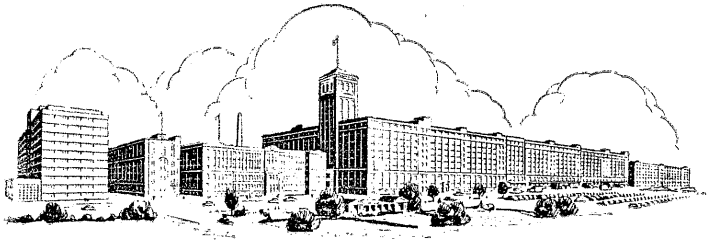
HOW TO REPAIR *Elgin* OUTBOARD MOTORS

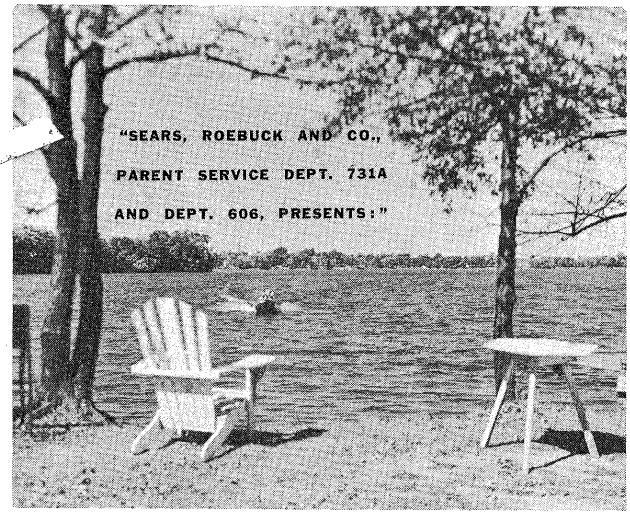
The following material is an exact reproduction of the material found in the training slides and narration which accompanied it.

Note that the narration will in some cases refer to colors in the slides which have not been reproduced herein.



SCRIPT FOR ELGIN OUTBOARD MOTOR SERVICE TRAINING FILM

SECTION I



(Scene 1)

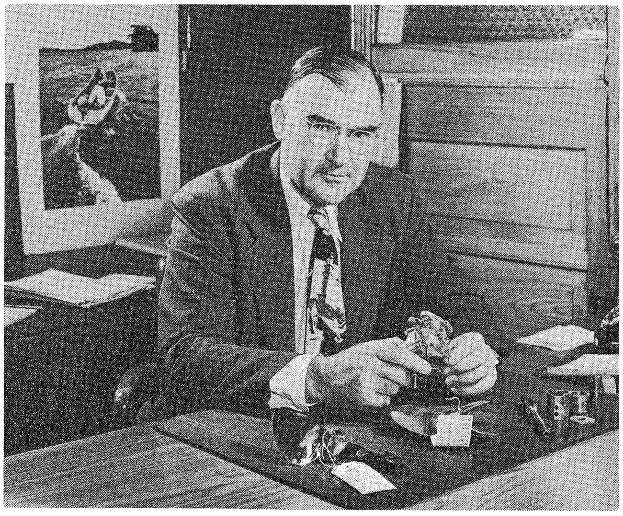
"Sears, Roebuck and Co., Parent Service Department 731A and Department 606, presents:"

HOW TO REPAIR

ELGIN OUTBOARD MOTORS

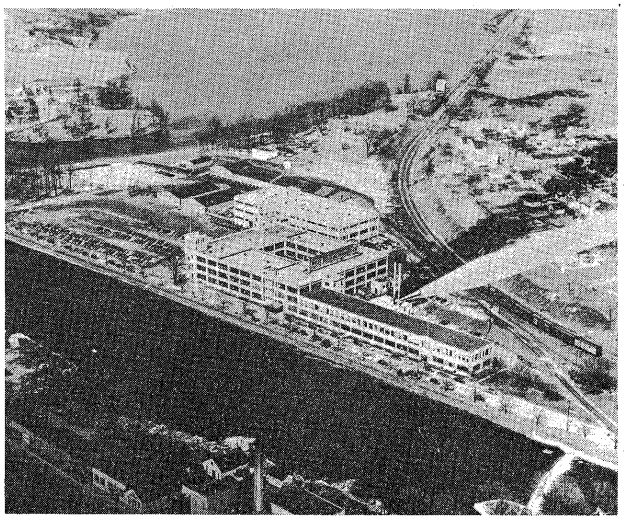
(Scene 2)

"HOW TO SERVICE ELGIN OUTBOARD MOTORS."



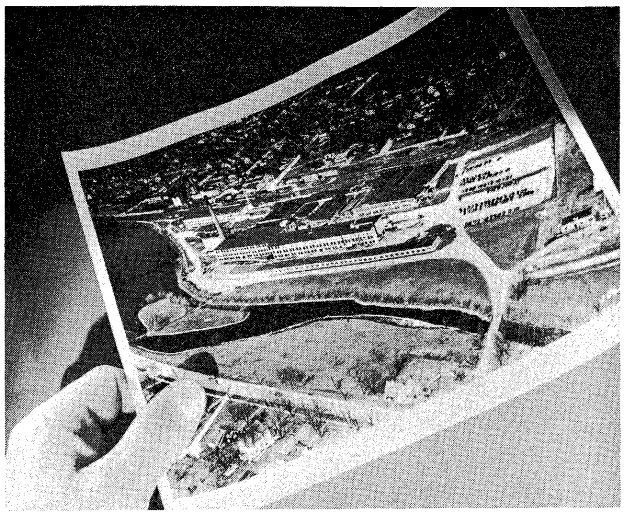
(Scene 3)
NARRATOR:

"Elgin motors are built to give many years of trouble-free service. Here is the man who can tell you all about Elgin quality, Cy Shogren, Sears' outboard motor buyer of Department 606." Will you tell us about Elgin quality, Mr. Shogren?



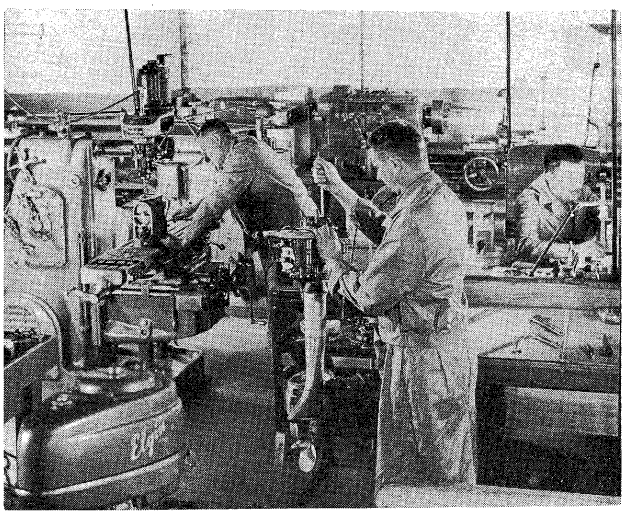
(Scene 4)
MR. SHOGREN:

If all of you could see the care and precision that goes into the manufacture and testing, you would know why we can safely say that the Elgin is *the* outboard motor. Here, at the West Bend Aluminum Company home plant...



(Scene 5)

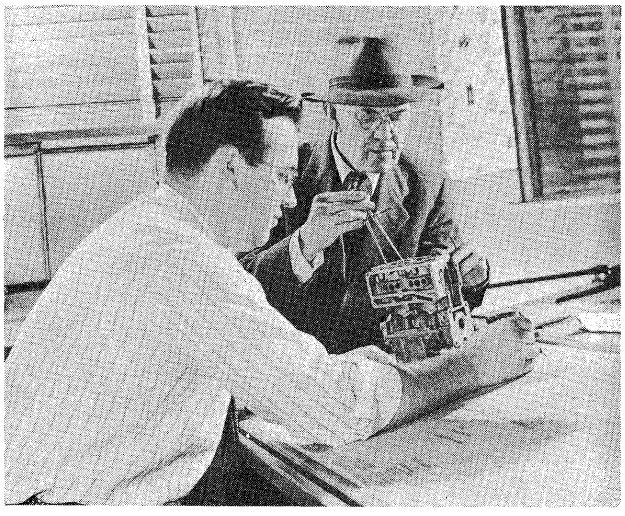
...and at the Hartford plant, Elgins are made. This company was selected from many as best qualified to make the post-war line of Elgins.



(Scene 7)

MR. SHOGREN:

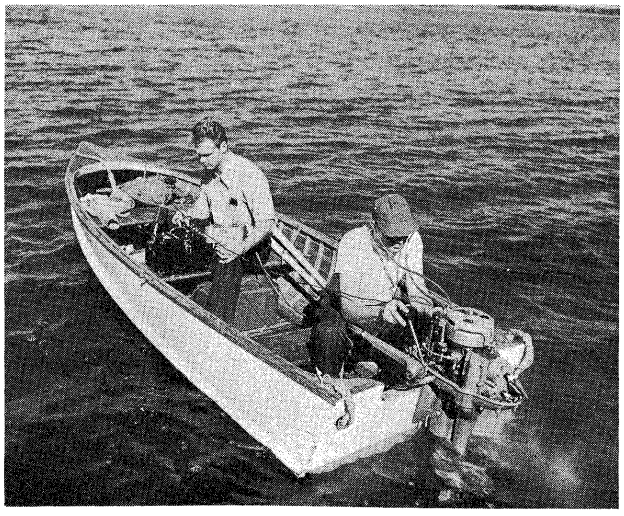
Let me tell you how each model is developed. After the design has been approved, sample motors are made by hand in the experimental laboratory, where a complete machine shop is maintained.



(Scene 6)

MR. SHOGREN:

In 1943, Sears asked West Bend Aluminum to design and produce a line of top-quality outboard motors. Sears stated the specifications...the designers and engineers went to work...and the Elgin was born.



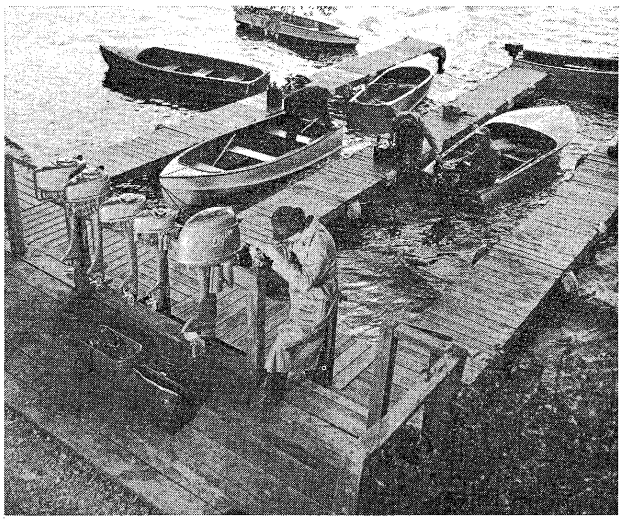
(Scene 8)

MR. SHOGREN:

These hand-made motors are then given speed and performance tests under actual running conditions at our proving base at Pike Lake, Wisconsin.

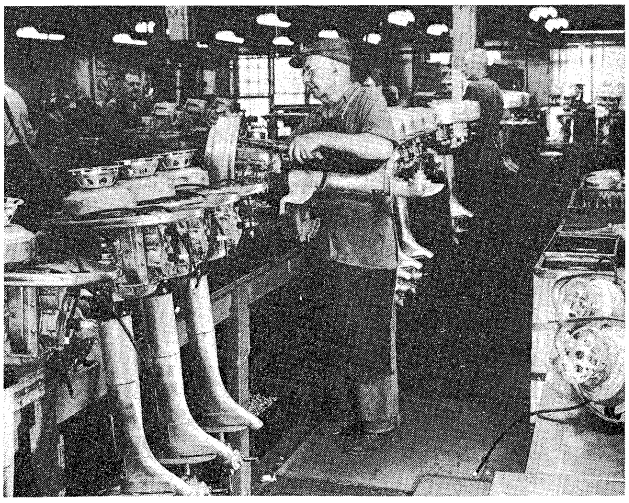
(Scene 9)
MR. SHOGREN:

Elgins are being continually tested. In Florida, salt water tests are run each winter, and before a new model is approved, it will have spent two seasons going through tough salt water tests.



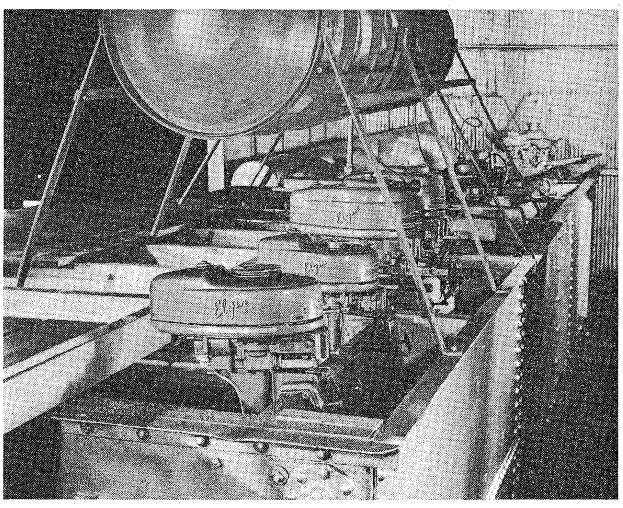
(Scene 11)
MR. SHOGREN:

Motors are then selected at random from these production samples, and are put through the same series of tests as the experimental motors.



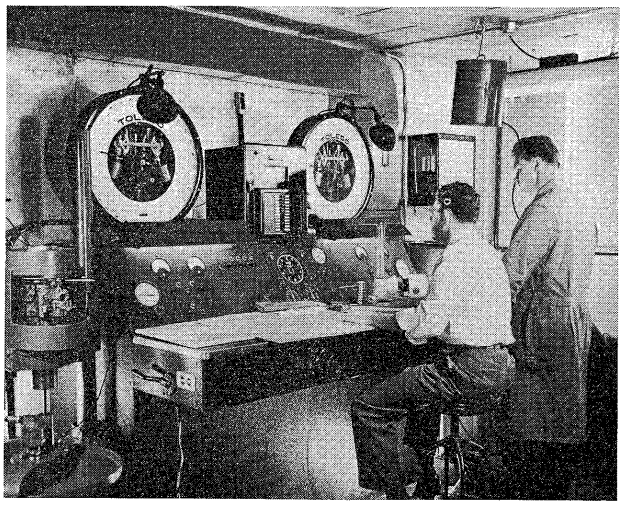
(Scene 10)
MR. SHOGREN:

After the Elgin has been thoroughly tested and approved, a sample production lot of motors is built on the regular assembly line.



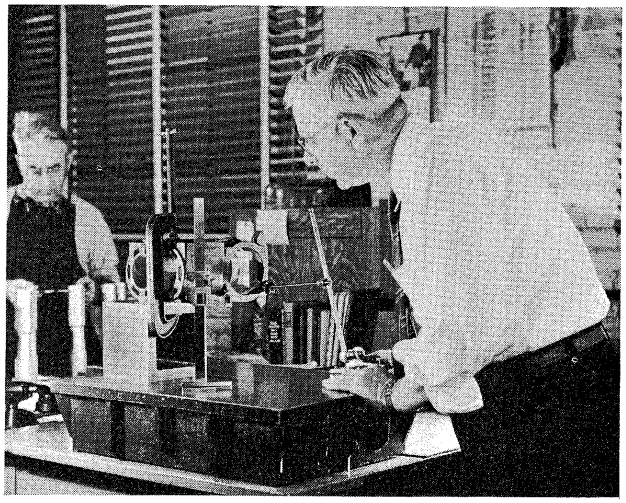
(Scene 12)
MR. SHOGREN:

These Elgins are also tested for endurance under conditions much more severe than they will ever encounter in normal operation. Here they are run continuously, twenty-four hours a day. Several years of performance can be simulated in a few weeks.



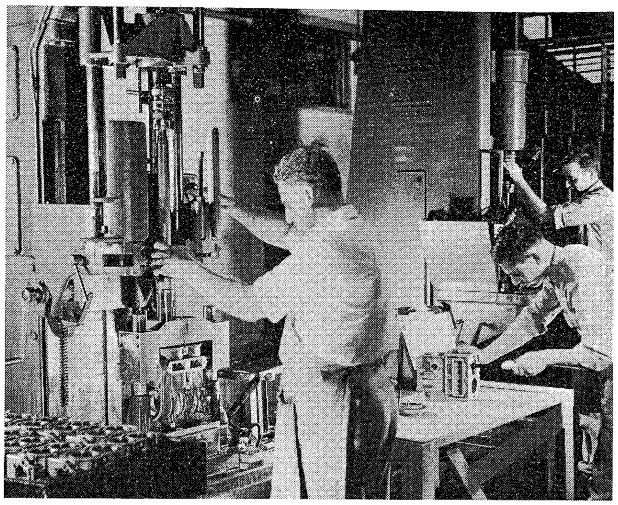
(Scene 13)
MR. SHOGREN:

After the completion of these tests, the horsepower certification test is conducted by the Outboard Boating Club of America, an independent agency which guarantees that Elgins develop their rated horsepower. This is the final step in development.



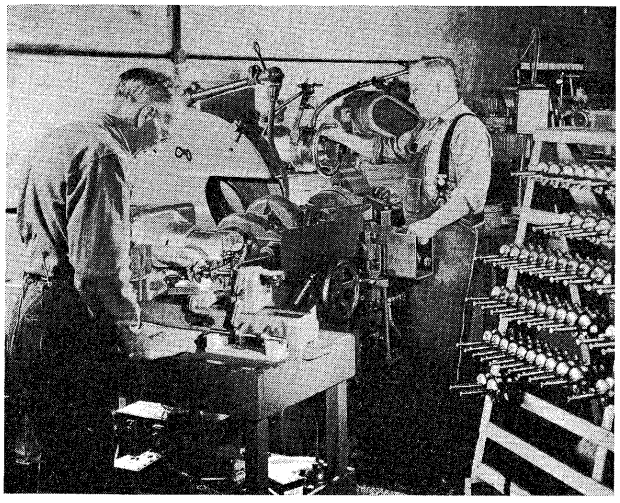
(Scene 14)
MR. SHOGREN:

A rigid inspection policy throughout all stages of manufacture, from raw materials to finished product, is an important factor in insuring the dependability and quality of Elgin motors.



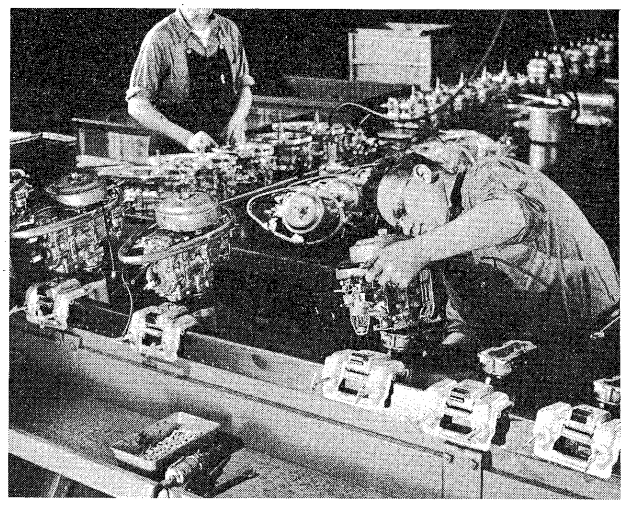
(Scene 15)
MR. SHOGREN:

Modern machines are used throughout the shop to speed production and cut costs. Here an inspector is checking parts for quality.



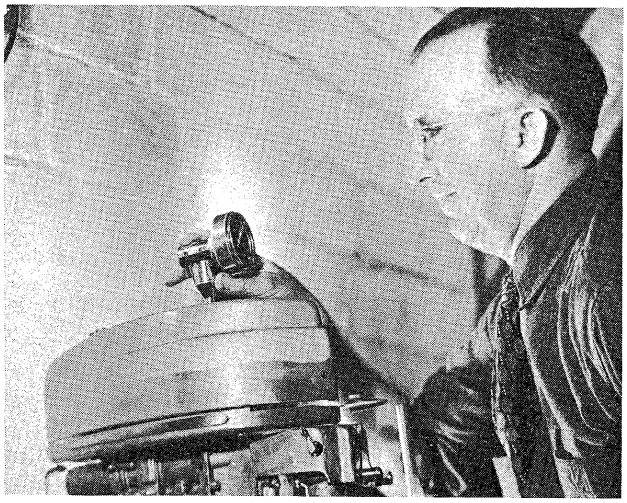
(Scene 16)
MR. SHOGREN:

In the crankshaft department, tolerances are measured in tenths-of-thousandths of an inch to insure perfect balance and parts interchangeability.



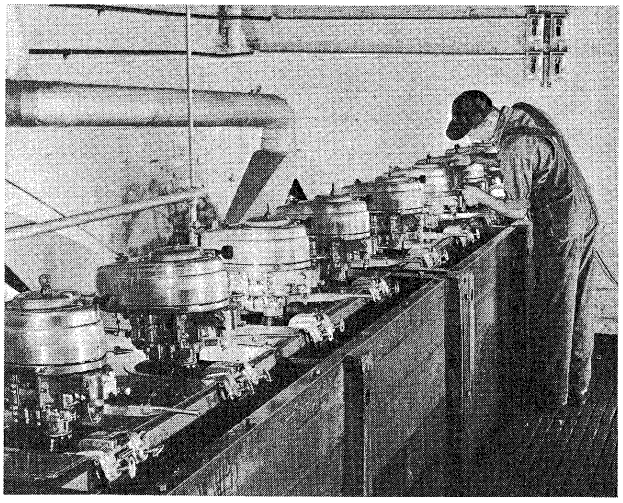
(Scene 17)
MR. SHOGREN:

The most modern assembly methods are used to insure quality at low cost.



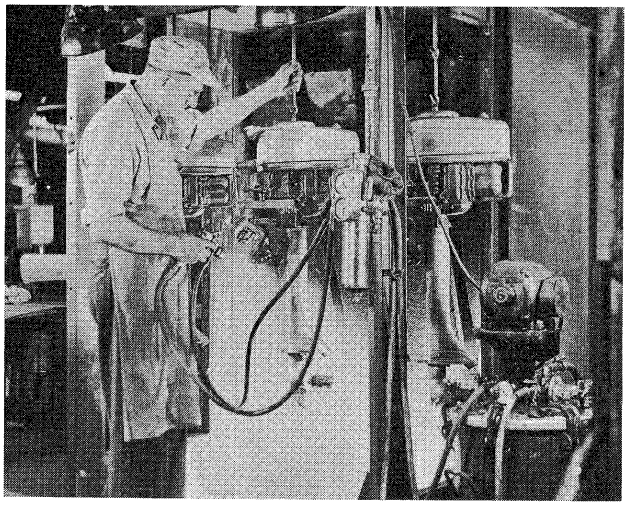
(Scene 19)

...where inspectors check each motor for smooth idling and running, acceleration, water pump output, and starter action.



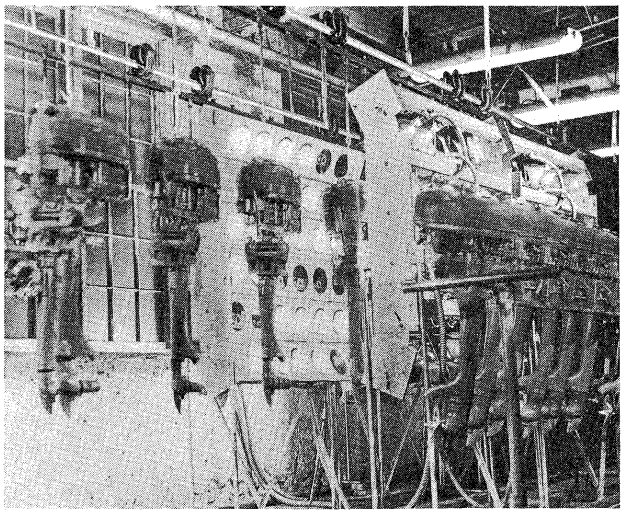
(Scene 18)
MR. SHOGREN:

Every Elgin is run in for one hour in the preliminary test tank and is then taken to the final test rooms...



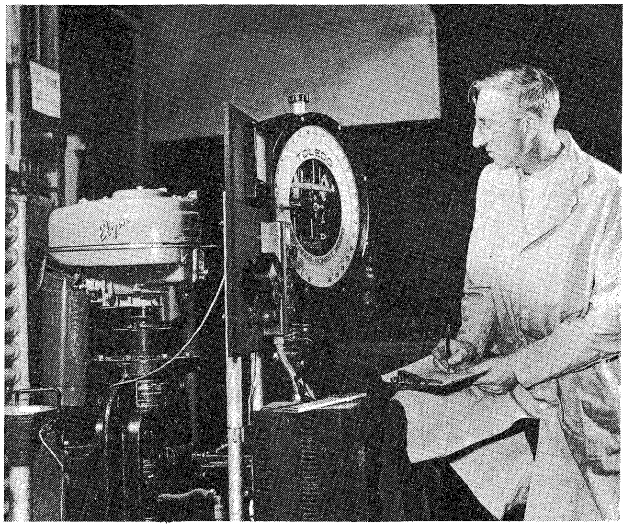
(Scene 20)
MR. SHOGREN:

A chemical film has been applied to the underwater Elgin parts to greatly increase their resistance to salt water corrosion. The engines are then cleaned and painted. The primer coat contains zinc chromate, developed by the Navy to resist salt water corrosion.



(Scene 21)
MR. SHOGREN:

Here, the finish coat of Elgin Marine Green, as well as the primer coat, is baked on by infra-red lights to insure a permanent, lasting finish.



(Scene 22)
MR. SHOGREN:

In addition to these tests, our own Sears' Laboratory at Chicago conducts independent tests -- not only on Elgin motors but on competitive motors as well -- in order to maintain a standard check on quality. Just another reason why you can say...

(Scene 23)

...the Elgin is the best outboard motor money can buy.

(Scene 24)
MR. SHOGREN:

It's fun to use an Elgin outboard. But...just like your car, an Elgin occasionally needs some attention. Let's see what's happening here.

(Scene 25)
CUSTOMER:

I'm going on my vacation tomorrow and would like to have my Elgin tuned up. It seems a little sluggish and I want it in first-class shape. Can you check it?

(Scene 26)
GIRL:

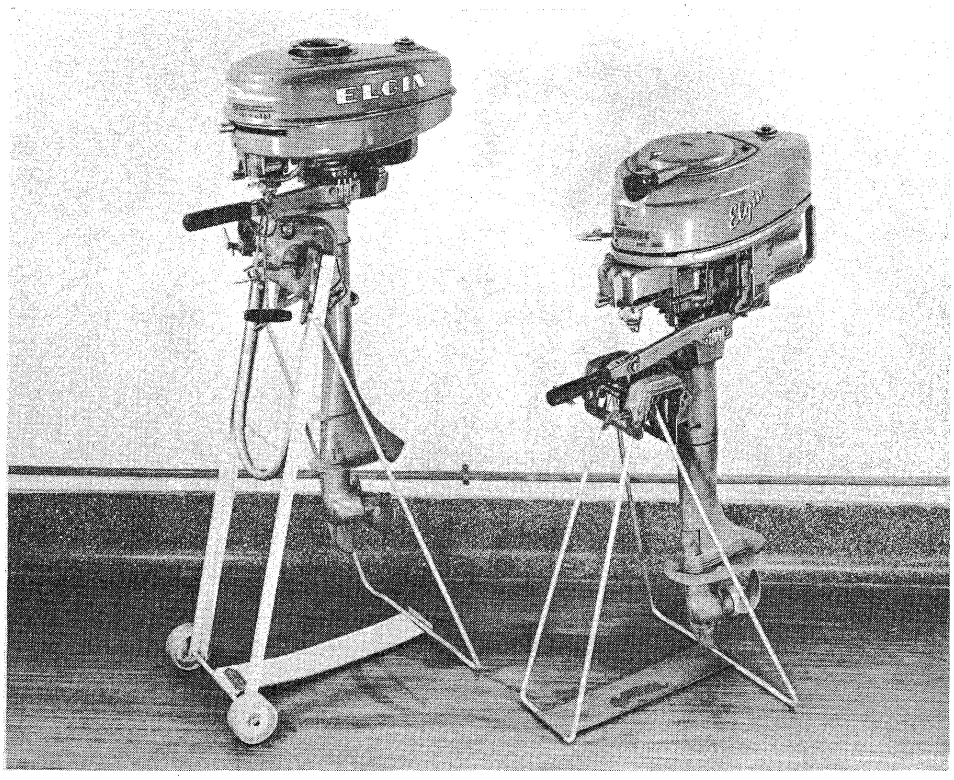
Why yes, we'll be glad to take care of it for you. It is rather short notice, but our servicemen really know Elgins.

(Scene 27)
GIRL:

Bill, this customer is leaving on his vacation tomorrow afternoon and would like to have his Elgin tuned up before he leaves. I told him you could do it.

SERVICEMAN:

Sure, be glad to

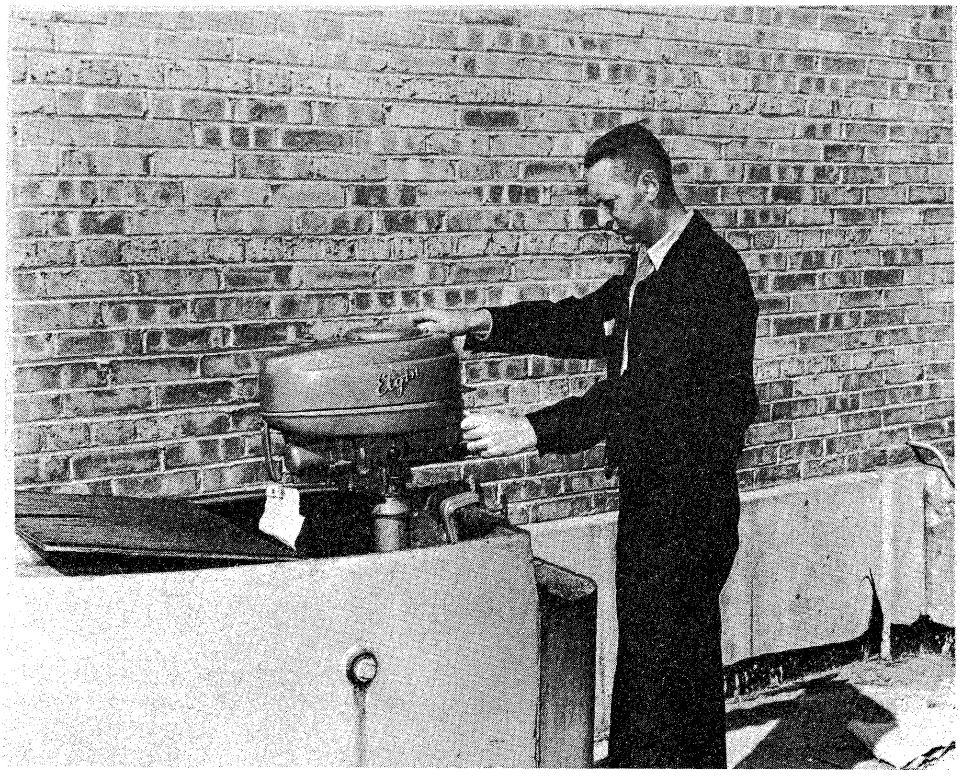


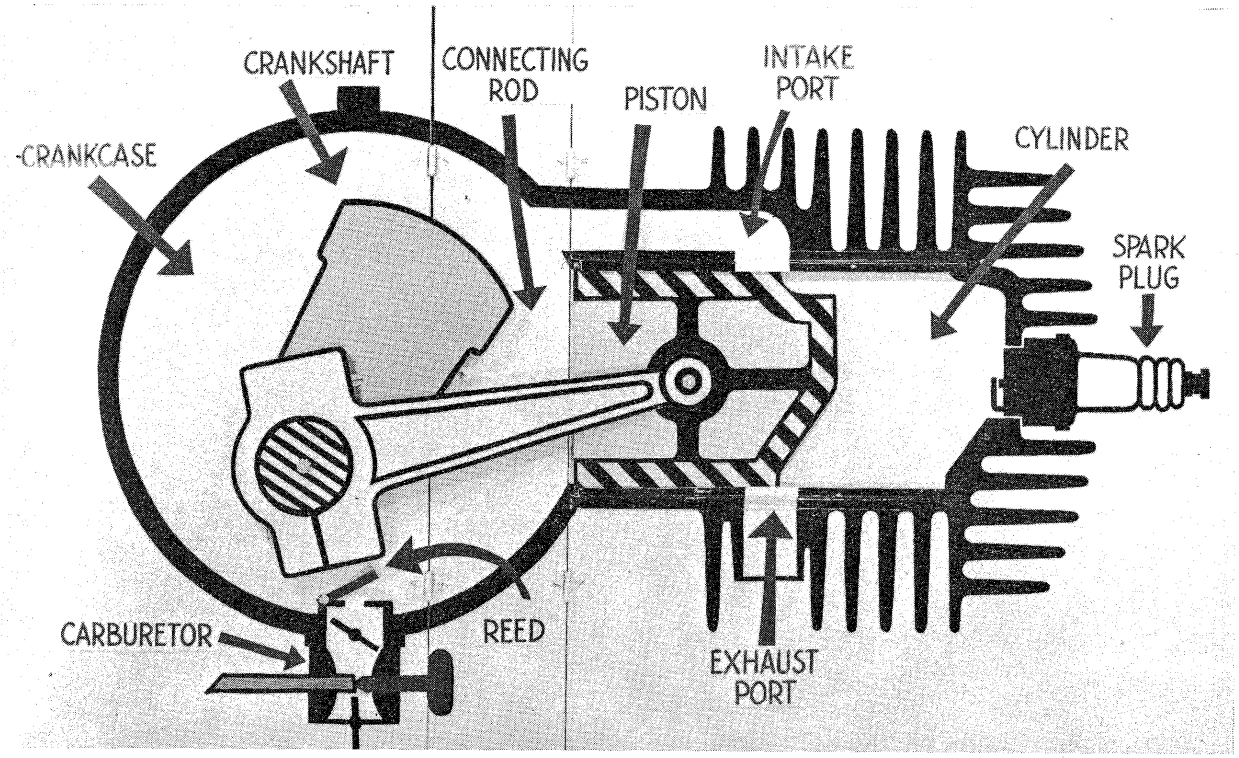
(Scene 27-A)
NARRATOR:

Be a good housekeeper. Always store customers' motors on a stand or movable rack to prevent damage to the merchandise while awaiting repair or delivery.

(Scene 28)
NARRATOR:

About 85% of your Elgin service problems can be solved by a minor tune-up. The other 15% will require a major overhaul due to normal wear, customer abuse or falling overboard.





(Scene 29)
NARRATOR:

In order to perform a tune-up on the Elgin motor, it is essential that you understand the principles of 2-cycle operation, carburetion and ignition. Here are the important parts of a 2-cycle engine.

1. METHOD OF DELIVERING FUEL TO THE COMBUSTION CHAMBER

2. LUBRICATION

3. FREQUENCY OF THE POWER STROKE

(Scene 30)
NARRATOR:

Two cycle engines differ from 4-cycle engines in the following ways:

1. Method of delivering fuel to the combustion chamber.

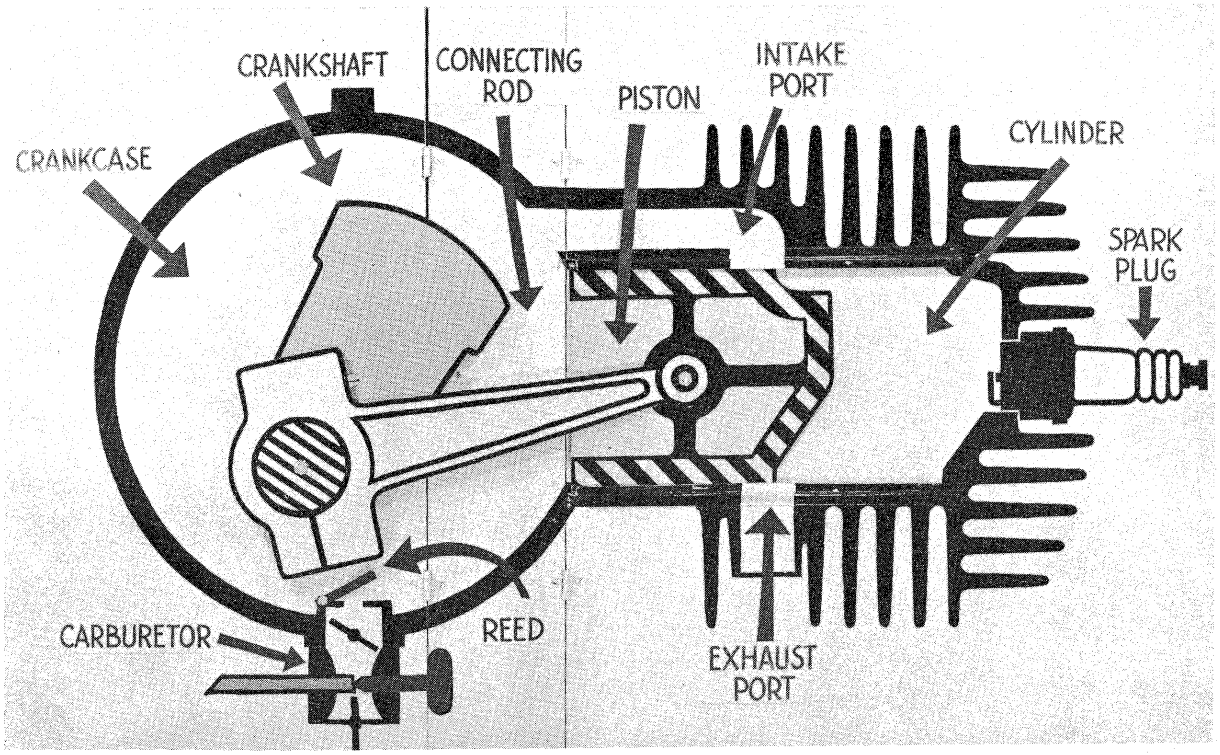
2. Lubrication.

3. Frequency of the power stroke.

1. METHOD OF DELIVERING FUEL TO THE COMBUSTION CHAMBER

(Scene 31)

Let's consider the first of these.



(Scene 32)
NARRATOR:

A two-cycle engine uses port openings rather than valves to admit the fuel and purge the exhaust from the combustion chamber.

The port holes are so located that they are opened and closed at the proper time by the piston as it travels up and down in the cylinder. The exhaust port is located higher than the intake port so that it opens first on the downstroke of the piston which permits the exhaust phase to begin slightly sooner than the intake phase.

The spacing between the ports is so slight that both port holes are open almost simultaneously. For this reason, the pistons of a 2-cycle engine have a 'deflector' top which the incoming fuel charge strikes as it enters the combustion chamber. This deflector creates turbulence in the incoming charge which gives more complete combustion and forces exhaust gases out of the cylinder.

2. LUBRICATION

(Scene 33)
NARRATOR:

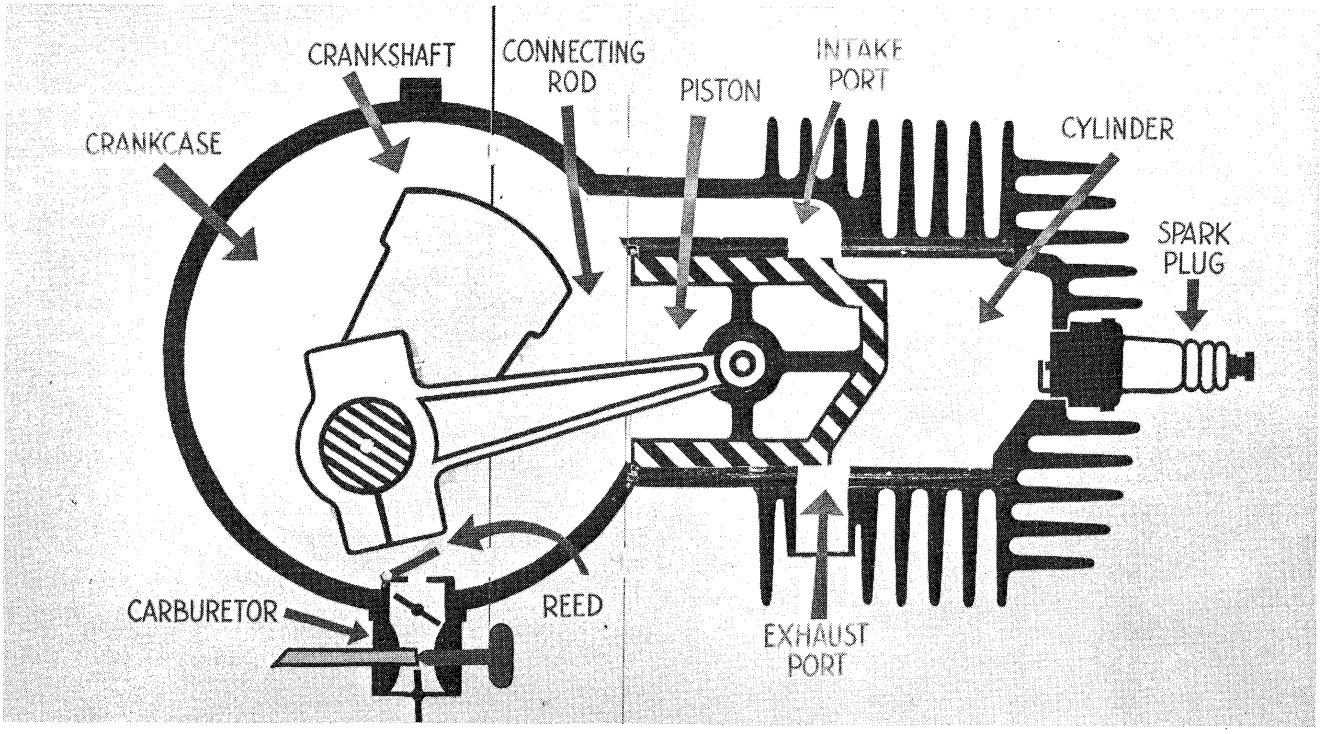
Now for the second point, lubrication. A 2-cycle engine is lubricated by the oil mixed with the fuel. Parts are lubricated as the fuel mixture passes through the crankcase and cylinder. A 4-cycle engine has a crankcase which contains oil. The oil is distributed by a pump or the "splash" system. No oil is added to the fuel.

3. FREQUENCY OF THE POWER STROKE

(Scene 34)
NARRATOR:

Third is frequency of the power stroke. There are four phases to a combustion cycle:

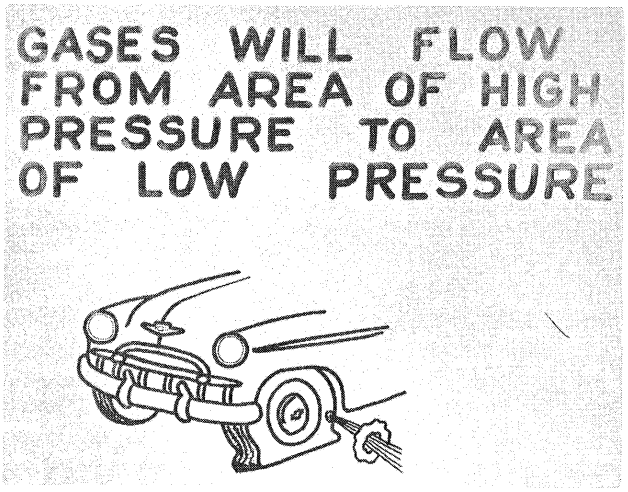
1. Intake
2. Compression
3. Power
4. Exhaust



(Scene 34-A)
NARRATOR:

In a two-cycle engine, two phases of the cycle are accomplished with every stroke of the piston and a power stroke occurs for every revolution of the crankshaft.

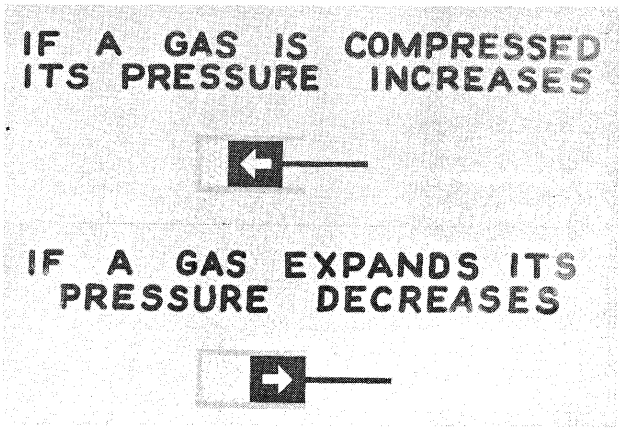
In a four-cycle engine, a stroke of the piston is required to accomplish each phase. A power stroke occurs for every two revolutions of the crankshaft.



(Scene 35)
NARRATOR

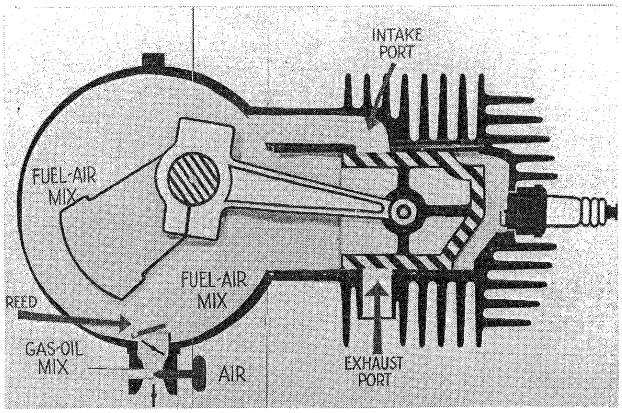
Two simple physical laws make a two-cycle engine possible:

First: Gases will flow from an area of high pressure to an area of lower pressure (like in a blowout).



(Scene 36)

Second: If a gas is compressed into a smaller area, the pressure increases and if a gas expands into a larger area, its pressure decreases. Keep these facts in mind as we discuss two-cycle operation.



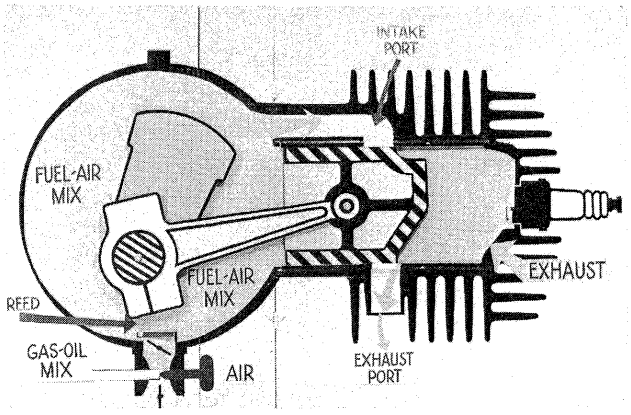
(Scene 37)
NARRATOR:

Here is a two-cycle engine in operation. Air, shown in blue, enters the carburetor -- mixes with the gas-oil mixture, shown in yellow, -- to produce the fuel-air mixture, shown in green.

The piston is approaching top dead center on the compression stroke. The red above the piston represents the spark plug firing. This ignites the compressed fuel-air mixture beginning the power stroke. Notice that both the intake and exhaust ports are closed by the piston.

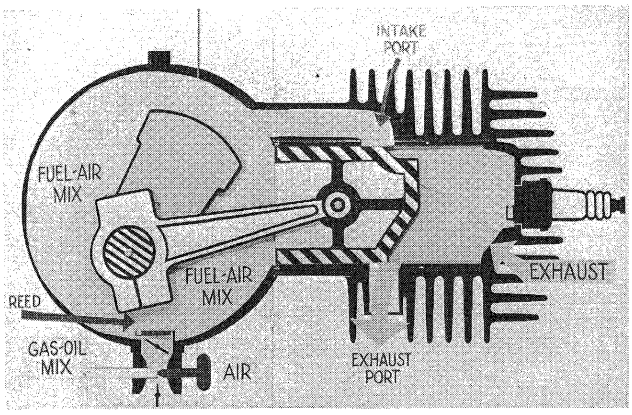
The reed valve is open, because, as the piston moved upward, the crankcase volume increased, reducing crankcase pressure to less than atmospheric.

At this point, air began to flow from the atmosphere into the carburetor where it picked up fuel -- then passed through the open reed valve into the crankcase.



(Scene 38)
NARRATOR:

Here the piston has moved down further on the power stroke. The combustion chamber is filled with burning gases shown in red, and as the exhaust port is uncovered, these which are under great pressure, rush out through the exhaust ports. As the piston moves down, pressure within the crankcase increases, closing the reed valves against their seats. This makes the crankcase a sealed chamber within which the fresh fuel charge is compressed ready for delivery to the combustion chamber.



(Scene 39)
NARRATOR:

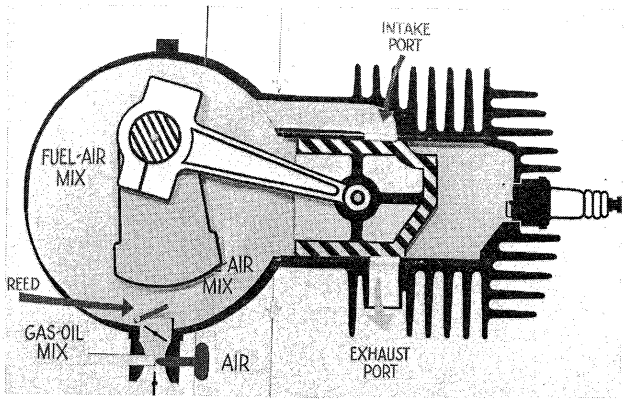
In this view, the piston is still moving downward and has uncovered the intake port.

As soon as the intake port is open, the fresh fuel charge rushes through the intake port into the combustion chamber.

It strikes the top of the piston -- is deflected along the cylinder wall as indicated by the green area in the cylinder.

The turbulence created by the deflector forces the exhaust gases out and gives more complete combustion.

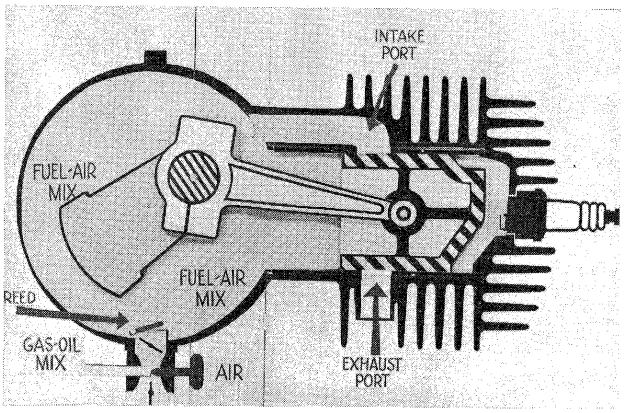
Notice that the reed valve is still closed and will remain closed until the piston moves upward again.



(Scene 40)
NARRATOR:

The piston is moving up on the compression stroke. The intake and exhaust ports are closed and compression of the fresh fuel charge takes place in the combustion chamber.

Pressure in the crankcase decreases as the piston moves up and a fresh charge of air flows through the carburetor where it picks up fuel.



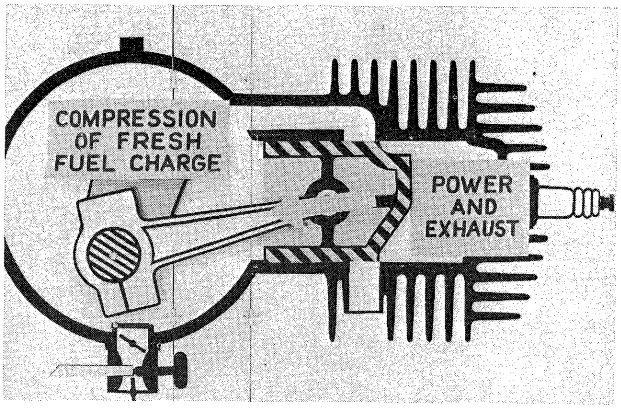
(Scene 41)
NARRATOR:

As the piston approaches top dead center, the spark plug fires - the power stroke begins and the cycle is complete. The exact time when the spark plug fires varies with engine speed.

At low speed the spark is retarded - fires later - when the piston is at or beyond top dead center.

This timing is built-in at the factory and cannot be changed in the field, except for the amount of spark advance and retard provided by the movement of the magneto control handle.

At high speed, the spark is advanced - fires earlier - before the piston reaches top dead center.

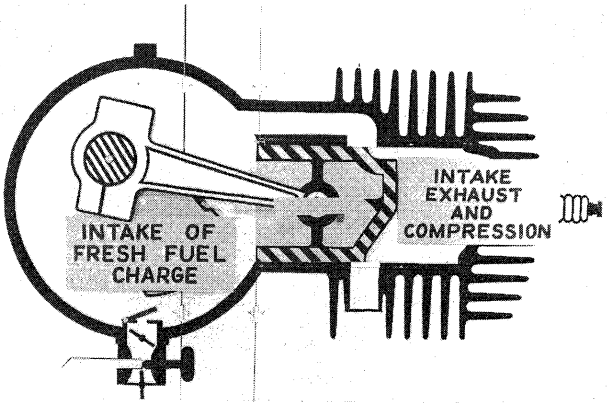


(Scene 42)
NARRATOR:

As you have seen, more than one phase of the cycle occur simultaneously in a two-cycle engine.

On the downstroke, power occurs above the piston as long as the ports are closed.

As soon as the ports open, exhaust begins and intake follows soon after. Below the piston, the fresh fuel charge is compressed in the crankcase.

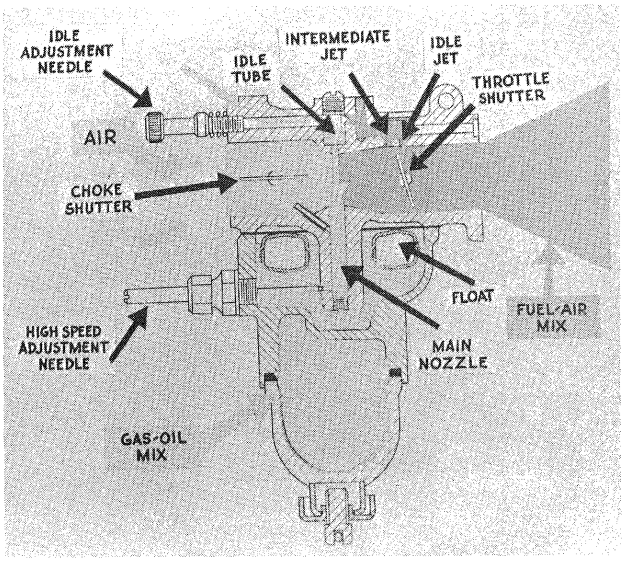


(Scene 43)
NARRATOR:

On the upstroke, exhaust and intake continue as long as the ports are open.

Compression begins when the ports are closed and continues until the spark plug fires.

Below the piston, a fresh fuel charge is drawn into the crankcase ready to be compressed during the next cycle.



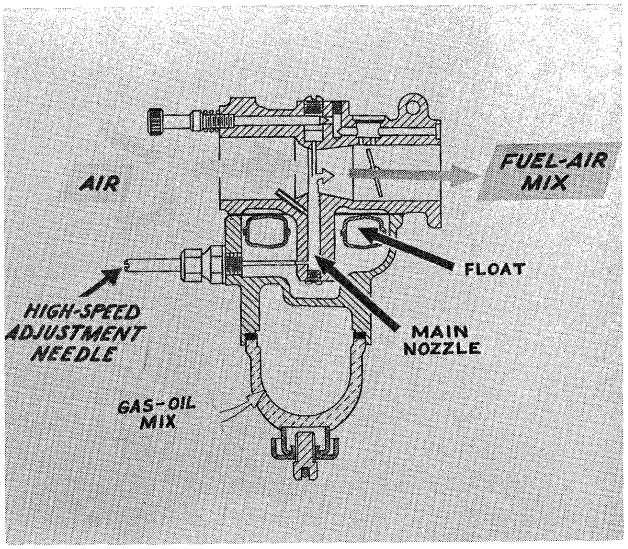
(Scene 44)
NARRATOR:

You have seen how a two-stroke-cycle engine operates -- now let us find out what the carburetor does.

The function of the carburetor is to mix air with the gasoline-oil mixture in the proper proportions to assure efficient combustion.

Too much air for the amount of fuel gives a "lean" mixture which causes hard starting, poor idling, and poor high speed performance. "Popping" is a sign of leanness.

Too much fuel for the amount of air gives a "rich" mixture which causes hard starting, flooding, galloping and incomplete combustion. A rich engine will not accelerate rapidly but will stutter a few seconds until the crankcase is cleared of excess fuel.



(Scene 45)
NARRATOR:

The carburetor is quite simple.

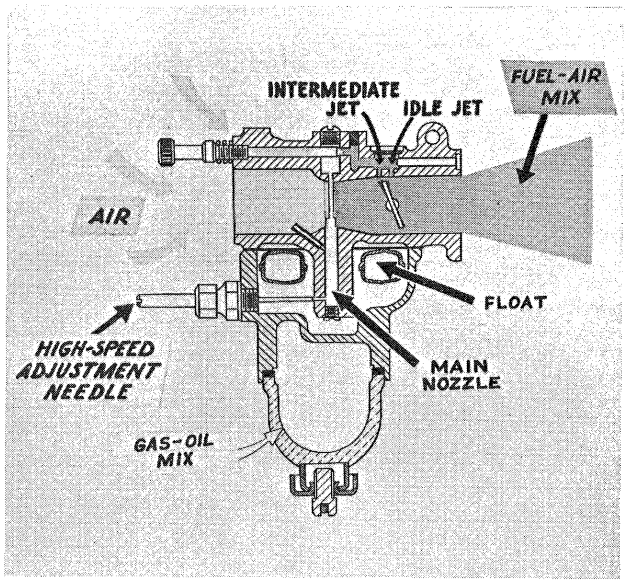
The gasoline-oil mixture indicated by yellow, flows to the carburetor by gravity in all models except the 16 H.P. which has a fuel pump.

The float controls the fuel level by opening and closing the inlet needle.

As fuel is used by the engine, the float drops with the fuel level, causing the inlet needle to open and allow more fuel to enter. When the fuel level rises, the float also rises, closing the inlet needle and shutting off the fuel.

The high speed adjustment needle controls the amount of fuel that enters the main nozzle.

Air, shown in blue, enters the carburetor, picks up fuel from the main nozzle, and the resulting fuel-air mixture, in green, passes through the reed valves into the crankcase.



(Scene 46)
NARRATOR:

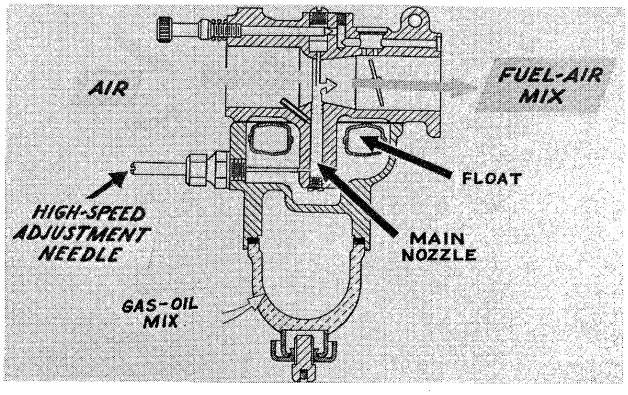
The fuel requirement of the engine changes as speed is changed.

The correct amount of fuel for each speed is metered by one or more of the three jets shown. Rate of flow is determined by the size of the hole and the velocity of air passing through the venturi.

The main nozzle, or jet, delivers the fuel required for high speed. The idle jet delivers the fuel mixture for low speed.

The intermediate jet meters the additional fuel needed in the "middle range" before the main nozzle begins to function at high speed.

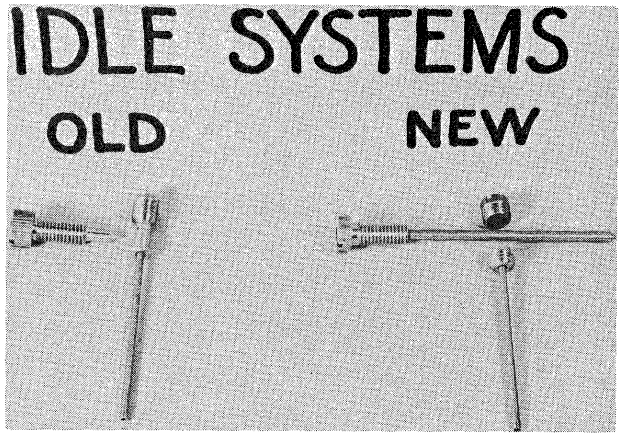
Let us see what happens when the engine is started.



(Scene 47)
NARRATOR

The float bowl is full of fuel and the high speed adjustment needle is open to permit fuel to enter the main nozzle.

As the pressure in the crankcase decreases, air rushes into the carburetor - blue at upper left. As the air passes over the main nozzle, pressure differences cause fuel - yellow - to rise through the main nozzle and mix with the incoming air. The green fuel-air mixture then passes through the open reed valves into the crankcase, where it is compressed on the next down-stroke of the piston.



(Scene 48)
NARRATOR:

The idle system of the carburetor is separate from the high speed system.

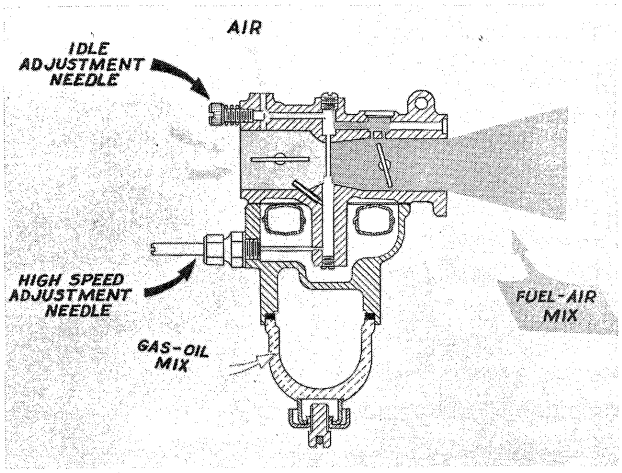
Two different idle systems have been used in Elgin carburetors todate.

The original version can be identified by the short adjusting needle and the long idle tube seen at the left.

The new version has a longer adjusting needle, a shorter idle tube and a small plug to provide access to the idle tube.

(Scene 49)
NARRATOR:

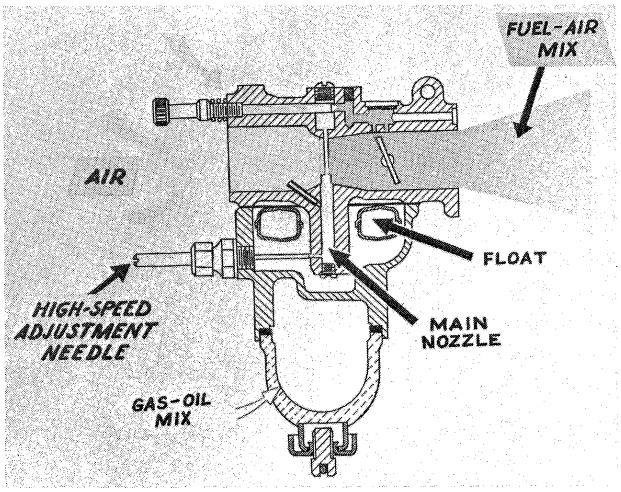
In the original version, air enters the idling passage through two small holes located directly behind the idle adjusting needle.



Fuel comes up through the idle tube, passes through a small hole near the top and mixes with the air.

This fuel mixture, shown in green, then passes through the idle or intermediate jet, or both and goes into the crankcase.

The amount of fuel is determined by the size of the hole in the idle tube. This hole must be kept open at all times. Always check and clean it when servicing a carburetor of this type. The amount of air is variable and is controlled by the idle adjusting needle. Only the amount of air is adjustable in this version.



(Scene 50)
NARRATOR:

In the new carburetor, air enters through a small hole located on the outside of the carburetor. The top blue arrow points to the approximate location

Fuel comes up through the idle tube, mixes with the air and passes through the idle or intermediate jet, or both, to the crankcase.

Notice that in this version, the fuel and air mix before they reach the point of adjustment.

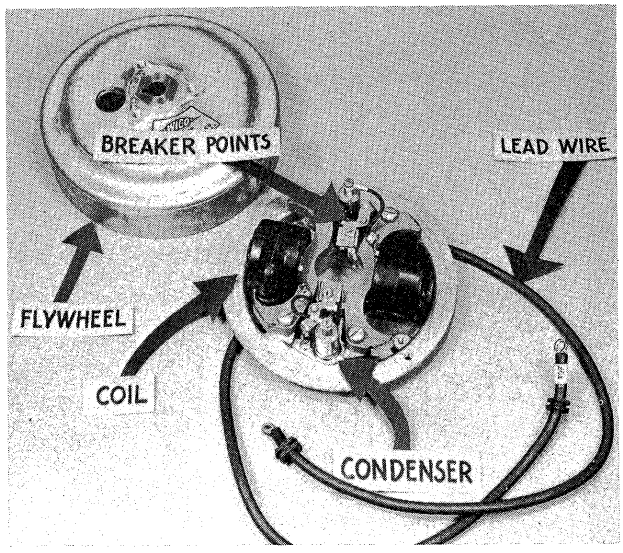
The volume of fuel mixture can be controlled more accurately and better idling results.

The hole in the idle tube is larger and does not readily clog with dirt. More will be said about carburetors in the section on tune-up.

DETAILS OF IGNITION

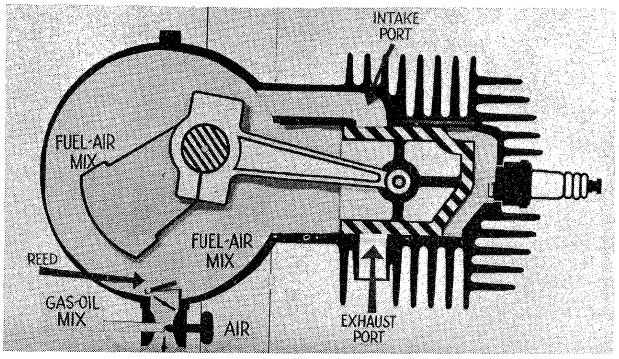
(Scene 51)
NARRATOR:

We assume that you servicemen have a working knowledge of magneto ignition and we'll show only how to service the Elgin magneto.



(Scene 52)
NARRATOR:

The function of a magneto is to generate an electrical spark discharge of sufficient strength to jump the gap of the two spark plug electrodes at the exact time the engine requires the spark. Spark timing is built-in at the factory and cannot be changed in the field beyond the limits of the magneto control lever adjustment.



(Scene 53)
NARRATOR:

Actually, three interrelated events must be "timed" in relation to each other. Intake port opening, exhaust port opening and the time of spark discharge.

The intake and exhaust ports are opened and closed by the piston.

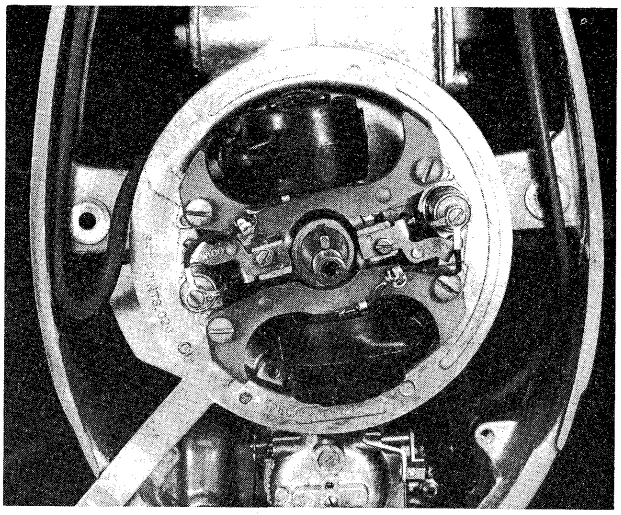
This timing is determined by the position of the crankshaft throw.

Spark discharge is controlled by the high point of the breaker cam which operates the breaker points in the magneto.

This cam is attached to the crankshaft by means of a key. Its position is fixed in direct relationship to the crankshaft throws. These are the built-in, invariable factors of spark timing.

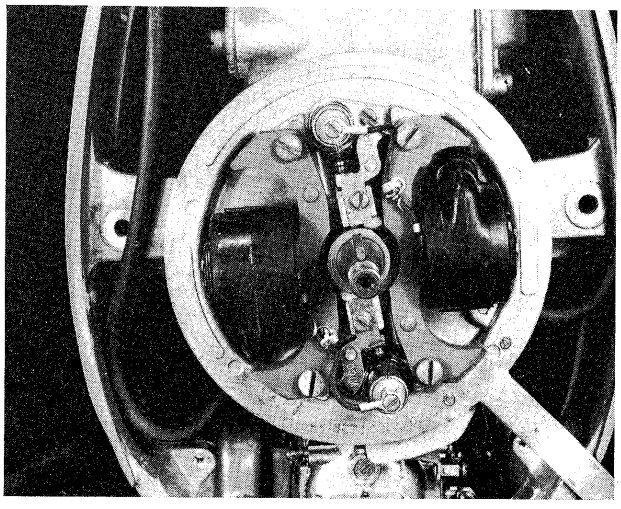
(Scene 54)
NARRATOR:

The only variable factor of spark timing is the adjustment of the amount of spark retard or advance to compensate for engine speed requirements. The adjustment is made by moving the magneto control lever clockwise to retard or counterclockwise to advance.



Here the magneto control lever has been moved to full retard.

Note that the cam followers of the breaker points are located at approximately 3 and 9 o'clock. The high point of the breaker cam is at 1 o'clock. As the crankshaft rotates, the high point of the breaker cam must travel 60 degrees to open the breaker point now at 3 o'clock and then must travel another 180 degrees to open the breaker point located at 9 o'clock.



(Scene 55)
NARRATOR:

Here we see the magneto with the spark

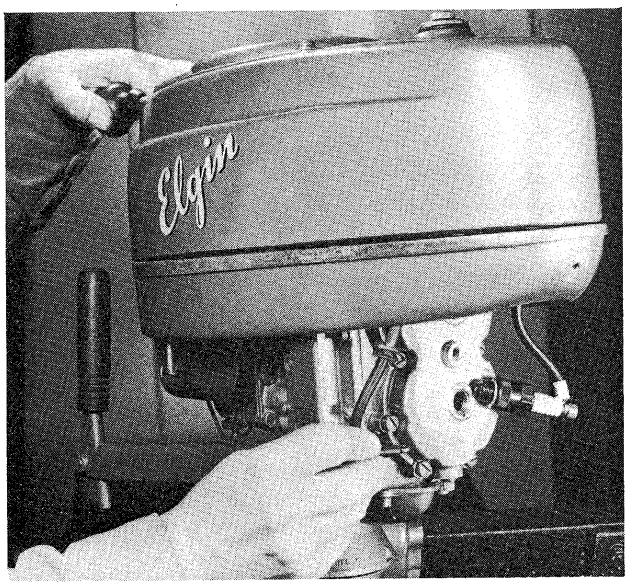
fully advanced.

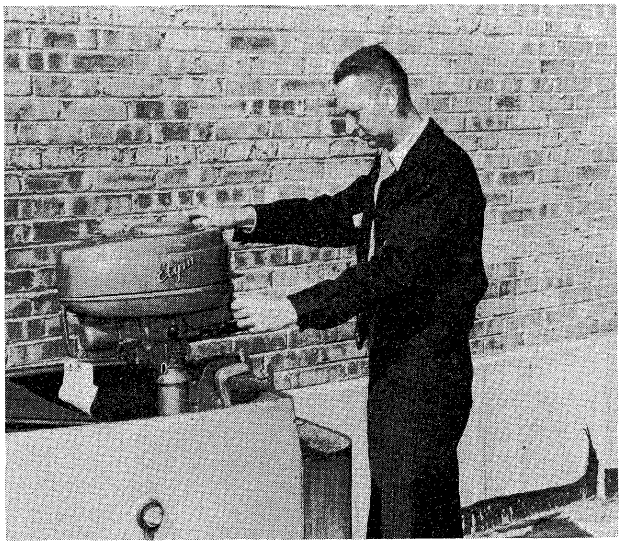
The high point of the breaker cam is still located at 1 o'clock but notice how the positions of the cam followers have changed.

The follower from 9 o'clock has advanced to approximately 6 o'clock while the follower from 3 o'clock has advanced to 12.

The top breaker point is still open and the breaker cam must travel only 150 degrees to open the other set of points. Thus, the time of spark plug firing is 'advanced'.

Service procedures for checking ignition will be covered in proper sequence.





(Scene 56)
NARRATOR:

Now let's look in on Bill and see how he tunes up the customer's Elgin.

The first thing Bill does is to put the Elgin in this tank and try to get it started.

If it doesn't start in 4 or 5 pulls, it probably won't start at all. Might as well start looking for the trouble, Bill. Why not check the ignition first?

(Scene 57)
NARRATOR:

Remove the carrying handle and spark plug cover if engine has them -- then, remove the magneto lead wires from the spark plug.

Be sure there is no free gasoline around the engine. Hold the lead wire terminal about 1/8" away from the head or metal part of the motor.

Rotate the crankshaft by pulling the starter rope. If the magneto is operating properly, a spark will jump from the lead wire terminal to the motor block.

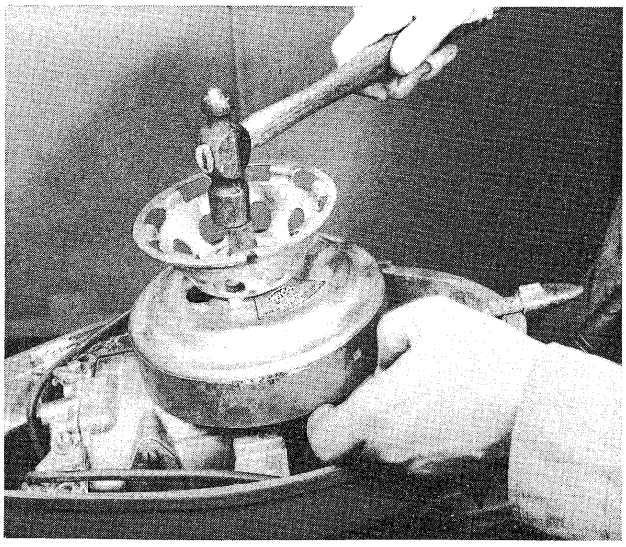
Repeat for other lead wire if motor is a twin.

If no spark is seen at one or more terminals, the magneto requires servicing.

To see if the spark plug is firing, remove the plug from the engine, attach the lead wire and place plug against the engine where electrodes can be observed as shown.

Pull the starter rope and see if a spark jumps the gap.

If no spark is seen, remove the spark plug and examine for cracks or breaks in the porcelain, fouled or burned electrodes or improperly spaced gap. If the spark plug looks bad, install a new one and repeat this procedure.



(Scene 58)
NARRATOR:

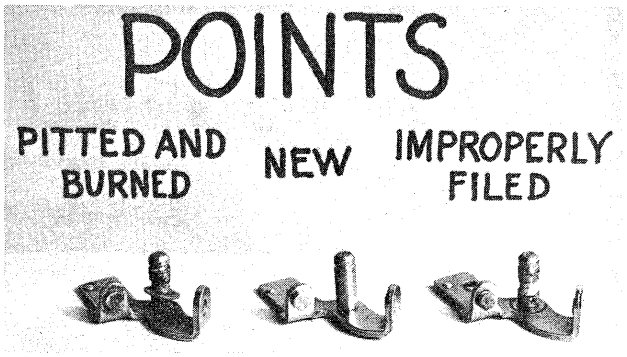
In order to service the magneto, it is necessary to remove the gasoline tank, fuel line and in some models, the instrument panel.

While the gasoline tank is off, clean and flush it out.

Blow out fuel line. Close the gasoline shut-off valve and air vent before removing the fuel tank. Remove the flywheel nut and lockwasher.

Use flywheel nut, part number 18091, as a flywheel knock-off nut. Turn it down to within two turns of the flywheel, then strike nut sharply with a medium weight hammer, lifting up on edge of the flywheel with the fingers at the same time, as shown.

Do not use a heavy hammer or strike too hard as you might bend the crankshaft. Lift off flywheel.



(Scene 59)
NARRATOR:

Check the breaker points. If burned or pitted, replace.

Breaker points should have a white, frosty appearance rather than a blue, cindery one as shown in the points on the left.

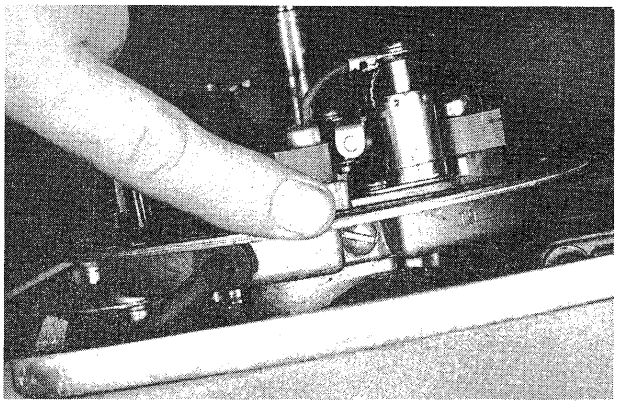
If points are dirty or oily, clean with a good solvent.

The filing of breaker points *is not recommended* as it is extremely difficult to file them and keep the face of the point flat.

The points at the right were improperly filed.

One side was considerably lower than the rest and no contact was obtained at this point.

If breaker points are pitted or burned, the condenser should be replaced as it is weak or leaks. Check the condenser for dielectric resistance, series resistance and capacity. Low voltage test equipment is necessary. Refer to SERVICE, Volume 12, Number 22, November 1951 for data on test equipment.



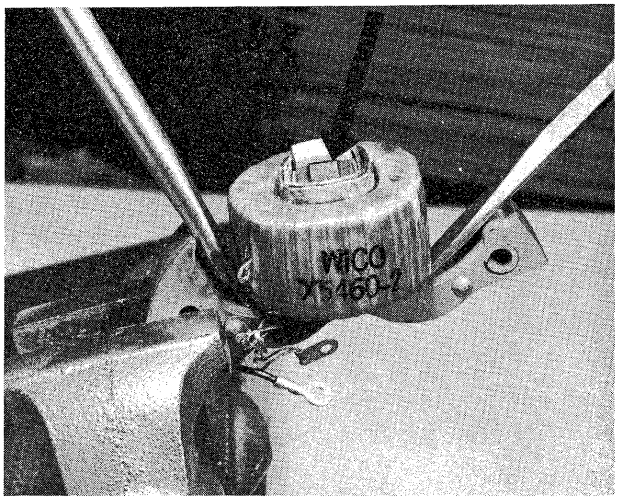
(Scene 60)
NARRATOR:

In order to check the magneto or parts on test equipment or if power head disassembly is indicated, it is necessary to remove the stator plate from the engine.

The stator plate is held in place by

the friction screw shown here.

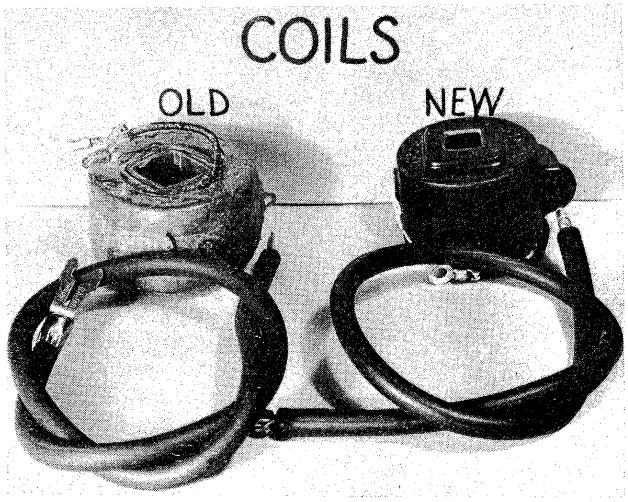
Loosen the screw until the stator plate can be lifted off -- do not completely remove screw. When reassembling the stator plate to the engine, tighten the friction screw just enough to provide sufficient tension to prevent the magneto control handle moving from vibration when the engine is running.



(Scene 61)
NARRATOR:

After the breaker points and condensers have been replaced and there is still no spark, check the coil. Use the proper test equipment and check for continuity, marginal leakage and spark discharge. To remove the coil from the core, bend the small tab indicated by the arrow, back against the core. Use two screw drivers and pry up as shown.

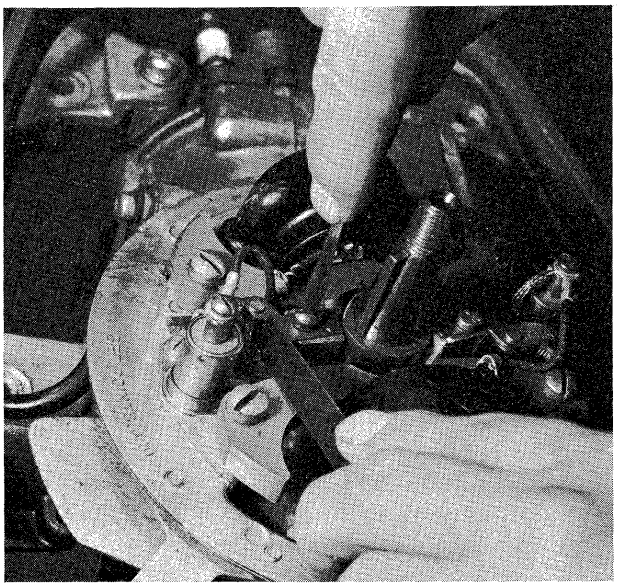
Replace coil and bend tab out away from the core to clamp coil in place.



(Scene 62)
NARRATOR:

Always check all wires in a magneto for broken insulation and loosen connections.

On the old style coil shown in the left, the lead wire threads through the ear on the coil. On the new style coil, a "plug-in" connection is found. Be sure that these connections are tight. If a spark plug cover is used on a motor which has the thrust type terminal as shown on the lead wire to the left, a spark plug protector must be used to prevent shorting out against the spark plug cover.



(Scene 63)
NARRATOR:

After the magneto has been completely checked and reassembled to the motor, check the breaker point gap spacing.

The correct spacing is .020 for all models using the Wico magneto.

Before installing the flywheel, make sure the breaker cam is properly installed.

The arrow which shows the direction of rotation should be up.

To set the points, rotate the crankshaft until the cam follower is located

at the keyway -- this will be the high point of the cam.

Loosen the screw which attaches the breaker point to the stator plate -- but do not remove.

Press the breaker plate toward the crankshaft until the points are open .020.

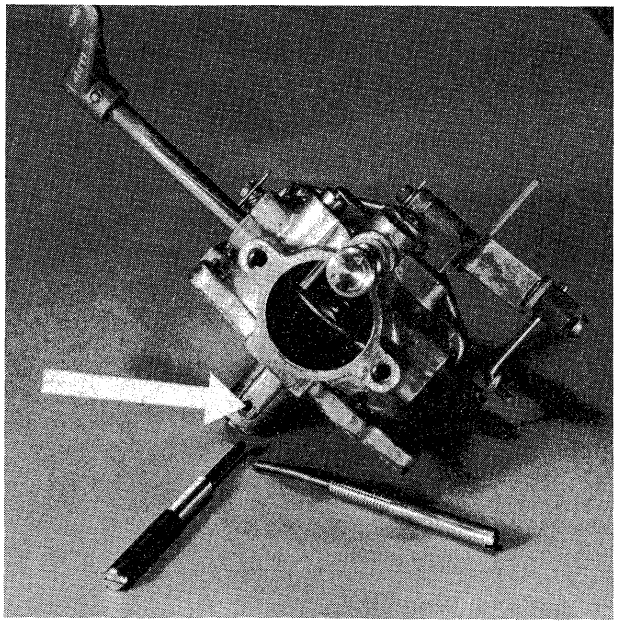
Check the spacing with a feeler gauge as shown.

Tighten the screw.

Repeat this procedure for the second breaker point if used.

Install flywheel, lockwasher and nut. Tighten nut securely.

Attach magneto lead wires to the spark plug terminals. Be sure the one marked "TOP" is assembled to the upper spark plug.



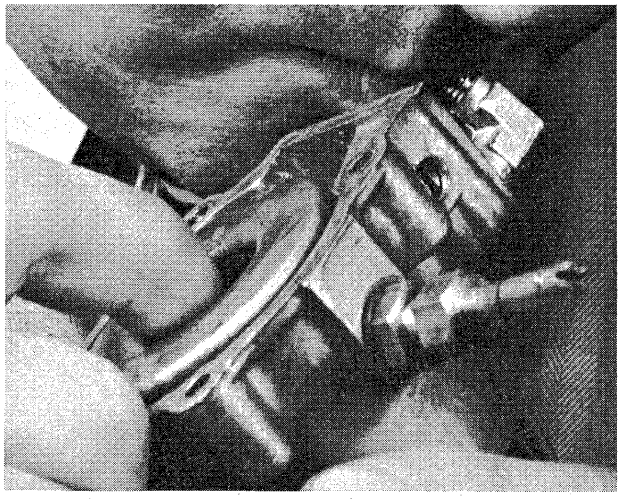
(Scene 64)
NARRATOR:

Remove the carburetor from the engine. Turn the main adjustment needle counter-clockwise several turns to prevent damage to the main adjustment needle and seat when disassembling. Separate carburetor into halves. Do not blow compressed air into an assembled carburetor as it will collapse the float.

The main adjustment needle controls the amount of fuel which enters the main nozzle; therefore, it is very important that the needle be straight, not worn excessively and that the seat indicated by the arrow is undamaged.

The needle at the right is badly bent at the tip. If this needle were forced into the seat, it would cause enough damage to make replacement of the entire carburetor necessary.

Clean the carburetor with a good solvent prior to inspection of the parts.



(Scene 65)
NARRATOR:

Check the inlet needle and seat to see if it is operating properly.

Blow through the carburetor elbow - lift the float up as far as possible.

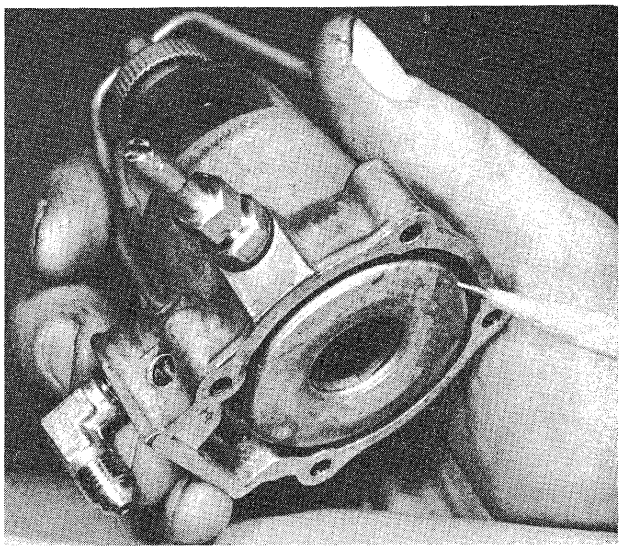
If the inlet needle is seating, the needle should close the passage and no air will pass through. Press the float down as far as it will go and blow again.

The needle should be lifted away from the seat and air should pass through.

If the float cannot be moved up and down or if the needle sticks, remove the large plug located near the carburetor elbow.

Inspect the inlet needle seat and replace if either the needle or seat is worn, corroded or rusty.

When installing the float, be sure the prongs on the float lever are engaged in the slot of the inlet needle.



(Scene 66)
NARRATOR

Check the float level.

This is important in maintaining the proper fuel level at all times.

If the float is too low - the engine will not have sufficient fuel for best high speed operation. If the float is too high -- the engine will flood. The proper float level can be determined by tipping the float bowl upside down, as shown here.

The free end of the float should extend beyond the body casting approximately 3/64th of an inch.

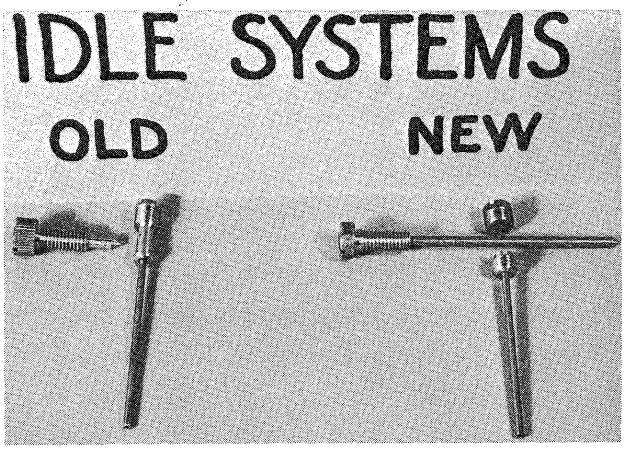
The float should never be lower than the body casting or more than 3/64 of an inch above it at the point indicated by the pencil.

(Scene 67)
NARRATOR:

Remove the idle tube and clean thoroughly.

All the fuel for low speed operation must pass through this tube, so the passage must be open.

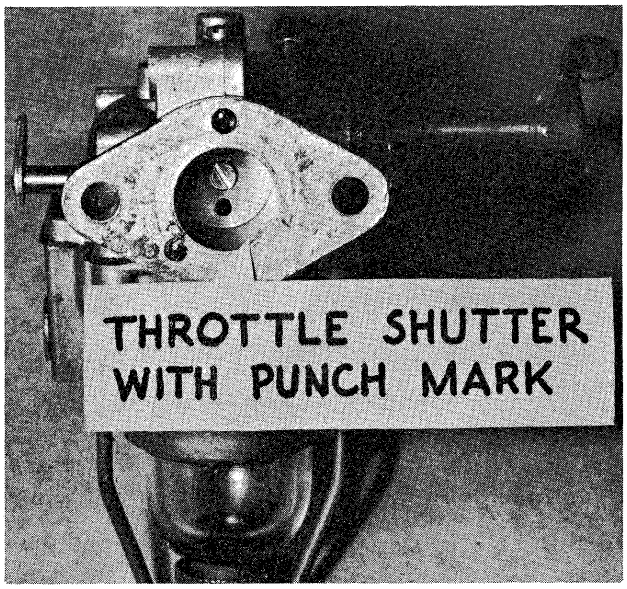
When reinstalling the idle tube, be



sure the idle tube gasket is in place.

If this gasket is omitted or damaged, air may leak into the fuel-air mix at this point causing the mixture to be leaner than desired.

Examine the idle adjustment needle and replace if bent or worn to excess.



(Scene 68)
NARRATOR:

Examine the throttle shutter to be sure it closes completely by the action of the return spring. Hold the carburetor with the choke bore away from you and look at the throttle shutter against a light.

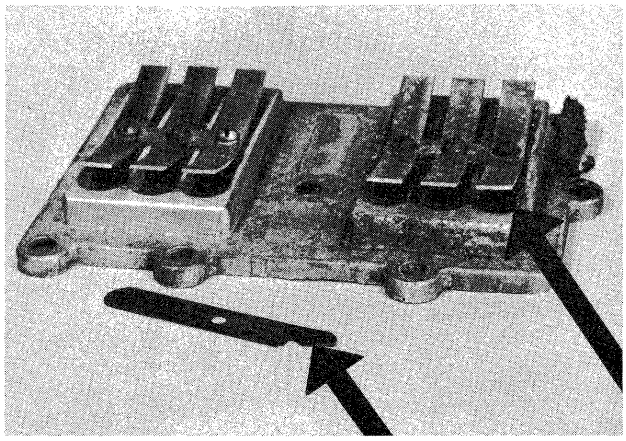
No light should appear around the edge of the throttle shutter when it is closed.

To adjust the position of the throttle shutter, loosen the screws and turn shutter until it fits properly.

Then tighten the screws.

If throttle shutter is removed for any reason, be sure to reinstall it with the identifying punch mark toward the rear flange as shown here, because the shutter has beveled edges which must match the sides of the bore when the shutter is closed.

Reassemble the carburetor halves using a new body gasket.



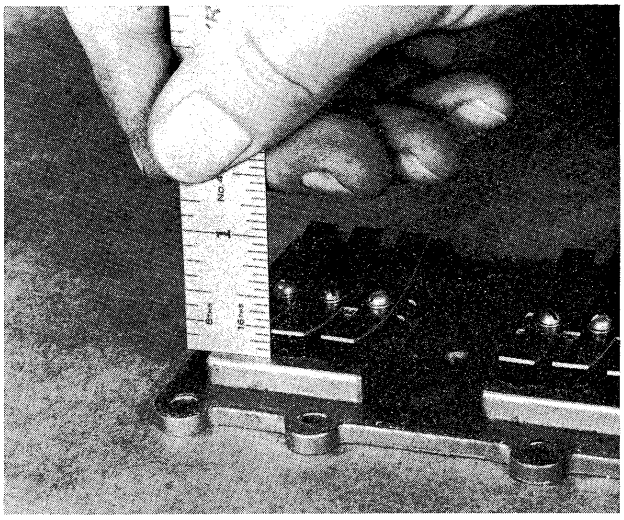
(Scene 69)
NARRATOR

Before reassembling the carburetor to the engine, remove the reed plate and inspect the reeds carefully. Replace all reeds which are cracked or broken as shown by the arrow on the left.

Dirt, rust and corrosion may cause the reeds to stand open, as shown by the arrow at the right. All reeds must seat tightly against the reed plate along their entire length, if they are to effectively seal the crankcase and prevent the escape of the fuel mixture during compression of the new fuel charge.

It may be necessary to remove the reeds and dress the reed plate with fine emery cloth to obtain a proper seating surface.

(Scene 70)
NARRATOR:

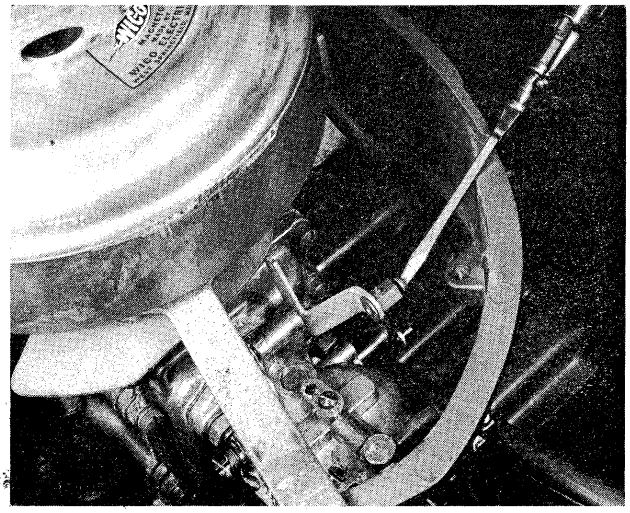


Check the height of the reed stop from the reed plate. This varies with different models -- see SERVICE magazine, Volume 13, June 1952, Number 8, for the correct spacing.

While the reed plate is off the engine, rotate the crankshaft and observe the condition of the connecting rods, bearings and cylinder walls.

If evidence of rust, corrosion, overheating, excessive wear or scoring is found, it will be necessary to disassemble the power head and replace the damaged parts.

If no power head repairs are indicated, reassemble the reed plate and carburetor to the engine, using all new gaskets.



(Scene 71) (see page 23)
NARRATOR

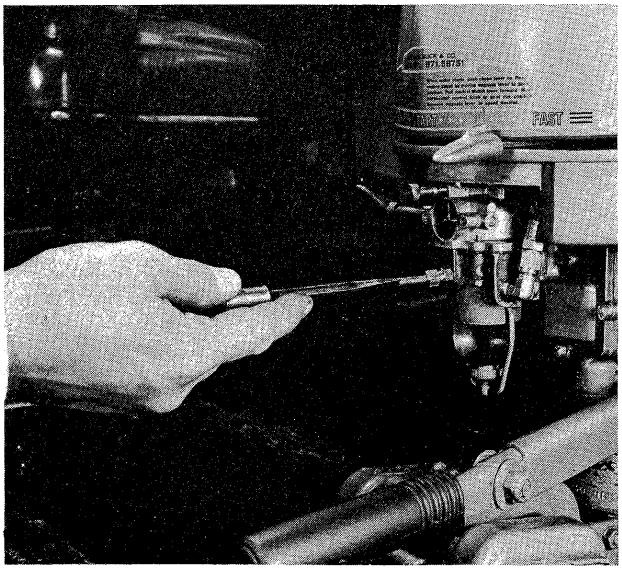
Before installing the gasoline tank, check the throttle linkage adjustment.

This adjustment is very important to good engine performance because it synchronizes the amount of spark advance with the amount of throttle opening. Movement of the throttle cam causes the bellcrank to move forward opening the throttle shutter by means of the throttle link.

By changing the effective length of this link, the time and amount of throttle opening can be varied. To make this adjustment, consult your parts book or Volume 13, June 1952, Number 8, of the SERVICE magazine for the correct setting for each model -- then move the magneto control lever to the position specified. At this position, the throttle should still be closed with all slack removed from the bellcrank mechanism.

When the magneto control handle is moved further to the right, the throttle should begin to open. When the magneto control lever has been moved as far as possible to the right, the throttle should be completely open.

If adjustment is necessary, loosen the screw indicated by the screw driver and lengthen or shorten the link as required to provide the correct adjustment.



(Scene 72)
NARRATOR:

Assemble the gasoline tank, connect the fuel line. Install the spark plugs and magneto lead wires. Then place the motor in a tank to adjust the carburetor. Begin with the high speed adjustment needle as this controls the amount of fuel which enters the main nozzle.

Turn the high speed needle clockwise until it is completely closed.

Just finger tight -- *do not force.*

This will give you a definite point from which to start adjusting.

Then turn the high speed needle counterclockwise about one full turn.

This will be a little rich but the engine will have sufficient fuel for starting.

Start the engine and allow it to warm up for a few minutes.

Advance the magneto control lever to "FAST" position -- to open the throttle.

Turn the high speed needle slowly in a clockwise direction, about 1/8th of a turn at a time, until the motor runs smoothly and at the greatest speed. Pause, for a few seconds, after each 1/8th turn to permit the new adjustment to take effect before turning further.

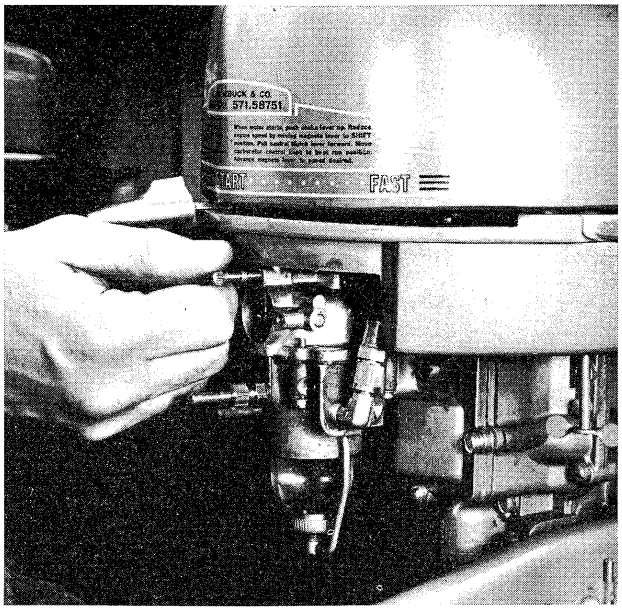
If the needle is turned clockwise too far, the engine will lose speed and stop due to leanness. If the needle is turned too far counterclockwise, it will lose speed and gallop from richness.

The correct adjustment is midway between these two points.

This will vary with different engines but will usually be between 5/8 and 3/4 of one turn open.

(Scene 73)
NARRATOR:

To adjust the motor for low speed operation, start the motor and make the high speed adjustment first. Turn the



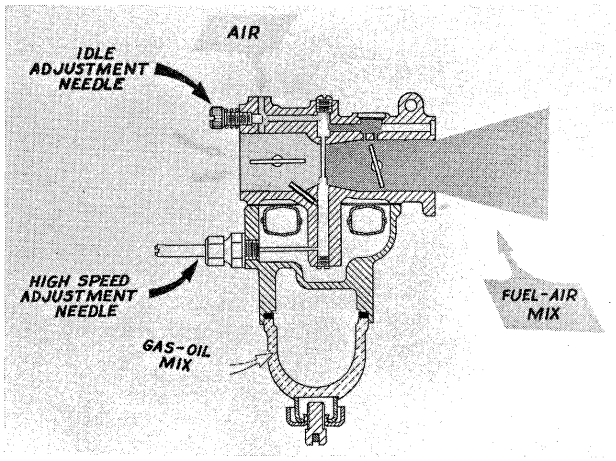
idle adjustment needle clockwise until it is completely closed.

Just finger tight.

Turn the idle adjustment needle counterclockwise about 1/2 turn -- retard the magneto control lever to "SLOW" position to close the throttle and observe engine performance.

If the mixture is too lean, the engine will pop, backfire and stop.

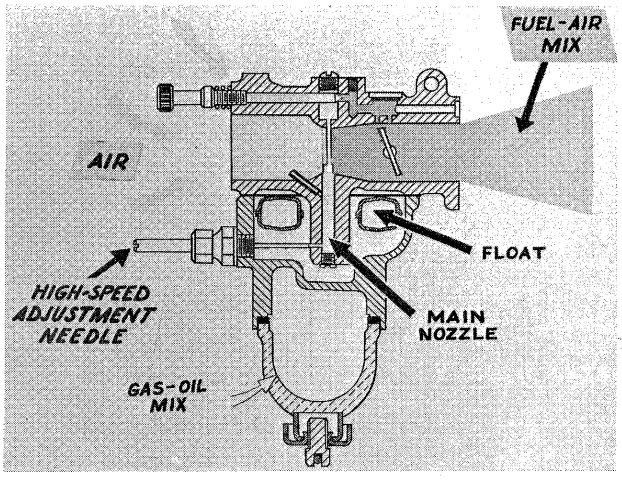
If the mixture is too rich, the engine will roll, gallop and run unevenly.



(Scene 74)
NARRATOR:

To adjust the idle needle of the original version Elgin carburetor, turn the needle clockwise to enrich, counterclockwise to make mixture leaner. Again, it is necessary to wait a few seconds for the adjustment to take effect before making a further adjustment.

With this idle system, the average idle needle setting will be from 3/8 to 5/8 of one turn open.



(Scene 75)
NARRATOR:

To adjust the idle needle of the new version of the Elgin carburetor, turn the needle counterclockwise to make richer, clockwise to make leaner. This is opposite to the older version.

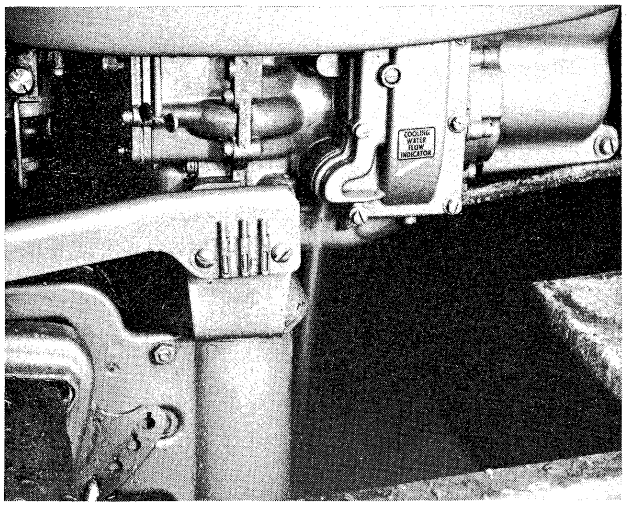
The average idle needle setting will be 5/8 to 3/4 of one turn open.

After the carburetor has been adjusted, install the carburetor control panel and the carburetor control knob -- always place the pointed indicator up toward the word "RUN" on the carburetor control, panel before tightening the set screw.

This will establish the best running position in the center of the panel and allow one quarter turn in each direction to permit further adjustments to be made without removing the knob.

(Scene 76)
NARRATOR:

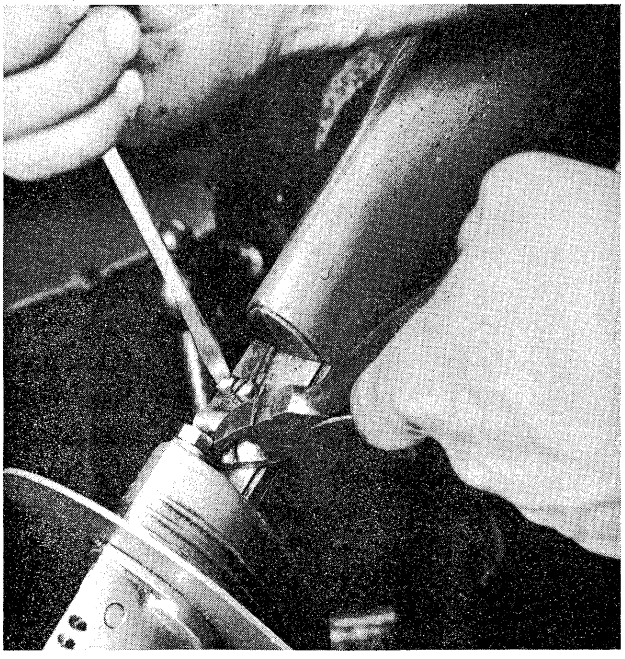
While the motor is running, check the



water outlet located in the exhaust port cover directly behind the steering handle.

A steady stream of water should flow from this hole at all speeds if the water pump is functioning properly.

If no water flows from this outlet hole, clean out the hole with a piece of wire, as it may be clogged. If the hole appears to be clean and still no water appears, disassemble the lower unit and check the water pump.



(Scene 77)
NARRATOR:

Before removing the motor from the tank, check the neutral clutch action by moving the control handle back and forth a few times.

When the lever is forward, the motor should be in "DRIVE" position, and the propeller should turn.

When the lever is back, the motor should be in "NEUTRAL" and the propeller should turn quite slowly or not at all.

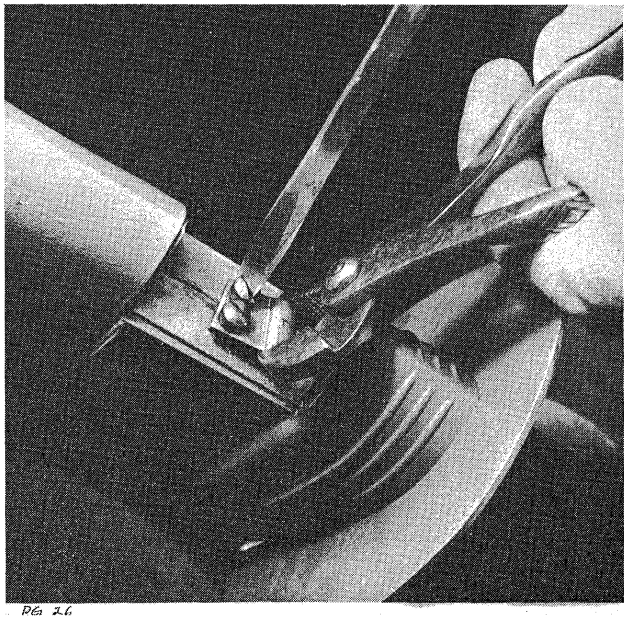
If adjustment is necessary, move the neutral clutch control lever forward to "DRIVE" position. This provides the maximum cable slack.

Remove the motor leg clip.

Loosen the two clamping screws enough to permit movement of the upper cable.

Hold the cable clamp in place; grasp the lower end of the upper cable with a pair of pliers and pull down until all the slack is removed from both cables.

Tighten the two clamping screws to prevent slippage.

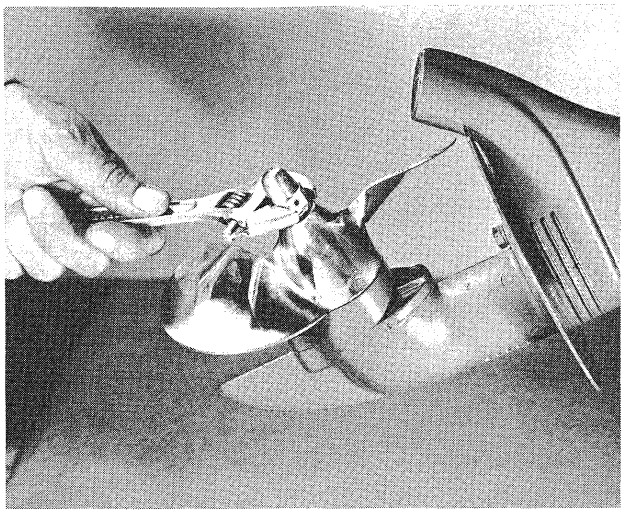


(Scene 78)
NARRATOR:

It is easier to tighten the clamp screws tightly if you hold the clamp with pliers as shown. Do this after

partially tightening the screws to prevent slippage.

Do not apply excessive tension to the cables as it may shorten the linkage to an extent where the clutch release cam will not travel far enough to disengage the clutch, preventing the engine from operating in neutral.

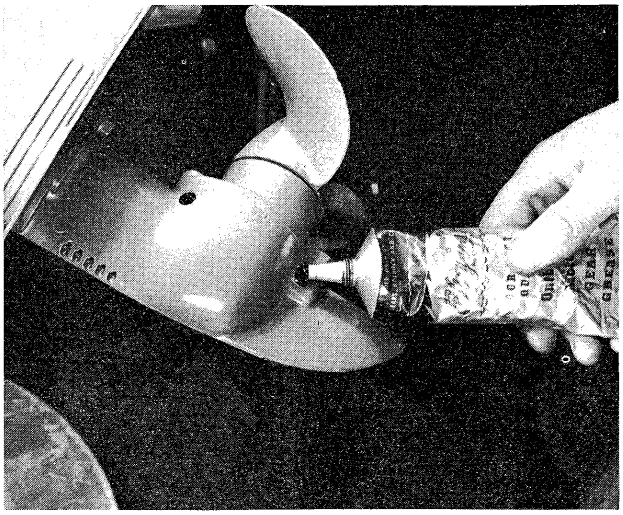


(Scene 79)
NARRATOR:

While the motor is running in the tank, look for propeller slippage, cavitation, or surging; to adjust the slip clutch.

Tighten the propeller nut until the slip clutch spring bottoms, then loosen the propeller nut 1/2 turn.

Install the cotter pin. Recheck slip slutch adjustment by running motor in tank.



(Scene 80)
NARRATOR:

After removing motor from the tank, check the amount of grease in the gear housing.

Remove both the filler plug lower, and the vent plug, top.

Fill with grease through the lower hole until grease appears at the top hole.

Replace both plugs. Be sure the vent screw washer is used on the top screw.

It is important that the gear housing be full of grease at all times to prevent excessive wear, gear noise and rusting if water enters the gear housing.

Always check the gear housing for grease after each 30 hours of operation.

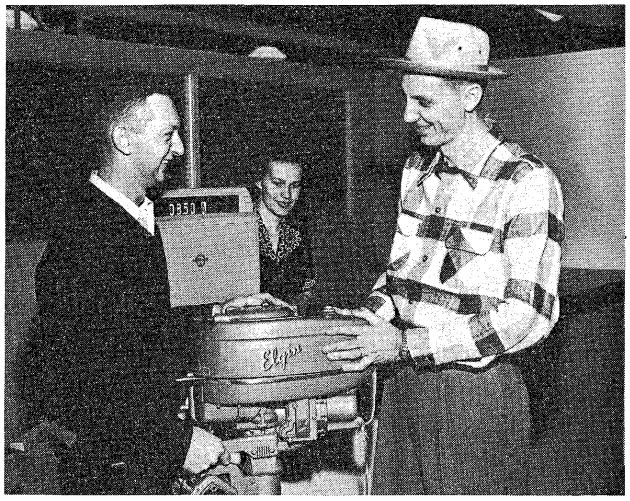
(Scene 81)
NARRATOR:

Here is an important step in any tune-up that is too often forgotten.

Show the customer how well his Elgin runs.

He will be pleased at your thoroughness and you will have another satisfied customer.

(Scene 81-A)
NARRATOR:



Be sure to explain to the customer how to mix his fuel -- what kind of oil to use and how much.

Then show him the correct procedure for starting and operating his Elgin.

He will appreciate it, and you will eliminate many minor complaints.

SECTION 2

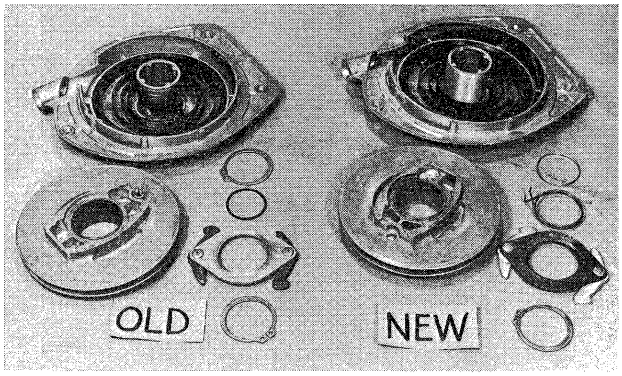
STARTER SERVICING

(Scene 82)
NARRATOR:

Now that the tune-up has been complete ed, let us consider some individual service problems which might occur.

We will begin at the top of the motor with the rewind starter.

Prior to 1951, Elgin motors were equipped with a semi-automatic, push-button type starter.



(Scene 83)
NARRATOR:

Since 1951, a fully automatic starter has been used. The fully automatic starter can be used on Elgins prior to 1951 models, provided the new starter collar is also used.

The most common starter repairs are so similar in procedure that we will consider them together for both types of starters.

Here we see the fully automatic starter torn down to show the difference between the first version and the later revision.

The early version contained two Waldes snap rings and one rubber "O" ring.

The starter pulley hub was machined with two snap ring grooves.

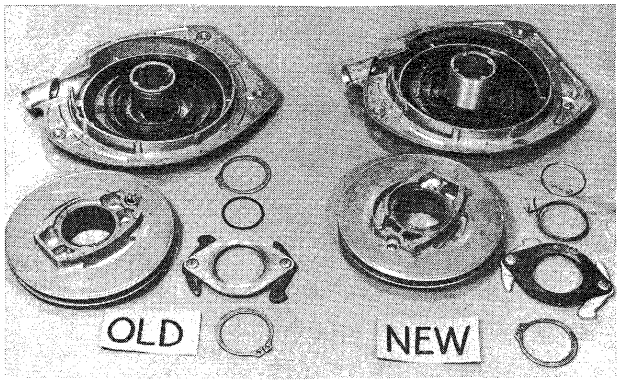
The starter rope was anchored to the pulley by a brass ferrule on the end of the rope.

Complaints were received from the field that the ferrule came off, allowing the rope to pull out. In some cases, burrs on the starter pulley cut through the rope.

If this starter was not properly lubricated or if the rubber "O" ring became twisted, the rewind action was sluggish, due to excessive friction. A clanging, bell-like sound was heard occasionally when the motor was running at high speed.

This was caused by the pawls creeping from vibration until they struck the starter collar which forced them back

into place.



(Scene 84)
NARRATOR:

To eliminate these complaints, the new starter was developed.

Only one Waldes ring is used, therefore, only one snap ring groove is found in the pulley hub.

The rubber "O" ring has been eliminated, and the stator spring is substituted. This spring prevents the pawls from creeping but does not have sufficient tension to cause sluggish rewind action. The clanging sound has been eliminated, and lubrication is not so critical.

The starter rope fastening has been relocated, and a knot is used instead of a ferrule.

It is possible to rework automatic rewind starters in the field to the latest version.

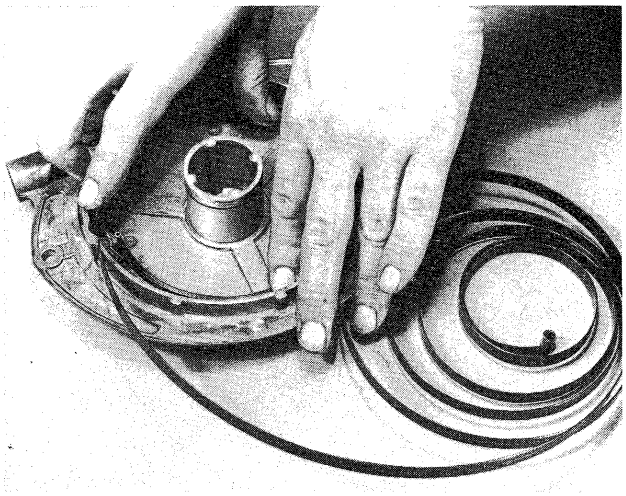
Order the starter rework kit which contains the necessary parts and installation instructions.

See SERVICE magazine, Volume 12, December 1951, Number 24, for details.

(Scene 85)
NARRATOR:

To install a starter spring, insert the loop end of the spring in the slot provided.

Be sure to use the wooden dowel in the fully automatic starter to prevent collapsing of the loop end.

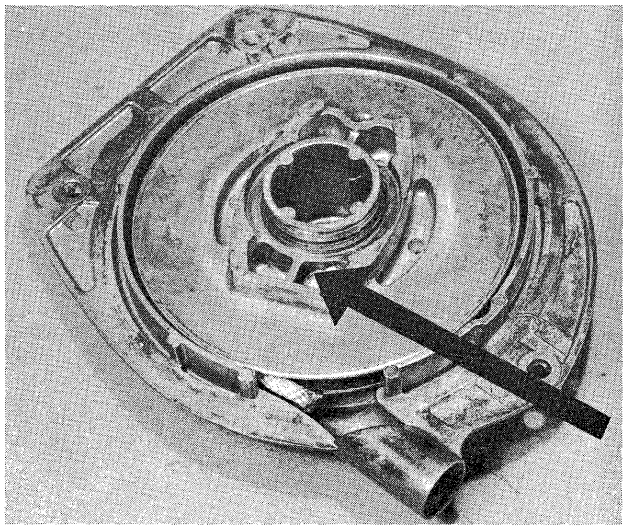


Wind the spring inside the retaining flange in a counterclockwise direction, keeping the hands opposite each other to prevent the spring from escaping.

After the spring is in place, observe the inner coil of the spring.

This coil must be large enough to permit the bosses on the under side of the starter pulley to pass inside the coil.

If such is not the case, bend the spring until the inner coil is large enough to permit passage of the starter pulley bosses.



(Scene 86)
NARRATOR:

Install the starter rope to the pulley, tie a knot in the end and pull knot down into the recess as shown by the arrow.

If it is necessary to cut the rope for any reason, light a match and burn the end of the rope. This will melt the nylon fibers and prevent the rope from fraying or unraveling.

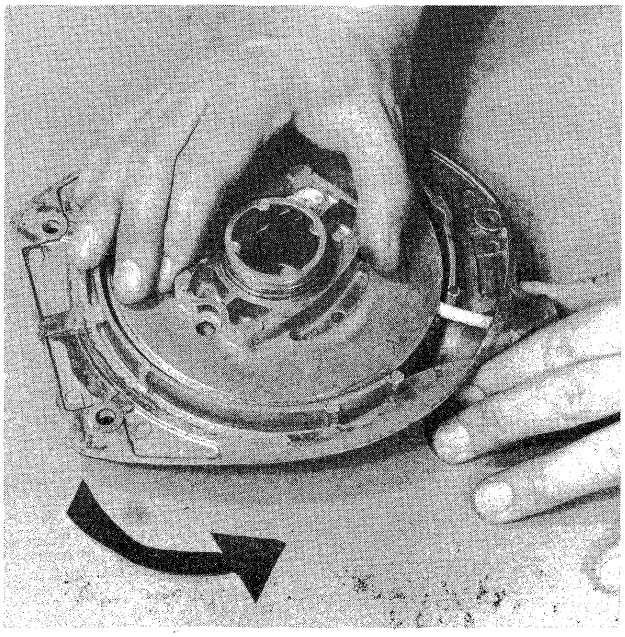
Wind the rope on the pulley in a counterclockwise direction.

Assemble the starter rope and pulley with the spring retaining notches downward. This is the point where initial tension is established on the rewind spring. Place the starter cover on the bench with the starter rope passage at about 6 O'clock, as you see here.

Assemble the starter rope pulley so that the knotted end of the rope is also at 6 o'clock, as shown by the arrow. (86)

Rotate the starter rope pulley slightly until the spring end is engaged in one of the four spring retaining notches on the under side of the pulley. Press pulley down into position. Turn the starter pulley counterclockwise, allowing the free end of the starter rope of pass by the rope passage in the cover the first time.

The second time around, pull the loose end of the starter rope through the rope passage in the cover and tie a large slip-knot to prevent the rope from rewinding on the pulley.



(Scene 87)
NARRATOR:

To check for proper rewind tension, pull the starter rope out as far as possible, then turn the starter rope pulley counterclockwise as far as it will go. The rewind spring is now completely bottomed.

This should be about 1/4 turn beyond the point where the starter rope is completely extended.

If the pulley turns less than 1/4 turn after the rope is extended, reduce the amount of initial tension applied.

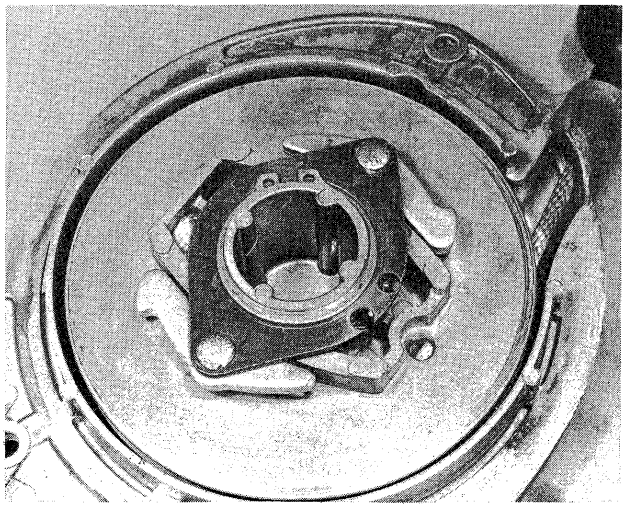
If the pulley turns more than 1/4 turn after the rope is extended, increase the initial tension. To change the amount of initial tension, untie the slip knot in the free end of the rope and allow rope to rewind on the pulley.

Lift pulley to disengage spring end from notches on under side of pulley.

Turn pulley counterclockwise to reduce tension and clockwise to increase.

Turn pulley only 90 degrees from original position as there are four spring retaining notches on the pulley hub and it is usually sufficient to move only one notch to correct the previous adjustment.

The standard rope length is 56 inches. If a rope of different length is used, a different adjustment of initial tension is required.

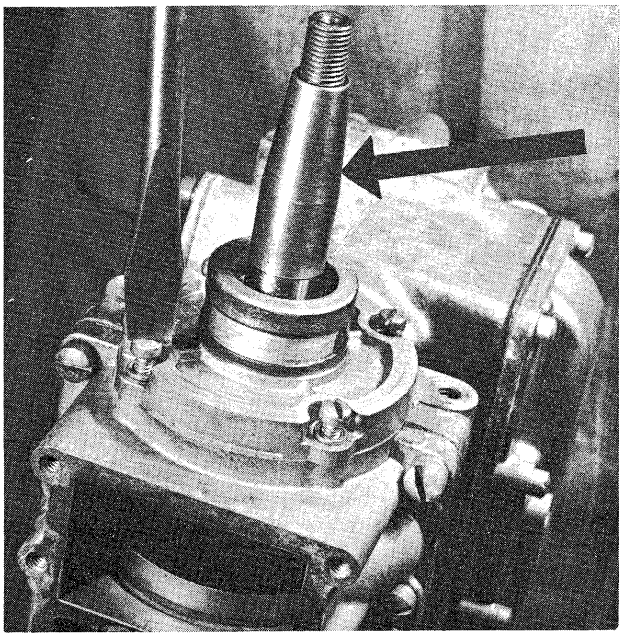


(Scene 88)
NARRATOR:

After the rewind spring tension has been adjusted, reassemble the start pawl stator spring to the pulley hub with the two prongs up in the position shown.

Install the starter pawl stator assembly with the pawls down. The concave side of the pawls must match the contour of the cam projection on the pulley. Insert the pronged ends of the stator spring into the spaces provided in the stator. Install the Waldes snap ring with the beveled side down. Use T-1082 pliers for this purpose. Install the starter rope handle and plug.

Assemble the starter to the engine.



CYLINDER AND CRANKCASE SERVICING

(Scene 89)
NARRATOR:

If repairs to the cylinder have been indicated by your inspection of the motor, remove the fuel tank, magneto, support plate, carburetor and reed plate. Then, before separating the cylinder from the motor leg, remove the intake port cover, exhaust port cover and plate, cylinder head and upper bearing cage.

It is suggested that these parts be removed at this time because the cylinder will be securely held by the motor leg, making it easier to work with.

(Scene 90)
NARRATOR:

Before lifting the upper bearing cage off the threaded end of the crankshaft, slip the sleeve over the crankshaft as shown. This will prevent the keyway and threads from damaging the seal during the process of disassembly.

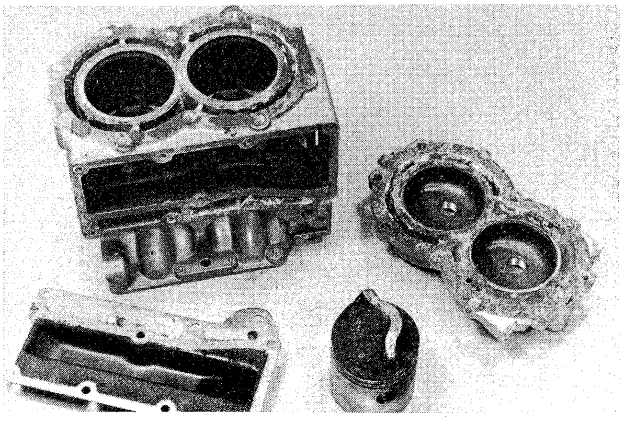
Also use the sleeve when reassembling the bearing cage. See SERVICE magazine, Volume 13, June 1952, Number 8, for the correct sleeve to use with the different models.

(Scene 91)
NARRATOR

Remove the cylinder from the motor leg and remove the crankcase cover.

Remove the connecting rod caps and push the pistons from the cylinder.

Mark with a file each connecting rod, cap and piston as to top or bottom location so they can be reassembled in the

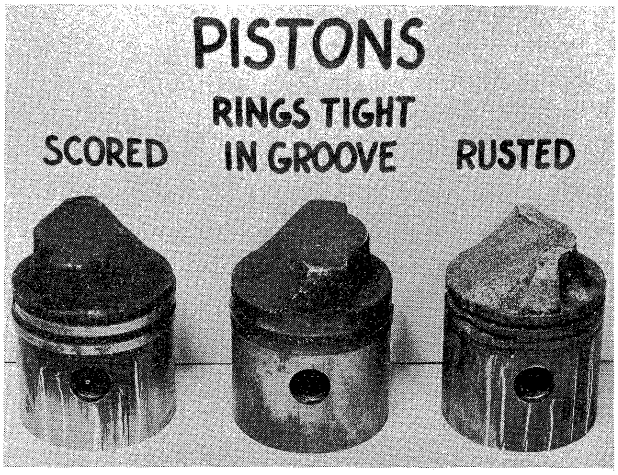


same order.

If loose needles are used, keep them with their respective rods. Lift out the crankshaft.

Remove piston pin lockrings and press out piston pins. Remove the piston rings from the piston and keep them in their relative positions so that they may be reassembled in the same order.

Clean carbon from the cylinder, cylinder head, piston, exhaust port plate and exhaust port openings. Use a blunt instrument or wire brush for this purpose.

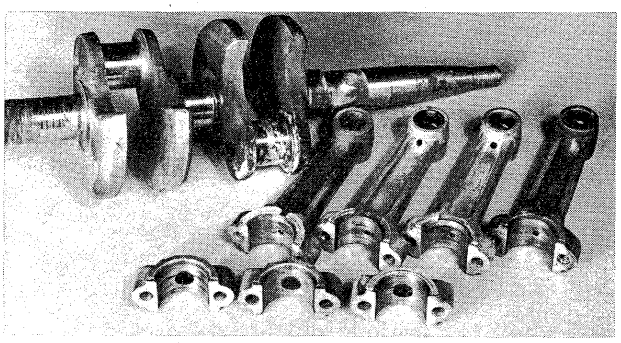


(Scene 92)
NARRATOR:

Inspect the cylinder walls and piston for scoring, rust or excessive wear. Always replace parts which are scored. See the "Fits and Tolerances" table in SERVICE magazine, Volume 13, June 1952, Number 8, for data on wear limits. Check the piston rings and pins for wear against this table. New piston rings should be installed only when necessary. Cylinder walls after running, acquire a very hard glaze, causing new piston rings to require an abnormally long break in period to attain top engine performance.

(Scene 93)
NARRATOR:

Examine the crankshaft, connecting rod



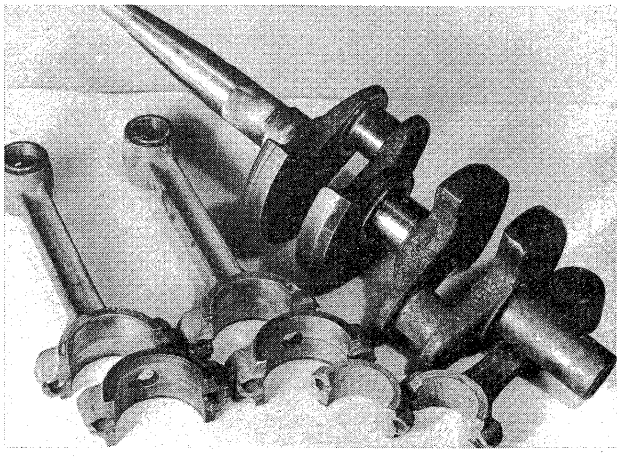
and cap for rust, excessive wear or evidences of overheating. The crankshaft shown here became overheated on the top connecting rod throw, and rod failure resulted. The connecting rods also show some discoloration at the bearings which indicates excessive heat. If connecting rod replacement is necessary, it is good practice to replace the crankshaft and both connecting rods.

Excessive heat might have caused the crankshaft to become soft, or excessive wear might have worn the journals out of round.

In either case, the use of old parts would cause an additional failure in a very short time.

Never file a connecting rod or cap in an attempt to obtain a better fit on the crankshaft.

If the wear is in excess of the limits shown in the "Fits and Tolerances" table, replace the rods.



(Scene 94)
NARRATOR:

Here we see the results of water in the lower cylinder. (Scene 94)

The connecting rod, cap and crankshaft are all badly rusted and pitted.

It would be impossible to clean these parts sufficiently to permit their re-use.

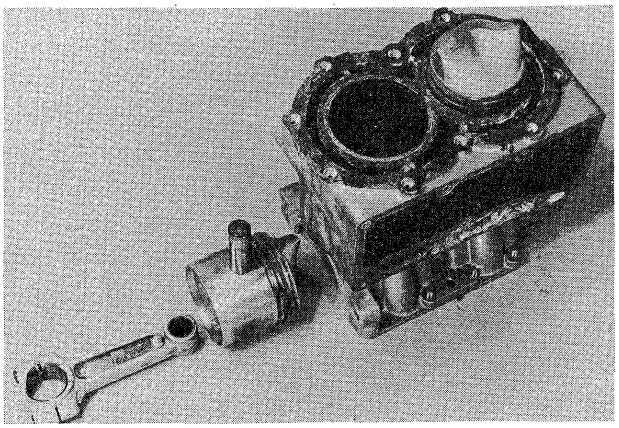
The two connecting rods and caps at the left show the result of excessive heat caused by too little oil in the gasoline.

Notice how discolored and blue the cap on the left is.

Never take a chance with a connecting rod, cap, needles or crankshaft which has turned blue from heat.

It has become so soft that any repair made would be only a waste of time.

Always replace such parts.



(Scene 95)
NARRATOR:

After the parts have been completely inspected and approved for re-use, assemble the piston rings to the piston in the same order that they were removed.

Notice that there is a beveled edge on one side on the piston ring -- this edge should be toward the top of the piston.

The piston rings should move freely in the ring groove.

Line up the piston ring gaps at the anchor pin. Assemble the piston to the connecting rod, press piston pin into place and install lock rings.

The closed end of the pin should be toward the intake port after the assembly of the piston to the cylinder to prevent the accumulation of fuel in the hollow piston pin.

When connecting rods are used which have oil grooves leading to the bearings, these oil grooves should also be on the intake side when assembled to the cylinder.

Lubricate all the parts well with motor oil, then assemble the pistons and connecting rods to the cylinder, using a piston ring compressor if available. Be sure that the piston ring gaps are lined up at the anchor pin.

The long tapered side of the piston top should be toward the exhaust ports as shown.

Remember that you marked the piston and connecting rods as to top or bottom location. Replace in the same position.

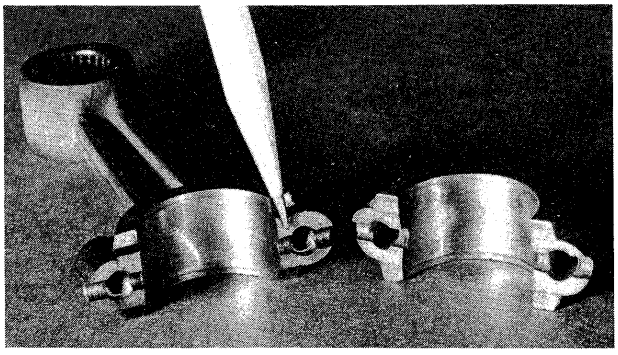
Install the crankshaft and assemble the connecting rods and caps.

Be sure the match marks on the connecting rod and cap are together.

Lubricate the bearings with motor oil.

Assemble the crankcase cover.

It is recommended that a small amount of Permatex or some other non-drying type of gasket sealer be used between the crankcase cover and the cylinder. Use it sparingly and do not allow any to reach the bearings.



(Scene 96)
NARRATOR:

The procedure for installing steel connecting rods and needle bearings is different from that used for die cast aluminum rods with bearing inserts.

When the Elgin steel connecting rods are machined, the rod and cap are all one piece.

The rough machining is done, then the cap is separated from the rod.

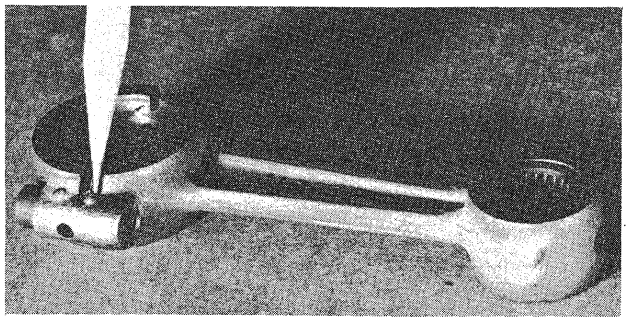
First a slot is cut halfway through the rod from each side at the point of separation.

Then the rod is struck a sharp blow which breaks or fractures the metal remaining.

Then the two pieces are reassembled, and the machining is finished.

This procedure results in a joint which has many rough, uneven edges at the point indicated by the pencil.

Because these rough edges will match perfectly only with the piece from which they were broken, perfect realignment of the connecting rod and cap is possible.

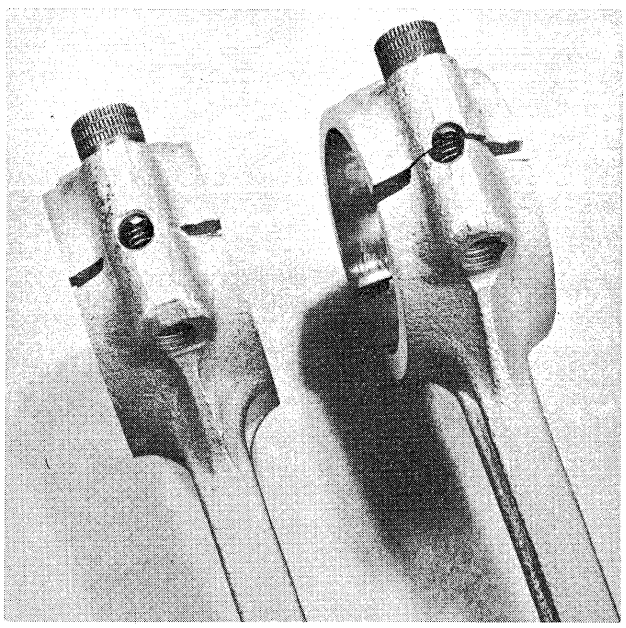


(Scene 97)
NARRATOR:

There are match marks on all the connecting rod and caps to guide you when reassembling the rods and caps to the crankshaft.

The pencil points to the match marks on a steel rod used on the 7½ H.P. Elgin.

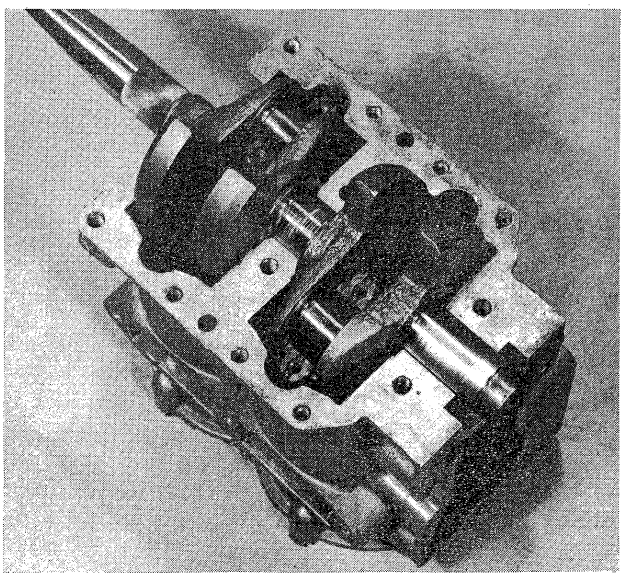
Be sure that these marks are together when assembling the rod and cap to the crankshaft.



(Scene 98)
NARRATOR:

If correctly assembled, the steel rods used on the Elgin 7½ and 16 H.P., will join together without a sign of a joint as shown in the rod on the left. The joint is not visible, and the hole that the screw passes through is perfectly round.

A joint which is readily visible as in the rod on the right, is not a good one and should be rechecked. Notice that the hole that the screw passes through is not round. A connecting rod assembled in this manner would fail immediately.



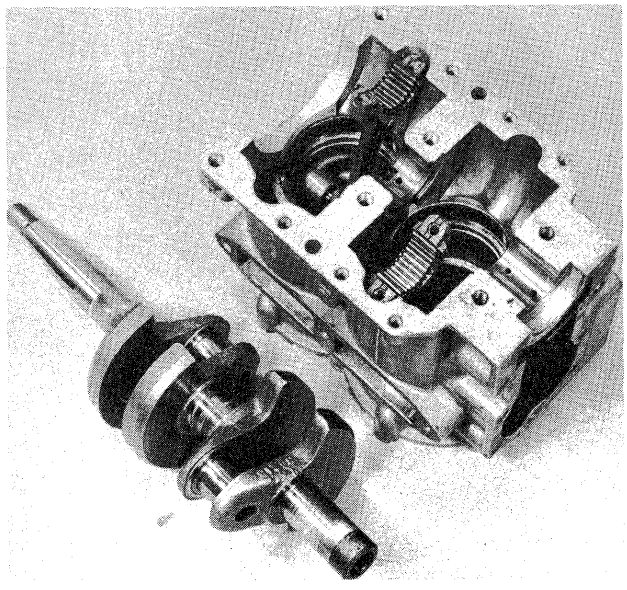
(Scene 99)
NARRATOR:

The first step in installing needle bearings is to assemble the piston and connecting rods to the cylinder as previously outlined, then line up the connecting rod bearing surfaces with the connecting rod throws of the crankshaft.

Press the piston and rods down in the cylinder far enough so that the bearing surfaces are near the crankcase parting line. Turn cylinder over to rest on the cylinder head face.

Place the crankshaft in position and align the bearing surfaces of the rods parallel to the throws of the crankshaft and about 1/8 inch below as shown. This will leave enough space for the needles to fit between the crankshaft and the connecting rod.

The tension of the piston rings will probably hold the pistons in place; but you may find it necessary to place a small block under the pistons to prevent them from slipping during assembly of the needles.



(Scene 100)
NARRATOR:

Remove the crankshaft.

Check the crankshaft, connecting rod, cap and needles to be sure they are clean.

Paint thinner makes a very good cleaner and does not leave a film.

Count out 14 needles and place them on the bearing surface of each connecting rod as shown.

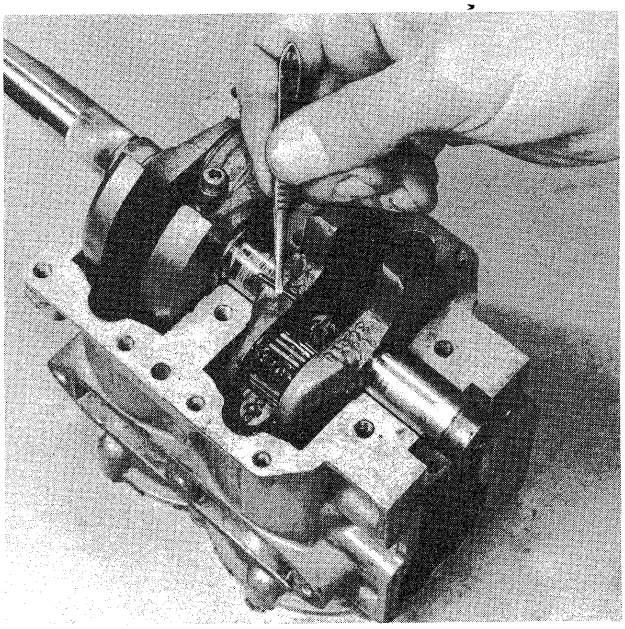
There are 28 needles used in each connecting rod of the 7½ H.P. Elgins.

It is not necessary to use grease on the connecting rod bearing surfaces to hold the needles in position unless you find it more convenient.

Be sure to reinstall the needles taken from the top rod back in the top rod if old parts are used.

Do the same for the lower rod.

Then place the crankshaft in position.



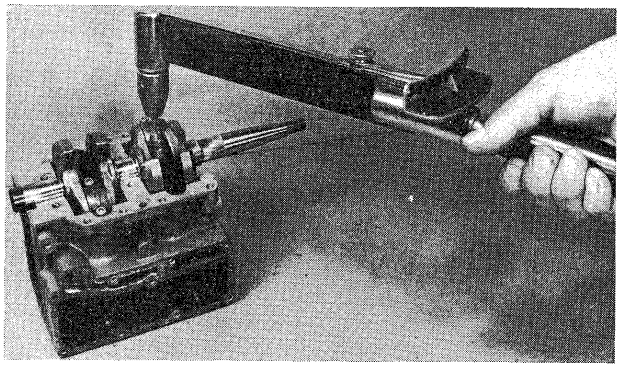
(Scene 101)
NARRATOR:

Place a light coating of gear or cup grease over the top of the crankshaft throw to prevent the needles from sliding.

Count out balance of 14 needles for each connecting rod and lay them over the crankshaft throw as shown. Then assemble the caps to their respective

rods, taking particular care to line up the match marks and the rough edges to produce an invisible joint.

Gradually tighten the connecting rod screws wiggling the cap gently back and forth until the cap fits perfectly.



(Scene 102)
NARRATOR:

Tighten the connecting rod screws with a torque wrench as shown here using 70 inch pounds of pressure.

Lubricate all bearings with oil before assembling the crankcase cover.

Install crankshaft seal, lower, with the lip side away from the crankcase.

Apply a light coat of Permatex to the crankcase at the parting line.

Do not allow Permatex to flow into bearings.

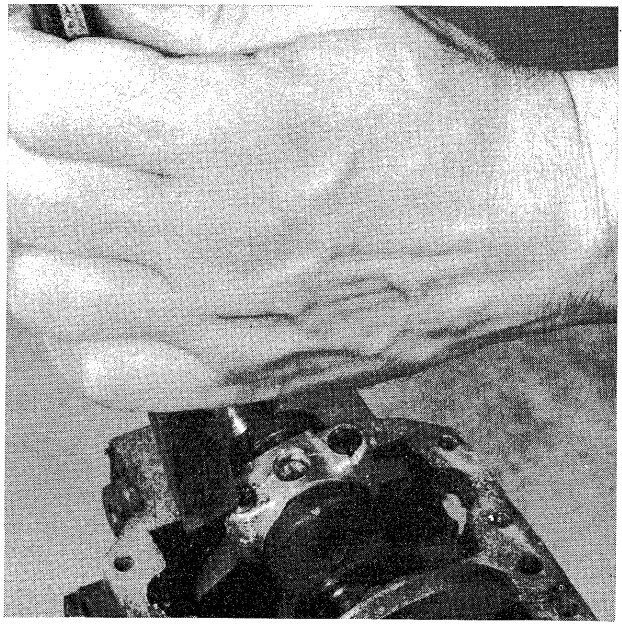
Assemble the crankcase cover to the crankcase.

Turn the crankcase so that it rests on the reed plate surface and rotate the crankshaft several times; then rap crankcase on bench to dislodge any loose bearing needles which might have fallen into the cylinder during assembly.

It is a good practice to count the needles, as they are assembled so that all are accounted for to prevent the possibility of needles falling into the crankcase unobserved.

By rapping the crankcase on the bench, any needles dropped are removed.

If needles have been dropped, it will be necessary to remove the connecting rod and cap and reassemble these needles to their respective rods.



(Scene 103)
NARRATOR:

In all motors where die cast aluminum connecting rods are used, "Stake" the connecting rod screws by peening metal from the cap into the screw slots to prevent them from turning. Use a dull screw driver or chisel and a small hammer.

It is necessary to bend the metal just enough to cause it to extend into the screw driver slot of the connecting rod screw.

Do not strike too hard or you may crack the connecting rod cap.

Assemble the cylinder head, intake and exhaust port plates, reed plate and carburetor using new gaskets.

Assemble the upper bearing cage using the proper crankshaft seal sleeve to prevent damage to the crankshaft seal.

Assemble the cylinder to the motor leg using a new gasket.

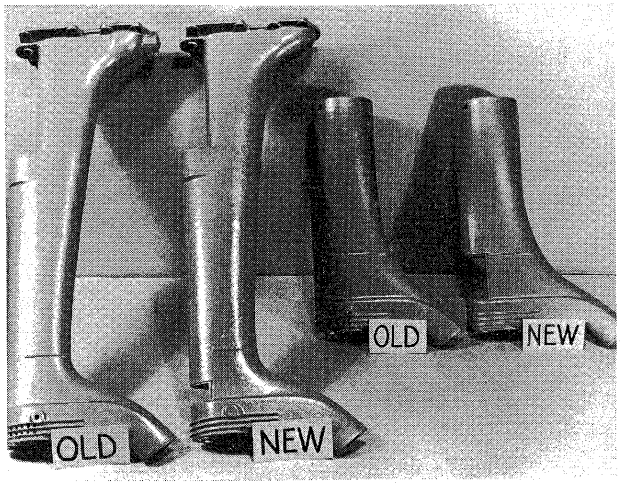
Be sure that the water line seal is in

place over the water line when assembling the cylinder to the motor leg.

SERVICING THE LOWER UNIT

(Scene 104)
NARRATOR:

If inspection of the motor indicates that the water pump or neutral clutch require attention, disassemble the lower unit.



(Scene 105)
NARRATOR:

These are the different styles of motor legs used on Elgin motors to date.

The two long legs at the left were used on standard motors without full reverse.

The two shorter legs were used on full reverse Elgins. Both legs marked "Old" were used with a long gear housing stud with a nut on the upper end. The legs marked "New" were used with a short gear housing stud and nut which can be reached through the recess shown near the bottom of the leg.

This recess is covered by a removable clip.

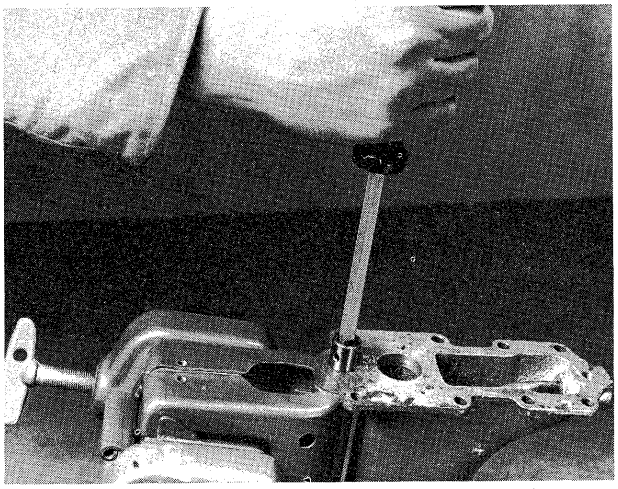
In the old legs, the water inlet holes are in the lower edge just above the anticavitation plate.

The new legs have no water inlet holes, because the water inlet is in the leading edge of the gear housing, and a passage transfers the water to the water pump.

If the old style gear housing without water inlet holes is used, the old motor leg with water inlet holes must be used.

If the new style gear housing with water inlet holds is used, either style leg may be used -- provided the correct anti-cavitation plate is also used.

This will be illustrated later.



(Scene 106)
NARRATOR:

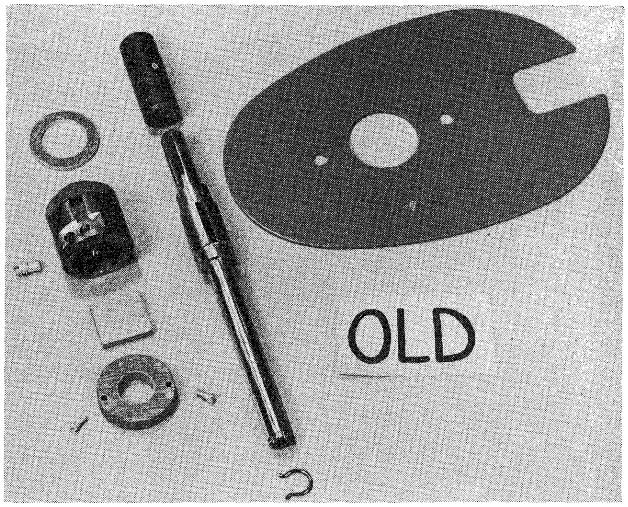
To remove the gear housing from the old style standard leg, it is necessary to remove the power head; drive out the groove pin which holds the king pin in the motor leg; then unscrew the gear housing stud nut.

Insert a long screw driver down inside the king pin as shown.

Unscrew the gear housing stud nut, remove the hex head screw which attaches the rear flange of the gear housing to the motor leg, then separate the gear

housing from the motor leg.

It is not necessary to remove the power head in order to separate the gear housing from the motor leg on full reverse models or those standard motors using the new leg.



(Scene 107)
NARRATOR:

Three different water pumps have been used on Elgin motors to date.

This is the water pump originally used on Elgin motors. It consisted of a bronze body, fiber head, cover and plunger and steel shaft with the plunger slot broached through it.

A water pump spacer was used above the head on all models having an anticavitation plate.

A lockscrew was used to fix the position of the body in the motor leg.

The anticavitation plate had a round hole through which the pump assembly passed.

This pump is no longer used in production and is not available for replacement.

(Scene 108)
NARRATOR:

This is the new style water pump used in production until September, 1952.

It consists of a sintered bronze body

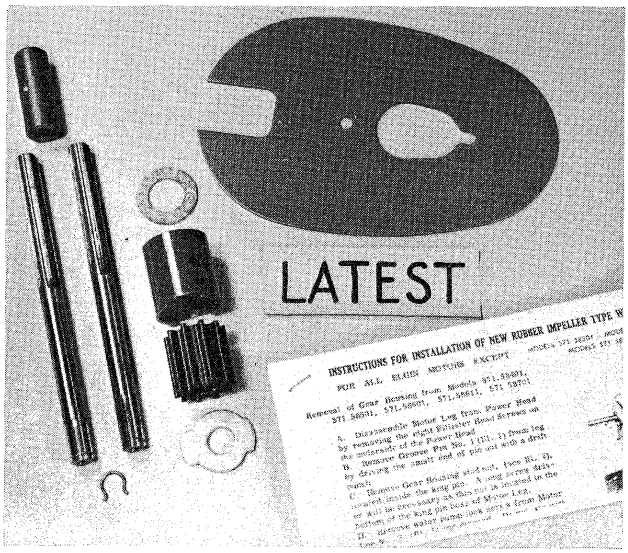
and cover, a rubber impeller with brass insert, a spring and two shafts.

An anticavitation plate of the new design shown here is also included.

The elongated hole in the center of the plate.

This design is necessary with the new style pump to provide a water passage from the inlet holes in the gear housing to the pump cavity in the motor leg. Each new style pump also contains a drive shaft coupling that is pinned to prevent it from slipping down on the long spline on the shaft.

Complete instructions and diagrams are packed in each water pump replacement kit.



(Scene 109)
NARRATOR:

The latest water pump was designed to improve water pump performance at high speed.

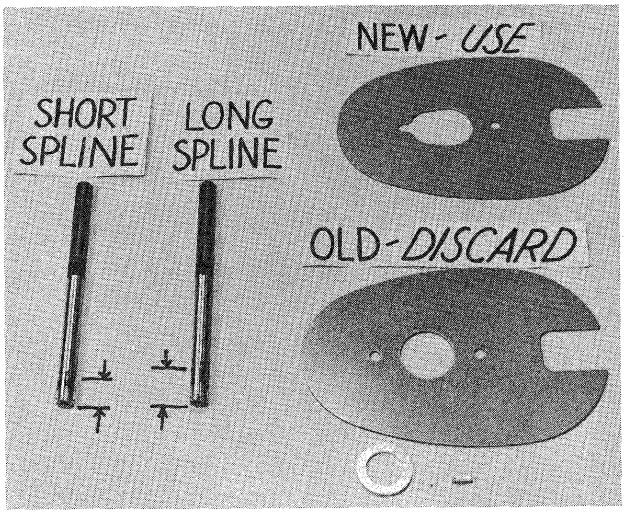
The internal contour of the body and the external contour of the cover were changed to extend the cam to the inlet holes, increasing the flow of water at high speed.

The new body and cover must be used together and neither part will fit together properly if used with old parts.

A gasket is used in the motor leg cavity above the water pump body to seal out exhaust gases.

The water pump spring has been eliminated.

Only the latest water pump is available for replacement.



(Scene 110)
NARRATOR:

To make this pump completely interchangeable with all water-cooled Elgins in the field, except the 16 H.P., two shafts are packed with each pump.

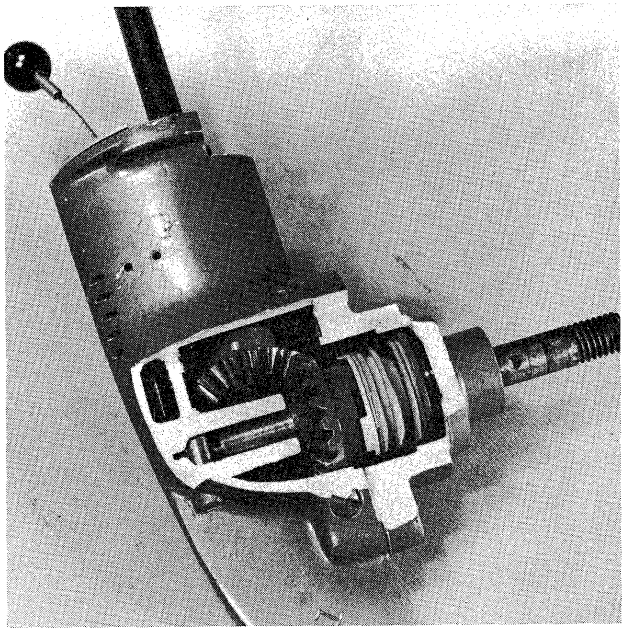
The short spline length is about 3/4 inch, and the long spline about one inch.

Compare the length of the internal spline in the bevel gear of the motor you are servicing and use the shaft with the same spline length.

The other shaft can be discarded.

Use the new anticavitation plate with the water passage shown in the top right corner and discard the old anticavitation plate, water pump spacer and the lockscrew shown at the lower right.

While you have the gear housing apart to service the water pump, let's look at the neutral clutch.



(Scene 111)
NARRATOR:

This cut-away shows the neutral clutch parts in drive-position.

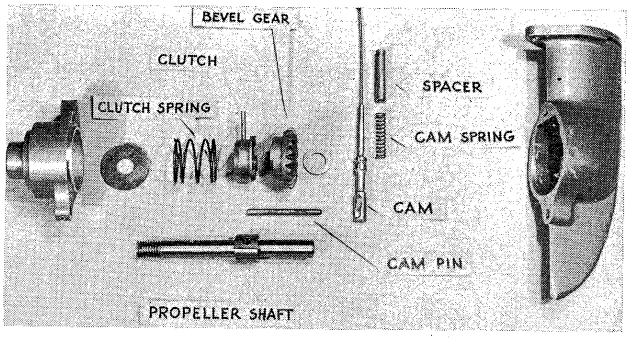
The bevel pinion, shown in red, drives the bevel gear also shown in red.

The bevel gear and pinion turn whenever the engine is running.

Motion is transmitted to the propeller shaft by means of the clutch, shown in yellow, which is attached to the propeller shaft by splines and a groove pin.

Notice the clutch spring, shown in green.

This spring forces the clutch against the bevel gear causing the clutch jaws to engage with the jaws on the bevel gear.

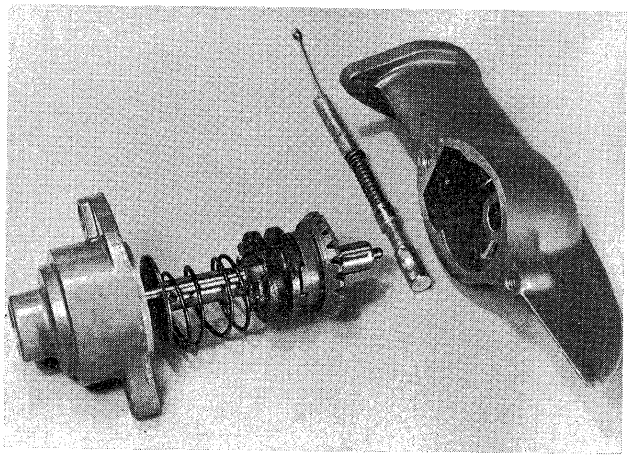


(Scene 112)
NARRATOR:

When the control lever is moved back to neutral position, the cam which has a contoured groove at its lower end presses against the cam pin causing the pin to move toward the rear of the propeller shaft.

The propeller shaft is hollow from the right end to the center of the spline.

The cam pin fits inside the propeller shaft and rests against the groove pin which attaches the clutch to the propeller shaft.



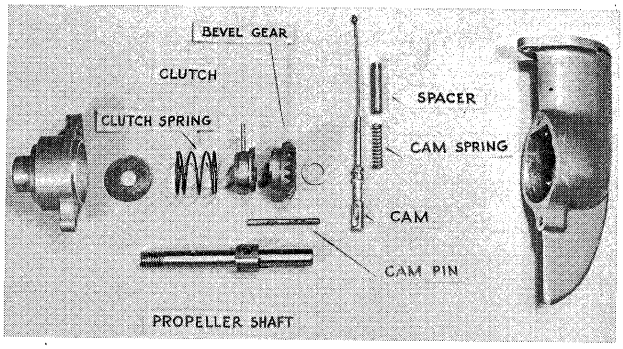
(Scene 113)
NARRATOR:

Here we see the clutch and bevel gear assembled to the propeller shaft.

Just the tip of the cam pin can be seen at the right end of the propeller shaft.

The contour of the cam groove is also quite evident. The cam spring and spacer are assembled over the cam and cable and force the cam down when the control lever is placed in "DRIVE" position.

In the event of cable slippage or breakage, the cam spring will force the cam down into "DRIVE" position so that the motor can be operated.

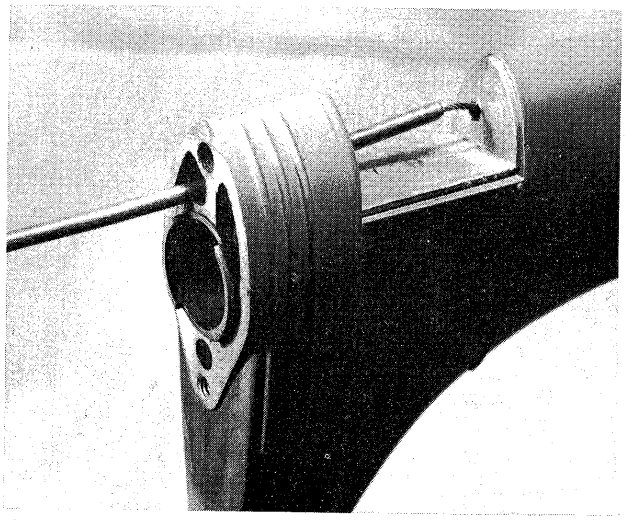


(Scene 114)
NARRATOR:

When servicing the neutral clutch, inspect the cam, cam pin, and groove pin for wear, and replace those parts that are worn.

These parts control the amount that the clutch will move when actuated by the control lever.

If any, or all, of these parts are worn excessively, the clutch may not move far enough to disengage from the bevel gear, and the engine will not operate in neutral.



(Scene 115)
NARRATOR:

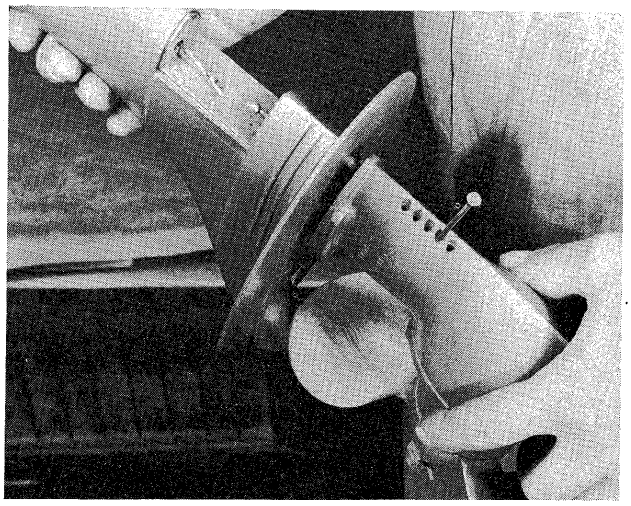
Here is a simple way to thread the upper cable through the motor leg.

Take a 2-foot length of 3/16 inch copper tubing and insert it into the cable holes in the motor leg from the bottom, as shown here.

Push the tubing into the motor leg until the top end is at the same level as the clutch positioning rod. Thread the new clutch release cable through the hole in the clutch rod and then into the upper end of the tubing.

Feed the cable through the hole in the clutch rod and down inside the tubing.

Pull the tubing out of the motor leg from the bottom, and the cable will be threaded through the hole.

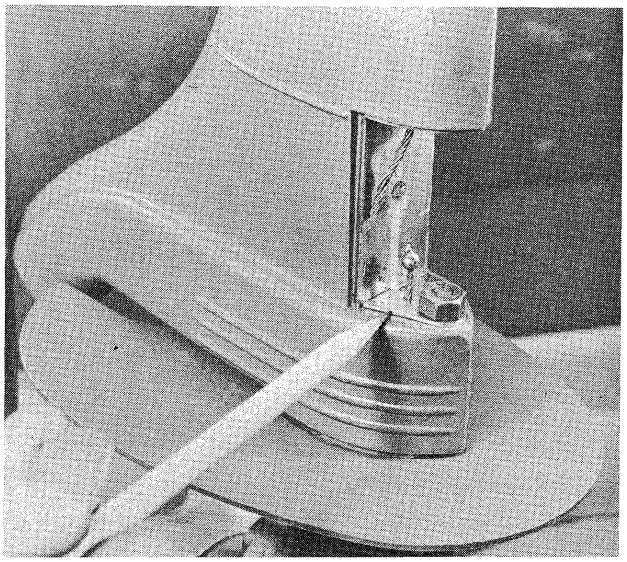


(Scene 116)
NARRATOR:

Because the spacer on the clutch release cam extends slightly above the top of the gear housing, it will interfere when assembling the water pump body and cover to the drive shaft short, preparatory to the assembling of the gear housing to the motor leg.

To eliminate this interference, press down on the spacer, compressing the spring as far as possible, then insert a nail in the water inlet hole second from the bottom, as shown.

The nail will extend over the washer located on top of the spring and will keep the spring compressed while installing the gear housing to the motor leg. When installation has been completed, remove the nail, and the spring will be released.



(Scene 117)
NARRATOR:

Before installing the gear housing stud nut and lockwasher, place the clutch release cable seal, over the gear housing stud.

Assemble the seal so that the notch fits around the clutch release cable to seal off the cable hole through the lower part of the motor leg.

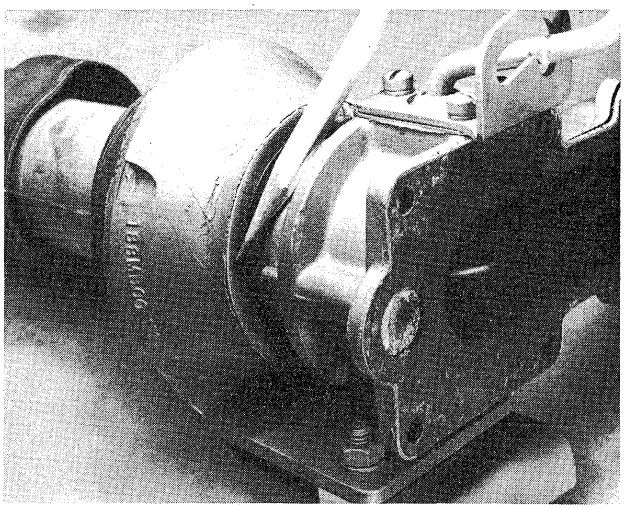
It is very important to use this cable seal because exhaust gases flow through the hole in the motor leg down into the water inlet passages in the gear housing and prevents water from entering.

This is especially true at high speed and causes the engines to overheat, resulting in considerable damage.

Adjust the neutral clutch cable linkage, as previously shown, and install the motor leg clip.

(Scene 118)
NARRATOR:

Steering is accomplished on the full



reverse models by the engagement of the stem bracket pin in a slot in the upper shock mount.

If the steering handle will turn without moving the motor, this stem bracket pin is broken and should be replaced.

When replacing the stem bracket or upper shock mount, be sure that the stem bracket pin is installed and engaged in the slot indicated by the pencil.

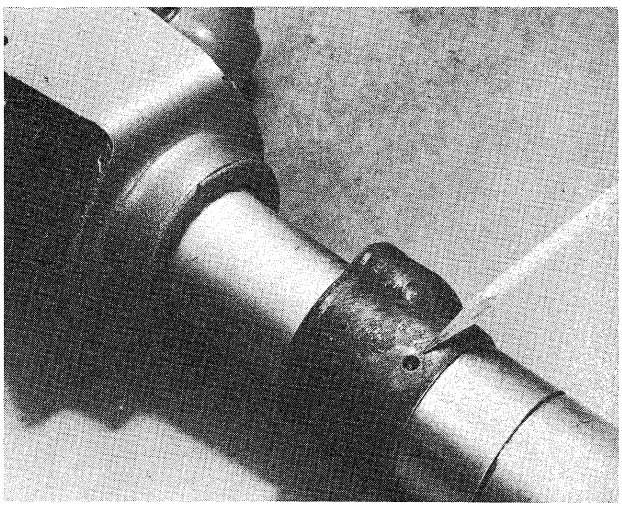
The stem bracket pin is assembled to the stem bracket from the top or cylinder mounting surface of the stem bracket, and the casting is peened slightly after the pin has been assembled to prevent it from falling out when the motor is tipped.

In 1952, this stem bracket pin was changed from a solid pin to a hollow roll-type pin to provide a passage for oil to pass through and lubricate the shock mount for easier steering.

A drilled shock mount and crankcase cover must be used together with the roll pin to provide passage for this oil which comes from the crankcase.

(Scene 119)
NARRATOR:

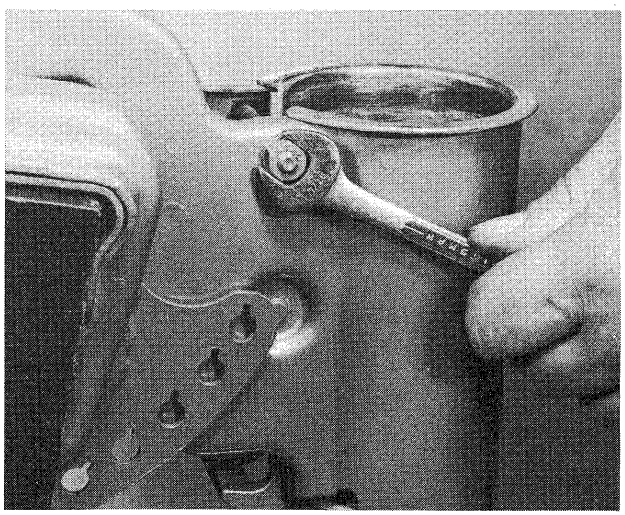
When replacing the full reverse cam, assemble the cam to the stem bracket with the flared, bell-shaped portion up and toward the rear of the stem bracket.



This is the only position in which the three holes in the cam, one of which is indicated by the pencil, will line up properly with the holes in the stem bracket.

For replacement, thread forming screws and lockwashers instead of rivets are supplied to attach the cam to the stem bracket.

This is done to facilitate field assembly of these parts, as special tools are required to peen the rivets. Lubricate both the upper and lower shock mounts before assembly to the swivel bracket.



(Scene 120A)
NARRATOR:

If the steering tension becomes too loose, causing the motor to wander off course, or becomes too tight, causing

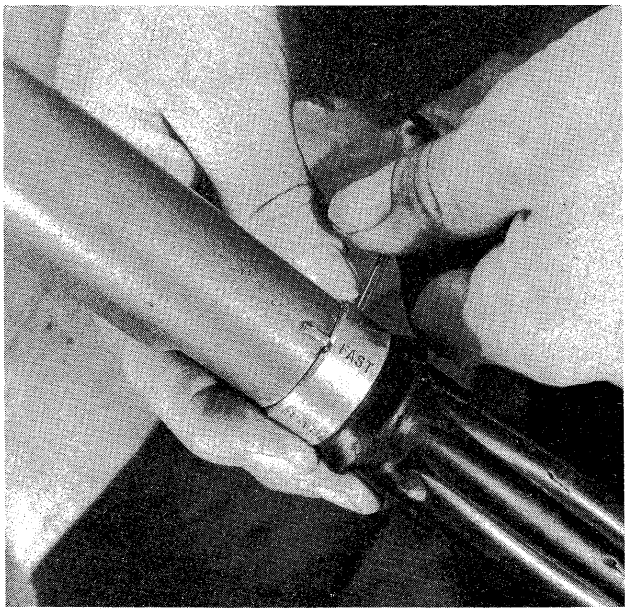
hard steering, the tension can be adjusted by tightening or loosening the nut as shown. It is good practice to lubricate the upper and lower shock mounts at least twice a season, or more often if required, using SAE #30 motor oil.

SECTION 3

16 H.P. ELGIN

(Scene 121)
NARRATOR:

In general, the principles and procedures, which you have already seen, apply also to the 16 H.P. Elgin. There are a few things which are different and must be considered.



(Scene 122)
NARRATOR:

For example, the spark and throttle controls are synchronized for smooth performance throughout the entire speed range and are controlled by rotating the steering handle grip.

To adjust the synchronized controls properly, four adjustments are necessary.

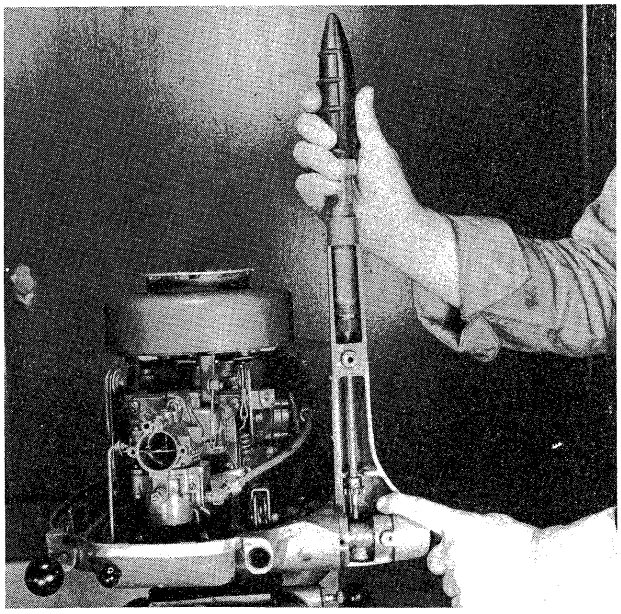
1. Proper positioning of the control rod pinion.

2. Adjustment of the magneto control cable.

3. Proper setting of the steering handle collar.

4. Adjustment of the throttle bell-crank linkage.

The first step is to turn the steering handle grip control counterclockwise as far as possible, then ...



(Scene 123)
NARRATOR:

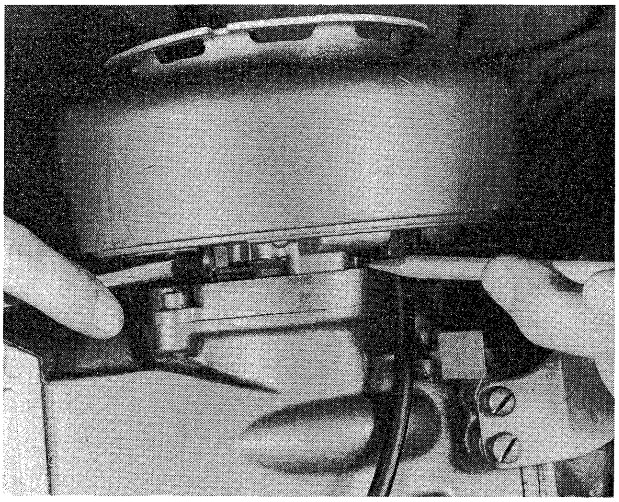
...lift the steering handle and observe the position of the control rod pinion in relation to the steering handle rack which moves side-ways as the steering handle is rotated.

The control rod pinion should be at

the extreme left end of the teeth in the steering handle rack. If such is not the case, remove the set screw underneath the steering handle and pull the control handle up until the pinion is disengaged from the rack, as shown.

Then move the steering handle rack to the right as far as desired and engage the pinion with the rack by pushing the control handle down.

Reinstall the set screw.



(Scene 124)
NARRATOR:

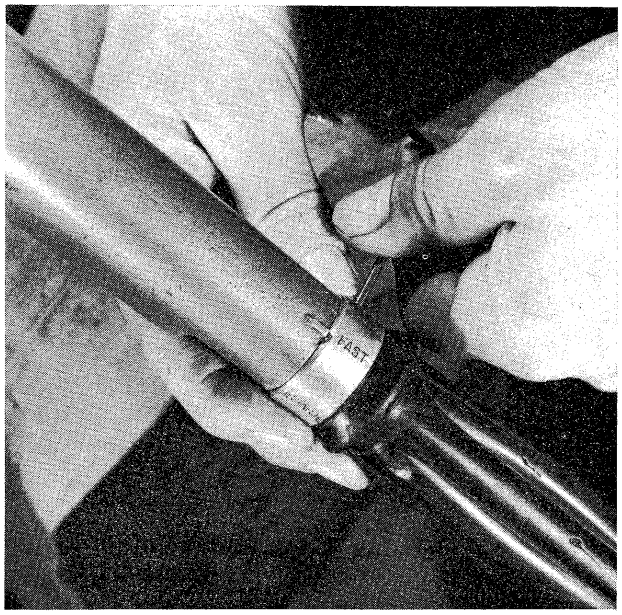
Observe the postion of the magneto stator plate. The projection on the lower side of the stator plate should be resting against the magneto control stop pin, indicated by the point of the pencil.

If adjustment is necessary, slightly loosen the screw which holds the magneto control cable slip in place and rotate the stator plate as desired.

This screw is located at the rear of the stator plate and can be seen at the point of the screwdriver in the picture.

Be sure to tighten this screw after the adjustment has been made.

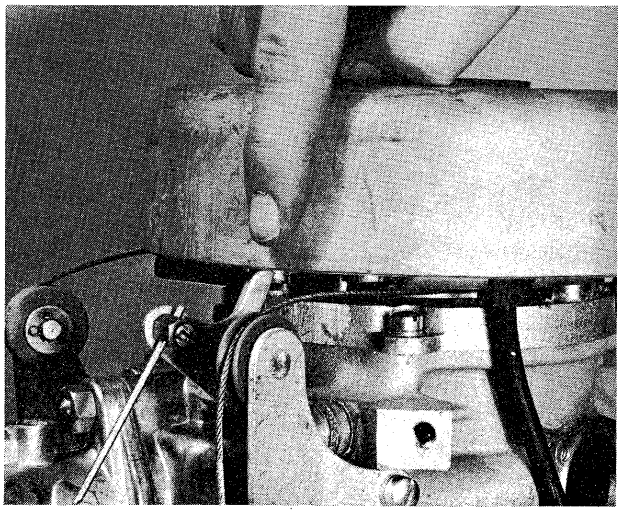
(Scene 125)
NARRATOR:



When the steering handle rack and pinion are in the positions mentioned, the stator plate projection is against the stop pin, and the steering handle collar should be at "FAST" position.

To adjust the collar, loosen the allen head set screw and turn collar as desired.

Be sure to tighten the set screw.



(Scene 126)
NARRATOR:

The last step is to adjust the throttle bellcrank linkage.

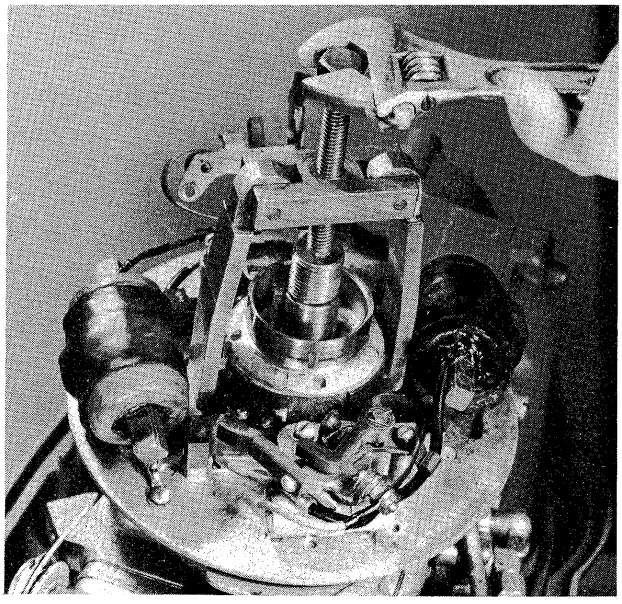
Turn the steering handle control clockwise to stop position; then turn it

counterclockwise until the bellcrank indicated by the arrow just begins to move forward.

This will be approximately at "SHIFT" position.

At this point, the throttle shutter in the carburetor should still be closed, there should be no slack in the bellcrank or throttle link, and the end of the throttle cam should be approximately 3/16 inch beyond the cam follower portion of the bellcrank, as shown below the finger. Now, turn the steering handle control counterclockwise to "FAST" position. The throttle shutter should now be completely open (horizontal) but may vary as much as 10 degrees from the horizontal and still be satisfactory.

To adjust the throttle link, loosen the small round head screw and shorten or lengthen the link as required Tighten the screw.



(Scene 127)
NARRATOR:

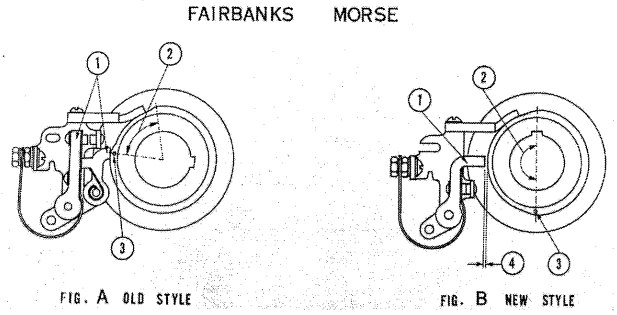
The Fairbanks-Morse magneto used on the earlier 16 H.P. Elgin is of the rotor type.

The magnets are contained in the rotor rather than in the flywheel as used on the smaller Elgins.

Here, we see the rotor being removed, using the special puller, T-1904, found in the Elgin tool kit for the 16 H.P. motor.

To use the rotor puller, loosen both sets of breaker points and both coils from the stator plate as shown.

Below the rotor is a Waldes snap ring and spring which must be removed before the stator plate can be lifted from the upper bearing cage.



(Scene 128)
NARRATOR:

Two different Fairbanks magnetos were used on the 16 Prior to 1953.

The major differences are shown here.

In Figure A, the breaker point assembly is of two-piece construction, one piece being the cam follower and the other the breaker point arm, shown as item one.

The flat portion of the cam covers slightly less than 90 degrees, shown as item two.

In this version, the breaker point spacing is set at .020 thousandths with the cam follower at the high point of the cam, at the mark indicated by item #3.

In Figure B, the breaker point is of one-piece construction, item one.

The flat portion of the cam covers nearly 180 degrees, item two.

In this version, the breaker point spacing is not actually measured.

The rotor is rotated until the cam follower is in the center of the flat protion of the cam.

The breaker assembly is moved until the follower is about .008 thousandths away from the cam, as shown in item four.

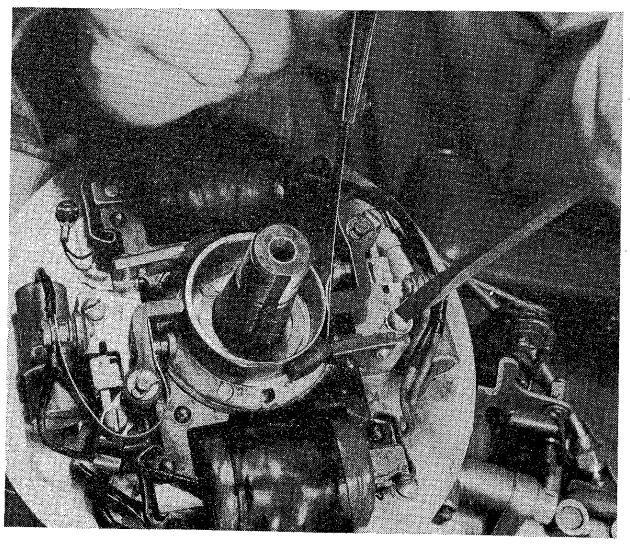
The mark on the rotor, item three, is completely disregarded.

When the breaker points are set in this way, the time of point opening is more rigidly controlled, and the points will close even after considerable wear of the cam follower, bearing cage, upper, and other parts involved.

Be sure to adjust both sets of breaker points in this manner and also to check the spacing, item four, at full advance as well as at full retard.

In order to accomplish this check, turn the control handle to "SLOW", check the spacing and then turn it to "FAST" and recheck.

If necessary, readjust the breaker points to obtain a minimum of .008 thousandths at both extremes.

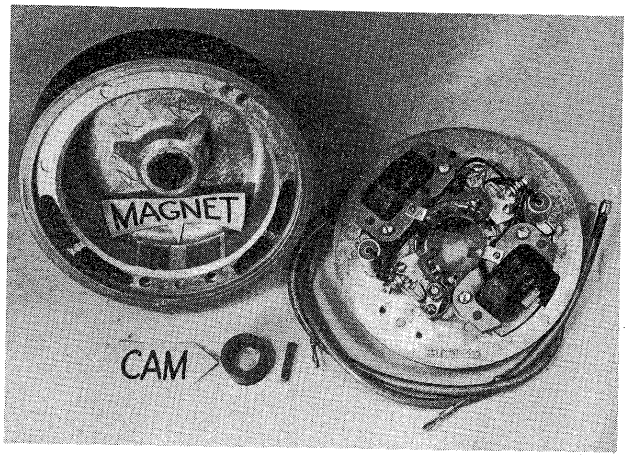


(Scene 129)
NARRATOR:

To adjust the breaker points as just described, place the feeler gauge between the cam follower and the center of the flat portion of the cam.

Adjust both sets of breaker points and recheck both sets at full retard and full advance to be sure a minimum of .008 thousandths is maintained at all times.

In setting breaker points by this method, the amount of breaker point opening is not actually measured, but will be about .015 thousandths.



(Scene 130)
NARRATOR:

Beginning with Model 58823, the 16 H.P. Elgins will have a new Fairbanks-Morse flywheel type magneto. The magnets are contained in the flywheel, and a breaker cam is used in place of the rotor previously used.

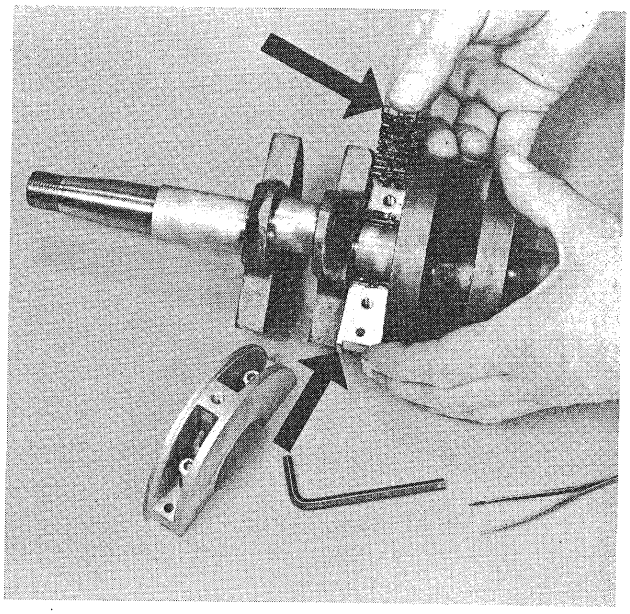
Breaker point spacing in this type magneto will be .020 and will be adjusted in the conventional manner. This magneto is similar to Wico in construction, and requires no new service procedures.

(Scene 131)
NARRATOR:

The 16 H.P. Elgin has loose needle bearings at the center main bearing location as well as at the connecting rods.

A center main bearing cage and a steel bearing race are also used.

The halves of the bearing race are



separated by the "fracture" method and have the same rough edges as the connecting rods to provide perfect alignment upon reassembly.

Match marks are provided as a guide.

To assemble the center main bearing assembly to the crankshaft, coat both halves of the bearing race with grease and place 14 loose needles on each half.

Take the half of the bearing race, containing the dowel hole, and place it under the center main bearing of the crankshaft.

Place the half of the center main bearing cage over the race, inserting the dowel of the cage into the hole in the race.

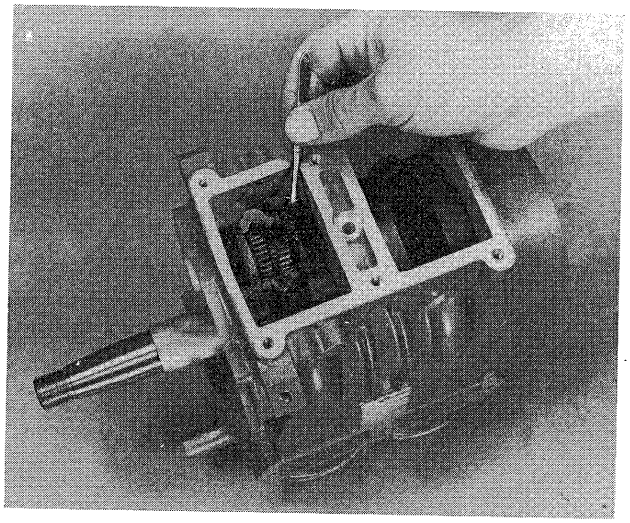
Be sure the flange of the center bearing cage is toward the top of the crankshaft as illustrated. This flange fits into a machined recess in the crankcase and must be toward the top of the crankshaft. Assemble the other half of the bearing race to the top of the center main bearing with the match marks together to insure a perfect joint.

Install the other half of the center bearing cage with the flange toward the top of the crankshaft. Drive in the dowels and tighten the socket head screws.

Draw the screws up tight.

Test the alignment of the bearing and needles by spinning the bearing cage on the crankshaft.

If assembly has been correct, the bearing cage should spin freely.

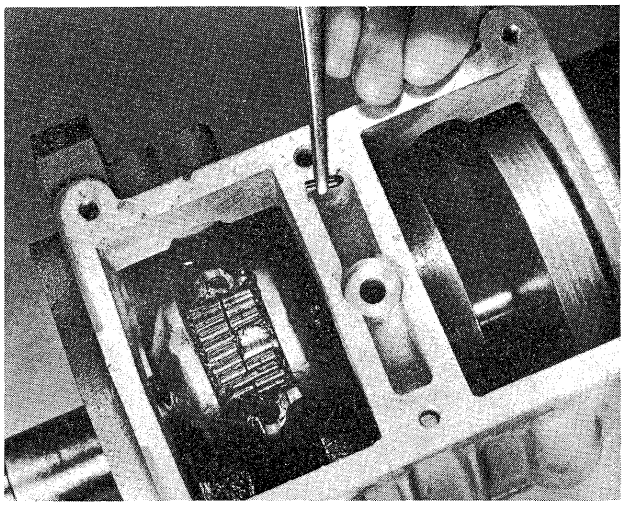


(Scene 132)
NARRATOR:

The original 16 H.P. Elgins used the same needle bearings at both the center main bearing and at the connecting rod locations.

Later, the needles at the connecting rod location were changed to shorter needles.

They are about one half the length of the original ones and twice as many are used -- arranged in two rows in each connecting rod. The method of assembly is the same as outlined for the 7-1/2 H.P. Elgin except that extreme care must be taken to keep them properly aligned in two rows during assembly, and they should be counted to be sure the correct number (54 per rod) are used. After the caps have been properly assembled and aligned, torque wrench pressure of .140-150 inch pounds should be applied.



(Scene 133)
NARRATOR:

In late 1952, the short needles were changed from two tapered ends to a new needle which has one tapered and one straight end as shown.

This was done to increase needle bearing life.

These needles must be assembled to the rod with the straight ends toward the center of the rod to provide an adequate thrust face and to prevent misalignment.

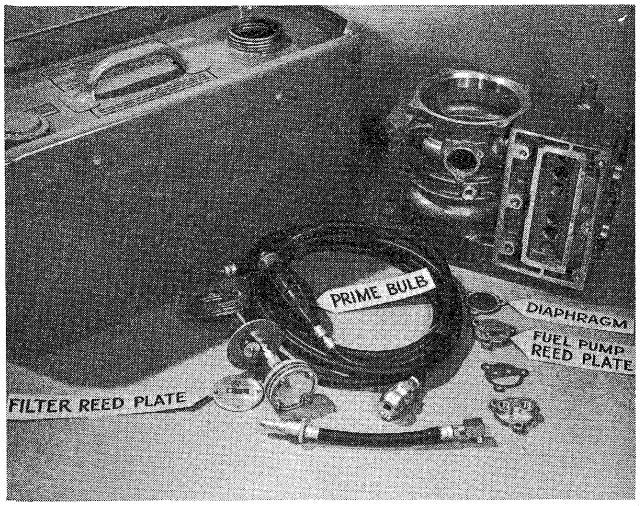
DETAILS OF

THE FUEL SYSTEM

(Scene 134)
NARRATOR:

Details of the fuel system.

(Scene 135)
NARRATOR:



The Elgin 16 H.P. fuel system is composed of a separate fuel tank prime bulb, a fuel pump and a neoprene fuel line which snaps on to the motor. The fuel tank holds 5-3/4 gallons of fuel mixture, sufficient for 2-1/4 hours of high speed operation. The prime bulb transfers fuel from the tank to the fuel line and carburetor when the engine is not running. A reed plate located inside the tank acts as a check valve and prevents the fuel from flowing back into the tank.

The fuel pump, shown in exploded form just below the crankcase, has a reed plate with two reeds and a diaphragm.

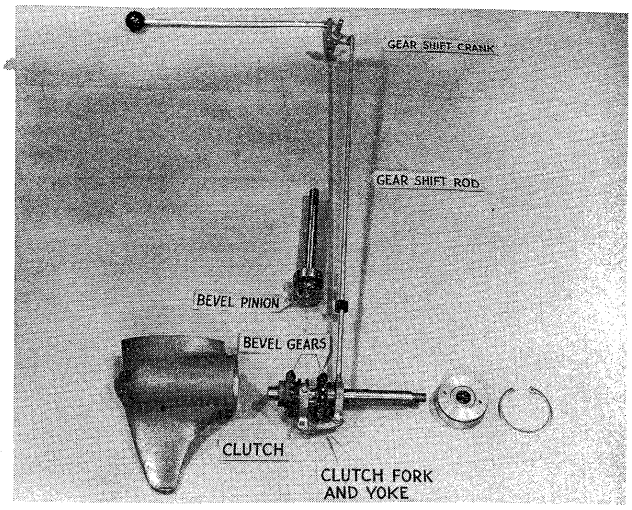
Before the motor is started, the prime bulb is squeezed several times to fill the fuel line and carburetor.

When the motor starts, crankcase pressure causes the diaphragm to pulsate drawing fuel from the tank with each pulsation.

The fuel pump reeds act as check valves, allowing the fuel to pass through and prevent it from flowing back into the fuel line.

All three reeds should seat against their respective reed plates, and the diaphragm must be free from holes or cracks for the fuel system to function properly.

(Scene 136)
NARRATOR:



Let's look at the gear shift mechanism of the 16 H.P. Elgin.

There is a bevel pinion on the end of the lower drive shaft.

Motion is transmitted to the bevel pinion through the drive shaft and coupling.

The two bevel gears on the propeller shaft engage with the pinion and all three revolve while the engine is running.

These gears have jaws which engage with the jaws of the clutch when the motor is shifted to forward or reverse.

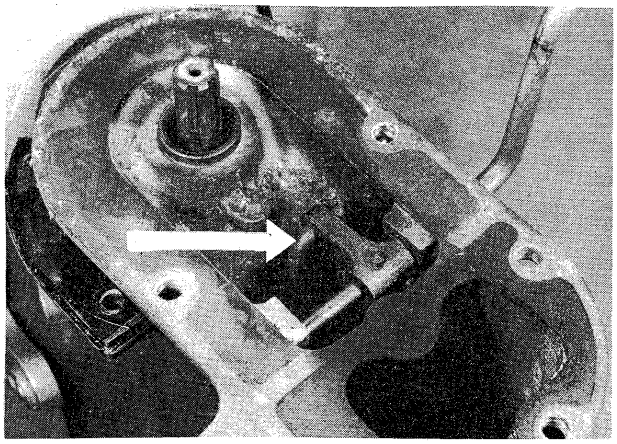
The clutch transmits the motion of the gear to the propeller shaft by means of internal splines in the clutch which match external splines on the propeller shaft.

When the motor is in neutral, the clutch is midway between the two gears, and the jaws do not engage with those on either gear.

When the motor is shifted to either forward or reverse, the clutch moves on the splines, until its jaws engage with the jaws on the proper gear.

The movement of the clutch is accomplished by the clutch fork and yoke connected to the gear shift crank by the long rod shown in the center of this picture.

A very fine screw thread at the lower end of this long rod permits adjustment to insure proper movement to all shift positions.



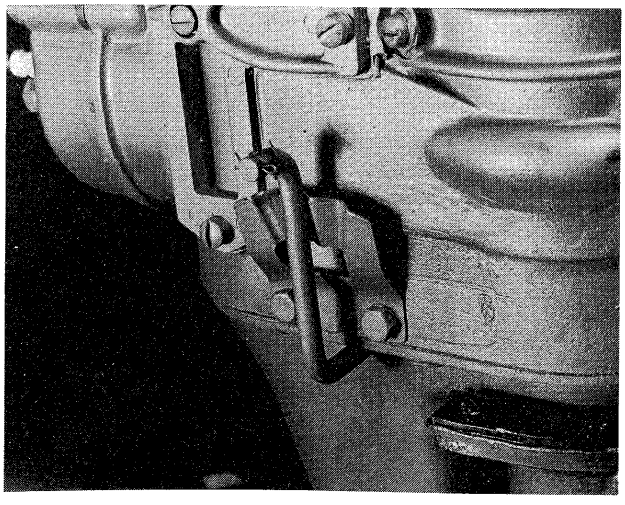
(Scene 137)
NARRATOR:

This is the upper end of the long gear shift rod.

The arrow indicates the point where it attaches to the gear shift crank.

The correct position of the gear shift crank when the motor is in neutral is perpendicular to the top of the motor leg.

If the gear shift crank is not in the position illustrated when the motor is in neutral, remove the upper end of the long gear shift rod from the hole in the arm and screw the rod in or out as required to obtain the correct adjustment.

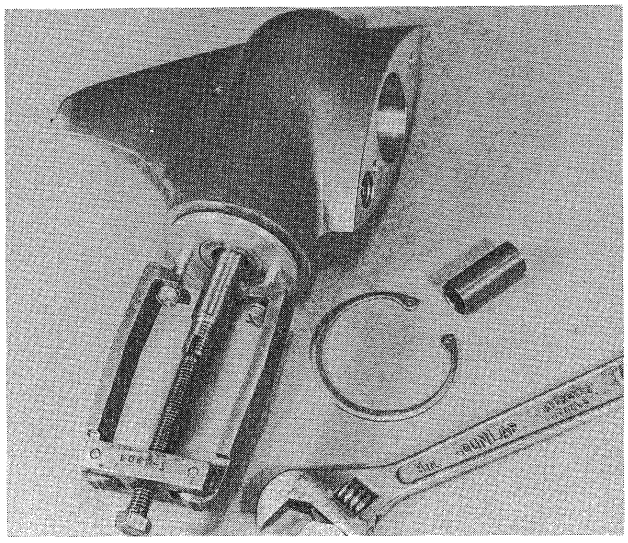


(Scene 138)
NARRATOR:

As a further check of the correct gear shift linkage adjustment, assemble the powerhead to the motor leg and observe where the gear shift crank fits into the grooves in the gear shift quadrant attached to the cylinder block.

The crank should fit into the center groove in the quadrant, as shown here, when the motor is in neutral. Rotate the propeller to be sure the motor is in neutral.

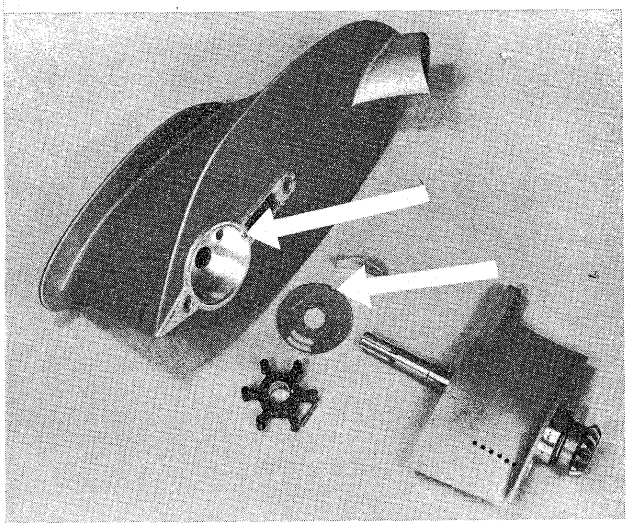
If the crank does not line up with the center groove in the quadrant, loosen the two hex head screws which hold the quadrant to the cylinder and move the quadrant until proper alignment is obtained.



(Scene 139)
NARRATOR:

If difficulty is experienced in removing the propeller shaft bearing cage from the gear housing, remove the Waldes snap ring, screw two 1/4 inch screws into the holes provided in the bearing cage and use the puller furnished in the 16 H.P. Elgin tool kit as illustrated.

This is the same puller that is used to remove the rotor from the magneto T-1904.



(Scene 140)
NARRATOR:

The water pump of the 16 H.P. Elgin is similar in design and operation to the one used on the smaller Elgins.

The water pump cam is removable and can be replaced when it becomes worn.

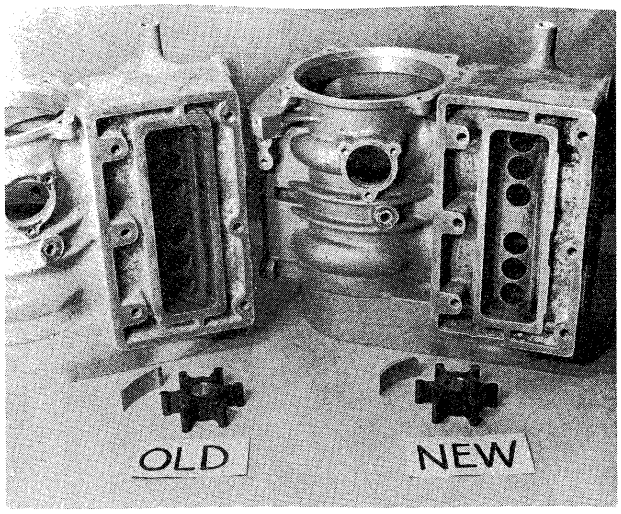
The water pump cover is also replaceable, and is now being treated with a hard coating which provides greater resistance to wear and corrosion.

When reassembling the 16 H.P. water pump, place the water pump cover over the drive shaft, lower, with the small notch toward the rear of the motor. Insert the water pump drive pin into the hole in the drive shaft, lower and place the impeller over the shaft with the recess over the drive pin. The cam should be assembled in the cavity of the motor leg, lower.

When assembling the water pump to the motor leg, rotate the drive shaft slightly, this will compress the vanes of the impeller enough to allow them to bend around the water pump cam.

Be sure that the small notch in the water pump cover fits over the groove pin located in the motor leg at the rear of the water pump cavity. The groove pin and notch are indicated by arrows.

(Scene 141)
NARRATOR:



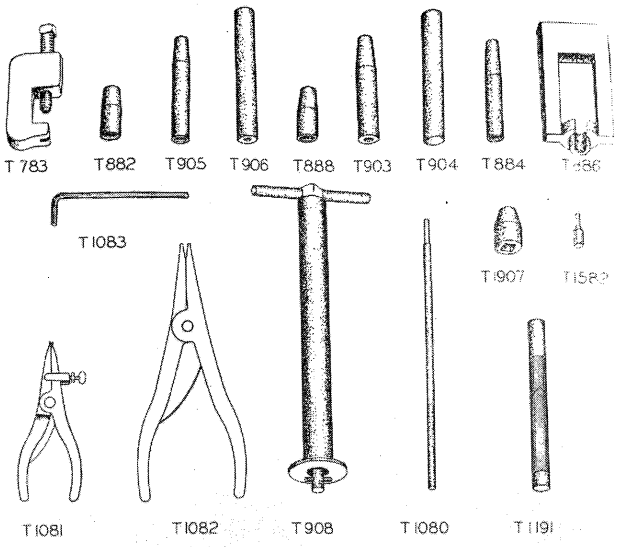


FIG 71 SPECIAL OVERHAUL TOOLS ELGIN OUTBOARD MOTORS

The first 809 16 H.P.Elgins were built as shown on the left.

The water passages in the cylinder block were narrow, causing excessive back pressure to build up in the cooling system and resulting in failure of the water pump impellers.

A thick water pump cam and standard impeller were used in this version.

To correct this condition, the water passages were enlarged, the water pump cam was made thinner, and the impeller was reworked to provide relief behind the vanes to enable them to flex more readily.

If the engine still has the old style block with the narrow water passages, the thick cam and the reworked impeller with relief behind the vanes must be used. If the cylinder block has the wider water passages, the thin cam and the standard impeller should be used.

(Scene 141A)
NARRATOR:

To do a good job, proper tools are required. This kit covers all the special tools needed to work on all Elgins except the 16 H.P.

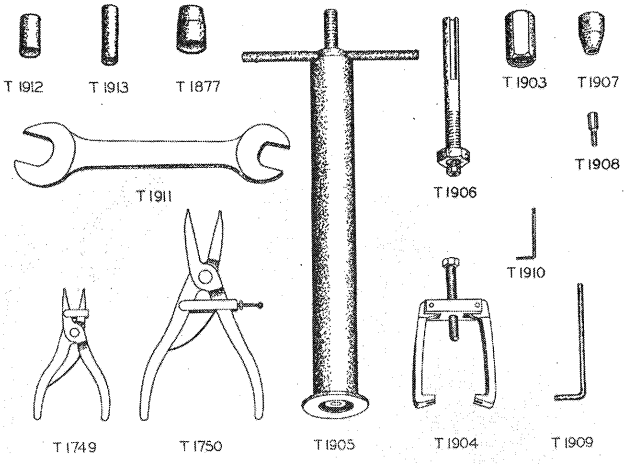


FIG 73 SPECIAL OVERHAUL TOOL KIT 16 H.P. ELGIN

(Scene 141B)
NARRATOR:

This kit is for the 16 H.P. Elgin. For details, see SERVICE, Volume 13, June 1952, Number 8, Page 244.

(Scene 142)
NARRATOR:

Here's one thing the salesman can do to help prevent minor complaints from the customer. Make sure the customer understands how to start and operate his Elgin.

Before delivering an Elgin motor to the customer, go out to the demonstration tank, put the Elgin in the tank and show the customer how easily it starts. Show him the starter, full reverse, neutral clutch, filtrap, bowl carburetor,

shock mounts and slip clutch. Point out that full instructions for starting and operating his Elgin are printed on the front decal. Tell him about the importance of reading and observing the instructions found in his parts list packed with each motor.

He will appreciate your thoroughness and will benefit from the instruction.

Your serviceman, too, will appreciate your efforts; the customer won't bring back the motor because he doesn't understand how to operate it.

(Scene 143)
NARRATOR:

The serviceman, too, should be sure the customer understands his Elgin and is satisfied with the work. When the customer calls for his motor, take him out to the tank, start and run the motor, invite the customer to operate the motor himself. He will be pleased to see how well his Elgin runs and grateful for the fast service he obtained.

(Scene 144)
NARRATOR:

Here's the happy ending to another story of a satisfied Sears customer.

The customer can go on his vacation confident that his Elgin will perform the way he wants it to. The serviceman feels the pride of a job well done. And the cash register has rung to the tune of $8.50 which shows a nice profit to the department. Everybody's happy, and that's the way it has to be at Sears.