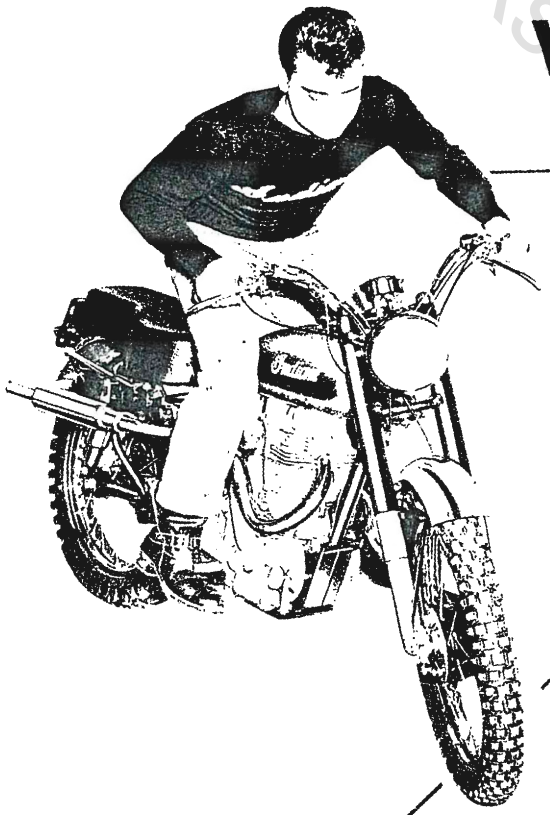
REPAIR and OVERHAUL

Indian

WOODSMAN



$1.50

THE Indian COMPANY
Springfield, Mass.

I N T R O D U C T I O N

These motorcycles are designed for highest quality performance. Carefully selected materials and precision construction provide exceptional ruggedness and quiet operation with minimum overall weight. Proper service methods are vital in maintaining the original performance characteristics of the machines.

The manufacturing and assembly tolerances of these models have been reduced to very small limits. The design moves almost entirely the need of measuring clearances. Due to this fact, care in the handling and cleaning of parts cannot be too highly stressed. An obsolutely clean working area, proper use of the correct tools and neat workmanship are required to accomplish the precise assembly necessary to assure satisfactory performance.

Special service tools have been designed to facilitate service operations and assure protection of the parts against damage and disfigurement. Further service information will periodically be published in the form of additional pages for this manual. Special information can be had at any time, from the Service Department.

500cc SINGLE CYLINDER WOODSMAN

WORKSHIP MANUAL

CONTENTS

500cc SINGLE CYLINDER WOODSMAN

SECTION A. TECHNICAL DATE

ENGINE

Cubic Capacity		499 cc
Stroke	Nominal	90 mm
Bore	Nominal	84 mm
	Actual	3.307"

(Rebore to .020" when wear exceeds .008" and again to .040" after a further .008" wear.)

Compression Ratio		7.25 to 1.
Piston Diameter		
Bottom of Skirt -	Fore and aft.	3.3047/3.3042"
	Top Lands.	3.287 /3.284"
Piston Rings.		
Width - Plain Rings (Two)		.063/ .062"
Scraper Rings (One)		.156/ .155"
Radial Thickness		.115/ .108"
Clearance in Grooves		.0035/.0015"
Replace Piston Rings when gap exceeds		1/16"
Oversize Pistons and Rings Available		.020" and .040"
Piston Boss Internal Diameter		.7500/.7498"
Piston Pin Diameter		.7500/.7498"
Con. Rod Small End Diameter		.7510/.75025"
Con. Rod Big End Diameter		1.62625/1.62575"
Crank Pin Diameter		.7507/ .7505"
Driving Side Main Ball Bearing (Two) Type.		SKF.CRL.8. and SKF.RLS.8.
Outside Diameter		2.25"
Inside Diameter		1.00"
Width		.625"
Timing Side Main Roller Bearing		
Outside Diameter		1.876 /1.875"
Inside Diameter		1.5002/1.4998"
Width		.750
Size of Rollers		
Diameter		.2500/ .2499"
Length		.328 / .327"

Graded Rollers are available of .0001" from .2490" to .2500".

Rocker Bearing Inside Diameter	.626/ .625"
Rocker Spindle Diameter	.624/ .6235"
Inlet Valve Stem Diameter	.3430/.3425"

Exhaust Valve Stem Diameter	.3410/.3405"
Valve Guide Internal Diameter	.3447/.3437"
Valve Guide External Diameter	.6275/.6270"
Guide Hole in Cylinder Head	.626 /.625 "
Tappet Stem Diameter	.375 /.374 "
Tappet Guide Internal Diameter	.376 /.375 "
Tappet Guide External Diameter	.7510/.7505"
Guide Hole in Crankcase	.750 /.749 "
Tappet Clearance with cold engine	
Inlet	Nil
Exhaust	Nil
Valve Spring Free Length	
Inner	2.032"
Outer	2.095"
(Renew when reduced by 3/16 inch).	
Valve Timing with .012" clearance	
Exhaust Opens	75° before B.D.C.
Exhaust Closes	35° after T.D.C.
Inlet Opens	40° before T.D.C.
Inlet Closes	70° after B.D.C.
Cam Spindle External Diameter	.6240/.6235"
Cam Bushing Internal Diameter	.6255/.6245"
Cam Lift	.3125"
Valve Lift (Approx.)	.3125"
Mag-dyno	
Speed	Half Engine Speed
Points	.015/.018"
Timing	3/8 before T.D.C.
Engine Sprocket	25 Teeth
Clutch Sprocket	56 Teeth
Final Drive Sprocket	17 Teeth
Primary Chain	
Type	Duplex 114038
Length	90 Pitches
Width	.628"
Pitch	.375"
Feed Oil Pump	
Speed	1/12 Engine Speed
Piston Dia.	.24975/.2495"
Stroke	.500"
Return Oil Pump	
Speed	1/12 Engine Speed
Piston Diameter	.37475/.3745"
Stroke	.500"
Spark Plug	
Type	KLG. FE. 100
Diameter	14 mm.

500cc SINGLE CYLINDER WOODSMAN

SECTION B. ENGINE SPECIFICATION

1. Engine
2. Cylinder Head
3. Cylinder
4. Piston
5. Connecting Rod
6. Crankcase
7. Crankshaft & Flywheel
8. Main Bearings
9. Cams
10. Valves
11. Valve Gear
12. Timing Drive
13. Ignition and Lighting System
14. Carburetor
15. Air Filter
16. Lubrication System
17. Breather
18. Gearbox
19. Clutch

500cc SINGLE CYLINDER WOODSMAN

SECTION B. ENGINE SPECIFICATION

B.1. ENGINE

The engine is a 499 cc vertical single-cylinder four-stroke with separate cylinder head and fully enclosed pressure-fed overhead valve gear. It has dry sump lubrication with the oil tank integral with the crankcase and a built-up steel crankshaft.

B.2. CYLINDER HEAD

The cylinder head is die-cast from aluminum alloy with ample finning to ensure adequate cooling. The exhaust pipe insert is cast in and the valve inserts are of austenitic iron and are shrunk in so that they are replaceable.

The large bore induction port is streamlined and blended to the valve seating.

B.3. CYLINDER

The cylinder barrel is cast from aluminum alloy or austenitic iron and has a liner of austenitic iron. The cylinder head is lapped onto the barrel without any gasket and is located by a pin, in the case of aluminum head and cylinder barrel. A gasket is used when aluminum head and cast iron barrel is used. The bore is norminally 84 mm and the stroke 90 mm giving a cubic capacity of 499 cc.

B.4. PISTON

The high compression piston is of low expansion aluminum alloy, heat treated, and form-turned oval. The compression ratio is 7¼ to 1. There are three piston rings, the top two of which are compression rings. Both are taper ground and one is chromium plated. The third ring is for oil control and is slotted.

B.5. CONNECTING ROD

The connecting rod is produced from a stamping of Hiduminium RR56 light alloy. The little end bearing is of alloy direct onto the piston pin. In case of wear after long service the little end can be bored out and fitted with a bushing, but this is rarely necessary.

The big end has a hardened chrome steel bushing pressed in and a floating bushing made from mild steel and white-metalled.

B.6. CRANKCASE

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

B.7. CRANKSHAFT AND FLYWHEEL

The crankshaft is built up from two steel flywheels bolted to the crank pin and bolted and keyed to the engine shafts, the whole being carefully balanced.

B.8. MAIN BEARINGS

On the driving side there are two bearings, one ball and one roller, both having inner and outer races, while on the timing side there are a roller bearing, with the rollers running on the shaft, and a plain phosphor bronze bushing.

B.9. CAMS

The cams are integral with the cam gears being machined from carbon steel and case hardened. They have internal bronze bushings running on fixed shafts in the timing case. The cam profiles are produced with silencing ramps to ensure quiet running.

B.10. VALVES

The inlet valve is machined from a stamping of Silicon-chrome valve steel and the exhaust valve is of austenitic steel.

B.11. VALVE GEAR

The valves are operated from the cams by means of large flat-based guided tappets, high quality tubular steel push rods, with steel caps, and overhead rockers. Two compression springs are fitted to each valve.

B.12. TIMING DRIVE

The cams are located in the timing case and are driven at half engine speed from the crankshaft by a positive geared drive.

The mag-dyno is driven from the inlet cam gear through two idler gears which also act as a gear pump to return the oil from the timing case to the oil tank.

B.13. IGNITION AND LIGHTING SYSTEM

Lighting and ignition are supplied from a Lucas Mag-dyno, which consists of a magneto running at ½ engine speed and a dynamo running at 1 1/3 engine speed.

B.14. CARBURETOR

Amal type 276/CX/1A.

B.15. AIR FILTER

The air supply to the carburetor is cleaned by a Vokes Micro-Vee Filter fitted direct onto the carburetor intake.

B.16. LUBRICATION SYSTEM

Lubrication is by a 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 piston type oil pumps running at 1/12 engine speed, positively driven from the timing side engine shaft through a worm gear.

The feed pump at the rear of the timing cover is for pumping oil from the tank to the big end bearing. This oil drains to the bottom of the crankcase and is pumped by the return pump back to the tank.

Some of the return oil is by-passed to the cylinder head for lubricating the rocker gear, whence it flows down to push rod tunnels to the timing case.

From here it is returned to the tank by the two idler gears in the timing drive which act as a gear pump.

The return pump has a capacity of approximately double that of the feed pump, which ensures that oil does not accumulate in the crankcase.

Both pumps are double-acting, but the two sides of the feed pump are interconnected, thereby giving an augmented and more even supply to the big end. Both sides of the return pump are also interconnected for draining the crankcase.

Separate spring-loaded relief valves control the pressure to the big end and to the valve gear. The oil supply to the big end is through internally drilled passages and that to the valve gear is through an external pipe.

Gauze strainers are provided for the feed oil leaving the tank and for the return oil from the crankcase. In addition, the feed oil to the big end is pumped under pressure through a large capacity felt filter.

An important feature of the design of this filter is that the internal arrangement is such that, should it be neglected and become clogged, the oil pressure will lift the spring end cap off its seating thereby automatically by-passing the filter so that the big end will not be deprived of lubrication, even though the oil may be dirty.

B.17. BREATHER

The efficient operation of the breather is of paramount importance to the performance of the engine because 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 cylinder and consequent smoking and oiling of the plug.

The breather is located on the driving side of the crankcase and consists of a small housing containing two pen-steel discs covering two holes drilled in the crankcase.

Accurate seating of the discs is ensured by a pen-steel plate held between the breather body and the crankcase.

B.18. GEARBOX

The gearbox is bolted onto 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.

The standard gear ratios are as follows, 6.06, 7.9, 10.9, 16.8 to 1.

B.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 cork inserts which give smooth operation and freedom from slipping in the presence of oil.

500cc SINGLE CYLINDER WOODSMAN

SECTION C. SERVICE OPERATIONS WITH ENGINE IN FRAME

1. Removal of Timing Cover
2. Valve Timing
3. Tappet Adjustment
4. Ignition Timing
5. Removal of the Gas Tank
6. Removal of the Cylinder Head
7. Removal of the Valves
8. Removal of the Rockers
9. Removal of the Valve Guides
10. Removal of the Cylinder Barrel
11. Removal of the Piston
12. Decarbonizing
13. Grinding in the Valves
14. Re-assembly after Decarbonization
15. Cleaning the Oil Filter
16. Overhaul of the Oil Pumps
17. Removal of Pump Worm and Timing Gear
18. Removal of the Mag-dyno Gear
19. Primary Chain Adjustment
20. Removal of the Engine and Clutch Sprocket
21. Removal of the Tappets and Guides
22. Dismantling the Breather
23. Removal of the Clutch
24. Removal of the Final Drive Sprocket
25. Pressure Relief Valves
26. Removal of the Mag-dyno

SECTION C. SERVICE OPERATIONS WITH ENGINE IN FRAME

C.1. REMOVAL OF THE TIMING COVER

First place a tray under the engine to catch the oil which will escape when the cover is removed.

Remove the exhaust pipe and silencer.

Remove nine screws from the cover, taking care not to lose the sealing washers, one for each screw.

Draw off the timing cover, tapping it lightly if necessary.

In refitting the timing cover see that the gasket is correctly located over the oil holes, using a little grease (not compound) to hold it in position.

See that the cork plug is in position in the hole in the pump worm. If the plug is damaged it should be renewed to ensure oil pressure to the big end bearing.

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

The filter chamber should be filled with clean oil before the timing cover is refitted.

To verify that the oil pumps are working after replacing the cover, start the engine up and remove the oil filler cap so that the oil return pipe can be seen. It may take several minutes before there is sufficient oil in the engine for the return flow through the relief valve to commence.

C.2. VALVE TIMING

The cams are integral with the cam gears and the position for correct timing is marked on the gears by small dots.

Rotate the engine to top dead center and put the exhaust (or right hand) cam gear in position so that the pair of dots on it are opposite the pair of dots on the timing gear on the crankshaft.

Put the inlet (or left hand) cam gear in position so that the single dot on it is opposite the single dot on the exhaust cam gear.

The correct timing at .012" clearance is as follows:

Exhaust opens 75° before bottom dead center.

Exhaust closes 35° after top dead center.

Inlet opens 40° before top dead center.

Inlet closes 70° after bottom dead center.

C.3. TAPPET ADJUSTMENT

The tappets are adjusted by the ball and socket joints which are located in a compartment at the side of the cylinder and access to which is obtained by removing the inspection cover.

Before checking the clearance or making any adjustment, rotate the engine until the piston is at the top of the firing stroke. This will ensure that both valves are closed and that the tappets are well clear of the silencing ramps on the cams. If the cylinder head has been dismantled, make sure that the end caps have been put back on the valve stems.

Because of the ball and socket joints at the bottom of the push rods, the tappet clearance cannot be measured there but between the valve stems and rockers, with the rocker box covers removed. To remove the rocker box covers the gas tank must be taken off. (See Section C.5).

The correct clearance is nil or as little as possible with the engine COLD.

To make the adjustment hold the push rod bottom and (Top hexagon) and turn the locknut (Middle hexagon) to the left. Screw the push rod cup (Bottom hexagon) to the left to take up clearance or to the right to increase the clearance, at the same time holding the push rod bottom end (Top hexagon). Lock the adjustment by tightening the locknut against the push rod end and then re-check the clearance.

Owing to the initial bedding down of the wearing surfaces, the tappets on new engines may require adjustment after the first few hundred miles.

C.4. IGNITION TIMING

The setting of the ignition timing depends upon the position of the mag-dyno gear relative to the mag-dyno shaft.

To obtain access to the mag-dyno gear it is necessary to remove the timing cover (See Section C.1).

The gear is mounted on a smooth taper on the mag-dyno shaft and held in position by a nut (RIGHT HAND THREAD). To remove the gear undo the nut and use the special extractor (See Special Tool Section).

Before setting the timing adjust the Contact breaker points to a clearance of .015 inch when fully opened and put the ignition lever in the full advance position. See that the screw in the magneto ring is in the end of the slot and that the ring is not sticking.

To set the timing, turn the engine until the piston is 3/8 inch before top dead center on the compression stroke, i.e. with both valves closed.

Insert a piece of thin tissue paper between the points of the contact breaker and turn the magneto forwards until the paper can just be pulled out. Give the gear a sharp tap to secure it on the shaft and then lock it by tightening the nut.

C.5. REMOVAL OF THE GASOLINE TANK

Turn off the gas tap.

Disconnect the gas pipe.

Remove the two bolts which secure the tank to the frame at front and rear and it can then be lifted clear.

C.6. REMOVAL OF THE CYLINDER HEAD

Remove the gas tank (See section C.5.).

Disconnect the engine steady.

Disconnect the plug lead and oil pipe.

Remove the exhaust pipe.

Push the carburetor back clear of the studs after removing the fixing nuts.

Remove the rocker box covers.

Remove the decompressor cable from the lever on the handlebar.

Turn the engine until both valves are closed.

Remove the rockers and bearings complete by undoing four $\frac{1}{4}$ inch nuts on each.

Lift out the push rods.

Remove six nuts, taking care not to lose the washers.

The head is lapped onto the cylinder barrel and the joint is made with compound. To break the seal, tap the head gently beneath the exhaust and inlet ports, NOT beneath the fins.

Lift the cylinder head off the barrel.

Before replacing the cylinder head clean off all the old compound from the joint and smear it with new compound.

Replace the six nuts and tighten them progressively and diagonally from one side to the other to prevent distortion.

Replace the pushrods with the adjustable parts downwards, remembering that the shorter rod is the inlet.

Replace the rockers and bearings, making sure that the oil feed holes are at the bottom and that the caps and bases are in line when tightened down. A sharp tap with a hammer on the end of the rocker will help to ensure this.

See that the rocker box gaskets are intact and replace the rocker box covers.

After the engine has been run long enough to get thoroughly hot, the tightness of the nuts should be re-checked.

It will be found convenient for this purpose to use a small auxiliary gas tank while the engine is being warmed up on the stand, because all the cylinder head nuts are not accessable with the proper tank in position.

C.7. REMOVAL OF THE VALVES

Remove the Cylinder Head and Rockers (Section C.6.).

Pry away the hardened steel thimble or end cap. If this has stuck it can be removed by means of a screwdriver.

Using a suitable compressing tool, compress the valve springs and remove the split conical collars 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 collars together in order that they may be re-assembled with the valve from which they were removed.

Deal similarly with the other valve in the head.

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

C.8. REMOVAL OF THE ROCKERS

See Section C.6.

C.9. REMOVAL OF THE VALVE GUIDES

To remove the valve guides from the head two Special Tools are required which can easily be made. (See special tool section).

The first is a piece of tube with an internal bore of not less than 7/8 inch.

The second is a mandrel about 4 inches long made from 9/16 inch diameter bar with the end turned down to 11/32 inch diameter for $\frac{1}{2}$ inch.

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

To fit a new guide, support the head at the correct angle and use a hand press and the same mandrel. If a hand press is not available and the guide is replaced by a hammer, use the mandrel to prevent damage to the guide which is of cast iron and must be treated with great care.

It is necessary to re-cut the valve seat and grind in the valve after a guide has been replaced.

C.10. REMOVAL OF THE CYLINDER BARREL

Remove the Cylinder Head (Section C.6.).

Put the piston at bottom dead center.

Remove the $\frac{1}{4}$ inch nut above the tappet chest and lift the barrel off.

When replacing the cylinder barrel, clean off the joint faces and fit a new paper washer.

C.11. REMOVAL OF THE PISTON

Remove the cylinder head and cylinder barrel (See Sections C.6. & C.10.).

With the tang of a file remove the wire circlip retaining the piston pin on the timing side.

Extract the piston pin using Special Tool (See tool section) (with adaptor), having first marked the pin so that it, and the piston, may be replaced the same way round.

During this operation put a piece of clean cloth in the top of the crankcase to prevent foreign matter getting in. In particular, take care not to drop the circlip in the crankcase.

C.12. DECARBONIZING

Having removed the cylinder head as described in Section C.6. scrape away all carbon, bearing in mind that you are dealing with aluminum which is easily damaged. Scrape gently to 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.

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 careful not to cause any damage to the valve faces.

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

While the cylinder and piston are not in position, 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 piston when the mouth of the crankcase is open.

C.13. GRINDING IN THE VALVES

Wipe the valve faces clean and examine them carefully. If they are at all pitted, have the faces re-cut. Pay similar attention to the valve seats in the head; excessive grinding will form a pocket and the gas flow will be restricted. The angle of

the valve face should be 45 degrees to the axis of the valve stem.

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 onto its appropriate guide, press it into the seat using a tool with a suction cup and with a backwards and forwards rotary motion, grind it onto its seat. 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.

C.14. 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 brown paper.

When re-assembling the engine, it is advisible to fit a new paper gasket between the cylinder barrel and the crankcase.

Smear clean oil over the piston, having replaced the rings if these have been removed, lower the piston over the connecting rod and insert the piston pin. Fit the circlip securing the piston pin.

If the piston ring gaps exceed 1/16" when the rings are in position in the barrel, new rings should be fitted. The correct gap for new rings is .011 - .015 inch. 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.

Oil the cylinder bore and lower the barrel over the piston and seat it gently on the paper gasket. Tighten down the nut above the tappet chest and replace the cylinder head and rockers as described in Section C.4.

C.15. CLEANING THE OIL FILTER

The oil filter is located in the timing cover immediately below the oil pumps. The felt element should be taken out and washed in gasoline after the first 500 miles and 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. 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. If the timing cover has been removed, fill the filter chamber with clean oil before replacing the cover.

C.16. OVERHAUL OF OIL PUMPS

Remove the timing cover as described in C.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 with Special Tool (See tool section), 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 paste.

Check the pump disc springs for fatigue by assembling in the timing cover and placing the pump covers in position. The latter should be held 1/8" inch off the timing cover if the springs are correct.

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.

Before replacing the timing cover on the engine, fill the filter chamber with clean oil.

The oil feed to the big end can be checked by partially unscrewing the feed plug in the timing cover between the oil pumps, and the oil return to the tank can be checked by removing the oil filler cap.

C.17. REMOVAL OF PUMP WORM AND TIMING GEAR

Unscrew the worm shaft by a hexagon head behind the worm, using Special Tool (see tool section). This is a LEFT HAND THREAD.

Withdraw the timing gear by means of a flat chisel placed behind the gear and tapped gently.

C.18. REMOVAL OF THE MAG-DYNO GEAR

Remove the timing cover and take off the hexagon nut holding the gear.

Extract the gear with the Special Tool (see tool section).

C.19. PRIMARY CHAIN ADJUSTMENT

Access to the primary chain adjuster is gained by removing the primary chain 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.

The chain should be adjusted so that there is $\frac{1}{4}$ inch up and down movement at the center of the top run of the chain.

After replacing the chain cover, remember to replenish the chaincase with oil.

C.20. REMOVAL OF THE ENGINE AND CLUTCH SPROCKETS

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

Unscrew the engine sprocket nut so that the engine sprocket, which is mounted on splines, can 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 distance pieces, clutch front plate, center retaining ring and the assembly of driving and driven clutch plates. The clutch sprocket can then be withdrawn from the center after removal of the large circlip which secures it.

C.21. REMOVAL OF THE TAPPETS AND GUIDES

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

To remove the guides use Special Tool (see tool section).

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

C.22. 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 compound very sparingly to the back of the steel plate taking great care to keep it away from the discs or their seatings.

C.23. REMOVAL OF THE CLUTCH

Remove the engine sprocket and clutch sprocket together as described in C.20.

To remove the clutch hub, hold the clutch with Special Tool (see tool section) and remove the center retaining nut and washer with a box wrench.

The hub can then be withdrawn from the shaft with Special Tool (see tool section).

C.24. REMOVAL OF THE FINAL DRIVE SPROCKET

Remove the clutch as described in C.23.

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.

C.25. PRESSURE RELIEF VALVES

There are two Pressure Relief Valves in the oil feeds to the big ends and to the rocker gear respectively. Their function is to prevent excessive pressure and their setting is not critical. The feed to the rocker gear comes from the return oil from the crankcase to the tank.

The pressure relief valves are set before leaving the factory and should not normally require to be desturbed. If, however, it is found necessary to dismantle either of them, they can be reset as follows:

ROCKER FEED RELIEF VALVE. This is located on the outside of the crankcase immediately below the lower end of the external oil pipe. It has a hexagon head and can be removed complete by unscrewing it out of the case.

The valve itself cannot be dismantled and, if found to be faulty, should be replaced by a new one.

BIG END RELIEF VALVE. This is located in the timing-side crankshaft and can only be adjusted when the crankshaft has been dismantled. It consists of a 5/16 inch dia steel ball and spring held in position by a screwed plug.

The valve is set to open when the oil pressure exceeds about 35 lbs per square inch and when set correctly there is a movement of about 3/32 inch of the ball off the seat. This can be measured without dismantling the crankshaft by pushing a thin rod through the

hole in the pump worm with the oil feed plug in the timing cover removed.

If the crankshaft is dismantled for any reason, it is always advisable to fit a new spring to the relief valve in case the original one has become weak.

If the valve is set to give too high pressure, the pump disc will be forced off its seating.

C.26. REMOVAL OF THE MAG-DYNO

Remove the mag-dyno gear (Section C.18.).

Unscrew the nut on the fixing strap bolt and swing the strap clear.

The mag-dyno can then be withdrawn.

In replacing the mag-dyno, see that the felt washer, retainer and spring are in position.

500cc SINGLE CYLINDER WOODSMAN ENGINE

SECTION D. REMOVAL OF ENGINE FROM FRAME

1. Disconnect the battery leads and remove the battery.
2. Turn off the gas and disconnect the gas pipe.
3. Take the slides out of the carburetor.
4. Remove the air cleaner.
5. Remove the exhaust pipe.
6. Disconnect the electric horn leads.
7. Disconnect the control cable from the mag-dyno.
8. Disconnect the Engine steady.
9. Remove the Rear Chain.
10. Remove the footrest bar.
11. Support the engine on a suitable box or wood block.
12. Remove the center stand and the stand stop.
13. Remove the front engine plates.
14. Remove the bolt securing the rear engine plate to the frame.
15. Lift the Engine and Gearbox out.

500cc SINGLE CYLINDER WOODSMAN

SECTION E. SERVICE OPERATION WITH ENGINE REMOVED

1. Removal of Gearbox.
2. Dismantling the Crankcase.
3. Main Bearings.
4. Replacement of the Cam and Idler Spindles.
5. Flywheel Assembly.
6. Re-Assembly of the Crankcase.

500cc SINGLE CYLINDER WOODSMAN

SECTION E. SERVICE OPERATIONS WITH ENGINE REMOVED

E.1. REMOVAL OF GEARBOX

Remove the primary chain case, engine sprocket and clutch (See Section C.24).

Remove four 3/8 inch nuts and the gearbox can then be withdrawn from the engine.

E.2. DISMANTLING THE CRANKCASE

Drain the oil tank by removing the drain plug.

Having removed the engine from the frame as described in Section D, dismantle the cylinder head, barrel, piston, timing gear, mag-dyno, etc., as described in Section C.

Remove the nuts on the driving side of the engine from four fixed studs at the rear of the crankcase.

Remove six studs passing through the crankcase.

The two halves of the crankcase can then be separated.

The timing side outer roller race and the bronze bushing will remain in the timing side half of the crankcase.

The driving side ball race and the driving side outer roller race will remain in the driving side half of the crankcase.

The driving side inner roller race and the inner distance piece will remain on the engine shaft.

E.3. MAIN BEARINGS

To remove the outer roller races from the crankcase halves, heat to 100° or more and drop the half case sharply on a flat block of wood or bench, when the race will drop out together with the spacer in the case of the driving side and the thrust washer in the case of the timing side.

Remove the circlip from the driving side crankcase and re-heat to remove the ball race.

To replace the bearings, heat the crankcase and press in the races in the following order:

DRIVING SIDE.	Use Special Tool (see tool section).
	Small Steel Washer.
	Cork oil-retaining Washer.
	Large steel washer.
	Ball bearing complete.
	Circlip.
	Outer Spacer.
	Outer roller race.
TIMING SIDE.	Use Special Tool (see tool section)
	Steel thrust washer.
	Outer roller race.

Care must be taken to see that the lead on the outside of the outer roller race enters the case first to make sure that it is square with the housing.

If it is necessary to replace the rollers, new ones are available graded in steps of .0001" from .2490" to .2500".

E.4. REPLACEMENT OF THE CAM AND IDLER SPINDLES

To remove the cam spindles heat the crankcase and tap the spindles out from inside.

To remove the idler spindles heat the crankcase as before, hold the spindles in a vice and tap the crankcase lightly with a hide hammer.

To replace the spindles use Special Tool (see tool section) which is a locating plate for all the spindles.

Start the spindles in the holes in the crankcase by tapping them lightly.

Offer the locating plate to the spindles, making sure that they are all upright. Tap the plate over the spindles until it touches the timing chest face, having first made sure that the latter is quite clean.

Drive the spindles home with a small hammer (not heavier than ½ lb.) and a drift.

Remove the locating plate.

E.5. FLYWHEEL ASSEMBLY

The flywheel assembly consists of crankshaft and connecting rod.

To dismantle the crankshaft remove the set screws securing the crank pin nuts.

Holding the crankshaft in a Special Jig, (see tool section), remove the crank pin nuts.

Using special tool, with a pair of steel bars (above 1" x 3/8" x 9" long) placed across, press out the crank pin with a hand press.

The connecting rod can then be removed.

Turn the crankshaft over in the jig and repeat with the other side if necessary.

To remove the timing side main shaft, take the set screw from the shaft nut and unscrew the nut. Drive the shaft out with a hammer and drift. To replace the timing side shaft, reverse the above process, making sure that the key is a good fit and that the nut is tightened securely by means of a box wrench with a 12 inch bar.

The driving shaft has no nut but is secured by tightening the sprocket nut after the assembly of the engine. It should be pressed in and out with a hand press or a hammer and drift. If the latter is used care must be taken not to damage the centers.

To re-assemble the crankshaft, press the crank pin into the timing side flywheel, making sure that the oil hole is in the correct position and that the thrust washer is facing the right way i.e. with the chamfer AWAY from the flywheel.

Test the oil passages with an air line or oil gun to make sure that they are clear.

Put the floating bushing over the crank pin.

Put the connecting rod over the floating bushing.

Place the other thrust washer over the crank pin.

Press the driving side flywheel on.

Put the flywheel in the assembly fixture (see tool section) to ensure that the flywheels and shafts are in line and replace the nut and set screw and tighten securely.

Test the oil passages again to ensure that they are clear.

If the same crank pin has been put back, it will be necessary to drill out the grub screw, in order to clean the oil passages after which a new grub screw must be fitted.

Mount the crankshaft between centers and true up to .0005 inch on either side of the shafts.

If the readings for the two shafts are high on opposite sides, the error can be corrected by gently tapping either or both of the flywheels.

If the readings are high on the same side of the two shafts, it is probably due to dirt or foreign matter in the joints and the crankshaft should be dismantled again, carefully examined and cleaned and re-assembled.

E.6. RE-ASSEMBLY OF THE CRANKCASE

Replace the outer roller races, etc., in the crankcase halves as described in Section E.3.

Fit the inner spacers and the rollers and cage in the driving side crankcase.

Lay the thrust washer on the bearing.

Assemble the flywheel into the bearing.

Make sure that the crankcase face is clean and apply jointing compound to it.

Put the thrust washer on the timing side shaft and the rollers and cage.

Put the mag-dyno straps over the studs in the timing side crankcase and place the latter in position over the flywheel.

Bolt the two halves of the crankcase together, making sure that the joint matches correctly so that the cylinder base is flat.

SECTION G. CARBURETOR

CARBURETOR

The carburetor is AMAL type 276/. The air lever should always be in the open position except for starting and warming up of the engine.

The main jet controls the gasoline supply when the throttle is more than three-quarters open. Although the fuel flows through the main jet at smaller throttle openings, the amount is metered by the effect of the needle in the needle jet. Each main jet is exactly calibrated and numbered, the larger the number the larger the jet.

The needle is tapered and attached to the throttle valve, with a spring clip which slides into one of five notches at the top of the needle. The needle controls the fuel supply through the needle jet from one-quarter to three-quarters open. The mixture in that range can be adjusted by lowering the needle in its jet, (inserting the clip into a higher notch of the needle) to make it leaner, or to richen the mixture by raising the needle.

The throttle cut-away controls the mixture just above idling from 1/8 to 1/4 open. The throttle valves are numbered as to type and size. They are normally fitted with a Nr; 6/4 valve in which the 6 denotes the type and the 4 the size of the cut-away in 1/16" (in this case 4/16 or 1/4"). To make the mixture richer in this range, install a throttle valve of smaller size i.e. a Nr. 6/3 or to weaken the mixture a greater cut-away or a Nr. 6/5.

The pilot air screw regulates the strength of the mixture for idling and for the initial throttle opening. To richen the mixture, turn the screw in and to weaken screw out.

1. When tuning the carburetor, always begin with the selection of the correct main jet. Ride the machine on a smooth road with a slight up gradient so that under test the engine is pulling. If when at full throttle the power seems better with the air lever in the closed position or with the throttle less than wide open, the main jet is too small. If the engine runs "heavily" the main jet is too large.
2. After installing the correct main jet and with the engine thoroughly warm, let the engine run slowly with the air fully open and the spark about half way retarded. Now screw up the throttle stop adjusting screw until the

engine begins to speed up. Now close the twist grip completely and make sure that there is a little slack in the control cable. If necessary, adjust the cable by means of the cable adjuster. Unscrew the throttle stop adjusting screw gradually until the engine is idling as slowly as possible, but still firing steadily and evenly. Next adjust the pilot air screw until the engine is at its maximum speed with this throttle and ignition setting. If the speed is now too high for idling, unscrew the throttle stop adjusting screw and, if necessary, correct adjustment of the pilot airscrew. When the best setting has been found, tighten the locknut on the throttle stop adjusting screw and adjust the cable adjuster until all but a little slack has been taken out of the cable.

3. If, as you take off from the idling range, there is spitting back from the carburetor, slightly richen the pilot mixture by unscrewing the pilot screw in about a half turn. If that is not effective, screw it back again and fit a throttle slide with a smaller cutaway. If the engine jerks under load at the throttle position just above idling, and if there is no spitting back, either the throttle needle is much too high or a larger throttle valve cutaway is needed to cure richness.

4. The needle controls the widest range of throttle opening and also acceleration. First try the needle in as low a position as possible (the clip in a groove at the top of the needle). If the acceleration is poor and with the air lever partly in the closed position, the results are better; raise the needle by two notches. If this is very much better, try lowering by one notch and finally leave it in the best position. On old carburetors, if richness cannot be cured by changing the needle position, the needle jet probably is worn and needs replacement.

5. To finish up the tuning operation, go over the idling procedure again as under paragraph #2.

Before attempting to tune the carburetor, it should of course be made sure that it is in good serviceable condition. Make certain that it is not flooding which would be due to a punctured float, dirt on the needle valve, a bent float needle or the clip not correctly engaged in its groove on the needle.

The union nut which holds the jet block in the carburetor body has to be tight.

SLOW RUNNING ADJUSTMENT

Start engine and screw pilot air adjuster right home while carefully closing the throttle. The engine should now eight 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.

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 stop 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 re-tighten 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.

FLOAT CHAMBER

The function of the float chamber is to control the gasoline in the carburetor at the correct level and anything which upsets its correct working will cause constant flooding, heavy engine running, and high gasoline consumption.

Dirt on the needle seating, a bent needle, a punctured float, a badly worn needle, or a carburetor not fitted upright, will all give the above symptoms.

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 the mixture is controlled by the needle in the throttle slide. 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 indication of intense heat.

To cure, raise needle in throttle slide one notch.

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

To remedy, lower the needle.

DRIVING HINTS

For normal running on level the choke can be left fully open and the spark fully advanced, the speed being controlled by the throttle; but when accelerating or climbing a hill it may be necessary to retard the ignition slightly, and while the engine is cold, partly close the choke lever.

As a guide to the correct positions for the spark and choke control levers, the beat of the engine should be studied. If the engine is "eight-stroking," i.e., firing on only every alternate firing stroke, the mixture is too rich and the choke lever should be opened further. If the engine cuts out on opening the throttle the mixture is too weak, and the choke lever should be closed further.

If the engine "pinks" (i.e., a sharp metallic knock), the ignition is too far advanced, or the mixture is on the weak side.

The carburetor is correctly set at the works, and is unlikely to require attention beyond occasional cleaning, and possible re-setting the slow running adjustment.

This adjustment is made with a pilot air adjuster screw fitted on the side of the carburetor. The adjustment should be made when the engine is warm, and should be set so that the engine will "tick-over" evenly when the throttle is nearly closed. A throttle stop is provided so that the throttle can be set to be slightly open when the control is shut.

Do not attemnt to save gasoline by fitting a small main jet. The main jet has no effect unless the machine is being driven at above half throttle.

AMAL CARBURETOR
DISASSEMBLING

The carburetor can be stripped while in position on the machine, but for examination it is advisable to remove it.

Remove the carburetor.

The carburetor is fitted to the induction stub by flange and two (2) bolts.

Ease bolt and remove carburetor complete with pipes from induction stub, then carburetor will hang on the control cables.

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

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 choke slide, compress spring as before and release nipple from the end of the slide and the slide is free.

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

The lower the needle, the weaker the mixture.

Remove the float chamber. It is held by a bolt at the base of the mixing chamber. There are two (2) fibre washers on this bolt; one under the head, and one between the float and mixing chambers.

To remove the float and needle, release the float chamber cap locking screw, and remove the cap.

Compress the spring clip on the top of the float and lift float from the chamber.

Remove the bolt at the base of the float chamber and the needle will fall out.

On the bolt at the base of the float chamber two (2) fibre washers are fitted in the same order as on the bolt at the base of the mixing chamber.

Remove the jet. The main jet is now exposed and can be removed from the needle jet. Remove the needle jet from the jet block. Remove the jet block by removing the union nut at the base of the mixing chamber.

Fit needle to the jet block.

Fit main jet to needle jet.

Fit jet block to mixing chamber located by groove and pin.

Fit mixing chamber union nut and fibre washer.

Fit float to the float chamber.

Fit float needle through the base of the chamber and the center of the float, compress the spring clip on the top of the float and allow the needle to enter the clip.

Release the clip and the clip will drop into the groove in the needle.

Fit the chamber top and lock with the locking bolt.

Fit the chamber to the mixing chamber (2 fibre washers).

Fit the bolt holding the union to the base of the float chamber, (2 fibre washers).

Fit needle to throttle slide in middle position.

Thread cable through the mixing chamber, the throttle cable to be nearer to the cylinder barrel.

The throttle cable has the shorter length of inner cable protruding from the outer cable.

Fit return spring to cable, the larger to the throttle.

Fit slides to cable.

Fit air slide to throttle slide.

Fit slide to the mixing chamber, carefully entering the needle into the needle jet. DO NOT FORCE.

Fit mixing chamber top.

Fit carburetor upright flange on induction stub.

WORKSHOP INSTRUCTIONS FOR SERVICING "INDIAN" MACHINES

SECTION J. FRAME

TRAILBLAZER 700, TOMAHAWK 500, WOODSMAN 500, & FIRE ARROW 250

J.1. TYPES OF FRAME

The above named models use four different frames, all of which are variations of the same basic type with swinging arm rear suspension.

The following are brief descriptions of the differences between the four types of frame.

FIRE ARROW: Pivot points for swinging arm carried in lugs brazed to Rear Wheel Support Arm. Front engine attachment lug with two holes carrying small curved engine plates.

TOMAHAWK: Similar to the Fire Arrow but with single ½ in. bore tube welded through lower end of front down tube for engine attachment.

WOODSMAN: Similar to the Fire Arrow but with pivot points for swinging arm carried in gusset plates between Rear Wheel Support Arm and bracing tubes joining Rear Wheel Support Arm to seat tube.

TRAILBLAZER: Front end similar to Fire Arrow and Woodsman. Rear end without seat tube, extended brackets carrying upper end of suspension units.

J.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 them out with a hammer and drift and new races can be fitted either under a press or by means of a hammer and a wooden drift.

J.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.

J.4. SERVICING REAR SUSPENSION UNITS

The proprietary units 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 re-assembling the spring should be greased to prevent it squeaking if it should come into contact with either of the covers during operation.

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

J.5. REMOVAL OF SWINGING ARM ASSEMBLY

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 (see tool section) 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 bushings these can be driven out by means of a hammer and a suitable drift and new bushings can be fitted under a press without difficulty. After fitting the bushings they must be reamed to .844/.843 in.

J.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. Note that the position of the stand when raised is controlled by the stop on the rear engine plate spacer. This should be adjusted so that the stand is as high as possible without actually hitting the exhaust pipe.

J.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 string. The alignment should be checked on both sides of the machine and if the front and rear tires are of different type 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 string to contact the front and rear tires.

J.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.

WORKSHOP INSTRUCTIONS FOR SERVICING "INDIAN" TRAILBLAZER 700 & TOMAHAWK 500

SECTION K. FRONT FORK

K.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 aluminium 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 oil is forced between the spring stud and the bore of the valve port forming 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.

K.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 any tendency to pitching or oscillation without interfering unduly with the free movement of the fork when the wheel encounters an obstacle.

The fork is filled with a light oil (S.A.E. 20) to a point above the lower end of the spring so that the damper chamber 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.

K-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 (see tool section) 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 (see tool section). 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 re-assembling 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 (see tool section).

K.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 (see tool section) 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.

K.5. STEERING HEAD RACES

The steering head bearing consists of two deep groove thrust races each containing nineteen ¼ in. diameter balls. The bearing is adjusted by tightening the steering stem locknut after loosening the ball head clip screw and both the fork crown clamp bolts. 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 (see tool section) is useful to ensure centralization of the cover tubes.

K.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 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 the 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.

K.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 in. 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 $7\frac{1}{2}$ fluid ounces in each leg. Recommended grade of oil is S.A.E. 20.

FRONT FORK FOR 500 WOODSMAN

This fork is identical with that used on the 500 Tomahawk and Trailblazer 700 except for the fork head which is of a simplified tyne which does not house either the speedometer, headlamp, switch or ammeter. The method of attaching the main tubes to the fork head is also different. The upper end of the main tubes is threaded internally instead of externally and the tubes are pulled up to a shoulder by means of a threaded plug screwed into the upper end. This plug is drilled to enable the fork to be filled with oil and is fitted with a hollow stud and cap nut. A pressed steel cover is sprung over the hexagon end of the plug to hide the inside nut.

Apart from the detail of attachment of the main tubes the method of servicing is the same as for the Tomahawk 500 and Trailblazer 700 except that it is possible to change the fork spring by simply removing the pressed steel cover from the upper end of the fork, unscrewing the cap nut and the screwed plug. If weight is then put on the front wheel the upper end of the spring will protrude from the top of the fork and can be withdrawn.

WORKSHOP INSTRUCTIONS FOR SERVICING
"INDIAN TRAILBLAZER 700, 500 TOMAHAWK, 500 WOODSMAN"

SECTION L. FRONT WHEEL WITH DUAL 6 IN. BRAKE

L.1. REMOVAL FROM FORK

To remove the front wheel from the forks place the machine on the center stand with sufficient blocking (about 2 in.) beneath each side of the stand to lift the wheel clear of the ground when tilted back onto the rear wheel. Slacken brake cable adjustments and disconnect cables from handlebar lever and from operating levers on the 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.

L.2. REMOVAL OF BRAKE COVER PLATE ASSEMBLIES

Lock the brake "on" by pressure on the operating lever and unscrew the cover plate nuts. The right and left hand cover plate assemblies can then be withdrawn from the respective brake drums.

L.3. REMOVAL OF BRAKE SHOES AND SPRINGS

This is best done by unscrewing the pivot pin locknuts, and the operating lever nuts after which the assembly of brake shoes, return springs, pivot pin and operating cam can be removed from the cover plate by light blows with a hammer and drift on the ends of the pivot pin and the operating cam. The return springs can then be unhooked from the spring posts in the brake shoes thus allowing the whole assembly to fall apart.

L.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.

L.5. REMOVAL OF HUB AXLE AND BEARINGS

To remove the hub axle and bearings having already removed the brake cover plate assemblies, lift out the felt washers and spacers. Now hit one end of the axle 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 axle and insert the latter once more in the hub at the end from which it

was removed. Now drive the axle through the hub the other way, then it will bring out the remaining bearing.

L.6. HUB BEARINGS

These are deep groove single row journal ball bearings 5/8 in. i/d by 1.9/16 in. o/d by 7/16 in. wide.

L.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 end play pre-loading of the bearings it is essential that there is a small clearance between the inner edge of the outer race of the bearing and the back of the recess in either end of the hub barrel. To prevent any possibility of side-play 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.

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.

L.8. REFITTING BALL BEARINGS

To refit the bearings in the hub two hollow drifts are required as shown in Tool Section. One bearing is first fitted to one end of the axle by means of the hollow drift; the axle 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 axle 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 spacers and the cover plate nuts, with either the cover plates themselves or additional 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 shim fitted

between the inner race and the shoulder on the spindle.

L.9. REASSEMBLY OF BRAKE SHOES ON TO COVER PLATES

Assemble each pair of shoes with their return springs on to the pivot pin and operating cam, putting a smear of grease in the grooves of the pivot pin and on the operating faces of the cam. Now fit the assembly into the cover plate putting a smear of grease on to the cylindrical bearing surface of the operating cam and secure with the pivot pin locknut and washer. Fit the operating lever, on its splines in a position to suit the extent of wear on the linings and secure with the nut and washer. Note that the position of the operating levers may have to be corrected when adjusting the brake after refitting the wheel. The range of adjustment can be extended by moving these levers on to a different spline. Limit of wear is reached when the cam is turned through nearly 90° with the brake hard on so that there is a danger that the operating springs cannot return the brake to the off position.

L.10. FLOATING CAM HOUSING

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 sufficient to prevent the cam housing 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 pins are secured by locknuts which are center punched as an additional precaution.

The leading shoe, (i.e. the one towards the rear of the machine) has a Servo action which renders it more effective than the trailing shoe. This Servo action causes the lining on the leading shoe to wear more quickly than that on the trailing shoe and at the same time tends to lift the leading shoe off the cam and press the trailing shoe harder on to the cam. 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 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.

L.11. REFITTING BRAKE COVER PLATES

After assembling the brake shoe pivot pins and operating cams into the cover plates repack the hub bearings with grease. The use of H.M.P. greases which have a soda soap base is not recommended as these tend to be slightly corrosive.

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

L.12. WHEEL RIM

The rim is Type WM2-19 in. plunged and pierced with forty holes for spoke nipples. The spoke holes are symmetrical, i.e. the rim can be assembled to the hub either way round. 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.

L.13. SPOKES

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

L.14. WHEEL BUILDING AND TRUING

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.

L.15. TIRE

Standard tires are Dunlop 3.50-19 in. Universal tread. The recommended pressure for front tire is 16 lb. per square inch for wheel loads not exceeding 280 lb., or 18 lb. per square inch for wheel loads up to 320 lb.

L.16. 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 to 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.

WORKSHOP INSTRUCTIONS FOR SERVICING "INDIAN 500 WOODSMAN MODEL"

SECTION L. FRONT WHEEL

The workshop instructions for servicing the front wheel with dual 6 in. front brake for the Trailblazer 700 and 500 Tomahawk apply equally to the similar wheel used on the 500 Woodsman Model with the following exceptions:

1. The rim is WM1-21 in., internal width 1.60 in.
2. The spoke length is 7 9/16 in.
3. The load to be carried by the 3.00-21 in tire is as follows:

Tire Section	Inflation Pressures - lb. per sq. in.			
Inches	16	18	20	24
	Load per tire - lb.			
3.00	160	180	200	240

WORKSHOP INSTRUCTIONS FOR SERVICING "INDIAN" MACHINES
500 TOMAHAWK, 500 WOODSMAN & 250 FIRE ARROW

SECTION M. REAR WHEEL (NON-DETACHABLE)

M.1. DESCRIPTION:

These instructions cover the servicing of three different rear wheels, all of the "non-detachable" type incorporating a rubber cushion drive and an internal expanding brake.

The wheel for the 250 Fire Arrow has a light type hub with 6" brake, $2\frac{3}{4}$ in. chain line and a two-piece spindle with detachable spacers, removal of which enables the inner tube to be changed with the wheel in position in the machine.

The 500 Tomahawk is fitted with a similar hub with a solid rear spindle and a 3 in. chain line.

The 500 Woodsman Scrambles Model has a heavier hub with 7 in. diameter brake, 3 in. chain line and heavier type ball bearings. This also has a solid spindle.

M.2. REMOVAL OF INNER TUBE WITH WHEEL IN POSITION IN FRAME (250 FIRE ARROW)

Place the machine on the center stand. Remove the detachable portion of the rear Fender and deflate the tire. Remove the right hand side of the tire from the rim, using tire levers in the ordinary way. Unscrew the center bolt, and withdraw this completely. Spring the fork ends slightly apart so as to release the slip collar, from the pin on the spacer and slide the slip collar out of the fork end. Disconnect the speedometer driving cable from the speedometer gearbox, remove the inner tube from the tire and withdraw it through the gap left between the inside of the fork end and the speedometer gearbox.

M.3. REMOVAL & REPLACEMENT OF COMPLETE WHEEL

Place machine on the center stand. Remove the seat and the detachable portion of the rear fender. 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 and the brake operating lever. Unscrew the brake cover plate anchor nut and remove this togehter with the washer behind it. Disconnect the speedometer driving cable, loosen the axle nuts (one axle nut and the center bolt in the case of the 250 Fire Arrow) and mark the chain adjuster cams to ensure replacing in the same position. Slide the wheel out of the brake shoe pivot pin from the slot in the fork end.

When replacing the wheel make sure that the dog gears on 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. 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 while the brake is off, while at the same time only a small travel of the brake pedal is necessary to put the brake on.

M.4. REMOVAL OF BRAKE SHOES FOR REPLACEMENT, FITTING NEW LININGS, ETC.

Remove the complete wheel as described in Section M.3., then remove the left hand spindle nut, chain adjuster and spacer, thus permitting the complete brake cover plate with operating cam, pivot pin, shoes and return springs to be lifted off the hub axle.

In the case of the 7 in. brake fitted to the 500cc Woodsman Model the brake shoes can then be removed, after detaching the return springs.

In the case of the 6 in. brake fitted to the 500cc Tomahawk and 250cc Fire Arrow Models, unscrew the pivot pin locknut and the operating lever nut, after which the assembly of the brake shoes, return springs, pivot pin and operating cam can be removed from the cover plate by unscrewing the pivot pin and applying light blows with a hammer and drift on the end of the operating cam. The return springs can then be unhooked from the spring posts in the brake shoes, thus allowing the whole assembly to fall apart.

M.5. 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 enable that the lining lies flat against the shoe. Standard linings are drilled to receive flat headed rivets.

M.6. REMOVAL OF HUB AXLE & BEARINGS

To remove the hub axle and bearings, having already removed the brake cover plate assembly and speedometer drive gearbox, lift out the felt washers and spacers then hit one end of the axle 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 axle and insert the latter once more in the hub at the end from which it was removed. Now drive the axle through the hub in the opposite direction, when it will bring out the remaining bearing.

M.7. HUB BEARINGS

These are deep groove single row journal ball bearings. The lighter bearings used in the 250 Fire Arrow and 500 Tomahawk hubs are 5/8 in. i/d by 1.9/16 in. o/d by 7/16 in. wide.

The heavier bearings used in the 500 Woodsman are 5/8 in. i/d by 1.13/16 in. o/d by 5/8 in. wide.

M.8. FITTING LIMITS FOR BEARINGS

The fit of the bearings in the hub barrel is important. The bearings are locked on the axle between shoulders and the spacers, which in turn are held up by the cover plate nuts. In order to prevent end play pre-loading of the bearings it is essential that there is a small clearance between the inner edge of the outer race of the bearing and the back of the recess in either end of the hub barrel. To prevent any possibility of sideplay 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.

	250 Fire Arrow & 500 Tomahawk	500 Woodsman
Bearing o/d	1.5622/1.5617 in.	1.8122/1.8117 in.
Housing bore	1.5620/1.5615 in.	1.8115/1.8110 in.
Bearing bore	.6252/ .6247 in.	.6252/ .6247 in.
Shaft diameter	.6252/ .6248 in.	.6252/ .6248 in.

M.9. REFITTING BALL BEARINGS

To refit the bearings in the hub two hollow drifts are required, as shown in Tool Section. One bearing is first fitted to one end of the axle by means of the hollow drift; the axle and bearing are then entered into one end of the hub barrel which is then supported on one of the hollow drifts and the other bearing is then threaded over the upper end of the axle 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 bearings and the bottom of the recesses fit

the spacers against the inner races of the bearings and either fit the assembly of brake cover plate, speedometer gearbox, etc., or make up this distance with tubular spacers. Fit and tighten the axle nuts. Tightening the nuts should not have any effect on the ease with which the axle can be turned. If tightening the nuts makes the axle 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 axle. In this case the bearing should be removed and a thin packing shim fitted between the inner race and the shoulder on the axle.

M.10. REMOVAL OF BRAKE OPERATING CAM AND BRAKE SHOE PIVOT PIN

The method of doing this has already been described in Section 4. dealing with the 6 in. brake. The method is precisely the same for the 7 in. brake except that owing to the different type of return springs used it is, in this case, possible to remove the shoes from the pivot pin and operating cam before the latter are removed from the cover plate.

M.11. CUSH DRIVE

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

If the cush drive rubbers become worn so that the amount of free movement measured at the tire exceeds $\frac{1}{2}$ in. to 1 in., the rubbers should be replaced. To obtain access to them remove the complete wheel as described, remove the brake cover plate complete with the brake shoe assembly, unscrew the three nuts at the back of the cush drive shell - if necessary holding the studs by means of the flats on the heads inside the brake drum. Drive out the three studs into the brake drum after which the sprocket/brake drum can be separated from the cush drive shell and the six cush drive rubbers can be 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 painted with soapsuds to facilitate entry of the vanes.

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 and also put grease on the inner face of the lockring. The three nuts should be tightened down solid as there is a shoulder on

the stud which prevents tightening of the nuts from locking the operation of the cushion drive.

M.12. REASSEMBLY OF BRAKE SHOES, PIVOT PIN & 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 the cylindrical bearing surface of the operating cam if this has been removed. Fit the operating lever and trunnion on its splines in a position to suit the extent of wear on the linings and secure with the nut. The range of adjustment can be extended by moving the lever on to a different spline.

M.13. 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 axle 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 correctly centered brake assembly and the screws securing the cam housing correctly tightened wear on both linings should be approximately equal.

M.14. FINAL REASSEMBLY OF HUB BEFORE REPLACING WHEEL

Before replacing the felt washers which form the grease seals, pack both bearings with grease.

Make sure that the inside of the brake drum is quite free from oil or grease, etc. Replace the felt washers, spacers, and brake cover plate assembly, speedometer drive gearbox, spacers, chain adjuster cams, the loose section of the axle and the axle nut. The wheel is then ready for reassembly into the machine.

M.15. WHEEL RIMS

The 250cc Indian Fire Arrow rim is Type WM2-19 in., internal width 1.580 in. The rim for the 500cc Tomahawk is WM2-19 in., internal width 1.580 in. The rim for the 500cc Woodsman is WM3-19 in., internal width 2.156 in.

All rims are pierced with forty holes for spoke nipples. Note that these rims are not symmetrical, i.e. the angle of the spokes on the two sides of the wheel is not the same.

The rim diameter after building is the same in each case, i.e. 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.

M.16. SPOKES

The spokes on the Fire Arrow and Woodsman are of the single butted type 8-10 gauge with 90° countersunk heads, angle of bend 95°-100°, length $7\frac{3}{4}$ in. brake side, $8\frac{1}{2}$ in. spoke flange side, thread diameter .144 in., 40 threads per inch. The Tomahawk uses spokes 1/8" longer i.e. 7 7/8" and 8 5/8".

M.17. WHEEL BUILDING & TRUING

The spokes are laced one over three and the wheel must be built central in relation to the outer faces of the spacers which fit between the fork ends. 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.

M.18. TIRE PRESSURES

The load which the tire will carry at different inflation pressures is shown below:

Tire Section	Inflation Pressures - lb. per sq. in.					
Inches	16	18	20	24	28	32
	Load per tire - lb.					
3.00	-	-	-	240	300	350
3.25	200	240	280	350	400	440
3.50	280	320	350	400	450	500
4.00	360	400	430	500	-	-

M.19. LUBRICATION

A greasing point is provided in the center of the hub barrel. Unless the barrel is packed full with grease on assembly (which is apt to lead to trouble through grease finding its way past the felt seals on to the brake linings) this greasing point is 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 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.

ILLUSTRATION INDEX
ALL MODELS

ILLUSTRATION NUMBER	DESCRIPTION	MODELS PRETAINING TO ARROW	WOOD.	TOM.	TRAIL.
1	Control Diagram	X			
2	Control Diagram			X	
3	Control Diagram				X
4	Wiring Diagram	X			
5	Wiring Diagram			X	
6	Wiring Diagram		X		
7	Wiring Diagram				X
8	Oiling Diagram	X			
9	Oiling Diagram		X		
10	Oiling Diagram			X	X
11	Fire Arrow Engine	X			
12	Fire Arrow Engine	X			
13	Fire Arrow Gearbox	X			
14	Woodsman Engine		X		
15	Trailblazer Engine				X
16	Gearbox		X	X	X
17	Clutch		X	X	X
18	Gearbox	X			
19	Gearbox		X	X	X
20	Gearbox outer cover removed		X	X	X
21	Primary Chain Adj.	X			
22	Primary Chain Adj.				X
23	Locking of Oil Pump Worm		X	X	X
24	Rocker Adjustment	X	X	X	X
25	Removal of Valves	X	X	X	X
26	Removal of Valve Spring	X	X	X	X
27	Removal of Piston Pin	X	X	X	X
28	Breaking Crankcases			X	X
29	Oil Pump	X	X	X	X
30	Magneto				X
31	Push Rod Adjustment	X	X		
32	Timing Marks			X	X
33	Timing Marks	X	X		
34	Exploded View Front Fork		X	X	X
35	Exploded View Front Fork	X			
36	Fork Crown Clamp & Stem Bolt	X	X	X	X
37	Rear Frame Section				X
38	Rear Brake Adjustment	X	X	X	X
39	Cushion Drive Assy.	X	X	X	X

ILLUSTRATION NUMBER	DESCRIPTION	MODELS PRETAINING TO ARROW	WOOD.	TOM.	TRAIL.
40	Exploded View Front & Rear Hubs	X			
41	Exploded View Removal of Rear Wheel				X
42	Exploded View Rear Hub		X	X	
43	Exploded View Front Hub		X	X	X
44	Exploded View Rear Hub				X
45	Removal of Brake Shoes	X	X	X	X

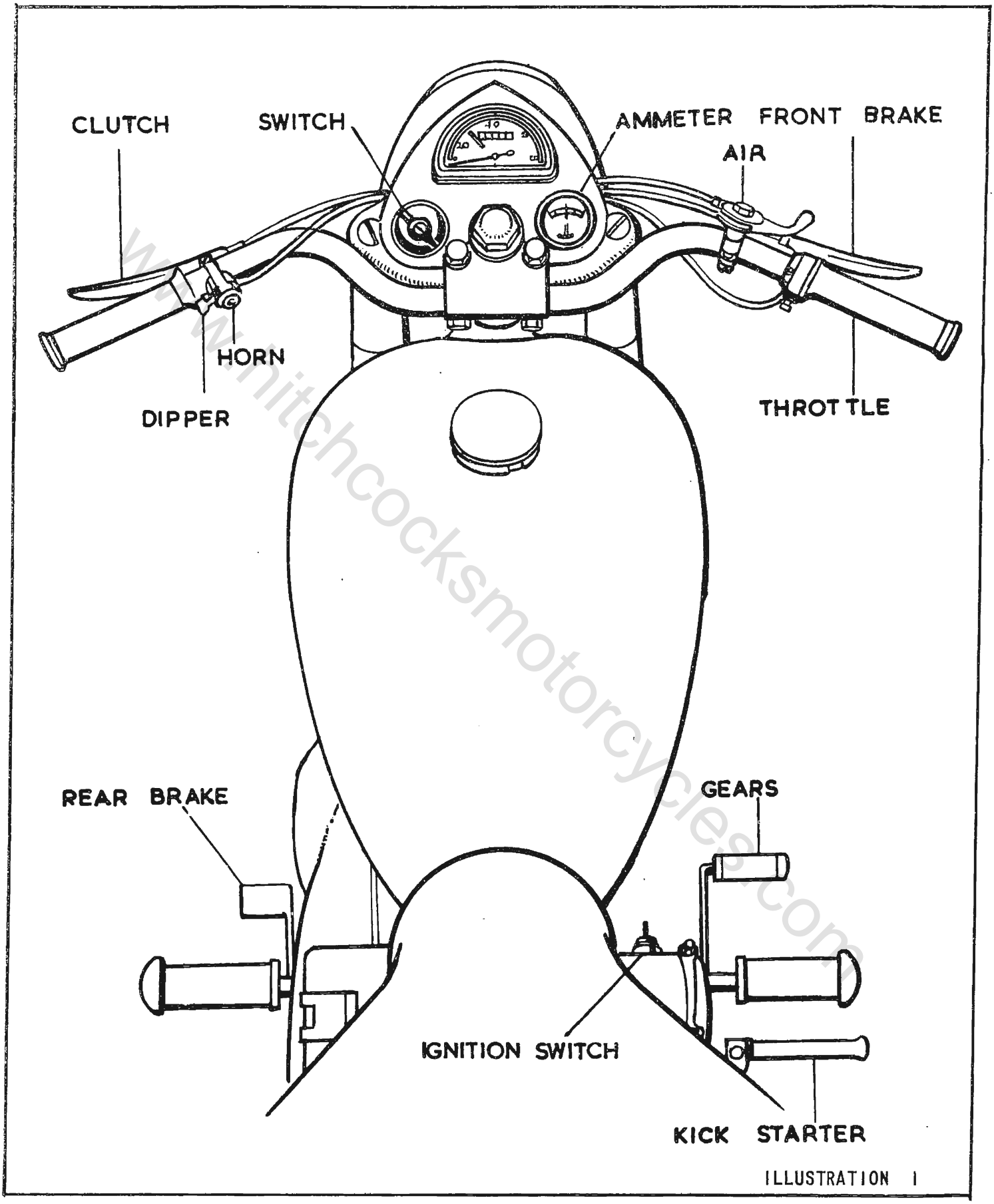


ILLUSTRATION 1

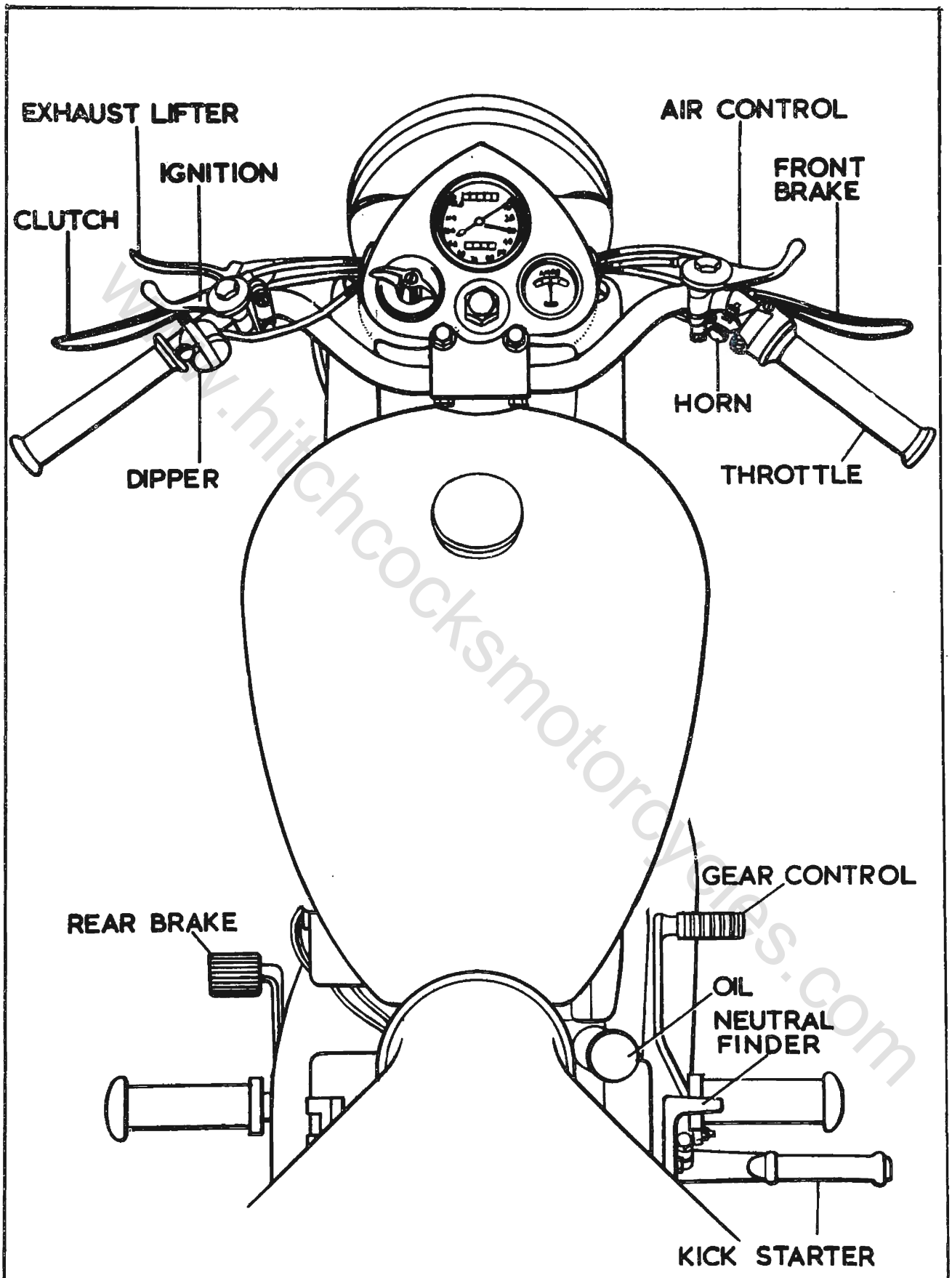


ILLUSTRATION 2

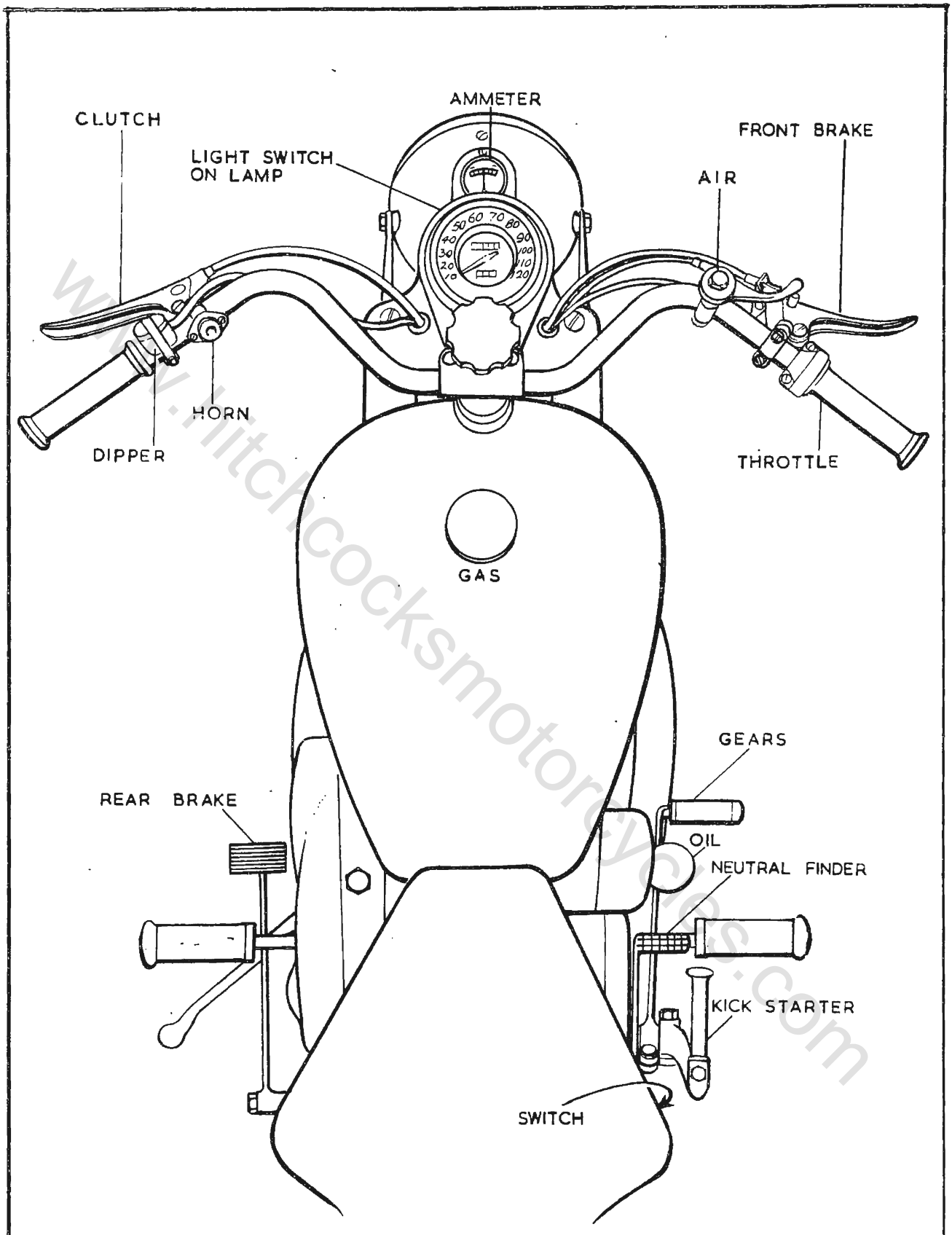
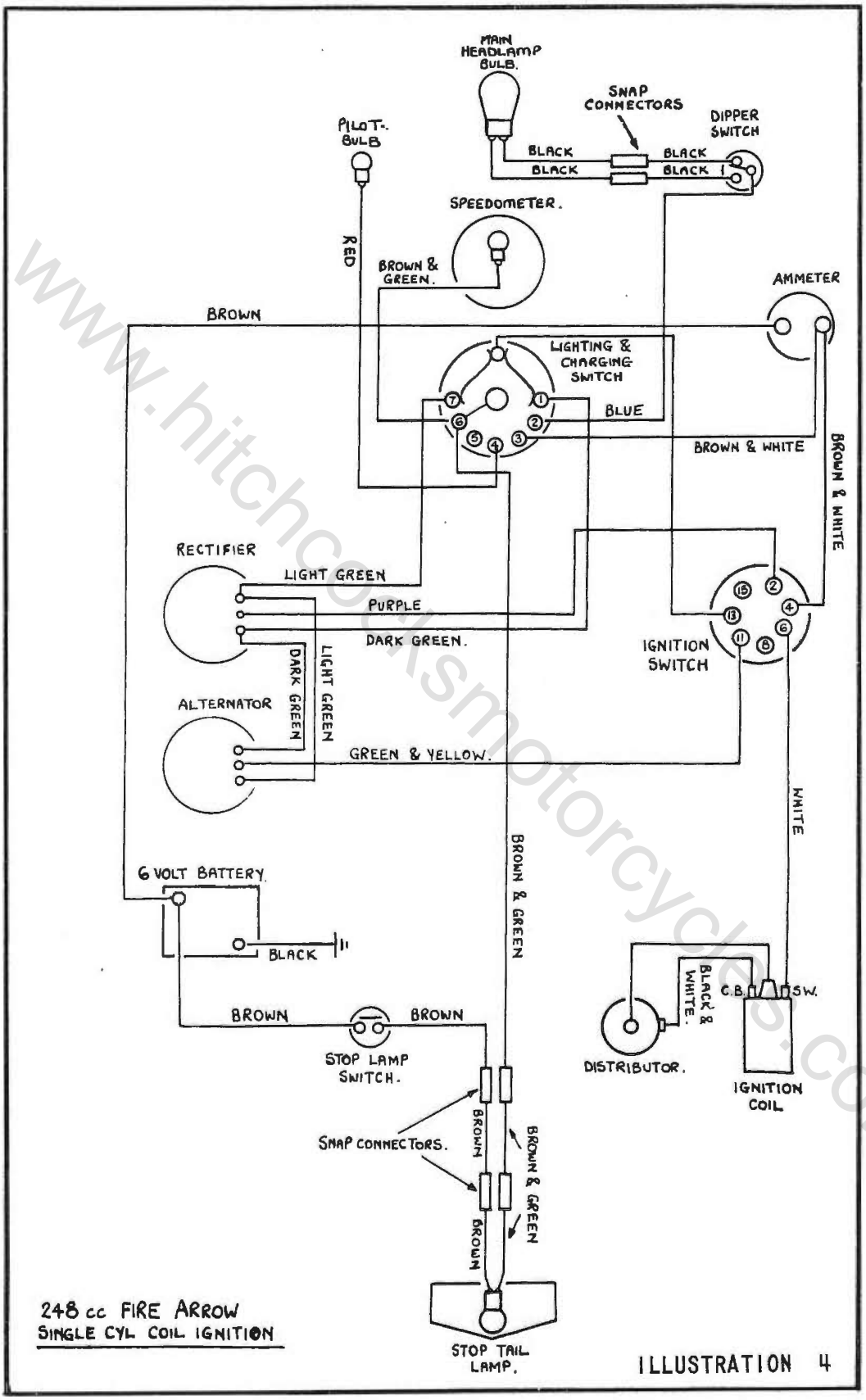
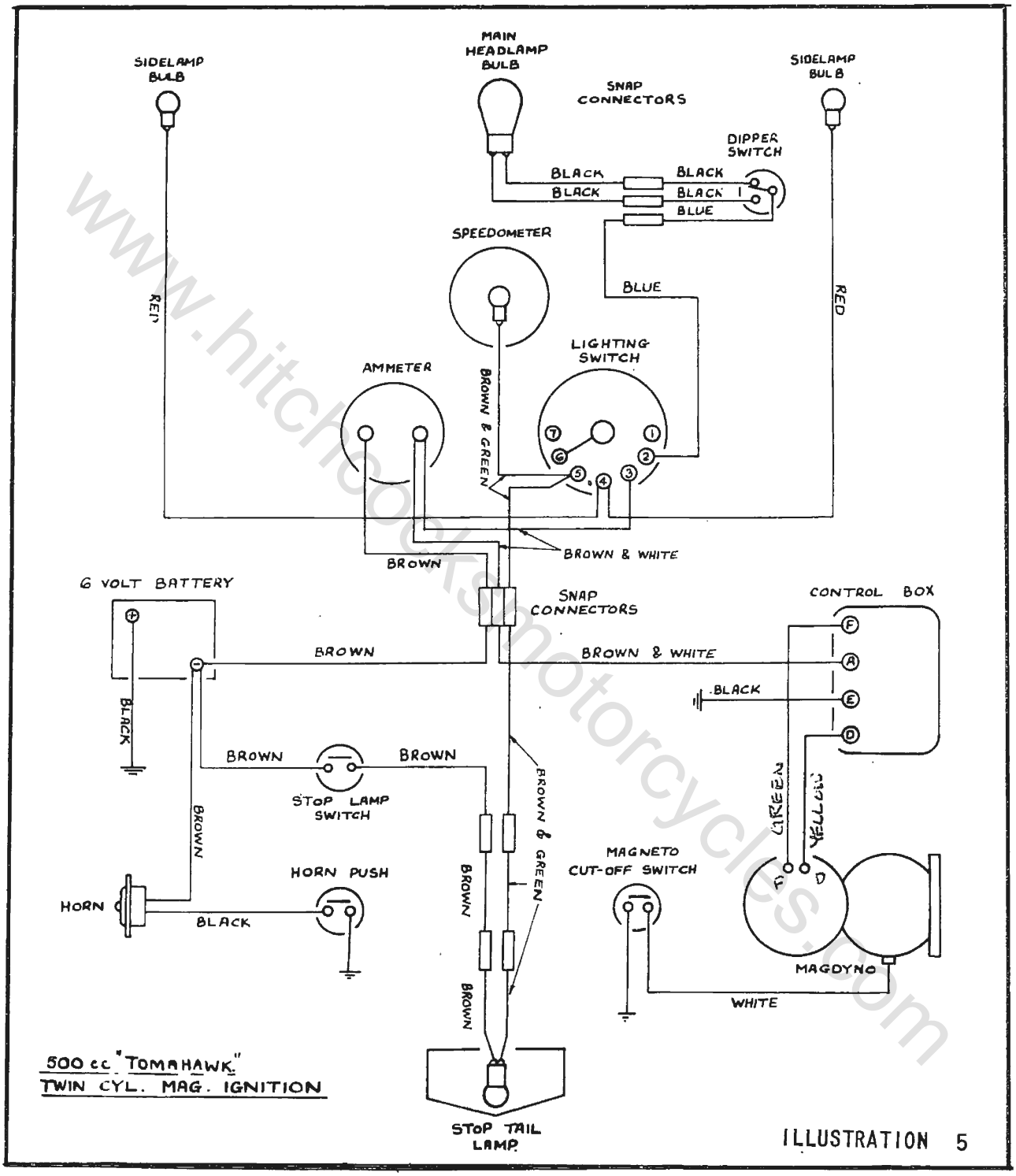


ILLUSTRATION 3



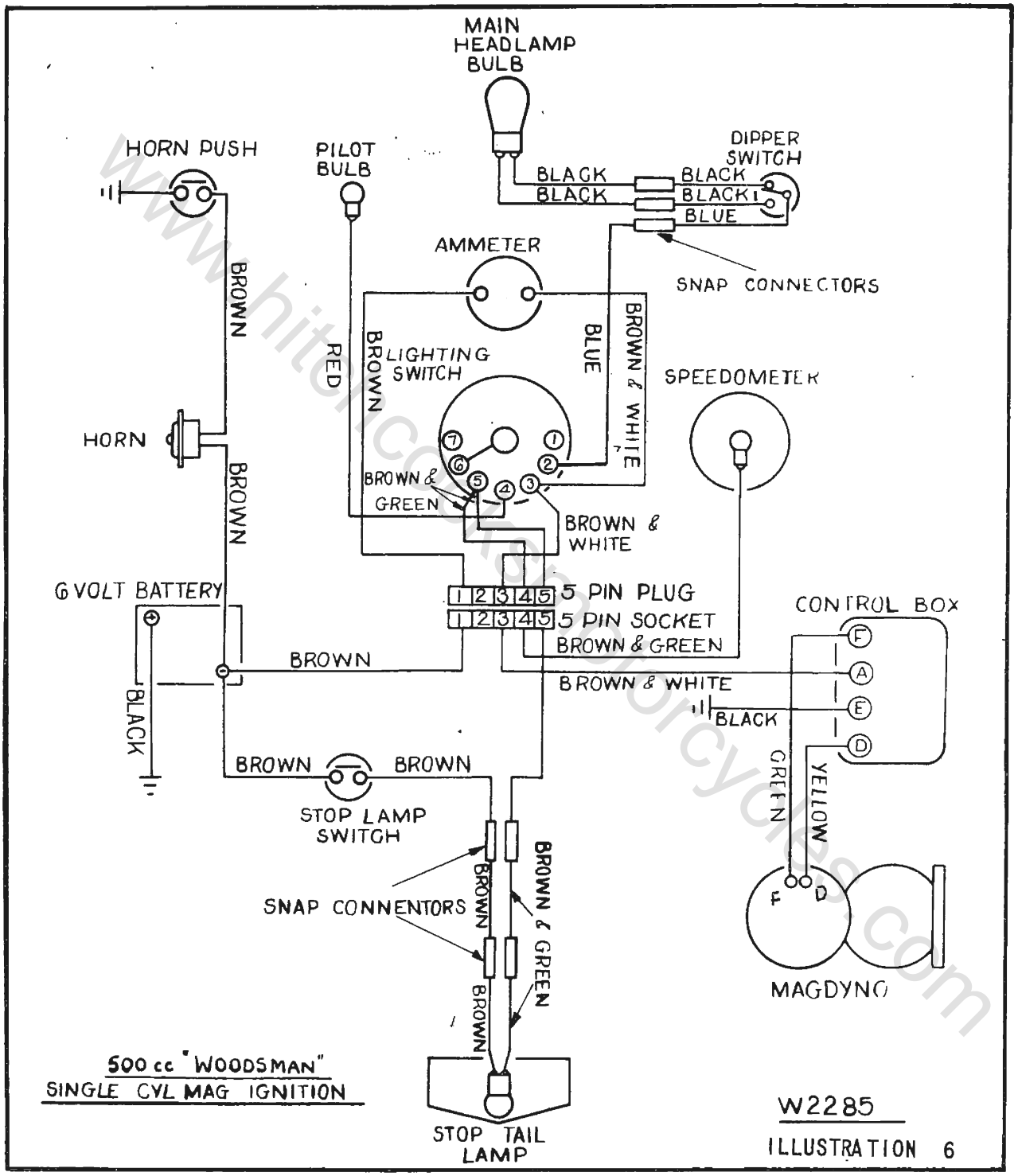
248 cc FIRE ARROW
SINGLE CYL COIL IGNITION

ILLUSTRATION 4



500 cc "TOMAHAWK"
TWIN CYL. MAG. IGNITION

ILLUSTRATION 5


MAIN HEADLAMP BULB
HORN PUSH
PILOT BULB
DIPPER SWITCH
BLACK
BLACK
BLACK
BLACK
BLUE
AMMETER
SNAP CONNECTORS
BROWN
RED
BROWN
LIGHTING SWITCH
BLUE
BROWN & WHITE
SPEEDOMETER
HORN
BROWN
BROWN & GREEN
BROWN & WHITE
6 VOLT BATTERY
1 2 3 4 5 5 PIN PLUG
1 2 3 4 5 5 PIN SOCKET
BROWN & GREEN
CONTROL BOX
F
A
E
D
BROWN
BROWN & WHITE
BLACK
BLACK
BROWN
BROWN
STOP LAMP SWITCH
SNAP CONNENTORS
BROWN
BROWN & GREEN
BROWN
GREEN
YELLOW
F
D
MAGDYNO
500 cc "WOODSMAN"
SINGLE CYL MAG IGNITION
STOP TAIL LAMP
W2285
ILLUSTRATION 6

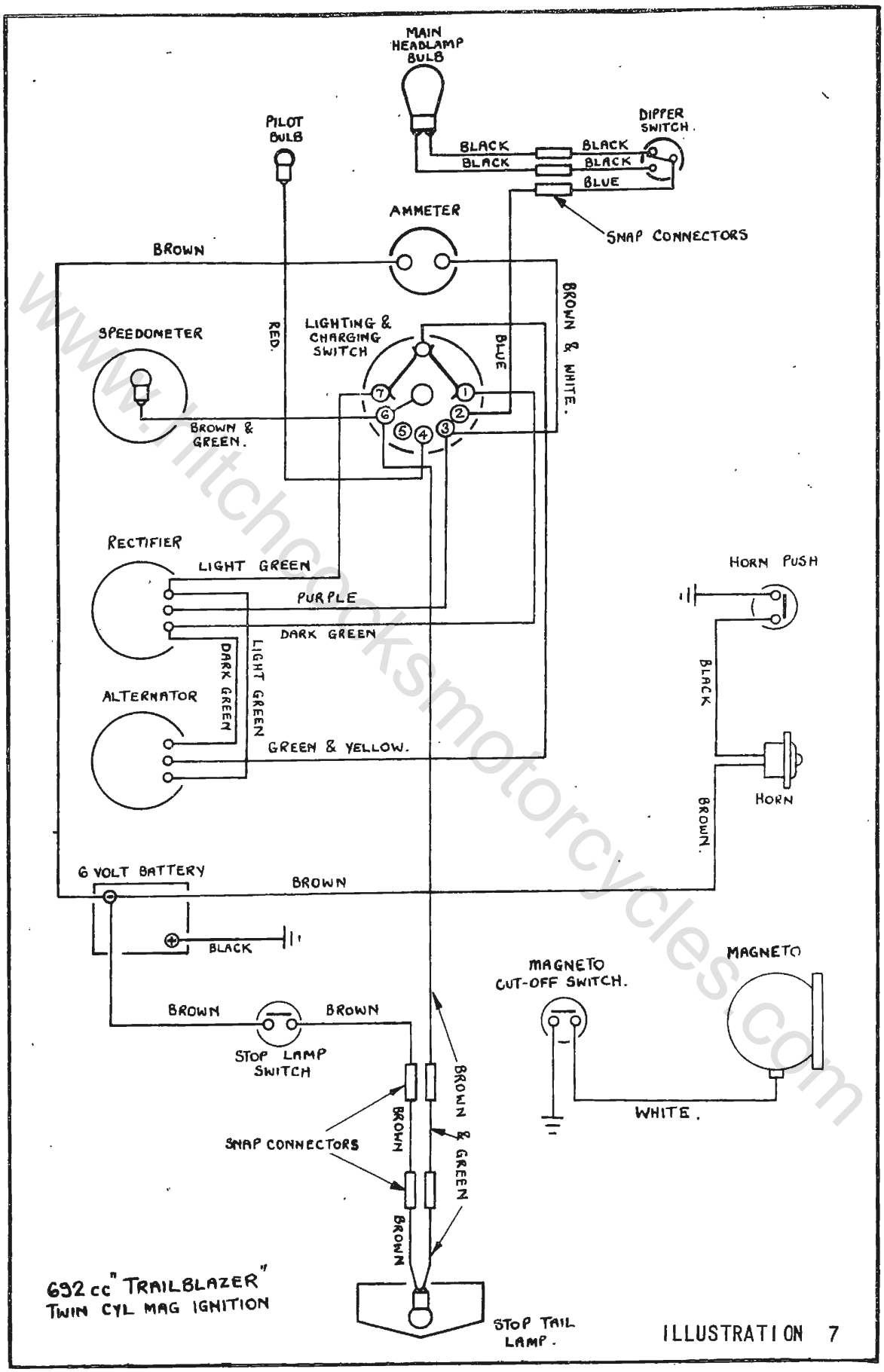
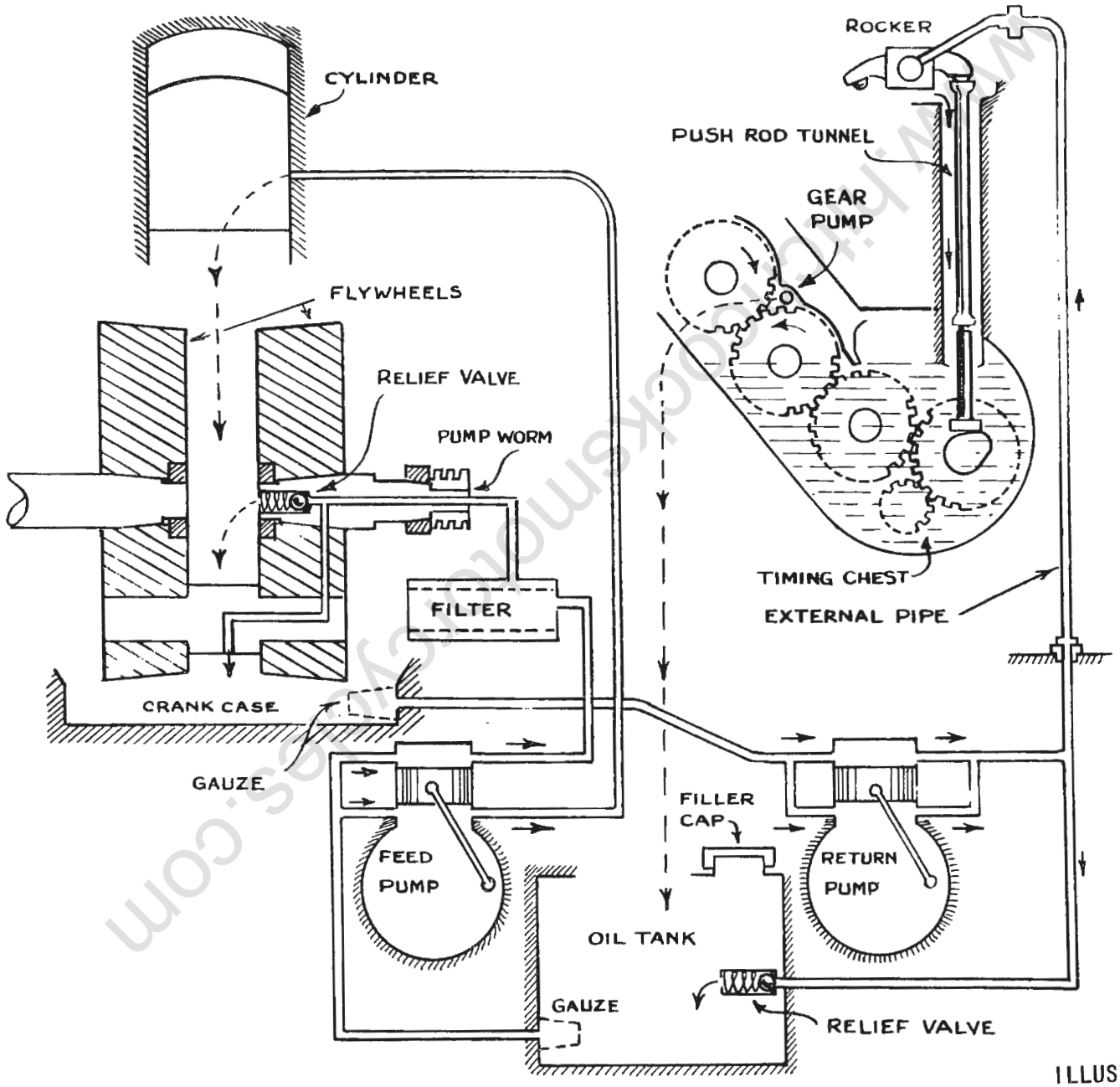


ILLUSTRATION 7



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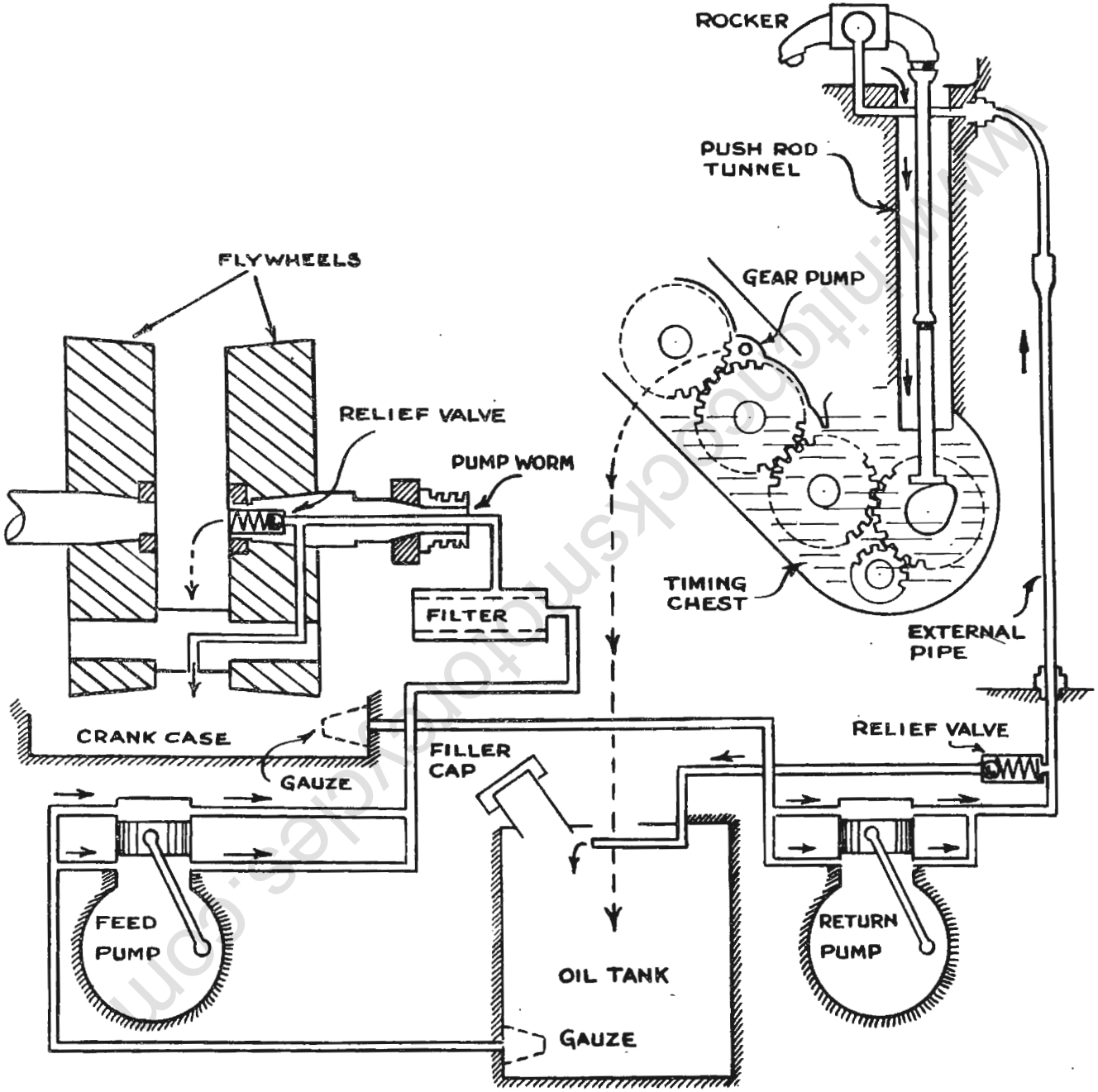

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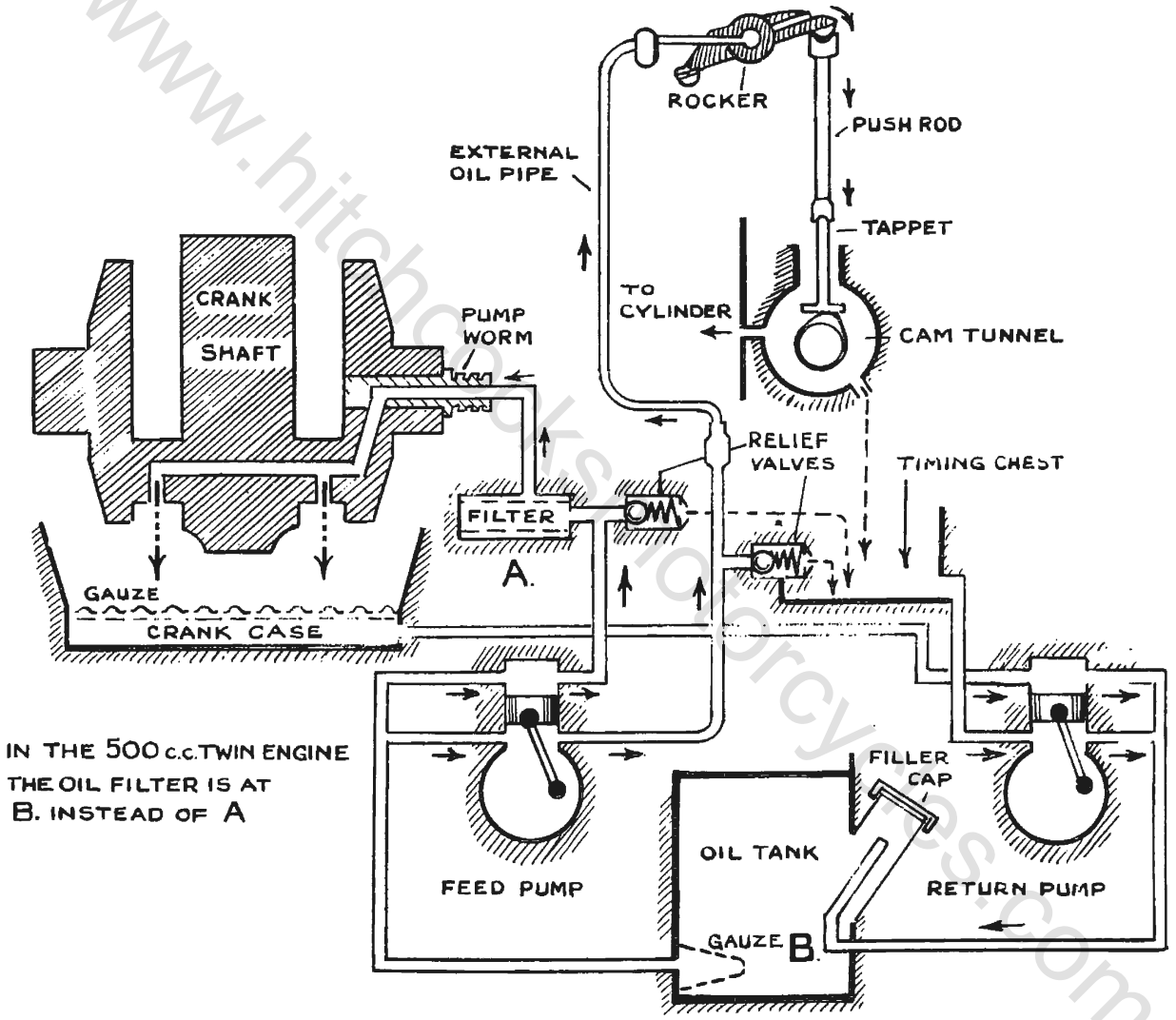
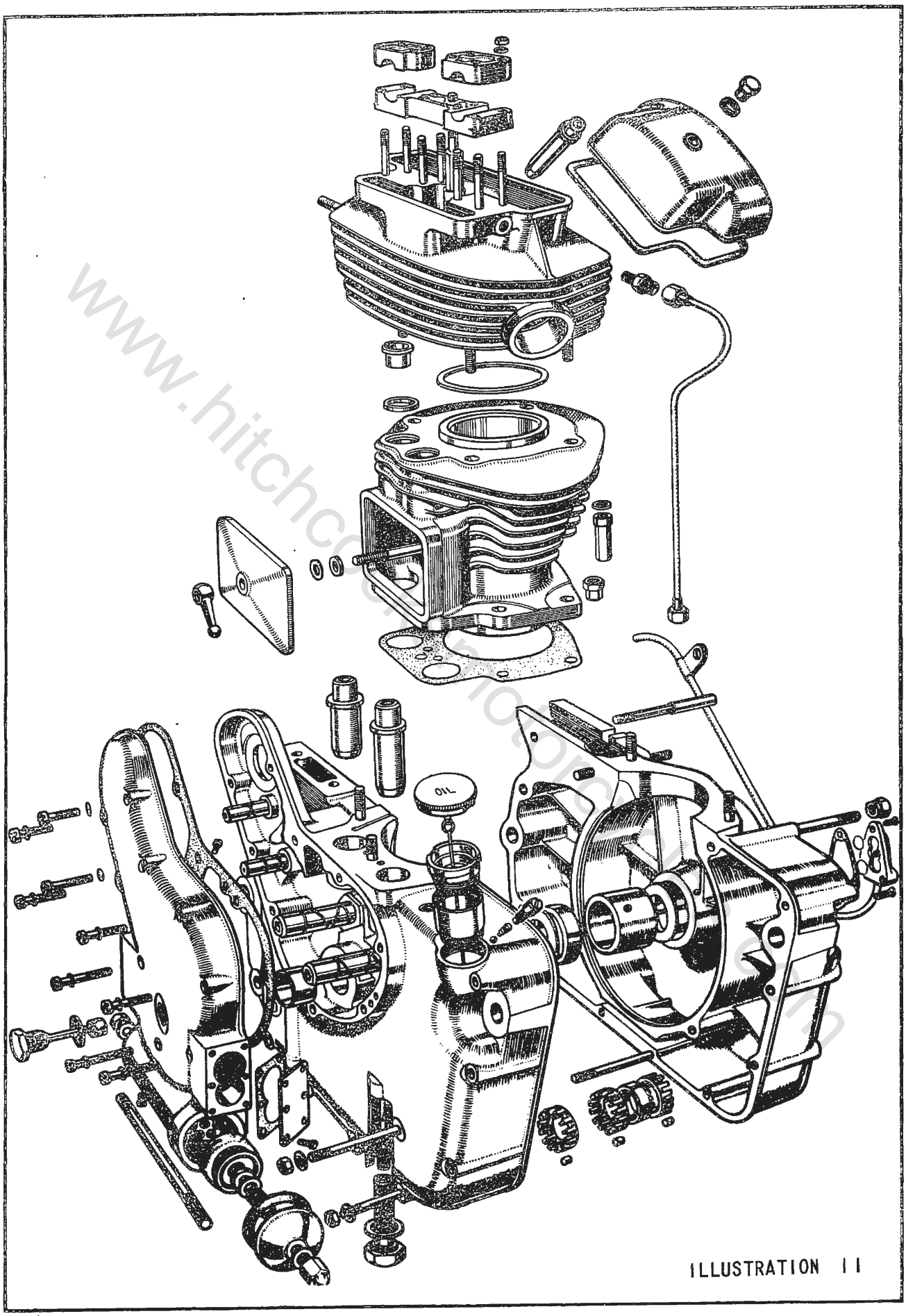


700 c.c ENGINE
LUBRICATION SYSTEM
DIAGRAMMATIC ARRANGEMENT

ILLUSTRATION 10



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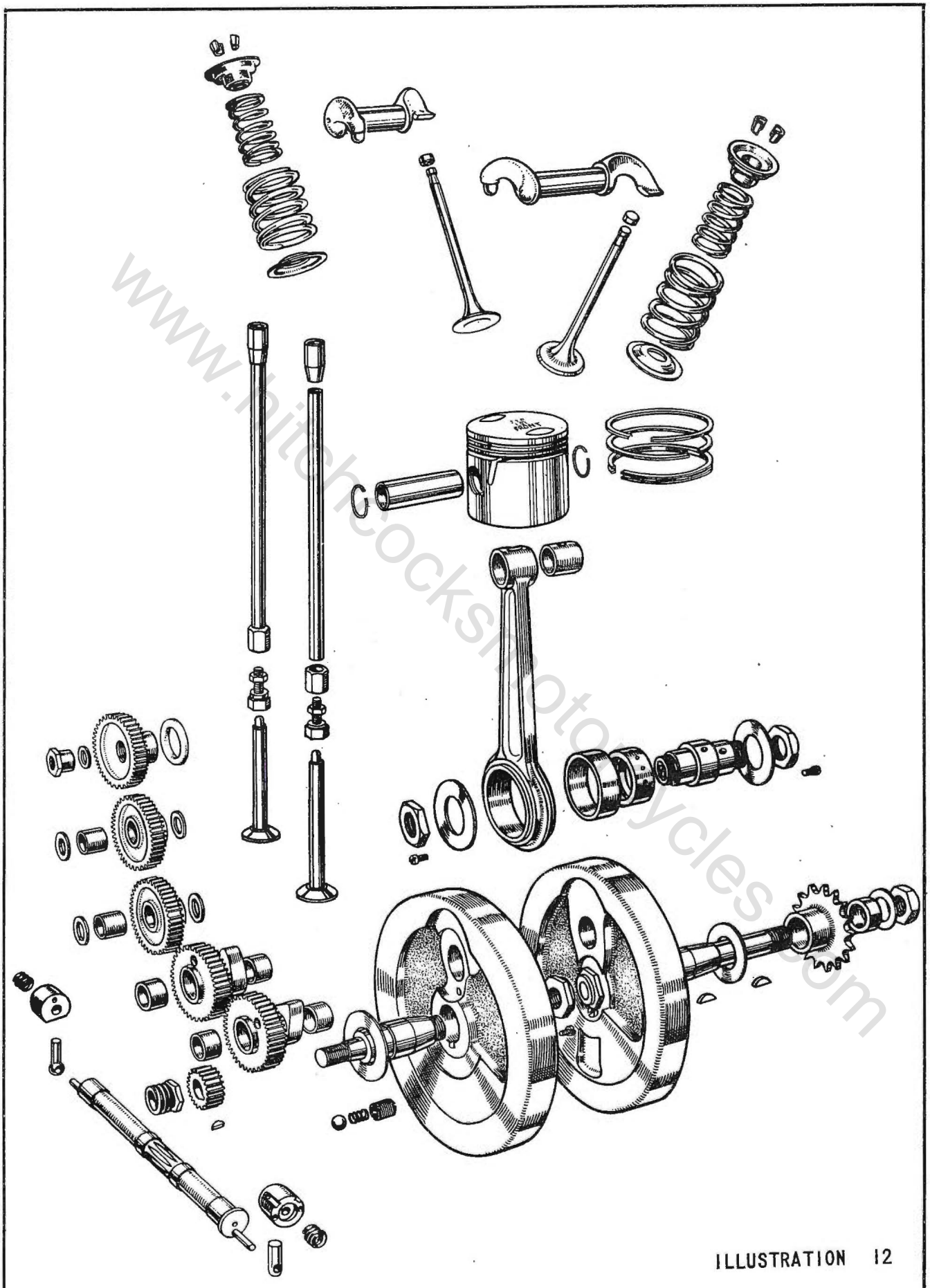

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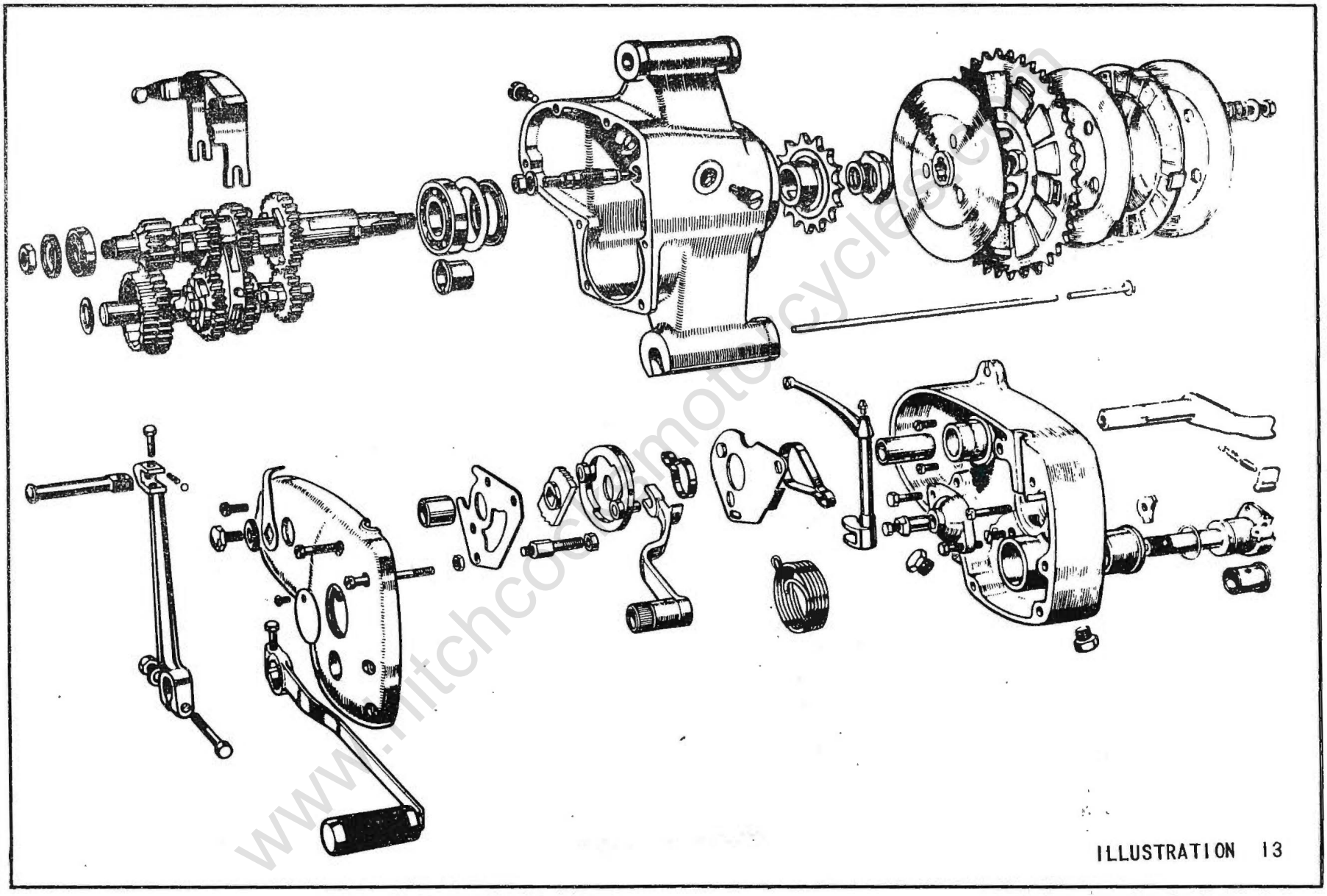

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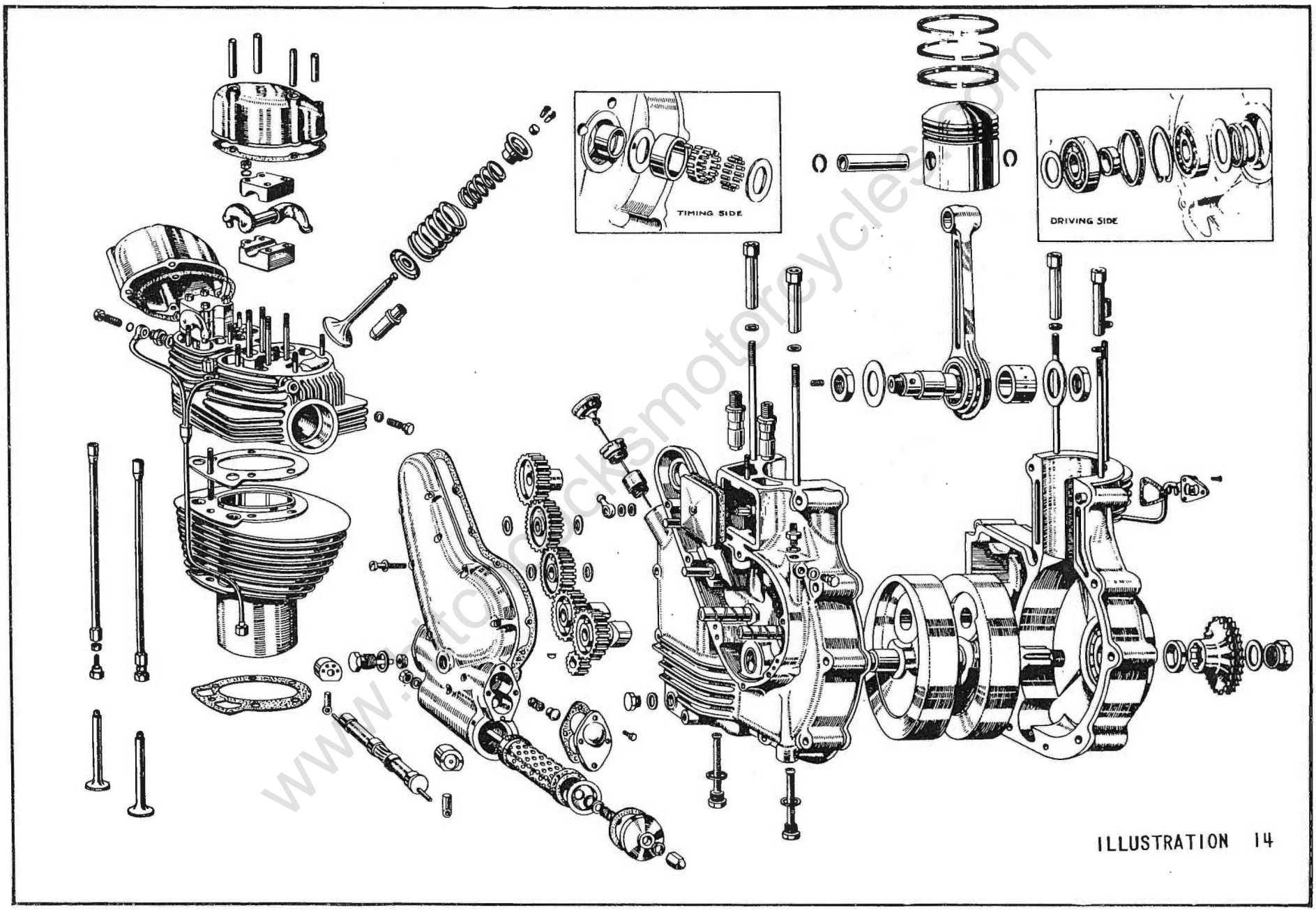

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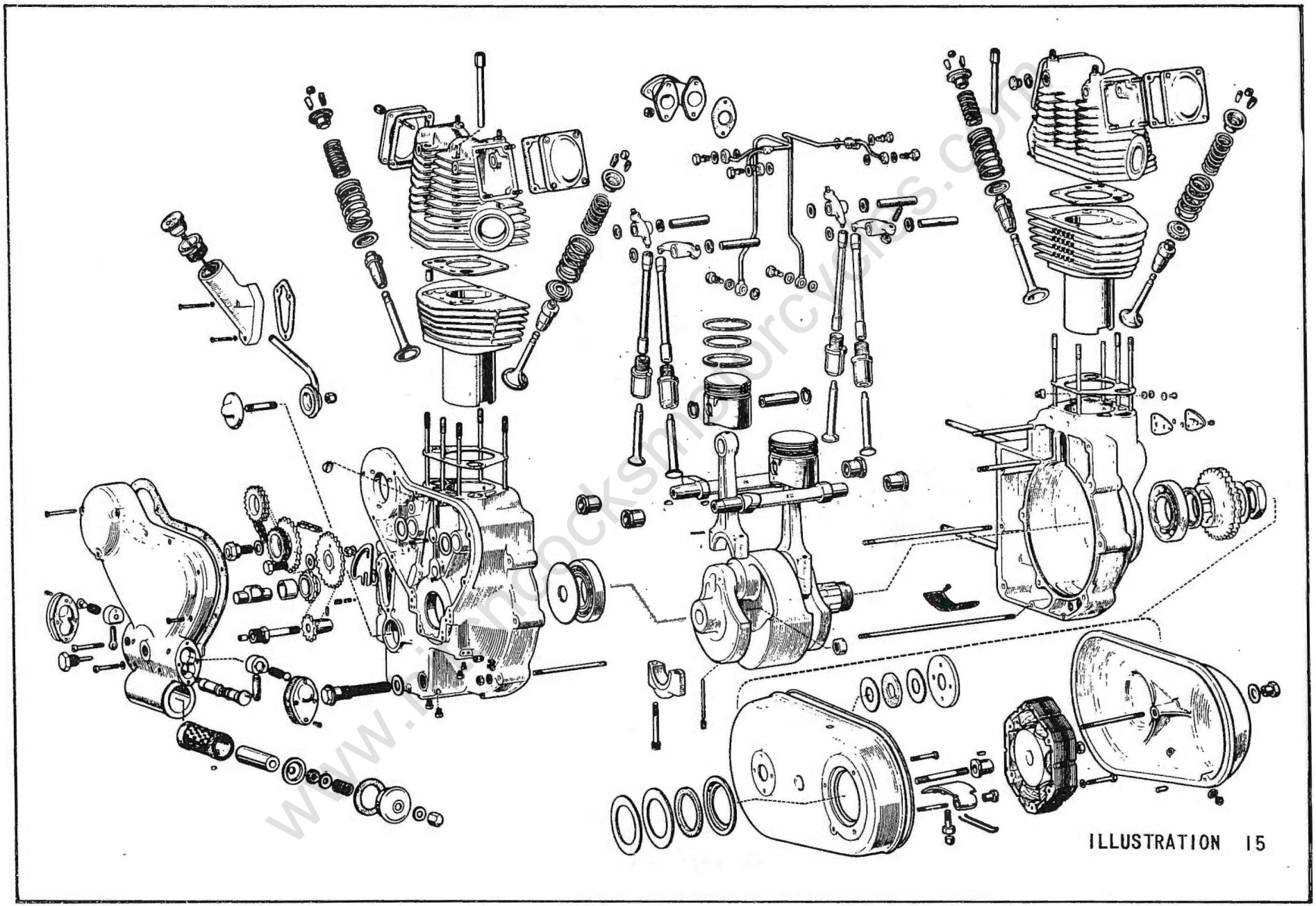

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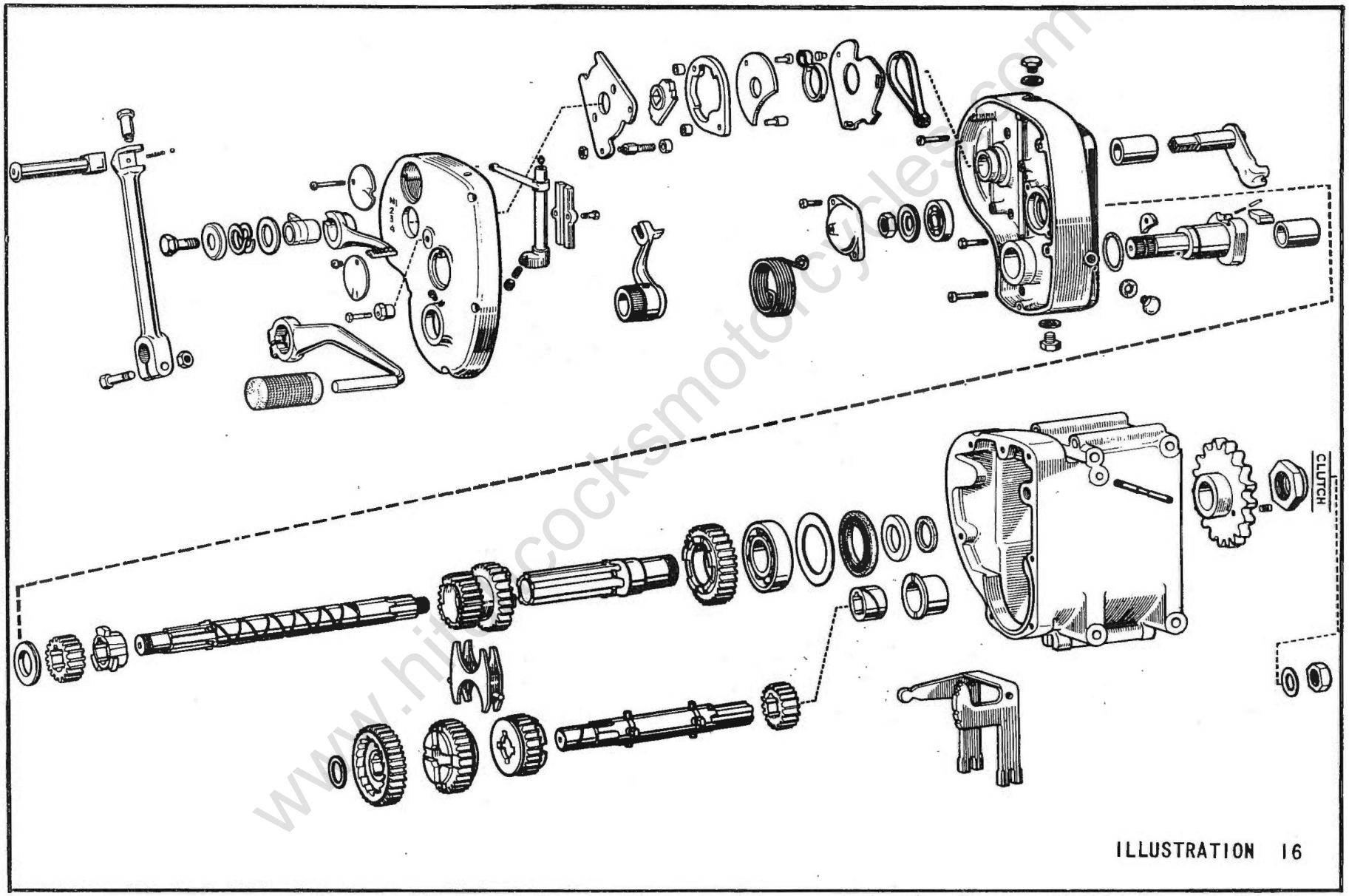

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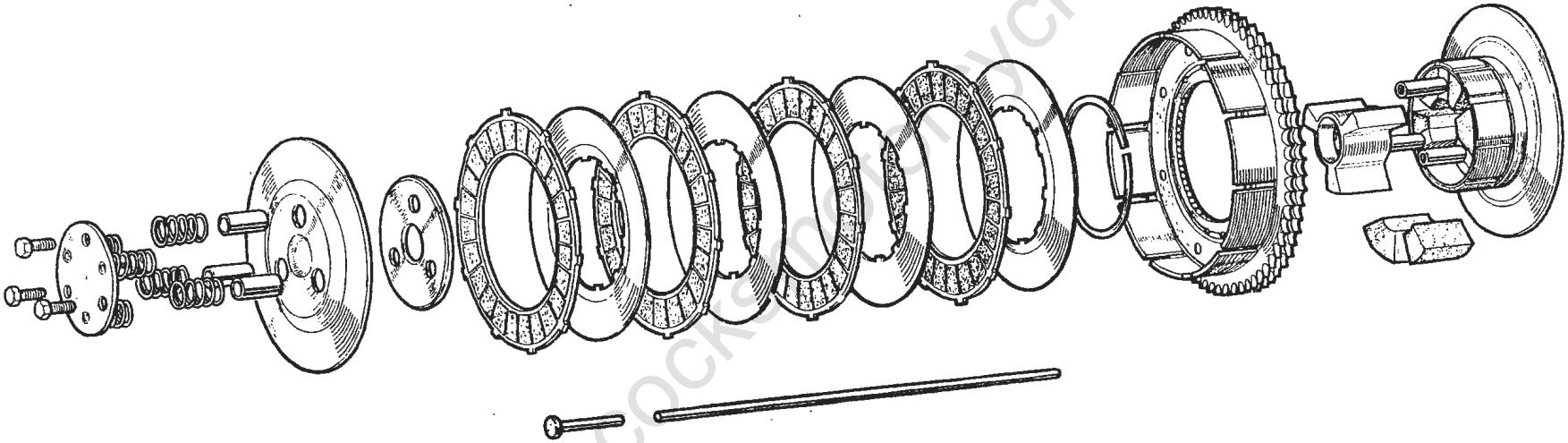

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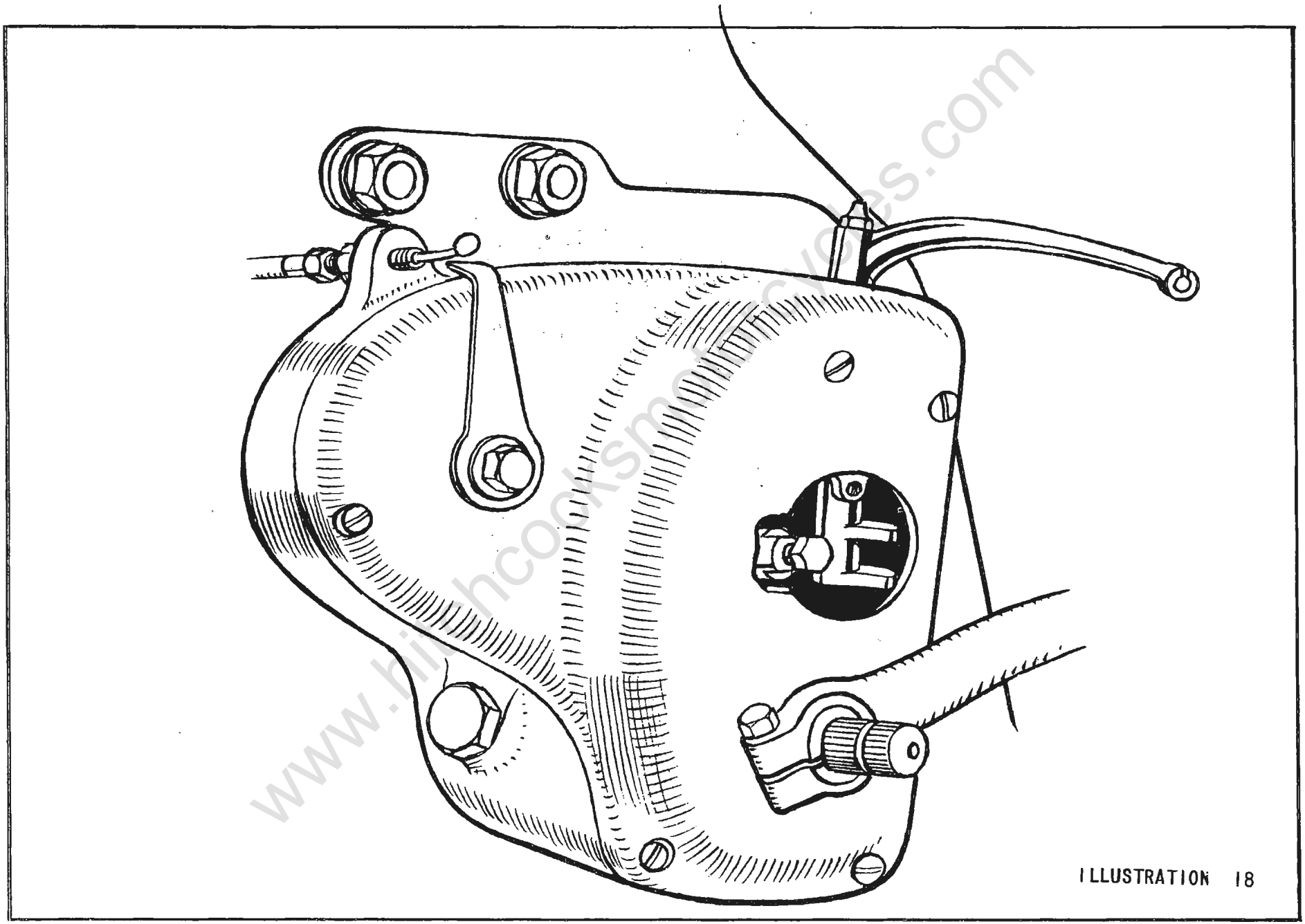

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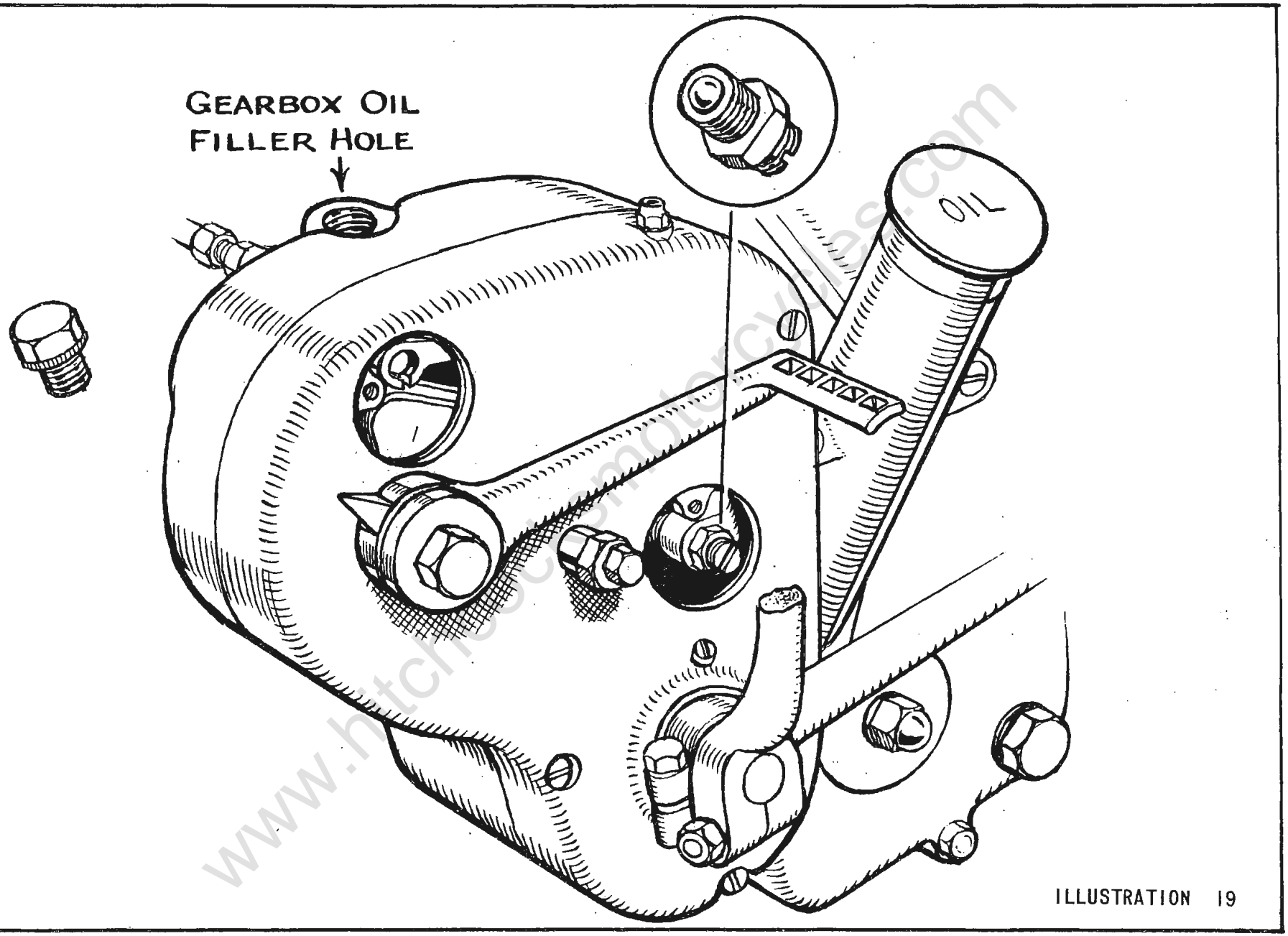
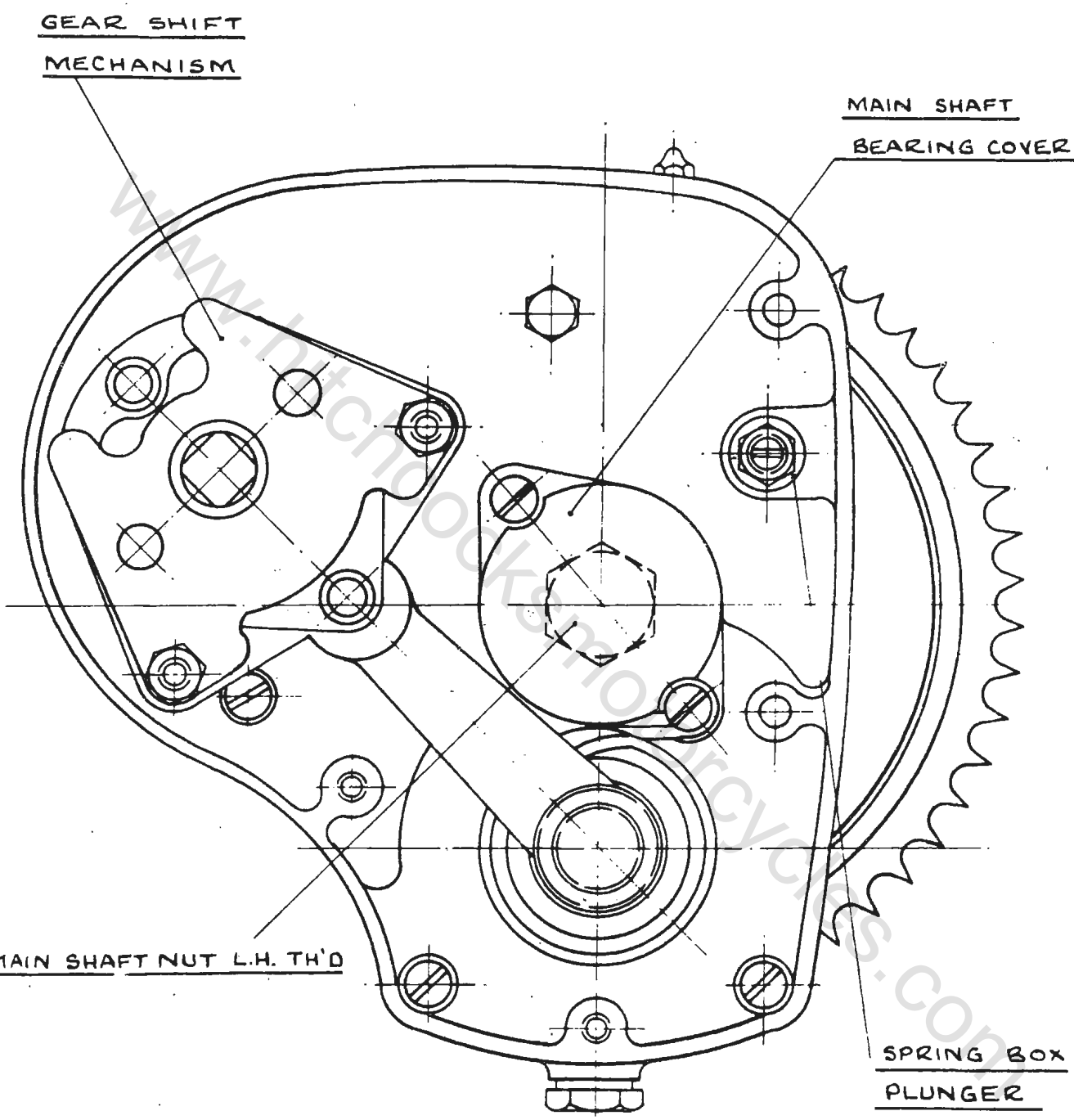
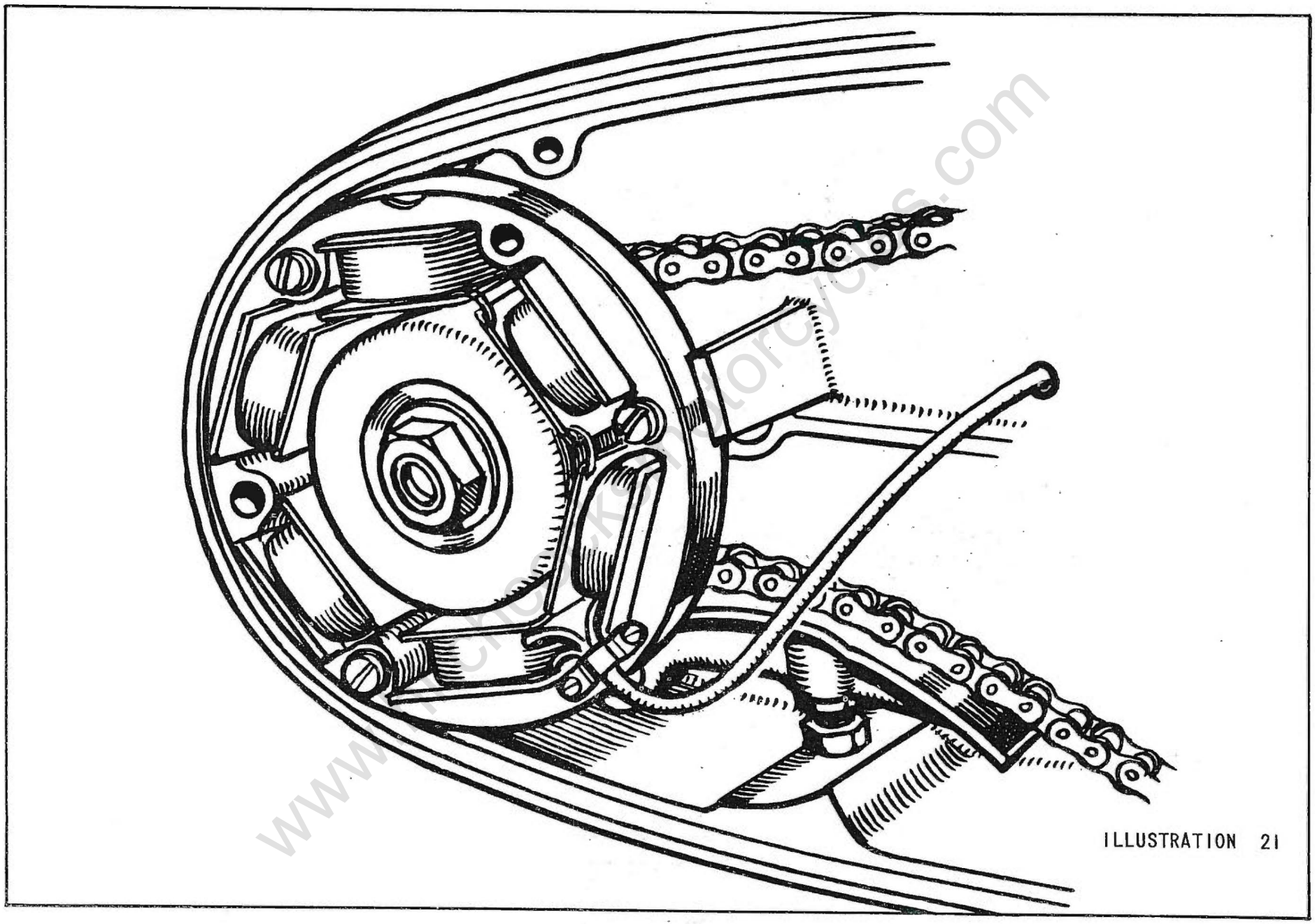


ILLUSTRATION 19



GEAR BOX WITH OUTER COVER REMOVED

ILLUSTRATION 20



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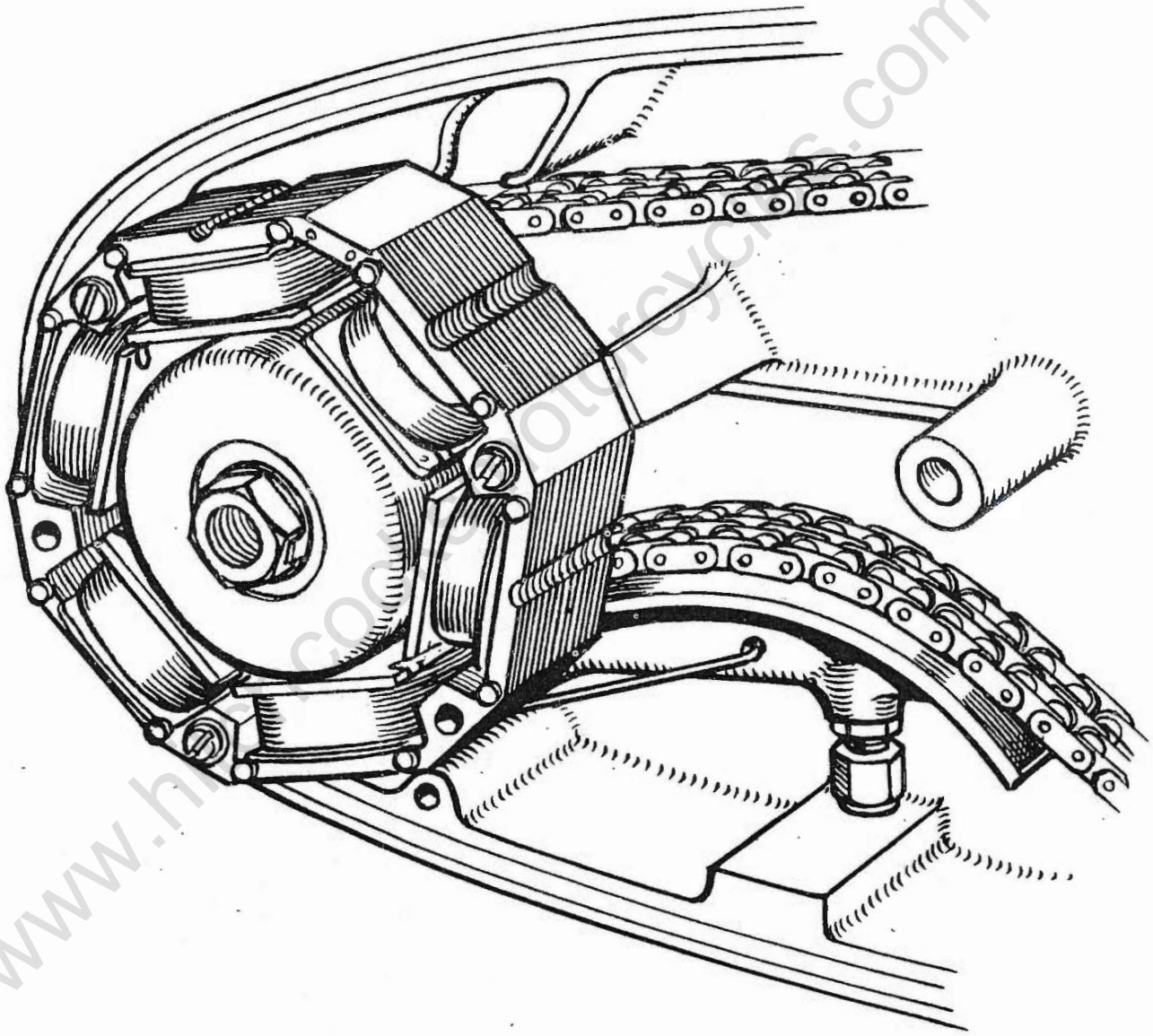
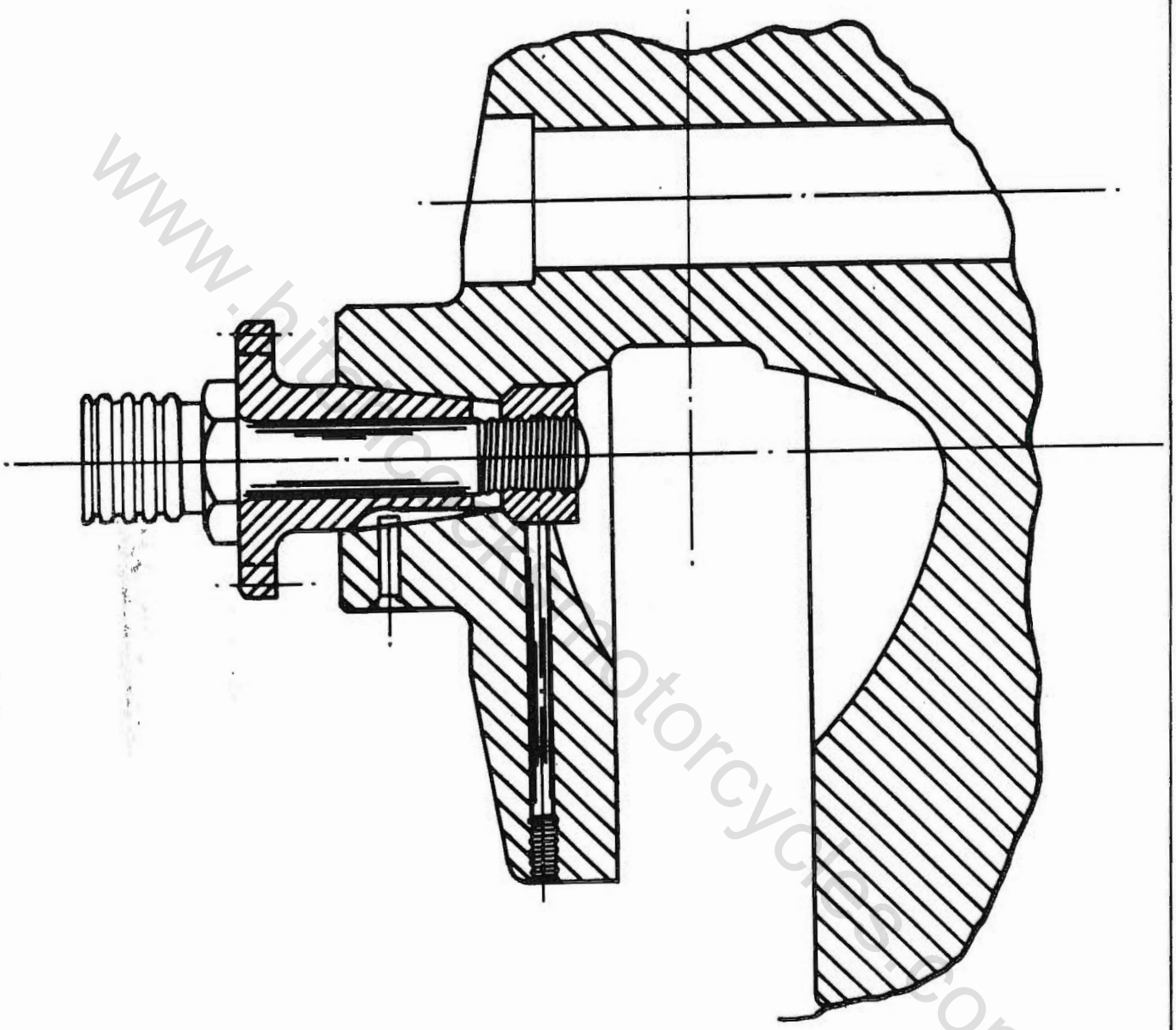


ILLUSTRATION 22



SECTION SHOWING LOCKING OF OIL PUMP WORM AND TIMING SPROCKET BY LOCKING ROD.

ILLUSTRATION 23

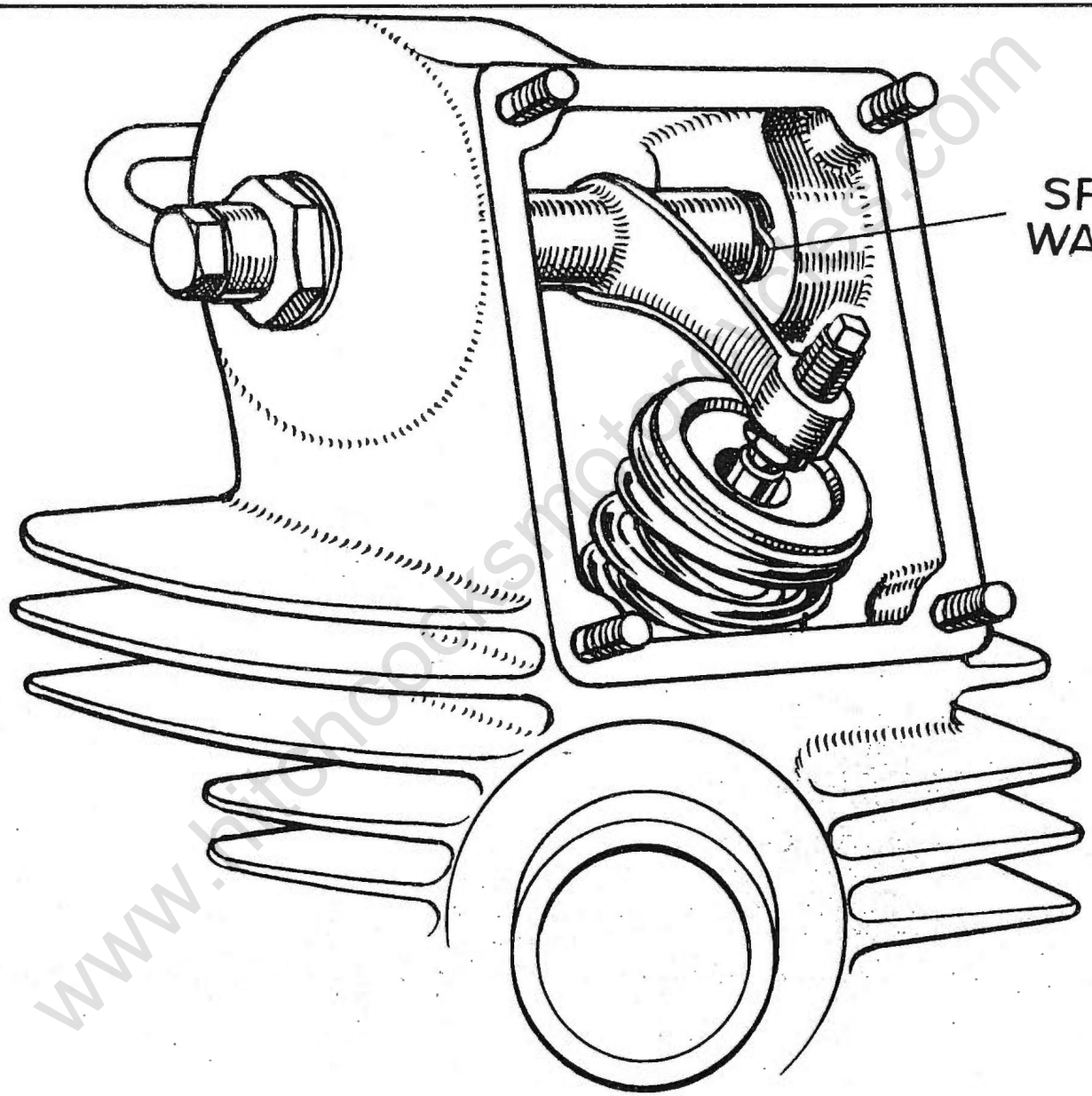
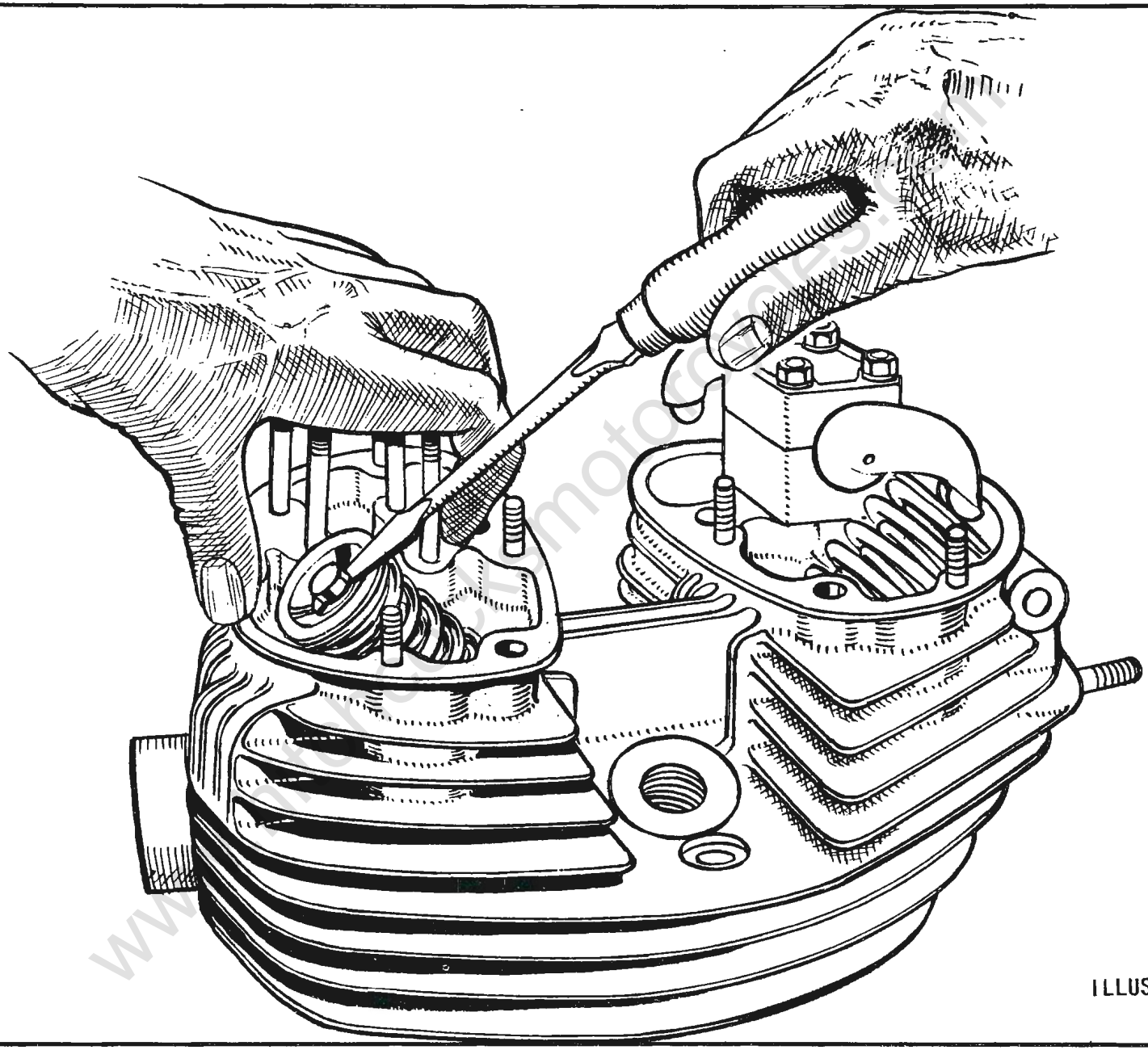


ILLUSTRATION 24



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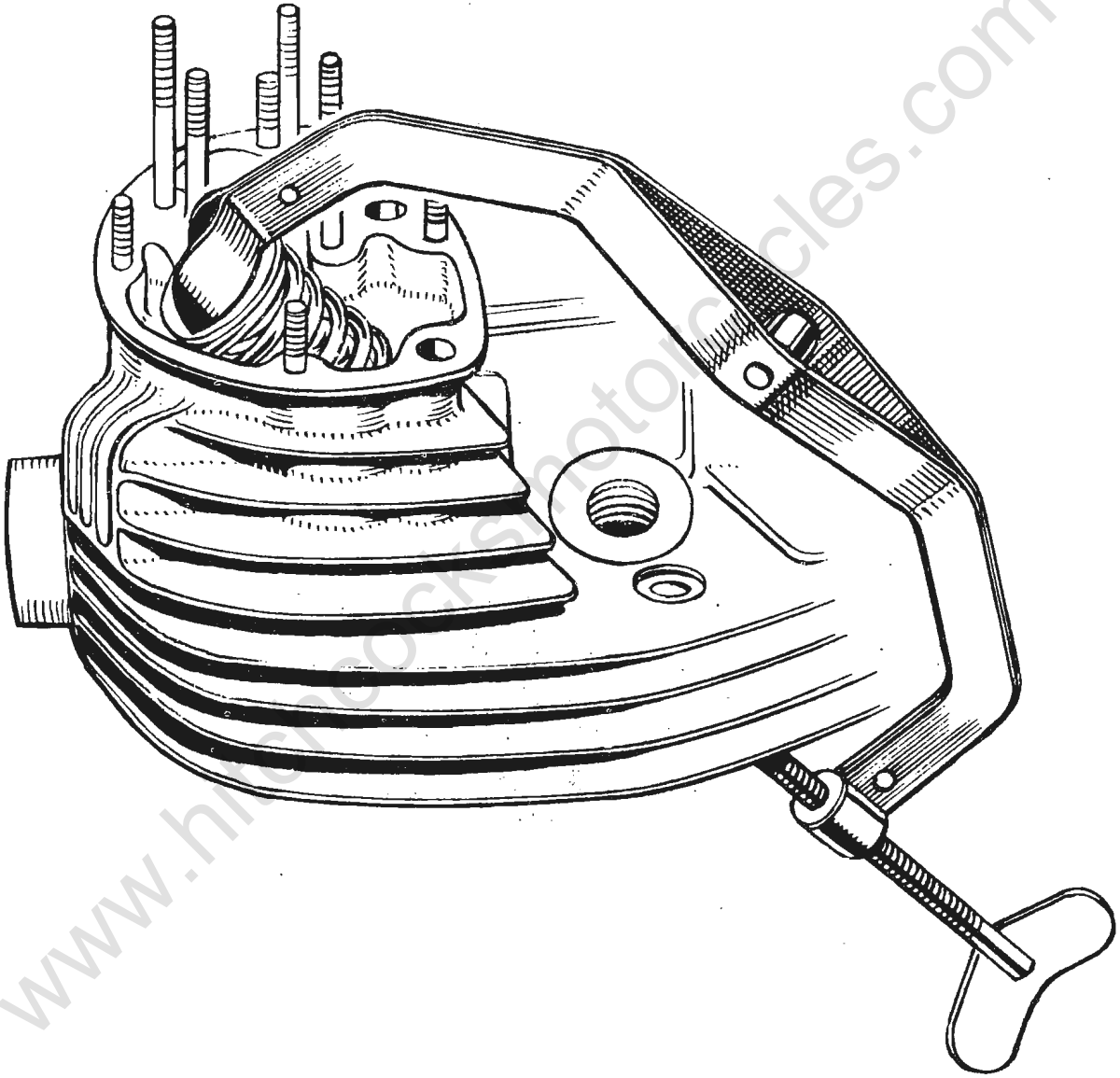
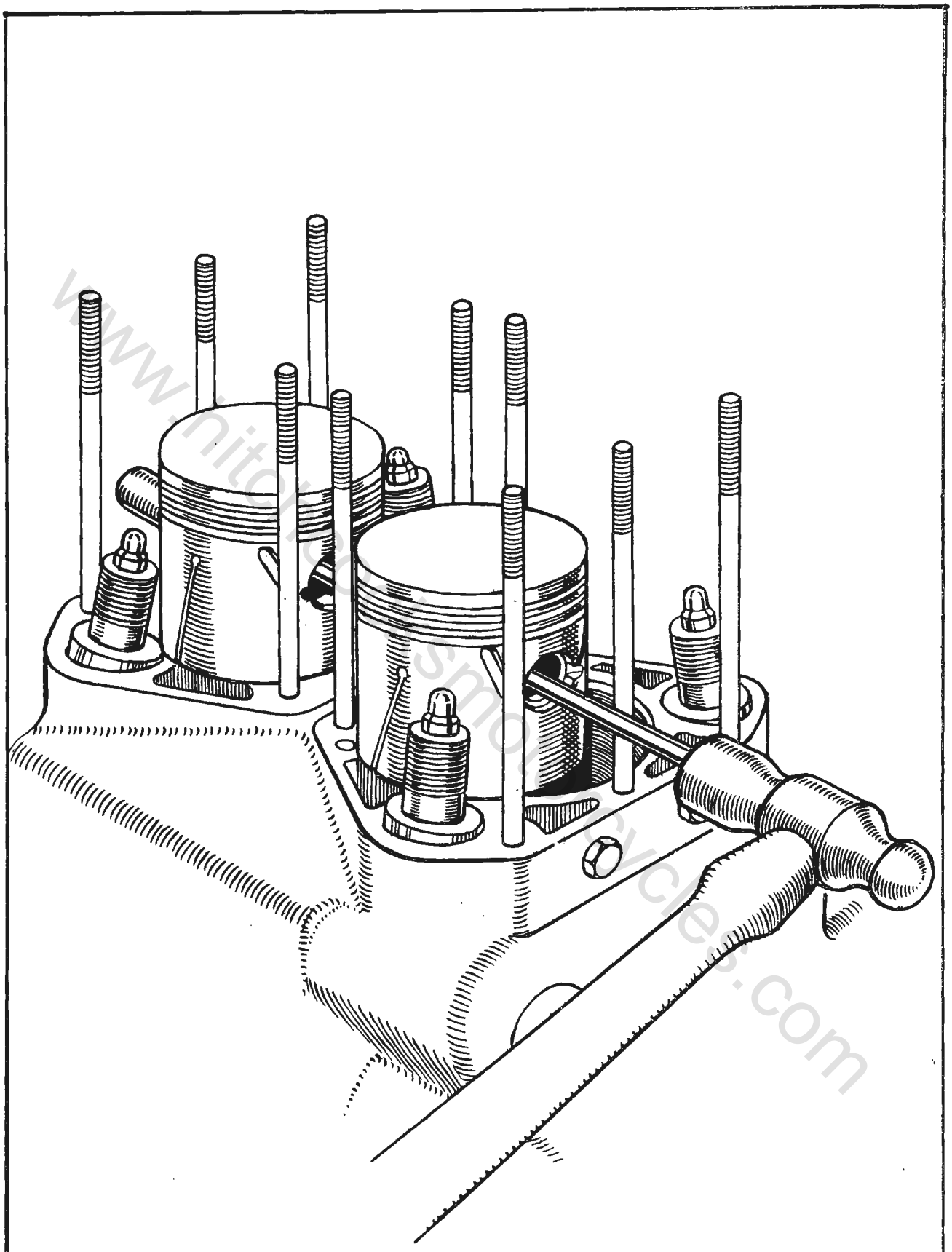


ILLUSTRATION 26



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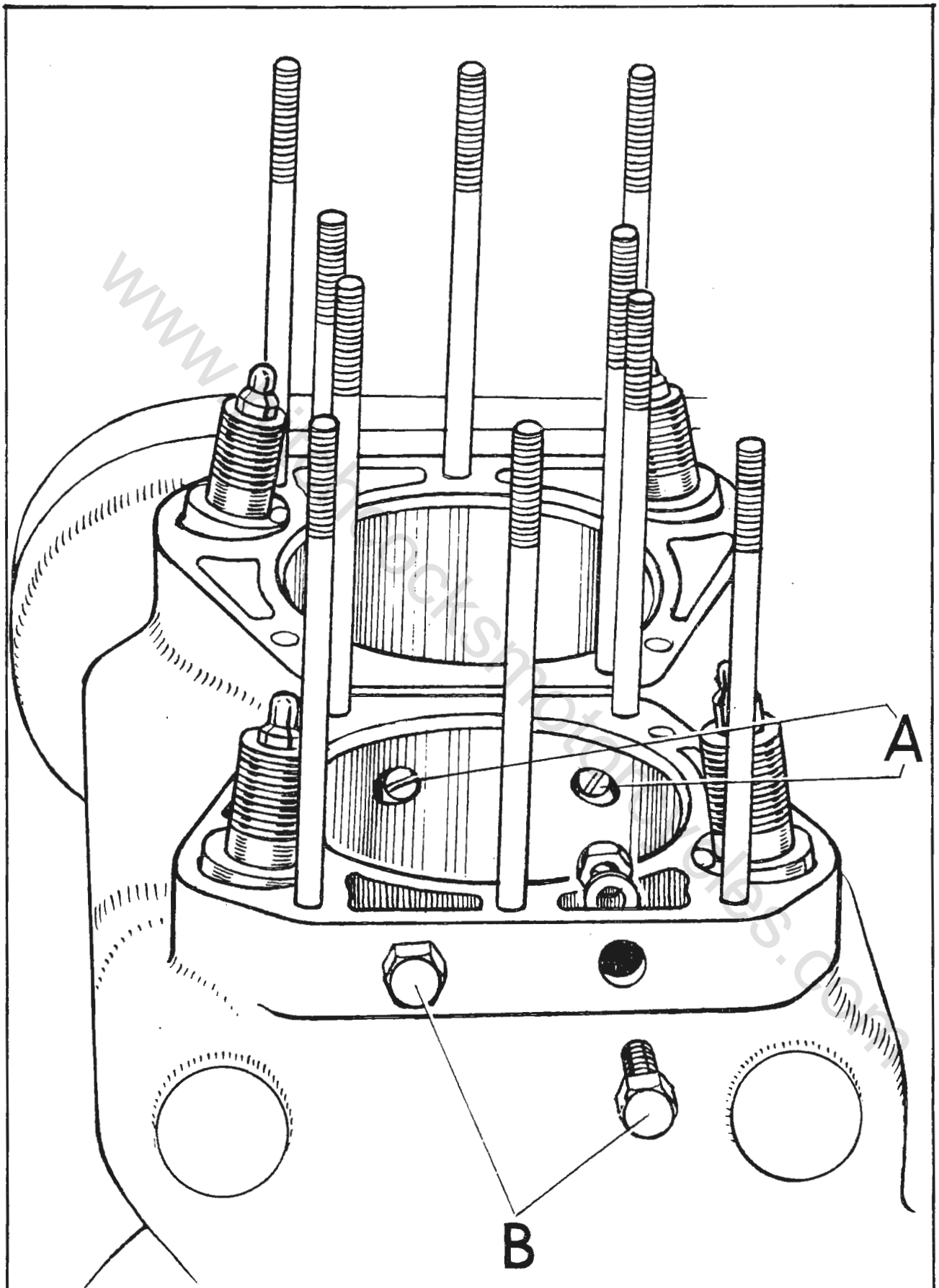

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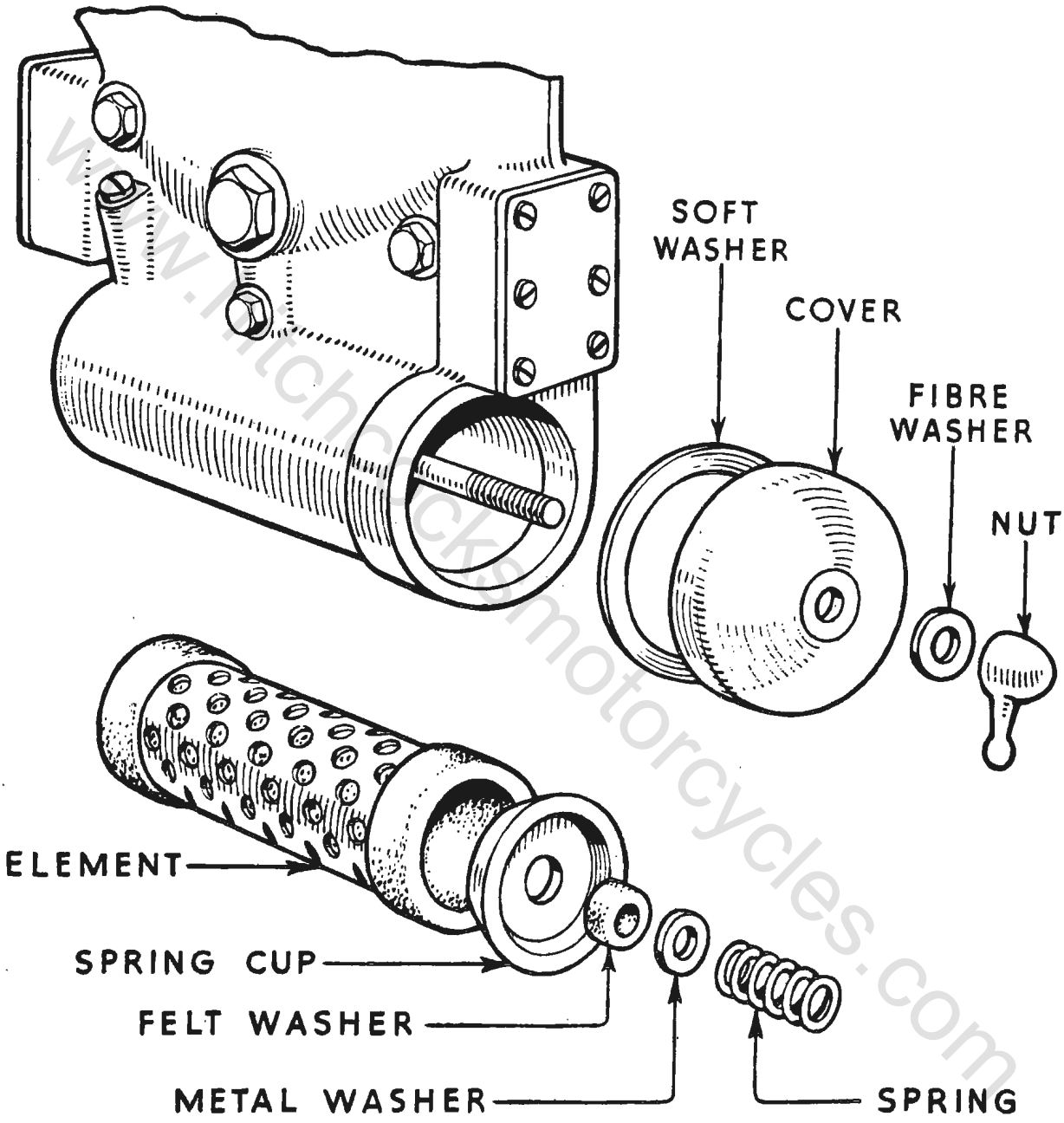


DETAIL OF FELT OIL CLEANER

ILLUSTRATION 29

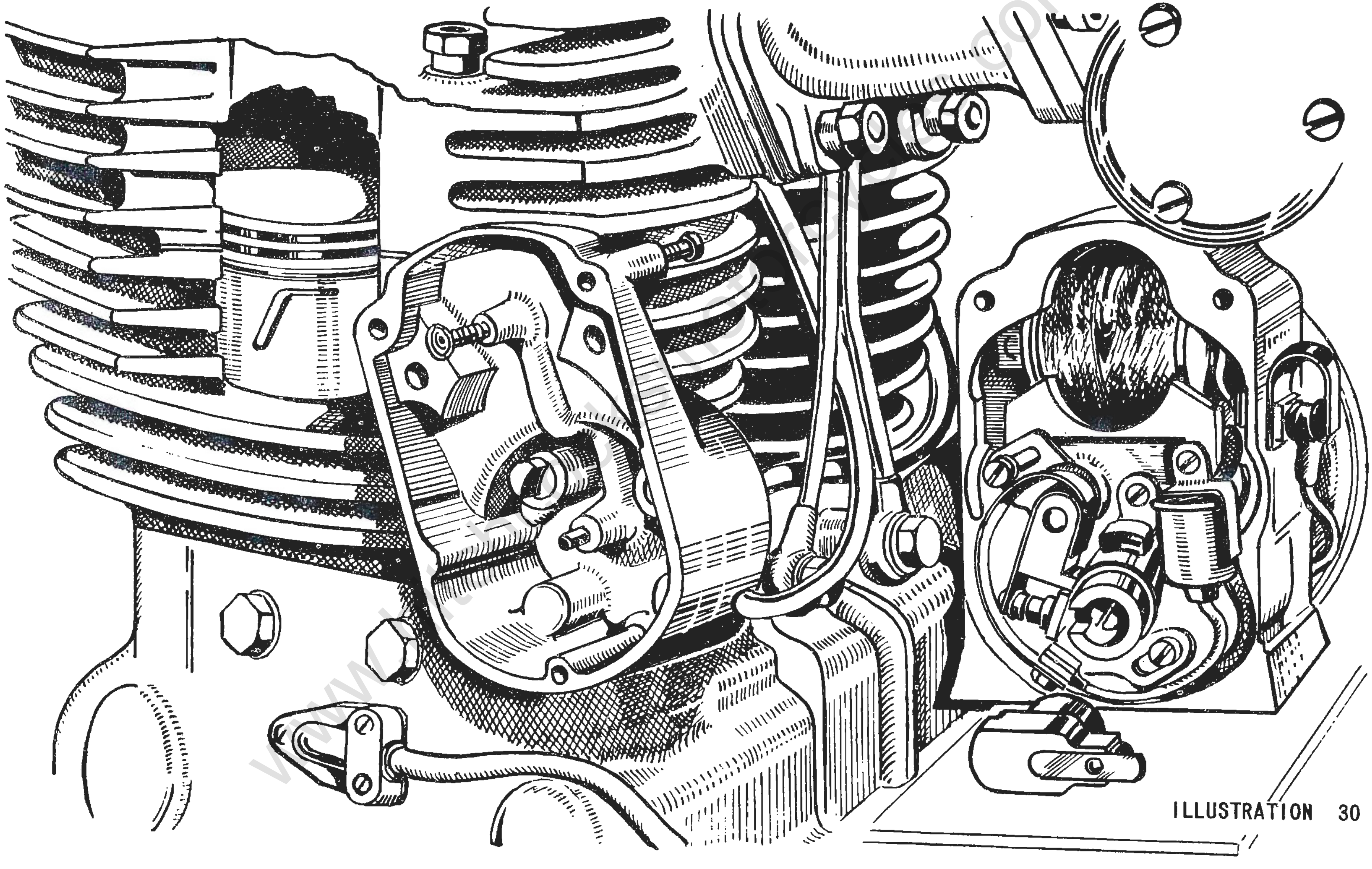
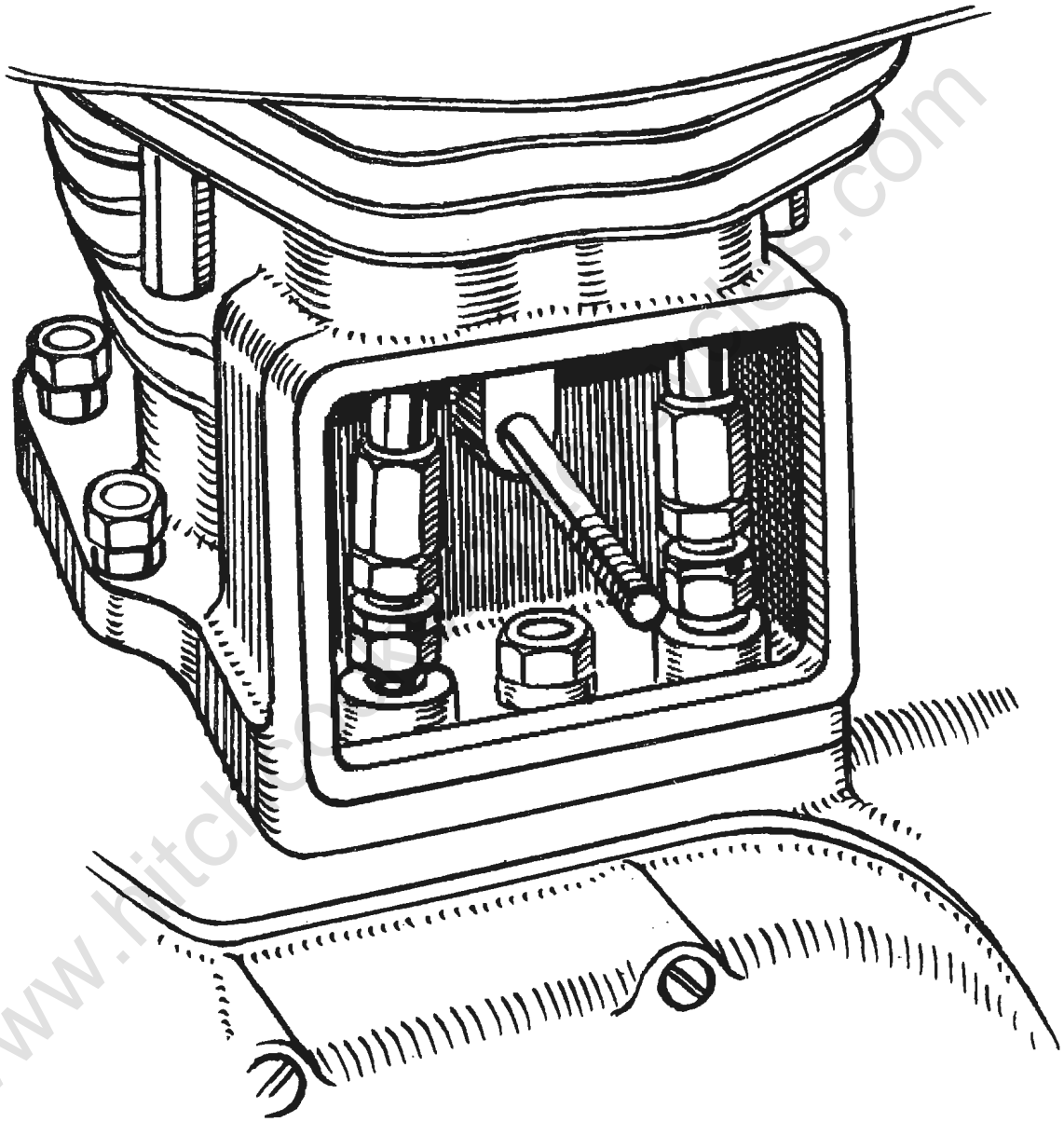


ILLUSTRATION 30



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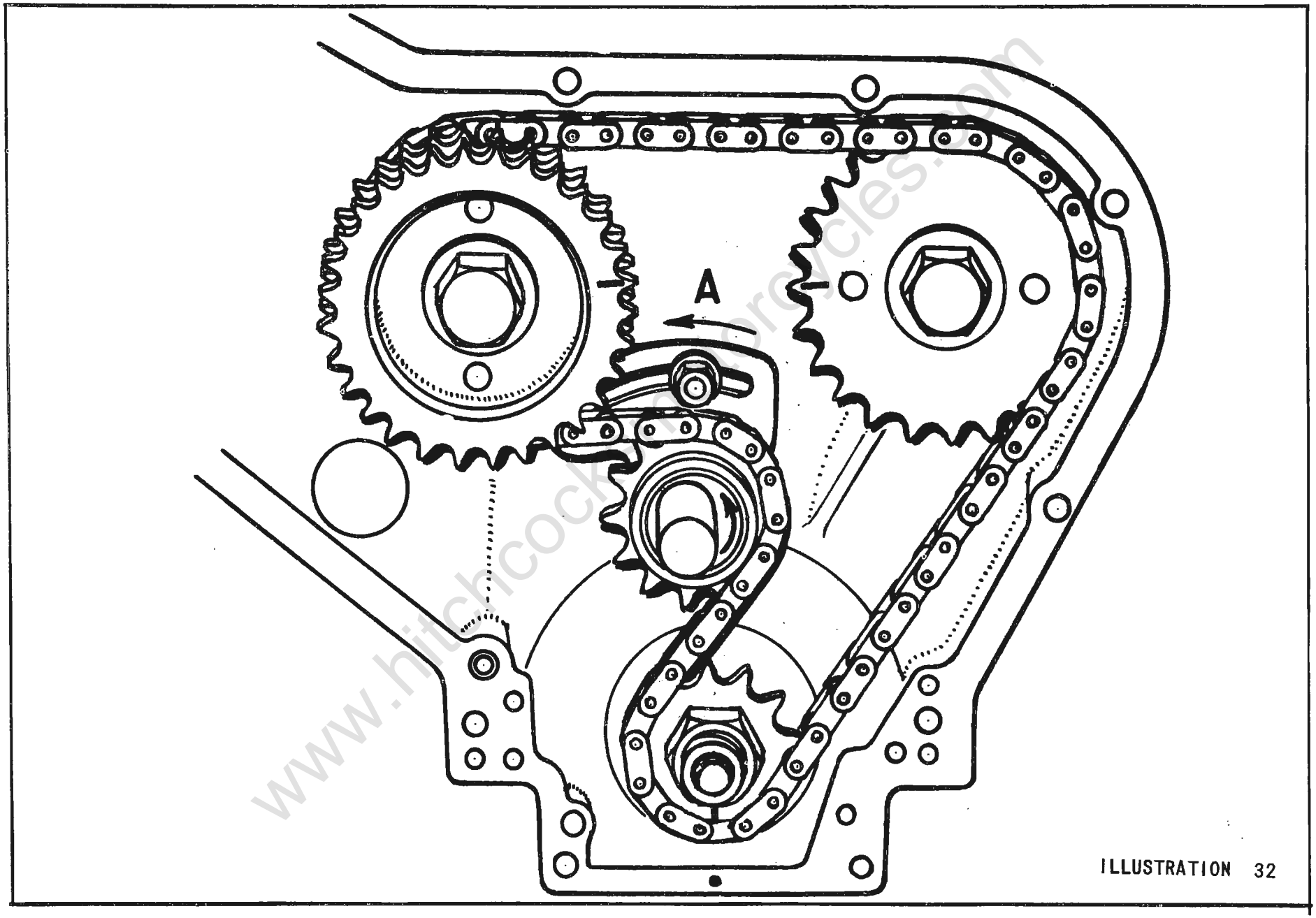

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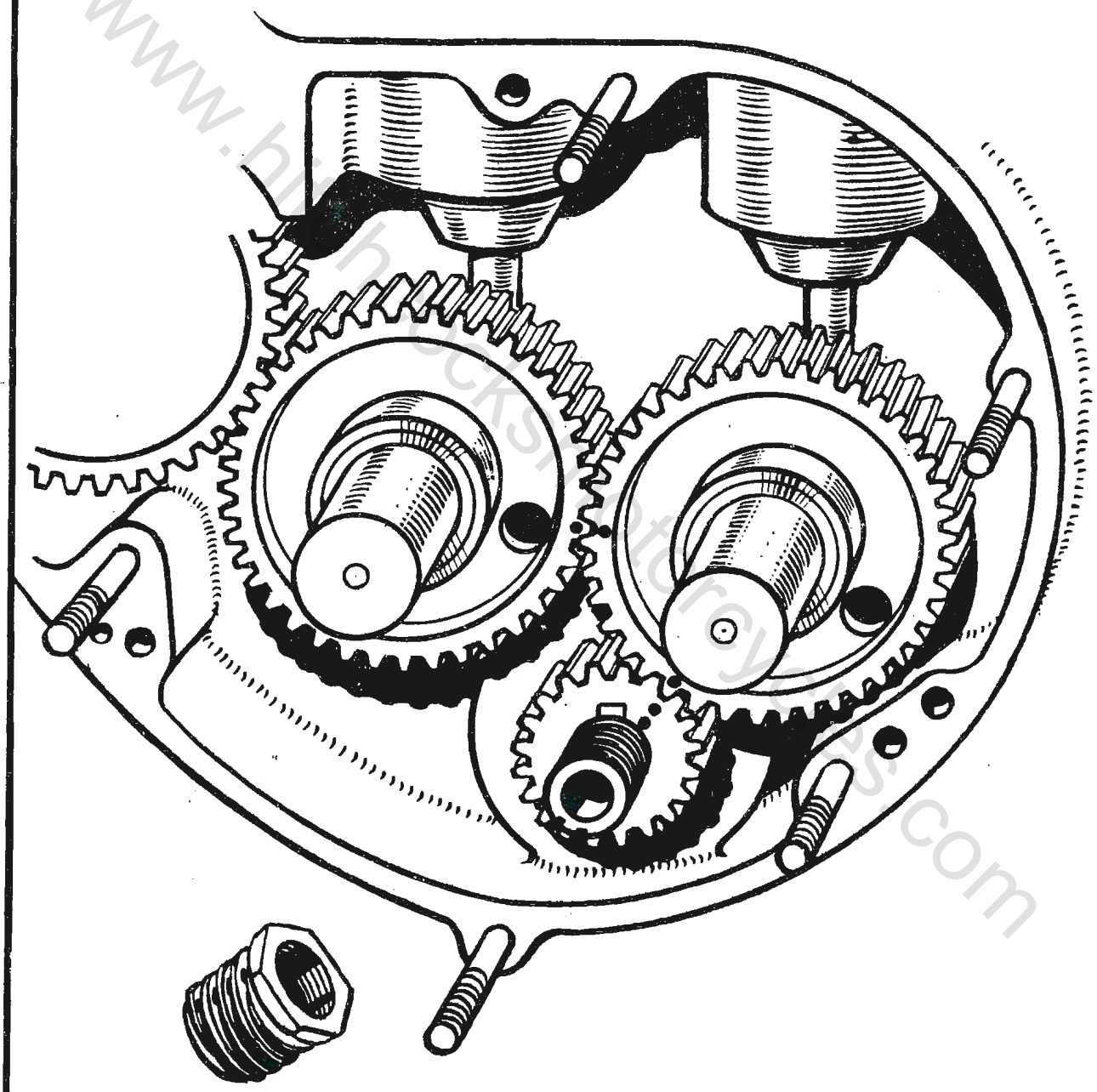

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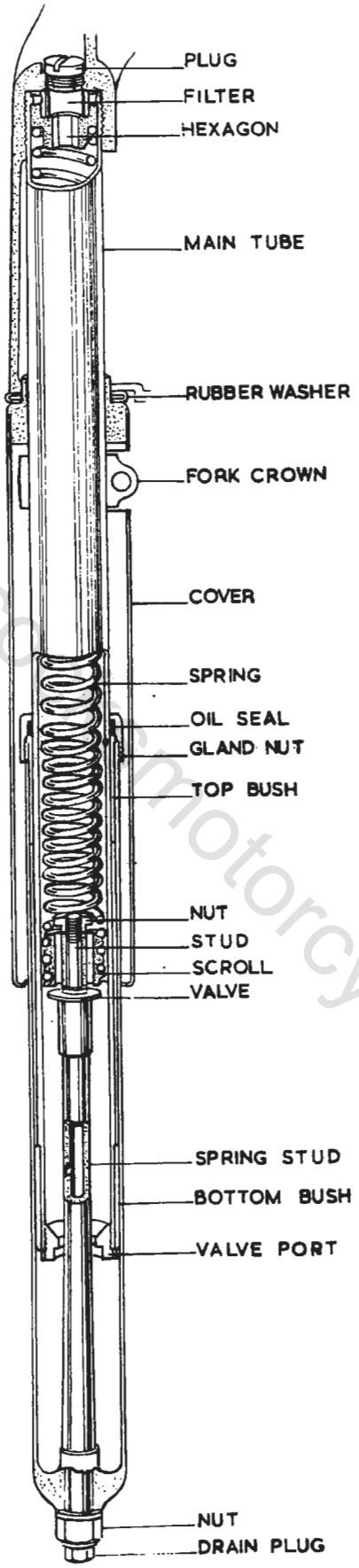

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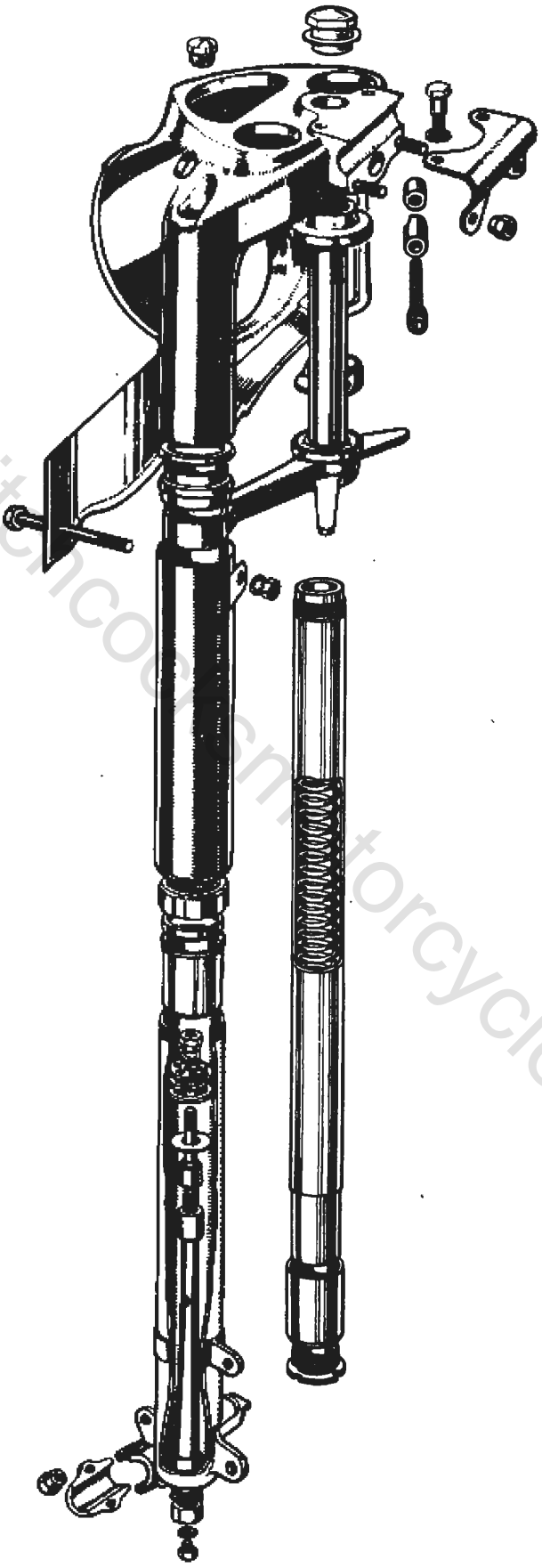

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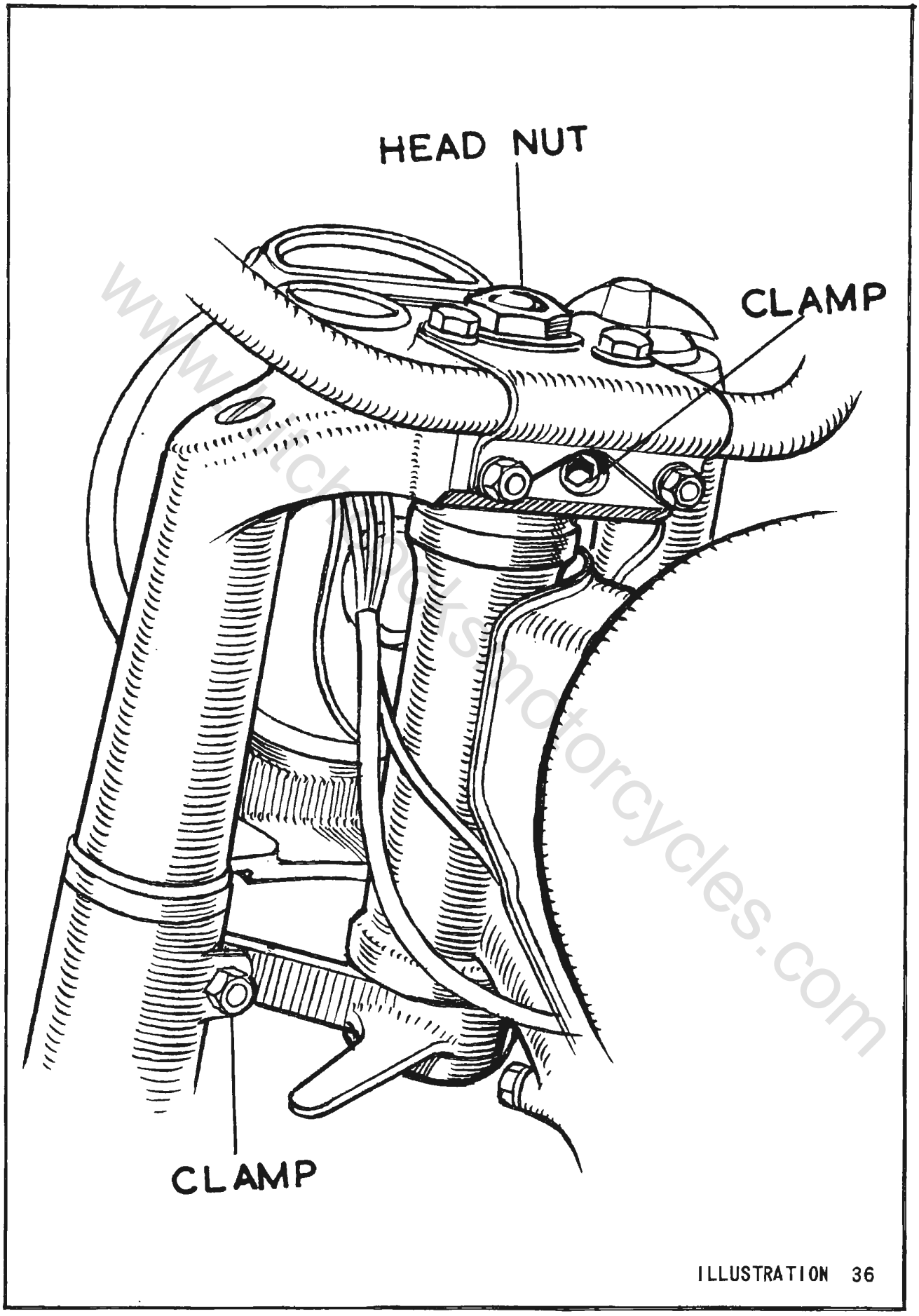

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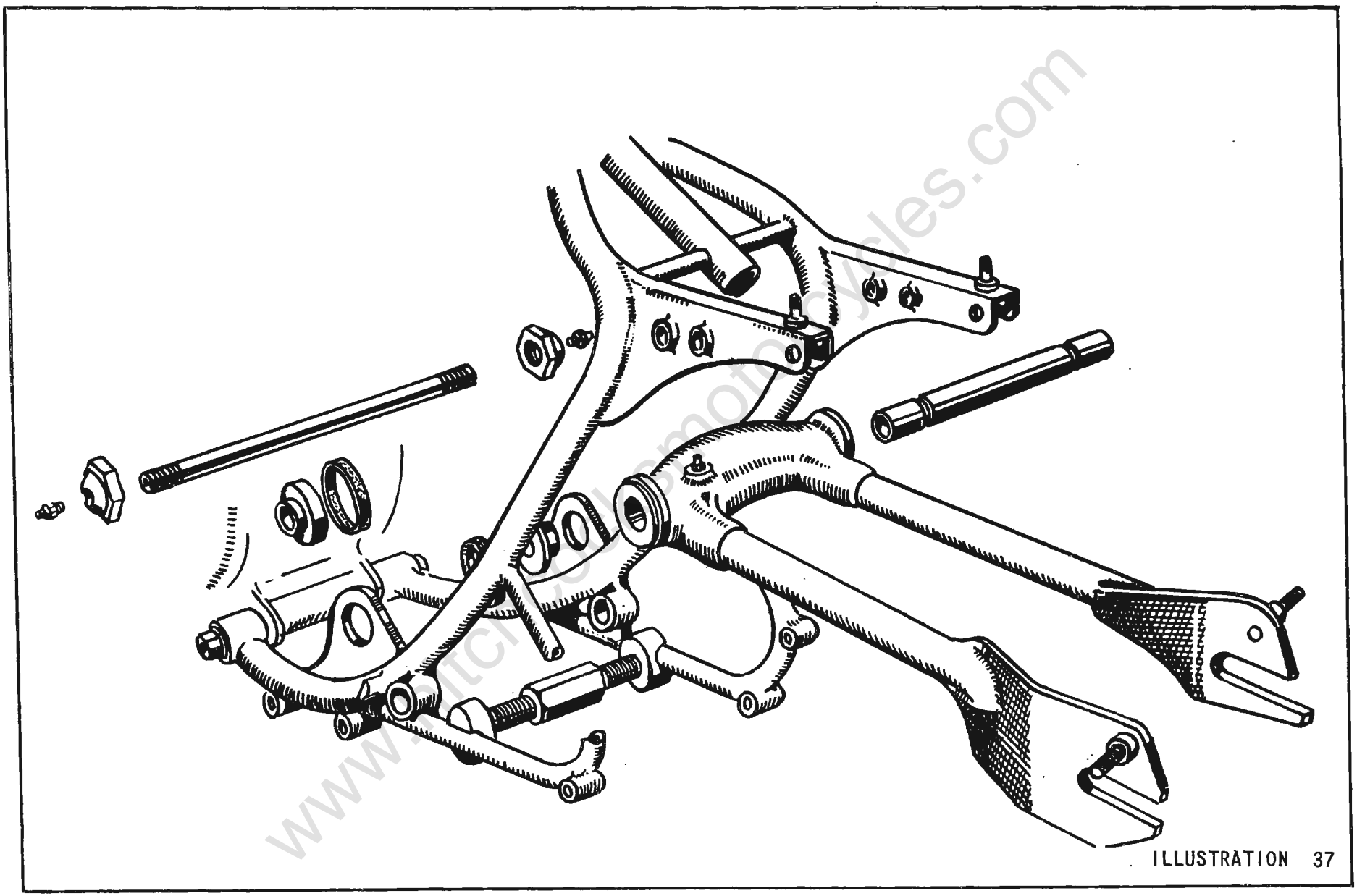

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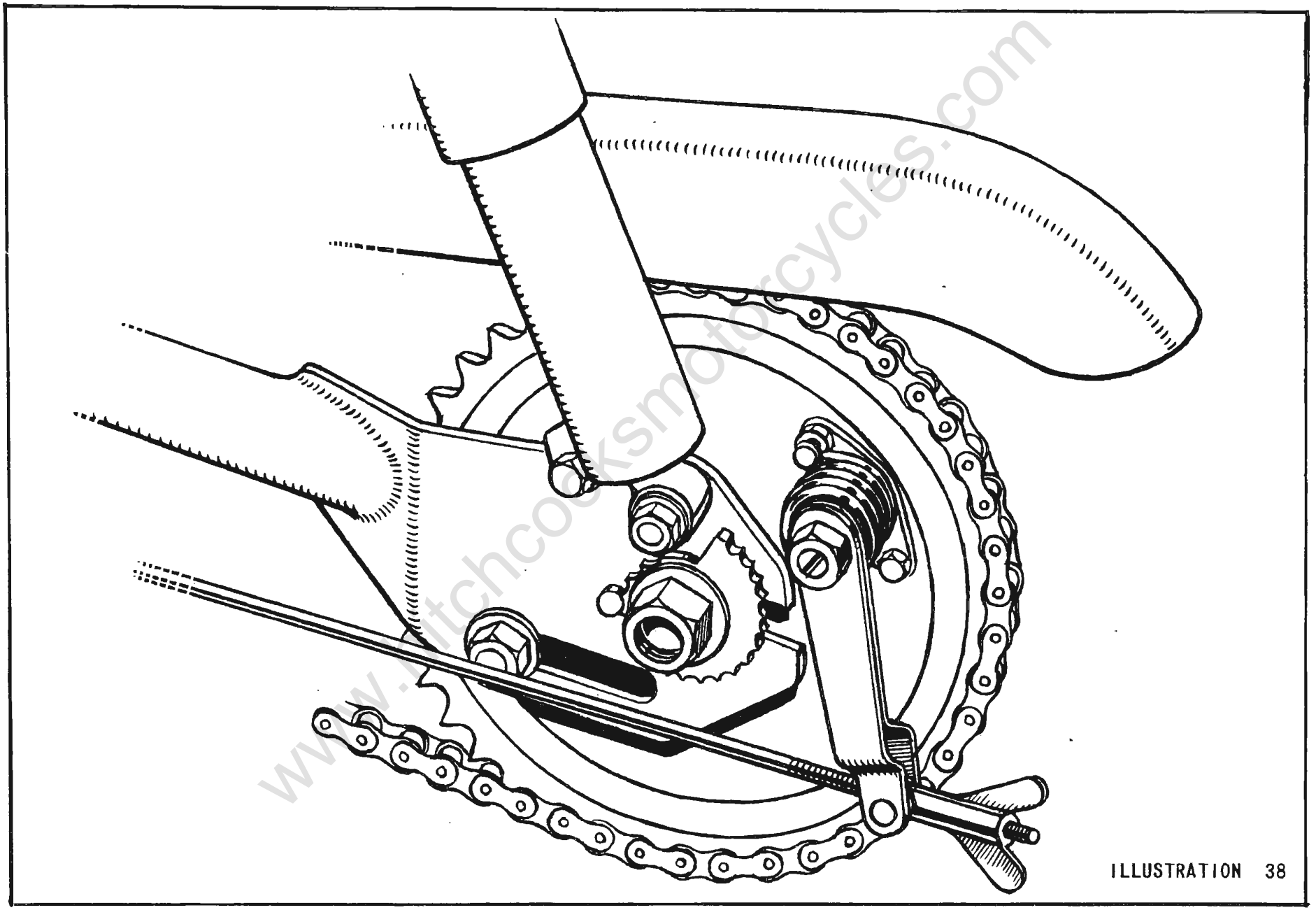

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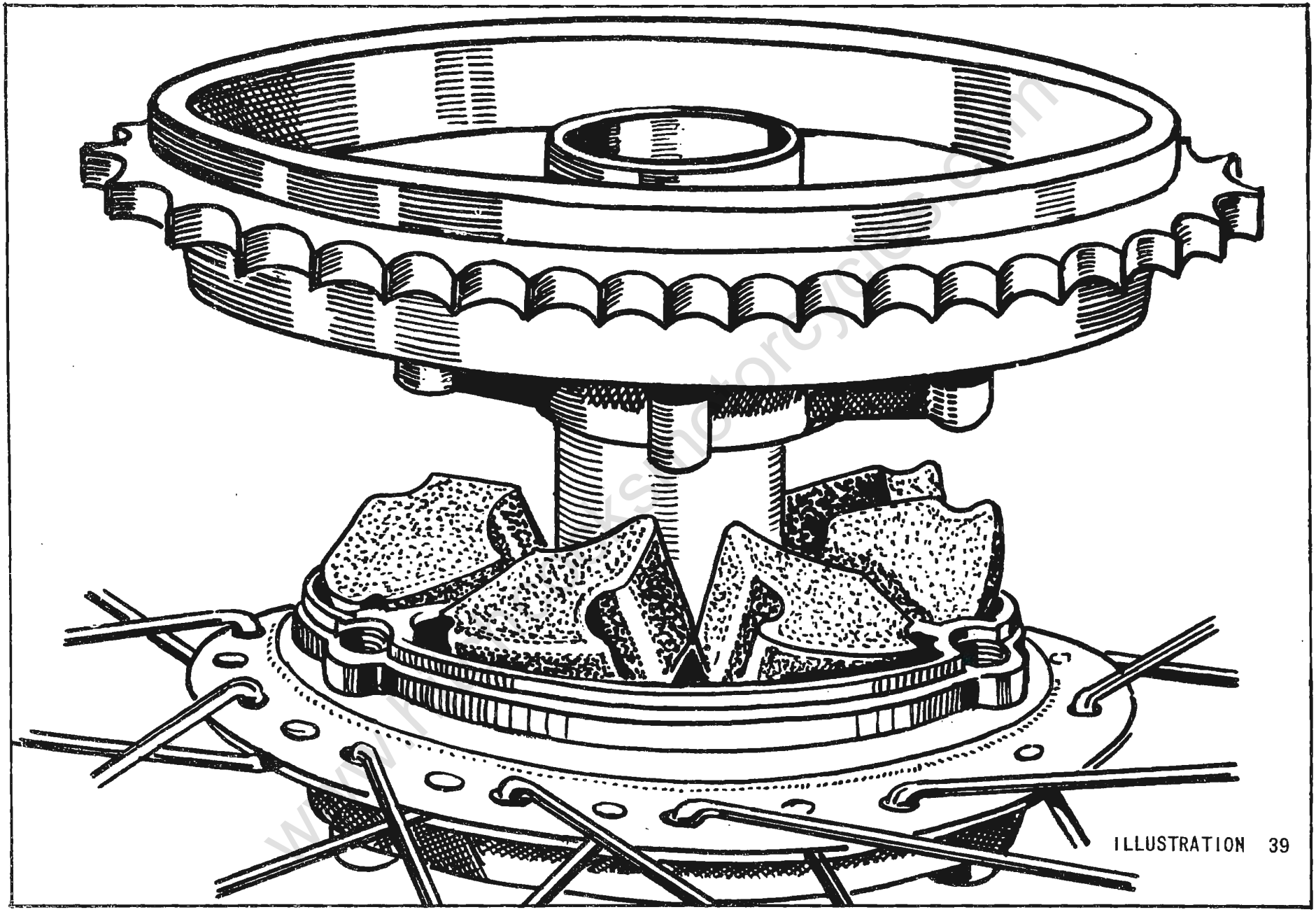

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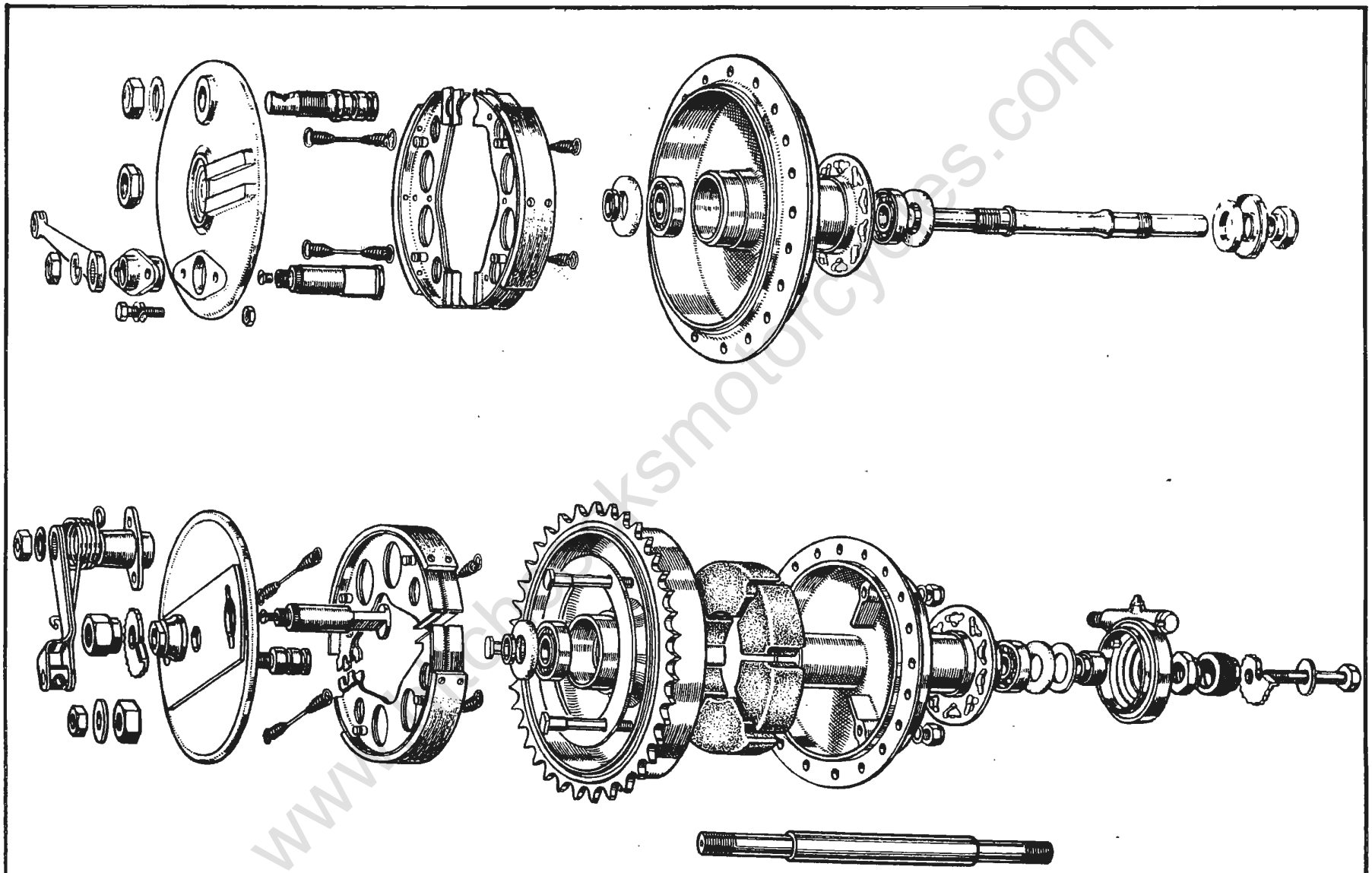

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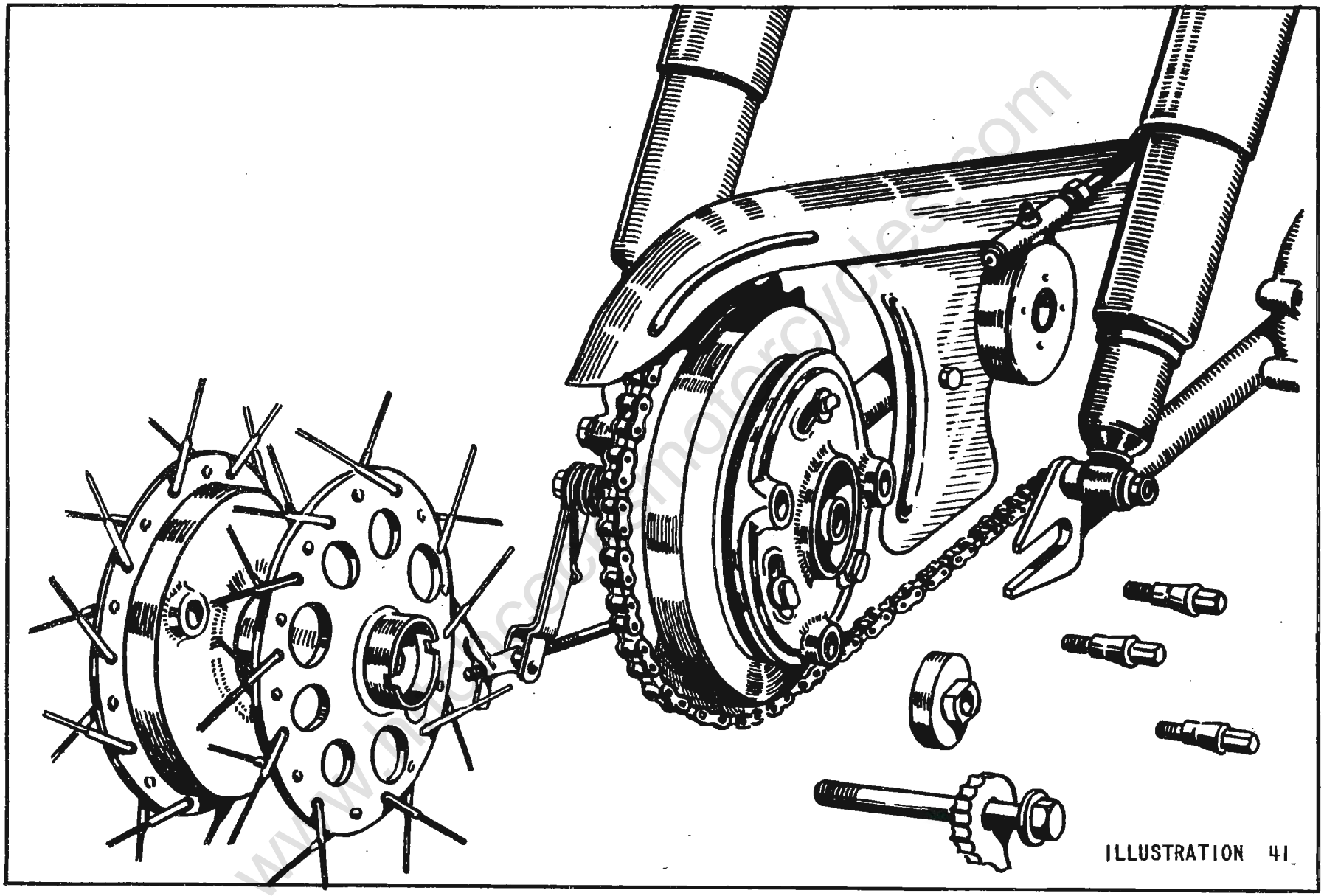

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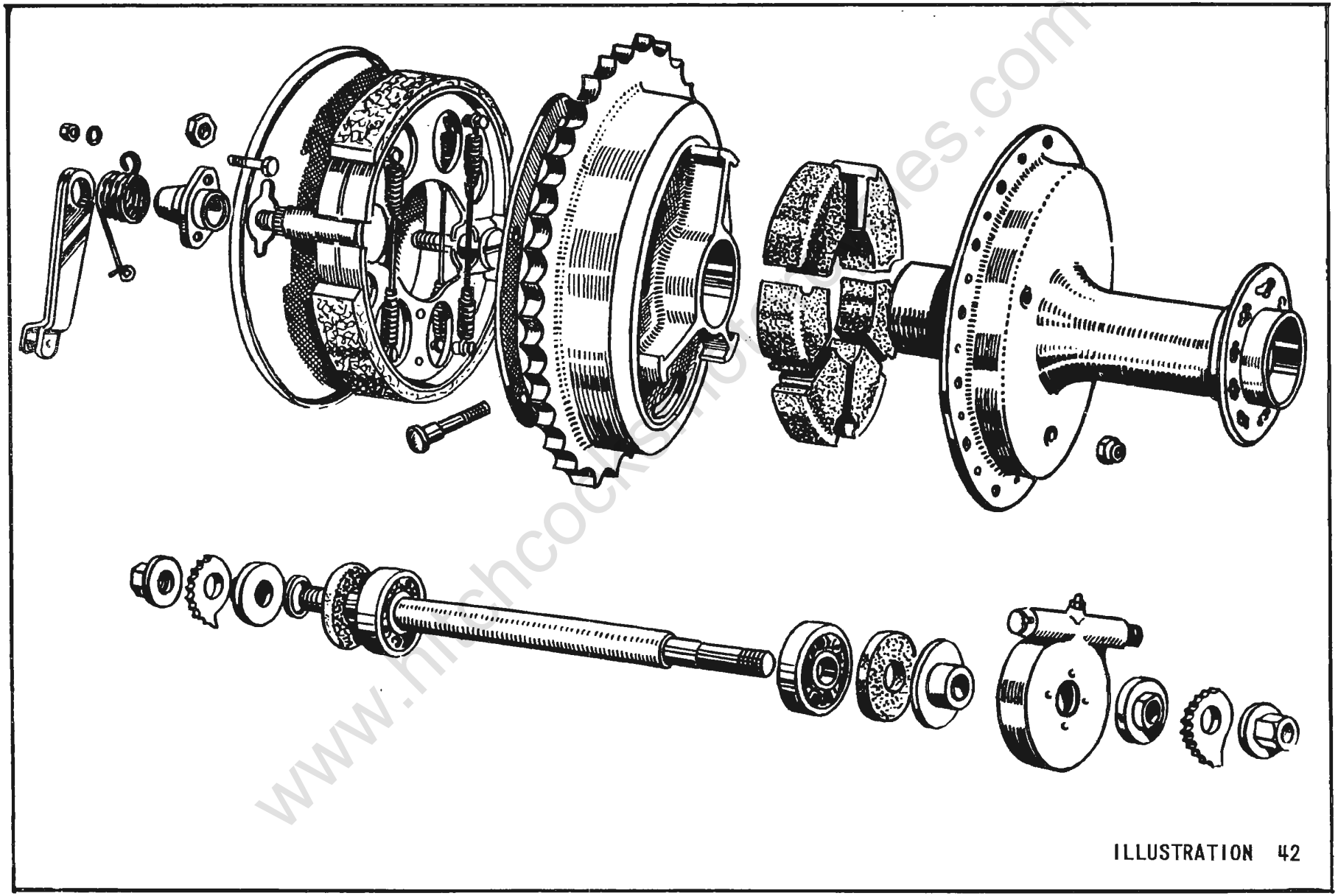

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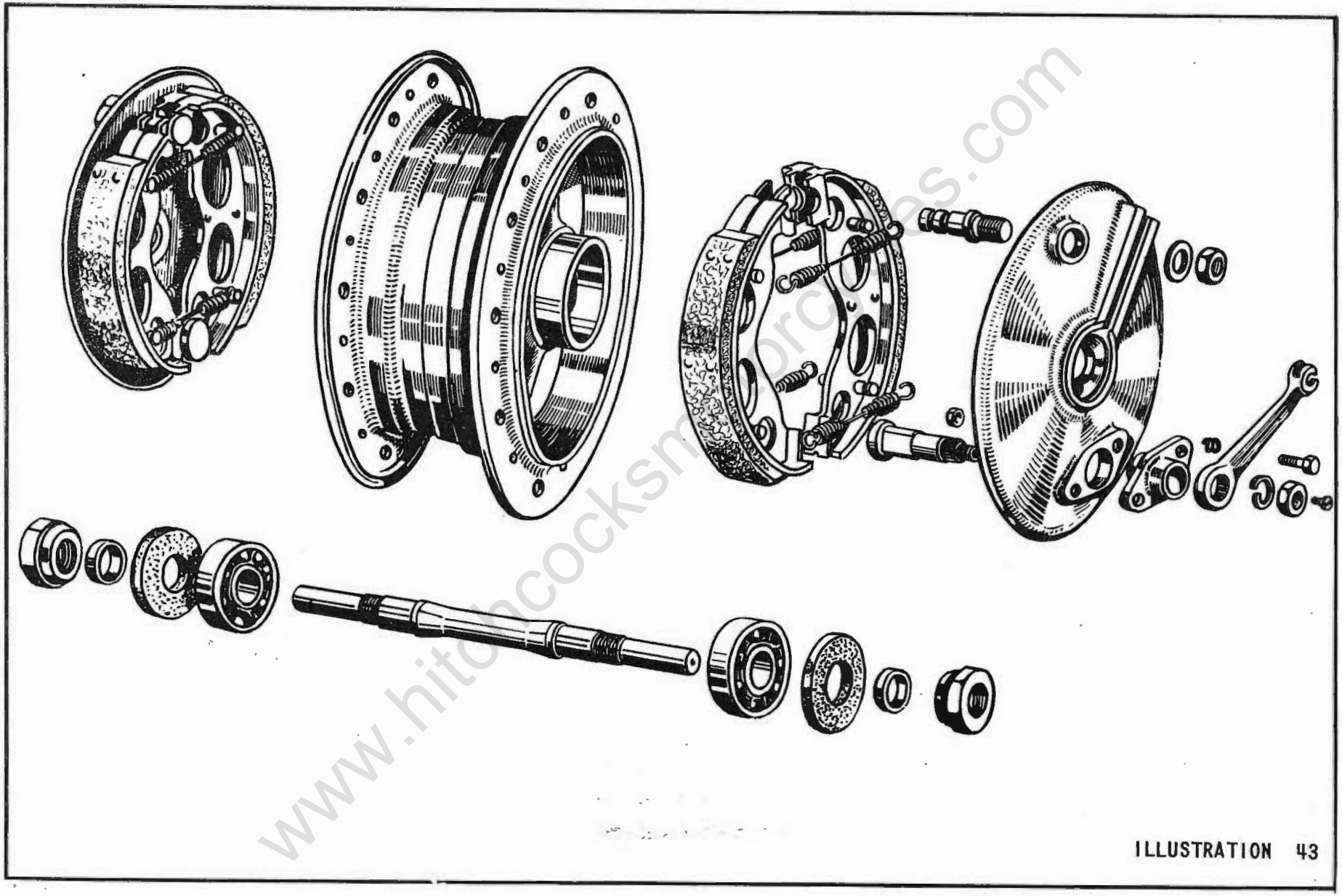

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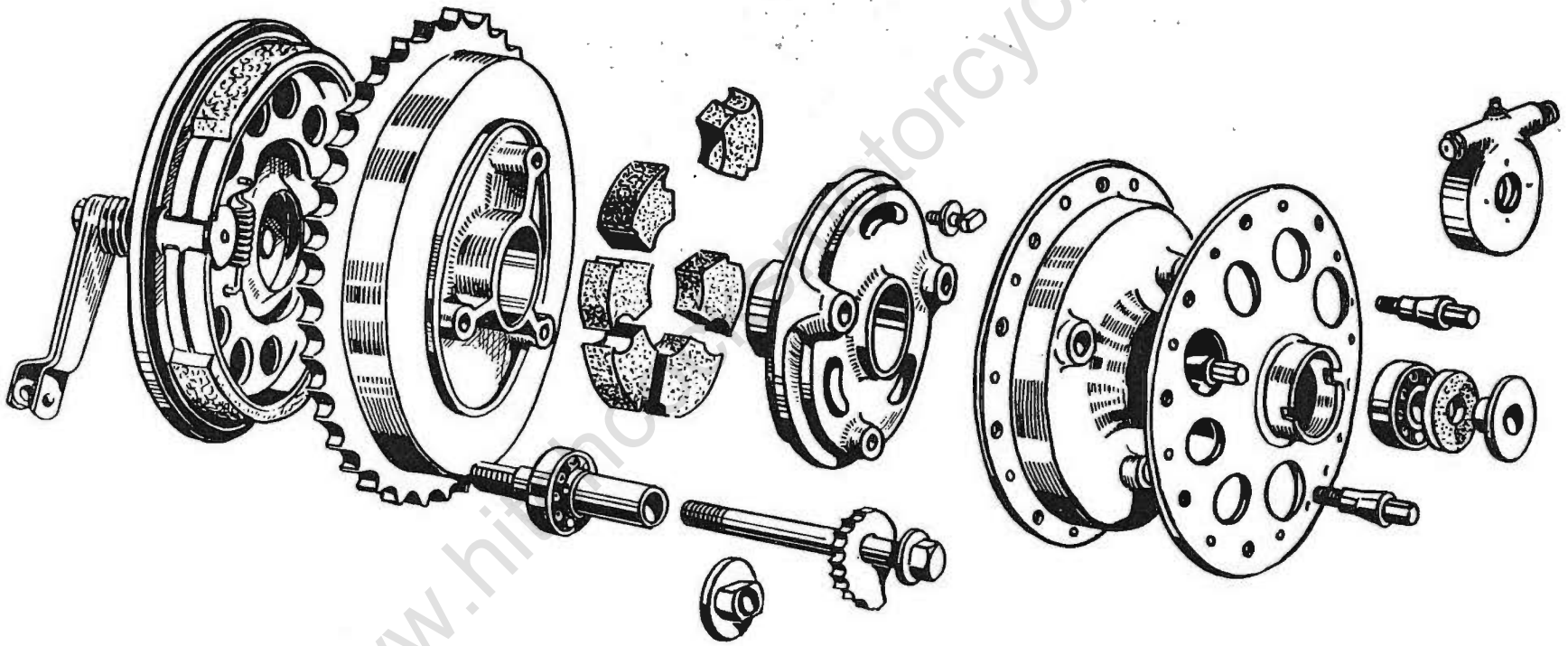

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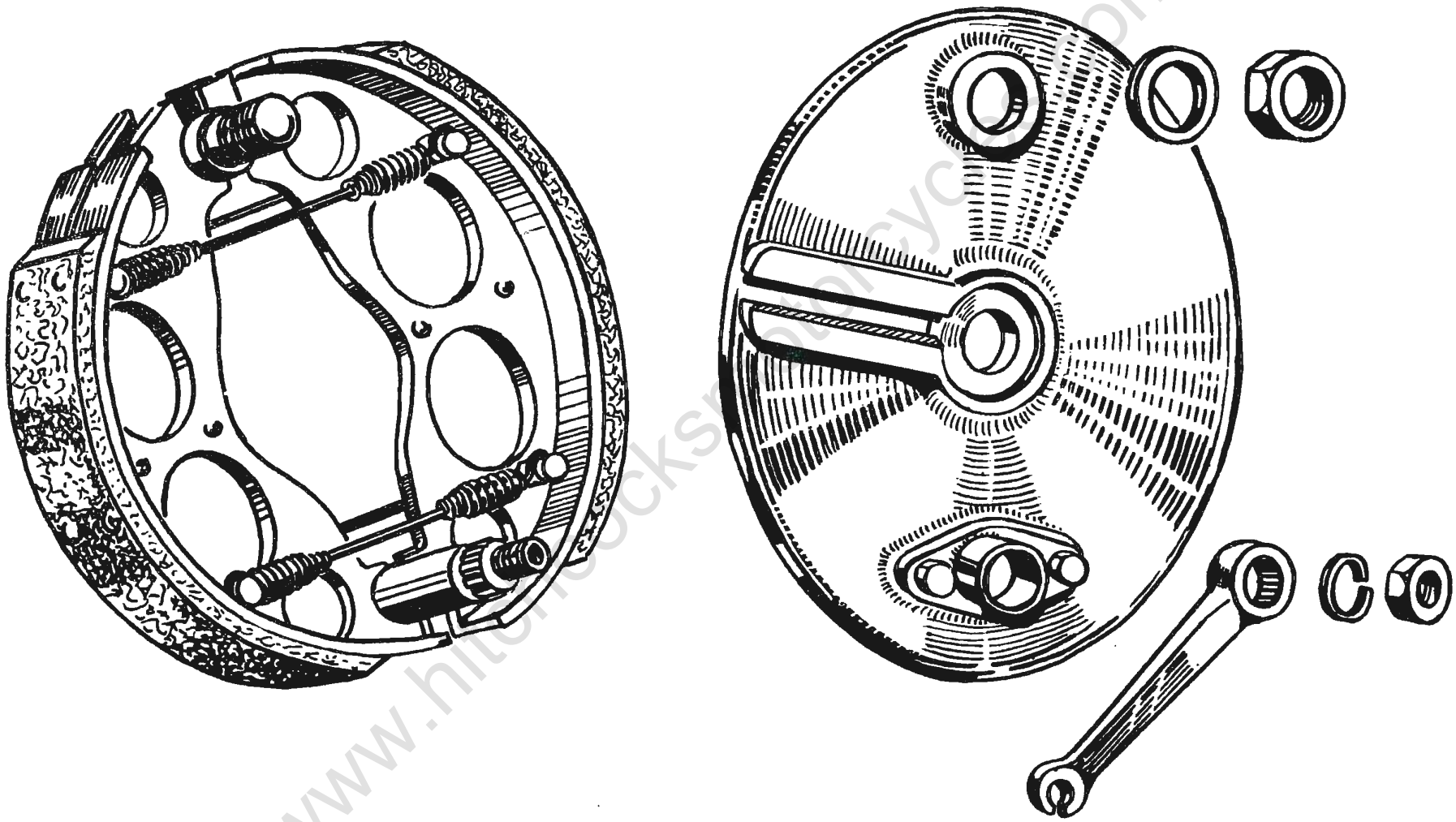

ILLUSTRATION 45