1976 Massey Whirlwind

INDEX

IGNITION

Functional Description:
(See SCHEMATIC FIG. 3-7).

Cuyuna engines are equipped with a flywheel magneto type ignition. An electrical current is generated by rotating a permanently magnetized flywheel about the ignition coil. The current initiated in this coil in turn energizes the primary coils of the external ignition coils. The secondary coils of the external ignition coils are situated in the force field generated by the primary coils.

When the points close, causing an interruption of the current flow through the primary winding, its force field immediately collapses and generates a very high voltage in the second coil. This voltage in the region of several thousand volts will jump the spark plug gap causing ignition to begin.

The collapsing lines of force cut through the primary windings, raising the voltage in that circuit also. As this occurs, the condenser absorbs the generated current to reduce the tendency to overload the points. As soon as the voltage level in the primary winding drops below that of the condenser, current again flows in the original direction, energizing the system. This occurrence and the reversal happens several times each cycle creating a powerful, long duration spark for more reliable ignition.

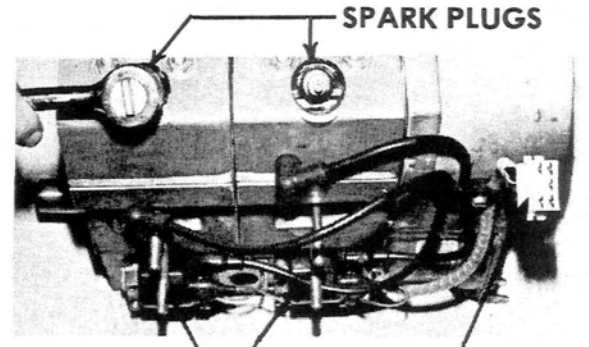


FIG. 3-3

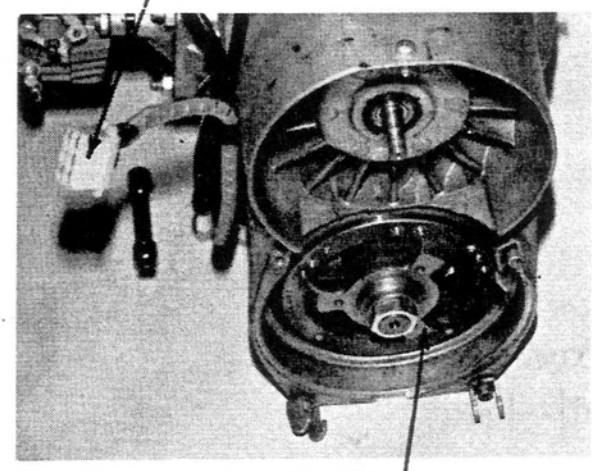


FIG. 3-4

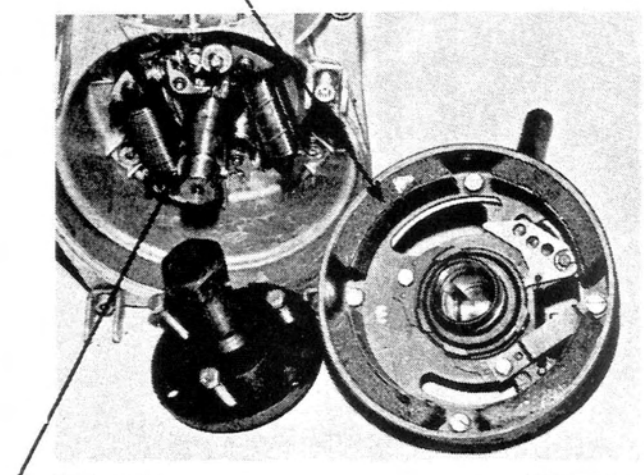


FIG. 3-5

MAIN ELEMENTS:

1. Ignition Coil (Stator)
2. Condensers (2)
3. Breaker Points (2)
4. Ignition Coils (External) (2)
5. Spark Plugs (2)

1976
Massey
Whirlwind

Service Manual

Engine Section

ENGINE SYSTEM

. unctional Description:

2-CYCLE ENGINE FUNDAMENTALS

The Cuyuna 2-cycle air-cooled gasoline engine, particularly the axial fan-cooled twin cylinder engine, has become very popular today for snowmobiles. It is uniquely qualified for this application because of its high power output, light weight and ease of lubrication, with fewer moving parts than other conventional 2-cycle and 4-cycle engines.

However, in order to get the best possible use and ensure that it retains its high degree of dependability and endurance, it must receive proper care and maintenance. Therefore, it is necessary for us to know something about the basic fundamentals of this engine and how it functions.

OPERATION

The Cuyuna 2-cycle Twin Cylinder engine is of the loop-scavenged third port type, the most widely used design today. It uses a mixture of gasoline, oil and air for combustion, lubrication and cooling. It fires on every stroke of each piston. There are two power strokes for every revolution of the crankshaft.

As the piston moves upward in the cylinder it draws the fuel/air mixture into the crankcase through the intake manifold while at the same time compressing fuel that has been forced into the combustion chamber. See Fig. 1-1A.

As the piston nears top dead center the spark plug is fired and the compressed fuel/air mixture burns and expands thereby forcing the piston downward on a power stroke.

As the downward stroke of the piston turns the crankshaft, it also starts to compress the fuel/air mixture in the crankcase and, simultaneously, opens the exhaust port and closes the intake port. See Figs. 1-1 B & C.

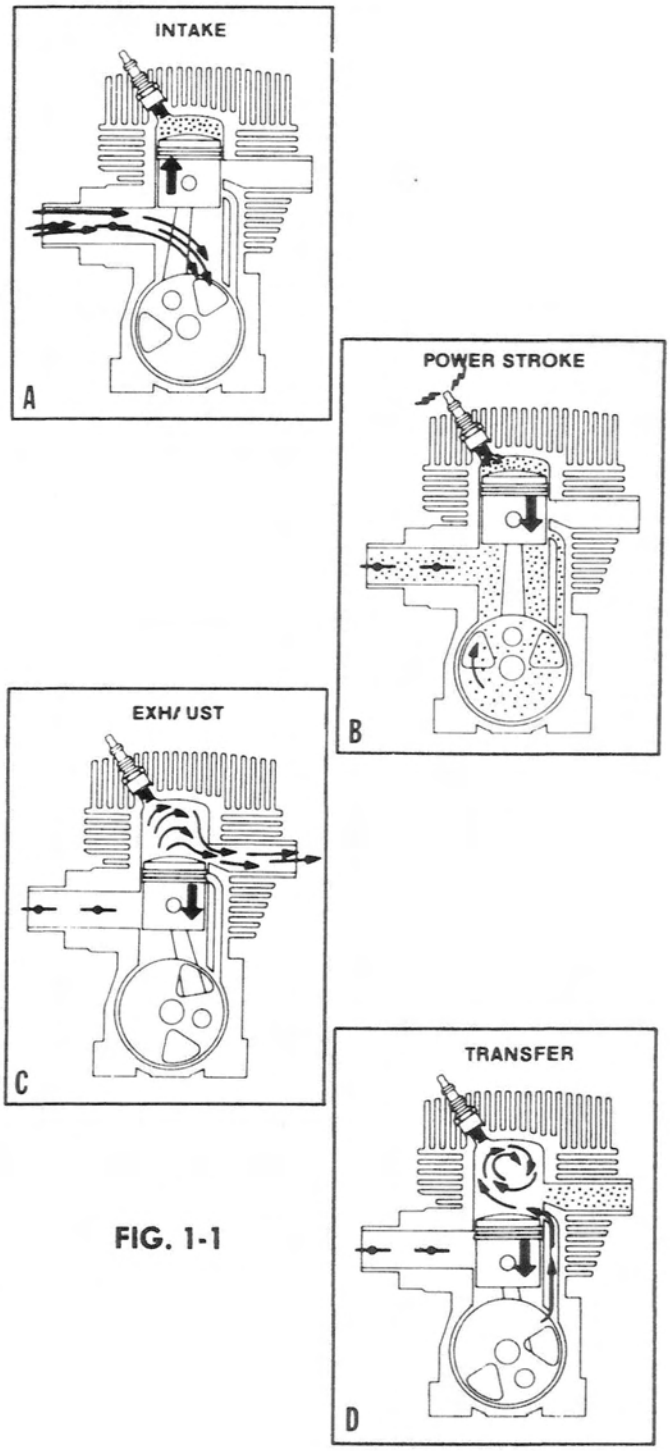


FIG. 1-1

After the exhaust port is fully open and the intake port is fully closed, further piston travel starts to open the transfer ports. The compressed fuel/air mixture from the crankcase then travels up the transfer ports and into the combustion area.

After most of the burned exhaust gases have left the cylinder, an incoming charge of fuel/air mixture scavenges the combustion area giving it a fresh charge and the cycle is then repeated. See Fig. 1-1 D.

Because lubrication is dependent on the mixing of oil and fuel, it is extremely important that good quality oil and gasoline are properly mixed. The proper ratio of oil to gasoline will prevent possible engine overheating, piston or cylinder scoring, or eventual engine seizure. Too much oil and not enough gasoline can lead to incomplete combustion, fouled plugs, carbon build-up and muffler clogging.

EXHAUST SYSTEMS

SELECTION

Selection of an exhaust system (including exhaust manifold, intermediate pipes, elbows and muffler), is a result of thorough test procedures involving measurement of fuel consumption, horsepower and noise level. Contrary to popular belief, the exhaust system is not only for quieting the engine, but also serves to increase horsepower output. Changes made to the original equipment exhaust system by changing any component in the system can result in loss of power and/or severe engine damage. For these reasons, intermediate lengths of pipe betweeen the cylinder and the muffler are particularly critical.

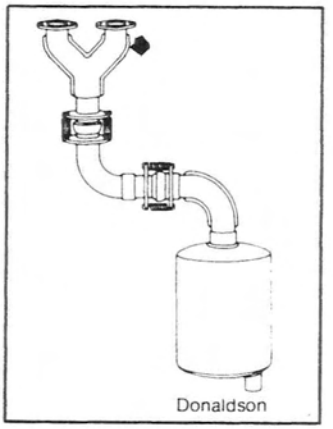
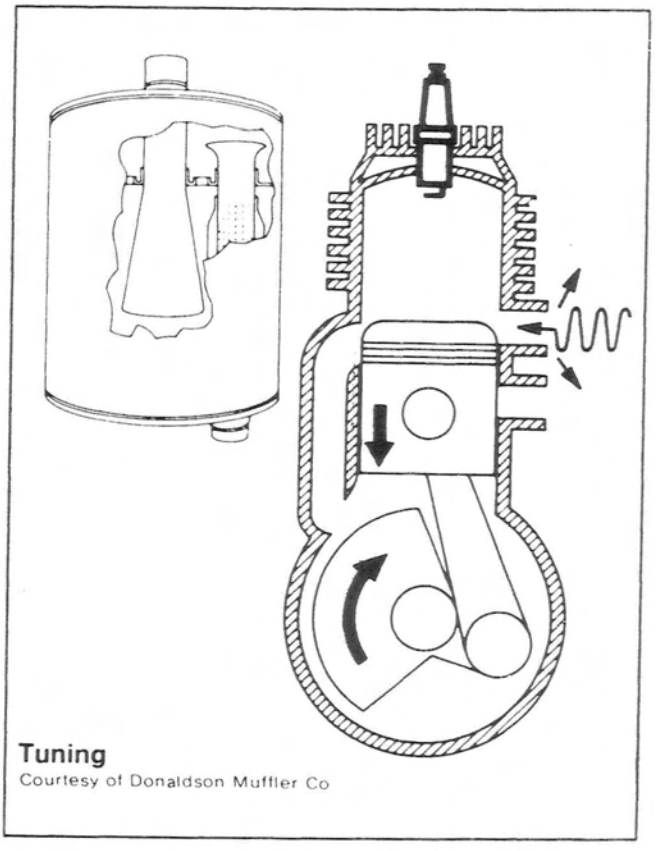


FIG. 1-2

TUNED MUFFLERS

Tuned mufflers allow the engine to exhaust its spent charge into an adequate volume and properly matched muffling system. More important, the mufflers that are tuned, incorporate designs that suck the exhaust gas from the cylinder allowing fuel and air to rapidly replace it and also "cram" over-scavenged fuel and air mixture from the exhaust pipe back into the cylinder using sound waves and sound energy. This is accomplished at the speed of sound which allows the engine to produce higher torque at higher RPMs.



Tuning
Courtesy of Donaldson Muffler Co

FIG. 1-3

HOW TUNING WORKS

The megaphone effect of the expanded intake tube scavenges exhaust gas from the cylinder allowing rapid replacement of the fuel/air mixture from the crankcase. Reflected sound waves and sound energy stop over-scavenging and return fuel/air mixture to the cylinder. It gives a supercharging effect even though it operates from the exhaust rather than the intake side. Over-scavenging is also retarded by moderate muffler back pressure. Silencing is accomplished after power is maximized by acoustical packing in the resonator outlet tube plus chambering and baffling which gives an effective 2-pass muffler design.

TABLE OF SPECIFICATIONS

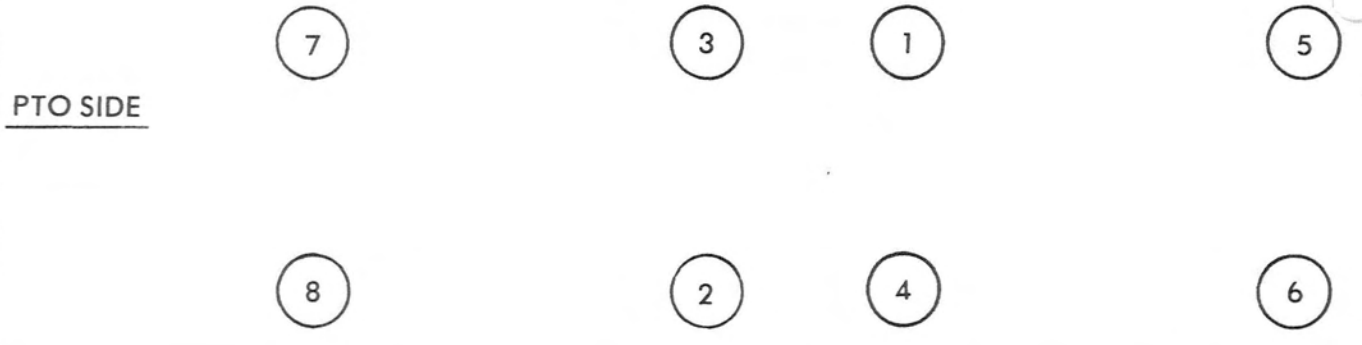
DESCRIPTION	ENGINE MODEL		
	CUYUNA 340	CUYUNA 400	CUYUNA 440
BORE	2.362" (60 mm)	2.559" (65.0mm)	2.658" (67.5mm)
STROKE	2.362" (60mm)		
DISPLACEMENT IN cc	338	398	428
COMPRESSION RATION (actual)	12:1	12:1	12:1
IGNITION SYSTEM	Bosch Flywheel Magneto		
LIGHTING COIL VOLTAGE AND OUTPUT	12V-150W	12V 150W	12V 150W
*TIMING BEFORE TDC (CENTRIFUGAL WEIGHT ADVANCED)	.102 - .112	.102 - .112	.102 - .112
TIMING BEFORE TDC (CENTRIFUGAL WEIGHT RETARDED)	.018" to .020"	.018" to .020"	.018" to .020"
BREAKER POINT GAP	.014" to .016"		
SPARK PLUG THREAD	14mm. x 1.25 - 3/4" reach		
SPARK PLUG GAP	.020" (0.5mm.)	.020" (0.5mm.)	.020" (0.5mm.)
SPARK PLUG (ORIGINAL EQUIPMENT)	CHAMPION N-3	CHAMPION N-3	CHAMPION N-3
TYPE OF ENGINE COOLING	Axial Flow Fan		
ROTATION OF CRANKSHAFT	Counterclockwise (PTO side)		
CARBURETOR	Walbro W F		
FUEL/OIL RATIO	As Specified on Massey approved Oil Container		
GASOLINE	95 octane, minimum (lead free not acceptable)		
TYPE OF OIL	Special 2-Cycle Snowmobile Oil		

* Do not exceed indicated advance, as this will result in severe engine damage.

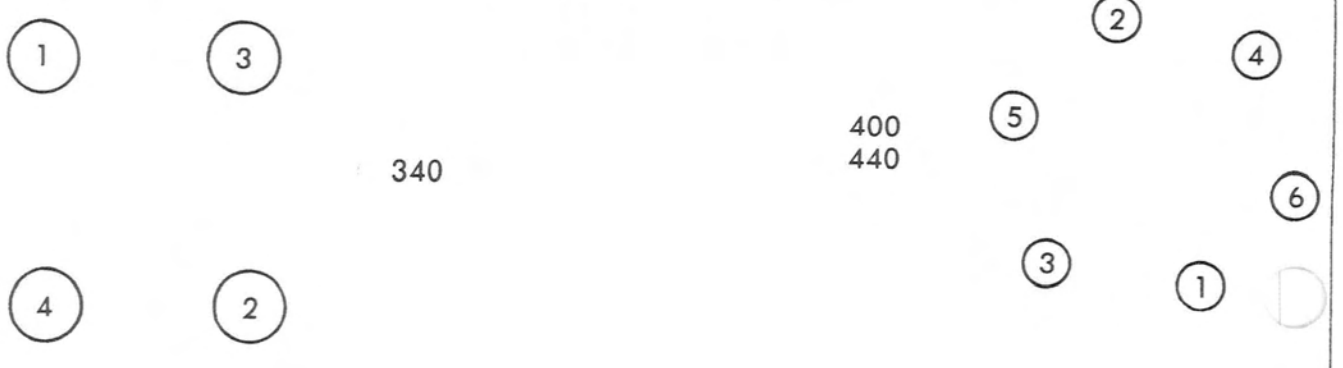
TABLE OF SPECIFICATIONS

TORQUE SPECIFICATIONS	CUYUNA 340	CUYUNA 400	CUYUNA 440
CYLINDER HEAD NUTS	28-32 Ft.-Lb.	16-18 Ft. - Lbs.	
CYLINDER BASE NUTS	16-18 Ft. - Lbs.		
FLYWHEEL NUT	44-50 Ft. - Lbs.		
INTAKE MANIFOLD NUTS	16-18 Ft. - Lbs.		
FAN HOUSING SCREWS	16-18 Ft. - Lbs.		
FAN WHEEL NUT	22-24 Ft. - Lbs.		
RING GEAR SCREWS (6mm.)	6-7 Ft. - Lbs.		
RING GEAR SCREWS (8mm.)	10-12 Ft. - Lbs.		

Tightening Sequence for Cylinder Base Nuts
All Models



Tightening Sequence for:
Cylinder Head Nuts, Fan Housing, Ring Gear Flange, Intake Manifold
and Recoil Starter Clamps



CUYUNA TWIN CYLINDER ENGINES

ODELS CUYUNA 400, 440

DISASSEMBLY

A. Recoil Starter

Remove four (4) screws holding the recoil assembly to the fan housing.

See Fig. 1-4.

See pages 1-28 A, B, C for recoil starter disassembly.

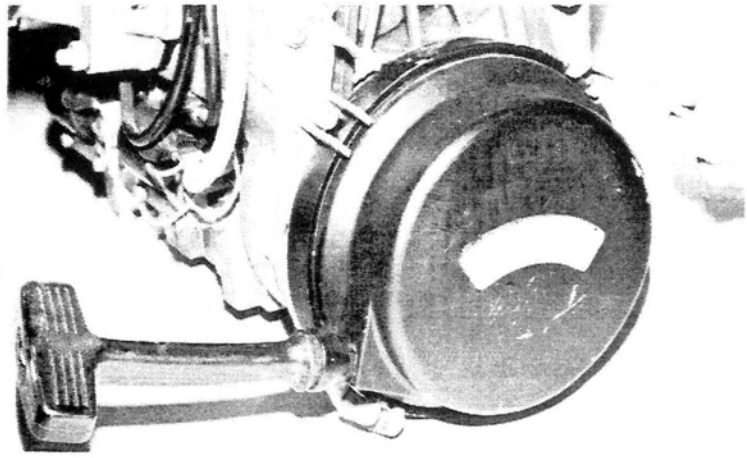


FIG. 1-4

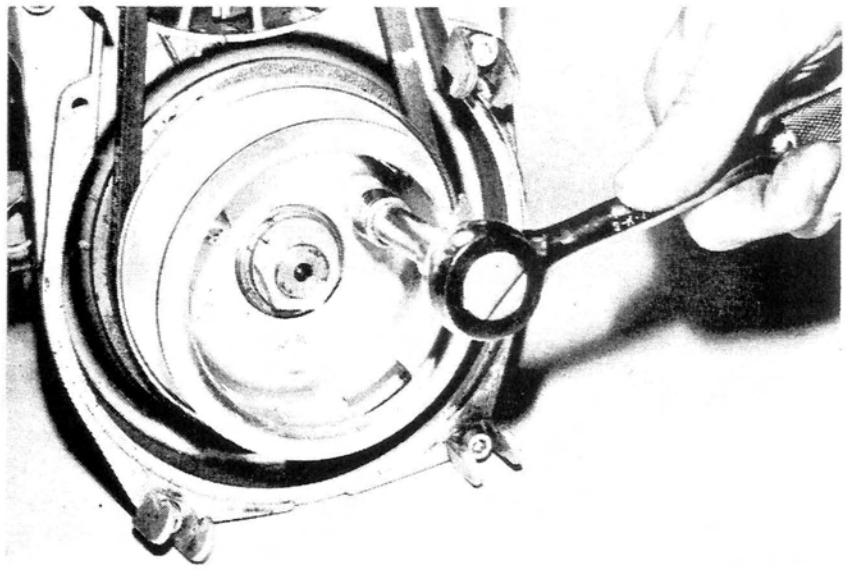


FIG. 1-5

B. Lower Fan Pulley and Carrier Assembly

Remove the three (3) hex head bolts on the carrier. Remove carrier, lower pulley assembly and V-belt. See Figs. 1-5, 1-6.

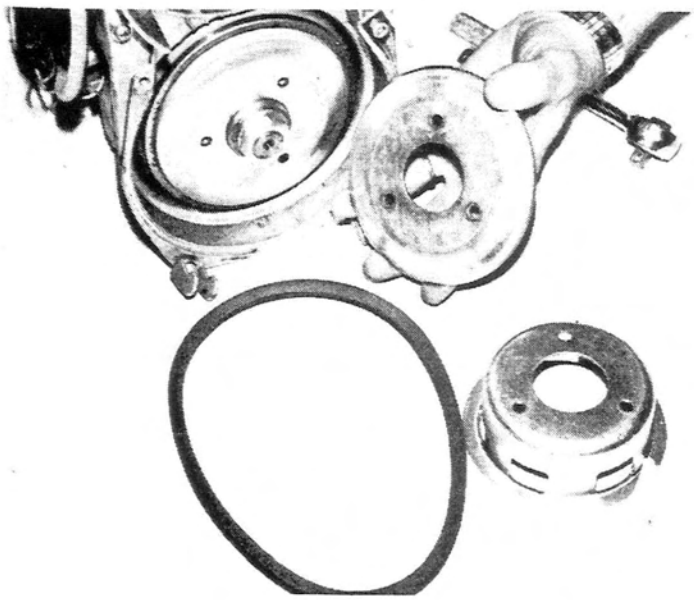


FIG. 1-6

C. Upper Fan Belt Pulley Assembly.

Insert a 3/16" drill or a suitable punch through the indexing hole into the impeller body. With a 17 mm socket wrench, remove the fan nut, lock washer, pulley halves and spacers. See Figs. 1-7, 1-8, 1-9.

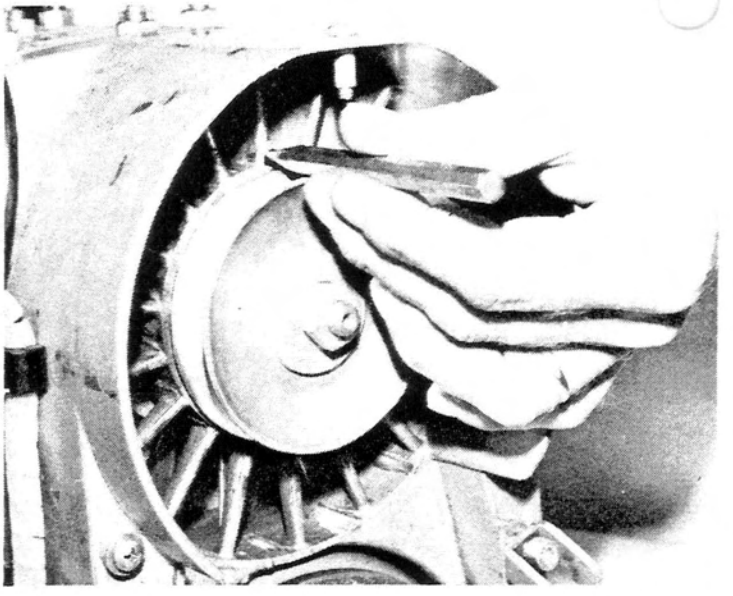


FIG. 1-7

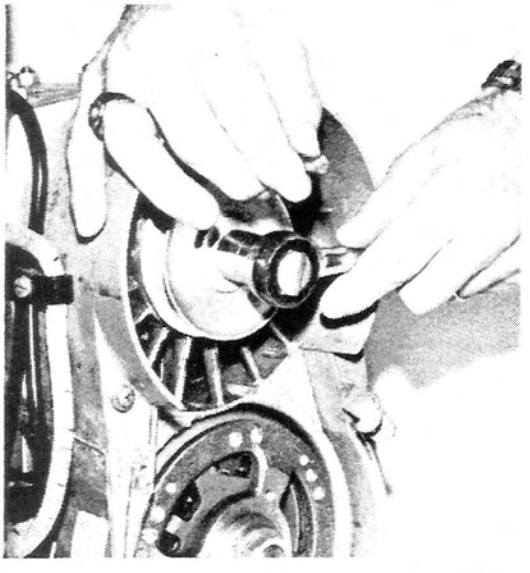


FIG. 1-8

FIG. 1-9

. Flywheel Magneto

Remove the crankshaft nut using a 27 mm socket wrench. Pull the flywheel by attaching flywheel puller 444-31-843-2 to the flywheel flange using bolts provided. Screw the three bolts through the puller into the flange and tighten evenly. With a socket wrench, tighten the puller bolt until the flywheel loosens on the crankshaft. See Figs. 1-10, 1-11, 1-12, 1-13.

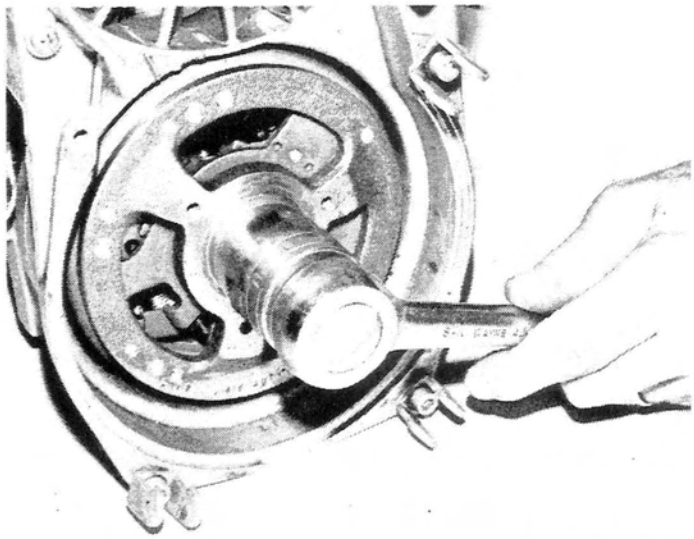


FIG. 1-10

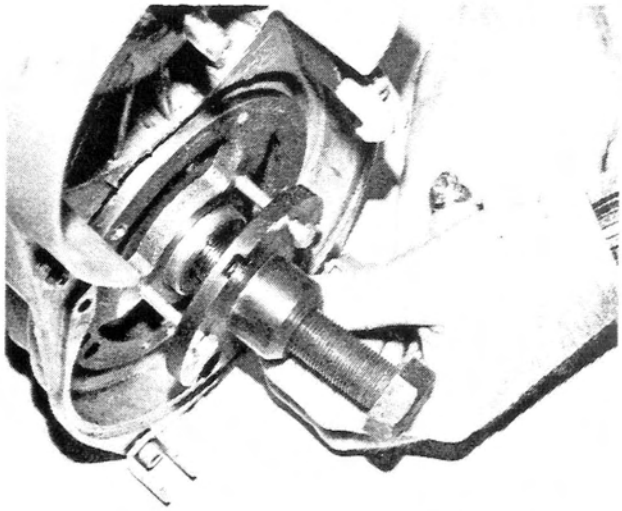


FIG. 1-11

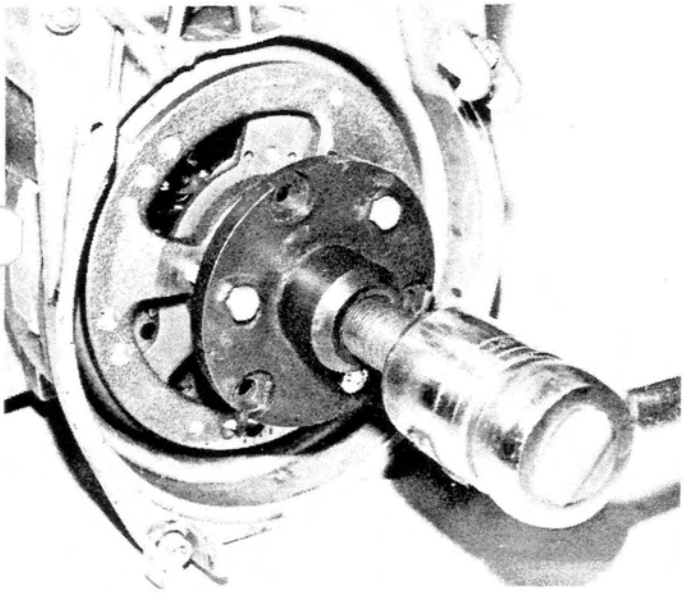


FIG. 1-12

NOTE: It is important that care be taken in removing the flywheel assembly because the positioning key located in the keyway may stay in its original position and thereby cause damage to the advance mechanism. A small ·epick or screwdriver may be used to loosen ·d remove the key.

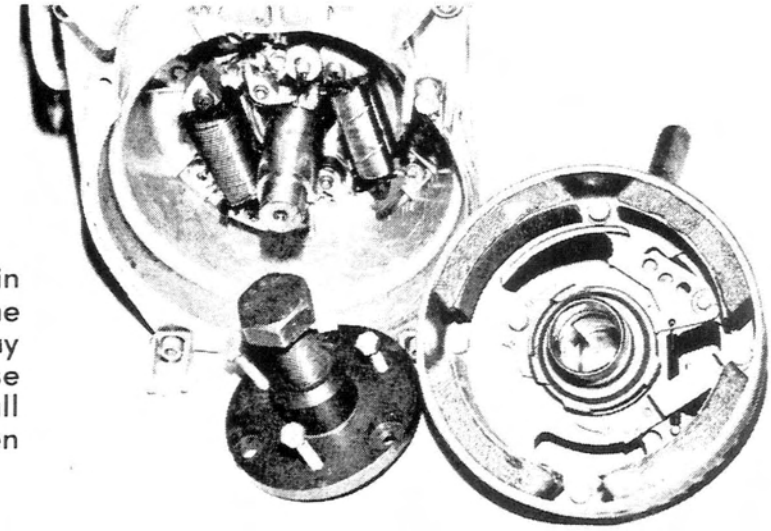


FIG. 1-13

E. Intake Manifold Assembly

Remove the four (4) intake manifold nuts and washers. Remove manifold assembly and insulators. See Figs. 1-14, 1-15.

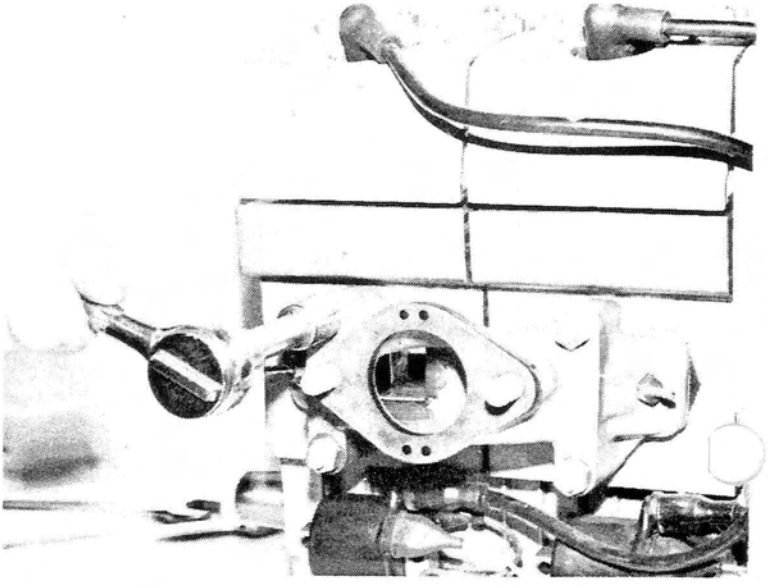


FIG. 1-14

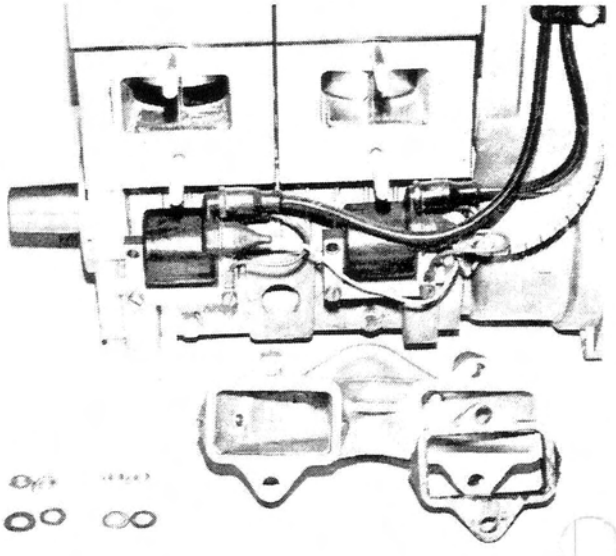


FIG. 1-15

Fan Housing and Armature Plate Assembly

Remove screw holding spark plug wire bracket to fan housing. With a socket type 5 mm Allen wrench and impact driver, remove the four (4) mounting bolts holding fan housing to crankcase. (See Fig. 1-16). Remove fan housing from crankcase (See Fig. 1-17).

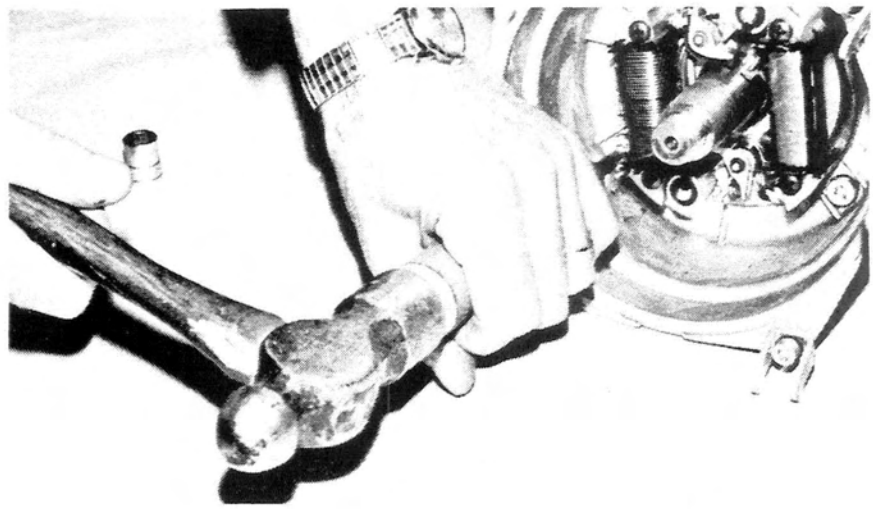


FIG. 1-16

Unplug connector housing coil wires. (Note color coding of wires.) Remove armature plate assembly and wires, as a unit, from fan housing.

FIG. 1-17

Remove the fan by tapping the end of fan shaft with a soft hammer. With a flat punch and hammer, tap the inner race of the furthest bearing in the housing. See Figs. 1-18, 1-19, 1-20.

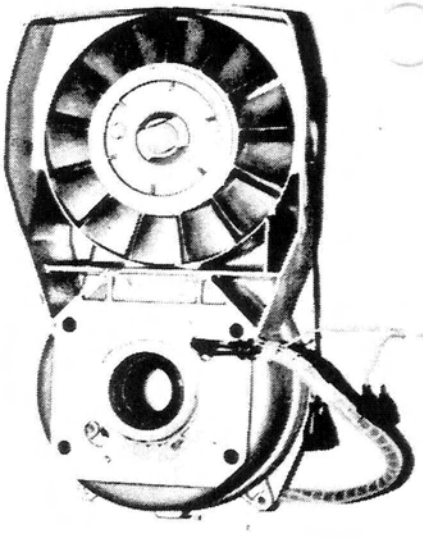


FIG. 1-18

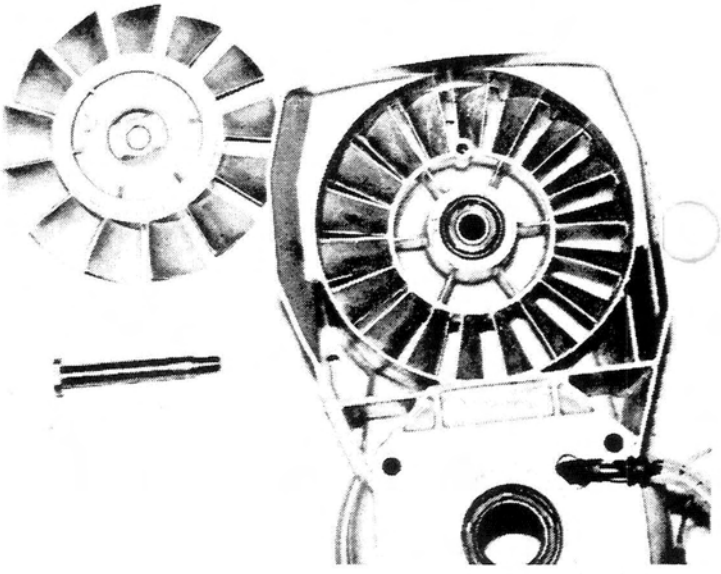


FIG. 1-19

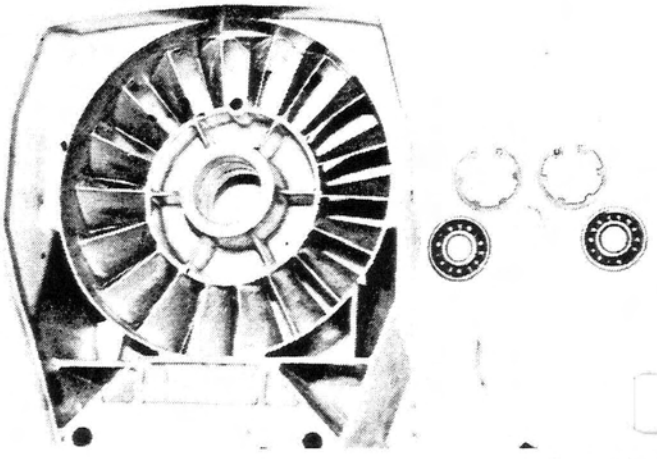
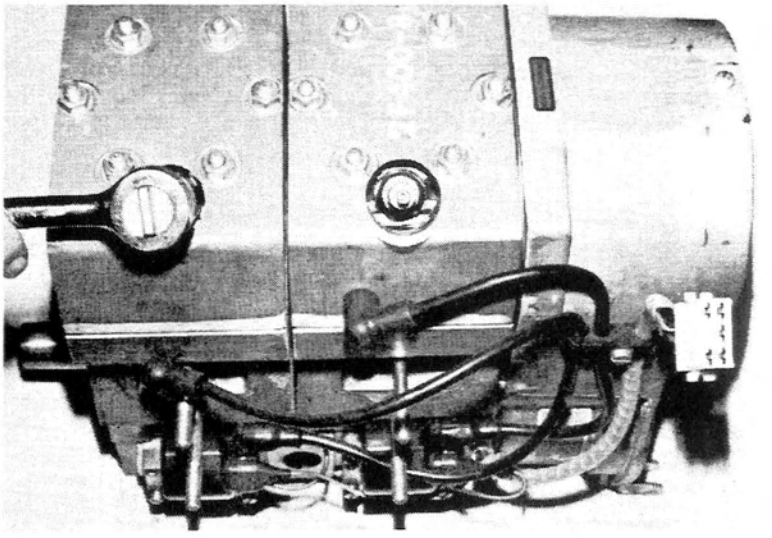


FIG. 1-20

G. Remove spark plugs with spark plug wrench. (See Fig. 1-21.)

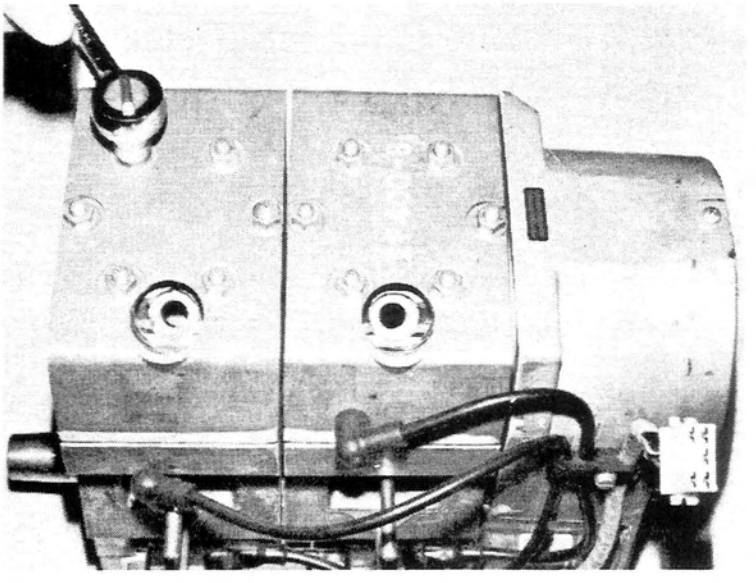
H. Cylinder Heads

Remove cylinder head nuts with a 13 mm socket wrench. Mark cylinder heads before removal from cylinder. Remove and discard gaskets. See Fig. 1-22.



I. Cylinders

Remove the eight (8) cylinder base nuts using a 13 mm socket wrench and remove the eight (8) spring washers. The cylinders may be removed. See Fig. 1-23.



NOTE: IMPORTANT

If removal of cylinders only is required, care must be taken that the crankcase seal is not disturbed. The removal of the PTO cylinder will allow the placement of two bolts and nuts with flat washers to apply constant pressure to crankcase assembly. Bolts should be placed in the center two holes (adjacent to the fan side cylinder). See Fig. 1-31. The second cylinder may now be removed.

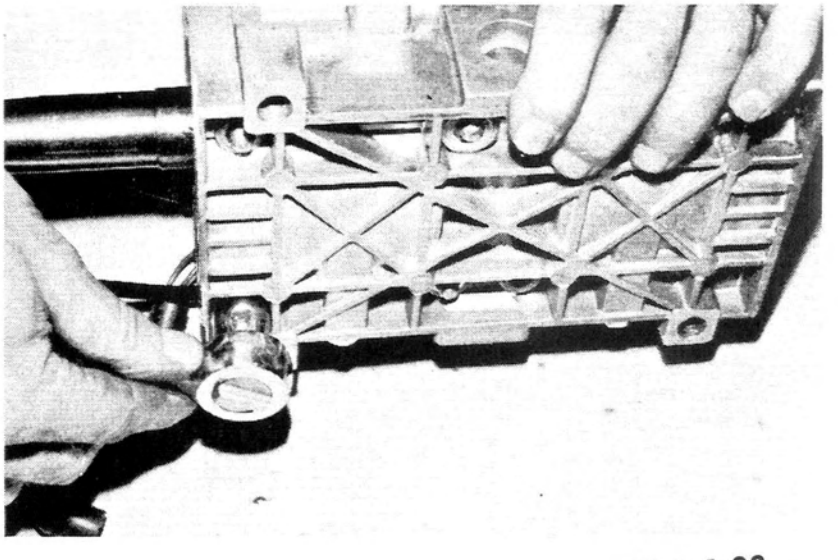


FIG. 1-23

J. Piston and Wrist Pin

With needle nose pliers, remove circlips from pistons. Heat the piston with a heat gun or propane torch. Heat only to the point where piston may still be held in hand. Push the pin out.

K. To separate the crankcase halves, hold upper portion of crankcase assembly in one hand, lifting slightly and tap the end of the crankcase with a soft hammer. The crankcase will separate and the crankcase may be removed. See Fig. 1-24.

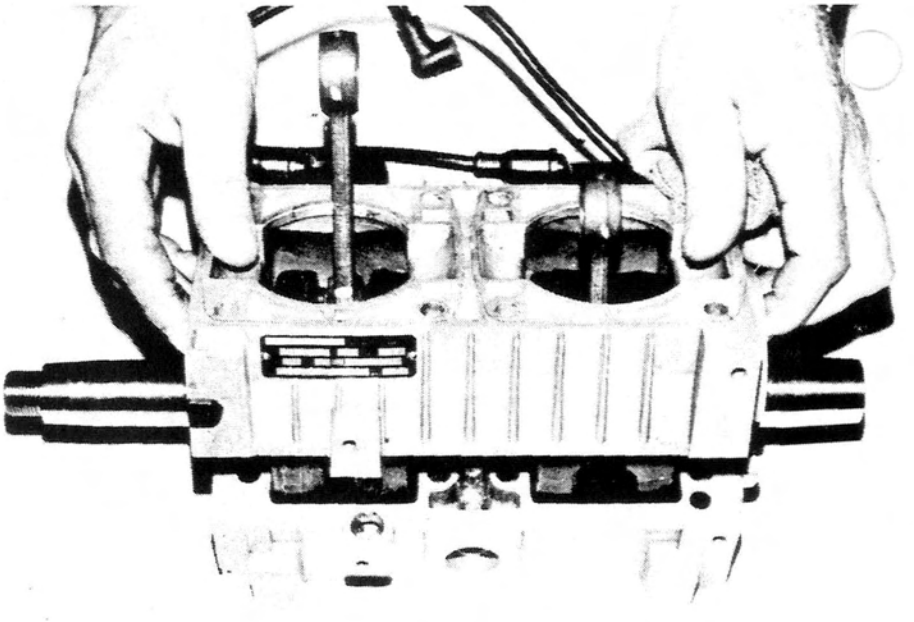


FIG. 1-24

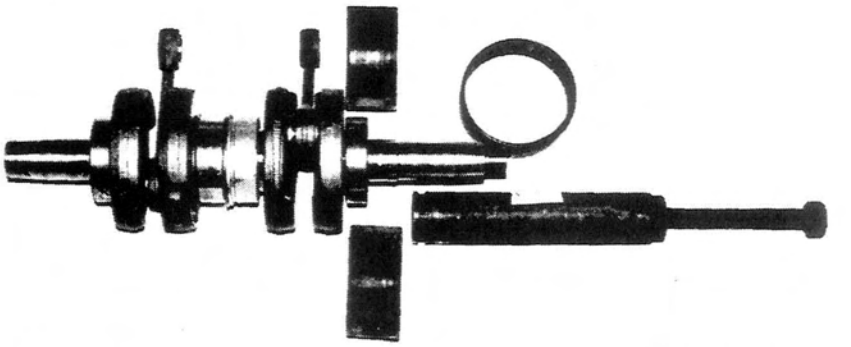


FIG. 1-25

L. Crankshaft Bearings

To remove crankshaft end bearings, use bearing puller 444-31-807-0. See Figs. 1-25, 1-26, 1-27. Slip the puller half shells around the outer bearing race and around puller assembly. Slide the retaining ring over the half shells. Using two (2) 27 mm wrenches, turn the center bolt clockwise with one wrench and use the second wrench to hold the puller body. Before removing the PTO side crankshaft bearing, insert a 1/2" 20 UNF bolt, 1/2" long, to protect the internal thread of the crankshaft.

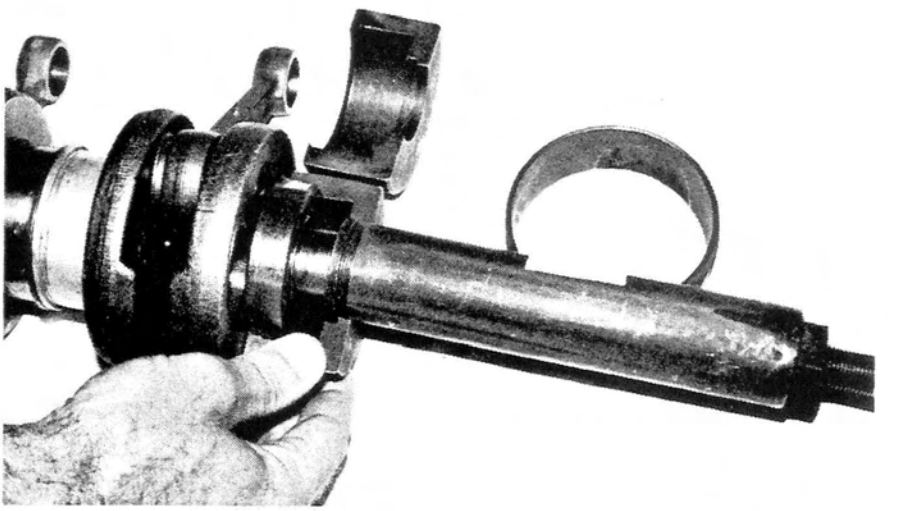


FIG. 1-26

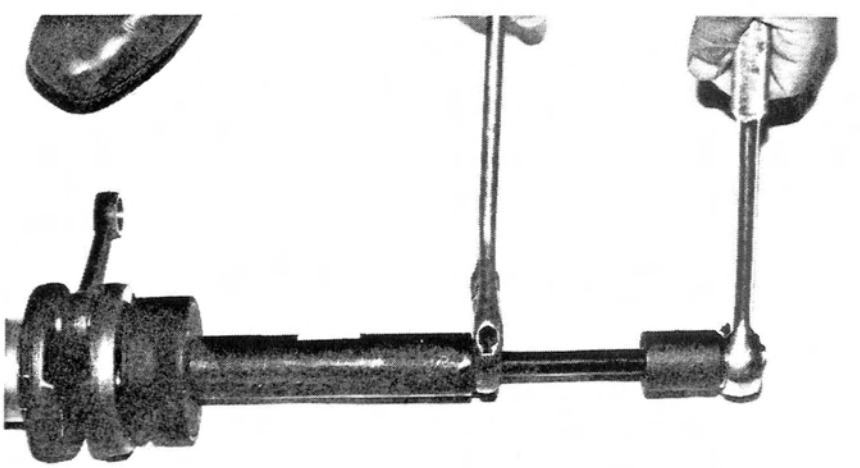


FIG. 1-27

ASSEMBLY

A. Crankshaft Bearings.

Heat crankshaft bearings in oil (or oven) to approximately 180 degrees.

Slide bearing on crankshaft.

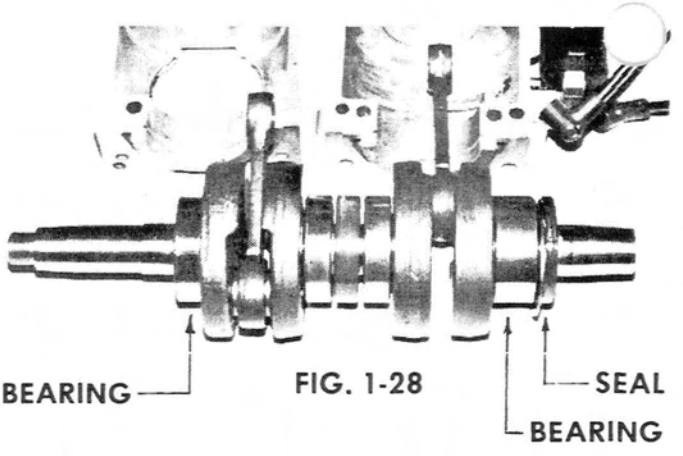


FIG. 1-28

B. Crankcase.

Inspect and clean both halves of crankcase. The proper sealant material such as Permatex Hy-Tack Spray should be now sprayed on crankcase sealing surfaces. See Fig. 1-29. Before installing crankshaft into crankcase lower half of it will be necessary that all bearing outer surfaces be wiped clean of foreign material so that proper sealing will occur. After installing PTO thrust washer and oil seal (inside groove of oil seal coated with light grease) place the crankshaft carefully into the lower crankcase half and properly position all components. See Figs. 1-30. Placement of the upper crankcase half may now be made. Be certain that the center seal is lined up with the crankcase split line.

Tap upper crankcase half to seat with lower half.

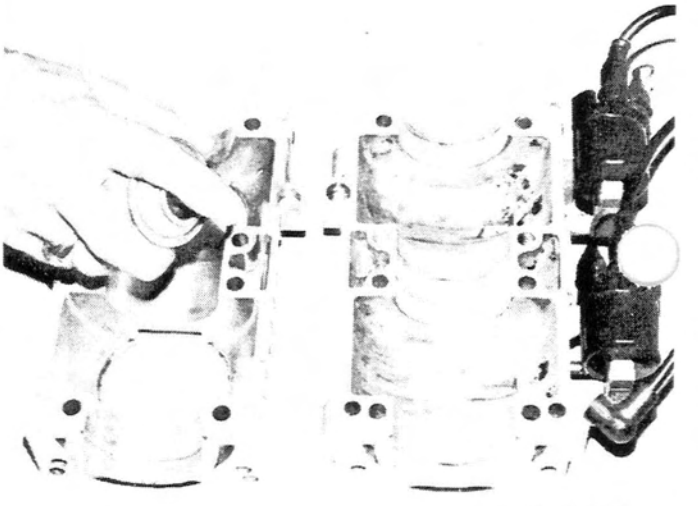


FIG. 1-29

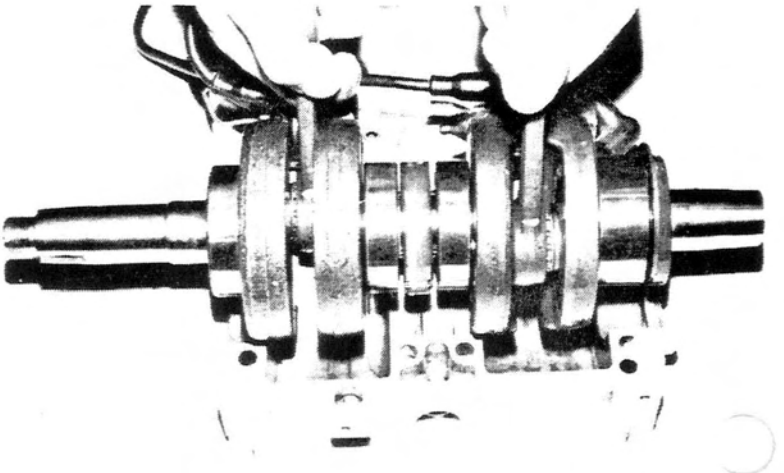


FIG. 1-30

Install two crankcase holding bolts in the center holes of the PTO side of crankcase. (Fig. 1-31) Tighten finger tight.

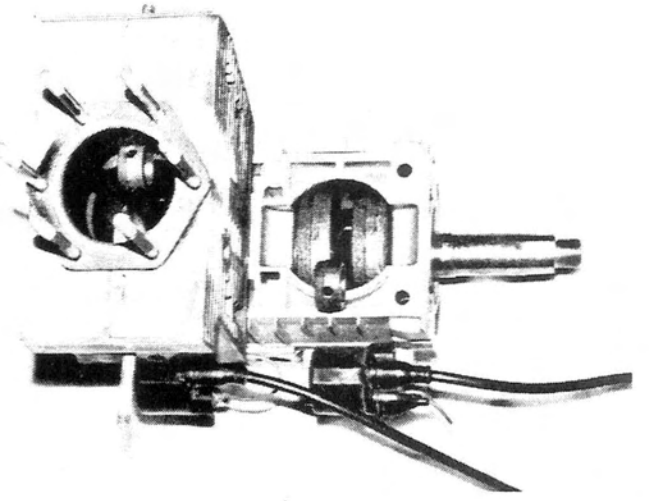


FIG. 1-31

C. Piston, Cylinder and Cylinder Heads

The pistons must be clean and free from carbon deposits and the piston rings must fit freely in their grooves. Rings are marked for proper side up. The arrow on the crown of pistons must point toward **exhaust side** of engine. Piston pins, needle bearings, check plates and circlips may now be installed, according to the procedure below. (Always use new circlips.) See Figs. 1-32, 1-33, 1-34, 1-35.)

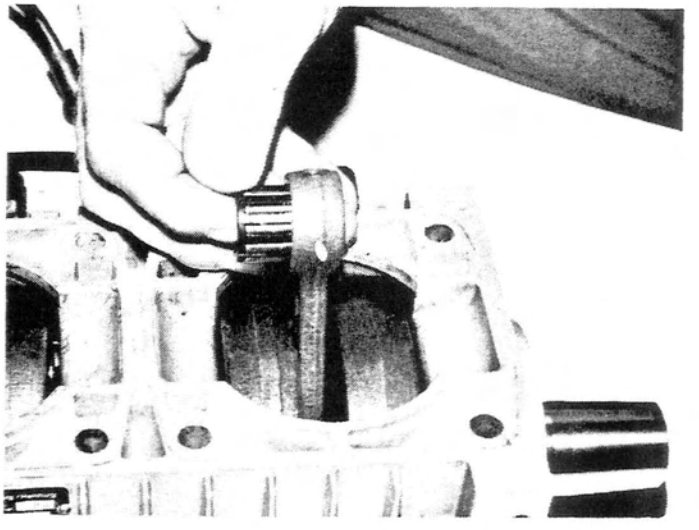


FIG. 1-32

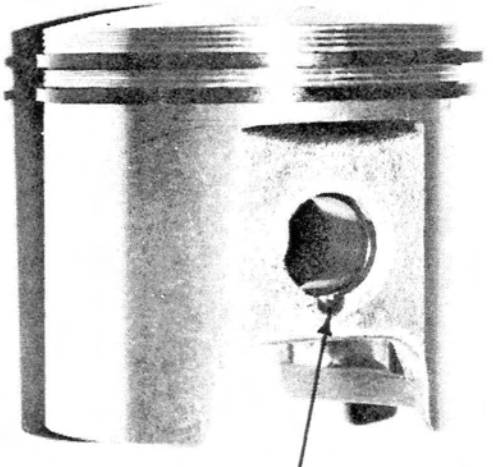


FIG. 1-33

1. Oil the piston pin end bearings.

2. Install one circlip in piston.

3. Heat the piston sufficiently to allow pin to push into piston and install pin.

4. Install second circlip. (See Fig. 1-33 for correct orientation of circlips.)

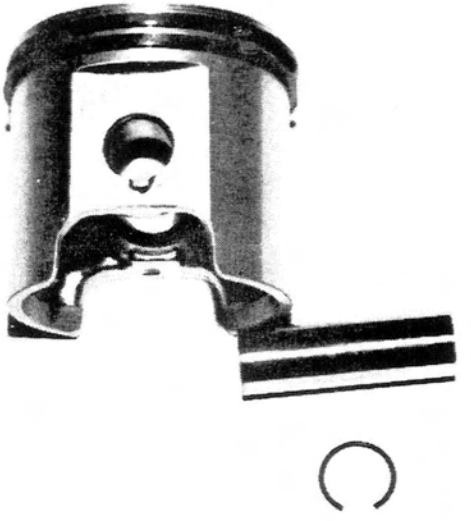


FIG. 1-34

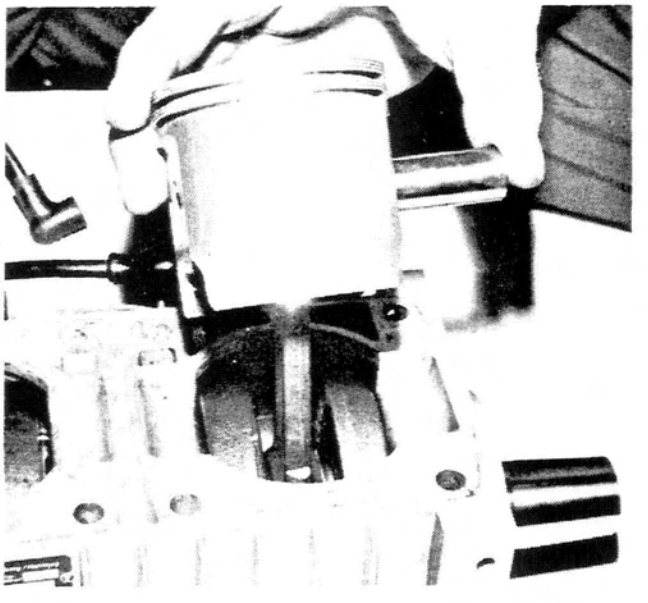


FIG. 1-35

Install base gaskets on the cylinder studs and position against the cylinder flanges (see Fig. 1-36). With the use of a ring compressor, lower cylinders one at a time over the pistons. Install base washers and nuts finger tight. See Fig. 1-37, 1-38.

Temporarily install the intake manifold without gaskets and tighten manifold nuts to sixteen (16) to eighteen (18) foot pounds. See Fig. 1-39. Cylinder base nuts may now be torqued to sixteen (16) to eighteen (18) foot pounds as outlined on specification page. The proper piston height can be measured at the top of the cylinder. The edge of the crown of the piston must not protrude above the top of the cylinder with the piston in the top dead center position. If the piston does protrude above the cylinder, a thicker base gasket must be used. See specification page for dimensions and color coding. It is important that only one cylinder at a time be adjusted or the crankcase will separate and lose it's seal.

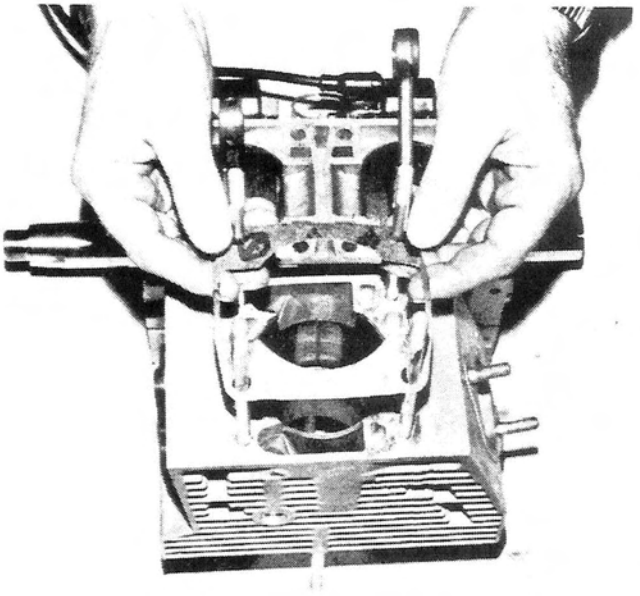


FIG. 1-36

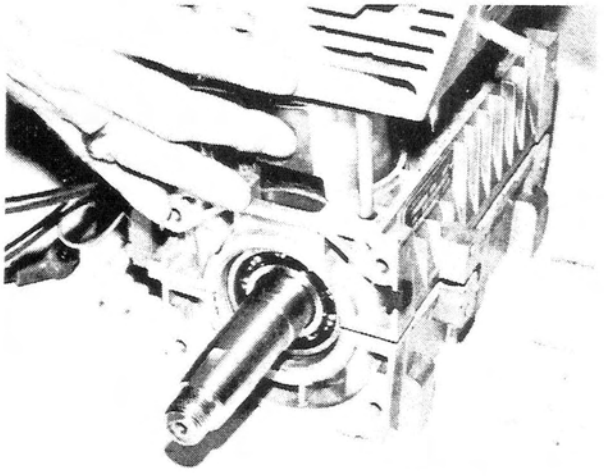


FIG. 1-37

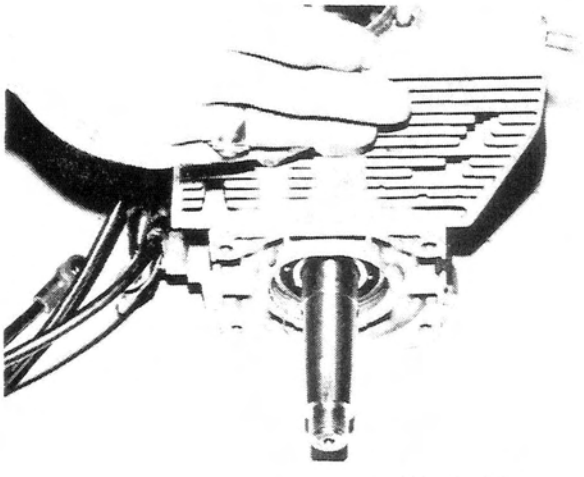


FIG. 1-38

Oil cylinders and pistons before installing cylinder heads. Install head gaskets with the wide side of inner metal flange of the gaskets **up** toward the cylinder heads. Torque cylinder head nuts to sixteen (16) to eighteen (18) foot pounds. (See Fig. 1-40).

NOTE: The head gasket for the 400 cc engine has an additional hole in it to distinquish it from the 440 cc gasket.

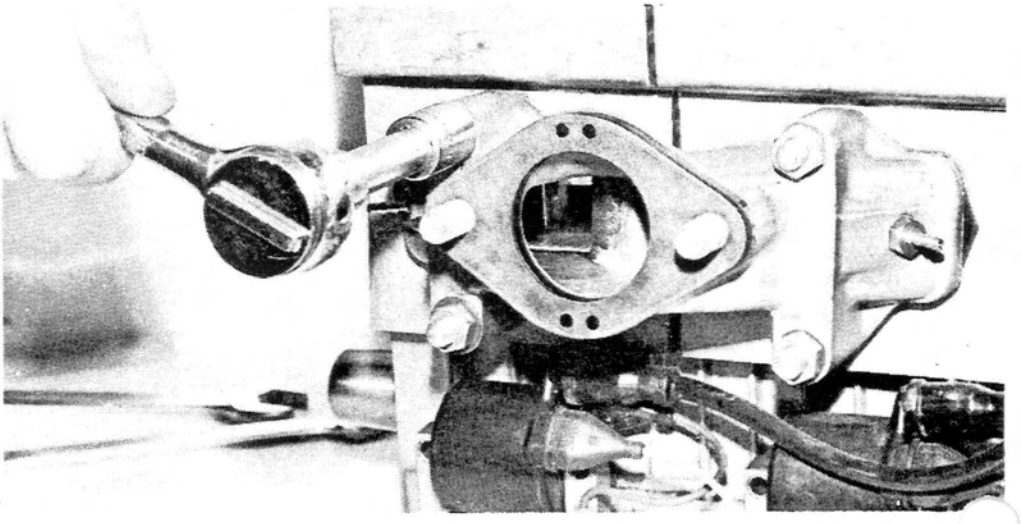


FIG. 1-39

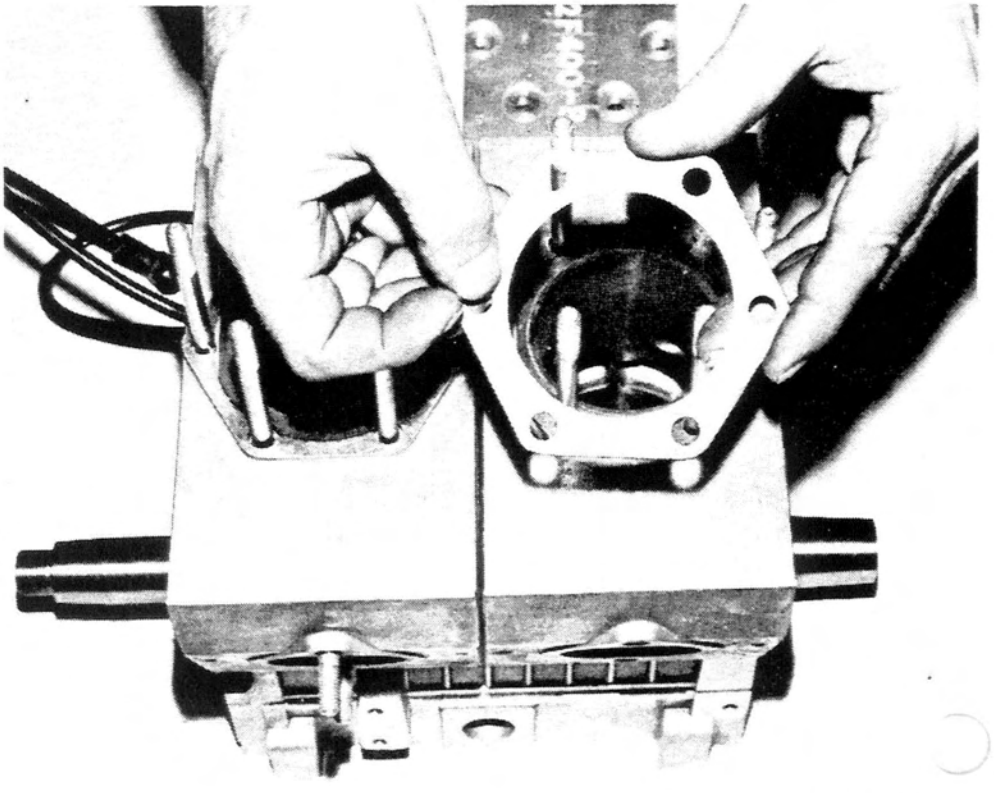


FIG. 1-40

D. Fan Housing and Impeller Bearings

Clean fan shaft hub. Install circlips and spacer. Use grease to hold spacer in place. Pack bearings in medium grease into housing with sealed surface outward. See Figs. 1-18, 1-19. Install fan and shaft.

E. Fan Housing and Armature Plate.

Install new seal in fan housing. Lubricate the inner groove of the oil seal with a light grease. See Fig. 1-38.

Install new o-ring and apply sealant material around o-ring surface (see Fig. 1-41). Install the armature plate wires through hole in fan housing and install armature plate with hold down screws, washers, and lockwashers. See Fig. 1-39.

Place fan housing assembly over crankshaft and position to crankcase assembly. Install the four Allen head screws and lockwashers and tighten evenly until fan housing is against crankcase assembly. See Fig. 1-40.

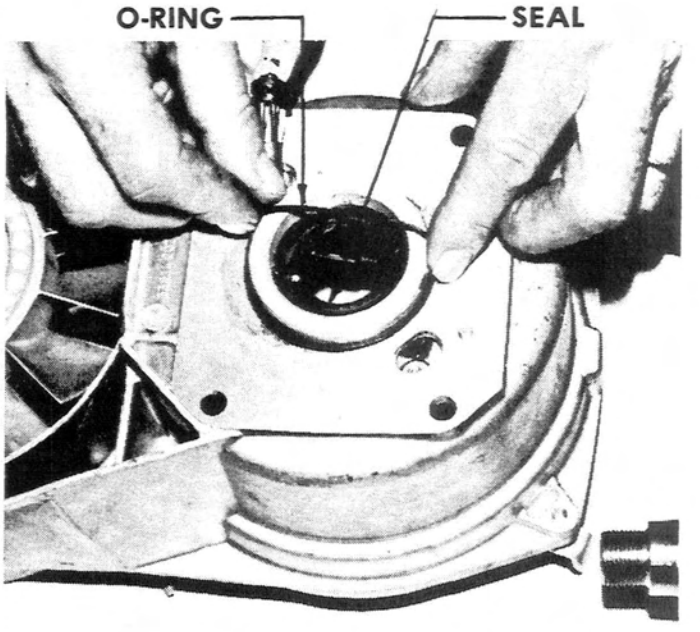


FIG. 1-38

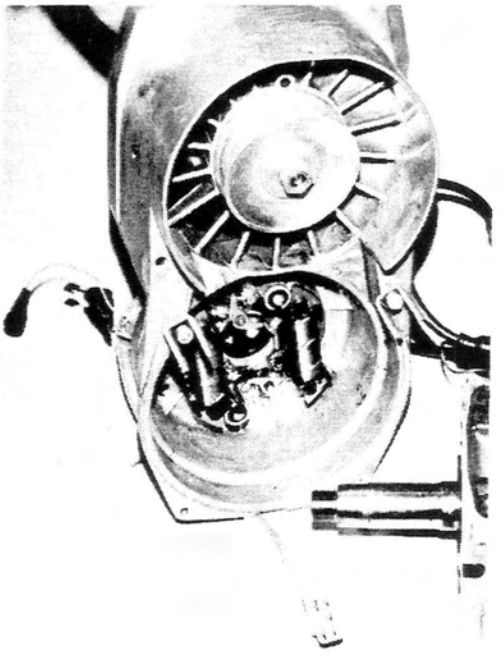


FIG. 1-39

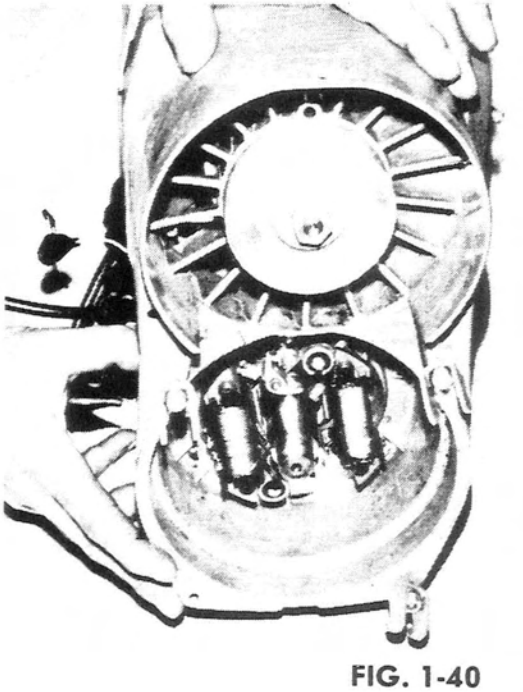


FIG. 1-40

Torque to sixteen (16) to eighteen (18) foot pounds. Connect ignition wires to external ignition coil and to connector housing. Check ground wires for proper position. Install ignition cable bracket to fan housing.

F. Intake Manifold

Install spacers, gaskets and intake manifold (Fig. 1-44). Torque nuts evenly to sixteen (16) to (18) foot pounds.

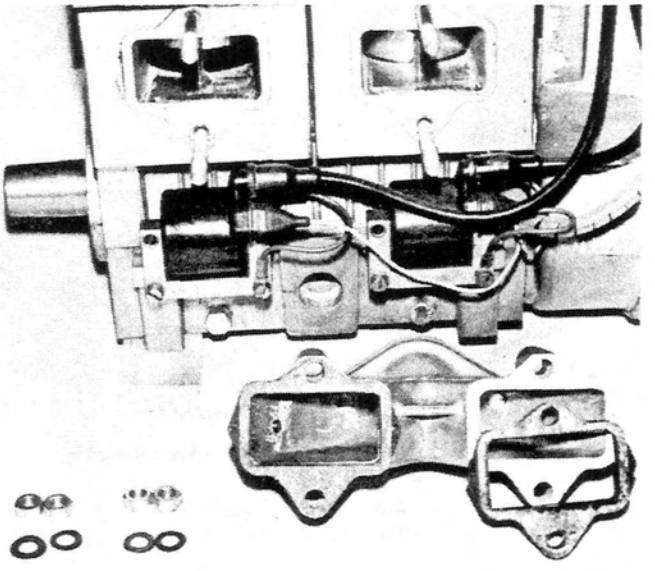


FIG. 1-44

G. Upper Fan Pulley Assembly

Install the tapered washer. Install pulley half, shims, second pulley half, tapered washer, lock washer and nut. Use 3/16" drill bit or punch to hold fan assembly and tighten nut. See Fig. 1-45.

H. Flywheel Assembly

Check advance mechanism for free operation, lubricate inside cam surface (Grooved area). Slide assembly over crankshaft and align key ways.

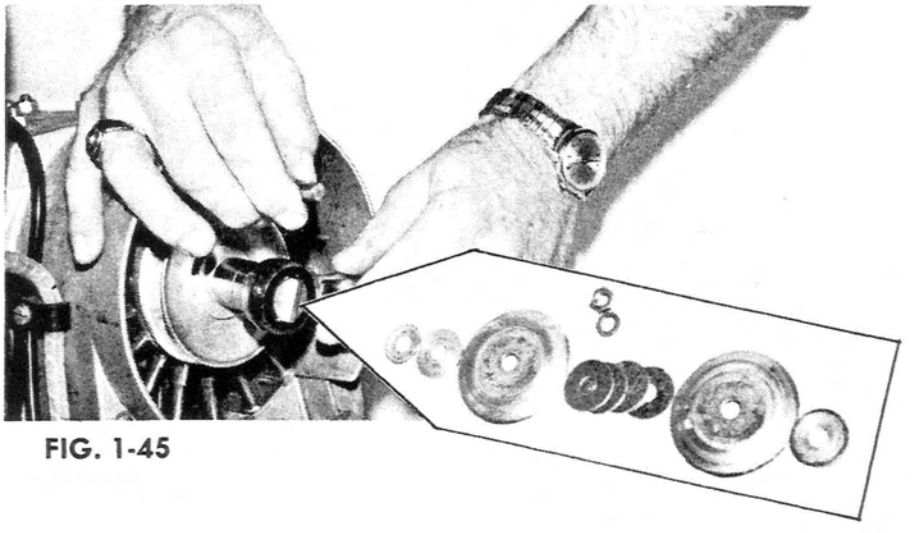


FIG. 1-45

Install key, lockwasher and nut in that order. Tighten securely. See Fig. 1-46. Follow Timing Procedure Section as next step.

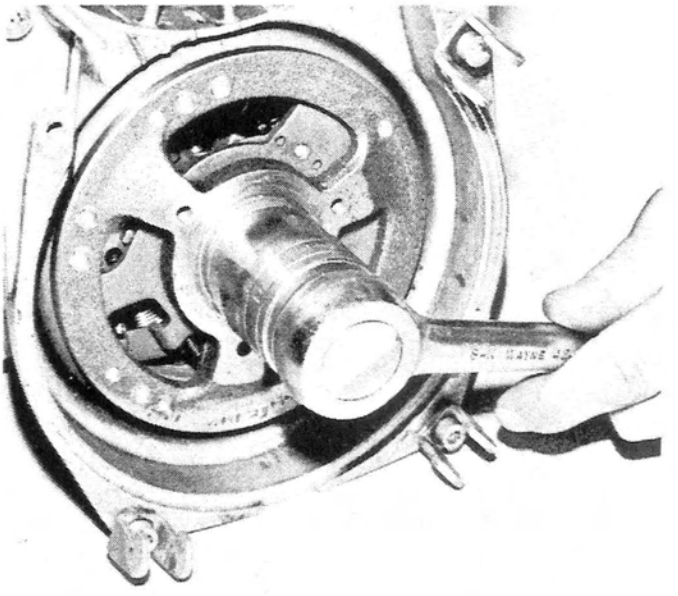


FIG. 1-46

I. Lower Fan Pulley Assembly

Install pulley half, belt, second pulley half, recoil carrier, lockwashers and bolts evenly while rotating crankshaft. The proper belt deflection should be 1/8" on each side. Proper adjustment can be made by adding or removing shims between upper pulley halves. See Fig. 1-47.

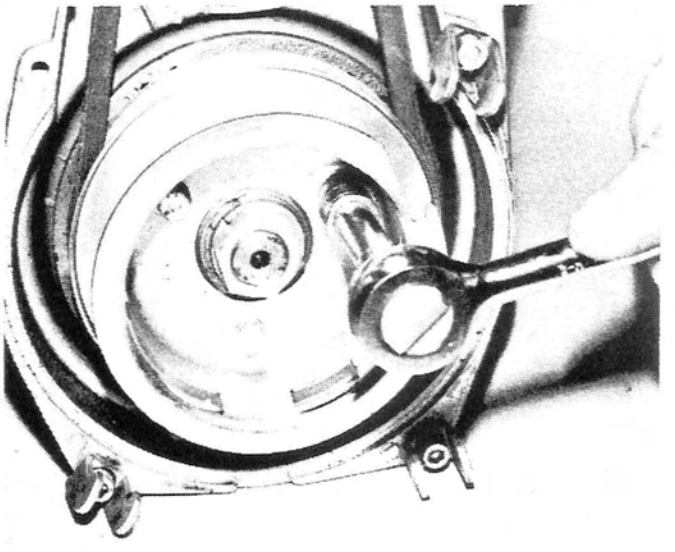


FIG. 1-47

J. Recoil Starter

Install the recoil starter assembly and tighten securely. See Fig. 1-48.

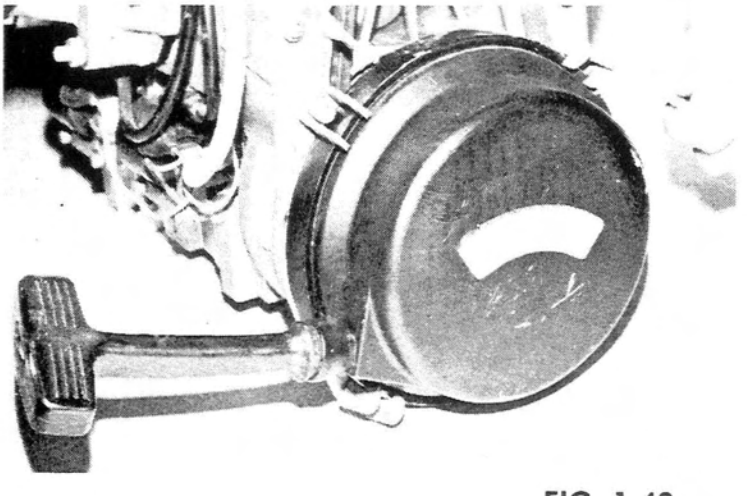


FIG. 1-48

RECOIL STARTER

Disassembly
(See Fig. 1-49 for recoil start breakdown, and Fig. 1-50 for Recoil Starter Assembly.)

1. Remove retaining nut (11), spring washer (12) and Thrust washer (8) from threaded shaft of reel hub. (Fig. 1-51).

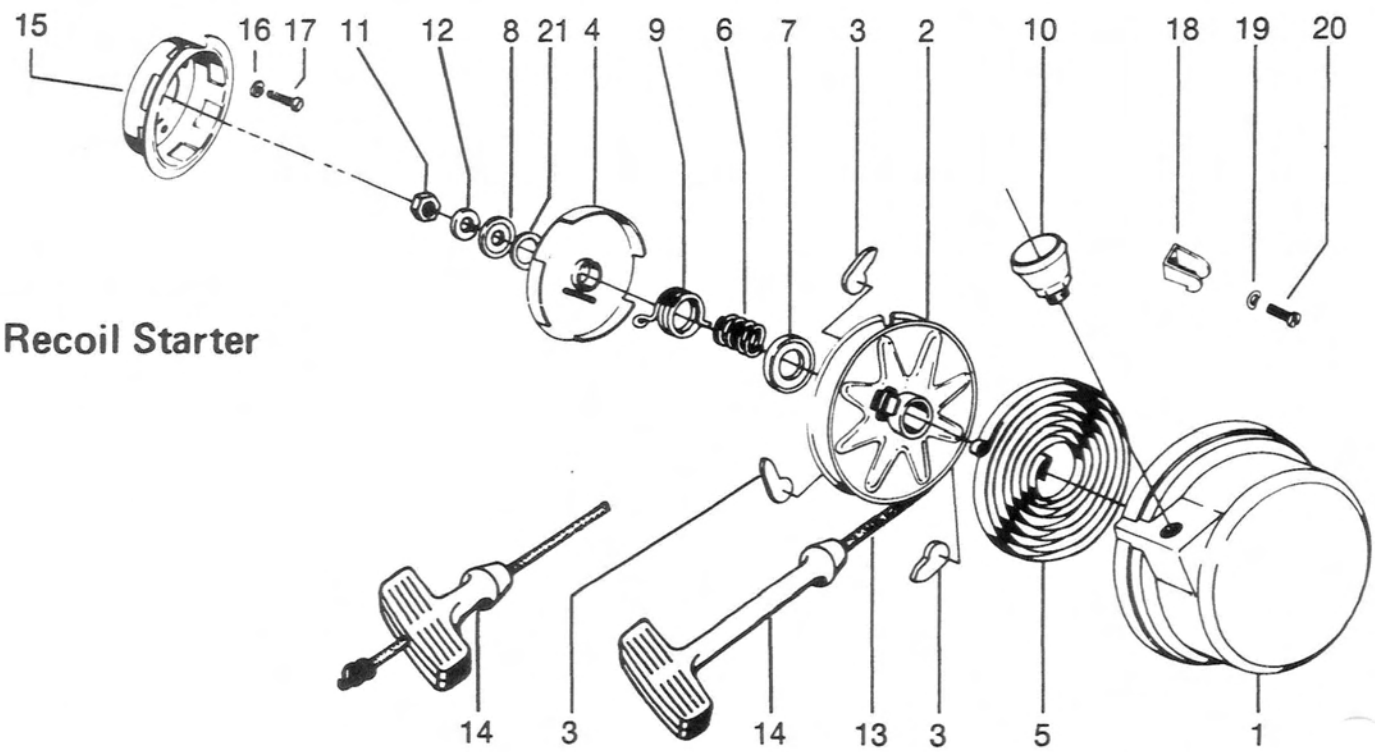
2. Manipulate friction plate (4) on reel hub until eye end of return spring (9) aligns with retaining slot. Remove friction plate. (Fig. 1-52, 1-53).

3. Remove the three pawls (3), (Fig. 1-54).

4. Remove return spring (9), spring (6) and cup washer (7). Fig. 1-53. Note position of plain end of return spring in the spring retaining hole in reel hub.

5. Unwind the rope; lift and untie the knotted end from center hub of reel, remove reel (2). (Fig. 1-55).

6. Lift long rolled end of main spring (5) from the fixed spring retaining pin in the case and carefully remove the spring (Fig. 1-56).



Recoil Starter

FIG. 1-49

7. Clean all parts, except rope, using a suitable cleaning solvent. If rope requires cleaning, wash it in a solution of soap and water. Thoroughly dry all parts after cleaning.

8. Inspect all parts for obvious damage and wear.

FIG. 1-50

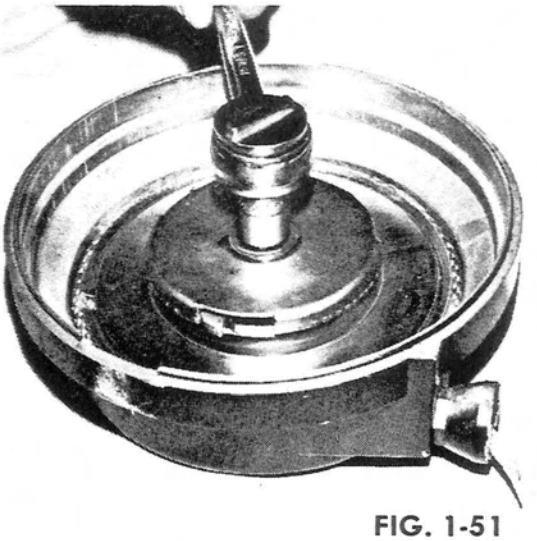


FIG. 1-51

FIG. 1-52

FIG. 1-53

FIG. 1-54

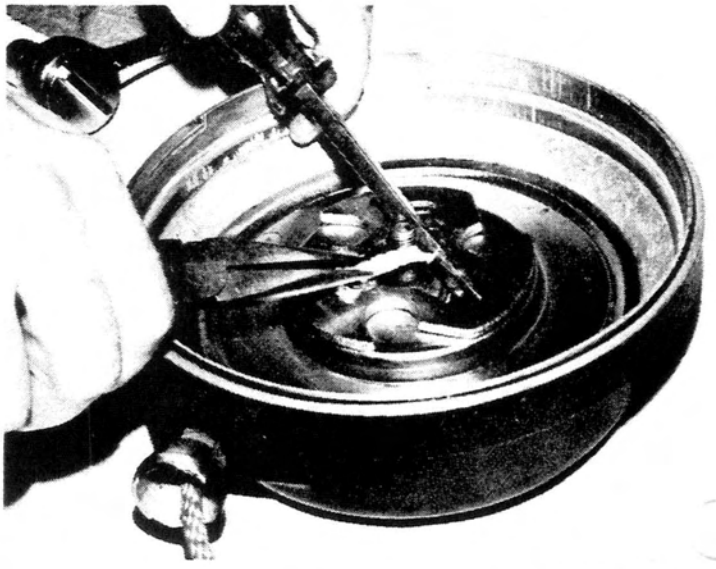


FIG. 1-55

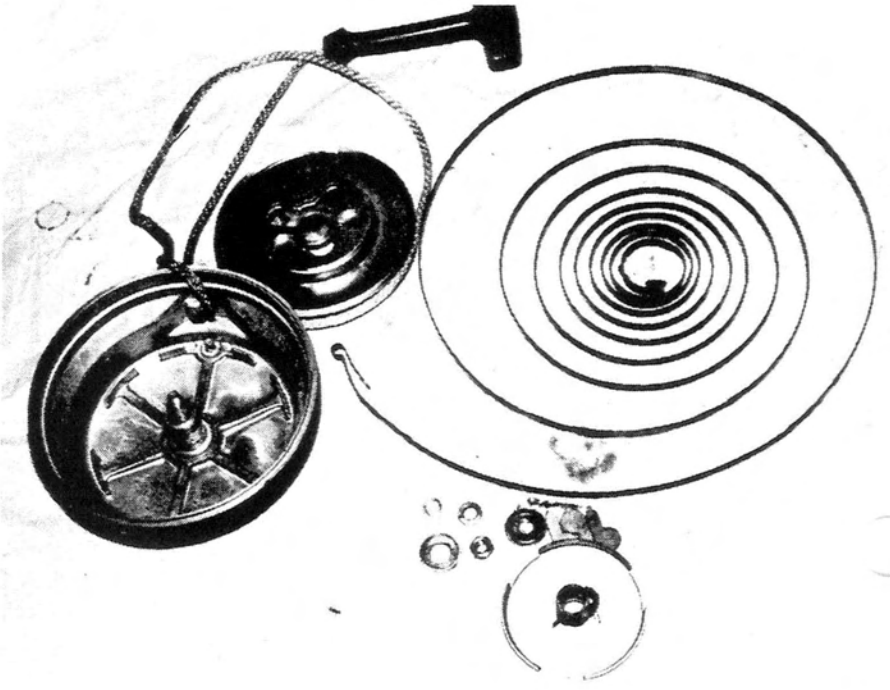


FIG. 1-56