GENERAL INSTRUCTIONS

JOHNSON *Sea-horse*
OUTBOARD MOTORS

for

Models TS, TD

Johnson Motors
WAUKEGAN, ILLINOIS

28M—1-46—NSP—1245 301458

Foreword

This instruction booklet is not a service manual, but a booklet prepared for the purpose of conveying to the Johnson Motor Owners, such information as will enable him to thoroughly understand the operation of his motor and the necessary procedure for its proper maintenance.

The motor consists of two major assemblies, namely—the power head and the lower unit. The power head (water cooled), contains the cylinder block, crankcase, crankshaft, piston and connecting rod assemblies, magneto, carburetor and gas tank—the power head is the engine (2 stroke cycle type, see page 9) or driving force. The lower unit contains the gearcase, consisting of the gears to drive the propeller, propeller shaft, water pump, driveshaft, exhaust outlet, brackets for attaching motor to the boat and the steering handle.

STEERING is accomplished by moving the steering handle to left or right as desired—see Fig. 1. It will be noted the entire motor turns with movement of the steering handle, thus steering is actually the result of propeller thrust. This arrangement makes possible 360 degree steering—consequently, to reverse direction of boat travel, simply turn motor around 180 degrees from normal operating position. See page 17.

LUBRICATION of the **power head** is provided by mixing oil and gasoline in proportions as instructed on page 11. This mixture is poured into the gas tank and requires no further attention until the tank is empty.

LUBRICATION of the **gearcase** is accomplished by inserting gear lubricant as instructed on page 12.

STARTING (cranking) is achieved by wrapping a cord around pulley on the flywheel provided for this purpose and by pulling briskly on grip of cord. Fig. 8. See starting instructions on page 16. Model TD(L) is provided with ready pull—simply pull on grip.

CONTROL (speed) is by movement of the magneto lever. See Figs. 1 and 9. Maximum speed is attained when lever is moved to extreme right (facing motor). Motor speed is reduced by moving lever to left (facing motor) as required to obtain desired results.

Dependability and long life are built into every Johnson Outboard Motor shipped from our factory—this is OUR RESPONSIBILITY. You will no doubt want to take full advantage of these valuable features and to enjoy hour after hour—year after year, that Dependability which can be realized only if the motor is properly cared for—That is YOUR responsibility.

The instructions contained in this booklet are essential and, if closely adhered to, will assist in obtaining the utmost from your Johnson Outboard Motor.

Johnson Service

It has always been the belief of Johnson Motors that a sale does not complete the transaction between the manufacturer and the buyer. It establishes, rather, a new obligation—an obligation whereby Johnson Motors agrees to assist the buyer in obtaining utmost service from a Johnson Outboard Motor.

With this policy ever utmost in our minds, we have built up an organization that consists of a nation-wide network of Johnson Service Stations to give prompt and efficient service to owners of Johnson Outboard Motors, Pages 28, 29 and 30.

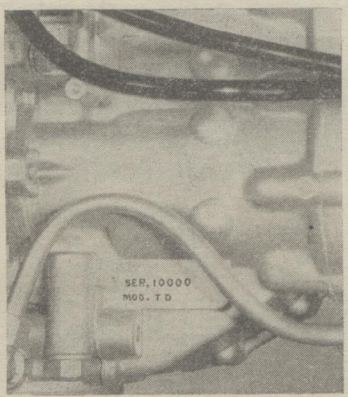
The first step in this structure is the local Johnson Dealer, who is supplied with first-aid parts, enabling him to make emergency and minor repairs. Second, the Authorized Service Station, which carries a stock of parts and equipment necessary to properly service Johnson Outboard Motors. Third is the District Service Station, with a complete stock of parts for all models, tool equipment and factory trained mechanics capable of making extensive repairs. In addition, Johnson Motors maintain a complete Service Department at the factory to extend, further, this Service to the Johnson Outboard Motor owner.

It has, therefore, been our endeavor to place a Service Station within easy reach of every Johnson Outboard Motor owner and to cooperate in lending our assistance whenever possible.

JOHNSON MOTORS

WAUKEGAN, ILLINOIS

Don't Fail to Register Your Motor



Showing Model and Serial Number

Your motor is known to the factory only by its MODEL and SERIAL NUMBER. This number is located on the side of the cylinder assembly as illustrated.

Always give the serial number and model when seeking information or ordering parts.

For assistance in case of theft, you should register the serial number of your motor by filling out and returning the registration card, enclosed in the tool kit, to the factory.

Warranty

We warrant each new outboard motor of our manufacture to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at the factory any part or parts thereof which shall, within three (3) months after delivery of such motor to original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties and representations expressed or implied and of all other liabilities in connection with the sale or use of any motors.

This warranty shall not apply to any motor which shall have been repaired or altered outside the factory in any way so as to affect its stability, nor which has been subject to misuse, negligence or accident.

We make no warranty in respect to trade accessories not of our manufacture; inasmuch as they are usually warranted separately by their respective manufacturers.

Because of the usual strains and accidents to which such products may be subjected, we make no warranty of either material or workmanship in racing outboard motors or any of our products when used for racing.

Claims must be entered on motors or motor parts returned to the factory for inspection, repair or replacement. Request form No. SE-16 from local Johnson Dealer or Service Station. This form should be filled in, signed by the motor owner and dealer or service station representatives and mailed to the factory with returned material, TRANSPORTATION CHARGES PREPAID.

INDEX

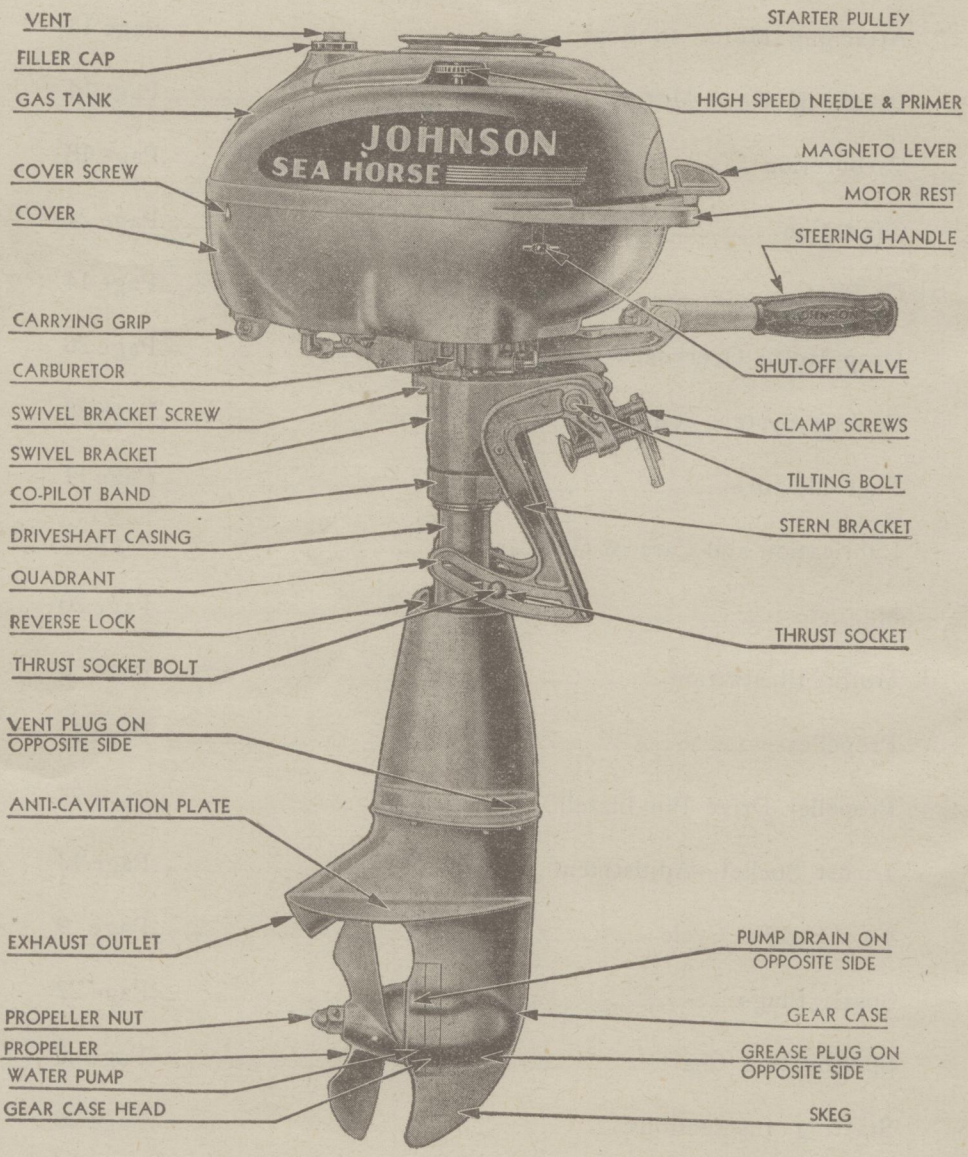


Fig. 1

Model TS (L)

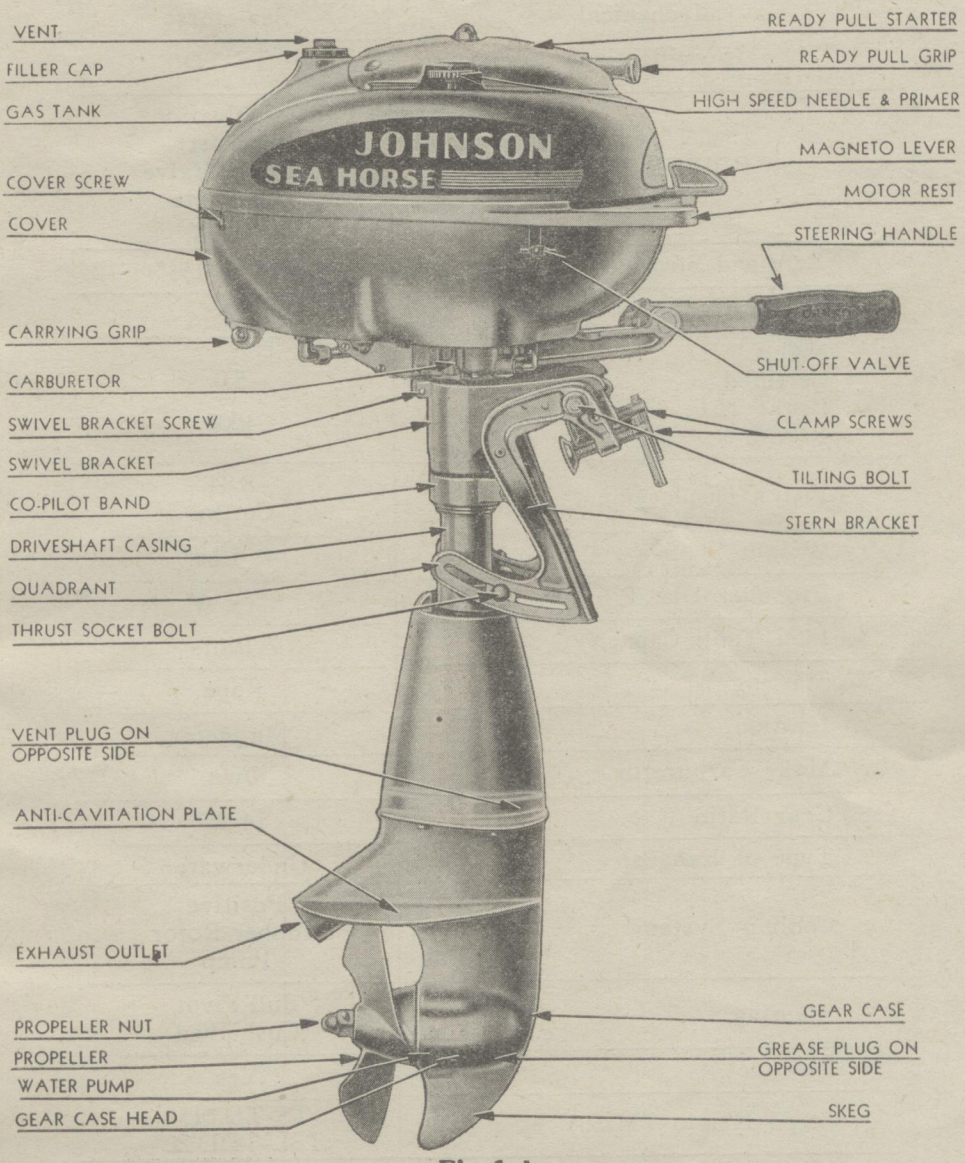


Fig. 1-A

Model TD (L)

SPECIFICATION CHART

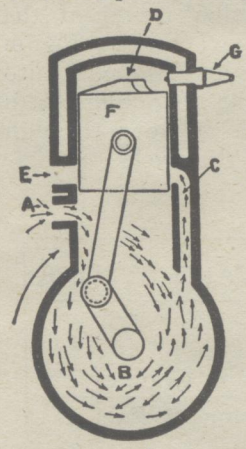
Mechanical Specifications	Sea-Horse TS-TD
POWER-HEAD	Combination 3-Port Rotary Valve Alternate Firing
Bore and Stroke	$1\frac{15}{16}$" x $1\frac{1}{2}$"
No. of Cylinders	2
N.O.A. Certified Brake H.P. at R.P.M.	5.0 4000
Piston Displacement	8.84 Cu. In.
Weight	41 Lbs.
Propeller Dia. Pitch	8" x 6"
Fuel Tank Capacity	7 Pints
Starting	Rope
Ignition	Magneto
Make Carburetor	Own
Gear Ratio	14-25
Type of Exhaust	Underwater
Cooling System	Positive Rubber Rotor Pump
Steering	Full Pivot Cushioned
Reverse	Yes
Stern Height (Max.)	TS-TD 15" TSL-TDL 20"

JOHNSON MOTORS
WAUKEGAN, ILLINOIS

The Two Stroke Cycle

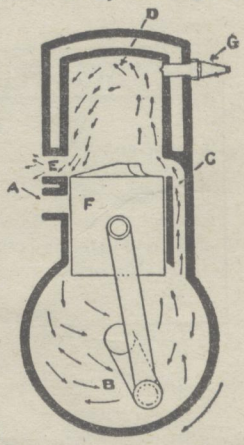
The two (stroke) cycle engine, such as used in all Johnson Outboard Motors, differs somewhat from the four (stroke) cycle engine used in your automobile, this difference being due to the method of conducting gases to and from the cylinder while in operation. The two (stroke) cycle engine employs an arrangement of ports rather than mechanically operated valves to accomplish this purpose, as shown in the following illustrations.

Illustration No. 1



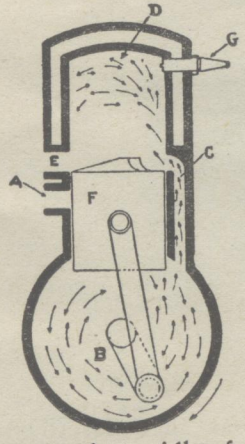
On the first upward stroke of the piston, a partial vacuum or low pressure is created in the crankcase. As the piston progresses in its upward movement and nears the end of the stroke, intake port "A" is uncovered causing fuel vapor from the carburetor to flow into the crankcase—"B". The crankcase is now fully charged. (Three-port type.)

Illustration No. 2



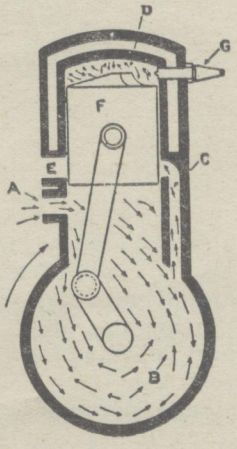
The piston on reaching the end of the stroke reverses its direction and begins a downward movement —covering or closing intake port "A". On its continued downward movement, the vapor charge in the crankcase is compressed until the piston nears the end of the stroke, when the by-pass port "C" is uncovered. This instantly releases the compressed crankcase charge, which flows thru the by-pass and into cylinder "D"—being directed upward by the piston deflector provided for this purpose.

Illustration No. 3



On the following upward stroke, the vapor now having being transferred to the cylinder is compressed and prepared for ignition. However, during this period a second charge has been drawn into the crankcase through intake port "A". There are now two charges—one compressed in cylinder "D" and the charge in the crankcase.

Illustration No. 4



At the end of the compression stroke, a spark, created by the magneto, jumps the gap between the points of spark plug "G"—igniting the compressed fuel vapor in cylinder "D". The vapor in burning expands rapidly, forces piston "F" downward to deliver power required to turn the propeller. Power, however, is not delivered throughout the entire length of the stroke, some time is required to rid the cylinder of burned gases and to receive a fresh charge from the crankcase for the succeeding power impulse.

As the piston travels downward on its power stroke, the fresh charge previously drawn into the crankcase is being compressed—**Illustration No. 2.**

Notice width of exhaust port "E" and by-pass port "C"—"E" is considerably wider than "C", therefore, piston "F" on nearing the end of its stroke uncovers the exhaust port somewhat earlier than it uncovers the by-pass port.

A comparatively high pressure exists within the cylinder at this time, consequently, at partial uncovering of exhaust port "E", the burned gases commence to flow out through the exhaust port. Further travel of the piston uncovers by-pass port "C". The compressed vapor charge now in the crankcase is instantly released, flowing through the by-pass port into the cylinder and directed upward by the deflector. The incoming fresh charge continues to force the burned gases out of the cylinder through the exhaust port and into the atmosphere to complete the cycle.

UPWARD STROKE		DOWNWARD STROKE
Compression	Takes Place ← in → Cylinder	Power Exhaust Intake from Crankcase
Admission of Fuel Vapor	Takes Place ← in → Crankcase	Compression of Fuel Vapor Fuel Vapor Discharge into Cylinder

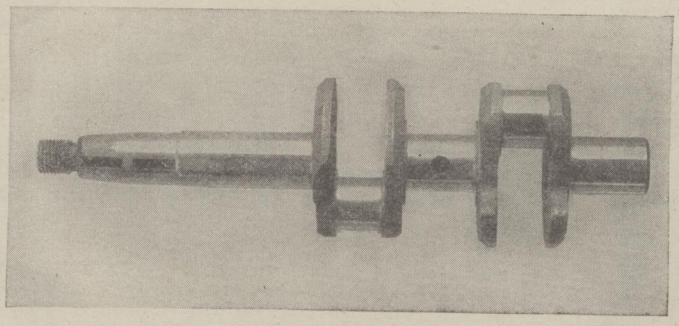


Fig. 2. Crankshaft

Model TS operates on the same general principal as that described above, however, method of crankcase induction differs in some respects. Use is made of two intake ports, that is, one built into the cylinder wall and operated by movement of the piston; the other into the center journal bearing, operated by rotation of the crankshaft. A hole, corresponding to the port (opening) in the center journal bearing, is drilled into the center journal (crankshaft) which leads directly to the crankcase chamber. This arrangement is known as a rotary valve. Figs. 2, 12, 13. By combining these features, it is possible to obtain highly efficient carburetion at all times.

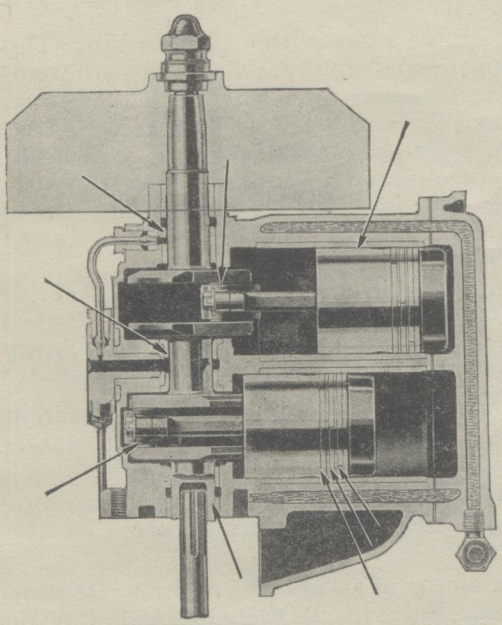


Fig. 3

Fuel Mixture

(Lubrication)

Since fuel vapors are first compressed in the crankcase of the engine, the most practical method of lubrication is by mixing the lubricating oil with the gasoline. Lubrication is obtained as the mixture of oil and gasoline enter the crankcase and is later transferred to the cylinders. Oil being less volatile than gasoline, a large portion of the fuel-oil mixture remains in the crankcase to lubricate the bearings and other moving parts. The remainder enters the cylinders with the pre-compressed charge to aid in the lubrication of piston and piston rings. Arrows indicate surfaces lubricated by oil mixed with the gasoline.

It is extremely important that the oil, in the amounts specified, be thoroughly mixed with the gasoline to insure efficient operation of the motor. Use Mobiloil AF or Moboil Marine No. 4 or an S.A.E. No. 40 oil of similar character and produced by a reputable concern.

To properly mix the oil and gasoline, they should be mixed in a separate container. Never, except in an emergency, attempt to mix the oil and gasoline in the motor tank. It cannot be thoroughly mixed. Should the motor be started under such circumstances, it will operate for a short period on an intensely rich oil mixture, smoking profusely until the poorly mixed fuel is consumed. It will then continue to operate almost entirely on gasoline, with little or no lubrication; overheating, seizure and premature wear are the ultimate results.

Avoid expensive repairs—take advantage of the qualities built into this motor by thoroughly mixing the oil and gasoline as instructed below:

Model	Oil Quantity	Capacity of Fuel Tank (Fuel-oil mixture)
TS and TD	½ Pint per Gal. of Gasoline	7 Pints

Use Mobiloil AF or Mobiloil Marine No. 4 or an S.A.E. No. 40 oil of similar character and manufactured by a reputable concern. BE SURE IT IS THOROUGHLY MIXED.

Note: The compression ratio of Johnson Outboard Motors is not high enough to warrant the use of gasoline containing ethyl lead (colored) to overcome certain combustion characteristics, common to high compression, high speed engines; however, since most gasolines now available contain ethyl lead in various quantities, it can be used successfully.

Due to atmospheric conditions and temperature changes, moisture con-

densation is more or less continually taking place within the gas tank. This results in water droplets accumulating in the tank, gas line and carburetor which, if excessive, is sufficient to interfere with performance of the motor, causing it to act, in many instances, as though it were starving for gasoline. (Water will not pass through the fine screens and small carburetor jets.) Be sure fuel system is free of moisture—likewise, all fuel should be run through a fine screen before pouring into gas tank. A funnel with screen installed serves this purpose nicely.

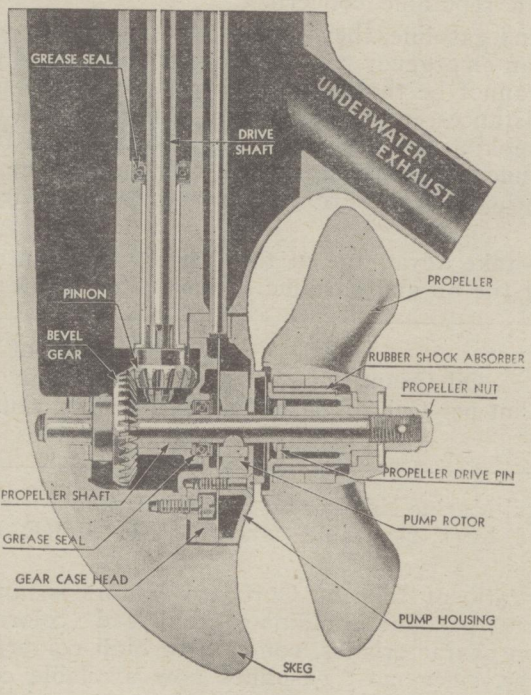
Lubrication and Care of the Gearcase

Since the gearcase is submerged in water when in use, it is IMPORTANT that the gears, bearings, etc. be properly lubricated at all times.

INSPECTION of the gearcase is necessary at regular intervals to drain accumulation of water which may be present and to refill with fresh lubricant. (Remove "vent" and "grease" plugs.)

Water in the gearcase is injurious if allowed to remain for any length of time, particularly if placed in storage, causing gears, bearings, propeller and pinion shafts to rust and become pitted.

To refill with gear lubricant, place motor in an upright position. Remove lower grease plug and upper vent plug. Fill with MOBILGREASE UW or SEA-HORSE GEAR LUBRICANT NO. 2—using a grease gun or tube inserted through lower opening. Insert lubricant until it flows from vent opening. Replace plugs—making certain they are secure.



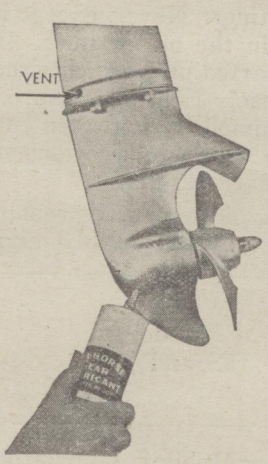


Fig. 4. Inserting Gear Lubricant

In extremely cold weather when water is apt to be near freezing point,

gear lubricant can be mixed with motor oil S.A.E. 30 or 40 to make it more fluid; this, however, necessarily will have to be left to discretion of the operator.

Prior to storage for any length of time be sure to remove all drain, vent and grease plugs to allow any water present in the gearcase and water channels to drain off. This will prevent freezing and bursting of the gearcase, driveshaft housing, water tubes and cylinder blocks, if the motor is to be exposed to freezing temperatures, likewise, eliminates all danger of rusting.

Costly repairs can be avoided if above instructions are closely adhered to.

Attaching the Motor to the Boat

It is essential the motor be properly mounted on the stern of the boat to get results. The object is to be sure the propeller operates at correct depth below the surface of the water and the line of propeller drive is horizontal or parallel to the line of boat travel.

Height of the stern governs the depth at which the propeller operates—the angle of propeller drive being determined by adjustment of the thrust socket.

For maximum efficiency, the following stern heights are recommended.

Model	Recommended Stern Height Inches
TSL & TDL	20″
TS & TD	15″

Should the stern be too high, cavitation will occur (see cavitation, page 24; if too low, a large portion of the gearcase will be exposed below the surface of the water, resulting in excessive drag to retard boat speed.

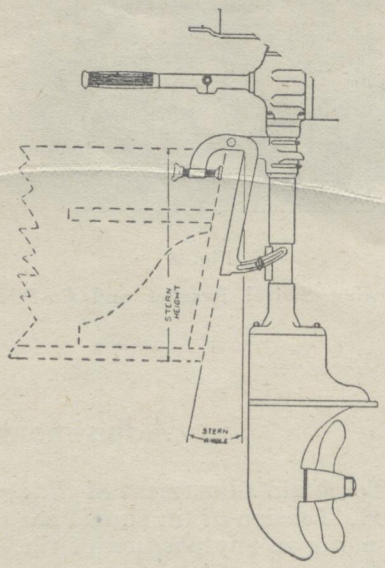


Fig. 5

Thrust Socket Adjustment

(Angle of Drive)

Since most boats are constructed with stern angle, it will be necessary to estimate the proper angle of drive with relation to the angle of stern.

The boat should "plane" or ride on an even keel.

Hang motor on the stern of the boat. Be sure to tighten clamp screws (Fig. 5 to prevent the motor from dropping overboard on sharp turns. This is IMPORTANT. (Do not use a wrench.) Tilt motor to estimated angle, loosen thrust socket nut, slide thrust socket up on quadrants until it rests firmly against driveshaft housing. Tighten thrust socket nut.

Start motor and operate at full throttle. Should the boat have a tendency to "squat" or ride with the bow high out of the water, it would indicate that the motor was tilted too far from the stern. The angle of drive, being di-

rected downward, will result in a downward thrust on the stern, likewise the squatting effect.

If the motor is tilted too close to the stern, the boat will be hard to control, with the bow "digging" or plowing into the water. This is due to upward thrust exerted on the stern.

On the average boat with an evenly distributed load, the thrust socket should be adjusted to permit the driveshaft to operate at right angle to the surface of the water at full throttle.

The Co-Pilot

THE CO-PILOT is an automatic mechanical device to assist in maintaining a true course of the boat whenever the steering handle is left free. This permits moving about in the boat without slowing down or stopping the motor to prevent its swerving to one side or the other. It also is of value when trolling or casting from the boat.

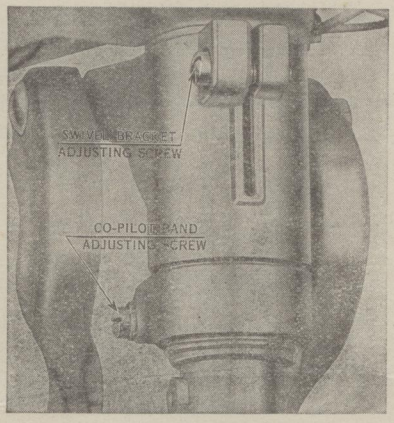


Fig. 6
Showing Swivel Bracket and Co-Pilot.

Its construction is simple in that the torque impulses of the motor are absorbed by the two small springs preventing the motor from pivoting in the swivel-bracket. Fig. 6.

Care and Adjustment of Co-Pilot

If for any reason steering is found to be too free or too stiff, adjustment can be obtained by either tightening or loosening the Co-Pilot band screw. Fig. 6.

The Co-Pilot is in constant action during the time the motor is being operated and should be oiled occasionally; a drop or two on the Co-Pilot band and swivel bracket from time to time will do.

Adjustment of Swivel Bracket

To obtain adjustment of tilting tension, tighten or loosen tilting bolt nut. Fig. 1. Tension of tilt should not be too great, but just sufficient to maintain the motor in any position of tilt.

To Break in New Motor

Under no circumstances should a new motor be operated at speeds beyond three-quarters throttle for at least five hours. This time is required to properly seat the bearing surfaces, pistons, piston rings and cylinder walls.

Performance and long life depend to a great extent on the manner in which the motor was first operated.

Starting Mixture

Since a rich starting mixture is essential for starting purposes, some arrangement must be built into the carburetor to accomplish it.

Model TS does not employ use of the conventional choke built into the carburetor, but relies on a primer (manually operated) to supply additional fuel for starting purposes.

Fig. 7. The primer is operated by depressing the plunger or high speed needle adjusting button as desired to obtain necessary starting mixture.

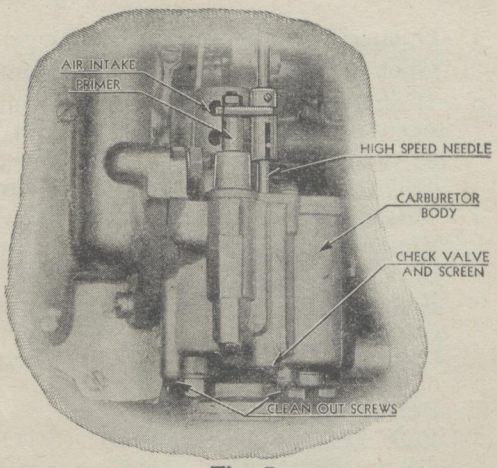


Fig. 7

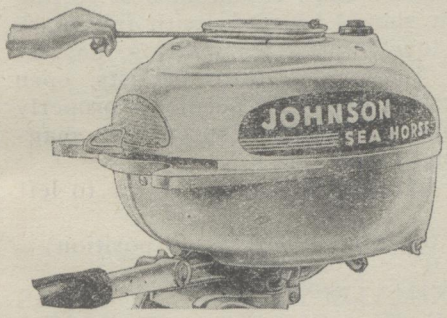


Fig. 8

Starting

Starting is accomplished first, by wrapping starting cord around starting pulley (clockwise); second, setting magneto lever in starting position, third, priming; fourth, pulling quickly on starting cord grip. See starting instructions, page 16.

Controls

Magneto and carburetor levers are synchronized, that is, operating in unison upon moving the magneto lever. Fig. 9. This feature is of value in that any desired speed, within the limits of the motor, can be obtained by merely shifting positions of the magneto lever; for full speed, shift to right; for intermediate and slow speeds shift to left (facing motor).

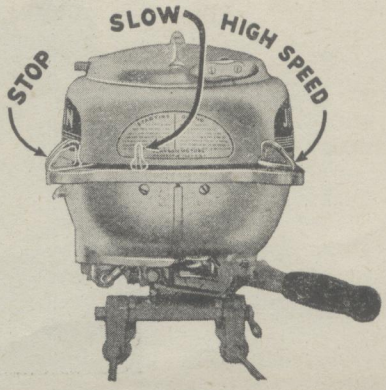


Fig. 9

Starting Instructions

1. Open air vent in gas tank filler cap.
2. Open shut-off valve (gas tank) on left side of motor. Fig. 1.
3. High speed needle (carburetor) is properly set at factory, however, in event setting has been altered, it should be unscrewed approximately ¾ turn from closed position. When motor is cold, more if necessary in cold weather. See page 18 for further instructions on carburetor.
4. Move magneto lever to starting position.
5. Wrap starting cord around starting pulley (clock-wise), knot of cord in notch of pulley.
6. Prime—(primer and high speed needle on carburetor are interconnected—press to prime and turn to adjust). Depress primer—needle button three or four times to obtain necessary rich starting mixture, when motor is cold. Fig. 10.
7. Pull rapidly on starting cord.

UPON HAVING STARTED MOTOR, proceed as follows:

8. Advance spark by moving magneto lever to right (facing motor). Since spark and carburetor levers are synchronized, control of the carburetor is accomplished by movement of the magneto lever, that is, motor speed is controlled by shifting position of the magneto lever. Fig. 9.
9. Close high speed needle (turn right) as required to obtain best setting for maximum speed. This adjustment should be made with full spark advance. Note—If motor tends to slow down after starting, depress primer-needle button several times. If slowing down persists, open high speed needle slightly (turn left). High speed needle is properly adjusted when motor consistently runs at maximum speed with magneto lever set at full advance position.
10. To reduce motor speed, retard spark by moving magneto lever to left (facing motor) as desired.
11. To stop motor, move magneto lever to extreme left (stop position)—hold until motor stops running. Fig. 9.

OPERATE NEW MOTOR AT APPROXIMATELY THREE FOURTHS (¾) CAPACITY FOR AT LEAST FIVE (5) HOURS TO PROPERLY BREAK IN.

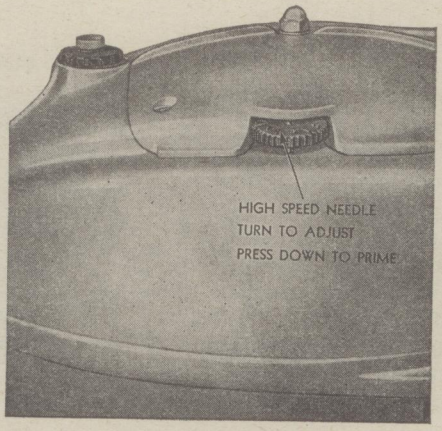


Fig. 10

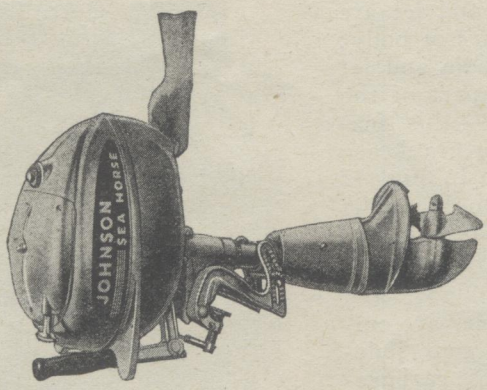


Fig. 11. Method of Carrying Motor.

REMOVING MOTOR FROM BOAT—Lift straight up, hold several seconds to be sure all water drains from under water exhaust. Exhaust channels lead directly to cylinder. Do not raise lower unit higher than power head before draining, if so water will flow into cylinder. Result—rust, failure to start and run, and expensive repairs.

Steering and Reverse

Steering is accomplished by moving the steering handle to left or right as desired. The motor pivots in such a way that direction of boat travel is governed by the propeller thrust, enabling full control of the boat the instant the motor is started.

Full pivot (360°) steering is provided—reverse being obtained by simply raising the steering handle and turning the motor around to reverse position. A reverse locking arrangement built into the thrust socket and drive shaft housing prevents tilting in reverse.

CAUTION: Be careful not to strike submerged obstructions when in reverse—the motor does not tilt in reverse.

Carburetion

Carburetion is of the full range type, thus providing efficient carburetion at all speeds—some departure from customary construction has been made nevertheless, in that only the high speed needle and jet are built into the carburetor body; the slow speed needle and jet are actually not a part of the carburetor proper — this feature is part of the crankcase assembly as shown in Fig. 12 and functions throughout the entire speed range of the motor.

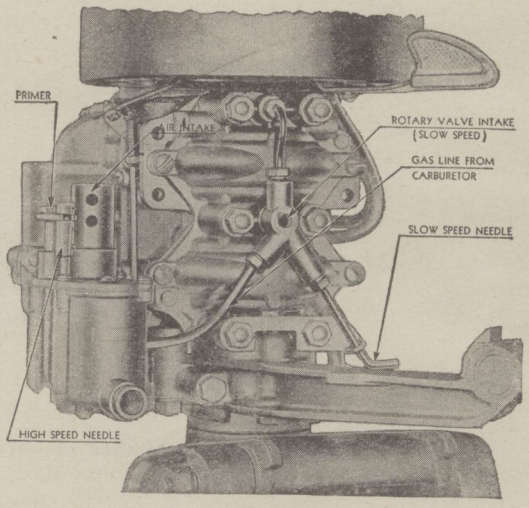


Fig. 12

Since both third port and rotary valve principles are employed, there are two independent systems of carburetion. The carburetor itself is of the conventional type—consisting of a float chamber, mixing chamber, throttle valve, needle for adjusting mixture and a connection to the intake manifold. The carburetor and third port operate only at intermediate and high speeds and cease to function entirely at slow speeds. Slow speed operation is maintained, however, by mixing air and gasoline in the slow speed opening which is conducted to the crankcase chamber by way of the rotary valve. Fig. 12 and 13.

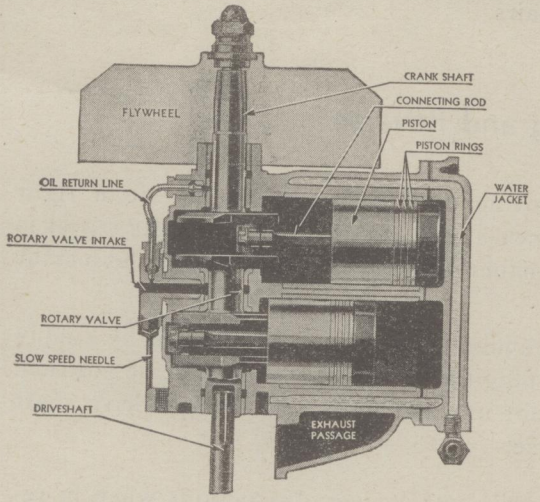


Fig. 13

To adjust carburetor, proceed as follows—(note, carburetion is properly adjusted prior to shipping motors from the factory.)

Some adjustment may however be necessary due to type of service or climatic conditions. There are two (2) adjustments —namely, High and Slow speed.)

1. Close slow speed needle, Fig. 12, turn right until it rests gently on its seat, then unscrew approximately ¾ turn. (Turn left.)

2. Close high speed needle, Fig. 10, turn right until it rests gently on its seat, then unscrew approximately ¾ turn. Turn left).

3. Start motor as instructed on page 16.
4. Operate at full speed with spark at full advance until normal motor running temperature is reached. Turn high speed needle to left or right as required to obtain maximum speed.
5. Retard spark by moving magneto lever to position midway between center and full retard (left of center facing motor). Turn slow speed needle, Fig. 12, to left or right as required to obtain smooth and consistent running at slow speeds.

High and slow speed needles should be adjusted separately—adjusted one at a time. Some may prefer to close the high speed needle entirely when making the slow speed adjustment. In this case open the slow speed needle approximately ¾ turn from closed position, start the motor and run until warm. Retard spark to slow speed range, turn slow speed needle to right or left slightly to obtain consistent slow speed operation.

Move spark lever to full advance position, gradually open the high speed needle until maximum speed is reached.

Do not change position of the slow speed needle to correct high speed performance. Once the slow speed needle is set, it should require little or no attention—do not change setting unless necessary.

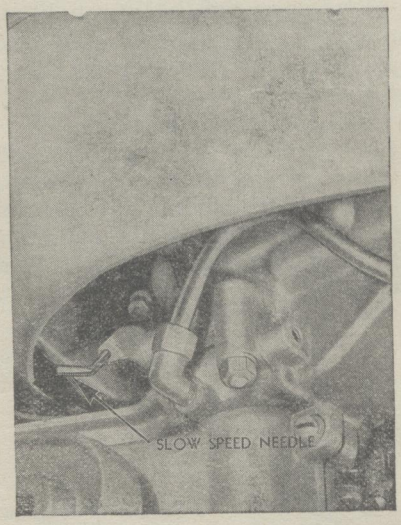


Fig. 14. Showing Location of Slow Speed Needle on Model TSL.

In event the slow speed intake is obstructed with foreign matter, simply open the slow speed needle three or four turns—depress primer vigorously several times to force out obstruction. Readjust slow speed needle as instructed above. Be sure check valve screen is clean. (See Fig. 7.)

Spark and magneto levers are synchronized, therefore movement of the magneto lever controls both spark and carburetor simultaneously.

THE PRIMER consists of a small cylinder and plunger built into the carburetor body, which, when depressed, forces a small amount of gasoline into the slow speed opening to provide rich starting mixture. Since priming is accomplished through the slow speed opening, the slow speed needle must be open. The motor cannot be primed if the slow speed needle is closed. Do not, however, open the slow speed needle beyond that required for best slow speed operation of the motor.

The Magneto

The magneto is a self-contained unit—requiring no assistance from outside sources such as a dry cell or storage battery to produce the strong spark so essential to easy starting. It consists chiefly of an armature plate, on which are mounted the ignition coil condenser and breaker points and a permanent magnet cast into the magnet rotor.

Its operation is extremely simple. As the pole pieces of the magnet pass over the heels of the coil, a magnetic field is built up about the coil, causing a current to flow through the primary winding.

At the proper time, the breaker points are separated by action of a cam, thus breaking the primary circuit. This stops the flow of primary current, which causes the magnetic field about the coil to break down instantly—an electrical current of exceptionally high voltage is induced in the fine secondary windings of the coil, and is carried to the spark plug where it jumps the gap between the points of the plug to ignite the compressed charge in the cylinder.

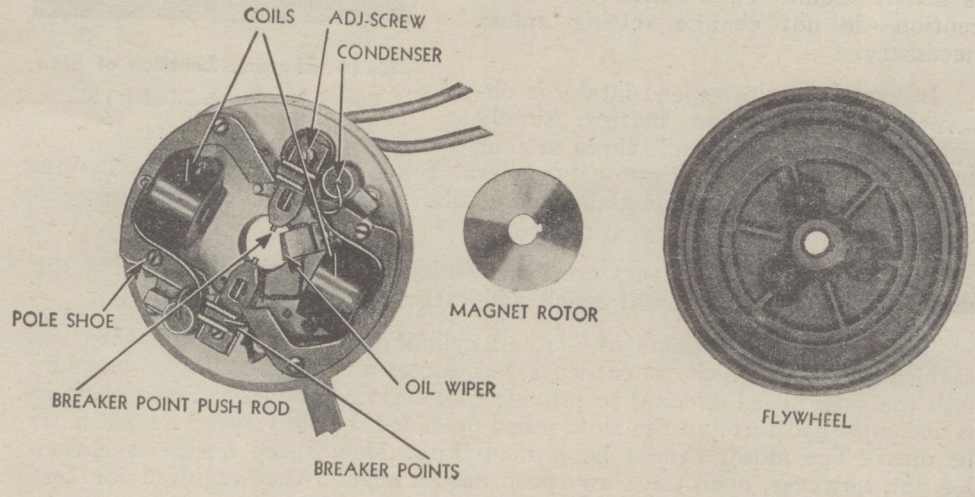


Fig. 15. Magneto Assembly

To Remove Flywheel

Unless a flywheel puller is available, it will be necessary to first remove the gas tank from the motor. Remove the flywheel nut; have someone grasp the flywheel rim and exert upward pressure. Hold a block of wood on top of the end of the crankshaft and strike a sharp blow with a hammer. One or two applications of this nature is all that should be necessary.

To Install Flywheel

First, make certain the keys are properly installed in the crankshaft and **fit snugly.** Remove coverplate from the flywheel. Install flywheel, being careful not to jar the keys loose. Place lock washer and nut into position. Draw up tightly on the nut. Replace cover plate. Have someone hold on to the rim of the flywheel to prevent its turning. Attach large wrench to flywheel nut, strike handle of the wrench with a mallet or heavy hammer to draw up as tightly as possible.

Start the motor and operate it for a short period, after which tighten nut in the same manner. One or two similar applications will properly secure the flywheel.

It is IMPORTANT that the flywheel be securely mounted. A loose flywheel will result in expensive repairs—damaging the hub of the flywheel, the crankshaft and other parts.

A loose flywheel frequently results in a noticeable knock in the motor and consistent shearing of the propeller pin without striking underwater obstructions.

TO ADJUST MAGNETO BREAKER POINTS—Since two coils are used (one for each cylinder) two condensers and two sets of breaker points are required, both of which may need occasional inspection from time to time.

Note flat machined on crankshaft and two push rods operating both sets of points are open when respective push rods ride on high side of crankshaft — closed when on flat. Correct breaker point gap setting is .020" (full open).

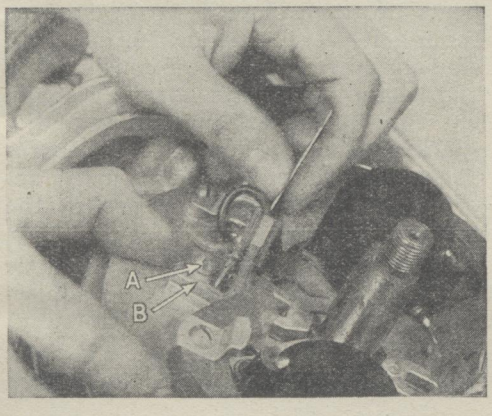


Fig. 16

To adjust gap setting Fig. 16—loosen screw "a". Turn crankshaft to position where push rod rides on high side. Check gap between points, using .020" feeler gauge as illustrated. If gap is less than .020" push breaker point bracket "b" in (towards crankshaft), sufficiently to obtain correct gap setting. Tighten screw "a". If gap is over .020" slide bracket "b", out (away from crankshaft). Adjust both points in like manner.

Spark Plugs

Due to the different speeds at which the various models operate, it is IMPORTANT that spark plugs of certain characteristics be installed in each model.

The following spark plugs are recommended for:

Model	Our Part No.	Spark Plug	Substitute
TS (L) and TD (L)	76-152	Champion J8-J	AC K7

It is important the correct spark plug be used to avoid consistent fouling or preignition and maintain maximum performance of the motor.

If a new spark plug is required, consult this chart before making purchase. If in doubt, see our local Johnson Dealer or Service Station. This is important. Unless the correct number and make of spark plug is used, consistent fouling of the plug or pre-ignition is likely to be experienced.

If pre-ignition is taking place, the insulator or porcelain exposed within the cylinder will be pitted or partially burned away. In extreme cases, the motor will continue to fire after cutting out magneto. Proper functioning of the plug is indicated by a comparatively dry insulator. (Section exposed within cylinder.)

Any tendency towards fouling is noticeable by a black gummy deposit on the insulator. This, however, may not be due entirely to the qualities of the spark plug, but to operation at slow speeds for long periods, such as trolling, or during the breaking-in period of a new motor or to the use of more oil than recommended.

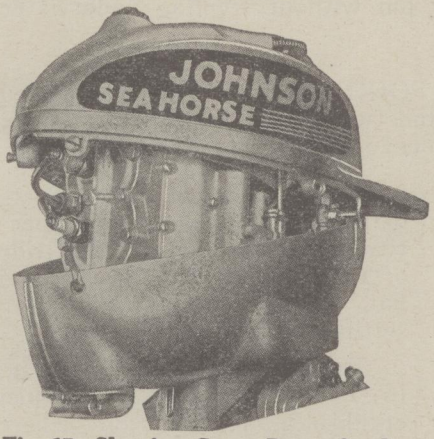


Fig. 17. Showing Cover Down for Inspection of Spark Plugs.

Pre-ignition in an outboard motor frequently leads the operator to believe the carburetor or the gas line at fault, or the difficulty due to lack of lubrication, causing sluggish action of the motor. The motor, when cold and just having been started, will operate normally for a short period until it heats up, then slow down or stop as though it were starving for gas. In slowing down, it cools off considerably and begins to operate normally again, but only until the temperature of the spark plug rises, then pre-ignition reappears. Pre-ignition is usually accompanied by rattling noises in the motor.

The spark plugs require very little attention other than occasional removal for inspection, cleaning and adjustment of the points. Correct setting .030".

The insulator should be wiped off with a dry cloth regularly, especially if operating in salt water, to remove all traces of moisture or residue, which often interferes with starting.

To inspect spark plugs loosen the four cover screws and let cover drop down as shown in Fig. 17.

The Cooling System

Use is made of a positive rotor pump to circulate water through the cooling system. Fig. 18. Action of the rubber rotor operating on an eccentric driven by the propeller shaft forces water through the various channels and water jackets to provide a cooling medium. The water carries off heat and is expelled inside of the driveshaft housing where it flows out with the underwater exhaust gases.

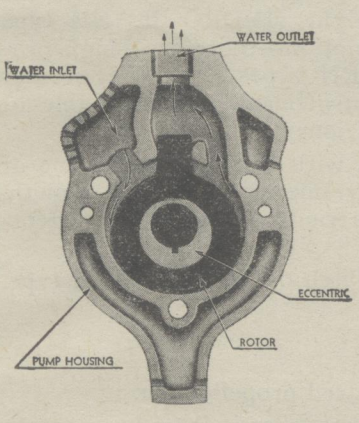


Fig. 18. Positive Rotor, Pump

No attempt should be made to run the motor out of water.

Functioning of the pump can easily be determined by noting small stream of water discharging from a hole drilled in the elbow attached to the lower side of the cylinder block.

Overheating is usually accompanied by rattling noises in the motor, causing it to slow down or to stop completely.

Care of the Cooling System

It is IMPORTANT, when operating in salt water, to flush the cooling system with FRESH water—this should be done as soon as possible after removal of the motor from the boat, to reduce the corrosive effects of salt water to a minimum. Flushing can be accomplished by operating the motor in a barrel of fresh water for several minutes.

Salt water, if permitted to remain in the water channels—particularly the water jackets, will set up sufficient corrosion to clog the water passages. Such a condition would naturally interfere with proper cooling and operation of the motor.

AFTER OPERATION IN SALT WATER—rinse off lower unit parts with fresh water and wipe with oily cloth. This will reduce the corrosive effects of salt water to a minimum.

Propellers

The size of the propeller is usually given in two dimensions—the DIAMETER and the PITCH. They are constructed with two or three blades, depending upon the nature of the service.

DIAMETER is the distance from the extreme tip of one blade to the tip of the other—two blade type—or the diameter of the circle described by the periphery of the blades—three blade type.

PITCH is the distance the propeller would advance in one revolution, if operating in a semi-solid substance, no slippage being evident.

FOR EXAMPLE—A 8" x 6" propeller will have an eight inch diameter and a 6 inch pitch—theoretically, advancing six inches per revolution.

But NO propeller is 100% efficient—certain losses prevail under all circumstances. The percentage of loss or slippage frequently runs as low as 10%, on extremely light racing hulls—and upwards of 40 to 60% on the heavier or cruising types.

EFFICIENCY of the propeller depends to a great extent, upon the shape and weight of the hull. The light weight HYDRO-PLANE type possibly offers the least resistance to forward motion—therefore—high propeller efficiency. The heavier SQUARE STERN types offer the greater resistance, especially if the power applied is insufficient and incapable of planing the boat—resulting in low propeller efficiency.

Keel interference—angle of propeller thrust, with relation to the line of forward motion—depth, at which the propeller operates—marine growth, below the water line —and, of course, the load carried are also factors affecting propeller efficiency.

Propeller, Models TS & TD—Diameter 8", Pitch 6", two (2) blade type.

Cavitation

Cavitation should not be confused with a sheared propeller pin.

Cavitation is a condition created whereby the propeller is forced to operate in turbulent or greatly disturbed water. Consequently, air is drawn from the surface into the propeller stream, which, naturally, lessens the load on the propeller, resulting in the propeller being turned at a high rate of speed. However, since the propeller is acting largely on air and turbulent water, its effectiveness is reduced considerably in that the propeller is merely churning the water rather than propelling the boat.

In most instances, cavitation is brought about by the propeller operating too near the surface of the water or to interferences created by the stern being too high. (See recommended stern heights, page 13.) A wide keel, extended to the stern of the boat, is often responsible for such interference and can be corrected by tapering to a feather edge—commencing approximately two feet forward of the stern.

Collection of grass and weeds on the gearcase also causes cavitation.

Bent or damaged propeller blades frequently result in excessive vibration and loss in propeller efficiency as well as to contribute towards causing cavitation.

The Shock Absorber

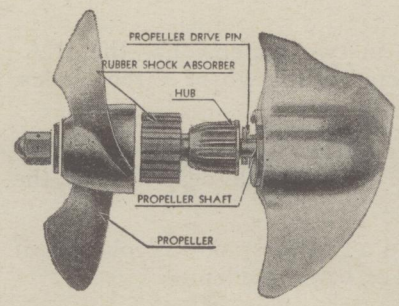


Fig. 19—Showing Rubber Shock Absorber and Hub, Model TS(L) and TD(L)

Models TS(L) and TD(L) are equipped with a shock absorber device built into the propeller, consisting of the propeller, rubber shock absorber and hub. See Fig. 19. The purpose of this feature is to reduce shearing of propeller drive pins to a minimum and to absorb shocks which otherwise might be injurious to the motor in event of striking underwater obstructions. Shock is absorbed by the rubber insert—it acts as a cushion between the propeller and hub.

To Install Propeller Drive Pin

To install a new drive pin, withdraw cotter pin securing propeller nut. Remove nut, propeller, rubber insert, hub and fragments of sheared pin and insert new pin. Replace hub, rubber insert, propeller and nut. See Fig. 19. Do not draw up too tightly on propeller nut but just enough to make certain the propeller hub rests firmly against the drive pin. It is possible to partially shear the new pin by drawing up too tightly on the nut. Insert cotter pin and lock in position.

The Ready Pull

This simple device is built into model TD(L) for the express purpose of eliminating the necessity of manually wrapping the cord around the starting pulley for cranking. Fig. 8. It consists of a ratchet plate about which are coiled a return spring and the starting cord and a pawl arrangement mounted on top of the magneto flywheel. Fig. 20.

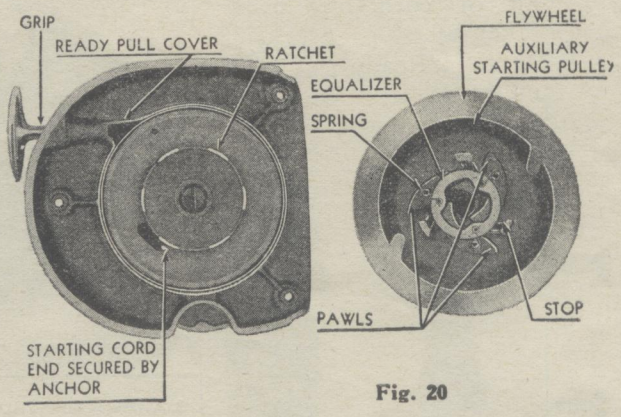


Fig. 20

When at rest, the pawls are held in an extended position by small springs, making a positive connection with the ratchet—thus when pulling on the starting cord grip, cranking effort is applied directly to the flywheel.

Upon having started the motor, the pawls disengage the ratchet automatically due to centrifugal force created by rotation of the flywheel. Once having started, "Ready Pull" mechanism remains idle, consequently since there is no action while the motor is in operation, there can be no wear on any of the parts. It is for this reason very little attention is necessary.

Immediately upon stopping the motor, centrifugal forces cease to act causing the springs to extend the pawls to engage with the ratchet—the "Ready Pull" is then again in position for cranking. Its action is automatic —simply pull on the cord to crank.

Care of the "Ready Pull"—Under no circumstances let the starting grip "snap" back into position after cranking by letting go. Retain hold of the grip until the cord has returned to normal position. Care should be exercised in this respect to prevent possible injury to the "Ready Pull" cover and starting cord.

In event the starting cord should break, remove the "Ready Pull" and crank motor in usual way by wrapping cord around auxiliary starting plate on the flywheel.

TO INSTALL NEW STARTING CORD proceed as follows—

1. Remove "Ready Pull."
2. Remove fragments of broken starting cord.
3. Obtain new cord. Attach grip as shown Fig. 21. Use only the special cable provided by the manufacturer.
4. Cut a small piece of wood to fit in ratchet as shown in Fig. 22.
5. Turn in anti-clockwise direction (right to left) 7 turns, using marker as indicated. Fig. 22. (Be sure to turn right to left—to do otherwise will damage the recoil spring.)
6. Insert starting cord as illustrated. Fig. 22.
7. Attach grip as shown.
8. Gradually release until all of cord has been taken up.
9. Attach "Ready Pull" to motor.

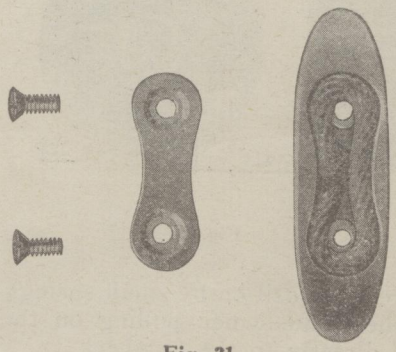


Fig. 21

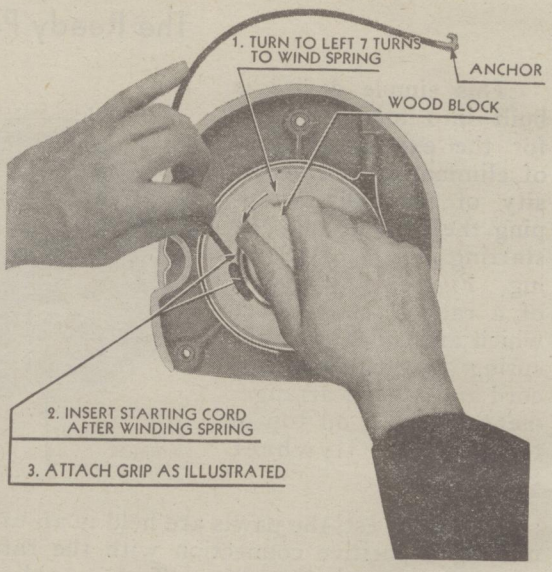


Fig. 22

If Motor is Dropped Overboard

Recover motor from water immediately, if possible.

Remove fuel tank, fuel line, carburetor, magneto and spark plugs. Drain all water that may remain. Wash with gasoline.

Work as much water as possible out of the cylinders and crankcase by turning motor slowly in upright and inverted positions.

Pour a small amount of oil into each cylinder; turn crankshaft to distribute oil.

Blow off armature plate with air pressure, if available; wipe with dry cloth. Place in warm dry place, be sure it is thoroughly dried and that no water remains about the coil.

Replace all parts previously removed. Clean and fill tank with fresh fuel mixture. (Make certain no water remains in tank.)

Start motor as instructed and allow to run until you are reasonably sure no water remains.

CAUTION—Do not under any circumstances attempt to start the motor until the armature plate has been thoroughly dried. Remaining drops of water are likely to set up a short circuit which may result in extensive repairs.

If the motor cannot be started, it should be disassembled at once to remove all traces of water clinging to the inside walls and motor parts. Each part should be dried and coated liberally with oil to prevent rusting. This is IMPORTANT, the motor should be attended to immediately.

Preparations for Storage

No Outboard Motor should be placed in storage, especially winter storage, without considering the necessary precautions.

Most IMPORTANT—Remove all plugs in the gearcase and driveshaft housing, marked "drain" and "grease," (See Motor Illustrations) to allow accumulative water in the gearcase and water remaining in the cooling system to drain off. Failure to take this precaution will result in bursted cylinder blocks, gearcase and possible injury to water channels and water tubes, due to freezing during the cold winter months. To make certain all water has been drained, rock motor from side to side.

If operated in salt water, flush cooling system with fresh water. See page 23.

Refill gearcase with MOBILGREASE UW OR SEAHORSE GEAR LUBRICANT "No. 2." Fig. 4.

Remove spark plugs—pour about a tablespoon of clean oil through each spark plug opening. Turn flywheel slowly to distribute oil on cylinder walls. Replace spark plugs.

Drain all fuel from gas tank, gas line and carburetor. Remove and clean carburetor and gas tank screens.

Under no circumstances should the motor be stored in an inverted position. It should be hung on a rack similar to the manner in which it is mounted on the boat.

Preparations for Operation After Storage

Remove spark plugs, attach ignition leads to some part of motor to prevent injury to the coils; spin motor with rope to blow out excess oil. Clean and replace spark plugs. Install new plugs if necessary.

Tighten all nuts and screws. Make sure flywheel nut is tight.

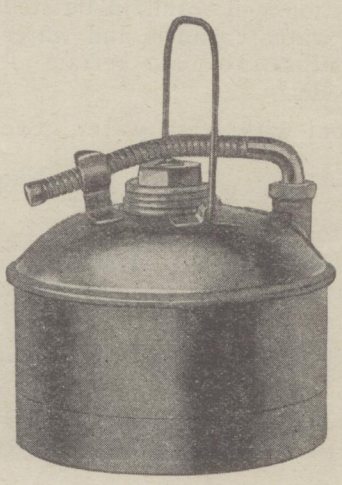
Fill gas tank with properly mixed fuel.

No. 76-307

USEFUL SEA-HORSE ACCESSORIES

SEA-HORSE GEAR LUBRICANT

A superior quality water proof gear lubricant, put in 12 oz. tubes, recommended for use in the gear case of all Johnson Outboard Motors—"It does not mix with water"—Equipped with tapered nozzle to fit opening in gearcase.



FUEL CANS

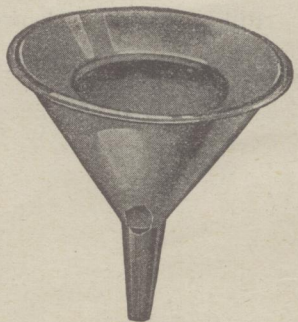
These fuel cans are designed for all around marine use and for Outboard Motors in particular. Constructed of heavy steel — breast and body acetylene welded together. Bottom is reinforced with heavy steel loop.

They are equipped with a flexible pouring spout. A solid brass valve is securely soldered to breast and reinforced with a steel brace, spot welded. Air vent automatically opens when turning spout to pouring position and locks securely when spout is returned to holder.

75-170—Fuel can (5 qt. cap.)
75-171—Fuel can (10 qt. cap.)
75-172—Fuel can (5 gal. cap.)

FILTERING FUNNEL

Much of the hard starting and poor performance of outboard motors can be traced to particles of dirt or water in the gasoline mixture. This funnel will put an end to this trouble. A 100 mesh bronze wire screen in the bottom removes all dirt or water that may be in your fuel mixture. A baffle plate around the top of funnel prevents gasoline from splashing out when refilling tank in rough water. It is built to stand hard usage. Inside of funnel is heavily galvanized.


No. 75-1

Johnson Motors Parts Distributors and Service Stations

All parts should be ordered from your nearest Service Station or Distributor

ALABAMA

Birmingham Outboard Marine
126 S. 20th St.
Birmingham

A. H. McLeod & Co.
St. Francis and Water Sts.
Mobile

ARIZONA

*Motor Supply Co.
315 N. Central Ave.
Phoenix

ARKANSAS

Vaughan Hardware Co.
Hot Springs

Stanley Outboard Motor Co.
115 Maple St.
North Little Rock

CALIFORNIA

*B. H. Hebgen Co.
1361 S. Flower St.
Los Angeles 15

S. W. Holmers
5368 E. Second St.
Long Beach

CANADA

Outboard, Marine & Mfg. Co. of Canada, Ltd.
Peterboro, Ontario

CONNECTICUT

Art Kelly's Garage
495 Lenox Ave.
Devon

The Essex Paint & Marine Co.
Essex

Clapp & Treat, Inc.
4 American Row
Hartford

MacKenzie Machine & Marine Works
E. Corner Water St.
New Haven

Dumont Marine Service
524-526 Main St.
New London

COLORADO

*Tede & Etchingham
1700 16th St.
Denver

WASHINGTON, D. C.

Nash Marine Supply
1300 Marine Ave., S. W.

FLORIDA

S. D. Strong
115 E. Orange Ave.
Eustis

Bryan Walker
648 W. University Ave.
Gainesville

Johnson O.B. Sales & Service
25 E. Adams
Jacksonville

*Lew Hewes
412-418 N. W. No. River Dr.
Miami

Hopkins-Carter Hardware Co.
139 S. Miami Ave.
Miami

Orlando O. B. Marine
2709 N. Orange Ave.
Orlando

Runyan Mach. & Boiler Works
Pensacola

Jim Camp Sporting Goods
203 S. Monroe St.
Tallahassee

Connelly & Son Marine Mart
114 S. Franklin St.
Tampa

GEORGIA

*Atlanta Outboard Mar.
311 Spring St., N. W.
Atlanta

Stubbs Hdwe. & Sporting Goods
121 Congress St., West
Savannah

ILLINOIS

Fred Ludolph
2257 Silverton Way
Chicago

W. L. Masters & Son
210-216 W. Chicago Ave.
Chicago

Maypole Boats & Motors
5901 W. Madison St.
Chicago

Voss Brothers
419 S. Adams
Peoria

Joe Johnson Garage
1114 5th Ave.
Rockford

Seyls Outboard Service
McHenry,

INDIANA

George N. Meyer
Lake James
Angola

Korte Bros., Inc.
219 W. Main St.
Fort Wayne

J. W. Millikan Sporting Shop
449 State St.
Hammond

Tippecanoe Boat Co.
Leesburg

Kindig Brothers
2221 Mishawaka Ave.
South Bend

Buffalo Tire Sales
1311 Wabash Ave.
Terre Haute

IOWA

Touristville Boat Livery
Clear Lake

R. B. Fitch
Martin Morris & Co.
229 Fifth Ave., So.
Clinton

Manawa Boat & Motor Co.
135 So. Main St.
Council Bluffs

Kautzky Sporting Goods Co.
522 Central Ave.
Fort Dodge

Lally's Service, Inc.
Mulberry and 12th
Des Moines

KENTUCKY

Ralph Forbes Camp
Burgin

J. C. Bennett Auto Co.
685 Armory Place
Louisville

KANSAS

Radio & Marine Service
2043 E. Lincoln St.
Wichita

LOUISIANA

Howard Griffin
712 S. Grand Ave.
Monroe

*S. & L. Service & Storage
320 Travis St.
Shreveport

MAINE

Church Electric Co.
2 Bridge St.
Augusta

Harold Drew
Cony Hill Sunoco Service
50 Cony St.
Augusta

M. S. Snowman
Ashland

Louis Gomez
Cove Camp Ellis
Saco

Albert G. Frost
26 Forest Ave.
Portland

MASSACHUSETTS

*Crandall-Hicks
959 Commonwealth Ave.
Boston

Outboard Motor Mart, Inc.
305 Atlantic Ave.
Boston

Rapp-Huckins Co., Inc.
138 Beverly St.
Boston

Allen Harbor Marine Service
Harwich Port

MICHIGAN

W. Johnson Service
114 N. Winter St.
Adrian

Bay City Hardware Co.
1609 Saginaw St.
Bay City

NOTE: Those starred (*) are Parts Distributors who carry a complete stock of parts.

Johnson Motors Parts Distributors and Service Stations

All parts should be ordered from your nearest Service Station or Distributor

*Henry H. Smith & Co.
356 Jefferson Ave., E.
Detroit

Lundin & Johnson
Ironwood

Harry Sorg
4301 Grand River Ave.
Detroit

Carl W. Schultz
175 Bay St.
Harbor Springs

Doc Wise Boats & Motors
1035 Ann Arbor
Flint

Junction Auto Parts
3315 E. Michigan Ave.
Jackson

Pine Lake Boat & Motor Co.
Route No. 1
Dexter

Murray Boat Shop
447 E. Front St.
Traverse City

MINNESOTA

Alexandria Hdwe. & Lbr. Co.
Alexandria

Northern Outboard Sales & Service
Brainerd

Alva Baker & Co.
Deer River

Duluth Hardware Co.
19-21 Second Ave., N.
Duluth

United Electric Service Co.
301 E. Superior St.
Duluth

Eric's O.B. Motor Sales & Service
209 Sheridan St.
Ely

Paul H. Kinports
928 Third St.
International Falls

Larson Boat Works
First St., N. E.
Little Falls

Mahowald Cycle Co.
Mankato

Nissawa Oil Co.
Nissawa

Auto Marine Shop
Ranier

*Motor Power Equipment Co.
2234 University Ave.
St. Paul 4

Park Machine Co.
199 W. 6th St.
St. Paul

Grande Hardware
Virginia

Walker Hardware Co.
Walker

MISSOURI

*Star Boat & Motor Co.
7414 E. 15th St.
Kansas City

Ralph G. Schmitt & Co.
1211 S. Vandeventer Ave.
St. Louis

Herrick Motor Co.
427 College St.
Springfield

NEBRASKA

City Gun & Lock Co.
317 S. 14th St.
Omaha

NEW JERSEY

Dale Yacht Basin
Bay Head

Harry Collins
346 Main St.
Mays Landing

Carl W. Bush Co.
518 Broad St.
Newark

NEW YORK

F. R. Smith & Son
Bolton Landing

J. B. Ottersten Co. Inc.
127 Varet St.
Brooklyn

Buffalo Marine Mart
1700 Niagara St.
Buffalo

Bennett Boat Co.
Mayfield, New York

Rich Marine Sales
Foot of Amherst St.
Buffalo

Swan Garage, Inc.
38 Swan St.
Buffalo

Charles E. Cool
61 Geneva St.
Geneva

*Outboard Motor Parts Co.
40 W. 62nd St.
New York City

Park Otbd. Mtr. Sales
107 S. 2nd St.
New Hyde Park, L. I.

Dunkirk Motor Boat Service
Dunkirk

Bronx Johnson Motor Co.
3395 E. Tremont Ave.
New York City

Armstrong & Galbraith
623-5 Sixth Ave.
New York City

McFarland Hardware
7710 Buffalo Ave.
Niagara Falls

Wards Sporting Store
321 Isabella St.
Ogdensburg

Valentine Brothers
134-18 Northern Blvd.
Flushing

Port Washington Marine
Main St.
Port Washington

Rochester Marine Co., Inc.
180 Clinton Ave., S.
Rochester

F. M. Baker
119 River St.
Saranac Lake

South Ozone Park Marine Repair
115-45 Lefferts Blvd.
S. Ozone Park, L. I.

Kembrell Service Station
2400 James St.
Syracuse

Harry H. Henry
1598 Broadway
Watervliet

Jesse L. Raynor
Montauk Highway
Westhampton Beach
Long Island

NORTH CAROLINA

Roy Parker
160 Coxe Ave.
Asheville

Pickard's Sporting Goods
209 Market St.
Wilmington

NORTH DAKOTA

Emery-Johnson Carnine Co.
7-9 S. Broadway
Fargo

OHIO

C. E. Baker
Buckeye Lake

Cincinnati Yacht & Supply Co.
2001 Eastern Ave.
Cincinnati

Powell-Clement Co.
430 Main St.
Cincinnati

Barnes Boat Mart
3107 Detroit Ave.
Cleveland

*Zucker Marine Supply Co.
5300 St. Clair Ave.
Cleveland

W. C. Kennedy & Son
210 S. High St.
Columbus

Worthy R. Brown & Son
Lakeside

Hall Bros. Garage & Mach.
114-116 Greene St.
Marietta

Drue Alexander
Russell's Point

Worthy R. Brown & Sons, Inc.
Cedar Point Pier
Sandusky

Lloyd Sherrill
c/o D.&S. Model Co.
3114 Third Street
Dayton

OREGON

*The Beebe Company
504 S. W. First Ave.
Portland 4

NOTE: Those starred (*) are Parts Distributors who carry a complete stock of parts.

Johnson Motors Parts Distributors and Service Stations

All parts should be ordered from your nearest Service Station or Distributor

PENNSYLVANIA

Robert S. Miller
Evergreen and Thompson St.
Harrisburg

Johnson & Towers, Inc.
113-115 Market St.
Philadelphia

Jack's B & R Service
2220 Germantown Ave.
Philadelphia

Pat O'Brien
401 Broad St.
Philadelphia

Motor Boat Sales & Service
6030 Broad St., East End
Pittsburgh

SOUTH CAROLINA

Carroll Gasque
728 Saluda
Columbia

SOUTH DAKOTA

Grovers Master Service Station
Aberdeen

TENNESSEE

The Athletic House
522 Gay St.
Knoxville

York Arms Company
162 S. Main St.
Memphis

TEXAS

E. A. Blanchette
1995 Franklin St.
Beaumont

Potchernick's
211 St. Mary's St.
San Antonio

Geo. Moore's Bt. & Mtr. Serv.
501 N. Akard St.
Dallas

Loe's Sptg. Gds.
111 S. Travis St.
Sherman

UTAH

*N. H. Bintz Co.
433 W. Third South St.
Salt Lake City

VERMONT

Champlain Marine Co., Inc.
Foot of Maple St.
Burlington

Charles R. McMaster
105 State St.
Rutland

VIRGINIA

Pinnell's
705 Broad St.

WASHINGTON

*Pacific Marine Supply Co.
1223 Western Ave.
Seattle

WEST VIRGINIA

Groves-Thornton Co.
810 Fourth St.
Huntington

Everett Greiner
1705 Staunton St.
Parkersburg

WISCONSIN

A. L. Koch Company
302 W. College Ave
Appleton

Sherrill Outboard Motor Shop
Chetek, Wisconsin

J. A. Dewyer Boat Works
Eagle River

Gordon Bent Company
125 Main St.
Green Bay

Marx Appliance
LaCrosse

Ruggles Motor Service
1848 Kenilworth Place
Milwaukee

Tessner Motor Boat Sales
1404 N. 11th St.
Milwaukee

Bricknell's Valley Marine
40 Lake Drive
Oshkosh

Holden Tire & Battery Service
Superior

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