TM 5-1042

WAR DEPARTMENT TECHNICAL MANUAL

TANK CAR HEATER

MODEL DS

2-CAR CAPACITY

MAINTENANCE MANUAL
AND PARTS LIST

WAR DEPARTMENT • 15 DECEMBER 1942

WAR DEPARTMENT TECHNICAL MANUAL

TM 5-1042

TANK CAR HEATER

MODEL DS

2-CAR CAPACITY

MAINTENANCE MANUAL
AND PARTS LIST

WAR DEPARTMENT • 15 DECEMBER 1942

United States Government Printing Office
Washington : 1942

WAR DEPARTMENT
WASHINGTON 25, D. C., 15 December 1942

TM 5–1042, Maintenance Manual and Parts Catalog, Tank Car Heater, Model DS, 2-car capacity, published for the information and guidance of all concerned.

[AG 062.11 (26 Apr 41)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL
Chief of Staff

OFFICIAL:
J. A. ULIO
Major General
The Adjutant General

MAINTENANCE MANUAL AND PARTS CATALOG
TANK CAR HEATER
TM5-1042

This manual has been prepared for the use of those who operate and service CLEAVER Tank Car Heaters, built for the Corps of Engineers, United States Army. It has, for convenience, four divisions: (1) Operator's Instructions, 2) Maintenance Instructions, (3) Parts List, and (4) Gasoline Engine Instructions and Parts List. Each of the first three divisions is preceded by an index having a black tab which lines up with the corresponding section name on the right-hand edge of the index sheet. The black tabs are quickly located by bending this book back.

THIS MANUAL APPLIES TO THE MACHINES FURNISHED ON THE FOLLOWING:

P.O. #54778, 26 UNITS
U.S.A. REGISTRATION NUMBERS: W057687 TO W057712, INC.
MFR. SERIAL NUMBERS:

689-41	693-41	714-42	727-42	731-42	753-42	779-42
691-41	694-41	715-42	728-42	732-42	754-42	780-42
692-41	695-41	716-42	729-42	736-42	765-42	784-42
	713-42	718-42	730-42	741-42	774-42	

P.O. #55322, 17 UNITS
U.S.A. REGISTRATION NUMBERS: W065521 TO W065537, INC.
MFR. SERIAL NUMBERS:

763-42	766-42	772-42	782-42	789-42	794-42	817-42
764-42	771-42	778-42	785-42	791-42	795-42	822-42
		781-42	787-42	793-42		

P.O. #55812, 122 UNITS
U.S.A. REGISTRATION NUMBERS: W091779 TO W091900, INC.
MFR. SERIAL NUMBERS:

773-42	814-42	838-42	869-42	889-42	908-42	931-42
783-42	815-42	839-42	871-42	891-42	909-42	932-42
786-42	816-42	840-42	872-42	892-42	912-42	933-42
788-42	818-42	853-42	873-42	893-42	914-42	934-42
790-42	819-42	854-42	874-42	894-42	915-42	937-42
792-42	820-42	855-42	876-42	895-42	916-42	938-42
798-42	821-42	856-42	877-42	896-42	917-42	939-42
799-42	826-42	857-42	878-42	897-42	919-42	940-42
800-42	827-42	858-42	879-42	898-42	920-42	941-42
801-42	828-42	859-42	880-42	899-42	921-42	942-42
802-42	829-42	861-42	881-42	900-42	922-42	944-42
808-42	831-42	862-42	882-42	901-42	924-42	946-42
809-42	833-42	863-42	883-42	902-42	925-42	948-42
810-42	834-42	864-42	884-42	903-42	927-42	949-42
811-42	835-42	865-42	885-42	904-42	928-42	950-42
812-42	836-42	866-42	886-42	905-42	929-42	995-42
813-42	837-42	867-42	887-42	906-42	930-42	1068-42
		868-42	888-42	907-42		

INDEX TO OPERATOR'S INSTRUCTIONS

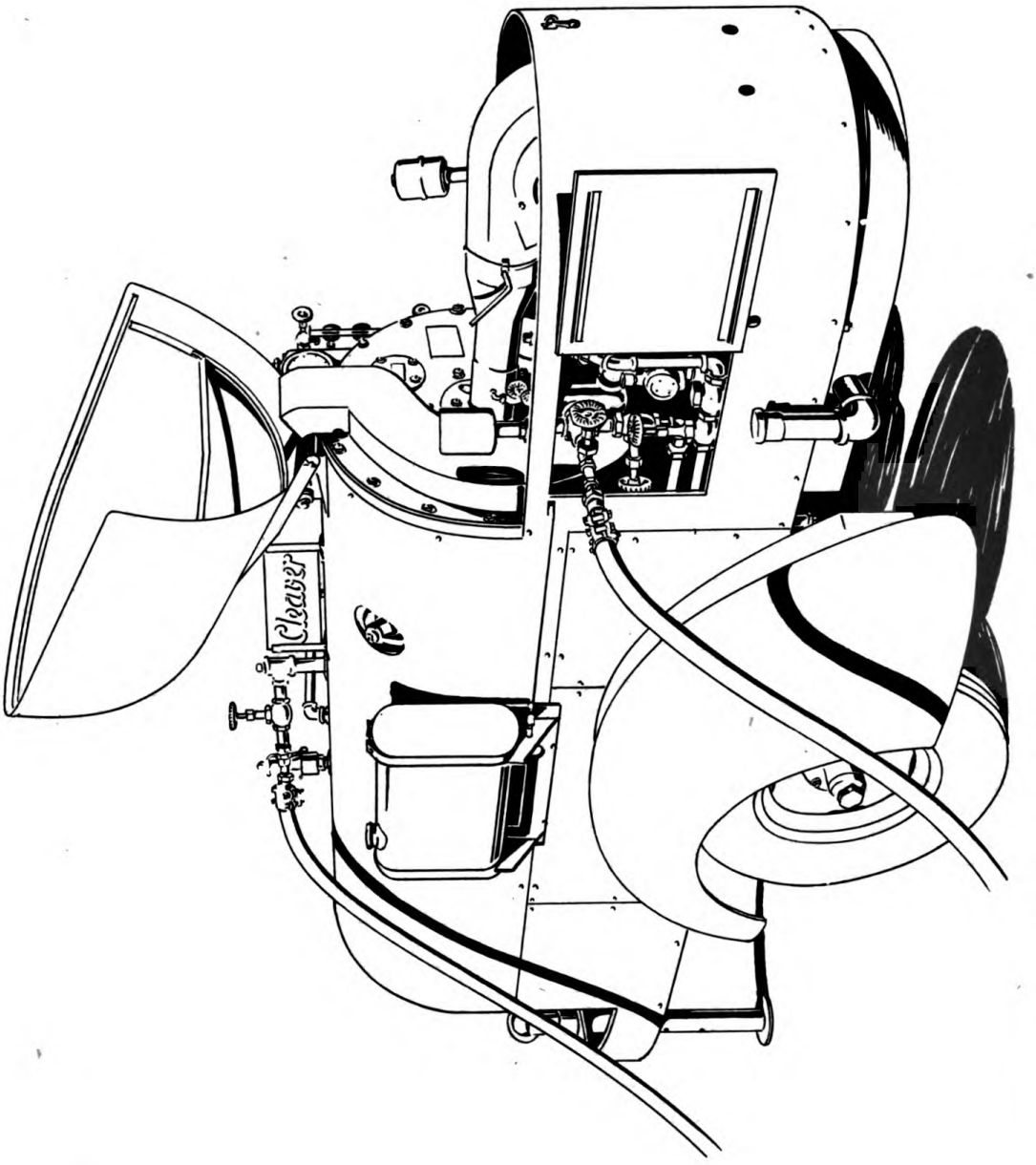


FIGURE 1

SPECIFICATIONS FOR 2-CAR HEATER - MODEL DS

ower Plant	Briggs & Stratton, Model Z, Type 304340
uel Oil Pump	Tuthill Pump Co., Model OL-K
ondensate Pump	Aurora Pump Co., Model D-40
heels	Motor Wheel Corp., #31677
ires	Goodrich Implement, 7.50 x 16
ire Pressure	48#
heel Bearings	Timken
asoline Tank Capacity	5 Gallons
hipping Weight	4100#
ength	13' 7"
idth	61-1/2"
eight	69"
uel Oil Tank Capacity	40 Gallons
ater Tank Capacity	30 Gallons
ater Content Boiler	96 Gallons
uel Consumption per Hour - Full Capacity	11 Gallons
rack Width (Centers)	49-1/4"

TABLE OF APPROXIMATE CAPACITIES AND CONSUMPTIONS FOR AN EIGHT HOUR DAY

ater	952 Gallons ; This is with no condensate return. This amount will decrease with the amount of condensate returned.

U. S. Army Specifications

uel Oil	2-102B	80 Gallons
lotor Fuel	2-103A	4 Gallons
rease	2-108 - Grade 2	1/4 Lb.
ubricating Oil	* SAE-30	1 Quart

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

FOREWORD

The CLEAVER Tank Car Heater is an oil-fired, high pressure steam boile of riveted construction, produced under strict supervision and code regulation for boilers and pressure vessels.

In contrast to other types of mechanical equipment such as engines and motors, which generally stop completely when neglected or otherwise abused, a steam boiler becomes a definite menace and, furthermore, may be damaged beyond the ability of readily available repair facilities if not properly operated and cared for.

By following a few simple rules, each operator may assure himself that the service he and the machine are assigned will be performed and that the nex individual to run it will not be handicapped because of his negligence. All points of operation are fully covered in this book, but if the following suggestions are remembered, the best possible performance will be assured and the machine's life definitely prolonged:

1. Keep a safe water level in the boiler. The most desirable height is about three (3) inches of water in the gauge glass. Should it fall to one (1) inch, determine the cause of water loss and make immediate corrections. Shut the machine down immediately if no water is visible in the water gauge glass.

2. Oil and lubricate at prescribed intervals.

3. Use clean water and frequently blow down boiler, water column and water gauge glass.

4. Keep all steam and water connections tight to avoid loss of water and waste of fuel.

5. Report operating irregularities which you are not able to correct to proper authorities.

This instruction book applies to the operation of both 2- and 3-car models of CLEAVER Tank Car Heaters as the machines are identical in construction, with the exception that the 3-car unit boiler is slightly larger and has a greater steaming capacity.

The terms "2-car" and "3-car" refer to the steam generating capacity o the units and express the ability of the machine to maintain steam pressure in the coil systems of two and three standard 10,000 gallon railroad tank cars simultaneously.

The function of a steam boiler is to convert and transfer the chemical energy in the fuel which is burned to heat energy in the steam and thus render it available for use in heating systems or for conversion into mechanical energy by an engine. The CLEAVER Heater is designed for heating purposes, chiefly in connection with bituminous materials such as road oils and asphalt 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 gain, minimizing the tendency to scale the water side of the boiler and practically eliminating the water supply problem. In cases where live steam is sed 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 rom time to time, either by using the injector or by drawing water from the ank on the unit by means of the turbine pump.

Performance of a steam boiler is judged by its efficiency, which is he proportion of the heat units the fuel consumed actually converted to steam eaving the boiler.

As the formation of soot or carbon on the fire side and scale on the ater side of a boiler act as insulation, it is therefore essential that both urfaces be kept as clean as possible. The CLEAVER Tank Car Heater is proided with a fuel oil burner which intimately mixes air and oil, providing omplete combustion, assuring the minimum deposit of soot on the tubes. This eature, together with the rapid passage of combustion gas through the combustion chamber and three successive passes of smaller tubes eliminates the ecessity of cleaning the tubes from the fire side before 5,000 hours of peration.

GENERAL DESCRIPTION OF CLEAVER TANK CAR HEATER

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

Of fire tube construction, the boiler is equipped with four complete asses 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 ire tube and the third and fourth passes below. The vent pipe or stack is a art of the outer head at the firing end of the boiler. (See cut-away view n page 4). The oil burner is of the pressure atomizing type with three fuel il atomizing nozzles. Two 5-gallon and one 4-gallon nozzles are used on the hree-car heater, giving a total burning rate of fourteen gallons per hour. he two-car heater is equipped with two 4-gallon nozzles and one 3-gallon ozzle, or a total of eleven gallons per hour. By manually operating the alves to the individual fuel oil nozzles and adjusting the air supply to the urner, 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 lower which is provided with a damper at the blower outlet to adjust the volume f air in correct proportion to the fuel burned.

The power plant is a single cylinder air-cooled gasoline motor, directly onnected to the condensate return pump. Power transmission to the blower nd to the fuel oil pump is by means of V belts. Boiler proper is insulated ith 1-1/2" Banroc blanket protected by sheet metal lagging. Space below he boiler at the towing end is utilized as a tool compartment, access to hich is by means of a top-hinged door at the right side of the towing end f the unit.

FIGURE 2

CUT-AWAY VIEW OF CLEAVER TANK CAR HEATER

MANUFACTURED BY

CLEAVER-BROOKS COMPANY MILWAUKEE, WIS., U.S.A.

Unlock hood over power plant and raise to resting position as shown n Figure 1, engaging pin safety lock on rest at top of boiler to prevent hood rom being blown down by the wind.

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

Locate the heater as near the work as possible, consistent with free ccess to other equipment being used on the project. Set unit as nearly level s possible by digging in either or both wheels or the front leg post. The crew jack provided with the machine may be used under the circular power lant 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
3. Gasoline
4. Lubricating Oil
5. Ball Bearing Grease

ater

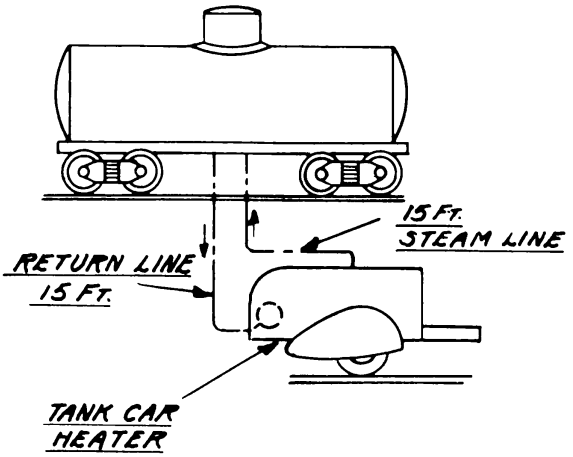
If the heating operation allows the return of all condensate to the oiler, fifty gallons of fresh water for boiler make-up should suffice for ach day's operations. However, if only part of the condensate is recovered, he fresh water requirements will be greater. Make-up water for the boiler ay be withdrawn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

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

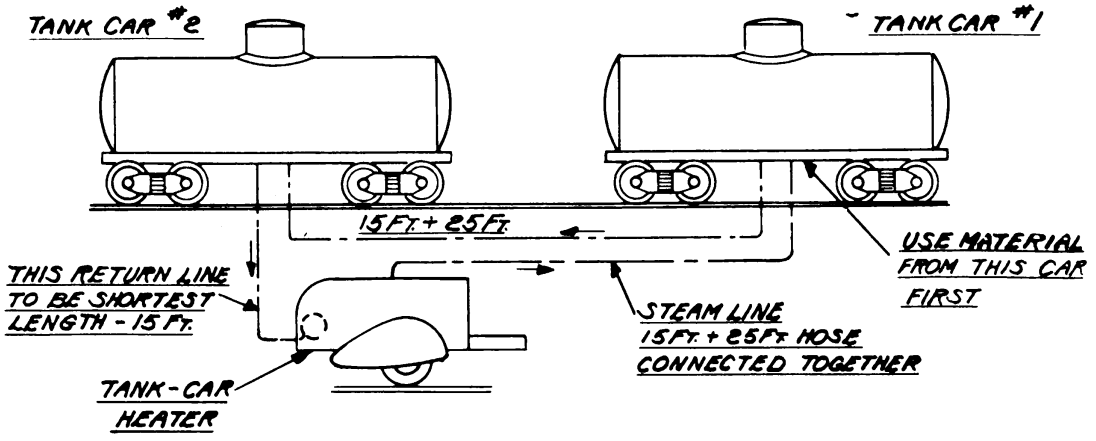
uel Oil

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

ONE-CAR HOOK-UP



TWO-CAR HOOK-UP



ALL HOSE 1" SIZE

FIGURE 3

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

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

team Outlet and Return Connections

The main steam outlet of the CLEAVER Tank Car Heater is located at the op center of the boiler proper, between the water column and injector steam onnections (See Figure 1). The 1-1/2" pipe fitting at the boiler is reduced y piping furnished with the unit to one inch at the upper elbow and a 1" globe alve provided as a shut off for all steam leaving the boiler. A 1" union is rovided at the valve, one half of which should be attached to the hose carry- ng steam to the process. Complete this hose connection, making the run as hort as possible. See Figure 3.

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

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

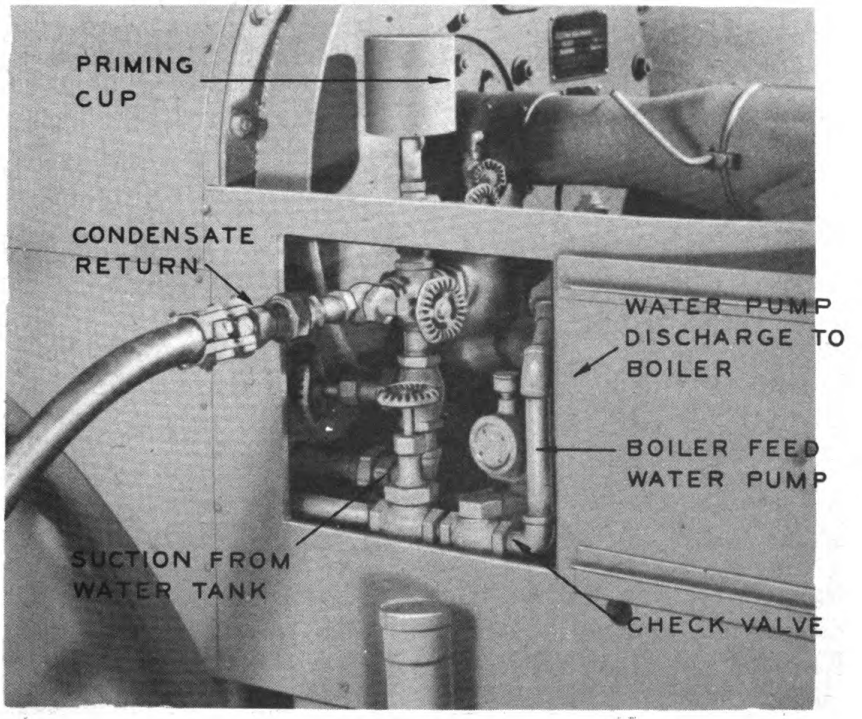


FIGURE 4

STARTING OPERATIONS

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.

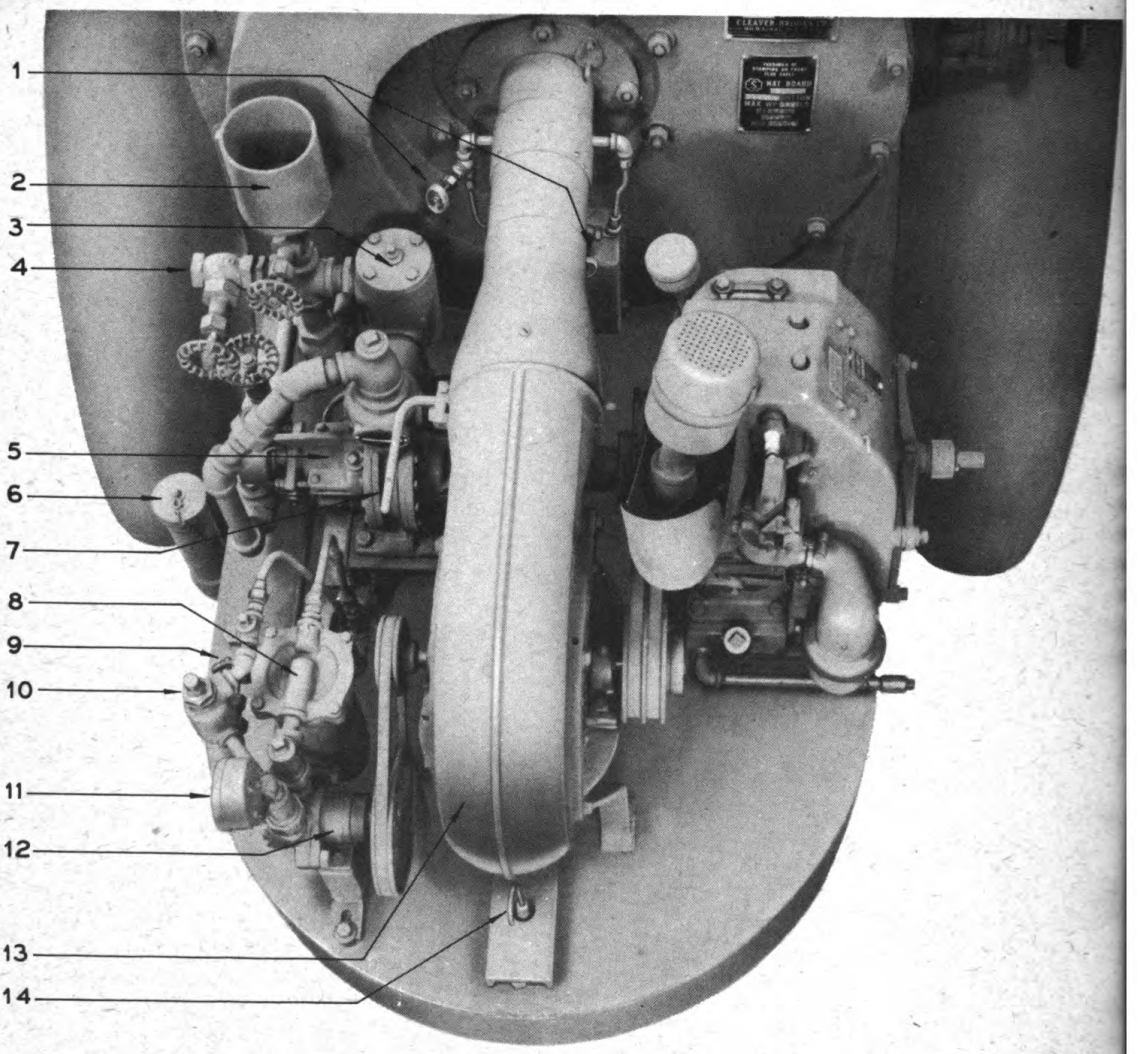


FIGURE 5

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

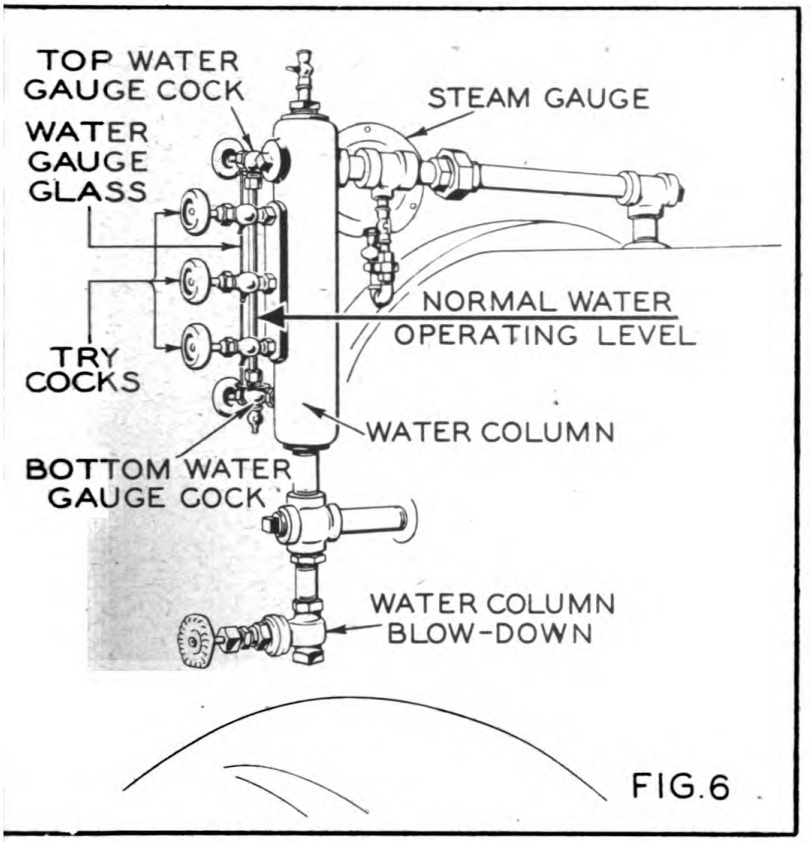


FIG.6

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) ıould be observed at all times by the operator to determine the boiler water ɛvel. Make sure that the top and bottom cocks are fully open by turning the ɔoden hand wheels to the left. Only with these cocks in the open position ın the boiler water assume the true water level in the glass. When starting ɔld, fill the boiler to the point where two inches of water appear in the ɩass. (Water expands when heated and as steam pressure is built up, the ɛvel 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".

FILLING BOILER WITH WATER

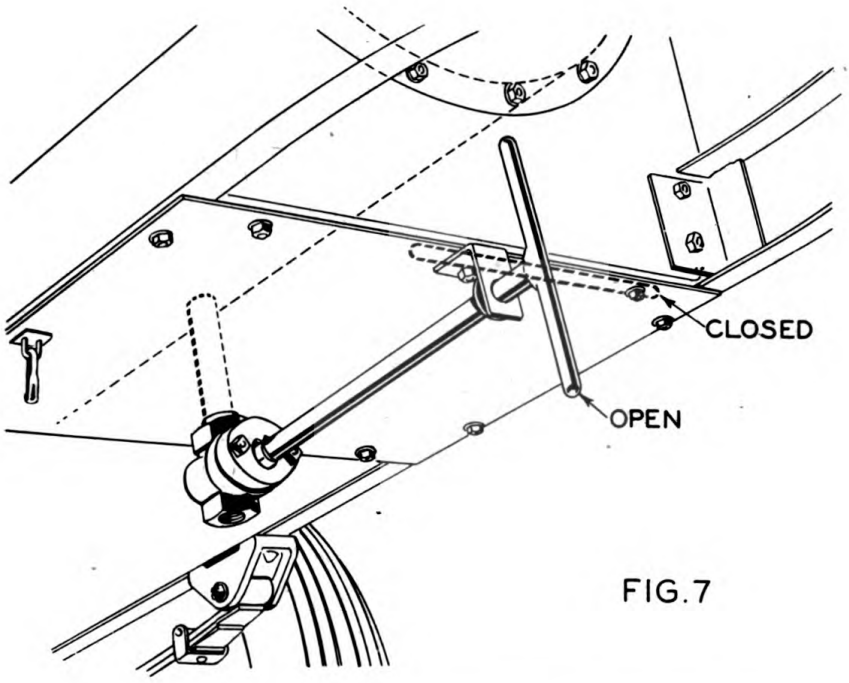


FIG.7

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 to 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 two-car heater water tank holds 30 gallons and the boiler requires 96 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.

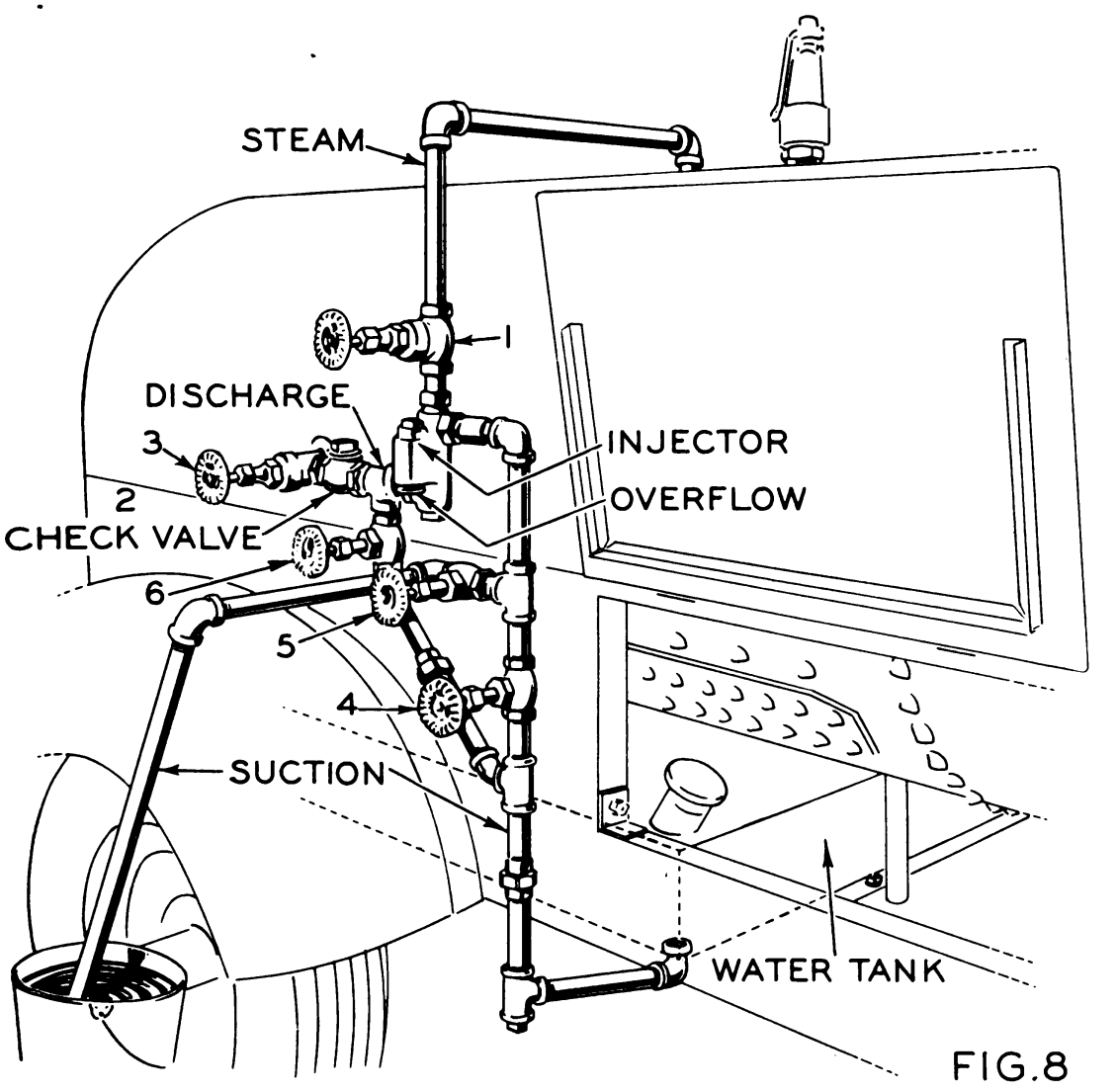


FIG.8

695816 O - 46 - 2

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.

Before attempting to start the engine, turn it over several revolutio slowly to assure free rotation of the water pump. If any binding action is o served or if the operator determines that any foreign matter has entered the water pump, it should be corrected as covered on Page 19, Maintenance Sectio

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.

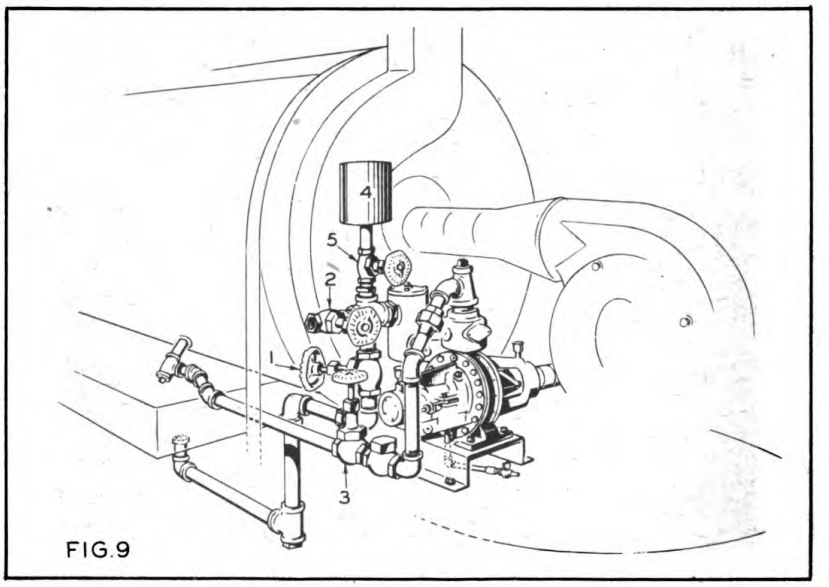


FIG.9

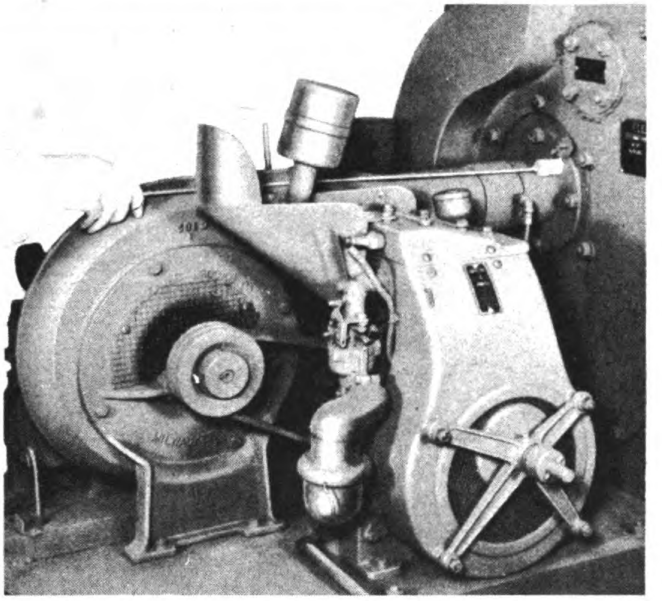


FIGURE 10

Check belt drives.

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

Stop engine.

Open main fuel oil valve to burner (No. 9, Figure 5) and close both iividual valves to the burner (Nos. 1 and 2). This allows start on but one zzle.

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

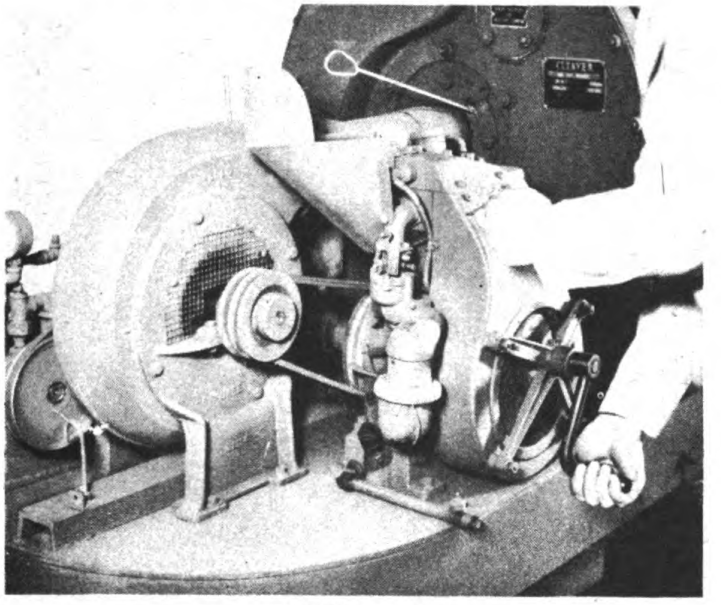


FIGURE 11

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.

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 CLEAVER 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 CLEAVER 2-Car Heater is approximately 34 horse power (3-Car Heater, 42 H.P.). 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.

f Steam Pressure Rises

If firing at full capacity with all three nozzles on, turn off Valve 1, igure 5, or Valve 2, and close air damper on blower outlet to point where urner smokes, then open damper until smoke disappears. If firing with only wo nozzles, turn off the remaining open valve.

f Steam Pressure Falls

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

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

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

iring Rule

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

ow Down

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

Blow down water column and water column gauge glass at least once ach 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!

The condensate return system on the CLEAVER 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 ater tank fill cap. When filled to neck, close steam valve and replace the ank cap.

OPERATING IRREGULARITIES AND THEIR CORRECTION

ow Steaming Capacity

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

Steam leaks, however small, should be corrected whenever detected and ll 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 nd 2, Figure 5).

Fuel oil pressure must not be less than 100 pounds.

o Adjust Fuel Oil Pressure

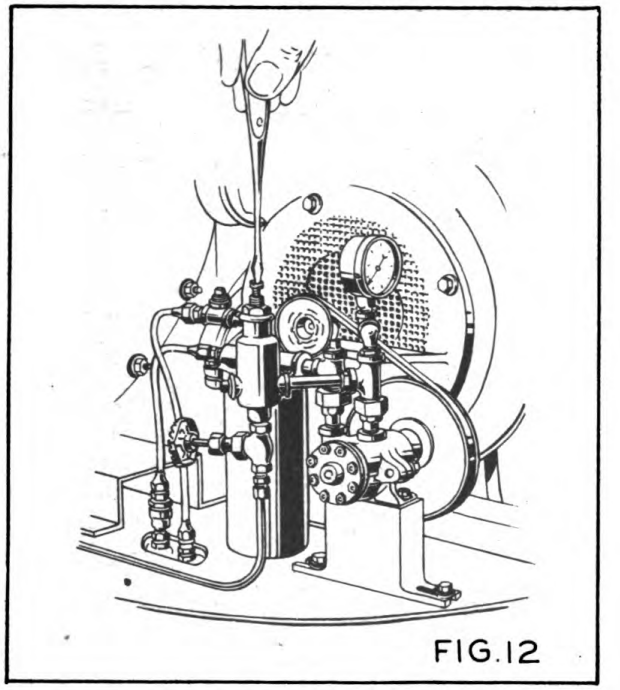


FIG.12

Remove hexagon cap at top of fuel oil pressure relief valve (See igure 12). With engine running, use screwdriver to increase tension on nternal spring to increase oil pressure, watching fuel oil pressure gauge hile making adjustment.

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

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

Replacing Fuel Oil Filter Element

The purpose of the fuel oil filter (See Figure 13) 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.

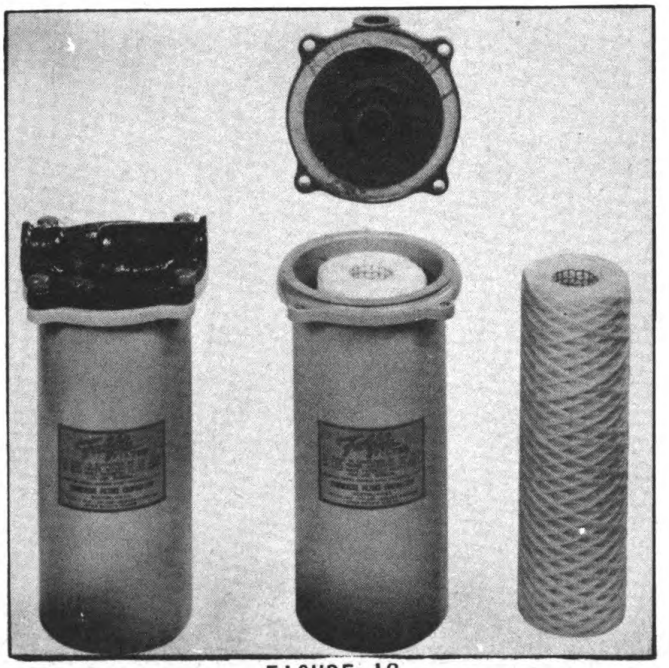


FIGURE 13

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 14.

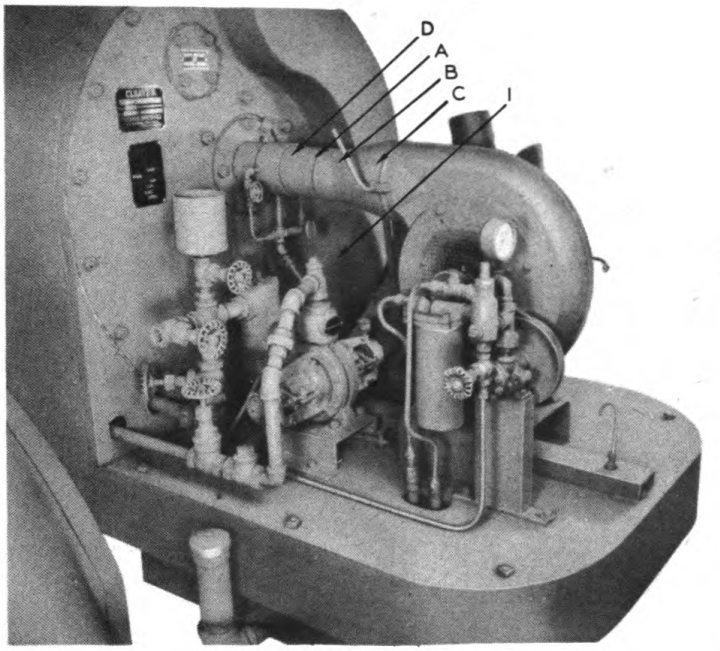


FIGURE 14

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 15.

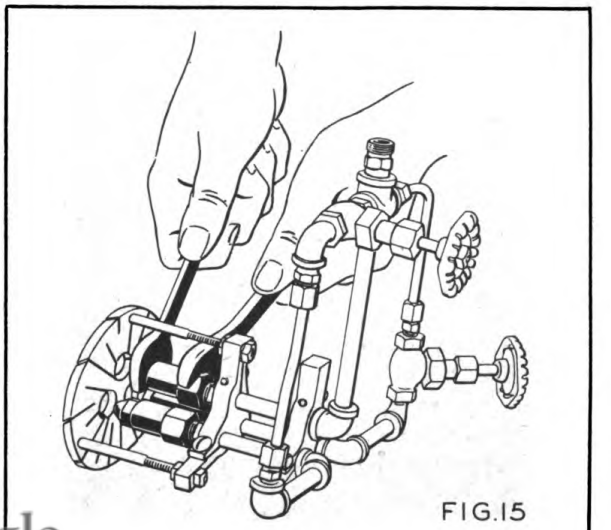


FIG.15

Remove all three nozzle tips from bodies, see Figure 15. Remove nozzl strainer screen from nozzle tip with the fingers, and with a screwdriver, the remaining internal part of the nozzle tip proper. Clean all internal surface of the nozzle tip and the slotted ports of the internal assembly, using a woo 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.

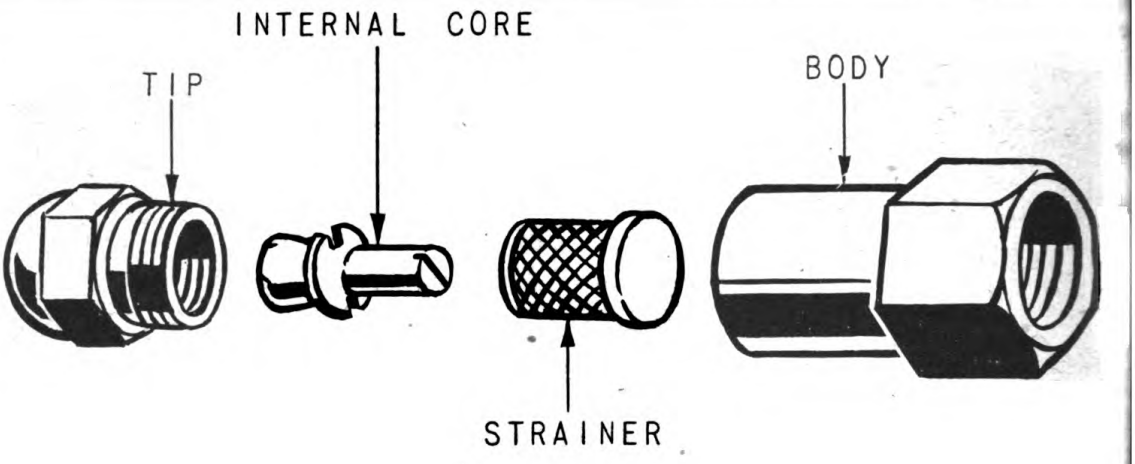


FIG. 16

IT IS ESSENTIAL THAT THE INTERNAL CORE BE TIGHTLY SEATED IN THE NOZZL 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 14). 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 in Maintenance Manual, Page 1.

he Water Pump

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

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

When priming trouble is being experienced, the packing glands may b oo loose, permitting air to be drawn into the pump. Draw up on glands, but ot too tightly.

o 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

ump 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 in Maintenance Section.

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 17, Maintenance Manual.

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 CLEAVER 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. t has no moving or working parts.

JNNING GEAR

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

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

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

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

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

STORAGE PROCEDURE

Drain boiler completely. Drain water column completely by opening ater column blow down valve. Drain water column gauge glass completely from ottom water column gauge cock. Drain injector and injector piping completely. rain water pump at cock under pump base. Drain oil from engine crank case. ttach caution tag to engine stating "crank case drained".

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

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

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

Store tires according to Service Regulations.

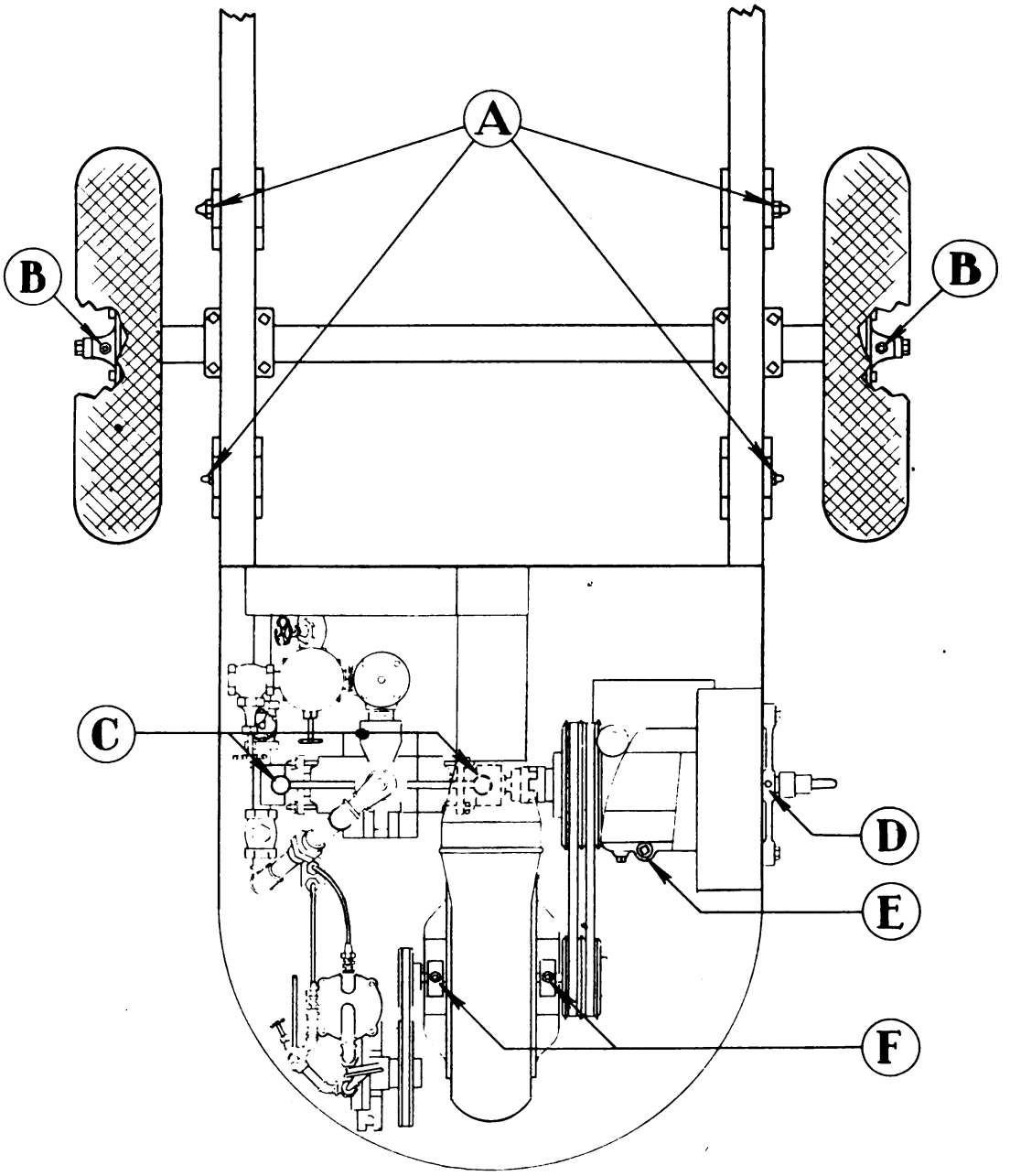


FIGURE 17

A. Spring Hangers and Spring Shackles,
Alemite Fittings.
Grease, General Purpose No. 2, U. S. Army
Specification 2-108, every 30 days while in service.
Grease when placing in storage.

B. Wheel Roller Bearings.
Grease, General Purpose No. 2, U. S. Army
Specification 2-108, every 30 days while in service.
Grease when placing in storage.

C. Two Water Pump Ball Bearings.
Use grease, General Purpose No. 2, U. S. Army
Specification 2-108
Fill grease cups when starting operation.
Grease sparingly. Turn down grease cups about two
turns every thirty days.

D. Hand Crank Oil Cup.
Oil using squirt can as required.

E. Briggs & Stratton Air-Cooled Gasoline Engine,
Use SAE 30 engine oil when temperature is $+32^{\circ}$ F., or over;
use SAE 10 when temperature is below $+32^{\circ}$ F. Drain and refill
after each twenty-five hours of operation.

F. Blower Shaft Ball Bearings.
Grease sparingly every 30 days.
Grease, General Purpose No. 2, U. S. Army
Specification 2-108.
Grease when placing in storage.

INDEX TO MAINTENANCE INSTRUCTIONS

695816 O - 46 - 3

THE BOILER

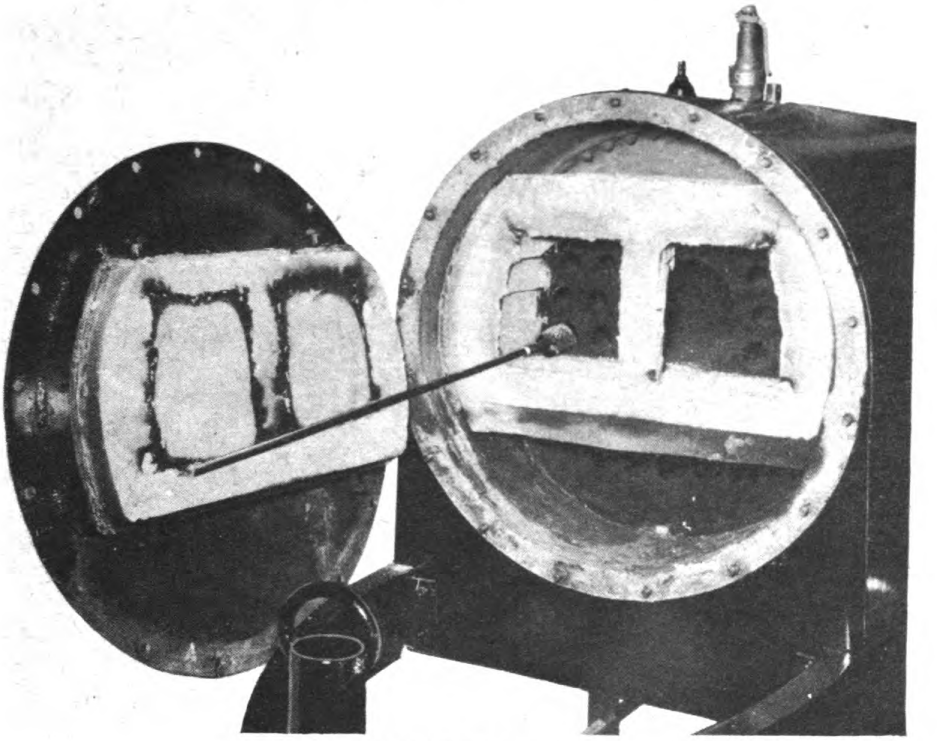


FIGURE IM

leaning Tubes

Tubes, or flues as they are sometimes called, in other types of oilers require daily or, in some cases, weekly cleaning. Because of the rinciple of firing the CLEAVER Tank Car Heater, the tubes do not require eriodic cleaning, and this work should not be attempted unless inspection as 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 2, Parts List)

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

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

With a screw driver, chisel or other prying instrument free head from ts mounting flange, leaving gasket attached to boiler shell flange if possi- le. When free all the way around, steady the head in position and remove he 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 22M. 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 boiler maker 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

If a 2-Car Heater, raise hood to operating position. If a 3-Car Heater, 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, Operator's Manual.

Disengage the union A, Figure 2M 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 2M).

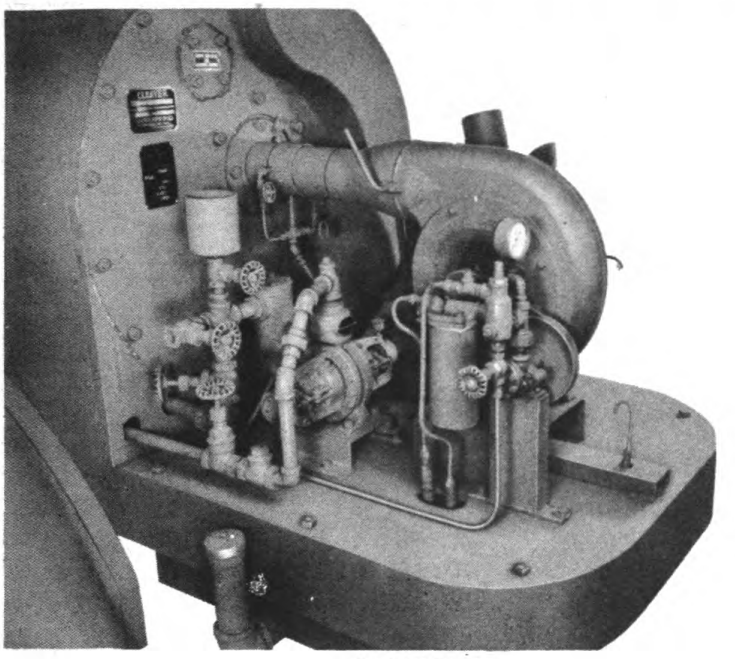


FIGURE 2M

The entire power plant assembly is then ready for removal from the machine after removing the five nuts from bolts E, Figure 2M.

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 2.

Remove all nuts from outer bolt circle attaching front head (firing end) to boiler shell (F, Figure 2M).

Remove all nuts from inner bolt circle, G, Figure 2M.

Remove four nuts attaching burner tube mounting ring (H, Figure 2M). Remove ring and set it aside.

Remove bottom steel baffle plate, Figure 3M.

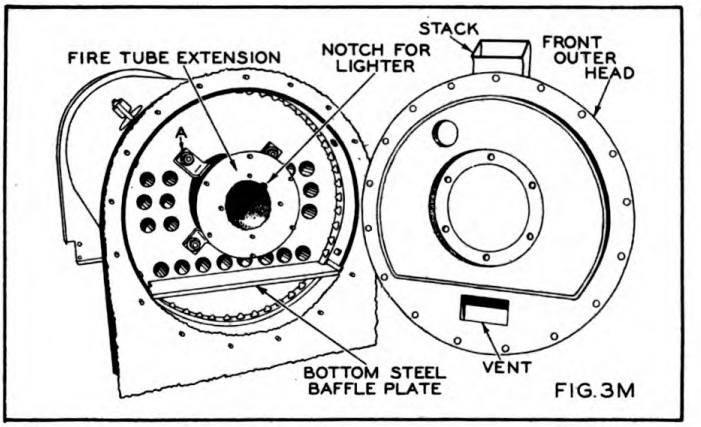


FIG. 3M

Remove fire tube extension, Figure 3M 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 4M, using precaution not to injure the tube shee

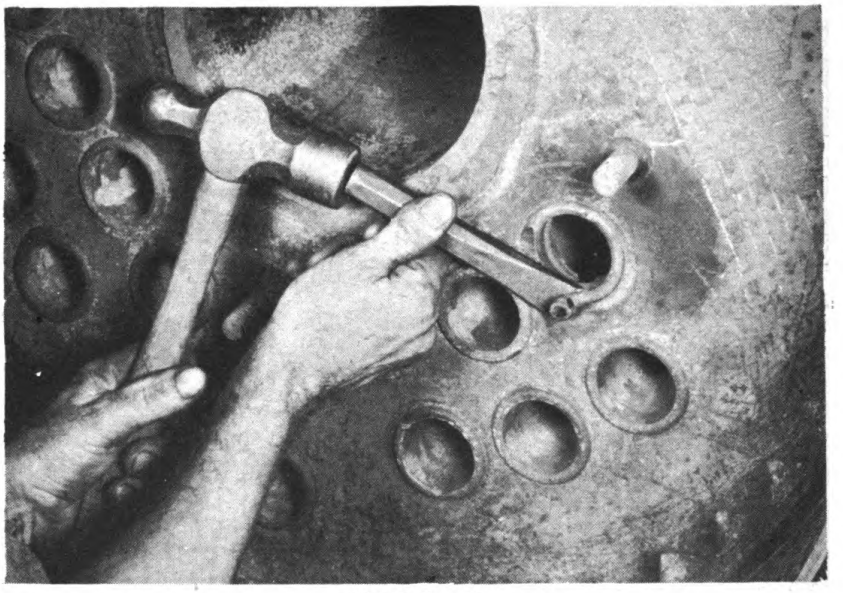


FIGURE 4M

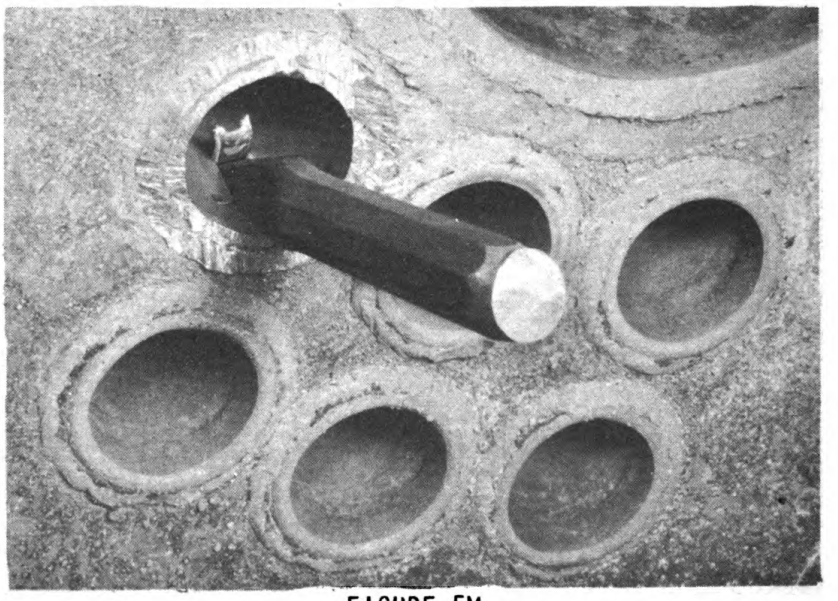


FIGURE 5M

After bead roll and weld has been removed, with a cape chisel cut a lit in both tube ends lengthwise as shown in Figures 5M and 6M.

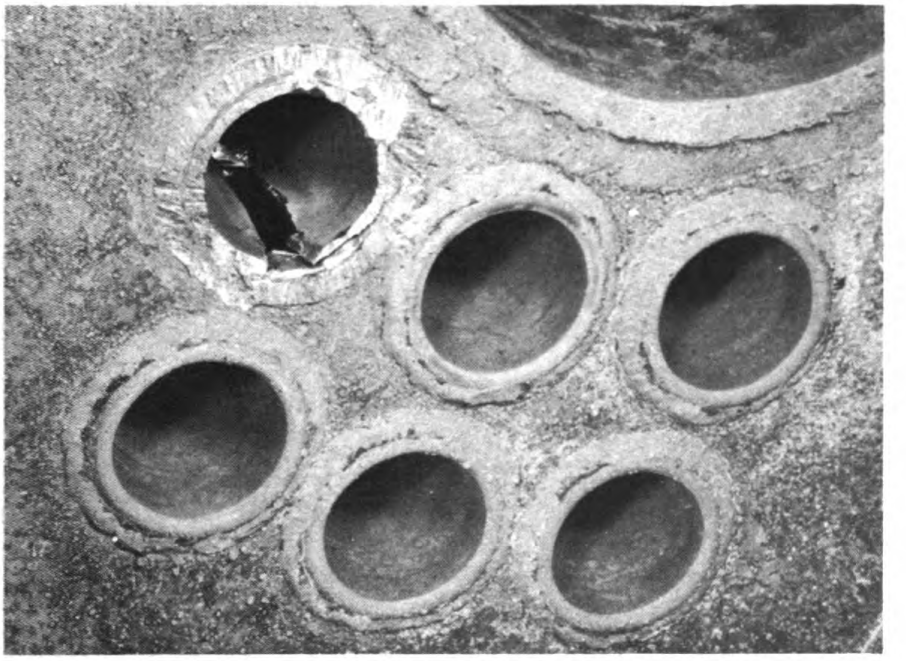


FIGURE 6M

With cape chisel turn in free ends of the tube as shown in Figure 7M.

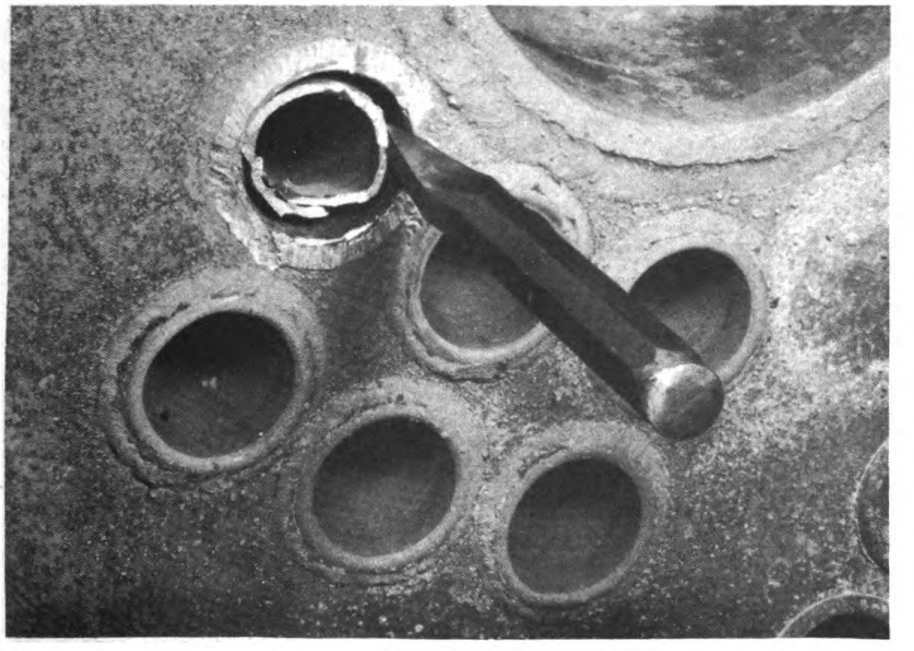


FIGURE 7M

Because of scale on water side of tube, it will be necessary to drive ut tube, shearing off scale as it passes through the tube sheet through which t is being driven. After tube is out, trim tube sheet hole with file, re- oving burrs as shown in Figure 8M.

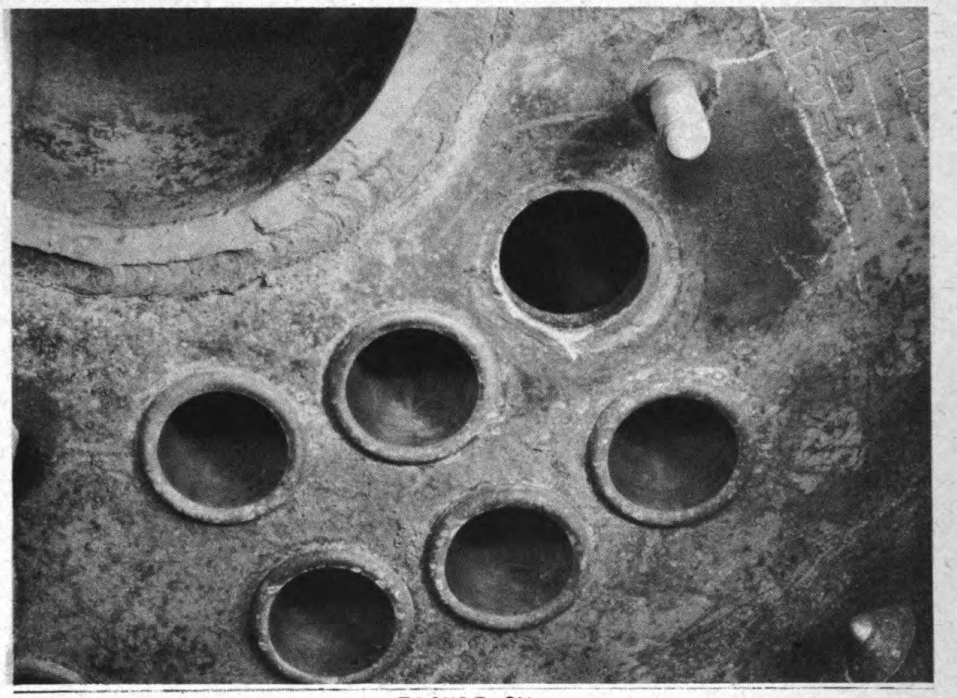


FIGURE 8M

Insert new tube which should extend from 1/4" to 3/8" beyond the outsides 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 9M.

NOTE: Figure 9M shows all tubes being replaced. The single flaring hammer blow on each has been applied to hold the tubes in place.

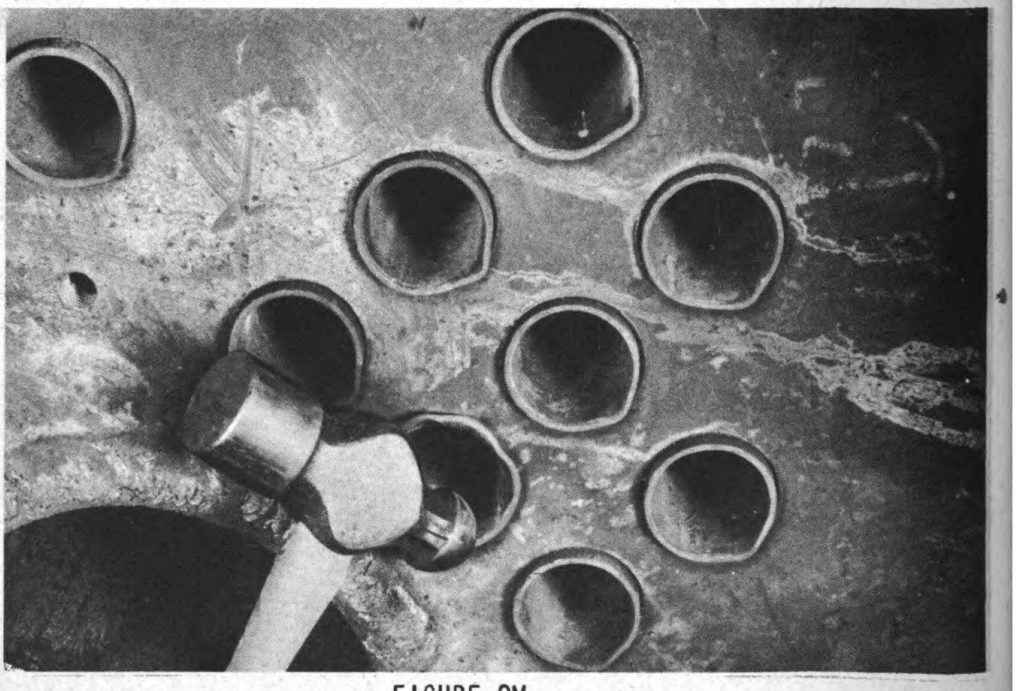


FIGURE 9M

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 10M.

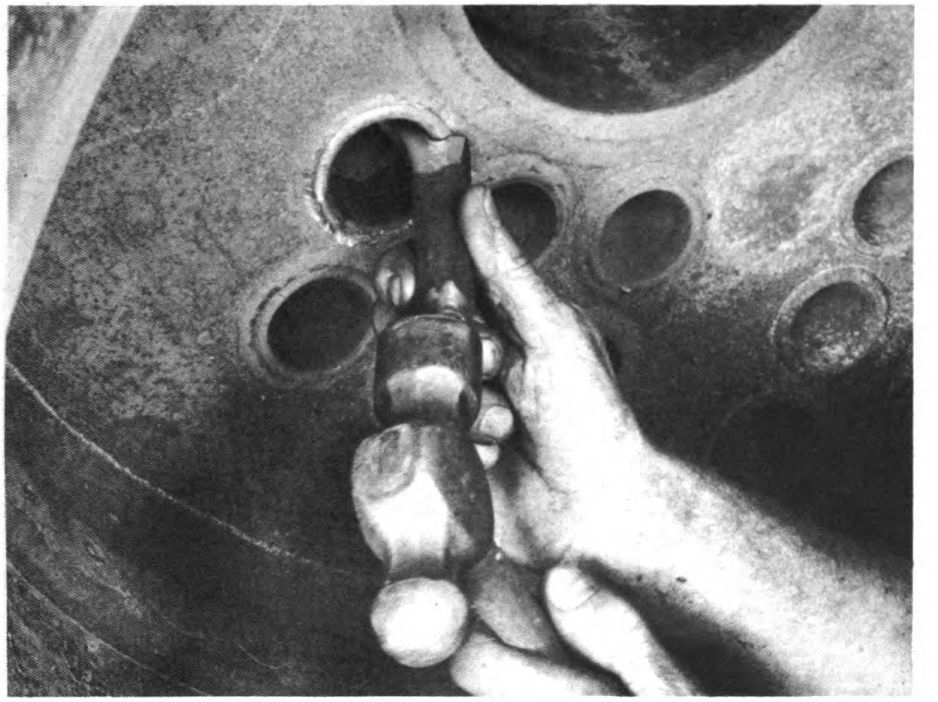


FIGURE 10M

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 11M.

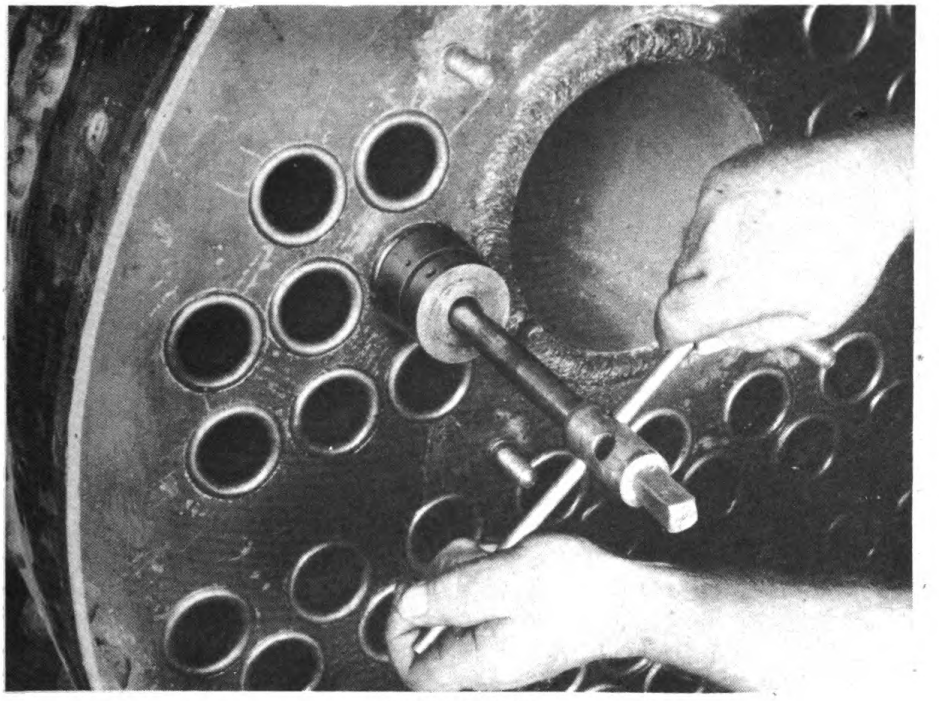


FIGURE 11M

A typical finished tube beading and rolling operation is shown is Figure 12M.

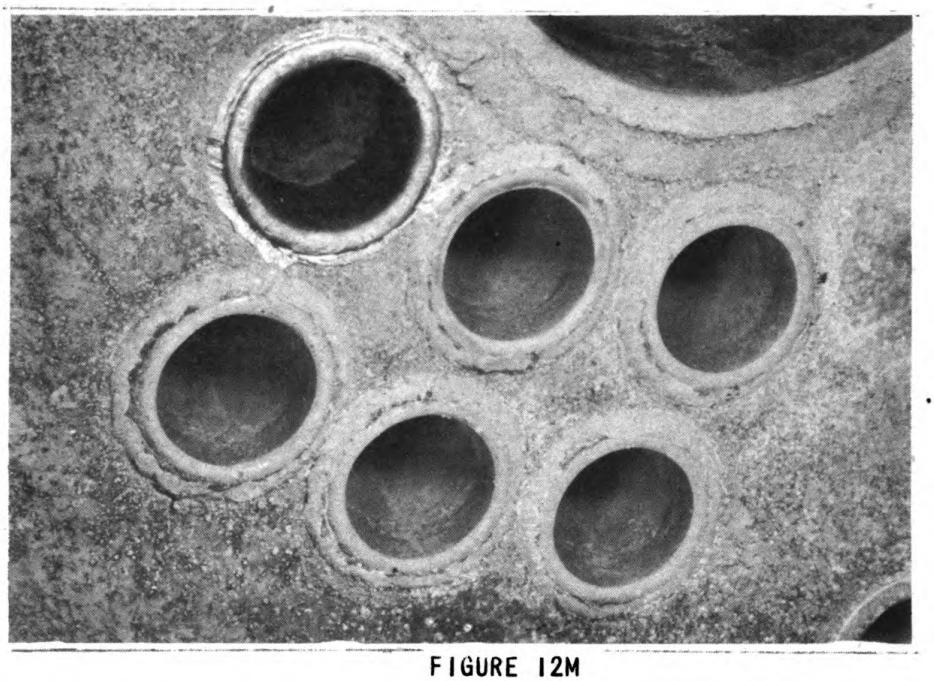


FIGURE 12M

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 2M, and the feed water discharge union A, Figure 2M. Arrange gasoline service to the engine.

Fill boiler with water completely as directed on Page 9, Operator's Manual.

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 guage.

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 2M to hold pressure in boiler and stop engine.

When test has been completed, detach unions A and B, Figure 2M and emove power plant assembly as previously directed.

Replace pop safety valve.

eassembly after Tube Replacement

ront Head (Firing End)

Replace bottom steel baffle plate (Figure 13M).

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

Prepare 1/16" asbestos paper gasket as shown in Figure 22M, brushing coat of oil and graphite on the boiler shell flange and on the outer head ıere the gasket is engaged.

Install gasket.

Replace oil burner air tube flange, Figure 2M.

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

Replace power plant assembly on chassis, attaching five nuts and lock ashers 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 trainer anf fuel oil relief valve.

Install oil burner inner assembly as directed on Page 20, Operator's anual.

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 uter head as directed under "Rebricking Boiler".

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 13M.

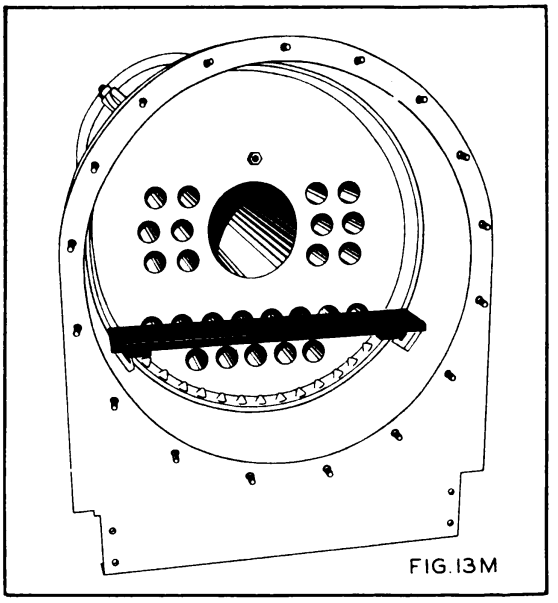


FIG.13M

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.

Preparing Cement for 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 14M.

With a trowel, apply a coat of refractory brick cement such as "Chico Brikset" to the side faces of bricks A and B, which adjoin the boiler flue sheet, the inner face of the boiler shell and the adjoining brick. Set them in place as shown in Figure 14M, pushing them as closely to the boiler flue sheet as possible.

Build up both sides, using bricks C, D, E and F as shown, packing the mixture of crushed fire brick and Portland cement between the bricks and boiler shell.

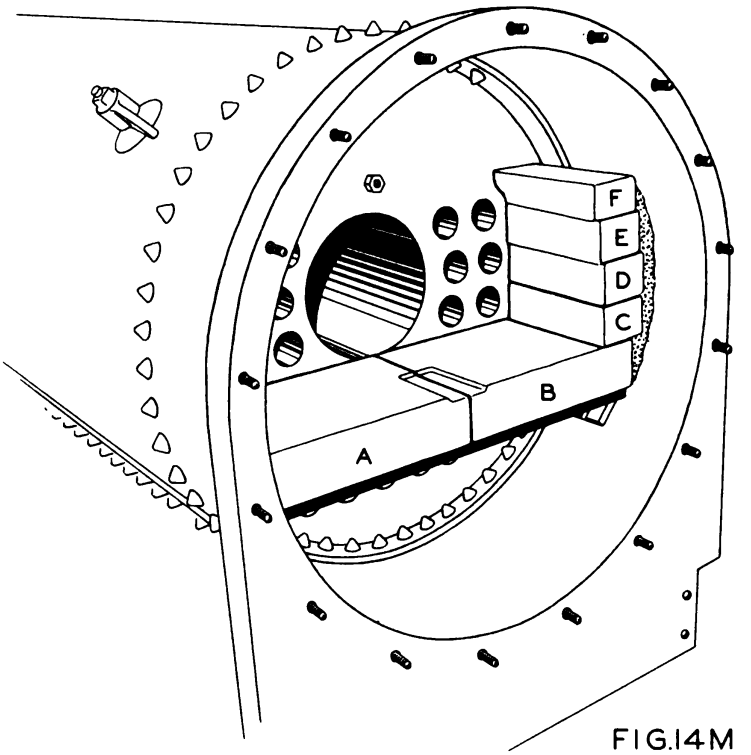


FIG.14M

Bricks C, D, E and F as shown in Figures 14M and 15M should also be given a trowel coat of high temperature plastic cement at the ends where they rest against the boiler flue sheet and on the surfaces contacting adjoining bricks and on the sides facing the boiler shell.

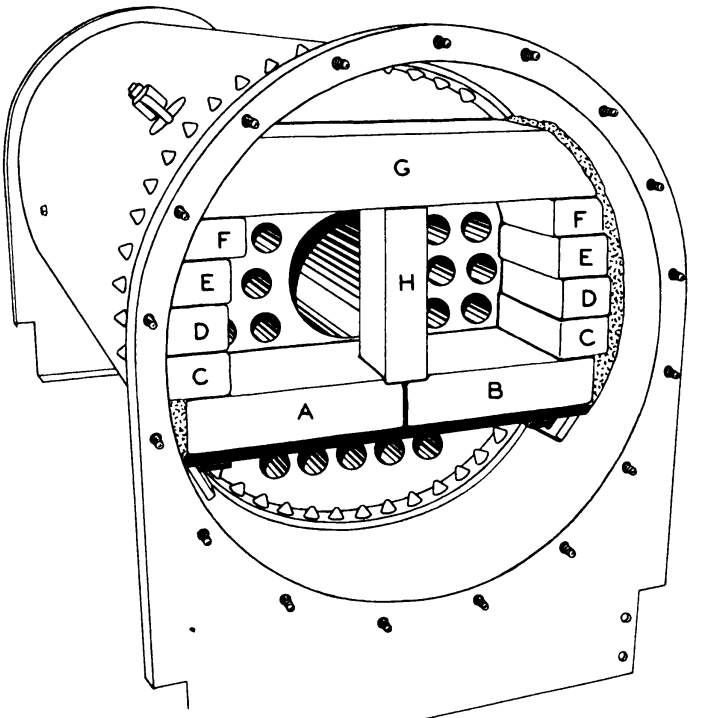


FIG.15M

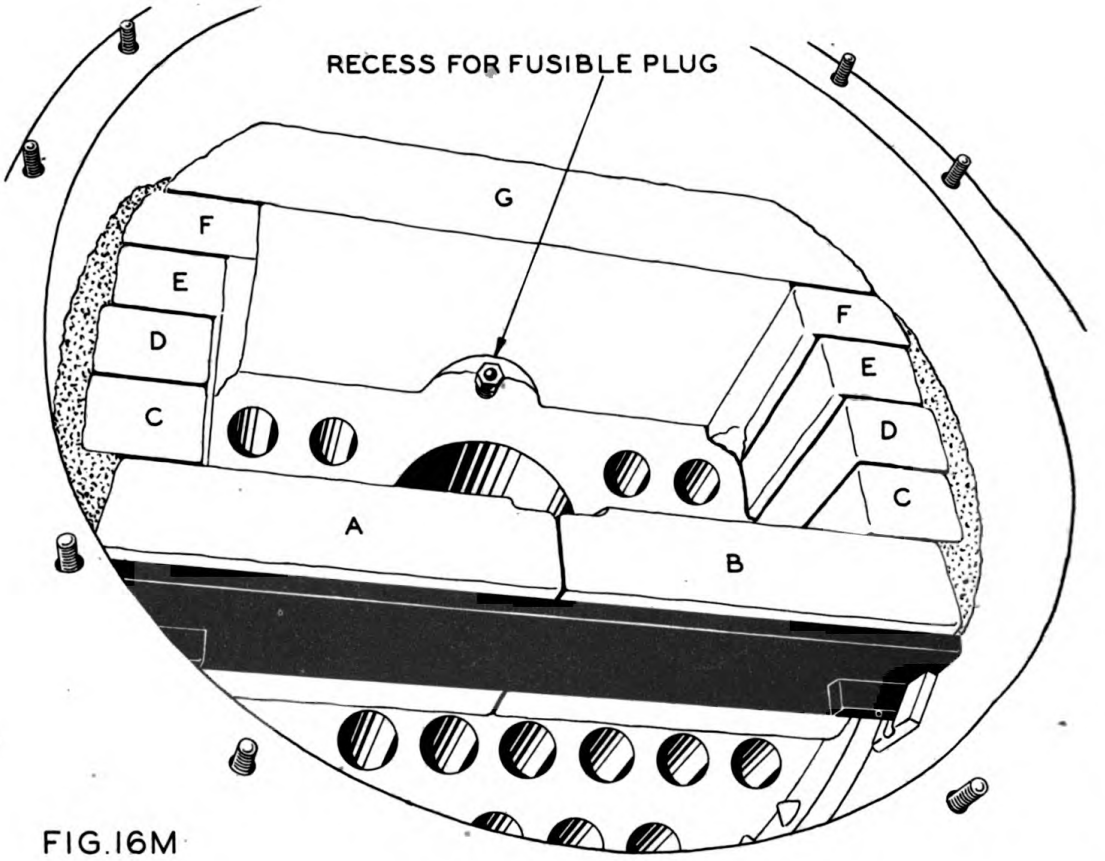


FIG.16M

With the bottom shelf and both side tiers in place, the vertical supporting brick H, Figure 15M, should be installed, sealing the joint between the lower shelf and vertical brick H also with a trowel coat of high temperature cement.

Apply a trowel coat of cement to the upper face of bricks F and set brick G in place, packing crushed fire brick and portland cement at the ends between the brick and the boiler shell, as shown in Figure 15M.

Notice that brick G 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 15M.

Rear Outer Head (Towing End)

Install the four machine bolts C, Figure 17M, 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 brick D in place, engaging the machine bolts C into the holes E drilled into the brick, setting them tightly as far down as they will go.

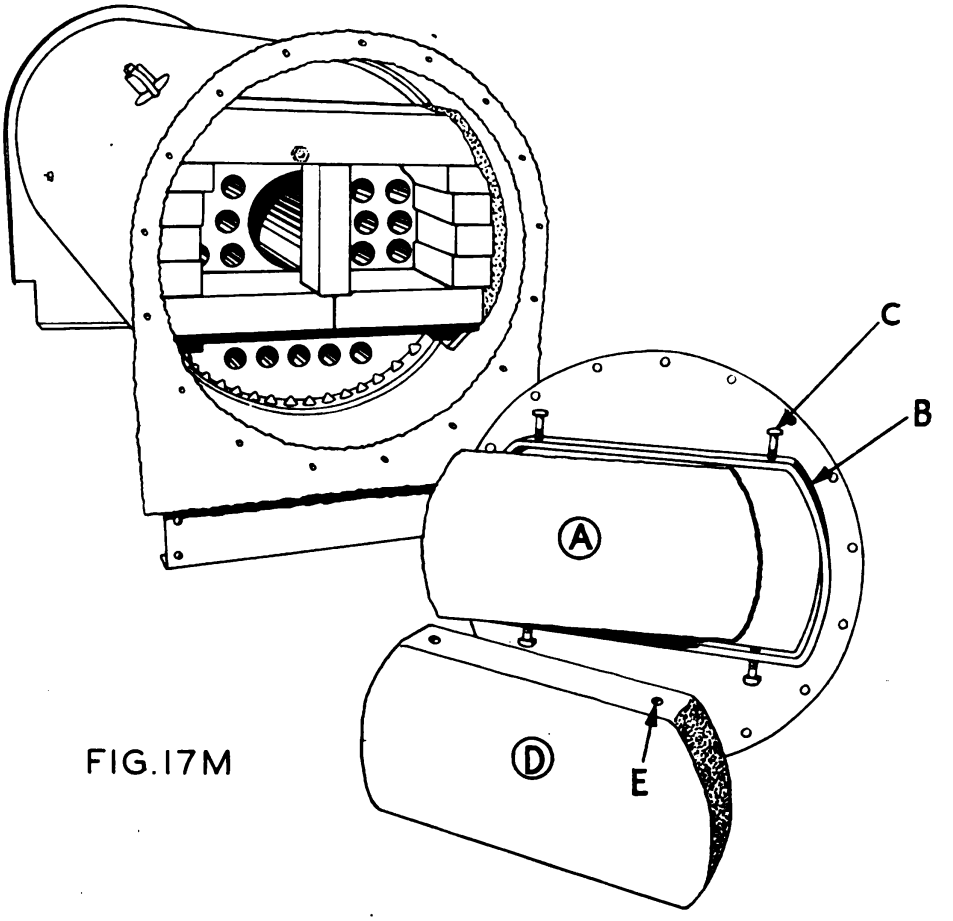


FIG.17M

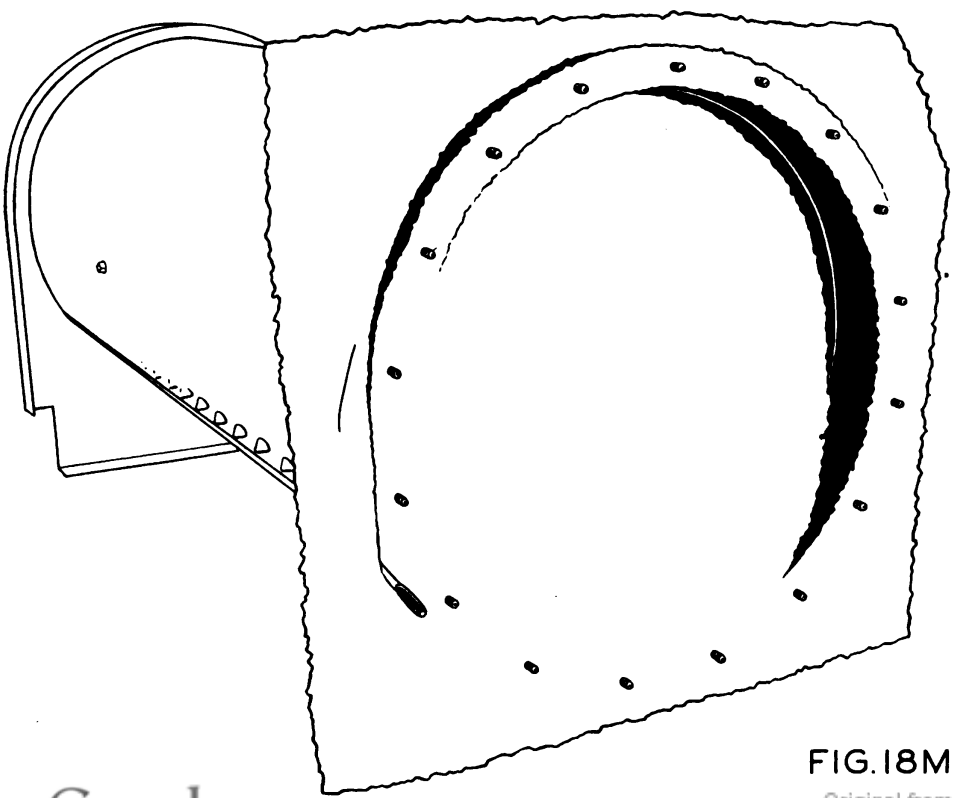


FIG.18M

Prepare the 1/16" asbestos paper gasket as shown in Figure 18M, 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 18M.

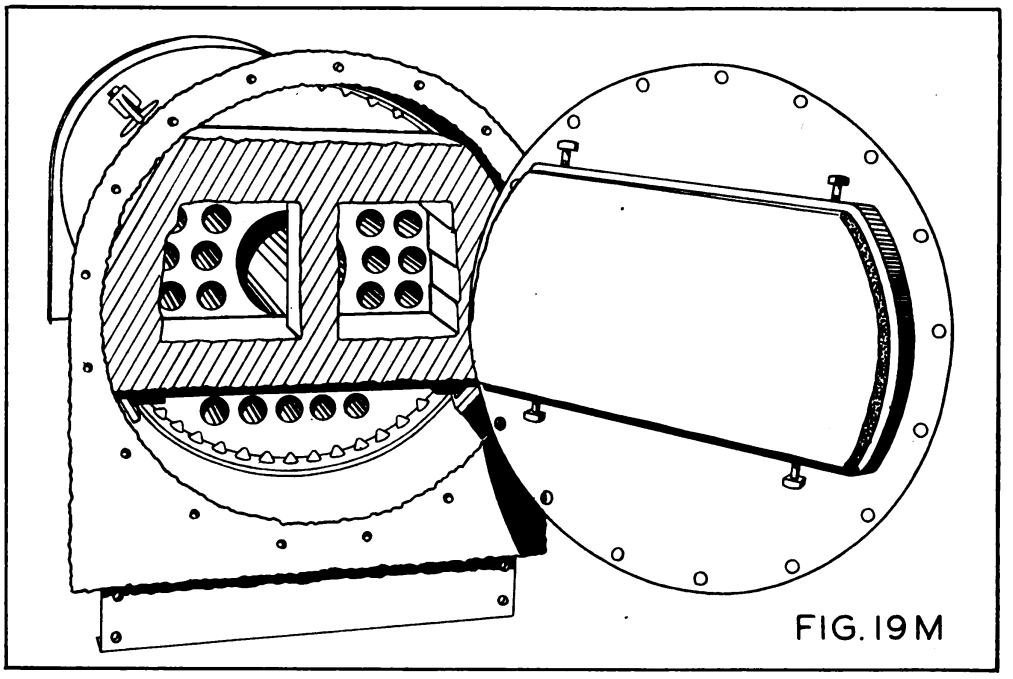


FIG. 19M

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 19M. This layer of asbestos cement provides an air-tight seal when the rear outer head is installed.

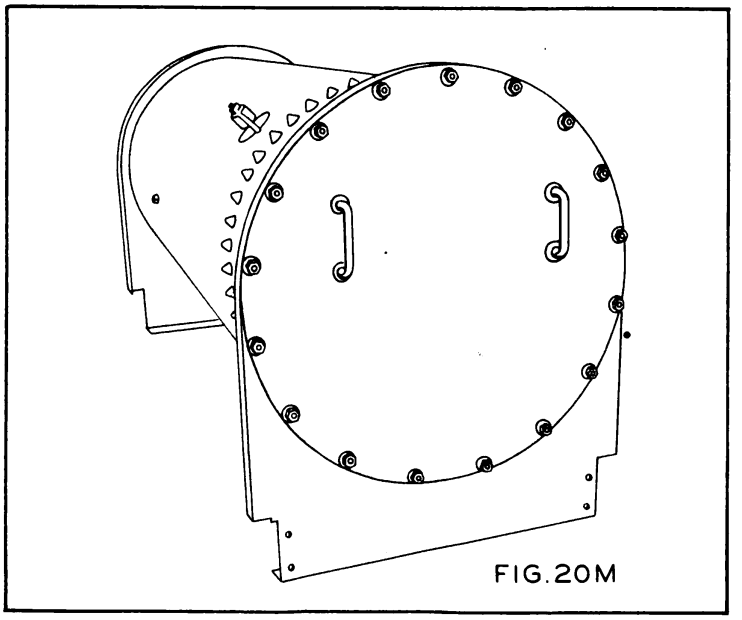


FIG. 20M

Install head and bolt down tightly, using washers and nuts as shown in Figure 20M.

The fire tube extension is the attachment which extends between the oiler flue sheet and the front outer head (firing end). It consists of a teel tube to which mounting brackets are welded to provide support on the oiler flue sheet and with a steel disc at the outer end which is provided ith studs for the attachment of the oil burner air tube mounting flange nd the front (firing end) outer head. The fire tube extension is lined ith refractory material at the factory, and in cases where replacements re 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 3.

Remove fire tube extension as directed on Page 4, and replace it with a new fire tube extension, noting carefully the proper position of the notch (Figure 22M) in the steel outer face of the fire tube extension which allows the insertion of the oil burner lighting torch.

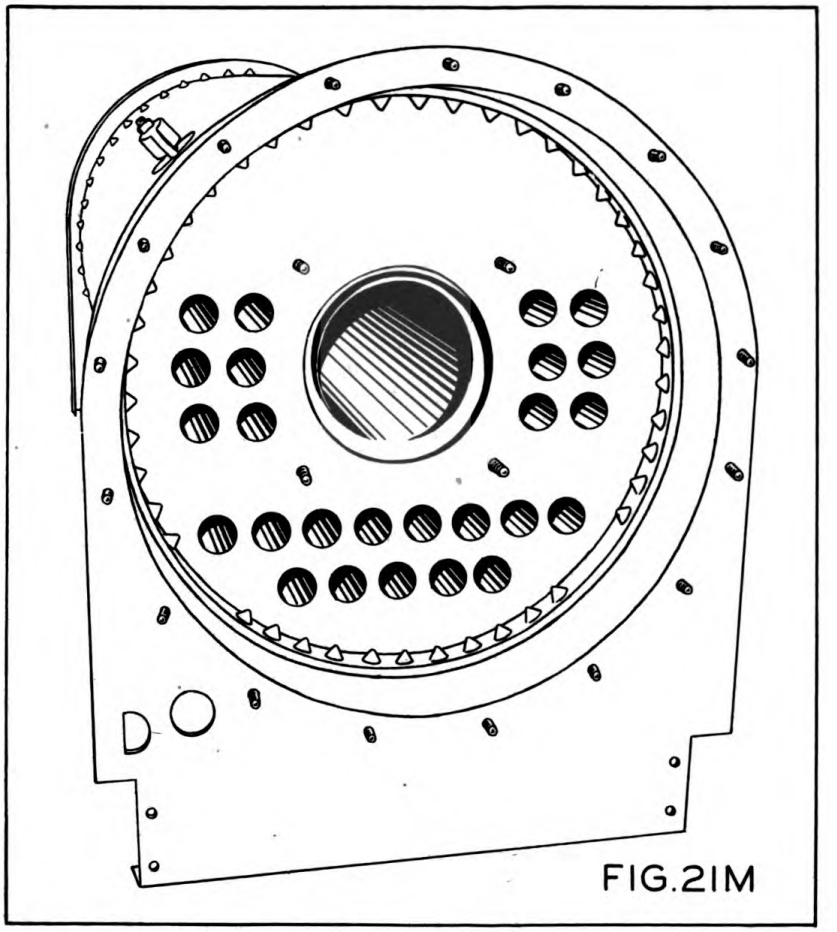


FIG.21M

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.

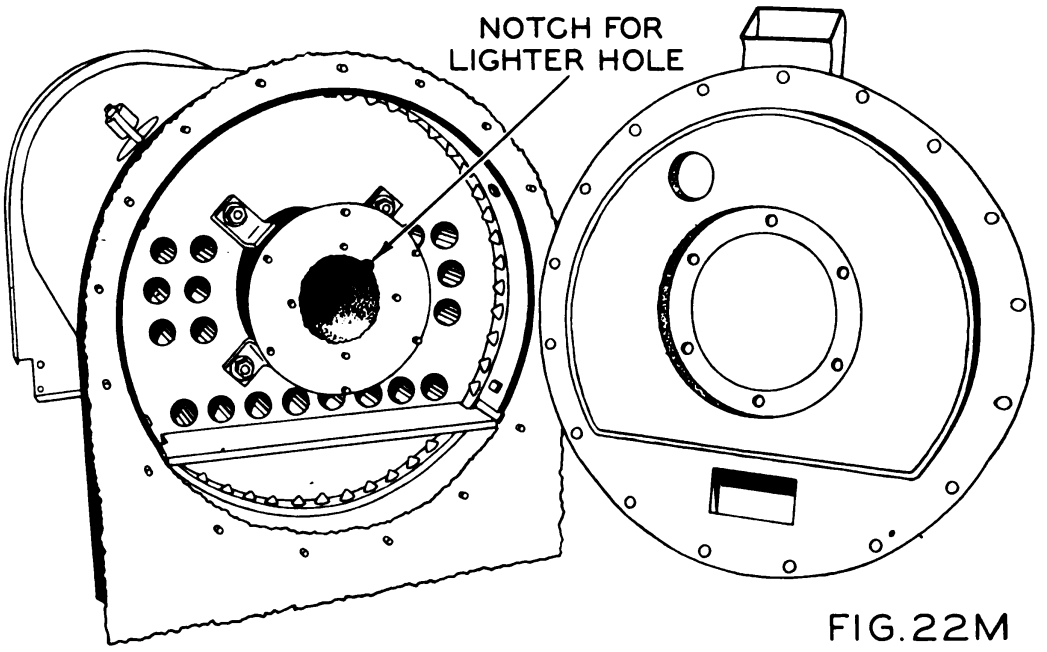


FIG.22M

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 22M. 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 23M, pulling down nuts snugly with washers between.

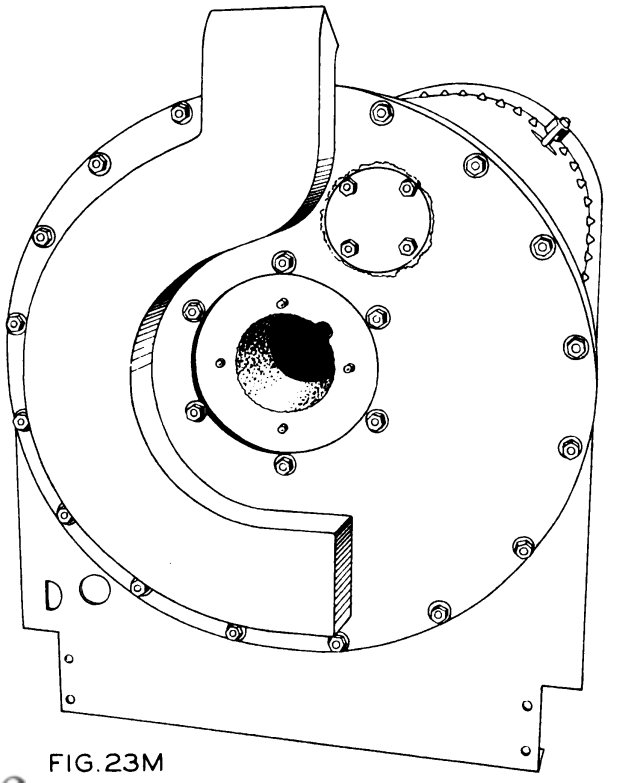


FIG.23M

Replace power plant assembly on chassis and install the six bolts and ıts attaching the base plate to chassis frame. Install copper tubing jumper ɔnnection between fuel oil tank and fuel oil filter. Install copper tubing ımper connection between fuel oil tank and fuel oil relief valve. See .gure 2M.

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

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

CLEANING WATER SIDE OF BOILER

CLEAVER Tank Car Heaters, because of their portable use, are sub-ɛcted to innumerable types of chemical combinations in feed water, and con-ɛquently no hard and fast rule may be applied to the treatment of feed water ɔ prevent the formation of scale on the tubes or the opposite case, which ɛsults in the pitting of the tubes. The important maintenance requirement ɜ to remove the scale and flush out the boiler as often as required as de-ɛrmined by inspection after removal of one or more of the four hand hole .ates.

Consult the nearest available authority on boiler water scale re-ɔval and proceed according to his recommendation after he has observed the ɔndition.

ınd Hole Plates

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

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

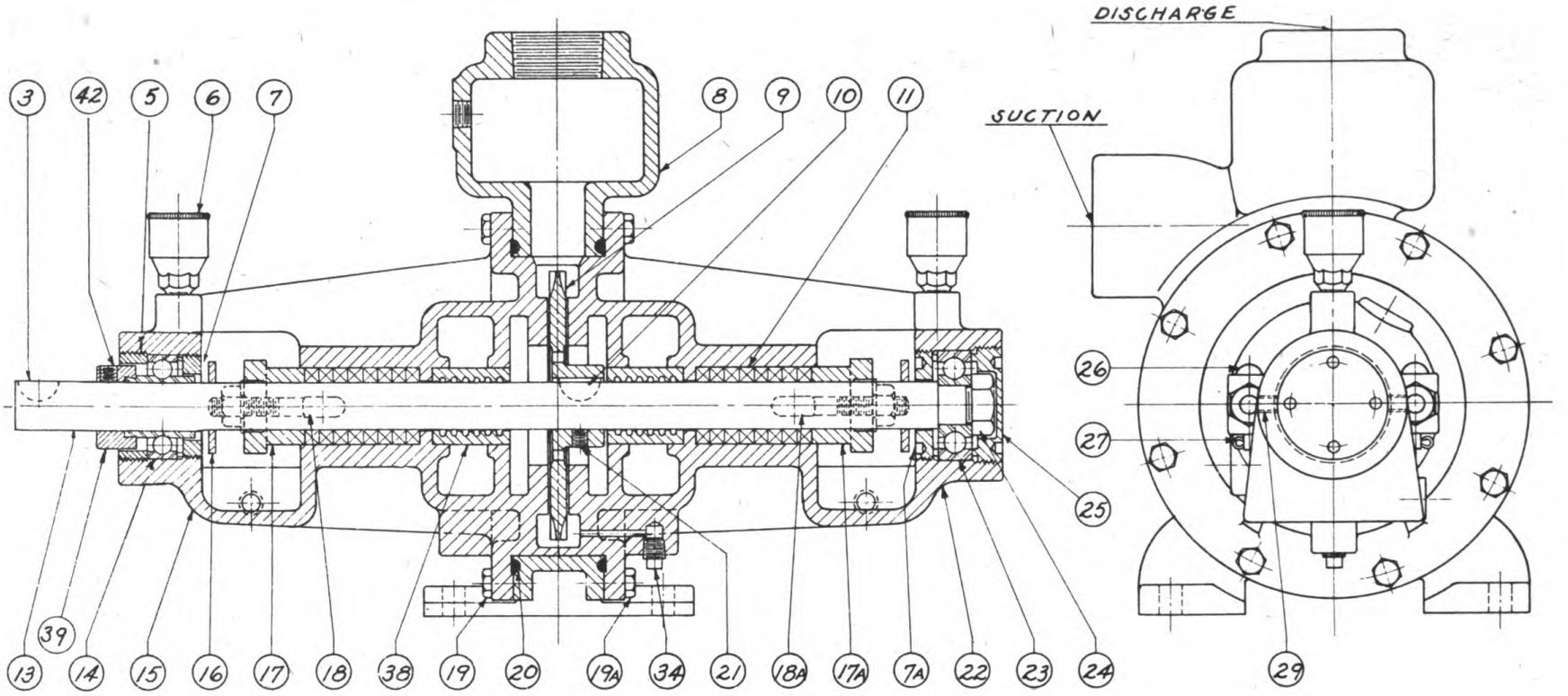
When replacing gaskets, apply a coat of graphite and oil to both ırfaces.

ɛplacing Fusible Plug

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

To replace, remove rear head as instructed on Page 1. For location f fusible plug, see Figure 16M.

THE FEED WATER PUMP



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

CLEAVER-BROOKS CO.
MILWAUKEE, WIS. U.S.A.

Follow operations in order given below and refer to cross section drawing on Page 18 for references.

Read instructions entirely before starting to disassemble.

1. Remove cover plate cap screws No. 19A.

2. Loosen adjusting nut set screws No. 29.

3. Remove adjusting nut No. 25.

4. Remove jam nut No. 24. (Requires socket type wrench)

5. Loosen packing gland eyebolts No. 18A and swing clear of gland No. 17A.

6. Cover plate No. 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 No. 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 hose 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 No. 25 partially. Make sure both adjusting nuts Nos. 25 and 7A are loose before starting the adjustment. Leave locknut #36 and adjusting nut No. 7 slightly loose.

2. Tighten adjusting nut No. 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 No. 25 just a fraction of turn or until you can rotate shaft freely. Now tighten up on adjusting nut No. 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 No. 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 No. 25 and No. 7A. Now readjust as per preceding instructions at operating temperature.

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

Should this treatment fail, ısmantle and clean the device as ɔllows:

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 24M.
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 nd reassemble, using Figure 24M as guide.

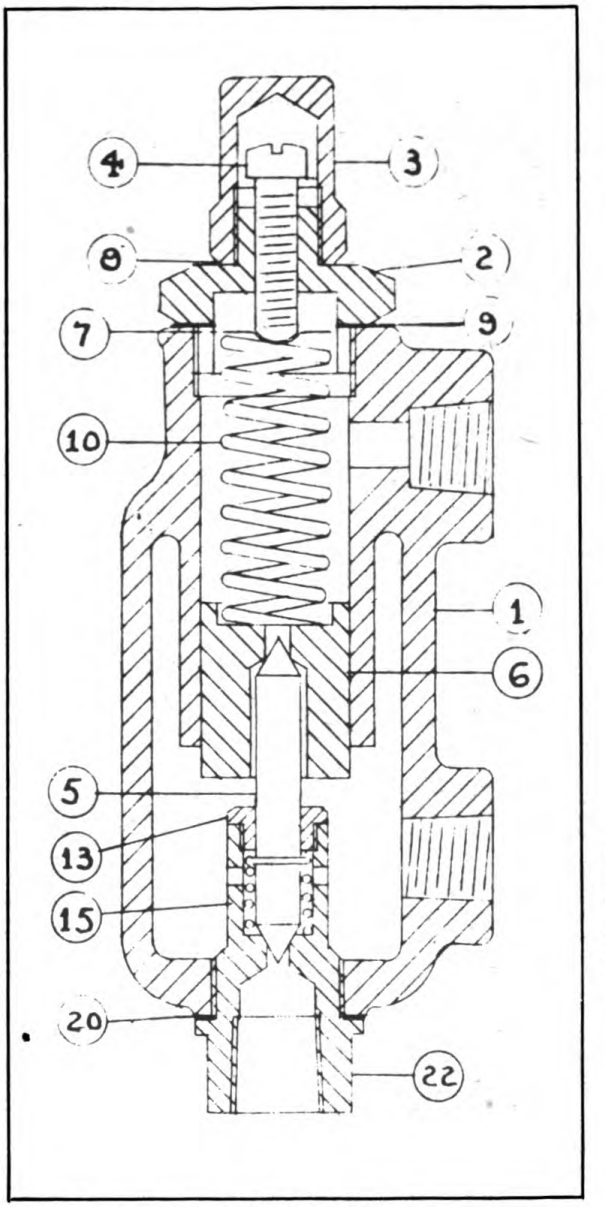


FIGURE 24M

Pumping Principle

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.

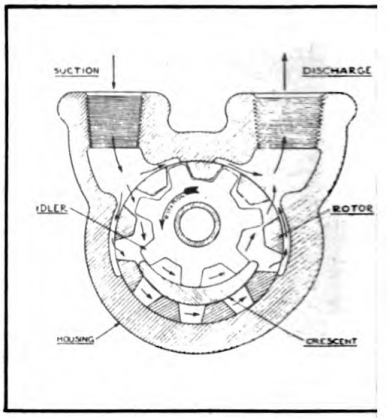


FIGURE 25M

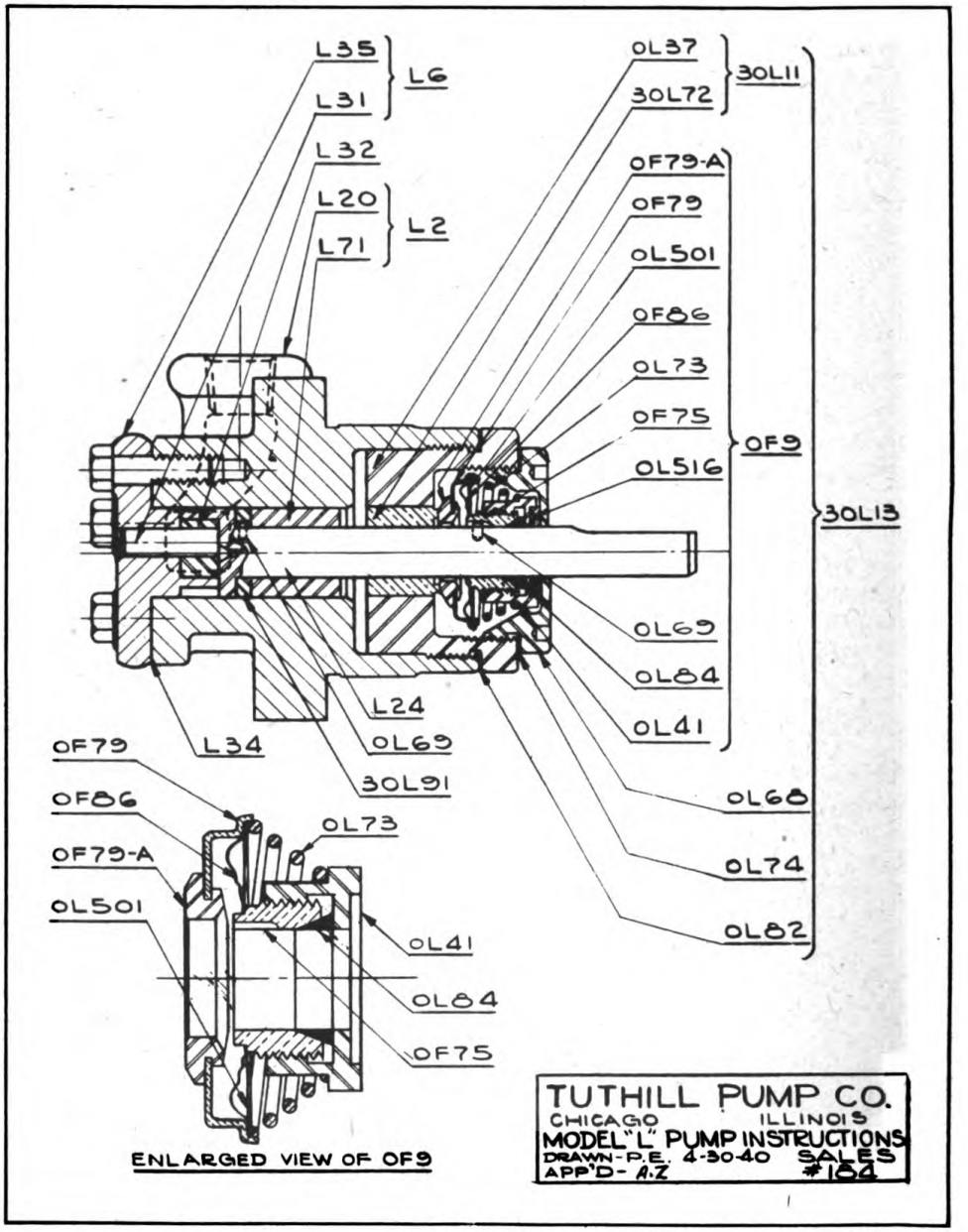


FIGURE 26M

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

To remove the seal assembly, 30L13, first place the pump in a vise so iat one jaw grips across the two ports. Do not squeeze too tightly as this ll 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 i the shaft, loosen nut 0L41 in the vise - being careful not to deform the it 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 irr raised on the shaft where the pin key enters the shaft. If so, a small le should be used to remove this burr.

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

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

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

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

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

The seal may be reinstalled or replaced by reversing the pre- iure as outlined above. Put a few drops of clean lubricating oil on e seal seat before replacing 0F9 assembly. When tightening the nut 41, it is necessary to create about 7# pressure on this nut toward the al. This is equivalent to compressing the seal .040".

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

Fuel Oil Burner

Cleaning fuel oil nozzles is fully discussed on Page 19 of the Operator's Manual 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 27M.

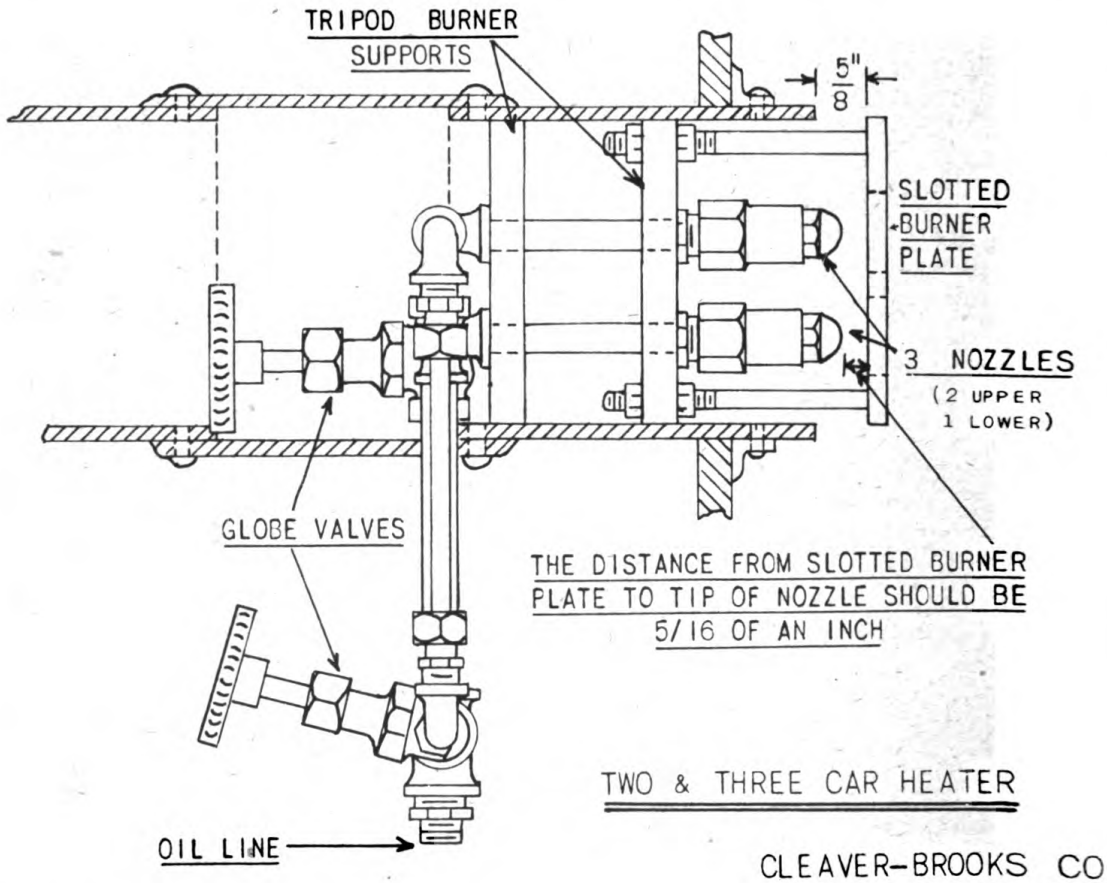


FIG. 27M SIDE VIEW

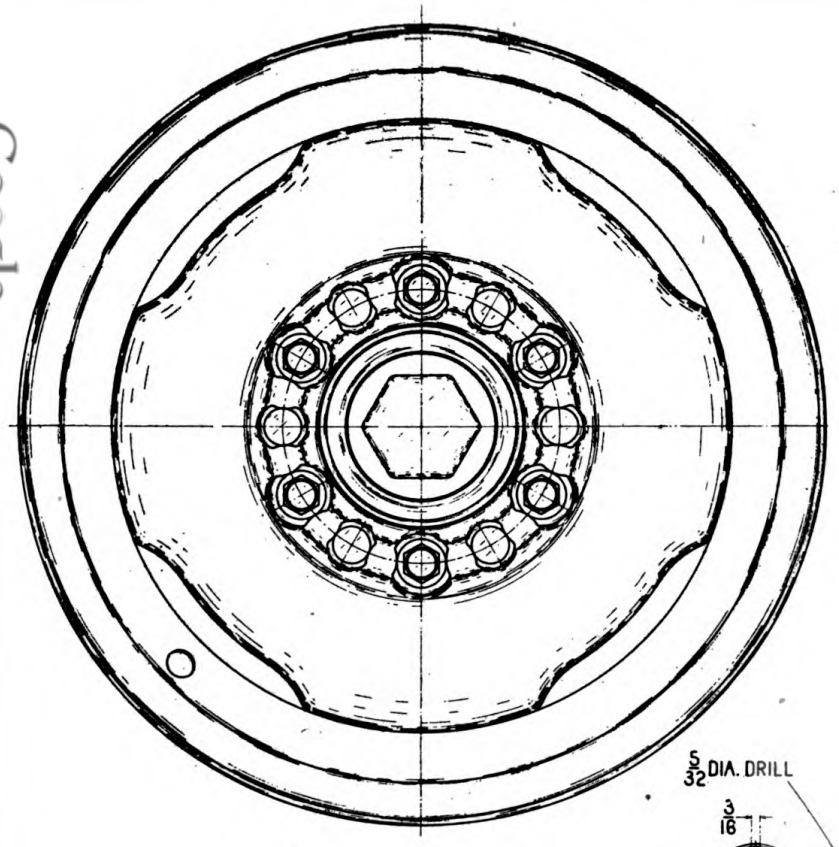
CHASSIS AND RUNNING GEAR

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

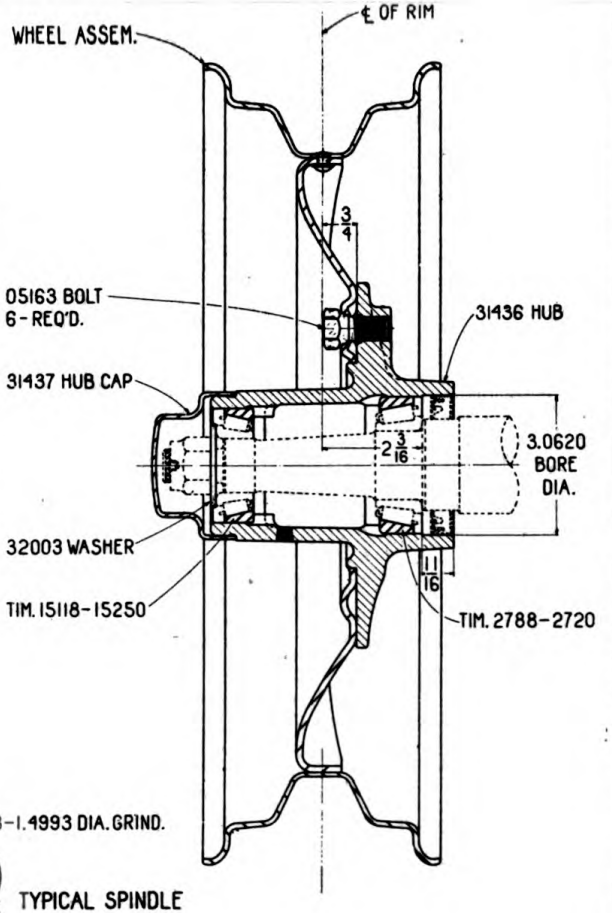
Figure 28M shows the arrangement of the wheel, axle and bearing assembly ...heels and bearings are removed and reassembled as instructed on Page 23 ...ator's section.



NOTE:

PART NUMBERS SHOWN ARE THOSE OF MANUFACTURER.

CONSULT PARTS SECTION FOR CORRECT CLEAVER-BROOKS PART NUMBER



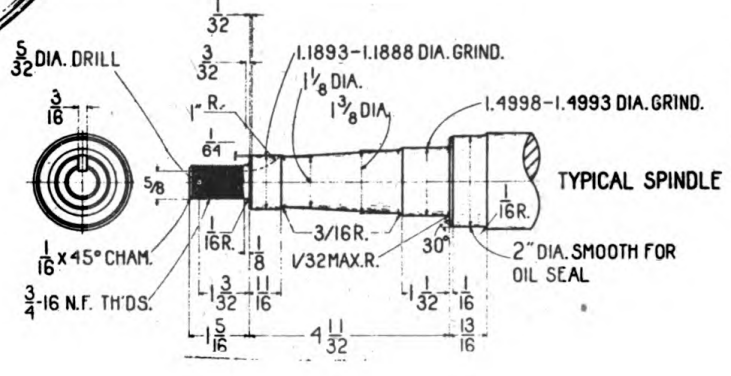


FIG. 28M

INDEX TO PARTS LIST

ACCESSORY LIST

CLEAVER TWO CAR HEATER

C-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
102020	Wheel	Motor Wheel Corp.	Lansing, Mich.	31677
102016	Wheel Bearing (Inner)	Timken Roller Bearing Co.	Canton, Ohio	2788
102018	Wheel Bearing Cup (Inner)	Timken Roller Bearing Co.	Canton, Ohio	2720
102017	Wheel Bearing (Outer)	Timken Roller Bearing Co.	Canton, Ohio	15118
102019	Wheel Bearing Cup (Outer)	Timken Roller Bearing Co.	Canton, Ohio	15250
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 Z Type 304340
109137	Spark Plug	Champion Spark Plug Co.	Toledo, Ohio	6M (Briggs & Stratton No. 7BC)
109185	Gasoline Tank	Wisconsin Motor Corp.	Milwaukee, Wis.	WE-106
912001	V-Belt	L. H. Gilmer Co.	Philadelphia, Pa.	3300

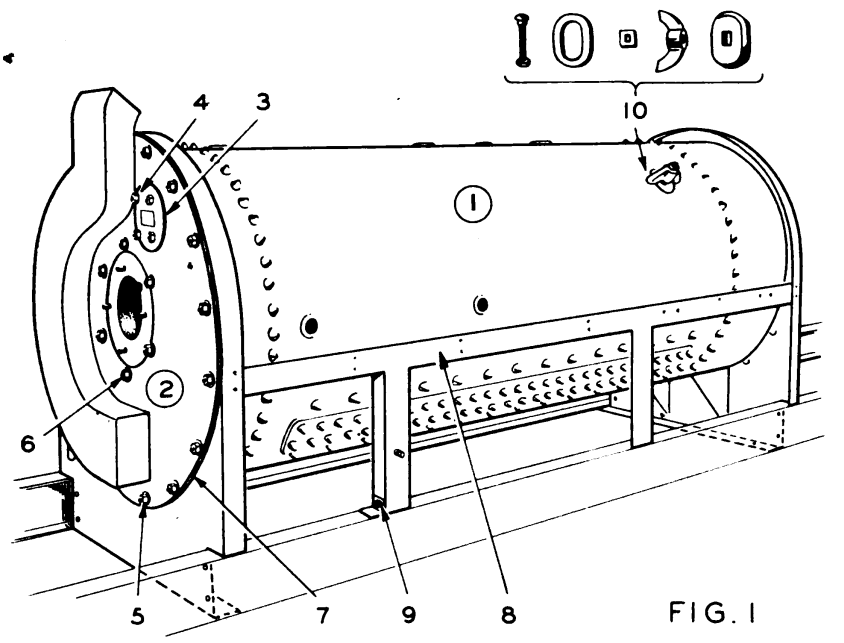


FIG. 1

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
1	101013	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	101014	See Reference No. 19, Page 3.	
3	101008	Plate, inspection hole, with gasket	1
4	902001	Stud, 1/2"x 1-1/2"	4
	901028	Nut, brass, hex., 1/2"	4
5	*	Bolts, machine, sq. hd., 1/2"x 1-1/2" (front and rear heads)	36
	901028	Nut, brass, hex., 1/2"	36
	*	Washer, wrought iron, 1/2"	36
6	901028	Nut, brass, hex., 1/2"	6
	*	Washer, wrought iron, 1/2"	6
7	901027	Gasket, 1/16" asbestos paper - 36" x 36"	1
8	105023	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	*	Bolt, 3/8 x 1" and nut	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
	*	Bolt carriage, hand hole, 5/8 x 4"	4
	*	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

* Common mill supply item.

FRONT HEAD (Firing End)

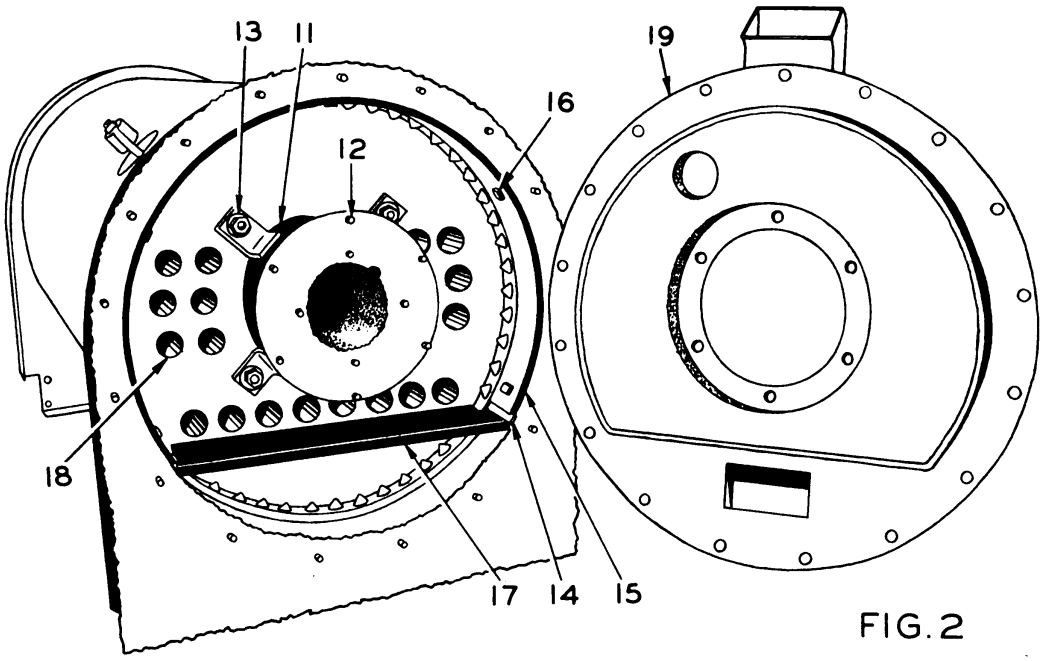


FIG. 2

REAR HEAD (Towing End)

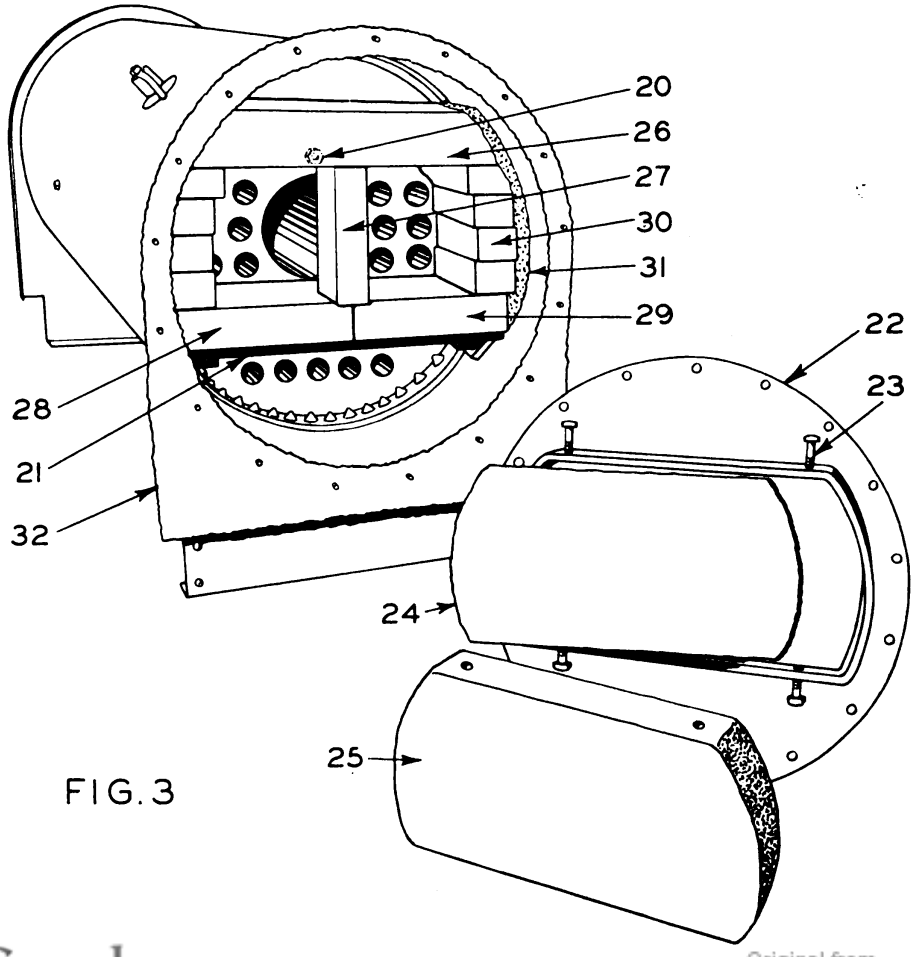


FIG. 3

FRONT HEAD (Firing End) See Figure 2

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
11	101001	Extension, fire tube, with refractory lining. (Not available without refractory lining.)	1
12	902001	Studs, 1/2"x 1-1/2"	10
13	902002	Stud, 5/8"x 2-1/4"	4
	*	Nut, 5/8", hex., brass	4
	*	Washer, 5/8", wrought iron	4
14	101015	Liner, asbestos, 1/4 x 4 x 60"	1
15	101016	Liner, steel, circular, 1/4 x 4 x 60"	1
16	*	Bolt, sq. hd. mach., 1/2 x 3/4"	5
	*	Nut, sq. hd., iron, 1/2"	5
17	101017	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	101014	Head, front firing end assembly with stack and refractory attached. (Parts comprising assembly not available separately)	1

REAR HEAD (Towing End) See Figure 3

20	901001	Plug, fusible, 1/2" outside type, Crane Co., #4752	1
21	101018	Support, steel, rear brick baffle 5/8" x 5" x 26"	1
22	101019	Head, rear outer assembly with 1/4" asbestos insulator, refractory tile, 4 tile retainer bolts & 2 outer handles	1
23	*	Bolt, 5/8 x 1-3/4", sq. hd., mach. (fire tile holding)	4
24	105024	Insulator, 1/4" asbestos, (between fire tile and outer head)	1
25	105025	Tile, fire, rear outer head cut to fit, (4 x 14 x 27", raw)	1
26	105026	Tile, fire, upper arch, cut to fit (4 x 9 x 27", raw)	1
27	105017	Brick, vertical, arch support, 2-1/2 x 4-1/2 x 13-1/2"	1
28	105027	Tile, fire, lower baffle, cut to fit (3 x 9 x 13" raw, left in direction of tow)	1
29	105028	Tile, fire, lower baffle, cut to fit (3 x 9 x 13" raw, right in direction of tow)	1
30	105020	Brick, fire, set, 8 pieces cut to fit, includes: 6 - 9" x 3-1/2" x 2-1/2" 2 - 9" x 4-1/2" x 2"	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	901027	Gasket, 1/16" asbestos paper, 36" x 36"	1

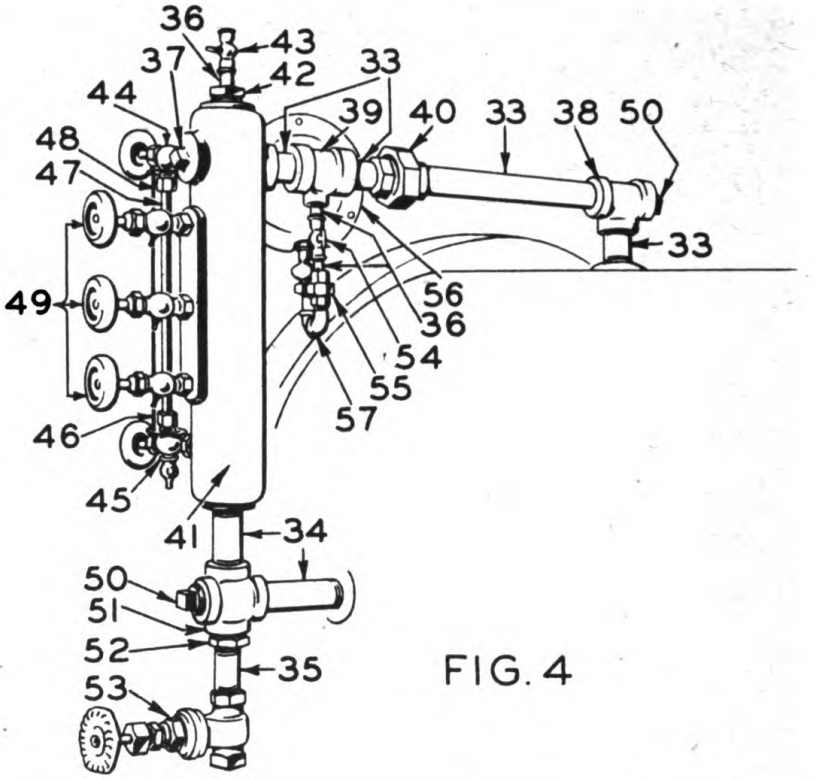


FIG. 4

BOILER BLOW-DOWN

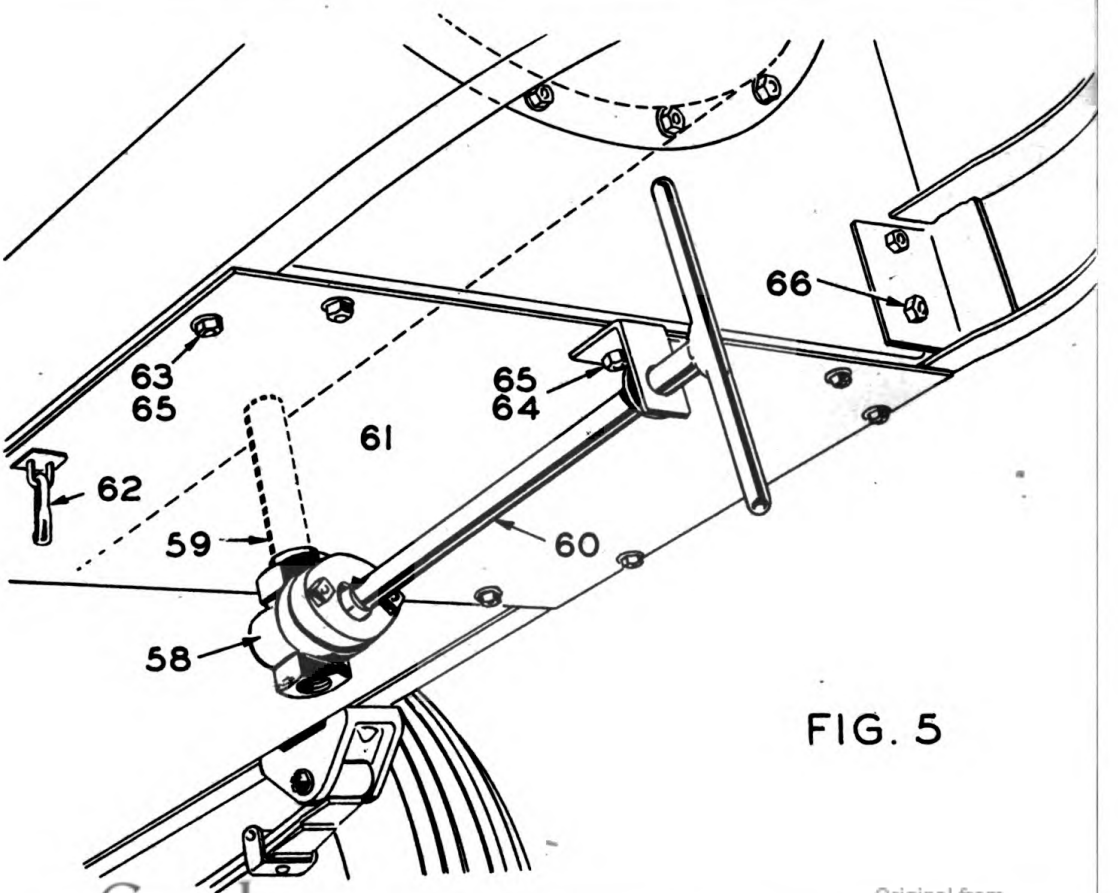


FIG. 5

WATER COLUMN (See Figure 4)

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
33	*	Nipple, 1", extra heavy, black	
34	*	Nipple, 1" x 4-1/2", brass, extra heavy	
35	*	Nipple, 3/4" x 3", brass, extra heavy	
36	*	Nipple, 1/4" x 1-1/2", extra heavy, brass	
37	*	Plug, 1", black iron	
38	*	Tee, 1", extra heavy, malleable	1
39	*	Tee, 1" x 1" x 1/4", extra heavy	1
40	*	Union, 1", extra heavy, ground joint	1
41	901008	Water Column, cast steel, 250#	1
42	*	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	*	Plug, solid brass, 1"	2
51	*	Cross, 1", extra heavy, brass	1
52	*	Bushing, 1" x 3/4", brass	1
53	904028	Valve, gate, 3/4", 300#	1
54	901016	Cock, brass, gauge, 1/4"	1
55	*	Union, 1/4", brass, extra heavy	1
56	907002	Gauge, steam, 4-1/2", 200#, U.S. Gauge Co.	1
57	*	Street Elbow, brass, 1/4", extra heavy	2

BOILER BLOW-DOWN (See Figure 5)

58	104001	Valve, blow-off, 1", extra heavy, 250# screwed, asbestos packed, Judson Governor Co., Rochester, New York	1
59	*	Nipple, 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	*	Bit Snap	1
63	*	Bolts, machine, 3/8 x 1"	8
64	*	Bolt, machine, 3/8 x 1-1/4"	1
65	*	Nuts, 3/8", hex.	9
	*	Washer, lock, 3/8"	9
66	*	Bolts, machine, 1/2 x 1-1/4"	8
	*	Nut, 1/2", hex.	8
	*	Washer, lock, 1/2"	8

* Common mill supply item. Nipples vary in length. Check required part for exact length.

FUEL OIL ASSEMBLY

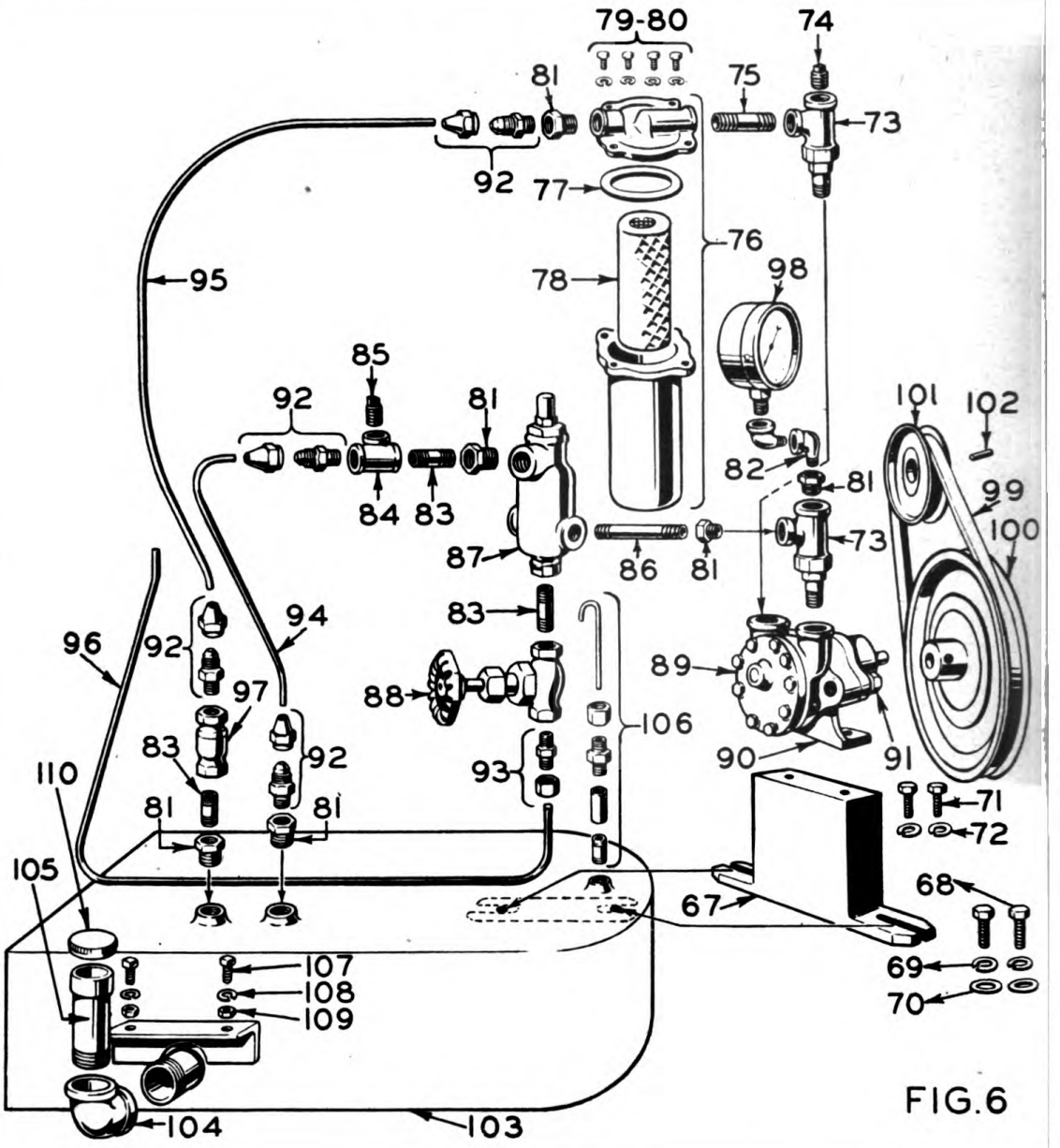


FIG.6

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
67	113002	Base Block, fuel oil pump	1
68	*	Cap Screw, 3/8 x 1-1/2"	2
69	*	Washer, lock, 3/8"	2
70	*	Washer, flat, 3/8"	2
71	*	Cap Screw, 5/16 x 1"	2
72	*	Washer, lock, 5/16"	2
73	103011	Union Tee, 3/8", black, ground joint	2
74	*	Plug, 3/8", black, iron	1
75	*	Nipple, 3/8 x 1-1/4", 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

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
79	*	Cap Screw, 1/4" x 1"	4
80	*	Washer, 1/4"	4
81	*	Bushing, 3/8" x 1/4"	6
82	*	Street Ell, 1/4", 90°, black	2
83	*	Nipple, 1/4", close	3
84	*	Tee, 1/4", black malleable	1
85	*	Plug, 1/4", black	1
86	*	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	*	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	*	Tubing, copper, 3/8" O.D., soft, .049" wall, 14-1/2" (discharge, relief valve to tank)	1
95	*	Tubing, copper, 3/8" O.D., soft, .049" wall, 14-1/2" (Suction, tank to filter)	1
96	*	Tubing, copper, 3/8" O.D., soft, .049" wall, 50" (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	*	Elbow, 2", black malleable	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	*	Bolt, fuel oil tank mounting, 1/2 x 1-1/2"	4
108	*	Washer, lock, 1/2"	4
109	*	Nut, 1/2", hex.	4
110	113007	Cap, fuel oil filler, with chain	1

* Common mill supply items. Nipples vary in length. Check required part for exact length.

INNER BURNER ASSEMBLY

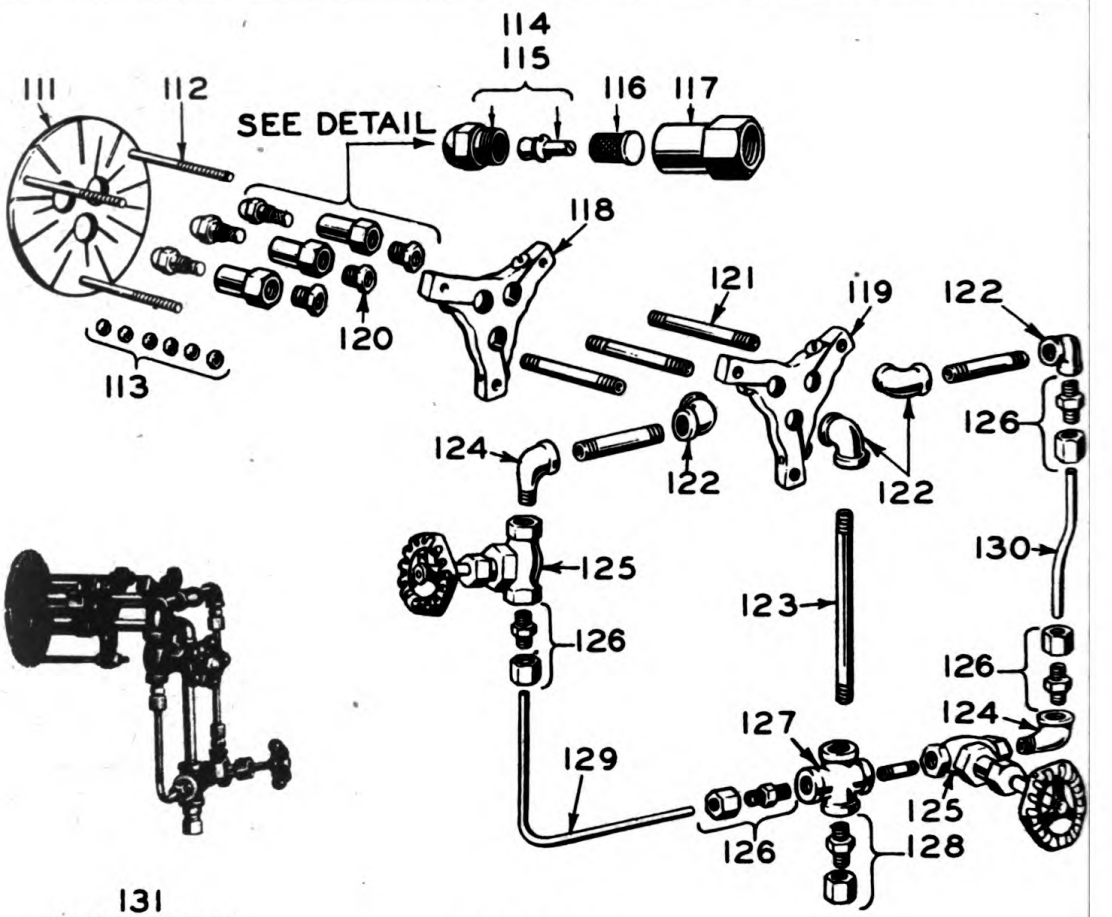


FIG. 7

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
111	103002	Plate, diffuser, with studs	1
112	103010	Stud, diffuser plate holding	3
113	*	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	903036	Bushing, brass, 1/4" x 1/8"	3
121	903037	Nipple, brass, ex. heavy, 1/8" x 3"	3

Continued on Page 9.

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
122	903038	Elbow, brass, 1/8"	4
123	903039	Nipple, brass, ex. heavy, 1/8"x 2-1/2"	1
124	903040	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

* Common mill supply items.

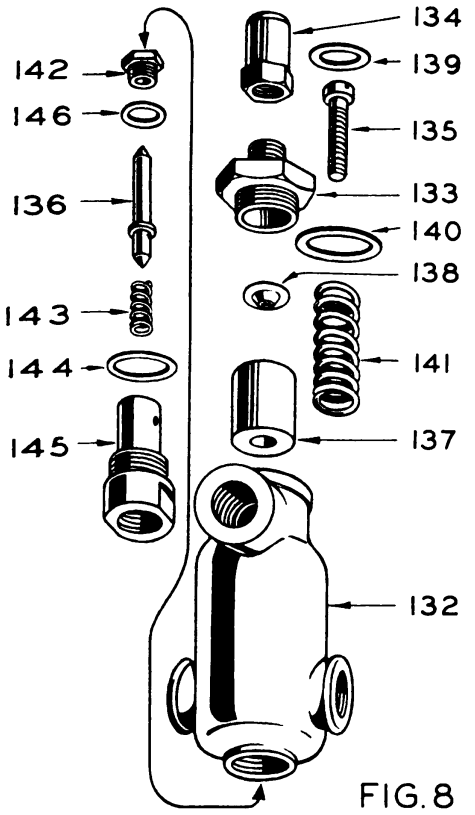


FIG. 8

FUEL OIL RELIEF VALVE

(See Ref. No. 87, Figure 6)

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

BLOWER AIR TUBE

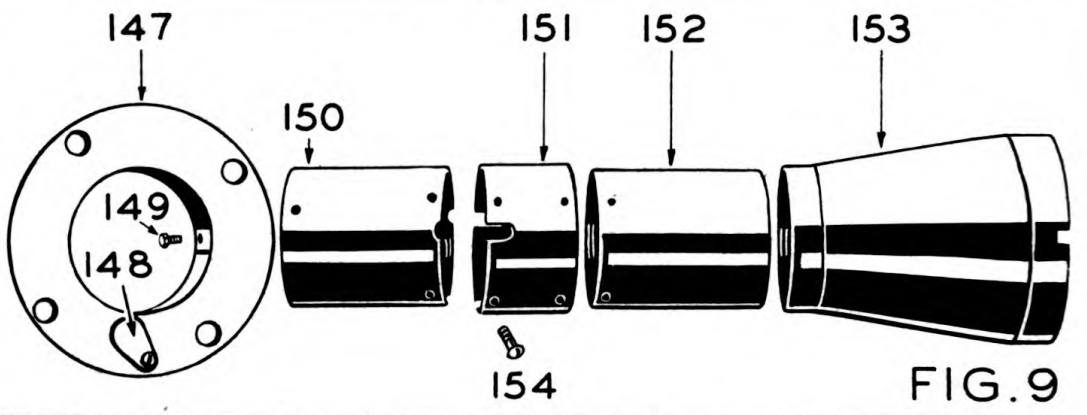


FIG.9

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	*	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	903035	Screw, machine, 10-32 x 1/4", round head, brass	12

BLOWER

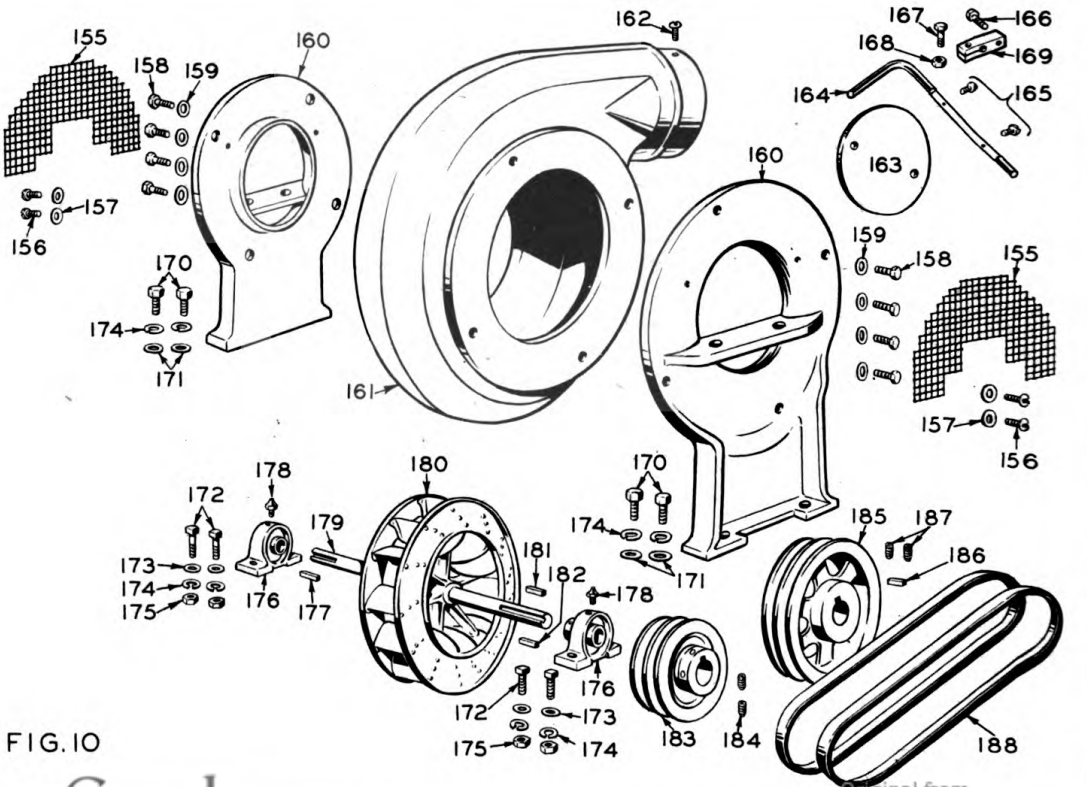


FIG.10

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
	903003	Blower Assembly, includes reference Nos. 155 to 181	1
155	903011	Screen, blower inlet	2
156	*	Screws, machine, 1/4-20 x 1/2", round head	4
157	*	Washer, flat, iron, 1/4"	4
158	*	Screw, cap, 3/8 x 1-1/4", U.S.S.	8
159	*	Washer, flat, iron, 3/8"	8
160	903009	Side Plate, blower (both sides identical)	2
161	903010	Housing, blower	1
162	*	Screw, machine, 1/4-20 x 1/2", round head	1
163	903004	Damper Disc	1
164	903021	Handle, damper	1
165	*	Screw, 10-32 x 1/4", brass, round head	2
165	*	Nut, 1/4-20, brass	2
166	*	Screw, cap, 1/4-20 x 1"	1
167	*	Screw, cap, 1/4-20 x 3/4"	1
168	*	Nut, 1/4-20, hex., iron	1
169	903005	Snubber, blower damper shaft	1
170	*	Screw, cap, 3/8" x 1-1/4"	4
171	*	Washer, lock, 3/8"	4
172	*	Screw, cap, 3/8" x 1-1/2"	4
173	*	Washer, 3/8", flat	8
174	*	Washer, 3/8", lock	4
175	*	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	*	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	*	Set Screw, Allen hollow head, 5/16"	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	*	Set screw, Allen hollow head, 5/16"	2
188	912032	V-Belt, "A" Texrope #A42	2

* Common mill supply items.

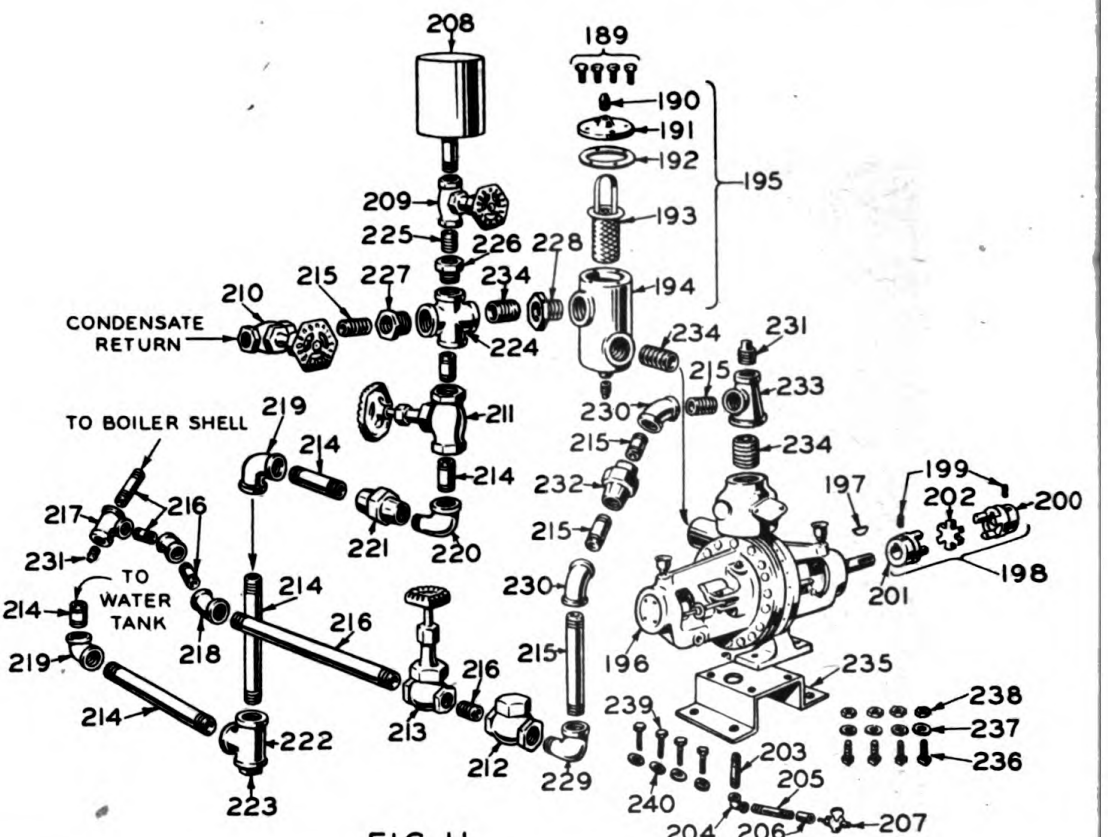


FIG. 11

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
189	914035	Cap Screw, 5/16" x 3/4"	4
190	*	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	*	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	*	Nipple, brass, 1/8" x 1-1/2"	1
204	*	Elbow, brass, 1/8"	1
205	*	Nipple, brass, 1/8" x 2-1/2"	1
206	*	Coupling, brass, 1/8"	1

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	*	Nipple, 1", standard iron pipe, black	
215	*	Nipple, 3/4", standard iron pipe, black	
216	*	Nipple, 3/4", ex. hvy., black	
217	*	Tee, 3/4", ex. hvy., black	
218	*	Elbow, 3/4", ex. hvy., black, 45°	
219	*	Elbow, 1", standard black	
220	*	Elbow, 1", standard black, street	
221	*	Union, 1", 200#, black ground joint	
222	*	Tee, 1", standard black	
223	*	Plug, 1", black iron	
224	*	Cross, 1", standard black	
225	*	Nipple, 1/2", standard black	
226	*	Bushing, 1" x 1/2", black	
227	*	Bushing, 1" x 3/4", black	
228	*	Bushing, 1-1/4 x 1", black	
229	*	Elbow, 3/4", standard black, street	
230	*	Elbow, 3/4", standard black, 45°	
231	*	Plug, 3/4", standard black	
232	*	Union, 3/4", 200#, black ground jnt.	
233	*	Tee, 1-1/4" x 3/4" x 3/4", black	
234	*	Nipple, 1-1/4", close, black	
235	114001	Base, Water Pump Mounting	
236	*	Bolt, Machine, Hex. Head, 5/16 x 1-1/4"	4
237	*	Washer, Lock, 5/16"	4
238	*	Nut, Hex., 5/16"	4
239	*	Bolt, Machine, hex. Head, 3/8" x 1"	4
240	*	Washer, Lock, 3/8"	4

* Common mill supply items. Nipples vary in length. Check required part for exact length.

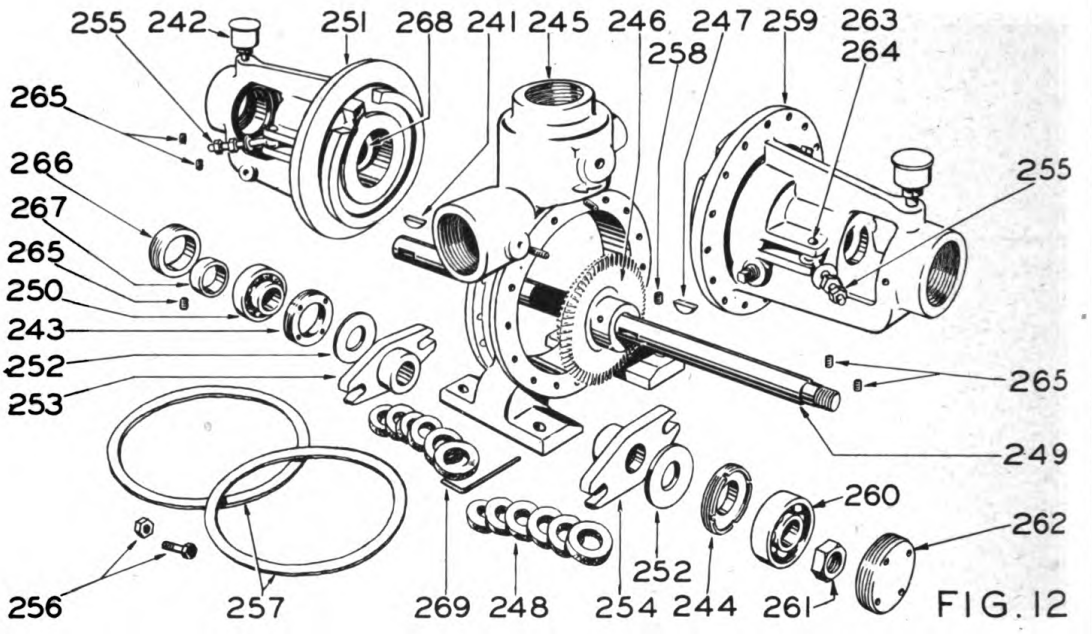


FIG. 12

REF. NO.	PART NO.	DESCRIPTION	AURORA PUMP NO.	NO. REQ.
241	914008	Key, Woodruff, for drive coupling	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	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" hollow head	21	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	26	4
264	914025	Pin, cotter	27	4
265	914026	Set Screw, 1/4" hollow head	29	4
266	914027	Locknut	36	1
267	914028	Lock Collar	37	1
268	914029	Bushing, cover	38	2
269	916013	Allen Wrench for 1/4" set screw		1

(See Page 12, Ref. #196, Fig. 11)

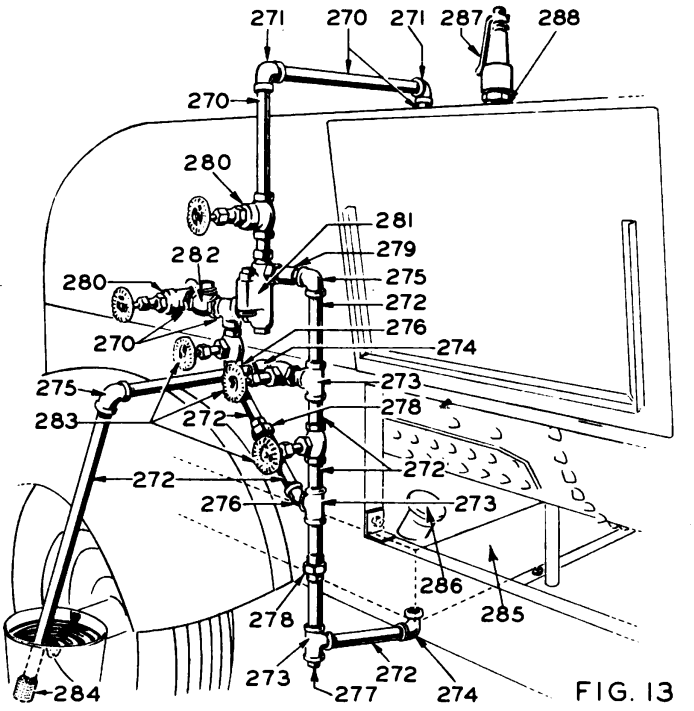
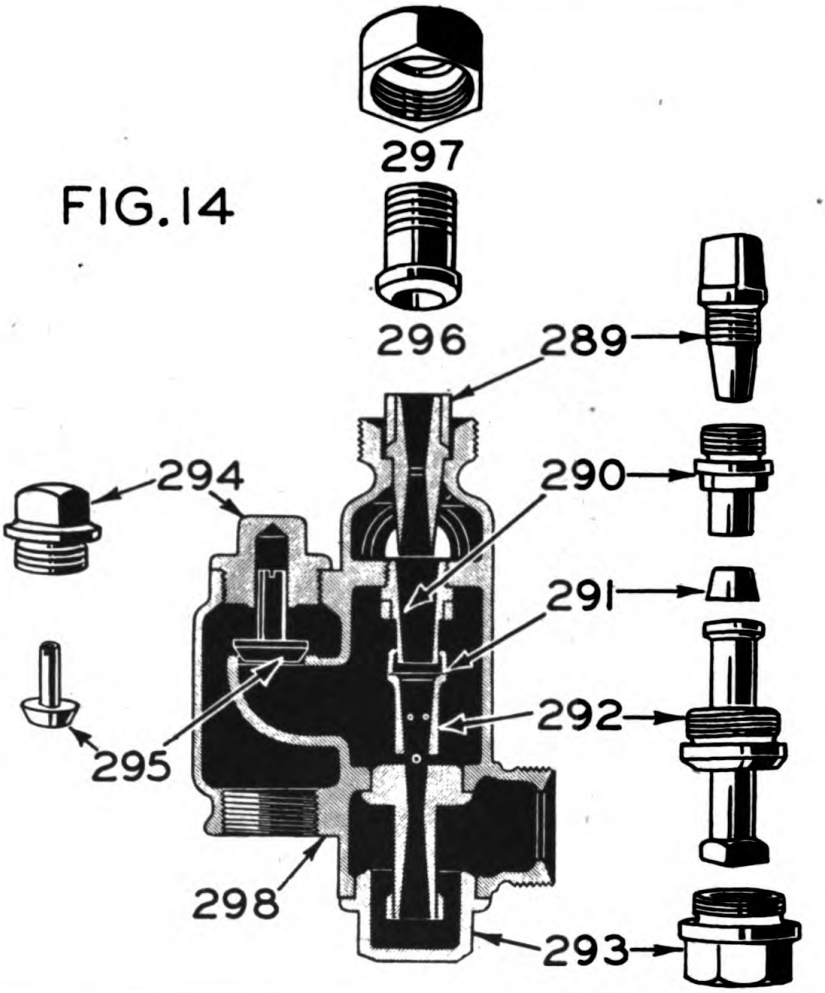


FIG. 13

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
270	*	3/4" Nipple, extra heavy	
271	*	3/4" Elbow, extra heavy	
272	*	3/4" Nipple, standard, black	
273	*	3/4" Tee, standard, black	
274	*	3/4" Street Ell, standard, black	
275	*	3/4" Elbow, standard, black	
276	*	3/4" Street Ell, 45°, std., black	
277	*	3/4" Plug, standard, black	
278	*	3/4" Ground Joint, 150#, blk., union	
279	*	3/4" Coupling, standard, black	
280	904022	Valve, globe, 3/4", extra heavy; Fig. 300S, Ohio Injector Company	2
281	904018	Injector, (see Figure 14)	
282	904013	Valve, check, 3/4", extra heavy, Fig. 304, Ohio Injector Co.	1
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	*	Extension Piece, 2", ex. hvy.	1

* Common mill supply items. Nipples vary in length. Check required part for exact length.

FIG.14



HOUSING AND INSULATION

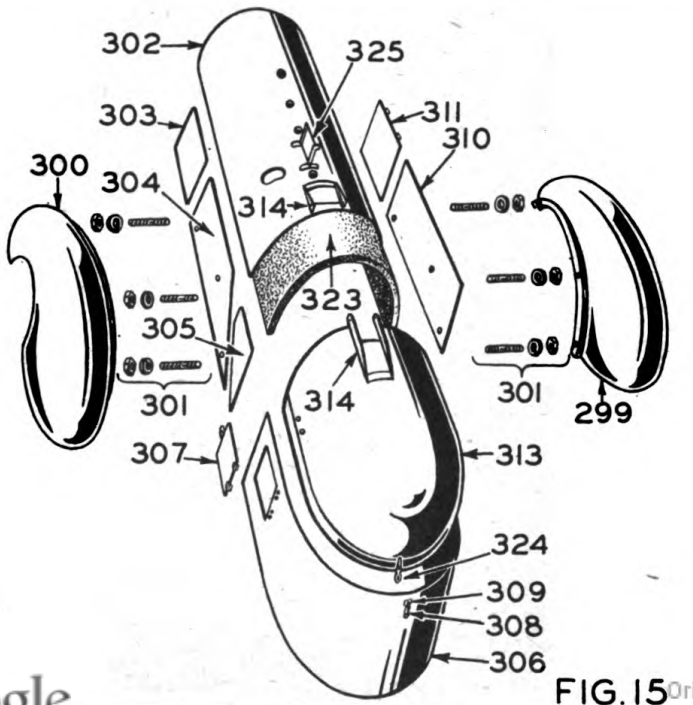


FIG.15

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
	904018	Injector, 3/4", Chicago Type, #1004, Size 3, Ohio Injector Co. (includes Parts No. 904042-904051 inclusive)	1
289	904042	Steam Jet	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 15)

299	102001	Fender Assembly, with channel iron mounting rail attached, right	1
300	102002	Fender Assembly, with channel iron mounting rail attached, left	1
301	902001	Stud, fender mounting, 1/2"x 1-1/2"	6
	*	Nut, 1/2", hex.	6
	*	Washer, lock, 1/2"	6
302	105029	Lagging, steel, top half boiler shell	1
303	105030	Housing, steel, left front side	1
304	105031	Housing, steel, left at fender	1
305	105032	Housing, steel, left rear at fender	1
306	105033	Housing, power plant apron, encircling power plant, including left door hinged; hinge hasp; outer rear hinge hasp staple	1
307	105006	Door, to water pump assembly, including butt hinges, hinge hasp and bit snap	1
308	905001	Bit Snap	3
309	*	Staple, hinge hasp	3
310	105034	Housing, right, at fender	1
311	105035	Housing, right, front side door to tool compartment assembly, with hinges, hinge hasp and bit snap	1
312	105038	Chain, tool door holding	1
313	105036	Hood, power plant, hinged assembly, with complete top hinge and hasp attached	1
314	105037	Hinge, hood to boiler lagging assembly	1
323	105013	Insulation "Banroc" Blanket, 1-1/2" x 24" x 48"	4
324	*	Hasp, hinge	1
325		Sign Plate	

* Common Mill Supply Item.

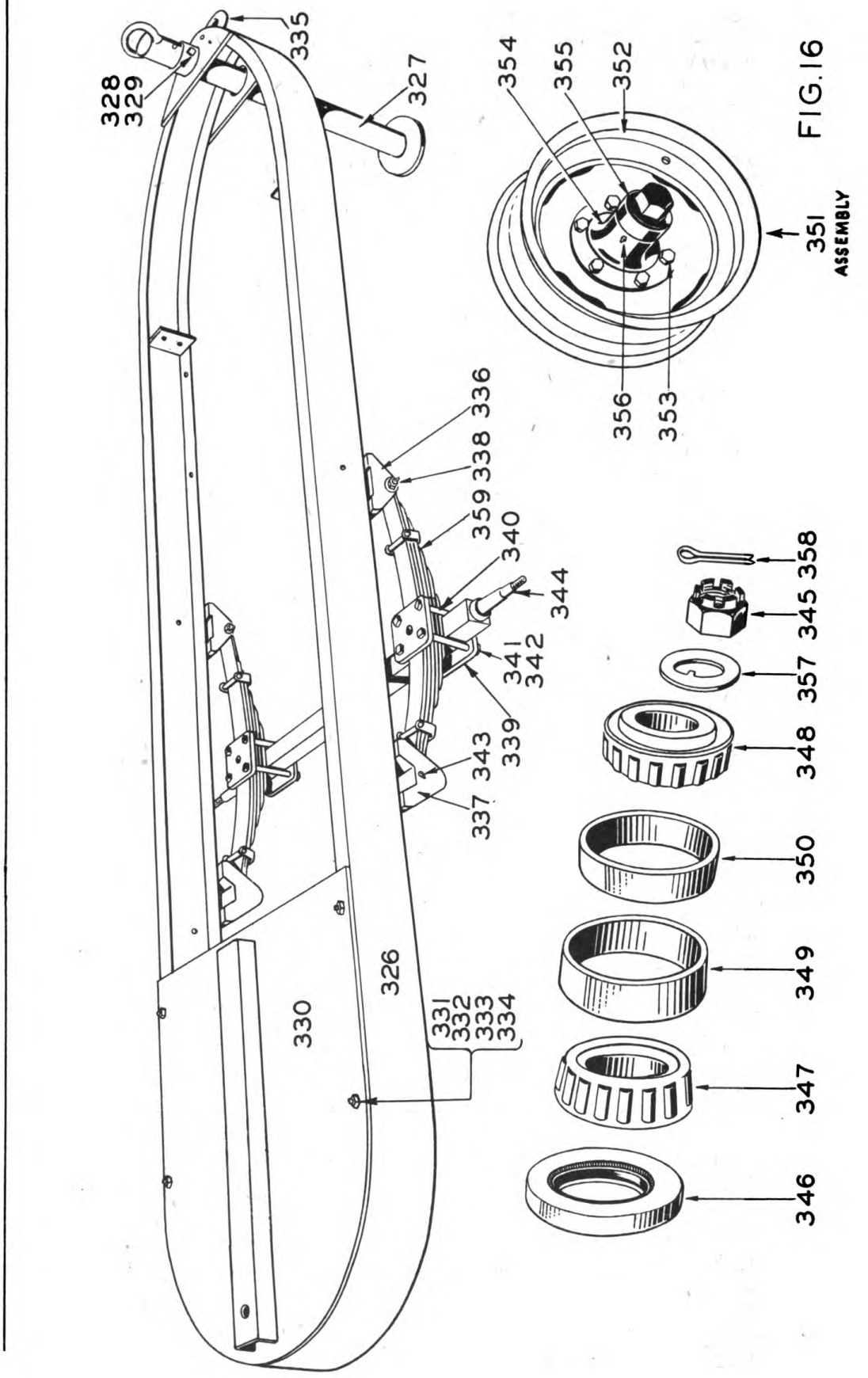


FIG. 16

REF. NO.	PART NO.	DESCRIPTION	NO. REQ.
126	102033	Chassis Frame Assembly, includes 6" channel iron frame, power plant base, spring hangers riveted on, lunette towing ring and front support leg	1
127	102005	Leg, front support with top ring (circular base must be welded in place after installed)	1
128	*	Machine bolt, 3/4 x 5-1/2"	1
129	*	Nut, 3/4", hex.	1
130	102034	Plate, base, for power plant and oil burner assembly	1
131	*	Machine Bolt, 1/2 x 1-3/4"	5
132	*	Nut, 1/2", hex.	5
133	*	Washer, lock, 1/2"	5
134	*	Washer, cast iron, bevel, 1/2"	5
135	102007	Lunette Ring, towing (must be welded in place)	1
136	102008	Hanger, spring, front	2
137	102009	Hanger, spring, rear	2
138	102010	Bolt, spring hanger, 3/4 x 4-3/4" with extra heavy castellated nut	2
139	102011	Plate, axle spring mounting, 5" square	4
140	*	Bolt, spring-axle mounting, 5/8 x 6-1/2"	8
141	*	Nut, 5/8", hex.	8
142	*	Washer, lock, 5/8"	8
143	*	Alemite Fittings, 1/8", male, 90°	4
144	102037	Axle, with key washer, castellated nuts and cotter keys, 2-1/2" square	1
145	102013	Nut, axle, lock, castellated	2
146	102015	Grease Seal Assembly, Chicago Rawhide Mfg. Co., #30620	2
147	102016	Roller Bearing, large, inner, Timken #2788	2
148	102017	Roller Bearing, small, outer, Timken #15118	2
149	102018	Cup, large inner bearing, Timken #2720	2
150	102019	Cup, small outer bearing, Timken #15250	2
151	102020	Wheel, disc, assembly, includes hubcap, wheel, studs, 102018 and 102019 large and small bearing cups in place. Motor Wheel Corp., #31677	2
152	102021	Wheel, disc only, less hub and studs	2
153	102022	Stud, wheel, hub	12
154	102023	Hub, only, less studs, with bearing cups installed	2
	102024	Tire, 7.50 x 16, 8 ply, implement type	2
	102025	Tube, inner, 7.50 x 16	2
155	102031	Cap, Hub, #31437 Motor Wheel Corp.	2
156	*	Alemite Stud	2
157	102030	Key Washer	2
158	*	Cotter Key	2
159	102035	Spring Assembly, 10 leaf, 2-1/2" wide, Tuthill Spring Co., #102	2

* Common mill supply items

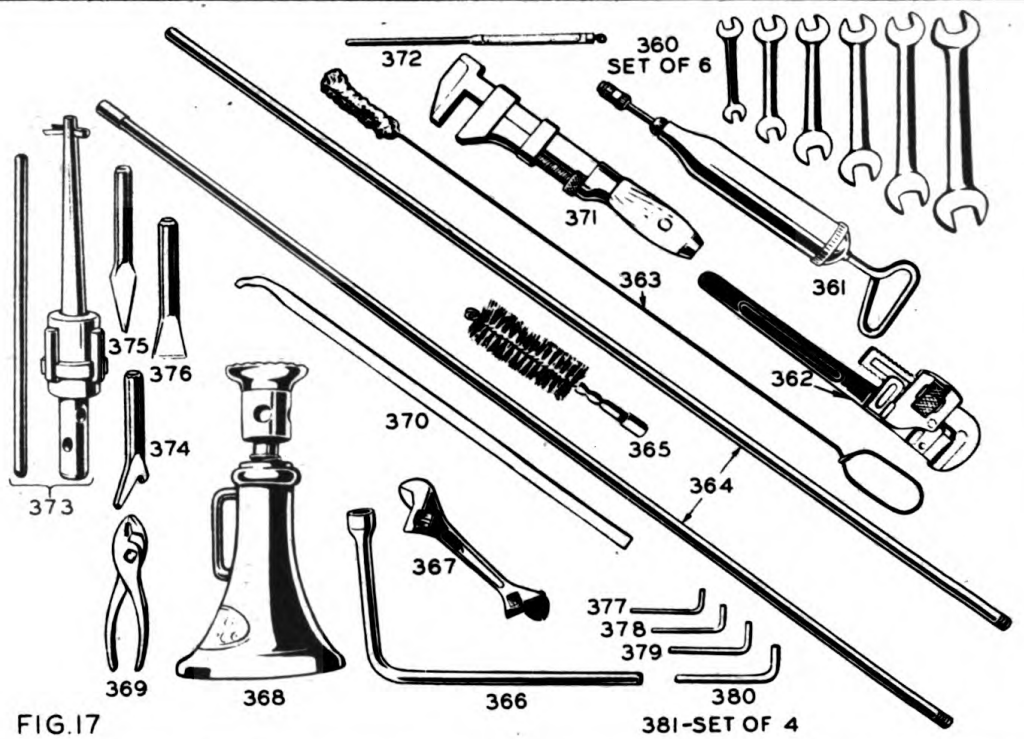


FIG.17

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	916006	Wrench, wheel stud	
367	916005	Wrench, adjustable 6-8"	
368	916010	Jack, 1/4 x 8" screw	
369	916007	Pliers, 6"	
370	916019	Tire Iron	
371	916025	Wrench, monkey	
372	107001	Thermometer, Taylor #21560, 50-400° F.	
373	916001	Tube Expander, 2"	
374	916022	Beading Tool	
375	916002	Cape Chisel	
376	916023	Cold Chisel	
377	916013	Wrench, Allen, 1/4"	
378	916014	Wrench, Allen, 5/16"	
379	916015	Wrench, Allen, 3/8"	
380	916016	Wrench, Allen, 7/16"	
381	916026	Wrench, Allen, set of four (includes Items 377 - 380 Inclusive)	
		Steam Hose and Couplings *(Not Illustrated)*	
382	116001	Hose, Rubber, Steam, 1", 5 Ply, 15 ft.	
383	116002	Hose, Rubber, Steam, 1", 5 Ply, 25 ft.	
384	116003	Coupling, hose, 1" male	
385	116004	Coupling, hose, 1" female	

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	LIST PRICE EA.
101001	11	3	1	70	$ 38.00
101005	18	3	46	10	4.00
101008	3	1	1	2	3.30
101011	10	1	4	2	.70
101012	10	1	4	2	1.00
101013	1	1	1	2100	2205.00
101014	19	3	1	80	46.80
101015	14	3	1	1	2.00
101016	15	3	1	11	11.70
101017	17	3	1	20	9.70
101018	21	3	1	15	9.50
101019	22	3	1	100	70.10
102001	299	17	1	60	56.00
102002	300	17	1	60	56.0(
102003	61	5	1	40	12.0(
102005	327	19	1	38	17.70
102007	335	19	1	15	5.20
102008	336	19	2	10	13.00
102009	337	19	2	10	17.40
102010	338	19	2	1	2.20
102011	339	19	4	2	3.00
102013	345	19	2	1/2	.20
102015	346	19	2	1/2	2.20
102016	347	19	2	1	2.20
102017	348	19	2	1	1.60
102018	349	19	2	1	2.00
102019	350	19	2	1	1.10
102020	351	19	2	45	11.10
102021	352	19	2	25	5.40
102022	353	19	12	1/4	.10
102023	354	19	2	15	5.40
102030	357	19	2	1/4	.10
102031	355	19	2	1/2	1.60
102033	326	19	1	400	207.10
102034	330	19	1	50	40.00
102035	359	19	2	45	12.50
102037	344	19	1	50	60.10
103001	131	9	1	10	47.20
103002	111	8	1	2	15.00
103003	118	8	1	2	7.50
103004	119	8	1	2	7.50
103005	147	10	1	8	15.00
103006	150	10	1	5	12.00
103007	151	10	1	4	8.50
103008	152	10	1	5	4.00
103009	153	10	1	4	4.80
103010	112	8	3	1	1.00
103011	73	6	2	2	2.20
104001	58	5	1	10	13.80
104002	60	5	1	10	7.50
104004	285	15	1	90	26.70

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	LIST PRICE EA.
105006	307	17	1	6	9.00
105013	323	17	4	15	7.00
105017	27	3	1	15	1.00
105020	30	3	1	40	3.50
105021	31	3	1	100	14.00
105023	8	1	2	27	12.50
105024	24	3	1	1	3.50
105025	25	3	1	30	15.50
105026	26	3	1	35	13.50
105027	28	3	1	20	6.90
105028	29	3	1	20	6.90
105029	302	17	1	60	36.70
105030	303	17	1	10	7.70
105031	304	17	1	10	9.00
105032	305	17	1	6	5.70
105033	306	17	1	50	26.70
105034	310	17	1	6	10.70
105035	311	17	1	6	9.00
105036	313	17	1	50	68.00
105037	314	17	1	3	11.70
105038	312	17	1	1	.80
107001	372	20	1	2	11.40
113001	129	9	1	3	1.00
113005	105	7	1	4	11.50
113006	106	7	1	1	5.00
113007	110	7	1	1	2.20
113008	130	9	1	1	1.00
113009	67	6	1	5	12.00
113010	103	7	1	50	28.40
114001	235	13	1	20	7.50
116001	382	20	*	25	42.30
116002	383	20	*	40	59.70
116003	384	20	*	2	3.30
116004	385	20	*	2	5.70
901001	20	3	1	1	3.80
901005	10	1	4	1/4	.20
901006	10	1	4	1/8	.14
901008	41	5	1	25	8.40
901009	43	5	1	1/2	1.50
901010	44	5	1	2	5.00
901011	45	5	1	2	5.50
901012	46	5	2	1/2	.40
901013	47	5	1	1	.60
901014	48	5	2	1/4	.10
901015	49	5	3	2	4.30
901016	54	5	1	1	1.50
901027	7-32	1-3	2	10	1.00
901028	4-5-6	1	46	1/8	.10
901032	207	13	1	1/4	1.50
902001	-12-301	1-3-17	20	1/4	.20
902002	13	3	4	1/4	.24

* Dependent upon operating conditions.

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	LIST PRICE EA.
903001	148	10	1	1/4	$ .40
903002	114	8	2	1/4	1.60
903003	*	11	1	60	167.00
903004	163	11	1	1	1.70
903005	169	11	1	1/2	1.70
903006	180	11	1	15	66.80
903007	176	11	2	4	9.90
903008	179	11	1	4	6.80
903009	160	11	2	18	18.50
903010	161	11	1	22	27.40
903011	155	11	2	1/2	3.70
903012	181	11	1	1/4	.20
903014	182	11	1	1/4	.20
903016	198	12	1	4	8.20
903017	200	12	1	2	3.30
903018	201	12	1	2	3.30
903019	202	12	1	1/4	2.00
903021	164	11	1	1/2	3.30
903033	117	8	3	1/4	.30
903034	116	8	3	1/4	.20
903035	154	10	12	1/4	.10
903036	120	8	3	1/4	.20
903037	121	8	3	1/4	.40
903038	122	9	4	1/4	.30
903039	123	9	1	1/4	.30
903040	124	9	2	1/4	.50
903041	127	9	1	1/4	1.90
903042	177	11	1	1/4	.20
903042	102	7	1	1/4	.20
903043	186	11	1	1/4	.20
903044	115	8	1	1/4	1.60
904007	87	7	1	5	13.00
904008	88	7	1	1	.80
904009	97	7	1	1	4.10
904011	211	13	1	8	10.70
904012	209	13	1	4	5.30
904013	212	13	1	3	10.20
904013	282	15	1	3	10.20
904014	210	13	1	5	8.50
904014	283	15	3	5	8.50
904016	287	15	1	8	33.10
904018	281	15	1	5	16.00
904022	280	15	2	6	16.00
904022	213	13	1	6	16.00
904024	284	15	1	1	1.80
904026	286	15	1	1	1.80
904028	53	5	1	5	24.90
904041	125	9	2	1	3.30
904042	289	17	1	1/4	3.00
904043	290	17	1	1/4	3.00
904044	291	17	1	1/4	1.50
904045	292	17	1	1/4	7.00
904046	293	17	1	1/4	2.40
904047	294	17	1	1/4	1.80
904048	295	17	1	1/4	1.10
904049	296	17	1	1/4	1.00

* Complete Assembly.

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	LIST PRICE EA.
904050	297	17	1	1/4	$ 1.00
904051	298	17	1	3	11.20
904053	132	9	1	2	5.30
904054	133	9	1	1/4	.60
904055	134	9	1	1/4	.20
904056	135	9	1	1/4	.20
904057	136	9	1	1/4	.70
904058	137	9	1	1/4	1.10
904059	138	9	1	1/4	.10
904060	139	9	1	1/4	.10
904061	140	9	1	1/4	.10
904062	141	9	1	1/4	.20
904063	142	9	1	1/4	.10
904064	143	9	1	1/4	.10
904065	144	9	1	1/4	.10
904066	145	9	1	1/4	2.10
904067	146	9	1	1/4	.10
905001	308	17	3	1/4	.60
907001	98	7	1	3	2.80
907002	56	5	1	5	6.50
912001	99	7	1	1	1.70
912002	100	7	1	3	3.90
912003	183	11	1	15	11.20
912005	185	11	1	15	16.00
912007	101	7	1	2	2.60
912032	188	11	2	3	2.10
913003	76	6	1	5	9.30
913004	77	6	1	1/4	.10
913005	78	6	1	1	1.30
913006	89	7	1	10	30.06
913007	90	7	1	2	.80
913008	92	7	4	1/4	1.00
913009	93	7	1	1/4	.30
913009	128	9	1	1/4	.30
913010	126	9	4	1/4	.20
914001	196	12	1	40	178.00
914003	242	14	2	1/4	.50
914004	243	14	1	1/2	2.50
914005	244	14	1	1/2	2.50
914006	245	14	1	10	60.00
914007	246	14	1	2	18.40
914008	247	14	1	1/4	.20
914008	241	14	1	1/4	.20
914009	248	14	16	1	1.70
914010	249	14	1	5	15.00
914011	250	14	1	1/2	8.00
914012	251	14	1	10	46.00
914013	252	14	2	1/4	.50
914014	253	14	1	1	4.00
914015	254	14	1	1	4.00
914016	255	14	4	1/2	.80
914017	256	14	8	1/4	.10
914018	257	14	2	1/4	1.00
914019	258	14	1	1/4	.20
914020	259	14	1	10	40.00

PART NO.	REF. NO.	PAGE	NO. REQ.	WEIGHT LBS.	LIST PRICE EA.
914021	260	14	1	1/2	$ 4.50
914022	261	14	1	1/4	.40
914023	262	14	1	1/4	2.50
914024	263	14	4	1/4	.20
914025	264	14	4	1/4	.10
914026	265	14	4	1/4	.20
914027	266	14	1	1/4	2.50
914028	267	14	1	1/4	1.00
914029	268	14	2	1/4	5.00
914030	194	12	1	1	6.30
914031	195	1	1	8	8.40
914032	193	12	1	1	1.00
914033	191	12	1	2	.80
914034	192	12	1	1/4	.20
914035	189	12	4	1/4	.10
914045	208	13	1	5	5.00
916001	373	20		3	33.40
916002	375	20		1	1.70
916004	362	20		6	5.50
916005	367	20		3	4.20
916006	366	20		3	1.30
916007	369	20		1	.80
916008	365	20		1	.80
916009	361	20		5	4.80
916010	368	20		15	7.40
916013	269-377	14-20	*	1/4	.20
916014	378	20		1/4	.20
916015	379	20		1/4	.20
916016	380	20		1/4	.20
916019	370	20		5	.80
916020	363	20		1	1.00
916021	364	20		10	1.50
916022	374	20		2	2.30
916023	376	20		1	1.50
916024	360	20		3	2.70
916025	371	20		6	2.50
916026	381	20		1	1.00

* Tools - Quantity Optional.

PART 4

OPERATING AND MAINTENANCE INSTRUCTIONS
SPARE PARTS PRICE LIST
FOR
BRIGGS AND STRATTON GASOLINE MOTOR

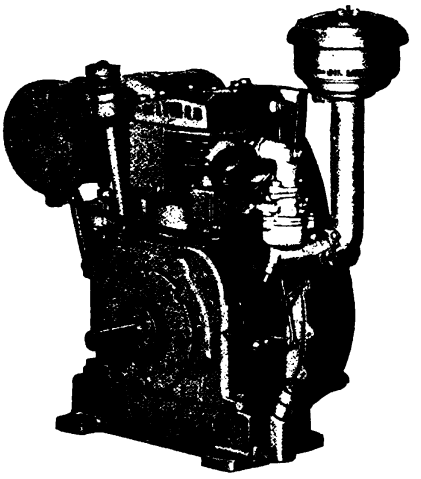
Operating Instructions

Adjustment and Repair Information • Parts List

For BRIGGS & STRATTON

MODEL "ZZ"

TYPE NO. 304665



INDEX

Read these instructions carefully before operating this Motor for the first time.

Guessing how to run it may cause you unnecessary inconvenience, aggravation or failure to receive the fine service that is built into it.

There is a right way to operate this Motor. This book tells you how.

Each Motor is carefully tested and adjusted at the factory before packing for shipment, and if correctly operated will perform beyond your expectations.

DO NOT START THIS MOTOR UNTIL YOU HAVE READ CAREFULLY THE "STARTING AND OPERATING INSTRUCTIONS" ON PAGE 2E

Starting and Operating Instructions

1. BEFORE STARTING THE MOTOR. Fill the crankcase with high grade oil not heavier than S.A.E. No. 30. When temperature is below 32° F., use oil not heavier than S.A.E. No. 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 62. Fill the gas tank with a good, clean, third grade gasoline. Tank holds five gallons. Do not mix oil and gasoline. See paragraphs 11 to 19.

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

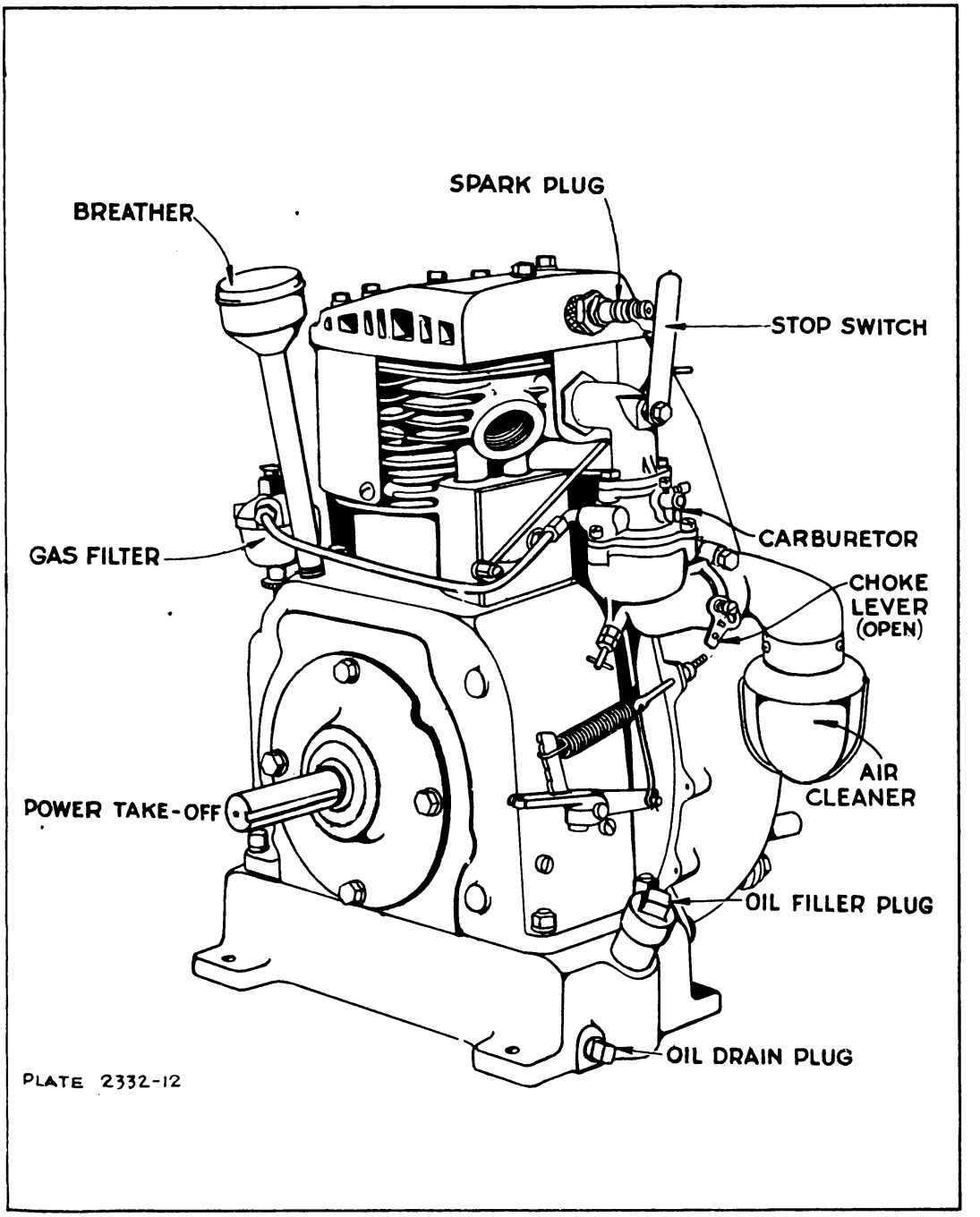
A. HAND CRANK STARTER TYPE. Pull out the compression release rod as far as it will come. Press the starter shaft in, to mesh gear with pinion on crankshaft. Crank rapidly and as soon as enough momentum is gained let go of the compression release rod and pull carburetor choke lever toward you to choke 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 4.

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.

Plate No. 1



Servicing Reference Chart

MOTOR FAILS TO START

	Paragraph
Out of Gasoline	1-16
Out of Oil	1-13-59-60
Dirt or Gum in Fuel System	16 to 19
Incorrect Use of Choke	20
Carburetor Out of Adjustment	22 to 26
Spark Plug Dirty	32-33
Ignition Cable Grounded	34
Magneto	35 to 46
Poor Compression	47 to 56
Air Cleaner Clogged	62

MOTOR STOPS

Out of Gasoline	1-16
Out of Oil	1-13-59-60
Dirt or Gum in Fuel System	16 to 19
Motor Overheated	13-59-60-61-62-63-64
Air Cleaner Clogged	62
Motor Overloaded	64

MOTOR OVERHEATS

Out of Oil	1-13-59-60
Oil Needs Changing	14-15
Oil Too Heavy	14-15
Carburetor Out of Adjustment	22 to 26
Poor Spark	31 to 46
Carbon	61
Muffler Clogged	63
Overloaded	64

MOTOR LACKS POWER

Lack of Oil	1-13-59-60
Add or Change Oil	13 to 15
Carburetor Out of Adjustment	22 to 26
Motor Not Up to Speed	22 to 30
Poor Spark	31 to 46
Poor Compression	47 to 56
Carbon	61
Air Cleaner Clogged	62
Muffler Clogged	63
Overloaded	64

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.

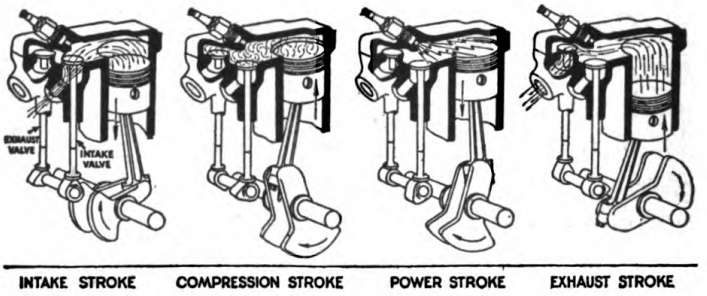
7. If you should experience any difficulty, follow the instructions referred to in the **Servicing Reference Chart** above. If you cannot easily remedy it, consult your dealer, or a nearby Briggs & Stratton Authorized Central Service Distributor.

8. 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.

9. 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.

10. 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 plate No. 2.

The 4-Stroke Cycle
Plate No. 2



11. 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.

12. USE THE RIGHT KIND OF OIL. Correct lubrication is important. See paragraph 1. We recommend the use of Mobiloil "Arctic" S.A.E. No. 30 or other high grade oil with similar characteristics having a low carbon residue and a body not heavier than S.A.E. No. 30. **A heavier oil which might be satisfactory in a tractor or for lubricating farm machinery must NOT be used.** Do not mix oil with the gasoline. This 4-cycle motor is provided with an independent efficient pump lubrication system which forces a stream of oil to all moving parts of the motor. There are no external parts which require separate oiling.

13. 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 five hours of motor operation. Capacity of oil reservoir is 4-1/2 pints.

14. **CHANGE OIL FREQUENTLY.** After every twenty-five 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.

15. 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.

16. **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 18.

17. **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.

18. **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 when motor is used again. The reason for this is that evaporation of stale gasoline causes most gum deposits.

19. **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 17 and 18.

20. **CORRECT USE OF THE CHOKE.** The correct carburetor setting (see paragraph 23) 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.

21. **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 19, 22 to 26. If motor will not fire at all, check the ignition system, see paragraphs 31 to 46, also compression, paragraphs 47 to 56.

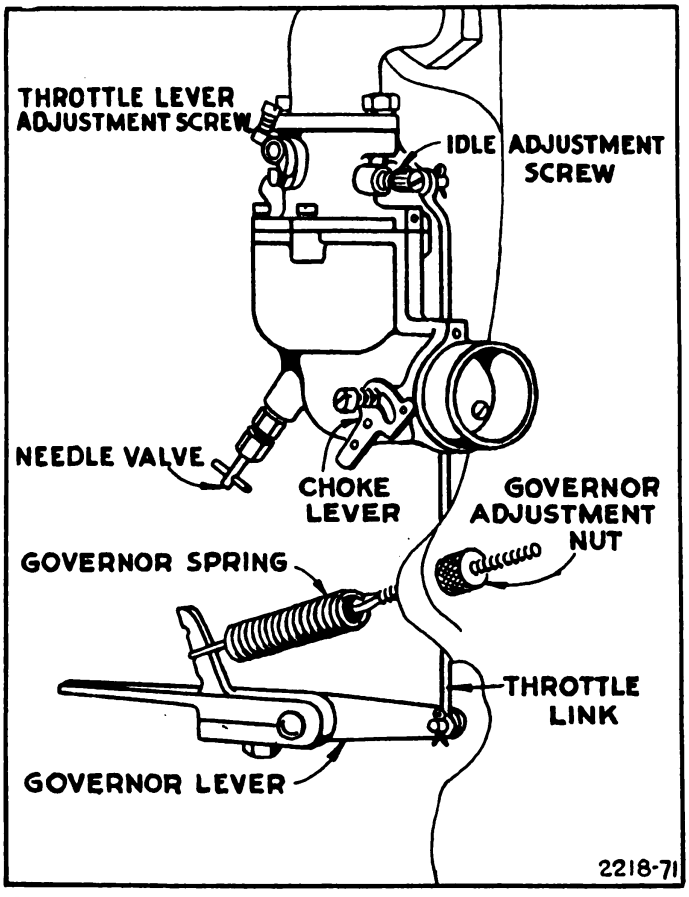
22. TO ADJUST THE CARBURETOR. The carburetor on this motor is of the gravity type. The gasoline supply is regulated by a needle valve. The throttle is automatically controlled by the governor, see paragraphs 27 to 30.

23. 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 27 to 30. 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.

24. 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. (Plate No. 3)

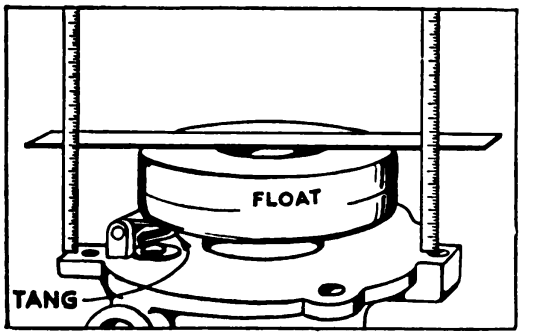
25. TO REMOVE AND REPLACE CARBURETOR. Disconnect gasoline line from carburetor and gasoline shut-off valve. Remove two cap screws and lockwashers from the intake elbow. Then remove the cotter pin from the throttle shaft lever and slip the throttle link off. To replace, reverse the operations as performed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

Carburetor and Governor Hook-Up
Plate No. 3



26. 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. See plate No. 3A. 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
Plate No. 3A



27. 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.

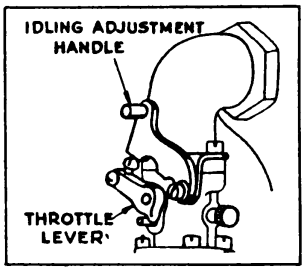
28. The governor was carefully adjusted at the factory to maintain normal speed under load. Do not re-adjust unless absolutely necessary. It can be changed by reducing or increasing the tension of the governor spring. Turn governor adjustment nut to the right or clockwise to increase motor speed. To left or anticlockwise to reduce motor speed. Recommended motor speed: 2200 to 3200 R.P.M. (Plate No. 3)

29. 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.

30. This motor is equipped with a hand idling device as shown in Plate #4. To idle motor, lower the idling adjustment lever. Raise the lever to bring motor back to normal running speed.

31. 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.

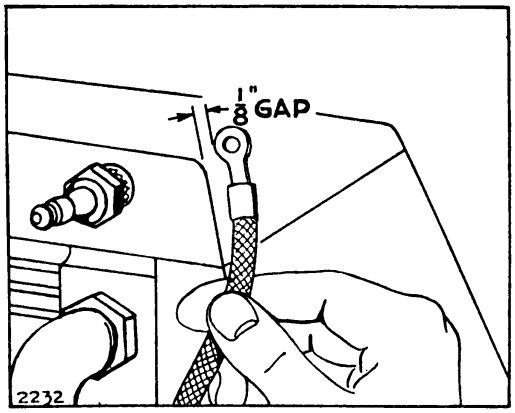
Idling Device Plate No. 4



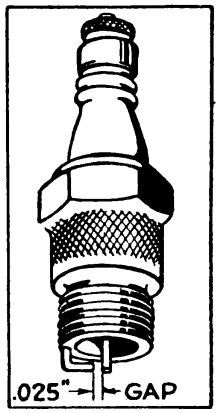
32. CHECK FOR SPARK. To prove that a satisfactory spark is being delivered by the magneto remove the ignition cable from the plug. Hold ignition cable terminal about 1/8" from any metal part of the cylinder head (keep hand on insulated part of the cable to avoid a shock). Turn motor with starter. and if the spark jumps this gap the entire ignition system, with the exception of the spark plug is O.K. See Plate No. 5 (To check spark plug see paragraph 33.) If no spark, check cable, see paragraph 34, and refer to magneto adjustments paragraphs 35 to 46.

33. SPARK PLUG ADJUSTMENT. Spark plugs should be cleaned and points reset to .025" after each 100 hours of operation. See plate No. 9 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. The spark plug can be cleaned by washing off the carbon with gasoline or kitchen scouring powder. Points should be scraped or sand-papered. See plate No. 6. 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 Plate No. 5



Spark Plug Plate No. 6



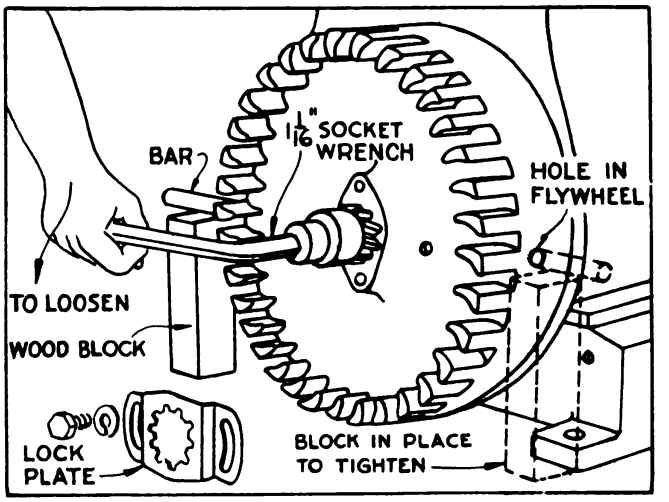
34. IGNITION CABLE. Insulation must not be broken, or soaked with oil or water, or grounded in any way where it touches the motor, or it will interfere with good ignition. Spark plug cable should be soldered to the secondary terminal (small brass plate coming out of the coil). Avoid touching coil with hot soldering iron. See plate No. 11.

35. 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 38. 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 this hole and place a block of wood under it. This will hold flywheel id 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. Plate #7.

36. 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.

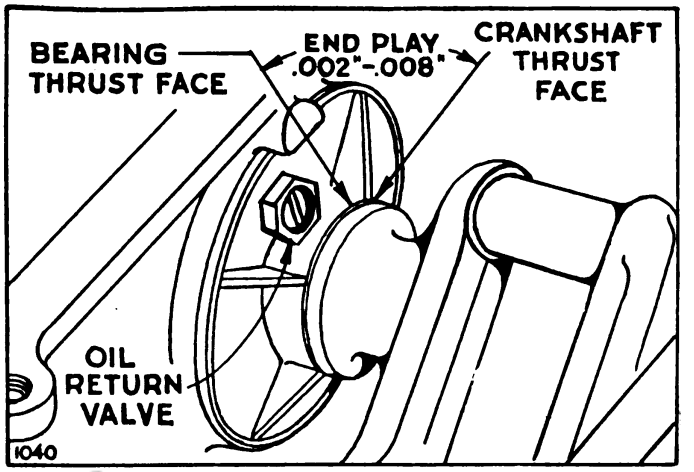
Removing Flywheel
Plate No. 7



37. TO REMOVE AND REPLACE MAGNETO ASSEMBLY. After removing flywheel as explained in paragraph 35, 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 plate No. 8. Use lockwashers under mounting screws. Page 27.

38. 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 22. If steel key is used and flywheel becomes loose it will damage the keyway in the crankshaft.

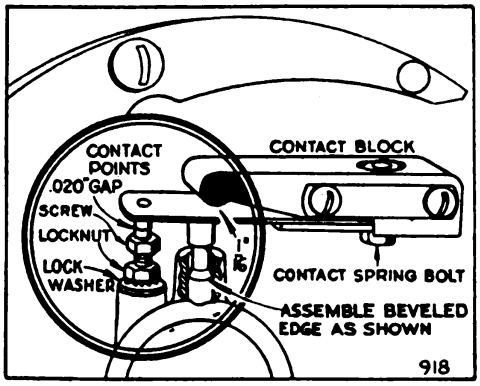
Correct End Play
Plate No. 8



39. 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 carborundum contact point file.

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

Magneto Contact Points
Plate No. 9

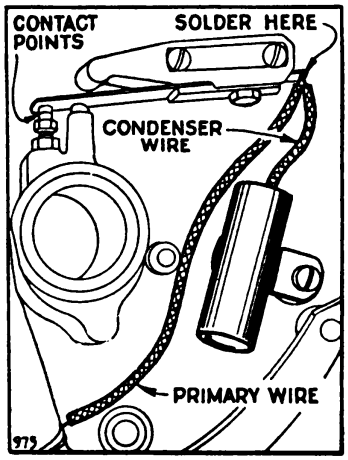


Tighten contact spring bolt. To adjust contact spring tension, turn crankshaft until points are in open position, then place 1/16" gauge between contact spring and round end of contact block, and tighten contact block screws. Turn contact screw to secure .020" gap and tighten locknut against lockwasher. See plate No. 9. If either or both points become badly pitted or burned, replace both points.

41. 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 plate No. 10).

42. If after new condenser has been installed the ignition system still does not deliver a satisfactory spark, we recommend sending the complete magneto unit including the flywheel to the nearest Briggs & Stratton Central Service Distributor for proper adjustment.

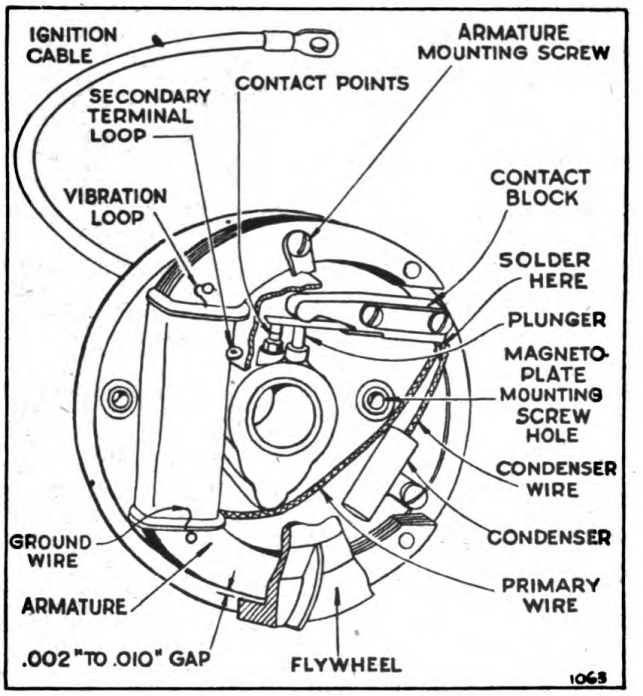
Condenser Installation
Plate No. 10



43. 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.

44. To install armature, place dust cover clip under upper mounting screw, tighten lower mounting screw. Then solder ignition cable tc 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 plate No. 11

Complete Magneto Assembly
Plate No. 11



45. 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.

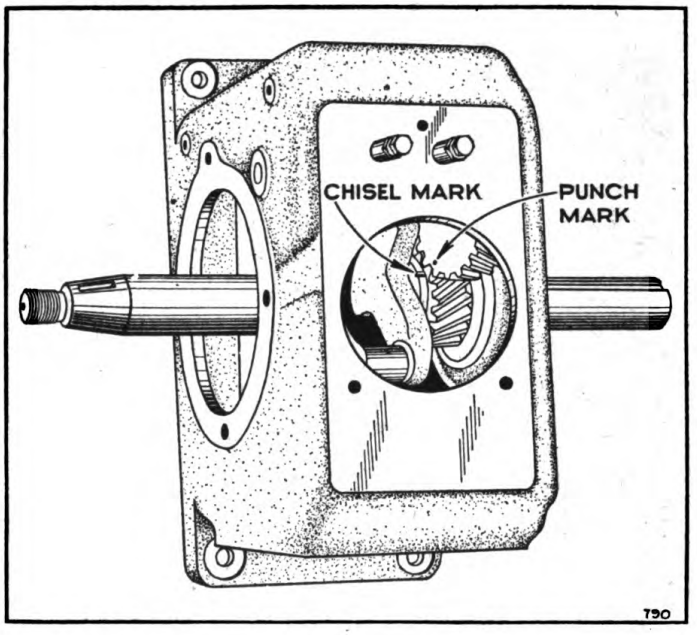
46. To check armature shoes for rub, chalk edges and mount flywheel in place. Remove spark plug to release compression. Turn flywheel several revolutions by hand. Remove flywheel and examine edges of armature shoes. High spots will have the chalk rubbed off. File high spots carefully with a fine file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

47. 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.

48. 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 — Plate No. 12



49. VALVE ADJUSTMENT. To check valve clearance, remove carburetor paragraph 25, and valve cover plate on cylinder back of carburetor. The correct clearance on the exhaust valve is .013" to .015". The clearance of the intake valve is .005" to .007". 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.

50. 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.

51. 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.

52. 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.

53. 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 plate No. 12.

54. 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.

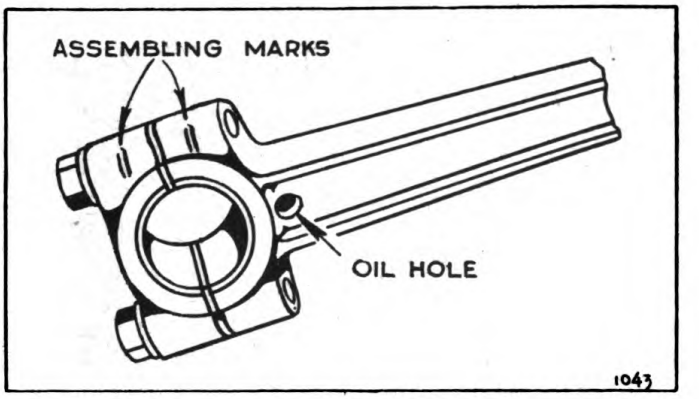
55. If an oversize piston is necessary, we recommend that reboring of cylinder be done by an Authorized Central Service Distributor or the factory.

56. 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.

57. 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.

58. CONNECTING ROD. When assembling connecting rod to crankshaft, the oil hole in the lower bearing must be toward the magneto side. See plate No. 13. The assembly marks on cap and rod must be on the same side.

Connecting Rod - Plate No. 13

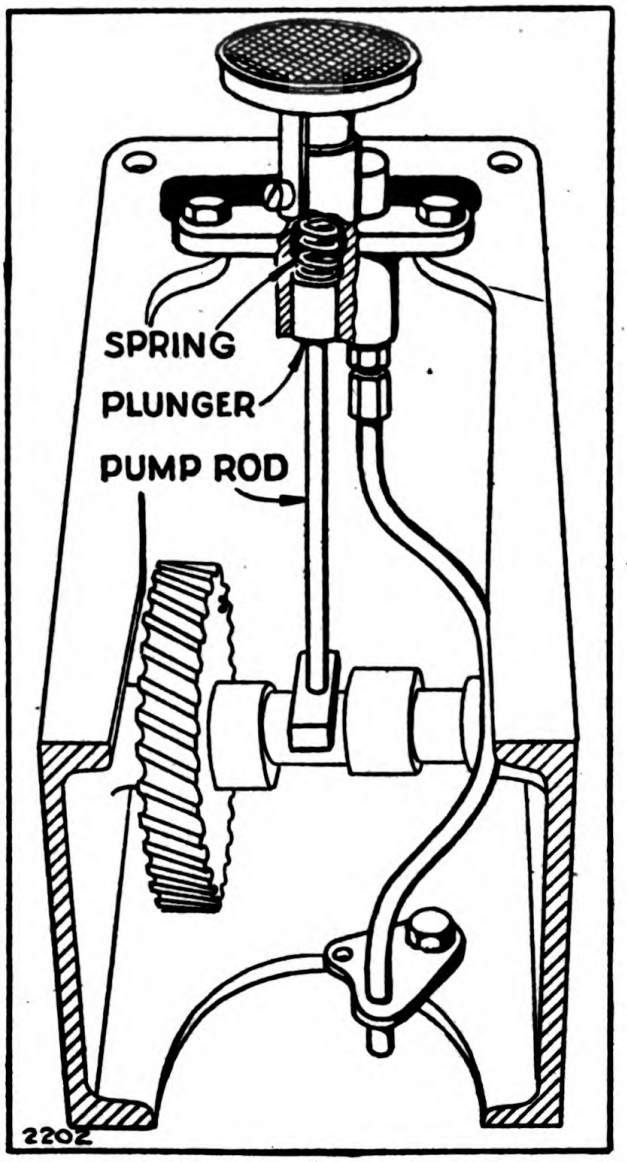


59. OIL PUMP. The oil pump is assembled to the crankcase with two bolts and lockwashers and is operated from an eccentric on the cam gear. An inoperative pump will result in insufficient lubrication which may score cylinder and piston assembly. To check oil pump, remove base and the two bolts that hold 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 plate No. 14.

60. 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 plate No. 8.

61. 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—Plate No. 14



62. 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.

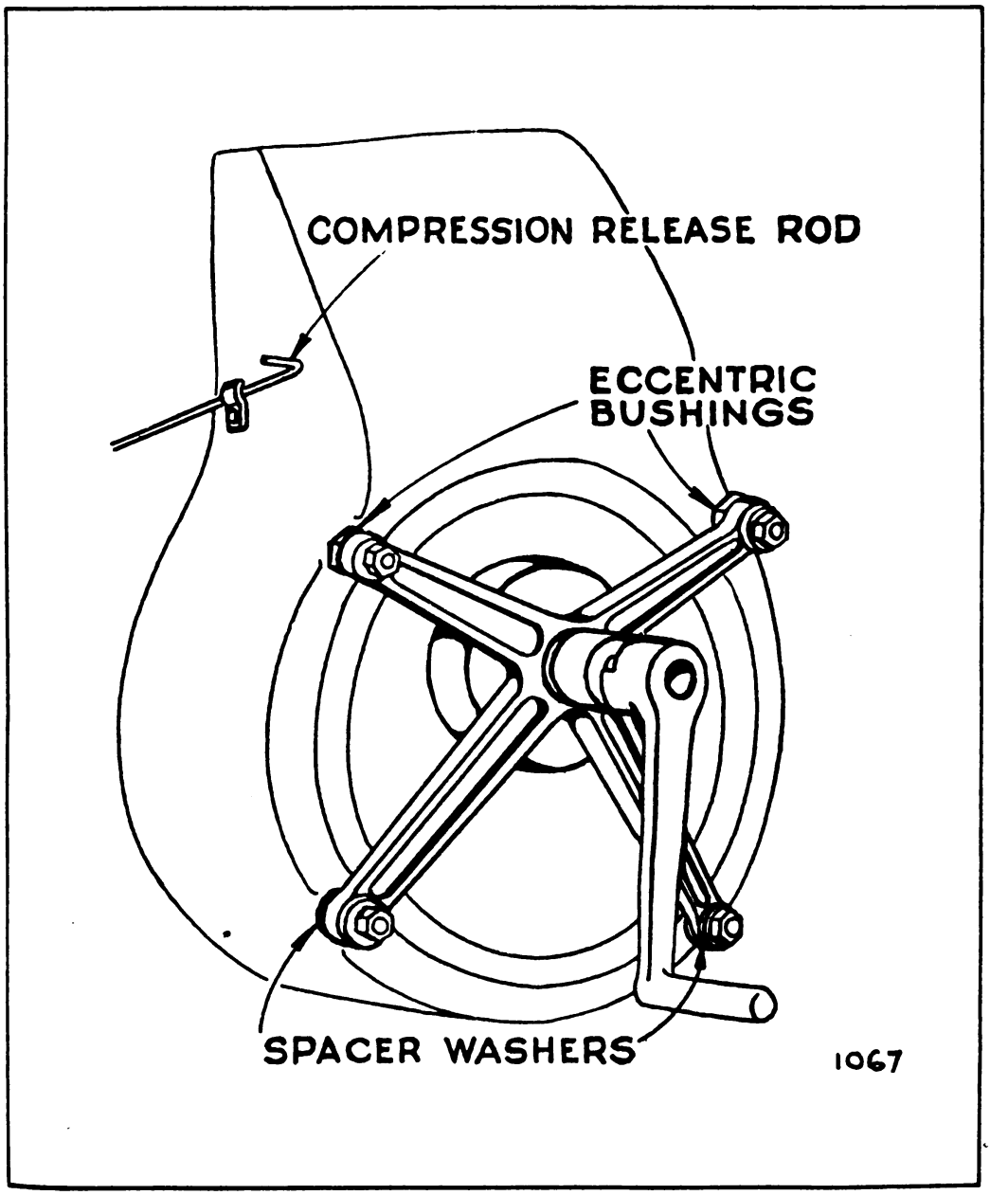
63. MUFFLER. After long periods of service it is possible that the muffler will become clogged to the point where it will affect the motor's power. To check the muffler unscrew it from the motor and run water into the open end of the muffler. If full streams of water come out of the small holes at the 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.

64. 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.

65. **CRANK STARTER ASSEMBLY.** The crank starter assembly shown in Plate No. 15 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.

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

Plate No. 15



PARTS LIST

MODEL "Z"

TYPE NOS. 304156 AND 304340

* * * * *

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.

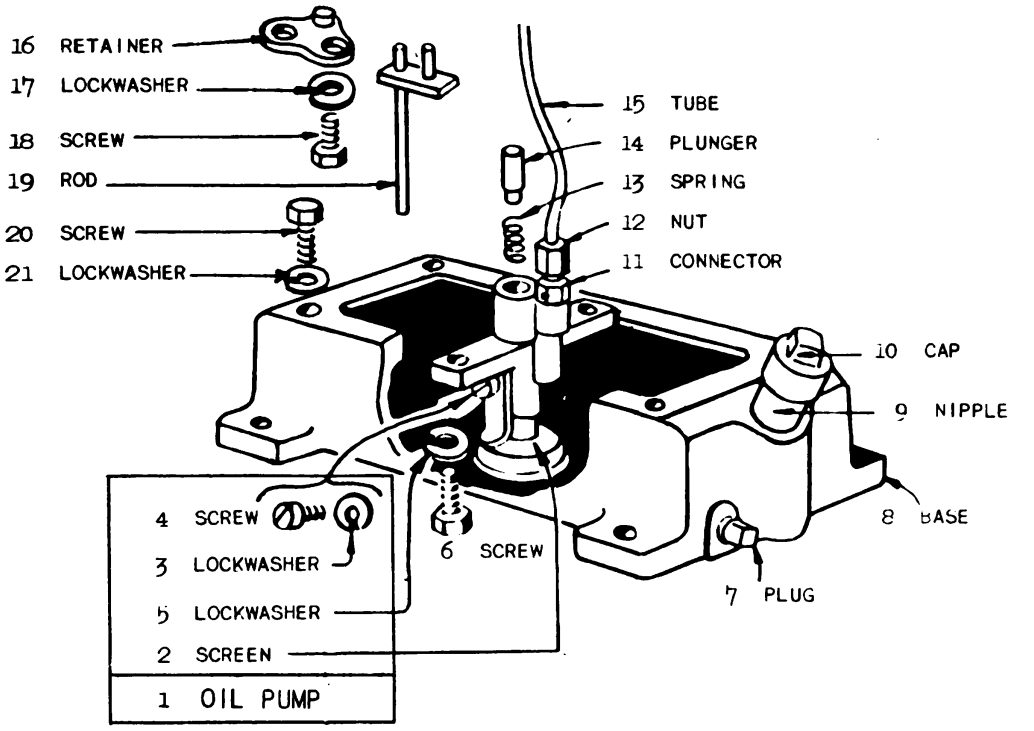


FIGURE B-1

EF.).	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	1
8	109044	Base (Cast Iron)	61287	1
9	109045	Oil Filler Nipple	92469	1
0	109046	Oil Filler Cap	69689	1
1	109047	Oil Tube Connector	63202	1
2	109048	Oil Tube Connector Nut	63217	1
3	109049	Oil Pump Spring	26413	1
4	109050	Oil Pump Plunger	23132	1
5	109051	Oil Pump Tube	99362	1
6	109052	Oil Tube Retainer	62081	1
7	109216	Lockwasher, 1/4 x 3/32 x 5/64"	90832	2
8	109217	Screw, 1/4-20 x 1/2", hex. hd.	90891	2
9	109053	Oil Pump Rod	66739	1
0	109243	Screw, 3/8-16 x 1-1/4", hex. hd.	90887	4
1	109227	Lockwasher, 11/32 x 1/8 x 3/32"	92268	4

ENGINE PARTS

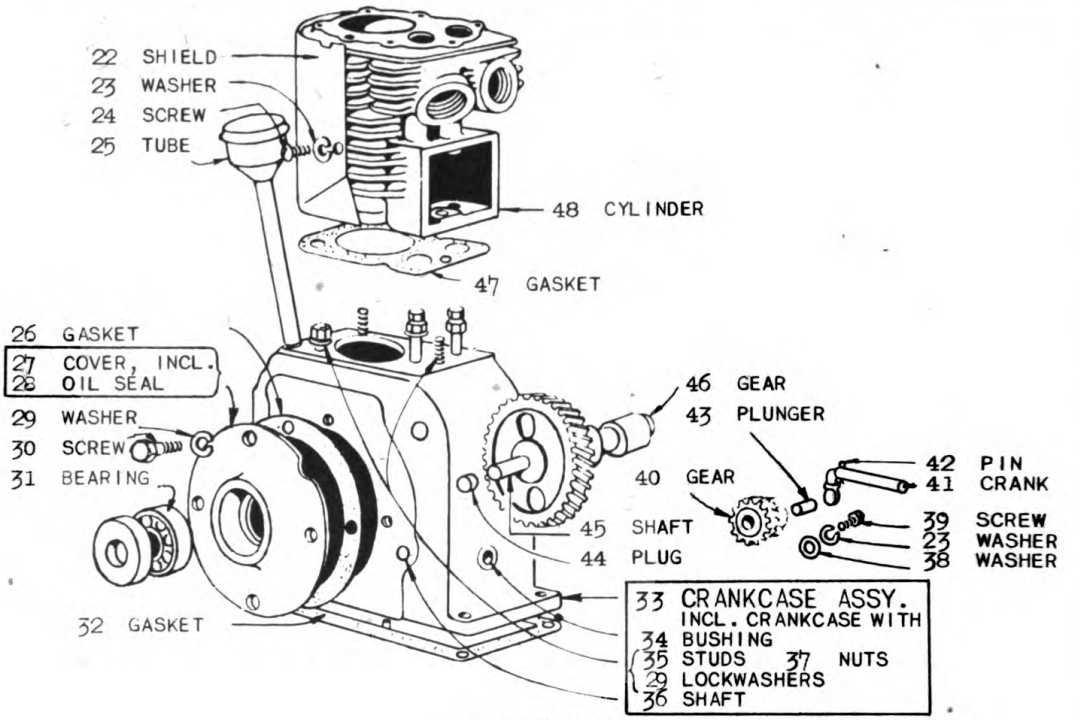


FIGURE B-2

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO RE
22	109021	Cylinder Shield	62924	1
23	109216	Lockwasher, 1/4 x 3/32 x 5/6"	90832	4
24	109246	Screw, 1/4-20 x 1/2", rd. hd.	90916	2
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	69739	1
32	109027	Base Gasket	65247	1
33	109028	Crankcase Assembly (Cast Iron) (Includes Items 34 - 37 inclusive, also Item 29)	99373	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	109038	Cam Gear	61454	1
47	109039	Cylinder Gasket	66477	1
	109040	Cylinder	99358	1

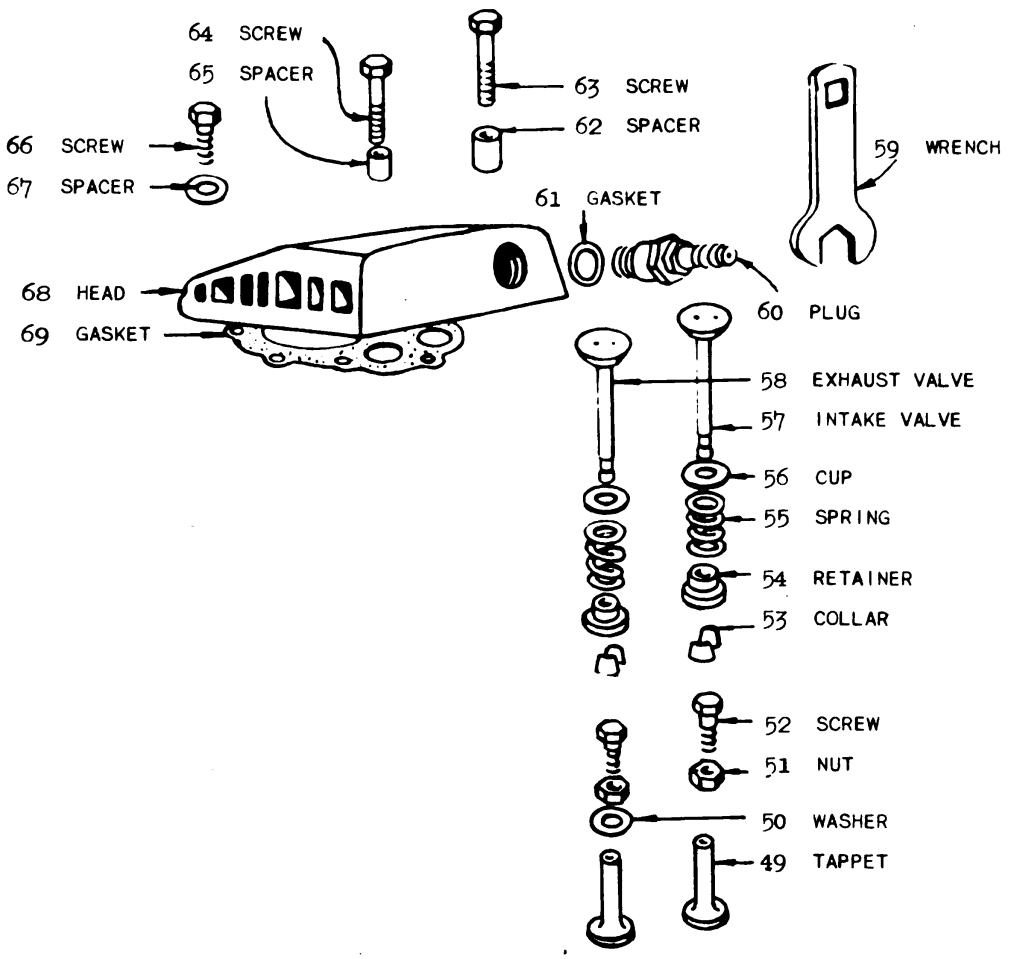
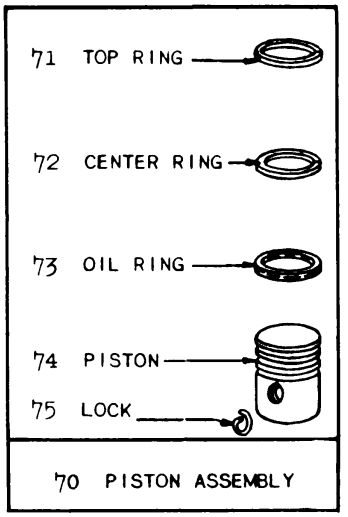


FIGURE B-3

F.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
	109001	Valve Tappet	26308	2
	109002	Valve Tappet Washer	62252	2
	109267	Nut, 1/4-28, hex.	90847	2
	109003	Valve Tappet Screw	90890	2
	109004	Valve Spring Collar	68283	4
	109005	Valve Spring Retainer	68293	2
	109006	Valve Spring	65906	2
	109007	Valve Spring Cup	62222	2
	109008	Intake Valve	68563	1
	109009	Exhaust Valve	23330	1
	109010	Spark Plug & Filler Cup Wrench	68652	1
	109011	Spark Plug with Gasket (Includes Item 61)	89572	1
	109012	Spark Plug Gasket	27090	1
	109013	Cylinder Head Spacer	63336	3
	109014	Cylinder Head Screw	91387	3
	109015	Cylinder Head & Valve Cover Screw	91386	2
	109016	Cylinder Head Spacer	63337	2
	109017	Cylinder Head & Connecting Rod Screw	91162	2
	109018	Cylinder Head Spacer	91324	2
	109019	Cylinder Head	61405	1
	109020	Cylinder Head Gasket	69737	1

ENGINE PARTS



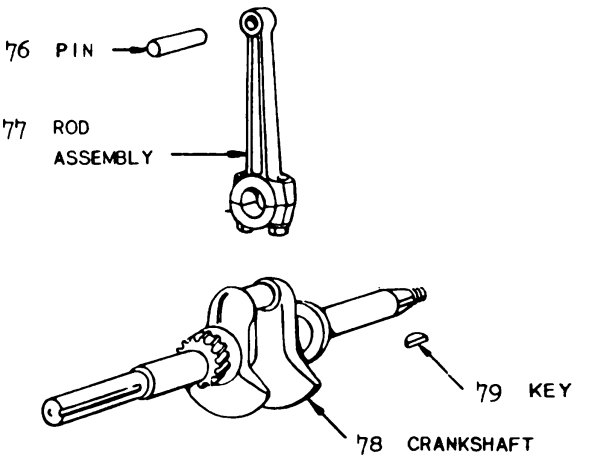


FIGURE 8-4

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.
70		Piston Assembly (Includes 71-75 Inclusive)	
	109099	Standard	99947
	109100	.010"-O.S.	99948
	109101	.020"-O.S.	99949
	109102	.030"-O.S.	99950
71		Top Compression Ring	
	109082	Standard	61964
	109083	.010" O.S.	21002
	109084	.020"-O.S.	21005
	109085	.030"-O.S.	21008
72		Center Compression Ring	
	109086	Standard	61963
	109087	.010" O.S.	21003
	109088	.020"-O.S.	21006
	109089	.030"-O.S.	21009
73		Oil Ring	
	109090	Standard	61292
	109091	.010"-O.S.	61335
	109092	.020"-O.S.	61336
	109093	.030"-O.S.	61337
74		Piston	
*	109094	Standard	69921
	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
	109104	.005"-O.S.	29103
77	109105	Connecting Rod Assembly	69642
	109106	Connecting Rod Shim	22246
	109107	Connecting Rod Washer	67502
	109231	Lockwasher, 5/16 x 1/8 x 1/16"	90366
	109108	Connecting Rod Screw	91162
78	109109	Crankshaft	26278
79	109110	Flywheel Key	66403

* Shim to fit

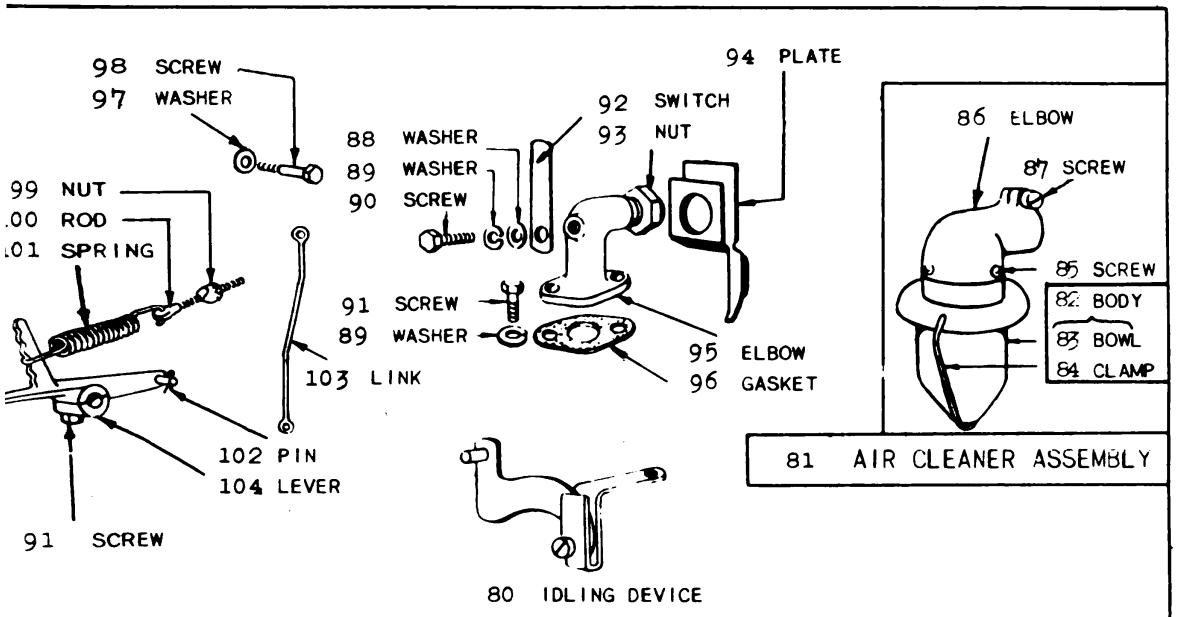
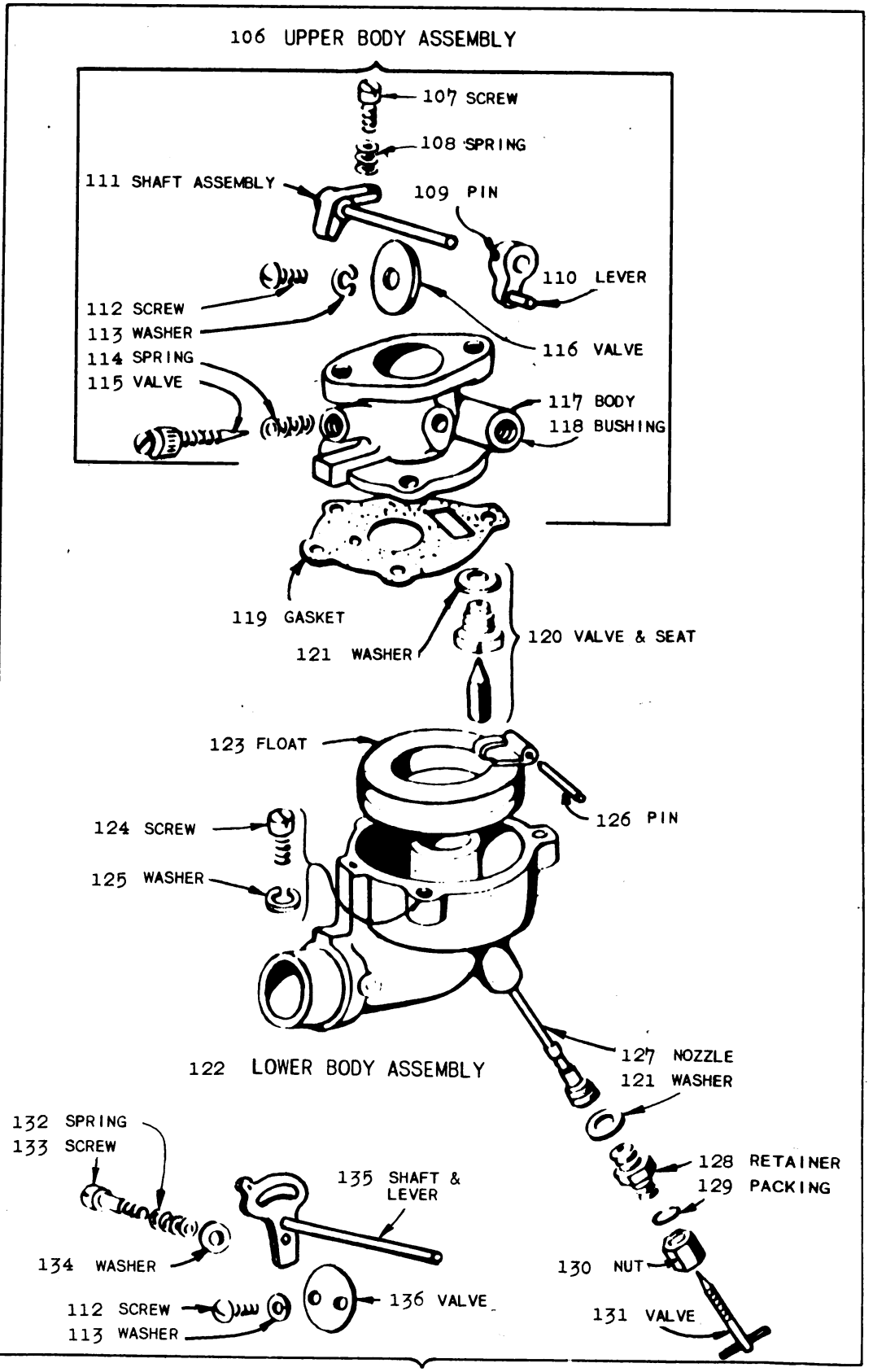


FIGURE B-5

F.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
)	109138	Idling Device	99458	1
l	109139	Air Cleaner Assembly (Items 82 - 87 Inclusive)	69947	1
2	109140	Air Cleaner Body (Items 83 - 84)	69948	1
3	109141	Air Cleaner Bowl	62455	1
4	109142	Air Cleaner Bowl Clamp	62466	1
5	109143	Screw, No. 7 x 1/2" Parker Kalon	91458	3
6	109144	Air Cleaner Elbow	61371	1
7	109215	Screw, 1/4-20 x 1", fill. hd.	91256	1
8	109145	Stop Switch Washer	67632	1
9	109216	Lockwasher, 1/4 x 3/32 x 5/64"	90832	3
)	109217	Screw, 1/4-20 x 1/2", hex. hd.	90891	1
l	109218	Screw, 1/4-20 x 3/4", hex. hd.	90700	3
2	109146	Stop Switch	62196	1
3	109147	Intake Elbow Locknut	63445	1
4	109148	Carburetor Baffle Plate	99393	1
5	109149	Carburetor Intake Elbow	61976	1
6	109150	Carburetor Gasket	65647	1
7	109151	Air Cleaner Washer	65084	1
8	109152	Air Cleaner Screw	91442	1
9	109153	Governor Spring Rod Nut	63520	1
0	109154	Governor Spring Rod	63334	1
1	109155	Governor Spring	67316	1
2	109219	Cotter Pin, 1/16 x 3/8"	92286	1
3	109156	Throttle Link	26160	1
4	109157	Governor Lever	29429	1

ENGINE PARTS



105 CARBURETOR ASSEMBLY
(BRIGGS & STRATTON)

FIGURE B-6

FIGURE B-6

?.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
5	109137	Carburetor Assembly (Off-Center Choke) (Items 106 - 136 Inclusive)	89536	1
6	109111	Upper Carburetor Body Assembly (Items 107 - 118 Inclusive)	99376	1
7	109220	Screw, 8-32 x 3/4", fill. hd.	91846	1
8	109112	Throttle Adjusting Spring	26119	1
9	109113	Throttle Lever Pin	23125	1
0	109114	Throttle Lever	21152	1
1	109115	Throttle Shaft Assembly	99524	1
2	109221	Screw, 4-16 x 1/4", rd. hd.	90029	3
3	109222	Lockwasher, 1/8 x 3/64 x 1/32"	90369	3
4	109116	Idling Valve Spring	26157	1
5	109117	Idler Needle Valve	23228	1
6	109118	Throttle Butterfly Valve	62940	1
7	109119	Upper Carburetor Body	99375	1
8	109120	Throttle Shaft Bushing	23108	1
9	109121	Carburetor Gasket	68947	1
0	109122	Inlet Valve and Seat (Includes Item 121)	99780	1
1	109123	Fibre Washer	68667	2
2	109124	Carburetor Body (Off-Center Choke)	89535	1
3	109125	Carburetor Float	99333	1
4	109223	Screw, 10-32 x 5/8", fill. hd.	90746	4
5	109224	Lockwasher No. 10	91427	4
6	109126	Float Hinge Pin	23114	1
7	109127	Carburetor Nozzle	99345	1
8	109128	Needle Valve Retainer	23117	1
9	109129	Needle Valve Packing	68677	1
0	109130	Needle Valve Packing Nut	23118	1
1	109131	Needle Valve	99346	1
2	109132	Choke Lever Spring	26155	1
3	109133	Choke Lever Screw	23123	1
4	109134	Choke Lever Washer	62899	1
5	109135	Choke Shaft and Lever (Off-Center)	89531	1
6	109136	Choke Valve (Off-Center)	62872	1

ENGINE PARTS

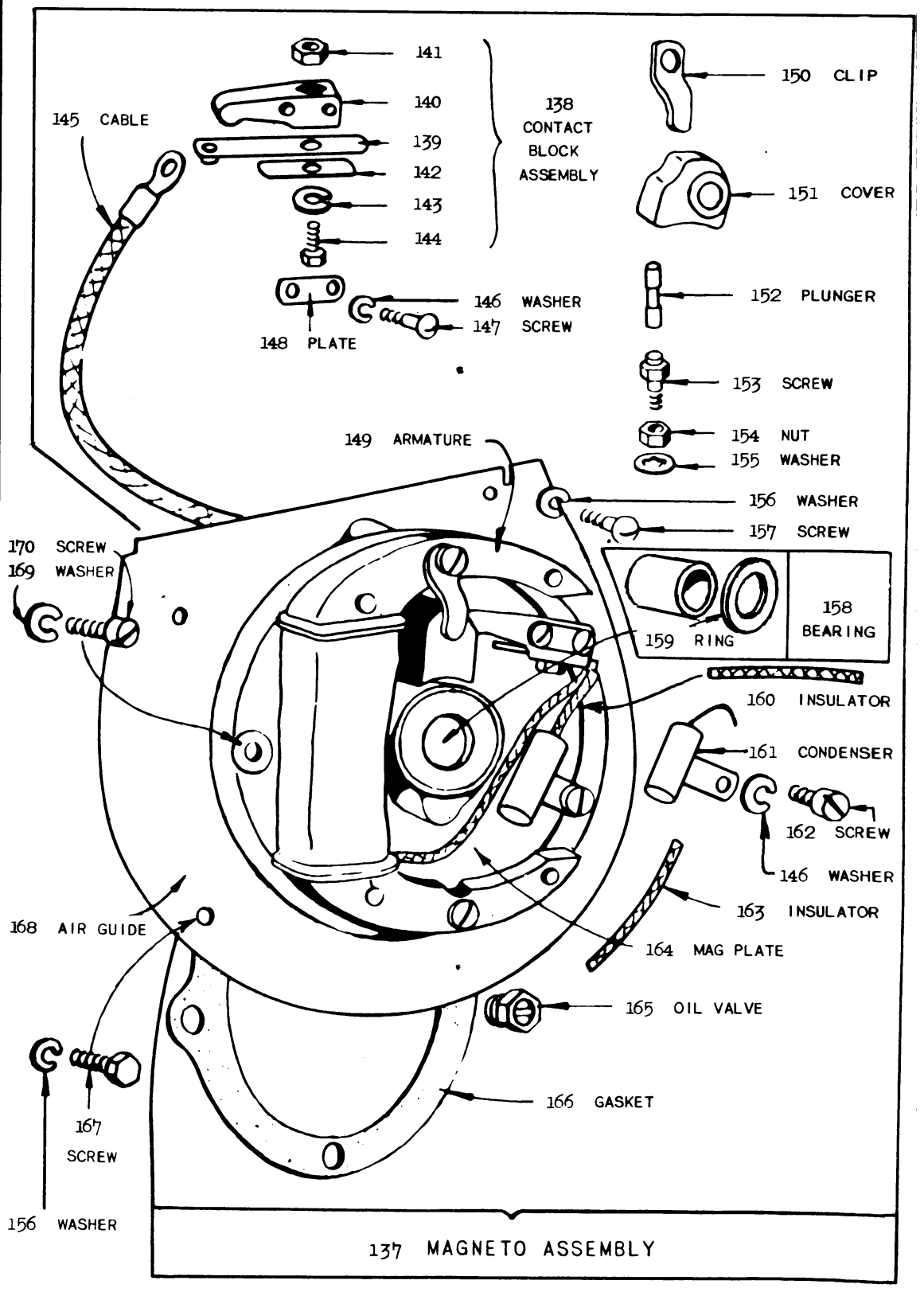


FIGURE B-7

FIGURE 8-7

C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
109158	Magneto Assembly (Items 138 - 170 Inclusive)	69835	1
109159	Contact Block Assembly (Items 139 - 144 Inclusive)	69780	1
109160	Contact Spring and Point	69754	1
109161	Contact Block	65078	1
109258	Nut, 8-32, hex.	90313	1
109162	Contact Spring Stop	62100	1
109259	Lockwasher, 11/64 x 5/64 x 1/32"	90367	1
109163	Contact Block Screw	63369	1
109164	Ignition Cable	69854	1
109234	Lockwasher No. 10	92290	3
109261	Screw, 10-32 x 7/8", rnd. hd.	91406	2
109165	Contact Connector Plate	62178	1
109166	Armature	29656	1
109167	Dust Cover Clip	68876	1
109168	Magneto Point Dust Cover	65198	1
109169	Magneto Point Plunger	65414	1
109170	Contact Point Screw	63238	1
109171	Contact Point Locknut	63239	1
109262	Shakeproof Lockwasher No. 6	91122	1
109216	Lockwasher, 1/4 x 3/32 x 5/64"	90832	8
109264	Screw, 1/4-20 x 1", rnd. hd.	91270	4
109172	Magneto Plate Bearing (Includes Item 159)	69911	1
109173	Oil Retainer Ring	62235	1
109174	Condenser Lead Insulator	65735	1
109175	Condenser	29652	1
109265	Screw, 10-32 x 1/4" fill. hd.	92308	1
109176	Armature Lead Insulator	65725	1
109177	Magneto Plate with Bearing	69876	1
109178	Oil Return Valve	89307	1
	Magneto Plate Gasket*		
109179	.015" Thick	66457	*
109180	.005" Thick	66527	*
109181	.009" Thick	66537	*
109226	Screw, 1/4-20 x 3/8", hex. hd.	91439	4
109182	Blower Housing Air Guide	62926	1
109183	Lockwasher	90774	3
109184	Magneto Plate Screw	91385	

* Use one of the three thicknesses

ENGINE PARTS

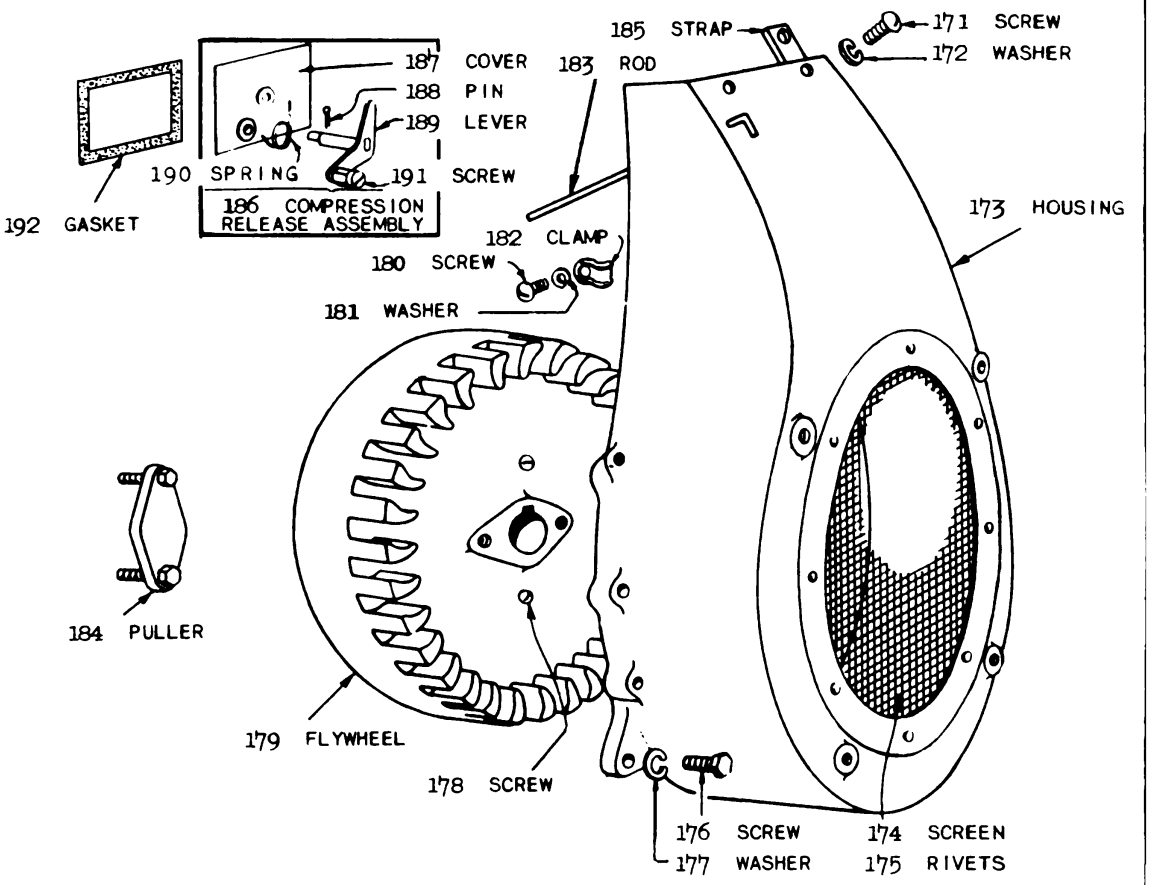
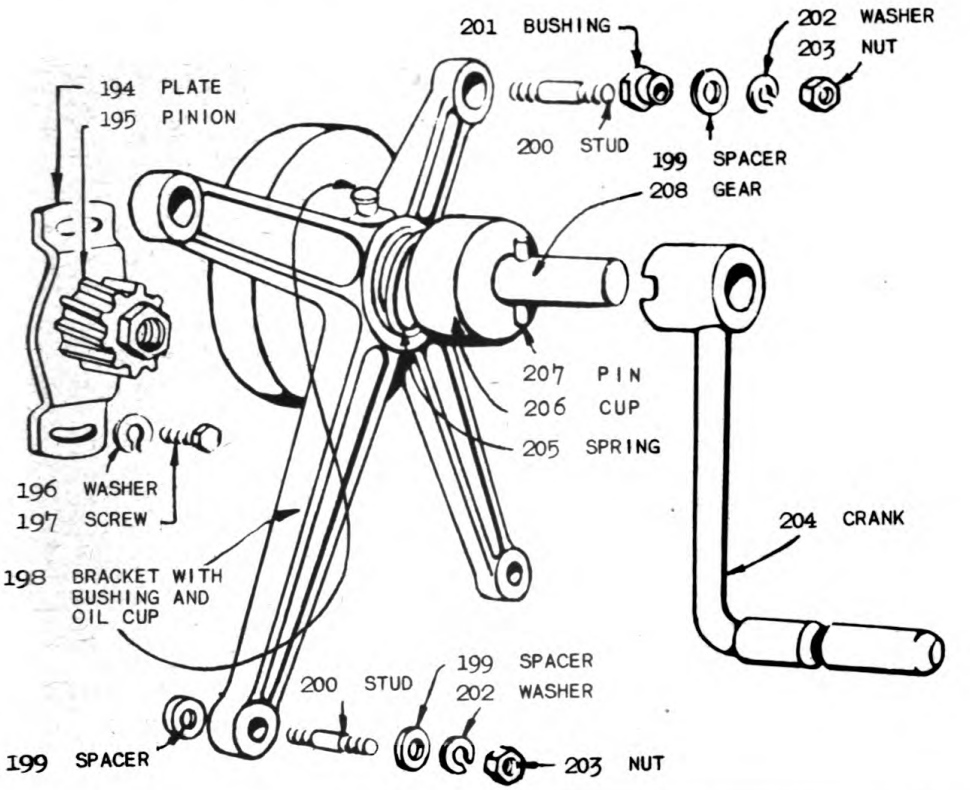


FIGURE 8-8

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO RE
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	109054	Blower Housing	99378	1
174	109055	Blower Housing Screen	62397	1
175	109056	Rivets	36436	8
176	109057	Blower Housing Mounting Screw	92272	8
177	109231	Lockwasher, 5/16 x 1/8 x 1/16"	90366	8
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
	109067	Valve Cover Plate Gasket	65237	1



193 CRANK STARTER ASSEMBLY

FIGURE B-9

F.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
3	109068	Crankstarter Assembly (Items 194 - 208 Inclusive)	29089	1
4	109069	Starter Pinion Lock Plate	62363	1
5	109070	Starter Pinion	63457	1
6	109225	Lockwasher, 1/4 x 5/64 x 1/16"	90699	2
7	109226	Screw, 1/4-20 x 3/8", hex. hd.	91439	2
8	109071	Starter Crank Bracket	69953	1
	109072	Shaft Bushing	63605	1
	109073	Starter Shaft Oil Cup	29222	1
9	109074	Starter Bracket Spacer	63460	6
0	109075	Starter Bracket Stud	63456	4
1	109076	Eccentric Bushing	63458	2
2	109227	Lockwasher, 11/32 x 1/8 x 3/32"	92268	4
3	109228	Nut, 3/8-24 hex.	92292	4
4	109077	Starter Crank	99024	1
5	109078	Crankstarter Spring	68156	1
6	109079	Starter Spring Cup	62254	1
7	109080	Starter Shaft Pin	63199	1
8	109081	Starter Gear and Shaft	69949	1

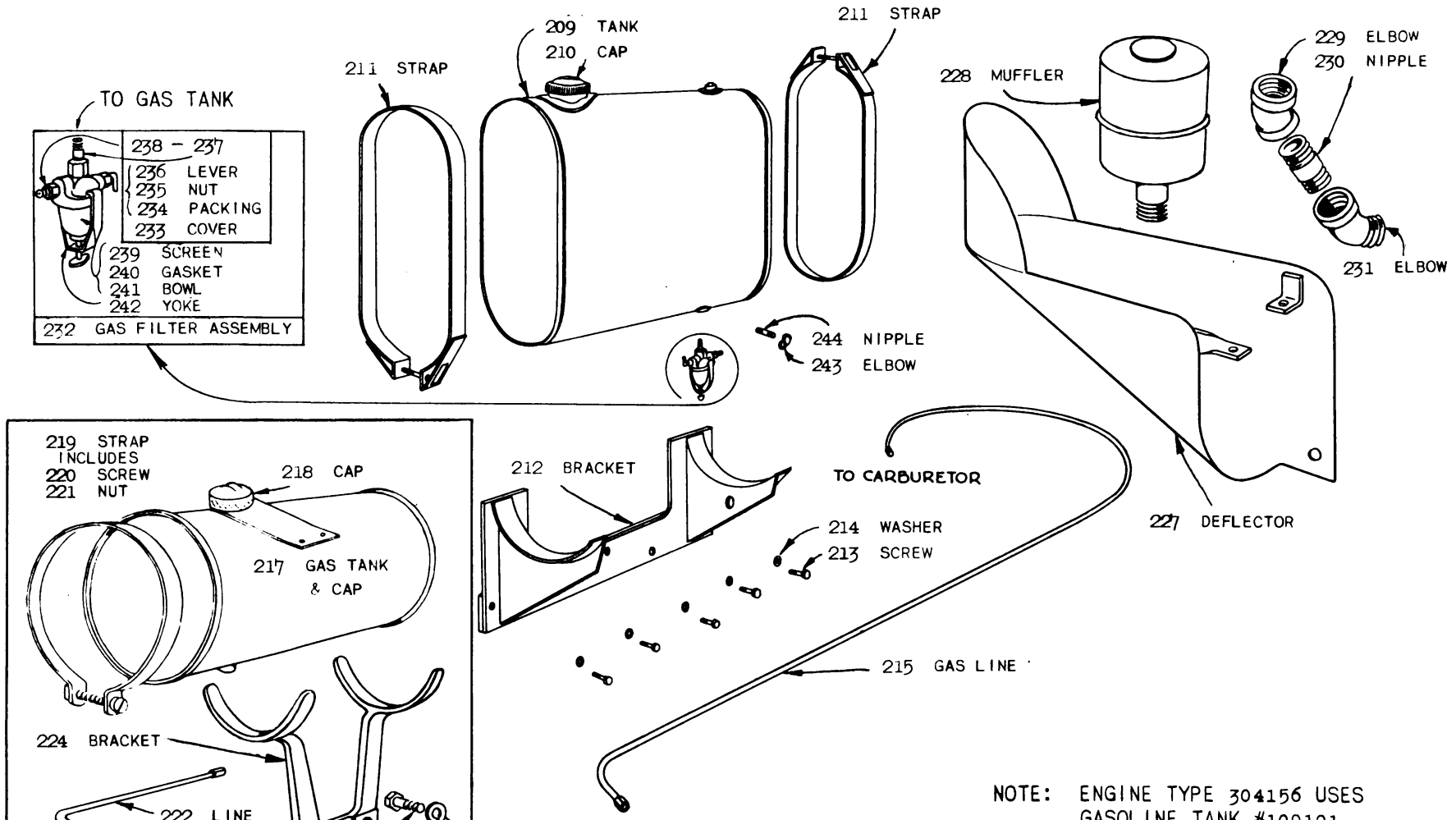


FIGURE B-10

NOTE: ENGINE TYPE 304156 USES GASOLINE TANK #109191.

TYPE 304340 USES TANK #109185

FIGURE B-10

F.	C-B CO. PART NO.	DESCRIPTION	ENG. MFR. NO.	NO. REQ.
9	109185	Gas Tank - 5 gallon (Includes Item 210) Wisconsin Motor #WE-106		1
0	109186	Gas Tank Cap - Wisconsin Motor #RC-77		1
1	109187	Gas Tank Strap with Bolt and Nut - Wisconsin Motor #PG-174B		2
2	109188	Gas Tank Bracket		1
3	109252	Cap Screw, 3/8-16 x 1"		5
4	109253	Lockwasher, 3/8"		5
5	109189	Gasoline Line, 6' long		1
6	109190	Old Style Gas Tank Assembly (Includes 8tems 217 - 226 Inclusive)		1
7	109191	Gas Tank and Cap - 1 gallon (Includes Item 218)	64589	1
8	109192	Gas Tank Cap	69961	1
9	109193	Gas Tank Strap (Includes Items 220 - 221)	69298	2
0	109254	Screw, 1/4-20 x 1-1/2", fill. hd.	91257	2
1	109255	Nut, 1/4-20, sq. hd.	90970	2
2	109194	Gasoline Line, 12-1/2" long	89080	1
3	109195	Gasoline Line Connector	63377	1
4	109196	Gas Tank Bracket	61380	1
5	109256	Screw, 1/2-20 x 1-1/2", hex. hd.	91229	2
6	109257	Lockwasher, 1/2"	90683	2
7	109197	Air Deflector		1
8	109198	Muffler	69134	1
9	109199	Exhaust Pipe Elbow, 45°	91415	1
0	109200	Exhaust Nipple	91416	1
1	109201	Exhaust Street Elbow, 45°	92130	1
2	109202	Gas Filter Assembly (Includes Items 233 - 242 Inclusive)	99910	1
3	109203	Gas Filter Cover Assembly (Items 234 - 238 Inclusive)	99909	1
4	109204	Shut Off Lever Packing	27019	1
5	109205	Shut Off Lever Nut	23346	1
6	109206	Shut Off Lever	23347	1
7	109207	Gas Filter Connector	91635	1
8	109208	Gas Filter Connector	53029	1
9	109209	Gas Filter Screen	62876	1
0	109210	Gas Filter Gasket	68477	1
1	109211	Gas Filter Bowl	68487	1
2	109212	Gas Filter Yoke Assembly	99665	1
3	109213	Gas Filter Elbow, 1/8", 90°		1
4	109214	Gas Filter Nipple, 1/8"		1

NUMERICAL

PARTS PRICE LIST

CLEAVER TANK CAR HEATER

BRIGGS & STRATTON ENGINE - MODEL Z, TYPE NO. 304156 & 304340

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRI EAC
49	109001	Valve Tappet	26308	21-E	$ 1.
50	109002	Valve Tappet Washer	62252	21-E	.
52	109003	Valve Tappet Screw	90890	21-E	.
53	109004	Valve Spring Collar	68283	21-E	.
54	109005	Valve Spring Retainer	68293	21-E	.
55	109006	Valve Spring	65906	21-E	.
56	109007	Valve Spring Cup	62222	21-E	.
57	109008	Intake Valve	68563	21-E	1.
58	109009	Exhuast Valve	23330	21-E	4.
59	109010	Spark Plug and Filler Cup Wrench	68652	21-E	.
60	109011	Spark Plug with Gasket (Includes Item 61)	89572	21-E	1.
61	109012	Spark Plug Gasket	27090	21-E	.
62	109013	Cylinder Head Spacer	63336	21-E	.
63	109014	Cylinder Head Screw	91387	21-E	.
64	109015	Cylinder Head and Valve Cover Screw	91386	21-E	.
65	109016	Cylinder Head Spacer	63337	21-E	.
66	109017	Cylinder Head and Connecting Rod Screw	91162	21-E	.
67	109018	Cylinder Head Spacer	91324	21-E	.
68	109019	Cylinder Head	61405	21-E	12.
69	109020	Cylinder Head Gasket	69737	21-E	.
22	109021	Cylinder Shield	62924	20-E	.
25	109022	Breather Tube	69314	20-E	1.
26	109023	Crankcase Cover Gasket	66717	20-E	.
27	109024	Crankcase Cover (Cast Iron) (Includes Item 28)	99936	20-E	12.
28	109025	Bearing Oil Seal	69740	20-E	3.
31	109026	Ball Bearing	69739	20-E	11.
32	109027	Base Gasket	65247	20-E	.
33	109028	Crankcase Assembly (Cast Iron) (Includes Items 34 - 37 Inclusive, also Item 29)	99373	20-E	24.
34	109029	Governor Crank Bushing	63341	20-E	.
35	109030	Cylinder Mounting Stud	23136	20-E	.
36	109031	Governor Gear Shaft	63343	20-E	.
38	109032	Governor Gear Washer	92305	20-E	.
40	109033	Governor Gear	69839	20-E	9.
41	109034	Governor Crank	69926	20-E	2.
43	109035	Governor Plunger	63335	20-E	.
44	109036	Cam Shaft Plug	65932	20-E	.
45	109037	Cam Shaft	66203	20-E	1.
46	109038	Cam Gear	61454	20-E	9.
47	109039	Cylinder Gasket	66477	20-E	.
48	109040	Cylinder	99358	20-E	33.
1	109041	Oil Pump Assembly (Items 2 - 4 Inclusive)	99360	19-E	3.
2	109042	Oil Pump Screen	99361	19-E	1.
7	109043	Oil Drain Plug	91084	19-E	.
8	109044	Base (Cast Iron)	61287	19-E	14.
9	109045	Oil Filler Nipple	92469	19-E	.
10	109046	Oil Filler Cap	69689	19-E	.

F.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
1	109047	Oil Tube Connector	63202	19-E	$ 1.00
2	109048	Oil Tube Connector Nut	63217	19-E	.20
3	109049	Oil Pump Spring	26413	19-E	.20
4	109050	Oil Pump Plunger	23132	19-E	.30
5	109051	Oil Pump Tube	99362	19-E	1.30
6	109052	Oil Tube Retainer	62081	19-E	.50
7	109053	Oil Pump Rod	66739	19-E	.80
8	109054	Blower Housing	99378	28-E	15.00
9	109055	Blower Housing Screen	62397	28-E	1.00
0	109056	Rivets	36436	28-E	.02
1	109057	Blower Housing Mounting Screw	92272	28-E	.10
2	109058	Magneto and Blower Flywheel	69808	28-E	30.00
3	109059	Ignition Cable Clamp	23581	28-E	.10
4	109060	Compression Release Rod	63609	28-E	.60
5	109061	Flywheel Puller	29020	28-E	.90
6	109062	Blower Housing Mounting Strap	62177	28-E	.50
7	109063	Compression Release Assembly (Items 187 - 191 Inclusive)	69950	28-E	4.00
8	109064	Valve Cover	69951	28-E	4.50
9	109065	Shaft Lever and Swivel	69952	28-E	4.00
0	109066	Compression Release Spring	67666	28-E	.50
1	109067	Valve Cover Plate Gasket	65237	28-E	.20
2	109068	Crankstarter Assembly (Items 194 - 208 Inclusive)	29089	29-E	23.00
3	109069	Starter Pinion Lock Plate	62363	29-E	.90
4	109070	Starter Pinion	63457	29-E	5.00
5	109071	Starter Crank Bracket	69953	29-E	8.00
6	109072	Shaft Bushing	63605	29-E	.60
7	109073	Starter Shaft Oil Cup	29222	29-E	.70
8	109074	Starter Bracket Spacer	63460	29-E	.20
9	109075	Starter Bracket Stud	63456	29-E	.30
0	109076	Eccentric Bushing	63458	29-E	.20
1	109077	Starter Crank	99024	29-E	3.00
2	109078	Crankstarter Spring	68156	29-E	.20
3	109079	Starter Spring Cup	62254	29-E	.40
4	109080	Starter Shaft Pin	63199	29-E	.30
5	109081	Starter Gear and Shaft	69949	29-E	7.00
		Top Compression Ring			
6	109082	Standard	61964	22-E	.80
7	109083	.010"-O.S.	21002	22-E	.80
8	109084	.020"-O.S.	21005	22-E	.80
9	109085	.030"-O.S.	21008	22-E	.80
		Center Compression Ring			
0	109086	Standard	61963	22-E	.80
1	109087	.010"-O.S.	21003	22-E	.80
2	109088	.020"-O.S.	21006	22-E	.80
3	109089	.030"-O.S.	21009	22-E	.80
		Oil Ring			
4	109090	Standard	61292	22-E	1.20
5	109091	.010"-O.S.	61335	22-E	1.20
6	109092	.020"-O.S.	61336	22-E	1.20
7	109093	.030"-O.S.	61337	22-E	1.20

REF. NO.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PR EA
74		Piston			
	109094	Standard	69921	22-E	$ 7
	109095	.010"-O.S.	69922	22-E	8
	109096	.020"-O.S.	69923	22-E	8
	109097	.030"-O.S.	69924	22-E	8
75	109098	Piston Pin Locks	65776	22-E	
70		Piston Assembly			
	109099	Standard	99947	22-E	9
	109100	.010"-O.S.	99948	22-E	11
	109101	.020"-O.S.	99949	22-E	11
	109102	.030"-O.S.	99950	22-E	11
76		Piston Pin			
	109103	Standard	69925	22-E	1
	109104	.005"-O.S.	29103	22-E	1
77	109105	Connecting Rod Assembly	69642	22-E	12
	109106	Connecting Rod Shim	22246	22-E	
	109107	Connecting Rod Washer	67502	22-E	
	109108	Connecting Rod Screw	91162	22-E	
78	109109	Crankshaft	26278	22-E	24.
79	109110	Flywheel Key	66403	22-E	
106	109111	Upper Carburetor Body Assembly (Items 107 - 118 Inclusive)	99376	25-E	9.
108	109112	Throttle Adjusting Spring	26119	25-E	
109	109113	Throttle Lever Pin	23125	25-E	
110	109114	Throttle Lever	21152	25-E	
111	109115	Throttle Shaft Assembly	99524	25-E	1.
114	109116	Idling Valve Spring	26157	25-E	
115	109117	Idler Needle Valve	23228	25-E	
116	109118	Throttle Butterfly Valve	62940	25-E	
117	109119	Upper Carburetor Body	99375	25-E	5.
118	109120	Throttle Shaft Bushing	23108	25-E	
119	109121	Carburetor Gasket	68947	25-E	
120	109122	Inlet Valve & Seat (Includes Item 121)	99780	25-E	1.
121	109123	Fibre Washer	68667	25-E	
122	109124	Carburetor Body (Off-Center Choke)	89535	25-E	8.
123	109125	Carburetor Float	99333	25-E	1.
126	109126	Float Hinge Pin	23114	25-E	
127	109127	Carburetor Nozzle	99345	25-E	1.
128	109128	Needle Valve Retainer	23117	25-E	
129	109129	Needle Valve Packing	68677	25-E	
130	109130	Needle Valve Packing Nut	23118	25-E	
131	109131	Needle Valve	99346	25-E	1.
132	109132	Choke Lever Spring	26155	25-E	
133	109133	Choke Lever Screw	23123	25-E	
134	109134	Choke Lever Washer	62899	25-E	
135	109135	Choke Shaft and Lever (Off-Center)	89531	25-E	1.
136	109136	Choke Valve (Off-Center)	62872	25-E	
105	109137	Carburetor Assembly (Off-Center Choke) (Items 106 - 136 Inclusive)	89536	25-E	20.
80	109138	Idling Device	99458	23-E	3.
81	109139	Air Cleaner Assembly (Items 82 - 87 Inclusive)	69947	23-E	14.

C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
109140	Air Cleaner Body (Items 83 - 84 Incl.)	69948	23-E	$ 10.00
109141	Air Cleaner Bowl	62465	23-E	1.50
109142	Air Cleaner Bowl Clamp	62466	23-E	.30
109143	Screw, No. 7 x 1/2" Parker Kalon	91458	23-E	.10
109144	Air Cleaner Elbow	61371	23-E	4.00
109145	Stop Switch Washer	67632	23-E	.10
109146	Stop Switch	62196	23-E	.20
109147	Intake Elbow Locknut	63445	23-E	.50
109148	Carburetor Baffle Plate	99393	23-E	1.00
109149	Carburetor Intake Elbow	61976	23-E	3.50
109150	Carburetor Gasket	65647	23-E	.20
109151	Air Cleaner Washer	65084	23-E	.10
109152	Air Cleaner Screw	91442	23-E	.20
109153	Governor Spring Rod Nut	63520	23-E	.10
109154	Governor Spring Rod	63334	23-E	1.00
109155	Governor Spring	67316	23-E	.40
109156	Throttle Link	26160	23-E	1.00
109157	Governor Lever	29429	23-E	2.50
109158	Magneto Assembly (Items 138 - 170 Incl.)	69835	27-E	18.00
109159	Contact Block Assembly (Items 139 - 144 Inclusive)	69780	27-E	1.30
109160	Contact Spring and Point	69754	27-E	.60
109161	Contact Block	65078	27-E	.80
109162	Contact Spring Stop	62100	27-E	.30
109163	Contact Block Screw	93369	27-E	.10
109164	Ignition Cable	69854	27-E	.70
109165	Contact Connector Plate	62178	27-E	.10
109166	Armature	29656	27-E	8.00
109167	Dust Cover Clip	68876	27-E	.20
109168	Magneto Point Dust Cover	65198	27-E	.50
109169	Magneto Point Plunger	65414	27-E	.60
109170	Contact Point Screw	63238	27-E	.80
109171	Contact Point Locknut	63239	27-E	.10
109172	Magneto Plate Bearing (Includes Item 159)	69911	27-E	1.40
109173	Oil Retainer Ring	62235	27-E	.10
109174	Condenser Lead Insulator	65735	27-E	.10
109175	Condenser	29652	27-E	1.00
109176	Armature Lead Insulator	65725	27-E	.10
109177	Magneto Plate with Bearing	69876	27-E	6.00
109178	Oil Return Valve	89307	27-E	.30
	Magneto Plate Gaskets*			
109179	.015" Thick	66457	27-E	.10
109180	.005" Thick	66527	27-E	.10
109181	.009" Thick	66537	27-E	.10
109182	Blower Housing Air Guide	62936	27-E	1.60
109183	Lockwasher	90774	27-E	.06
109184	Magneto Plate Screw	91385	27-E	.10
109185	Gas Tank - 5 gallon (Incl. Item 210 Wis. Motor #WE-106)		31-E	13.00
109186	Gas Tank Cap - Wis. Motor #RC-77		31-E	1.04

* Use one of the three thicknesses.

REF. NO.	C-B CO. PART NO.		ENG. MGR. NO.	PAGE NO.	PRIC EACH
211	109187	Gas Tank Strap with Bolt and Nut, Wisconsin Motor #PG-174B		31-E	$ 2.4
212	109188	Gas Tank Bracket		31-E	14.4
215	109189	Gasoline Line, 6' long		31-E	1.0
216	109190	Old Style Gas Tank Assembly (Includes Items 217 - 226 Inclusive)		31-E	15.3
217	109191	One Gallon Gas Tank and Cap (Includes Item 218)	64589	31-E	8.0
218	109192	Gas Tank Cap	69961	31-E	.7
219	109193	Gas Tank Strap (Incl. Items 220 - 221)	69298	31-E	.7
222	109194	Gasoline Line - 12-1/2" Long	89080	31-E	.9
223	109195	Gasoline Line Connector	63377	31-E	.7
224	109196	Gas Tank Bracket	61380	31-E	4.5
227	109197	Air Deflector		31-E	7.2
228	109198	Muffler	69134	31-E	5.0
229	109199	Exhaust Pipe Elbow, 45°	91415	31-E	.9
230	109200	Exhaust Nipple	91416	31-E	.4
231	109201	Exhaust Street Elbow, 45°	92130	31-E	.9
232	109202	Gas Filter Assembly (Items 233 - 242 Inclusive)	99910	31-E	3.5
233	109203	Gas Filter Cam Assembly (Items 234 - 238 Inclusive)	99909	31-E	2.5
234	109204	Shut Off Lever Packing	27019	31-E	.1
235	109205	Shut Off Lever Nut	23346	31-E	.3
236	109206	Shut Off Lever	23347	31-E	.5
237	109207	Gas Filter Connector	91635	31-E	.3
238	109208	Gas Filter Connector	53029	31-E	.4
239	109209	Gas Filter Screen	62876	31-E	.3
240	109210	Gas Filter Gasket	68477	31-E	.1
241	109211	Gas Filter Bowl	68487	31-E	.3
242	109212	Gas Filter Yoke Assembly	99665	31-E	1.0
243	109213	Gas Filter Elbow, 1/8" 90°		31-E	.3
244	109214	Gas Filter Nipple, 1/8"		31-E	.3
87	109215	Screw, 1/4-20 x 1", fill. hd.	91256	23-E	.1
89	109216	Lockwasher, 1/4 x 3/32 x 5/64"	90832	23-E	.0
90	109217	Screw, 1/4-20 x 1/2", hex. hd.	90891	23-E	.1
91	109218	Screw, 1/4-20 x 3/4", hex. hd.	90700	23-E	.1
102	109219	Cotter Pin, 1/16 x 3/8"	92286	23-E	.0
107	109220	Screw, 8-32 x 3/4", fill. hd.	91846	25-E	.1
112	109221	Screw, 4-16 x 1/4", rd. hd.	90029	25-E	.1
113	109222	Lockwasher, 1/8 x 3/64 x 1/32	90369	25-E	.0
124	109223	Screw, 10-32 x 5/8", fill. hd.	90746	25-E	.1
125	109224	Lockwasher No. 10	91427	25-E	.0
196	109225	Lockwasher, 1/4 x 5/64 x 1/16"	90699	29-E	.0
197	109226	Screw, 1/4-20 x 3/8", hex. hd.	91439	29-E	.1

F.	C-B CO. PART NO.	DESCRIPTION	ENG. MGR. NO.	PAGE NO.	PRICE EACH
2	109227	Lockwasher, 11/32 x 1/8 x 3/32"	92268	29-E	$ .04
3	109228	Nut, 3/8-24, hex.	92292	29-E	.06
1	109229	Screw, 1/4-20 x 5/8", rd. hd.	91698	28-E	.10
7	109231	Lockwasher, 5/16 x 1/8 x 1/16"	90366	28-E	.04
3	109232	Screw, 1/4-20 x 3/8", rd. hd.	91195	28-E	.06
)	109233	Screw, 10-32 x 1/2", rd. hd.	90597	28-E	.06
1	109234	Lockwasher No. 10	92290	28-E	.04
3	109235	Cotter Pin, 1/16 x 1/2"	92288	28-E	.04
1	109236	Screw, 10-32 x 5/16", rd. hd.	90010	28-E	.10
)	109237	Lockwasher No. 12	91059	19-E	.04
1	109238	Screw, 12-24 x 5/16", fill. hd.	91921	19-E	.10
3	109240	Screw, 5/16-24 x 3/4", hex. hd.	90950	19-E	.10
)	109243	Screw, 3/8-16 x 1-1/4", hex. hd.	90887	19-E	.10
1	109246	Screw, 1/4-20 x 1/2", rd. hd.	90916	20-E	.10
)	109248	Screw, 3/8-24 x 3/4", hex. hd.	91028	20-E	.10
)	109252	Cap Screw, 3/8-16 x 1"		31-E	.12
1	109253	Lockwasher, 3/8"		31-E	.06
)	109254	Screw, 1/4-20 x 1-1/2", fill. hd.	91257	31-E	.10
1	109255	Nut, 1/4-20, sq. hd.	90970	31-E	.10
3	109256	Screw, 1/2-20 x 1-1/2", hex. hd.	91229	31-E	.20
3	109257	Lockwasher, 1/2"	90683	31-E	.06
.	109258	Nut, 8-32 hex.	90313	27-E	.10
)	109259	Lockwasher, 11/64 x 5/64 x 1/32"	90367	27-E	.06
7	109261	Screw, 10-32 x 7/8", rd. hd.	91406	27-E	.10
3	109262	Shakeproof Lockwasher No. 6	91122	27-E	.06
'	109264	Screw, 1/4-20 x 1", rd. hd.	91270	27-E	.10
3	109265	Screw, 10-32 x 1/4", fill. hd.	92308	27-E	.10
.	109267	Nut, 1/4-28, hex.	90847	21-E	.10