

WORK SHOP MANUAL
FOR THE
RABBIT SUPERFLOW MOTOR SCOOTER
MODEL S601
STARTER DYNAMO
AND
TORQUE CONVERTER



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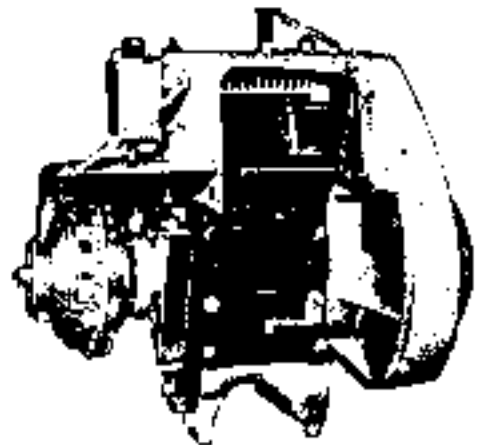
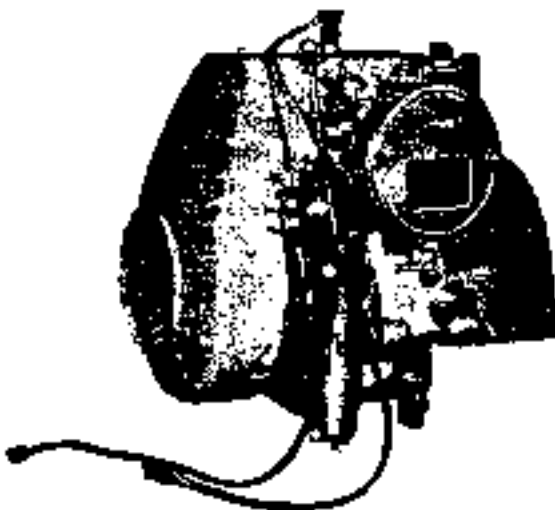
INTRODUCTION

An electric starter is incorporated in the Model S60C Rabbit Scooter. Explained below are the functions and performance of this electric starter, and its disassembly, assembly and maintenance procedures.

With the electric starter, the structure and the manner of operation is now different from the old flywheel magneto type. However, if the user sufficiently understands the functions of the electric starter and masters its manner of operation, it will provide many advantages over the kick starter.

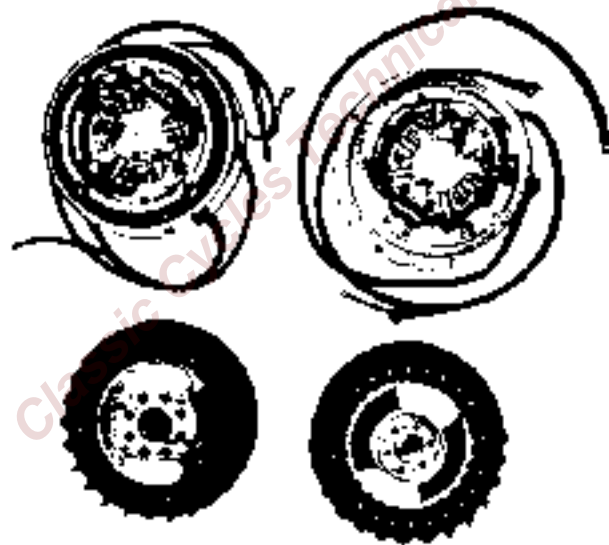
The reader of this manual is requested to learn the proper handling of the new mechanism and tell the customers exactly how it should be operated.

Note: For the handling of the engine, see the S60C Workshop Manual Engine Section.








1. Types and Performance of Electric Starter Components

Name	Type	Performance
Starter-dynamo	SAC 1000 (made by Hiraide Magneto Kogyo) BA-02 (made by Kokusan Denki)	Starter performance: 12 V 0.4 IP Dynamo performance: 1700~6000 r.p.m., 13.5 V, over 7 A
Regulator	AFR-1000 (made by Hiraide Magneto Kogyo) ZR-401 (made by Kokusan Denki)	Cut-in voltage/r.p.m. , 13.5 ± 0.5 V/1500 r.p.m. or less
Ignition coil	SAC-1700 (made by Hiraide Magneto Kogyo) SA-01 (made by Kokusan Denki)	Sparking performance (among 3-points): Low speed 300 r.p.m., 8 V.....over 6 mm High speed 6000 r.p.m., 12 V.....over 7 mm
Batteries	DC-8 (made by Matsushita Denko) BK 6-6 (made by Furukawa Denki)	6 V 13 AH, two in series



2. Function Starter-Dynamo (For their locations, see Fig. 3-1)

	Part name	Location
Starter-dynamo	Stator <ul style="list-style-type: none"> Field coil Contact breaker (point) Carbon brush 	Installed on engine shaft retaining
	Armature (rotor) <ul style="list-style-type: none"> Armature Commutator 	Fitted to tapered section of crank shaft.
Fan		Fitted to tapered section of armature.
Regulator	<ul style="list-style-type: none"> Starter electro-magnetic switch Current relay Voltage regulator   	Bolted on floor board inside frame duct.
Ignition coil		Outer side of shaft retaining plate.
Batteries		Attached on rear frame inside body cover.

Function

<p>Starter function</p>	<p>Supplied with power from batteries, it works as a DC motor to start engine.</p>
<p>Dynamo function</p>	<p>As engine begins to turn by itself, equipment automatically becomes a dynamo to charge batteries to secure power for next starting of engine and for operating other electrical units in general.</p>
<p>Starter electro magnetic switch function:</p>	<p>At time of starting engine (when starter button is pressed), it connects with batteries to supply current to starter. (This electromagnetic switch is used as starter current is very strong.)</p>
<p>Cutout relay (for switching charging circuit)</p>	<p>(1) When engine rotation speed is below a certain level (cut-in rotation speed 1500 r.p.m.), dynamo generated voltage is lower than battery voltage. Therefore, it severs connection with batteries to prevent discharge due to reverse current from batteries. (2) When engine rotation speed is over a certain limit (1500 r.p.m.), it connects with batteries to start charging them.</p>
<p>Voltage regulator (relay for adjusting charging voltage)</p>	<p>After cutout relay comes into operation, engine speed may grow higher to make generated voltage too high and strain batteries. This equipment keeps voltage below certain limit during battery charging</p>

Ignition

It supplies power for engine starting and for operation of other electrical units in general.

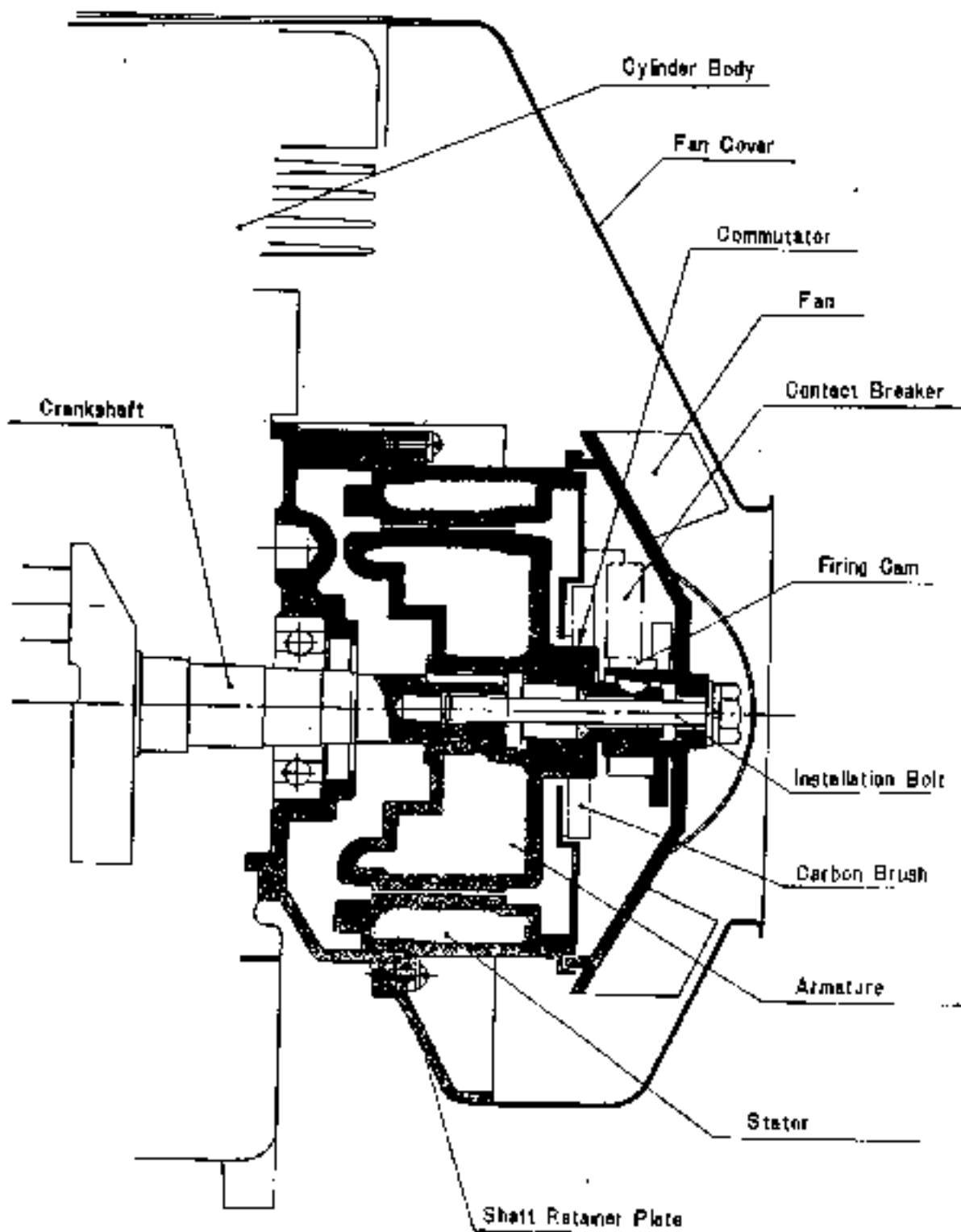
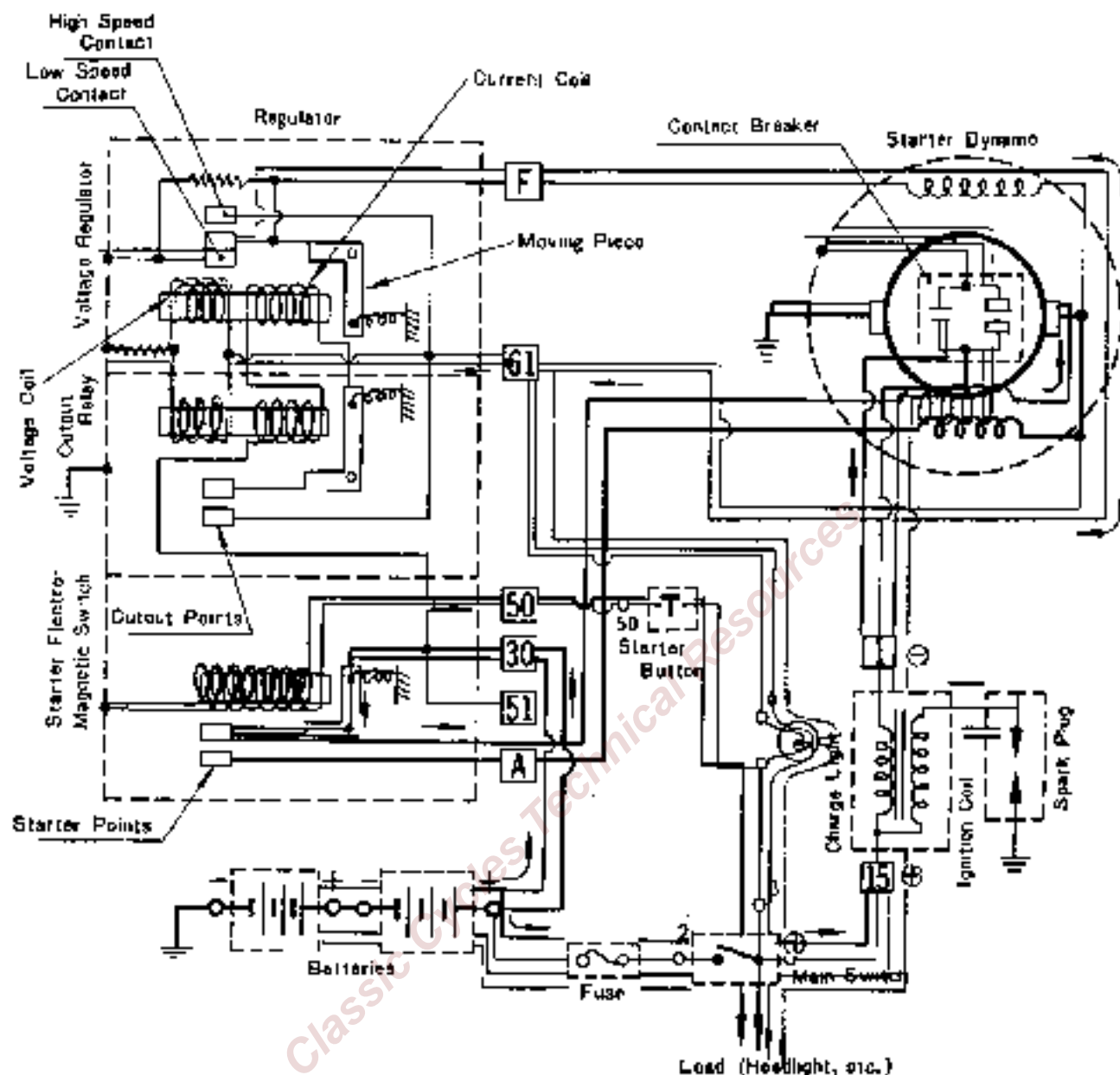


Fig. 3-1



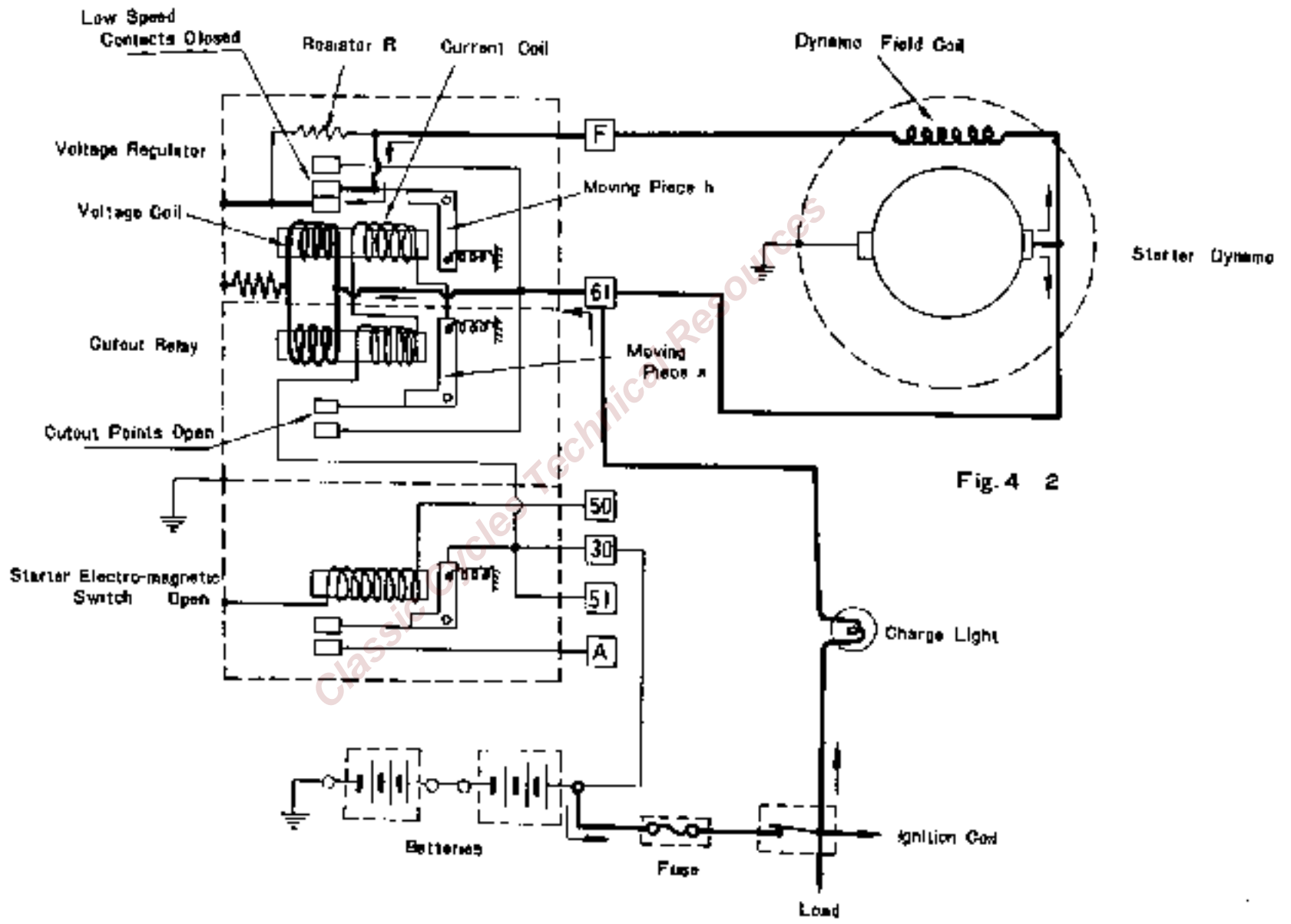
3. Operating Principles of Starter-Dynamo and Regulator

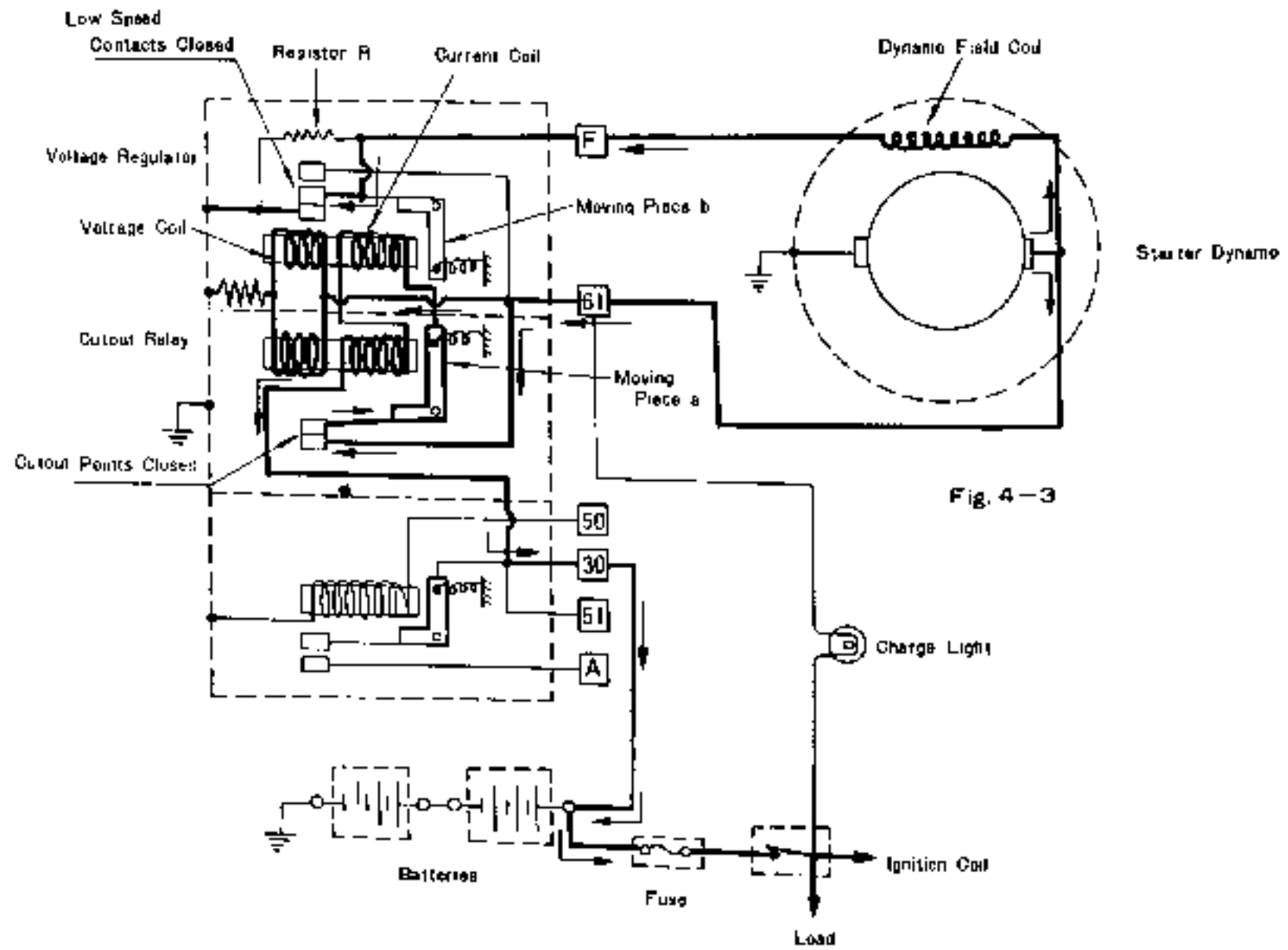
3-1. Starter Operation (Fig. 4-1)

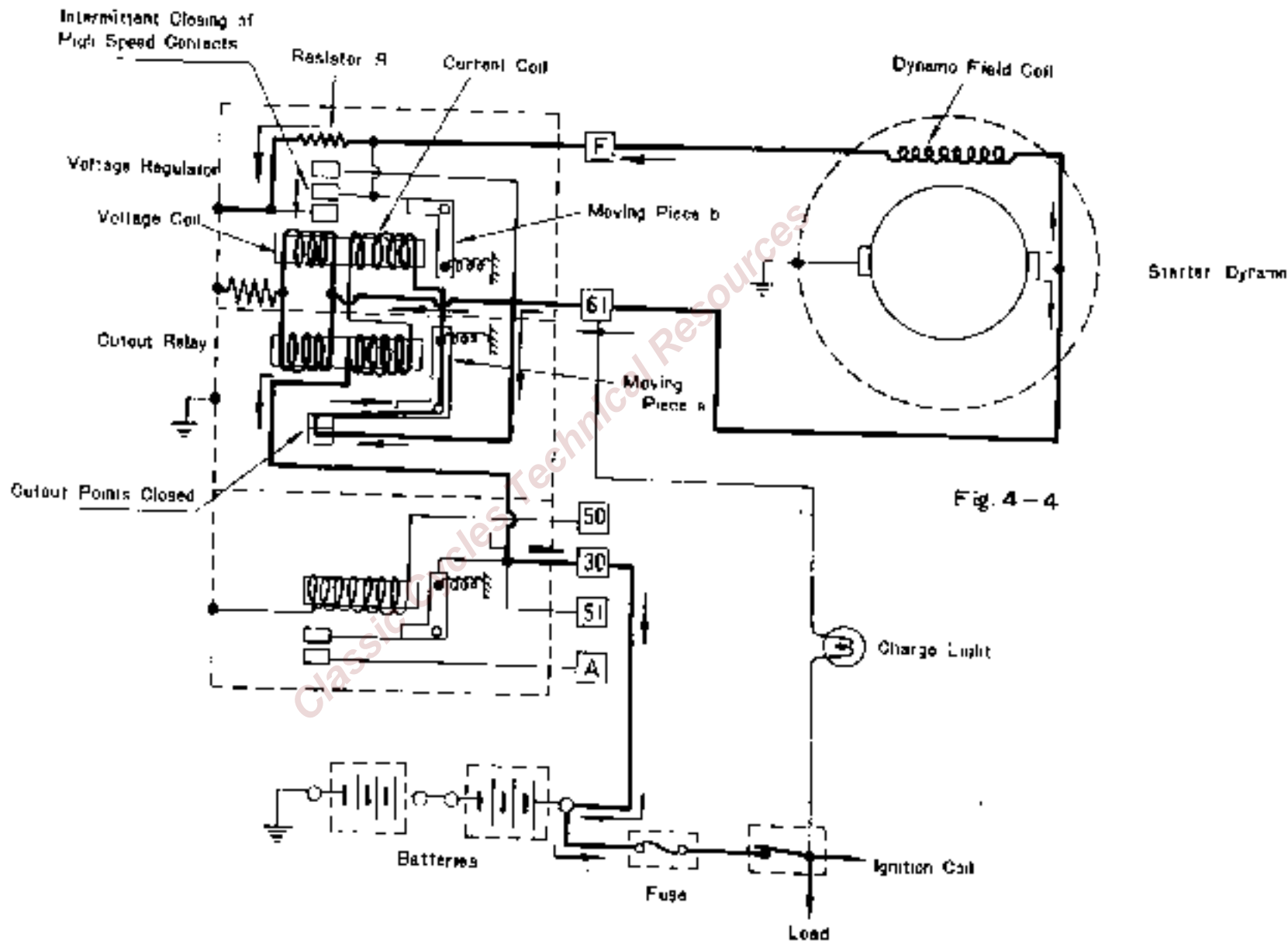
Operation	Current	Charge light	Starter electro-magnetic switch	Starter dynamo	Engine
Main switch ON	Blue route from batteries	On	Does not operate. Starter contacts open.	Still	Still
Starter button pressed	Red route from batteries	Off	Operates. (1) Current runs in Electromagnet. (2) Movable contact attracted. (3) Starter contact open.	Turns as starter.	Started by starter.
Starter button released	Yellow route from batteries	On	Does not operate. (1) Movable contact returns. (2) Starter contact open.	Driven by engine, operates as dynamo.	Operates by itself.

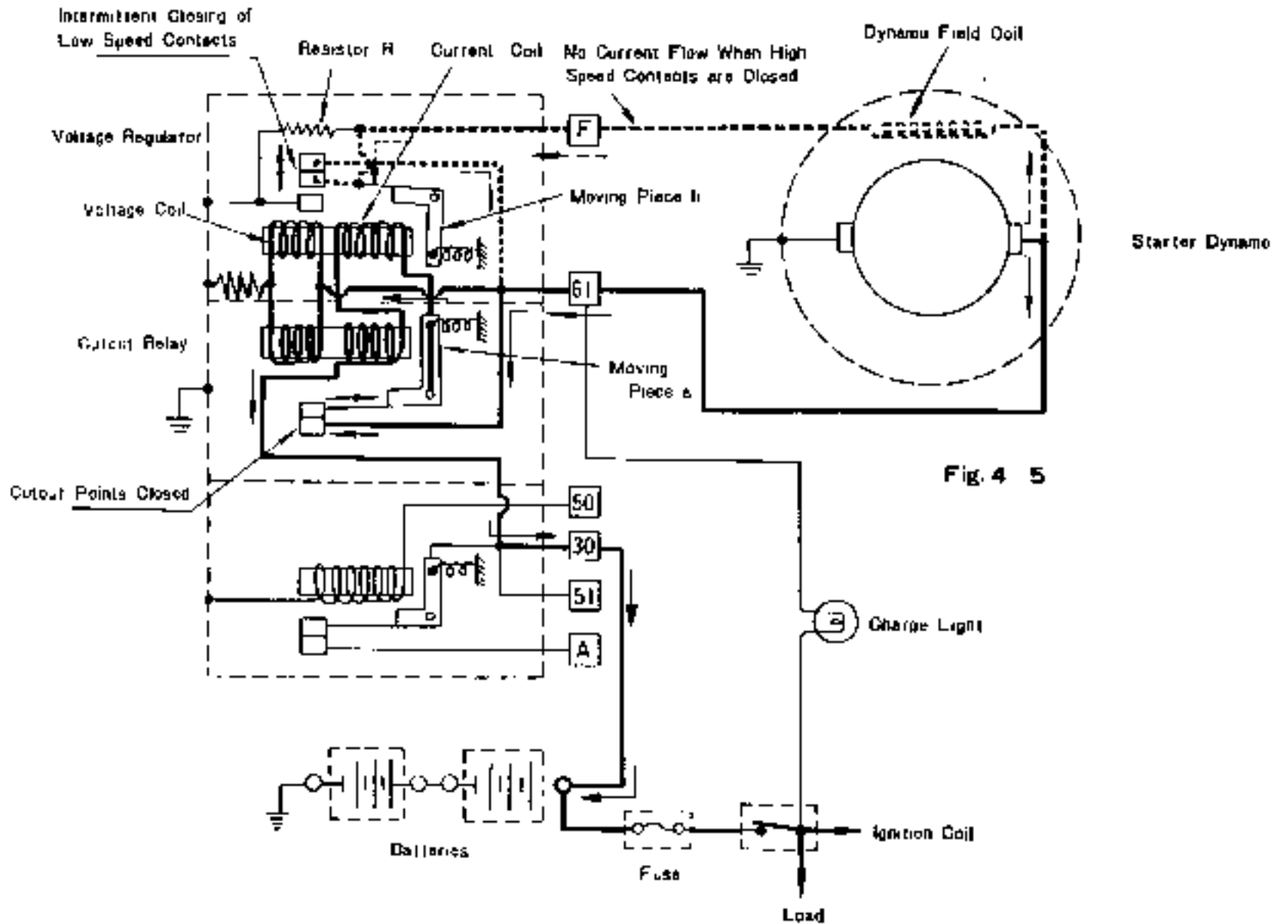
3-2. Regulator Operation

Fig.	Engine rotation speed	Dynamo-generated voltage	Operation of cutout relay	Operation of voltage regulator	Batteries	Charge light
4-2	Below 1500 r.p.m. (cutin rotation speed)	Below 13V (below battery voltage)	Cutout contact opens. Disconnects with batteries to prevent discharge due to reverse current from them, as dynamo-generated voltage is lower than battery voltage.	Low-speed contact opens, High-speed contact closes.	Dis-charge	On
4-3	1500 r.p.m. ~ 1700 r.p.m.	13V ~ 13.5 V (over battery voltage)	(1) Current runs from dynamo to voltage coils. (2) Iron cores of voltage coils work as electro-magnets to attract movable contact a. (3) Cutout contact closes. (4) Current from dynamo passes cutout contact and amperage coils and charges batteries.	(1) Current runs in voltage, amperage coils to produce electro-magnetic force, (2) The more low-speed contact is opened, the less movable contact b is attracted.	Charge	Off
4-4	1700 r.p.m. ~ 2000 r.p.m.	Over 13.5 V	(1) Dynamo-generated voltage rises. (2) Current in voltage and amperage coils increases and consequently produces more electromagnetic force. (3) Connection at cutout contact secure.	(1) More current runs in voltage and amperage coils and electromagnetic force is increased, (2) Movable contact b is attracted to iron cores of coils. (3) Low-speed contact open. (High-speed contact not touched.) (4) Current in field coil decreases as it is connected with resistor R. (5) Dynamo-generated voltage decreases. (6) Current in voltage and amperage coils decrease and electromagnetic force weakens. (7) Movable contact b is brought back by return spring. (8) Low-speed contact closes. (9) Dynamo-generated voltage rises. (10) Electromagnetic force increases again to attract movable contact b. Low-speed contact opens. This oscillatory process is repeated to keep generated voltage constant.	Charge	Off
4-5	Over 2000 r.p.m.	Rises further	Same as above. (1) Electromagnetic force of coils is strengthened further and strongly attracts movable contact b. (2) High-speed contact closes. (3) Terminal G1 and Terminal F come to same voltage and current ceases to run in field coil, with result that dynamo-generated voltage suddenly falls. (4) Electromagnetic force of coils decreases, high-speed contact opens; dynamo-generated voltage rises. (5) Electromagnetic force increases and high-speed contact closes. This oscillatory process is repeated.		Charge	Off












4. Disassembly

The process of disassembling the equipment will provide valuable information when the user must deal with disorders and breakdowns, or conduct checks, or make adjustments. It is therefore advised that the process be studied closely and carefully, and that numerical measurements be made and results kept on record.

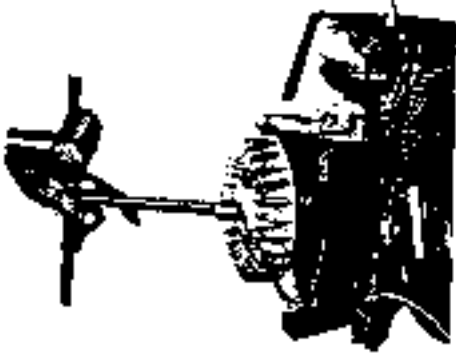
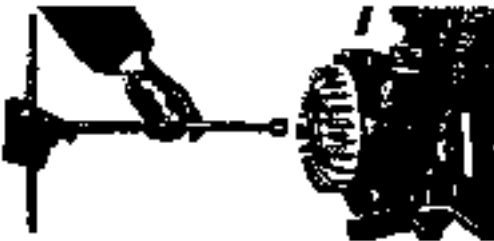
4-1. Special Tools for Disassembly and Assembly of Equipment


Tool No.	Name of Tool	Uses
Y-79-65A	Installation Tool	Spacer for tightening armature.
Y-79-66B	Disassembly Rod	For extracting armature.
Y-79-67D	Disassembly Bolt	For extracting fan.

4-2. Removing Equipment from Scooter Body


Sequence	Fig.	Parts to be disconnected	Main disassembly operations	Remarks	Tools used
1	4-1	Battery connection	<p>(1) Take off battery box cover inside legshield. (2) Detach connector from + terminal of batteries.</p> 	Be sure to detach connector from (+) terminal; otherwise current might short-circuit.	10 mm spanner (for 6 mm screws)
2	4-2	Regulator connections	<p>(1) Open regulator inspection window. (2) Disconnect engine side regulator connections - Terminals F (yellow), G (red), and A (black thick).</p> 		Plus screw driver
3	4-3	Ignition coil connection	<p>Disconnect terminal 15 (+) wiring (blue).</p> 		7/8" spanner (box) (for 5 mm screws)
4		Others			

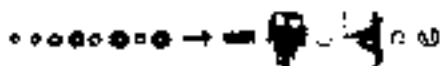
4-3. Major Disassembly

Sequence	Fig.	Parts to be disconnected	Main disassembly operations	Remarks	Tools used
5		Ignition coil	(1) Disconnect wiring at terminal 1 (-) terminal (brown). (2) Remove two 5mm bolts holding ignition coil bracket and shaft retainer plate. (3) Remove spark plug cap.		#9 spanner (box) (for 5 mm bolts) #10 spanner (box) (for 6 mm bolts)
6		Fan cover	Take off cover by removing three 6mm bolts, two 5mm bolts and four 5mm plus screws.	Take care not to lose any bolts or washers. Keep them together.	Plus screw driver #10 spanner (box) (for 6 mm bolts) #9 spanner (box) (for 5 mm bolts)
7		Dust cover (fan center)	Take off cover by removing two 5mm screws.		Screw driver
8	4-8	Fan	(1) Take off 10 mm bolt fastening fan to crankshaft. In this case, loosen bolt by hitting handle of box spanner or medium-size monkey spanner, with wooden hammer. (When clutch cover is off, hold clutch to keep it from turning; if clutch is already out, use Y-79-733 turn holder.)	(1) 10 mm bolt is right-handed. (2) Take care not to let woodruff key fall out of tapered part after fan is removed.	#17 box spanner (for 10 mm screws) or medium-size monkey spanner. Wooden hammer, Y-79-670 Disassembly bolt. (14 mm bolt can be substituted.) #23 box spanner (for 14 mm bolts)
					
	4-9		(2) Screw fan extracting tool into 14 mm screw part, and fan will come off tapered part where it is fixed.		
					

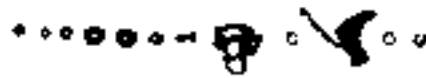
Sequence	Fig.	Parts to be disconnected	Main disassembly operations	Remarks	Tools used
9		Stator	<p>(1) Take off carbon brush; carefully lift carbon brush holding spring by point of screw driver, draw brush into holder, and let holding spring press side of brush, and brush will stop in position free of armature commutator.</p> <p>(2) Remove lead wiring clamp.</p> <p>(3) Take out stator by removing four 6mm plus screws fixing it on shaft retainer plate and take out stator carefully.</p> <p>(4) Detach rubber cap on each lead wire terminal and rubber bush at lead wire outlet in stator base.</p> <p>(5) Take out lead wire from outlet in stator base.</p>	<p>(1) Always lift up carbon brush before removing or installing stator.</p> <p>(2) In taking out wiring from outlet in stator base, take care not to damage metal terminals.</p>	<p>Screw driver</p> <p>Plus screw driver</p>
10	4-10	Armature	<p>Insert disassembly rod into hole at end of armature, screw in 10mm bolt removed in (8), and turn until armature comes off.</p> 		<p>Y-79-669 Disassembly rod (Substitute: 17mmφ × 70mm rod) #17 hex spanner (for 10mm bolts) 10mm bolt</p>
11		Regulator	<p>(1) Disconnect wirings at terminals (6L), (50) and (30) on body side.</p> <p>(2) Remove regulator by loosening 6mm plus screws.</p>	<p>Hiraide Type: 4 screws</p> <p>Kokusan Type: 3 screws</p>	<p>Plus screw driver</p>

4-4. Parts Disassembly

Sequence	Fig.	Parts to be disconnected	Main disassembly operations	Remarks	Tools used
12		Starter cable	Take off rubber cap and remove from nut.		10 box spanner (for 6mm screws)
13	4-13	Carbon brush	<p>(1) Remove small screw fixing carbon brush lead wire.</p> <p>(2) Remove holding spring from brush and slip carbon brush from holder.</p> 	Take care to keep connection between carbon brush and lead wire.	Screw driver
14	4-14	Contact breaker	<p>(1) Detach lead wire.</p> <p>(2) Remove contact breaker installation screws.</p> <p>(3) Take off slipper retaining ring on contact breaker shaft.</p> <p>(4) Breaker plate and slipper will become removable.</p>		Screw driver 6 spanner (for 3mm bolts)



Kokusan Type



Hiraide Type

5. Checking and Adjustment

(See separate Adjustment Standards)



Illustration	Part checked	Object of checking	Adjustment	Caution	Remarks
	Entire stator	Carbon dust resulting from carbon brush wear.	Clean stator interior and brush holders of carbon powder clinging to them. (Wipe them with clean cloth or cloth soaked in benzine.)	When soaking engine equipment in gasoline to wash it, always dry with air.	
5-1	Carbon brush	(1) Length of carbon brush. Check every 10,000 km (6,200 mi). (2) Contact between carbon brush and commutator.	(1) Carbon brush should be changed when it has become less than 15 mm.  (2) Check strength of spring holding brush. If worn, spring must be changed.	(1) Do not carelessly grind off contact surfaces of brush and commutator. (2) When brush is to be changed, always use genuine spare brush.	
S T	Contact breaker	(1) Contact gap should be checked after every 3,000 ~ 5,000 km of operation.	(1) Adjust gap to 0.3 ~ 0.4 mm.	(1) Insert feeler gage exactly parallel to contact surfaces and adjust it properly.	
A T O		(2) Firing angle	(1) Set firing angle at $5^{\circ} \pm 1.5^{\circ}$ before top dead center.	Firing angle: Initial— 5° Angle of advance $23^{\circ} \sim 24^{\circ}$ (Consequently, firing angle after angle of advance is $28^{\circ} \sim 29^{\circ}$) Angle of advance: Start—1,200 r.p.m. End—1,500 r.p.m.	
R		(3) Wear and corrosion on contact surfaces.	(1) If corroded, contact surfaces turn dark purple; if worn, they become white and rough, or even rugged. (2) Worn or corroded contact surfaces should be polished carefully with thin, fine sandpaper or oil stone. (3) In polishing, care must be taken so that surfaces, after polishing, will touch each other evenly.	(1) Remember that partial contact between surfaces after polishing will result in fast wearing of surfaces. (2) Oil, moisture or dust clinging to contact surfaces will result in fast wearing of contacts. Insert paper between them from time to time to clean.	

Illustration	Part checked	Object of checking	Adjustment	Caution	Remarks
	S T	(4) Contact breaker shaft	(1) See if contact breaker shaft is shaky. If it is too shaky, it must be changed. (2) After each 5,000 km supply shaft with oil which will not flow out easily when heated (magneto grease #250).		
5-2	Oiling felt	Lubrication of cam surface—sufficient or not.	(1) Rub in a little grease after every 5,000 km to prevent wear on contact breaker slipper part.	If fluid oil (engine oil, etc.) is used, contact surfaces may be affected by splashes, which must be avoided.	
	Armature	Commutator surface	(1) Wipe clinging carbon with benzine-soaked clean cloth. (Clean surface and groove.) (2) If surface is damaged, showing scaling, make it smooth by touching it with fine file and then polishing it lightly with #00 sandpaper.	Strictly avoid touching surface with oily fingers or letting surface become oily.	
	Automatic advance angle device		Make sure it works perfectly after attaching to engine. Take to service shop for disassembly adjustment.	Excessive installation torque (specified later) can cause shaft distortion and trouble.	
	Regulator	Test procedure explained later.	If it needs adjustment, send it to a service shop. Never touch its interior yourself.		
	Lead wires	(1) Connection at each terminal.	(1) If found loose, it should be fastened securely and sufficiently. (2) Cover it with rubber cap to avoid contact with other things.	Starter cable (black, terminal A) and cable between batteries and regulator (black, terminal 30) are thick because they form starter circuit and are subject to strong current. Do not mistake them for other thin lines.	

6. Adjustment Standards

No.	Item	Measurement		Adjustment		Procedure	Caution
		Procedure	Instrument	Maker	Limit		
1	Stator- armature clearance air gap	Measure inner diameter of stator pole and outer diameter of armature core and take 1/2 of difference.	Micrometer	Hiraida Standard Kokusai	0.40~0.45 0.44~0.51	If there are dents or scratches, repair affected parts only carefully.	If ID and OD deviate from specified values due to processing, performance will fall.
2	Carbon brush	Measure length	Slide calipers	Hiraida Kokusai	16 14	22 20	Change brush. Check brush after every 10,000 km. Always use genuine spare part. One made of different material may damage commutator.
3	Carbon brush holding spring	Measure pressure of spring in operational condition.	Spring balance (1 kg)	Hiraida Kokusai	300 g 500 g	When brush is new: 500~700 g 700~900 g	Change brush or spring
		 <p>Fig. 1.</p>					
4	Contact breaker point gap	Measure gap when points are open.	Feeler gage	Hiraida Kokusai	0.25~0.45	0.3~0.4	Polish worn or oxidized contact surfaces with thin sandpaper of all stone. Check how they fit, and adjust them until specified value is reached.
5	Contact breaker spring	Measure pressure of spring when points are open.	Spring balance (1.5 kg)	Hiraida Kokusai	600 g 500 g	800~1000 g 900~1100 g	Replace
6	Outer diameter of commutator	Measure outer diameter.	Slide calipers	Hiraida Kokusai	45 mm 46 mm	46 mm	Grind outer diameter, finish with #40 sandpaper; surface roughness less than 3.5; OD deflection less than 0.05.
7	Depth of valve be- tween segments	Measure depth from commutator outer circumference.		Hiraida Kokusai	H=0.45 H=0.45	H=0.2~0.7 H=0.4	Take to service shop for adjustment.


No.	Item	Measurement		Adjustment				Caution
		Procedure	Instrument	Maker	Limit	Standard	Procedure	
8	Clearance between cam and bow	Measure inner diameter of cam and outer diameter of bow.	Micrometer	Hiraida Kokusai		0.300-0.125 0.030-0.072		If too tightened excessively, this clearance may change making operation faulty.
9	Automatic advance angle spring		Spring Balance (1 kg)	Hiraida Kokusai		500-700 g	Adjusted by screw adjuster plate. If not adjustable, spring must be changed.	As this part is sealed, repair should be done at service shop.
10	Ignition advance angle	Measured by advance angle measuring device.		Hiraida Kokusai		Initial setting: 3.5-6.5° before top dead center. Advance angle: 22-24° Advance angle: Start 1200 r.p.m. End 1500 r.p.m.	Change if not adjustable.	Adjustment must be done at service shop.
11	Ignition coil	Measure by three-point gap.	Three point gap. Tachometer. Voltmeter	Hiraida Kokusai	Over 6mm at 300 r.p.m. 8 V. Over 6mm at 600 r.p.m. 12 V	Over 6mm at 300 r.p.m. 5 V. Over 5mm at 600 r.p.m. 12 V.	Change coil.	
12	Voltage generated by starter dynamo (single unit)	Ground wire F. Measure voltage between (S) terminal and ground.	Voltmeter (0.5% class). Tachometer.	Hiraida Kokusai		Over 15 V at 1,300 r.p.m. or more.	Repair or change starter dynamo.	

No.	Item	Measurement		Adjustment			Caution	
		Procedure	Instrument	Maker	Limit	Standard		Procedure
13	Voltage generated by starter-dynamo (Regulator no-load idling voltage)	With starter-dynamo and regulator in perfect connection and with no load, measure voltage between (30), (30) and ground.	Voltmeter (0.5 class), Tachometer.	Hirude Kokusai		15.0-16.5 V at 1,500 r.p.m. or more.	Adjust starter dynamo. Adjust or change regulator.	Regulator adjustment should always be made at service shop
14	Voltage generated by starter dynamo (Regulator resistance load voltage)	Insert voltmeter and variable resistor between (30) and ground. Measure voltage when current is 1 A.	Voltmeter Ammeter. Tachometer.	Hirude Kokusai		13.5±0.5 V at over 1,500 r.p.m.	Same as above	
15	Regulator coils	Under same conditions as above, raise rotation speed gradually until pointer of ammeter begins to swing. At this point, measure rotation speed and voltage.	Voltmeter. Ammeter. Tachometer.	Hirude Kokusai		13.0-14.0 V at 1,500 r.p.m. or less.	Adjust or exchange starter dynamo or regulator.	

7. Assembly

7-1. Installation of Engine

Best care must be taken in assembling the engine after it is checked or repaired.

Sequence	Illustration	Part	Main assembling operations	Cautions	Tools used
1	6-1	Armature	<p>(1) Sufficiently clean crankshaft and tapered section of armature (wipe off oil).</p> <p>(2) Fit armature into crankshaft by matching key.</p> <p>(3) By means of installation tool, screw in 10mm clamp bolt and fasten equipment to standard torque. (3.7 kg-m, 325 in-lb)</p>  <p>(4) After equipment is fastened, remove 10 mm clamp bolt.</p>	<p>(1) Taper $\frac{1}{32}$.</p> <p>(2) Remove impurities from tapered section and fit it in so that it will not be shaky.</p>	<p>Y-79-600 Installation tool Torque wrench #17 socket</p>
2		Stator	<p>(1) See if carbon brush of stator is lifted; if it is not, lift it in manner as shown in section for Disassembly.</p> <p>(2) Fit stator to shaft retainer plate by faucet joint after cleaning. With red line mark coming to top center, adjust 6mm screw holes and fix equipment by four 6mm pins screws.</p> <p>(3) Collect the lead wires in a bundle and fix in place with clamp. Take out end through shaft retainer plate outlet hole.</p> <p>(4) Fit plug to outlet hole and rubber caps to each terminal.</p> <p>(5) Let carbon brush touch commutator. Be sure they are in contact.</p>	<p>(1) Never fail to confirm position of carbon brush. If this is neglected, carbon brush may be damaged, or dynamic may be found out of condition.</p> <p>(2) When taking out lead wires, take care not to damage metal terminals.</p>	<p>Plus screw driver Screw driver</p>
3		Fan	<p>(1) Sufficiently clean tapered shaft at end of armature and taper hole of fan.</p> <p>(2) Fit fan into position with key.</p> <p>(3) Screw in 10 mm bolt and tighten to specified torque. (2.5 kg-m, 220 in-lb)</p> <p>(4) Insert finger through contact point inspection door and check whether cam operates smoothly.</p>	<p>(1) Taper: Hissaido $\frac{1}{32}$, Kokusan $\frac{1}{32}$.</p> <p>(2) See that there is no interference between cam and breaker, cam and oil felt.</p>	<p>Torque wrench (#17 socket)</p>

Sequence	Illustration	Part	Main assembling operation	Cautions	Tools used
4		Check contact breaker point gap.	(1) Bring top mark (red T) on fan to top mark on stator. (2) Check contact breaker point gap with feeler gage. Gap: 0.3—0.4 mm. (3) Point gap may be adjusted by loosening breaker plate installation bolts and turning eccentric screw.	(1) See if contact points are oily or burnt. (2) Insert feeler gauge parallel to point surfaces. (3) After adjustment, reinstall securely.	Feeler gage Screw driver
5		Check firing angle.	(1) See if fan mark (red mark not marked T) coincides with stator top mark when contact points are open. Firing angle initial setting: $5 \pm 1.5^\circ$ (2) If it does not coincide, adjust by loosening adjusting plate on which contact breaker plate is installed.	(1) After adjustment, reinstall securely.	Screw driver
6		Dust cover	Tighten two small screws.	Check for presence of impurities.	Screw driver
7		Fan cover	Fix equipment with three 6mm bolts, one 5mm bolt, and five 5mm plus screws. Use a spring washer on each.	In fixing fan cover, be careful not to let rectifier panel end touch and damage lead wire insulation or starter terminal rubber caps.	1/10 hex spanner (for 6mm bolts) 1/9 hex spanner (for 5mm bolts) Plus screw driver
8		Ignition coil	(1) Fasten equipment to shaft retainer plate with two 6mm bolts. (2) Attach brown line (Terminal ①) to Terminal 1 (-) of ignition coil. (3) Install spark plug cap.	Connect wirings securely.	1/10 hex spanner (for 6mm bolts) 1/9 hex spanner (for 5mm bolts)

8. Engine Installation on Scooter Body to Trial Operation

Sequence	Illustration	Process	Work details and cautions	Remarks
1		Installing engine on scooter body	See S 601 Workshop Manual Body Section.	
2		Regulator and ignition coil connections	Connect above lines securely by referring to attached name plates.	Regulator: Terminal F—one yellow line " 61—two lines, red " white " 50—one red line " 30—one thick black " line " 51 none " A—one thick black " line See Wiring Diagram.
3		Battery connection	First check on regulator and ignition connections to see if any lead wire or terminal is damaged or out of order, and if there are any obstacles (wires, etc.) that might cause trouble. If there are none, make connection at (+) terminal of batteries securely. Check ground wire connections.	
4		Preparations for operation	(1) Close battery cover. (2) Add fuel and lubrication oil (in transmission case). (3) Check other installation points and parts of scooter body.	
5		Starting		If starter does not work smoothly, take steps as shown in Troubleshooting.
6		Starter check	(1) Starter: Remove spark plug cap, turn main switch "ON" and press starter button. If the starter turns smoothly at 500~700 r.p.m., starter is good. (2) Dynamo: If the charge light goes out at below 1,500 r.p.m., dynamo is good.	See above.

9. Cautions in Handling

1. Do not use the starter continuously for more than five minutes as it consumes much power in a short time.
2. If the engine fails to start after pressing the starter button once, repeat up to about five times. If the engine still does not start, let the starter rest for about three minutes, and then try again.
3. At night when very cold, start the engine with the switch in the daytime position and turn the light on after the engine has started turning.
4. Once the engine starts, be careful not to press the starter button again. Pressing it for several minutes during driving—for instance, by mistaking it for the horn button—will lead to no serious consequences. Nevertheless, it will consume much battery power and may affect the engine or relay.
5. When stopping the engine, be sure to turn the key to "OFF" or "LOCK" to prevent waste of battery power.
6. When the starter does not turn powerfully (due to battery over-discharge or increased viscosity of lubricating oil in winter), use rope starter.
7. Use SAE 10W-30 Lubricating Oil. If this is not used, SAE #20 may be used in winter and SAE #30 at other times.

As the battery capacity decreases in winter, use oil with less viscosity resistance.

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PREFACE

The torque converter is simple in construction, has very few places that may be damaged, and is easy to handle. However, owing to the use of torque converting oil, its construction differs from that of ordinary mechanical reduction gearing, and there are many points that must be explained for maintenance.

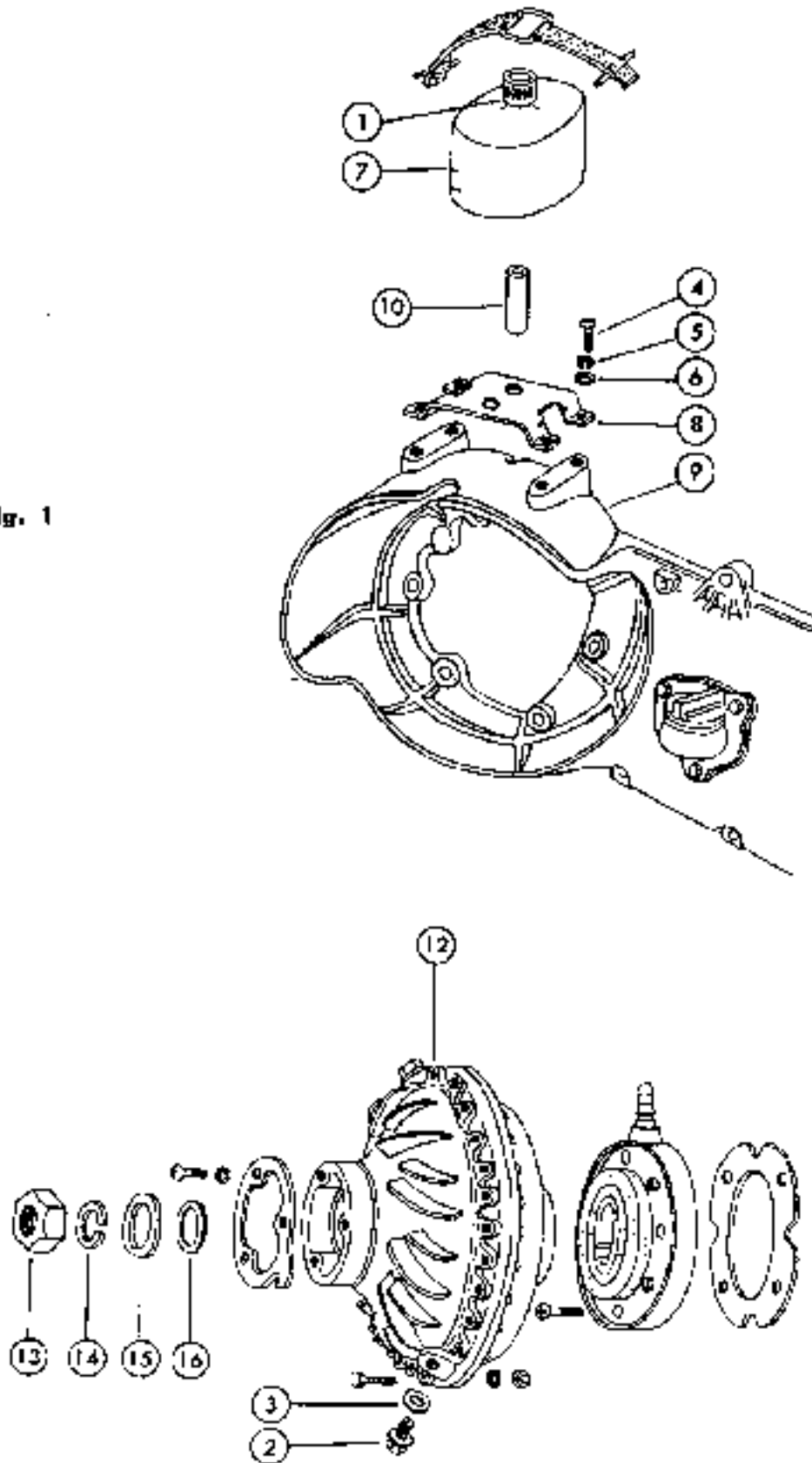
Since it is a device for transmitting pneumatic energy by means of the kinematic energy of the torque converting oil, the oil pressure and temperature will rise to a certain degree. Various measures are applied to deal with this pressure and temperature rise. This manual gives the various standards for its maintenance and repair as well as procedures for handling to ensure satisfactory service. The functions stated in the specifications can be obtained only through proper handling and proper maintenance. Therefore, study this service manual carefully to apply proper maintenance and to give proper guidance to the users concerning its use.

1. TOOLS REQUIRED FOR DISMANTLING AND ASSEMBLY

5, 6 and 14mm box spanners, medium size plus screw driver, mallet, tweezers, and torque converter extractor (M-79-468/1)



Fig. 1



2. DISMANTLING PROCEDURE

(1) Dismantling Torque Converter from Engine

FIG.	ORDER	OPERATION	DISMANTLING PROCEDURE	PRECAUTION	REMARKS	TOOL USED
1	1	Exterior washing	Thoroughly wash the exterior surface to prevent dust and grime from entering when dismantling.	Do not use water.	If water settles inside or mixes with the torque converter oil, it will evaporate and expand during operation.	Use light oil or gasoline for washing. Brush.
1	2	Drain torque converter oil	(a) Remove the oil tank cap ①. (b) Remove the plug screw ② and drain the oil into the oil drain pan. (Turn the plug handle downward.)	Do not lose 8 mm fiber packing ③.	Torque converter oil will not flow out unless ② is removed.	6 mm box spanner and oil drain pan.
1	3	Removal of 14mm tightening bolt	(a) Remove the 14 mm nut ④ which holds the converter proper ⑤ on the crankshaft. As shown in the photo, remove by using a mallet to tap the handle of the box spanner. (b) Remove the 14 mm spring washer ⑥, special washer ⑦, and "O" ring ⑧.			Mallet and 14 mm box spanner.

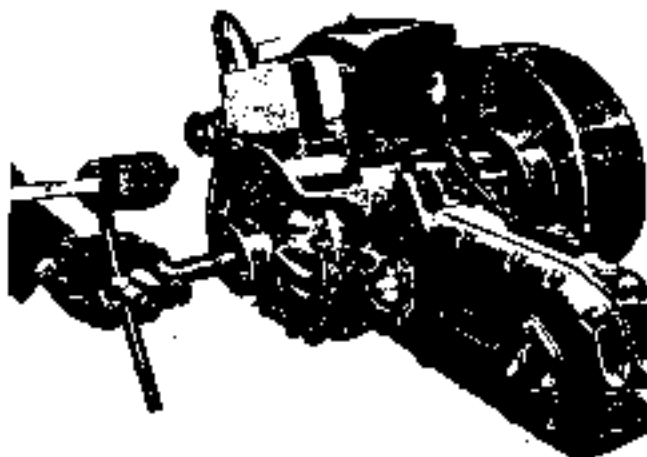


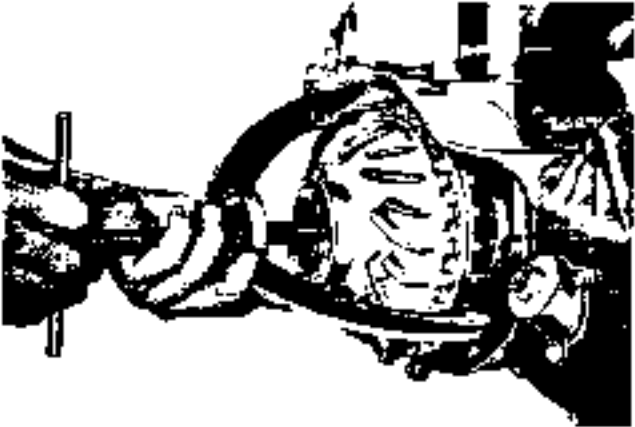
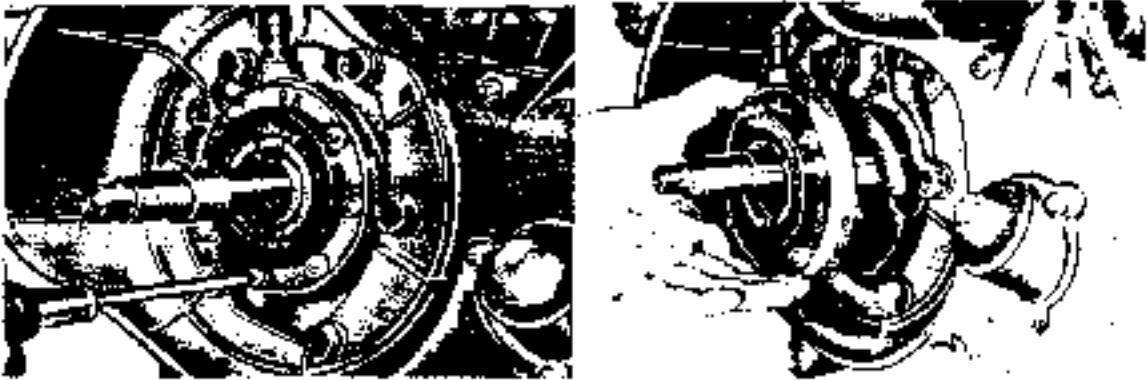
FIG.	ORDER	OPERATION	DISMANTLING PROCEDURE	PRECAUTION	REMARKS	TOOL USED
1	4	Detachment of the torque converter proper	Since the converter proper (a) is fixed on the crank by a key, detach it by using the special tool shown in the photo.	(a): Extract slowly from the crankshaft so that the oil seal will not be damaged. (b): "O" ring (b) will come out with it, be careful not to damage it.		Mallet and torque converter extractor TY-79-268/11
						
1	5	Detachment of oil tank	Unscrew the four 6mm screws (a). Oil tank (b) and oil tank bracket (c) will come out together when (b) is pulled upward from the chain case.	Do not use bolts and washers.		Plus screw driver
						

FIG.	ORDER	OPERATION	DISMANTLING PROCEDURE	PRECAUTION	REMARKS	TOOLS USED
2	6	Detachment of the free wheel.	(a) Unscrew four plus screws (1), and the free wheel (2) will come out. If it is difficult to separate, pry lightly by inserting a thin metal like a screw driver between the free wheel and chain case. (b) Remove the spacer.	When pulling out the free wheel, do not damage the oil seal lip.		Plus screw driver

The torque converter is now completely detached from the engine main body by the above procedure.

The individual parts of the torque converter are disassembled next.

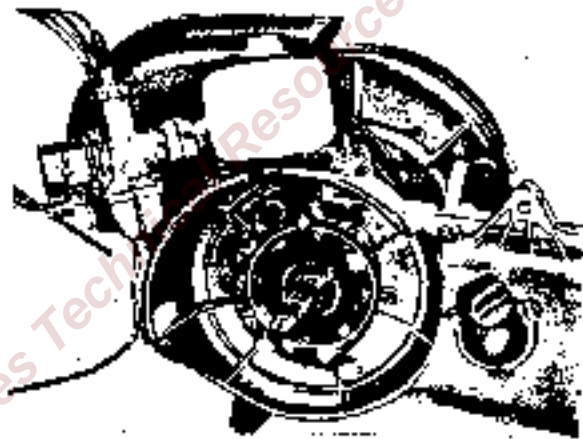
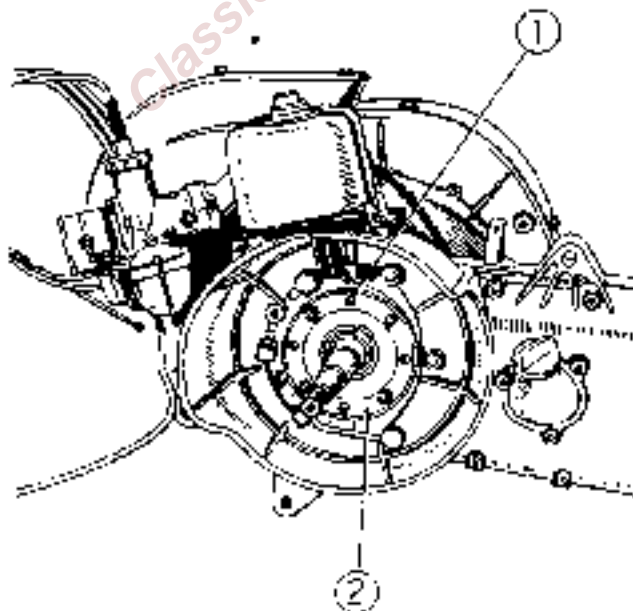


Fig. 2



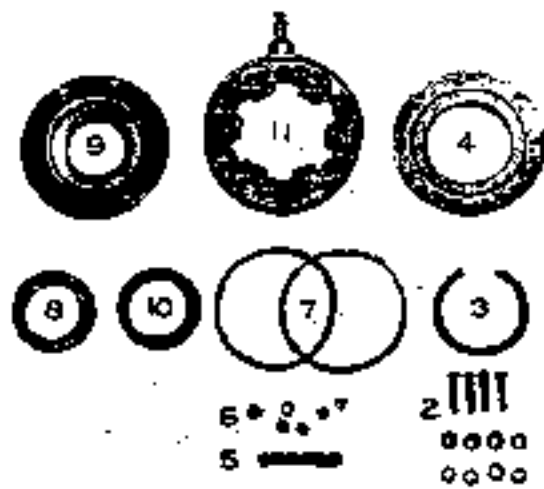
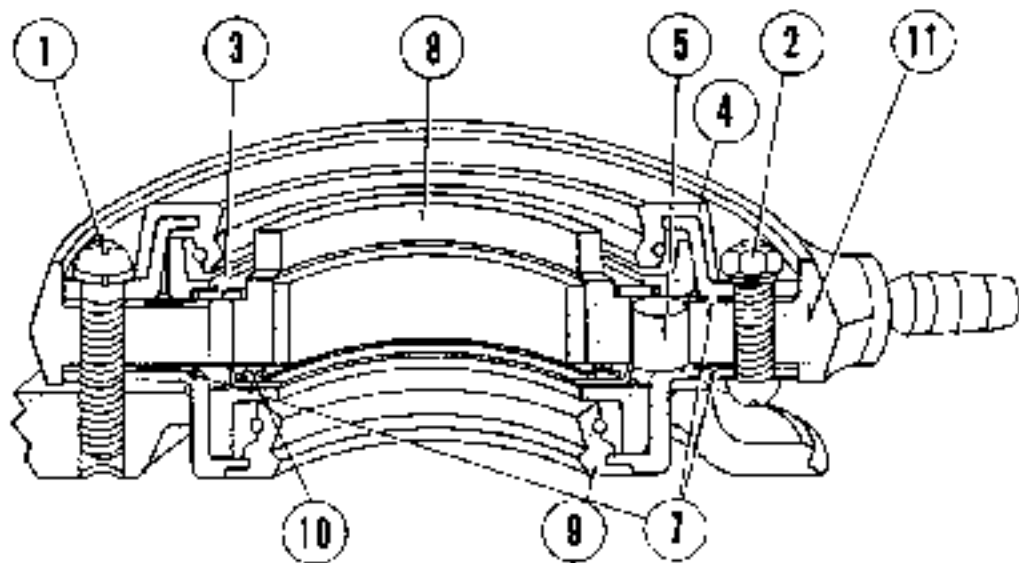


Fig. 3

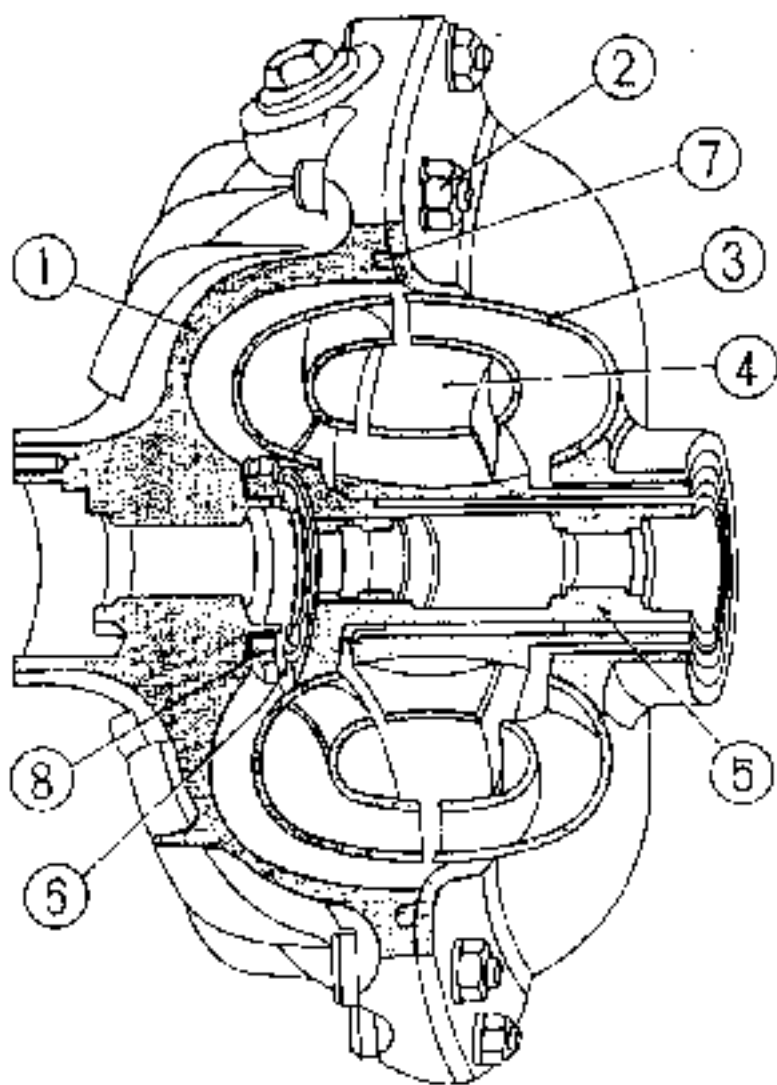


(2) Disassembly of Torque Converter Parts

(A) Disassembly of Free Wheel

FIG.	ORDER	OPERATION	DISMANTLING PROCEDURE	PRECAUTION	REMARKS	TOOL USED
3	1	Disassembling the freewheel sub-assembly	<p>(a) Remove the four 5mm screws (A).</p> <p>(b) Detach the oil seal (B) and packing (C).</p> <p>(c) Remove the retaining ring (D).</p> <p>(d) Detach the roller (E) and remove spring (F) by means of tweezers.</p> <p>(e) Remove the free wheel shaft complete (G) and the oil seal (H) packing (I) and thrust bearing (J) will separate from the free wheel retainer complete (K).</p>	<p>Note carefully the relative positions of the various parts for proper reassembly. Since the packing is thin paper, handle it with care.</p>		5mm box spanner, tweezers and plus screw driver

Fig. 4



(B) Disassembly of Converter Proper

FIG.	ORDER	OPERATION	DISMANTLING PROCEDURE	PRECAUTION	REMARKS	TOOL USED	
	4	1	Removal of 5 mm bolt	a. Remove the 5mm Bolts (2).	Remove the bolts evenly on opposite sides in the order 1 → 2 → 3 → 4 → 5 as shown in the photo:	Remove the bolts evenly on opposite sides to prevent deformation of impeller.	5mm box spanner
	4	2	Disassemble of converter	1a) Tap lightly around the perimeter of the impeller case complete (1) and impeller complete (2) as shown in photo before disassembly. This will facilitate separation as it is held together by lock pins. 1b) Disassemble in the order of impeller complete (3); "O" ring (4); stator complete (5), turner complete (6), and thrust bearing (7).	Since the thrust receiver (8) is force fitted in the impeller case complete, do not detach it unless the thrust surface is damaged.		Mallet.

This completes the total disassembly of the type MS3-A Torque Converter.

3. TROUBLE SHOOTING

Having explained the construction of the torque converter, we shall now deal with the types of trouble that may occur, how to investigate their causes, and the repair method to be applied.

(1) Leakage of Torque Converter Oil

Apply the following procedure to find where the leakage is occurring.

- ① Use cloth to wipe clean the exterior surface of the torque converter.
- ② Place a piece of paper at right angle to the converter rotating plane as shown in Figure 5.
- ③ Operate the engine at about 2,000 r.p.m.
- ④ Oil will splatter on the paper as illustrated in Fig. 5 and indicate the point of leakage.

Even when there is no leakage, oil adhering to the surface of the converter directly after supplying converter oil may splatter on the paper although the surface has been wiped with cloth. This condition will disappear after 2~3 minutes of operation.

Fig. 5

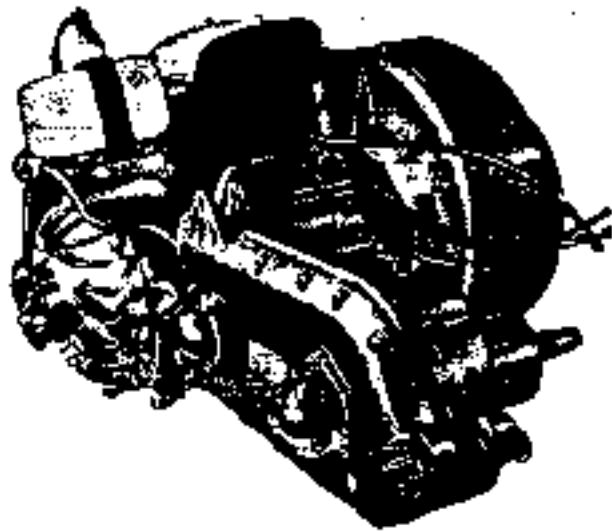
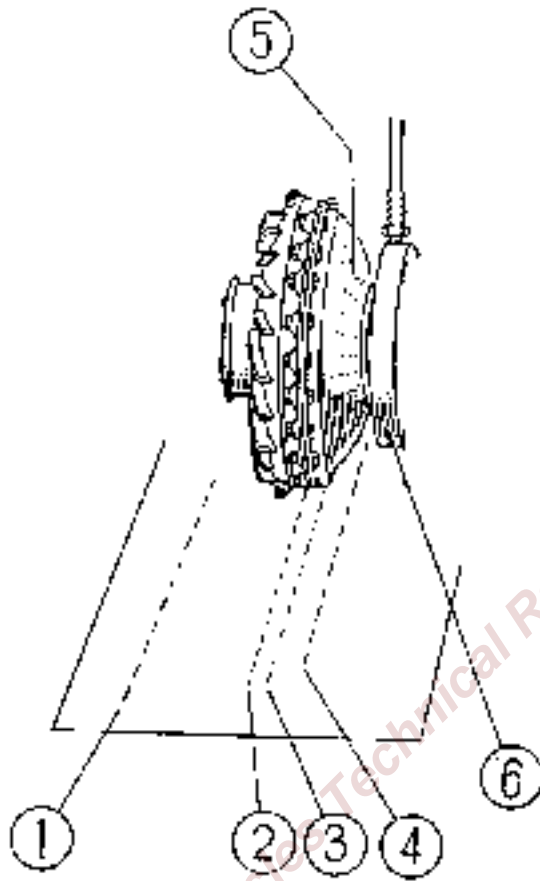


Fig. 6

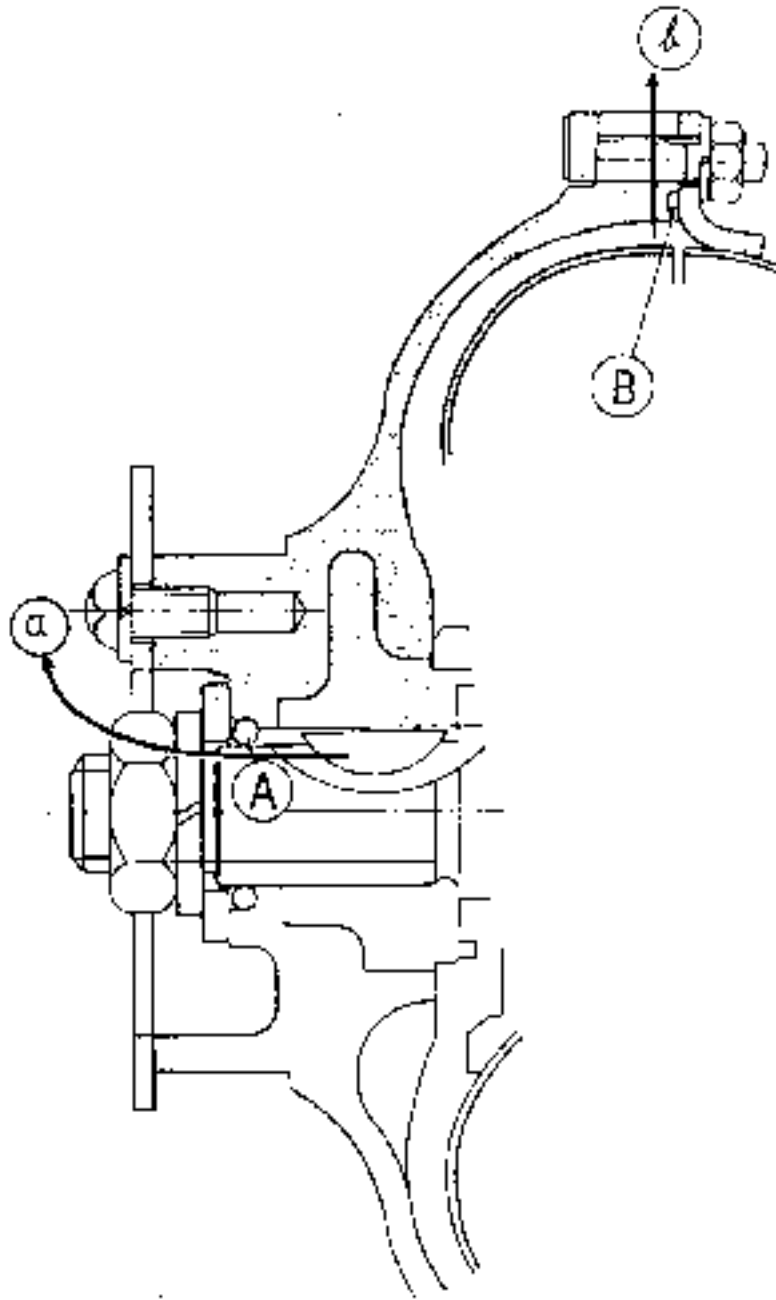


FIG.	OIL TRACE LINE	LEAKAGE POINT	CAUSE	MEASURES TO BE APPLIED
5 6	①	Oil leaks from ⑧ in Fig. 6.	Leakage from ⑧... Due to damaged "O" ring ⑧	Replace with new part.
5 6	②	Oil leaks from ⑩ in Fig. 6	"O" ring ⑩ tends to stretch slightly in radial direction and it has become deformed or glazed.	Replace with new part
5 7	③ or ④ ○ if radial oil trace is found in lines ③ when engine is stopped (Fig. 5)	Oilseal ⑥ in Fig. 7 is damaged and oil leaks from the oilseal lip (Fig. 7)	Check the mileage when the oil level is at the maximum line and check the mileage again when the oil level drops to the minimum line. If the distance travelled is less than 3,200 km (2,000 miles), the oilseal is damaged. (0.020 pints-125 miles)	Replace with new oilseal. If scratches, burns, etc. are found on the opposing shaft, finish it carefully and smoothly with sand paper.
5 7	Oil adheres to hand when hand is placed on ⑩ (Fig. 5)	Oil leaks through ⑧, ⑩ or ⑪. (Fig. 7)	(a) Leakage from ⑧... There is oil on base ⑩ of nipple due to damage of vinyl tube ⑧ (b) Leakage from ⑩ or ⑪... due to damaged packings ⑩	Replace with new parts
Note	Oil does not leak out of converter but air diminishes	(a) Oil leaks into the crank case through oilseal ⑥ (b) As indicated by ⑨ in the following diagram, oil leaks into crank case through the oilseal. (c) Oil leaks through the soft hole gap such as ⑦ in Fig. 7.	(a) Oil leaks due to damage lip of oilseal. (b) " (c) Due to damage the packing ⑩ (Fig. 7)	Replace with new part.

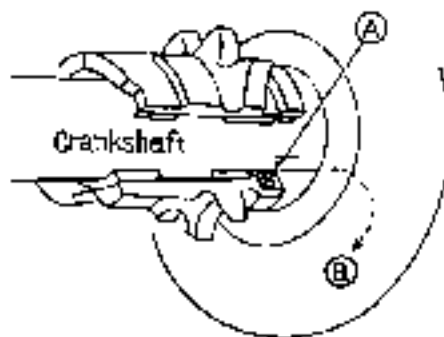
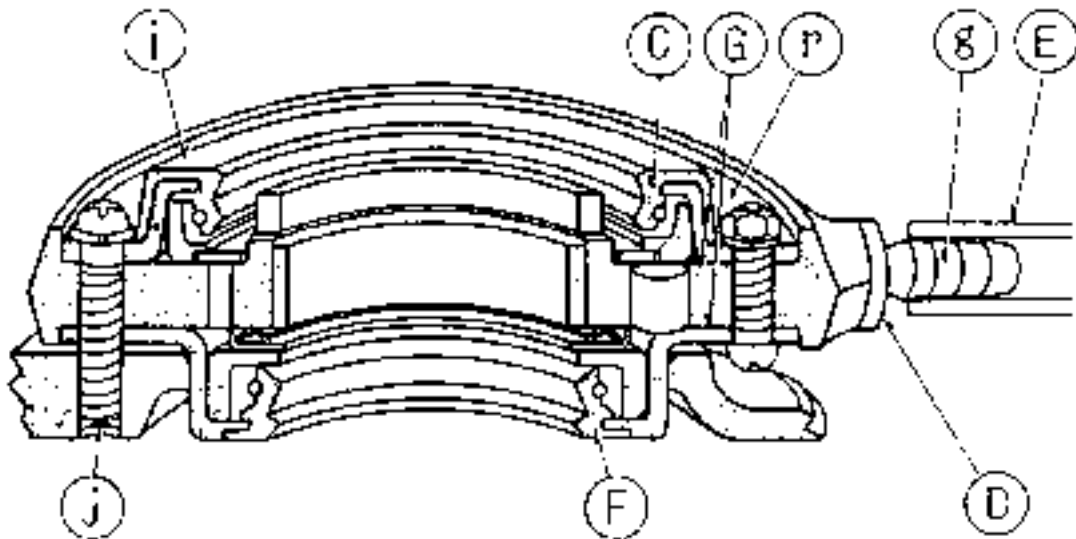
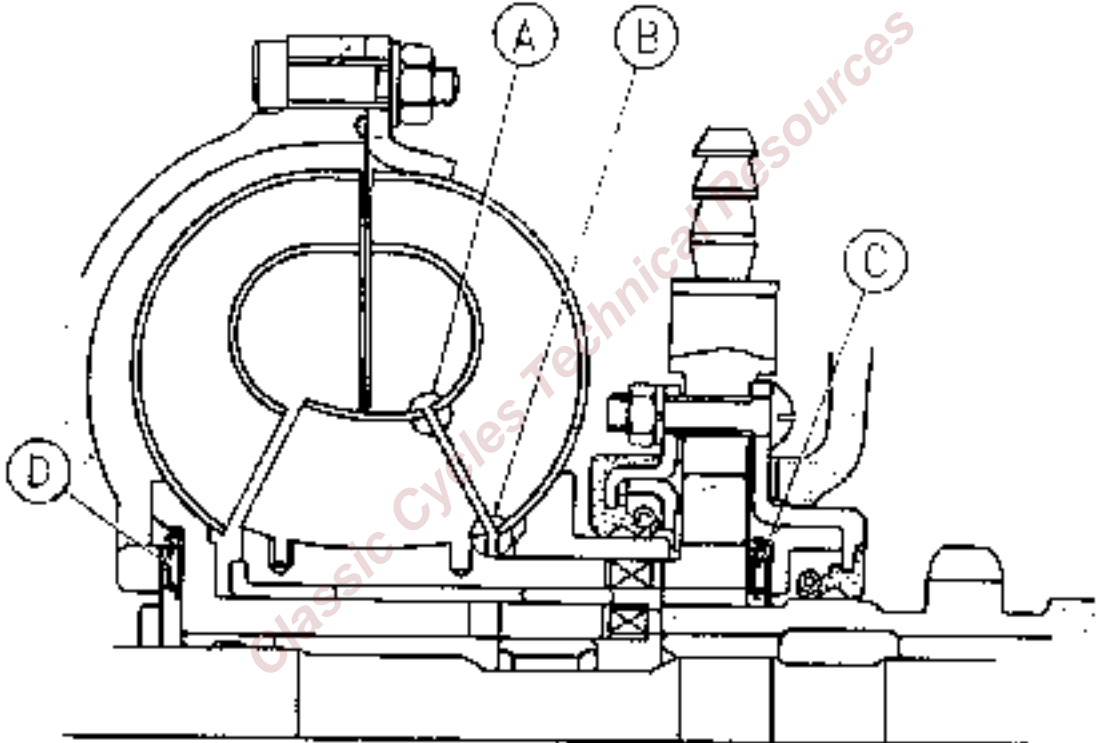


Fig. 7



(2) Other Troubles

TROUBLE ITEM	DEFECT	CAUSE	MEASURES TO BE APPLIED
Metallic noise is heard inside converter.	The stator is hitting the impeller.	When stator is hitting impeller, Point (A) or (B) in following diagram is first. This is due to wear of thrust bearing or too much clearance at (C) and (D).	Replace the bearing.



4. ASSEMBLING PROCEDURE

The dismantling procedure is reversed for assembling. If it is not done properly, assembling work will become difficult and trouble will occur. The assembling procedure is explained here for your convenience.

FIG.	ORDER	ASSEMBLING POINT	PROCEDURE	PRECAUTIONS	REMARKS	TOOL USED
4	1	Assembling of converter proper	Assemble in the order of ① → ② → ③ → ④ → ⑤ → ⑥	1. Clean each sliding surface and rotating surface for abnormal conditions. 2. Repair if found abnormal. 3. Replace "O" ring ⑦ if it is damaged as it will cause leakage.		
	2	Attachment of 5mm bolts	As in the case of dismantling, tighten the opposing bolts evenly. Tightening torque is 0.36 kg-m (2.58 ft.-lb, 31 in.-lb).			5 mm box spanner
3	3	Assembling of free-wheel small assembly	(a) Assemble in order of ① → ② → ③ → ④ (b) Insert spring ⑤ and roller ⑥ after inserting free-wheel shaft complete ⑦ (c) Insert ⑧, ⑨ and then ⑩ (d) Tighten the 5mm screw ⑪	(a) Do not mistake the front and back side of the free-wheel retainer cam plate ① (refer to photo)		Tweezers, 5 mm box spanner, plus screw driver

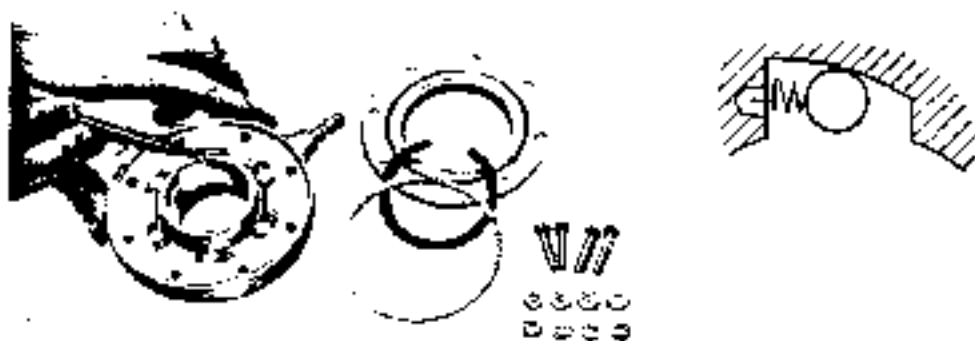
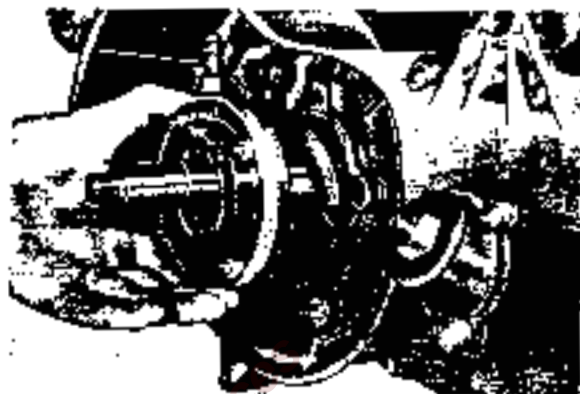
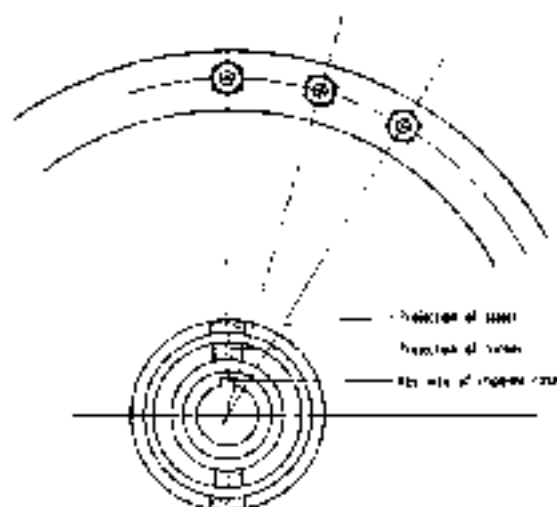
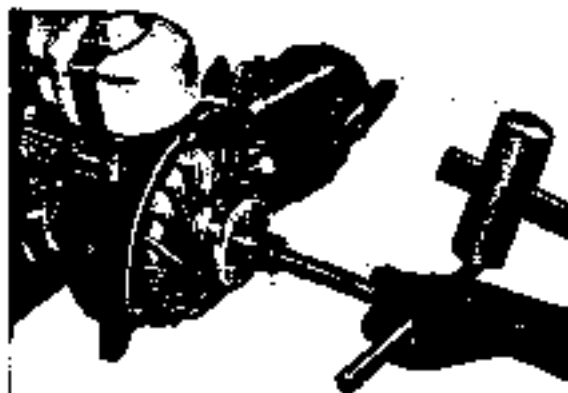


FIG.	ORDER	ASSEMBLING POINT	PROCEDURE	PRECAUTIONS	REMARKS	TOOL USED
	4	Mounting	Assemble the free-wheel assembly as shown in photo. Insert spacer and freewheel together on the crankshaft.	Set the relative position as shown in photo.		
2	5	Bolting of free wheel assembly on engine	Tighten the four 5 mm plus screw.	Tighten the four screws evenly.		Plus screw driver
1	6	Attachment of oil tank	Place vinyl pipe (3) on nipple of free-wheel and attach the oil tank on the chain case with four 6 mm screws (4).	Replace the vinyl pipe if possible	If the vinyl pipe is deformed by heat, oil leakage will occur.	Plus screw driver

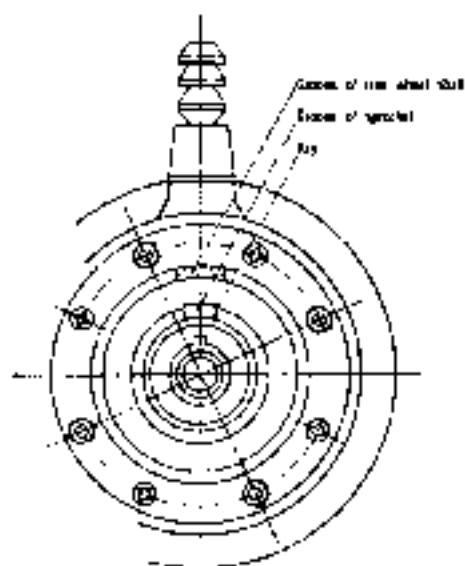


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FIG.	ORDER	ASSEMBLING POINT	PROCEDURE	PRECAUTIONS	REMARKS	TOOL USED
1	7	Tightening of converter proper	After mounting ⑬, ⑭, ⑮ and ⑯, tighten the 14 mm nut ⑰.	To reassemble the torque converter assembly, adjust the position of the grooves and key as shown in the illustration. Carefully maintaining those relative positions, fit the torque converter on the shaft and carefully aligning the key and key groove, slide into position. When the torque converter is correctly aligned and installed, the "O" ring will sit easily on the shaft. If the torque converter is installed improperly and tightened, the groove edges will become damaged.		Plus screw driver, 14mm box spanner and Mallet



"Converter proper" side



"Free wheel" side

FIG.	ORDER	ASSEMBLING POINT	PROCEDURE	PRECAUTIONS	REMARKS	TOOL USED
1	6	Supply of converter oil.	Remove blind plug (8) (Turn the blind plug hole upward) and pour oil slowly into the tank mouth until oil flows out of (9). Then close the blind plug and pour in oil to the prescribed level. Finally, tighten (1).	Since rust preventive agent, oxidizing preventive agent and bubble eliminating agent are contained in the oil, mix thoroughly before pouring in.		

Fig. 8

5. STANDARD TIGHTNESS AND PLAY (gap)

The standard play (gap) and the measuring method for the important parts are listed in the following table (Refer to Fig. 81).

PART NO.	STANDARD MEASUREMENT	MEASURING METHOD	REMARKS	MEASURING INSTRUMENT
1	0.2T ~ 0.14L (mm)	Measure inner diameter of oil seal lip with slide calipers.	(a) Do not push up lip when measuring inner diameter of oil seal lip. (b) Do not damage lip.	(a) Slide calipers (b) Micrometer
2	0.8T ~ 1.2T (mm)			
3	0.8T ~ 1.2T (mm)			
4	0.2T ~ 0.14L (mm)			
5	Free gap of 0.04L ~ 0.08L (mm)	Measure inner and outer diameter with micrometer.		Micrometer
6	0.08L ~ 0.18L (mm)			
7	0.05L ~ 0.1L (mm)			
			L: Clearance T: Tightness Operation becomes poor if this gap increases.	

6. INSPECTION

After completion of assembly, inspect the following points:

- (1) Check whether parts are tightened to indicated torques.
- (2) Rotate the converter proper lightly by hand and check for abnormal resistance.
- (3) Wipe off all oil silt on converter exterior when filling oil.
- (4) Operate the engine and check for oil leakage.
- (5) When the engine is stopped, the oil level in the tank will usually drop to some extent. Therefore, replenish oil to the prescribed level. When replenishing oil, air may be left in the small corners inside the converter. The oil level drop occurs when this air comes out during operation.

7. HANDLING

- (1) Differing from the ordinary centrifugal clutch, the torque converter will be transmitting a torque, although slight, to the rear wheel even when the engine is revolving slowly. Therefore, when "starting," **ALWAYS LOCK THE FRONT WHEEL BRAKE.**
- (2) Before operation, check the oil level in the oil tank to see if it is proper. Do not fill above the maximum oil level.
- (3) Best oil level for operation is between the maximum and minimum tank oil levels.
- (4) If converter is not filled completely with oil, efficiency may drop.
- (5) The oil level in the oil tank will rise during operation due to heat expansion, but it will return to the original level when cooled after operation.
- (6) When checking the oil level, place the scooter in level position and have the converter temperature equal to the outdoor temperature.
- (7) This torque converter is of the air-tight type, and the tank cap should be removed occasionally when the engine is cold to equalize the air pressure. The cap must be refitted tightly.
- (8) Use the specified torque converter oil. Since anti-rust, anti-oxidizing and bubble eliminating agents are contained in the torque converter oil, it will display 100 percent efficiency. Mix this oil well before pouring into the torque converter.
- (9) This oil will become quite dirty at first due to the initial wear of various torque converter parts. Therefore, change this oil after travelling 3,000 km.
- (10) When the specified oil is not available, the following type may be used but it must be replaced with the specified oil as soon as possible.
 - (a) Spindle oil (for bicycles, etc.)
 - (b) No. 30 automobile oil 50% + kerosene 50%. Mixed thoroughly.

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