TM 5-1078

WAR DEPARTMENT TECHNICAL MANUAL

HEATER, ASPHALT, TRAILER-MOUNTED, 3-CAR, 42 HP, CLEAVER-BROOKS, MODEL DS-31,

(ENGINE: BRIGGS & STRATTON, MODEL ZZ)

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MAINTENANCE INSTRUCTIONS AND PARTS CATALOG

WAR DEPARTMENT • 24 APRIL 1944

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Washington 25, D. C., (25 April 44)

TM 5-1078, (Heater, Asphalt, Trailer-Mounted, 3-Car, 42 HP, CLEAVER-BROOKS, Model DS-31 (Engine: Briggs & Stratton, Model ZZ), is published for the information and guidance of all concerned.

A.G. 300.7 (27 November 43)

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NOTE: *The Tank Car Heater to which this publication applies is equipped with a Model "ZZ" Briggs & Stratton Engine, Type No. 304665.* or 304786 *Consult publication TM5-1014 for the machine equipped with Briggs & Stratton Engine Model "Z", Type Nos. 304340 and 304156.*

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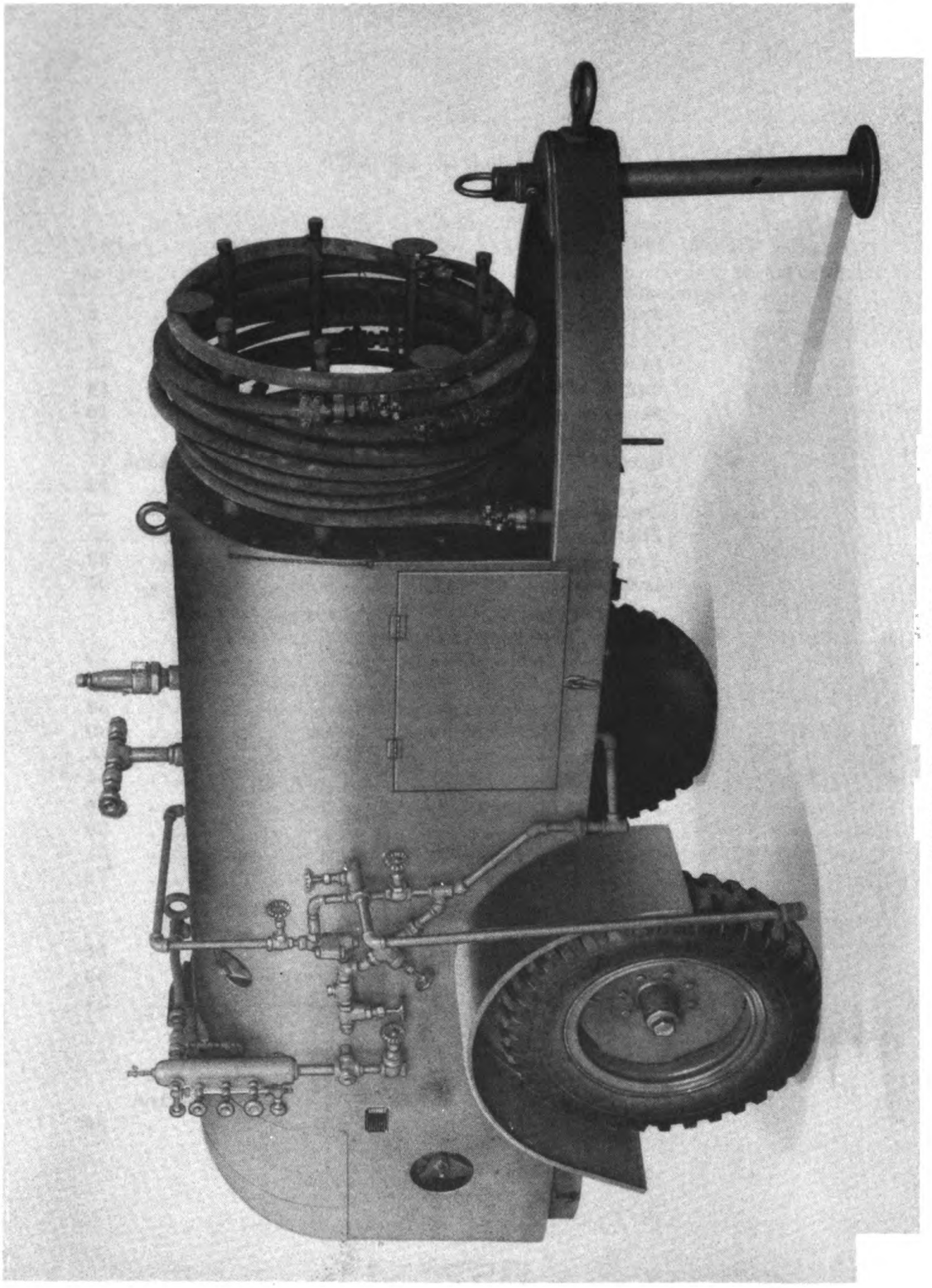


FIGURE 1 3-CAR HEATER MODEL DS-31

DESCRIPTION

The Model DS-31 Tank Car Heater is a self-contained steam generating plant constructed for operation at pressures up to 125 pounds per square inch, fired by an oil burner and equipped with built-in fuel and water tanks. Water is fed to the boiler by two methods, a standard injector and a power driven pump which may draw water either from the reserve tank or condensate from the coils in the tank cars being heated.

The boiler, of fire tube construction, is equipped with four complete passes of flue gas travel, the first pass being the large center tube or combustion chamber, the second pass of two groups of tubes at either side of the fire tube and the third and fourth passes below. The vent pipe or stack is a part of the outer head at the firing end of the boiler. (See cut-away view on page 4). The oil burner is of the pressure atomizing type with three fuel oil atomizing nozzles. Two 5-gallon and one 4-gallon nozzles are used on the three-car heater, giving a total burning rate of fourteen gallons per hour. By manually operating the valves to the individual fuel oil nozzles and adjusting the air supply to the burner, the firing rate may be varied to suit the steam requirement.

All air for combustion of the fuel oil is supplied by the engine driven blower which is provided with a damper at the blower outlet to adjust the volume of air in correct proportion to the fuel burned.

The power plant is a model "ZZ" Briggs & Stratton motor, air-cooled, direct connected to the condensate return pump. Power transmission to the blower and to the fuel oil pump is by means of V belts. Boiler proper is insulated with 1-1/2" Banroc blanket protected by sheet metal lagging. Space below the boiler at the towing end is utilized as a tool compartment, access to which is by means of a top-hinged door at the right side of the towing end of the unit.

The Model DS-31 Heater is designed for heating purposes, chiefly in connection with bituminous materials such as road oils and asphalts. Heat leaves the boiler in the form of steam and is given up as the asphalt or road oil is heated, and, as the heat is exchanged, the steam is condensed to hot water and returned to the boiler by the condensate pump.

By returning all condensate to the boiler, water is used over and over again, minimizing the tendency to scale the water side of the boiler and practically eliminating the water supply problem. In cases where live steam is used to atomize fuel oil for aggregate dryer burners, it is, of course, impossible to recover the condensate and the boiler water level must be restored from time to time, either by using the injector or by drawing water from the tank on the unit by means of the turbine pump.

SPECIFICATIONS FOR 3-CAR HEATER - MODEL DS-31

Power Plant	Briggs & Stratton, Model ZZ, Type 304665
Fuel Oil Pump	Tuthill Pump Co., Model OL-K
Condensate Pump	Aurora Pump Co., Model D-40
Wheels	Motor Wheel Corp., #L32283
Tires	Goodrich Implement, 7.50 x 16
Tire Pressure	48 Lbs.
Wheel Bearings	Timken
Gasoline Tank Capacity	5 Gallons
Shipping Weight	5000 Lbs.
Length	13 ft. 8 in.
Width	67 in.
Height	79-1/2 in.
Fuel Oil Tank Capacity	55 Gallons
Water Tank Capacity	45 Gallons
Water Content Boiler	156 Gallons
Fuel Consumption per Hour - Full Capacity	14 Gallons
Track Width (Centers)	53 in.

TABLE OF APPROXIMATE CAPACITIES AND CONSUMPTIONS FOR AN EIGHT HOUR DAY

Water		1392 Gallons This is with no condensate return. This amount will decrease with the amount of condensate returned.

U. S. Army Specifications

Fuel Oil	2-102B	112 Gallons
Motor Fuel	2-103A	4 Gallons
Grease	CG-Grease, General Purpose No. 1 (above +32° F.) No. 0 (+32° F. to 0° F.)	1/4 Lb. 1 Quart
Lubricating Oil	* SAE-30	

*Atmospheric temperature + 32° F., or over.
Use SAE-10 for temperature under + 32° F.

INDEX TO OPERATOR'S INSTRUCTIONS

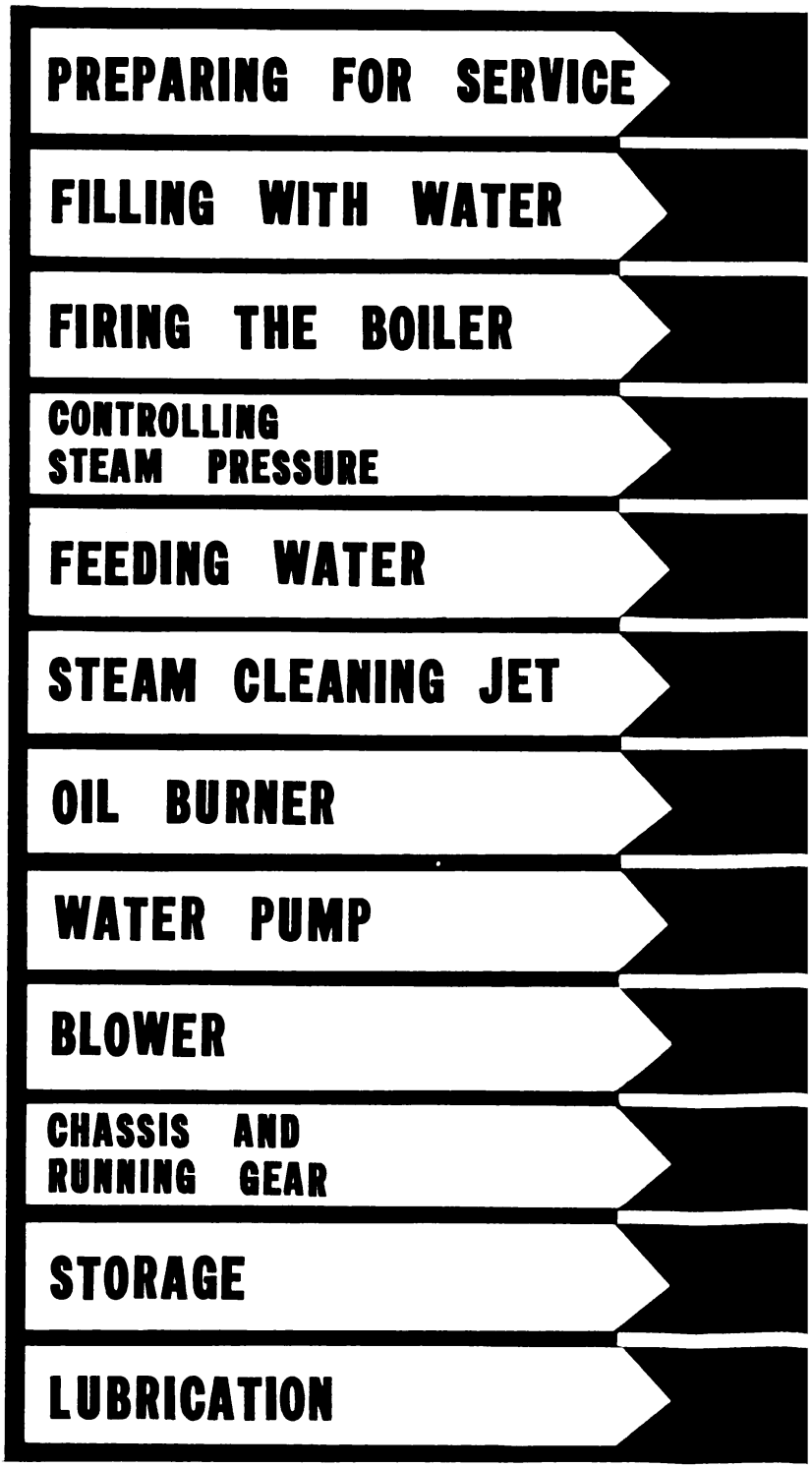


FIGURE 2

CUT-AWAY VIEW OF MODEL DS-31 TANK CAR HEATER

PREPARING MACHINE FOR SERVICE

Unlock hood over power plant and raise to extreme position allowed by the automatic brackets and the lower slightly to engage the mechanism to hold it in the fully open position.

From the inside, open left door of operating housing. Unlock tool compartment door, right front, at bottom of unit chassis.

Locate the heater as near the work as possible, consistent with free access to other equipment being used on the project. Set unit as nearly level as possible by digging in either or both wheels or the front leg post. The screw jack provided with the machine may be used under the circular power plant frame end to relieve the weight from the tires during operating period.

The following should be provided in sufficient quantity to assure continued operation for the period stipulated:-

1. Fresh Water
2. Fuel Oil - 2 - 102B
3. Motor Fuel 2-103A
4. Lubricating Oil - Above +32° F. OE SAE 30
   +32° to 0° F. OE SAE 10
5. Grease - CG, General Purpose No. 1 (Above +32° F)
   No. 0 (+32° F.to 0° F.)

Water

If the heating operation allows the return of all condensate to the boiler, fifty gallons of fresh water for boiler make-up should suffice for each day's operations. However, if only part of the condensate is recovered, the fresh water requirements will be greater. Make-up water for the boiler may be withdrawn from the built-in water tank on the unit by either the pump or the injector. The valve and piping arrangement also permits drawing water from an open bucket or barrel by the injector.

If only salt water is available, proceed according to instructions on Page 22.

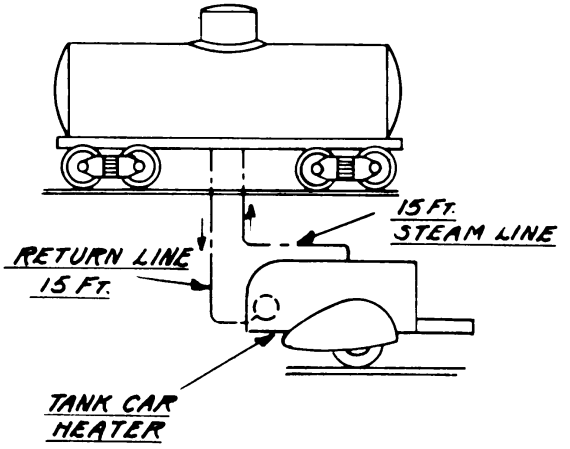
Fuel Oil

The Model DS-31 Tank Car Heater is designed for use with No. 3 U.S. Standard fuel oil, having a viscosity not exceeding 50 seconds Saybolt Universal at 100° F. Lighter fuels such as No. 1 and No. 2 may be used very satisfactorily. Practically all clear or straw-colored so-called tractor or Diesel fuels are suitable, but black, heavy viscous oils should be avoided as the pressure atomizing nozzle cannot atomize them for proper combustion.

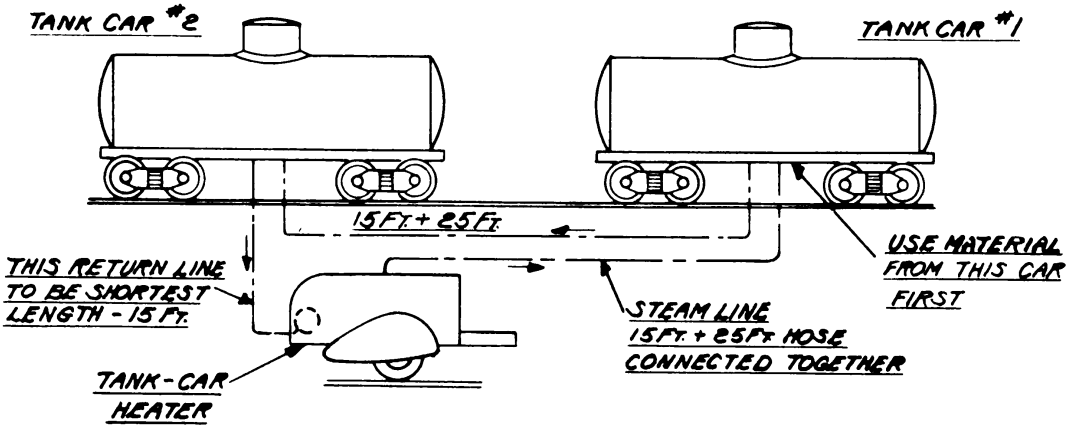
Should no other fuel oil be available, kerosene or coal oil may be used, but lubricant must be added to lubricate the gear-type fuel oil pump. Add one half pint #30 lubricating oil to each 5 gallons kerosene.

Gasoline may be used for fuel oil as a last resort, but the operator is cautioned to exercise every care in handling to prevent accidents. Add one quart lubricating oil per 5 gallons gasoline fuel used.

ONE-CAR HOOK-UP



TWO-CAR HOOK-UP



ALL HOSE 1" SIZE

THREE-CAR HOOK-UP

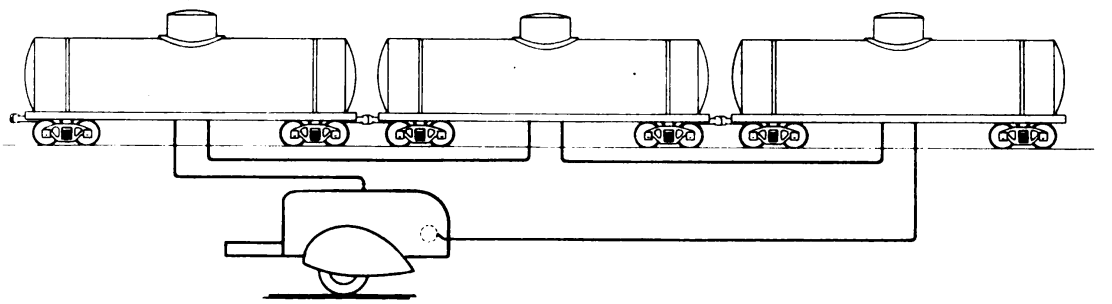


FIGURE 3 CAR HOOK-UP

Caution

When firing the oil burner with gasoline, extra precaution must be taken for safety. Should it fail to ignite on the first start, or the fire go out during the running operation. the combustion chamber must be purged of the carbureted or vaporized and highly explosive gases before again inserting the torch for a new start. With the fuel supply shut off, run the unit with the blower air damper open for at least 15 minutes before again attempting to fire.

Steam Outlet and Return Connections

The main steam outlet of the Model DS-31 Tank Car Heater is located at the top center of the boiler proper, between the water column and injector steam connections (See Figure 1). The 1-1/2" pipe fitting at the boiler is reduced by piping furnished with the unit to one inch at the upper elbow and a 1" globe valve provided as a shut off for all steam leaving the boiler. Remove steam hose from rack at towing end of unit. A 1" union is provided at the valve, one half of which should be attached to the hose carrying steam to the process. Complete this hose connection, making the run as short as possible. See Figure 3.

If the heating is by means of steam coils, the live steam line should be connected to the inlet connection, so marked on the device, and a hose connection provided from the outlet to carry the steam condensate back to the condensate pump, which in turn forces it into the boiler as feed water. The return line connection is attached to the valve leading to the condensate pump strainer as shown in Figure 4.

If steam is being used in coil heating and also in the steam atomizer of an aggregate dryer, a branch should be provided in the main steam line to serve that device, using pipe or hose of the size recommended. In all cases where steam is being used for more than one appliance, a stop valve should be installed in the steam inlet line to each.

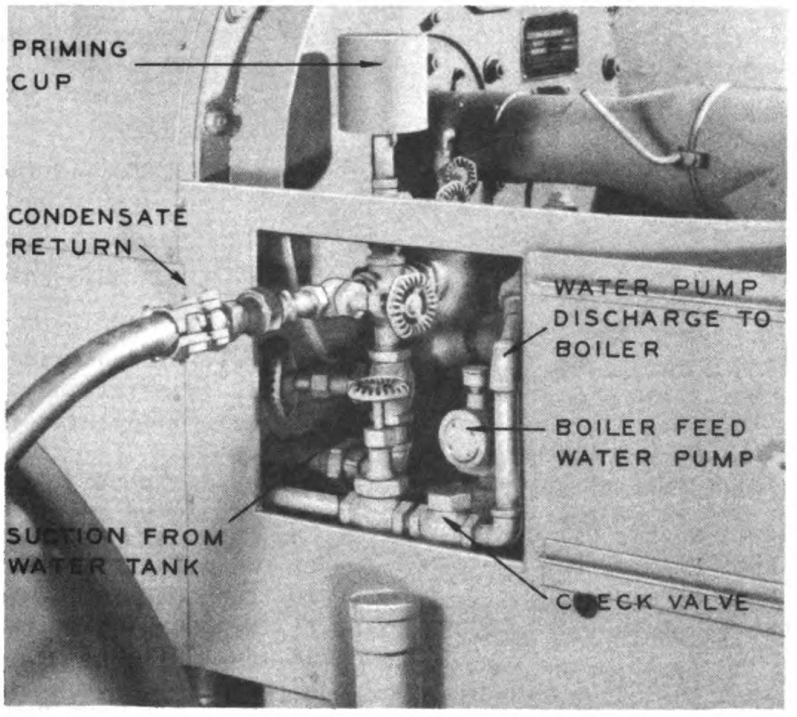


FIGURE 4 WATER PUMP

Fill gasoline tank located on the left side of the unit with approximately 5 gallons of fuel and open the valve in the sediment separator beneath it, allowing the fuel to pass to the carburetor of the engine.

Using fuel oil as recommended on page 5, fill the fuel oil tank with approximately 50 gallons of oil. Filler neck and cap are located on the left outer side of the power plant, immediately below the side door of the power plant housing. See No. 6, Figure 5. Fuel oil tank is vented for convenience in filling by goose-neck copper tubing assembly extending up through operating deck between blower and side housing. See No. 14, Figure 5.

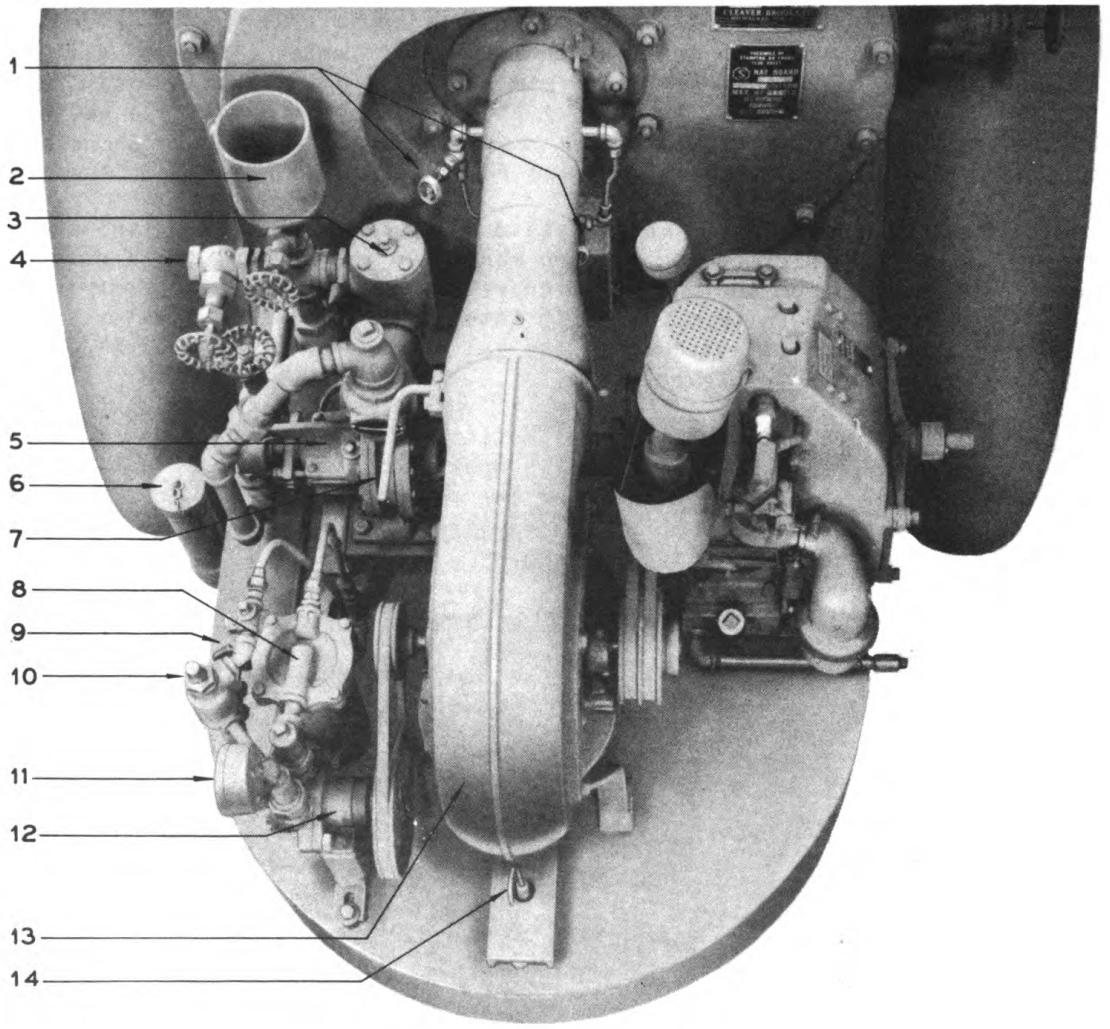


FIGURE 5 POWER PLANT

1. Individual Nozzle Oil Control Valves
2. Water Pump Priming Cup
3. Water Pump Strainer
4. Condensate Return
5. Water Pump
6. Fuel Oil Fill Neck
7. Burner Air Damper Handle
8. Fuel Oil Filter
9. Main Fuel Oil Shut-off Valve
10. Fuel Oil Relief Valve
11. Fuel Oil Pressure Gauge
12. Fuel Oil Pump
13. Blower
14. Fuel Oil Tank Vent

FILLING BOILER WITH WATER

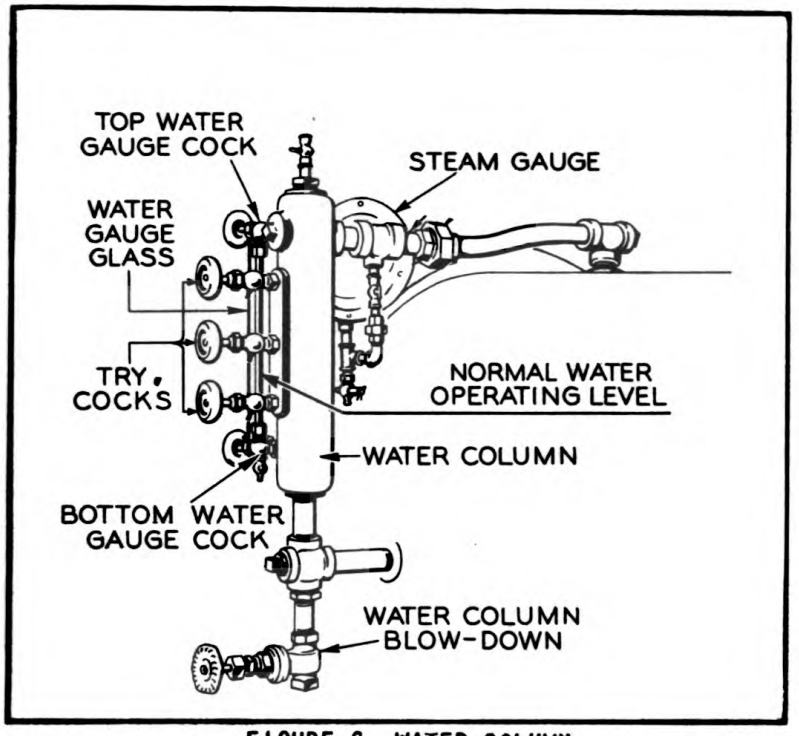


FIGURE 6 WATER COLUMN

Any one of several methods may be used to fill the boiler with water for a cold start, the simplest being to remove the tee at the main steam outlet at the top of the boiler and fill either with pressure hose or by pouring with hand bucket.

Make sure that the boiler blow-down or drain valve is closed with its operating handle horizontal as shown in Figure 7.

The boiler water gauge glass installed on the water column (See Figure 6) should be observed at all times by the operator to determine the boiler water level. Make sure that the top and bottom cocks are fully open by turning the wooden hand wheels to the left. Only with these cocks in the open position can the boiler water assume the true water level in the glass. When starting cold, fill the boiler to the point where two inches of water appear in the glass. (Water expands when heated and as steam pressure is built up, the level will rise to about four inches in the glass.)

(Select one of the three methods described below, according to conditions.)

Through Cold Injector

If water pressure service is available, a hose with 3/4" fittings may be attached to the injector inlet (See Figure 8) and a 3/4" iron pipe plug screwed into the injector overflow.

Open Valve 3 (discharge to boiler), Valve 1 (steam to injector) and Valve 5 in the water supply line. Close Valves 4 and 6. Start water flow, venting air displaced by water by opening one or more water column tri-cocks.

When water has reached the recommended level of two inches in the glass, shut off supply, remove plug from injector and close Valves 1, 3, 4, 5 and 6. Water pressure service to the injector may be used in this way for all water feeding requirements during operation as explained under "Operating Injector".

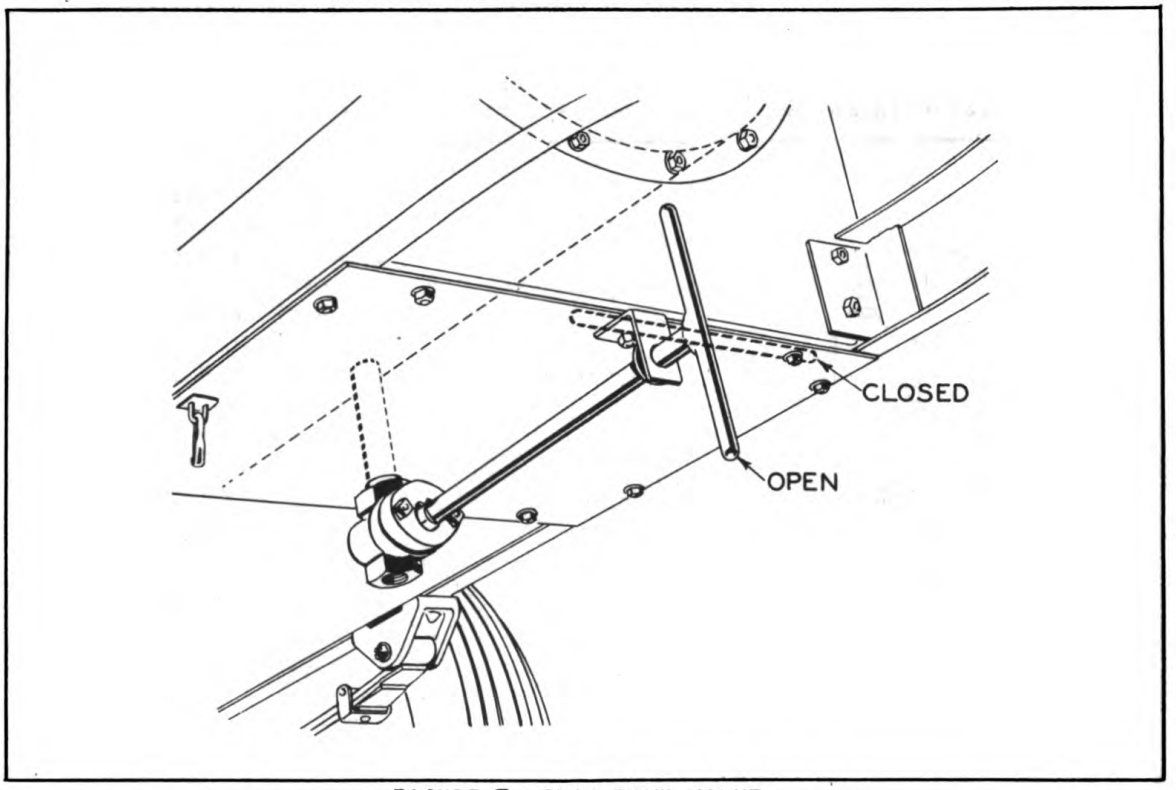


FIGURE 7 BLOW DOWN VALVE

Through Main Steam Outlet

If no water pressure is available, disconnect the tee from the 1-1/2" nipple between it and the boiler and fill with buckets, using a funnel if available, until about 2" water appears in the glass. Replace tee on main steam outlet and attach hose tc point of steam use. Close main steam outlet valve.

Through Water Pump (See Figure 9)

Fill water supply tank with water and make provisions to add sufficient water to its 30 gallons to make up the 90 gallons the boiler will require for start, leaving a full tank for operations. Follow instructions as to engine and fuel oil preparations. The three-car heater water tank holds 45 gallons and the boiler requires 156 gallons. Close main fuel oil valve #9, Figure 5.

Open Valve 1, allowing water to be drawn from the water tank to the pump suction or inlet.

Close Valve 2, cutting off the return condensate line to prevent air being drawn into the pump.

Open Valve 3, allowing water to be discharged from the pump to the boiler.

Fill priming cup (4) with water and open Valve 5.

Start engine.

Keep priming cup filled with water to run to pump until about a half pail of water has been drawn into pump and close Valve 5.

Water should then be picked up by the pump and drawn from the tank and forced into the boiler. To check water pump flow at start, open blow down valve (Figure 7) and close when steady flow of water appears.

When two inches of water appears in glass, close Valve 1 to stop water feeding.

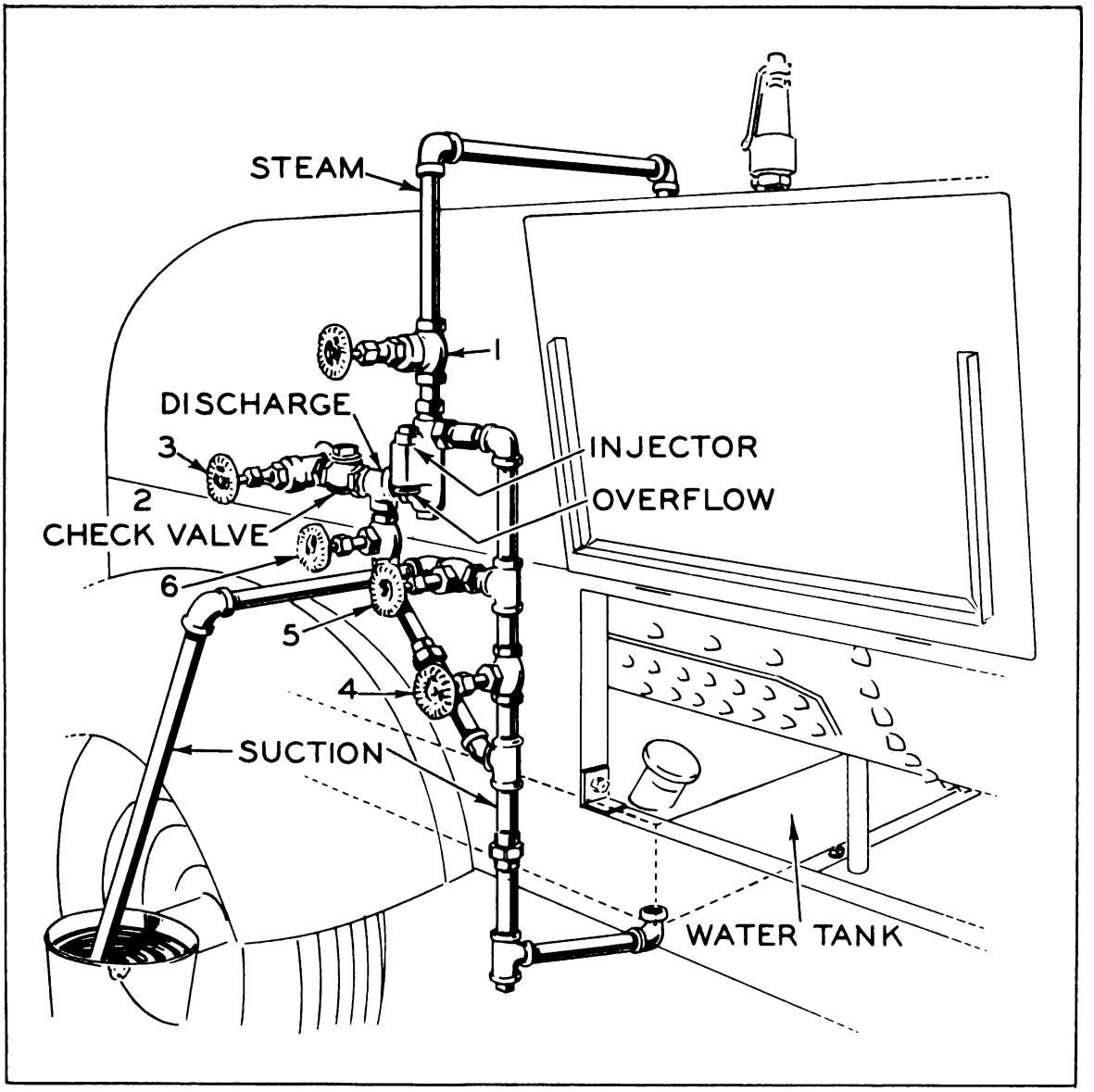


FIGURE 8 INJECTOR

FIRING THE BOILER

IMPORTANT

A SAFE WATER LEVEL IN THE BOILER IS THE MOST IMPORTANT FACTOR IN THE OPERATION OF THIS EQUIPMENT.

ALL OTHER MATTERS OF OPERATION CONTROL ARE SECONDARY! DO NOT FIRE AT ANY TIME WHEN WATER DOES NOT SHOW IN WATER GLASS!

Having made the following preliminary arrangements, the unit is ready for service:

1. Unit setting level.
2. Gasoline in tank.
3. Fuel oil tank filled.
4. Boiler water to 2 inches in gauge glass.
5. Steam connections to point of use.
6. Condensate return connection to pump.
7. Water supply.
8. Fuel oil supply.

Consult instructions on care and operation of Briggs & Stratton motor - Part 4 of this book.

Before attempting to start the engine, turn it over several revolutions slowly to assure free rotation of the water pump. If any binding action is observed or if the operator determines that any foreign matter has entered the water pump, it should be corrected as covered on Page 47.

Close main valve in fuel oil line to burner (No. 9, Figure 5).

At this point, the operator should make certain that the engine will start and run properly before attempting to fire the burner.

Start engine by releasing compression lock as shown in Figure 11. Speed should be between 2150 and 2200 R.P.M.

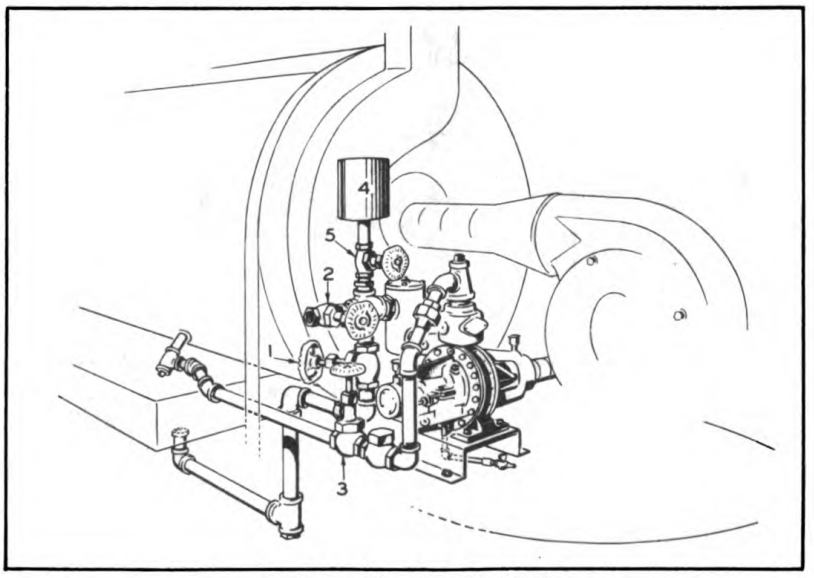


FIGURE 9 WATER PUMP

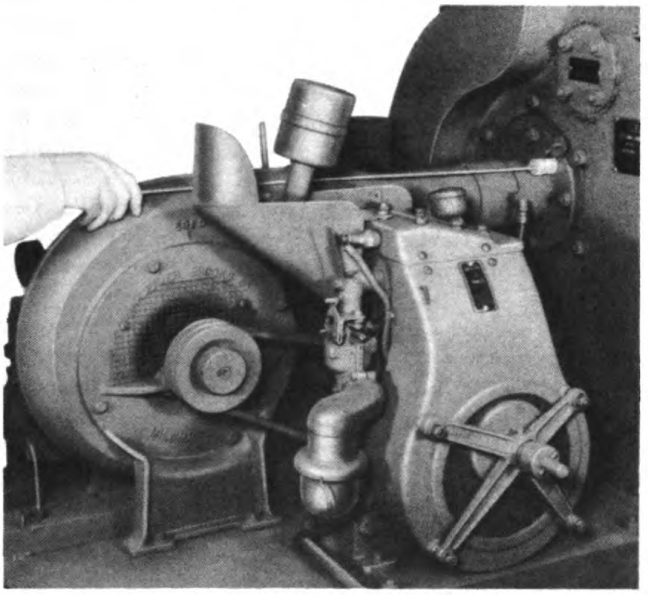


FIGURE 10 INSERTING LIGHTER TORCH

Check belt drives.

While engine is warming up, the fuel oil pump (No. 12, Figure 5) should withdraw fuel oil from the tank, building up a pressure of 100 pounds on the fuel oil pressure gauge (No. 11, Figure 5). If the pressure is above or below 100 pounds, adjust fuel oil pressure relief valve (No. 10) to 100 pounds, the recommended pressure, as described on Page 17.

Stop engine.

Open main fuel oil valve to burner (No. 9, Figure 5) and close both individual valves to the burner (No. 1). This allows start on but one nozzle.

Shut off all air to burner by turning handle on butterfly air damper at blower outlet to vertical position (No. 7, Figure 5).

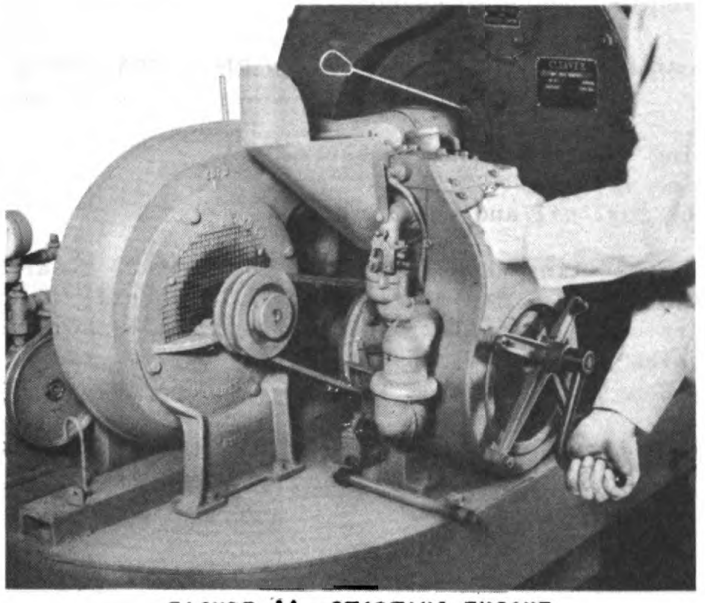


FIGURE 11 STARTING ENGINE

Open lighter port hole located at right of burner air tube where entering boiler. See Figures 10 and 11. Immerse wick end of torch in gasoline and ignite. Insert flaming end of torch into lighter port hole only far enough for torch to rest at bottom of combustion chamber, about 15 inches.

Start engine. Fuel oil pressure to nozzles should immediately reach 100 pounds and the oil fire will ignite. Immediately remove torch and open air damper only sufficiently to eliminate emission of smoke at stack. Extinguish torch flame.

To fire at full capacity, turn on second nozzle by fully opening the individual fuel oil valve below burner tube. See Nos. 1 and 2, Figure 5. First opening turn of valve should be very slow to prevent snuffing out of fire. Again open air damper only far enough to eliminate smoke. Open remaining valve to fire third nozzle and again adjust air to burn without smoke.

See that cock in pipe to steam gauge is open.

CONTROLLING STEAM PRESSURE

Maintaining Steam Pressure

The first indication of steam pressure will be the emission of steam from one of the water column tri-cocks which was opened to relieve the pressure created as the water replaced the air in filling boiler. Close all water column tri-cocks, the "steam to injector" valve and the main steam outlet valve.

The pop safety valve on the Model DS-31 Heater is set to blow off at 125# gauge. Highest recommended operating pressure is about 120#. Pressure closer to the blow off point of 125# results in unnecessary blow offs, wasting water and fuel.

Determine pressure at which steam is used. When boiler pressure reaches that point, gradually open main steam valve, cracking the valve first so that only a trickle of steam is emitted as evidenced by the hiss of steam through the small valve opening. Open further to the fully open position at the rate of about one valve turn every 10 seconds.

With the steam consuming equipment in operation, the boiler operator's duties involve:

1. Keeping constant steam pressure.
2. Feeding water.
3. Adding fuel oil and gasoline.

The steam generating capacity of the Model DS-31 3-Car Heater is approximately 42 horse power. Steam pressure will gradually rise so long as the steam generating rate of the boiler exceeds the steam consumption rate. Should the steam consumption exceed the capacity of the boiler, the pressure will gradually fall.

Obviously, then, the operator should fire the fuel oil burner at a rate which will keep the steam pressure constant at the desired point.

If Steam Pressure Rises

If firing at full capacity with all three nozzles on, turn off either of the valves (No. 1, Figure 5,) and close air damper on blower outlet to point where burner smokes, then open damper until smoke disappears. If firing with only two nozzles, turn off the remaining open valve.

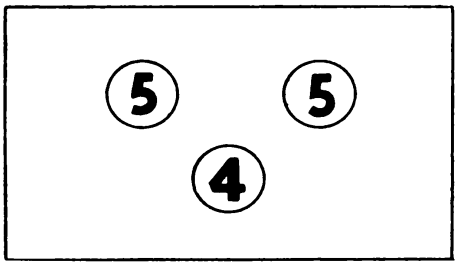


FIGURE 12

ARRANGEMENT OF FUEL NOZZLES IN OIL BURNER
FIGURES INDICATE GALLONS PER HOUR

If Steam Pressure Falls

Burn more oil by turning on the valve to an additional fuel oil nozzle. Increase air to fire by opening air damper to eliminate smoke.

If pressure falls with all three nozzles firing, and steam consuming appliance is hot, steam is being used faster than it can be generated.

(Pressure may fall slightly when feeding cold water to boiler, but will recover gradually between water feeding cycles.)

Firing Rule

After each fuel oil burning rate change, adjust air delivery at blower outlet. As oil is increased, supply more air; as oil is decreased, cut down air. Operate at all times with only sufficient air to eliminate smoke, at which point flame is most efficient.

Blow Down

Blow down boiler at blow down valve (Figure 7) by opening valve to allow vigorous passage of steam and water for at least five seconds and, with a head of steam, at least once each 8 hours.

Blow down water column and water column gauge glass at least once each 8 hours.

Keep water gauge glass clean.

NEVER FIRE BOILER WHEN NO WATER APPEARS IN THE WATER GAUGE GLASS -- OTHERWISE YOU WILL INVITE SERIOUS DAMAGE!

FEEDING WATER

The condensate return system on the Model DS-31 Heater is of the "trapless" or "closed" type. Do not install traps of any type between the discharge end of heating coils and the feed water pump on the heater. No valves in addition to that on the condensate inlet (See Figure 9) at the water pump on the machine are required.

Where the operation uses steam for aggregate dryer burner atomization and in coil heating, the condensate from the coils is returned to the boiler, and water must be added either by the injector method or by pumping from the water tank to replace that lost through steam entering the dryer.

Condensate Return Insufficient to Maintain Boiler Water Level

Draw water from tank by opening Valve 1, Figure 9. If level in boiler does not rise, close condensate return valve No. 2, Figure 8. Prime pump as described on Page 10 if pump does not pick up water.

Operating Injector

The injector is a steam operated device which forces water from an open container, or a water pressure line into the boiler. It will not operate properly on boiler pressure under about 35 pounds.

Open fully Valve 3, Figure 8, in the discharge line from the injector to the boiler.

Open fully Valve 5 in the supply pipe either from water pressure line or open container. If drawing water from open container, see that inlet strainer is fully submerged in water. Close Valves 4 and 6.

Quickly open steam Valve 1 and injector should immediately pick up water, forcing it into the boiler. If water spills out overflow, gradually close supply water Valve 5 until overflow stops and injector picks up water.

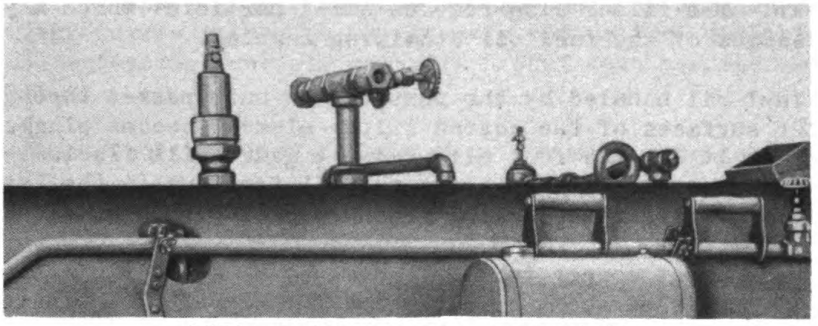
Injector will not operate with hot make-up water or while device itself is hot. If, after several attempts to operate, water spills out overflow, close steam Valve No. 1 and dash cold water over it to cool. When cooled, proceed with new start.

To Fill Water Tank With Injector (See Figure 8)

1. Close Valve 3 (injector discharge to boiler)
2. Close Valve 4 (tank suction to injector)
3. Open fully Valve 6 (injector discharge)
4. Open Valve 5 (water supply valve)
5. Open fully steam-to-injector Valve No. 1.

Water will be picked up from open container and fed to tank. Remove water tank fill cap. When filled to neck, close steam valve and replace the tank cap.

STEAM CLEANING JET



STEAM CLEANING JET FIGURE 13

Remove steam cleaning jet from heater, first loosening bracket wing nuts. Provide a steam hose connection between heater outlet and jet. Control steam by throttling valve attached to jet.

OPERATING IRREGULARITIES AND THEIR CORRECTION

Low Steaming Capacity

No boiler can keep up steam pressure if the total steam load connected to it is greater than its output capacity when fired at its maximum rate.

Steam leaks, however small, should be corrected whenever detected and all recoverable hot condensate returned to the boiler by the method provided.

See that engine is up to speed. (2150-2200 R.P.M.)

Make sure that fuel oil is turned on to all three nozzles (Valves 1, Figure 5)

Fuel oil pressure must not be less than 100 pounds.

To Adjust Fuel Oil Pressure

Remove hexagon cap at top of fuel oil pressure relief valve (See Figure 14). With engine running, use screwdriver to increase tension on internal spring to increase oil pressure, watching fuel oil pressure gauge while making adjustment.

To decrease oil pressure, turn screw out. To increase pressure, turn screw in.

When fuel oil pressure has been adjusted to 100 pounds, replace cap snugly against gasket, making it oil-tight.

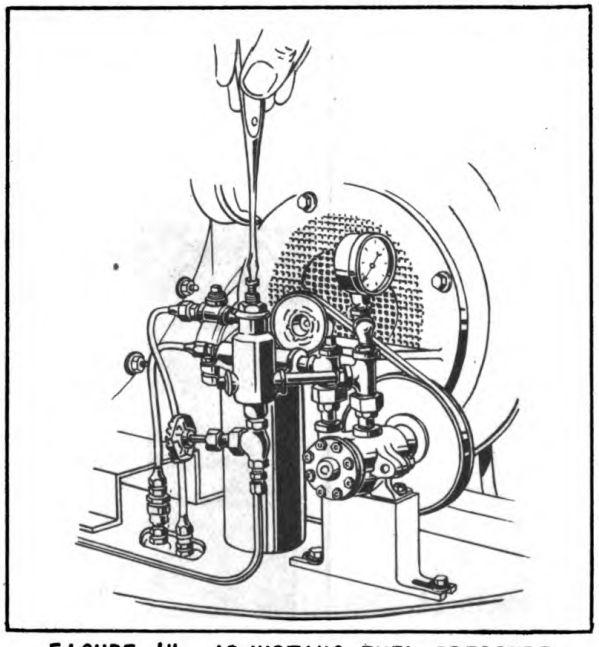


FIGURE 14 ADJUSTING FUEL PRESSURE

Replacing Fuel Oil Filter Element

The purpose of the fuel oil filter (See Figure 15) is to remove all foreign matter from the fuel oil to keep abrasives out of the pump, preventing excessive wear. The filter also removes small particles which may lodge in the small passages of the fuel oil atomizing nozzles.

All fuel oil handled by the pump on the unit passes through the filter. When the outer surfaces of the cotton filter element become plugged, oil will not pass through it and the fuel oil pressure gauge will fluctuate between 0 and 100 pounds pressure, extinguishing the oil fire due to the lack of the proper quantity of oil at the proper pressure of 100 pounds.

1. Disconnect copper tubing leading from the fuel oil tank to the filter body by detaching the copper tubing fitting at filter inlet.

2. Disconnect 3/8" union at top of fuel oil pump which attaches filter housing to pump and remove complete filter unit from machine.

3. Remove 4 cap screws attaching filter cap to body and withdraw old filter element from housing.

4. Thoroughly clean housing inside.

5. Insert new filter into housing.

6. Assemble filter body and cap with gasket between, installing the four cap screws and lock washers.

7. Attach assembly to fuel oil pump by making up 3/8" union tightly.

8. Attach copper tubing to suction line by connecting copper tubing connector.

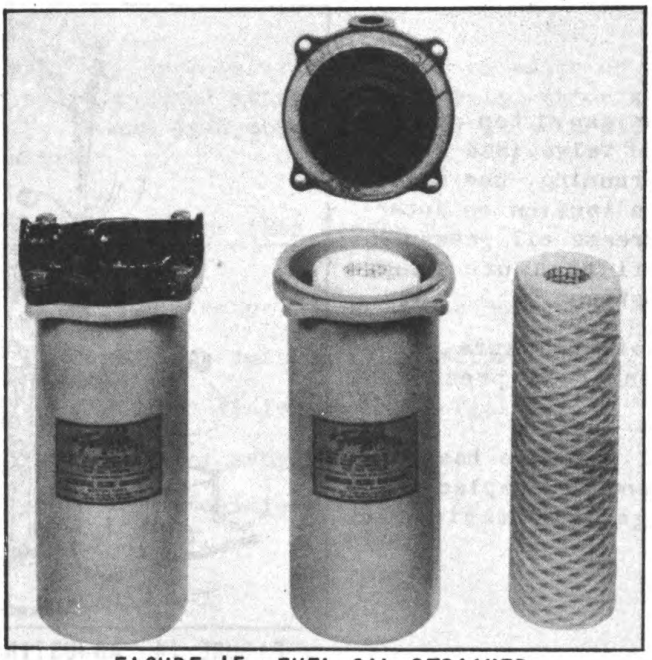


FIGURE 15 FUEL OIL STRAINER

OIL BURNER

Clean Fuel Oil Nozzles

Fuel oil pressure gauge may show 100 pounds, but plugged or partially plugged atomizing nozzle internals may greatly reduce fuel oil delivered to the fire, thus decreasing fuel oil capacity. Shut down machine and dismantle burner as follows:

Disconnect fuel oil line to burner at copper tubing connector, No. 1, Figure 16.

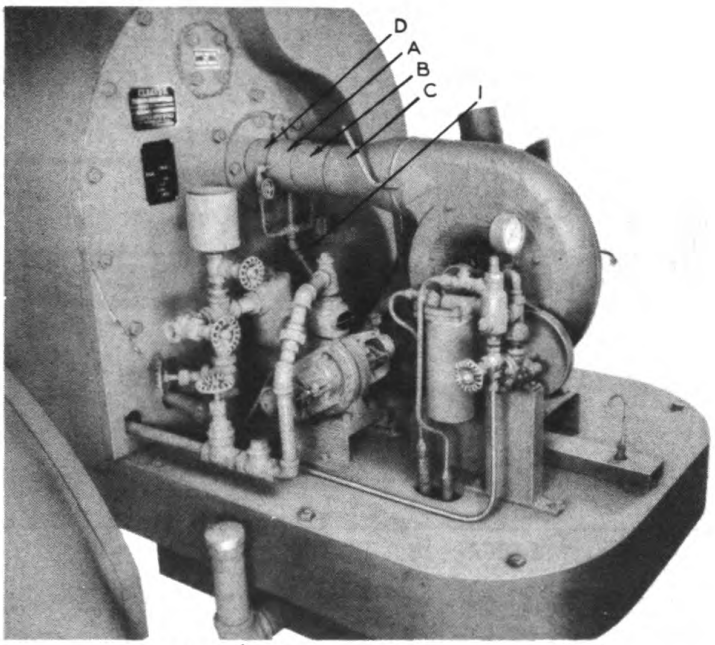


FIGURE 16 REMOVING BURNER

Remove 8 brass screws attaching brass air tube collar to front and rear connecting tubes. Slide collar A toward the blower on brass tube B. Withdraw tube B with collar A from air cone adapter C and withdraw burner assembly by pulling it away from the boiler until free.

Select two open end wrenches, one to fit the steel nozzle tip and the other to fit the hexagon fitting on the brass nozzle body as shown in Figure 17.

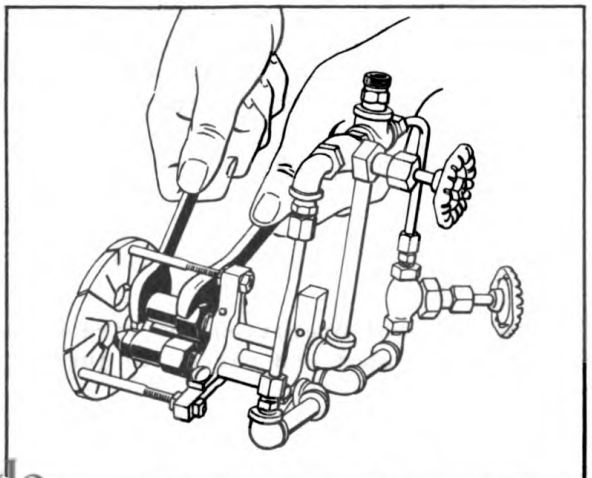


FIGURE 17 REMOVING BURNER NOZZLES

Remove all three nozzle tips from bodies, see Figure 17. Remove nozzle strainer screen from nozzle tip with the fingers, and with a screwdriver, the remaining internal part of the nozzle tip proper. Clean all internal surfaces of the nozzle tip and the slotted ports of the internal assembly, using a wood splinter so that the small oil grooves will not be damaged, particularly the small hole in the nozzle tip proper. Clean nozzle strainer screen carefully, removing all foreign matter to allow free passage of fuel oil through nozzle. Replace nozzle internal core, using a screwdriver to set it tightly, but not excessively so.

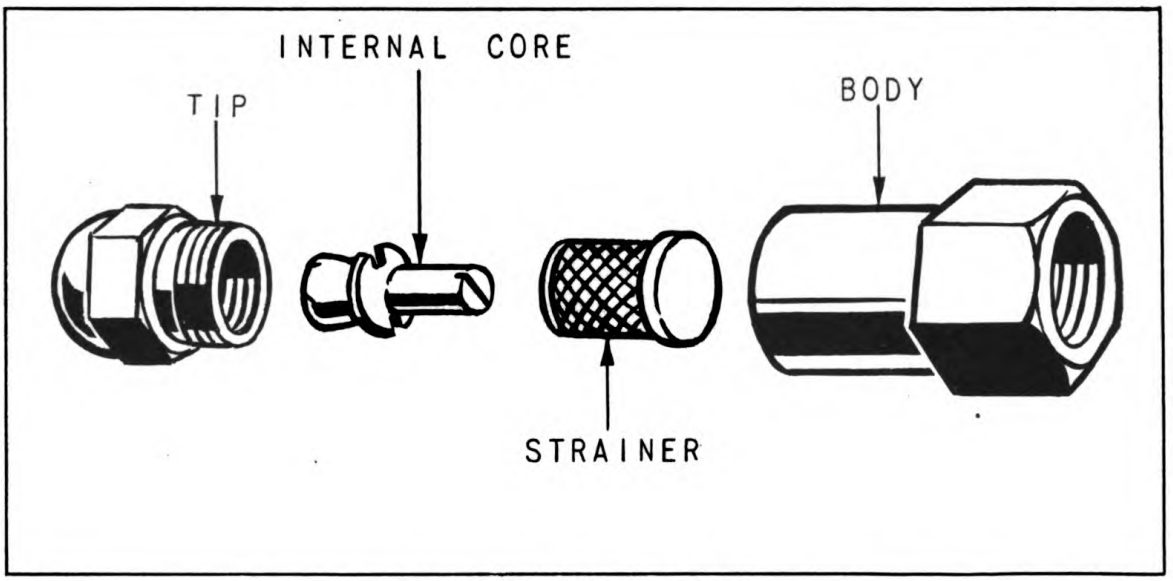


FIGURE 18 BURNER NOZZLE

IT IS ESSENTIAL THAT THE INTERNAL CORE BE TIGHTLY SEATED IN THE NOZZLE TIP FOR PROPER ATOMIZATION OF THE FUEL OIL.

Replace the strainer screen, screwing it into the nozzle assembly only finger-tight. Replace nozzle into brass nozzle body, using open end wrenches as when removed, seating tips tightly to prevent fuel oil leakage.

Installing Oil Burner

Insert oil burner internal assembly into air tube D attached to the boiler head with fuel oil tubing inlet connection at bottom (See Figure 16). See that collar A is outside of tube B and insert tube B into air cone adapter C. Slide collar A toward and slightly over tube D, lining up holes and installing the four screws attaching collar A to air tube D. Line up holes and attach tube B to collar A with the four screws.

Connect fuel oil tubing to burner inlet at the bottom of the burner assembly.

Boiler Tubes

After about 5,000 hours of operation the fire side of the boiler tubes may be sufficiently coated with soot and carbon to justify cleaning. Clean tubes as prescribed on Page 29.

THE WATER PUMP

ALIGNMENT. The flexible coupling between pump and engine should be carefully aligned. Inaccurate alignment results in rapid wear of the coupling bushings, heating of the bearings, causes noisy operation and may materially shorten the life of the pump.

STUFFING BOXES. Packing glands should be drawn up while pump is in operation - just enough to prevent excessive leakage. A slight leakage of a few drops per minute is recommended as this reduces friction losses and avoids scoring of the shaft. Once a shaft becomes scored, packing box difficulties can be expected. Use only special metallic packing furnished with pump. All old packing should be removed and new packing installed occasionally.

When priming trouble is being experienced, the packing glands may be too loose, permitting air to be drawn into the pump. Draw up on glands, but not too tightly.

No water delivered or not pumping full capacity.

(a) Pump not primed

(b) Air leaks in return line

(c) Suction lift too high

(d) Return line or strainer clogged

(e) Mechanical defects

(f) Air leaks through stuffing boxes

Pump takes too much power.

(a) Packing too tight

(b) Impeller out of adjustment and rubs casing. Check pump - should turn freely by hand.

Keep rust or dirt out of the pump by cleaning the condensate strainer (See No. 3, Figure 5) as often as experience shows necessary.

Be sure that all piping, valve stems, and strainer cover on suction side of turbine are tight, as air leaks will positively prevent the turbine from pumping water.

When there is danger of freezing, open cock under pump and drain.

Keep grease cups filled.

Do not throttle valve in discharge line to reduce capacity.

If pump is to be idle for a long period, it should be taken apart, cleaned and oiled as described on page 47.

Blower Speed

All air for combustion is provided by the blower and during normal running operation the stack should be clear of smoke. If blower smokes with three nozzles firing and with air damper in blower outlet open, increase engine speed only sufficiently to clear smoke.

Engine should not be run faster than required to drive blower to produce sufficient air to assure smokeless operation under full capacity with butterfly damper in blower wide open.

Boiler Scale

Scale on the water side of the boiler tubes may eventually decrease the proper steam capacity of the unit. Make up water should be treated for scale removal as described on Page 45.

COLD WEATHER OPERATION

When operating at temperatures below freezing, precautions should be taken to see that piped water supply is kept open to prevent interference to boiler water feed.

Injector should be operated frequently to prevent freezing as boiler upper surface is insulated and radiated heat may be insufficient to prevent freezing.

During cold weather shut-down periods, the machine should be drained completely as instructed in the first paragraph under "Storage Procedure" following.

EMERGENCY OPERATION WITH SALT WATER

The Model DS-31 Tank Car Heater should not be operated with salt water unless absolutely necessary as the salt will be deposited in scale form on the water side of the tubes and materially reduce heating capacity and shorten the life of the boiler.

To operate with salt water, fill boiler as directed under "Filling With Water" and proceed with operations as with fresh water, recovering and returning all condensate to the boiler that it is possible to save, as condensate is pure distilled water.

As soon as fresh water is available, stop machine, drain and refill with fresh water.

The chassis may be considered a part of the boiler under-structure. It has no moving or working parts.

RUNNING GEAR (See Page 53.)

Removing and Reassembly of Wheel Bearings - Jack up wheel and remove hub cap which is right-hand-threaded to the wheel hub.

Remove cotter pin and unscrew castellated nut holding outer bearing in place.

Pull off wheel. Remove outer bearing from inside hub with the fingers. Inner bearing will remain on axle. Wash bearings in fuel oil or kerosene thoroughly and carefully clean interior of hub.

Reassembly of Wheel Rearings - Install grease seal on axle shoulder with leather face out. Install larger inner bearing on axle with taper toward axle end. With both bearing races properly placed inside the hub, grease both bearings and races thoroughly and install wheel and hub.

Insert small outer bearing with the taper away from the axle end. Install castellated nut and while wheel is spinning, tighten until tension stops wheel. Loosen to next cotter pin position (approximately 1/6 turn) and install cotter pin. Grease outer bearing thoroughly and install hub cap.

DEAD STORAGE

Refer to TM5-9715, Preparation of Corps of Engineers Equipment for Storage, issued by the Engineer Field Maintenance Office, P.O. Box 1679, Columbus, Ohio.

EXPORT SHIPMENT PROCEDURE

Refer to TM5-9711, Preparation of Corps of Engineers Equipment for Export, issued by Engineer Field Maintenance Office, P.O. Box 1679, Columbus, Ohio.

LIMITED STORAGE

Drain boiler completely. Drain water column completely by opening water column blow down valve. Drain water column gauge glass completely from bottom water column gauge cock. Drain injector and injector piping completely. Drain water pump at cock under pump base. Drain oil from engine crankcase. Attach caution tag to engine stating "crankcase drained".

Remove spark plugs and inject cylinder oil at the top of pistons and on valves. Replace spark plugs.

Clean all tools and after an oil bath, replace them in water proof paper and store in right front tool compartment.

When completely drained, close bottom blow down valve. Close main steam valve to injector. Close main steam outlet valve. Close all three water column tri-cocks. Close gauge glass bottom gauge cock. Close upper and lower water column gauge glass cocks. (The object of closing the above valves is to store the boiler air tight to prevent the entry of moisture.)

Store tires according to Service Regulations.

LUBRICATION INSTRUCTIONS FOR

HEATER, ASPHALT, 3 CAR, GASOLINE

(CLEAVER-BROOKS MODEL DS-31)

MFR.'S SERIAL No. located on plate on front head of boiler.

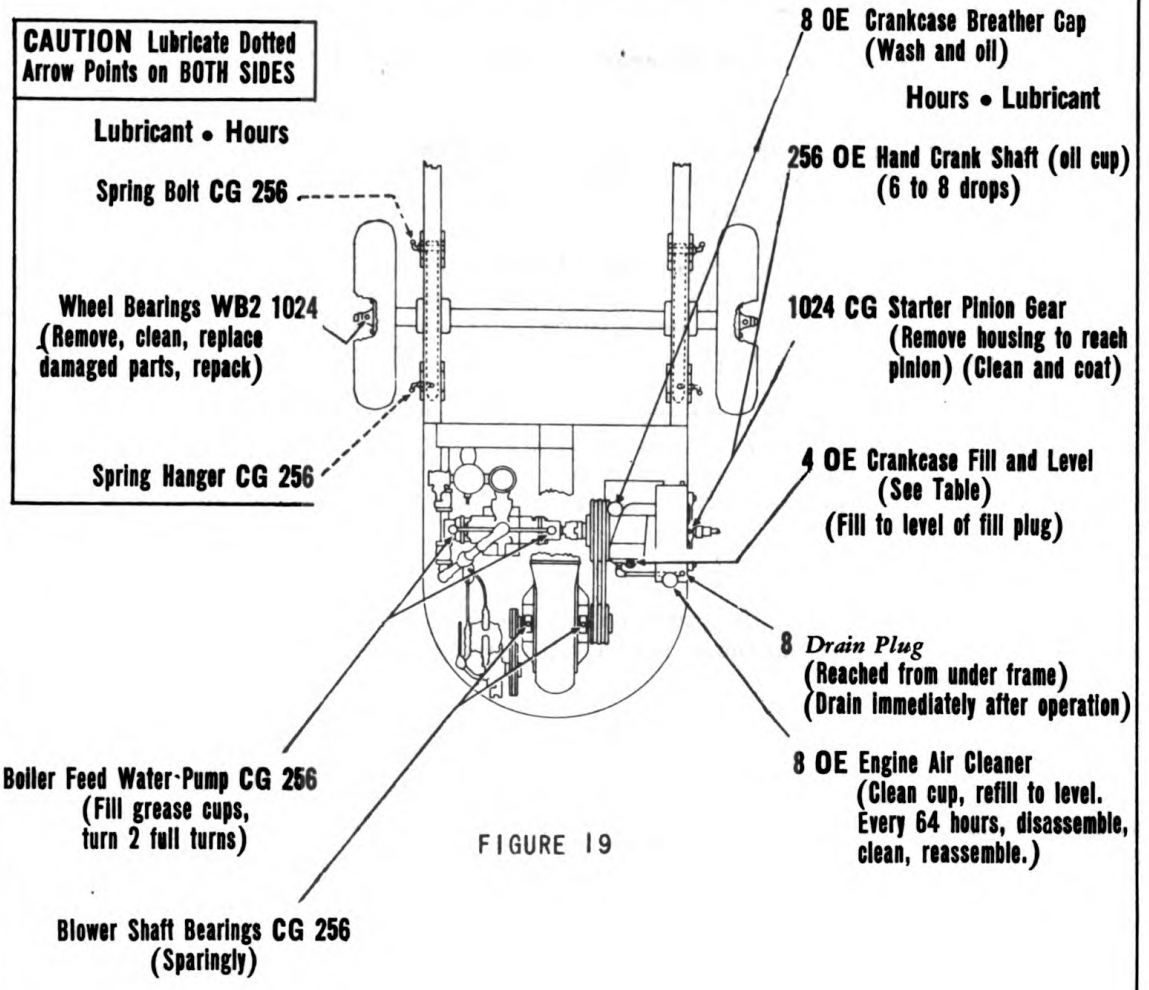


FIGURE 19

— KEY —

LUBRICANTS	
OE—Oil, engine (Except crankcase) SAE 30 (above +32° F.) SAE 10 (+32° F. to 0° F.)	CG—Grease, general purpose No. 1 (above +32° F.) No. 0 (below +32° F.) WB—Grease, general purpose No. 2

TABLE OF CAPACITIES AND LUBRICANTS TO BE USED

UNIT	CAPACITY (Approx.)	LOWEST EXPECTED AIR TEMPERATURE		
		ABOVE +32° F.	+32° F. to 0° F.	Below 0° F.
Crankcase	2¼ qt.	OE SAE 30	OE SAE 10	See Cold Weather Note

TIRE PRESSURES

45 lb.

NOTES

Additional Lubrication and Service Instructions on Individual Units and Parts

1. FITTINGS—Clean before applying the lubricant gun.

2. CLEANING—SOLVENT, dry-cleaning, or OIL, fuel, diesel, will be used to clean or wash all parts. Use of gasoline for this purpose is prohibited. All parts will be thoroughly dry before relubrication.

3. HOURS—The hours indicated are for normal service. For extreme conditions of heat, water and dust, change crankcase oil and lubricate more frequently.

4. OIL CAN POINTS—Every 64 hours, lubricate linkages, throttle control rods, etc., with OE.

5. POINTS REQUIRING NO LUBRICATION—Fuel Oil Pump, Chassis Springs.

COLD WEATHER NOTE

When shutting down engine drain crankcase; then add ½ qt. gasoline to 1¾ qt. OE-10. Run engine 5 minutes to mix.

INDEX TO MAINTENANCE INSTRUCTIONS

THE BOILER

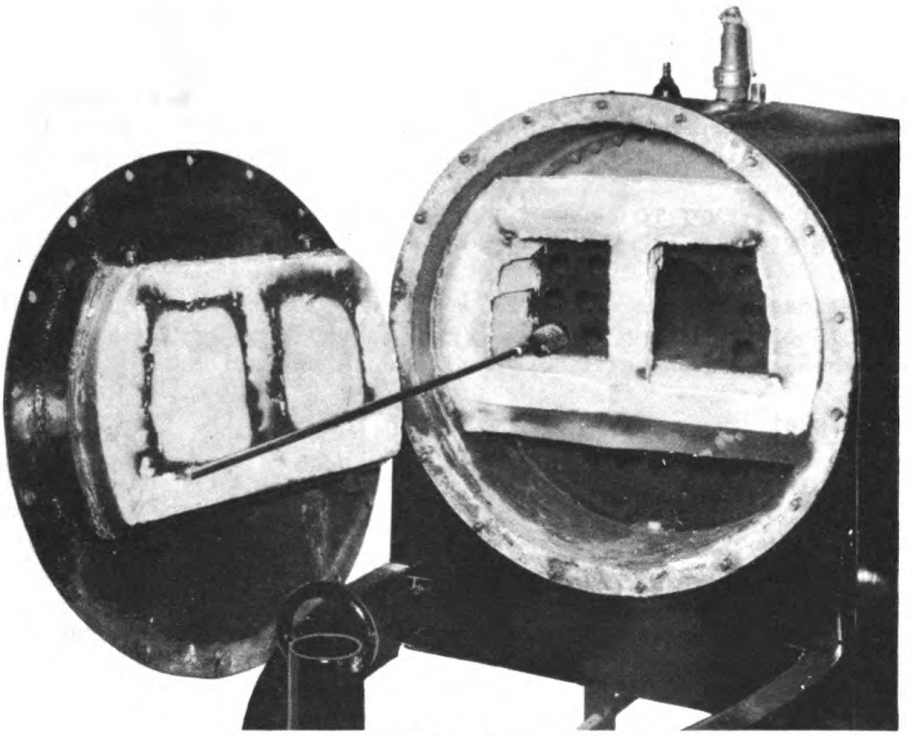


FIGURE 20 CLEANING TUBES

Cleaning Tubes

Tubes, or flues as they are sometimes called, in other types of boilers require daily or, in some cases, weekly cleaning. Because of the principle of firing the Model DS-31 Tank Car Heater, the tubes do not require periodic cleaning, and this work should not be attempted unless inspection has revealed the need for tube cleaning.

Tools Required:

1 Wrench to fit outer head nuts
1 Heavy screw driver
1 Wire flue brush and handle

Material Required:

1 Outer head gasket (See Ref. No. 32, Page 61.)

Tubes should be cleaned from the end opposite the firing end of the unit.

Remove all hexagon nuts from the studs attaching the outer head to the boiler shell except one at the top and one at the bottom, which are loosened to about three threads engaged.

With a screw driver, chisel or other prying instrument free head from its mounting flange, leaving gasket attached to boiler shell flange if possible. When free all the way around, steady the head in position and remove the remaining two nuts.

Bearing in mind that the head weighs about 100 pounds and that there is a brick attached to its fire side, remove it by the handles and lay it, brick up, on the floor.

With the wire flue brush assembled to its iron-pipe handle, start with the upper tubes, forcing brush entirely through each tube until it is free at the opposite end, then pull toward open end in a continuous movement.

DO NOT ATTEMPT TO REVERSE BRUSH DIRECTION WHILE BRUSH IS IN A TUBE AS IT WILL STICK TIGHTLY.

Continue brushing each tube with full length sweeps until brush comes out clean. Soot or carbon dislodged and pushed into baffle chamber will be blown out when the machine is again placed in operation.

Replacing Gasket

If outer head gasket has been broken or for any other reason needs replacement, cut new gasket from 1/16" asbestos paper 36" wide as shown in Figure 41. Remove old gasket and brush on coat of mixed lubricating oil and graphite, if available, to both metal surfaces before replacing.

If brickwork has been found defective, repair as instructed under "Replacing Brickwork".

Seal between brick built into boiler and brick attached to outer head is formed by a trowel coat of asbestos cement. If asbestos cement is available, remove old coating from brick surfaces and apply new surface with plastic mixture asbestos cement and water.

Replace head and pull up all attaching outer nuts tightly.

REPLACING BOILER TUBES

The work of installing boiler tubes should be assigned a skilled boilermaker if at all possible. However, these instructions cover the operation fully and any skilled mechanic with proper tools can perform the operation.

Preparing for Tube Replacement

Disengage the hood supporting brackets, then remove the pin in the top hinge and set the hood aside.

Remove the side housing by removing all screws attaching it to the boiler head and the base frame.

Remove the oil burner and air tube assembly as instructed on Page 19.

Disengage the union A, Figure 21 in the water pump discharge line. Disengage the union B in the feed water pump suction line from the water tank to the water pump. Detach the copper tubing jumpers leading from the fuel oil tank to the fuel oil filter and to the fuel oil relief valve (C and D, Figure 21).

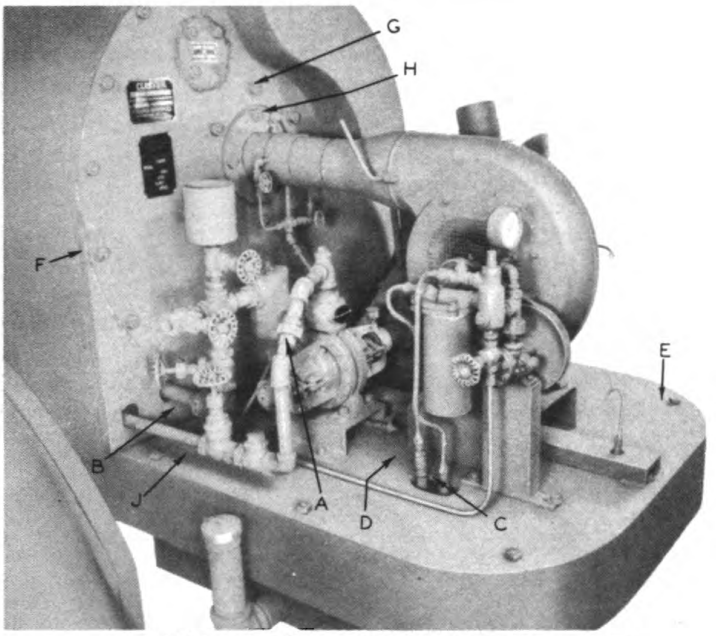


FIGURE 21 REMOVING POWER PLANT

The entire power plant assembly is then ready for removal from the machine after removing the five nuts from bolts E, Figure 21.

Remove power plant assembly, using a hoist if available and set it aside.

Remove rear outer head (towing end) as instructed under "Cleaning Tubes", Page 30.

Remove all nuts from outer bolt circle attaching front head (firing end) to boiler shell (F, Figure 21).

Remove all nuts from inner bolt circle, G, Figure 21.

Remove four nuts attaching burner tube mounting ring (H, Figure 21). Remove ring and set it aside.

Remove bottom steel baffle plate, Figure 22.

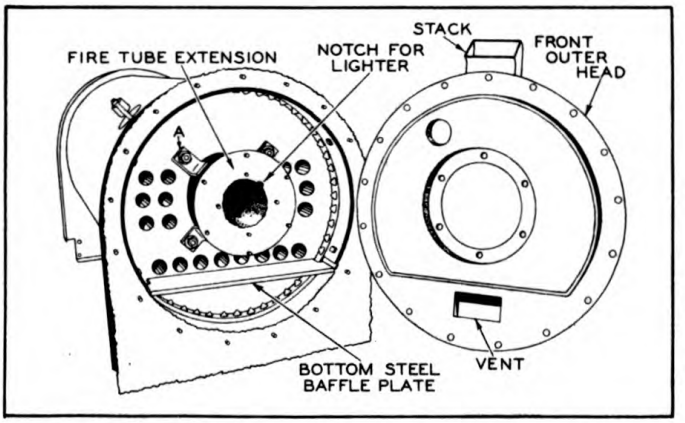


FIGURE 22 REMOVING FIRE TUBE EXTENSION

Remove fire tube extension, Figure 22 by detaching the four nuts and washers "A".

CAUTION:

Bear in mind the fact that the fire tube extension weighs about 75 pounds, so remove bottom nuts first and the upper two after making provision to support it for removal.

Remove fire tube extension and set it aside.

Remove all brick in the rear (towing end) baffle chamber using precautions to loosen cemented joints to save brick if possible.

Remove steel bottom brick supporting bar by raising from guide seats.

With ball peen hammer and cold chisel, remove bead and weld from both tube ends as shown in Figure 23, using precaution not to injure the tube sheet.

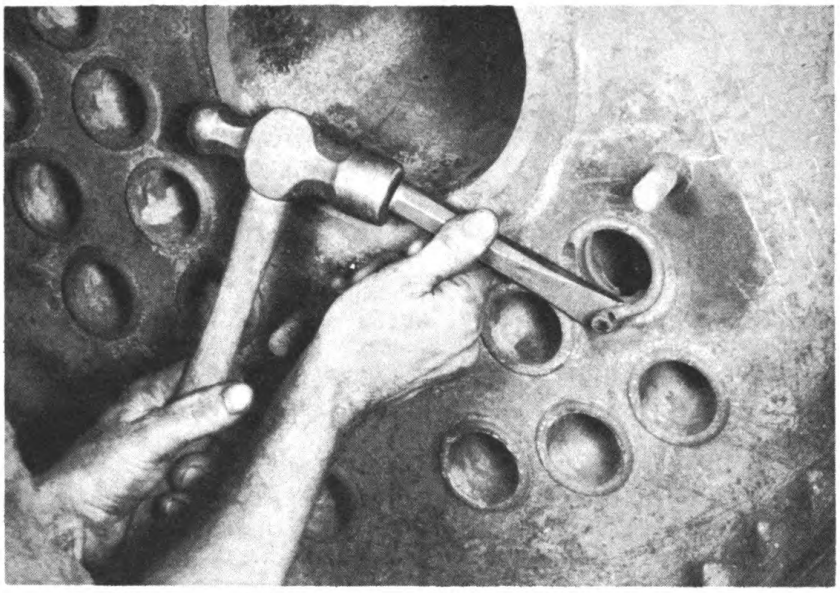


FIGURE 23 REMOVING BEAD

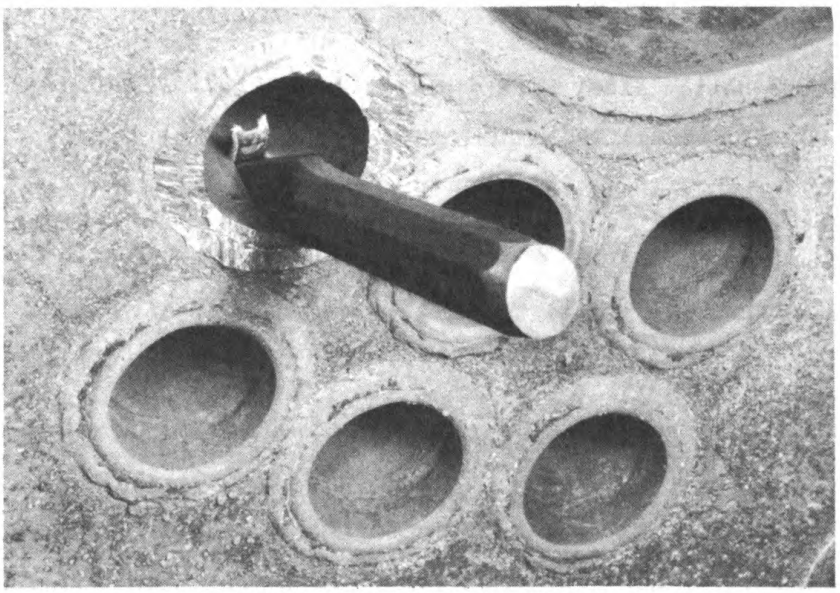


FIGURE 24 SLITTING TUBE

After bead roll and weld has been removed, with a cape chisel cut a slit in both tube ends lengthwise as shown in Figures 24 and 25.

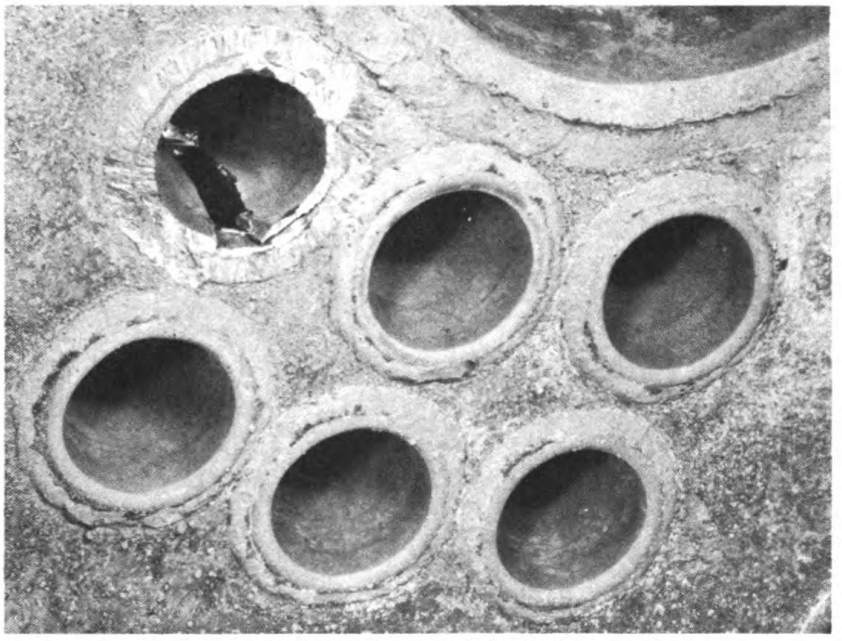


FIGURE 25 SLIT TUBE

With cape chisel turn in free ends of the tube as shown in Figure 26.

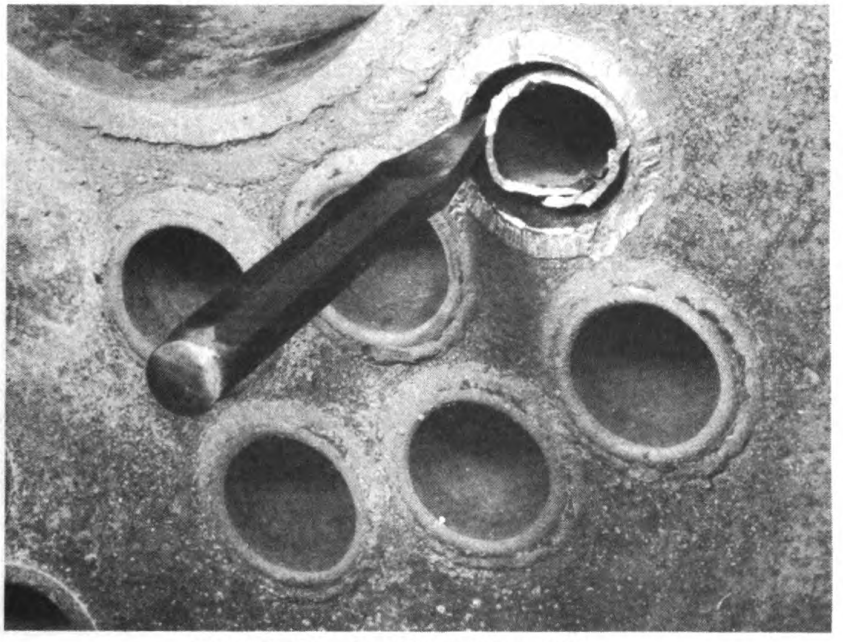


FIGURE 26 TURNING TUBE END

Because of scale on water side of tube, it will be necessary to drive out tube, shearing off scale as it passes through the tube sheet through which it is being driven. After tube is out, trim tube sheet hole with file, removing burrs as shown in Figure 27.

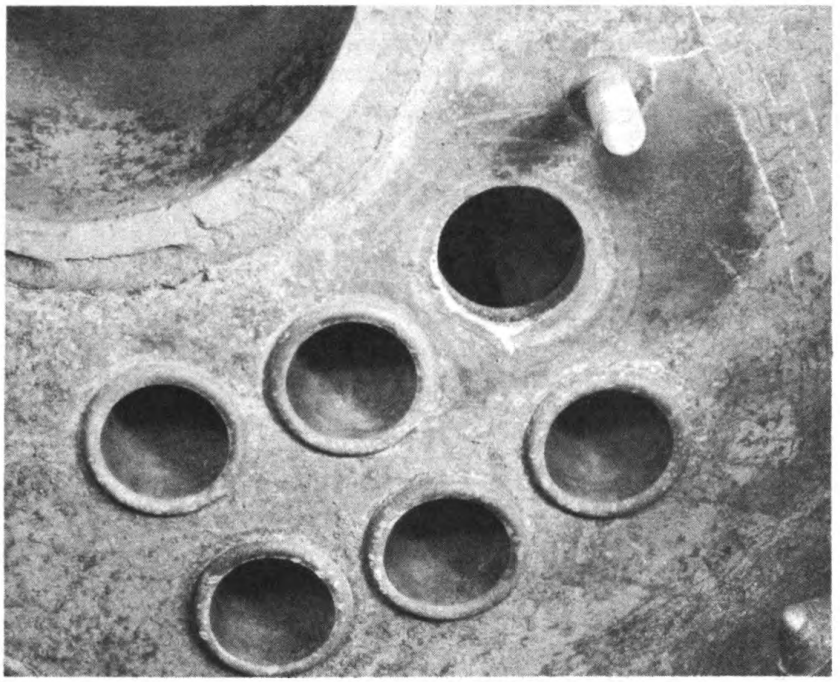


FIGURE 27 TUBE HOLE

Insert new tube which should extend from 1/4" to 3/8" beyond the outer sides of the tube sheet.

With a ball peen hammer, flare out the projecting section of the tube all the way around as shown in Figure 28.

NOTE: Figure 28 shows all tubes being replaced. The single flaring hammer blow on each has been applied to hold the tubes in place.

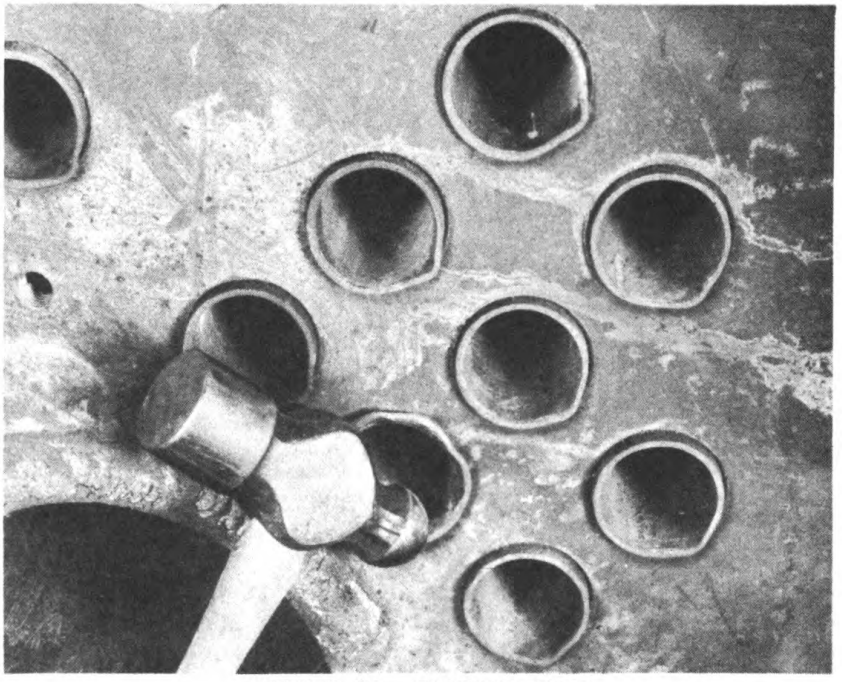


FIGURE 28 FLARING TUBE

After both ends have been flared with a hammer, use beading tool to roll over edge of tube tightly against flue sheet as shown in Figure 29.

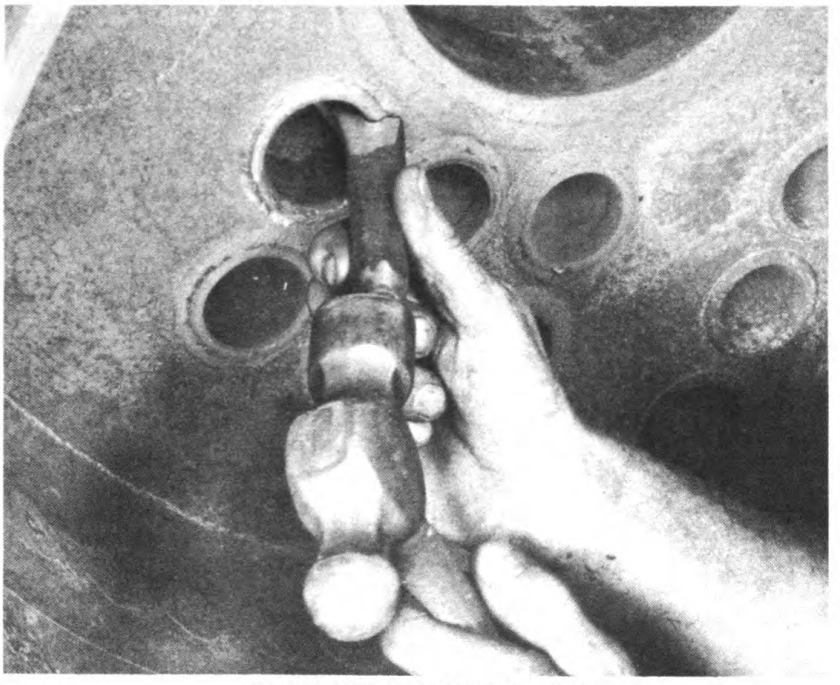


FIGURE 29 BEADING TUBE

The final operation in tube replacement is to expand the tube to place a shoulder just inside the tube sheet. The tube expander is used for this purpose as shown in Figure 30.

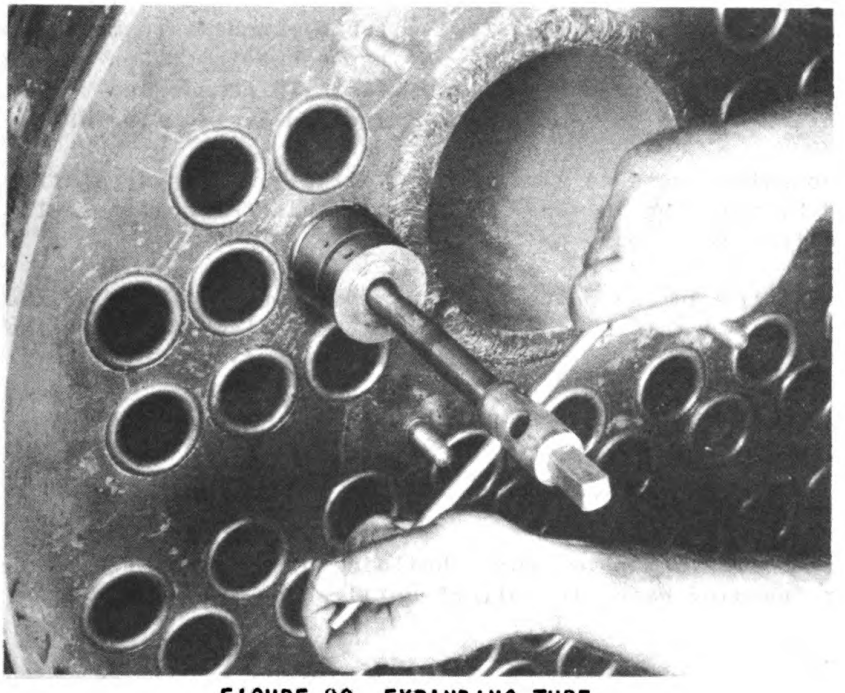


FIGURE 30 EXPANDING TUBE

A typical finished tube beading and rolling operation is shown in Figure 31.

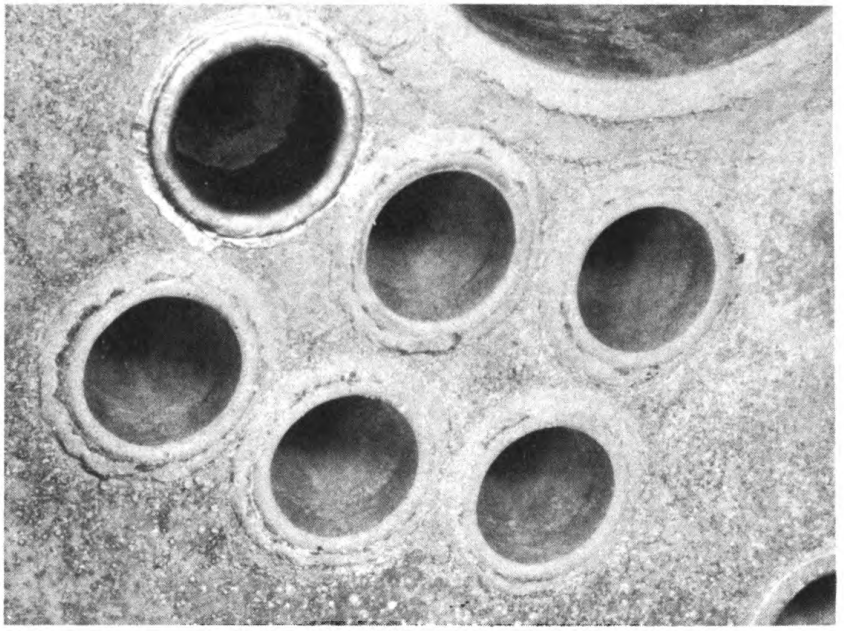


FIGURE 31 NEW TUBE INSTALLED

Hydrostatic Test after Tube Replacement

After boiler tube repairs or replacement operations have been completed, the boiler should be pressure tested to reveal any leaks that may appear. The most satisfactory method is the hydrostatic or water pressure test.

Remove pop safety valve and replace with plug.

If water pressure service is available, connect to main steam outlet and fill boiler to overflowing. Boost pressure by means of a hand or other type of water pressure pump to at least 175 pounds and carefully inspect the entire circle where the tube is rolled at the flue sheet.

If no water pressure service is available, the hydrostatic test must be performed by building up water pressure within the boiler shell, using the turbine type feed water pump on the unit.

Replace the entire power plant assembly on the frame of the unit and attach only the feed water suction pipe union B, Figure 21, and the feed water discharge union A, Figure 21. Arrange gasoline service to the engine.

Fill boiler with water completely as directed on Page 9.

Fill water tank.

Start engine and prime pump, building up boiler water pressure as directed under "Feeding Water to Boiler" until about 150 pounds pressure shows at gauge.

NOTE: Maximum pressure built up by the pump depends upon the condition of the pump and from 100 to 150 pounds may be the maximum pressure obtainable. When pressure no longer rises with pump running, close Valve J, Figure 21 to hold pressure in boiler and stop engine.

When test has been completed, detach unions A and B, Figure 21 and remove power plant assembly as previously directed.

Replace pop safety valve.

Reassembly after Tube Replacement

Front Head (Firing End)

Replace bottom steel baffle plate (Figure 32).

Replace fire tube extension by attaching it to the flue sheet studs by installing the four washers and nuts.

Prepare 1/16" asbestos paper gasket as shown in Figure 41, brushing a coat of oil and graphite on the boiler shell flange and on the outer head where the gasket is engaged.

Install gasket.

Replace oil burner air tube flange, Figure 21.

Replace outer head, installing washers and nuts on all studs.

Replace power plant assembly on chassis, attaching five nuts and lock washers securing base plate to chassis.

Attach two unions in feed water pump suction and discharge piping.

Replace fuel oil copper tubing connection to tank from fuel oil strainer and fuel oil relief valve.

Install oil burner inner assembly as directed on Page 20.

Attach fuel oil copper tubing line to bottom burner connection. Replace side housing around oil burner.

Replace top hood over power plant assembly.

Install brick in rear baffle chamber (towing end) and replace rear outer head as directed under "Rebricking Boiler".

BRICK REFRACTORY REPAIR AND REPLACEMENT

Consult parts list and secure proper brick, cement and gaskets required.

Rear Baffle Chamber (Towing End)

Remove rear outer head as directed under "Cleaning Boiler Tubes".

Remove brick from baffle chamber compartment, leaving only the bottom steel supporting plate shown in Figure 32.

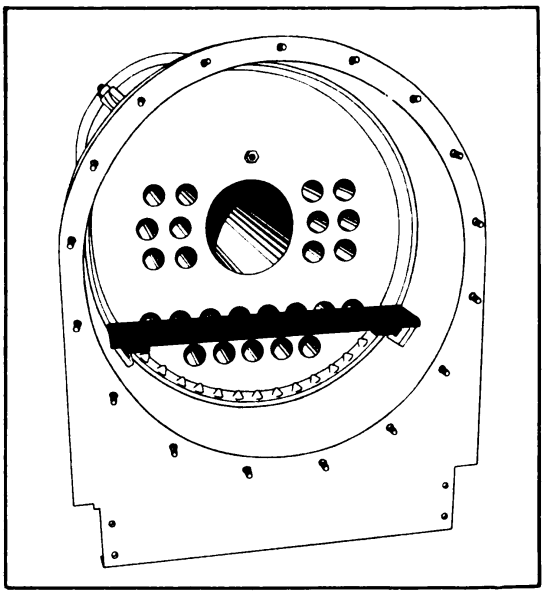


FIGURE 32 REAR BAFFLE CHAMBER

With wire brush or other instrument, thoroughly clean all metal surfaces to adjoin new brick, including the flue sheet (the boiler head to which the large fire tube and the smaller tubes are attached) and the inside of the boiler shell.

If the brick attached to the rear (towing end) outer head is to be replaced, break out the remaining pieces with a hammer and chisel, exposing the bolts engaging the brick and which go through the supporting frame. With a small pipe wrench, turn out all the bolts toward the inside and discard them.

Rebricking

Mix sufficient common Portland cement and water with about 20 pounds crushed fire brick to a plastic consistency to be used as a fill between the side brick and the inner face of the boiler shell as shown in Figure 33.

With a trowel, apply a coat of refractory brick cement to the faces of pre-cast bricks A and B which adjoin the boiler head, the boiler shell and the bottom supporting shelf. (See Figure 33). Install bricks A and B and, when in place, apply a trowel coat of cement to the area of both where joined with brick C. Make sure that bricks A and B are pushed firmly against the boiler flue sheet.

With bricks A and B in place apply cement to the surface of brick C adjoining the flue sheet and at the ends where faced against bricks A and B and set in place firmly against the boiler flue sheet.

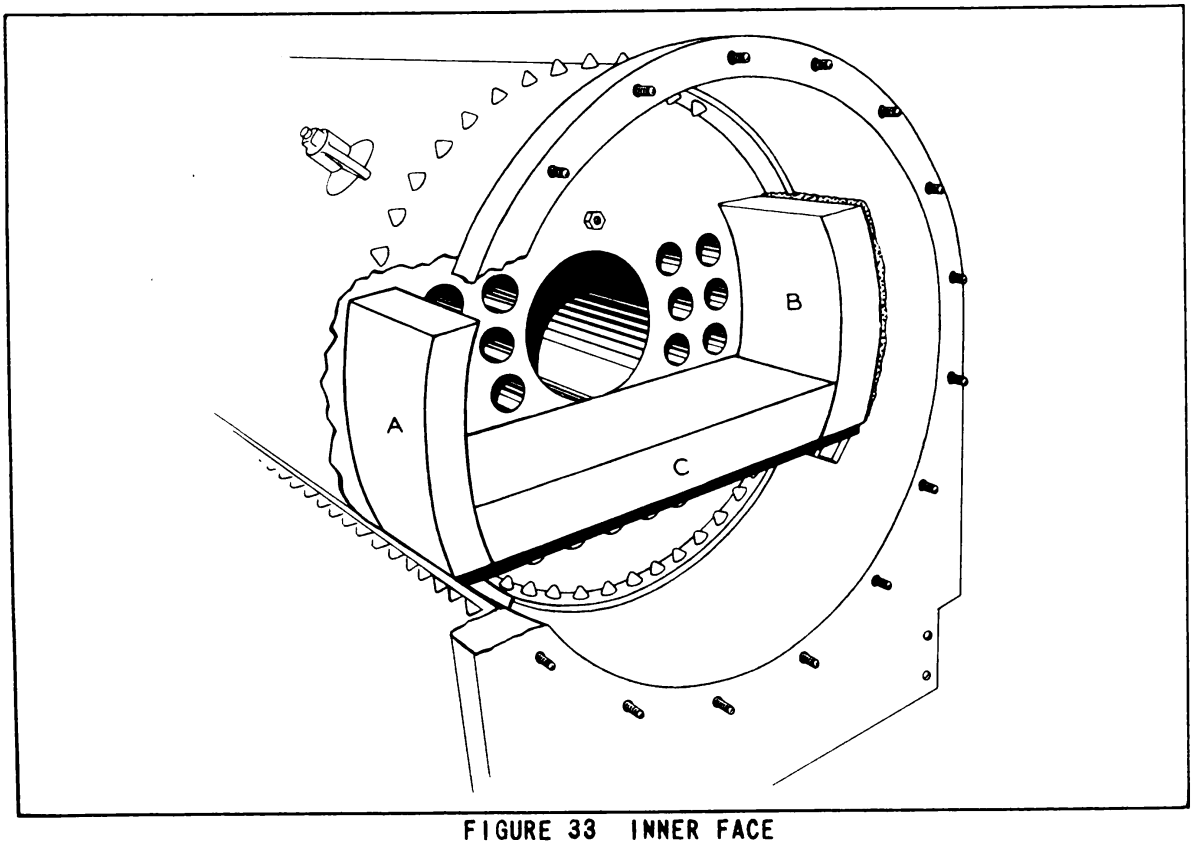
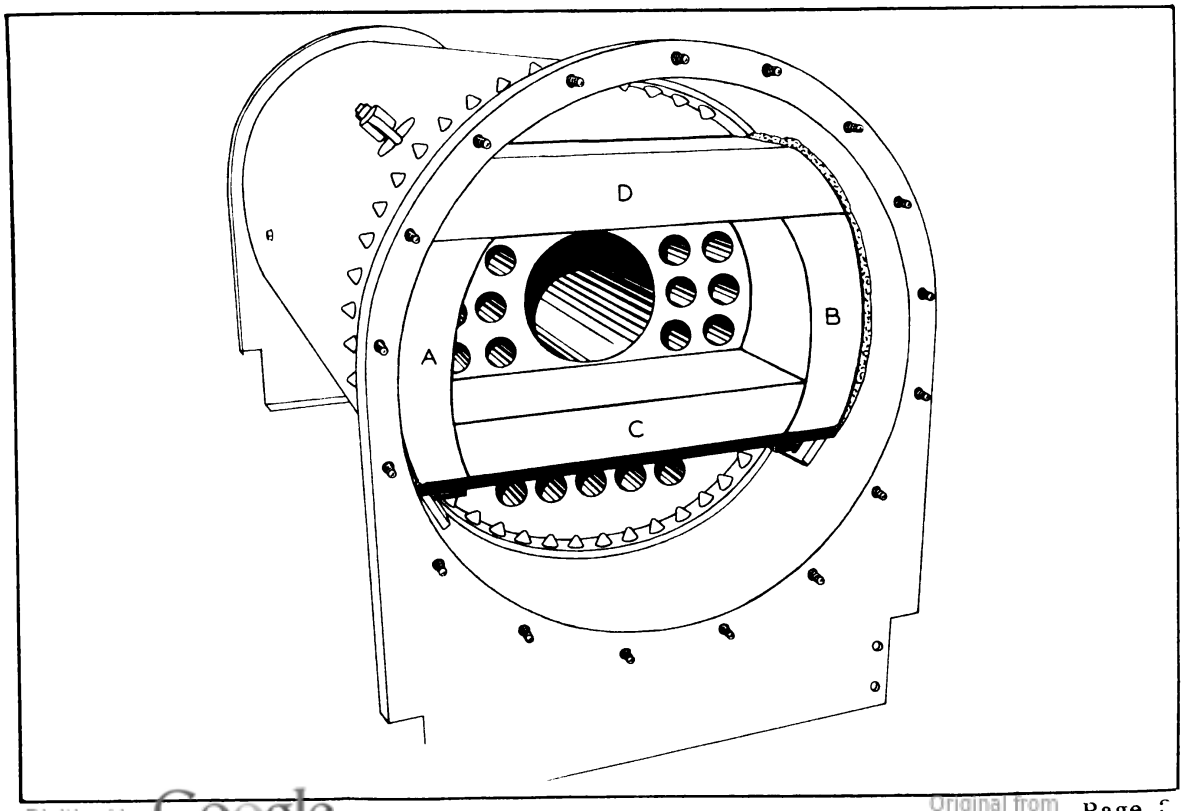


FIGURE 33 INNER FACE

FIGURE 34 REFRACTORY BRICK



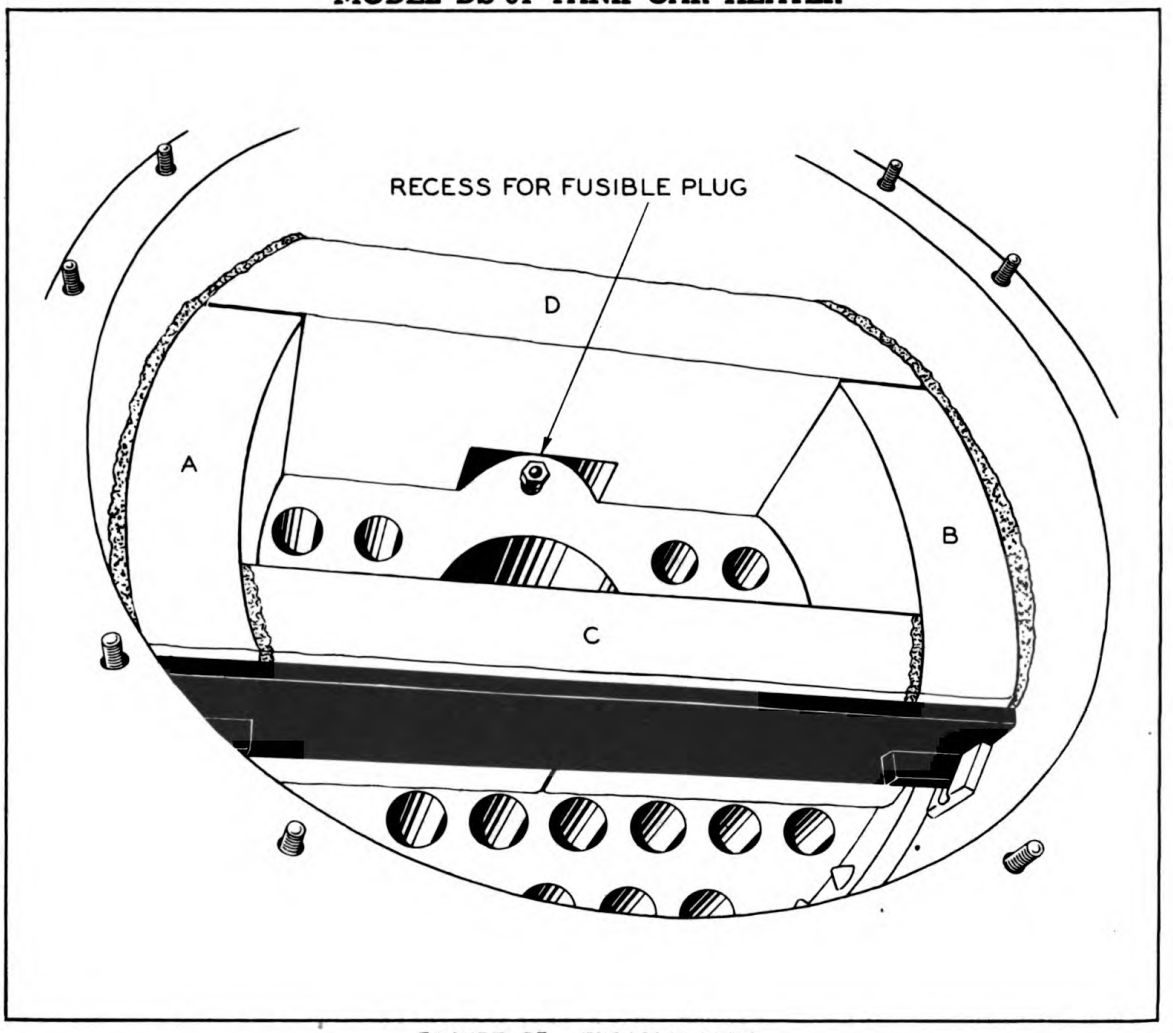


FIGURE 35 FUSIBLE PLUG

Apply a trowel coat of cement to the upper face of bricks A & B and set brick D in place, packing crushed fire brick and portland cement at the ends between the brick and the boiler shell, as shown in Figure 34.

Notice that brick D is provided with a recess at the edge contacting the boiler flue sheet to provide access to the boiler fusible plug, as shown in Figure 35.

Rear Outer Head (Towing End)

Install the six machine bolts C, Figure 36, with the ends of the bolts flush with the inner surface of the steel brick frame B, which is welded to the inner face of the outer head. Insert the asbestos board insulator A while the head is flat on the floor and set bricks D, E & F in place, engaging the machine bolts C into the holes G drilled into the brick, setting them tightly as far down as they will go.

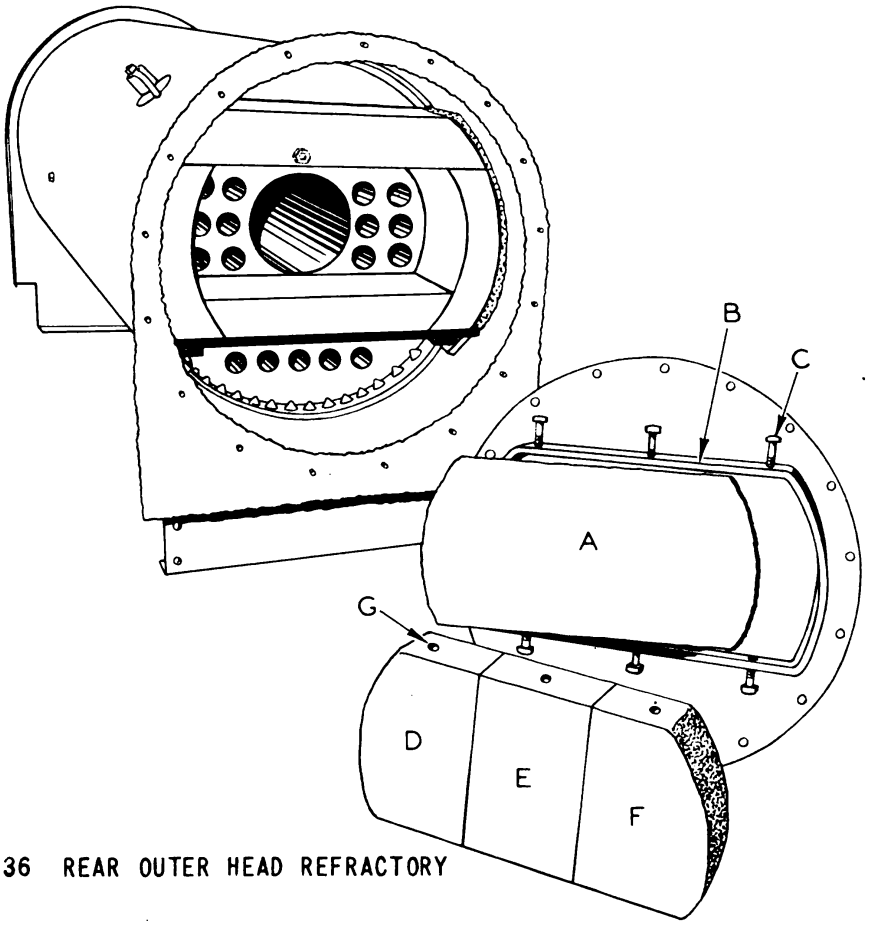


FIGURE 36 REAR OUTER HEAD REFRACTORY

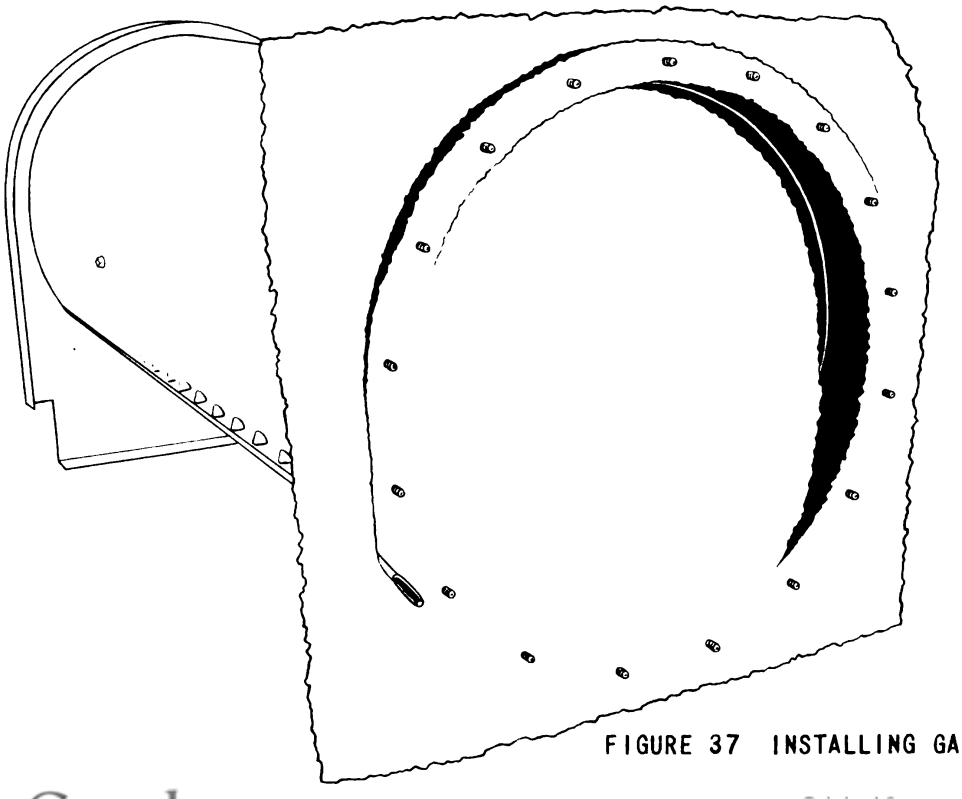


FIGURE 37 INSTALLING GASKET

Prepare the 1/16" asbestos paper gasket as shown in Figure 37,, laying the gasket against the ends of the studs, forcing each stud through the paper gasket with the fingers.

Cut the gasket to shape, using a pocket knife as shown in Figure 37.

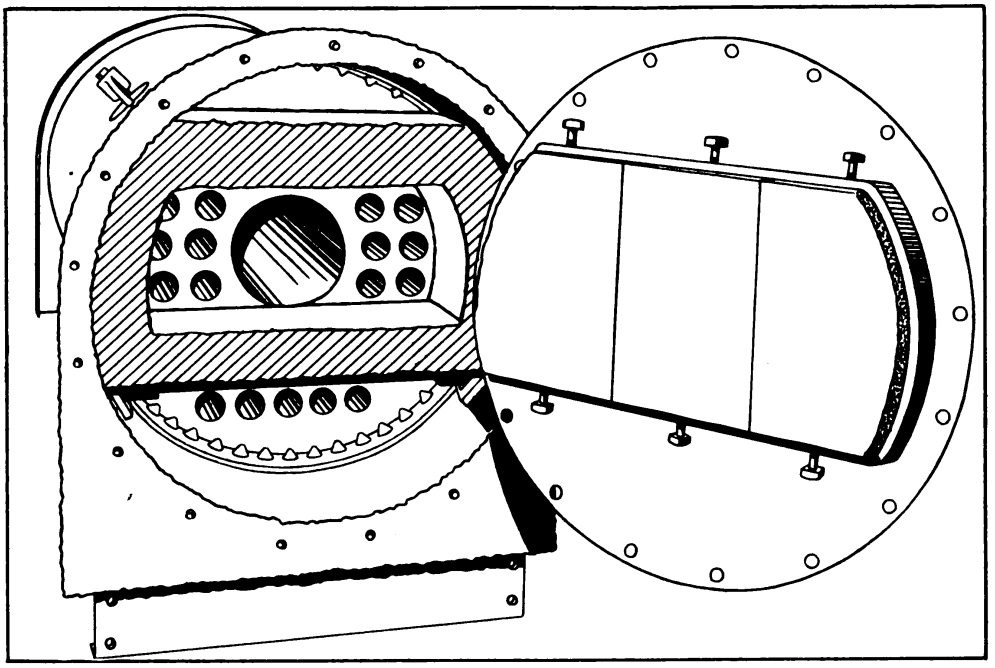


FIGURE 38 INSTALLING REAR OUTER HEAD

Prepare plastic mixture of asbestos cement and water, applying a trowel coat to the surfaces of the brick installed in the boiler proper where they engage the brick attached to the outer head, as indicated by the shaded portion of Figure 38. This layer of asbestos cement provides an air-tight seal when the rear outer head is installed.

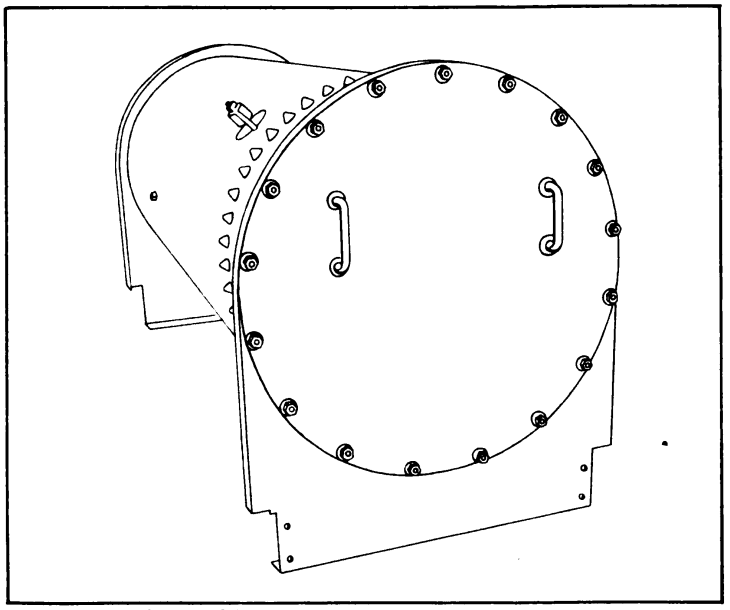


FIGURE 39 REAR OUTER HEAD INSTALLED

Install head and bolt down tightly, using washers and nuts as shown in Figure 39.

REPLACING FIRE TUBE EXTENSION

The fire tube extension is the attachment which extends between the boiler flue sheet and the front outer head (firing end). It consists of a steel tube to which mounting brackets are welded to provide support on the boiler flue sheet and with a steel disc at the outer end which is provided with studs for the attachment of the oil burner air tube mounting flange and the front (firing end) outer head. The fire tube extension is lined with refractory material at the factory, and in cases where replacements are necessary, the entire fire tube extension should be replaced if possible.

Dismantle power plant, oil burner assembly, and front (firing end) outer head as instructed on Page 31.

Remove fire tube extension as directed on Page 32, and replace it with a new fire tube extension, noting carefully the proper position of the notch (Figure 41) in the steel outer face of the fire tube extension which allows the insertion of the oil burner lighting torch.

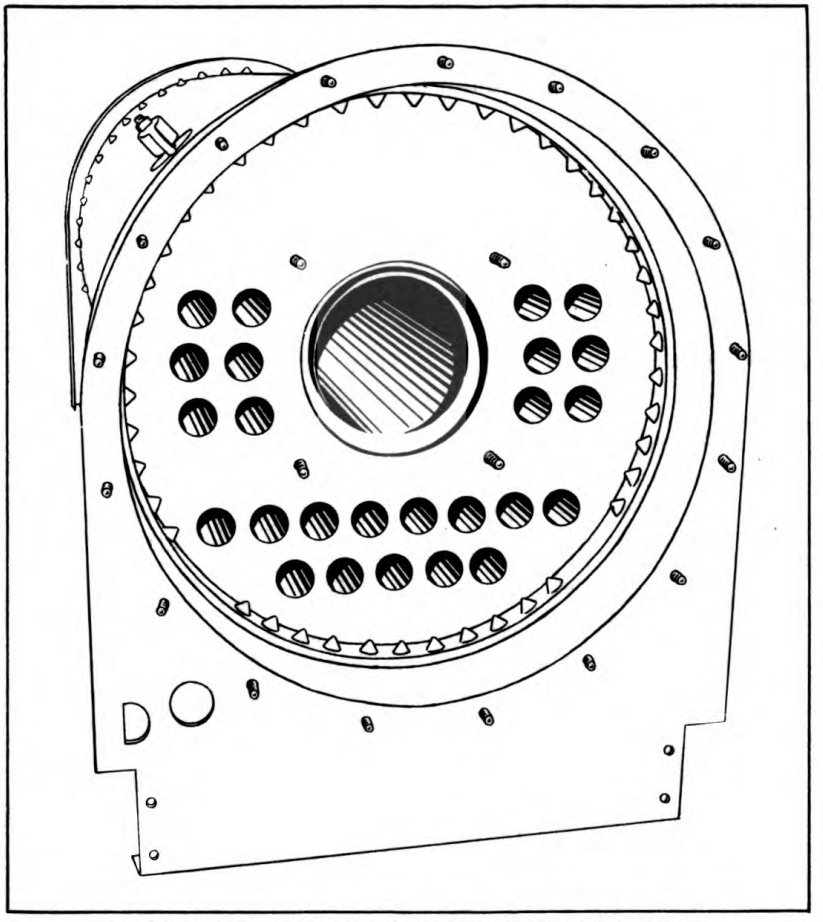


FIGURE 40 REPLACING FIRE TUBE EXTENSION

Place a straight edge across the outer head mounting flange of the boiler shell proper so as to position the outer face of the fire tube extension in the proper line.

Prepare two or three handfuls of crushed fire brick, Portland cement and water, and by hand, seal the joint between the fire tube extension and the boiler fire tube proper, packing in the plastic mixture tight thus effecting as smooth an inside firing surface as possible.

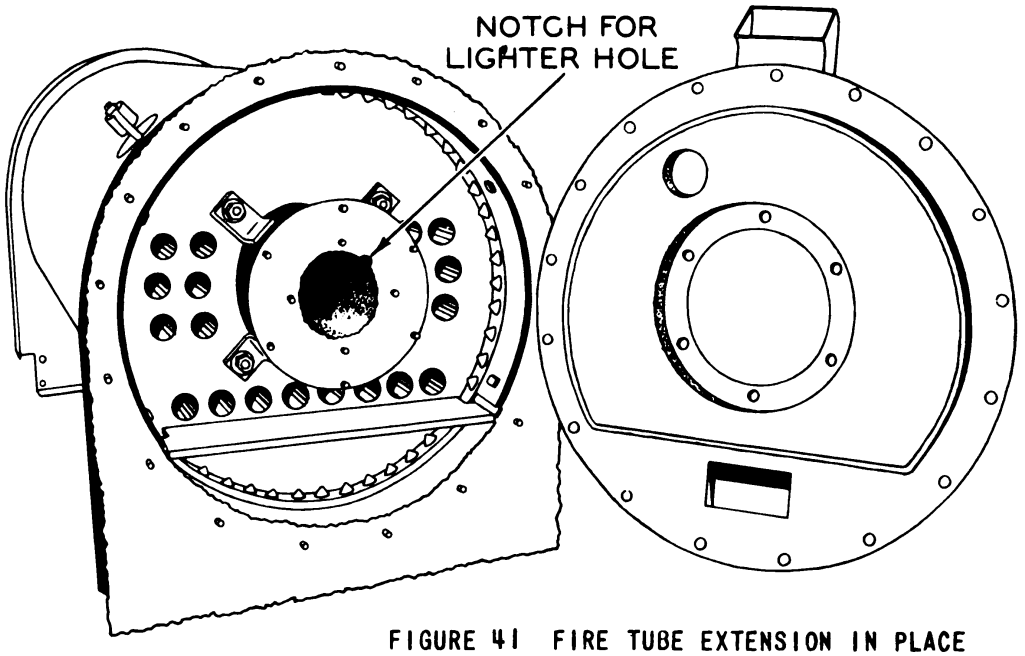


FIGURE 41 FIRE TUBE EXTENSION IN PLACE

Prepare and install a 1/16" asbestos paper gasket to be placed between the boiler shell outer head flange and the outer head proper, as shown in Figure 41. The center position of the gasket cut-away should be prepared as a gasket to cover the entire steel outer surface of the fire tube extension, resting between the front outer head, the steel oil burner mounting flange and the fire tube extension face.

Install the front outer head (firing end) as shown in Figure 42. pulling down nuts snugly with washers between.

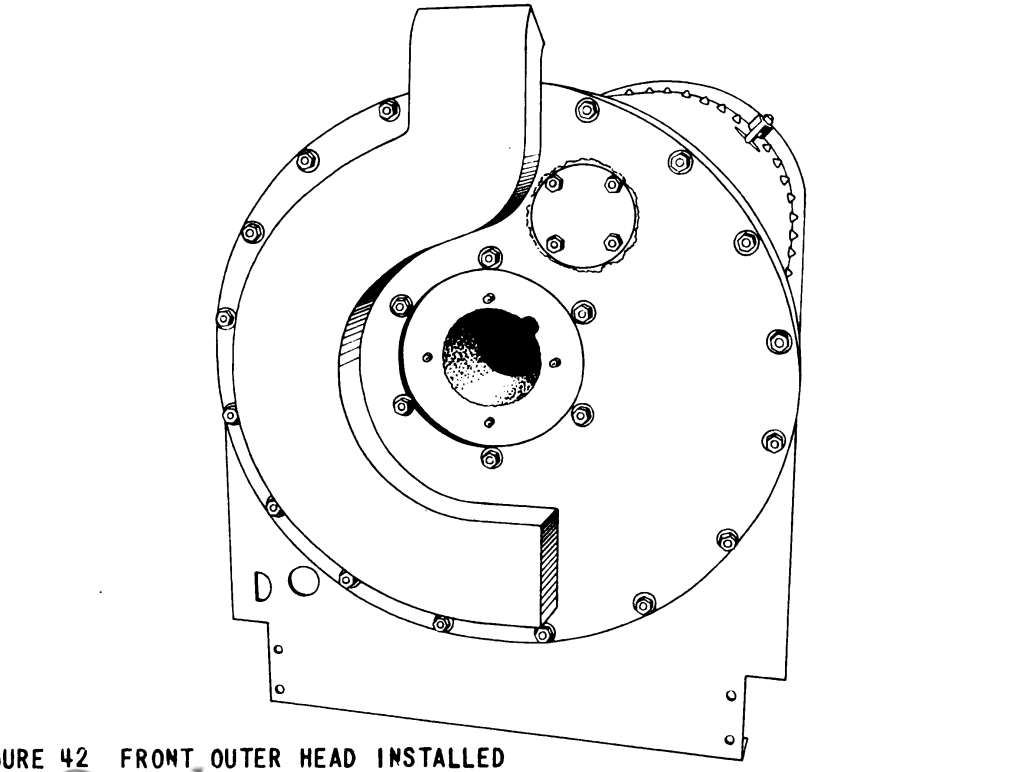


FIGURE 42 FRONT OUTER HEAD INSTALLED

Replace power plant assembly on chassis and install the six bolts and nuts attaching the base plate to chassis frame. Install copper tubing jumper connection between fuel oil tank and fuel oil filter. Install copper tubing jumper connection between fuel oil tank and fuel oil relief valve. See Figure 21.

Assemble oil burner inner assembly into boiler and install sectional blower air tube assembly as instructed under "Cleaning Fuel Oil Nozzles", Operator's Section.

Assemble unions in the 1" water suction pipe leading to the water pump and in the 3/4" water pump discharge line.

CLEANING WATER SIDE OF BOILER

Model DS-31 Tank Car Heaters, because of their portable use, are subjected to innumerable types of chemical combinations in feed water, and consequently no hard and fast rule may be applied to the treatment of feed water to prevent the formation of scale on the tubes or the opposite case, which results in the pitting of the tubes. The important maintenance requirement is to remove the scale and flush out the boiler as often as required as determined by inspection after removal of one or more of the four hand hole plates.

Consult the nearest available authority on boiler water scale removal and proceed according to his recommendation after he has observed the condition.

Hand Hole Plates

Two hand holes are located in the sides of the top half of the boiler shell, one toward the right (towing end), and the other toward the left (firing end) front. The remaining two hand holes are located on the left bottom side of the boiler, front and rear. Access to the two lower hand holes may be gained by removing the front and rear steel panels at the left lower side of the housing.

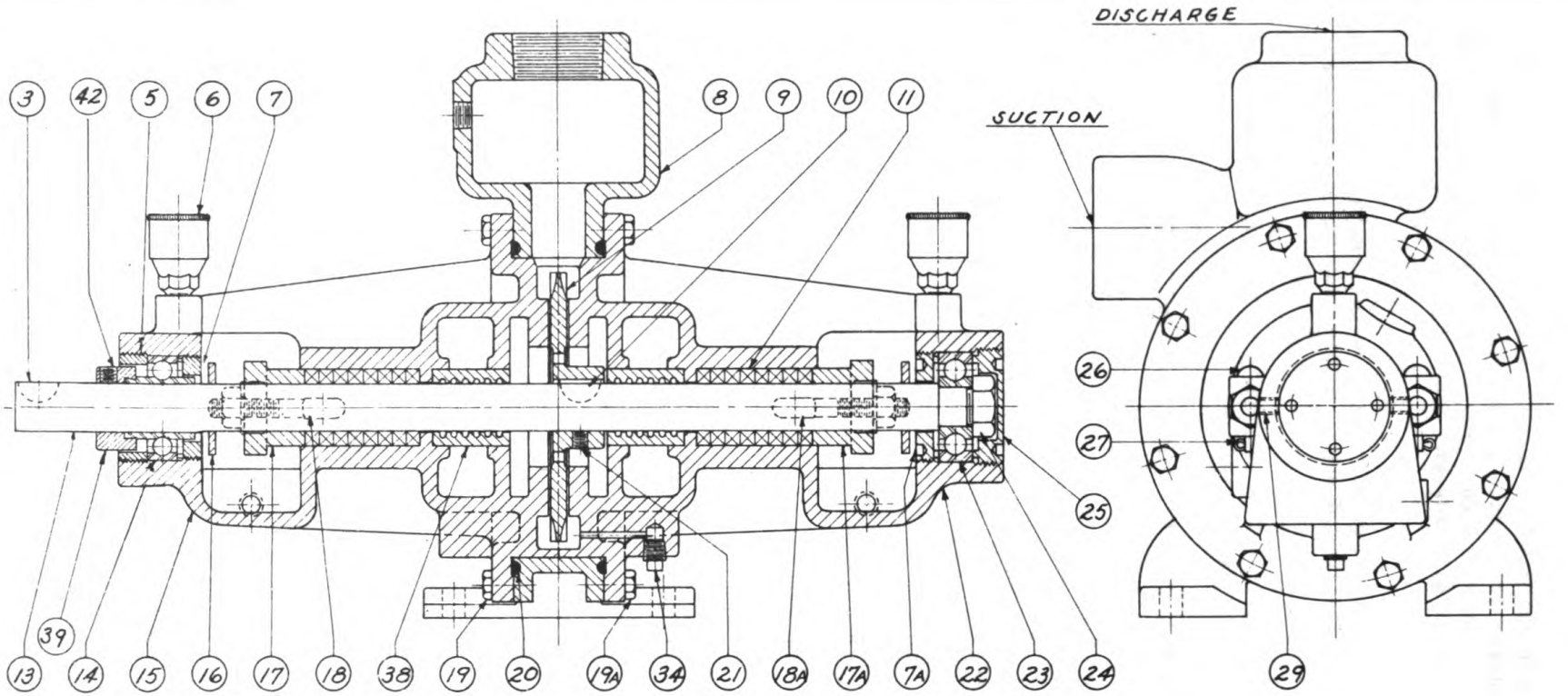
When removing a hand hole plate be careful not to drop it inside the boiler. With a pair of pliers, hold the hand hole bolt and remove the outer nut. Remove the yoke, then release the plate, and gasket with a hammer if stuck to the boiler shell inside surface. Grasp the bolt and remove the plate which is attached to the bolt head.

When replacing gaskets, apply a coat of graphite and oil to both surfaces.

Replacing Fusible Plug

The fusible plug which melts on a low-water condition and warns the operator by an emission of steam from the stack, is located on the rear flue sheet (towing end) just above the fire tube.

To replace, remove rear head as instructed on Page 29. For location of fusible plug, see Figure 35.



NO.	PART	NO.	PART	NO.	PART
3	WOODRUFF KEY	15	COVER (LEFT)	24	JAM NUT
6	GREASE CUP	16	SLINGER	25	ADJUSTING NUT
7	ADJUSTING NUT	17	GLAND	26	CLEVIS PIN
8	SHELL	18	EYE BOLT, NUT + WASHER	27	COTTER PIN
9	IMPELLER	19	CAPSCREW	29	SETSCREW
10	WOODRUFF KEY	20	GASKET	34	DRAIN PLUG
11	PACKING	21	SETSCREW	42	LOCK COLLAR SETSCREW
13	SHAFT	22	COVER (RIGHT)	5	ADJUSTING NUT
14	BALL BEARING	23	BALL BEARING	38	COVER BUSHING
				39	LOCK COLLAR

FIGURE 43 FEED WATER PUMP

THE FEED WATER PUMP

Follow operations in order given below and refer to cross section drawing Figure 43 for references.

Read instructions entirely before starting to disassemble.

1. Remove cover plate cap screws (19A).

2. Loosen adjusting nut set screws (29).

3. Remove adjusting nut (25).

4. Remove jam nut (24). (Requires socket type wrench).

5. Loosen packing gland eyebolts (18A) and swing clear of gland (17A).

6. Cover plate (22) can now be removed - should it stick, tap lightly around flanged edge to loosen or drive flat edged tool (screw driver or chisel) between flanges of cover plate and pump shell at several points around shell. (Be careful or you will break flanges).

7. Loosen set screw (42) and remove lock collar (39).

8. Remove adjusting nut (5).

9. Remove Woodruff key (3) so that shaft will be allowed to slip through bearing.

10. Withdraw shaft and impeller from pump. As shaft is removed, gland (17) and slinger (16) will also come off.

11. To remove impeller from shaft loosen set screw (21).

12. To remove cover (15), remove cap screws (19). Ball bearings may be removed from bearing housings by pushing them outward from stuffing box side of bearing housing.

REASSEMBLY OF WATER PUMP

Although both covers which make up the bearing housings and stuffing boxes appear similar, they are not interchangeable. Determine proper cover by matching intake and discharge ports of each cover with those in the shell.

1. Install impeller on shaft with Woodruff key between. Face hub of impeller toward threaded end of shaft. Do not seat set screw.

2. Insert shaft and impeller into right hand cover (22).

3. Remove grease cup over bearing (23) and install bearing from outer end. Sighting through grease passage hole and while bearing is snug against shoulder of shaft, line up pump side of bearing with center of grease passage hole.

4. Holding shaft in this position, locate impeller on shaft so that its face, toward cover (22), barely clears without rubbing. Carefully remove the shaft and tightly set screw (21) on impeller hub, making sure that Woodruff Key (#10) is in place.

5. With all packing (11) removed, insert shaft through cover (22) with packing gland (17A) and slinger (16) in place. Pass shaft through adjusting nut (7A), insert bearing and install jam nut (24) with socket wrench.

6. Install adjusting nut (25) loosely.

7. Install cap screws (19A).

8. Install cover (15) with packing gland (17) and slinger (16) and adjusting nut (7) in place.

9. Install ball bearing (14), adjusting nut (5) and bearing collar (39) rotating until it slips into the adjusting nut. Turn on shaft until it binds, then seat set screw (42).

INSTRUCTIONS FOR ADJUSTING IMPELLER CLEARANCE (After Assembly)

1. Screw in adjusting nut (25) partially. Make sure both adjusting nuts (25) and (7A) are loose before starting the adjustment. Leave locknut (36) and adjusting nut (7) slightly loose.

2. Tighten adjusting nut (25) sufficiently that shaft will not turn (to try this take hold of coupling and try to rotate.) The impeller is now rubbing against cover plate on coupling side of pump.

3. Loosen adjusting nut (25) just a fraction of turn or until you can rotate shaft freely. Now tighten up on adjusting nut (7A) and try to rotate again. If pump turns over freely with no indication of impeller rubbing, the pump is properly adjusted. If rubbing still occurs, you can work the two adjusting nuts "back and forth" until pump does rotate freely. Do not tighten up on adjusting nuts too much, just bring up firmly by very light taps on hammer. After proper adjustment has been secured, then lock adjusting nuts by tightening up the adjusting nut set screws (29), located in the bearing arms.

4. It is recommended that impeller adjustment be made with packing removed from pump.

IMPORTANT

When pumping hot liquids, should pump fail to rotate freely due to excessive expansion of casing and shaft, loosen adjusting nuts (25) and (7A). Now readjust as per preceding instructions at operating temperature.

THE FUEL OIL RELIEF VALVE

If fuel oil pressure shows 100 pounds and no oil is delivered at the burner, the internal parts of the relief valve may be stuck. Tap the device with a hammer handle (not the head) to dislodge foreign matter that may be causing it to stick.

Should this treatment fail, dismantle and clean the device as follows:

1. Stop engine.
2. Disconnect union tee attaching valve to fuel oil pump.
3. Detach copper tubing below valve at bottom of relief valve.
4. Detach copper tubing connector in line leading to fuel oil tank.
5. Remove cap, #3, Figure 44..
6. Remove adjusting screw, #4.
7. Hold device securely (do not compress vise jaws around it) and remove bonnet, #2.
8. Withdraw spring guide, #7, spring, #10, and piston, #6.
9. Dismantle bottom assembly by removing seat, #22.

Clean all parts carefully and reassemble, using Figure 44 as a guide.

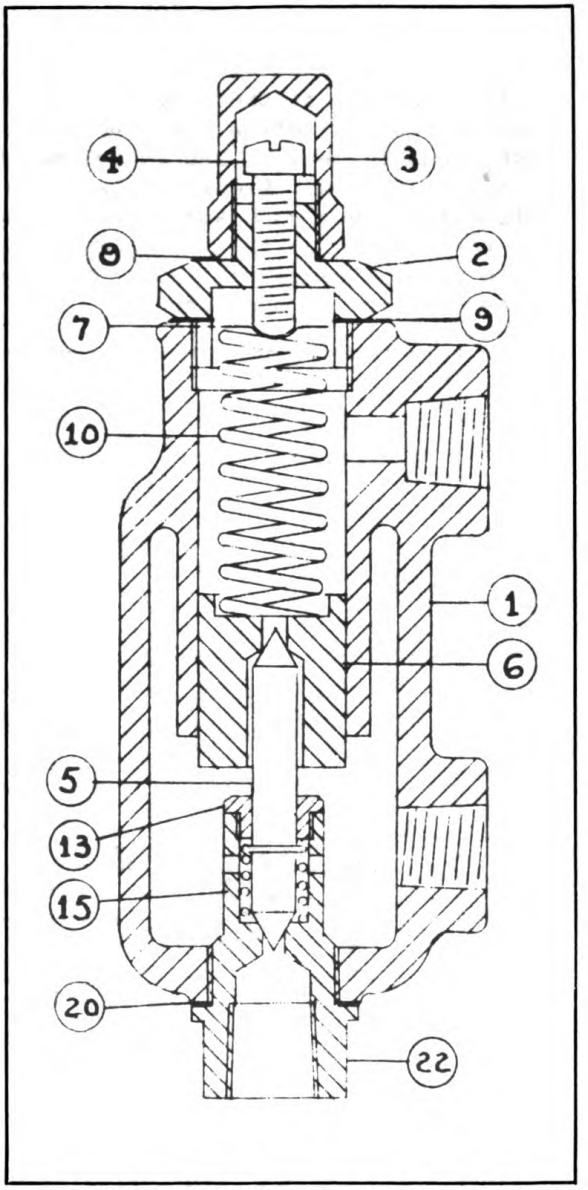


FIGURE 44 FUEL OIL RELIEF VALVE

FUEL OIL PUMP

The pumping principle is the same for all Tuthill Model L pumps and is known as the "internal gear" principle. See accompanying figure. Power is applied to the rotor and transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by a crescent-shaped projection. As the teeth come out of mesh, there is an increase in volume which creates a partial vacuum. Liquid rushes into the pump to fill this vacuum and stays in the spaces between the teeth both of the idler and rotor until the teeth mesh. The liquid is then forced from these spaces and out of the pump.

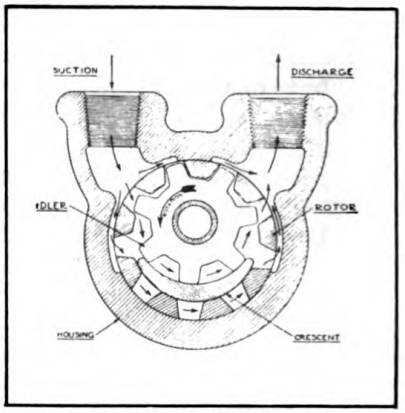


FIGURE 45 FUEL OIL PUMP

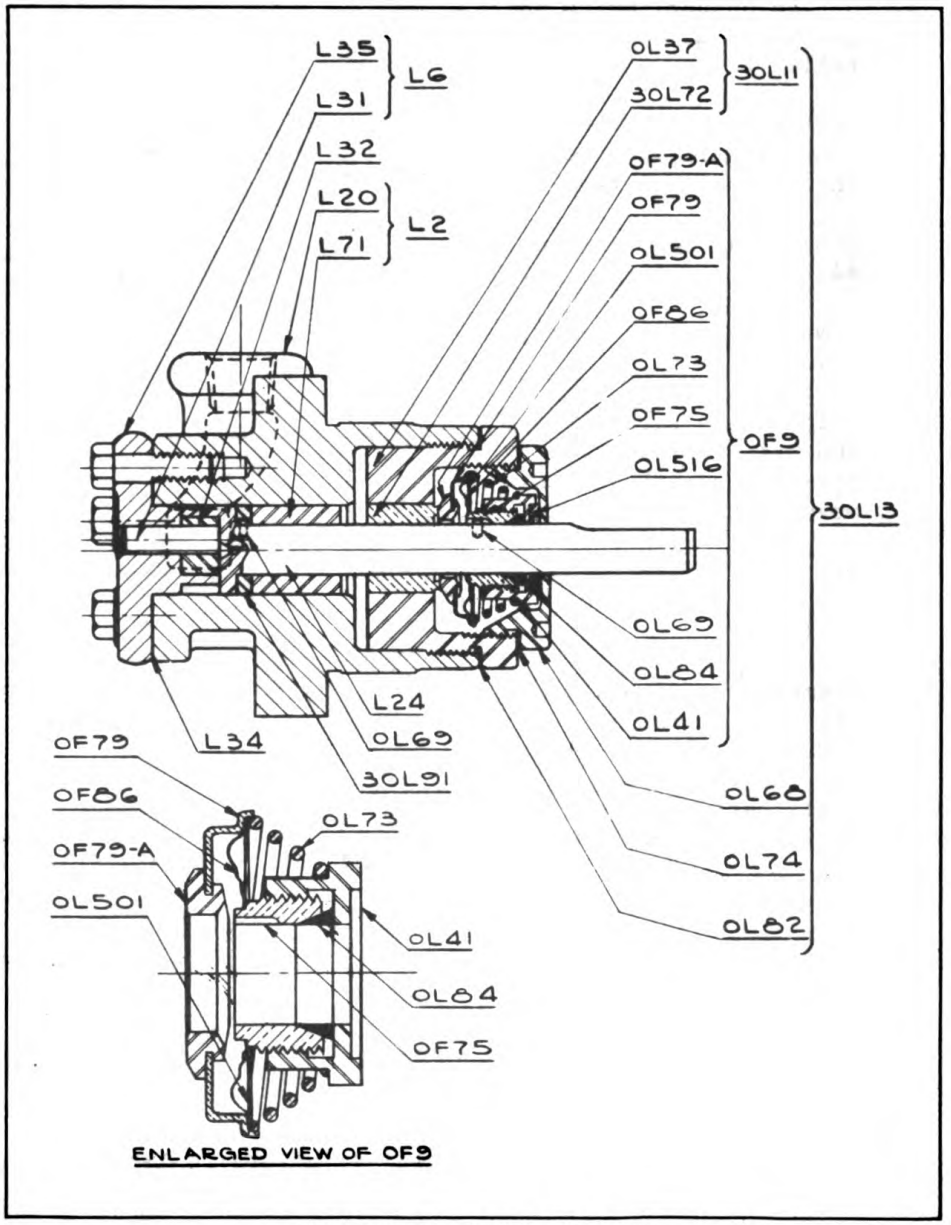


FIGURE 46 FUEL OIL PUMP

If for any reason this pump requires service of any nature it should, if at all possible, be returned to the factory for correction. However, in extreme cases when it is absolutely necessary to take the pump apart in the field, the following procedure must be strictly adhered to.

To remove the seal assembly, 30L13, first place the pump in a vise so that one jaw grips across the two ports. Do not squeeze too tightly as this will deform the casting.

Remove cap 0L68, using a spanner wrench if one is available.

Then, holding shaft from rotating by placing a wrench across the flat on the shaft, loosen nut 0L41 in the vise - being careful not to deform the nut by applying too much pressure - and pull 0F9 assembly off the shaft.

With a pair of small tweezers, remove pin key 0L69.

At this point care should be exercised to see if there is a small burr raised on the shaft where the pin key enters the shaft. If so, a small file should be used to remove this burr.

Then place the pump again in the vise as before and remove housing plug assembly, 30L11.

When the seal assembly is removed from the pump, both the seal parts and the seal assembly must be kept absolutely clean and free from dirt or any other foreign matter.

The rotor and idler may then be removed from the pump by removing the screws securing the front cover.

When the front cover is again assembled onto the pump, extreme care should be taken to see that the gasket has been kept in good condition. Both sides of the gasket should be covered with a coating of cup grease or very thin shellac and particular attention should be given to see that the screws are tightened evenly. Position the cover with the crescent at the bottom, opposite the ports and the locating notch in the rim of the cover, at the top between the two ports.

Before the seal is again put in its place, the shaft of the pump should be turned by hand to see that it does not bind. In case of tight spots, tap the outer edge of the cover lightly until the gears turn smoothly.

The seal may be reinstalled or replaced by reversing the procedure as outlined above. Put a few drops of clean lubricating oil on the seal seat before replacing 0F9 assembly. When tightening the nut 0L41, it is necessary to create about 7# pressure on this nut toward the seal. This is equivalent to compressing the seal .040".

Before the pump is reinstalled it should be tested for freeness by revolving the shaft by hand.

OIL BURNER ASSEMBLY

Fuel Oil Burner

Cleaning fuel oil nozzles is fully discussed on Page 19 which includes directions for disassembly of the burner assembly proper.

In making replacement of any parts of the inner burner assembly, reassemble according to Figure 47.

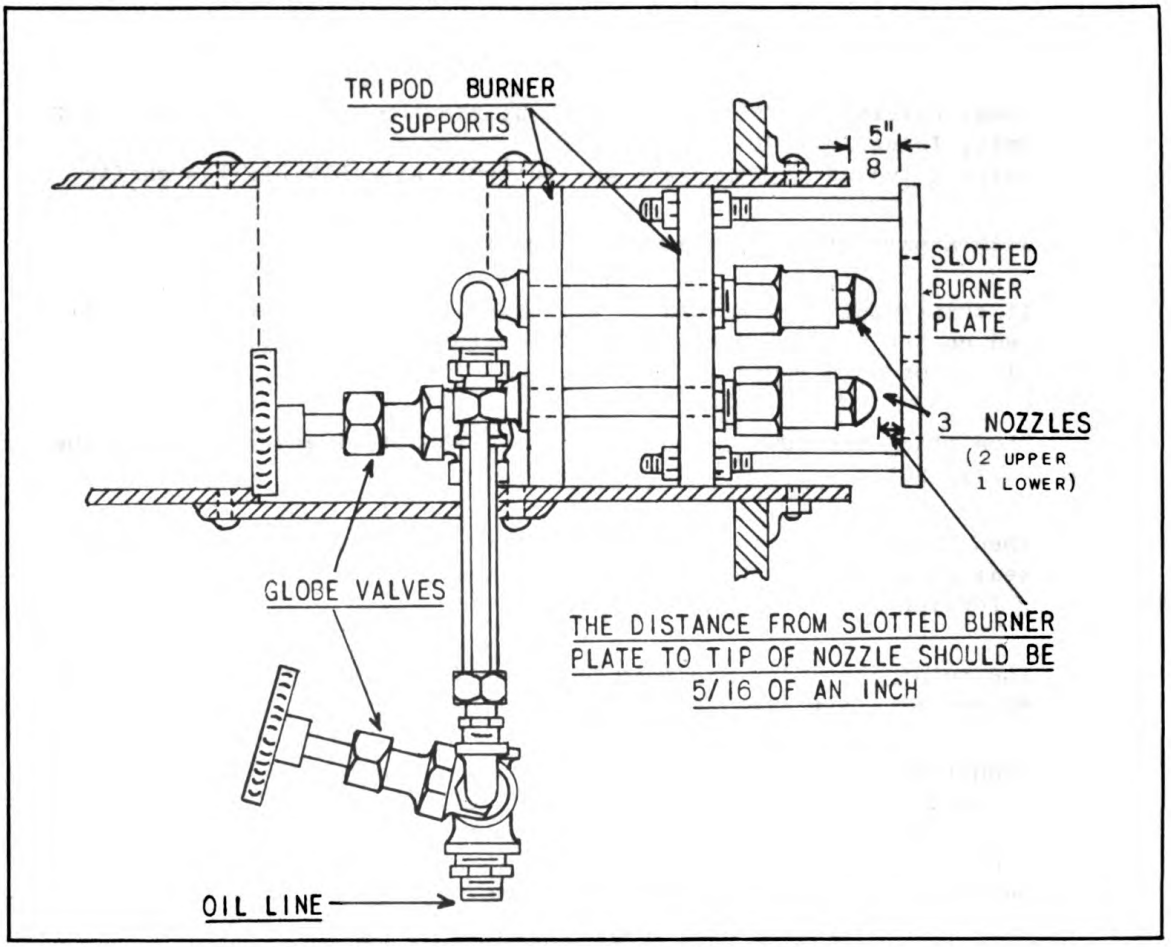


FIGURE 47 OIL BURNER ASSEMBLY

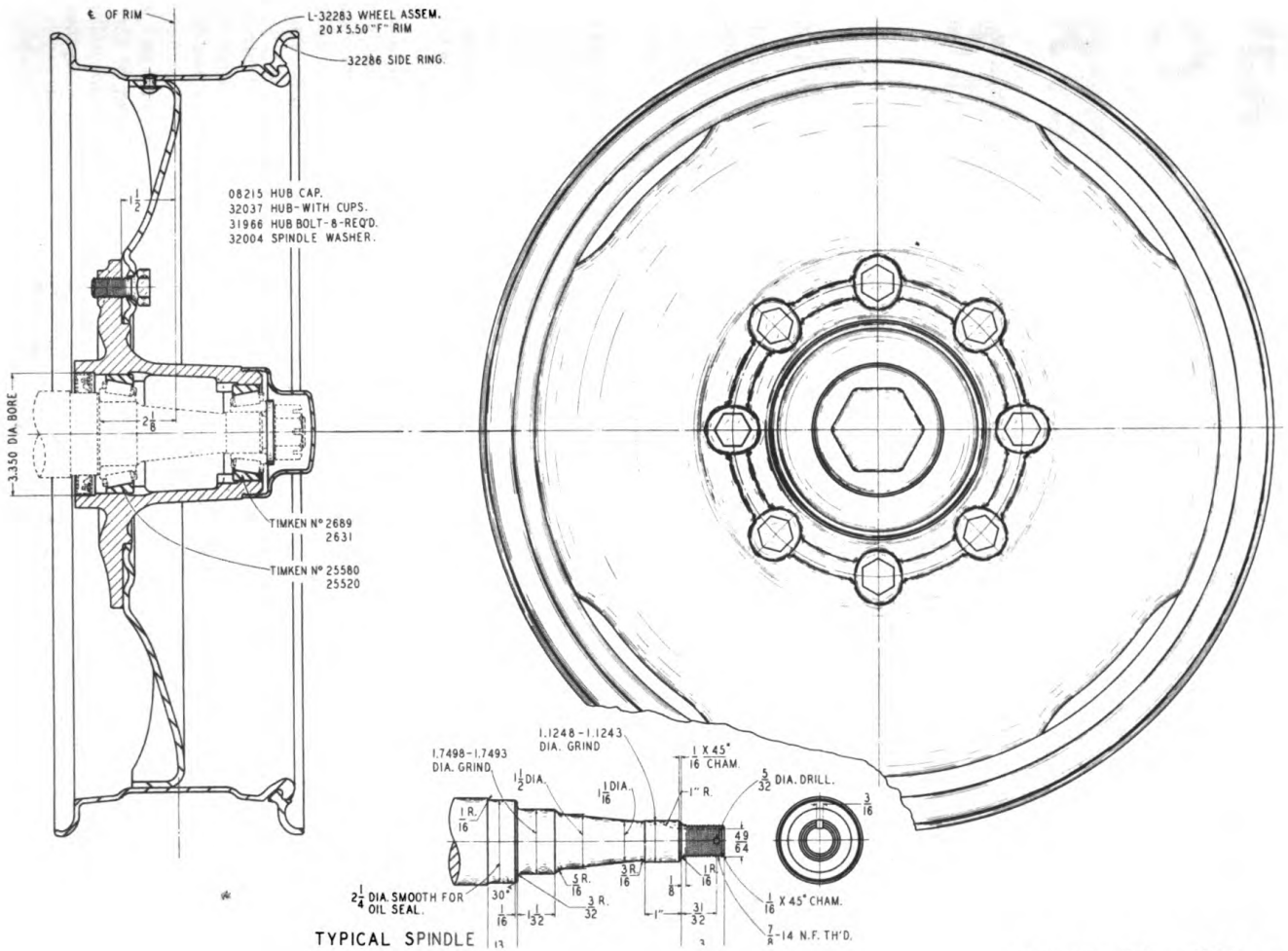
CHASSIS AND RUNNING GEAR

CHASSIS

The Chassis or frame of the unit is the supporting member upon which the entire boiler and power plant assemblies are mounted. It has no moving parts and requires no adjustments.

WHEELS AND AXLES

Figure 48 shows the arrangement of the wheel, axle and bearing assembly. Wheels and bearings are removed and reassembled as instructed on Page 23.



NOTE:

PART NUMBERS SHOWN ARE THOSE OF MANUFACTURER.

CONSULT PARTS SECTION FOR CORRECT CLEAVER-BROOKS PART NUMBER

FIGURE 48 WHEEL, HUB AND BEARING ASSEMBLY

INDEX TO PARTS LIST

WARNING

SPARE PARTS can be supplied promptly and accurately only if positively identified by correct part number and correct part name.

FURNISH THIS INFORMATION ON ALL REQUISITIONS, WITHOUT FAIL, on all requisitions, give name of machine, name of manufacturer, model or size, manufacturer's serial number of each machine and subassemblies attached to machine, and components and accessories for which spare parts are required.

List spare parts for only one make or kind of machine on each requisition.

Requisitions must be double spaced to provide room for office notations when necessary.

The marginal notes give instructions for preparing a requisition for spare parts for Engineer Equipment.

The revised WD AGO Form No. 445 has new column headings as shown below. Under revised heading "Nomenclature and Unit" list the article and the unit (ea for each; lb for Pound; etc.) Under heading "Maximum or Authorized Level" list the authorized organizational allowances or depot stock levels given in ENG 7 and ENG 8 of the ASF Engineer Supply Catalog (Superseding Part III, Corps of Engineers Supply Catalog). The total number on hand for each item is listed under "On Hand." In column headed "Due In" enter the total quantity previously requisitioned but not delivered. Column headed "Required" is to be changed to read "Quantity Desired" and column headed "Approved" is to read "Remarks." For "Initial" and "Replenishment" requisitions, the sum of "Quantity Desired," "Due In," and "On Hand" should equal "Maximum or Authorized Level."

State TYPE OF ISSUE designation by use of one of the following terms:
(1) "INITIAL"—first requisition of authorized allowances.
(2) "REPLENISHMENT" — subsequent requisitions to maintain authorized allowances. (State period covered, i. e., 1 Apr—31 Apr)
▼(3) "SPECIAL" — requisitions for necessary repairs not covered by allowances, or for repair of deadlined equipment.

Type "SPARE PARTS" in upper right hand corner of requisition.

Address requisitions to Engineer Field Maintenance Office, P. O. Box 1679, Columbus, Ohio.

Give complete shipping instructions. Special instructions for packing, marking, routing, etc., should be given at bottom of requisition.

State proper nomenclature of machine, also make, model, machine serial number and U. S. A. registration number.

State OCE stock numbers when available.

Prepare a separate requisition for each different machine.

State basis or authority and date delivery is required, immediately below description of machine. State number of Technical Manual or ASF Supply Catalog to which you referred.

Double Space between items.

Group parts required under group headings as shown in approved WD manuals.

State manufacturer's parts number and nomenclature accurately. Do not use abbreviations.

(SAMPLE) SPARE PARTS

REQUISITION

To: Engineer Field Maintenance Office, P.O. Box 1679, Columbus, Ohio — No. of Sheets 1 — Sheet No. 1

Requisition No. E-908-4-44 — Date 10 Feb. 1944 — Period Special

SHIP TO Engineer Property Officer, Fort Lewis, Washington

MARKED FOR: Supply Officer, 150th Engr. Regiment, Fort Lewis, Washington

[redacted] Indicate organization and address of Supply Officer signing requisition if different from "SHIP TO" address

For the Commanding Officer

John E. Doe

John E. Doe, Major, C. E.

Supply Officer

MFGR. PART No.	NOMENCLATURE	UNIT	AUTH. or MAX. LEVEL	ON HAND	DUE IN	QUANTITY DESIRED	REMARKS
	PARTS FOR HEATER, ASPHALT, TRAILER MOUNTED, 3-CAM, MODEL DS WITH BRIGGS & STRATTON ENGINE MODEL 77, TYPE NO. 304668						
	Basis: Repair of Disabled equipment. Delivery is requested by 20 July, 1943						
	BRIGGS & STRATTON ENGINE GROUP						
100020	GASKET, Cylinder Head	ea.	-	0	0	1	
10w008	VALVE, Intake	ea.	-	0	0	1	
10w00w	VALVE, Exhaust	ea.	-	0	0	2	
	CLEAVER-BROOKS ASPHALT HEATER GROUP						
113007	CAP, Fuel Oil Filler, with Chain	ea.	-	0	0	1	
w61005	GASKET, Handhole	ea.	-	0	0	2	
	COMMON SUPPLIES						
917214	PLUG, Black, 3/8"	ea.	-	0	0	1	

*Nonexpendable items such as tools must be accounted for, when requisitioned, by a statement that they have been placed on REPORT OF SURVEY or STATEMENT OF CHARGES.

Emergency requisitions sent by telephone, telegraph or radio must always be confirmed immediately with requisition marked: "Confirming (state identifying data)."

▼Engineer Supply Officers within the Continental United States will use only this period designation.

The marginal notes give instructions for preparing the Property Issue Slip for spare parts for Engineer equipment.

Until new WD AGO Forms 446 are available, use the revised form and type or write in corrections and revisions as shown below.

Under revised heading "Nomenclature and Unit" list the article and the unit (ea for each; lb for pound; etc.). Under heading "Maximum or Authorized Level" list the authorized organizational allowances or depot stock levels given in ENG 7 and ENG 8 of the ASF Engineer Supply Catalog (Superseding Part III, Corps of Engineers Supply Catalog). The total number on hand for each item is listed under "On Hand." In column headed "Due In" enter the total quantity previously requisitioned but not delivered. Column headed "Required" is to be changed to read "Quantity Desired" and column headed "Approved" is to read "Action." On "Initial" and "to Repair Deadlined Equipment" Property Issue Slips, the sum of "Quantity Desired," "Due In," and "On Hand" should equal "Maximum or Authorized Level."

State TYPE OF ISSUE designation by use of one of the following terms:
(1) "INITIAL"—first requisition of authorized allowances.
(2) "REPLENISHMENT" — subsequent requisitions to maintain authorized allowances. (State period covered, i. e., 1 Apr—31 Apr)
▼(3) "SPECIAL" — requisitions for necessary repairs not covered by allowances, or to repair deadlined equipment.

Give complete shipping instructions. Special instructions for packing, marking, routing, etc., should be given at bottom of the Property Issue Slip.

State proper nomenclature of machine, also make, model, machine serial number and U. S. A. registration number.

State OCE stock numbers when available.

Prepare a separate requisition for each different machine.

State basis for authority and date delivery is required, immediately below description of machine. State number of Technical Manual or ASF Supply Catalog to which you referred.

Double Space between items.

Group parts required under group headings as shown in approved WD manuals.

State manufacturer's parts number and nomenclature accurately. Do not use abbreviations.

WAR DEPARTMENT
W. D., AGO Form No. 446
6 August, 1942

PROPERTY ISSUE SLIP

TYPE OF ISSUE

Initial	Replenishment	Debit Memo Receipt	Credit Memo Receipt
	X		

To: 150th Engr. Regiment Supply Officer No. of Sheets 1 Sheet No. 1

Voucher No. Date 10 Feb 1944 Issue Slip No.

For Co. A - 1st Engr. Bn. (Organization Unit)

Date 10 Feb 1944
For the Commanding Officer

Issuance or acceptance of quantities shown in "action" column is authorized. Items marked "Ext" will be ordered. When received, these items will be issued on presentation of this slip.

For the Station Supply Officer

194

Organization Supply Officer

MFGR. PART No.	NOMENCLATURE AND UNIT	AUTH. or MAX LEVEL	ON HAND	DUE IN	QUANTITY DESIRED	ACTION
	PARTS FOR HEATER, ASPHALT, TRAILER MOUNTED, 2-CAR, MODEL DS WITH BRIGGS & STRATTON ENGINE MODEL 77, TYPE NO. 304665					
	Basis: Repair of Disabled equipment Delivery is requested by 30 July, 1943					
	BRIGGS & STRATTON ENGINE GROUP					
104020	GASKET, Cylinder Head ea.	-	0	0	1	
104008	VALVE, Intake ea.	-	0	0	1	
104009	VALVE, Exhaust ea.	-	0	0	2	
	CLEAVER-BROOKS ASPHALT HEATER GROUP					
113007	CAP, Fuel Oil Filler, with Chain ea.	-	0	0	1	
901005	GASKET, Handhole ea.	-	0	0	2	
	COMMON SUPPLIES					
917218	PLUG, Black, 3/8" ea.	-	0	0	1	

*

*Nonexpendable items such as tools must be accounted for, when requisitioned, by a statement that they have been placed on REPORT OF SURVEY or STATEMENT OF CHARGES.

Supply officers of posts, camps and stations who receive Property Issue Slips from using organizations will transfer information on above form to WD AGO Form No. 445, "Requisition" and forward to Area or Theater Depot if overseas; if within the continental United States and no local source of supply from which procurement can be made is available, forward requisitions to the Engineer Field Maintenance Office, P. O. Box 1679, Columbus, Ohio. For further information on preparation of Property Issue Slips and Requisitions, see Army Service Forces Manual M-403, "Station Supply Procedure;" WD Circular No. 170, "Simplified Property Accounting Procedure," 24 July 1943, as amended by WD Circular No. 39, 29 January 1944.

▼In Continental United States, using organizations will use only this period designation. (Substitute "SPECIAL" for "REPLENISHMENT" in head of form.)

ACCESSORY LIST

THREE CAR HEATER

G-B CO. PART NO.	DESCRIPTION	MANUFACTURER	MFR. ADDRESS	MFR. PART NO.
904007	Fuel Oil Relief Valve	Monarch Mfg. Works	Philadelphia, Pa.	G49B
903002	Fuel Oil Nozzle	Monarch Mfg. Works	Philadelphia, Pa.	PLP
913006	Fuel Oil Pump	Tuthill Pump Co.	Chicago, Illinois	OL-K
913003	Fuel Oil Filters	Commercial Filters Corp.	Boston, Mass.	AS-8
903016	Flexible Coupling	Lovejoy Flexible Coupling Co.	Chicago, Illinois	IAO-95
903003	Blower	Clarage Fan Co.	Kalamazoo, Mich.	6CHS
102040	Wheel	Motor Wheel Corp.	Lansing, Mich.	L 32283
102045	Wheel Cone, (Inner Bearing)	Timken Roller Bearing Co.	Canton, Ohio	25580
102047	Wheel Cup, (Inner Bearing)	Timken Roller Bearing Co.	Canton, Ohio	25520
102044	Wheel Cone, (Outer Bearing)	Timken Roller Bearing Co.	Canton, Ohio	2689
102046	Wheel Cup, (Outer Bearing)	Timken Roller Bearing Co.	Canton, Ohio	2631
102041	Stud, Hub With Wheel	Motor Wheel Corp.	Lansing, Mich.	31966
102042	Hub, With Cups, Less Studs	Motor Wheel Corp.	Lansing, Mich.	32037
102043	Cup, Hub	Motor Wheel Corp.	Lansing, Mich.	08215
914011	Water Pump Bearing	Fafnir Bearing Co.	New Britain, Conn.	SM-1012K-2
914021	Water Pump Bearing	Fafnir Bearing Co.	New Britain, Conn.	303
903007	Blower Bearing	Fafnir Bearing Co.	New Britain, Conn.	LAK-11/16" Pillow Blk.
907002	Steam Pressure Gauge	U. S. Gauge Co.	New York, N. Y.	4-1/2" steel flanged case, 0-200# 1/4" back male connection
904016	Pop Safety Valve	Consolidated Ashcroft Hancock Co.	Bridgeport, Conn.	Fig. 1445
904018	Injector, 3/4"	Ohio Injector Co.	Wadsworth, Ohio	Type 1004 - Size 3
104001	Boiler Blow Down Valve	Judson Governor Co.	Rochester, N. Y.	1" Ex. Heavy 250# screwed asbestos packed
914001	Water Pump	Aurora Pump Co.	Aurora, Illinois	D-40
109000	Engine	Briggs & Stratton Corp.	Milwaukee, Wis.	Model ZZ Type 304665
109137	Spark Plug	Champion Spark Plug Co.	Toledo, Ohio	6M (Briggs & Stratton No. 89572)
109185	Gasoline Tank	Wisconsin Motor Corp.	Milwaukee, Wis.	WE-106
912001	V-Belt	L. H. Gilmer Co.	Philadelphia, Pa.	3300
912004	V-Belt	Allis-Chalmers Mfg. Co.	Milwaukee, Wis.	A46

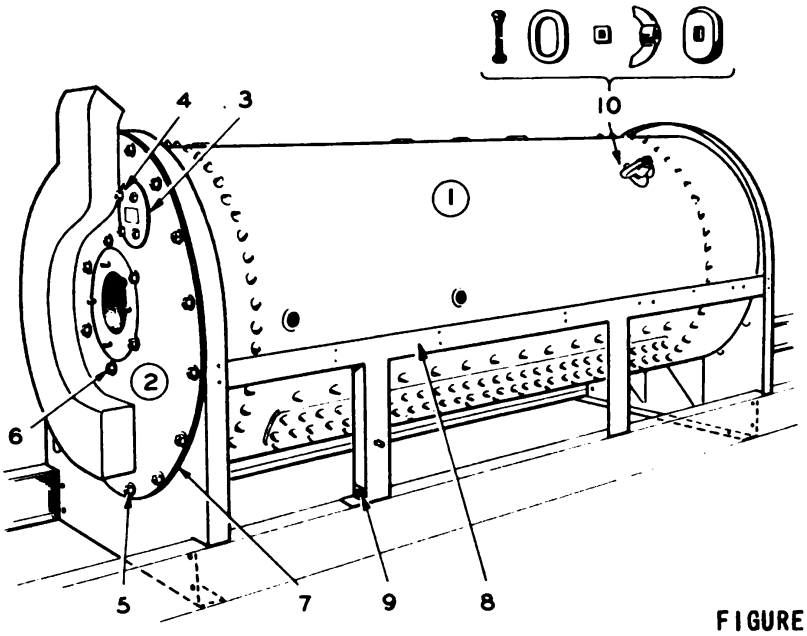


FIGURE 49 BOILER

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	101006	Boiler shell and tube assembly, with front and rear outer heads, fire tube extension, front and rear mounting saddles, all refractory brick installed, less insulation and steel lagging, including burner mounting flange studs.	1
2	101007	See Reference No. 19, Page 61.	
3	101008	Plate, Inspection hole, with gasket	1
4	921115	Stud, 1/2" x 1-1/2"	4
	921055	Nut, brass, hex., 1/2"	4
5	921095	Bolts, machine, sq. hd., 1/2" x 1-1/2" (front and rear heads)	36
	921055	Nut, brass, hex., 1/2"	36
	921078	Washer, wrought iron, 1/2"	36
6	921055	Nut, brass, hex., 1/2"	6
	921078	Washer, wrought iron, 1/2"	6
7	901002	Gasket, 1/16" asbestos paper - 44" x 36"	1
8	105022	Frame, lagging support. Side member consists of one horizontal and two vertical supports. (Must be welded in place at front and rear heads.)	2
9	921301	Bolt, 3/8 x 1"	4
	921024	Nut, hex. USS 3/8"	4
10	101011	Yoke, hand hole, for 2-3/4 x 3-1/2" hand hole	4
	101012	Plate, hand hole, 2-3/4 x 3-1/2"	4
	921072	Bolt, hand hole, 5/8 x 4"	4
	921040	Nut, hand hole bolt, 5/8" hex., iron	4
	901005	Gasket, hand hole, 2-3/4 x 3-1/2"	4
	901006	Gasket, hand hole bolt head, 1-1/2" sq.	4

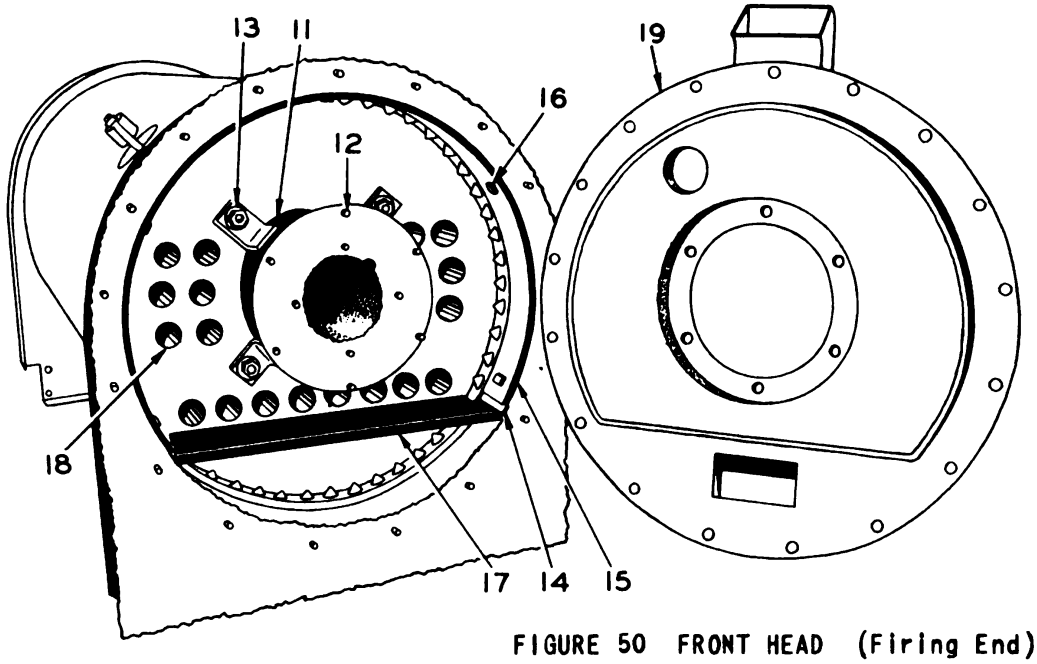


FIGURE 50 FRONT HEAD (Firing End)

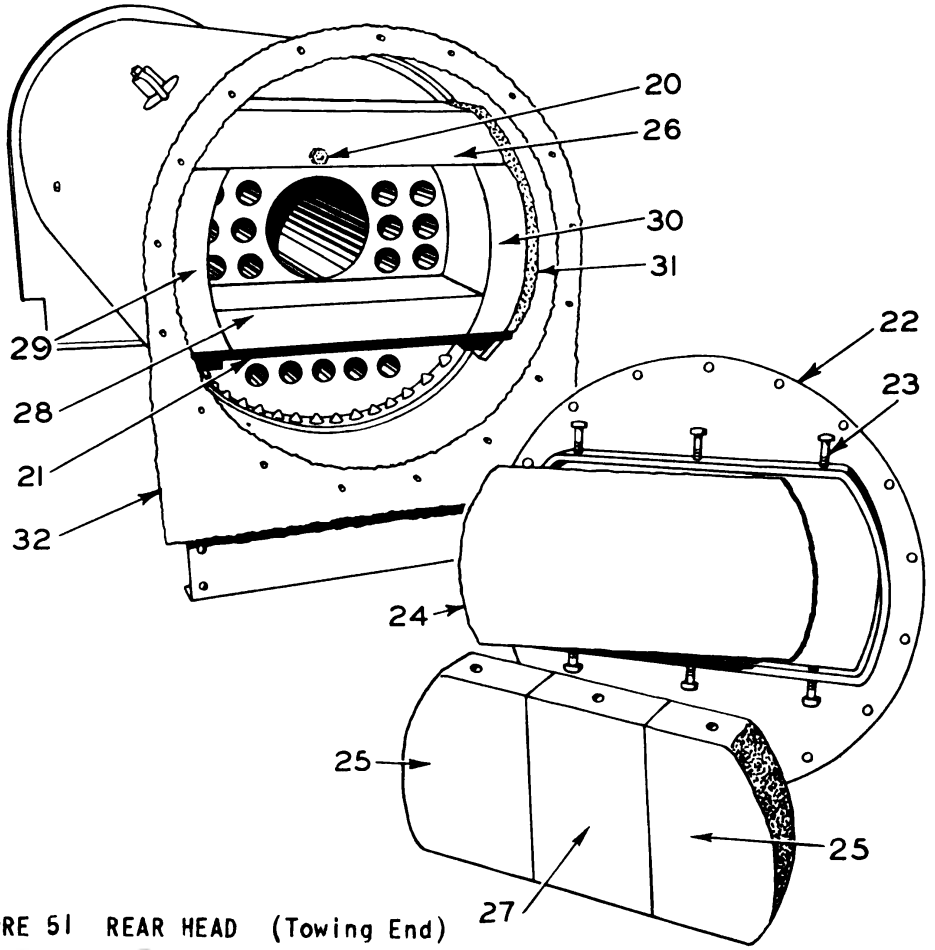


FIGURE 51 REAR HEAD (Towing End)

FRONT HEAD (Firing End) See Figure 50

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
11	101001	Extension, fire tube, with refractory lining. (Not available without refractory lining.)	1
12	921115	Studs, 1/2"x 1-1/2"	10
13	921116	Stud, 5/8"x 2-1/4"	4
	921043	Nut, 5/8", hex., brass	4
	921338	Washer, 5/8", wrought iron	4
14	101010	Liner, asbestos, 1/4 x 4 x 60"	1
15	101003	Liner, steel, circular, 1/4 x 4 x 60"	1
16	921093	Bolt, sq. hd. mach., 1/2 x 3/4"	5
	921330	Nut, sq. hd., iron, 1/2"	5
17	101004	Baffle, front, steel, 1/2 x 7-5/8 x 23'	1
18	101005	Tube, boiler, 2" O.D. x 5' x 13 ga., seamless	46
19	101007	Head, front firing end assembly with stack and refractory attached. (Parts comprising assembly not available separately)	1

REAR HEAD (Towing End) See Figure 51

20	901001	Plug, fusible, 1/2" outside type Crane Co., #4752	1
21	101009	Support, steel, rear brick baffle 5/8" x 5" x 27-1/4"	1
22	101020	Head, rear outer assembly with 1/4" asbestos insulator, refractory tile, 6 tile retainer bolts, 2 outer handles & 9 couplings welded in place for hose mounting	1
23	921097	Bolt, 5/8 x 1-3/4". sq. hd., mach. (fire tile holding)	6
24	105014	Insulator, 1/4" asbestos, (between fire tile and outer head)	1
25	105047	Tile, fire, rear outer head cut to fit, sides	2
26	105043	Tile, fire, upper arch, cut to fit	1
27	105048	Tile, fire, rear outer head, center	1
28	105046	Tile, fire, lower baffle, cut to fit	1
29	105044	Tile, moulded fire, left	1
30	105045	Tile, moulded fire, right	1
31	105021	Cement Kit, includes wet and dry cement: 25 lb. "Chico" or "Setscold" 50 lb. Crushed fire-brick and 5 lb. Asbestos cement.	1
32	901002	Gasket, 1/16" asbestos paper, 36" x 44"	1

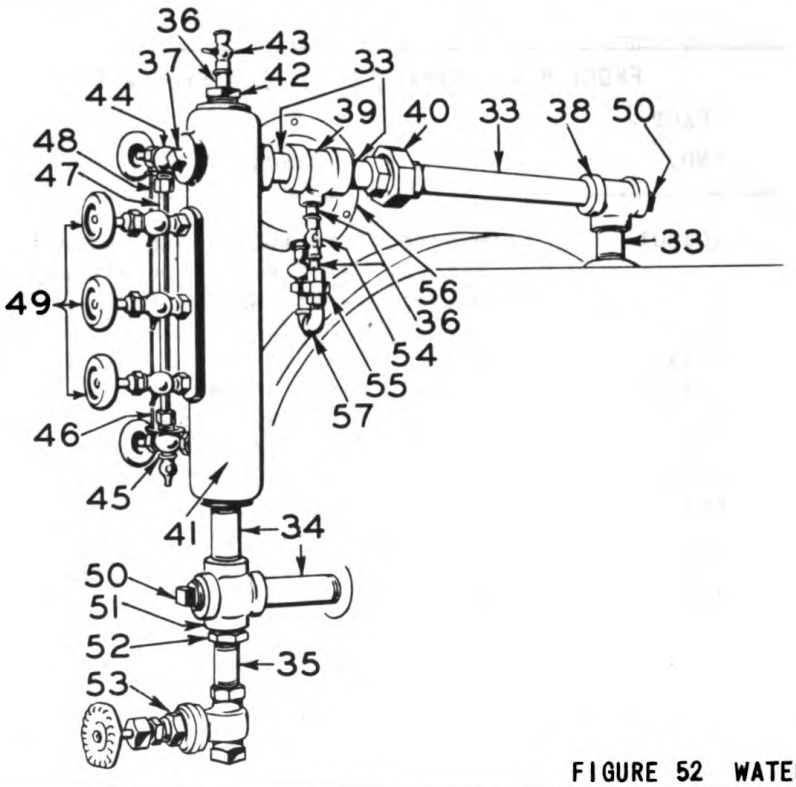


FIGURE 52 WATER COLUMN

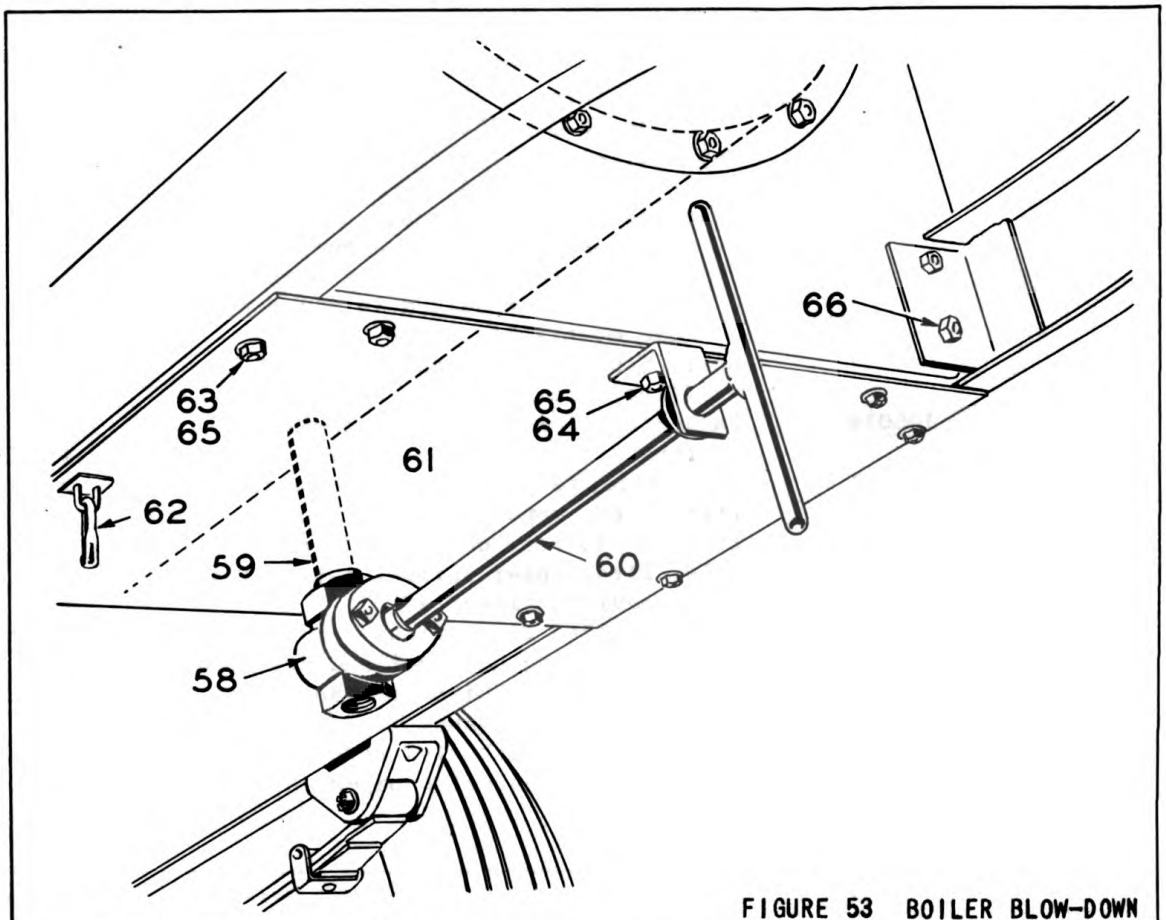


FIGURE 53 BOILER BLOW-DOWN

PARTS LIST

WATER COLUMN (See Figure 52)

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
33	117500	Pipe, ex. hvy., 1" x 14", Bent to fit	1
33A	917543	Nipple, ex. hvy. black 1" x 2"	1
33B	917587	Nipple, ex. hvy. black 1" x 2-1/2"	2
34	920503	Nipple, ex. hvy. brass, 1" x 4-1/2"	1
35	920412	Nipple, 3/4" x 3", brass, extra heavy	1
36	917171	Nipple, 1/4" x 1-1/2", extra heavy, brass	3
37	920531	Nipple, ex. hvy. brass, 1" x 5-1/2"	1
38	917526	Tee, 1", extra heavy, black	1
39	917592	Tee, 1" x 1" x 1/4", extra heavy	1
40	917593	Union, 1", extra heavy, ground joint, black	1
41	901008	Water Column, cast steel, 250#	1
42	920527	Bushing, 1" x 1/4", black	1
43	901009	Cock, 1/4", brass, steam	1
44	901010	Gauge Glass, Fitting, water, upper (Ohio Injector Co., Chicago Type)	1
45	901011	Gauge Glass Fitting, water, lower	1
46	901012	Guard Rod, water gauge glass	2
47	901013	Gauge Glass, water, Pyrex, 5/8 x 10-1/4"	1
48	901014	Gasket, rubber, water gauge glass, 5/8"	2
49	901015	Tri-Cock, water column, 1/2", Chicago Type, Ohio Injector Co.	3
50	917591	Plug, solid brass, 1"	3
51	917532	Cross, 1", extra heavy, brass	1
52	917533	Bushing, 1" x 3/4", brass	1
53	904028	Valve, gate, 3/4", 300#	1
54	901016	Cock, brass, gauge, 1/4"	1
55	920101	Union, 1/4", brass, extra heavy	1
56	907002	Gauge, steam, 4-1/2", 200#, U.S. Gauge Co.	1
57	920129	Street Elbow, brass, 1/4", extra heavy	1
57A	917109	Tee, Brass, 1/4"	1
57B	614078	Petcock, brass, 1/4"	1

BOILER BLOWDOWN (See Figure 53)

58	104001	Valve, blow-off, 1", extra heavy, 250# screwed, asbestos packed, Judson Governor Co., Rochester, New York	1
59	917594	Pipe, 1" x 8", extra heavy, black	1
60	104002	Handle, blow-off assembly, with mounting bracket	1
61	102003	Plate, bottom, tool compartment 24 x 32-1/2" with hinge hasp staple	1
62	905001	Bit Snap	1
63	921301	Bolts, machine, 3/8 x 1"	8
64	921239	Bolt, machine, 3/8 x 1-1/4"	1
65	921024	Nuts, 3/8", hex.	9
65A	921009	Washer, lock, 3/8"	9
66	921312	Bolts, machine, 1/2 x 1-1/4"	8
66	921346	Nut, 1/2", hex.	8
66	921053	Washer, lock, 1/2"	8

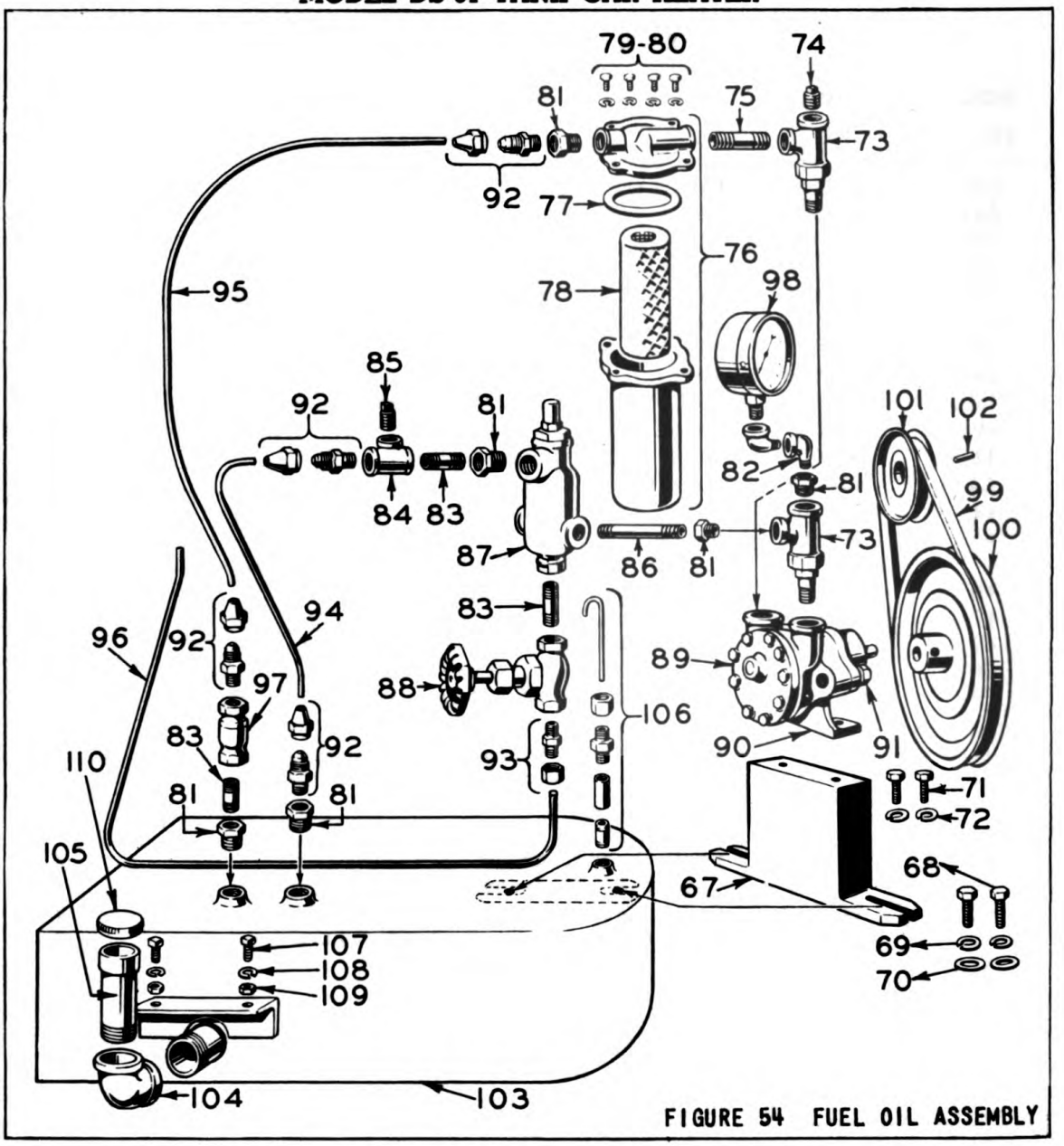


FIGURE 54 FUEL OIL ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
67	113002	Base Block, fuel oil pump	1
68	921111	Cap Screw, 3/8 x 1-1/2" hex. hd.	2
69	921009	Washer, lock, 3/8"	2
70	921010	Washer, flat, 3/8"	2
71	921187	Cap Screw, 5/16 x 1"	2
72	921003	Washer, lock, 5/16"	2
73	103011	Union Tee, 3/8", black, ground joint	2
74	917218	Plug, 3/8", black,	1
75	920200	Nipple, 3/8 x 1-1/2", black	1
76	913003	Filter, fuel oil, assembly, Model AS8 Commercial Filters Corp.	1
77	913004	Gasket, fuel oil filter body	1
78	913005	Element, fuel oil filter	1

FUEL OIL ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
79	921188	Cap Screw, 1/4" x 1"	4
80	921001	Lockwasher, 1/4"	4
81	917219	Bushing, black, 3/8" x 1/4"	6
82	917169	Elbow, street, 1/4", 90°, black	2
83	917194	Nipple, 1/4", close	3
84	917121	Tee, 1/4", black	1
85	917122	Plug, 1/4", black	1
86	917119	Nipple, 1/4" x 3", black	1
87	904007	Valve, fuel oil relief, Monarch Mfg. Works, Philadelphia, Pa., Figure G49B (See Figure 8, Page 9 for detail)	1
88	904008	Valve, 1/4", globe, Figure 407, Lunkenheimer	1
89	913006	Pump, fuel oil, Tuthill Pump Co., Chicago, Illinois, Model OL-K (less foot)	1
90	913007	Foot, fuel oil pump	1
91	921112	Cap Screw, 1/2" x 1"	2
92	913008	Connector, copper tubing, 3/8" O.D., copper x 1/4", male I.P.S. flared type	4
93	913009	Connector, copper tubing, 3/8" O.D., copper x 1/4", male I.P.S., compression type	1
94	920201	Tubing, copper, 3/8" O.D., soft, .049" wall, 14-1/2" (discharge, relief valve to tank)	1
95	920201	Tubing, copper, 3/8" O.D., soft, .049" wall, 14-1/2" (Suction, tank to filter)	1
96	920202	Tubing, copper, 3/8" O.D., soft, .049" wall, 52" (relief valve to burner)	1
97	904009	Valve, check, 1/4", Figure 740, vertical, Lunkenheimer	1
98	907001	Gauge, fuel oil pressure, 2", 0-200#, 1/4" male connection (back)	1
99	912001	V-Belt, "A", #3300, Gilmer	1
100	912002	Sheave, 1 groove, 6.0A pitch diam., 7/16" bore, 1/4" set screw only	1
101	912007	Sheave, 1 groove, 3.0A pitch diam., 11/16" bore, 3/16" x 3/32" keyseat	1
102	903042	Key, 3/16"	1
103	113004	Tank, fuel oil, assembly complete with oil filler pipe, filler cap, return suction vent and drain fittings welded in place	1
104	917823	Elbow, 90°, 2", black	1
105	113005	Filler, neck assembly, with cap, brazed to 2 x 6-1/2" nipple, threaded one end	1
106	113006	Vent Assembly, fuel oil tank, includes copper tube and attaching fitting	1
107	921095	Bolt, fuel oil tank mounting, 1/2 x 1-1/2"	4
108	921053	Washer, lock, 1/2"	4
109	921346	Nut, 1/2", hex.	4
110	113007	Cap, fuel oil filler, with chain	1

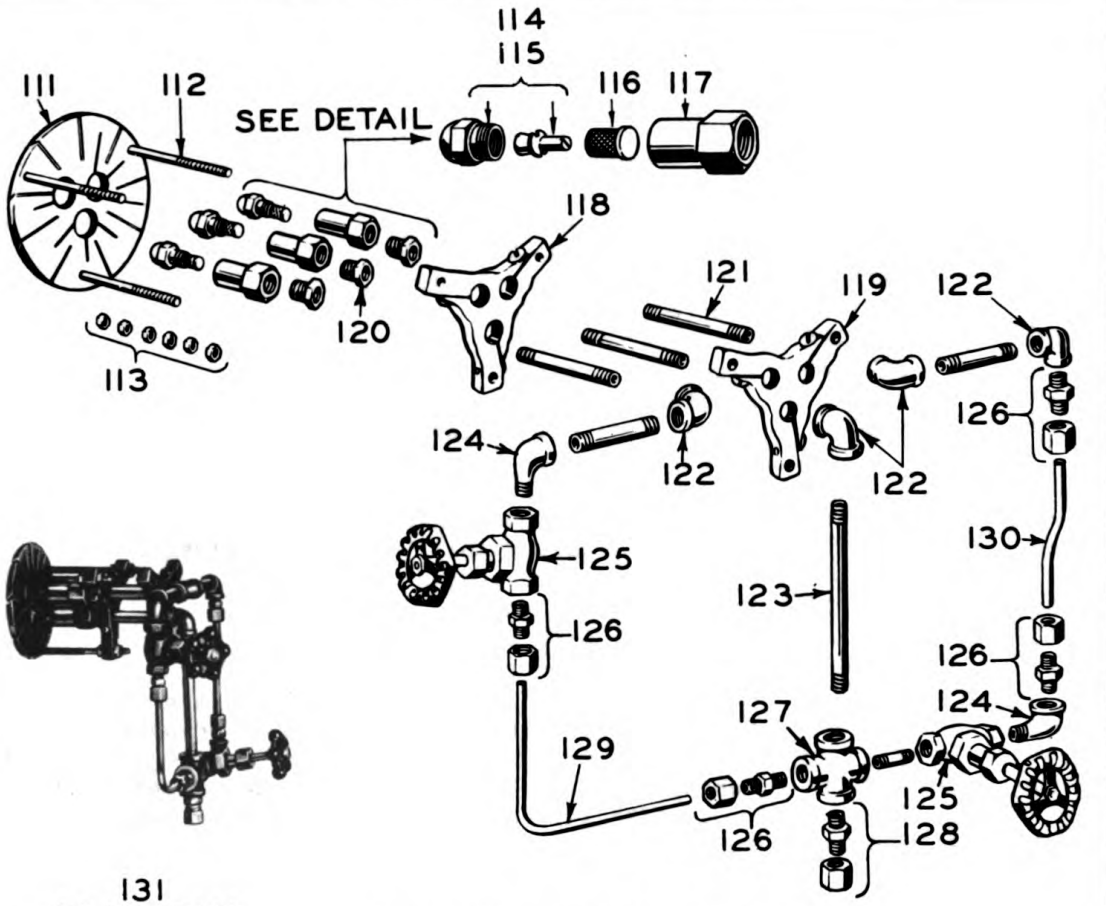


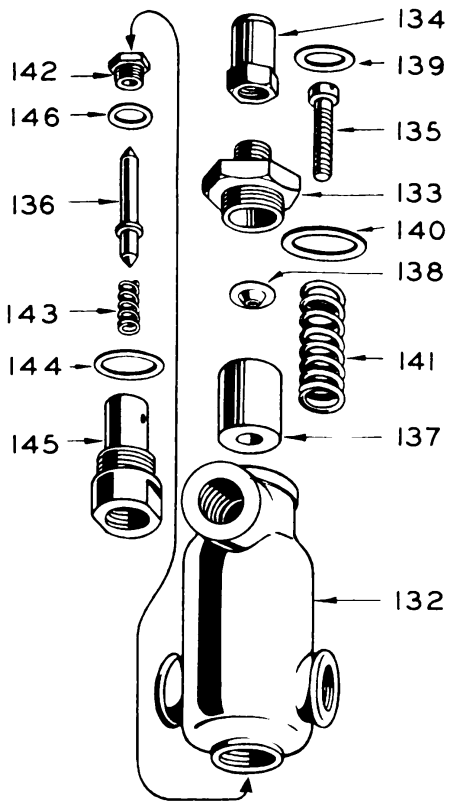
FIGURE 55 INNER BURNER ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
111	103002	Plate, diffuser, with studs	1
112	103010	Stud, diffuser plate holding	3
113	921017	Nut, 1/4-20, brass	6
114	903002	Nozzle, fuel oil atomizing, tip and matched internal part, Monarch Mfg. Works, Philadelphia, Pa., Type PLP, 4.00 gal. per hour capacity	1
115	903032	Nozzle, fuel oil atomizing, tip and matched internal part, Monarch Mfg. Works, Philadelphia, Pa., Type PLP, 5.00 gal. per hour capacity	2
116	903034	Strainer, fuel oil nozzle, Monarch Mfg. Works, Philadelphia, Pa., Type F80	3
117	903033	Body, nozzle, Monarch Mfg. Works, Philadelphia, Pa., long brass type	3
118	103003	Tripod, brass burner support (front)	1
119	103004	Tripod, brass burner support (rear)	1
120	917100	Bushing, brass, 1/4" x 1/8"	3
121	917093	Nipple, brass, ex. heavy, 1/8" x 3"	3

PARTS LIST

INNER BURNER ASSEMBLY

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
122	917000	Elbow, brass, 1/8"	4
123	917094	Nipple, brass, ex. heavy, 1/8"x 2-1/2"	1
124	917010	Street Elbow, brass, 1/8"	2
125	904041	Valve, globe, 1/8", Lunkenheimer, Fig. 407	2
126	913010	Connector, copper tubing, 1/8" male, I.P.S. x 1/4" O.D. copper, compression type	4
127	903041	Cross, brass, special 1/4"x 1/8"x 1/8"x 1/8"	1
128	913009	Connector, copper tubing, 3/8" O.D. copper x 1/4" male I.P.S., compression type	1
129	113001	Tubing, 1/4" O.D. copper, jumper, left nozzle valve to cross assembly	1
130	113008	Tubing, 1/4" O.D. copper, jumper, right nozzle valve to cross assembly	1
131	103001	Burner Assembly, inner, fuel oil, (Includes Ref. Nos. 111 to 130 inclusive)	1



(See Ref. No. 87, Figure 54)

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
132	904053	Body	1
133	904054	Bonnet	1
134	904055	Cap	1
135	904056	Set Screw	1
136	904057	Valve Stem	1
137	904058	Piston	1
138	904059	Spring Guide	1
139	904060	Gasket, cap	1
140	904061	Gasket, bonnet	1
141	904062	Spring	1
142	904063	Locknut	1
143	904064	Spring, valve lifting	1
144	904065	Gasket, seat	1
145	904066	Seat, 1/4"	1
146	904067	Gasket, locknut	1

FIGURE 56 FUEL OIL RELIEF VALVE

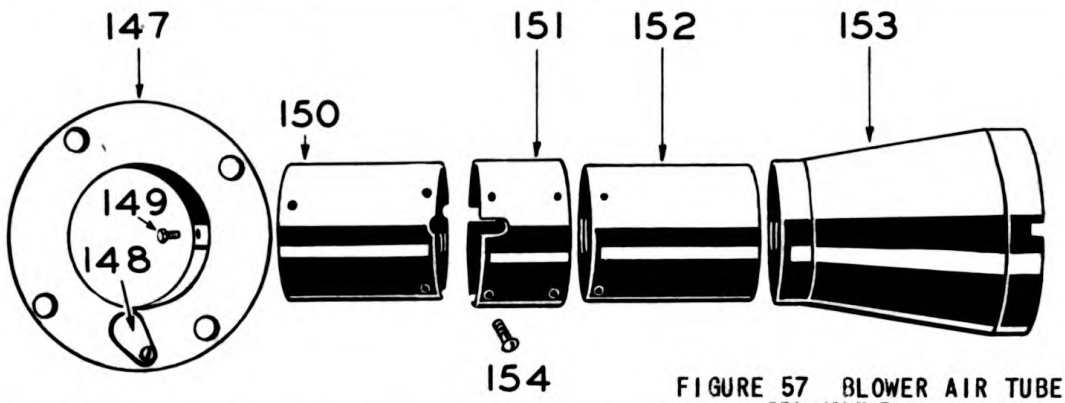


FIGURE 57 BLOWER AIR TUBE

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
147	103005	Flange, steel, oil burner air tube mounting, with lighter port hole cover	1
148	903001	Cover, lighter hole, with attaching screw	1
149	921074	Cap screw, hex. head, 1/4 x 1/2"	3
150	103006	Tube, brass, burner air, boiler end, 4-3/4" long	1
151	103007	Collar, brass, air tube, 2-3/4" long	1
152	103008	Tube, brass, air, collar to adapter cone, 5-1/8" long	1
153	103009	Adapter, air tube cone, blower	1
154	921308	Screw, machine, 10-32 x 1/4", round head, brass	12

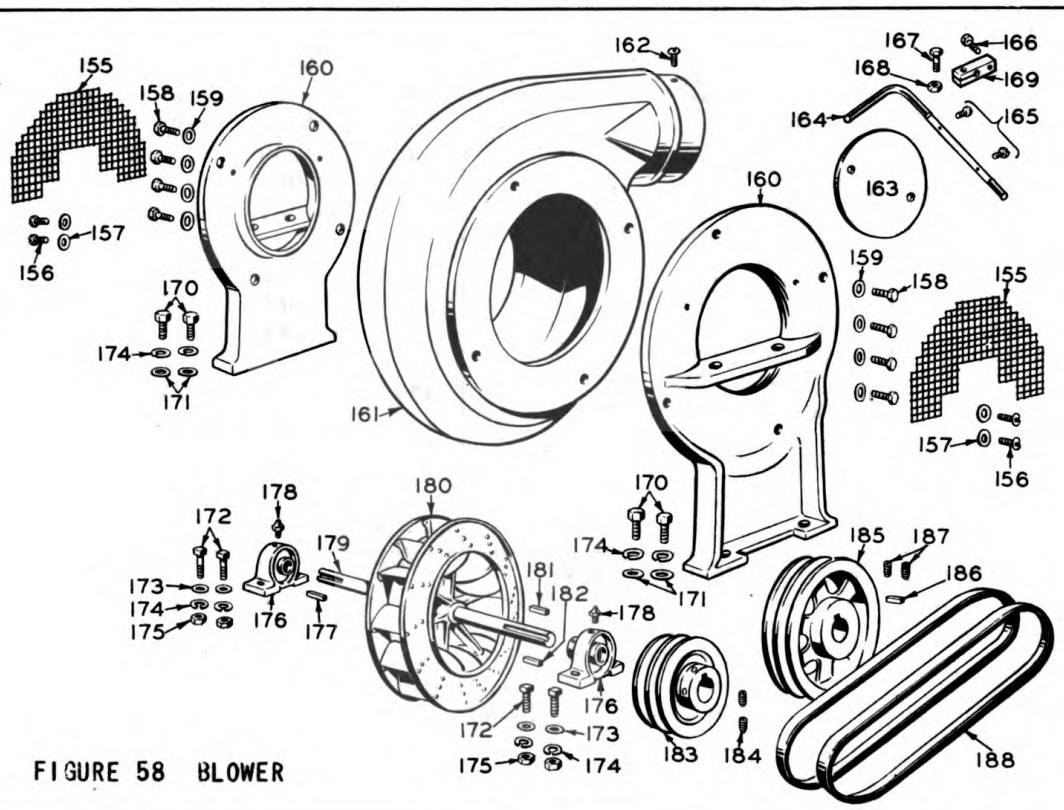


FIGURE 58 BLOWER

PARTS LIST

BLOWER (See Figure 58)

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
	903003	Blower Assembly, includes reference Nos. 155 to 181	1
155	903011	Screen, blower inlet	2
156	921197	Screws, machine, 1/4-20 x 1/2", round head	4
157	921177	Washer, flat, iron, 1/4"	4
158	921023	Screw, cap, 3/8 x 1-1/4", U.S.S.	8
159	921010	Washer, flat, iron, 3/8"	8
160	903009	Side Plate, blower (both sides identical)	2
161	903010	Housing, blower	1
162	921197	Screw, machine, 1/4-20 x 1/2", round head	1
163	903004	Damper Disc	1
164	903021	Handle, damper	1
165	921308	Screw, 10-32 x 1/4", brass, round head	2
165	921017	Nut, 1/4-20, brass	2
166	921188	Screw, cap, 1/4-20 x 1"	1
167	921027	Screw, cap, 1/4-20 x 3/4"	1
168	921077	Nut, 1/4-20, hex., iron	1
169	903005	Snubber, blower damper shaft	1
170	921023	Screw, cap, 3/8" x 1-1/4"	4
171	921009	Washer, lock, 3/8"	4
172	921111	Screw, cap, 3/8" x 1-1/2"	4
173	921010	Washer, 3/8", flat	8
174	921009	Washer, 3/8", lock	4
175	921302	Nut, 3/8", square, iron	4
176	903007	Bearing, ball, and pillow block, 11/16" Type LAK, Fafnir Bearing Co.	2
177	903042	Key, 3/16" square x 1"	1
178	913067	Alemite Fitting, 1/8", straight	2
179	903008	Shaft, blower	1
180	903006	Wheel, blower	1
181	903012	Key, blower wheel shaft, 3/16" sq. x 1-1/2"	1
182	903014	Key, blower driven sheave, 3/16" square x 2"	1
183	912003	Sheave, blower driven, 4.6 "B" pitch diam., 2 groove, 11/16" bore, 3/16 x 3/32 K.S.	1
184	921365	Set Screw, Allen hollow head, 5/16" x 1/2"	2
185	912005	Sheave, blower drive, 2 groove, 7.4 "B" pitch diam., 1" bore, 1/4 x 1/8" K.S.	1
186	903043	Key, 1/4" square x 3", blower drive sheave (also under coupling half)	1
187	921365	Set screw, Allen hollow head, 5/16"	2
188	912004	V-Belt, "A" Texrope A46	2

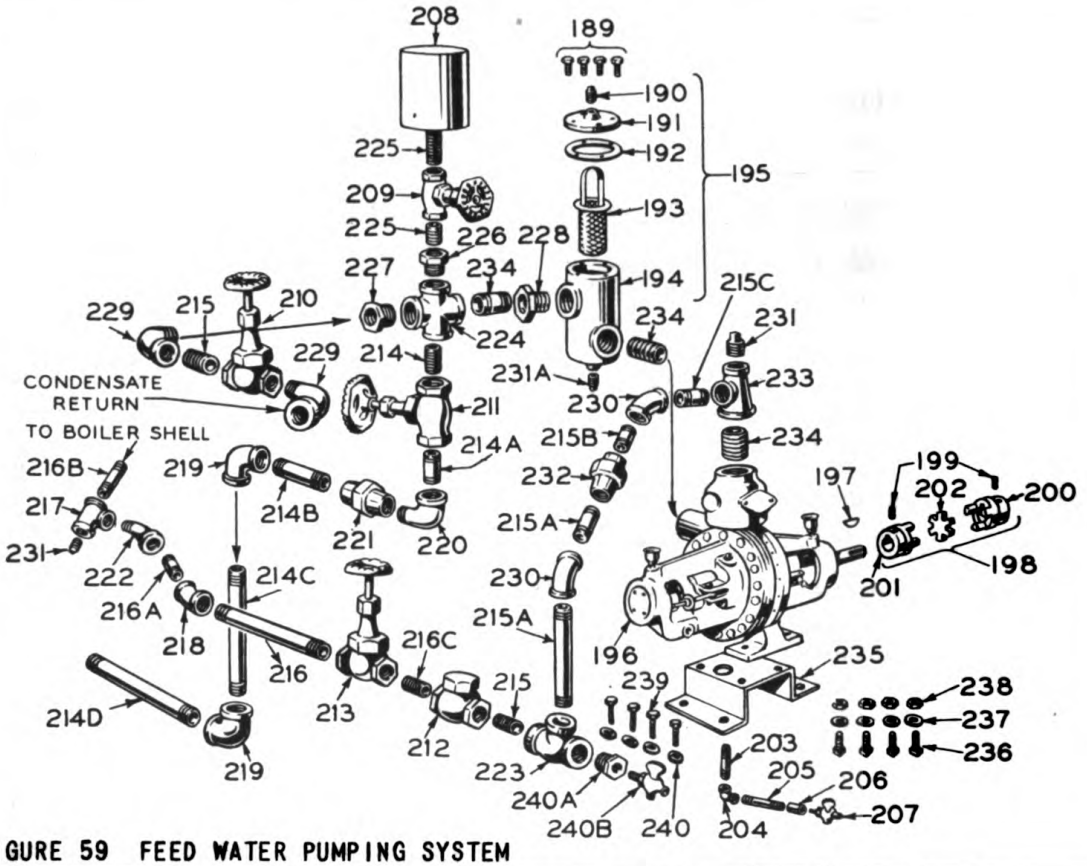


FIGURE 59 FEED WATER PUMPING SYSTEM

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
189	914035	Cap Screw, 5/16" x 3/4"	4
190	917024	Plug, 1/8", black iron	2
191	914033	Cap, feed water strainer	1
192	914034	Gasket, feed water strainer cap	1
193	914032	Strainer, basket, water pump	1
194	914030	Strainer, body, water pump	1
195	914031	Strainer Assembly, (includes Ref. Nos. 189 to 194 inclusive)	1
196	914001	Pump, water } See Fig. 12 for detail	
197	914008	Key, Woodruff }	
198	903016	Coupling, flexible, assembly. Lovejoy Flexible Coupling Co., Chicago, Ill. #IA095 mild steel. 1" bore, 1/4" x 1/8" K.S. x 25/32" bore, 5/32" x 5/64" K.S. (includes Nos. 200 to 202 inclusive)	1
199	921365	Set Screw, Allen hollow head, 5/16"	1
200	903017	Coupling, flexible, 1" half only	1
201	903018	Coupling, flexible, 25/32" half only	1
202	903019	Insert Cushion, flexible coupling	1
203	917001	Nipple, brass, 1/8" x 1-1/2"	1
204	917000	Elbow, 90°, brass, 1/8"	1
205	917003	Nipple, brass, 1/8" x 2-1/2"	1
206	917054	Coupling, brass, 1/8"	1

PARTS LIST

FEED WATER PUMPING SYSTEM

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
207	901032	Cock, air, brass, 1/8", male	1
208	914045	Cup, water pump priming	1
209	904012	Valve, globe, 1/2", 225#, Ohio Injector Co., #270	1
210	904014	Valve, globe, 3/4", 225#, Ohio Injector Co., #270	1
211	904011	Valve, globe, 1", 225#, Ohio Injector Co., #270	1
212	904013	Valve, check, 3/4", 300#, Ohio Injector Co., #304	1
213	904022	Valve, globe, 3/4", 300#, Ohio Injector Co., #300-S	1
214	917596	Nipple, Black 1" Close	1
214A	917516	Nipple, black 1" x 2-1/2"	2
214B	920533	Pipe, black 1" x 10-1/2"	1
214C	917519	Nipple, black, 1" x 6"	1
214D	917550	Pipe, black, 1" x 11-1/2"	1
215	920443	Nipple, black 3/4" x Close	2
215A	917435	Nipple, black 3/4" x 4-1/2"	2
215B	917433	Nipple, black, 3/4" x 3-1/2"	1
215C	917437	Nipple, black, 3/4" x 6"	1
216	923445	Pipe, black, ex. hvy., 3/4" x 26-1/2"	1
216A	920423	Nipple, black, ex. hvy., 3/4" x 4"	1
216B	920488	Nipple, black, ex. hvy., 3/4" x 2"	1
216C	917428	Nipple, black, ex. hvy., 3/4" x Close	1
217	920418	Tee, Ex. hvy., black, 3/4"	1
218	920413	Elbow, ex. hvy., 45°, black, 3/4"	1
219	917542	Elbow, 90°, black, 1"	2
220	917583	Elbow, Street, 90°, black, 1"	1
221	917530	Union, black, 1"	1
222	920435	Elbow, Street, ex. hvy., 45°, black, 3/4"	1
223	917469	Tee, black, 3/4"	1
224	920528	Cross, black, 1"	1
225	917364	Nipple, black, 1/2" close	2
226	917528	Bushing, black, 1" x 1/2"	1
227	917529	Bushing, black, 1" x 3/4"	1
228	917612	Bushing, black, 1-1/4" x 1"	1
229	917446	Elbow, Street, 90°, black, 3/4"	2
230	917452	Elbow, 45°, black, 3/4"	2
231	917449	Plug, black, 3/4"	2
231A	917024	Plug, black, 1/8"	1
232	917450	Union, black, 3/4"	1
233	917688	Tee, black, 1-1/4" x 3/4" x 3/4"	1
234	917687	Nipple, black, 1-1/4", Close	2
235	114001	Base, Water Pump Mounting	1
236	921310	Bolt, Machine Hex. Hd., 5/16" x 1-1/4"	4
237	921003	Washer, Lock, 5/16"	4
238	921012	Nut, Hex., 5/16"	4
239	921301	Bolt, Machine Hex. Hd., 3/8" x 1"	4
240	921009	Washer, Lock, 3/8"	4
240A	923404	Bushing, black, 3/4" x 1/4"	1
240B	614078	Cock, Air, 1/4" Male	1

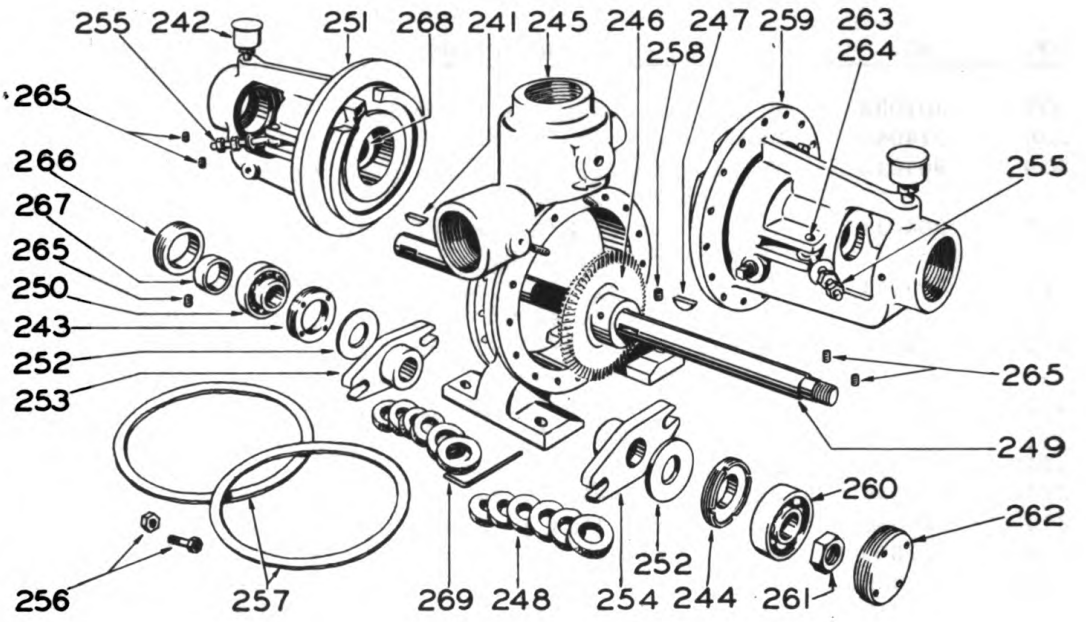


FIGURE 60 BOILER FEED PUMP

REF. NO.	PART NO.	DESCRIPTION	AURORA PUMP NO.	NO. REQ.
241	914008	Key, Woodruff, drive coupling 5/32" x 3/4" Dia.	3	1
242	914003	Grease Cup	6	2
243	914004	Nut, adjusting, drive end	7	1
244	914005	Nut, adjusting, blind end	7-A	1
245	914006	Shell, pump body	8	1
246	914007	Impeller	9	1
247	914008	Key,Woodruff,impeller on shaft 5/32" x3/4"Dia.	10	1
248	914009	Packing, pump shaft	11	16
249	914010	Shaft, impeller	13	1
250	914011	Bearing, ball, drive end	14	1
251	914012	Cover, drive end	15	1
252	914013	Slinger, water	16	2
253	914014	Gland, packing, drive end	17	1
254	914015	Gland, packing, blind end	17-A	1
255	914016	Eye Bolt, nuts and washer packing gland	18	4
256	914017	Cap Screw and nut	19	8
257	914018	Gasket	20	2
258	914019	Set Screw, 1/4 x 1/4" USS hollow head	42	1
259	914020	Cover, blind end	22	1
260	914021	Bearing, ball, blind end	23	1
261	914022	Nut, jam	24	1
262	914023	Nut, adjusting	25	1
263	914024	Pin, clevis 1/4 x 1 1/4"	26	4
264	914025	Pin, cotter 1/16 x 1"	27	4
265	914026	Set Screw, 1/4" x 1/4" SAE hollow head	21 & 29	4
266	914027	Locknut	5	1
267	914028	Lock Collar	39	1
268	914029	Bushing, cover	38	2
269	916013	Allen Wrench for 1/4" set screw		1

(See Page 70, Ref. #196, Fig. 59)

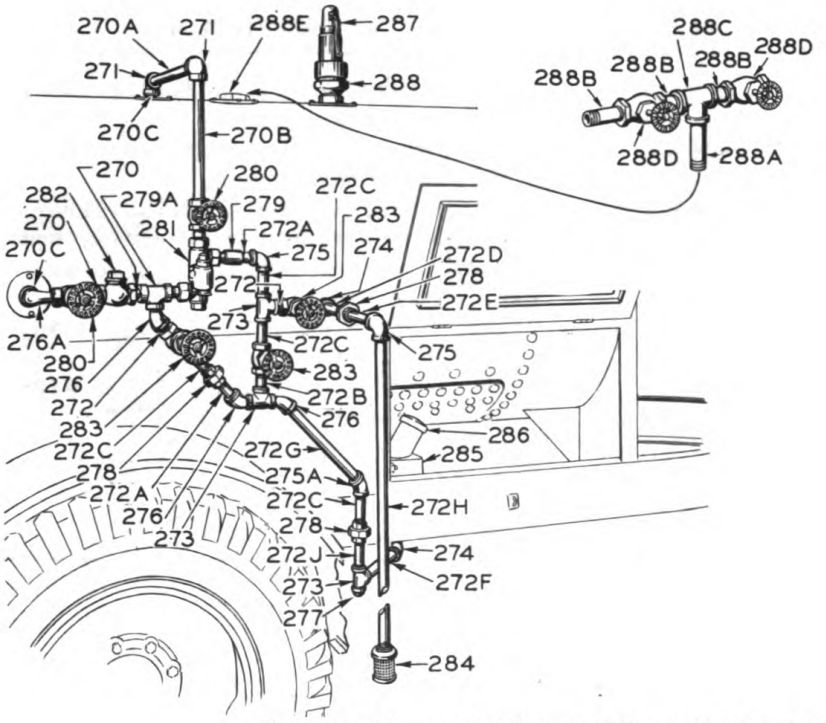


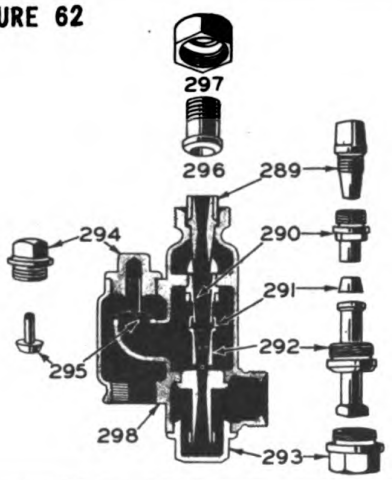
FIGURE 61 INJECTOR PIPING - STEAM POP VALVE

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
270	917428	Nipple, ex. hvy., black, 3/4" close	2
270A	920417	Pipe, ex. hvy., black, 3/4" x 20-1/2"	1
270B	920437	Pipe, ex. hvy., black, 3/4" x 12"	1
270C	920423	Nipple, ex. hvy., black, 3/4" x 4"	2
271	920466	Elbow, ex. hvy., 90°, black, 3/4"	2
272	920443	Nipple, black, 3/4", Close	2
272A	917430	Nipple, black, 3/4" x 2"	2
272B	917431	Nipple, black, 3/4" x 2-1/2"	1
272C	917432	Nipple, black, 3/4" x 3"	4
272D	917476	Nipple, black, 3/4" x 5-1/2"	1
272E	917437	Nipple, black, 3/4" x 6"	1
272F	920424	Pipe, black, 3/4" x 8"	1
272G	917441	Pipe, black, 3/4" x 11"	1
272H	917445	Pipe, black, 3/4" x 42"	1
272J	917433	Nipple, black, 3/4" x 3-1/2"	1
273	917469	Tee, black, 3/4"	3
274	917446	Elbow, Street 90°, black, 3/4"	2
275	917451	Elbow, 90°, black, 3/4"	2
275A	917452	Elbow, 45°, black, 3/4"	1
276	917447	Elbow, Street, 45°, black 3/4"	3
276A	920420	Elbow, Street, ex. hvy., 90°, black, 3/4"	1
277	917449	Plug, black, 3/4"	1
278	917450	Union, black, 3/4"	3
279	917453	Coupling, black, 3/4"	1
279A	920418	Tee, ex. hvy., black, 3/4"	1
280	904022	Valve, globe, 3/4", extra heavy, Fig. 300S, Ohio Injector Company	2
281	904018	Injector, (see Figure 62)	1
282	904013	Valve, check, 3/4", extra heavy, Fig. 304, Ohio Injector Co.	1

REF. NO.	PART NO.	INJECTOR PIPING - STEAM POP VALVE DESCRIPTION	NO. REQ.
283	904014	Valve, Globe, 3/4", 225#, Fig. 270, Ohio Injector Company	3
284	904024	Strainer, 3/4", injector, suction Ohio Injector Company	1
285	104004	Tank, water, assembly, with filler neck, cap, mounting brackets, companion clips, gaskets and bolts	1
286	904026	Cap, water tank filler	1
287	904016	Valve, pop safety, 125#, Fig. 1445, 2" Consolidated Ashcroft	1
288	920860	Extension Piece, 2", ex. hvy., #128	1
288A	920755	Nipple, Ex. Hvy., 1-1/2" x 6"	1
288B	917543	Nipple, Ex. Hvy., 1" x 2"	3
288C	923705	Tee, Ex. Hvy., 1-1/2" x 1" x 1"	1
288D	904087	Valve Glove 1" Lunk., Fig. 407	2
288E	917891	Bushing, Ex. Hy, 2" x 1-1/2"	1

INJECTOR

FIGURE 62



REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
	904018	Injector, 3/4", Chicago Type, #1004, Size 3,	1
289	904042	Ohio Rejector Co.	1
290	904043	Lifting Tube	1
291	904044	Ring	1
292	904045	Forcing Tube	1
293	904046	Barrel Cap	1
294	904047	Overflow Cap	1
295	904048	Overflow Check	1
296	904049	Union	1
297	904050	Nut	1
298	904051	Body	1

HOUSING AND INSULATION (See Figure 63)

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
299	102051	Fender Assembly, with channel iron mounting rail attached, right	1
300	102050	Fender Assembly, with channel iron mounting rail attached, left	1
301	921115	Stud, fender mounting, 1/2" x 1-1/2"	6
	921346	Nut, 1/2", hex.	6
	921053	Washer, lock, 1/2"	6
302	105001	Lagging, steel, top half boiler shell	1
303	105002	Housing, steel, left front side	1
304	105003	Housing, steel, left at fender	1
305	105004	Housing, steel, left rear at fender	1

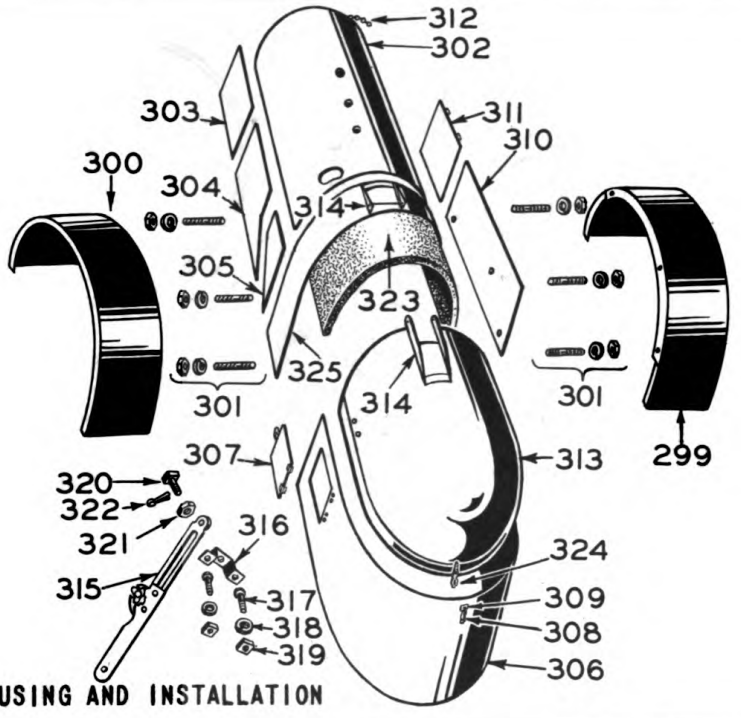


FIGURE 63 HOUSING AND INSTALLATION

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
306	105005	Housing, power plant apron, encircling power plant, including left door hinged; hinge hasp; outer rear hinge hasp staple	1
307	105049	Door, to water pump assembly, including butt hinges; hinge hasp and bit snap	1
308	905001	Bit snap	3
309		Staple, hinge hasp, welded to housing	3
310	105007	Housing, right, at fender	1
311	105008	Housing, right, front side door to tool compartment assembly, with hinges, hinge snap and bit snap	1
312	105038	Chain, tool door holding	1
313	105009	Hood, power plant, hinged assembly, with complete top hinge and hasp attached	1
314	105010	Hinge, hood to boiler lagging assembly	1
315	105050	Support, hood holding assembly	2
316	105039	Bracket	4
317	921309	Bolt, stove, R.H., 1/4" x 3/4"	8
318	921001	Washer, 1/4"	8
319	921195	Sq. Iron Nut, 1/4"	8
320	105040	Bolt, 3/8" x 1", Machine, Drilled tip	4
321	921302	Nut, 3/8" Square	4
322	921031	Cotter Key, 1/8" x 1-1/4"	4
323	105013	Insulation "Banroc" Blanket, 1-1/2" x 24" x 48"	3
324		Hasp, hinged, welded to hood	1
325	105052	Housing steel, center	1

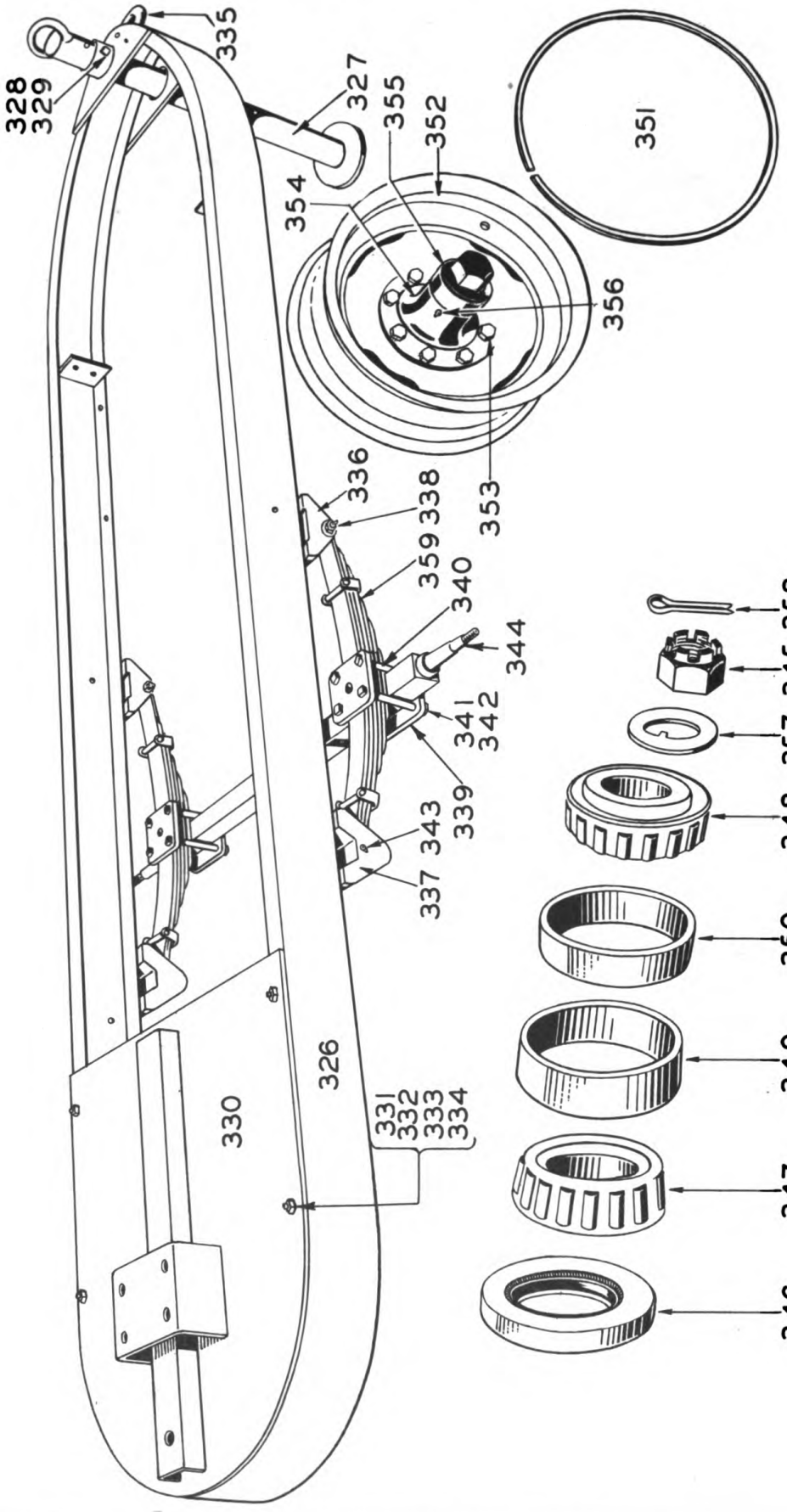


FIGURE 64 CHASSIS AND RUNNING GEAR

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
326	102004	Chassis Frame Assembly, includes 6" channel iron frame, power plant and blower base plate welded on, spring hangers riveted on, lunette towing ring and front support leg	1
327	102005	Leg, front support with top ring (circular base must be welded in place after installed)	1
328	921306	Machine bolt, 3/4 x 5-1/2"	1
329	921038	Nut, 3/4", hex.	1
330	102006	Plate, base, for power plant and oil burner assembly	1
331	921147	Machine Bolt, 1/2 x 1-3/4"	5
332	921346	Nut, 1/2". hex.	5
333	921053	Washer, lock, 1/2"	5
334	921113	Washer, cast iron, bevel, 1/2"	5
335	102007	Lunette Ring, towing (must be welded in place)	1
336	102008	Hanger, spring, front	2
337	102009	Hanger, spring, rear	2
338	102010	U-Bolt, spring hanger, 3/4" x 4-3/4"	2
	921090	Nut, castellated SAE 3/4	2
339	102011	Plate, axle spring mounting, 5" square	4
340	921081	Bolt, spring-axle mounting, 5/8 x 6-1/2"	8
341	921040	Nut, 5/8", hex.	8
342	921052	Washer, lock, 5/8"	8
343	916087	Alemite Fittings, 1/8", male, 90°	4
344	102038	Axle, with key washer, castellated nuts and cotter keys, 2-1/2" square	1
345	921343	Nut, castellated SAE 1-1/8"	2
346	102039	Grease Seal Assembly, Chicago Rawhide Mfg. Co., #33528	2
347	102045	Roller Bearing, large, inner, Timken #25580	2
348	102044	Roller Bearing, small, outer, Timken #2689	2
349	102047	Cup, large inner bearing, Timken #25520	2
350	102046	Cup, small outer bearing, Timken #2631	2
351	102048	Ring, side Motor Wheel Corp. #32286	2
352	102040	Wheel, disc only, less hub and studs Motor Wheel Corp. #L32283 (20 x 5.50)	2
353	102041	Stud, wheel, hub, Motor Wheel Corp. #31966	16
354	102042	Hub, only, less studs, with bearing cups installed, Motor Wheel Corp. #32037	2
	102024	Tire, 7.50 x 16, 8 ply, implement type	2
	102025	Tube, inner, 7.50 x 16	2
355	102043	Cap, Hub, #08215, Motor Wheel Corp.	2
356	913067	Fitting, Alemite, 1/8"	2
357	102030	Washer, slotted, 1-1/8"	2
358	921087	Pin cotter, 3/16" x 2-1/2"	2
359	102029	Spring Assembly, 10 leaf, 2-1/2" wide, Tuthill Spring Co., #101	2

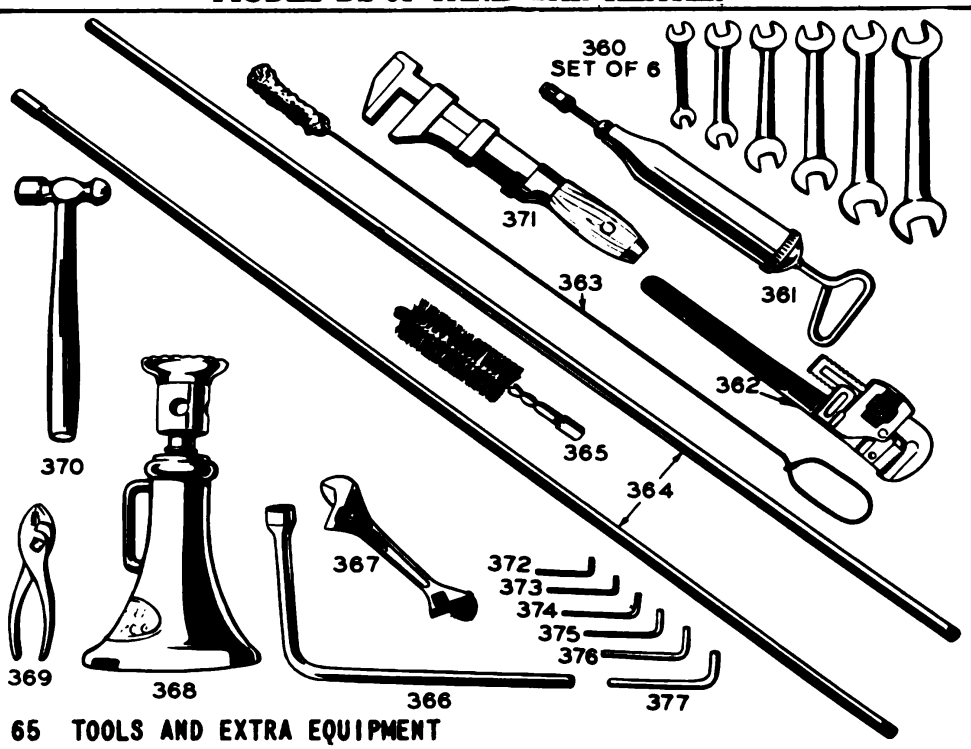


FIGURE 65 TOOLS AND EXTRA EQUIPMENT

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
360	916024	Wrench, open end, set of six, 1/4" to 1"	
361	916009	Grease Gun, Zirk	
362	916004	Wrench, pipe, 14"	
363	916020	Lighter Torch	
364	916021	Flue Brush Handle	
365	916008	Flue Brush, 1-7/8"	
366	916103	Wrench, wheel stud	
367	916005	Wrench, adjustable, 8"	
368	916010	Jack, 1-1/4" x 8" screw	
369	916007	Pliers, 6"	
370	916028	Hammer, Ball Pien, 16 oz.	
371	916025	Wrench, monkey - 12"	
372	916011	Wrench, Allen for 1/8" set screw	
373	916012	Wrench, Allen for 3/16" set screw	
374	916013	Wrench, Allen for 1/4" set screw	
375	916014	Wrench, Allen for 5/16" set screw	
376	916015	Wrench, Allen 3/8" set screw	
377	916016	Wrench, Allen for 7/16" set screw	
		Steam Hose and Couplings *(Not Illustrated)*	
378	116001	Hose, Rubber, Steam, 1", 5 Ply, 15 ft.	
379	116003	Coupling, Hose, 1" male	
380	116004	Coupling, Hose, 1" female	

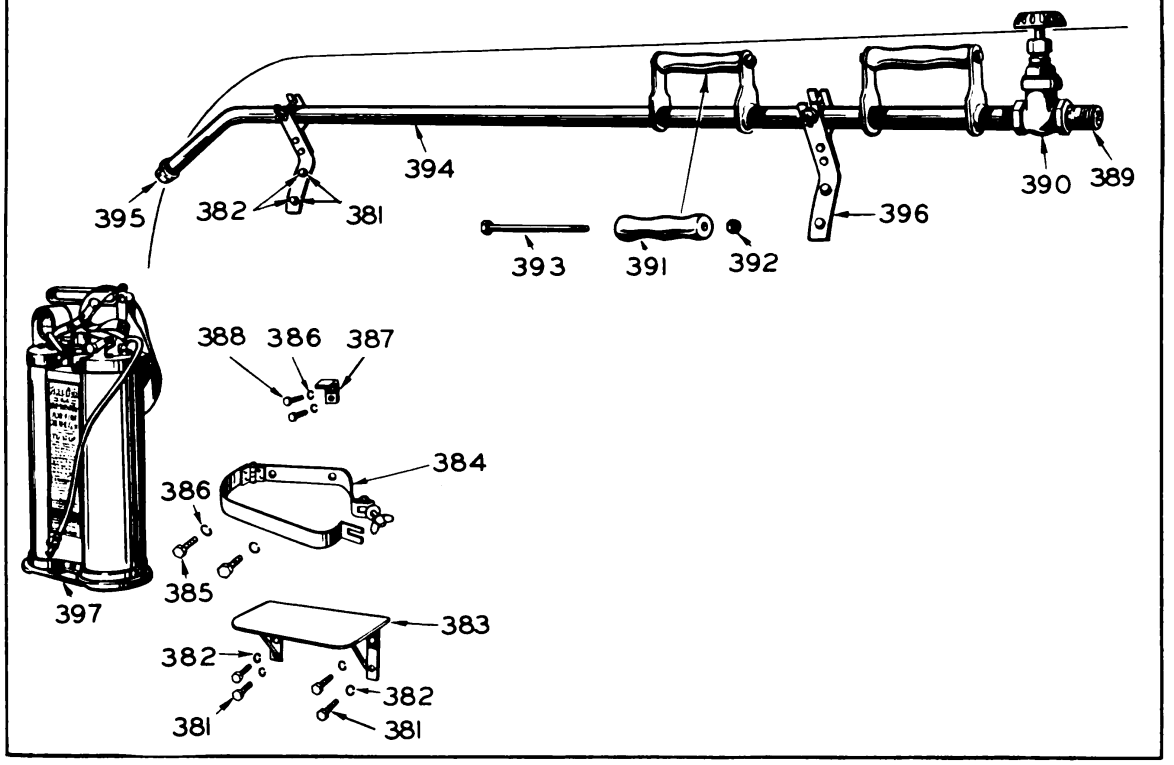


FIGURE 66 STEAM JET

REF. NO.	PART NO.	DESCRIPTION	NO. REG.
381	921336	Capscrew, 5/16" x 3/4"	8
382	921003	Lockwasher, 5/16"	8
383	116014	Base, Fire Extinguisher	1
384	116015	Clamp, Fire Extinguisher	1
385	921027	Capscrew, 1/4" x 3/4"	2
386	921001	Lockwasher, 1/4"	4
387	116016	Clip, Fire Extinguisher	1
388	921074	Capscrew, 1/4" x 1/2"	2
389	917517	Nipple, Black, 1" x 3"	1
390	904109	Valve, Gate, Lunk. Fig. 2125, 1"	1
391	116008	Handle, Steam Jet, Wood	2
392	921024	Nut, Hex, 3/8"	2
393	921211	Bolt, 3/8" x 7"	2
394	116006	Pipe, 1" x 6' with handle straps welded on	1
395	116007	Cap, Pipe 1", Drilled 1/4"	1
	116005	Steam Jet Complete, Incl. Ref. No. 389 to 395	1
396	116017	Bracket, Steam Jet, Mounting	2
397	916140	Fire Extinguisher	1

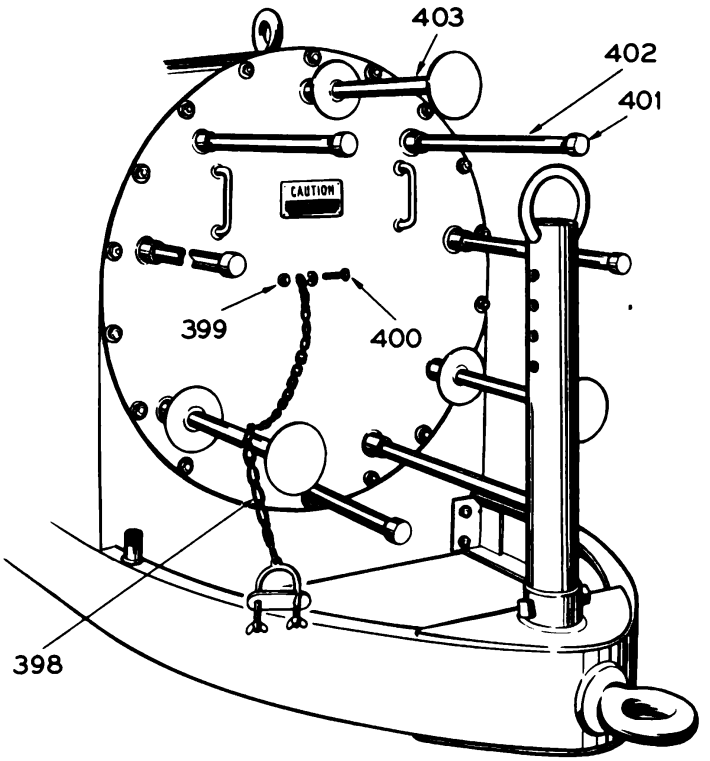


FIGURE 67 HOSE RACK

REF. NO.	PART NO.	DESCRIPTION	NO. REG.
398	116012	Chain, U Clamp, & Wing nuts, Hose Fastening	1
399	921014	Nut, Hex, 10-32	1
400	921429	Bolt, Stove, 10-32, 1"	1
401	920588	Cap, Pipe, 1"	6
402	923534	Pipe, Black, 1" x 20-1/4"	6
403	116013	Guide, Hose, (1" x 20-1/4" with one 5" diam. plate welded on each end)	3

PARTS LIST

PART NO.	REF NO.	PAGE	NO. REQ.	WEIGHT LBS.	★ LIST PRICE EA.
101001	11	61	1	70	$ 38.00
101003	15	61	1	11	11.70
101004	17	61	1	20	10.10
101005	18	61	46	10	4.00
101006	1	59	1	2400	2839.00
101007	19	61	1	94	50.10
101008	3	59	1	2	3.30
101009	21	61	1	15	9.80
101010	14	61	1	1	2.00
101011	10	59	4	2	.70
101012	10	59	4	2	1.00
101020	22	61	1	100	95.00
102003	61	63	1	40	12.00
102004	326	77	1	400	220.00
102005	327	77	1	38	17.70
102006	330	77	1	50	42.80
102007	335	77	1	15	5.20
102008	336	77	2	10	13.00
102009	337	77	2	10	17.40
102010	338	77	2	1	2.20
102011	339	77	4	2	3.00
102029	359	77	2	45	14.90
102030	357	77	2	1/4	.10
102038	344	77	1	80	83.00
102039	346	77	2	1/2	.85
102040	352	77	2	40	10.60
102041	353	77	16	1/4	.10
102042	354	77	2	15	13.00
102043	355	77	2	1/2	.60
102044	348	77	2	1/4	1.68
102045	347	77	2	1/4	2.28
102046	350	77	2	1/2	1.04
102047	349	77	2	1/2	1.34
102048	351	77	2	1/2	1.90
102050	300	74	1	70	56.00
102051	299	74	1	70	56.00
103001	131	67	1	10	47.20
103002	111	66	1	2	15.00
103003	118	66	1	2	7.50
103004	119	66	1	2	7.50
103005	147	68	1	8	15.00
103006	150	68	1	5	12.00
103007	151	68	1	4	8.50
103008	152	68	1	5	4.00
103009	153	68	1	4	4.80
103010	112	66	3	1	1.00
103011	73	64	2	2	2.20
104001	58	63	1	10	13.80
104002	60	63	1	10	7.50

★ Set prices subject to change without notice

MODEL DS-31 TANK CAR HEATER

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	★ LIST PRICE EA.
104004	285	74	1	90	$ 26.70
105001	302	74	1	60	40.00
105002	303	74	1	10	8.00
105003	304	74	1	10	9.50
105004	305	74	1	6	6.00
105005	306	75	1	50	30.00
105007	310	75	1	6	11.00
105008	311	75	1	6	9.00
105009	313	75	1	50	83.50
105010	314	75	1	5	12.20
105013	323	75	3	15	7.00
105014	24	61	1	3	3.70
105021	31	61	1	100	14.00
105022	8	59	2	27	13.36
105038	312	75	1	1	.80
105039	316	75	4	1/2	2.90
105040	320	75	4	1/4	.20
105043	26	61	1	40	23.00
105044	29	61	1	20	5.80
105045	30	61	1	20	5.88
105046	28	61	1	40	9.40
105047	25	61	2	16	6.40
105048	27	61	1	20	5.70
105049	307	75	1	6	10.00
105050	315	75	2	5	5.58
105052	325	75	1	15	2.50
113001	129	67	1	3	1.00
113002	67	64	1	5	12.50
113004	103	65	1	50	30.00
113005	105	65	1	4	11.50
113006	106	65	1	1	5.00
113007	110	65	1	1	2.20
113008	130	67	1	1	1.00
114001	235	71	1	20	7.50
116001	378	78	*	25	42.30
116003	379	78	*	2	3.30
116004	380	78	*	2	5.70
116005	*	79	1	16	29.50
116006	394	79	1	10	14.00
116007	395	79	1	1/4	.40
116008	391	79	2	1	.50
116012	398	80	1	1-1/2	3.37
116013	402	80	3	3	2.94
116014	383	79	1	5	3.27
116015	384	79	1	3	4.42
116016	387	79	1	1/2	.60
116017	396	79	2	1	6.75
117500	33	63	1	1	.92
614078	57B & 240B	63 & 71	2	1/4	2.50
901001	20	61	1	1	3.80
901002	7	59	1	10	1.20
901002	32	61	1	10	1.20
901005	10	59	4	1/4	.20
901006	10	59	4	1/8	.14
901008	41	63	1	25	8.40
901009	43	63	1	1/4	1.50

** Complete Assembly

* Dependent on Operating Conditions

PARTS LIST

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	★ LIST PRICE EA.
901010	44	63	1	2	$ 5.00
901011	45	63	1	2	5.50
901012	46	63	2	1/2	.40
901013	47	63	1	1	.60
901014	48	63	2	1/4	.10
901015	49	63	3	2	4.30
901016	54	63	1	1	1.50
901032	207	71	1	1/4	2.80
903001	148	68	1	1/4	.40
903002	114	66	1	1/4	1.60
903003	*	69	1	60	167.00
903004	163	69	1	1	1.70
903005	169	69	1	1/2	1.70
903006	180	69	1	15	66.80
903007	176	69	2	4	9.90
903008	179	69	1	4	6.80
903009	160	69	2	18	18.50
903010	161	69	1	22	27.40
903011	155	69	2	1/2	3.70
903012	181	69	1	1/4	.20
903014	182	69	1	1/4	.20
903016	198	70	1	4	8.20
903017	200	70	1	2	3.30
903018	201	70	1	2	3.30
903019	202	70	1	1/4	2.00
903021	164	69	1	1/2	3.30
903032	115	66	2	1/4	1.60
903033	117	66	3	1/4	.30
903034	116	66	3	1/4	.20
903041	127	67	1	1/4	1.90
903042	177	69	1	1/4	.20
903042	102	65	1	1/4	.20
903043	186	69	1	1/4	.20
904007	87	65	1	5	13.00
904008	88	65	1	1	4.80
904009	97	65	1	1	4.10
904011	211	71	1	8	10.70
904012	209	71	1	4	5.30
904013	212	71	1	3	10.20
904013	282	73	1	3	10.20
904014	210	71	1	5	8.50
904014	283	74	3	5	8.50
904016	287	74	1	8	33.10
904018	281	73	1	5	16.00
904022	280	73	2	6	16.00
904022	213	71	1	6	16.00
904024	284	74	1	1	1.80
904026	286	74	1	1	1.80
904028	53	63	1	5	24.90
904041	125	67	2	1	3.30
904042	289	74	1	1/4	3.00
904043	290	74	1	1/4	3.00
904044	291	74	1	1/4	1.50
904045	292	74	1	1/4	7.00
904046	293	74	1	1/4	2.40

MODEL DS-31 TANK CAR HEATER

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	★ LIST PRICE EA.
904047	294	74	1	1/4	$ 1.80
904048	295	74	1	1/4	1.10
904049	296	74	1	1/4	1.00
904050	297	74	1	1/4	1.00
904051	298	74	1	3	11.20
904053	132	67	1	2	5.30
904054	133	67	1	1/4	.60
904055	134	67	1	1/4	.20
904056	135	67	1	1/4	.20
904057	136	67	1	1/4	.70
904058	137	67	1	1/4	1.10
904059	138	67	1	1/4	.10
904060	139	67	1	1/4	.10
904061	140	67	1	1/4	.10
904062	141	67	1	1/4	.20
904063	142	67	1	1/4	.10
904064	143	67	1	1/4	.10
904065	144	67	1	1/4	.10
904066	145	67	1	1/4	2.10
904067	146	67	1	1/4	.10
904087	288D	74	2	2	9.62
904109	390	79	1	3	7.06
905001	308 & 62	75 & 63	4	1/4	.60
907001	98	65	1	3	2.80
907002	56	63	1	5	6.50
912001	99	65	1	1	1.70
912002	100	65	1	3	3.90
912003	183	69	1	15	11.20
912004	188	69	2	3	2.20
912005	185	69	1	15	16.00
912007	101	65	1	2	2.60
913003	76	64	1	5	9.30
913004	77	64	1	1/4	.10
913005	78	64	1	1	1.30
913006	89	65	1	10	30.06
913007	90	65	1	2	.80
913008	92	65	4	1/4	1.00
913009	93	65	1	1/4	.30
913009	128	67	1	1/4	.30
913010	126	67	4	1/4	.20
913067	178 & 356	69 & 77	4	1/4	.10
914001	196	70	1	40	178.00
914003	242	72	2	1/4	.50
914004	243	72	1	1/2	2.50
914005	244	72	1	1/2	2.50
914006	245	72	1	10	60.00
914007	246	72	1	2	18.40
914008	247	72	1	1/4	.20
914008	241	72	1	1/4	.20
914009	248	72	16	1	1.70
914010	249	72	1	5	15.00
914011	250	72	1	1/2	8.00
914012	251	72	1	10	46.00
914013	252	72	2	1/4	.50

PARTS LIST

	NO. REQ.	★ LIST PRICE EA.			
914015	254	72	1	1	$ 4.00
914016	255	72	4	1/2	.80
914017	256	72	8	1/4	.10
914018	257	72	2	1/4	1.00
914019	258	72	1	1/4	.10
914020	259	72	1	10	40.00
914021	260	72	1	1/2	4.50
914022	261	72	1	1/4	40
914023	262	72	1	1/4	2.50
914024	263	72	4	1/4	.20
914025	264	72	4	1/4	.10
914026	265	72	4	1/4	.20
914027	266	72	1	1/4	2.50
914028	267	72	1	1/4	1.00
914029	268	72	2	1/4	5.00
914030	194	70	1	1	6.30
914031	195	70	1	8	8.40
914032	193	70	1	1	1.00
914033	191	70	1	2	.80
914034	192	70	1	1/4	.20
914035	189	70	4	1/4	.10
914045	208	71	1	5	5.00
916004	362	78	*	6	5.50
916005	367	78	*	3	4.20
916007	369	78	*	1	.80
916008	365	78	*	1	.80
916009	361	78	*	5	4.80
916010	368	78	*	15	7.40
916011	372	78	*	1/4	.20
916012	373	78	*	1/4	.20
916013	269 & 374	72 & 78	*	1/4	.20
916014	375	78	*	1/4	.20
916015	376	78	*	1/4	.20
916016	377	78	*	1/4	.20
916020	363	78	*	1	1.00
916021	364	78	*	10	1.50
916024	360	78	*	3	2.70
916025	371	78	*	6	2.50
916028	370	78	*	2	2.90
916087	343	77	4	1/4	.20
916103	366	78	*	3	1.26
916140	397	79	1	40	105.00
917000	122 & 204	67 & 70	5	1/4	.30
917001	203	70	1	1/4	.12
917003	205	70	1	1/4	.16
917010	124	67	2	1/4	.50
917024	190 & 231A	70 & 71	3	1/4	.10
917054	206	70	1	1/4	.24
917093	121	66	3	1/4	.40
917094	123	67	1	1/4	.30
917100	120	66	3	1/4	.20
917019	57A	63	1	1/4	.38
917119	86	65	1	1/4	.08
917121	84	65	1	1/4	.20
917122	85	65	1	1/4	.02

* Tools - Quantity Optional

MODEL DS-31 TANK CAR HEATER

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	★ LIST PRICE EA.
917171	36	63	3	1/4	.32
917194	83	65	3	1/4	.06
917218	74	64	1	1/4	.02
917219	81	65	6	1/4	.08
917364	225	71	2	1/4	.06
917428	216C & 270	71 & 73	3	1/4	.16
917430	272A	73	2	1/4	.10
917431	272B	73	1	1/4	.10
917432	272C	73	4	1/4	.10
917433	215B	71	1	1/4	.12
917433	272J	73	1	1/4	.12
917435	215A	71	2	1/4	.14
917337	215C & 272E	71 & 73	2	1/4	.16
917441	272G	73	1	1/4	.32
917445	272H	73	1	1/4	1.26
917446	229 & 274	71 & 73	4	1/4	.30
917447	276	73	3	1/4	.30
917449	231 & 277	71 & 73	3	1/4	.06
917450	232 & 278	71 & 73	4	1/4	.60
917451	275	73	2	1/4	.18
917452	230 & 275A	71 & 73	3	1/4	.30
917453	279	73	1	1/4	.24
917469	223 & 273	71 & 73	4	1/4	.24
917476	272D	73	1	1/4	.16
917516	214A	71	2	1/4	.22
917517	389	79	1	1/4	.14
917519	214C	71	1	1/4	.20
917526	38	63	1	1/4	1.60
917528	226	71	1	1/4	.12
917529	227	71	1	1/4	.12
917530	221	71	1	1/4	.82
917532	51	63	1	1/4	3.46
917533	52	63	1	1/4	.46
917542	219	71	2	1/4	.34
917543	33A & 288B	63 & 74	4	1/2	.46
917550	214D	71	1	1/4	.76
917583	220	71	1	1/4	.38
917587	33B	63	2	1/4	1.04
917591	50	63	3	1/4	.60
917592	39	63	1	1/4	1.60
917593	40	63	1	1/4	2.14
917594	59	63	1	1/4	.44
917596	214	71	1	1/4	.10
917612	228	71	1	1/4	.14
917687	234	71	2	1/4	.14
917688	233	71	1	1/4	.66
917823	104	65	1	1/4	1.02
917891	288E	74	1	1/4	.30
920101	55	63	1	1/4	2.40
920129	57	63	1	1/4	.80
920200	75	64	1	1/4	.06
920201	94 & 95	65	2	1/4	2.20
920202	96	65	1	1/4	3.60
920412	35	63	1	1/4	.98
920413	218	71	1	1/4	$ 1.14
920417	270A	73	1	1/4	.82
920418	217 & 279A	71 & 73	2	1/4	1.34

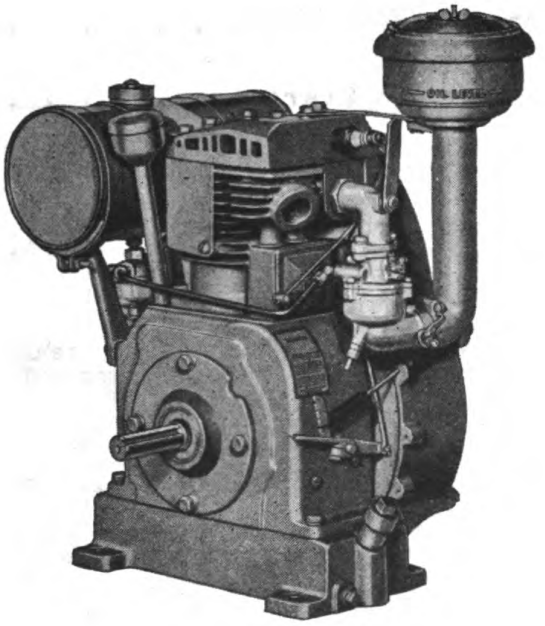
PARTS LIST

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	★ LIST PRICE EA.
920420	276A	73	1	1/4	1.20
920423	216A & 270C	71 & 73	3	1/4	.22
920424	272F	73	1	1/4	.22
920435	222	71	1	1/4	1.20
920437	270B	73	1	1/4	.48
920443	215 & 272	71 & 73	4	1/4	.08
920466	271	73	2	1/4	.94
920488	216	71	1	1/4	.17
920503	34	63	1	1/4	1.76
920527	42	63	1	1/4	.12
920528	224	71	1	1/4	.58
920531	37	63	1	1/4	2.12
920533	214B	71	1	1/4	.26
920588	401	80	6	1/4	.26
920755	288A	74	1	1-1/2	.56
920860	288	74	1		1.00
921001	80, 318& 386	65, 75 & 79	16	1/4	.02
921003	72,237 & 382	64,71 & 79	14	1/4	.02
921009	69,171 & 174 65A & 240	64,69 & 63 & 71	23	1/4	.01
921010	70,159 & 173	69	18	1/4	.01
921012	238	64 & 71	4	1/4	.02
921014	399	80	1	1/4	.02
921017	113 & 165	65 & 69	8	1/4	.06
921023	158 & 170	69	12	1/4	.04
921024	9,65 & 392	59,63 & 79	15	1/4	.02
921027	167 & 385	69 & 79	3	1/4	.04
921031	322	75	4	1/4	.02
921038	329	77	1	1/4	.08
921040	10 & 341	59 & 77	12	1/4	.06
921043	13	61	4	1/4	.42
921052	342	77	8	1/4	.02
921053	108, 301, 333, 66	65, 776, 74, & 63	23	1/4	.02
921055	4, 5, & 6	59	46	1/4	.10
921072	10	59	4	1/2	.22
921074	149 & 388	64 & 78	5	1/4	.04
921077	168	69	1	1/4	.02
921078	5 & 6	59	42	1/4	.02
921081	340	77	8	1/4	.44
921087	358	77	2	1/4	.04
921090	338	77	2	1/4	.10
921093	16	61	5	1/4	.08
921095	5 & 107	59 & 65	40	1/4	.08
921097	23	61	6	1/4	.14
921111	68 & 172	64 & 69	6	1/4	.04
921112	91	65	2	1/4	.06
921113	334	77	5	1/4	.08
921115	4,12 & 301	59,61 & 74	20	1/4	.20
921116	13	61	4	1/4	.24
921147	331	77	5	1/4	.08
921177	157	69	4	1/4	.01
921187	71	64	2	1/4	.04
921188	79 & 166	65 & 69	5	1/4	.02

MODEL DS-31 TANK CAR HEATER

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	★ LIST PRICE EA.
921195	319	75	8	1/4	.02
921197	156 & 162	69	5	1/4	.10
921211	393	79	2	1/2	.10
921239	64	63	1	1/4	.04
921301	9,63 & 239	59.63 & 71	16	1/4	.04
921302	175 & 321	69 & 75	8	1/4	.10
921306	328	77	1	1/4	.46
921308	154 & 165	68 & 69	14	1/4	.10
921309	317	75	8	1/4	.04
921310	236	71	4	1/4	.06
921312	66	63	8	1/4	.08
921330	16	61	5	1/4	.04
921336	381	79	8	1/4	.04
921338	13	61	4	1/4	.03
921343	345	77	2	1/4	.20
921346	66, 109, 301 &332	63, 65, 74, & 77	23	1/4	.04
921365	184,187 & 199	69 & 70	5	1/4	.20
921429	400	80	1	1/4	.02
923404	240A	71	1	1/4	.12
923445	216	71	1	2	.80
923534	402	80	6	2	1.20
923705	288C	74	1	1/2	.26

GASOLINE ENGINE



BRIGGS & STRATTON

MODEL "ZZ"

TYPE NO. 304665 or 304786

INDEX

Starting and Operating Instructions

1. BEFORE STARTING THE MOTOR. Fill the crankcase with high grade oil not heavier than OE S.A.E. 30. When temperature is below 32° F., use oil not heavier than OE S.A.E. 10.

A HEAVIER OIL MUST NOT BE USED. The oil filler plug is painted blue and is located on top of motor base. With the motor level, remove filler plug and pour oil in opening until it rises to the level of the filler plug opening. Crankcase holds 4-1/2 pints. Fill air cleaner with light engine oil, (SAE 10) to the indicated oil level. See paragraph 59. Fill the gas tank with a good, clean, third grade gasoline. Tank holds five gallons. Do not mix oil and gasoline. See paragraphs 10 to 17.

2. HOW TO START. Open gasoline shut-off valve in gas filter or gasoline tank.

A. HAND CRANK STARTER TYPE. Pull out the compression release rod as far as it will come. Press the starter shaft in, to mesh gear with pinion on crankshaft. Crank rapidly and as soon as enough momentum is gained let go of the compression release rod and pull carburetor choke lever toward you to choke carburetor. After motor starts, gradually open the choke valve until motor runs smoothly with the choke valve wide open. (A warm motor does not require as much choking as a cold motor.)

3. FAILURE OF MOTOR TO START. If motor fails to start after a reasonable number of trials do not make any adjustments until you have studied the instructions referred to in the SERVICING REFERENCE CHART, on page 92.

4. HOW TO STOP. Press the stop switch mounted on the intake elbow against the end of the spark plug. Hold it until motor stops firing. This will ground the spark.

5. GENERAL DATA. You will find your Briggs & Stratton motor substantially built. It is made of high grade materials by skilled workmen, in a factory fully equipped with the most modern machinery. Before it was shipped, it received many tests and careful inspections.

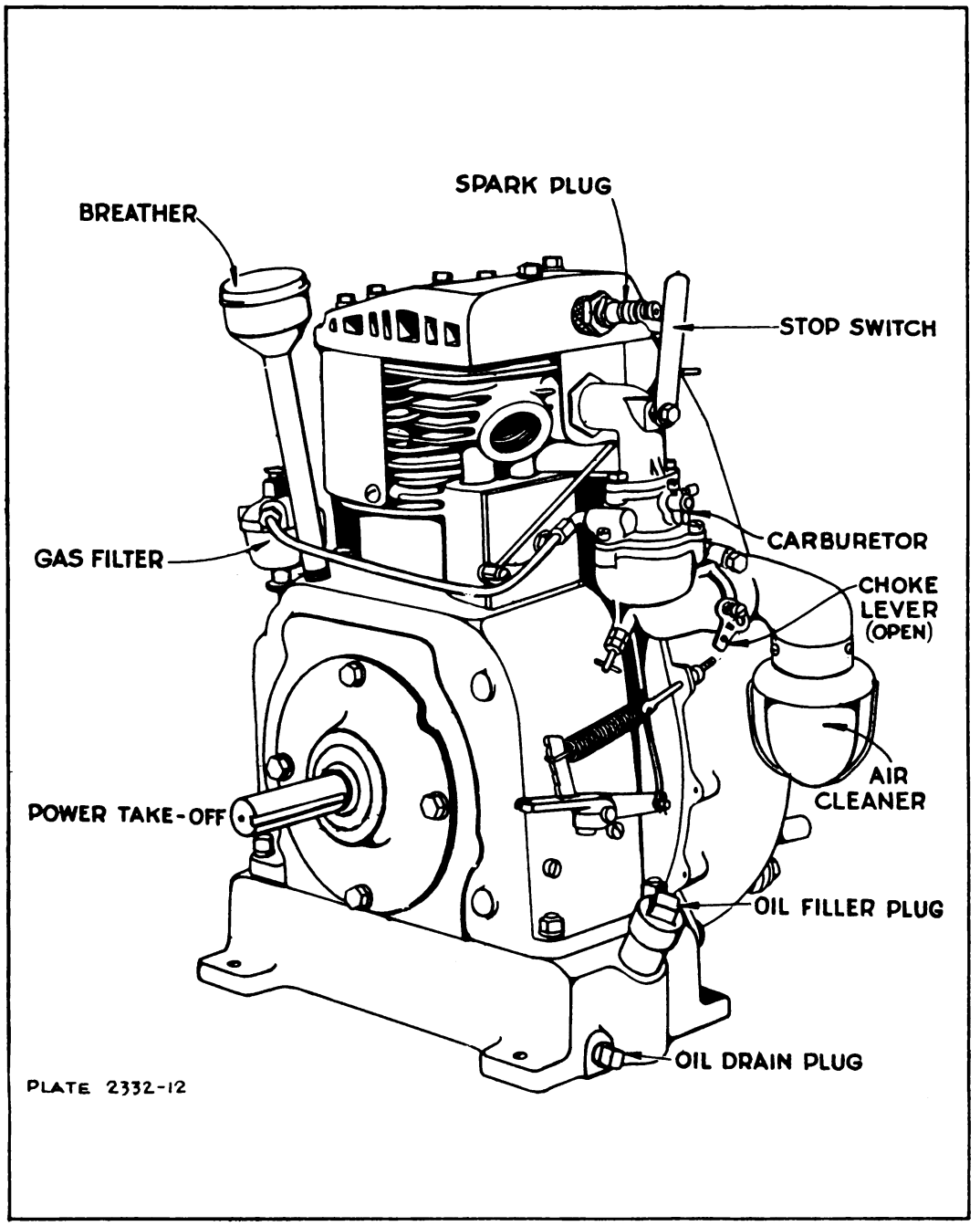


Figure 68 Engine

Servicing Reference Chart

MOTOR FAILS TO START

	Paragraph 14
Out of Gasoline	1
Out of Oil	1-11-56-57
Dirt or Gum in Fuel System	14 to 17
Incorrect Use of Choke	18
Carburetor Out of Adjustment	20 to 24
Spark Plug Dirty	30-31
Ignition Cable Grounded	32
Magneto	33 to 43
Poor Compression	44 to 53
Air Cleaner Clogged	59

MOTOR STOPS

Out of Gasoline	14
Out of Oil	1-11-56-57
Dirt or Gum in Fuel System	14 to 17
Motor Overheated	11-56-57-58-59-60-61
Air Cleaner Clogged	59
Motor Overloaded	61

MOTOR OVERHEATS

Out of Oil	1-11-56-57
Oil Needs Changing	12-13
Oil Too Heavy	12-13
Carburetor Out of Adjustment	20 to 24
Poor Spark	29 to 43
Carbon	58
Muffler Clogged	60
Overloaded	61

MOTOR LACKS POWER

Lack of Oil	1-11-56-57
Add or Change Oil	11 to 13
Carburetor Out of Adjustment	20 to 24
Motor Not Up to Speed	20 to 28
Poor Spark	29 to 43
Poor Compression	44 to 53
Carbon	58
Air Cleaner Clogged	59
Muffler Clogged	60
Overloaded	61

Instructions for Adjustment and Repair

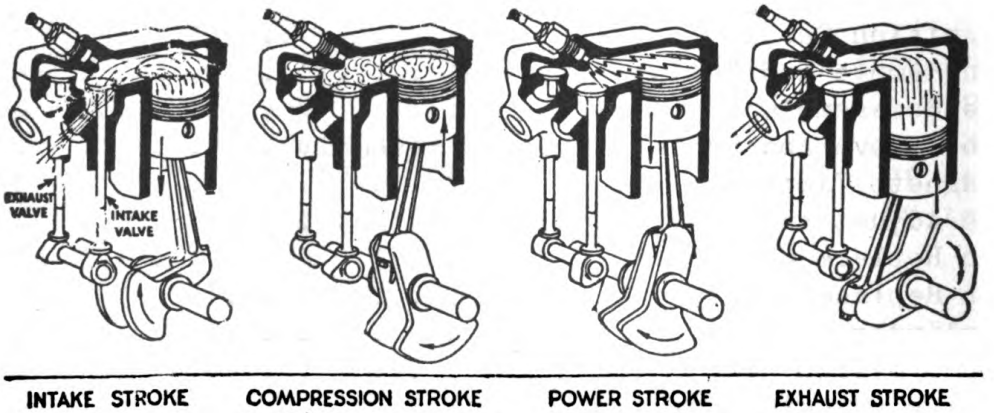
6. Your motor will give you better service if you do not tinker with it. This does not mean, however, that it does not require a certain amount of attention. Give it the right kind of fuel, oil and care. Keep it clean both inside and out. You will be well repaid in trouble-free, satisfactory service.

7. OPERATING REQUIREMENTS. A gasoline motor to operate properly must have all parts in correct adjustment to provide good ignition, carburetion, compression and cooling. And of equal importance, the oil and gasoline used must be clean and of recommended grades. The following instructions fully explain the simple adjustments and offer operating recommendations that will assure you of complete satisfaction. We urge you to carefully observe them.

8. The reliability, economy and ease of starting which characterize this motor are due in part to the fact that it is of the 4-stroke cycle design commonly called "4-cycle", the same design used in all automotive motors. As the name indicates, there are four strokes to one complete power cycle.

9. HOW A 4-CYCLE MOTOR OPERATES. On the **intake stroke** the piston goes down, producing a vacuum in the cylinder, thereby drawing fuel up through the carburetor so that the space above the piston becomes filled with combustible gas. During this stroke the intake valve is open Next the piston comes up on the **compression stroke** with both valves closed. At the top of the compression stroke a spark occurs at the spark plug, firing the highly compressed gas. This produces an explosion above the piston which forces it down on the **power stroke.** Both valves are closed. On the next upstroke of the piston, called the **exhaust stroke,** the exhaust valve is open, and the burned gases driven out. See Figure 69.

The 4-Stroke Cycle
Figure 69



10. KEEP THE MOTOR CLEAN. It will pay you to keep your motor clean both inside and outside. See that no dirt or water enters motor when filling with oil or gasoline. As a precautionary measure always wipe off the gasoline cap and oil filler plug, as well as around them before refilling. Dirt in the motor or gasoline tank will cause trouble and even serious damage. Also be sure to remove any dirt or grass that may accumulate in the flywheel housing or between cylinder fins.

11. ADD OIL REGULARLY. A motor which is run without oil will be ruined within a few minutes. To avoid the possibility of such an occur-

rence and the resulting expense, always fill the oil reservoir at the blue plug to the top of the filler plug opening after each four hours of motor operation. Capacity of oil reservoir is 4-1/2 pints.

12. CHANGE OIL FREQUENTLY. After every eight hours of motor operation, the oil should be completely drained from the crankcase. Do not remove motor from its mounting base. Remove the yellow oil drain plug, located at either end of motor base, and let the oil flow into a pan or other receptacle you use. We do not recommend flushing out with kerosene. Replace the drain plug, refill with fresh oil and replace the blue filler plug.

13. In the normal running of any motor, small particles of metal from the cylinder walls, pistons and bearings will gradually work into the oil. Dust particles from the air also get into the oil. If the oil is not changed regularly these foreign particles cause increased friction and a grinding action which shortens the life of the motor. Sludge, a gummy mass, forms which clogs up the oil passages. Fresh oil also assists in cooling, for old oil gradually becomes thick and loses its cooling as well as its lubricating qualities.

14. USE CLEAN GASOLINE. A good grade of clean, fresh gasoline is recommended. Too high test gasoline may form vapor-lock in gas line when motor gets hot. This interrupts the flow of gasoline and causes motor to stop. Be sure that the small vent hole in the gasoline tank cap is not clogged up, for air must enter the tank to allow the gasoline to flow to the carburetor. Test by blowing through top of cap. See paragraph 16.

15. AVOID GUMMY GASOLINE. If you experience trouble with a gummy, sticky substance with a peculiar sharp obnoxious smell, change to another grade of gasoline. This gum comes from the gasoline and clogs carburetor, gas line, gasoline tank, etc. You can check your gasoline by evaporating a half pint in an open dish. If a quantity of gum remains, try another kind that is clean and fresh.

16. YOU CAN AVOID MOST TROUBLE FROM GUM IF YOU WILL KEEP THE TANK FULL WHEN YOU ARE NOT USING THE MOTOR. If you use it only occasionally, drain tank completely and refill wher motor is used again. The reason for this is that evaporation of stale gasoline causes most gum deposits.

17. TO CLEAN THE FUEL LINES. Disconnect the gasoline line at the carburetor and also at the gas filter. Blow through the gas line to clear it. To clean the gas filter, first close the shut-off valve and loosen thumb screw. Remove and clean glass bowl, gasket and screen. Open shut-off valve to see if gasoline flows freely from the tank. IMPORTANT: IMPORTANT: If you find a gummy varnish-like substance, alcohol or acetone will dissolve it. See paragraphs 15 and 16.

18. CORRECT USE OF THE CHOKE. The correct carburetor setting (see paragraph 21) gives the motor the best mixture to run on when it is hot. For starting, it is necessary to choke the carburetor to get a rich mixture, because cold gasoline does not vaporize readily. A warm or hot motor requires very little choking. Until you become familiar with your motor, however, you may make the mistake of not choking the carburetor enough or you may choke it too much. If motor fails to start after cranking three or four times with the choke closed, try cranking two or three times with the choke part-way down and then all the way down, or open. Use motor choke the same as you use an automobile choke.

19. TO PRIME THE MOTOR. The motor may fail to start for the reason that either the carburetor is incorrectly adjusted or dirty, or the fuel line is dirty or clogged, or you are out of gasoline. To determine the cause, prime the motor by removing the spark plug and pour a half teaspoonful of gasoline into the spark plug opening. Replace the spark plug and crank the motor. If it fires for three or four revolutions and stops, the difficulty is definitely in the fuel system. See paragraphs 17, 20 to 24. If motor will not fire at all, check the ignition system, see paragraphs 29 to 43, also compression, paragraphs 44 to 53.

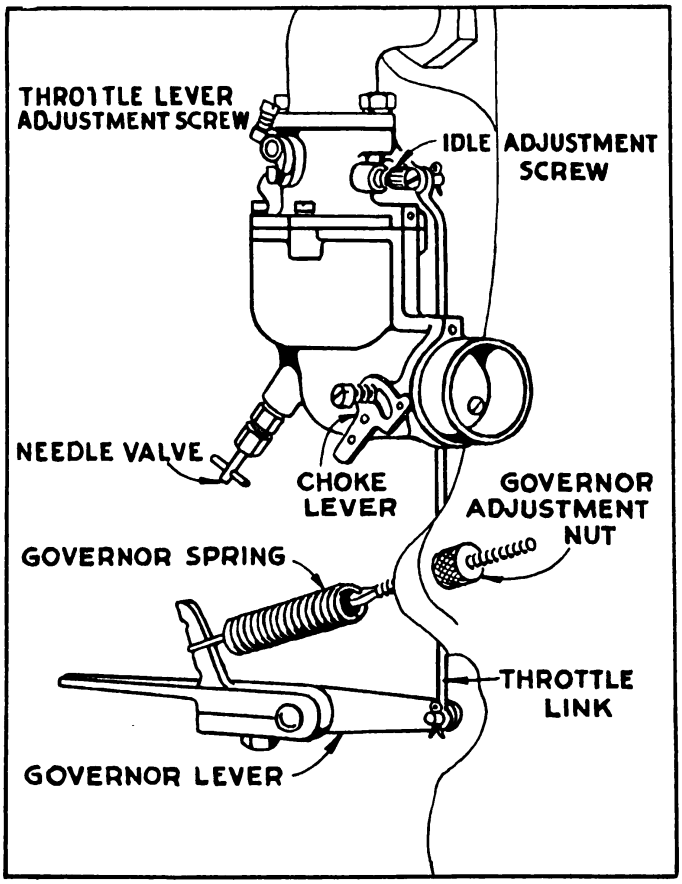
20. TO ADJUST THE CARBURETOR. The carburetor on this motor is of the gravity type. The gasoline supply is regulated by a needle valve. The throttle is automatically controlled by the governor, see paragraphs 25 to 28.

21. To adjust the carburetor, completely close needle valve by turning to right or clockwise as far as possible. Do not screw up too tight or use force when closing needle valve, or needle valve may be damaged. From closed position, open needle valve one to one and one-quarter turns. After the motor has been started and warmed up make final adjustment with the choke wide open by turning the needle valve to the point at which motor operates most smoothly with full load. This setting will also take care of starting with use of the choke. When starting cold motor, if it is necessary to keep choke partially closed several minutes before motor runs smoothly, carburetor setting is too lean and needle valve should be opened a notch or two--turn to left. For governor adjustments see paragraphs 25 to 28. The idle adjustment screw setting is about a half to three-quarters of a turn open. Do not force screw against seat or you will damage both.

22. The throttle lever adjustment screw is set at the factory to permit idling speed of about 1200 R.P.M. We do not recommend adjusting the throttle to bring the speed lower. If you want to idle the motor at a higher speed than 1200 R.P.M. turn the throttle lever adjusting screw to the right or in a clockwise direction. (Figure 70.)

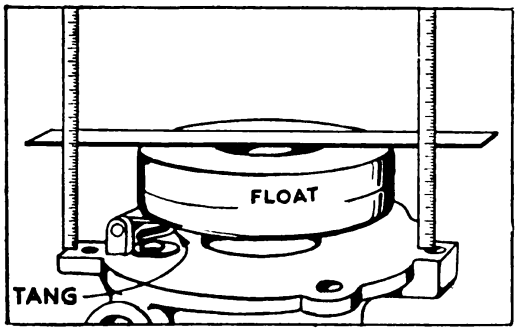
23. TO REMOVE AND REPLACE CARBURETOR. Disconnect gasoline line from carburetor and gasoline shut-off valve. Remove two cap screws and lockwashers from the intake elbow. Then remove the cotter pin from the throttle shaft lever and slip the throttle link off. To replace, reverse the operations as performed above. Use a new cotter pin if necessary.

Carburetor and Governor Hook-Up
Figure 70



24. TO CLEAN CARBURETOR. Remove it from the motor as explained in the previous paragraph. Remove gas line connector elbow. To disassemble carburetor, FIRST remove needle valve, stuffing box nut, packing nut gland and nozzle. Then remove screws and lockwashers from the upper carburetor body. CAUTION: The upper and lower bodies are interlocked by the nozzle and failure to disassemble in above order will result in damaged parts. To check inlet valve and seat, pull out brass pin holding carburetor float. A worn or dirty inlet valve and seat or incorrect float level will cause carburetor to leak. In reassembling, float should be in a horizontal position when it closes inlet valve and seat. To check float, invert upper carburetor body and place a scale or a flat, straight piece of steel across carburetor float and see that distance from top of float to carburetor body flange is equal at both sides of float. Figure 71. The float hinge tang can be bent to attain proper position of float. If any parts are gummy, clean them in alcohol or acetone. Blow through all passages and openings. Do **not** use wire to clean out small holes. Replace worn or damaged parts.

Carburetor Float Position
Figure 71



25. GOVERNOR--CORRECT MOTOR SPEED. The speed of your motor is automatically maintained under varying loads by a centrifugal governor. It is operated from the cam gear.

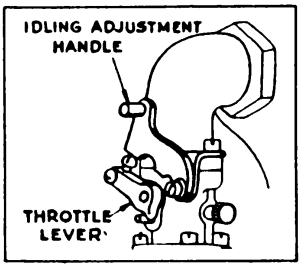
26. The governor was carefully adjusted at the factory to maintain normal speed under load. Do not re-adjust unless absolutely necessary. It can be changed by reducing or increasing the tension of the governor spring. Turn governor adjustment nut to the right or clockwise to increase motor speed. To left or anticlockwise to reduce motor speed. Recommended motor speed: 2200 to 3200 R.P.M. (Figure 70)

27. RESETTING GOVERNOR LEVER. If the governor lever has been loosened or removed from the governor shaft, it is easily reset. With the carburetor attached to motor and hooked up to governor lever with throttle link, loosen screw holding governor lever on the shaft. Push the governor lever toward the left as far as it will go. Hold it in this position and turn the governor shaft to the right with pliers until it strikes a stop in the crankcase. Tighten screw that holds governor lever to shaft until the lever is snug. Push governor lever to the right as far as it will go and tighten screw securely.

28. This motor is equipped with a hand idling device as shown in Figure 72 To idle motor, lower the idling adjustment lever. Raise the lever to bring motor back to normal running speed.

29. THE IGNITION SYSTEM. The spark is produced by a high tension magneto consisting of armature, condenser, contact points, and rotating magnets cast in a flywheel. This is a simple self-contained system which is very reliable. It also does away with batteries. The ignition current is sent into the motor cylinder through the ignition cable and spark plug. The magneto itself as well as the cable and spark plug must all be in proper condition and adjustment to insure a good hot spark.

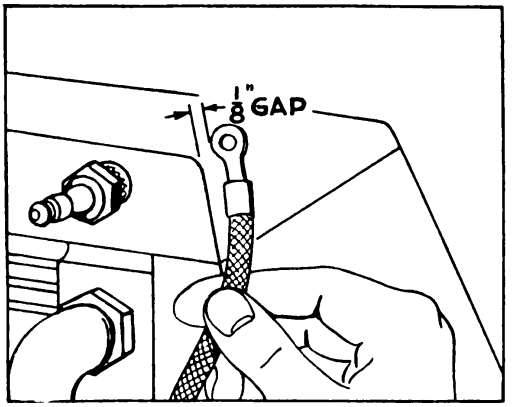
Idling Device
Figure 72.



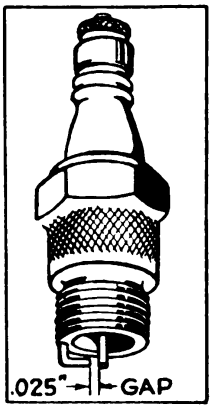
30. CHECK FOR SPARK. To prove that a satisfactory spark is being delivered by the magneto remove the ignition cable from the plug. Hold ignition cable terminal about 1/8" from any metal part of the cylinder head (keep hand on insulated part of the cable to avoid a shock). Turn motor with starter, and if the spark jumps this gap the entire ignition system, with the exception of the spark plug is O.K. See **Figure 73** (To check spark plug see paragraph 31.) If no spark, check cable, see paragraph 32, and refer to magneto adjustments paragraphs 33 to 43.

31. SPARK PLUG ADJUSTMENT. Spark plugs should be cleaned and points reset to .025" after each 100 hours of operation. See Figure 74 Points burn away in service. The porcelain is to prevent the spark from jumping anywhere except at the gap, and if cracked or broken it will prevent the plug firing. Water on the outside of the spark plug may permit the high voltage current to leak over the surface of the porcelain. Dirt or carbon on it will do the same thing. Clean spark plug with sand blast cleaner. Always keep a new plug on hand. We recommend the use of Champion No. 6M or its exact equivalent. When reassembling spark plug to cylinder head put a little graphite grease on threads. Do not get grease on points.

Checking Spark
Figure 73



Spark Plug
Figure 74



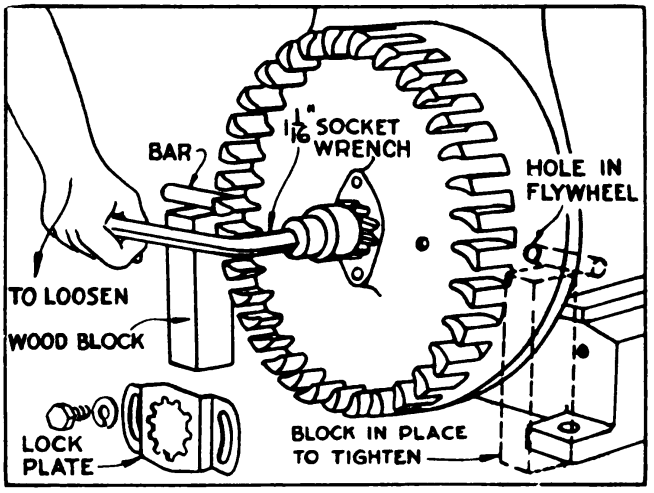
32. IGNITION CABLE. Insulation must not be broken, or soaked with oil or water, or grounded in any way where it touches the motor, or it will interfere with good ignition. Spark plug cable should be soldered to the secondary terminal (small brass plate coming out of the coil). Avoid touching coil with hot soldering iron. See Figure 79.

33. TO REMOVE AND REPLACE FLYWHEEL. The flywheel is securely mounted to the crankshaft by means of a taper fit, a soft key, pinion gear and lock. See paragraph 36. Remove compression release rod, blower case with starter assembly intact and starter pinion lock. Turn flywheel until 3/8" dia. hole in rim is at carburetor side of motor. Insert rod or punch in this hole and place a block of wood under it. This will hold flywheel rigid and prevent its turning as you loosen nut. Use a 1-1/16" socket

wrench with a "T" or "L" handle. To loosen nut, tap end of wrench with hammer. Remove nut, loosen flywheel with the flywheel puller furnished with the Motor. Figure 75.

34. TO REASSEMBLE THE FLYWHEEL. Put a very thin coat of cup grease on the crankshaft taper and see that flywheel key is in place. Mount flywheel on crankshaft. Turn flywheel until hole in rim is at gas tank side of motor. Then reverse all other operations in the preceding paragraph. Apply grease to starter gears.

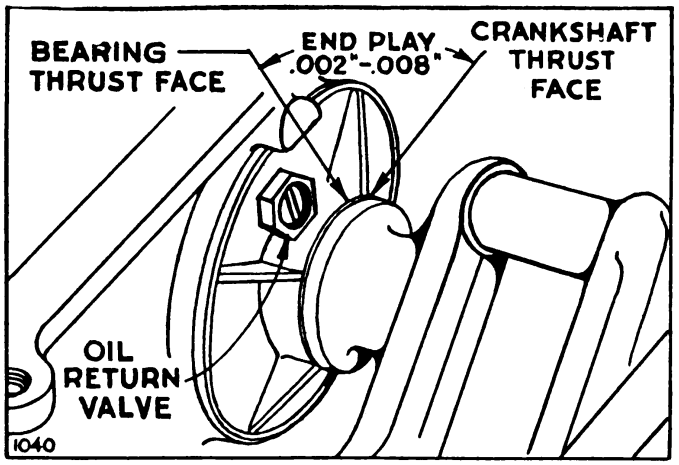
Removing Flywheel
Figure 75



35. TO REMOVE AND REPLACE MAGNETO ASSEMBLY. After removing flywheel as explained in paragraph 33, detach the ignition cable from the spark plug and remove the back plate, flywheel key, contact point dust cover and the four magneto mounting screws. Turn the crankshaft so that the contact plunger holds the contact points open and then remove magneto assembly. To replace, reverse the operations and use the old gasket between the plate and crankcase, or, if damaged, a new gasket. See Ref. No. 166 for proper thickness to get correct end play of .002" to .008" between magneto bearing and crankshaft thrust faces, as shown in Figure 76. Use lockwashers under mounting screws. Page 115.

36. MAGNETO TIMING. The magneto assembly is always correctly timed with the motor when the flywheel is assembled to the tapered crankshaft with a key and securely held in place with pinion gear and nut lock. Do not attempt to change the timing by relocating any parts or filing crankshaft timing flat. Always use soft key Ref. No. 79, Page 110. If steel key is used and flywheel becomes loose it will damage the keyway in the crankshaft.

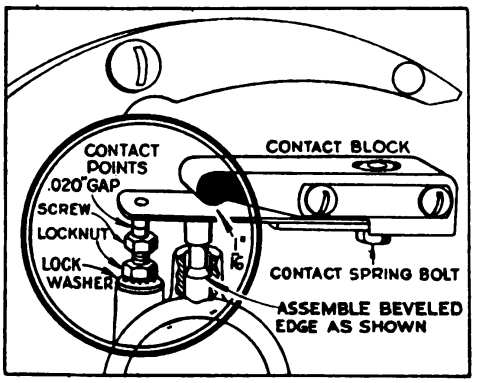
Correct End Play
Figure 76



37. TO ADJUST AND CLEAN CONTACT POINTS. While magneto plate is on motor crankcase, turn crankshaft by hand to see if contact points open and close properly. Points must be clean and line up squarely to make good electrical contact. Do not use a steel file on contact points -- use a contact point file.

38. To line up contact points loosen contact spring bolt. Move contact spring assembly to line up with contact screw point.

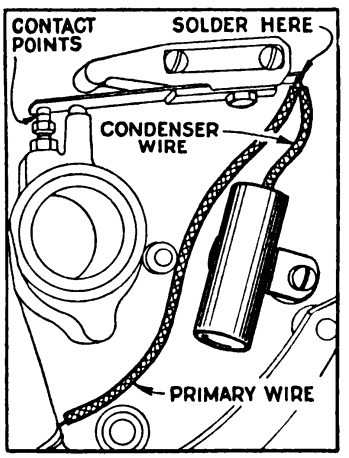
Magneto Contact Points
Figure 77



Tighten contact spring bolt. To adjust contact spring tension, turn crankshaft until points are in open position, then place 1/16" gauge between contact spring and round end of contact block, and tighten contact block screws. Turn contact screw to secure .020" gap and tighten locknut against lockwasher. See Figure 77. If either or both points become badly pitted or burned, replace both points.

39. TO REPLACE CONDENSER. A leaky or weak condenser may cause the motor to start hard, to sputter, or misfire under load. If motor misfires after checking gasoline line, carburetor, spark plug, cable and contact points, install a new condenser. Slip the short insulator sleeve over the condenser wire. Solder the end of condenser wire and primary wire to contact spring. (See Figure 78).

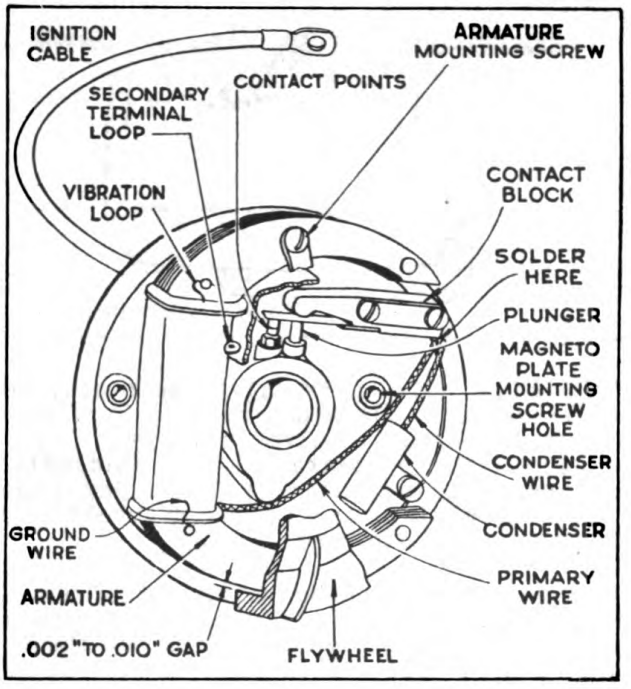
Condenser Installation
(Figure 78.)



40. TO REPLACE ARMATURE. Remove armature lead wire from contact spring, and high tension ignition cable from secondary terminal loop in the armature. Both wires are soldered. Save as much of the hydrolene as possible so that you can insulate high tension terminal when you assemble new armature. Do not use battery compound or tar as it will melt and run over the entire magneto assembly. Unscrew two armature mounting screws and pry armature loose with screw driver.

41. To install armature, place dust cover clip under upper mounting screw, tighten lower mounting screw. Then solder ignition cable to the terminal and fill pocket, formed with flap, with hydrolene. Solder armature lead wire to contact spring. Replace dust cover and the clip holding cover in place, tighten upper armature mounting screw. See **Figure 79.**

Complete Magneto Assembly
Figure 79



42. Air gap of .002" to .010" must be maintained between armature shoes and flywheel poles. Gap must only be sufficient to prevent rubbing but not over .010" or poor ignition will result.

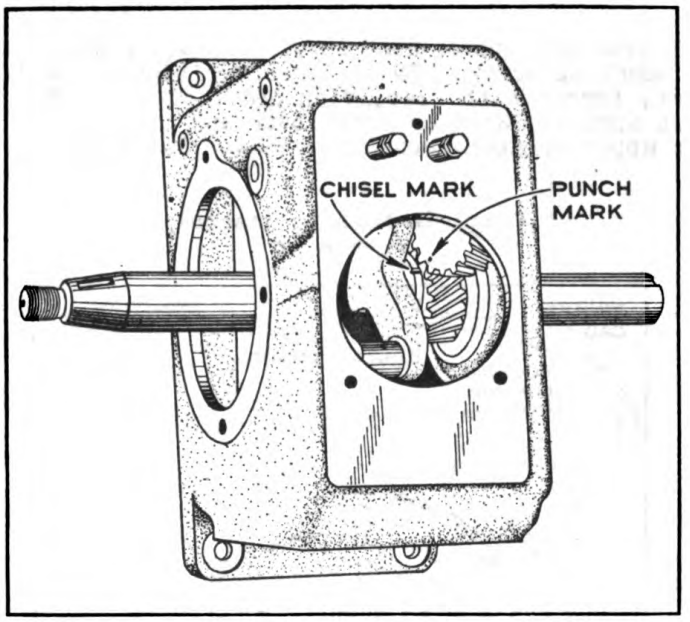
43. To check armature shoes for rub, chalk edges and mount flywheel in place. Remove spark plug to release compression. Turn flywheel several revolutions by hand. Remove flywheel and examine edges of armature shoes. High spots will have the chalk rubbed off. File high spots carefully with a fine file until flywheel no longer rubs, but do not remove too much metal.

44. CYLINDER HEAD. The cylinder head is held on with seven cap screws. When the cylinder head has been removed for the purpose of cleaning carbon or grinding valves, care should be used in replacing it. Use a new gasket if possible. Otherwise, clean the old one and coat both sides with cup grease. We do not recommend the use of shellac on cylinder head gaskets. Tighten each cap screw a little at a time so that the cylinder head is pulled down evenly. Screws need be only moderately tight.

45. COMPRESSION. Proper compression is obtained when valves seat properly, gaskets do not leak, and piston and rings are properly fitted. When tuning up a motor, it is always well to check compression. This is done by turning the motor over quickly by hand. If turned slowly sticky valves may not be detected. If a point of resistance is offered every other revolution, compression should be satisfactory. If motor turns over

without compression resistance for a full cycle, it is possible that a worn piston or piston rings, leaky valves or leaky gaskets are present. See that spark plug has a gasket under it and is drawn up tight. Also check cylinder head gasket and tighten cylinder head bolts.

Valve Timing — Figure 80



46. VALVE ADJUSTMENT. To check valve clearance, remove carburetor paragraph 23, and valve cover plate on cylinder back of carburetor. The correct clearance on the exhaust valve is .020". The clearance of the intake valve is .020". These clearances to be adjusted when motor is cold. Tappet clearance is adjusted by loosening tappet locknut and turning tappet screw to desired position. Securely tighten the tappet locknut after adjusting valve clearance.

47. To remove valves, remove cylinder head, and if not dismantled, drain oil from crankcase. Invert cylinder. Compress the spring with valve spring compressor, and with end of a screwdriver push out the split collars, and release spring compressor. Tilt cylinder back far enough to allow valve to drop, permitting its stem to clear the spring. Pry spring out with end of screwdriver.

48. To replace valves and valve springs, compress spring in valve spring compressor. Turn tool to inverted position with collar retainer washer on top. Drop each part of the split collar in place in retainer washer one at a time. When first half of split collar is placed in retainer washer, push it around to the back of valve stem to allow easy placing of second half.

49. To reseat valves, grind in the same manner as automobile valves. If valves stick they may be coated with gum or carbon. To remove gum use alcohol or acetone. Clean valve stems throughly with wire brush or emery cloth. Also scrape all carbon from valve ports.

50. The timing of the valves is taken care of by the meshing of the cam shaft gear with the gear on the crankshaft. These gears are properly meshed when the mark on the cam shaft gear is in line with the mark on the crankshaft collar. See **Figure 80.**

51. PISTON. The piston in this motor is made of a special aluminum alloy which is very light in weight. The standard clearance between the piston skirt and cylinder wall is .007" to .0085". This clearance is to compensate for the considerable expansion of aluminum when hot. The top and

second lands of the piston are smaller than the skirt to allow for greater expansion at the piston head. When piston is removed be sure to thoroughly clean carbon from head of piston and ring grooves. If piston is out of round or scored it should be replaced.

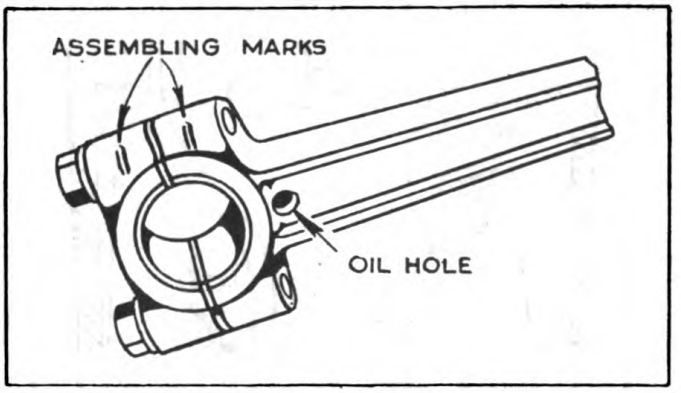
52. If an oversize piston is necessary, we recommend that reboring of cylinder be done by an Authorized Central Service Distributor or the factory.

53. PISTON RINGS. The piston rings when fitted in the cylinder should have a gap of .007" to .015". The rings should be fitted in the cylinder below the piston ring travel. Before assembling new rings to piston be sure that piston ring grooves are thoroughly cleaned and rings move in grooves freely.

54. PISTON PIN. The piston pin is a slip fit in the piston. To remove it from the piston, first remove lock rings, then slip pin out of piston.

55. CONNECTING ROD. When assembling connecting rod to crankshaft, the oil hole in the lower bearing must be toward the magneto side. See Figure 81. The assembly marks on cap and rod must be on the same side.

Connecting Rod – Figure 81

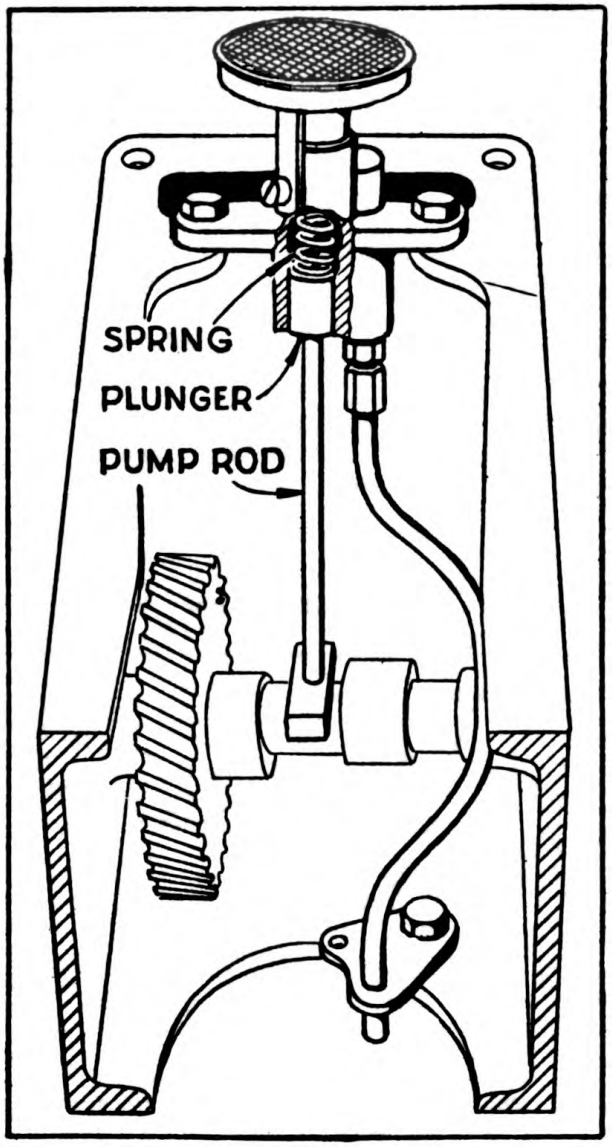


56. OIL PUMP. The oil pump is assembled to the crankcase with two bolts and lockwashers and is operated from an eccentric on the cam gear. An inoperative pump will result in insufficient lubrication which may score cylinder and piston assembly. To check oil pump, remove base and the two bolts that hold pump in place. Place the pump in a pan of oil about 1/2" deep. Work plunger up and down. A stream of oil will be forced out of the hole in the oil tube or pump plunger if the pump is in good operating condition. If clogged, remove plunger and plunger-spring and submerge the parts in gasoline or kerosene for three or four hours to loosen accumulated sludge or gum. If the pump is still inoperative, it should be replaced. In assembling, be sure that spring and plunger are in place as shown in Figure 82.

57. OIL LEAKS. If oil leaks from either end of crankshaft bearings, remove base from motor. Oil return valves are screwed into crankcase and magneto back plate below the main bearings. Remove oil return valve and clean or flush with gasoline and blow out any dirt lodged under the small disc. Replace if necessary. See Figure 76.

58. CARBON. Excessive carbon is caused by improper grade of oil--too much oil usually the result of piston rings not seating properly or sticking--carburetor set too rich--or long service. An unusual amount of carbon is noticeable by motor knocking or loss of power. Occasionally remove carbon from valves, valve ports, piston head, piston rings and piston grooves, cylinder head and top of cylinder bore.

Oil Pump - Figure 82



59. AIR CLEANER. The air cleaner is to protect the motor from dust and dirt. No motor can stand up under the grinding action that takes place when dust and dirt particles are drawn into the motor through the carburetor. Clean the air cleaner occasionally by removing it and washing in kerosene. Test it to see if it is clogged by blowing through it or noting if motor performs better with it off. If clogged it should be replaced. Keep the oil level up to the beading. See instructions on air cleaner label.

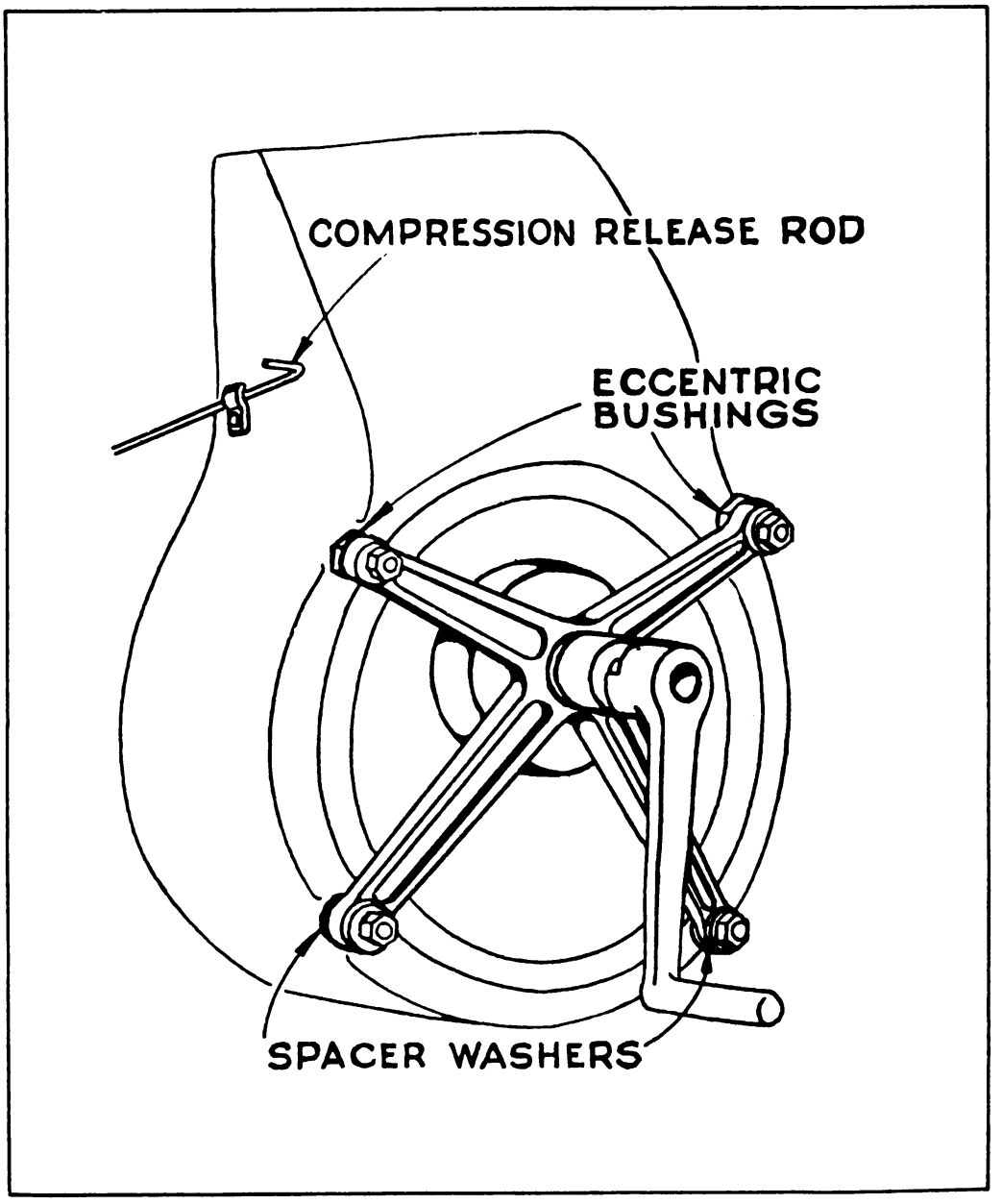
60. MUFFLER. After long periods of service it is possible that the muffler will become clogged to the point where it will affect the motor's power. To check the muffler unscrew it from the motor and run water into the open end of the muffler. If full streams of water come out of the small holes at the end of the muffler, you will know that it is not clogged up. If the water runs through very slowly, however, the muffler is probably clogged and should be replaced.

61. OVERLOAD. Always be sure that the machine the motor is operating is well lubricated and running freely. If it is not, it may cause the motor to become overloaded, resulting in it overheating, losing power, or even stopping entirely.

62. CRANK STARTER ASSEMBLY. The crank starter assembly shown in Figure 83 is mounted on the blower housing on four studs and held in place by plain washers, lockwashers, and nuts. To mount starter assembly place two eccentric bushings on upper studs, and two plain washers on lower studs. Then place starter bracket gear and shaft assembly and four plain washers, lockwashers and nuts on studs. Press starter shaft toward motor and turn the two eccentric bushings until gears mesh with as little back lash as possible and without binding. Tighten nuts securely. Oil the crankgear shaft, through the oil cup, and grease the pinion gear teeth occasionally to reduce wear.

63. PARTS. All parts should be ordered from this book using part number indicated.

Crank Starter - Figure 83



PARTS LIST

MODEL "ZZ"

TYPE (NO. 304665)

* * * * *

TO FIND THE CORRECT NUMBER

OF THE PART YOU NEED

1. Make a note of your motor TYPE NUMBER (Not the Serial Number) that appears on the metal name-plate attached to motor blower housing.

2. Refer to pages illustrating parts and locate the Reference Number by comparing your old part with the illustrations. Assemblies include all part numbers bracketed in illustrations. All parts shown in assembly brackets on which part numbers are given can be purchased separately.

3. After the Reference Number has been identified, refer to the parts list below or opposite to the illustration where these Reference Numbers are listed in numerical order. Find the corresponding Cleaver-Brooks part number of the part wanted and order by that Cleaver-Brooks part number.

4. When ordering parts -- or writing for service information -- always specify the MODEL LETTER -- TYPE NUMBER -- and SERIAL NUMBER of your motor.

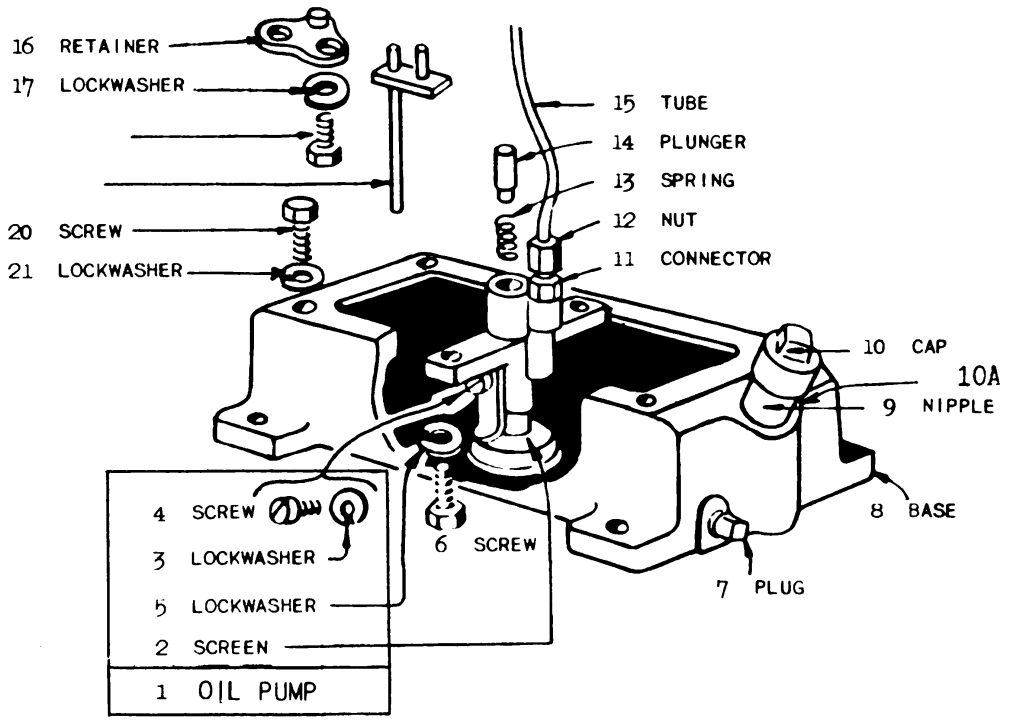


FIGURE 84 BASE

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
1	109041	Oil Pump Assembly (Items 2-4 Inclusive)	99360	1
2	109042	Oil Pump Screen	99361	1
3	109237	Lockwasher No. 12	91059	1
4	109238	Screw, 12-24 x 5/16", fill hd.	91921	1
5	109231	Lockwasher, 5/16 x 1/8 x 1/16"	90366	2
6	109240	Screw, 5/16-24 x 3/4", hex. hd.	90950	2
7	109043	Oil Drain Plug	91084	2
8	109044	Base (Cast Iron)	61287	1
9	109045	Oil Filler Nipple	92469	1
10	109046	Oil Filler Cap	69689	1
10A	109268	Oil Filler Cap Gasket	65434	1
11	109047	Oil Tube Connector	63202	1
12	109048	Oil Tube Connector Nut	63217	1
13	109049	Oil Pump Spring	26413	1
14	109050	Oil Pump Plunger	23132	1
15	109051	Oil Pump Tube	99362	1
16	109052	Oil Tube Retainer	62081	1
17	109216	Lockwasher, 1/4 x 3/32 x 5/64"	90832	1
18	109217	Screw, 1/4-20 x 1/2", hex. hd.	90891	1
19	109053	Oil Pump Rod	66739	1
20	109243	Screw, 3/8-16 x 1-1/4", hex. hd.	90887	4
21	109227	Lockwasher, 11/32 x 1/8 x 3/32"	92268	4

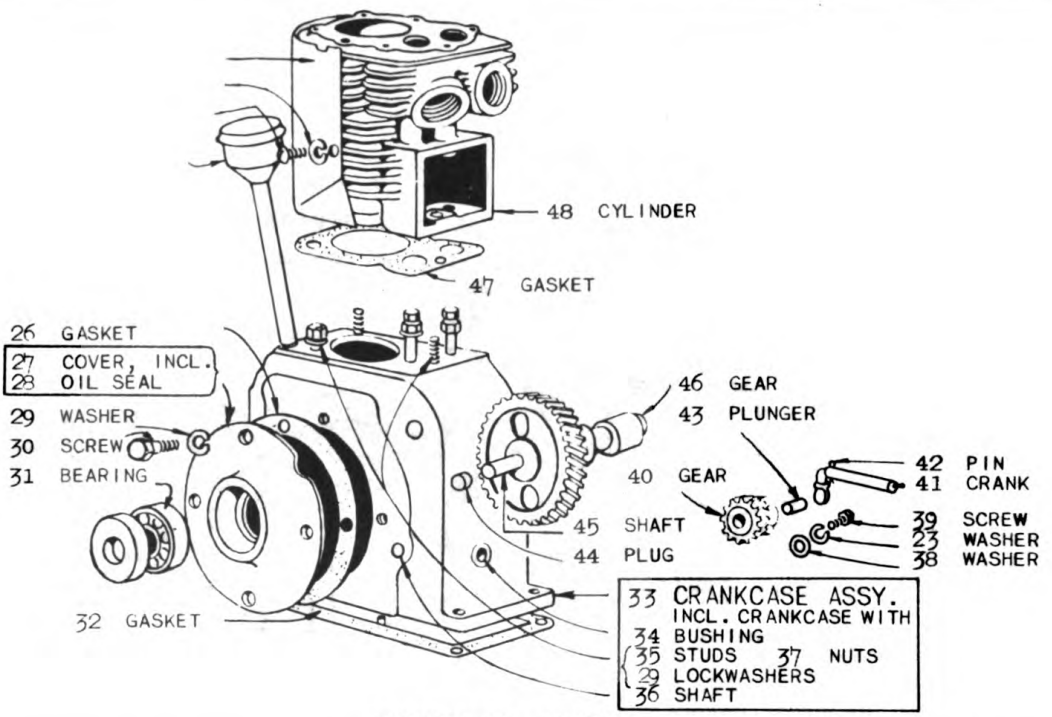


FIGURE 85 CRANKCASE

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
22	109269	Cylinder Shield	89609	1
23	109216	Lockwasher, 1/4 x 3/32 x 5/16"	90832	2
24	109246	Screw, 1/4-20 x 1/2", rd. hd.	90916	1
25	109022	Breather Tube	69314	1
26	109023	Crankcase Cover Gasket	66717	1
27	109024	Crankcase Cover (Cast Iron) (Includes Item 28)	99936	1
28	109025	Bearing Oil Seal	69740	1
29	109227	Lockwasher, 11/32 x 1/8 x 3/32"	92268	7
30	109248	Screw, 3/8-24 x 3/4", hex. hd.	91028	4
31	109026	Ball Bearing - MRC - 306-SF Marlin Rockwell Corp.	69739	1
32	109027	Base Gasket	65247	1
33	109270	Crankcase Assembly (Cast Iron - Includes Items 34 - 37 inc. & Item 29)	99951	1
34	109029	Governor Crank Bushing	63341	1
35	109030	Cylinder Mounting Stud	23136	3
36	109031	Governor Gear Shaft	63343	1
37	109228	Nut, 3/8-24 hex.	92292	3
38	109032	Governor Gear Washer	92305	2
39	109217	Screw, 1/4-20 x 1/2", hex. hd.	90891	2
40	109033	Governor Gear	69839	1
41	109034	Governor Crank	69926	1
42	109235	Cotter Pin, 1/16 x 1/2"	92288	1
43	109035	Governor Plunger	63335	1
44	109036	Cam Shaft Plug	65932	1
45	109037	Cam Shaft	66203	1
46	109271	Cam Gear	21113	1
47	109039	Cylinder Gasket	66477	1
48	109272	Cylinder	99397	1

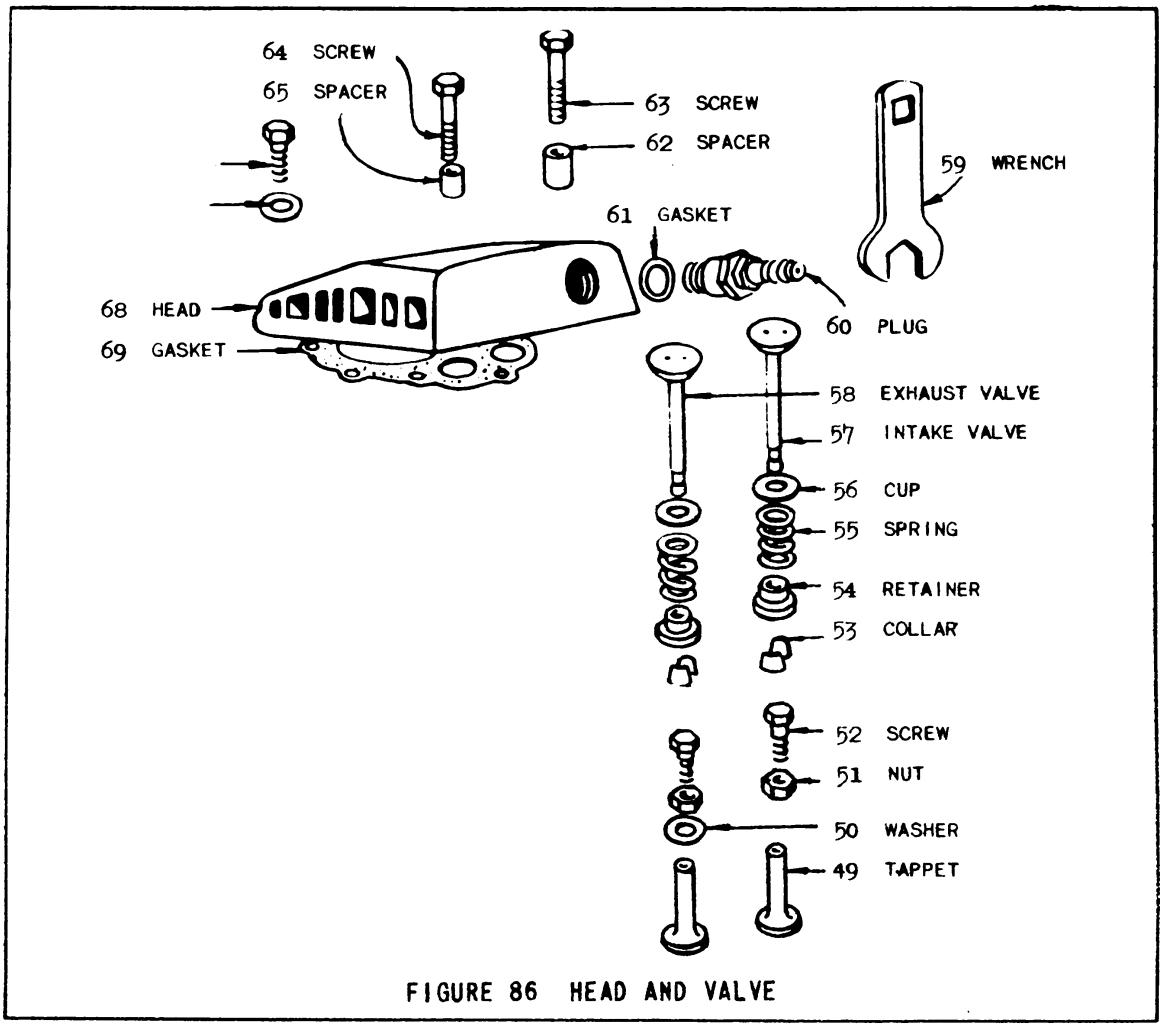


FIGURE 86 HEAD AND VALVE

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
49	109273	Valve Tappet	26279	2
50	109002	Valve Tappet Washer	62252	1
51	109267	Nut, 1/4-28, hex.	90847	2
52	109003	Valve Tappet Screw	90890	2
53	109004	Valve Spring Collar	68283	2
54	109005	Valve Spring Retainer	68293	2
55	109006	Valve Spring	65906	2
56	109007	Valve Spring Cup	62222	2
57	109008	Intake Valve	68563	1
58	109274	Exhaust Valve	23631	1
59	109010	Spark Plug & Filler Cup Wrench	68652	1
60	109011	Spark Plug with Gasket (Includes Item 61)	89572	1
61	109012	Spark Plug Gasket	27090	1
62	109013	Cylinder Head Spacer	63336	3
63	109014	Cylinder Head Screw	91387	3
64	109015	Cylinder Head & Valve Cover Screw	91386	2
65	109016	Cylinder Head Spacer	63337	2
66	109017	Cylinder Head & Connecting Rod Screw	91162	2
67	109018	Cylinder Head Spacer	91324	2
68	109019	Cylinder Head	61405	1
69	109020	Cylinder Head Gasket	69737	1

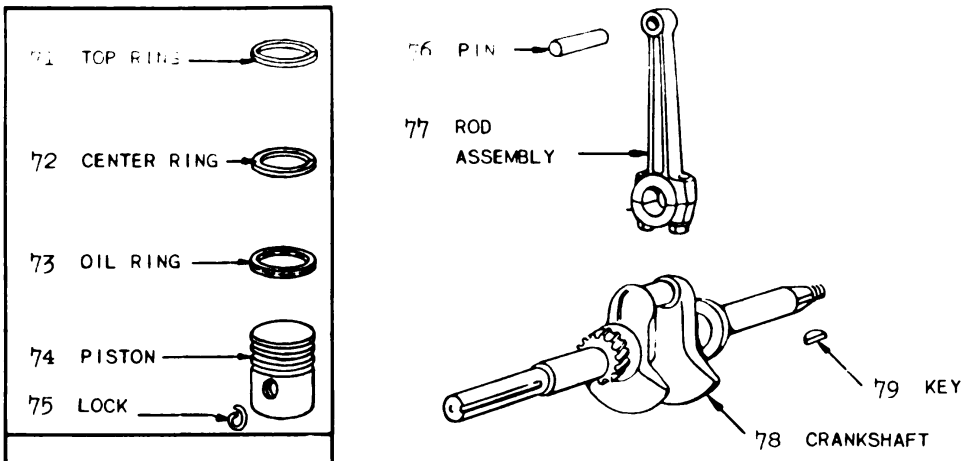


FIGURE 87 PISTON AND CRANKSHAFT

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
70		Piston Assembly (Includes 71-75 Inclusive)		
	109099	Standard	99947	1
	109100	.010"-O.S.	99948	
	109101	.020"-O.S.	99949	
	109102	.030"-O.S.	99950	
71		Top Compression Ring		
	109082	Standard	61964	1
	109083	.010" O.S.	21002	
	109084	.020"-O.S.	21005	
	109085	.030"-O.S.	21008	
72		Center Compression Ring		
	109086	Standard	61963	1
	109087	.010" O.S.	21003	
	109088	.020"-O.S.	21006	
	109089	.030"-O.S.	21009	
73		Oil Ring		
	109090	Standard	61292	1
	109091	.010"-O.S.	61335	
	109092	.020"-O.S.	61336	
	109093	.030"-O.S.	61337	
74		Piston		
	109094	Standard	69921	1
	109095	.010"-O.S.	69922	
	109096	.020"-O.S.	69923	
	109097	.030"-O.S.	69924	
75	109098	Piston Pin Lock	65776	
76		Piston Pin		
	109103	Standard	69925	1
	109104	.005"-O.S.	29103	1
77	109275	Connecting Rod Assembly	89602	1
	109276	Connecting Rod Bushing	23590	1
	109277	Lockwasher, 5/16 x 1/8 x 1/16"	91388	2
	109278	Connecting Rod Screw	90386	2
78	109109	Crankshaft	26278	1
79	109110	Flywheel Key	66403	1

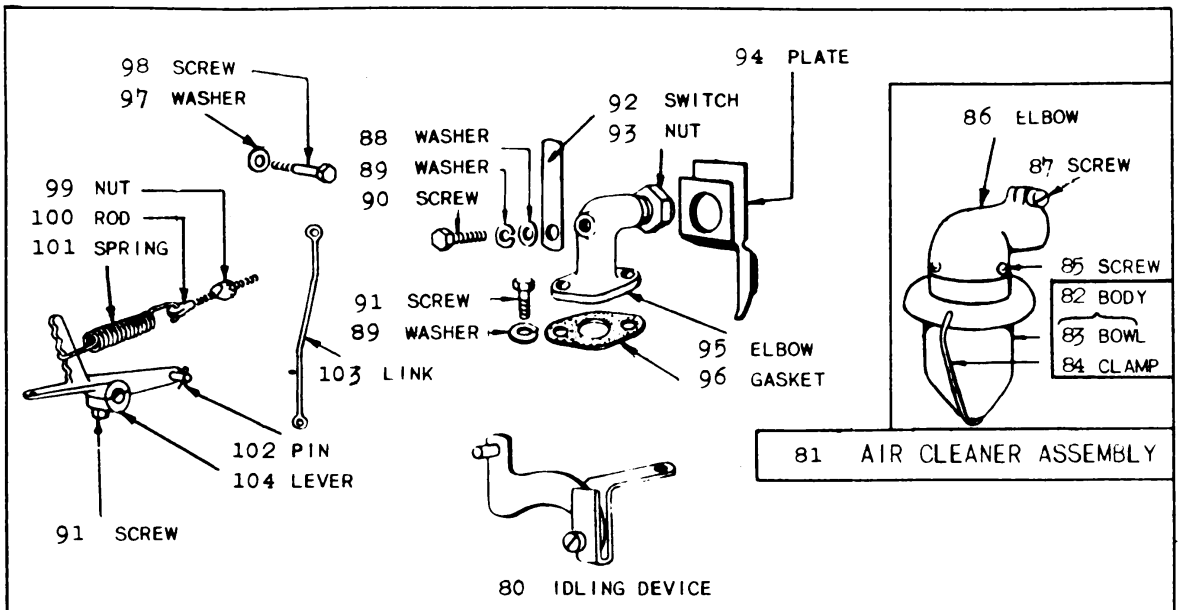


FIGURE 88 AIR CLEANER

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
80	109138	Idling Device	99458	1
81	109139	Air Cleaner Assembly (Items 82 - 87 Inclusive)	69947	1
82	109140	Air Cleaner Body (Items 83 - 84)	69948	1
83	109141	Air Cleaner Bowl	62465	1
84	109142	Air Cleaner Bowl Clamp	62466	1
85	109143	Screw, No. 7 x 1/2" Parker Kalon	91458	3
86	109144	Air Cleaner Elbow	61371	1
87	109215	Screw, 1/4-20 x 1", fill. hd.	91256	1
88	109145	Stop Switch Washer	67632	1
89	109216	Lockwasher, 1/4 x 3/32 x 5/64"	90832	3
90	109217	Screw, 1/4-20 x 1/2", hex. hd.	90891	1
91	109218	Screw, 1/4-20 x 3/4", hex. hd.	90700	3
92	109146	Stop Switch	62196	1
93	109147	Intake Elbow Locknut	63445	1
94	109279	Carburetor Baffle Plate	22149	1
95	109149	Carburetor Intake Elbow	61976	1
96	109150	Carburetor Gasket	65647	1
97	109151	Valve Cover Washer	65084	1
98	109152	Valve Cover Screw	91442	1
99	109153	Governor Spring Rod Nut	63520	1
100	109154	Governor Spring Rod	63334	1
101	109155	Governor Spring	67316	1
102	109219	Cotter Pin, 1/16 x 3/8"	92286	2
103	109156	Throttle Link	26160	1
104	109157	Governor Lever	29429	1

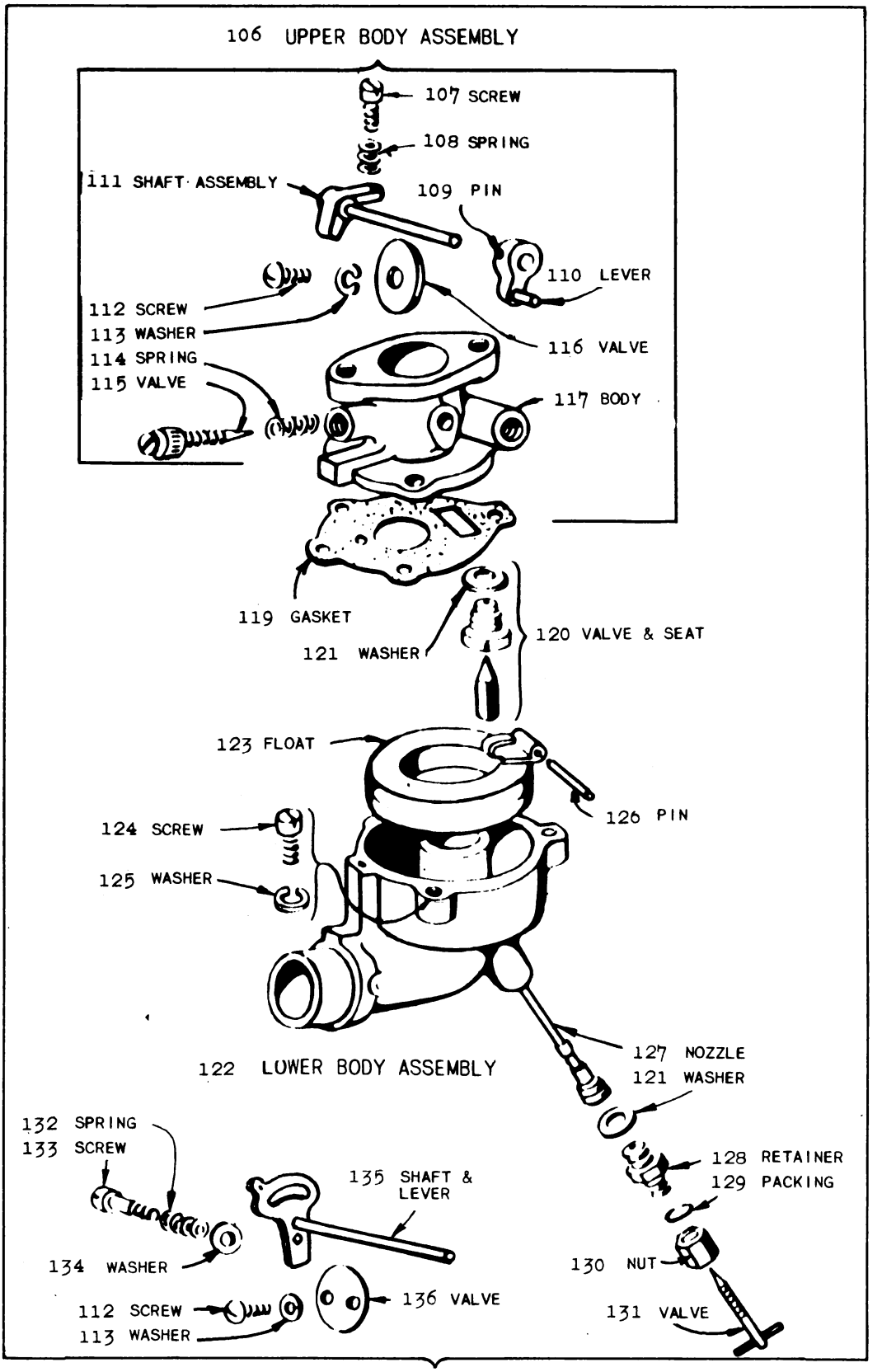


FIGURE 89 CARBURETOR

FIGURE 89

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REG.
105	109280	Carburetor Assembly (Off-Center Choke) (Items 106 - 136 Inclusive)	89920	1
106	109111	Upper Carburetor Body Assembly (Items 107 - 118 Inclusive)	99376	1
107	109220	Screw, 8-32 x 3/4", fill. hd.	91846	1
108	109116	Throttle Adjusting Spring 109112	26157	1
109	109113	Throttle Lever Pin	23125	1
110	109114	Throttle Lever	21152	1
111	109115	Throttle Shaft Assembly	99524	1
112	109221	Screw, 4-16 x 1/4", rd. hd.	90029	3
113	109222	Lockwasher, 1/8 x 3/64 x 1/32"	90369	3
114	109116	Idling Valve Spring	26157	1
115	109117	Idler Needle Valve	23228	1
116	109118	Throttle Butterfly Valve	62940	1
117	109119	Upper Carburetor Body	99375	1
119	109281	Carburetor Gasket	27034	1
120	109122	Inlet Valve and Seat (Includes Item 121)	99780	1
121	109123	Fibre Washer	68667	2
122	109282	Carburetor Body (Off-Center Choke)	89915	1
123	109125	Carburetor Float	99333	1
124	109223	Screw, 10-32 x 5/8", fill. hd.	90746	4
125	109224	Lockwasher No. 10	91427	4
126	109126	Float Hinge Pin	23114	1
127	109127	Carburetor Nozzle	99345	1
128	109128	Needle Valve Retainer	23117	1
129	109129	Needle Valve Packing	68677	1
130	109130	Needle Valve Packing Nut	23118	1
131	109131	Needle Valve	99346	1
132	109132	Choke Lever Spring	26155	1
133	109133	Choke Lever Screw	23123	1
134	109134	Choke Lever Washer	62899	1
135	109135	Choke Shaft and Lever (Off-Center)	89531	1
136	109136	Choke Valve (Off-Center)	62872	1

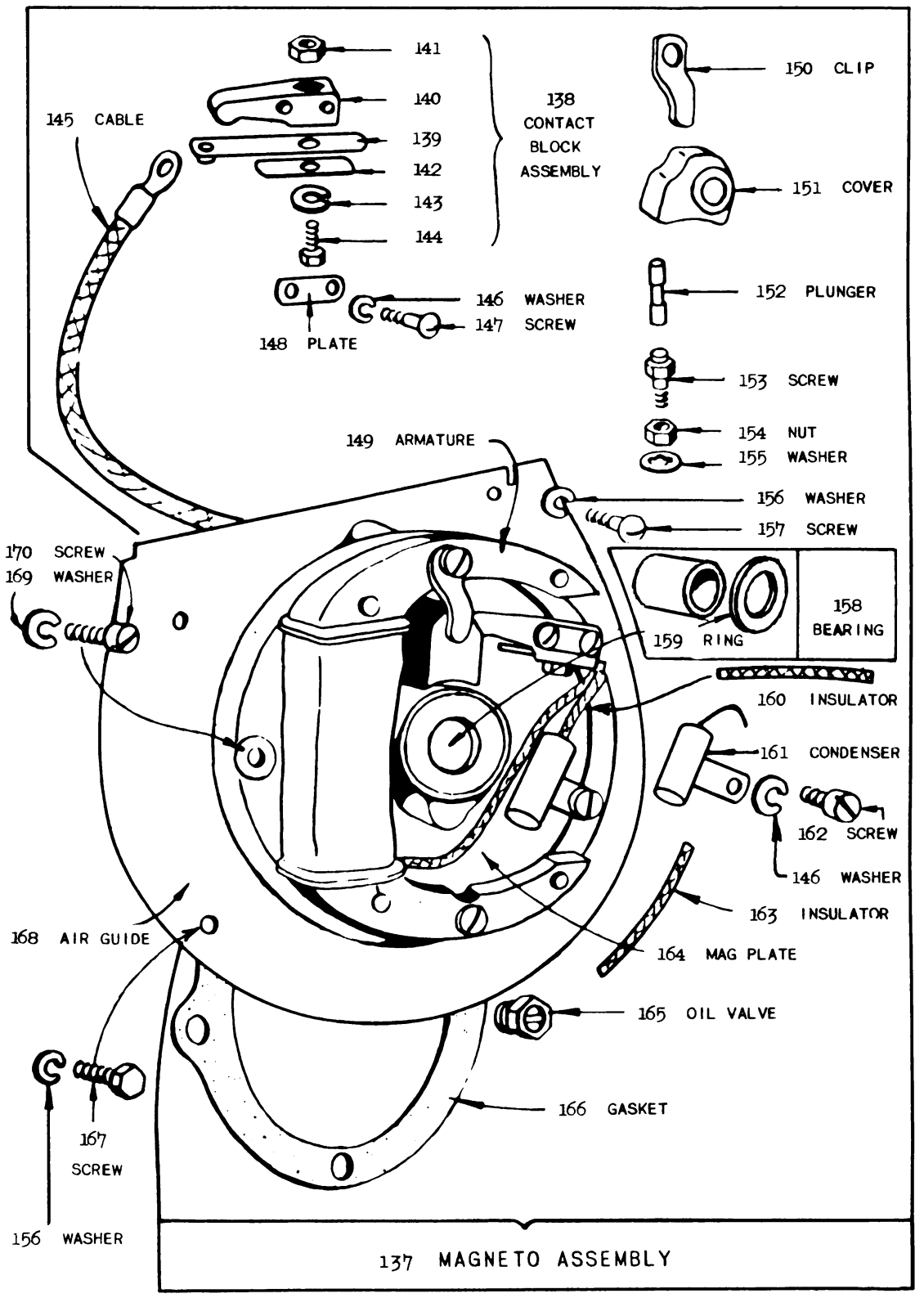


FIGURE 90 MAGNETO

FIGURE 90

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
137	109158	Magneto Assembly (Items 138 - 170 Inclusive)	69835	1
138	109159	Contact Block Assembly (Items 139 - 144 Inclusive)	69780	1
139	109160	Contact Spring and Point	69754	1
140	109161	Contact Block	65078	1
141	109258	Nut, 8-32, hex.	90313	1
142	109162	Contact Spring Stop	62100	1
143	109259	Lockwasher, 11/64 x 5/64 x 1/32"	90367	1
144	109163	Contact Block Screw	63369	1
145	109164	Ignition Cable	69854	1
146	109234	Lockwasher No. 10	92290	3
147	109261	Screw, 10-32 x 7/8", rnd. hd.	91406	2
148	109165	Contact Connector Plate	62178	1
149	109166	Armature	29656	1
150	109167	Dust Cover Clip	68876	1
151	109168	Magneto Point Dust Cover	65198	1
152	109169	Magneto Point Plunger	65414	1
153	109170	Contact Point Screw	63238	1
154	109171	Contact Point Locknut	63239	1
155	109262	Shakeproof Lockwasher No. 6	91122	1
156	109216	Lockwasher, 1/4 x 3/32 x 5/64"	90832	6
157	109264	Screw, 1/4-20 x 1", rnd. hd.	91270	2
158	109172	Magneto Plate Bearing (Includes Item 159)	69911	1
159	109173	Oil Retainer Ring	62235	1
160	109174	Condenser Lead Insulator	65735	1
161	109175	Condenser	29652	1
162	109265	Screw, 10-32 x 1/4" fill. hd.	92308	1
163	109176	Armature Lead Insulator	65725	1
164	109177	Magneto Plate with Bearing	69876	1
165	109178	Oil Return Valve	89307	1
166		Magneto Plate Gasket*		
	109179	.015" Thick	66457	*
	109180	.005" Thick	66527	*
	109181	.009" Thick	66537	*
167	109283	Screw, 1/4-20 x 1/2", hex. hd.	90891	4
168	109284	Blower Housing Air Guide	62201	1
169	109277	Lockwasher	91388	4
170	109184	Magneto Plate Screw	91385	4

* Use one of the three thicknesses

MODEL DS-31 TANK CAR HEATER

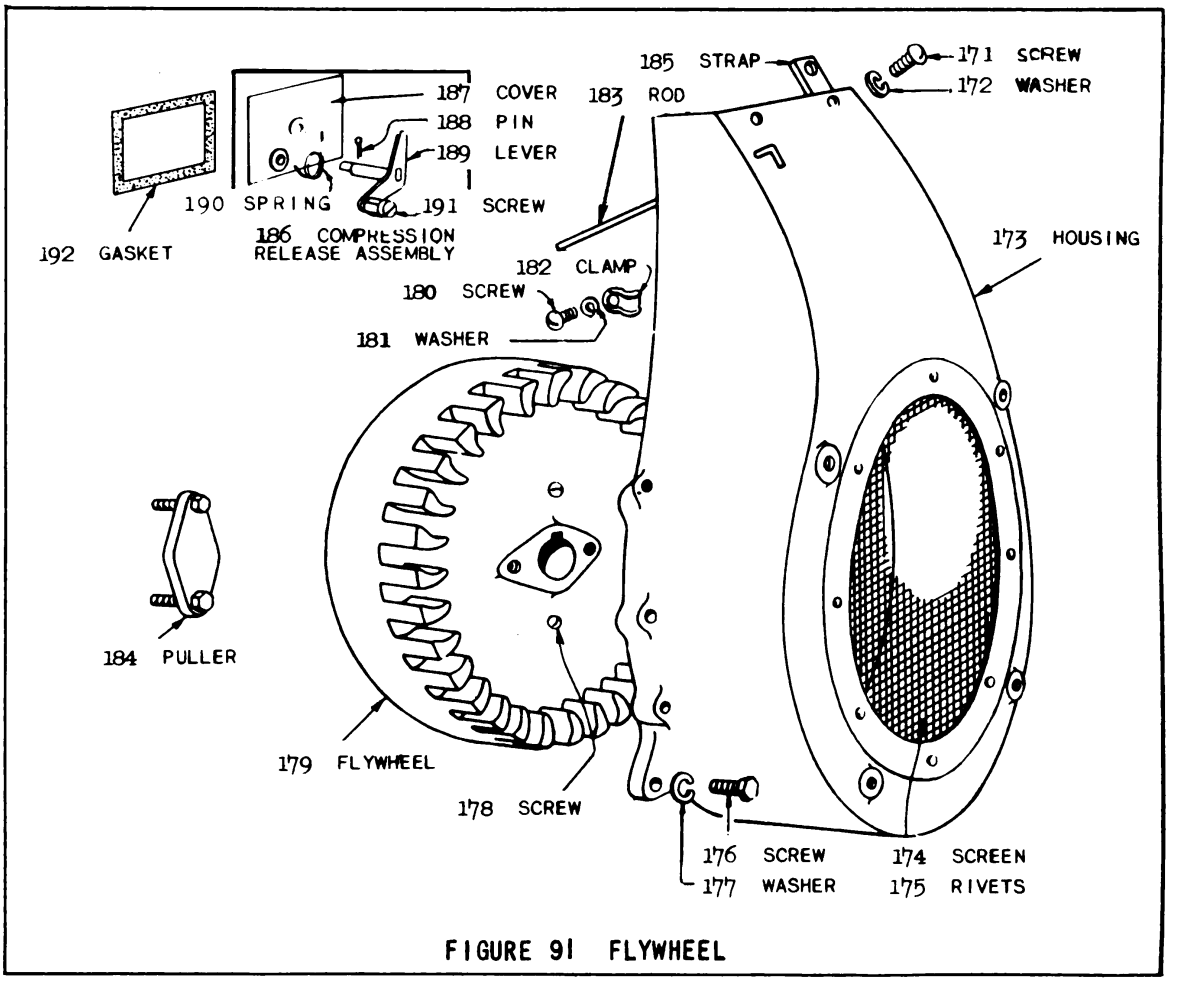
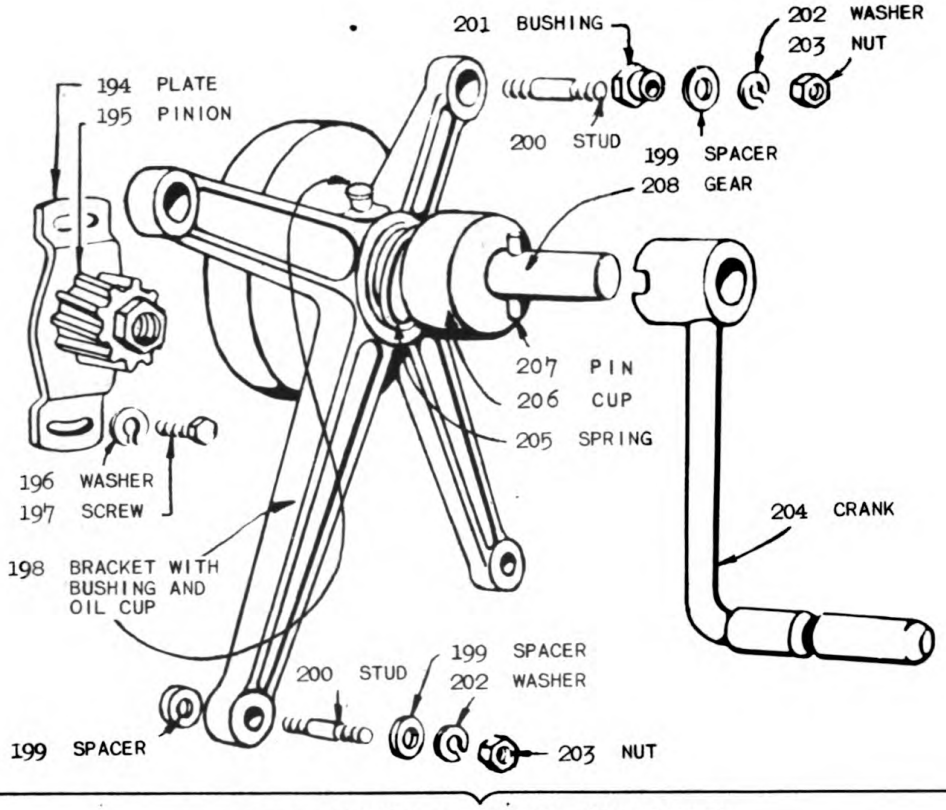


FIGURE 91 FLYWHEEL

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
171	109229	Screw, 1/4-20 x 5/8", rnd. hd.	91698	4
172	109216	Lockwasher, 1/4 x 3/32 x 5/64"	90832	4
173	109285	Blower Housing	99974	1
174	109055	Blower Housing Screen	62397	1
175	109286	Rivets	46277	6
176	109057	Blower Housing Mounting Screw	92272	2
177	109231	Lockwasher, 5/16 x 1/8 x 1/16"	90366	2
178	109232	Screw, 1/4-20 x 3/8", rnd. hd.	91195	2
179	109058	Magneto and Blower Flywheel	69808	1
180	109233	Screw, 10-32 x 1/2", rnd. hd.	90597	1
181	109234	Lockwasher No. 10	92290	1
182	109059	Ignition Cable Clamp	23581	1
183	109060	Compression Release Rod	63609	1
184	109061	Flywheel Puller	29020	1
185	109062	Blower Housing Mounting Strap	62177	2
186	109063	Compression Release Assembly (Items 187 - 191 Inclusive)	69950	1
187	109064	Valve Cover	69951	1
188	109235	Cotter Pin, 1/16 x 1/2"	92288	1
189	109065	Shaft Lever and Swivel	69952	1
190	109066	Compression Release Spring	67666	1
191	109236	Screw, 10-32 x 5/16", rnd. hd.	90010	1
192	109067	Valve Cover Plate Gasket	65237	1



193 CRANK STARTER ASSEMBLY

FIGURE 92 CRANK STARTER

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
193	109068	Crankstarter Assembly (Items 194 - 208 Inclusive)	29089	1
194	109069	Starter Pinion Lock Plate	62363	1
195	109070	Starter Pinion	63457	1
196	109225	Lockwasher, 1/4 x 5/64 x 1/16"	90699	2
197	109226	Screw, 1/4-20 x 3/8", hex. hd.	91439	2
198	109071	Starter Crank Bracket	69953	1
	109072	Shaft Bushing	63605	1
	109073	Starter Shaft Oil Cup	29222	1
199	109074	Starter Bracket Spacer	63460	6
200	109075	Starter Bracket Stud	63456	4
201	109076	Eccentric Bushing	63458	2
202	109227	Lockwasher, 11/32 x 1/8 x 3/32"	92268	4
203	109228	Nut, 3/8-24 hex.	92292	4
204	109077	Starter Crank	99024	1
205	109078	Crankstarter Spring	68156	1
206	109079	Starter Spring Cup	62254	1
207	109080	Starter Shaft Pin	63199	1
208	109081	Starter Gear and Shaft	69949	1

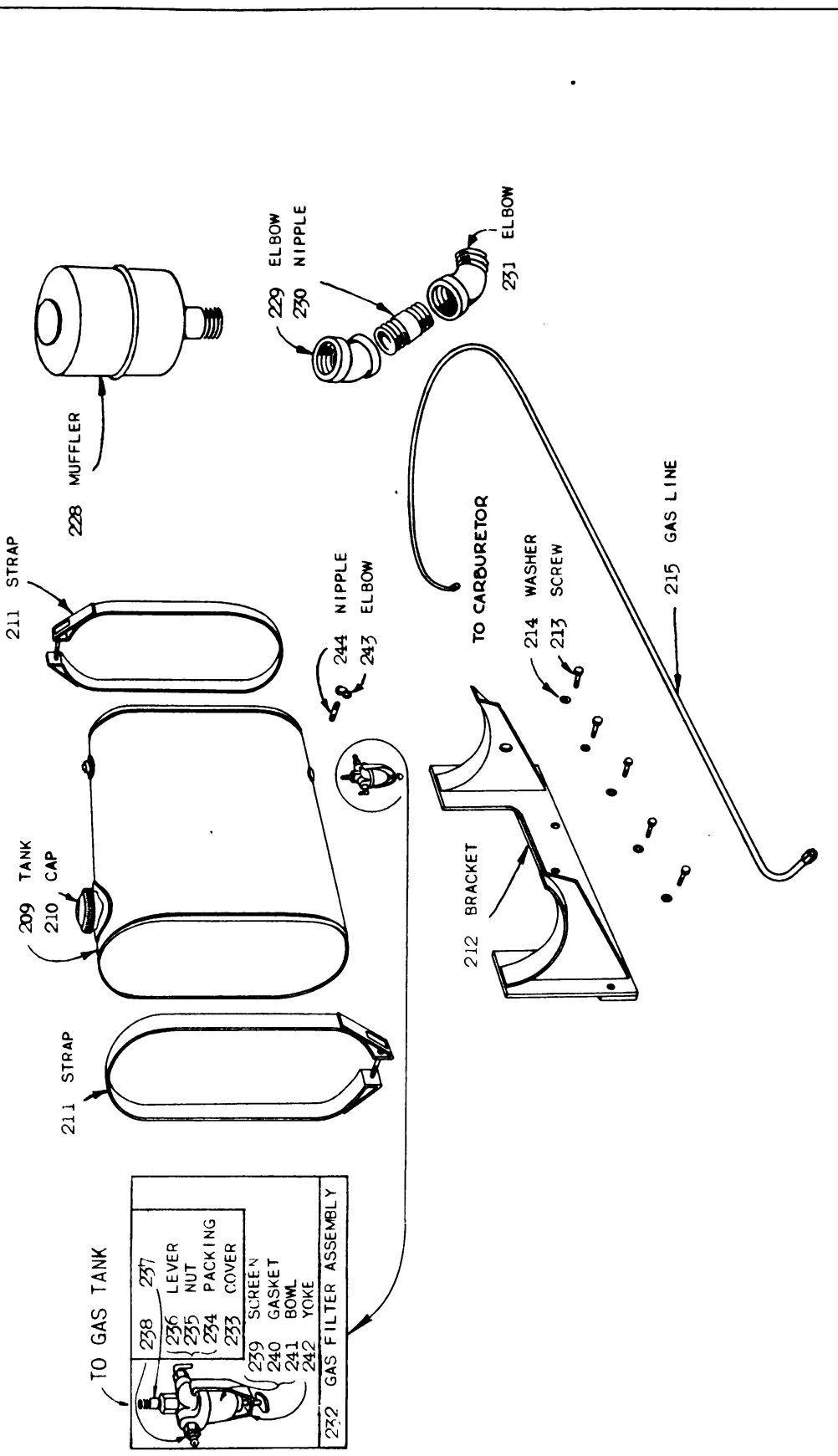


FIGURE 93 GASOLINE TANK

FIGURE B-10

FIGURE B-10

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
209	109185	Gas Tank - 5 gallon (Includes Item 210) Wisconsin Motor #WE-106		1
210	109186	Gas Tank Cap - Wisconsin Motor #RC-77		1
211	109187	Gas Tank Strap with Bolt and Nut - Wisconsin Motor #PG-174B		2
212	109188	Gas Tank Bracket		1
213	109252	Cap Screw, 3/8-16 x 1"		5
214	109253	Lockwasher, 3/8"		5
215	109189	Gasoline Line, 10' long		1
228	109198	Muffler	69134	1
229	109199	Exhaust Pipe Elbow, 45°	91415	1
230	109200	Exhaust Nipple	91416	1
231	109201	Exhaust Street Elbow, 45°	92130	1
232	109202	Gas Filter Assembly (Includes Items 233 - 242 Inclusive)	99910	1
233	109203	Gas Filter Cover Assembly (Items 234 - 238 Inclusive)	99909	1
234	109204	Shut Off Lever Packing	27019	1
235	109205	Shut Off Lever Nut	23346	1
236	109206	Shut Off Lever	23347	1
237	109207	Gas Filter Connector	91635	1
238	109208	Gas Filter Connector	53029	1
239	109209	Gas Filter Screen	62876	1
240	109210	Gas Filter Gasket	68477	1
241	109211	Gas Filter Bowl	68487	1
242	109212	Gas Filter Yoke Assembly	99665	1
243	109213	Gas Filter Elbow, 1/8", 90°		1
244	109214	Gas Filter Nipple, 1/8"		1

NUMERICAL
PARTS PRICE LIST
CLEAVER TANK CAR HEATER
BRIGGS & STRATTON ENGINE - MODEL ZZ, TYPE NO. 304665

REF. NO.	C-B CO. PART No.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
50	109002	Valve Tappet Washer	62252	109	.10
52	109003	Valve Tappet Screw	90890	109	.10
53	109004	Valve Spring Collar	68283	109	.20
54	109005	Valve Spring Retainer	68293	109	.20
55	109006	Valve Spring	65906	109	.30
56	109007	Valve Spring Cup	62222	109	.06
57	109008	Intake Valve	68563	109	1.50
59	109010	Spark Plug and Filler Cup Wrench	68652	109	.40
60	109011	Spark Plug with Gasket (Includes Item 61)	89572	109	1.30
61	109012	Spark Plug Gasket	27090	109	.10
62	109013	Cylinder Head Spacer	63336	109	.60
63	109014	Cylinder Head Screw	91387	109	.20
64	109015	Cylinder Head and Valve Cover Screw	91386	109	.20
65	109016	Cylinder Head Spacer	63337	109	.50
66	109017	Cylinder Head and Connecting Rod Screw	91162	109	.10
67	109018	Cylinder Head Spacer	91324	109	.06
68	109019	Cylinder Head	61405	109	12.00
69	109020	Cylinder Head Gasket	69737	109	.50
22	109021	Cylinder Shield	62924	108	.90
25	109022	Breather Tube	69314	109	1.60
26	109023	Crankcase Cover Gasket	66717	108	.50
27	109024	Crankcase Cover (Cast Iron) (Includes Item 28)	99936	108	12.00
28	109025	Bearing Oil Seal	69740	108	3.00
31	109026	Ball Bearing	69739	108	11.00
32	109027	Base Gasket	65247	108	.70
34	109029	Governor Crank Bushing	63341	108	.50
35	109030	Cylinder Mounting Stud	23136	108	.10
36	109031	Governor Gear Shaft	63343	108	.70
38	109032	Governor Gear Washer	92305	108	.10
40	109033	Governor Gear	69839	108	9.00
41	109034	Governor Crank	69926	108	2.50
43	109035	Governor Plunger	63335	108	.70
44	109036	Cam Shaft Plug	65932	108	.10
45	109037	Cam Shaft	66203	108	1.00
47	109039	Cylinder Gasket	66477	108	.20
1	109041	Oil Pump Assembly(Items 2-4 Incl.)	99360	107	3.00
2	109042	Oil Pump Screen	99361	107	1.50
7	109043	Oil Drain Plug	91084	107	.20
8	109044	Base (Cast Iron)	61287	107	14.00
9	109045	Oil Filler Nipple	92469	107	.40
10	109046	Oil Filler Cap	69689	107	.80

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
11	109047	Oil Tube Connector	63202	107	$ 1.00
12	109048	Oil Tube Connector Nut	63217	107	.20
13	109049	Oil Pump Spring	26413	107	.20
14	109050	Oil Pump Plunger	23132	107	.30
15	109051	Oil Pump Tube	99362	107	1.30
16	109052	Oil Tube Retainer	62081	107	.50
19	109053	Oil Pump Rod	66739	107	.80
174	109055	Blower Housing Screen	62397	116	1.00
176	109057	Blower Housing Mounting Screw	92272	116	.10
179	109058	Magneto and Blower Flywheel	69808	116	30.00
182	109059	Ignition Cable Clamp	23581	116	.10
183	109060	Compression Release Rod	63609	116	.60
184	109061	Flywheel Puller	29020	116	.90
185	109062	Blower Housing Mounting Strap	62177	116	.50
186	109063	Compression Release Assembly (Items 187 - 191 Inclusive)	69950	116	4.00
187	109064	Valve Cover	69951	116	4.50
189	109065	Shaft Lever and Swivel	69952	116	4.00
190	109066	Compression Release Spring	67666	116	.50
192	109067	Valve Cover Plate Gasket	65237	116	.20
193	109068	Crankstarter Assembly (Items 194 - 208 Inclusive)	29089	117	23.00
194	109069	Starter Pinion Lock Plate	62363	117	.90
195	109070	Starter Pinion	63457	117	5.00
198	109071	Starter Crank Bracket	69953	117	8.00
	109072	Shaft Bushing	63605	117	.60
	109073	Starter Shaft Oil Cup	29222	117	.70
199	109074	Starter Bracket Spacer	63460	117	.20
200	109075	Starter Bracket Stud	63456	117	.30
201	109076	Eccentric Bushing	63458	117	.20
204	109077	Starter Crank	99024	117	3.00
205	109078	Crankstarter Spring	68156	117	.20
206	109079	Starter Spring Cup	62254	117	.40
207	109080	Starter Shaft Pin	63199	117	.30
208	109081	Starter Gear and Shaft	69949	117	7.00
71		Top Compression Ring			
	109082	Standard	61964	110	.80
	109083	.010"-O.S.	21002	110	.80
	109084	.020"-O.S.	21005	110	.80
	109085	.030"-O.S.	21008	110	.80
72		Center Compression Ring			
	109086	Standard	61963	110	.80
	109087	.010"-O.S.	21003	110	.80
	109088	.020"-O.S.	21006	110	.80
	109089	.030"-O.S.	21009	110	.80
73		Oil Ring			
	109090	Standard	61292	110	1.20
	109091	.010"-O.S.	61335	110	1.20
	109092	.020".O.S.	61336	110	1.20
	109093	.030"-O.S.	61337	110	1.20

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
74		Piston			
	109094	Standard	69921	110	$ 7.00
	109095	.010"-0.S.	69922	110	8.50
	109096	.020"-0.S.	69923	110	8.50
	109097	.030"-0.S.	65776	110	.06
75	109098	Piston Pin Locks			
	109099	Standard	99947	110	9.80
	109100	.010".0.S.	99948	110	11.30
	109101	.020"-0.S.	99949	110	11.30
	109102	.030"-0.S.	99950	110	11.30
76		Piston Pin			
	109103	Standard	69925	110	1.00
	109104	.005"-0.S.	29103	110	1.20
77	109106	Connecting Rod Shim	22246	110	.10
	109108	Connecting Rod Screw	91162	110	.10
78	109109	Crankshaft	26278	110	24.00
79	109110	Flywheel Key	66403	110	.10
106	109111	Upper Carburetor Body Assembly (Items 107 - 118 Inclusive)	99376	113	9.00
109	109113	Throttle Lever Pin	23125	113	.10
110	109114	Throttle Lever	21152	113	.40
111	109115	Throttle Shaft Assembly	99524	113	1.30
114	109116	Idling Valve Spring	26157	113	.10
115	109117	Idler Needle Valve	23228	113	.50
116	109118	Throttle Butterfly Valve	62940	113	.20
117	109119	Upper Carburetor Body	99375	113	5.60
120	109122	Inlet Valve & Seat (Inc. Item 121)	99780	113	1.60
121	109123	Fibre Washer	68667	113	.10
123	109125	Carburetor Float	99333	113	1.00
126	109126	Float Hinge Pin	23114	113	.20
127	109127	Carburetor Nozzle	99345	113	1.20
128	109128	Needle Valve Retainer	23117	113	.50
129	109129	Needle Valve Packing	68677	113	.10
130	109130	Needle Valve Packing Nut	23118	113	.40
131	109131	Needle Valve	99346	113	1.20
132	109132	Choke Lever Spring	26155	113	.10
133	109133	Choke Lever Screw	23123	113	.10
134	109134	Choke Lever Washer	62899	113	.10
135	109135	Choke Shaft and Lever (Off-Center)	89531	113	1.20
136	109136	Choke Valve (Off-Center)	62872	113	.70
80	109138	Idling Device	99458	111	3.50
81	109139	Air Cleaner Assembly (Items 82 - 87 Inclusive)	69947	111	14.00

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
82	109140	Air Cleaner Body (Items 83 - 84 Inclusive)	69948	111	$ 10.00
83	109141	Air Cleaner Bowl	62465	111	1.50
84	109142	Air Cleaner Bowl Clamp	62466	111	.30
85	109143	Screw, No. 7 x 1/2" Parker Kalon	91458	111	.10
86	109144	Air Cleaner Elbow	61371	111	4.00
88	109145	Stop Switch Washer	67632	111	.10
92	109146	Stop Switch	62196	111	.20
93	109147	Intake Elbow Locknut	63445	111	.50
127	109149	Carburetor Intake Elbow	61976	113	3.50
128	109150	Carburetor Gasket	65647	113	.20
129	109151	Air Cleaner Washer	65084	113	.10
130	109152	Air Cleaner Screw	91442	113	.20
131	109153	Governor Spring Rod Nut	63520	113	.10
132	109154	Governor Spring Rod	63334	113	1.00
133	109155	Governor Spring	67316	113	.40
135	109156	Throttle Link	26160	113	1.00
136	109157	Governor Lever	29429	113	2.50
137	109158	Magneto Assembly (Items 138 - 170 Incl.)	69835	115	18.00
138	109159	Contact Block Assembly (Items 139 - 144 Inclusive)	69780	115	1.30
139	109160	Contact Spring and Point	69754	115	.60
140	109161	Contact Block	65078	115	.80
142	109162	Contact Spring Stop	62100	115	.30
144	109163	Contact Block Screw	63369	115	.10
145	109164	Ignition Cable	69854	115	.70
148	109165	Contact Connector Plate	62178	115	.10
149	109166	Armature	29656	115	8.00
150	109167	Dust Cover Clip	68876	115	.20
151	109168	Magneto Point Dust Cover	65198	115	.50
152	109169	Magneto Point Plunger	65414	115	.60
153	109170	Contact Point Screw	63238	115	.80
154	109171	Contact Point Locknut	63239	115	.10
158	109172	Magneto Plate Bearing (Includes Item 159)	69911	115	1.40
159	109173	Oil Retainer Ring	62235	115	.10
160	109174	Condenser Lead Insulator	65735	115	.10
161	109175	Condenser	29652	115	1.00
163	109176	Armature Lead Insulator	65725	115	.10
164	109177	Magneto Plate with Bearing	69876	115	6.00
165	109178	Oil Return Valve	89307	115	.30
166		Magneto Plate Gaskets*			
	109179	.015" Thick	66457	115	.10
	109180	.005" Thick	66527	115	.10
	109181	.009" Thick	66537	115	.10
170	109184	Magneto Plate Screw	91385	115	.10
209	109185	Gas Tank - 5 gallon (Incl. Item 210 Wis. Motor #WE-106)		119	13.00
210	109186	Gas Tank Cap - Wis. Motor #RC-77		119	1.04

* Use one of the three thicknesses.

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
211	109187	Gas Tank Strap with Bolt and Nut, Wis. Motor #PG-174B		119	$ 2.40
212	109188	Gas Tank Bracket		119	14.40
215	109189	Gasoline Line, 10' long		119	1.00
228	109198	Muffler	69134	119	5.00
229	109199	Exhaust Pipe Elbow, 45°	91415	119	.90
230	109200	Exhaust Nipple	91416	119	.40
231	109201	Exhaust Street Elbow, 45°	92130	119	.90
232	109202	Gas Filter Assembly (Items 233-242 Inclusive)	99910	119	3.50
233	109203	Gas Filter Cam Assembly (Items 234-238 Inclusive)	99909	119	2.50
234	109204	Shut Off Lever Packing	27019	119	.10
235	109205	Shut Off Lever Nut	23346	119	.30
236	109206	Shut Off Lever	23347	119	.50
237	109207	Gas Filter Connector	91635	119	.30
238	109208	Gas Filter Connector	53029	119	.40
239	109209	Gas Filter Screen	62876	119	.30
240	109210	Gas Filter Gasket	68477	119	.10
241	109211	Gas Filter Bowl	68487	119	.30
242	109212	Gas Filter Yoke Assembly	99665	119	1.00
243	109213	Gas Filter Elbow, 1/8" 90°		119	.30
244	109214	Gas Filter Nipple, 1/8"		119	.30
87	109215	Screw, 1/4-20 x 1", fill. hd.	91256	111	.10
89	109216	Lockwash, 1/4 x 3/32 x 5/64"	90832	111	.04
90	109217	Screw, 1/4-20 x 1/2", hex. hd.	90891	111	.10
91	109218	Screw, 1/4-20 x 3/4", hex. hd.	90700	111	.10
102	109219	Cotter Pin, 1/16 x 3/8"	92286	111	.04
107	109220	Screw, 8-32 x 3/4", fill. hd.	91846	113	.10
112	109221	Screw, 4-16 x 1/4", rd. hd.	90029	113	.10
113	109222	Lockwasher, 1/8 x 3/64 x 1/32"	90369	113	.04
124	109223	Screw, 10-32 x 5/8", fill. hd.	90746	113	.10
125	109224	Lockwasher No. 10	91427	113	.06
196	109225	Lockwasher, 1/4 x 5/64 x 1/16"	90699	117	.04
197	109226	Screw, 1/4-20 x 3/8", hex. hd.	91439	117	.10
202	109227	Lockwasher, 11/32 x 1/8 x 3/32"	92268	117	.04
203	109228	Nut, 3/8-24, hex.	92292	117	.06
171	109229	Screw, 1/4-20 x 5/8" rd. hd.	91698	116	.10

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
178	109232	Screw, 1/4-20 x 3/8", rd. hd.	91195	116	$ .06
180	109233	Screw, 10-32 x 1/2", rd. hd.	90597	116	.06
181	109234	Lockwasher No. 10	92290	116	.04
188	109235	Cotter Pin, 1/16 x 1/2"	92288	116	.04
191	109236	Screw, 10-32 x 5/16", rd. hd.	90010	116	.10
3	109237	Lockwasher No. 12	91059	107	.04
4	109238	Screw, 12-24 x 5/16", fill. hd.	91921	107	.10
6	109240	Screw, 5/16-24 x 3/4", hex. hd.	90950	107	.10
20	109243	Screw, 3/8-16 x 1-1/4", hex. hd.	90887	107	.10
24	109246	Screw, 1/4-20 x 1/2", rd. hd.	90916	108	.10
30	109248	Screw, 3/8-24 x 3/4", hex. hd.	91028	108	.10
213	109252	Cap Screw, 3/8-16 x 1"		119	.12
214	109253	Lockwasher, 3/8"		119	.06
225	109256	Screw, 1/2-20 x 1-1/2", hex. hd.	91229	119	.20
226	109257	Lockwasher, 1/2"	90683	119	.06
141	109258	Nut, 8-32 hex.	90313	115	.10
143	109259	Lockwasher, 11/64 x 5/64 x 1/32"	90367	115	.06
147	109261	Screw, 10-32 x 7/8", rd. hd.	91406	115	.10
155	109262	Shakeproof Lockwasher No. 6	91122	115	.06
157	109264	Screw, 1/4-20 x 1", rd. hd.	91270	115	.10
162	109265	Screw, 10-32 x 1/4", fill. hd.	92308	115	.10
51	109267	Nut, 1/4-28, hex.	90847	109	.10
10A	109268	Oil Filler Cap Gasket	65434	107	.10
22	109269	Cylinder Shield	89609	108	.90
33	109270	Crank Case Assembly (Cast Iron) Includes Items 34-37 inclusive, also Item 29	99951	108	.90
46	109271	Cam Gear	21113	108	9.00
48	109272	Cylinder	99397	108	33.00
49	109273	Valve Tappet	26279	109	1.50
58	109274	Exhaust Valve	23631	109	4.50
77	109275	Connecting Rod Assembly	89602	110	12.00
77	109276	Connecting Rod Bushing	23590	110	1.00
77-169	109277	Lock Washer 5/16" x 1/8" x 1/16"	91388	110	.05
77	109278	Connecting Rod Screw	90386	110	.10
94	109279	Carburetor Baffle Plate	22149	111	1.00
105	109280	Carburetor Assembly (Off-Center Choke) Items 106-136 inclusive.	89920	113	20.00
119	109281	Carburetor Gasket	27034	113	.20
122	109282	Carburetor Body (Off-Center Choke)	89915	113	8.50
167	109283	Screw, 1/4"-20 x 1/2" Hex. Hd.	90891	115	.10
168	109284	Blower Housing Air Guide	62201	115	1.70
173	109285	Blower Housing	99974	116	15.00
175	109286	Rivets	46277	116	.02