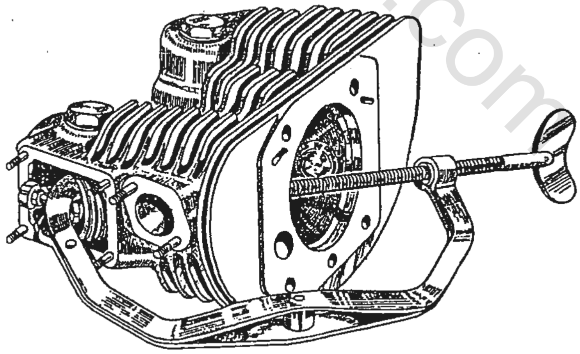
Fit the head nuts *and washers* and tighten down lightly. At this stage fit the induction pipe on single carburetter models. Do not overtighten the nuts—20 lbs. ft. is the recommended figure. Tighten each nut a little at a time in turn. Begin with the two inside nuts and the one by the spark plug, leaving the final tightening of the corners to the last.

31. Removal of the Valves

Having removed the cylinder head, remove the rocker-box covers, each held by four nuts, and swing the rocker clear of the valve. Using a suitable valve spring compressing tool, compress the valve springs and remove the split collets from the end of the valve stem. Slacken back the compressing tool and release the springs. Withdraw the valve and place its springs, top spring collar (and bottom collar if it is loose) and split collets together in order that they may be reassembled with the valve from which they were removed.

Deal similarly with the other valves in the heads.

If the valve will not slide easily through the valve guide, remove any slight burrs on the end of the valve stem with a carborundum stone. If the burrs are not removed and the valve is forced out, the guide may be damaged.



REMOVAL OF VALVES

Fig. 6

32. Removal of the Rockers

To remove the rocker, first take off the cylinder head. Remove the hexagon plug on the inner side and the rocker spindle may be drawn out by means of a bolt screwed into the rocker spindle, which is tapped $\frac{5}{16}$" B.S.F.

On reassembling make sure that the spring washers are fitted on the sides of the rockers nearest the centre of the engine and the plain thrust washers on the outer sides.

33. Removal of the Valve Guides

To remove the valve guides from the heads two special tools are required which can easily be made.

The first is a piece of tube with an internal bore of not less than $\frac{7}{8}$ in.

The second is a mandrel about 4 in. long made from $\frac{9}{16}$ in. diameter bar with the end turned down to about $\frac{5}{16}$ in. diameter for $\frac{1}{2}$ in.

Support the cylinder head on the tube which fits over the collar of the valve guide. Using the mandrel force the guide out of the head with a hand press or by using a hammer.

To fit a new guide, support the head at the correct angle and use a hand press and the same mandrel. If a hand press is not available and the guide is replaced by a hammer, use a piece of tube of $\frac{9}{16}$ in. internal diameter to prevent damage to the bore of the guide. If a valve guide is removed for any reason, an oversize one should be fitted in order to maintain the interference. It is necessary to re-cut the valve seat and grind in the valve after a guide has been replaced. (See Subsection 38.)

A worn exhaust valve guide may give rise to slight smoking from the exhaust pipe due to oil passing down the valve stem on to the hot valve head. This may also be caused or increased by faulty operation of the breather.

34. Removal of the Sparking Plugs

Care must be taken when removing and replacing the sparking plugs not to damage the threads in the cylinder heads.

If the threads do become damaged, they can be tapped out to a larger size and steel wire inserts fitted.

Special tools are available for tapping and inserting the steel wire inserts. The latter tool consists of a piece of $\frac{7}{16}$ in. diameter tube or rod with a slot cut in the end.

The insert is placed over the tool with the tag engaging in the slot and it is screwed into the plug hole in the cylinder head from the outside until the last coil is 1 to $1\frac{1}{2}$ threads below the top face. A reverse twist of the tool will then break off the tag.

If the cylinder head has been removed, the fitting of the insert will be facilitated if the tool is put through the hole from the inside and the insert screwed back from the outside.

If the cylinder head has not been removed, care must be taken not to drop the end of the tag into the cylinder and in such a case it is better to break off the tag with a pair of long-nosed pliers.

35. Removal of the Cylinders

When the cylinder heads have been removed the cylinders can be lifted clear of the studs. This should be done with the pistons at top dead centre.

It is advisable to put a clean cloth over the mouth of the crankcase to prevent anything, such as a piece of broken piston ring, from falling in.

When replacing the cylinders, clean off the joint faces and fit new paper joints, two to each cylinder.

36. Removal of Pistons

Remove the cylinder heads and cylinders.

With a tang of a file remove the two outer circlips retaining the gudgeon pins. Remove the long central cylinder studs which come opposite the gudgeon pins.

Use Special Tool No. E 5477/T to extract the gudgeon pin or using a rod about $\frac{1}{4}$ in. in diameter insert this right through one gudgeon pin and drive the other pin out of its piston, supporting the connecting rod substantially meanwhile to prevent distortion.

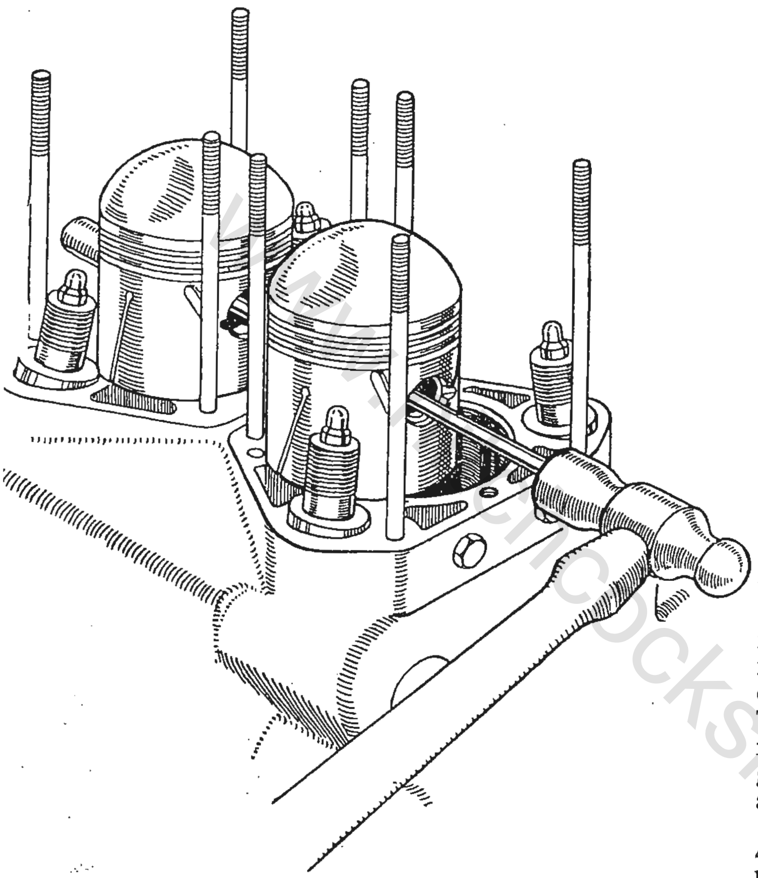
Having lifted the first piston away, the other one may be readily removed in the same manner. Mark the pistons and gudgeon pins so that they go back into the same pistons the same way round and so that the pistons go back into the same barrels the same way round.

Take care not to drop the gudgeon pin circlip into the crankcase. A clean cloth should be put over the mouths of the crankcase to prevent this.

37. Decarbonising

Having removed the cylinder heads as described in Subsection 30, scrape away all carbon, bearing in mind that you are dealing with aluminium which is easily damaged. Scrape gently and avoid scoring the combustion chamber or the valve seats which are of austenitic iron shrunk into the head. Be careful while performing this work not to injure the joint faces which bed down on to the head gaskets.

Do not, in any circumstances, use caustic soda or potash for the removal of carbon from aluminium alloy.



REMOVAL OF PISTONS

Fig. 7

Scrape away all carbon from the valve heads and beneath the heads, being very careful not to cause any damage to the valve faces.

If the piston rings are removed the grooves should be cleaned out and new rings fitted. For cleaning the grooves, a piece of discarded ring thrust into a wooden handle and filed to a chisel point is a useful tool.

If the piston ring gaps exceed $\frac{1}{16}$ in. when the rings are in position in the barrel, new rings should be fitted. The correct gap for new rings is ·015—·020 in. The gap should be measured in the least worn part of the cylinder, which will be found to be the extreme top or bottom of the bore.

While the cylinders and pistons are not in position on the engine, cover the crankcase with a clean cloth to prevent the ingress of dust and dirt of all kinds. Do not, of course, attempt to scrape the carbon from the pistons when the mouths of the crankcase are open.

38. Grinding-in Valves

To grind a valve, smear the seating with a little grinding-in compound, place a light, short coil spring over the valve stem and beneath the head, insert the valve into its appropriate guide, press it on to the seat using a tool with a suction cup and with a backwards and forwards rotary motion, grind it on to its seat. Alternatively, a tool which pulls on the valve stem can be used. Frequently lift the valve and move it round so that an even and true seating is obtained. If no light spring is available, the lifting will have to be done by hand. Continue grinding until a bright ring is visible on both valve and seating.

The faces and seats of the exhaust valves are cut at 45 degrees but the profiles of the inlet valves are of a special streamlined design which eliminates pockets and sharp edges and allows a smooth flow of gas without eddies.

If the inlet valves or their seats are pitted and require re-cutting, care must be taken to reproduce the correct profile as shown in Fig. 8.

The cylinder heads should preferably be returned to the Works for the inlet valve seats to be re-cut but, if this is not possible, a special tool consisting of an arbor No. T.2053 and cutter No. T.2054 is available. Great care must be exercised in using this tool as it is located off the valve guides and these may be damaged if suitable apparatus is not employed.

The inlet valve faces and seats can be cut at 45 degrees in cases of emergency but this may have a deleterious effect on the performance of the engine.

39. Reassembly after Decarbonising

Before building up the engine, see that all parts are scrupulously clean and place them conveniently to hand on a clean sheet of brown paper.

Check the piston ring gaps to find out whether excessive wear has taken place (see Subsection 37).

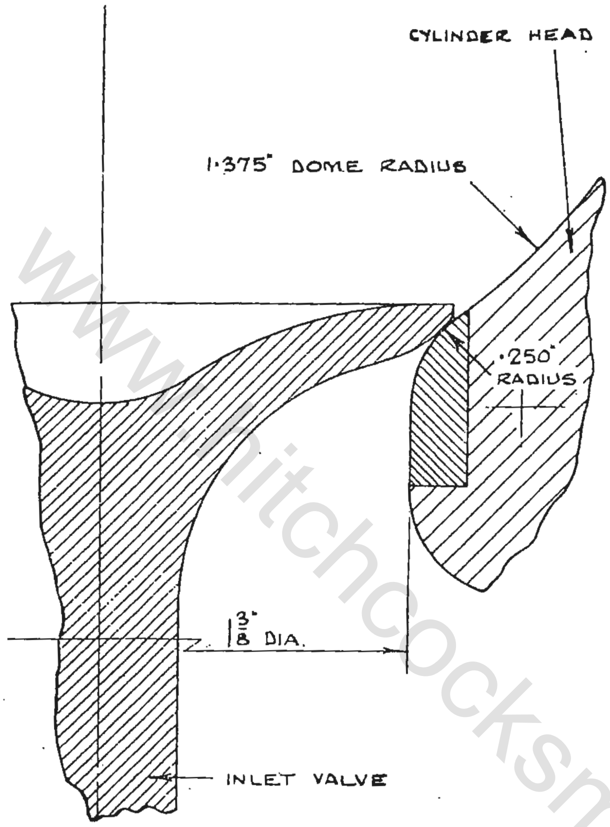
It is advisable to fit new gaskets to the cylinder base and cylinder head. Two paper gaskets are fitted to the base of each cylinder.

Smear clean oil over the pistons, having replaced the rings if these have been removed, lower the piston over the connecting rod and insert the gudgeon pin from the outer side. Fit the circlip and then fit the second piston in a similar manner.

Oil the cylinder bores and lower the barrels over the pistons and seat them gently on their gaskets.

Drop the push rods down their tunnels on to the tappet heads, shallow cups upwards.

Replace the cylinder heads as described in Subsection 30.



INLET VALVE SEAT PROFILE

Fig. 8

After the engine has been assembled, run it for a brief period at a speed which will ensure that the ignition has been advanced by the automatic advance device. If it is run too slowly "blueing" of the exhaust pipes may take place.

After the engine has been run for some time and has become thoroughly hot, go over **all** the cylinder head and other nuts to ensure that they are tight.

40. Cleaning the Oil Filters

The oil filter is located in the timing cover immediately below the oil pumps and is in the feed circuit to the big ends.

The filter element is removed by unscrewing the nut holding the end cap in position. When reassembling the filter after cleaning, take care that no grit or other foreign matter is sticking to it. The aluminium cylinder fitted over the rod inside the filter element is to reduce the free space which has to be filled after cleaning before oil reaches the big ends. After emptying the filter chamber it is essential to run the engine slowly for about five minutes to ensure that oil is reaching the big ends.

The felt element should be taken out and washed in petrol after the first 500 miles and after every subsequent 2,000 miles. Fit a new element every 5,000 miles.

41. Overhaul of Oil Pumps

Remove the timing cover as described in Subsection 20.

Remove the end plates from both pumps.

Remove the pump discs and plungers.

Remove the pump spindle which can be pulled out from the front or return pump end after removal of the locating screw.

Check the fit of the plungers in the pump discs which should have a minimum of clearance but should be able to be moved in and out by hand.

If, when fitting a new disc or plunger, the plunger is found to be too tight a fit, carefully lap with metal polish until it is just free. If the pump disc is not seating properly or if a new pump disc is being fitted, it should be lapped to the seating with Special Tool No. E.5425, using Carborundum 360 Fine Paste or liquid metal polish until an even grey surface is obtained.

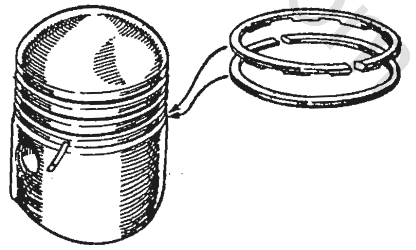
Wash all passages, etc., thoroughly with petrol after lapping to remove all traces of grinding paste.

Check the pump disc springs for fatigue by assembling in the timing cover and placing the pump covers in position. If the springs are correct, the pump cover should be held $\frac{1}{4}$ in. off the timing cover by the pump spring.

The pump spindle should be renewed if excessive wear has taken place on the teeth.

Reassemble the oil pumps, replacing the paper cover gaskets if necessary. Before fitting each cover fill the pump chamber with clean oil.

Having assembled the pumps, lay the timing cover flat and fill the oil ports by means of an oilcan. Turn the pump spindle with a screw driver in a clockwise direction looking on the front and it can then be seen whether the pumps are operating correctly.



CORRECT RELATIVE POSITIONS OF DUAL SCRAPER RINGS

Fig. 9

Fill the filter chamber with clean oil and replace the timing cover, taking great care not to damage the gasket where the section is narrow. (See Subsection 20.)

When the timing cover has been refitted on the engine, the oil feed to the big ends can be checked by partially unscrewing the feed plug in the timing cover between the oil pumps. The oil return to the tank can be checked by removing the oil filler cap. The feed to the rockers can be observed by removing the rocker-box covers, when oil will be seen flowing down the surface of the push rods.

42. Removal of the Timing Chains

Remove the magneto and chain (Subsection 45).

Loosen the chain tensioner locknut and stud.

Lift the adjusting plate clear of the chain tensioner spindle.

Remove the chain tensioner spindle and sprocket.

Lift the chain off the sprockets.

43. Removal of Pump Worm and Timing Sprocket

Remove the timing chains (Subsection 42).

Unscrew the oil pump worm by means of the hexagon head behind it. This is a **Left-Hand Thread.**

Withdraw the timing sprocket using Special Tool No. E.4869.

44. Removal of the Camshaft Sprockets

Remove the timing chains (Subsection 42).

Unscrew the camshaft sprocket fixing bolt, **which has a Left-Hand Thread,** at the same time holding the sprocket.

Withdraw the sprocket by means of a suitable extractor.

45. Removal of the Magneto

Remove the timing cover (Subsection 20).

Remove the magneto sprocket or auto-advance coupling (Subsection 24).

Remove three fixing nuts and withdraw the magneto.

46. Removal of the Engine and Clutch Sprockets

The primary chain is endless so that it is necessary to remove both the engine and clutch sprockets simultaneously.

The alternator stator is removed by undoing the three fixing nuts, after which the stator can be pulled off the three studs on which it is located.

Remove the central hexagon bolt securing the alternator rotor, which can then be drawn off, taking care not to lose the key.

Unscrew the engine sprocket nut, using Special Tool No. E.4877. The engine sprocket is mounted on splines and can then be removed with the clutch sprocket.

To remove the clutch sprocket, unscrew the three pressure plate pins and remove the pressure plate assembly, the centre retaining plate and the assembly of driving and driven clutch plates. The clutch sprocket can then be withdrawn from the centre after the removal of the large circlip which secures it.

47. Removal of the Tappets and Guides

It is only necessary to remove the tappets and guides if they have become worn.

Remove the cylinder heads and barrels. (Subsections 30 and 35.)

Extract the tappet guides, using Special Tool No. E.5790, having heated the case first.

The guides are made from Nickel Chrome Alloy Iron and if a guide should break while removing it, it can be withdrawn with a pair of pliers if the crankcase is heated locally with a blowlamp. Otherwise it is necessary to dismantle the crankcase and drive the tappet and guide out from underneath using a heavy bar in the cam tunnel.

The guide should have an interference of ·0015 to ·0025 in. in the crankcase and can be driven in with a bronze drift, care being taken when the guide is nearly home to avoid breaking the collar.

If a tappet guide is taken out it should be replaced by an oversize one.

48. Dismantling the Breathers

If the breathers are not operating efficiently, they may cause pressure in the crankcase, instead of a partial vacuum, giving rise to smoking or over-oiling.

See that the discs and backplate of the breather on the crankcase immediately below the left-hand cylinder are clean and undamaged, and that the discs are seating properly.

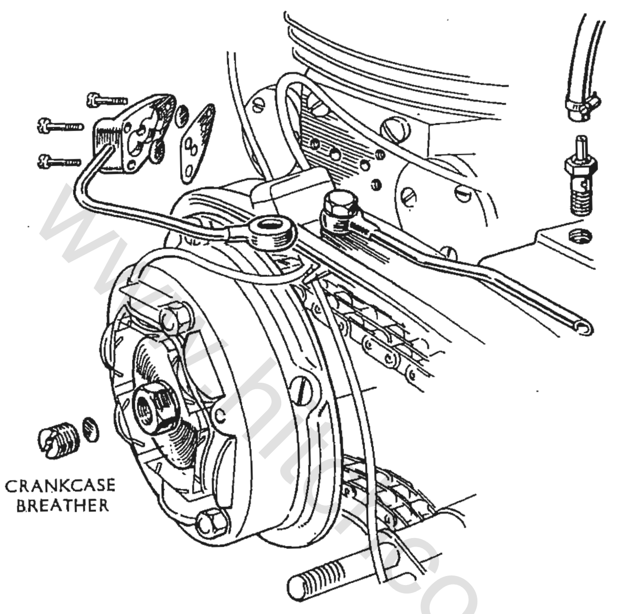
When reassembling the breather, apply jointing compound sparingly to the back of the steel plate, taking great care to keep the compound away from the discs and seatings.

The breather which operates through the crankshaft, may be inspected by removing the slotted plug from the head of the rotor retaining bolt. (See Fig. 10.)

49. Removal of the Clutch

Remove the engine sprocket and clutch sprocket together as described in Subsection 46.

To remove the clutch hub, hold the clutch with



CRANKCASE BREATHERS

Fig. 10

Special Tool No. E.4871 and remove the centre retaining nut and washer with a box spanner.

The hub can then be withdrawn from the shaft with Special Tool No. E.5414.

50. Removal of the Final Drive Sprocket

Remove the clutch as described in Subsection 49.

Remove the primary chain tensioner.

Remove the rear half of the primary chain case by taking out three socket screws and the centre stud.

Remove the grub screw locking the final drive sprocket nut.

Hold the sprocket and remove the nut (**Right-Hand Thread**). The sprocket can then be withdrawn.

51. Oil Seal Behind Engine Sprocket

This consists of a neoprene oil seal, with a garter spring, backed up by either one or two steel washers. The correct order of assembly is as follows:—

(1) Press the oil seal W43382 into the chain case from the front with the garter spring facing the inside of the case. The seal should be pressed in till its outer face is flush with the inner surface of its housing in the back half of the chain case.

(2) Into the recess thus formed at the back of the chaincase fit the thicker washer W34069.

(3) If provided, fit the thinner washer W34068 so that it lies between W34069 and the edge of the outer race of the driving side main ball bearing.

(4) Fit the back half of the chain case to the engine and tighten the three socket screws W38027. This should result in the oil seal being pushed in to the chain case so that its face stands slightly proud of the inner surface of its housing.

(5) Fit the engine sprocket, taking great care not to damage the lip of the seal when pushing the sprocket through it.

52. Oil Pipe Unions

The oil feed to the rocker gear is through pipes from unions at the back of the crankcase below the cylinder base to unions on the cylinder heads.

The tapped holes into which the unions screw into the aluminium are fitted with steel wire inserts to prevent the threads in the aluminium from stripping.

The method of fitting the thread inserts is the same as that used for the sparking plug inserts described in Subsection 34.

53. Rocker Oil Feed Relief Valve

There is a pressure relief valve in the oil supply to the rocker gear, whose function is to prevent excessive pressure and whose setting is not critical.

The valve is located in the crankcase face behind the timing cover and consists of a $\frac{3}{16}$ in. diameter steel ball held in position by a spring and a brass plug.

The valve is set before leaving the Works and should not normally require to be disturbed but, if it is found necessary to dismantle it, it can be reset by screwing the plug in until it is flush with the face of the crankcase, which will cause the pressure to be relieved at approximately 10 lbs. per square inch. The plug is prevented from moving by peening over the aluminium into the screw-driver slot with a small centre punch.

54. Fitting the Alternator

The alternator consists of two parts, the stator and the rotor.

The stator is mounted on to the primary chain-case with three studs and distance pieces.

The rotor, which contains the permanent magnets, is mounted on the end of the crankshaft and is located by a key and secured by a special bolt and washer.

The radial air gap between the rotor and the poles of the stator should be ·020 in. in all positions and care must be taken when refitting to see that it is not less than ·010 in. at any point.

Fit the rotor first, making sure that it is located concentrically on the end of the crankshaft. Attention must be given to the seating of the key because a badly-fitting key may cause the rotor to run unevenly. Finally secure the rotor with the appropriate bolt and washer.

Place the three distance pieces over the three chaincase studs. The stator can then be fitted, with the coil connections facing outwards.

Replace the nuts and shakeproof washers only finger-tight, and insert six strips (preferably of non-magnetic material) ·015 in. thick and about ⅛ in. wide between the rotor and each pole piece.

Tighten the stator nuts and withdraw the strips.

Check the air gap with narrow feelers and, if less than ·010 in. at any point, remove the stator and set the three studs carefully until the correct gap is obtained.

An alternative, and more satisfactory, method of assembling the alternator requires the use of Special Tool No. T2055/19.

This is a gauge ·015 in. greater in radius than the rotor and fits over the adaptor on the end of the crankshaft in the rotor's place.

The stator is then put in position on the studs in the chaincase and the nuts tightened up.

Remove the gauge and fit the rotor, then check the air gap.

Service Operations with Engine Removed

55. Removal of the Engine Gearbox Unit from the Frame

Disconnect the battery leads.

Remove the dual seat and petrol tank.

Remove the engine steady.

Remove the tool box cover and slide the flexible connection to the air cleaner off the induction pipe (where fitted).

Remove the exhaust pipes.

Disconnect the electric horn leads.

Loosen the rectifier bracket and swing the rectifier clear.

Remove contact breaker cover.

Remove carburetter fixing pins.

Remove the rear chain.

Disconnect the clutch cable.

Remove the footrest bar.

Remove the bottom rear engine bolt and the bolt securing the gearbox bracket to the frame. Loosen the nuts on the chainstay pivot bolt.

Support the engine on a suitable box or wood block.

Raise the centre stand and remove the spring.

Loosen the bottom gearbox nuts and swing the lower engine plates down.

Remove the front engine plates, horn and stand.

Lift the engine out of the frame.

56. Removal of the Gearbox

Remove the engine sprocket and clutch (Subsections 46 and 49).

Remove the rear half of the primary chaincase by removing three socket screws and the centre stud.

The gearbox and gearbox bracket can now be withdrawn from the back of the crankcase after unscrewing the four nuts which secure them.

57. Dismantling the Crankcase

Drain the oil tank by removing the drain plug.

Having removed the engine from the frame as described in Subsection 55, dismantle the heads, barrels, pistons, timing gear and magneto, as described in Subsections 20, 30, 35, 36, 42, 43, 44 and 45.

Remove the gearbox as described in Subsection 56.

Remove the two hexagon-headed plugs on the driving side of the crankcase just below the cylinder base.

Access can now be obtained through the plug holes to two screws holding the two halves of the crankcase together which must be removed. (See Fig. 11.)

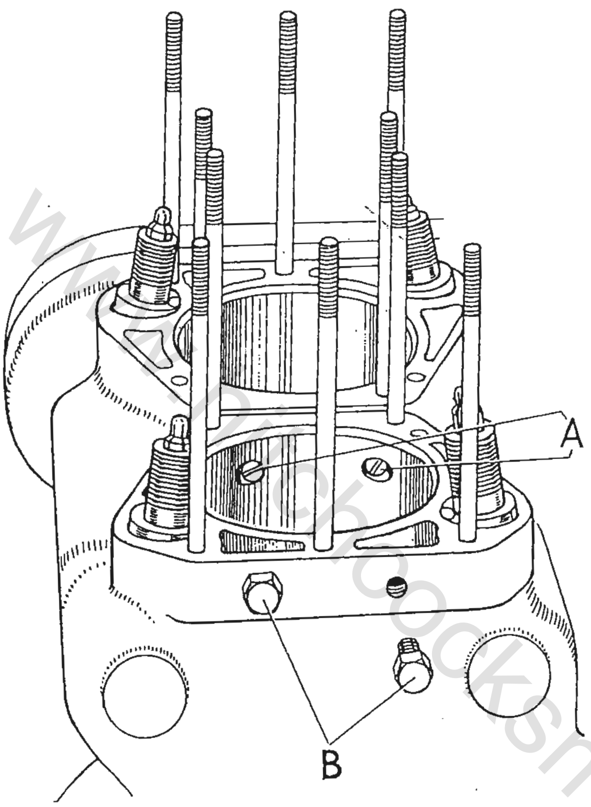
Remove three nuts in the timing chest, two nuts on the driving side crankcase, two loose studs through the bottom of the crankcase and two loose studs through the back of the oil tank. (The other studs have already been removed to take the engine out of the frame.)

Turn the crankshaft until the connecting rods are at bottom dead centre and the two halves of the crankcase can then be separated, tapping the crankcase with a soft mallet.

The inner race of the roller bearings on the timing side will remain on the crankshaft bringing with it the cage and rollers and leaving the outer race fixed to the crankcase.

The inner race of the ball bearing on the driving side is a tight fit on the shaft and can be removed with Special Tool No. E.5121. If this is not available, the shaft can be driven out with a hide mallet or a soft metal drift.

To avoid damage to the ball bearing the case should be heated to about 100°C. before doing this.



REMOVAL OF SCREWS IN CRANKCASE
Fig. 11

58. Main Bearings

To remove the ball bearing from the driving side crankcase, heat the crankcase to about 100 degrees C. by immersion in hot water or in an oven after which the bearing can be driven out using a drift **which applies pressure to the outside race only.**

When refitting a new ball bearing, heat the crankcase in the same way and use the same drift taking great care to keep the bearing square with the bore.

To remove the outer roller race from the timing side crankcase, first heat the crankcase then drive the race out using a small punch through the three holes provided.

The inner race and rollers can be withdrawn from the crankshaft using a claw type extractor.

When refitting the inner race drive it on to the shaft until just flush with the end and no further.

59. Fitting the Connecting Rods

To remove the connecting rods from the crankshaft, unscrew the socket screws in the connecting rods, having first removed the security wires through the heads (if fitted).

If the big end bearings caps are removed to examine the condition of the bearings, *make sure that the caps are refitted the same way round on the same rods and that the rods themselves are refitted the same way round on the same crank pins.*

In refitting the connecting rods, the socket screws should be tightened with a torque wrench set at 250 in. lb. (21 ft. lb.).

No cotter pins or other locking devices are fitted. If the socket screws are correctly tightened they will never come loose. If they are *not* adequately tightened they are liable to fatigue failures. Use only genuine big end screws, Part No. 47876 These have a very high fatigue strength due to the use of a special steel and the fact that the threads are rolled *after* heat treatment. Wiring the heads is not recommended.

If it is necessary to replace the big ends, a service crankshaft can be supplied with connecting rods fitted.

60. Reassembly of Crankcase

If the main bearings have been removed fit the replacement ball bearing in the driving side crankcase and the outer roller race in the timing side as described in Subsection 58. The outer race should be pressed home until it nips the steel and rubber oil seal W46200 (steel washer W36275/A on early engines) and should then be secured by making four equally spaced centre punch marks in the case so as to spread the aluminium over the radiused edge of the race.

Assembly of the two halves of the crankcase on to the crankshaft is easier if the crankcase is warmed while the crankshaft is cold. If the driving side is fitted first take particular care not to knock a roller out of the timing side main bearing when fitting the timing side case—this could cause serious damage to the engine. Risk of this is obviated by fitting the timing side of the case first but, if this is done, care must be taken not to rotate the crankshaft until it has been located endways by fitting the engine sprocket and tightening the nut right home. Rotation of the shaft before it is positioned correctly could score the inside of the timing side of the case.

It is possible to assemble the crankcase cold but the bearing clearances will then be reduced. This may necessitate wrapping a piece of thin string round the rollers of the timing side bearing to ensure their easy entry into the outer race. When cold it will be necessary to draw the driving end of the crankshaft through the ball bearing by means of the sprocket nut and a temporary distance piece used in place of the sprocket and somewhat shorter than it. The nut and distance piece must then be removed and the shaft locked into place by tightening the nut after fitting the sprocket.

Whichever method of assembly is used make sure that all parts are scrupulously clean, put clean oil on bearings, remove all traces of old jointing compound and any protruding pieces of metal from the joint face by means of a scraper and put fresh jointing compound on the face between the two halves of the crankcase. Do not forget the distance piece W34062 between the driving side ball bearing and the crank web and make sure that the camshafts are correctly fitted, exhaust at the front, inlet at the rear. Lift the tappets to clear the cams.

Bolt the two halves of the crankcase together before the jointing compound has set. Do not forget the two screws between the cylinder barrels (see Fig. 11).

61. Crankshaft Plugs

The oil passage through the big ends is sealed by two screwed aluminium plugs locked by a centre punch.

If the crankcase is taken out of the engine for any reason, the plugs should be removed and the oil passage cleared of sludge.

62. Pump Worm Threads

If the threads in the crankshaft, into which the pump worm screws, become damaged, a steel wire insert can be fitted. The crankshaft should preferably be returned to the Works for this to be done or, alternatively, the hole can be drilled out $\frac{7}{16}$ in. in diameter, using the timing sprocket as a drill bush and new threads tapped with a special tool. **Note that the thread is left-hand.**

The method of fitting the wire insert is the same as described in Subsection 34, for the sparking plugs.

Gearbox and Clutch

63. Description of the Clutch

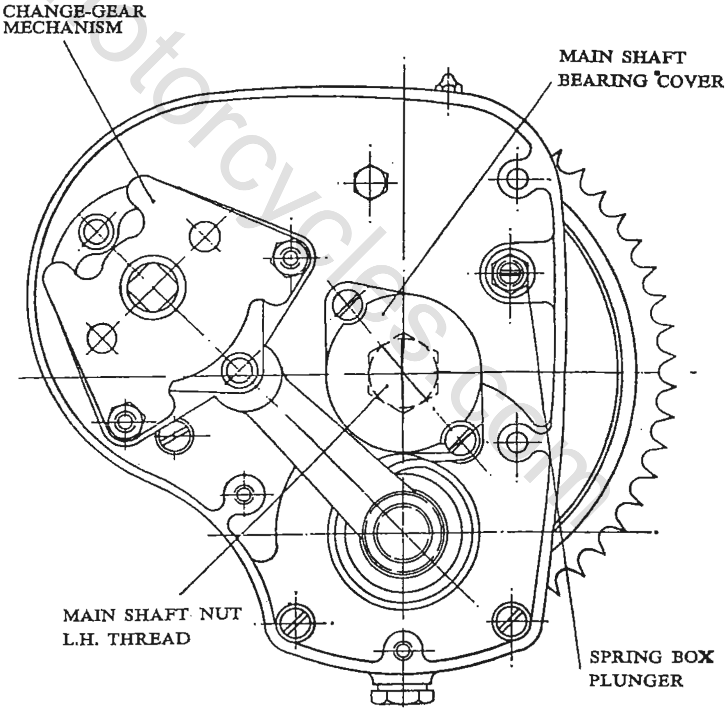
The clutch is built into the clutch sprocket and is mounted on the gearbox mainshaft which projects through into the primary chaincase.

There are six driven plates which are plain and five driving plates, giving ten friction surfaces.

The driven plates comprise the clutch centre back plate, two dished and two flat steel plates on splines on the clutch centre drum, and the clutch front plate. (See Fig. 13.)

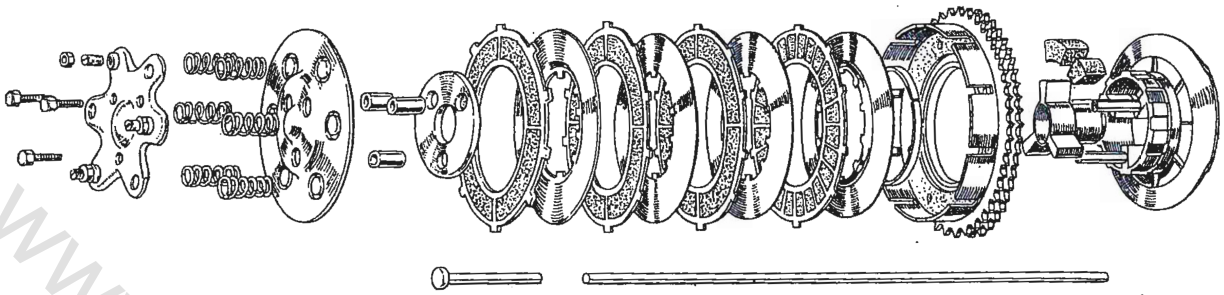
The driving plates include the clutch sprocket itself, which has a ring of friction material bonded to it (riveted on early models) and is located on the clutch centre drum by an anti-friction bearing consisting of 54 balls, $\frac{3}{16}$ in. diameter (in early models) or a ring of low friction material (in later ones). There are four loose friction plates splined to the clutch outer drum, which is riveted to the clutch sprocket. On early models the two plates nearest to the sprocket have keystone-shaped inserts of friction material and the two outer plates have bonded-on segments of "J.17" (a synthetic cork-based material which gives particularly good grip under oily conditions). On later models all the driving plates have bonded-on facings of J.17 material.

Pressure is applied to the clutch plates by six springs fitted between the outside of the clutch



GEARBOX WITH OUTER COVER REMOVED

Fig. 12



EXPLODED VIEW OF CLUTCH
Fig. 13

front plate and the inside of a star-shaped pressure plate.

The clutch operating mechanism consists of a lever mounted on the inside of the outer cover of the gearbox and operated by the control cable and handlebar lever. When the control is operated the clutch front plate is caused to move to the left, against the pressure of the springs, by means of a pad pushed by a rod passing through the gearbox mainshaft and operated by the lever in the outer cover through an adjusting screw and ball.

The clutch centre drum drives the mainshaft through a cush drive with six rubber blocks.

64. Description of the Gearbox

The operation of the gearbox is shown diagrammatically in Fig. 14.

The clutch sprocket A is mounted on the end of the mainshaft B which passes through the mainshaft sleeve C on the end of which is the final drive sprocket D.

At the other end of the mainshaft B is a pinion E which engages with a pinion F on the layshaft G. At the other end of the layshaft G is a pinion H engaging with a pinion J which runs free on the mainshaft sleeve C.

The mainshaft sleeve C has splines on which slides a double pinion KL. This double pinion KL engages with two pinions M and N which are free to rotate or slide on the layshaft G.

The double pinion KL has dogs at each end which can engage with dogs on the pinion E or on the pinion J.

The pinions M and N have internal dogs which can engage or slide over projecting dogs P and Q on the layshaft G.

The double pinion KL and the pinions M and N all slide together and are moved by the operator fork R and are located by a spring plunger S which engages with a notched plate which is part of the operator arm R.

The kickstart lever is connected to the pinion F on the layshaft by a ratchet mechanism which automatically disengages when the lever is released.

65. Removal of the Gearbox

This is described in Subsection 56.

The gearbox can, however, be completely dismantled with the engine in the frame except for the removal of the inside operator and the bearings in the gearbox shell.

66. To Dismantle the Gearbox

First remove the kickstart crank, the change-gear lever and the neutral finder and pointer.

Remove four screws and the gearbox outer cover can then be detached.

Remove the change-gear mechanism, by taking off the two nuts securing it.

Remove the mainshaft bearing cover which is attached by two screws.

Remove four cheese-headed screws and one hexagon bolt.

Remove the spring box locating plunger nut and washer.

Remove the mainshaft nut **(left-hand thread).**

The gearbox inner cover can then be removed.

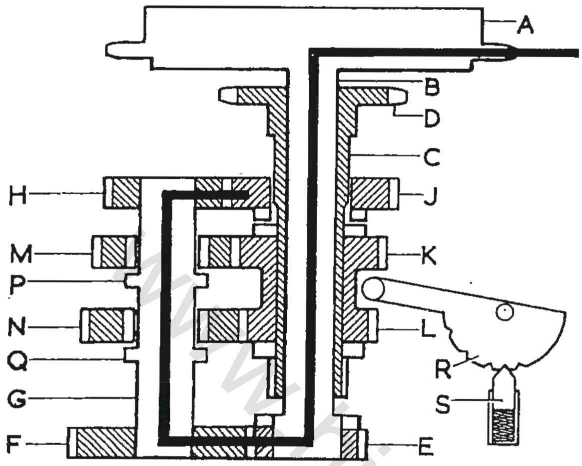
The mainshaft can be drawn straight out if the clutch has been removed, which, however, should be done before taking off the gearbox inner cover. (See Subsection 49.) The top gear pinion and dog will come away with the mainshaft.

The layshaft can then be removed and the 2nd and 3rd gears drawn off the final drive sleeve together with the operator fork.

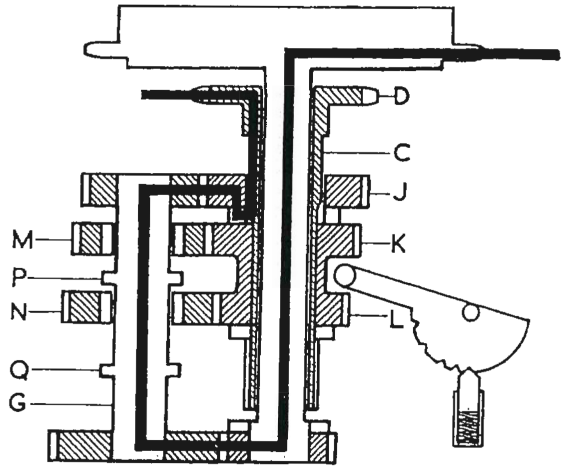
To take out the final drive sleeve, the final drive sprocket must be removed and this is preferably done before removing the inner cover. (See Subsection 50).

67. Removal of the Ball Races

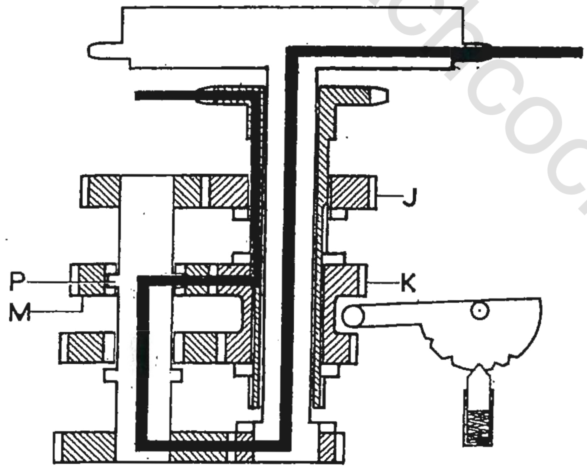
The mainshaft ball bearings can be removed by using a stepped drift $1\frac{7}{16}$—$1\frac{11}{64}$ in. diameter for



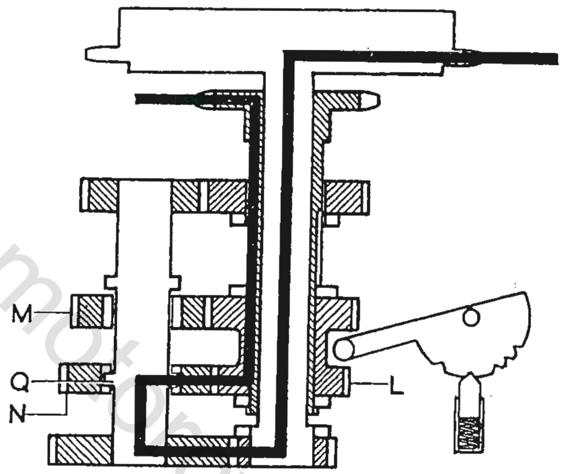
(A) NEUTRAL



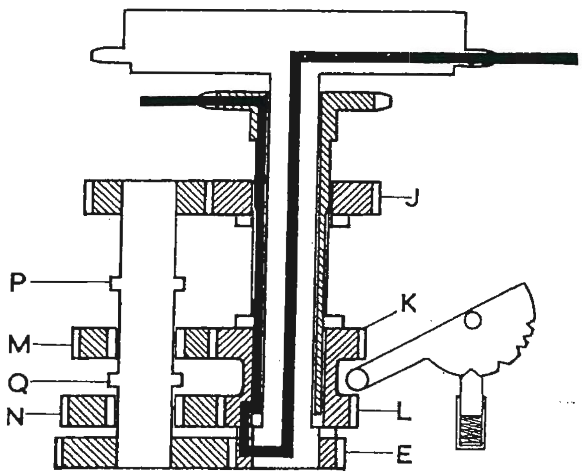
(B) FIRST GEAR



(C) SECOND GEAR



(D) THIRD GEAR



(E) TOP GEAR

Fig. 14A—Neutral. None of the dogs is engaged so that the mainshaft B and pinions E, F, H, J are rotating but the mainshaft sleeve C and the final drive sprocket are stationary.

Fig. 14B—Bottom Gear. The sliding pinions K, L, M, N have moved over so that the dogs on K engage with the dogs on the pinion J. This causes the double pinion KL, the mainshaft sleeve C and the sprocket D to rotate with the pinion J which is being driven from the mainshaft through the layshaft G. The dogs P and Q are not engaged.

Fig. 14C—Second Gear. The sliding pinions have moved so that the dogs on J are disengaged but the dogs P on the layshaft engage with the pinion M. The drive from the mainshaft and layshaft then passes through pinions M and K to the splines on the mainshaft sleeve and the pinion J is free on the sleeve.

Fig. 14D—Third Gear. The sliding pinions have moved further over so that the dogs Q on the layshaft engage with the pinion N which drives the pinion L and thus the mainshaft sleeve, the pinion M being free on the layshaft.

Fig. 14E—Top Gear. The sliding pinions have now moved right over so that both sets of dogs P and Q on the layshaft have disengaged but the dogs on the double pinion KL have engaged with those on the pinion E and the mainshaft and sleeve rotate together giving a one to one drive through the gearbox from the clutch sprocket to the output sprocket, the pinions M, N, J being free to rotate.

OPERATION OF GEARS

Fig. 14

the bearing in the box and $\frac{13}{16}$—$\frac{39}{64}$ in. diameter for the bearing in the cover.

When refitting the bearings stepped drifts of $2\frac{5}{16}$—$1\frac{11}{64}$ in. diameter and $1\frac{11}{16}$—$\frac{39}{64}$ in. diameter must be used for the bearings in the box and cover respectively.

Note the oil seal in the recess behind the larger mainshaft bearing.

68. Change-Gear Mechanism

If the two nuts securing the change-gear ratchet mechanism are slackened the adjuster plate can be set in the correct position. In this position the movement of the gear lever necessary to engage the ratchet teeth will be approximately the same in each direction.

If the plate is incorrectly adjusted, it may be found that, after moving from top to third or from bottom to second gear, the outer ratchets do not engage the teeth on the inner ratchets correctly.

If, when fitting new parts, it is found that the gears do not engage properly, ascertain whether a little more movement is required or whether there is too much movement so that the gear slips right through second or third gear into neutral. If more movement is required, this can be obtained by filing the adjuster plate very slightly at the points of contact with the pegs on the ratchet ring.

If too much movement is already present, a new adjuster plate giving less movement must be fitted.

69. Reassembling the Gearbox

The procedure is the reverse of that given in Subsection 66, but the following points should be noted:—

If the mainshaft top gear pinion and dog have been removed, make sure that the dog is replaced the right way round or third and top gears can be engaged simultaneously.

Make sure that the trunnions on the operator fork engage with the slots in the inside operator.

See that the mainshaft is pushed right home. It may tighten in the felt washer inside the final drive shaft nut.

The layshaft top gear and kickstarter pinion should be assembled on the layshaft and the kickstarter shaft and ratchet assembled on to it before fitting the end cover. Do not forget the washer on the layshaft between the kickstarter pinion and the kickstarter shaft.

The joint between the gearbox and the inner cover should be made with gold size, shellac or a similar jointing compound.

Make sure that all parts are clean before commencing assembly. In normal climates the recesses in the gearbox should be packed with soft grease and the box should be filled up to the correct level with engine oil. (See Subsection 73.) **On no account must heavy yellow grease be used.**

70. Dismantling and Reassembling the Clutch

The method of removing the clutch is described in Subsection 46.

When reassembling the clutch, the following sequence must be adhered to, after first securing the clutch sprocket with the large circlip.

Fit the cush rubbers, retaining plate and three distance tubes, and follow with the pressure plate assembly as follows:—

Plain dished plate (dish projecting outwards.)
Friction plate (with inserts on early models).
Plain flat plate.
Friction plate (with inserts on early models).
Plain flat plate.
Friction plate (with bonded facings).
Plain dished plate (dish projecting inwards).
Friction plate (with bonded facings).
Front plate.
Pressure plate and springs.

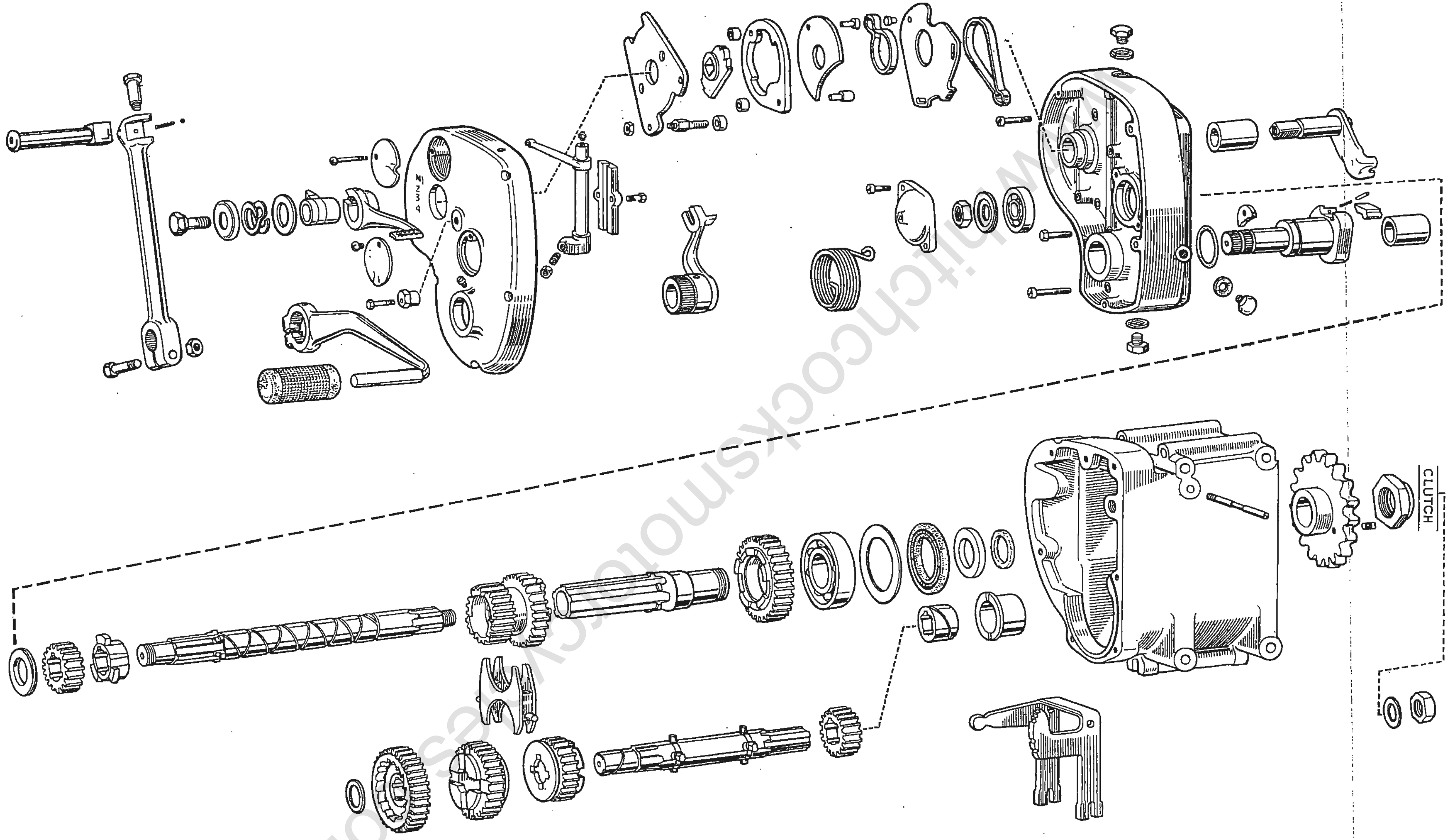
When reassembling the pressure and front plates, see that the three distance pieces are fitted over the pins securing the pressure plate to the clutch centre drum. These must pass through the holes in the front plate into the three recesses in the clutch centre retaining plate. Note that three strong (13g) and three weak (14g) springs are used. These *must* be fitted alternately and, in the case of later models with adjusting screws on three arms of the pressure plate, the 14g springs *must* be fitted behind the adjusting screws. The three pressure plate pins must be locked up tight.

If the clutch lifts unevenly adjust one or, if necessary, two of the adjusting screws in the pressure plate (later models). These screws can also be used to increase the spring pressure when wear has taken place on the friction surfaces but care must be taken not to screw them in too far. This could reduce the lift of the clutch by causing some of the springs to become coil bound, thus causing clutch drag.

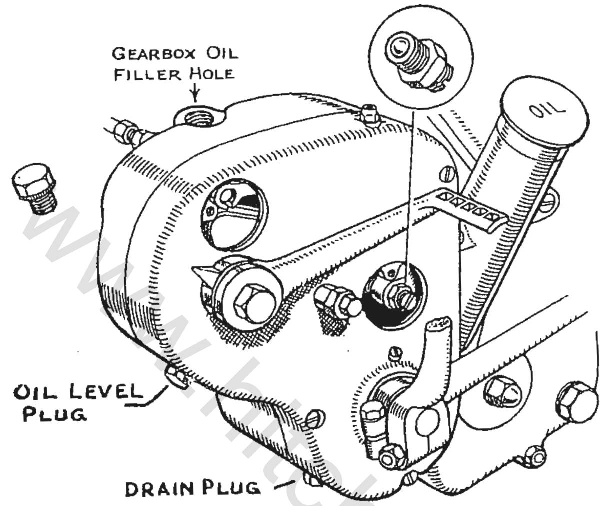
71. Adjustment of Clutch Control

It is essential that there is about $\frac{1}{32}$ in. free movement in the clutch cable, to ensure that all the spring pressure is exerted on the plates.

There are three points of adjustment for the clutch control. The first is in the clutch operating lever in the gearbox and is accessible after removing the lower inspection cover in the front cover of the gearbox (see Fig. 16). The clutch cable should be slacked right off or, preferably, disconnected when making this adjustment. Slacken the locknut and adjust the centre screw in or out



EXPLODED VIEW OF GEARBOX
Fig. 15



CLUTCH ADJUSTMENT
Fig. 16

until it is as nearly as possible in line with the clutch push rod. Tighten the locknut and check that no part of the lever is hard against the inside of the gear box front cover or either of the inspection covers.

The second and third adjustments are in the outer casing of the clutch control cable. There is an adjustable sleeve with a locknut forming the abutment for the outer casing at the gearbox end (in some machines this may be replaced by a mid-cable adjuster about 12 in. from the handlebar lever) and also a finger-operated sleeve and locknut at the handlebar end.

To adjust the control cable, having first set the adjuster in the gearbox clutch operating lever correctly, couple up the control cable, screw the adjusting sleeve at the handlebar end of the casing in as far as possible then unscrew it two turns. Now adjust the sleeve at the gearbox end of the casing until there is $\frac{1}{32}$ in. to $\frac{1}{16}$ in. slack in the control. If the control is adjusted in this manner the finger adjustment at the handlebar end can be used to take up any slack which may appear temporarily as the result of the friction material swelling due to heat if the clutch has to be slipped a great deal in traffic. This adjustment can also be used to give more clearance temporarily if this is necessary as a result of wear of the friction linings. This, however, should be corrected finally by adjusting the centre screw in the gearbox clutch operating lever.

72. Adjustment of the Neutral Finder

The neutral finder is adjusted by means of an eccentric stop secured to the front of the gearbox cover by a bolt which limits the travel of the operating pedal. Slacken the bolt and turn the eccentric until the correct movement of the pedal is obtained.

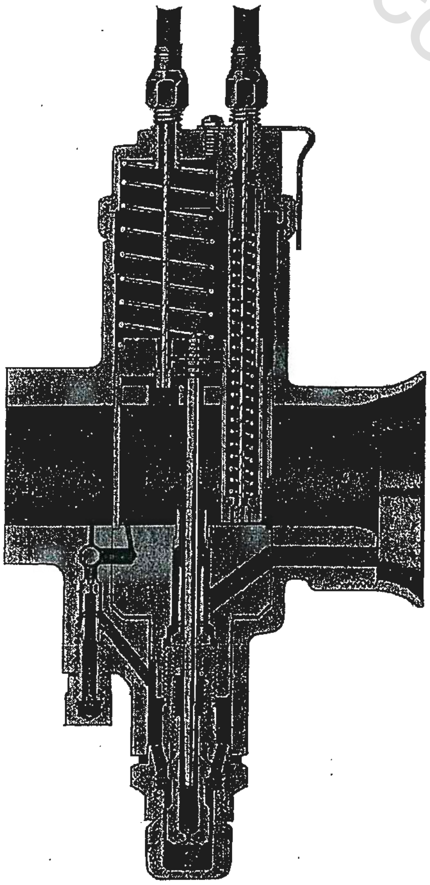
73. Gearbox Oil Level

The gearbox is filled with oil by removing a plug in the top and the correct level can be checked by removing a second plug lower down on the left-hand side looking at the cover. (See Fig. 16.)

Amal Monobloc Carburetter

74. General Description

Two of the well-known AMAL Monobloc carburetters are fitted direct on to the inlet ports as standard though for special purposes a model is available with a single carburetter supplying both cylinders through a branched induction manifold. A sectioned view of the carburetter is shown in Fig. 17 and an "exploded" view in Fig. 19 which actually illustrates the left-hand carburetter of a pair, or the type used when only one carburetter is fitted. On early models the right-hand carburetter had no float or float chamber but was fed with petrol from the float chamber on the left-hand carburetter through a connecting tube joining the two main jet holders. On recent machines the right carburetter has its own float chamber which is on the right-hand side of the mixing chamber, the carburetter being a mirror image of that illustrated. Each float chamber contains a metal or plastic barrel-shaped float operating on a nylon fuel needle with a powerful lever action which ensures a positive cut-off unless there is dirt on the seating.



SECTION THROUGH MIXING CHAMBER, SHOWING AIR VALVE AND THROTTLE CLOSED

Fig. 17

The supply of air to the engine is controlled by a throttle slide which carries a taper needle operating in the needle jet. The needle is secured to the throttle slide by a spring clip fitting in one of five grooves and the mixture strength throughout a large proportion of the throttle range is controlled by the position of this needle in the slide and by the size of the jet in which it works. There is, however, a restricting or main jet at the bottom of the needle jet and the size of this controls the mixture strength at the largest throttle openings. At very small throttle openings petrol and air are fed to the engine through a separate pilot system, which has an outlet at the engine side of the throttle. The air supply to this pilot system is controlled by the pilot air screw and the slow running of the engine can be adjusted by means of this screw and a stop which holds the throttle open a very small amount. The throttle slide is cut away at the back and the shape of this cut-away controls the mixture at throttle openings slightly wider than that required for slow running. There is a compensating system to prevent undue enriching of the mixture with increasing engine speed, this system consisting of a primary choke surrounding the upper end of the needle jet through which air is drawn in increasing quantities as the depression in the main choke increases. This air supply and the supply to the pilot system are taken from two separate ducts in the main air intake to the carburetter so that all the air passing to the engine can be filtered by fitting an air cleaner to the main carburetter air intake.

Two small cross holes in the needle jet, at a level just below the static level in the float chamber, permit petrol to flow into the primary choke when the engine is not running or when it is running at very low speeds, thus forming a well of petrol which will be drawn into the engine on starting or accelerating from low speeds. At moderately high engine speeds the level of petrol in the float chamber falls slightly and in consequence no more fuel flows through the cross holes in the needle jet so that the petrol well remains empty until the engine slows down or stops.

A handlebar controlled air slide is provided to enrich the mixture temporarily when required.

75. Tuning the Carburetter(s)

The throttle opening at which each tuning point is most effective is shown in Fig. 18. It should be remembered, however, that a change of setting at any point will have some effect on the setting required at other points; for instance, a change of main jet will have some effect on the mixture strength at half throttle which, however, is mainly controlled by the needle position. Similarly an alteration to the throttle cut-away may affect both the needle position required and the adjustment of the pilot air screw. For this reason it is necessary to tune the carburetter in a definite sequence, which is as follows:

First—Main Jet. The size should be chosen which gives maximum speed at full throttle with the air control wide open. If two different sizes of jet give the same speed the larger should be chosen for safety as it is dangerous to run with too weak a mixture at full throttle.

Second—The pilot air screw should be set to give good idling. Note that the pilot jet is detachable and two sizes are available, 25 c.c. and 30 c.c. If the pilot air adjusting screw requires to be screwed out less than half a turn the larger size pilot jet should be used; if the air screw requires to be screwed out more than 2-3 turns fit the smaller size of pilot jet.

Third—The throttle valve should be selected with the largest amount of cut-away which will prevent spitting or misfiring when opening the throttle slowly from the idling position.

Fourth—The lowest position of the taper needle should be found consistent with good acceleration with the air slide wide open.

Fifth—The pilot air screw should be checked to improve the idling if possible. When setting the adjustment of the pilot air screw this should be done in conjunction with the throttle stop. Note that the correct setting of the air screw is the one which gives the fastest idling speed for a given position of the throttle stop. If the idling speed is then undesirably fast it can be slowed down by unscrewing the throttle stop a fraction of a turn.

It will be noted that of the four points at which adjustments are normally made, i.e., pilot air screw, throttle cut-away, needle position and main jet size, the first and third do not require changing of any parts of the carburetter. Assuming that the carburetter has the standard setting to suit the particular type of engine any small adjustments occasioned by atmospheric conditions, changes

PHASES OF AMAL MONOBLOC CARBURETTER THROTTLE OPENINGS

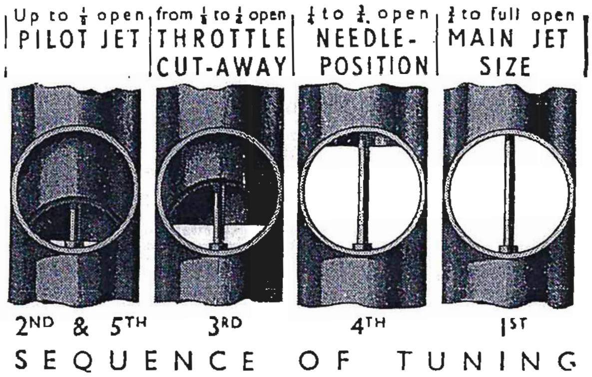


Fig. 18

in quality of fuel, etc., can usually be covered by adjustment of the pilot air screw and raising or lowering the taper needle one notch. If, however, the machine is used at very high altitudes or with a very restricted air cleaner a smaller main jet will be necessary. The following table gives the reduction in main jet size required at different altitudes:

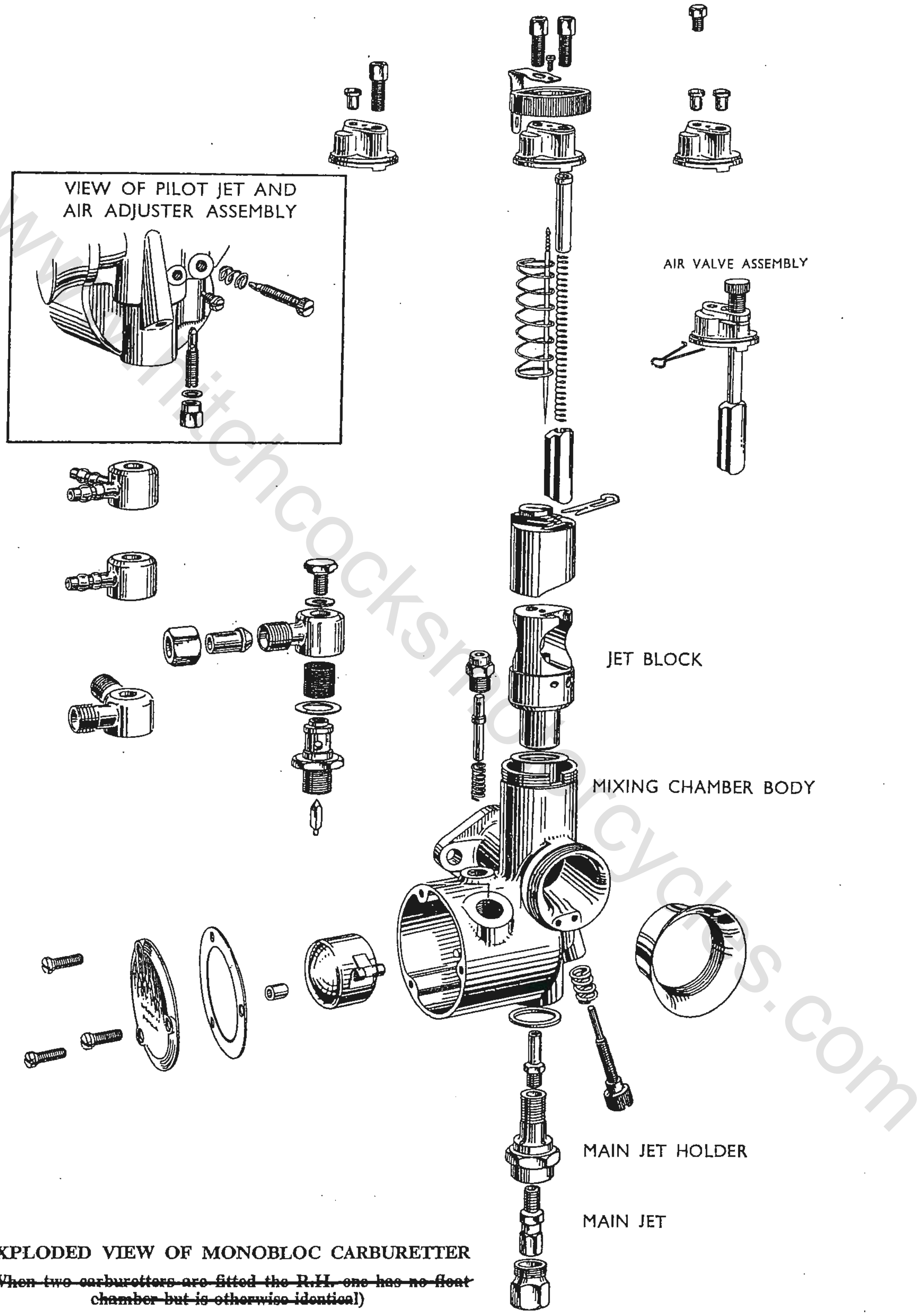
Altitude, ft.	Reduction, %
3,000	5
6,000	9
9,000	13
12,000	17

In the case of carburetters for engines running on alcohol fuel considerably larger jets are needed. In most cases a No. 113 needle jet will be required and the main jet size will require to be increased by an amount varying from 50% to 150% according to the grade of fuel used.

If the engine is run on fuel containing a small proportion of alcohol added to the petrol, a rough and ready guide is that the main jet should be increased by 1% for every 1% of alcohol in the fuel. In most cases alcohol blends available from petrol pumps do not contain sufficient alcohol to require any alteration to the carburetter setting.

The range of adjustment of the taper needle and the pilot air screw are determined by the size of the needle jet and of the pilot outlet respectively. Standard needle jets have a bore at the smallest point of ·1065 in. and are marked 106. Alternative needle jets ·1055 in., ·1075 in., ·109 in. and ·113 in. bore are available and are marked 105, 107, 109 and 113 respectively.

The standard pilot outlet bore is ·025 in. but in some cases larger size pilot outlets are used. Since the pilot outlet is actually drilled in the body of the carburetter it is necessary to have a carburetter with



EXPLODED VIEW OF MONOBLOC CARBURETTER

~~(When two carburetters are fitted the R.H. one has no float chamber but is otherwise identical)~~

Fig. 19

the correct size pilot outlet if the best results are to be obtained.

The accompanying table shows the standard settings for Amal Monobloc Carburetters used on Royal Enfield "Interceptor" motor cycles.

These may be taken as correct for all normal conditions and for practical purposes carburetter tuning consists only of setting the pilot air screw and throttle stop.

76. Tuning Sequence with Two Carburetters

When setting the slow running on machines fitted with two carburetters the following procedure is recommended —

(1) See that both throttle slides are open the same amount for any given position of the twist grip. This is most easily checked by looking into the air intakes while slowly opening and closing the throttles with the air slides wide open. Make sure that the highest point of the cut-away on the throttle valve reaches the top of the bore simultaneously in both carburetters. If necessary adjust one or both mid-cable adjusters in the throttle cables.

(2) Repeat this procedure for the air slides.

(3) Start the engine and let it run at a fast idle till thoroughly warm. Open the air slides fully and remove the H.T. lead and waterproof plug cap from the right-hand sparking plug, opening the throttle if necessary to keep the engine running on one cylinder.

(4) Adjust the throttle stop on the left-hand carburetter to hold the throttle just wide enough open to keep the engine running with the twist grip shut.

(5) Adjust the pilot air screw on the left-hand carburetter to give the maximum speed for this throttle position.

(6) Slow down the engine as far as possible by adjusting the throttle stop and reset the pilot air screw if necessary to give the maximum speed for the new throttle position. Repeat till the engine is running as fast as possible on the smallest possible throttle opening.

(7) Replace the right-hand plug cap and lead and remove the left-hand ones.

(8) Repeat (4), (5) and (6) on the right-hand carburetter.

(9) Replace the left-hand plug cap and lead. The engine should now be running steadily at a fast idle.

(10) Slow the engine down by unscrewing each throttle stop equally. If running becomes lumpy adjust each pilot air screw an equal amount. If necessary, slow engine down further by unscrewing each throttle stop equally but do not try to get *too* slow an idle with a hot engine otherwise it will be liable to stop when only partly warmed up.

77. Dismantling Carburetter

The construction of the carburetter is clearly shown in Fig. 19.

If the float chamber floods, first make sure that there is no dirt on the fuel needle seating. Owing to the use of a nylon needle and the leverage ratio between float and needle, flooding is very unlikely with this type of carburetter unless dirt is present or, of course, the float is punctured.

If it is necessary to remove the jet block note that this is withdrawn from the upper end of the

Settings for AMAL Monobloc Carburetters on Royal Enfield 736 c.c. "Interceptor" Motor Cycles

Carburetter Type No.	Choke Bore in.	Main Jet c.c.	Needle Jet in.	Needle Position	Throttle Valve	Pilot Jet c.c.	Remarks
L/H 389/85 R/H 389/86	$1\frac{3}{16}$	380	·1065	3	389/3½	25	Float on L/H Carburetter only. Tube connecting Jet Holders.
L/H 389/205 R/H 689/205	$1\frac{3}{16}$	380	·1065	4	389/3½	25	L/H Float on L/H Carburetter. R/H Float on R/H Carburetter. No connecting tube.
L/H 389/225 R/H 689/225	$1\frac{3}{16}$	400	·109	3	389/3	30	As 389/205 and 689/205 but special rich setting for Californian market.
389/226	$1\frac{3}{16}$	360	·1065	3	389/3½	25	For single Carburetter Model.

Notes: Some 389/205 and 689/205 were sent out with No. 3 needle position.
Some 389/205 and 689/205 were converted to 389/225 and 689/225 without renumbering.
Needle positions:—No. 1 = clip in top groove. No. 5 = clip in bottom groove.

mixing chamber after unscrewing the jet holder. Be careful not to damage the jet block when removing or refitting it. Note that the large diameter of the jet block pulls down on to a thin washer.

A single strand of an inner control cable is useful for clearing the small passages in the jet block and care must be taken not to enlarge these by forcing the wire through them. Compressed air from a pipe line or a tyre pump is preferable. A choked main jet should be cleared only by blowing through it.

78. Causes of High Petrol Consumption

If the petrol consumption is excessive first look for leaks either from the carburetter, petrol pipes, 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 Subsections 75 and 76 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. Remember that faults in other parts of the machine can have a marked effect on petrol consumption. Examples of this are binding brakes, chains too tight or out of line and, in particular, under-inflated tyres.

Lucas Twin-Cylinder Magneto

Models K2F 42369B and L.U. 54044111 (Automatic Advance)

79. General

This magneto incorporates a wound rotating armature and a high-energy permanent magnet field system, this latter being cast integral with the body. The unit is designed for 3-point flange fixing.

Small breathing holes are provided in the body of the magneto. These holes should not be allowed to become blocked.

On earlier models provision is made for altering the ignition timing by the manual control method, in which the cam ring is moved relatively to the armature. The lever controlling this movement is mounted conveniently on the handlebars and is connected by Bowden cable to the magneto. On later models an automatic advance and retard mechanism is fitted to the magneto driving sprocket.

80. Lubrication

To be carried out every 3,000 miles.

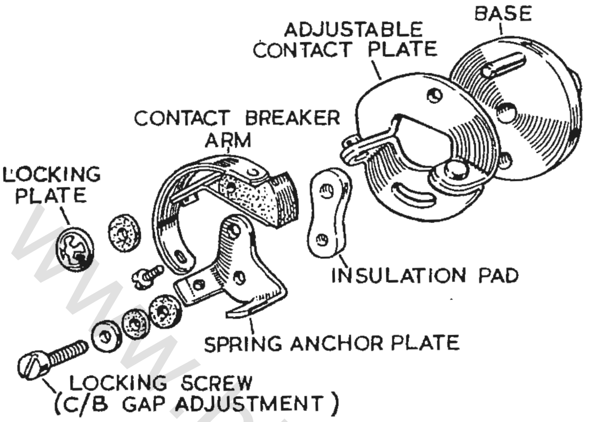
(i) Wipe the outside of the magneto to remove dirt or grease, and then take off the contact breaker cover. Unscrew the hexagon-headed screw in the centre of the contact breaker and withdraw the contact breaker from its housing. Prise off the special locking plate from the contact breaker arm pivot pin, taking care not to lose the insulating washer beneath it.

Slacken the screw which retains the contact breaker arm spring. The contact breaker arm may then be lifted from its pivot.

Wipe away any dirt or grease from the contacts with a petrol-moistened cloth. If necessary, use a very fine carborundum stone to polish the contacts, recleaning afterwards with a petrol-moistened cloth. Smear the pivot pin with a little Mobilgrease No. 2 before refitting the contact breaker arm.

In the case of magnetos with manual control remove the cam ring, which is a sliding fit in its housing, and lightly smear inside and outside surfaces with Mobilgrease No. 2. Both removal and refitting of the cam can be made easier if the handlebar control lever is half retarded, thus taking the cam away from its stop pin. Apply one or two drops of thin machine oil to the felt cam lubricator in the housing. Refit the cam, taking care that the stop peg in the housing and the plunger of the manual timing control engage with their respective slots. There is no need to disturb the cam ring when automatic advance mechanism is fitted.

Refit the contact breaker. This can be made easier if the contact breaker heel is away from the



K2F (42369B) MAGNETO CONTACT BREAKER
Fig. 20

cam lobe; turn the engine until this is so. The key on the projecting part of the contact breaker base must engage with the keyway in the armature shaft. Refit the hexagon-headed screw and tighten with care. It must not be slack, nor must undue force be used.

(ii) *Bearings*. The main bearings of the magneto are packed with grease during manufacture and need no attention until a general overhaul is undertaken.

81. Adjustments

Check every 3,000 miles.

(i) *Setting contact breaker gap*. The contact breaker gap must be set to 0·012–0·015 in. when the contacts are fully separated.

To adjust the gap, turn the engine until the contacts are fully opened. Slacken the cheese-headed screw which locates the spring anchor plate; the plate on which the contact is mounted may then be moved away from or towards the contact breaker arm, to give the required clearance.

(ii) *Adjusting the Timing Control Cable*. Slackness in the manual control timing can be taken up by sliding the waterproofing rubber shroud up the cable and turning the hexagon-headed cable adjuster. After adjusting, return the rubber shroud to its original position over the adjuster and control barrel.

82. Cleaning

To be carried out every 6,000 miles.

Check the contact breaker contacts and, if necessary, clean them as described in Subsection 80. Wipe the outside of the magneto to remove dirt or grease. Check the cable adjuster and control barrel for signs of water ingress.

Remove the high tension pick-ups and polish with a soft dry cloth. Each carbon brush must move freely in its holder and, if necessary, clean it with a petrol-moistened cloth. Should a brush be worn to within $\frac{1}{8}$ in. of the shoulder it must be renewed.

Whilst the pick-up moulding is removed, clean the slip ring track and flanges by holding a soft dry cloth against them with a suitably shaped piece of wood while the engine is slowly turned.

The high tension cables must be kept clean and dry.

83. High Tension Cables

If, on inspection, the high tension cable shows signs of deterioration, it must be replaced, using 7 mm. rubber, P.V.C. or neoprene covered ignition cable. To fit a new high tension cable, bare the end for about $\frac{3}{8}$ in., thread the knurled moulded nut over the cable, and thread the bared cable through the washer removed from the old cable.

Bend back the strands radially, and screw the nut into the pick-up moulding.

The latest engines are fitted with special high resistance H.T. cables (green) which prevent interference with radio or television without the need for a separate mid-cable or plug cap suppressor. These cables have a non-metallic thread carrying the H.T. current and are supplied complete with metal ferrules at each end. They must not be cut or shortened and, if replaced by standard type cables, a suppressor of about 5,000 ohms resistance must be fitted as close as possible to the sparking plug in order to comply with the law in the U.K. and many overseas countries.

84. Renewing Timing Control Cable (Manual Control)

The Bowden timing control cable should be renewed if it becomes frayed, otherwise moisture may enter the contact breaker housing.

To do this, slip back the rubber shroud and, by means of the hexagon at the base, unscrew the control barrel. If the cable and the plunger to which it is attached are now pulled upwards, the cable nipple can be disengaged from the plunger slot.

Soften the solder and remove the nipple.

Thread the new length of cable through the rubber shroud, cable adjuster, control barrel, sealing washer and restoring spring. Solder the nipple to the end of the cable. Engage the nipple with the slot in the plunger and screw the control barrel into the body, ensuring that the sealing washer is correctly fitted between the barrel and the body. Take up any slackness in the cable by means of the adjuster before refitting the rubber shroud in position.

85. Contact Breaker Springs

Correct contact breaker spring pressure, measured at the contacts, is 18—24 oz.

86. Servicing. Testing Magneto in Position on Engine

To locate cause of misfiring or failure of ignition, check as follows :—

(i) Remove the sparking plugs from the engine. Hold the end of the H.T. cable about $\frac{1}{8}$ in. from the cylinder block and crank the engine. If strong and regular sparking is produced the fault lies with the sparking plug or plugs which must be cleaned and adjusted or renewed.

(ii) If no sparking is produced, examine the H.T. cable and, if necessary, renew it as described in Subsection 83.

(iii) Very occasionally, the fault may be due to a cracked or punctured pick-up moulding. This type of fault is not easily detected by inspection, and a check should therefore be made by substitution.

(iv) If the ignition cut-out switch is suspected, disconnect the cable at the magneto and retest. If the magneto now functions normally. the fault is in either the cable or the cut-out switch. Correct by replacement.

(v) If the magneto has recently been replaced or removed, it may be incorrectly timed. See Subsection 24.

(vi) Check the contact breaker for cleanliness and correct contact setting as described under Maintenance.

If the cause of faulty operation cannot be traced from the foregoing checks, the cause may be an internal defect in the magneto. The magneto should therefore be removed from the engine for dismantling.

Further ignition particulars are given in a booklet issued by the makers, a copy of which we shall be pleased to forward upon request.

87. Automatic Advance Mechanism

This forms the coupling between the magneto driving sprocket and the magneto spindle. It consists of two weights which are pivotally mounted and fly outwards due to centrifugal force when the engine speed increases, thus advancing the angular position of the spindle in relation to the sprocket. The movement is restrained by two small tension springs and is limited in both directions by positive metal stops. The rate of advance is controlled by the strength of the springs and, in order to obtain sufficient advance to suit moderate speed part throttle conditions, fairly weak springs are fitted. In consequence it may sometimes be found that the engine has stopped with the coupling in the fully advanced position. This is due to the engine having bounced back off compression when it stopped and to the springs being unable to overcome the frictional drag of the contact breaker fibre heel on the cam either when the engine was turning backwards or when it is stationary. As soon as the engine is rotated slowly forwards by the kick starter, however, the magneto should return to the fully retarded position as the frictional drag will then assist the springs instead of opposing them.

The mechanism is automatically lubricated and requires no attention beyond making sure that the springs are securely fastened and that it operates freely. If it does not, the probable reason is that the chain is too tight (see Subsection 27). For timing instruction with the automatic advance coupling see Subsection 24.

Generator/Rectifier Charging Set

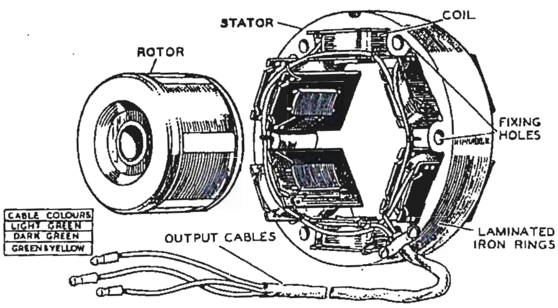
88. General (6-volt Sets)

(a) Constructional Notes

The alternator consists of a spigot mounted 6-coil laminated iron stator with a rotor carried on and driven by an extension of the crankshaft. The rotor has an hexagonal steel core, each face of which carries a high energy permanent magnet keyed to a laminated pole tip. The pole tips are riveted circumferentially to brass side plates, the assembly being cast in aluminium and machined to give a smooth external finish.

As shown in Figure 21, there are no rotating windings, commutator, brushgear, bearings or oil seals and consequently the alternator requires no maintenance apart from an occasional check of the three-way connector in the three output cables to see that this is clean and tight.

If removal of the rotor becomes necessary for any purpose, there will be no necessity to fit keepers to the rotor poles. When the rotor is removed, wipe off any metal swarf that may have been attracted to the pole tips and put the rotor in a clean place.

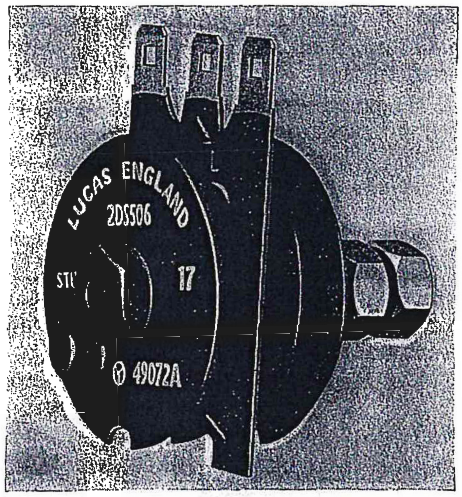


STATOR AND ROTOR OF ALTERNATOR RM19

Fig. 21

(b) Rectifier

A bridge-connected rectifier is fitted to convert the alternator output to a uni-directional battery charging current. The rectifier requires no maintenance apart from an occasional check to see that the connections are clean and tight. The nuts that clamp the rectifier plates together must never under any circumstances be slackened, as the clamping pressure has been carefully adjusted during manufacture to obtain the correct performance characteristics. A separate nut is used for securing the unit to the machine and this nut should be checked occasionally to see that it is tight.



RECTIFIER

Fig. 22

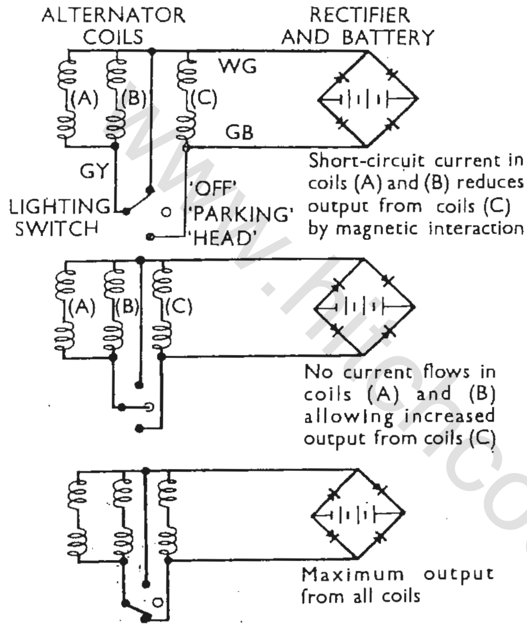
(c) Operation (6-volt Sets)

The alternator stator is wound with three pairs of series-connected coils, one pair being permanently connected across the rectifier. The purpose of this latter pair is to provide a small trickle charging current for the battery whenever the engine is running.

Connections to the remaining coils vary according to the demand on the battery and, as shown schematically in Figure 23, depend on the positions of the lighting switch. When no lights are in use, the coils are short-circuited and the alternator output is regulated to its minimum value by interaction of the rotor flux with the flux set up by the current flowing in the shorted coils. In the "Pilot" or parking lights position, the shorting link is disconnected and, the regulating fluxes being consequently reduced, the alternator output increases and compensates for the parking lights load. In the "Head" position of the lighting switch, the output is further increased by all three pairs of coils being connected in parallel.

In the case of a machine frequently left standing with the lights "on" and which does only a small amount of daylight running it may be found that a higher charge rate for daylight running is desirable.

This can be achieved by disconnecting and taping up one end of the green/white lead (light green on some early models) which runs from No. 7 terminal



CIRCUIT DIAGRAMS FOR POSITIONS OF LIGHTING SWITCH (6-volt Sets)

Fig. 23a

on the earlier switch LU31491A (LU31784A/D if Airflow fairing is fitted) or No. 4 terminal on the later plug and socket switch LU34289A, to one of the outside terminals of the rectifier. This open circuits the four coils which are normally short circuited and so increases the output from the other two. If a still higher rate of daylight charge is required (as, for example, on a machine equipped with a radio transmitter) this can be obtained by cross connecting the green/white and green/black (light green and dark green on some early models) leads at the snap connectors in the leads from the alternator. This brings four instead of two coils into action both for daylight running and when running on the pilot lights, the remaining two coils being short circuited or open circuited according to whether the short circuiting lead from switch to rectifier is connected or not. The following are the approximate maximum charge rates from an R.M.19 alternator into a 6-volt battery with the various connections described above:—

2 coils charging, 4 short circuited—3 amps.
2 coils charging, 4 open circuited—4$\frac{3}{4}$ amps.
4 coils charging, 2 short circuited—6$\frac{1}{2}$ amps.
4 coils charging, 2 open circuited—7$\frac{3}{4}$ amps.
6 coils charging —10 amps.

The higher charge rates should only be used in exceptional circumstances as running for long periods at these rates will overcharge the battery causing excessive gassing and loss of acid.

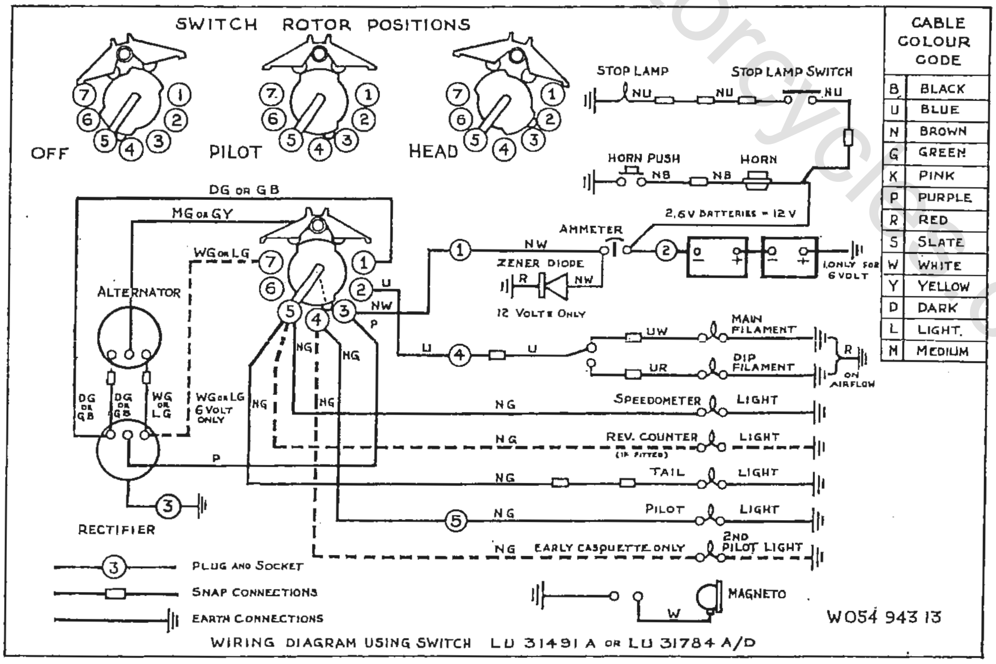
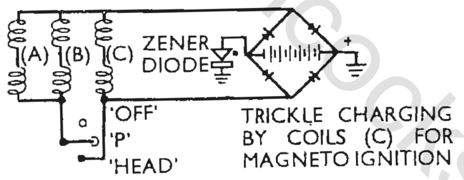


Fig. 24a

(d) Operation (12-volt Sets)

The voltage generated by a permanent magnet A.C. generator of the type fitted to the Royal Enfield "Interceptor" model is entirely dependent on the voltage of the battery to which it is connected. The same generator can, therefore, be used to charge either a 6-volt or a 12-volt battery. The current delivered against 12 volts is naturally less than it is against 6 volts but at any speed above 1,000 r.p.m. (18 m.p.h. in top) more than half the 6-volt current is delivered at 12 volts and at maximum speed the proportion is over 80%. The electrical output measured in watts is, therefore, greater at 12 volts than at 6 volts at any normal speed and is nearly twice as much at high speeds. Advantage can be taken of this to use higher wattage bulbs which consume less current, so that the voltage drop in the cable harness is less and the increase in useful light is greater than would be expected from the increased wattage of the bulbs.



CIRCUIT DIAGRAM (12-volt Sets)
Fig. 23b

Another advantage of the 12-volt system is that it enables the Zener diode system of regulation to be used. The Zener diode has the remarkable property of changing from a non-conductor to a conductor at a critical voltage which can be arranged to be 14 volts, i.e., when the 12-volt battery is discharged, the Zener diode, which is in a circuit in parallel with the battery, does not take current, but as the battery voltage rises the diode begins to pass current so that less goes into the battery. This gives much better regulation than can be achieved by the arbitrary switching in and out of coils.

89. Maintenance

(a) Check wiring occasionally to see that all connections are clean and tight.

(b) Check tightness of rectifier securing nut.

(c) On 12-volt sets check that Zener diode is tightened securely on to a clean flat surface. When functioning, the diode acts as an earth connection for quite large currents and will overheat if not in good contact with a fair mass of metal, preferably aluminium. On the other hand, do not over-tighten as the securing bolt is ¼ in. diameter U.N.F. thread and is made of copper for maximum thermal conductivity. It can easily be stripped or broken.

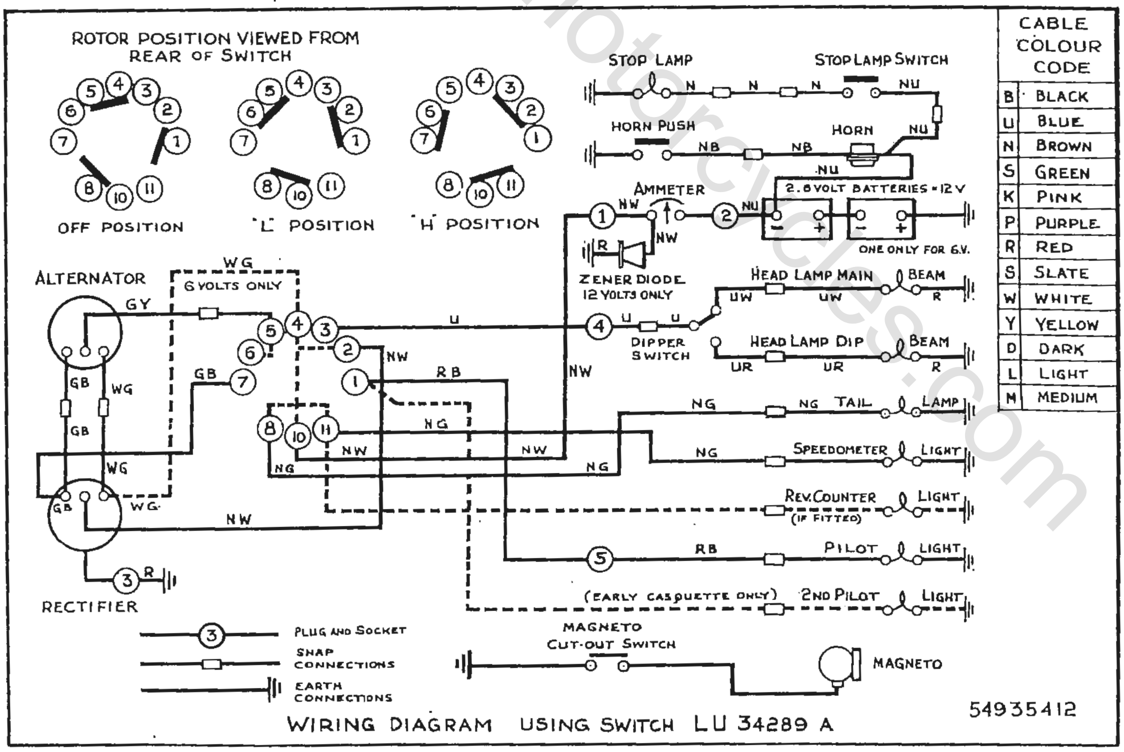


Fig. 24b

Battery—Models MLZ9E & MKZ9E-2

90. General

Both types of battery are of modern construction with translucent polystyrene cases through which the acid level can be seen. Each cell contains nine plates with separators formed from a dry inert micro-porous material which does not dilute the acid as did the wet wood separators formerly used. Special anti-spill filler plugs are fitted venting into a common chamber.

The larger MLZE battery is used with 6-volt sets. Two of the smaller MKZE—2 batteries connected in series are used with 12-volt sets.

These batteries must not be filled beyond the filling line indicated on the side of the case. This is below the tops of the plates and separators.

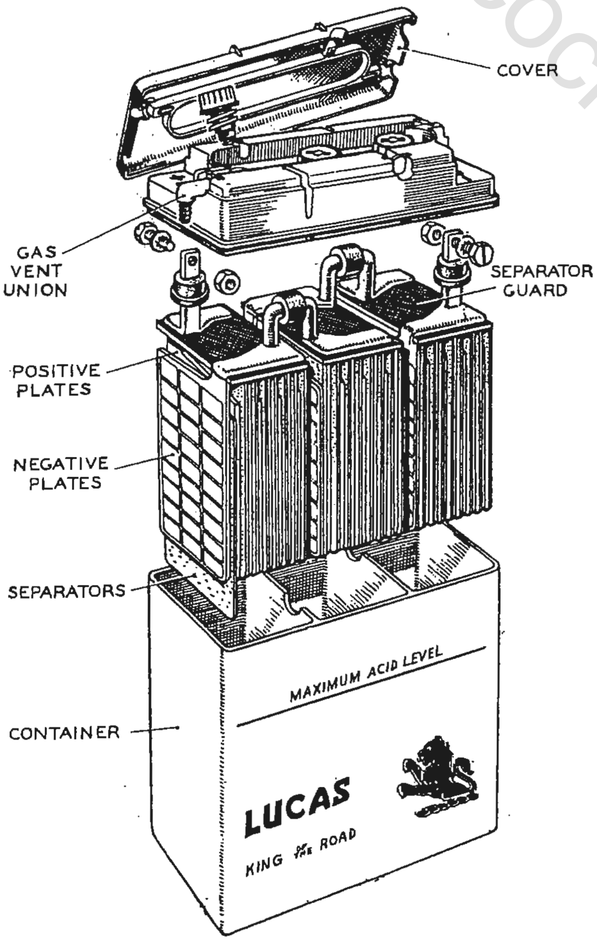


Fig. 25

The acid level will rise slightly while the battery is on charge but will fall again during off charge periods when the upper ends of the plates will be kept wet by capillary attraction.

These batteries are supplied in the "dry charged" condition and must be filled in accordance with instructions in Sub-sections 91 and 92.

91. Technical Data

	MLZ9E	MKZ9E-2
Nominal Voltage	6	6
No. of Plates per Cell ...	9	9
Volume of Acid per Cell ...	90 c.c.	80 c.c.
Amp. Hr. Capacity:		
10 hr. rate	12	7
20 hr. rate	13	8
Recharge Current	1·2 amps.	0·7 amps.
S.G. of acid for filling dry charged battery:		
(a) Climates normally below 80°F. (26·6°C.) ...	1·260	1·260
(b) Climates normally above 80°F. (26·6°C.)... ...	1·210	1·210

Note.—The above acid densities are corrected to 60°F. (15·5°C.).

To prepare 1·260 s.g. electrolyte slowly pour one part by volume of 1·835 s.g. acid into three parts of distilled water.

To prepare 1·210 s.g. electrolyte use four parts of water.

Always add acid to water, never vice versa, or dangerous spurting may result.

92. Filling and Soaking the Batteries

Discard the vent hole sealing tapes.

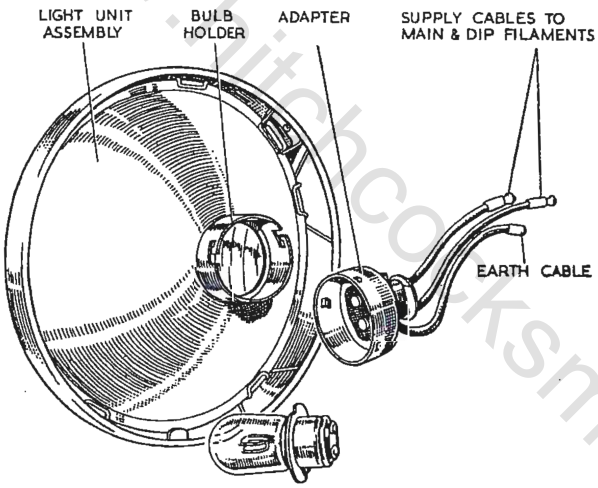
Pour into each cell in one operation pure dilute sulphuric acid of appropriate specific gravity to the coloured line denoting the maximum filling level and allow the battery to stand for one hour. Check the level and syphon off surplus acid from any cell where it has risen higher than the acid level line. Thereafter keep the acid just level with the coloured line by topping up with distilled water.

A discharge can be taken from the battery one hour after it has been filled but, if time permits, it is advisable to first give the battery a four hour freshening charge at the normal recharge rate, i.e., 1·2 amperes for MLZ9E or 0·7 amperes for MKZ9E—2.

Head and Tail Lamps

93. Headlamp

Various types of head lamp have been fitted to "Interceptor" models, depending on the date of manufacture, whether for the British or American market and whether or not an airflow fairing is fitted. All embody a Lucas "light unit" of the type shown in Fig. 26, with a "prefocus" bulb



HEADLAMP MCF700

Fig. 26

with filaments for main and dipped beams. The earlier models for the British market had a casquette fork head fitted with a unit as shown in Fig. 26 with no pilot bulb, twin pilot lamps being provided in the casquette. Later British machines had a similar unit, MCF 700P, incorporating a pilot bulb in the lower part of the reflector, the pilot lamps being no longer in the casquette. All American models and the latest British models have a headlamp model SS700P consisting of the unit as used in MCF700P mounted in a separate shell carried on brackets attached to the fork tubes. All machines fitted with "airflow" fairings have a lamp, F700P, mounted on a flange attached to the fairing and provided with three spring-loaded screws for adjusting the vertical and horizontal aim of the beam. This also contains a pilot lamp and uses the same light unit as the MCF700P and SS700P lamps.

Machines with separate headlamps, type SS700P, have provision for adjusting the vertical aim by pivoting the lamp shell in the brackets which support it. Machines with casquette headlamps also have provision for adjusting the vertical aim. This is done by loosening the top screw securing the "fixing ring," LU/553267, to the casquette itself. The entire reflector, front rim and lens can then be inclined backwards or forwards as required before retightening the screw. Horizontal aim on these machines, and on those with SS700P lamps, is fixed and depends on the accuracy of machining of the fork head, etc. Correct vertical aim is most important and this should be adjusted with the machine carrying its normal load. A beam set too high not only fails to light the road but will also dazzle oncoming drivers even when the dipped beam is used. A beam set too low does not cause dazzle but fails to show up objects far enough ahead and is, therefore, not safe for fast driving.

94. Lucas Light Unit

The unit incorporates a combined reflector and front lens assembly (see Fig. 26). This construction ensures that the reflector and lenses are permanently protected, thus the unit keeps its high efficiency over a long period. A "prefocus" bulb is used, the filaments of which are accurately positioned with respect to the reflector, thus no focusing device is necessary.

The bulb has a large cap and a flange, which has been accurately positioned with relation to the bulb filaments during manufacture. A slot in the flange engages with a projection on the inside of the bulb holder positioned at the back of the reflector.

A bayonet-fitting adaptor with spring-loaded contacts secures the bulb firmly in position and carries the supply to the bulb contacts.

The outer surface of the lens is smooth to facilitate cleaning. The inner surface is formed of a series of lenses which determine the spread and pattern of the light beams.

In the event of damage to either the lens or reflector a replacement light unit must be fitted.

95. Replacing the Light Unit and Bulb

Slacken the securing screw at the top of the headlamp rim. Remove the front rim and Light Unit assembly.

Withdraw the adaptor from the Light Unit by twisting it in an anti-clockwise direction and pulling it off. Remove the bulb from its locating sleeve at the rear of the reflector.

Disengage the Light Unit securing springs from the rim and lift out the Light Unit.

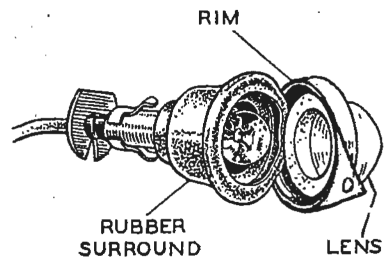
Position the new unit in the rim so that the word "TOP" on the lens is correctly located when the assembly is mounted on the headlamp. Refit the securing springs ensuring that they are equally spaced around the rim.

Replace the bulb and adaptor. The main bulb must be the Lucas "prefocus" type—6 v. 30/24 watt Lucas No. 312 or 12 v. 50/40 watt Lucas No. 446. When a pilot bulb is fitted in the leadlamp this should be 6 v. 3 watt Lucas No. 988 or 12 v. 6 watt Lucas No. 989.

Locate the bottom of the Light Unit and front rim assembly in the headlamp shell or in the fixing rim attached to the casquette fork head. Press the front on and tighten the securing screw at the top of the headlamp.

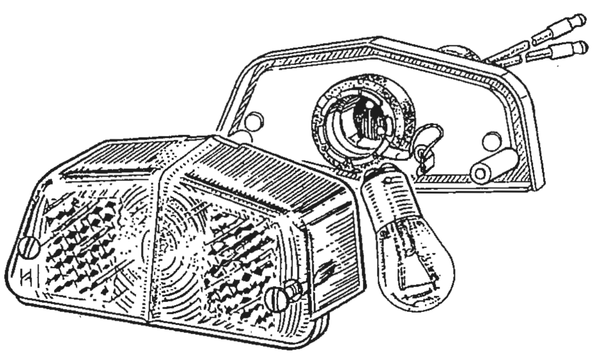
96. Parking Lights (Early Models with Casquettes)

Access to the parking bulbs is obtained by removing the parking lamp rim (see Fig. 27). This is forced over the edge of the rubber lamp body and is additionally secured by means of a small fixing



PARKING LIGHT EARLY U.K. MODELS
Fig. 27

screw. After removal of the lamp rim the parking lamp lens can be pulled out of the rubber body, after which the bulb will be accessible. Replace-



STOP-TAIL LAMP L.564
Fig. 28

ment bulbs should be 6 v. 3 watt Lucas No. 988 or 12 v. 6 watt Lucas No. 989.

97. Tail Light

The Lucas lamp, Type 564 (Fig. 28) is a combined stop and tail light and also incorporates a reflector.

Access to the bulb is obtained by removing the two screws which secure the plastic cover.

The correct bulb is Lucas No. 384 6 volt 6/18 watt. The 6 watt filament provides the normal tail light, while the 18 watt filament is illuminated on movement of the brake pedal. For 12 volt sets the bulb is Lucas No. 380, 12 volt, 6/21 watt.

(Note.—6 watt bulbs are now required by law in Great Britain on machines of more than 250 c.c. capacity.)

Care must be taken that the leads to the stop tail lamp are correctly connected, as the use of the 18 watt filament on the normal tail light will not only discharge the battery but could cause trouble from excessive heat affecting the plastic cover. At the same time, the 6 watt filament, if used as a stop-tail light, will be ineffective in bright sunlight or at night when the tail light filament is illuminated.

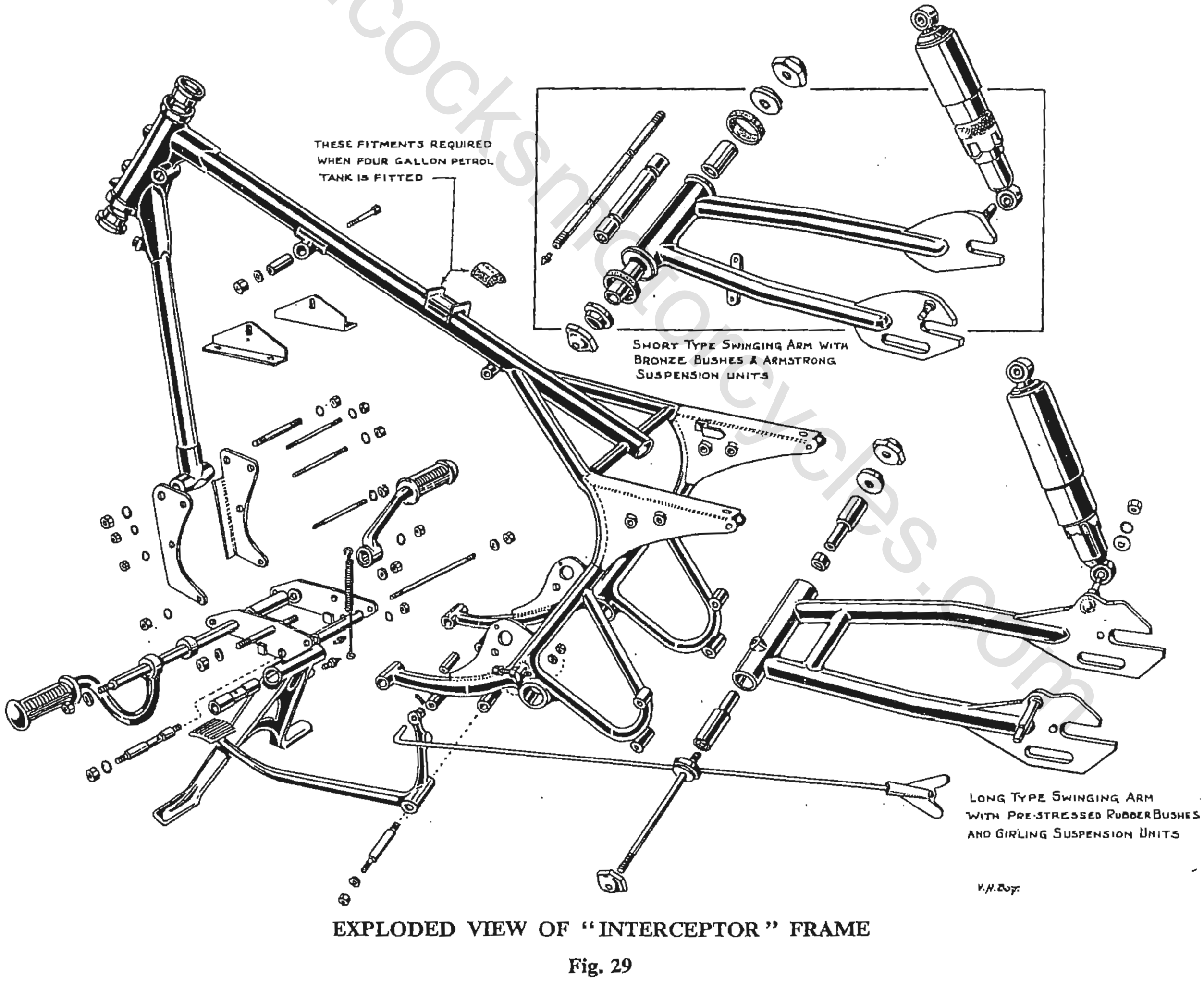
Frame

98. Description of Frame

The frame is built throughout of cold drawn weldless steel tubing with brazed or welded joints, liners being fitted where necessary for extra strength. All the main frame members are made of chrome-molybdenum alloy steel tubing which retains its strength and resistance to fatigue after brazing or welding.

The rear wheel is carried in a swinging arm unit which forms the chainstays. Two different lengths of swinging arm have been used, a shorter one, giving 54 in. wheelbase, on the earlier models for the English market and a longer one, giving 57 in. wheelbase for the American market and later models for the English market. Two types of pivot bearings have been used at the forward end of the swinging arm.

(a) Bronze bushes working on a steel tube secured to the main frame by a long bolt passing through the pivot lugs. Hardened steel thrust washers are provided to deal with side thrust. Two greasing points are provided and rubber sealing bands are fitted to exclude wet and dirt.



EXPLODED VIEW OF "INTERCEPTOR" FRAME

Fig. 29

(b) Pre-stressed rubber bushes with inner and outer metal sleeves. The inner sleeves are extended inwards and butt against a short distance piece fitted between them. The outer ends of the inner sleeves project beyond the ends of the rubber bushes and bear against steel thrust washers fitting into recesses in the main frame pivot lugs. A long steel bolt and nuts secure the whole assembly. No greasing is necessary with the rubber bushes.

99. Steering Head Races

The steering head races, 34085, are the same at the top and bottom of the head lug and are the same for all models. They are easily removed by knocking them out with a hammer and drift and new races can be fitted either under a press or by means of a hammer and a wooden drift.

100. Removal of Rear Suspension Unit

Place the machine on the centre stand and remove the dual seat and rear mudguard. (See Subsection 28.)

Remove the top pivot pin nut, drive out the pivot pin, then hinge the suspension unit back on the lower pivot pin. After removing the lower nut, the unit may be pushed off the pivot pin welded to the fork end.

101. Servicing Rear Suspension Units

The proprietary units fitted are sealed and servicing of the internal mechanism can be carried out only by the manufacturers.

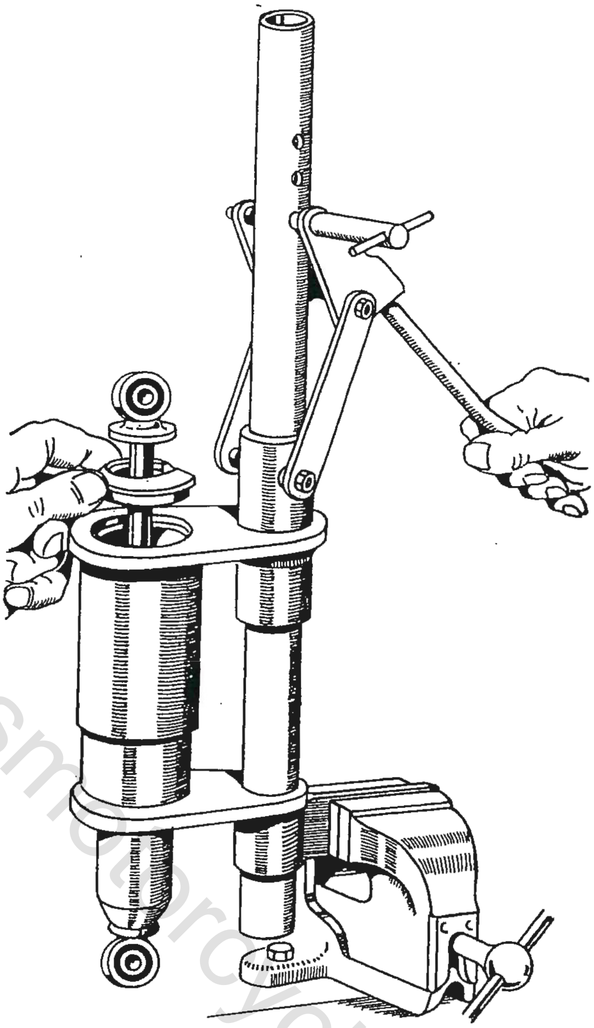
The rubber bushes in the top and bottom eyes can easily be renewed and the spring can be removed by pushing down on the top spring cover so as to release the split collar above it. After removal of the split collar the top cover and spring can be lifted off. When reassembling, the spring should be greased to prevent rust and squeaking if it should come into contact with either of the covers (when fitted).

Early machines were fitted with Armstrong adjustable dampers, either $8\frac{1}{2}$ in. or $8\frac{3}{4}$ in. closed length. These have two springs each, a long one at the top and a shorter one at the bottom. By turning a knurled collar the lower spring can be made inoperative, giving a stiff suspension, or allowed to function, giving a softer action. The stiff suspension is suitable for pillion work or with a light sidecar; the softer suspension is for normal solo work. For heavy sidecar work a stiffer top spring can be supplied.

The part numbers of suitable springs for these dampers are:—

Bottom spring, common to all—AT6/521.

Top spring, $8\frac{1}{2}$ in. dampers, 130 lb./in.—AT6/452.



REAR SPRING COMPRESSOR

Fig. 30

Top spring, $8\frac{1}{2}$ in. dampers, 150 lb./in.—AT6/520.

Top spring, $8\frac{3}{4}$ in. dampers, 130 lb./in.—AT6/439.

Top spring $8\frac{3}{4}$ in. dampers, 150 lb./in.—AT6/444 (W42358).

Later machines are fitted with Girling dampers which have only one spring but which can have the pre-load varied by turning the bottom spring cup by means of a "C" spanner (supplied in the tool kit) thus raising the rear of the machine and preventing bottoming on the bump stop under heavy loads. The lowest position is suitable for normal solo work, the middle position is for use with a pillion passenger and the top position is suitable for sidecar work. The part number for the spring for these dampers is 64539963, colour code Red/Orange, rating 132 lb./in.

When replacing a spring the use of a compressor, as shown in Fig. 30, is a great convenience. If one is not available, reduce the spring load as much as possible by setting Armstrong dampers to their "soft" position and Girling dampers to their lowest setting.

When the spring is removed it should be possible to push the plunger up and down *slowly* throughout the length of its stroke but it should resist *sudden* movements, particularly in the direction of the rebound. If it does not, or if there are signs of leakage of the hydraulic fluid, the complete damper unit should be exhanged for a service replacement. When making this test always hold the damper approximately upright so that the hydraulic fluid is at the lower end.

102. Removal of Swinging Arm Chain Stays

(a) With Bronze Bushes

First remove one of the pivot pin nuts and pull the pivot pin out from the other end. To release the pivot bearing it is necessary to spread the rear portion of the frame, using the frame expander E.5431, which will spread the frame sufficiently to enable the spigots on the thrust washers to clear the recesses in the pivot lugs forming part of the frame.

If it is necessary to remove the bronze bushes these can be driven out by means of a hammer and a suitable drift and new bushes can be fitted under a press without difficulty. After fitting the bushes they must be reamed to ·844/·843 in.

(b) With Rubber Bushes

The procedure is the same as above except that there is no need to spread the frame tubes.

If it is necessary to replace or remove the rubber bushes a press capable of exerting a load of 10/12 tons will be necessary. Support one end of the pivot tube on a piece of tube with a bore just large enough to accept the outside diameter of the outer metal sleeve of the rubber bush ($1\frac{1}{16}$ in.). Press one bush into the pivot tube, thus pushing out the other bush and the distance piece between them. Do this by means of a mandrel $1\frac{1}{32}$ in. diameter with one end stepped down to $\frac{31}{64}$ in. diameter to locate it in the inner sleeve of the bush.

Note.—This procedure will normally scrap one or both the rubber bushes which should not be removed unnecessarily. When fitting replacement bushes do not forget the distance piece between them.

103. Centre Stand

To remove the centre stand unscrew the nut from one end of the stand spindle, knock out the latter and withdraw the stand complete with its bearing sleeve after disconnecting one end of the stand spring.

104. Wheel Alignment

Note that it is not possible to guarantee that the wheels are correctly aligned when the same notch position is used on both adjuster cams. It is therefore not sufficient to count the notches and use the same position on both sides of the machine. The only way to guarantee that the wheels are in line is to check the alignment from front wheel to back using either a straight edge or a piece of taut string. The alignment should be checked on both sides of the machine and if the front and rear tyres are of different section allowance must be made for this.

It is usual to check the alignment of the wheels at a point about six inches above the ground but, if the alignment is checked also towards the top of the wheels, it will be possible to ascertain whether or not the frame is twisted so as to cause one wheel to be leaning while the other is vertical. To do this it is always necessary to remove the mudguards and, unless a straight edge cut away in its centre portion is available, it will be necessary also to remove the cylinders, toolboxes, battery, etc., in order to allow an unbroken straight edge or a piece of taut string to contact the front and rear tyres.

105. Lubrication

The steering head races, swinging arm pivot bearing and stand pivot bearing should be well greased on assembly. The swinging arm pivot on early models and stand pivot are provided with grease nipples but no nipples are provided for the steering head as experience has shown that the provision of nipples at this point causes trouble through chafing and cutting of control and lighting cables. If the steering head bearings are well packed they will last for several years or many thousands of miles.

Recommended greases are Shell Retinax A, Castrolease LM, Esso Multipurpose Grease H, Marfak Multipurpose 2, Mobilgrease MP, or Energrease L2.

Front Fork

106. Description

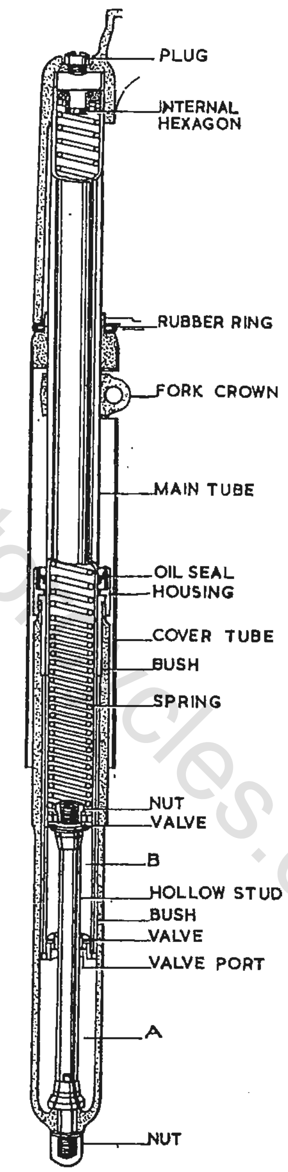
The telescopic fork consists of two legs each of which comprises a main tube of steel tubing. This may be either of chrome molybdenum alloy steel in 12 or 14 gauge or of 8 g. carbon steel. The outside diameter is the same in each case and the 12 g. alloy steel tube is at least as strong as the 8 g. carbon steel but, owing to the different wall thicknesses of the various tubes, different springs and other internal fittings have to be used with them. (See Subsection 109.) The 8 g. carbon steel main tubes were not fitted to machines for the U.S.A., nor to sidecar machines. The main tube is screwed into either the casquette fork head or into a fascia panel housing twin speedometer and revolution counters, and is securely clamped to the fork crown.

Fitted over the lower end of the main tube is the slider, or bottom tube, made of high strength aluminium alloy with an integral lug which carries the wheel spindle. The lower end of the main tube carries a steel bush held in place by a "valve port" which screws into the tube. This bush is a sliding fit in the bore of the bottom tube, the upper end of which carries a flanged bronze bush which is secured by means of a threaded steel housing containing an oil seal.

The spring, which is loaded in compression only, is fitted inside the upper end of the main tube with its upper end against the underside of the upper spring guide, which is brazed into the upper end of the tube. The lower end of the spring rests on top of the lower "spring guide," which is secured to a hollow spring stud held in the lower end of the fork slider, or bottom tube, and moving up and down with it. This spring stud passes through the "valve port" at the lower end of the main tube. Non-return disc valves are fitted on top of the "valve port" and underneath the lower "spring guide" so that the space between these, inside the main tube, becomes a damper chamber providing hydraulic control of the fork movement. (See Subsection 107.)

The lower ends of the main tubes and upper ends of the bottom tubes are protected either by a metal cover tube secured to the fork crown or by corrugated flexible gaiters. The upper ends of the main tubes are protected either by an extension of the casquette head or by cover tubes, carrying the lamp brackets, between the fascia panel and the fork crown.

A special fork is available for sidecar machines. This has bottom tubes with extended wheel lugs giving less trail and is fitted with stronger springs. A steering damper is standard on both solo and sidecar models.



SECTION OF FORK LEG
Fig. 31

Three cross holes towards the lower end of the main tubes ensure lubrication of the upper bearing bushes.

107. Operation of the Fork

The fork provides a range of movement of 6 in. from the fully extended to the fully compressed position. The movement is controlled by the compression spring and by the hydraulic damping system. The hydraulic damping is light on the bump stroke and heavier on the rebound stroke, thus damping out any tendency to pitching or oscillation without interfering unduly with the free movement of the fork when the wheel encounters an obstacle.

The fork is filled with a light oil (S.A.E. 20) to a point above the lower end of the spring so that the damper chamber "B" is always kept full of oil. Upward movement of the wheel spindle forces oil from the lower chamber "A" through the annular space between the spring stud and the bore of the valve port into the damper chamber "B." During this stroke oil pressure on the underside of the disc valve on top of the valve port causes this to lift so that oil can also pass from "A" to "B" through the eight holes in the valve body. Since, however, the diameter of "B" is less than "A" there is not room in "B" to receive all the oil which must be displaced from "A" as the fork operates. The surplus oil passes through a cross hole towards the lower end of the spring stud and up the centre hole in the stud, spilling out through the nut which secures the lower spring guide to the spring stud. *The size of this cross hole has a considerable effect on the amount of damping both on the bump and rebound strokes.* The smaller the hole the heavier is the damping, in fact, if the hole were not there the forks would be solid. The usual size is $\frac{3}{16}$ in. diameter, which gives very light damping, but in some cases a $\frac{1}{8}$ in. hole has been used, giving more damping, and, for America a $\frac{3}{32}$ in. diameter hole giving very heavy damping. If the action of the fork is free for slow movements but too solid when a bump is encountered the $\frac{3}{32}$ in. or $\frac{1}{8}$ in. hole should be opened up, to $\frac{3}{16}$ in. With the larger sized hole it is possible that most of the oil will bypass the valve port, on the bump stroke, thus tending to cause cavitation in chamber "B." In this case the drop in pressure in "B" will cause the upper disc valve beneath the lower spring guide to open, thus admitting oil into chamber "B" from above and keeping it full.

On the rebound stroke the oil in the damper chamber "B" is forced through the annular space between the spring stud and the bore of the main tube valve port. During this stroke pressure in chamber "B" closes the two disc valves at the upper and lower ends of the chamber so that the only path through which the oil can escape is the annular space between the spring stud and the port. Damping on the rebound stroke is therefore heavier than on the bump stroke. At the extreme end of either bump or rebound stroke a small taper portion on the spring stud enters the bore of the valve port, thus restricting the annular space and increasing the amount of damping. At the extreme end of the bump stroke the larger diameter taper on the oil control collar enters the main counterbore of the valve port thus forming a hydraulic cushion to prevent metal to metal contact.

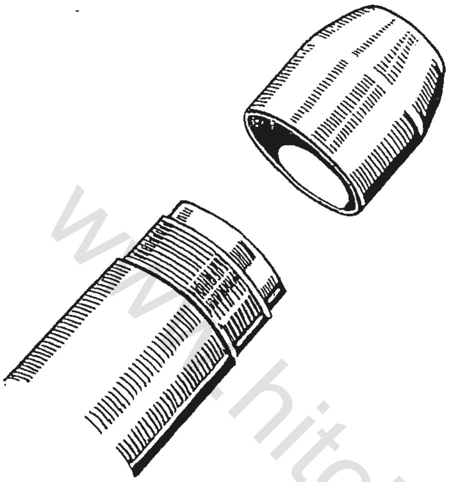
108. Dismantling the Fork to Replace Spring, Oil Seal or Bearing Bushes

Place the machine on the centre stand, disconnect the front brake control and remove the front wheel and mudguard complete with stays. Unscrew the bottom spring stud nut which will allow oil to run out of the fork down to the level

MAIN TUBE SPANNER
Fig. 32

of the cross hole in the spring stud. Now knock the spring stud upwards into the fork with a soft mallet, thus allowing the remainder of the oil to escape. Pull the fork bottom tube down as far as possible, thus exposing the oil seal housing. Unscrew this housing either by means of a spanner on the flats with which it is provided or by using the gland nut hand grips (E.5417). The bottom tube can now be withdrawn completely from the main tube, leaving the bottom tube bush, oil seal housing and oil seal in position on the main tube.

Now unscrew the main tube valve port using "C" spanner (E5418). The spring stud and spring can now be withdrawn from the lower end of the main tube.



MAIN TUBE SEAL GUIDE
Fig. 33

The steel main tube bush (38156) can now be tapped off the lower end of the tube, if necessary using the bottom tube bush for this purpose. Before doing this, however, it is advisable to mark the position of the bush with a pencil line so as to ensure reassembling it in the same position on the main tube. The reason for this is that these bushes are finish ground to size after fitting on to the tubes so as to ensure concentricity. After removal of the main tube bush the bottom tube bush, oil seal housing and oil seal can be removed.

In case of difficulty in removing the main tube bush it is possible to withdraw the oil seal housing after loosening the crown clip bolt, removing the plug screw and unscrewing the main tube from the fork head by means of a hexagon bar ·500 in. across flats (Unbrako wrench W.11) or the special tool shown in Fig. 32.

109. Springs

The following table gives particulars of the springs which are available together with the gauge of main tube in which they can be fitted.

Part No.	Rate lb./in.	Total Coils	Wire Gauge	Outside Diam. ins.	Free Length ins.	Main Tube Gauge
40857	37/40	69	6	$1\frac{3}{16}$	$20\frac{3}{4}$	14
41569	40/50	68	$5\frac{1}{2}$	$1\frac{3}{16}$	$21\frac{1}{2}$	14
48228	30/35	$76\frac{1}{2}$	6	$1\frac{1}{8}$	$22\frac{1}{4}$	12
41952	45/50	67	$5\frac{1}{2}$	$1\frac{1}{8}$	$21\frac{1}{4}$	12
46615	30	89	7	$\frac{31}{32}$	21	8

Note that there is no spring suitable for heavy sidecar work that will fit in the 8 g. main tubes. For this class of work 12 gauge tubes W42695 with springs W41952 or 14 gauge tubes with springs W41569 should be used. These tubes, being of chrome molybdenum steel have ample strength for all ordinary road work with the heaviest sidecar.

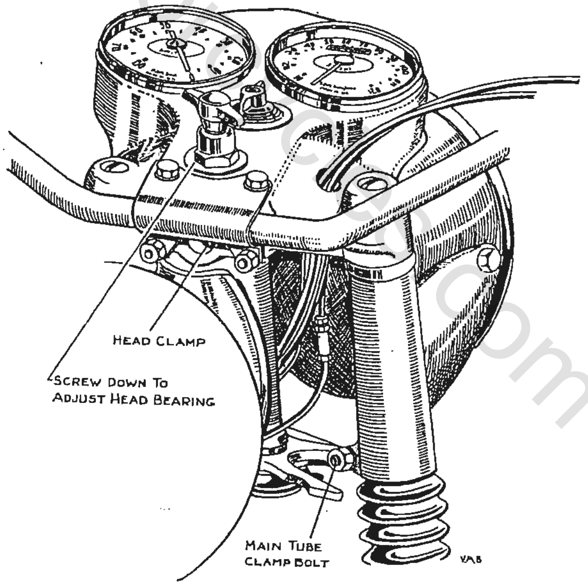
110. Reassembly of Parts

When refitting the oil seal, or fitting a new one, great care must be exercised not to damage the synthetic rubber lip which forms the actual seal. If the seal has been removed from the upper end of the main tube and is refitted from this end a special nose piece (Fig. 33) must be fitted over the end of the tube to prevent the thread from damaging the oil seal.

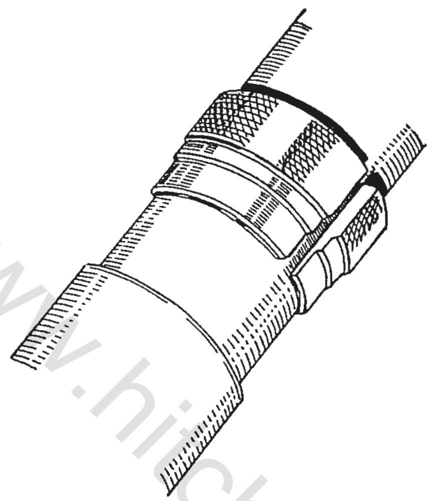
The spring stud is a tight fit in the hole at the lower end of the bottom tube. Once the stud has been entered in the hole push the bottom tube up sharply against the spring until two or three threads on the stud project beneath the end of the bottom tube. Now fit the nut and washer and pull the stud into position by tightening the nut. If necessary fit the nut first without the washer until sufficient thread is projecting to enable the washer to be fitted.

111. Steering Head Races

The steering head bearing consists of two deep groove thrust races each containing nineteen



SHOWING THE POSITIONS OF THE CLAMP BOLTS SECURING THE STEERING STEM AND FORK TUBES
Fig. 34



OUTER COVER CENTRALISING BUSHES

Fig. 35

¼ in. diameter balls. The bearing is adjusted by tightening the steering stem locknut after loosening the ball head clip screw and both the fork crown clamp bolts (Fig. 34.) The head should be adjusted so that, when the front wheel is lifted clear of the ground, a light tap on the handlebars will cause the steering to swing to full lock in either direction, while at the same time there should be only the slightest trace of play in the bearings. When testing for freedom of movement the steering damper should be disconnected by unscrewing the anchor plate pin. Do not forget to tighten the ball head clip screw and fork crown clamp bolts. Before tightening the latter make sure that the cover tubes (if fitted) are located centrally round the main tubes so that the bottom tube does not rub inside the cover tube. A pair of split bushes (Fig. 35) is useful to ensure centralisation of the cover tubes.

112. Removal of Complete Fork

The fork complete with front wheel and mudguard can be removed from the machine if necessary by adopting the following procedure.

Disconnect all electrical leads to the lighting switch and ammeter. Switches on all models are a push fit in a rubber bush in the casquette or fascia panel with the exception of early U.S.A. models which had the switch in the headlamp. The ammeter is a push fit in a rubber bush in the casquette head. On other models it is mounted in the headlamp, which can be removed complete. Recent models have switches containing a multi-point plug and socket connector, which can be pulled apart after removing the entire switch from the casquette or fascia panel. U.S.A. models have a plug and socket connector in the cable harness leading to the lamp (see Figs. 24a and 24b. In the case of early U.K. models with no plug and socket connector all leads should be disconnected at their lower ends rather than at the switch.

Disconnect the lighting leads and driving flexes from the speedometer and revolution counter (when fitted). Unscrew the steering damper knob and rod after removal of the split pin through the lower end of the rod. Undo the steering damper anchor plate pin so as to disconnect the damper from the frame of the machine.

Remove the two plug screws and loosen the steering head clip bolt and the two fork crown clamp bolts.

Now unscrew the fork main tubes from the fork head and the steering stem locknut from the top of the steering stem, turning each tube and the nut a turn or two at a time. When the nut has been removed from the steering stem and the main tubes have been completely unscrewed from the fork head the complete fork and wheel with steering stem can be lifted out of the head lug of the frame.

113. Lubrication

The lubrication of the fork bearings is effected by the oil which forms the hydraulic damping medium. All that is necessary is to keep sufficient oil in the fork to ensure that the top end of the bottom spring stud is never uncovered even in the full rebound position. The level of oil in the fork can be gauged by removing the top plug screw and inserting a long rod about ⅜ in. diameter. If slightly tilted this will ledge against the nut at the upper end of the bottom spring stud and indicate the level of oil above the stud. If the fork is empty to start with the quantity required is approximately 7½ fluid ounces in each leg. Recommended grades of oil are Shell X-100 20/20w, Castrolite, Essolube 20w, Mobiloil Arctic, Energol, S.A.E. 20w and Havoline 20/20w.

Front Wheel

With Single 7 in. Brake (U.S.A.) or Dual 6 in. Brake (U.K.)

114. Removal from Fork

To remove the front wheel from the fork place the machine on the centre stand with sufficient packing (about 2 in.) beneath each side of the stand to lift the wheel clear off the ground when tilted back on to the rear wheel. Slacken the brake cable adjustment(s) and disconnect the cable(s) from the handlebar lever and from the operating cam lever(s) on the hub. Unscrew the four nuts securing the fork leg caps and allow the wheel to drop forward out of the front fork. Make sure that the machine stands securely on the rear wheel and centre stand—if necessary place a weight on the saddle or a strut beneath the fork to ensure this.

115. Removal of Brake Cover Plate Assembly

Lock the brake "on" by pressure on the operating lever and unscrew the cover plate nut. The cover plate assembly can then be withdrawn from the brake drum.

116. Replacing Brake Linings

Brake linings are supplied either in pairs ready drilled complete with rivets or ready fitted to service replacement brake shoes.

Part Nos. are:—

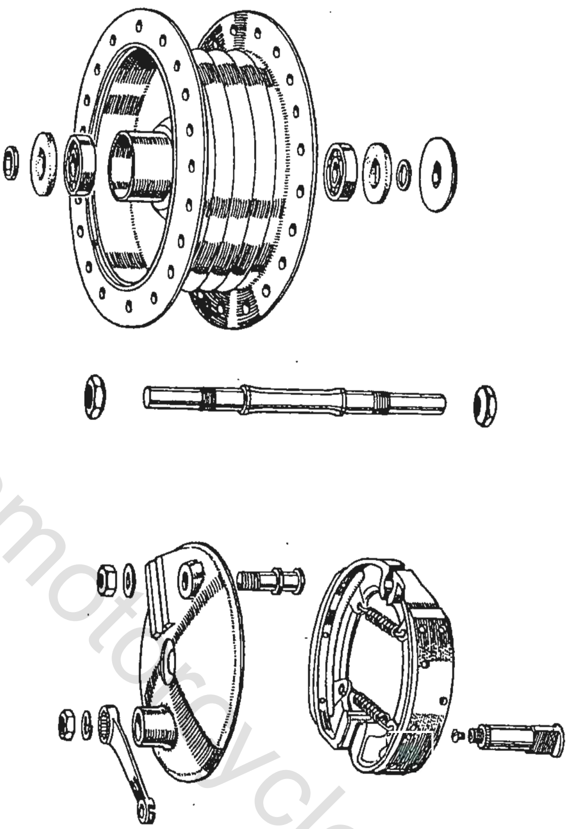
Front, 7 in. × 1½ in.—43263 (lined shoe).
(U.S.A.) —43264A/BX (lining and rivets).
Front, 6 in. × 1 in. —41342A (lined shoe).
(U.K.) —41284A/BX (lining and rivets).

When riveting linings to shoes, secure the two centre rivets first then work towards each end in turn. This will ensure that the lining lies flat against the shoe. Standard linings are Ferodo AM2, which are drilled to receive cheese-headed rivets.

117. Removal of Brake Operating Cam(s)

To remove the operating cam unscrew the nut, 10314, which secures the operating lever to the splines on the cam. A sharp tap on the end of the cam spindle will now free the lever, after which the cam can be withdrawn from its housing.

To remove pivot pin, unscrew nut and tap out pin.

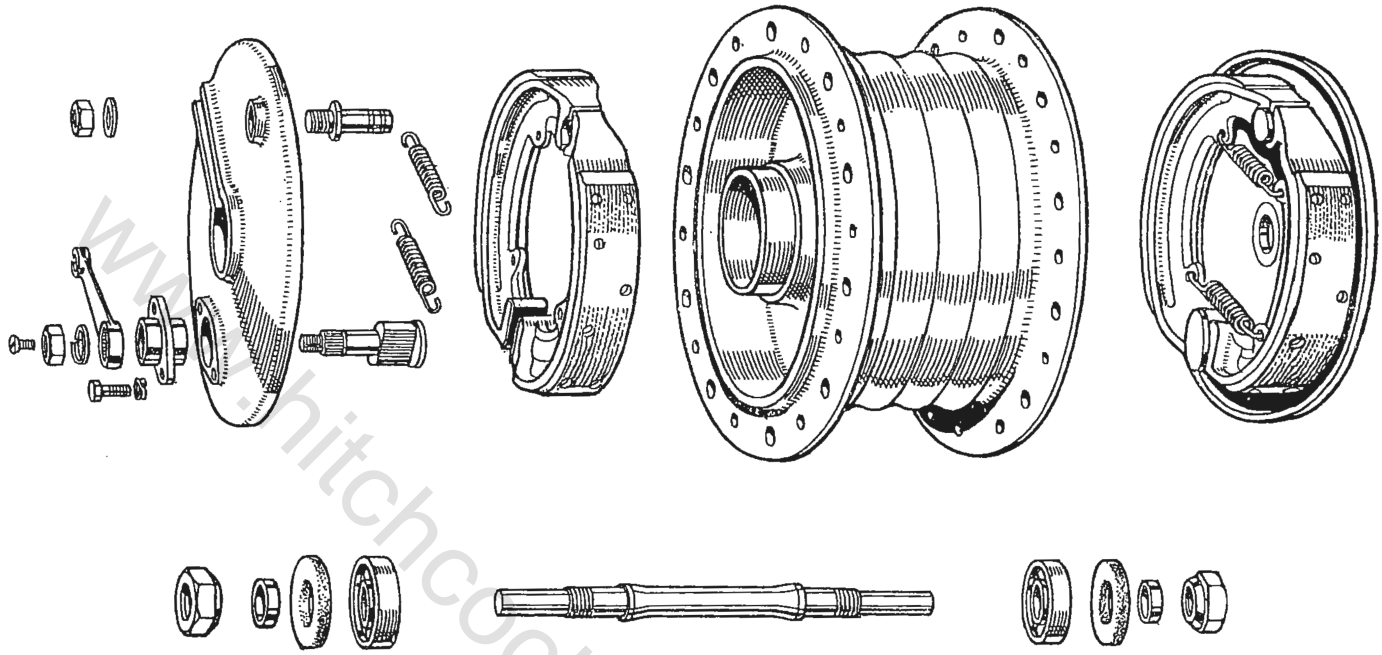


7 in. FRONT HUB AND BRAKE

Fig. 36

118. Removal of Hub Spindle and Bearings

To remove the hub spindle and bearings, having first removed the brake cover plate(s), unscrew the retaining nut and remove the dust excluder from the non-brake side of the hub. Now remove the felt washers and distance washers and hit one end of the spindle with a copper hammer or mallet, thus driving it out of the hub, bringing one bearing with it and leaving the other in position in the hub. Drive the bearing off the spindle and insert the latter once more in the hub at the end from which it was removed. Now drive the spindle through the hub the other way, when it will bring out the remaining bearing.



DUAL 6 in. FRONT HUB AND BRAKE
Fig. 36a

119. Hub Bearings

These are deep-groove single-row journal ball bearings, $\frac{5}{8}$ in. i/d by $1\frac{9}{16}$ in. o/d by $\frac{7}{16}$ in. wide. The Skefko Part No. is RLS5. Equivalent bearings of other makes are Hoffmann LS7, Ransome and Marles LJ $\frac{5}{8}$ in., Fafnir LS7. Bearings with slack fitting internal clearances marked "C3," "000" or "***" should be specified.

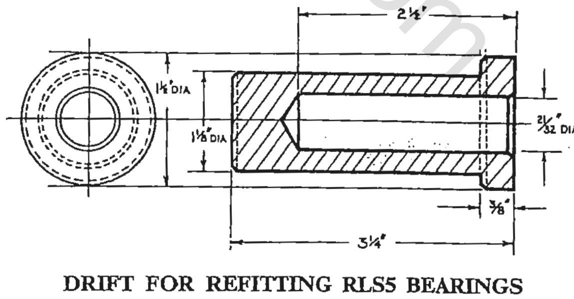
120. Fitting Limits for Bearings

The fit of the bearings in the hub barrel is important. The bearings are locked on the spindle between shoulders and the distance pieces, 30538, which in turn are held up by the nuts on the spindle. In order to prevent endways pre-loading of the bearings it is essential that there is a small clearance between the inner edge of the outer race of the bearing and the back of the recess in either end of the barrel. To prevent any possibility of sideways movement of the hub barrel on the bearings it is, therefore, necessary for the bearings to be a tight fit in the barrel, but this fit must not be so tight as to close down the outer race of the bearing and thus overload the balls. The following are the manufacturing tolerances which control the fit of the bearings. The figures for the bearings themselves are for SKF bearings, but other manufacturers' tolerances are similar.

Bearing o/d, 1·5622/1·5617 in.
Housing bore, 1·5620/1·5616 in.
Bearing bore, ·6252/·6248 in.
Shaft diameter, ·6252/·6248 in.

121. Refitting Ball Bearings

To refit the bearings in the hub, two hollow drifts are required, as shown in Fig. 37. One bearing is first fitted to one end of the spindle by means of the hollow drift ; the spindle and bearing are then entered into one end of the hub barrel, which is then supported on one of the hollow drifts. The other bearing is then threaded over the upper end of the spindle and driven home by means of the second hollow drift either under a



DRIFT FOR REFITTING RLS5 BEARINGS
Fig. 37

press, or by means of a hammer, which will thus drive both bearings into position simultaneously. In order to make quite sure that there is clearance between the inner faces of the outer bearing races and the bottom of the recesses, fit the distance washers, cover plate, dust excluder and the nuts on the spindle. Tightening the nuts should not have any effect on the ease with which the spindle can be turned. If tightening the nuts makes the spindle hard to turn this may be taken as proof that the bearings are bottoming in the recesses in the hub barrel before they are solid against the shoulders on the spindle. In this case, the bearing should be removed and a thin packing shim fitted between the inner race and the shoulder on the spindle.

122. Reassembly of Brake Shoes and Operating Cam into Cover Plate

No difficulty should be experienced in carrying out these operations. Put a smear of grease on the pivot pin and on the operating face of the cam ; also on to the cylindrical bearing surface of the operating cam. Fit the operating lever on its splines in a position to suit the extent of wear on the linings and secure with the nut and washer. Note that the position of the operating lever may have to be corrected when adjusting the brake after refitting the wheel. The range of adjustment can be extended by moving this lever on to a different spline. Limit of wear is reached when the cam is turned through nearly 90° with the brake hard on, so that there is a danger that the springs cannot return the brake to the off position.

Note that the cams in the 6 in. dual brakes are fitted into housings bolted to the cover plates. The bolt holes in the flanges on the housings are slotted and double coil spring washers are fitted beneath the heads of the securing bolts. The housings are intended to be *free to be moved by hand* in the direction of the slots though not free enough to move by their own weight or under the influence of road shocks. The bolts are secured by locknuts inside the cover plate which should be centre punched as an additional precaution.

The use of floating cam housings makes the brake more powerful since the cam is free to move to follow up wear on the more efficient leading shoes, i.e., those towards the rear of the machine. At the same time the wear on the leading shoe linings will be greater than on the trailing shoes and in time the limit of float of the cam housings will be reached, after which the brake will continue to act as a fixed cam brake with some loss of efficiency. This can be restored by removing the shoes and refitting them in the opposite positions.

123. Final Assembly of Hub before Replacing Wheel

Before replacing the felt washers which form the grease seals, pack all bearings with grease. If new felt seals are fitted soak these in engine oil.

Recommended greases are:—Shell Retinax A, Castrolease LM, Esso Multipurpose Grease H, B.P. Energrease L2, Mobilgrease MP and Marfak Multipurpose Grease 2. These are all lithium soap greases and should not be mixed with lime, aluminium or soda soap greases.

Make sure that the inside of the brake drum is free from oil, grease, dust or damp. Replace the felt washers, distance collars and brake cover plate(s) and securely tighten the spindle nuts.

124. Wheel Rim

The wheel rim is WM2—19 in., plunged and pierced with forty holes for spoke nipples. The spoke holes are symmetrical, i.e., the rim can be assembled to the hub either way round. The rim diameter after building is 19·06 in., the tolerances on the circumference of the rim shoulders where the tyre fits being 59·925/59·865 in. The standard steel measuring tape for checking rims is $\frac{1}{4}$ in. wide, ·011 in. thick, and its length is 59·985/59·925 in.

125. Spokes

The spokes are of the single-butted type, 8-10 gauge, with 90° countersunk heads, and rolled threads ·144 in. diameter, 40 t.p.i., thread form British Standard Cycle. Spokes for use with 6 in. brakes are $6\frac{11}{16}$ in. long, Part No. 29205. Spokes for use with 7 in. brakes are $6\frac{5}{16}$ in. long. Part No. 44476. All spokes initially are bent to approximately 110° at the head end. Spokes threaded from the outside of the spoke flanges are hit with a hide hammer after lacing, but before truing the wheel, to make them fit close to the flange. This increases the bend to approximately 80°.

126. Wheel Building and Truing

The spokes are laced one over two, and the wheel rim must be built central in relation to the faces of the nuts on the spindle. The rim should be trued as accurately as possible, the maximum permissible run-out both sideways and radially being plus or minus $\frac{1}{32}$ in.

127. Tyre

The standard tyre is Dunlop 3·25—19 in., Ribbed. For the U.S.A. a 3·50—19 in. tyre is fitted. When removing the tyre always start close to the valve and see that the edge of the cover at the other side of the wheel is pushed down into the well of the rim.

When replacing the tyre fit the part by the valve last, also with the edge of the cover at the other side of the wheel pushed down into the well. Slightly inflate the tube and, if available, paint the rim and tyre with soapy water, or water containing a soapless detergent to assist the tyre in slipping over the edge of the rim.

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 supplied in the tool-kit. The use of long levers and/or excessive force is liable to damage the walls of the tyre. After inflation, make sure that the tyre is fitting evenly all the way round the rim. A line moulded on the wall of the tyre indicates whether or not the tyre is correctly fitted. If the tyre has a white mark indicating a balance point, this should be fitted near the valve.

128. Tyre Pressure

The recommended pressure for the front tyre for solo use is 18 lb. per sq. in. This is the same for both 3·25 in. and 3·50 in. section tyres. If a sidecar is fitted determine the load on the tyre and refer to the table in Subsection 148.

129. Lubrication

Grease the bearings by packing them with grease after removal of the brake cover plates, etc. as described in Subsection 115.

Note that the brake cam is drilled for a grease passage but the end of this is stopped up with a countersunk screw instead of being fitted with a grease nipple. This is done to prevent excessive greasing by over-enthusiastic owners. If the cam is smeared with grease on assembly it should require no further attention but, in case of necessity, it is possible to remove the screw, fit a grease nipple in its place and grease the cam by this means.

Rear Wheel

130. Description

This wheel is of the "detachable" type, which enables the main portion of the wheel to be removed from the machine without disturbing the chain or brake. The wheel incorporates the well-known Enfield cush drive and also a 7 in. internal expanding brake.

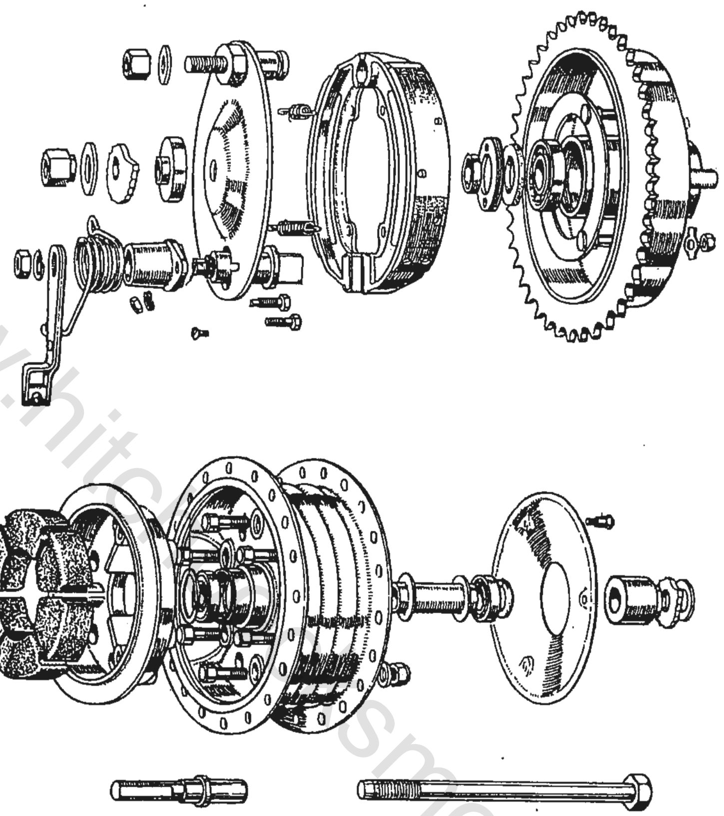
131. Removal and Replacement of Main Portion of Wheel for Tyre Repairs, etc.

Place the machine on the centre stand, if necessary putting packing pieces beneath the legs of the stand to lift the wheel clear of the ground. Unscrew the loose section of the spindle and withdraw this, together with the chain adjuster cam, preferably marking it to ensure that it is replaced in the same position. Now slide the distance collar out of the fork end and lift away the speedometer drive gearbox, which can be left attached to the driving cable. The spacing collar and the felt washer behind it may now be removed to prevent risk of them falling out when manipulating the tyre. If, however, these are too tight a fit in the hub to come out easily they may be left in place. The main body of the wheel can now be pulled across to the right-hand side of the machine, thus disengaging the six driving pins from the cush drive shell and enabling the wheel to be removed from the machine. (See Fig. 39.)

When replacing the main portion of the wheel, reverse the foregoing procedure. The cush drive shell can be prevented from rotating when turning the wheel to engage the six driving pins, if the machine is placed in gear or the rear brake is operated, taking care, when replacing the speedometer drive gearbox, that the driving dogs inside the gearbox engage with the slots in the end of the hub barrel. Before tightening the centre spindle make sure that the speedometer drive gearbox is correctly positioned so that there is no sharp bend in the driving cable.

132. Removal and Replacement of Complete Wheel for Access to Brake

Place the machine on the centre stand and remove the rear mudguard unit. Disconnect the rear driving chain at the spring link and remove the chain from the rear wheel sprocket. Unscrew the rear brake rod adjusting nut completely and depress the brake pedal so as to disengage the rod from the trunnion in the brake operating lever. Unscrew the brake cover plate anchor nut and remove this together with the washer behind it. Unscrew the loose section of the spindle two or three turns and the spindle nut by a similar amount. Mark the chain adjuster cams to ensure



EXPLODED VIEW OF QUICKLY DETACHABLE REAR HUB

Fig. 38

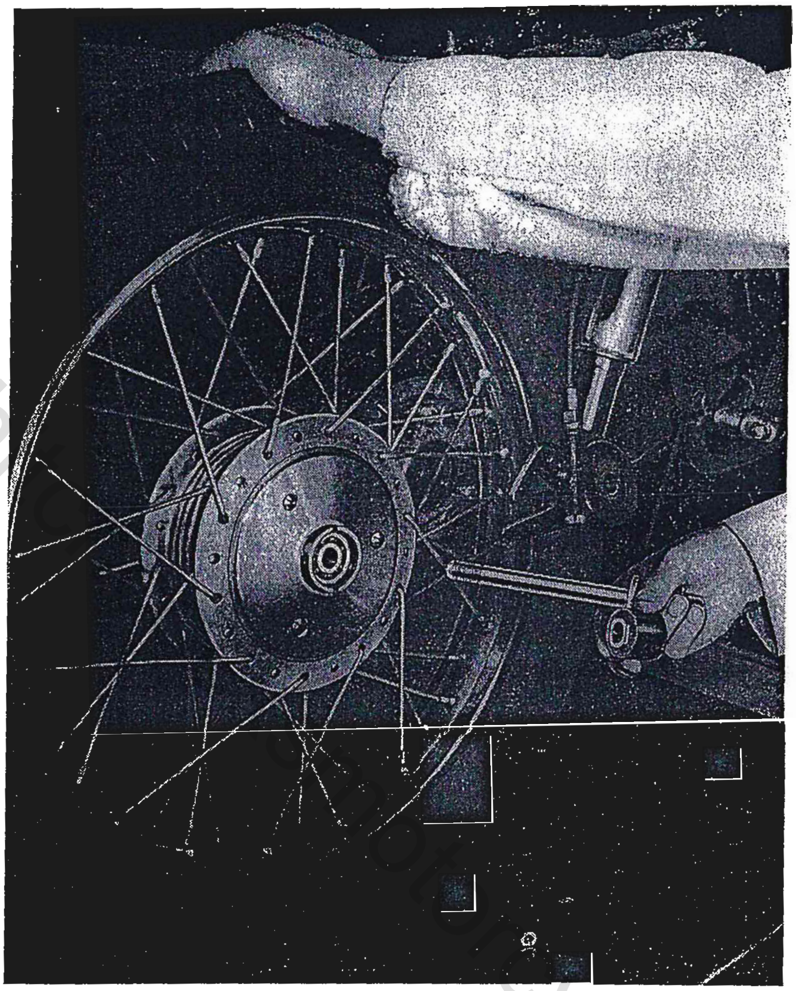
replacing in the same position.* Disconnect the speedometer driving cable and slide the wheel out of the fork ends, tilting it so as to disengage the end of the brake shoe pivot pin from the slot in the fork end.

When replacing the wheel make sure that the dogs on the gear in the speedometer drive gearbox are engaged with the slots in the end of the hub barrel. Make sure also that the speedometer drive gearbox is correctly positioned so that there is no sudden bend in the driving cable. When replacing the connecting link in the driving chain, make sure that the closed end of the spring link points in the direction of travel of the chain. Replace the chain adjuster cams in their original positions or, if necessary, turn each of them the same number of notches to tension the chain and maintain correct wheel alignment. The chain should have ½ in. up and down minimum movement when the rear suspension is fully extended as it will be tighter in the normal laden position. Do not forget to refit the brake rod and adjust the brake so that the wheel turns freely when the brake is off, while at the same time only a small travel of the brake pedal is necessary to put the brake on.

* Note that the wheel is not necessarily correctly lined up when the same notch position is used on both adjuster cams. Once the position of the cams which gives correct alignment has been found this alignment will, however, be maintained if both cams are moved the same number of notches. See also Subsection 104.

133. Removal of Brake Shoes for Replacement, etc.

Remove the complete wheel as described above, then remove the spindle nut, chain adjuster and the distance collar, thus permitting the complete brake cover plate assembly, with operating cam, pivot pin, shoes and return springs, to be lifted off the hub spindle. The brake shoes can then be removed after detaching the return springs.



REMOVAL OF WHEEL (OFFSIDE VIEW)
Fig. 39

Brake linings are supplied either in pairs ready drilled complete with rivets (Part No. 41285A/BX) or ready fitted to service replacement brake shoes (Part No. 41343A). When riveting linings to shoes, secure the two centre rivets first so as to ensure that the lining lies flat against the shoe. Standard linings are Ferodo AM2, which are drilled to receive cheese-headed rivets.

134. Removal of Brake Operating Cam

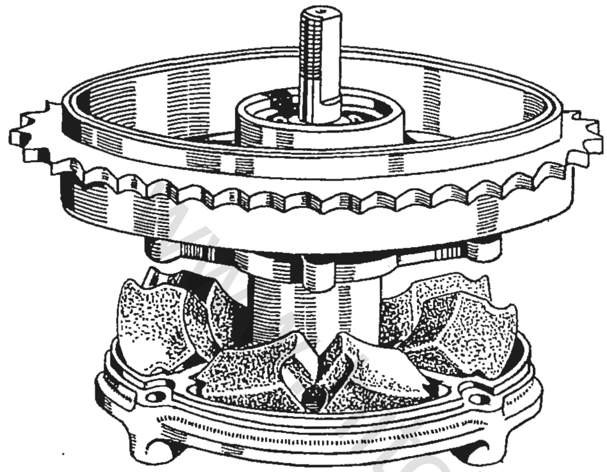
To remove the operating cam unscrew the nut which secures the operating lever to the splines on the cam. A sharp tap on the end of the cam spindle will now free the lever, after which the cam can be withdrawn from its housing.

Do not try to remove the brake shoe pivot pin as this is cast into the cover plate.

135. Cush Drive

The sprocket/brake drum is free to rotate on the hub barrel. Three radial vanes are formed on the back of the brake drum and three similar vanes are formed on the cush drive shell. Six rubber blocks are fitted between the vanes on the brake drum and those on the cush drive shell, thus permitting only a small amount of angular movement of the sprocket/brake drum relative to the hub barrel and transmitting both driving and braking torques and smoothing out harshness and irregularity in the former.

If the cush drive rubbers become worn so that the amount of free movement measured at the tyre exceeds ½ in. to 1 in., the rubbers should be replaced. To obtain access to them remove the complete wheel as described above ; then unscrew



REASSEMBLY OF CUSH DRIVE
Fig. 40

the loose section of the spindle completely. The main portion of the wheel can then be lifted away from the assembly consisting of the fixed portion of the spindle, sprocket/brake drum complete with brake and the cush drive shell. Now remove the brake cover plate complete with brake shoes as described above, and unscrew the three nuts at the back of the cush drive shell after bending back the locking washers. The three studs are brazed to the lockring and should be driven out of the cush drive shell, each a little at a time to avoid distorting the lockring or bending the studs. The sprocket/brake drum can now be separated from the cush drive shell and the six cush drive rubbers lifted out.

When reassembling the cush drive the entry of the vanes between the rubbers will be facilitated if the latter are fitted into the driving shell first and then tilted. The rubbers should be liberally smeared with soapsuds to facilitate entry of the vanes. Grease the inner face of the lockring before assembling and tighten the three nuts down solid as there is a shoulder on the stud which prevents tightening of the nuts from locking the operation of the cush drive. Do not forget to bend up the tabs of the three locking washers.

When reassembling the cush drive, coat the inside of the bore of the sprocket/brake drum liberally with grease where it fits over the hub barrel.

136. Removal of Ball Bearings

To remove the ball bearings take the complete wheel out of the machine and separate the main portion of the wheel from the sprocket/brake drum cush drive shell assembly as described above. To remove the bearing from the sprocket/brake drum, first remove the brake cover plate complete with brake shoe assembly ; then remove the distance collar and unscrew the bearing retaining ring with a peg spanner. Now screw the loose section of the spindle into the fixed section and drive out the bearing by hitting the hexagon-headed end of the loose section of the spindle.

To remove the bearings from the loose half of the hub barrel, first lift away the distance collar, speedometer drive gearbox, the spacing collar and the felt washer. Remove the bearing retaining circlip from the driving sprocket end of the barrel. Between the two bearings is a spacer, slotted at one end to enable a drift to be used on the bearing at that end. Remove this bearing first, then enter the loose section of the spindle into the spacer and drive out the remaining bearing by means of a hammer and drift applied to the hexagon-headed end of the spindle.

137. Hub Bearings

These are deep-groove single-row journal ball bearings. The sprocket/brake drum bearing is a Skefko RLS7, $\frac{7}{8}$ in. i/d, by 2 in. o/d, by $\frac{9}{16}$ in. wide. Equivalent bearings of other makes are Hoffmann LS9, Ransome & Marles LJ $\frac{7}{8}$ in., and Fafnir LS9. The two bearings in the hub barrel are Skefko RLS5, $\frac{5}{8}$ in. i/d, by $1\frac{9}{16}$ in. o/d, by $\frac{7}{16}$ in. wide. Equivalent bearings of other makes are Hoffmann LS7, Ransome & Marles LJ $\frac{5}{8}$ in. and Fafnir LS7. Bearings with slack fitting internal clearances marked "C3," "000" or "***" should be specified.

138. Fitting Limits for Bearings

The fit of the bearings in the hub barrel and sprocket/brake drum is important. The following are the manufacturing tolerances which control this and also the fits on the fixed and loose portions of the wheel spindle.

RLS5 Bearing o/d	...	1·5622/1·5617 in.
Hub Barrel bore	...	1·5620/1·5616 in.
RLS5 Bearing bore	...	·6252/·6248 in.
Loose Spindle dia.	...	·624/·622 in.
RLS7 Bearing o/d	...	1·9995/1·9990 in.
Sprocket bore ...	...	1·9994/1·9990 in.
RLS7 Bearing bore	...	·8752/·8748 in.
Fixed Spindle dia.	...	·8749/·8745 in.

All inner races are locked in position when the spindle nuts are tightened. The outer race of the RLS7 bearing is located by a screwed retaining ring and one of the RLS5 bearings is located by a circlip. Axial movement of the sprocket and/or barrel is therefore not possible. We recommend "Loctite" Sealant Grade C to secure any outer races which appear to have been rotating.

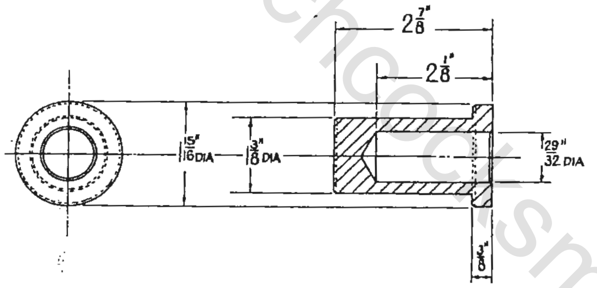
139. Removal of Hub Driving Pins

To remove the six driving pins from the aluminium full-width hub, first remove the hub cap after unscrewing the three screws attaching it to the hub. Unscrew the six Simmonds nuts and drive out the pins.

140. Refitting Ball Bearings

To refit the sprocket/brake drum bearing, use a hollow drift as shown in Fig. 41. The bearing is first fitted to the fixed section of the spindle ; the spindle and bearing are then entered into the sprocket/brake drum and driven home, preferably under a press or using light hammer blows.

The two bearings in the hub barrel are pressed in, using the drift part of E.4823. First assemble



DRIFT FOR REFITTING RLS7 BEARING
Fig. 41

the bearing into the circlip grooved end of the barrel and fit the circlip. Replace the bearing spacer, the slot in the spacer can be at either end of the hub, and assemble the second bearing, supporting the hub on the inner race of the other bearing. If the drift part of E.4823 is not available it is essential that the last bearing is assembled by applying pressure to both inner and outer races simultaneously to avoid pre-loading the two hub barrel bearings.

141. Reassembly of Brake Shoes and Operating Cam into Cover Plate

No difficulty should be experienced in carrying out these operations. Put a smear of grease on the pivot pin and on the operating face of the cam ; also on to the cylindrical bearing surface of the operating cam if this has been removed. Fit the operating lever and trunnion on its splines in a position to suit the extent of wear on the linings and secure with the nut. The range of adjustment can be extended by moving the lever on to a different spline.

142. Centring Cam Housing

Note that the bolt holes in the cam housing are slotted, thus enabling the brake shoe assembly to be centred in the drum. It is not intended that on rear brakes the cam housing should be left free to float but the shoes should be centred by leaving the screws just short of dead tight. The brake cover plate assembly with the shoes should then be fitted over the spindle into the brake drum and the brake applied as hard as possible by means of the operating lever. This will centre the shoes in the drum. The screws should then be tightened dead tight and secured with the locknuts. If the shoes are not correctly centred, the brake will be either ineffective or too fierce, depending on whether the trailing or leading shoe first makes contact with the drum. With the brake assembly correctly centred and the screws securing the cam housing correctly tightened wear on both linings should be approximately equal.

143. Final Reassembly of Hub Before Replacing Wheel

Before replacing the felt washers which form the grease seals, pack all bearings with grease. If new felt seals are fitted, soak these in engine oil.

Recommended greases are:—Shell Retinax A, Castrolease LM, Esso Multipurpose Grease H, B.P. Energrease L2, Mobilgrease MP and Marfak Multipurpose Grease 2. These are all lithium soap greases and should not be mixed with lime, aluminium or soda soap greases.

Make sure that the inside of the brake drum is free from oil, grease, dust or damp. Replace the felt washers, distance collars and brake cover plate and securely tighten the spindle nuts.

144. Wheel Rims

Machines for the U.K. are fitted with a WM2-19 in. rim, those for the U.S.A. with a WM3-18 in. rim. In both types the spoke holes are symmetrical, i.e., the rim can be assembled to the hub either way round. Rim diameters after building are 19·06 and 18·06 in. respectively. Tolerances on the circumference of the rim shoulders where the tyre fits are 59·925/59·865 in. for the 19 in. rim and 56·783/56·723 in. for the 18 in. rim. The standard steel measuring tape for checking rims is ¼ in. wide, ·011 in. thick, and its length is 59·985/59·925 in. for the 19 in. rim and 56·843/56·783 in. for the 18 in.

145. Spokes

The spokes are of the single-butted type, 8-10 gauge, with 90° countersunk heads and rolled threads, ·144 in. diameter, 40 t.p.i., thread form British Standard Cycle. Spokes for use with

19 in. rims are $6\frac{11}{16}$ in. long, Part No. 29205. Spokes for use with 18 in. rims are $6\frac{3}{16}$ in. long, Part No. 40636. All spokes initially are bent to approximately 110° at the head end. Spokes threaded from the outside of the spoke flanges are hit with a hide hammer after lacing, but before truing the wheel to make them fit close to the flange. This increases the bend to approximately 80°.

146. Wheel Building and Truing

The spokes are laced one over two and the wheel rim must be built central in relation to the outer faces of the distance collars. The rim should be trued as accurately as possible, the maximum permissible run-out both sideways and radially being plus or minus $\frac{1}{32}$ in.

147. Tyre

The standard tyre is Dunlop Gold Seal K70, 3·50×19 in. for the U.K., 4·00×18 in. for the U.S.A.

When removing the tyre always start close to the valve and see that the edge of the cover at the other side of the wheel is pushed down into the well in the rim.

When replacing the tyre fit the part by the valve last, also with the edge of the cover at the other side of the wheel pushed down into the well. Slightly inflate the tube and, if available, paint the rim and tyre with soapy water, or water containing a soapless detergent to assist the tyre in slipping over the edge of the rim.

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 supplied in the tool-kit. The use of long levers and/or excessive force is liable to damage the walls of the tyre. After inflation make sure that the tyre is fitting evenly all the way round the rim. A line moulded on the wall of the tyre indicates whether or not the tyre is correctly fitted. If the tyre has a white mark indicating a balance point, this should be fitted near the valve.

148. Tyre Pressures

With a solo rider of normal weight (150 lbs.) the correct tyre pressure is 20 lb. per sq. in. for 3·50-19 in. tyres and 16 lb. per sq. in. for 4·00-18 in. tyres. The addition of a pillion passenger of about the same weight increases these to 30 lb. per sq. in. and 22 lb. per sq. in. respectively.

With riders of unusual weight, or when carrying heavy luggage or when a sidecar is fitted the load on each tyre should be determined and the pressures increased in accordance with the following table.

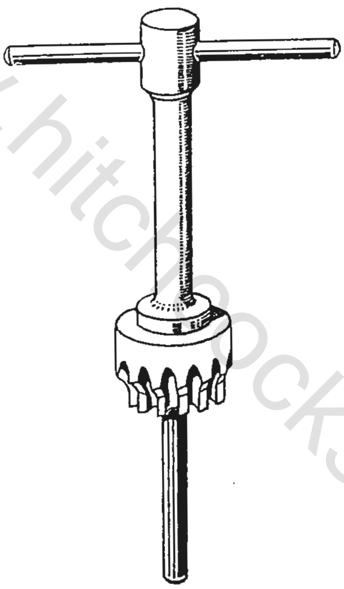
Tyre Section ins.	Maximum Load lb. at Pressure of lbs. per sq. in.					
	16	18	20	24	28	32
3·25	200	230	260	320	380	440
3·50	280	310	335	390	450	500
4·00	360	395	430	500	570	640

149. Lubrication

Grease the bearings by packing them with grease after removal of the brake cover plate and speedometer drive gearbox as described above.

Note that the brake cam is drilled for a grease passage but the end of this is stopped up with a countersunk screw instead of being fitted with a grease nipple. This is done to prevent excessive greasing by over-enthusiastic owners. If the cam is smeared with grease on assembly it should require no further attention but in case of necessity it is possible to remove the screw, fit a grease nipple in its place and grease the cam by this means.

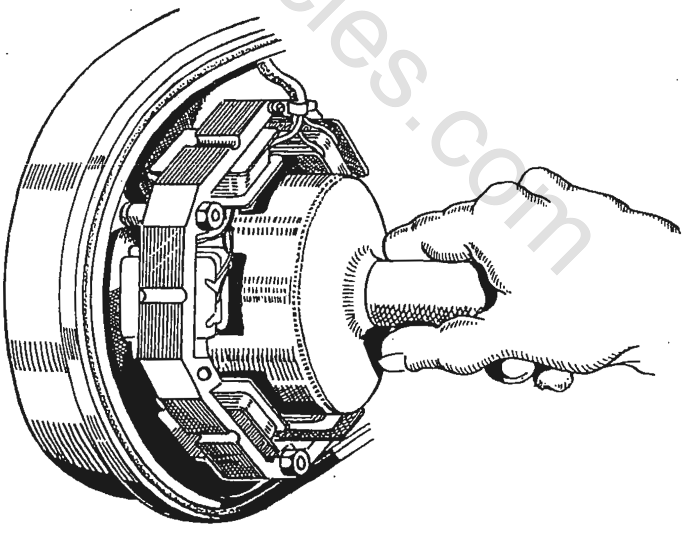
Special Tools

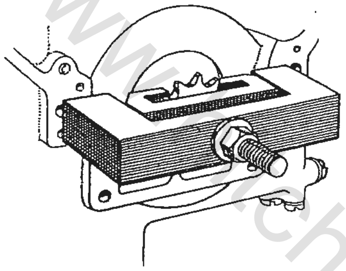


T.2053
INLET VALVE SEAT ARBOR

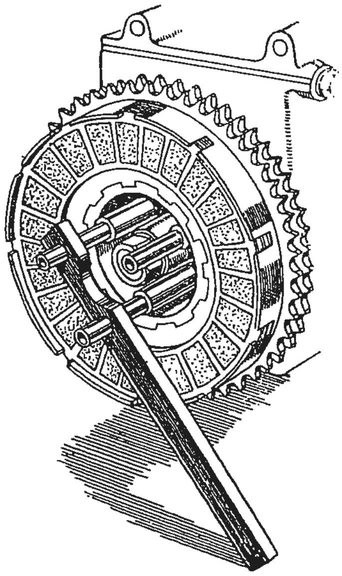
T.2054
INLET VALVE SEAT CUTTER

T.2055/19
ASSEMBLY GAUGE IN USE TO CENTRALISE ROTOR

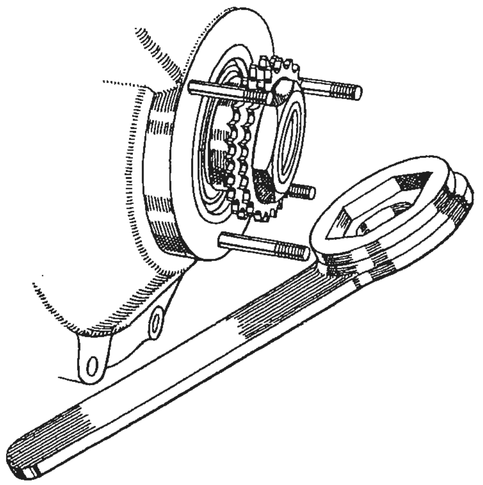




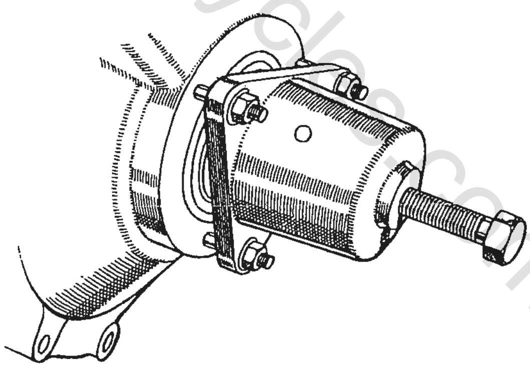
E.4869
TIMING SPROCKET EXTRACTOR



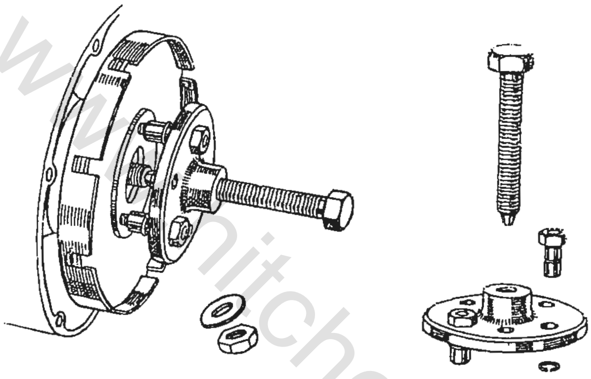
E.4871
CLUTCH HOLDING TOOL



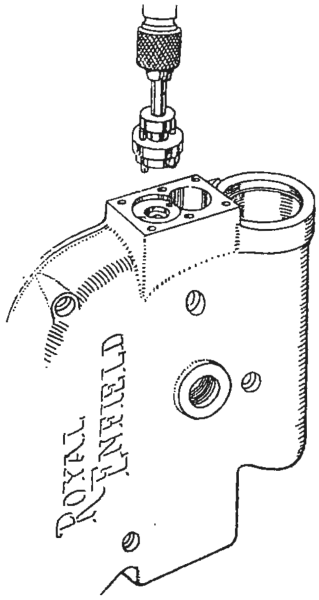
E.4877
ENGINE SPROCKET NUT SPANNER



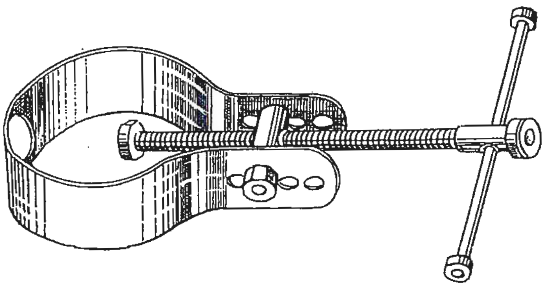
E.5121
CRANKSHAFT EXTRACTOR



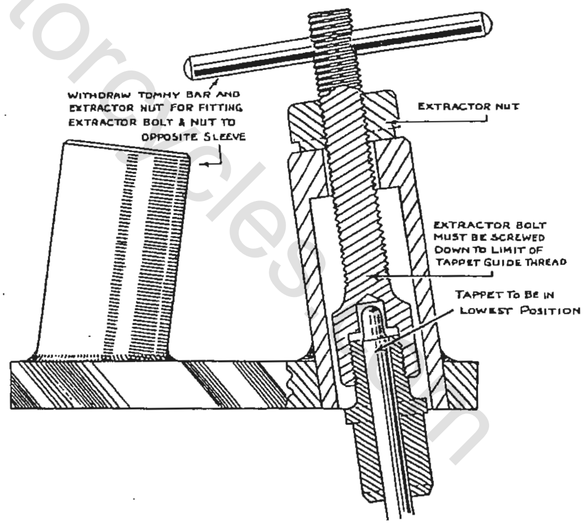
E.5414
CLUTCH HUB EXTRACTOR



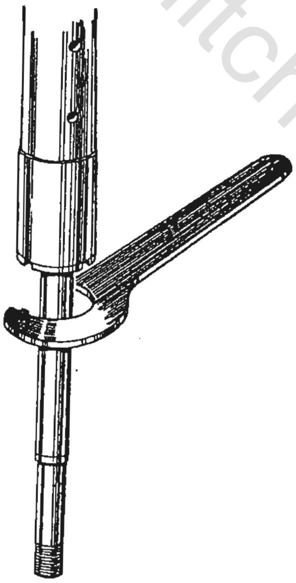
E.5425
PUMP DISC LAPPING TOOL



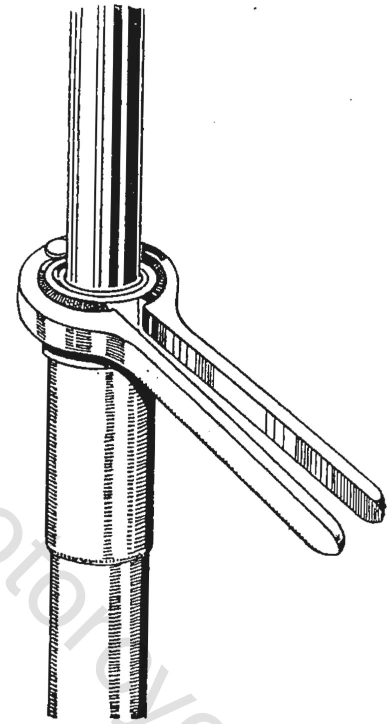
E.5477/T
GUDGEON PIN EXTRACTOR



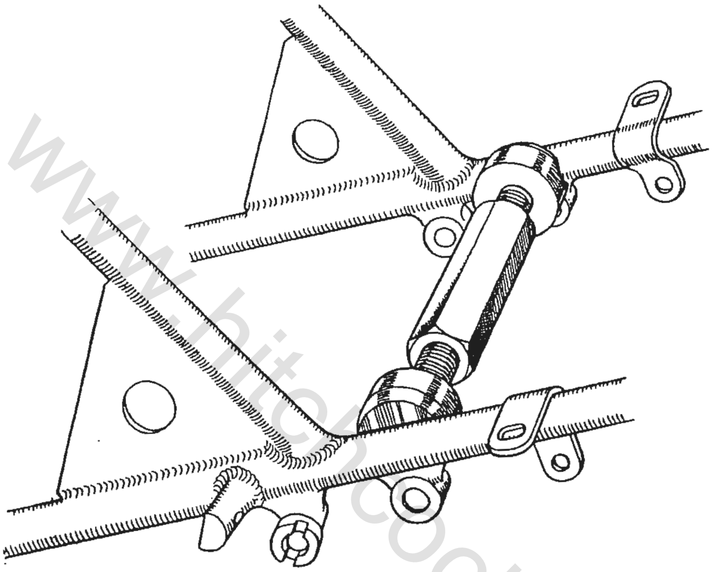
E.5790
TAPPET GUIDE EXTRACTOR



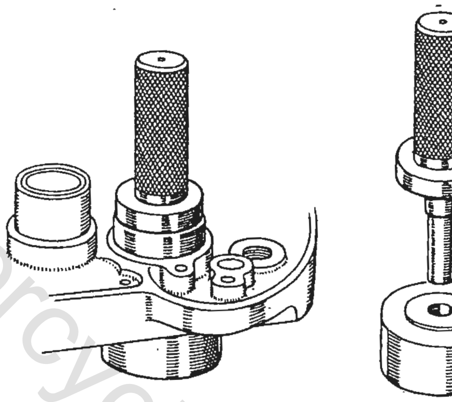
E.5418
VALVE PORT "C" SPANNER



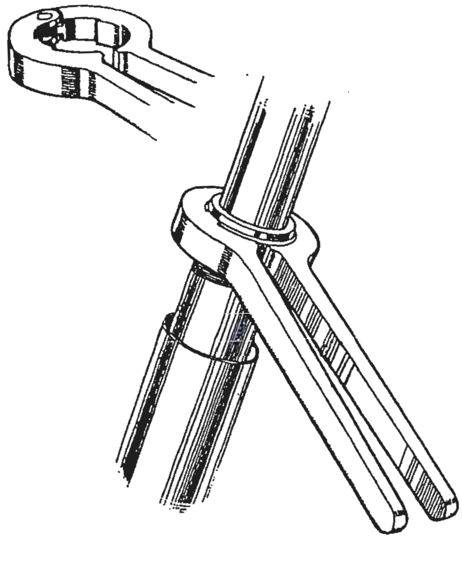
E.4912
OUTER TUBE HAND GRIPS



E.5431
FRAME EXPANDER



E.4823
GEARBOX COVER BALL BEARING
ASSEMBLY TOOL



E.5417
GLAND NUT HAND GRIPS