

OPPOSED TWIN ENGINE
SHAFT DRIVE

1964

TECHNICAL SPECIFICATIONS

MARUSHO MAGNUM 500 TYPE

ENGINE

Type	4 Stroke Opposed twin O.H.V
Bore & Stroke	68mm×68mm
Displacement	493 cc
Compression ratio	9.6 : 1
Bhp & rpm	40 at 7,000
Carburetion	(2) MIKUNI VM28
Oil System	wet sump, gear pump
Oil Capacity	2ℓ

POWER TRANSMISSION

Clutch type	Single dry plate
Primary drive	Direct
Final drive	Shaft & Spiral bevel gears
Transmission	Forward 4-Speed Constant mesh
Gear ratio (Overall : 1)	4th 5.12
	3rd 6.73
	2nd 8.95
	1st 13.8

ELECTRICAL SYSTEM

Ignition	Battery & coil
Ignition timing	5° BTDC (30° at full advance)
Breaker point gap	0.3mm~0.4mm, .012"-.016"
Spark plug	NGK BC 64EW
Spark plug gap	0.6mm~0.7mm .024"-.028"
Battery	MBN-3-12 12V6A <i>electric start - 12V10A</i>

VEHICLE & CHASSIS

Overall length	2105 mm, <i>82.87"</i>
Overall width	755 mm, <i>29.72"</i>
Overall height	985 mm, <i>38.78"</i>
Wheel base	1400 mm, <i>55.118"</i>
Ground clearance	130 mm, <i>5.19"</i>
Caster	63°
Trail	93 mm, <i>3.66"</i>
Gross weight	188 kg <i>w/ oil + 1/2 tank fuel</i>
Suspension (front)	telescopic fork
Suspension (rear)	swing arm
Tire size (front)	3.25-18
Tire size (rear)	3.50-18
Tire pressure (front)	2.0 kg/cm ²
Tire pressure (rear)	2.2 kg/cm ²
Fuel tank capacity	15ℓ

406 Lbs.

BULBS

Head lamp	12V 35/25W
Tail lamp	12V 8W
Stop lamp	12V 25W
Speedometer lamp	12V 3W
Pilot lamp	12V 3W

ABILITY

Max top speed	100 MPH
Climing ability	24°30'
Fuel consumption	40 km/l at 60 km/h

*SS 1/4-mile 15.7 sec @ 84 mph, SS 1/8-mile 8.6 sec
MAX RPM - 7000 @ 60mph*

*TAPPET CLEARANCE in. - .006" (cold)
ex. - .006"*

Engine and Frame Numbers

As Shown in Fig-1 engine number is die-pressed on the upper right corner of the crank case, and as shown in Fig-2 frame number, on the right side of the head pipe of the frame. The number are shown in the following manner:

	<u>Model</u>		<u>Serial No.</u>
Engine No.	2	-	0001
Frame No.	F9	-	0001

These number are important. When you place any complaints or orders for parts, these number must be referred to, for proper correction of your request. These should be kept in order and not revised arbitrarily.

Fig-1
(Engine Number)

Fig-2
(Frame Number)

1. ENGINE

1-1 Engine

The engine system is shown in Fig-3. The system is arranged in a line to ensure its simplicity, compactness, and simple handling.

(1) Engine Removal

The following method will ensure prompt adjustment and removal of the engine. The work should proceed in the following order. To remove the engine from the frame it will save time and effort remove the engine assemblies and the transmission separately.



- 1) Remove the exhaust pipes.
- 2) Remove the vumper
- 3) Remove the air cleaner assy.
- 4) Remove the air pipes.
- 5) Remove the carburetors.
- 6) Remove the chrome joint cover.
- 7) Remove the joint clips.
- 8) Remove the clutch wire.
- 9) Remove the neutral and third gear switch terminal wiring.
- 10) Remove the rear brake adjusting screw.
- 11) Move the rear swinging arm toward the rear end of the fender after removing the pivot shaft and take out the three pins from the rubber joint yolk. see fig.-4.
- 12) Remove the nuts from the transmission. At this point the transmission can be removed. After this you can proceed to removing the engine in the following order.

- | | |
|------------------------------|--------------------------------|
| 13) Remove the dinamo cover. | 14) Dinamo stator (Generator). |
| 15) Governor. | 16) point plate. |
| 17) Engine hanger plate. | 18) Engine set bolts, and then |
| 19) Plug cords. | |

It is possible to remove or replace the engine easily either from the left or the right side by positioning fly wheel side up. Due to its weight two attendants are required to remove the engine.



1-2 Cylinder Head And Manifold

Cylinder head is made of aluminium alloy. The valve seat is made of a special cast iron shrunk in at 350° - 400° C. and finished by rolling. Manifold is also made of aluminium alloy finished by buffing.

A. Cylinder Head Dissassembling

By removing six tappet cover bolts, two 8 m/m nuts and *It* 6 m/m nuts, you will expose the cylinder head. also by removing the four head nuts, the cylinder, the cylinder head the *rocker arm* support can all be removed. as shown, in Fig.-7 the valve's *thin* can be removed by using the valve jack.

B. Checking and Assembling Cylinder Head.

(1.) Checking

- Accumulated carbon in the cylinder-clean.
- Accumulated carbon in the valve-clean.
- Wear of the **stem** of the valve.
- Contact of the valve and the valve seat.
- Strength of the valve spring large and small.
- Wear of the valve guide.



(2.) Assembling

Before assembling, the cutter is *applied* to the valve seat as shown in Fig-9. Ideally the width *of the* contacting faces of the valve and the valve seat is 1 m/m (.039 37) to 1.5 m/m (0,0590) at the center, and such faces are *to* contact each other equally all over the circle.

The same is applicable to rubbing *the* valve and the valve seat together. This is very important to *maintain* the high efficiency of the machine.

When assembling, the cylinder head must always be cleaned, and the valves are to be oiled.

1-3 Cylinder, Piston and Piston Ring

(1) Cylinder barrel is made of aluminium alloy, the inside, a special cast iron sleeve which is fitted in at 250°-300°C.

Fig.-9

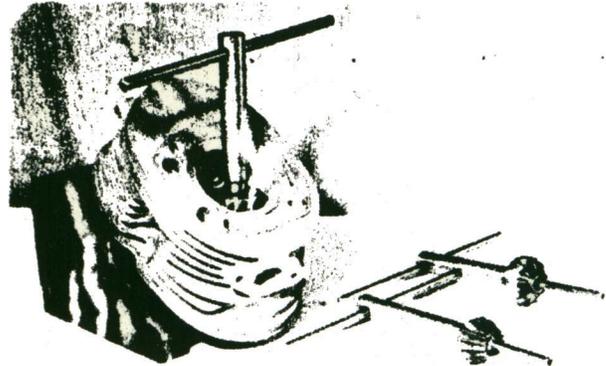
- 1) Checking
 - a. Burning.
 - b. wear of the sleeve.
- 2) Assembling
 - a. The clearance between the cylinder and the piston should be kept within $0.055-0.065$ mm. too narrow the clearance may result in burning.
 - b. The piston or the cylinder should be oiled before assembling.

.00216"-.00256"

(2) Piston is made of LOW-X material. To prevent any burning or to avoid any side pressure of the explosion, the outside of the piston is tapered and shaped like a cam, and the piston hole is offset. To show this offsetting an arrow mark is die-pressed on the head. When mounting, the piston is set, so that this arrow mark points toward the front part of the machine (i.e. toward the front wheel)

- 1) Checking
 - a. Burning.
 - b. Accumulated carbon on the top.
 - c. Wear of the piston pin hole.
 - d. Wear of the piston ring groove.
- (3) Piston Ring
 - 1) Checking
 - a. Check wear of the piston ring.

3 compression rings, 2 oil rings one under compression rings + one at bottom of piston skirt.



1-4 Crank Shaft and Connecting Rod

Crank shaft has at its front and rear part the dynamo side and the driving side respectively, and in between it has the middle crank which functions as a balance weight. These are put together by pressure and fixed by two crank pins.

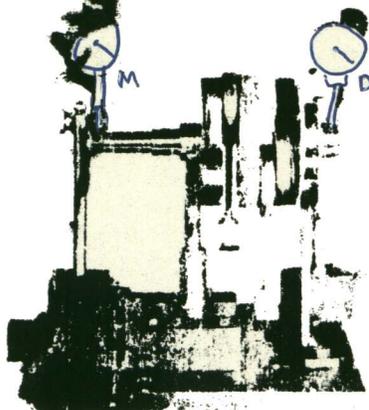
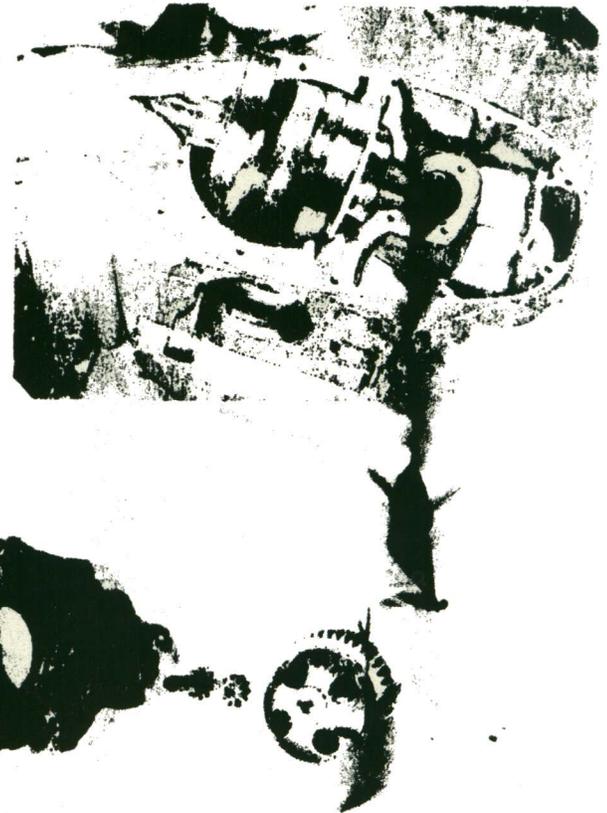
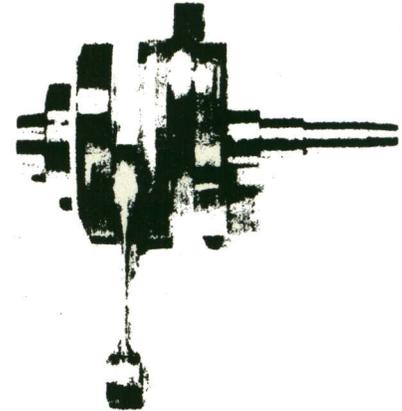
- 1) Flathead screw
- 2) Shaft collar
- 3) Birth plate
- 4) Crank shaft M
- 5) Crank pin
- 6) Controkker retainer
- 7) Connecting rod roller
- 8) Connecting rod
- 9) Middle crank
- 10) Crank shaft D
- 11) Bearing
- 12) Key

The crank shaft assemblies can be removed as shown in Fig-17 but no other method is workable.

- 1) Checking
 - a. Deflection of the center of the shaft.
 - b. Wearing of the crank pin.
 - c. Cleanliness of the oil bus plate.
 - d. Wear of the large end of the connecting rod.
 - e. Wear of the smaller end of the connecting rod.

As shown in Fig-18 measure the deflection of the crank shaft by using two "V" blocks each placed under each end and applying the dial gauge to the top of M and D side of the crank shaft. The deflection should be kept within less than 0.05 mm (0.0019) each at the measuring points.

Fig-16



2) Assembling

- a. Heat the crank case and replace the rear bearing housing at 80°-100° C. The oil hole must be located at the Bottom.
- b. The crank shaft assy is to be replaced in the same direction as it was removed.
- c. Replace the front oil bus plate.
- d. Replace the crank shaft collar.
- e. Mount the main bearing housing (Set the oil pump gear at the same time)
- f. Put in the #6207 bearing.
- g. Replace the bearing holder.
- h. Put in the crank gear pin
- i. Push in the crank gear.

By this process the crank shaft ass,y will be replaced into the crank case.

1-5 Oil Pump System

(1) Disassembling and Checking

As in the case of dismantling the crank shaft ass,y checking is impossible unless the oil pump system is dismsntled up to the front bearing.

- a. Check wearing of the outer circle of the oil pump gear measuring the diameter by micrometer. (Do the same with the shaft simultaneously.)
- b. Check by the cylinder guage wearing of the inside circle of the bearing housing.
- c. Check wearing of the bottom end of the bearing housing Refer to the standard list for the standard measurment of the depth guage.

NOTE:

When the clearance between the gear and the housing becomes too large, volume of the oil brought in by pressure, will decrease.

It may result in overheating of the engine or burning in some case.

This may also result in the noise.

Special attention must therefore be given to the proper maintenance of this clearance.

1-6 Cluth

(1) Disassembling

As in the case of removing the engine, just by removing the transmission, the clutch can be dismantled even when the engine is still mounted to the frame.



1. Flywheel
2. Lock washer
3. Fly wheel bolt
4. Coil spring
5. Pressure spring
6. Clutch desk
7. Outer plate
8. Lock washer
9. Binding bolt

(2) Checking and Assembling

- a. Wear of the clutch disc.
- b. Strength of the coil spring. (Check it in the same manner as the valve spring)
- c. Tightness of the clutch disc revet.
- d. The fly wheel being heavy, special attention is to be given to fitting it firmly. Careless fitting may result in undesirable condition of the machine due to loosely wheel.
- e. Outer plate should be set to place the clutch disc to the center. Transmission can be mounted easily if clutch disc is centered.

1-7 Transmission System

Transmission is of the stopper type and of the constant mesh forward four step method. As shown in Fig-25 the gear system has the main shaft, the counter shaft and the spline shaft. The mesh for each step is low, second, third and top as shown respectively in Fig-26, 27, 28, and 29.

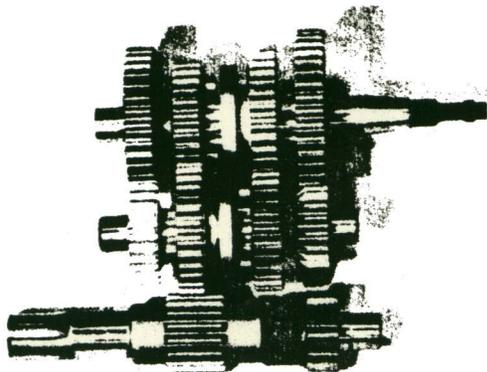


Fig-25
Neutral

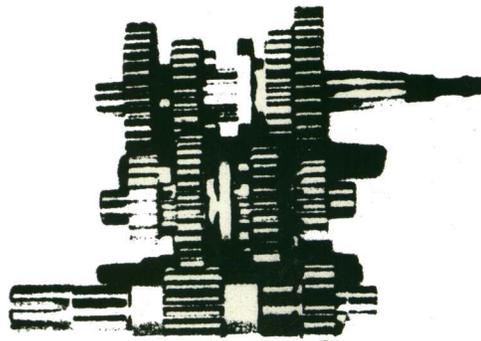


Fig-26
1st

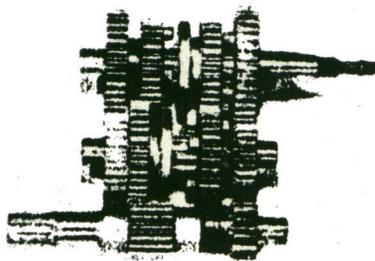


Fig 27
2nd

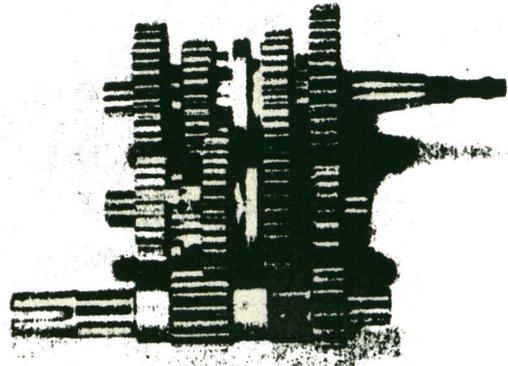


Fig-28
3rd

(1) Disassembling

As in the case of removing the engine, the transmission can be dismantled by removing the transmission only from the frame.

- a. Drain the oil remaining in the transmission.
- b. Remove the joint yoke.
- c. Remove the change terminal switch.
- d. Remove the rear cover binding bolt.
- e. Loosen the change knock bolt by this process you can remove the rear cover.

(2) Checking

- a. Wear of the each gear.
- b. Wear of the each shaft
- c. Damages on the boss of the each gear.

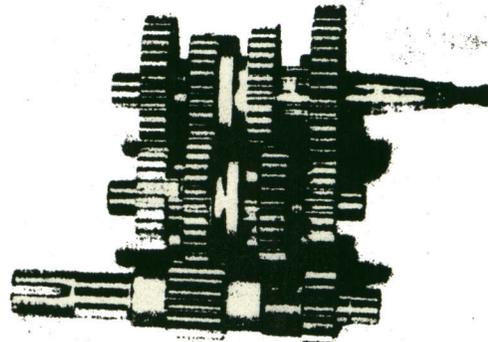


Fig-29
4th

1-8 Change Mechanism

Transmission is of the stopper four step type and is operated in the following way:

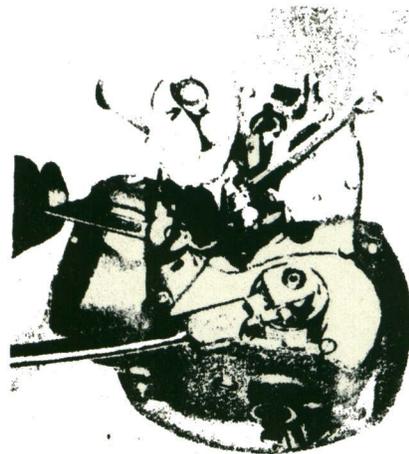
Stopper type step in

Neutral = Low = 2nd = 3rd = Top

Kick up

Top = 3rd = 2nd = Low = Neutral

- (1) Checking
 - a. Smoothness of the change drum movement.
 - b. Wear of the shift fork hook.
 - c. maintenance of the distribution ration between the change ratchet and the drum knock pin.
- (2). Assembling
 - a. It is not necessary remove the change pivot pin unless it become loose. It is advised not to adjust the gears unnecessarily. It may result in changing the gear positions or setting gear in improper position.
 - b. The change knock is replaced after setting the rear cover.



1-9 Electric System

As shown in Fig-33 you will see the dynamo with the governor point above it by removing the dynamo cover placed at the front part of the engine.

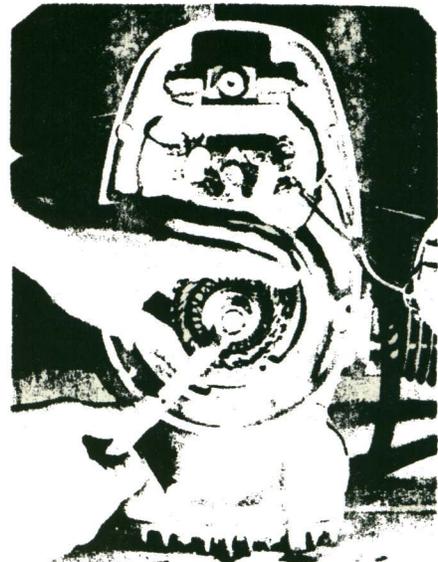
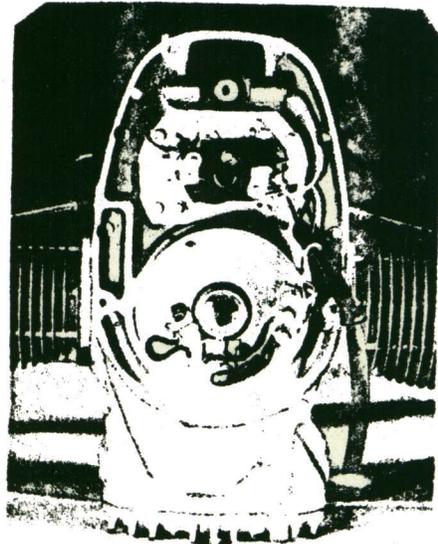
(1) Disassembling

Remove the two stator connections. Since the two carbon brushes are attached it make assembling easier if the brush spring is push down toward the side and fixed beforehand. Remove the amature binding bolt, and then the amature can be removed by adjusting the amature extract bolt. As the amature position is not keyed, it can be replaced regardless of the position.

The governor is a press fit together with the governor shaft, but by removing the binding bolt the governor comes off. The governor shaft can be removed from the taper by adjusting the amature extract bolt. The point plate is fixed by the four set screws.

(2) Checking

- a. Wear of the carbon brush
- b. Wear and burning damages of the point contact
- c. Movement of the governor point cam, and greasing.



- d. Depth of the undercut of the commutator and its cleanliness.
- e. The automatic spark advance spring.
- f. Other damage such as on dynamo cord and each terminal.

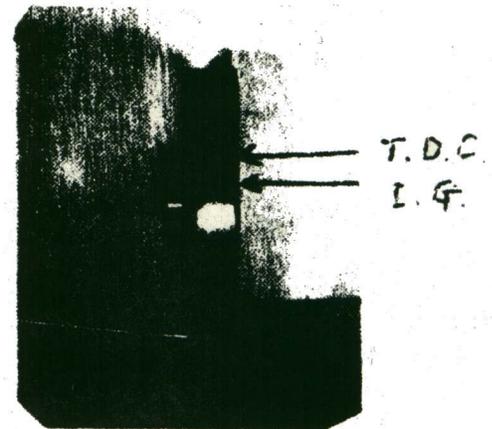
(3) Assembling

As previously mentioned, the amature can be replaced regardless of the position, and after setting the stator the carbon brush must always be lowered. Unless the brush is in the contacting position, no charging is possible.

The governor shaft has no key. When it is replaced either the left or the right tappet cover is removed and the amature binding bolt should be tightened by rotating it clockwise. When the intake valve is closed there will be (When sitting on the machine) a rubber cap on the left side of the crank case in which the fly wheel is exposed. If you remove the rubber cap you will see the marks "IG" and "T.D.C." on the outer circle of the fly wheel.

Point adjustment should be done starting with the right contact point. The left contact point is for the left cylinder and the right point for right cyl.

The contact point is positioned both the left and the right at 180° and if the point is adjusted from the left side looking toward the machine the other side will be adjusted almost simultaneously. However, as the electric position and the point clearance are made to be adjustable separately, you can adjust them in the same manner if there is any difference.



(4) Adjustment

It is important not to tighten the governor shaft too much from the every beginning. Just keep it to the degree that the governor and the governor shaft revolve by hand. As previously mentioned, when the compression stroke comes near the dead point, you are beginning to see the mark "I.G." through the hole, and when the mark comes to the center, the point begins to open by rotating the governor to the left. At this position, tighten the bolt. Do the same with the left and right cylinder. The point clearance must always be kept within 0.3 to 0.4 m/m. (0.0118 - 0.0157)

2. CHASSIS

2-1 Steering Handle and Miscellaneous Wires

Handle and holder, wires, dimmer, switch, etc.

Handle is made of 22.27 pipe, and through the handle bracket it is fixed together with the rubber bushes on and under the dashboard. This absorbs shock in driving and slight vibration caused by the engine and others in operation.

On the left handle grip are installed the clutch wire and the dimmer switch and on the right, the accel holder and the front brake wire.

- (1) Checking
 - a. Damages on the covers of the accel wire, the clutch wire and the front brake wire, the wires themselves, and each terminal.
 - b. Damages on the distribution cord covers and the cord themselves.
 - c. Bends in the handle.
 - d. Damages on the grip rubbers.
- (2) Assembling
 - a. Inject oil in each wire before assembling.
 - b. Mind putting the accel wire through the regular channel

2-2 Front Fork

Front fork is the traditional telescopic oleo fork, and removed easily by removing the dashboard and the binding nut. Needless to mention that the work is simpler after removing the front wheel and the front fender.

When the fork is to be dismantled due to the oil leakage, it should be done in order beginning with the outer tube nut, the fork piston knock, the fork piston, the snap ring and the slid metal.

- (1) Checking
 - a. Wear of the inner tube, the slid metal and piston.
 - b. Damages on the oil seal lip and the O ring.
 - c. Strength of the fork spring.
 - d. Bend in the inner tube.
 - e. Wear of the outer tube.
- (2) Assembling

Assembling is done in the reverse order to the disassembling and special attention is to be given to the seal lip.

2-3 Rear Fork

Rear fork has the traditional high quality oval tube. As the outstanding feature of the shaft-driven system the rear fork can easily be adjusted and removed just by removing the pivot shaft. The rear wheel and the bevel case assy, are to be taken, too.

- (1) Checking
 - a. Distortion of the left and the right tubes.
 - b. Damages on the oil seal lip of the right tube.
- (2) Assembling

Replace the swinging arm to the frame first and then the bevel case assy, the rear suspension, and the rear wheel in order.

Oil is liable to come in the joint of the rear fork and the bevel case assy,. To prevent this, apply a coating liquid packing to the joint before tightening. (For information, the recommended liquid packing are: Atomjit [a German brand] and Three bond [a Japanese brand]

2-4 Rear Suspension

Rear suspension has the oil damper along with the coil spring making your driving most comfortable.

(1) Disassembling

Unscrew the rear brake adjustment screw and then the suspension binding bolt and nut. The rear suspension can easily be removed. In case the suspension has an oil leaking, the work is done as follows:

- a. Remove the suspension bracket.
- b. Remove the cylinder binding nut.
- c. Remove the suspension piston.

(2) Checking and assembling

- a. Strength of the suspension spring.
- b. Damages on the suspension damper bush.
- c. Wear and bend of the suspension piston rod.
- d. Damages on the O ring.
- e. Wear of the piston cylinder.
- f. Damages of the oil seal/
- g. Assembling is done in the reverse order to the disassembling. Important is to give special attention to the O ring, the oil seal, etc. to prevent the oil leakage.

2-5 Drive Shaft and Final Bevel Gear

The special Lilac system is employed. This system has long been studied and developed as a Lilac tradition. Czeppa joint is used as a contact to the pinion gear through the transmission to the rubber joint yoke. This can be handled very simply. It absorbs not only driving shocks and vibrations of the transmission system but makes gear changes very smooth.

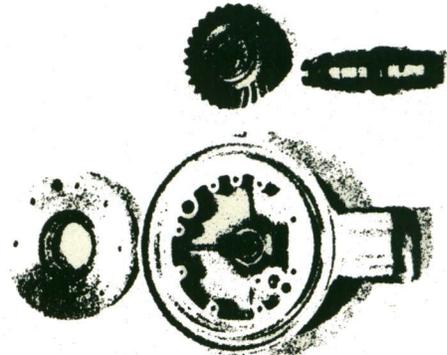
(1) Disassembling

By the same process for disassembling the gear fork, the drive shaft can easily be removed when the rear fork is taken off. The pinion side and the mitt gear side of the bevel case assy, are disassembling separately.

- a. Remove the brake shoes.
- b. Remove the rear brake arm.
- c. Loosen the pivot Shaft.
- d. Remove the binding vises for the bevel case pannel. Then the mitt gear will be demounted.

As shown in Fig-41 a special bearing is to be used to work on the pinion side. Before this the case assy, is heated up to about 100° C.

- (1) Checking and Assembling
- a. Condition of the bevel gear engagement.
 - b. Damages on the gears.
 - c. Damages on the ball bearing.
 - d. Damages on the oil seal.
 - e. Damages on the taper roller Bearing.
 - f. Wear of the gears.
 - g. Wear of the joint metal.
 - h. Wear of the joint pin.
 - i. Wear of the joint pin hole.
 - j. Damages on the rubber joint.
 - k. Inject oil to the bearings and around the gears when assembling. Special attention is to be given to the oil seal lip. The same as the dismantling, heat the case beforehand. This makes the work simpler to hold and plug in the bearing.



2-6 Brakes

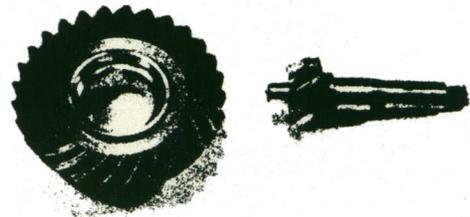
Front and rear brakes have the single cam system.

- (1) Disassembling
- a. Remove the front shaft and wheel. Then the front brake can be de-mounted easily.
 - b. Remove the rear shaft and the wheel. Then the rear brake can be taken out. The brake shoes are mounted to the bevel case side.
- (2) Checking
- a. Wear of the brake shoe.
 - b. Wear of the brake cam.
 - c. Damages on the brake shoe spring.
 - d. Wear of the brake cam shaft.



2-7 Fuel Tank and Fuel Cock

Fuel tank is installed together with the rubber bush on the frame by the three point support system which absorbs vibrations. These can be de-mounted or replaced easily by removing the double sheet.



Fuel cock is fixed on the rear right side of the fuel tank. It is double switching type and has in its cup a metal filter,. The dust will be accumulated on the bottom, requiring periodical cleanings.

- (1) Checking
 - a. Damages on the fuel tube.
 - b. Cleanliness of the cup.
 - c. Damages on the fiber packing.
 - d. Damages on the rubber packing.

2-8 Front and Rear Wheel

Front and rear wheel have the special straight sporks. The system is not only natural but assures the excellent durability of its drum.

- (1) Disassembling (Front)
 - a. Untighten the 8 m/m bolt both left and right.
 - b. Remove the front shaft nut.
 - c. Take out the front shaft, Then the front wheel can be removed.

Disassembling (Rear)

- a. Remove the rear shaft nut.
- b. Take out the rear shaft, Then the rear wheel can be demounted.
- (2) Checking
 - a. Looseness of the sporks.
 - b. Wear of the brake drum ring.
 - c. Damages on the bearing.
 - d. Damages on the oil seal.
 - e. Greasing.

2-9 Main Stand, Brake Pedal and Side Stand

- (1) Disassembling
 - a. Side stand can be removed by taking off the outer nut and bolt.
 - b. Main stand can be removed by taking out the two outer split pins and the nut.
 - c. Brake pedal can be removed by taking out the split pins of the rear brake rod and the frame pivot.
- (2) Checking
 - a. Damages on each spring.
 - b. Greasing of the brake pedal.

2-10 Frame

Frame is made of the strong high quality pipes and the oval pipes which make up the cradle type. On the steering head a ball race is pressed in.

- (1) Checking

- a. Defectiveness such as breakage of the frame.
- b. Bending of the head pipe.
- c. Damages on or wearing of the ball race.

2-11 Speedmeter and Meter Unit

As speedmeter in neutral and charge lamps are built in the speedmeter. Each has the mark " N " and " C " respectively and is distinguished by colour, green and red. A lamp for night driving is also built in.

Intergrating meter has the system that the numbers for one and four figures are in black against white background and that the other numbers are in white against black background. This makes it easier to read and to establish term of the periodical inspection of the machine.

- (1) Checking
 - a. Inclination of the needle.
 - b. Difference between the needle indication and the actual speed.
 - c. Damages on the meter cable.
 - d. Damages on and wearing of the meter unit.

3. ELECTRIC APPARATUS SYSTEM

3-1 Load System

A new type sealed beam is employed for the head light which is made more compact. Its complete disassembling is done by removing each wiring in the body and the two binding bolts.

3-2 Ignition System

Battery ignition system is employed. The left and the right ignition coils are fixed separately to the frame where the fuel tank is installed. The secondary coils are connected with the spark plugs through the upper part of the crank case.

4. DAILY INSPECTION, ADJUSTMENT & MAINTENANCE

4-1 Compression Checking

Insufficient compression pressure brings about inefficiency of the engine and the irregular revolution, and sometimes stops the engine at the low revolving performance.

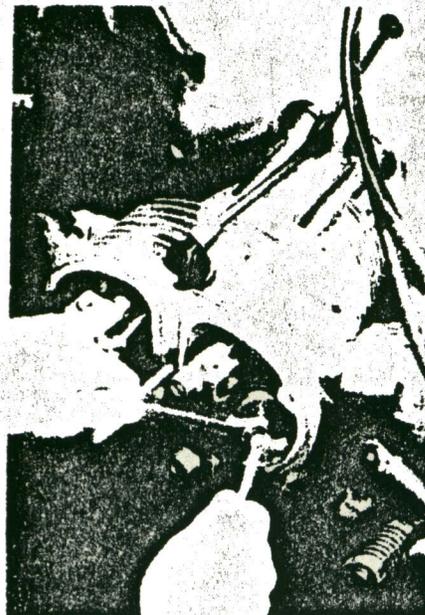
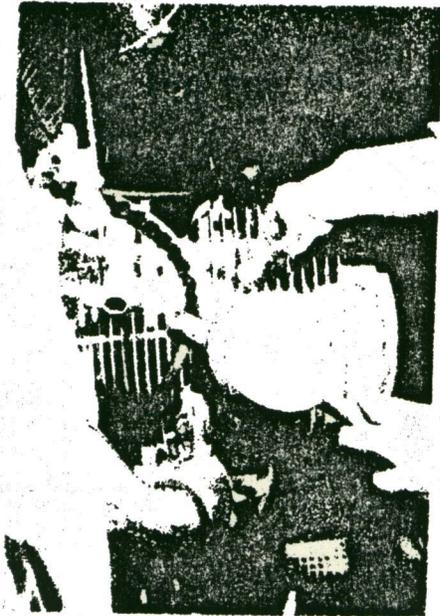
- a. Heat the engine and lubricate the cylinder and the relative devices.
- b. Open completely the throttle grip and the air shutter.
- c. Kick 3 to 5 times after holding tightly so that no compression gas may leak.

4-2 Adjustment of Tappet

Improper tappet clearance causes inefficiency of the engine and missing. The adjustment is done left and right separately at the place where the compression stroke is at the upper dead (The part on the flywheel show T.D.C.) The clearance is to be kept within .006 by the filler gauge under cold condition for Intake & Exhaust.

4-3 Ignition Timing and Point Adjustment

Point and ignition timing can be adjusted as previously explained in the paragraph 1-9 "Electric System".



4-4 Adjustment of Spark Plug. SPARK PLUG NGK BE 64EW

Spark Plug is most important in the ignition system. It receives the high-voltage current created by the ignition coil and sparks it to ignite the mixture to work the engine. Even properly selected plugs will gradually have accumulated carbon in inside of its ignition part in a long run. The accumulated carbon turns on the electricity and lowers the efficiency of the plug. The plug must therefore be removed occasionally for cleaning. The plug is to be cleaned by wire or a wire brush and washed by gasoline before being replaced.

GAP = 0.6 - 0.7 mm
.024 - .028"

4-5 Brake Adjustment

Brake is a kind of life line, and requires constant checking before driving.

(1) Front Brake

The front brake can be adjusted by the adjuster bolt attached to the brake panel, and if necessary, it can be further adjusted by the adjuster screw attached to the handle lever.

(2) Rear Brake

Adjustment is possible by the adjuster nut fixed to the end of the brake rod.

4-6 Clutch Adjustment

For the perfect performance of the clutch, the clutch lever should have a little play.

The lever is adjusted so that it has a play of 15 - 20 m/m at its top.

This can be done by adjusting the adjuster screw attached to the side of the clutch lever or if necessary by adjusting further the adjuster bolt fixed to the release arm located at the rear end of the engine.

4-7 Periodical Inspection and Supply of Oil

Intergrating speedmeter has one and four figure number in black in the white backrround, and the four figure number indicate the unit of hundred.

Time of Inspection	200 mi	Each 300 mi	1000 mi Each	Each 1500 mi	2500 mi Each	Remarks
Engine oil		Change	Change	Change	Change	SAE #40-50
Mission Oil	Change	Check	Change	Check	Change	SAE #90
Bevel case	Change	Check	Check	Check	Change	HE #90-140
Front Fork		Check			Change	SAE #30
Front, rear drum					Plus spindle	Grase
Metr Units			Oiling			
Wires				Check		
Battery		Check		Check		Distilled Water
Air Cleaner			Cleaning			Cleaning
Dainamo			Check			Brush

4-8 Periodical Inspection and Tightening

In a long run each binding bolt and nut will gradually become loose by vibration or some other causes such as damages, etc. To maintain high efficiency and safety of the machine these should properly be tightened.

For this purpose the following list is provided for your periodical checking and tightening of each bolt and nut by the torque wrech.

<u>Checking and Tightening</u>	<u>Tightening Torque</u>
Engine sheet bolt and nut	3.0 kg-m
Rear fork pivot shaft nut	3.0
Front fender binding bolt	1.5
Front shaft binding nut nut	3.5
Front shaft binding bolt	1.5
Front crawn binding bolt	1.5
Tank binding bolt	1.5

5. TROUBLE SHOOTING

No matter how the machine is excellent some trouble may happen in a long run. If anything happens most accurate judgement and prompt adjustment are necessary. The following list may help you find what trouble you are confronting:

5-1 Starting Difficulties

- No sparking plug - - - - -
- a. Burning out fuse.
 - b. Defective circulet.
 - c. Broken ignition coil.
 - d. Improper clearance of the contact point or stained clearance.
 - e. Bad plug.
 - f. Stained or broken plug.
 - g. Bad condenser.
 - h. Bad main switch.
 - i. Ineffective insulation of the secondary wire.
 - j. Run out battery.
- Low compression pressure - - Improper adjustment of the tappet.
- a. Pressure leakage by improper contact of the valve.
 - b. Wear of the piston.
 - c. Wear of the piston ring.
 - d. Bad gasket.
 - e. Burnt valve stem.
- No ignition plug - - - - -
- a. No gas.
 - b. Closed or stuffed gasoline cock.
 - c. Wrong insertion of the plug code.
 - d. Dusted main jet.
 - e. Over sanction of gasoline.
 - f. Overflow of the cabulattor.

5-2 Speed and power Difficulties

- Wheel - - - - -
- a. Damaged bearing
 - b. Low pressure of the air.
 - c. Brakes still applied.
 - d. No grease in bearing.
- Bevel gear driving system -
- a. Damaged bearings.
 - b. No oils.
 - c. Broken gears.

- Irregular clutching - - - - -
- a. Slipperly face of the worn out clutch.
 - b. Oily clutch desk causing slipping.
 - c. Improper adjustment of the clutch wire which causes to slip.
- Irregular electric system - -
- a. Wrong ignition timing.
 - b. Improper point gap.
 - c. Bad plug.
- Irregular fuel system - - - - -
- a. Impoper mixture ratio.
 - b. Closed shatter of the air cleaner.
 - c. Stuffed air ceaner.
 - d. Impoper adjustment of the carbulattor.
 - e. Stuffed hole of the tank cap.
 - f. Stuffed maffler.
- Others - - - - -
- a. Burnt piston.
 - b. bad packing of the manifold or carbulattor.
- 5-3 Irregular Revolution
- Low revolution - - - - -
- a. Imporper adjustment of the tappet.
 - b. Improper ignition timing.
 - c. Fuel too thick.
 - d. Fuel too thin.
 - e. Imcomplete binding of the carbulator.
 - f. Stained plugs.
 - g. Bad contact point.
 - h. Bad contact of the condenser.
- High revolution - - - - -
- a. Improper tappet clearance.
 - b. Weak valve spring.
 - c. Improper ignition timing.
 - d. Fuel too thick.
 - e. Fuel too thin.
 - f. Stuffed air cleaner.
 - g. Stuffed tank cap.
 - h. Stuffed fuel cock pipe.
- 5-4 Oil Invasion and Knocking
- Oil invasion - - - - -
- a. Wear of the cylinder or piston.
 - b. Wear of the piston ring.
 - c. Damaged piston or cylinder.
 - d. Wear of the valve guide or valve stem.
 - e. Stuffed oil hole of the cylinder or cylinder head.

- Knocking - - - - - a. Engine over heated.
 b. Compression ratio too early.
 c. Ignition timing too early.
 d. Low octane number.
 e. Over road.

5-5 Engine Noise

- Tappet sound - - - - - a. Large tappet clearance.
 b. Wear of the locker arm or locker shaft.
 c. Bend of the push rod.
 d. Improper contact of the round ends of the push rod and the locker arm.
 e. Wear and improper contact of the lifter pin
 f. Wear cam of the cam shaft.
- Piston Sound - - - - - a. Improper piston clearance.
 b. Burnt piston.
 c. Damaged cylinder.
 d. Wear of the piston ring.
- Gear Noise - - - - - a. Improper engagement of the crank and the cam gear.
 b. Improper engagement of the oil pump gear.
 c. Deflection of the center of the crank shaft.
- Clutch sounds - - - - - a. Wear of the clutch disk spline.
 b. Deflection of the center of the clutch disk.
 c. Deflection of the center of the fly wheel.
- Other Sounds - - - - - a. Wear of the crank bearing.
 b. Oil splash plate touching the housing.
 c. Wear of the cam shaft bearing.
 d. Longitudinal oscillation of the cam shaft.
 e. Bad bore of the cam gear bringing about its longitudinal oscillation.
 f. Broken governor.

- Knocking - - - - - a. Engine over heated.
 b. Compression ratio too early.
 c. Ignition timing too early.
 d. Low octane number.
 e. Over road.

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 b. Burnt piston.
 c. Damaged cylinder.
 d. Wear of the piston ring.
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 c. Deflection of the center of the crank shaft.
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 c. Wear of the cam shaft bearing.
 d. Longitudinal oscillation of the cam shaft.
 e. Bad bore of the cam gear bringing about its longitudinal oscillation.
 f. Broken governor.

5-6 Irregular Clutching

Slippery Clutch - Oily Facing
 Weak Clutch Spring.
 Improper Adjustment of the Wire.

Ineffective Clutch Bend of the pressure plate
 Bend or wearing of the facing.
 Large play of the wire.

5-7 Transmission Problems

Unworkable Change - Broken Shift fork boss.
 Broken hook of the shift fork.
 Irregular revolution of the shift drum.
 Burnt gear.
 Improper adjustment of the change ratchet.

Heavy Change - Unsmooth movement of the gear & the spline.
 Improper fixing of the pilot switch.
 Ineffective clutch.

Noise - Improper engagement of the gear.
 Damaged teeth of the gear.
 Wearing of the Bearing.

Loose Change - Improper adjustment of the pivot pin.
 Loose Change knock.
 Broken or weak change knock spring.
 Large facing clearance of the shift.
 Wear of the boss of the gear.

SERVICE NOTES

Timing Maintenance

1. Be sure to check the spark advance governor mechanism for correct degree of advance.
 - a. Over-advanced setting of the governor causes:
 - (1). Excessive heat build-up
 - (2). Hole in piston
 - (3). Blown Gaskets
 - (4). Connecting Rod Bearing going out
 - (5). Piston seizure
 - (6). Loss of power
 - b. Underadvanced setting of the governor causes:
 - (1). Loss of power
 - (2). Low fuel economy
2. The spark advance governor mechanism becomes mistimed due to:
 - a. Normal wear and tear of the aligning parts
 - b. Normal wear and tear of the moving parts
 - c. Breakage due to reasons above or excessive abuse of engine
 - d. Breakage due to insufficient lubrication of the moving parts

To make the proper adjustments of the spark advance mechanism, determine the amount of the over-advance and its probable cause. To find the probable cause of the over-advance, remove the governor mechanism from the camshaft and visually inspect all component parts for breakage wear, tear, weakness, and looseness. If moving parts are worn, replace the whole governor and go through the spark advance check. If the aligning parts are worn, replace those parts and go through the spark advance check.

To determine the amount of the spark over-advance and to go through the spark advance check is the same operation.

The amount of the spark advance is 30 degrees BEFORE TOP DEAD CENTER as measured at the crank at 3000 rpm.

The amount of the spark advance is 15 degrees BEFORE TOP DEAD CENTER as measured AT THE GOVERNOR at 1500 rpm of the camshaft.

The tools needed for the spark advance check are:

1. Timing light
2. Screwdriver
3. Pencil
4. Metal scribe (any metal scratcher)

Timing Maintenance (continued)

Mount the spark advance governor mechanism, connect the timing light and start the engine. Set the engine to idle (below 2000 rpm) and use timing light to set contact points to spark the plugs at the IGNITION POINT MARK on the flywheel. After doing this for both cylinders shut the engine off.

Now rotate the flywheel so that the T.D.C. or T.C. mark appears at the flywheel window. Align the T.D.C. marks with the marks on the window. The pistons are now at TOP DEAD CENTER. Mark this position at the open space on the generator field housing. Be sure the mark coincides with one of the insulating dividers on the armature. Now make smaller marks to the left of the T.D.C. mark. Each mark should coincide with the divider insulator on the armature. Now make a mark on the armature where the T.D.C. mark was made. (See illustrations.)

Timing marks are now ready to be used for the spark advance check. The T.D.C. mark represents the zero degree point from which the spark advance degree will be measured. Each smaller mark to the left of the T.D.C. mark represents approximately 12.41 degrees. This is because each division is equal to the separation of the armature dividers and there are twenty-nine (29) dividers in the armature. Divide 29 into 360 degrees and get 12.41 degrees separation per divider.

Start the engine. Shine the timing light on the marks that were made. The mark made on the armature should show up in the timing light near the first small mark made to the left of the T.D.C. mark. This indicates the idling spark setting that was initially set up (this is at the I.G. mark which means 10 degrees B.D.T.C. (before top dead center) at the crank).

Now speed up the engine to where the spark advance is actuated (above 2000 rpm). Note where the armature mark coincides with the field markings. If the armature markings shows up beyond $2 \frac{1}{2}$ small marks this means an over-advanced spark setting. ($2 \frac{1}{2} \times 12.41$ degrees = 31 degrees).

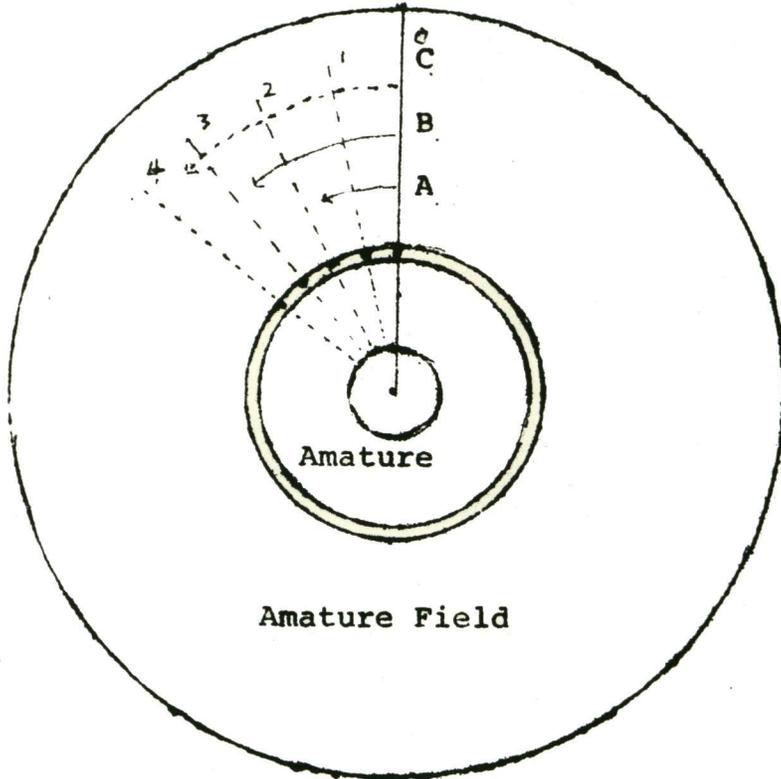
Stop the engine. Adjust the spark advance stop so that there is less movement of the centrifugal weights and go through procedure above until the armature mark does not show up beyond $2 \frac{1}{2}$ small marks. Ideally the armature mark should stop at 2.42 marks for 30 degrees spark advance.

The spark advance check is now complete.

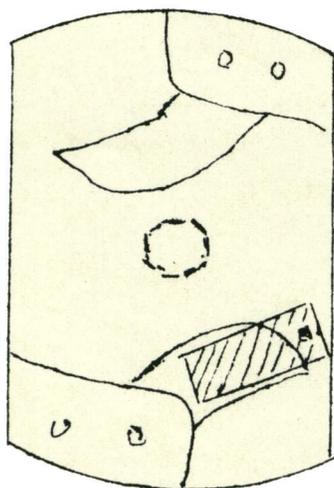
Set up the Correct Timing

24.

I.G. or T.D.C.



1. Set up a I.G. mark on the Zero line.
A is a correct advance.
(1.1/2 degree)
B and C are not correct Ad.
2. Set up a T.D.C. mark on the Zero line.
B is a correct advance.
(2.1/2 degree)
A and C are not correct Ad.



---Plate "D."

Automatic-Governer

3. If you will a find of the over-advance Or (short-advance) See C. you must move again the Automatic-Governer plat "D. Push-in, or Push-out,.

Left
coil wire

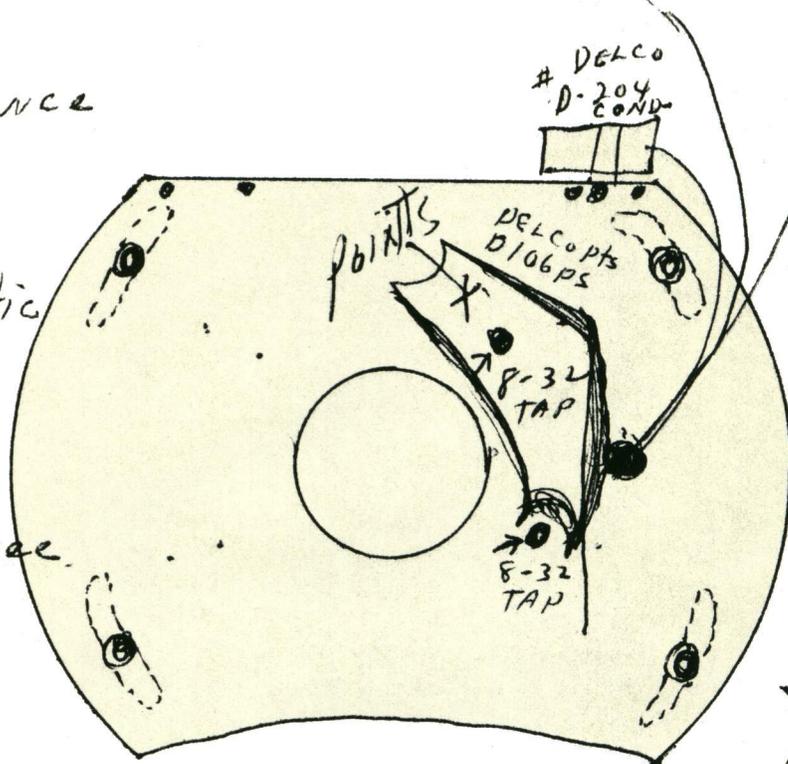
MARUSHO TIMING PLATE

Rt. Coil
wire

to USE BMW ADVANCE
+ GM POINTS + COND.

Rotate PLATE to
get PROPER ADVANCE

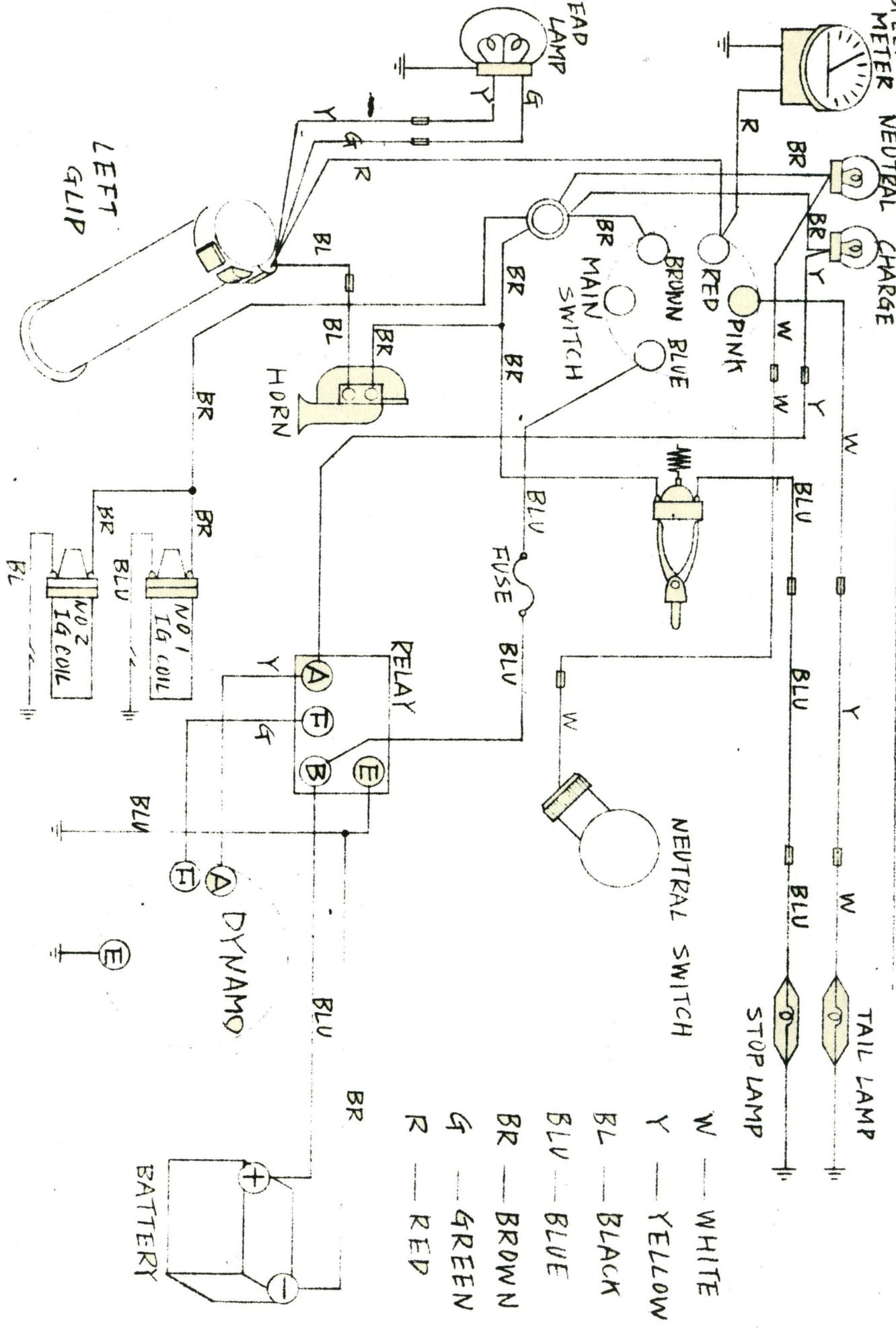
USE BMW AUTOMATIC
ADVANCE - IT MUST
BE ALIGNED PERFECT
SO BOTH CYLS WILL
FIRE AT SAME DEGREE.
10° IDLE AND ADVANCE
TO 30° ON ROAD



ALIGN ADVANCE
by tapping RT
LT OR UP + DOWN
UNTILL BOTH CYLS
ARE THE SAME
IF NOT ALIGNED
RODS GO OUT
+ PISTONS GET
HOLES

- 1- Remove everything from point plate
- 2- Slot mounting Holes
- 3- DRILL AND TAP RT. LOWER INNER GUIDE PIN HOLE
8-32 (COND. # D 204 + COND BRKT. # 1944118)
- 4- USE GM POINTS # D106 PS MT. LOWER END +
INSTALL ON ENG THEN POSITION TOP SCREW SO
POINT WITH CONTACT BREAKER CAM THEN DRILL +
TAP 8-32 ALSO - THE POINTS WILL HAVE TO HAVE
A SPACER UNDER THEM TO GET OUT TO THE RIGHT
CONTACT AREA (I USE THE BOTTOM PART OF 3 OLD POINT
SETS D106PS PICK THEM UP FROM SOME MECHANIC OR
HAVE USED WASHERS)
- 5- MOUNT CONDENSER ON RT SIDE OF PLATE AND
CONNECT BOTH WIRE^{COIL} TO 1 SET OF POINTS

MARUSHO ST-500 ELECTRIC WIRING DIAGRAM



- W — WHITE
- Y — YELLOW
- BL — BLACK
- BLU — BLUE
- BR — BROWN
- G — GREEN
- R — RED

LEFT GLIP

