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# TM 5-1042

WAR DEPARTMENT TECHNICAL MANUAL

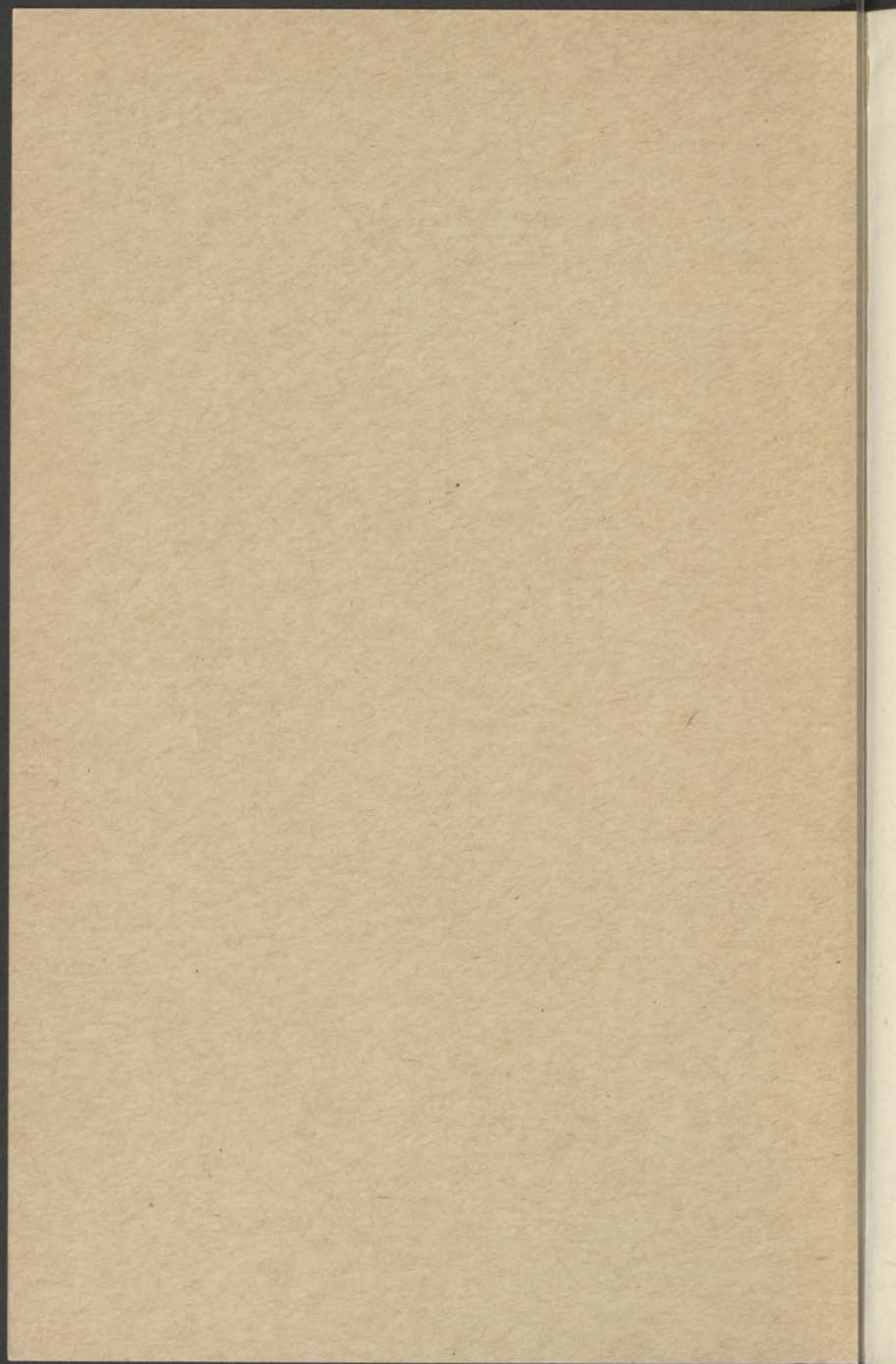
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## TANK CAR HEATER MODEL DS 2-CAR CAPACITY

MAINTENANCE MANUAL  
AND PARTS LIST

WAR DEPARTMENT • 15 DECEMBER 1942

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# TANK CAR HEATER

## MODEL DS

### 2-CAR CAPACITY

#### MAINTENANCE MANUAL AND PARTS LIST

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WAR DEPARTMENT • 15 DECEMBER 1942

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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:

OFFICIAL:

J. A. ULIO  
*Major General*  
*The Adjutant General*

G. C. MARSHALL  
*Chief of Staff*

# 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:

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| 692-41 | 695-41 | 716-42 | 729-42 | 736-42 | 765-42 | 784-42 |
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| 786-42 | 816-42 | 840-42 | 872-42 | 892-42 | 912-42 | 933-42  |
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| 790-42 | 819-42 | 854-42 | 874-42 | 894-42 | 915-42 | 937-42  |
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| 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  |
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|        |        | 868-42 | 888-42 | 907-42 |        |         |



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**WATER PUMP**

**BLOWER**

**CHASSIS AND  
RUNNING GEAR**

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**LUBRICATION**

# THE CLEAVER 2-CAR HEATER . MODEL DS

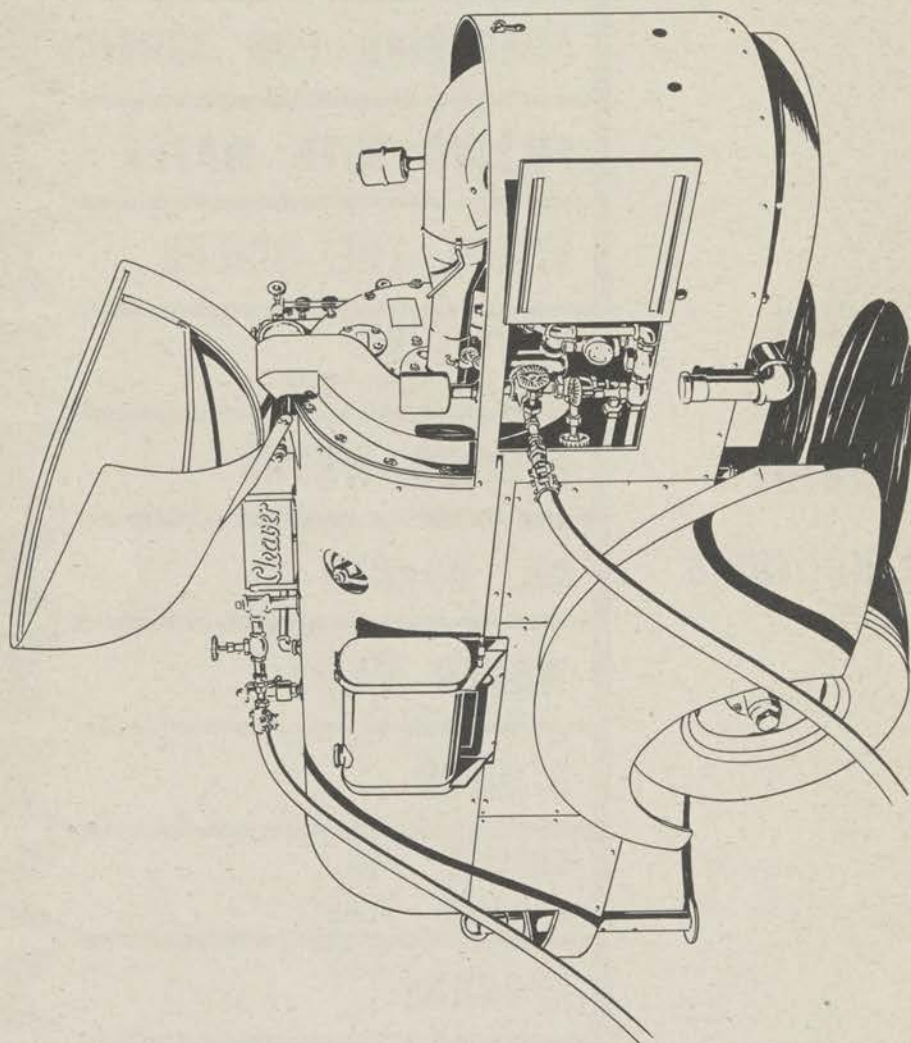


FIGURE 1

THE CLEAVER 2-CAR HEATER MODEL DS

Powe  
Fuel  
Conc  
Whee  
Tire  
Tire  
Whee  
Gas  
Ship  
Leng  
Widt  
Heig  
Fuel  
Wate  
Wate  
Fuel  
Trac  
  
Wate  
  
Fuel  
Moto  
Greas  
Lubr

## SPECIFICATIONS FOR 2-CAR HEATER - MODEL DS

|                                              |                                         |
|----------------------------------------------|-----------------------------------------|
| Power Plant                                  | Briggs & Stratton, Model Z, Type 304340 |
| Fuel Oil Pump                                | Tuthill Pump Co., Model OL-K            |
| Condensate Pump                              | Aurora Pump Co., Model D-40             |
| Wheels                                       | Motor Wheel Corp., #31677               |
| Tires                                        | Goodrich Implement, 7.50 x 16           |
| Tire Pressure                                | 48#                                     |
| Wheel Bearings                               | Timken                                  |
| Gasoline Tank Capacity                       | 5 Gallons                               |
| Shipping Weight                              | 4100#                                   |
| Length                                       | 13' 7"                                  |
| Width                                        | 61-1/2"                                 |
| Height                                       | 69"                                     |
| Fuel Oil Tank Capacity                       | 40 Gallons                              |
| Water Tank Capacity                          | 30 Gallons                              |
| Water Content Boiler                         | 96 Gallons                              |
| Fuel Consumption per Hour -<br>Full Capacity | 11 Gallons                              |
| Track Width (Centers)                        | 49-1/4"                                 |

TABLE OF APPROXIMATE CAPACITIES AND CONSUMPTIONS  
FOR AN EIGHT HOUR DAY

|       |                                                                      |
|-------|----------------------------------------------------------------------|
| Water | 952 Gallons :                                                        |
|       | This is with no condensate return.                                   |
|       | This amount will decrease with the amount<br>of condensate returned. |

## U. S. Army Specifications

|                 |                 |            |
|-----------------|-----------------|------------|
| Fuel Oil        | 2-102B          | 80 Gallons |
| Motor Fuel      | 2-103A          | 4 Gallons  |
| Grease          | 2-108 - Grade 2 | 1/4 Lb.    |
| Lubricating 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 boiler of riveted construction, produced under strict supervision and code regulations 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 next 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 of 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 asphalts. Heat leaves the boiler in the form of steam and is given up as the asphalt or road oil is heated, and, as the heat is exchanged, the steam is condensed to hot water and returned to the boiler by the condensate pump.

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

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

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

## GENERAL DESCRIPTION OF CLEAVER TANK CAR HEATER

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

Of fire tube construction, the boiler is equipped with four complete passes of flue gas travel, the first pass being the large center tube or combustion chamber, the second pass of two groups of tubes at either side of the fire tube and the third and fourth passes below. The vent pipe or stack is a part of the outer head at the firing end of the boiler. (See cut-away view on page 4). The oil burner is of the pressure atomizing type with three fuel oil atomizing nozzles. Two 5-gallon and one 4-gallon nozzles are used on the three-car heater, giving a total burning rate of fourteen gallons per hour. The two-car heater is equipped with two 4-gallon nozzles and one 3-gallon nozzle, or a total of eleven gallons per hour. By manually operating the valves to the individual fuel oil nozzles and adjusting the air supply to the burner, the firing rate may be varied to suit the steam requirement.

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

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

# THE CLEAVER TANK CAR HEATER

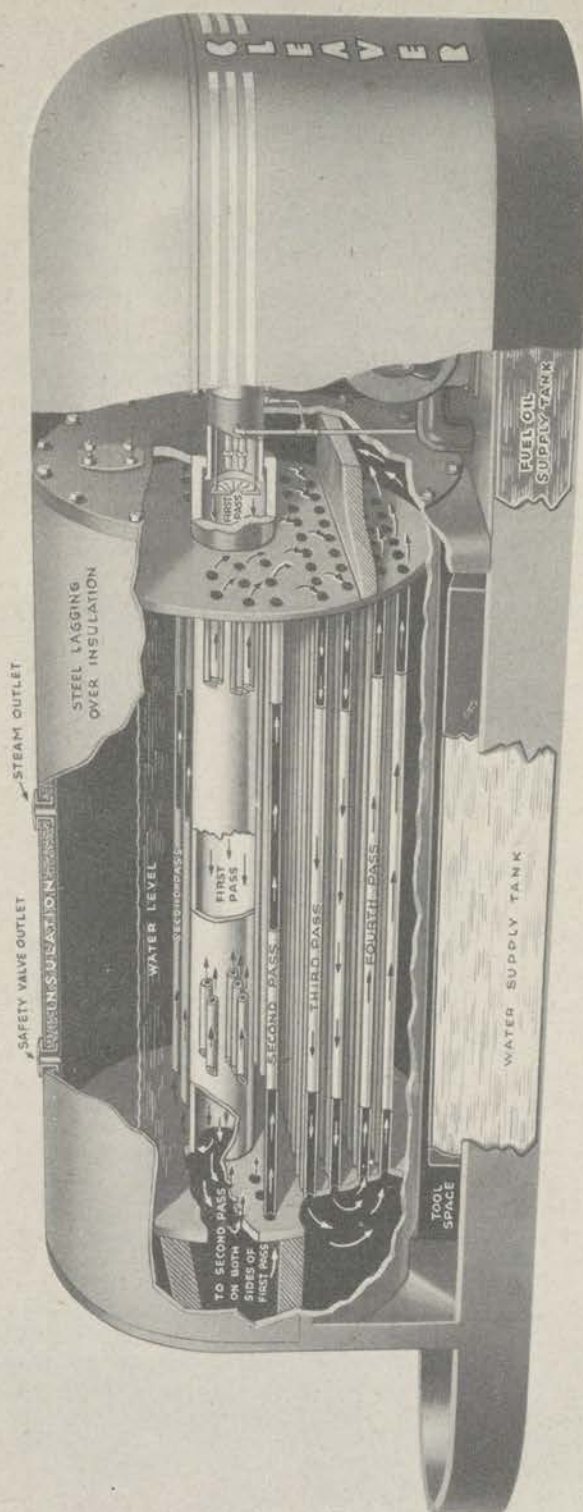


FIGURE 2

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 in Figure 1, engaging pin safety lock on rest at top of boiler to prevent hood from being blown down by the wind.

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

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

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

1. Fresh Water
2. Fuel Oil
3. Gasoline
4. Lubricating Oil
5. Ball Bearing Grease

#### Water

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

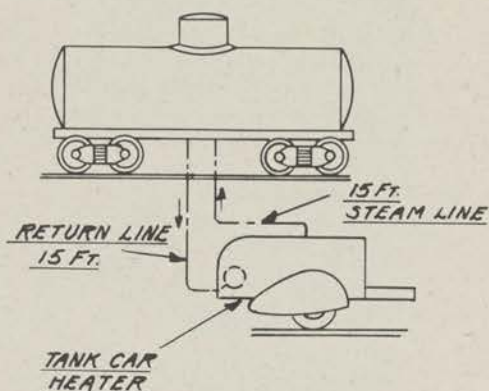
If only salt water is available, proceed according to instructions on Page 22.

#### Fuel Oil

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

## PREPARING MACHINE FOR SERVICE

## ONE-CAR HOOK-UP



## TWO-CAR HOOK-UP

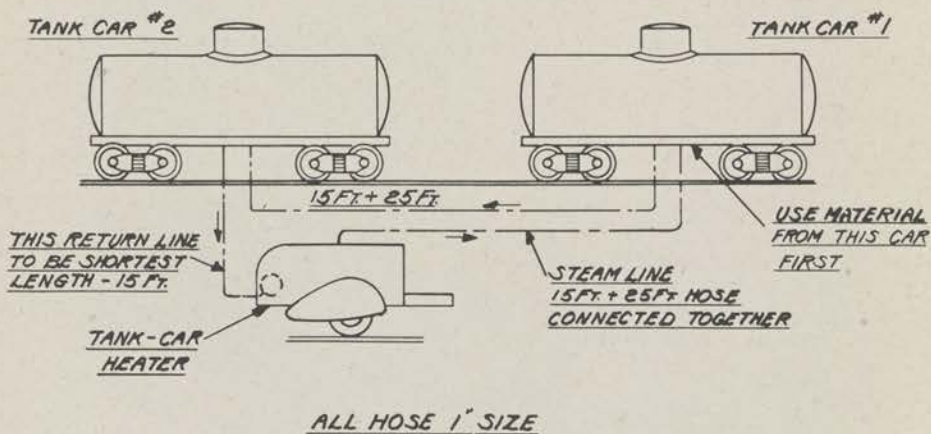


FIGURE 3

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

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

#### Steam Outlet and Return Connections

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

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

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

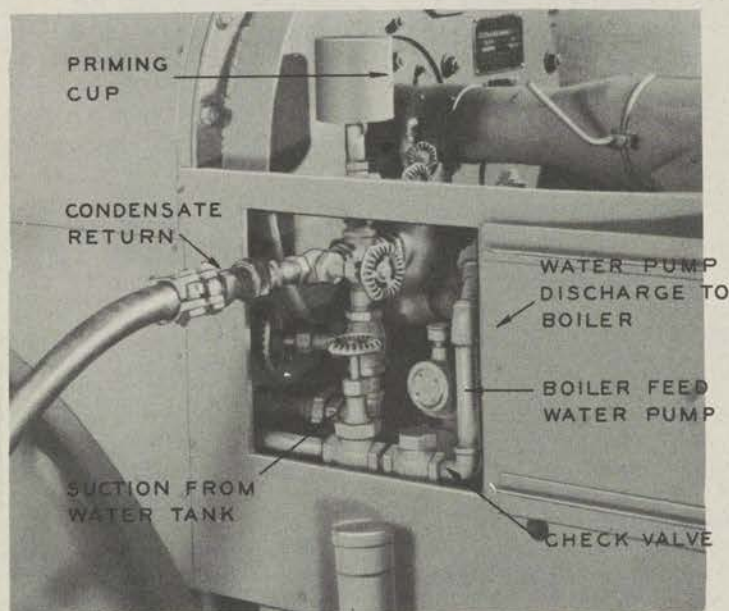


FIGURE 4

## 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.

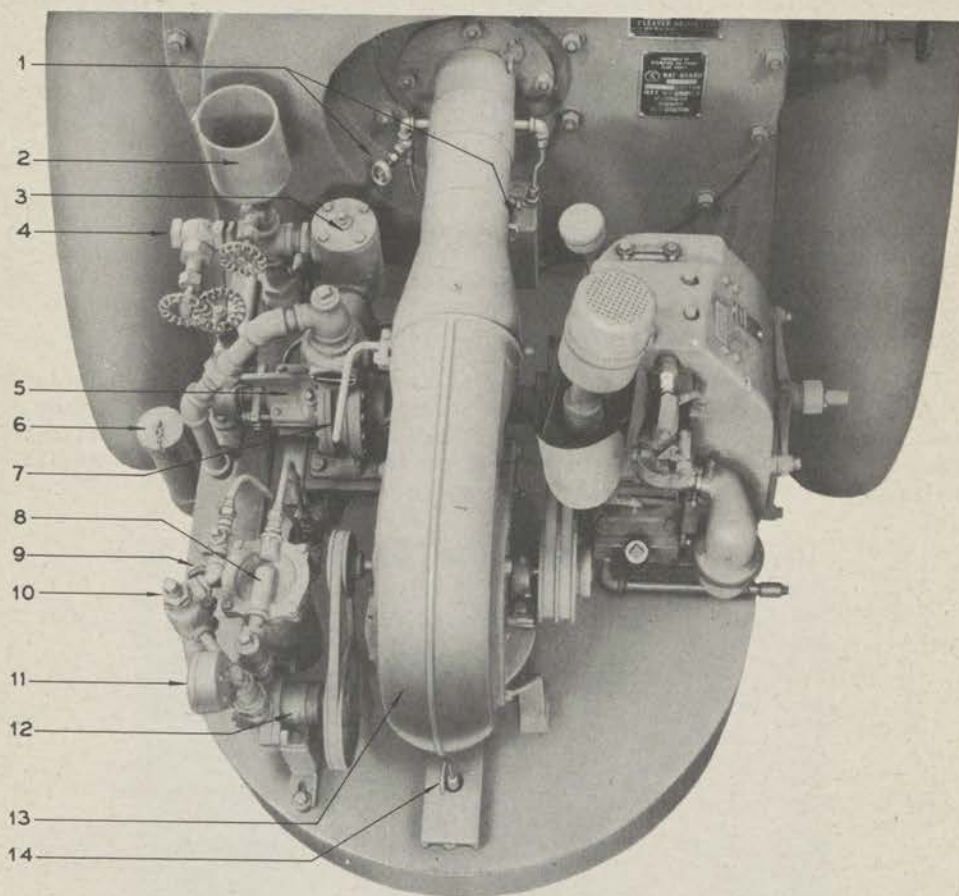
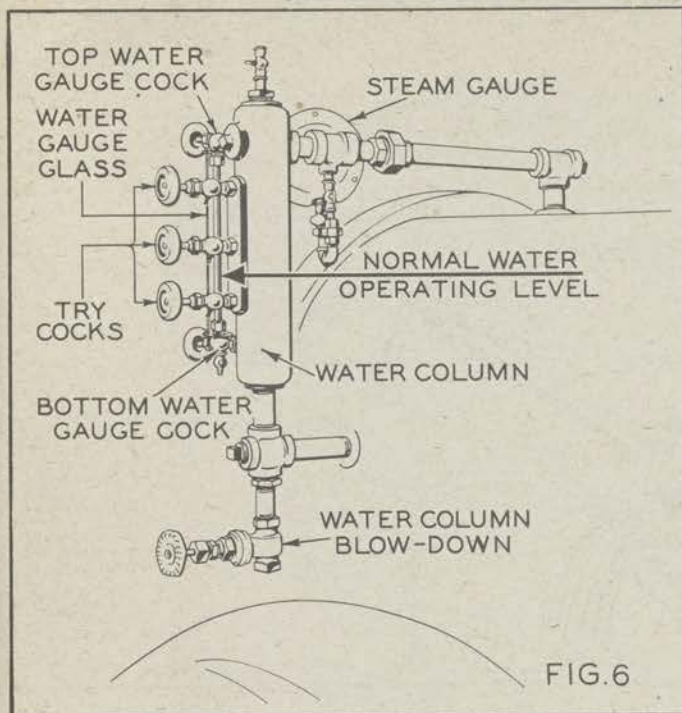


FIGURE 5

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



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.

FIG.6

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

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

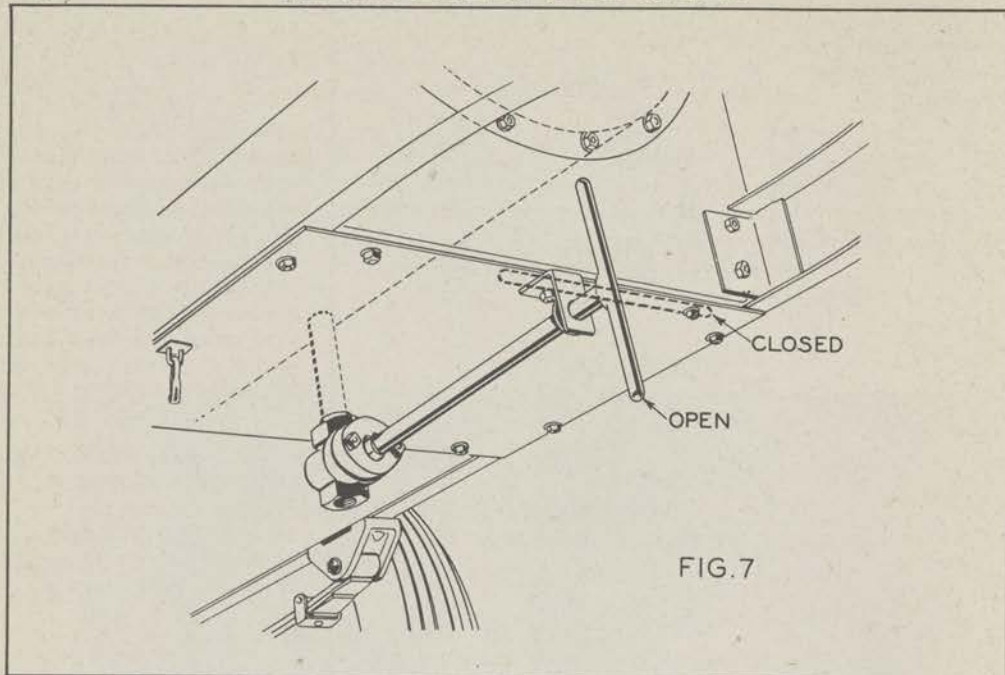
#### Through Cold Injector

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

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

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

## FILLING BOILER WITH WATER

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.

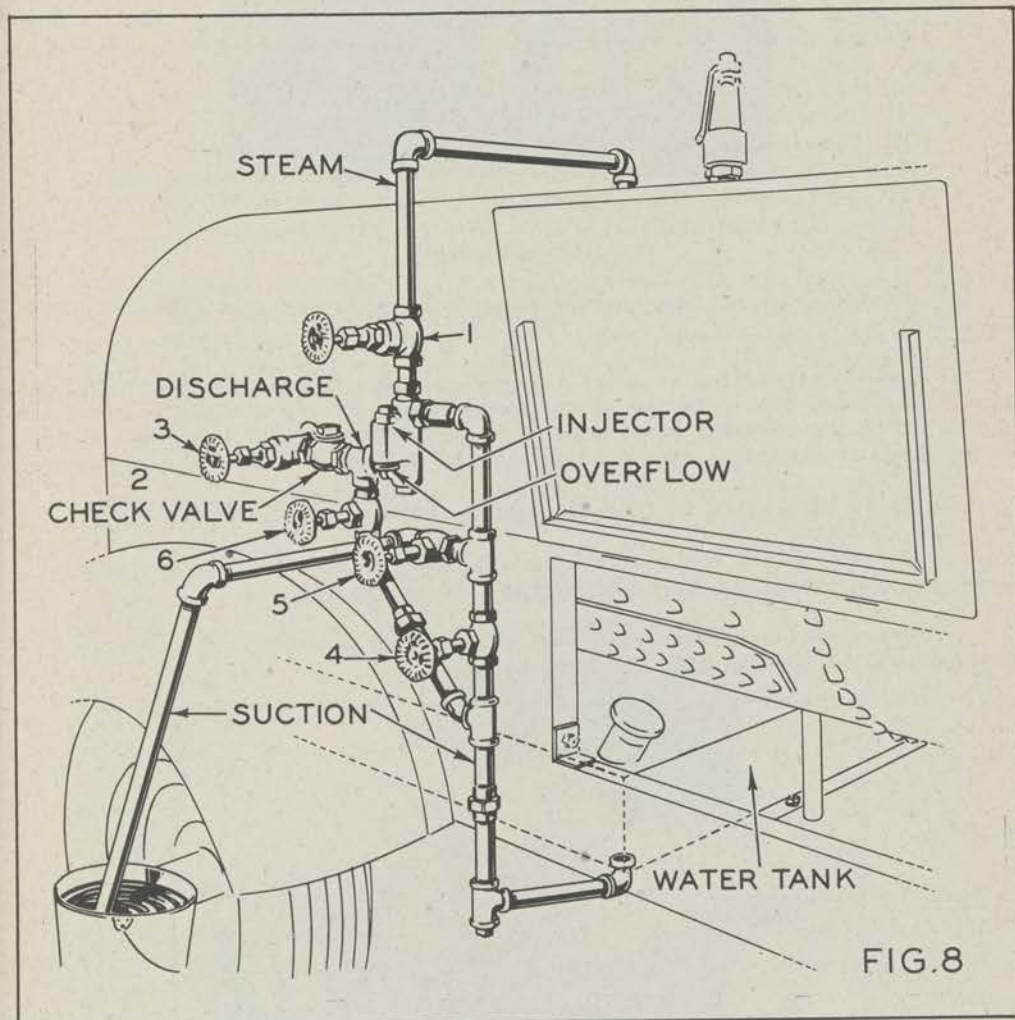
Fill priming cup (4) with water and open Valve 5.

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.



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

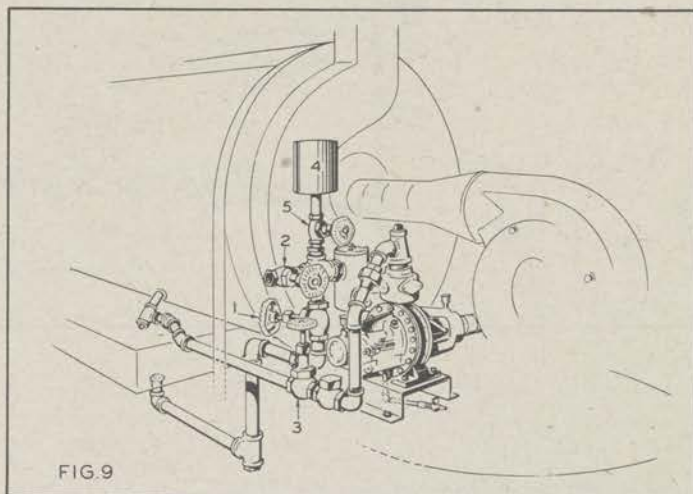
Consult instructions on care and operation of Briggs & Stratton motor - Part 4.

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

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

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

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



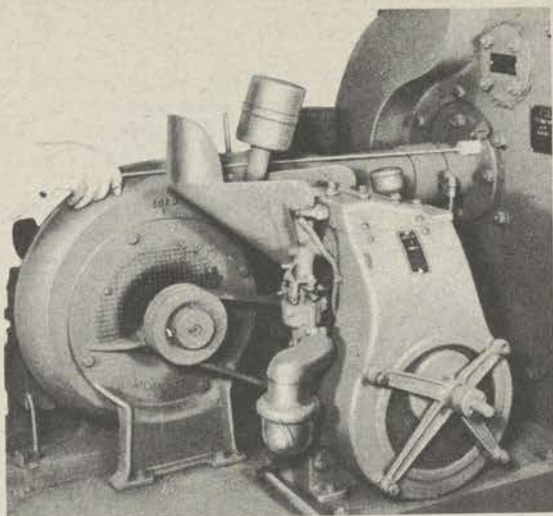


FIGURE 10

Check belt drives.

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

Stop engine.

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

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

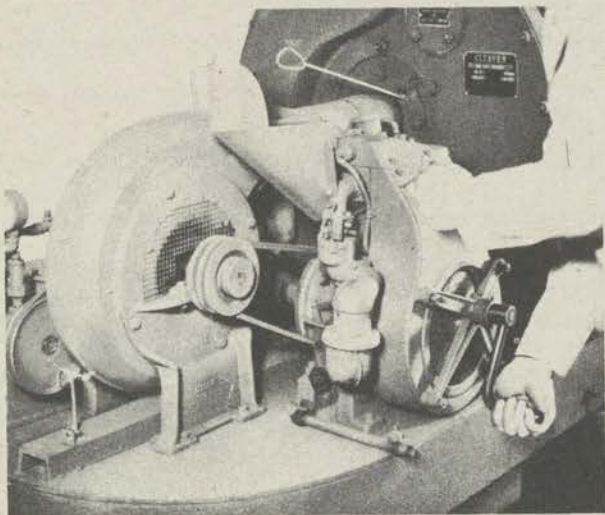


FIGURE 11

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.

### If Steam Pressure Rises

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

### If Steam Pressure Falls

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

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

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

### Firing Rule

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

### Blow Down

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

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

Keep water gauge glass clean.

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

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 water tank fill cap. When filled to neck, close steam valve and replace the tank cap.

## OPERATING IRREGULARITIES AND THEIR CORRECTION

### Low Steaming Capacity

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

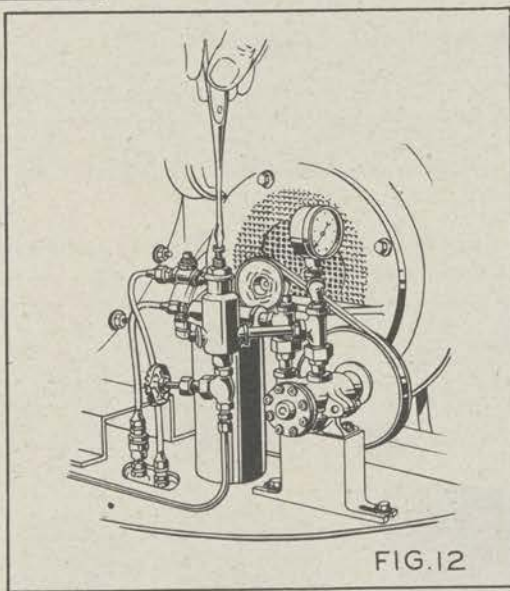
Steam leaks, however small, should be corrected whenever detected and all recoverable hot condensate returned to the boiler by the method provided.

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

Make sure that fuel oil is turned on to all three nozzles (Valves 1 and 2, Figure 5).

Fuel oil pressure must not be less than 100 pounds.

### To Adjust Fuel Oil Pressure



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

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

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

### 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.

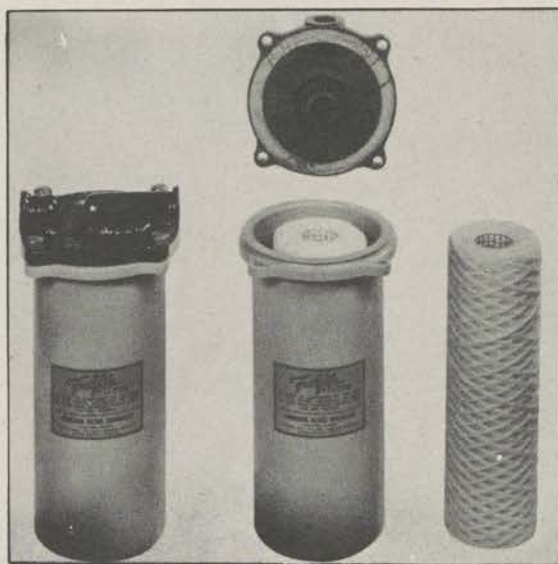


FIGURE 13

### 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.

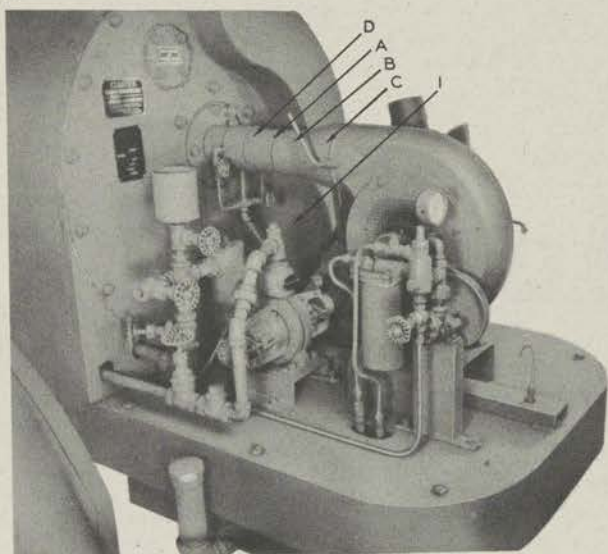


FIGURE 14

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.

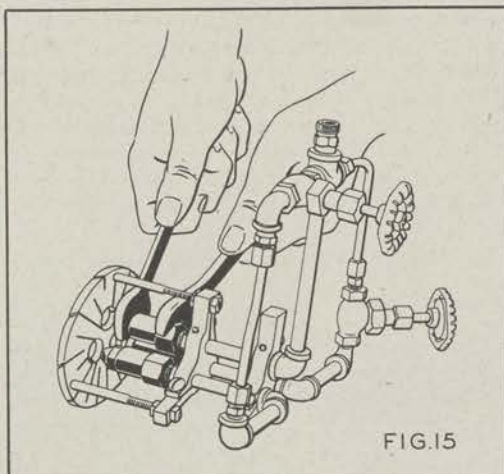


FIG.15

Remove all three nozzle tips from bodies, see Figure 15. Remove nozzle strainer screen from nozzle tip with the fingers, and with a screwdriver, the remaining internal part of the nozzle tip proper. Clean all internal surfaces of the nozzle tip and the slotted ports of the internal assembly, using a wood splinter so that the small oil grooves will not be damaged, particularly the small hole in the nozzle tip proper. Clean nozzle strainer screen carefully, removing all foreign matter to allow free passage of fuel oil through nozzle. Replace nozzle internal core, using a screwdriver to set it tightly, but not excessively so.

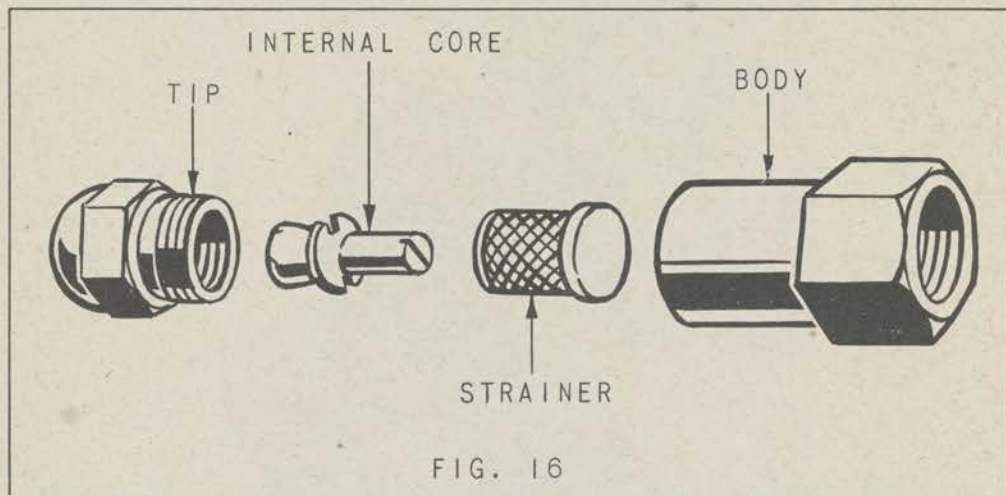


FIG. 16

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

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

### Installing Oil Burner

Insert oil burner internal assembly into air tube D attached to the boiler head with fuel oil tubing inlet connection at bottom (See Figure 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.

### The Water Pump

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

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

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

No water delivered or not pumping full capacity.

- (a) Pump not primed
- (b) Air leaks in return line
- (c) Suction lift too high
- (d) Return line or strainer clogged
- (e) Mechanical defects
- (f) Air leaks through stuffing boxes

Pump takes too much power.

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

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

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

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

Keep grease cups filled.

Do not throttle valve in discharge line to reduce capacity.

If pump is to be idle for a long period, it should be taken apart, cleaned and oiled as described 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. It has no moving or working parts.

### RUNNING GEAR

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

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

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

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

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

### STORAGE PROCEDURE

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

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

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

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

Store tires according to Service Regulations.

# CHASSIS AND RUNNING GEAR

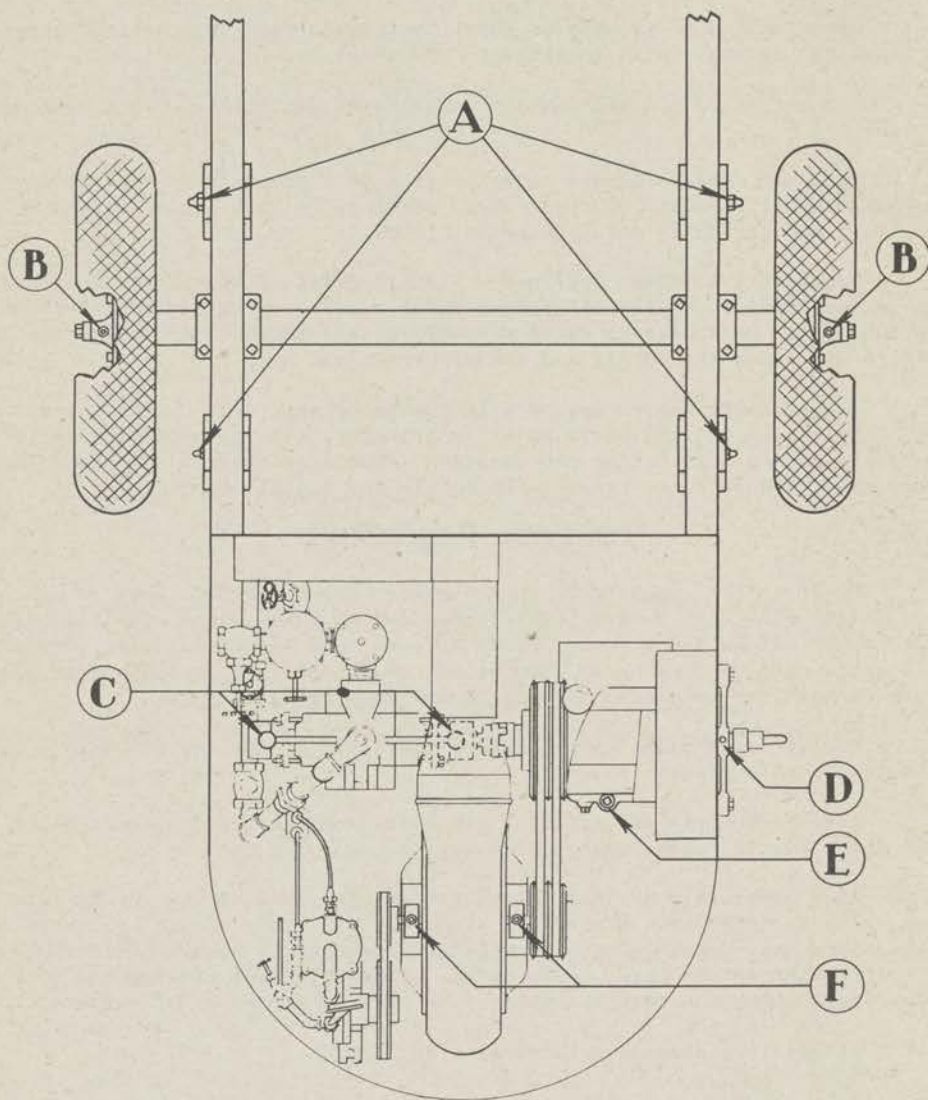


FIGURE 17

- 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.

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**CHASSIS AND  
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## THE BOILER

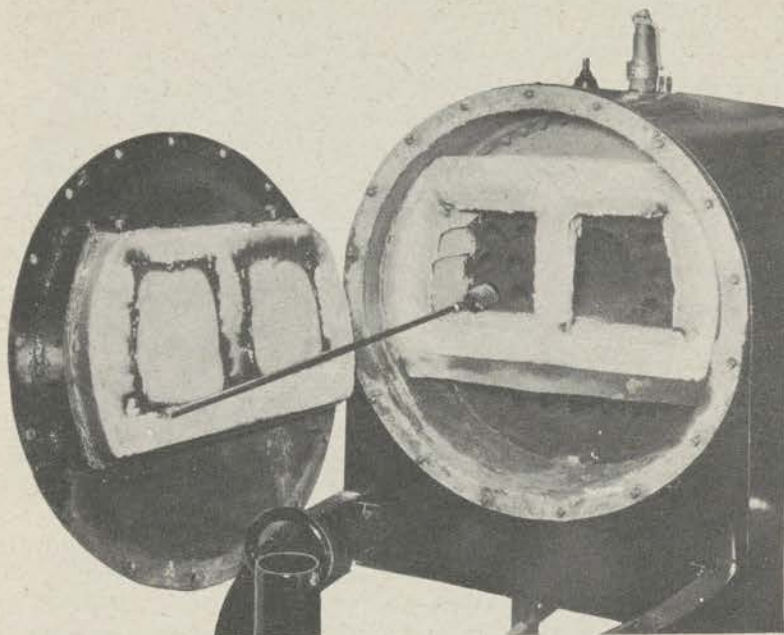


FIGURE 1M

Cleaning Tubes

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

Tools Required:

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

Material Required:

- 1 Outer head gasket (See Ref. No. 32, Page 2, Parts List)

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

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

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

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

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

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

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

#### Replacing Gasket

If outer head gasket has been broken or for any other reason needs replacement, cut new gasket from 1/16" asbestos paper 36" wide as shown in Figure 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).

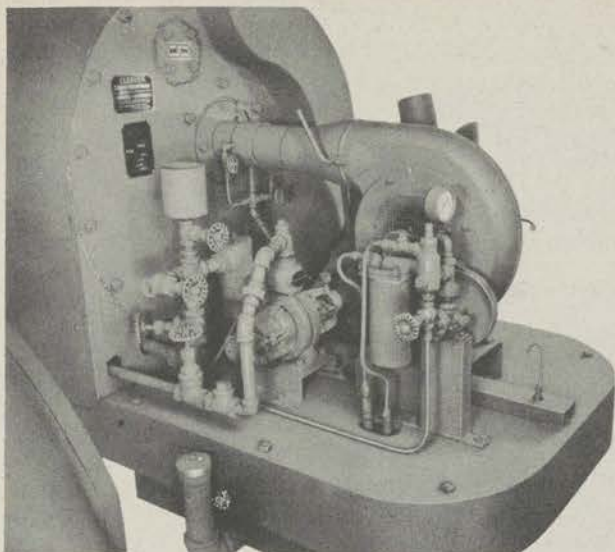


FIGURE 2M

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.

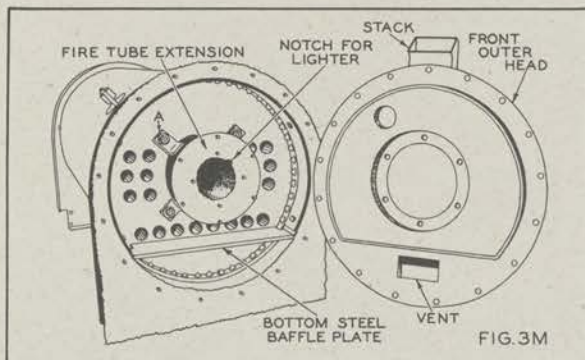
Remove rear outer head (towing end) as instructed under "Cleaning Tubes", Page 2.

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.



Remove fire tube extension, Figure 3M by detaching the four nuts and washers "A".

## REPLACING BOILER TUBES

## 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 sheet.

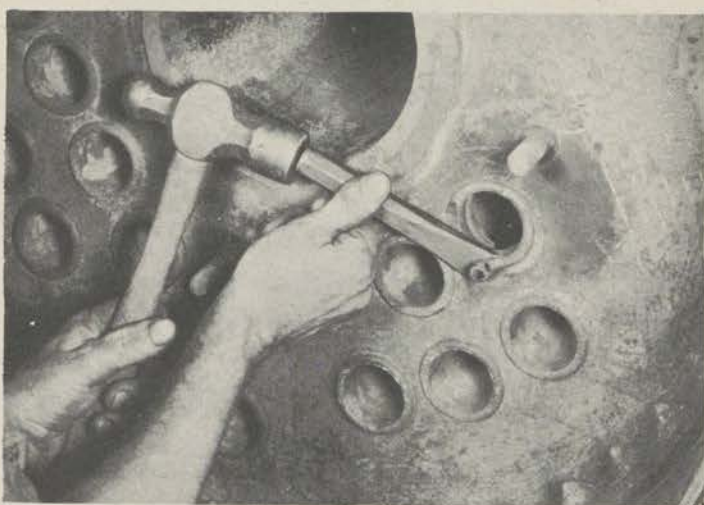


FIGURE 4M

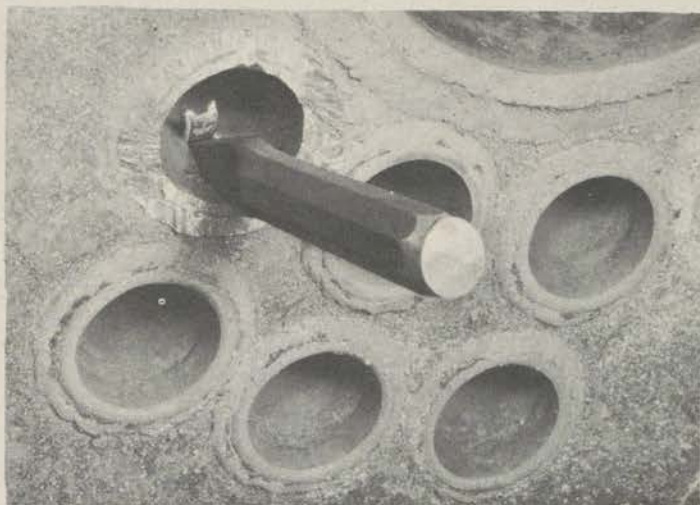


FIGURE 5M

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

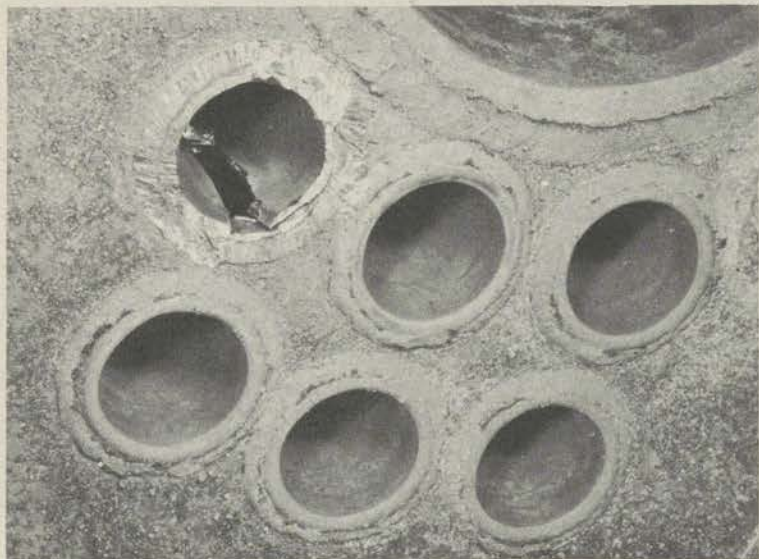


FIGURE 6M

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

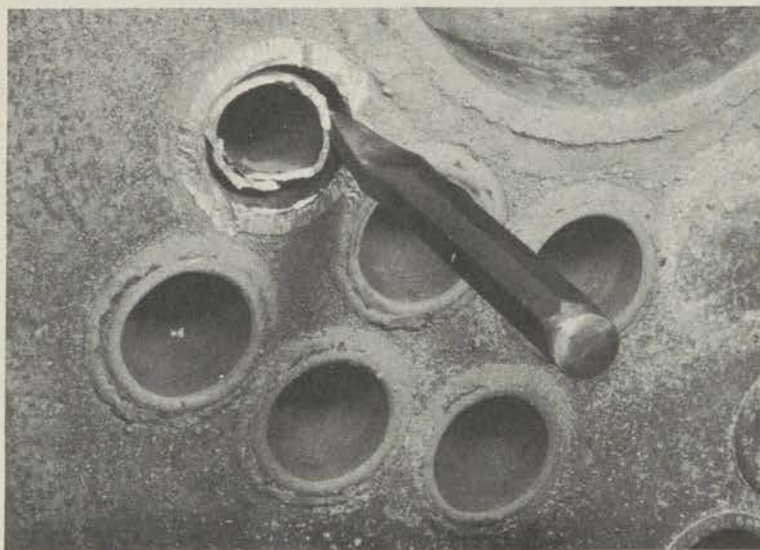


FIGURE 7M

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

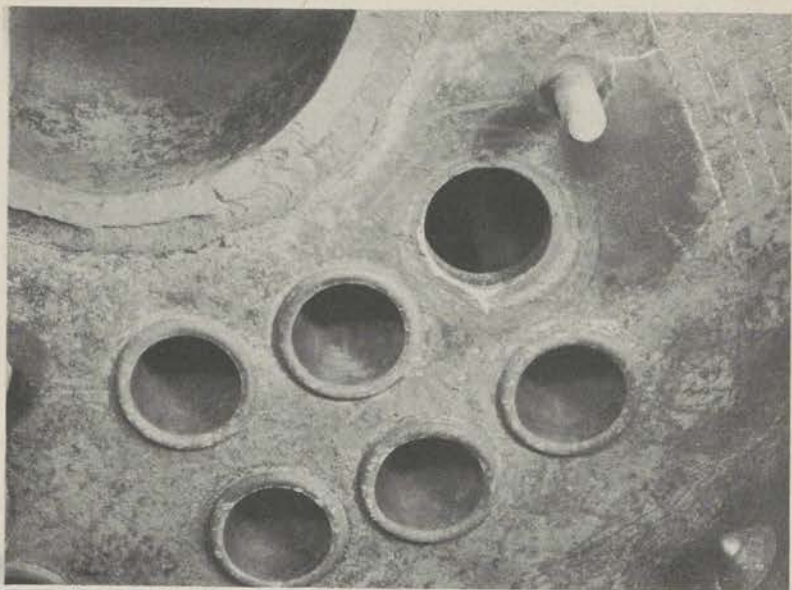


FIGURE 8M

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

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

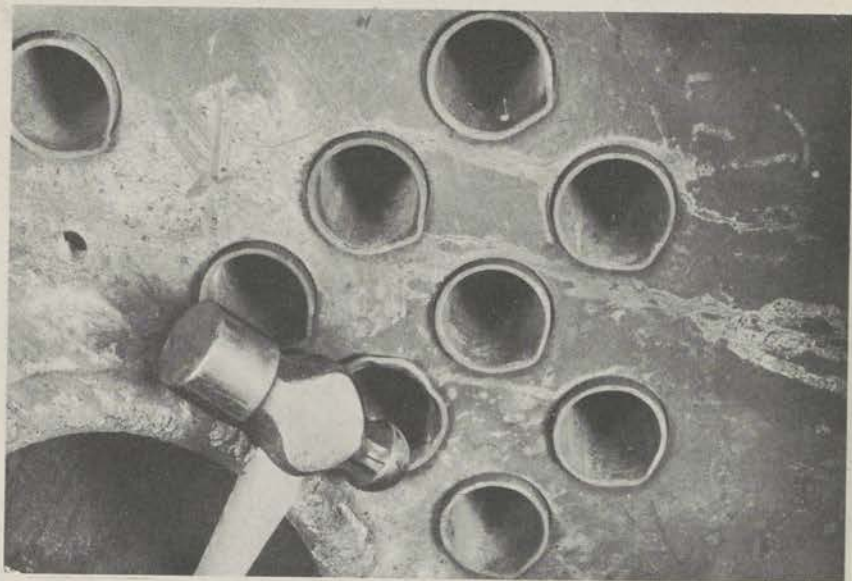


FIGURE 9M

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.

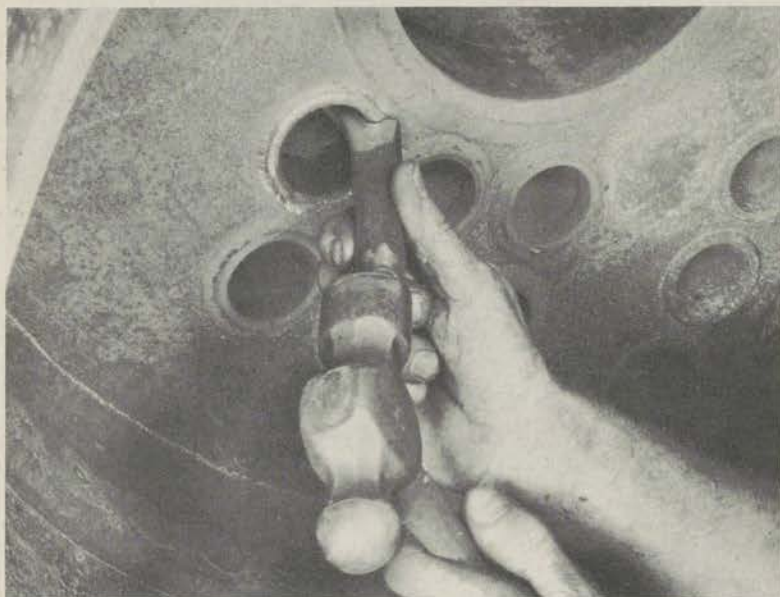


FIGURE 10M

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 in Figure 12M.

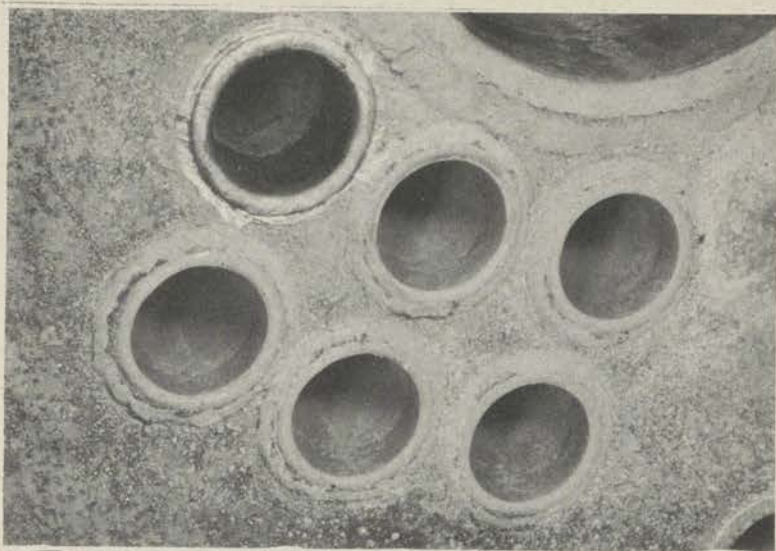


FIGURE 12M

#### 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 gauge.

NOTE: Maximum pressure built up by the pump depends upon the condition of the pump and from 100 to 150 pounds may be the maximum pressure obtainable. When pressure no longer rises with pump running, close Valve J, Figure 2M to hold pressure in boiler and stop engine.

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

Replace pop safety valve.

Reassembly after Tube ReplacementFront Head (Firing End)

Replace bottom steel baffle plate (Figure 13M).

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

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

Install gasket.

Replace oil burner air tube flange, Figure 2M.

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

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

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

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

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

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

Replace top hood over power plant assembly.

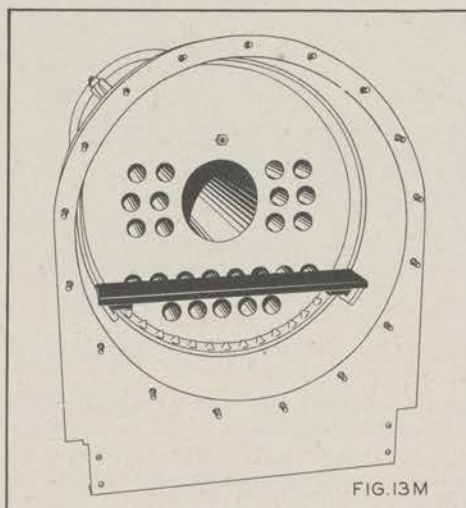
Install brick in rear baffle chamber (towing end) and replace rear outer head as directed under "Rebricking Boiler".

*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.



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 the boiler shell.

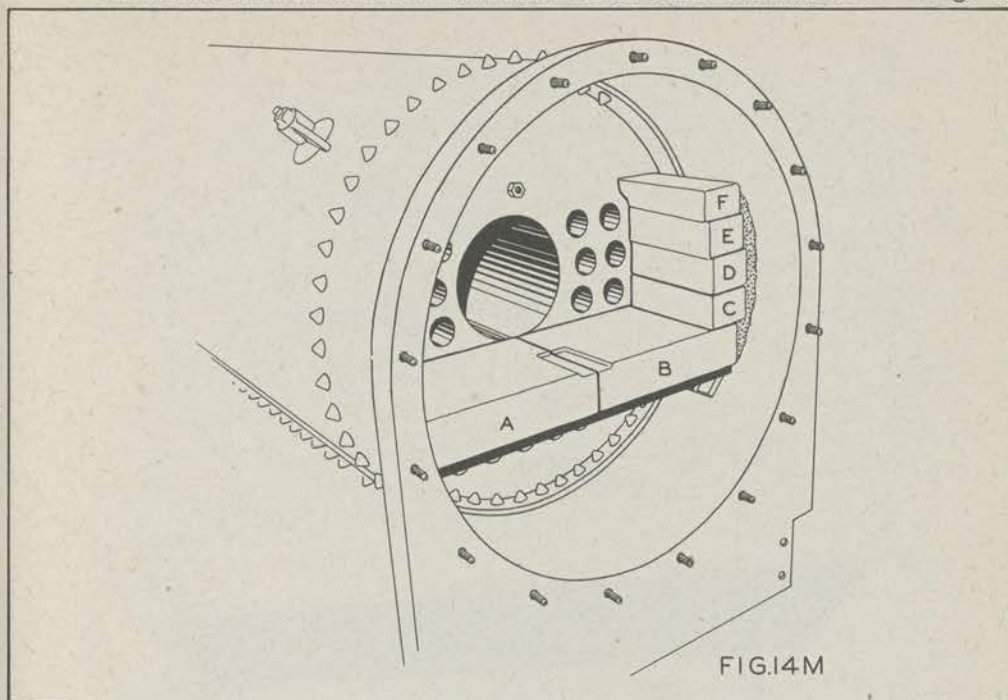


FIG. 14M

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.

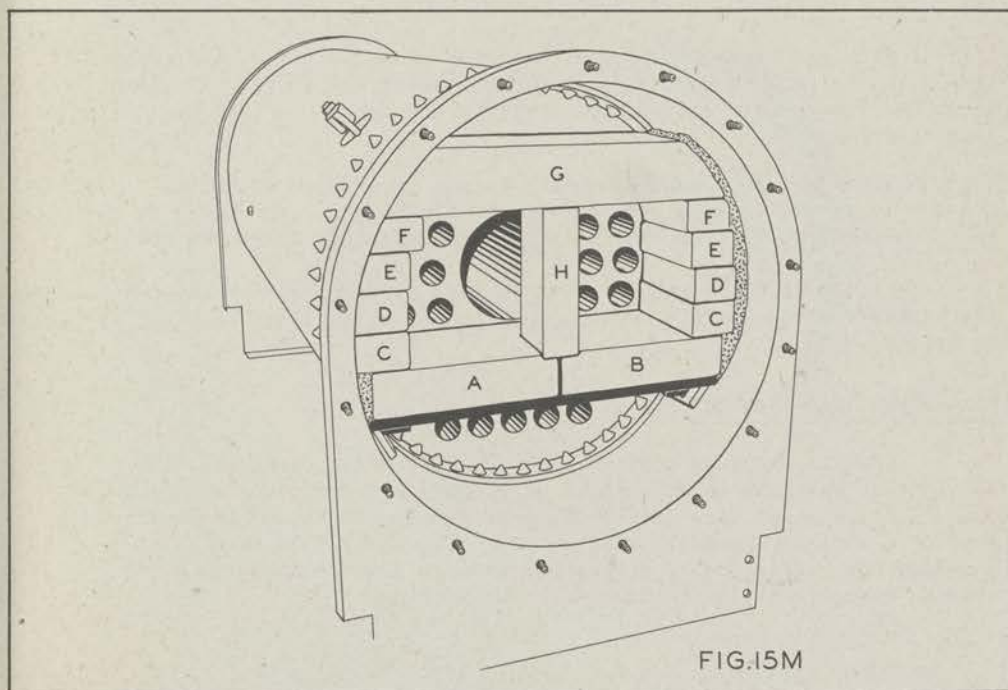


FIG. 15M

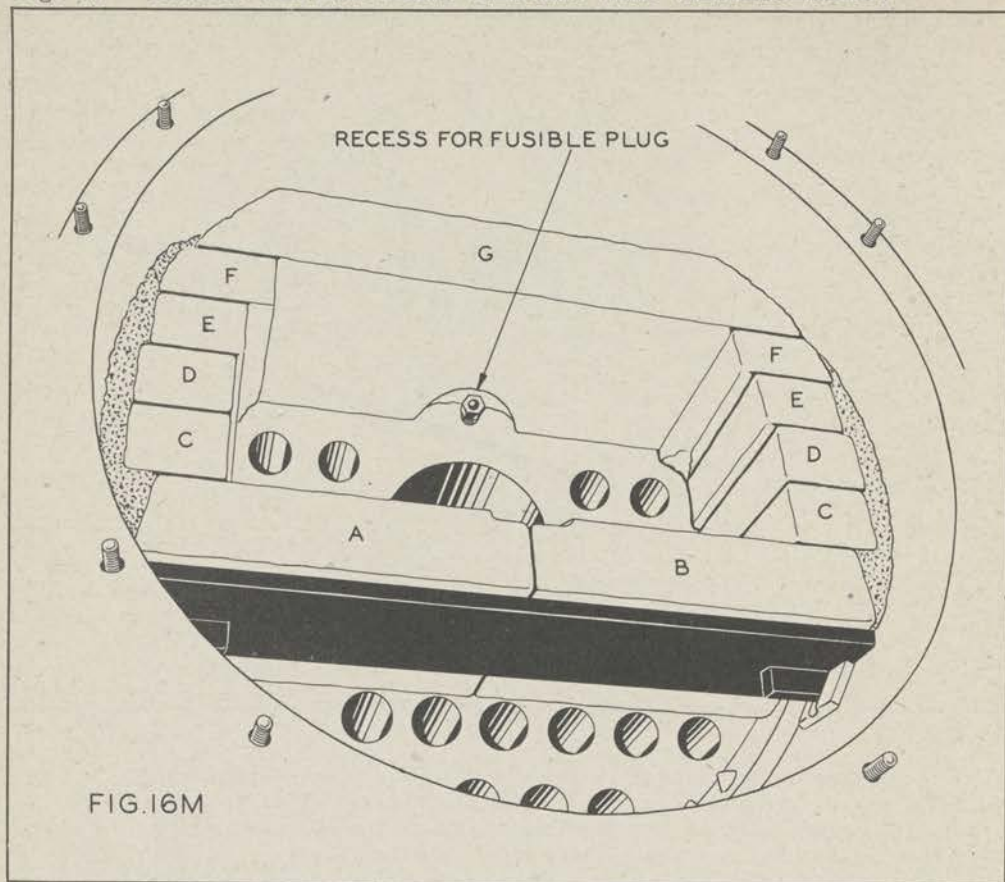


FIG. 16M

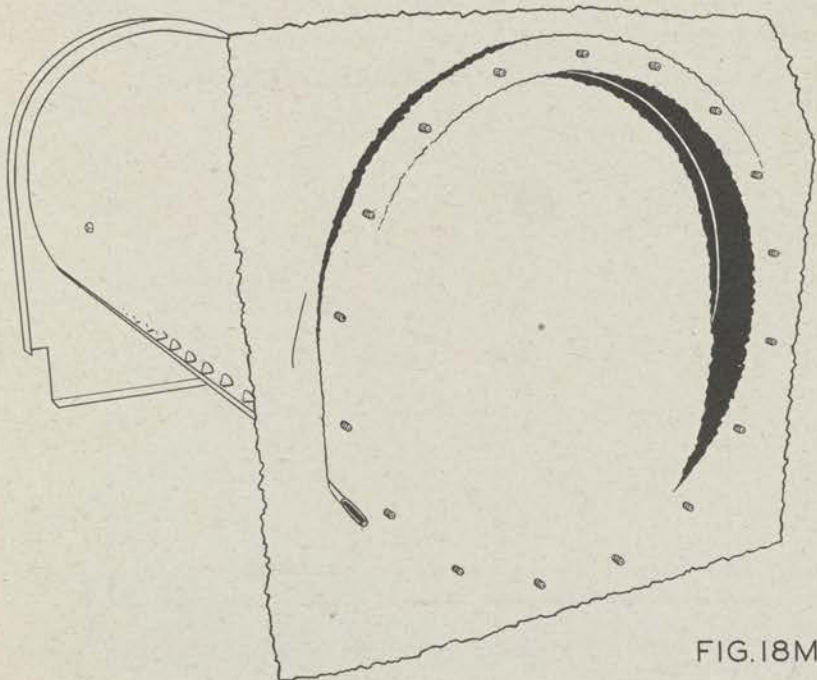
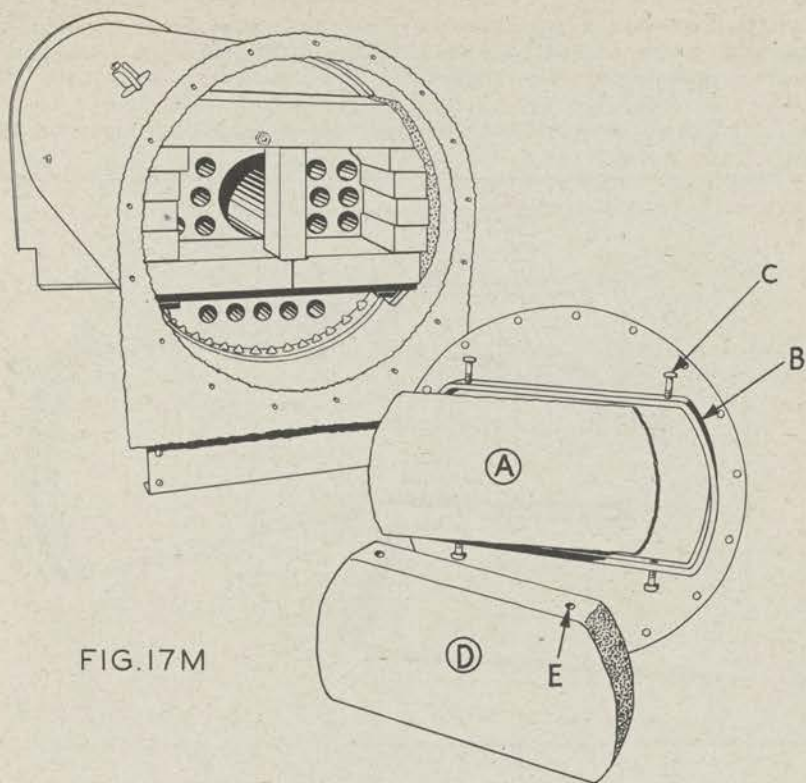
With the bottom shelf and both side tiers in place, the vertical supporting brick H, Figure 15M, should be installed, sealing the joint between the lower shelf and vertical brick H also with a trowel coat of high temperature cement.

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.

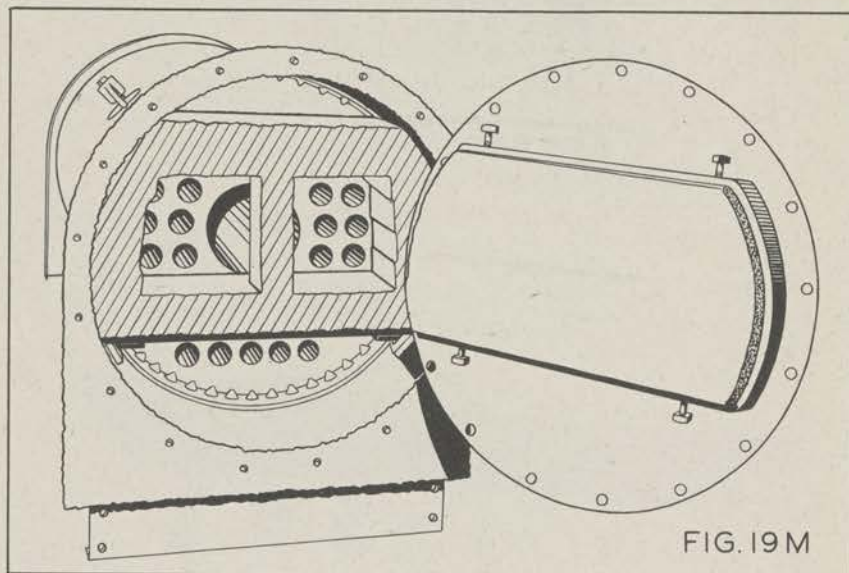
#### Rear Outer Head (Towing End)

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.

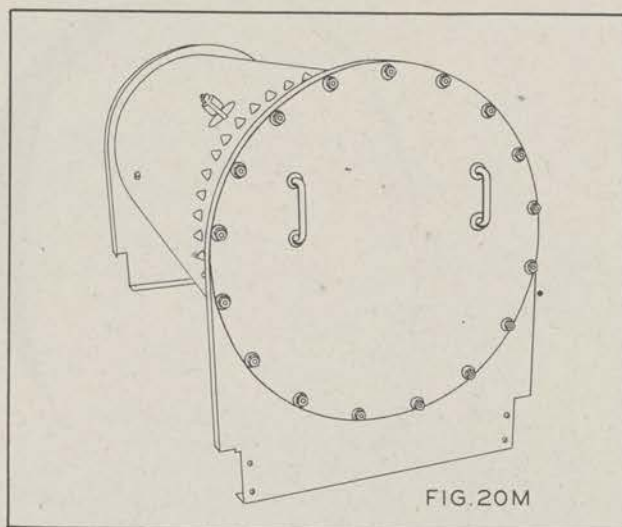


Prepare the 1/16" asbestos paper gasket as shown in Figure 18M, laying the gasket against the ends of the studs, forcing each stud through the paper gasket with the fingers.

Cut the gasket to shape, using a pocket knife as shown in Figure 18M.



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.

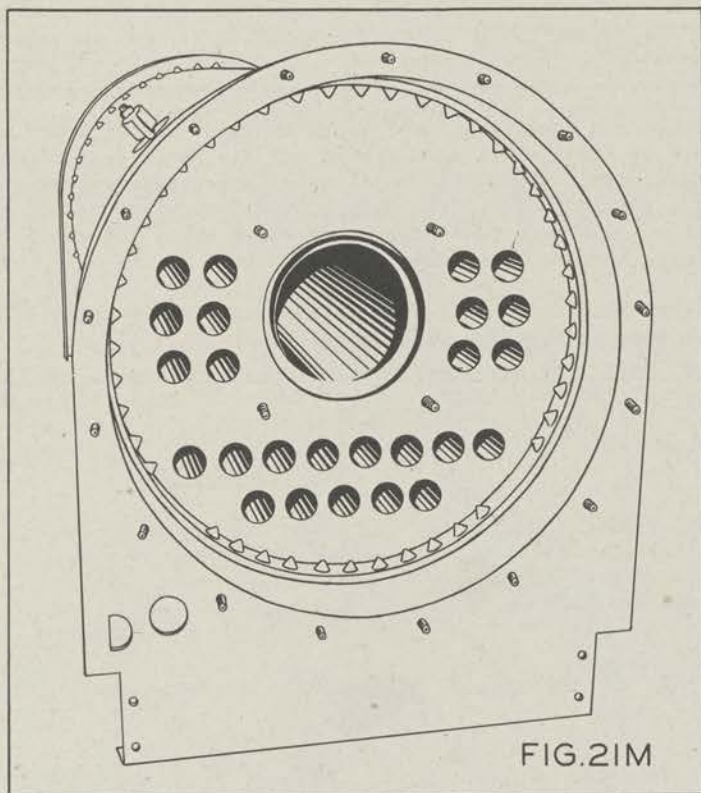


Install head and bolt down tightly, using washers and nuts as shown in Figure 20M.

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

Dismantle power plant, oil burner assembly, and front (firing end) outer head as instructed on Page 3.

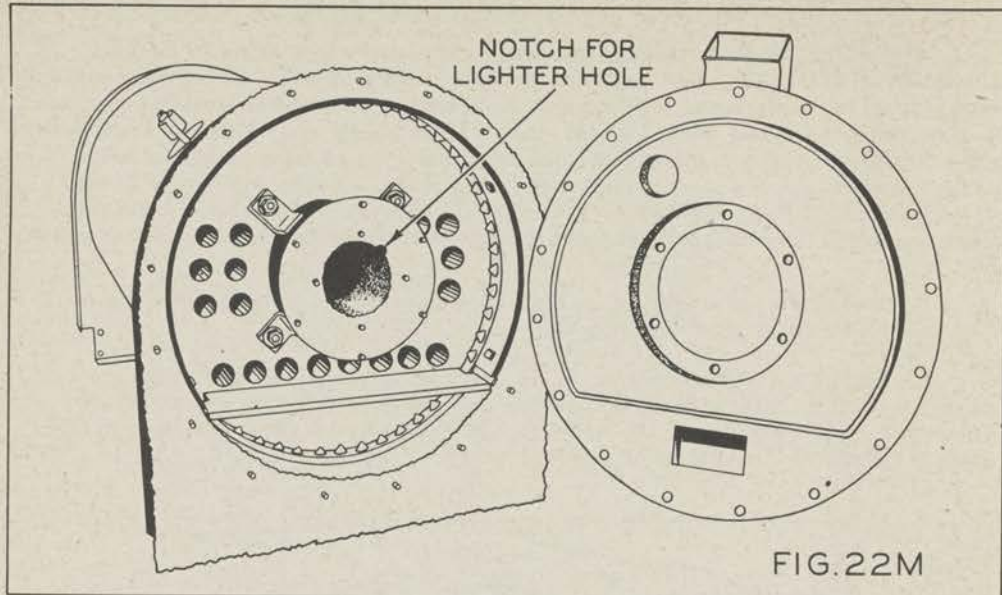
Remove fire tube extension as directed on Page 4, and replace it with a new fire tube extension, noting carefully the proper position of the notch (Figure 22M) in the steel outer face of the fire tube extension which allows the insertion of the oil burner lighting torch.



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.

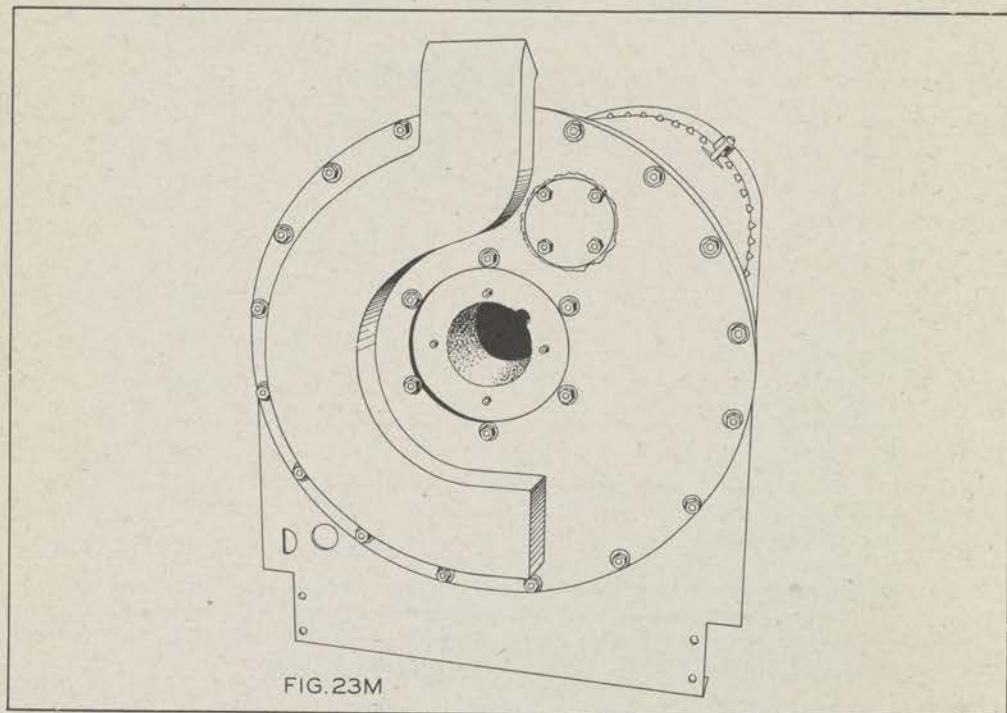
Prepare two or three handfuls of crushed fire brick, Portland cement and water, and by hand, seal the joint between the fire tube extension and the boiler fire tube proper, packing in the plastic mixture tight thus effecting as smooth an inside firing surface as possible.

## REPLACING FIRE TUBE EXTENSION



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.



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

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

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

### CLEANING WATER SIDE OF BOILER

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

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

#### Hand Hole Plates

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

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

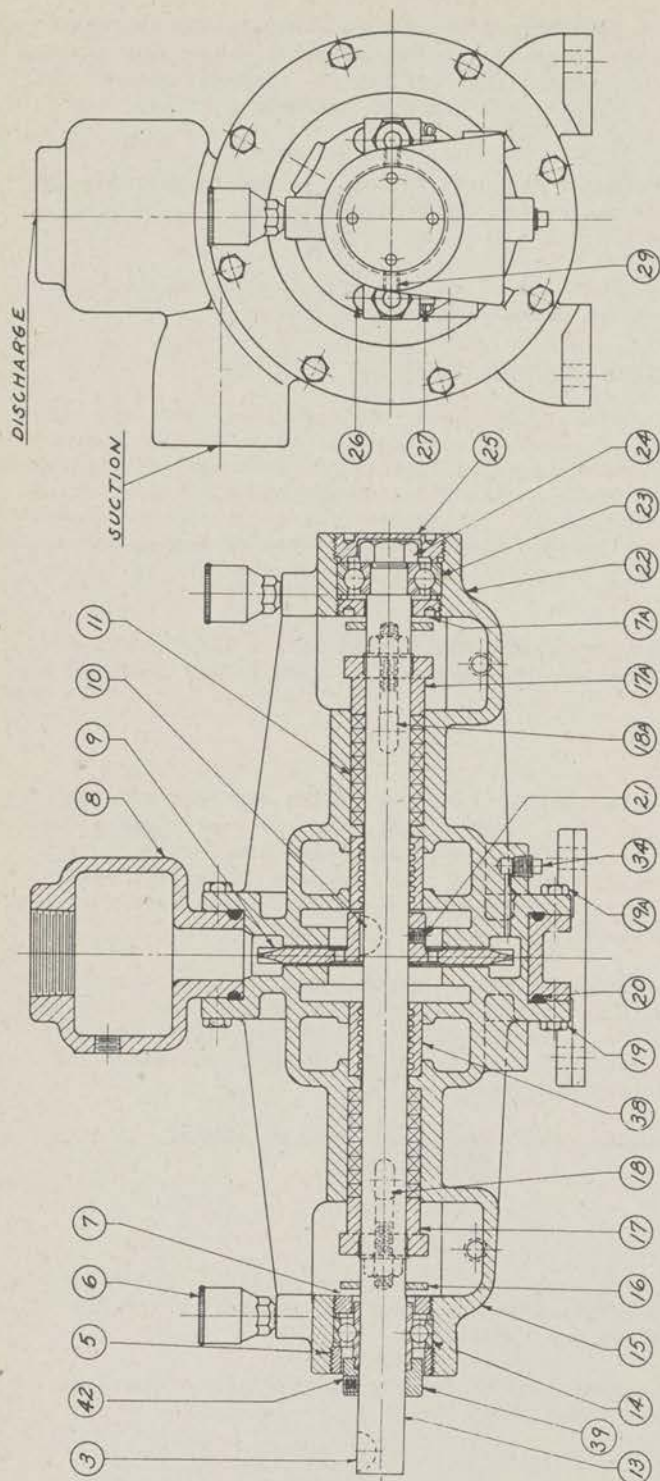
When replacing gaskets, apply a coat of graphite and oil to both surfaces.

#### Replacing Fusible Plug

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

To replace, remove rear head as instructed on Page 1. For location of 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 | BLAND               | 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          |

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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.

## THE FEED WATER PUMP

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 burner, the internal parts of the relief valve may be stuck. Tap the device with a hammer handle (not the head) to dislodge foreign matter that may be causing it to stick.

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

1. Stop engine.
2. Disconnect union tee attaching valve to fuel oil pump.
3. Detach copper tubing below valve at bottom of relief valve.
4. Detach copper tubing connector in line leading to fuel oil tank.
5. Remove cap, #3, Figure 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 and reassemble, using Figure 24M as a guide.

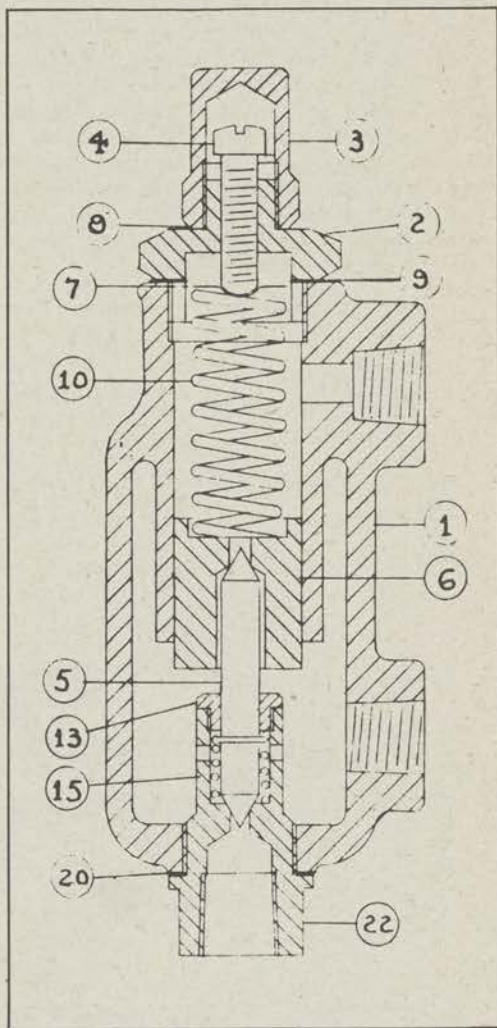


FIGURE 24M

## THE FUEL OIL PUMP

### 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.

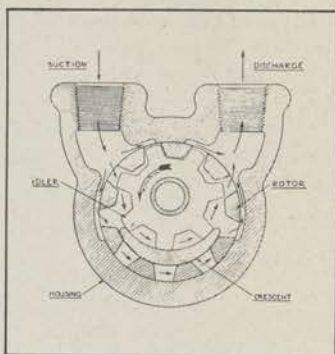


FIGURE 25M

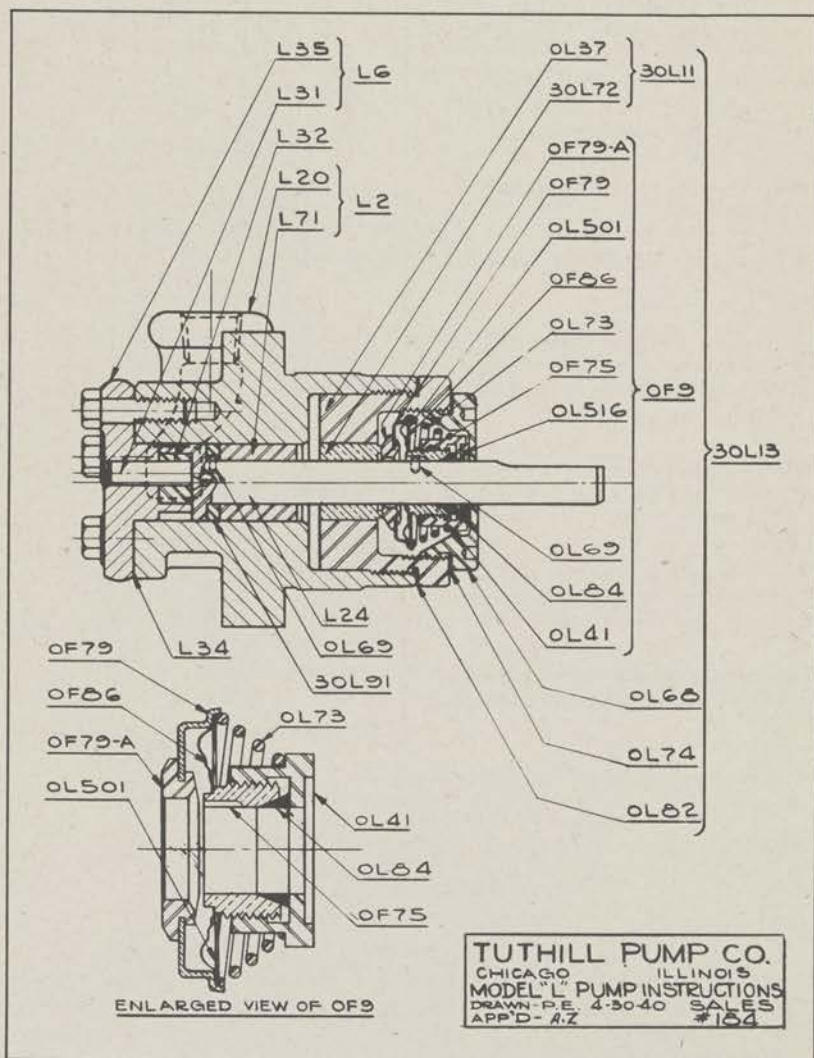


FIGURE 26M

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

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

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

Then, holding shaft from rotating by placing a wrench across the flat on the shaft, loosen nut 0L41 in the vise - being careful not to deform the nut by applying too much pressure - and pull OF9 assembly off the shaft.

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

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

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

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

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

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

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

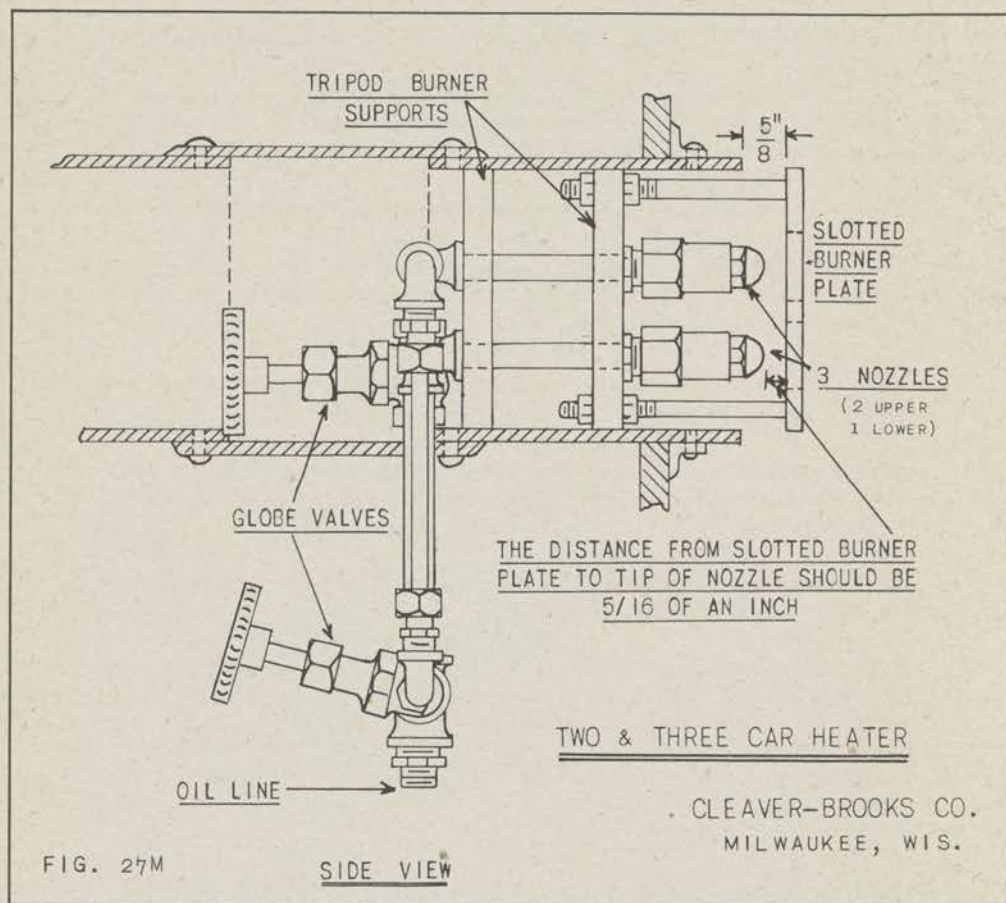
The seal may be reinstalled or replaced by reversing the procedure as outlined above. Put a few drops of clean lubricating oil on the seal seat before replacing OF9 assembly. When tightening the nut 0L41, it is necessary to create about 7# pressure on this nut toward the seal. This is equivalent to compressing the seal .040".

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

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.

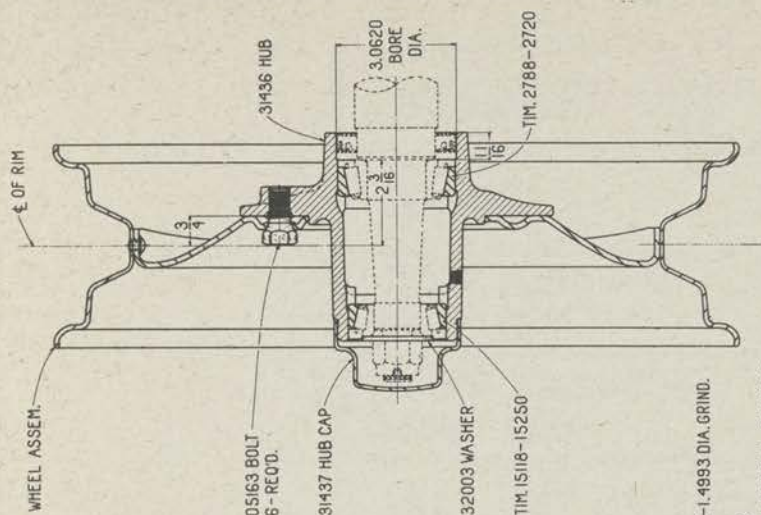
In making replacement of any parts of the inner burner assembly, reassemble according to Figure 27M.

**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. Wheels and bearings are removed and reassembled as instructed on Page 23, Operator's section.



## NOTE:

PART NUMBERS  
SHOWN ARE  
THOSE OF MAN-  
UFACTURER.

CONSULT PARTS  
SECTION FOR  
CORRECT  
CLEAVER-BROOKS  
PART NUMBER

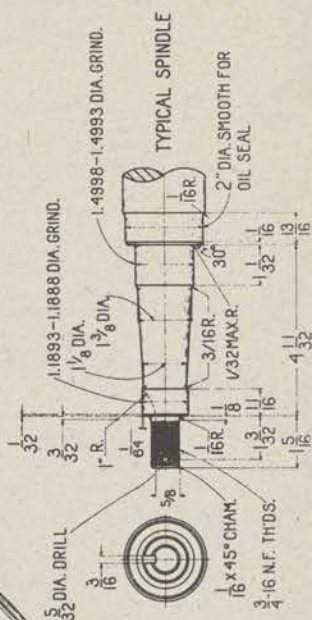


FIG. 28M



# **INDEX TO PARTS LIST**

## **ACCESSORY LIST**

### **BOILER**

**FRONT HEAD —  
REAR HEAD**

**WATER COLUMN —  
BLOW DOWN**

### **FUEL OIL ASSEMBLY**

### **INNER BURNER ASSB.**

### **FUEL OIL RELIEF VALVE**

**BLOWER AIR TUBE —  
BLOWER**

**FEED WATER  
PUMPING SYSTEM**

**BOILER FEED PUMP —  
INJECTOR PIPING**

**INJECTOR PARTS —  
INSULATION - HOUSING**

**CHASSIS AND  
RUNNING GEAR**

### **TOOLS AND HOSE**

### **PRICE LIST**

# A C C E S S O R Y   L I S T C L E A V E R   T W O   C A R   H E A T E R

| C-B CO.<br>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<br>case, 0-200# 1/4"  |
| 904016              | Pop Safety Valve          | Consolidated Ashcroft Hancock Co. | Bridgeport, Conn.  | back male connection<br>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#<br>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<br>No. 7BC)            |
| 109185              | Gasoline Tank             | Wisconsin Motor Corp.             | Milwaukee, Wis.    | WE-106                                       |
| 912001              | V-Belt                    | L. H. Gilmer Co.                  | Philadelphia, Pa.  | 3300                                         |
| 912004              | V-Belt                    | Allis-Chalmers Mfg. Co.           | Milwaukee, Wis.    | A42                                          |

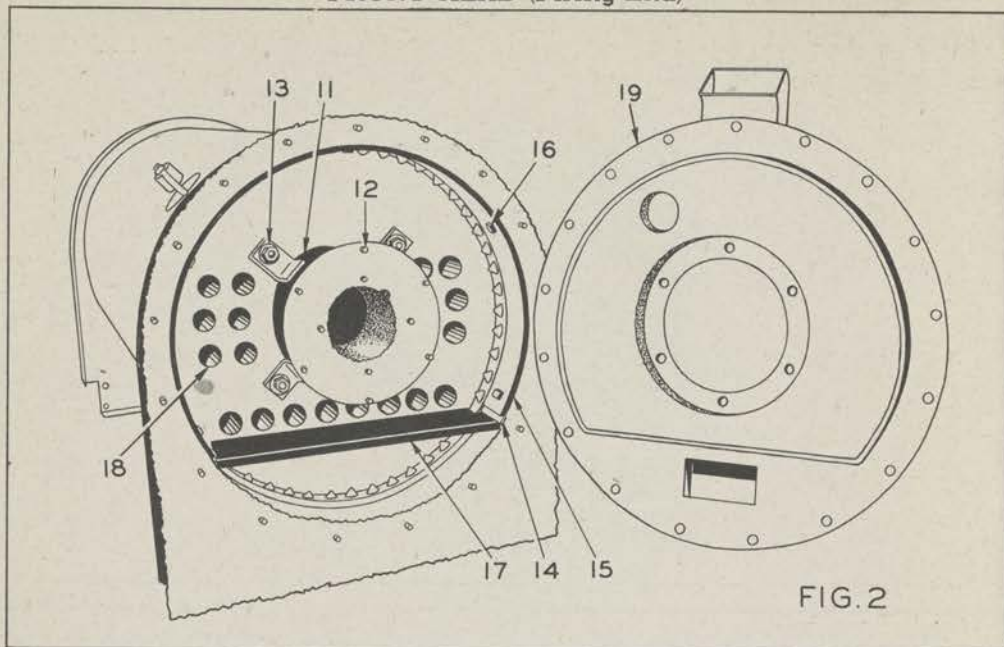
|        |        |
|--------|--------|
| 912001 | V-Belt |
| 912004 | V-Belt |



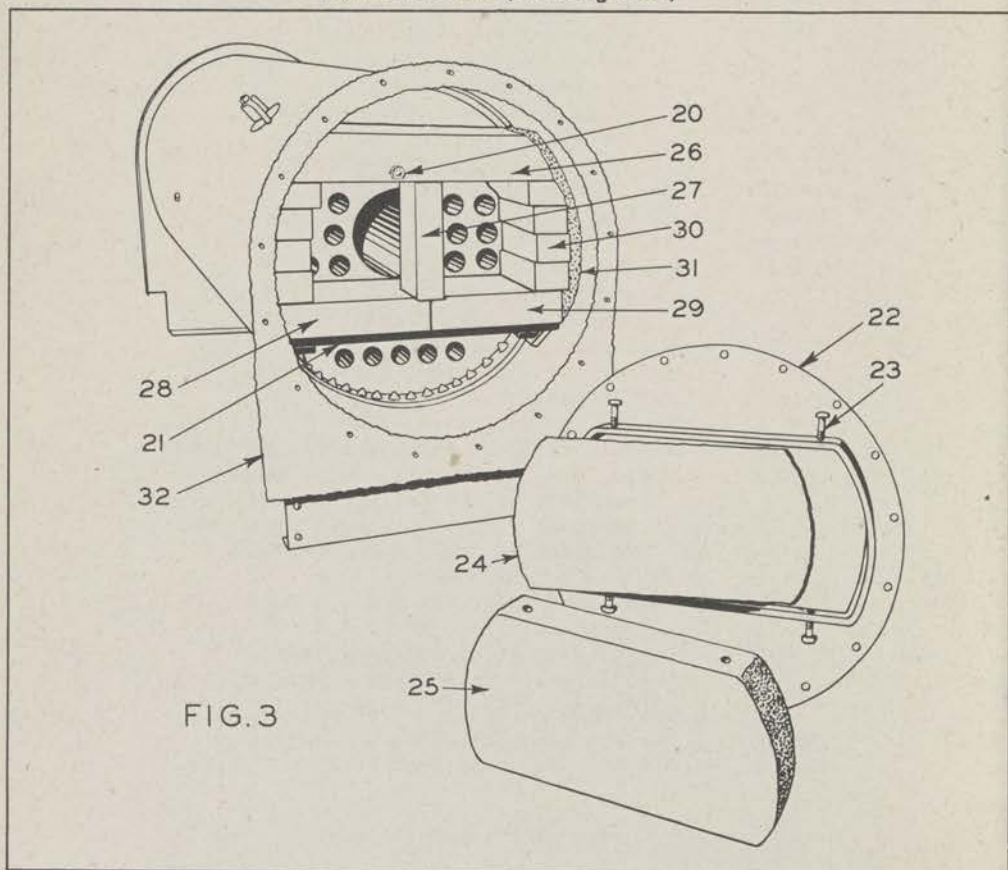
| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                                                                                                                                                                       | NO.<br>REQ. |
|-------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 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)



# REAR HEAD (Towing End)



## FRONT HEAD (Firing End) See Figure 2

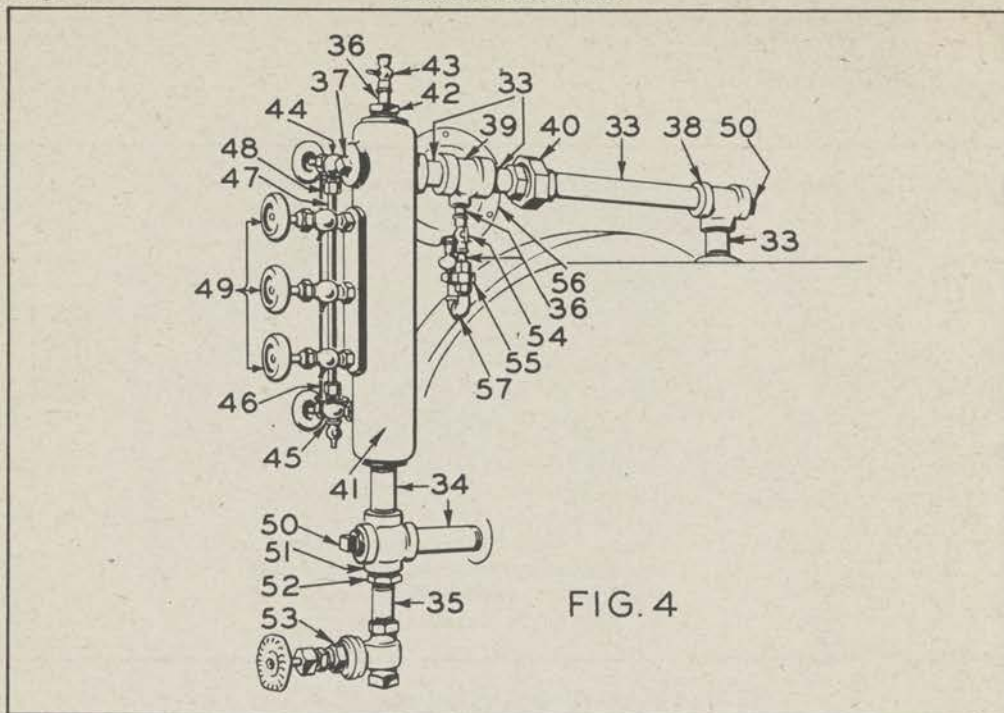
Page 3

| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                                                              | NO.<br>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           |

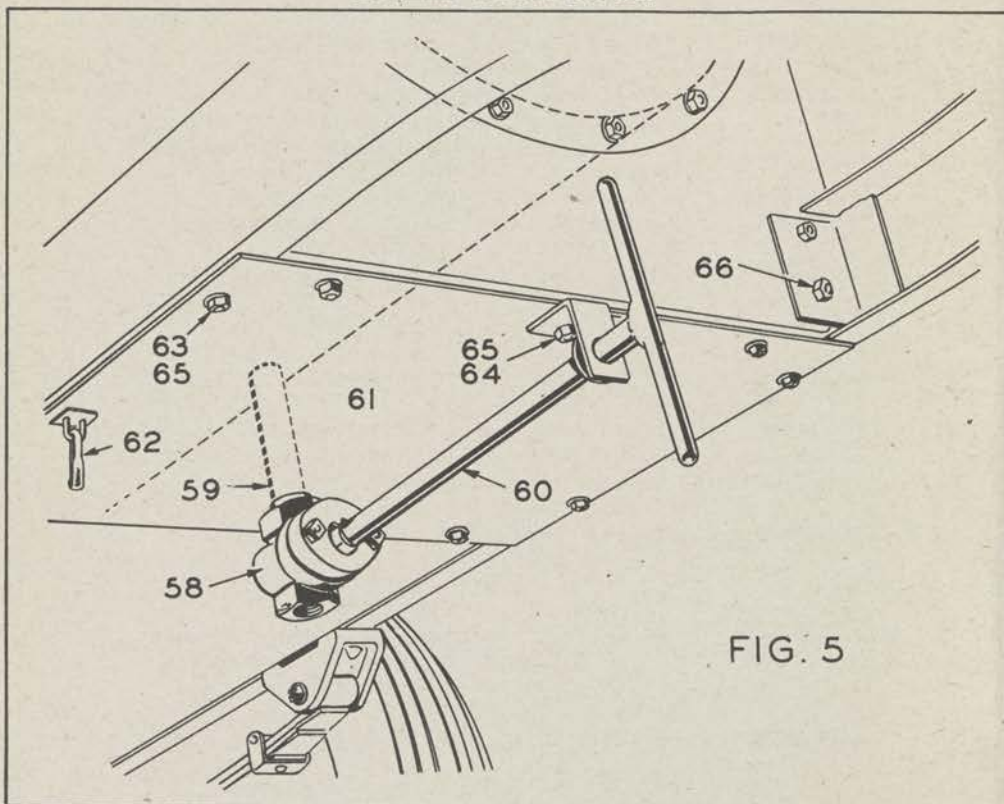
## REAR HEAD (Towing End) See Figure 3

|    |        |                                                                                                                                     |   |
|----|--------|-------------------------------------------------------------------------------------------------------------------------------------|---|
| 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:<br>6 - 9" x 3-1/2" x 2-1/2"<br>2 - 9" x 4-1/2" x 2"                                | 1 |
| 31 | 105021 | Cement Kit, includes wet and dry cement:<br>25 lb. "Chico" or "Setscold"<br>50 lb. Crushed fire-brick and<br>5 lb. Asbestos cement. | 1 |
| 32 | 901027 | Gasket, 1/16" asbestos paper, 36" x 36"                                                                                             | 1 |

# WATER COLUMN



# BOILER BLOW-DOWN



# WATER COLUMN (See Figure 4)

Page 5

| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                            | NO.<br>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<br>(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,<br>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#<br>screwed, asbestos packed, Judson<br>Governor Co., Rochester, New York | 1 |
| 59 | *      | Nipple, 1" x 8", extra heavy, black                                                                             | 1 |
| 60 | 104002 | Handle, blow-off assembly, with mount-<br>ing bracket                                                           | 1 |
| 61 | 102003 | Plate, bottom, tool compartment 24 x 32-1/2"<br>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

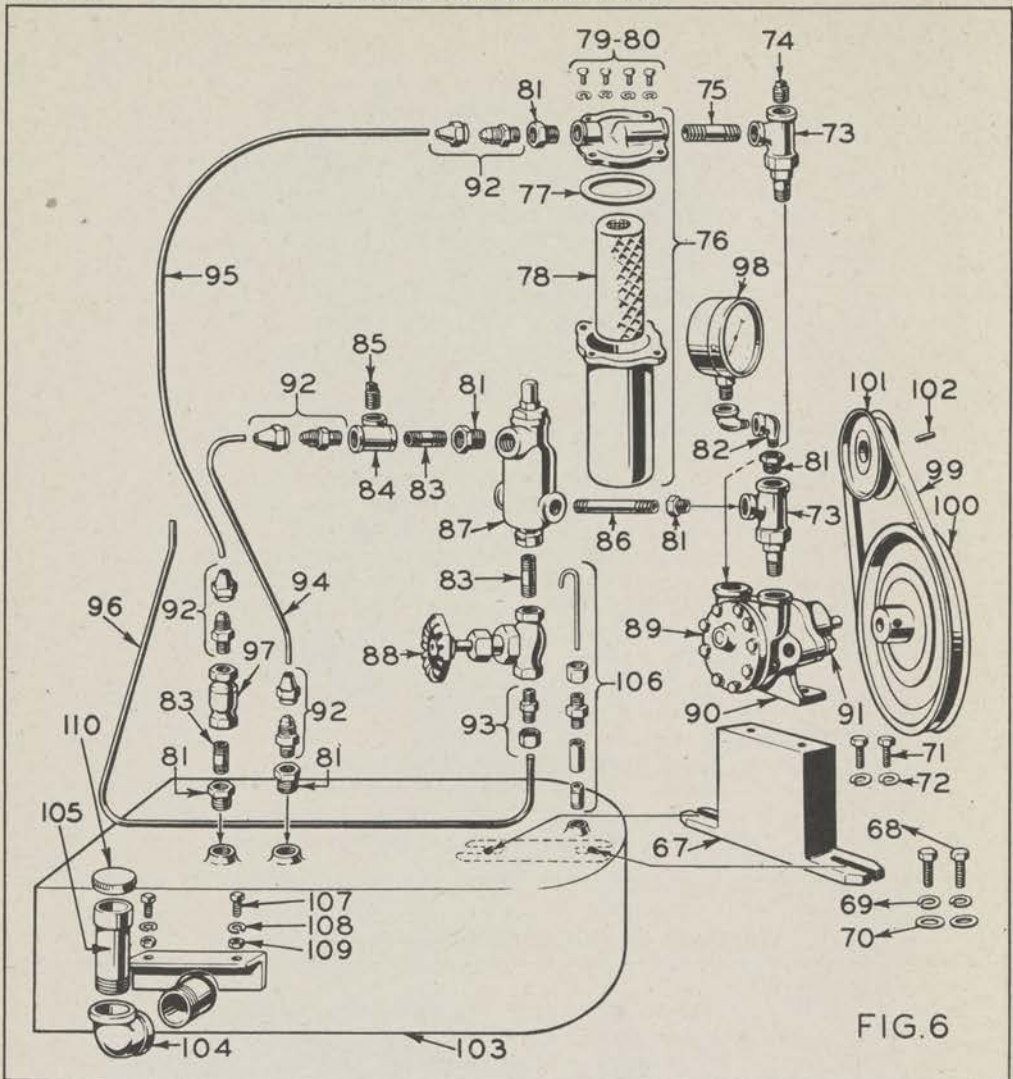


FIG. 6

| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                       | NO.<br>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<br>Commercial Filters Corp. | 1           |
| 77          | 913004      | Gasket, fuel oil filter body                                      | 1           |
| 78          | 913005      | Element, fuel oil filter                                          | 1           |

## FUEL OIL ASSEMBLY

Page 7

| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                                                                      | NO.<br>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,<br>Philadelphia, Pa., Figure G49B<br>(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,<br>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.,<br>copper x 1/4", male I.P.S. flared type                                                   | 4           |
| 93          | 913009      | Connector, copper tubing, 3/8" O.D., copper<br>x 1/4", male I.P.S., compression type                                             | 1           |
| 94          | *           | Tubing, copper, 3/8" O.D., soft, .049" wall,<br>14-1/2" (discharge, relief valve to tank)                                        | 1           |
| 95          | *           | Tubing, copper, 3/8" O.D., soft, .049" wall,<br>14-1/2" (Suction, tank to filter)                                                | 1           |
| 96          | *           | Tubing, copper, 3/8" O.D., soft, .049" wall,<br>50" (relief valve to burner)                                                     | 1           |
| 97          | 904009      | Valve, check, 1/4", Figure 740, vertical,<br>Lunkenheimer                                                                        | 1           |
| 98          | 907001      | Gauge, fuel oil pressure, 2", 0 - 200#,<br>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"<br>bore, 1/4" set screw only                                                           | 1           |
| 101         | 912007      | Sheave, 1 groove, 3.0A pitch diam., 11/16"<br>bore, 3/16 x 3/32" keyseat                                                         | 1           |
| 102         | 903042      | Key, 3/16"                                                                                                                       | 1           |
| 103         | 113004      | Tank, fuel oil, assembly complete with oil<br>filler pipe, filler cap, return suction<br>vent and drain fittings welded in place | 1           |
| 104         | *           | Elbow, 2", black malleable                                                                                                       | 1           |
| 105         | 113005      | Filler, neck assembly, with cap, brazed to<br>2 x 6-1/2" nipple, threaded one end                                                | 1           |
| 106         | 113006      | Vent Assembly, fuel oil tank, includes<br>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

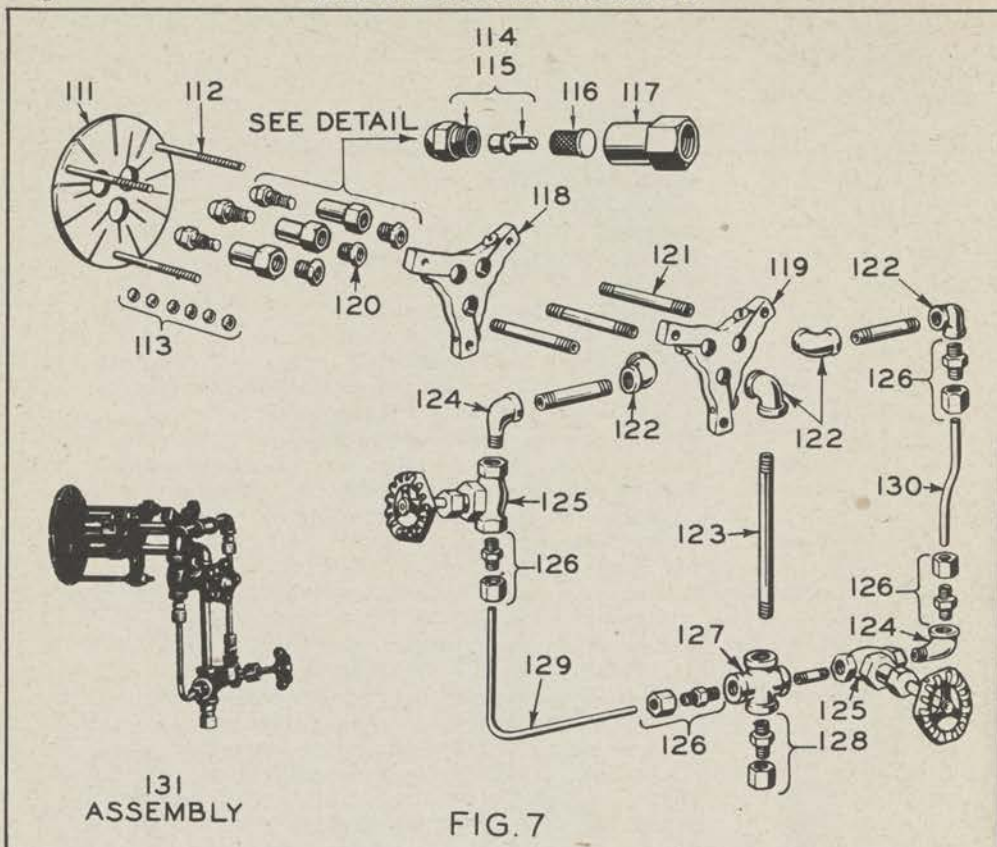


FIG. 7

| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                                                                             | NO.<br>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.

# INNER BURNER ASSEMBLY

Page 9

| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                         | NO.<br>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.<br>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<br>x 1/4" male I.P.S., compression type  | 1           |
| 129         | 113001      | Tubing, 1/4" O.D. copper, jumper, left<br>nozzle valve to cross assembly            | 1           |
| 130         | 113008      | Tubing, 1/4" O.D. copper, jumper, right<br>nozzle valve to cross assembly           | 1           |
| 131         | 103001      | Burner Assembly, inner, fuel oil, (Includes<br>Ref. Nos. 111 to 130 inclusive)      | 1           |

\* Common mill supply items.

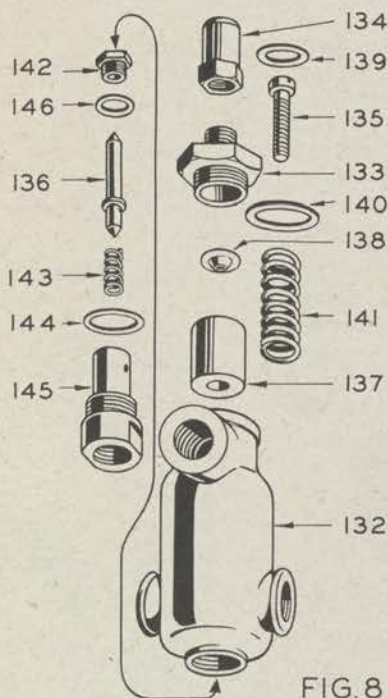


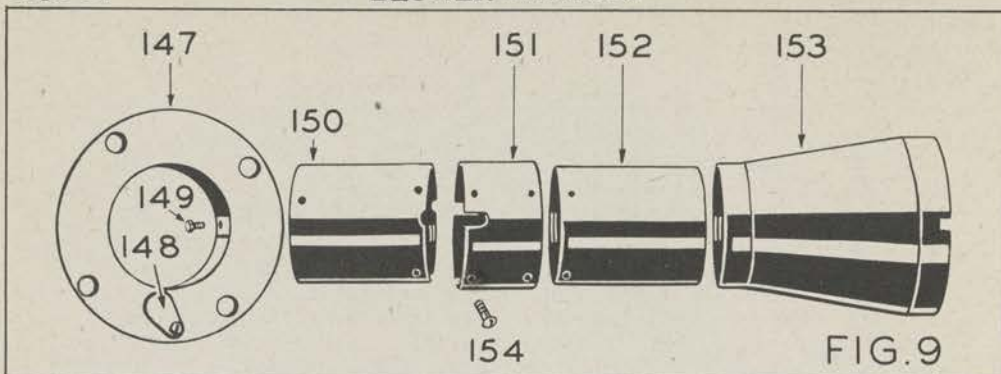
FIG. 8

## FUEL OIL RELIEF VALVE

(See Ref. No. 87, Figure 6)

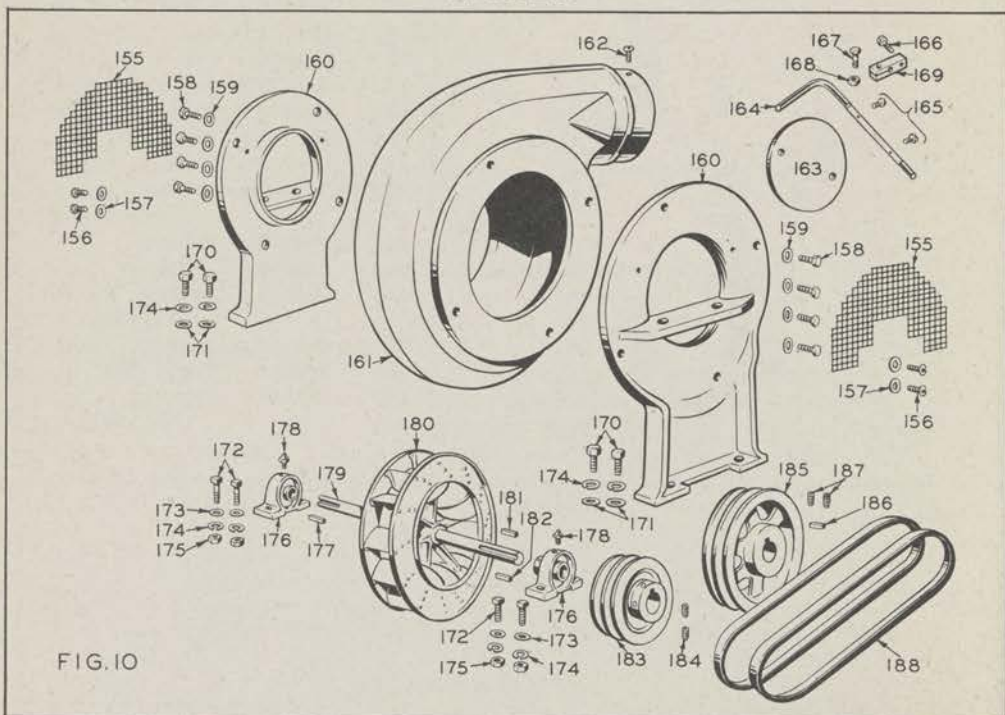
| REF.<br>NO. | PART<br>NO. | DESCRIPTION              | NO.<br>REQ. |
|-------------|-------------|--------------------------|-------------|
| 132         | 904053      | Body                     | 1           |
| 133         | 904054      | Bonnet                   | 1           |
| 134         | 904055      | 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,<br>bonnet        | 1           |
| 141         | 904062      | Spring                   | 1           |
| 142         | 904063      | Locknut                  | 1           |
| 143         | 904064      | Spring, valve<br>lifting | 1           |
| 144         | 904065      | Gasket, seat             | 1           |
| 145         | 904066      | Seat, 1/4"               | 1           |
| 146         | 904067      | Gasket,<br>locknut       | 1           |

## BLOWER AIR TUBE



| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                  | NO.<br>REQ. |
|-------------|-------------|------------------------------------------------------------------------------|-------------|
| 147         | 103005      | Flange, steel, oil burner air tube mounting,<br>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,<br>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,<br>5-1/8" long                     | 1           |
| 153         | 103009      | Adapter, air tube cone, blower                                               | 1           |
| 154         | 903035      | Screw, machine, 10-32 x 1/4", round head,<br>brass                           | 12          |

## BLOWER



## BLOWER (See Figure 10)

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| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                               | NO.<br>REQ. |
|-------------|-------------|-------------------------------------------------------------------------------------------|-------------|
|             | 903003      | Blower Assembly, includes reference<br>Nos. 155 to 181                                    | 1           |
| 155         | 903011      | Screen, blower inlet                                                                      | 2           |
| 156         | *           | Screws, machine, 1/4-20 x 1/2",<br>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<br>identical )                                             | 2           |
| 161         | 903010      | Housing, blower                                                                           | 1           |
| 162         | *           | Screw, machine, 1/4-20 x 1/2", round<br>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,<br>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.<br>x 1-1/2"                                            | 1           |
| 182         | 903014      | Key, blower driven sheave, 3/16"<br>square x 2"                                           | 1           |
| 183         | 912003      | Sheave, blower driven, 4.6 "B" pitch<br>diam., 2 groove, 11/16" bore, 3/16<br>x 3/32 K.S. | 1           |
| 184         | *           | Set Screw, Allen hollow head, 5/16"                                                       | 2           |
| 185         | 912005      | Sheave, blower drive, 2 groove, 7.4<br>"B" pitch diam., 1" bore, 1/4 x 1/8"<br>K.S.       | 1           |
| 186         | 903043      | Key, 1/4" square x 3", blower drive<br>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.

## FEED WATER PUMPING SYSTEM

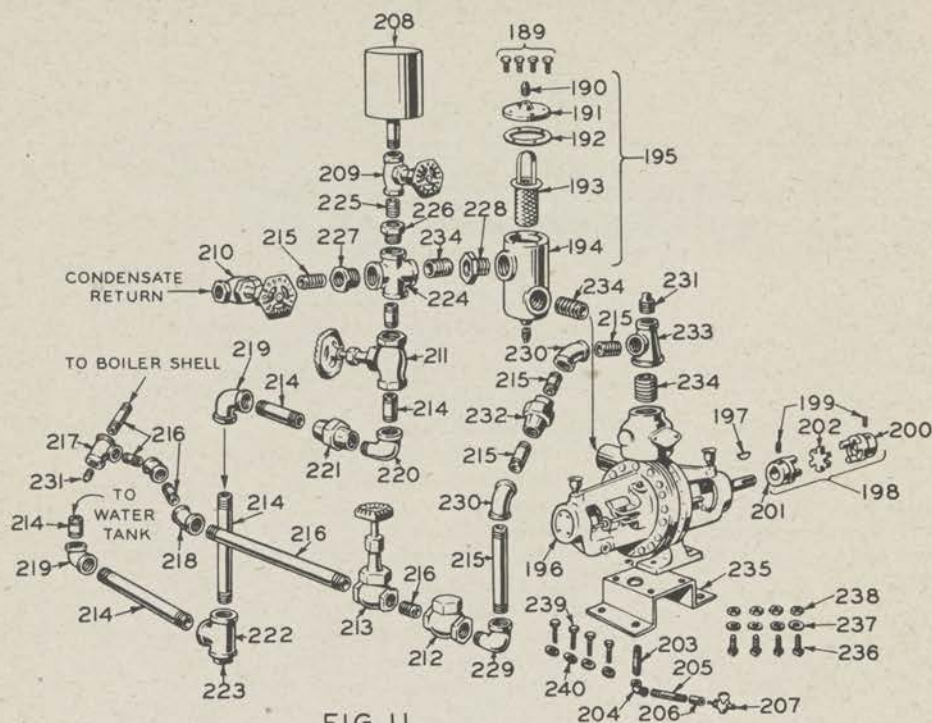


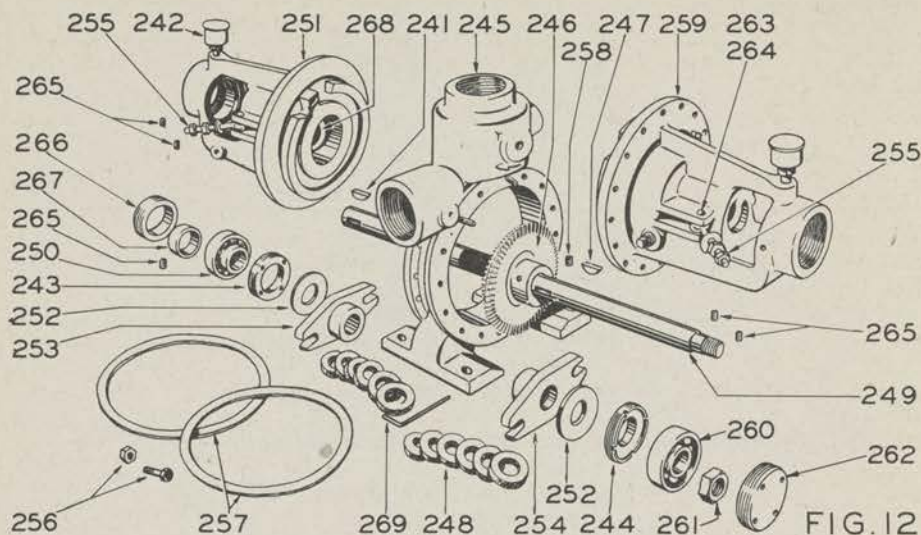
FIG. 11

| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                                                                                                                                    | NO.<br>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.<br>NO. | PART<br>NO. | DESCRIPTION                                              | NO.<br>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 In-<br>jector Co., #270   | 1           |
| 210         | 904014      | Valve, globe, 3/4", 225#, Ohio In-<br>jector Co., #270   | 1           |
| 211         | 904011      | Valve, globe, 1", 225#, Ohio In-<br>jector Co., #270     | 1           |
| 212         | 904013      | Valve, check, 3/4", 300#, Ohio In-<br>jector Co., #304   | 1           |
| 213         | 904022      | Valve, globe, 3/4", 300#, Ohio In-<br>jector 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.

## BOILER FEED PUMP



| REF.<br>NO. | PART<br>NO. | DESCRIPTION                             | AURORA<br>PUMP NO. | NO.<br>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)

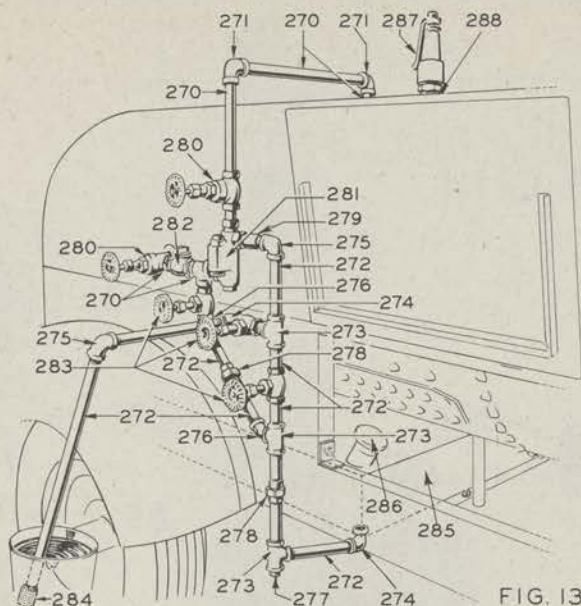


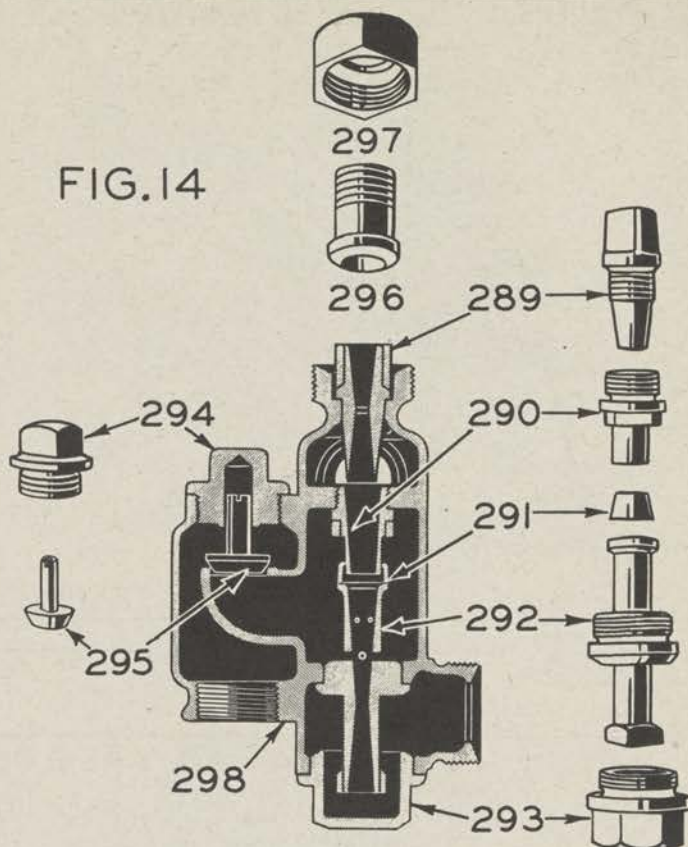
FIG. 13

| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                                                 | NO.<br>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,<br>Fig. 300S, Ohio Injector Company                                        | 2           |
| 281         | 904018      | Injector, (see Figure 14)                                                                                   |             |
| 282         | 904013      | Valve, check, 3/4", extra heavy,<br>Fig. 304, Ohio Injector Co.                                             | 1           |
| 283         | 904014      | Valve, Globe, 3/4", 225#, Fig. 270,<br>Ohio Injector Company                                                | 3           |
| 284         | 904024      | Strainer, 3/4", injector, suction,<br>Ohio Injector Company                                                 | 1           |
| 285         | 104004      | Tank, water, assembly, with filler<br>neck, cap, mounting brackets, com-<br>panion clips, gaskets and bolts | 1           |
| 286         | 904026      | Cap, water tank filler                                                                                      | 1           |
| 287         | 904016      | Valve, pop safety, 125#, Fig. 1445,<br>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.

# INJECTOR

FIG.14



## HOUSING AND INSULATION

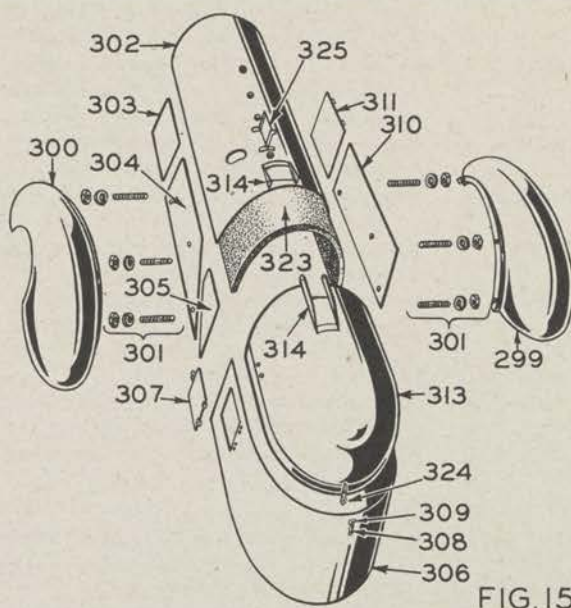


FIG.15

# INJECTOR (See Figure 14)

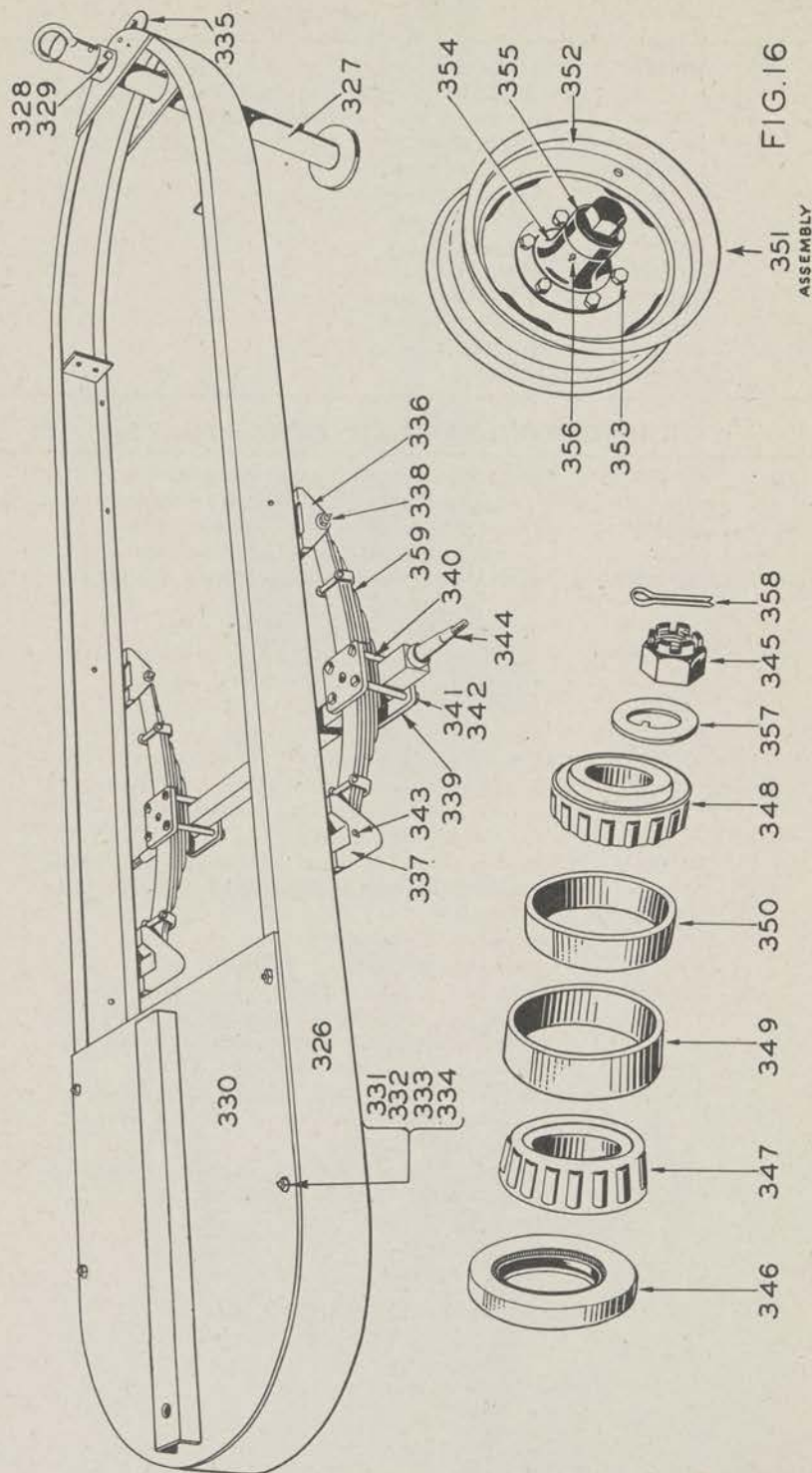
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| REF.<br>NO. | PART<br>NO. | DESCRIPTION                                                                                                       | NO.<br>REQ. |
|-------------|-------------|-------------------------------------------------------------------------------------------------------------------|-------------|
|             | 904018      | Injector, 3/4", Chicago Type, #1004,<br>Size 3, Ohio Injector Co. (includes<br>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<br>mounting rail attached, right                                                               | 1 |
| 300 | 102002 | Fender Assembly, with channel iron<br>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<br>power plant, including left door<br>hinged; hinge hasp; outer rear<br>hinge hasp staple | 1 |
| 307 | 105006 | Door, to water pump assembly, including<br>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<br>tool compartment assembly, with<br>hinges, hinge hasp and bit snap                          | 1 |
| 312 | 105038 | Chain, tool door holding                                                                                                          | 1 |
| 313 | 105036 | Hood, power plant, hinged assembly,<br>with complete top hinge and hasp<br>attached                                               | 1 |
| 314 | 105037 | Hinge, hood to boiler lagging assembly                                                                                            | 1 |
| 323 | 105013 | Insulation "Banroc" Blanket, 1-1/2"<br>x 24" x 48"                                                                                | 4 |
| 324 | *      | Hasp, hinge                                                                                                                       | 1 |
| 325 |        | Sign Plate                                                                                                                        |   |

\* Common Mill Supply Item.



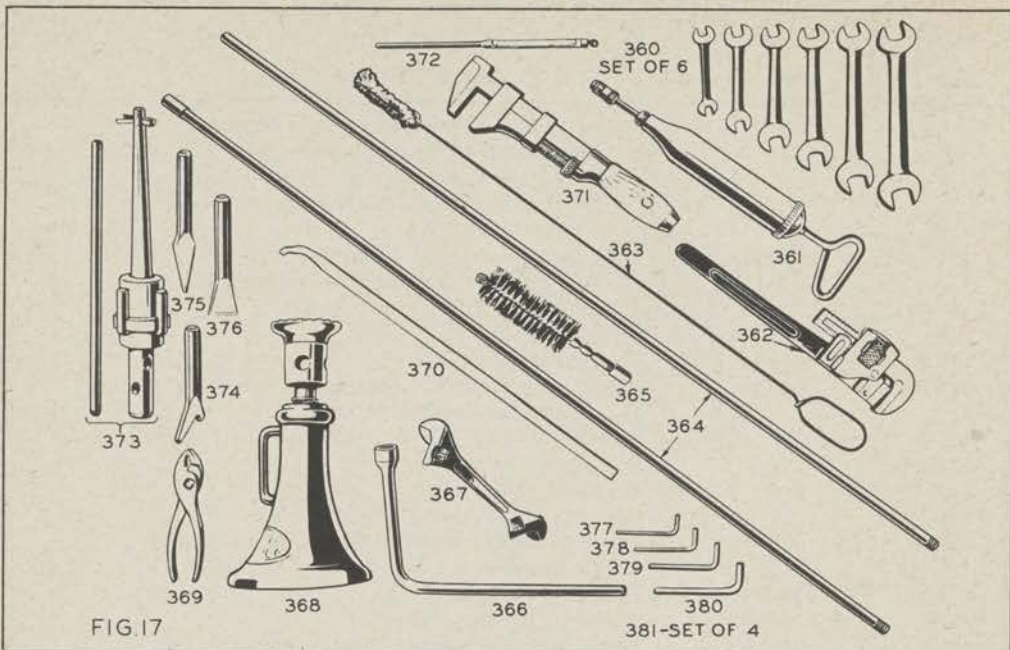
## CHASSIS AND RUNNING GEAR

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| RFF. | PART   |                                                                                                                                                | NO.  |
|------|--------|------------------------------------------------------------------------------------------------------------------------------------------------|------|
| NO.  | NO.    | DESCRIPTION                                                                                                                                    | REQ. |
| 326  | 102033 | Chassis Frame Assembly, includes 6" channel iron frame, power plant base, spring hangers riveted on, lunette towing ring and front support leg | 1    |
| 327  | 102005 | Leg, front support with top ring (circular base must be welded in place after installed)                                                       | 1    |
| 328  | *      | Machine bolt, 3/4 x 5-1/2"                                                                                                                     | 1    |
| 329  | *      | Nut, 3/4", hex.                                                                                                                                | 1    |
| 330  | 102034 | Plate, base, for power plant and oil burner assembly                                                                                           | 1    |
| 331  | *      | Machine Bolt, 1/2 x 1-3/4"                                                                                                                     | 5    |
| 332  | *      | Nut, 1/2", hex.                                                                                                                                | 5    |
| 333  | *      | Washer, lock, 1/2"                                                                                                                             | 5    |
| 334  | *      | Washer, cast iron, bevel, 1/2"                                                                                                                 | 5    |
| 335  | 102007 | Lunette Ring, towing (must be welded in place)                                                                                                 | 1    |
| 336  | 102008 | Hanger, spring, front                                                                                                                          | 2    |
| 337  | 102009 | Hanger, spring, rear                                                                                                                           | 2    |
| 338  | 102010 | Bolt, spring hanger, 3/4 x 4-3/4" with extra heavy castellated nut                                                                             | 2    |
| 339  | 102011 | Plate, axle spring mounting, 5" square                                                                                                         | 4    |
| 340  | *      | Bolt, spring-axle mounting, 5/8 x 6-1/2"                                                                                                       | 8    |
| 341  | *      | Nut, 5/8", hex.                                                                                                                                | 8    |
| 342  | *      | Washer, lock, 5/8"                                                                                                                             | 8    |
| 343  | *      | Alemite Fittings, 1/8", male, 90°                                                                                                              | 4    |
| 344  | 102037 | Axle, with key washer, castellated nuts and cotter keys, 2-1/2" square                                                                         | 1    |
| 345  | 102013 | Nut, axle, lock, castellated                                                                                                                   | 2    |
| 346  | 102015 | Grease Seal Assembly, Chicago Rawhide Mfg. Co., #30620                                                                                         | 2    |
| 347  | 102016 | Roller Bearing, large, inner, Timken #2788                                                                                                     | 2    |
| 348  | 102017 | Roller Bearing, small, outer, Timken #15118                                                                                                    | 2    |
| 349  | 102018 | Cup, large inner bearing, Timken #2720                                                                                                         | 2    |
| 350  | 102019 | Cup, small outer bearing, Timken #15250                                                                                                        | 2    |
| 351  | 102020 | Wheel, disc, assembly, includes hubcap, wheel, studs, 102018 and 102019 large and small bearing cups in place. Motor Wheel Corp., #31677       | 2    |
| 352  | 102021 | Wheel, disc only, less hub and studs                                                                                                           | 2    |
| 353  | 102022 | Stud, wheel, hub                                                                                                                               | 12   |
| 354  | 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    |
| 355  | 102031 | Cap, Hub, #31437 Motor Wheel Corp.                                                                                                             | 2    |
| 356  | *      | Alemite Stud                                                                                                                                   | 2    |
| 357  | 102030 | Key Washer                                                                                                                                     | 2    |
| 358  | *      | Cotter Key                                                                                                                                     | 2    |
| 359  | 102035 | Spring Assembly, 10 leaf, 2-1/2" wide, Tuthill Spring Co., #102                                                                                | 2    |

\* Common mill supply items

## TOOLS AND EXTRA EQUIPMENT



| REF.<br>NO.                                       | PART<br>NO. | DESCRIPTION                                                      | NO.<br>REQ. |
|---------------------------------------------------|-------------|------------------------------------------------------------------|-------------|
| 360                                               | 916024      | Wrench, open end, set of six,<br>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<br>Items 377-380 Inclusive) |             |
| <u>Steam Hose and Couplings (Not Illustrated)</u> |             |                                                                  |             |
| 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                                        |             |

## PARTS PRICE LIST CLEAVER 2-CAR HEATER MODEL DS

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| 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          | 56.00          |
| 102003   | 61       | 5    | 1        | 40          | 12.00          |
| 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   | 5-12-301 | 1-3-17 | 20       | 1/4         | .20            |
| 902002   | 13       | 3      | 4        | 1/4         | .24            |

\* Dependent upon operating conditions.

# PARTS PRICE LIST CLEAVER 2-CAR HEATER MODEL DS Page 23

| 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           | *3.00          |
| 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.

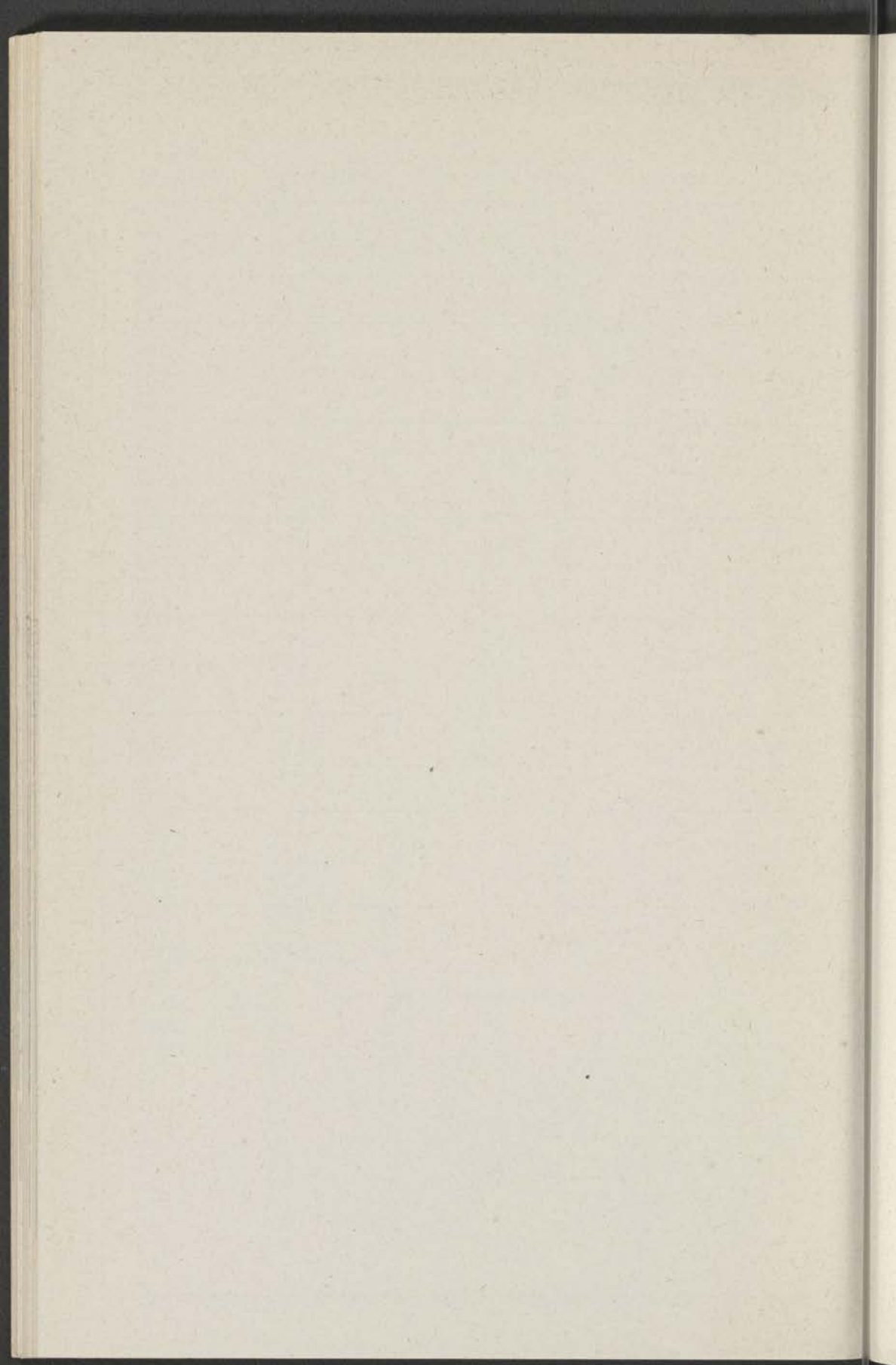
| PART NO. | REF. NO. | PAGE | NO. REQ. | WEIGHT LBS. | LIST PRICE EA. |
|----------|----------|------|----------|-------------|----------------|
| 904050   | 297      | 17   | 1        | 1/4         | \$ 1.00        |
| 904051   | 298      | 17   | 1        | 3           | 11.20          |
| 904053   | 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          |

# PARTS PRICE LIST CLEAVER 2-CAR HEATER MODEL DS Page 25

| 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            |
| 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.

\* Tools - Quantity Optional.



**PART 4**

**OPERATING AND MAINTENANCE**

**INSTRUCTIONS**

**SPARE PARTS PRICE LIST**

**FOR**

**BRIGGS AND STRATTON**

**GASOLINE MOTOR**

Startin  
Servic  
Instru  
Repai  
Parts  
Illustr  
Price

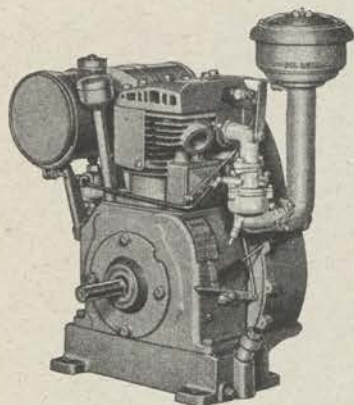
# Operating Instructions

Adjustment and Repair  
Information • Parts List

For BRIGGS & STRATTON

**MODEL "ZZ"**

TYPE NO. 304665



## INDEX

|                                             | Page |
|---------------------------------------------|------|
| Starting the Motor.....                     | 2-E  |
| Servicing Reference Chart.....              | 4-E  |
| Instructions for Adjustment and Repair..... | 5-E  |
| Repair Parts .....                          | 18-E |
| Parts List, Models "ZZ" .....               | 19-E |
| Illustrated Parts .....                     | 17-E |
| Price List .....                            | 32-E |

**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

|                                     | Paragraph |
|-------------------------------------|-----------|
| Before Starting the Motor . . . . . | 1         |
| How to Start . . . . .              | 2         |
| Failure of Motor to Start . . . . . | 3         |
| How to Stop . . . . .               | 4         |
| General Data . . . . .              | 5         |

**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.

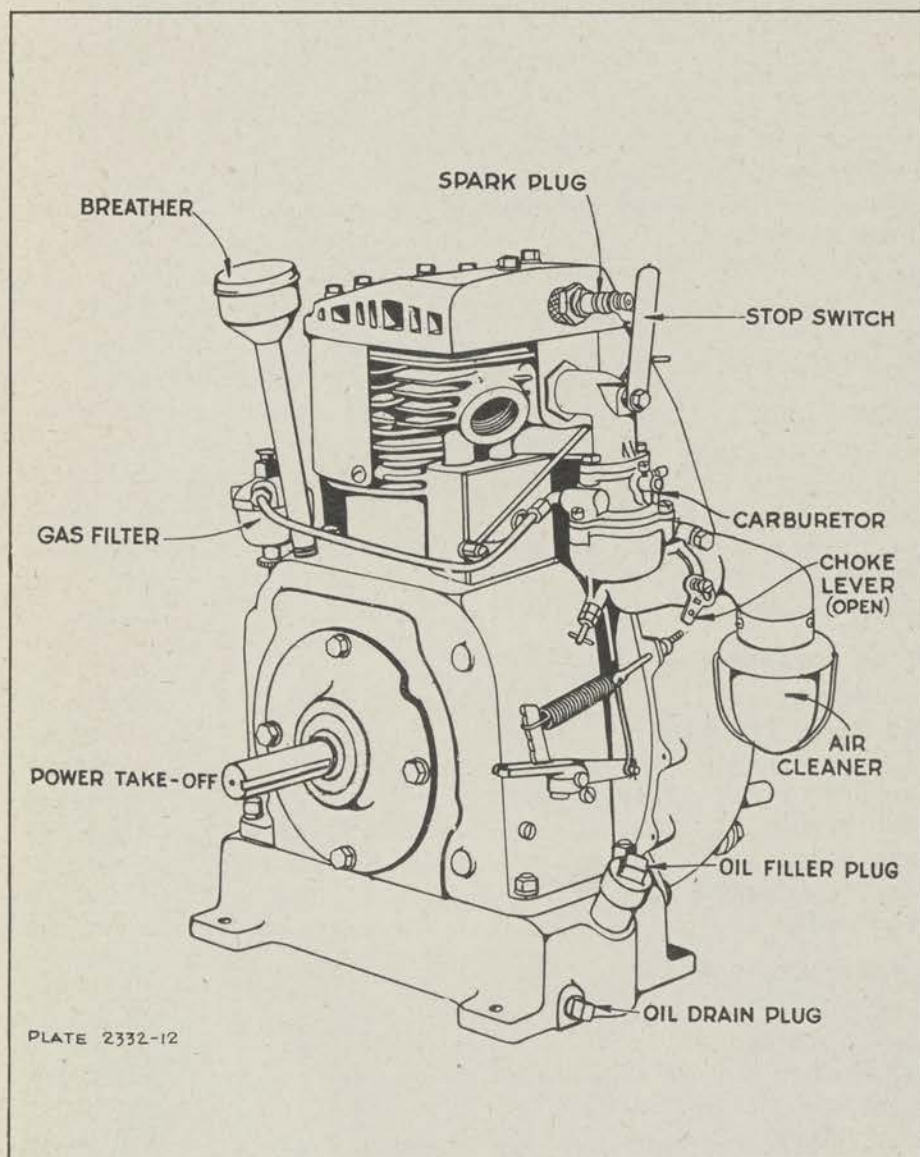
**A. HAND CRANK STARTER TYPE.** Pull out the compression release rod as far as it will come. Press the starter shaft in, to mesh gear with pinion on crankshaft. Crank rapidly and as soon as enough momentum is gained let go of the compression release rod and pull carburetor choke lever toward you to choke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

|                                                  | Paragraph |
|--------------------------------------------------|-----------|
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| Keep the Motor Clean . . . . .                   | 11        |
| Use the Right Kind of Oil . . . . .              | 12        |
| Add Oil Regularly . . . . .                      | 13        |
| Change Oil Frequently . . . . .                  | 14        |
| Use Clean Gasoline . . . . .                     | 16        |
| Avoid Gummy Gasoline . . . . .                   | 17        |
| To Clean the Fuel Lines . . . . .                | 19        |
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| To Prime the Motor . . . . .                     | 21        |
| To Adjust the Carburetor . . . . .               | 22        |
| To Remove and Replace Carburetor . . . . .       | 25        |
| To Clean Carburetor . . . . .                    | 26        |
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| Ignition Cable . . . . .                         | 34        |
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| Oil Leaks . . . . .                              | 60        |
| Carbon . . . . .                                 | 61        |
| Air Cleaner . . . . .                            | 62        |
| Muffler . . . . .                                | 63        |
| Overload . . . . .                               | 64        |
| Hand Crank Starter . . . . .                     | 65        |
| Parts . . . . .                                  | 66        |

## ENGINE INSTRUCTIONS

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.

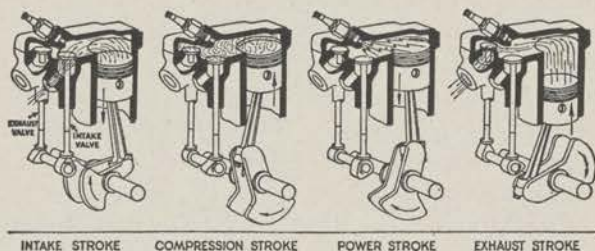
7. If you should experience any difficulty, follow the instructions referred to in the **Servicing Reference Chart** above. If you cannot easily remedy it, consult your dealer, or a nearby Briggs & Stratton Authorized Central Service Distributor.

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:** 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.

## ENGINE INSTRUCTIONS

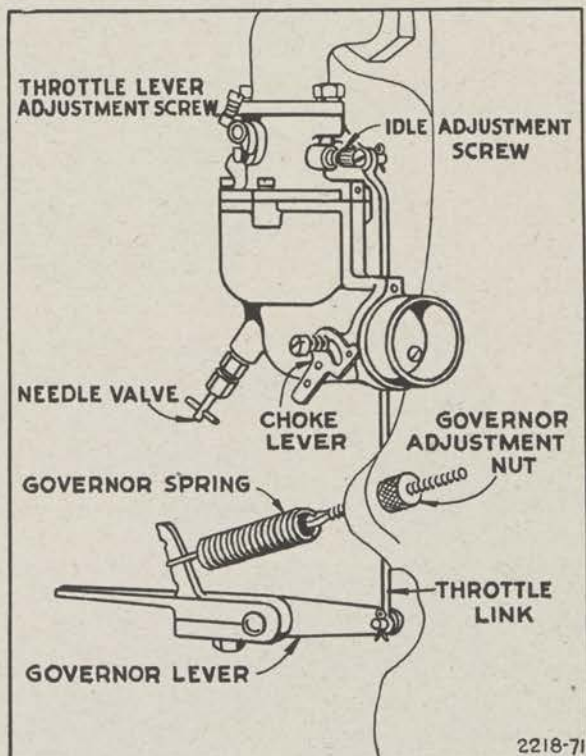
**22. TO ADJUST THE CARBURETOR.** The carburetor on this motor is of the gravity type. The gasoline supply is regulated by a needle valve. The throttle is automatically controlled by the governor, see paragraphs 27 to 30.

**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)

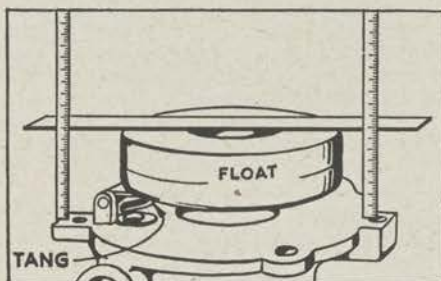
**25. TO REMOVE AND REPLACE CARBURETOR.** Disconnect gasoline line from carburetor and gasoline shut-off valve. Remove two cap screws and lockwashers from the intake elbow. Then remove the cotter pin from the throttle shaft lever and slip the throttle link off. To replace, reverse the operations as performed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

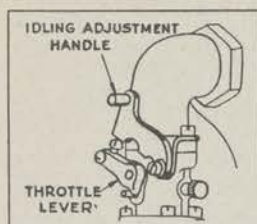
**29. RESETTNG GOVERNOR LEVER.** If the governor lever has been loosened or removed from the governor shaft, it is easily reset. With the carburetor attached to motor and hooked up to governor lever with throttle link, loosen screw holding governor lever on the shaft. Push the governor lever toward the 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.

## ENGINE INSTRUCTIONS

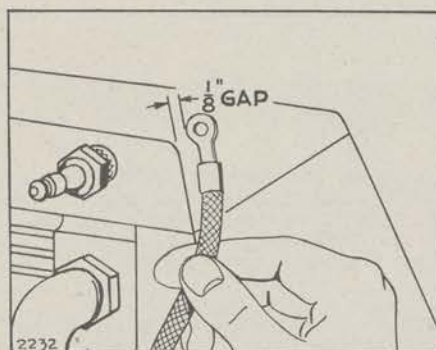
Idling Device  
Plate No. 4



**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  $\frac{1}{8}$ " 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



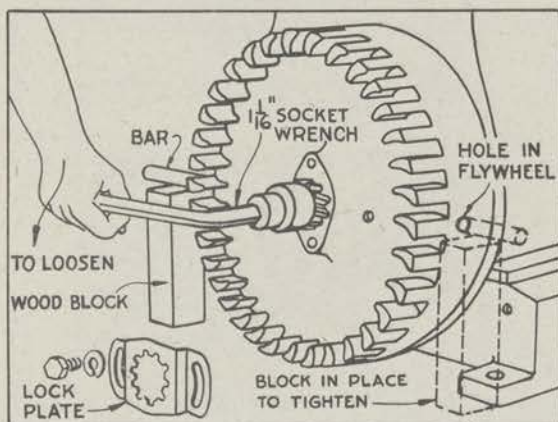
**34. IGNITION CABLE.** Insulation must not be broken, or soaked with oil or water, or grounded in any way where it touches the motor, or it will interfere with good ignition. Spark plug cable should be soldered to the secondary terminal (small brass plate coming out of the coil). Avoid touching coil 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  $\frac{3}{8}$ " dia. hole in rim is at carburetor side of motor. Insert rod or punch in this hole and place a block of wood under it. This will hold flywheel rigid and prevent its turning as you loosen nut. Use a  $1\frac{1}{16}$ " 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.

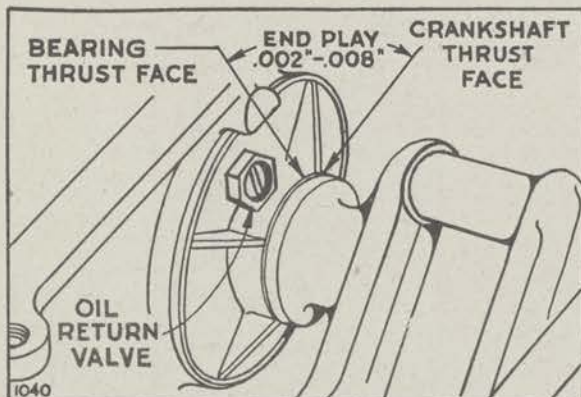
Removing Flywheel  
Plate No. 7



**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

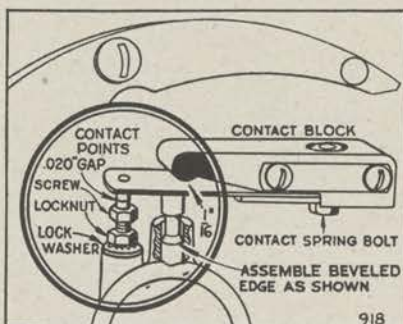


## ENGINE INSTRUCTIONS

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

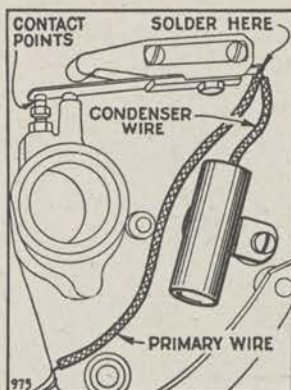


Tighten contact spring bolt. To adjust contact spring tension, turn crankshaft until points are in open position, then place 1/16" gauge between contact spring and round end of contact block, and tighten contact block screws. Turn contact screw to secure .020" gap and tighten locknut against lockwasher. 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.

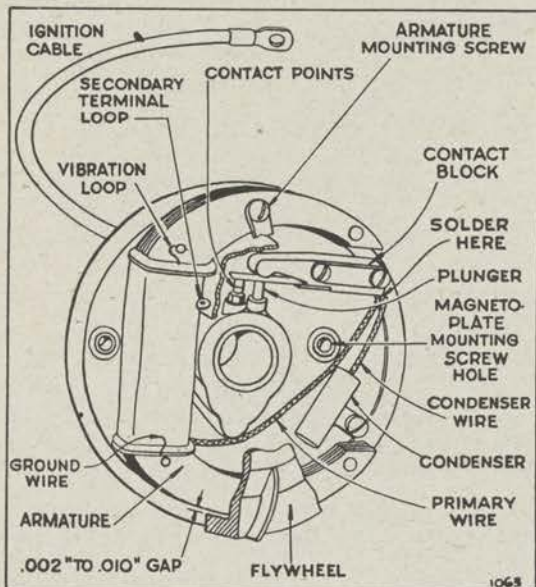
Condenser Installation  
Plate No. 10



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 to the terminal and fill pocket, formed with flap, with hydrolene. Solder armature lead wire to contact spring. Replace dust cover and the clip holding cover in place, tighten upper armature mounting screw. See 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, but do not remove too much metal.

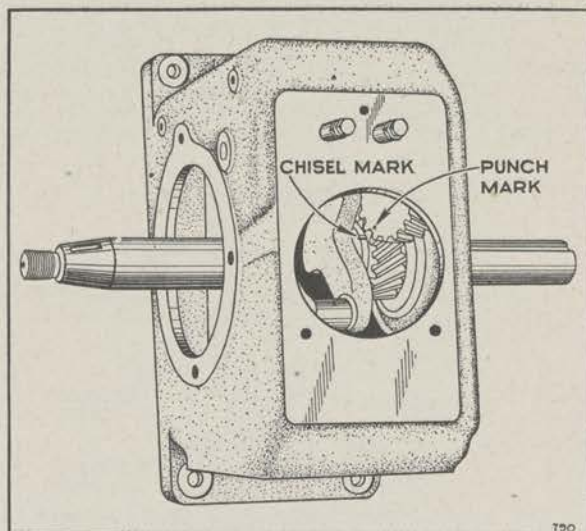
47. **CYLINDER HEAD.** The cylinder head is held on with seven cap screws. When the cylinder head has been removed for the purpose of cleaning carbon or grinding valves, care should be used in replacing it. Use a new gasket if possible. Otherwise, clean the old one and coat both sides with cup grease. 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

## ENGINE INSTRUCTIONS

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 reseal 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 thoroughly 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.

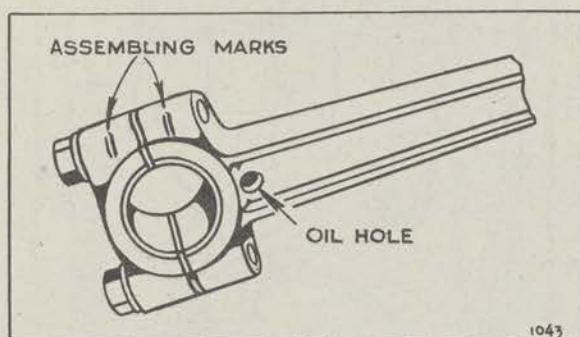
55. If an oversize piston is necessary, we recommend that reboring of cylinder be done by an Authorized Central Service Distributor or the factory.

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

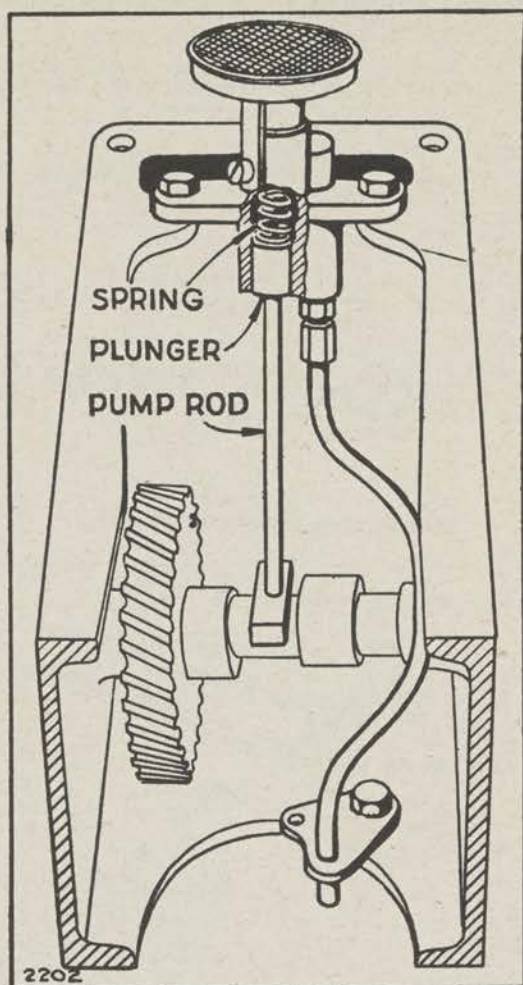


59. **OIL PUMP.** The oil pump is assembled to the crankcase with two bolts and lockwashers and is operated from an eccentric on the cam gear. An inoperative pump will result in insufficient lubrication which may score cylinder and piston assembly. To check oil pump, remove base and the two bolts that 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.

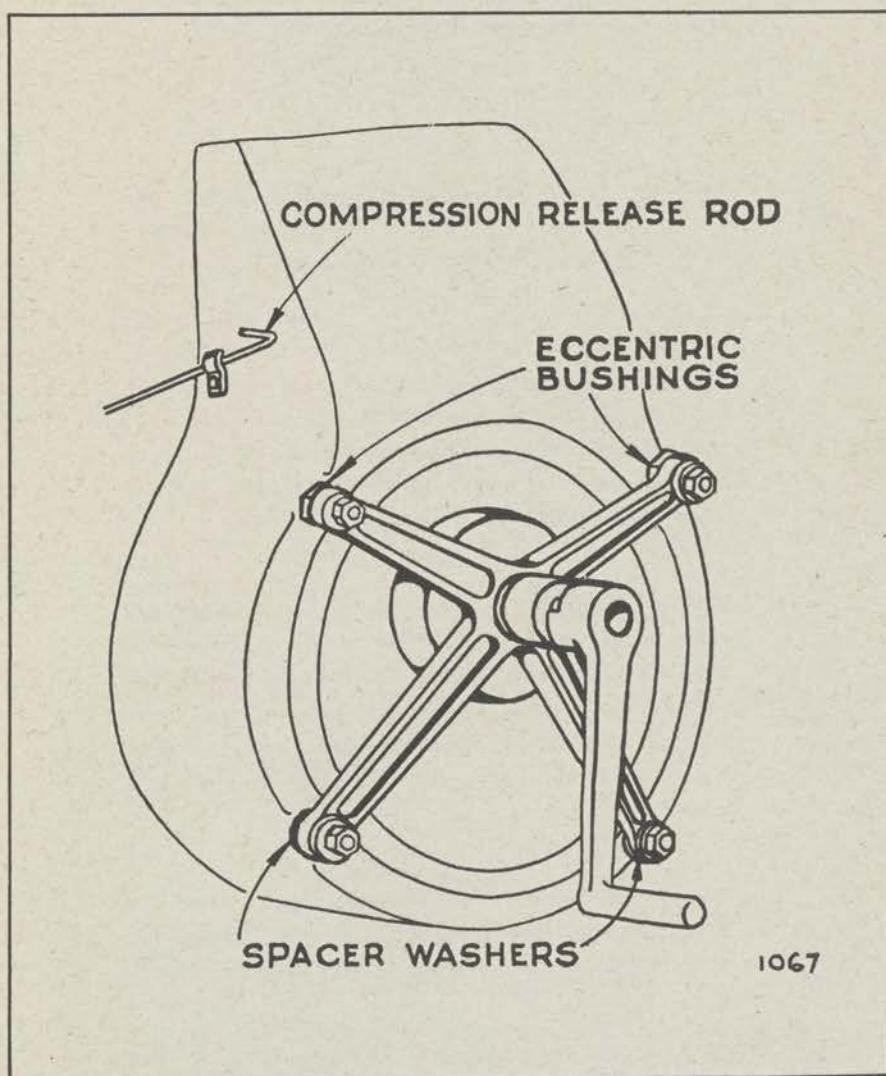
**63. MUFFLER.** After long periods of service it is possible that the muffler will become clogged to the point where it will affect the motor's power. To check the muffler unscrew it from the motor and run water into the open end of the muffler. If full streams of water come out of the small holes at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

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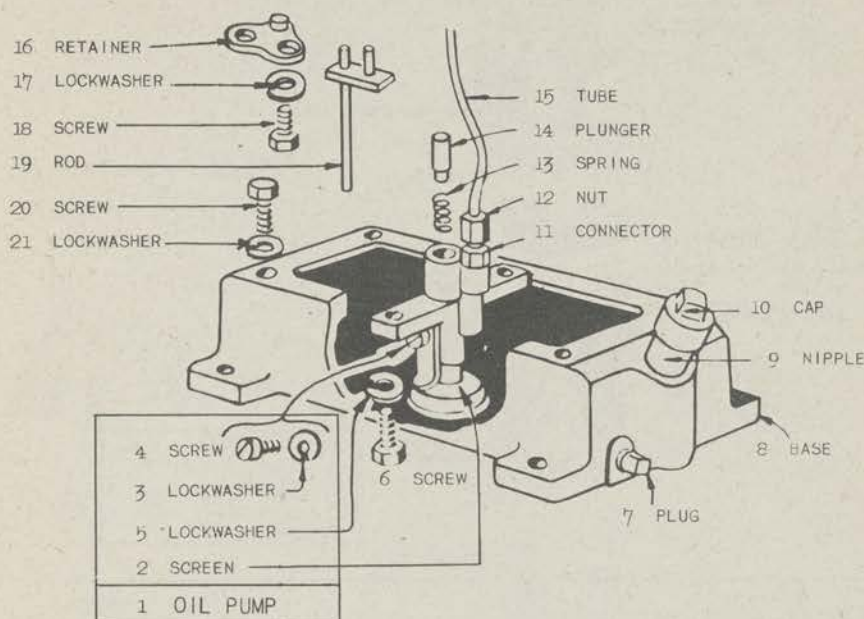


FIGURE B-1

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                | ENG.<br>MFR.<br>NO. | NO.<br>REQ. |
|-------------|------------------------|--------------------------------------------|---------------------|-------------|
| 1           | 109041                 | Oil Pump Assembly (Items 2-4<br>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           |
| 10          | 109046                 | Oil Filler Cap                             | 69689               | 1           |
| 11          | 109047                 | Oil Tube Connector                         | 63202               | 1           |
| 12          | 109048                 | Oil Tube Connector Nut                     | 63217               | 1           |
| 13          | 109049                 | Oil Pump Spring                            | 26413               | 1           |
| 14          | 109050                 | Oil Pump Plunger                           | 23132               | 1           |
| 15          | 109051                 | Oil Pump Tube                              | 99362               | 1           |
| 16          | 109052                 | Oil Tube Retainer                          | 62081               | 1           |
| 17          | 109216                 | Lockwasher, 1/4 x 3/32 x 5/64"             | 90832               | 2           |
| 18          | 109217                 | Screw, 1/4-20 x 1/2", hex. hd.             | 90891               | 2           |
| 19          | 109053                 | Oil Pump Rod                               | 66739               | 1           |
| 20          | 109243                 | Screw, 3/8-16 x 1-1/4", hex. hd.           | 90887               | 4           |
| 21          | 109227                 | Lockwasher, 11/32 x 1/8 x 3/32"            | 92268               | 4           |

## ENGINE PARTS

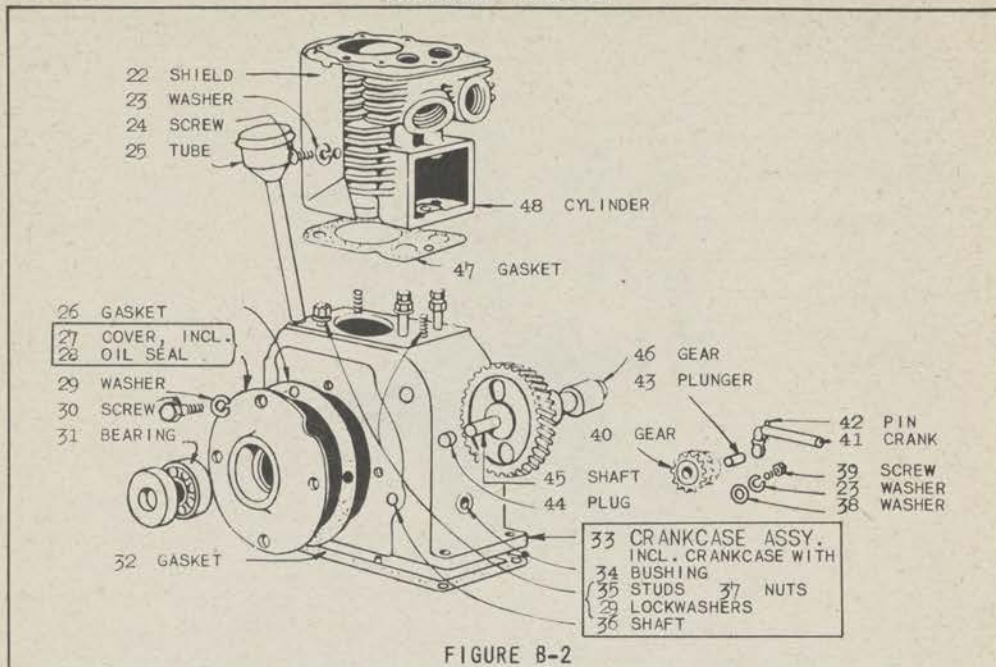


FIGURE B-2

| REF. NO. | C-B CO. PART NO. | DESCRIPTION                                                                         | ENG. MFR. NO. | NO. REQ. |
|----------|------------------|-------------------------------------------------------------------------------------|---------------|----------|
| 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 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)<br>(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)<br>(Includes Items 34-37 inclusive,<br>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 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        |
| 48       | 109040           | Cylinder                                                                            | 99358         | 1        |

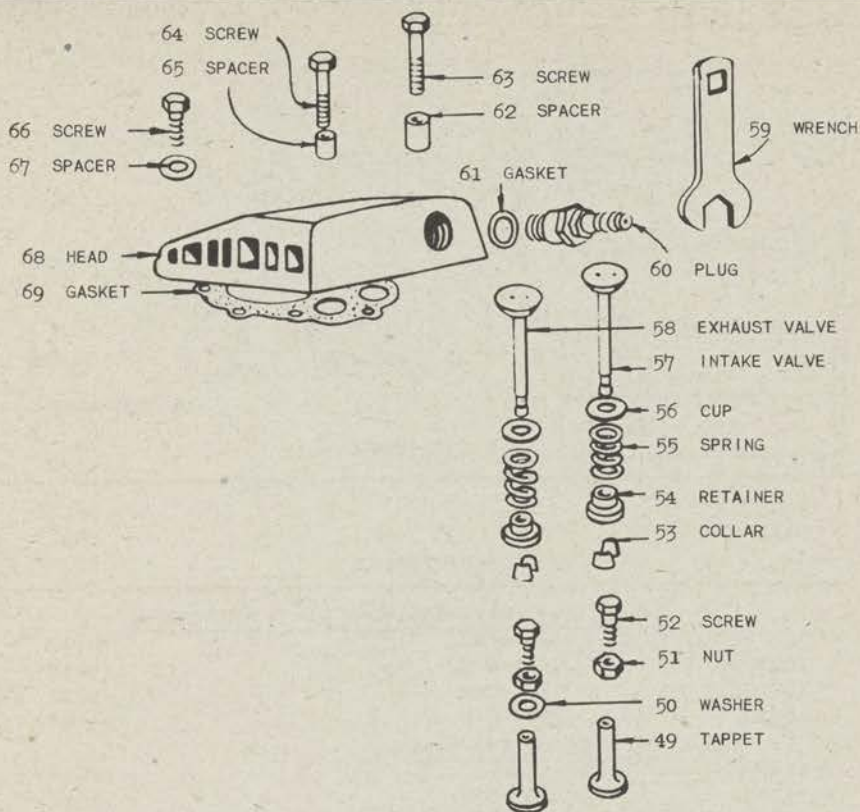


FIGURE B-3

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                  | ENG.<br>MFR.<br>NO. | NO.<br>REQ. |
|-------------|------------------------|----------------------------------------------|---------------------|-------------|
| 49          | 109001                 | Valve Tappet                                 | 26308               | 2           |
| 50          | 109002                 | Valve Tappet Washer                          | 62252               | 2           |
| 51          | 109267                 | Nut, 1/4-28, hex.                            | 90847               | 2           |
| 52          | 109003                 | Valve Tappet Screw                           | 90890               | 2           |
| 53          | 109004                 | Valve Spring Collar                          | 68283               | 4           |
| 54          | 109005                 | Valve Spring Retainer                        | 68293               | 2           |
| 55          | 109006                 | Valve Spring                                 | 65906               | 2           |
| 56          | 109007                 | Valve Spring Cup                             | 62222               | 2           |
| 57          | 109008                 | Intake Valve                                 | 68563               | 1           |
| 58          | 109009                 | Exhaust Valve                                | 23330               | 1           |
| 59          | 109010                 | Spark Plug & Filler Cup Wrench               | 68652               | 1           |
| 60          | 109011                 | Spark Plug with Gasket<br>(Includes Item 61) | 89572               | 1           |
| 61          | 109012                 | Spark Plug Gasket                            | 27090               | 1           |
| 62          | 109013                 | Cylinder Head Spacer                         | 63336               | 3           |
| 63          | 109014                 | Cylinder Head Screw                          | 91387               | 3           |
| 64          | 109015                 | Cylinder Head & Valve Cover Screw            | 91386               | 2           |
| 65          | 109016                 | Cylinder Head Spacer                         | 63337               | 2           |
| 66          | 109017                 | Cylinder Head & Connecting Rod Screw         | 91162               | 2           |
| 67          | 109018                 | Cylinder Head Spacer                         | 91324               | 2           |
| 68          | 109019                 | Cylinder Head                                | 61405               | 1           |
| 69          | 109020                 | Cylinder Head Gasket                         | 69737               | 1           |

## ENGINE PARTS

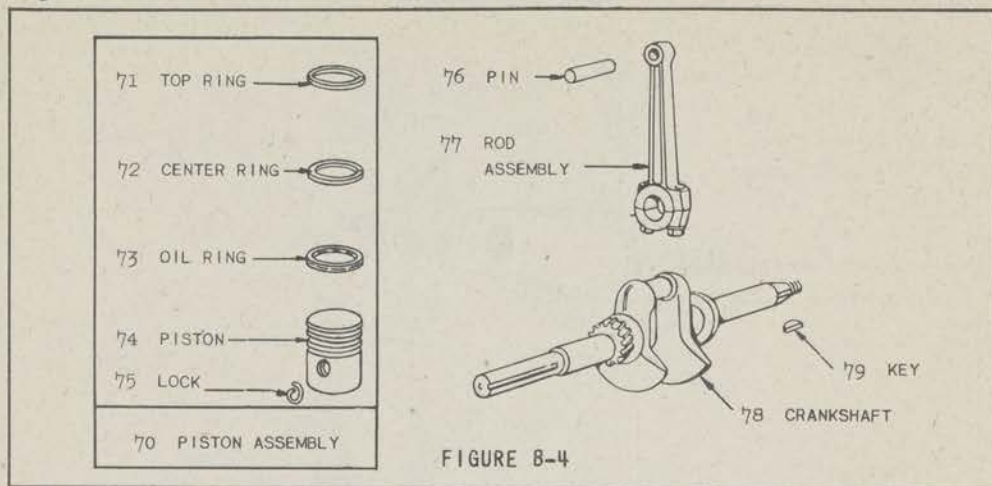


FIGURE 8-4

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                       | ENG.<br>MFR.<br>NO. | NO.<br>REQ. |
|-------------|------------------------|---------------------------------------------------|---------------------|-------------|
| 70          |                        | <u>Piston Assembly (Includes 71-75 Inclusive)</u> |                     |             |
|             | 109099                 | Standard                                          | 99947               | 1           |
|             | 109100                 | .010"-O.S.                                        | 99948               |             |
|             | 109101                 | .020"-O.S.                                        | 99949               |             |
|             | 109102                 | .030"-O.S.                                        | 99950               |             |
| 71          |                        | <u>Top Compression Ring</u>                       |                     |             |
|             | 109082                 | Standard                                          | 61964               | 1           |
|             | 109083                 | .010" O.S.                                        | 21002               |             |
|             | 109084                 | .020"-O.S.                                        | 21005               |             |
|             | 109085                 | .030"-O.S.                                        | 21008               |             |
| 72          |                        | <u>Center Compression Ring</u>                    |                     |             |
|             | 109086                 | Standard                                          | 61963               | 1           |
|             | 109087                 | .010" O.S.                                        | 21003               |             |
|             | 109088                 | .020"-O.S.                                        | 21006               |             |
|             | 109089                 | .030"-O.S.                                        | 21009               |             |
| 73          |                        | <u>Oil Ring</u>                                   |                     |             |
|             | 109090                 | Standard                                          | 61292               | 1           |
|             | 109091                 | .010"-O.S.                                        | 61335               |             |
|             | 109092                 | .020"-O.S.                                        | 61336               |             |
|             | 109093                 | .030"-O.S.                                        | 61337               |             |
| 74          |                        | <u>Piston</u>                                     |                     |             |
|             | 109094                 | Standard                                          | 69921               | 1           |
|             | 109095                 | .010"-O.S.                                        | 69922               |             |
|             | 109096                 | .020"-O.S.                                        | 69923               |             |
|             | 109097                 | .030"-O.S.                                        | 69924               |             |
| 75          | 109098                 | Piston Pin Lock                                   | 65776               |             |
| 76          |                        | <u>Piston Pin</u>                                 |                     |             |
|             | 109103                 | Standard                                          | 69925               | 1           |
|             | 109104                 | .005"-O.S.                                        | 29103               |             |
| 77          | 109105                 | Connecting Rod Assembly                           | 69642               | 1           |
|             | 109106                 | Connecting Rod Shim                               | 22246               | *           |
|             | 109107                 | Connecting Rod Washer                             | 67502               | 2           |
|             | 109231                 | Lockwasher, 5/16 x 1/8 x 1/16"                    | 90366               | 2           |
|             | 109108                 | Connecting Rod Screw                              | 91162               | 2           |
| 78          | 109109                 | Crankshaft                                        | 26278               | 1           |
| 79          | 109110                 | Flywheel Key                                      | 66403               | 1           |

\* Shim to fit

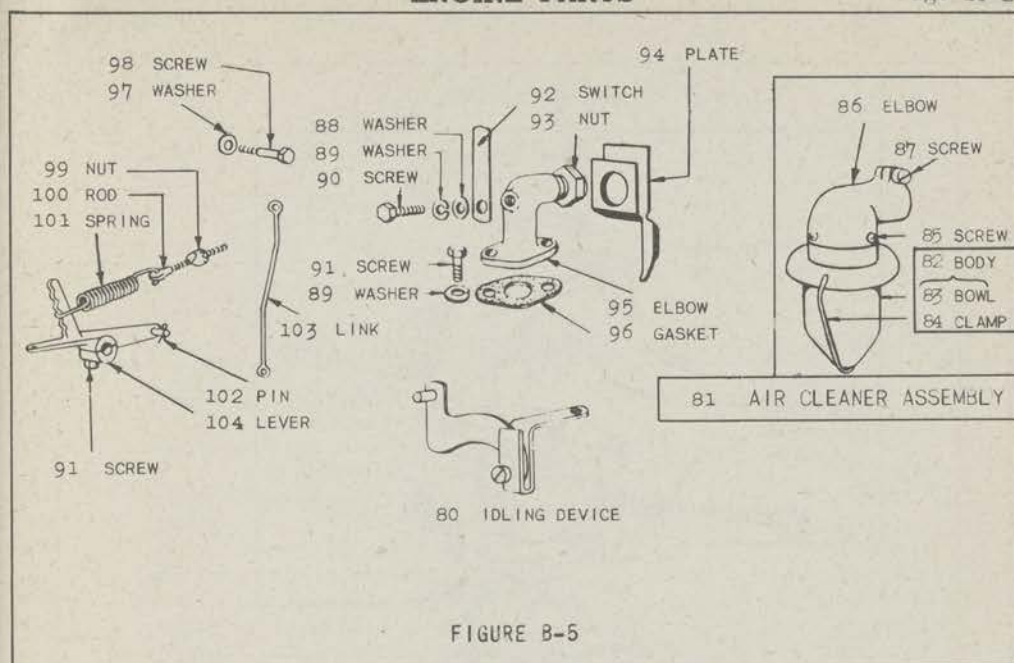


FIGURE B-5

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                       | ENG.<br>MFR.<br>NO. | NO.<br>REQ. |
|-------------|------------------------|---------------------------------------------------|---------------------|-------------|
| 80          | 109138                 | Idling Device                                     | 99458               | 1           |
| 81          | 109139                 | Air Cleaner Assembly<br>(Items 82 - 87 Inclusive) | 69947               | 1           |
| 82          | 109140                 | Air Cleaner Body<br>(Items 83 - 84)               | 69948               | 1           |
| 83          | 109141                 | Air Cleaner Bowl                                  | 62455               | 1           |
| 84          | 109142                 | Air Cleaner Bowl Clamp                            | 62466               | 1           |
| 85          | 109143                 | Screw, No. 7 x 1/2" Parker Kalon                  | 91458               | 3           |
| 86          | 109144                 | Air Cleaner Elbow                                 | 61371               | 1           |
| 87          | 109215                 | Screw, 1/4-20 x 1", fill. hd.                     | 91256               | 1           |
| 88          | 109145                 | Stop Switch Washer                                | 67632               | 1           |
| 89          | 109216                 | Lockwasher, 1/4 x 3/32 x 5/64"                    | 90832               | 3           |
| 90          | 109217                 | Screw, 1/4-20 x 1/2", hex. hd.                    | 90891               | 1           |
| 91          | 109218                 | Screw, 1/4-20 x 3/4", hex. hd.                    | 90700               | 3           |
| 92          | 109146                 | Stop Switch                                       | 62196               | 1           |
| 93          | 109147                 | Intake Elbow Locknut                              | 63445               | 1           |
| 94          | 109148                 | Carburetor Baffle Plate                           | 99393               | 1           |
| 95          | 109149                 | Carburetor Intake Elbow                           | 61976               | 1           |
| 96          | 109150                 | Carburetor Gasket                                 | 65647               | 1           |
| 97          | 109151                 | Air Cleaner Washer                                | 65084               | 1           |
| 98          | 109152                 | Air Cleaner Screw                                 | 91442               | 1           |
| 99          | 109153                 | Governor Spring Rod Nut                           | 63520               | 1           |
| 100         | 109154                 | Governor Spring Rod                               | 63334               | 1           |
| 101         | 109155                 | Governor Spring                                   | 67316               | 1           |
| 102         | 109219                 | Cotter Pin, 1/16 x 3/8"                           | 92286               | 1           |
| 103         | 109156                 | Throttle Link                                     | 26160               | 1           |
| 104         | 109157                 | Governor Lever                                    | 29429               | 1           |

## ENGINE PARTS

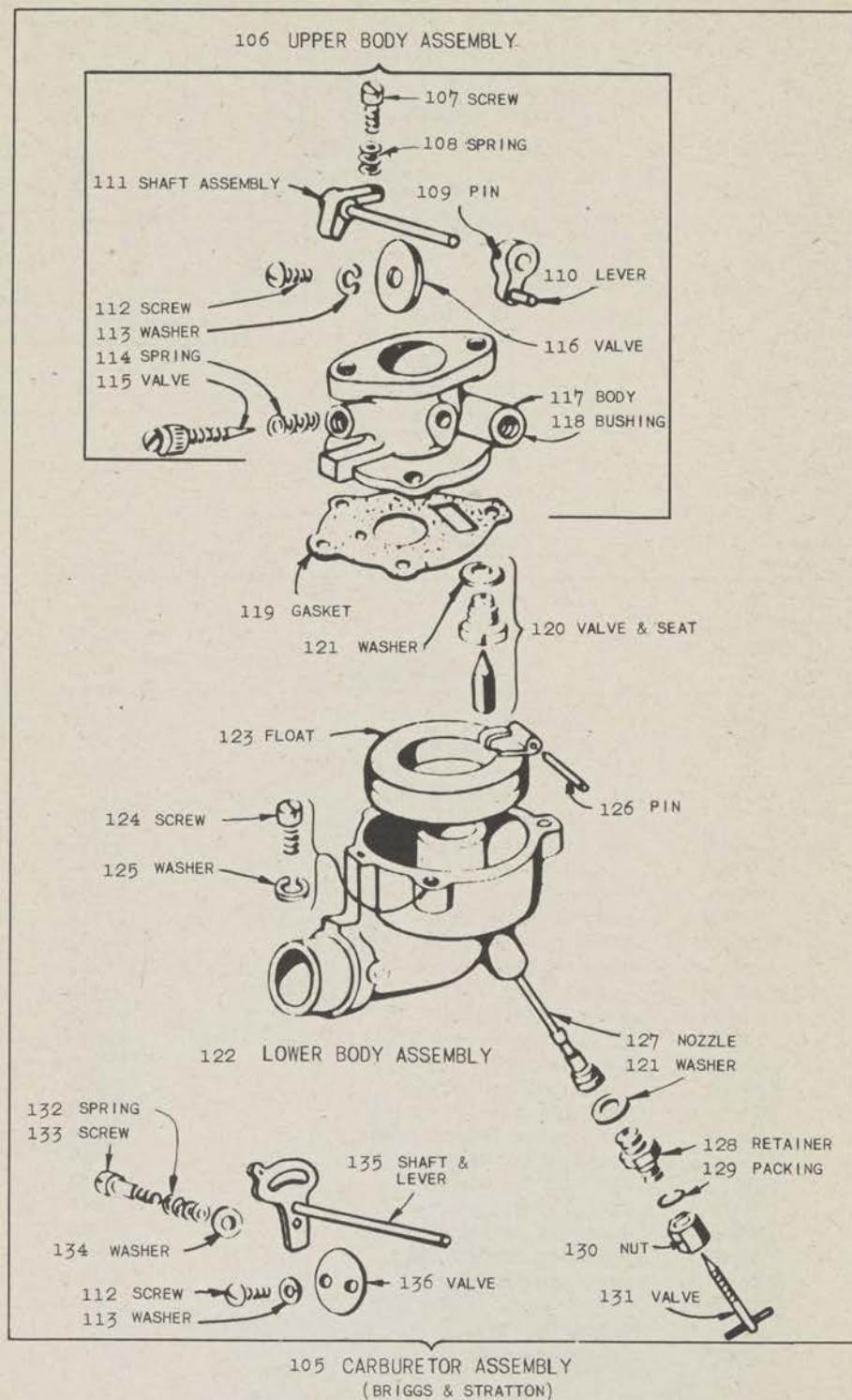


FIGURE 8-6

FIGURE 8-6

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                                           | ENG.<br>MFR.<br>NO. | NO.<br>REQ. |
|-------------|------------------------|-----------------------------------------------------------------------|---------------------|-------------|
| 105         | 109137                 | Carburetor Assembly (Off-Center Choke)<br>(Items 106 - 136 Inclusive) | 89536               | 1           |
| 106         | 109111                 | Upper Carburetor Body Assembly<br>(Items 107 - 118 Inclusive)         | 99376               | 1           |
| 107         | 109220                 | Screw, 8-32 x 3/4", fill. hd.                                         | 91846               | 1           |
| 108         | 109112                 | Throttle Adjusting Spring                                             | 26119               | 1           |
| 109         | 109113                 | Throttle Lever Pin                                                    | 23125               | 1           |
| 110         | 109114                 | Throttle Lever                                                        | 21152               | 1           |
| 111         | 109115                 | Throttle Shaft Assembly                                               | 99524               | 1           |
| 112         | 109221                 | Screw, 4-16 x 1/4", rd. hd.                                           | 90029               | 3           |
| 113         | 109222                 | Lockwasher, 1/8 x 3/64 x 1/32"                                        | 90369               | 3           |
| 114         | 109116                 | Idling Valve Spring                                                   | 26157               | 1           |
| 115         | 109117                 | Idler Needle Valve                                                    | 23228               | 1           |
| 116         | 109118                 | Throttle Butterfly Valve                                              | 62940               | 1           |
| 117         | 109119                 | Upper Carburetor Body                                                 | 99375               | 1           |
| 118         | 109120                 | Throttle Shaft Bushing                                                | 23108               | 1           |
| 119         | 109121                 | Carburetor Gasket                                                     | 68947               | 1           |
| 120         | 109122                 | Inlet Valve and Seat<br>(Includes Item 121)                           | 99780               | 1           |
| 121         | 109123                 | Fibre Washer                                                          | 68667               | 2           |
| 122         | 109124                 | Carburetor Body (Off-Center Choke)                                    | 89535               | 1           |
| 123         | 109125                 | Carburetor Float                                                      | 99333               | 1           |
| 124         | 109223                 | Screw, 10-32 x 5/8", fill. hd.                                        | 90746               | 4           |
| 125         | 109224                 | Lockwasher No. 10                                                     | 91427               | 4           |
| 126         | 109126                 | Float Hinge Pin                                                       | 23114               | 1           |
| 127         | 109127                 | Carburetor Nozzle                                                     | 99345               | 1           |
| 128         | 109128                 | Needle Valve Retainer                                                 | 23117               | 1           |
| 129         | 109129                 | Needle Valve Packing                                                  | 68677               | 1           |
| 130         | 109130                 | Needle Valve Packing Nut                                              | 23118               | 1           |
| 131         | 109131                 | Needle Valve                                                          | 99346               | 1           |
| 132         | 109132                 | Choke Lever Spring                                                    | 26155               | 1           |
| 133         | 109133                 | Choke Lever Screw                                                     | 23123               | 1           |
| 134         | 109134                 | Choke Lever Washer                                                    | 62899               | 1           |
| 135         | 109135                 | Choke Shaft and Lever (Off-Center)                                    | 89531               | 1           |
| 136         | 109136                 | Choke Valve (Off-Center)                                              | 62872               | 1           |

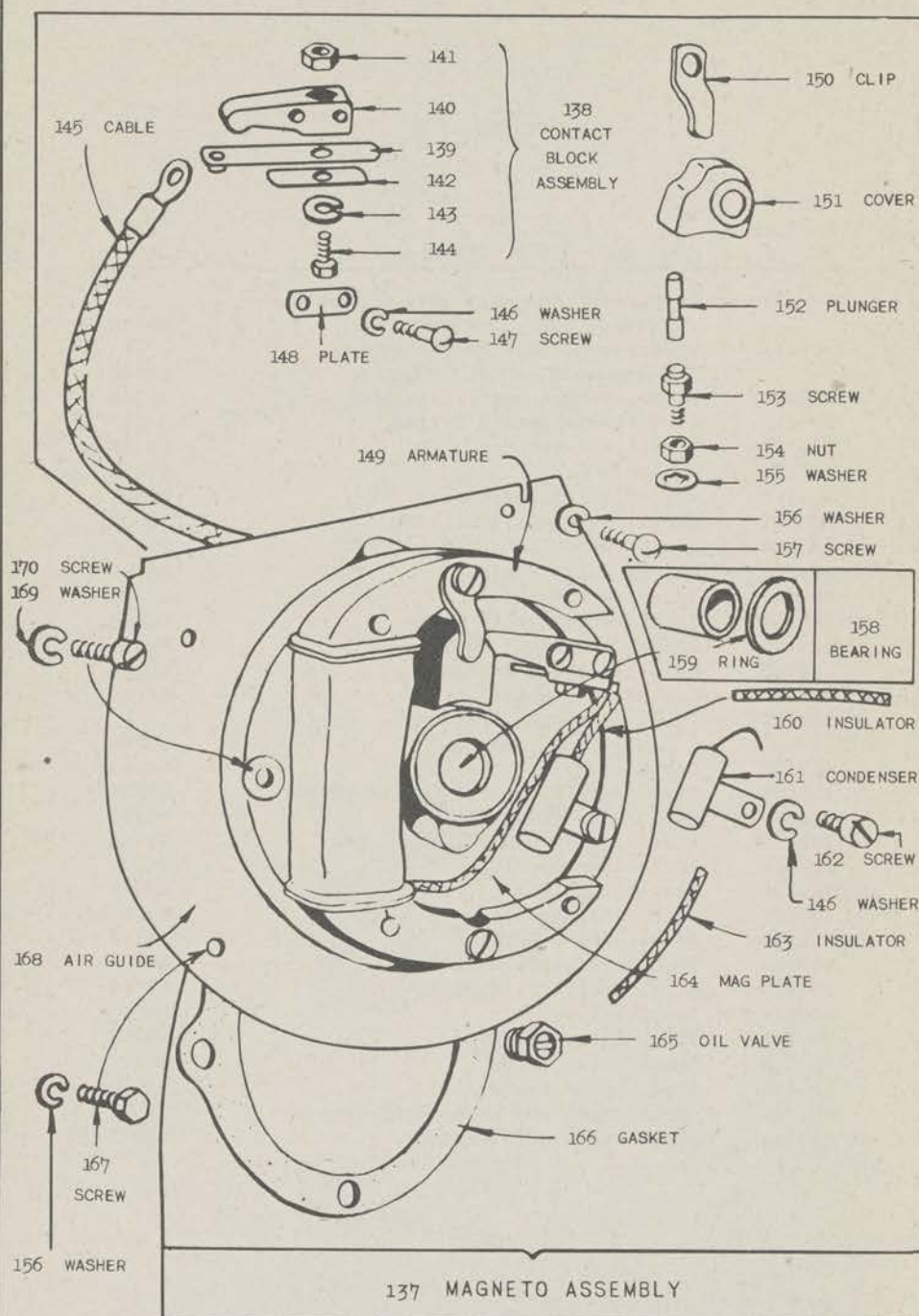


FIGURE B-7

FIGURE 8-7

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                           | ENG.<br>MFR.<br>NO. | NO.<br>REQ. |
|-------------|------------------------|-------------------------------------------------------|---------------------|-------------|
| 137         | 109158                 | Magneto Assembly<br>(Items 138 - 170 Inclusive)       | 69835               | 1           |
| 138         | 109159                 | Contact Block Assembly<br>(Items 139 - 144 Inclusive) | 69780               | 1           |
| 139         | 109160                 | Contact Spring and Point                              | 69754               | 1           |
| 140         | 109161                 | Contact Block                                         | 65078               | 1           |
| 141         | 109258                 | Nut, 8-32, hex.                                       | 90313               | 1           |
| 142         | 109162                 | Contact Spring Stop                                   | 62100               | 1           |
| 143         | 109259                 | Lockwasher, 11/64 x 5/64 x 1/32"                      | 90367               | 1           |
| 144         | 109163                 | Contact Block Screw                                   | 63369               | 1           |
| 145         | 109164                 | Ignition Cable                                        | 69854               | 1           |
| 146         | 109234                 | Lockwasher No. 10                                     | 92290               | 3           |
| 147         | 109261                 | Screw, 10-32 x 7/8", rnd. hd.                         | 91406               | 2           |
| 148         | 109165                 | Contact Connector Plate                               | 62178               | 1           |
| 149         | 109166                 | Armature                                              | 29656               | 1           |
| 150         | 109167                 | Dust Cover Clip                                       | 68876               | 1           |
| 151         | 109168                 | Magneto Point Dust Cover                              | 65198               | 1           |
| 152         | 109169                 | Magneto Point Plunger                                 | 65414               | 1           |
| 153         | 109170                 | Contact Point Screw                                   | 63238               | 1           |
| 154         | 109171                 | Contact Point Locknut                                 | 63239               | 1           |
| 155         | 109262                 | Shakeproof Lockwasher No. 6                           | 91122               | 1           |
| 156         | 109216                 | Lockwasher, 1/4 x 3/32 x 5/64"                        | 90832               | 8           |
| 157         | 109264                 | Screw, 1/4-20 x 1", rnd. hd.                          | 91270               | 4           |
| 158         | 109172                 | Magneto Plate Bearing (Includes Item 159)             | 69911               | 1           |
| 159         | 109173                 | Oil Retainer Ring                                     | 62235               | 1           |
| 160         | 109174                 | Condenser Lead Insulator                              | 65735               | 1           |
| 161         | 109175                 | Condenser                                             | 29652               | 1           |
| 162         | 109265                 | Screw, 10-32 x 1/4" fill. hd.                         | 92308               | 1           |
| 163         | 109176                 | Armature Lead Insulator                               | 65725               | 1           |
| 164         | 109177                 | Magneto Plate with Bearing                            | 69876               | 1           |
| 165         | 109178                 | Oil Return Valve                                      | 89307               | 1           |
| 166         |                        | <u>Magneto Plate Gasket*</u>                          |                     |             |
|             | 109179                 | .015" Thick                                           | 66457               | *           |
|             | 109180                 | .005" Thick                                           | 66527               | *           |
|             | 109181                 | .009" Thick                                           | 66537               | *           |
| 167         | 109226                 | Screw, 1/4-20 x 3/8", hex. hd.                        | 91439               | 4           |
| 168         | 109182                 | Blower Housing Air Guide                              | 62926               | 1           |
| 169         | 109183                 | Lockwasher                                            | 90774               | 3           |
| 170         | 109184                 | Magneto Plate Screw                                   | 91385               |             |

\* Use one of the three thicknesses

## ENGINE PARTS

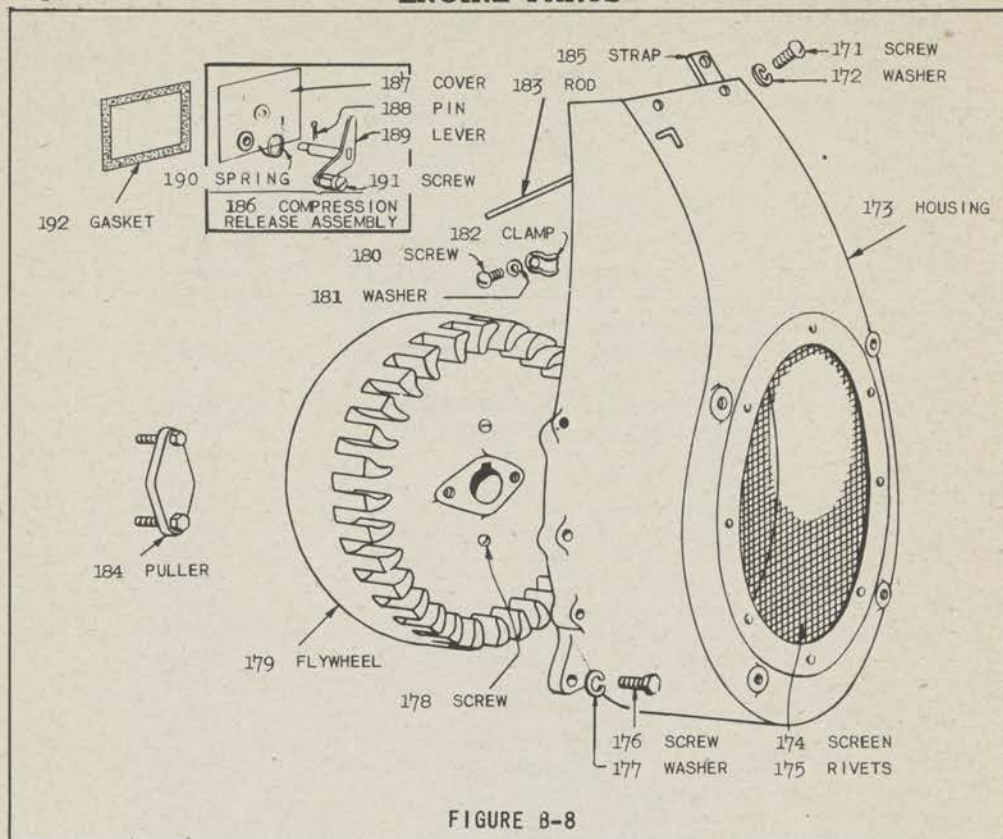


FIGURE 8-8

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                                 | ENG.<br>MFR.<br>NO. | NO.<br>REQ. |
|-------------|------------------------|-------------------------------------------------------------|---------------------|-------------|
| 171         | 109229                 | Screw, 1/4-20 x 5/8", rnd. hd.                              | 91698               | 4           |
| 172         | 109216                 | Lockwasher, 1/4 x 3/32 x 5/64"                              | 90832               | 4           |
| 173         | 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<br>(Items 187 - 191 Inclusive) | 69950               | 1           |
| 187         | 109064                 | Valve Cover                                                 | 69951               | 1           |
| 188         | 109235                 | Cotter Pin, 1/16 x 1/2"                                     | 92288               | 1           |
| 189         | 109065                 | Shaft Lever and Swivel                                      | 69952               | 1           |
| 190         | 109066                 | Compression Release Spring                                  | 67666               | 1           |
| 191         | 109236                 | Screw, 10-32 x 5/16", rnd. hd.                              | 90010               | 1           |
| 192         | 109067                 | Valve Cover Plate Gasket                                    | 65237               | 1           |

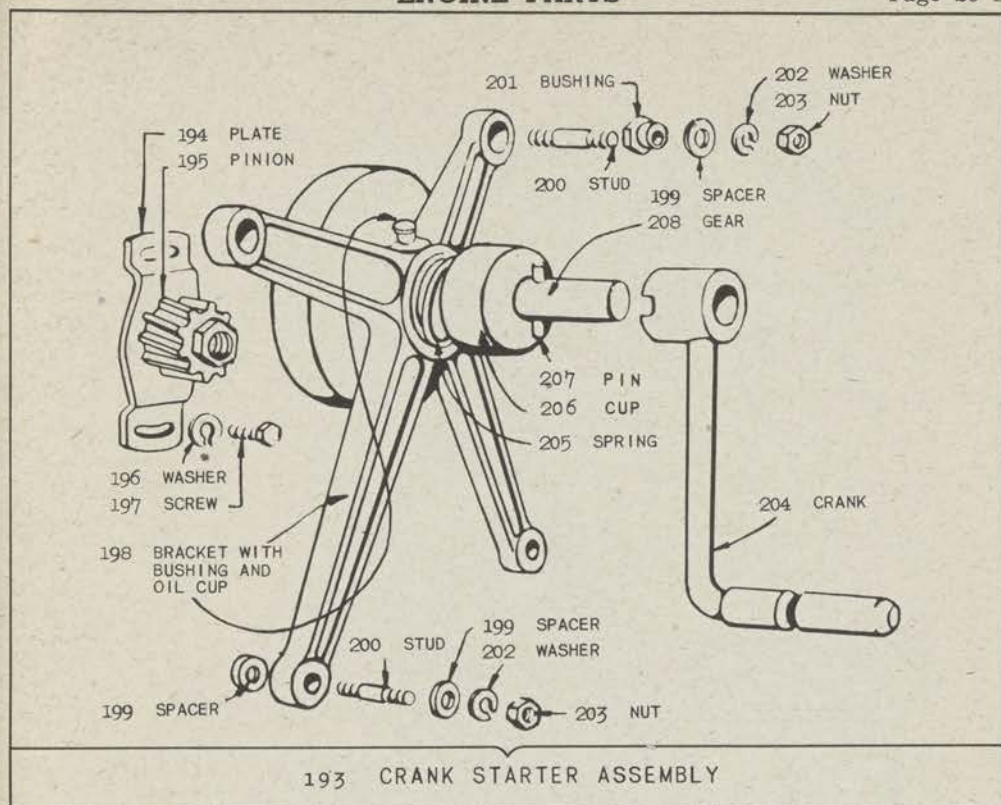


FIGURE B-9

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

# ENGINE PARTS

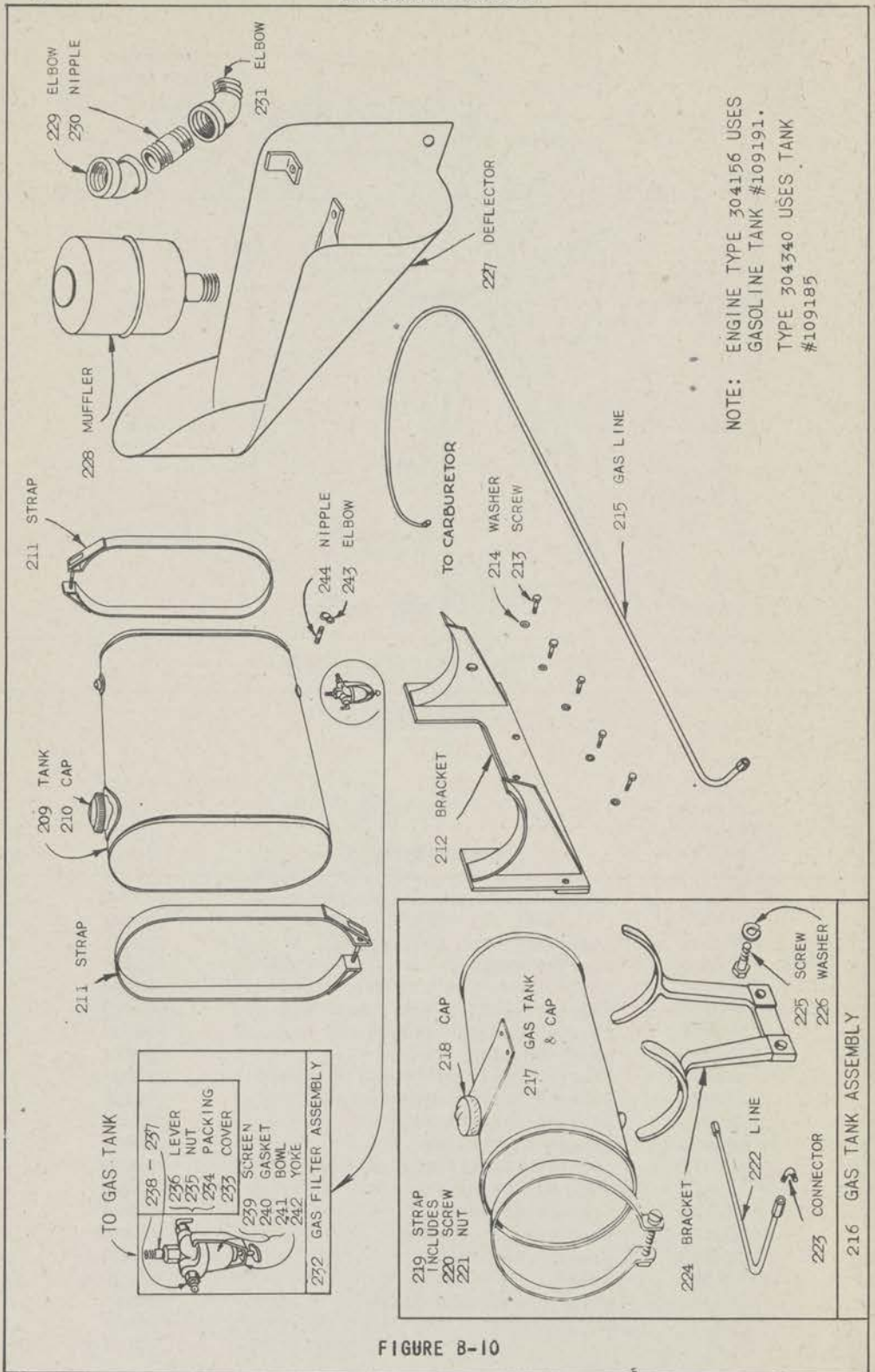


FIGURE 8-10

## ENGINE PARTS

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FIGURE 3-10

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                                         | ENG.<br>MFR.<br>NO. | NO.<br>REQ. |
|-------------|------------------------|---------------------------------------------------------------------|---------------------|-------------|
| 209         | 109185                 | Gas Tank - 5 gallon (Includes<br>Item 210) Wisconsin Motor #WE-106  |                     | 1           |
| 210         | 109186                 | Gas Tank Cap - Wisconsin Motor #RC-77                               |                     | 1           |
| 211         | 109187                 | Gas Tank Strap with Bolt and Nut -<br>Wisconsin Motor #PG-174B      |                     | 2           |
| 212         | 109188                 | Gas Tank Bracket                                                    |                     | 1           |
| 213         | 109252                 | Cap Screw, 3/8-16 x 1"                                              |                     | 5           |
| 214         | 109253                 | Lockwasher, 3/8"                                                    |                     | 5           |
| 215         | 109189                 | Gasoline Line, 6' long                                              |                     | 1           |
| 216         | 109190                 | Old Style Gas Tank Assembly<br>(Includes Items 217 - 226 Inclusive) |                     | 1           |
| 217         | 109191                 | Gas Tank and Cap - 1 gallon<br>(Includes Item 218)                  | 64589               | 1           |
| 218         | 109192                 | Gas Tank Cap                                                        | 69961               | 1           |
| 219         | 109193                 | Gas Tank Strap (Includes Items 220 - 221)                           | 69298               | 2           |
| 220         | 109254                 | Screw, 1/4-20 x 1-1/2", fill. hd.                                   | 91257               | 2           |
| 221         | 109255                 | Nut, 1/4-20, sq. hd.                                                | 90970               | 2           |
| 222         | 109194                 | Gasoline Line, 12-1/2" long                                         | 89080               | 1           |
| 223         | 109195                 | Gasoline Line Connector                                             | 63377               | 1           |
| 224         | 109196                 | Gas Tank Bracket                                                    | 61380               | 1           |
| 225         | 109256                 | Screw, 1/2-20 x 1-1/2", hex. hd.                                    | 91229               | 2           |
| 226         | 109257                 | Lockwasher, 1/2"                                                    | 90683               | 2           |
| 227         | 109197                 | Air Deflector                                                       |                     | 1           |
| 228         | 109198                 | Muffler                                                             | 69134               | 1           |
| 229         | 109199                 | Exhaust Pipe Elbow, 45°                                             | 91415               | 1           |
| 230         | 109200                 | Exhaust Nipple                                                      | 91416               | 1           |
| 231         | 109201                 | Exhaust Street Elbow, 45°                                           | 92130               | 1           |
| 232         | 109202                 | Gas Filter Assembly<br>(Includes Items 233 - 242 Inclusive)         | 99910               | 1           |
| 233         | 109203                 | Gas Filter Cover Assembly<br>(Items 234 - 238 Inclusive)            | 99909               | 1           |
| 234         | 109204                 | Shut Off Lever Packing                                              | 27019               | 1           |
| 235         | 109205                 | Shut Off Lever Nut                                                  | 23346               | 1           |
| 236         | 109206                 | Shut Off Lever                                                      | 23347               | 1           |
| 237         | 109207                 | Gas Filter Connector                                                | 91635               | 1           |
| 238         | 109208                 | Gas Filter Connector                                                | 53029               | 1           |
| 239         | 109209                 | Gas Filter Screen                                                   | 62876               | 1           |
| 240         | 109210                 | Gas Filter Gasket                                                   | 68477               | 1           |
| 241         | 109211                 | Gas Filter Bowl                                                     | 68487               | 1           |
| 242         | 109212                 | Gas Filter Yoke Assembly                                            | 99665               | 1           |
| 243         | 109213                 | Gas Filter Elbow, 1/8", 90°                                         |                     | 1           |
| 244         | 109214                 | Gas Filter Nipple, 1/8"                                             |                     | 1           |

## ENGINE PARTS PRICE LIST

## NUMERICAL

## PARTS PRICE LIST

## CLEAVER TANK CAR HEATER

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

| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                                                         | ENG.<br>MGR.<br>NO. | PAGE<br>NO. | PRICE<br>EACH |
|-------------|------------------------|-------------------------------------------------------------------------------------|---------------------|-------------|---------------|
| 49          | 109001                 | Valve Tappet                                                                        | 26308               | 21-E        | \$ 1.50       |
| 50          | 109002                 | Valve Tappet Washer                                                                 | 62252               | 21-E        | .10           |
| 52          | 109003                 | Valve Tappet Screw                                                                  | 90890               | 21-E        | .10           |
| 53          | 109004                 | Valve Spring Collar                                                                 | 68283               | 21-E        | .20           |
| 54          | 109005                 | Valve Spring Retainer                                                               | 68293               | 21-E        | .20           |
| 55          | 109006                 | Valve Spring                                                                        | 65906               | 21-E        | .30           |
| 56          | 109007                 | Valve Spring Cup                                                                    | 62222               | 21-E        | .06           |
| 57          | 109008                 | Intake Valve                                                                        | 68563               | 21-E        | 1.50          |
| 58          | 109009                 | Exhaust Valve                                                                       | 23330               | 21-E        | 4.00          |
| 59          | 109010                 | Spark Plug and Filler Cup Wrench                                                    | 68652               | 21-E        | .40           |
| 60          | 109011                 | Spark Plug with Gasket<br>(Includes Item 61)                                        | 89572               | 21-E        | 1.30          |
| 61          | 109012                 | Spark Plug Gasket                                                                   | 27090               | 21-E        | .10           |
| 62          | 109013                 | Cylinder Head Spacer                                                                | 63336               | 21-E        | .60           |
| 63          | 109014                 | Cylinder Head Screw                                                                 | 91387               | 21-E        | .20           |
| 64          | 109015                 | Cylinder Head and Valve Cover Screw                                                 | 91386               | 21-E        | .20           |
| 65          | 109016                 | Cylinder Head Spacer                                                                | 63337               | 21-E        | .50           |
| 66          | 109017                 | Cylinder Head and Connecting Rod Screw                                              | 91162               | 21-E        | .10           |
| 67          | 109018                 | Cylinder Head Spacer                                                                | 91324               | 21-E        | .06           |
| 68          | 109019                 | Cylinder Head                                                                       | 61405               | 21-E        | 12.00         |
| 69          | 109020                 | Cylinder Head Gasket                                                                | 69737               | 21-E        | .50           |
| 22          | 109021                 | Cylinder Shield                                                                     | 62924               | 20-E        | .90           |
| 25          | 109022                 | Breather Tube                                                                       | 69314               | 20-E        | 1.60          |
| 26          | 109023                 | Crankcase Cover Gasket                                                              | 66717               | 20-E        | .50           |
| 27          | 109024                 | Crankcase Cover (Cast Iron)<br>(Includes Item 28)                                   | 99936               | 20-E        | 12.00         |
| 28          | 109025                 | Bearing Oil Seal                                                                    | 69740               | 20-E        | 3.00          |
| 31          | 109026                 | Ball Bearing                                                                        | 69739               | 20-E        | 11.00         |
| 32          | 109027                 | Base Gasket                                                                         | 65247               | 20-E        | .70           |
| 33          | 109028                 | Crankcase Assembly (Cast Iron)<br>(Includes Items 34-37 Inclusive,<br>also Item 29) | 99373               | 20-E        | 24.50         |
| 34          | 109029                 | Governor Crank Bushing                                                              | 63341               | 20-E        | .50           |
| 35          | 109030                 | Cylinder Mounting Stud                                                              | 23136               | 20-E        | .10           |
| 36          | 109031                 | Governor Gear Shaft                                                                 | 63343               | 20-E        | .70           |
| 38          | 109032                 | Governor Gear Washer                                                                | 92305               | 20-E        | .10           |
| 40          | 109033                 | Governor Gear                                                                       | 69839               | 20-E        | 9.00          |
| 41          | 109034                 | Governor Crank                                                                      | 69926               | 20-E        | 2.50          |
| 43          | 109035                 | Governor Plunger                                                                    | 63335               | 20-E        | .70           |
| 44          | 109036                 | Cam Shaft Plug                                                                      | 65932               | 20-E        | .10           |
| 45          | 109037                 | Cam Shaft                                                                           | 66203               | 20-E        | 1.00          |
| 46          | 109038                 | Cam Gear                                                                            | 61454               | 20-E        | 9.00          |
| 47          | 109039                 | Cylinder Gasket                                                                     | 66477               | 20-E        | .20           |
| 48          | 109040                 | Cylinder                                                                            | 99358               | 20-E        | 33.00         |
| 1           | 109041                 | Oil Pump Assembly (Items 2-4 Inclusive)                                             | 99360               | 19-E        | 3.00          |
| 2           | 109042                 | Oil Pump Screen                                                                     | 99361               | 19-E        | 1.50          |
| 7           | 109043                 | Oil Drain Plug                                                                      | 91084               | 19-E        | .20           |
| 8           | 109044                 | Base (Cast Iron)                                                                    | 61287               | 19-E        | 14.00         |
| 9           | 109045                 | Oil Filler Nipple                                                                   | 92469               | 19-E        | .40           |
| 10          | 109046                 | Oil Filler Cap                                                                      | 69689               | 19-E        | .80           |

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| REF.<br>NO. | C-B CO.<br>PART<br>NO. | DESCRIPTION                                                 | ENG.<br>MGR.<br>NO. | PAGE<br>NO. | PRICE<br>EACH |
|-------------|------------------------|-------------------------------------------------------------|---------------------|-------------|---------------|
| 11          | 109047                 | Oil Tube Connector                                          | 63202               | 19-E        | \$ 1.00       |
| 12          | 109048                 | Oil Tube Connector Nut                                      | 63217               | 19-E        | .20           |
| 13          | 109049                 | Oil Pump Spring                                             | 26413               | 19-E        | .20           |
| 14          | 109050                 | Oil Pump Plunger                                            | 23132               | 19-E        | .30           |
| 15          | 109051                 | Oil Pump Tube                                               | 99362               | 19-E        | 1.30          |
| 16          | 109052                 | Oil Tube Retainer                                           | 62081               | 19-E        | .50           |
| 19          | 109053                 | Oil Pump Rod                                                | 66739               | 19-E        | .80           |
| 173         | 109054                 | Blower Housing                                              | 99378               | 28-E        | 15.00         |
| 174         | 109055                 | Blower Housing Screen                                       | 62397               | 28-E        | 1.00          |
| 175         | 109056                 | Rivets                                                      | 36436               | 28-E        | .02           |
| 176         | 109057                 | Blower Housing Mounting Screw                               | 92272               | 28-E        | .10           |
| 179         | 109058                 | Magneto and Blower Flywheel                                 | 69808               | 28-E        | 30.00         |
| 182         | 109059                 | Ignition Cable Clamp                                        | 23581               | 28-E        | .10           |
| 183         | 109060                 | Compression Release Rod                                     | 63609               | 28-E        | .60           |
| 184         | 109061                 | Flywheel Puller                                             | 29020               | 28-E        | .90           |
| 185         | 109062                 | Blower Housing Mounting Strap                               | 62177               | 28-E        | .50           |
| 186         | 109063                 | Compression Release Assembly<br>(Items 187 - 191 Inclusive) | 69950               | 28-E        | 4.00          |
| 187         | 109064                 | Valve Cover                                                 | 69951               | 28-E        | 4.50          |
| 189         | 109065                 | Shaft Lever and Swivel                                      | 69952               | 28-E        | 4.00          |
| 190         | 109066                 | Compression Release Spring                                  | 67666               | 28-E        | .50           |
| 192         | 109067                 | Valve Cover Plate Gasket                                    | 65237               | 28-E        | .20           |
| 193         | 109068                 | Crankstarter Assembly<br>(Items 194 - 208 Inclusive)        | 29089               | 29-E        | 23.00         |
| 194         | 109069                 | Starter Pinion Lock Plate                                   | 62363               | 29-E        | .90           |
| 195         | 109070                 | Starter Pinion                                              | 63457               | 29-E        | 5.00          |
| 198         | 109071                 | Starter Crank Bracket                                       | 69953               | 29-E        | 8.00          |
|             | 109072                 | Shaft Bushing                                               | 63605               | 29-E        | .60           |
|             | 109073                 | Starter Shaft Oil Cup                                       | 29222               | 29-E        | .70           |
| 199         | 109074                 | Starter Bracket Spacer                                      | 63460               | 29-E        | .20           |
| 200         | 109075                 | Starter Bracket Stud                                        | 63456               | 29-E        | .30           |
| 201         | 109076                 | Eccentric Bushing                                           | 63458               | 29-E        | .20           |
| 204         | 109077                 | Starter Crank                                               | 99024               | 29-E        | 3.00          |
| 205         | 109078                 | Crankstarter Spring                                         | 68156               | 29-E        | .20           |
| 206         | 109079                 | Starter Spring Cup                                          | 62254               | 29-E        | .40           |
| 207         | 109080                 | Starter Shaft Pin                                           | 63199               | 29-E        | .30           |
| 208         | 109081                 | Starter Gear and Shaft                                      | 69949               | 29-E        | 7.00          |
| 71          |                        | <u>Top Compression Ring</u>                                 |                     |             |               |
|             | 109082                 | Standard                                                    | 61964               | 22-E        | .80           |
|             | 109083                 | .010"-O.S.                                                  | 21002               | 22-E        | .80           |
|             | 109084                 | .020"-O.S.                                                  | 21005               | 22-E        | .80           |
|             | 109085                 | .030"-O.S.                                                  | 21008               | 22-E        | .80           |
| 72          |                        | <u>Center Compression Ring</u>                              |                     |             |               |
|             | 109086                 | Standard                                                    | 61963               | 22-E        | .80           |
|             | 109087                 | .010"-O.S.                                                  | 21003               | 22-E        | .80           |
|             | 109088                 | .020"-O.S.                                                  | 21006               | 22-E        | .80           |
|             | 109089                 | .030"-O.S.                                                  | 21009               | 22-E        | .80           |
| 73          |                        | <u>Oil Ring</u>                                             |                     |             |               |
|             | 109090                 | Standard                                                    | 61292               | 22-E        | 1.20          |
|             | 109091                 | .010"-O.S.                                                  | 61335               | 22-E        | 1.20          |
|             | 109092                 | .020"-O.S.                                                  | 61336               | 22-E        | 1.20          |
|             | 109093                 | .030"-O.S.                                                  | 61337               | 22-E        | 1.20          |

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| 74          |                        | <u>Piston</u>                                                         |                     |             |               |
|             | 109094                 | Standard                                                              | 69921               | 22-E        | \$ 7.00       |
|             | 109095                 | .010"-O.S.                                                            | 69922               | 22-E        | 8.50          |
|             | 109096                 | .020"-O.S.                                                            | 69923               | 22-E        | 8.50          |
|             | 109097                 | .030"-O.S.                                                            | 69924               | 22-E        | 8.50          |
| 75          | 109098                 | Piston Pin Locks                                                      | 65776               | 22-E        | .06           |
| 70          |                        | <u>Piston Assembly</u>                                                |                     |             |               |
|             | 109099                 | Standard                                                              | 99947               | 22-E        | 9.80          |
|             | 109100                 | .010"-O.S.                                                            | 99948               | 22-E        | 11.30         |
|             | 109101                 | .020"-O.S.                                                            | 99949               | 22-E        | 11.30         |
|             | 109102                 | .030"-O.S.                                                            | 99950               | 22-E        | 11.30         |
| 76          |                        | <u>Piston Pin</u>                                                     |                     |             |               |
|             | 109103                 | Standard                                                              | 69925               | 22-E        | 1.00          |
|             | 109104                 | .005"-O.S.                                                            | 29103               | 22-E        | 1.20          |
| 77          | 109105                 | Connecting Rod Assembly                                               | 69642               | 22-E        | 12.00         |
|             | 109106                 | Connecting Rod Shim                                                   | 22246               | 22-E        | .10           |
|             | 109107                 | Connecting Rod Washer                                                 | 67502               | 22-E        | .10           |
|             | 109108                 | Connecting Rod Screw                                                  | 91162               | 22-E        | .10           |
| 78          | 109109                 | Crankshaft                                                            | 26278               | 22-E        | 24.00         |
| 79          | 109110                 | Flywheel Key                                                          | 66403               | 22-E        | .10           |
| 106         | 109111                 | Upper Carburetor Body Assembly<br>(Items 107 - 118 Inclusive)         | 99376               | 25-E        | 9.00          |
| 108         | 109112                 | Throttle Adjusting Spring                                             | 26119               | 25-E        | .20           |
| 109         | 109113                 | Throttle Lever Pin                                                    | 23125               | 25-E        | .10           |
| 110         | 109114                 | Throttle Lever                                                        | 21152               | 25-E        | .40           |
| 111         | 109115                 | Throttle Shaft Assembly                                               | 99524               | 25-E        | 1.30          |
| 114         | 109116                 | Idling Valve Spring                                                   | 26157               | 25-E        | .10           |
| 115         | 109117                 | Idler Needle Valve                                                    | 23228               | 25-E        | .50           |
| 116         | 109118                 | Throttle Butterfly Valve                                              | 62940               | 25-E        | .20           |
| 117         | 109119                 | Upper Carburetor Body                                                 | 99375               | 25-E        | 5.60          |
| 118         | 109120                 | Throttle Shaft Bushing                                                | 23108               | 25-E        | .20           |
| 119         | 109121                 | Carburetor Gasket                                                     | 68947               | 25-E        | .20           |
| 120         | 109122                 | Inlet Valve & Seat (Includes Item 121)                                | 99780               | 25-E        | 1.60          |
| 121         | 109123                 | Fibre Washer                                                          | 68667               | 25-E        | .10           |
| 122         | 109124                 | Carburetor Body (Off-Center Choke)                                    | 89535               | 25-E        | 8.50          |
| 123         | 109125                 | Carburetor Float                                                      | 99333               | 25-E        | 1.00          |
| 126         | 109126                 | Float Hinge Pin                                                       | 23114               | 25-E        | .20           |
| 127         | 109127                 | Carburetor Nozzle                                                     | 99345               | 25-E        | 1.20          |
| 128         | 109128                 | Needle Valve Retainer                                                 | 23117               | 25-E        | .50           |
| 129         | 109129                 | Needle Valve Packing                                                  | 68677               | 25-E        | .10           |
| 130         | 109130                 | Needle Valve Packing Nut                                              | 23118               | 25-E        | .40           |
| 131         | 109131                 | Needle Valve                                                          | 99346               | 25-E        | 1.20          |
| 132         | 109132                 | Choke Lever Spring                                                    | 26155               | 25-E        | .10           |
| 133         | 109133                 | Choke Lever Screw                                                     | 23123               | 25-E        | .10           |
| 134         | 109134                 | Choke Lever Washer                                                    | 62899               | 25-E        | .10           |
| 135         | 109135                 | Choke Shaft and Lever (Off-Center)                                    | 89531               | 25-E        | 1.20          |
| 136         | 109136                 | Choke Valve (Off-Center)                                              | 62872               | 25-E        | .70           |
| 105         | 109137                 | Carburetor Assembly (Off-Center Choke)<br>(Items 106 - 136 Inclusive) | 89536               | 25-E        | 20.00         |
| 80          | 109138                 | Idling Device                                                         | 99458               | 23-E        | 3.50          |
| 81          | 109139                 | Air Cleaner Assembly<br>(Items 82 - 87 Inclusive)                     | 69947               | 23-E        | 14.00         |

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| 82          | 109140                 | Air Cleaner Body (Items 83 - 84 Incl.)                       | 69948               | 23-E        | \$ 10.00      |
| 83          | 109141                 | Air Cleaner Bowl                                             | 62465               | 23-E        | 1.50          |
| 84          | 109142                 | Air Cleaner Bowl Clamp                                       | 62466               | 23-E        | .30           |
| 85          | 109143                 | Screw, No. 7 x 1/2" Parker Kalon                             | 91458               | 23-E        | .10           |
| 86          | 109144                 | Air Cleaner Elbow                                            | 61371               | 23-E        | 4.00          |
| 88          | 109145                 | Stop Switch Washer                                           | 67632               | 23-E        | .10           |
| 92          | 109146                 | Stop Switch                                                  | 62196               | 23-E        | .20           |
| 93          | 109147                 | Intake Elbow Locknut                                         | 63445               | 23-E        | .50           |
| 94          | 109148                 | Carburetor Baffle Plate                                      | 99393               | 23-E        | 1.00          |
| 95          | 109149                 | Carburetor Intake Elbow                                      | 61976               | 23-E        | 3.50          |
| 96          | 109150                 | Carburetor Gasket                                            | 65647               | 23-E        | .20           |
| 97          | 109151                 | Air Cleaner Washer                                           | 65084               | 23-E        | .10           |
| 98          | 109152                 | Air Cleaner Screw                                            | 91442               | 23-E        | .20           |
| 99          | 109153                 | Governor Spring Rod Nut                                      | 63520               | 23-E        | .10           |
| 100         | 109154                 | Governor Spring Rod                                          | 63334               | 23-E        | 1.00          |
| 101         | 109155                 | Governor Spring                                              | 67316               | 23-E        | .40           |
| 103         | 109156                 | Throttle Link                                                | 26160               | 23-E        | 1.00          |
| 104         | 109157                 | Governor Lever                                               | 29429               | 23-E        | 2.50          |
| 137         | 109158                 | Magneto Assembly (Items 138 - 170 Incl.)                     | 69835               | 27-E        | 18.00         |
| 138         | 109159                 | Contact Block Assembly<br>(Items 139 - 144 Inclusive)        | 69780               | 27-E        | 1.30          |
| 139         | 109160                 | Contact Spring and Point                                     | 69754               | 27-E        | .60           |
| 140         | 109161                 | Contact Block                                                | 65078               | 27-E        | .80           |
| 142         | 109162                 | Contact Spring Stop                                          | 62100               | 27-E        | .30           |
| 144         | 109163                 | Contact Block Screw                                          | 93369               | 27-E        | .10           |
| 145         | 109164                 | Ignition Cable                                               | 69854               | 27-E        | .70           |
| 148         | 109165                 | Contact Connector Plate                                      | 62178               | 27-E        | .10           |
| 149         | 109166                 | Armature                                                     | 29656               | 27-E        | 8.00          |
| 150         | 109167                 | Dust Cover Clip                                              | 68876               | 27-E        | .20           |
| 151         | 109168                 | Magneto Point Dust Cover                                     | 65198               | 27-E        | .50           |
| 152         | 109169                 | Magneto Point Plunger                                        | 65414               | 27-E        | .60           |
| 153         | 109170                 | Contact Point Screw                                          | 63238               | 27-E        | .80           |
| 154         | 109171                 | Contact Point Locknut                                        | 63239               | 27-E        | .10           |
| 158         | 109172                 | Magneto Plate Bearing<br>(Includes Item 159)                 | 69911               | 27-E        | 1.40          |
| 159         | 109173                 | Oil Retainer Ring                                            | 62235               | 27-E        | .10           |
| 160         | 109174                 | Condenser Lead Insulator                                     | 65735               | 27-E        | .10           |
| 161         | 109175                 | Condenser                                                    | 29652               | 27-E        | 1.00          |
| 163         | 109176                 | Armature Lead Insulator                                      | 65725               | 27-E        | .10           |
| 164         | 109177                 | Magneto Plate with Bearing                                   | 69876               | 27-E        | 6.00          |
| 165         | 109178                 | Oil Return Valve                                             | 89307               | 27-E        | .30           |
| 166         |                        | <u>Magneto Plate Gaskets*</u>                                |                     |             |               |
|             | 109179                 | .015" Thick                                                  | 66457               | 27-E        | .10           |
|             | 109180                 | .005" Thick                                                  | 66527               | 27-E        | .10           |
|             | 109181                 | .009" Thick                                                  | 66537               | 27-E        | .10           |
| 168         | 109182                 | Blower Housing Air Guide                                     | 62936               | 27-E        | 1.60          |
| 169         | 109183                 | Lockwasher                                                   | 90774               | 27-E        | .06           |
| 170         | 109184                 | Magneto Plate Screw                                          | 91385               | 27-E        | .10           |
| 209         | 109185                 | Gas Tank - 5 gallon<br>(Incl. Item 210 Wis. Motor #WE-106) * |                     | 31-E        | 13.00         |
| 210         | 109186                 | Gas Tank Cap - Wis. Moto #RC-77                              |                     | 31-E        | 1.04          |

\* Use one of the three thicknesses.

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| 211         | 109187                 | Gas Tank Strap with Bolt and Nut,<br>Wisconsin Motor #PG-174B       |                     | 31-E        | \$ 2.40       |
| 212         | 109188                 | Gas Tank Bracket                                                    |                     | 31-E        | 14.40         |
| 215         | 109189                 | Gasoline Line, 6' long                                              |                     | 31-E        | 1.00          |
| 216         | 109190                 | Old Style Gas Tank Assembly<br>(Includes Items 217 - 226 Inclusive) |                     | 31-E        | 15.30         |
| 217         | 109191                 | One Gallon Gas Tank and Cap<br>(Includes Item 218)                  | 64589               | 31-E        | 8.00          |
| 218         | 109192                 | Gas Tank Cap                                                        | 69961               | 31-E        | .70           |
| 219         | 109193                 | Gas Tank Strap (Incl. Items 220 - 221)                              | 69298               | 31-E        | .70           |
| 222         | 109194                 | Gasoline Line - 12-1/2" Long                                        | 89080               | 31-E        | .90           |
| 223         | 109195                 | Gasoline Line Connector                                             | 63377               | 31-E        | .70           |
| 224         | 109196                 | Gas Tank Bracket                                                    | 61380               | 31-E        | 4.50          |
| 227         | 109197                 | Air Deflector                                                       |                     | 31-E        | 7.20          |
| 228         | 109198                 | Muffler                                                             | 69134               | 31-E        | 5.00          |
| 229         | 109199                 | Exhaust Pipe Elbow, 45°                                             | 91415               | 31-E        | .90           |
| 230         | 109200                 | Exhaust Nipple                                                      | 91416               | 31-E        | .40           |
| 231         | 109201                 | Exhaust Street Elbow, 45°                                           | 92130               | 31-E        | .90           |
| 232         | 109202                 | Gas Filter Assembly<br>(Items 233 - 242 Inclusive)                  | 99910               | 31-E        | 3.50          |
| 233         | 109203                 | Gas Filter Can Assembly<br>(Items 234 - 238 Inclusive)              | 99909               | 31-E        | 2.50          |
| 234         | 109204                 | Shut Off Lever Packing                                              | 27019               | 31-E        | .10           |
| 235         | 109205                 | Shut Off Lever Nut                                                  | 23346               | 31-E        | .30           |
| 236         | 109206                 | Shut Off Lever                                                      | 23347               | 31-E        | .50           |
| 237         | 109207                 | Gas Filter Connector                                                | 91635               | 31-E        | .30           |
| 238         | 109208                 | Gas Filter Connector                                                | 53029               | 31-E        | .40           |
| 239         | 109209                 | Gas Filter Screen                                                   | 62876               | 31-E        | .30           |
| 240         | 109210                 | Gas Filter Gasket                                                   | 68477               | 31-E        | .10           |
| 241         | 109211                 | Gas Filter Bowl                                                     | 68487               | 31-E        | .30           |
| 242         | 109212                 | Gas Filter Yoke Assembly                                            | 99665               | 31-E        | 1.00          |
| 243         | 109213                 | Gas Filter Elbow, 1/8" 90°                                          |                     | 31-E        | .30           |
| 244         | 109214                 | Gas Filter Nipple, 1/8"                                             |                     | 31-E        | .30           |
| 87          | 109215                 | Screw, 1/4-20 x 1", fill. hd.                                       | 91256               | 23-E        | .10           |
| 89          | 109216                 | Lockwasher, 1/4 x 3/32 x 5/64"                                      | 90832               | 23-E        | .04           |
| 90          | 109217                 | Screw, 1/4-20 x 1/2", hex. hd.                                      | 90891               | 23-E        | .10           |
| 91          | 109218                 | Screw, 1/4-20 x 3/4", hex. hd.                                      | 90700               | 23-E        | .10           |
| 102         | 109219                 | Cotter Pin, 1/16 x 3/8"                                             | 92286               | 23-E        | .04           |
| 107         | 109220                 | Screw, 8-32 x 3/4", fill. hd.                                       | 91846               | 25-E        | .10           |
| 112         | 109221                 | Screw, 4-16 x 1/4", rd. hd.                                         | 90029               | 25-E        | .10           |
| 113         | 109222                 | Lockwasher, 1/8 x 3/64 x 1/32                                       | 90369               | 25-E        | .04           |
| 124         | 109223                 | Screw, 10-32 x 5/8", fill. hd.                                      | 90746               | 25-E        | .10           |
| 125         | 109224                 | Lockwasher No. 10                                                   | 91427               | 25-E        | .06           |
| 196         | 109225                 | Lockwasher, 1/4 x 5/64 x 1/16"                                      | 90699               | 29-E        | .04           |
| 197         | 109226                 | Screw, 1/4-20 x 3/8", hex. hd.                                      | 91439               | 29-E        | .10           |

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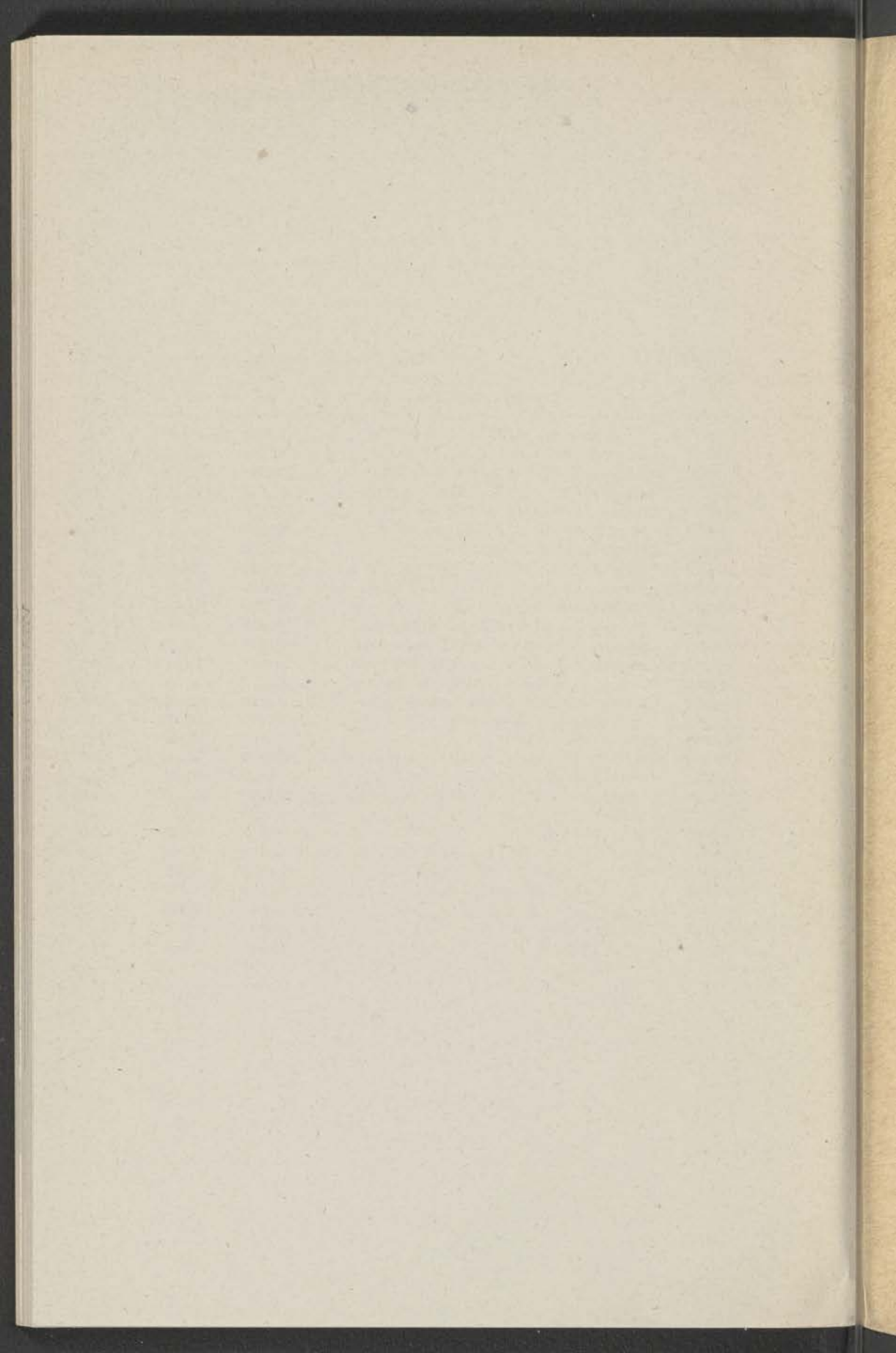
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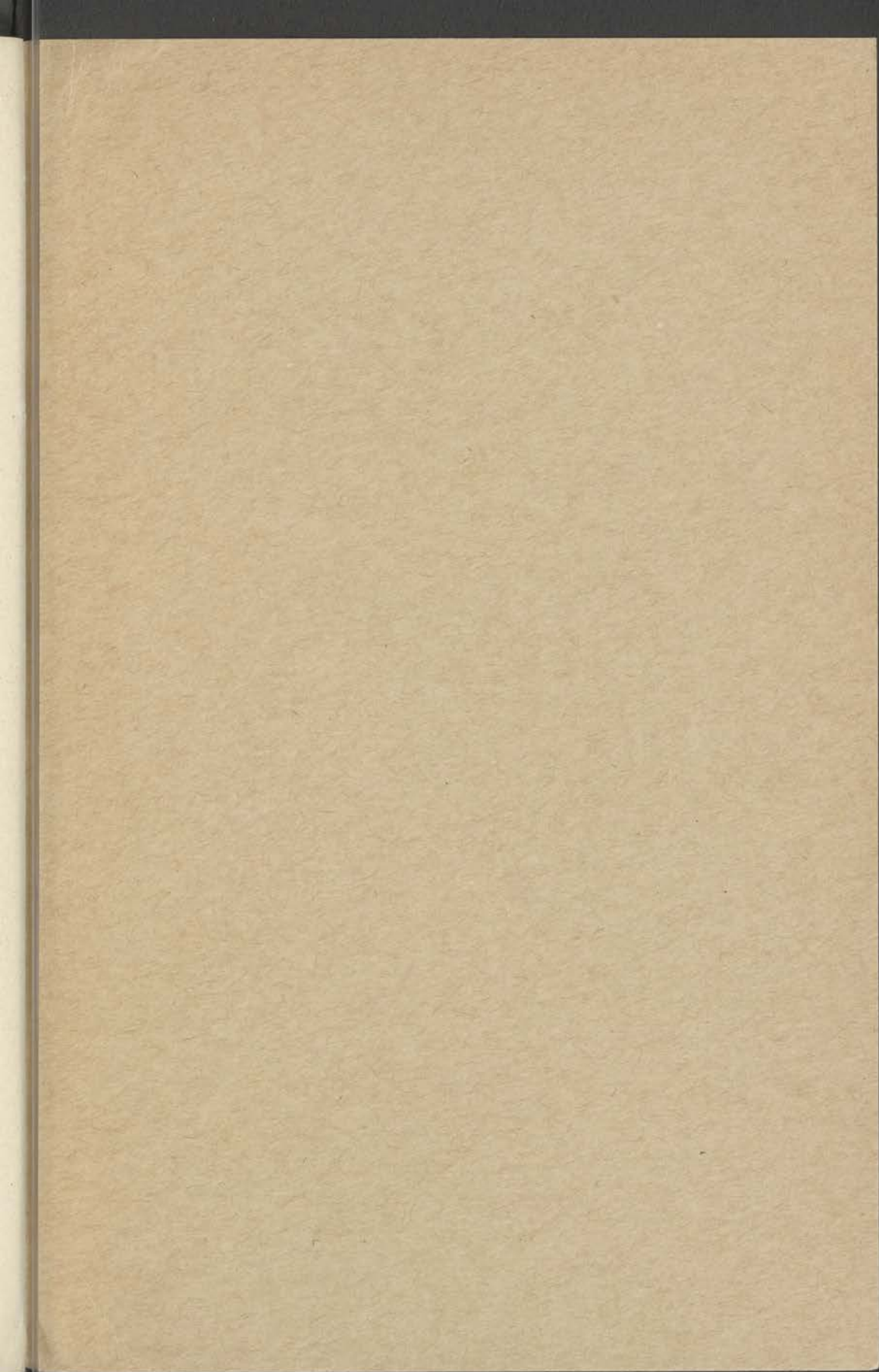
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| 202         | 109227                 | Lockwasher, 11/32 x 1/8 x 3/32"   | 92268               | 29-E        | \$ .04        |
| 203         | 109228                 | Nut, 3/8-24, hex.                 | 92292               | 29-E        | .06           |
| 171         | 109229                 | Screw, 1/4-20 x 5/8", rd. hd.     | 91698               | 28-E        | .10           |
| 177         | 109231                 | Lockwasher, 5/16 x 1/8 x 1/16"    | 90366               | 28-E        | .04           |
| 178         | 109232                 | Screw, 1/4-20 x 3/8", rd. hd.     | 91195               | 28-E        | .06           |
| 180         | 109233                 | Screw, 10-32 x 1/2", rd. hd.      | 90597               | 28-E        | .06           |
| 181         | 109234                 | Lockwasher No. 10                 | 92290               | 28-E        | .04           |
| 188         | 109235                 | Cotter Pin, 1/16 x 1/2"           | 92288               | 28-E        | .04           |
| 191         | 109236                 | Screw, 10-32 x 5/16", rd. hd.     | 90010               | 28-E        | .10           |
| 3           | 109237                 | Lockwasher No. 12                 | 91059               | 19-E        | .04           |
| 4           | 109238                 | Screw, 12-24 x 5/16", fill. hd.   | 91921               | 19-E        | .10           |
| 6           | 109240                 | Screw, 5/16-24 x 3/4", hex. hd.   | 90950               | 19-E        | .10           |
| 20          | 109243                 | Screw, 3/8-16 x 1-1/4", hex. hd.  | 90887               | 19-E        | .10           |
| 24          | 109246                 | Screw, 1/4-20 x 1/2", rd. hd.     | 90916               | 20-E        | .10           |
| 30          | 109248                 | Screw, 3/8-24 x 3/4", hex. hd.    | 91028               | 20-E        | .10           |
| 213         | 109252                 | Cap Screw, 3/8-16 x 1"            |                     | 31-E        | .12           |
| 214         | 109253                 | Lockwasher, 3/8"                  |                     | 31-E        | .06           |
| 219         | 109254                 | Screw, 1/4-20 x 1-1/2", fill. hd. | 91257               | 31-E        | .10           |
| 221         | 109255                 | Nut, 1/4-20, sq. hd.              | 90970               | 31-E        | .10           |
| 225         | 109256                 | Screw, 1/2-20 x 1-1/2", hex. hd.  | 91229               | 31-E        | .20           |
| 226         | 109257                 | Lockwasher, 1/2"                  | 90683               | 31-E        | .06           |
| 141         | 109258                 | Nut, 8-32, hex.                   | 90313               | 27-E        | .10           |
| 143         | 109259                 | Lockwasher, 11/64 x 5/64 x 1/32"  | 90367               | 27-E        | .06           |
| 147         | 109261                 | Screw, 10-32 x 7/8", rd. hd.      | 91406               | 27-E        | .10           |
| 155         | 109262                 | Shakeproof Lockwasher No. 6       | 91122               | 27-E        | .06           |
| 157         | 109264                 | Screw, 1/4-20 x 1", rd. hd.       | 91270               | 27-E        | .10           |
| 162         | 109265                 | Screw, 10-32 x 1/4", fill. hd.    | 92308               | 27-E        | .10           |
| 51          | 109267                 | Nut, 1/4-28, hex.                 | 90847               | 21-E        | .10           |





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