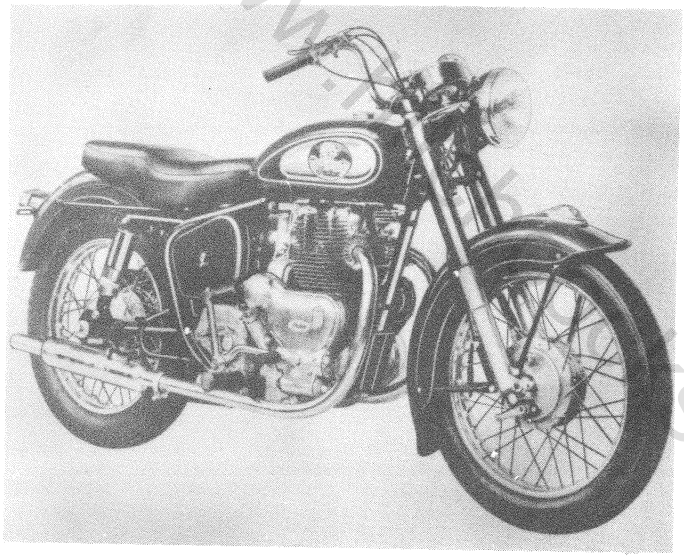
REPAIR and OVERHAUL

Indian



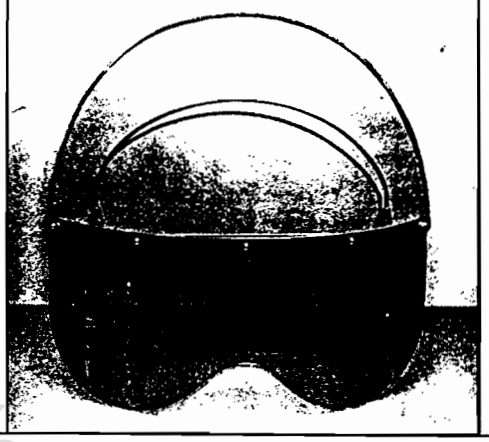
TRAILBLAZER

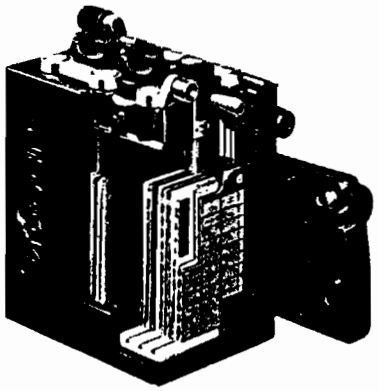
APACHE

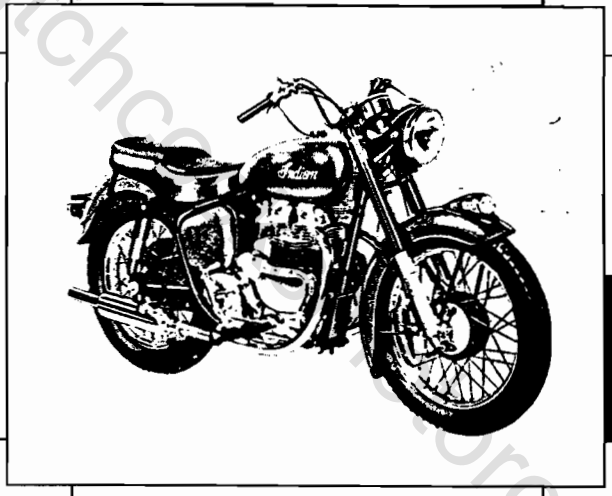
THE Indian COMPANY
Springfield, Mass.

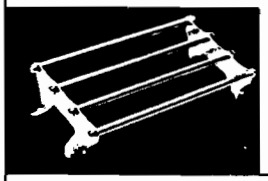
ALL THE BEST IN ACCESSORIES

Indian









QUALITY MERCHANDISE

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SPRINGFIELD, MASS.

TABLE OF CONTENTS

Section B4

ENGINE SPECIFICATIONS

Apache & Trailblazer

1. Engine

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

2. Cylinder Heads

The cylinder heads are die-cast from light aluminum alloy with ample finning to ensure adequate cooling. The exhaust pipe inserts are cast in and the valve inserts are of austentic iron and are shrunk in so that they are replaceable. Steel wire thread inserts which are easily renewable are provided for the sparking plugs to prevent damage to the threads in the heads. 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 70 m.m., the stroke being 90 m.m. The cubic capacity of the engine is 692 c.c. The cylinder heads are located on the cylinders by hollow dowels.

4. Pistons

The high compression pistons are of low expansion aluminum alloy, heat treated and form-turned oval and having split skirts. There are three piston rings, the top two of which are compression rings. Both are taper ground and the top one is chromium plated. The third ring is for oil control and is slotted. The compression ratio for the Apache is 8.6 to 1, for the Trailblazer 8 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 wrist 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 are babbit lined steel inserts which are renewable. The detachable bearing caps are bolted to the connecting rods by means of high tensile socket screws, secured by cotter pins.

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 meehanite cast iron, and it is carefully balanced.

The main journals are ground and the big end journals are ground and hand-lapped.

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 with silencing ramps to ensure quiet running.

10. Valves

The inlet valves are machined from stampings of special EN52 steel.

The exhaust valves are machined from stampings of special nimonic 80 steel.

11. Valve Gear

The valves are operated from the camshafts by means of large flat based guided tappets, tubular alloy push rods and overhead rockers. Two compression springs are fitted to each valve.

12. Timing Drive

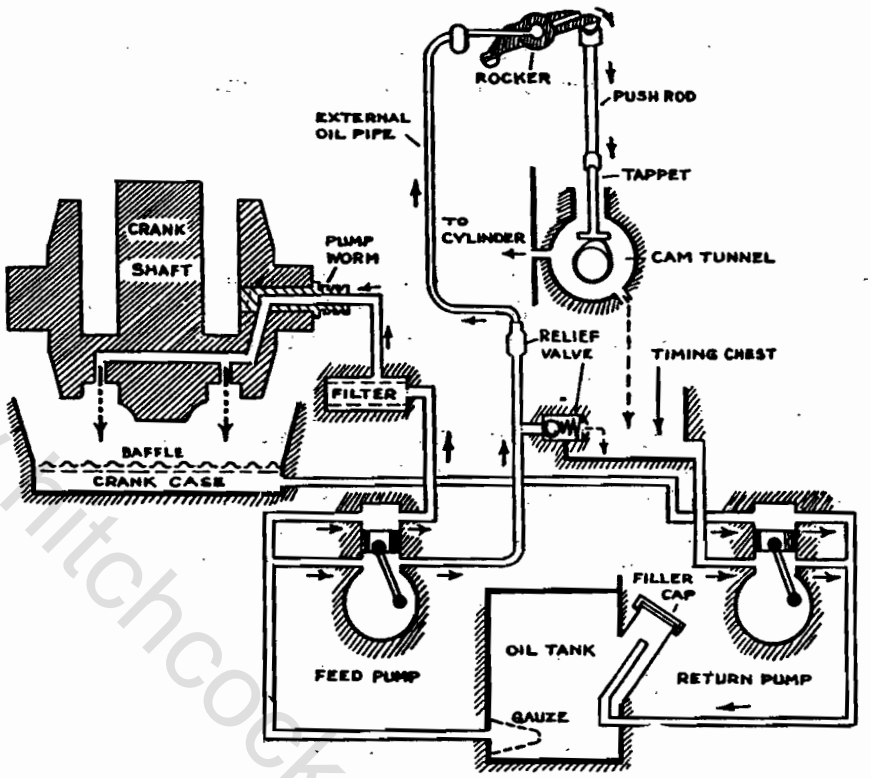
The camshafts are located in the crankcase, running in bronze bushes. They are driven by a common, endless chain from the timing sprocket on the crankshaft and the tightness of the chain can be adjusted by means of the chain tensioner in the timing chest.

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

13. Ignition and Lighting System (Trailblazer) (See Sec. G1 AND G2)

Separate systems are provided for ignition and lighting. The former is by the latest type of Lucas brushless magneto with rotating magnet and stationary contact breaker. The magneto runs at half engine speed and has a built-in distributor and double cam.

Lighting current is supplied by the battery which is charged through a rectifier from an alternator consisting of a rotating magnet mounted on the crankshaft and running in a six-coil stator in the primary chaincase.



LUBRICATION SYSTEM (Diagrammatic Arrangement)
Fig. 2

13. A. Ignition and Lighting System (Apache) (See Section B1 and C2)

Separate systems are provided for ignition and lighting. The former is the Lucas K2F magneto manually controlled. The magneto runs at half engine speed and has a built-in distributor and double cam.

Lighting current is supplied by the battery which is charged through a rectifier from an alternator consisting of a rotating magnet mounted on the crankshaft and running in a six-coil stator in the primary chaincase.

14. Carburettor (Trailblazer)

Amal Monobloc, Type 376/36. Bore 1 1/16 in.

Main Jet	240
Needle Jet	Standard
Pilot Jet	30 c.c.
Throttle Valve	No. 3 1/2
Needle Position	No. 3
Pilot Outlet	.025 in.

15. Air Filter (Trailblazer)

The air filter is a Vokes Micro-Vee felt and gauze dry filter, 5 in. diameter and housed in a compartment of the toolbox.

16. Lubrication System

Lubrication is by the 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 1/6 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 the rocker on to the top end of the pushrod. It flows down the push rod into the cam tunnel where it lubricates the cams and tappets and then into the timing chest, lubricating the timing chains. There are small holes from the cam tunnels through the cylinder walls for the purpose of lubricating the skirts of the pistons.

Both pumps are double acting, one side of the feed pump supplying the big ends only and the other side the rockers and valve gear. In a similar manner one side of the return pump pumps the big end oil back to the tank from the crankcase and the other side the valve gear oil back to the tank from the timing chest.

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 aluminum 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.

17. Breather

The efficient operation of the breather is of paramount importance to the performance of the engine as it acts as a non-return valve between the crankcase and the outside atmosphere, causing a partial vacuum in the crankcase and rocker boxes which prevents the passage of oil into the cylinders and consequent smoking and oiling of the plugs.

The breather is located on the driving side of the crankcase and consists of a small housing attached to the crankcase by three screws and having a short rubber tube with flattened end, which acts as a non-return valve.

On some models the housing contains two pensteel discs covering two holes drilled in the crankcase. Accurate seating of the discs is ensured by a pensteel plate held between the breather body and the crankcase.

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 Sec. E4).

The standard gear ratios are as follows:

Trailblazer

	Solo	Sidecar
Bottom Gear	12.05	13.55
Second Gear	7.87	8.85
Third Gear	5.63	6.34
Top Gear	4.33	4.88

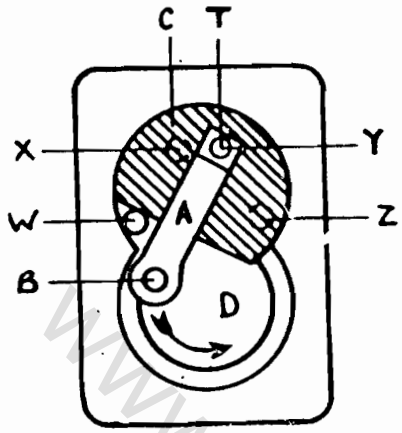
19. Clutch

The clutch has six pressure plates and five friction plates, including the sprocket which is lined on both sides with friction material. The other friction plates have Klinger inserts which give smooth operation and freedom from slipping in the presence of oil.

OIL PUMP DIAGRAMS

Trailblazer & Apache

Fig. 3A

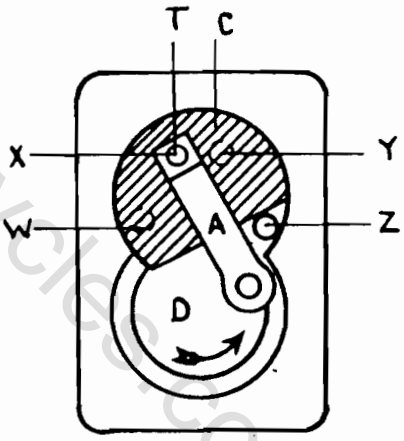


Feed Pump Position 1

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.

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.



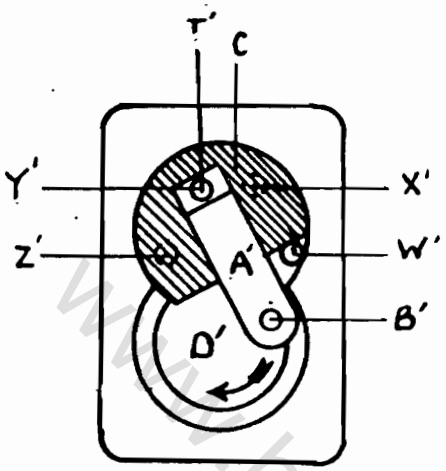
Feed Pump Position 2

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.

OIL PUMP DIAGRAMS

Trailblazer & Apache

Fig. 3B

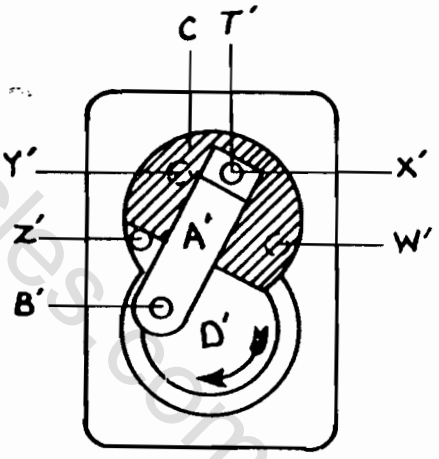


Return Pump Position 1

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 timing chest.

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.



Return Pump 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 timing chest.

Section C4

SERVICE OPERATIONS WITH ENGINE IN FRAME

Apache & Trailblazer

1. Removal of 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 is split or otherwise damaged, a new one should be fitted, of the latest type.) If the plug is damaged it should be renewed to ensure oil pressure to the big end bearings.

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 remove 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 to circulate.

2. 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 center line and the mark on the crankshaft sprockets pointing vertically downwards. If it is necessary to remove the sprockets see Sections 23 and 24.

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

3. 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 clearance between the end of the screw and the valve stem cap should be nil or as little as possible with the engine COLD.

To adjust the clearance, loosen the locknut beneath the rocker arm, turn the screw with a small spanner and re-tighten the locknut.

The adjustment for each valve should be made with the corresponding valve of the other cylinder fully open. This ensures that the tappet is well clear of the ramp which is located on either side of the cam to reduce valve noise.

If, after long service, the valve stem caps or the rocker adjusting screws are found to be worn, they should be renewed, as uneven thrust due to the screw being in a different position after adjustment may cause lateral movement of the rocker giving rise to a sharp tapping noise.

4. Ignition Timing (Trailblazer)

To obtain access to the magneto sprocket it is necessary to remove the timing cover (See Section 1).

The sprocket is built into the automatic advance device and is mounted on a smooth taper on the magneto shaft. It is held in position by a nut. (Right Hand Thread).

To remove the sprocket and auto-advance device, unscrew the nut and this will draw the sprocket off.

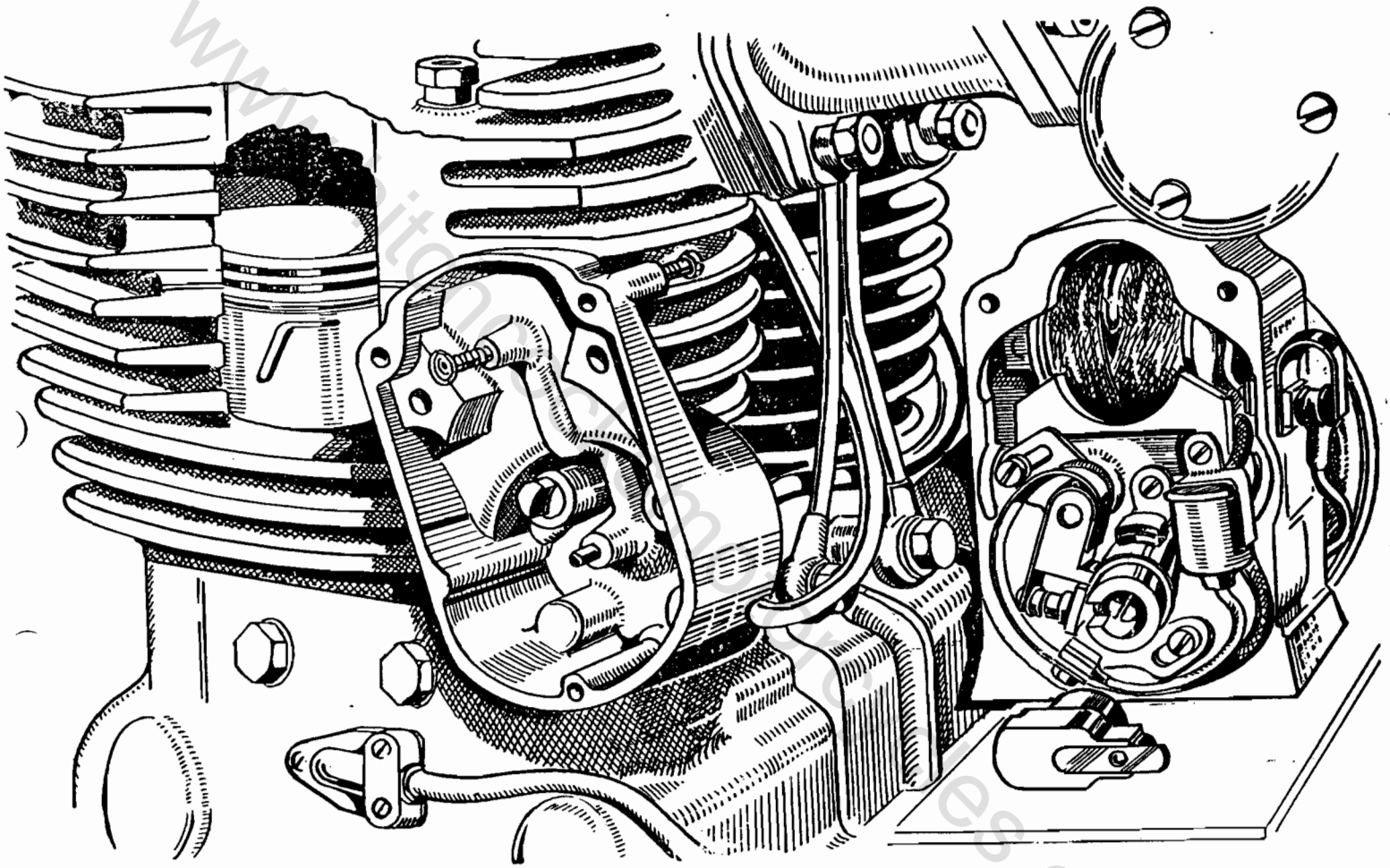
Before setting the timing remove the rotor arm of the distributor and adjust the contact breaker points to a clearance of .015 in. when fully opened.

Because of the auto-advance mechanism, the timing is normally in the "retard" position when the engine is stationary. Rotate the two halves of the coupling relatively to each other against the springs, i.e., into the "advance" position, and hold it in this position with a piece of wire.

To set the timing, turn the engine until the pistons are 3/8 to 7/16 in. before top dead center on the compression stroke of the left hand cylinder, i.e., with both valves closed.

MAGNETO TIMING

Fig. 1



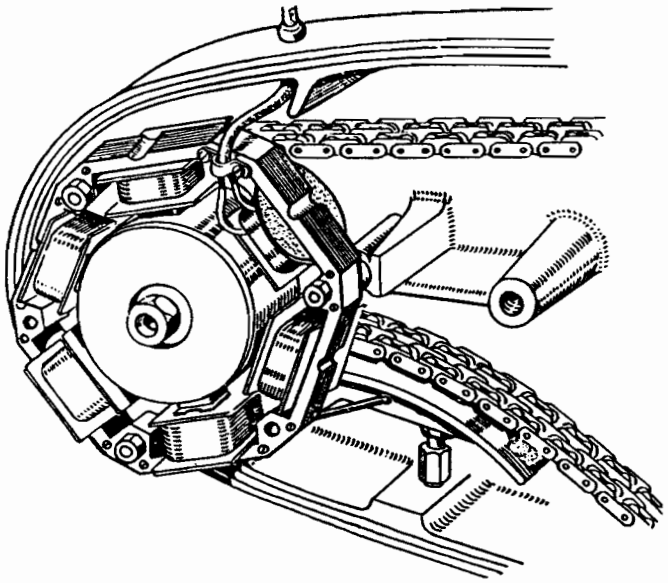
Insert a thin piece of tissue paper between the points of the contact breaker and turn the magneto anti-clockwise until the paper can just be pulled out, making sure that the rotor arm of the distributor when replaced will be pointing towards the segment connected to the left hand sparking plug lead.

Tighten the sprocket and auto-advance device on to the magneto shaft, taking care that it does not slip.

Remove the piece of wire holding the auto-advance mechanism.

The timing can be checked by removing the cap from the magneto and holding the rotor arm of the distributor in the advanced position, which is 3/8 to 7/16 in. before top dead center, without the necessity of taking off the timing cover.

On no account must the cam be altered from its original position on the rotor shaft or the efficiency of the magneto will be affected.



PRIMARY CHAIN ADJUSTMENT

Fig. 2

5. Primary Chain Adjustment

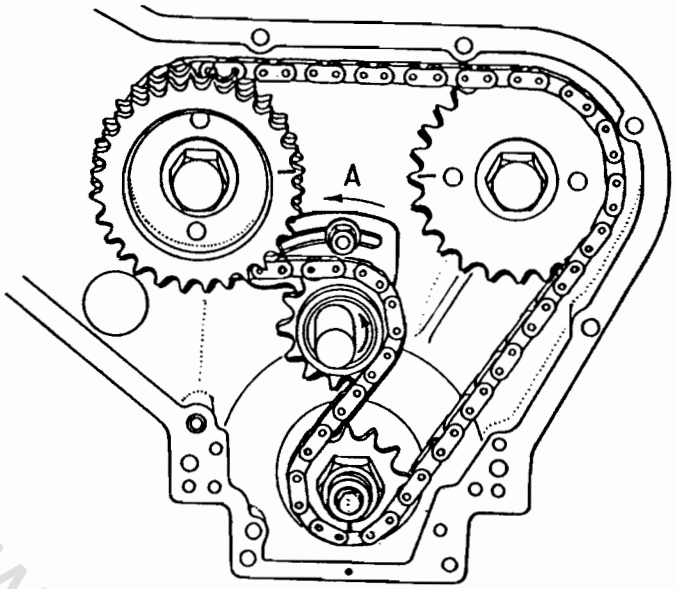
The tension of the primary chain can be checked through the inspection cover in the primary chain case and, should it require adjustment, access to the adjuster is gained by removing the chain case cover, which is held in position by a single nut. Before removing the nut, place a tray under the engine 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 1/4 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.



TIMING CHAIN ADJUSTMENT SHOWING TIMING MARKS

Fig. 3

6. Timing Chain Adjustment

Before adjusting the tension of the timing chain, turn the engine until the chain is in its tightest position and any slack is between the rear cam sprocket and the timing sprocket on the engine shaft.

The tension of the timing chain is altered by moving the quadrant after slackening the nut which secures it. This rotates the eccentric spindle on which the chain tensioner idler sprocket is mounted. Tightening of the chain is effected by moving the quadrant to the left.

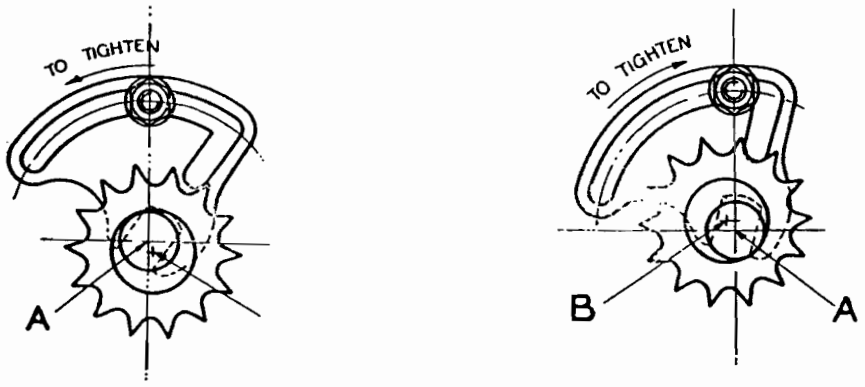
It is imperative that the quadrant is fitted the right way round and that the eccentric spindle is fitted correctly in the quadrant fork. If the chain tightens when the quadrant is moved to the right, the tensioner has been wrongly assembled and may cause damage to the quadrant (see Fig. 4).

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 maladjusted, it may give rise to a loud noise which can be mistaken for a faulty bearing. If such a noise is heard, therefore, first check the adjustment of the timing chain.

7. Magneto Chain Adjustment

To adjust the magneto chain tension, remove the timing cover (SeeSec. 1), slacken the three magneto fixing bolts, slide the magneto back until the chain has about 3/16 in. up and down movement, then tighten the fixing bolts.



CORRECT INCORRECT

TIMING CHAIN ADJUSTMENT

Fig. 4

8. Removal of Dual Seat and Rear Fender (Trailblazer)

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

Remove the two nuts on either side of the seat attaching it to the frame and lift the seat and fender off.

9. Removal of Gas Tank

Turn off the gas shut-off.

The gas tank is attached to the frame by two studs, the front bolt going through a rubber mounted sleeve set in the frame. To remove the tank, first disconnect the gas line and then unscrew one nut on the front and rear studs. Gently tap out the studs and the gas tank can be removed by raising the rear end first and then sliding the tank backwards.

10. Removal of Cylinder Head

First remove the gas tank and gas pipe (Sec. 9).

The dual seat may also be removed if desired (Sec. 8).

Disconnect the engine brace.

Disconnect the oil pipes and plug leads.

Remove the exhaust pipes and carburetor and intake manifold.

Remove the rocker box covers.

Turn the engine until both valves are closed on one cylinder.

Remove the five cylinder head nuts and lift off the head.

Repeat for other head.

In replacing the head, see that the dowels are in position in the cylinder barrel and that the push rods are the right way up (shallow cups upwards).

Apply a thin coat of jointing compound to both sides of the gasket and place it in position.

Lower the cylinder head over the push rods, making sure that the rockers locate in the push rod cups.

Fit the head nuts and washers and partially tighten down.

When both heads have reached this stage, fit the intake manifold and tighten the nuts. The cylinder head nuts can now be finally tightened down progressivley and diagonally from one side to the other to prevent distortion. After the engine has been run long enough to get thoroughly hot, the tightness of the nuts should be re-checked. (Tighten to 16 foot pounds with a torque wrench).

11. Removal of Valves

Swing the rocker clear of the valve and if an end cap is fitted remove. Using a suitable valve spring compressing too, compress the valve springs and remove the split conical 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 conical collets together in order that they may be re-assembled 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.

12. Removal of Rockers

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

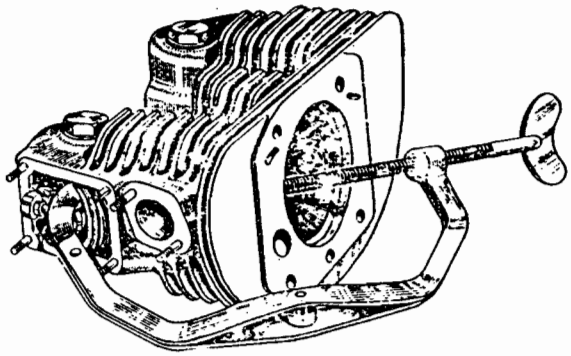
On re-assembling make sure that the spring washers are fitted on the sides of the rockers nearest the center of the engine and the plain thrust washers on the outer sides.

13. Removal of 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 7/8".

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



REMOVAL OF VALVES
Fig. 5

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 9/16 in. internal diameter to prevent damage to the bore of the guide. If a valve guide is removed for any reason, an oversized one should be fitted in order to maintain the correct fit. It is necessary to re-cut the valve seat and grind in the valve after a guide has been replaced. (See Sec. 18).

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.

14. Renewal of Sparking Plug Inserts

A steel thread insert is fitted into each sparking plug bore to prevent damage to the threads in the alloy cylinder heads.

This insert should not normally require renewal but if it does become damaged, for instance by a faulty plug, it can be pulled out with a pair of pliers and a new one fitted.

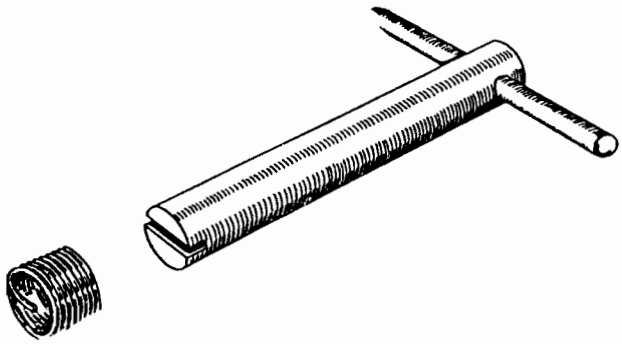
To fit a new insert a special tool, consisting of a piece of 7/16 in. diameter tube or rod with a slot cut in the end is required.

The new 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 1/2 threads below the top face. A reverse twist of the tool will then break off the tag.

If the cylinder head has not been removed from the engine, 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.

15 Removal of Cylinders

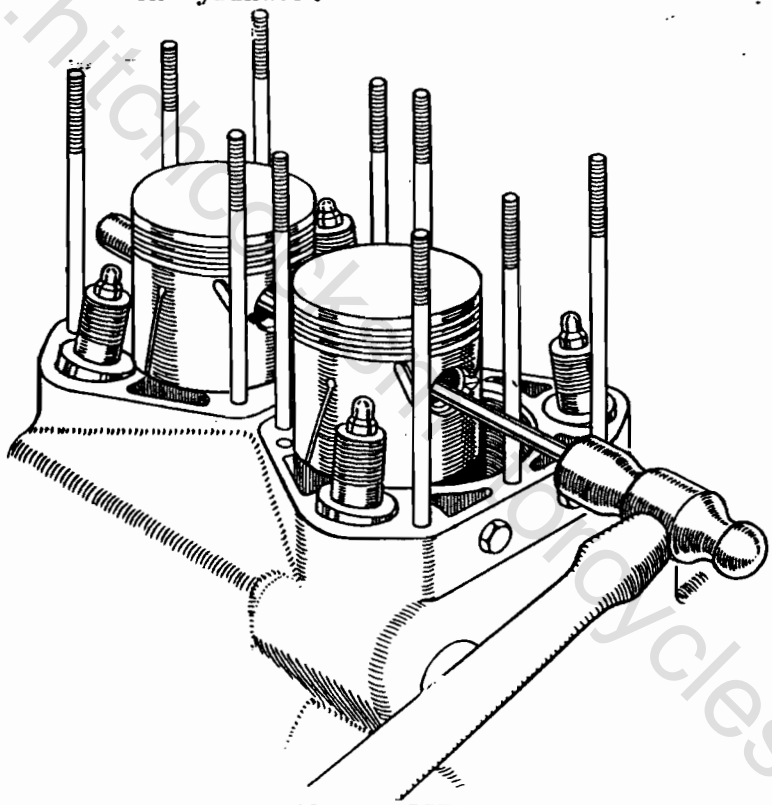
When the cylinder heads have been removed the cylinders can be lifted clear of the studs. This should be done with the pistons at bottom dead center.



SPARKING PLUG INSERT

Fig. 6

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



REMOVAL OF PISTONS

Fig. 7

16. Removal of Pistons

Remove the cylinder heads and cylinders.

With a tang of a file remove one of the wire circlips retaining the wrist pins. If necessary rotate the engine slightly until the pistons are in such a position that the wrist pins will clear the long cylinder studs when being withdrawn.

Use Special Tools to extract the wrist pin or using a rod about 1/4 in. in diameter insert this right through one wrist 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 wrist pins so that they go back into the cylinders in their original positions.

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

17. Decarbonizing & Piston Ring Fitting

Having removed the cylinder heads as described in Section 10, scrape away all carbon, bearing in mind that you are dealing with aluminum 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 aluminum alloy.

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 1/16 in. when the rings are in position in the barrel, new rings should be fitted. The correct gap for new rings is .011 - .015 in. The gap should be measured in the least worn part of the cylinder, which will be found to be 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.

18. 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 and inlet valves are cut at 45 degrees. The valve inserts are shrunk into the cylinder head. The tolerances should be approximately .004.

If the inserts should become worn, new inserts can be fitted if the cylinder head is returned to the factory. Also if the seat of the insert is ground too deep it is a good policy to have new inserts fitted so that the valve seat can be considerably reduced and this would naturally increase efficiency.

No attempt should be made to peen the alloy around the insert as this will not secure the insert sufficiently unless the tolerances are correct. Valves should be ground in a semo-rotary fashion so that an even surface of seat is obtained. For competition purposes it is some times possible to releive the inside of the insert so that a larger valve can be fitted. It is not advisable to relieve the insert of more than 1/2 of its normal thickness.

19. Re-Assembly after Decarbonizing

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

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 wrist pin from the outer side. Fit the circlip and then fit the second piston in a similar manner.

Check the piston ring gaps to find out whether excessive wear has taken place (see Sec. 17).

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.

Fit the copper cylinder head gaskets and see that the dowels are in position.

Replace the cylinder heads as described in Sec. 10.

After the engine has been assembled, run it for a brief period at a fast idle speed.

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

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

The filter element is removed by unscrewing the nut holding the end cap in position. When re-assembling the filter after cleaning, take care that no grit or other foreign matter is sticking to it. The aluminum 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.

21. Overhaul of Oil Pumps

Remove the timing cover as described in Sec. 1.

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.

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, using carborundum 360 fine paste or liquid metal polish until an even grey surface is obtained. Wash all passages, etc., thoroughly with gas after lapping to remove all traces of grinding parts.

The feed pump spring is stronger than that in the return pump and care must be taken to see that they are not interchanged. The feed pump is at the rear.

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 1/4 in. off the timing cover by the feel pump spring and 1/8 in. off by the return pump spring.

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

Re-assemble 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 oil can. Turn the pump spindle with a screwdriver in a clockwise direction looking on the front and it can then be seen whether the pumps are operating correctly.

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.

When the timing cover has been refitted on the engine, the oil feed to the big ends can be checked with engine running 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.

22. Removal of Timing Chains

Loosen the magneto fixing bolts.

Remove the magneto sprocket (Sec. 4).

Lift the magneto chain off the cam sprocket.

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.

23. Removal of Pump Worm and Timing Sprocket

Remove the timing chains (Sec. 22).

Unscrew the oil pump worm by means of the hexagon head behind it. This is a Left Hand Thread. Do not attempt to withdraw the sprocket by tapping the worm as this will dislodge the locking nut in the crankshaft. (See Sec. D Subsection 6.)

24. Removal of Camshaft Sprockets

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

Withdraw the sprockets by means of a suitable extractor.

Remove the timing chains (Sec. 22).

25. Removal of Magneto Sprocket (Trailblazer)

Remove the timing cover and unscrew the nut securing the automatic advance mechanism. This will draw off the sprocket and auto-advance device from the magneto shaft.

26. Removal of Engine and Clutch Sprockets

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

Remove the alternator stator by undoing three fixing screws.

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

Unscrew the engine sprocket nut. The engine sprocket is mounted on splines and can then be removed with the clutch sprocket.

To remove the clutch sprocket unscrew the three clutch spring pins then lift away the spring cap, springs and spacers, clutch front plate, center retaining ring and the assembly of driving and driven clutch plates. The clutch sprocket can then be removed from the center after removal of the large circlip which secures it.

When replacing the engine sprocket, take care that the felt washer is not nipped behind the sprocket. This would make the engine very hard to turn over and would damage the washer and allow leakage from the crankcase.

27. Removal of Tappets and Guides

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

Remove the cylinder heads and barrels. (Sections 10 and 15.)

Extract the tappet guides, having heated the case first.

The guides are made from Nicket 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 oversized one.

28. Dismantling the Breather

If the breather is not operating efficiently, it may cause pressure in the crankcase, instead of a partial vacuum, giving rise to smoking or overoiling.

See that the discs and backplate are clean and undamaged and that the discs are seating properly.

When re-assembling the breather, apply jointing compound sparingly to the back of the steel plate taking great care to keep it away from the discs or their seatings.

29. Removal of Clutch

Remove the engine sprocket and clutch sprocket together as described in Sec. 26.

To remove the clutch hub, hold the clutch hub and remove the center retaining nut and washer with a box spanner.

The hub can then be withdrawn from the shaft.

30. Removal of Final Drive Sprocket

Remove the clutch as described in Sec. 29.

Remove the primary chain tensioner.

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

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.

31. Removal of Bearing Housing Felt Washer

Remove the engine sprocket, clutch and rear half of the primary chain case.

The felt washer is located in the steel housing at the back of the chain case.

Great care must be taken not to nip the felt washer behind the sprocket on re-assembly as this would make the engine very hard to turn over and would damage the washer and allow leakage from the crankcase.

32. 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 unions are fitted with steel wire thread inserts to prevent the threads in the aluminum from stripping.

The method of fitting the thread inserts is the same as that used for the sparking plug inserts described in Sec. 14.

33. Rocker Oil Feed Relief Valves

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 3/16 in. diameter steel ball held in position by a spring and a brass plug.

The valve is set before leaving the factory 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 aluminum into the screwdriver slot with a small center punch.

34. Fitting the Alternator (Trailblazer)

The alternator consists of two parts, the stator and the rotor. The stator is mounted on the back half of the primary chaincase, being held in position by three studs and spacers. The rotor, which contains the permanent magnets is mounted by means of an adaptor on the end of the crankshaft and is secured by a stud and nut and located by a key.

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 re-fitting 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. The nut holding The rotor in position is secured by a tab washer.

Having fitted the rotor, place the three spacers over the three studs in the primary chaincase and put the stator in position 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 1/8 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 file or grind the pole piece carefully until the correct gap is obtained.

35. Removal of the Magneto (Trailblazer)

The magneto is bolted to the timing side crack-case by the hexagon-headed screws. Access to these is obtained by removing the timing cover (Sec. 1) and the magneto sprocket and automatic advance device (Sec. 25).

Section D4

SERVICE OPERATIONS WITH ENGINE REMOVED

Apache & Trailblazer

1. Removal of the Engine from the Frame

Disconnect the battery leads.

Remove the daul seat and gas tank.

Remove the engine brace.

Remove the tool box cover and slide the flexible connection to the air cleaner off the carburetor.

Remove the exhaust pipes.

Disconnect the magneto cut-out lead.

Remove the slides from the carburetor.

Remove the rear chain.

Remove the footrest bar.

Remove the bottom rear engine bolt.

Support the engine on a suitable box or wood block.

Raise the center stand and remove the spring.

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

Remove the front engine plates and horn.

Lift the engine out of the frame.

2. Removal of Gear Box

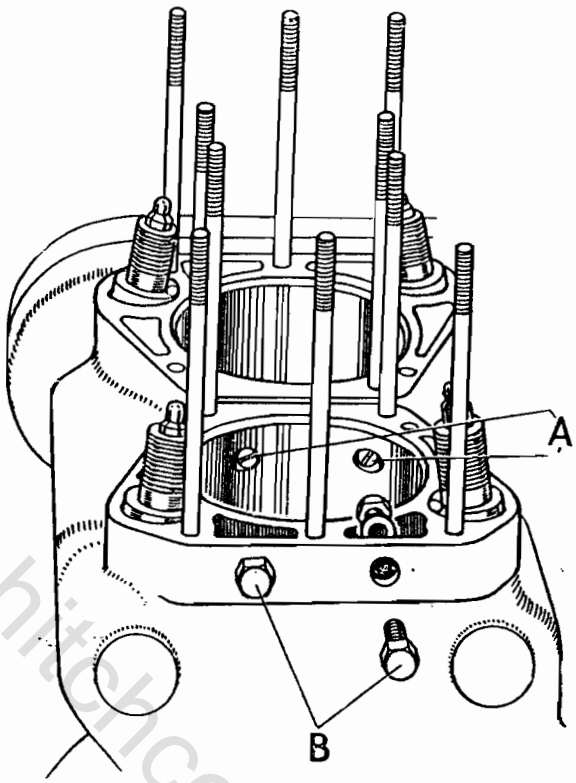
Remove the engine sprocket and clutch (Sec. C, Subsections 26 and 29).

Remove the rear half of the primary chaincase by removing three socket screws and the chain tensioner pivot. (Sec. C, Subsection 30).

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

3. Dismantling the Crankcase

Drain the oil tank by removing the drain plug.



REMOVAL OF SCREWS IN CRANKCASE

Fig. 1

Having removed the engine from the frame as described in Sec. 1, dismantle the heads, barrels, pistons, timing gear, magneto, etc., as described in Sec. C4.

Remove the gearbox as described in Sec. 2.

Remove the two hexagon-headed plugs on the driving side of the crankcase just below the cylinder base. (On no account must these plugs be disturbed unless the driving side cylinder has been or is to be lifted because they cannot be tightened without holding the nuts inside.)

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

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 a hide mallet or a soft metal drift.

4. Main Bearings

To remove the ball bearings 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.

5. Fitting the Connecting Rods

To remove the connecting rods from the crankshaft, first take out the cotter pins securing the socket screws in the connecting rods and then remove the socket screws themselves.

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

In refitting the connecting rods, the socket screws should be tightened with a torque wrench set at 200 - 220 in. - lbs.

If the cotter pins do not come in line remove the socket screws and use a different thickness of washer. A difference of .005 in. in the washer alters the position of the screw approximately 1/8 of a turn.

There is a recess in one side of the connecting rod for a cotter pin head and this side must face outwards when the connecting rod is assembled on the crankshaft to avoid fouling between the cotter and the crankshaft web.

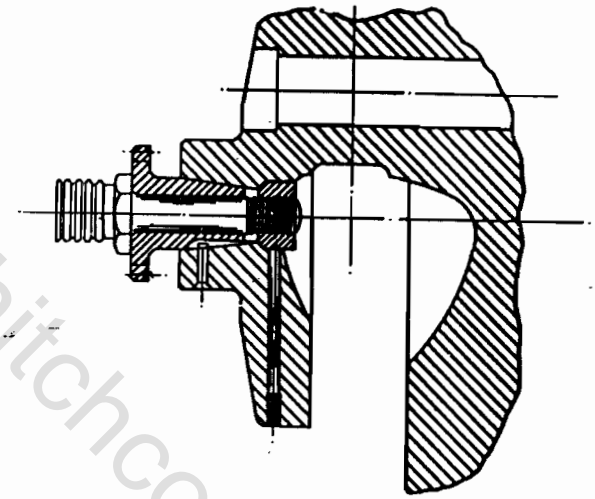
If it is necessary to replace the big ends, a service crankshaft can be supplied with connecting rods fitted.

6. Re-Assembly of the Crankcase.

Fit the outer roller race in the timing side crankcase, the ball-bearing in the driving side crankcase and the inner roller race on the crankshaft as described in Sec. 4.

Be sure that the inner race is driven on just flush with the end of the crankshaft and no further.

There are several methods of assembling the crankcase. If the timing-side is fitted to the crankshaft first, care must be taken not to score the inside of the case. If the driving-side is fitted first it is possible, with some makes of roller bearing, though not probable, to drop one of the rollers into the crankcase and cause serious damage to the engine.



Section Showing Locking of Oil Pump Worm & Timing Sprocket by Locking Rod.

PUMP WORM LOCKNUT

Fig. 2

(a) Timing-side First.

Lay the crankcase flat on the bench and insert the shaft, with the inner roller race in position, arranging the connecting rods so that they do not foul the crankcase.

Insert the camshafts in their correct position (exhaust front, inlet rear).

Pur the spacer in position on the driving side of the crankshaft.

Heat the driving-side crankcase and bearing to 100 degrees C. and drop it over the crankshaft, making sure to lift the tappets clear of the cams.

Bolt the two halves of the crankcase together. The crankshaft should now be drawn into its correct position by fitting the engine sprocket temporarily and tightening the nut while the crankcase is still hot.

(b) Driving-side First. Support the crankshaft with the driving end pointing upwards and place the spacer in position. Heat the driving-side crankcase to about 100 degrees C. and place it over the crankshaft. Fit the engine sprocket and tighten the nut while the crankcase is still hot.

Invert the crankshaft and crankcase and support it on two blocks of wood or a large block with a hole in it.

Insert the camshafts in their correct position (exhaust front, inlet rear).

Apply jointing compound to the driving-side crankcase.

Heat the timing-side crankcase (with the outer roller race) to about 100 degrees C. and drop it over the crankshaft, making sure to lift the tappets clear of the cams.

Bolt the two halves of the crankcase together.

If so desired the heated timing-side crankcase can be supported on a block or blocks as above and the crankshaft dropped into it.

Alternatively, the crankshaft can be supported in a vertical position as above and the crankcase driven on to it (without heating) by means of a tubular drift applied to the inner race of the bearing or the crankcase may be drawn on to the shaft by means of the sprocket nut with a temporary spacer in place of the sprocket.

7. Pump Worm Locknut

The pump worm is held in position in the end of the crankshaft by a steel nut which is permanently fixed in the crankshaft and should not be removed.

The nut is fitted in a recess and locked by means of a long peg which in turn is held by a lock screw in the timing side crank web.

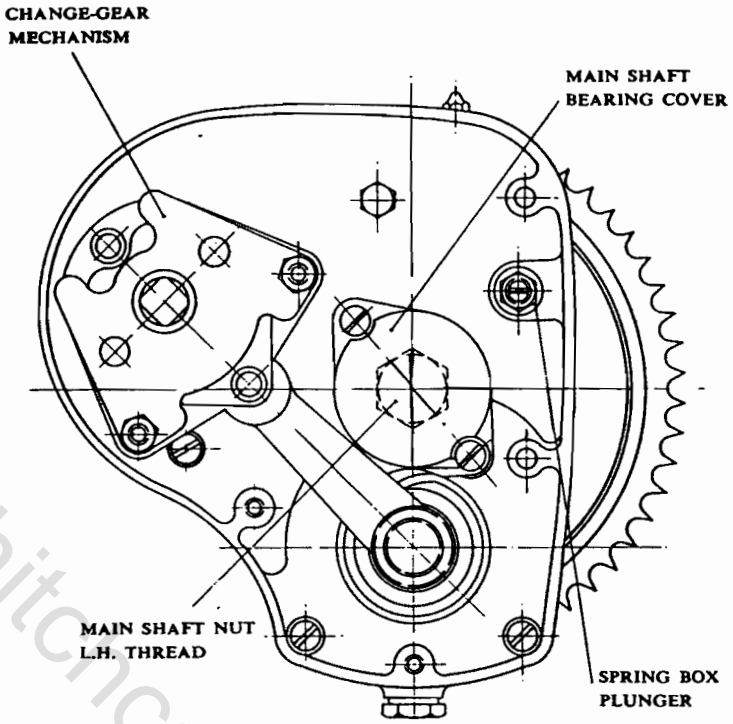
If it is necessary to refit the nut, assemble the timing sprocket with the pump worm and nut in the crankshaft while out of the crankcase and tighten it up.

By means of a long drill through the hole in the crankshaft web, countersink the nut to about 1/8 in. Insert the locking rod and lock screw.

Remove the pump worm and sprocket and re-assemble after the shaft has been fitted in the crankcase.

Section E4

GEARBOX AND CLUTCH



GEARBOX WITH OUTER COVER REMOVED
Fig. 1

1. Removal of Gearbox

This is described in Sec. D1 or D2.

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.

2. To Dismantle the Gearbox

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

Remove the top small inspection cover and disconnect the clutch cable.

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 main shaft bearing cover which is attached by two screws.

Remove the fillister headed screws and one hexagon bolt.

Remove the spring box locating plunger nut and washer.

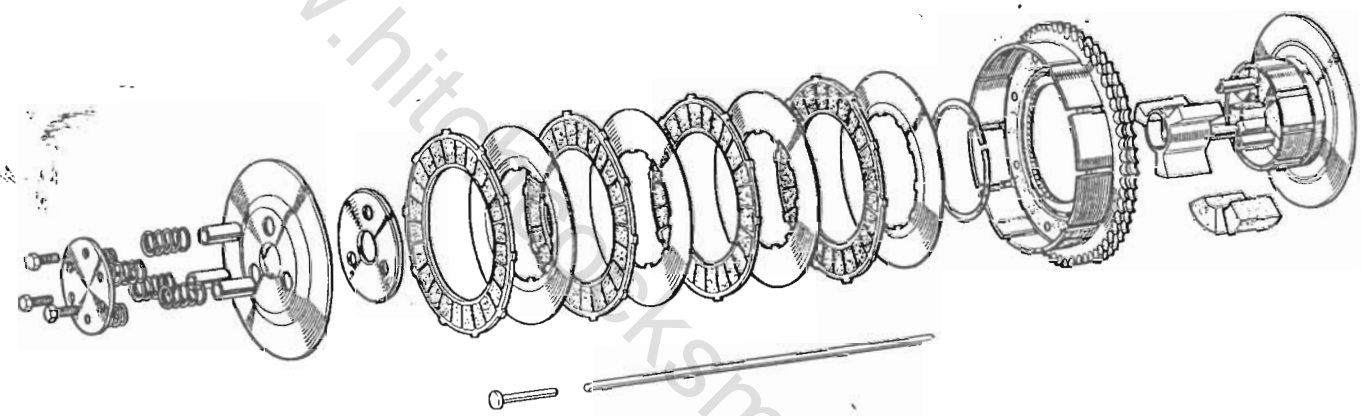
Remove the main shaft nut (Left Hand Thread).

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 Sec. C4.) The top gear pinion and dog will come away with the mainshaft.

The counter shaft can then by removed and the second and third 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 Sec. C4.)



EXPLODED VIEW OF CLUTCH

Fig. 2

3. Removal of the Ball Races

The mainshaft ball bearings can be removed by using a stepped drift 1 7/16 - 1 11/64 in. diameter for the bearing in the box and 13/16 - 39/64 in. diameter must be used for the bearings in the box and cover respectively.

Note the felt washer in the recess behind the larger main shaft bearing and the dished pen-steel washer between the bearing and the felt washer. The second dished pen-steel washer, if fitted, has a smaller central hole and is on the other side of the main shaft bearing and is nipped between the inner face of the bearing and the shoulder on the final drive sleeve. See that both of the dished pen-steel washers have their raised portions facing towards the clutch and final drive sprockets.

4. 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 thrid 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.

5. Re-Assembling the Gearbox

The procedure is the reverse of that given in Sec. 2, but the following points should be noted;

If the main shaft 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 main shaft is pushed right home. It may tighten in the felt washer inside the final drive shaft nut.

The counter shaft top gear and kickstarter pinion should be assembled on the counter shaft and the kick-starter shaft and ratchet assembled on to it before fitting the end cover. Do not forget the washer on the counter shaft 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. The box should be filled up to the correct level with engine oil. (See Sec. 9). On no account must heavy yellow grease be used.

6. Dismantling and Re-Assembling of the Clutch

The method of removing the clutch is described in Sec. C4.

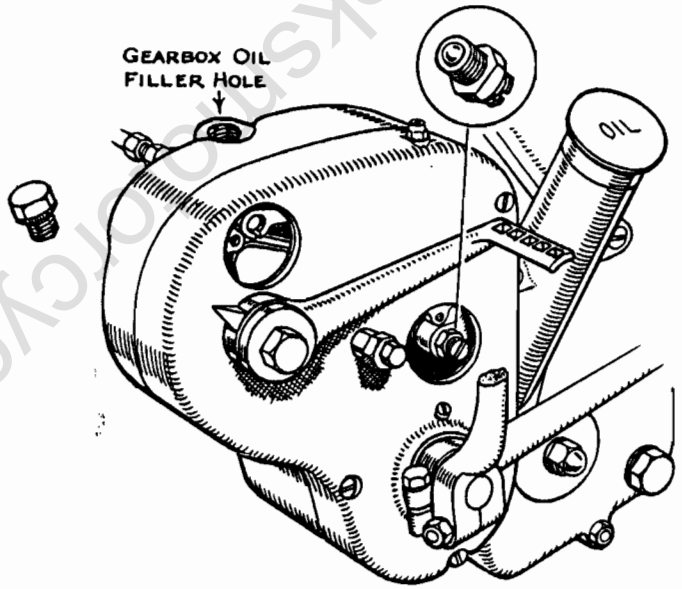
When re-assembling, note that two of the steel plates are dished and that other(s) are flat. The correct order of assembly is shown on the exploded drawing.

Do not forget to replace the cush rubber or plate retaining cover before fitting the pressure plate.

Make sure that the spacers inside three of the springs pass through the holes in the pressure plate. The other three springs are located by means of bosses on the clutch cap.

CLUTCH ADJUSTMENT

Fig. 4



Tighten the spring pins as far as they will go.

If the clutch lifts unevenly it is probably that one of the springs has taken a set, in which case new springs should be fitted.

7. Adjustment of the Clutch Control

It is essential that there should be about 1/16 in. free movement in the clutch cable, to ensure that all the spring pressure is exerted on the plates.

There are two points of adjustment for the clutch cable. The first is at the top of the gearbox just behind the oil filler plug and is provided for taking up any stretch in the cable. The adjustment is made by screwing the collar in or out of the gearbox shell. The connection between the end of the cable and the horizontal lever can be seen if the top small inspection cover on the front of the gearbox is removed. Tighten the locknut on the screwed collar after adjustment has been made.

The other point of adjustment is behind the lower inspection cover on the front of the gearbox and is for compensating for wear on the clutch plate inserts. To make the adjustment, remove the inspection cover, slacken the locknut and turn the central screw. Tighten the locknut after adjustment has been made.

The reason for the two points of adjustment is to enable the lever and fork behind the cover to be kept in their proper positions whether the need for adjustment is caused by plate wear or cable stretch.

Owing to initial bedding down of the clutch plate inserts, the clutch control may require adjustment after the first few hundred miles with a new machine. This point should therefore be examined soon after delivery and adjustment made if necessary.

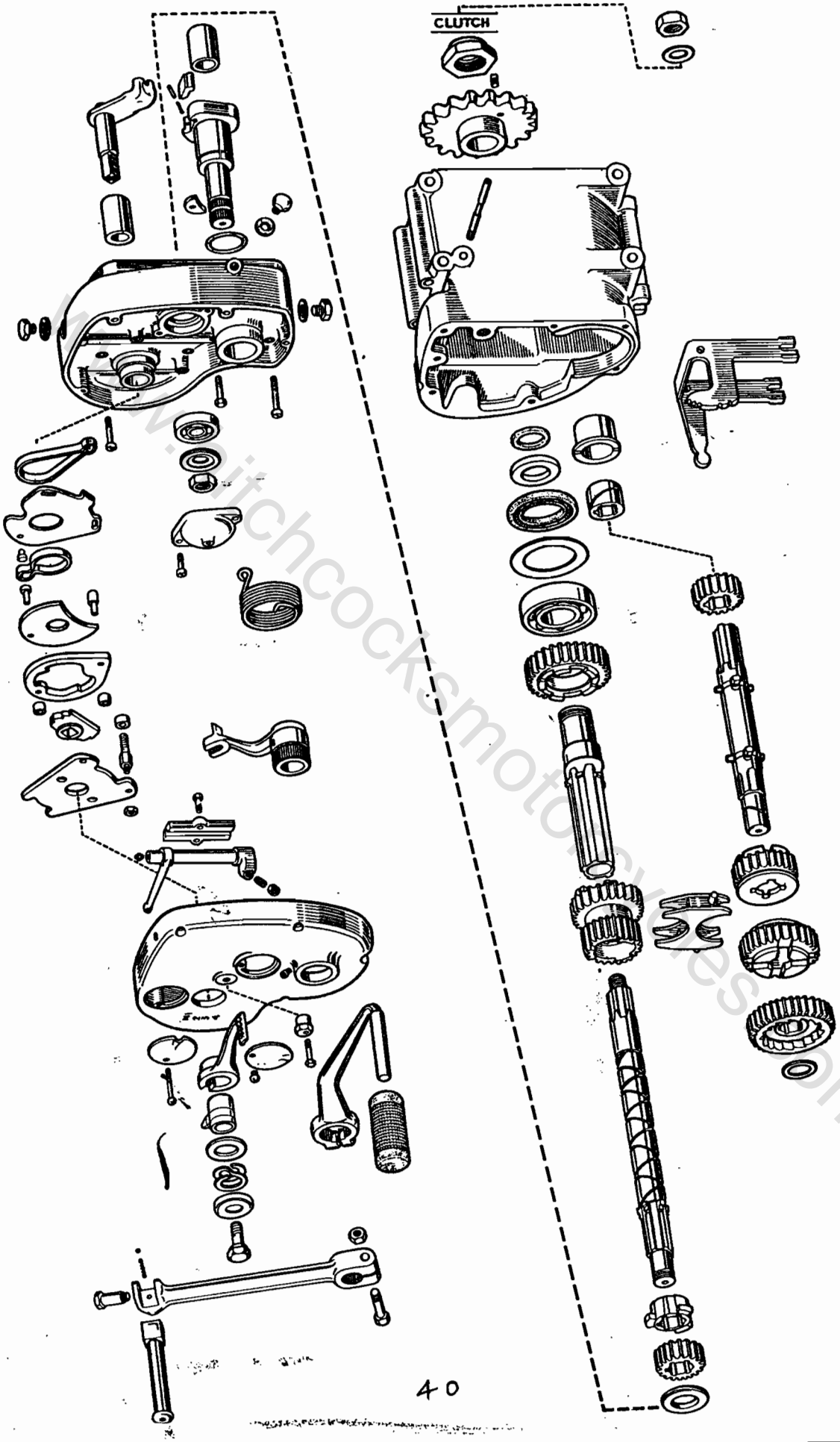
8. Adjustment of the Neutral Finder

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.

9. Gearbox oil Level

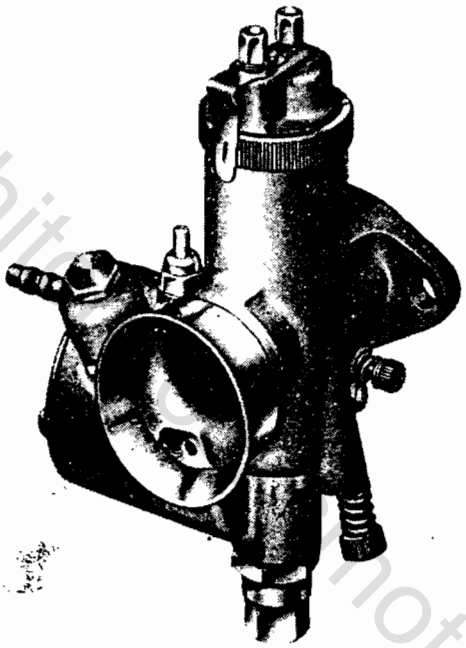
The gearbox is filled with oil by removing a plug in the top and the correct level can be checked by removing a second plug lower down on the right hand side looking at the cover.

EXPLODED VIEW OF GEARBOX



Section G

AMAL MONOBLOC CARBURETOR



Section G

AMAL MONOBLOC CARBURETOR

Tomahawk & Trailblazer

The new Amal monobloc carburetor has been completely redesigned and differs from the original model by incorporating compensating air bleed, which is part of an elaborate compound air bleed system, which is one of the main features contributing to increased efficiency. The pilot air intake is also newly positioned. A detachable pilot jet is incorporated. The needle jet is improved and a more accessible main jet is embodied.

The unit itself is very neat and robust. The carburetor consists of a one-piece unit die-cast out of zinc alloy. No separate float chamber system if employed, but in its place is a barrel-shaped reservoir, which is part of the main casting, and in this casting is housed a barrel-type float, designed to actuate on a pivot instead of rising and falling, and so impinge on a nylon needle which controls the flow of fuel from an external pipe.

A big feature in this design is that angles up to 20° - when the carburetor is fitted - do not obstruct the working of the float; thus if the carburetor is employed for use in down-draft carburetion, no difficulty will be experienced in the operation of the float. Also, when machines are being used for racing and necessitate the machine itself being leaned over when cornering, the pivot of the float being attached at right angles to the wheel base, reduces the possibility of the float sticking.

The needle and main jet are located in the base of the reservoir, which will eliminate any possibility of fuel weakness in running conditions.

The main jet and needle jet are quickly removed by removing the hexagon cap at the base of the mixing chamber. A compensating method for rich mixture, which is due to quick throttle openings, is provided by small cross bleed holes in the tall needle jet.

There is also a further compensating air bleed in the form of a drill-way, which is open to atmosphere at the mouth of the intake and leads through the monobloc casting. This drill-way connects with a similar aperture in the jet block body in which it continues at a downward angle with an outlet to the space around the needle jet.

The bleed aperture is the larger of the two holes seen at the face of the intake. The smaller hole is the pilot intake, which carries are through both the casting and the jet block into the engine side of the body, where its purpose is to draw fuel through a screw-type detachable pilot jet. The final gasoline and air pilot proportions are governed by an air-adjusting screw and a small hole on the engine side of the throttle.

The system of compound air bleed and the use of the flat-top spray tube are probably responsible for the improved performance and economy claim of this system.

The jet block is solidly made. The throttle slide is keyed internally for location with the jet block, and the fine-tuned finish of the slide makes smoother action, which results in longer life under working conditions.

This carburetor is available in the following bore sizes:

Model 375: 21" - 32"; 23" - 32"; 25" - 32"; 13/16" or 7/8".

Model 376: 15/16"; 1.00" or 1 1/16".

Type 389: 1 3/82"; 1 1/8"; 1 5/32" or 1 3/16".

Im summing up, this carburetor has an all-round advantage with improved fuel consumption and is designed to give good acceleration al all speeds.

Fig. 1 Section through float chamber. (See next page).

Fig. 2 Section through mixing chamber, showing air valve and throttle closed. (See next page).

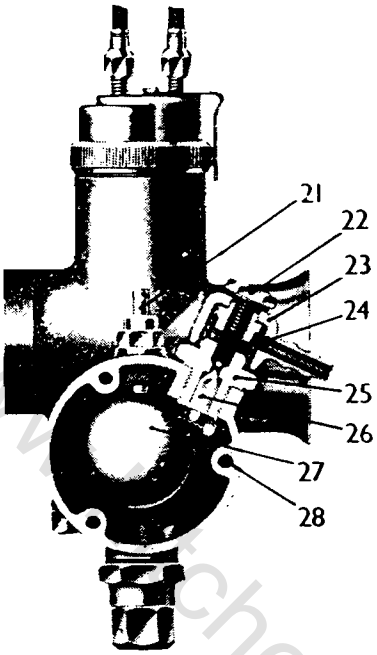
Fig. 3 Diagrammatic section of carburetor showing only the lower half of the throttle chamber, with the throttle a little open- and the internal primary air passages to the main jet and pilot system. (See next page).

1. Mixing Chamber Top
2. Mixing Chamber Cap
3. Carburetor Body
4. Jet Needle Clip
5. Throttle Valve
6. Jet Needle
7. Pilot Outlet
8. Pilot By-pass
9. Pilot Jet
10. Gasoline Feed to Pilot Jet
11. Pilot Jet Cover Nut
12. Main Jet Cover
13. Main Jet
14. Jet Holder
15. Needle Jet
16. Jet Block
17. Air Valve
18. Mixing Chamber Cap Spring
19. Cable Adjuster (air)
20. Cable Adjuster (throttle)
21. Tickler
22. Banjo Bolt
23. Banjo
24. Filter Gauze
25. Needle Seating
26. Needle
27. Float
28. Side Cover Screws
29. Pilot Air Adjusting Screw
30. Throttle Adjusting Screw
31. Air to Pilot Jet
32. Feed Holes in Pilot Jet
33. Bleed Holes in Needle Jet
34. Primary Air Choke
35. Primary Air Passage
36. Throttle Valve Cutaway

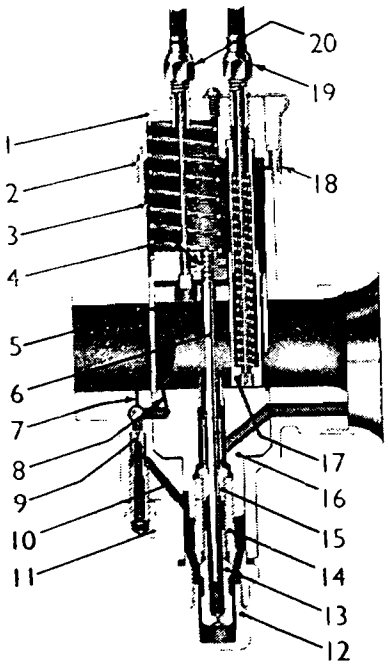
Carburetor Service

Remove the carburetor.

Remove the slides and needle. The slides and needle can be examined without removing the cables.



Section through Float Chamber



Section through Mixing Chamber

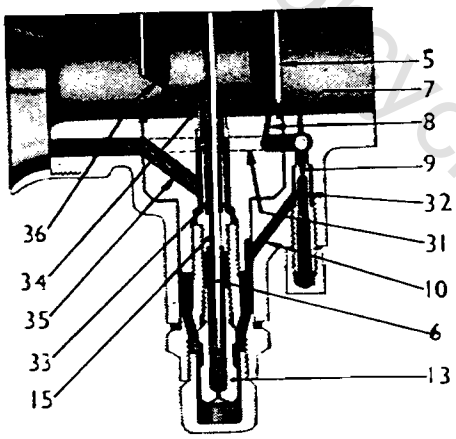


Fig. 3

To remove the main jet unscrew the main jet cover, the exposed main jet can then be unscrewed from the jet holder.

e. Needle and Needle Jet. The needle is attached to the throttle valve and being taper - either allows more or less gasoline to pass through the needle jet as the throttle is opened or closed throughout the range, except when idling or nearly full throttle.

The taper needle position, in relation to the throttle opening, can be set according to the mixture required by fixing it to the throttle valve with the jet needle clip in a certain groove, thus either raising or lowering it. Raising the needle richens the mixture and lowering it weakens the mixture at throttle openings from quarter to three-quarters open. The needles are marked with the letters B, C, or D. B type are fitted in the 375 carburetor. C type in the 376 carburetor. D type in the 389 carburetor. The needles in some cases are marked with a number in addition to a letter.

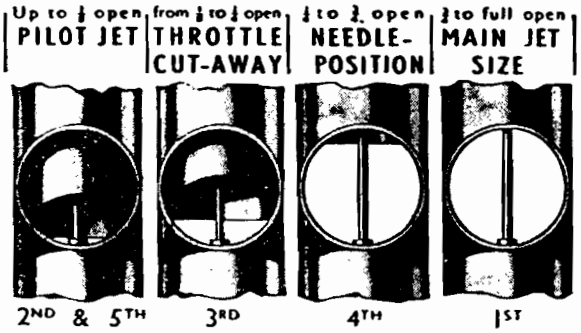
f. Throttle Valve Cut-Away. The atmospheric side of the throttle is cut away to influence the depression on the main fuel supply and thus gives a means of tuning between the pilot and needle jet range of throttle opening. The amount of cut-away is recorded by a number marked on the throttle valve, 376/3 means throttle valve type 376 with No. 3 cut-away; larger cut-aways, say 4 and 5, give weaker mixtures and 2 a richer mixture.

g. Air Valve is used only for starting and running when cold, and for experimenting with, otherwise run with it wide open.

h. Tickler, a small plunger spring loaded, in the float chamber wall. When pressed down on the float, the needle valve is allowed to open and so "flooding" is achieved. Flooding temporarily enriches the mixture until the level of the gas subsides to normal.

Note: The carburetor is automatic throughout the throttle range - the air valve should always be wide open, except when used for starting, or until the engine has warmed up. Get the motor going perfectly on a quiet road, with a slight up gradient, so that on test the engine is pulling.

PHASES OF AMAL NEEDLE JET CARBURETTER
THROTTLE OPENINGS



SEQUENCE OF TUNING

Throttle Stop and Starting Setting

It is desirable to be able to close the twist grip completely, without the engine stopping. For this purpose, an adjustable throttle top is provided.

Slacken the small screwdriver headed locking pin and holding the shaped stop piece against the mixing chamber body with the left thumb, rotate the adjuster until a slight increase in engine revolutions is heard.

Turn the adjuster back until the engine resumes its original speed and retighten the screw.

For easy starting, rotate the adjustment as far as possible, in a clockwise direction. This will raise the throttle slide to the best starting position. Return the adjuster to its normal position after starting.

Tuning Controls

a. This fig. 4 is three diagrammatic sections of the carburetor, to show the throttle adjusting screw (30), and the pilot air adjusting screw (29).

b. Throttle Adjusting Screw. Set this screw to hold the throttle open sufficiently to keep the engine running when the twist grip is shut off.

c. Pilot Air Adjusting Screw. This screw regulates the strength of the mixture for "idling" and for the initial opening of the throttle. The screw controls the depression on the pilot jet by metering the amount of air that mixes with the gasoline.

d. Main Jet. The main jet controls the gasoline supply when the throttle is more than three-quarters open, but at smaller throttle openings, although the supply of fuel goes through the main jet, the amount is diminished by the metering effect of the needle in the needle jet. Each jet is calibrated and numbered, so that its exact discharge is known and two jets of the same number are alike. NEVER REAM A JET OUT, GET ANOTHER OF THE SAME RIGHT SIZE. The bigger the number, the bigger the jet.

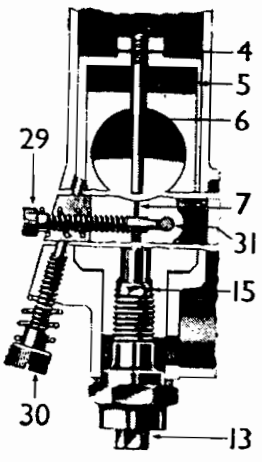


Fig. 4.


(d) MAIN JET.

How to Tune Up

1. Main Jet with Throttle in Position 1

Test the engine for full throttle; if when at full throttle, the power seems better with the throttle less than wide open, or with the air valve closed slightly, the main jet is too small. If the engine runs "heavily" the main jet is too large. If testing for speed work, note the jet size is rich enough to keep engine cold, and to verify this, examine the spark plug by taking a fast run, declutching, and stopping the engine quickly. If the plug body at the end has a cool appearance, the mixture is correct; if sooty, the mixture is rich; if, however, there are signs of intense heat, the mixture is too weak and a larger jet is necessary.

2. Pilot Jet with Throttle in Positions 2 and 5

With engine idling too fast with the twist grip shut off the throttle shut down onto the throttle adjusting screw, and ignition set for best slow running: (1) Screw out throttle adjusting screw until the engine runs slower and begins to falter, then screw pilot air adjusting screw in or out, to make engine run regularly and faster. (2) Now gently lower the throttle adjusting screw until the engine runs slower and just begins to falter. Adjust the pilot air adjusting screw to get best slow running. If this second adjustment makes engine run too fast, go over the job again a third time.

3. Throttle Cut-Away with Throttle in Position 3

If, as you take off from the idling position, there is objectionable spitting from the carburetor, slightly richen the pilot mixture by screwing in the air screw sufficiently, but if this is not effective, screw it back again, and fit a throttle with a small cut-away. If the engine jerks under load at this throttle position and there is no spitting, either the jet needle is much too high, or a larger throttle cut-away is required to cure richness.

4. Neelde with Throttle in Position 4

The needle controls a wide range of throttle openings and also the acceleration. Try the needle in as low a position as possible, with the clip in a groove as near the top as possible. If acceleration is poor and with air valve partially closed the results are better, raise the needle by two grooves. If very much better, try lowering the needle by one groove and leave it where it is best. If mixture is too rich with clip in groove No. 1, nearest the top - the NEEDLE JET probably wants replacement because of wear. If the needle itself has had several year's use, replace it also.

5. Finally go over the idling again for final touches.

How to Trace Faults

There are only two possible faults in carburetion, either richness or weakness of mixture.

The throttle slide is the one that is drum-shaped and has the jet needle attached to it.

To remove the throttle slide from the cable, compress the spring, allowing the nipple on the end of the cable to leave the hole in which it is fitted, and on releasing the spring allow the nipple to pass through the larger hole, and the slide is free from the cable.

To remove the needle from the throttle slide, remove the spring clip at the top of the slide. The needle is normally fitted into the middle notch.

The lower the needle the weaker the mixture.

The float chamber on the new Amal monobloc carburetor is combined with the mixing chamber and can be taken apart by removing the banjo bolt which will release the banjo itself.

On some of the models a filter gauze is housed inside the banjo.

The needle seating valve can now be removed and the nylon needle can be examined. To remove the float, remove the three side cover screws and withdraw the float sideways. The float should be examined for any leaks.

Jet Removal

Remove the main jet cover which will expose the main jet. This is numbered, so that special tuning for high speed work can be done. The needle jet can be removed by unscrewing the jet holder.

Reassembly is done on a reverse procedure.

Mixture Adjustment

The pilot air adjuster controls the mixture of air and gasoline up to 1/8 throttle opening, from 1/8 to 3/4 throttle mixture is controlled by the needle in the throttle valve. From 3/4 to full throttle the main jet is the control. Weak mixture is indicated by spitting and blue flames from the carburetor, pinking, running hot and plug points showing indications of intense heat.

To cure, raise needle in throttle valve one notch.

Rich mixture is indicated by thumpy running, black exhaust and the engine does not respond readily to throttle opening.

To remedy lower the needle.

Slow Running Adjustment

Start engine and screw pilot air adjuster right home while carefully closing the throttle. The engine should now 8-stroke and run heavily.

Gradually unscrew the pilot air screw; the engine speed will increase and the throttle will need further closing.

Repeat the process until by a combination of throttle and pilot air adjustment a regular even slow running is obtained.

Racing Practice

Racing practice is also followed in the jet holder, which carries the needle jet at the top and the main jet at the bottom. Conical seating faces eliminate seepage at the main jet, and the jet itself is exposed for cleaning, or changing, on removal of the cap nut at the bottom of the instrument.

The five-groove stainless steel taper needle is longer than in the old type carburetor, and the needle jet also is of new design. Made in aluminum-bronze, a good wear resistant material, the needle jet is, in fact, the key to the improved performance of the new carburetor in terms of low cruising consumption and quick response to opening of the throttle.

Slightly below the fuel level there is a small, transverse bleed hole through the walls of the needle jet. There is also an annual clearance between the jet and the block; this clearance space is in communication with the primary air passage in the jet block. When the throttle is shut, or the opening is small, fuel flows outward through the bleed hole and forms a well in the clearance space. Sudden opening of the throttle causes this reserve of gasoline to be drawn past the outside of the needle jet, through the diffuser tube and into the choke; the mixture is thus sufficiently enriched to enable the engine to accelerate quickly and cleanly.

When steady cruising conditions are reached, the depression on the needle jet causes air from the primary passage to be drawn inward through the bleed hole into the needle jet. There it mixes with the gasoline and so weakens the mixture delivered to the choke. Easing of the throttle reduces the depression on the needle jet and permits fuel to refill the well, in readiness for the next acceleration need.

Pilot-jet and main-jet characteristics are unaffected by this two way compensation, which concerns only acceleration and part-throttle cruising. To simplify cleaning, the pilot jet is no longer embodied in the jet block. To clean the pilot hole on the older series carburetor, the instrument had to be completely dismantled; now it is necessary only to detach a cap nut under the choke body, whereupon the pilot jet can be unscrewed. This modification also permits variations in pilot jet size to be tried out when the carburetor settings for a new type of engine are being determined.

On earlier instruments the pilot and primary air was supplied through a single passage near the entrance to the choke. It was found that, at certain fixed throttle openings, there was occasionally a tendency for fuel to be pushed out of the passage, under reverse flow, instead of air being drawn in. This minor bother has been cured by locating separate inlets for pilot and primary air in a vertical face at the extreme entrance to the choke.

Indications of;

Richness	Weakness
Black smoke in exhaust.	Spitting back in carburetor.
Gasoline spraying out of carburetor.	Erratic slow running
Four strokes, eight-stroking.	Overheating.
Two strokes, four-stroking.	Poor acceleration.
Heavy, lumpy running	Engine goes better if;
Spark plug sooty.	Throttle is not wide open, or
	Air valve is partially closed.

If richness or weakness is present, check if caused by ;

1. Gasoline Feed — Check that jets and passages are clear, that filter gauze in float chamber banjo connection is not choked with foreign matter, and that there is ample flow of fuel. Check there is no flooding.
2. Air Leaks — At the connection to the engine, or due to leaky inlet valve stems.
3. Defective or Worn Parts — As a loose fitting throttle valve
4. Air Cleaner Being Choked up
5. An Air Cleaner Having Been Removed

Removing the silencer, or running with a straight through pipe, requires a richer setting.

Having verified the correctness of fuel feed and that there are no air leaks, check over ignition, valve operation and timing. Now at throttle position, test to see if mixtures are rich or weak. This is done by partially closing the air valve, and if engine runs better, weakness is indicated, but if engine runs worse, richness is indicated.

	To Cure Richness	To Cure Weakness
Position 1.	Fit smaller main jet.	Fit larger main jet.
Position 2.	Screw out pilot air adjusting screw.	Screw pilot air adjusting screw-in.
Position 3.	Fit a throttle with larger cut-away.	Fit a throttle with smaller cut-away.
Position 4.	Lower needle one or two grooves.	Raise needle one or two grooves.

Note; It is not correct to cure a rich mixture at half throttle by fitting a smaller main jet, because the main jet may be correct for power at full throttle; the proper thing to do is to lower the needle.

Section G1d

LUCAS ROTATING MAGNET MAGNETO MODEL SR2

Trailblazer & Tomahawk

1. General

The magneto rotor comprises a permanent magnet fitted with two laminated pole shoes. The stator consists of laminated pole pieces bridged by a laminated coil core. The coil has concentrically wound primary and secondary windings.

The rotor is driven by the engine through an automatic advance coupling and induces an alternating magnetic field in the laminated iron core of the coil. Magnetic flux due to current flowing in the primary winding tends to oppose any change in direction of the magnetic field in the laminated iron core. In this way, field reversals due to the rotating magnet are delayed until the contact breaker opens. This removes the restraining influence of the primary winding and the consequent rapid reversal of the magnetic flux linked with the coil causes a high voltage to be induced in the secondary winding.

The body of the magneto is formed of a single casting enclosed at the contact breaker end by a moulded cover. The cover is designed with the high tension cable outlets in a downward direction, thus preventing the retention of moisture at the terminal connections. The coil and capacitor are robustly constructed and specially treated to withstand very arduous conditions.

The automatic timing control is a centrifugally operated mechanism enabling an angular movement of the magneto rotor to occur relative to the drive. The mechanism consists of two members flexibly coupled by pivoted spring-loaded governor weights and toggles. At low engine speeds and during starting, the weights are closed and a delayed spark is produced. As the engine speed increases, the governor weights swing out and advance the rotor (and thus the cam and the spark) relative to the drive.

2. Routing Maintenance

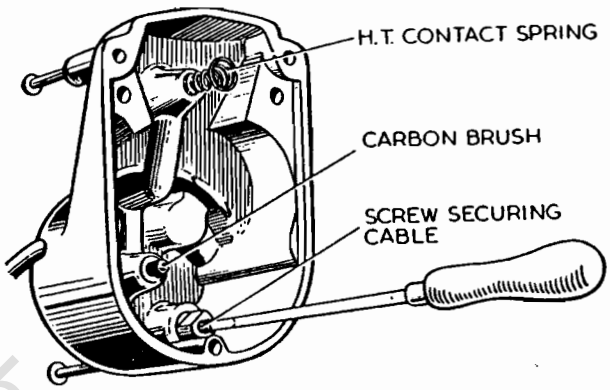
(a) Lubrication

TAKE GREAT CARE TO PREVENT OIL OR GREASE GETTING ON OR NEAR THE CONTACTS.

(i) After every 150 running hours (say 5,000 miles) remove the moulded cover and add a few drops of thin machine oil to the visible end of the contact breaker pivot post.

(ii) After 1,000 running hours (say 30,000 miles) remove the moulded cover and withdraw the rotating electrode. Slacken the fixed-contact plate securing screws and pivot the assembly to the fullest extent of the adjusting slots. Slacken the nut securing the end of the contact breaker spring, and lift off the moving-contact assembly. Smear the pivot pin with a small quantity of Mobilgrease No.2 or its equivalent. Replace the components in the reverse order of dismantling.

(iii) The magneto rotor is mounted on ball bearings. These bearings are packed with high melting point grease before leaving the factory and require no attention for a considerable time. About every two years, or when the engine is undergoing a general overhaul, the magneto should be dismantled by a Lucas Service Depot or Agent and the bearings repacked with high melting point grease.



TIGHTENING CABLE SECURING SCREW

Fig. 1

(b) Cleaning

(i) Occasionally remove the moulded cover and wipe the inside of the cover with a soft dry cloth. Clean the electrodes, the spaces between the electrodes and see that the carbon brush is clean and moves freely in its holder. Clean the outside of the cover before replacing it.

(ii) Examine the contact breaker. If the contacts are burnt or dirty, clean them by polishing with a very fine carborundum stone or fine emery cloth. The contacts may be cleaned more easily if the moving contact assembly is removed, as Sub-section 2 (a) (ii).

(c) Adjusting Contact Breaker

After cleaning check the gap between the contacts. Turn the engine until the contacts show the maximum opening which should measure 0.010 in. to 0.012 in. If the setting is incorrect slacken the two screws securing the fixed-contact plate and move the plate until the correct gap is obtained. Tighten the securing screws and measure the gap again. Check the gap for the other position of the engine giving maximum opening of the contacts. Refit the distributor gear so that the marked teeth of the gear and of the drive engage, retighten the gear retaining screw.

During the first 20 hours' running of a new magneto or replacement contact set, most of the bedding-down of the contact breaker heel occurs. The contact breaker gap should, therefore, be checked and, if necessary, reset as described above.

(d) Replacement of High Tension Cables

Use 7 m.m. P.V.C. or neoprene-covered rubber insulated ignition cable for the high tension leads. When connecting a new cable to the magneto do not bare the cable but cut if off flush to the required length. Remove the moulded

cover, slacken the cable retaining screw and pull out the old cable. Push the new cable fully home and secure by tightening the screw. The pointed end of this will pierce the insulation, make contact with the cable core and lock the cable in place. After fitting a high tension cable a continuity test should be made between the cover electrode and plug end of the cable.

3. Servicing

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

(i) Remove the sparking plugs from the engine. Hold the end of each high tension cable about 1/8 in. from the cylinder block and operate the kickstarter. If strong and regular sparking is produced the sparking plugs should be cleaned and adjusted.

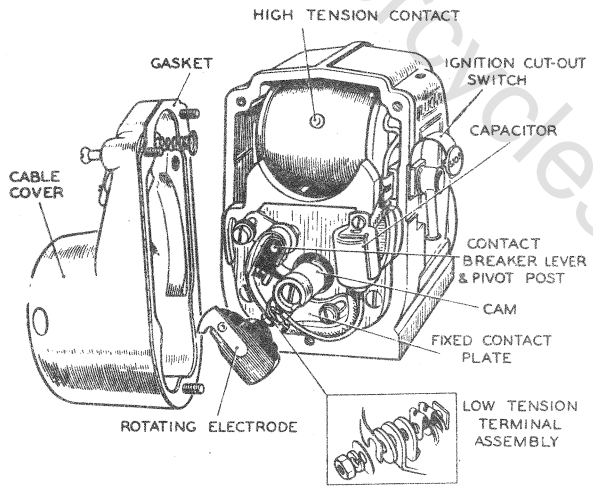
(ii) If no sparking is produced, examine the high tension cable and if necessary renew it as described in Sub-section 2(d).

(iii) Disconnect the cable to the cut-out switch at the magneto and re-test. If the magneto now functions normally the defect is in either the cable or the cut-out switch. Correct by replacement.

NOTE: In no circumstances must the contact breaker cam be removed from or turned on the spindle. The cam is correctly positioned when the magneto is built and the performance of the instrument depends on this position being maintained.

4. Automatic Advance Mechanism

This is automatically lubricated and requires no attention beyond making sure that it operates freely and the springs are securely fastened. For timing instructions see Sec. C4. Subsection 4.



MAGNETO MODEL SR2 WITH COVER REMOVED

Fig. 2

Section G2e

LUCAS A.C. GENERATOR/RECTIFIER CHARGING SET

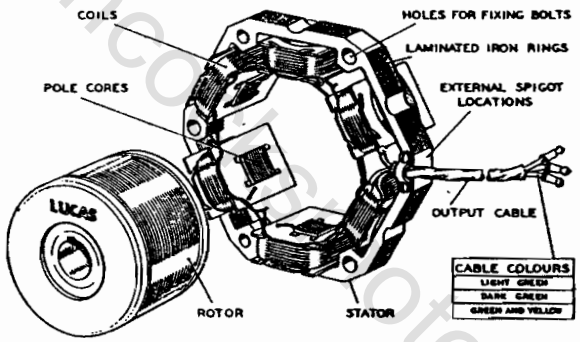
Trailblazer & Tomahawk

1. General

The Lucas A.C. Generator/Rectifier set comprises four main components.

1. Alternator with magnet rotor.
2. Bridge-connected rectifier.
3. Lighting switch.
4. 6-volt battery.(See Sec. G4a)

Under normal running conditions, electrical energy in the form of rectified A.C. Passes through the battery from the alternator, the rate of charge depending on the position of the lighting switch. When no lights are in use, the alternator output is sufficient only to trickle charge the battery. When the lighting switch is turned to the "Pilot" or "Head" positions the current increases proportionately.



STATOR AND ROTOR OF ALTERNATOR RM14

Fig. 1

2. Alternator Model RM14

Model RM14 alternator (See Fig.1) has an outside diameter of 5 7/8 in. and gives a high output at low r.p.m. The alternator comprises two main components, a stator and a rotor. The stator is built up from iron laminations and carries three pairs of series-connected coils insulated from the laminations. The rotor has a hexagonal steel core, each face of which carries a 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. The stator and rotor can be separated without the need to fit magnetic keepers to the rotor poles.

As the rotor turns, rapid and repeated reversals of flux take place in the coil cores. These lines cut through the turns of the coil and induce alternating voltages in that coil. External connections are taken to these coils from a bridge-connected rectifier. (See Fig. 2)

3. Circuit Detail

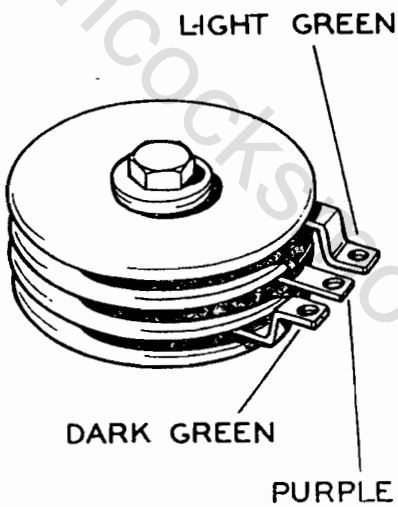
The alternator stator carries three pairs of series connected coils, one pair being permanently connected across the rectifier bridge network. The purpose of this latter pair is to provide some degree of charging current for the battery whenever the engine is running.

Connections to the remaining coils vary according to the position of the lighting switch, as shown schematically in Fig. 3, The basic charging circuits are as shown in Fig. 3 (a) (b) and (c) for lighting switch positions "Off", "Pilot" and "Head" respectively.

When no lights are in use the alternator output is regulated to its minimum value by interaction of the rotor flux and the flux set up by current flowing in the short-circuited coils.

In the "Pilot" position these coils are disconnected and the regulating fluxes are consequently reduced. The alternator output therefore increases and compensates for the additional parking light load.

In the "Head" position the alternator output is further increased by connecting all three pairs of coils in parallel.



GENERAL VIEW OF RECTIFIER

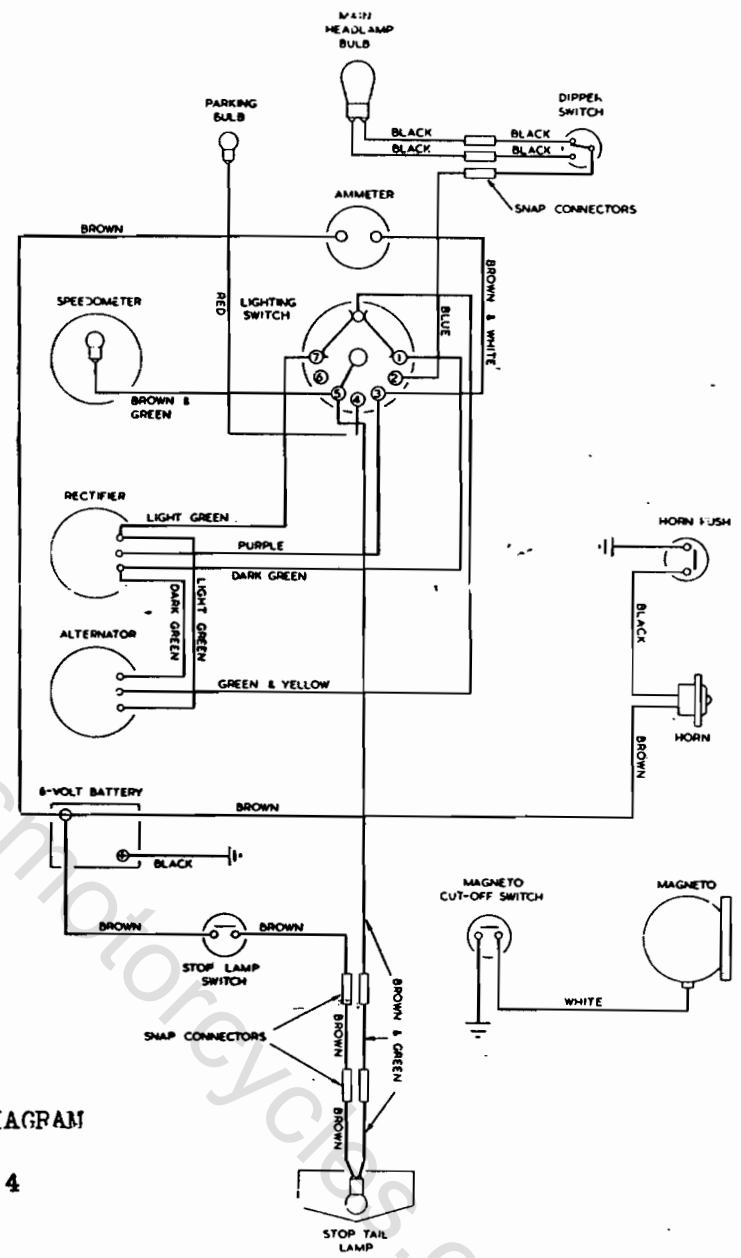
Fig. 2

4. Maintenance

If the rotor or stator or the engine crankshaft or rear half of the chain-case have been disturbed the air gap between the rotor and stator should be checked. If a feeler gauge at least .008 in. thick cannot be passed between the rotor and each of the stator poles the alignment should be checked.

The nuts which clamp together the rectifier plate assembly must not under any circumstances be slackened. They have been carefully set during manufacture to give correct rectifier performance. A separate nut is used to secure the rectifier to the frame of the motorcycle.

Make sure that all cable connections including the snap connectors are clean and tight and that insulation on the cables is not worn or burnt through.

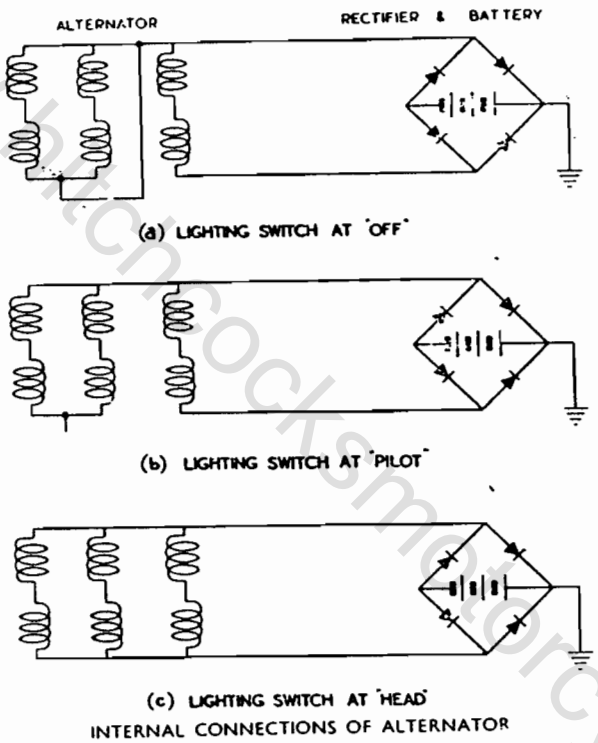


WIRING DIAGRAM

Fig. 4

CIRCUIT DIAGRAMS FOR POSITIONS OF LIGHTING SWITCH

Fig. 3



(a) LIGHTING SWITCH AT 'OFF'

(b) LIGHTING SWITCH AT 'PILOT'

(c) LIGHTING SWITCH AT 'HEAD'

INTERNAL CONNECTIONS OF ALTERNATOR

Section G4a

BATTERY MODEL PUZ7E

Trailblazer, Apache, Tomahawk, Woodsman

1. General

The model PUZ7E (see Fig. 1) is a "dry-charged" battery and is supplied without electrolyte but with its plates in a charged condition. When the battery is required for service it is only necessary to fill each cell with sulphuric acid of the correct specific gravity. No initial charging is required, but the battery must be left to stand at least one hour after filling before putting the machine into service.

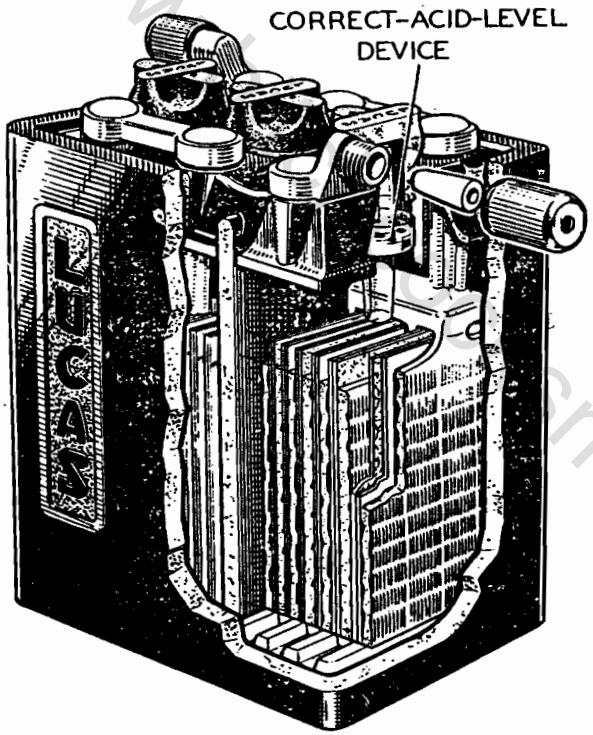


Fig. 1

2. Preparation for Service

The electrolyte is prepared by mixing together distilled water and concentrated sulphuric acid, using lead-lined tanks or suitable glass or earthenware vessels. Slowly add the acid to the water, stirring with a glass rod. Never add water to the acid, as this causes dangerous spurting of the concentrated acid. The specific gravity of the filling electrolyte depends on the climate in which the battery is to be used.

Specific gravity of electrolyte for filling "dry-charged " batteries:

Climates below 90°F. (32°C.)	Climates above 90°F. (32°C.)
Filling, 1.270	Filling, 1.210

The approximate proportions of acid and water to obtain these specific gravities:

To obtain specific gravity (corrected to 60°F.) of:	Add 1 vol. of 1.835 S.G. acid (corrected to 60°F.) to:
1.270	2.9 vols. of water
1.210	4.0 vols. of water

Heat is produced by the mixture of acid and water, the electrolyte should be allowed to cool before pouring it into the battery.

The specific gravity of the electrolyte varies with the temperature. For convenience in comparing specific gravities, they are always corrected to 60 degrees F., which is adopted as a reference temperature.

The method of correction is as follows:

For every 5 degrees F. below 60 degrees F., deduct .002 from the observed reading to obtain the true specific gravity at 60 degrees F. For every 5 degrees F. above 60 degrees F. add .002 to the observed reading to obtain the true specific gravity at 60 degrees F.

The temperature must be that indicated by a thermometer having its bulb actually immersed.

Fill the cells to the tops of the separators, in one operation. The battery filled in this way is 90% charged. When time permits, a short freshening charge for no more than four hours at the normal recharge rate of 1.5 amps should be made.

3. Routine Maintenance

Every two weeks (or more frequently in hot climates) examine the level of electrolyte in the cells and if necessary add distilled water to bring the level up to the tops of the separators. The use of a Lucas Battery Filler will be found helpful, as it ensures that the correct electrolyte level is automatically maintained and also prevents distilled water from being spilled on the top of the battery (see Fig. 2).

Occasionally examine the terminals, clean and coat them with vaseline. Wipe away all dirt and moisture from the top of the battery and ensure that the connections are clean and tight.

4. Servicing

If the battery is subjected to long periods of night parking with the lights on, without suitable opportunities for recharging, a low state of charge is to be expected.

Measure the specific gravity of the acid of each cell in turn with a hydrometer (see Fig. 3).

The following table shows the state of charge at different values of specific gravities:

State of Charge	Temperature under 90°F.	Temperature over 90°F.
Battery fully charged.	1.270 - 1.290	1.210 - 1.230
Battery about half charged.	1.190 - 1.210	1.130 - 1.150
Battery fully discharged.	1.110 - 1.130	1.050 - 1.070

If the battery is discharged, it must be recharged, either on the motorcycle by a period of daytime running or from an external D.C. supply at the normal recharge rate of 1.5 amp.

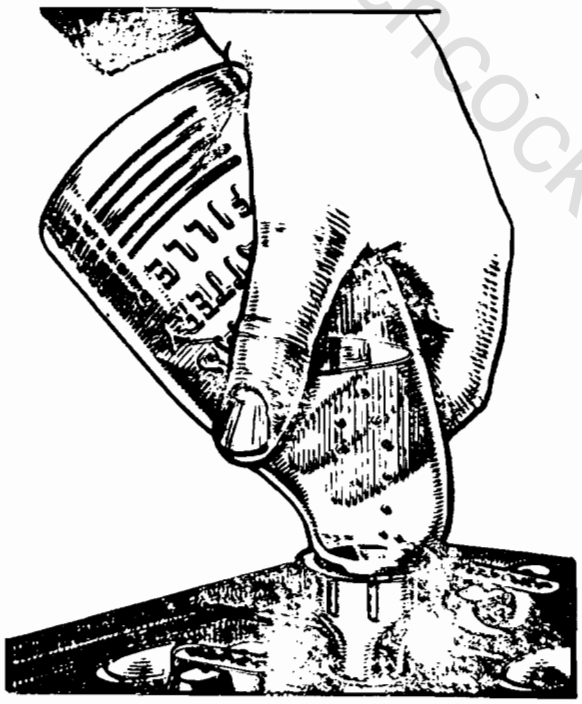


Fig. 2

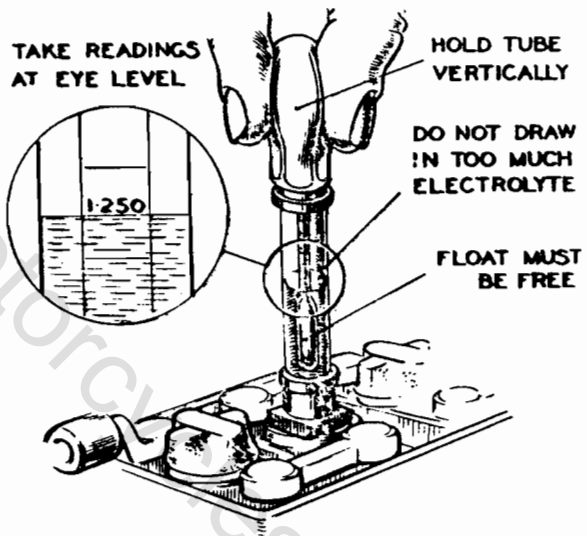


Fig. 3

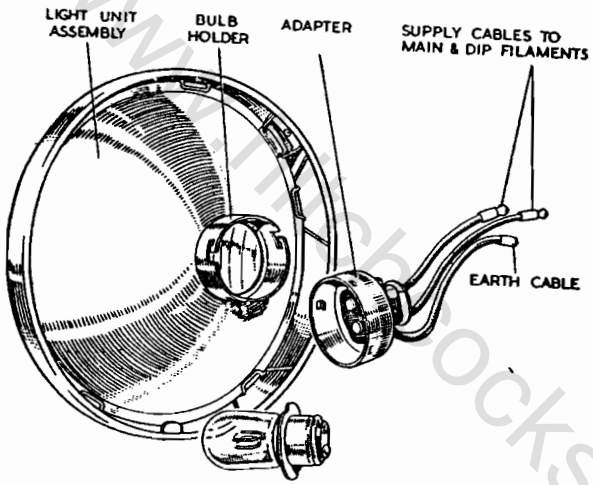
Section G5d

HEAD AND TAIL LAMPS

Apache, Trailblazer, Tomahawk, Woodsman

1. Headlamp

In all the above models the headlamp incorporates the Lucas Light Unit MCF700. This is built into the Casquette fork head which contains twin parking lamps as well as the ammeter and switch. (Tomahawk only).



HEADLAMP MCF700
Fig. 1

2. Lucas Light Unit

The unit incorporates a combined reflector and front lens assembly (see Fig.1). 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.

3. 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 bulb must be the Lucas "prefocus" type - 6 v. 30/24 watt Lucas No. 312.

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.

4. Parking Lights

Access to the parking bulbs is obtained by removing the parking lamp rim (see Fig.2). This is forced over the edge of the rubber lamp body and is additionally secured by means of a small fixing 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.

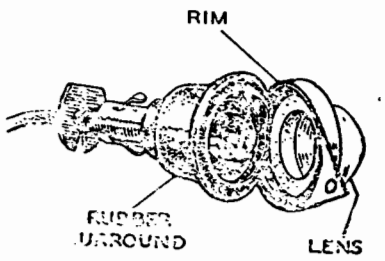
5. Tail Light

The Lucas Lamp, Type 564 (Fig. 3) is a combined stop and tail light and also incorporated as a reflector.

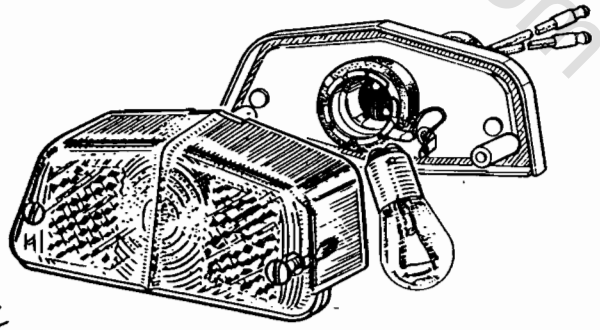
Access to the bulb is obtained by removing the two screws which secure the plastic cover.

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.

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.



PARKING LIGHT
Fig. 2



STOP-TAIL LAMP L.564
Fig. 3

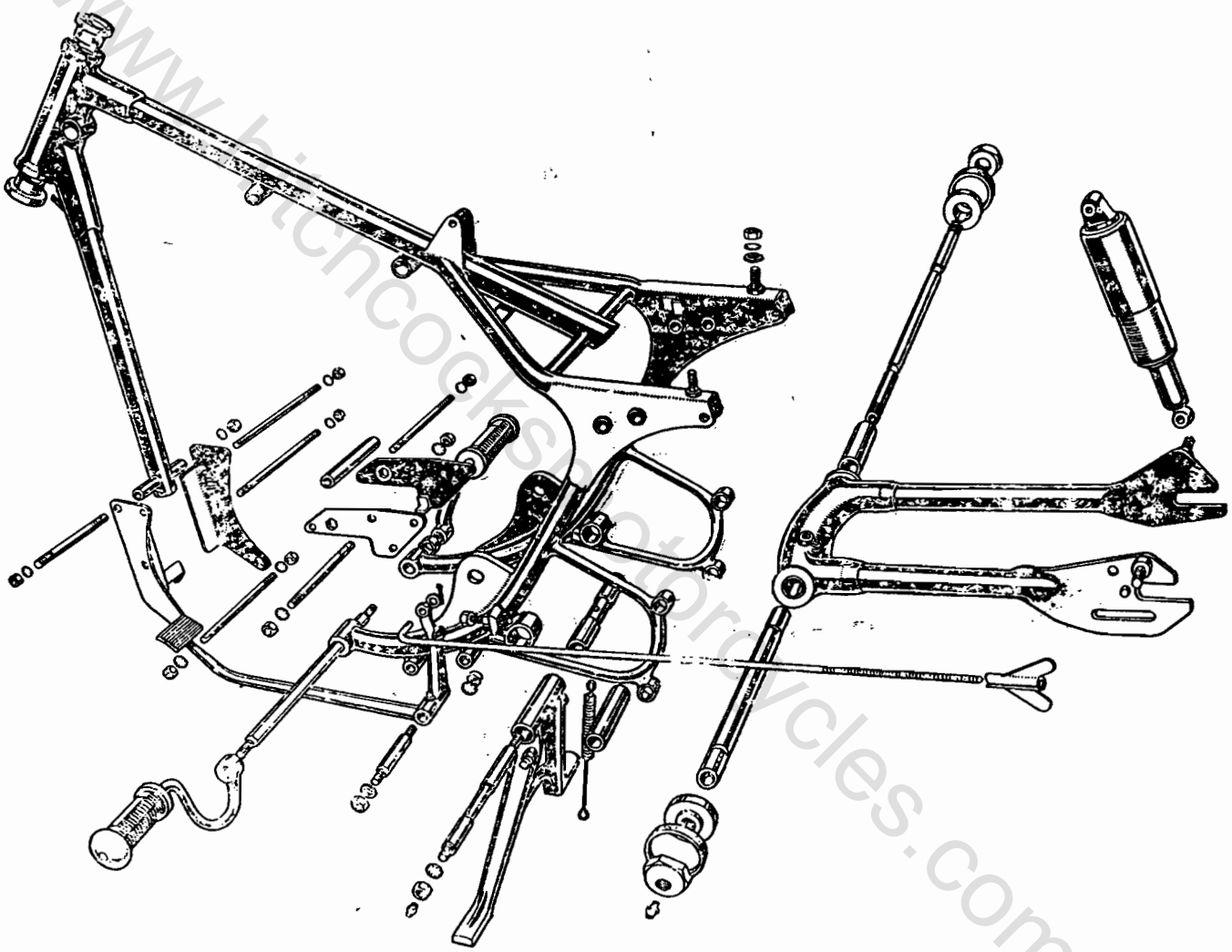
Section H2

FRAME

Apache, Trailblazer, Tomahawk, Woodsman

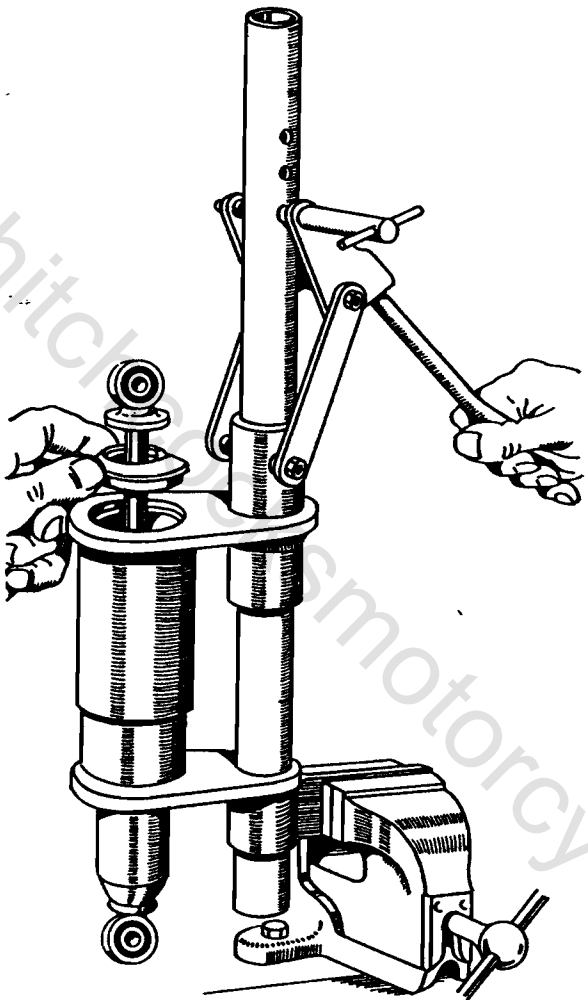
EXPLODED VIEW OF FRAME

Fig. 1



REAR SPRING COMPRESSOR

Fig. 2



1. 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 chromemolybdenum alloy steel tubing which retains its strength and resistance to fatigue after brazing or welding.

The swinging arm unit which forms the chain stays is provided with large diameter phosphor bronze bushes and pivots on a stout steel tube which is 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. The torsional rigidity of the swinging arm unit helps to maintain the rear wheel upright in the frame and thus relieves the wheel spindle of bending stresses to which it is subject with other types of rear suspension.

2. Steering Head Races

The steering head races, 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 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.

3. Removal of Rear Suspension Unit

The rear suspension units are readily removed by undoing the top pivot pin nut, driving out the pivot pin, then hinging the suspension unit back on the lower pivot pin, removing the lower nut and pushing the suspension unit off the pivot pin welded to the fork end.

4. 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.

The standard solo springs have a rate of 100 - 105 lbs. per inch and it is not difficult to compress these by hand. Heavier springs having a rate of 130 lbs. per inch are available which may require the use of a spring compressor, as shown in Fig. 2.

5. Removal of Swinging Arm Chain Stays

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, 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.

6. Center Stand

To remove the center 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.

7. 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 tires 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 fenders and, unless a straight edge cut away in its center portion is available, it will be necessary also to remove the cylinder, toolboxes, battery, etc., in order to allow an unbroken straight edge or a piece of taut string to contact the front and rear tires.

8. Lubrication

The steering head races, swinging arm pivot bearing and stand pivot bearing should be well greased on assembly. The swinging arm pivot 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.

Section J1

FRONT FORK

Apache, Trailblazer, Tomahawk, Woodsman

1. Description

The telescopic fork consists of two legs each of which comprises a main tube of chrome molybdenum alloy steel tubing which is screwed into the fork head at the upper end and securely clamped to the fork crown. Fitted over the lower end of the main tube is the bottom tube made of high strength aluminum with an integral lug which carries the wheel axle. Fitted on the lower end of the main tube is a steel bushing which is a close fit in the bore of the bottom tube. The upper end of the bottom tube carries a bronze bushing which is a close fit over the outside diameter of the main tube. The bushing is secured to the bottom tube by means of a threaded housing which contains an oil seal. A spring stud is fitted in the lower end of the bottom tube and a valve port is secured to the lower end of the main tube. As the fork operates a hydraulic damping system. A compression spring is fitted inside the main tube, between the upper end of the spring stud and the upper end of the main tube.

2. Operation of the Fork

The fork provides a range of movement of 6 in. from the fully extended to the fully compressed positions. 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 and tendency to pitching or oscillation without interferring 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 is always kept full of oil. Upward movement of the fork forces oil from the lower chamber, through the annular space between the spring stud and the bore of the main tube valve port into the damper chamber. During this stroke the pressure on the underside of the valve plate causes this to lift so that oil can also pass from one chamber through the eight holes in the valve body. Since, however, the diameter of one chamber is less than that of the other chamber there is not room to receive all the oil which must be displaced in the fork legs operation. The surplus oil passes through the crosshole in the spring stud and up the center hole in the stud, spilling out through the nut which secures the upper end of the spring stud to the bronze guide at the lower end of the fork spring.

On the rebound stroke the oil in the damper chamber is forced through the annular space between the spring stud and the bore of the main tube valve port. During this stroke pressure in the top chamber 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 controlled collar enters the main counterbore of the valve port thus forming a hydraulic cushion to prevent metal to metal contact.

3. Dismantling the Fork to Replace Spring, Oil Seal or Bearing Bushings

Place the machine on the center stand, disconnect the front brake control and remove the front wheel and fender complete with braces. Unscrew the bottom spring stud nut which will allow oil to run out of the fork down to the level of the crosshole 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 wrench on the flats with which it is provided or by using the gland nut hand grips, which are supplied for servicing the fork. The bottom tube can now be withdrawn completely from the main tube, leaving the bottom tube bushing, oil seal housing and oil seal in position on the main tube.

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

The steel main tube bushing can now be tapped off the lower end of the tube, if necessary using the bottom tube bushing for this purpose. Before doing this, however, it is advisable to mark the position of the bushing 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 bushings are finished ground to size after fitting onto the tubes so as to ensure concentricity. After removal of the main tube bushing the bottom tube bushing, oil seal housing and oil seal can be removed.

In case of difficulty in removing the main tube bushing 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 across flats, or a special tool.

4. 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 must be fitted over the end of the tube to prevent the thread from damaging the oil seal.

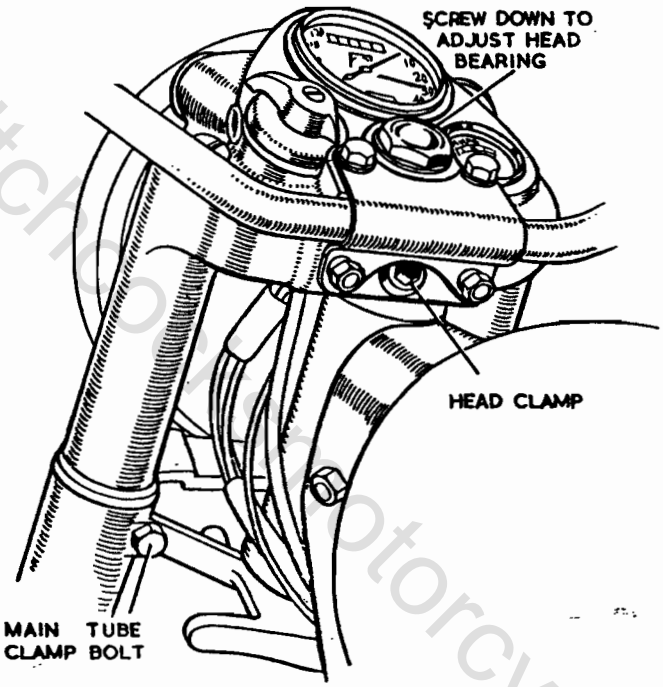
The spring stud is a tight fit in the hole at the lower end of the bottom tube. Once the stud has been entered in the hole push the bottom tube up sharply against the spring until two or three threads on the stud project beneath the end of the bottom tube. Now fit the nut and washer and pull the stud 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.

5. Steering Head Races

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

TOMAHAWK

Fig. 1

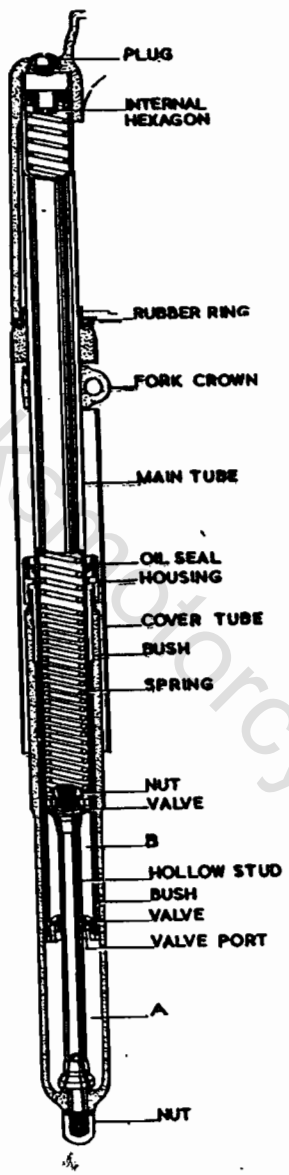


SHOWING THE POSITIONS OF THE CLAMP BOLTS SECURING THE STEERING STEM AND FORK TUBES

TOMAHAWK

SECTION OF FORK LEG

Fig. 2



containing 19 1/4 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. 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, if fitted, 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 are located centrally round the main tubes so that the bottom tube does not rub inside the lower cover tube. A pair of split bushes is useful to ensure centralization of the cover tubes.

6. Removal of Complete Fork

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

In the case of the Apache and Trailblazer 700 remove the headlamp complete with cable harness, having disconnected the leads from the battery and alternator.

In the case of the 500 Tomahawk the lighting switch and ammeter should be removed from the fork head and leads disconnected from them. The switch and ammeter are push fits into the rubber bushings in the fork head.

Disconnect the speedometer drive from the speedometer head and unscrew the steering damper knob and rod (if fitted) 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.

7. 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 3/8" diameter. If slightly tilted this will lodge 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 7 1/2 fluid ounces in each leg. Recommended grade of oil is S.A.E. 20.

Section K3

FRONT WHEEL

Apache, Trailblazer, Tomahawk, Woodsman

1. Removal of Front Fork

To remove the front wheel from the fork place the machine on the center stand and front stand, if fitted, or alternatively with sufficient packing (about 2 ") beneath each side of the stand to lift the wheel clear of the ground when tilted back on to the rear wheel. Slacken brake cable adjustments and disconnect cables from handlebar lever and from operating cam levers on hub. Unscrew the four nuts securing the fork bottom tube lug caps and allow the wheel to drop forwards out of the front fork. Make sure that the machine stands securely on the rear wheel and center stand - if necessary place a weight on the saddle or a strut beneath the fork to ensure this.

2. Removal of Brake Cover Plate Assemblies

Lock the brake "on" by pressure on the operating lever, (R.H.) or (L.H.) and unscrew the cover plate nuts. The right and left hand cover plate assemblies can then be withdrawn from the respective brake drums.

3. Removal of Brake Shoes and Springs

Unhook the springs from the shoes and lift away the latter. The pivot post and operating cam can then be withdrawn after removing the nuts which secure them.

4. Replacing Brake Linings

Brake linings are supplied either in pairs ready drilled complete with rivets or ready fitted to service replacement brake shoes. When riveting linings to shoes, secure the two center rivets first so as to ensure that the lining lies flat against the shoe. Standard linings are Ferodo MS3, which are drilled to receive flat headed rivets.

Note: Some hubs were supplied fitted with bonded brake linings with no rivets. These can be serviced only by the use of the service replacement brake shoes.

5. Removal of Hub Spindle and Bearings

To remove the hub spindle and bearings having already removed the brake cover plate assemblies, lift out the felt washers and spacing washers. Now hit one end of the wheel 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.

6. Hub Bearings

These are deep groove single row journal ball bearings 5/8" i/d by 1 9/16" o/d by 7/16" wide. The Skefko Part No. is RLS5. Equivalent bearings of other makes are Hoffmann LS7, Ransome and Marles LJ 5/8", Fischer LS7.

7. 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 spacers, which in turn are held up by the cover plate nuts. In order to prevent endways preloading 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 hub 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/.6247 in.
Shaft diameter	.6252/.6248 in.

8. Refitting Ball Bearings

To refit the bearings in the hub two hollow drifts are required, as shown in Fig. 2. 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 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 spacing washers, and the cover plate nuts, with either the cover plates themselves or additional packing washers behind the nuts. 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.

9. Reassembly of Brake Shoes to Cover Plates

Assemble the pivot pin and operating cam into the cover plate, putting a little grease on the cylindrical portion of the cam. Smear a little grease on the pivot pin and on the flat portion of the cam. Assemble the shoes in position and hook the springs into them. The easiest way to do this is to hold the brake assembly in a vice by means of the locknut on the pivot pin and then pull the springs by means of a loop of fine strong string.

10. Floating Cam Housings

Note that the cam housings are intended to be left free to float. The bolt holes in the cam housings are slotted and the securing pins are provided with double coil spring washers beneath their heads to enable them to be tightened sufficiently to prevent the cam housings moving under the influence of road shocks, while at the same time they can be, and should be, left free enough to be capable of being moved by hand in the direction of the slots. The

limit of float of the cam housing will be reached, after which the brake will continue to function as a fixed cam brake with some loss of efficiency. This can be restored by removing the shoes and fitting them in the opposite positions. Floating cam brakes are self-centering and there is no need to take any special precautions to see that the two linings are of equal thickness or that the brake shoe assembly is centered in the drum.

11. Refitting Brake Cover Plates

After assembling the brake shoe pivot pin and operating cams into the cover plates repack the hub bearings with grease.

Before fitting the spacing washers and felt washers make sure that the inside of the brake drums are quite clean and free from oil or grease, damp, etc., and replace the brake cover plate assemblies. Securely tighten the cover plate nuts.

12. Wheel Rim

The rim has forty holes for spoke nipples. The spoke holes are symmetrical, i.e., the rim can be assembled to the hub either way round. Rim diameter after building is 19.062 in., tolerances on the circumference of the rim shoulders where the tire fits being 59.930/59.870 in. The standard steel measuring tape for checking rims is 5/16 in. wide, .011 in. thick and its length is 59.964/59.904 in.

13. Spokes

The spokes are of the single butted type 8 - 10 gauge with 90 degree countersunk heads, angle of bend 95° to 100°, length 6 5/8 in., thread diameter .144 in., 40 threads per inch.

14. Wheel Building and Timing

The spokes are laced one over two and the wheel rim must be built central in relation to the nuts which secure the brake cover plates. The rim should be trued as accurately as possible, the maximum permissible run-out both sideways and radially being plus or minus 1/32 in.

15. Tire

When removing the tire 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 tire 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.

If the correct method of fitting and removal of the tire 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 tire. After inflation make sure that the tire is fitting evenly all the way round the rim. A line moulded on the wall of the tire indicated whether or not the tire is correctly fitted. If the tire has a white mark, indicating a balance point, this should be fitted near the valve.

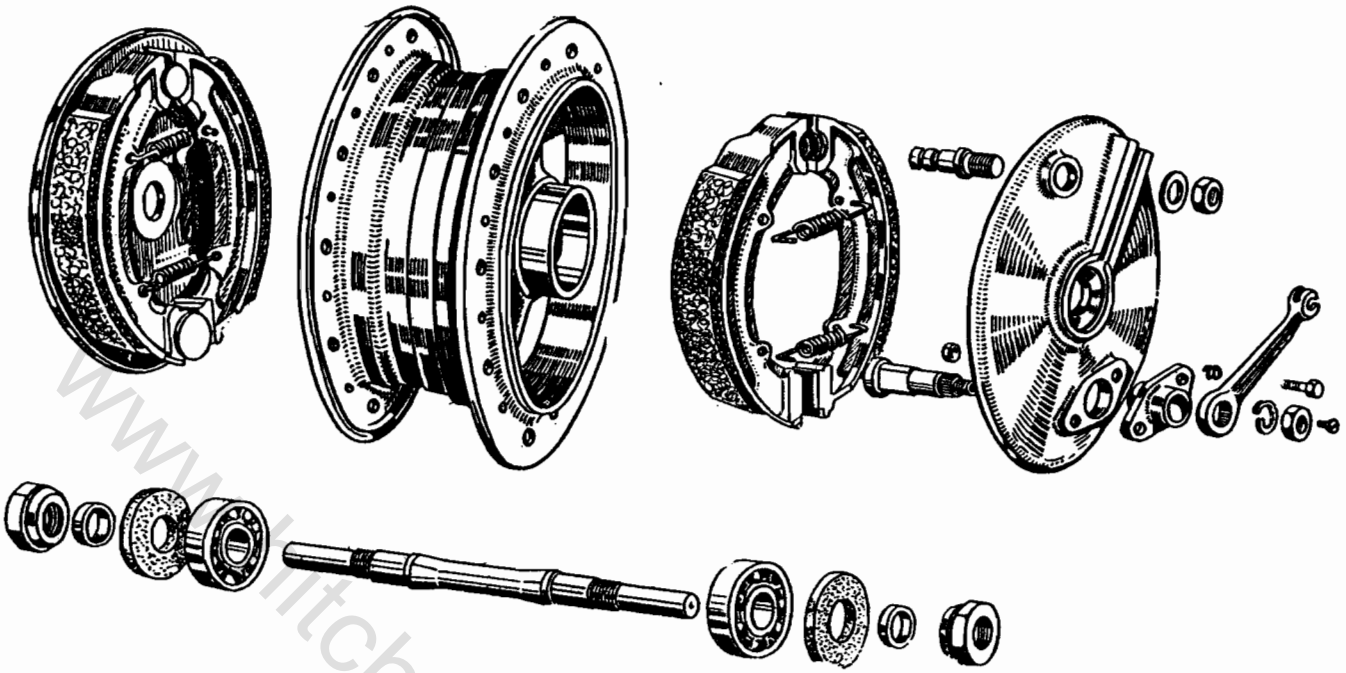
16. Tire Pressure

The recommended pressure for the front tire is 18 lb. per square inch for wheel loads up to 240 lb.

17. Lubrication

Two greasing points are provided both of which lead grease to the center of the hub barrel. Unless the barrel is packed full with grease on assembly (which is apt ot lead to trouble through grease finding its way past the felt seals on to the brake linings) these greasing points are of little value and the best way to grease the bearings is by packing them with grease after dismantling the hub as described above.

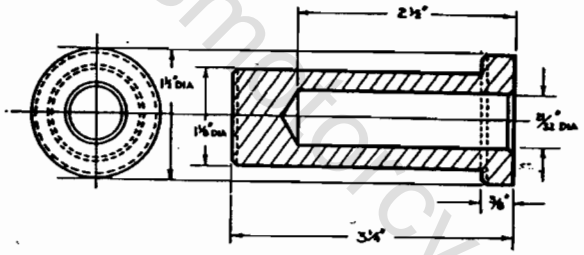
Note that the brake cams are drilled for grease passages but the ends of these are stopped up with countersunk screws instead of being fitted with grease nipples. This is done to prevent excessive greasing by over-enthusiastic owners. If the cams are smeared with grease on assembly they should require no further attention but in case of necessity it is possible to remove the screws, fit grease nipples in their place and grease the cams by this means.



DUAL FRONT BRAKE

Fig. 1

pins are secured by locknuts which are centre punched as an additional precaution.



DRIFT FOR REFITTING BEARINGS

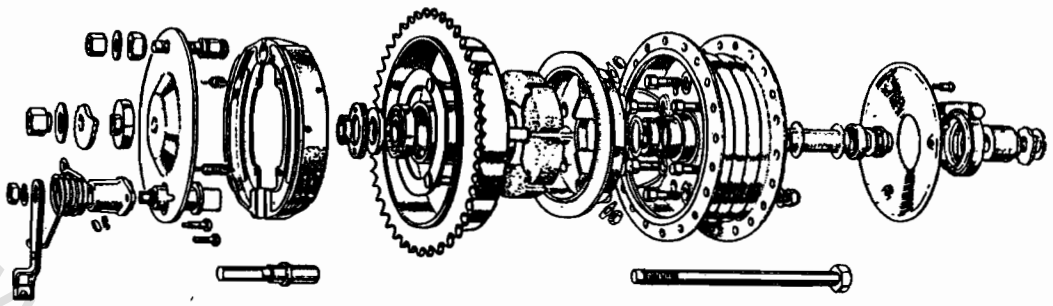
Fig. 2

The leading shoes (i.e. those towards the rear of the machine) have a servo action which render them more effective than the trailing shoes. This servo action causes the linings on the leading shoes to wear more quickly than those on the trailing shoes and at the same time tends to lift the leading shoes off the cams and press the trailing shoes harder on to the cams. With a fixed cam housing the result is that the majority of the cam pressure is applied to the less efficient trailing shoe. By leaving the housing free to float the cam can follow up the leading shoe thus maintaining equal pressure between the cam and the two shoes and so making full use of the more efficient leading shoe. Owing to the servo action the wear on the leading shoe with a floating cam housing is greater than that of the trailing shoe and in time the

Section L4

REAR QUICKLY DETACHABLE WHEEL

Apache, Trailblazer, Tomahawk, Woodsman



EXPLODED VIEW OF QUICKLY DETACHABLE REAR HUB

Fig. 1

1. 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 cush drive and also a 7 in. internal expanding brake.

2. Removal and Replacement of Main Portion of Wheel for Tire Repairs, etc.

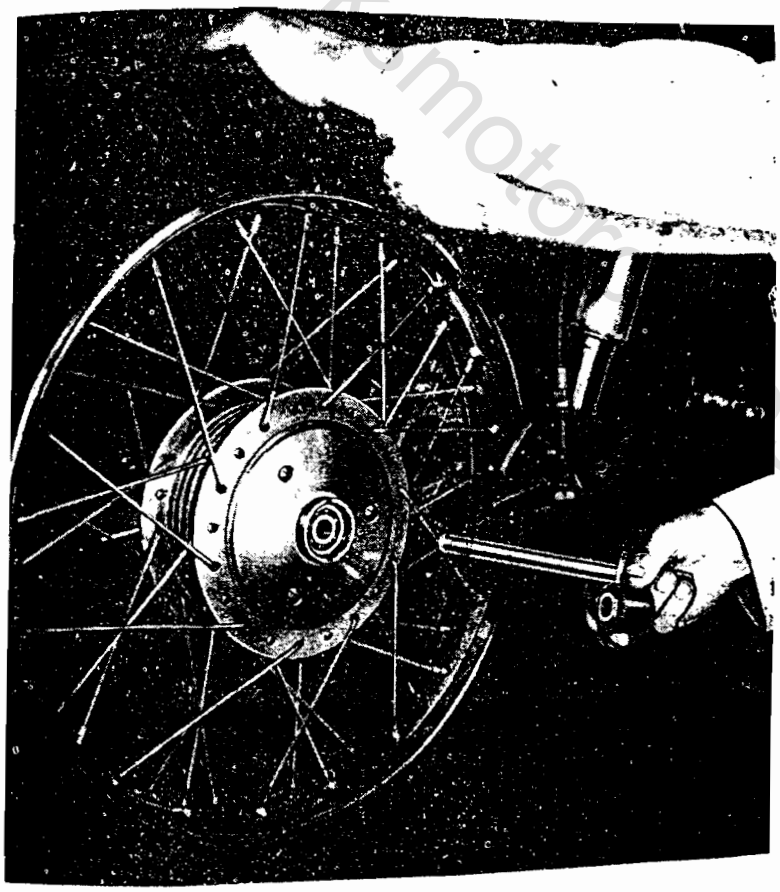
Place the machine on the center stand, if necessary putting packing pieces beneath the legs of the stand to lift the wheel clear of the ground. Remove the dual seat (if fitted) and the detachable portion of the rear fender. Unscrew the loose section of the spindle and withdraw this, together with the chain adjuster cam, preferably marking this to ensure that it is replaced in the same position. Now slide the spacing 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 tire. 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 lifted out of the machine.

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 center spindle make sure that the speedometer drive gearbox is correctly positioned so that there is no sharp bend in the driving cable.

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

Place the machine on the centre stand and remove the dual seat (if fitted) and detachable portion of the rear fender as if for removal of the main portion of the wheel only. Disconnect the rear driving chain at the spring link and remove the chain from the rear wheel sprocket leaving it in position on the gearbox countershaft 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 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. 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 light pressure on the brake pedal is necessary to put the brake on.



REMOVAL OF WHEEL (OFFSIDE VIEW)
Fig. 2

4. Removal of Brake Shoes for Replacement, etc.

Remove the complete wheel as described above, then remove the spindle nut, chain adjuster and the spacing collar, thus permitting the complete brake cover plate 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. The brake linings are bonded to the shoes and if requiring to be renewed, should be sent for servicing.

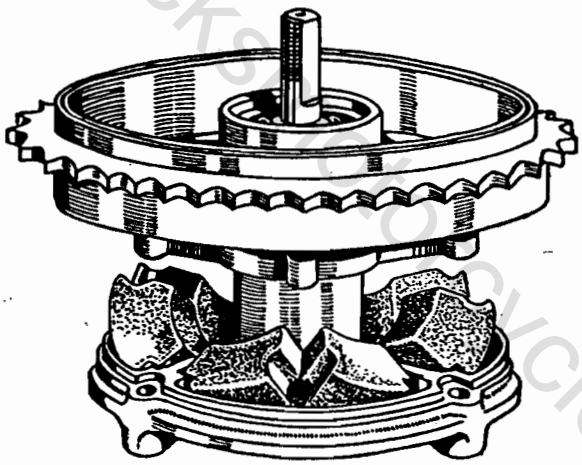
5. Removal of Brake Operating Cam and Brake Shoe Pivot Pin

The pivot pin is threaded into the torque plate from which it can be unscrewed after removing the locknut.

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.

6. 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.



RE-ASSEMBLY OF CUSH DRIVE

Fig. 3

If the cush drive rubbers become worn so that the amount of free movement measured at the tire exceeds 1/2 in. to 1 in., the rubbers should be replaced. To obtain access to them remove the complete wheel as described above; then unscrew 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, tighten 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.

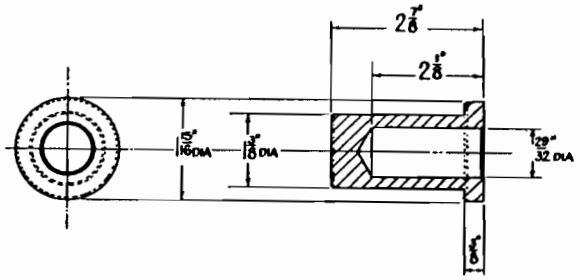
7. Removal of Ball Bearings

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 spacing collar and unscrew the bearing retaining ring with 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 spacing 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.

8. Removal of Hub Driving Pins

To remove the six driving pins from the aluminum 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.



DRIFT FOR RE-FITTING BEARING

Fig. 4

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Remove the complete wheel as described above, then remove the spindle nut, chain adjuster and the spacing collar, thus permitting the complete brake cover plate 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. The brake linings are bonded to the shoes and if requiring to be renewed, should be sent for servicing.

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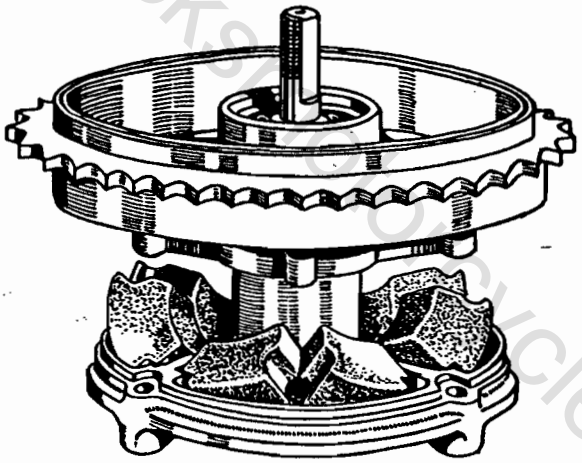

RE-ASSEMBLY OF CUSH DRIVE

Fig. 3

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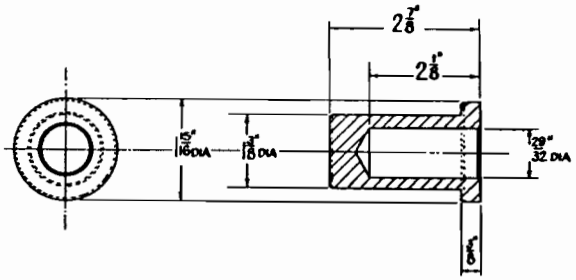

DRIFT FOR RE-FITTING BEARING

Fig. 4

9. Refitting Ball Bearings

To refit the sprocket/brake drum bearing, use a hollow drift as shown in Fig. 4. 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. First assemble 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 hubs, and assemble the second bearing, of the hubs, and assemble the second bearing, supporting the hub on the inner race of the other bearing. If the drift part 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.

10. Reassembly of Brake Shoes, Pivot Pin and Operating Cam into Cover Plate

No difficulty should be experienced in carrying out these operations. Make sure that the pivot pin is really tight in the cover plate and put a smear of grease in the grooves of the pivot pin and on the operating face of the cam; also on to the cylindrical bearing surface of 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.

11. Centering Cam Housing

Note that the bolt holes in the cam housing are slotted thus enabling the brake shoe assembly to be centered 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 centered 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 center the shoes in the drum. The screws should then be tightened dead tight and secured with the locknuts. If the shoes are not correctly centered 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 centered and the screws securing the cam housing correctly tightened wear on both linings should be approximately equal.

12. Wheel Rim

The wheel has 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 19.062 in., the tolerances on the circumference of the rim shoulders where the tire fits being 59.930/59.870 in. The standard steel measuring tape for checking rims is 5/16 in. wide, .011 in. thick, and its length is 59.964/59.904 in.

13. Spokes

The spokes are of the single butted type, 8 - 10 gauge, with 90 degrees countersunk heads, thread diameter, .144 in., 40 threads per inch. The inner

spokes are 6 5/8 in. long with an angle of bend 100 degrees and the outer spokes 6 3/4 in. long with an angle of bend 80 degrees.

14. 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 spacing collars. The rim should be trued as accurately as possible, the maximum permissible run-out both sideways and radially being plus or minus 1/32 in.

15. Tire

When removing the tire 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 tire 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.

If the correct method of fitting and removal of the tire 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 tire. After inflation make sure that the tire is fitting evenly all the way round the rim. A line moulded on the wall of the tire indicates whether or not the tire is correctly fitted. If the tire has a white mark indicating a balance point, this should be fitted near the valve.

16. Tire Pressures

The recommended pressures for the rear tire are 16 lb. per square inch for wheel loads not exceeding 280 lb., 18 lb. per square inch for loads up to 320 lb., 20 lb. per square inch for loads up to 350 lb., 24 lb. per square inch for loads up to 400 lb., 28 lb. per square inch up to 450 lb., and 32 lb. per square inch up to 500 lb.

17. Lubrication

Grease the bearing by packing them with grease after dismantling the hub 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.

Systematic Fault Location of Alternator Sets

The following tests are carried out in a systematic way, so that each unit is eliminated as the tests are carried out. This is the easiest way of checking the A.C. system and is broken into two parts, checking the A.C. side of the system and then the D.C. side.

The A.C. Test

The first thing to test is the alternator. Disconnect the three leads which come from the alternator and which are located under the seat of the motorcycle. Start the machine and run to 3,000 r.p.m., apply the A.C. voltmeter with the 1-ohm load to the following colored cables.

Note: All these are the minimum readings obtainable.

	Fire Arrow RM13 Lightweights	Tomahawk RM14 Twins
Dark Green & Light Green	3 Volts Minimum	4 Volts Minimum
Light Green & Mid-Green	6 Volts Minimum	6½ Volts Minimum
Mid & Dark Green Together & Light Green	8 ½ Volts Minimum	9 Volts Minimum

Systematic Fault Location of Alternator Sets

If these readings are not obtained in any of these connections, then the rotor is demagnetized and should be replaced. If only one of the readings is low, then the stator coil is shorted or grounded and a replacement stator should be fitted.

Do not demagnetize rotor if the readings are higher than given in the test, as this will be compensated for by the rectifier.

Reconnect the three leads and continue to rectifier test.

Rectifier Test

To test the rectifier disconnect the mid-green cable that comes from the alternator and goes into the harness. Join the mid-green and dark green cables together that come from the alternator, disconnect the brown colored lead which is on Terminal #2 (the center Terminal of the rectifier), connect the D.C. voltmeter with the 1-ohm load from Terminal #2 on the rectifier and ground. Start the machine and run to 3,000 r.p.m. There should be a minimum reading of 6.5 volts for the RM13 and 7.5 volts for the RM14, proving that the rectifier is passing the A.C. voltage through it and converting it to D.C. If you don't get these readings, check the center ground bolt of rectifier and ground, and providing these are good, then replace the rectifier as one of the plates is open circuited.

HOW TO LOCATE AND REMEDY TROUBLE

Condition	Possible Causes	Method of Detection and Remedy
Engine will not start.	Controls not set correctly for starting.	See that the ignition is switched on, gas turned on and everything is in order for starting.
	Contact breaker inoperative.	Crank the engine and check that the contact breaker opens and closes correctly.
	Contacts need cleaning & adjustment.	Clean & adjust the contact breaker as described above.
	Plugs not sparking.	Detach the high tension cables from the plugs. Hold the cables 1/8" (3.17mm) from the engine & see if a spark jumps the gap when the engine is cranked. (i) if a spark is produced, check the plugs by substitution. (ii) If no spark is produced, check the cables by substitution. Clean & check inside of cable cover.
	Defect in cut-out circuit.	Disconnect the remote cut-out and crank the engine. If the engine now starts, renew the connecting cable or switch.
	Incorrect timing.	Check the magneto-to-engine timing. (See Sec. C4).
Engine Misfires	Defective fuel supply.	Inspect the carburetor, gas supply, etc.
	Sparking plugs need cleaning & adjusting.	Remove plugs from engine. Clean off soot or carbon & check plug "points" for correct gap width (.018 in.)
	Contacts need cleaning and adjusting.	Clean and adjust the contact breaker.
	Defective high tension supply.	Check high tension cables by substitution. Clean and check inside of cable cover.

If, after making the above checks a fault in the magneto is suspected but cannot be located, the nearest Lucas Service Depot or the Indian Company should be called.

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