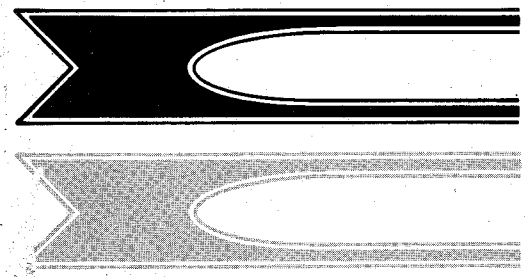
1964
EVINRUDE
SERVICE MANUAL

SPORTFOUR
SPORTFOUR HEAVY DUTY
60 HP



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60452

SECTION 1
INTRODUCTION

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SPORTFOUR

The Evinrude 60 HP Sportfour outboard motor is designed and built for dependable high performance. To assure continued peak operation, it is important that every Evinrude owner be able to receive skilled and thorough service for his motor. Customer satisfaction and profitable service operation depend on service "know-how" and training.

Read this manual carefully so that you are familiar with the service procedures - then keep it readily available as a reference book in your service department.

Always remember, each service job is a chance for you to maintain motor performance that will keep your customer happy to be an Evinrude owner.

ARRANGEMENT OF MANUAL

This Service Manual includes the specific information you will need to service the Sportfour. All general procedures are covered in abbreviated form, mostly by reference to procedural illustrations. The specific procedures which apply only, or primarily, to this motor are covered in fully-illustrated, detailed, step-by-step instructions.

The General Service Information section will help you diagnose a malfunctioning motor. It includes specifications, tune-up procedures, and a Trouble Check Chart. Clearances and torque values are also included for quick reference during servicing operations. Each of the following sections, Fuel System, Ignition System, Power Head, Lower Unit, and Electrical System, Manual Starter gives detailed instructions for disassembly, inspection, reassembly, and operating adjustments of the components. These procedures will help you service a specific system, or completely overhaul the Sportfour.

PARTS CATALOG

The Evinrude 1964 Parts Catalog contains exploded views illustrating the correct sequence of all parts as well as a complete listing of the parts for replacement. This catalog can be of considerable help as a reference during disassembly and reassembly.

SERVICE POLICY

Whether within or following the warranty period, Evinrude Motors has a constant interest in its products.

It is Evinrude's policy to assist dealers in building up their service knowledge and facilities so that they can give prompt, efficient service. The Evinrude Service School, frequent Service Bulletins, and this Service Manual represent tangible efforts to give Evinrude owners the best and most prompt service possible. This Service Manual covers all phases of servicing the Sportfour. However, new situations sometimes arise in servicing a motor. If a service question does not appear to be answered in this manual, you are invited to write to the Service Department for additional help. Always be sure to give complete information, including motor model number and serial number. Write to:

Evinrude Motors
4143 North 27th Street
Milwaukee, Wisconsin 53216
Attention: Service Department

Be sure that you are familiar with the Evinrude warranty. If you have any questions, write the Evinrude Service Department.

SPECIAL SERVICE TOOLS

Evinrude has specially-designed tools to simplify some of the disassembly and reassembly operations. These tools are illustrated in this Service Manual, in many cases in actual use. Refer to the Evinrude Special Service Tool Catalog No. 164 for a description and ordering instructions for these tools.

OUTBOARD MOTOR NOMENCLATURE

Sometimes the words "right" and "left" are very confusing when referring to the sides of an outboard motor. Therefore, the sides are referred to as STARBOARD or PORT sides. STARBOARD means on the right hand while facing the bow (FRONT) of the boat; PORT means left hand. See Figures 1-1 and 1-2.

Service required for the Evinrude 60 HP Sportfour is generally one of three kinds . . . . . .

1. NORMAL CARE AND MAINTENANCE, which includes putting a new motor into operation, storing motors, lubrication, and care under special operating conditions such as salt water and cold weather.

2. OPERATING MALFUNCTIONS due to improper motor mounting, propeller condition or size, boat condition, or the malfunction of some part of the motor. This includes motor tune-up procedures to keep the motor in prime operating condition.

3. COMPLETE DISASSEMBLY and overhaul, such as inspecting a motor that has been submerged or rebuilding trade-in units.

It is important to you as the service man to determine before disassembly just what the trouble is, and how to correct it quickly and with minimum expense to the owner. This section of the manual is designed to help you diagnose motor malfunctions and correct them.

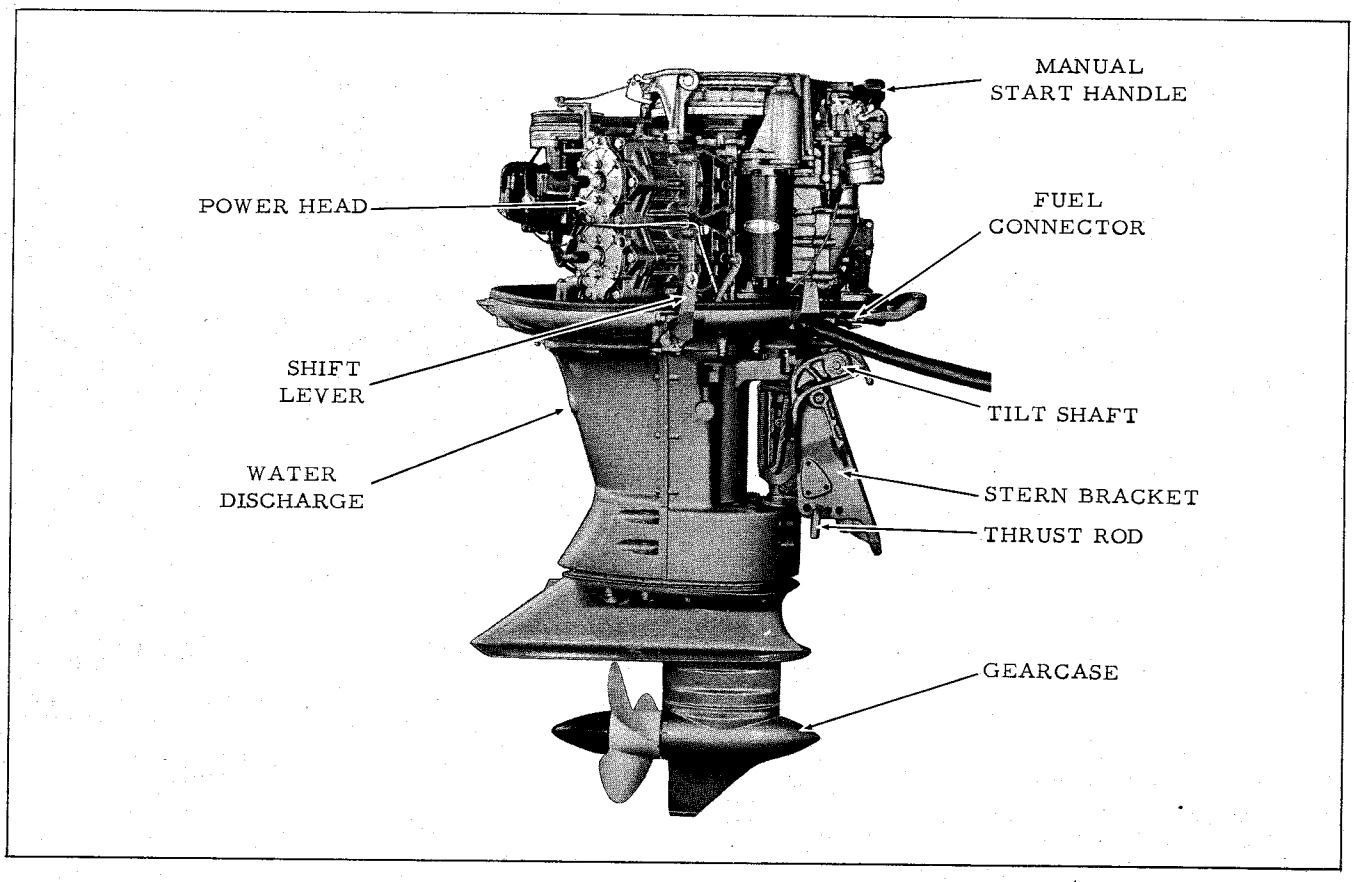

Figure 1-1. Starboard Side

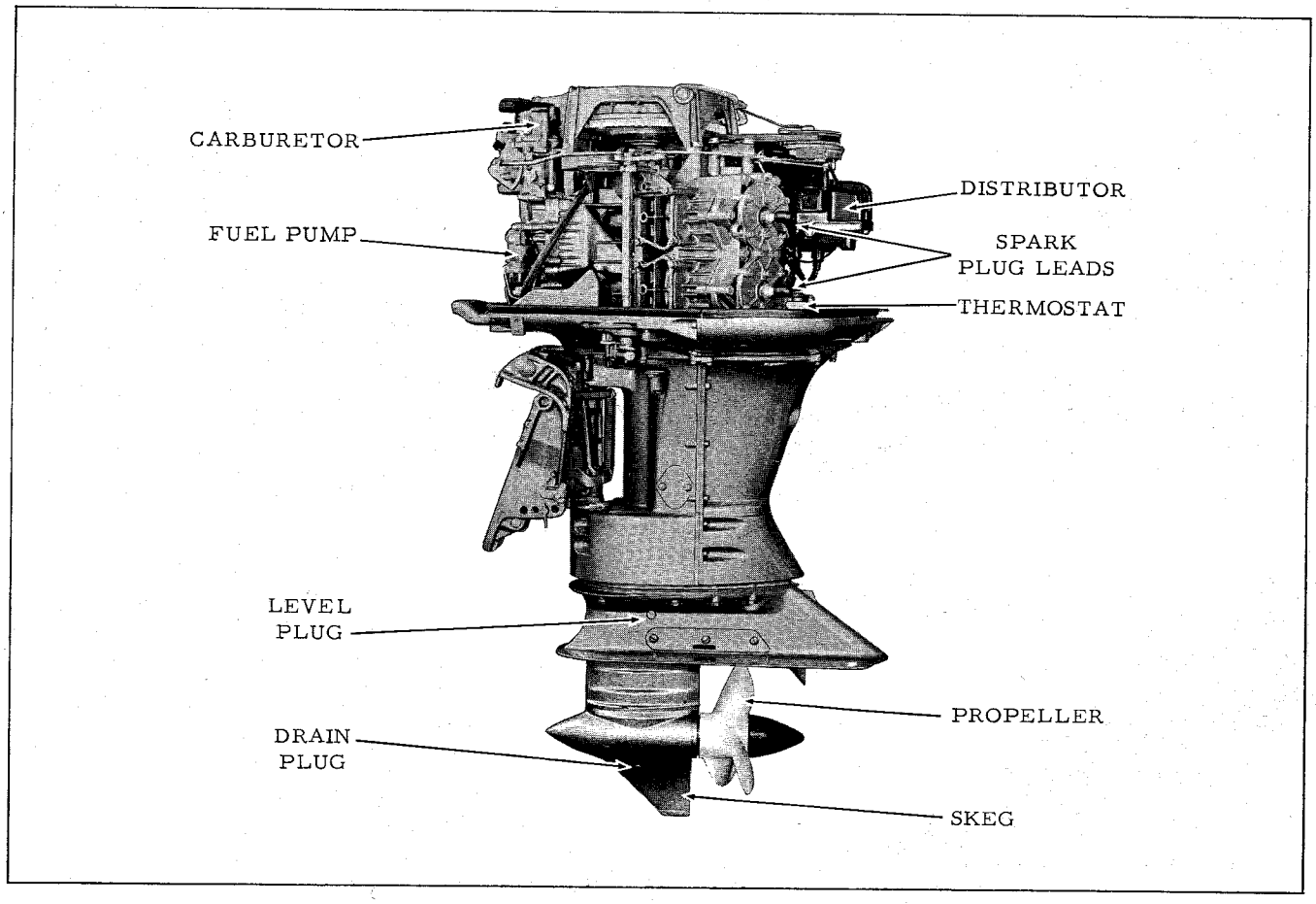

Figure 1-2. Port Side

SECTION 2

GENERAL SERVICE INFORMATION

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SPECIFICATIONS

Model numbers	60452 - Standard length (15" transom) 60453 - 5" longer (20" transom) 60432 - Standard length, heavy duty 60433 - 5" longer, heavy duty
*Horsepower (O.B.C.-certified)	60 hp at 4500 rpm
Full throttle operating range	4000 to 5000 rpm
Engine type	90° V-type 4 cylinder, 2 cycle
Bore and stroke	3" bore x 2-1/2" stroke
Piston displacement	70.7 cubic inches
Piston ring sets (3 per set)	
standard	Part Number 593428
.020" oversize	Part Number 593429
.040" oversize	Part Number 593430
Diameter of ring	3.000 in. (standard)
Width of ring	.0935 - .0925 in.
Lbs. compression recommended when compressed	10 to 13 lbs.
Piston less rings	
standard	Part Number 593183
.020" oversize	Part Number 593400
.040" oversize	Part Number 593401
Crankshaft size	
top journal	1.2658 - 1.2653 in.
center journal	1.3752 - 1.3748 in.
bottom journal	1.1815 - 1.1810 in.
Connecting rod crank pin	1.1819 - 1.1812 in.
Cooling system	Thermostatically controlled recirculating system
Propeller gear ratio	20:23 Standard 17:29 Heavy duty
Propeller drive pin, standard	Part Number 307217 9/32" x 2-5/32" stainless steel
Propeller drivepin, heavy duty	Part number 305500 5/16" x 1-7/8"
Standard propeller	9-1/2" diameter x 10" pitch, 3 blade
Propeller options, standard gearcase	10" diameter x 9-1/4" pitch 10" diameter x 11" pitch 10" diameter x 12" pitch 10-1/4" diameter x 10" pitch
Propeller, heavy duty gearcase	To be supplied by dealer
Speed control	Knob on steering bracket or remote control
Gear shift control	Forward, neutral, and reverse
Weight (standard length, without fuel tank)	221-1/2 lbs. standard gearcase 227 lbs., heavy duty gearcase (Fuel tank weight 12 lbs. net)
Fuel capacity	6 gallons, suction type tank
Starter	Electric and Simplex self-winding
Starter amp draw when cranking	Maximum 140 amp
Ignition	Distributor type magneto
Spark plug	AC-M42K, Champion J4J, Auto-Lite A21X - 14mm
Spark plug gap	.030 inch
Spark plug torque	20 - 20-1/2 Foot-pounds
Breaker point gap	.020 inch
Condenser capacity	.37 to .41 Mfd.
Carburetion	Twin barrel, downdraft, float feed type, with high- and low-speed adjustments, automatic hot air choke
Float level setting	1/4" from rim of casting
Carburetor orifice plug	2 grooves for identification. .089" orifice. Use a #43 drill as gage.
Inlet needle seat	.081" to .084". Use a #44 drill as gage

*Horsepower established at sea level. Allow 2% reduction per 1000' above sea level.

CLEARANCE CHART

POWER HEAD	
Piston and wrist pin - loose end	.0006 Max. - .0001 Min.
Piston ring gap	.017 Max. - .007 Min.
Piston ring groove clearance	.007 Max. - .0045 Min.
Cylinder and piston	.005 Max. - .0035 Min.
Crankshaft bearings	
Upper	Roller type
Center	Roller type
Lower	Ball type
Crankshaft end play	.007" Maximum
Connecting rod bearings	
Piston end	Roller type
Crankshaft end	Roller type
LOWER UNIT	
Gearcase head and propeller shaft	Roller type
Driveshaft to gearcase bushing - upper	Roller type
Pinion to gear-case	Roller type
Propeller shaft to gearcase - front	Tapered roller
Front gear to front bushing	Press fit
Front gear bushing to propeller shaft	.002 Max. - .001 Min.
Propeller shaft to gearcase - rear	Roller type
Reverse gear to rear bearing	.002 Max. - .0005 Min.
Rear gear bushing to propeller shaft	.0018 Max. - .0008 Min.
Propeller on shaft at drive pin hole	.006 Max. - .002 Min.
Propeller on shaft above the shoulder	.005 Max. - .001 Min.

TORQUE CHART

POWER HEAD	
Flywheel nut	70-85 Foot-pounds
Connecting rod screws	348-372 Inch-pounds (29-31 Foot-pounds)
Cylinder head screws	168-192 Inch-pounds
Crankcase to cylinder screws	
Upper	144-168 Inch-pounds
Center	162-168 Inch-pounds
Lower	144-168 Inch-pounds
Spark plugs	20-20-1/2 Foot-pounds
LOWER UNIT	
Gearcase stud nuts	24-26 Foot-pounds
Slip clutch propeller	320-420 Foot-pounds
Pull at propeller shaft to overcome reverse lock (standard length)	380-480 pounds

STANDARD SCREWS

	Inch-Pounds	Foot-Pounds
No. 6	7-10	
No. 8	15-22	
No. 10	25-35	2-3
No. 12	35-40	3-4
1/4"	60-80	5-7
5-16"	120-140	10-12
3/8"	220-240	18-20

CAUTION

When tightening two or more screws on the same part, DO NOT tighten screws completely, one at a time. To avoid distortion of the part, first tighten all screws together to one-third of specified torque, then to two-thirds of specified torque, then torque down completely.

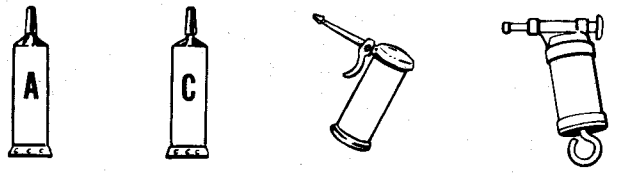
NOTE: Re-check torque on cylinder head screws and spark plugs after motor has been run and has reached operating temperature.

LUBRICATION CHART

LUBRICATION POINT	LUBRICANT	FREQUENCY (PERIOD OF OPERATION)	
		FRESH WATER	#SALT WATER
1. Gearcase See Figure 2-3	OMC Type "C" Lubricant	Check level after first 10 hours of operation and every 50 hours of operation thereafter. Add lubricant if necessary. Drain and refill every 100 hours of operation or once each season, whichever occurs first.	Same as Fresh Water Same as Fresh Water
2. Starter Pinion Gear Shaft See Figure 2-4	SAE 90 Oil	60 days	30 days
3. Carburetor and Magneto Linkage See Figure 2-5	OMC Type "A"	60 days	30 days
4. Tilt and Trailing Lever See Figure 2-6	OMC Type "A"	60 days	30 days
5. Safety Switch Cam See Figure 2-7	OMC Type "A"	60 days	30 days
6. Throttle Shaft Gears See Figure 2-8	OMC Type "A"	60 days	30 days
7. Throttle and Shift Shaft Bearings See Figures 2-9, 2-10, and 2-11	SAE 90 Oil	60 days	30 days
8. Gear Shift Lever Shaft and Lockout See Figures 2-12, 2-13, and 2-14	OMC Type "A"	60 days	30 days
9. Swivel Bracket Fitting See Figure 2-15	OMC Type "A"	60 days	30 days

#Some areas may require more frequent lubrication.

TYPES OF LUBRICANT



OMC TYPE "A" | OMC TYPE "C" | OIL CAN SAE 90 | GREASE GUN OMC TYPE "A"

GEARCASE

Remove plugs and gasket assemblies marked "OIL DRAIN" and "OIL LEVEL" from port side of gearcase. With propeller shaft in a horizontal plane, allow oil to drain completely.

Refill with OMC Type "C" lubricant. With propeller shaft still in horizontal position, fill until lubricant appears at "OIL LEVEL" hole. See Figure 2-3.

Install "OIL LEVEL" plug before removing lubricant filler hose from "OIL DRAIN" hole. Drain plug can then be installed without oil loss.

If filler type can is not available, install drain plug. Slowly fill gearcase through "OIL LEVEL" hole, allowing trapped air to escape. Install plug.

LUBRICATION POINTS

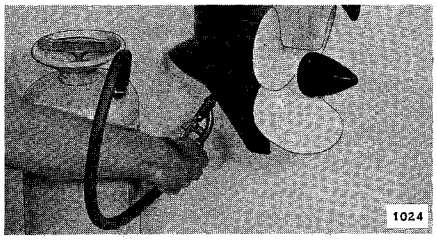


Figure 2-3. Gearcase

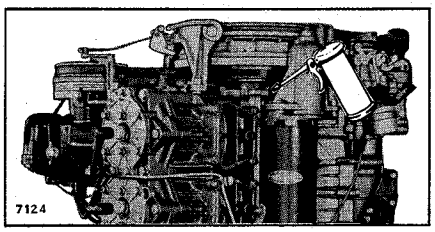


Figure 2-4. Starter Pinion Gear Shaft

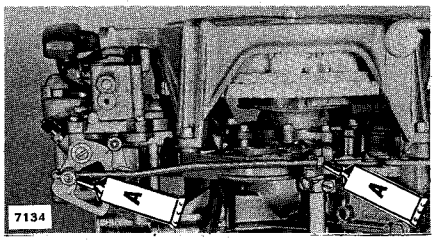


Figure 2-5. Carburetor & Magneto Linkage

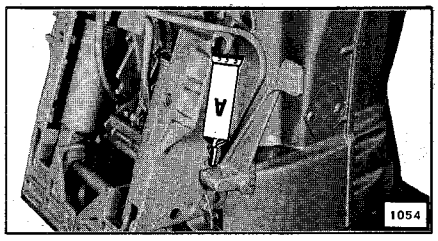


Figure 2-6. Tilt & Trailing Lever

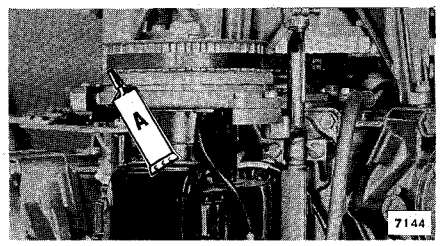


Figure 2-7. Safety Switch Cam

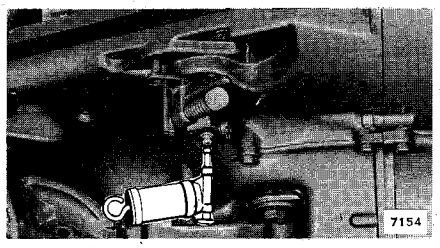


Figure 2-8. Throttle Shaft Gears

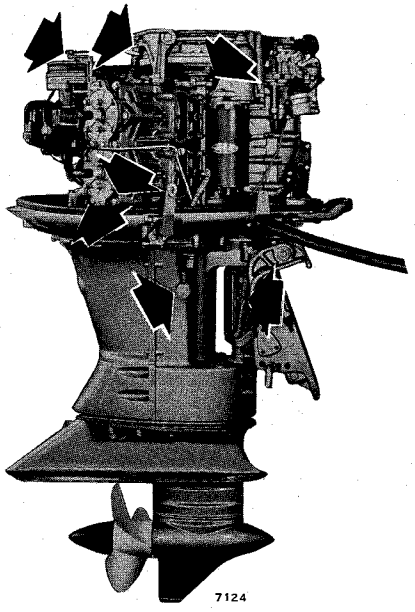


Figure 2-1. Starboard Side

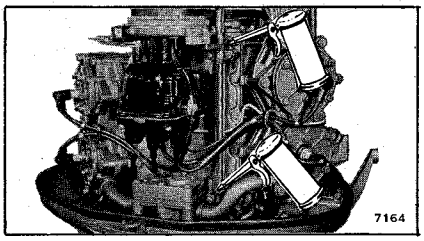


Figure 2-9. Throttle & Shift Shaft Bearings

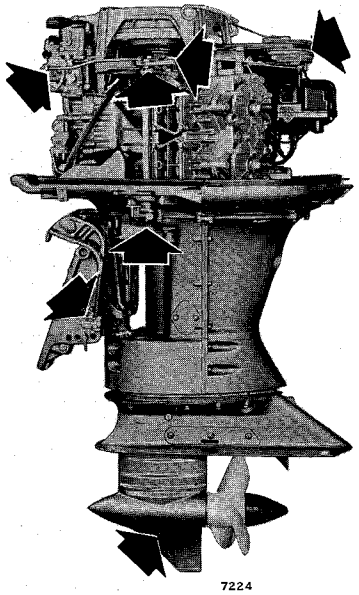


Figure 2-2. Port Side

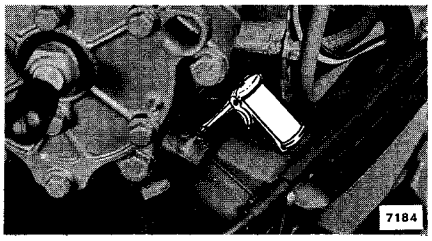


Figure 2-10. Throttle & Shift Shaft Bearings

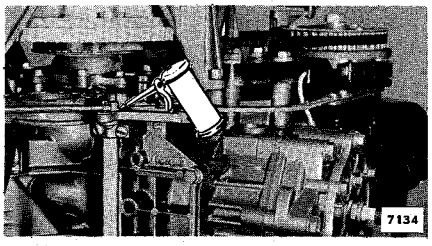


Figure 2-11. Throttle & Shift Shaft Bearings

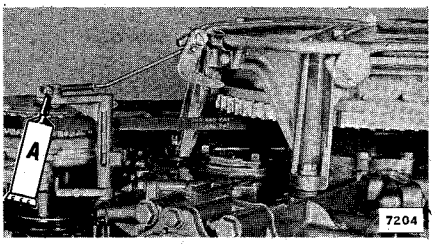


Figure 2-12. Gear Shift Lever Shaft & Lockout

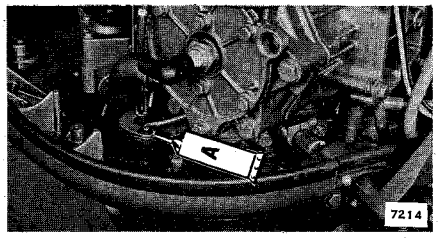


Figure 2-13. Gear Shift Lever Shaft & Lockout

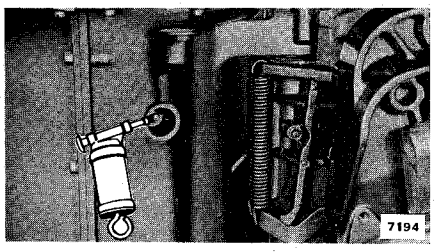


Figure 2-14. Gear Shift Lever Shaft & Lockout

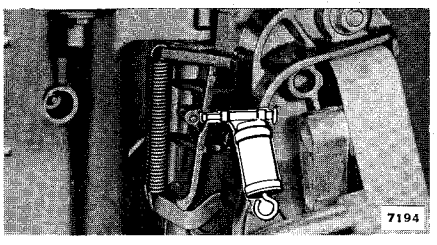


Figure 2-15. Swivel Bracket Fitting

TUNE-UP PROCEDURE

When an owner brings a motor to you for a tune-up, or for some minor operating malfunction, the following procedure should be used as a guide to determine the cause of the malfunction. Write down the owner's comments. Keep an accurate card file on your service shop operation. Each service operation should be on record as to the:

OWNER'S NAME
DATE
MODEL NO.
SERIAL NO.
NATURE OF COMPLAINT
NATURE OF WORK PERFORMED
COST TO THE OWNER
WAS WORK PERFORMED UNDER WARRANTY?

After writing down the owner's comments, check the motor visually and begin a systematic tune-up procedure. Consult the Trouble Check Chart to find the causes of any malfunction which may be discovered when tuning up the motor.

1. Remove exhaust covers, intake by-pass covers, and cylinder heads. Slowly rotate flywheel and visually inspect pistons, rings, and cylinders for wear, freeness, and carbon deposits.

SPECIAL NOTE

Piston ring condition should be determined before continuing tune-up. Gum and varnish deposits on rings or pistons may be removed with an application of OMC Accessory Engine Cleaner.

If pistons and rings are considered to be in satisfactory condition for continued service, reinstall covers, using new gaskets.

2. Remove and inspect spark plugs. Clean and regap or replace as necessary.

3. Clean carbon from cylinder heads and top of pistons. Reinstall cylinder heads, using new gaskets.

4. Inspect and test points, condenser, coil, and ignition wires. See Section 4 for test procedures.

5. Inspect carburetor and choke.

6. Inspect fuel pump and lines. Clean filter bowl and inspect for chips or cracks. Replace filter element and gasket.

7. Synchronize distributor and carburetor linkage. See Section 4.

8. Check propeller for condition and correct pitch. See Section 6.

9. Drain and refill gearcase and thoroughly lubricate all components of the motor. See Pages 2-4 and 2-5.

10. Tighten all screws and nuts, etc., to specified torque. See Page 2-3. Retorque cylinder head screws after motor test has been completed.

11. Tank-test and adjust carburetor high- and low-speed needles; check cooling system operation. Use a tachometer for accurate rpm tests.

12. Fog motor for storage, using OMC Accessory Rust Preventative Oil.

TROUBLE CHECK CHART

TROUBLE	POSSIBLE CAUSE
1. MOTOR WILL NOT START	A. FUEL SYSTEM - See Section 3 Fuel line improperly connected Engine not primed Speed control not advanced (throttle closed) Engine flooded Old fuel Clogged fuel filter Choke not closing completely Choke spring broken or disconnected Fuel system faulty B. IGNITION SYSTEM - See Section 4 Timing, cam, or linkage improperly adjusted Inverted breaker cam Sheared flywheel key Safety switch screws loose Ignition system faulty C. ELECTRICAL SYSTEM - See Section 7 Starter circuit faulty
2. LOSS OF POWER - (Assuming Ignition OK)	A. POWER HEAD - See Section 5 Lower bearing head loose (check end play) Carburetor and distributor not synchronized Throttle control lever (won't advance)

TROUBLE CHECK CHART (CONT)

TROUBLE	POSSIBLE CAUSE
2. LOSS OF POWER (CONT)	Air leak at manifold gaskets - warped manifold (backfires) Broken leaf valves (backfires) Cracked carbon seal (water in cylinders) Excessive carbon on pistons and cylinder head Stuck piston, rings, or scored cylinder B. CARBURETOR - See Section 3 Poor fuel mix - too much oil Carburetor adjustment - (too lean - backfires) (too rich - excessive fuel) Linkage screws loose Choke not operating Air leaks at packing nuts Inlet needle and seat worn or sticky Incorrect carburetor float setting Incorrect orifice plug C. FUEL PUMP AND TANK - See Section 3 Faulty fuel hose (poor clamps or seals) (kinked) Fuel tank or pump filter plugged Fuel filter restricted Fuel and vent valves not opening Valves not operating Operating hose passage restricted Diaphragm leaking or damaged Fuel system hoses plugged D. EXHAUST GAS ENTERING CARBURETOR - See Section 6 Exhaust cover screws leaking Cover plate gasket damaged Damaged exhaust housing seal Exhaust relief boot cut Adapter gaskets leaking Cracked exhaust housing Exhaust tube to cylinder screws loose or missing E. OVERHEATING POWER HEAD - See Section 5 Exhaust cover gasket leaking Inner exhaust cover leaking Thermostat housing broken Pressure control valve damaged Power head gasket improperly installed or damaged Head gasket leaking (warped head) (water in cylinders) F. LOWER UNIT - See Section 6 Water intakes obstructed Pump housing air bleed restricted Water passages obstructed Pump plate not sealing (bottom) Pump impeller damaged Pump housing or plate worn Pump housing seal worn (driveshaft grooved) Water tube bushing loose G. EXHAUST GASES ENTERING COOLING SYSTEM - See Section 6 Pump impeller plate not sealing (bottom) Damaged water tube grommets or "O" rings Gearcase stud lockwasher leaking Pump housing seal damaged (5" adapter seals) Exhaust outlet gasket missing Exhaust tube to adapter gasket damaged
3. ENGINE MISFIRES (Assuming Fuel System & Carburetor OK)	A. SPARK PLUGS - See Section 4 Crossed or reversed leads Cover or inner terminal damaged (spark plug point out of H.T. lead) Faulty leads Loose - low torque Incorrect heat range Defective (cracked insulator)

TROUBLE CHECK CHART (CONT)

TROUBLE	POSSIBLE CAUSE
3. ENGINE MISFIRES (CONT)	B. DISTRIBUTOR - See Section 4 Incorrectly adjusted points (vibration) Incorrect timing Loose wiring Coil or condenser damaged (loose) Fibre breaker block worn Points dirty or pitted Defective breaker cam C. CORRODED OR CRACKED DISTRIBUTOR CAP & ROTOR - See Section 4 Incorrect rotor Loose distributor ground cable Rotor brush stuck or worn Carbon path in distributor cap Worn shaft bearings
4. POOR PERFORMANCE ON BOAT	A. INCORRECT PROPELLER Incorrect tilt angle (smoking) Poor fuel mix - too much oil - (smoking) Remote controls incorrectly adjusted Propeller hub slipping Bent or worn propeller Exhaust outlet damaged or missing Bent gear housing or exhaust housing (broken driveshafts) Altitude horsepower loss Catamaran (single engine) - venturi effect Exhaust leaks Overheating B. CAVITATION Protruding hull attachments Keel too long Bent propeller (vibration) Transom too high C. BOAT Improper load distribution Marine growth on bottom Added weight (water absorption) Hook in bottom
5. STARTER MOTOR WILL NOT OPERATE	A. STARTING CIRCUIT - See Section 7 Loose or corroded battery connections Safety switch inoperative (loose) Throttle advanced too far Poor or broken battery connections Weak or shorted battery Defective key or starter switch Jammed starter drive Damaged starter drive parts Worn brushes Broken brush spring Open circuit in solenoid Burned commutator Broken field terminal Shorted or open windings - armature or field B. EXCESSIVE STARTER CURRENT DRAW - See Section 7 Worn or dry armature shaft bearings Excessive friction in engine Brushes not seating Dirty or corroded commutator Loose pole pieces Shorted armature or field Bearing heads buckled

SECTION 3
FUEL SYSTEM

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DESCRIPTION

FUEL FLOW

The Sportfour 60 HP fuel system consists of fuel tank, fuel pump, and carburetor. The fuel tank is non-pressurized, suction operated. A diaphragm-displacement type fuel pump on the motor draws fuel from the tank and furnishes it to the carburetor through a fuel filter.

CARBURETOR

The carburetor is a two-barrel, downdraft type. See Figure 3-1. High- and low-speed needle valves are adjustable. Carburetor and magneto are synchronized through an adjustable linkage.

LEAF VALVES

There are four individual leaf plate housings, one for each cylinder, but all attached to a common leaf plate base. Each leaf plate housing has twin 4-segment leaf valves attached, one on each side. The entire assembly is mounted between the crankcase and intake manifold, and may be removed for inspection and repairs. See Figure 3-2.

CHOKE AND CHOKE SOLENOID

The carburetor is fitted with a manual choke to reduce the ratio of air to fuel for cold starts. Two choke valves, one in the air inlet of each barrel, are mounted to a common choke shaft.

When the choke lever is pulled out, the valves are held in a closed position, restricting the flow of air to the carburetor.

A choke solenoid, mounted on the carburetor, closes the choke valves when the choke switch is depressed. The choke solenoid operates the choke valves through a spring, allowing the choke to open partially as crankcase suction increases. See Figure 3-3.

FUEL PUMP

The fuel pump is of the diaphragm-displacement type, and is operated by changes in crankcase pressure. Alternate suction and pressure in the crankcase are transmitted to the pump diaphragm through a flexible hose. Suction created on the upward stroke of the piston causes the diaphragm to displace and draw in fuel through the inlet valve. On the fol-

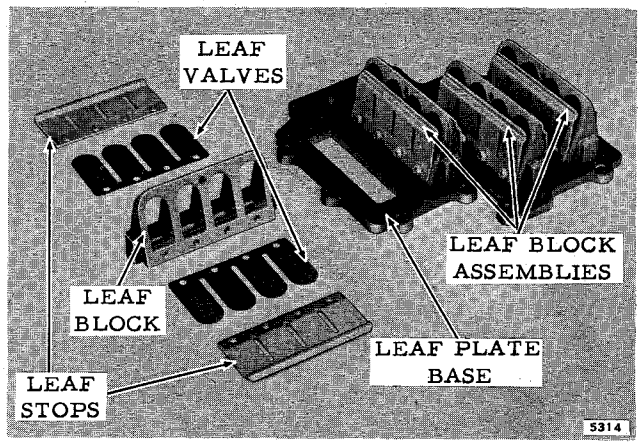

Figure 3-2. Leaf Valve Assembly

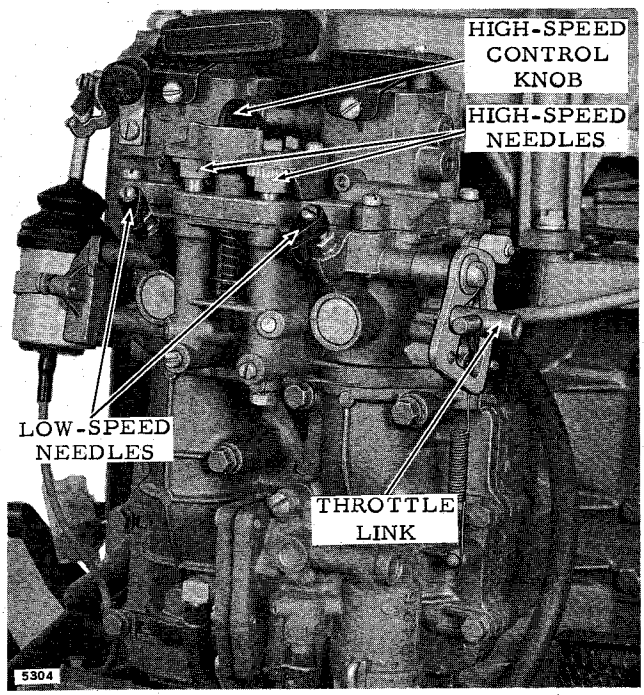

Figure 3-1. Carburetor and Choke Assembly

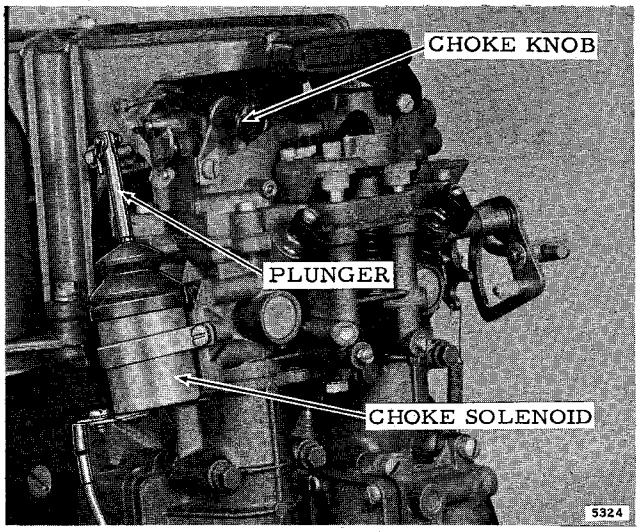

Figure 3-3. Choke Solenoid

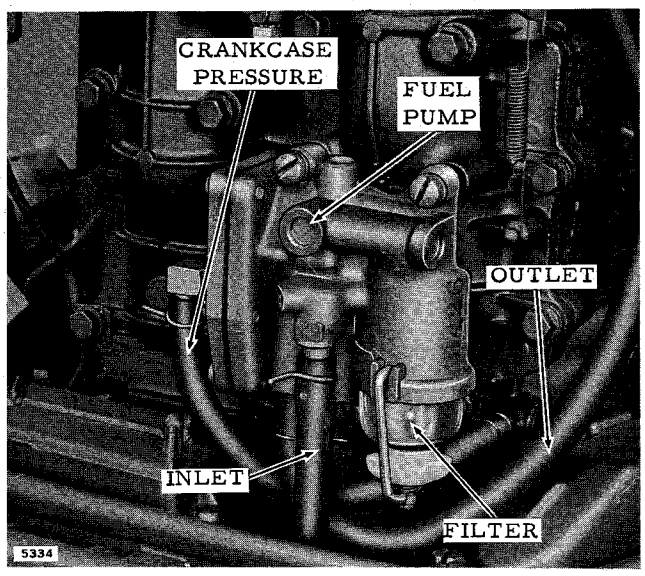

Figure 3-4. Fuel Pump, Filter, and Hoses

lowing downward stroke of the piston, crankcase pressure flexes the diaphragm in the opposite direction. The inlet valve is then seated, preventing the return of fuel to the tank, while the discharge valve is opened, allowing fuel to pass to the carburetor.

Fuel is drawn through a fine mesh filter before entering the pump to remove impurities. See Figure 3-4.

FUEL TANK

The fuel tank is a non-pressurized, suction operated tank. Fuel is lifted from the tank to the carburetor by the fuel pump. Priming is achieved by squeezing the primer bulb (part of the fuel line) several times or until pressure required to squeeze the bulb increases. The connector nearest the primer bulb must be connected to the fuel tank. See Figure 3-5.

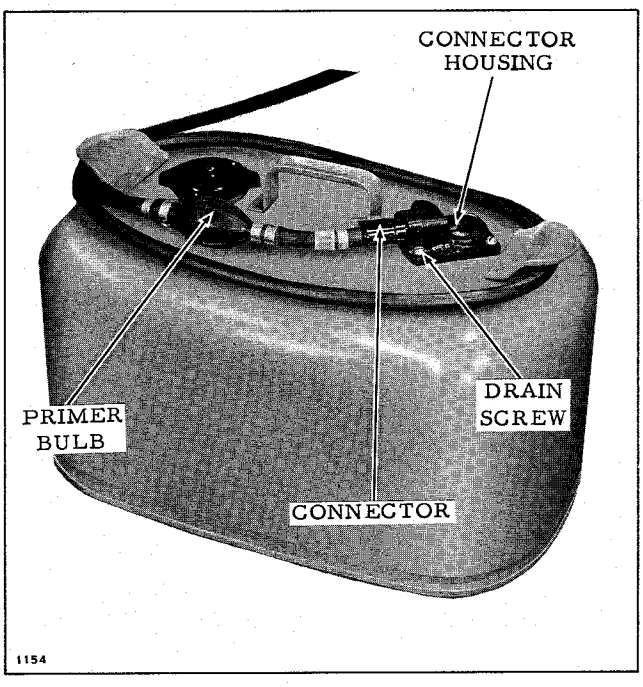

Figure 3-5. Fuel Tank

The tank air inlet and fuel outlet are sealed until the supply line connector is plugged into the tank. When the fuel line is attached, two disc valve plungers are depressed, forcing the disc valves off their seats. This vents the tank to the atmosphere and opens the fuel outlet. "O" ring seals in the fuel connectors shut off fuel flow when the line is disconnected from the tank or motor. To facilitate draining and cleaning, a drain screw has been provided in the fuel tank upper housing.

REMOVAL OF CARBURETOR

a. Remove outer set screw and loosen inner set screw to disconnect throttle control rod. See Figure 3-6.

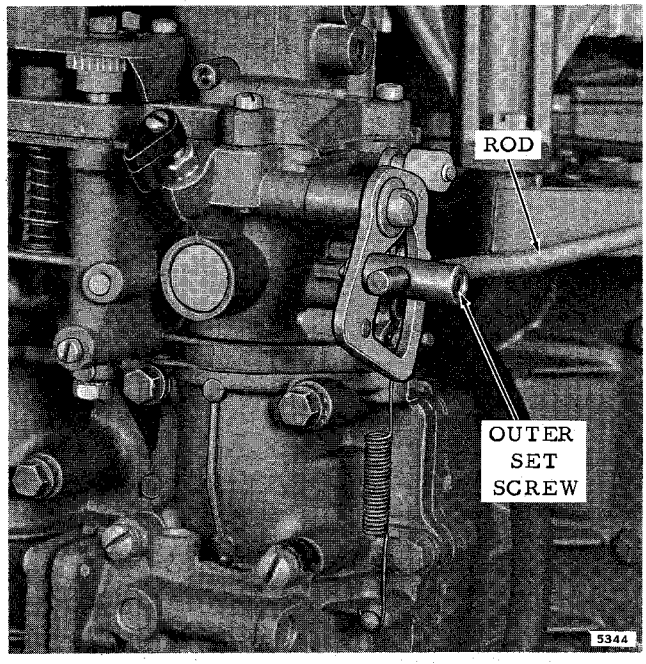

Figure 3-6. Throttle Linkage

b. Disconnect solenoid wire.

c. Disconnect fuel pump hoses, marking them to assure correct reassembly.

d. Remove carburetor and gasket from manifold by removing three screws. See Figure 3-7.

e. Remove fuel pump from intake manifold by removing three screws.

f. Remove intake manifold and leaf plate assembly from crankcase, being careful to avoid damaging leaf plate. To facilitate removal of intake manifold, remove starboard silencer assembly from lower front motor cover.

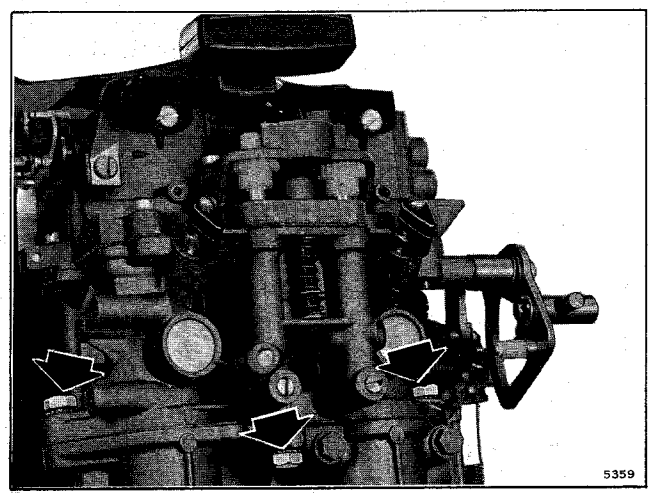

Figure 3-7. Carburetor Attaching Screws

DISASSEMBLY OF CARBURETOR

Disassemble the carburetor in a logical sequence, paying particular attention to the following assemblies.

CARBURETOR BODY

a. Drain the carburetor by removing the plugs from the carburetor body. See Figure 3-8.

b. Remove orifice plugs. To prevent damaging threads in carburetor body, use fixed jet screwdriver (Special Tool #379664). See Figure 3-9.

c. Remove air intake screens.

d. Remove choke solenoid from carburetor body and remove lever and bellcrank from carburetor cover.

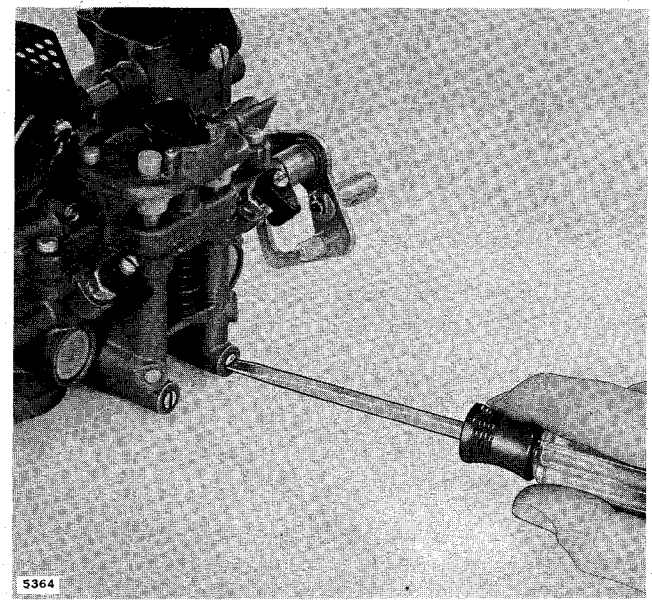

Figure 3-8. Removing Drain Plugs

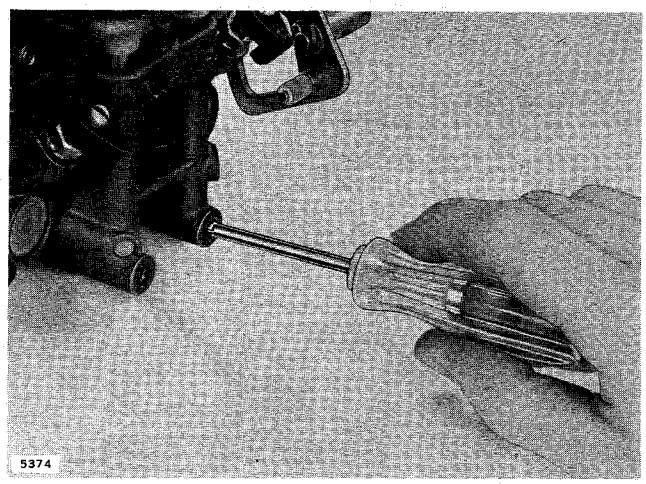

Figure 3-9. Removing Orifice Plugs

e. The threaded ends of the choke and throttle valve attaching screws are staked during assembly to prevent loss during operation.

NOTE

Under normal conditions removal of choke and throttle valves is not necessary. See "Cleaning, Inspection, and Repair" for service instructions.

f. Remove high-speed control gear shaft retainer ring, washers, spring, and shaft. See Figure 3-10.

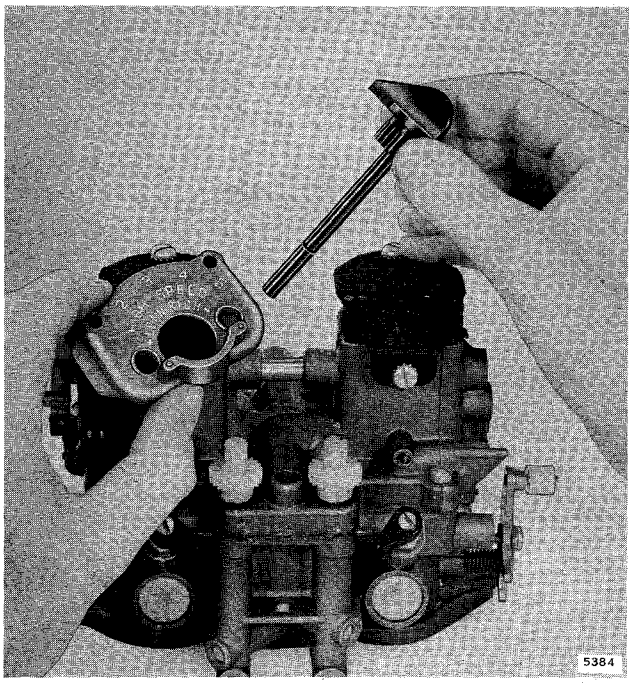

Figure 3-10. High-Speed Control Gear Assembly

FLOAT AND NEEDLE VALVES

a. Separate the carburetor cover from the carburetor body by removing eight screws. See Figure 3-11.

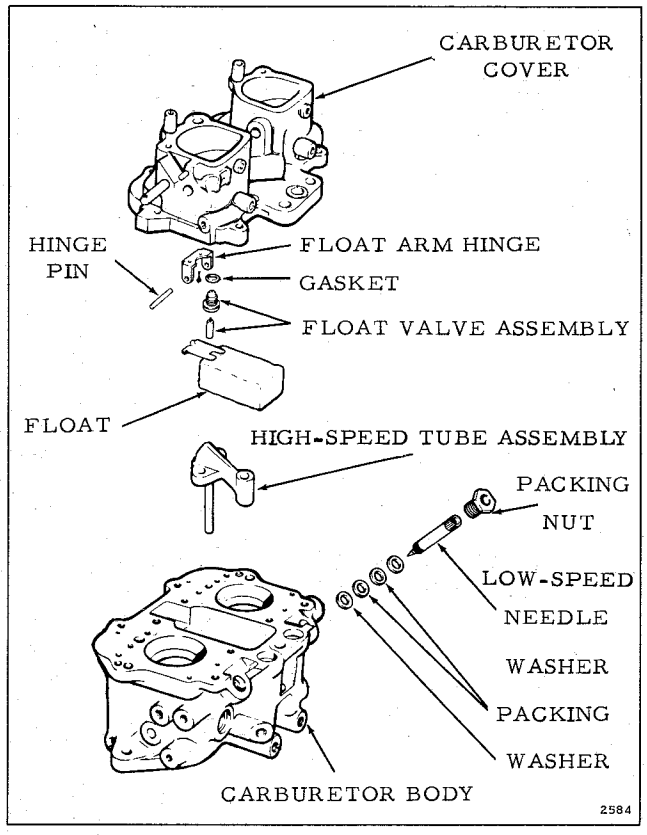

Figure 3-11. Carburetor Assembly

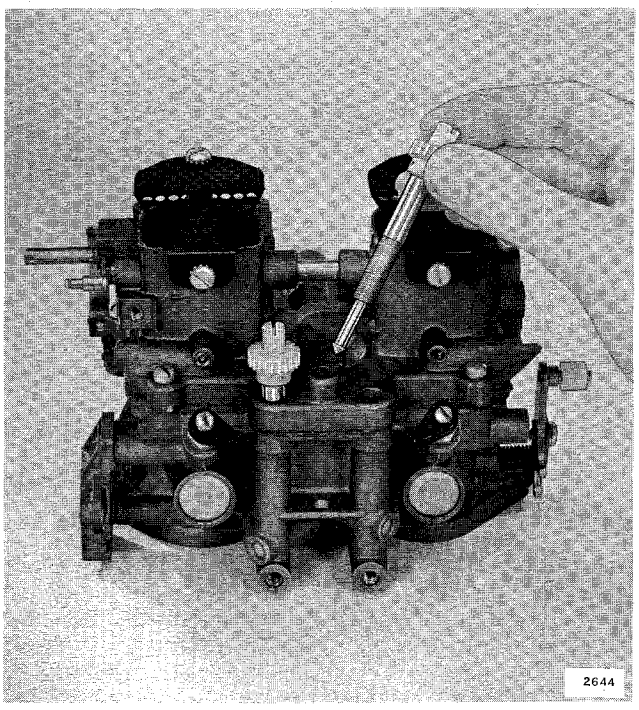

Figure 3-12. Removing High-Speed Valves

b. Remove nylon hinge pin to permit removal of float and float arm assembly. Remove float valve, float valve seat, and gasket assembly from carburetor cover. See Figure 3-11.

c. Remove control gear cover, high-speed valves, and detent. See Figure 3-12.

d. Remove low-speed needle packing nuts and low-speed needle valves from carburetor. Removal of needles will be facilitated by replacing knobs upside down on needles. See Figure 3-13.

e. Remove needle valve packing and washers, being careful to avoid damaging threads.

LEAF BLOCK ASSEMBLIES

Disassemble leaf block assemblies. See Figure 3-14. Special caution is necessary in disassembling the leaf block assemblies; do not damage or interchange the leaves. The leaves must be absolutely flat to

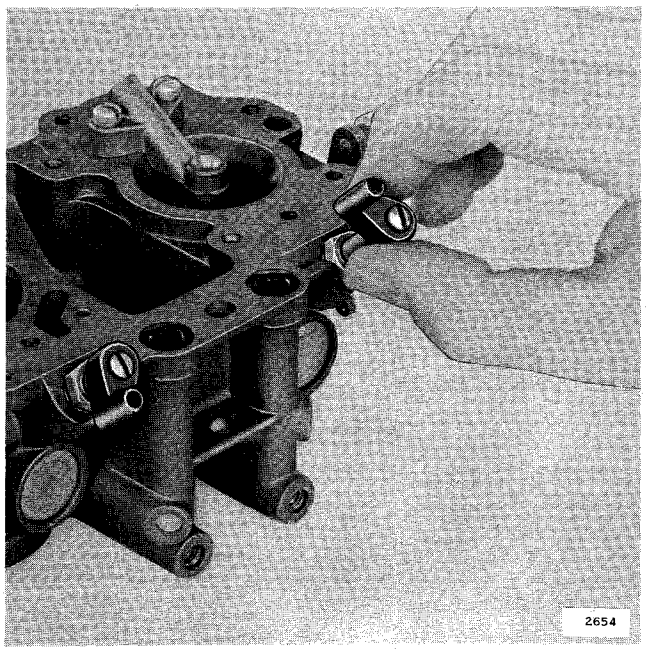

Figure 3-13. Removing Low-Speed Valves

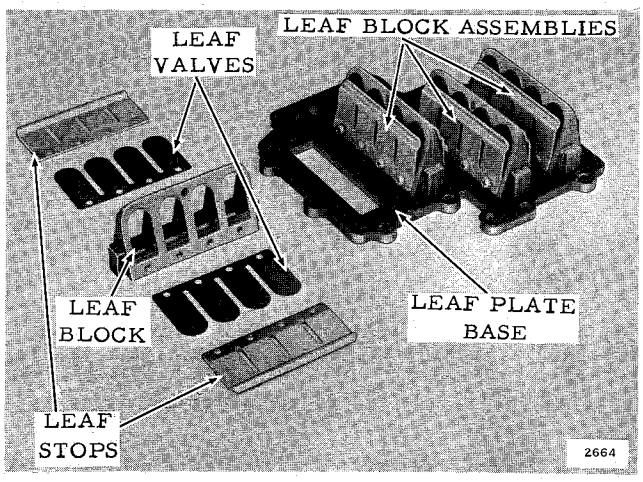

Figure 3-14. Leaf Valve Assembly

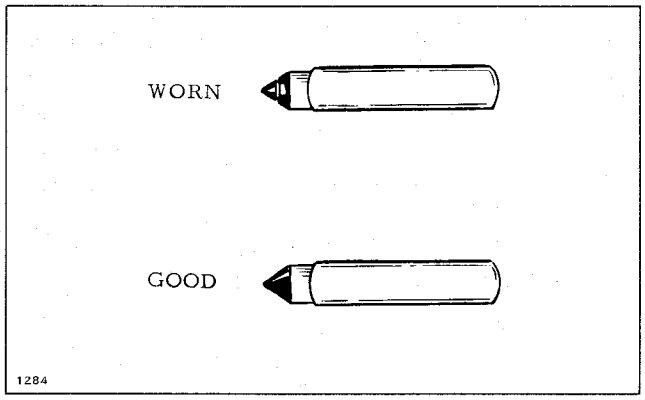

Figure 3-15. Needle Valve Condition

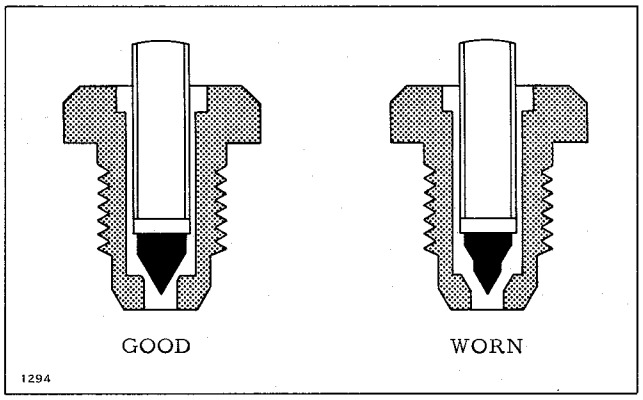

Figure 3-16. Needle Valve Seat Condition

maintain a tight seal with the plate. DO NOT under any circumstances bend or flex the leaves by hand. It is advisable to clean, inspect, and immediately reassemble the leaf block assemblies, rather than leave them apart for reassembly later.

CLEANING, INSPECTION, AND REPAIR

GENERAL INSTRUCTIONS

Clean all parts, except float, in solvent and blow dry. Do not dry parts with a cloth as lint may cause trouble in the reassembled carburetor. Be sure all particles of gaskets are removed from gasket surfaces. Flush out all passages in the carburetor body with solvent and remove any gummy deposits with OMC Accessory Engine Cleaner. Certain solvents will not remove this gum which accumulates particularly in the float chamber and on the needle valves.

FLOATS AND NEEDLE VALVES

a. If a float has become damaged, discard it and install a new one. If the float appears to be in good condition, thoroughly clean it before reinstalling.

b. Check for float bowl leakage at the float hinge pin areas; if leakage exists, remove hinge pin and reinstall, using a varnish type sealer such as Gasoila. If leakage still exists, the hinge pin and/or float bowl must be replaced. Check float arm for vibration wear at the area where it contacts the needle valves, and replace if necessary. Replace valve seat gasket.

c. Inspect the tapered ends of the float valve needles for grooves, nicks, or scratches; if any are found, replace float valve assembly. See Figure 3-15. Gum or varnish on the needle must be removed with OMC Accessory Engine Cleaner. DO NOT attempt to alter the shape of needle valves or seats.

d. Check the needle valve seats with a magnifying glass. If seat is nicked, scratched, or worn out-of-round, it will not give satisfactory service. See Figure 3-16. The valve seats are matched with the needles; if the seat or the needle is damaged, both parts must be replaced. Upon reassembly of the needles and seats always use new valve seat gaskets and "O" rings.

e. Make sure the grooves in the orifice plugs are open.

LOW-SPEED NEEDLES

Inspect the tapered ends of the low-speed needles for grooves, nicks, or scratches. If any are found, replace the needle valve. See Figure 3-17.

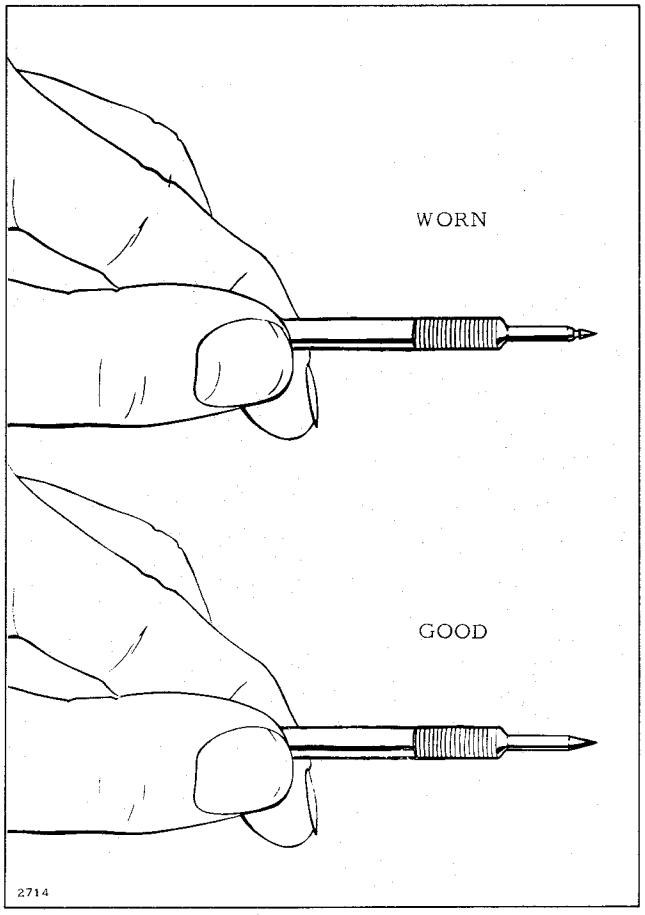

Figure 3-17. Low-Speed Needle Valve Condition

LEAF VALVES

The only requirements for leaf valves are that they must be cleaned of all dirt, gum, and varnish, and that the leaves must be perfectly flat and without distortion so that they form a perfect seal with the plate. DO NOT attempt to bend or repair a damaged leaf; replace it if broken or damaged. Also check condition of leaf stop for bent elements and replace if damaged. If a leaf valve is damaged, both the leaf valve and stop must be replaced.

OIL DRAIN VALVE ASSEMBLY

a. The oil drain leaf valve assembly ordinarily requires little or no attention. When the motor is being serviced, however, remove and clean the oil drain openings on the leaf plate base.

b. If gum or varnish is found in the crankcase during servicing, clean the leaf plate in OMC Accessory Engine Cleaner, as it is likely that gum and varnish have also been deposited there.

c. Make sure that the leaf valve seats against the leaf plate, and that there is .040" clearance under the leaf stop. See Figure 3-18.

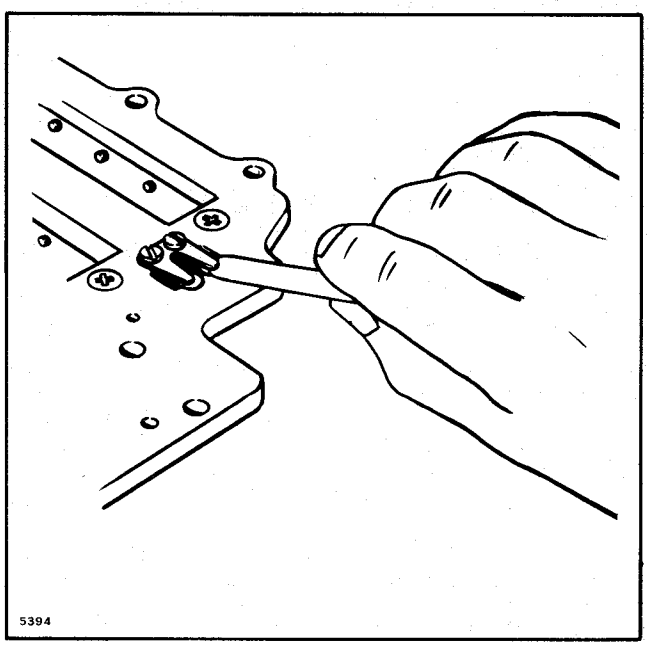

Figure 3-18. Checking Oil Drain Valve

CARBURETOR BODY

a. Clean out all the jets and passages, and the venturi, making sure no gum or varnish deposits remain. Dry after cleaning with compressed air. Keep clean for final reassembly.

b. Check all gasket surfaces for nicks, scratches, or distortion. Slight irregularities can be corrected with the use of a surface plate and emery cloth.

c. Check throttle and choke shafts for excessive play. Check operation of choke and throttle valves to be sure they correctly shut off air flow, yet move freely without binding. Replace carburetor body if valves or shafts are excessively worn or damaged.

NOTE

The threaded edges of the choke and throttle valve attaching screws are staked during carburetor assembly to prevent loss during operation. Disassembly of these valves is possible, but replacement of the carburetor body is recommended.

SOLENOID

The choke solenoid requires very little attention. For efficient operation, the plunger should be free from corrosion so that it can move freely in the solenoid housing. It is not necessary to lubricate the solenoid plunger since the oil film will only attract dust and cause sluggish plunger movement.

HIGH-SPEED TUBE ASSEMBLIES

Thoroughly clean, making sure no gum or varnish deposits remain. Dry after cleaning with compressed air. Keep clean for final assembly. The high-speed tubes are not serviced individually; if replacement is necessary, the entire assembly must be replaced.

CORE PLUGS

If leakage occurs at a core plug area, follow these steps:

a. If leakage is slight, a smart tap with a hammer and flat end punch in the center of the core plug will normally correct this condition. See Figure 3-19.

b. If leakage persists, drill a 1/8 inch hole through the center of the core plug to a depth of not more

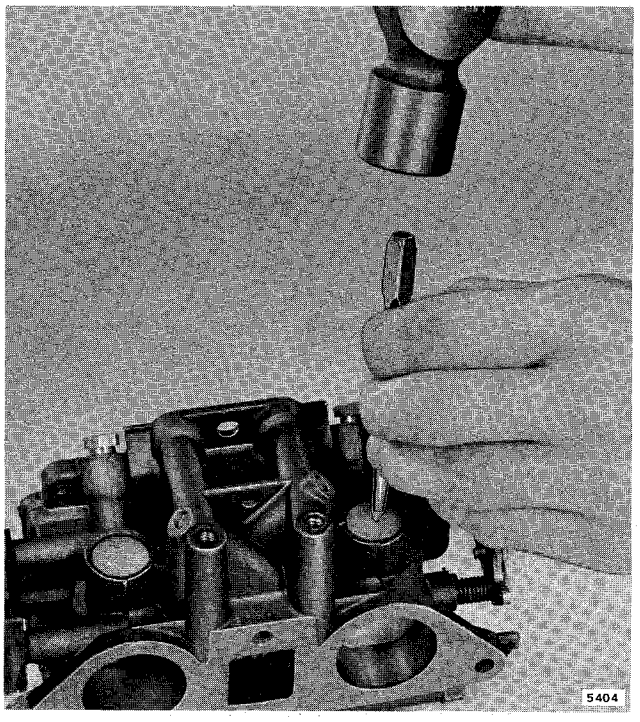

Figure 3-19. Installing or Tightening Core Plug

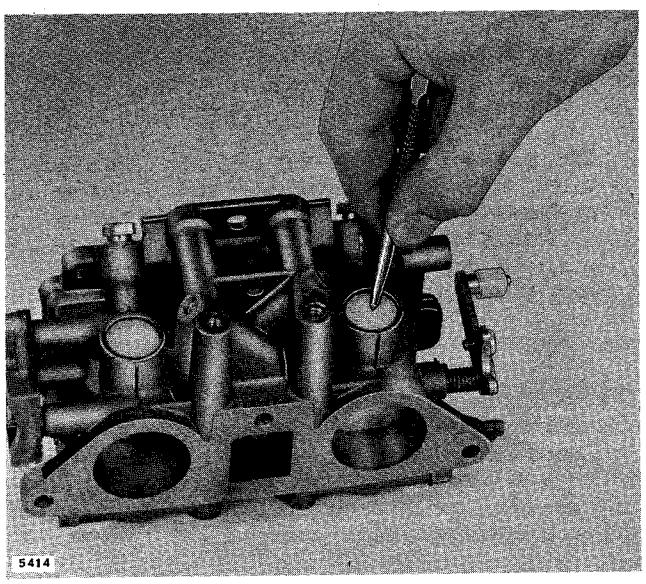

Figure 3-20. Removing Core Plug

than 1/16 inch below its surface. With a punch, carefully pry out the core plug. See Figure 3-20.

c. Inspect and clean casting contact area; if nicks, scratches, or an out-of-round condition exist, the casting will have to be replaced. If the casting opening is normal, apply a bead of Sealer 1000 to the outer edge of a new core plug and place the new core in the casting opening, convex side up. Flatten to a tight fit with a flat end punch and hammer. Check for leakage.

LEAD SHOTS

If leakage occurs at a lead shot area, follow these steps:

a. If leakage is slight, a smart tap with a hammer in the center of the lead shot will normally correct this condition. See Figure 3-21.

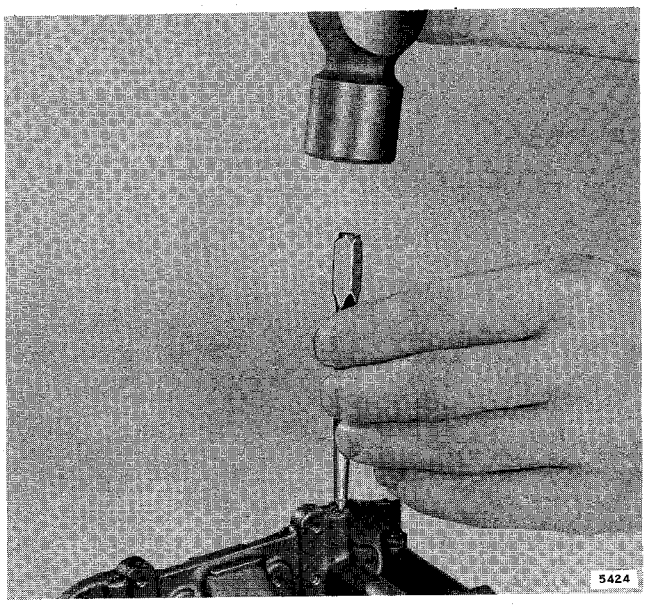

Figure 3-21. Installing or Tightening Lead Shot

b. If leakage still exists, remove the lead shot with an appropriate sharp tool. See Figure 3-22.

c. Clean and inspect casting opening.

d. If the casting opening is normal, install new lead shot in casting opening and flatten out with light hammer taps. Check for leakage.

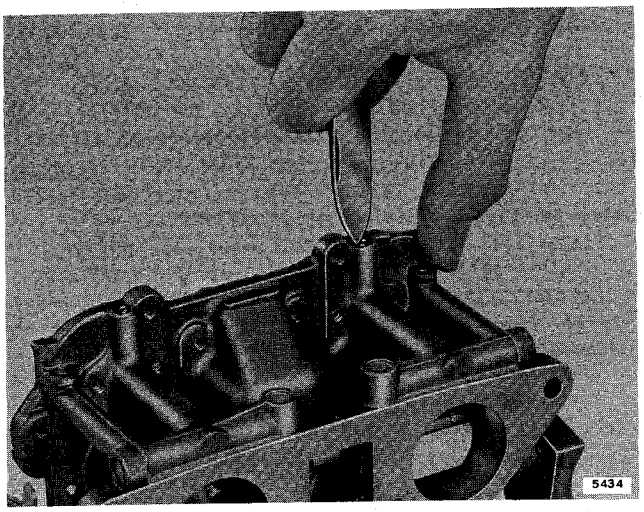

Figure 3-22. Removing Lead Shot

REASSEMBLY OF CARBURETOR

GENERAL INSTRUCTIONS

Reassemble the carburetor, paying particular attention to the following procedure. Keep all dust, dirt, and lint out of the carburetor during reassembly. Be sure that parts are clean and free from gum, varnish, and corrosion when reassembling them. Replace all gaskets and "O" rings. DO NOT attempt to use original gaskets and "O" rings because leaks may develop after the engine is back in use.

Check the Torque Chart in Section 2 for correct torque recommendations during reassembly.

CARBURETOR BODY

a. Replace the high-speed orifice plugs and screw plugs.

b. Install new packing and packing washers in sequence shown in Figure 3-11. Install the low-speed needles, turning in carefully with finger pressure (use one of the adjusting knobs for this operation) until it comes lightly against the seat, then back off 1-1/4 turns. CAUTION should be taken to prevent jamming the needles against the seats.

c. Low-speed needle valves will be adjusted after the carburetor has been completely assembled and installed on the motor.

d. Install the packing nuts, and tighten until needles can just be turned under finger pressure.

e. Attach the high-speed venturi assemblies to the carburetor body, using venturi locating gage (Special Tool #379242) to assure correct positioning for optimum performance. See Figure 3-23.

f. Check operation of the choke to be sure valves correctly shut off air flow. Excessive air leakage around the edges of the valves will cause improper functioning of the choke.

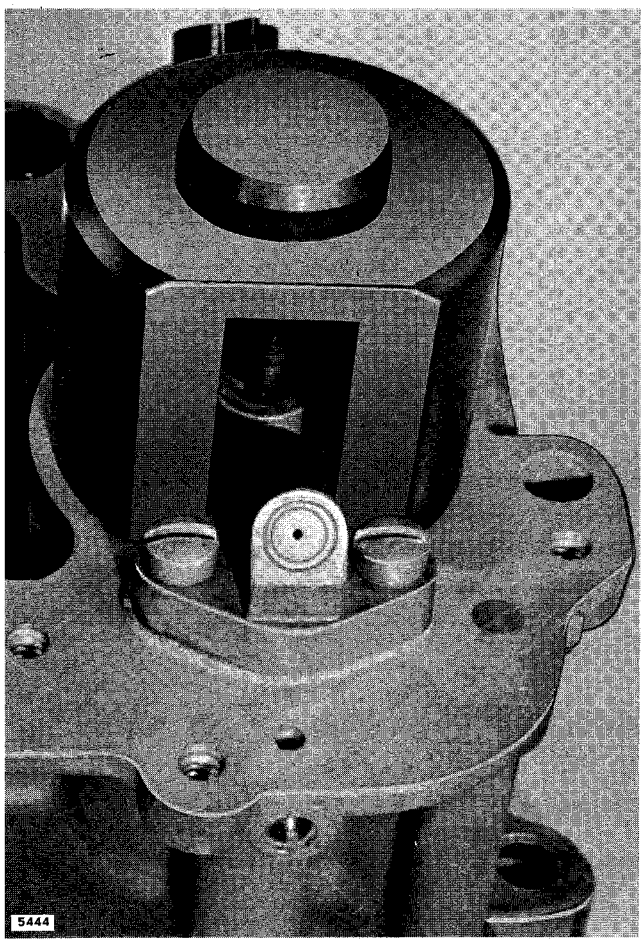

Figure 3-23. Venturi Locating Gage

CARBURETOR COVER

a. Replace float valve seat and gasket, float valve, float, and hinge pin.

b. Check for correct positioning of float. Turn carburetor cover upside down so weight of float closes needle. With float arm straight, float should be parallel with face of casting and approximately 1/4" from casting. See Figure 3-24.

c. Attach carburetor cover to carburetor body, using a new gasket.

d. Install the high-speed needle valve and gear assemblies. Turn the needles in carefully until seated lightly, then back out 3/4 turn. DO NOT turn down tight as the taper on the needles may be damaged.

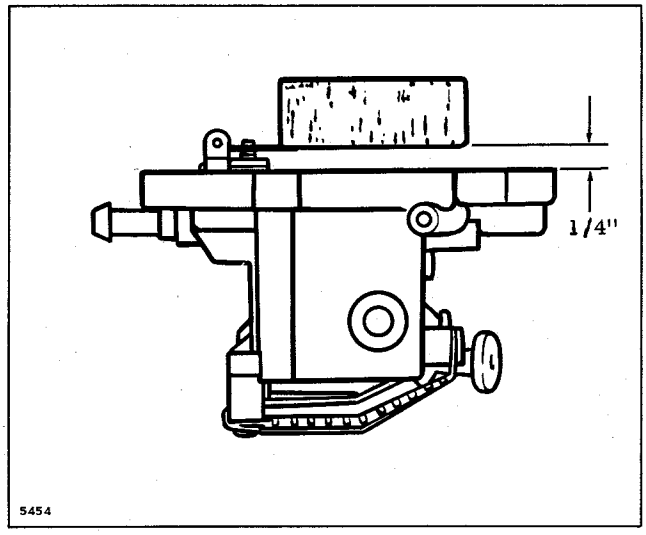

Figure 3-24. Float Level

e. Replace high-speed control gear and cover. High-speed needles will be adjusted after the carburetor has been completely reassembled and installed on the motor.

CHOKE AND CHOKE SOLENOID

a. Check the choke for free operation. Choke valves must move freely, without binding.

b. Attach choke arm to choke shaft, and install choke solenoid and spring.

c. Adjust position of choke solenoid so that choke valves close when plunger bottoms in solenoid. Closed end of solenoid should be approximately flush with boss. See Figure 3-25. With choke knob pulled all the way out, choke shaft should have 1/16" free movement.

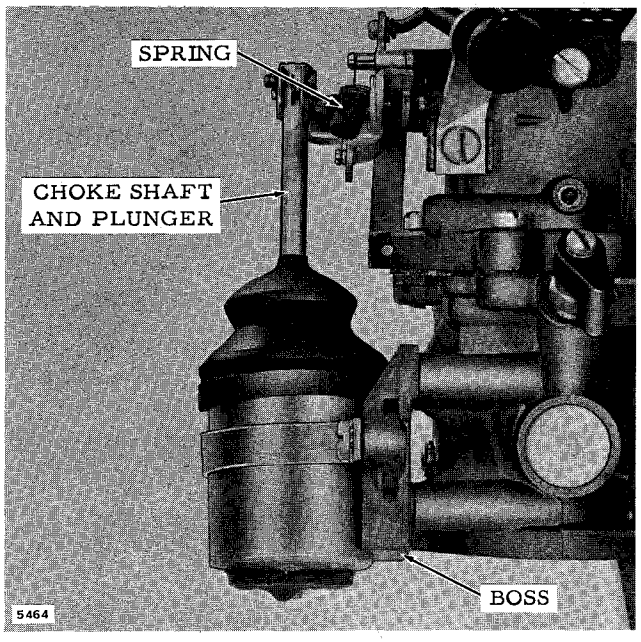

Figure 3-25. Choke Solenoid Adjustment

LEAF VALVES

a. The importance of keeping the leaves in these valves free from distortion cannot be over-emphasized. Replace any leaf or leaf stop which shows any indication of distortion or damage.

b. The leaf is so designed that it maintains constant contact with the leaf plate, and will spring away from the plate when predetermined pressure is exerted against it. Leaf travel away from the plate is limited by the leaf stop. When pressure is removed, the inherent spring action of the segments returns and holds them against the plate. Attach the leaf segments and leaf stop to the leaf plates, then examine each leaf carefully. Each leaf must lie flat against the plate with no edges turned up or away from the plate.

c. Attach the four leaf plate assemblies to the leaf plate base, using a new gasket. Tighten screws to specified torque to avoid distortion of the leaf plates.

REASSEMBLY OF CARBURETOR TO MOTOR

a. Using a new gasket, install the intake manifold and leaf plate assembly on the motor, and attach with screws. Tighten screws to torque specified in Section 2.

b. Attach fuel line to fuel connection on carburetor cover. Replace carburetor assembly on intake manifold, using a new gasket.

c. Attach fuel pump to intake manifold with three screws, and connect fuel pump hoses.

d. Attach solenoid wire at solenoid screw terminal. Install air inlet shields.

e. Attach throttle control rod. Check throttle cam adjustment as described under "Carburetor Operator Operating Adjustments". Check synchronization of linkage as described in Section 4, "Synchronizing Carburetor and Magneto Linkage".

CARBURETOR ADJUSTMENTS

ADJUSTING CAM FOLLOWER

Adjust the position of the throttle arm with respect to the cam follower as follows:

a. Check the position of the throttle arm with respect to the cam follower. Remove carburetor synchronizing rod to gain access to adjusting screw. See Figure 3-26. NOTE: There are two set screws securing the rod, one above the other. Removal of the outer locking screw will allow access to the rod locking screw.

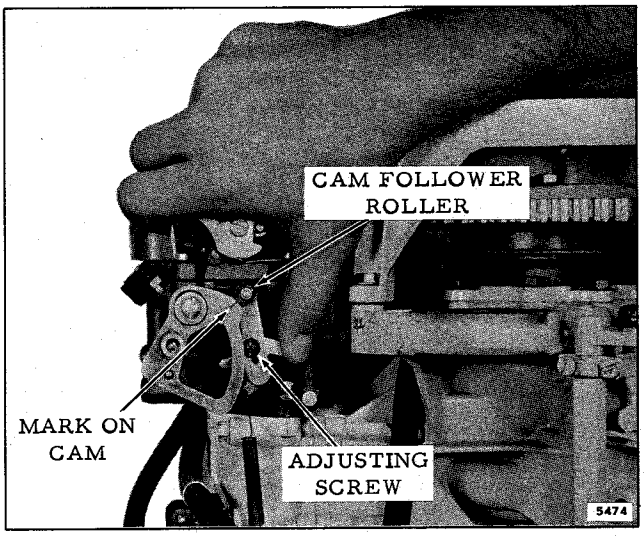

Figure 3-26. Throttle Cam Adjustment

b. Position throttle cam so that synchronizing mark falls in line with the center of the cam follower roller.

c. Loosen adjusting screw and move throttle arm to its limit so that throttle valves are closed. Make sure that cam follower roller is contacting cam and tighten screw.

d. Replace the carburetor synchronizing rod and check synchronization of carburetor and distributor linkage.

SYNCHRONIZING CARBURETOR AND DISTRIBUTOR LINKAGE

To assure proper spark advance at all throttle settings, carburetor and distributor must be synchronized after distributor linkage has been reassembled. Follow the instructions given in Section 4, "Synchronizing Carburetor and Distributor Linkage."

ADJUSTING HIGH- AND LOW-SPEED NEEDLES

a. Remove low-speed adjusting knobs and replace upside down on low-speed needle valves to clear stops on carburetor. Turn each needle gently into its seat, then back out 1-1/4 turns.

b. Lift high-speed control gear knob and turn 180° so pointer rests on control gear cover. Turn each high-speed needle clockwise and seat gently, then back out 3/4 turn.

c. Start motor.

NOTE

Allow motor to reach normal operating temperature by running in a tank with test propeller at one-half throttle or slightly more at least 5 minutes before proceeding to next step.

d. With motor in gear, run at full throttle. Lean out one high-speed needle by turning clockwise until motor starts to slow down, then enrich high-speed needle by turning counterclockwise two notches. Repeat adjustment on second high-speed needle.

NOTE

Since it is almost impossible to detect minor speed changes in the V-4 motor, a tachometer must be used to obtain proper adjustment. Use one throughout the adjusting procedure.

e. Keep motor in gear and retard throttle to fast idle position (700 to 750 rpm). Slowly lean one low-speed needle valve by turning clockwise until motor hesitates or spits slightly; then enrich needle valve by turning counterclockwise 1/8 turn, or to where the highest rpm reading and smoothest performance are obtained. Repeat adjustment on second low-speed needle.

f. Adjustment of high-speed needle MUST be repeated as described in step (d).

g. Snap throttle wide open and note response. If motor hesitates, repeat step (e) and step (d) until motor responds without hesitation. Final adjustment must always be made on high-speed needles.

h. Replace high- and low-speed knobs in normal position without disturbing positions of needles.

i. The carburetor is now properly adjusted. Any further operating adjustments of the high-speed mixture will be made simultaneously through the high-speed control gear.

j. Adjust idle adjustment screw so that motor idles between 600 and 650 rpm IN GEAR.

REMOVAL OF FUEL PUMP AND FILTER

Before starting fuel pump repair, remove, and install a new fuel filter. Check for chipping on edge of fuel fitler bowl. If any is found, replace bowl and gasket. See Figure 3-27. Also remove the fuel hose from the fuel tank and blow through all passages and lines with compressed air to be sure they are open. If clogged lines are the cause of the difficulty, this procedure would eliminate unnecessary disassembly of the fuel pump. If not, fuel pump valves may be stuck or the pump diaphragm may be ruptured.

If fuel pump overhaul is necessary, remove pump from intake manifold by disconnecting fuel inlet and outlet hoses and crankcase suction hose.

NOTE

Color code fuel hoses for correct reassembly.

Remove three screws attaching fuel pump to power head.

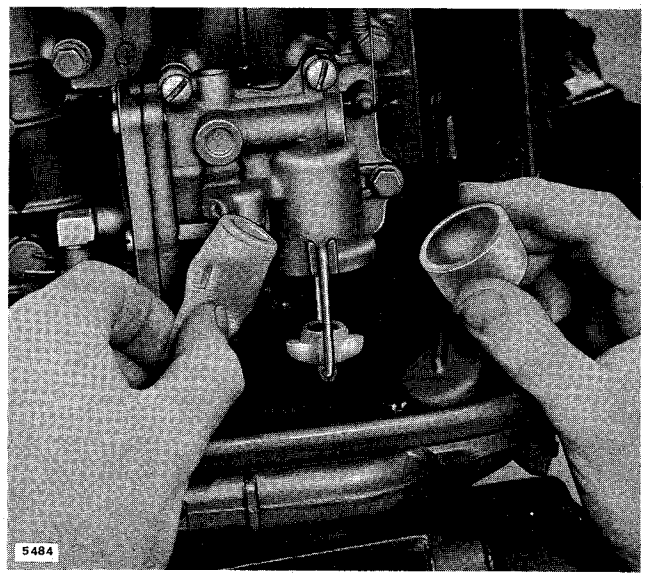

Figure 3-27. Removing Fuel Filter

DISASSEMBLY OF FUEL PUMP

GENERAL INSTRUCTIONS

Note carefully the positions of parts of the fuel pump during disassembly, to avoid errors later in reassembling the pump. See Figure 3-28. Take all precautions to keep dirt from getting into parts, since very small amounts of dirt can cause improper functioning of the pump.

a. Remove six screws attaching cover and elbow to pump body. All parts of the pump with the exception of the valves and valve retainer may be lifted out.

b. Remove the two screws attaching the valve retainer to the pump body. Lift out the retainer and valves.

CLEANING, INSPECTION, AND REPAIR

Clean all parts of the pump and fuel connectors in solvent and blow dry. DO NOT dry parts with a cloth, as lint may stick to the parts and clog the passages or prevent the valves from seating. Dissolve any gummy deposits with OMC Accessory Engine Cleaner (grease solvents will not dissolve these deposits). Inspect diaphragm carefully for cracks. Replace all gaskets and any worn or damaged parts.

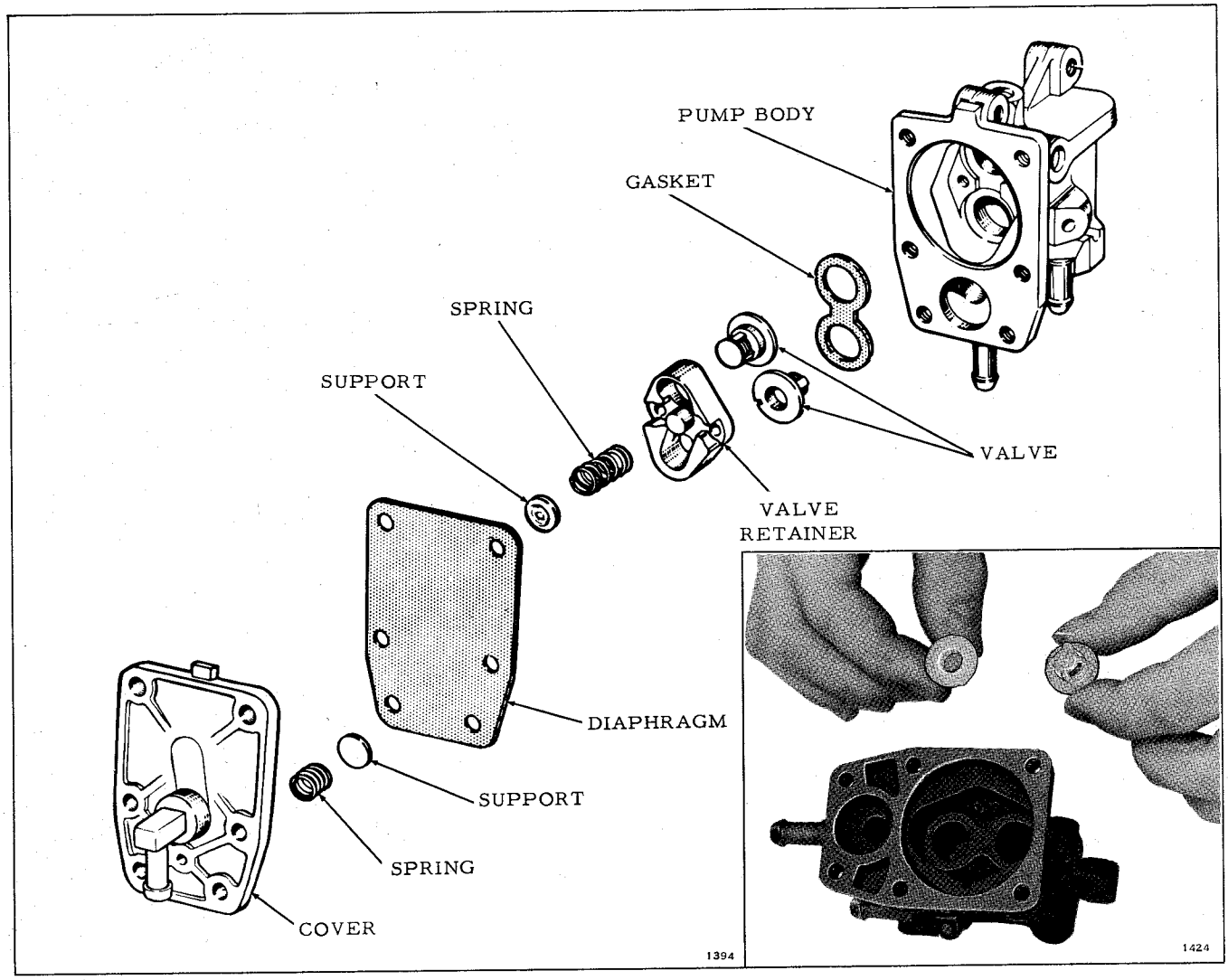

Figure 3-28. Fuel Pump Assembly

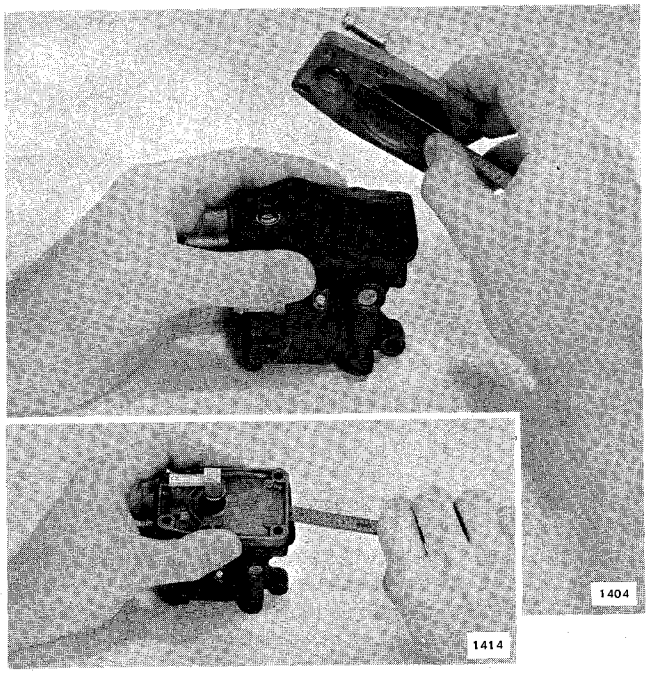

Figure 3-29. Reassembling Fuel Pump

REASSEMBLY OF FUEL PUMP

a. Place gasket into pump body. Install valves in positions shown in Figure 3-28. Install valve retainer.

b. To facilitate assembly of diaphragm and springs, a straight edge may be used to hold down the parts under the diaphragm while the screws are being attached. See Figure 3-29.

c. Attach assembled fuel pump to power head with screws. Reconnect fuel hoses and crankcase suction hose.

NOTE

If leakage occurs at the core plugs in the fuel pump body, follow corrective measures outlined under "Core Plugs".

FUEL TANK

FUEL MIXTURE

A motor in excellent mechanical and operating condition may give faulty performance because of an improper fuel mixture. Petroleum gum and varnish

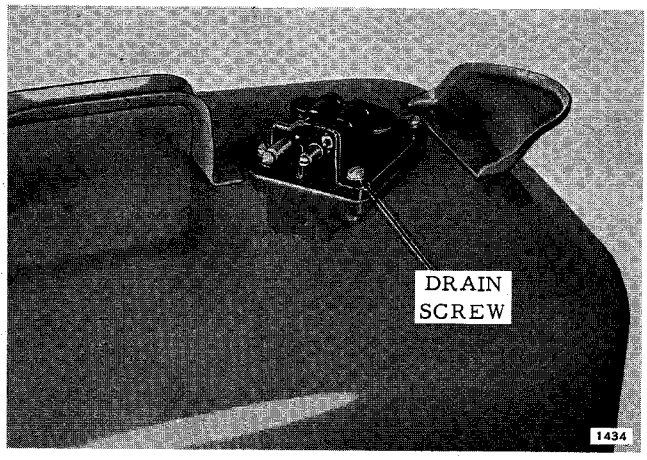

Figure 3-30. Fuel Tank Upper Housing

which precipitate from a stale mixture may clog the filter screen and any small orifices, interfering with starting and normal running. For proper fuel mixtures, see Owner's Manual.

To assure that the fuel tank contains the proper mixture, drain and flush the tank at least once a year, and at every tune-up or major repair. To facilitate complete draining of the tank, a drain screw is provided in the fuel tank upper housing. See Figure 3-30. Clean the tank by flushing with clear gasoline or solvent. Primer pump, screens, etc., may be inspected and cleaned as described below. Refill the tank with the correct fuel mixture.

DESCRIPTION

The fuel tank is of simple but rugged construction, with a capacity of 6 gallons of fuel mixture. It contains the bulb primer (for priming the fuel pump), fuel level gage, fuel hose and connectors, a bracket arrangement to hold fuel line when not in use, and a carry grip. The fuel tank upper housing, which provides the connection to the fuel hose, contains two release valves and a disc valve which prevent any escape of gasoline or fumes, minimizing the danger of explosion or fire.

CLEANING, INSPECTION, AND REPAIR

UPPER HOUSING AND FUEL LEVEL INDICATOR

The fuel level indicator is mounted to the upper housing and fuel line assembly. The entire assembly may be removed by removing the four attaching screws. Lift the assembly from the tank carefully to avoid damaging the indicator float or the screen at the end of the fuel hose. See Figure 3-31.

Check for free movement of the indicator on the indicator pin. Remove the pin from the indicator to make sure that the float arm is not bent and that the float is not damaged or oil-soaked.

Remove the two screws attaching the indicator support to the upper housing, and clean it with grease solvent or lacquer thinner to remove any scum or deposits which may be clouding the lens. Inspect the lens seal for cracks or shrinkage which may allow leakage. The release valves must seat tightly to prevent gasoline or fumes from leaking out, but must open a clean passage for air to enter the tank and for fuel to be drawn out when the fuel hose is connected. Dirt may clog the passages and may also prevent the valves from seating properly. The release valves are best cleaned by removing the core plugs and disassembling. To remove core plugs,

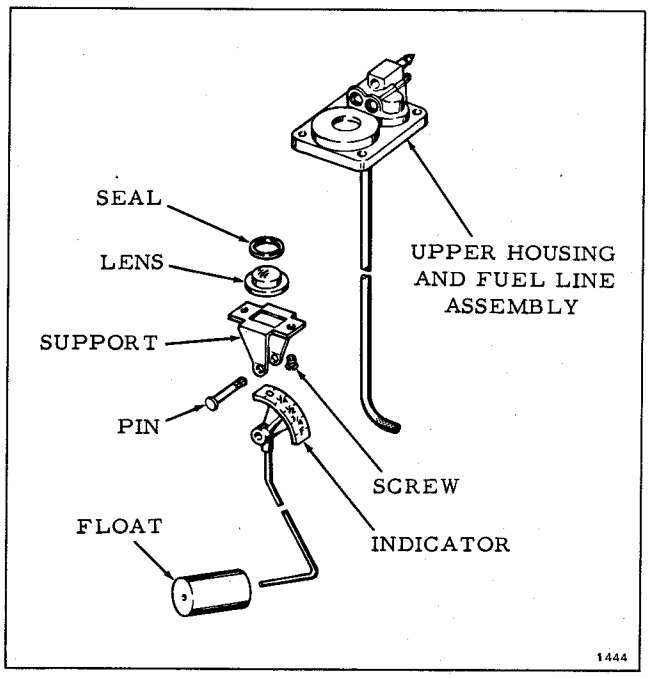

Figure 3-31. Fuel Tank Level Indicator

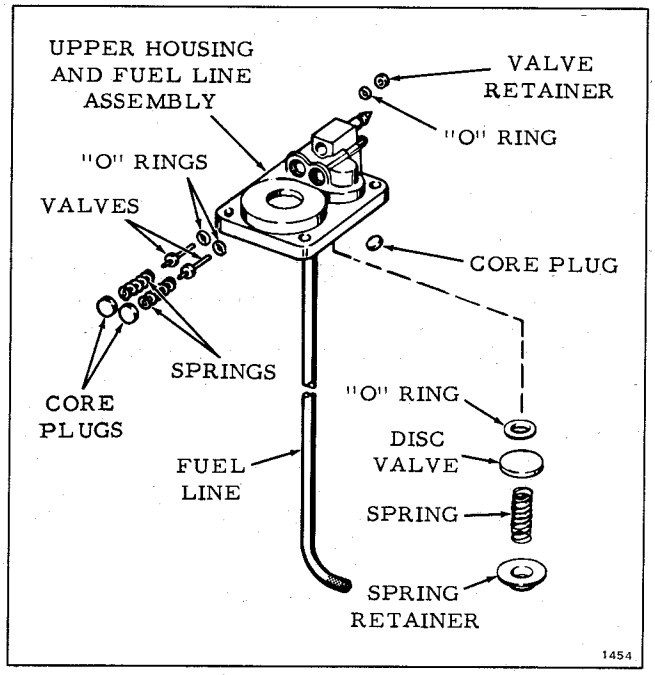

Figure 3-32. Fuel Tank Upper Housing and Valves

carefully drill a small hole through the center of the plug (avoid damaging spring), and pry the plug out with a punch. Replace valve seats ("O" rings) to assure a tight seal. See Figure 3-32.

The air inlet disc valve must seat tightly to prevent fumes from escaping the tank when the fuel hose is connected, but must allow air to enter the tank. The disc valve spring retainer is staked to the upper housing and may be removed by filing off the burrs if replacement is necessary. Restake with a small punch.

HOSE AND PRIMER BULB ASSEMBLY

CLAMPS

To disassemble hose clamps, grip clamp with pliers. Bend overlapping hook backward (in direction of arrow) to release clamp. See Figure 3-33.

To assemble hose clamps, grip clamp firmly with pliers. Apply slight pressure to hook on underside with screwdriver. Squeeze clamp with pliers until hooks interlock. See Figure 3-34.

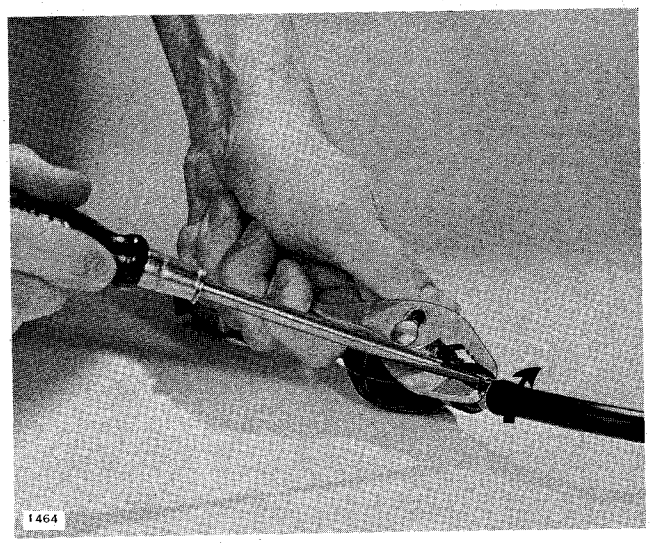

Figure 3-33. Removing Hose Clamp

CONNECTOR HOUSINGS

Installation of the "O" ring in the fuel hose connectors requires the use of two instruments, one to hold the plunger down and one to remove the "O" ring. Both instruments are illustrated and can be made easily of 16 gage (1/16" diameter) steel wire. A piece of discarded remote control wire may be used. Form a small hook on the bottom end of the longer tool of about 1/16" radius. After cutting the wires to length, be sure the ends are rounded off to prevent scratching or damaging the "O" ring seats or the plungers. See Figure 3-35.

To remove the "O" ring from the connector, proceed as follows:

a. Place the connector in a vise between two wood blocks.

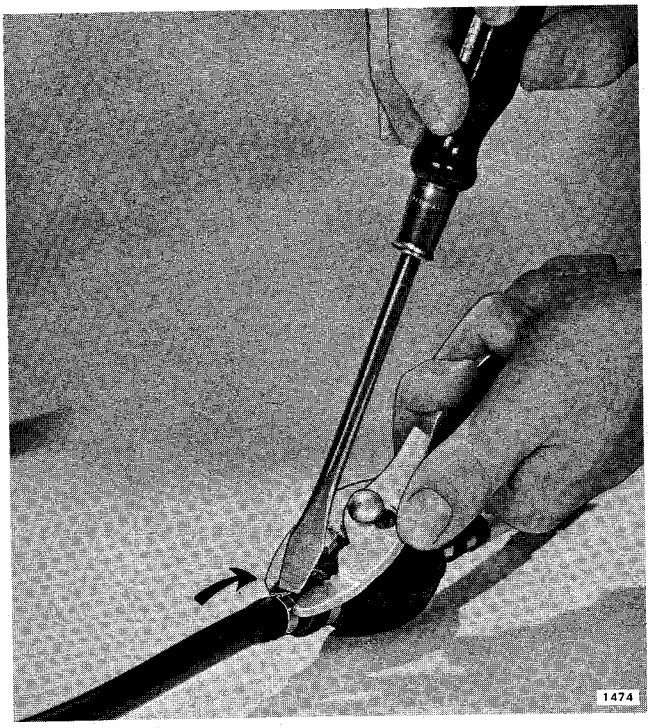

Figure 3-34. Attaching Hose Clamp

b. Push the plunger down with the straight instrument.

c. Insert the hooked instrument between the "O" ring and its seat with the hook in a flat or horizontal position. See Figure 3-36.

d. Twist the hook around to grasp the "O" ring, then pull out.

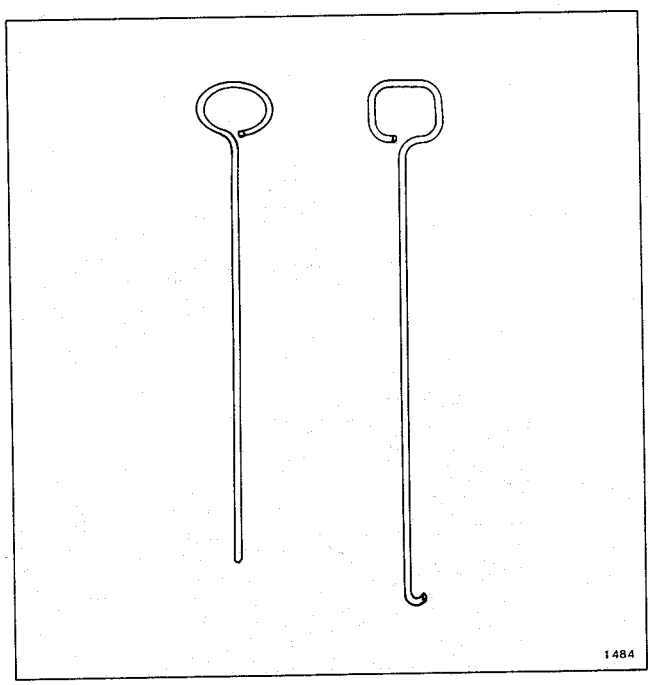

Figure 3-35. "O" Ring Tools

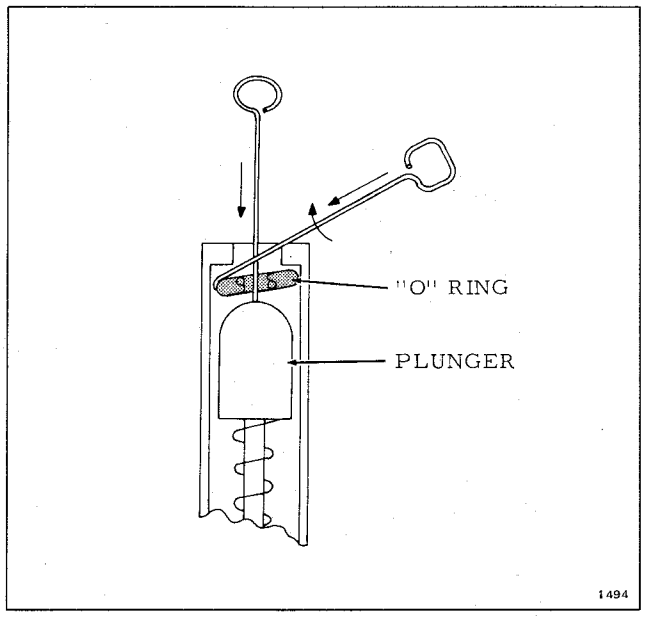

Figure 3-36. Removing "O" Rings

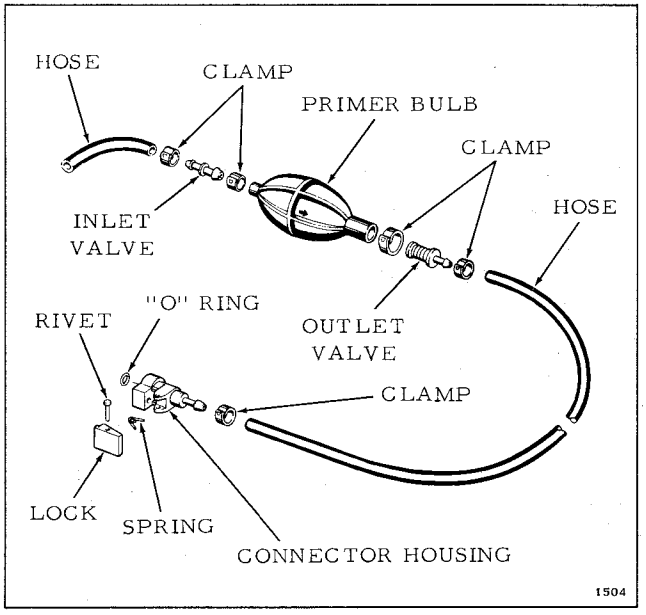

Figure 3-37. Primer Bulb and Hose Assembly

To install the "O" ring in the connector, proceed as follows:

a. Place a drop or two of oil on the "O" ring.

b. Place the "O" ring on face of the connector.

c. Push the plunger down with the straight instrument.

d. Pinch the "O" ring together and gently push into position with fingers.

When reassembling the fuel hose, check for cracks in the primer bulb or in the hose. The primer bulb must be attached so that fuel flow is from the shorter to the longer hose length. Fuel flow through the primer bulb is indicated by an arrow. See Figure 3-37.

SECTION 4

IGNITION SYSTEM

Table of Contents

DESCRIPTION

The ignition system on the 60 HP Sportfour consists of a distributor type magneto, high tension leads, and spark plugs.

MAGNETO

The magneto uses a single coil, two permanent magnets cast into the magneto housing, breaker points, and a rotor to develop the high voltage necessary for ignition. The high voltage developed in the magneto coil is distributed to each of the four spark plugs by the rotor through the distributor cap and high tension leads. The magneto rotor, breaker point cam, and distributor rotor are driven by a timing belt which synchronizes the magneto with the crankshaft. See Figure 4-1.

BREAKER POINTS AND CONDENSER

A double set of breaker points is mounted on the breaker plate. The cam has two lobes 180° apart and the breaker points are located 90° apart on the breaker plate, thus interrupting the current through the magneto coil four times in each revolution. The condenser momentarily absorbs the current flowing through the primary of the coil after the points open and hastens the collapse of the magnetic field by creating a high frequency oscillation in the circuit. The condenser also reduces pitting of the breaker points by absorbing any sparking across them. See Figure 4-2.

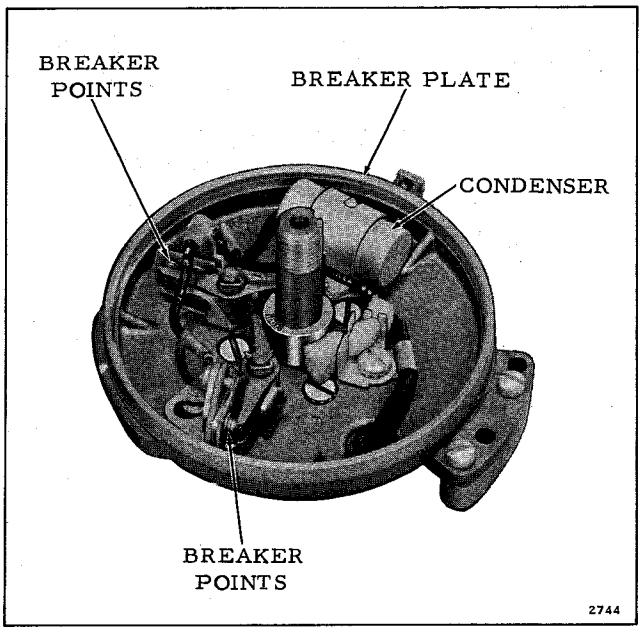

Figure 4-2. Breaker Plate

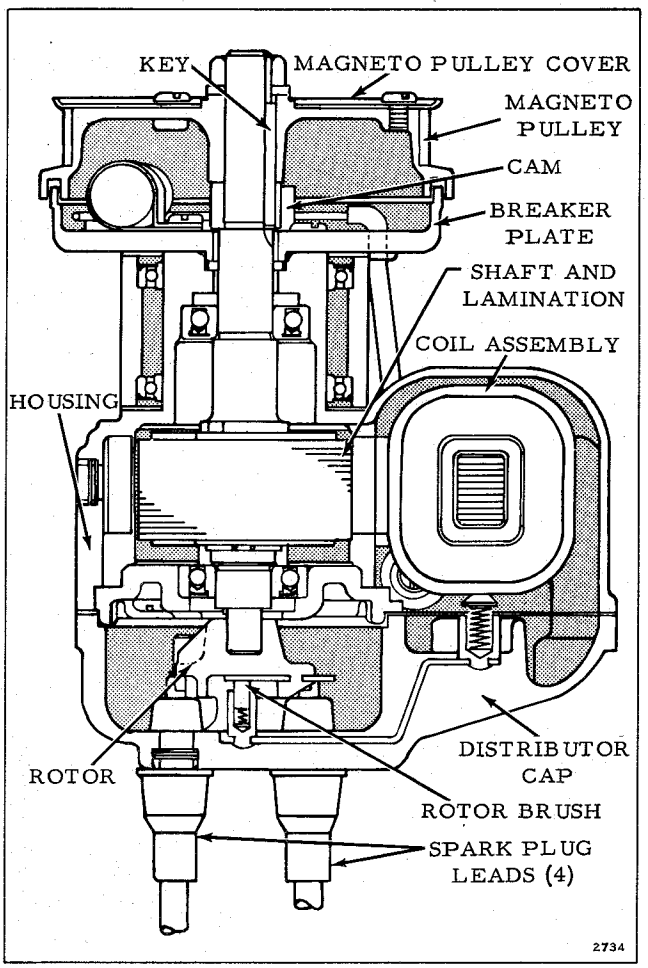

Figure 4-1. Magneto - Cutaway View

SPARK PLUGS

Spark plugs having the proper heat range are very important for peak operation of the motor. Evinrude motors are designed to operate with M42K, J4J, or A21X spark plugs. Spark plugs are classified according to the temperatures at which they are designed to operate, HOT or COLD. See Figure 4-3.

Selection of the correct spark plug depends on the type of service to which it is subjected. Unless the

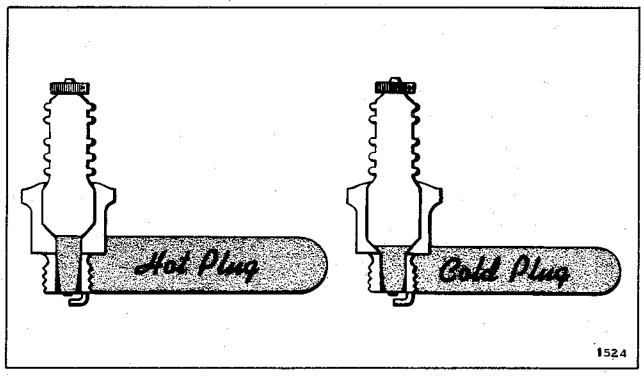

Figure 4-3. HOT and COLD Plugs

spark plug is properly suited to the motor, trouble may arise which might be interpreted as carburetor difficulty. Very low trolling speeds will tend to foul plugs due to the oil not burning from the core. However, at full throttle with a hotter plug, the operating temperature may be too high, resulting in pre-ignition.

An extreme temperature range will be difficult to control with one plug. Spark plugs furnished with the motor are selected for average service. Spark plugs recommended for the 60 HP Sportfour are:

1. Champion: J4J
2. Auto-Lite: A21X
3. AC: M42K

REMOVAL OF MAGNETO FROM POWER HEAD

a. Disconnect safety switch lead and ground (ignition key) switch lead. See Figure 4-4.

b. Twist high tension leads off spark plugs. Unscrew leads from distributor cap.

c. Remove two linkage screws. See Figure 4-4.

d. Remove the three bracket mounting screws and slide magneto bracket forward to release belt tension. Lift belt off pulley. Magneto and bracket assembly may now be removed from power head. See Figure 4-4.

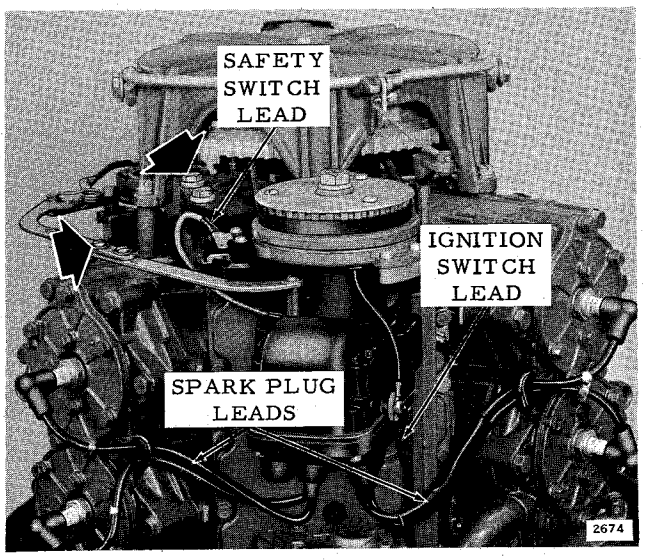

Figure 4-4. Magneto Leads and Attaching Screws

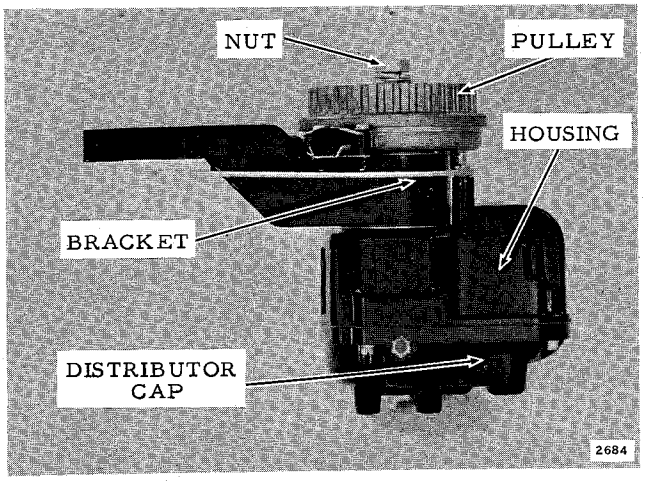

Figure 4-5. Magneto Pulley and Nut

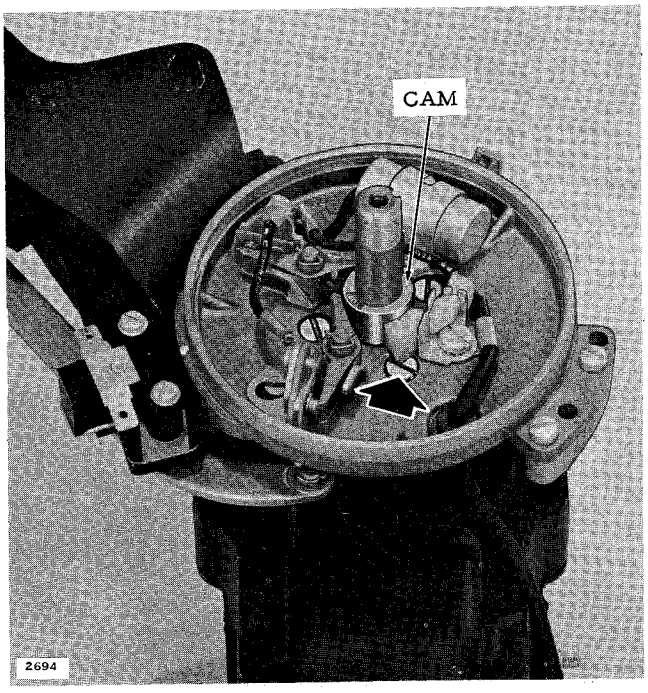

Figure 4-6. Magneto Cam and Breaker Plate Attaching Screws

DISASSEMBLY OF MAGNETO

a. Remove distributor shaft nut, lockwasher, and flat washer. See Figure 4-5. Lift magneto pulley, magneto cam, and shaft key from distributor shaft. See Figure 4-6.

b. Remove screws attaching breaker plate to magneto housing. Remove breaker plate assembly. Components of breaker plate assembly may be removed by removing the attaching screws.

c. Separate bearing bracket and magneto housing, noting positions of washers.

d. Remove distributor cap and gasket from housing, and remove rotor. See Figure 4-7.

NOTE

DO NOT misplace carbon brush and spring located in center cavity of cap. Check ventilating screens in cap.

e. Disconnect coil primary leads from insulated screw terminal and retainer spring screw. Remove retainer springs and lift coil from housing. See Figure 4-8.

f. Distributor shaft bearings are easily damaged if the shaft is pressed from the magneto housing, as any stress applied will be placed on a critical area of both bearings. Therefore do not attempt to remove the shaft unless it is certain that the bearings are in need of cleaning or inspection. Check for wear and dirt in the bearings by rotating the shaft slowly by hand, noting any roughness or grit as it turns. Move the shaft slowly from side to side and up and down to check for side or end play. Shaft should rotate freely and smoothly, without any play in any direction. See Figure 4-9. If necessary to remove or replace bearings, use an arbor press and a suitable support, such as a piston ring compressor. DO NOT hammer on bearings or shaft. Wash bearings in grease solvent and repack half full of a high-speed ball bearing grease having a high (340°F.) melting point. See Figure 4-10.

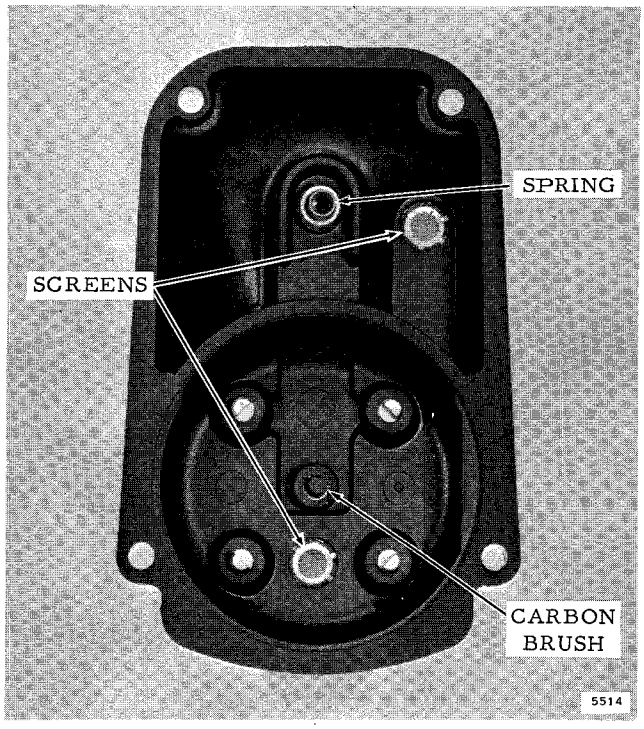

Figure 4-7. Carbon Brush and Spring

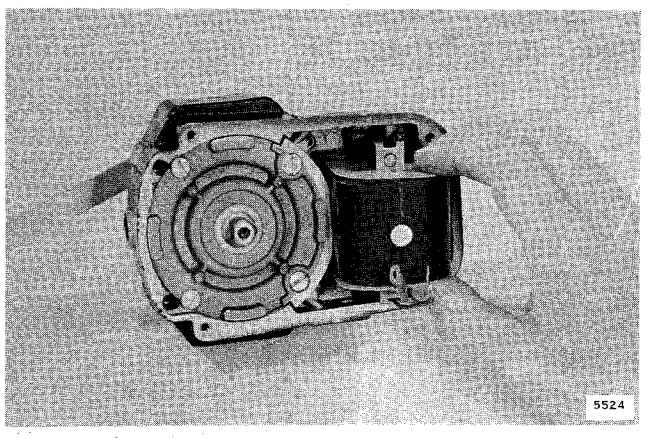

Figure 4-8. Removing Coil

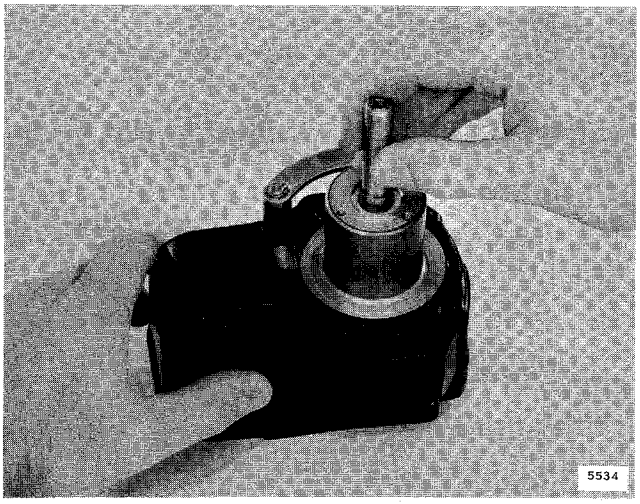

Figure 4-9. Checking Bearings

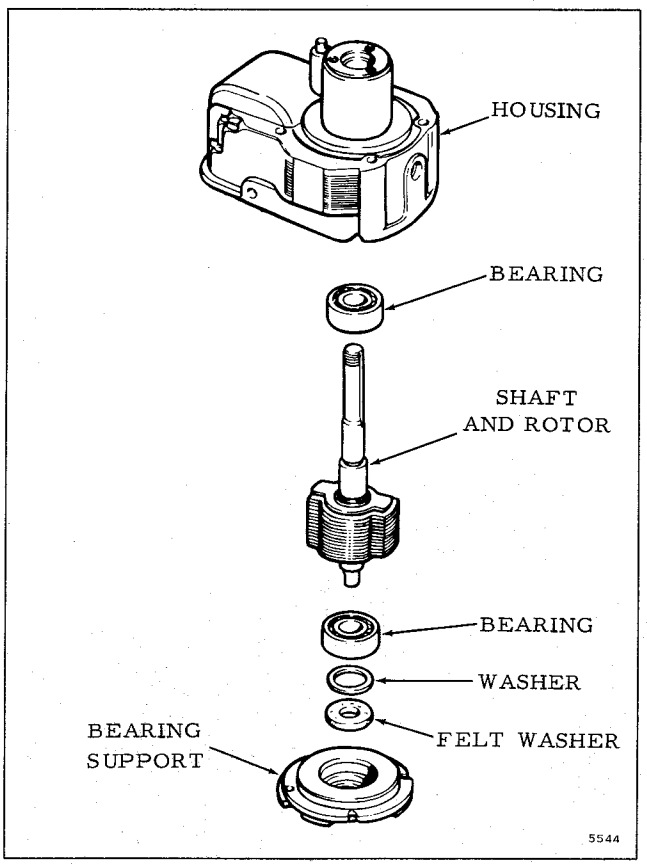

Figure 4-10. Rotor Shaft and Bearing Assembly View

CLEANING, INSPECTION, AND REPAIR

SPARK PLUGS

Inspect plugs for cracked porcelain and excessively worn electrodes.

Clean the electrodes with a point file and adjust to the specified gap, .030 inch. In re-gapping, adjust only the ground side electrode, as attempting to bend the center electrode will crack the insulator. See Figure 4-11. DO NOT sandblast spark plugs.

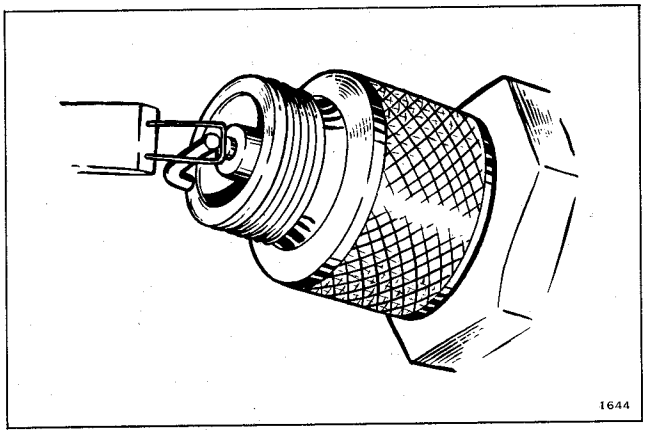

Figure 4-11. Checking Spark Plug Gap

Poor motor performance and premature spark plug failure may result from improper spark plug installation.

Before installing the plug, be sure the plug seat in the cylinder head is clean and free from obstructions. See Figure 4-12. Install a new spark plug gasket, screw the plug in by hand, then tighten to the specified 20 to 20-1/2 foot-pounds.

DO NOT use Heli-coil inserts when cylinder head spark plug threads have been stripped. Heli-coils do not conduct heat as well as the aluminum threads and pre-ignition can result. On motors where the threads have been stripped, replace cylinder head so that the spark plugs can perform properly.

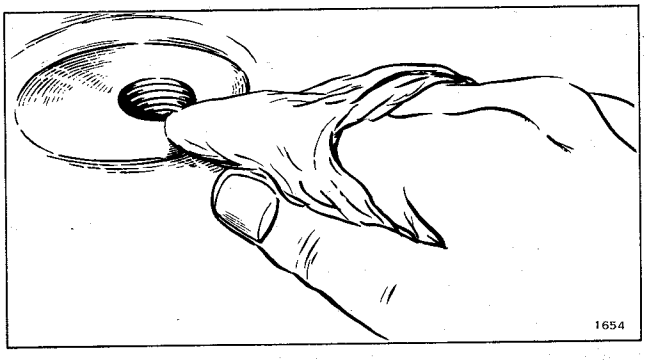

Figure 4-12. Cleaning Spark Plug Seat

CLEANING BREAKER POINTS

a. After extensive service, the breaker points may become worn, dirty, or out of adjustment. Inspect the breaker assemblies for corrosion or other wear. Questionable breaker points should be replaced. Check action of the spring and free movement of the breaker arm. DO NOT change breaker arm spring tension.

b. Dirt, foreign particles, and oil are very detrimental to contact performance. The oils and acids from a person's hand, even though clean, can affect contact resistance. Oil deposits on the points will cause them to burn out after a very short period of operation. Never file points - replace them.

c. To remove any traces of dirt from contacts, lightly saturate a piece of bias tape in alcohol or trichlorethylene, insert between the points and work it up and down. Repeat entire cleaning procedure for second set of points.

d. Check points for good electrical contact, using ignition analyzer as described under "Breaker Point Testing". Check and adjust breaker point setting as necessary as described under "Breaker Point Adjustment".

TESTING COIL, CONDENSER, AND BREAKER POINTS

TEST EQUIPMENT

To determine accurately the condition of components of the ignition system, an ignition analyzer should be used. Without the use of test equipment, coils, condensers, or breaker point assemblies may be replaced needlessly.

A wide variety of ignition analyzers is available from various manufacturers. The use of the Model MA-75 ignition analyzer manufactured by the Stevens Experimental Company is recommended and is discussed here, since this unit has provisions for checking all functions of the ignition system.

Detailed instructions for the use of any tester are provided with the unit; therefore, only general information is given here. All components of the ignition system should be checked, even though replacing a part seems to have corrected the trouble. For example, replacing points may have increased the spark, but a further improvement might be realized if a condenser is found to be weak and is replaced.

COIL TESTING

The coil is tested under conditions of actual operation, as the tester provides an interrupted primary current and measures the induced secondary voltage. If the coil is in good condition and is suitable for use, the induced secondary voltage, as read on

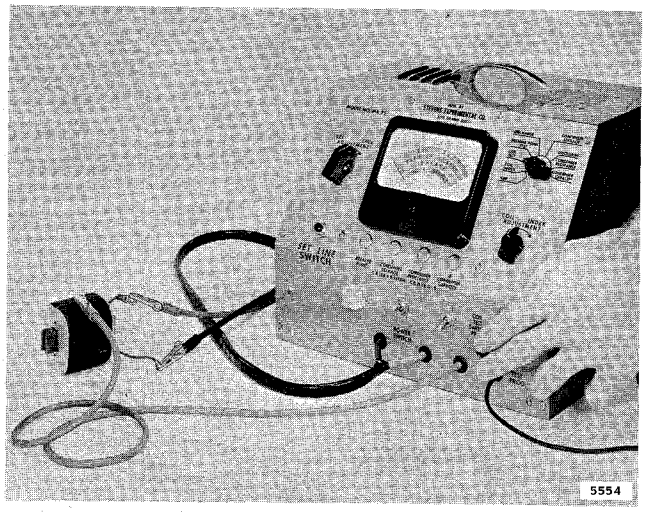

Figure 4-13. Testing Coil

the meter, will fall within the green ("good") area, with primary current adjusted as specified. Connect the black primary lead from the analyzer to the coil's ground lead, and connect the red primary lead from the analyzer to the coil's breaker point lead. Connect the secondary lead from the analyzer to the coil's secondary terminal. See Figure 4-13.

A low reading on the tester indicates a weak coil which must be replaced. No attempt should be made to improve this reading by increasing primary current; the coil is defective if it cannot be made to give a good reading on the specified primary current. A completely dead coil is indicated if there is no reading.

Check for leakage from the coil (caused by moisture, cracks in the coil housing, or carbon paths) by running the test probe over the outside of the coil. Replace any coil which shows any leakage. See Figure 4-14.

CAUTION

Perform all tests on the coil on a wooden or insulated bench top to prevent leakage or shock hazards.

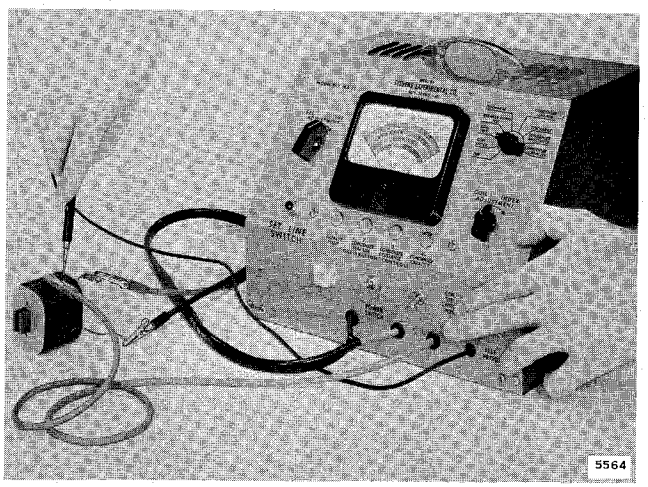

Figure 4-14. Testing Coil for Leakage

CONDENSER TESTING

The Stevens Ignition Analyzer Provides three tests of condenser condition: condenser leakage, condenser resistance, and condenser capacity.

Refer to Section 2 of this manual for condenser specification. The condenser may be tested while mounted on the breaker plate by disconnecting the lead from the breaker assembly. Connect one test lead to the breaker plate (or the condenser mounting clip if test is made off the plate) and connect second test lead to condenser pigtail lead. The condenser should be replaced if it fails to meet any of the three tests. See Figure 4-15.

CAUTION

High voltage is applied to the condenser in the leakage test. Handle leads carefully and turn selector switch to "Discharge" before disconnecting leads from condenser.

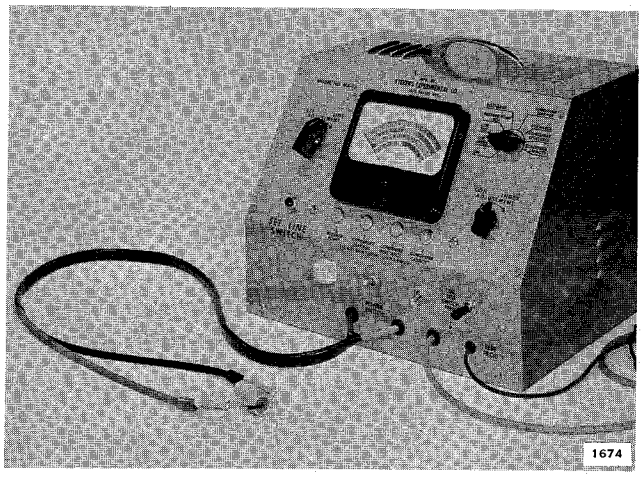

Figure 4-15. Testing Condenser

BREAKER POINT TESTING

It is possible to check the electrical condition of the points with the ignition analyzer. Connect one test lead to the breaker arm, and connect the second test lead to the breaker assembly screw terminal. If the points are good, meter reading will be in the green area on the "Breaker Test" scale. If reading is in red area, do not immediately reject the points, but check the test lead connections to make sure that they are tight. A secure contact is necessary because of the current used in this test. See Figure 4-16.

NOTE

NEVER FILE POINTS to bring reading within the green ("good") area. Reject the points if cleaning with trichlorethylene does not give a satisfactory reading.

Leads at the breaker point screw terminal must be disconnected for this test.

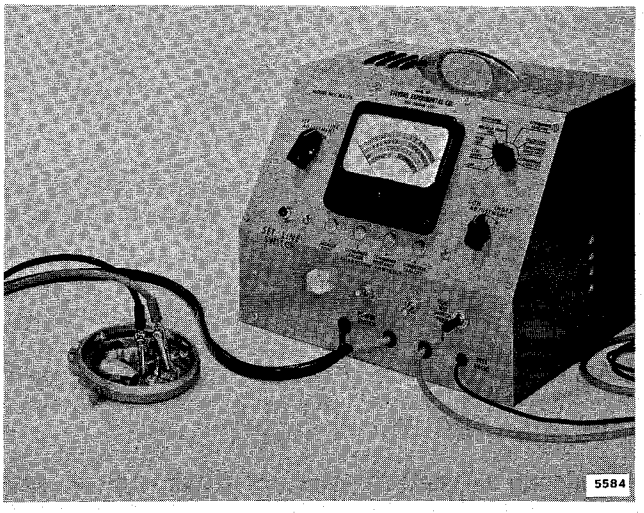

Figure 4-16. Testing Breaker Points

LEAKAGE TESTING

The distributor cap, rotor, and spark plug high tension leads may be tested for leakage or insulation failures by using the ignition analyzer and the ignition coil. Connect the coil to the ignition analyzer as for the coil test. Connect a separate test lead with suitable clips to the secondary terminal of the coil and to the conductor of the component being tested (coil lead terminal on distributor cap, rotor arm, and spark plug high tension lead). Probe the entire insulated surface of the component being tested with the grounded test probe. See Figure 4-17.

Arcing will be apparent wherever the insulation has broken down, due to moisture or carbon trails.

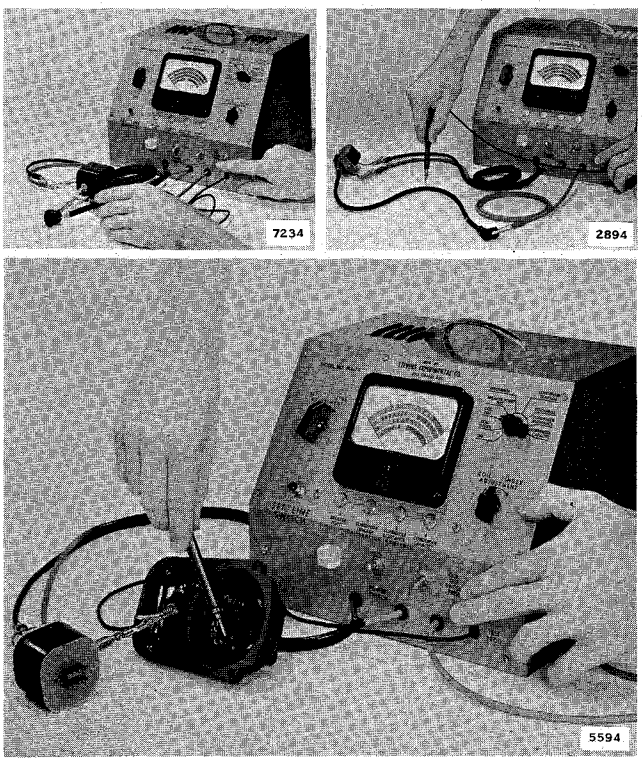

Figure 4-17. Leakage Testing

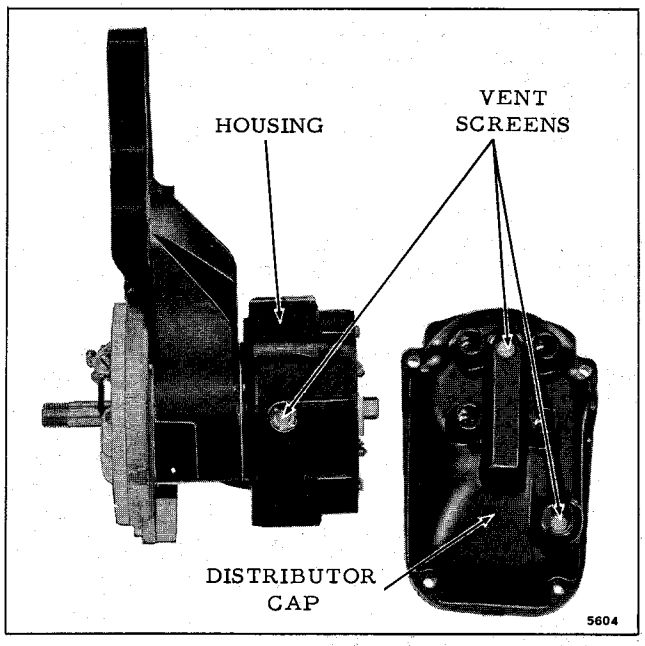

Figure 4-18. Vent Screens - Distributor Cap

DISTRIBUTION CHAMBER

It is very important that the distributor cap retaining screws be kept tight at all times. This will assure positive location and prevent dirt from entering the distribution chamber. The ventilating screens in the distributor cap and magneto housing should be kept free from dirt to assure proper ventilation. Screens that are punctured should be replaced, since the fine mesh of the screens serves to contain any spark or flashover within the magneto. See Figure 4-18.

REASSEMBLY OF MAGNETO

a. Reassemble bearings and shaft to magneto housing. Use an arbor press to assemble bearings to the shaft. Press shaft with upper bearing into magneto housing. Place bearing washer and felt washer into recess in bearing support, and press support into position over lower bearing. Fasten bearing support to magneto housing with four screws. Tighten flat head screws first to assure correct alignment of shaft.

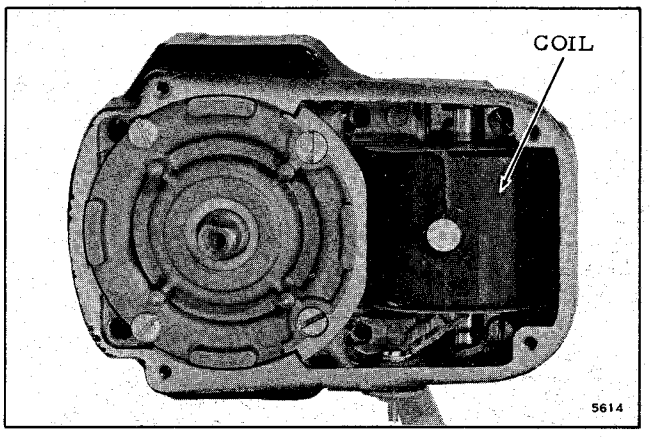

Figure 4-19. Correct Coil Position

b. Install coil with insulators in housing and secure with retainer springs and screws. Coil must be positioned so that core laminations butt against field laminations. See Figure 4-19. Connect primary leads to ground screw and to insulated screw terminal.

c. Attach rotor to shaft. Carbon brush and spring must be in place in distributor cap. Attach cap to housing with screws and lockwashers, using a new gasket.

d. Reassemble magneto housing and breaker plate to bearing bracket, making certain that washers (steel and felt) are in place.

e. Install key and cam to shaft. Replace components of breaker plate if these were removed. Replace pulley, and fasten with washers and nut. Screw high tension leads into distributor cap.

REASSEMBLY OF MAGNETO TO MOTOR

a. Attach magneto bearing bracket to motor with screws and washers, leaving screws loose enough to permit belt adjustment. Adjust breaker points as described under "Breaker Point Adjustment". Check for spark on each cylinder by connecting spark plug high tension leads to a spark checker (Stevens Experimental Co. Part #S-13. Place belt in position over pulley, and time magneto and flywheel as described under "Belt Timing".

b. Connect safety switch and ground (ignition key) leads. Connect high tension leads to spark plugs in correct sequence.

c. Connect throttle arm to magneto linkage and adjust as described under "Synchronizing Carburetor and Magneto Linkage". Check safety switch adjustment as described under "Safety Switch Adjustment".

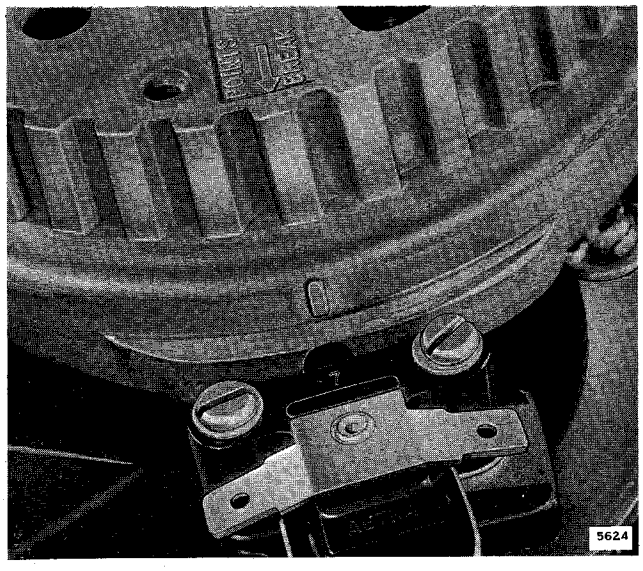

Figure 4-20. Timing Marks - Magneto Pulley

OPERATING ADJUSTMENTS

NEW TIMING BELT INSTALLATION

a. Remove rewind starter. Release belt tension by loosening three screws attaching magneto bracket to power head. Cut away old belt.

b. Install new belt. Belt may be installed without removing flywheel by threading carefully between flywheel and starter and between flywheel and carburetor. Check timing and belt tension as described under "Belt Timing".

c. Tighten magneto bracket mounting screws, and replace rewind starter. Check linkage adjustment as described under "Synchronizing Carburetor and Magneto Linkage".

BELT TIMING

a. Rotate pulley so that timing mark is in line with center of safety switch plunger. See Figure 4-20.

b. Rotate the flywheel so that the timing marks on the flywheel, starter housing, and by-pass cover plate are in line. See Figure 4-21.

NOTE

Rotate the flywheel in a clockwise direction ONLY to prevent damage to the water pump impeller. To relieve power head compression and to prevent accidentally starting the motor while rotating the flywheel, remove spark plug, and ground spark plug wires.

c. With timing mark on flywheel aligned, timing mark on magneto pulley and safety switch plunger should be in line. See Figure 4-20. If not, loosen magneto bracket mounting screws to release belt tension, and rotate pulley until marks are aligned.

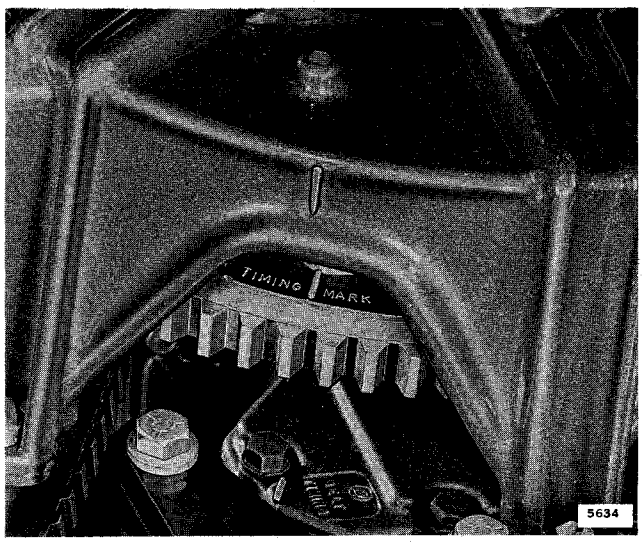

Figure 4-21. Timing Marks - Flywheel

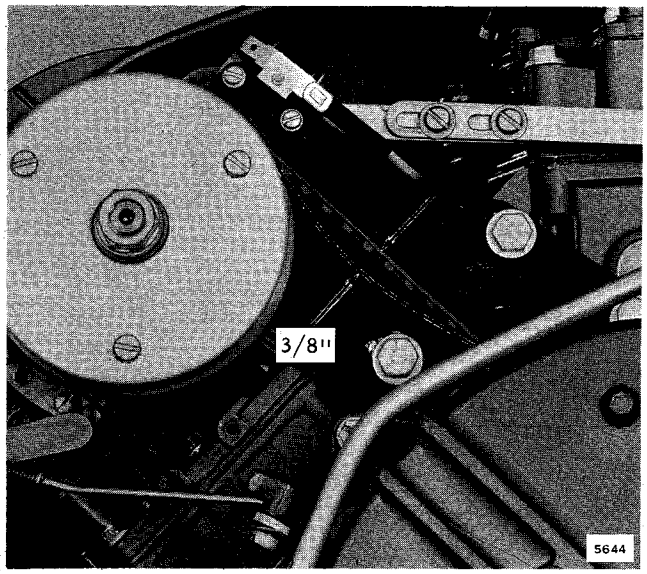

Figure 4-22. Correct Belt Tension

d. Adjust magneto bearing bracket for proper amount of slack in belt. Belt tension is correct when belt can be deflected 5/16" to 3/8" under 1 lb. pressure applied near center of belt. See Figure 4-22.

e. Tighten bracket mounting screws to torque specified in Section 2. Check linkage synchronization as described under "Synchronizing Carburetor and Magneto Linkage".

BREAKER POINT ADJUSTMENT

a. To adjust breaker points with test light, timing belt must be removed to permit magneto pulley to turn freely through 180°. Visually inspect points to make sure that both sets open approximately .020".

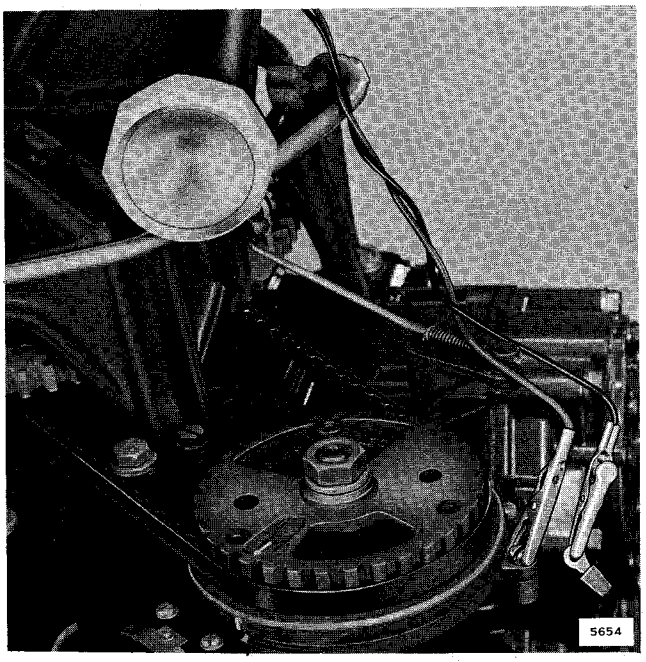

Figure 4-23. Connections for Checking Timing

b. Disconnect breaker point lead from insulated screw terminal and connect it to a meter or test light. Ground meter or test light to the magneto breaker plate. See Figure 4-23.

c. Rotate the magneto pulley so that the mark on the pulley lines up with the synchronizing mark on the breaker plate. The breaker point arm nearest the condenser should be on the high lobe of the cam.

d. Loosen breaker point lock screw and turn breaker point adjusting screw so that points close, causing the meter or test light to register a closed circuit. Tighten lock screw. See Figure 4-24.

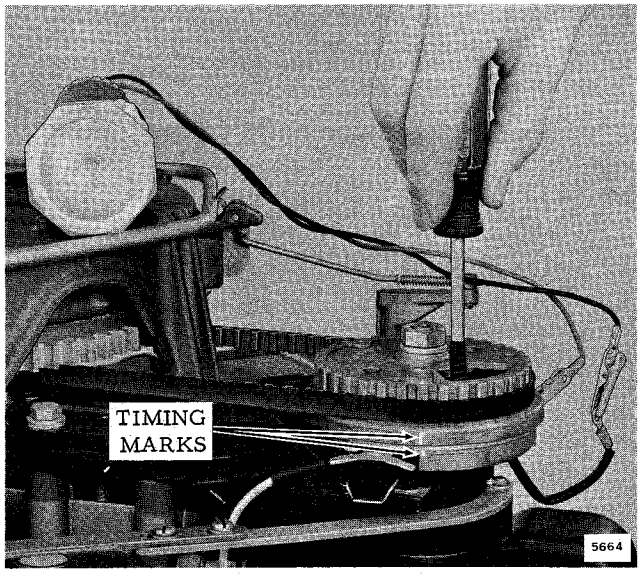

Figure 4-24. Adjusting Breaker Points

e. Recheck adjustment by rotating pulley slightly in both directions. Points should be closed at the instant the pulley mark is aligned with the mark on the breaker plate.

f. Rotate pulley 90° so that mark on pulley lines up with second mark on breaker plate. See Figure 4-25. Repeat breaker point adjustment for second set of points. Care should be taken that points break 90° apart to assure even firing on all cylinders.

g. Check belt timing and linkage synchronization. Replace pulley cover, and reconnect breaker point lead at insulated screw terminal.

SYNCHRONIZING CARBURETOR AND MAGNETO LINKAGE

a. To assure correct synchronization of carburetor and magneto linkage, check the timing of the magneto first. (See "Belt Timing".)

b. With the shift lever in forward gear, move the magneto to the full advance position by hand. The inside surface of the control shaft arm should now

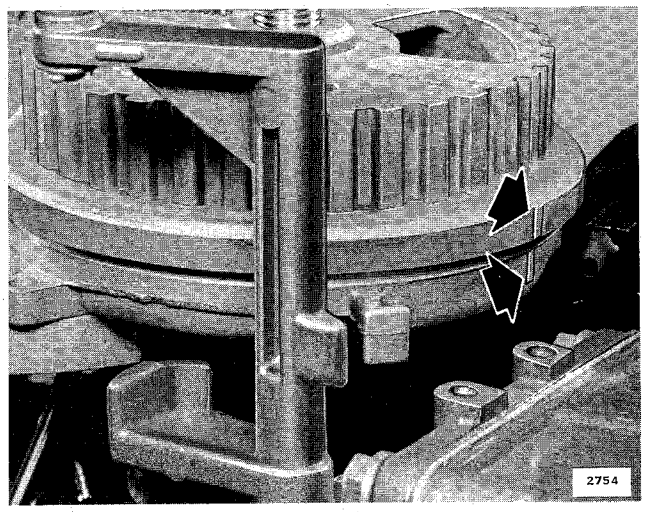

Figure 4-25. Second Timing Mark

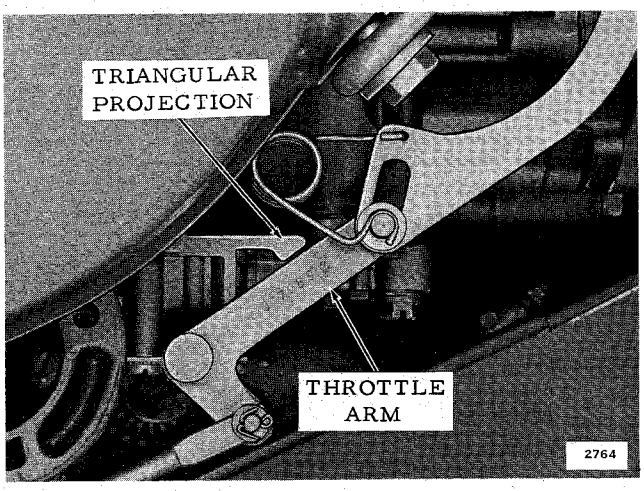

Figure 4-26. Throttle Arm Alignment

be parallel to the edge of the triangular projection on the control shaft bracket when viewed from above. See Figure 4-26.

c. If the control shaft arm is not in the correct position, loosen the two linkage screws and make the adjustment while holding the magneto in full advance position. Be certain the two adjustment screws are retightened.

d. Check the position of the throttle arm with respect to the cam follower. Remove carburetor synchronizing rod to gain access to clamp screw. See Figure 4-271.

NOTE

There are two set screws securing the rod, one above the other. Removal of the outer locking screw will allow access to the rod locking screw.

e. Position throttle cam so that synchronizing mark falls in line with the center of the cam follower roller. Loosen clamp screw and move throttle arm to its limit to close throttle valves. Make sure the roller is contacting the cam and retighten clamp screw.

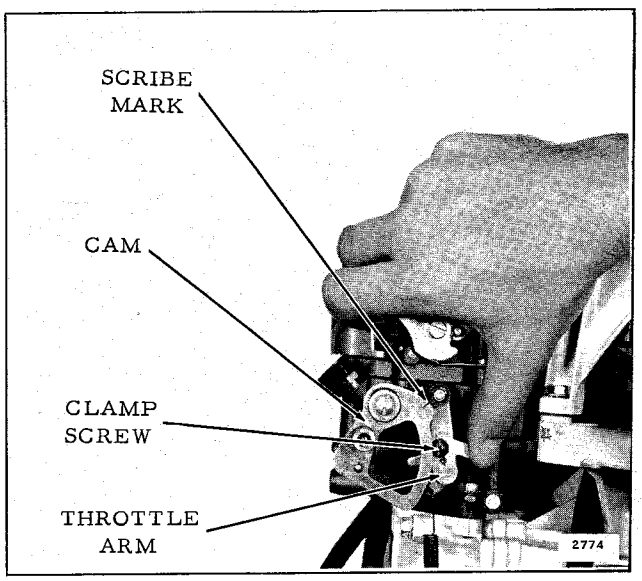

Figure 4-27. Throttle Adjustment

f. Replace the carburetor synchronizing rod through the pivot pin leaving set screw loose. With engine in forward gear, advance throttle lever to full open position and insert a .020" feeler gage between the control shaft arm and the stop on the control shaft bracket. See Figure 4-28. Hold cam in wide open position and tighten set screw. Replace lock screw.

g. Remove gage and work throttle to be certain that the arm is opening full against its stop on the carburetor. The carburetor and magneto linkage are correctly synchronized when the throttle control shaft and the throttle arm reach their full open positions at the same time, and the magneto reaches full advance position as described above. See Figure 4-29.

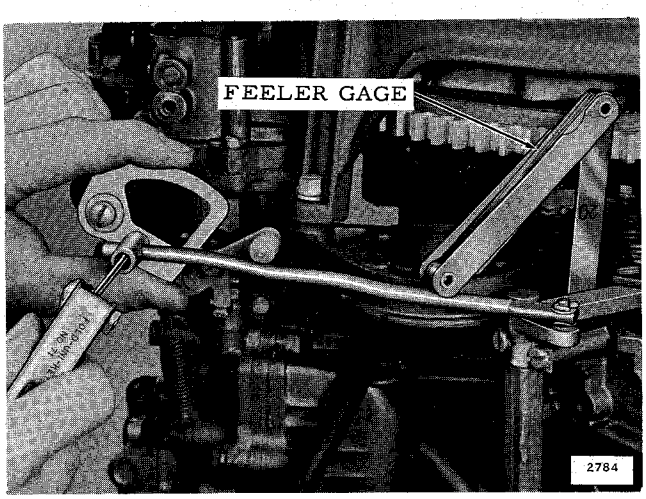

Figure 4-28. Adjusting Throttle Linkage

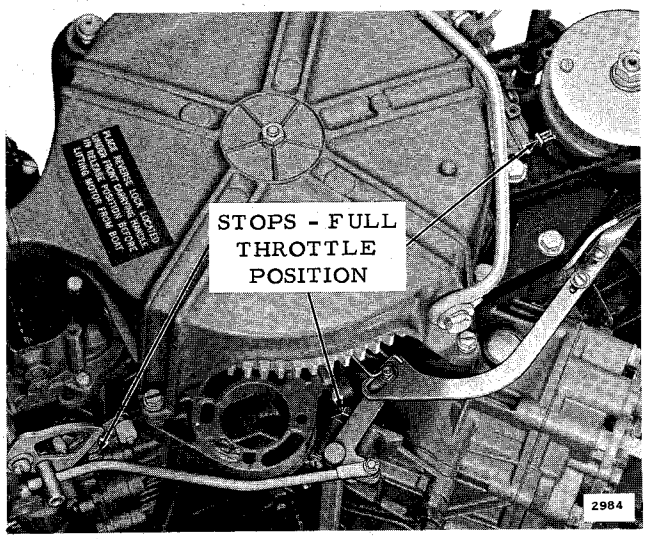

Figure 4-29. Full Throttle Position

SAFETY SWITCH ADJUSTMENT

A safety switch is mounted on the distributor bracket. This switch prevents starting at full throttle. The motor can be started at low throttle in gear or in neutral. To adjust switch, loosen adjustment screw. Set switch to close at midpoint on cam slope. See Figure 4-30.

A click can be heard when the switch closes. Tighten screws after adjustment is made. The switch is normally open and must close to permit starting. Check with test light if available. When switch button is at mid-point on cam slope, light should show, indicating switch closing.

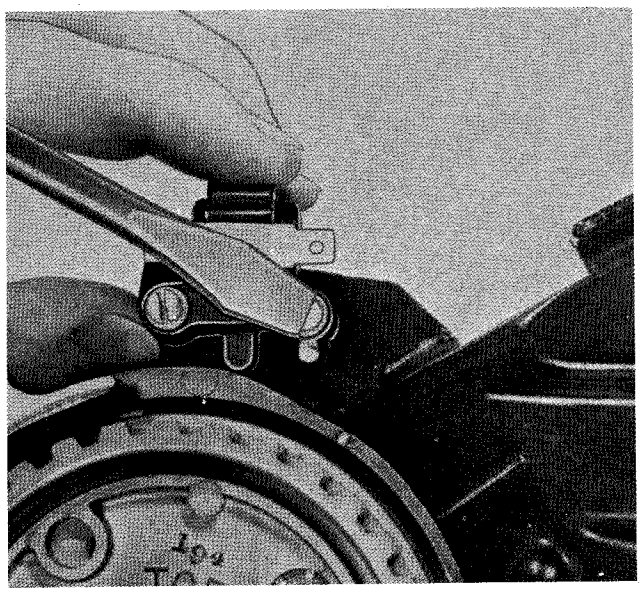

Figure 4-30. Adjusting Safety Switch

SECTION 5

POWER HEAD

Table of Contents

DESCRIPTION

The power head consists of the cylinders, pistons, connecting rods, crankshaft, and crankcase. The power head has two banks of horizontally-mounted cylinders in a "V" formation 90° apart. The firing order is combined so that each cylinder delivers one power impulse per crankshaft revolution, thus giving one power impulse at every 90 degrees of crankshaft rotation. See Figure 5-1.

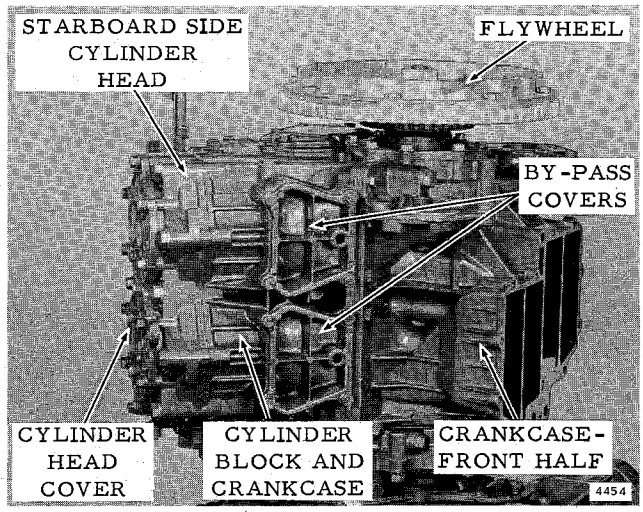

Figure 5-1. Power Head

CRANKCASE AND CYLINDERS

To provide equal fuel vapor distribution to the four cylinders, the crankcase is divided into four equal areas, and each is sealed off from the others through the use of compression type sealing rings on the crankshaft webs. All four crankcase distribution chambers must be isolated from each other at all times to prevent compression leakage between cylinders. See Figure 5-2.

CYLINDER HEADS

There are separate cylinder heads for each bank of cylinders. The cylinder head covers are numbered to correspond to the ignition firing order. The starboard cylinder head cover is numbered 1 upper and 3 lower and the port cylinder head cover is numbered 2 upper and 4 lower.

PISTONS

The pistons, with the piston rings, receive the force of combustion in the cylinder head, so it is necessary that both the pistons and piston rings be properly fitted to form a seal between the piston head and cylinder walls. To retain maximum power within the cylinder above the piston head, the cylinder must be perfectly round and the piston rings correctly seated in their grooves.

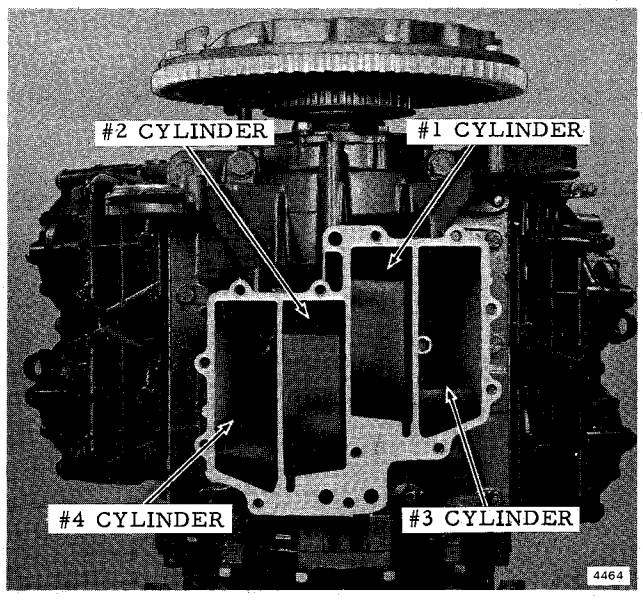

Figure 5-2. Crankcase Compression Chambers

CONNECTING RODS, CRANKSHAFT, AND BEARINGS

The connecting rods provide linkage between the piston and crankshaft. Connecting rod bearings include a roller bearing at the wrist pin, and a split cage roller bearing at the crankshaft. The crankshaft is of the two-throw type and is supported by three main bearings. A double row roller bearing is used at the upper journal. A split cage roller bearing at the center journal is aligned to the cylinder block by a dowel pin. A ball bearing at the bottom journal absorbs the radial and vertical thrust loads of the crankshaft.

COOLING SYSTEM

The cooling system is a pressurized, recirculating, temperature-controlled system. The thermostat maintains consistent operating temperatures throughout the entire range of motor operation, increasing motor life and efficiency. See Figure 5-3.

THERMOSTAT OPERATION

The thermostat housing contains the pressure release valve and spring, Vernatherm control element, and thermostat valve and spring. The circulation of water through the cooling system by the water pump and the ratio of coolant discharge to intake is controlled by the balanced action between the pressure control valve and the Vernatherm control element actuating the thermostat valve. See Figure 5-4.

When the power head and cooling system temperatures reach 145°F., the Vernatherm control element opens the thermostat valve, allowing heated water to pass through the water discharge. The drop

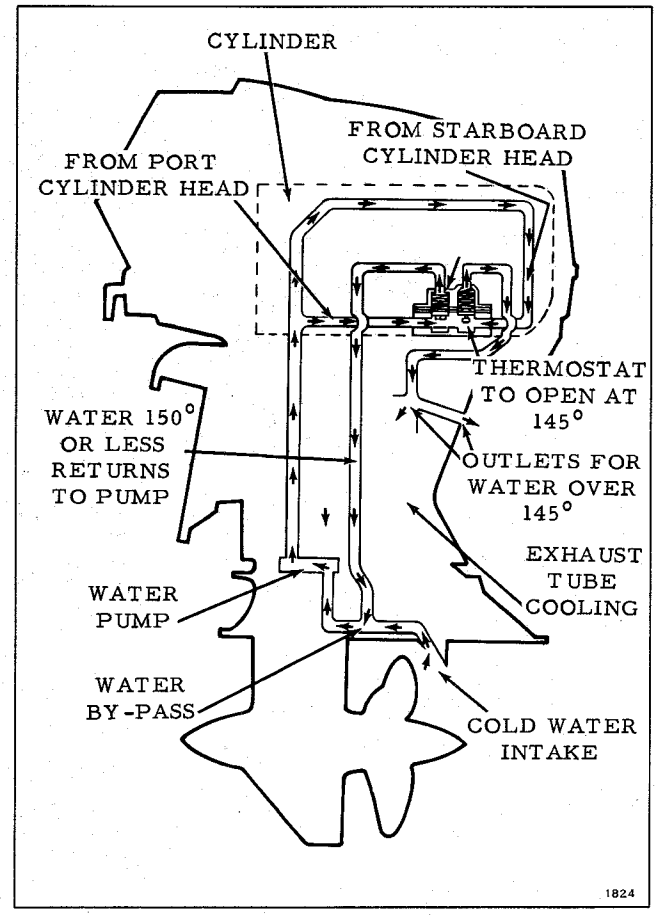

Figure 5-3. Cooling System

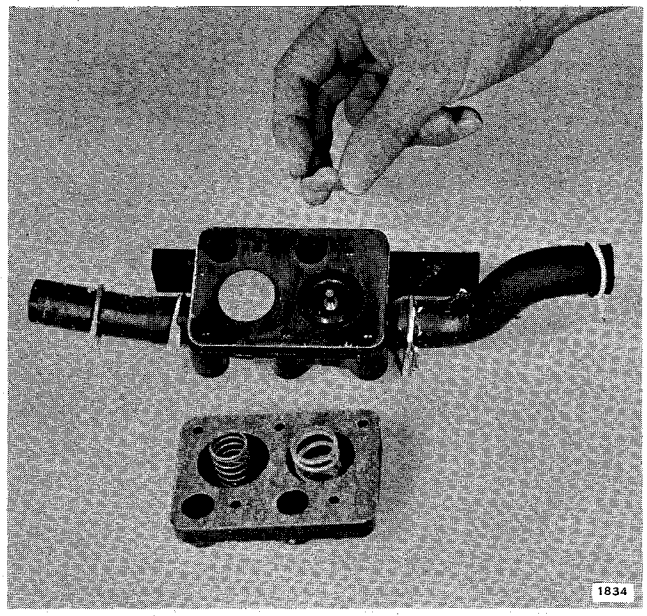

Figure 5-4. Thermostat Assembly

in cooling system pressure caused by the opening of the thermostat valve causes the pressure valve to close, preventing cooling system water from being recirculated through the water pump and causing fresh water to be drawn through the water intake. This action provides perfect combustion temperatures in any water and any weather.

CHECKING MOTOR TEMPERATURE

Markal Thermomelt Stik, a heat sensitive stick similar to a crayon which melts on contact with a surface at a specific temperature, is used to measure power head temperature.

The motor is best checked when operating on a boat. If this is not possible, run the motor in a test tank for at least five minutes, at a maximum speed of 3000 rpm. Mark the surface to be checked with the Stik. The mark will appear dull and chalky. When the surface temperature reaches the temperature rating of the Stik, the mark will melt, becoming liquid and glossy in appearance. On some painted surfaces on which the Stik will not leave a mark, it will be necessary to hold the Stik against the surface. See Figure 5-5.

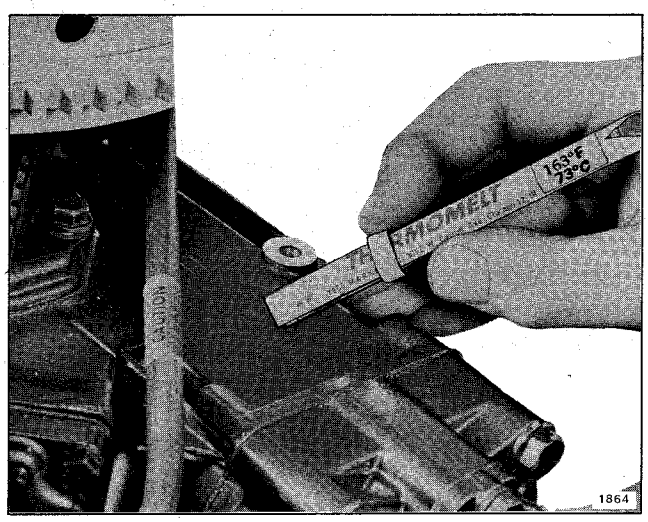

Figure 5-5. Checking Motor Temperature

Two Thermomelt Stiks are necessary to check a motor - a 125°F Stik and a 163°F Stik. With the motor at operating temperature, the 125° mark should melt and the 163° mark should not melt.

If the 125° mark does not melt after a reasonable length of time, the thermostat is stuck open and the motor is running too cold. If the 163° mark also melts, the cooling system is not functioning properly, allowing the motor to overheat. Check for a worn pump assembly, leaky water system, or malfunctioning thermostat.

REMOVAL OF POWER HEAD FROM EXHAUST HOUSING

a. Disconnect throttle linkage at throttle cam and distributor. Remove throttle control shaft with linkage from power head.

b. Disconnect all electrical connections from motor cable, including ignition, safety switch, and starter leads. Identify leads to assure correct reassembly.

c. Remove front and rear lower motor covers, and rear exhaust housing cover.

d. Remove carburetor, leaf valve assembly, fuel pump, and fuel lines as described in Section 3.

e. Remove manual starter as described in Section 7.

f. Using an appropriate flywheel holding fixture, remove flywheel attaching nut. Remove flywheel, using puller (Special Tool #378103). See Figure 5-6.

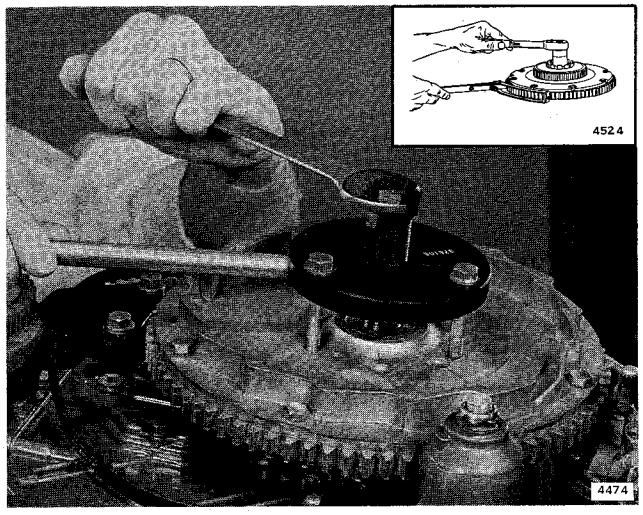

Figure 5-6. Removing Flywheel with Puller

g. Remove magneto as described in Section 4. Remove starter motor with Bendix drive.

h. Disconnect thermostat hoses.

i. Remove six nuts and six screws attaching power head to exhaust tube. See Figures 5-7 and 5-8. Lift power head from exhaust tube and place on bench for disassembly. Hosit may be used if available by reattaching manual starter with lifting bail. Power head must be placed on bench so that crankshaft is horizontal and crankcase is facing up. Weight of power head should be supported by the four bosses on the four cylinders.

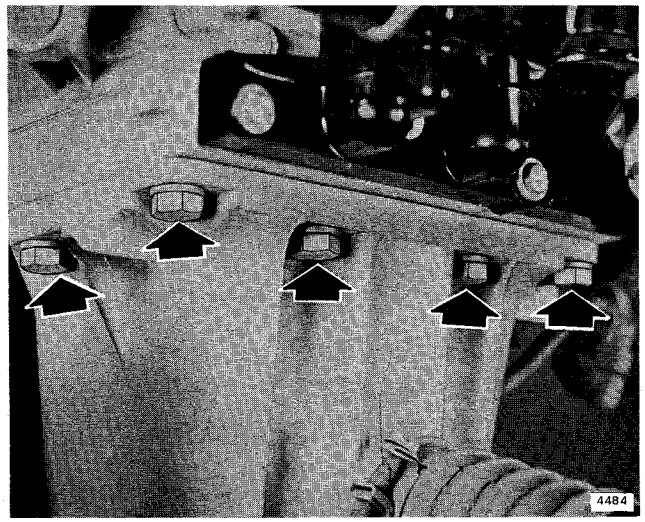

Figure 5-7. Removing Power Head Screws

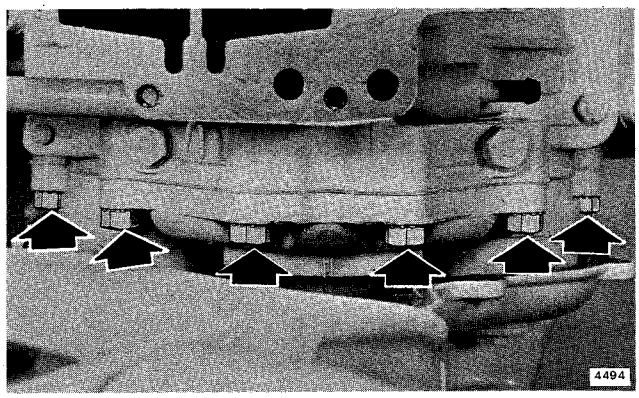

Figure 5-8. Removing Power Head Nuts

DISASSEMBLY OF POWER HEAD

a. Drive two taper pins out of crankcase and cylinder block assembly. Drive from back of crankcase toward front. See Figure 5-9. Remove six large and eight small screws attaching crankcase to cylinder block.

b. Remove hex screws from upper crankcase head.

c. Remove hex screws from lower crankcase head. Remove carbon seal from lower end of crankshaft by removing retaining ring. Then remove the other components of seal assembly. Use Truarc No. 4

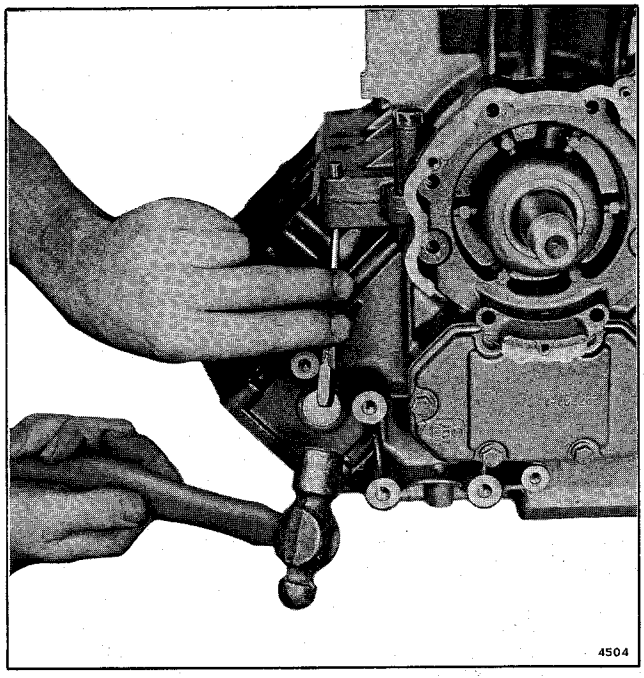

Figure 5-9. Removing Taper Pins

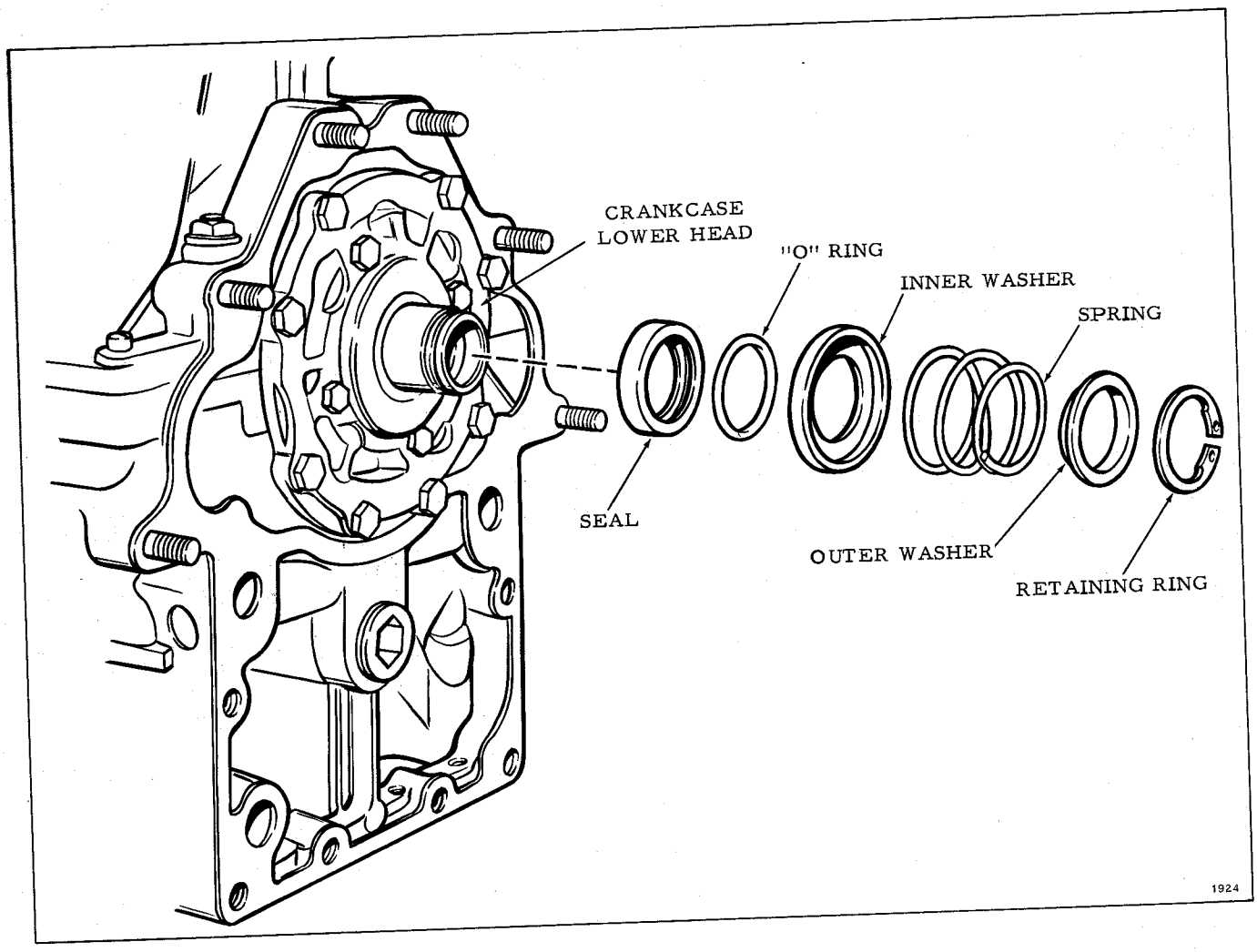

Figure 5-10. Carbon Seal Assembly

pliers (Special Tool #307429) to remove retaining ring. See Figure 5-10.

d. Loosen but do not remove entirely, the screws holding lower bearing retainer plate to lower crankcase head. Tap crankshaft with rawhide mallet to break seal between crankcase and cylinder. Crankcase may be removed to expose the crankshaft and connecting rods for further disassembly.

CRANKSHAFT, CONNECTING RODS, AND PISTONS

CAUTION

Pistons, connecting rods, rod bearings, etc., are wearing parts and seat with the operation of the motor. Because of this, it is essential to maintain their original positions at reassembly. Mark each connecting rod and cap, piston, and bearing component to assure correct mating when they are reassembled. Also mark the cylinders from which they are removed, and keep the needles of each cylinder together.

a. Remove connecting rod caps, then needle bearing assemblies. A 5/16 inch 12-point deep socket is required for removing connecting rod cap screws.

b. Lift crankshaft and crankcase heads from cylinder block and place on bench for disassembly. See Figure 5-11. Reinstall connecting rod caps on rods and remove the connecting rods and pistons from the cylinders.

c. Lift the upper crankcase head from the crankshaft. To remove seal, insert punch through bottom

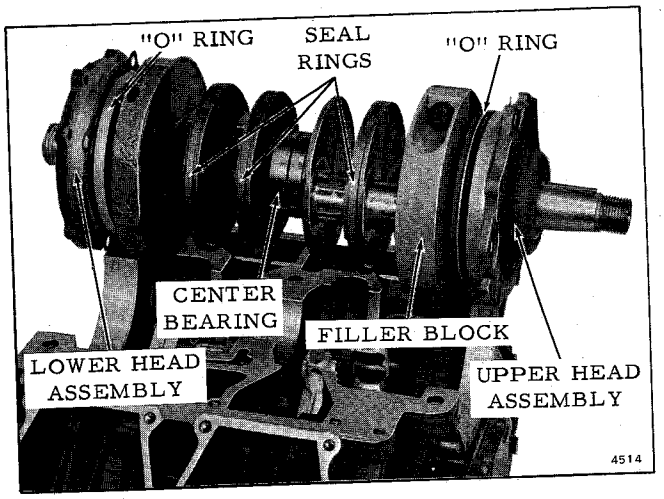

Figure 5-11. Removing Crankshaft

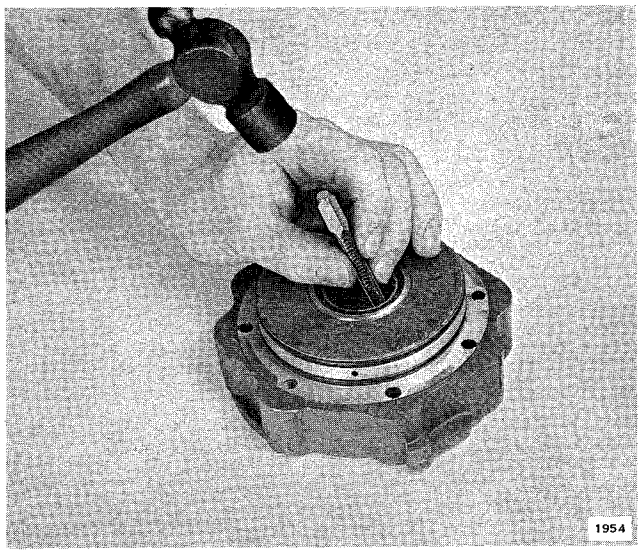

Figure 5-12. Removing Crankcase Head Seals

of bearing to engage seal lip, and drive seal out with hammer. See Figure 5-12. DO NOT reuse seal. To remove bearing, press out from top side of crankcase head with arbor press.

d. Remove four screws (lower crankcase head to lower bearing retainer plate) and remove lower crankcase head from crankshaft. See Figure 5-13. Use Truarc pliers No. 4 (Special Tool #307429) to remove retaining ring under bearing.

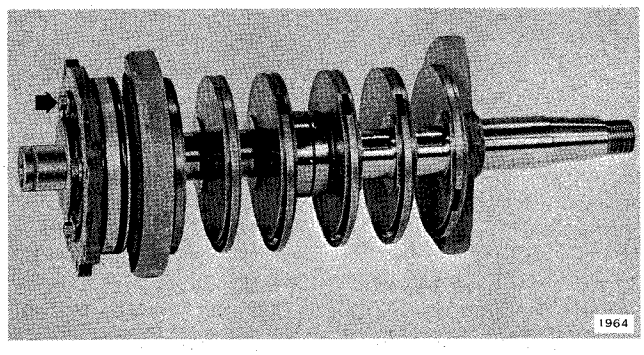

Figure 5-13. Bearing Retainer Plate Screws

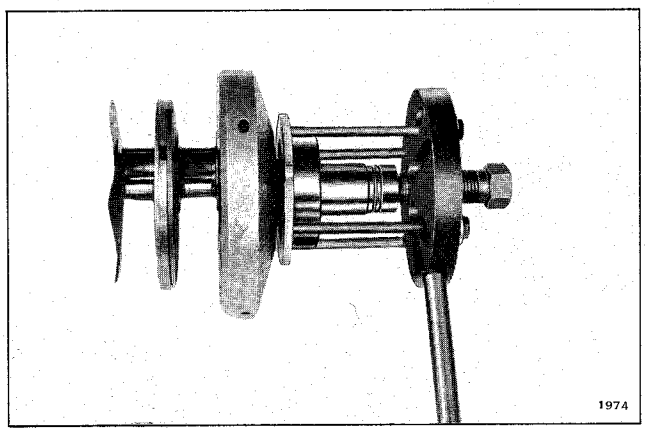

Figure 5-14. Pulling Lower Crankshaft Bearing

e. Inspect ball bearing at lower end of crankshaft and remove if damaged. This can be accomplished by using flywheel puller (Special Tool #378103) provided with four screws, 1/2-28 x 4" long, and threading the screws into the tapped holes in the bearing retainer. Screws are provided as part of adapter kit (Special Tool #378104). See Figure 5-14.

f. The center journal needle bearing may be removed by lifting the retaining ring, sliding it to one side, and separating the two halves of the bearing. See Figure 5-15.

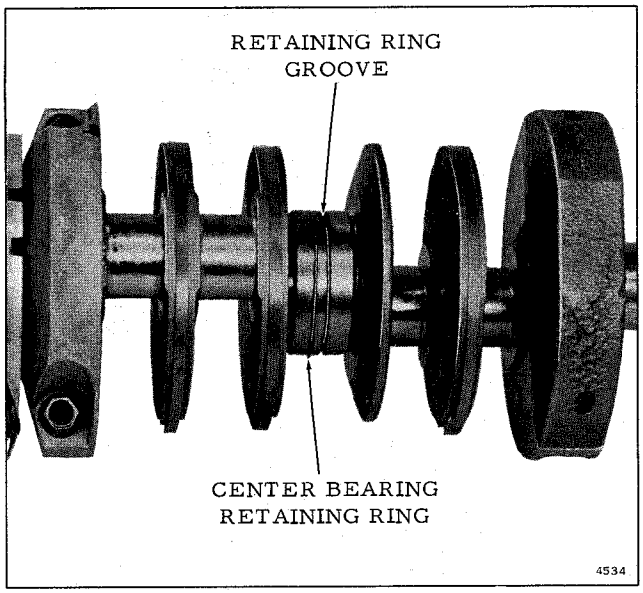

Figure 5-15. Removing Center Journal Bearing

g. Remove the ring from the pistons by prying the ends loose enough to grip them with pliers and then breaking them away from the piston. DO NOT try to save the rings even when they are not stuck. Install a complete set of new rings on every power head service job.

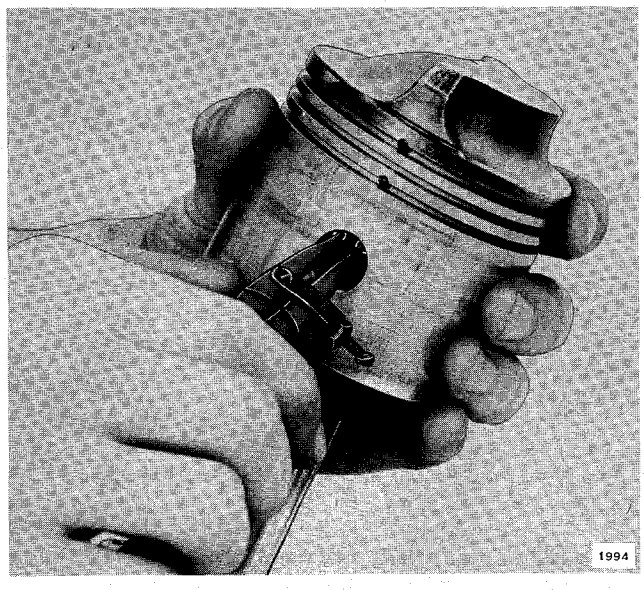

Figure 5-16. Removing Wrist Pin Retaining Ring

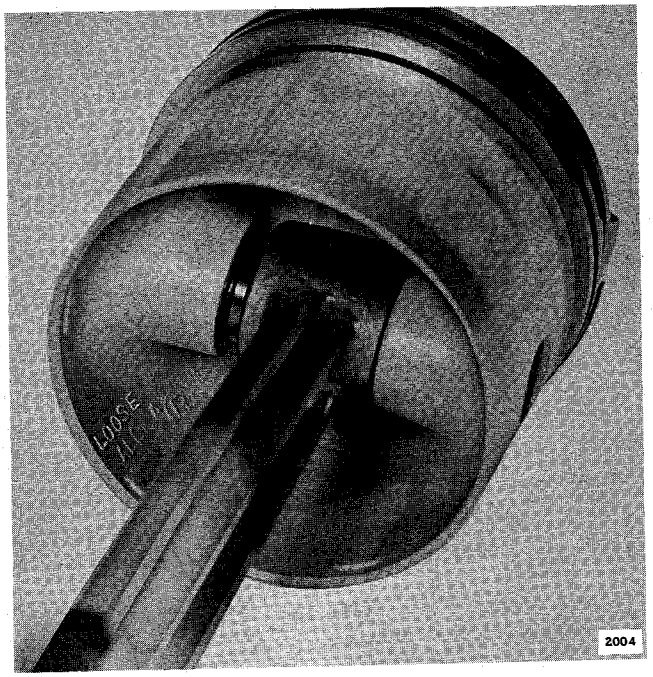

Figure 5-17. "LOOSE" Mark on Piston

h. Remove wrist pin retaining ring, using Truarc No. 1 pliers (Special Tool #303857). See Figure 5-16.

i. Push wrist pin through to free piston from rod.

CAUTION

One side of piston is marked "LOOSE" on inside. See Figure 5-17. When wrist pin is to be removed, "LOOSE" side of piston must be up and driving tool must be applied to loose side. Always drive from loose side to tight side, being careful not to distrot piston. See Figure 5-18.

CLEANING, INSPECTION, AND REPAIR

CYLINDER BLOCK AND CRANKCASE

Check cylinder walls for excessive wear, and check cylinder ports for carbon accumulation. Cylinder walls wear in various degrees depending on lubrication and conditions under which the motor is operated. Major portion of wear is in the port area and the area covered by ring travel.

Check cylinder for size and wall straightness by using an inside micrometer or dial-bore indicator. Refer to Section 2 for specified dimensions. If wear is greater than .003", replace cylinder block, or rebore block for oversize pistons. Pistons and ring sets are available .020" and .040" oversize.

NOTE

If your shop is not equipped to rebore cylinder blocks, write the Evinrude Service Department about our reboring service.

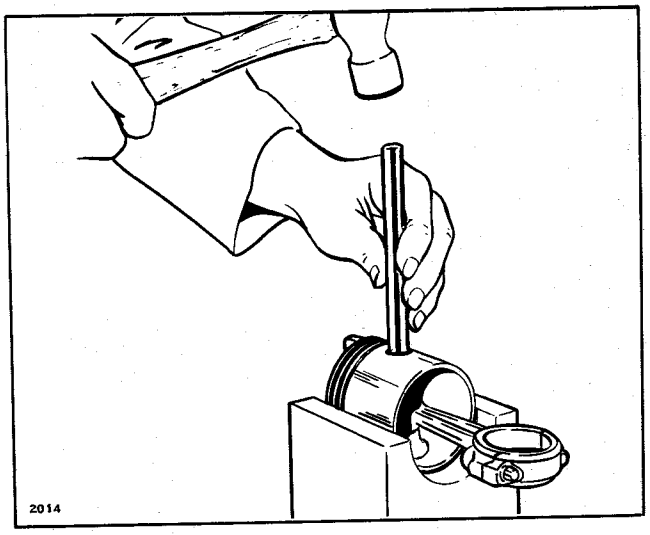

Figure 5-18. Driving Out Wrist Pin

Carbon accumulation on walls of the exhaust ports restricts the flow of exhaust gases and has considerable effect on performance of the motor. Carefully scrape carbon from cylinder heads and exhaust ports with scraper or other blunt instrument. Walls of exhaust ports and all exhaust passages must be free from carbon deposits to insure maximum performance. Avoid getting carbon in water jackets.

With continued operation of the motor, the cylinder walls will take on a glaze which reduces the effectiveness of the seal between the piston rings and the cylinder walls. The result will be reduced compression and a decrease in performance of the motor. Before reinstalling the pistons, break the glaze by using a fine cylinder hone to refinish cylinder walls. A few up and down motions of the tool should be sufficient to remove cylinder wall glaze. See Figure 5-19.

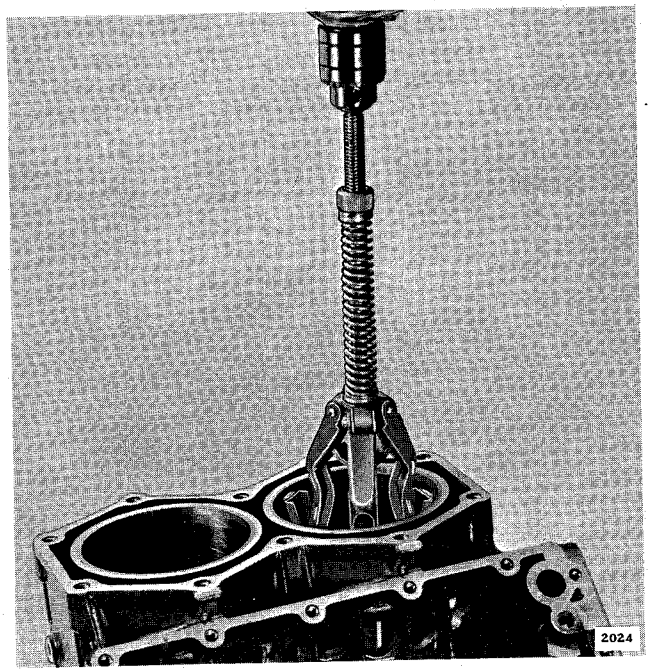

Figure 5-19. Breaking Cylinder Glaze

GASKET SURFACES

Remove all traces of dried cement, using lacquer thinner or trichlorethylene. Check all gasket faces for flatness. Under certain conditions, gasket faces may warp or spring, particularly where thin sections or flanges are employed and are subject to temperature changes.

To check for flatness, lay a sheet of No. 120 emery cloth on a surface plate or piece of plate glass. Place the part to be surfaced on the emery cloth and move slowly back and forth several times in a figure 8 motion, exerting evenly distributed, light pressure.

If the surface is actually warped or sprung, high spots making contact with the surface plate will take on a dull polish, while the low areas will have retained their original state. To insure flatness over the entire surface, continue surfacing until the entire gasket surface has been polished to a dull luster. Finish surfacing with No. 180 emery cloth. See Figure 5-20.

CRANKSHAFT

SEAL RINGS

Check crankshaft seal for excessive wear. Seal rings should fit snugly in cylinder block and crankcase, and should form a tight seal around crankshaft webs. Correct seal sizes are given in Section 2.

BEARINGS

a. All areas where the bearings are to be serviced should be kept free from accumulation of oil and dirt to avoid contaminating the bearings. DO NOT spin ball or roller bearings before they are cleaned, as dirt in the raceways may cause serious damage.

b. Place bearings in a wire basket and immerse in a solvent such as Solvasol. The tank should have a screened false bottom to prevent settlings from being stirred up into the bearings. Agitate basket frequently until grease, oil, and sludge are thoroughly loosened and can be flushed out. Bearings that contain especially heavy carbon deposits or hardened grease should be soaked in a separate container of solvent.

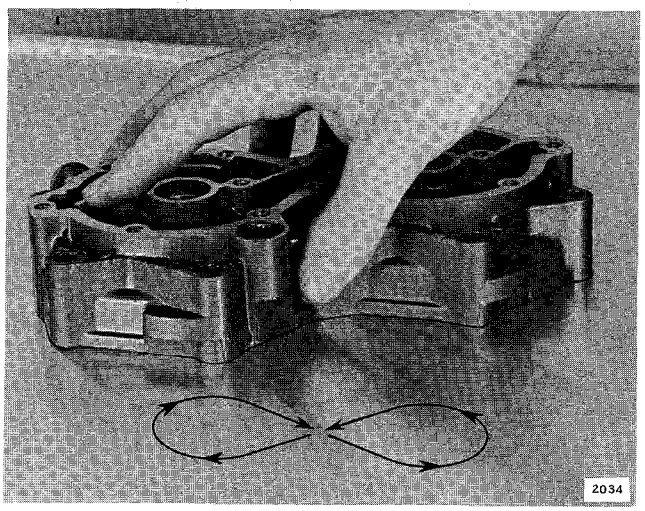

Figure 5-20. Surfacing Cylinder Head

c. Using a spray gun with air filter and a clean solvent, flush each bearing until all dirt and residue are removed. Turn one of the races slowly while flushing to help dislodge dirt from around balls and separator pockets. Blow solvent out of bearings, using dry, filtered air, being careful not to spin bearings by force of air.

d. Since dry bearings rust rapidly, lubricate them at once in light, clean oil. Rotate them a few times and, after draining the excess oil, place them in a covered container until reassembly.

e. Discard bearings which show any of the following:

(1) Rusted balls, rollers, or raceways.

(2) Fractured ring. This may be caused by forcing a cocked bearing off a shaft, or by too heavy a press fit.

(3) Worn, galled, or abraded surfaces. These may be caused by too loose a fit, or bearing locked by dirt and turning on shaft or in housing.

(4) Badly discolored balls, rollers, and races. This is usually due to an inadequate supply of lubricant. Moderate discoloration of balls and raceways is not a cause for discard.

SEALS

a. Replace upper crankcase head seal. DO NOT reuse seal. Seat new seal with lip facing in and flush with top of crankcase head.

b. Lower crankcase head seal should be replaced and any parts of this assembly should be replaced if damaged or worn. Note "O" ring to be assembled in groove inside carbon seal.

PISTONS

Check the pistons for roundness, excessive skirt wear, and scoring. The piston skirts must be perfectly round and unscratched to prevent the entry of exhaust gases into the compression chamber. See Figure 5-21. Carefully remove carbon deposits. Inspect the ring grooves for carbon accumulation, excessive wear, or damage to the ring seats. Carefully scrape carbon from the ring grooves, making certain that carbon clinging to the bottom and sides of the grooves has been thoroughly removed without scratching or otherwise damaging the grooves. A tool for cleaning the ring grooves can be made from a broken ring with a sharpened edge. Care must be taken not to damage the lower ring lands. See Figure 5-22. Check piston for size and roundness, using a micrometer. NOTE: Remove carbon from inside of piston head.

Before installing new piston rings, check gap between ends of ring by placing ring in its respective

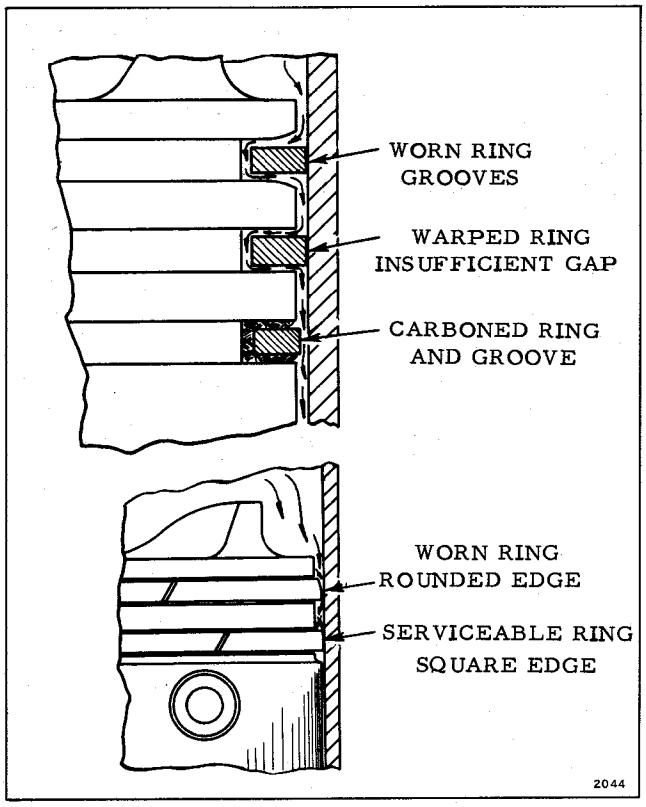

Figure 5-21. Piston and Ring Condition

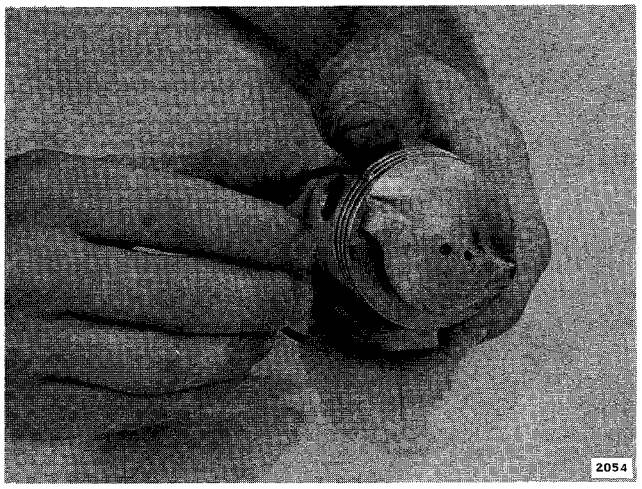

Figure 5-22. Cleaning Carbon from Ring Grooves

cylinder bore, then pushing the ring down in the bore slightly with the bottom of the piston to square it up. See Figure 5-23. Check for ring groove clearance with feeler gage. See Figures 5-24 and 5-25. Correct gap and groove clearances are given in Section 2.

REASSEMBLY OF POWER HEAD

Proceed slowly. Make no forced assemblies unless press fits are called for and make no "dry" assemblies. Be sure all parts to be assembled are clean and free from dirt and grit. Perfectly good cylinder walls, pistons, and rings can be ruined in a few minutes of operation unless all forms of grit are removed before assembly. Work in clean surroundings and with reasonably clean hands. Coat all bearing surfaces, cylinder walls, etc., with clean oil before assembly.

NOTE

Always use new gaskets throughout when reassembling the power head.

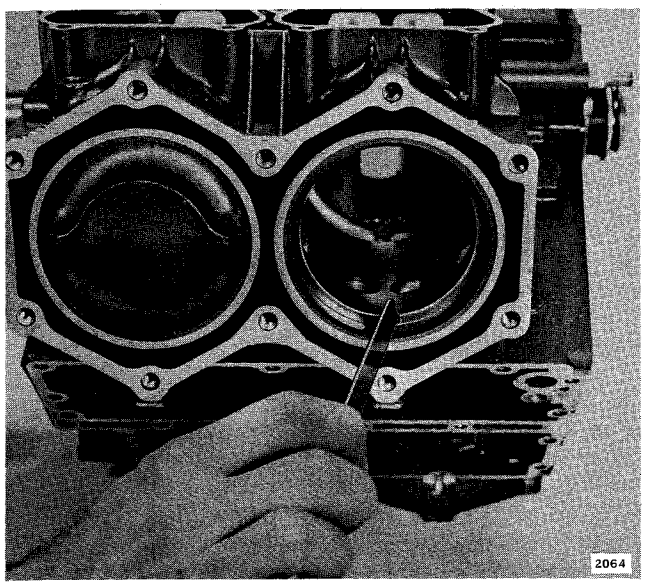

Figure 5-23. Checking Fit of Ring in Cylinder

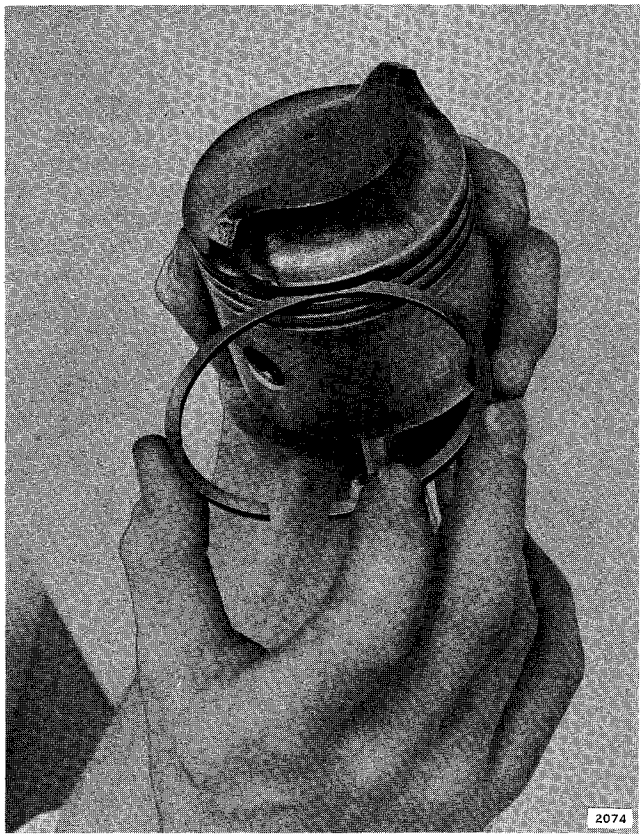

Figure 5-24. Checking Fit of Ring in Groove

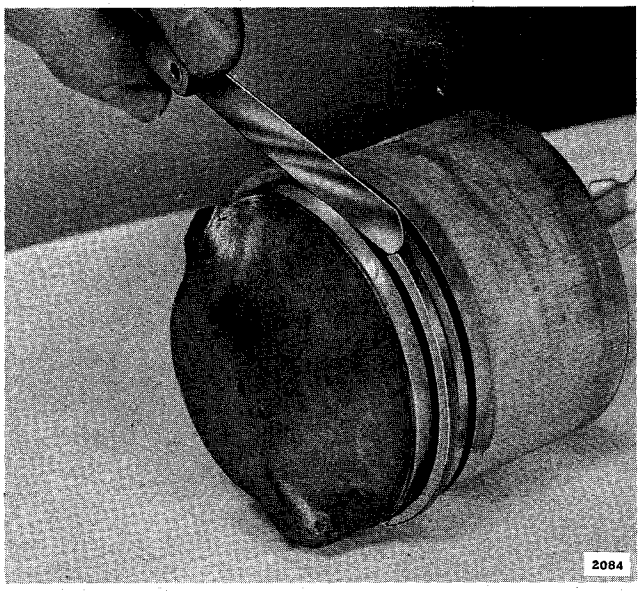

Figure 5-25. Checking Ring Groove Clearance

PISTONS, WRIST PINS, AND CONNECTING RODS

a. The difference between port and starboard cylinders must be considered when assembling pistons to rods. Pistons must be installed in cylinders with intake side of deflector toward intake port. Oil hole in wrist pin end of connecting rod must be toward top of motor. See Figures 5-26 and 5-28.

b. Apply coat of oil to wrist pin, making sure surface is clean. Place a drop or two of oil in each pin hole in the piston.

CAUTION

One of the piston bosses is bored for a slip fit on the wrist pin and the other for a press fit. When installing the wrist pin, drive from the side marked "LOOSE", using a fixture to guard against distortion or damage during the operation.

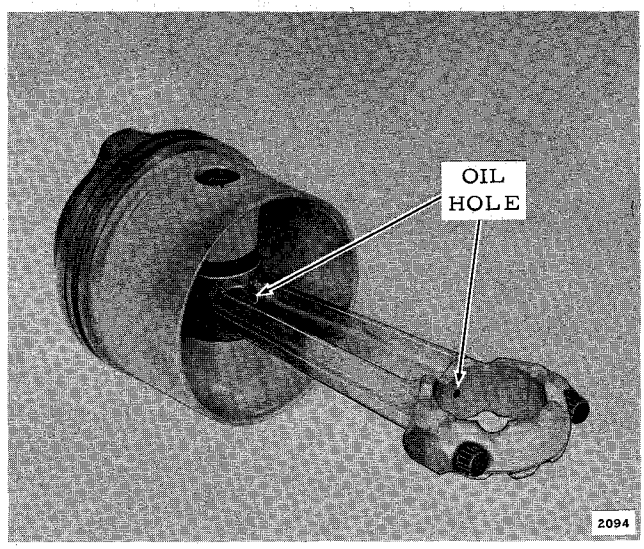

Figure 5-26. Connecting Rod Oil Hole

c. Insert wrist pin through slip fit side of piston. Oil wrist pin bearing in connecting rod. Place connecting rod in position, then proceed to drive the pin "home". This can be accomplished more easily if the piston is heated slightly, causing it to expand.

d. Replace retaining rings, making certain they come to rest securely in the groove provided for this purpose.

e. Check piston with micrometer to determine whether piston has been distorted during assembly. See Figure 5-27. If slightly out-of-round, place in fixture and tap high side with light mallet (DO NOT use hammer) to restore original roundness. Proceed carefully and caliper frequently until the piston is rounded out.

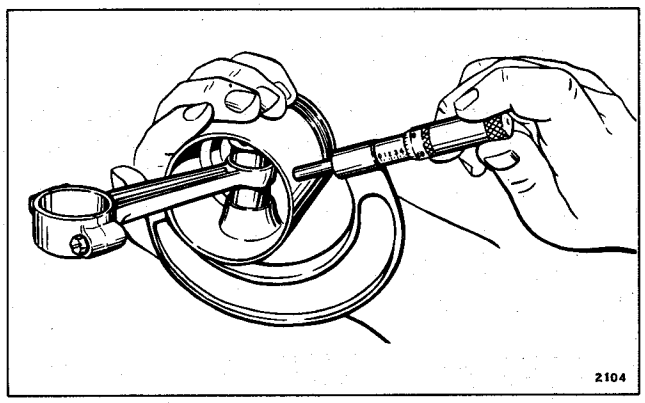

Figure 5-27. Checking Piston for Roundness

PISTON RINGS

Install the piston rings on each piston. Spread each ring with a ring expander just enough to slip it over the head of the piston and down into place. Be sure the rings fit freely in the piston ring grooves. The ring grooves are pinned to secure the position of the rings, primarily to prevent ends of the rings from catching on the edges of the ports in the cylinders, but also to assure staggering of the ring gaps.

PISTON AND CONNECTING ROD INSTALLATION

Coat pistons and cylinder bores with oil and install piston and connecting rod assemblies, being sure to match each assembly with the cylinder it was removed from. The intake side of the piston deflector must be placed toward the intake port. The use of automotive type ring compressing tools should be avoided, as these frequently cause damaged pistons and broken piston rings through imperfect alignment of the ring gap and piston dowel pin. The use of Special Tool #308479 (for standard size rings and pistons only) is recommended. Using one hand to push the piston into the cylinder, use the free hand to guide the connecting rod into place and to align the rod with respect to the crankshaft. See Figure 5-28.

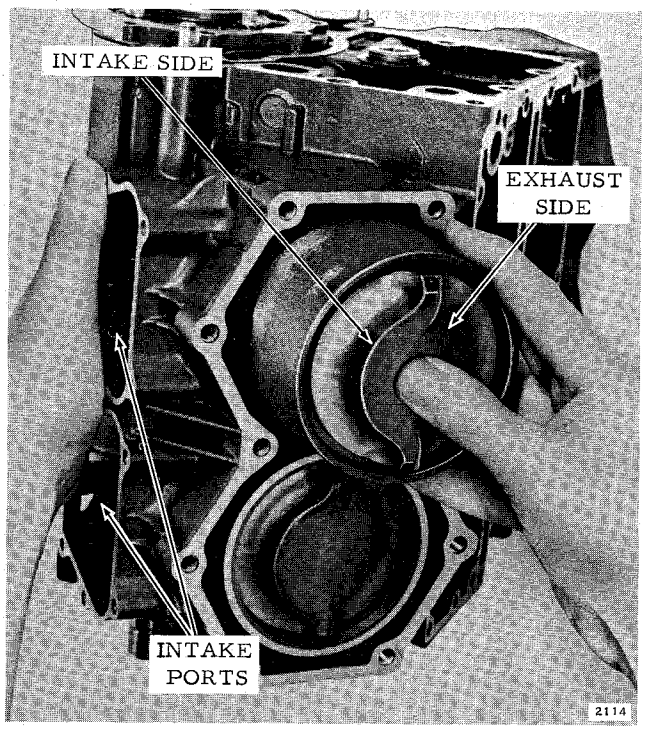

Figure 5-28. Installing Piston in Cylinder

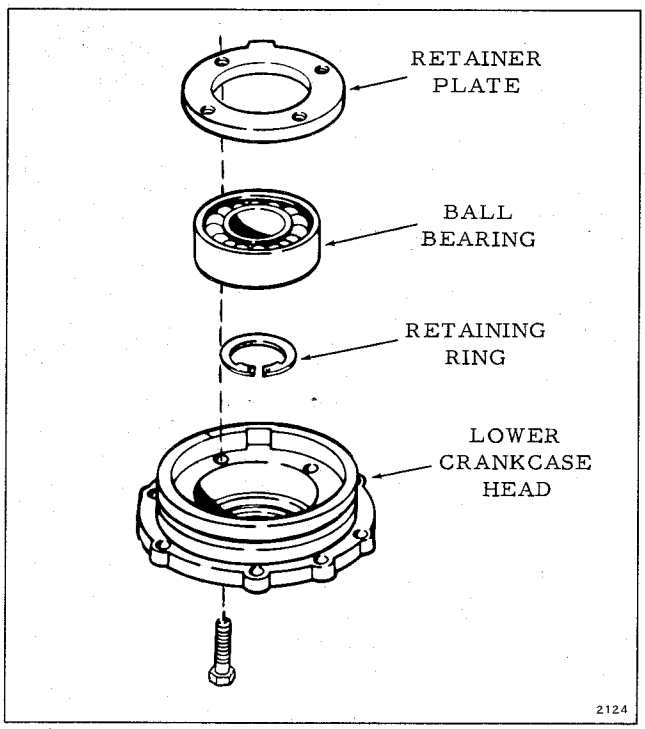

Figure 5-29. Lower Crankcase Head Assembly

CRANKSHAFT

a. Place lower bearing retainer plate over lower end of crankshaft. Using an arbor press, press ball bearing onto lower journal. Oil ball bearing, and install retaining ring.

b. Install "O" rings on lower crankcase head and place crankcase head in position with the lug cavity aligned with the lug on the bearing retainer plate. See Figure 5-29.

c. Insert retainer plate screws, using new "O" rings or screws if necessary. Draw the screws up tight, then back off two turns to provide a slight degree of end movement which will facilitate crankcase installation.

d. Oil and install center main bearing on center journal of crankshaft. Dowel pin hole in bearing must be positioned toward cylinder block.

e. Assemble crankshaft to cylinder block. While installing crankshaft, pistons must be as close to top of cylinders as possible, and crankpins should be aligned vertically. See Figure 5-30. While placing the crankshaft into position, rotate the crankcase heads slightly to prevent damage to the "O" rings. Note dowel pin in center bearing location in cylinder block and corresponding hole in center journal bearing race. Adjust position of bearing assembly to fit over dowel pin.

f. Apply a coat of OMC Needle Bearing Grease Part #378642, to aid in retaining needle bearings and retainers during assembly. Assemble needle bearings and connecting rod caps to two crankpins at top of crankshaft webs, then turn crankshaft one-half turn to assemble remaining bearings and caps. Place flywheel key and flywheel in position temporarily to facilitate rotating the crankshaft.

g. The connecting rod needle bearing retainer is a matched assembly and must be retained as such. Do not interchange halves of these assemblies or turn end for end. Connecting rods and caps also are matched. Caps are not interchangeable with those of other rods, neither may the caps of the same rods be turned end for end. To assist correct assembly, small embossings are provided on matching sides of rod and cap.

h. With needle bearings in place, attach connecting rod cap. Draw a pencil over edge surface on both

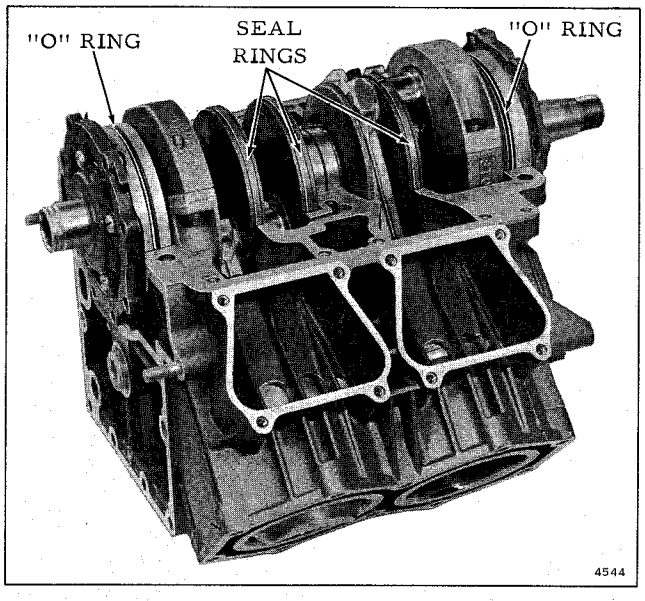

Figure 5-30. Correct Crankshaft Installation

sides of rod to make certain cap and rod are aligned at this point. If not aligned, offset edge can be felt with the pencil point. See Figure 5-31. Misalignment will affect free normal action of the needles, and may result in damage later on. See Figure 5-32. Tighten connecting rod screws to torque specified in Section 2, using torque wrench. Rods should float on crank pins.

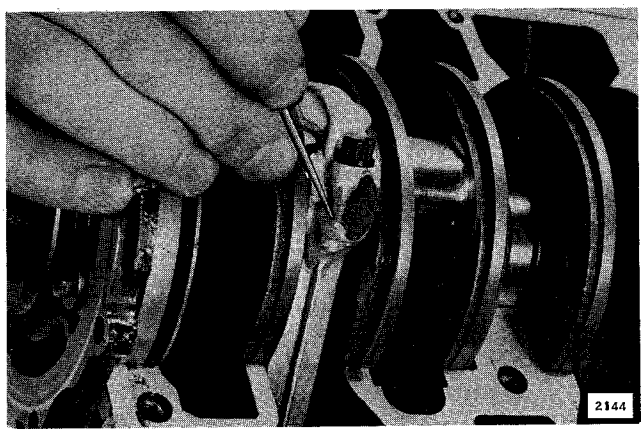

Figure 5-31. Checking Connecting Rod Cap Alignment

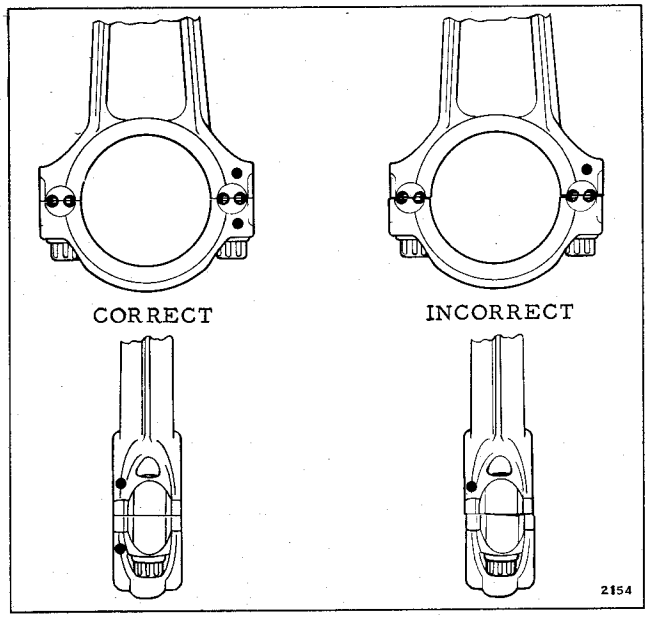

Figure 5-32. Correct and Incorrect Alignment

CRANKCASE AND CYLINDER

a. The crankcase face is grooved for installation of a rubber sealing strip. The new strip should be threaded into the grooves and cut somewhat longer than actually necessary to obtain a good butt seal at both ends against the crankcase heads. Run a fine bead of Sealer 1000 cement in grooves to secure strip in position while trimming. With thumb pressure, force strip to outer edge of groove. After cement has set trim ends with a sharp knife, allowing approximately 1/32 inch of the strip to extend beyond edge of machined surface. See Figure 5-33.

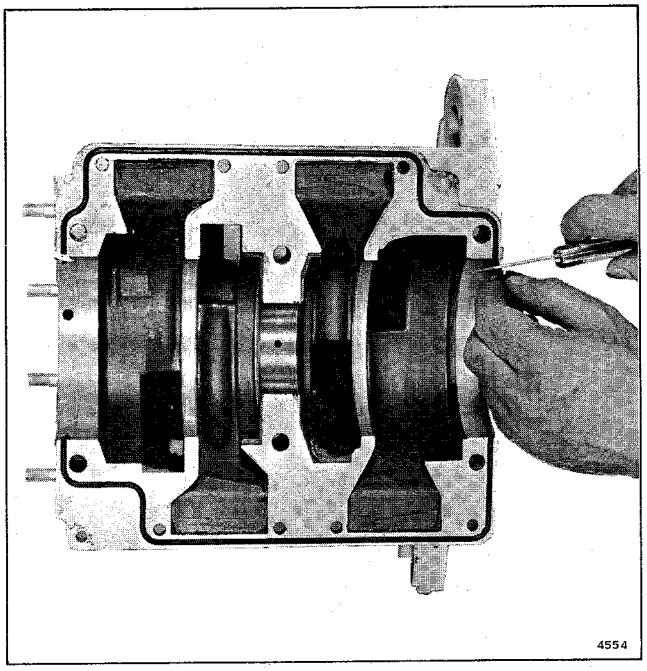

Figure 5-33. Trimming Crankcase Seal

b. Apply and spread evenly a thin coat of Sealer 1000 to crankcase face.

c. Place crankcase in position on cylinder block and crankshaft, using care to avoid damaging crankcase head gaskets and "O" rings. Rotate crankcase heads to their correct positions.

d. Replace crankcase taper pins, driving in carefully with a hammer.

e. Install crankcase screws finger tight.

NOTE

One of the eight smaller screws is shorter than the rest. This screw fastens the starter mounting bracket to the crankcase and should be kept loose for installation of the starter later.

f. Install lower crankcase head screws finger tight.

g. Check for binding between the crankshaft and the bearings or connecting rods by rotating the crankshaft with the flywheel.

h. Tighten all screws to specified torque, beginning with the large crankcase screws.

i. Install a new carbon seal and replace any parts of this assembly which are damaged or worn. Note "O" ring to be assembled in groove inside carbon seal.

REASSEMBLY OF POWER HEAD TO EXHAUST HOUSING

a. Make sure gasket surfaces of power head and power head adapter are clean. Place a new gasket in position on the power head adapter.

b. Place power head on lower unit adapter, using care to avoid damage to splined ends of crankshaft and driveshaft. Splines may be more easily engaged by bringing power head into position with the intake manifold facing slightly to port side of motor, and rotating power head until the splines engage. DO NOT in any case cause the driveshaft to be rotated counterclockwise, as the water pump impeller vanes may be damaged.

c. Install cylinder heads, using new gaskets. Tighten cylinder head bolts to specified torque, following the sequence shown. See Figure 5-34.

NOTE

Re-torque cylinder head screws after motor test has been completed.

d. Install cylinder head covers, using new gaskets. Tighten capscrews to specified torque.

e. Install water bypass, exhaust, and bypass covers in their respective positions.

f. Check crankshaft and flywheel tapers for any traces of oil. This assembly must be perfectly dry. Oil or grease remaining on tapers will permit the flywheel hub to spread. Swab both tapered surfaces with solvent and blow dry with compressed air. Inspect both tapers for burrs or nicks.

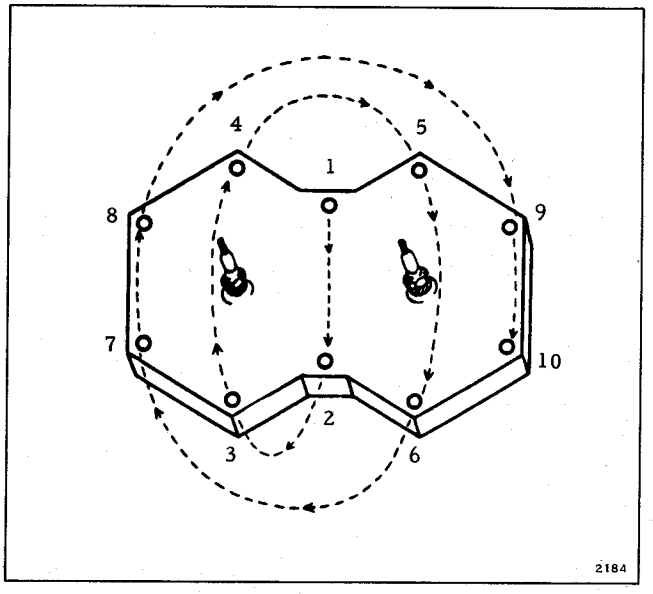

Figure 5-34. Cylinder Head Torquing Sequence

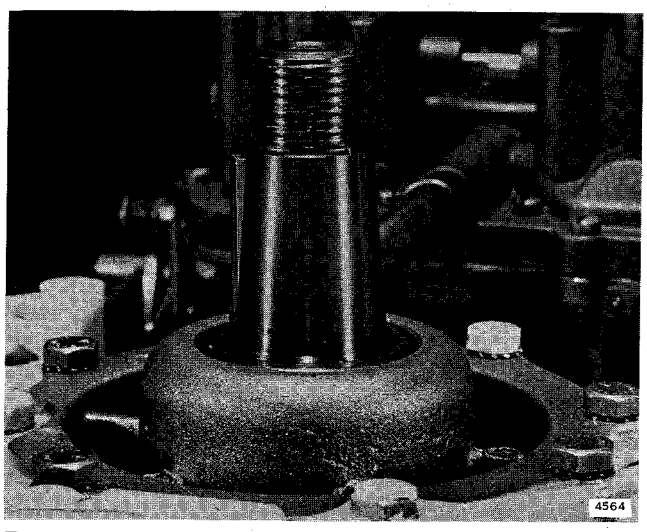

Figure 5-35. Correct Position of Flywheel Key

g. Assemble flywheel key to crankshaft with outer edge vertical. See Figure 5-35. Install timing belt. Replace flywheel, and tighten flywheel nut to specified torque.

Assembly of the power head is now complete except for the installation of manual and electric starters, thermostat assembly, leaf valves and carburetor, magneto and linkages, fuel pump, and motor covers. These items can be assembled in sequence as outlined in other sections of this manual.

BREAK-IN

Be sure that when a motor is returned to service after an overhaul, the owner is advised to follow break-in procedures exactly. This includes the use of the 24-1 fuel mix for the first ten hours.

For the first 5 to 10 minutes, operate motor at a fast idle. Check operation of water pump. For remainder of first hour, do not operate motor over 3000 rpm (approximate) or one-half throttle (approximate).

NOTE

With easy planing boats, it would be desirable to bring the boat into planing position with full power and then immediately reduce the throttle setting to approximately 3000 rpm (one-half throttle). BE SURE boat maintains planning attitude at this throttle setting.

During second hour, bring boat into planing attitude and reduce power to 4000 rpm (approximate) or three-quarters throttle (approximate), while maintaining planing attitude. At intervals during the second hour, apply full power for periods of one to two minutes, returning throttle to original setting (4000 rpm - three-quarters throttle) for a cooling period.

Avoid continuous full throttle operation for extended period during the next few hours. Check motor temperature frequently.

SECTION 6
LOWER UNIT

Table of Contents

DESCRIPTION

RUBBER MOUNTS AND SEALS

There are two exhaust housings: an inner housing or exhaust tube; and an outer housing enclosed by a combination of front and rear cover assemblies. The outer exhaust housing, which carries the power head by means of the adapter plate, "floats" inside the front and rear covers on five rubber mounts and the exhaust tube seal ring. Two of the rubber mounts support the adapter plate and power head at the top of the front exhaust cover, and the three other rubber mounts support the outer exhaust housing at the bottom of the front exhaust cover. In this way all power head and driveshaft vibrations are completely isolated and are prevented from being transmitted to the stern bracket and the boat transom. In addition, the rubber seal ring positions the outer exhaust housing within the rear exhaust cover and also prevents water and exhaust gases from rising above this point. See Figure 6-1.

SHOCK ABSORBERS

Two hydraulic shock absorbers are mounted between the swivel bracket and stern bracket to reduce the shock resulting from hitting an underwater obstruction at high speed. The shock absorbers employ a tapered orifice which presents a greater resistance to motion at the full tilt position than at the normal position. See Figure 6-2.

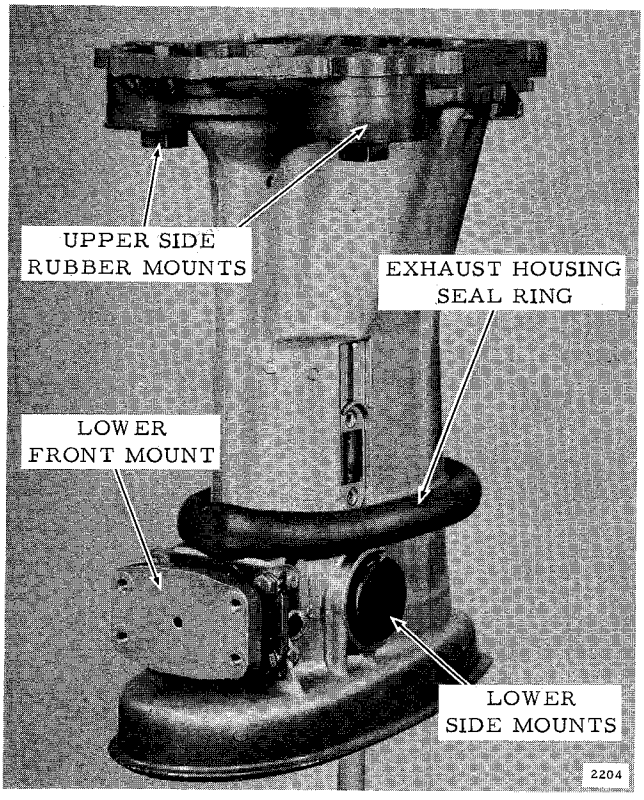

Figure 6-1. Rubber Mounts and Seals

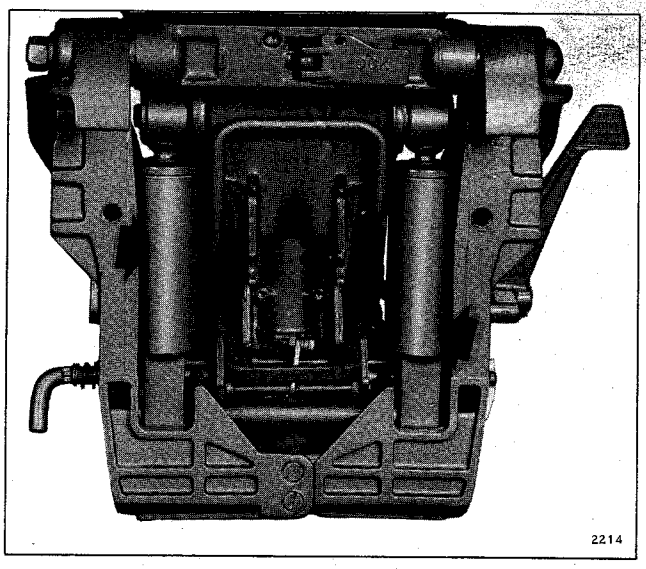

Figure 6-2. Shock Absorbers

In operation, upon hitting an underwater obstuction, the motor is allowed to tilt freely initially, but encounters greater resistance as it reaches full tilt position. After clearing the obstruction, the motor encounters decreasing resistance as it reaches normal position. Shock absorption throughout the full length of travel prevents the motor from slamming against the boat transom as it returns to normal position.

EXHAUST RELIEF

Normally, exhaust gases are conducted down through the inner exhaust tube and out through the underwater exhaust outlet. However, in starting, water in the underwater outlet creates back pressure. This can cause hard starting. Exhaust relief is provided by an outlet in the water discharge passage above the waterline. Since no water is discharged until after the motor is started, the exhaust gases will initially be discharged through the water discharge passage. See Figure 6-3.

WATER PUMP

Water for cooling the power head is circulated by the water pump, located at the top of the upper gearcase and driven directly by the driveshaft. The pump consists of a synthetic rubber impeller which is keyed to the driveshaft, and the pump housing which is offset from center with respect to the driveshaft. Because the housing is offset, the impeller blades flex as they rotate, varying the space between them. The pump inlet port, located in the stainless steel plate which forms the lower part of the pump housing, is open to the blades when the space between them is increasing. The pump outlet port, in the impeller housing, is open to the blades when the space between them is decreasing. Thus at low speeds the impeller works as a displacement pump. At higher speeds,

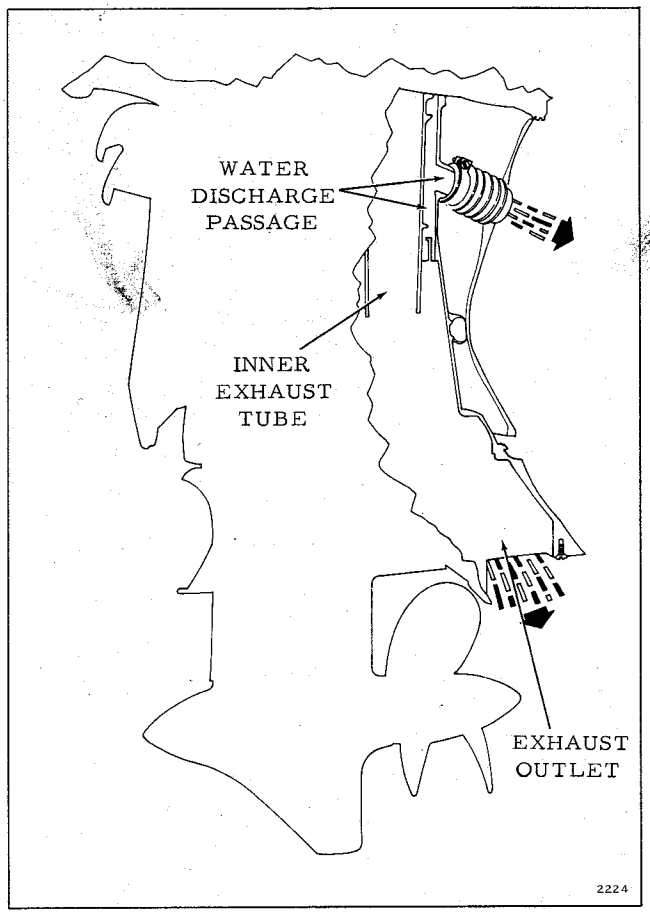

Figure 6-3. Lower Unit Cutaway Showing Exhaust Relief

water resistance keeps the blades from flexing, and the pump acts as a circulator, enough water being provided by the forward motion of the motor thru the water. See Figure 6-4. Heavy duty water pumps are available for service in extremely sandy or muddy waterways.

GEARCASE AND SHIFT LINKAGE

The gearcase and shift linkage consist of:

1. The driveshaft pinion gear;
2. The forward and reverse driving gears;
3. The propeller shaft;
4. The clutch shifter dog, splined to the propeller shaft;
5. The clutch dog cradle and shifter lever; and
6. The shift lever linkage to handle on starboard side of lower front motor cover. See Figure 6-5.

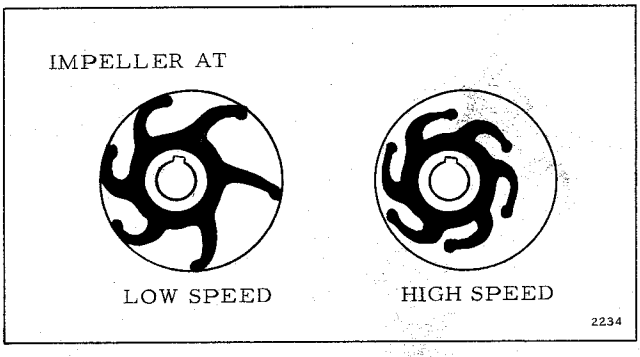

Figure 6-4. Water Pump Impeller Positions

Power is transmitted thru the driveshaft to the drive pinion, which drives both forward and reverse gears. The clutch dog is splined to the propeller shaft while the forward and reverse driving gears rotate on the propeller shaft in opposite directions. The shift lever slides the clutch dog forward or backward on the propeller shaft to engage either drive gear. The gear shift is in neutral when the clutch dog is in between forward and reverse gears.

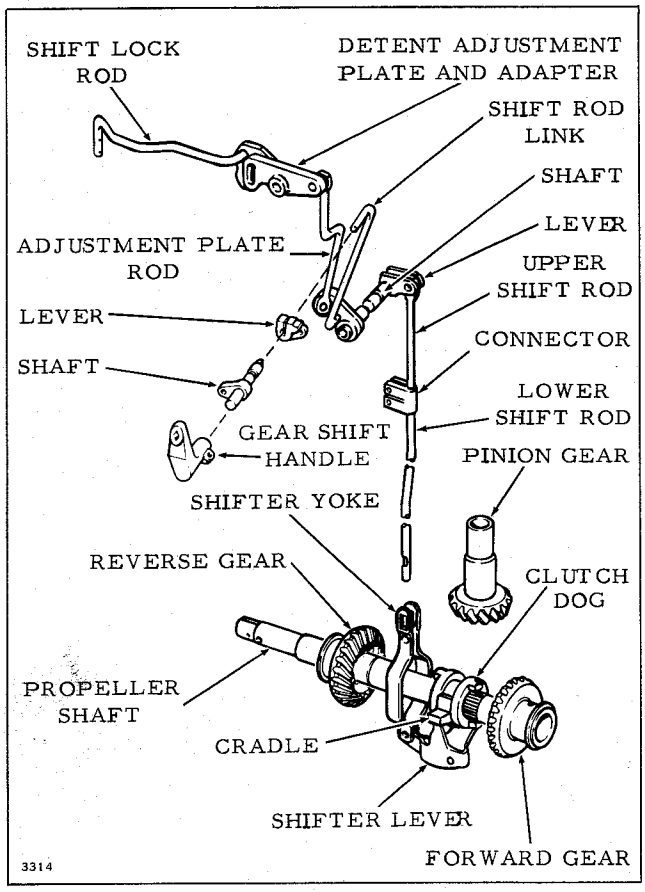

Figure 6-5. Gear Shift Linkage

REMOVAL OF EXHAUST HOUSING GROUP

It is possible to remove the upper and lower gearcase assembly without removing the power head from the motor. However, if disassembly of the exhaust housing is required, it is necessary first to remove the power head. See Section 5 for instructions.

REMOVAL OF GEARCASE

The upper and lower gearcase assembly may be removed from the exhaust housing and power head as follows:

a. Disconnect spark plug wires.

b. Drain lubricant from gearcase.

c. Remove outer and inner exhaust housing cover plates. Remove lower screw from shift rod connector. See Figure 6-6.

d. Remove eight screws holding gearcase to outer exhaust housing or gearcase extension. See Figure 6-7. Remove upper and lower gearcase assembly and shift rod from exhaust housing, taking care to avoid damaging driveshaft which extends upward to the power head.

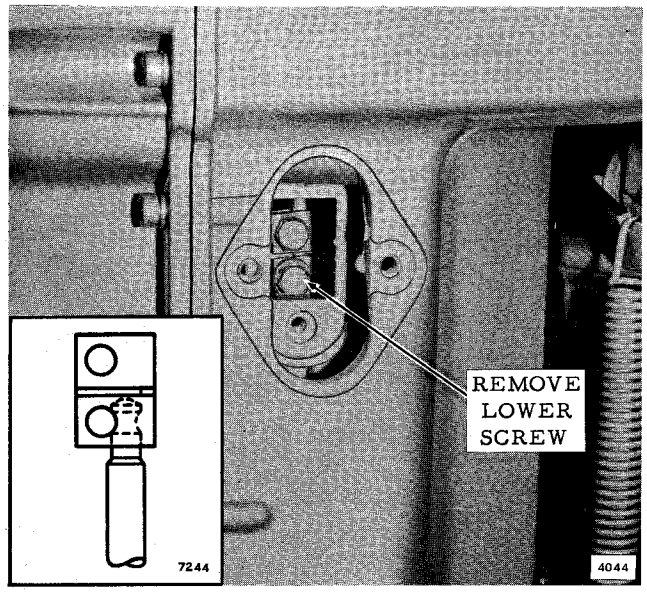

Figure 6-6. Disconnect Shift Rod

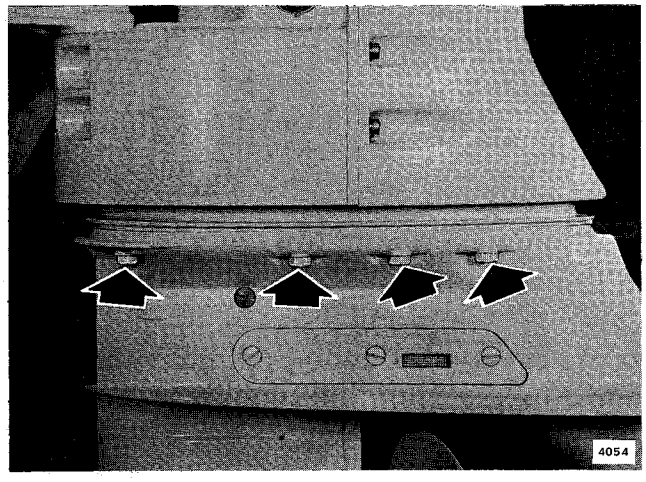

Figure 6-7. Removing Gearcase Screws

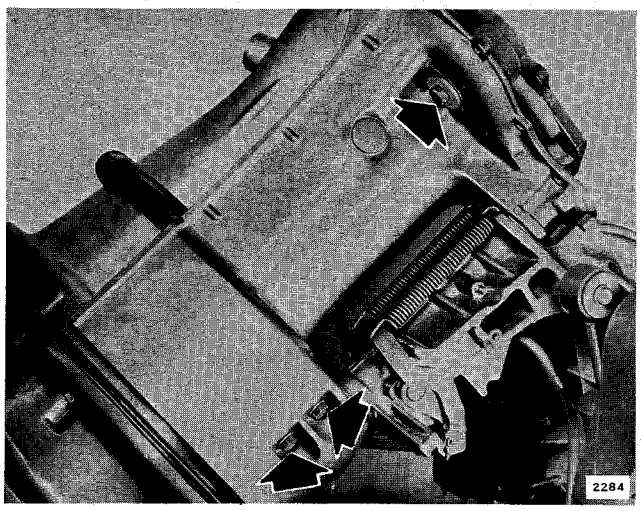

Figure 6-8. Exhaust Housing Attaching Screws

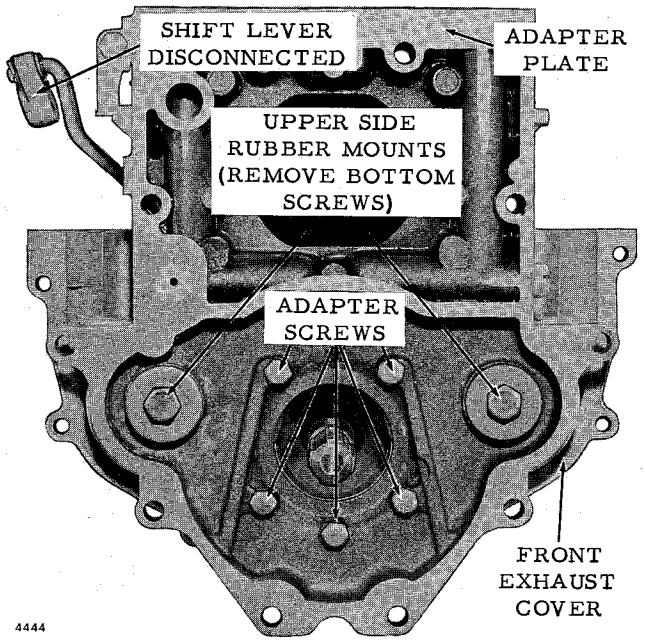

Figure 6-9. Power Head Adapter Screws

REMOVAL OF EXHAUST HOUSING AND COVERS

a. Remove power head. See Section 5 for instructions.

b. Remove screws attaching rear exhaust housing cover to front exhaust housing cover. Lift rear exhaust housing cover from outer exhaust tube assembly.

c. The exhaust housing and adapter plate, which carry the power head and thermostat, are rubber mounted to the front exhaust cover. To release the exhaust housing, disconnect the shift linkage, and remove the two bottom screws from the upper side rubber mounts, and the four lower front mount screws. See Figures 6-8 and 6-9.

d. To remove adapter plate, remove five screws attaching adapter plate, to outer exhaust housing. Remove two upper rubber mount to adapter screws. See Figure 6-9. Lift adapter plate with tubes out of outer exhaust housing, being careful to avoid damage to water tubes, grommets, and couplings. Remove upper mounts from front exhaust cover.

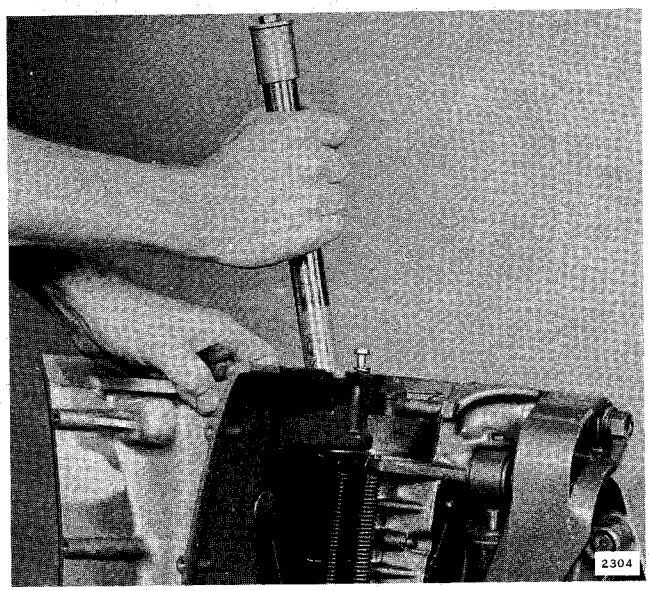

Figure 6-10. Removing Pivot Shaft and Front Cover

e. The front exhaust cover is hinged to the swivel bracket by a pivot shaft. Loosen steering friction screw to release tension on steering friction spring. Remove screw and washer from bottom of pivot shaft. To detach front exhaust cover from swivel bracket, drive pivot shaft up from bottom and remove from top. See Figure 6-10. Tag upper and lower thrust washers to assure correct reassembly; they are not interchangeable.

DISASSEMBLY OF STERN BRACKET

a. Remove the thrust rod and retainer, and the thrust rod spring from the stern bracket.

b. Remove two screws fastening port and starboard stern brackets. Remove tilting shaft bolt, nut, spring, and washers from top of stern brackets.

c. Remove retaining rings and washers holding shock absorbers to swivel bracket. Pull stern brackets and shock absorbers off of swivel bracket and pivot pin. See Figure 6-11.

d. Remove top and bottom seals from swivel bracket. Inspect needle bearings and remove if damaged.

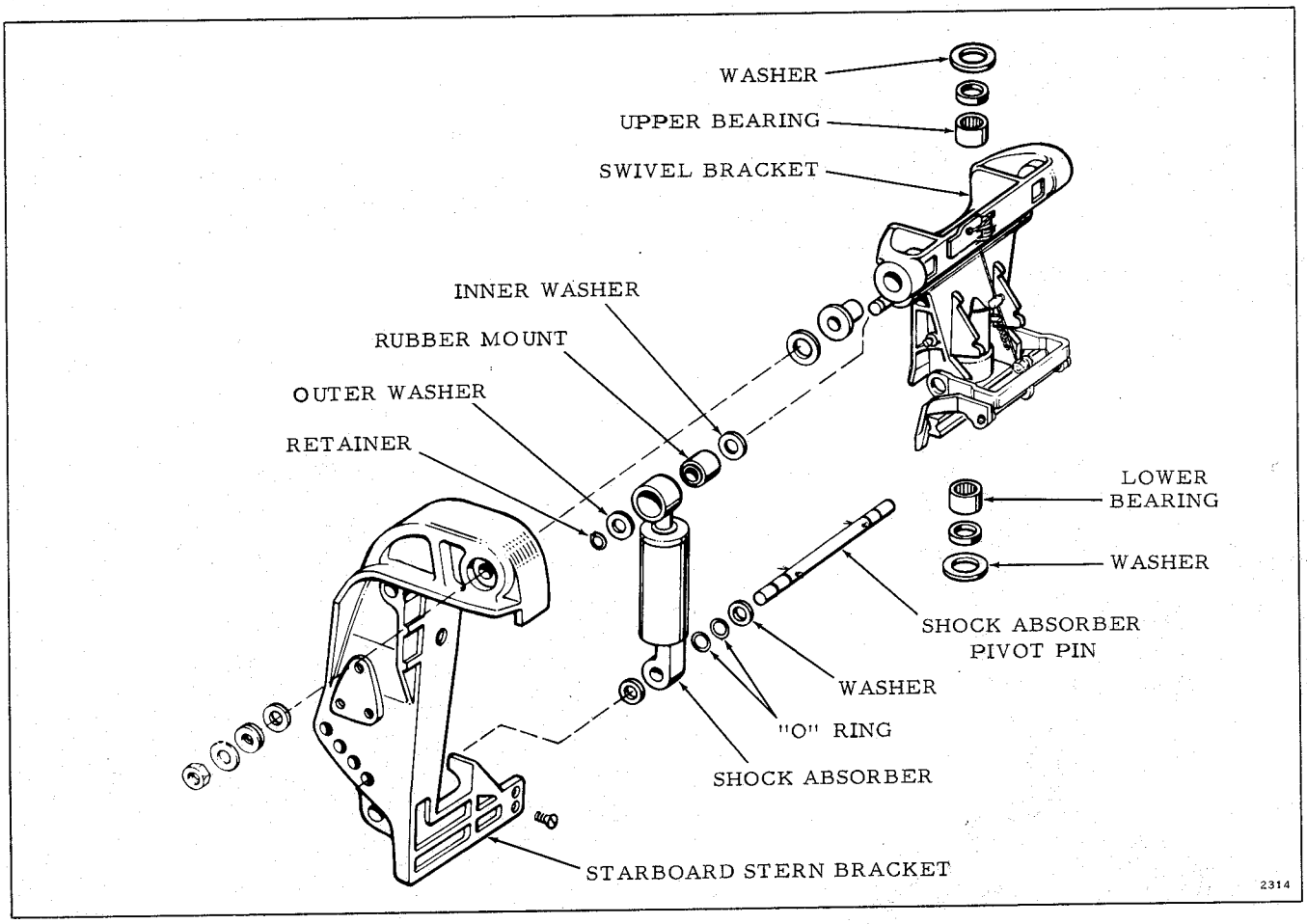

Figure 6-11. Stern Bracket Disassembly

DISASSEMBLY OF STANDARD LOWER GEARCASE

a. Remove cotter pin, propeller nut, drive pin, thrust washer, and propeller.

b. Remove four screws attaching impeller housing to upper gearcase. Slide complete impeller assembly up on driveshaft to expose bearing cap assembly. See Figure 6-12. Remove four screws attaching bearing cap assembly to lower gearcase. Driveshaft with bearing and impeller assemblies, may now be lifted from lower gearcase. See Figure 6-13.

c. Remove "O" ring, impeller housing and impeller, and lower bearing cap assembly from driveshaft. Remove seals from impeller and bearing cap with punch. If damaged, press bearing from bearing cap, using an arbor press.

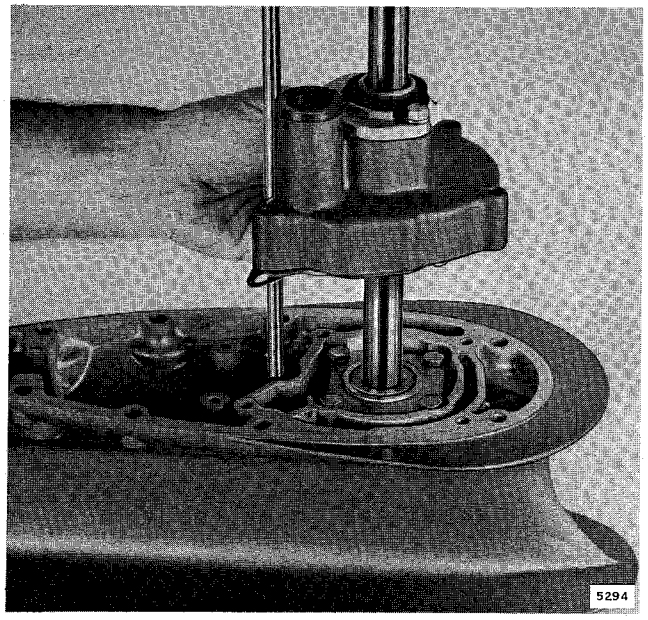

Figure 6-12. Water Pump Assembly

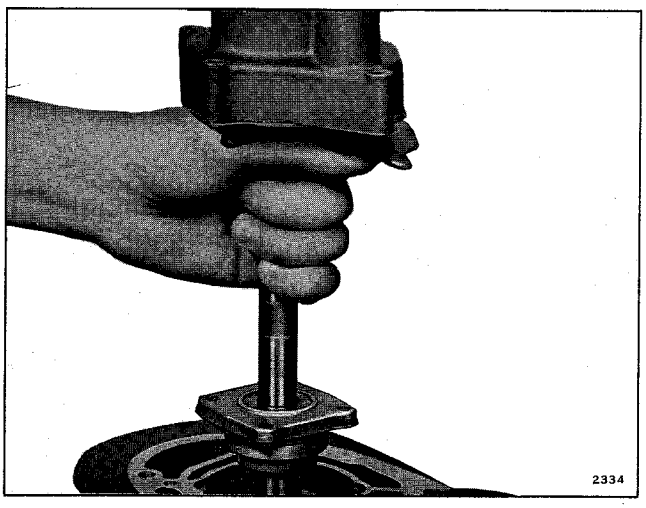

Figure 6-13. Removing Driveshaft and Water Pump

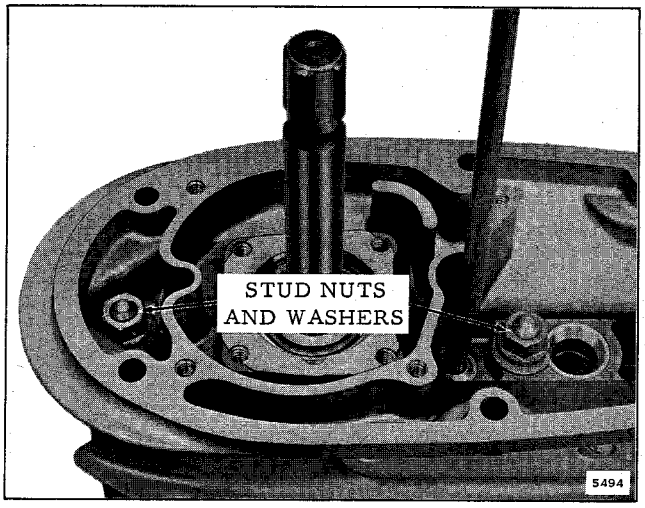

Figure 6-14. Gearcase Stud Nuts

d. Drain gearcase. Use a 9/16 inch deep socket to remove gearcase stud nuts. See Figure 6-14. Discard the nuts, since they are not to be re-used. These are self-locking nuts and lose their locking ability after being removed.

e. Separate upper and lower gearcases enough to remove nut and screw holding shift rod to yoke. Pull upper gearcase off of studs and remove shift rod. Turn slightly as bends in rod tend to bind if pulled straight out. NOTE: Remove carbon from shift rod and lubricate with oil before removing shift rod from upper gearcase. Remove shift rod bushing, "O" ring and gasket using bushing punch (Evinrude Special Tool #378778). Drive out from bottom to top. See Figure 6-15.

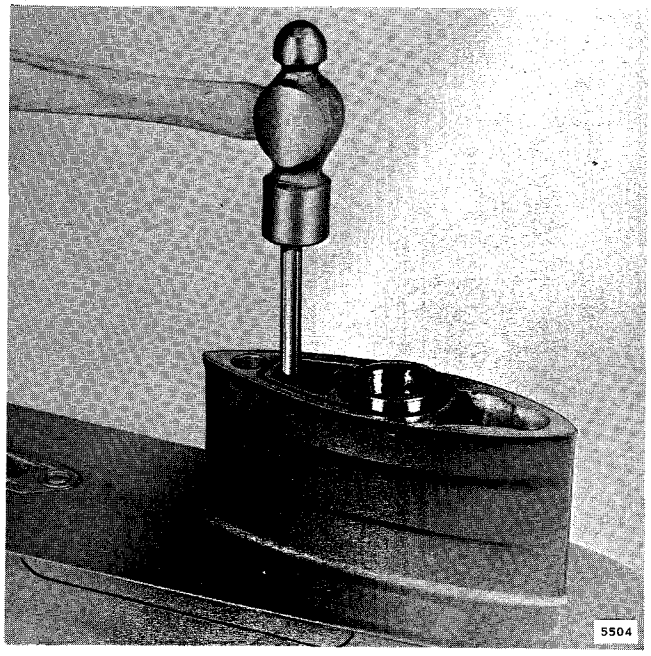

Figure 6-15. Driving Out Shift Rod Bushing

f. Remove shifter yokes from lower gearcase.

g. Using flywheel puller (Special Tool #378103) with bolts 1/4 - 20 x 6 inches long, remove gearcase head and bearing. See Figure 6-16.

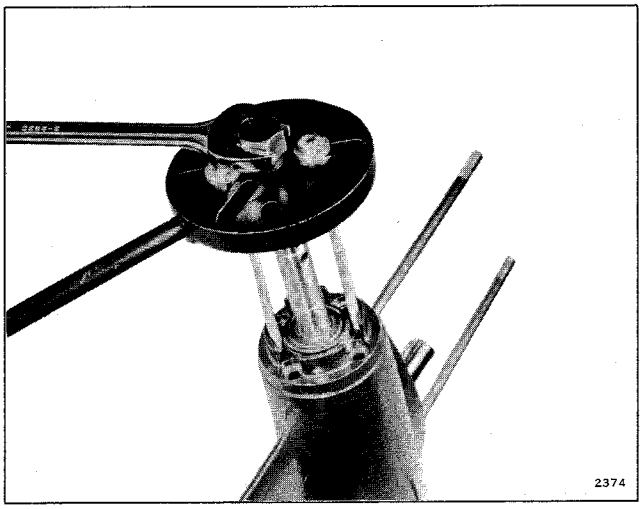

Figure 6-16. Removing Gearcase Head

h. Remove retaining ring with Truarc No. 5 pliers (Special Tool #303859). See Figure 6-17.

i. The reverse drive assembly can now be removed by withdrawing the propeller shaft. See Figure 6-18.

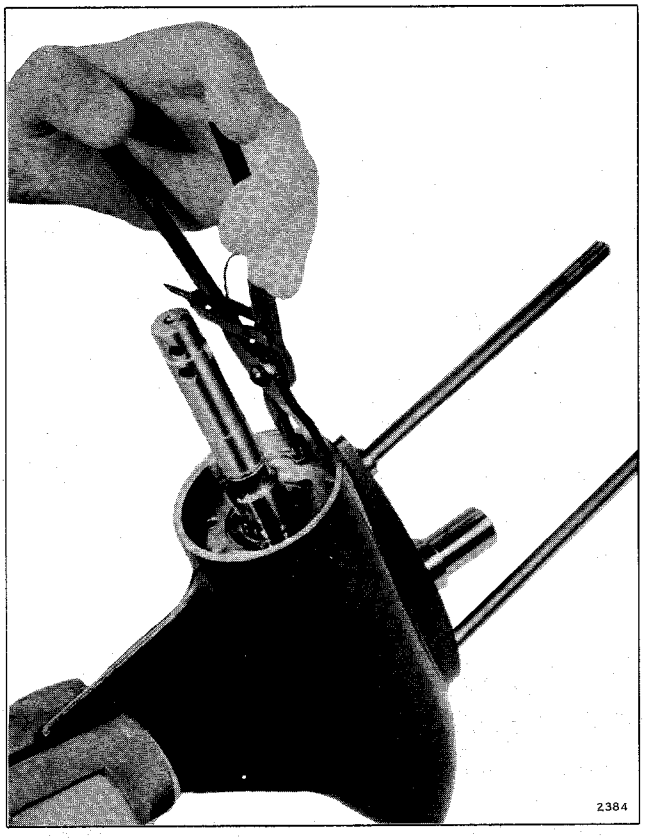

Figure 6-17. Removing Truarc Ring

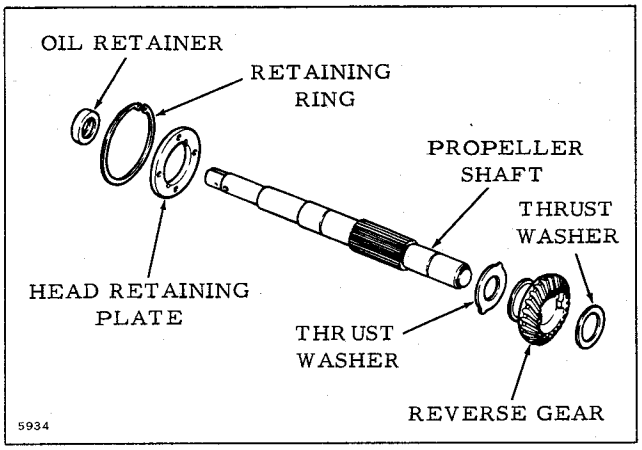

Figure 6-18. Removing Reverse Gears and Propeller Shaft

j. Remove shift lever pivot pin, cradle, clutch dog, and shift lever. See Figure 6-19.

k. Tilt the pinion gear toward the rear and withdraw it through the gearcase head opening. See Figure 6-20. The forward drive gear and bearing will drop out if gearcase is turned over.

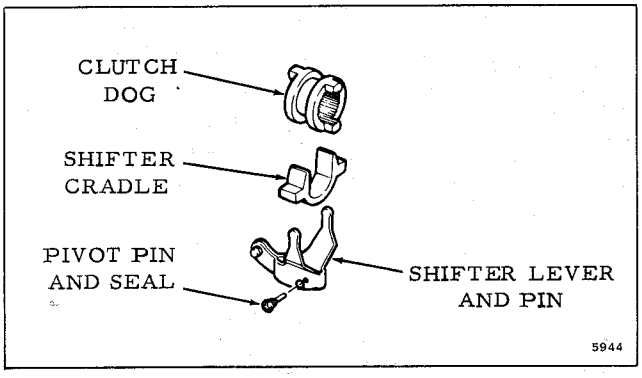

Figure 6-19. Shift Lever, Dog, and Cradle

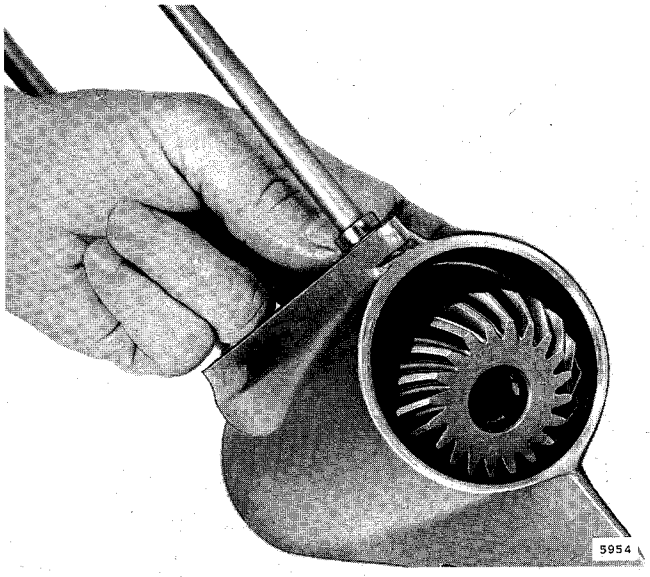

Figure 6-20. Removing Drive Pinion

l. Remove from bearing race, using bearing puller kit (Special Tools #379843 and race puller #379649). See Figure 6-21.

m. If bearing is damaged, press bearing and seal from gearcase head with an arbor press. If necessary, remove upper and lower pinion bearings from upper gearcase, using puller kit (Special Tools #378445 and puller jaw #308095).

Puller jaws must be lined up fore and aft, as there are side obstructions in the gearcase. See Figure 6-22.

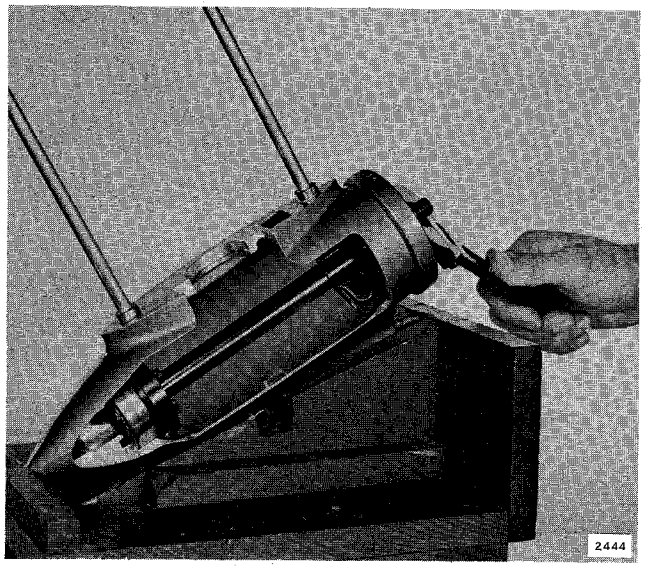

Figure 6-21. Pulling Forward Bearing Race

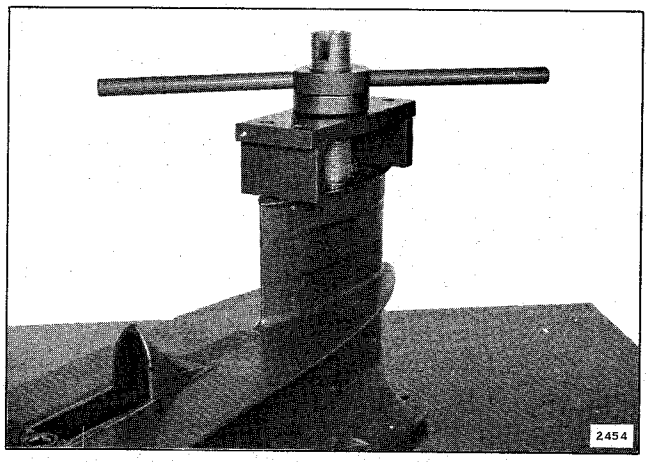

Figure 6-22. Pulling Pinion Bearings

DISASSEMBLY OF HEAVY DUTY LOWER GEARCASE

a. Remove cotter pin, propeller nut, drive pin, thrust washer, and propeller.

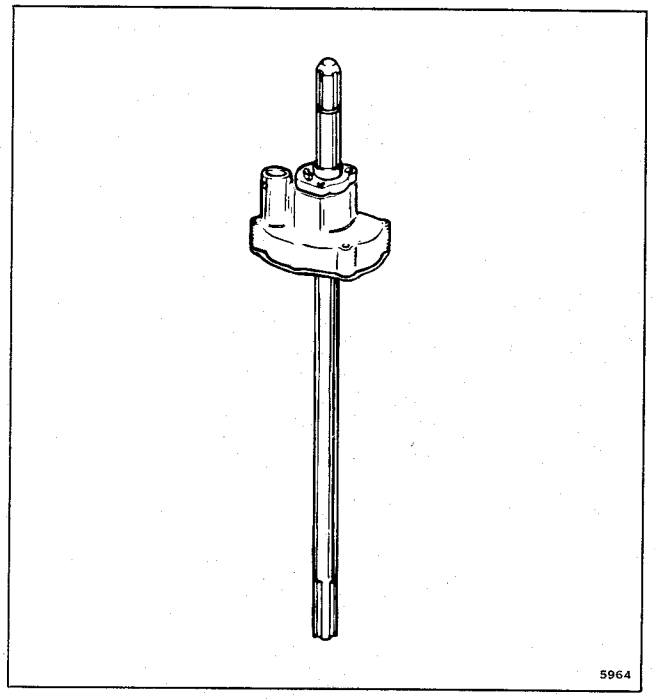

Figure 6-23. Removing Pump and Shaft

b. Remove four screws attaching impeller housing to upper gearcase. Lift off driveshaft and impeller housing assembly. See Figure 6-23. These may be further serviced as with the standard unit.

c. Drain gearcase. Remove pivot pin from starboard side of lower gearcase and ten screws holding gearcase halves together. Remove lower half to expose complete drive assembly.

d. The propeller shaft with all components can be lifted out as a unit. See Figure 6-24.

e. Remove driveshaft support and pinion gear.

f. Remove driveshaft pinion and thrust bearings using puller kit (Special Tools #378445, adaptor sleeve #308097, and puller jaw #308094). See Figure 6-25.

NOTE

Do not lose shim between thrust bearing and shoulder in housing. This is an assembly gaged to a precise tolerance at the factory to control proper meshing of gears.

g. Remove oil retainer and driveshaft bushing from top of gearcase.

CLEANING, INSPECTION, AND REPAIR

a. Clean all parts with cleaning solvent such as Solvasol and dry with compressed air.

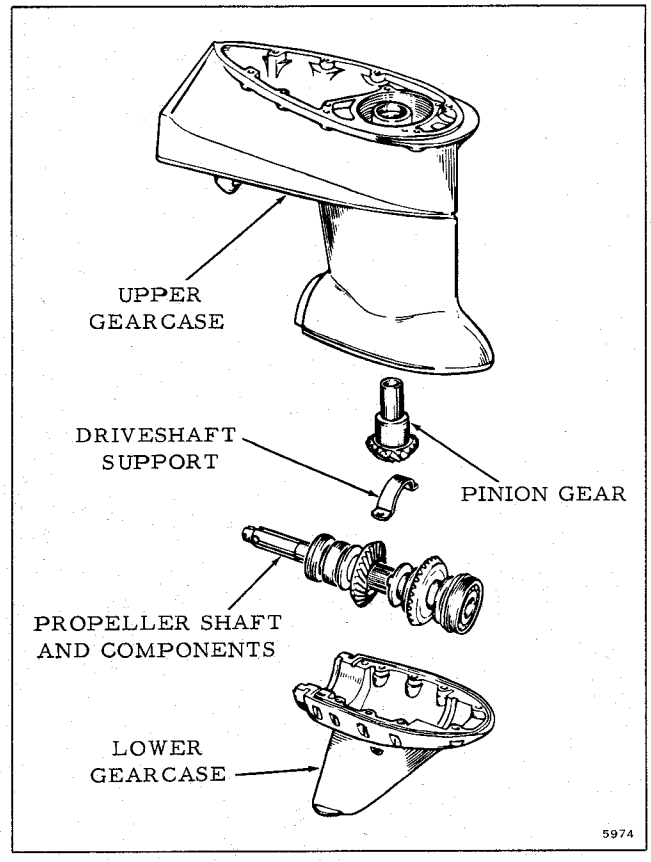

Figure 6-24. Removing Propeller Shaft and Gear Assembly

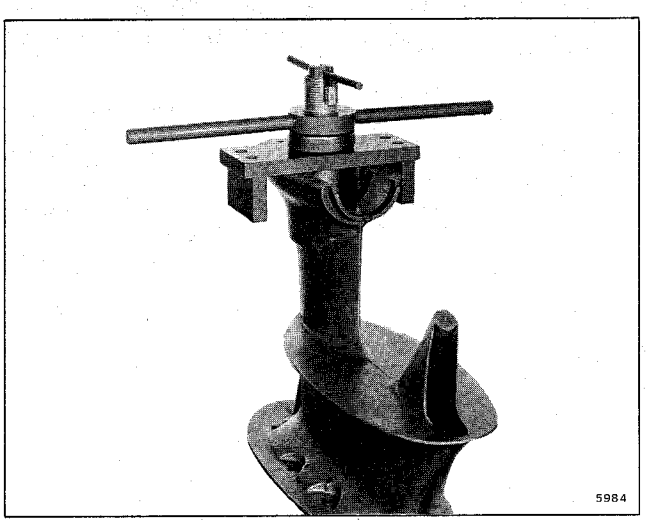

Figure 6-25. Removing Pinion Bearing

b. Discard all oil seals, "O" rings, and gaskets. Discard the upper pinion bearing, the upper driveshaft bearing, and the gearcase head bearing if these have been removed as the thin steel case housing the needles will be damaged in removal.

c. Inspect driveshaft splines for wear. A lower unit bent from striking a submerged obstruction can cause extensive damage to driveshaft. Replace shaft if worn.

d. Inspect propeller for nicks, broken blades, and cracks. DO NOT attempt to weld cracked or broken propellers. Remove minor nicks with a file. Note that the aft side of the propeller is flat while the other side is rounded. File blades accordingly to retain shape. Check pitch on propeller pitch block.

See Evinrude Special Service Tool Catalog No. 164 for proper fixture to check pitch of propeller. To straighten bent blades, use a piece of leather strap or belting under the part of the blade that touches the fixture. Rap high part of blade smartly with a No. 3 rawhide mallet. The leather allows a slight overbend to correct for the blade's tendency to spring back. See Figure 6-26. Check rubber slip clutch, using propeller torque fixture assembly (Special Tool #378448), with torque shaft (Special Tool #308114). See Figure 6-27.

e. Inspect gearcase for chipped paint and nicks on the machined surfaces. Remove nicks and re-surface faces on a surface plate. Start with Number 120 grit emery and finish with Number 180 grit. Check parallelism on plate with a surface gage and scriber. A drill press table will also serve, using

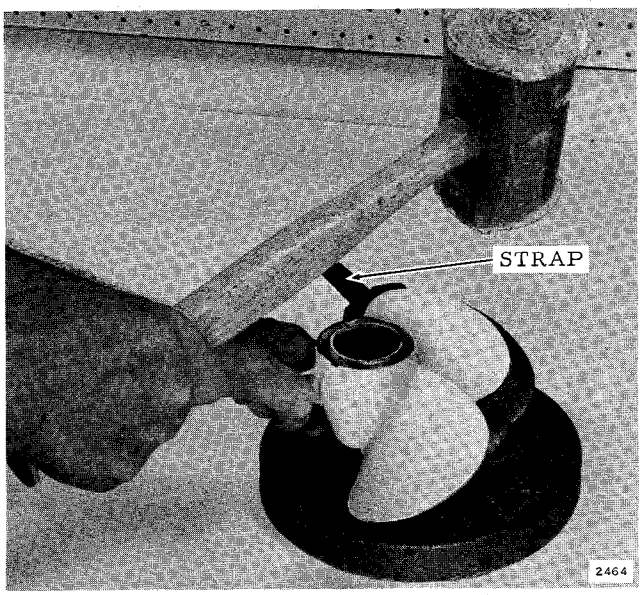

Figure 6-26. Propeller Straightening Fixture

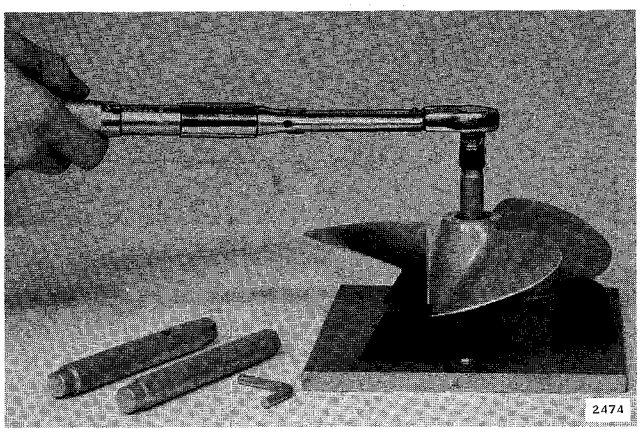

Figure 6-27. Torque Checking Fixture

the spindle as a gage. Do not attempt to straighten a bent gear case; replace it.

f. Re-surface and inspect outer exhaust housing in like manner. Replace if bent.

g. Inspect water tubes for obstructions or kinks which may restrict water flow.

h. Inspect water pump impeller and replace if vanes are damaged or worn excessively. Inspect pump housing for scoring and replace if damaged. Inspect impeller housing plate and replace if scored or pitted.

i. Check water intake screen and clean by removing by-pass cover and gasket and reverse flushing. Discard gasket. A leaking gasket here will pass exhaust into the cooling system, causing over-heating and pre-ignition.

j. Inspect drive gears, pinion gear, and thrust washers for wear. Inspect driving surfaces of shifter clutch dog and drive gears. If chipped or badly worn, replace them to avoid possible jumping out of gear. Chipped driving surfaces and exceptional wear may indicate improper shifting practice by operator of motor.

REASSEMBLY OF STANDARD LOWER GEARCASE

a. Install front propeller shaft bearing race, using driver shaft, guide plate, and bearing race installer (Special Tools Driver #309933, Guide Plate #309932, and Installer #379248). Place nose of gearcase against a large block of wood, driving race into position with a #3 rawhide mallet. See Figure 6-28. Install cone shaped roller bearing in race, tapered end first.

b. Using propeller shaft, install forward gear. Propeller shaft must again be removed to permit installation of pinion gear. Install pinion gear with thrust bearing and washer in place. Holding pinion gear in place, install shift lever, cradle, and clutch dog. Install propeller shaft, reverse gear, and thrust washer. Slide large reverse gear thrust washer, bronze side towards gear, onto propeller shaft, followed by the gearcase head retaining plate. Lock in place with the Truarc retaining ring, flat side of ring against plate. See Figure 6-29.

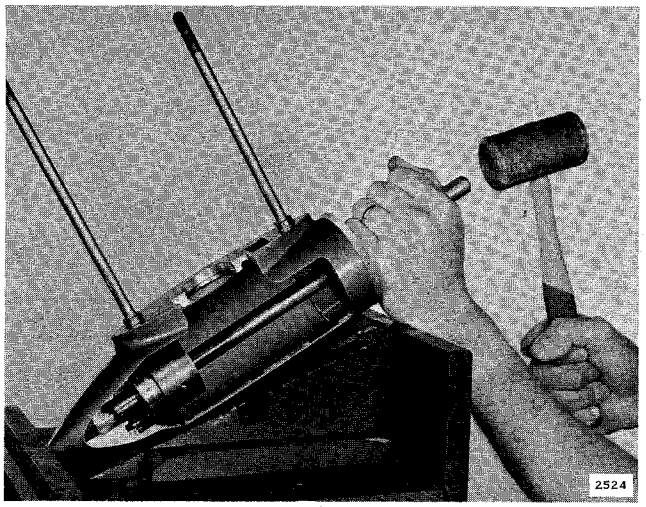

Figure 6-28. Installing Front Bearing Race

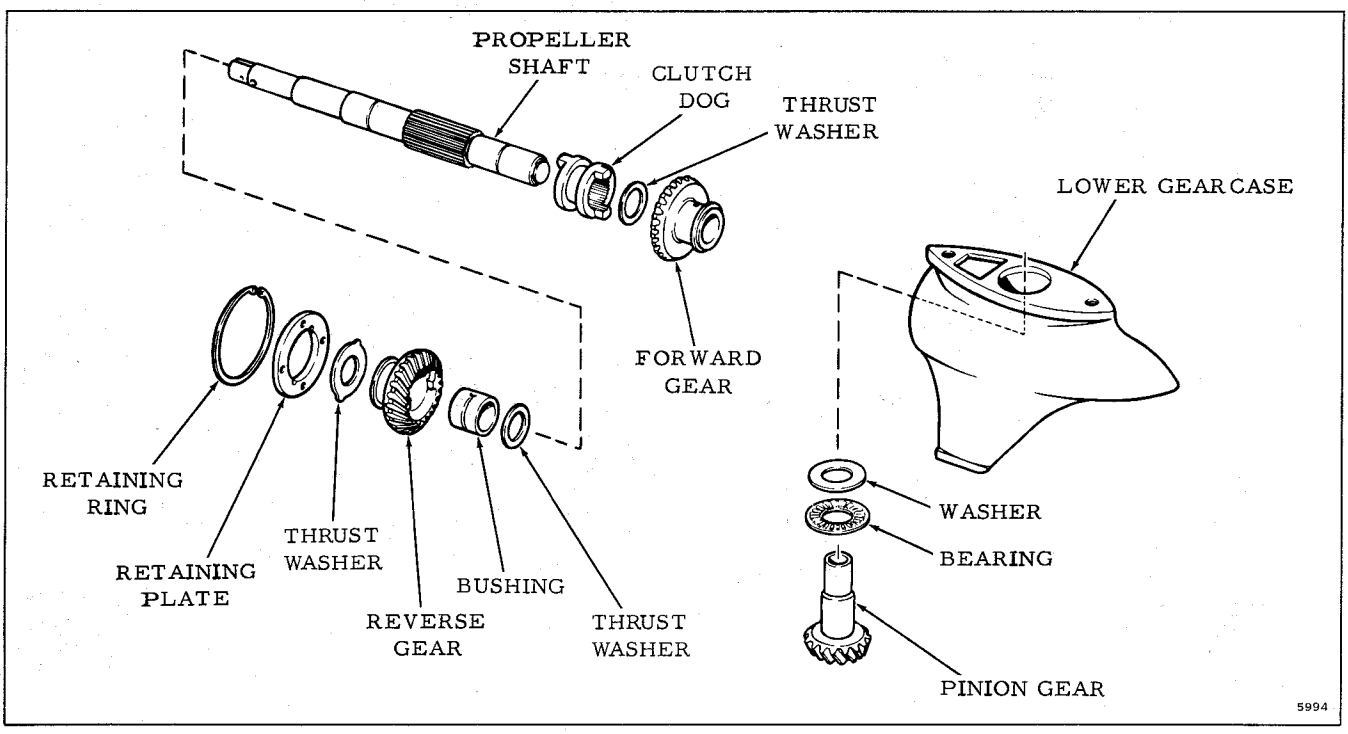

Figure 6-29. Installing Propeller Shaft and Gears

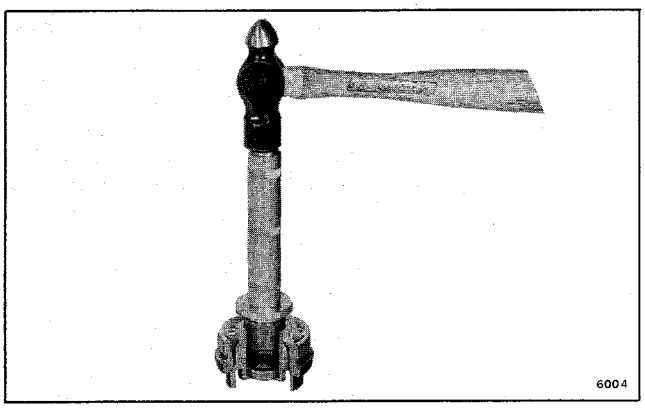

Figure 6-30. Installing Bearing in Gearcase Head

c. If bearing has been removed, install new bearing and seal in gearcase head, using Special Tools #308119, #378737 and #308104. See Figure 6-30. Press against hardened (lettered) side of bearing only. Bearing should be flush with inner surface, and seal should be flush with outer surface of head.

d. Install gearcase head on gearcase, making sure large seal ring is properly positioned in groove in gearcase head. Secure with screws dipped in Perfect Seal #4 non-hardening sealer, using new "O" rings on each screw to assure an oil-tight assembly.

e. Install pivot pin with new seal and install shifter yokes on shifter lever pin using screw and nut to hold in position until connecting shift rod.

f. Press new upper pinion bearing into position, using Evinrude bearing installer, (Special Tools #378446 and #308102) with driver (Special Tool #378737). Figure 6-31. Press against lettered side of bearing, and install flush with step at top of recess. (Bottoming bearing in recess may distort bearing cage.)

g. Install new upper driveshaft bearing, pressing against hardened (lettered) end of bearing only. Install new seal, lettered side up.

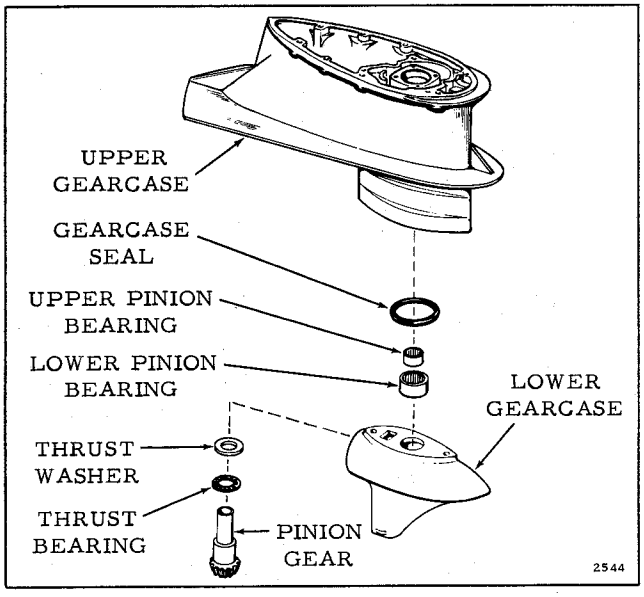

Figure 6-31. Pinion Bearing Assembly

h. Install shift rod bushing and new "O" ring and gasket, using bushing punch (Evinrude Special Tool #378778). Oil shift rod and insert through bushing, turning slightly to prevent bends in rod from binding in bushing. Angular bend at top end of rod should face forward towards driveshaft.

i. Coat "O" ring groove with Sealer 1000 to assure an oil-tight seal between upper and lower gearcases. Place new "O" ring in position.

j. Apply a liberal coating of OMC Needle Bearing Assembly Grease, Part Number #378642, to outer race and rollers of lower pinion bearing. Place rollers in position in race.

k. With the upper gearcase inverted, lower it onto the lower gearcase until shift rod can be connected. Loosen yoke screw while forcing shift rod between yokes to avoid yokes slipping off of shifter lever pin in bottom of gearcase. With rod in position in yoke, tighten nut and screw to torque specified in Section 2.

l. Apply Sealer 1000 between upper and lower gearcase and around stud nuts. Push gearcase together and install washers and new stud nuts, tightening to torque specified in Section 2.

m. Insert driveshaft in gear housing. Twist slightly to mesh with pinion gear splines.

n. If seals and driveshaft bearing have been removed, install new bearing and seal into housing. Press against lettered side of bearing and seal.

o. Position new "O" ring on bearing cap, and oil driveshaft. Carefully slip bearing cap over splined end of driveshaft and down onto gearcase. Dip screws in Perfect Seal No. 4, and tighten to specified torque.

p. Place new impeller housing gasket and impeller housing plate in position.

q. Insert impeller key and slide impeller down driveshaft and over key.

r. Install impeller housing. Dip screws in Perfect Seal No. 4 and tighten to specified torque. Attach cover, using new gasket, seal, and seal rings. See Figure 6-32. Dip screws in Perfect Seal No. 4 and tighten to specified torque. Install new grommet in impeller housing to prevent exhaust gases from getting into the cooling system, causing overheating and pre-ignition. It is especially important that the impeller housing seal ring fit properly to prevent exhaust gases from feeding back into the intake manifold through the driveshaft tube. Install new "O" ring on driveshaft.

REASSEMBLY OF HEAVY DUTY LOWER GEARCASE

a. With the use of (Special Tool, Driver #378737 and Tool #308101) install a new upper pinion bearing in upper gearcase. A mallet or arbor press may be used. Make certain bearing is placed on driver with lettered (flat) side towards flange on tool.

NOTE: Upper pinion bearing must be installed first.

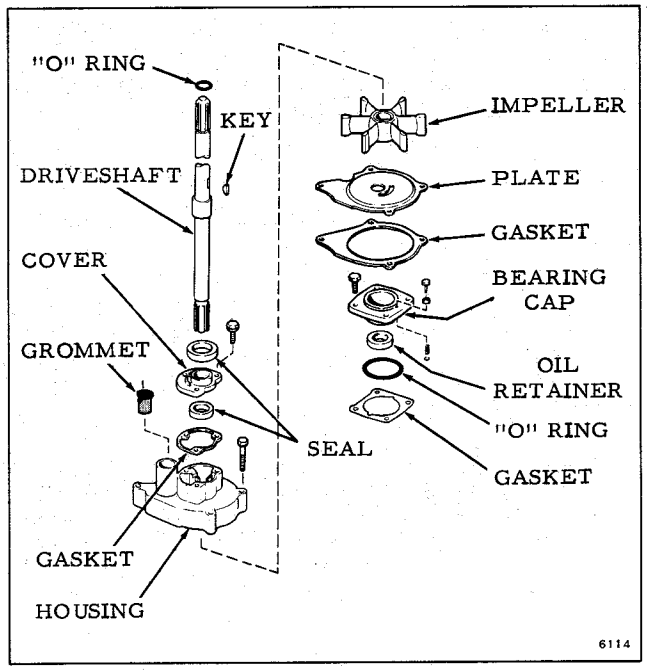

Figure 6-32. Water Pump - Standard Gearcase

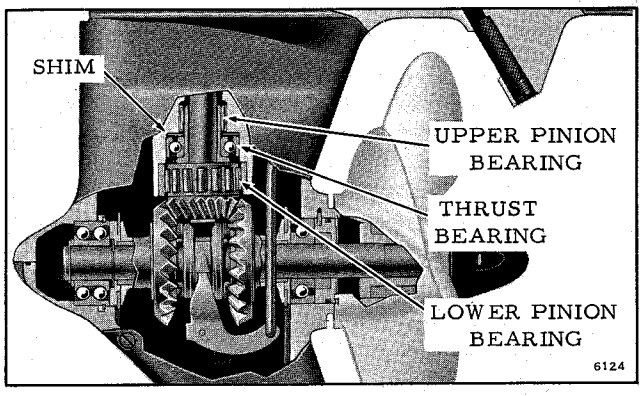

Figure 6-33. Heavy Duty Gearcase Cutaway

b. With the use of Special Tools, Driver #378737 and Tool #308100, install pinion thrust bearing, and lower pinion bearing in upper gearcase. See Figure 6-33.

NOTE

If new pinion thrust bearing is to be installed be sure to use the new shim supplied with the bearing.

Locate shim in recessed area in upper gearcase. Place lower pinion bearing on driver (either side up). Place pinion thrust bearing on driver making certain that the lettered side (flat) is towards the flange on the driver. A mallet or arbor press may be used to make this installation. See Figure 6-33.

c. Insert pinion gear and install driveshaft support.

d. Install propeller shaft with oil retainer housing, bearings, thrust washers, gears, bushings and clutch dog. See Figure 6-34. Tabs on thrust washers fit into skeg half of gearcase, bronze sides must face gears.

e. Place cradle, shift lever, and rod in position.

f. Wash machined faces of gearcase halves. Coat seal groove with Sealer 1000 and install a new seal. Coat face of bottom gearcase with Sealer 1000 to insure a water- and oil-tight fit. Also apply sealer between screw holes and inside cavity of gearcase to prevent possible leakage through screw holes. Trim ends of seal strip squarely, allowing about 1/32 inch overhang of the seal groove. Touch up ends of seal with Sealer 1000.

g. Install lower gearcase. (Be sure oil retainer housing fits on dowel in upper gearcase, and seal ends butt squarely against oil retainer housing and are not pinched between gearcase halves.) Insert both front and rear screws and tighten to bring gearcase halves together. Insert shifter lever pivot pin through gearcase and lever. Tighten to specified torque. Then insert remaining screws (dip all screws in Perfect Seal #4) and tighten, beginning with center screws and alternating from side to side progressively towards ends. Tighten to specified torque.

h. If driveshaft bushing and seal have been removed, install bushing and new seal. Install driveshaft, twisting slightly to engage with splines in pinion gear.

i. Install new seals in impeller housing and cover. Position new impeller plate gasket and impeller plate on gearcase, and insert impeller key.

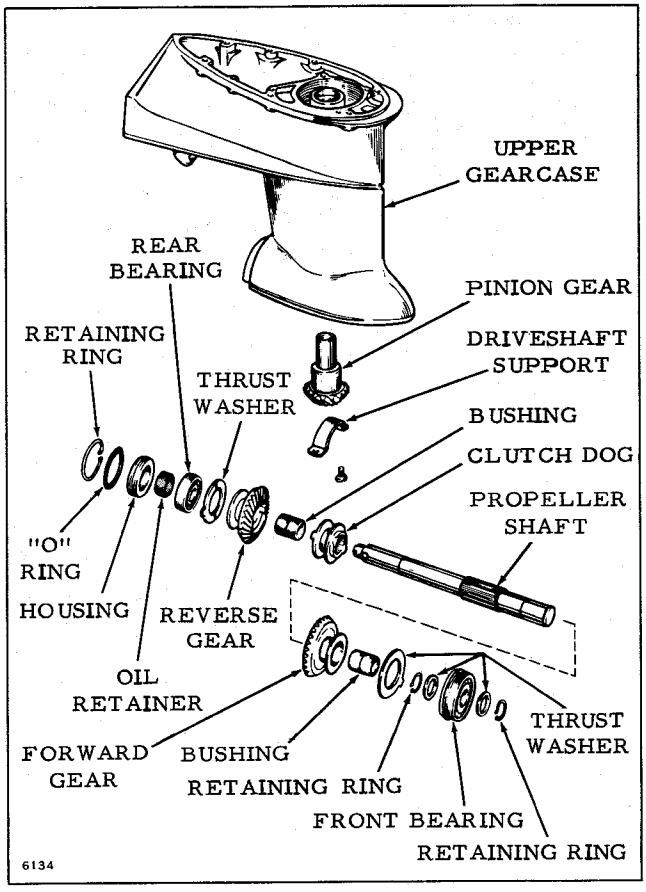

Figure 6-34. Installing Propeller Shaft and Gears

j. Oil impeller and slide down driveshaft over key. Install impeller housing. Dip screws in Perfect Seal #4 thread lubricant and tighten to specified torque. Attach cover, using new gasket, seal, and seal rings. Dip screws in Perfect Seal #4 thread lubricant and tighten to specified torque. Install new grommet in impeller housing to prevent exhaust gases from getting into the cooling system, causing overheating and pre-ignition. It is especially important that the impeller housing seal ring fit properly to prevent exhaust gases from feeding back into the intake manifold through the driveshaft. Install new "O" ring on driveshaft. See Figure 6-35.

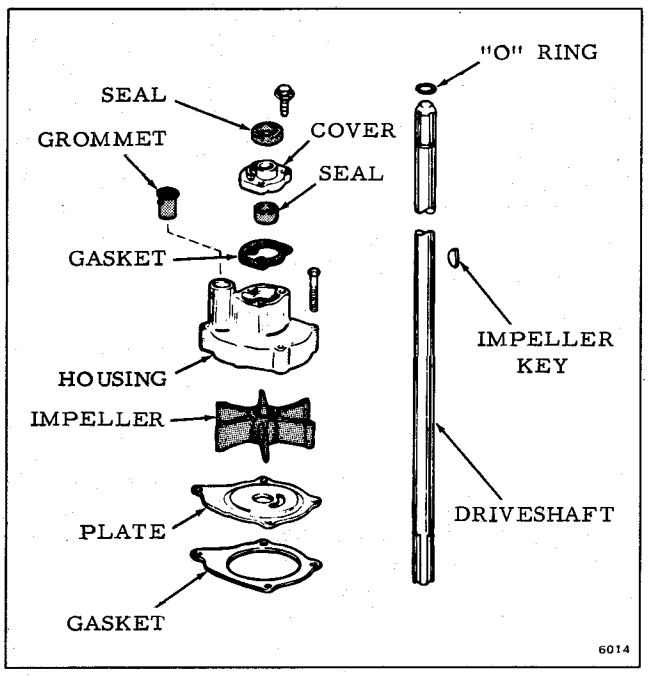

Figure 6-35. Water Pump - Heavy Duty Gearcase

REASSEMBLY OF EXHAUST HOUSING GROUP

a. Press new bearings and seals into swivel bracket, if removed.

b. Reassemble stern brackets to swivel bracket.

c. Attach front exhaust cover to swivel bracket with pivot shaft. Place outer exhaust housing in position in front exhaust cover. Insert four screws through front exhaust cover and rubber mount on outer exhaust housing. Tighten to torque specified in Section 2.

d. Place upper rubber mounts in front exhaust housing, and leave attaching screws loose for ease of installing adapter. Using new gaskets, place adaptor assembly, with inner exhaust tube and water tubes, in position. Tighten screws at each rubber mount and five screws to outer exhuast housing. Make certain that water tube grommets remain in place. Connect shift linkage. See Figure 6-6 and install power head as described in Section 5.

e. Place assembled gearcase under exhaust housing using a new gasket. Carefully raise gearcase into position, making sure driveshaft engages crankshaft splines, shift rod aligns with connector, and water tubes are correctly positioned. Fasten gearcase to exhaust housing with screws dipped in Perfect Seal #4. Tighten to specified torque.

f. Connect shift rod and install inner and outer exhaust cover plates, using new gaskets. Dip attaching screws in Perfect Seal #4 and tighten to specified torque.

g. Attach exhaust relief boot. Install rear exhaust cover, using new seal ring to prevent passing exhaust gases into the motor cover. Attach rear lower motor cover.

h. Fill gearcase with OMC Type "C" Lubricant and grease propeller shaft. See Figure 6-36.

Figure 6-36. Filling Gearcase

i. Install propeller, thrust washer, new drive pin, and propeller nut, securing nut with new cotter pin.

j. Connect spark plug wires.

k. Touch up scratches on lower unit and propeller with spray enamel of a matching color.

GEAR SHIFT ADJUSTMENT

Marks scribed on the gear shift detent adapter for adjustment purposes indicate points at which shifter dog just begins to engage forward or reverse gear.

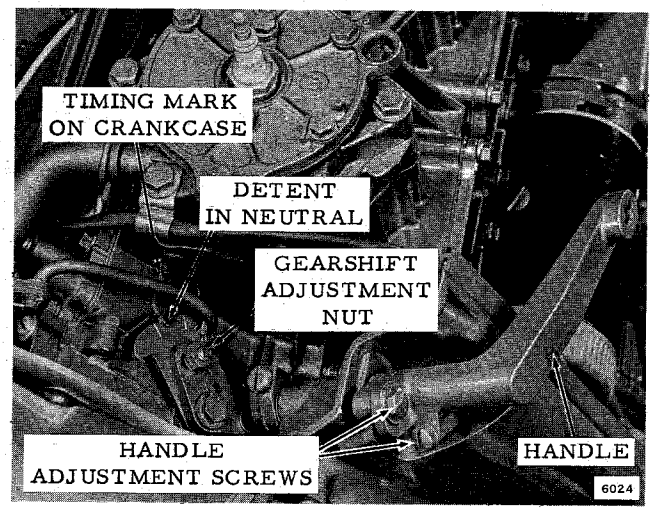

Figure 6-37. Gearshift Detent

When the detent spring rests in the "valley" between the two scribe marks on the detent adapter, the gears should be in neutral. See Figure 6-37.

To check linkage, proceed as follows:

a. Disconnect and ground spark plug wires. Move shift lever forward while rotating propeller clockwise from back of motor. When clutch dog engages forward gear, stop turning propeller and return lever to neutral. Turn propeller another inch in same direction and hold shift lever forward so clutch dog bears against but does not mesh with forward gear. If adjustments are correct, forward scribe

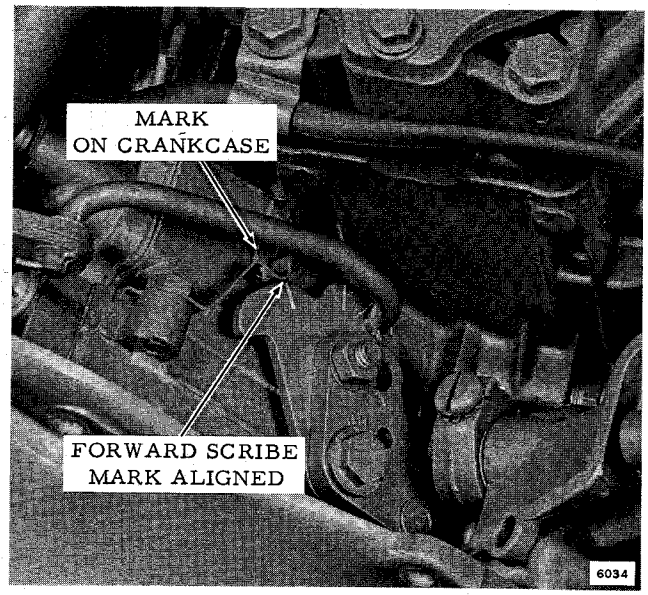

Figure 6-38. Forward Gear Aligned

mark should align with slanted edge of embossed mark on crankcase. See Figure 6-38. To adjust, loosen detent adjustment nut and move detent adapter to align marks. Tighten nut.

b. Place gear shift handle in neutral. Handle should be aligned parallel to the drive and crankshafts. To adjust, loosen the shift handle clamping and adjustment screws. Move lever as required and tighten screws. See Figure 6-37.

SECTION 7

ELECTRICAL SYSTEM

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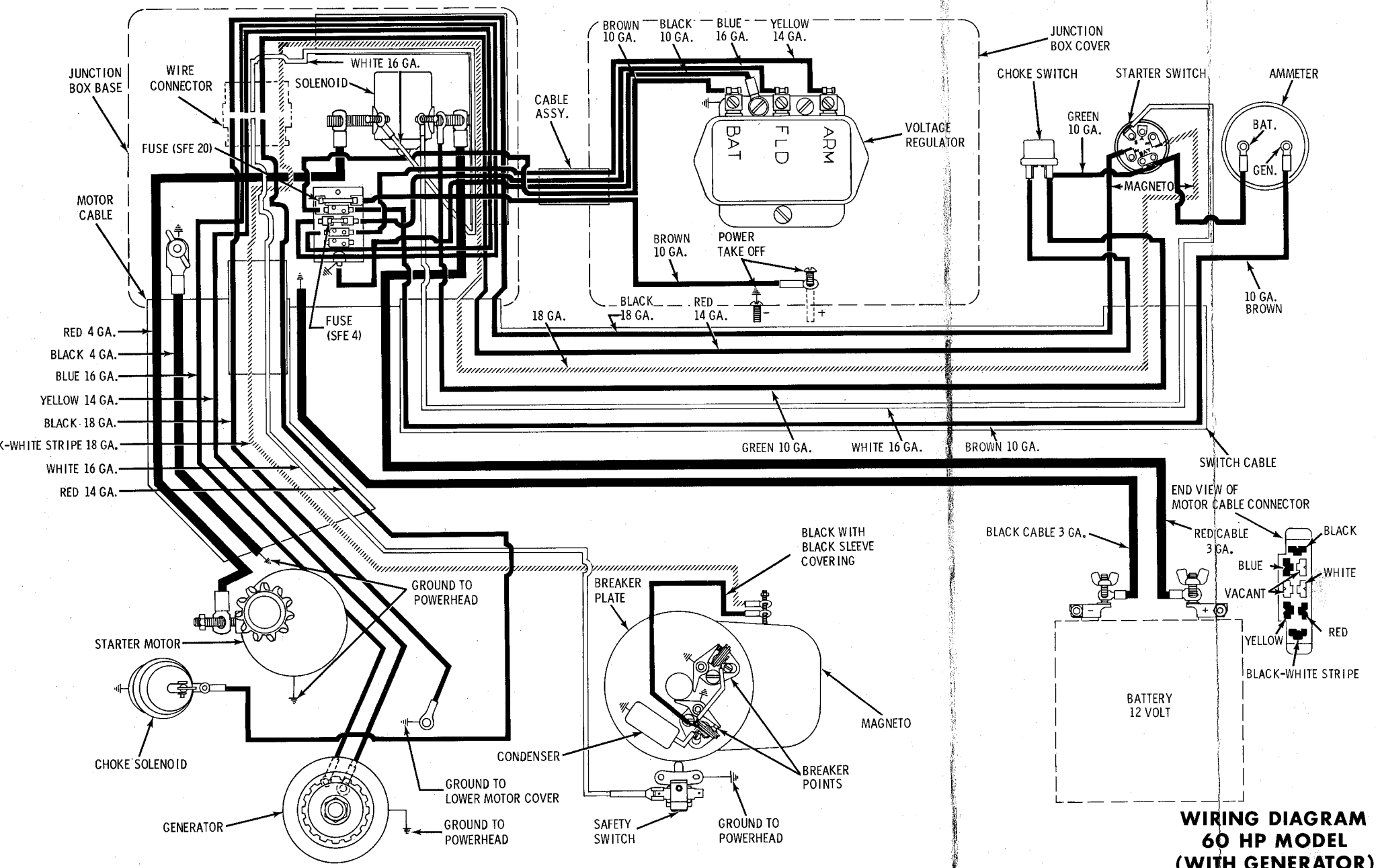


WIRING DIAGRAM
60 HP MODEL
(WITH GENERATOR)

DESCRIPTION

The complete electrical system is made up of the ignition system, the starter system, and the storage battery. See Figure 7-1. Also included is the junction box, which contains the starter solenoid, and which serves as a terminal box where connections can be made between the storage battery and electrical motor or boat accessories. See Figure 7-2.

TROUBLESHOOTING THE ELECTRICAL SYSTEM

Trouble in the electrical system often is first evidenced by failure of the starter to operate, and may be caused by failure of any one or more of the components covered in this section. A large percentage of electrical circuit as well as component failures are caused by loose or dirty electrical wiring connections. Starter system troubleshooting is included in the Trouble Check Chart in Section 2. Servicing of the starter solenoid and starter, and battery maintenance, are covered in this Section.

BATTERY SPECIFICATIONS

For best performance, we recommend a 12-volt, 60 ampere hour battery, or better, with a minimum of 2 minutes cold starting capacity at 300 amperes discharge, zero degrees Fahrenheit, and a 10 second voltage reading of 7.5 volts.

The important thing to remember is that a customer's complaint about poor electric starting may be traceable to a battery with specifications not conforming to these recommended specifications.

BATTERY TESTING

The condition of the battery cells may be checked quickly and accurately by the following "light load test" procedure. See Figure 7-3.

a. Before starting the test, add water as necessary to bring the electrolyte to the proper level.

b. Place load on battery by holding starter switch on for 3 seconds. It makes no difference whether starter turns motor or not.

c. Turn on an 8 to 10 ampere load by turning ignition switch to "ON" position and turning on lights or other accessories. After 1 minute, with 8 to 10 ampere load still on, read individual cell voltages of battery with voltmeter having .01 volt scale division.

NOTE

After testing, close openings made in sealing compound by the probes of the voltmeter above the connector straps, by pressing the sealing compound with a blunt tool.

If any cell reads 1.95 volts or more, and the difference between the highest and lowest cell is less than .05 volt, battery is good and sufficiently charged.

If cell readings are both above and below 1.95 volts and the difference between the highest and lowest reading is less than .05 volt, the battery should be fully recharged for good performance.

If any cell reads 1.95 volts or more but there is a difference of .05 volt or more between the highest and lowest cell, the battery should be replaced.

If the reading for all cells is less than 1.95 volts, the battery is too low to test properly; however, this does not necessarily indicate a defective battery. A battery in this condition should be boost charged but not fully charged at this time, and the "light load test" repeated, using the 8 to 10 ampere load during the test.

If the battery is found to be good after boosting, it should be fully recharged before returning it to service. If none of the cells come up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not come up after second boost charge should be replaced.

BATTERY CHARGING

Boost charge 12-volt batteries at 50 amperes for 20 minutes (1000 ampere minutes). If the charger will not give this rate, charge for an equal number of ampere minutes at best rate available. DO NOT boost battery more than this amount for the "light load test".

If batteries are to be fully charged by means of a quick charger, the charge rate must be "tapered" (reduced to a safe limit) when the electrolyte temperature reaches 125° F., or when gassing becomes excessive. Failure to do so may harm the battery.

If the battery is to be slow charged, adjust electrolyte to proper level by adding water, then charge the battery at 5 amperes until fully charged. Full charge of the battery is indicated when all cell gravities do not increase when checked at three intervals of one hour and all cells are gassing freely. Plenty of time must be allowed for slow charging. Charge periods of 24 hours or more are often required.

BATTERY CARE

The battery should be kept charged at all times. The state of charge should be checked by making specific gravity readings with a battery hydrometer. It is suggested that specific gravity readings and checking for replacement of water be made every two weeks. If the battery has been standing for 30 days, it should be recharged before being placed into service to assure reliable starting. Charge battery up to the specific gravity recommended by the battery manufacturer.

The specific gravity of the battery electrolyte should be checked with a battery hydrometer, preferably one that has a built-in thermometer and correction chart. No other method should be used to determine the charge condition of a battery. Note also that a hydrometer reading is not accurate if water has been recently added, due to the fact that the water has not had a chance to mix with the electrolyte.

The proper water level should be maintained at all times. If water is added in freezing weather, the battery should be charged to full charge at once. Only pure distilled water or water approved for battery use should be added to the battery to replace water lost through evaporation. Never add acid except when acid has been lost by spilling.

Install the battery near the junction box. For mounting the battery, use a frame securely fastened to the boat. A loose battery may shift in the boat, damaging itself or other equipment. Tighten hold-down nuts evenly until battery is secure. If hold-down nuts are too tight, distortion and damage to battery case will result.

STARTER SYSTEM

DESCRIPTION

The electric starting system consists of the starter motor, starter and choke switches, starter and choke solenoids, safety switch, and the necessary cables and wires with their connectors. The starter motor supplies cranking power to the motor, converting electrical energy from the battery into mechanical power which is transmitted through the drive pinion gear and the flywheel ring gear. The starter switch controls the operation by activating the starter solenoid which makes and breaks the circuit between the battery and starter motor.

The starter solenoid closes the circuit through a movable contact disc which strikes two terminal contacts that are connected to the starter motor circuit. The solenoid winding contains many turns of wire which, when energized by the starter switch, exert a magnetic pull on the solenoid plunger, causing it to move the contact disc against the terminal contacts. See Figure 7-4. The operation of the choke solenoid is basically the same except that it activates the choke valve through a spring. Operation of the choke solenoid is discussed in detail in Section 3, Fuel System.

The starter motor drive pinion is disengaged when at rest and is made to mesh with the flywheel ring gear by the rotation of the starter motor armature. After the motor has started, the starter pinion is driven faster than the starter motor shaft and moves down the screw shaft out of mesh with the flywheel. See Figure 7-5.

The safety switch opens the starter circuit, preventing accidental engaging of the starter motor, whenever the throttle lever is set beyond start position. The switch is operated by a plunger which rides on a cam on the lower distributor housing. Adjustment of the safety switch is covered in Section 4, Ignition.

REMOVAL OF STARTER FROM POWER HEAD

Due to the construction of the starter motor, maintenance operations are generally limited to periodic checking for looseness of mounting. Unless it is certain that the starter motor requires attention, do not remove it for overhaul. A thorough check should be made of the battery, cables, starting solenoid, and switch as outlined in the Trouble Check Chart in Section 2. Check the starter motor by using the no load test. With 10.0 volts applied to the starter motor, maximum current should be 60.0 amperes and minimum speed should be 8000 rpm. See Figure 7-6. If it has been determined that the starter motor is malfunctioning, removal can be accomplished as follows:

a. Disconnect lead from starter motor.

b. Remove two thru-bolts from starter motor.

c. Starter motor can be dropped from starter drive housing. If it is necessary to remove starter drive housing, loosen screw and remove starter drive from crankcase. See Figure 7-7.

DISASSEMBLY OF STARTER

a. Remove drive end head, taking care to avoid damaging bearing in head on teeth of armature pinion.

b. Remove commutator head by tapping lightly with a rubber mallet. Remove brushes and spring from holder. Lift armature from frame and field assembly. See Figure 7-5.

c. To disassemble starter drive, remove nut at top of drive housing. Note the relative positions of the parts while disassembling to aid in reassembly later. See Figure 7-8.

CLEANING, INSPECTION, AND REPAIR

a. Inspect the brushes; replace if one-half worn, damaged, or cracked. Replace brush springs if weak.

b. Clean commutator with Grade 00 sandpaper. If commutator surface is unevenly worn or pitted, turn on a lathe. Remove any trace of oil from commutator.

c. Check the armature on a growler for shorted turns. See Figure 7-9. Check armature for grounding by using a test light or meter. See Figure 7-10. Inspect armature insulation for indications of overheating or damaged windings. Clean off any deposits of carbon or foreign matter which may contribute to later failure of the windings.

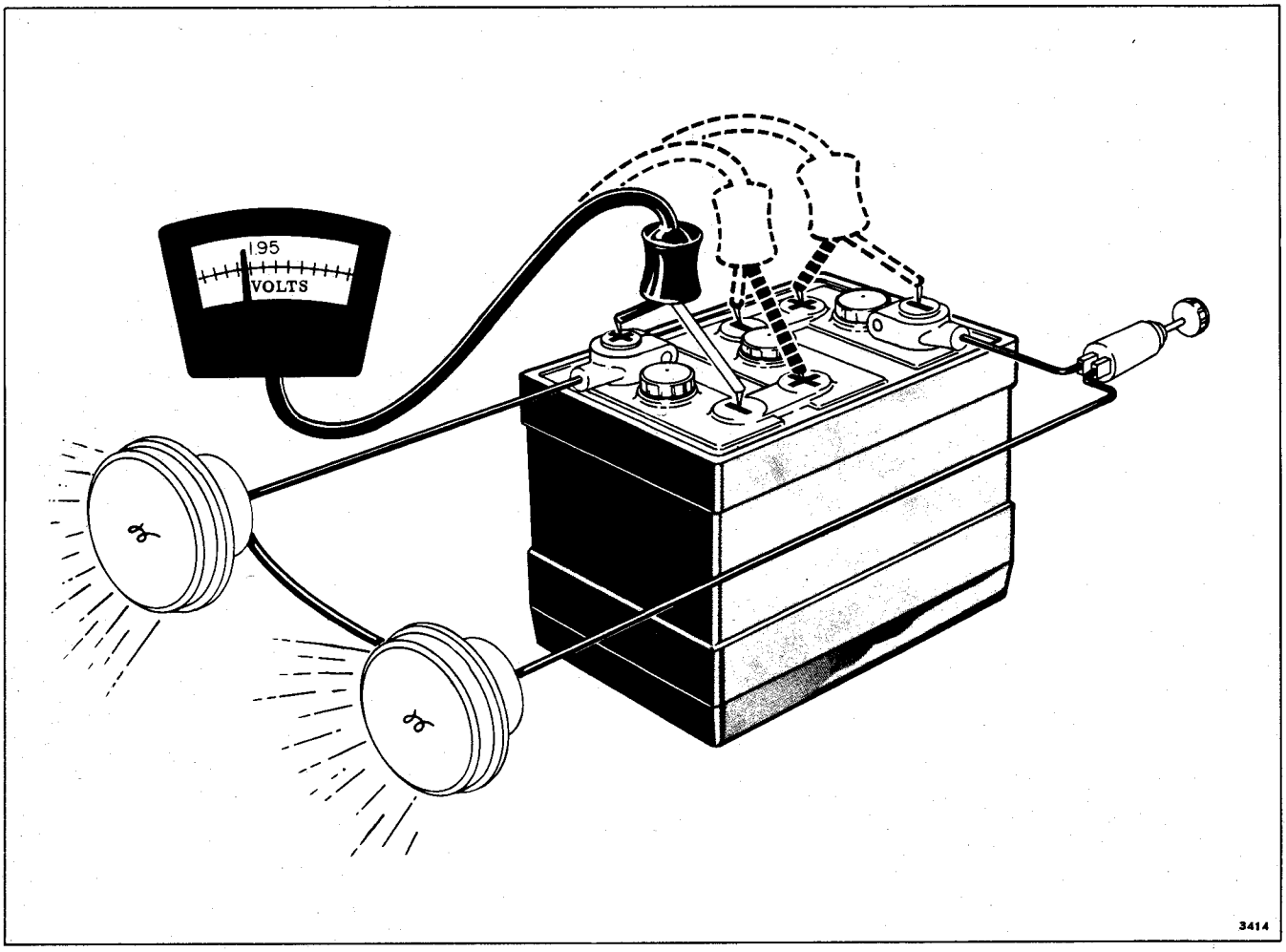


Figure 7-3. Light Load Test

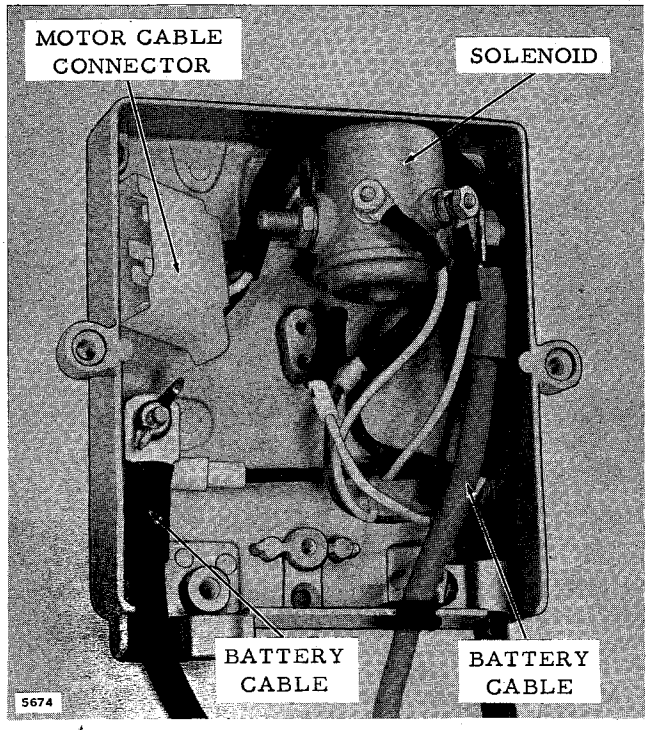


Figure 7-2. Junction Box

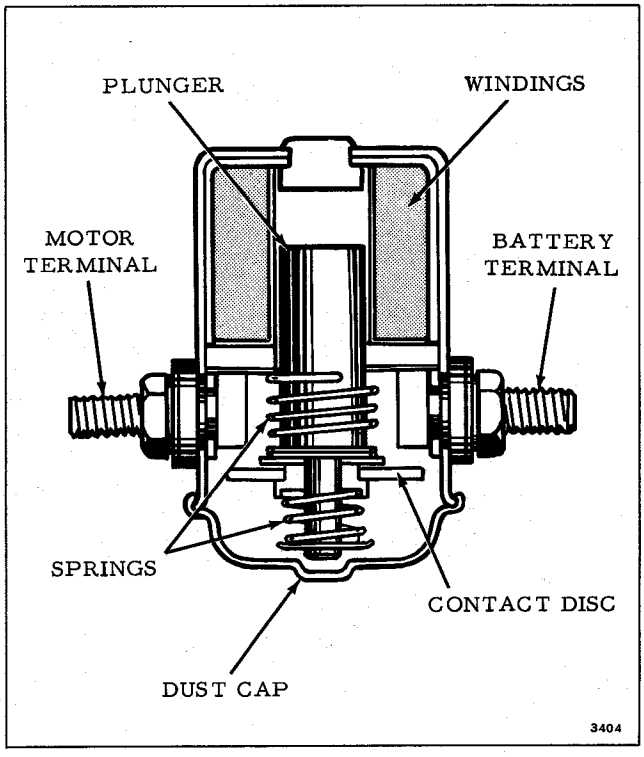


Figure 7-4. Starter Solenoid

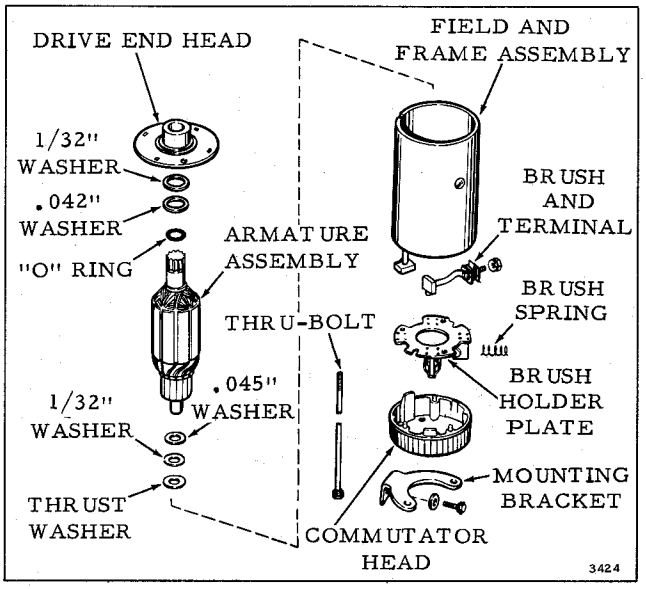


Figure 7-5. Starter Assembly

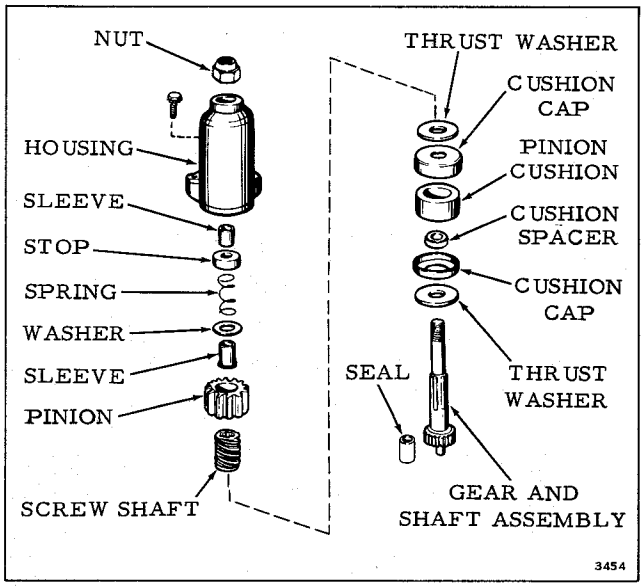


Figure 7-8. Starter Drive Assembly

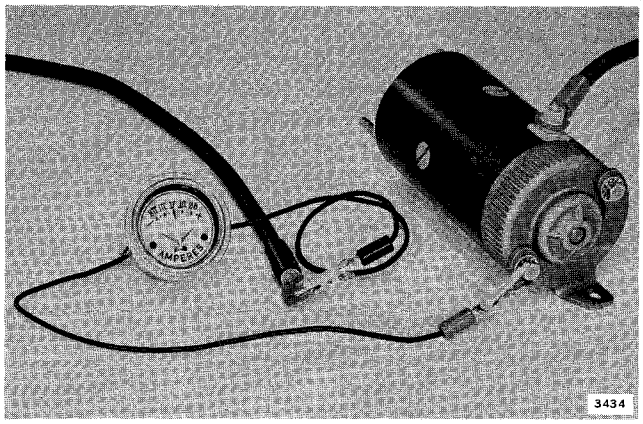


Figure 7-6. Starter Motor Test

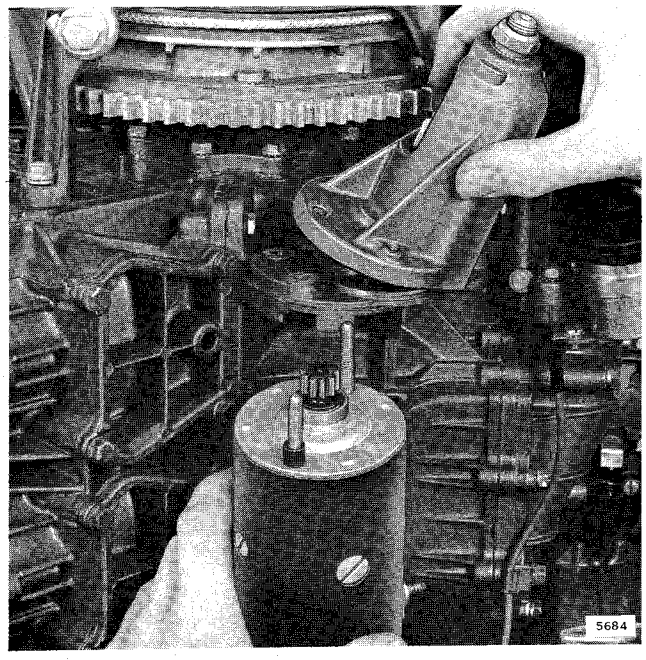


Figure 7-7. Removing Starter and Drive

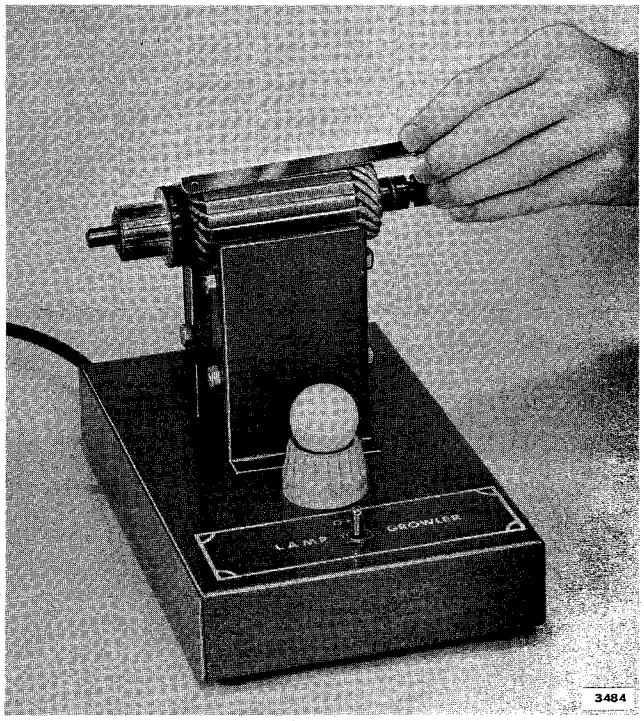


Figure 7-9. Checking Armature on Growler

d. Using a test light, check field windings for continuity between field brush lead and frame of motor (ground). See Figure 7-11.

e. DO NOT clean the starter drive assembly while the starter motor and drive are installed on the power head. The cleaning agent will drain into the starter motor, washing dirt from the drive into the starter bearings, commutator, etc. After disassembling the drive, clean each part with a grease solvent and inspect for wear or distortion.

f. If the pinion does not properly engage the flywheel, the pinion and screw shaft assembly may be worn, distorted, or dirty. Locate cause of binding and correct before completing assembly.

g. The starter solenoid is a sealed unit and is not serviced separately. To test the solenoid, remove the junction box cover and operate the starter switch, or apply 12 volts from a separate battery. See Figure 7-12. The solenoid plunger should give an audible click as it operates. The solenoid must be replaced as a unit if defective.

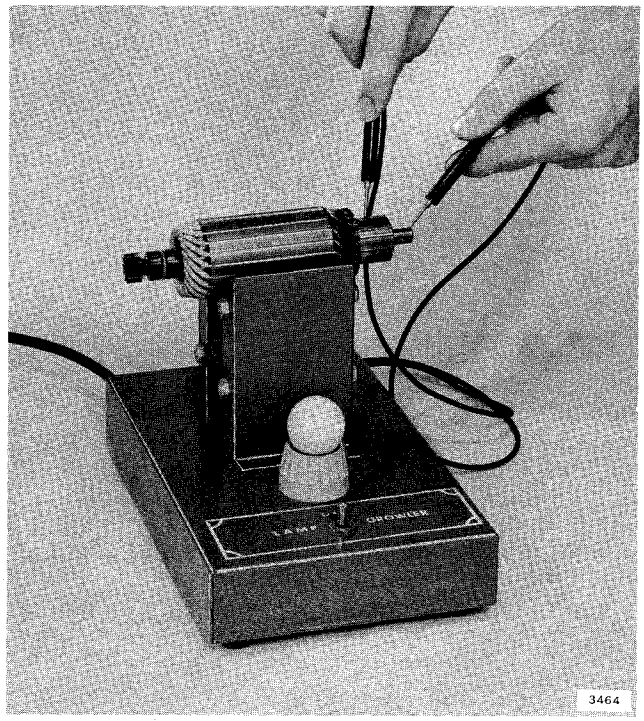


Figure 7-10. Checking Armature for Grounding

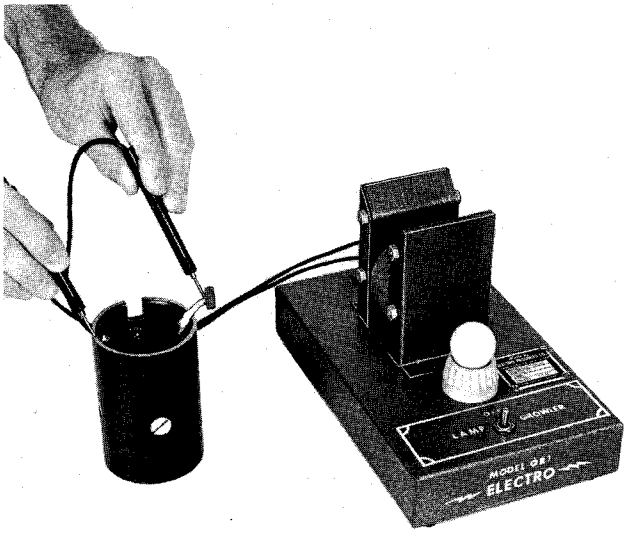


Figure 7-11. Checking Field Continuity

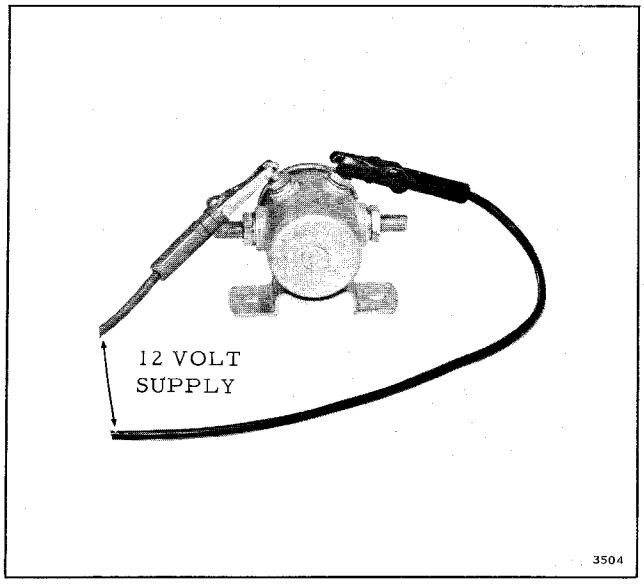


Figure 7-12. Checking Solenoid Coil

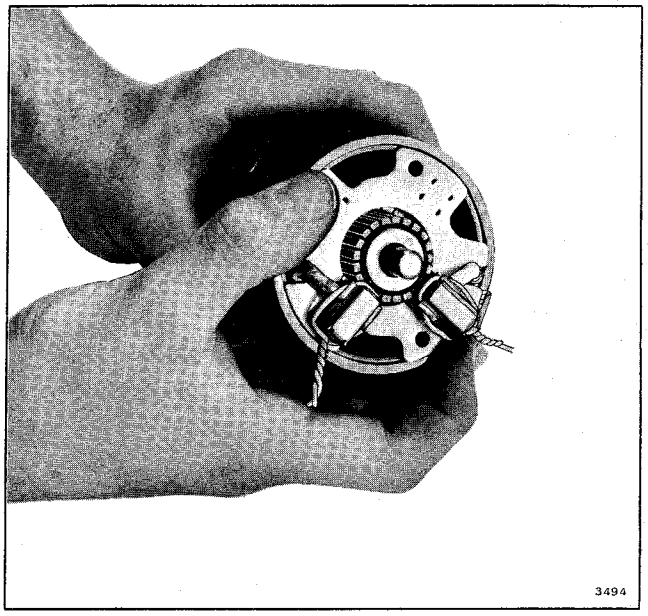


Figure 7-13. Reassembling Starter

REASSEMBLY OF STARTER

a. Lubricate the armature shaft and drive screw threads each with one drop of SAE No. 10 oil. This lubrication should be very light as the oil may capture dust and form a gum, restricting the operation of the drive.

b. Reassemble the starter drive, replacing any part not in good condition. Do not force parts together as all parts are designed for free operation and any binding may cause failure of the drive to function.

c. To facilitate reassembly of the starter motor, insert brushes and brush spring in holder, and tie in place with fine wire or string. Assemble brush holder and armature to frame and field assembly, and remove string or wire. See Figure 7-13.

d. Replace commutator and drive end heads to complete starter motor assembly.

e. Check starter motor with no load test. With 10.0 volts applied to the motor terminals, maximum current should be 60.0 amperes and minimum speed should be 8000 rpm. See Figure 7-6.

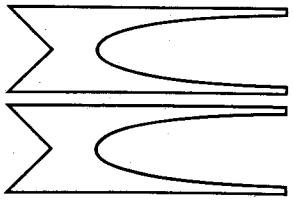
REASSEMBLY OF STARTER TO POWER HEAD

a. Thread two thru-bolts through starter motor mounting bracket and through starter motor assembly.

b. Place starter in position against crankcase, and attach mounting bracket to power head with capscrew.

c. Place starter drive housing in position on crankcase, and tighten thru-bolts. Replace and tighten capscrew attaching starter drive to power head.

d. Reconnect starter motor lead.



SECTION 8

REMOTE CONTROL

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DESCRIPTION

The manual starter engages the power head flywheel ratchet with a spring loaded pawl when the starter rope handle is pulled. A coil spring winds tight as the rope unwinds and recoils as the handle is returned to the housing. See Figures 8-1 and 8-2.

CAUTION

Never release starter handle at end of stroke, allowing rope to snap back. Serious damage could occur.

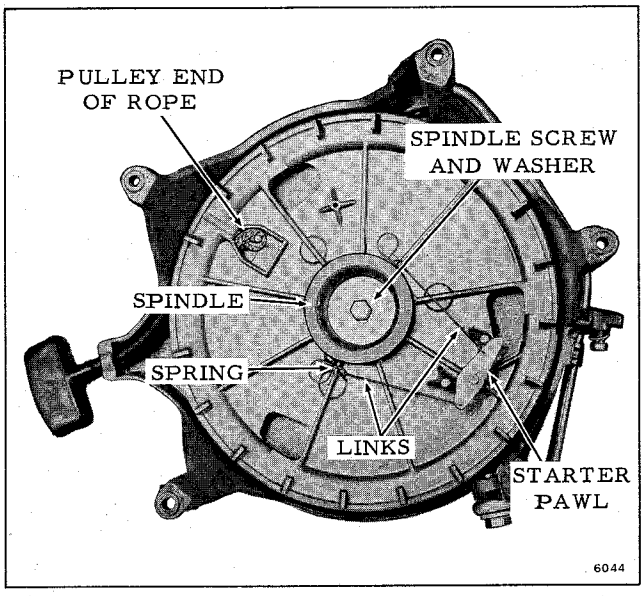

Figure 8-1. Manual Starter

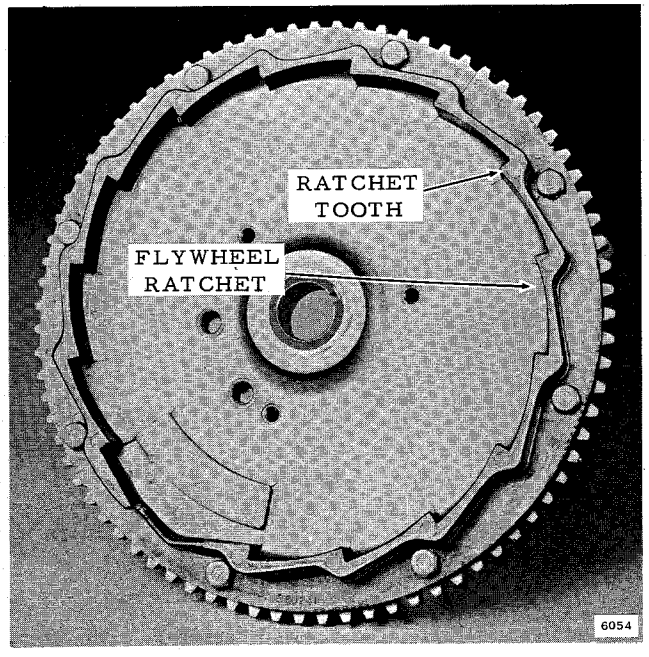

Figure 8-2. Flywheel Ratchet

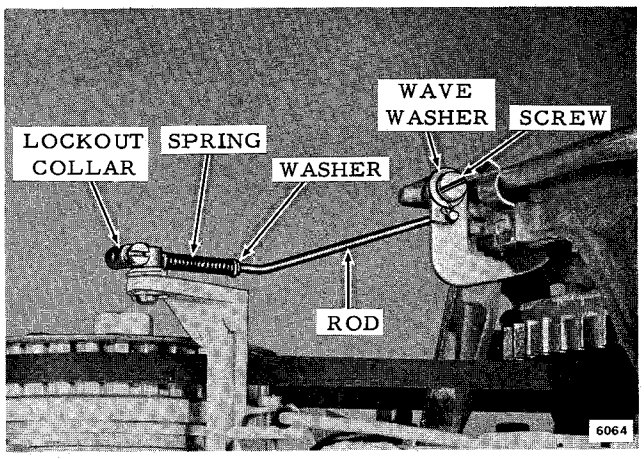

Figure 8-3. Starter Lock-Out Lever Mechanism

A lock-out lever linked to the gear shift prevents manual starter engagement while in forward or reverse gear. See Figure 8-3.

REMOVAL OF STARTER

CAUTION

It is good practice to wear safety glasses while disassembling and reassembling a recoil starter.

a. Remove screw and wave washer to detach starter lock-out linkage from starter housing. See Figure 8-3.

b. Remove five screws and washers and lift starter away from power head.

DISASSEMBLY OF STARTER

a. Pull starter rope out far enough to tie a slip knot in the rope.

b. Pry out rope anchor and remove handle. Release knot allowing pulley to recoil slowly until spring tension is reduced. See Figure 8-4.

c. Remove pawl retaining ring and lift off pawl with links and spring. See Figure 8-1.

d. Remove nut, screw, and washer from spindle. Hold starter, bottom side down, over bench and jar housing against bench top to dislodge pulley spindle and spring. See Figure 8-1.

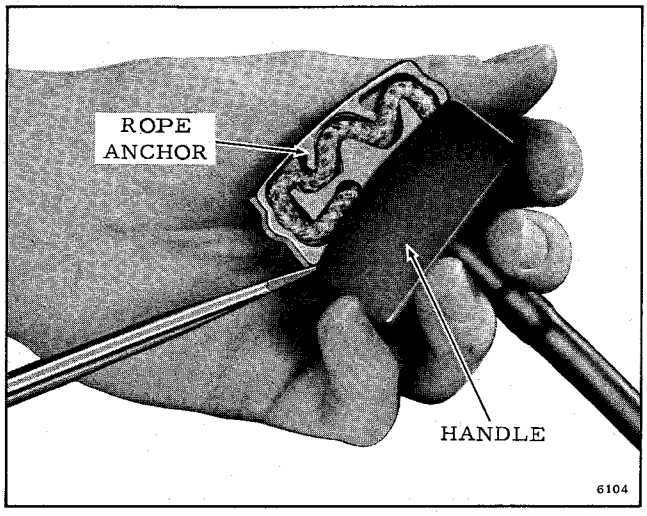

Figure 8-4. Removing Rope Anchor

CLEANING, INSPECTION, AND REPAIR

a. Wash parts in a solvent such as Solvasol and dry with compressed air.

b. Inspect starter rope and discard if frayed.

c. If rope shows excessive wear, inspect pulley, rope guide hole in housing and rope anchor for sharp edges and rough surfaces. Remove by filing and polishing with emery cloth.

d. Examine anchor pins in pulley and housing.

e. Check spindle friction spring, links, and pawl.

f. Inspect recoil spring for cracks and loss of tension.

REASSEMBLY OF STARTER

a. Place housing end of spring loop over anchor pin in housing. Carefully coil spring into housing. See Figure 8-5.

b. Lubricate recoil spring with OMC Type "A" lubricant.

c. Note alignment of inside end of spring loop with anchor pin in pulley and align with pliers if necessary. See Figure 8-6.

d. Place pulley in housing, making sure spring loop slips over pulley anchor pin. Grease and install spindle with screw, washer, and nut. Tighten to torque specified in Section 2.

e. Wind pulley counterclockwise against spring tension until tight. Unwind pulley about one turn or until pin can be slipped through aligning holes in pulley and housing. Lock pulley to housing with pin. See Figure 8-7.

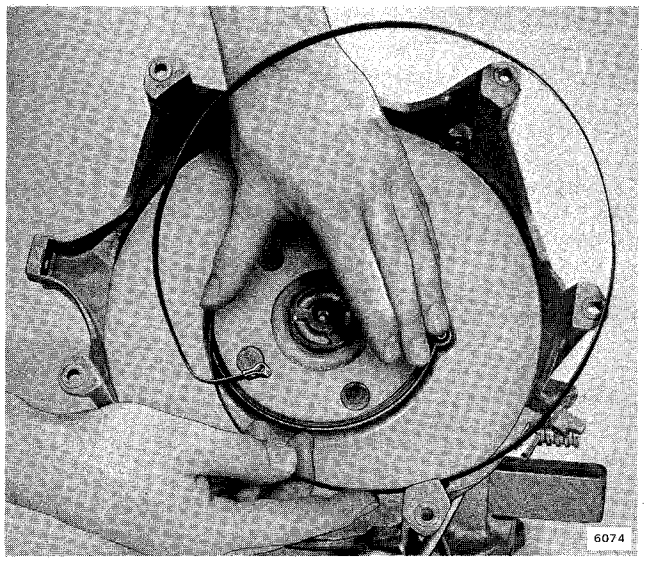

Figure 8-5. Coiling Spring into Housing

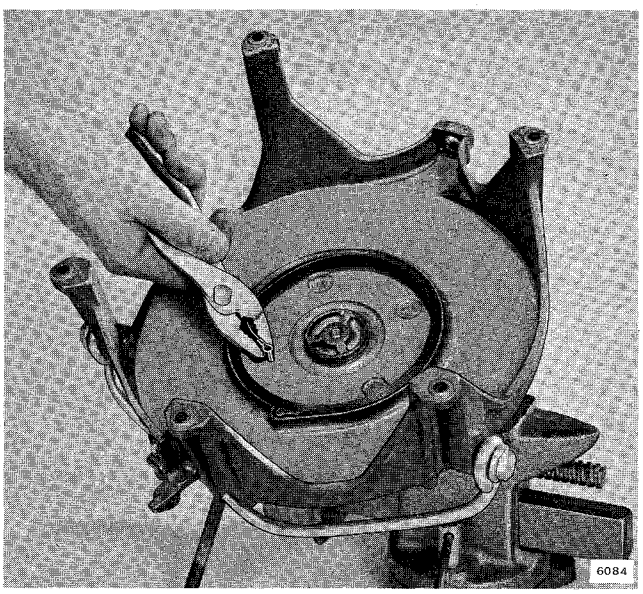

Figure 8-6. Aligning Inside End of Spring Loop

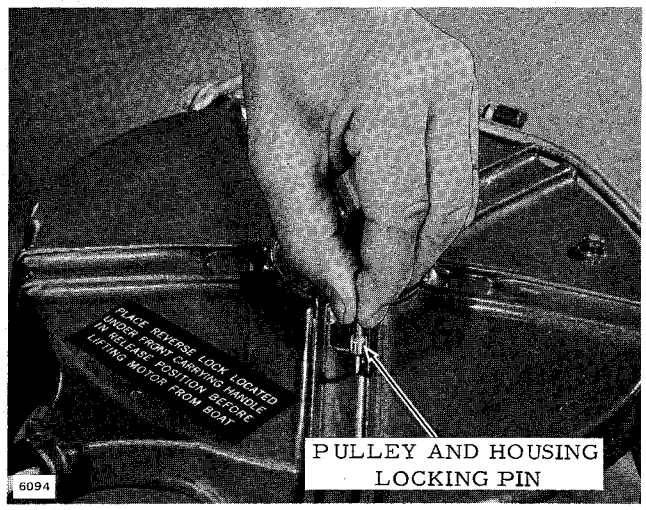

Figure 8-7. Pin Locking Pulley to Housing

f. Measure new rope and cut to a length of 69-3/4 inches. Singe both ends of rope to a length of 1/2 inch to fuse nylon fibers. Rope ends must be stiff to hold properly in pulley and rope anchor.

g. Tie knot in rope and thread through hole in pulley and guide hole in housing. Lubricate handle end of rope and install handle, using Evinrude Starter Rope Threading Tool (Special Tool #378774). See Figure 8-8. Lay rope into channel in rope anchor with stiff end of rope butted against end of channel. Press anchor into handle.

h. Remove pin and allow pulley to recoil slowly. Install spindle friction spring and pawl and secure with retaining ring.

i. Check action of pawl by pulling rope handle. When rope is pulled, pawl should extend. When rope is released, pawl should retract.

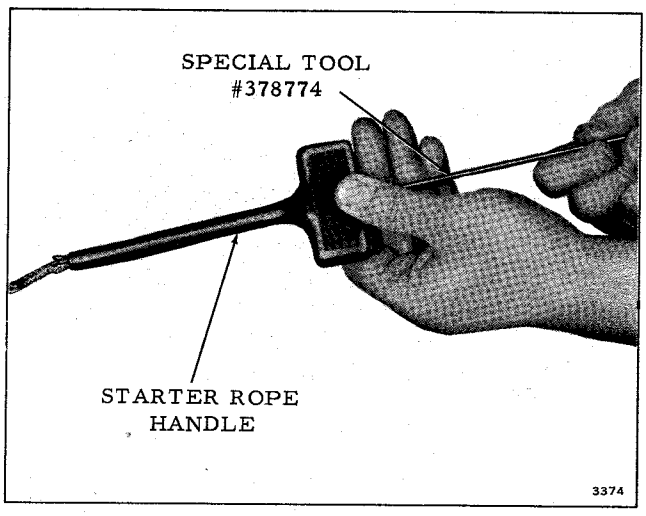

Figure 8-8. Rope Threading Tool

REASSEMBLY OF STARTER TO POWER HEAD

a. Attach starter to power head with five screws and washers and tighten to torque specified in Section 2.

b. Attach starter lock-out linkage with screw and wave washer. See Figure 8-3.

c. Check adjustment of lock-out linkage. Shift motor into forward gear and check to be certain locking lever fully engages the flywheel. Repeat the same operation in reverse gear. If adjustment is necessary loosen collar set screw and relocate collar as necessary. See Figure 8-3.