

YAMAHA

SERVICE MANUAL



YAMAHA INTERNATIONAL CORPORATION
7733 Telegraph Road • Montebello, California 90054

YAMAHA

MOTORCYCLES



SERVICE MANUAL

**COVERING
ENGINE REPAIR PROCEDURE**

YDS3 ENGINE REPAIR PROCEDURE OUTLINE

I - DISASSEMBLY

<u>PHASE</u>	<u>SEQUENCE OF STEPS</u>	<u>CRITICAL POINTS</u>
1-Removal of engine from frame.	a-Remove exhaust pipe. b-Remove throttle valve assemblies from top of carburetor. c-Remove right crankcase cover and disconnect (6) wires. d-Loosen rubber air cleaners elbows and disconnect gas lines. e-Remove chain. f-Remove gear change pedal and kick starter crank. g-Disconnect oil pipe, plug line, and disconnect Autolube cable. h-Remove (4) engine mounting bolts. i-Lift out engine.	1-Use special wrench on ring nut (don't beat) 2-Protect throttle valves by tying them up.
2-Carburetor and dynamo removal.	a-Remove carburetors. b-Remove dynamo yoke (3bolts). c-Remove armature. d-Remove key.	1-Use special bolt to remove armature (don't beat) 2-Hold timing plate with large pliers to keep it from turning.
3-Cylinder assembly removal.	a-Remove oil piping nozzle. b-Remove heads. c-Remove cylinders. d-Remove pistons: 1-remove outer clips. 2-press out pin with special tool.	1-Use pin removal tool. Do not beat on pin and strain rod or bearing.

- 4-Left crankcase cover disassembly.
- a-Remove cover complete with oil pump.
 - b-Remove push cap, clutch fitting nut, and reduction gear nut.
 - c-Slip off clutch assembly.
 - d-Slip off large reduction gear.
- 1-When loosening clutch fitting nut, hold clutch housing with special tool.
- 5-Shifter assembly removal.
- a-Loosen and remove cover.
 - b-Take off clip.
 - c-Loosen (4) bolts and slip off assembly.
 - d-Remove shifter shaft and shifter forks together.
- 6-Splitting the crankcase
- 1-Use of special tools.
 - 2-Use soft hammer properly so that halves split evenly.
 - 3-Watch position of connecting rod so that it will clear case.
- 7-Transmission removal
- 1-Use of soft hammer.
- 8-Crankshaft assembly removal.
- 1-Use of special tool.
 - 2-Position of connecting rod.

II - INSPECTION

- 1-Crankshaft repair
- a-Use of special tools.
 - b-Trueing and balancing.
- Also see crankshaft manual.
- 2-Gearbox inspection.
- a-Location of special thrust washers and spacers.
- 3-Bearing and oil seal inspection.

- 4-Inspection of clutch friction plates and pressure plates.
- a-Use of special tools.
 - b-Visual inspection on a surface plate.

III - ASSEMBLY (clean all parts first)

- | | | |
|--|--|---|
| 1-Inserting crankshaft into left case | | 1-Special tool.
2-Position of connecting rod.
3-Guiding O-ring into place. |
| 2-Replacing transmission components. | a-Sequence | 1-Positioning of kick starter pawls. |
| 3-Fitting together the crankcase halves. | a-Apply bonding compound to mating surfaces.
b-Tap with soft hammer to close up evenly. | |
| 4-Replacement of shifter assembly. | a-Fit shifter forks into place and insert shaft.
b-Put unit into place and tighten.
c-Fasten change link clip.
d-Adjust change lever.
e-Replace shifter cover. | 1-Correct positioning of shifter forks.
2-Relationship of shifter fork and shifter cam during replacement.
3-Relationship of shifter pawl working plate and shifter pawl. |
| 5-Assembly of left crankcase components. | a-Replacement of big reduction gear.
b-Clutch assembly replacement.
c-Replace and tighten nut.
d-Replace push cap.
e-Replace left cover. | 1-Replace (5) washers one at a time.
2-Hold housing with special tool when tightening nut. |

6-Cylinder assembly replacement.

--Replace as follows:

- a-Needle bearings.
- b-Piston (with rings), pin and clips.
- c-Cylinder.
- d-Head.
- e-Oil pipe.

- 1-Position of arrow on piston.
- 2-Apply oil to needle bearings and piston rings.
- 3-Torque the cylinder head nuts in pattern.
- 4-Positioning of clips.

7-Replacement of Carburetors and Dynamo.

--Replace as follows:

- a-Armature.
- b-Dynamo.
- c-Carburetors.

- 1-Position of brushes.
- 2-Position of cam.

8-Final checks and adjustments.

- a-Oil
- b-Timing.

9-Mounting Engine in frame.

- a-Lift into place.
- b-Secure (4) mounting bolts.
- c-Fasten oil pipe.
- d-Replace gear change pedal and kick crank.
- e-Replace chain.
- f-Connect dynamo wires
- g-Replace right case cover.
- h-Replace throttle valve assemblies and fuel lines.
- i-Replace exhaust pipes.

10-Final Adjustment

- a-Synchronize carburetors.
- b-Synchronize oil pump with throttle.
- c-Bleed oil pump.
- 1-Special tool.

YA6 ENGINE REPAIR PROCEDURE OUTLINE

I - DISASSEMBLY

<u>PHASE</u>	<u>SEQUENCE OF STEPS</u>	<u>CRITICAL POINTS</u>
1. Removal of engine from frame	a-Remove exhaust pipe b-Remove change arm c-Remove foot rest arm d-Remove left crankcase cover & disconnect 5 wires from dynamo e-Disconnect clutch wire f-Remove center cover, chain case & chain g-Remove air cleaner cover & air cleaner h-Remove kick crank and right crankcase cover i-Disconnect cable from oil pump j-Remove carburetor k-Disconnect oil line from oil pump. l-Remove 3 engine mounting bolts m-Lift out engine n-Drain oil	1-Use special wrench on ring nut (don't beat) 2-When taking off air cleaner, it is necessary to remove 1 bolt from case cover. 3-Remove throttle valve and oil plunger after removing carburetor.
2-Dynamo and Sprocket removal	a-Remove governor assembly b-Remove dynamo yoke, 2 bolts c-Remove armature d-Remove crankshaft key e-Remove sprocket f-Remove push rod	1-Hold governor ass'y when removing armature setting bolt. 2-Use special armature removal bolt. 3-Use special holding tool while removing sprocket. 4-Don't forget steel ball.

- | | | |
|--------------------------------------|---|---|
| 3-Cylinder assembly removal | <ul style="list-style-type: none"> a-Remove head b-Remove cylinder c-Remove piston <ul style="list-style-type: none"> -Remove clip -Push out piston pin. | <ul style="list-style-type: none"> 1-If piston pin is tight, use special removal tool. |
| 4-Right crankcase cover disassembly. | <ul style="list-style-type: none"> a-Remove oil pump (3 bolts & oil pipe) b-Remove case cover complete c-Remove clutch spring holding screw and spring d-Remove inner headed push rod and clutch plates e-Remove clutch fitting nut and reduction gear nut f-Slip off clutch boss & housing g-Slip off primary pinion h-Remove valve cover i-Slip out valve and collar j-Remove valve knock pin | <ul style="list-style-type: none"> 1-Oil pump worm shaft is locked inside; leave it. 2-Use clutch holding tool to loosen clutch nut & primary pinion nut. 3-Use pin punch to remove valve knock pin. |
| 5-Splitting the crankcase | <ul style="list-style-type: none"> a-Remove stopper guide screw, spring, and pin b-Remove main axle bearing cover, clip, and adjusting shim c-Remove change axle clip d-Remove all crankcase bolts | <ul style="list-style-type: none"> 1-Don't forget to remove clips. 2-Use special case splitting tool. 3-Use soft hammer properly so that halves split evenly |
| 6-Transmission removal. | <ul style="list-style-type: none"> a-Remove change axle bracket and ratchet wheel. b-Slip off change lever, shift pawl ass'y and change axle together. c-Remove transmission ass'y and shifter ass'y together. d-Remove kick spring, gear & axle. | <ul style="list-style-type: none"> 1-Use soft hammer when removing transmission. |
| 7-Crankshaft assembly removal. | <ul style="list-style-type: none"> a-Remove crankshaft "O" ring | <ul style="list-style-type: none"> 1-Use special tool |

II - INSPECTION

YA6 - PAGE 3 of 5

1-Crankshaft inspection:

See YDS3 or crankshaft manual

2-Gear box inspection:

Check location of special thrust washers and spacers.

3-Bearing and oil seal inspection.

III - ASSEMBLY (Clean all parts first)

1-Insert crankshaft into right case

- a-Insert crank
- b-Replace "O"ring

- 1-Use special tool
- 2-Position of
connection rod.

2-Replacing transmission

- a-Replace kick spring, gear and shaft together
- b-Replace transmission assembly and shifter assembly together
- c-Replace change axle bracket and ratchet wheel
- d-Replace change lever, shifter pawl and change axle.

- 1-When replacing kick gear, watch that it clears the ratchet wheel guide.
- 2-Check for correct positioning of ratchet wheel.
- 3-When replacing transmission, a soft hammer should not be necessary.
- 4-Try changing gears after replacing all.

3-Fitting together the crankcase halves

- a-Apply bonding compound to mating surfaces
- b-Tap carefully with soft hammer to close up evenly
- c-Replace and tighten all bolts
- d-Replace change axle clips
- e-Replace main axle clip and bearing cover
- f-Replace stopper parts and screw

- 1-Use good quality compound
- 2-Draw up halves evenly
- 3-After completing all steps, repeat gear change test (all gears)

4-Assembly of right crankcase components

- a-Replace valve knock pin
- b-Replace valve collar & valve
- c-Replace valve cover
- d-Replace primary pinion
- e-Replace clutch housing & clutch boss.
- f-Replace & tighten clutch fitting nut and reduction gear nut.
- g-Replace push rod & clutch plate.
- h-Replace & tighten clutch holding screw.
- i-Replace right crankcase cover
- j-Replace oil pump

- 1-Correct positioning of valve.
- 2-Special tool when tightening nuts
- 3-When replacing right case cover, watch oil pump drive gear position.
- 4-Oil pump replacement must be smooth.

5-Cylinder assembly replacement

- a-Replace needle bearing
- b-Replace piston, pin, clip.
- c-Replace cylinder
- d-Replace head

- 1-Arrow on piston points forward.
- 2-Apply oil to needle bearing and piston rings.
- 3-Position of mark on rings (TP is up)
- 4-Position & seating of clips
- 5-Torque cylinder head nuts in pattern

6-Replacement of
dynamo & sprocket

- a-Replace crankshaft key
- b-Replace armature
- c-Replace dynamo yoke
- d-Replace governer assembly

- 1-Position of brushes.
- 2-Position of cam.
- 3-Use sprocket holding tool
when tightening.

7-Final check
and adjustment

- a-Put in oil
- b-Set timing

8-Mounting engine
in frame

- a-Lift into place
- b-Secure mounting bolts
- c-Connect oil pipe
- d-Replace carburetor and
throttle assembly with
cable
- e-Replace right crankcase
cover and kick crank
- f-Replace air cleaner and
cover
- g-Replace chain and case
- h-Connect dynamo wires & left cover
- i-Replace & tighten foot rest arm.
- j-Replace change arm
- k-Replace exhaust pipe

- 1-Direction of chain clip.
- 2-Use ring nut wrench.

9-Final adjustment

- a-Synchronize oil pump with throttle
- b-Bleed oil pump
- l-Special tool

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MOTORCYCLES



SERVICE MANUAL

COVERING

CRANKSHAFT PROCEDURES

YAMAHA

CRANKSHAFT REPAIR



A ROUTINE & PROFITABLE REPAIR SHOP SERVICE

WITH

SPECIAL INCENTIVES:

- More Yamahas on the road than ever before.
- Less in-shop time per machine than sending out the crank for further work.
- Longer-lasting overhauls when you do it thoroughly and don't skip the crank.
- Better customer satisfaction.
Each customer wants his own shop to do the whole job and to do it fast and right.

SUBJECT: CRANKSHAFT TEARDOWN, REPLACEMENT & REASSEMBLY
ALL MODELS

November, 1964
Los Angeles, Calif., U.S.A.
Leo C. Lake, Jr.

The crankshaft and its parts are constantly being exposed to very high speeds and great stresses. These components are not only subject to wear but are required to possess a high degree of accuracy. It is for these reasons that a complete check of the crankshaft should be routine procedure any time this unit is exposed or shows any pre-disassembly symptoms of need of repair. If this check reveals any faults, then complete disassembly of the unit is the next logical, and just as routine, step in shop procedure.

Replacement of crankshaft parts by the service shop should be regarded and approached on the same manner as with other service demands. These parts, if and when needed, are the economical and expedient way to effect repair. A blanket policy of unit replacement is to be discouraged. Excessive wear, if and when it occurs, usually requires only the replacement of a few parts.

The additional tools required for this job usually consist of nothing more than a small hydraulic press and some sort of centering device or set of V blocks. The indicator used for crankshaft alignment is to be found already in use on other operations. In the case of the twins, a standard Yamaha tool is available for separating the two sides of the crank to expose the center main bearing and its seal. To make this teardown and reassembly easier on all cranks, Yamaha can also sell you a crankshaft pot and a complete set of wedges, support shims, and drive rods.

As to the holding fixture used for alignment, this can usually be found in one form or another around most shops in the shape of a lathe or support stand used for other purposes. If special purchase is necessary, a small inexpensive lathe, even a wood lathe, meets the crankshaft demands because no driving mechanism is required here.

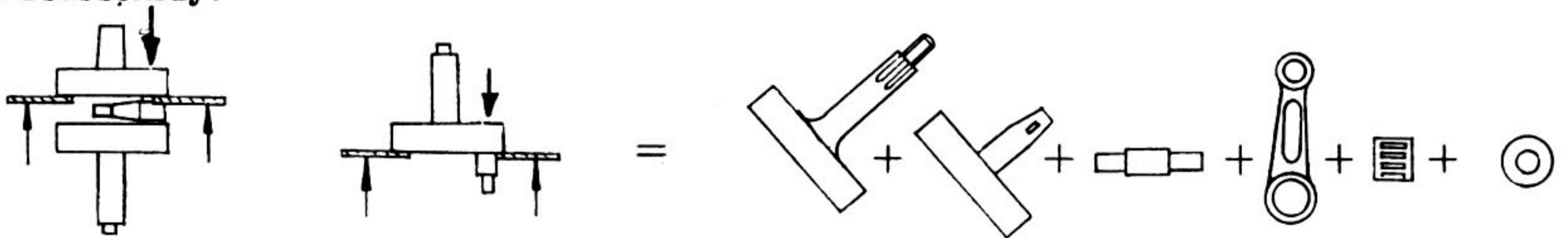
Now that we have established the fact that this is a good thing to be doing,

let us look briefly at the procedure and see just what it consists of. The single cylinder cranks are all about the same. They all have two webs with a main shaft sticking out one side, and the two webs are connected by a pin which carries the connecting rod. The whole procedure, from start to finish, is relatively simple. Disassembly is simply two pushes of the press.

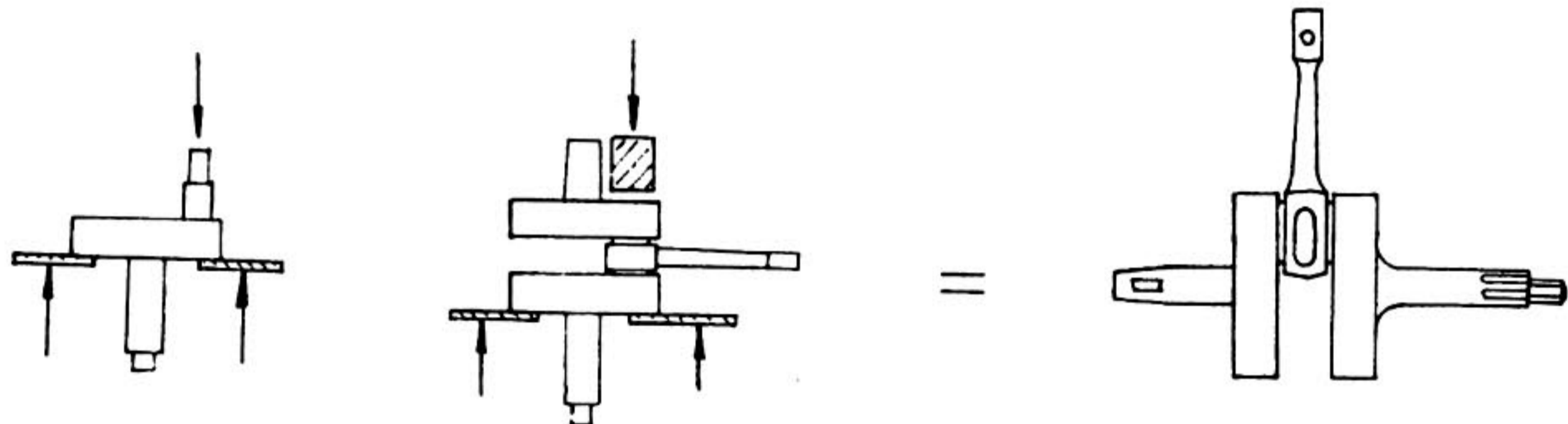
Relignment is nothing more than a little whopping around with a lead or brass hammer. Schematically, it looks like this:

When ↓ = pressure head and ↑ = support, then:

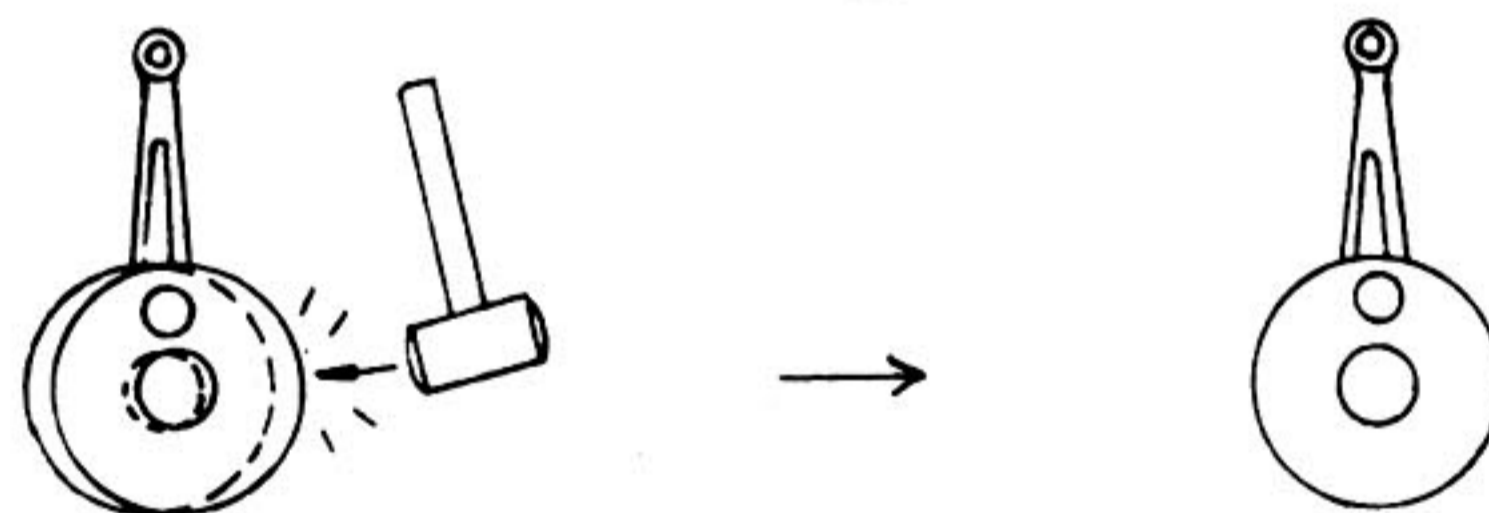
Disassembly:



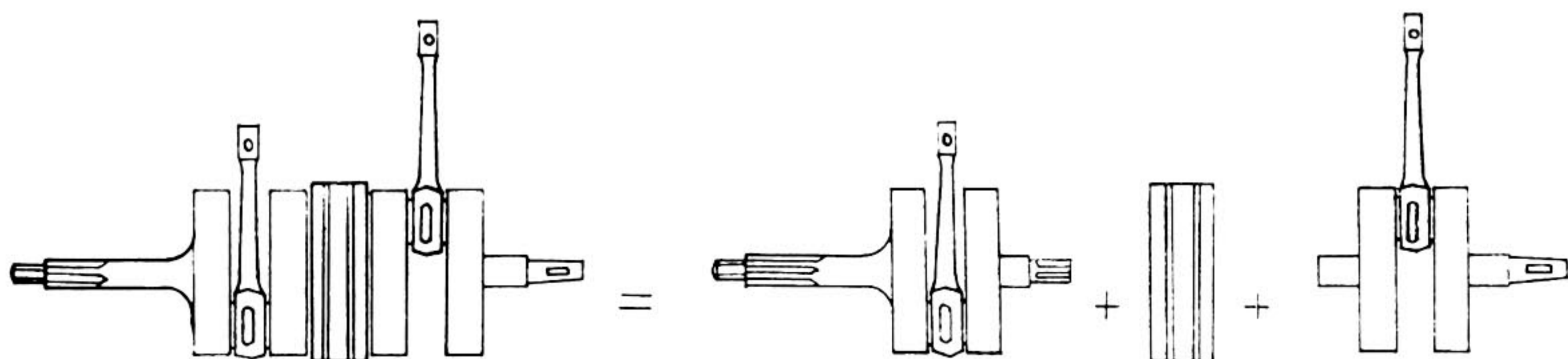
Reassembly:



Realignment:



Twin cylinder cranks? They are nothing more than two singles connected together, and they are made in such a way that assembly is through a splined fitting that cannot be off just a little. Just line up the two parts by sight with the cranks opposite and press them together. All realignment consists of for the twins is to treat each side as a single first, and then run a check on the whole unit later, or to put it schematically again:



DISASSEMBLY

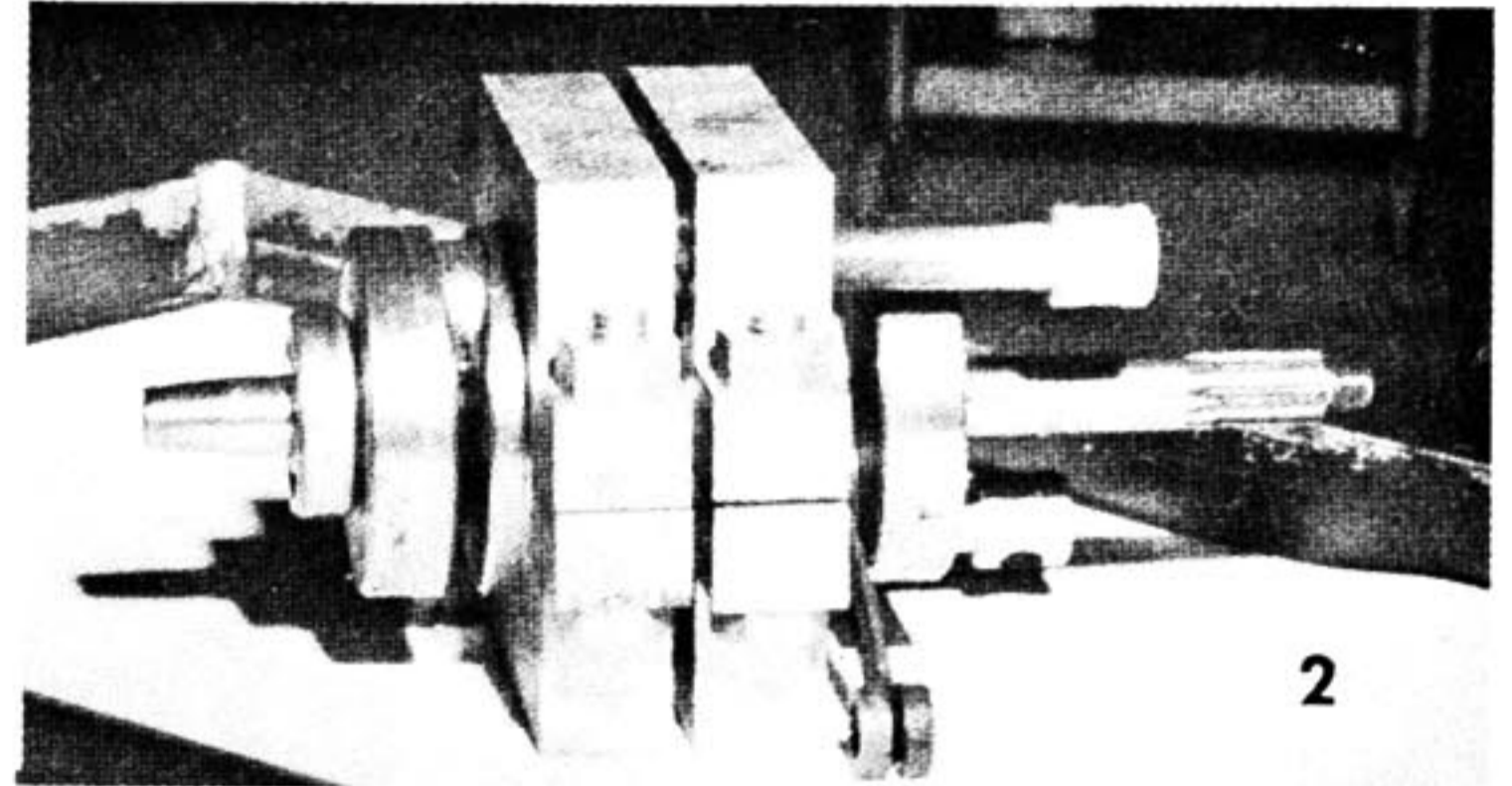
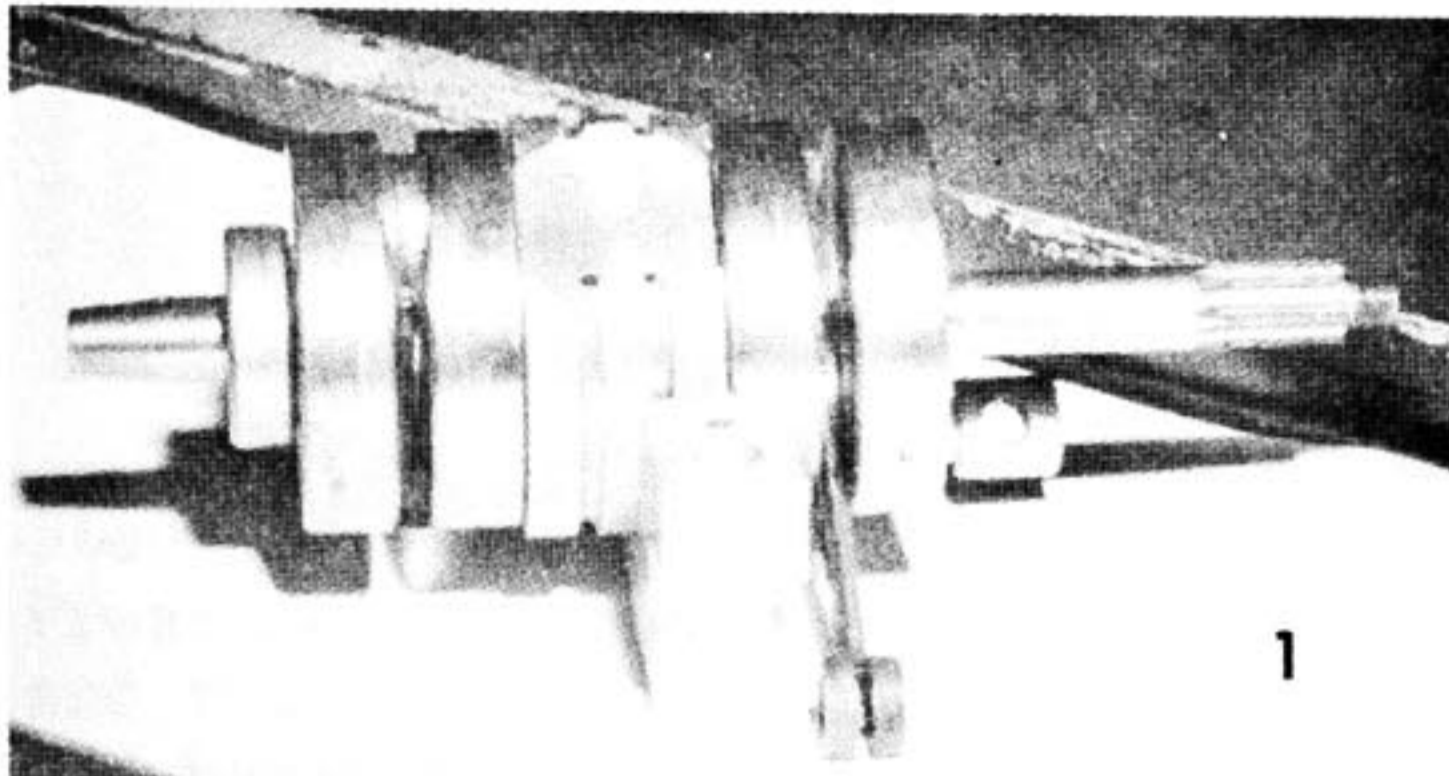
Step 1
Crankshaft ready for disassembly. Lower half of one side of separating device is in place.

Illus. 1

Step 2

Illus. 2

Separating device in place.



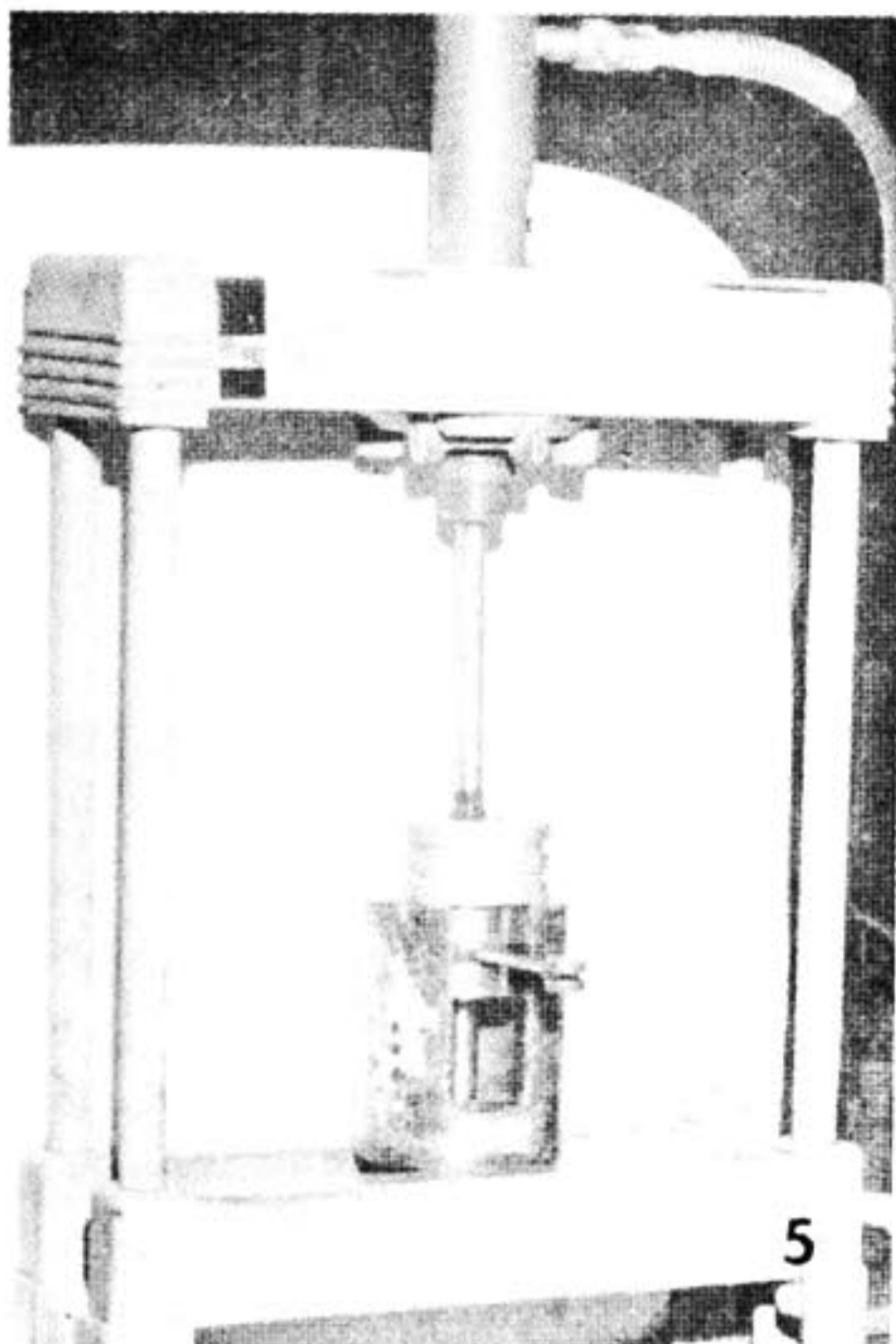
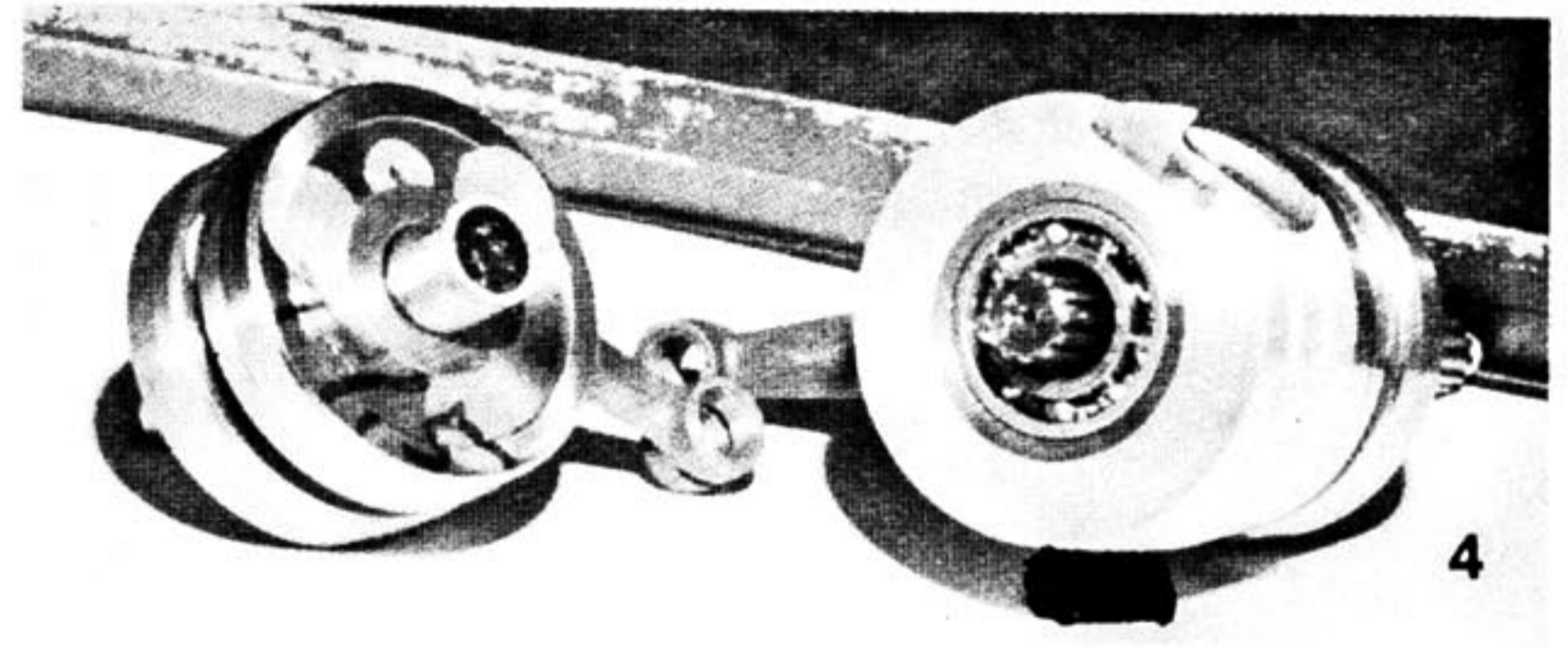
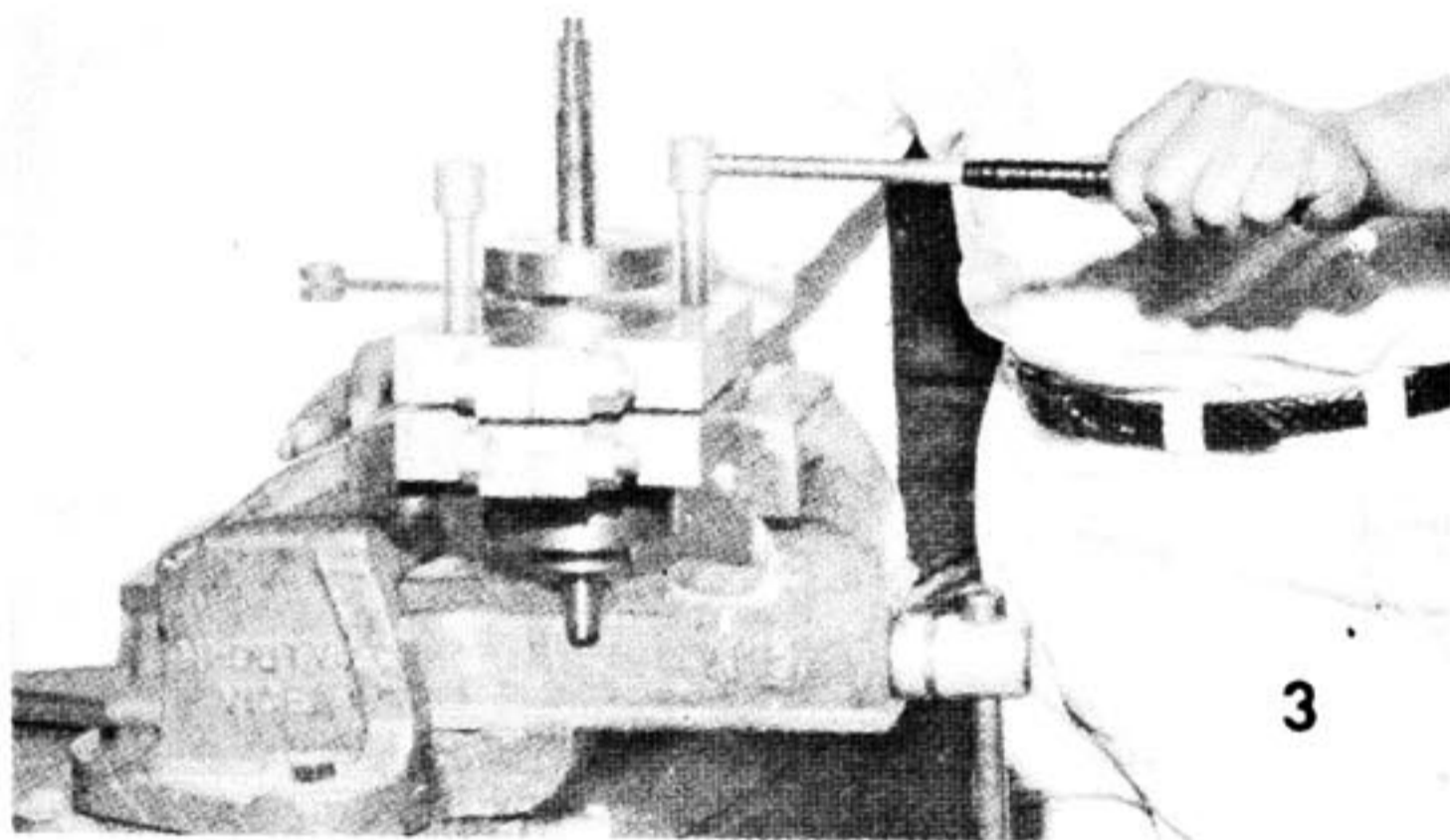
Step 3
Separating device in operation. Separate evenly; turn the screws alternately, $\frac{1}{2}$ turn at a time.

Illus. 3

Step 4

Illus. 4

The two sides pulled apart. Notice splines for later assembly reference.

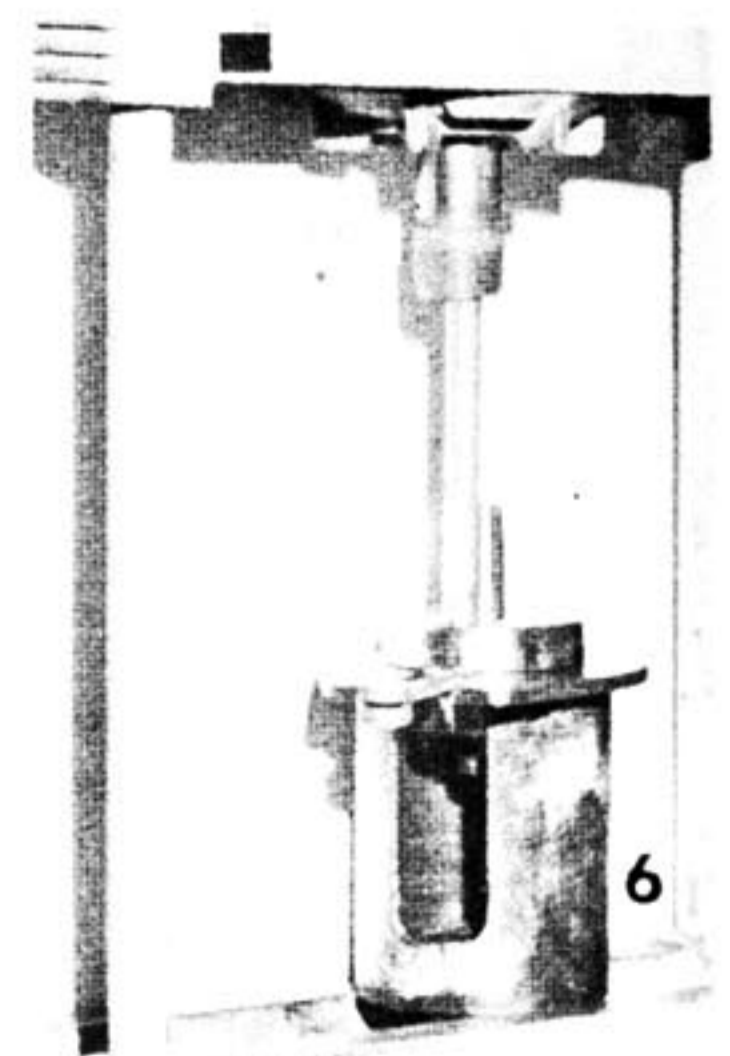


Step 5
Press shaft out of bearing carrier. If bearings come out with shaft, use bearing puller to remove from shaft.

Illus 5

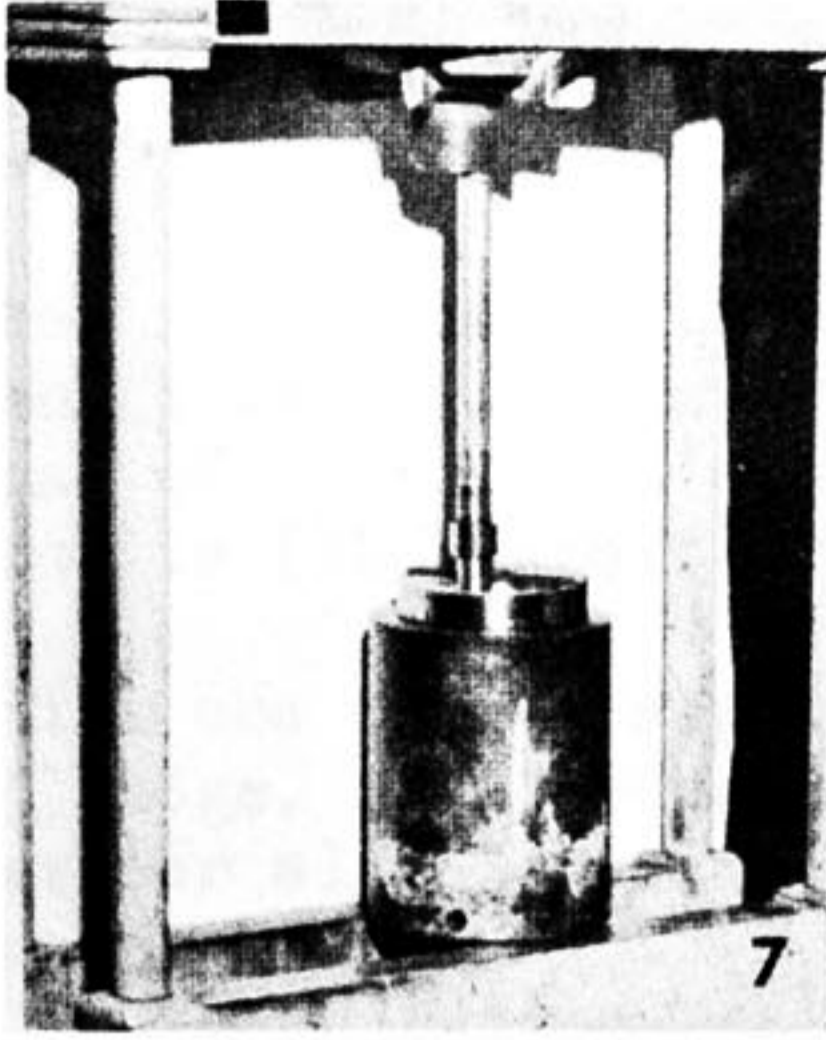
Step 6
Remove pin, note use of web support plates to put the support under the top web. Repeat this operation for the other three webs.

Illus. 6



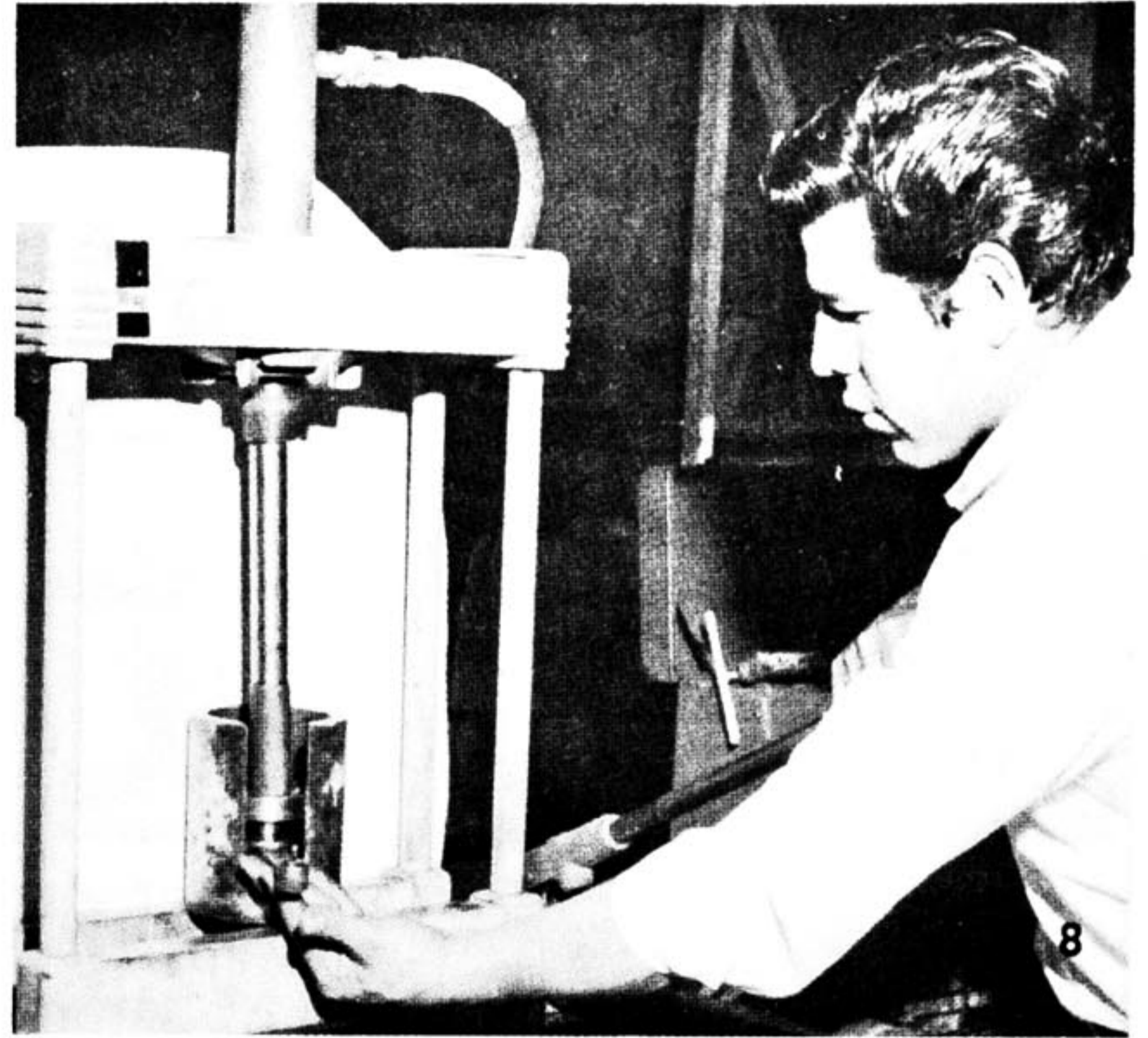
Step 7
All parts are now disassembled. Inspect all pieces, replace as needed.

ASSEMBLY

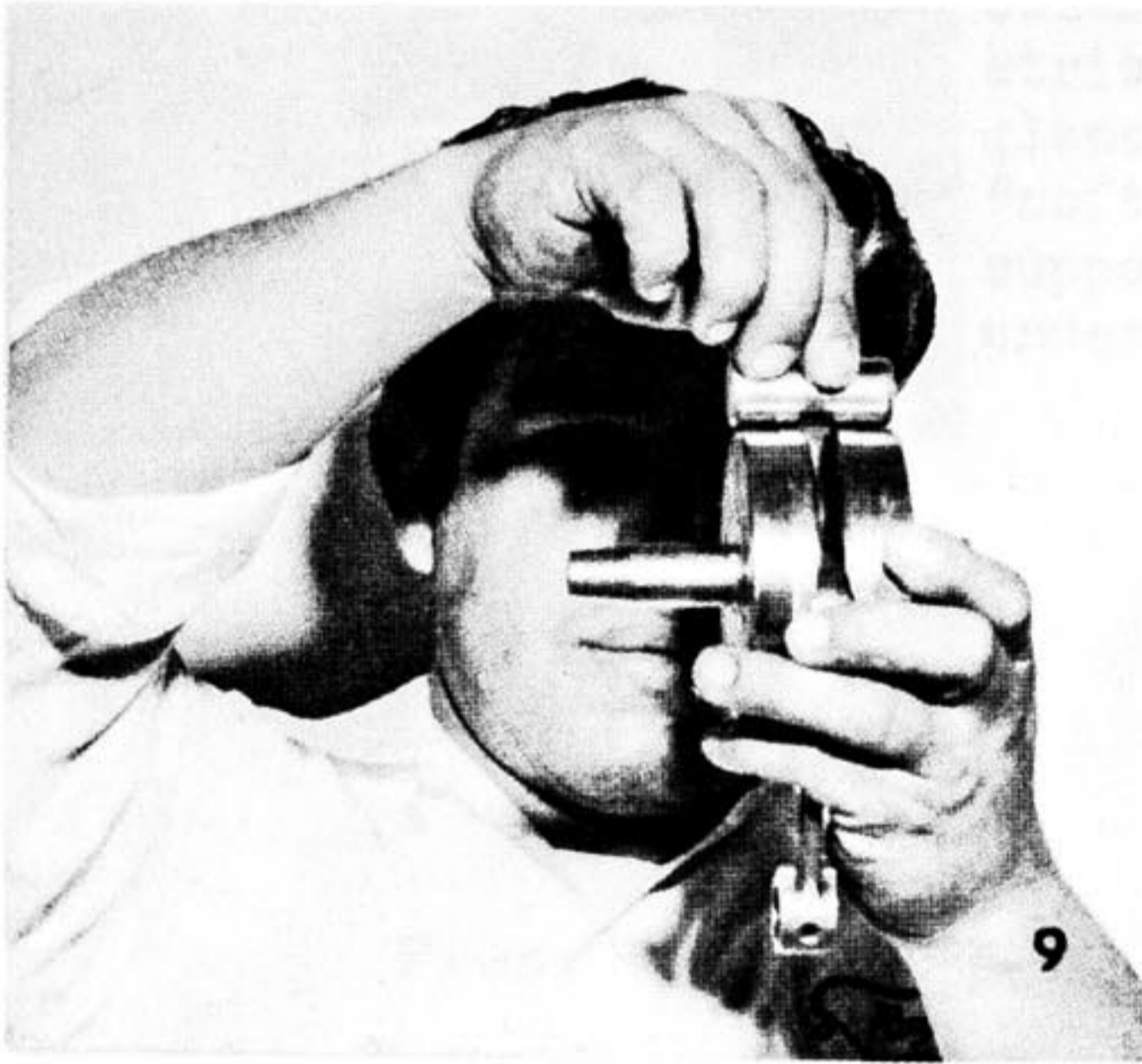


Step 1 Illus. 7

Press the pin into first web as shown.



Step 2 Illus. 8
Press second web on pin, bearing and rod in place. Make sure that rod hangs free during operation. Use of crankshaft pot gives rough alignment.



Step 3

Illus. 9

Checking alignment.

Do this with pin on far and near side. Hit web with brass or lead hammer to move. Then mount this assembly between centers and indicate to the following maximum tolerances:

Edge of web: .002" (.05mm)

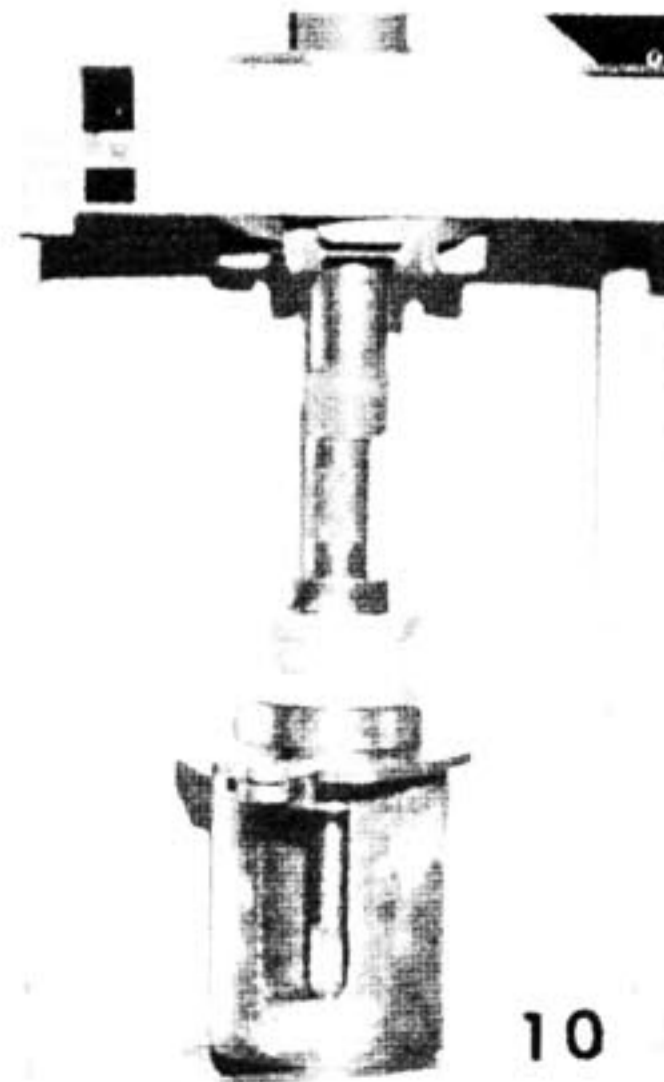
Shaft: .0012" (.03mm)

Repeat steps 1,2,& 3 above for other side.

Step 4
Insert bearings (number side out) and seal into carrier piece. Apply grease to inside of seal.

Step 5

Check general configuration. With long, male-splined shaft on left, two holes in top of bearing carrier piece should be forward.



Step 6

Illus. 10

Shown pressing the bearing and carrier assembly onto the center shaft.

Again note use of web support plates.

ASSEMBLY (Continued)

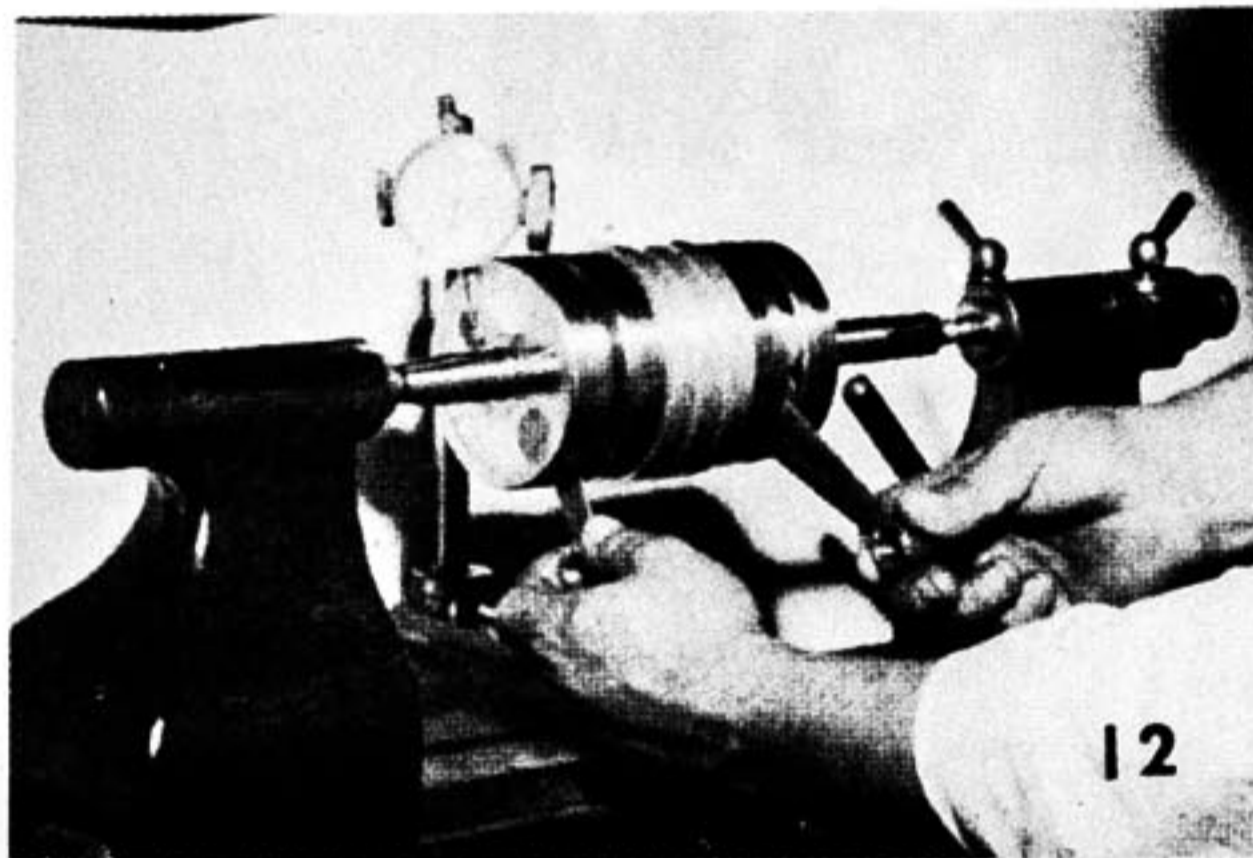
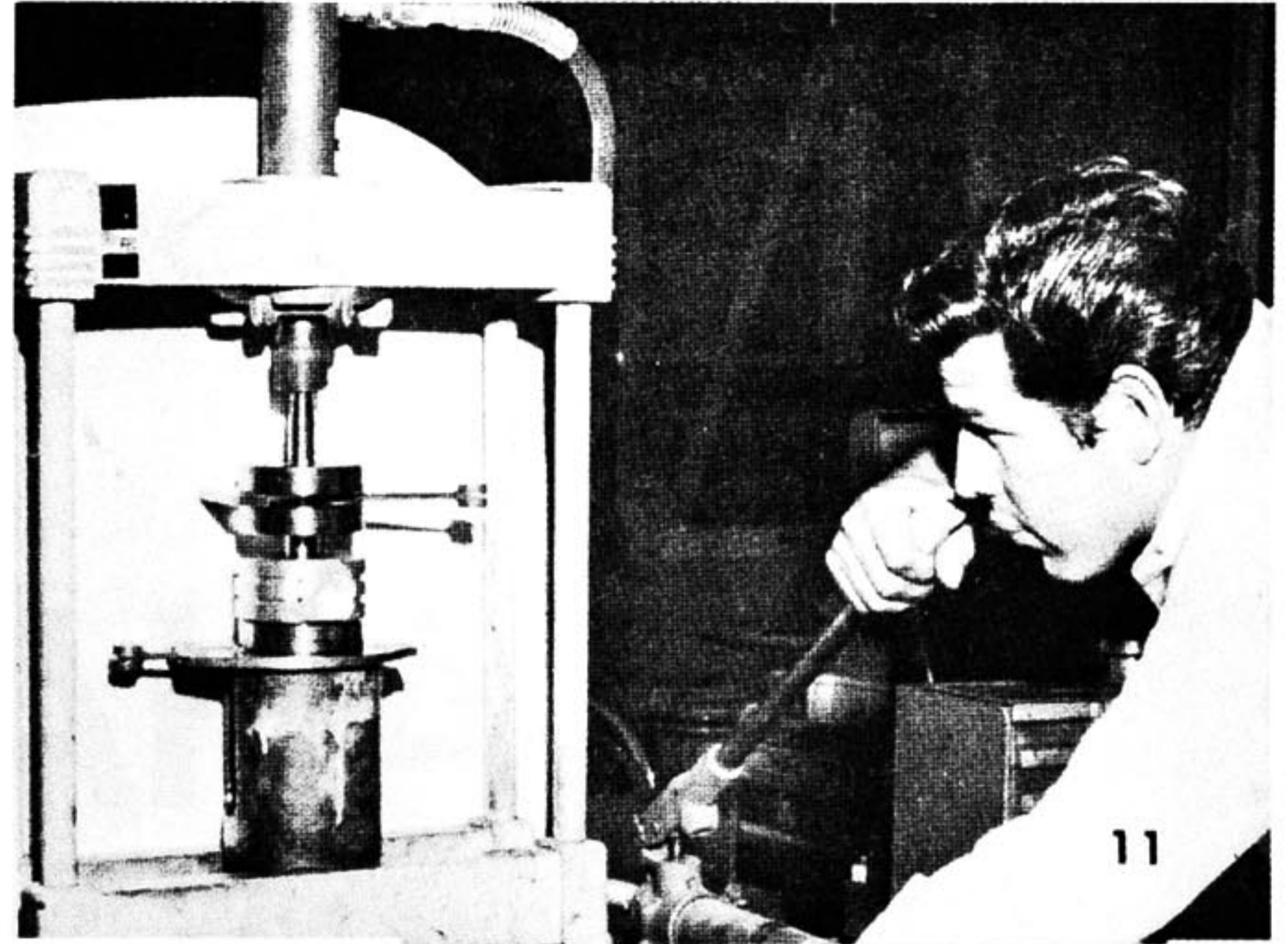
Step 7

Illus. 11

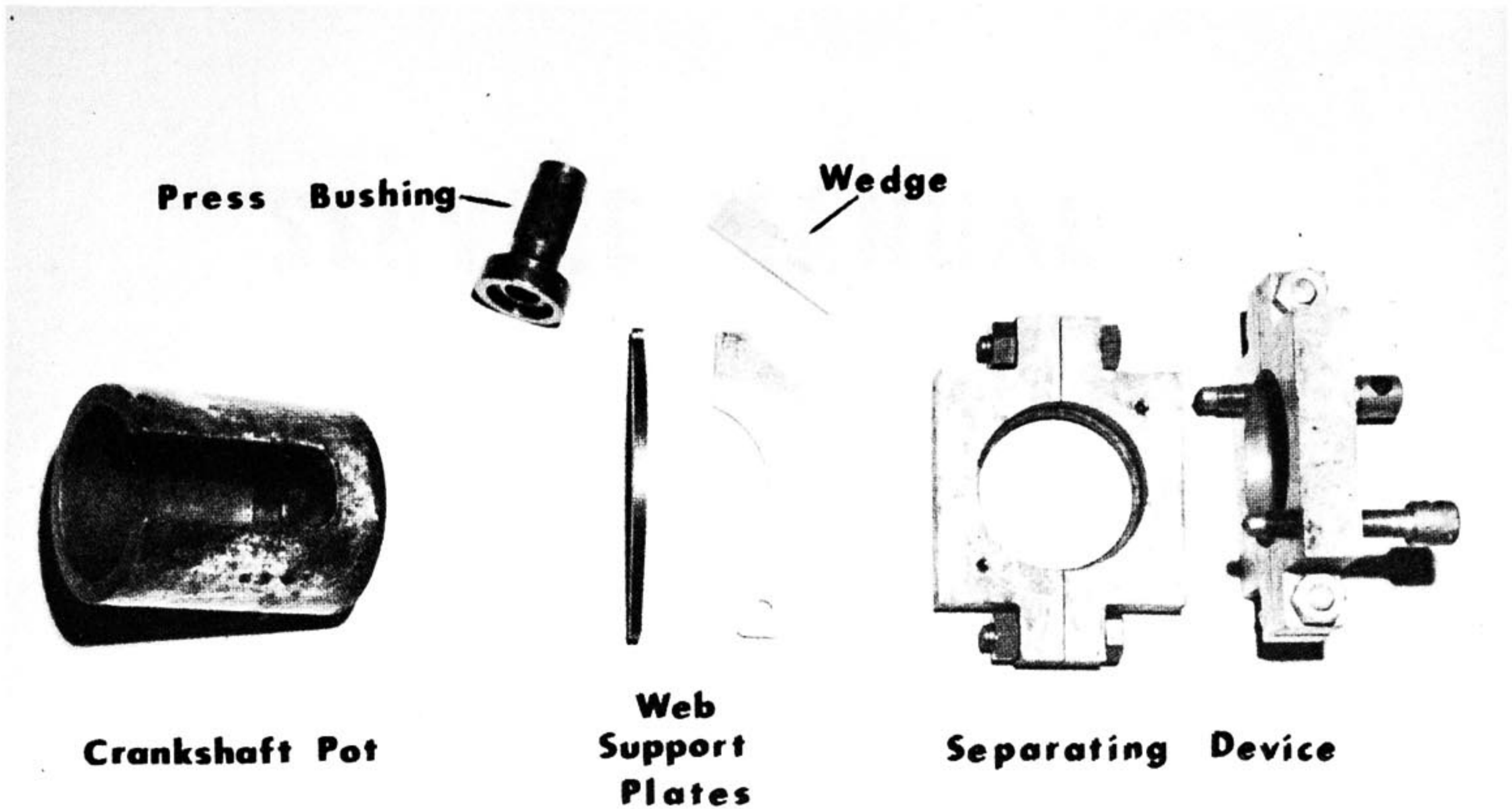
Press right and left halves of crank together. Make sure that pins of the two sides are opposite (180° apart).

Notice use of web support plates and wedge. The wedge maintains previous alignment and keeps the strain off pin.

To use wedge, tap lightly into place, opposite the pin.



Step 8 Illus. 12 & 13
Final alignment, consult manual for tolerances. To change the crankshaft assembly alignment, strike the shaft with a glancing blow from a "soft" hammer while supporting the assembly under the outermost web.



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COVERING
CRANKSHAFT DATA

SERVICE DATA

Crank deflection should be within the limits shown below:

(1)	(2)	(3)	(4)	(5)	(mm)
0.03	0.02	0.06	0.06	0.02	

Model	A	B	C	D	E	F	(mm)
MJ-2S	38.0	12.0	6.5	198.5	-	-	
MJ-2T	38.0	12.0	6.5	163.0	-	-	
YG-1	43.0	12.0	8.0	184.5	-	-	
YA-5	50.0	15.5	9.0	173.5	-	-	
YD-2	50.0	15.5	9.0	313.5	45.0	145.0	
YD-3	50.0	15.5	9.0	313.5	45.0	145.0	
YDT-1	50.0	15.5	9.0	313.5	45.0	145.0	
YDS-1	50.0	15.5	9.0	313.5	45.0	145.0	
YDS-2 (old)	50.0	15.5	9.0	313.5	45.0	145.0	
YDS-2 (new)	50.0	17.5	8.0	306.25	45.0	145.0	
YJ-1	43.0	12.0	8.0	184.5	-	-	
YA-6	50.0	17.5	9.0	168.0	-	-	
YDS3	52.0	17.5	9.0	320.25	47.0	151.0	

Model	G	H	I	J	K
MJ-2S	49.0	111.5	15.75	13.0	75.0
MJ-2T	49.0	76.0	15.75	13.0	75.0
YG-1	81.0	60.5	17.50	15.5	76.1
YA-5	58.0	65.5	20.5	17.25	123.0
YD-2	58.5	110.0	20.5	17.25	93.0
YD-3	58.5	110.0	20.5	17.25	93.0
YDT-1	58.5	110.0	20.5	17.25	93.0
YDS-1	58.5	110.0	20.5	17.25	93.0
YDS-2 (old)	58.5	110.0	20.5	17.25	93.0
YDS-2 (new)	51.25	110.0	21.0	16.25	93.0
YJ-1	81.0	60.5	17.5	15.5	76.1
YA-6	58.5	59.5	20.5	16.25	110.0
YDS-3	53.75	115.5	21.5	17.25	93.0

YAMAHA

MOTORCYCLES



SERVICE MANUAL

COVERING
YAMAHA AUTOLUBE SYSTEM

WHAT IS YAMAHA AUTOLUBE?

The engineering challenge in the development of the Autolube system lay in two facts. First, the delivery of the oil had to be variable in relationship to both engine speed and power thrust (throttle opening). Second, the volume of oil handled by the metering device was so small that the mechanical processes involved both in the manufacture and operation of this metering device had to be extremely accurate. To look at the picture more factually, imagine that 1 quart of oil were to be applied gradually and accurately over a span of some 4 million revolutions of the engine. This challenge was met by Yamaha and solved with Autolube.

Autolube is an automatic lubricating device for 2-cycle gasoline engines. Developed by the Yamaha Technical Research Institute, it meters the oil with respect to throttle opening as well as engine revolutions and reliably delivers this oil by means of a precision pump.

As a result, the Yamaha 2-cycle engines do not require a gasoline-oil mixture that other 2-cycle engines must use.

Since the Yamaha Autolube functions according to throttle opening and engine revolutions, it delivers the proper amount of oil to the engine at all times. In addition to these advantages over the conventional oiling system, this application of new, fresh oil can readily be recognized as superior to the re-circulating lubrication system of 4-cycle engines.

OPERATIONAL ADVANTAGES OF YAMAHA AUTOLUBE

1. Excellent lubrication

In comparison to pre-mixed 2-cycle engine lubrication, the Autolube system delivers larger particles of unmixed oil directly to the areas in need of lubrication, thus causing less friction and less actual combustion of the oil.

In comparison to the re-circulated oiling systems of the 4-cycle engines, the constantly fresh oiling system of the Autolube means less acids, less varnished, less contamination of the vital engine parts, and no messy periodic oil changes. In comparison to the conventional gas-oil mixture lubrication, with the Autolube it does not matter whether the oil can be easily mixed with gasoline or not. The Autolube, therefore, can use any oil with high viscosity index, strong oil film, excellent oiliness, low pour point etc.

2. Oil economy-

Oil consumption is less than that of the conventional pre-mixing system.

3. Less carbon accumulation-

The spark plug, cyclinder head, cylinder, piston, piston ring, exhaust pipe, muffler and other parts are coated with less carbon than the conventional system.

4. Less exhaust smoke-

Less oil available for combustion means a much cleaner exhaust.

5. Improved engine performance-

Combustion efficiency and engine performance have been increased in all phases of operation.

6. Simplified fuel supply-

It is not necessary to do any mixing. Straight gasoline goes in the fuel tank; oil goes in the oil tank.

7. Ease of operation-

The driver has no problems concerning a correct ratio of gasoline-oil, the pump automatically selects the proper mixture.

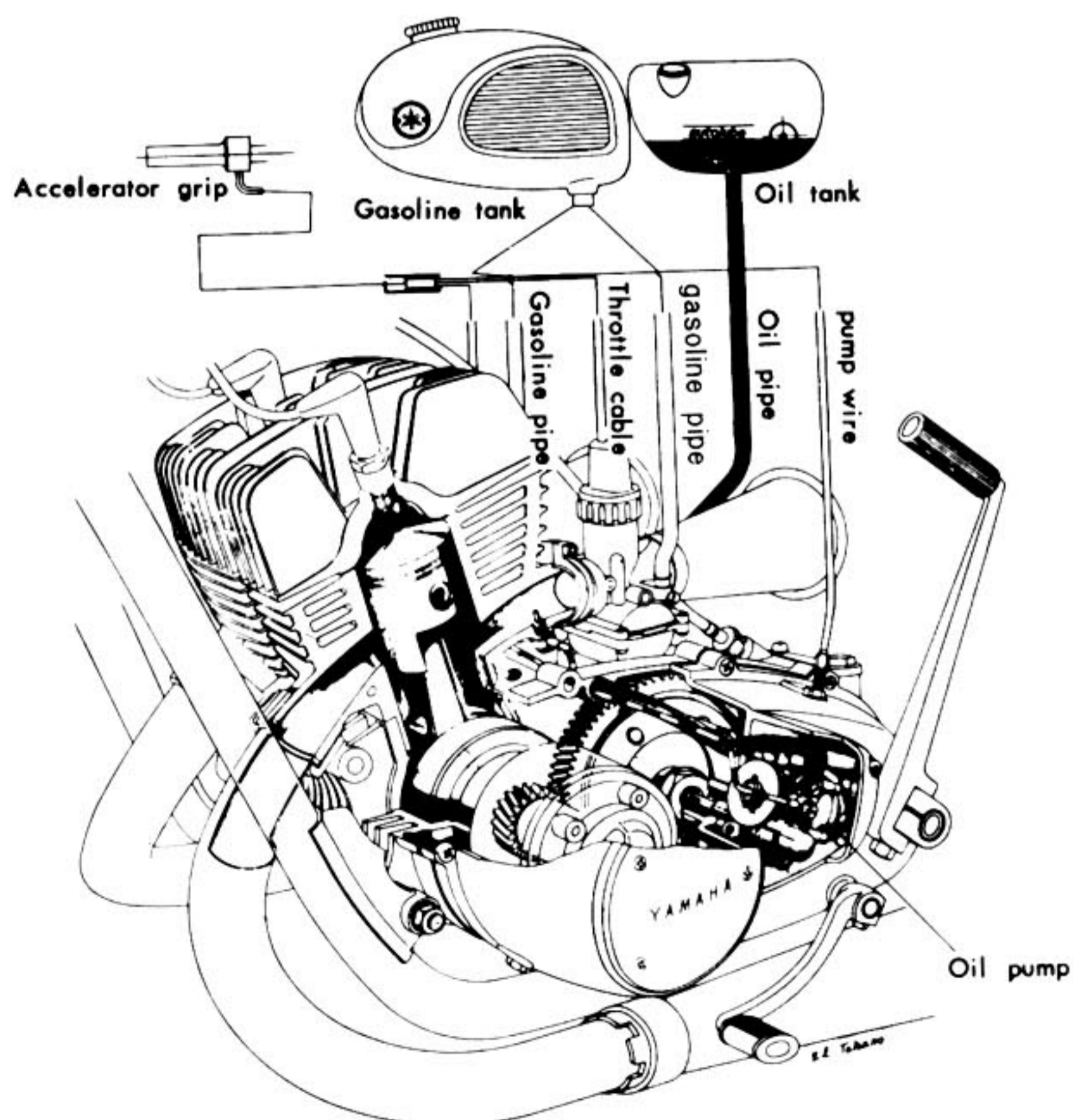
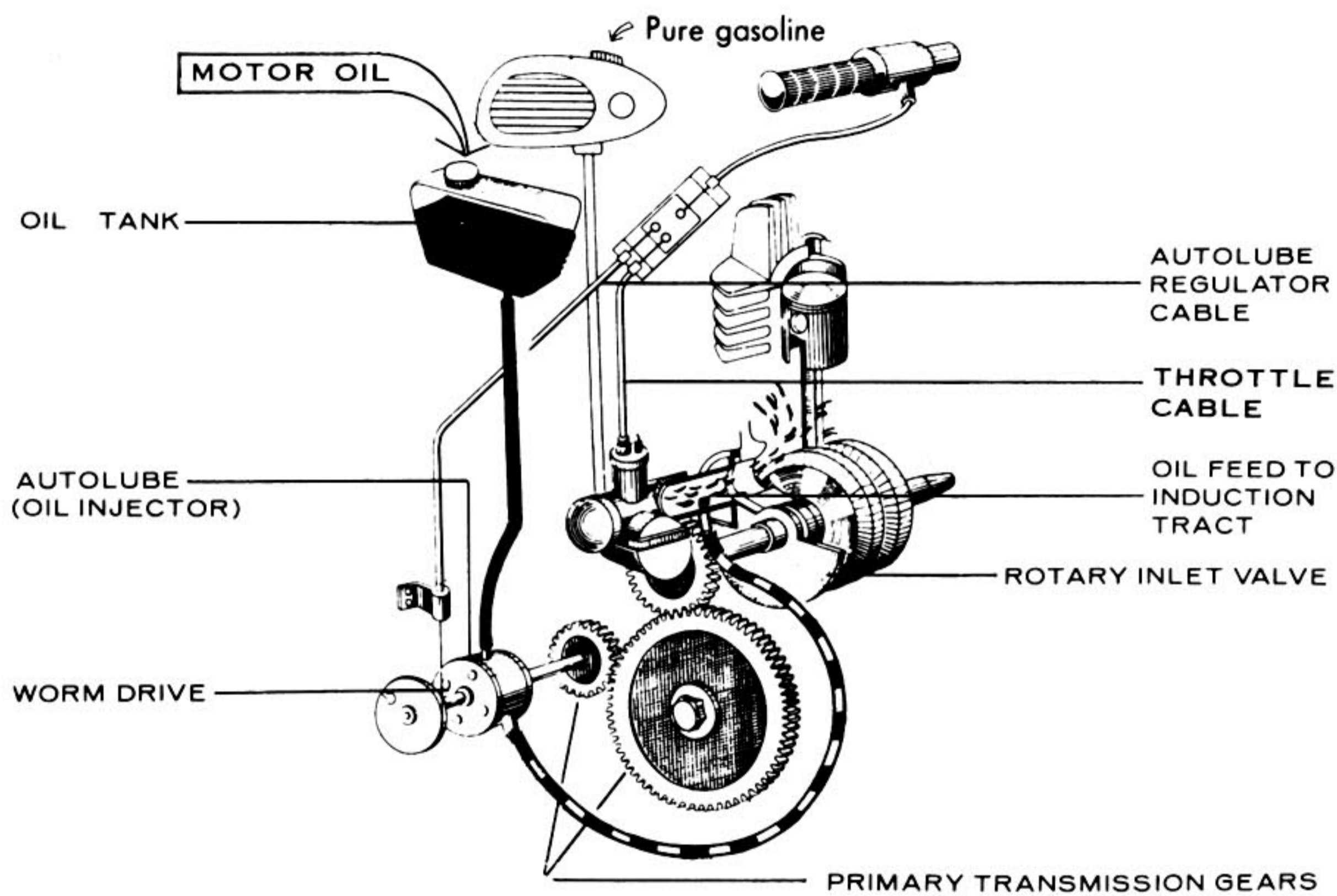
MECHANICAL ADVANTAGES OF YAMAHA AUTOLUBE

The oil pump used for the Yamaha Autolube is an engine-driven plunger pump coupled to a rotating distributor. The amount of oil delivered is adjustable. Air, if trapped while piping the unit, can be completely removed prior to operation.

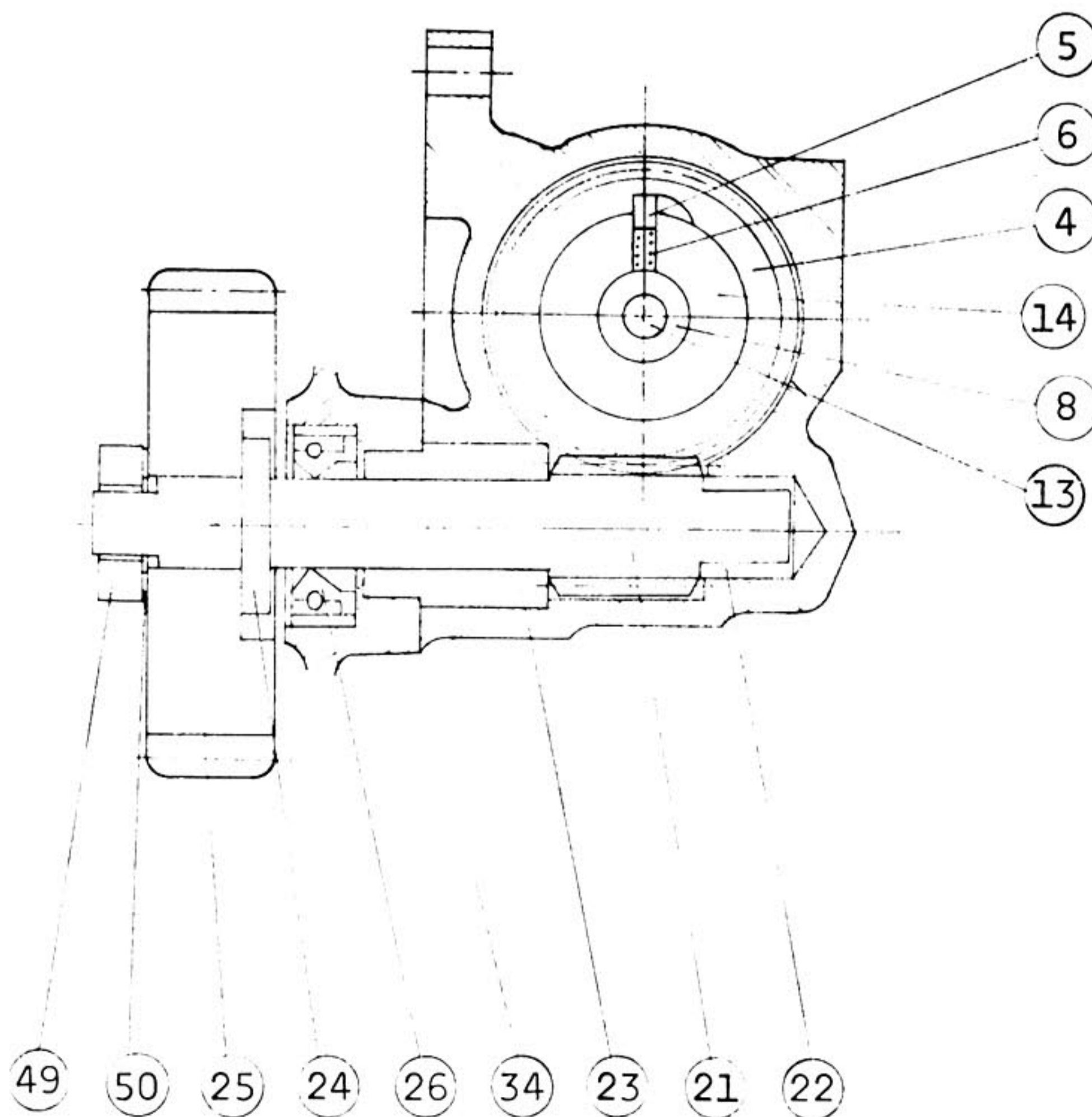
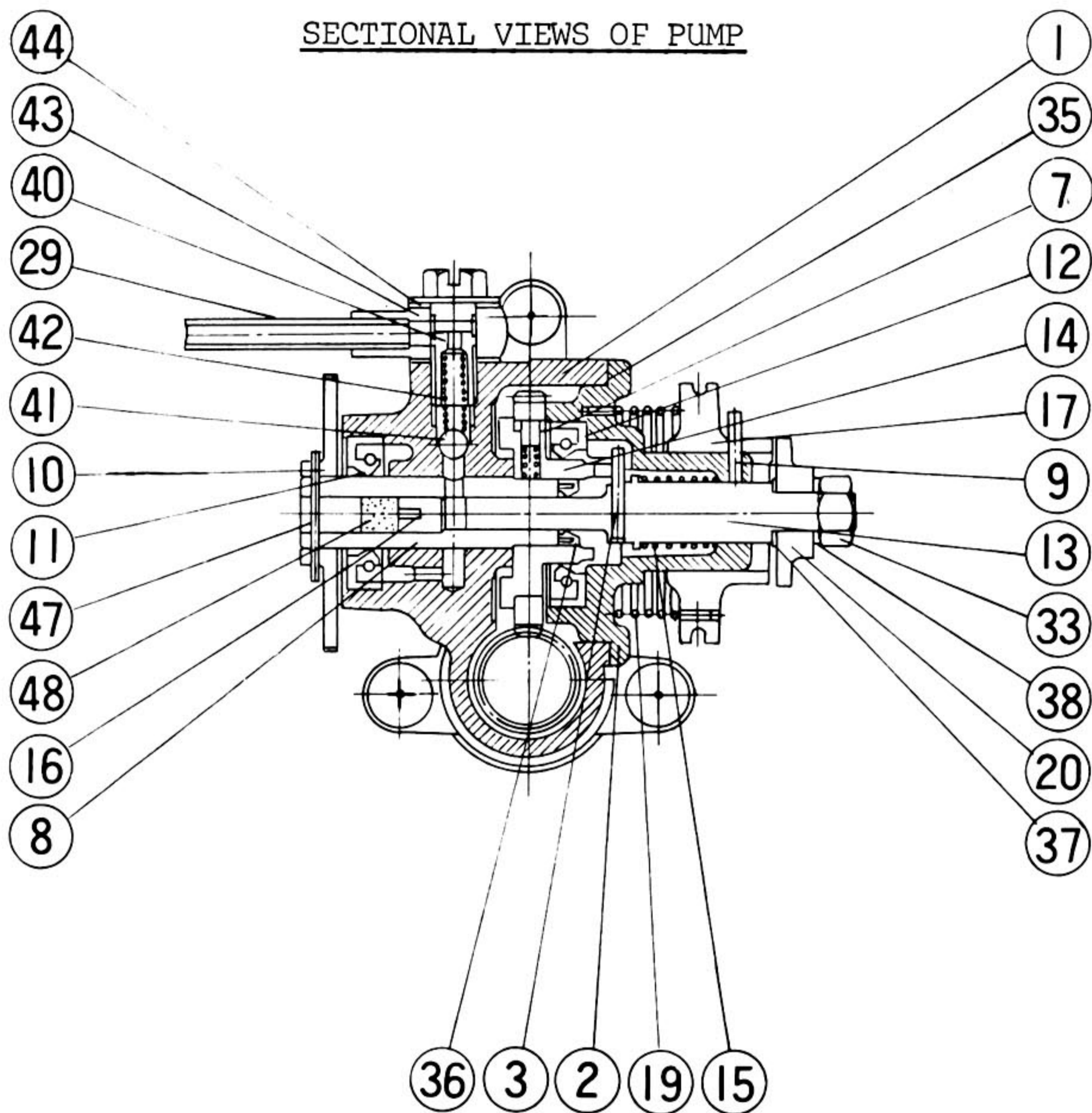
YAMAHA AUTOLUBE SYSTEM

(YA6 and YG1K)

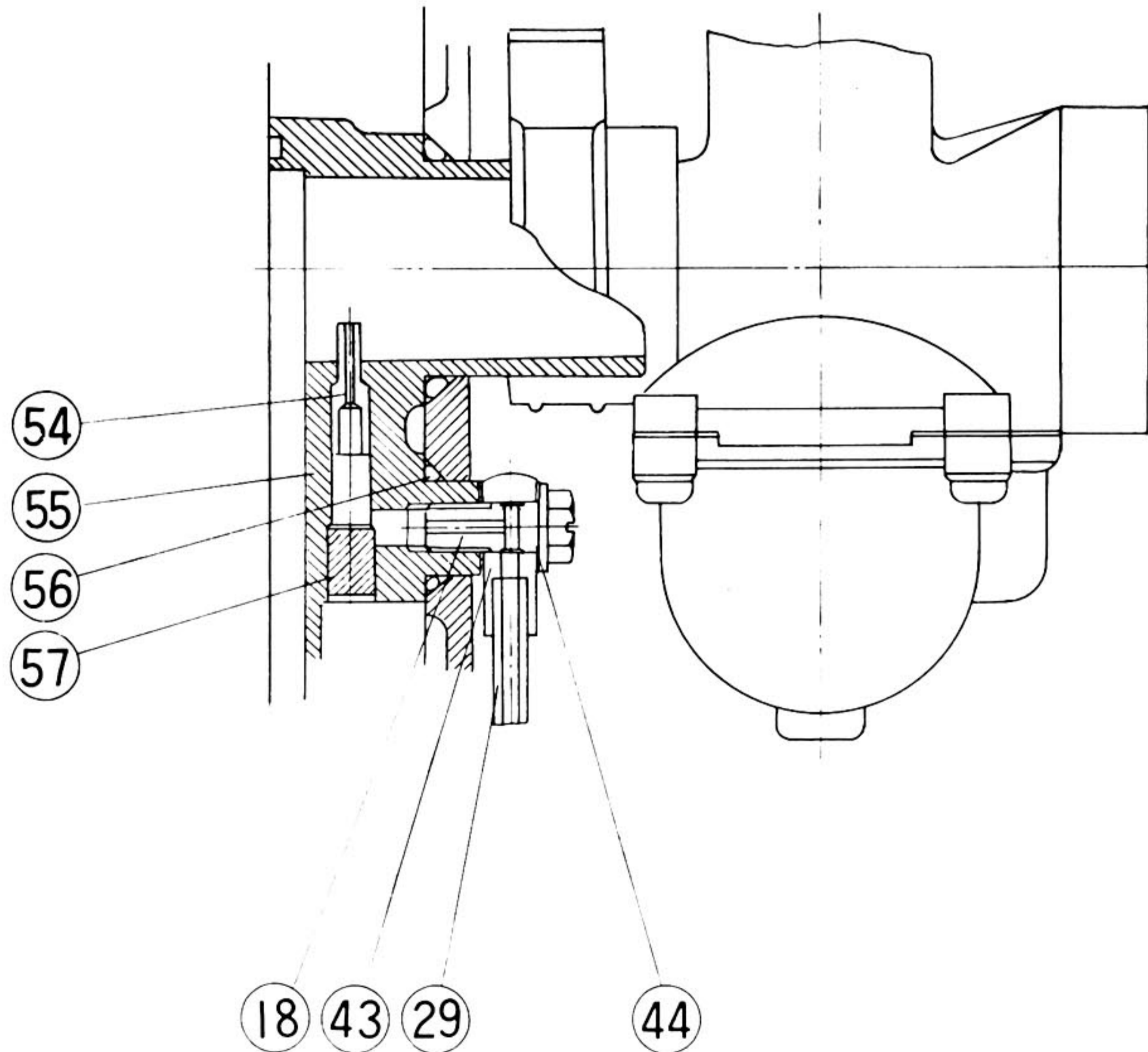
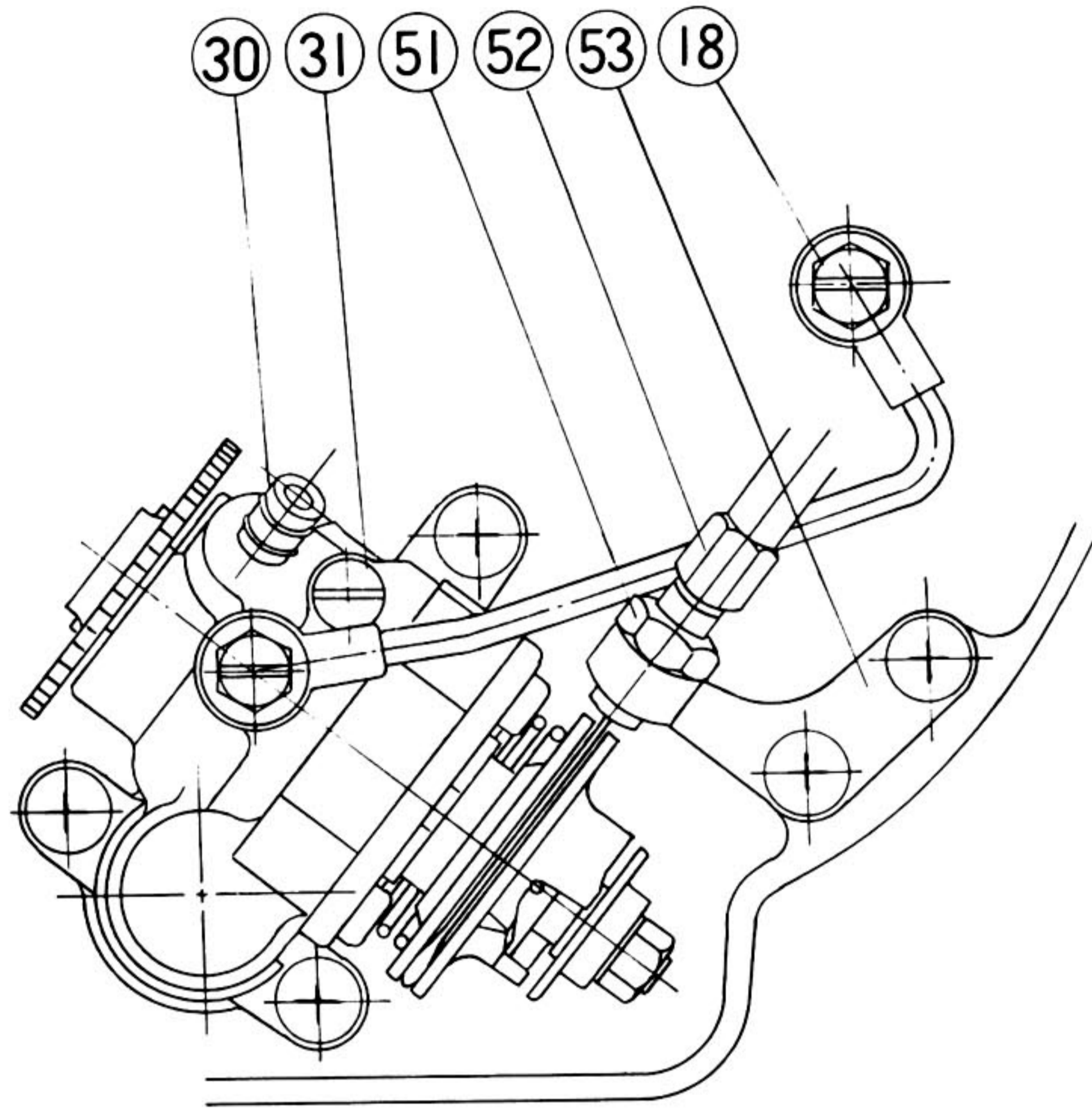
(Simplified Illustration)



SECTIONAL VIEWS OF PUMP

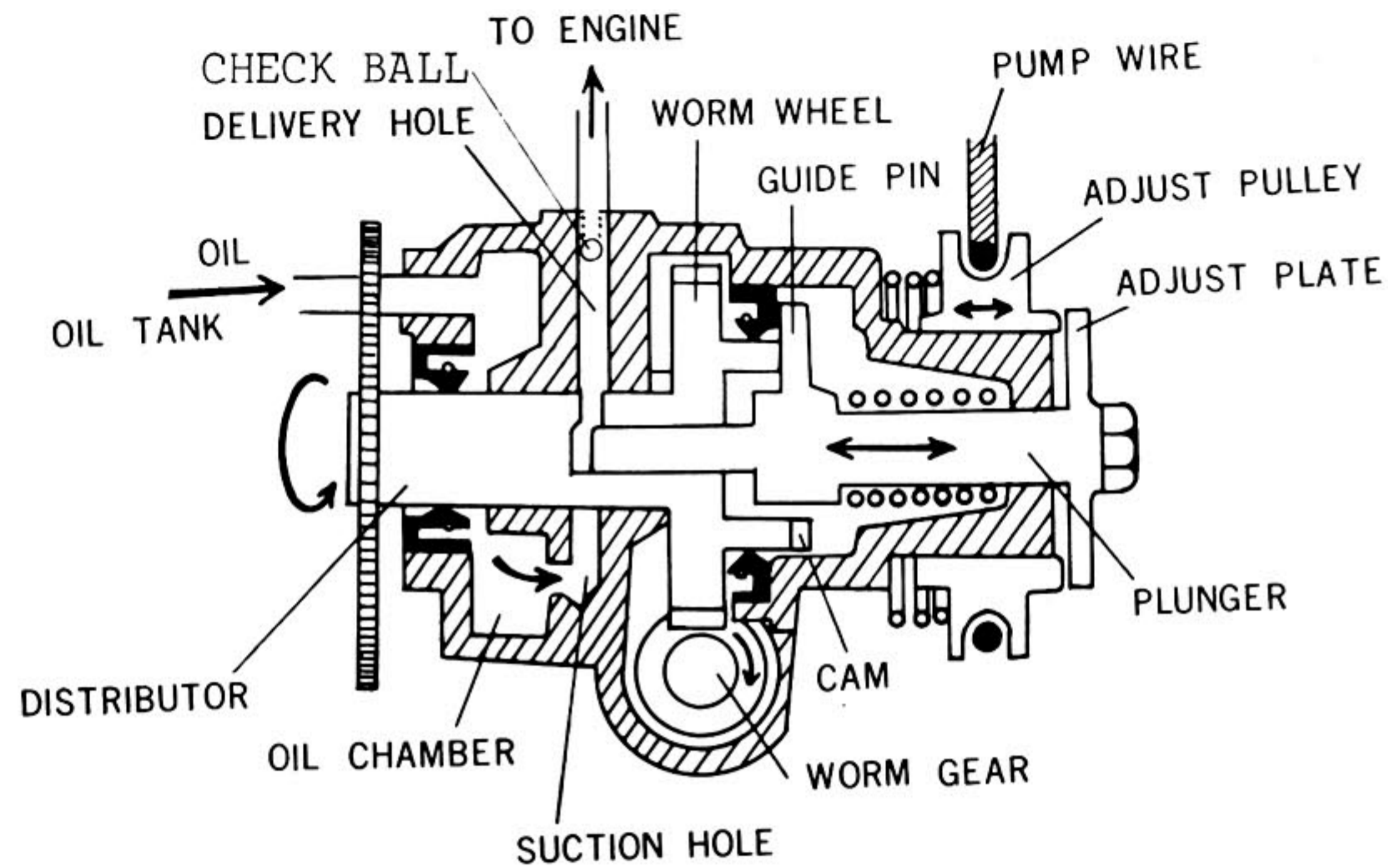


SECTIONAL VIEWS - (Cont.)



No.	Name of part	Part Stock No.		
		YDS3	YA6	YG1K (YG1K-T)
1.	Pump case	DS3 0861	YA6 0861	YA6 0861
2.	Pump case cover	YA6 0864	YA6 0864	YA6 0864
3.	Plunger cam guide pin	YA6 0846	YA6 0846	YA6 0846
4.	Worm Wheel	YA6 0841	YA6 0841	YA6 0841
5.	Worm wheel pin	YA6 0845	YA6 0845	YA6 0845
6.	Pin return spring	YA6 0843	YA6 0843	YA6 0843
7.	Worm wheel plate	YA6 0842	YA6 0842	YA6 0842
8.	Distributor	DS3 0862	YA6 0862	YA6 0862
9.	Adjust pulley guide pin	YA6 0851	YA6 0851	YA6 0851
10.	Starter plate	YA6 0815	YA6 0815	YA6 0815
11.	Distributor oil seal	S 10215	S 10215	S 10215
12.	Plunger cam oil seal	S 14255	S 14255	S 14255
13.	Plunger	YA6 0863	YA6 0863	YA6 0863
14.	Plunger cam	(Integral with Distributor)		
15.	Plunger return spring	YA6 0847	YA6 0847	YA6 0847
16.	Distributor plug	(Integral with Distributor)		
17.	Adjust pulley	DS3 0853	YA6 0853	G1D 0853
18.	Banjo bolt (B)	DS3 0821	YA6 0821	YA6 0821
19.	Adjust pulley return spring	DS3 0852	YA6 0852	YA6 0852
20.	Adjust plate	YA6 0855	YA6 0855	YA6 0855
21.	Worm shaft	DS3 0812	YA6 0812	G1D 0812
22.	Worm shaft inner metal	(Integral with Pump case)		
23.	Worm shaft outer metal	YA6 0811	YA6 0811	G1D 0811
24.	Worm shaft pin	---	YA6 0813	YA6 0813
25.	Drive gear	---	YA6 0810	G1D 0810
26.	Worm shaft oil seal	S 10227	S 10227	S 10227
29.	Delivery pipe	(A) DS3 0822	YA6 0822	G1D 0822
	" "	(B) DS3 0823	---	---
30.	Suction pipe connector	(Integral with Pump case)		
31.	Breather bolt	YA6 0829	YA6 0829	YA6 0829
32.	Breather gasket	YA6 0828	YA6 0828	YA6 0828
33.	Adjust plate lock nut	YA6 0857	YA6 0857	YA6 0857
34.	Pump case gasket	YA6 0814	YA6 0814	G1D 0814
35.	Pump case cover gasket	YA6 0848	YA6 0848	YA6 0848
36.	Plunger oil seal	S 0493	S 0493	S 0493
37.	Adjust shim	YA6 0854	YA6 0854	YA6 0854
38.	Wave washer	YA6 0856	YA6 0856	YA6 0856
40.	Banjo bolt (A)	YA6 0825	YA6 0825	YA6 0825
41.	Check ball	BA-5-32	BA-5-32	BA-5-32
42.	Check ball spring	YA6 0827	YA6 0827	YA6 0827
43.	Banjo	(Integral with Delivery Pipes)		
44.	Banjo gasket	YA6 0820	YA6 0820	YA6 0820
47.	Cutter pin	YS20-1.2-15	YS-1.2-15	YS20-1.2-15
49.	Drive gear lock nut	---	YS04-8	YS04-8
50.	Washer	---	YS17-8	YS17-8
51.	Washer	YS04-6	YS04-6	YS04-6
52.	Pump wire adjust screw	YA6 0527	YA6 0527	YA6 0527
53.	Wire adjust holder	---	YA6 0526	G1D 0526
54.	Nozzle	Included in Cylinder)	(Included in Valve cover)	(Included in Valve cover)
		DS3 0004	YA6 0050	G1D 0050
		DS3 0005		
55.	Valve cover	---	YA6 0050	G1D 0050
56.	Valve cover O-ring C	---	OR2.4-11.8	OR2.4-11.8
57.	Valve cover plug	---	(Integral with Valve Cover)	

PUMP MECHANISM, GENERAL MECHANICAL FEATURES



1. The pump drive is carried through reduction gears from the crankshaft of the engine to the worm gear which rotates the worm wheel and the distributor.

The reduction gear ratios are as follows:

YG1K, YG1K-T	78.716 : 1
YA6	46.000 : 1
YDS3	43.300 : 1

2. An oil hole in the distributor opens and closes the suction hole and the delivery hole alternately.
3. As the distributor rotates, the cylindrical cam moves the plunger back and forth, pumping the oil in and out.
4. The plunger stroke is regulated by means of a cable connected to the accelerator grip.

As described above, the Autolube action depends not only upon the revolution of the engine but also on the throttle opening, so that oil is always delivered in proper proportion to operating condition requirement.

MAIN PARTS AND THEIR FUNCTION

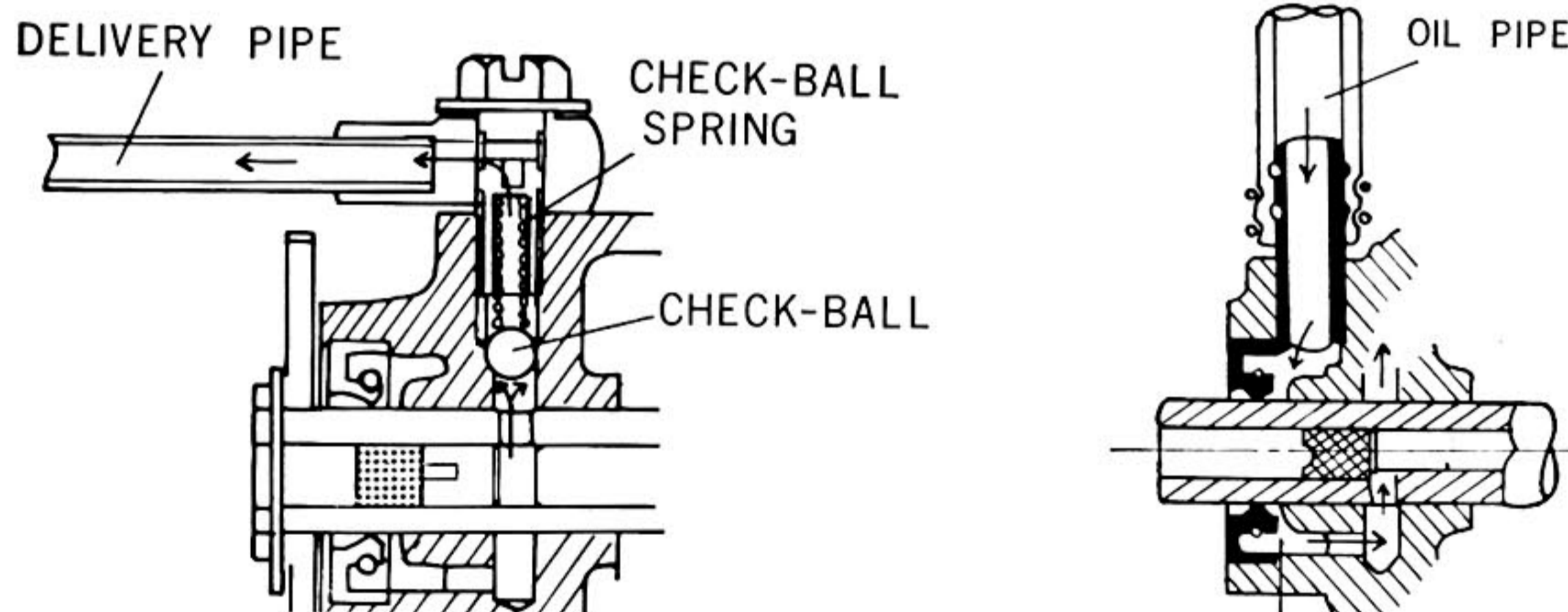
1. Oil passage

The oil line carries oil from the oil tank into the oil chamber of the pump case and, by action of the plunger, is then drawn into the oil chamber of the distributor through the suction hole in the pump case.

Oil coming out of the outlet hole under pressure pushes up the check-ball and spring to enter the delivery pipe which carries it to the nozzle in the rotary valve cover or in the intake passage. It is then delivered through the nozzle to the vital parts in need of lubrication.

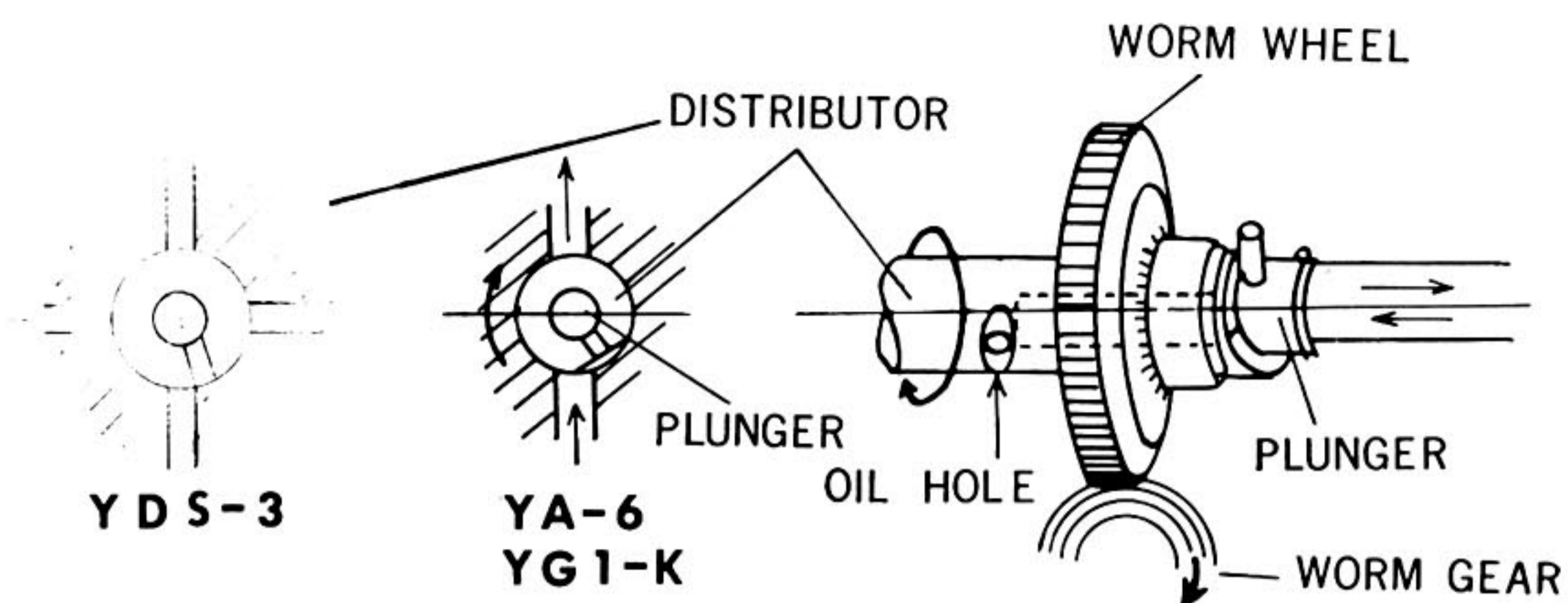
2. Check-ball and check-ball spring

The check-ball and check-ball spring work as a check valve to prevent the oil from seeping out of the pump case while the engine is not in action.



3. Distributor and plunger

The distributor is rotated by the worm gear and opens and closes the suction hole and delivery hole in the pump case.

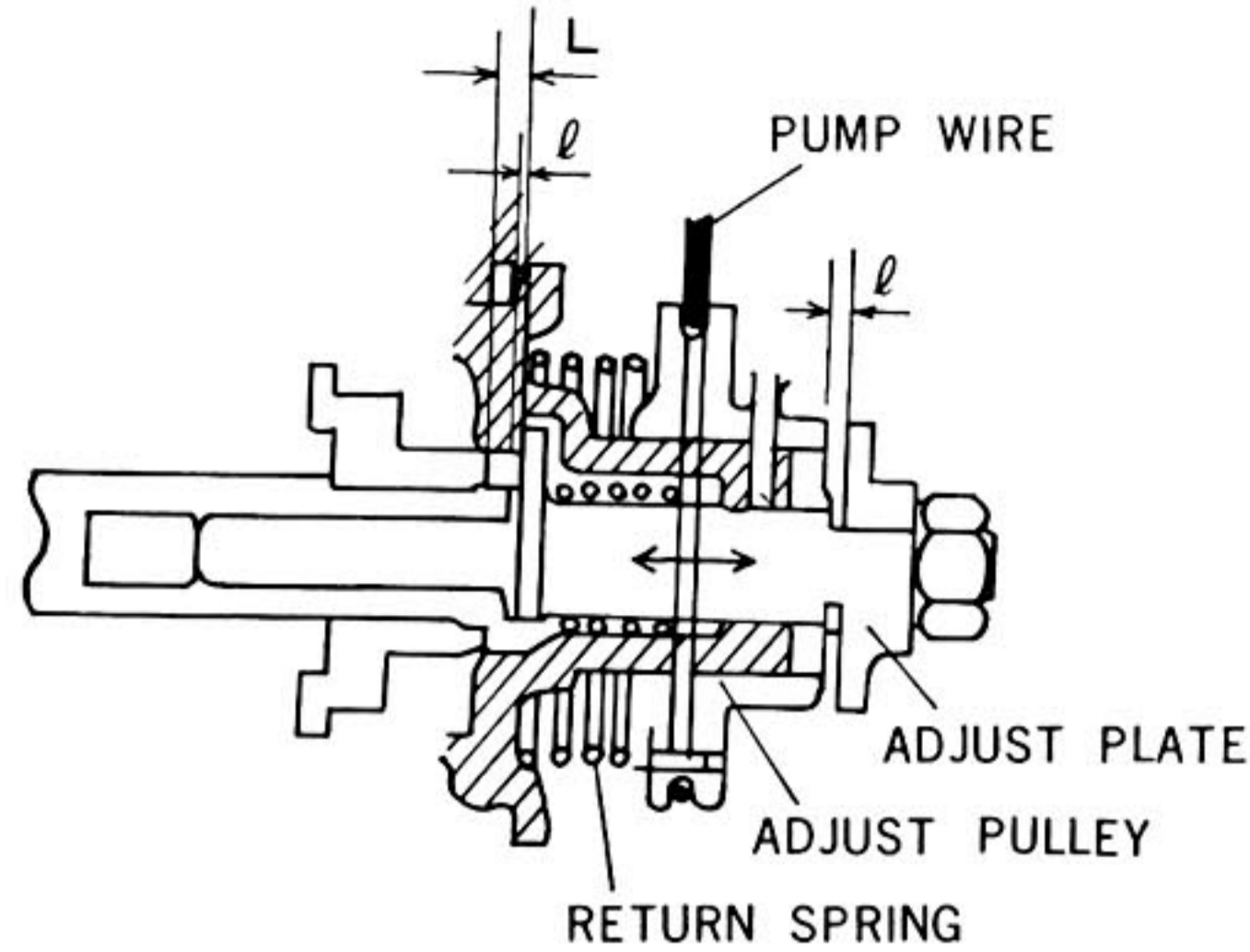


On the opposite side of the worm wheel from the distributor is the plunger cam which rotates against the guide pin of the plunger. This guide pin is held against the cam, causing the plunger to move back and forth.

4. Relationship between plunger stroke and throttle opening:

The total volume of oil pumped is determined by the length and frequency of the plunger stroke. The frequency of the plunger stroke is always in direct proportion to the engine through reduction gears. The length of the plunger stroke is variable and is regulated by the same throttle action that controls the carburetor throttle valve slide.

The plunger stroke is equal to the clearance between the adjusting plate on the right side of the plunger and the adjusting pulley fitted around the pump case. The throttle, when turned, pulls the pump cable which rotates the adjusting pulley. This causes the adjusting pulley cam to push against the guide pin and move the pulley to the left, increasing the clearance and the pump stroke length.



L: Height of Plunger cam = 1.8	—————	+0.05 -0.12	(mm)	YG1K YG1K-T
	= 2.0	—————	+0.05 -0.15	(mm)
	= 2.2	—————	+0.05 -0.15	(mm)

l: Clearance between adjust plate and pulley
 = 0.24 +0.02 (mm) for all models

5. Breather bolt and starter plate

The breather bolt (31) is used when bleeding air out of the pump. Removing the bolt allows oil to flow from the oil chamber. The starter plate (10) is used to manually rotate the pump when desired. The pump and its lines may easily be primed by rotating the wheel.

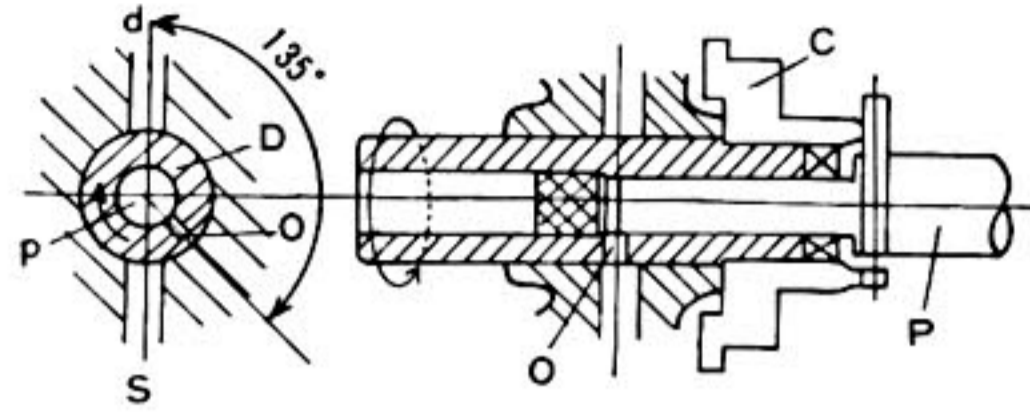
6. Distributor-plunger mechanism

Identification:

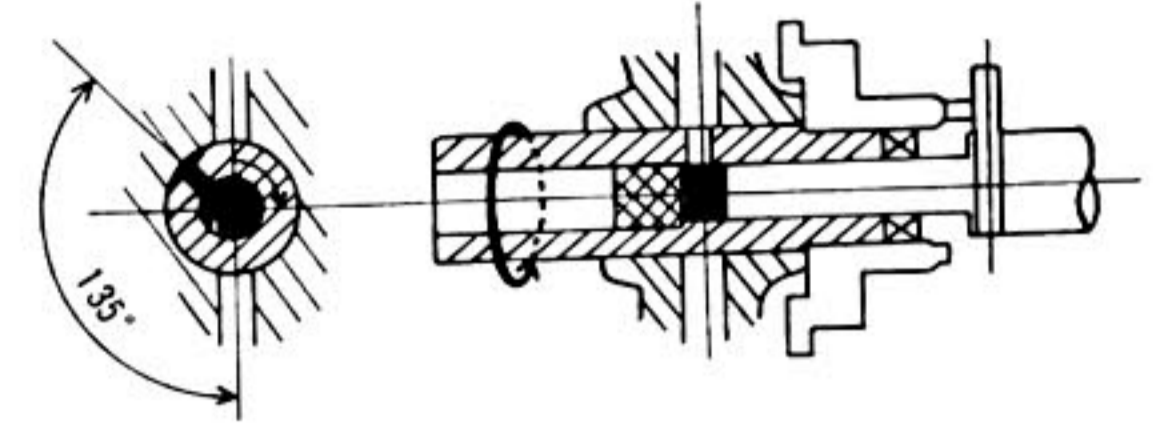
D: Distributor P: Plunger C: Cylindrical Cam
O: Oil hole S: Suction hole d: Delivery hole

SUCTION STROKE

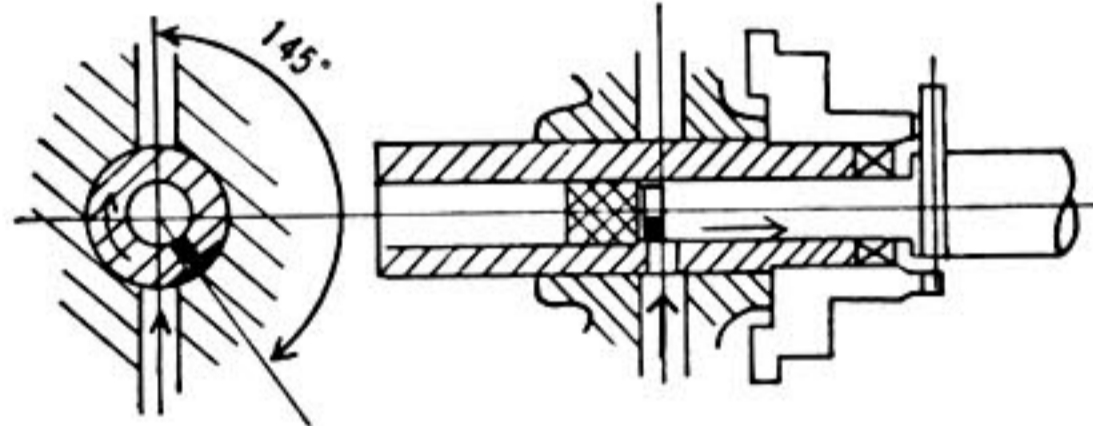
DELIVERY STROKE



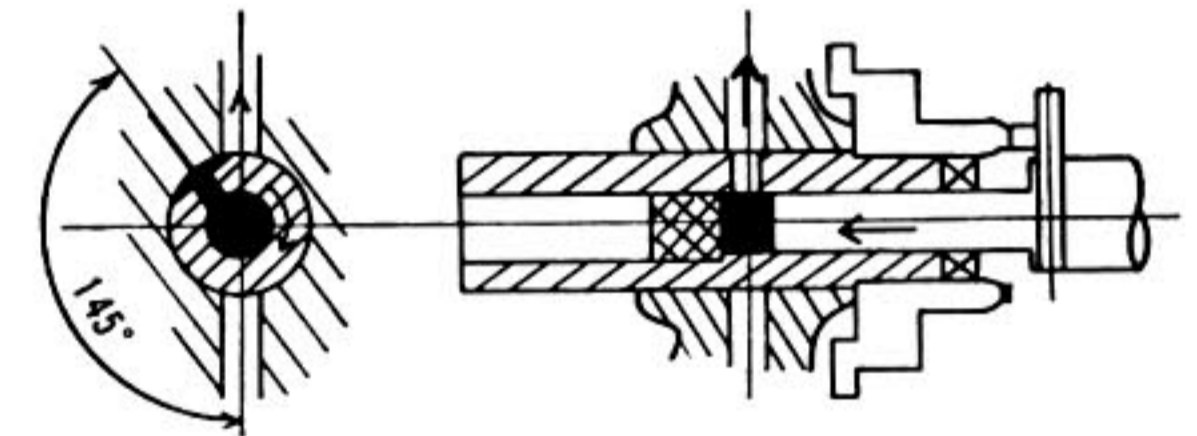
1. Plunger is not in action; Suction hole is about to be opened.



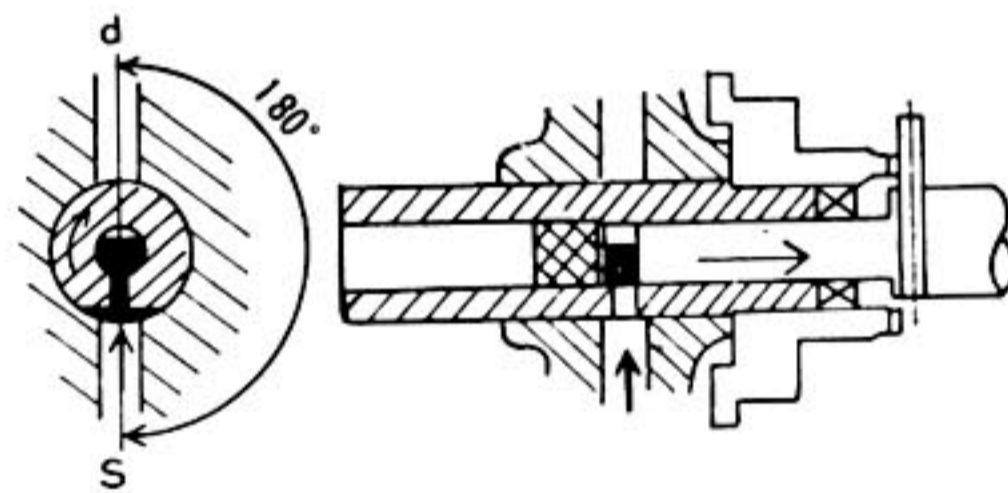
6. Plunger is not in action; Delivery hole is about to open.



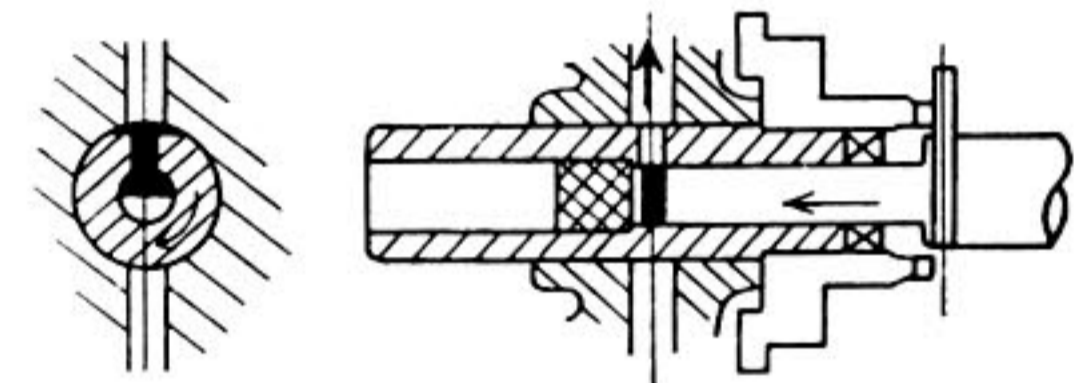
2. Plunger moves back to let oil in.



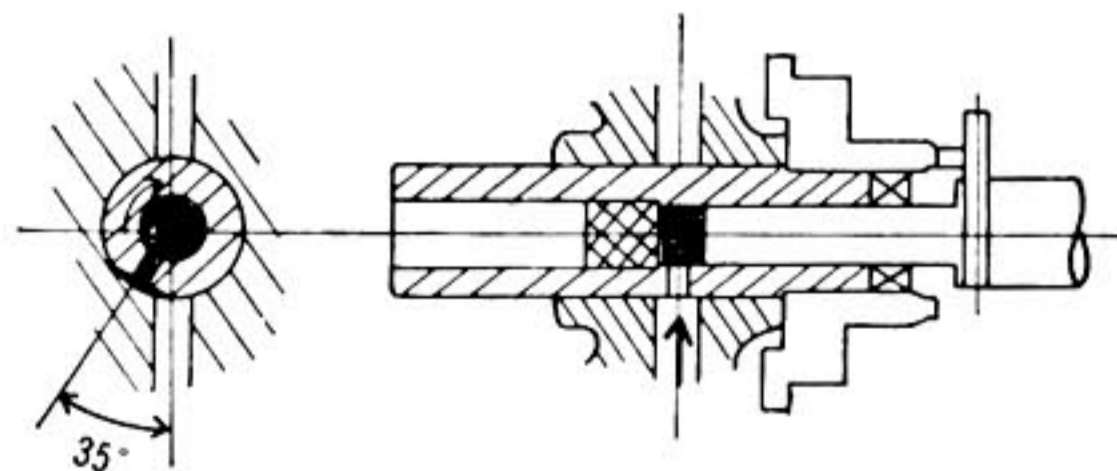
7. Plunger moves ahead forcing oil out.



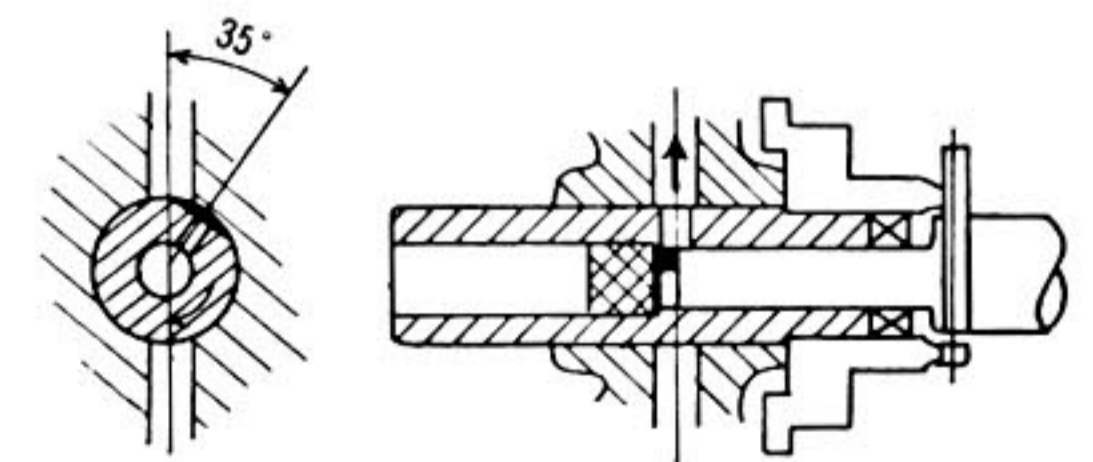
3. Plunger moves further back; Suction hole is fully open.



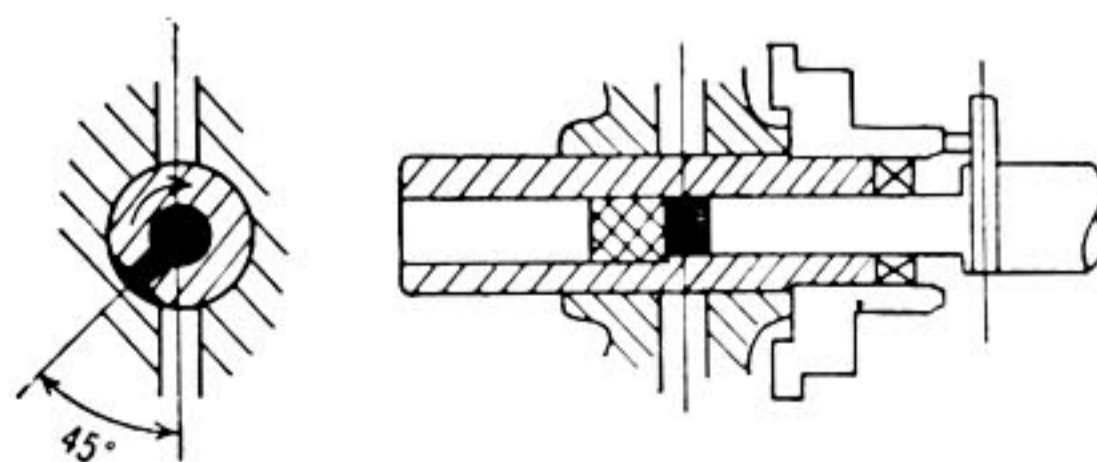
8. Plunger continues delivery action.



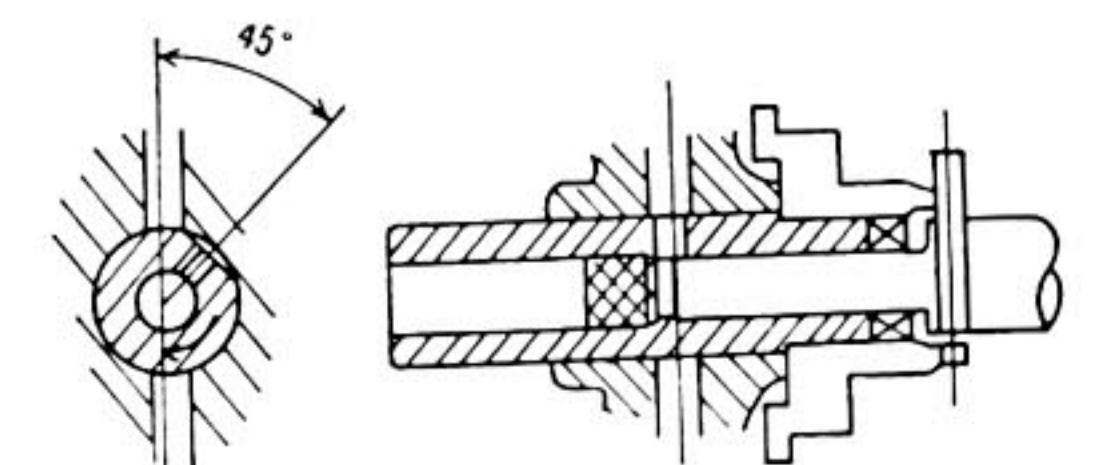
4. Plunger stops; Suction hole is still partially open.



9. Plunger stops; delivery hole is still partially open.



5. Plunger is not in action; Suction hole is closed.



10. Plunger is not in action; Delivery hole is closed.

DISTRIBUTOR-PLUNGER MECHANISM
(YDS-3)

Identification:

D: Distributor
O: Oil Hole

P: Plunger
S₁ S₂: Suction Hole

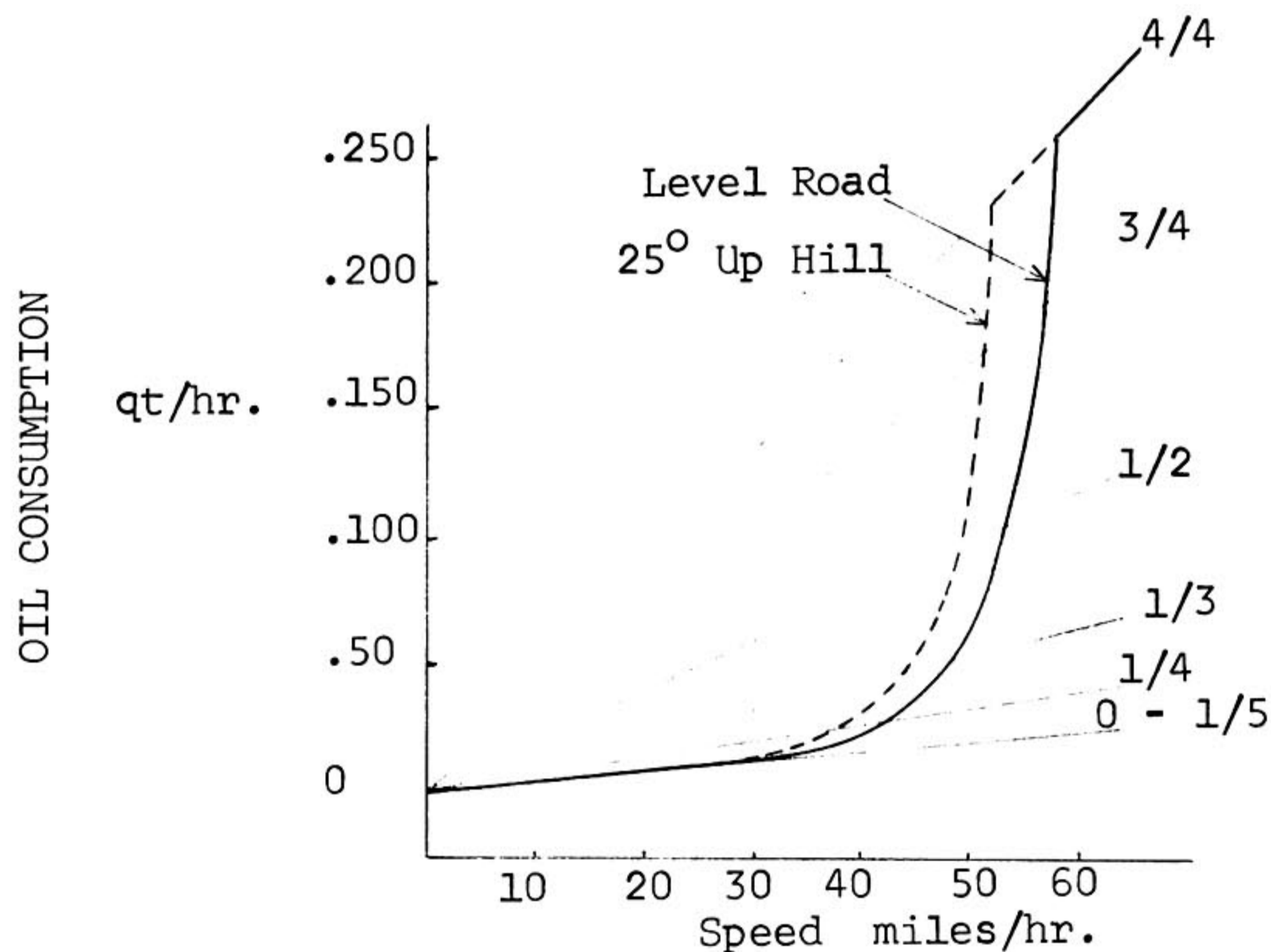
d₁ d₂: Delivery Hole

SUCTION STROKE

DELIVERY STROKE

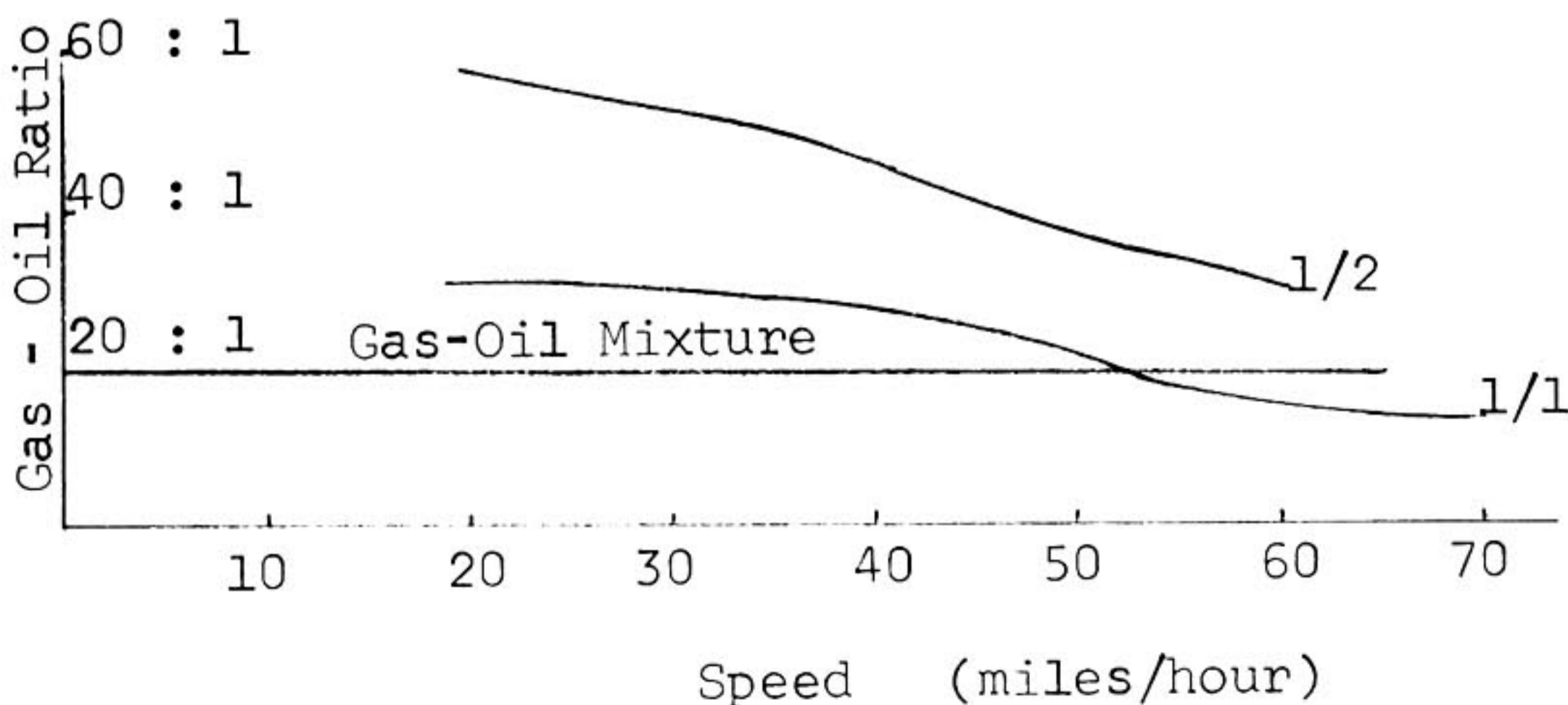
	<p>1. Plunger is not in action: Suction hole is about to be opened.</p>		<p>6. Plunger is not in action; Delivery hole is about to open.</p>
	<p>2. Plunger moves back to let oil in.</p>		<p>7. Plunger moves ahead forcing oil out.</p>
	<p>3. Plunger moves further back; Suction hole is fully open.</p>		<p>8. Plunger continues delivery action.</p>
	<p>4. Plunger stops; Suction hole is partially open.</p>		<p>9. Plunger stops; delivery hole is still partially open.</p>
	<p>5. Plunger is not in action; Suction hole is closed.</p>		<p>10. Plunger is not in action; Delivery hole is closed.</p>

3. Oil Consumption: As shown in the figures below, speed alone is not the sole determinant of oil needs. Even in running at the same speed, oil requirement for climbing a hill is much more than that for driving on a paved, level road because of the greater throttle opening. For example: Under level operating conditions, the engine uses 1/4 oz/hr at 25 MPH. When the throttle is opened to 1/3 for acceleration, oil consumption immediately reaches about 7/8 oz/hr before speed increases take place. Since engine revolution increases with sustained acceleration, further oil consumption changes follow.



4. Gasoline-to-oil ratios:

The gasoline-to-oil ratios, for driving on a paved level road in 4th gear on YA6 vary as follows:



This figure also shows excessive oil consumption with fixed ratio of 20 : 1.

With the 4th gear at over 8,000 RPM, the gas-oil ratio for YA6 is about 18: 1, which combats overheating and seizure problems, while at less than 1/5 throttle opening the pump is at minimum feed, allowing adequate lubrication even when the throttle is shut off after the engine reaches high RPM. This means that there is no oil starvation even if the engine is used as a brake for a long period, a revolutionary difference from conventional pre-mix oiling systems.

5. Inspection and maintenance

In case of adjustment, repair or replacement, special care should be exercised as the pump consists of a number of precision-machined parts. After any replacement, be sure to bleed the air from the pump and adjust the stroke in accordance with following directions.

PUMP SETTING

- The correct plunger stroke for each model is shown in the following table:

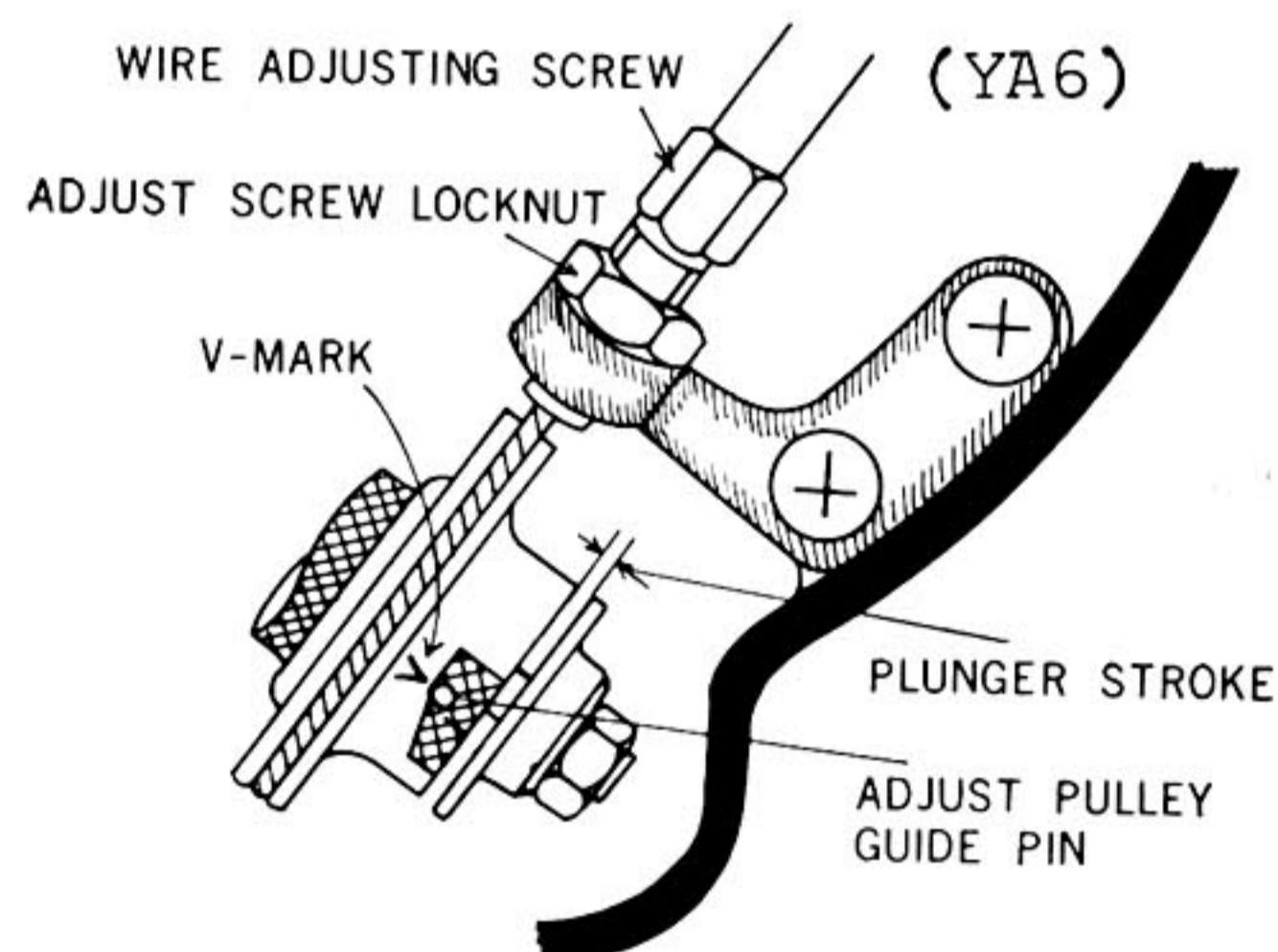
STROKE MODEL	MINIMUM mm	MAXIMUM mm	CABLE SETTING AT
YG1-K	0.24 ⁺ _{-0.02}	1.8 ^{+0.05} _{-0.12}	1/2 Throttle Opening
YA-6	0.24 ⁺ _{-0.02}	2.0 ⁺ _{-0.05}	1/2 Throttle Opening
YDS-3	0.24 ⁺ _{-0.02}	2.2 ^{+0.05} _{-0.15}	Throttle Closed

In case of complete re-assembly of the unit, check to these limits before remounting, by rotating the starter plate by hand. Adjustment is made by means of shims. All pumps assembled at the Yamaha factory have been adjusted.

2. The V-mark on the adjusting pulley should align with the adjusting pulley guide pin at 1/2 throttle opening for YG1K and YA6 and at throttle closed for YDS3.

(For YA6 and YG1K)

- a. After mounting the pump on the engine, connect the pump cable.
- b. Turn throttle half open and maintain (use a special tool) the throttle position.
- c. Match the V-mark to the guide pin by turning the adjusting screw at the end of the pump cable housing.



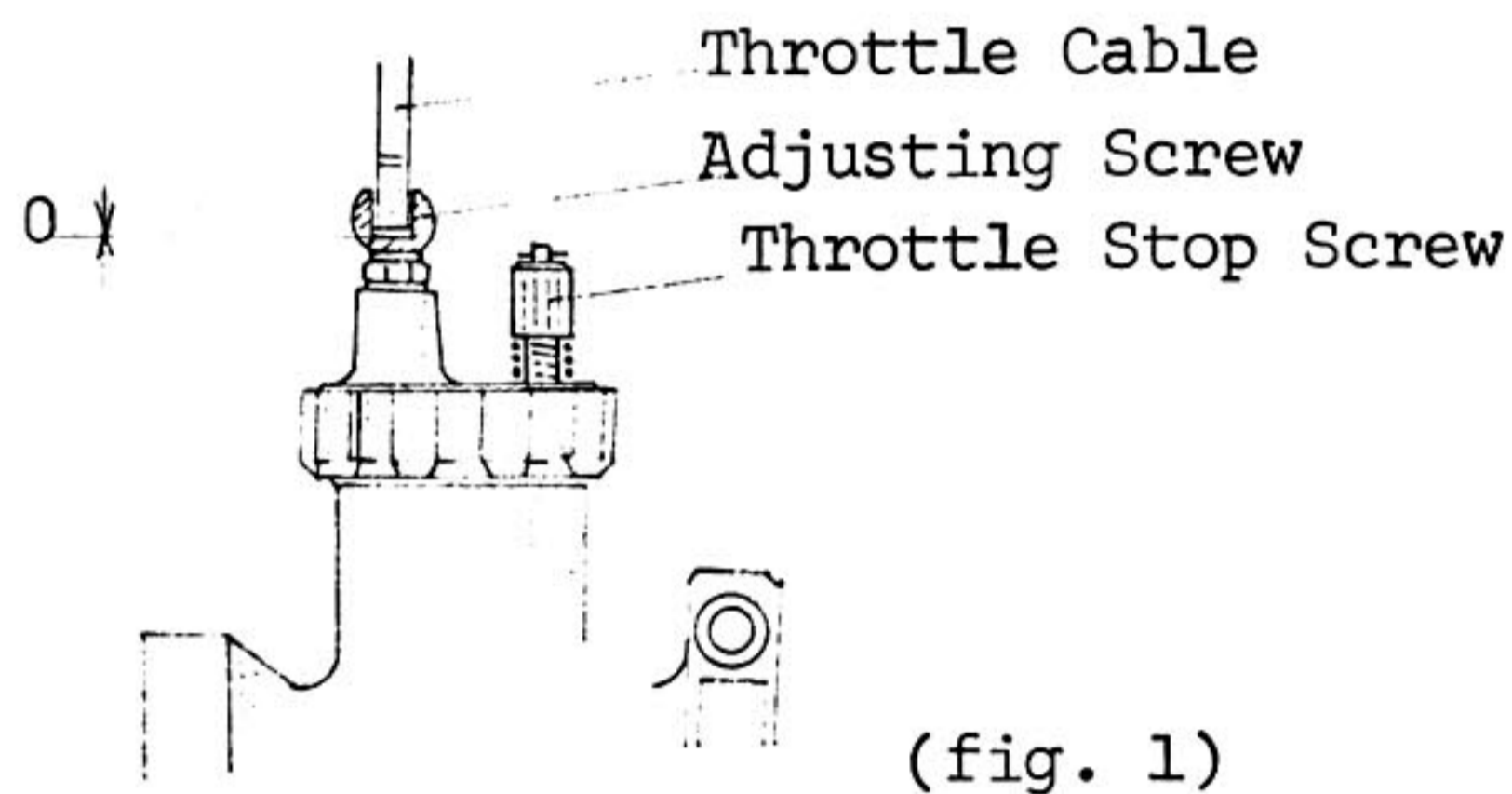
(For YDS3)

- a. Same as above (a)
- b. Close throttle.
- c. Match the V-mark to the guide pin by turning the adjusting screw at the end of the pump cable housing.

HOW TO COUPLE THE PUMP AND THE CARBURETOR THROUGH CONTROL CABLES.

YDS3

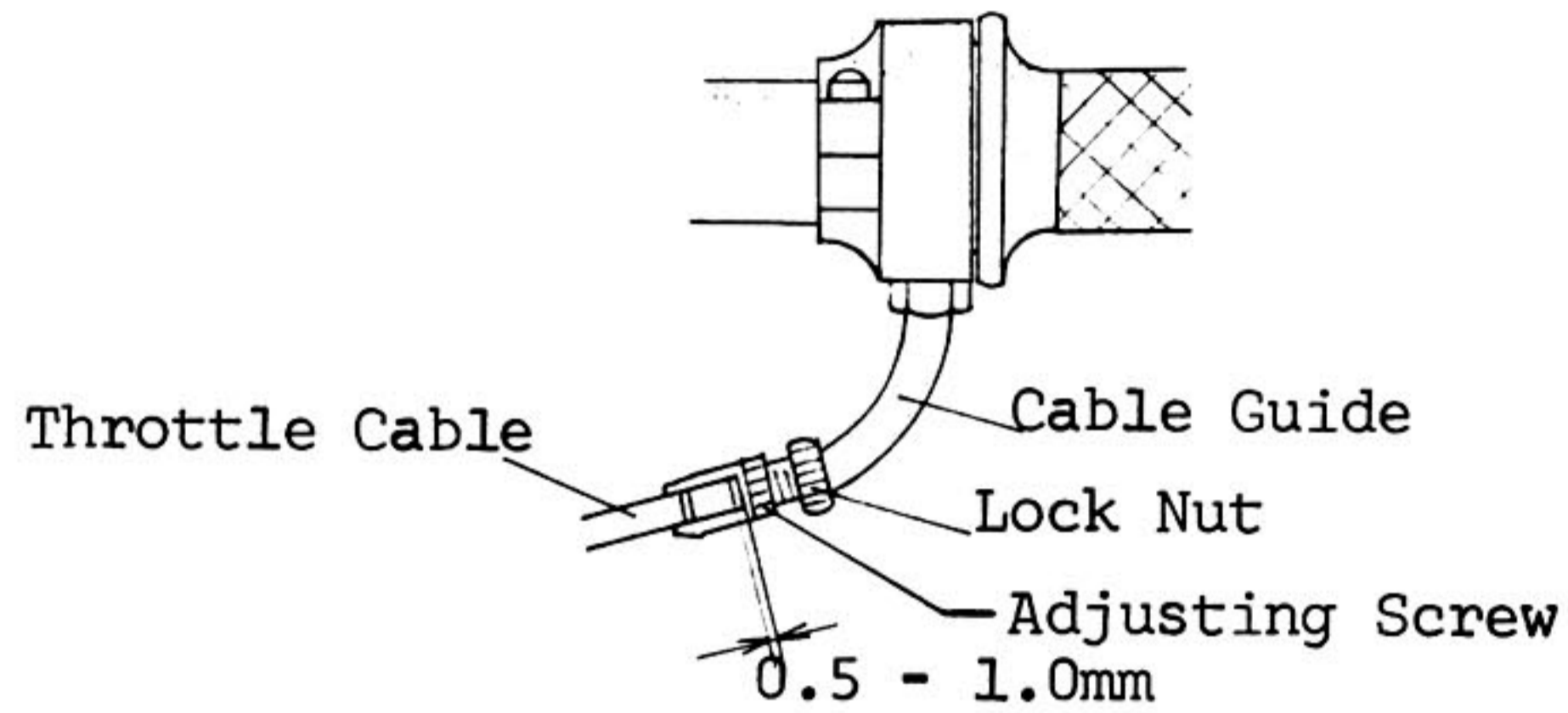
1. Start engine. Adjust the throttle stop screw of the carburetor to keep the engine revolutions at around 1,000 rpm. Make sure that both cylinders are working in a similar condition by hearing exhaust noise from both mufflers. (Fig. 1) Shut off engine.



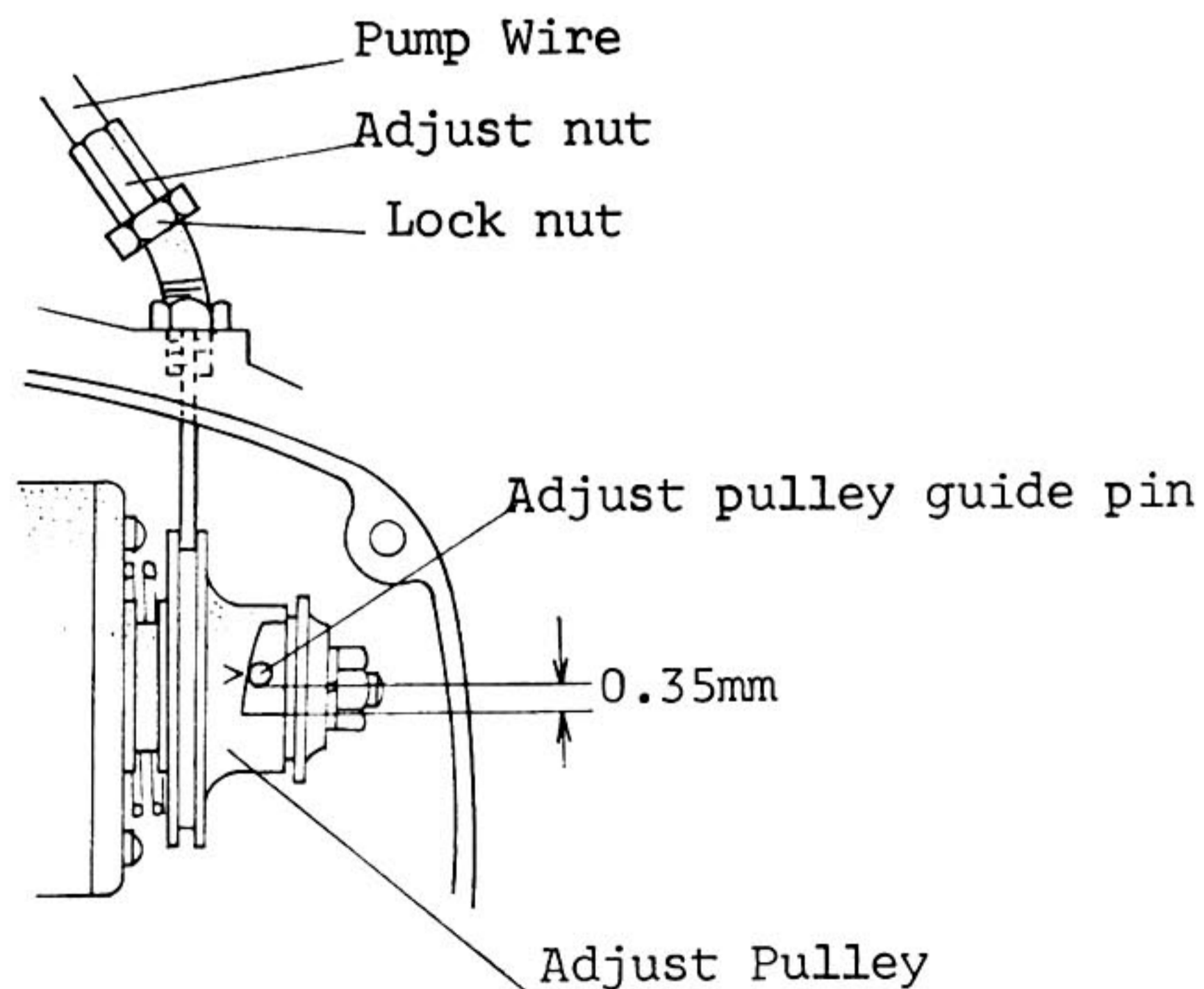
(fig. 1)

2. Synchronize the throttles as follows:
 - a. Disconnect the rubber intake elbows. Put a finger in each carburetor and have someone else open the throttle slowly, several times. If the slides do not start simultaneously, adjust the throttle cable until they do. Make sure that slides are starting up from idle position each time.
 - b. (Simple way) Pull the outer housing of each throttle cable (B) to find out the play of cable, and turn the adjusting screw to make the cable work without any play. (See Fig. 1 above)

3. Make the play of the throttle cable (a) 0.5 to 1.0 mm. (Figure 2) by pulling the outer cable and turning the adjust screw. This play is necessary to allow the cables to flex, when turning, without affecting throttle opening.



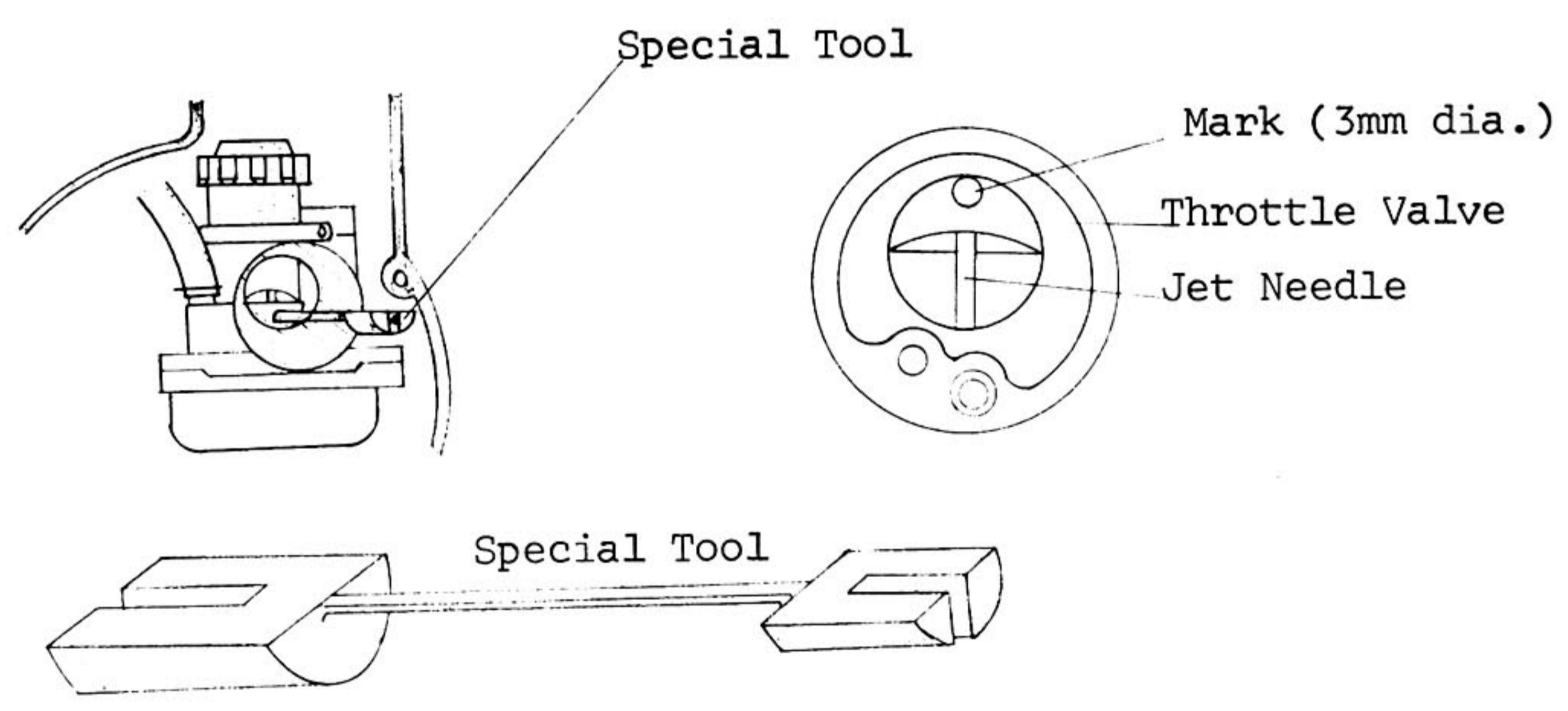
4. In the closed condition of the throttle valve and leaving the throttle cable (a) without touching it anymore, adjust the pump cable, as already mentioned. (Figure 3)



YA6 & YG1K

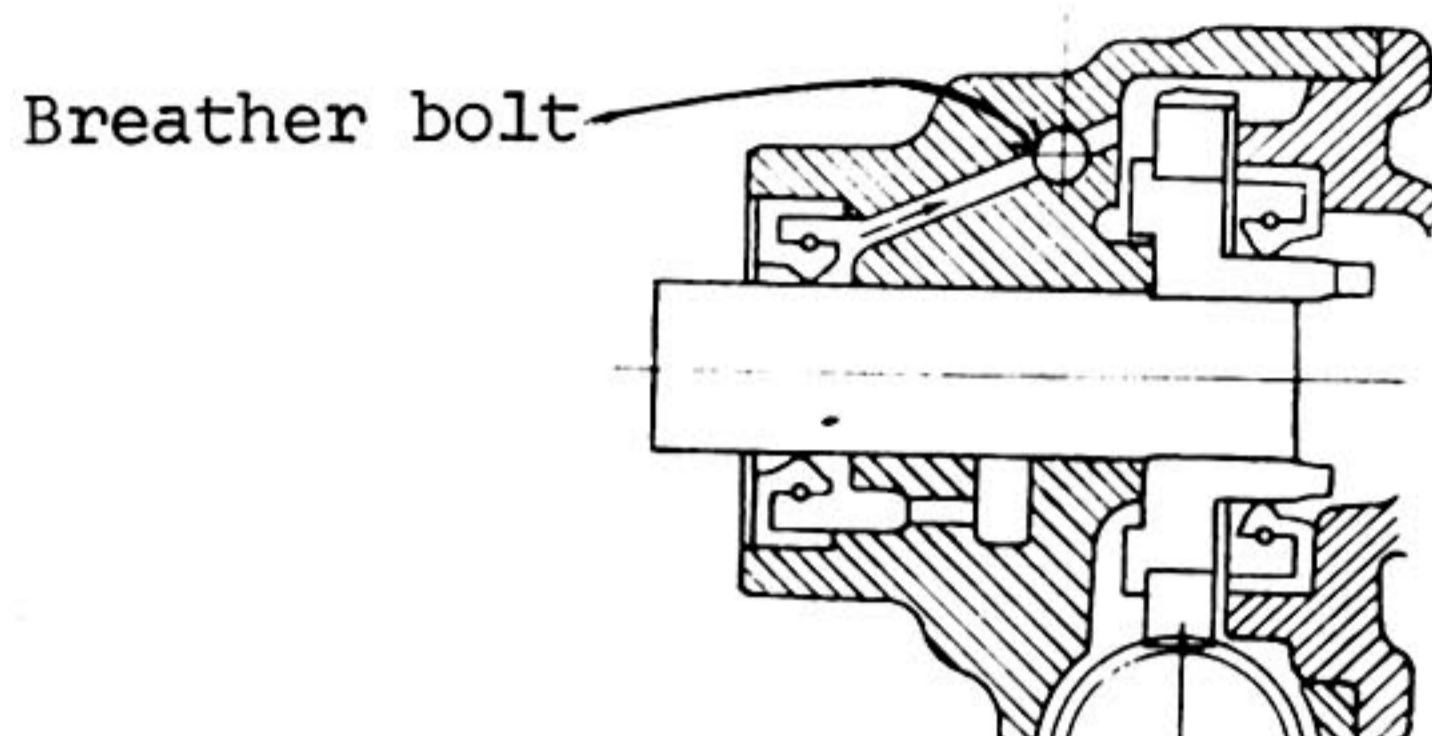
1. In adjusting the pump cable, a special tool is used to keep the throttle valve in a 1/2 open position. On the late products of YA6 and YG1K, a small circle (3 mm diameter) has been marked on the throttle valve to show the 1/2 throttle position with this mark is as follows:

When the upper part of the circle comes in contact with the top edge of the main bore of the carburetor, the throttle valve is at 1/2 opening. (See Figure 4)



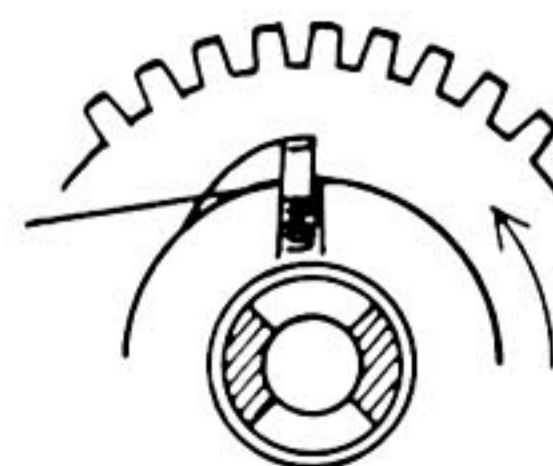
REMOVING AIR FROM THE PUMP (BLEEDING)

To bleed the pump, remove the breather bolt and turn the starter plate clockwise until oil runs out through the breather bolt hole, or start the engine and run at idle only.



DISASSEMBLY AND ASSEMBLY OF OIL PUMP

1. When disassembling, be careful not to scratch the lip of the oil seals, case-to-distributor surfaces, distributor-to plunger surfaces, plunger cam guide pin or its groove in the pump case cover.
2. Assembly
 - (Oil Seal insertion)
 - a. Apply grease to the lips of oil seals.
 - Distributor oil seal should be flush with the case end.
 - Plunger oil seal should be inserted at least (3.2mm) beyond the plunger cam face.
 - Plunger cam oil seal should be flush with the pump case cover.
 - b. Apply oil to the distributor and pump case. Make sure the distributor turns smoothly.
 - c. The worm wheel should be attached as illustrated below. Check the pin proper operation.



- d. The plunger cam guide pin should be carefully fitted **into** the groove in the pump case cover.
- e. Do not tighten the adjusting plate locknut too much. Tighten only until the lockwasher flattens.
- f. After oiling the distributor and plunger apply sealing compound to the pump case surfaces and gasket. Tighten 4 bolts evenly.
- g. Check plunger stroke by turning the starter plate.
(See table)
- h. Attach delivery pipe, banjo bolt, gasket, check-ball and check-ball spring after cleaning these parts.

3. Mounting

- a. Apply grease to wormshaft oil seal.
- b. Be careful not to scratch the teeth of the drive gear.
- c. Apply sealing compound to the matching surface of the case and gasket. Tighten 3 bolts evenly. (2 bolts for YG1K)
- d. After connecting pump cable and oil pipe, bleed the pump, and adjust the cable.
- e. Check for oil seepage.

CHECK POINTS AFTER MOUNTING

Start engine and check as follows:

- a. Check for oil leaks.
- b. Check starter plate for slow and smooth rotation.
- c. Check rotation and travel of the adjusting plate as the throttle is turned both ways.
- d. Check oil level in the tank; if below inspection hole add 1 quart.

AUTOLUBE OIL CHARACTERISTICS

Oil used in the Autolube should have the following characteristics:

- a. Strong oil film, high viscosity index, excellent oiliness.
- b. Low residual carbon content.
- c. Ashless detergent.
- d. Low pour point.

The above oil characteristics are to be found in most all the major brands of oil on the market. The low residual carbon content refers to the oil itself and its effect is noticeable in the amount of carbon left behind after many miles of operation. By and large, the higher quality oils all conform to these specifications.

The ashless detergent characteristics refer to the detergent additives present in the oil. These ashless additives are more satisfactory for 2-cycle operation in most cases than are the sulfide additives and cause cleaner crankcase chambers, pistons and rings, and also combustion chambers and exhaust outlet passages. These ashless additives are greatly desirable in their cleansing action and do not harm the lubrication characteristics of the oil.

Two cycle oils as such are not only less available, but lose part of their advantages in Autolube (non pre-mix) systems. They have also been designed primarily for outboard engines where different operating temperatures and conditions are met during operation.

Because this oil is fed to the engine separately from the gasoline tank, a low pour point becomes increasingly important for Autolube use, particularly in the cold climates. As an added advantage for the Autolube system, the high viscosity index can be stressed without compromising with easy-mixing qualities necessary for pre-mix oils.

For average climates, SAE #30 motor oil is recommended. For operating conditions below 0°F, 10W-30 is recommended.

TROUBLE SHOOTING

TROUBLE

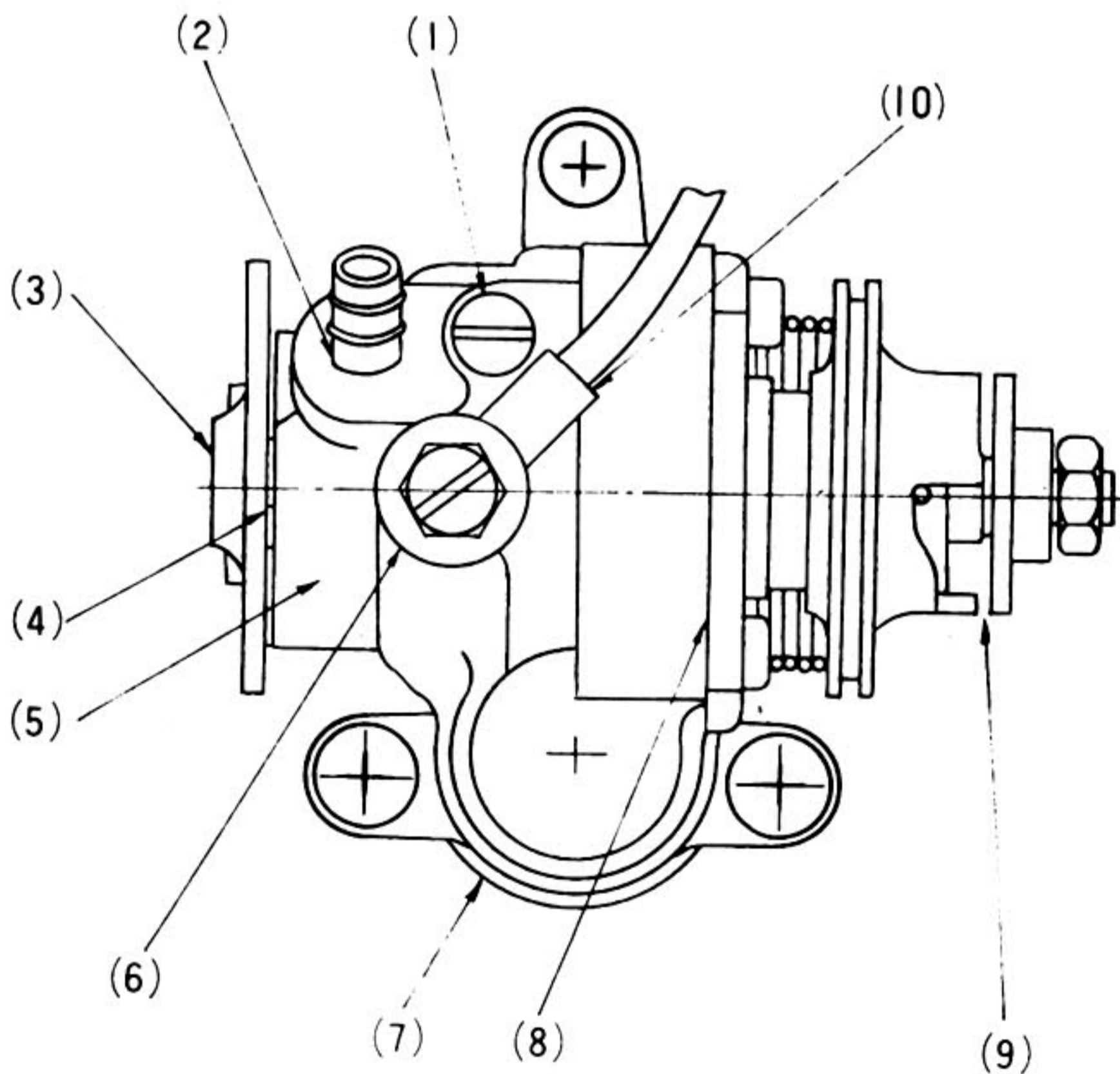
PROBABLY BECAUSE

REMEDY

1. Poor oil delivery

a. Bubbles in oil in the pump case.

a. Bleed the pump in the way mentioned before.
b. Check the following points for oil leaking:

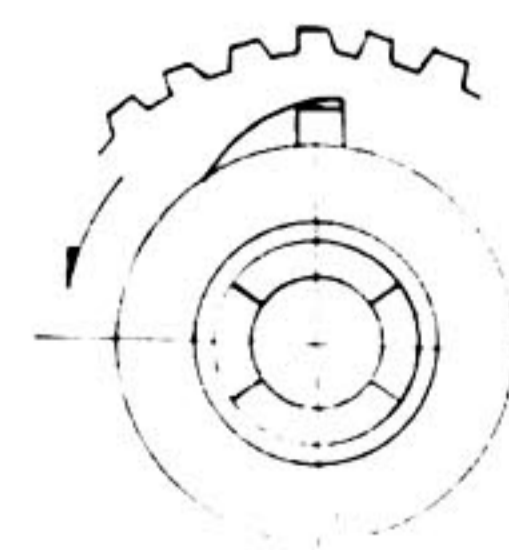
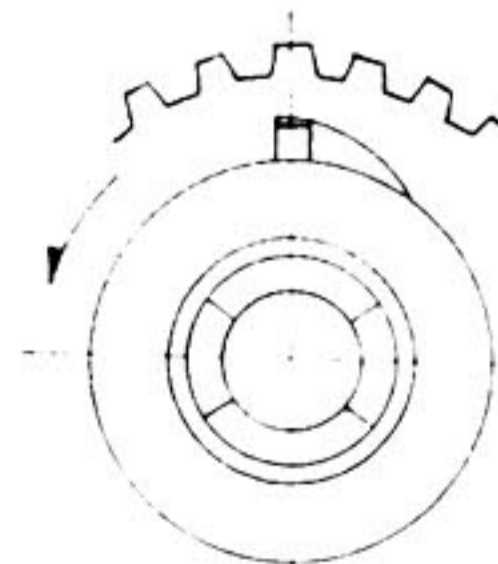


- (1) Breather gasket.
- (2) Suction pipe connector and pump case.
- (3) Distributor oil seal.
- (4) Distributor plug.
- (5) Pump case
- (6) Banjo and pump case.
- (7) Pump and crankcase cover.
- (8) Pump case cover & pump case.
- (9) Terminal of plunger; plunger cover, plunger cam oil seal and plunger oil seal.

2. Pump fails to work. (Engine works.)

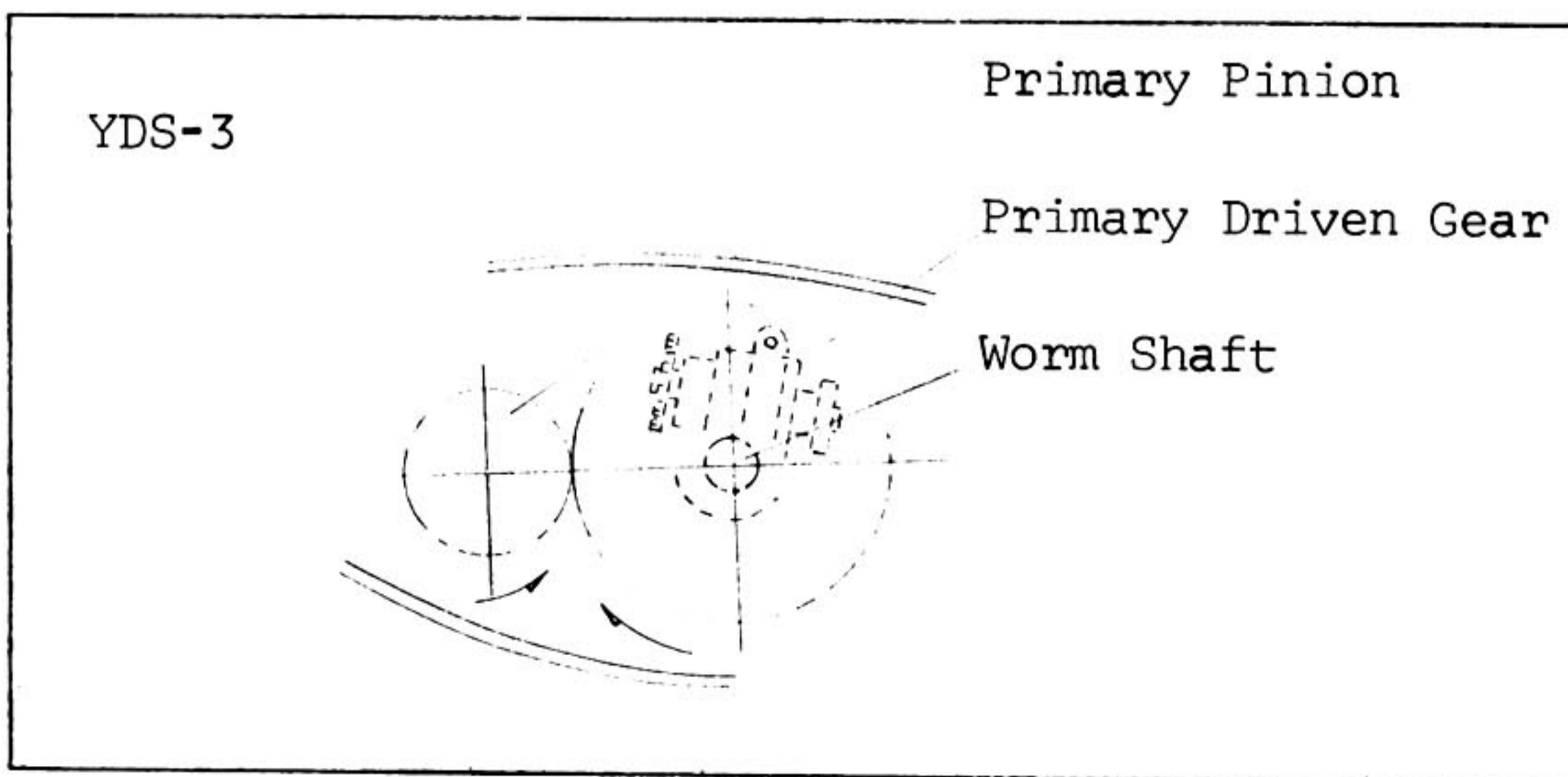
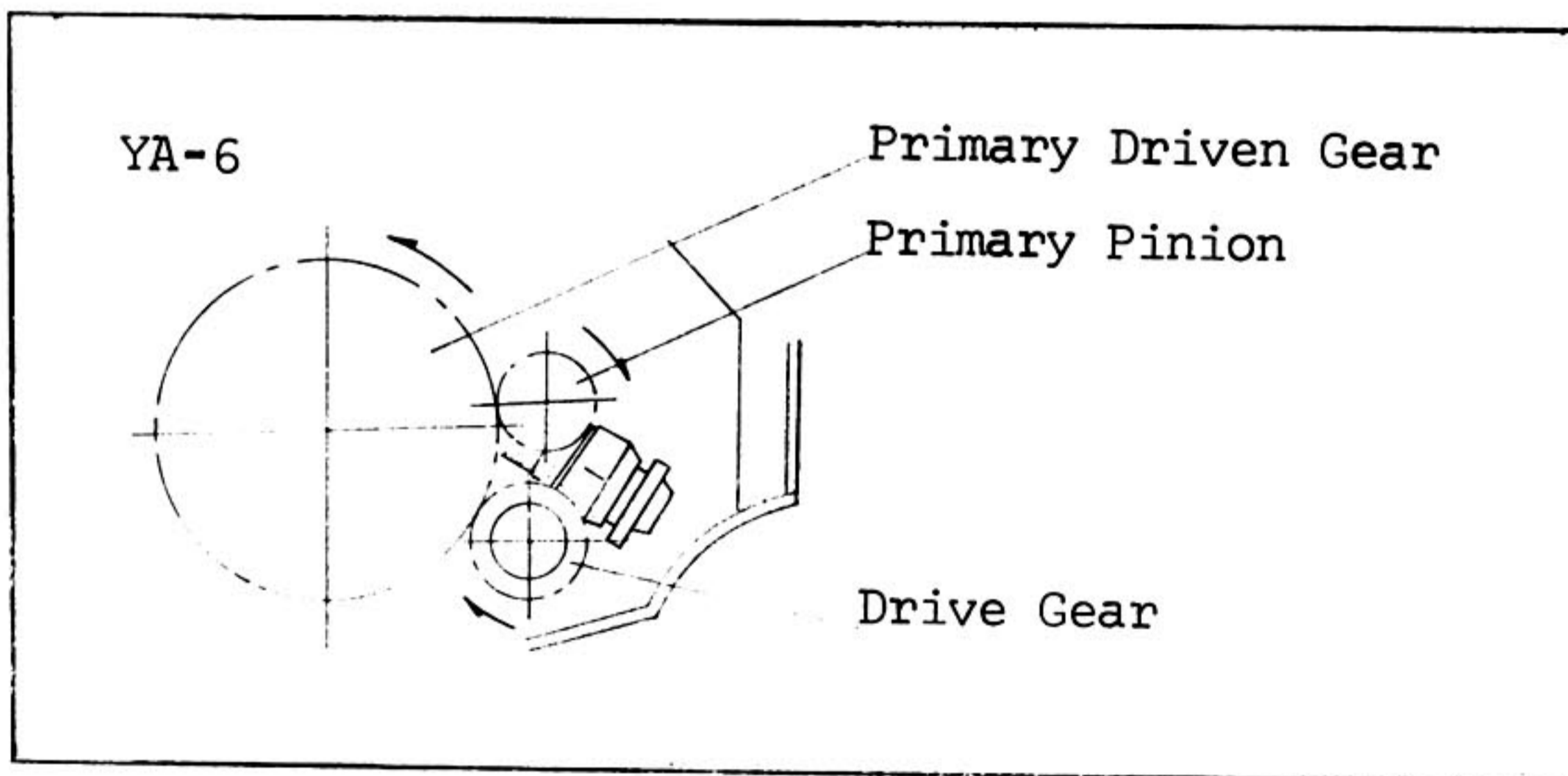
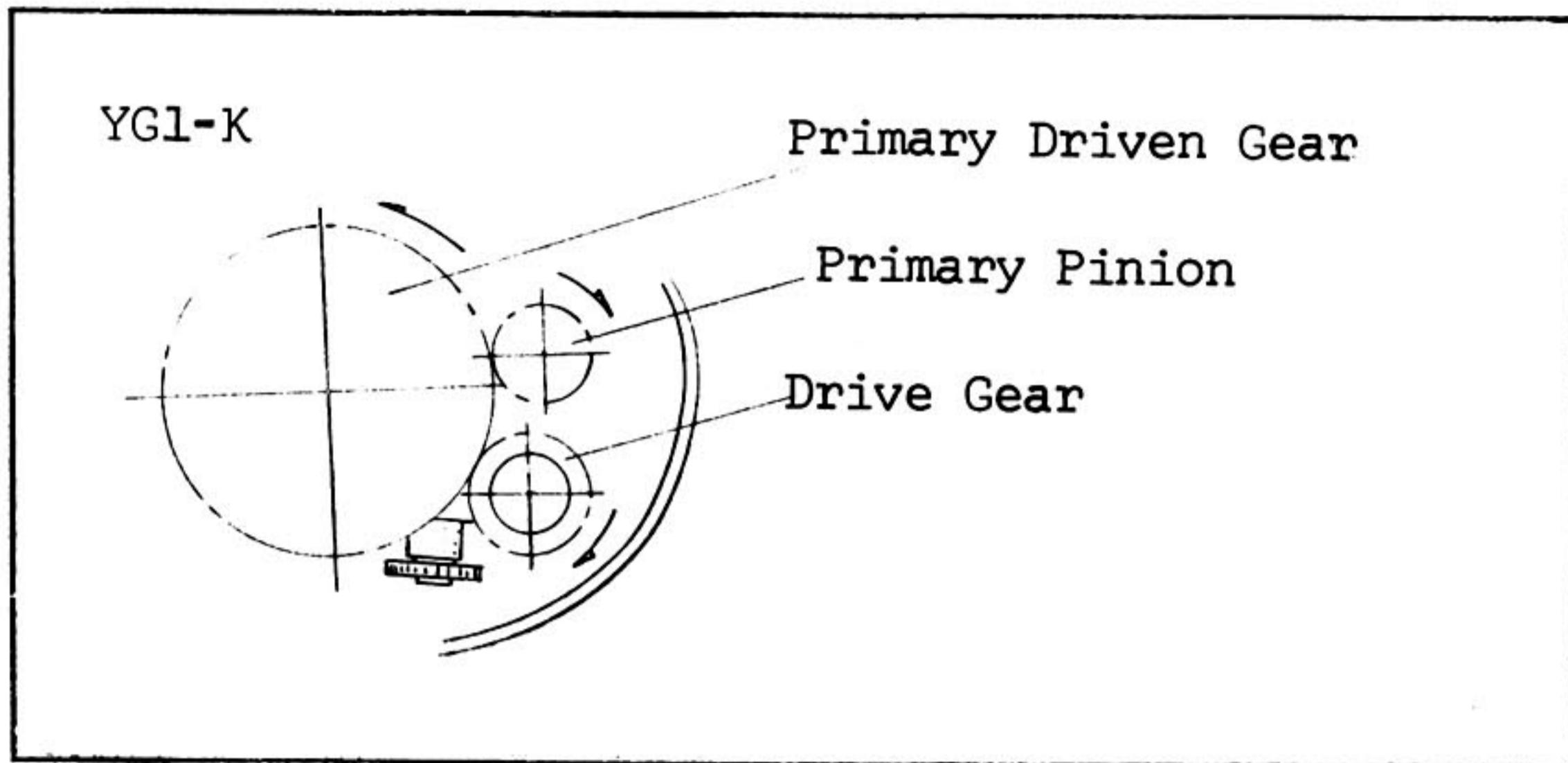
a. Wrong setting of worm wheel.

a. Set correctly.



<u>TROUBLE</u>	<u>PROBABLY BECAUSE</u>	<u>REMEDY</u>
	b. Defective worm wheel pin.	b. Clean pin hole.
	Clogged pin hole. Worn pin hole. Deformed return spring.	Replace spring.
3. Plunger does not work. (Distributor or starter plate rotates.)	a. Worn or clogged guide groove for plunger cam guide pin.	a. Replace pump case cover.
	b. Adjust-pulley guide pin missing.	b. Replace pump correctly.
4. Distributor hard to rotate.	a. Incorrect adjustment of worm wheel plate.	a. Proper clearance is 0.05 to 0.1 m.m.
	b. Incorrect fitting of plunger cam oil seal.	b. Replace or refit.
5. Distributor partly hard to rotate.	Worn or clogged guide groove for plunger cam guide pin.	Replace pump case cover.
6. Adjust-pulley fails to move in contact with cam surface.	a. Incorrect fitting of adjustment components.	a. Refit
	b. Too tight fitting between adjust pulley and pump case cover.	b. Replace
7. Incorrect Pump setting.	a. Defective cam of adjust pulley.	a. Replace
	b. Defective plunger cam.	b. Replace
	c. Wrong fitting of control cable to adjust pulley.	c. Refit
	d. Too big clearance between adjust pulley and pump case cover.	d. Replace
	e. Too much play in cable.	e. Readjust

PUMP DRIVING



YAMAHA

MOTORCYCLES



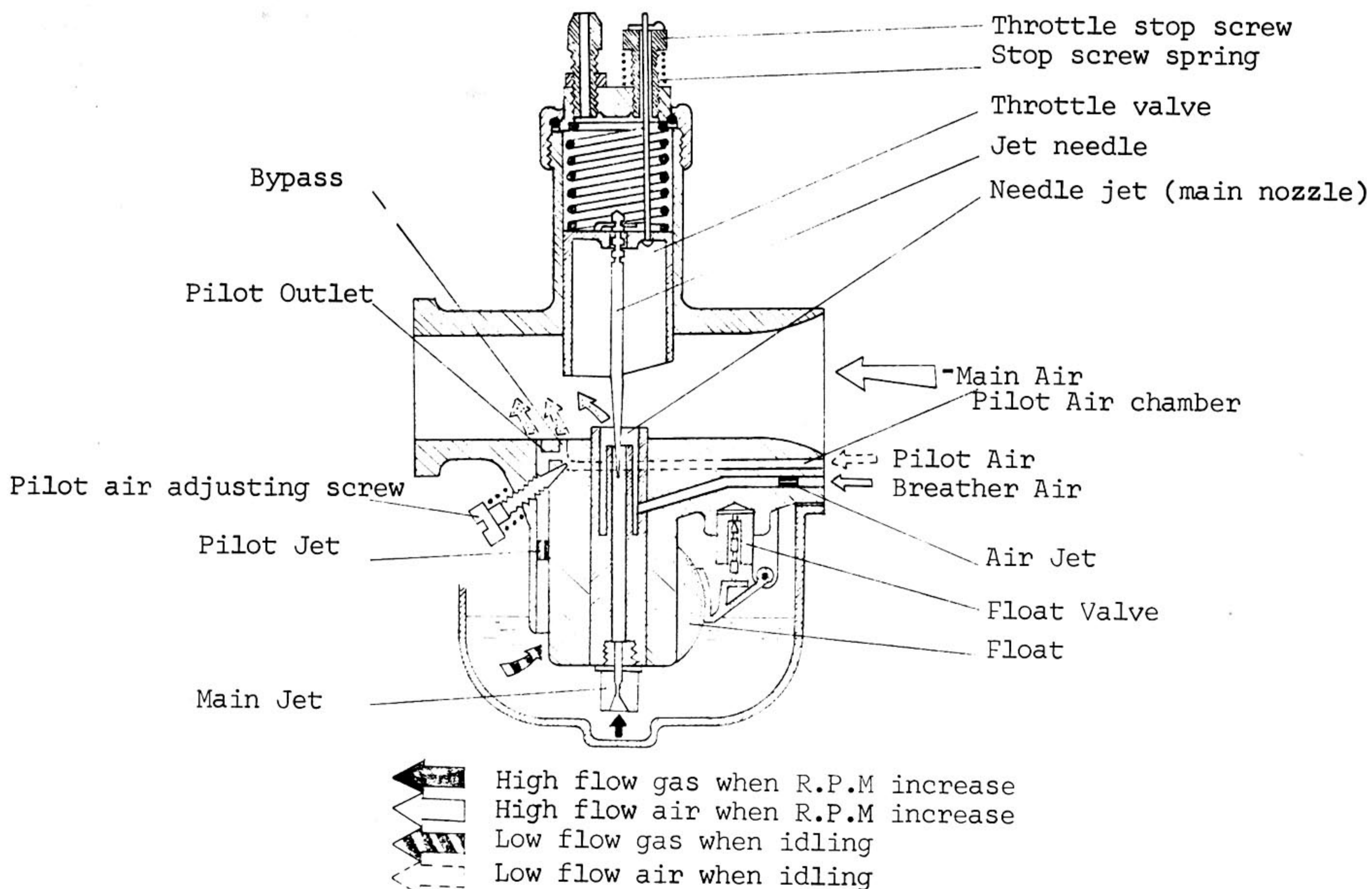
SERVICE MANUAL

COVERING
CARBURETION

CARBURETION

1. Principle 2. Mechanism 3. Adjustment
4. Carburetor equipped with starter jet.

The carburetor's main functions are mixing the gasoline with air, and passing the mixture to the engine. Even if the rest of the engine is the best, a wrong adjustment of the carburetor can reduce the full capacity of the engine. Also this may cause the engine to overheat and cut the life of the engine. To obtain maximum performance, it is as important to handle and treat the carburetor carefully as it is to have the timing properly adjusted. The following material pertains to piston type, throttle valve carburetors:



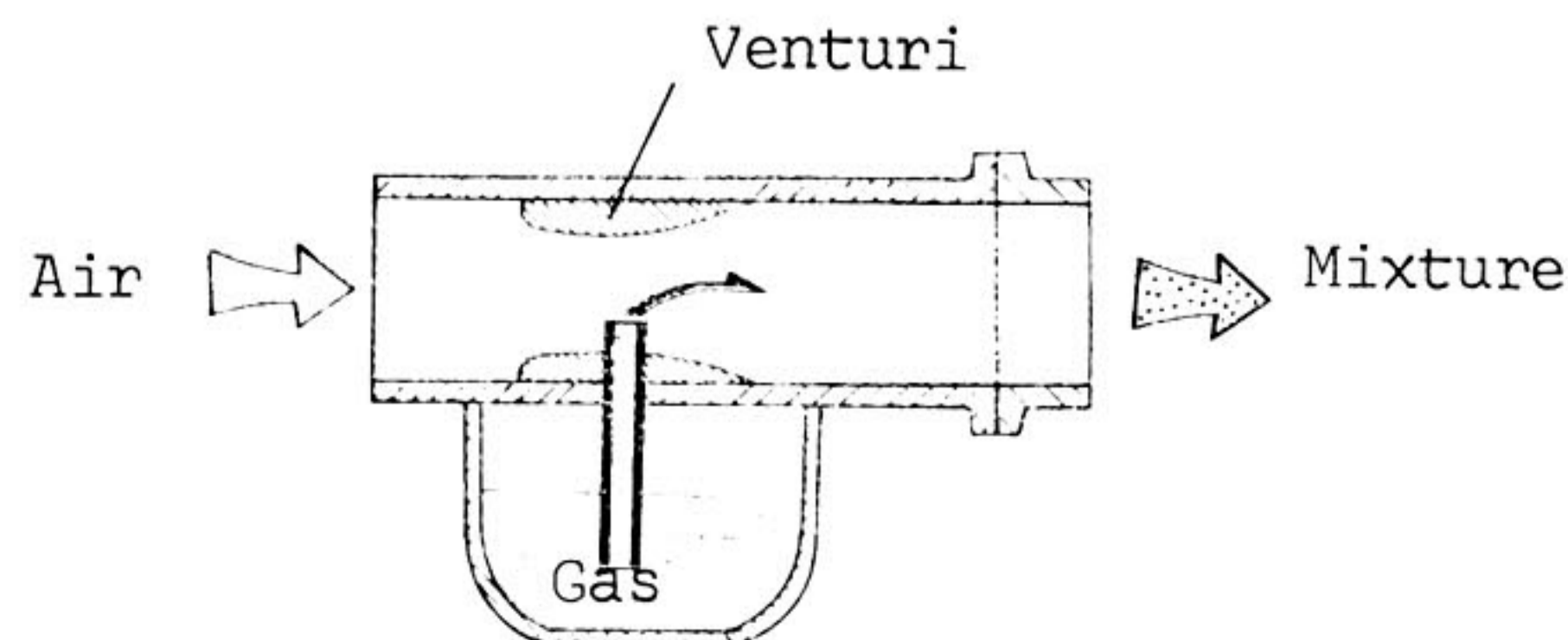
1. The principle of the carburetor: To ignite (explode) the mixture of gas and air in the cylinder, the mixture must be very fine and in a state of evaporation. In order to mix the gas and air to this point, the carburetor must be constructed to serve special purposes. The carburetor makes the mixture into a misty form before passing it into the cylinder. This misty mixture, before entering into the cylinder, passes through the inlet pipe where the heat of the engine causes it to approach the evaporating point. This is now ready to ignite in the cylinder following compression. To make the misty form of mixture we need:

- a. The flow of air.
- b. The pressure of air.

By using these 2 forces we acquire the mixture. For this purpose the venturi pipe is used. When passing through the venturi pipe, the flow of air is squeezed. This causes the air to go faster and the pressure is lowered. The narrow space is called the venturi pipe.

Explanation of two-cycle engine breathing: during engine compression stroke (when the piston is going up), the pressure of the crankcase is lowered, allowing the air at normal pressure to pass in through the venturi pipe. Meanwhile fuel enters through the nozzle in the middle of the venturi pipe. This fuel flows up from the float chamber because of the normal atmospheric pressure below and the reduction of air pressure on the top end. When the entering gas contacts the fast flowing air the mist is formed.

The actual carburetor used must suit the many complicated requirements of the particular engine in question.



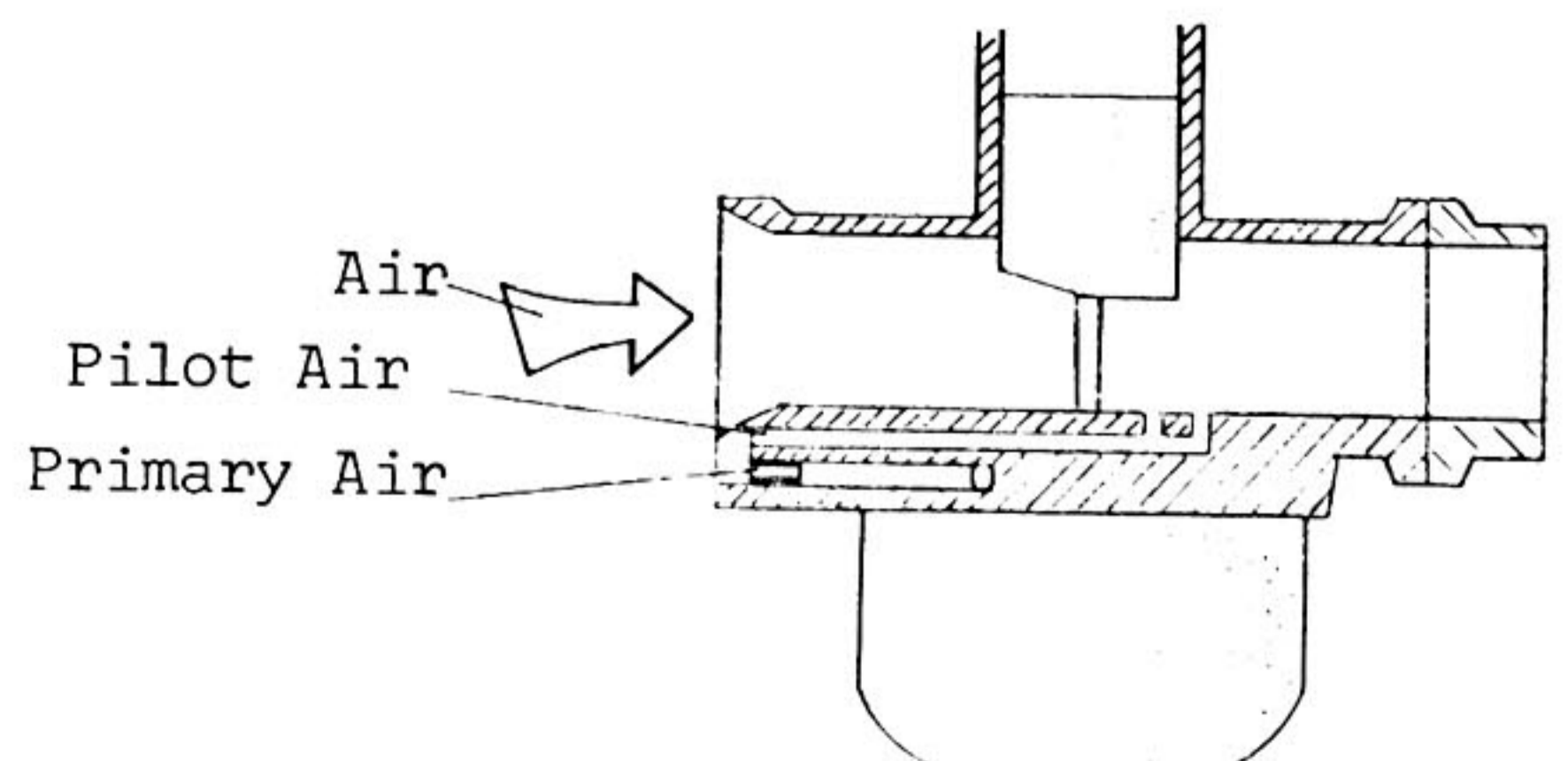
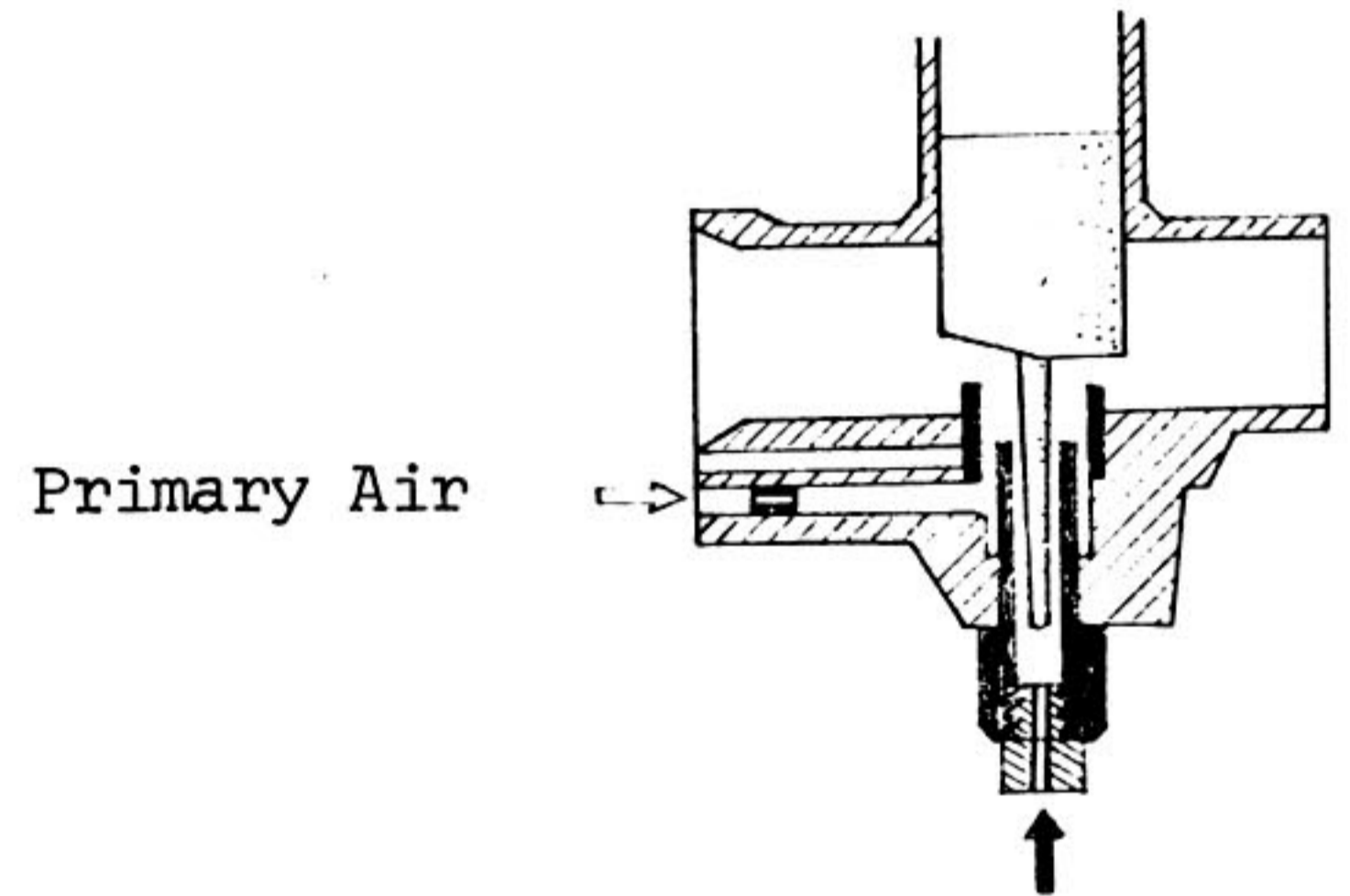
2. Mechanism: Yamaha uses the AMAL carburetor. The opening of the throttle valve will change the gas and air volumes sufficiently to automatically suit the requirements of the engine. The VM type carburetor which is used by Yamaha is built with a float chamber and mixing chamber. The float chamber is used to maintain a given fuel level by means of a float valve and float. The mixing chamber's main function is to control the flow of air and gas to make the required mixture for the engine. The flow of air (2-1) and gas (2-2) and the method of mixing the two (2-3) will be explained in the following paragraphs.

2-1 Air Flow, in four stages

with throttle opening of the mixing chamber:

a. When the throttle opening is from 0-1/8 (Idle)-
Air passes from the pilot air chamber, goes by the bypass, mixes with the mixture from the bypass, goes out of the pilot outlet into the main bore and again mixes with the air from the main bore.

b. 1/8 - 1/4 Opening -
(Slow) - When the engine is running slowly, air from the pilot chamber is not sufficient. Therefore, the air from the main bore is used heavily with the air from the primary air chamber

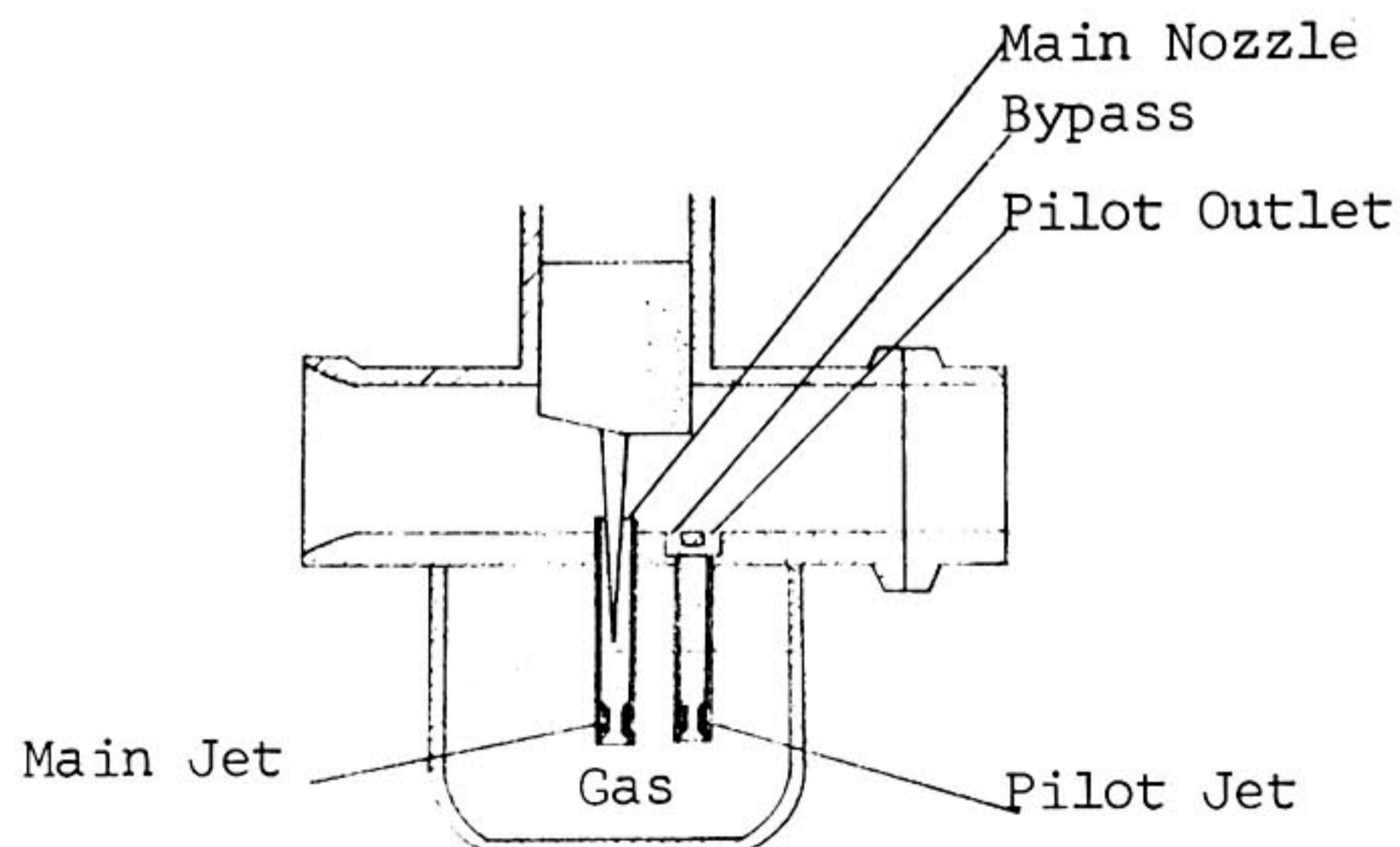


2-1 AIR FLOW - (Cont.)

- c. 1/4-3/4 Opening (Medium) - Air from the primary chamber goes thru the main nozzle and mixes with air from the main bore.
- d. 3/4 - Full Opening (High) - same as 1/4-3/4

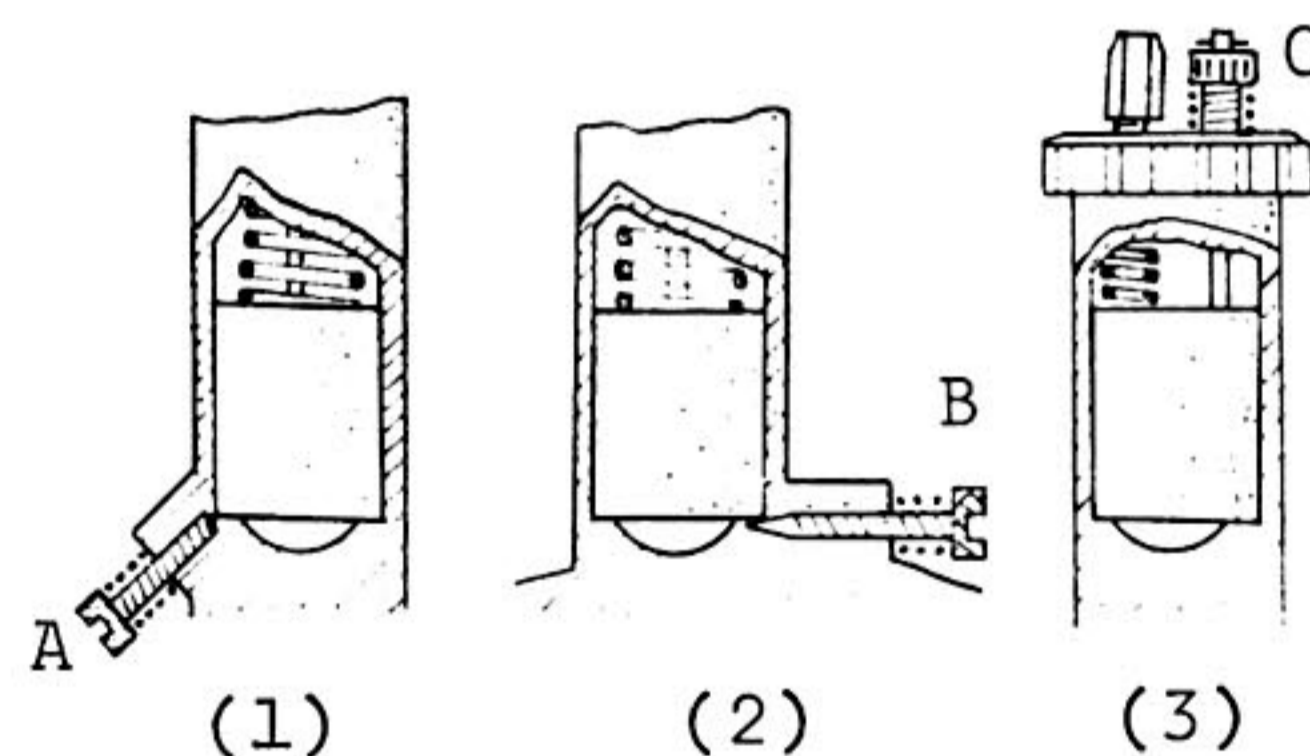
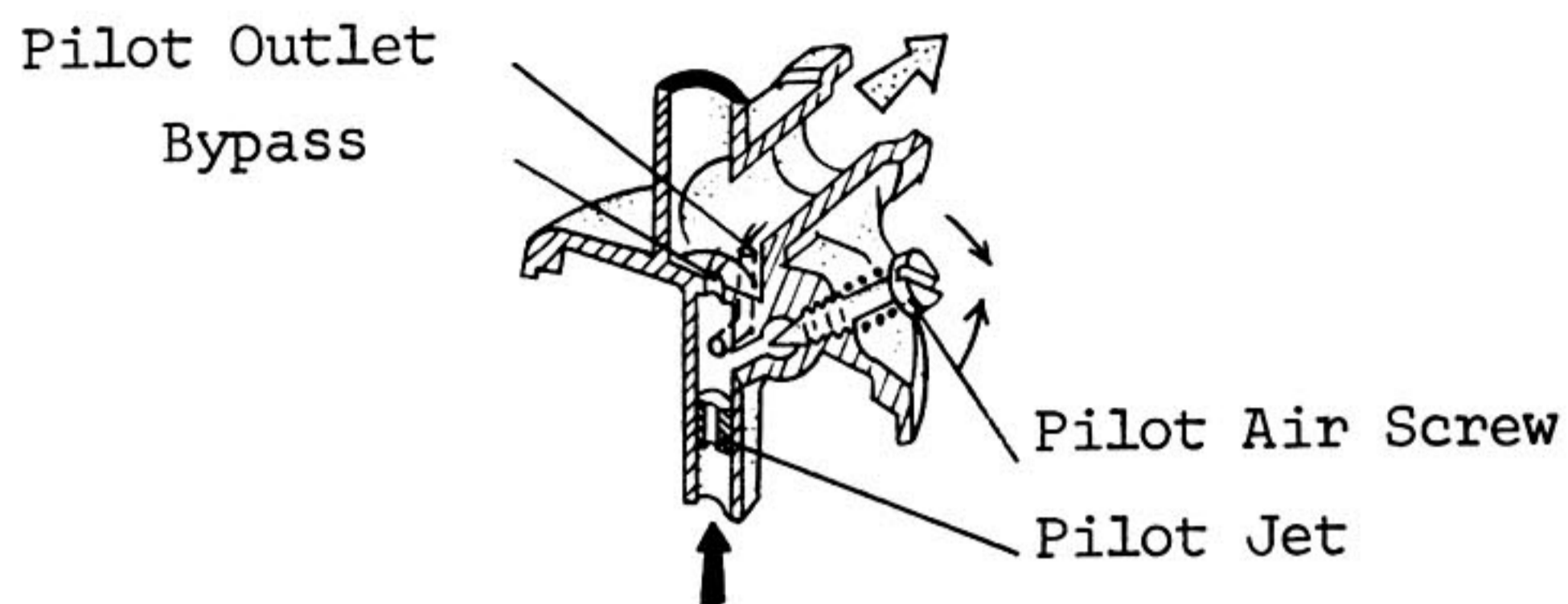
2-2 GAS FLOW

- a. 0-1/8 (Idle) Gas passes thru the float chamber and pilot jet. It is measured to the amount required and goes out thru the pilot outlet. If it is insufficient, the necessary extra gas comes thru the bypass.
- b. 1/8-1/4 Opening (Slow) - At this speed more gas is required, so gas for the main jet comes thru the main nozzle.
- c. 1/4-3/4 (Medium) - Gas from the float chamber passes thru the main jet between the main jet needle and needle jet, and out from the main nozzle.
- d. 3/4 - Full (High) - Same as 1/4-3/4.



2-3 MIXTURE OF GAS & AIR

a. (Idle) - Gas passes thru the pilot jet - The air passes through the pilot air chamber where the adjustment is made by the pilot air adjusting screw. The gas and air mix and form a heavy mixture which is rough and too rich to burn. At this time air from the bypass and main bore mix with the heavy mixture, form the right mixture for idling and the final proper mixture enters into the cylinder. When the throttle valve is returned completely, the position can be adjusted by the throttle stop screw. Three different methods of construction are illustrated on the right.

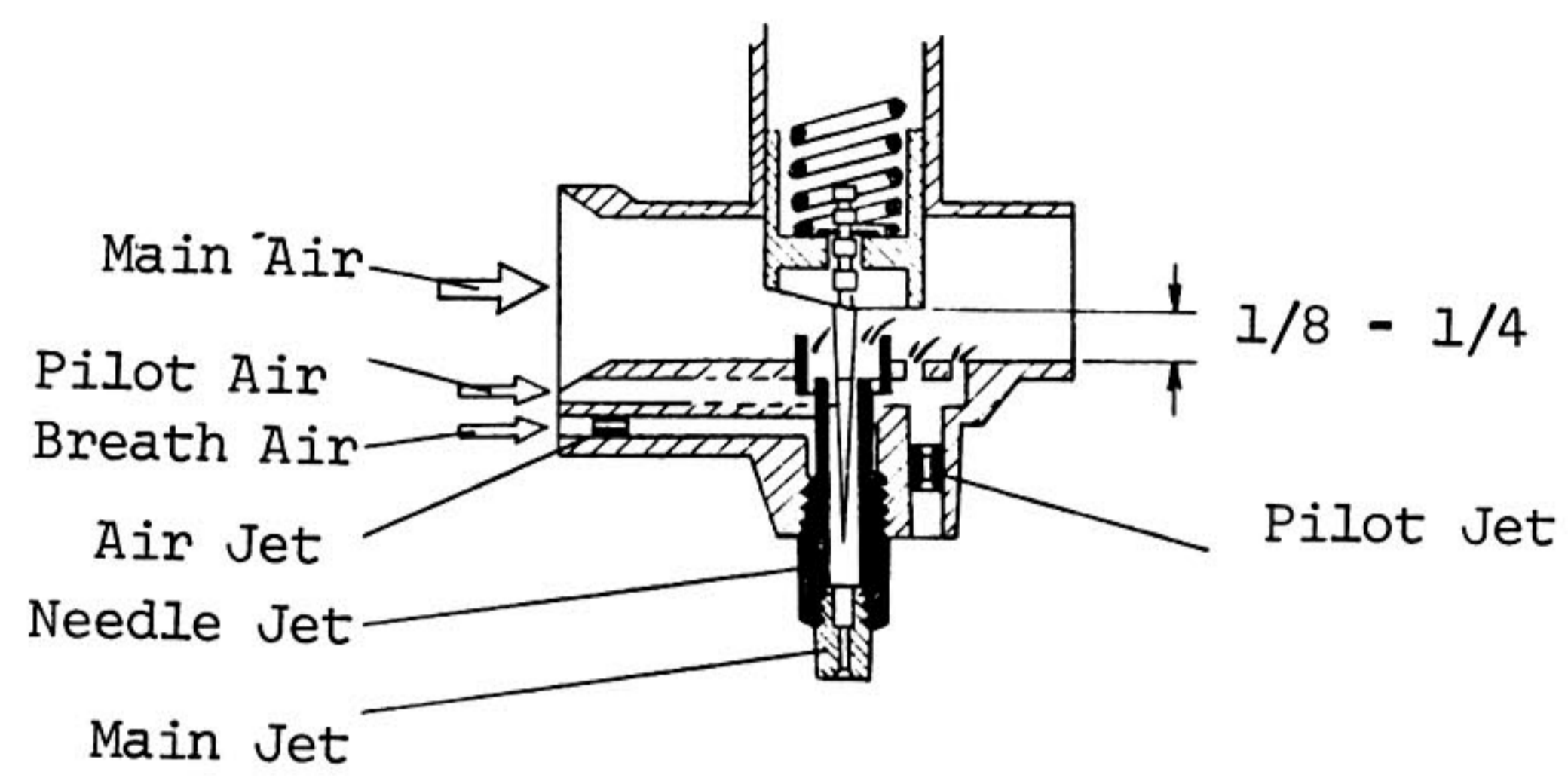


b. (Slow) At this opening the above gas is not sufficient for the increased volume of air. Air is no longer pulled through the bypass and in place the heavy mixture enters thru the bypass and pilot outlet. (See illus. #6) This mixture combines with more air and passes on to the cylinder.

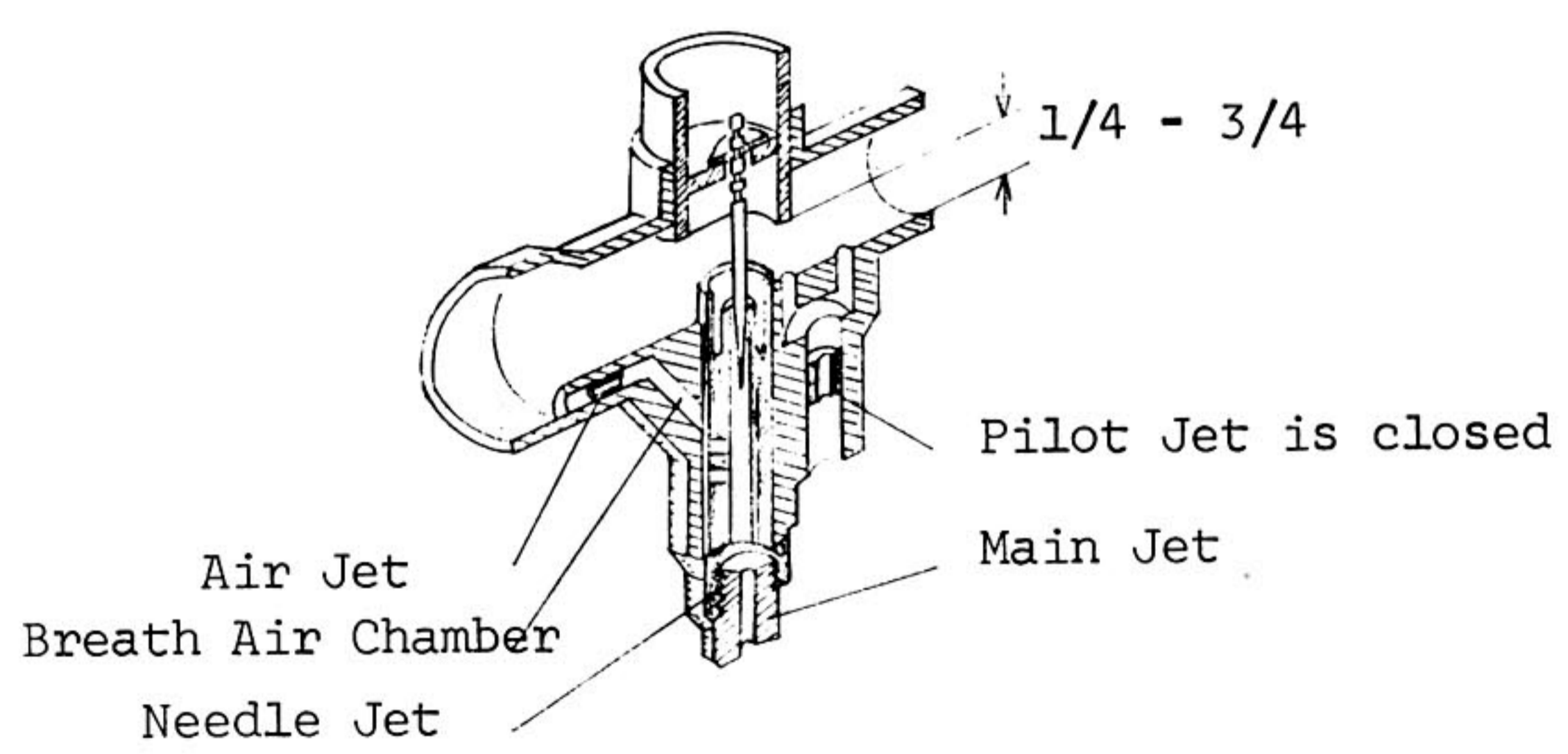
2-3 MIXTURE OF GAS & AIR - (CONT.)

c. From Slow to Medium -

To give the engine extra power at this period, more mixture is required. Air is increased and the flow is faster. Thus the pressure is lowered and this causes the heavy mixture (primary air chamber and main jet) from the main nozzle to mix with the heavy mixture from the pilot outlet and bypass.



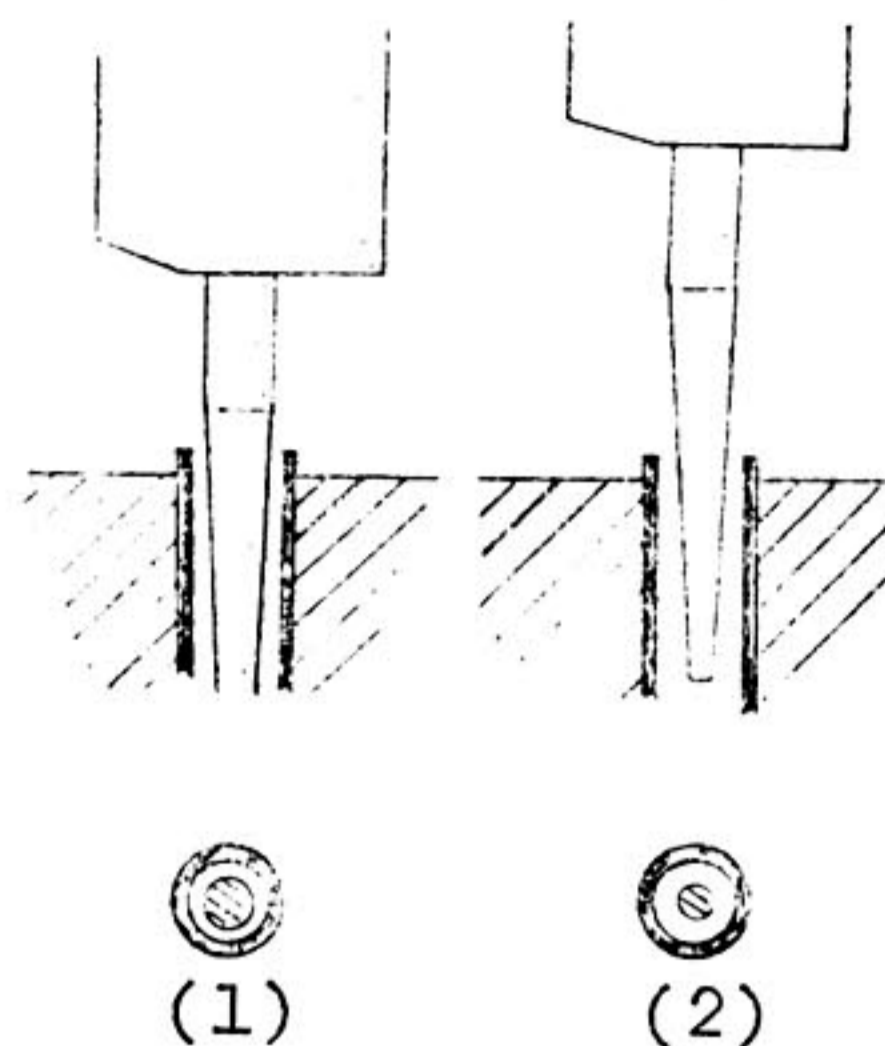
d. Medium - The pilot system is stopped. Gas passes thru the main jet between needle jet and needle and mixes with the breather air of the primary air chamber. This heavy mixture comes out to the main nozzle, combines with the air from the main bore and goes on to the cylinder. The needle jet and needle are basically composed of a tube and tapered needle.



2-3 MIXTURE OF GAS & AIR

(Cont.)

The needle is fastened to the throttle valve and moves up (open), and down (closed), with it. This controls the flow of the heavy mixture from the main bore and causes it to mix in proper proportion with the air in the main bore.



- e. (High) When the accelerator is wide open, the throttle valve will rise to the top and cause the main bore opening to be at maximum. The flow volume of air is heaviest, and gas flow will change with the changing flow of air. Since the throttle valve is at the top and the space between the needle and needle jet is too wide, the control of the flow of heavy mixture is not accurate. To control this situation the main jet at the bottom of the needle jet is used.

3. ADJUSTMENT

The troubles of the carburetor are usually concerned with a mixture that is too lean or too rich.

Some of the symptoms of a malfunctioning carburetor:

RICH

- a. Gas runs thru the muffler
- b. Gas returns from the carburetor opening.
- c. The RPM is uneven.
- d. Sparkplug gets dirty.

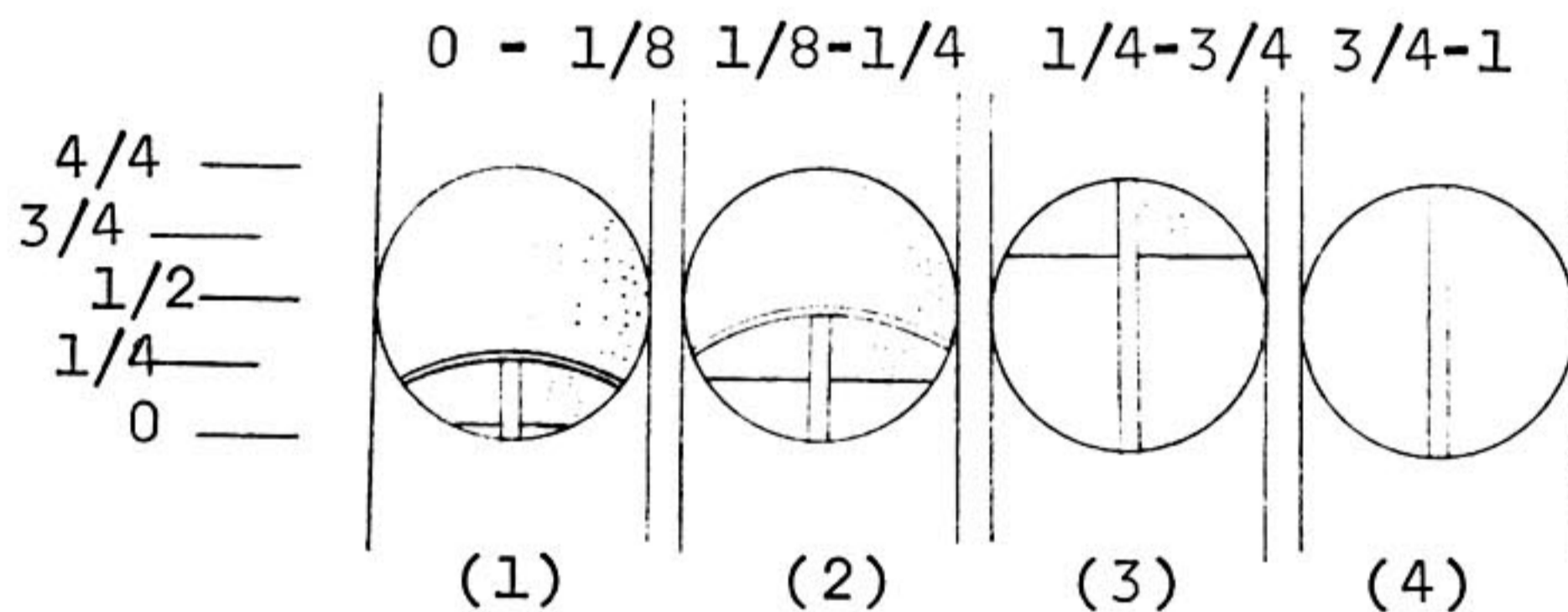
LEAN

- a. Carburetor coughs.
- b. Low RPM and uneven.
- c. Engine overheats.
- d. Pull on choke lever to give better result.

3- ADJUSTMENT - (Cont.)

To adjust the carburetor, the following four divisions should be recognized:

<u>THROTTLE VALVE OPENING</u>	<u>ITEM TO ADJUST</u>	<u>TOO RICH</u>	<u>TOO LEAN</u>
0-1/8	Pilot Air Screw	Screw out	Screw in
1/8-1/4	Throttle valve	Larger cutaway	Smaller cutaway
1/4-3/4	Jet needle	Raise needle clip (Lower jet needle)	Lower needle clip. (Raise jet needle)
3/4-1	Main Jet	Use smaller numbered main jet	Use higher num- bered main jet.



3-1 Before adjusting the carburetor check for the following troubles:

- a. Restricted gas lines:
1. Fuel cock
 2. Fuel Pipe
 3. Float valve arm
 4. Float valve
 5. Main, pilot, needle jet, etc.

- b. Air Leaks:
 - 1. Loose connections of carburetor.
 - 2. Bent flange, or other damaged parts.
- c. Faulty parts:
 - 1. Throttle valve is worn by friction.
 - 2. Needle jet and/or jet needle are worn.
 - 3. Jet is loose (usually the main jet).
- d. Air Cleaner:
 - 1. Dirty cleaner
 - 2. Loose joints
- e. Engine:
 - 1. Oil seal is worn out.
 - 2. Gaskets are faulty.
 - 3. Timing is off.

3-2 ADJUSTMENT - After checking the malfunctions above, the following adjustment procedure is recommended.

a. Adjustment of pilot jet:

When the opening is 0-1/8 - First drop the throttle valve to the bottom then with throttle stop screw raise the idling. Again slowly drop the valve until the engine rpm is uneven. Now use the pilot air screw and turn to the smoothest and highest rpm. Turn the throttle stop screw to reduce the rpm to the desired point. Repeat the above procedure whenever the rpm is high or uneven. In the above procedure you will notice that it is necessary to go back and forth several times from the stop screw to the air screw in order to arrive at the final optimum relationship of the two.

b. Adjustment of the cutaway on the throttle valve:

Adjust at 1/8-1/4 opening - When opening the throttle from idle and the carburetor coughs, screw in the pilot air screw to get a richer mixture. When this does not help, return the pilot air screw to the original position; then change the throttle valve to a smaller cutaway. If the engine labors excessively when the throttle is opened during operation, change the cutaway to a larger one.

c. Adjustment of jet needle.

Adjust at 1/4-3/4: The jet needle effects the throttle valve opening especially during acceleration of the engine.

To begin with, lower the jet needle to the bottom (put the clip on the top notch) and check the acceleration. If the engine is not running smoothly, use the choke. If the engine then runs smoother, raise the jet needle (lower the clip by one notch.)

Use this method to find the best position for the clip.

When the jet needle is at the bottom and the mixture is too rich, usually the jet needle is worn out.

d. Adjustment of the main jet:

Adjust at 3/4 - full: If the engine does not run smoothly under full acceleration, reduce the acceleration slightly or use the choke. If this causes the engine to run smoother, the main jet is too small and needs a larger one. At full acceleration if the engine labors, the main jet is too large and should be changed.

3-3 Points of importance when adjusting:

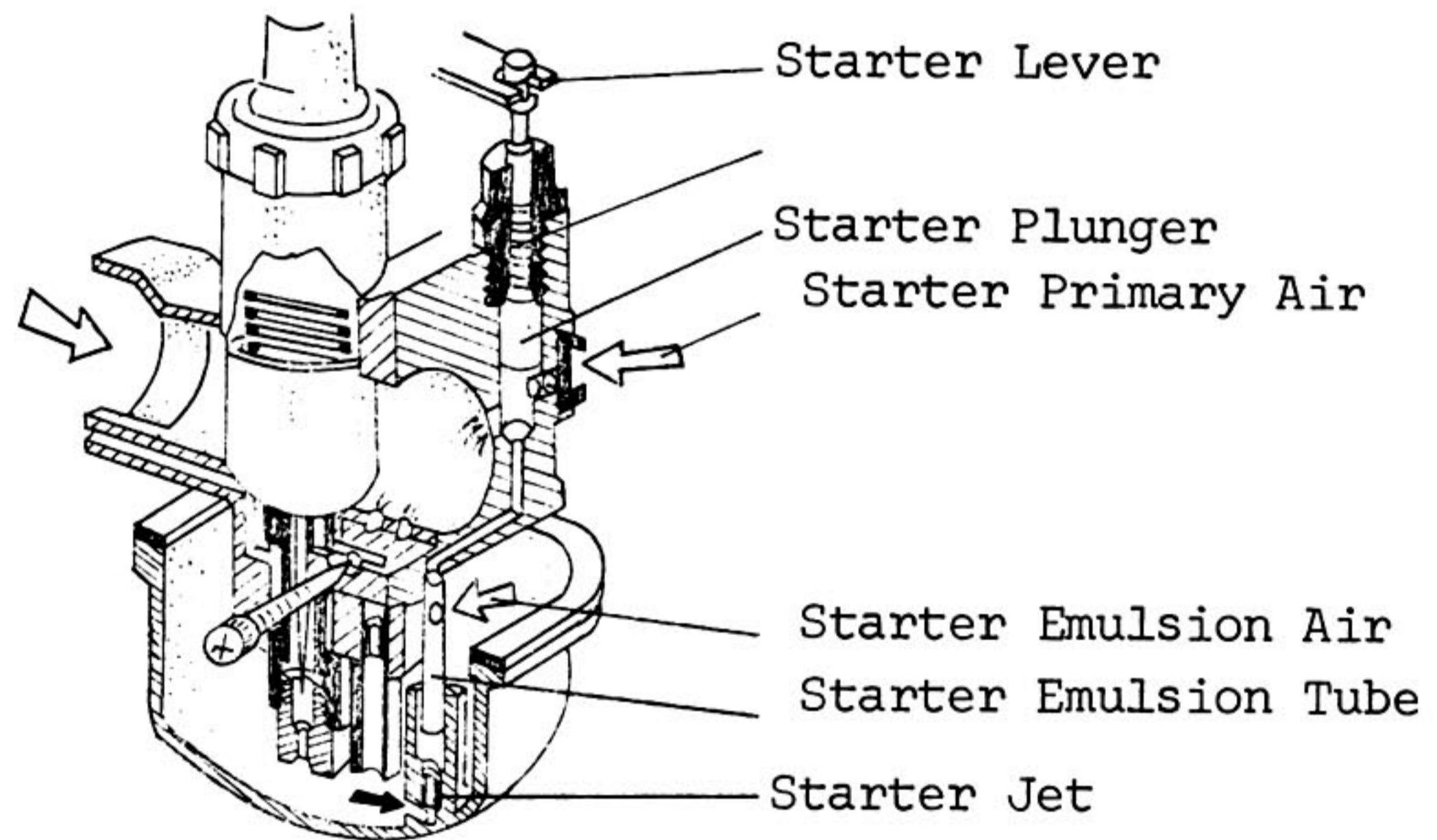
- a. All Yamaha motorcycles are factory adjusted to standard settings, and all following adjustments should be made accordingly.
- b. Throttle valve cutaways are factory selected and standard, requiring no further adjustment. The cutaway size is numbered on the throttle valve and the larger the number the larger the size.
- c. The jet needles have 5 notches for the clip. The numbers run from top to bottom. When the clip is at the top notch, the position of the needle is at lowest, thus causing the opening of the main nozzle to become smaller.
- d. The size of the main jet is imprinted on the main jet. The larger the number the larger the main jet inlet hole. Size 20 to 100 are numbered by 5, ie; 20,25,30,35, etc., 100 sizes and up are numbered in increments of 10, ie; 100, 110, 120, etc.

3-4 Other adjustments and relationships:

- a. Elevation and main jets: The higher the elevation, the less atmospheric pressure there is, so the mixture becomes richer. The main jet should be smaller than standard as the elevation is increased.
 Up to 3,300 feet Standard size
 3,300-6,600 feet Standard size less 5%
 For every 3,300 feet increase, the size should be reduced 5%
- b. Air cleaner and main jet-When installing an air cleaner on a motorcycle without an air cleaner, a smaller main jet should be used. When removing the air cleaner, a larger main jet should be used because the mixture gets thinner and overheats the engine.
- c. Muffler and main jet-When removing the inner cylinder of the muffler (baffle) or replacing with a racing muffler, the main jet should be larger.
- d. Adjusting the twin carburetors: When adjusting this type of carburetion, the steps mentioned previously should be done step by step together from one carburetor to the other. The opening of the throttle valve should be exactly the same on the left and right carburetors. To adjust the throttle valves use the cable adjuster and the throttle stop screw.

4 - Difference between the standard carburetor and the carburetor equipped with starter jet: When starting a cold engine, a rich mixture should be used. The old type carburetor required the use of a tickler to raise the level of gas and a choke to stop the air flow in order to produce the needed rich mixture. When using this method, the use of choke and tickler must be changed according to temperature or altitude changes.

The Yamaha motorcycle is equipped with the carburetion starter jet and eliminates the old system. On this new carburetor, when the starter lever is pulled the starter plunger goes up, then the gas goes thru the starter jet and passes thru the starter emulsion tube. While



passing thru the starter emulsion, air is sucked in and the rich mixture is formed. The rich mixture is then mixed with starter primary air and passes thru the main bore and to the cylinder. This makes it possible to start the engine without opening the accelerator.

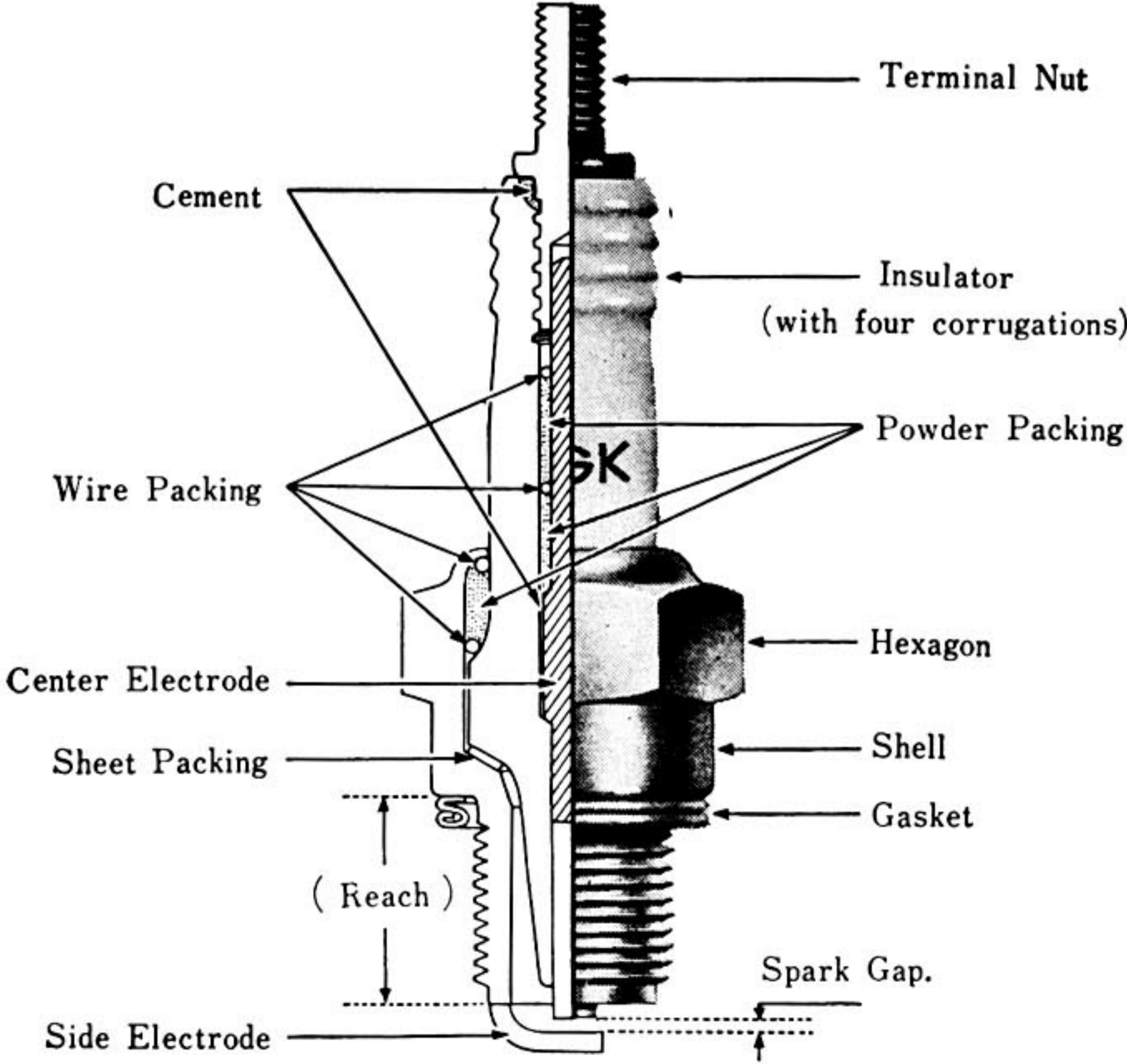
YAMAHA

MOTORCYCLES



SERVICE MANUAL

COVERING SPARK PLUGS



NGK ORIGINAL SPARK PLUGS FOR YAMAHA MOTORCYCLES

Model	Thread size 14 ϕ mm
YAMAHA 55 MJ- 2	B- 7 H Z
YAMAHA 55 MJ- 2 TRAIL MASTER	B- 7 H Z
YAMAHA 80 YG1	B- 7 H Z
YAMAHA 80 YG1 TRAIL MASTER	B- 7 H
YAMAHA 125 YA 5	B- 7 H
YAMAHA 125 YA 6	B- 7 H Z
YAMAHA 250 YD3	B- 7 H Z
YAMAHA 250 YDT1	B- 7 H Z
YAMAHA 250 S YDS2	B- 7 H Z
YAMAHA MOTOCROSSER	B-10 E N
YAMAHA RACER TD1	B-10 E N
YAMAHA 55 YJ-1	B-7H
YAMAHA 80 MG-1T	B-7H
YAMAHA 250 YDS-3	(B-77HC B-8H

HEAT RANGE CHART OF NGK SPARK PLUGS FOR YAMAHA MOTORCYCLES

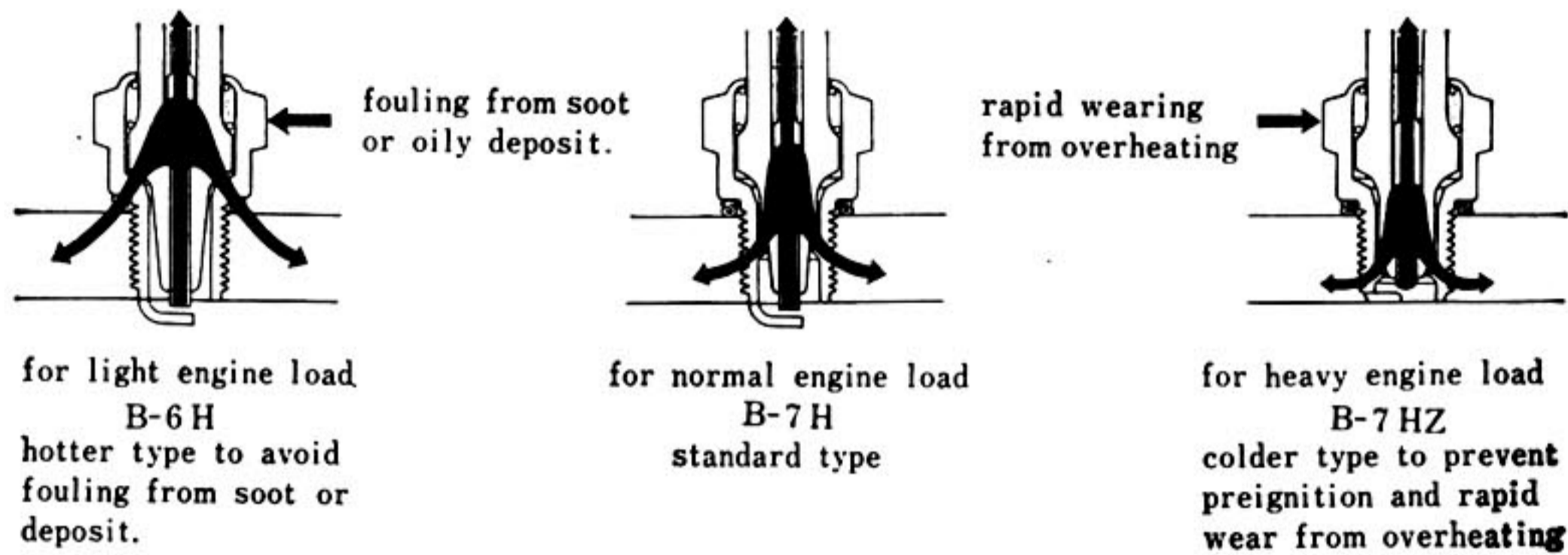
PLUG SIZE	HEAT RANGE	NGK TYPE	PLUG SIZE	HEAT RANGE	NGK TYPE
THREAD SIZE	HOT	B - 4 H	THREAD SIZE	HOT	B - 8 E N
14 mm	↑ ↓	B - 6 H	14 mm	↑ ↓	B - 9 E N
REACH		B - 7 H	REACH		B - 10 E N
12.7 mm		B - 7 H Z	19 mm		B - 11 E N
HEX. SIZE	COLD	B - 7 H Z	HEX. SIZE	COLD	B - 12 E N
20.6 mm		B-77HC	20.6 mm		
		B-8H			

Spark Plugs are designed in several "Heat Ranges". "Heat Range" refers to the ability of spark plugs to absorb and dissipate heat. Spark Plugs with long insulator noses retain heat enough to burn off oil and combustion deposits under light service conditions. Spark plugs with short insulator noses will transfer heat rapidly and prevent preignition and detonation under severe service conditions.

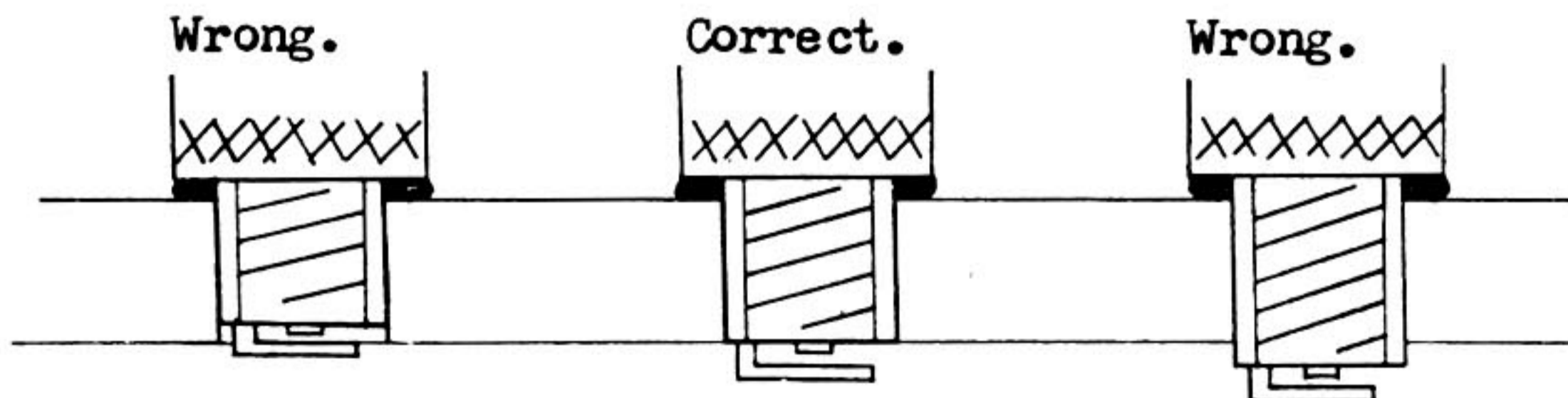
CHOOSING THE RIGHT SPARK PLUG

The NGK Spark Plug numbering system on the insulators indicates the "Heat Range" of each type. The higher or larger numbers designate "colder" plugs which dissipate heat quickly for high speed and heavy load. The lower or smaller numbers designate "hotter" plugs which retain the heat for low or slow speed and light load.

For example, if the B-7H becomes fouled with carbon or combustion products, replace with type B-6H. If the B-7H becomes overheated and causes preignition or rapid electrode wear, replace with type B-7HZ.



There are different lengths of spark-plugs with the same thread size. When choosing a spark-plug be sure to select the correct reach. If a wrong length plug is used, the engine's full capacity cannot be obtained. When the reach is too long, there is a possibility of it touching the piston and damaging it.



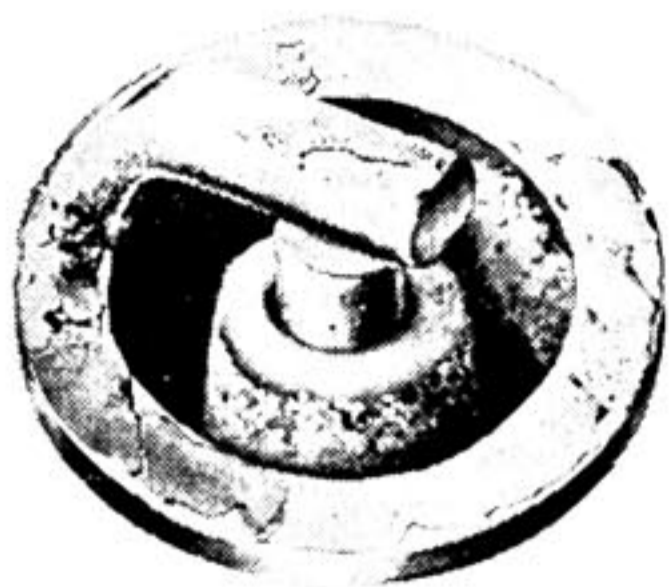
VARIOUS ASPECTS OF FIRING ENDS OF SPARK PLUGS

When your motor-cycle is running in good condition.
The color of firing end of your plug is brownish-white or greyish-white.

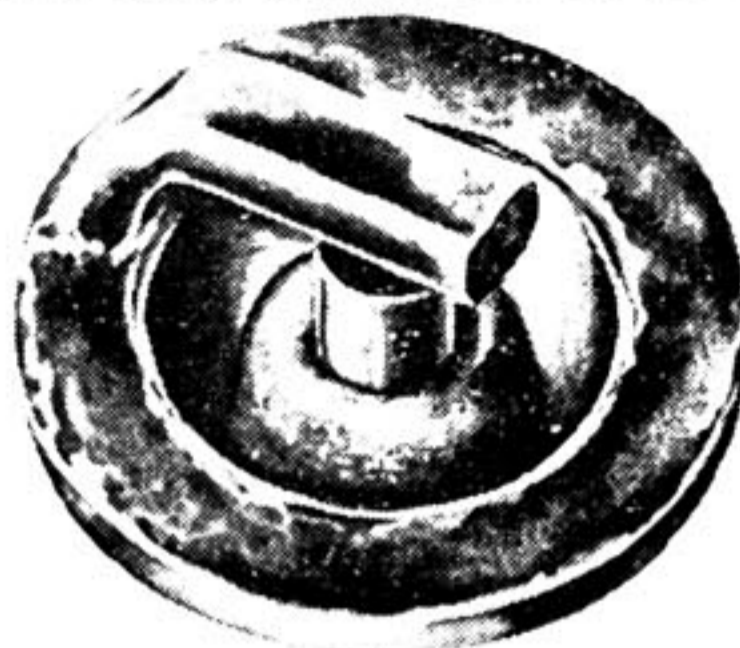
What color has your plug?

When the firing end is carbon-fouled or has some blister on the surface.

Your plug proves not to be suitable for your engine.



Firing end in good condition



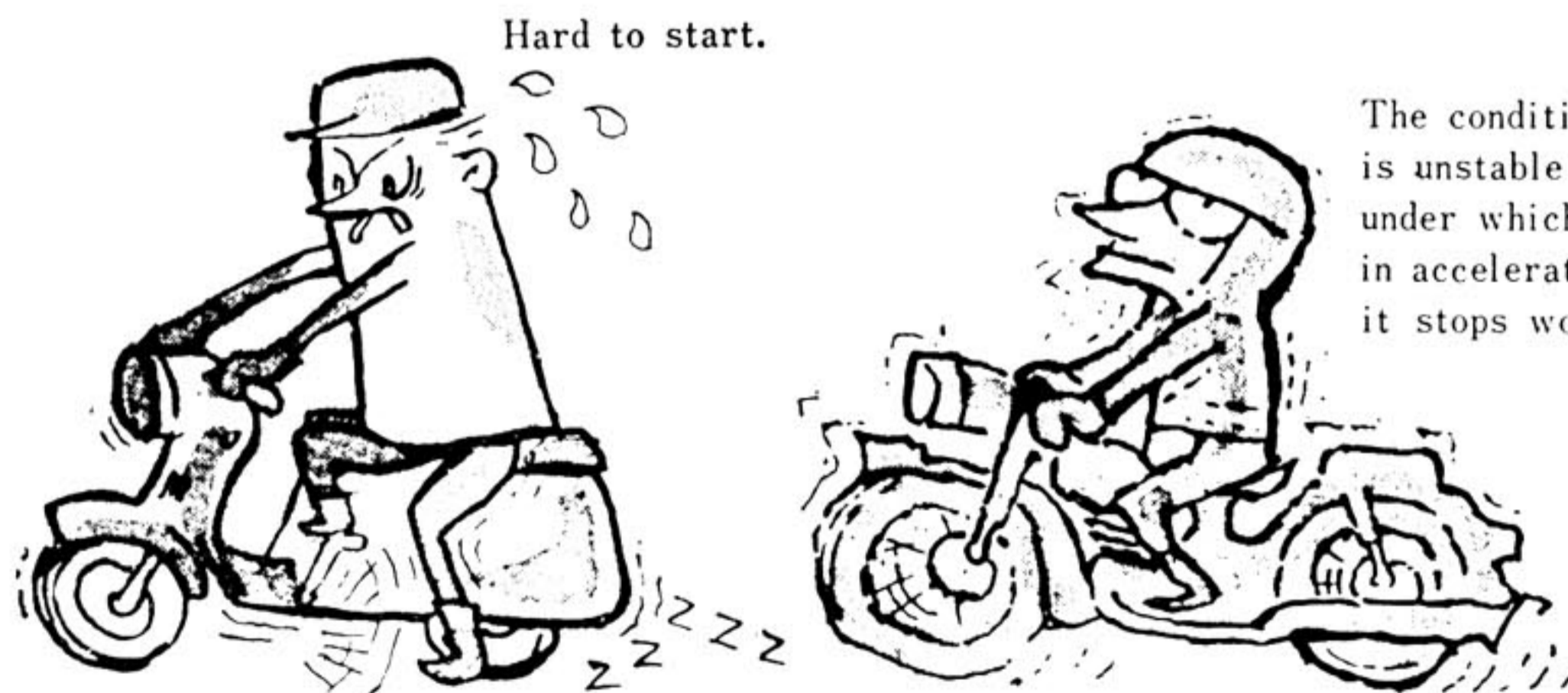
Wet oil and carbon fouling.



Dry carbon and oil deposit

When your plug is fouled.

The trouble which occurs to your plug is oil or carbon fouling. Especially in 2 cycle-engine, the plug is easily fouled. When the plug becomes fouled, the spark gets small and, at last, the plug fails to spark.



The fouled plug generally can be cleaned and made serviceable. But when it is heavily-fouled, change it for a hotter type plug(lower number one).When you do not use "NGK Spark Plug", please change it for the original "NGK Spark Plug". Be sure to check the following cases, when your plug gets fouled.

- 1) Excessive choking.
- 2) Fuel mixture is too rich.
- 3) The space of the spark-gap is not uniform, too wide or too narrow. (regular space; 0.6-0.7mm.)
- 4) The spark timing is late or the breaker-point is burned or pitted.
- 5) The compression is low because of defective rings or worn cylinders.

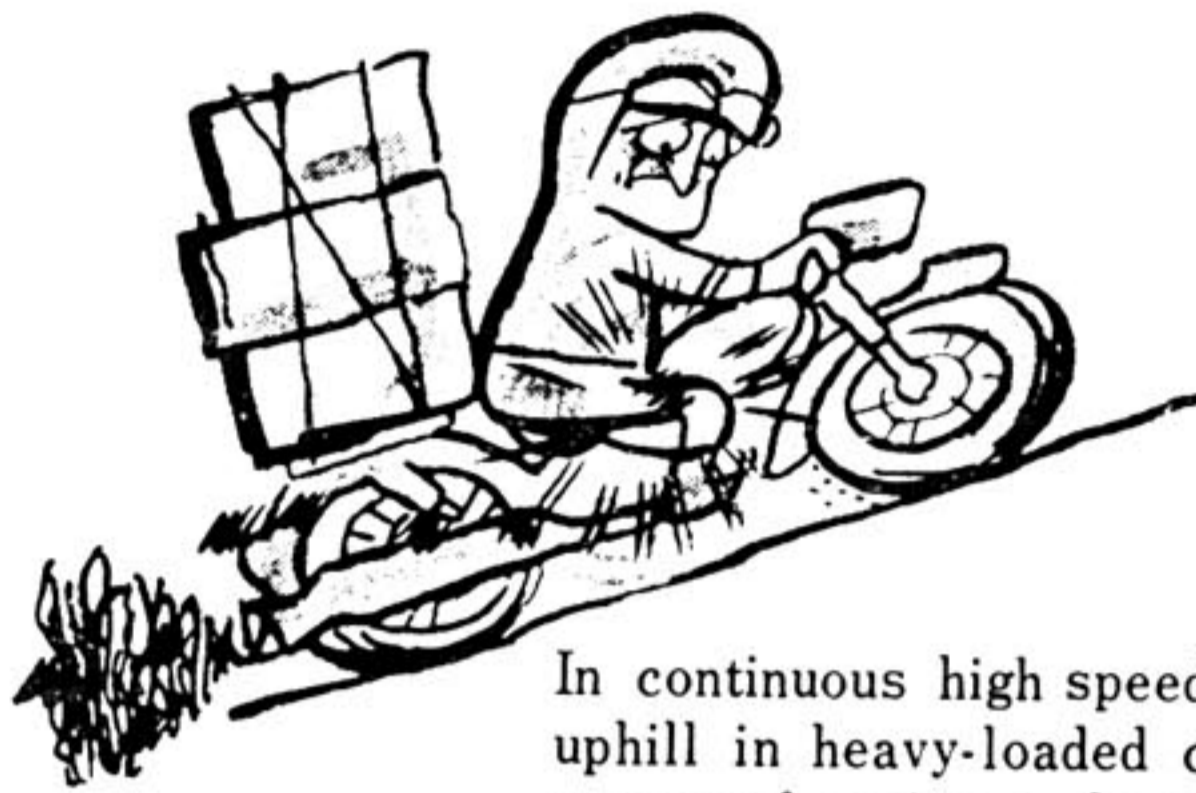
WHEN YOUR PLUG CAUSES OVERHEATING



Grain-like substance



Burned electrode

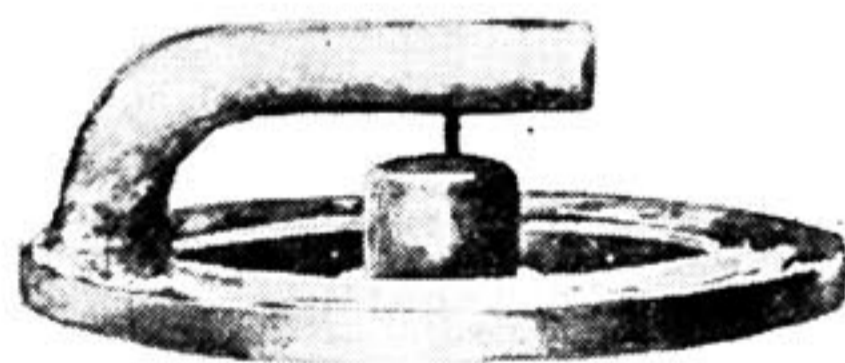


In continuous high speed driving or going uphill in heavy-loaded condition, the power of engine is lost, and you cannot accelerate it.

In this condition, you had better change your plug for colder type one.

And take caution in the following cases which may cause overheating.

- 1) The plug is not firmly installed or its gasket is lost.
- 2) Fuel mixture is too weak.
- 3) Ignition timing is too advanced.
(Especially in 2-cycle engines, when the engine timing not adjusted, the plug causes fouling or overheating.)



A plug does not spark, as there is something between electrodes. This is called "bridging".

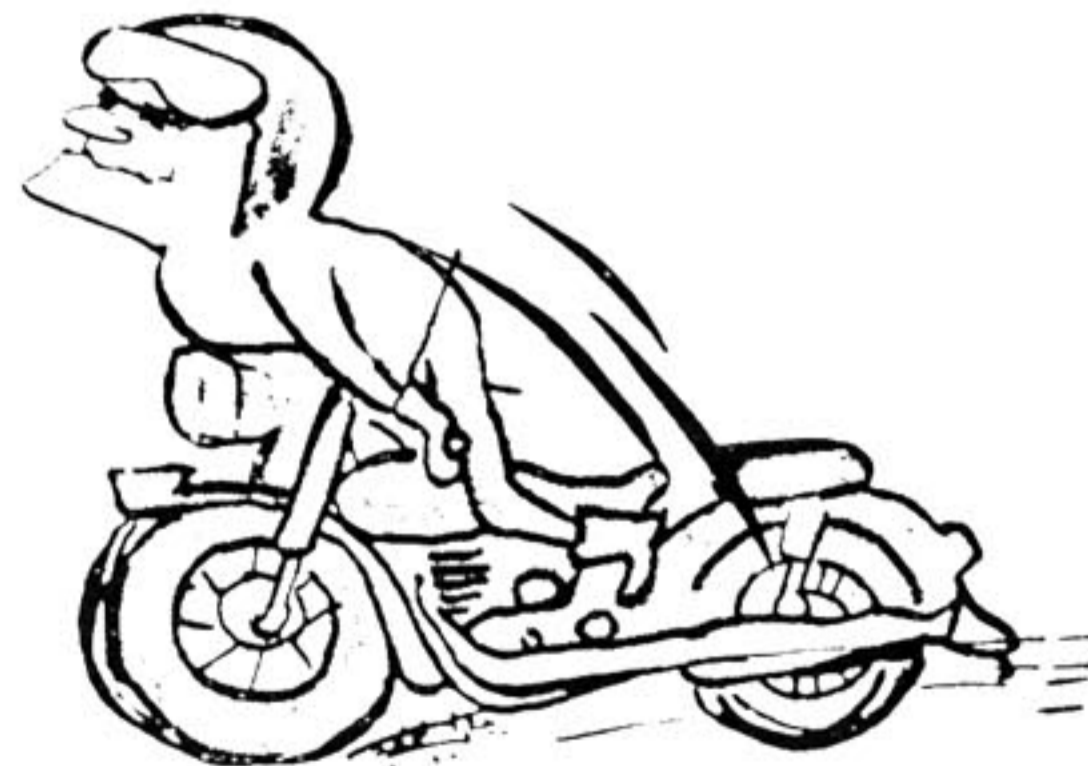
Bridge.

This trouble is common in the 2 cycle engine. The plug gets something bridged between its electrodes, so that electricity leaks away through this bridge. Consequently the plug misfires and the engine stops working.

But this trouble is not caused by the plug proper.

In this condition;

- 1) You had better make the spark gap a little wider.
- 2) Polish up the breaker point.
- 3) Adjust the Air-Cleaner.
- 4) Clean up the exhaust muffler and make necessary engine adjustments.



INSTALLATION OF SPARK PLUGS

1. How to install a plug.

First screw a plug into the cylinder head until it touches the gasket, and then tighten it securely by a plug-wrench.

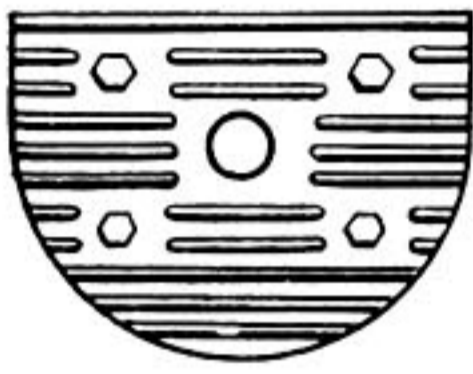
Thread size	Torque	Torque		In using new gasket, the degree of turning range is 180°-240°.
10 mm	1.1~1.5kg-m	8-11	Foot-Lbs.	
12 mm	2.1~2.6kg-m	15-19	Foot-Lbs.	
14 mm	3.0~3.5kg-m	22-25	Foot-Lbs.	

2. Adjustment of spark gaps.

The correct gap spacing is 0.6mm in magneto-ignition system engines.

When you use a plug for a long time, the electrodes are worn out and the gap spacing gets wider, so you need to adjust it sometimes.

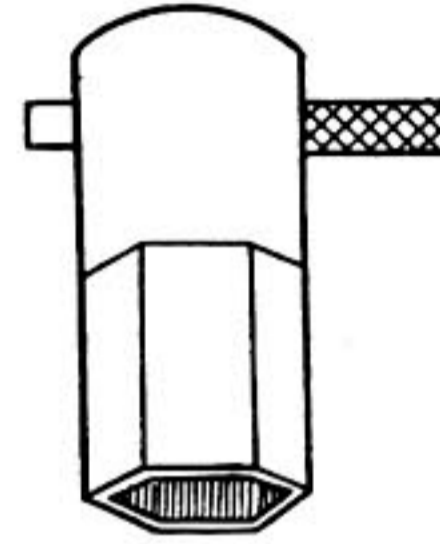
Especially in 2 cylinder engines, it is important that the gap spacing of both spark plugs are the same.



Clean the gasket seat.



Use gasket without fail.



Use a plug wrench in installing a plug.

3. Cleaning of plugs.

Even if a plug is selected right, deposits and carbon accumulate on its firing end as you use it for a long time.

This deposit, especially of carbon, decreases the efficiency of plugs, as this carbon easily transmits electricity.

For this reason you need to clean plugs sometimes. You had better use the NGK Plug Cleaner in cleaning a plug. But if you do not have it at hand, remove dirt in a spark plug with a needle or a piece of wire and clean it in gasoline.

It is harmful to heat a plug in fire.



Heating injures a plug.



It is the best way to clean a plug with the NGK plug cleaner.



When you do not have a cleaner, clean it with wire or needle.

SPARK-PLUG COMPARISON CHART.

N.G.K.	Champion.	A C.	Aute lite.	Bosch.	K.L.G.	Lodge.
B-6H	UL15Y L10 L7	45F 44F 44FFS	AE6 AE62 AE52	W225T1	F50 F70	2HN
B-7H	L9Y L5	42FF	AE3	W240T1	F80 F100	3HN
B-7HZ	L5					
B-77HC	LA10				F250 F260	R49
B-8H	LA10				F250 F260	R49
B-8HN					F260	
B-6E	N8 N6 N5	45XL 44XL 44N	AG52 AG42 AG5	W175T2 W225T2	FE50 FE70	CL14
B-7E	N3 N9Y	442N	AG32 AG3	W240T2 W260T2	FE100 FE220	3HLN
B-8EN				290 300	FE250 FE260	RL49
B-9EN	NA14			380 400	FE280 FE290	RL50
B-10EN	NA18			440 450	FE300	RL51
B-11EN	NA19				FE320	RL52
B-12EN					FE340	RL53

YAMAHA TUNING SUPPLEMENT
14mm TYPE SPARK PLUG COMPARISON TABLES

Reach	Heat Range	Hitachi	NGK	Champion	AC	Auto-lite	Lodge	KLG	Bosch
				L-10	43F	AE-4		F-70	W175T1
			B-6H	+L-86 +L-85			HN. H14	F-75	
		M-45		L-7	42FF	AE-3	HH-14		
	Hot		B-7H		42F			PF-70	W225T1
	↑	M-44		+L-81			2HN	F-80	
1/2"			B-7HZ	L-5	42FA				W240T1
			B-77HC	L-63R			3HN	F-100	
			B-8HN	L-58R		AE-903	R-47	F-260	W310T16
	Cold		B-9HN	L-56T		AE-603	R-49	F-280	W340T16
			B-10HN	L-55T		AE-403	R-51	F-300	W370T16
			B-11HN	L-53T		AE-203	R-52	F-320	W400T16
			B-12HN	L-52T			R-53	F-340	W440T16
				N8, N-84	46N 45N, 45XL	AG-5	CLHN	FE-50	W145T2
		L-45		N-6	44N, C42N	AG-4	HBLH	FE-70	W160T2
	Hot		*B-6E	N-5	43N, C45XL	AG-3	HBLH	FE-75	W175T2
	↑			N-4		AG-2	HLN	FE-80	W225T2 W240T2
3/4"			*B-7E				2HLN	FE-100	W240T17
			B-8EN	N-58R		AG-903	RL-47	FE-260	W310T17
	Cold		B-9EN			AG-603	RL-49	FE-280	W340T17
			B-10EN	N-55T		AG-403	RL-51	FE-300	W370T17
			B-11EN	N-53T		AG-203	R L-52	FE-320	W400T17
			B-12EN	N-52T			RL-53	FE-340	W440T17

The above comparisons have been made on a heat range basis.
This list is subject to change.

+ = .472" reach.

* = automobile type, not suitable for motorcycles.

YAMAHA

MOTORCYCLES



SERVICE MANUAL

COVERING
CONVERSION TABLES

CONVERSION FORMULAS FOR YAMAHA MOTORCYCLE SPECIFICATION & SERVICE DATA

LENGTH

1 meter = 3.281 feet
1 millimeter = 0.03937 inch

1 foot = 0.3048 meter
1 inch = 25.4 millimeter

WEIGHT

1 kilogram = 2.205 pound
1 gram = 0.03527 ounce

1 pound = 0.4536 kilogram
1 ounce = 28.35 gram

VOLUME

1 liter = 2.113 pint
1 liter = 0.2642 gallon
1 cubic centimeter = 0.061 cubic inch

1 pint = 0.4732 liter
1 gallon = 3.785 liter
1 cu. inch = 16.39 cu. centimeter

SPEED

1 Kilometer per hour = 0.6214 mile per hr. 1 mile per hr. = 1.609 kil. per.hr.

FUEL CONSUMPTION

1 Kilometer per liter = 2.352 mile per gallon

1 mile per gallon = 0.4252 kilometer per liter

AREA

1 square millimeter = 0.00155 square inch

1 square inch = 6.452 sq. centimeter
1 square inch = 645.2 sq. millimeter

1 square centimeter = 0.155 square inch

STRESS OR PRESSURE

1 kilogram per square centimeter = 0.01 kilogram per square millimeter
1 kilogram per square millimeter = 0.1422 pound per square inch
1 pound per square inch = 7.031 kilogram per square millimeter

HORSEPOWER

1 metric horsepower (ps) = 0.9859 horsepower = 0.7355 kilowatt

METRIC TABLE

1 kilometer = 1000 meter
1 kilogram = 1000 gram
1 liter = 1000 cubic centimeter

1 meter = 100 centimeter = 1000 mil.
1 millimeter = 1000 micron

YAMAHA

MOTORCYCLES



SERVICE MANUAL

**COVERING
ELECTRICAL COMPONENTS**

ELECTRICAL COMPONENTS

PRINCIPLES & TESTS

INDEX

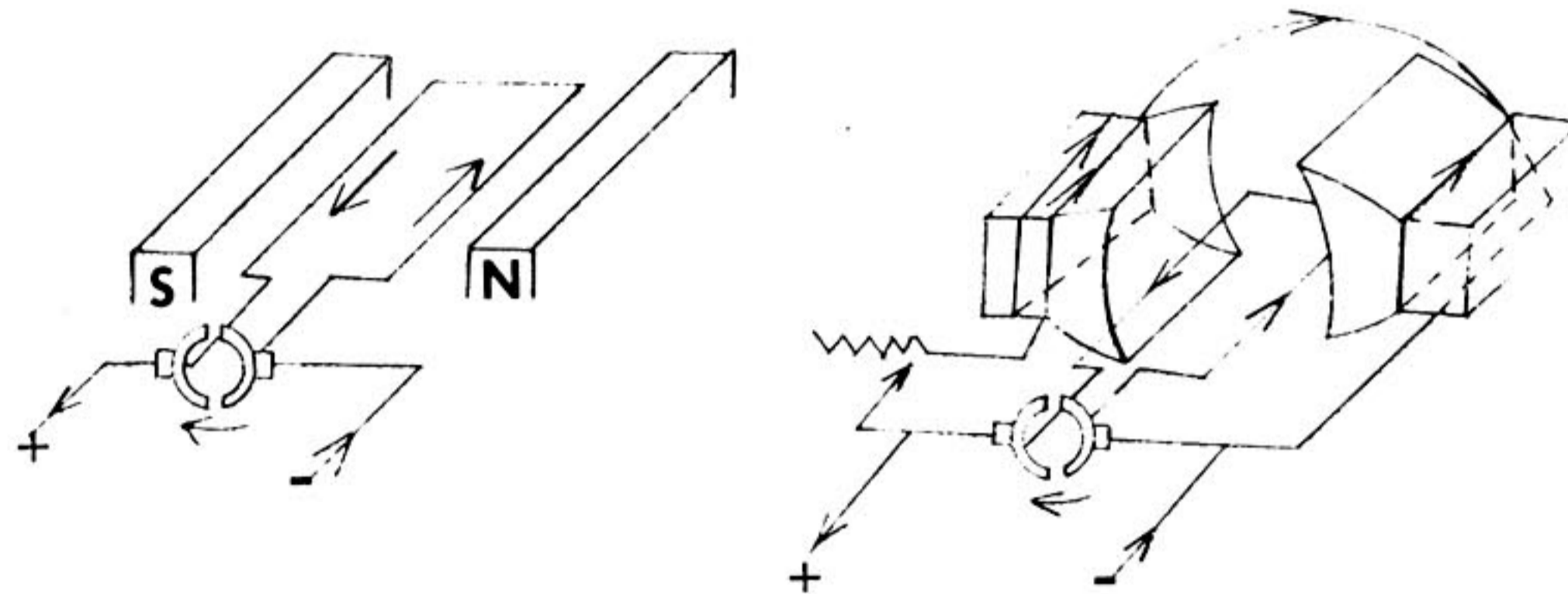
- I - GENERATOR SYSTEMS
 - 1-DC Generator (dynamo)
 - 2-Magneto
 - 3-Starter Motor (integral with Generator)
- II - REGULATOR
- III - CUT-OUT
- IV - IGNITION COIL
- V - HORN
- VI - STARTER SWITCH
- VII - BATTERY
- VIII - YAMAHA ELECTRO-TESTER
- IX - RECTIFIER (SELENIUM) CHECKER
- X - ELECTRICAL SPECIFICATION TABLES (2)

Please note that in the following material the word "continuity" is used whereas in practically all cases it should read "continuity and/or resistance" for the sake of technical correctness. The word continuity indicates a perfunctory check; that is to say, we may check out an item to see if it is good or bad, and if it is bad we throw it away and replace it with a new one. But if it is bad, and we want to find out how bad, then we should carry this test out on the resistance basis and find out exactly how far from specifications it does deviate. So if we are "super-tuning", then we should extend each test to the resistance basis and actually identify our weak points before they become absolute failures and thus narrow down our margin of failure. The specification sheet contains all the information necessary for this type of "super-tuning", if such is desired.

I. GENERATOR

1. D.C. Dynamo with self-exciting fields.

A. Principle: When a wire is passed through a magnetic field, an electrical potential is created within that wire. This principle is the basis of construction of all generators. If this wire takes the form of a rotating armature and the magnetic poles become the outer fields, then the generated current is carried out in a DC form if a commutator is used. The field poles are energized by the field coils through which electrical current is shunted. Electrical current is generated by the application of sufficient force to rotate the armature between these magnetic poles.



B. Maintenance: Generally when checking the generator for charging current that is too high, you find that the lights are too bright, bulbs burn out, and fuses are blown. When the charging current is too weak, lights are dim and the battery runs down. Identify the trouble by simple tests.

The following methods are used to check by external appearance and by the use of the electrical tester:

B-1 Check by external appearance for the following conditions:

- a. Wires are connected correctly and securely.
- b. Oil and/or water spots. Wipe dynamo clean.
- c. Dust from the carbon brush is short circuiting the dynamo. Wipe the dynamo.
- d. The face of the carbon brush is rough. The crankshaft is not centered correctly and/or the armature is not concentric.
- e. The carbon brush is worn out. When the brushes get shorter than the recommended minimum, replace.
- f. The commutator of the armature is dirty and the face is rough. Use fine sandpaper and smooth it out. Hold the sandpaper lightly and turn the armature evenly to get a balanced commutator.

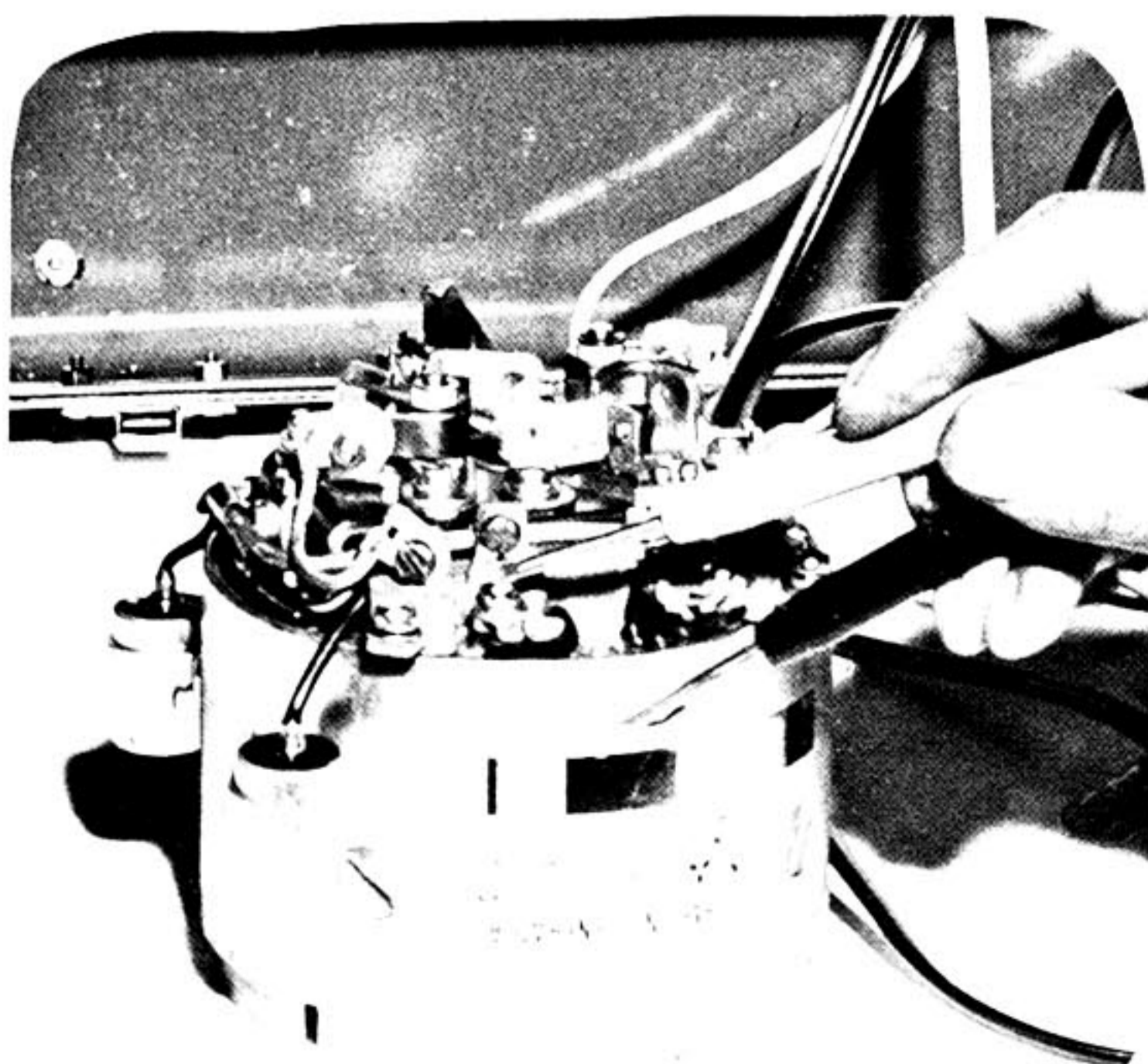
- g. The mica gap is filled with carbon. Use a thin bladed knife and clean the gap to the set depth.
- h. The soldering of the armature is broken. Resolder.
- i. Carbon brush spring is too weak. Replace.



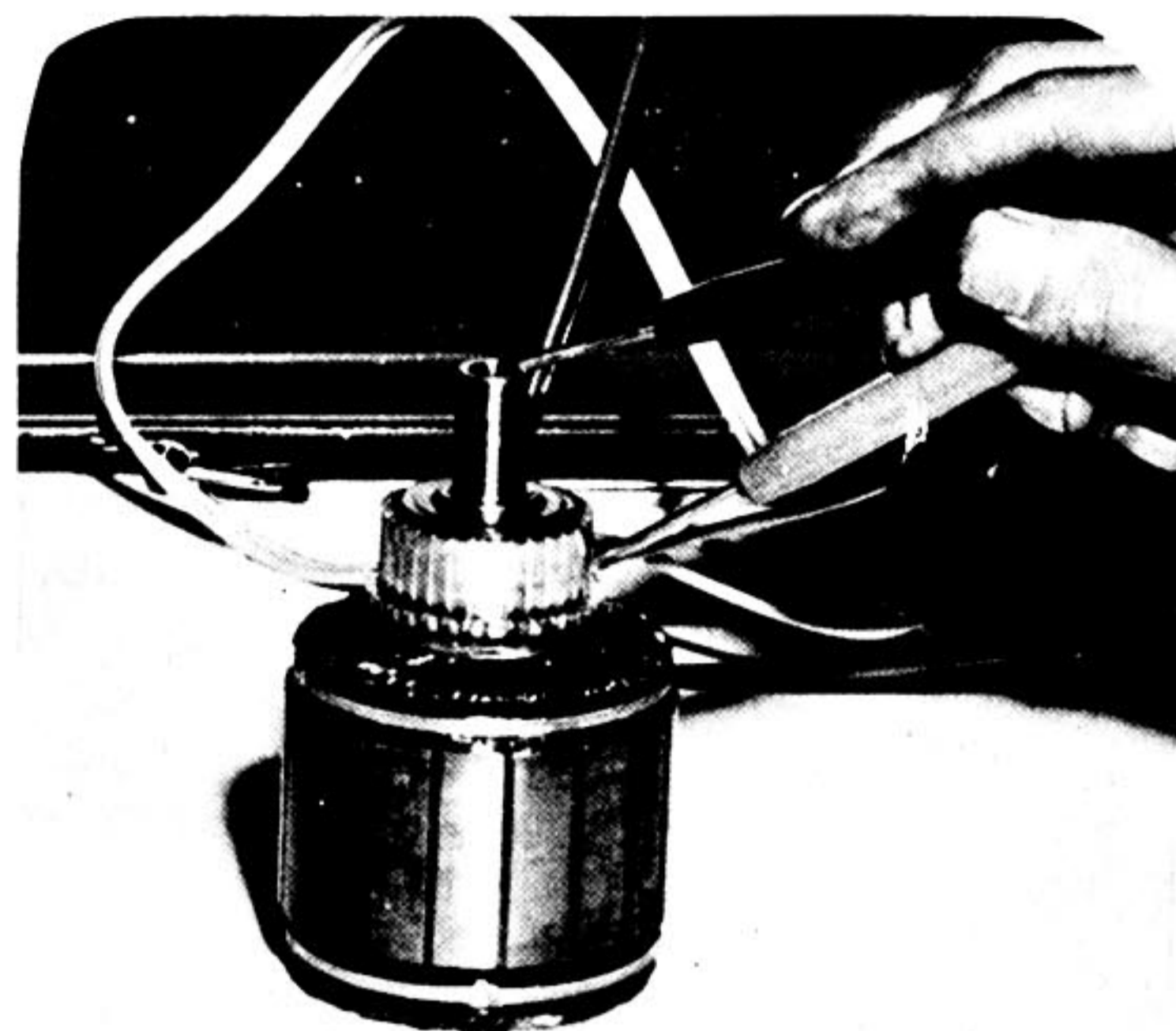
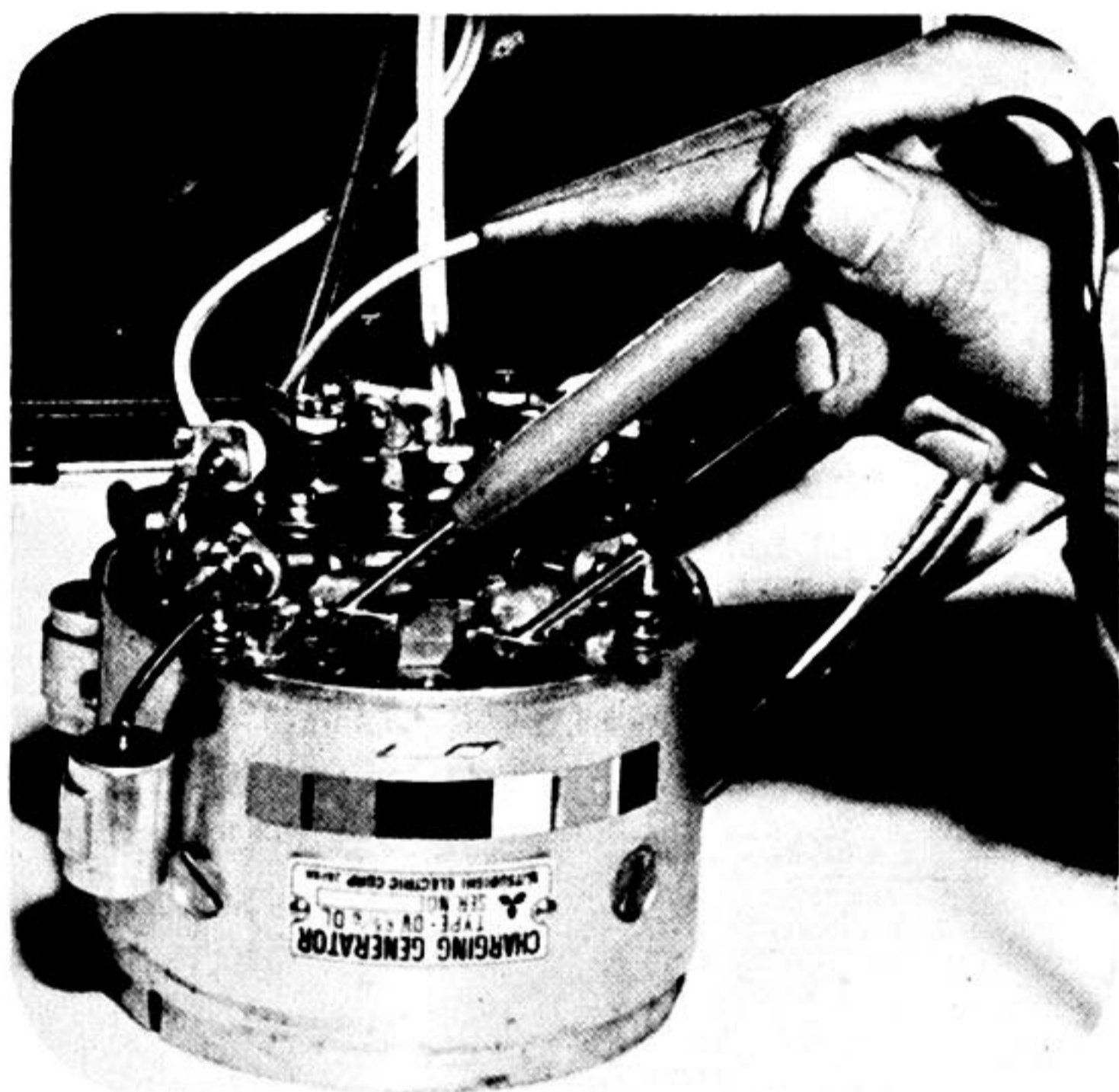
B-2 Electrical Tester Use:

Remove all wires of the wire harness. Remove the dynamo and check for the following:

- a. Insulation of the terminal. - By using the tester, check the insulation of each terminal of the dynamo and the yoke. If the insulation is faulty, check for shorted rivets and carbon dust on the terminal plate. Usually these are the causes of short circuits.
- b. Insulation of the positive carbon brush: The positive carbon brush^{is} insulated from the yoke. If the insulation is faulty, the brush holder and yoke are causing the short circuit.

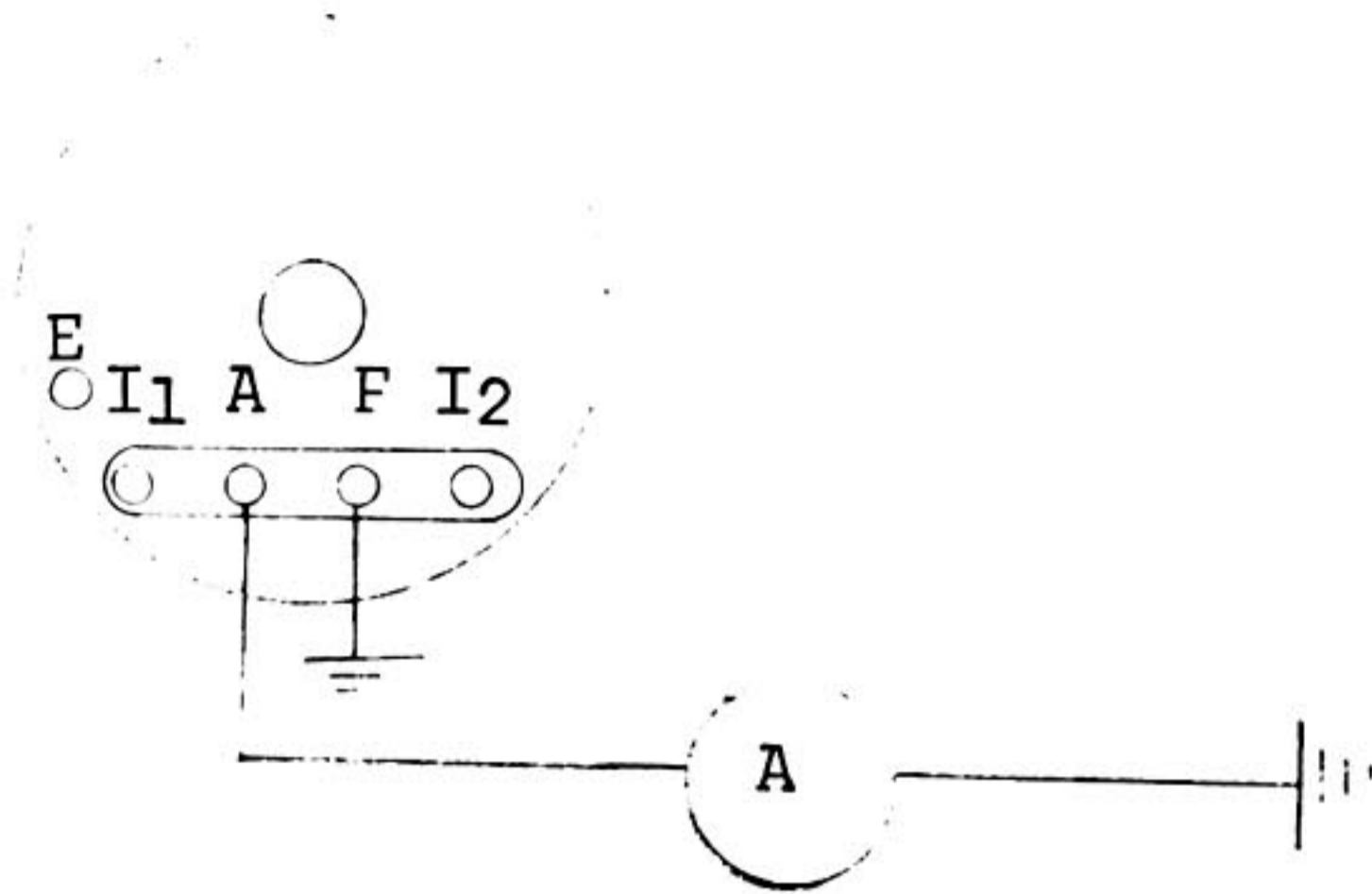


- c. Testing the field coil - Remove inlet wires from terminal "A" and "F". Attach tester lead wires to terminal "A" and "F" for continuity and resistance. If there is no continuity between the two wires, the field coil is faulty (wire is broken). If the wire is not broken check "A" or "F" wire of the yoke for insulation. If there is a shortage, it is in the field coil of the yoke.
- d. Armature Insulation - If there is continuity between the armature body and armature commutator, there is a short. Replace the armature.



- e. When all the above (continuity, resistance and insulation) have been tested and everything checks out, use the following method to check the voltage. Install the dynamo on the engine. Ground terminal inlet wire "F". Connect the voltage tester lead wire (+) to terminal "A" and (-) to ground. Start engine and run at approximately 1600 rpm, (over this rpm, the dynamo will be damaged). Use tester, and check the generating voltage. Usually if there is no voltage, the armature is faulty. Repairing the armature is very complicated and it is more economical to replace it.

Rewire all wires (inlet and wire harness). Start the engine and run up to 2500 to 3000 rpm. Check the generating voltage from terminal "A". If the voltage is higher or lower than specified voltage (without battery), it is then necessary to check the regulator. (See illustration on next page.)

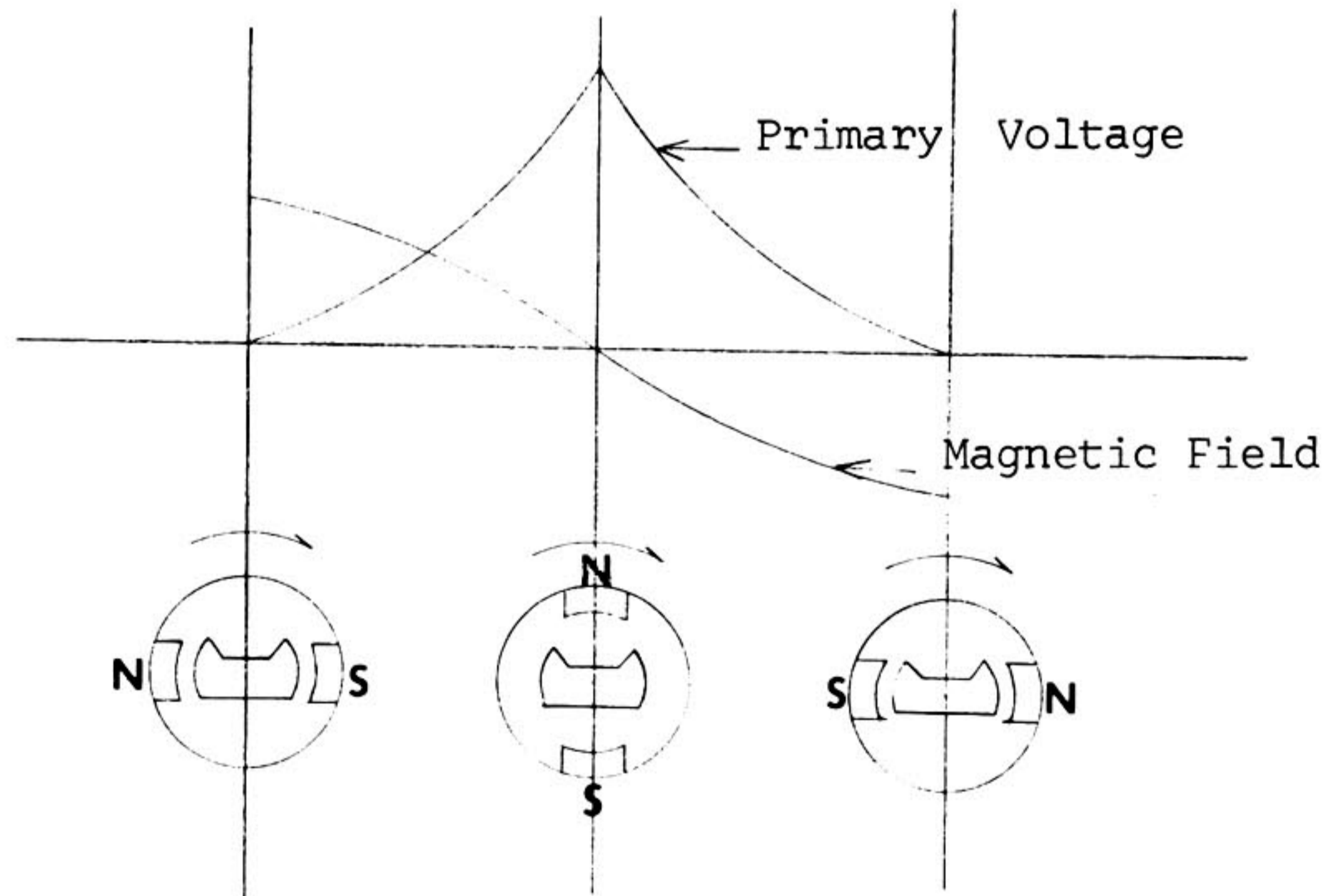


2. Magneto:

A. Principles of ignition and lighting systems:

A-1 Ignition:

The rotation of the crankshaft revolves the flywheel which contains a permanent magnet. This magnetic field passes across the static coil which is thus excited and produces an electrical potential. This primary current goes through the contact breaker and condenser and into the ignition coil where it is transformed into a higher (secondary) voltage which is carried to the spark-plug to cause ignition.



A-2 Lighting:

Electricity is made in the same manner as above. This electricity is used for lighting or charging. When the engine rpm is high, the flywheel turns fast. The electricity (no load voltage) that comes out of the light coil will rise with increased flywheel revolutions. When this voltage is connected to a load with the light coil inductance, the resistance of AC will increase. This action is the basis of regulation of voltage. When used for charging the battery, this current first passes thru the selenium rectifier and is changed to DC.

A-3 Ignition coil (Secondary Circuit):

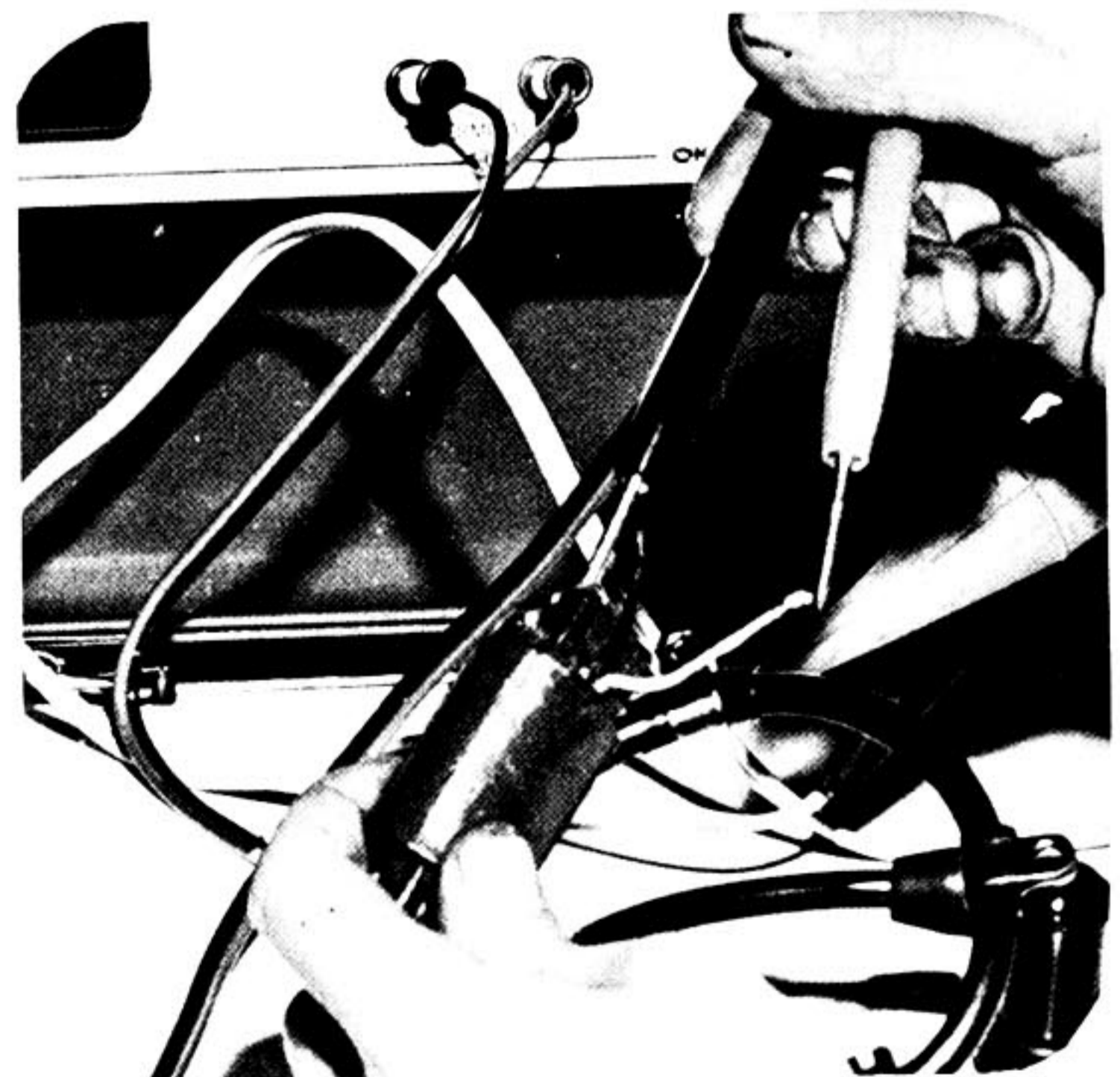
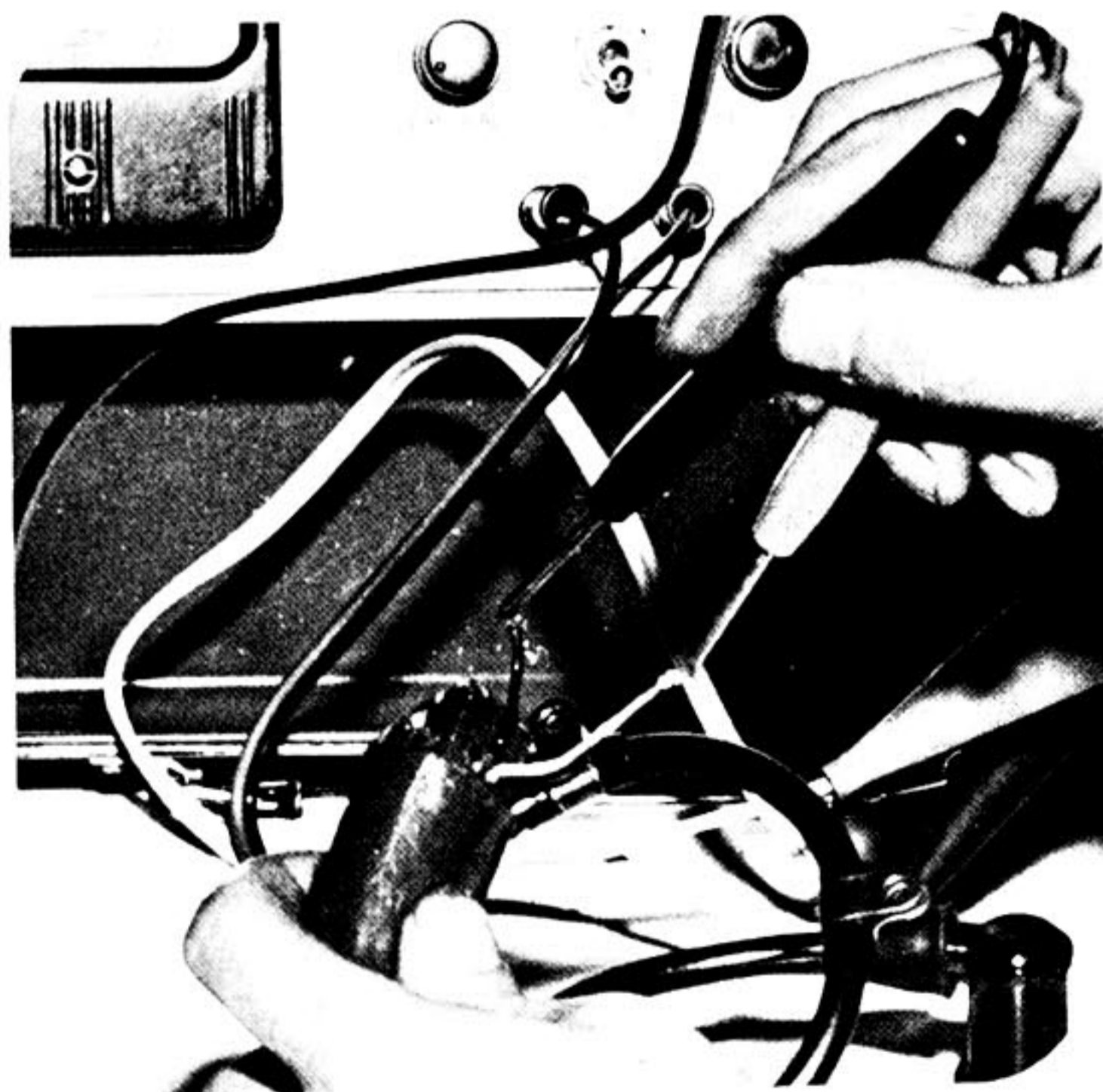
This type of ignition coil system has the ignition coil separated from the magneto, and the power source comes from the primary ignition coil which is the magneto.

B. Maintenance:

1. Check by external appearance for the following conditions:
 - a. Wire connections are correct and secure.
 - b. Oil and water spots. Clean magneto.
 - c. For damaged or uneven points of contact breaker. Replace or use fine sandpaper to make the contact points even.
 - d. Weakened condition of the magnet in the flywheel. When the ignition coil, contact breaker and condenser are good; dim lights and a weak spark usually indicate a weak magnet in the flywheel. Replace the flywheel. The magnet in the flywheel could be recharged with magnet recharger.
 - e. The ignition coil and light coil could be burnt out from excessive heat. If so, replace.
 - f. Check whether the flywheel and armature are touching. If so, the crankshaft is eccentric or the diameter of the coil pole is too large.

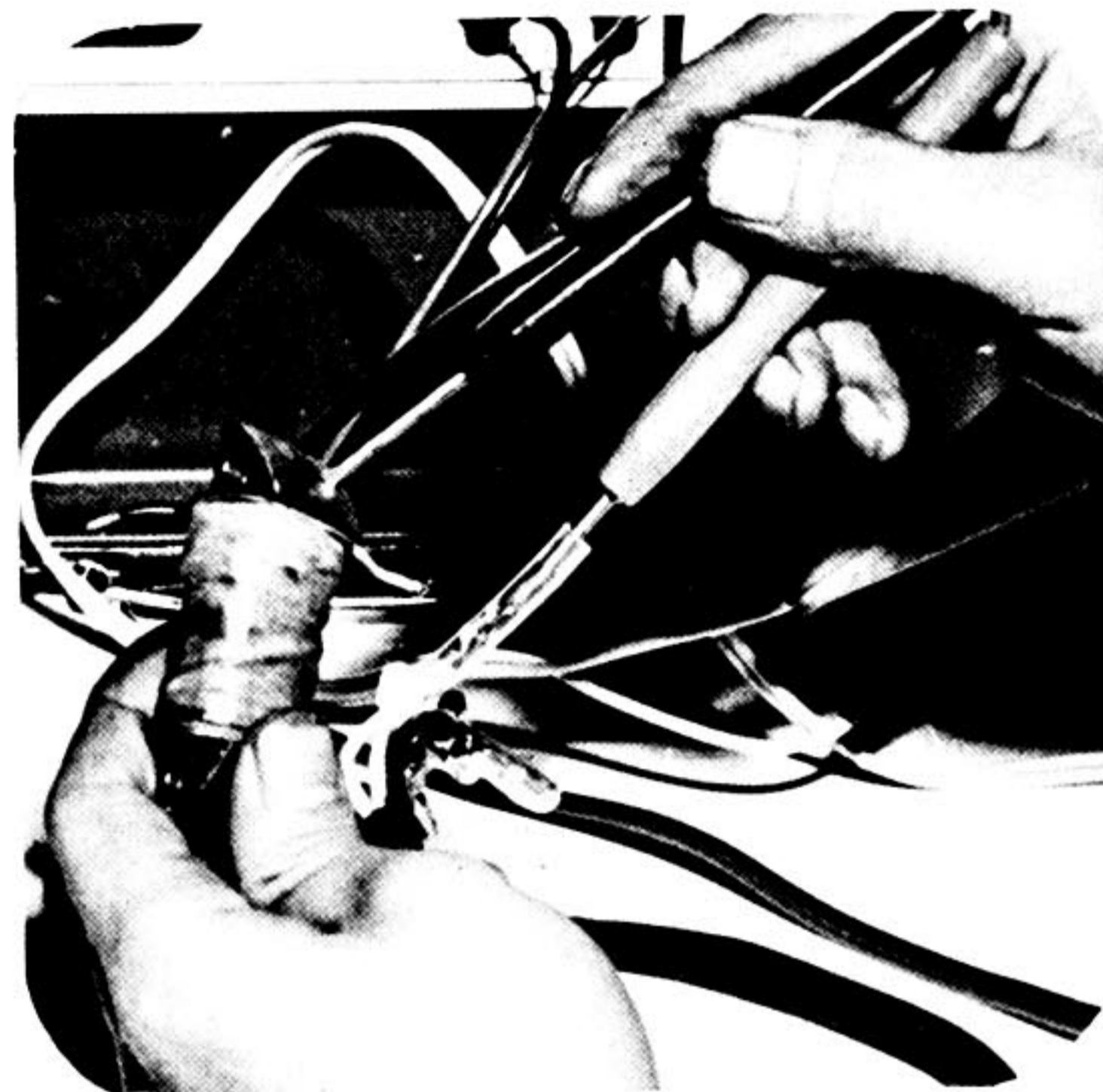
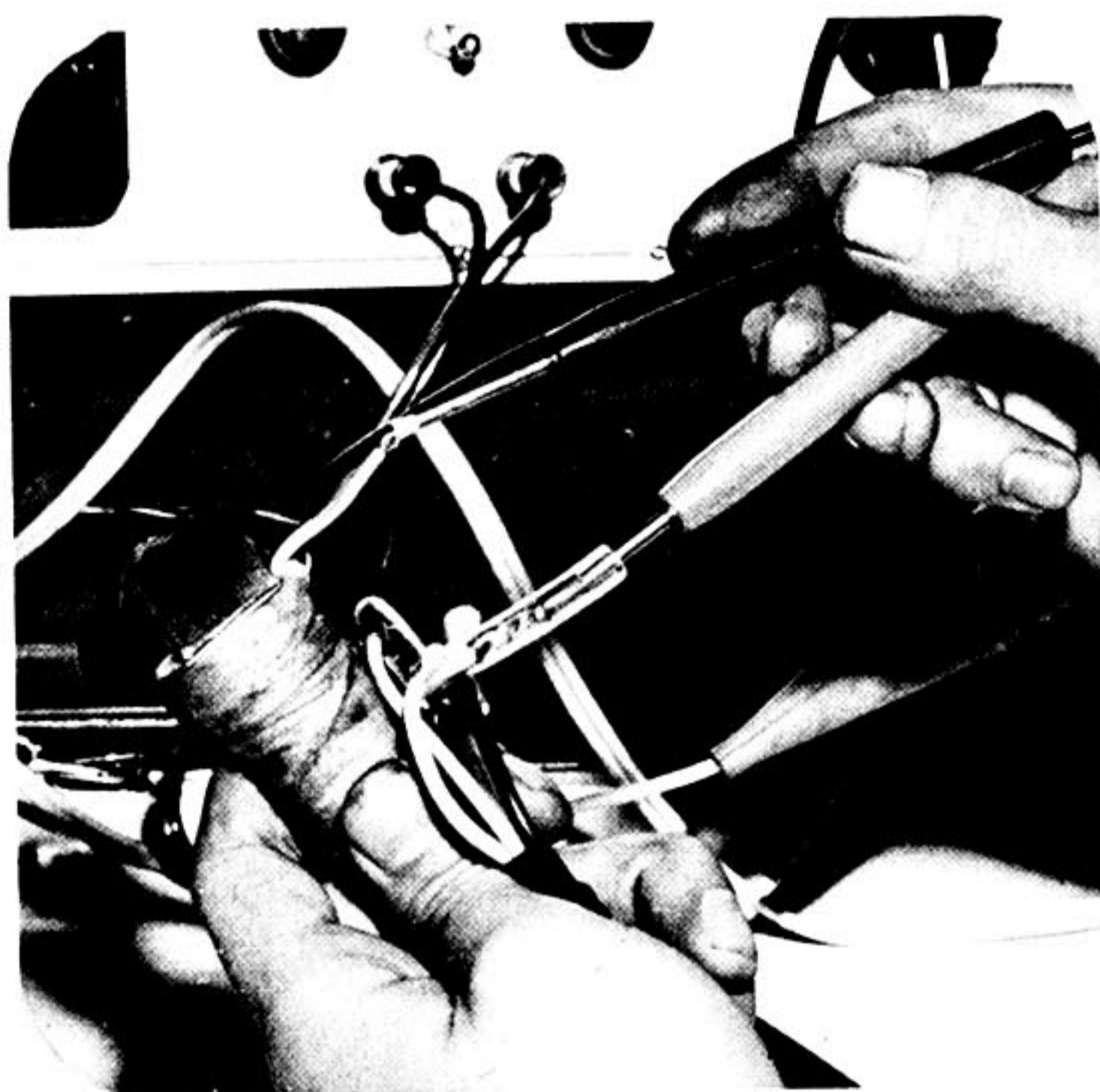
C. Electrical Tester Use:

1. Ignition coil - Remove. Check the continuity of the low tension wiring for a broken wire. Replace if faulty. Check for insulation, use one low tension wire and ground (body of ignition coil). If there is continuity, this indicates a short in the coil. Replace.



2. Light coil - Remove. All three wires should have continuity with each other and with the core since they are all inter-connected and grounded.

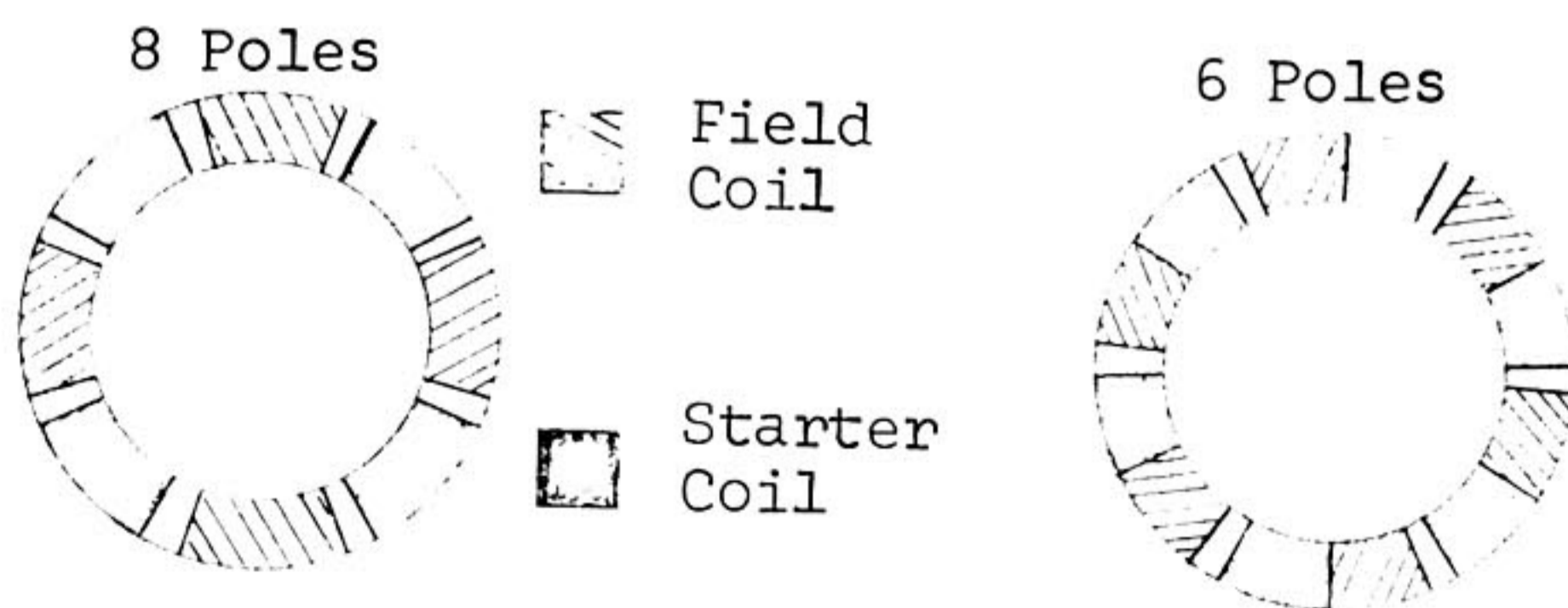
3. Primary Ignition coil - Remove magneto ignition coil and check the two wires for continuity which should exist. Next remove one tester from the wire and touch it to the core. This should show an open circuit from wire to ground. If there is continuity, it indicates a defective internal ground.



3. Starter, integral with generator.

A. Principle:

The dynamo assembly is equipped with two kinds of field coils. One is for the starter, the other is for the generator. When the starter button is pressed, a large amount of current goes into the dynamo starter coil. The armature becomes a motor and turns, rotating the crankshaft.

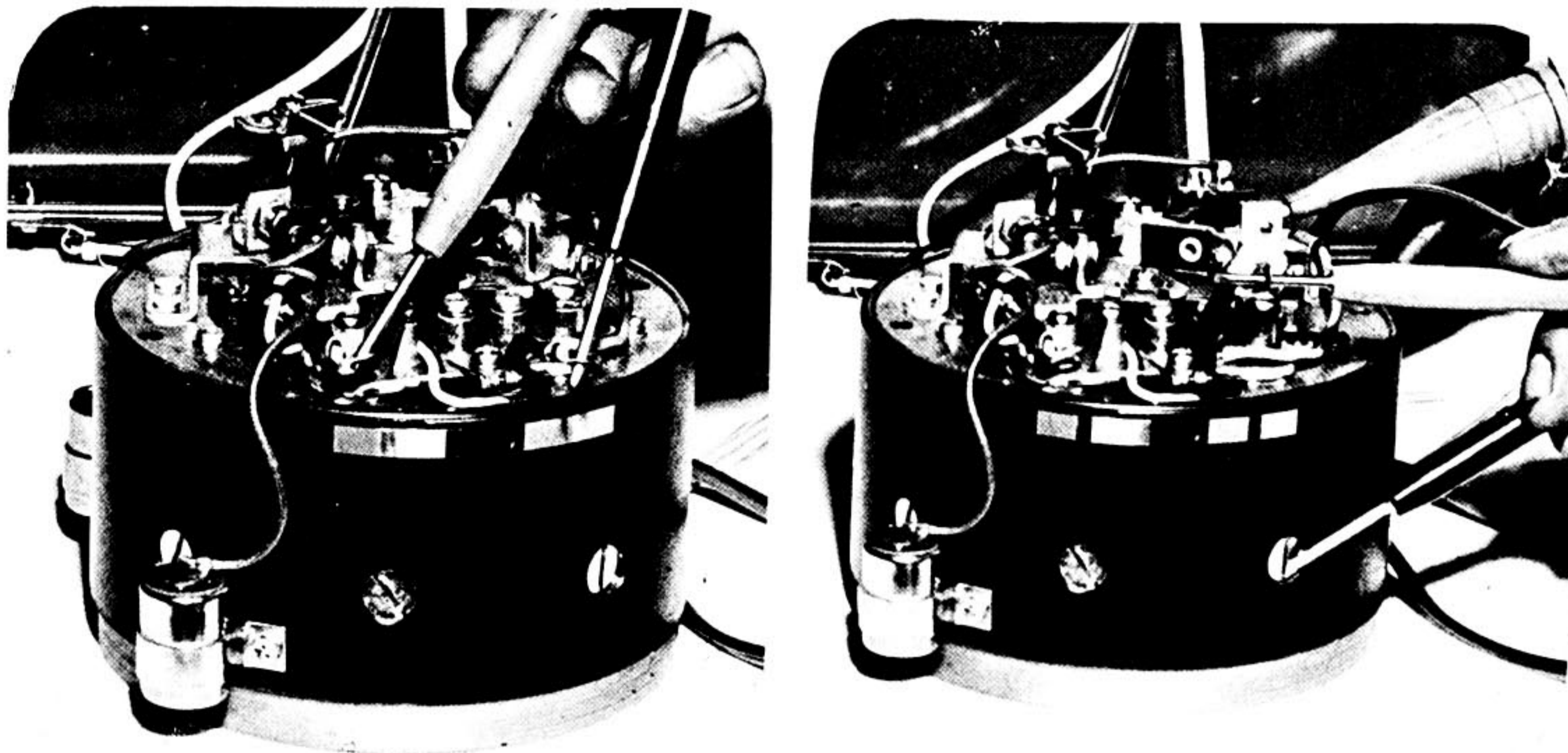


B. Maintenance:

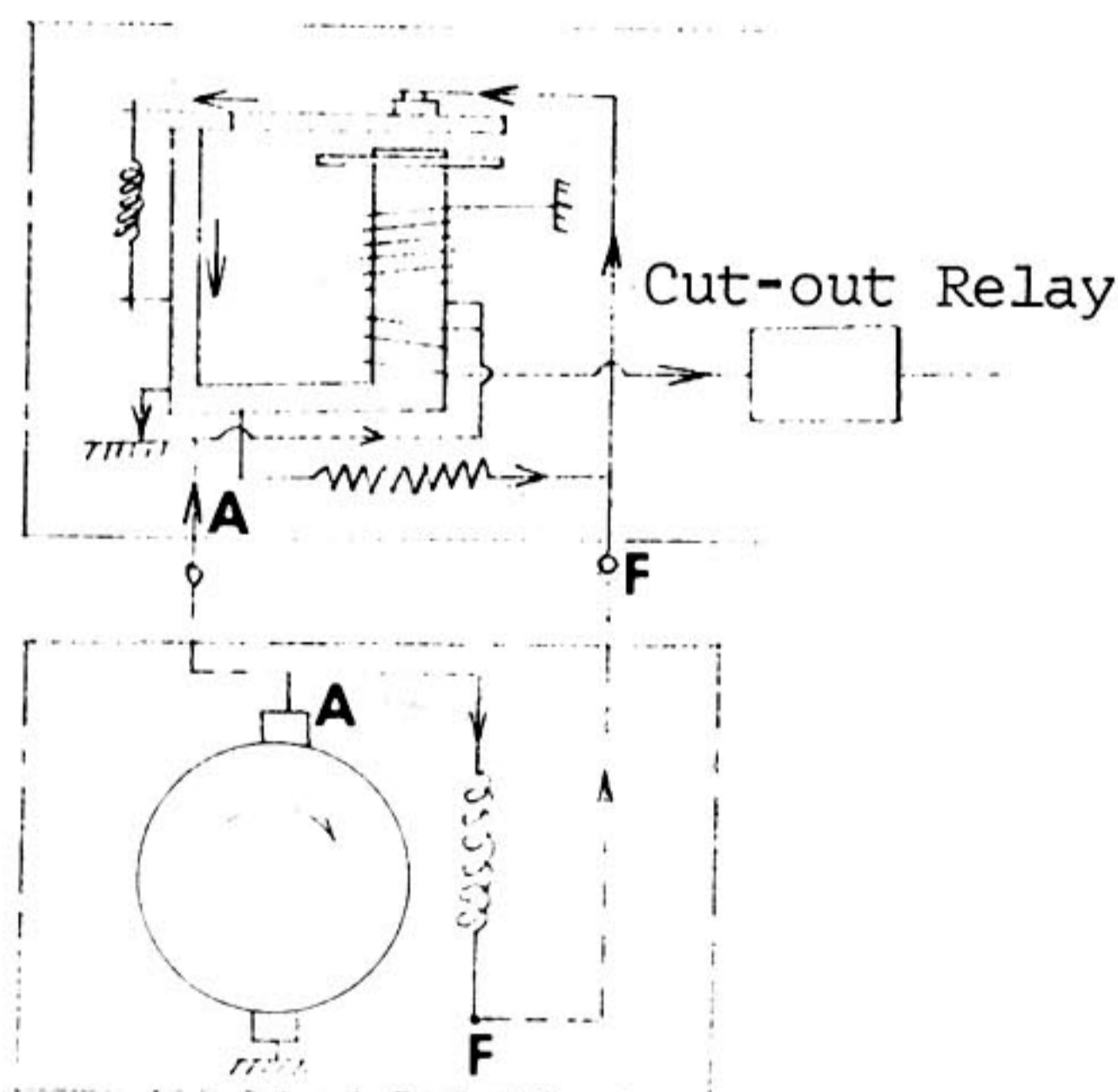
Checking and repairing the dynamo starter action is similar to the generator. The starter dynamo has its own carbon brushes and starter coils. To check these, the following steps are recommended.

- a. Brushes-Check the positive brushes for insulation between the yoke and brush holder. If there is no insulation, repair.

- b. Starter coil - Remove wires "M", "F" and "A" from both inlet and outlet (wire harness). Check the continuity between inlet wires "M" and "F". If there is no continuity, the wire in the starter coil is broken. Check wire "M" (inlet) and yoke for insulation. If there is no insulation (faulty), the coil is shorted to the body.



- c. The starter dynamo is influenced by the conditions of the dynamo. Make sure the battery, switch and wires are in good operational condition.



II. REGULATOR (Point Type for DC current)

A. Principle:

The voltage that is produced by the generator will rise with increased revolution of the engine, so this electricity cannot be used directly for charging and lighting. The main function of the regulator is to regulate the voltage. The principle components are a spring which works to keep the points closed and a magnet which works in the opposite direction and opens the points to break the circuit.

When the revolution of the engine is low, the voltage will be low. The resultant electrical magnetic force will be weaker than the adjusting spring, so the points will remain in contact. With this action, the current from the generator will pass into the field coils, increase their magnetism and increase the voltage generated. With the increased voltage, the electric magnetic force in the regulator becomes stronger, and this releases the points. This reduces the field coil voltage, and the generated ~~points~~ voltage is decreased. The points then make contact again and this action is repeated to regulate the voltage.

B. Maintenance:

The Yamaha regulator and cutout relay are assembled together in one case.

When the dynamo is in good operational condition, the following 4 types of malfunctions of the regulator may exist: These should be checked and adjusted.

1. No charge to battery
2. Insufficient charging amperage
3. Over charge
4. Uneven charging rate

B-1 Check by the appearance of regulator for:

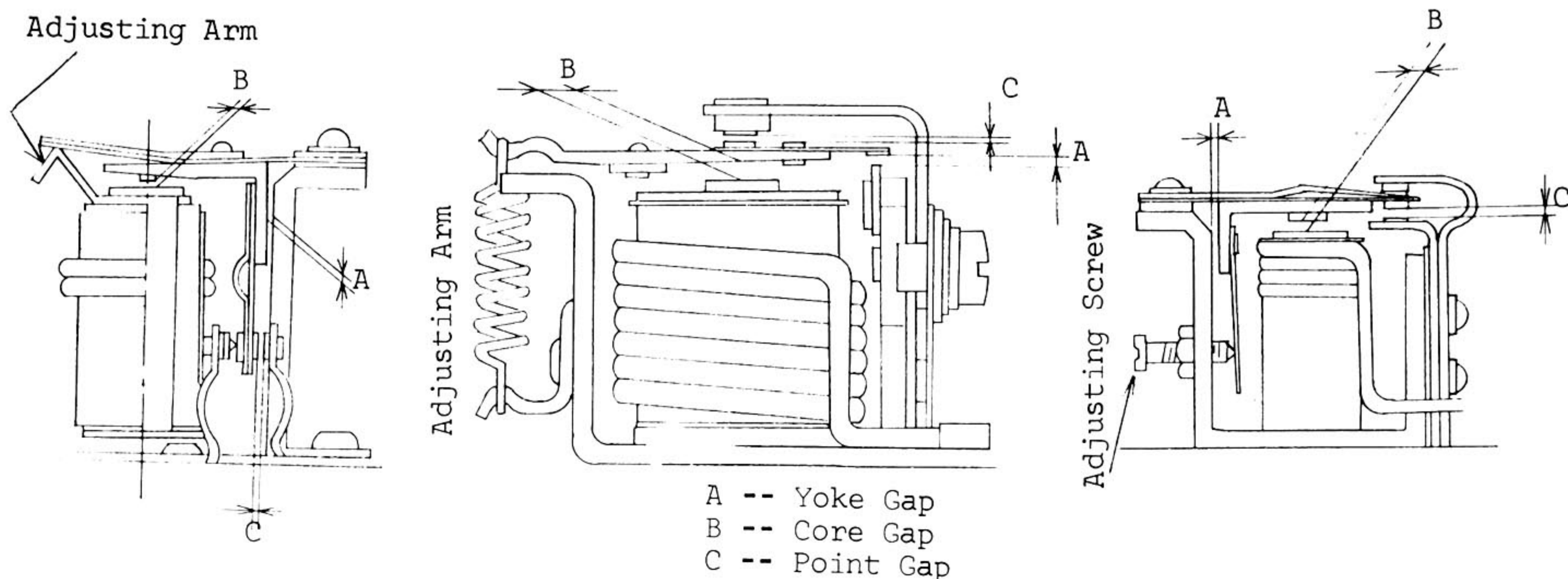
- a. Dirty points or core gaps.
- b. Burnt points
- c. Burnt coil
- d. Soldering broken or loose screws
- e. Short in lead wires
- f. Regulator poorly grounded

B-2 Testing of the insulation and resistance by use of the tester:

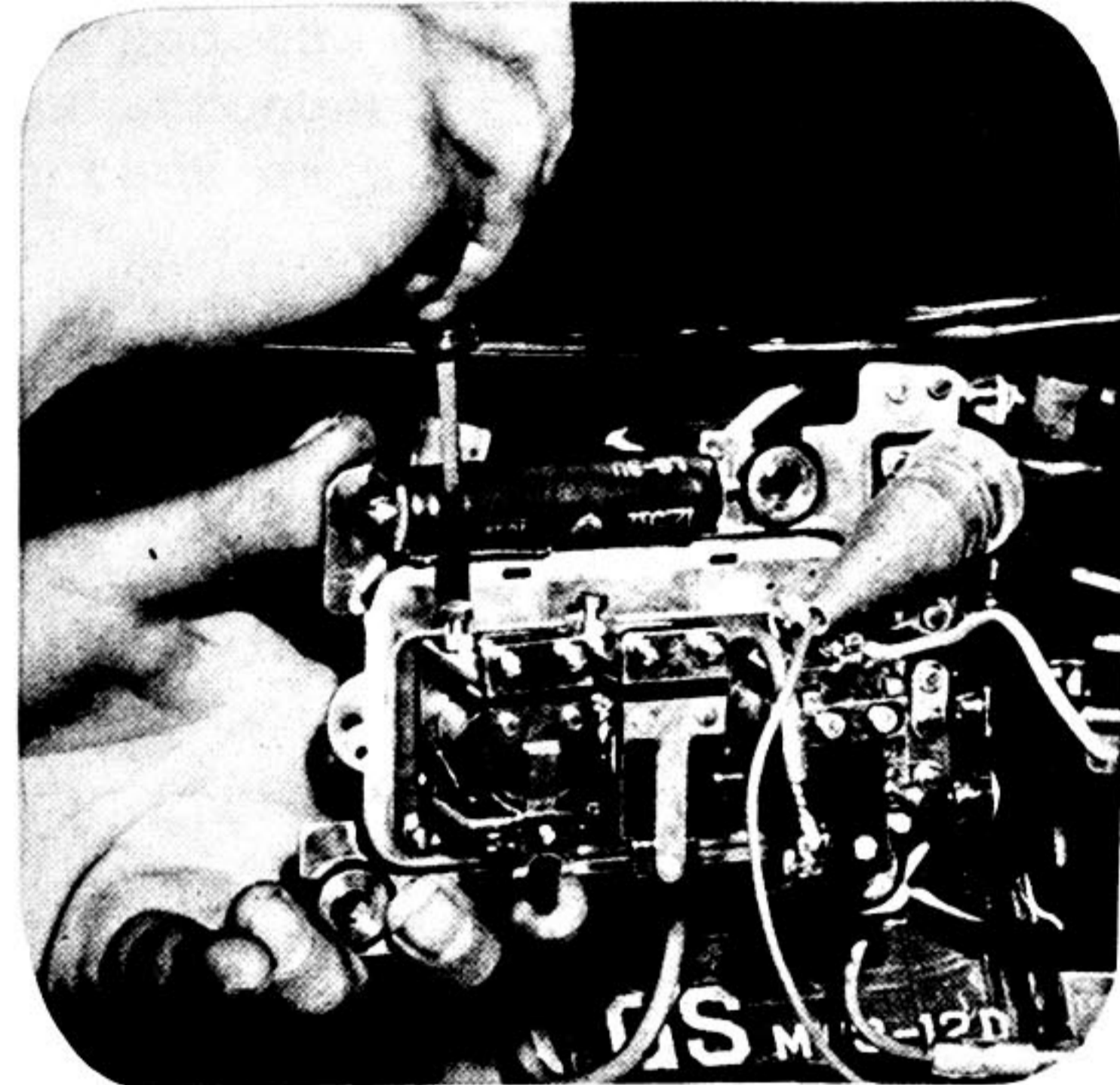
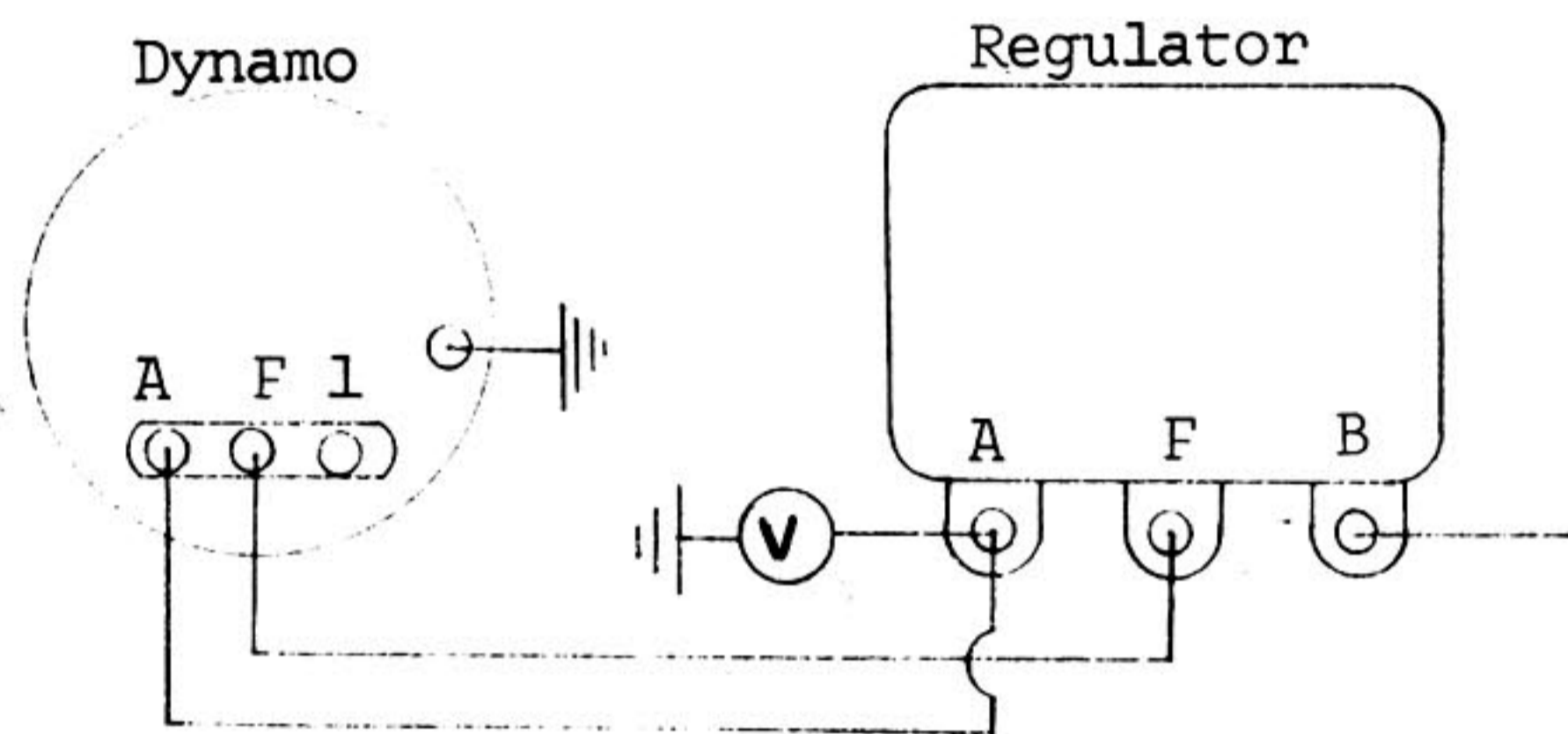
- a. Break in line of the coil lead wires.
- b. Short in voltage coil
(Test without tester) - connect battery, (proper voltage) positive to terminal "A" and negative to ground. Slip a small piece of flat steel into the electro magnetic field (core gap). If it pulls the metal, the coil wire is not broken.
- c. Resistance of the regulator (See specification Tables)

B-3 Adjustments of the regulator - The following steps are divided into mechanical adjustments and electrical adjustments:

- a. Mechanical adjustment - When disassembling or reassembling the regulator, set the yoke, point, and core gaps in accordance with specifications. Adjust the yoke, ~~gap,~~^{core,} and point gaps in this order, by bending the arm or using the adjustment screw.



- b. Electrical adjustment - Use the volt meter by connecting positive lead wire to the terminal "A" and ground the negative lead wire. Turn the engine to 2500 to 3000 RPM than take the voltage reading. If the voltage is higher or lower than specification, use the following adjustment procedure: Tightening the adjusting spring will cause the voltage to rise. When reducing the voltage, loosen the adjusting screw or lower the adjusting arm.

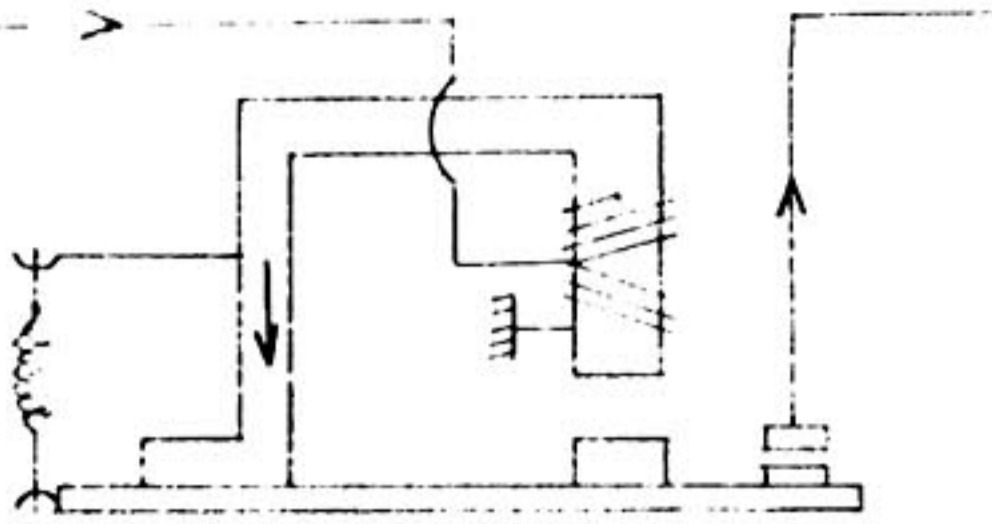


C. Related precautionary measures:

1. Disconnect the battery after starting the engine, and check the generated voltage, (no load voltage).
2. After adjusting the regulator, check for loose screws and connections. If found, recheck voltage reading.
3. When changing into higher RPM range, there is a slight difference in voltage from standard setting. If there is a difference of 0.5 Volt or more, check the gaps in the regulator. With high RPM and resultant drop, the core gap is less than that used in setting at higher (low RPM) voltage, and vice versa.

A. Principle:

When the generator output drops, current from the battery flows back to the generator. To stop the back-flow, the cut-out relay is used to break the circuit. A regulator is basically a set of points with a magnetic coil opposed by a spring. When the revolution of the generator drops, causing low voltage, the adjusting spring is stronger than the electrical magnetic force and the points are separated, breaking the charging circuit. When the generator RPM rises and the electrical magnetic force becomes stronger, this forces the points to contact at a predetermined voltage.



B. Maintenance:

When the generator and regulator are in good condition; the following three types of malfunctions are to be checked and adjusted:

- a. No charge.
- b. Insufficient charging amperage.
- c. Uneven charging rate.

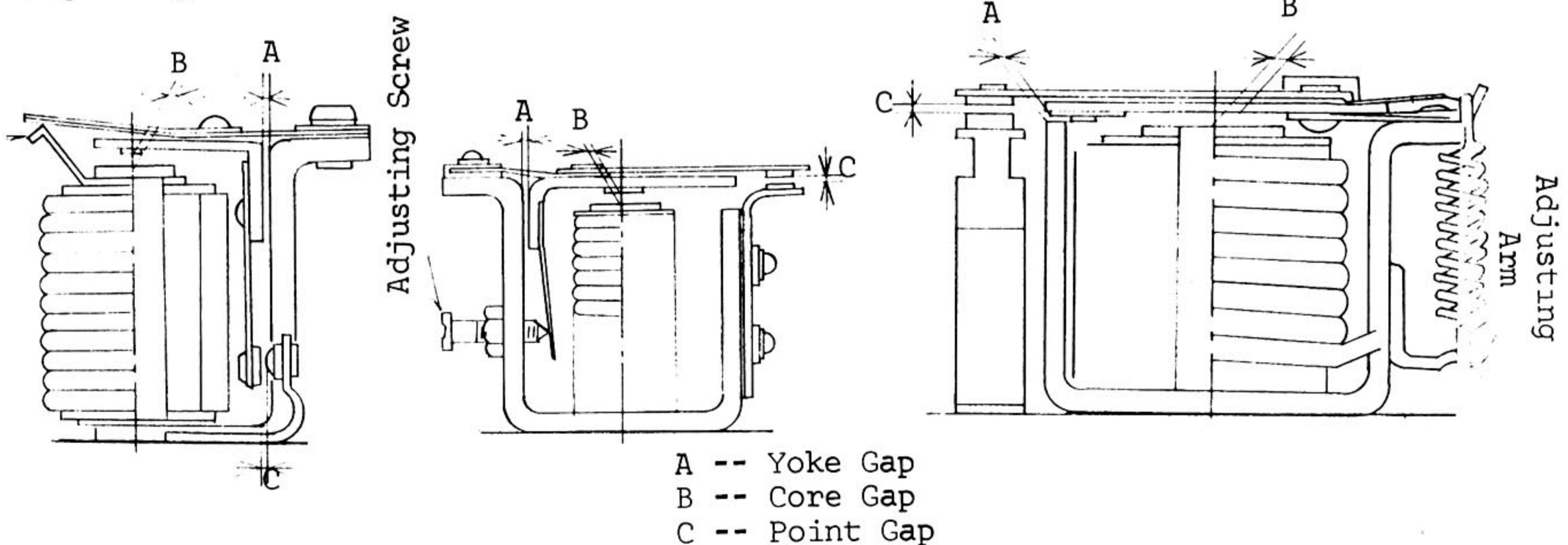
B-1 Checking by the appearance of cutout relay

Check the cutout relay in the same manner as in II-B-2 (regulator)

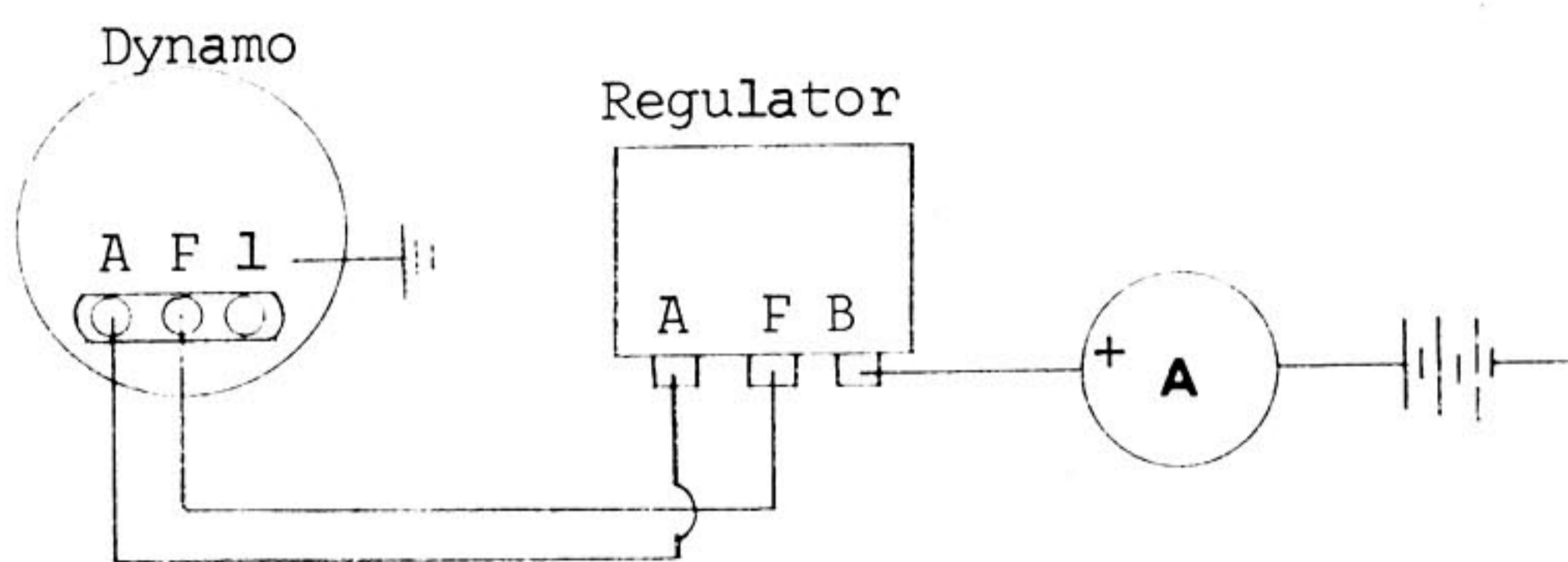
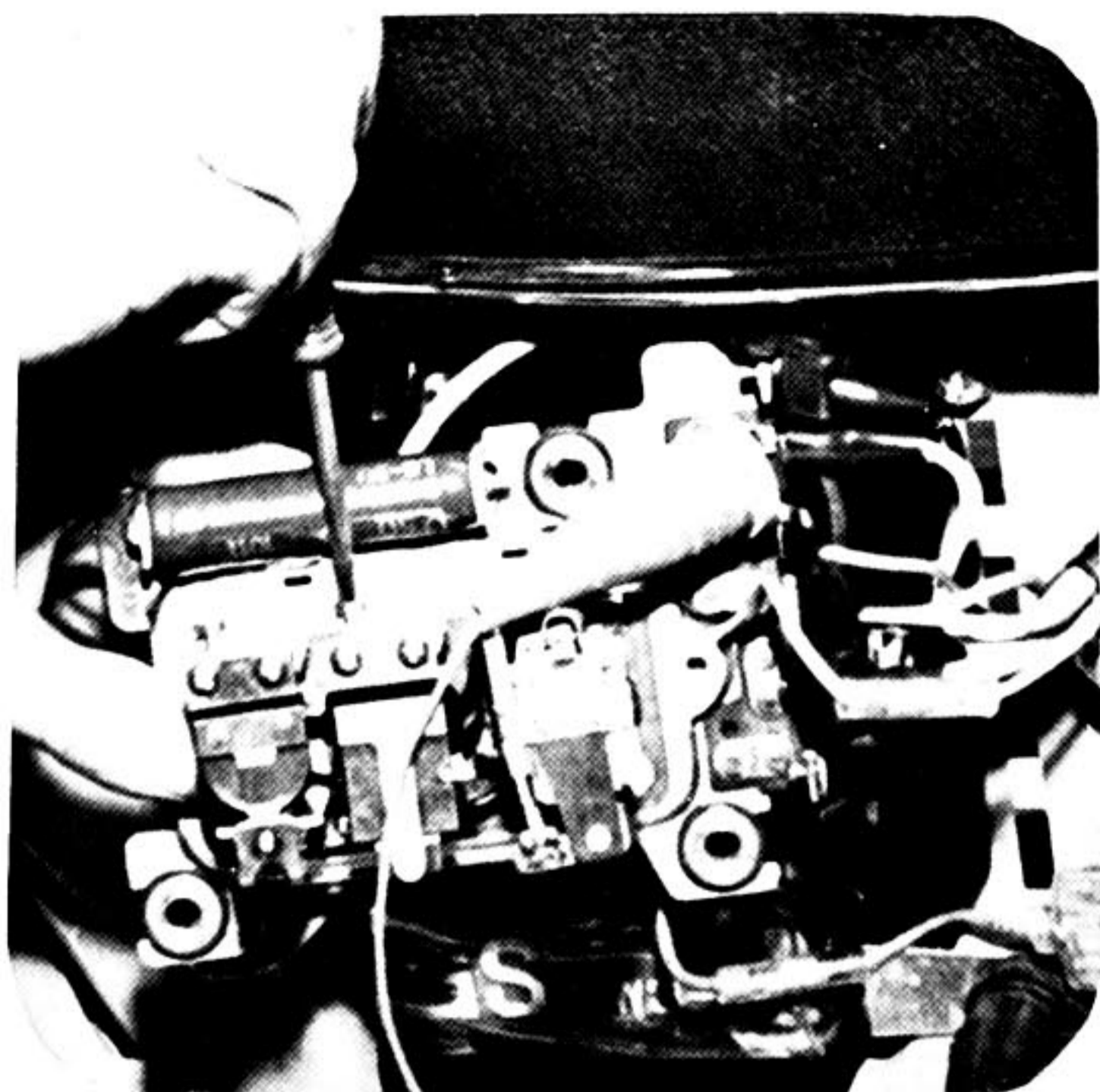
B-2 Adjustment of cutout relay

- a. The Mechanical adjustments are the same as in II-B-3 (regulator)

Adjusting Arm



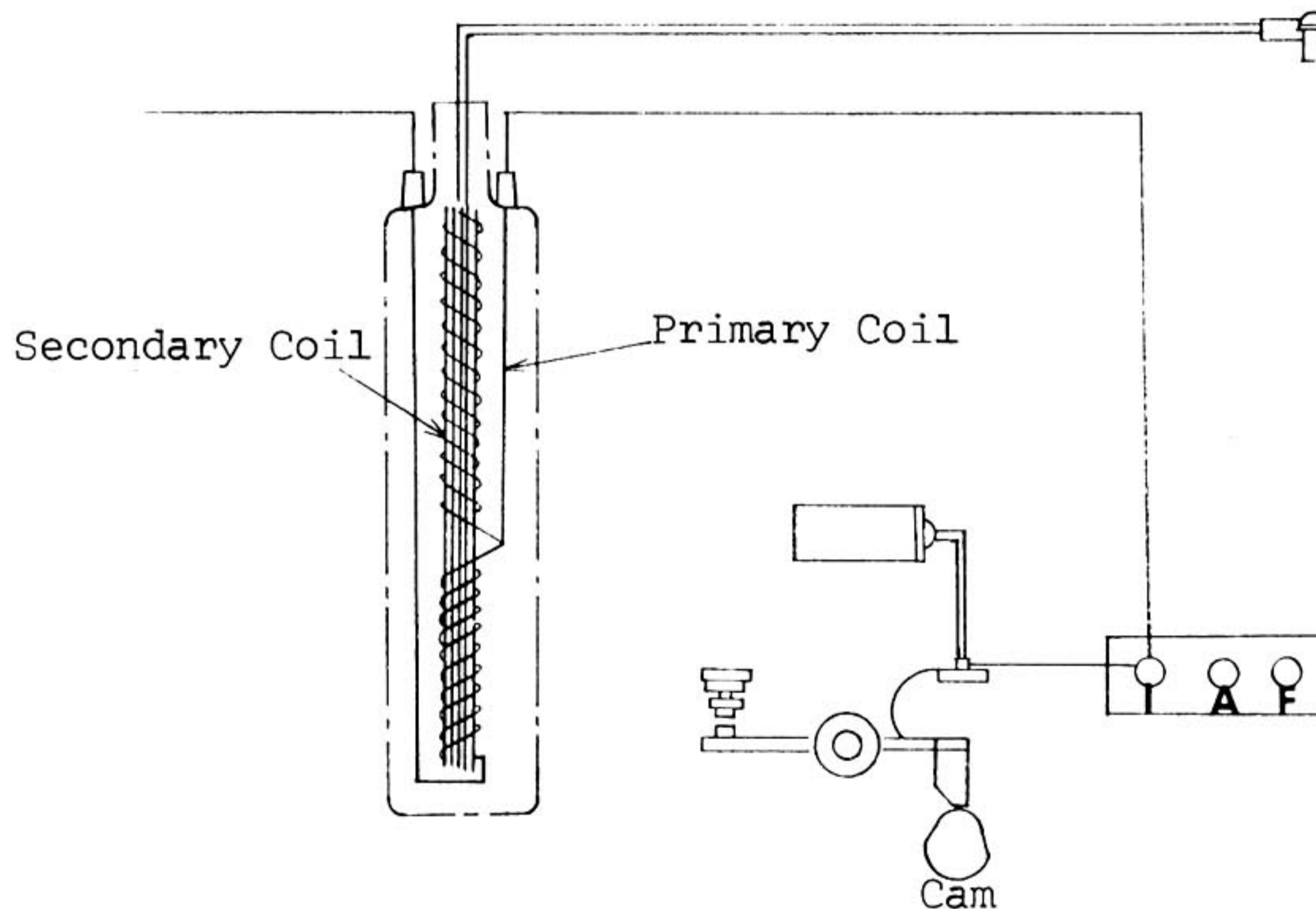
- b. Electrical adjustment-Using the electro tester with the same connection as in the adjustment of regulator, measure the cut-in voltage. When the voltage is higher than specification, loosen the adjusting spring to bring the cut-in voltage down by using the adjusting screw or adjusting arm. With the electro tester, check the charging rate. Remove the fuse and make a series connection with the amp meter. The ampere rate will be different depending on the condition of battery being used.



IV. Ignition Coil.

A. Principle:

In the ignition coil there are the high and low tension coils. The ignition coil is a form of a transformer which produces a high secondary voltage. The terminal of the low tension coil is connected to the battery, contact breaker and condenser. The contact breaker connects and disconnects the current in the low tension coil. When the ^{low} tension current is disconnected, the high tension coil generates high voltage.

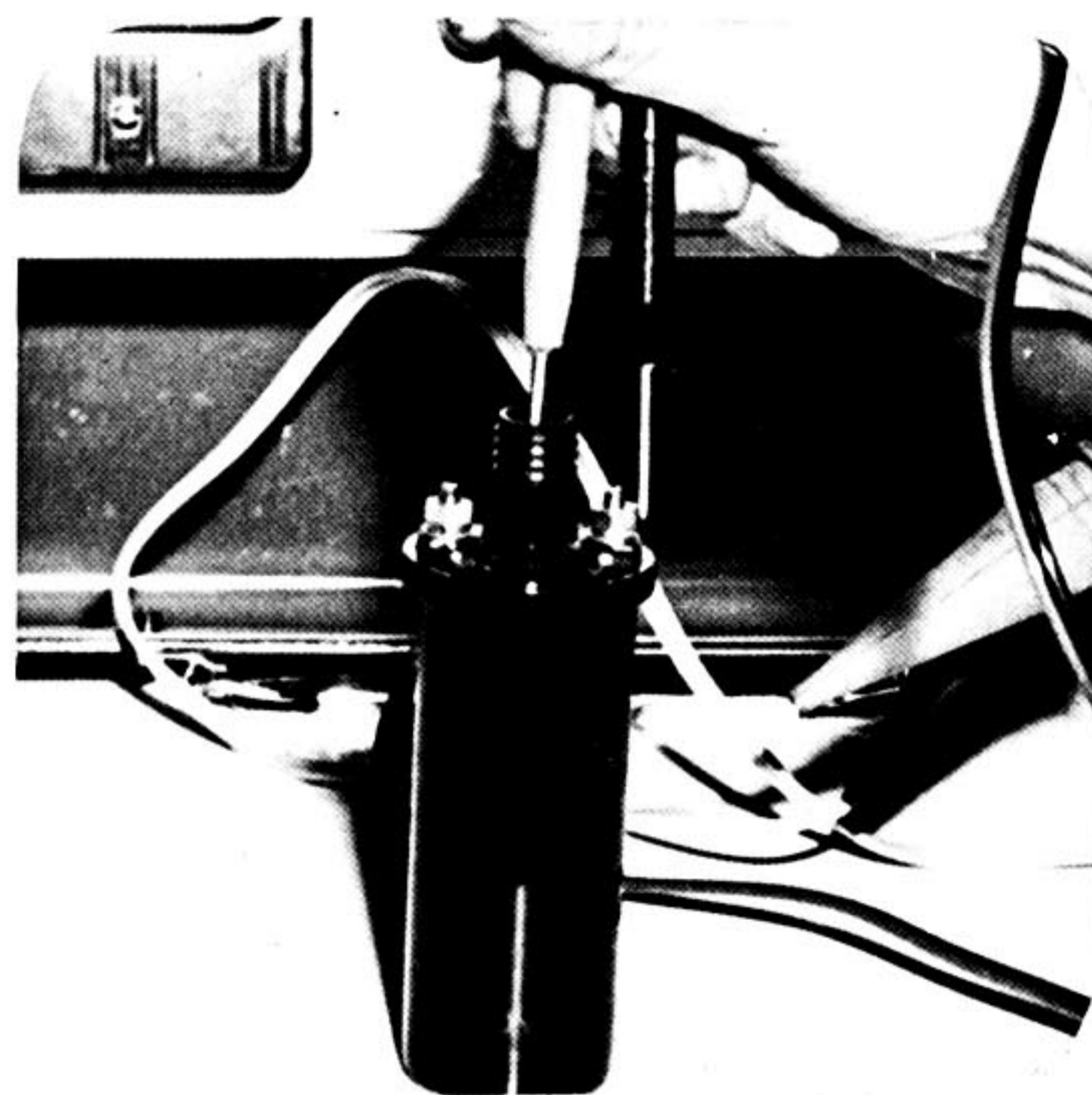
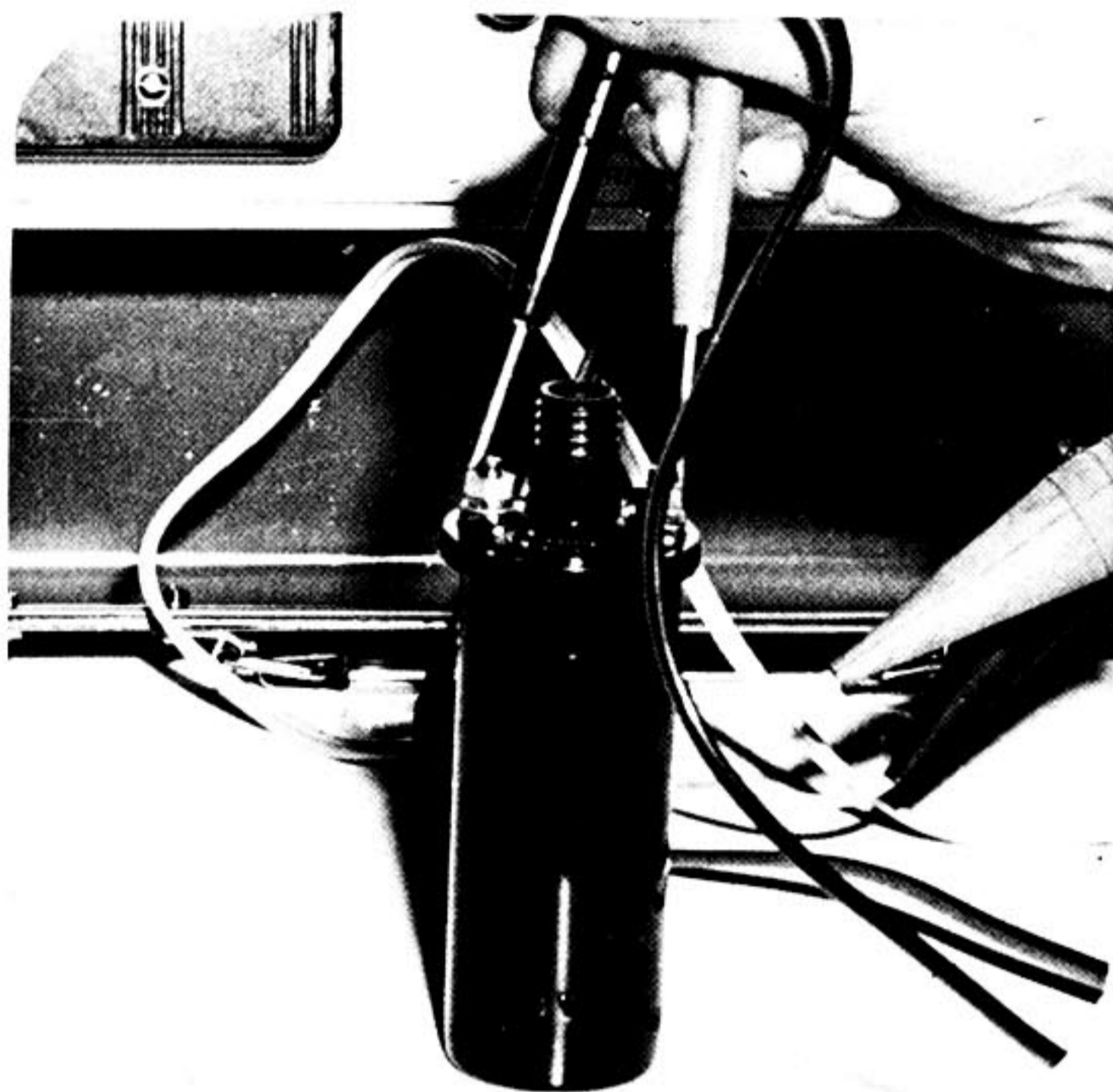


B. Maintenance:

When the battery, contact breaker & condenser, are in good operating condition and the following malfunctions occur, check the ignition coil:

- a. No spark
- b. Weak spark
- c. Uneven sparks

- B-1 Continuity test_ Test ^wthe continuity tester by connecting to the positive and negative primary terminals. If there is no continuity, the inner coil is broken. If there is continuity, take one of the tester lead wires and connect it with the high tension terminal. If no continuity, the high tension coil is broken. This test should be made on the resistance scale, not with the light.



- B-2 Spark test
- Use the Yamaha electro tester and check the spark gap against the specified minimum with the Yamaha tester.
 - To test as installed, no tester available: First remove the high tension wire from the sparkplug. Next, remove the plug cap from the high tension cord. Hold the end approximately $\frac{1}{4}$ inch (6mm) from the cylinder head. Kick the engine, and if there is a strong spark, the ignition coil is usable.
- B-3 The ignition coil in normal use. The ignition coil always produces high voltage. Therefore, the high tension cord and terminals should be clean at all times. Be sure that the high tension cord is well connected to the high tension terminal. If not, leakage will occur and damage the ignition coil. Water will cause short, and conductors should be well covered.

A. Principle:

Yamaha motorcycles are equipped with one of two types horns.

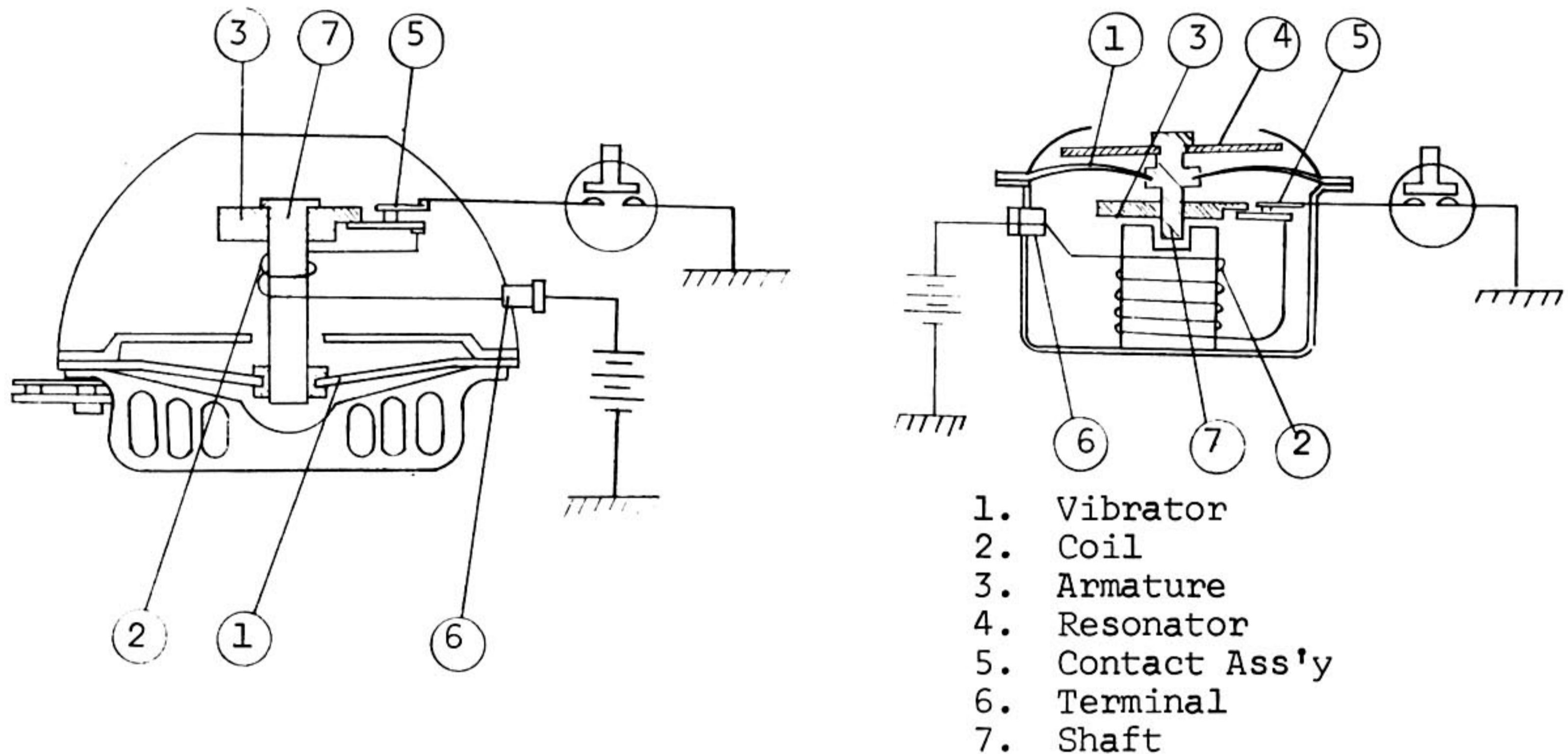
V-A-1 horn with intensifying trumpet:

7-1 When the horn button is pressed, current is supplied thru the terminal, coil, contact assembly and yoke. As it passed thru the coil, the core becomes magnetized and pulls the armature. At an adjusted point, the points in the contact assembly disconnect, the current is cut-off, the core loses the magnetic pull and the armature returns. The armature is connected to the vibrator by a shaft, and is returned by the vibrator. When the armature is returned to the original position, the points in the contact assembly complete the circuit again. This process repeats rapidly. Air vibration from the vibrator is amplified as it funnels through the expansion chamber.

V-A-2. Mike type horn.

To vibrate the vibrator, the above system is used.

The difference is that when the armature is pulled, it strikes the end of the core and activates the resonator and makes a loud sound.



B. Maintenance:

The following three malfunctions ^{are} to be checked and adjusted if necessary:

1. Does not work
2. Weak sound
3. Not uniform

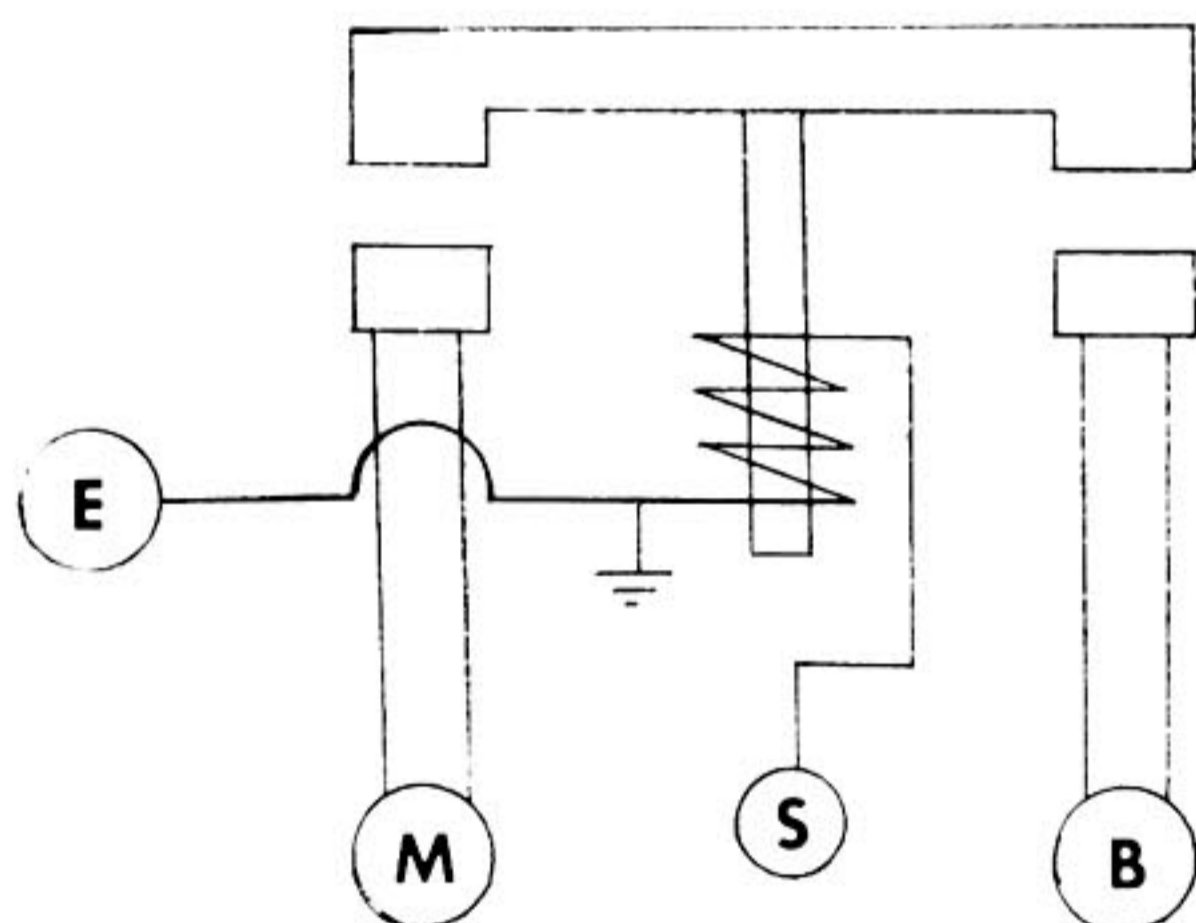
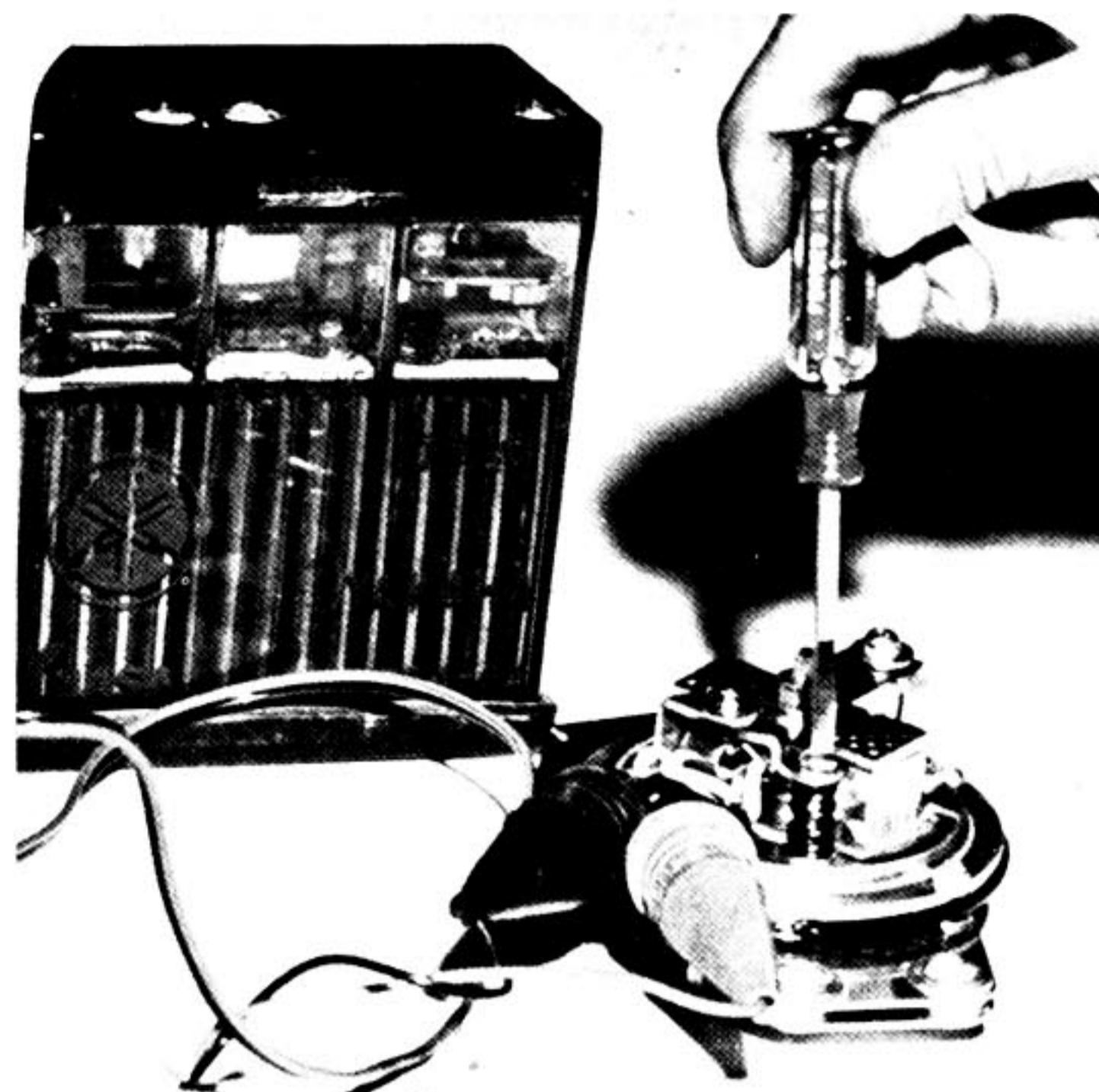
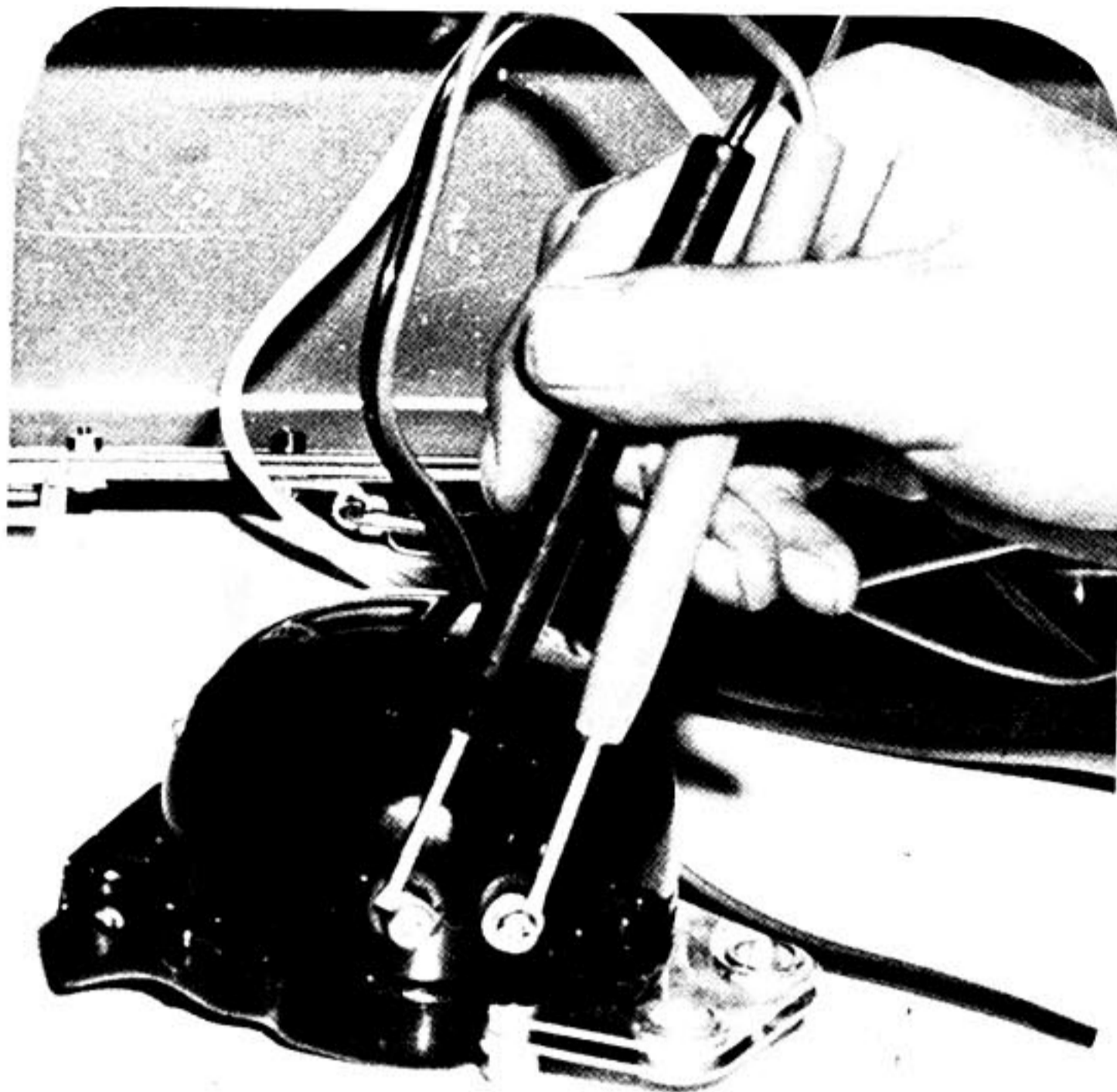
B-1 Check by appearance

- a. Dirt in the horn
- b. Water in the horn
- c. Screw is loose and soldering is broken.
- d. Points are loose or worn out.
- e. Armature-to-core gap is too narrow.
- f. The vibrator is broken.

Check the battery and horn button for good operating condition before checking the above.

B-2 Check the continuity by use of the electro tester. Connect the lead wires to both terminals. When there is no continuity, the coil lead wire is broken, or the points are faulty and do not make contact.

- B-3 Adjusting the horn: Connect the lead wire from the horn directly to the battery and tighten or loosen the adjusting screw on the horn. Normally, when tightening (screw in) the sound becomes louder. When there is no sound, unscrew the adjusting screw until sound is heard, then adjust to tone desired.

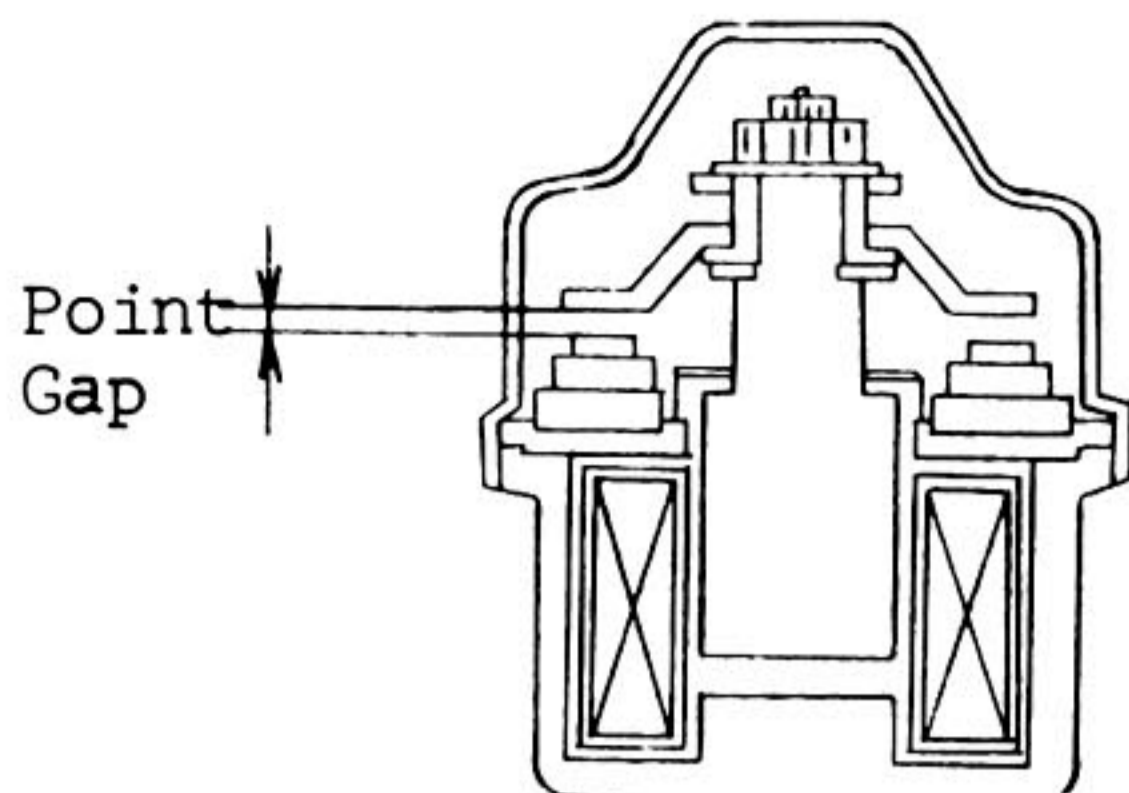


VI. Starter Relay Switch

A. Principle: When the starter button is pressed, a large amount of current must go to the starter coils. (as illus.) When the button is pressed, the current passes thru terminal "S" and into the magnetic switch coil. The core then becomes magnetic and connects the contact rod which enables the large volume of current to pass directly to the starter dynamo.

B. Maintenance: If the starter does not function, check the starter switch, if the battery, starter dynamo, starter button are in good operational condition.

B-1 Check by appearance for loose screw and/or broken soldering.



B-2 Continuity test - Check the continuity between the terminal "S" and ground. When there is no continuity, the coil is broken. Another way to test; connect the wire from terminal "S" to the positive terminal of the battery, ground the negative of the battery. If the core becomes magnetic and the points contact, the switch is in good condition.

VII. Battery

Maintenance: The battery has the important functions of lighting and starting the engine. Without frequent checks and upkeep, the battery will drop in life expectancy and power.

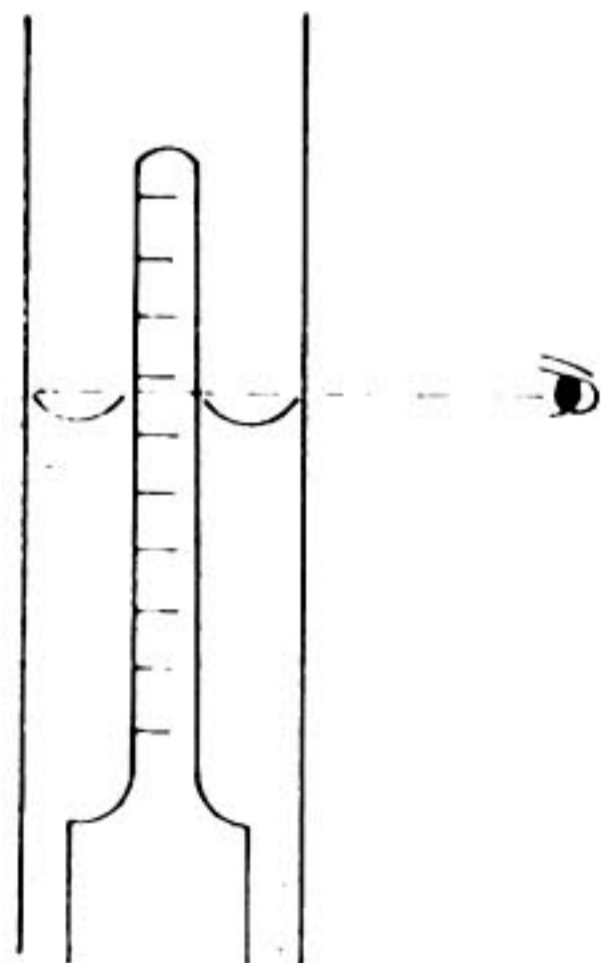
The following instructions on maintenance are to be followed to get the most out of it:

1. Handling of battery prior to installment.
 - a. The batteries used by Yamaha are dry-charged in the manufacturing process. Do not remove the tape until ready to fill with acid. Since the battery is factory charged, when air enters into the cell, the charged power in the battery will start to run down.
 - b. Although this battery could be used as soon as it is filled with acid, it is recommended that a 5 or 6 hour recharging be applied. Most of the batteries are stocked for several months, and the dry-charge capacity is slowly lowered so that recharging is importance. With ideal conditions of warehousing, the "instantaneous" power of the battery drop 20% one month after manufacture, and 50% after 1 year in stock.

2. Filling battery with acid.

- a. Remove the red tap on the battery and remove the caps. Fill with factory recommended specific gravity tested acid to the top line. Wait one or two hours after filling and check the level of acid. Refill acid to the top level before recharging. Specific gravity is measured as compared to normal water weight.

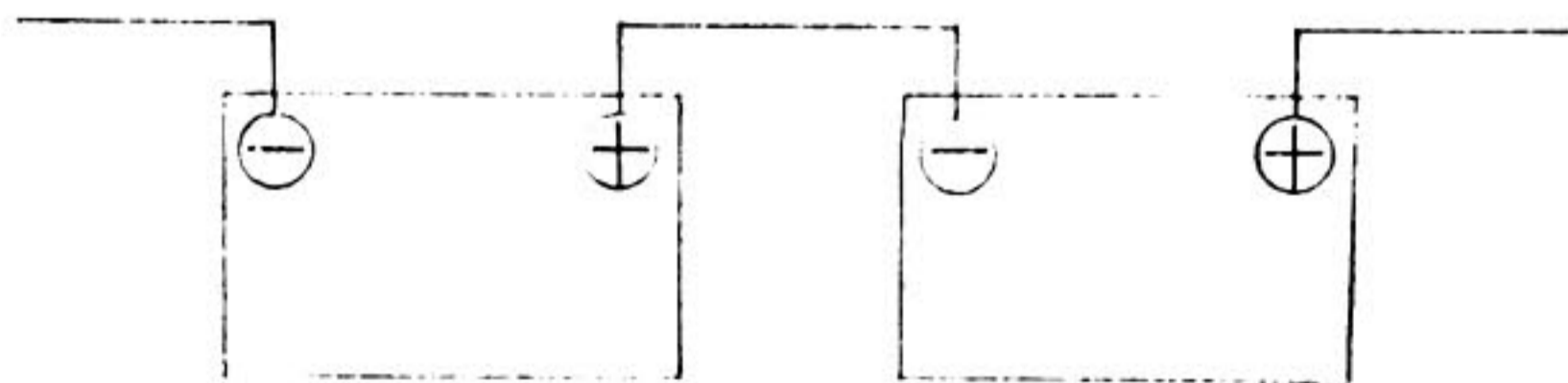
Acid 1.280 = x normal weight at 20°C (68°F). To measure the acid specific gravity, use a hydrometer.



- b. Acid should be clean and free of other matter. In the event of polution, sulfation will start.
- 3. Recharging the battery.
 - a. When filling the battery as explained in 2a, recharge within 5 to 6 hours. Use a 10%, 10 hour charging rate. ie; 11 A H battery should be charged with 1.1 ampere charger setting. When battery is full, bubbles form. At this time check the reading with the hydrometer. If it is lower than the recommended level, leave the charger on until the desired level is obtained.
 - b. Always clean the battery and refill with distilled water before recharging. When charging make sure that the positive wire of the charger is connected to the positive terminal, and negative wire to the negative terminal of the battery. If by mistake a reverse connection is made, the battery will discharge completely; and then positive will change to negative and vice versa, making it unusable.
 - c. When charging, the temperature of the battery will rise. If it heats up to 45°C (110°F) stop charging. Reset charging again when battery cools. The vapor from a charging battery contains hydrogen and oxygen, and is highly explosive.
 - d. When using a quick charger, high amperage is used. To charge the battery for a long period this way will cause the battery to be unusable.
 - e. Some of the batteries used by Yamaha have a plastic tube to drain off the gas. Before using a new battery, always cut off the end of the tube.

- 4. Installing battery onto the motorcycle.

When installing a battery in a motorcycle, always make sure the connection is correct. The Yamaha motorcycle is equipped with red wire for positive and black wire for negative. When using two 6 volt batteries in a 12 volt system, make certain that the connection is correct as illustrated. Make sure that all wires and batteries are taped or bound~~ed~~ to avoid disconnection.



- 5. Maintenance of Battery.
 - a. Make frequent checks (at least once a month) on the acid level. Fill with distilled water to the level.
 - b. When the lights are dim, horn does not work, or starter fails; remove battery and recharge.
 - c. When battery is not in use for a long period, recharge once a month. A battery discharges itself whether in use or not. The higher the temperature, the faster it discharges. Always store a battery in cool, dark place.
 - d. In cold climate, the battery's chemical reaction is lowered and this will lessen the capacity, so upkeep must be maintained. Also, when a battery is discharged, the acid specific gravity is low and this will make it easier to freeze. When re-

charging, to get the best result, use a higher temperature room.

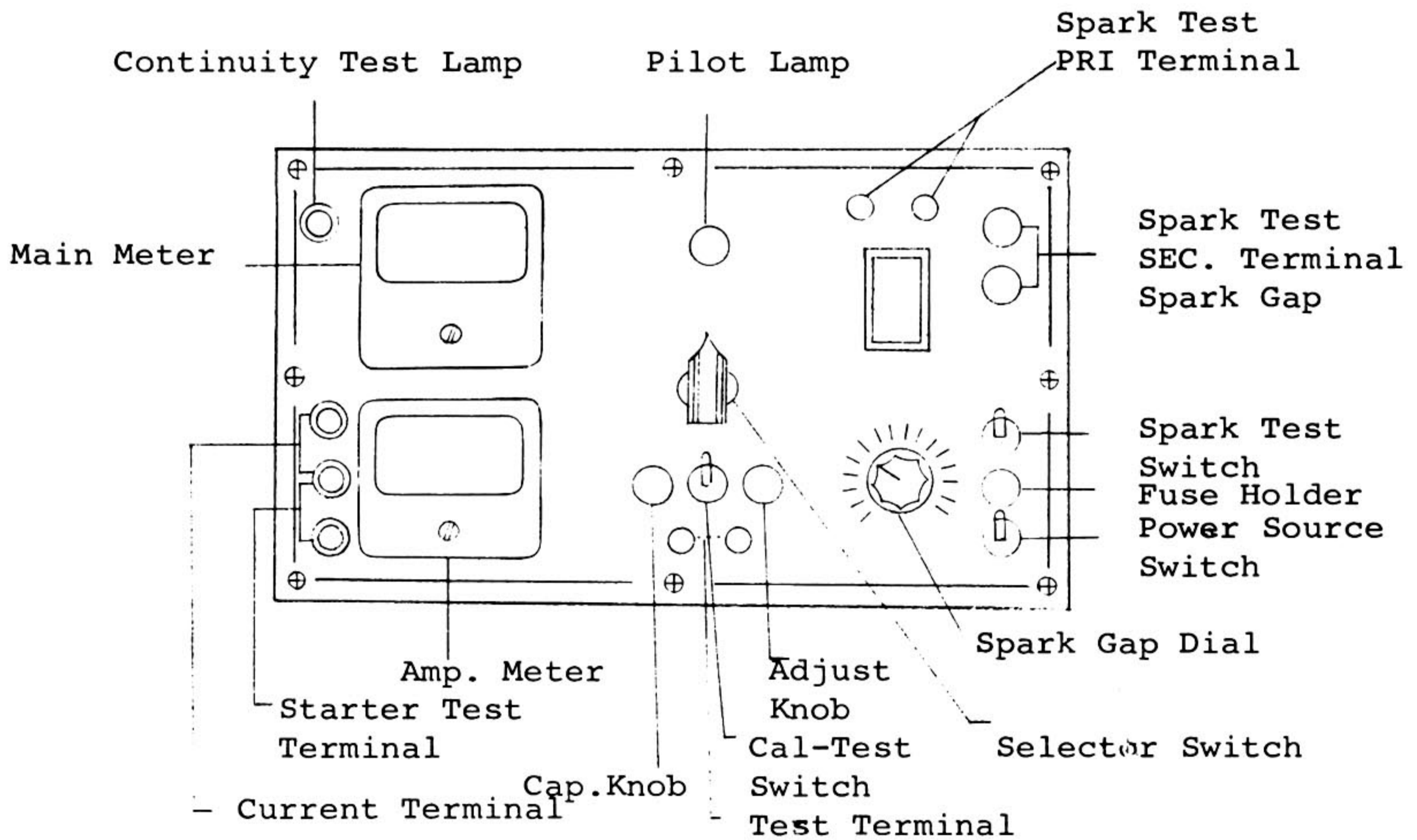
6. Batteries in a self-starter system.
 - a. It requires a strong force to turn over in engine. When using a self starter, amperage requirements are high. This is usually about a 100 A electric current that drops to 50 to 40 A, that continues until the engine fires. The self starter type battery is made to furnish this current. When the battery is worn down and the electric current is not sufficient, the engine will not turn over. A fully charged battery is able to start the engine approximately 100 times before recharging.
 - b. When the engine is in good operating condition, it only takes a moment to start. If pressing the starter button for 3 to 5 seconds does not start the engine, then wait for 3 to 5 seconds to restore the battery, and try again. Pressing the starter button for long periods will run down the battery and its life will be shortened.
 - c. When the specific gravity is 1.200 at 20°C, the battery will not turn over the engine and must be recharged.
 - d. A battery should be recharged any time the hydrometer reading is 1.250 or less.

VIII YAMAHA ELECTRO TESTER

MODEL SY

Operating Instructions

In servicing or adjusting any part of the electrical system, refer to the "Maintenance Manual" of vehicle being tested for all specifications or detailed information.



MAIN TESTS WHICH CAN BE EFFECTED WITH THE TESTER

D.C. Voltage measurements:	from 0 to 20 Volts
A.C. Voltage measurements:	from 0 to 20 Volts
D.C. Current measurements:	from -20 to +20 Amps. from -100 to +100 Amps. (only starter motor)
Test of insulation:	from 0 to 20 Meg-ohms as 500 Volt Megger)
Resistance measurements:	from 0 to 20 Kilo-ohms.
Condenser capacity measurements:	from 0 to 0.5 Microfarads.
Test of Ignition coil:	by adjustable spark gap with third ionizing point.
Continuity Test	
Ignition timing and timing advance:	by twin type timing light.

1-CONNECTION OF POWER SOURCE

A-Tests which necessitate a power source:

1. Insulation test (Meg-ohm)
2. Resistance test (Kilo-ohm)
3. Capacity test of Condenser
4. Continuity test
5. Spark test (Ignition coil test)
6. Timing light

B-Voltage of Power Source: The power source is a 6 or 12 volt battery. The battery in the machine being serviced may be used. Before connecting the cord with the power source, check the voltage of battery. This is very important.

C-Check the position of power source switch: Make sure that the switch is on the 6 volt side or to the 12 volt position according to the voltage utilized.

When connected to the power source, the pilot lamp on the board will light up. If the pilot lamp is not lighted, check the connection of cord and fuse (5 Amps.) on the power source switch.

2 - MEASUREMENT OF RESISTANCE

- A-Turn the selector switch to "Insulation (Meg-ohm) or to "Resistance (Kilo-ohm)"
- B-Zero adjustment:
Flip change over switch (marked "Cal-Test") to the up position. Turn the Zero Adjustment Knob marked "Res. Cal" until the pointer of the meter comes to "0" (at the right end of the scale).
- C-Connect the test-leads with the terminals marked "Test Terminal", flip the change-over switch to the down position and apply the other ends of leads to the test piece.
- D-A 500 Volt megger is available for measurement of insulation resistance. The Resistance (Kilo-ohm) test is used for measurement of internal resistance of the ignition secondary coil.

3 - CONDENSER TEST

MEASUREMENT OF CAPACITY (MICRO-FARADS)

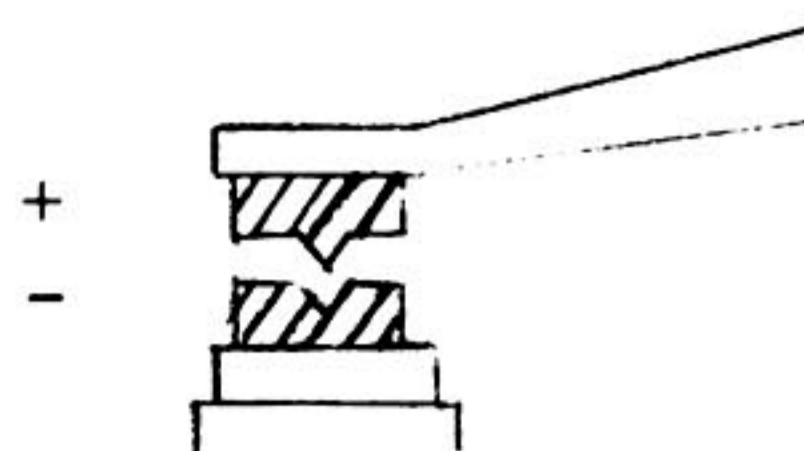
- A-Turn the selector-switch to "C capacity".
- B-Adjust the scale for measurement of capacity by the capacity adjustment knob "Cap-Cal". until the pointer of the meter shows the equivalent value to the capacity (inscribed in the name plate) of the standard condenser built in the Electro-Tester.
- C-Apply the test cords to the terminal marked "Test-Terminal", connect the condenser to be tested with the other ends of the cords and flip the change-over switch down, then the pointer will show the capacity of the condenser to be tested.

OVERLOAD VOLTAGE TEST

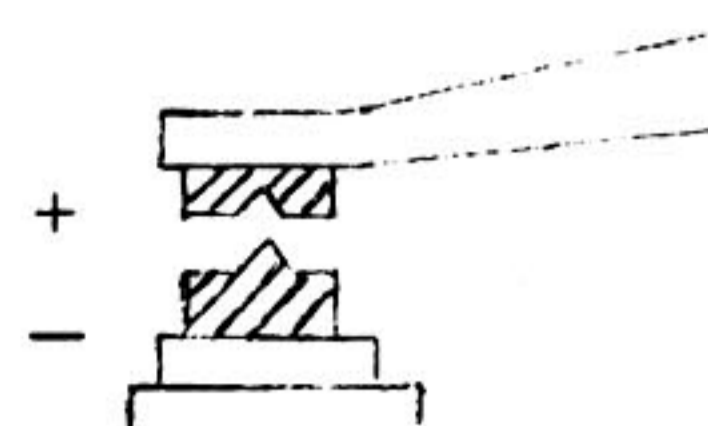
- A-Measure the insulation resistance by the procedure mentioned in paragraph 2D (Insulation Test). Contact the two ends of the cord with the condenser to be tested, the pointer of the meter will move to the right and then slowly return to the left. Keep the connection till the pointer comes to a stop.
- B-Read the pointer of the scale by Meg-ohm. When it shows 5 Meg-ohms or over, the overload voltage is excellent.

NOTE: Immediately after this test, the tested condenser is charged with 500 Volts, so discharge it by grounding.

CONDITION OF CONTACT POINTS WITH A FAULTY CONDENSER:



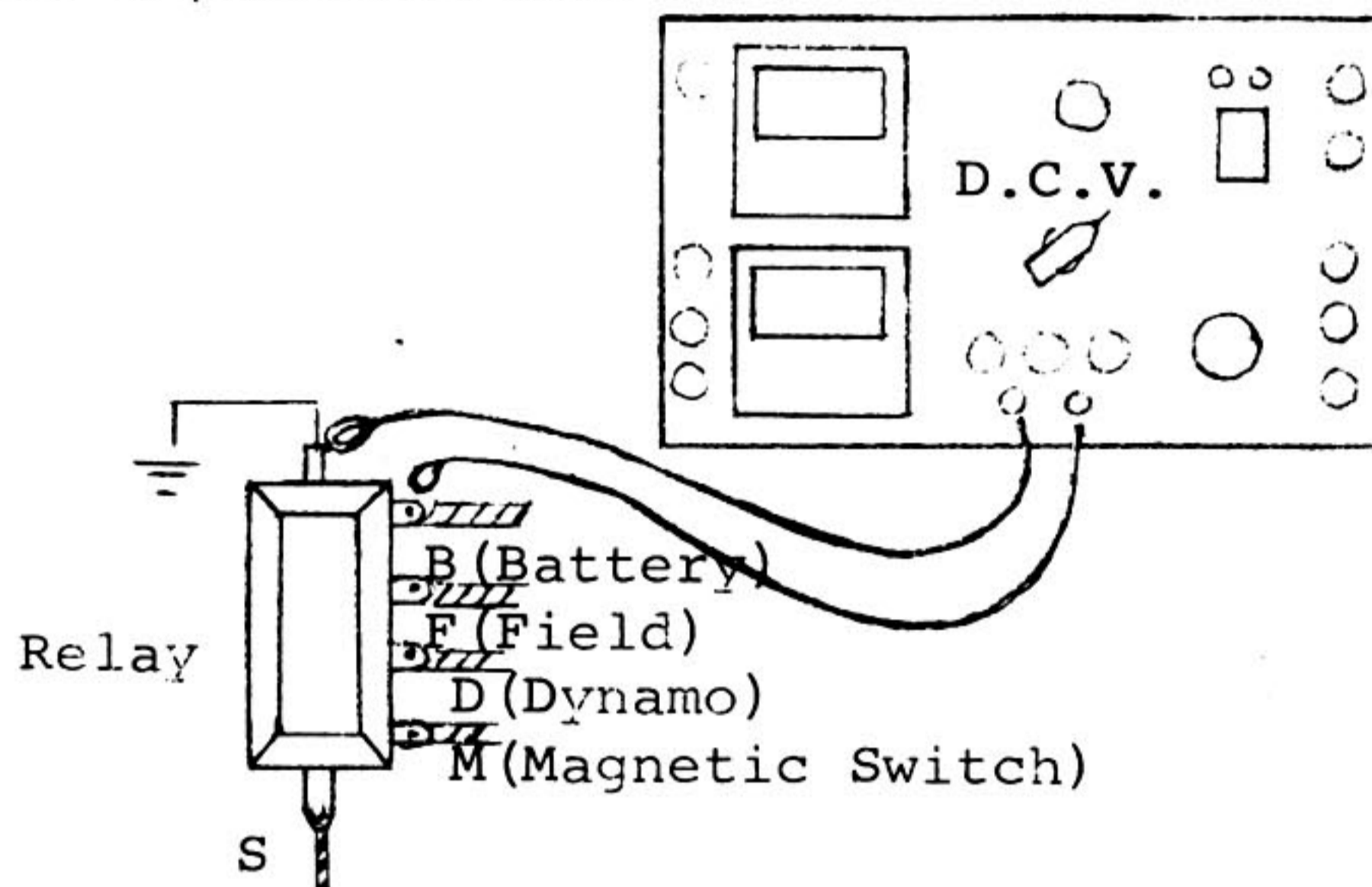
Low Capacity



Excessive Capacity

4 - MEASUREMENT OF VOLTAGE REGULATOR OUTPUT

In a parallel circuit:



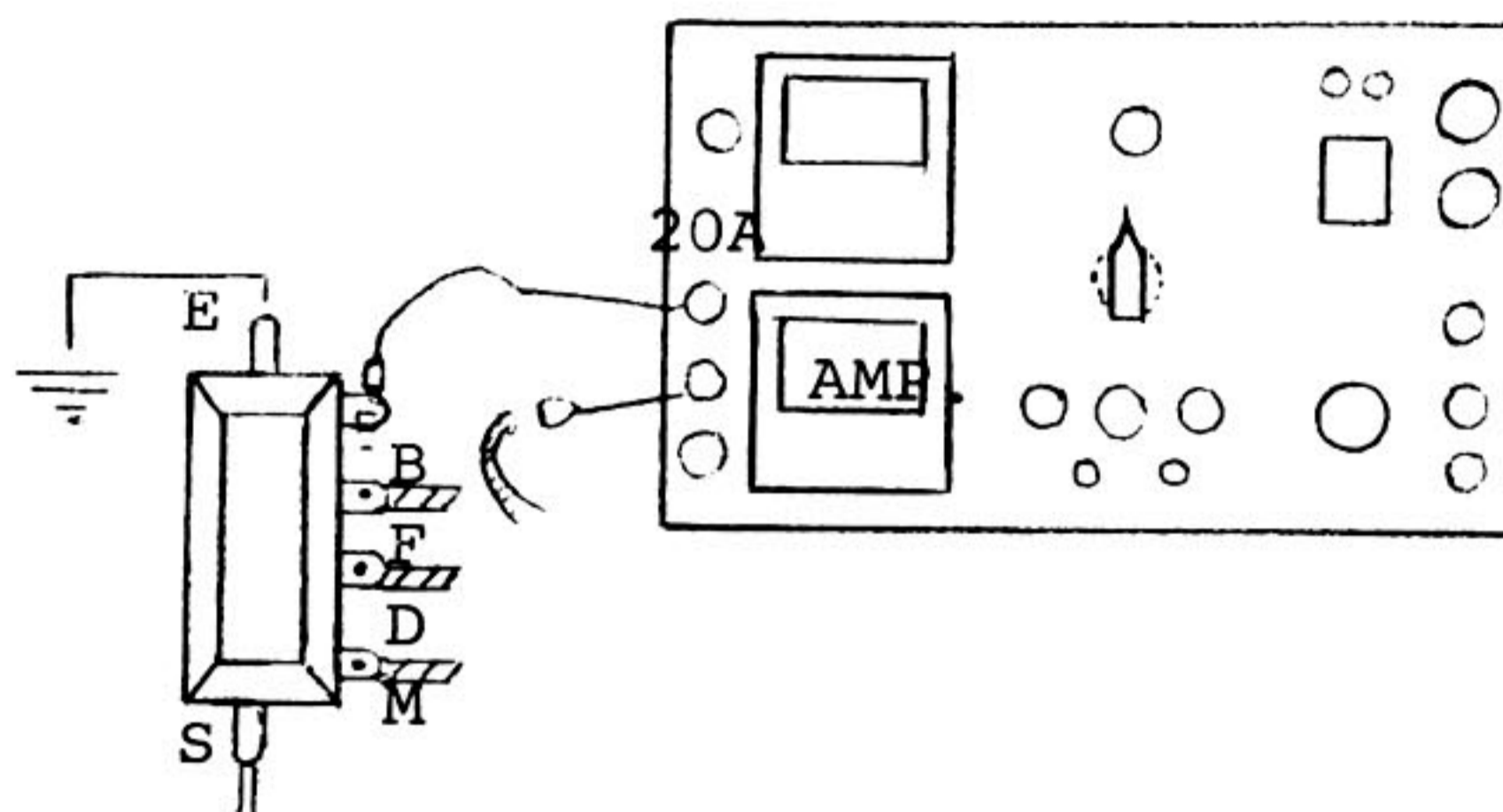
(Starter Switch)

Refer to the specifications of each machine for voltage setting.

When A.C. voltage is measured, the selector switch must be turned to "AC VOLTAGE"

5 - MEASUREMENT OF CURRENT (+20 Amp.)
Connect in a series circuit.

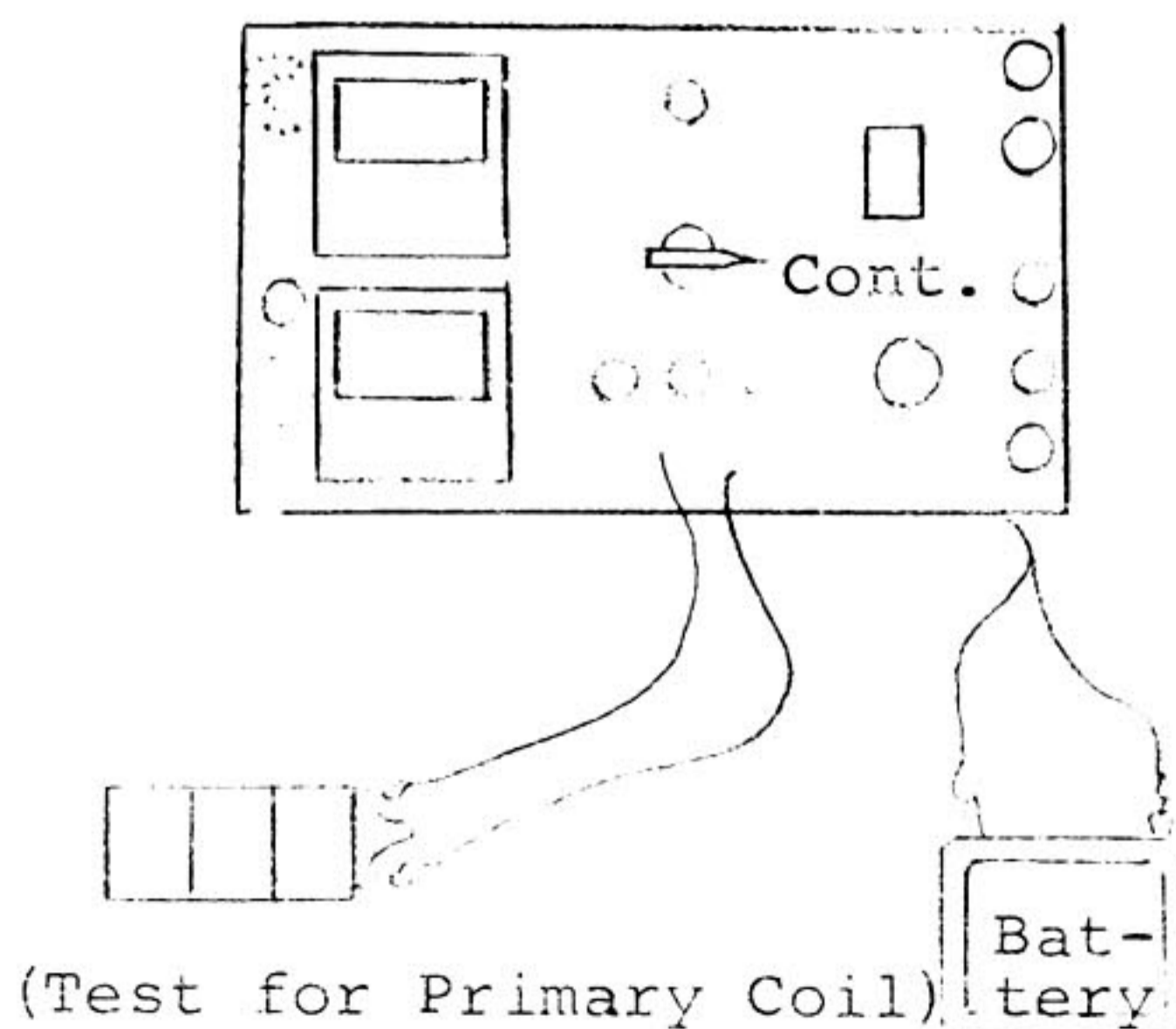
Measurement of charging and discharging current:



- 1-Use the ampere-cords (thick black ones)
- 2-The selector-switch has no relationship to this test.
- 3-When testing as illustrated in the diagram above, the generating voltage of dynamo is measured. The cut-in voltage of cut-out relay is measured, at the same time.

6 - CONTINUITY TEST

- 1-Where the test circuit is not charged.
 - A-Connect with power source.
 - B-Turn the selector-switch to "CONTINUITY TEST"
 - C-If the continuity is complete, the test lamp will be lighted.



2-Where the test circuit is charged.

- a. The power source is not necessary.
- b. The process is same as the preceding.
- c. If the continuity is complete, the test lamp will be lighted.

7 - TEST OF IGNITION COIL - (Spark Test)

A-Connect the Electro-Tester to power source.

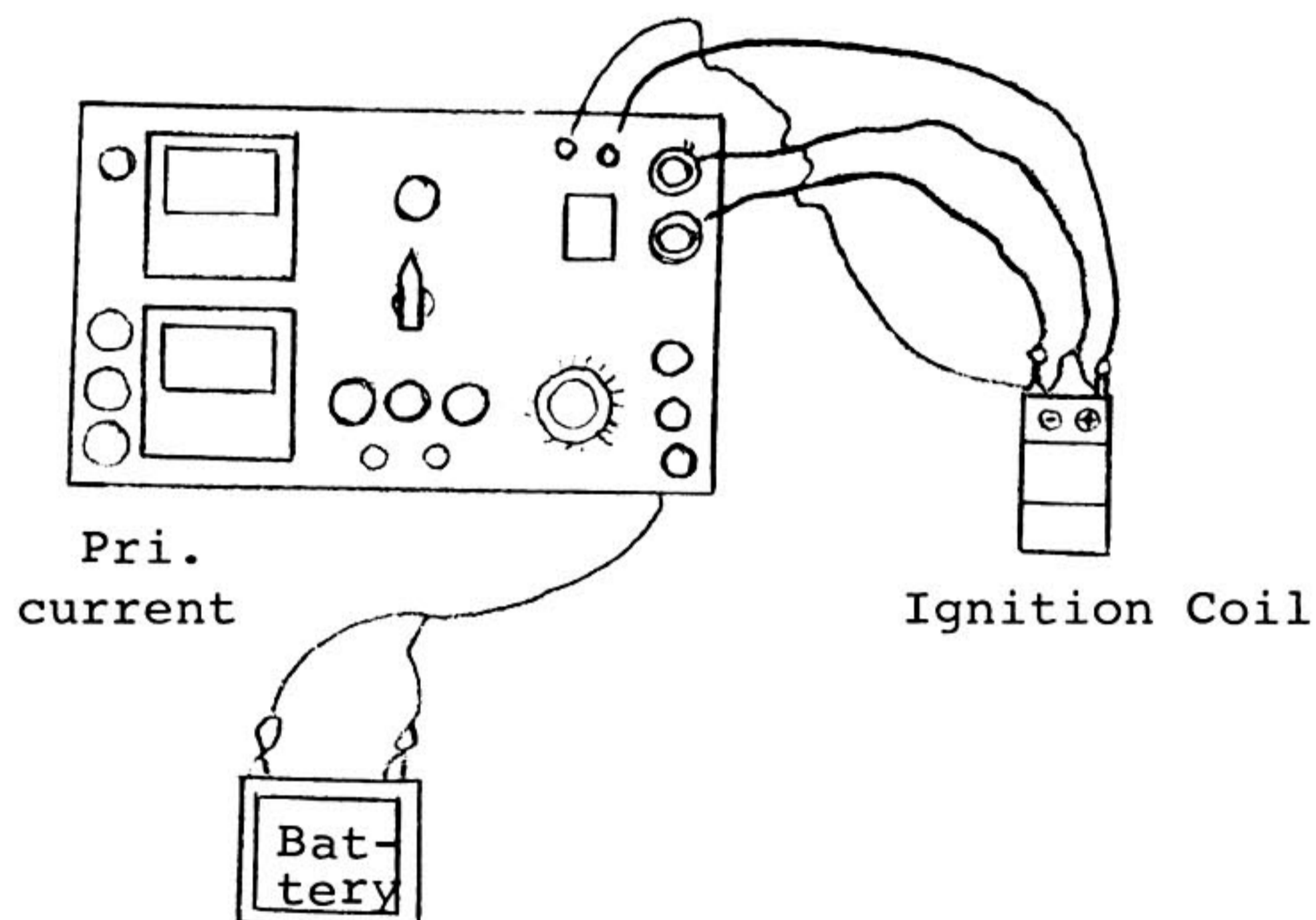
B-Connect the ignition coil to be tested as shown in the diagram below:

C-Flip the spark test switch up.

D-Turn the spark gap dial, and measure the length of spark generated there by millimeters.

E-After this test is down, flip the spark-test switch down.

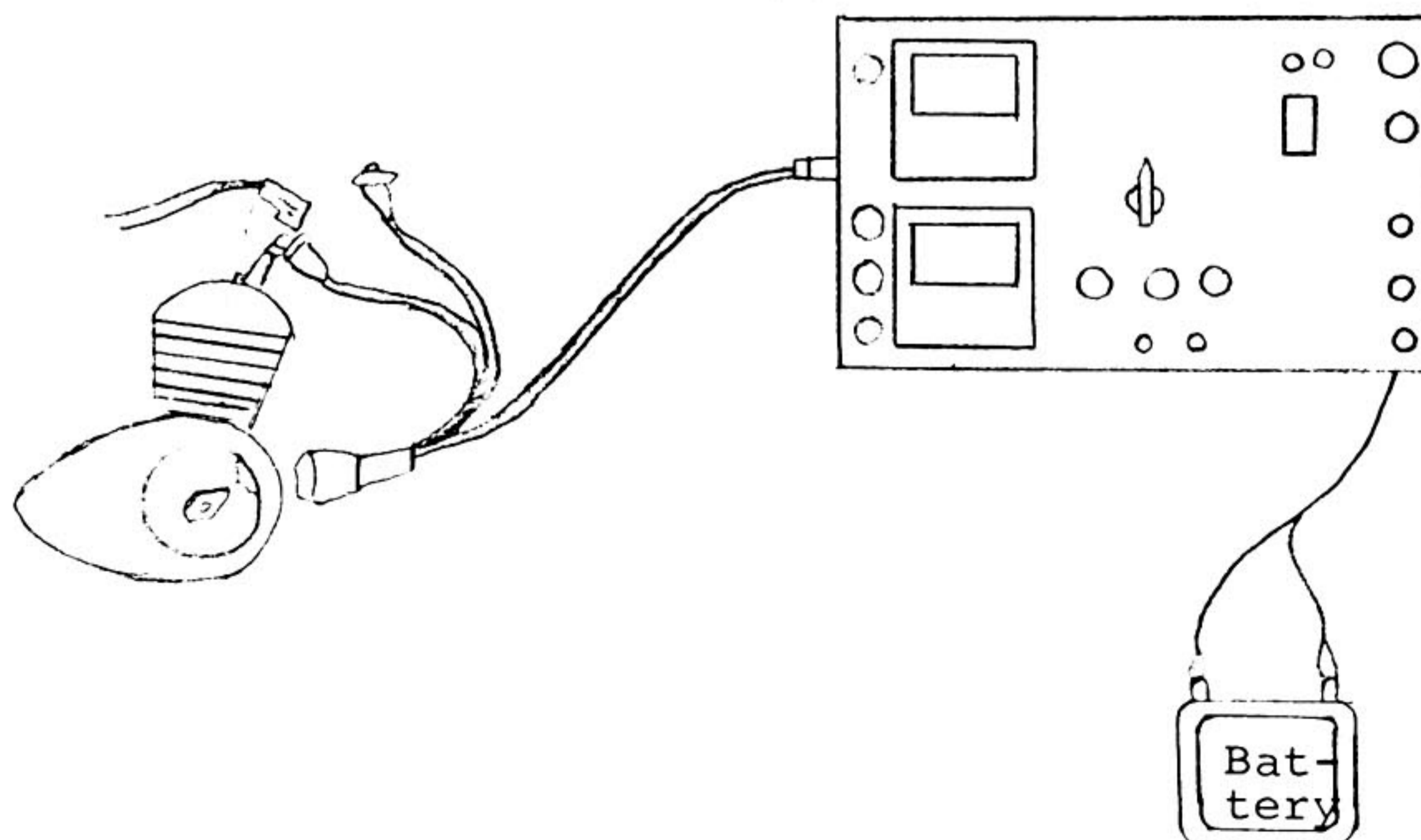
F-Six millimeters or over is enough for the spark length.



8 - TIMING LIGHT

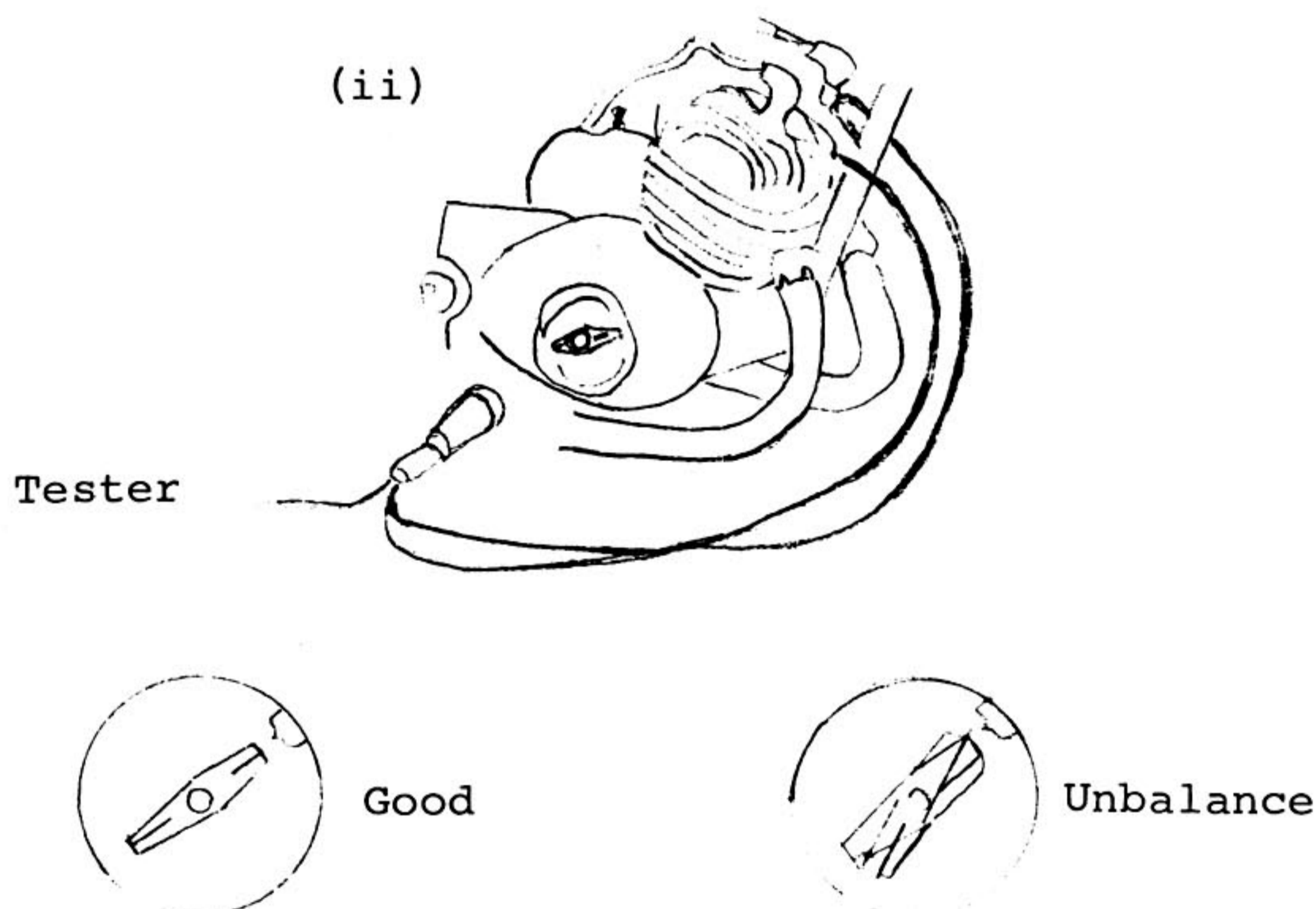
1-Adjustment of Ignition Timing.

A-Connect power source and the timing light as shown in the diagram below:



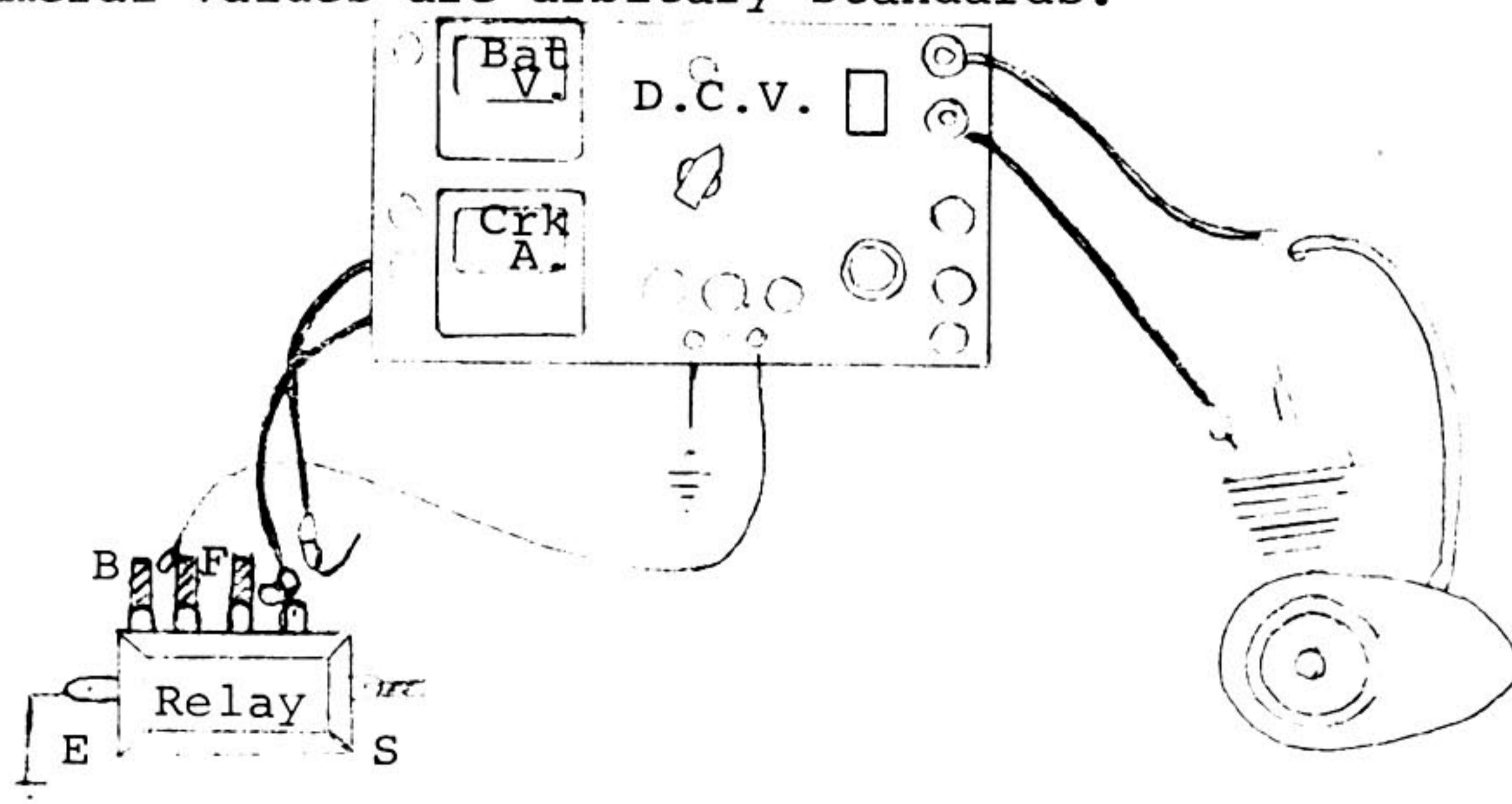
- B-When the engine is started, the light flashes and timing mark is seen stopped.
- C-When the mark is seen at an advanced position relative to the direction of rotation, the ignition timing is late; and when the mark is seen at a retarded position, the ignition timing is early.
- D-When the revolutions of an engine equipped with an automatic advance system are increased in steps, the timing mark will be seen moving towards the retarded position.

2 - Inspection of Ignition timing balance of two cylinder engine.



9-- STARTER TEST

The numeral values are arbitrary standards.



- 1-Connect a tachometer (Electric type) as shown in the diagram for measurement of:
 - a. Starter RPM.
 - b. The current draw of the starter.
 - c. Terminal voltage of battery.
 - d. The spark length when engine is cranking.

- 2-Push the starter-button, and observe:
 - a. The revolutions should reach 400 rpm or more.
 - b. The current draw will be 100 Amps. or more for a moment and come down to 20 - 50 Amps.
 - c. The voltage will drop to 8 volts or so for a moment and then come back to 10 - 10.5 volts or more.
 - d. A spark of 5 - 6 millimeters in length should be discharged at the spark-gap of the tester. (Adjust the spark-gap beforehand.)

- 3-Trouble Shooting the Starter:
 - a. If the rpm of starter drops lower than that specified:
 - (1) The starting current is too high; There is a short circuit.
 - (2) The starter current is too low: There is a disconnection or poor contact in the circuit.
 - (3) Voltage drop of battery is too large: The capacity of the battery is too small.
 - b. Starter revolutions are correct but the engine does not start.
 - (1) Weak spark: Trouble in the ignition coil or condenser.
 - (2) Strong spark: Trouble in the fuel system or the spark plug.
 - c. The starting current reached 100 Amps. or more, but the engine will not start: Mechanical troubles in the cylinder or piston.

- 4-In the case of new machines, start the inspection work with the checking of battery capacity. The checking of electric equipment should always commence from the power source.

IX - RECTIFIER (SELENIUM) CHECKER

How to check the rectifier

1. Connect the power source leads to 12 volt battery as follows:
Red lead wire to positive terminal and black lead wire to negative.
 2. Connect Red test lead wire to positive side of rectifier and black test wire to the negative side.
- A. Voltage drop test:
1. Turn toggle switch to V drop.
 2. Turn "Current Adjust" knob until meter pointer points at mark.
 3. Push "V drop" button.
Green Zone of upper scale indicates good condition.
- B. Reverse current test:
1. Turn toggle switch to "Reverse C".
 2. Green zone of under scale indicate good condition
- C. Caution:
1. Pilot lamp shows wrong connection or bad rectifier.
 2. Rectifier should be tested individually.

SPECIFICATION TABLE -
BATTERY

TABLE OF SPECIFICATIONS - BATTERY

Model	Type	Maker	Voltage (V)	Capacity (AH)	Charging Rate (A)	Sulphuric Acid Specific Gravity at 68°F	
						Temperature	Tropical
MF1	BST-12F	Furukawa	12	6	0.6	1.280	1.240
MJ2	MG3-12	GS	12	6	0.6	1.280	1.240
YJ1	B31-6	Yuasa	6	4	0.4	1.260	1.220
YG1	BST2-6	Furukawa	6	4	0.4	1.260	1.220
MG1							
YA5	SPT3-12	Furukawa	12	10	1.0	1.280	1.240
	MBH3-12F	Yuasa	12	10	1.0	1.280	1.240
YA6	MW3-12	GS	12	10	1.0	1.280	1.240
	MB3-12	Yuasa	12	10	1.0	1.280	1.240
	SPT-12	Furukawa	12	10	1.0	1.280	1.240
YA3	BS6-6A	Furukawa	6	11	1.1	1.280	1.240
YD2							
YD3							
YDT1	MBH3-12	Yuasa	12	10	1.0	1.280	1.240
	SPT3-12	Furukawa	12	10	1.0	1.280	1.240
YDS1	MBL4-6	Furukawa	6	7.5	0.7	1.260	1.220
YDS2							
YDS3	MBF4-6A	Yuasa	6	7.5	0.7	1.260	1.220

NOTE: V = Volt
AH = Ampere hour
A = Ampere

	Item	MF1	MF2, MJ2	YJ1	YG1
Dynamo and Magneto	Dynamo type	SS106-01	GS106-103	FAZ-1DL	F11-L17 FBH-1B11
	Point gap	0.3-0.35mm	0.3-0.35mm	0.2-0.4mm	0.3-0.4mm
	Contact pressure	500-700g	500-700g	650-750g	700-900g
	Condensor capacity (in μF)	0.22 μF ±10%	0.22 μF ±10%	0.25±10%	0.27+F±
	Length of brush	19.5mm	19.5mm		
	Usable limit length	8mm	8mm		
	Strength of brush spring	400-560g	400-560g		
	Commutator diameter	37.5 ϕ	32 ϕ		
	Commutator wear limit	2mm	2mm		
	Mica under cut	0.5-0.8mm	0.5-0.8mm		
	Mica under cut limit	0.2mm	0.2mm		
	Resistance of field coil	7.3 Ω	7.6 Ω		
	Advance				
Ignition timing	22° (1.85mm)	25° (2.2mm)	23° (2.0mm)	23° (2.0mm)	
Regulator	Regulator type	T104-03	T104-52		
	Voltage to be adjusted at no load	3000RPM 16.5-17v	3000RPM 15.8-16.5v		
	Yoke gap	0.9-1.0mm	0.6-0.7mm		
	Core (air) gap	0.6-0.7mm	0.4-0.5mm		
	Point gap	0.4-0.5mm	0.4-0.5mm		
	Voltage coil resistance	9.85 Ω	14.4 Ω		
Cut out realy	Cut in voltage		12.5-13v5v		
	Yoke gap		0.6-0.7mm		
	Core gap		1.0-1.1mm		
	Point gap		0.6-0.7mm		
	Voltage coil resistance		14.4 Ω		
Magne-tic Coil	Core gap		1.3-1.4mm		
	Point gap	1.5mm	1.4-1.5mm		
	Magnetic coil resistance	4.94 Ω	11.3 Ω		
Ignition Coil	Spark property (minimum)	100RPM 8v more 6mm	100RPM 8v more 6mm	500RPM more 6.6mm	500RPM more 6.
		7000RPM 14v more 7mm	7000RPM 14v more 7mm	5000RPM more 8mm	5000RPM more 8mm
	Primary resistance	4.9 Ω	4.9 Ω		
	Secondary resistance	5.5K Ω	81±10% Ω		4K Ω

J1	YG1	YA3	YA5	YA6	YD2	YD3, YDT1	
	F11-L17	GS-01	GS113-01				
AZ-DL	FBH-1B1L		GS113-02	GS113-02	GS-02,06	GS216-02,03	GS2
2-0.4mm	0.3-0.4mm	0.3-0.35mm	0.3-0.35mm	0.3-0.35mm	0.3-0.35mm	0.3-0.35mm	0.3
50-750g	700-900g	700-850g	500-700g	500-700g	700-850g	700-850g	500
±10%	0.27+F±10%	0.22μF±10%	0.22μF±10%	0.22μF±10%	0.22μF±10%	0.22μF±10%	0.2
		19.5mm	19.5mm	19.5mm	19.5mm	19.5mm	19.
		8mm	8mm	11.5mm	8mm	8mm	8mm
		280-380g	400-560g	400-500g	400-560g	400-560g	400
		37.5φ	37.5φ	37.5φ	37.5φ	37.5φ	37.
		2mm	2mm	2mm	2mm	2mm	2mm
		0.5-0.8mm	0.5-0.8mm	0.5-0.8mm	0.5-0.8mm	0.5-0.8mm	0.5
		0.2mm	0.2mm	0.2mm	0.2mm	0.2mm	0.2
		7.4Ω	6.8Ω	6.8Ω	9.04Ω	9.04Ω	9.0
		24°1600RPM	19°1600RPM	19°1600RPM	17.5°1600RPM	17.5°1600RPM	17.
3°(2.0mm)	23°(2.0mm)	29°(4.5-5.5mm)	24°(2.6mm)	24°(2.6mm)	22.5°(2.5-2.7)	25°(2.5-2.7)	25°
						YD2, YD3, YDT1	
		T107-02,05	T107-11,13	T107-52		T107-03	T107-15
			3000RPM	3000RPM		3000RPM	3000RPM
		3000RPM 15-16v	15.4-16.5v	15.8-16.2v		15.3-16.4v	15.3-16
		0.9-1.0mm	0.9-1.0mm	0.6-0.7mm		0.9-1.0mm	0.6-0.7
		0.6-0.7mm	0.6-0.7mm	0.4-0.5mm		0.6-0.7mm	0.4-0.5
		0.4-0.5mm	0.4-0.5mm	0.4-0.5mm		0.4-0.5mm	0.4-0.5
		10.1Ω	9.85Ω	14.4Ω		10.1Ω	14.4Ω
		12.5-13v5v	12.5-13.5v	12.5-13.5v		12.5-13.5v	12.5-13
		0.9-1.0mm	0.9-1.0mm	G10.6-0.7mm G21.0-1.1mm		0.9-1.0mm	0.6-0.7
		0.6-0.7mm	0.6-0.7mm			0.6-0.7mm	1.0-1.1
		0.7-0.8mm	0.7-0.8mm	0.6-0.7mm		0.7-0.8mm	0.6-0.7
		10.1Ω	9.85Ω	14.4Ω		10.1Ω	14.4Ω
				1.3-1.4mm			
		2mm	2mm	1.4-1.5mm		2mm	2mm
		4.94Ω	4.94Ω	11.3Ω		4.94Ω	4.94Ω
00RPM	500RPM	100RPM 8v	100RPM 8v	100RPM 8v		100RPM 8v	100RPM 8
ore 6.6mm	more 6.6mm	more 6mm	more 6mm	more 6mm		more 6mm	more 6mm
000RPM	5000RPM	7000RPM 14v	7000RPM 14v	7000RPM 14v		7000RPM 14v	7000RPM
ore 8mm	more 8mm	more 7mm	more 7mm	more 7mm		more 7mm	more 7mm
		4.9Ω	4.9Ω	4.9Ω		4.9Ω	4.9Ω
	4KΩ	5.5KΩ	5.5KΩ	5.5KΩ		5.5KΩ	5.5KΩ

YAMAHA ELECTRICAL SPECIFICATION TABLE

03, YDT1		YDS1	YDS2	YDS3	TD1	
216-02,03	GS216-04,05	DV65AL	DV65BL	DV65BL	MC2RY	
3-0.35mm	0.3-0.35mm	0.3-0.35mm	0.3-0.35mm	0.3-0.35mm	0.2-0.3mm	
0-850g	500-700g	500-600g	500-600g	500-600g	900-1100g	
22 μ F \pm 10%	0.22 μ F \pm 10%	0.22 μ F \pm 10%	0.22 μ F \pm 10%	0.22 μ F \pm 10%	0.2-0.24 μ F	
0.5mm	19.5mm	18mm	18mm	18mm		
mm	8mm	12mm	12mm	12mm		
0-560g	400-560g	500-700g	500-700g	500-700g		
5 ϕ	37.5 ϕ	35 ϕ	35 ϕ	35 ϕ		
mm	2mm	1mm	1mm	1mm		
5-0.8mm	0.5-0.8mm	0.5-0.8mm	0.5-0.8mm	0.5-0.8mm		
2mm	0.2mm	0.2mm	0.2mm	0.2mm		
04 Ω	9.04 Ω	4.06 Ω	4.06 Ω	4.06 Ω		
7.5 $^{\circ}$ 1600RPM	17.5 $^{\circ}$ 1600RPM					
9 (2.5-2.7)	25 $^{\circ}$ (2.5-2.7)	25 $^{\circ}$ (2.8mm)	19 $^{\circ}$ (1.8mm)	19 $^{\circ}$ (1.8mm)		
3 YDT1						
	T107-15	RHG	RHG	RHG		
	3000RPM	3000RPM	3000RPM	3000RPM		
4v	15.3-16.4v	7.6-8.0v	7.1-7.7v	7.1-7.7v		
0mm	0.6-0.7mm	0.3-0.45mm	0.3-0.45mm	0.3-0.45mm		
7mm	0.4-0.5mm	0.9-1.1mm	0.9-1.1mm	0.9-1.1mm		
5mm	0.4-0.5mm					
	14.4 Ω					
3.5v	12.5-13.5v	6.5-7.0v	6.5-7.0v	6.5-7.0v		
0mm	0.6-0.7mm	0.25 \pm 0.15mm	0.25 \pm 0.15mm	0.25 \pm 0.15mm		
7mm	1.0-1.1mm	0.4 \pm 0.1mm	0.4 \pm 0.1mm	0.4 \pm 0.1mm		
3mm	0.6-0.7mm	0.4-0.6mm	0.4-0.6mm	0.4-0.6mm		
	14.4 Ω					
	2mm					
	4.94 Ω					
8v	100RPM 8v more 6mm	500RPM 6v more 6mm	500RPM 6v more 6mm	500RPM 6v more 6mm	500RPM more 6mm	
14v	7000RPM 14v more 7mm	9000RPM 6v more 6mm	9000RPM 6v more 6mm	9000RPM 6v more 6mm	9000RPM more 10mm	
	4.9 Ω	1.7 Ω	1.7 Ω	1.7 Ω		
	5.5K Ω	5.5K Ω	5.5K Ω	5.5K Ω		

YAMAHA

MOTORCYCLES



SERVICE MANUAL

COVERING
MECHANICAL MEASURING DEVICES

I. Micrometer (Metric)

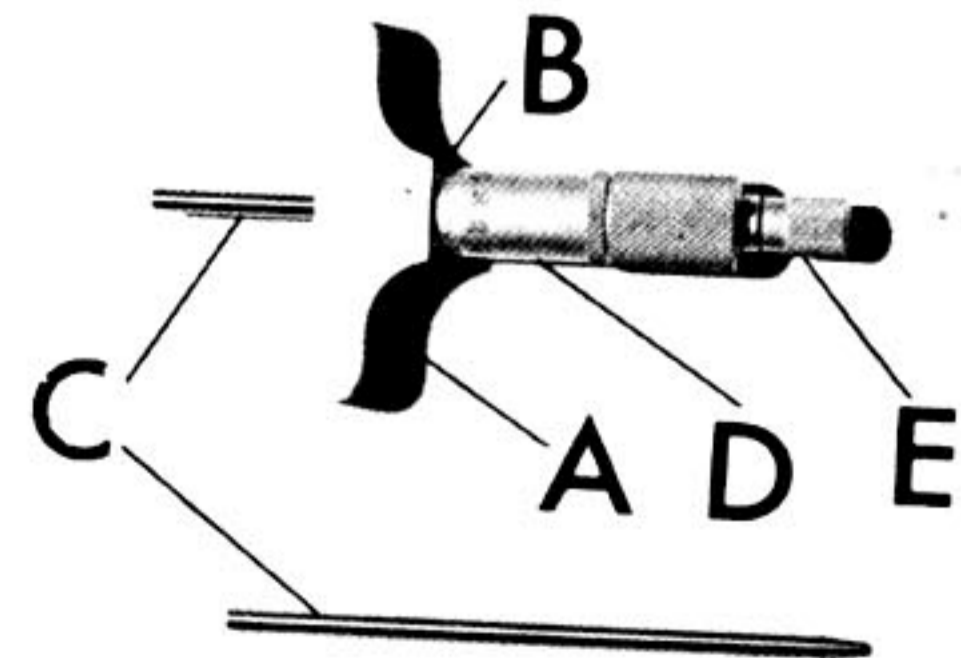
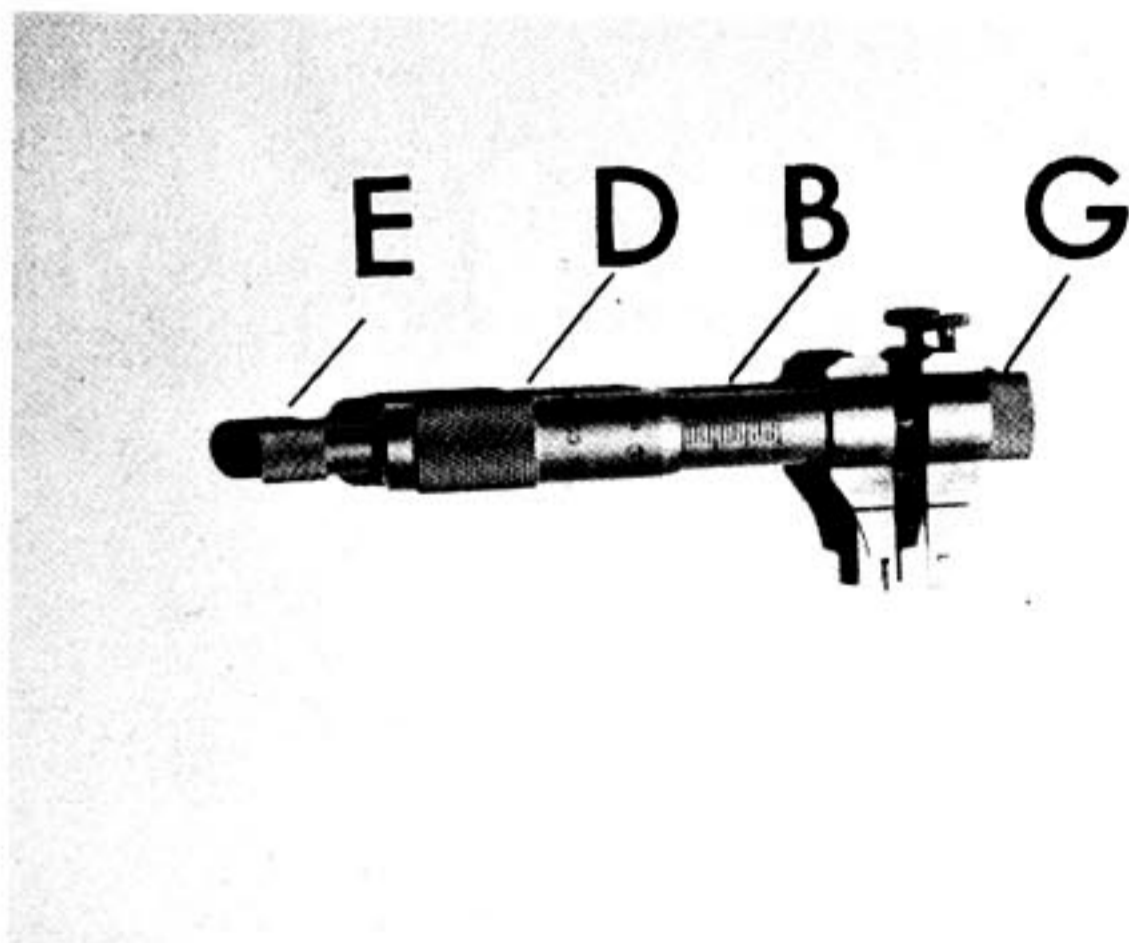
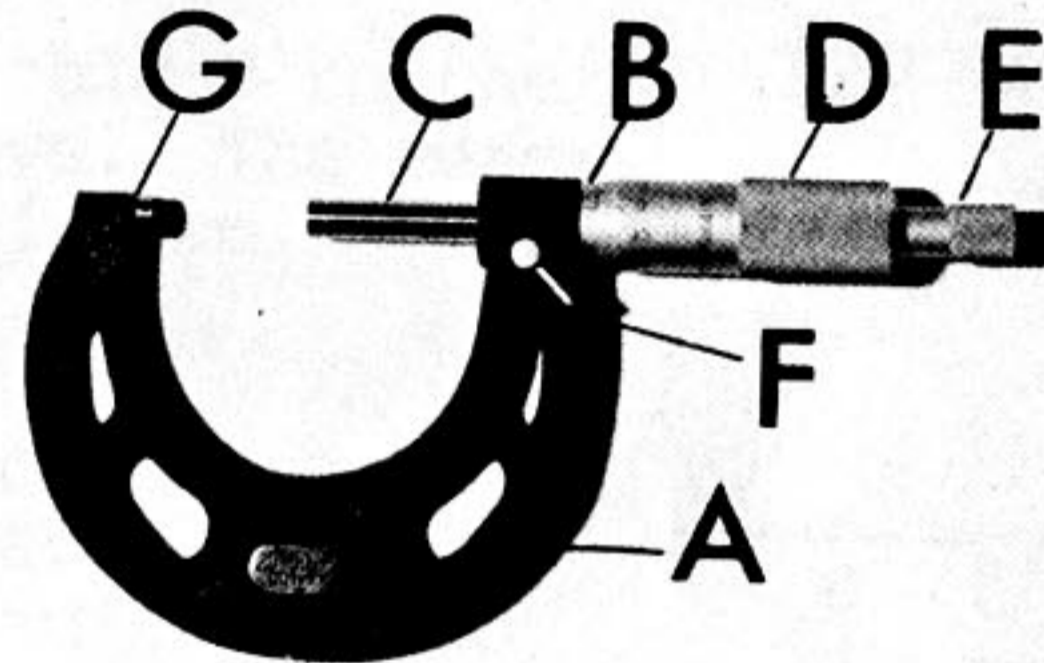
There are three types of micrometers normally used when repairing Yamaha Motorcycles.

- a. Outside diameter micrometer
- b. Inside diameter micrometer
- c. Depth micrometer

All three are based on the same principle but are used for measuring different types of objects. They are based on an accuracy reading of 1/100mm.

The spindle of the micrometer moves in and out as the ratchet is turned - one revolution giving an axial movement of 0.5mm. The spindle screw moves in a fixed nut so that the turning of the spindle and the axial movement are proportioned.

The thimble is fixed on the spindle and indicates the percentage of the revolution, while the sleeve counts the total revolutions. The scale on the thimble is divided into 50 equal parts, thus one graduation is 1/50 of the 0.5mm distance of travel per complete revolution, or 1/100mm. Total measurement is obtained by reading the scale on the sleeve and adding to it the reading on the thimble.

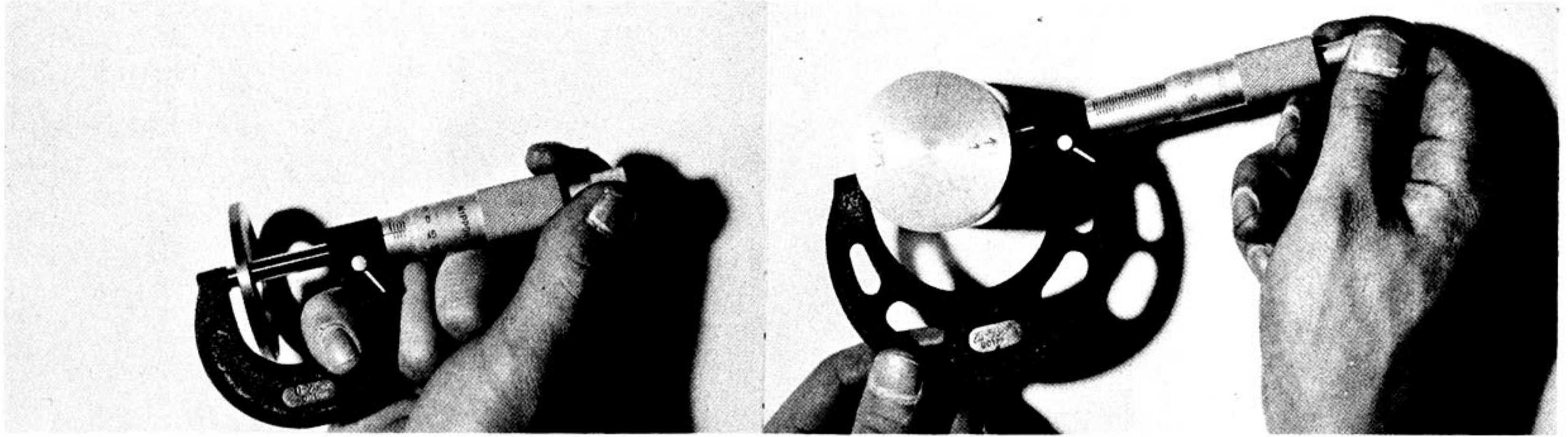


- | | |
|--------------------|-------------------------|
| A. Frame or base. | E. Ratchet |
| B. Sleeve | F. Clamp |
| C. Spindle or rod. | G. Anvil (or fixed end) |
| D. Thimble | |

I - 1. Outside micrometer.

a. How to use.

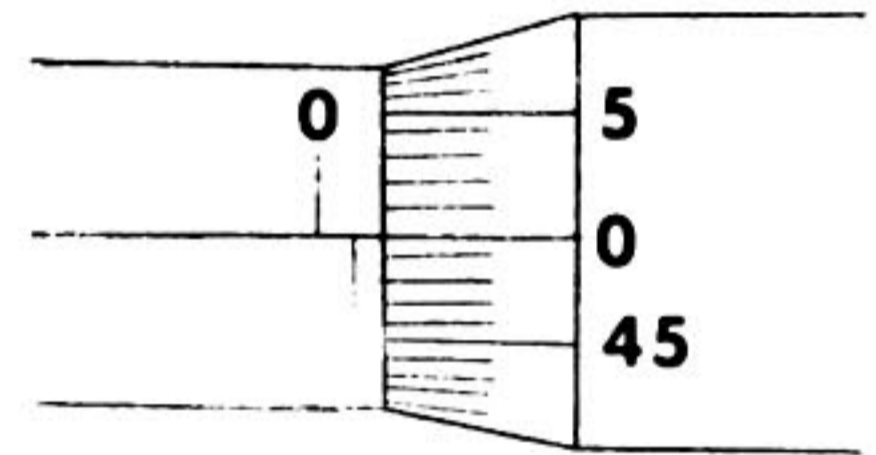
This micrometer is used to measure the diameter, width, length and thickness. The object to be measured is placed between anvil and spindle by placing the object next to the anvil and holding the micrometer evenly. Turn the ratchet slowly to the right until two or three clicking sounds are heard, then read the scale.



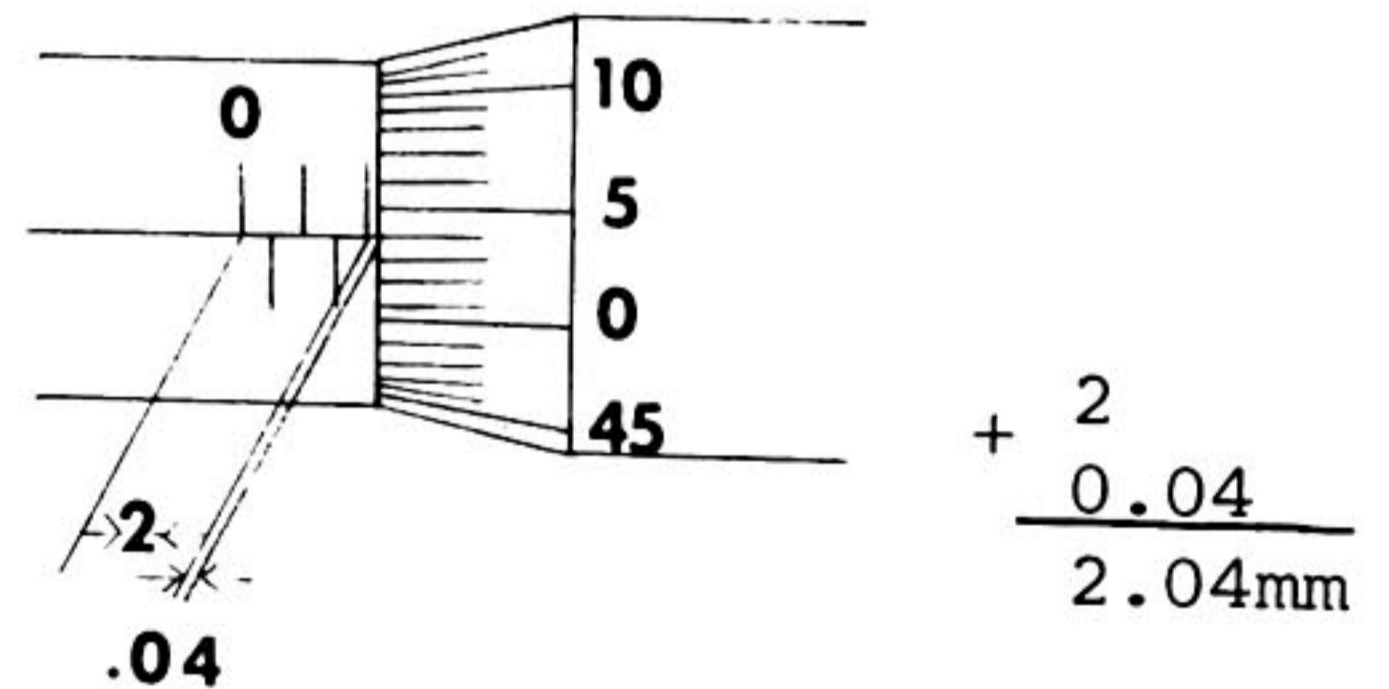
b. Example of the reading.

Read the mm measured on the sleeve and next read the thimble scale where the center line is, add the two readings to get the total.

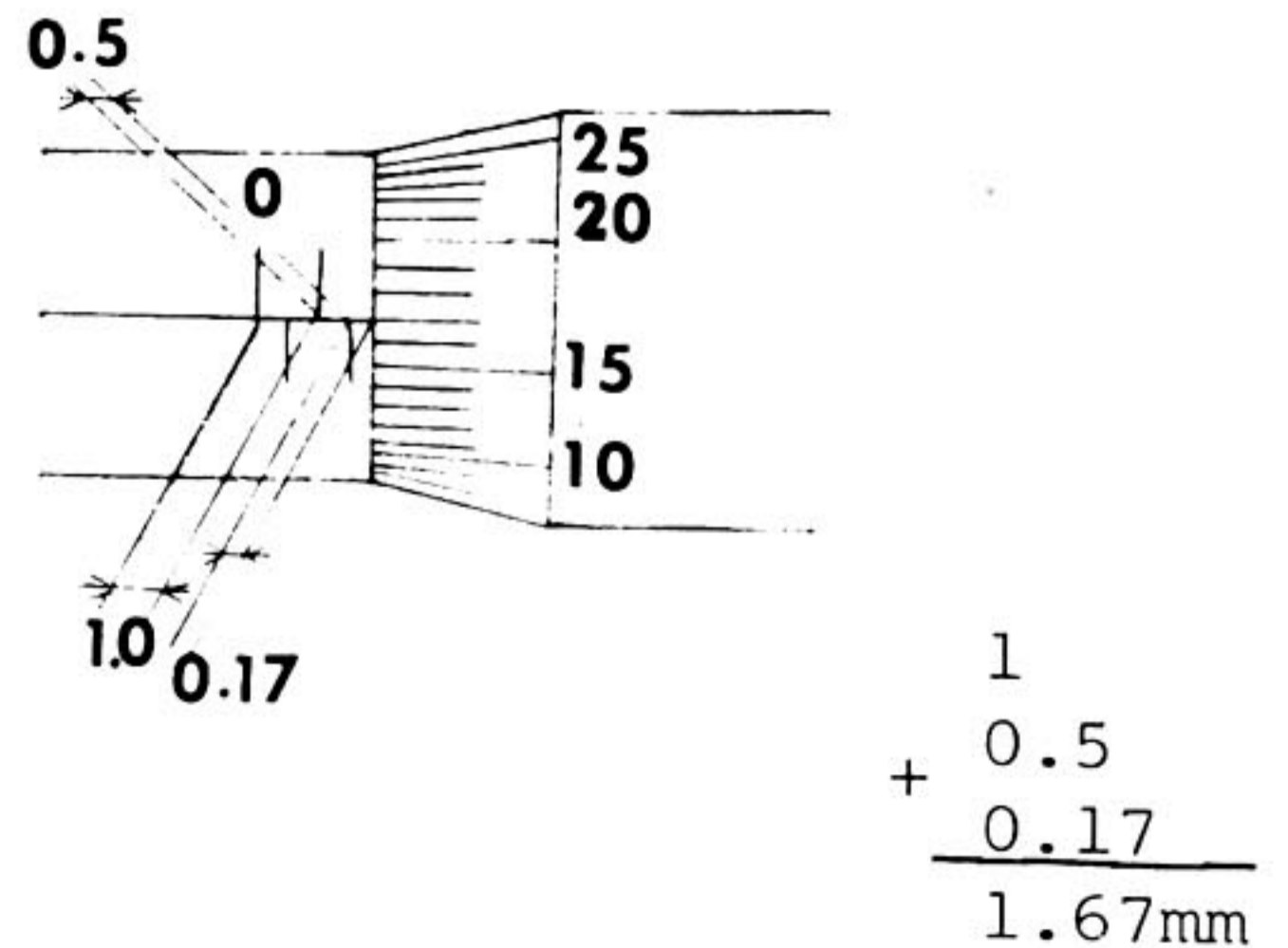
(1) Bring the thimble scale 0 to the center line of sleeve. The reading as illustrated is 1mm.



(2) As illustrated, read the mm on the sleeve, next read the scale on the thimble. Reading should be 2.04mm.



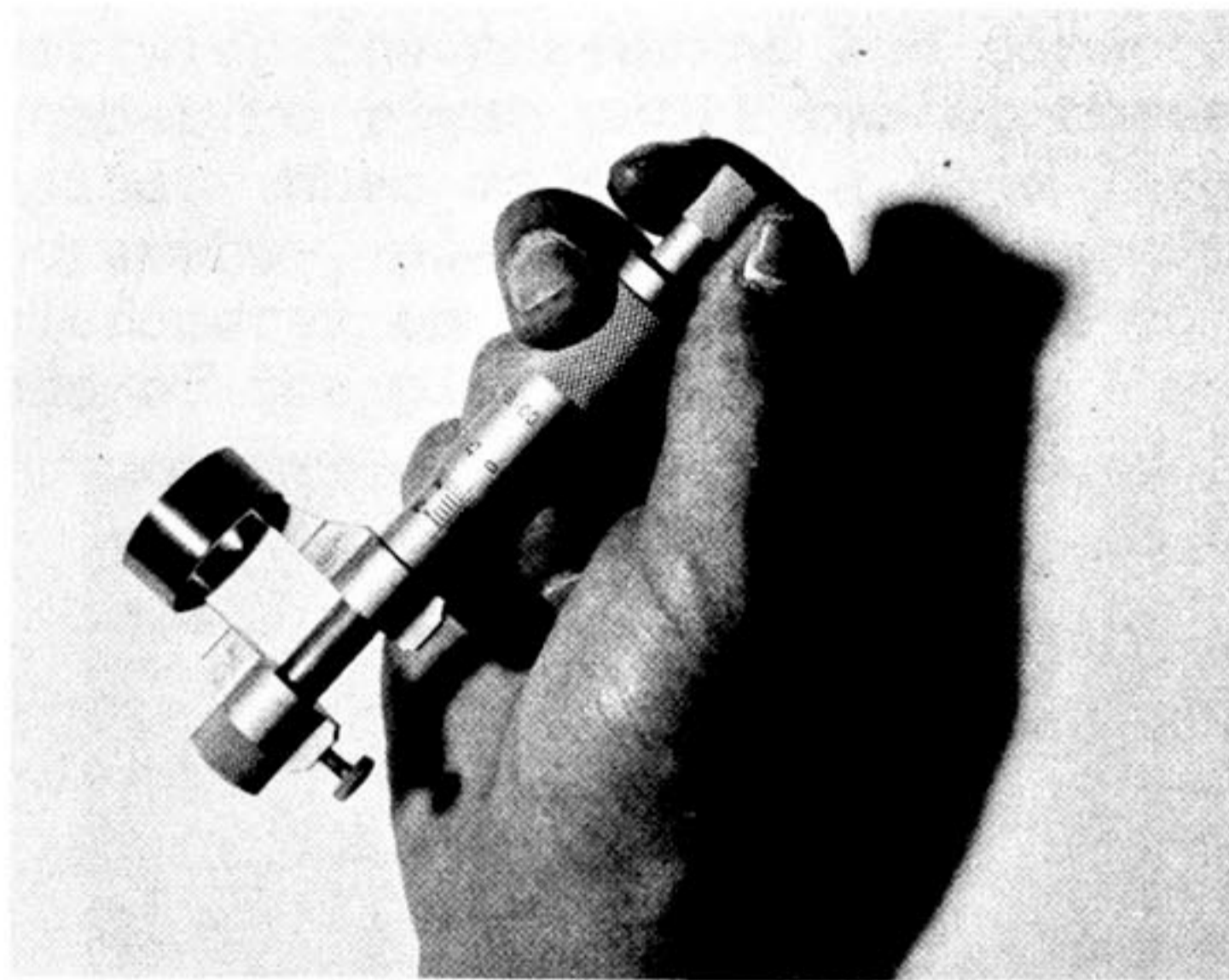
(3) As illustrated, the sleeve reading is slightly over 1.5 and the thimble reading is 0.17, the total is 1.67mm.



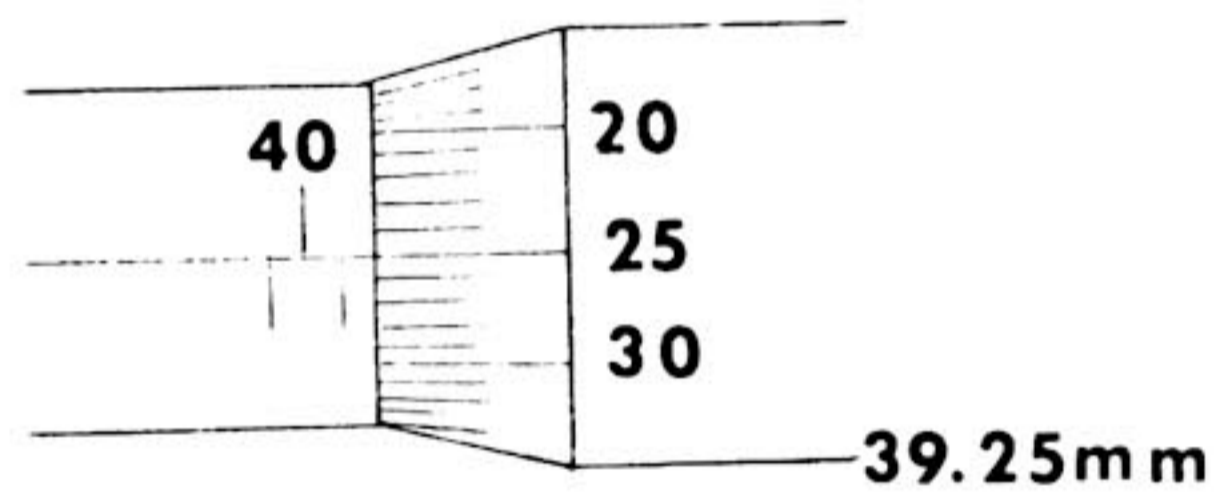
I - 2. Inside micrometer: Used to measure inside diameters.

a. How to use.

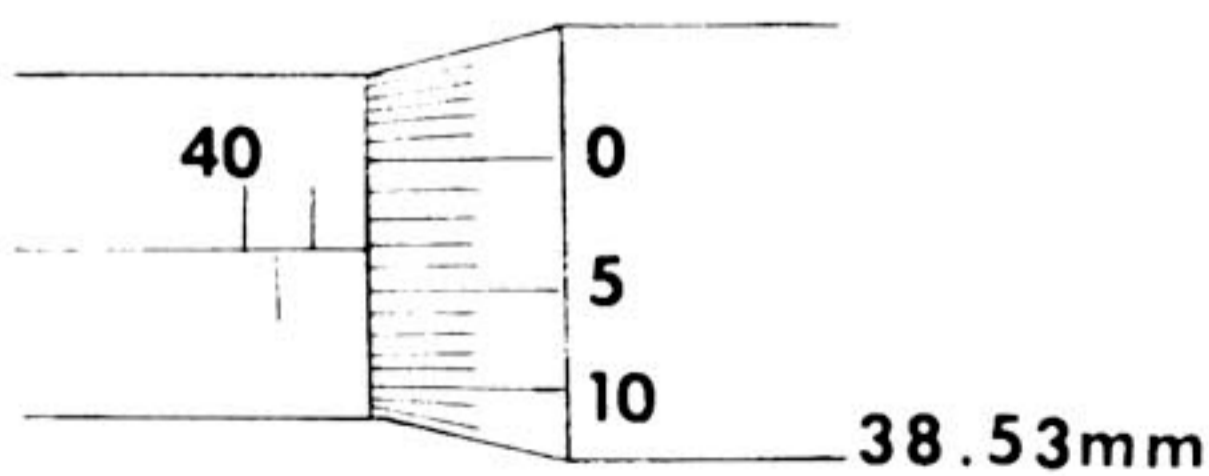
Place the micrometer inside the object to be measured against the anvil (fixed end); and by holding the micrometer evenly turn the ratchet until two or three clicking sounds are heard.



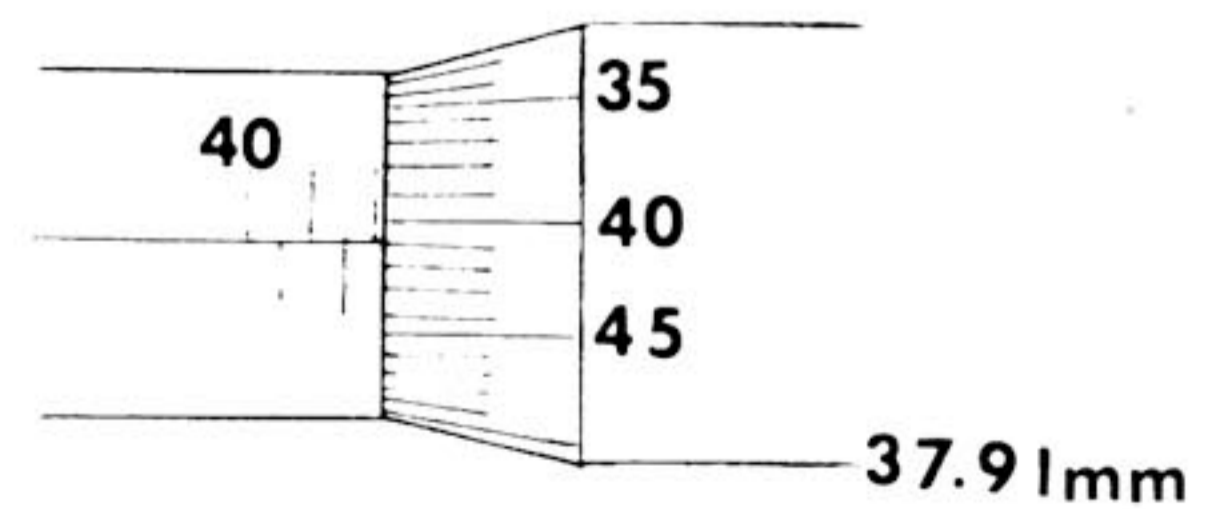
b. Example of the reading.



Sleeve	- - -	39.0+
Thimble	- -	<u>.25</u>
Total		39.25mm



Sleeve	- - -	38.5+
Thimble	- -	<u>.03</u>
Total		38.53mm

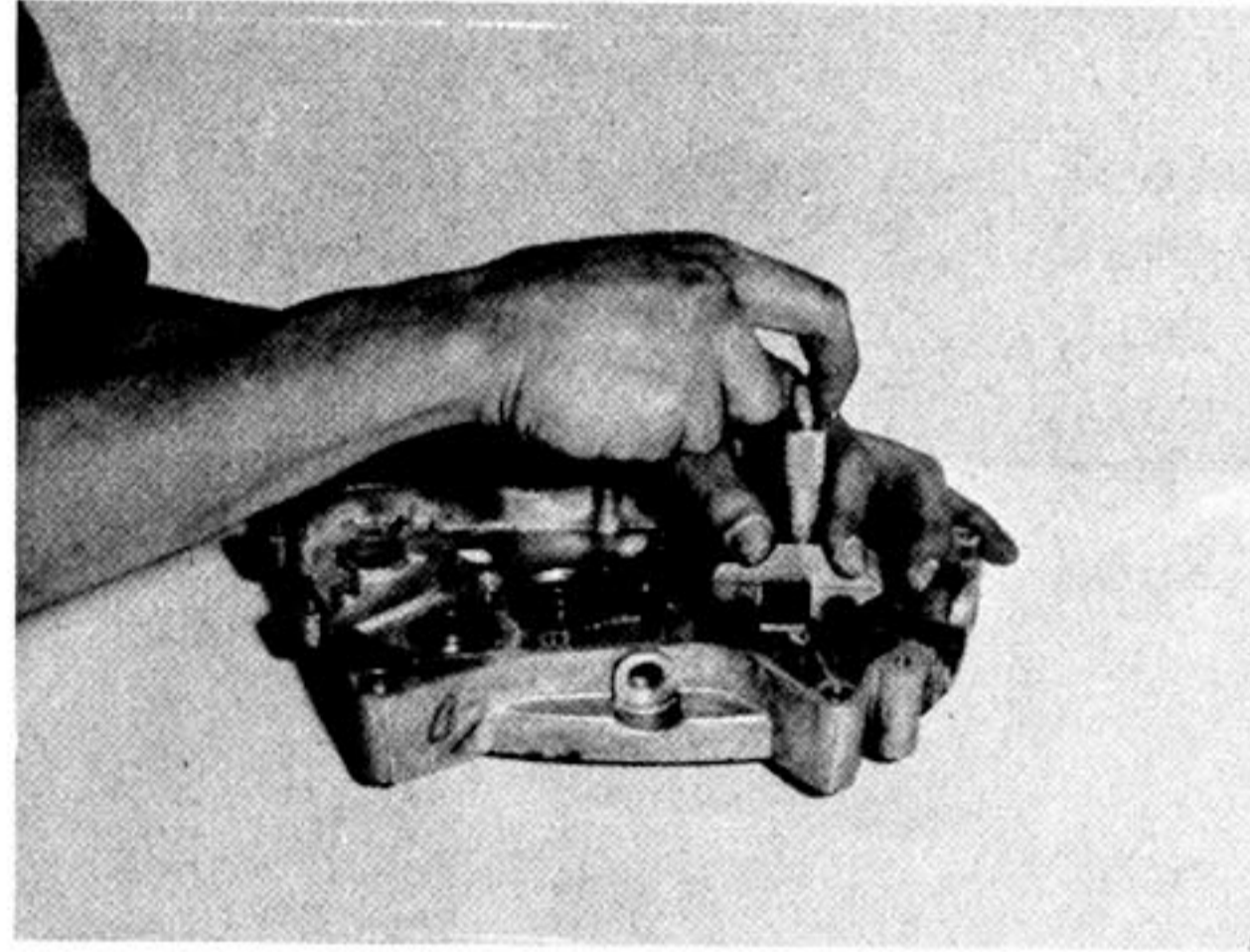


Sleeve	- - -	37.5+
Thimble	- -	<u>.41</u>
Total		37.91mm

I - 3. Depth micrometer

a. How to use.

This micrometer is used to measure the depth. Place the base on the object with the measuring rod directly over the bottom, turn the ratchet to right until two or three clicks are heard. Read the scales. When measuring a hole larger than the base of depth micrometer, place a leveled plate over the hole, then place the micrometer on it, with the rod to the bottom. Subtract the thickness of the plate



b. Example of the reading.

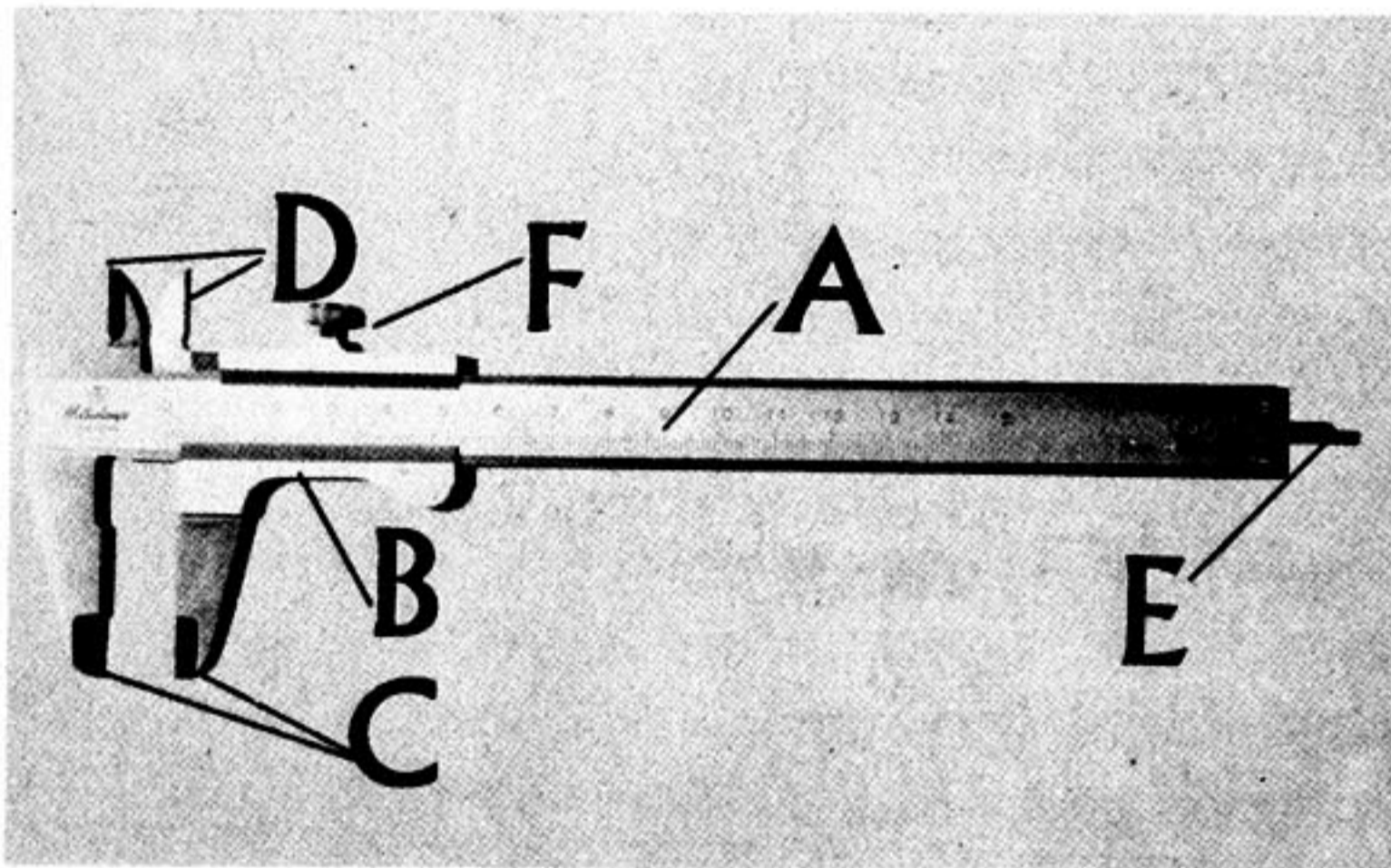
Reading the scale is exactly the same as with inside micrometers.

I - 4. NOTE

1. When using the micrometer, do not force the thimble.
2. Repeat two or three times to get correct measurement.
3. Do not attempt to take measurement while object is moving or turning.
4. When holding the micrometer, hold the frame only. For best results, use micrometer frame holder.
5. Clean the object to be measured before measuring.
6. Do not use the micrometer for a caliper.
7. Clean and oil the micrometer after uses.
8. Check periodically for rust, when not in use.

II. Vernier caliper. (Metric)

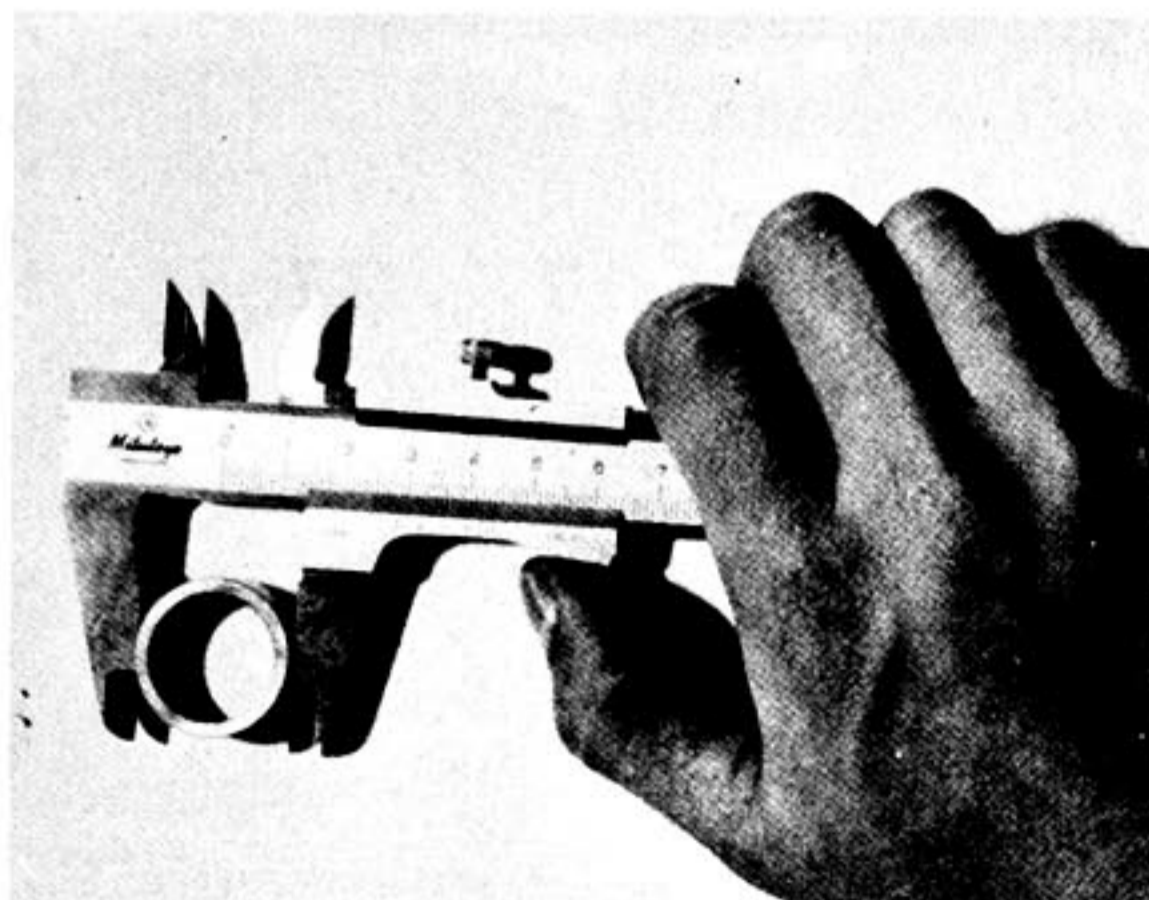
The vernier caliper used by Yamaha is based on 1/20mm (0.05mm) units. This vernier caliper can be used to take the width, thickness, outside diameter, inside diameter and depth measurement. The scale (base) is in 1 mm units and the caliper is 19/20mm units. The vernier slides along the scale and indicates the length of movement. To read the length of movement, the 0 line of the vernier will point to the graduation on the scale, this indicates the mm units. Next, to get the fraction of the mm, read the graduation on the vernier that is aligned with the graduation on the scale, and this will indicate the fraction of mm. Add the scale units and the fraction of the vernier graduation, and this will give the total length of movement.



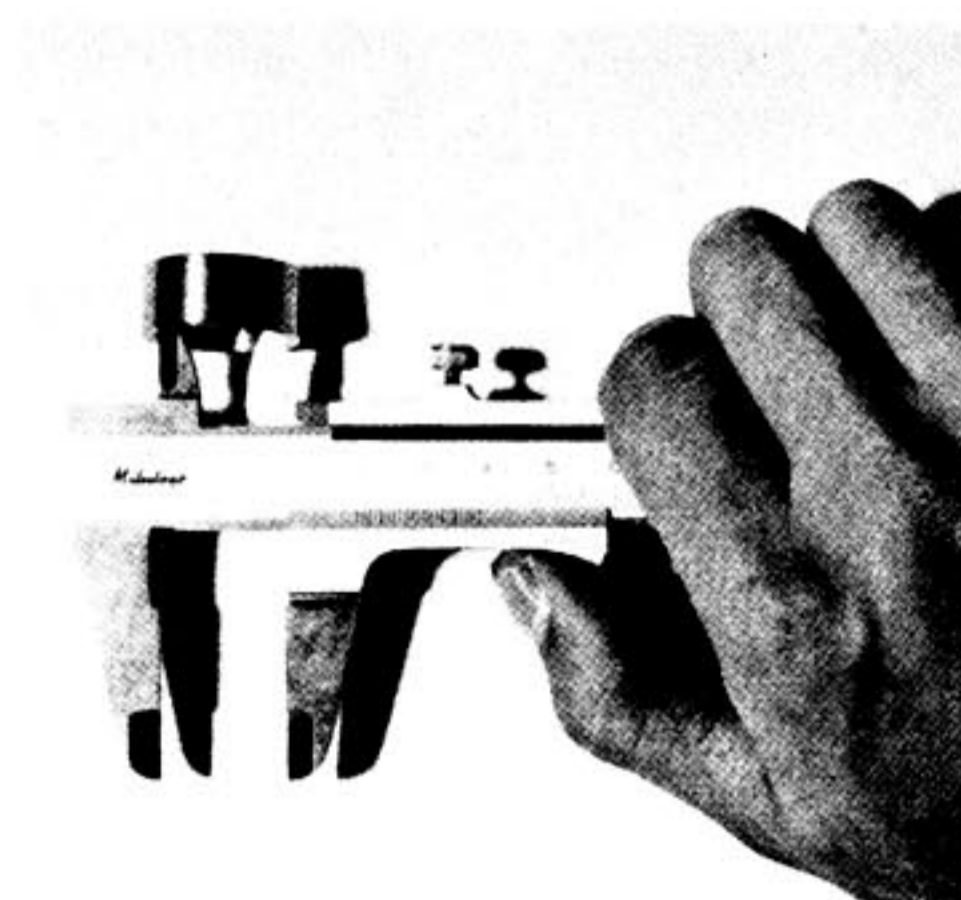
- A. Scale
- B. Vernier
- C. Jaws
- D. Nibs
- E. Rod
- F. Lock

Example: Move the vernier graduation 0 line past the 15mm line on the main scale, until the 13th graduation line on the vernier will align with the graduation above it on the main scale. The reading then will be:

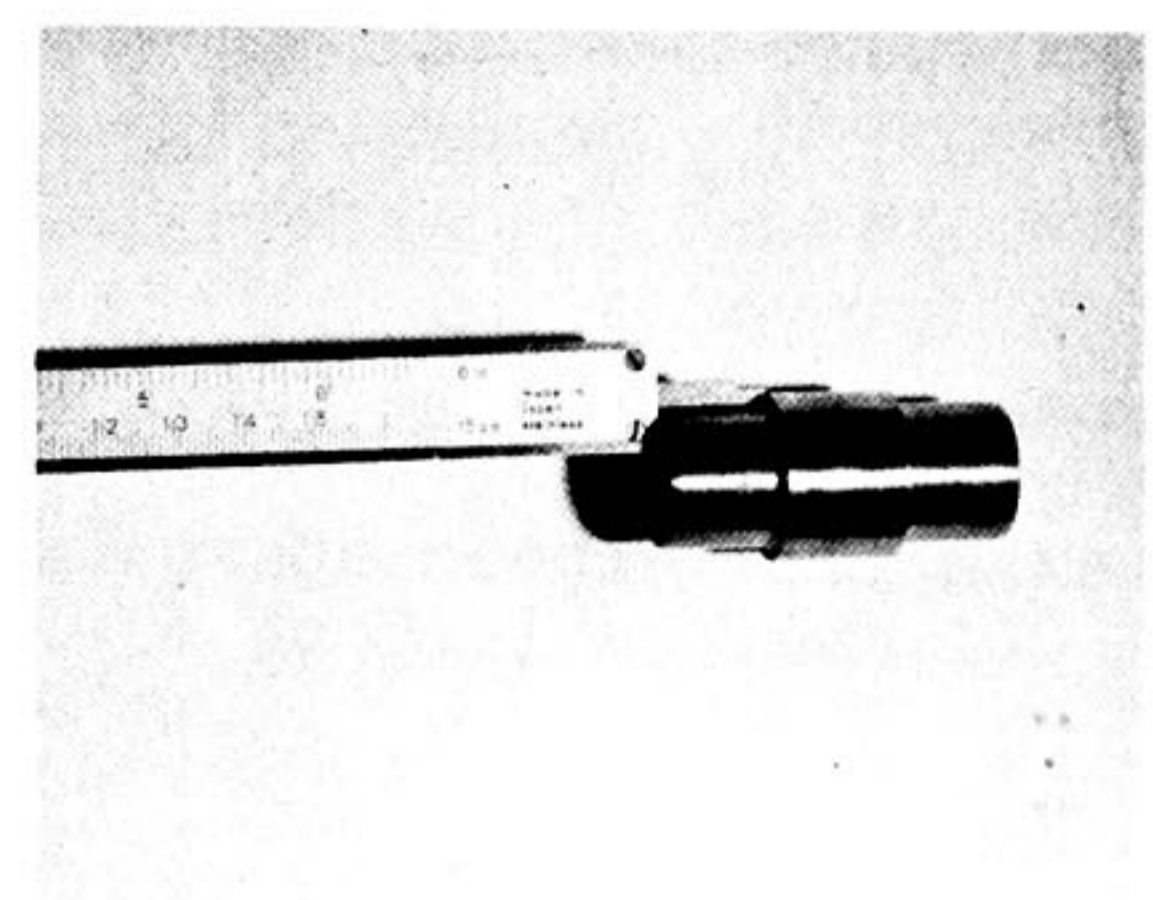
Main scale	- - - - -	15.++
Vernier scale	6.5/10ths	
	(same as 13/20ths)	- - - .65
	Total	<u>15.65</u> mm



OUTSIDE



INSIDE



DEPTH

a. How to use:

1. Outside diameter, thickness and width.

To use the caliper use the jaws. First fit the fixed jaw on the object and move the adjusting jaw of the caliper evenly and read the graduation on the main and vernier scales.

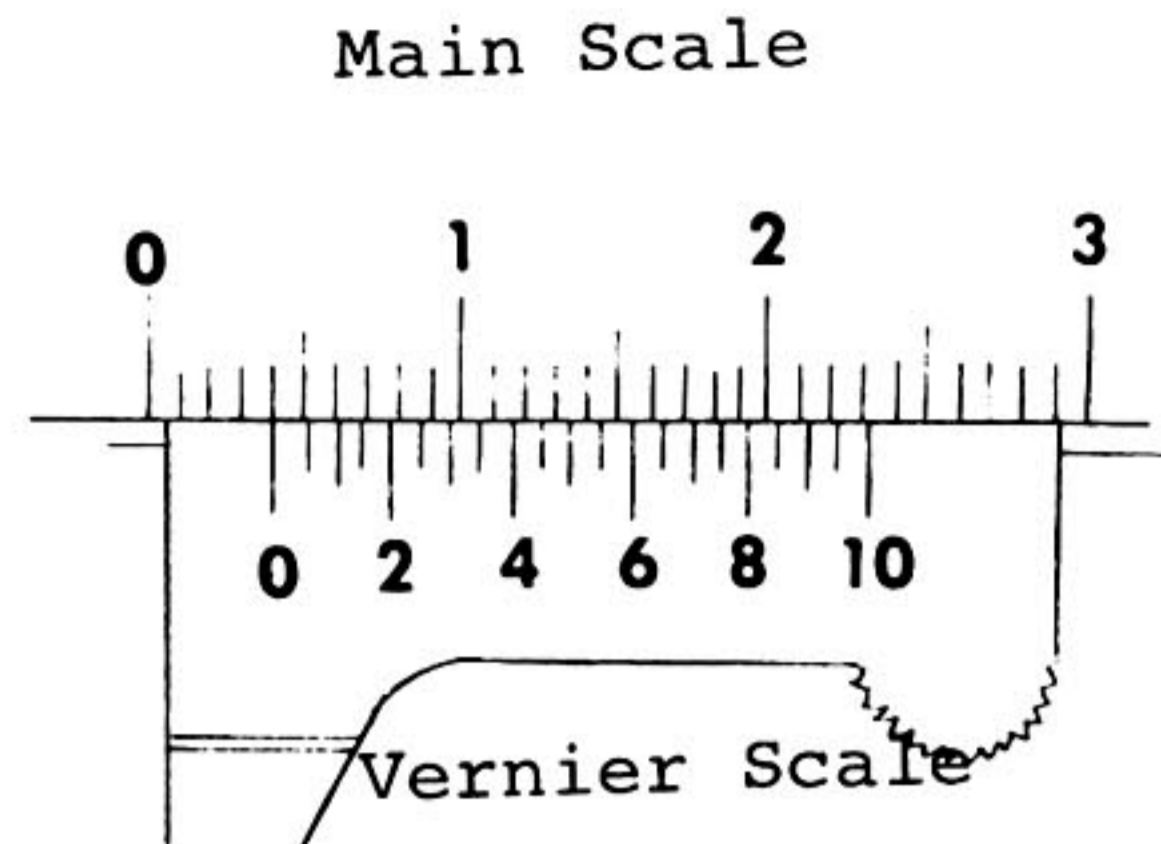
2. Inside diameter: When measuring the inside diameter use the nibs. Set the fixed nib and move the adjusting nib by moving the caliper until it stops, read the graduation on the main and vernier scales.

3. Depth:

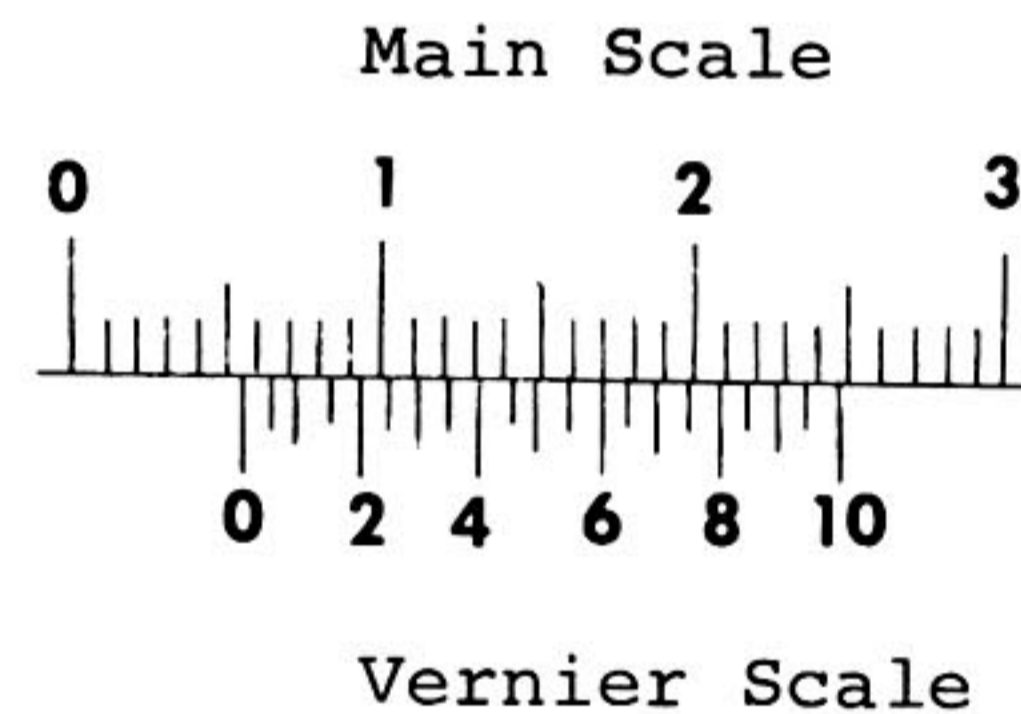
Use the depth rod to measure the depth. Place the edge of the scale and move the caliper until the rod stops, then read the graduation on the main and vernier scales.

b. Example of the reading.

1. Main scale - - 4.++
 Vernier scale .00
 Total 4.00 mm



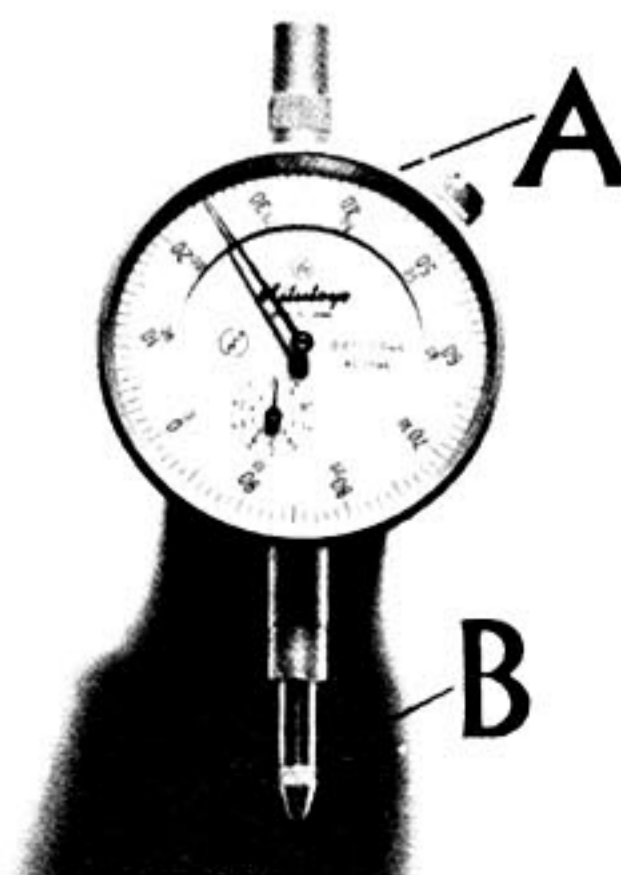
2. Main scale - - 5.++
 Vernier scale .60
 Total 5.60 mm



III. Dial Guage. (Metric)

The dial guage used by Yamaha registers in 1/100 mm units to measure the stroke and runout.

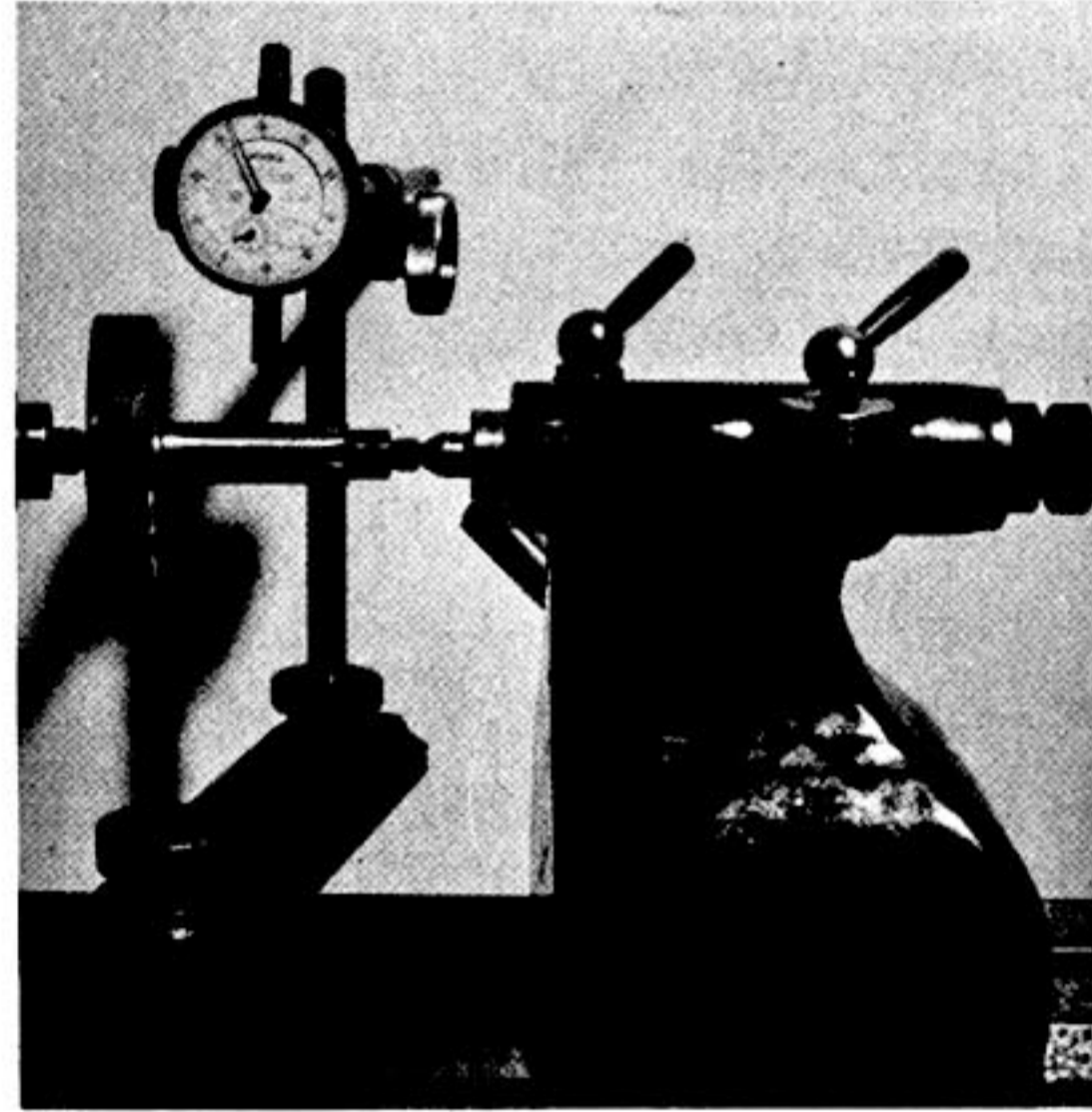
When the measuring rod moves 1 mm, the dial guage needle will make one complete turn. The graduation face plate is divided into 100 equal divisions. Each line indicate 1/100 mm.



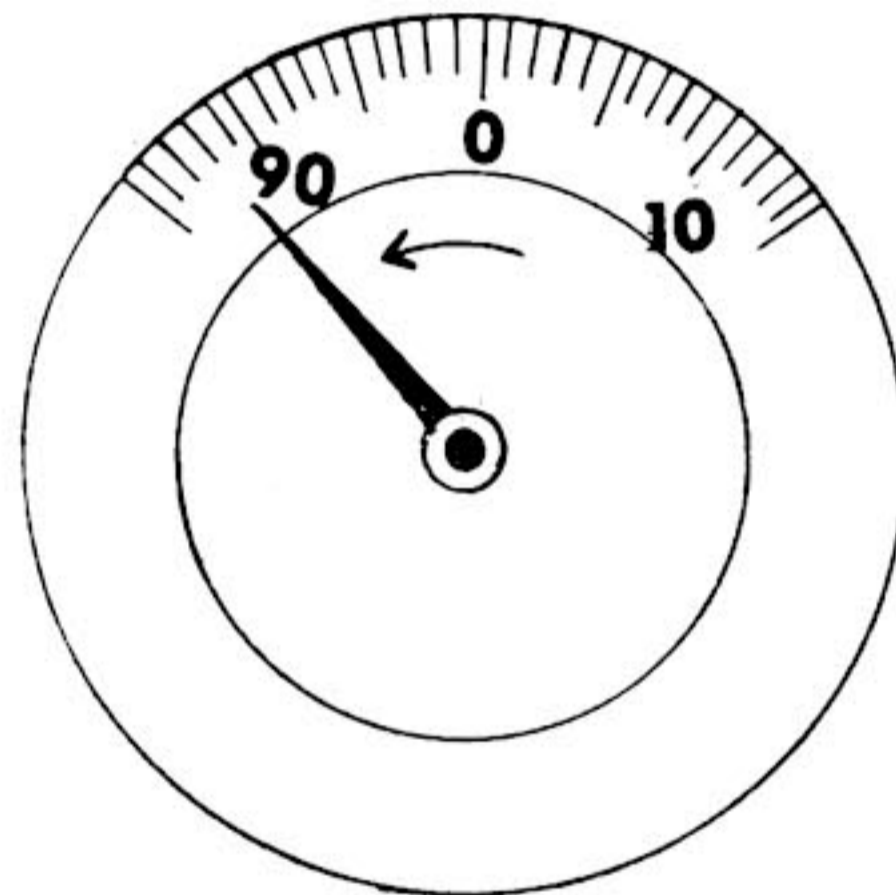
- A. Dial Face
 B. Rod

a. How to use the dial guage.

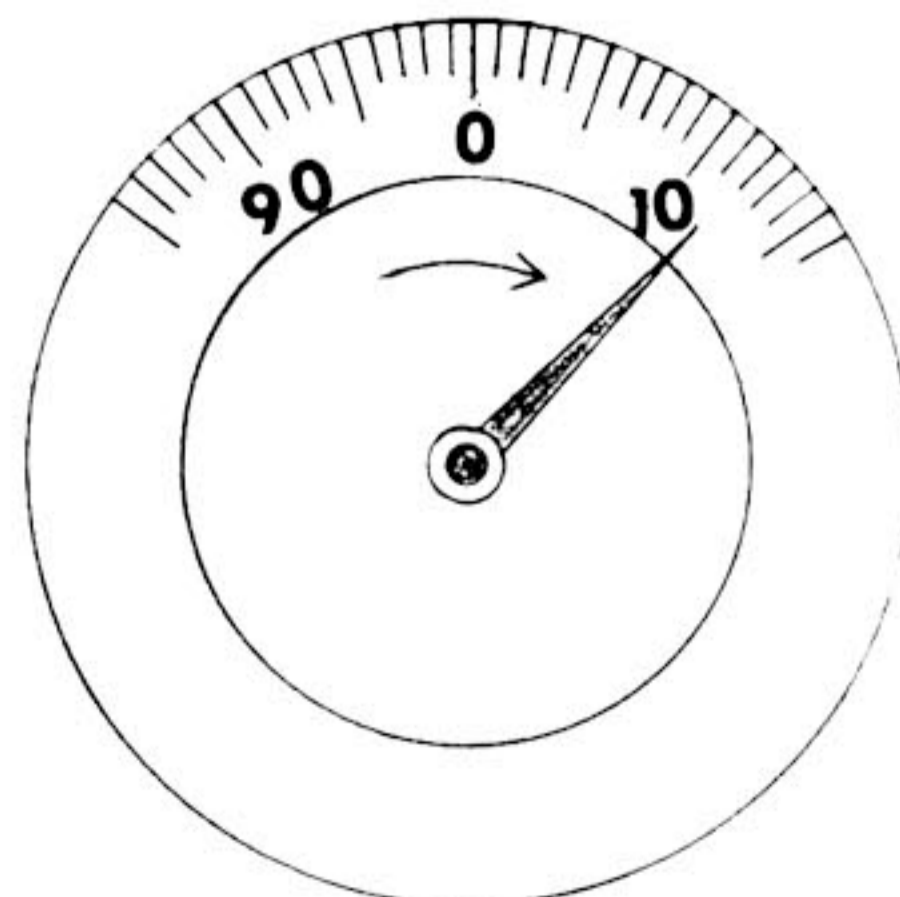
Set the dial guage in the guage holder, near the object, then by turning or moving the object set the rod on the measuring point and turn the dial face to 0. When turning or moving the object and the dial needle moves to the right, the measuring rod moved up. When moved to the left, the rod moves down. The needle indicates the movement of the rod.



b. Example of the reading.



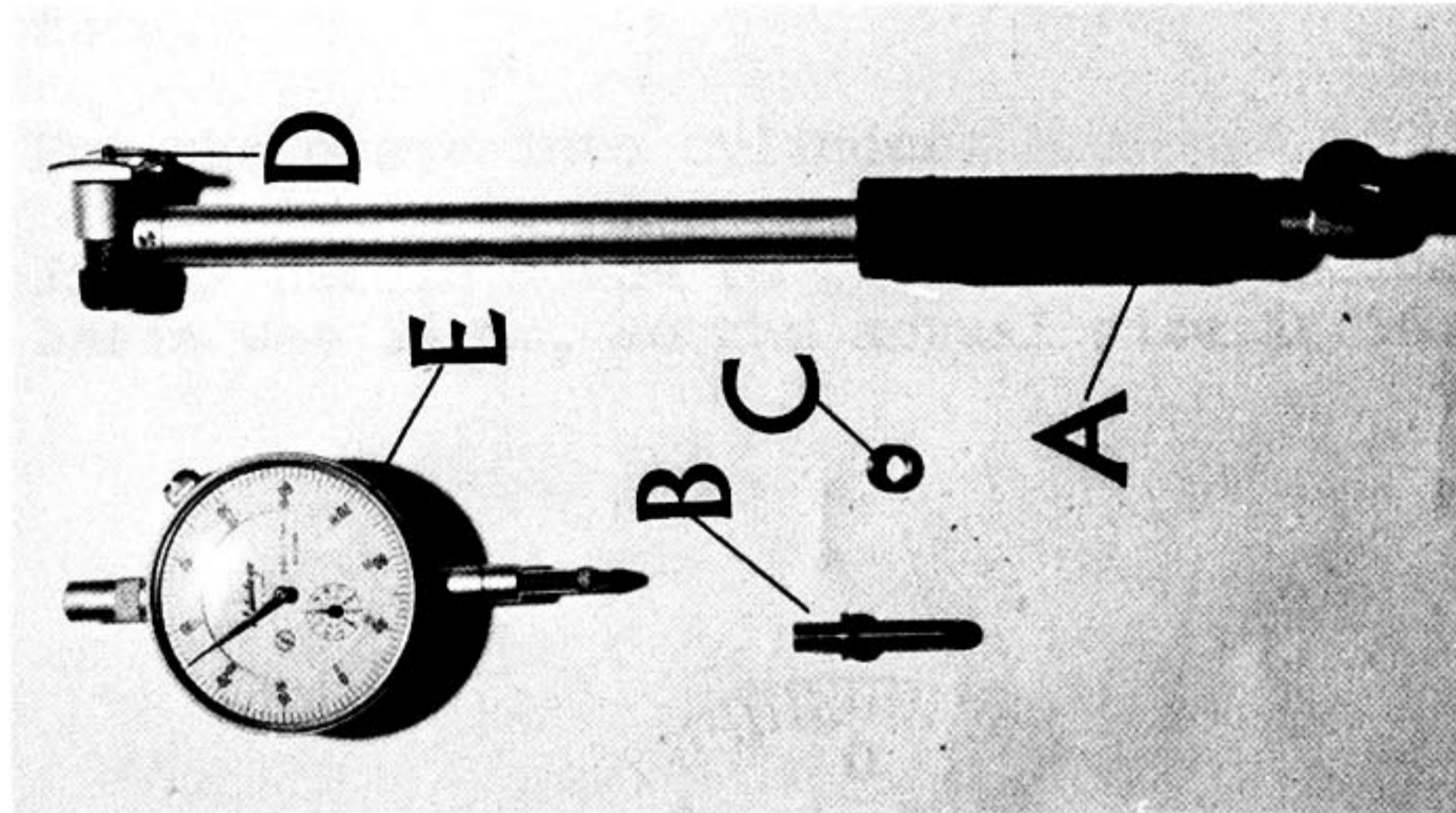
- 0.12 mm



+ 0.12 mm

IV. Cylinder guage (bar type) Metric

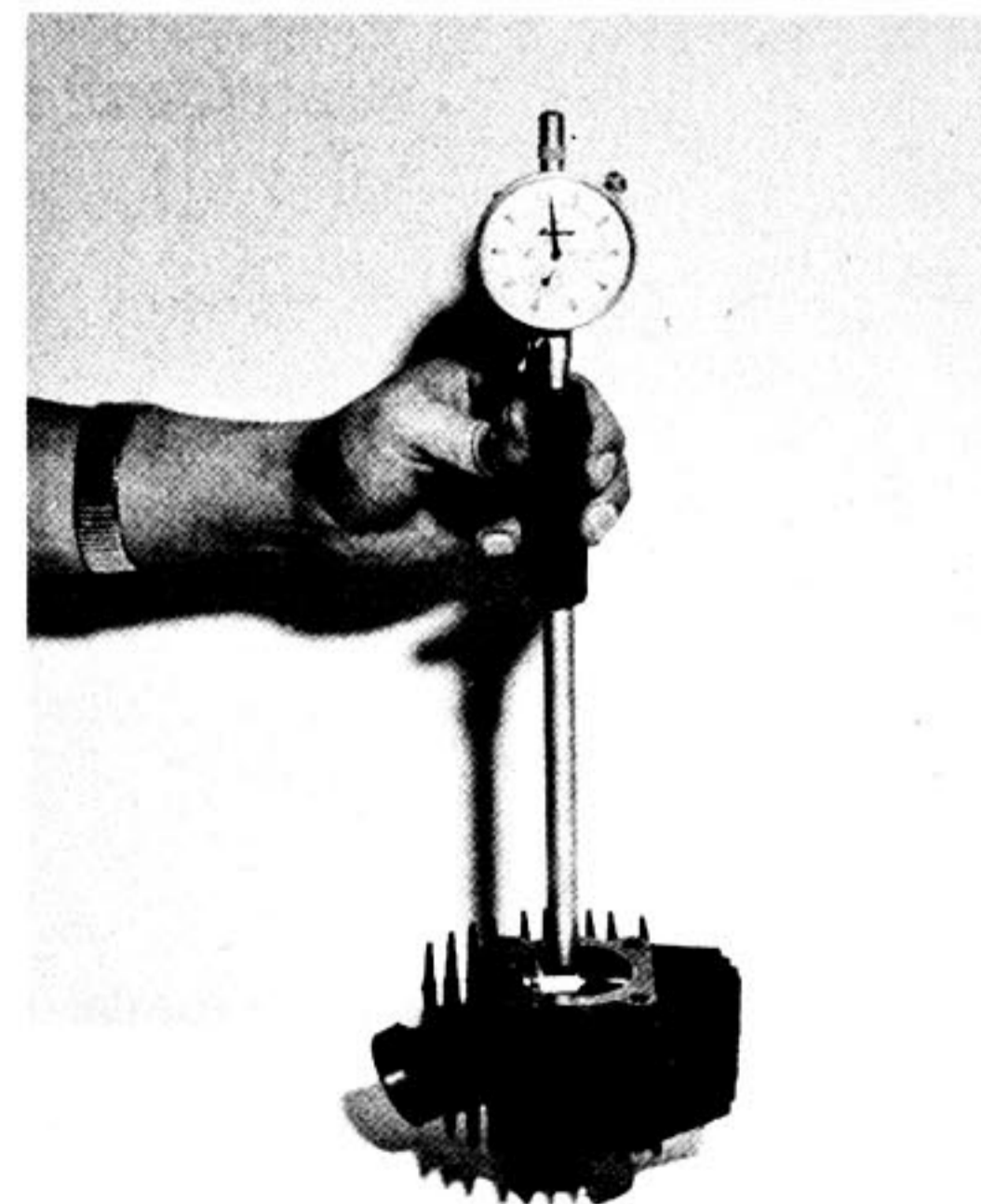
The cylinder guage used by Yamaha is based on 1/100 mm units to measure the inside diameter of the cylinder. This guage has a measuring rod and the movement of this rod is indicated on the dial guage.



- A. Handle
- B. Anvil
- C. Shim
- D. Rod
- E. Dial Guage

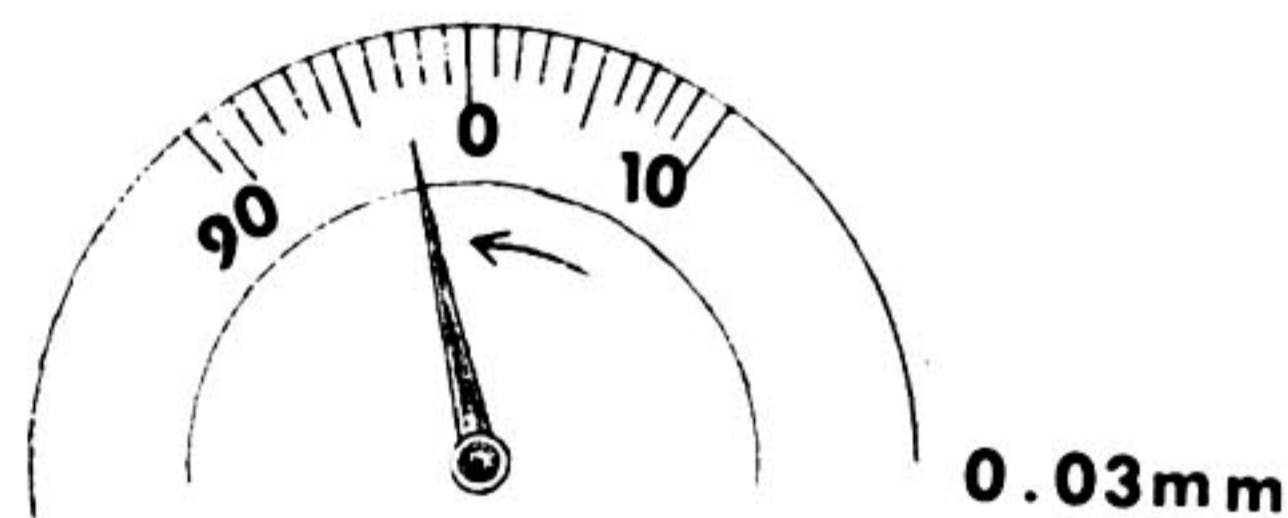
a. How to use the cylinder guage:

1. When measuring the object, measure the diameter with a scale and select the correct anvil and adjusting shim.
2. Use the outside micrometer and set to the diameter of the object. Place the anvil end of the cylinder guage in the micrometer and set the 0 of the dial face.
3. Align the anvil end with the line on the cylinder and move the end with the measuring rod first and straighten the bar. Then read the graduation on the dial face. When the needle moves to the right, it is less than set measure; left indicates larger than set measure.



b. Example of the reading

1. When the diameter is 54 mm, use a 50 mm anvil and select the 4 mm adjusting shim.
2. Set the micrometer to 54.00 mm, place the anvil end of the cylinder gauge in the micrometer and set the 0 of the dial face.
3. Put the gauge into cylinder.
4. If the needle moves to the left and indicates 0.03 mm, the basis was 54 mm, so the actual size is 54.03 mm.



c. NOTE:

- a. Make sure the cylinder gauge is placed correctly in the micrometer, otherwise the measurement will be incorrect.
- b. Hold the cylinder gauge by handle only.
- c. Take two or three measurements for correctness.

NO.	ITEM	SIZE OR APPLICATION	SUPPLIED FROM YAMAHA	BASIC SET NECESSARY	ADDITIONAL RECOMMENDED	PRICE	INVENTORY
010100	Screw Driver (Slotted)	Set		X		Set \$11.75	
010101	Screw Driver	1/4 x 4"		X			
010102	Screw Driver	5/16 x 4"		X			
010103	Screw Driver	3/8 x 6"		X			
010104	Screw Driver	7/16 x 8"		X			
010105	Screw Driver	7/16 x 12"		X			
010106	Screw Driver	9/32 x 1-1/2"		X			
010200	Phillips Screw Driver	Set		X		Set 11.43	
010201	Phillips Screw Driver	0 - 2-1/2"		X			
010202	Phillips Screw Driver	1 - 3"		X			
010203	Phillips Screw Driver	2 - 4-1/4"		X			
010204	Phillips Screw Driver	3 - 6"		X			
010205	Phillips Screw Driver	4 - 8"		X			
010206	Phillips Screw Driver	2 - 9/16"		X			
010301	T-Handle Screw Driver	Large	X			1.00	
010302	T-Handle Screw Driver	Medium	X			1.00	
010303	T-Handle Screw Driver	Small	X			1.00	
010401	T-Handle Phillips Driver	Large	X			1.00	
010402	T-Handle Phillips Driver	Medium	X			1.00	
010403	T-Handle Phillips Driver	Small	X			1.00	
020101	Special wrench for Dynamo	6 x 8 mm	X			.48	
020102	Open End Wrench	6 x 7 mm		X		1.19	
020103	Open End Wrench	8 x 9 mm		X		1.25	
020104	Combination Wrench	10 mm		X		1.85	
020105	Combination Wrench	12 mm		X		2.09	
020106	Combination Wrench	14 mm		X		2.19	
020107	Combination Wrench	17 mm		X		2.69	
020108	Combination Wrench	19 mm		X		2.89	
020109	Open End Wrench	21 x 23 mm		X		3.65	
020201	Adjustable Wrench	6 x 3/4"		X		2.25	
020202	Adjustable Wrench	12 x 1-5/16"		X		5.09	

NO.	ITEM	SIZE OR APPLICATION	SUPPLIED FROM YAMAHA	BASIC SET NECESSARY	ADDITIONAL RECOMMENDED	PRICE	INVENTORY
030100	Socket Set	3/8" Drive		X		Set \$37.56	
030101	Ratchet	7"		X			
030102	Extension	3-1/2"		X			
030103	Hinge Handle	7-5/8"		X			
030104	Universal Joint			X			
030105	Sparkplug Socket	13/16"		X			
030106	Speed Handle	16 - 7/8"		X			
030107	Socket	8 mm		X			
030108	Socket	9 mm		X			
030109	Socket	10 mm		X			
030110	Socket	11 mm		X			
030111	Socket	12 mm		X			
030112	Socket	13 mm		X			
030113	Socket	14 mm		X			
030114	Socket	15 mm		X			
030115	Socket	16 mm		X			
030116	Socket	17 mm		X			
030117	Socket	18 mm		X			
030118	Socket	19 mm		X			
030119	Steel Box	18-1/3 x 5-1/4 x 1-1/2"		X			
040101	Flex Handle	3/8" Dr. 12"		X		4.19	
040102	Flex Handle	1/2" Dr. 15"		X		6.89	
040103	Extension	3/8" Dr. 7-1/2"		X		1.95	
040104	Adapter	3/8" female - 1/2" male		X		1.55	
040105	Adapter	1/2" female - 3/8" male		X		1.85	
040106	Socket	21 mm		X		1.25	
040107	Socket	23 mm		X		1.45	
040108	Socket	26 mm		X		1.55	
040109	Socket	29 mm		X		1.85	
040110	Socket	32 mm		X		1.85	
040201	T-Handle Socket Wrench	7 mm	X			1.00	
040202	T-Handle Socket Wrench	9 mm	X			1.00	
040203	T-Handle Socket Wrench	10 mm	X			1.00	
040204	T-Handle Socket Wrench	12 mm	X			1.00	
040205	T-Handle Socket Wrench	14 mm	X			1.00	
040206	T-Handle Socket Wrench	17 mm	X			1.00	
040207	T-Handle Socket Wrench	19 mm	X			1.00	
040208	T-Handle Socket Wrench	21 mm	X			1.00	

NO.	ITEM	SIZE OR APPLICATION	SUPPLIED FROM YAMAHA	BASIC SET NECESSARY	ADDITIONAL RECOMMENDED	PRICE	INVENTORY
050101	Thin nose plier	5-1/2"		X		\$1.73	
050102	Plier (Std.)	6-1/2"		X		2.69	
050103	Cutting Plier	6"		X		3.69	
050106	Power truck plier	7-1/2"		X		2.59	
050107	Power truck plier	10"		X		3.35	
050108	Lever wrench plier	8"		X		2.89	
050109	Retaining ring plier		X			3.00	
050110	Retaining ring plier		X			3.00	
050201	Ball pein hammer	12oz		X		3.45	
050202	Soft face hammer	32oz		X		6.65	
050203	Plastic hammer			X		3.09	
050204	Brass hammer			X		5.15	
050104	Needle Nose side cutter	6-3/4"		X		3.73	
060101	Tap	5mm	X			2.50	
060102	Tap	6mm	X			2.50	
060103	Tap	8mm	X			2.50	
060104	Tap	10mm	X			2.50	
060201	Die	5mm	X			2.00	
060202	Die	6mm	X			2.00	
060203	Die	8mm	X			2.00	
060204	Die	10mm	X			2.00	
060301	Tap Wrench		X			1.00	
060401	Die Stock	5 & 6mm	X			1.00	
060402	Die Stock	8mm	X			1.00	
060403	Die Stock	10mm	X			1.00	
060501	Reamer	10mm	X			3.00	
060502	Reamer	12mm	X			3.00	
060503	Reamer	14mm	X			3.00	

7. CHISEL, PUNCH & FILE

8. TESTER, CHECKER & CHARGER

_TOOLS - PAGE 4 of 7

NO.	ITEM	SIZE OR APPLICATION	SUPPLIED FROM YAMAHA	BASIC SET NECESSARY	ADDITIONAL RECOMMENDED	PRICE	INVENTORY
070100	Chisel and Punch	Set		X		Set \$ 5.28	
070101	Center Punch	3/8"		X			
070102	Rivet or pin punch	5/16" x 1/8"		X			
070103	Rivet or pin punch	3/8" x 3/16"		X			
070104	Starting punch	5/16"		X			
070105	Cord Chisel	1/2"		X			
070106	Vinyl Kit			X			
070200	File	Set		X		Set 6.45	
070201	Half round bastard file	10"		X			
070202	Round bastard file	8"		X			
070203	Knife file	6"		X			
070204	Warding file	4"		X			
070205	Mill file	10"		X			
070206	Cross file	8"		X			
080101	Yamaha electro-tester		X			115.00	
080201	Point checker		X			15.00	
080301	Selenium rectifier chkr.		X			35.00	
080401	Tachometer (Engine speed tester)	Electrical Hi-12000 rpm Low-4000 rpm	X				
080501	Battery charger	6 or 12 volt 18 cells 36 control steps 1 - 6 Amp.		X		44.10	

9. GAUGE & SCALE

TOOLS - PAGE 5 of 7

NO.	ITEM	SIZE OR APPLICATION	SUPPLIED FROM YAMAHA	BASIC SET NECESSARY	ADDITIONAL RECOMMENDED	PRICE	INVENTORY
090101	Outside micrometer	0 - 25 mm	X			\$ 10.00	
090102	Outside micrometer	25 - 50 mm	X			15.00	
090103	Outside micrometer	50 - 75 mm	X			18.00	
090201	Inside micrometer	0 - 25 mm	X			40.00	
090202	Inside micrometer	25 - 50 mm	X			45.00	
090301	De-th micrometer		X			30.00	
090401	Vernier Caliper	0 - 150mm 1/20 mm	X			15.00	
090501	Dial gauge	0 - 10mm 0.01 mm	X			12.00	
090601	Cylinder gauge	35 - 60 mm	X			35.00	
090701	Thickness gauge			X		1.35	
090702	Plug gap gauge			X		1.39	
090703	Tire pressure gauge	2 - 50 lbs.			X	1.50	
090801	Metric torque wrench	3/8" Dr. 10 m- kg 500 cm-kg		X		32.95	
090901	Compression gauge	0 - 300 lbs.			X	18.15	

10. MISCELLANEOUS

TOOLS - PAGE 6 of 7

NO.	ITEM	SIZE OR APPLICATION	SUPPLIED FROM YAMAHA	BASIC SET NECESSARY	ADDITIONAL RECOMMENDED	PRICE	INVENTORY
100101	Riversible drill	3/8" Dr.			X	\$ 53.55	
100102	Drill Bit Set	1/16" - 1/2"			X	24.43	
100201	Soldering gun				X	12.95	
100301	Yamaha Hone		X			18.00	
100401	Hack Saw			X		3.95	
100501	Bolt cracking tool				X	6.50	
100601	Pistol Oiler	6 oz.			X	1.49	
100701	Combination Pattern Snips	10"		X		3.79	
100801	Wire Stripper				X	2.50	
100901	Chain Cutter				X		
101001	Bearing Puller				X		
101101	Impact Driver				X		
101102	Impact Driver Bit (std.)				X		
101103	Impact Driver (Phillips)				X		
101201	Tool Box	19" x 7-1/32 x 9-1/8"		X		9.99	
110101	Bench vise	4-1/2" x 6" x 3-5/8"			X	31.20	
110201	Grinder	1/3 HP			X	49.45	
110301	Hydraulic shop press	12 - 15 Tons			X	128.25	
110401	Crankshaft Centering Device				X		
110501	Surface Plate	20" x 20"			X		

11. YAMAHA SPECIAL TOOLS

TOOLS - PAGE 7 of 7

NO.	ITEM	SIZE OR APPLICATION	SUPPLIED FROM YAMAHA	BASIC SET NECESSARY	ADDITIONAL RECOMMENDED	PRICE	INVENTORY
110101	Clutch holding tool	MJ2	X			\$ 1.50	
110102	Clutch holding tool	YG1	X			1.50	
110103	Clutch holding tool	YA5	X			1.50	
110104	Clutch holding tool	YA6	X			1.50	
110201	Armature puller	YA5,6 & YD2,3	X			1.00	
110202	Armature puller	YDS1,2,3	X			1.00	
110301	Flywheel puller	YG1	X			4.00	
110401	Flywheel holding tool	YG1	X			2.00	
110501	Crankcase separator	All models	X			2.50	
110601	Crank puller	YA, YD, YDS	X			7.00	
110602	Crank puller	MJ2	X			2.00	
110603	Crank puller	YDS3	X			7.00	
110701	Valve cover tool	YA5	X			2.00	
110801	Kick spring tool	YA, YD, YDS	X			1.50	
110901	Exhaust pipe wrench	YA, YD, YDS	X			2.50	
110902	Exhaust pipe wrench	MJ2, YG1	X			1.50	
111001	Dial gauge attachment (1)	All models	X			1.00	
111002	Dial gauge attachment (2)	All models	X			1.00	
111101	Fork tube tool	YG1, YA5	X			2.50	
111102	Fork tube tool	YA6	X			2.00	
111103	Fork tube tool	YD3, YDS2, YDT1	X			2.00	
111104	Fork tube tool	YDS3	X			2.00	
111201	Conrod bush puller	12 mm	X			2.00	
111202	Conrod bush puller	14 mm	X			2.00	
111301	Slide metal locking tool	YA5	X			2.50	
111401	Oil Pump Adjusting Tool	YG1, YA6	X			1.50	
111501	Crankshaft separator	YD, YDS	X			25.00	
111601	Crankshaft pot ass'y.	MJ2	X			15.00	
111602	Crankshaft pot ass'y.	YD, YDS	X				
111701	Clutch Separator	YD, YDS	X			35.00	

YAMAHA

MOTORCYCLES



SERVICE MANUAL

COVERING
GENERAL TUNING THEORIES

YAMAHA SPEED MANUAL
Volume I - General Theory

- 1-Foreword
- 2-General considerations for tuning 2 cycle engines
- 3-How to select proper gear reduction ratios for racing
- 4-Tuning tips.

FOREWORD
to
Volume I and Volume II

Modern motorcycle engines, like other engineering items, are what can be called a series of compromises for greater efficiency. The average rider requires a motorcycle that will run smoothly at idle speed, that can be ridden easily in stop and go traffic, and that possesses reliability and economy of operation.

These features can be designed into any engine only at the expense of performance. This booklet contains the step that can be taken to eliminate these "compromises" in the search for optimum performance. At this time it must be pointed out that if all these modifications are properly performed, the motorcycle will become a racing type and will not possess any of the docile habits of its predecessor counterpart. Therefore, it may be that for those people requiring either a dual purpose vehicle (ie; for both transportation and limited participation in sporting events) or just better performance for the street, only a limited amount of modification would be advisable.

This booklet does not presume to offer a sure formula for success in any event. Success does not always come to those who possess the fastest motorcycle. It is speed, allied with reliability and skill, that is eventually rewarded.

We sincerely hope that the following will in some small way help to hasten this reward.

2 - GENERAL CONSIDERATIONS FOR TUNING 2-CYCLE ENGINES

A general treatment of tuning
crankcase and loop scavenging
2-cycle motorcycle engines
for speed

By Masayasu Nakamura
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A. Introduction

In this paper I am discussing the tuning of the crankcase scavenging type 2 cycle gasoline engine only, because the Yamaha engines all belong to this category.

There are many measures for increasing the output of 2-cycle engines, and those measures are closely related with each other. For example, let us consider the most commonly taken step for increasing horsepower, -decreasing combustion chamber volume-when^{it} is intended to increase combustion chamber compression ratio for higher output. With this measure, an increased output is normally expected. However, merely increasing combustion chamber compression ratio will bring about various difficulties, such as over-heating, increased mechanical loss, and mechanical vulnerability of structural members; namely: crankshaft, connecting-rod, etc. Over-heating and increased mechanical loss result in decreasing output as well as piston seizure, and excessive mechanical defects of the crankshaft, connecting-rod and other parts. This brings about broken crankshaft, burnt connecting-rod small-end and big-end bearings, and other things. In addition, if crankcase compression ratio is not increased at the same time, the higher residual combustion pressure works adversely against the scavenging efficiency. Furthermore, the distance between sparkplug electrode and piston crown becomes close, which brings about local over-heating of the piston crown, finally resulting in damaged piston, local melting of piston crown and pre-ignition.

As mentioned above, only changing combustion chamber volume causes so many difficulties that, if we want to really increase output, various other measures have to take place simultaneously and correctly.

The basic considerations for increased output of 2-cycle engines are as follows:

- (1) To intake as much air-fuel mixture (in weight) as possible into the crankcase per revolution of engine.
- (2) To expel exhaust gas as completely as possible from the combustion chamber per revolution of engine.
- (3) To intake as much air-fuel mixture (in weight) as possible into the combustion chamber per revolution of engine.
- (4) To compress the air-fuel mixture in the combustion chamber as highly as structural strength and fuel octane number allow.
- (5) To ignite the compressed air-fuel mixture at the best location and timing.
- (6) To convert the explosion gas pressure into torque of the shaft as efficiently as possible.
- (7) To reduce all possible mechanical and thermal loss.

The practical measures for tuning are considered to be as follows:

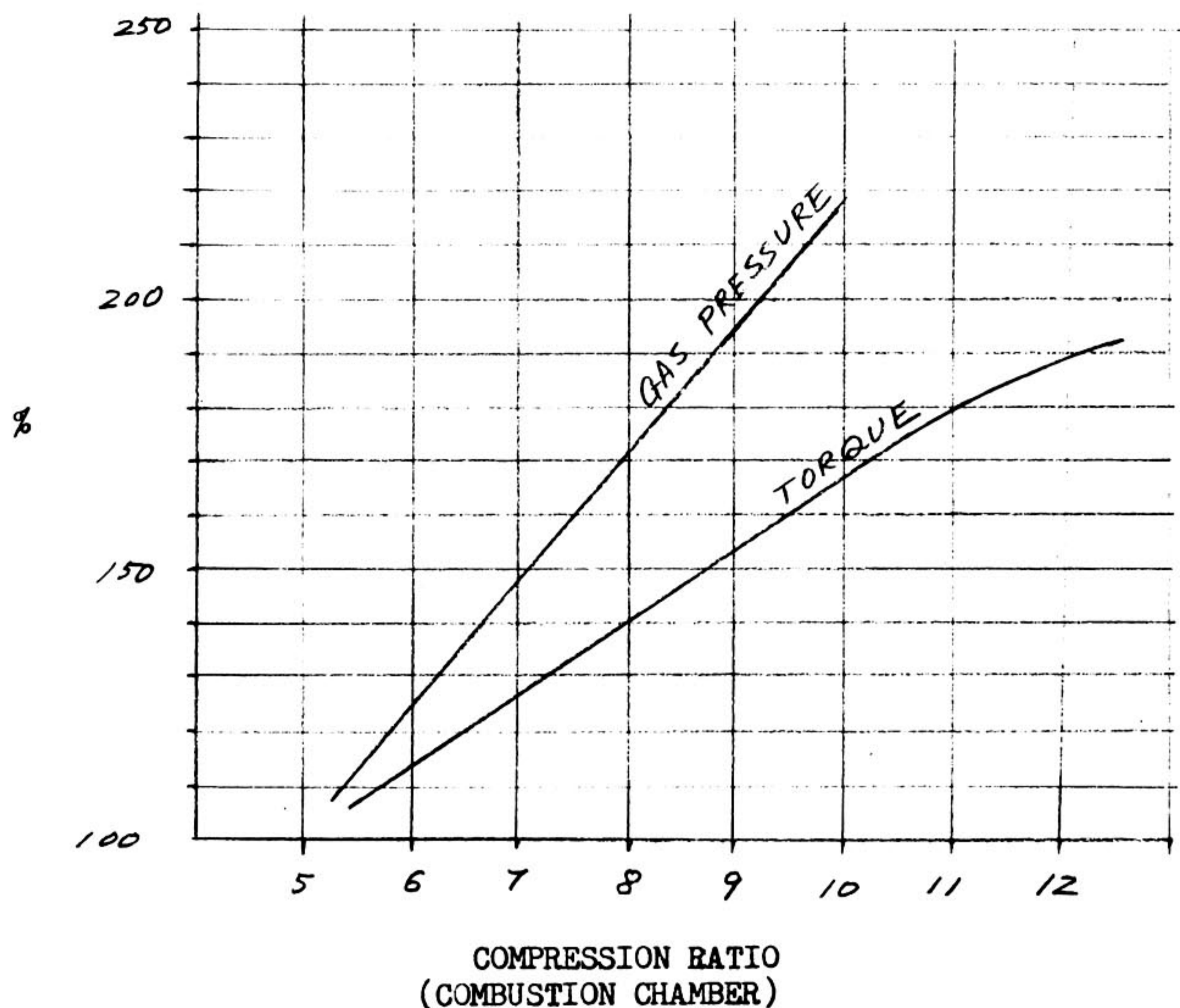
- (1) To increase compression ratio of combustion chamber.
- (2) To increase compression ratio of crankcase.
- (3) To change port timing of exhaust port, intake port and transfer port.
- (4) To reduce gas flow resistance in exhaust, intake and transfer passages.
- (5) To tune exhaust passage.
- (6) To tune intake passage.
- (7) To reduce mechanical loss:
 - (a) To reduce frictional loss of oil seals, bearings and other sliding parts;
 - (b) To reduce oil viscosity loss in primary reduction gears, gear box gears, crankshaft web, clutch housing, etc.
 - (c) To reduce transmission loss in chain and sprockets.
- (8) To select the best spark plug and its location.
- (9) To select the best fuel and oil.
- (10) To take proper cooling measures to prevent over-heating due to high output.

B. Measures for increasing output

1. Increasing compression ratios of combustion chamber and crankcase.

Increasing the compression ratio of the combustion chamber will bring about increased torque only if other difficulty will not result. It is a notable fact that increased engine torque is followed by extremely high explosion gas pressure.

Fig.1 shows the percentage of increased engine torque and explosion gas pressure due to the increasing of combustion chamber compression ratio.



In Fig.1, we can easily see that a 1 point increased compression ratio of the combustion chamber from a compression ratio of 8 to 9 will result in an increased engine torque of 9.5%, while the explosion gas pressure increases by 11.5%. The greatly increased explosion gas pressure brings about an increased side pressure of the piston which may result in piston seizure and increased friction loss, and also brings about increased bearing lead which may cause added strains on the crankshaft, connecting rod and other parts as well as burnt bearings. It is true, however, that as structural strength, cooling capacity and fuel octane number permit, the compression ratio of the combustion chamber is "the higher the better", disregarding the scavenging problem.

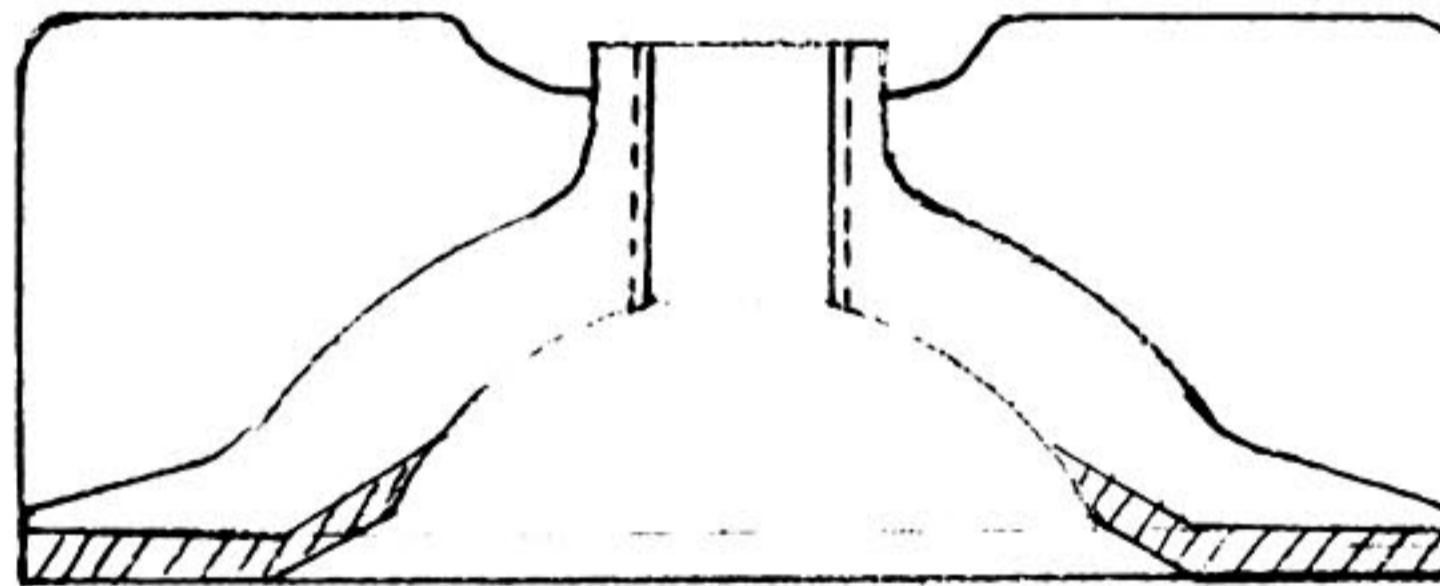
For efficient scavenging, the scavenging pressure must be high to some extent compared with exhaust gas pressure. At the moment when the transfer port opens, exhaust gas pressure in the cylinder must be lower than scavenging pressure in order for scavenging to begin. Hence, it is necessary to increase scavenging pressure to cope with increased exhaust gas pressure due to higher compression ratio. Increased scavenging pressure can be obtained by increasing crankcase compression ratio. There is another means of lowering exhaust gas pressure, and that is to increase the blow down period by changing exhaust port timing.

This advances the exhaust port opening to a point ahead of that of the transfer port opening. This step, however, results in decreased effective stroke of the piston as well as reduced compression ratio of the combustion chamber.

Increased crankcase compression ratio is necessary for promoting scavenging efficiency and for completing scavenging and intaking in an extremely short time due to ultra-high revolutions of the engine. It is, however, to be remembered that unnecessarily high crankcase compression ratio results in increased intake gas velocity which causes pressure drop in intake passages and increased intake resistance. Big carburetors are sometimes a good remedy for this difficulty, if it is remembered that too big a carburetor brings about low intake gas velocity which necessitates using a big main jet. Thus the engine does not run smoothly and shows poor acceleration in medium and low revolution range due to insufficient atomization of fuel.

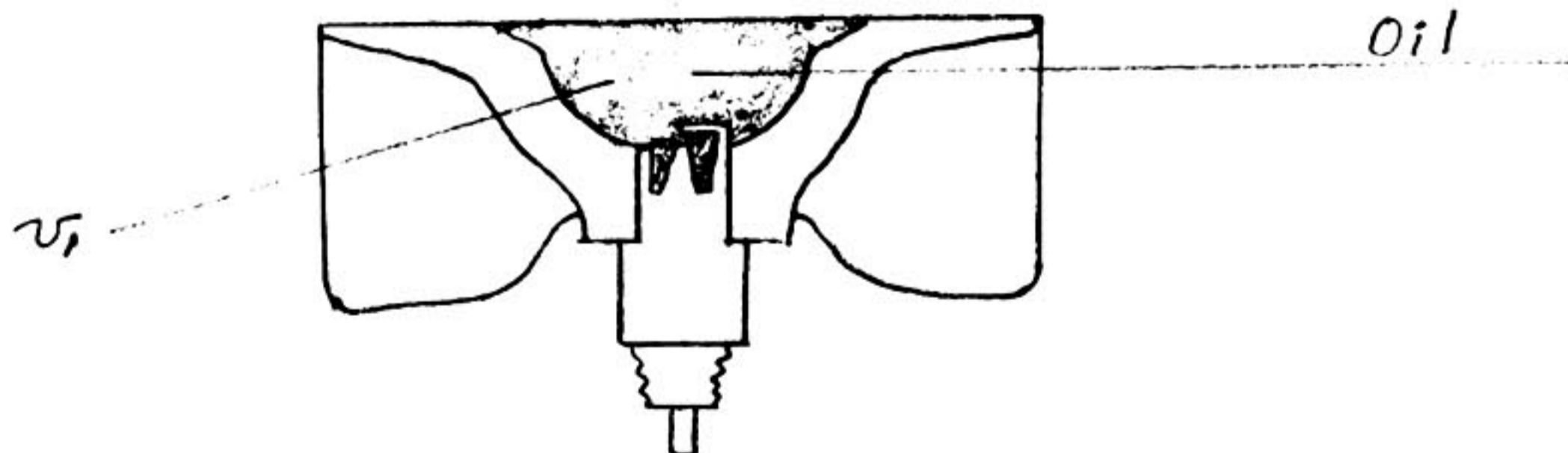
From the above explanation, it may be understood that both combustion chamber compression ratio and crankcase compression ratio have their optimum figure for the engine's particular character, and can be determined through a systematically conducted experiment.

The practical measure to increase combustion chamber compression ratio is to reduce the cylinder head volume by cutting off the flange and reshaping as shown below.



Calculate compression ratio of combustion chamber as follows:

- (a) Measure (in c.c) the cylinder head volume v_2 by filling it with oil.



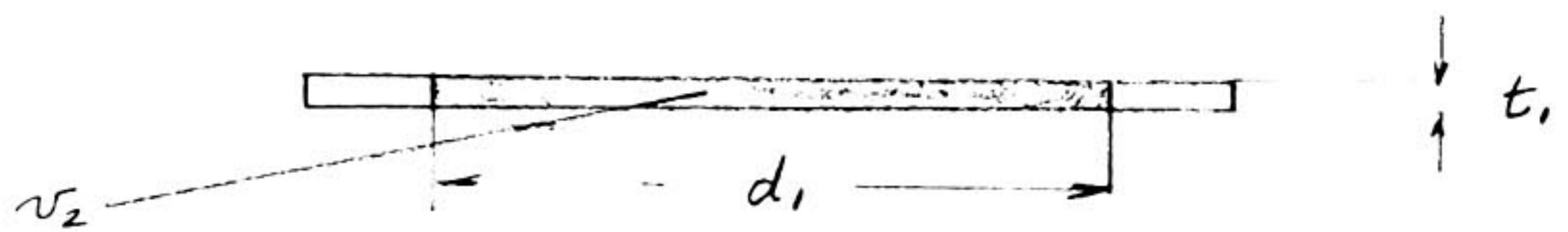
- (b) Calculate (in c.c.) the volume v_2 occupied by the cylinder head gasket.

$$v_2 = \frac{\pi \times d_1^2 \times t_1}{4}$$

Where d_1 = inside diameter of gasket in cm.

t_1 = thickness of gasket in cm,

$\pi = 3.14$



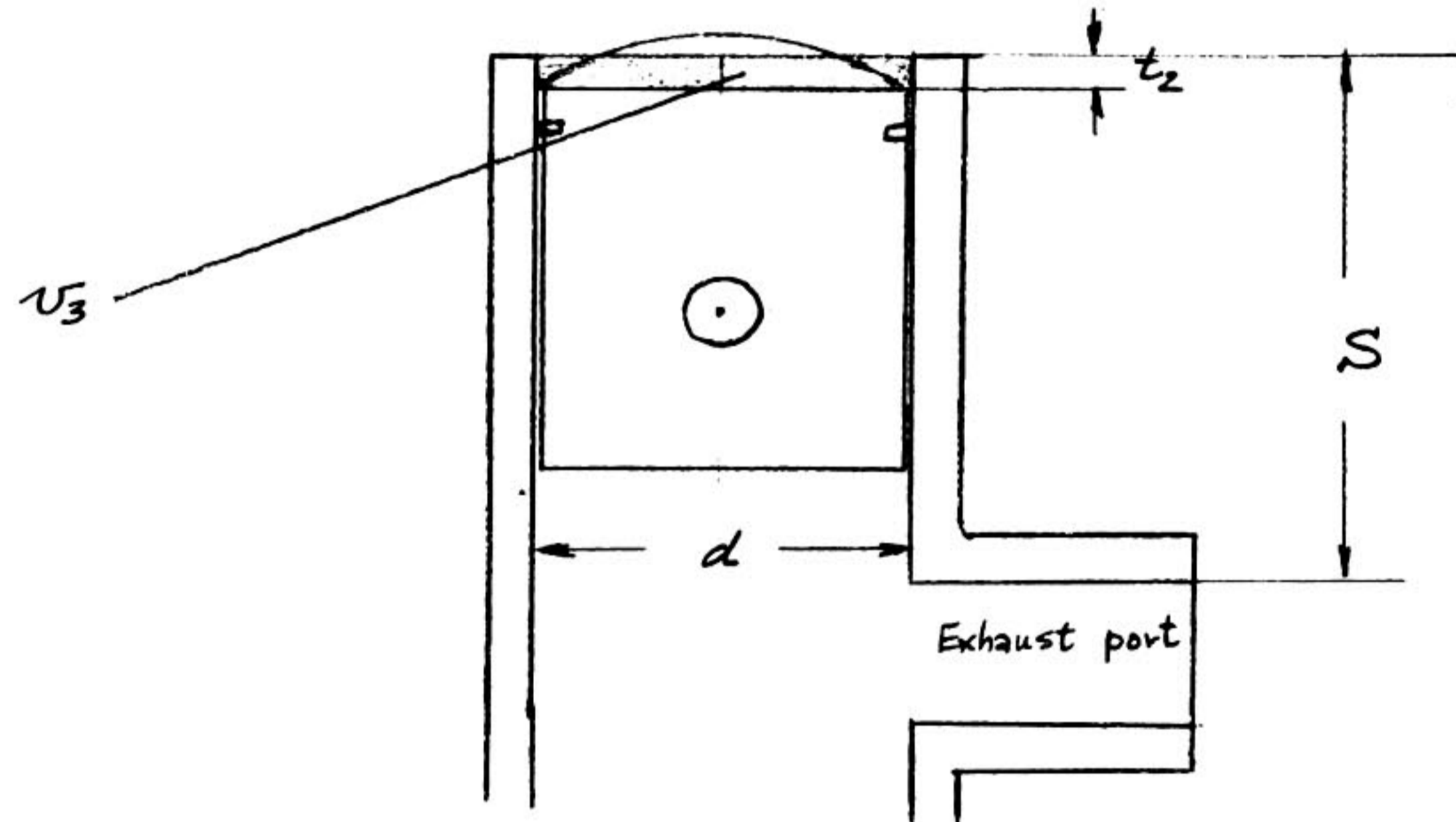
- (c) Calculate volume v_3 (in c.c.) of a flat, disc-shaped space which exist between the top edge of the cylinder and the top surface of the piston of TDC (assume that the piston is flat).

$$v_3 = \frac{\pi \times d^2 \times t_2}{4} \quad (\text{c.c.})$$

Where, d =bore in cm

t_2 =thickness of space in cm (distance from top of cylinder to top of piston at TDC)

$\pi = 3.14$



- (d) Calculate the stroke volume v_4 of piston in c.c.

$$v_4 = \frac{\pi \times d^2 \times (S - t_2)}{4} \quad (\text{c.c.})$$

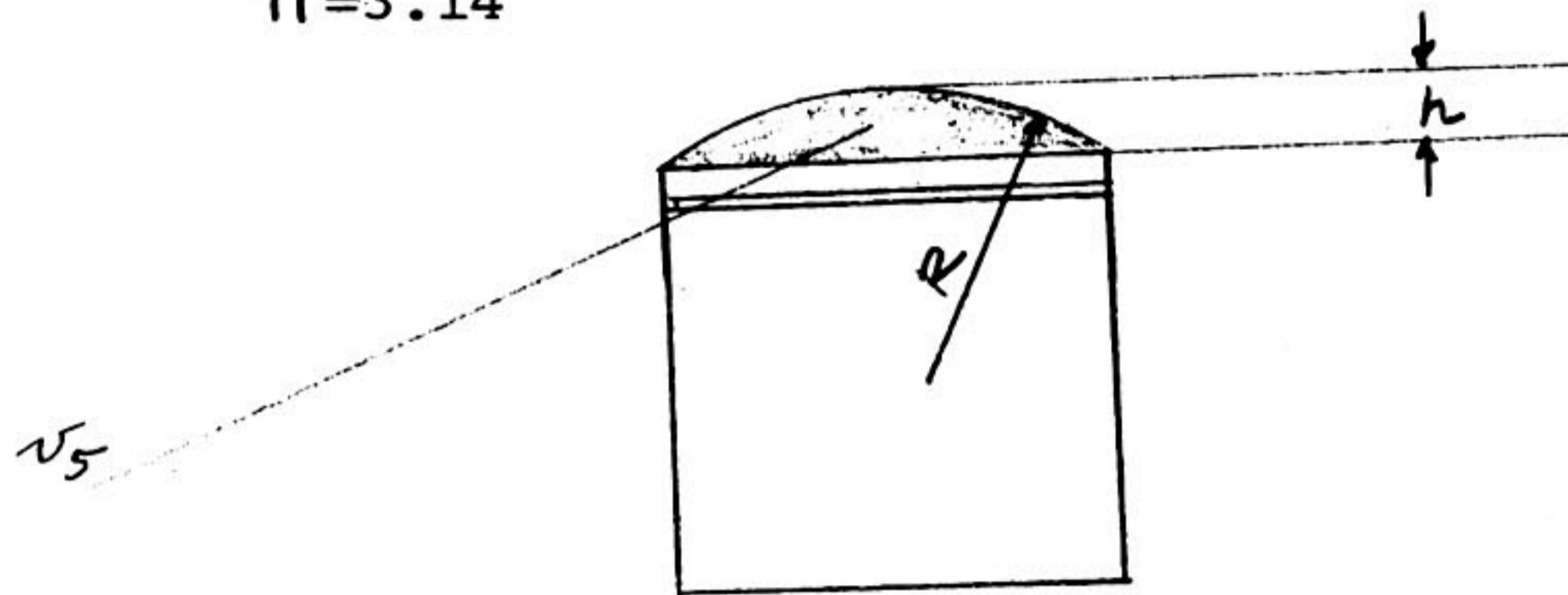
Where, d =bore in cm.

s =Distance between the upper end of the cylinder and the upper edge of exhaust port in cm.

(e) Calculate (in c.c.) the volume v_5 of the piston crown.

$$v_5 = \frac{\pi \times h^2 \times (3R - h)}{3}$$

Where, h = height of piston crown in cm.
 R = radius of piston crown in cm.
 $\pi = 3.14$



(f) The actual compression ratio of combustion chamber is given in the following equation:

$$\text{Compression Ratio} = \frac{v_1 + v_2 + v_3 - v_5 + v_4}{v_1 + v_2 + v_3 - v_5} = 1 + \frac{v_4}{v_1 + v_2 + v_3 - v_5}$$

Example

Given Data

$v_1 = 10.7 \text{ cc}$ (measured by filling cylinder head volume with oil)

$d = 5.6 \text{ cm}$ ($= 56 \text{ mm}$) $= d_1$

$t_1 = 0.05 \text{ cm}$ ($= 0.5 \text{ mm}$)

$t_2 = 0.02 \text{ cm}$ ($= 0.2 \text{ mm}$)

$s = 2.7 \text{ cm}$ ($= 27 \text{ mm}$)

$h = 0.32 \text{ cm}$ ($= 3.2 \text{ mm}$)

$R = 12 \text{ cm}$ (120 mm)

$\pi = 3.14$

Computation

$$v_2 = \frac{\pi \times d_1^2 \times t_1}{4} = \frac{3.14 \times (5.6)^2 \times 0.05}{4} = 1.23$$

$$v_3 = \frac{\pi \times d^2 \times t_2}{4} = \frac{3.14 \times (5.6)^2 \times 0.02}{4} = 0.49$$

$$v_4 = \frac{\pi \times d^2 \times (s - t_2)}{4} = \frac{3.14 \times (5.6)^2 \times (2.7 - 0.02)}{4} = 66.0$$

$$v_5 = \frac{\pi \times h^2 \times (3R - h)}{3} = \frac{3.14 \times (0.32)^2 \times (3 \times 12 - 0.32)}{3} = 3.82$$

$$\text{Compression ratio} = \frac{v_1 + v_2 + v_3 + v_4 - v_5}{v_1 + v_2 + v_3 - v_5} = 1 + \frac{v_4}{v_1 + v_2 + v_3 - v_5}$$

(Substituting)

$$= 1 + \frac{66}{10.7 + 1.23 + 0.49 - 3.82} = 1 + 7.7 = \underline{8.7}$$

Compression ratio of the combustion chamber is usually about:

For street model6 ~ 8:1
For scrambler or
road racer9 ~ 10:1

Compression of the air-fuel mixture in the crankcase is done during the period from the closing of intake port to the opening of transfer ports. In ordinary street models, this compression stroke angle is 55 ~ 70 degrees, while in racing engines it is extremely short; such as about 12 degrees.

When the piston is going down:

The crankcase volume just after the inlet port was closed ... V_3
" " just before the transfer port opens V_2
" " when the piston is B.D.C. V_1

V_3/V_1 corresponds to the scavenging volume, and V_1/V_2 to the scavenging pressure. In ordinary 3-port engines, V_1/V_2 is 1.30 to 1.50 for both street and racing models, and V_3/V_2 is 1.20 to 1.40. Rotary disc inlet valve engines, however, have far larger V_3 than 3-port ones because of their asymmetrical inlet port timing. Compression ratio V_3/V_2 of the crankcase of rotary disc valve engines are more than 1.50. Anyway, it is necessary to reduce V_1 as small as possible in order to increase actual crankcase compression ratios.

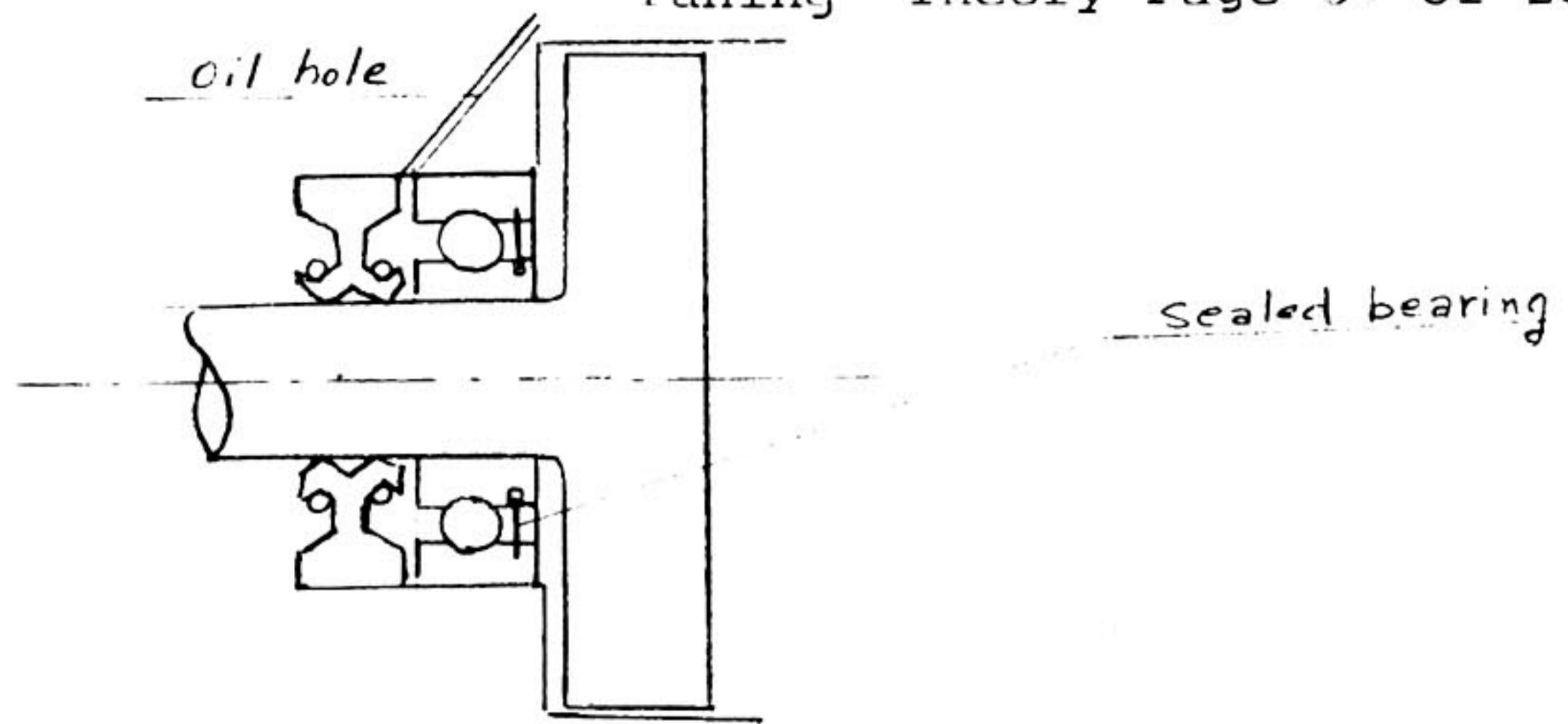
In tuning for high performance with a high speed engine, we need not worry if we make too high a crankcase compression ratio, because even if we may try to increase the compression ratio, it is always rather difficult to achieve our objective to our satisfaction.

Increasing crankcase compression ratio is simply reducing the unnecessary space in the crankcase while taking care not to disturb the gas flow of intaking and scavenging passages.

Practical measures are as follows:

- (a) Fill the balancing holes in the crankshaft webs with light materials such as aluminum alloy, cork, etc.
- (b) Use single side sealed bearings for the crankshaft as shown below:

(continued)



- (c) Fill all the unnecessary spaces in the crankcase with aluminum alloy.
- (d) Reduce the outside diameter of crankshaft web if possible and fill the space between the crank web and the crankcase.

2. Changing Port Timing

In high speed engines; exhaust, scavenging and intake processes have to be completed within a very short time, such as 0.001 or 0.003 seconds. Therefore, each port opening time has to be longer, which means that each port must open earlier. On the other hand, the area of port and passage must be wider. Early opening of exhaust port results in decreased effective piston stroke, causing less torque in the lower speed of engine ranges. Fig.II shows the difference of port timing between Yamaha YDS2 and TDIA. From this figure, we can see how early and how long the exhaust port opens in the racing engine. We can also study the other port timing. In tuning engines for speed, each port timing is modified from that of street model engine as follows:

- (a) Exhaust port timing Exhaust port opens 8% to 20% earlier than the street model in piston stroke.
- (b) Transfer port timing Transfer port opens 4% to 10% earlier than the street model in piston stroke.
- (c) Inlet port timing For 3-port type, inlet port opening period can be increased up to around 30% more than street model in crank angle. For rotary disc valve model, inlet port opens up to about 25% earlier than street model, and closes up to about 20% later in crank angle.

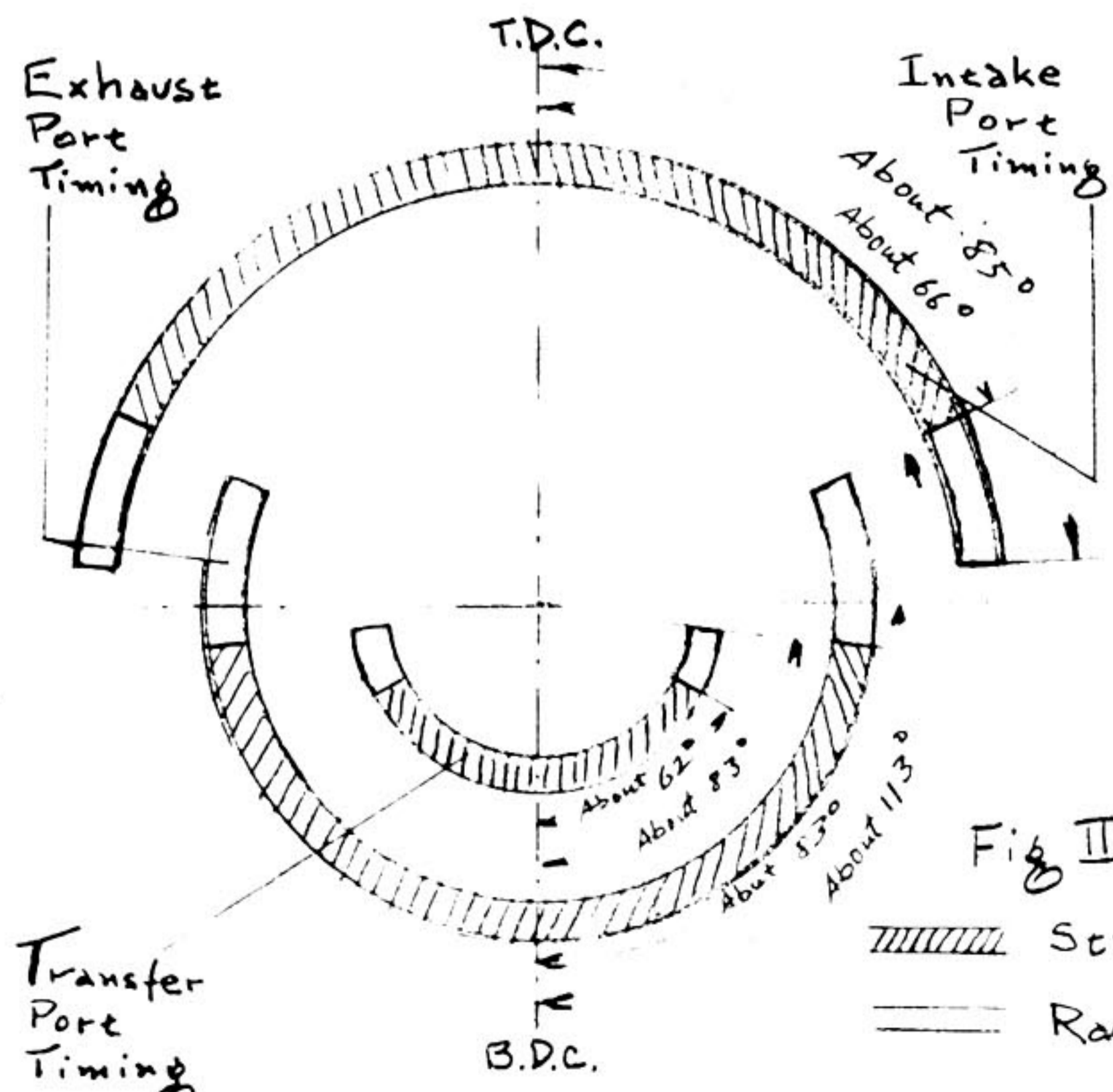


Fig II

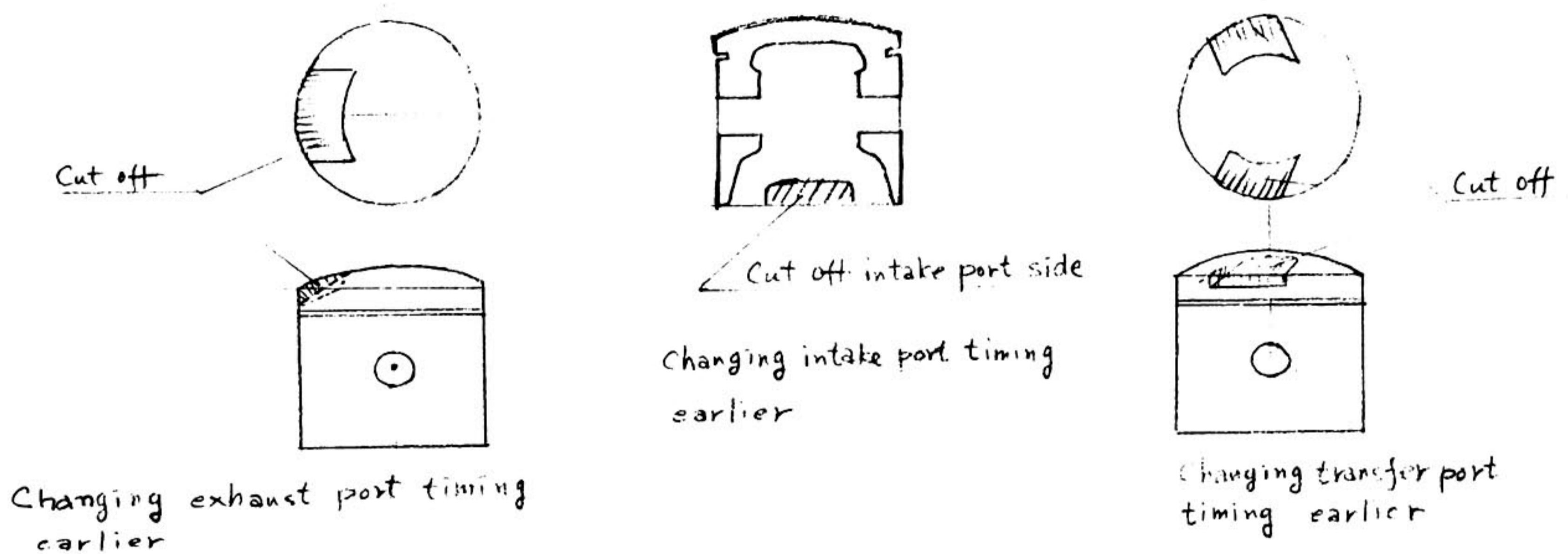
Street Model
 Racing Model

The above mentioned figures are just for a target for tuning, so actually the port timing modification must be done by the "step by step" method.

In addition to modification of the port timing, all the gas flow passages should be finished and reshaped to reduce gas flow resistance in the following way:

- (a) Make the wall of each passage as smooth as possible.
- (b) Make the passage bend smoothly and avoid sudden change in sectional area through the passage.
- (c) Make the minimum sectional area of passages as wide as possible.

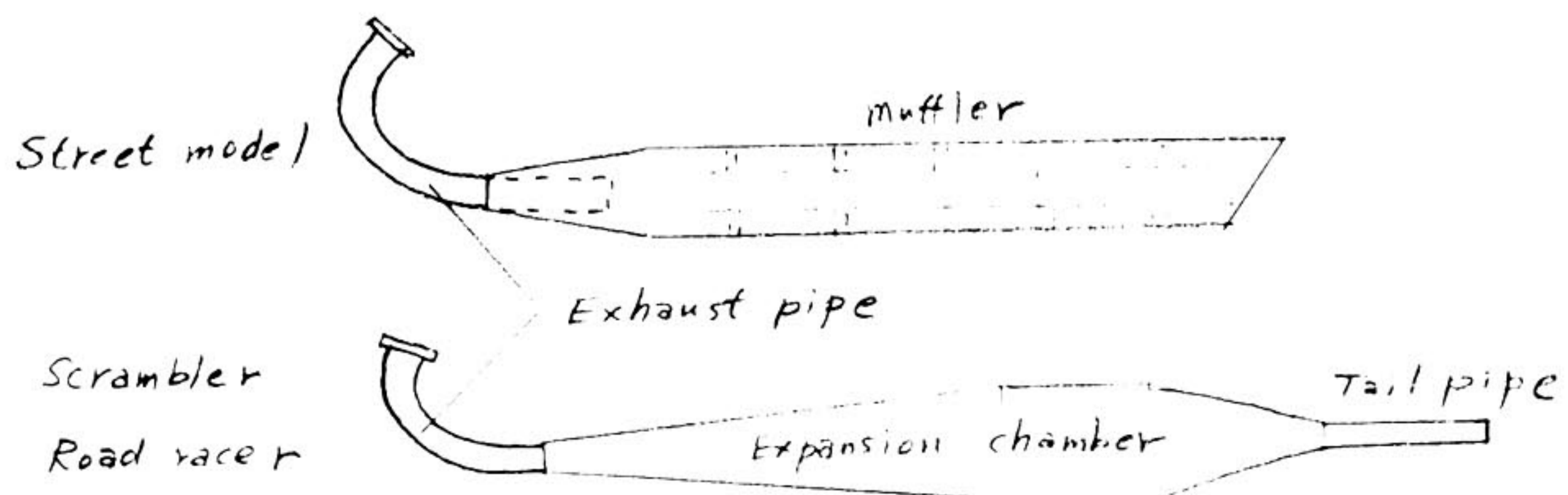
There is another way to change port timing. We can do this by modifying piston crown as follows:



The maximum cutting off depth in piston crown should be less than 2 mm for fear of disturbing scavenging gas flow and because of thermal deformation and decreased strength of the piston.

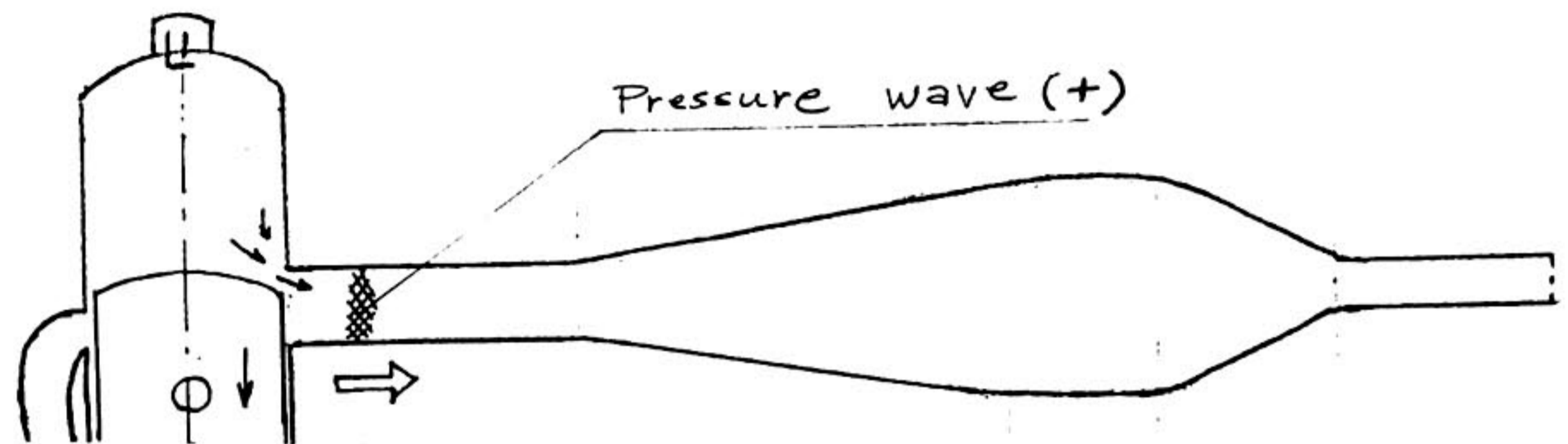
3. Tuning exhaust passages

Generally the exhaust passage consists of cylinder exhaust port, exhaust pipe, and muffler for the street model. However for scramblers and road-racers, exhaust pipe and muffler are welded together forming a so called expansion pipe. Here muffler consists of two parts: expansion chamber, and tail pipe.

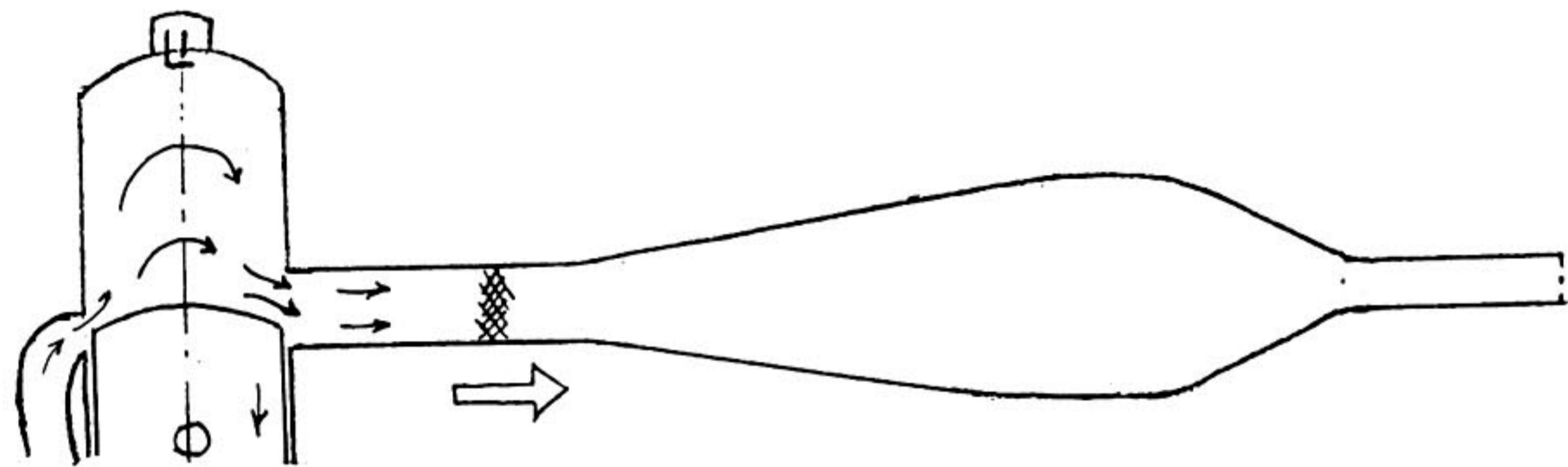


This expansion pipe is specially tuned for a high output at extremely high-speed revolutions of the engine. In tuning an expansion pipe for a scrambler or road-racer engine, various items such as port timing, compression ratios of combustion chamber and crankcase, piston displacement etc, are used as the factors to determine the size and shape of expansion pipe. Exhaust gas pulsation or longitudinal vibration of gas column are made most of for generating high output at a desired high-speed revolutions. A brief explanation about how pulsation or longitudinal vibration of exhaust gas is used for high output is as follows:

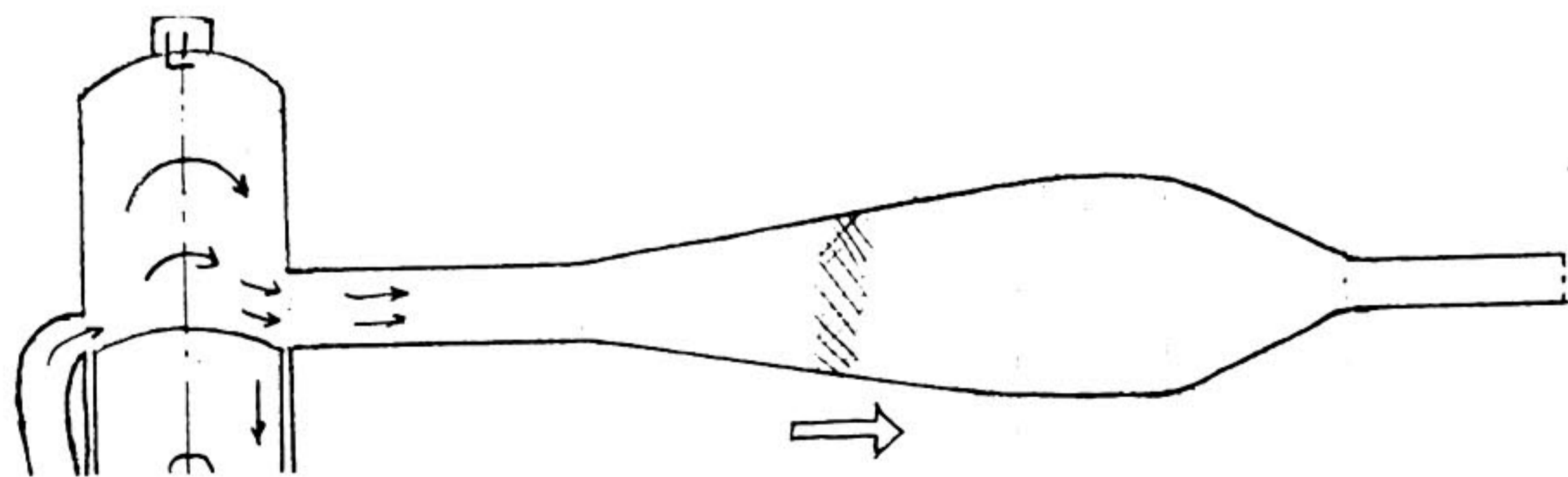
- (a) When the exhaust port is opening, a pressure wave is generated by the high pressure of exhaust gas in the exhaust pipe just outside the exhaust port of cylinder.



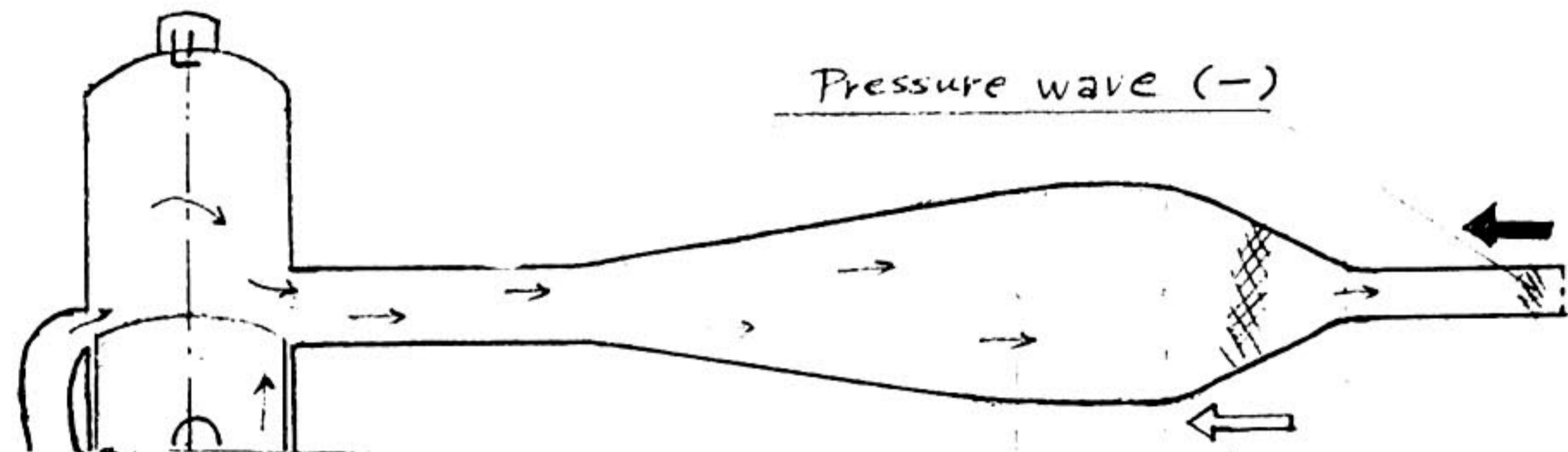
- (b) This pressure wave travels in the exhaust pipe through the exhaust gas flow with a sound velocity, causing a low pressure area behind it, which makes it easy for the coming exhaust gas to flow out of the exhaust port



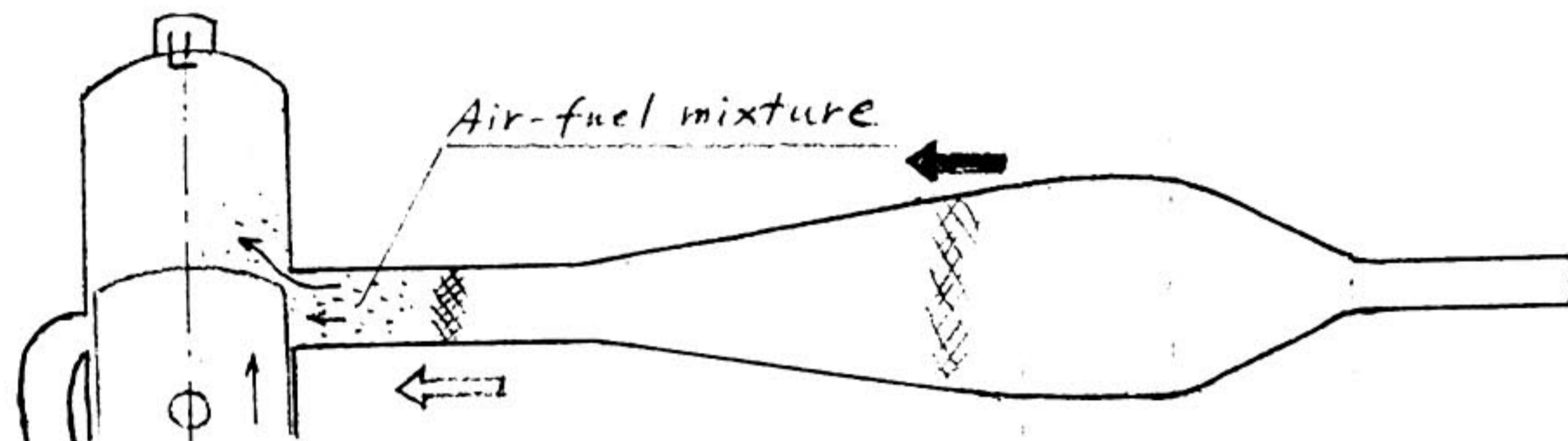
- (c) When coming to the divergent part of expansion chamber, the pressure wave gradually decreases its amplitude and reduces gas flow resistance.



- (d) The pressure wave, when traveling through the convergent part of the expansion chamber, gradually increases its amplitude and, coming to the narrowest part of the expansion chamber, is partially reflected back toward the exhaust port of the cylinder. The continuing wave (plus pressure wave) travels further through the tail pipe where the open end sets up a reverse phase (minus pressure wave). This action is explained further in (f).

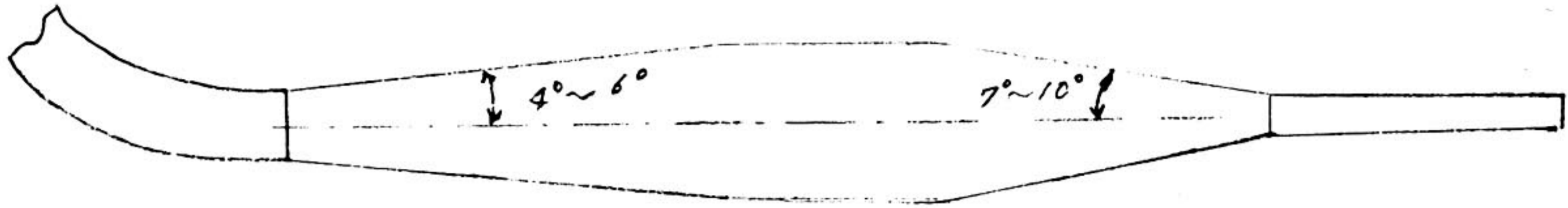


- (e) The reflected plus pressure wave, if properly tuned and designed, comes back to the cylinder exhaust port and pushes back the air-fuel mixture which has passed through combustion chamber in the process of scavenging and tends to continue on through into the exhaust pipe. Thus this reflected pressure wave holds the charge in the combustion chamber where it can effectively raise efficiency.



- (f) The reflected minus pressure wave, returning from the open end of the tail pipe, arrives at the exhaust port of the cylinder some time behind the arrival of the plus wave. If the arrival of the minus pressure wave is timed to be just at or a little before the opening of exhaust port, it generates negative pressure in front of the exhaust port and eases exhausting and scavenging. The converging rate (slope) of the expansion chamber must be larger than that of the diverging part for the purpose of causing good reflection of the plus pressure wave, but too large a converging rate brings about increased exhaust gas flow resistance.

The usual shape of expansion chamber is as follows:



The inside diameter of the tail pipe, which is the smaller the better for reflection of the plus wave and for increased charging efficiency, should not be too small for fear of increasing exhaust gas resistance and thus decreasing exhaust and scavenging efficiencies. The ratio between the inside diameters of the tail pipe and exhaust pipe is usually 0.6 to 0.8. The length of tail pipe determines the time difference between the plus pressure wave and the minus wave.

Numerical example

Engine is a 250 c.c. racing twin. Exhaust port opens 110 degree before B.D.C. and closes 110 degree after B.D.C. The expansion pipe is to be tuned at a engine revolution of 10000 rpm. (N=rpm)
Exhaust port opening period is $60/N \times 220/360$ (sec.)

$$= 60/10000 \times 220/360$$

$$= 0.0037 \text{ sec.}$$

L Distance between exhaust port and beginning of tail pipe. (m)

L_1 Tail pipe length (m)

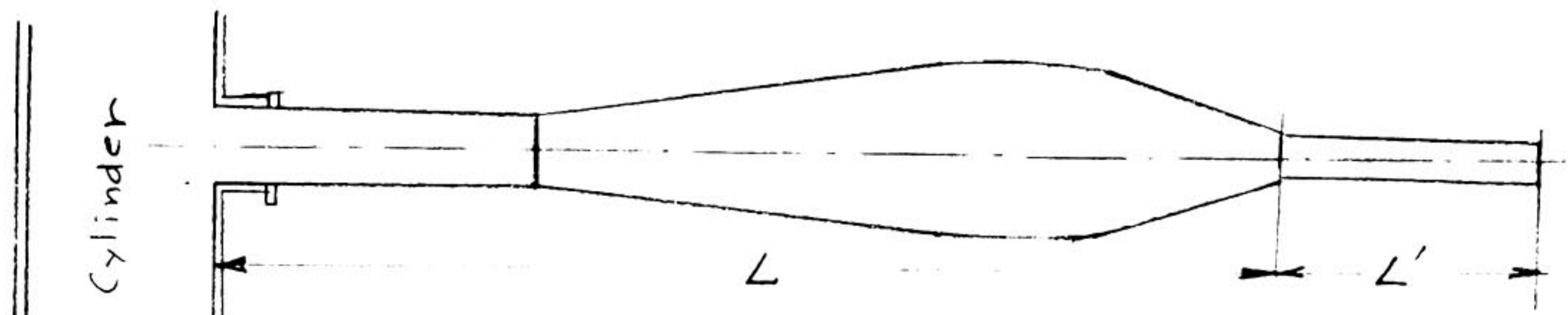
a = Sound velocity (m/sec)

a = 500 m/sec (approximately), if we consider that exhaust gas temperature is around 400 degrees C and mean inside diameter of exhaust passage is 0.04 m (=40mm) and use the following experimental equation:

$$a = 332 \sqrt{\frac{273 + t}{273}} - 0.8 (1/d)$$

t ... Temperature in degree C.

d ... Means inside diameter of exhaust passage in m.



$$2L/a = 0.0037$$

$$a = 500 \text{ m/sec}$$

$$L = 0.0037 \times 500 / 2 = 0.925 \text{ (m)} = 925 \text{ (mm)}$$

Time difference T between plus and minus waves is:

$$T = 2 L' / 500 \text{ if } L' = 0.2 \text{ (m)}$$

$$T = 2 \times 0.2 / 500 = 0.0008 \text{ sec}$$

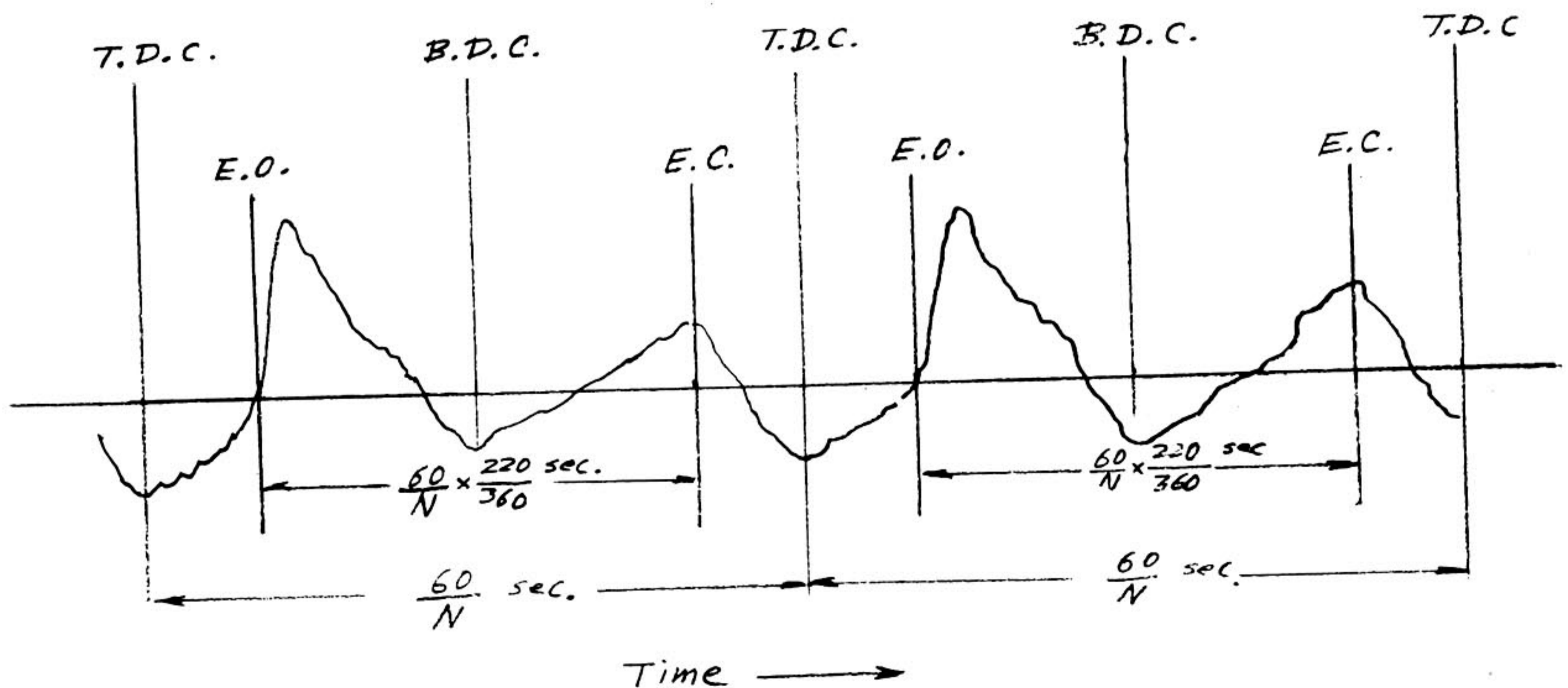
0.0008 sec is expressed in crankshaft angle as follows:

$$360 \times N/60 \times 0.0008 = 48 \text{ degree.}$$

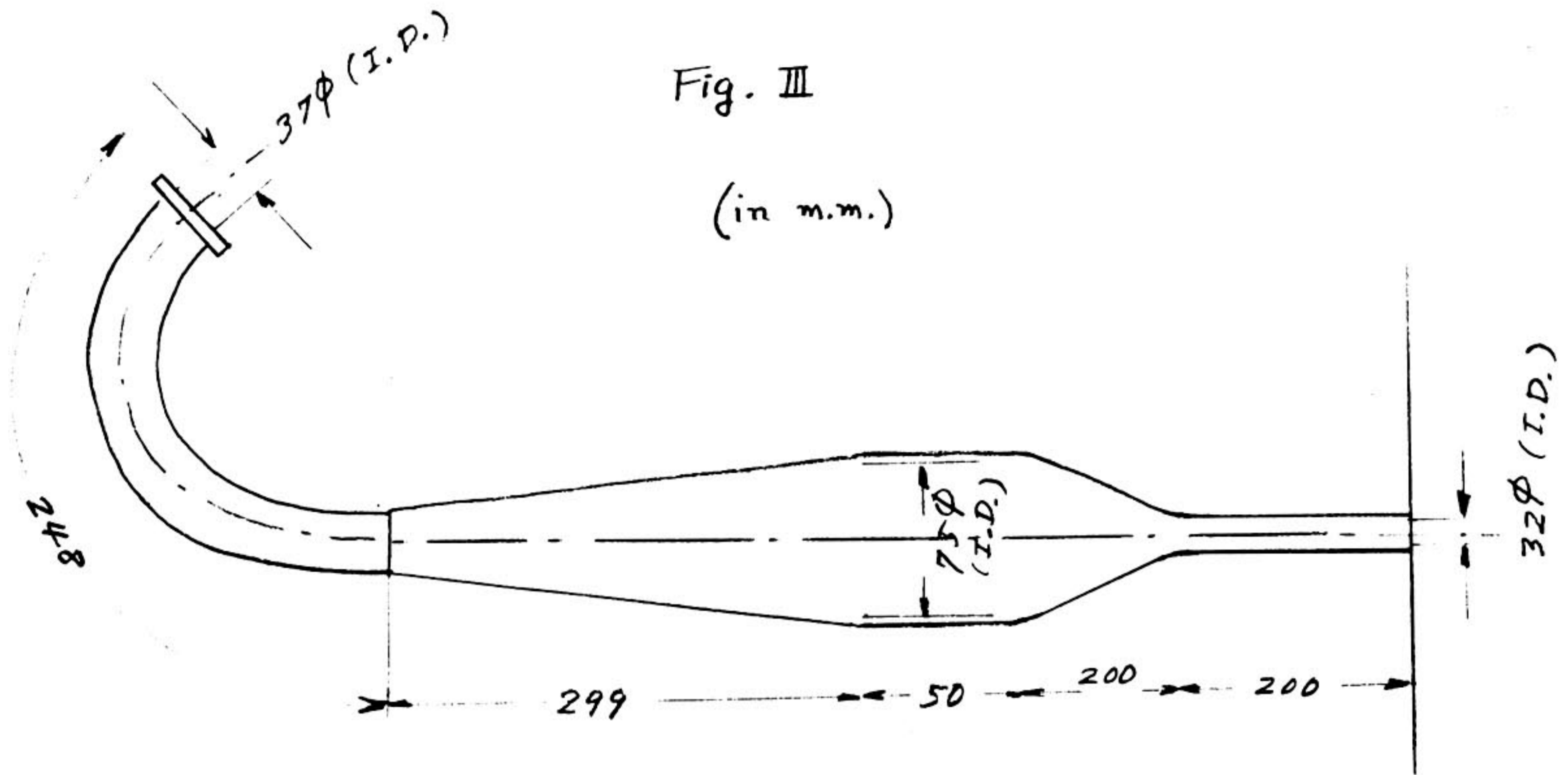
Therefore, if a 0.2 m tail pipe is used, the minus wave arrives at the exhaust port 48 degree behind the plus wave.

Actually, the sound velocity varies at every part of the exhaust passage, and is not exactly decided from what part of the expansion pipe both waves reflect. This way of calculation is, therefore, suitable only for characteristic study or anticipating rough dimensions of an expansion pipe. Actual dimensions should be decided through experiments.

Exhaust Gas Pressure Diagram



E.O. ----- Exhaust port opens
E.C. ----- " " closes



4. Tuning intake passages

The same process of thinking on exhaust passages can be applied for tuning intake passages. It is advisable that during all the period when intake port is opening that the pressure ahead of intake port in the intake passage be high, especially at the moment of the closing of this port. However, through rough calculations, it is found that even a 0.2 m length intake passage is necessary to tuning for high speed revolutions such as 10000 rpm. Therefore, only the inertia effect should be considered in tuning intake passages in the following ways:

- (a) Make the wall surfaces of the intake passages smooth.
- (b) Eliminate any kind of roughness and step in the intake passage.
- (c) Make the radius of bent intake passages as large as possible.
- (d) Make the intake passage as short as possible.

These are 4 steps effective in reducing gas flow resistance, increasing the inertia effect and in preventing intake air-fuel mixture from being heated.

As mentioned before, the main bore of the carburetor should be larger.

The main bore of racing engine carburetors are usually of the following size:

50 - 55 c.c.	18φ - 22φ	(diameter in mm)
70 - 90 c.c.	22φ - 24φ	
90 - 125 c.c.	24φ - 27φ	

5. Reducing mechanical loss

There are various steps to reduce mechanical loss as follows:

- a. Change plain bearings into needle roller bearings.
- b. Weaken the oil seal spring.
- c. Reduce the reciprocating mass in order to decrease the friction due to side pressure of piston and bearing load.
- d. Use such oils as have good lubricating performance at higher temperatures.

6. Reducing oil viscosity loss

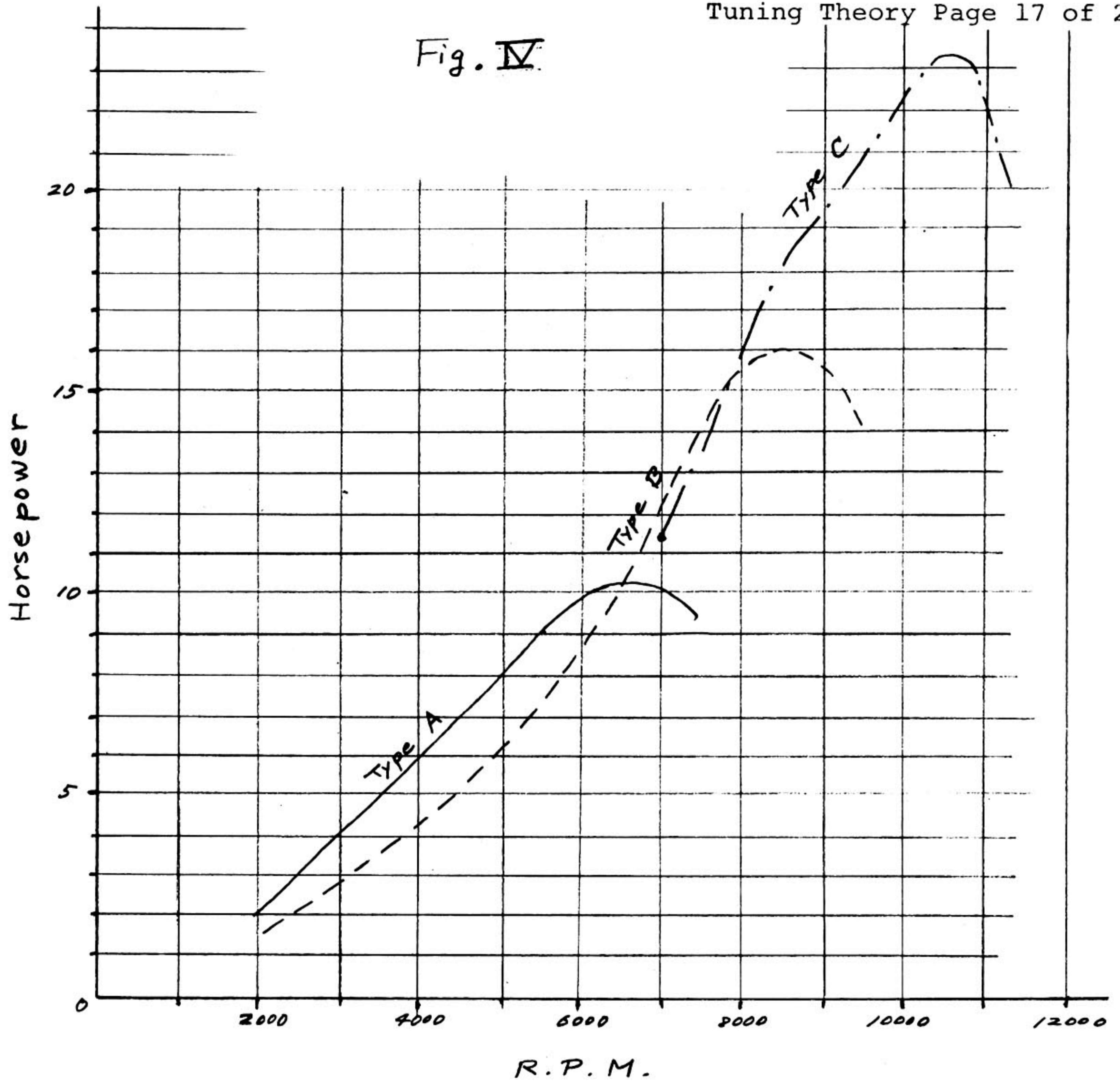
- a. Reduce the oil level for primary reductions gears to a minimum; ditto for clutch housing.
- b. Use a little thinner oil for primary reduction gears than for gearbox.

C. Conclusion

As mentioned in the introduction of this paper, the most important thing to be considered is that all the individual modifications are closely related with each other. A separate modification may sometimes result reversely or work in vain. The modification, therefore, should be done gradually and by the "step by step" method.

Fig.IV, shows horsepower curves of an experimental 125 c.c. engine, when it was tuned for scrambler and road-racer.

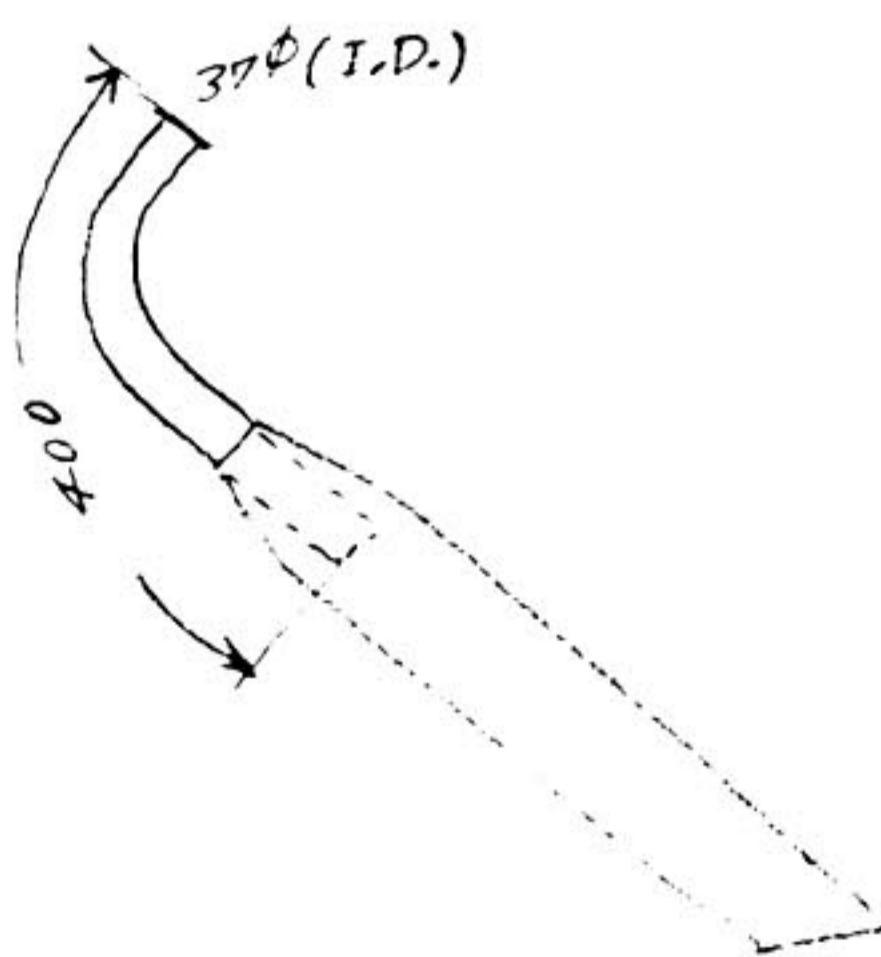
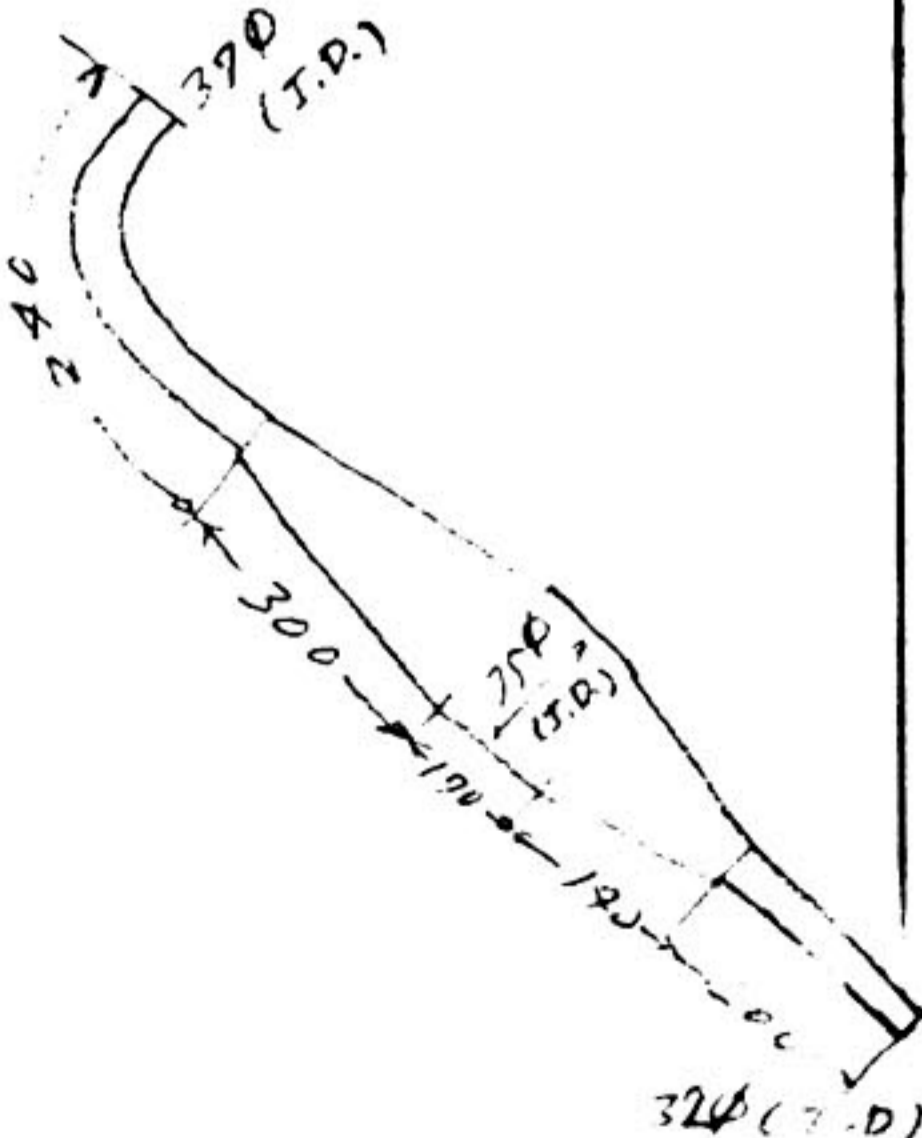
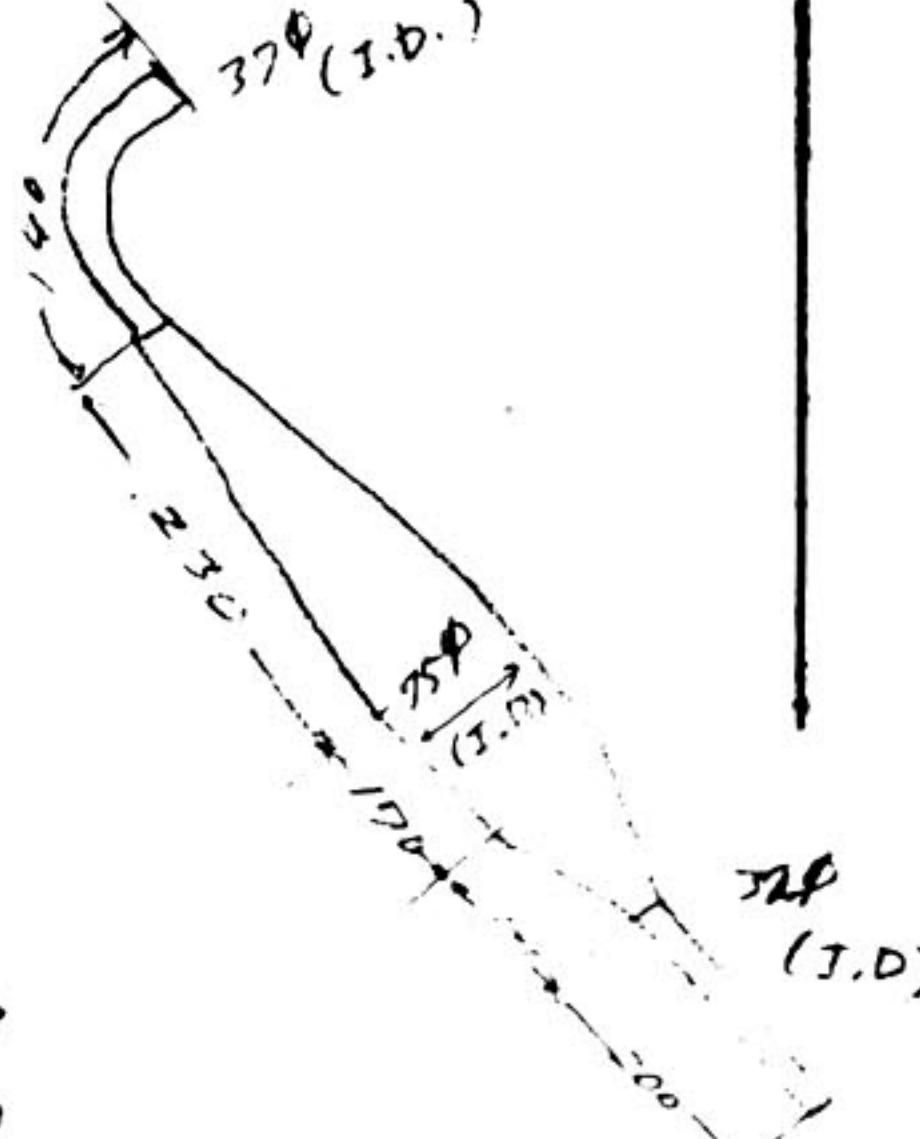
Fig. IV



Type A For street running.

Type B For scrambling.

Type C For road racing. Cannot be used in the RPM range less than 7000 because of instability.

Type	A (Street Model)	B (Scrambler)	C (Road-racer)
Cylinder head Volume (c.c.)	16.5	10.5	9.8
Cylinder port (from upper end)	Ex. 33mm Transf. 41mm	Ex. 29mm Transf. 39mm	Ex. 27mm Transf. 39mm
Piston	2mm width piston- ring --- 2	1mm width piston- ring -- 1 Piston crown ex.side 2mm cut. down	Same as left Same as left
Ignition timing	2.5mm B.T.D.C.	2.0mm B.T.D.C.	2.0mm B.T.C.D.
Intake rotary disc valve timing	Open ... 110° B.T.D.C. Close .. 39° A.T.D.C.	Open--130° B.T.D.C. Close--55° A.T.D.C.	Open ..130° B.T.D.C. Close.. 10 ° A.T.D.C. 60
Carburetor	Main bore: 22 ϕ MJ = #190	Main bore=23 ϕ MJ: #180 #200	Main bore=27 ϕ MJ=#180 #200
Crankshaft & Crankcase	—	—	Crankshaft web outside diame- ter reduced by 18mm to increase crankcase com- pression ratio.
Muffler or Expansion pipe			

3 - GEAR RATIO SELECTION
By Tony Murphy

In any form of competition the advantage of increased torque and/or horsepower is of little consequence if it is not used correctly. A most important consideration is the selection of the proper overall gear ratio. Gear ratio determines the way in which the power of the engine will be used and the choosing of this ratio is equally important in all types of competition.

Many things must be taken into consideration in the selection of this final ratio. Length of the race course; speed at which the corners can be negotiated; length of the race; length of the longest straight away; weather conditions; fuel consumption; altitude; uphill; downhill: all these are influencing factors. The final decision, however, should be based on lap times (time as opposed to speed) since the winner is the one who covers the required distance in the shortest elapsed time. High speed on the straighter sections is of little consequence if lap times suffer as a result.

An easy mistake to make is to attempt to reach peak R.P.M. in high gear at the end of the longest straightaway. As an example, let us consider a race course with long straightaways and slow corners. The speed attained at the end of these straightaways is not nearly so important as the time that it takes to reach the end. The motorcycle that can exit from the corners quickly may be traveling 10 mph slower than the competitor when it reaches the end. However, as long as it reaches the other end first the higher speed of the competitor is of no advantage. Additionally, the fact that a higher gear ratio is required by the competitor in order to reach this high speed will severely hamper his acceleration away from the slower corners. Top speed is always a secondary consideration.

As mentioned, other considerations are also important. On a wet surface, relatively high ratios limit wheelspin and therefore are sometimes an advantage. On a long race, reliability and fuel consumption become more important. An overstressed engine is short lived and an engine running at consistently high

rpm uses more fuel. Therefore, a higher ratio would have the advantage of both reliability and less consumption.

An additional point to remember about long races is the fact that a rider becomes more familiar with the course as the race progresses. Therefore, it is conceivable that a slightly higher gear ratio than first anticipated can be used since, as the race progresses, it may be used to advantage. An old axiom applies here and it is well worth remembering. "The faster you go, the more gear you can pull."

While on the subject of long races it must also be remembered that tires, brakes and rider wear out and therefore this must be anticipated beforehand and applied in the selection of the final gear ratio.

In a long race where a fuel stop must be made it is advisable to anticipate the total amount to be used and divide it evenly throughout the race. Start the event with half and when the stop is made replenish with the other half. This has the advantage of maintaining a constant weight and therefore making the rider more comfortable and also allowing the motorcycle to carry a slightly higher gear ratio throughout. A matter of 10 pounds can effect gear ratio considerably.

This particular theme can be varied if it is felt that the last part of the race will become a "Trophy dash." In this case the lighter the load the better. Remember however, that the increased load of the fuel in the opening stages of the race will tend to increase rider fatigue and wear on the brakes and tires.

As with the preparation of engines we must again "compromise" in order to reach the ultimate goal. The decisions involved are most important and must be made only after careful consideration of all the facts and circumstances.

Once the ratio has been selected it appears a simple matter to tighten both drive sprocket and rear wheel sprocket and prepare for the race. However, there are additional considerations that can pay dividends.

Gear ratio is nothing more than a reduction ratio composed of a driven diameter (no. of teeth) and a driving diameter (no. of teeth). By dividing the driver into the driven we obtain the numerical ratio. (Example: 20T rear wheel-10T engine) $10\sqrt[2]{20}$. This is numerically a two to one ratio. However, this can also be obtained by a 15T engine and 30T rear wheel sprocket.

As a general rule the larger the front sprocket the better, this allows a larger radius on which the chain can travel and therefore reduces the chance of it leaving the sprocket due to its high inertia.

The closer the diameters are to each other the better. This increases chain life, and chain length can be kept to a desirable minimum.

Once the foregoing procedures have been carried out and all appears satisfactory it now becomes the rider's turn to put them to good use. If all of the correct decisions have been made there will be usable horsepower where and when it is needed and the rider can concentrate on the all important job of racing.

4 - TUNING TIPS
By Tony Murphy

Final tuning should consist of a thorough check of all the essential components (i.e., engine, clutch, gearbox, etc.) to insure that nothing has been overlooked.

Once this has been completed it is always advisable to systematically check every nut and bolt to make certain that they are tight. Remember, the races can be lost if any part should not perform its function correctly. Failures are perhaps as often attributable to negligence in preparation as they are to mechanical failures. The most insignificant part can become the most important if it should cause a race to be lost.

In racing events when a practice period is permitted, there are several things that should be checked and adjusted between practice and the race. If enough time is available, ignition timing and point gap should be checked; condition of sparkplug to determine fuel mixture; control lever adjustment (allowing for possible wear during the race) and tire pressures. Tire pressures should be determined by existing conditions and/or the recommendation of the tire manufacturer.

In a dirt race where the use of an air cleaner is necessary, it is good to check the condition or possibly replace with a clean filter.

For those who wish to be meticulous in their preparation, the method of removing the cylinder head in order to determine the efficiency of the fuel mixture has much to recommend it.

Not only can an accurate reading of the combustion efficiency be made, but the piston rings and cylinder head gasket can be inspected for signs of failure. It also has the added advantage of keeping you busy and this leaves ~~a~~ little time to develop the inevitable "butterflies" that befall all racers before an event.

In conclusion, it is wise to remember that the "other fellow" may have followed the very same procedures as you. This leaves the race winning to the riders ability. But, after all, is not the race being held to determine who has the most ability anyway?

YAMAHA

MOTORCYCLES



SERVICE MANUAL

COVERING
GENUINE YAMAHA TUNING

YAMAHA SPEED MANUAL

Volume II - GYT

YAMAHA FACTORY RECOMMENDED PROCEDURE
COVERING
YG1 - YA6 & YJ1

Each chapter covers all phases of tuning the standard machine for speed.

In this booklet, parts are referred to as MOD and GYT.

MOD = MODIFIED part, and refers to a part which was originally Yamaha standard, and was then changed to the given specifications for speed purposes.

GYT = GENUINE YAMAHA TUNING part, and refers to a part which has been manufactured by Yamaha especially for speed purposes.

All units of measurement not specified are millimeters.
Inches = millimeters x 0.03937

It is the desire and intention of the Yamaha Factory that the treatment of each model be regarded as a complete, balanced unit. Tests have shown that the given recommendations are most effective ONLY when ALL modifications and/or GYT replacements are performed on the particular machine in question. The sum total results are what count, and these results are a balanced end product of all the many complicated individual processes that go on inside of an operating engine. Changes, if performed individually, may have little if any effect and have even been known to have adverse effect. We, therefore, suggest that for ultimate satisfaction, the GYT procedure be followed through completely.

It should be understood that this information is offered strictly on its own value and as a service to Yamaha Racing Enthusiasts.

Yamaha International Corporation specifically makes no recommendations as to its application whatsoever, nor should such be implied. Furthermore, Yamaha International Corporation assumes no warranty or liability for engine performance, endurance, failure, destruction or any other condition, in part or in whole, as a result of any individual or group following the listed procedures.

Chapter I

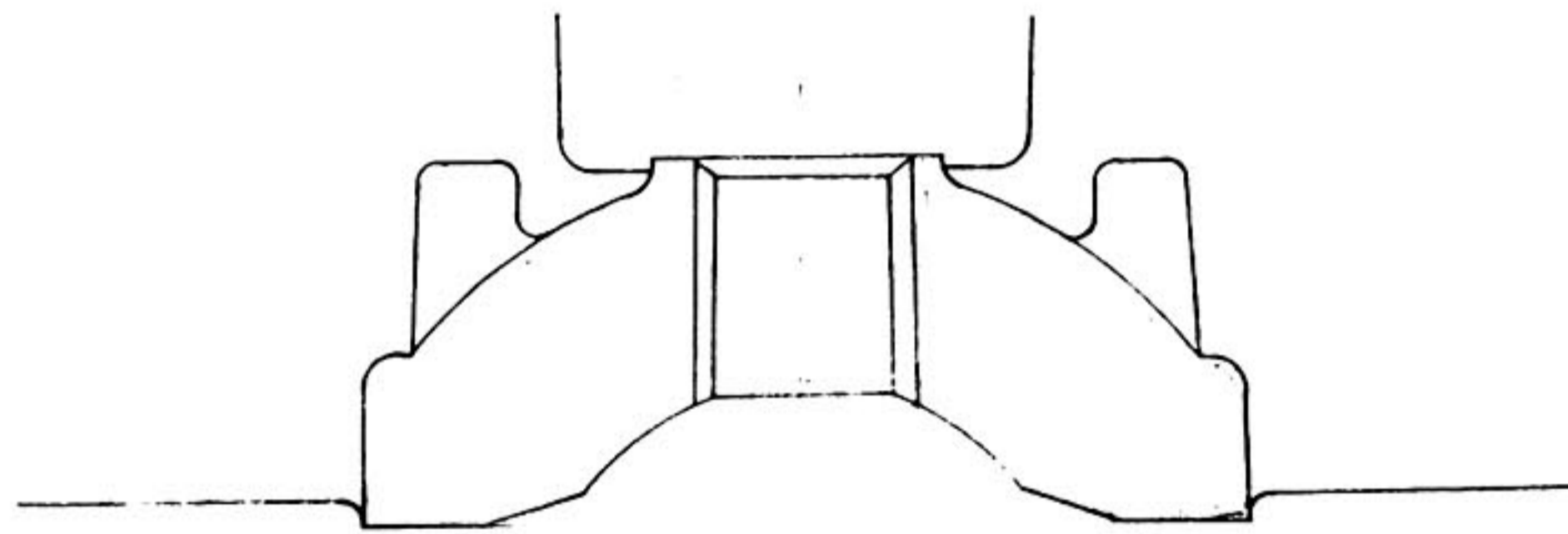
TUNING THE YG1 FOR SPEED
(Including the GYT Parts List)

How to tune YG1 for speed, especially for scrambler, is explained in this chapter.

1 - CYLINDER HEAD

A-GYT head:

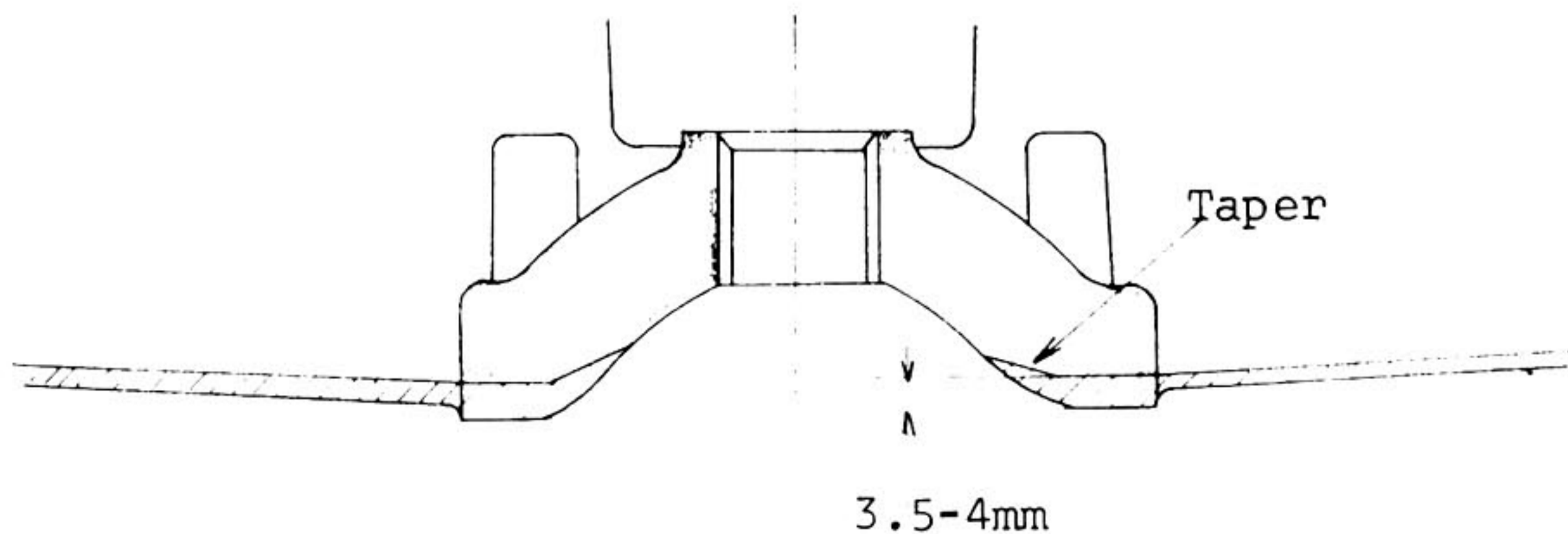
- Combustion chamber volume 4.5 ± 0.15 cc.
- Sparkplug B-8EN or B-9EN (Long Reach)



B-MOD head:

This modification may result in decreased rigidity and strength of the head, which may cause deformation and cracking. It is hoped, therefore, that the GYT head will be used. The modification process of the standard head is shown in the facts and illustration below:

- a. Cut off the flat flange of the cylinder head by about 4 mm and reshape the hem of the combustion and cooling fins as shown below.
- b. The combustion chamber volume of the MOD head should be 4.5 ± 0.15 cc, while the volume of the standard head is - 11.2c.c.
- c. The sparkplug should be B-8HN or B-9HN.



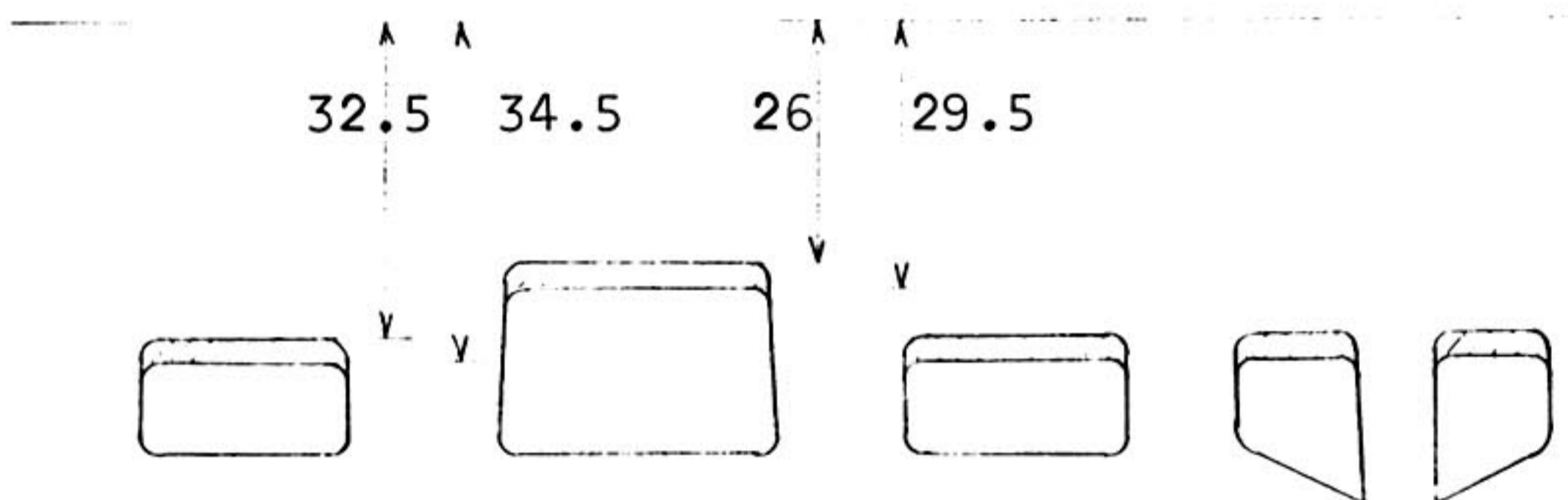
2 - CYLINDER

A-GYT cylinder:

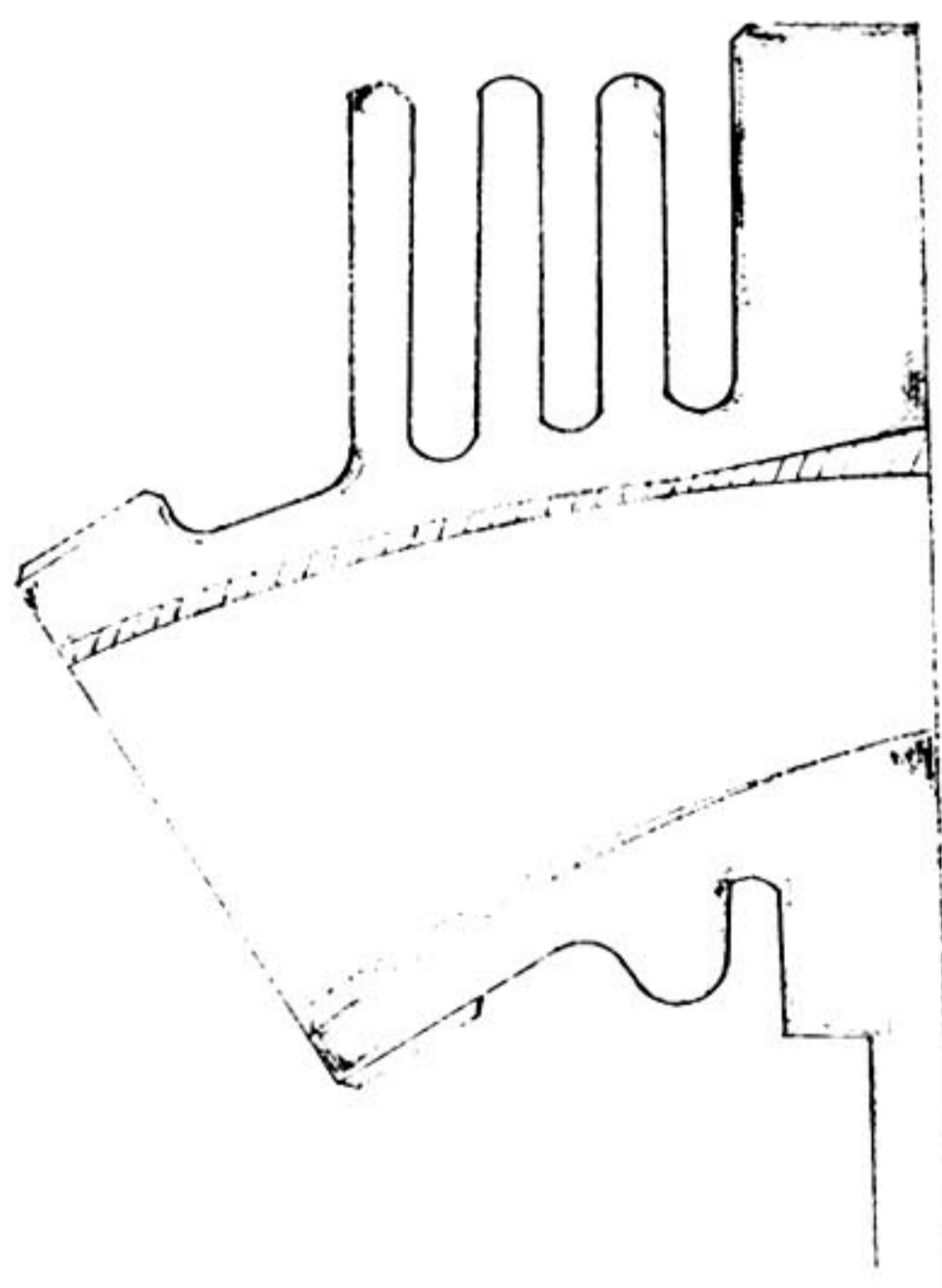
- Material Aluminum alloy
 - Finishing Wall of the cylinder is chrome-plated with Yamaha's special process.
- Port specifications same as MOD cylinder.

B-MOD cylinder:

- a. Grind exhaust port and transfer ports at their upper edges in order to change port timing. (See illustration)



- b. Grind exhaust port to expand the exhaust gas passage as shown below:



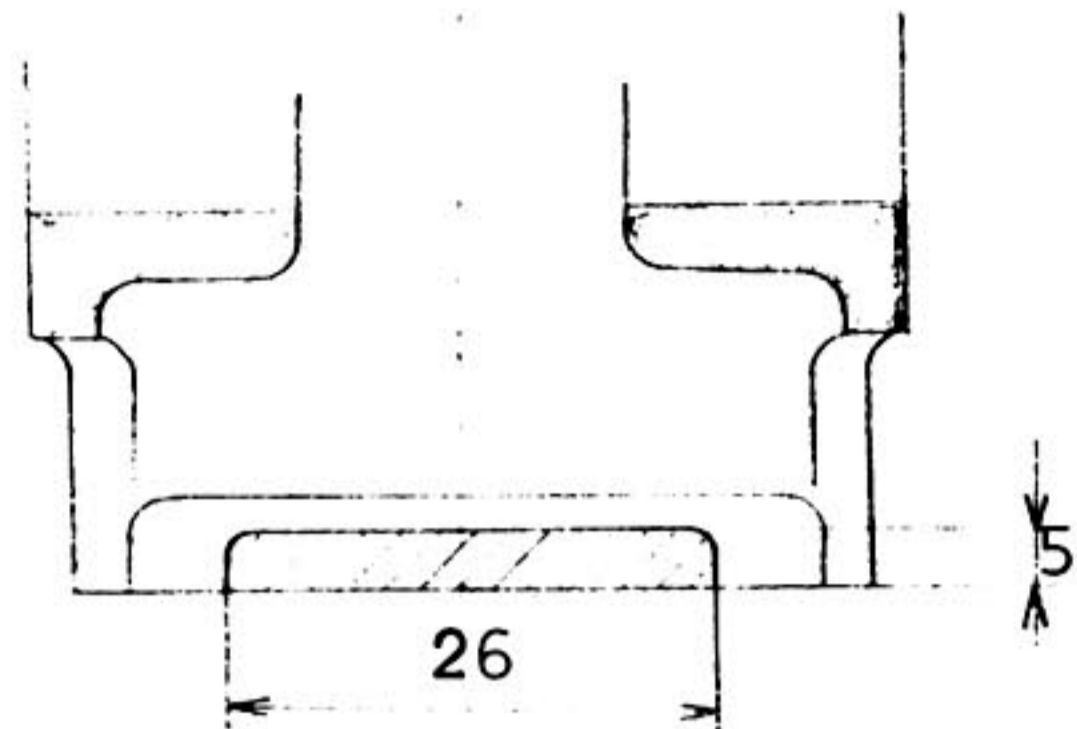
3 - PISTON AND PISTON RINGS

A-GYT piston & Rings:

Piston ring groove width 1.5
 Piston and piston rings ^(GYT) should be used with the GYT cylinder.
Never use chrome rings in a chrome cylinder

B-MOD piston and rings:

Cut off the piston skirt contacting the third transfer port (opposite exhaust) as shown in the figure below:



4 - ROTARY VALVE

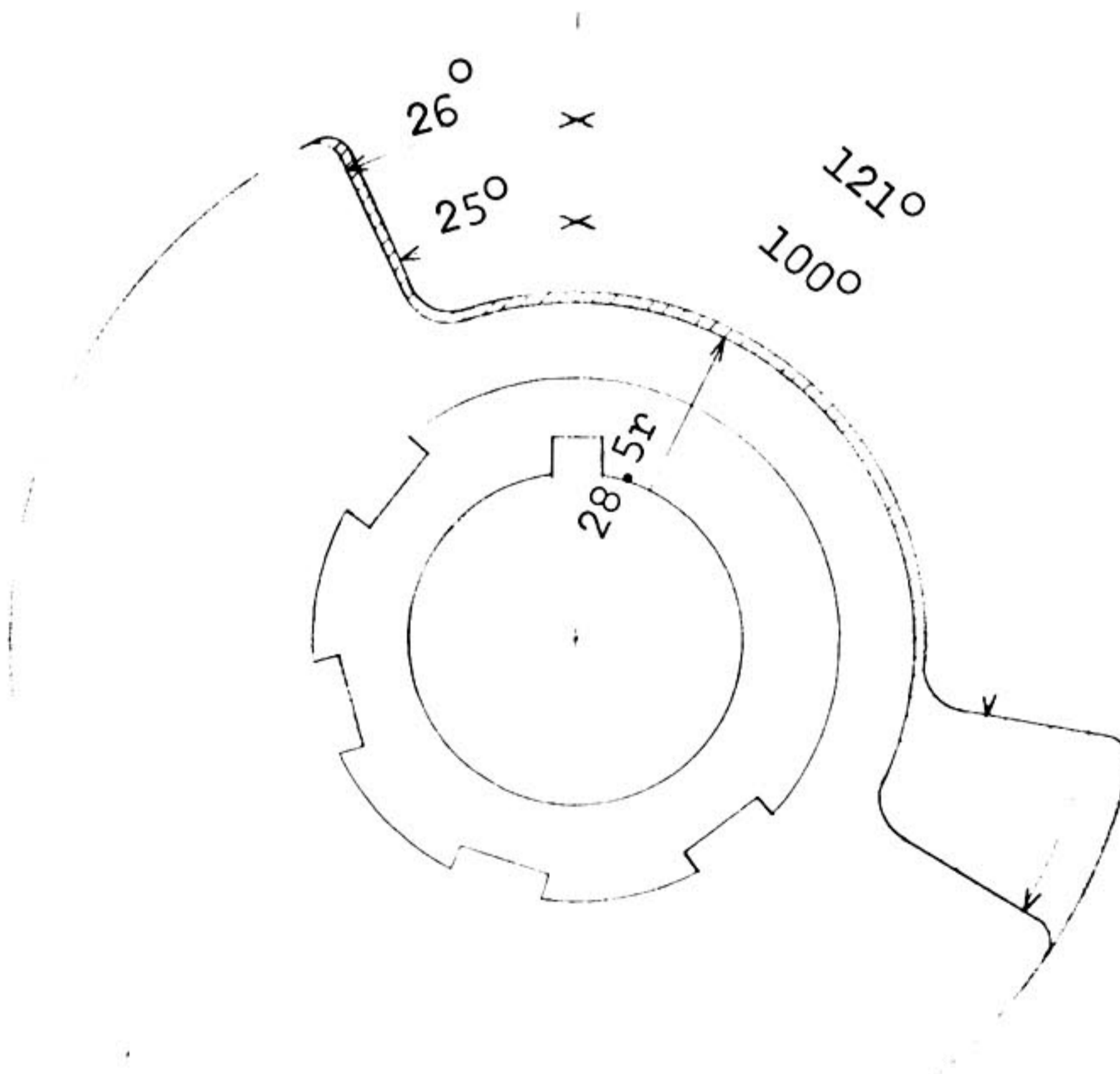
A-GYT valve:

Cut off and reshape the standard valve to increase the intake port opening period. (per illustration)
 When doing this modification, the new 4-notch type valve should be used. Comparison of the MOD valve and the GYT valve must take into consideration the fact that the MOD valve is not as reliable. The modification process may decrease the strength of the finished part, and the choice of the GYT valve is recommended.

Intake Port Timing - MOD and GYT (Piston travel from TDC).

- Intake Port opens 36.0mm before TDC
- Intake Port closes 10.7mm after TDC

Rotary valve illustration, MOD and GYT:

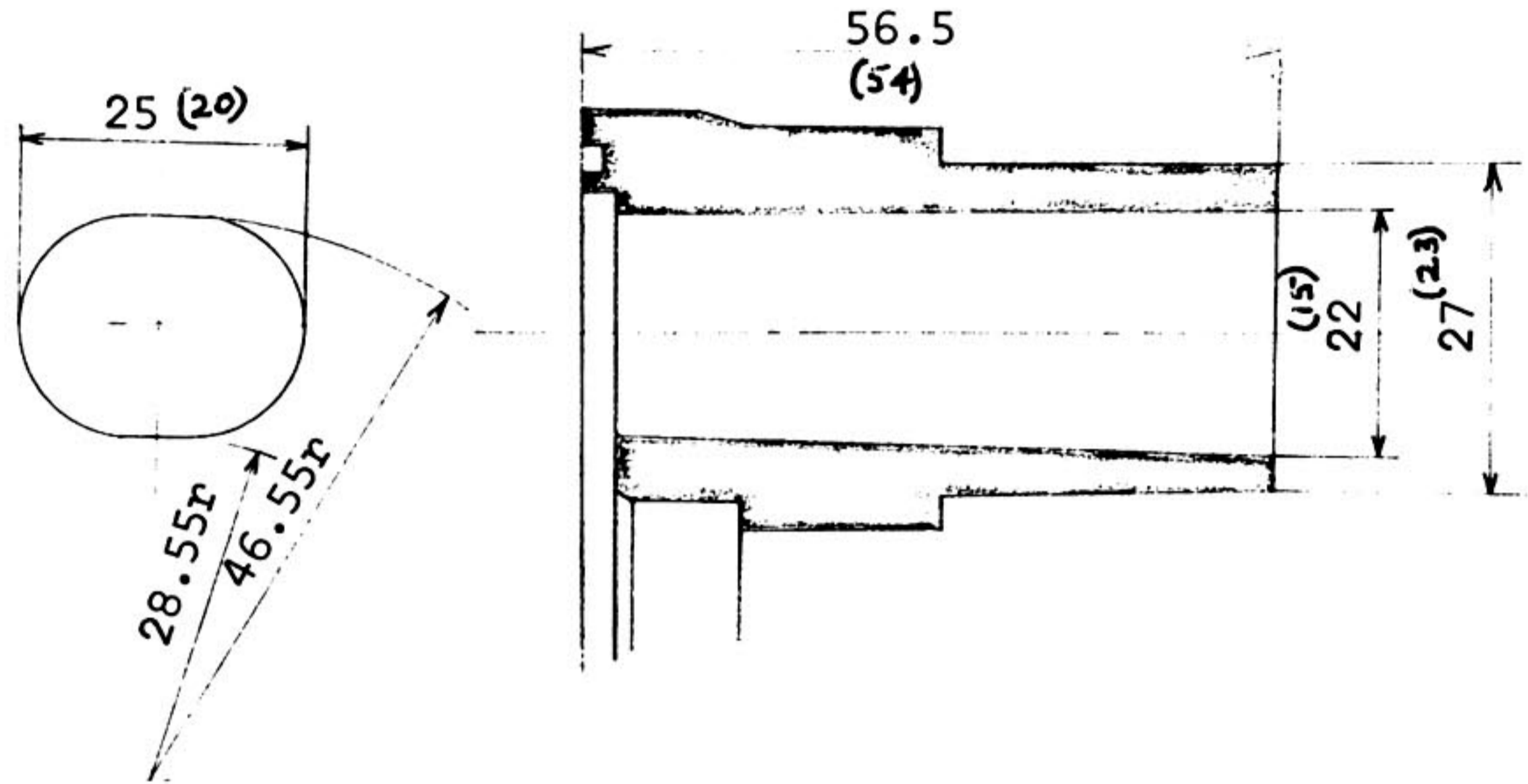


5 - VALVE COVER

A-GYT cover:

In order to use the bigger carburetor (MIKUNI VM 22 SC), only GYT valve cover can be used. Valve cover O-ring (B) for YA6 should be used with this substitution.

The GYT cover is different from the standard as shown in the illustration:



B-MOD cover: none

6 - CARBURETOR

In place of MIKUNI VM 15 SC (standard carburetor), MIKUNI VM 22 SC is used. Main setting figures of this GYT carburetor are as follows:

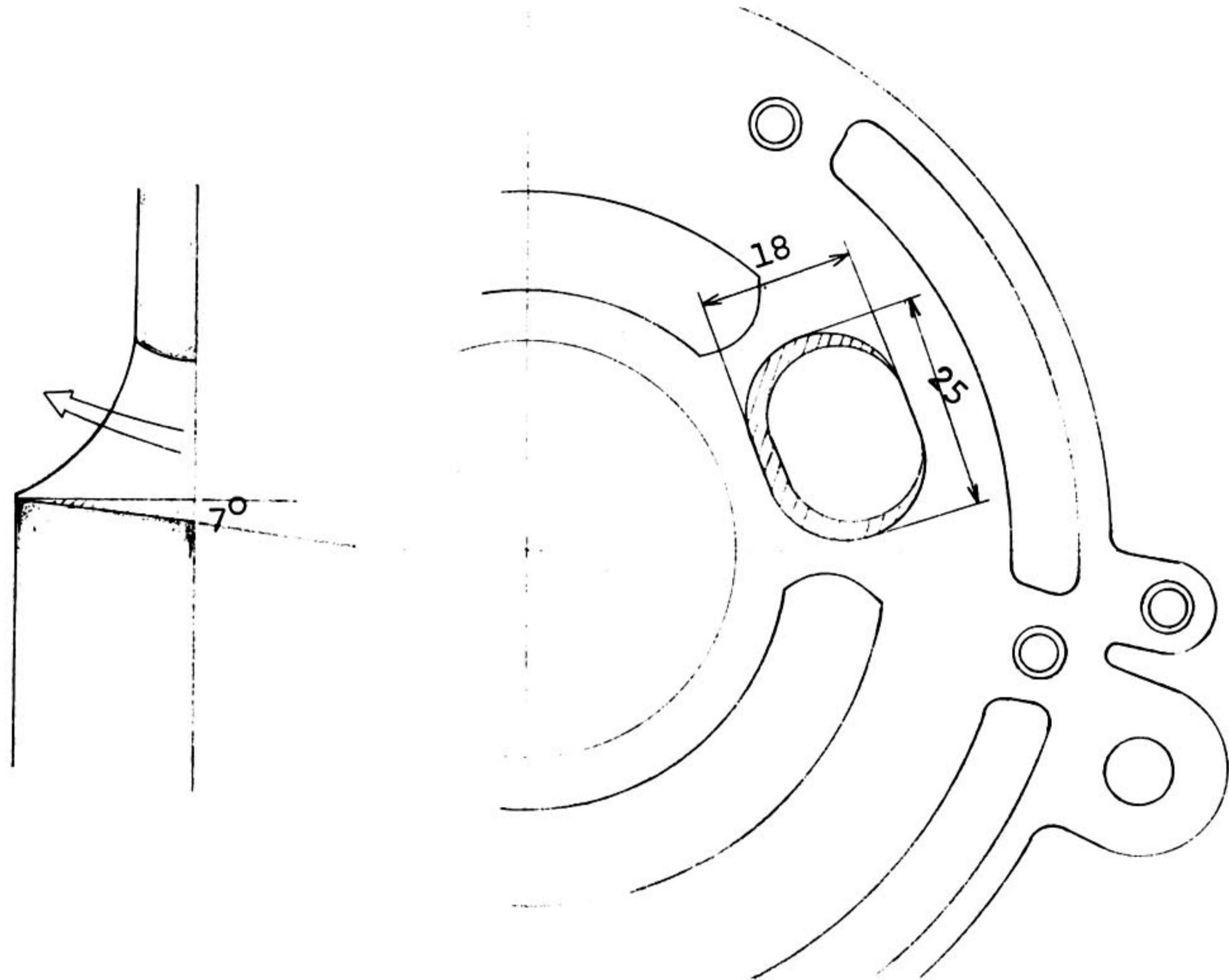
- Main jet #260 (Main jet range #250 to #280)
- Jet needle #22 M₃ - 3 stage
- Cut away #2.5

7 - RIGHT CRANKCASE

A-GYT case: None

B-MOD case:

Reshape the intake port of the crankcase-right in order to match it to the intake port of the valve cover. (See Illustration)



The intake passage; which consists of the main bore of the carburetor, valve cover, valve and right crankcase; should be smoothly connected without any steps.

8 - RIGHT CRANKCASE COVER

A-GYT cover:

With the change of carburetor and valve cover, only the GYT right crankcase cover can be used.

B-MOD cover: None

9 - CARBURETOR CHAMBER COVER

A-GYT cover:

Special (with gasket) for this application.

B-MOD cover: None

10 - CARBURETOR CAP AND CAP PLATE

A-GYT cap and plate:

Genuine GYT parts only. In order to secure the carburetor cap in proper position, cap plate is screwed to the carburetor cover. The screw is YS12-5-12.

B-MOD parts: none

11 - MUFFLER (EXPANSION PIPE COMPLETE)

A-GYT assembly:

GYT parts must be used. This is the most important part for speed tuning.

GYT Expansion pipe complete

The expansion chamber complete consists of the following parts:

- a. Exhaust pipe
- b. Ring nut
- c. Expansion pipe
- d. Pipe stay
- e. Protector lock nut
- a. c. d and e are welded together

How to install the expansion pipe complete

- a. Screw the ring nut to the cylinder loosely.
- b. Make a hole of 8.5mm diameter at the place where the hole of expansion pipe stay matches on the frame pressing.
- c. With a 8mm bolt, the expansion pipe is fastened to the frame (by using a 8mm nut inside), while tightening the ring nut on the other side gradually.

B-MOD muffler: none

12 - SECONDARY REDUCTION SPROCKET RATIO MODIFICATION

In accordance with the conditions of the race track, the secondary reduction sprocket ratio should be selected from those combinations made from the following drive sprockets and wheel sprockets.

Drive sprocket 11 T, 12 T, 13 T, 14 T and 15 T.
Sprocket-wheel 51 T, 53 T and 55 T. (51 T sprocket is standard YG1T part.)

13 - GEAR CHANGE ARM

A-GYT arm:

The standard gear change arm may be used, but for better operation and for increased strength the GYT arm is recommended. This GYT part is made of malleable cast iron, has no heel-operating bar and is equipped with a rubber cover on the toe-operating bar.

B-MOD arm: open

14 - FRONT FORK MODIFICATION

A-GYT spring:

The standard fork may be used, but it is better to replace the spring with the GYT spring. The standard front fork spring is too soft for racing. (Scramble racing, not road racing)

The GYT spring is same as that of YGLT, but with chrome-plating.

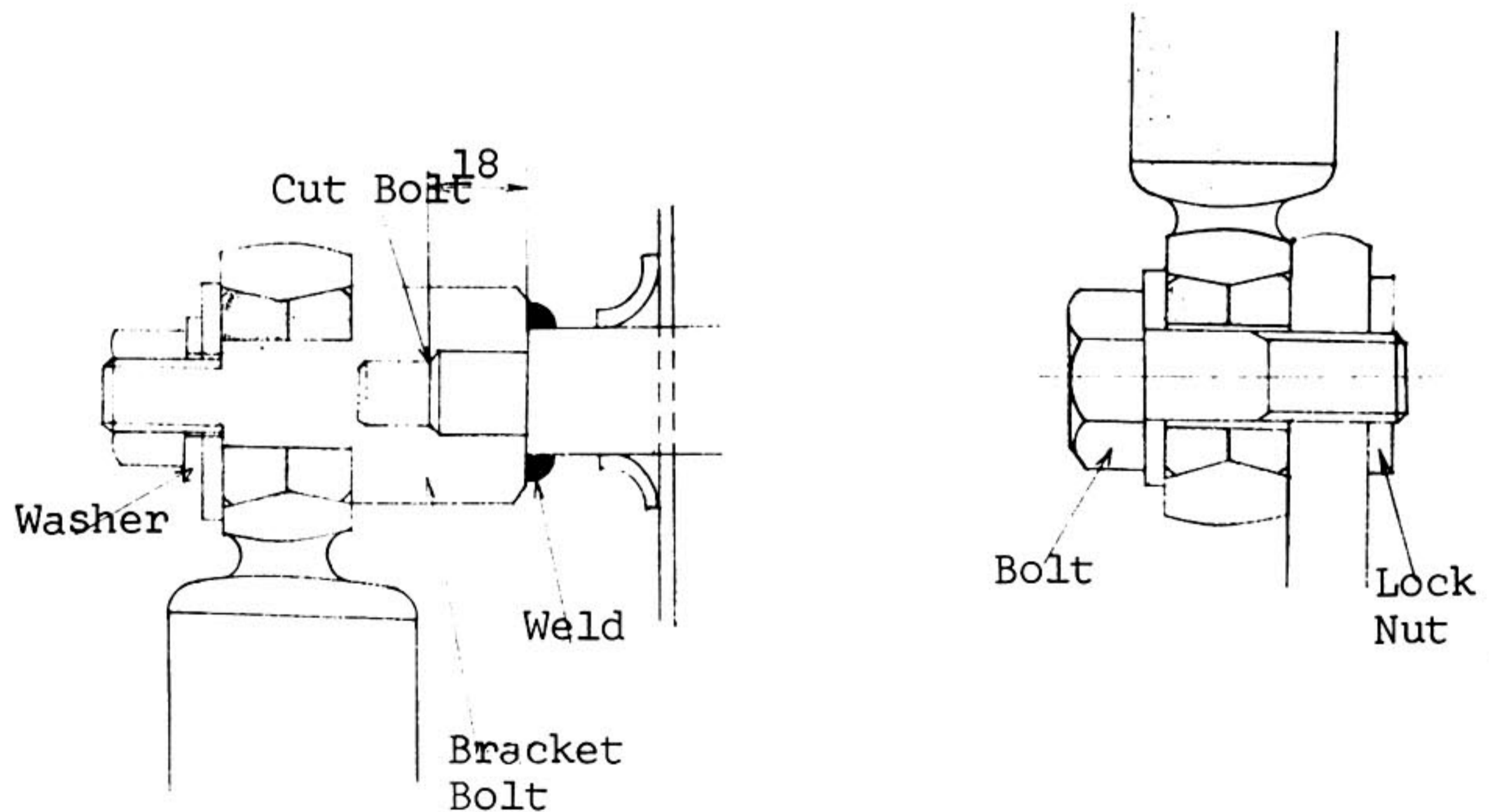
15 - REAR SUSPENSION UNIT MODIFICATION

The standard rear suspension unit may be used, but the factory has prepared the GYT part with increased hydraulic damping co-efficiency. The genuine tuning part is same as that of YGLT with exposed chrome-plated spring.

When using the larger wheel sprocket, the drive chain may contact the rear suspension unit. Therefore, the rear suspension unit bracket left side should be modified as follows:

A-Upper bracket:

- a. Cut off the thread part of the upper bolt, left side.
- b. Weld the GYT rear suspension unit bracket A to the upper bolt. (See illustration) The rear suspension unit bracket bolt in the left side will be screwed from the outside in order to install the rear suspension unit outside of the swing-arm.



16 - TIRE MODIFICATION

The standard rims and brake hubs are used for both front and rear wheels. The front tire should be changed to 2.50-17 with caramel pattern and the rear tire to 2.75-17 with block pattern.

If you want to use the bead spacers for the prevention of rear tire slipping, these are included in the Genuine Tuning Parts Kit, and you need to make holes in the rim.

17 - OTHER MODIFICATIONS TO FRAME

All the unnecessary things to be removed. Seat, handle bar, front fender, rear fender, footrest, and other parts should be modified as you wish.

18 - ELECTRIC EQUIPMENT MODIFICATION

The standard magneto can be used after removing the lighting coil. All the other electric equipment considered unnecessary should be removed.

19 - SPECIAL SERVICE DATA FOR TUNING

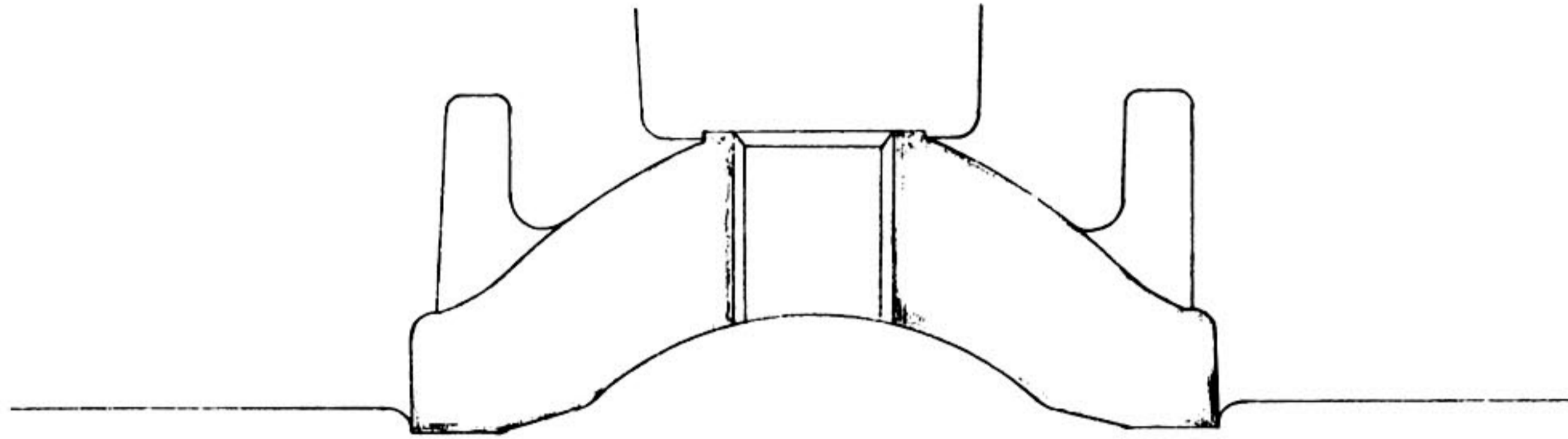
- a. Piston clearance 0.050 - 0.060mm for cast iron cylinder
0.040 - 0.050mm for alluminum alloy
cylinder.
- b. Ignition timing 2.2 - 2.4 mm
- c. Gasoline-oil mixing ratio 15 : 1

GENUINE YAMAHA TUNING PARTS KIT FOR YG1

<u>Stock No.</u>	<u>Part Name</u>	<u>Quant/Unit</u>	<u>Remarks</u>
	Cylinder head	1	
	Cylinder	1	
	Piston (Piston ring width: 1.5mm)	1	
	Valve	1	
	Valve cover	1	
	Spark plug (B-8EN or B-9EN)	1	
	Piston ring	2	
	Valve cover O-ring (Common to YA6)	1	
	Carburetor (VM22SC)	1	
	Carburetor cap	1	
	Carburetor cap hold plate	1	
	Carburetor cap hold plate set screw	4	
	Expansion pipe complete (Upswept-type)	1	
	Exhaust pipe gasket	1	
	Expansion pipe protector	1	
	Protector set screw	3	
	Drive sprocket (11 T, 12 T, 13 T, 14 T or 15 T)	1	
	Gear change arm	1	
	Gear change pedal (Set with change arm)		
	Crankcase cover, Right	1	
	Carburetor cover	1	
	Carburetor cover gasket	1	
	Front fork spring (Common to YG1T)	2	
	Rear suspension unit bracket bolt A	1	
	Rear suspension unit bracket bolt B	1	
	Rear suspension unit bracket nut	1	
	Rear suspension unit (Common to YG1T)	2	
	Sprocket wheel (51 T, 53 T or 55 T)		
	Front tire (2.50 - 17)	1	
	Rear tire (2.75 - 17)	1	
	Bead spacer for 2.75 tire	2	
	Spring washer (For attaching upper eye of rear suspension unit)	1	

TUNING THE YA6 FOR SPEED
Including GYT parts list

- 1 - CYLINDER HEAD - GYT Head: +0.05
 A-Combustion chamber volume 10.5-0.03
 Spark plug B-8EN or B-9EN (Long reach spark plug.)

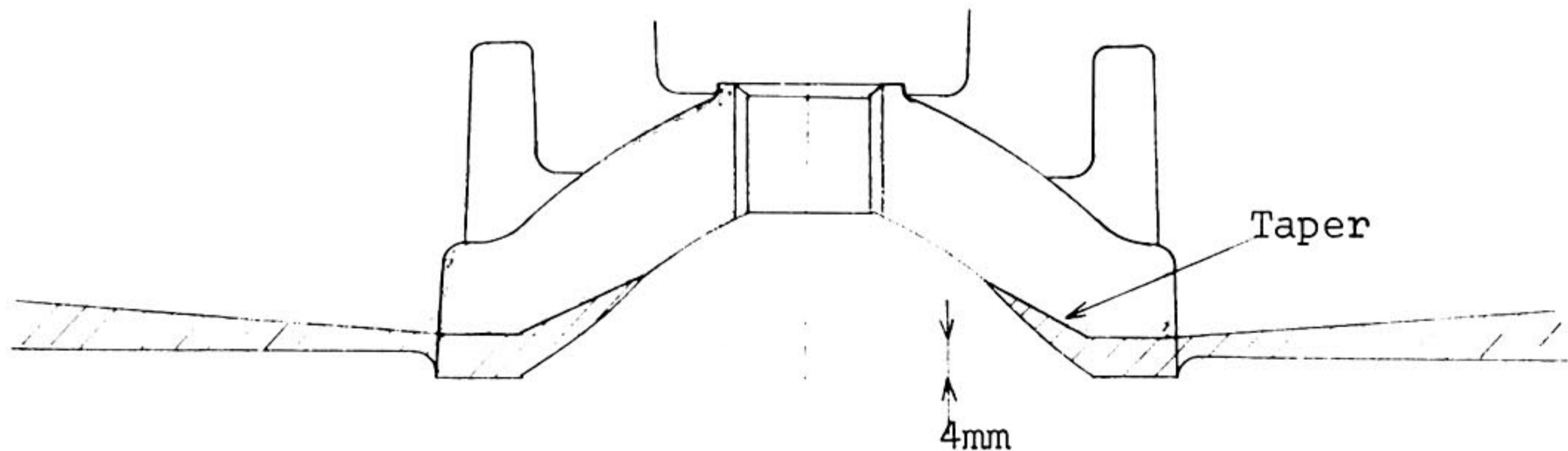


B-MOD head:

- Cut off the flat flange of the cylinder head by about 3.7mm and reshape the hem of the combustion chamber and cooling fins as shown in the figure below.
- The combustion chamber volume of the modified cylinder head should be $10.5 + 0.05\text{cc}$ (The volume of the standard part is $16.5 + 0.5\text{cc}$) - 0.3cc
- The spark plug should be B-8HN or B-9HN.

This modification may result in decreased rigidity and strength of the cylinder head, which will cause deformation and cracking. We therefore, wish that the GYT head will be used.

Modification of standard cylinder head



2 - CYLINDER

A-GYT cylinder:

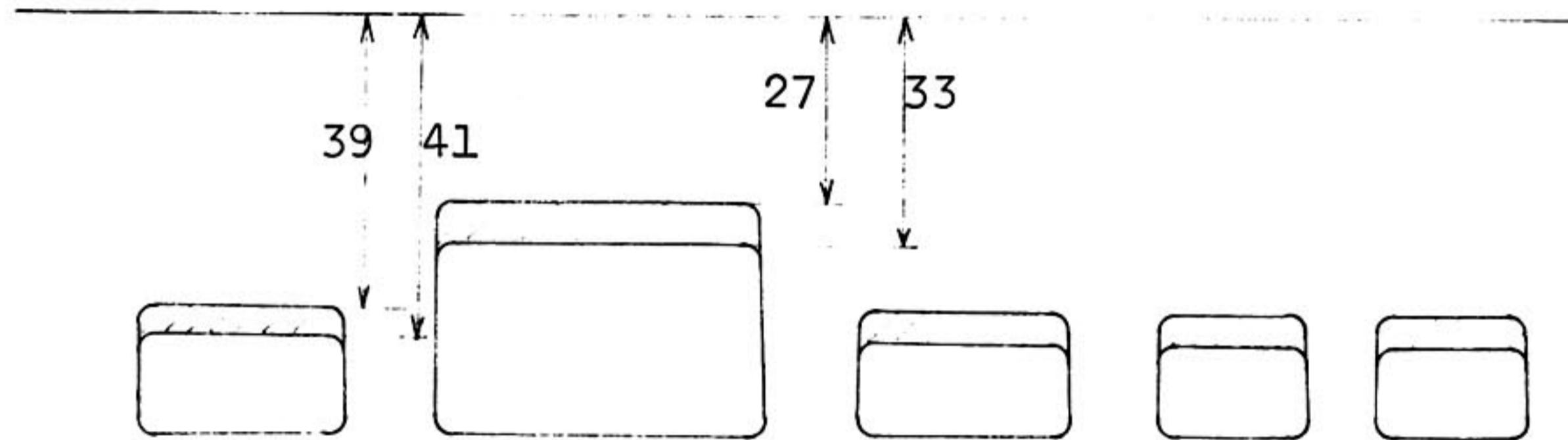
Material Aluminum Alloy

Finish Cylinder Wall is Chrome-Plated
with Yamaha's special process.

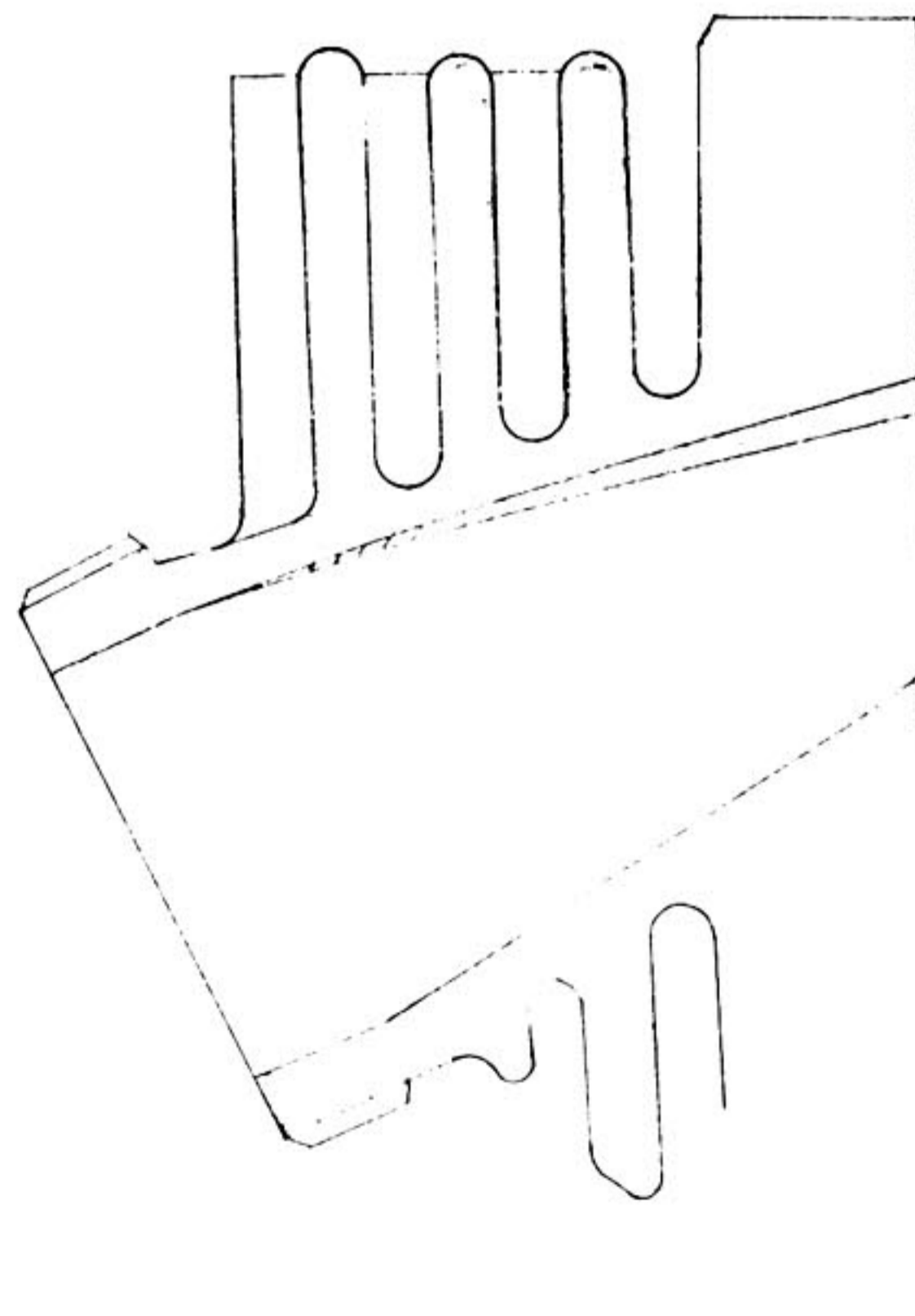
Port specifications same as MOD cylinder.

B-MOD cylinder:

- a. Grind the exhaust port and transfer ports at their upper edges in order to change port timing. (See figure below).



- b. Grind the exhaust port to expand the exhaust gas passage as shown below:



3 - PISTON AND PISTON RINGS

A-GYT piston and rings

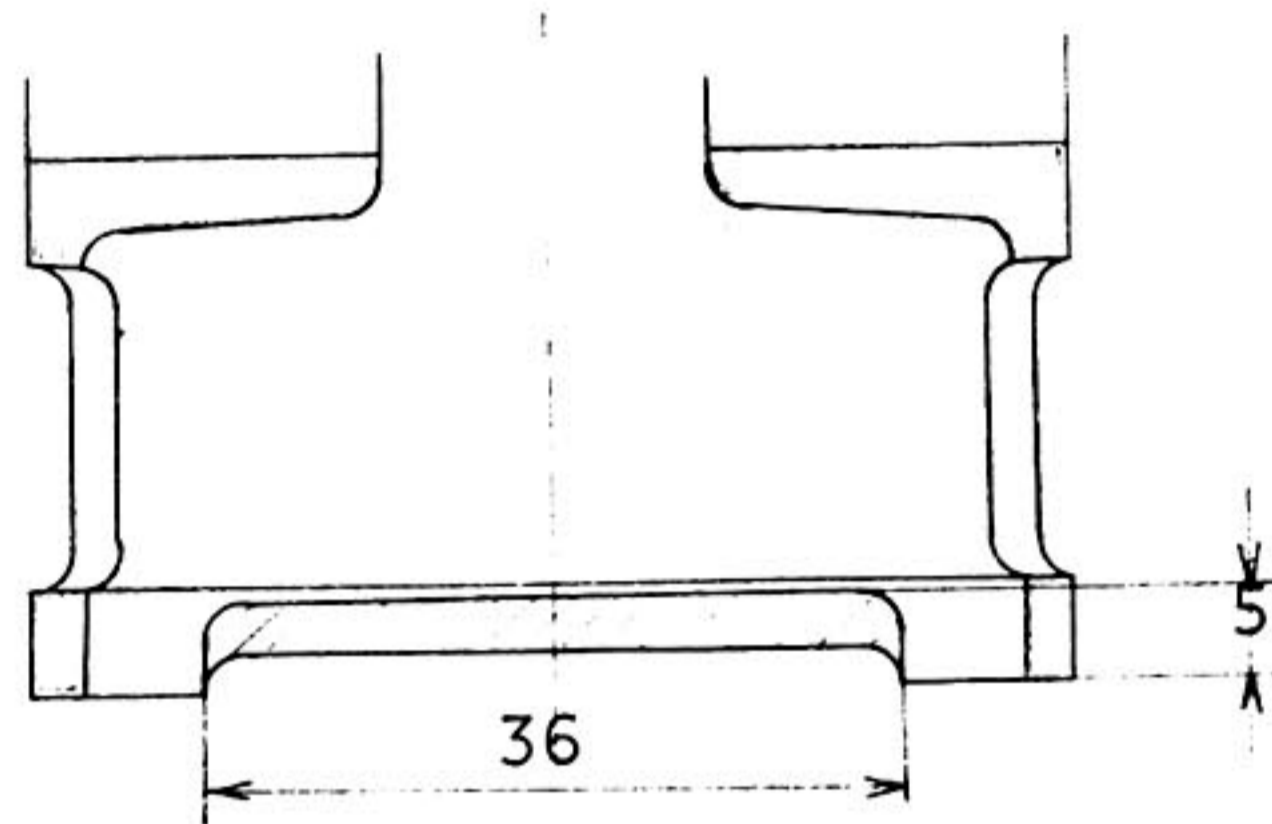
Piston ring groove width 1.5mm

Piston rings are same as YDS3 second piston rings

This piston and these piston rings should be used with the cylinder from the GYT parts kit. Never use chrome rings in a chrome cylinder.

B-MOD piston and rings

Cut off the piston skirt contacting the third transfer port (opposite exhaust) as shown in the figure below.



4 - ROTARY VALVE

A-MOD valve

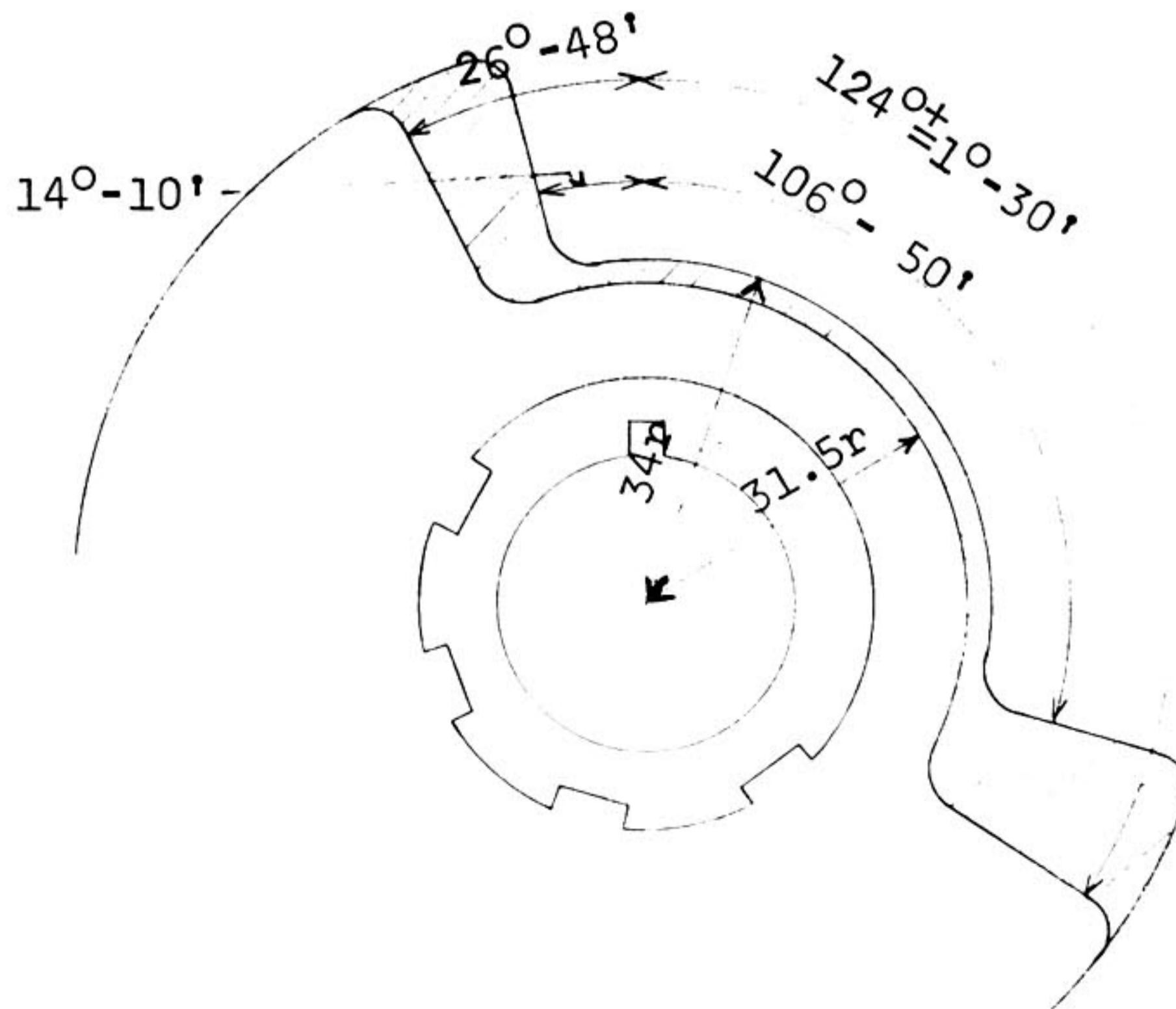
Cut off and reshape the standard valve to increase the intake port opening period. (See illustration.) After the modification, the intake port timing will be as follows:

Intake port opens 42.6mm before T.D.C.

Intake port closes 10.5mm after T.D.C.

If you modify the standard valve, there will be no problem in the strength of the valve.

Modification of the standard valve



B-GYT valve.

Just the same as the preceding illustration.

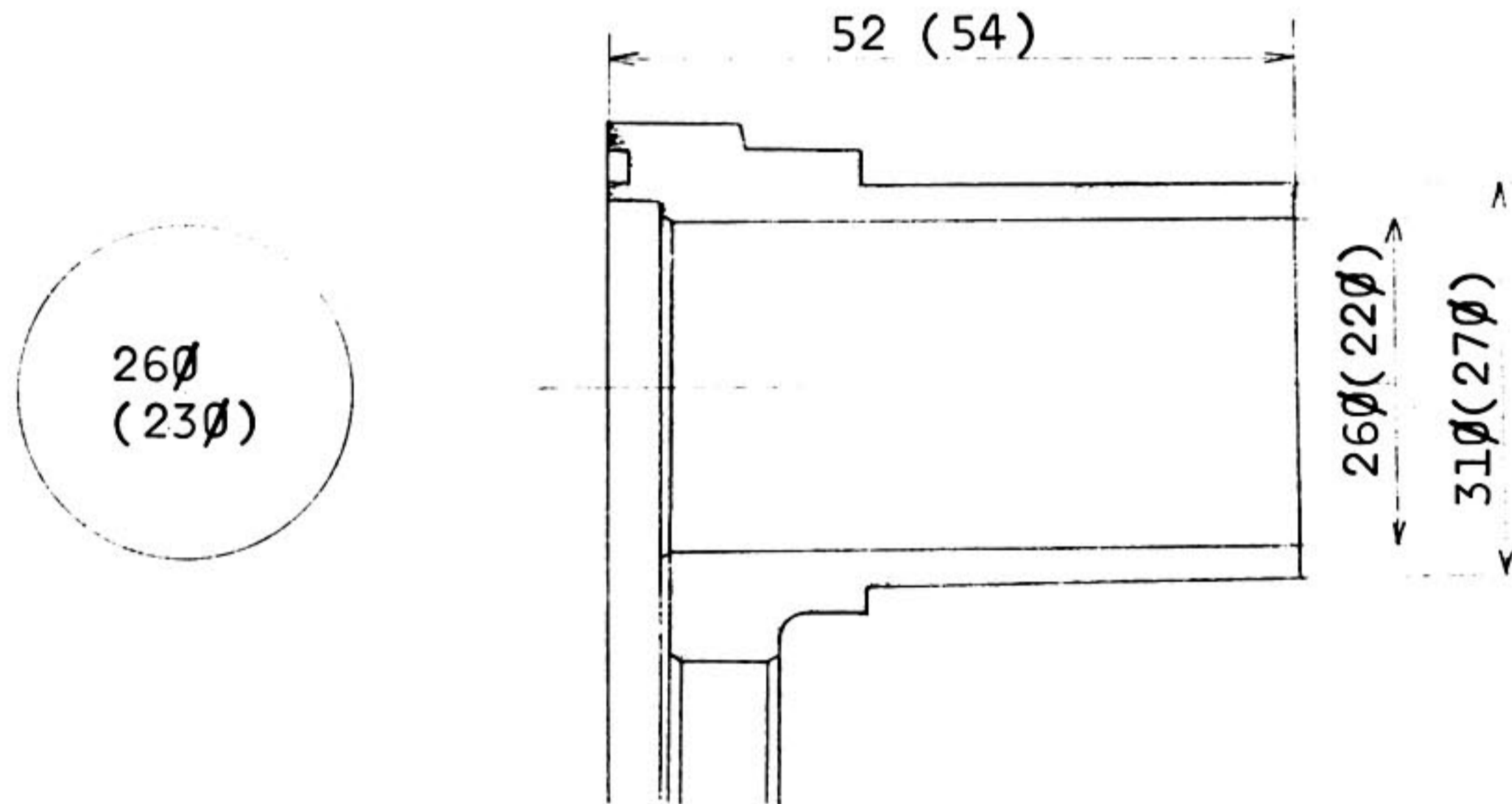
5 - VALVE COVER

A-GYT cover:

In order to use the bigger carburetor (VM 26 SC), only the GYT cover can be used.

The GYT part is different from the standard part as shown. For this modification, the valve cover O-ring (B) should be changed to 30 x 3 from the standard part 26 ϕ x 3.2 ϕ

(ϕ = mm dia.)



B - MOD cover: none

6 - CARBURETOR

In place of MIKUNI VM 22SC, (Std.), MIKUNI VM 26 SC is used. Main setting figures of this GYT carburetor are as follows:

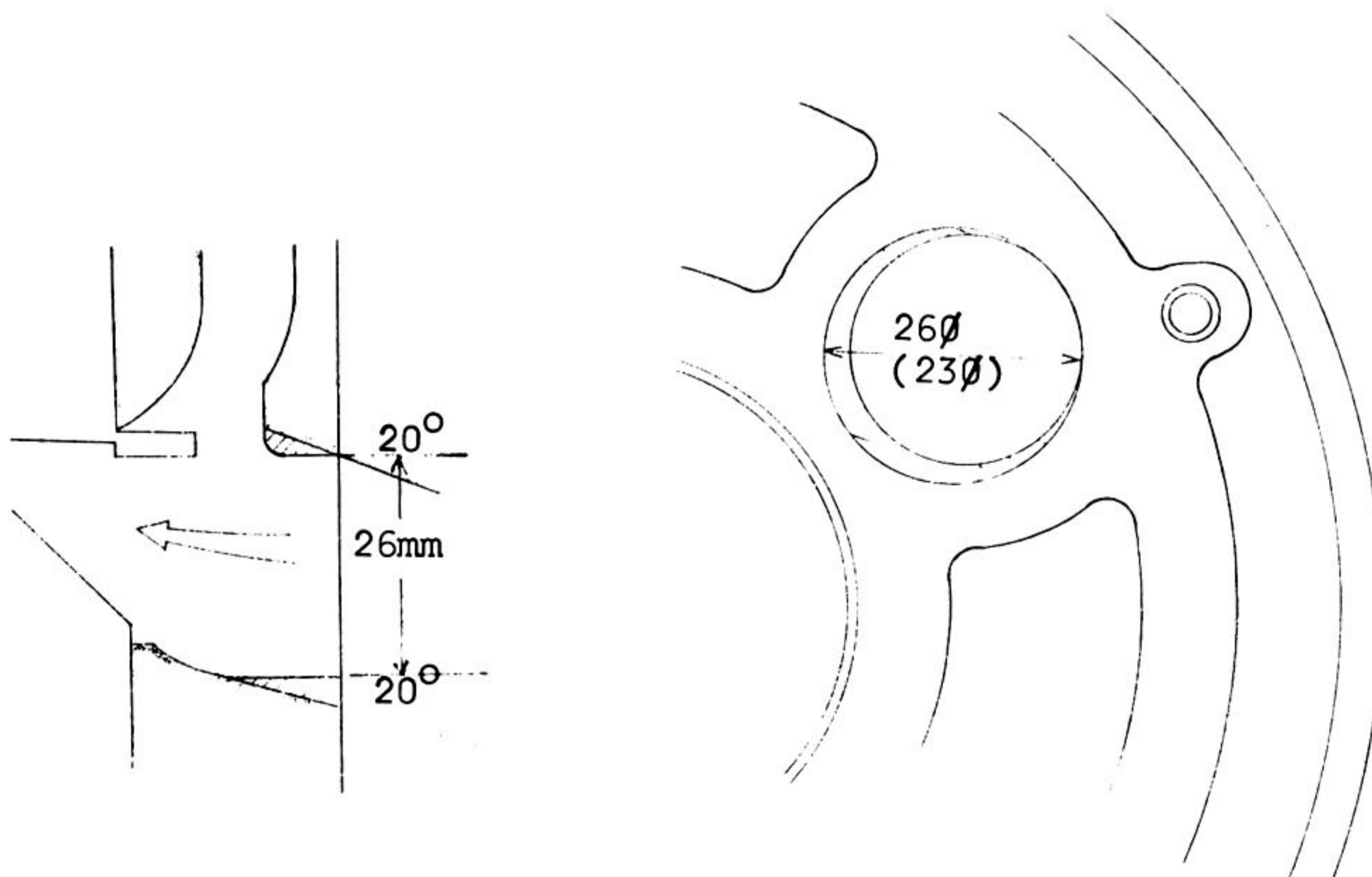
Main jet	#190
Jet needle	28 A -3 stage
Cut Away	#2.5

In accordance with the conditions of the racing track, weather, altitude, temperature etc., the main jet range is from #180 to #200.

7 - CRANKCASE RIGHT

A-MOD case:

Reshape the intake port of the crankcase-right in order to match to the intake port of the valve cover. (See figure below.)



The intake passage consisting of the main bore of the carburetor, valve cover, valve and crankcase-right should be smoothly connected without any steps.

B-GYT case: none

8 - RIGHT CRANKCASE COVER

A-GYT cover:

With the change of carburetor and valve cover, only the GYT part can be used. The GYT cover has an enlarged carburetor chamber and can be fitted with the GYT carburetor cap and GYT cap plate. In place of the air duct seal rubber, a GYT part gasket will be used.

B-MOD cover: none

9 - CARBURETOR COVER

The GYT part only can be used with the changes in the carburetor and crankcase cover. As to the gasket, the GYT part must be used.

10 - CARBURETOR CAP AND CAP PLATE

GYT parts only. In order to secure the carburetor cap at the proper position, the cap plate is screwed to the carburetor cover. The screw used is YS12-5-12.

11 - CLUTCH SPRING MODIFICATION

For the purpose of preventing the clutch from slipping, the spring pressure should be increased in the following way:

A steel washer; 10mm inside diameter, 16mm outside diameter, and about 2mm thickness; should be used as a seat for the clutch spring. This part is included in the genuine tuning parts kit under the name of the clutch spring spacer.

Genuine tuning parts kit includes the following clutch related parts:

Clutch plate (B)	5
Friction plate	5
Clutch spring spacer	5

In addition to the above mentioned clutch plate (B), one standard clutch plate must be used when assembling the clutch as well as using the clutch spring spacer under each clutch spring.

12 - MUFFLER (EXPANSION PIPE COMPLETE)

A-GYT assembly:

Genuine tuning parts must be used. This is the most important part for speed tuning.

GYT Expansion pipe complete, consisting of:

- a. Exhaust pipe
 - b. Ring nut
 - c. Expansion pipe
 - d. Pipe stay
 - e. Protector lock nut
- a., c., d and e are welded together.

How to install the expansion pipe assembly:

- a. Screw ring nut to the cylinder loosely.
- b. Weld a 8mm nut at the place where the hole of expansion pipe stay matches on the frame pressing.
- c. Fix the expansion pipe by using 8mm bolt.

B-MOD muffler: none

13 - SECONDARY REDUCTION SPROCKET RATIO

According to the conditions of the racing track, the secondary reduction sprocket ratio should be selected from those combinations made from the following drive sprockets and wheel sprocket:

Drive sprocket 13T, 14T and 15T (Standard)
 Wheel sprocket 55T, 57 and 39T (Standard)
 The rear wheel clutch should be replaced with that of YAT1.

14 - GEAR CHANGE ARM WITH PEDAL

The standard part can be used. For better operation and increased strength of the change arm, the GYT part will be used with the GYT left crankcase cover.

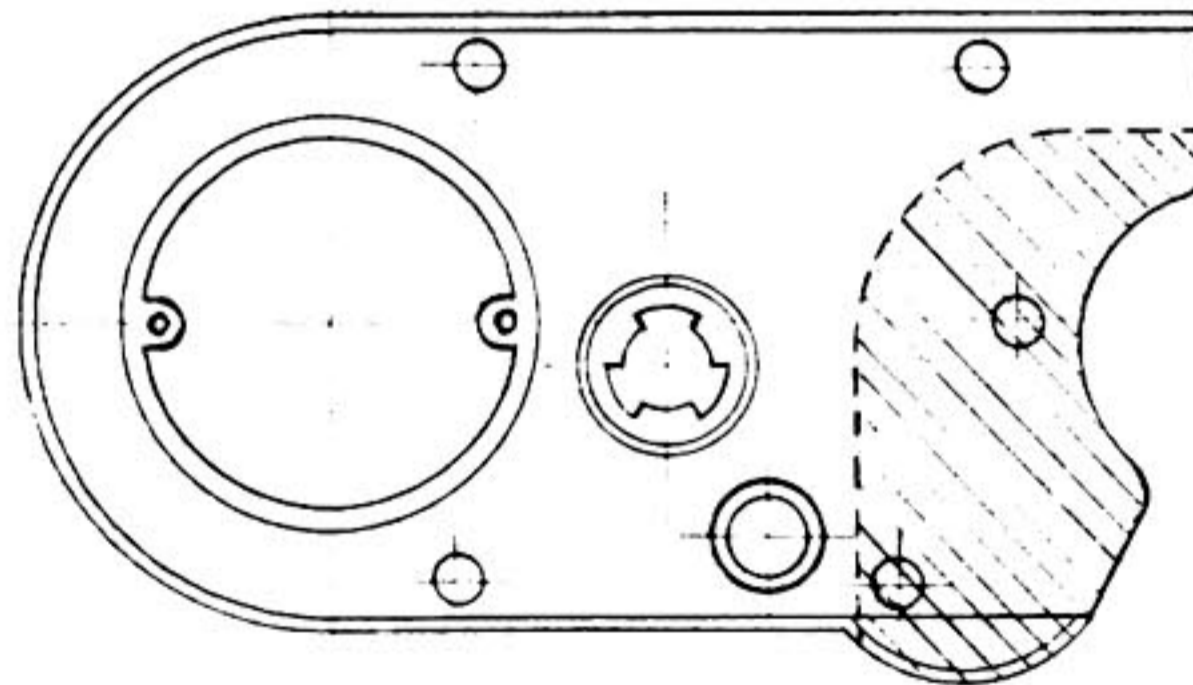
GYT arm:

Made of malleable cast iron, with no heel operating bar and equipped with a rubber cover on the toe-operating bar.

15 - LEFT CRANKCASE COVER

A-MOD cover:

The standard part may be used, but for easier exchange of the drive sprocket, the standard part may be reshaped in its rear part as shown below:



B-GYT cover:

A GYT left crankcase cover can be supplied. This part is designed for equipping a magneto in place of the starter dynamo. The total width is 23mm thinner than the standard part.

16 - KICK CRANK

The standard part can be used. A GYT crank, which has a straight arm, can be supplied.

17 - FRONT WHEEL MODIFICATION

18 inch rim or 19 inch rim should be used in place of the standard 16 inch rim. When adapting a 18 inch rim, the front wheel assembly with 18 inch rim, of YDS3 and the front hub of YA6 or YA5, use longer spokes.

In order to change the standard rim to 19 inch one, the following Genuine Yamaha Tuning parts should be used:

19 inch rim, spoke, nipple and (300 - 19) motorcross tire.
The standard hub can be used.

18 - REAR WHEEL MODIFICATION

18 inch rim should be used. For this purpose, set up a rear wheel assembly by using the 18 inch rim of YDS3, the rear hub of YA6 or YA5, with a motocross tire.

The GYT parts kit for this modification includes the following:

18 inch rim, rear wheel spoke (A) and (B),
and 3.25-18 tire with tube and rim band.

19- FRONT FORK

In order to use 18 inch or 19 inch tire and also to make the front spring harder, GYT front fork should be used. The damping co-efficient has been changed to match scrambling needs.

20 - REAR SUSPENSION UNIT

The rear suspension unit for YDS3 may be used as well as the GYT rear suspension unit which has a stronger spring and a modified damping co-efficient.

21 - OTHER MODIFICATIONS TO FRAME

All unnecessary things should be removed.

Seat, handle bar, front fender, rear fender, footrest and other parts should be modified as you wish.

22 - ELECTRIC EQUIPMENT MODIFICATION

The starter dynamo should be replaced by a magneto with which the standard ignition coil is used. All other unnecessary electrical components should be removed.

23 - SPECIAL SERVICE DATA FOR SPEED TUNING

- A. Piston clearance 0.050 - 0.060mm for cast iron cylinder.
0.040 - 0.050mm for aluminum alloy cylinder.
- B. Ignition timing 2.0 \pm 0.05mm before T.D.C.
- C. Gasoline-oil mixing ratio 15 : 1

GENUINE YAMAHA TUNING PARTS KIT LIST FOR YA6

<u>Stock No.</u>	<u>Part Name</u>	<u>Quan./unit</u>	<u>Remarks</u>
	Cylinder head	1	
	Cylinder	1	
	Piston (Piston ring width: 1.5mm)	1	
	Valve	1	
	Valve cover	1	
	Valve cover O-ring B (or 30 ϕ x 3 ϕ)	1	
	Spark plug (B-8EN or B-9EN)	1	
	Piston ring	2	
	Carburetor (VM26SC)	1	
	Expansion pipe assembly (Upswept type)	1	
	Exhaust pipe gasket	1	
	Expansion pipe protector	1	
	Protector set screw	3	
	Clutch plate (B)	5	
	Friction plate	5	
	Clutch spring spacer	5	
	Drive sprocket (12T, 13T or 14T)	1	
	Gear change arm	1	
	Change pedal (Common to YD3 and YDS3)	1	
	Kick crank	1	
	Kick lever	1	
	Crankcase cover-left	1	
	Crankcase cover-right	1	
	Carburetor cover	1	
	Carburetor cap	1	
	Air duct seal gasket	1	
	Carburetor cover gasket	1	
	Carburetor cap hold plate	1	
	Carburetor cover set screw (YS12-6.20)	1	
	Carburetor cover set screw (YS12-6.55)	2	
	Hold plate set screw (YS12-5.12)	4	
	Front fork assembly	1	
	Rear suspension unit assembly	2	
	Sprocket wheel (55T)	1	
	Sprocket wheel (57T)	1	
	Front wheel spoke A #10	18	
	Front wheel spoke B #10	18	
	Rear wheel spoke A #9 x #10	18	
	Rear wheel spoke B #9 x #10	18	
	Front rim (1.60A x 19) 19 inch rim	1	
	Rear rim (1.85 x 18) 18 inch rim	1	
	Front tire (3.00 - 19)	1	
	Rear tire (3.25 - 18)	1	
	Tube for front tire (3.00 19)	1	
	Rim band for front tire (3.00 - 19)	1	
	Bead spacer for 3.25 - 18 tire	2	
	Tube for rear tire (3.25 - 18)	1	

GENUINE YAMAHA TUNING PARTS LIST FOR YA6 - CONT.

<u>Stock No.</u>	<u>Part Name</u>	<u>Quan./unit</u>	<u>Remarks</u>
	Rim band for front tire (3.00 - 19)	1	
	Bead spacer for 3.25 - 18 tire	2	
	Tube for rear tire (3.25 - 18)	1	
	Rim band	1	
	Oil seal (SD-26.42.6)	1	
	Sprocket wheel set bolt (10)	4	
	Lock washer	2	(Common to YD3)
	Radial ball bearing (6205D)	1	(Common to YA5)
	Coupling	1	
	Stop ring (42)		
	Magneto	1	

CHAPTER III

TUNING THE YJ1 FOR SPEED
(Including GYT Parts List)

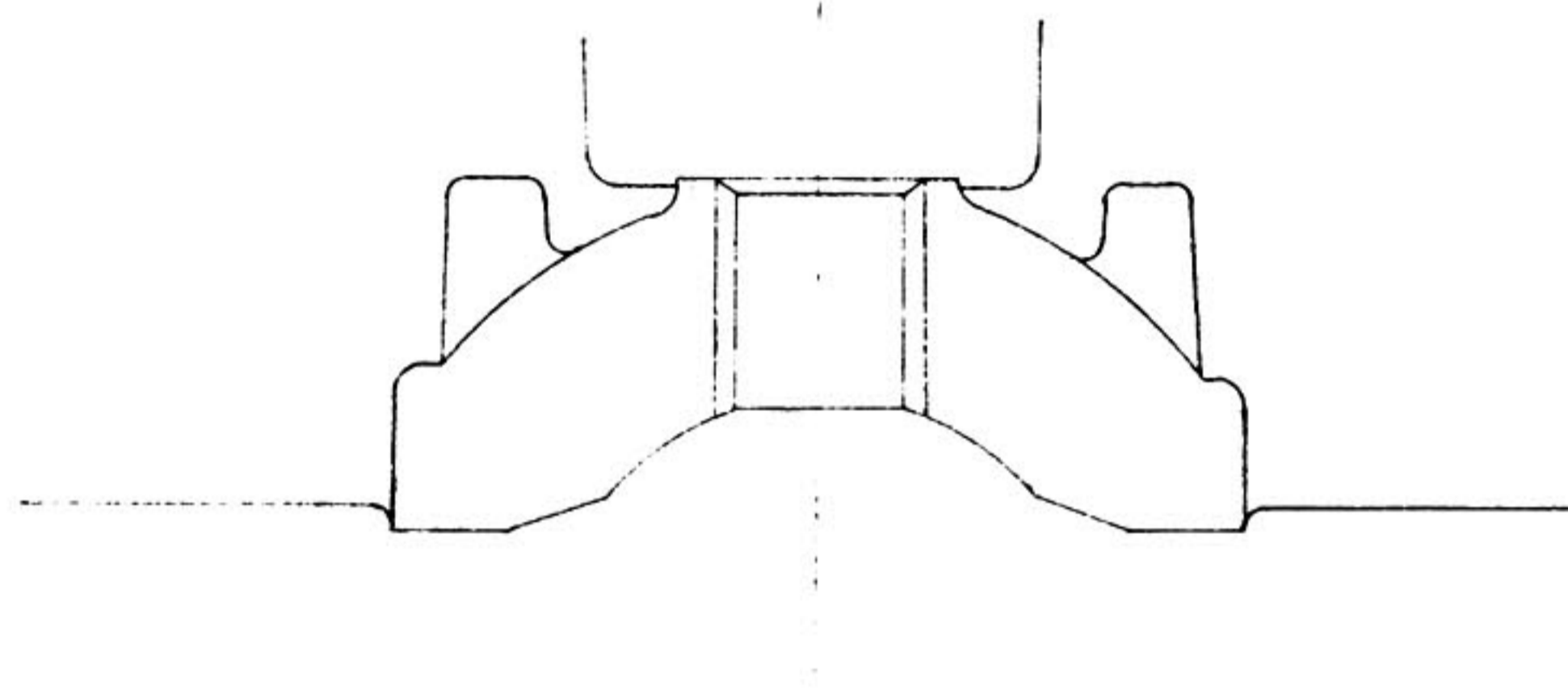
How to tune the standard YJ1 for speed, especially for scrambler, is explained in this chapter.

1 - CYLINDER HEAD

A-GYT head:

Combustion chamber volume 4.5 + 0.15cc

Spark plug B-8EN or B-9EN (Long reach spark plug.)



B-MOD head:

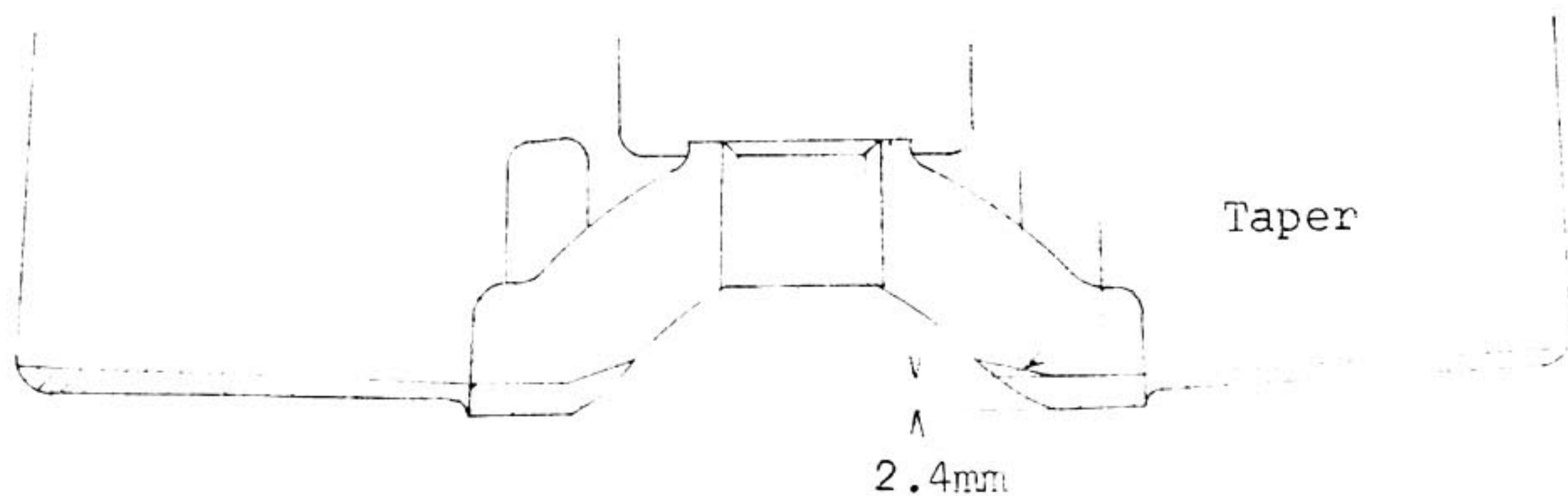
a. Cut off the flat flange of the cylinder head by 2.4mm and reshape the hem of the combustion chamber and cooling fins as shown in the figure below.

b. The combustion chamber volume of the MOD cylinder head should be 4.5 + 0.15cc. The volume of the standard part is 6.1cc.

c. The spark plug should be B-8HN or B-9HN

This modification may result in decreased rigidity and strength of the cylinder head, which will cause deformation and cracking. It is therefore hoped that the cylinder head included in the GYT parts kit will be used.

How to modify the standard cylinder head is shown in the figure below:



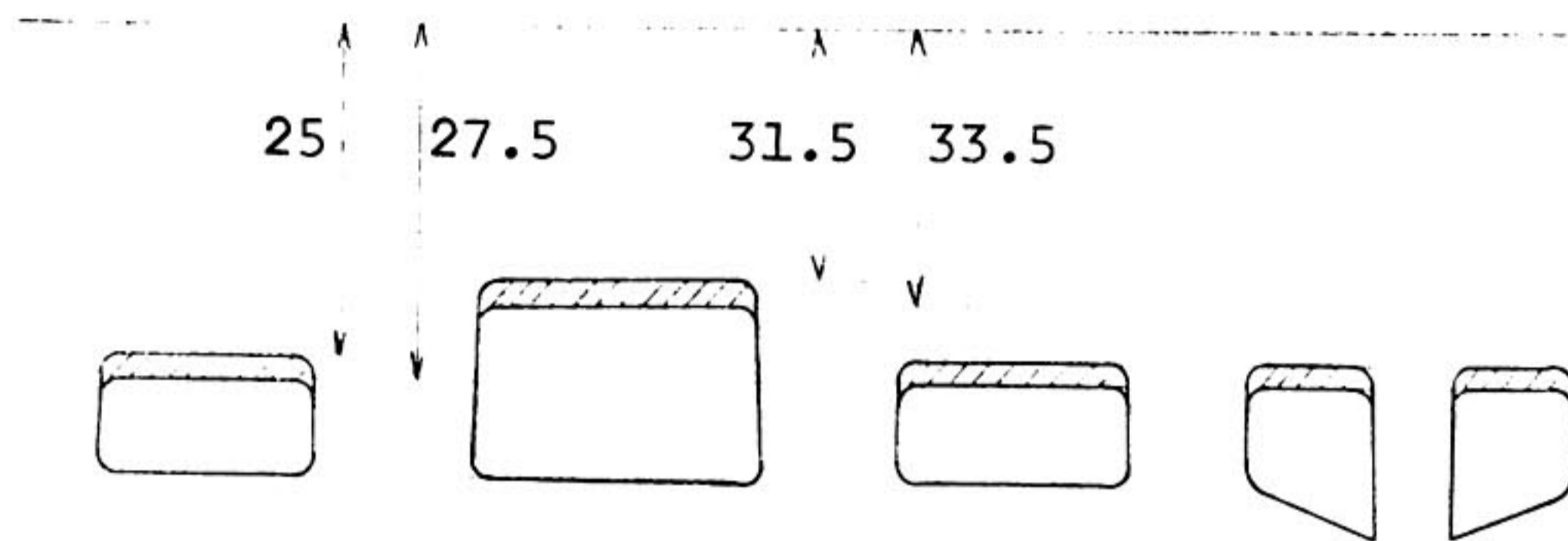
2 - CYLINDER

A-GYT cylinder:

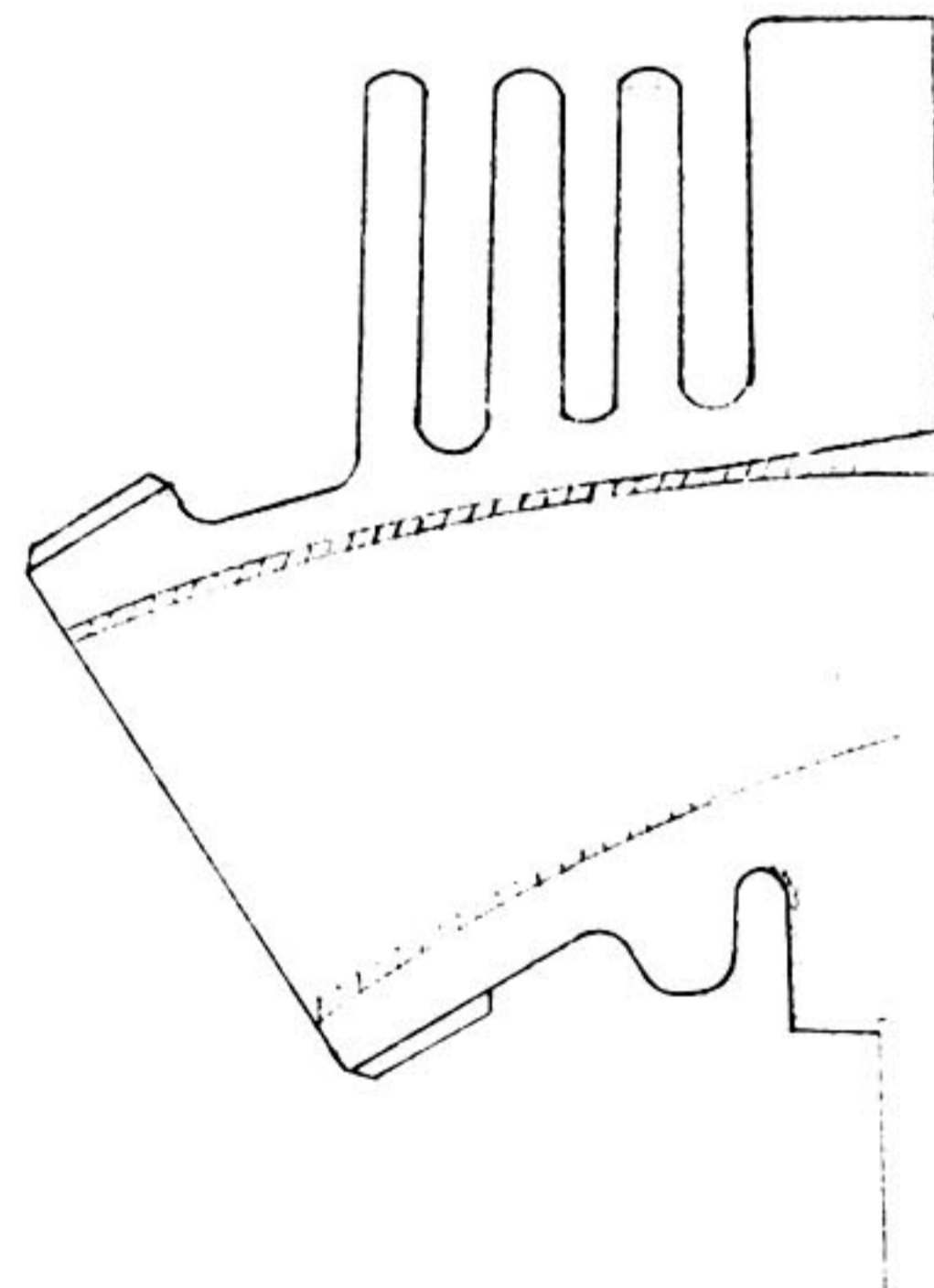
Material Aluminum alloy
Finish Cylinder wall is chrome-plated with
Yamaha's special process.
Port specifications same as MOD cylinder.

B-MOD cylinder:

Grind the exhaust port and the transfer ports at their upper edges in order to change the port timing. (See figure below)



Grind the exhaust port to expand the exhaust gas passage as shown below:



3 - PISTON

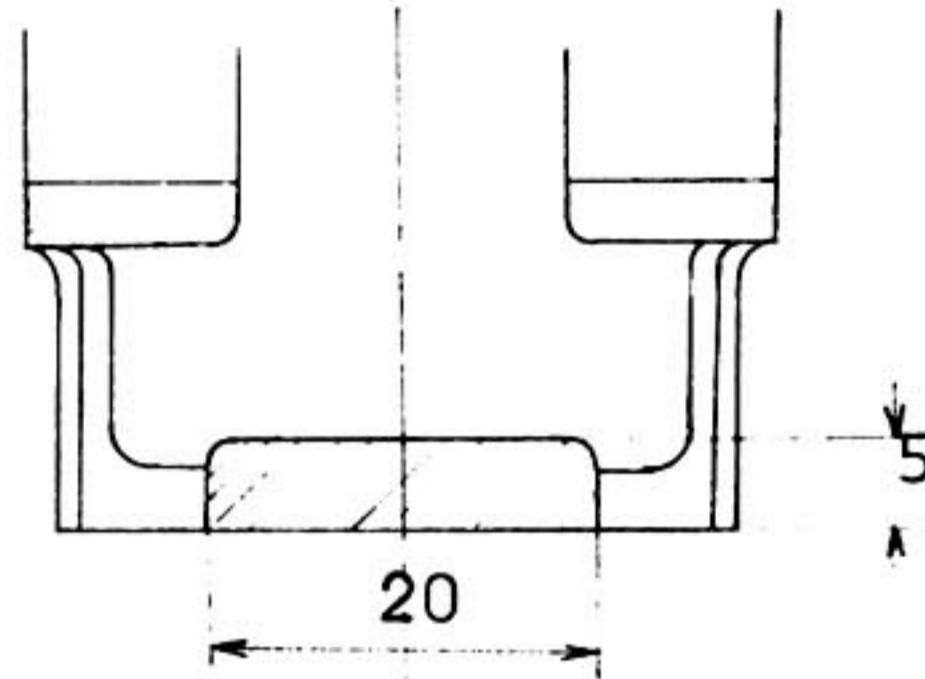
A-GYT piston:

Do not use the chrome-plated piston ring which is standard for the top groove. For aluminum alloy, chrome-plated cylinder; two standard rings should be used.

The genuine tuning part piston is made of the same material as the standard piston.

B-MOD piston:

Cut off the piston skirt contacting the third transfer port (opposite exhaust) as shown in the figure below:



4 - ROTARY VALVE

A-GYT valve:

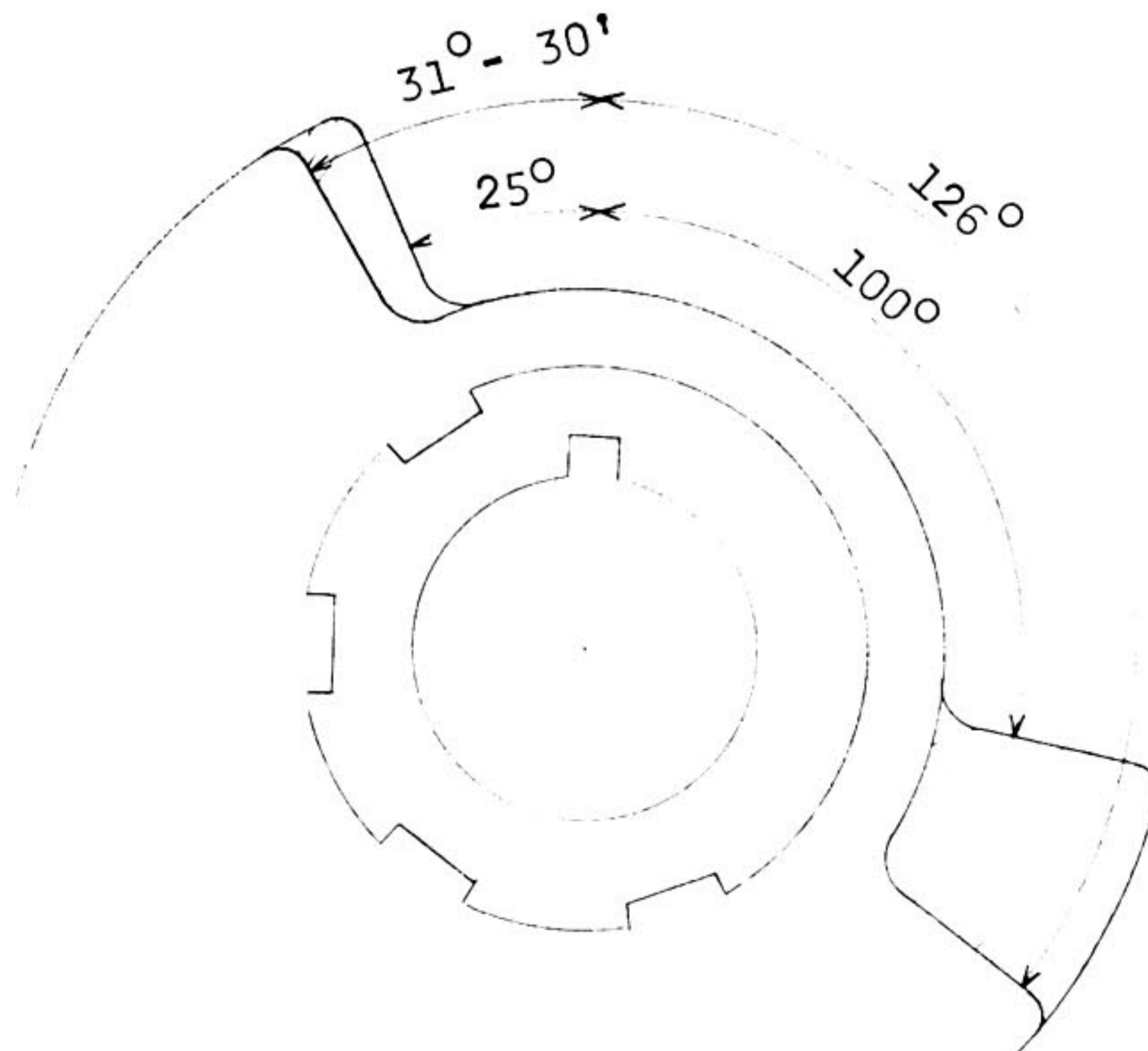
The outside diameter of the steel hub is smaller than standard to increase the strength of the plastic material part. The outside diameter of the steel hub is 41mm while 45mm is standard; in addition to this, the material of plastics has been improved for increased strength.

B-MOD valve:

Cut off and reshape the standard valve to increase the intake port opening period. (See illustration) After the modification, the valve intake port timing will be as follows:

- Intake port opens 34.3mm before T.D.C.
- Intake port closes 10.1mm after T.D.C.

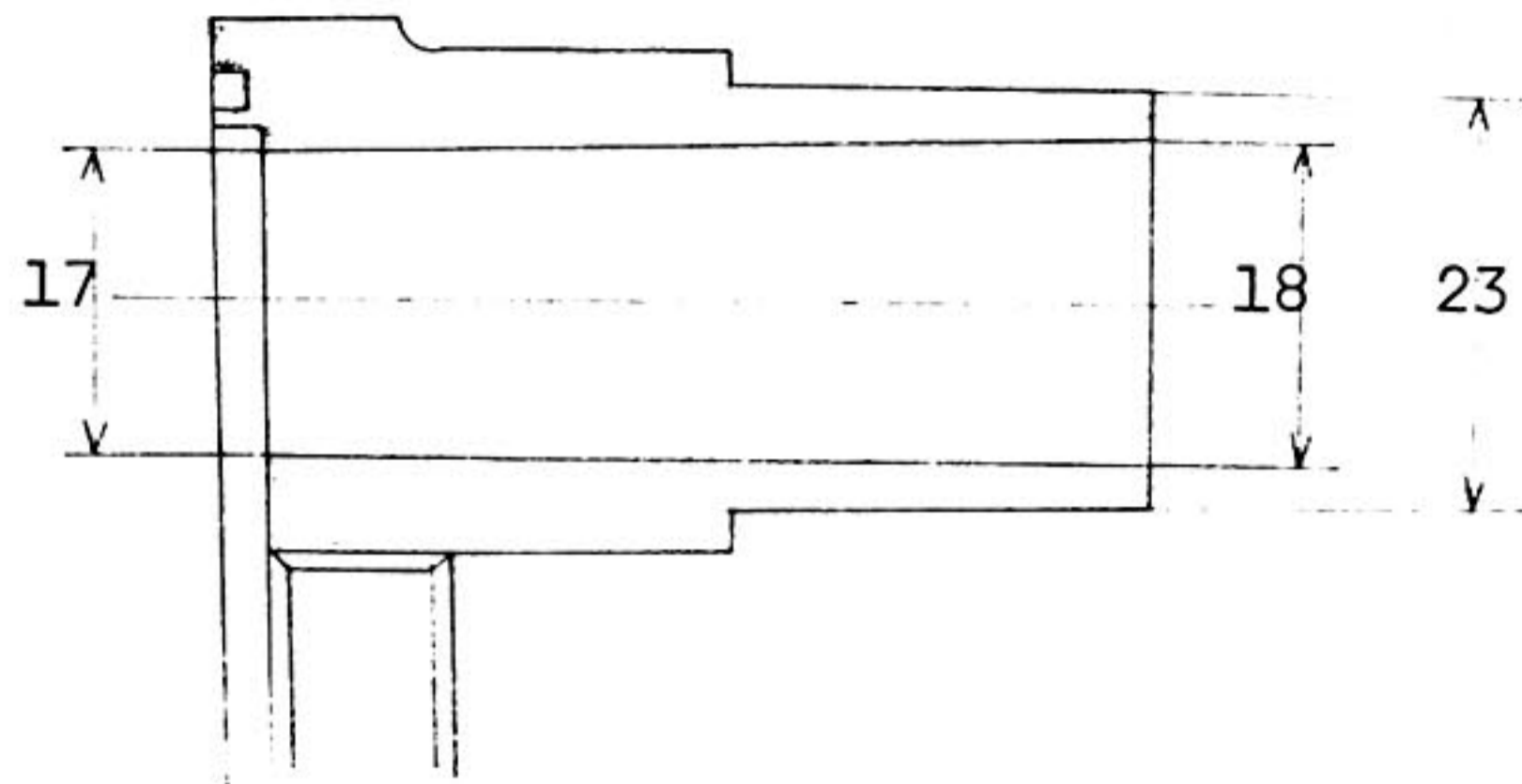
When doing this modification or ordering the GYT part, the same caution as stated in the chapter on the YG1 must be taken. Modifying the standard part may decrease its strength, so it is recommended that the GYT valve be used for safety.



5 - VALVE COVER

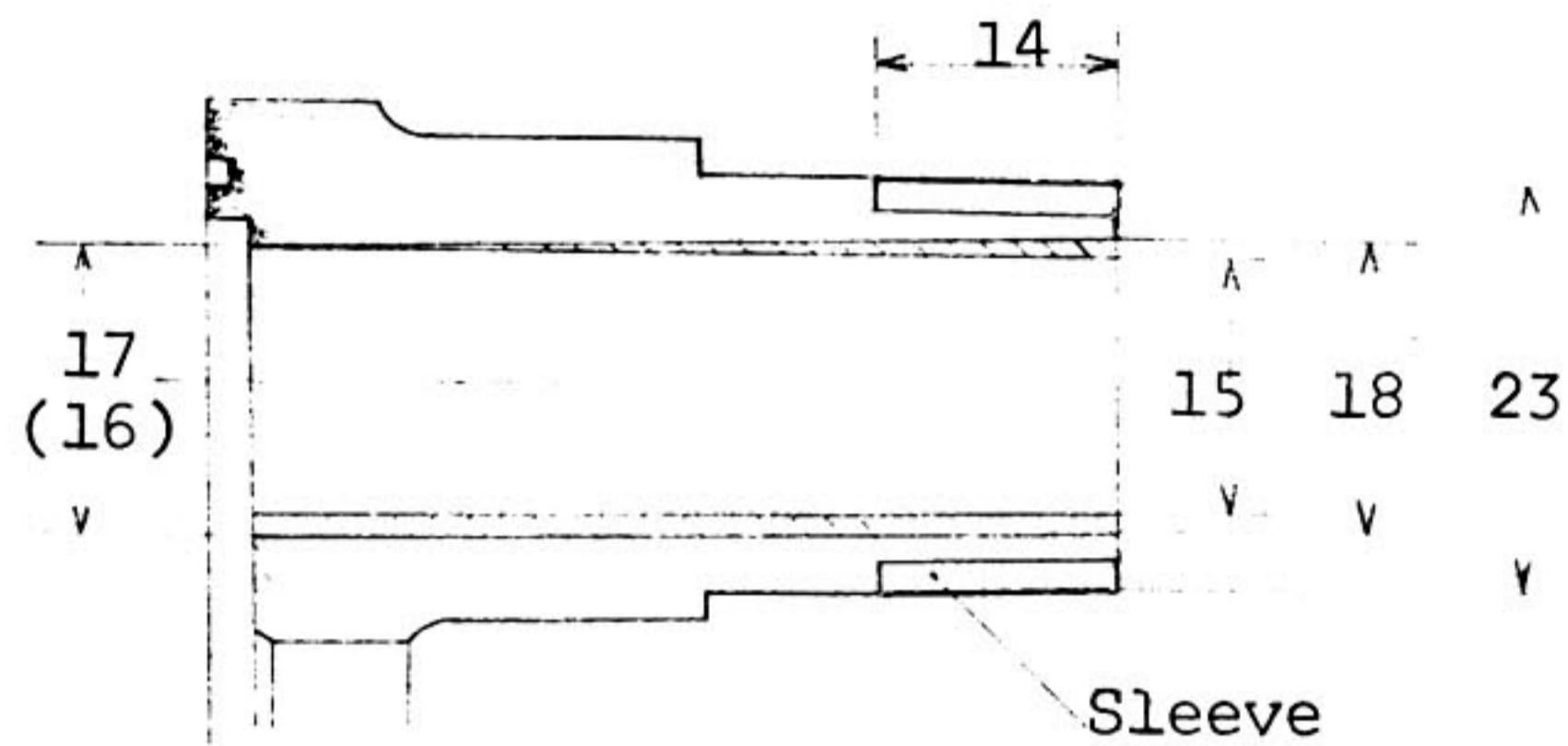
A-GYT cover:

See illustration. When using the GYT part, the MOD. spacer is unnecessary.



B-MOD cover:

In order to use a bigger carburetor (MIKUNI VM 18SC), the standard part must be modified as shown below:



And, at the same time, a cylindrical spacer shown above is necessary to install the new big carburetor.

6 - CARBURETOR

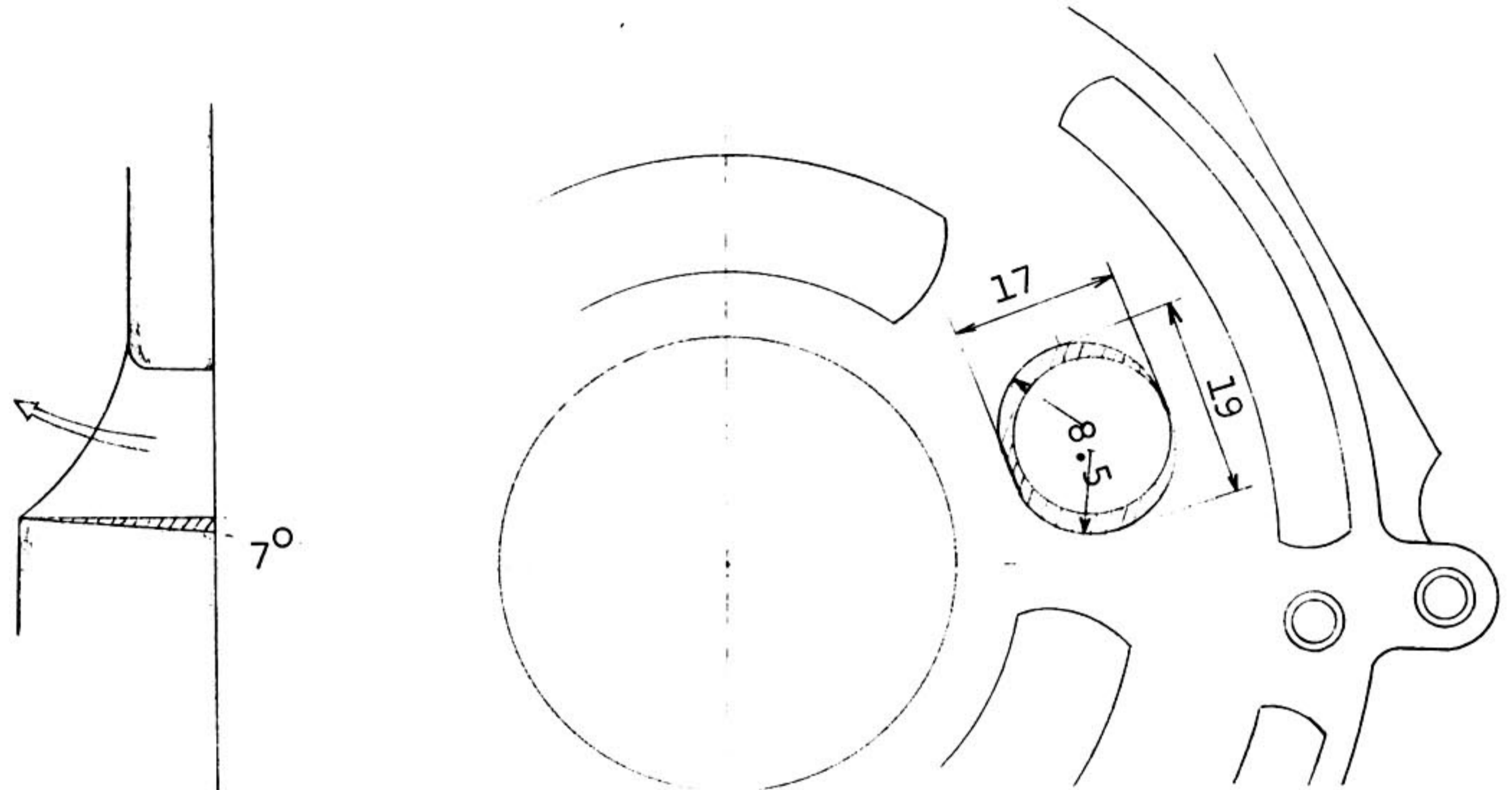
In place of MIKUNI VM14SC (standard), MIKUNI VM18SC is used. Main setting figures of this GYT carburetor are as follows:

- Main jet #110 (Main jet selected may be from (95 to #110) in accordance with particular racing conditions.)
- Jet needle 4J₄ - 3 stage
- Cut away #2.0

To meet various conditions of races, these settings may be changed slightly for better results.

7 RIGHT CRANKCASEA-MOD case:

Reshape and enlarge the intake port of the right crankcase in order to match to the intake port of the valve cover. (See below)

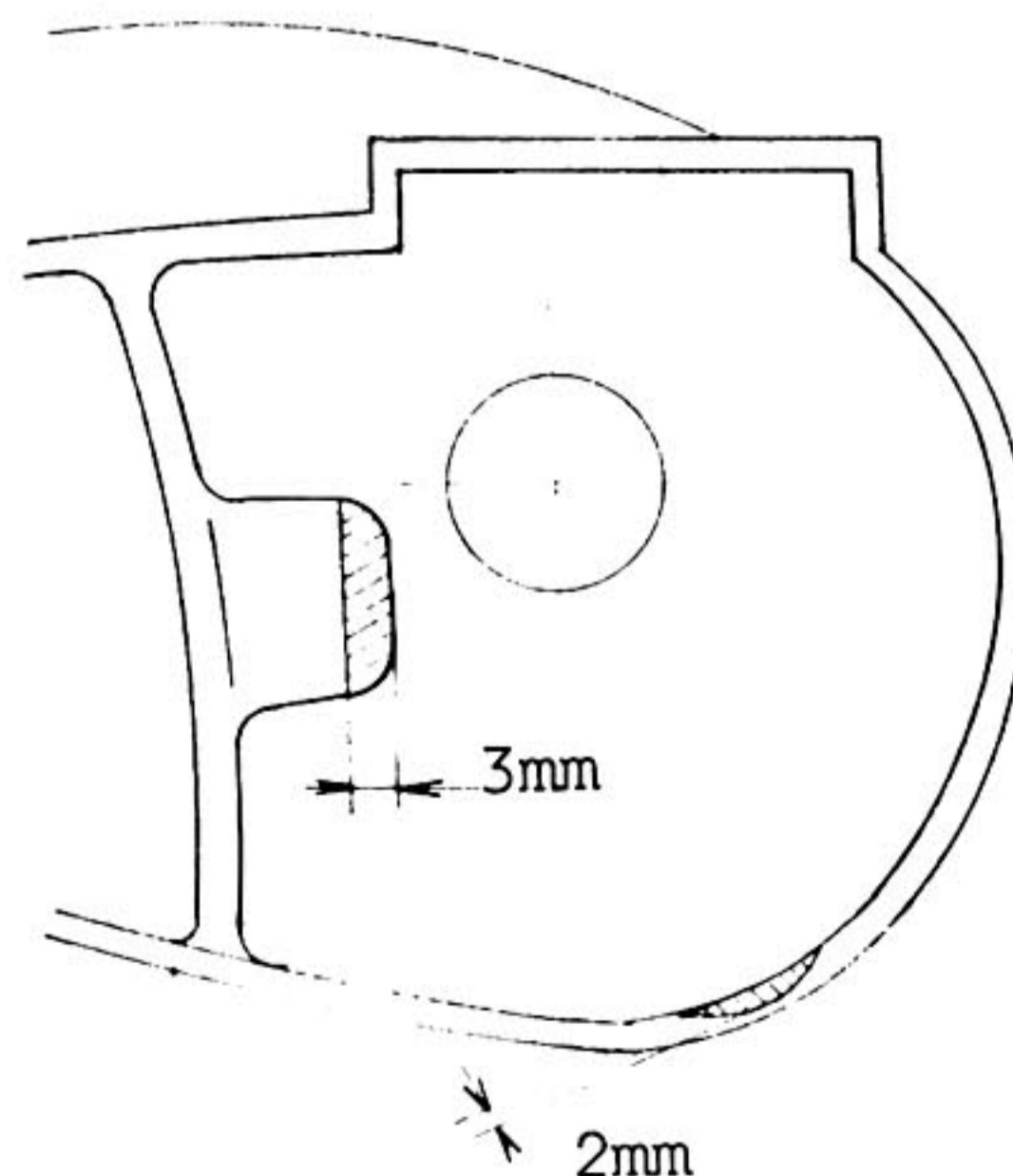


The intake passage which consists of the main bore of the carburetor, valve cover, valve and right crankcase should be smoothly connected without any steps.

B-GYT case: none

8 - RIGHT CRANKCASE COVERA-MOD cover:

With the change of carburetor, the carburetor chamber in the right crankcase cover must be reshaped as shown below:



B-GYT cover:

This has the enlarged carburetor chamber and can be fitted with GYT carburetor cap and GYT cap plate.

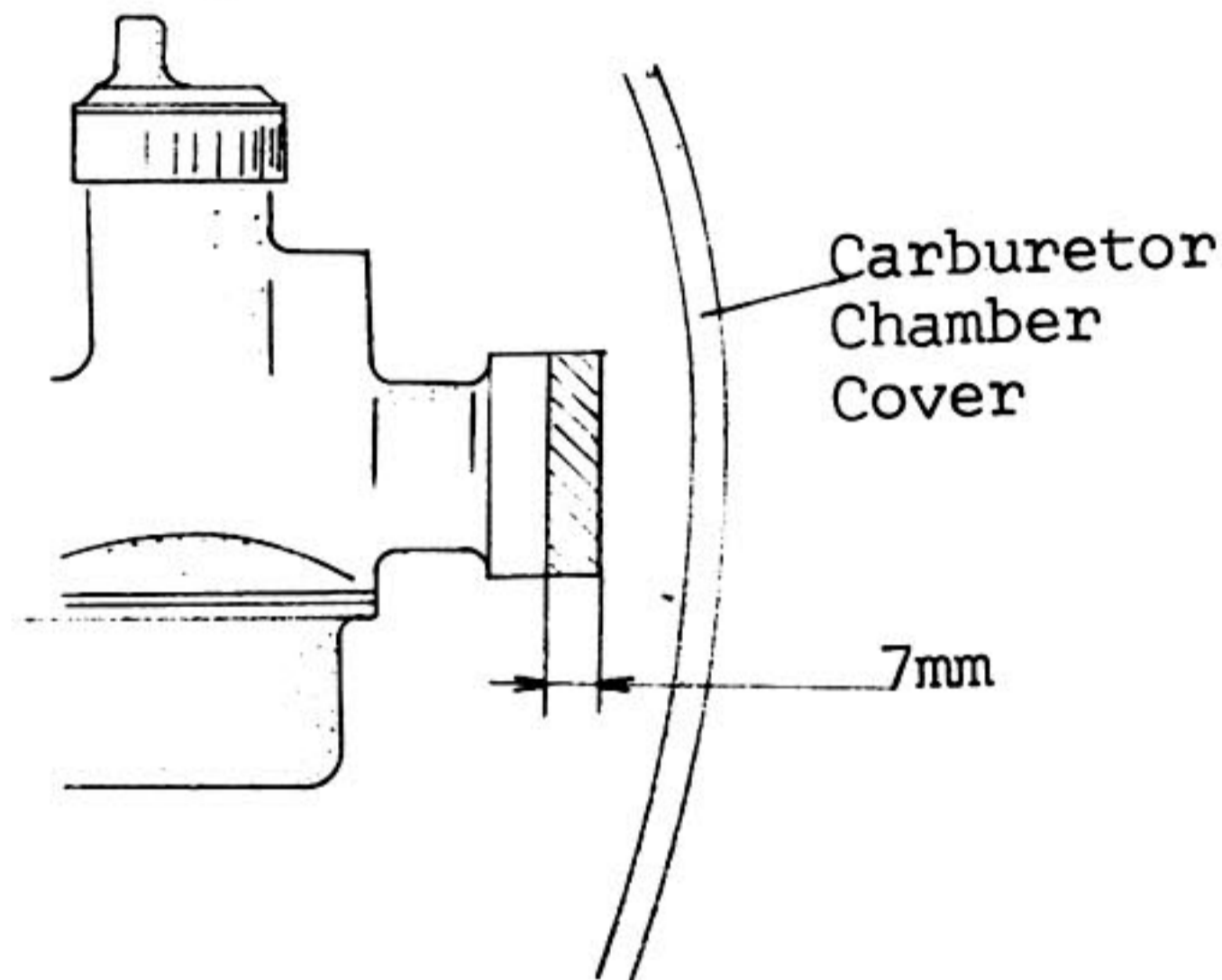
9 - CARBURETOR CHAMBER COVER

A-GYT cover:

This GYT part must be used with the GYT right crankcase cover. It is not necessary to cut off the funnel of the carburetor in this case. This part is common to YG1 GYT part.

B-Standard cover:

The standard carburetor cover can be used when the MOD right crankcase cover is used. In this case, however, the distance between the carburetor and the inside surface of the cover becomes very small which results in lowered suction efficiency. To avoid this, the funnel of the carburetor should be cut off by about 7mm shown below.



10 - CARBURETOR CAP AND CAP PLATE

A-GYT cap:

This part is necessary when using the GYT right crankcase cover and carburetor cover. The carburetor cap must be attached and secured to the crankcase and the crankcase cover by screwing the cap plate to them. The screw used for this purpose is YS12-5.12.

B-Standard cap:

When the standard right crankcase cover and carburetor cover are used, the standard carburetor cap should be fitted. It is advisable to secure the carburetor cap with adhesive tape.

11 - MUFFLER (EXPANSION PIPE COMPLETE)

A-GYT assembly:

GYT part must be used. This is one of the most important parts for tuning and consists of:

- a. Exhaust pipe
 - b. Ring nut
 - c. Expansion pipe
 - d. Pipe stay
 - e. Protector lock nut
- a., c., d., and e. are welded together.

How to install the expansion pipe assembly:

- a. Screw the ring nut to the cylinder loosely.
- b. Make a hole of 8.5mm diameter at the place where the hole of expansion pipe stay matches on the frame pressing.
- c. With a 8mm bolt, the expansion pipe will be fastened to the frame by using an 8mm nut inside, while tightening the ring nut gradually.

12 - SECONDARY REDUCTION RATIO

According to the conditions of the racing track, the secondary reduction sprocket ratio should be selected from those combinations made of the following drive sprockets and wheel sprockets:

Drive sprocket 11T, 12T, 13T and 14T (Standard)
 Wheel sprocket 51T, 53T, and 55T

13 - GEAR CHANGE ARM

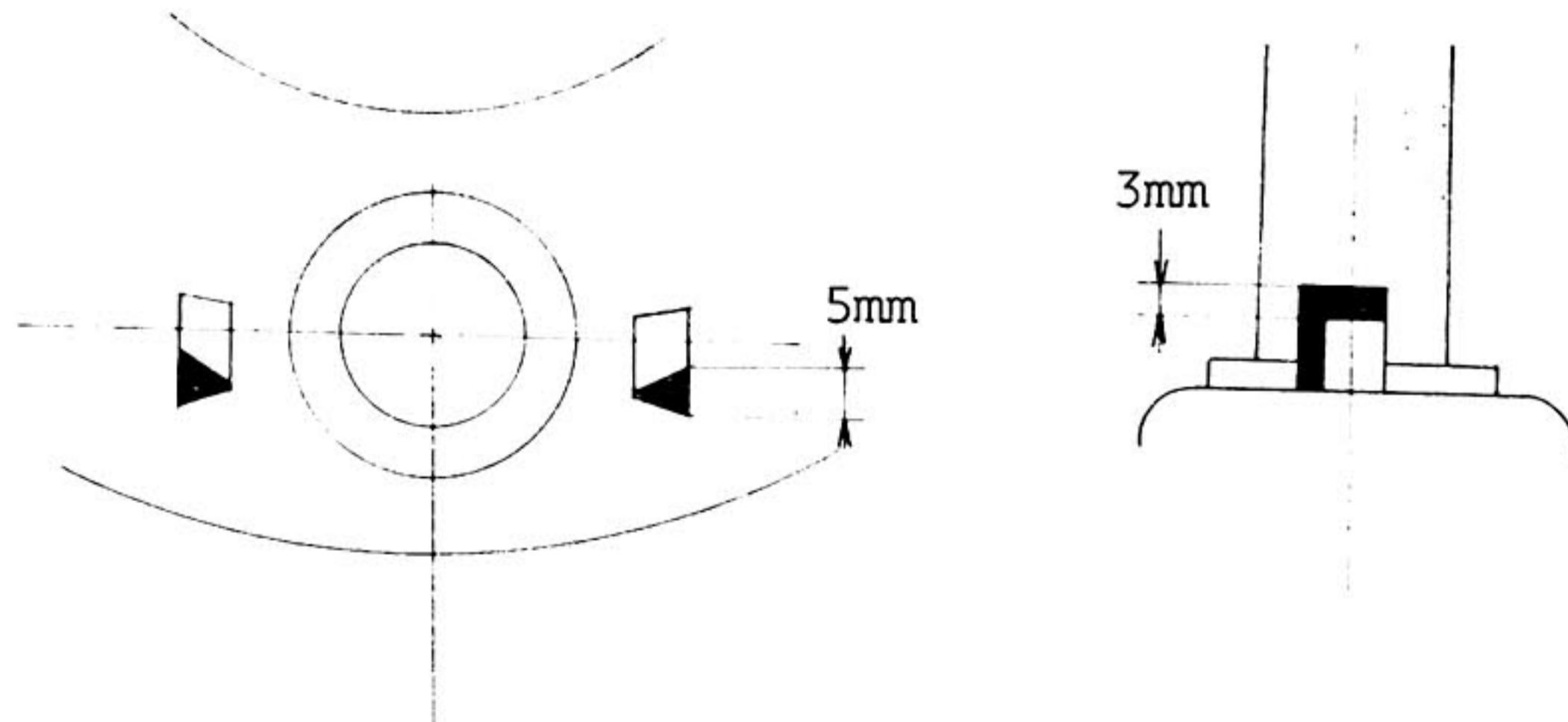
The standard gear change arm may be used, but for better operation and for increased strength the GYT part is advisable. This tuning part is made of malleable cast iron, has no heel-operating bar and is equipped with a rubber cover on the toe-operating bar.

14 - FRONT FORK

The front fork of YG1 should be used in place of the standard front fork of YJ1 which is too soft for racing. For this modification, the following parts are necessary:

YG1 front fork assembly, upper bracket, steering nut and brake shoe plate.
 The GYT front fork spring for YG1 should be used for this modification.

The stopper of the under bracket does not contact with the frame steering head, so the under bracket must be modified by welding a small piece of steel plate to the stopper as shown below:



15 - REAR SUSPENSION

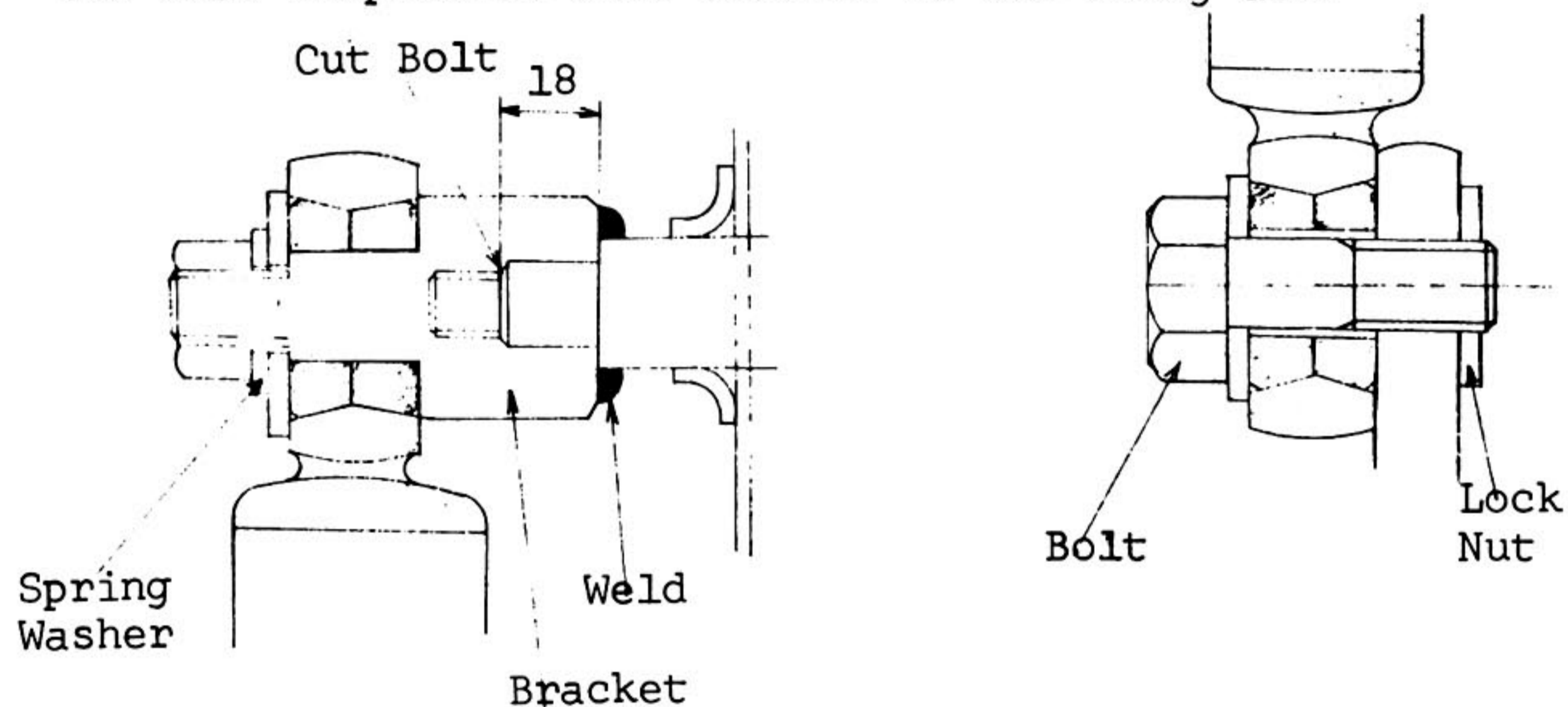
The standard rear suspension unit is too soft for racing, so the GYT part should be used. This GYT unit has an exposed chrome-plated spring and an increased hydraulic damping co-efficiency. When employing the larger sprocket wheels, the drive chain may touch the rear suspension unit. Therefore, the rear suspension unit bracket of the left side should be modified as follows:

For upper bracket:

- a. Cut off the thread part of the left upper bolt.
- b. Weld the rear suspension unit bracket to the upper bolt as shown in the illustration.
- c. Remove the rubber bushing collar at the upper eye of the unit before installation.

For lower bracket:

The rear suspension unit bracket bolt in the left side will be screwed from the outside in order to install the rear suspension unit outside of the swing-arm.

16 - TIRE MODIFICATION

The standard rims can be used for both front and rear, but tires should be replaced by motocross tires.

<u>Genuine Tuning Part (Tires)</u>	
Front tire	2.25 - 17
Rear tire	2.25 - 17

If you want to use the bead spacers for the prevention of the slippage of the rear tire, these are included in the genuine tuning parts kit and you will need to make holes in the rim to accommodate them.

17 - MODIFICATIONS TO THE FRAME

All the unnecessary things are to be removed.

Seat, handle bar, front fender, rear fender, footrest and other parts should be modified as you wish.

18 - ELECTRIC EQUIPMENT MODIFICATION

The standard magneto can be used after removing the lighting coil.

All other electric equipment considered unnecessary should be removed.

19 - SPECIAL SERVICE DATA FOR TUNING

- a. Piston clearance 0.050 - 0.060mm for cast iron cylinder.
0.040 - 0.050mm for aluminum alloy
cylinder.
- b. Ignition timing 2.0 + 0.05mm before T.D.C.
- c. Gasoline-oil mixing ratio. 15 : 1

GENUINE YAMAHA TUNING PARTS KIT FOR YJ1

<u>Stock No.</u>	<u>Part Name</u>	<u>Quan./unit</u>	<u>Remarks</u>
	Cylinder head	1	
	Cylinder	1	
	Piston	1	
	Valve	1	
	Valve cover	1	
	Spark Plug (B-8EN or B-9EN)	1	
	Carburetor (VM18SC)	1	
	Carburetor cap	1	
	Carburetor cap hold plate	1	
	Hold plate set screw (YS12-5.12)	4	
	Expansion pipe comp. (Upswept type)	1	
	Expansion pipe protector	1	
	Protector set screw	3	
	Drive sprocket (11T, 12T, 13T, 14T & 15T)	1	Common to YG1
	Gear change arm (Common to YG1 tuning part)	1	
	Gear change pedal (Common to YD3 and YDS3)	1	
	Crankcase cover - right	1	
	Carburetor cover (Common to YG1 tuning part)	1	
	Carburetor cover gasket (Common to YG1 tuning part)	1	
	Rear suspension unit	2	
	Rear suspension unit bracket bolt B	1	
	Rear suspension unit bracket nut	1	
	Front fork assembly	1	
	Sprocket, wheel (51T, 53T and 55T)	1	
	Front tire (2.25 - 17)	1	
	Rear tire (2.25 - 17)	1	
	Bead spacer for 2.25 tire	2	

GENUINE YAMAHA TUNING PROGRAM
SUPPLEMENTARY REFERENCE

YDS3 ENGINE TUNING

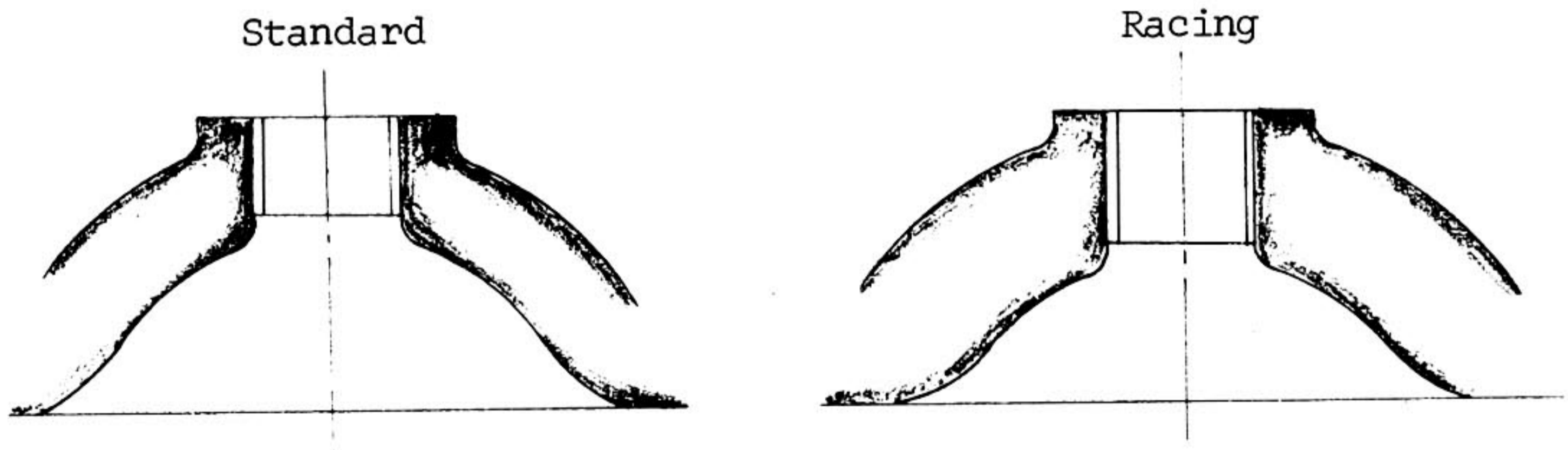
In tuning a YDS3 engine for speed as a scrambler, it is advisable to replace all the essential parts with Genuine Yamaha Tuning Parts. Parts that should be replaced are as follows:

- | | |
|----------------------------|---------------------|
| 1. Cylinder head | 6. Magneto |
| 2. Cylinder | 7. Clutch |
| 3. Piston & Piston Ring | 8. Sparkplug |
| 4. Expansion pipe complete | 9. Gears & Sprocket |
| 5. Carburetor | 10. Oil pump |
| | 11. Air Cleaner |

Principle difference between these parts and the standard ones are as follows:

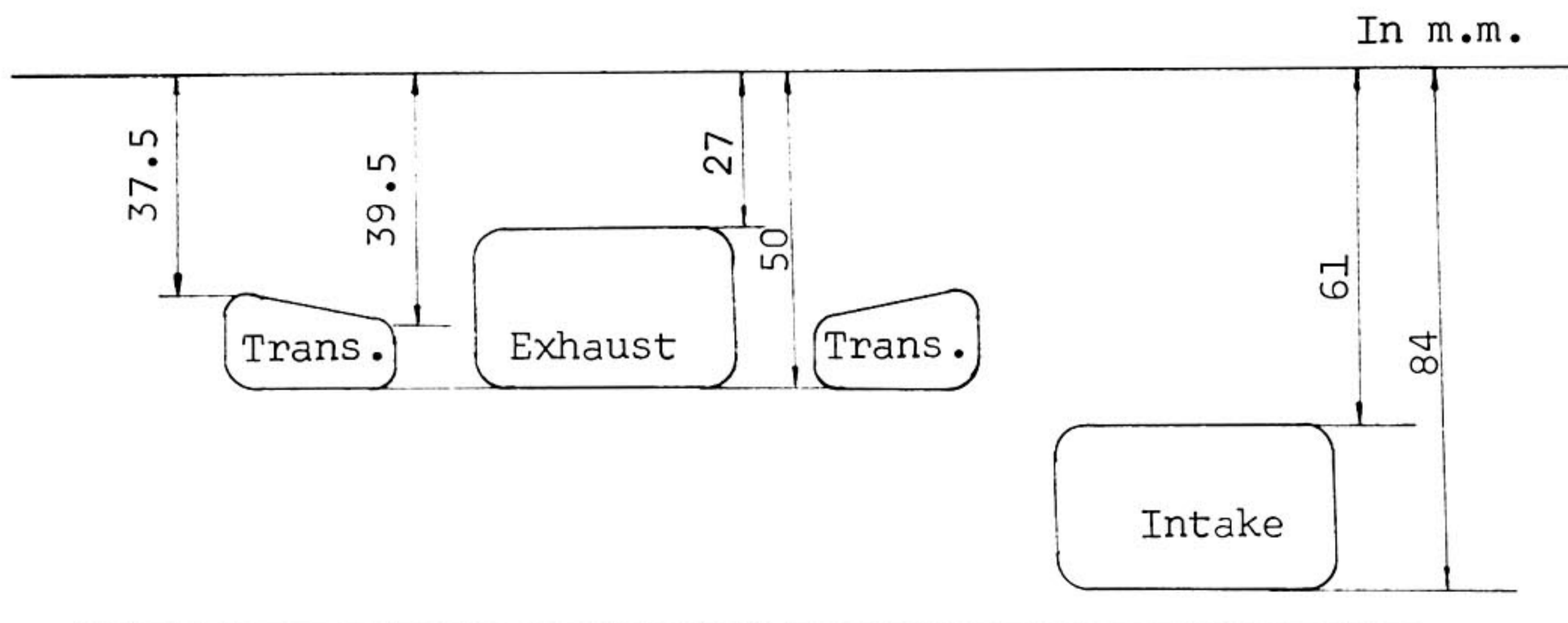
1. Cylinder head

The combustion chamber volume is about 10 cc, while that of the standard model is about 14.3 cc.



2. Cylinder

The porting diagram is as follows:



3. Piston & Piston Rings

For a scrambler engine, the standard model piston and piston rings can be used. (For road-racer engines, shorter piston with single piston ring will be used.)

Piston clearance 0.0022 \pm 0.0024 inch
0.055 \pm 0.060 mm

4. Expansion pipe complete

Only the GYT part can be used.

5. Carburetor

For a scrambler, the standard model carburetor can be used. (For road-racer, the MIKUNI 276 carburetor should be used with TD1B cylinder.)

6. Magneto

The dynamo should be replaced by a magneto

Ignition timing 0.079 - 0.001 inch before TDC
2.0 - 0.03 mm before TDC

7. Clutch

The following parts should be replaced with:

- a. Primary drive gear assembly & primary driven gear assembly . . TD1B Standard Parts
- b. Clutch springs . . TD1B Standard Parts (Stronger)
- c. Friction plates . . TD1B Standard Parts (Semi-metallic facing) Increase quantity from 4 to 5.
- d. Clutch plates . . . Increase quantity from 3 to 4.
- e. Clutch pressure plate . . . TD1B Standard Part.

8. Sparkplug

Use B-10EN for the Genuine Yamaha Tuning Part cylinder head, while the standard model used B-77HC

9. Gears & Sprocket

The gear-box gears may be changed by using the following parts:

3rd - 4th pinion TD1B Standard Part
5th gear wheel TD1B Standard Part
4th Pinion TD1B Standard Part
4th gear wheel TD1B Standard Part

For the drive sprocket, 14, 15 and 16-teeth sprockets are available.

10. Oil Pump

The oil pump must be removed, and a fuel-oil mixture used with a mixing ratio of 12 : 1 to 16 : 1.

11. Air cleaner

A bigger filter should be used to reduce intake resistance.

YAMAHA

MOTORCYCLES



SERVICE MANUAL

COVERING
CONVERSION TABLES

EQUIVALENT CHARTS

m.m.					
0.01 --	0.00039	0.10 -	0.00393	1.00 --	0.03937
0.02 --	.00078	.20 --	.00787	2.00 --	.07874
0.03 --	.00118	.30 --	.01181	3.00 --	.11811
0.04 --	.00157	.40 --	.01574	4.00 --	.15748
0.05 --	.00196	.50 --	.01968	5.00 --	.19685
0.06 --	.00236	.60 --	.02362	6.00 --	.23622
0.07 --	.00275	.70 --	.02755	7.00 --	.27559
0.08 --	.00314	.80 --	.03149	8.00 --	.31496
0.09 --	.00354	.90 --	.03543	9.00 --	.35433
				10.00 --	0.39370
				20.00 --	.78740
				30.00 --	1.18110
				40.00 --	1.57480
				50.00 --	1.96850
				60.00 --	2.36220
				70.00 --	2.75590
				80.00 --	3.14960
				90.00 --	3.54330

EXAMPLES:

.76 m.m. = ? inch

m.m.	
.70 =	.02755
+ .06 =	<u>.00236</u>
.76 =	.02991

8.76 m.m. = ? inch

m.m.	
8.00 =	.31496
.70 =	.02755
+ .06 =	<u>.00236</u>
8.76	.34487

Fractional	Decimal				
1/64 -----	.01562	11/32-----	.34375	43/64-----	.68187
1/32 -----	.03125	23/64-----	.35937	11/16 -----	.6875
3/64 -----	.04687	3/8-----	.375	45/64-----	.70312
1/16-----	.06250	25/64-----	.39062	23/32-----	.71875
5/64 -----	.07812	13/32-----	.40625	47/64-----	.73437
3/32 -----	.09375	27/64-----	.42187	3/4-----	.750
7/64 -----	.10937	7/16-----	.4375	49/64-----	.76562
1/8 -----	.125	29/64-----	.45312	25/32-----	.78125
9/64 -----	.14062	15/32-----	.46875	51/64-----	.79687
5/32 -----	.15625	31/64-----	.48437	13/16-----	.8125
11/64 -----	.17187	1/2-----	.500	53/64-----	.82812
3/16-----	.1875	33/64-----	.51562	27/32-----	.84375
13/64 -----	.20312	17/32-----	.53125	55/64-----	.85937
7/32 -----	.21875	35/64-----	.54687	7/8-----	.8750
15/64 -----	.23437	9/16-----	.5625	57/64-----	.89062
1/4-----	.250	37/64-----	.57812	29/32-----	.90625
17/64 -----	.26562	19/32-----	.59375	59/64-----	.92187
9/32 -----	.28125	39/64-----	.60937	15/16-----	.9375
19/64 -----	.29687	5/8-----	.625	61/64-----	.95312
5/16-----	.3125	41/64-----	.64062	31/32-----	.96875
21/64 -----	.32812	21/32-----	.65625	63/64-----	.98437

Gallon	Quart	Pint	Liter
1	4	8	3.785
1/4	1	2	.946
1/8	1/2	1	.473
.264	1.056	2.113	1

YAMAHA

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SERVICE MANUAL

COVERING
CRANKSHAFT DATA

