MAICO

MC 250
MC 400
MC 440
MC 501

Instruction book
Service manual

From January 1974

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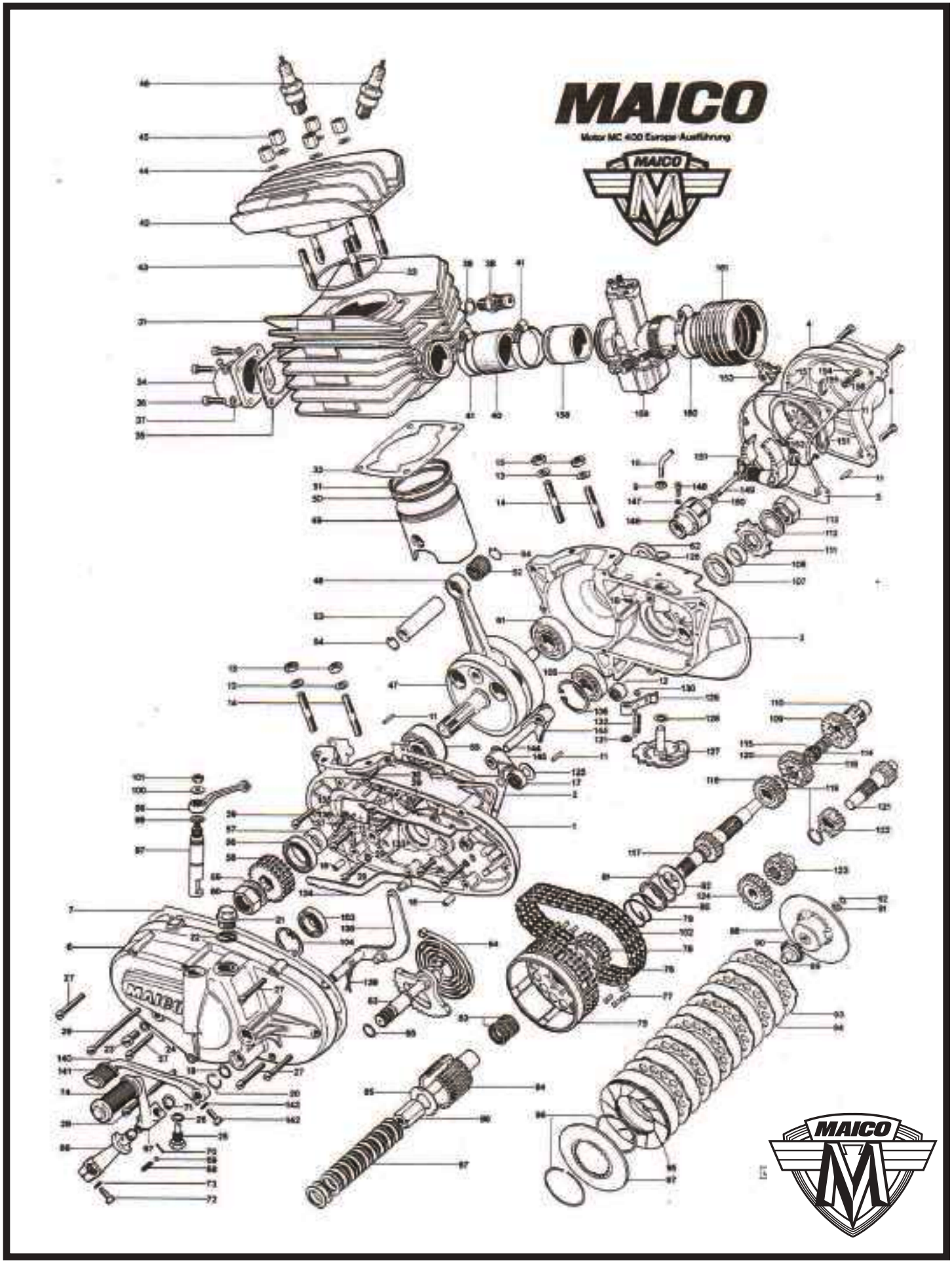
I. PREFACE

The Maico models MC 250, 400, 450 and 501 CCM are constructed and designed especially for competition and off-road use. They are suitable for moto-cross and enduro competition, and for crossing any difficult terrain. The moto-cross models are known for their high horse-power output, special frame geometry and exceptional light weight. Fore these three qualities to be used fully, the machine must always be tuned and serviced to the highest degree. These instructions, together with basic mechanical knowledge will assure trouble free performance.

II. TECHNICAL DATA

Maico MC	250 CCM	400 CCM	440 CCM	501 CCM
Motor:	Air cooled, Piston Port, 2 Stroke Engine			
No. of Cylinders:	1	1	1	1
Bore:	67 mm	77 mm	82 mm	91,6 mm
Stroke:	70 mm	83 mm	83 mm	76 mm
Displacement (C.C.)	247 ccm	386 ccm	438 ccm	501 ccm
Compression Ratio:	12 : 1	12 : 1	12 : 1	12 : 1
Brake Horse-Power (Din)	33/7000 RPM	43/6700 RPM	47/6900 RPM	51/6900 RPM
Carburetor:	Bing Type V54	Bing Type V 54	Bing Type V 54	Bing Type V 54
Diameter:	36 mm	36 mm	36 mm	38 mm
Main Jet:	175-180	185	185	185
Needle Jet:	280-285	285	285	285
Low Speed:	35	40	40	40
Needle Position:	As Required	As Required	As Required	As Required
Idler Air Screw:	1 1/2 Turns As Required			
Ignition:	Internal Rotor Magneto Type Appt. MZ 465 With Internal Primary and External Secondary Ignition Coils			

Spark Plug:	Champion	Champion	Champion	Champion
Type:	N2 or N2G	N2 or N2G	N2 or N2G	N2 or N2G
In Moist or Cold Conditions:	N3 or N3G	N3 or N3G	N3 or N3G	N3 or N3G
Timing Advance:	2.8 to 3.2 mm BTDC	3.5 to 3.7 mm BTDC	3.5 mm BTDC	3 mm BTDC
Points Gap at Top Dead Center:	0.3 mm	0.3 mm	0.3 mm	0.3 mm
Primary Drive:	Endless Renold Chain 3/8" x 7/32", 54 Link			
Primary Drive Ratio:	Double row 39/21 = 1,86	Triple row 39/21 = 1,86	Triple row 39/21 = 1,86	Triple row 39/21 = 1,86
Clutch:	Multi Plate wet Clutch Driving the Main Shaft			
Transmission:	Dog Shifting 4-Speed, Operated by Shift Forks Optional Close or Wide Ratio			
Gear Ratio:			MC	GS
1. Gear			1.99	2.78
2. Gear			1.52	1.79
3. Gear			1.23	1.29
4. Gear			1.0	1.0
Gear Oil:	1 Liter gear oil (1 quart) Winter - SAE 50 Summer - SAE 90 Or Bel Ray Racing Gear Oil (MC5)			
Final Drive:	Continuous chain 5/8" x 1/4" 120 links Sprockets: Rear wheel - 59 (52). Drive shaft - 11, 12, 13 or 14 Tooth as required.			
Frame:	Double-Downtube Lightweight Frame Made of Chrome-Moly Tubing.			
Main Measurements:				
Overall length	2120 mm			
Overall Heigth	1150 mm			
Overall Width	850 mm			
Wheelbase	1400 mm			
Steering Head Angle (Rake)	60 degrees			
Trial	140 mm			
Ground Clearance	210 mm			
Front Suspension:	Hydraulic dampened telescopic forks with 180 mm travel			
Rear Suspension:	Swinging arm with hydraulic shock absorbers.			
WHEELS:				
Front:	1.60 x 21" Steel-chromed or aluminum alloy rim.			
Rear:	1.85 x 18" Steel-chromed rim 2.15 x 18" Aluminum alloy rim			
TIRES:				
Front:	3 :00 x 21"			
Rear	4 :00 - 4 :50 x 18"			
Tire Pressure:	As required (7 to 12 lbs. per sq. in.)			
Front Brake:	Drum brake 136 mm diameter			
Rear Brake:	Drum brake 160 mm diameter			
Fuel Tank:	Fiberglass or aluminum alloy tank with 5.5 or 8.5 liter capacity.			
Petcocks:	Two - 3 position petcocks with large flow capacity and built in screen filter.			
Air Filter:	Large volume foam air filter in fiberglass air cleaner box.			


MAICO
Motor MC 400 Europa-Ausführung
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MAICO

III. DESCRIPTION OF THE MACHINES

The Maico MC 250, 400, 440 and 501 ccm Motorcycles are very high performance competition motorcycles which are designed for off-road use in difficult terrain or on a moto-cross race track.

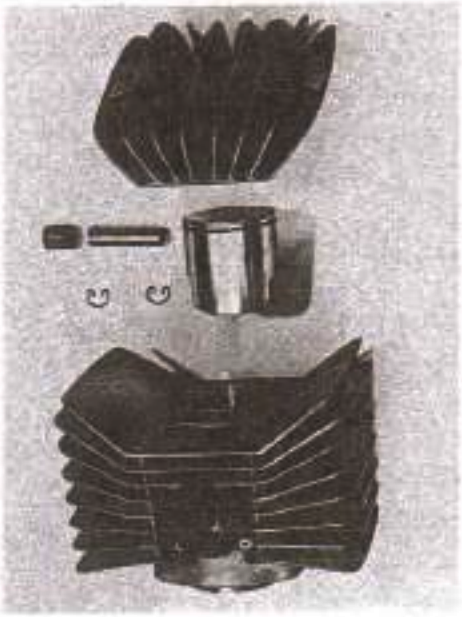
A. MOTOR

1. CYLINDER

The cylinder is a special moto-cross cylinder constructed of a light alloy material with a shrunken cylinder sleeve. The cooling fins are arranged radially for better cooling even at low speeds. The cylinder is fastened to the crank cases by four 8 x 28 mm studs. Between the cylinder and main cases is a paper gasket 0.3 mm thick.

2. CYLINDER HEAD

Is also constructed of a light alloy material. The cooling fins are again arranged radially with five - 8 mm or 10 mm studs mounting it to the cylinder. The cylinder head gasket is made of soft copper (0.6 mm thick).



3. Cylinder piston, Cylinder head

3. THE PISTON

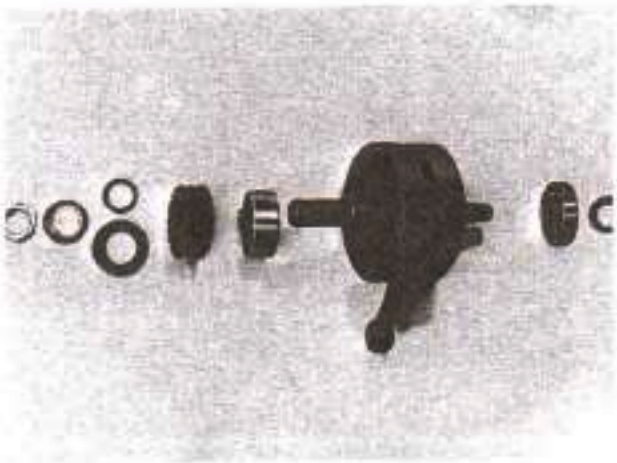
The MAHLE piston is forged of a special piston alloy containing a large amount of silicon. With "L" shaped piston ring in the 250, 440 and 501. An "L" shaped and a rectangular piston ring is used in the 400. The piston clearance in the cylinder measures 0.05 to 0.07 mm. The piston oversizes are available in approximately 0.15 mm intervals.

Example:	250 CC	400 CC	440 CC
Std.	66.95	76.95	81.95
1st over	67.10	77.10	82.10
2nd over	67.25 to 68.00	77.25 to 78.00	82.25 to 83.00

Pistons other than MAHLE are not recommended.

4. CRANKSHAFT AND CONNECTING ROD

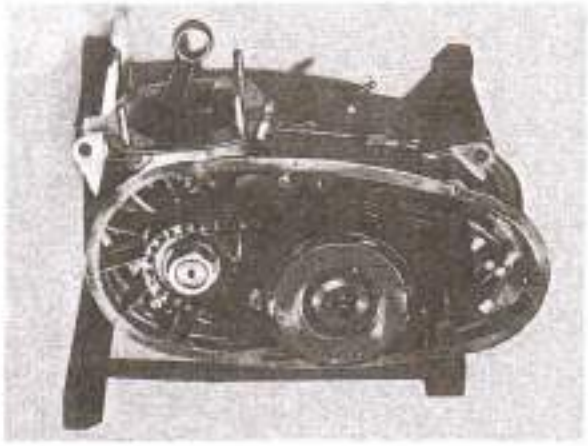
The crankshaft halves are turned on a lathe from rough forgings. After careful machine finishing, they are heat treated for better case hardening (they are also tempered after being heat treated). The right half or magneto half is tapered. The left half has a key way or splines to attach the primary drive sprocket. The connecting rod is forged as well. The journal for the needle bearings is caged. The radial play of the big end bearing is 0.03 mm to 0.04 mm. The play of the wrist pin to the wrist pin bearing is 0.002 to 0.005 mm.



4. Crankshaft, Bearings, Seals

5. PRIMARY DRIVE

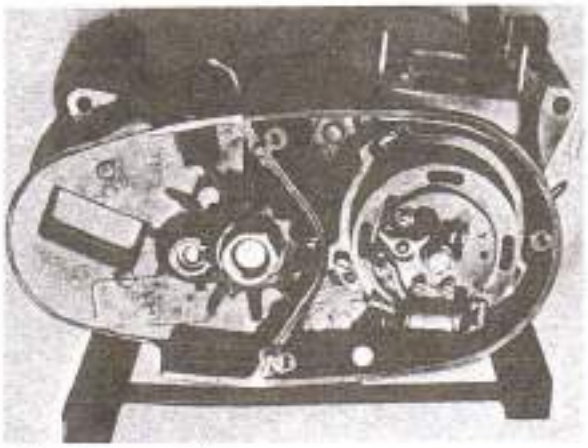
The primary drive from the crankshaft to the clutch is by means of a double-row chain 3/8" x 7/32" in the MC 250 and a triple-row chain 3/8" x 7/32" in the 400, 440 and 501. The chain is an endless type and has 54 links. The manufacture is RENOLD. Other brand chains are not recommended.



5. Primary drive

6. MAGNETO - IGNITION COILS

The Magneto, an APPT MZ 65 rotates in the same direction as the motor cycle moves. It is attached to the right crankshaft on a tapered outer journal. A 4 mm screw determines the proper position of the magnet. The primary coil, condensor and contact breaker are mounted on the stator. The main coil is mounted under the fuel tank and fastened to the frame. The manufacturer is PRUFEX # BZ 140/1, or BOSCH # PA 0221500800.



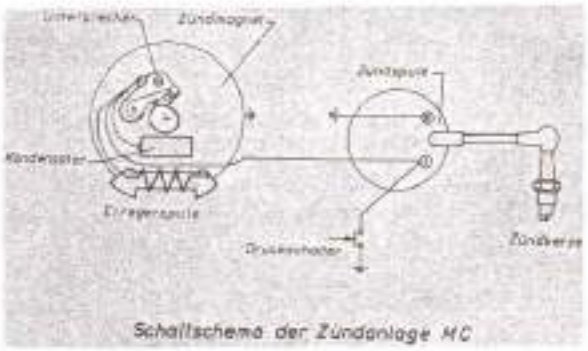
6. Ignition compl.

7. CLUTCH

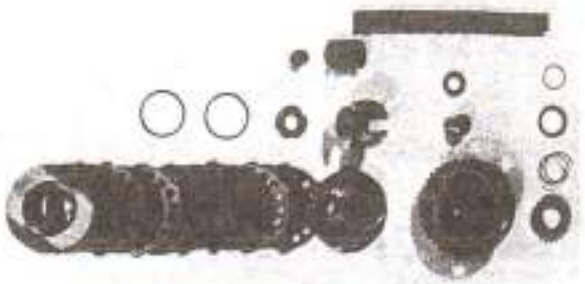
The clutch is attached to the transmission main shaft. It is an oilbath clutch which is built in three different models. The MC 250 has a clutch which is used in conjunction with the double row primary chain. It has six toothed outer clutch plates which are 99 mm in diameter and the final outer clutch plate which has a cork facing. Eighten stacked saucer type springs are used with the 400 and 440. There is a choice of two different clutches. The smaller unit with 99 mm diameter plates and a triple link chain, or the unit with 119 mm diameter plates, also triple link chain. The MC 501 comes with the larger diameter unit only.

Small Diameter Clutch:
Six outer toothed plates and six inside toothed plates without any facing and one outside plate with a cork facing and one pressure plate locked with 2 rings. Twenty saucer type springs stacked in series of 2.

Large Diameter Clutch:
Six outer toothed plates with a cork facing and five inner toothed plates without facing. Twenty saucer type springs stacked singly. ( ) ( )



7. Wiring Diagram



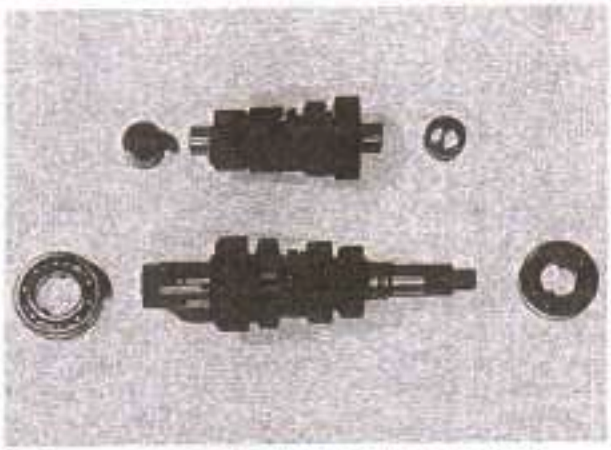
8. Small Duplex clutch Disassembled

8. GEARBOX

The gearbox is a dog shifting type 4 speed with 2 shift forks and a shifting cam. It is available in two different ratios, the wide ratio, which is used mainly for Enduro type competition and the close ratio, which is used for moto-cross competition. On the output drive shaft is the primary final drive sprocket. It is available in sizes that range from 11 to 14 teeth, for 5/8" x 1/4" chain.

9. SHIFT LINKAGE

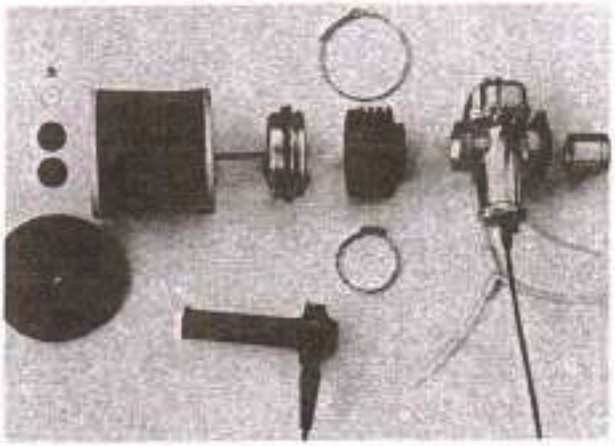
The shifting of the transmission is by a foot operated shift lever, moving a shift shaft (In the left side primary cover). The function of the remaining components (Pull rod, hook ratchet, and shift cam) results in selecting the various gears with 2 shift forks. These shift forks are produced of the highest quality steel.



9. Transmission with Bearings Disassembled

10. CARBURETOR - AIR CLEANER

The carburetor is a concentric type V 54 36 Ø or 38 Ø mm (On the 501) which is attached to the cylinder with a flexible rubber hose. The only difference in carburetors is the setting. The air filter is a micro filter available either in paper (KNECHT NO: E 426/1) or foam replacement (FILTRON) which is located in a air box under the seat.



10. Carburetor, Air Cleaner Boot, Air Cleaner Assy

11. EXHAUST SYSTEM

The exhaust systems are specially designed, and when changed or altered, there will most likely be a decrease in horse-power and performance. There are 2 different types of systems available for each model.

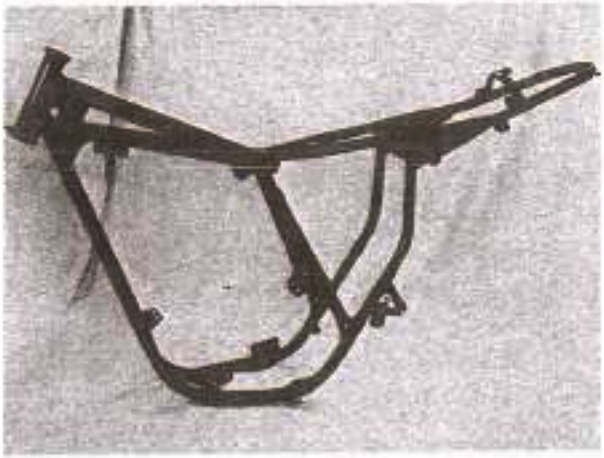
A. Unmuffled - Moto-cross - Competition
B. Muffled - App. 94 Decibel muffled (For export to USA)

There is a considerable difference between the MC 250 exhaust system and the 400, 450 and 501 exhaust system.

B. CHASSIS

1. FRAME

The double-down tube frame is made of high quality chrome moly tubing. The welds are partially welded with the heli-arc principle and partially welded with acetylene and oxygen. Especially on areas subjected to high stress often found in moto-cross competition.

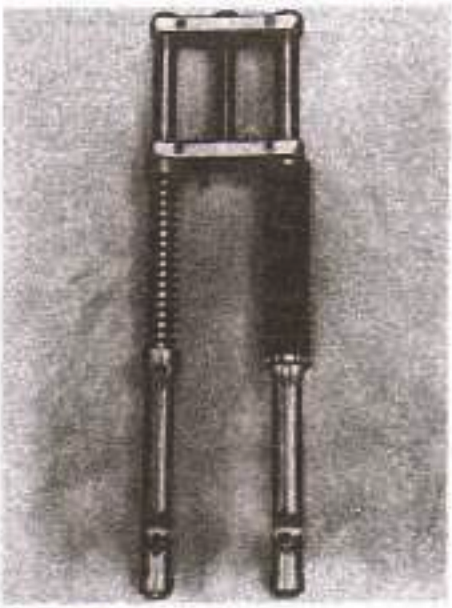


11. Frame (Bare)

2. TELESCOPIE FRONT FORKS

The telescopie forks with hydraulic dampening have 180 mm of travel. The springs are mounted externally on the fork tubes and are covered with rubber fork boots. The hydraulic shocks are mounted in the fork sliders, and have optimal dampening characteristics.

Each fork tube is filled with 230 cc (7.2 fl. oz.) of fork oil. The fork tubes are sealed on top with plugs containing air escape valves, whose proper functioning is essential.



12. Telescopie Fork

3. SWINGING ARM - REAR SUSPENSION

The swing arm has a very wide bushing surface with two rubber-metal bushings. Either Girling or Koni springs and shocks are available. The shocks dampening characteristics are especially developed for Maico.

4. SEAT

The seat is a one-man seat specially fitted and developed after years of moto-cross sport. Special care was taken selecting the composition of the foam rubber in the seat for maximum comfort.

5. FUEL TANK

The fuel tank (fiberglass or aluminium alloy) is shock-mounted on the frame with soft rubber bushings. Two petcocks provide a large volume of fuel flow.

6. FOOT PEGS

The foot pegs are short, spring loaded folding moto-cross foot pegs without rubber covers.

7. HANDLE BARS AND CONTROL LEVERS

The handle bar is made of high quality 22 mm (7/8") diameter chromed tubing, strengthened with a cross bar. The control levers and twist grip are made by Magura. The clutch and brake lever are made of cast aluminium alloy with a ball on the ends for safety. The twist grip, also made by Magura, is made of plastic with 80 degress of turning movement with the 36 mm carb. All cables are coated with Teflon for minimum friction.

8. FENDERS

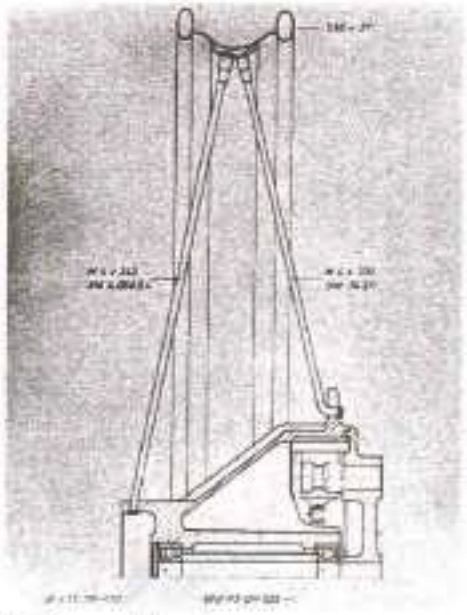
The front fender is rubber-mounted on the lower triple clamp. The rear fender is also rubber-mounted under the seat and on the rear frame member. Both fenders are made from vibration resistant fiberglass.

9. FRONT WHEEL

The rim is available in either chromed steel or aluminium alloy. The measurements are 1.60 x 21". The tire is 3.00 x 21" - moto cross with a rim lock to keep the tire from spinning on the rim. The front hub (drum brake) is made of cast aluminium alloy, with a cast-in steel brake drum ring. The brake diameter is

136 Ø mm 18 spokes M 4 x 243 mm
18 spokes M 4 x 230 mm

On the small end of the hub is a reinforcing ring made of aluminium alloy for strength.



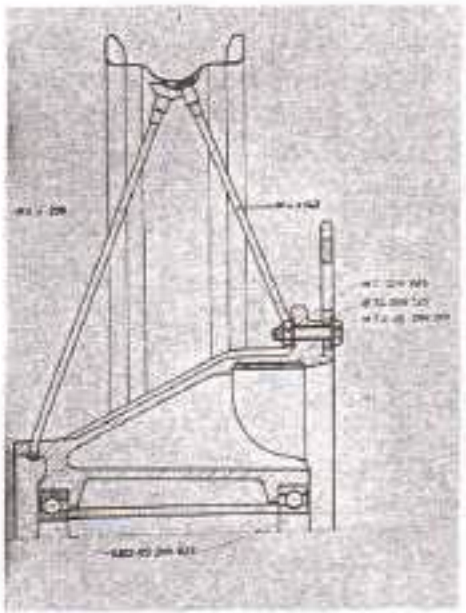
13. Front Wheel

10. REAR WHEEL

This rim is also available in chromed steel, size 1.85 x 18", or aluminium alloy, size 2.15 x 18". The tire is either a 4.00 or 4.50 x 18" - moto cross type with one rim lock to secure the tire to the rim. The rear hub is steel made with a cast-in brake drum, 160 mm diameter with a large recession for heavy duty bearings especially for moto cross. The brake shoes are forged of magnesium with epoxied brake linings.

18 spokes M 4 x 143 mm
18 spokes M 4 x 208 mm

The rear brake is operated with the right foot by a forged aluminium alloy foot lever connected with a steel brake rod.



14. Rear Wheel

IV. SERVICE INSTRUCTIONS

A. PREPARATION FOR COMPETITION USE

1. TIMING

Tools needed for setting the timing are a dial indicator, feeler gauge, and a buzz box or circuit breaker light. The dial indicator is either screwed into the vertical spark plug hole or mounted to one of the cylinder head studs with a special fastening plate, if the head is removed. The points gap should be set at .3 mm at top dead center, measured with the feeler gauge.

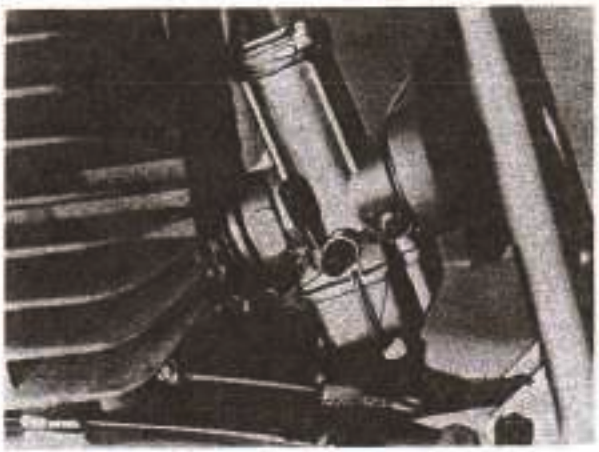
Next, the crank shaft is rotated approximately 45° counter clockwise. The crank shaft is then slowly rotated clockwise until the dial shows 2.8 - 3.2 mm before top dead center for the MC 250 or 501, or 3.5 - 3.7 mm for the MC 400 and 440. The ignition points should just open at these settings. If this is not the case, then the three screws holding the stator plate in place should be loosened and the stator plate should be rotated until the ignition points open at the above settings This should be checked with the buzz box or circuit breaker light. One lead is grounded and the other lead is connected to the ignition points. The stator plate is then rotated counter clockwise to achieve more spark advance and it is turned clockwise to achieve less spark advance. When the proper amount of advance is found and the ignition points break the circuit at the previously mentioned settings, then the screws holding the stator plate in position should be re-tightened evenly to prevent the timing from slipping while tightening the screws. The spark advance should be double-checked after screws are tightened to assure proper timing.

15. Setting Ignition Timing with Dial Indicator

2. ADJUSTMENT OF CARBURETOR

The basic adjustmnet jetting of the carburetor is shown in the technical data. Idle adjustment is performed while engine is warm with twist grip closed. It is regulated by moving the carb-slide while throttle is closed with the larger screw on the left side of the carb. The farther it is turned in (clockwise), the higher the idle. The mixture at idling R.P.M. is regulated with the air adjustment screw which is located directly behind the idle adjustment screw. The more this screw is turned in (clockwise), the richer the mixture. The basic setting should be $1\frac{1}{2}$ to 2 turns out (counter clockwise) from the point where the screw is bottomed out. Each engine must be individually jetted and adjusted.

Other factors to be considered when jetting carburetors are humidity, altitude, type of fuel and mixture ratio, etc. Jetting should always start with the larger jet sizes and then work down from there to prevent seizure. With proper jetting, the spark plug should have a tobacco brown color. (The spark plug MUST be the proper heat range!)



16. Setting u. Tuning Carburetor

Petcocks

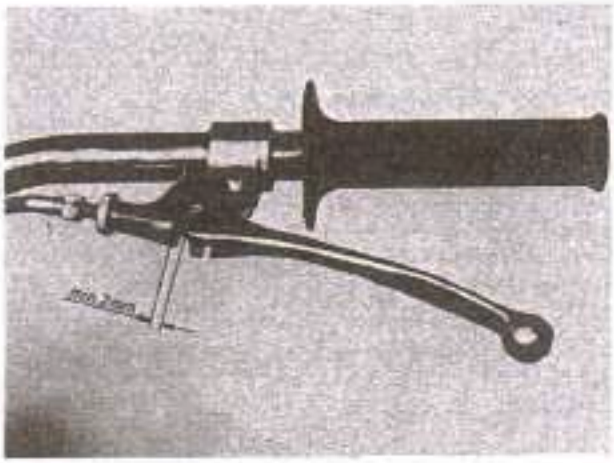
In the two petcocks are screens to prevent dirt from entering the float bowl. These screens must be cleaned regularly. Caution — Only large volume petcocks can be used for adequate fuel flow.

3. AIR FILTER

Before each race the air filter should be checked and cleaned. A paper filter should be cleaned from the inside out, using compressed air. The foam filter is washed in gasoline or solvent. Then, the foam filter should be penetrated thoroughly with motor oil (SAE 20), and both ends of either filter smeared with grease for sealing. Before re-installation of the filter, the inside of the air cleaner box should also be cleaned. The rubber boot leading to the carburetor should be checked to see that it is sealed properly.

4. CLUTCH, PRIMARY CHAIN - GEAR BOX

The clutch is checked by actual operation. The springs will eventually have to be replaced or the clutch plates will be replaced if there is excessive slippage. The clutch handlebar lever is adjusted so that there is 2 to 3 mm play in it. (.080" to .120"). The primary chain is checked for excess play. The magnetic drain plug is cleaned every time the oil is changed to see if any broken rollers from the chain are attached. Replace any defective parts immediately.



17. Clutch adjustment at the lever

5. CYLINDER AND PISTON

The play between piston and cylinder wall should be checked with a feeler gauge. The same should be done to the piston ring end gap to assure good compression. A softened head gasket should be installed and the cylinder head bolts tightened to 18 foot pounds.

6. CRANK SHAFT

While the cylinder is not on the crankcases the play in the lower connecting rod bearing should be checked.

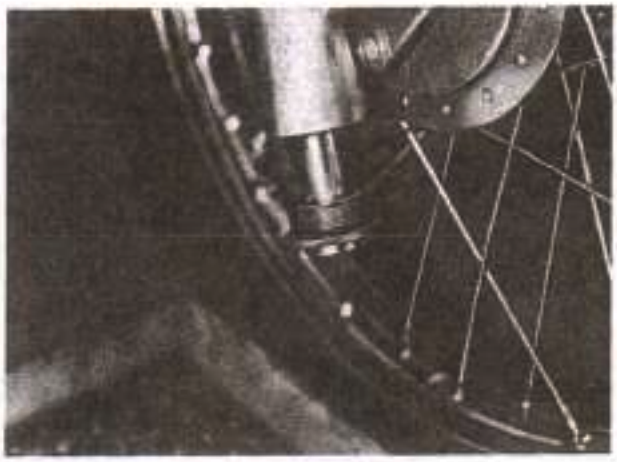
7. FRAME

The frames are free of maintenance. The steering head welds should be checked for cracks. If a crack is discovered, the frame should be welded by a qualified welder. The steering head bearing races should be inspected regularly for signs of rust or abrasions.

8. TELESCOP FORKS - STEERING

Changing fork oil — The upper triple clamp pinch bolts (8 mm Allen) must be loosened, also remove the air escape caps (36 mm). Next, the caps (27 mm) at the very bottom of the forks are loosened to remove fork oil. After a thorough flushing of the forks with solvent or gas the bottom caps (the threads should be oiled) are re-tightened and 230 cc (7.2 fl. oz.) of fork oil is poured into each fork tube. The upper caps are then re-installed and the upper pinch bolts are re-tightened. Much care should be given to the forks, for if the forks don't work properly, the rider cannot perform to the best of his ability.
Service — Front forks — After loosening the pinch bolts, both fork tubes should be taken out of the triple clamps. The play in the steering head bearings should then be checked and adjusted. The individual tubes are checked to see if they are bent. The fork slider is slid up and down on the fork tube in an up and down motion to see if there is any binding on either the tube or the slider. The fork tubes must also be checked visually for scars and scratches. The fork seals should be replaced if there is any leakage.

Next, the air release valves, located in the top oil filler caps, should be checked by compressing forks and observing air pressure release. The fork should return to its original position. If this is not the case, one must countersink the seating of the ball (for the air release valve) lightly, (app. 150° - 160°). The surface should have no grooves. Otherwise the ball should be tapped into the seat lightly. During re-assembly of the forks, care must be taken that there is no pressure on the fork tubes or sliders after re-tightening the fork pinch bolts and the front axle.



18. Changing Fork oil (Draining)

19. Filling Fork oil

9. REAR WHEEL SUSPENSION

The rear wheel suspension is produced by a swinging arm which is attached to the frame with rubber bushings and either Girling or Koni shocks. A properly functioning rear suspension gives maximum performance in difficult terrain. It is important to have both shock absorbers adjusted to produce the same dampening. The bushings of the swing arms should be checked for play. (Worn bushings MUST be replaced). A light yellow or brown color on the dampening rods of the shocks is proof of too much load on the shock absorbers. The swingarm bushings should be replaced if necessary. Also, a warped or bent swingarm should be replaced.

Mounting of Koni shock absorbers

1. The retaining clips and springs on original shocks must be removed.
2. The bottom spring retainer is put on its lowest setting (Three different adjustments are possible.)
3. The shock rod is extended completely and the original spring is slipped over the shock body oil reservoir.
4. The spring is compressed and the retaining clips are slipped into position.
5. The top and bottom shock eyes are aligned by rotation of the top eye

Dampening Adjustment of Koni Shocks

In all Koni ("D" series) shocks the dampening is adjustable. When they are obtained from the Koni factory they are set on the lowest adjustment, and can be mounted immediately. If stronger dampening is desired, the shocks dampening can be adjusted. The spring preload can also be adjusted to a stronger setting. The adjustment of the shock from extremely soft to extremely hard is in 6 different steps, as follows:

1. Remove the complete shock and remove the spring and clips.
2. Extend the shock rod completely and push the rubber bumper to the bottom. If the bumper sticks, pry it loose with a screwdriver. The retainer nut (19 mm) is then loosened by securing the top shock eye with a screwdriver or in a vice. The eye, retainer nut, and rubber bumper are then removed. Also remove the aluminum spacer and do not re-install it. This will result in 1/3 more shock travel.

3. The retainer nut and eye are replaced and re-tightened. The shock rod is pushed all the way to the bottom and rotated clockwise until it engages and drops into the shock adjustment slots. When the rod is rotated to the extreme counter-clockwise position, the shock is on the lightest setting.
4. There are five, half-revolution adjustments possible for dampening. We suggest for the first adjustment, 2 to 3 half turns clockwise is ample. This is achieved by rotating the shock rod clockwise while engaged in the adjustment slots.
5. The shock rod must then be pulled out without rotating it, to release it from the adjustment mechanism.
6. The shock can then be re-assembled in reverse order. Be sure to re-install the rubber bumper. Failing to do so can seriously damage the shock under use. Pay special attention that the right and left shock are adjusted equally. This will result in maximum performance of the Koni shocks.

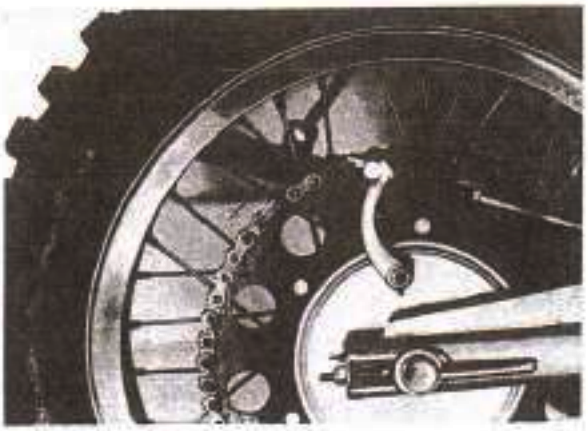
10. WHEELS

The wheels must be centered carefully and exactly. All spokes must be free of damage and adjusted equally very often. The wheel bearings are checked for play and being sealed from outside elements. The brake drum should be cleaned of rust with emery cloth.

11. CHAIN

It is important to use only good quality chain 5/8" x 1/4" – Regina – CZ – Diamond, etc., and to service it regularly by washing it in solvent and then lubricating it.

20. Chain Adjustment

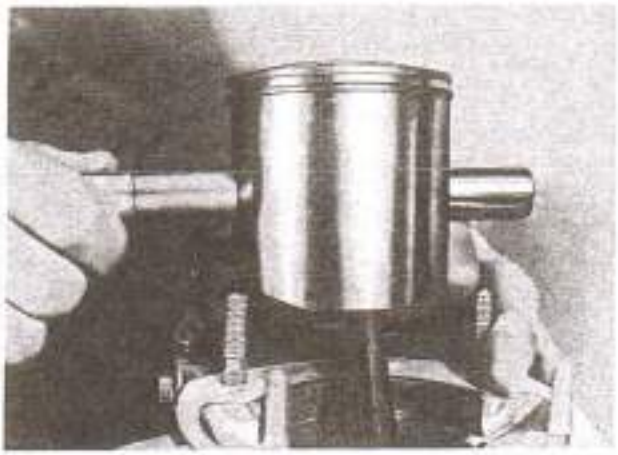


21. Master link

B. ASSEMBLY AND REPAIR INSTRUCTIONS FOR ENGINE

1. Removal from Frame

1.1 Remove the tank
1.2 Remove the exhaust
1.3 Remove the carburetor
1.4 Remove the cylinder head and top engine brace
1.5 Remove the ignition wire
1.6 Remove the 10 mm x 1 engine mount bolts front and rear
1.7 Disconnect the chain
1.8 Loosen the 8 mm bolt on bottom of engine
1.9 Remove the clutch cable
1.10 Remove the engine

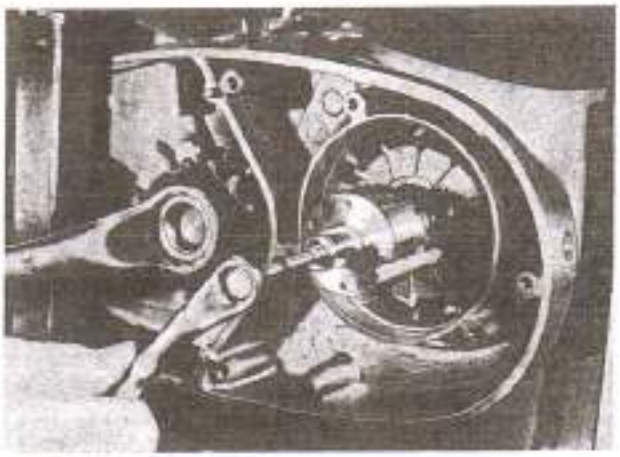


22. Piston Disassembly

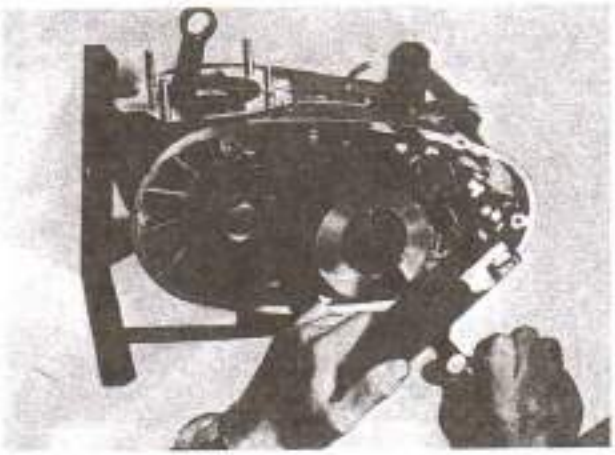
2. Disassembly of Engine

We suggest using the original MAICO engine stand.

2.1 Drain gear oil — one (SW 17mm) drain plug on lower left side.
2.2 Remove the cylinder by loosening the four 8 mm nuts (SW 13mm) at the base of the cylinder. The paper base gasket is removed taking care not to tear it. Make sure no dirt enters the crank case.
2.3 Remove the piston — the circlips on both sides of the piston are removed with needle nose pliers. An aluminium pin is used to remove the piston pin by tapping the pin lightly. Use caution not to apply any pressure to the side of the connecting rod.
2.4 Lay engine on primary case side and remove timing cover.
2.5 Remove stator by loosening and removing 3 - 6 mm screws. Push rubber plug out with screw driver.
2.6 Remove the 8 mm hex bolt fromthe center of the rotor magnet and remove the nut which keeps the magnet in position on the crank shaft. A pin, available through your dealer 60 mm long, is inserted in the middle of the magnet and the 8 mm bolt is re-inserted and tightened while crank shaft is held stationary by a wooden fork around the connecting rod after piston pin is re-inserted, widging against the wooden fork. The bolt is tightened until the magnet pops off.
2.7 The engine is turned around with the primary case facing up. The kickstarter lever is removed and the 7 case screws. The cover can then be lifted off.
2.8 Disassembly of the clutch is done with the help of a two-prong puller. By compressing the clutch on the clutch push pin with the puller, the two keeper rings are removed



23. Pulling Ignition Magnet

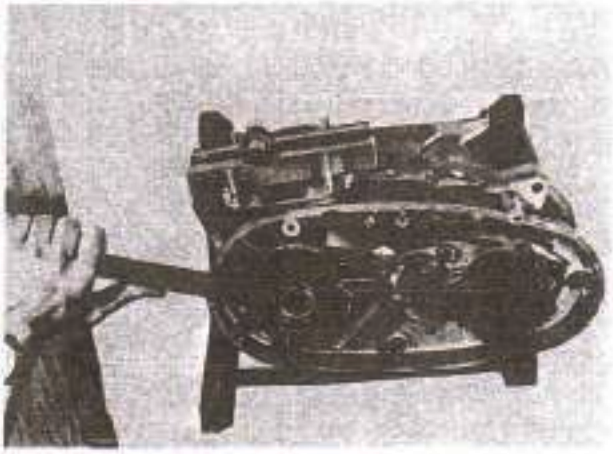


24. Clutch Disassembly

with a screw driver. The puller is then removed and the clutch plates and springs are lifted out. On the small clutch the clutch nut retainer is also lifted out. The clutch body is held stationary with a special tool (available through the dealer) while the nut is loosened and removed. The clutch body, clutch housing, primary chain, and kickstarter shaft can now be removed.

25. Holding The Clutchbody With Special Holding Tool

2.9 Removal of the drive sprocket on the crank shaft — The crank shaft must be held stationary by the same means as mentioned before for removal of rotor magnet.



26. Removing the sprocket on the crankshaft

2.10 Splitting the crank cases — The pull spring of the hook ratchet is removed with pliers after the pull rod retainer, pull rod, and the eight 6 mm case screws are removed. Light pressure is applied to the crank shaft journal and main gear shaft.

2.11 Removal of transmission — The shift fork shaft is pulled out, then the main shaft, with slider gears and eventually the lay shaft. The spacer ring and three needle bearings are then lifted out of the hole in the final drive gear. The 32 mm nut on the outside of the primary sprocket is removed by blocking the primary sprocket. The primary sprocket and primary drive gear are then removed by tapping lightly on it.

2.12 The shift cam and pawl can now be removed.

2.13 The crank shaft can be lifted out of the right side.

2.14 Removing the bearings requires heating the cases to 120°C (240°F) and a press.

3. Assembly of the engine — Shimming of individual parts

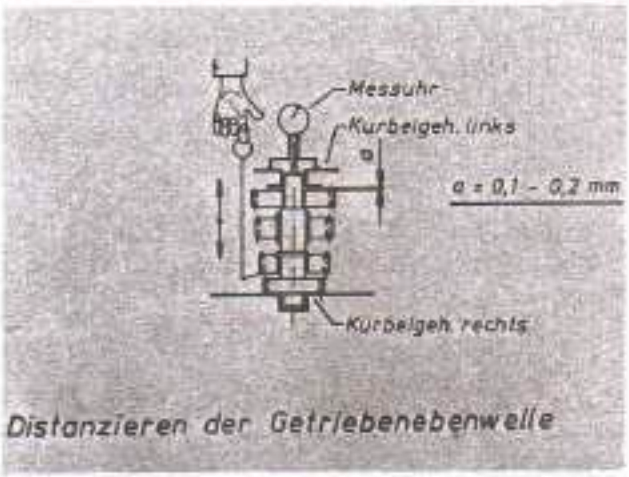
3.1 The installation of the bearings is done by heating the cases to 120°C and a press. Seals must be coated with locktite on the outer surface and smeared with a grease on the inner surface. Then they are also installed with a press.

3.2 The right case half is set on the mounting stand.

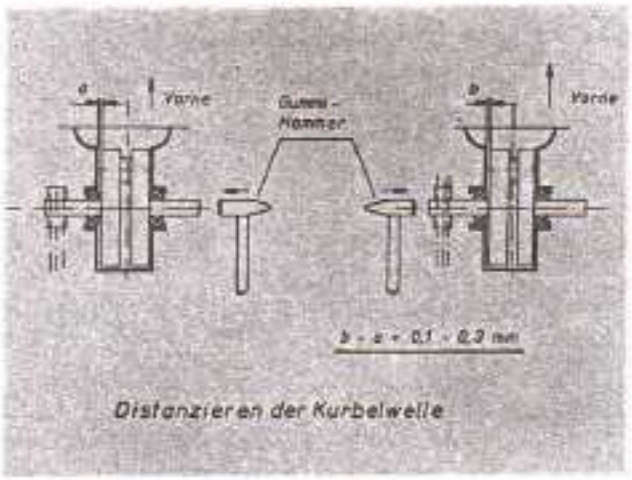
3.3 The crank shaft is inserted in the right case half.

3.4 The shift cam and pawl with springs are inserted.

3.5 The final drive gear, spacer ring and three needle bearings, main shaft with sliders, lay shaft with sliders, and shift forks are re-fitted. The shift fork shaft can then be re-located.
3.6 A new greased center case gasket is fitted on the case and the left case half is re-fitted with the eight 6 mm case screws.
3.7 The shimming of the crank shaft and transmission is done with the help of the sketch provided.



27. Shimming the layshaft



28. Shimming the crankshaft

3.8 The transmission is tested in the individual gears to see if the shift forks have sufficient play. If this is not the case, the problem must be remedied.
3.9 The kickstarter shaft and coil spring are re-inserted and rotated clockwise until there is sufficient tension. This is usually $1\frac{1}{2}$ revolutions. The hook ratched and pull rod are re-inserted and the pull spring re-located on the hook ratchet.
3.10 The clutch is inserted next with the main drive sprocket and the primary chain. (Be careful not to forget the washer between mainshaft bearing and the clutch housing and body). Check to see if plates are warped or the teeth on the plates are worn. Replace worn out parts.
3.11 Never use more than 20 clutch springs (MC250 - 18 double ((|) and MC 400, 440, 501 - large triplex clutch, 20 single ( ) ( ).)
3.12 The primary case cover is re-installed. Be sure the hole in the shift shaft is in line with the pin on the pull rod.
3.13 The piston is heated lightly and with the help of an aluminium pin, the piston pin is re-installed. The two piston pin circlips are inserted. Be sure they fit in the grooves completely.
3.14 A base gasket is re-fitted and the cylinder re-mounted.
3.15 The cylinder head is then re-mounted only securing it with the three front bolts, not torquing them down until the engine is back in the frame, and a softened head gasket is fitted. (This is achieved by heating the gasket to red-hot and then placing it in cold water). The head nuts are torqued to 18 foot pounds.
3.16 Gear box is filled with 1 liter gear oil (oil filler screw SW 19).

C. ASSEMBLY AND REPAIR INSTRUCTIONS FOR CHASSIS

1. Disassembly of Forks

1.1 Remove front wheel
1.2 Remove handlebars and bar clamps
1.3 Loosen both top 10 mm pinch bolts and remove both fork caps.
1.4 Loosen both bottom pinch bolts and pull both fork tubes out of triple clamps.
1.5 Drain fork oil
1.6 Unscrew bottom fork caps and remove snap rings. Then pull complete dampening units out of the tubes.
1.7 Pull sliders from fork tubes.

2. Assembly of forks

2.1 The following items must be checked:
The hard chromed surface of the fork tubes, as well as the straightness. The inside surface of the fork sliders must be without ridges or scratches. The seals must be checked for leakage. Pistons, valves must be checked for leakage.
2.2 Slide the slider onto the fork tube.
2.3 The complete dampening unit is inserted in the bottom of the fork tube. The snap ring is re-located and the bottom cap threads are oiled and re-tightened with a 27 mm wrench.
2.4 The fork spring is well greased and installed on the fork tube. The rubber fork boots are mounted over the spring.
2.5 The individual fork tubes are inserted in the triple clamps and the bottom pinch bolts are tightened.
2.6 The top plugs are mounted (making sure the air release valves are functioning properly) and the top pinch bolts are tightened.
2.7 Handlebars and front wheel are mounted.

3. Swing-Arm — Rear suspension disassembly

3.1 The rear wheel is removed by removing brake rod, chain, and chain guide. The rear axle nut is removed (SW 24mm) and then the axle is pulled out.
3.2 The shocks are removed (SW 13mm)
3.3 The swing arm pivot axle nut is removed with SW 19 mm socket.

Assembly

3.4 The shocks are tested under use. It is important to have the shock damping adjusted the same. (Adjustment, see Section IV - 9)
3.5 The swing arm should be checked for straightness and if need be, the swing arm bushings should be replaced.
3.6 In mounting shocks, caution must be taken not to have any side pressure on them.

4. Disassembly and re-assembly of front wheel

4.1 Remove front brake cable
4.2 Remove 8 mm (SW 13) bolt from brake anchor rod.
4.3 Loosen both 8 mm (SW 13) pinch nuts on the fork sliders.
4.4 Unscrew axle nut (SW 22) and pull axle by inserting a rod or screwdriver in the hole provided in the axle.
4.5 The assembly is performed in reverse order.

5. Disassembly and re-assembly of rear wheel

5.1 Remove the master link from chain.
5.2 Remove brake rod.
5.3 Remove chain guide (SW 13) from backing plate.
5.4 Remove rear axle nut with 24 mm wrench. Then pull rear axle
5.5 Remove rear wheel along with brake backing plate.
5.6 The assembly of the rear wheel is performed in reverse order.

SHOP BULLETINS AND RACING MODIFICATIONS

WORK SHOP BULLETIN NO. 1

Subj.: 250, 360 & early 400cc clutch

If slipping or incomplete clutch release occurs correct as follows:

1. Steel clutch
   Machine .020 inch (.5mm) from the fiber clutch plate. This machining to be done on one side only.

2. All fiber clutch
   Machine one fiber plate, one side only per step one above.

Note: USE a total of 20 clutch springs stacked as shown.

(( )) (( )) (( )) (( )) (( ))

Subj.: Late 400 & 501 clutch

If the big clutch will not release, cut the clutch arm (located on the case) approximately 3/4 inch. Bend the clutch lever outward until the lever fits flat to the bar grip when pulled all the way in.

If the clutch still will not release, check the splined steel plates for flatness. If all of the steel plates are flat, then machine .010 to .020 from one side of one fiber plate. Be sure to undercut the unlined area at least .020 or else the clutch will slip.

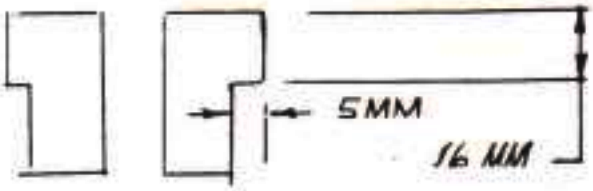
Note: USE a total of 18 - 20 clutch springs stacked as shown.

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )

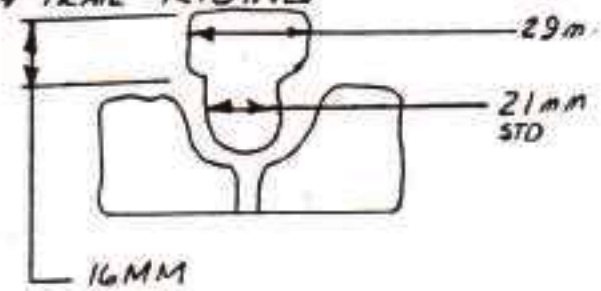
SHOP BULLETIN #3

BULLETIN
250cc MODIFICATIONS

STAGE I FOR MOTOCROSS & TRAIL RIDING



EXHAUST PORT



INLET & BOOST PORT

MAKE EXHAUST PORT & INLET PORT AS WIDE AS POSSIBLE. WATCH THE STUD HOLES THEY ARE VERY CLOSE TO THE PORTS. DO NOT RAISE OR LOWER ANY OF THE PORTS. MATCH HOLE IN PISTON TO BOOST PORT.

STAGE II FOR FAST MOTOCROSS & TT SCRAMBLES THIS IS PLUS STAGE I

CUT EXHAUST HEAD PIPE 3.5 INCHES. MOVE CONE FORWARD & WELD.
ADD 1.25 INCHES TO CENTER SECTION LENGTH.
RAISE EXHAUST PORT HEIGHT TO 38 MM.
USE 34MM CARB OR 36 MM CARB.

STAGE III TT SCRAMBLES, ROAD RACING ETC.

THIS IS STAGE I & II INCLUDED.

MILL HEAD 0.050 INCHES. CUT .050 FROM QUENCH AREA
DO NOT CHANGE THE CONTOUR.
RETARD IGNITION TO 1.5 MM BTDC
RAISE EXHAUST PORT TO 36 MM
IGNITION MUST BE MODIFIED TO ACCEPT MAICO 125 POINTS OR MISS FIRE WILL OCCUR.
LOWER INLET TO 113 MM
USE CHAMPION L-76 OR BOSCH 340 PLUGS

SHOP BULLETIN #9

If the gear box is missing gears either shifting up or shifting down, this means that the shift linkage is not in its center location.

To position the shift linkage into its proper location, remove the clutch cover and push the shift linkage pull rod No. 1750 forward to its maxium travel. Mark this position of the pin in the rod onto the case gasket surface; use a pencil. Now pull the rod all the way to the rear and mark this position of the pull rod pin onto the case gasket surface.

Now divide the distance between these two marks. Mark this center position line over the gasket surface and continue the line 1/2 inch out over the outside of the case.

Next mark tne center line of the shift shaft pin hole (No. 1049). Draw this line over the gasket surface and continue this line onto the outer surface of the case. Now place the cover onto the case.

If the two lines are not matched, then remove the shift spindle from the case and bend the dog leg portion until the lines match. Replace the spindle into the cover and remark the center line of the shift spindle pin hole. Reinstall the cover onto the case and re-examine the marks. Adjust the shift spindle once again if necessary.

SHOP BULLETIN #11

T T pipe for 400cc may be made by cutting the center cylinderical section of the exhause pipe 2.75 inches. Widen all ports to maximum. Do not raise or lower ports.

CAUTION:

This raises the RPM.

Reduces low speed torque.

Reduces reliability.

Increases speed & horsepower.

This is not for motocross.

SERVICE BULLETIN

Inspection and Adjustment of the 250, 400, 450, and 501 Transmission

Before taking the engine apart it is recommended to clean the engine. Try to avoid direct steel hammer hits on the parts. Split the engine carefully and take out the transmission.

Check for wear: dog pinion gear, sliding gears, shifting forks, cam assembly, guide bush.

Check for excess side play: between retainer ring and dog pinion gear.

ATTENTION: Brakeage of transmissions can be caused by improper chain alignment. (Chain jumps out of sprocket and locks the engine.)

On 250, 400, 501 Square barrel 'T' or old transmissions check the mainshaft or bronze bush and sleeve pinion for free rotation. Before assembling or inserting into the countershaft it should be lubricated with anti-friction lub.

Cleaning the transmission parts and gears is advisable for proper adjustments.

1. Insert the gears and with crankcase gasket close the engine housings. The layshaft clearance should be checked after fixing the engine cases together and tightened with three middle engine screws. The engine cases are easy to work without the crankshaft. Tighten the countershaft nut. The inspection of the transmission gears is easier to check with the engine cases lying clutch side up.

2. Leave the gear engaged in nautral position and fix the dial indicator (shown in fig. #2) on the case. With the half of a bended hook the end should be inserted into the hole (fig. #2B), lifting the third gear in the layshaft find the L/Shaft clearance. The layshaft clearance should be 0.10 mm (.004") to 0.20 mm (.008"). If it is more than that, shims should be added to obtain the clearance.

3. Insert the thrust washer in the mainshaft, either by inserting the clutch body, or use some bushes to pull the mainshaft all the way towards clutch side and tighten the mainshaft nut. With a screwdriver turn the cam into the neutral position. Shifting forks should be inspected through the hole (fig. #2 A, B) for up and down axle play.

4. Turn the cam to the first gear position and insert the hooked wire in hole B (fig. #2) and lift up the second gear (layshaft slider). Check the upper shift fork axle play through the hole A.

5. Move the shifting cam into the second gear position and hook the wire into the hole A (fig. #2) and the third gear in the mainshaft should be lifted (mainshaft slider) upwards. (You might not be able to find the play if you did not pull the mainshaft towards clutch side.) Check the bottom fork play.

6. The cam is shifted to the third gear position and the hooked wire should be inserted into the hole B (fig. #2) and press down the layshaft slider and check the upper fork play.

7. For fourth gear groove the gear into the fourth gear position and insert the wire in hole A (fig. #2). The third gear in the main shaft (Mainshaft sliding gear) should be pressed down while checking the bottom fork play.

For the radial crankshafts the play should be checked, if you changed the crank, main bearings and crankcases. With the help of a feeler gauge insert the feeler gauge in between the crank and engine cases. The crankcase play should be 0.20 mm (.008") to 0.36 mm (0.14"). If it is more than that, shims should be obtained until clearance is obtained.

Some of the reasons for gear slipping:

The hooked rachet should be inspected in both edges (fig. #3C). Check the pullrod for bend. To avoid the over engagement weld the hooked rachet as shown in fig. #3 B. to obtain the clearance in the cases. Fig. #3 A (111 to 112 mm)(4.13").

There is a difference in the gear changing crank (shiftershaft) and the gear changing pullrod between Radials (250, 400, 450, 501, U, U1) and the Square Barrels. The gear change return spring must be bent and adjusted so that the gearchanging crank shifts in proper way, in accordance with the modification to the pullrod and the crankcase (fig. #4 areas A & C). The proper position for the crank adjusted with the side cover screw hole as shown in fig. #4 B.

Illustration Fig. #4 A depicts the related positions for the 250, 400, and 450

radials and also the U 501. The Fig. #4 C depicts the related positions for the 250, 360, 400 and 501 square barrels.

The crank return spring in Fig. #4 B must apply pressure to both sides of the positioning stub (fig. #4 areas D-1 and D-2) and no clearance should be present.

Service Bulletin No. 1
February 8, 1974

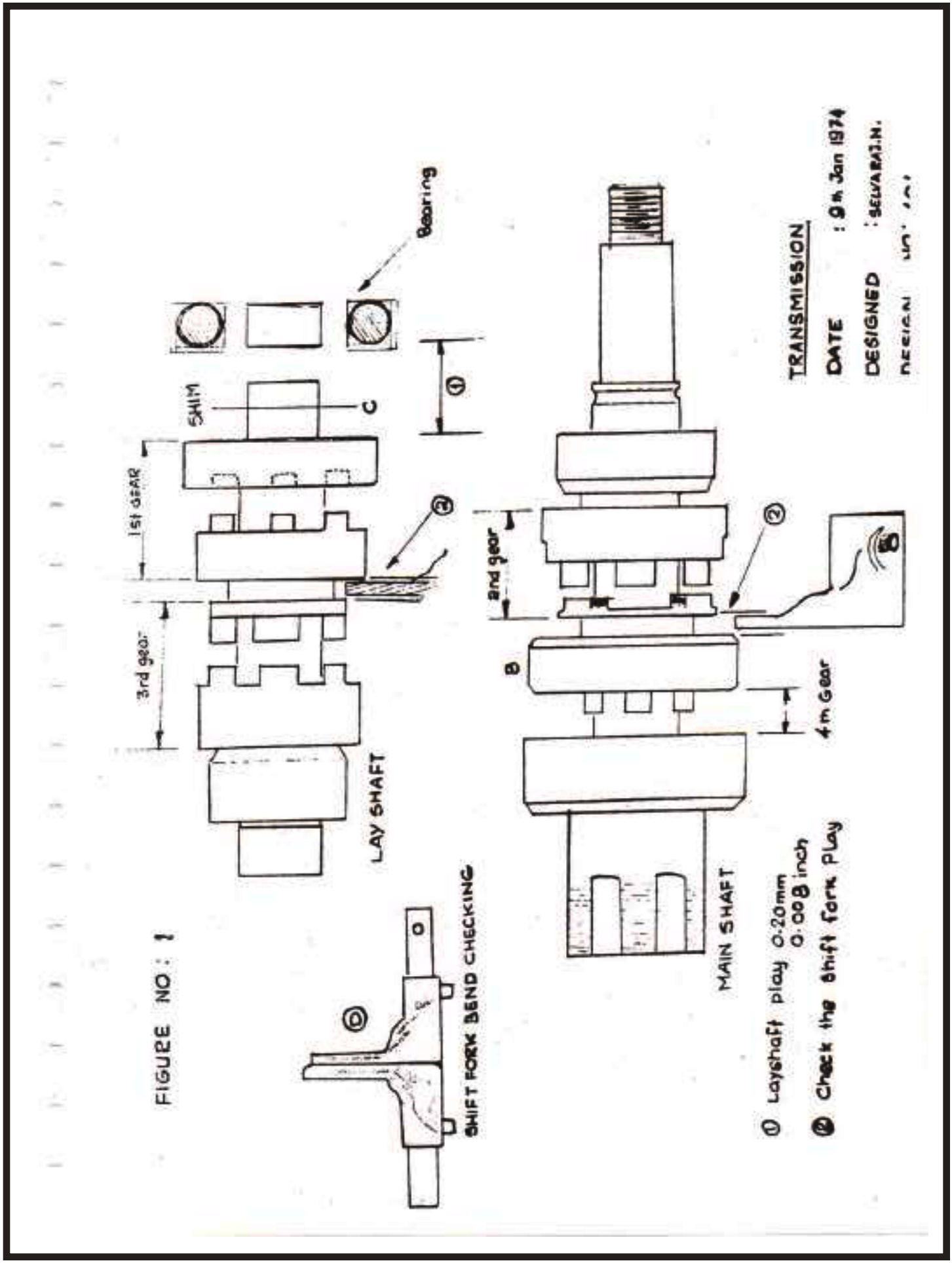

TRANSMISSION
DATE : 9th Jan 1974
DESIGNED : SELVARAJ.N.
Bearing
SHIM
C
1st GEAR
3rd gear
LAY SHAFT
2nd gear
B
4th Gear
MAIN SHAFT
SHIFT FORK BEND CHECKING
① Layshaft play 0·20mm 0.008 inch
② Check the shift fork Play

FIGURE NO : 1

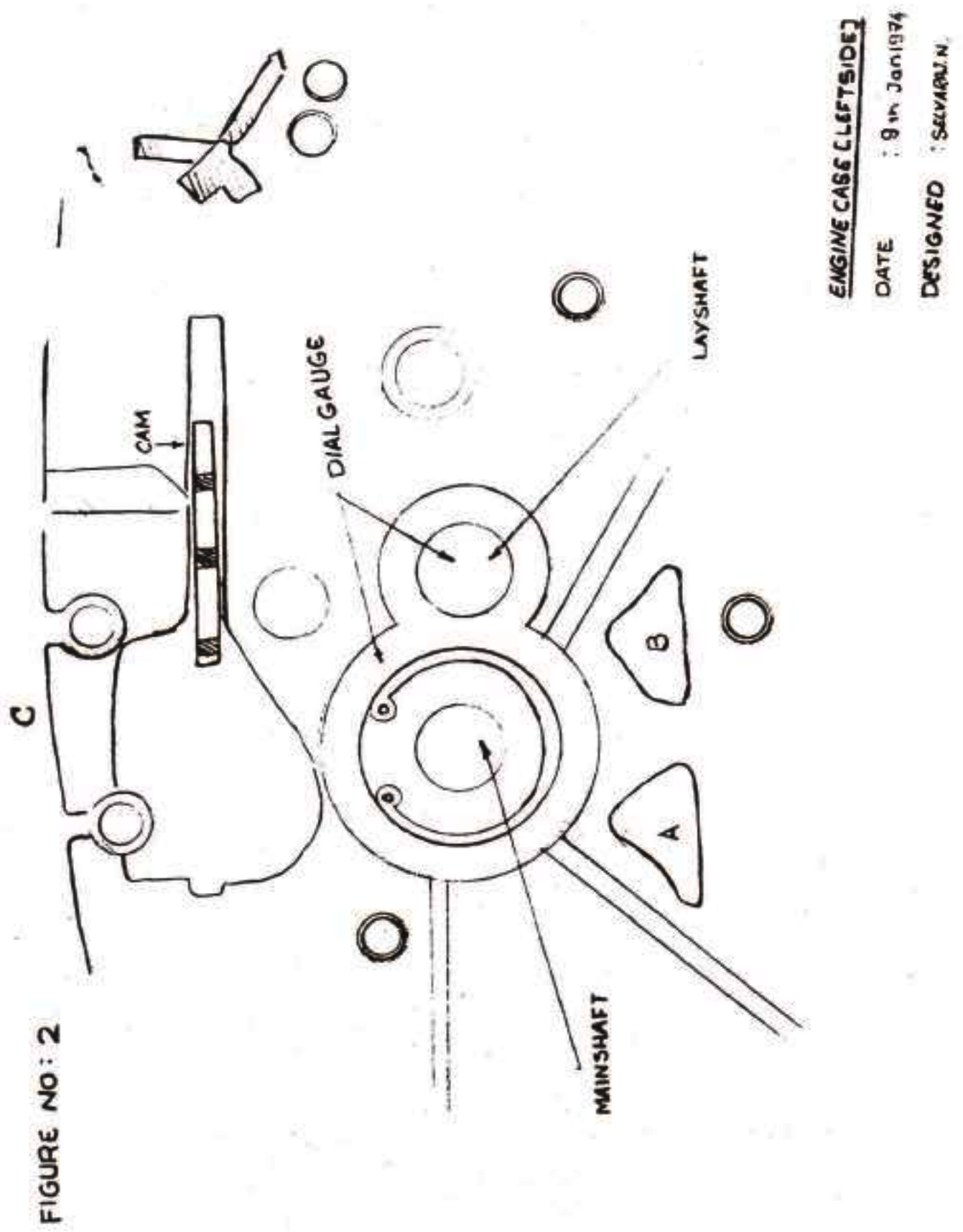
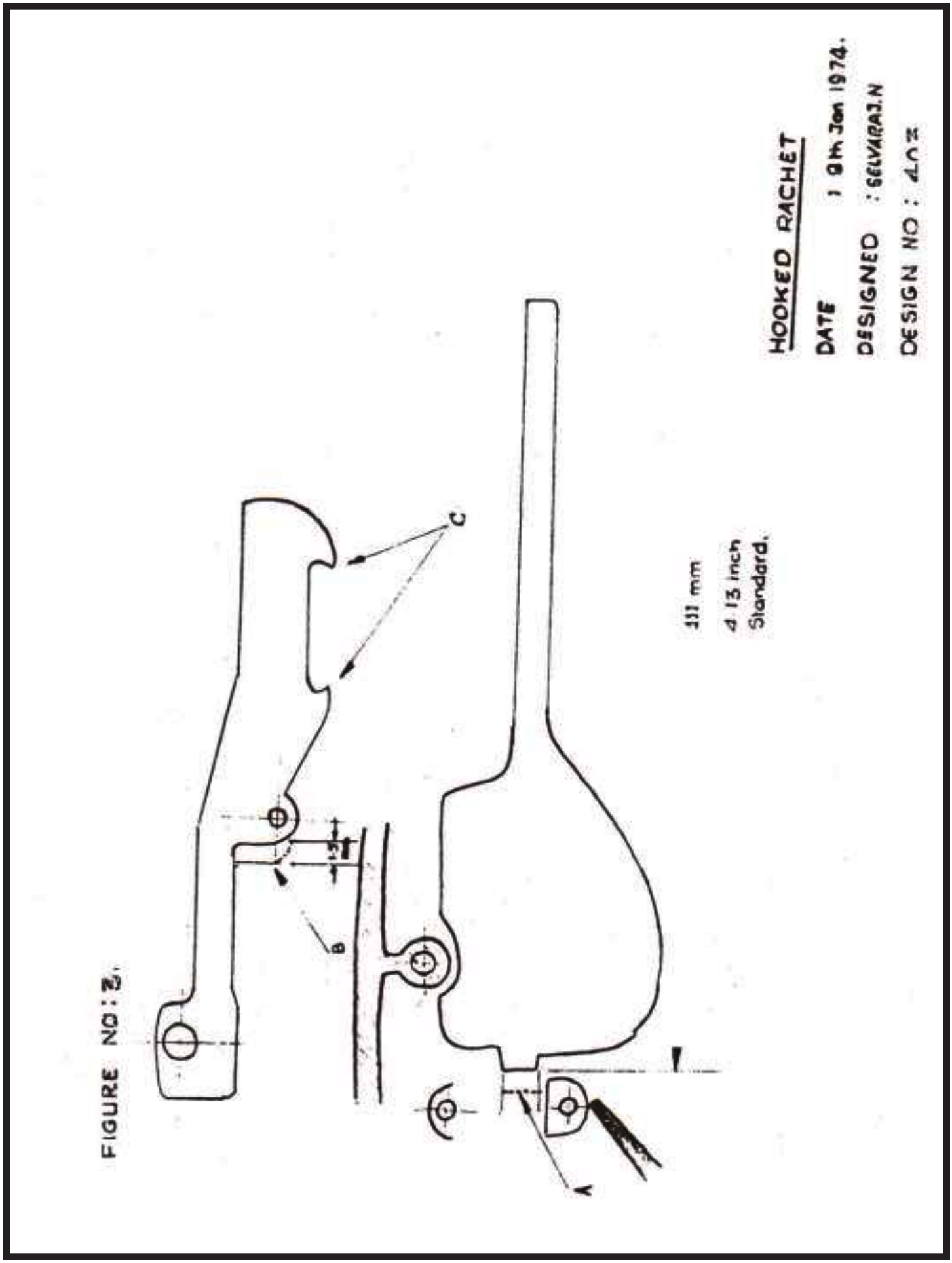

ENGINE CASE (LEFTSIDE)
DATE : 9th Jan1974
DESIGNED : SELVARAJ.N
LAYSHAFT
DIAL GAUGE
CAM
C
B
A
MAINSHAFT

FIGURE NO: 2


HOOKED RACHET
DATE : 19th Jan 1974.
DESIGNED : SELVARAJ.N
DESIGN NO : 402
111 mm
4.13 inch
Standard.
A
B
C
FIGURE NO: 2.

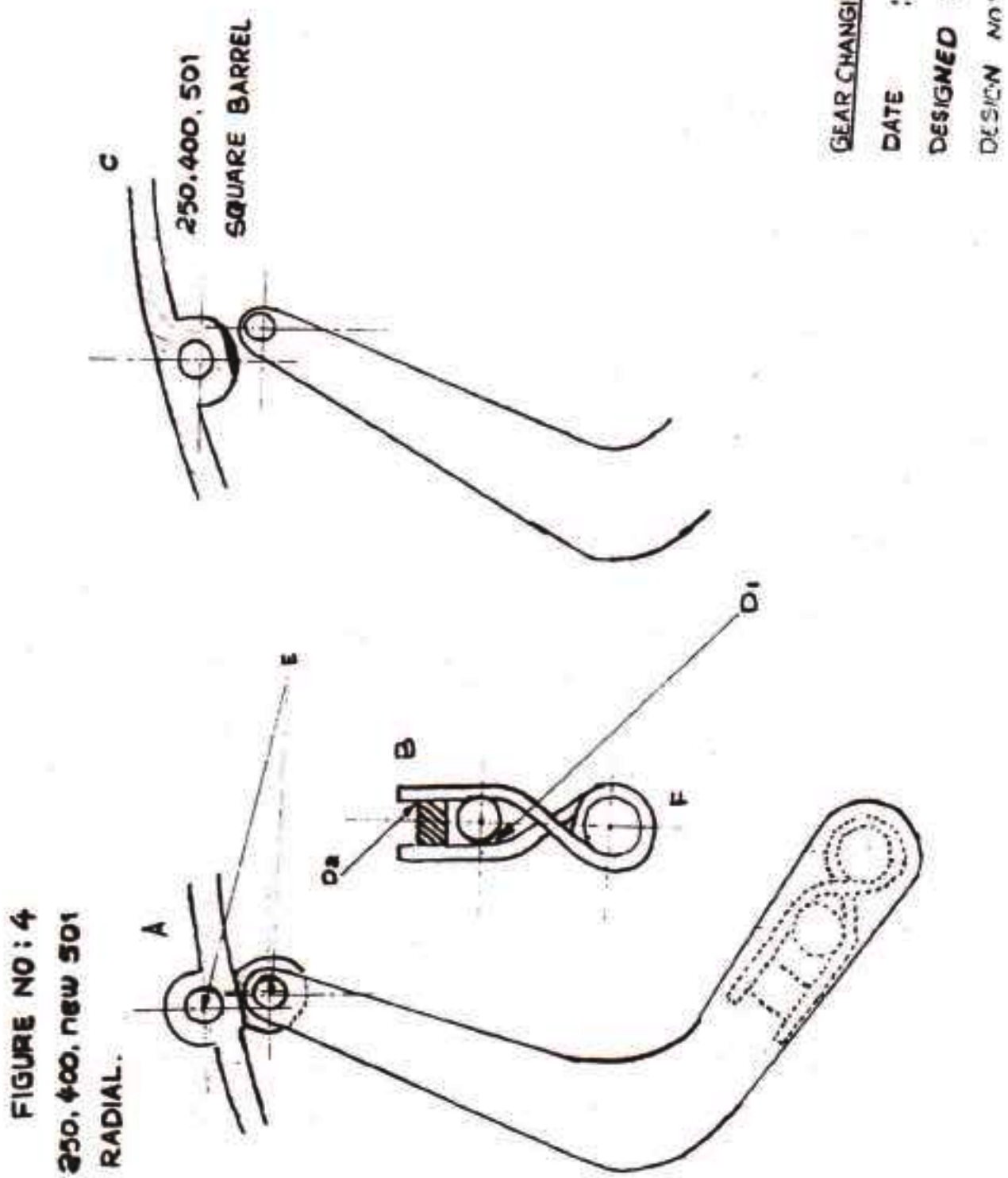


FIGURE NO : 4
250, 400, new 501
RADIAL.

SHOP BULLETIN #4

400cc

Cooper Motors does not recommend increasing the 400cc engine speed through changing the ports or changing the exhaust system. Some performance can be gained by widening the inlet and exhaust ports as described Stage I. of the 250cc bulletin. For TT performance remove 2.75 inches from the center cylinderical section of the expansion chamber and reweld. The main pipe mount will have to be moved the same amount.

SHOP BULLETIN #5

Rear Sprocket Bolts

We suggest that the rear sprocket bolts be secured using Loc-tite Stud lock grade and then tightened to 10 foot pounds. Tighten the lock nuts to 10 foot pounds also. Allow 24 hours for the Loc-tite to harden.

SHOP BULLETIN #6

Rear Wheel Spokes

It is suggested to disassemble the rear wheel flange side spokes and install flat washers under the spoke heads. This keeps the spokes from bending the flange and coming loose.

SHOP BULLETIN #7

Rear Wheel Bearings

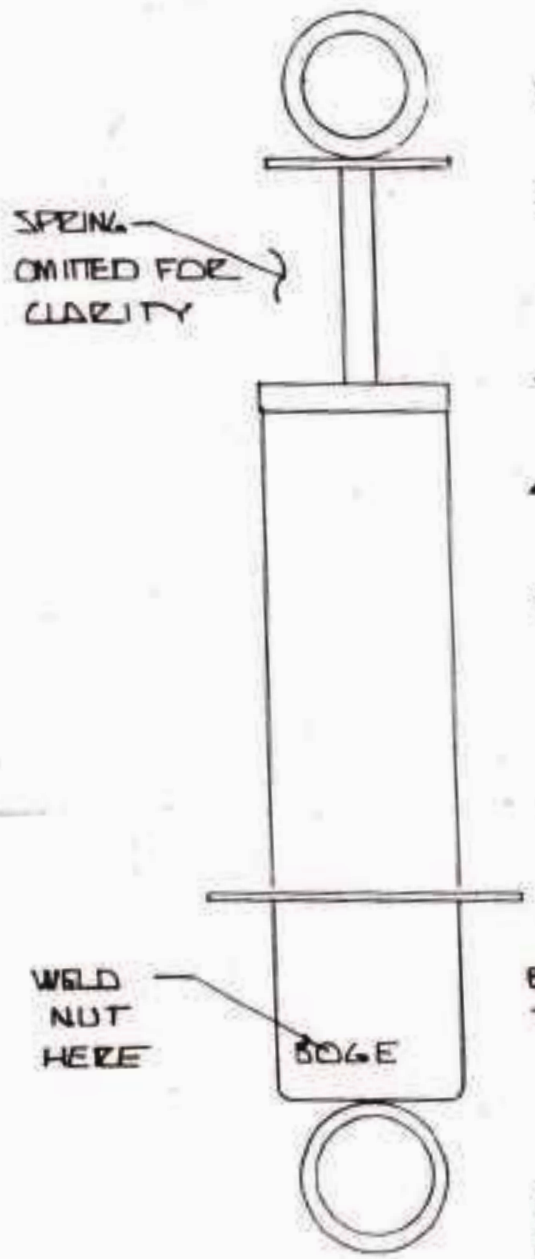
Metal chips left in the rear hub during fabrication will fall out of the vent holes and cause the rear wheel bearings to seize. It is suggested to cover over the two vent holes, located between the wheel bearings, with duct tape.

SHOP BULLETIN #8

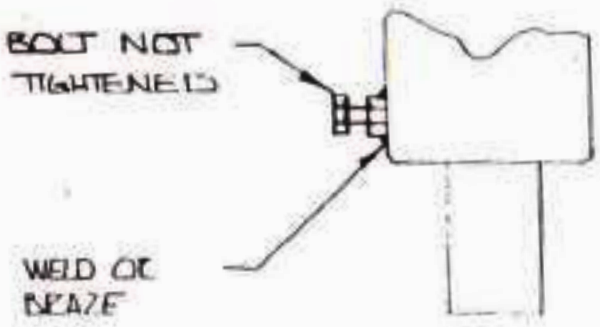
Leaking Forks

The front forks will leak if dirt is allowed to accumulate on top of the fork seal. It is suggested to use an old fork on top of the new seal to prevent dirt from damaging the new seal.

SHOCK MODIFICATION



1. WELD ¼-28 NUT DIRECTLY OVER THE "O" IN BODY.
2. DRILL THROUGH THE HOLE IN THE NUT WITH A 3/16 DRILL. TRY TO KEEP THE CHIPS FROM FALLING INTO THE SHOCK
3. DRAIN THE OIL INTO A MEASURING CUP. THERE SHOULD BE ABOUT 1½ OUNCES.
4. MIX ¾ OUNCE OF AUTOMATIC TRANSMISSION FLUID TO ¾ OUNCE OF 20 WT MOTOR OIL.
5. FILL USING A CUT 3 IN 1 OIL CAN AS A FUNNEL. STROKE THE SHOCK SHAFT UP & DOWN UNTIL 1½ OUNCES OF FLUID HAS FILLED INTO THE UNIT
6. TIGHTEN THE BOLT SO THAT BOLT HEAD TOUCHES THE NUT FIRMLY.



SHOP BULLETIN #2

250cc	250cc	250cc	501cc	400cc	400cc	400cc	400cc	
4	1	6DP	1	1	0	6DH	6FJ	Needle
2	2	2	2	2	2	5	3	Needle-Notches from lean position
1610	275-280	159 0-5	285-290	280-285	109	159 5-0	159 0-5	Needle Jet
5	1	2.5	1	1	3.0	2.0	1.5	Slide
35	40	35	35	40	20	35	35	Pilot Jet
-	-	2.0	-	-	-	2.0	2.0	Air Jet
1.5	1.5	1.5	1.5	1.5	1.5	2.0	1.5 1 1/2	Air Screw (Turns)
165	170-180	210	180-190	175-185	420	270	310	Main Jet
3.0	2.7	2.7	3.5	3.8	3.8	3.8	3.8	Engine Tining BTDC (mm)
30 Bing	36 Bing	34 Mikuni	36 Bing	36 Bing	36 Amal	34 Mikuni	36 Mikuni	Carburettor (mm) Size and Make
L-2G	L-2G	L-2G	N-2G	L-2G	L-2G	L-2G	L-2G	Champion spark plug. GAP at .022-.024
L-3	L-3G	L-3G	-	-	-	-	-	Hot Plug

This jetting was developed using a Zollner engine dynomometer at C.R. Axtell's in Glendale, Calif. The jetting is for maximum horse power sea level to about 3500 feet. If jetting changes are required always change the pilot jet first, then the needle jet, then slide, then the main jet.

For a rough rule of thumb reduce the jet sizes 10% for every 5000 feet of altitude ie 40 pilot to 35 then to 30.

NOTE: The Bing Carburettor is usually supplied one needle jet too rich.

Carburettor-Jetting for sea level