r in your plant, whether used
ss steam or heating, was undoubtedly
ed with the ASME Code and other
is established to insure safety.

the burner and burner controls may
governed by City or local Codes
r insurance company. The boiler as
was therefore received with the
of reliable operation.

– safe, reliable, and efficient operation
e maintained by following a basic
ce program. This principle applies to
mpressors, furnaces or automobiles
ece of mechanical equipment.

ble manufacturer furnishes an
lerstand operator's manual that includes
you need to know for the
e of his product.

l should be your most valuable
rstanding the correct function of the
ghout its life. If your manual
st, it will pay you to contact the
er for a replacement.

INDEX

RSIDE CARE

RSIDE CARE

'osion, foaming, priming wet steam, and iormally the result of improper water-

vith proper blowdown procedures, is im- heating surfaces free of scale and pro- r treatment consultants are the experts y will analyze your water and recommend on the analysis and the amount of raw

also recommend the blowdown procedure reduce the concentrations in the boiler.

: aimed at prevention of scale formation iinating the corrosion caused by oxygen :ing carryover of water that might be .

ly closed systems and should not require ever, some systems may have been in- system water is lost with regularity and edwater treatment should then be used corrosion due to oxygen in the make

en Corrosion and Pitting

iis disease, proper feedwater treatment

ll handhole and manhole covers for a shell, and tube sheets — at least once ecommended.)

(especially near the rear of the boiler) / evidence of blisters, "pock marks" or

tions, your feedwater treating program evision.

WATERSIDE CARE

Item 2 — PREVENT Scale Formation

Look-out for this one! Scale acts as an insulator and can result in overheating of the furnace, tubes, and tube sheets. This condition can cause tube leakage, tube end cracking, and other pressure vessel problems.

Again — your water treatment program requires checking.

During your visual check of the waterside, use your fingernails or small hammer to obtain samples of scale formation which may be present. Carefully check the rear portion of the boiler as this is the area most susceptable to scale formation.

Remove any samples and refer them to your feedwater treatment consultant — NOW!

Scale formation within any boiler is cause for immediate concern and action.

Item 3 — ELIMINATE Mud Accumulation

Sometimes water conditions or treatment chemicals will result in a collection of mud and sediment in the bottom of the boiler.

Your visual check will reveal the presence of this mud.

Use a high pressure hose to wash out the "belly" of the boiler. (Re-check — with your hand — to see if you have done an effective job!)

' Steam or Carryover

caused by:

s in the boiler due to lack of blowdown.
eatment.
oiler nozzle causing excessive steam
r out of the boiler.
:h hit the boiler due to quick opening
antaneous boiler overloading.
g due to increased plant load.
steam header.

y:
ding "lack of steam."

irebox

lers have flat areas with flame or heat
other side. These flat areas have stay
ce the flat areas. Be sure these flat
sure the horizontal flat areas are free
lakes of scale. Mud and scale build-up
transfer and cause overheating. Wash
ure hose.
rosion or thinning. Check with your
ut safety.

manhole gaskets on hand. The spiral
if they are in good condition. Merely
e sealing surface. Non-metallic gaskets
ded.
ight seal at handhole covers. A slight
al to erode giving a poor seat for the
serious it must be patched and, since
iring it may require a certified welder.

Item 7 — "Lay-Up" of Idle Boiler

This is important!

For a short lay-up period (less than (3) months) it is good practice to flood the boiler. This decreases the possibility of oxygen corrosion or pitting.

With boiler in flooded condition, fire to steaming temperature with boiler vented from highest point of shell. This will drive off the greatest percentage of entrained oxygen.

Add the correct feedwater treatment as indicated by your feedwater treatment consultant. Make sure that there is no possibility of the boiler water freezing. (Add glycol if boiler is subject to freezing temperatures.) Close all valves and open all service switches. Swing open boiler head at stack end of unit to prevent flow of warm, moist air through boiler tubes.

For extended lay-up periods, check your boiler operators manual and consult your boiler inspector for proper procedures.

If boiler water freezing is possible or if your boiler is located in a "dry" climate, the "dry" lay-up method may be preferable. Drain the boiler and open all handholes and the manhole. Place trays of silca gel on the top of the tubes to absorb moisture. Swing open boiler head at stack end of unit to prevent flow of warm, moist air through boiler tubes.

To prevent condensation from forming in the control cabinet, keep the control circuit energized.

Whichever method is used, common sense dictates a periodic recheck of fireside and waterside conditions during lay-up to allow variations from the above methods for special area or job-site conditions.

DE CARE

Sheets

hts) the fireside of furnace and tubes
r "pock" marks. This could indicate
sation of flue gases and formation of

by:

er water temperature (control setting)
sation of water vapor in the flue gas.
the unit has the longest possible "on"
s promote condensation.
the unit is much too large for the

nce of soot deposits. Soot decreases
ncy.

be cleanings varies with the fuel and
; instructions will recommend cleaning
designed, properly adjusted unit might
e a year.

ll a thermometer in the boiler vent
erature rises above normal, it means
leaning.

ort periods of time could be a sign of
air and adjustment of the air-fuel ratio

FIRESIDE CARE

Carefully check tube sheet for any evidence of leakage at tube ends. Whitish streaks or deposits would indicate this condition and tube re-rolling may be required. If this condition exists, your boiler manufacturer's authorized service technician should be contacted.

Gaskets

Visually check door gaskets to make sure they are in good condition and that they are properly secured. An effective seal of fireside is required to prevent loss of efficiency, burning of gaskets and deformation of door steel.

Replace door gaskets if they don't give you a tight seal.

Refractory

At the same time that you check the waterside, check the fireside. (Minimum once per year — twice per year recommended.)

Swing the boiler heads open so that **all** refractory is "open" to your visual check. Wash coat all refractory surfaces and caulk any areas showing cracking or erosion.

Loose or broken baffle tile should be replaced. For complete refractory replacement, consult your boiler operators manual.

All new boilers should be opened and visually inspected to check for shipping and rigging damage.

ıER CARE

ıe need for tube cleaning, nozzle clean-
age adjustment, etc. is to KEEP A DAILY
and other gauge data. Variations from
ıelp you avoid serious problems.

in oil pressure can indicate a plugged
ve, or air leak in the suction line. A
:an indicate malfunction of temperature
ment.

ı gas pressure can mean a drop in city
unction of the regulator.

en log entries are made. A rise in stack
mean poor combustion or fouled fireside
ıres will vary as much as 100° F. in five

:h no trace of haze. Cloudy, hazy, or
or burner adjustment. The fire may be
ıroper mixing of air and fuel, etc.

lly checked for tightness and visually
/" movement.

es should be visually checked by observ-
ıts down. If the fire does not cut off —
f solenoid valve fouling or wear. Repair
ous problems.

r nozzle or cup cleaning. This is like
ıued good operation. Frequency of clean-
rner characteristic and **your experience.**

tive maintenance program is your direct
er operation.

CONTROL CARE

Your Operators Manual is an excellent guide to control functions, control care, and control adjustment.

Don't make assumptions about the operation of any switch or control. A periodic visual check of all switches and their condition can avoid serious problems.

Water Level Controls

The water column and low water cutoff should be blown daily on high and low pressure steam boilers.

Low water cutoff on steam boilers should be checked once a week under actual operating conditions. A practical way to check your control is to shut off the feedwater pump and let the water evaporate under normal steaming conditions. Carefully watch the gauge glass and mark the exact point at which the low water cutoff shuts down the boiler. This gives you a reference point for other "checks" to see if the control operation is the same or erratic. If erratic, control replacement may be indicated.

On hot water boilers, periodically check the low water cutoff by manual trip of control.

When you inspect the waterside of the unit for scale, mud, etc., remove all plugs in piping crosses or tees on water column and low water cutoffs. Clean out or "rod" out all foreign matter. Evidence of heavy sludge or mud indicates need for review of feedwater treatment program or blowdown schedule.

AGAIN REMEMBER: A planned preventive maintenance program is your direct route to safe, dependable boiler operation.

MANCE CHECKS

em to prevent boiler problems. Check the rrective action:

f valve blowing due to automatic make-up ater during periods of decreased tempera- g. night-time or weekend "dropback" in

ef valve blowing due to faulty automatic

anks.

m "over-pressure" (Recommend 15-20 psi, ressure equivalent to boiler operating

through boiler under all system operating

ice or connection on top of boiler shell.

f boiler low water cut-off piping not used, ound.

gh points pulling air into system during

and feedwater treatment if required by dic boiler drainage.

rotection when common heating — cooling om cooling to heating.

-up of the load from a "cold boiler start" of your boiler.

Steam System

Check your system to prevent the following problems and take the necessary corrective action or notify the proper person in authority about the problem.

a) Feeding cold, raw make-up water into a "hot" boiler.

b) Lack of feedwater treatment, oxygen removal, regular water analysis, and blowdown program.

c) **Remember** — A **slow pick-up** of the load from a "cold boiler start" may add years to the life of your boiler.

Boiler Stack Temperature

If your boiler's stack temperature is more than 150° above the steam or water temperature, it's too high.

Tube cleaning and burner adjustment are your solutions. If this does not reduce stack temperature, you have an inefficient design.

High stack temperature means wasted heat.

Boiler Flue Gas Analysis

Periodically check the analysis of the flue gas, and make sure that you check O_2 and CO as well as CO_2. O_2 should be a maximum of 1-2% and there should not be any CO.

Rating	Gas	#2 Oil	#6 Oil
A	10% CO_2	12.8% CO_2	13.8% CO_2
B	9% CO_2	11.5% CO_2	13.0% CO_2
C	8.5% CO_2	10% CO_2	12.5% CO_2
D	8% or less	9% or less	12% or less

A = Excellent
B = Good
C = Fair
D = Poor

Measurement of CO_2, O_2 and CO is a good indication of combustion efficiency and burner performance.

EFFICIENCY

Cost

ɔd if your boiler operates with high effi-
ˈ your plant is determined by two factors.

ɲess of heating surfaces.

y of the burner to be adjusted to (and
ıs.

the cleanliness of the heating surfaces
the fire side are the factors that allow
transferred to the boiler water. Good
ult in maximum heat transfer and less
ashioned designs or soot and scale on
ansfer, increase the temperature of the
uced operating efficiency.

xcess air over and above the theoretical
etely burn a certain quantity of fuel. If
supplied, the fire will smoke and cause
ʌith soot and carbon.

uantities of excess air are used, the
stion and this heated air is exhausted
wasted. Proper air to fuel ratios are
operation and should be checked with
ıge 13 "Boiler Flue Gas Analysis."

HOLD DOWN FUEL COSTS

High Efficiency Means Real Dollar Savings

The relationship between fuel-to-steam efficiency and fuel costs can best be explained with examples.

Let's take a 200 horsepower boiler which burns No. 6 oil (costing 8¢ a gallon) (150,000 Btu per gallon).

This 200 horsepower boiler produces 7,000 lbs. of steam per hour, or 70,000 lbs. in a 10 hour day.

In a 260 day-year (average number working days).

260 x 70,000 = 18,200,000 lbs. of steam per year.

This is the load of the plant. The boiler used, or fuel used, can't change this. This is dependent on and determined by your building or process load.

Assume your equipment is old, in years or design, your stack temperature is high and CO_2 is low. The efficiency of your boiler is 65%.

You must burn approximately 180,000 gallons of oil at a cost of $14,378 to receive 18,200,000 lbs. of steam.

However, if your boiler would operate at 80% efficiency, indicated by reduced stack temperature and high CO_2 in the flue gas, your costs would be much less.

At 80% efficiency you would burn about 146,000 gallons of oil and your cost would drop to $11,648 to produce 18,200,000 lbs. of steam.

Thus, the difference between 80% efficiency and 65% efficiency represents cost savings of more than $2,700 yer year.

BOILER EFFICIENCY

Boiler A 65% Efficient $ Fuel Cost	Boiler B 80% Efficient $ Fuel Cost	$ Saving Per Year Boiler B over A
$ 7,189	$ 5,824	$1,365
14,378	11,648	2,730
21,567	17,472	4,095
28,756	23,296	5,460
35,945	29,120	6,825
43,134	34,944	8,190

intain high efficiency results in actual

0% Minimum Efficiency—Could be 85%

DID YOU KNOW?

1. Packaged Boiler Ratings

Packaged boilers are rated on the basis of maximum continuous output from the nozzle in terms of pounds of steam/hr., from and at 212° F., Btu/hr., or boiler horsepower. This is the guaranteed output of the boiler.

2. Equivalent Units for Defining Boiler Output

Item	Equivalent Units
1 Pound steam, from & @ 212° F.	970 Btu/lb.
1 Square foot EDR steam	240 Btu/hr.
1 Square foot EDR water	150 Btu/hr.
1 Boiler horsepower, (Bhp)	34.5 Pounds of steam/ hour from & @ 212° F.
	33,472 Btu/hr.
	139.5 Square feet EDR steam
	223 Square feet EDR water

3. Equivalent Units for Fuels

Item	Equivalent Units
No. 2 Oil	140,000 Btu/gal.
No. 5 Oil	148,000 Btu/gal.
No. 6 Oil	150,000 Btu/gal.
1 Therm	100,000 Btu
1 Kw	3,413 Btu

4. Fuel Consumption/Hr. per Bhp @ 80% Fuel to Steam Efficiency

Fuel	Consumption
No. 2 Oil	0.3 gal./hr. per Bhp
No. 5 Oil or No. 6 Oil	0.28 gal./hr. per Bhp
Gas — 500 BTU/cu. ft.	84 Cu. Ft./Hr. per Bhp
Gas — 800 BTU/cu. ft.	53 Cu. Ft./Hr. per Bhp
Gas — 1000 BTU/cu. ft.	42 Cu. Ft./Hr. per Bhp

D MAINTENANCE

naintain will be maintained. If a compo-
inspect, it will tend to be overlooked or
nt that a boiler be designed to simplify
trouble" out of maintenance.
nis has been done in the packaged boiler
oks Model CB design.

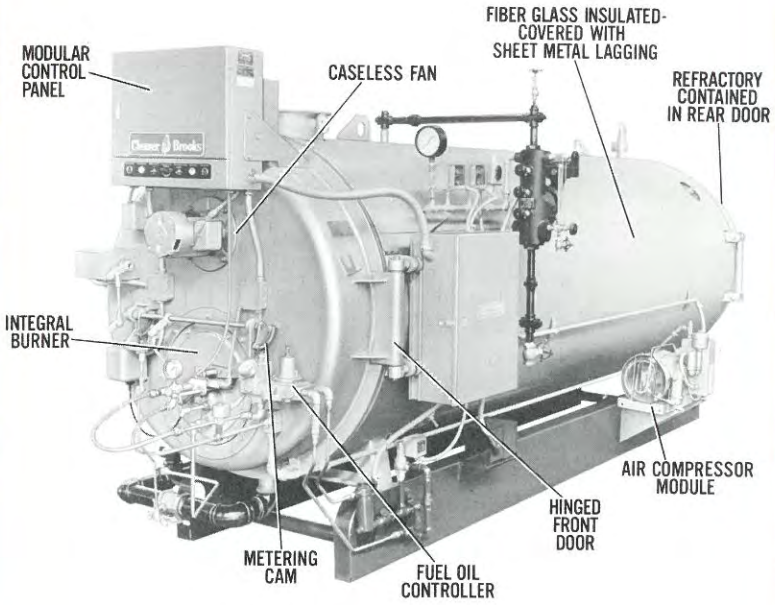
and controls are unified in one control

ccurately regulate oil viscosity and pres-

arranged for quick inspection and clean-
d replaced in less than a minute without
r opening front head.
nts "in line" with hinged front door; oil
roken to gain access to fireside.
heads, easily opened to provide ready
d tube sheets in less than 10 minutes.
ear, assure access to tube sheets quickly
lts. Hinges are adjustable.
nines degree of atomization. No further
produce high CO_2.
ical controls with plug-in modules that
sion.
Direct drive, no V-belts, vibration free.
nat provides exact amount of air needed

ir forces oil out of nozzle and burner
with hot oil. No carbonized burner tip.
so air matches oil or gas for proper
ce assures excellent flow characteris-

y air damper for accurate secondary



Cleaver Brooks

Milwaukee, Wisconsin
Lebanon, Pennsylvania
Greenville, Mississippi
Stratford, Ontario, Canada

WATER GAUGE GLASS

NOTICE:

READ ALL WARNINGS AND INSTRUCTIONS BEFORE PERFORMING INSTALLATION OR MAINTENANCE.

WARNING!

SAFETY GLASSES AND GLOVES SHOULD BE WORN AT ALL TIMES WHEN WORKING WITH OR EXAMINING WATER GAUGE GLASS AND CONNECTIONS.

IMPROPER INSTALLATION OR MAINTENANCE OF GAUGE GLASS AND CONNECTIONS CAN CAUSE IMMEDIATE OR DELAYED BREAKAGE RESULTING IN BODILY INJURY AND/OR PROPERTY DAMAGE.

USE AND CARE

DO NOT's

DO NOT use the glass if it contains any scratches, chips, or any other visible signs of damage.

DO NOT reuse any tubular glass or glass packings.

DO NOT subject gauge glass to bending or torsional stresses.

DO NOT over tighten glass packing nuts.

DO NOT allow glass to touch any metal parts.

DO NOT exceed the recommended pressure of the gauge or gauge glass.

DO NOT clean the gauge or gauge glass while pressurized or in operation.

CONBRACO

CONBRACO INDUSTRIES, INC.
P.O. BOX 247
MATTHEWS, NORTH CAROLINA 28106
MADE IN U.S.A.

WATER GAUGE GLASS

DO's

DO verify proper gauge has been supplied.

DO examine gauge glass and packings carefully for damage before installation.

DO install protective guards and utilize automatic ball checks where necessary to help prevent injury in case of glass breakage.

DO inspect the gauge glass daily, keep maintenance records, and conduct routine replacements.

DO protect glass from sudden changes in temperatures such as drafts, water spray, etc.

MAINTENANCE

Examine the gauge glass regularly for any signs of clouding, scratching, erosion, or corrosion. The glass should be inspected daily until the need for replacement becomes apparent. This will help establish the routine inspection and routine replacement schedules.

CLEANING

Use commercial non-abrasive glass cleaners to keep the glass clean. Use diluted acids such as Hydrochloric (muriatic) acid when regular cleaners do not seem to work. Do not use wire brushes or any other abrasive materials which could scratch the glass.

INSPECTION

Examine the surface of the glass for scratches, corrosion, chips, cracks, surface flaws, or nicks. To do this, shine a very bright concentrated light at an angle of about 45 degrees. A defective glass will glisten as the light strikes imperfections. Glass which appears cloudy or roughened, and will not respond to cleaning, should be replaced.

STORING

Keep gauge glass in original packaging until ready to install.

I-5334-00 Rev.D

Important Specifications

GATOR GRIP gaskets are an especially compounded elastomer

When Ordering:

Specify either "E" or "OB"

SPECIFY ¼ THICK

ELLIPTICAL – "E"

SIZE	KIND
2" x 3" x 3/8" E	Handhole
2-1/4" x 3-1/4" x 1/2" E	Handhole
2-1/4" x 3-3/4" x 1/2" E	Handhole
2-1/2" x 3-1/4" x 3/8" E	Handhole
2-1/2" x 3-1/2" x 1/2" E	Handhole
2-1/2" x 3-3/4" x 3/8" E	Handhole
2-1/2" x 3-3/4" x 5/8" E	Handhole
2-3/4" x 3-1/2" x 3/8" E	Handhole
2-3/4" x 3-1/2" x 5/8" E	Handhole
2-3/4" x 3-3/4" x 1/2" E	Handhole
2-3/4" x 4-1/4" x 1/2" E	Handhole
2-3/4" x 4-1/2" x 5/8" E	Handhole
3" x 3-3/4" x 1/2" E	Handhole
3" x 4" x 1/2" E	Handhole
3" x 4" x 5/8" E	Handhole
3" x 4" x 3/4" E	Handhole
3" x 4-1/4" x 5/8" E	Handhole
3" x 4-1/2" x 1/2" E	Handhole
3" x 4-1/2" x 5/8" E	Handhole
3" x 4-1/2" x 3/4" E	Handhole
3" x 5" x 9/16" E	Handhole
3-1/4" x 4-1/4" x 1/2" E	Handhole
3-1/4" x 4-1/4" x 3/4" E	Handhole
3-1/4" x 4-1/2" x 3/8" E	Handhole
3-1/4" x 4-1/2" x 1/2" E	Handhole
3-1/4" x 4-3/4" x 9/16" E	Handhole
3-1/4" x 5" x 9/16" E	Handhole
3-1/2" x 4-1/2" x 7/16" E	Handhole
3-1/2" x 4-1/2" x 1/2" E	Handhole
3-1/2" x 4-1/2" x 5/8" E	Handhole
3-1/2" x 5-1/2" x 5/8" E	Handhole
3-3/4" x 4-3/4" x 9/16" E	Handhole
3-3/4" x 5-1/4" x 5/8" E	Handhole
3-3/4" x 5-1/2" x 9/16" E	Handhole
4" x 5" x 5/8" E	Handhole
4" x 5-1/4" x 9/16" E	Handhole
4" x 6" x 9/16" E	Handhole
4" x 6" x 3/4" E	Handhole
4-1/2" x 5-1/2" x 9/16" E	Handhole
4-1/2" x 6-1/2" x 9/16" E	Handhole
4-1/2" x 6-1/2" x 1-1/4" E	Handhole
5" x 6" x 5/8" E	Handhole
5" x 7" x 3/4" E	Handhole
5-3/4" x 7-1/4" x 3/4" E	Handhole
6" x 8" x 3/4" E	Handhole
6" x 9" x 1" E	Handhole
6" x 10" x 3/4" E	Handhole
MANHOLE	
9" x 14" x 1-1/4" E	Manhole
9-1/2" x 15-1/2" x 1" E	Manhole
9-3/4" x 15-1/2" x 1" E	Manhole
10" x 14" x 1-1/2" E	Manhole
10" x 15" x 1-3/8" E	Manhole
10" x 16" x 1-1/4" E	Manhole
10-1/2" x 14-1/2" x 1-3/8" E	Manhole
10-1/2" x 15" x 1-1/4" E	Manhole
11" x 15" x 1-3/16" E	Manhole
11" x 15" x 1-1/4" E	Manhole
11" x 15" x 1-3/8" E	Manhole
11" x 16" x 1-1/4" E	Manhole
12" x 15" x 1-1/4" E	Manhole
12" x 16" x 1-5/16" E	Manhole

SPECIFY  ¼ THICK

OBROUND – "OB" (Straight Sided)

SIZE	KIND
2" x 3" x 1/2" OB	Handhole
2-1/4" x 3-1/4" x 3/8" OB	Handhole
2-1/4" x 3-1/4" x 1/2" OB	Handhole
2-1/4" x 3-3/4" x 9/16" OB	Handhole
2-1/2" x 3-1/2" x 1/2" OB	Handhole
2-1/2" x 3-3/4" x 1/2" OB	Handhole
2-3/4" x 3-1/2" x 1/2" OB	Handhole
2-3/4" x 3-3/4" x 1/2" OB	Handhole
2-3/4" x 4-1/2" x 1/2" OB	Handhole
3" x 4" x 1/2" OB	Handhole
3" x 4-1/4" x 1/2" OB	Handhole
3" x 4-1/2" x 9/16" OB	Handhole
3" x 4-3/4" x 1/2" OB	Handhole
3" x 5" x 9/16" OB	Handhole
3-1/4" x 4-1/4" x 9/16" OB	Handhole
3-1/4" x 4-1/2" x 1/2" OB	Handhole
3-1/4" x 4-3/4" x 1/2" OB	Handhole
3-1/4" x 4-3/4" x 5/8" OB	Handhole
3-1/4" x 5-1/4" x 9/16" OB	Handhole
3-1/2" x 4-1/2" x 1/2" OB	Handhole
3-1/2" x 5" x 9/16" OB	Handhole
3-1/2" x 5-1/2" x 9/16" OB	Handhole
3-5/8" x 4-5/8" x 1/2" OB	Handhole
3-3/4" x 5-1/4" x 1/2" OB	Handhole
4" x 5" x 1/2" OB	Handhole
4" x 6" x 5/8" OB	Handhole
4-1/2" x 5-1/2" x 9/16" OB	Handhole
4-1/2" x 6-1/2" x 5/8" OB	Handhole
6" x 10" x 3/4" OB	Handhole
11" x 15" x 1-3/16" OB	Handhole

SPECIAL GASKETS

5/8" Bolt Gasket 1/8" thk.  Bolt

3/4" Bolt Gasket 1/8" thk.  Bolt

3/4" Bolt Gasket 1/4" thk. Bolt

1-3/4" Washout Plug Gasket (fits 1-1/2" Washout Plugs) 1/8" thk.

2-7/32" Washout Plug Gasket (fits 2" Washout Plugs) 1/8" thk.

6-1/4" x 15-1/2"-5/8" holes (8) 1/4" Thk. coil cover gasket for firebox boilers

6-1/4" x 15-1/2"-5/8" holes (8) 1/8" Thk. coil cover gasket for firebox boilers

Round Gaskets 1/4" thk.  Handhole

1-7/8" x 2-7/8"
2-1/4" x 3-1/4"
2-1/2" x 3-1/2"
2-3/4" x 3-3/4"
3" x 4"
3-1/2" x 4-1/2"
3-7/8" x 4-7/8"
4" x 5"
4-1/2" x 5-1/2"
5" x 6"

4" x 5" x 1/2" D  Diamond

7-5/8" x 7-5/8" x 5/8" Square

Shore A. Hardness
60-70 duro. (Medium)

Tensile strength
1900 lb./sq. inch

Elongation
(300% (means a one inch piece can be stretched to 3 inches before it breaks)

• Volume changes in water: a continuous boil of 2184 hours —standard ASTM test time— volume increased by 2.7% [i.e. thickness was .250 (¼") thick increased to .257 thick]

• Hardness changes under steam: under steam for 900 hours at 250 PSI at 407 to 435° F., the hardness changes from 65 duro to 61 duro. Tensile changed from 1900 PSI to 1025 PSI which is still 4 times the pressure contained. Elongation changed from 300% to 207% (i.e. a 2 inch piece must be stretched to over 4 inches before it would break.

• There is no physical change whatsoever at 350/375° F. wet heat.

All prices f.o.b Bedford, N. H. 03102

No minimum order

Prices subject to change without notice.

No returns without prior authorization.

WHY & HOW BULLETIN

NO. 201

MALSBARY

WINTER THAWING OF CULVERTS, STORM DRAINS, CATCH BASINS AND GUTTERS

WHY? Frozen rain and snow plug drainage systems every year in Northern cities. Partial thaws melt only surface ice and snow. Water backs up behind frozen drains and culverts, makes driving hazardous, causes property damage and complaints.

HOW three cities solved the problem quickly and economically with Malsbary trailer-mounted steam cleaners . . .

Elm Grove, Wisconsin—The Village of Elm Grove is a small residential community near Milwaukee. Each Spring, the Public Works Department thaws clogged culverts throughout the Village with its Malsbary 250HPC trailer-mounted Muni-Cleaner, fitted with a 20-foot thawing lance at the end of one steam hose. The cleaner is set to produce maximum heat and impact—hot solution to 325 degrees and 300 pounds pressure. After breaking a small opening in the ice with a pick, the heated lance is pushed gently through the hole until it melts its way to the far end of the culvert. Because the lance delivers high pressure hot water instead of steam, you can literally bore a hole through ice—and do it quickly. Once a hole is formed, water runs freely through the culvert and easily melts the remaining ice. The process normally takes about 30 to 35 minutes per culvert and requires only one operator. Elm Grove crews thaw from 50 to 200 culverts each Spring, depending on the weather conditions.

MALSBARY MANUFACTURING COMPANY

845 - 92ND AVENUE
OAKLAND, CALIFORNIA
(415) 632-7272
CABLE: MALSBARYCO

April 21, 1969

Mr. R. H. Ford, Superintendent
Public Works Department
City Hall Green Street
Concord, New Hamphsire 03301

Dear Mr. Ford:

Thank you for your recent inquiry. We appreciate your interest in Malsbary products and hope you will find the enclosed literature helpful.

Our District Manager or one of his authorized dealers will get in touch with you soon to discuss your specific needs and to provide more detailed information. He will ask you questions about your needs and desires regarding a solution to your problem. Your answers will speed specific help to you. In the meantime, if you need faster service, his address appears at the bottom of this letter.

Thanks again for your consideration.

Sincerely,

MALSBARY MANUFACTURING COMPANY

W. Burr Henion
Manager, Marketing Services

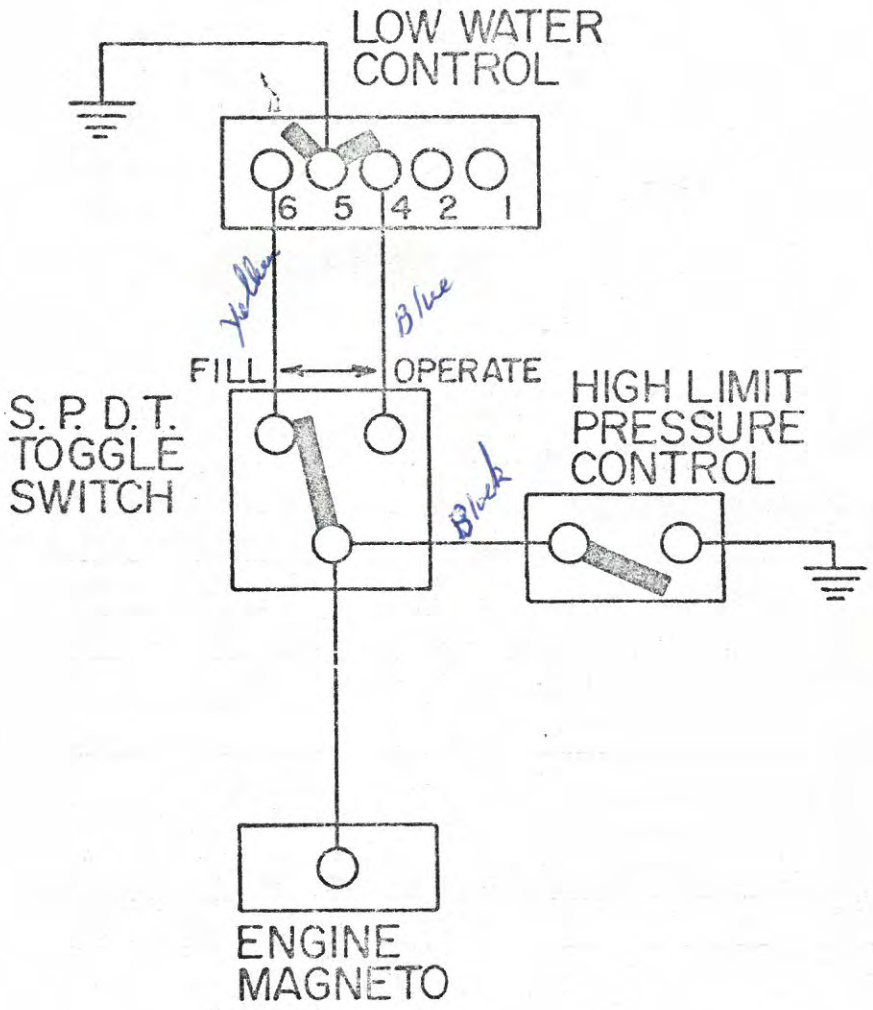
WBH:cp

Enclosure:
W&H #201

Kenneth E. Parkin
63 Chestnut Street
Westboro, Massachusetts 01581

Reference:
Government Product News
March 1969

cc:
K. E. Parkin
V. F. DeVinny



DENOTES ENGINE GROUND

S.O. H 83409 (MILITARY)

EN-12292-E
8-18-67

SCALE	
DATE	8-15-67
DRAWN	MAB
CHECKED	TLK
APPROVED	COR

STRATFORD ONTARIO — Cleaver Brooks® — LEBANON PENN.
MILWAUKEE, WISCONSIN

PS & PSM-50

DRWG. NO. 3630-1044

12/for 27.72

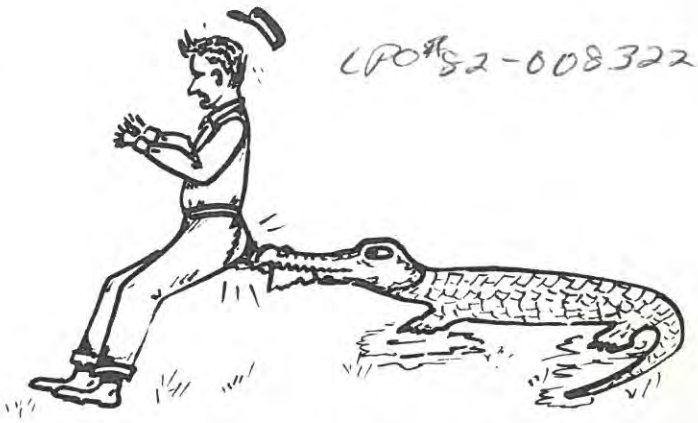
GATOR GRIP GASKETS

LPO# 52-008322

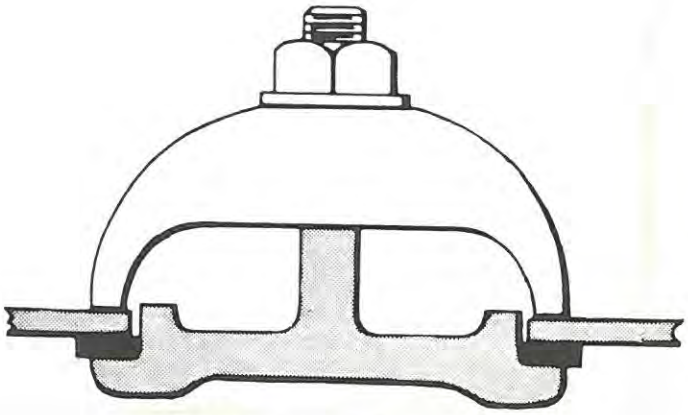
STEAM • LIQUIDS • AIR

For Boiler Manholes & Handholes, Hot Water Units, Air & Softener Tanks, Etc.

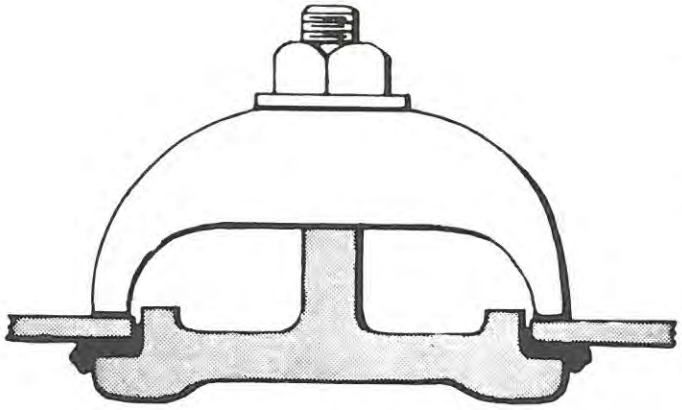
(See important SPECIFICATIONS—reverse side)



GATOR GRIP GASKETS—"THEY NEVER LET GO"



Proper pressure on gasket



Improper pressure on gasket

INSTALLATION INSTRUCTIONS

- Remove old gasket and clean the surfaces on both boiler and plate.
- Place GATOR GRIP GASKET on handhole or manhole plate. Be sure the gasket fits on the plate. Use NO lubricants or adhesives.
- After plate is in boiler and gasket is in place, set crab nut only enough to provide a snug fit. Make it hand tight, then snug with a wrench about ¼ turn. DO NOT PULL DOWN EXCESSIVELY, as GATOR GRIP GASKETS should never be compressed as much as the asbestos type.
- If gasket leaks while pressure is being built up, tighten enough to stop leakage. DO NOT TIGHTEN MORE THAN NECESSARY TO PREVENT LEAKAGE.
- WARRANTY: Our gaskets are free from defects in workmanship nd materials. We will replace any that are returned to us and found by us to be defective. Our liability ceases with the above and it is the purchasers liability for installation cost, mishaps, service charges or any other charges or costs, etc., that might accrue relative to same, negligent or non-negligent, or improper or proper use of same.

STANDARD & SPECIAL SIZES TO FIT EVERY TYPE BOILER, WATER & SOFTENER TANK, ETC.

ORDER before 3 P.M. and it will go TODAY!!!

ORDER FROM:

fredericksealinc.

FREDERICK PARKWAY
BEDFORD, N.H. 03102

603-668-0900

UNCONDITIONALLY GUARANTEED

Will stop leakage to 200 PSI prox and 350°F prox. Even on warped or pitted flanges!!!

WATER GAUGE & GAUGE GLASS INSTALLATION INSTRUCTIONS

CD Boiler Works
Installed 1/06

INSTALLATION

Only properly trained personnel should install and maintain water gauge glass and connections. Remember to wear safety gloves and glasses during installation. Before installing, make sure all parts are free of chips and debris.

1. Apply Teflon tape or pipe dope to pipe threads. Install top gauge fitting (fitting without a drain valve) into the uppermost tapping. Wrench tighten the fitting until it is snug and the glass outlet is pointing at five o'clock (about 1/8 turn from its final downward vertical position).

2. Install the bottom gauge fitting (the fitting with a drain valve) until it is snug and the glass outlet is pointing directly upward. Verify top and bottom fittings are threaded into the tappings the same number of turns (distance A = distance B).

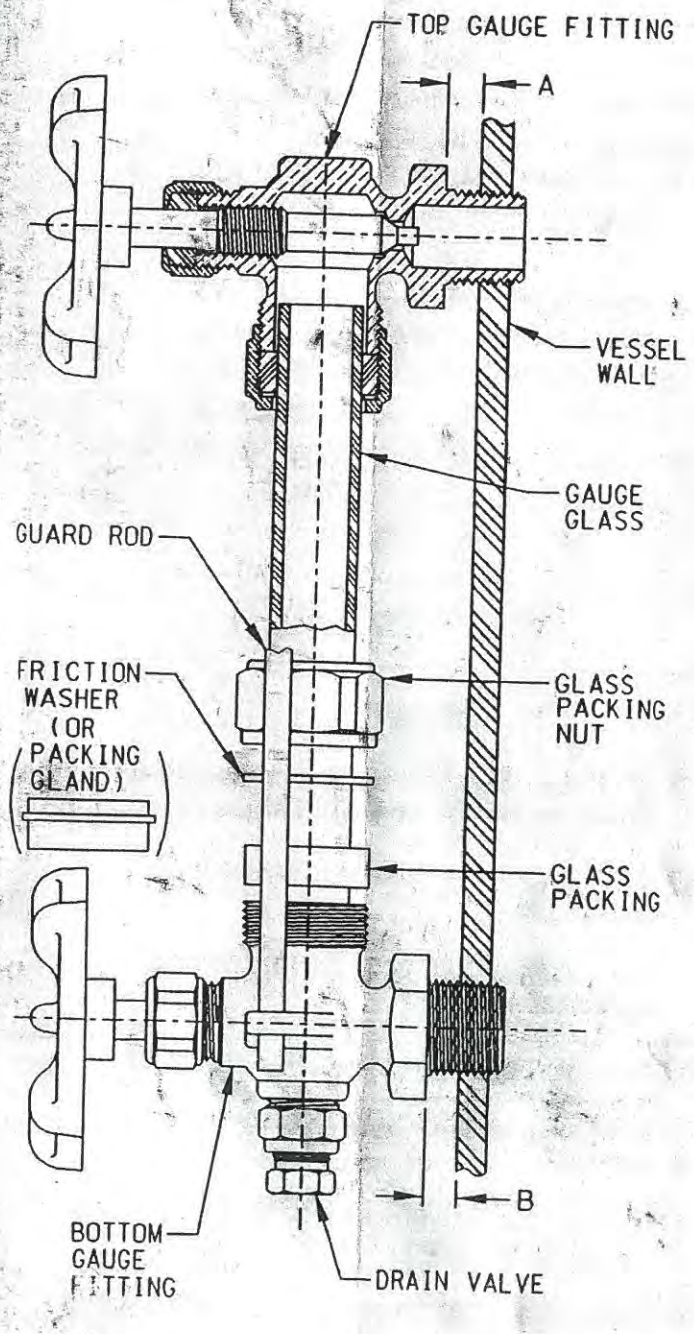
3. Remove glass packing nut, friction washer (or packing gland, depending upon the model), and glass packing from the fittings, and place them, in same order, on to both ends of the gauge glass. Push both packings about an inch up the gauge glass.

4. Gently insert one end of the glass into the top gauge fitting. Keeping the glass inside the top fitting, gently rotate the top gauge fitting clockwise until vertically aligned with the bottom gauge fitting, then insert glass into bottom fitting until glass bottoms out on the shoulder inside the bottom fitting.

5. Carefully raise glass about 1/16" and slide lower glass packing down until the glass packing contacts the lower gauge fitting. DO NOT allow the glass to remain in contact with any metal!

6. Carefully slide upper glass packing up as far as possible.

7. Hand tighten both glass packing nuts, then tighten 1/2 turn more by wrench. Tighten only enough to prevent leakage. DO NOT OVER TIGHTEN! If any leakage should occur, tighten slightly, a quarter turn at a time, checking for leakage after each turn.



WARNING: California law requires that this warning be given to the consumer. This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

SECTION 6
WARRANTY

SAVE THIS SECTION FOR YOUR RECORD

BRIGGS & STRATTON ENGINE WARRANTY

For ONE YEAR from purchase date, Briggs & Stratton Corp. will replace for the original purchaser, FREE OF CHARGE, any part, or parts, found upon examination by any Factory Authorized Service Center, or by the Factory at Milwaukee, Wisconsin, to be DEFECTIVE IN MATERIAL AND/OR WORKMANSHIP.

All transportation charges on parts submitted for replacement under this Warranty must be borne by purchaser.

There is no other Warranty express or implied. Briggs & Stratton Corp. shall in no event be liable for consequential damages.

BRIGGS & STRATTON CORP.

C. L. COUGHLIN – PRESIDENT

NOTE: The Briggs & Stratton Engine Warranty does not cover breakage of parts or damage to parts due to abuse or failure to follow the recommended maintenance procedures. The warranty also excludes any accessories, controls or equipment which are not manufactured by Briggs & Stratton Corporation.

If warranty service is needed contact your nearest Authorized Service Center. For Prompt Attention your center will need to know the engine model, type and code number, the trouble experienced and the total number of hours the engine has run. If you differ with the decision of a Service Center on a warranty claim, ask the Service Center to submit all supporting facts to the Factory for review. If the Factory decides that your claim is justified, you will be fully reimbursed for those items accepted as defective.

FILL IN THE REQUIRED INFORMATION:

Engine Model No. _____ Type No. _____ Code No. _____

Dealer Purchased From _____ Date _____

Type of Equipment _____

Name or Trademark of Equipment Manufacturer _____

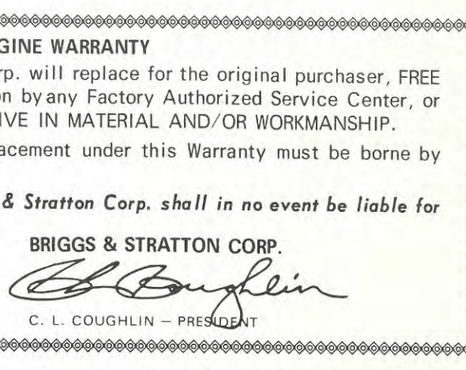
(See Illustration on Page 1 to locate Model, Type and Code Number)

SERVICE & REPAIR INFORMATION

If service or repair is needed, contact an Authorized Briggs & Stratton Service Center. To serve you promptly and efficiently, the Service Center will need the model, type and code number on your engine. (See Section 6).

Each Authorized Service Center carries a stock of original Briggs & Stratton repair parts and is equipped with special service tools. Trained mechanics assure expert repair service on all Briggs & Stratton engines.

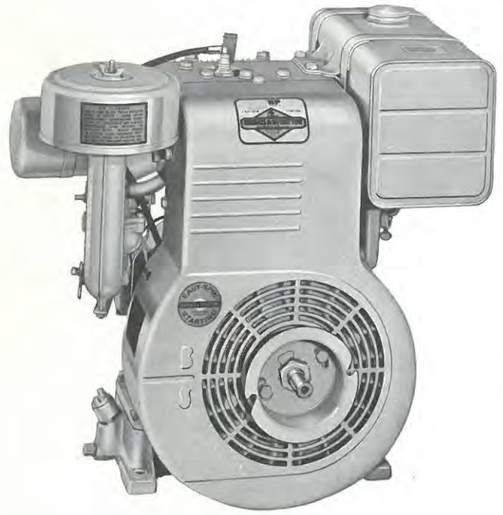
Your nearest service center is listed in the 'Yellow Pages' under "Engines, Gasoline" or "Gasoline Engines". He is one of over 12,000 authorized dealers available to serve you.



FOR REPAIRS AND SERVICE CONTACT THE DEALER DISPLAYING THIS SIGN

BRIGGS & STRATTON ENGINES ARE MADE UNDER ONE OR MORE OF THE FOLLOWING PATENTS:

2,669,322	2,796,453	3,114,851	3,149,618	3,194,224	3,252,449	DESIGN		
2,693,789	2,999,491	3,118,433	3,165,094	3,236,937	3,276,439	D-191,806	D-196,017	D-197,175
2,693,791	2,999,562	3,144,097	3,168,936	3,242,741	3,378,099	OTHER PATENTS PENDING		



Briggs & Stratton
OPERATING AND MAINTENANCE INSTRUCTIONS

MODELS
200400 to 200454
233400 to 233454

CAUTION

TO PREVENT ACCIDENTAL STARTING always remove the spark plug before working on the engine or equipment driven by the engine.

DO NOT RUN THE ENGINE IN AN ENCLOSED AREA. Exhaust gases contain carbon monoxide, an odorless and deadly poison.

DO NOT FILL GASOLINE TANK WHILE ENGINE IS RUNNING. Spilling gasoline on a hot engine may cause a fire or explosion.

IMPORTANT: Read Operating Instructions (Section 1 & 2) Before Starting Your Engine.

SECTION 1
BEFORE STARTING

(1) **FILL CRANKCASE WITH OIL** – Use a high quality detergent oil classified "For Service MS". Nothing should be added to the recommended oil.

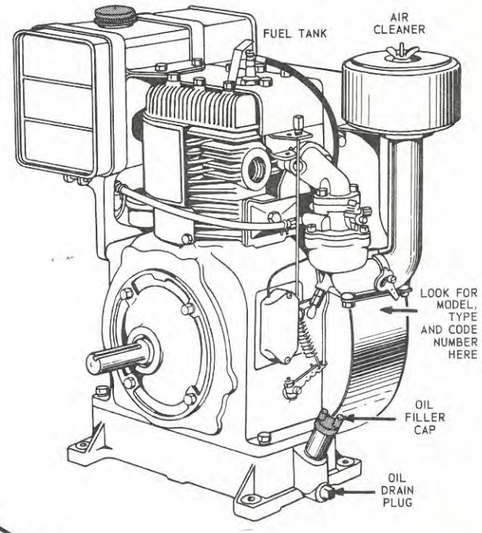
Summer	Winter (Below 40° F)
Use SAE 30	Use SAE 5W-20

DIRECTIONS: Place the engine level. Remove oil filler plug or Oil-Minder. FILL THE OIL SUMP TO OVERFLOWING or to the FULL mark on dipstick. Pour slowly. Capacity 3 Pints.

EXTENDED OIL FILL. (Optional) Remove cap and dipstick and fill to full mark on dipstick. When checking oil level push dipstick assembly firmly but slowly until cap bottoms on tube. Do not overfill. Dipstick assembly must be pushed fully into tube at all times when engine is operating.

(2) **FILL FUEL TANK** – Use clean, fresh "regular" grade gasoline. Fill tank completely.

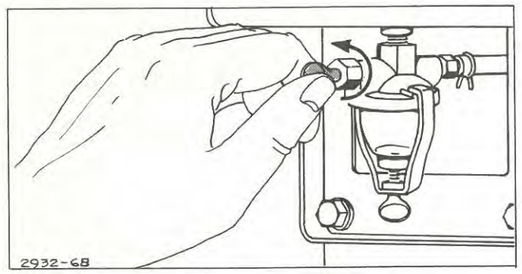
DO NOT MIX OIL WITH GASOLINE.



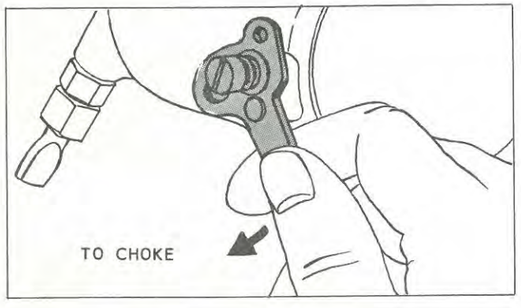
FORM NO. 270373-19
PRINTED IN U.S.A.

BRIGGS & STRATTON CORP.
Milwaukee, Wisconsin 53201

(1) OPEN FUEL VALVE



(2) CLOSE THE CHOKE

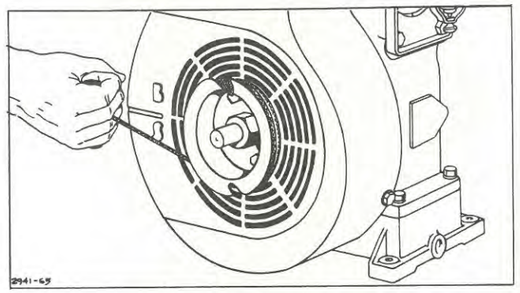


(3) **START ENGINE** – Engine may be equipped with rope or electric starter.

CAUTION: ALWAYS KEEP HANDS AND FEET CLEAR OF MOWER BLADE OR OTHER ROTATING MACHINERY.

a. Rope Starter

Place knot in pulley notch and wind rope around pulley in a clockwise direction. Pull rope with choke closed to prime the engine. Open choke slightly and repeat operation.

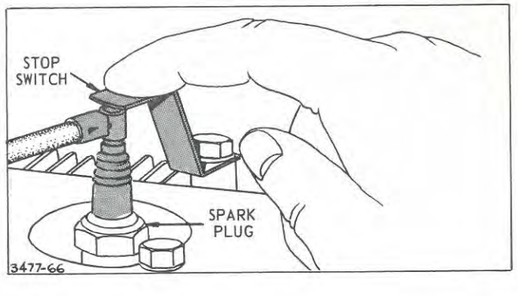


After engine warms up open choke gradually until engine runs smoothly with choke wide open (counter-clockwise position).

b. 12 Volt D.C. Electric Starter

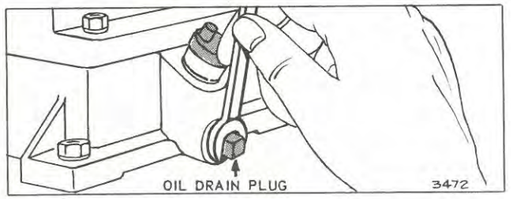
Press starter button on powered equipment. When engine starts, open choke gradually.

(4) **TO STOP ENGINE** – Push the stop switch against end of spark plug.

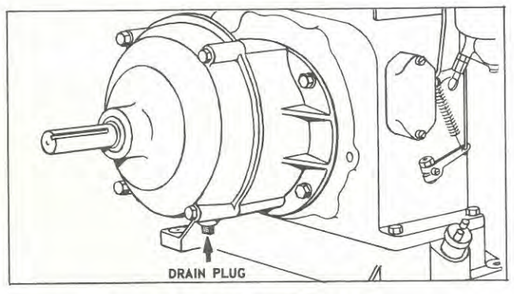


CHECK OIL LEVEL before starting and after every 5 hours of operation. BE SURE OIL LEVEL IS MAINTAINED.

CHANGE OIL (Crankcase) after 5 hours of operation. Remove the oil drain plug. Drain oil while engine is warm. Replace drain plug. Remove oil filler cap or plug and refill with new oil. Replace oil filler cap or plug. Add oil regularly after each 5 hours of operation. Thereafter change oil every 25 hours of operation.

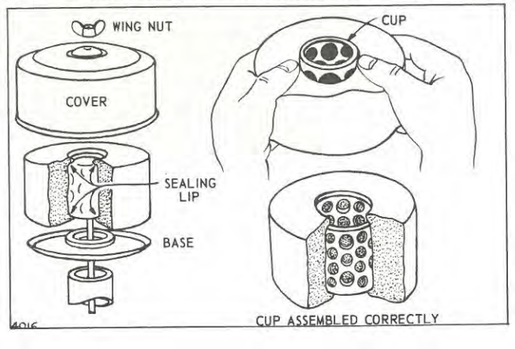


CHANGE OIL (Gear Reduction - Optional) The reduction gears are lubricated by engine crankcase oil. Remove drain plug from gear case cover to drain oil remaining in gear case when crankcase oil is changed.



SERVICING "OIL-FOAM" ® AIR CLEANER

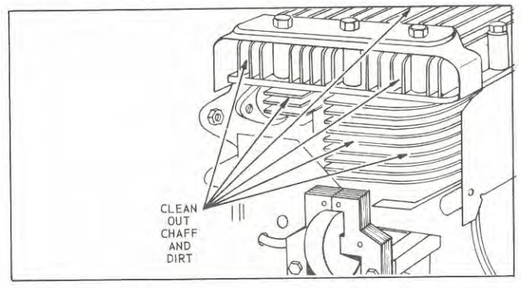
Clean and re-oil the air cleaner frequently (every few hours under extremely dusty conditions). Clean and re-oil at least every 25 hours under normal conditions.



1. Remove wing nut and cover.
2. Lift off foam element from base.
3. Push down foam element as shown and pull out screen.
4. A – Wash foam element in kerosene or liquid detergent and water to remove dirt.
   B – Wrap foam in cloth and squeeze dry.
   C – Saturate foam in engine oil. Squeeze to remove excess oil.
   D – Put screen inside element. Be sure sealing lip is over end of screen (top and bottom).
5. Reassemble parts as shown. Fasten to engine. Screw wing nut down tight.

CLEAN COOLING SYSTEM

Grass or chaff may clog cooling system after prolonged service in cutting tall dry grasses or hay. Continued operation with a clogged cooling system causes severe overheating and possible engine damage. Remove blower housing and clean regularly.



DRAIN FUEL TANK AND CLEAN FUEL FILTER

Loosen thumb screw below filter bowl.

Remove and clean filter bowl and screen.

Open shut-off valve to see if fuel flows freely from the tank. IMPORTANT: If you find a gummy, varnish-like substance use alcohol or acetone to dissolve it.

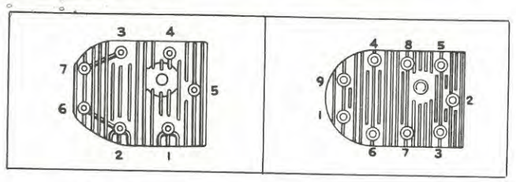
CLEAN SPARK PLUG

Clean spark plug and reset gap at .030" every 100 hours of operation. When worn out replace with AC GC 46, Autolite A71 or Champion J-8.

CAUTION: Blast cleaning of spark plugs in machines that use abrasive grit is not recommended. Spark plugs should be cleaned by scraping or wire brushing and washing with a commercial solvent or gasoline.

CLEAN COMBUSTION CHAMBER every 100-300 hours of operation. If the engine operates at constant speed and at relatively constant load, the use of regular automotive fuels results in a gradual build-up of tetra-ethyl lead deposits in the combustion chamber.

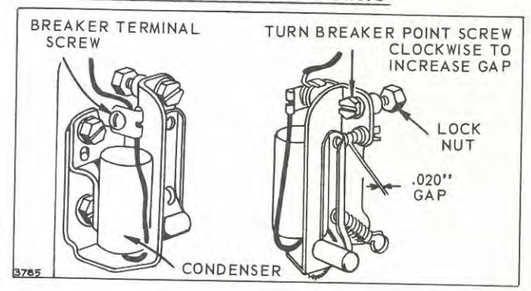
This causes the engine to lose power and prevents the valves from seating properly. Removing the deposits is easy and will pay big dividends in reliability and increased valve life.



SERIES 200400 SERIES 233400

1. Remove cylinder head screws. Be sure to note if screws are of different length and have steel washers as they must be replaced in original position.
2. Turn crankshaft until piston is at top of cylinder bore and both valves are closed. Scrape and wire brush the lead and carbon deposits from cylinder head and combustion chamber.
3. Re-use cylinder head gasket only if in good condition. Replace cylinder head. Turn each screw in with wrench until screw head is lightly seated.
4. Use socket wrench with 6 inch handle and turn all screws 1/4 turn. Tighten screws in sequence illustrated. Run engine approximately 5 minutes and retighten all screws approximately 1/4 turn.

CLEAN AND ADJUST CONTACT POINTS



Remove cover.

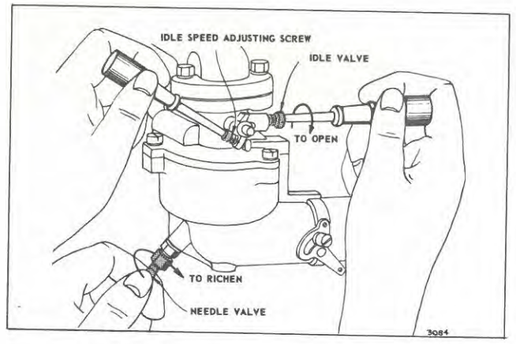
Clean points with a carborundum contact point stone. Then insert a hard finished card or piece of paper and close and open points. The paper will absorb any dirt or filings on the points. Adjust breaker points as follows:

a. Rotate crankshaft until points open to widest gap.
b. Loosen lock nut illustrated above until it is just snug.
c. Rotate breaker point screw to obtain .020'' gap.
d. When gap is .020'' tighten locknut.
e. Replace breaker box cover.

SECTION 4
ADJUSTMENTS

CARBURETOR ADJUSTMENT

Minor carburetor adjustment may be required to compensate for differences in fuel, temperature, altitude and load.



Initial Adjustment:

Turn needle valve clockwise until it just closes. **CAUTION:** Valve may be damaged by turning it in too far.

Now open needle valve 1-1/2 turns counterclockwise.

Close idle valve in same manner and open it 1/2 to 3/4 turns. This initial adjustment will permit the engine to be started and warmed up prior to final adjustment.

Final Adjustment:

Turn needle valve in until engine misses (lean mixture), then turn it out past smooth operating point until engine runs unevenly (rich mixture). Now turn needle valve to the mid-point between rich and lean so the engine runs smoothly.

Hold throttle at idle position, set idle speed adjusting screw until fast idle is obtained (1200 RPM). Hold throttle in idle position and turn idle valve in (lean) and out (rich) until engine idles smoothly. Then reset idle speed so that engine idles at 1200 RPM. Release throttle – engine should accelerate without hesitation or sputtering. If engine does not accelerate properly, re-adjust carburetor to a slightly richer mixture.

SPEED CONTROL ADJUSTMENTS

The correct operating speed range is 1800 to 3600 RPM. The standard speed setting (no load) is 2900 RPM. Idle speed is 1200 RPM.

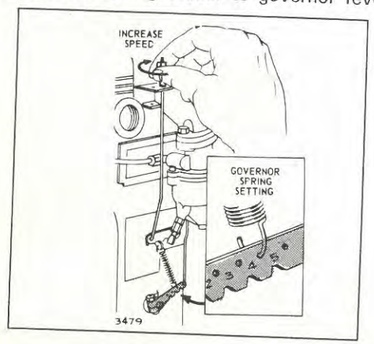
Thumb Nut Adjustment

To increase speed, turn nut (clockwise) or move lower end of governor spring farther away from governor lever shaft.

To reduce speed, turn nut (counterclockwise) or move lower end of spring closer to governor lever shaft.

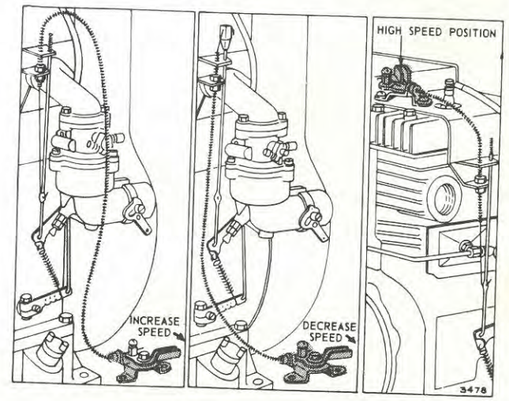
If the speed of the engine is not steady although the carburetor has been properly adjusted, move the spring farther away from the governor lever shaft.

If the speed variation between no load and full load is too great, move spring closer to governor lever shaft.



REMOTE GOVERNOR SPEED CONTROL ADJUSTMENT

Engine speed is controlled by movement of the control lever. To adjust: Move control lever to HIGH speed position. Loosen screw on swivel. Move wire through swivel until desired operating speed is obtained. Retighten swivel screw; bend loose end of wire around swivel. Cut off excess wire. Be sure to remove or loosen thumb screw on governor control rod.



SECTION 5
GENERAL INFORMATION

Your engine is 4 cycle, single-cylinder and L-head. It is air cooled.

MODEL SERIES 200400

Bore	3''
Stroke	2 7/8''
Displacement	20.32 cu. in.
Horsepower	8.0 HP max. @ 3600 RPM
Torque (Ft.-Lbs.)	13.45 max. @ 2600 RPM

MODEL SERIES 233400

Bore	3''
Stroke	3 1/4''
Displacement	22.97 cu. in.
Horsepower	9.0 HP max. @ 3600 RPM
Torque (Ft.-Lbs.)	15.75 max. @ 2400 RPM

The horsepower ratings listed above are established in accordance with the Society of Automotive Engineers Test Code - J607. For practical operation, the horsepower loading should not exceed 85% of these ratings. Engine power will decrease 3½% for each 1,000 feet above sea level and 1% for each 10° above 60° F.

TUNE-UP SPECIFICATIONS

Spark Plug Gap	.030''
Ignition Point Gap	.020''
Intake Valve Clearance	.007'' - .009''
Exhaust Valve Clearance	.017'' - .019''

STORAGE INSTRUCTIONS

Engines stored for over 30 days should be completely drained of fuel to prevent gum deposits forming on essential carburetor parts, fuel filter, fuel lines and tank.

a. Remove filter bowl, open shut-off valve and drain tank completely.
b. Replace filter bowl. Leave fuel valve open.
c. Operate engine until it stops from lack of fuel.
d. While engine is still warm, drain and clean the oil sump. Refill with fresh oil.
e. Remove spark plug, pour one ounce (2 or 3 tablespoons) of SAE 30 oil into cylinder and crank slowly to spread oil. Replace spark plug.
f. Clean dirt and chaff from cylinder, cylinder head fins and blower housing.

Major engine repairs should not be attempted unless you have the proper tools and a thorough knowledge of internal combustion engines.

INSTRUCTIONS

1. *TO START: BEFORE* turning on burner, *steady stream of water must flow from steam gun.*

2. *TO STOP: SHUT OFF BURNER FIRST,* then wait for steady water stream before turning off pump.

3. FUELS: USE either kerosene or #2 household fuel oil. Kerosene burns cleaner than household fuel oil. For more power use #2 fuel oil. DO NOT USE DIESEL FUEL, unless machine is adjusted for it.

4. COIL CARE: ALWAYS use MASTER'S STEAM CLEANING COMPOUNDS. ALWAYS use MASTER'S Internal and External COIL CLEANING CHEMICALS. INTERNAL COIL CLEANER removes lime from inside of coil. EXTERNAL COIL CLEANER removes soot. If water is excessively hard, install a water softening machine. If only moderately hard, add MASTER WATER SOFTENER to cleaning compound. If pumping rate thru coil diminishes, delime coil.

5. DRY STEAM, OVERHEATING, ERRATIC OPERATION: READ INSTRUCTION BOOK (Gallonage test) (Thumb test)
   a) Check and tighten water pump packing nut, (replace packing, if needed).
   b) Keep compound tank valve closed when tank is empty.
   c) Drain surge tank (pulsation chamber) daily after each use.
   d) Remove stones, dirt, pebbles, etc. from steam gun and water tank. Check steam hose for internal swelling.
   e) If insufficient water is pumped, remove, clean and replace check valves. Make gallonage test.
   f) Eliminate suction leaks. Pump may be sucking air with each suction stroke. (Tighten fittings on suction lines; fill detergent tank either with detergent, or if not using detergent — with water — to insure no air is sucked into lines.)
   g) Rebuild and/or repack water pump every 2–3 years, if needed.

6. STEAM HOSE: Avoid vehicles driving over it; don't kink it; don't let dry steam overheat it. Hose manufacturers guarantee steam hose free of defects at TIME OF INITIAL USE ONLY. As much as 100 ft. of steam hose may be connected to machine, if desired.

7. INLET (GARDEN) HOSE: Don't starve machine for water. Use good quality garden hose, $\frac{5}{8}$" inside diameter or $\frac{3}{4}$" I.D. Cheap undersize hose is poor economy.

8. EXTENSION CORD: Your extension cord MINIMUM WIRE SIZE — No. 12-3. This means a 3 conductor extension cord made out of No. 12 gauge copper wire. Use of an undersized extension cord results in overheating, overloading, and possible failure of this fine machine. Your machine is internally grounded; you should plug it into a GROUNDED OUTLET for your safety.

9. CORRECT SIZING OF FUSES OR CIRCUIT BREAKERS ON 115 VOLT MACHINES: The heavy-duty components of this machine require 30 ampere fusing or circuit breaker protection.

10. MAXIMUM OPERATING ECONOMY: — and fastest steam cleaning require a highly concentrated Steam Cleaning Compound to allow maximum dilution in machine. MASTER'S STEAM CLEANING COMPOUND dilutes 40 to 1 with water, when filling tank, and costs no more than others with lower dilution rates.

11. FOR WHISPER-QUIET BEST CLEANING, use MASTER'S WHISPER ATTACHMENT with almost no fog. Use MASTER'S CONTACT NOZZLES for space-age contact cleaning. Use MASTER'S FLAT FLOOR SWEEPERS for floors.

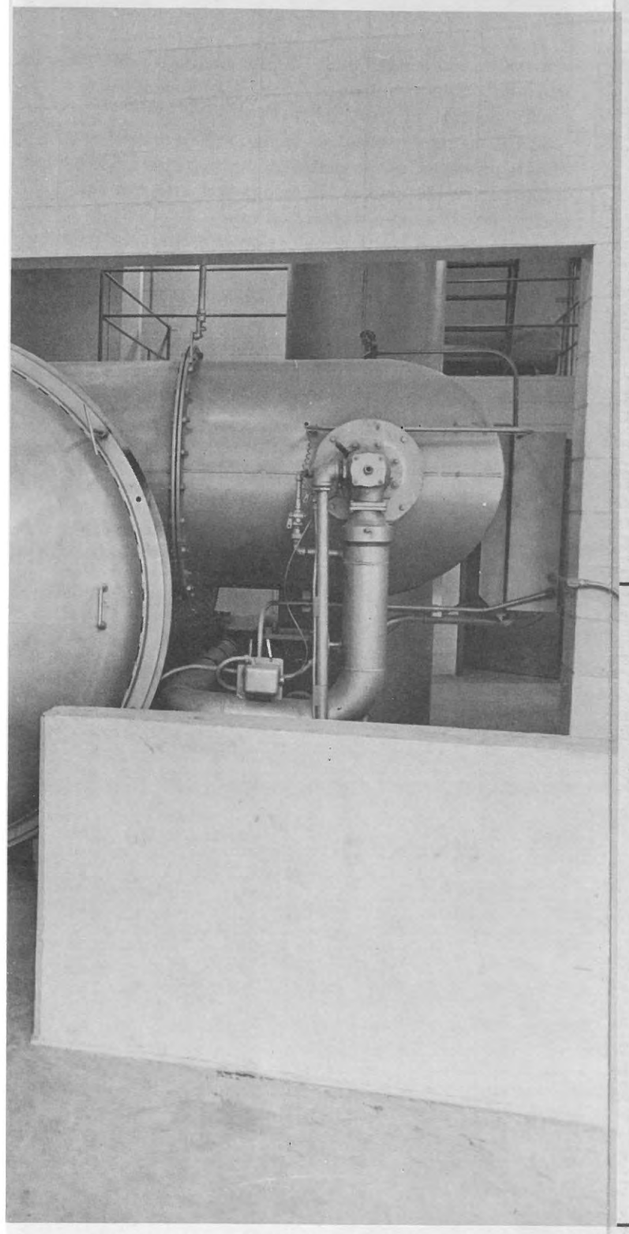
12. WINTER PROTECTION: Keep machine from freezing. (a) Drain both water tank and soap tank. (b) Disconnect garden hose and then turn on oil burner to boil water out of coil. Turn on pump and burner several times to remove maximum amount of moisture from pump and coil. If compressed air is available, blow air through entire system, at same time. Open bottom drain under pump and leave it open, when machine is not in use. MASTER assumes no responsibility with respect to your ability to dry out your machine to keep it from freezing.

GUARANTEE: is for 90 days, at the factory, Holland Patent, N.Y., against defects in materials and workmanship. Guarantee is void if non-approved chemicals are used in MASTER CLEANING MACHINES.

MEL SEARS & COMPANY
HOLLAND PATENT, N.Y. 13354

KS INTRODUCES

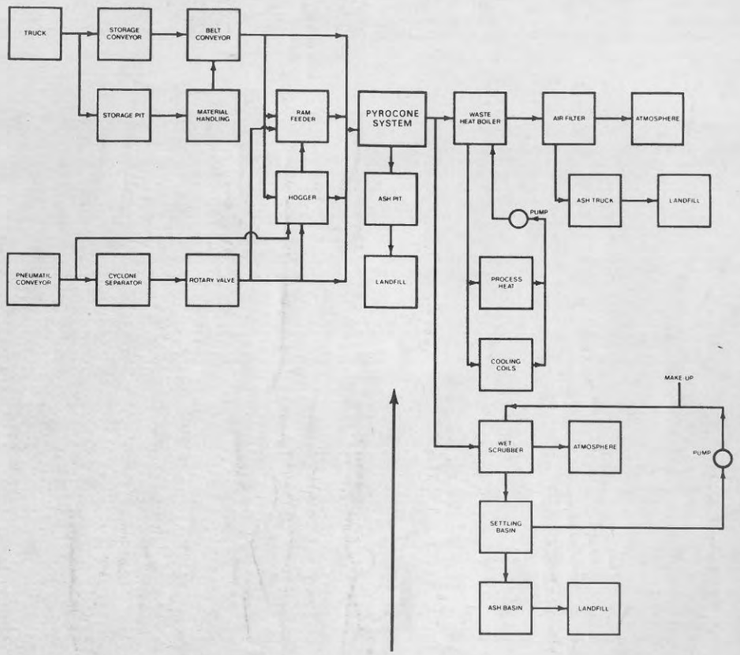
INNOVATIONS IN...



PYROTRON SYSTEM

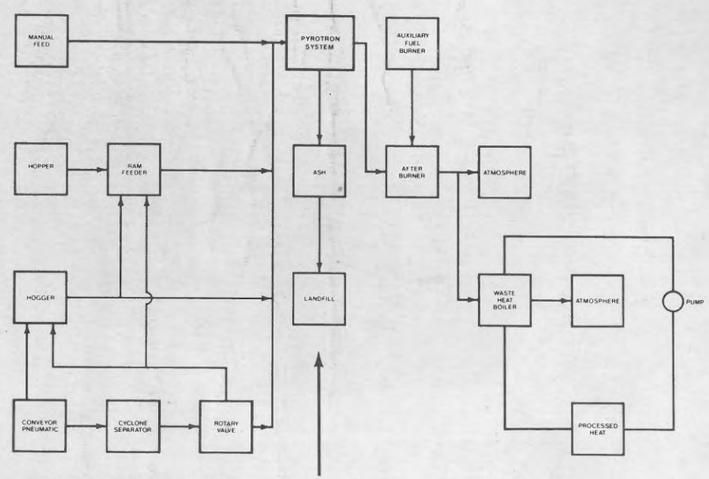
DISPOSAL SYSTEMS

The Cleaver-Brooks Pyrocone System



Material Handling Equip't. | Pyrocone | Flue Gas Filtering Equip't.

The Cleaver-Brooks Pyrotron System



Material Handling Equip't. | Pyrotron | Flue Gas Filtering Equip't.

Cleaver Brooks

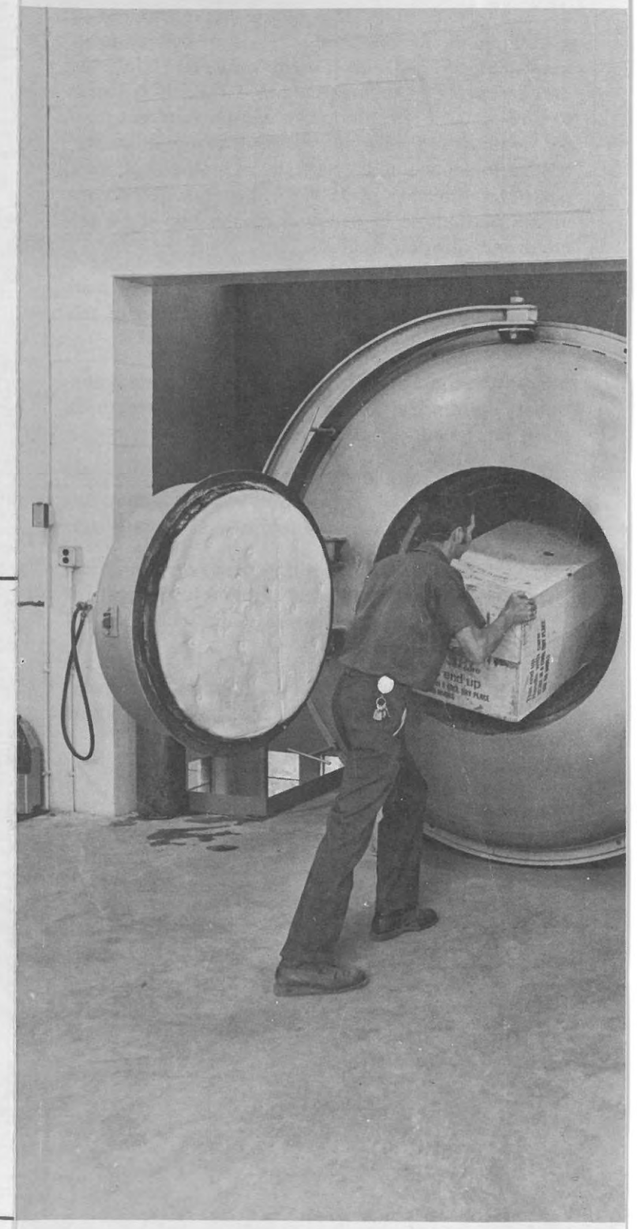
DIVISION OF AQUA-CHEM, INC.

MILWAUKEE, WISCONSIN, U.S.A.

850-5224 Rev. 11/70

CLEAVER-BROO

TWO DYNAMIC



THERMAL WASTE

THE CLEAVER-BROOKS PYROCONE SYSTEM

The revolutionary Pyrocone system meets all of today's tough, new national air quality standards at a fraction of the operational costs of conventional incinerators. Talk about efficiency; The Cleaver-Brooks Pyrocone Incinerator has a reduction factor of 95% to 97%. Resulting ash will contain less than 5% combustible material. The after burner chamber, critical to any incinerator efficiency, operates at temperatures in excess of 1500° F. Ninety-nine percent of the particulate is removed by the two-stage cyclone separator air filter.

All of this at a burning rate 4 to 8 times faster than a conventional incinerator and in a fraction of the floor space.

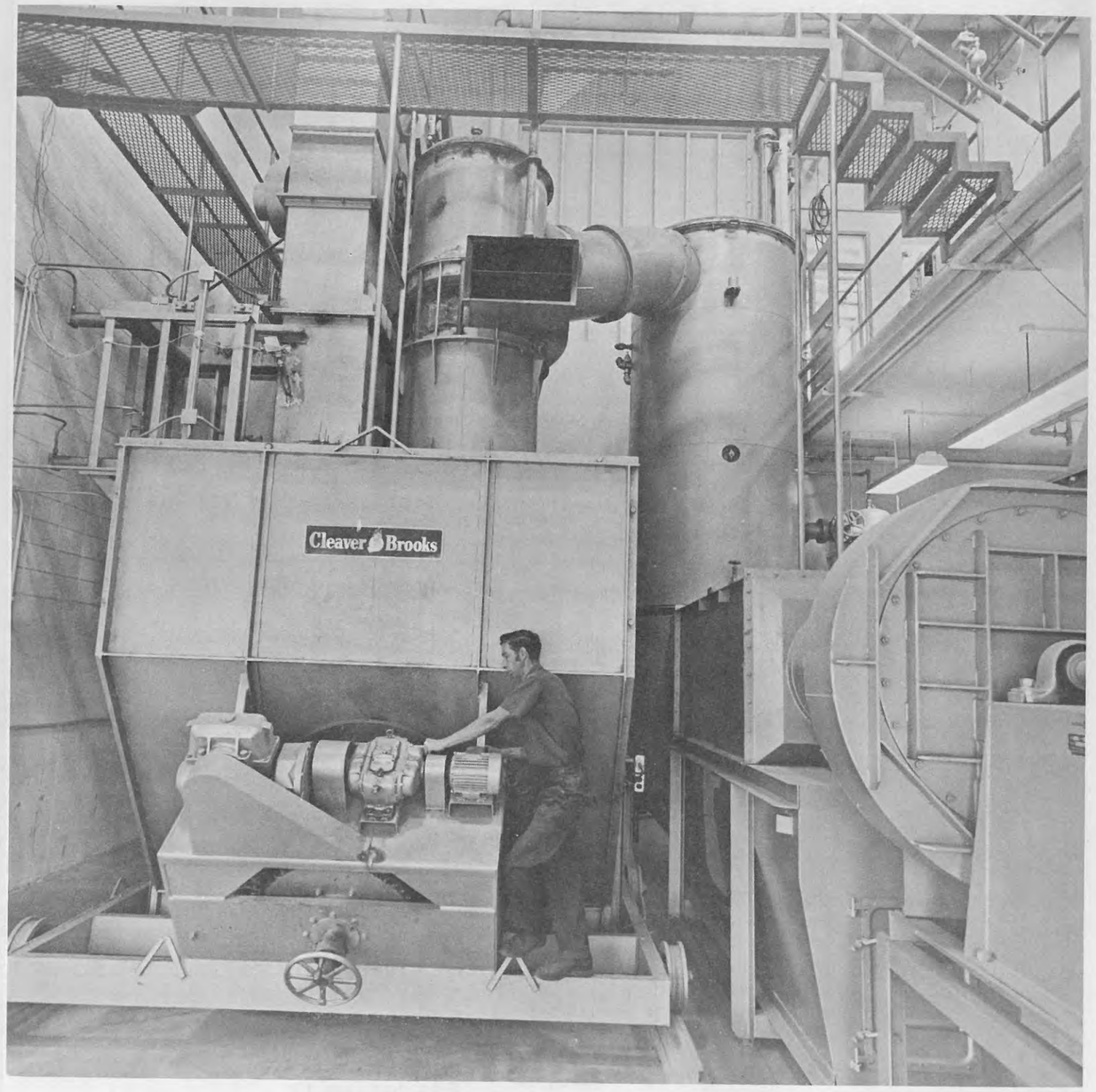
In addition to its simple, compact design and revolutionary burning efficiency, Pyrocone also features these important money-saving advantages.

Flexibility — Completely interlocked, self-compensating speed and temperature control automatically adjusts to a wide variety of waste materials.

Controllability — This is a one man operation. The control console's indicator lights and thermal recorders permit a continuous visual check on all phases of the operation.

Compatibility — this unit can function effectively with almost any materials handling equipment or flue gas filtering equipment.

Maintenance — The cone is easily accessible for routine inspection and periodic clean out. The self-agitating design has an inherent anti-clinker advantage, also assuring longer grate life.



PYROCONE SYSTEM

THE CLEAVER-BROOKS PYROTRON SYSTEM

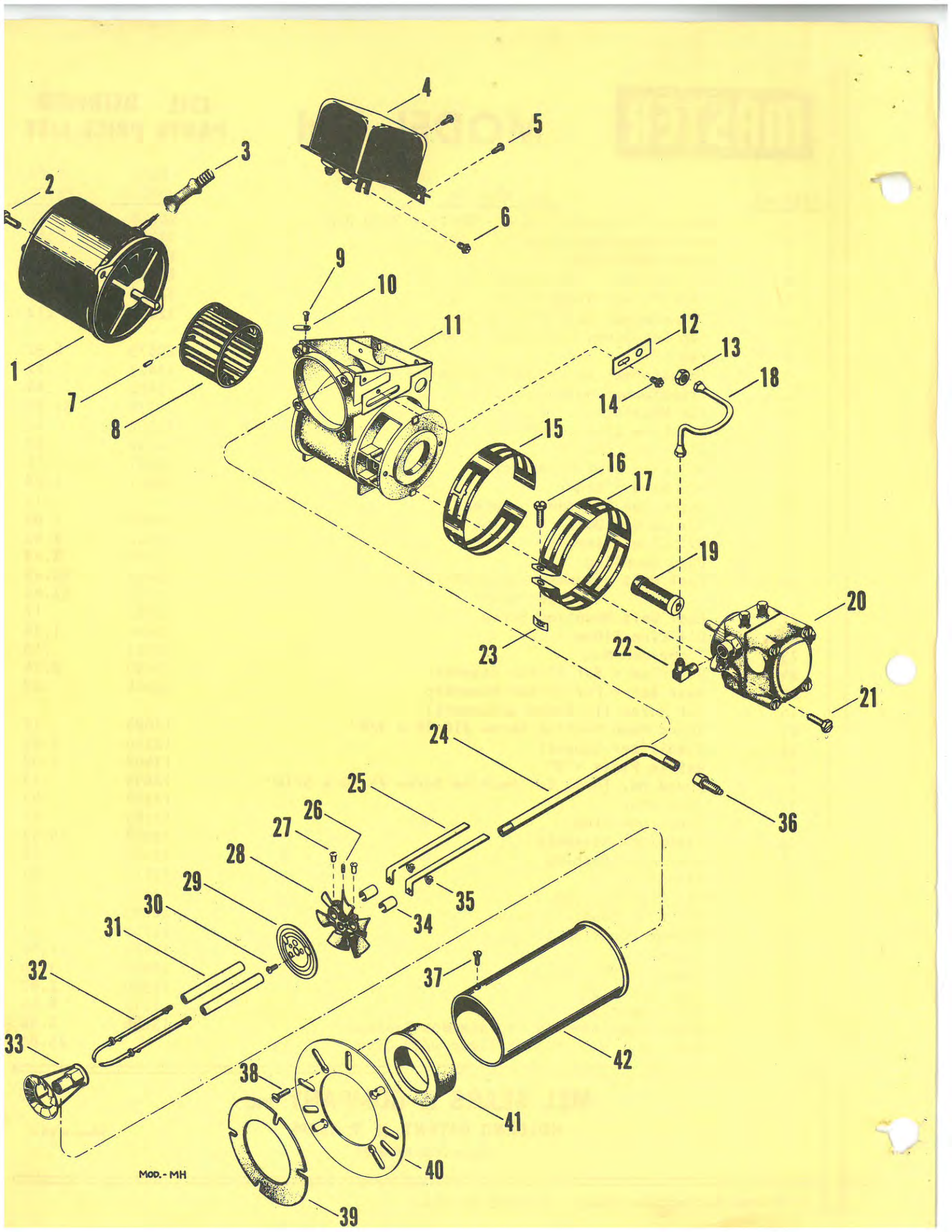
The Pyrotron uses a two stage thermal destruction process which achieves a reduction factor of 95% to 97% by volume of combustibles. This results in an ash residue with less than 5% combustible content. The high incineration efficiency is achieved by accurate control of the fuel air ratio.

In the primary stage, the ignited waste material is disintegrated to form a densely concentrated smoke-laden gas*. The gas is then released into the secondary chamber at a controlled rate.

In the second stage combustion chamber, the gas is mixed with oxygen in a forced air stream and re-ignited by an auxiliary burner to a temperature of +1500° F to assure complete thermal disintegration.

By controlling the fuel air ratio in the secondary chamber, Pyrotron can efficiently handle a wide variety of waste materials found in commercial and industrial plants.

* Smoke is a suspension of particulate matter in the gaseous products of combustion. Light colored smoke is formed from volatile matter that escapes the fuel bed in a gas stream that is neither ignited nor heated to sufficient temperature to cause continuing pyrolysis. Black smoke is formed from volatile matter which is condensed to a liquid aerosol and then heated to a high temperature in the absence of oxygen so that the liquid droplets are converted by continuing pyrolysis to a solid black particulate form.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MOD. - MH

MASTER MODEL MH

OIL BURNER PARTS PRICE LIST

ITEM NO.	DESCRIPTION	PART NUMBER	USER PRICE
1	Motor - 1/8 HP - 115 V - 60 Cy - 3450 RPM	20627	$ 50.40
2	Motor Mounting Screw	12701	.14
3	Motor Cord Cover	13029	.30
4	Transformer 115V-60 cy.	20593	34.50
5	Transformer Hinge Screw	12697	.12
6	Transformer Hold Down Screw	12697	.12
7	Fan Set Screw (Included w/Fan)	-	
8	Fan	20673	6.92
9	Transformer Hold Down Clip Screw	13423	.12
10	Transformer Hold Down Clip	13422	.44
11	Fan Housing	4776	32.20
12	Oil Line Slot Cover	13392	.42
13	Oil Line Locknut	12342	.27
14	Oil Line Slot Cover Screw	12697	.12
15	Air Band - Inner	20601	1.28
16	Screw for Air Band - Outer	-	.15
17	Air Band - Outer - 8 Slot	20602	1.65
18	Oil Line Assembly	13522	1.45
19	Pump Coupling	13424	2.49
20	Fuel Unit - Sundstrand A2VA-7016	13495	53.45
	Webster M34DA	13370	53.45
21	Fuel Unit Mounting Screw	12701	.17
22	Oil Line Elbow	13494	1.38
23	Tinnerman Nut	12343	.19
24	Oil Pipe - For 5" Gun Assembly	13650	2.24
25	Buss Bar - For 5" Gun Assembly	13446	.67
26	Set Screw (Included w/Support)	-	
27	Round Head Machine Screw #10-24 x 3/8"	12694	.12
28	Stabilizer Support	12320	2.94
29	Baffle Plate - 3"	13408	2.08
30	Round Hd. Thrd. Cut.Machine Screw #4-40 x 5/16"	12695	.19
31	Insulator	12354	.87
32	Electrode Stem	13163	.87
33	Flamelock Assembly	12988	14.32
34	Insulator Bushing	12408	.54
35	Palnut	13110	.27
36	Oil Pipe Fitting	13393	.69
37	Air Cone Mounting Screw	12699	.12
38	Flange Mounting Screw	12700	.12
39	Gasket	12484	1.80
40	Flange - 9"	20640	3.40
41	Air Cone - 3"	12989	2.47
42	Air Tube - 5"	2717	4.55
43	Electrode Assembly Replacement Package	13286	2.88
44	Gun Assy. - 5" - Stabilizer w/3" Disc.	-	25.80

7/1/74

MEL SEARS & COMPANY, INC.
HOLLAND PATENT, N. Y. 13354
Phone: (315) 865-8101

Printed in U.S.A.

Prices subject to change without notice.

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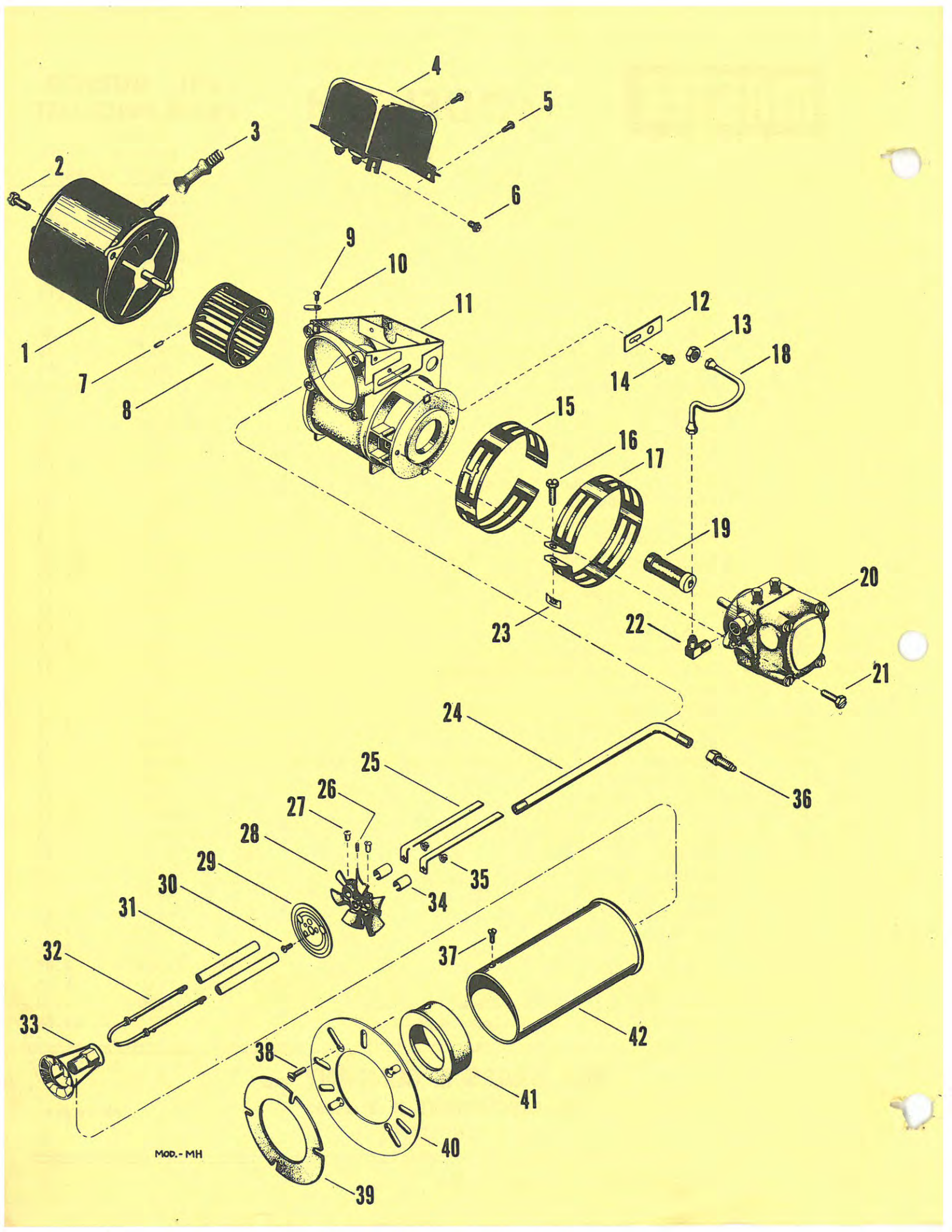
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GENERAL INSTRUCTIONS

COIL TYPE

MASTER

Cleaning Machines

1-315-865-8101

MEL SEARS & COMPANY
HOLLAND PATENT, N.Y. 13354

MASTER SERVICE POLICY

OFFICIAL INDUSTRY-WIDE SERVICE POLICY

adopted by

THE EQUIPMENT AND TOOL INSTITUTE

FIELD SERVICE POLICY:

Field maintenance involves time and travel costs. The inclusion of these costs in the purchase price of machines would tend toward discrimination against users who have no need for service assistance, therefore:

Field service and repairs are available anywhere in the USA. A fair charge will be made to cover travel time and road expense, as well as parts used, and repair labor. This will apply regardless of whether the machine is less than one year old, or more than one year old. The factory does not participate in field service charges, except for the actual cost of the parts; such charges being made solely by the person rendering such services, to cover his costs to make such service possible.

Master Warranties apply to service at the factory only. (Please see guarantee supplied with your machine for further details.)

MEL SEARS & COMPANY
HOLLAND PATENT, N.Y.
13354

1. THANK YOU . . . . . .

. . . . . for ordering your Master Cleaner. Use Master Chemicals in it.

2. BASIC FACTS:

Master oil-fired steam cleaning machine is a grouping of three units of proper size, co-ordinated to work well together. They are (1) a good BURNER (2) a good WATER PUMP (3) an efficient COIL. They must be combined to work well as a team, to produce *enough steam pressure with enough water content* in it. If any one of the three malfunctions, problems develop. If the coil receives *too much* water or solution for the amount of available heat, high steam pressures cannot develop. Conversely, if too much heat enters the coil for the amount of *solution* flowing through it, the steam becomes super-heated and dry. *Dry steam is bad:* it does no cleaning, it overheats the machine, it damages the steam hose, the safety relief valve, and the pressure gauge. It should be avoided. When you turn on the burner and the machine begins to make steam you first see warm water and then hot water coming from the gun, then steam begins to come and as the steam gauge pressure increases on up to 100 psi or more there is usually a point somewhere between 50 and 75 psi where the gun pulsates. (i.e., a slug of water comes from the gun and then a quantity of steam and then water and then steam, etc., etc., etc. This is called gun pulsation). Gun pulsation makes it difficult to aim the gun exactly where the cleaning is desired. The gun jerks in the user's hand. As the pressure continues to rise the pulsations disappear and a steady even flow of steam is produced. The most perfect steam cleaning results exactly above the pulsation point when the flow of steam first begins to even out. If the heat is increased above this point and the pressure rises considerably, the steam becomes more and more dry. Wet steam cleans. Dry steam does not. The wetter the steam, the more it cleans. Technically a steam cleaning machine produces *super saturated vapor solution.* Steam is a gas. It propels the water. It breaks the water up into millions of droplets and hurls them at high velocity at the work. Steam is also a heat transfer agent - - the steam propels the hot water at high impact velocity -- millions of droplets of boiling hot water are thrown against the work at high speeds. The more hot water and the more chemical, the better the cleaning. The main difference between small machines and large ones is in the amount of hot water being thrown at the work. By itself alone the steam would not do much cleaning. The bigger the steam cleaning machine, the faster you clean, because of the greater volume of water thrown against the work, together with the cleaning compound used. Master machines produce very wet steam at higher pressures.

If you have any of the following problems with your steam cleaning machines:

a) Too high a steam gauge reading.
b) Steam too wet and gauge reading too low.
c) No steam out of gun; only blue smoke.
d) Varying gauge pressure readings (erratic).
e) Insufficient water flow when burner is turned off.
f) Machine works but does not clean efficiently (not enough moisture in nozzle output). Steam too dry.

(If you have any of above troubles) do this:

1. *MAKE GALLONAGE TEST.*
2. *MAKE THUMB TEST.*
3. *ELIMINATE SUCTION LEAKS.* Check all plumbing connections, especially suction lines.
4. If soap-compound tank is empty, close soap valve.
5. Remove, clean and re-install check valves.
6. Make sure V-belt is not bottoming on small pulley. If V-belt is loose, bend spring bracket to increase spring tension; have plenty of belt tension. If belt is worn, replace. Check pulleys for wear.
7. Check for excessively low line voltage to machine.
8. IF BURNER DOES NOT LIGHT:
   a) Prime fuel pump.
   b) Check transformer for spark.

c) Check for plugged fuel nozzle.
NEVER USE DIESEL FUEL OIL: IT DEPOSITS LAYERS OF SOOT AND CARBON ON COIL over a period of time, reducing thermal efficiency.

COMPONENTS INFORMATION

1. HOSE:

Output hose is guaranteed good when you get it. This guarantee is limited to initial use only. Used properly, it will last a long time. Hose manufacturers, carefully test their output hose before shipment. If defective when used the *first time*, replacement may be made *as decided by the hose manufacturer.*

HOSE can be bruised, kinked, or run over by a car and the effects are not apparent on the outside of the hose. *Do not drive vehicles over hose.*

Hose can be burned by dry steam. Even a short exposure to excessively hot dry steam can "cook" the inside of your steam hose. Should hose show defects during the first use of the machine, send it to us and we will submit it to the rubber company involved. If they agree that it was a factory defect and replace it to us, we will replace it to you without cost. If they decide the malfunction is due to poor handling or misuse, then the customer pays for the new hose.

Hoses with swivel ends (one swivel end or two) are available at slight extra cost. Swivels eliminate kinking. *Use only Master hose*. A machine that gives 100 psi pressures with Master hose may give 60 psi with another hose, or up to 130 psi if it is the wrong kind. Your output hose is calibrated to the machine. Do not change brands. If you must purchase hose locally, make sure it is exactly the same hose as shipped with your machine; since another hose type, even if from the same source, may produce unexpected results. Hose lengths can be coupled together to 100 ft. maximum total length.

2. MOTORS:

General Electric, Westinghouse, Marathon Electric, or other makes of motors, Warranty - 1 year. These manufacturers maintain local repair service stations in your trading area. If you cannot locate such a local repair service depot, write the factory for the name and address of the nearest station. Do not send these motors to us for repair as this will involve additional postage and expense in our sending them to your repair station.

3. SAFETY RELIEF VALVE OR SAFETY AUTOMATIC UNLOADER:

Every Master Cleaner has a safety relief valve or pressure unloader incorporated into its construction.

DO NOT ATTEMPT TO ADJUST THE SAFETY RELIEF VALVE: THE VALVE HAS BEEN CALIBRATED AND SET AT THE FACTORY.

Slight seepage is normal.

If leakage is excessive, replace entire valve. Overheating the machine by running it with insufficient water will overheat this safety valve and affect the calibration.

4. CHECK VALVES: Part No. 31

All Master Steam Cleaning Machines have two or more check valves per cylinder.

One or more of them is an *inlet check valve*, and one is an *outlet check valve* because one is installed reversed relative to the others.

These valves are interchangeable.

Make sure they are not installed backwards to the proper installation since the flow of the water must be into the pump and then out of the pump on the high pressure side going to the surge tank and then to the coil.

Check valves must be clean and kept clean. *THUMB TEST TELLS*. See Section #29.

If dirt gets under the check valves the machine may operate erratically. This will cause dry steam (bad).

If machine does not function perfectly, remove both check valves, clean thoroughly, then re-install.

Tapping them sometimes helps to jar dirt loose from under the seats. *THEN MAKE THUMB TEST. Section #29.*

If performance at steam gun is not up to normal in any way, MAKE THUMB TEST.

5. PRESSURE GAUGE:

Each Master Steam Cleaner is equipped with a steam pressure gauge. Rough handling, jarring or bumping may damage your gauge. Replace promptly.

If gauge reads above zero when machine is not running, gauge mechanism has been strained, usually due to overheating of machine: or running with insufficient cold water entering the coil, *or fire left on when water was inadvertently turned off.*

If temperature of steam rises drastically for any reason of malfunction, steam becomes super-heated, usually resulting in possible damage to *pressure gauge, safety relief valve, and steam hose*. Water must flow at all times when burner is firing.

If any abnormality is noticed in the type or quality of steam coming out of gun; turn off burner and correct condition, before using machine further.

6. COIL:

A COIL IS A HEAT TRANSFER ELEMENT. Heat from outside of the coil must transfer to the water inside of the coil. 1/32" layer of soot on outside of coil is an efficient insulator, wastes fuel and lowers performance. Remove this soot from the outside of the coils.

USE MASTER'S SOOT CHASER. Pour into fuel tank. You can remove soot with a wire brush and an air nozzle and blow the soot all over everything and everybody. Also you can do it the easy way by adding one bottle of *MASTER'S SOOT CHASER* when filling the fuel tank, several times a year, or as needed. This will keep the outside of the coil clean and maintain high steam pressure. Add *MASTER'S SOOT CHASER* to tankfuls of fuel at first sign of soot or smoky chimney. Use it regularly. *THE OUTSIDE SURFACE OF THE COIL MUST BE KEPT CLEAN!* After adding soot chaser chemical, use machine in normal manner. If soot builds up quickly, find the reason.

7. FUEL:

Use kerosene, or #2 household fuel oil. Kerosene burns cleaner. *NEVER USE DIESEL OIL*. Your machine was tested and calibrated at the factory using kerosene. #2 household fuel oil also burns cleanly, and is smokeless when burner is properly adjusted. It burns hotter than kerosene. This means a steam gauge pressure difference of between 10 or 20 psi. If you want more pressure than you get with kerosene, simply change to #2 household fuel oil. Diesel oil is bad for your machine. It will deposit layers of soot on the coil unless machine is expertly adjusted to burn same.

8. COIL CARE:

All Master Steam Cleaners are built with removable coils.

Disconnect piping connection at each end of coil, then the coil slides out for repair or replacement. To remove burner and tank head, remove screws holding tank head and tap with soft mallet. Tank end "walks" out while tapping, then pull coil out.

MAKE OCCASIONAL GALLONAGE TEST -- See Section #28.

If your gallonage test indicates insufficient water being pumped, run a gallon of *MASTER'S INTERNAL COIL CLEANER* through machine for 30 minutes or more, then dump and flush. To do this, pour *MASTER's INTERNAL COIL CLEANER* into the water tank, place gun in same water tank, start water pump, add an occasional shot of heat to keep warm, and let it circulate. This cleans out lime, dirt, sedimentation, etc., from inside of coil. *USE IT REGULARLY* every 3 - 6 months. *never put white wash, disinfectants, abrasives, or acids* through coil.

Coils can clog up completely in four hours or four years. Keep them clean. Coils can freeze and crack in cold weather. Coils can overheat if run without water flowing inside of coil. *Coils do not become defective in use due to malfunctioning or manufacture*. Each coil is hydrostatically tested for leakage at pressures of 2000 psi.

If you have a leaky coil and you think it is due to manufacture, the entire unit should be returned to the factory freight prepaid. Upon examination thereof, if the coil is in our opinion, defective due to poor welding or any other factory fault, the entire unit will be replaced.

If the coil has been frozen and cracked, or melted or burned due to overheating, the regular charge will be made for repair or replacement. (See parts price list.)

The factory does not assume any liability for liming of coils or for sooting of the external surfaces of the coils, or for freezing.

Liming condition can be indicated by continual dry steam and excessive high pressure indication. Liming condition can also be indicated by excessively low pressure when the lime coating is so thick that it acts as an effective insulator. For normal water conditions the water softener and conditioner chemicals to be found in Master's Steam Cleaning Compound are usually sufficient to keep the coils in excellent condition. If hardness of water used is excessive, buy a water softener.

9. SWEATING OF COIL -- DRIPPING OF WATER FROM DRAINAGE HOLES UNDER COIL SECTION WHEN BURNER IS ON:

A small amount of water trickles out of the openings at each end of the coil (bottom of the machine). *This is condensate*. *It is normal*. There is moisture in the air. Moisture comes out of the tail pipe of high compression automobiles. Similarly, moisture trickles, and on very humid days actually streams down from the machine. This does not mean the coil is leaking. It indicates efficient combustion. Do not be fooled into thinking your coil is defective. Condensate is normal to any well designed cleaning machine.

10. COMBUSTION CHAMBER:

Master Cleaners are designed and built to burn smokelessly. Anytime your cleaner shows smoke or soot coming out of the chimney, something is wrong and you should correct it. Adjust the air shutter on the oil burner. There must be *exactly* enough air for the *exact amount of fuel being burned, so that the fire always burns clean*. You should never see flame coming out of the chimney.

One puff of smoke when you start the machine, and *one puff* when you turn it off, are permissible. If you can see smoke at any other time, your machine needs adjustment. Call your nearest local oil burner serviceman or adjust the air shutter yourself. If necessary, remove fuel nozzle etc., clean and replace same.

11. WATER:

Have your water checked for hardness. Any water department, or hospital, or water-softener vendor can test it. If not hard, the chemicals and additives in Master's compounds will do sufficient softening to keep your coil in good condition. If you have hard water, *purchase a mechanical water softening machine*. Install it ahead of your steam cleaner.

All heat transfer coils should regularly be cleaned with Master's Internal Coil Cleaner. The harder your water is, the oftener you should use it. See Section 8 for application.

12. WATER HOSE:

Cheap plastic water hose is poor economy. Use garden hose with 5/8" minimum inside diameter, 3/4" ID is better.

13. WATER TANK:

Water tank is float controlled to maintain proper water level.

a) Float valve is not a positive shut-off control valve. It is intended only to control water level when machine is in use. After cleaner is shut off, then turn water supply off at some other valve elsewhere or disconnect garden hose cold water supply.
b) Paint inside of water tank annually to keep from rusting.
c) Machine will work with gravity fed water supply too, such as water from barrels on a wagon or truck.
Never use river water or gritty water unless thoroughly filtered and clarified.

14. SOAP TANK:

Pour small amount of Master's Liquid Compound into bottom of soap tank; fill tank to top with cold water. Depress float valve in water tank, by hand, to fill compound tank. *IMPORTANT: If soap tank is empty; close soap control valve,* or machine may suck in air and overheat.

If you run water pump with empty soap tank and the soap control valve is open, water pump will suck in some air with each suction stroke of pump, *causing dry steam*, which could be injurious to steam hose, safety relief valve, and steam pressure gauge. Keep compound valve closed when not in use.

15. WATER PUMP: See pump sheet.

Sould your pump require service, ship it to the factory. Repairs will be made at lowest possible cost.

In cold weather, *ALWAYS* rotate pump pulley by hand one full revolution, before turning on switch. If ice is inside pump cylinder, *better to know it, than to crack pump casting*.

REMEMBER - *ALWAYS START WATER PUMP FIRST*. *NEVER* turn on burner *unless you see a solid steady stream* of water coming out of the steam gun.

16. TO SHUT OFF YOUR MASTER STEAM CLEANING MACHINE:

Turn off burner but allow water pump to continue pumping.

When a steady flow of water comes from steam gun, turn off water pump. This prevents settling of solid particles on inner coil surfaces. Coil does not lime up as fast in hard water areas where this practice is observed. Hoses last longer.

17. WINTER PROTECTION:

If the machine freezes, it will be damaged (same as an automobile).

a) Each Master Cleaner has a drain plug at the bottom of each supply tank, also an air inlet valve so that compressed air may be used to blow out the machine if it is to be left outdoors in freezing weather. If compressed air is not available; after machine is turned off and all tanks containing water and soap have been drained, turn on the fire (with water pump running) and allow it to run approximately *30 seconds* in order to burn the moisture out of the coils. Repeat 2 or 3 times *or more* as deemed necessary. A slight amount of moisture remaining on the check valves could form frost on check valve discs. Next time start-up is attempted outdoors in freezing weather, check valves might not function till machine warms up *above freezing* temperatures.
b) Drain tanks, burn out moisture using burner, add compressed air at valve furnished; then add one gallon antifreeze and pump it through.

18. SURGE TANK:

The surge tank is a pulsation chamber which takes the water knock and hammer noise out of the system. *DRAIN DAILY.*

19. OIL BURNER: (Sections 19, 20, 21, 22, 23, 24)

The gun type pressure atomizing burner is exactly the same as used in millions of oil heated homes, consisting of a *high pressure rotary fuel pump*, and an *air blower* to meter the exact amount of air into the combustion chamber, an *electric motor*, an *ignition transformer* developing 10,000 volts and which runs continuously during cleaning operation. The transformer ignites the atomized spray of fuel. Kerosene or No.2 household fuel may be used. Your machine was tested with kerosene. If you use No. 2 household fuel oil, you may have to reduce size of flame by adjusting burner bypass screw, located under the acorn nut. No. 2 fuel oil is 2% or 3% hotter, containing more BTU's per gallon, and will result in approximately 15 to 20 pounds higher steam gauge reading. Kerosene burns a little cleaner.

PERMISSIBLE OIL BURNER PRESSURE: 90 psi min.-130 max. *FACTORY ADJUSTED FOR KEROSENE AT APPROXIMATELY 100 - 120 psi FUEL PUMP PRESSURE. For #2 fuel oil, ADJUST FUEL PUMP PRESSURE LOWER.* The fuel pump, usually Sundstrand or Webster, is a positive displacement pump of internal spur gear construction. It pumps over 9 gallons of fuel per hour and uses a fuel control bypass to shunt the extra fuel not needed by the nozzle, bypassing from the pump outlet back to the pump inlet (from the high pressure side back to the low pressure side within the pump). Your fuel oil pump has one acorn nut. Underneath this nut is an adjusting spring seating against the ball and seat, thus controlling the amount of fuel bypassed (and therefore, the amount going to the spray nozzle) and thus the size of the flame. The size of the flame determines the steam pressure developed.

ADJUSTMENT: TO ADJUST PRESSURE, REMOVE ACORN NUT, TURN SLOTTED SCREW CLOCK-WISE TO IN-

CREASE; COUNTER-CLOCK-WISE TO DECREASE. To read pressure *ASSEMBLE A PRESSURE GAUGE WITH 1/8" male pipe thread end and screw into lower plugged opening while running; ADJUST TO DESIRED PRESSURE.* For higher steam pressures, after adjusting the fuel pump pressure, make sure that the correct amount of water is being pumped (see gallonage test section #28) also if convenient change from kerosene to #2 household fuel oil. Make sure there is no soot layer on the outside of the coil and that the inside of the coil is free and clean of lime deposits or sedimentation due to hard water, or using unknown brands of compound containing insoluble fillers that do no cleaning.

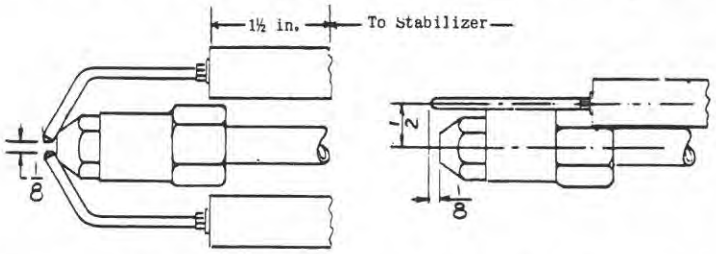
On MH Burners there is no acorn nut. Simply turn adjusting screw.

20. BURNER NOZZLES:

Oil burner spray nozzles wear out in time (the hole becomes enlarged). They should be replaced at least once a year. If you purchase a nozzle locally, make sure it is an 80° nozzle with *solid round cone spray*. Other type nozzles, such as hollow cone spray nozzle, are not satisfactory for this application.

21. SPACING OF ELECTRODES:

The electrodes should be spaced 1/8" apart. They should extend 1/8" beyond the end and 1/2" above the center of the nozzle tips as shown in drawing below.



ELECTRODE SETTING: It is important to carefully check the setting of Electrode Points before putting the Oil Burner into operation. Electrodes are carefully checked at the factory, but may be jarred out of adjustment during transportation. Unless the adjustments are as shown, poor ignition of the oil spray may result. Never permit any electrode or part thereof to be closer than 1/4" of any grounded surface, to avoid spark jumping to nearest "ground" surface.

22. AIR ADJUSTMENT:

The air supply to the combustion chamber has been factory adjusted to maintain a CO_2 reading between 8% and 10% in the flue gasses with a clean flame. The higher the efficiency, the more the condensation. This is normal.

Combustion air adjustments are to be made to give the highest CO_2 without visible smoke (unburned carbon) at the chimney. Condensate may drip out of each end of coil section. It indicates high thermal efficiency.

If you can see any smoke coming from chimney, burner is out of adjustment, (assuming the correct clean fuel is being used.

Adjust the air shutter.

Wipe clean, entire nozzle assembly, disassemble fuel nozzle, clean thoroughly and re-assemble. To remove nozzle assembly, first remove transformer, disconnect fuel line leading to nozzle, and entire nozzle assembly will come out. Oil-burner repairmen are familiar with these details.

IMPINGEMENT:

If you put it back in crooked so the oil sprays off at an angle and hits the coil before completely igniting, it will not burn in a fully atomized condition; instead it will keep wetting the coil and drip out of bottom of machine. If any oil drips, this is usually the trouble, and black smoke will rise from chimney.

If burner does not start, push the reset button.

Never turn on the burner before water comes out of the gun. *WATER MUST FLOW FIRST.*

Fuel Oil burns hotter than kerosene; gives steam pressures 15-20 psi higher. If burner smokes, find the cause and cure it.

Only one puff of smoke is permissible, when you turn it on.

Thereafter, *IT MUST BURN CLEANLY.* Check for low voltage, which gives lower blower rpm.

Check flexible coupling between burner motor and fuel pump.

Burner must have plenty of air, but not excessive air. Excess air causes noxious odors.

If fuel pressure is too low or too high, - - - *SMOKE!*

Any water, moisture or condensation in fuel oil will cause smoke; try any dry-gas additives such as used in autos, putting one or two cans in fuel tank, or use fuel oil conditioner. Any speck of dirt in tiny hole in fuel nozzle will cause flame shape distortion and *SMOKE!* For ideal fuel atomization, the fuel pump should be running at 100 psi fuel pump outlet pressure.

If you allow the fuel pump to run dry, you may have to prime it using one of the methods listed as follows:

A. Fill fuel tank full of fuel, turn burner on, and then lift handle end of machine about 8 or 9 inches to tilt it, and thus causing fuel to flow to burner and expel air.

B. Turn burner on after removing any one plug on fuel pump such as 1/4" low pressure plug or 1/8" thread high pressure plug. When fuel squirts out, immediately replace plug and burner should start up.

C. Place mouth on fuel tank opening and blow with 1/4" plug removed. This will expel the air if burner is running. Simply replace plug and proceed. Best system is to keep the fuel tank nearly full and don't run out of fuel. This entire burner is unconditionally guaranteed *at the factory* for one year against defects of material and workmanship. It must not be run dry (without fuel).

D. Turn burner switch on and off a few times to prime fuel pump and start burner.

NOTE: Every domestic oil burner repair man is familiar with this type of burner and most of them carry parts in stock for same.

23. SUNDSTRAND FUEL PUMP &/or WEBSTER FUEL PUMP, etc.

Oil fuel pumps can be repaired in your local area, through your local oil burner dealer or supply house.

24. IGNITION:

If oil burner does not fire, check transformer for spark. Use a well insulated screwdriver and arc across the two high voltage terminals. You should be able to draw a spark almost 3/4" long. If no spark, check wiring. If wiring is OK, replace transformer.

25. WATER & ELECTRICITY:

HAVE YOU HAD YOUR WATER CHECKED FOR HARDNESS? Any hospital, or City Water Dept. or any soft water salesman (softeners) will gladly check the hardness of your water. If very hard, buy a water softening machine.

A. Garden hose containing incoming cold water to the machine must be connected at all times when the machine is running. Make sure your building pipe lines can deliver to the machine as much as, or more than the GPM rating of your cleaning machine. Example: If your building supply lines deliver 2-1/2 gpm, you cannot use a 3 gpm machine, unless you install an accummulator tank for accummulating reserve water. If this is your problem, telephone factory for instructions.

USE GOOD QUALITY GARDEN HONE; 3/4" ID is ideal. 5/8" O.D. is OK. Anything less tends to starve the machine. Don't risk it.

USE #12-3 good quality extension lead cord. Light duty extension cords reduce performance. If your building voltage is low, machine will run slower, and both the steam and the power wash will be hotter. If the condition is extreme, it could make the steam too dry to clean.

PURE STEAM DOES NOT CLEAN. It is the hot water in the steam that does the cleaning. The wetter the steam, the more the cleaning. That is why POWER WASH, being 100% water, cleans better than steam, and more quickly too.

26. DETERGENTS, COMPOUNDS, ETC.

All steam cleaning chemicals sold today (practically 99% are liquid) contain some caustic materials for strength of cleaning heavy grease dirt. Those few that do not contain strong caustic elements do clean but more slowly. Caustic materials cannot be used on fine car finishes; for they will dull them. For heaviest grease dirt, use our LIQUID HD CAUSTIC material; dilute it 40-1 on placement into the machine; i.e. one part Concentrate to 40 parts water. This becomes the "MIX" in your detergent tank. This mix then enters the pump along with the water pumped; so the actual percentage of chemical in the stream coming from the gun is very small; about 1200-1 or better. You see from this; the compound must be a strong concentrate for maximum economy of chemicals.
For both steam cleaners and power washing machines, or for combination machines, LIQUID IS MORE CONVENIENT THAN POWDER. WE RECOMMEND LIQUID. IF YOU DO USE POWDER, SPECIFY OUR OWN MITTLESS # 42; it works and will not clog up your machine.

IN A PRESSURE WASHING MACHINE + + + + + + + + + + + NEVER USE A CAUSTIC DETERGENT CHEMICAL.
IN A COMBINATION STEAM CLEANER & POWER WASHER + + NEVER USE A CAUSTIC DETERGENT CHEMICAL.
SAFEST PROCEDURE IS TO USE A COMBINATION CLEANING DETERGENT CHEMICAL; such as our LIQUID AP. This is non-caustic and can be used for finest car finishes as well as heaviest grease dirt. In each of our cleaning machines, equipped with HYDRO-STIR, you can use our powdered MITTLESS #42, a fast dissolving powder, safe and very effective. Will not hurt fine finishes. There are several thousand good cleaning chemicals on the market today. Two-thirds of them are excellent products for use in our machines. Avoid the remaining third, for they can grind out pumps, clog up coils, and petrify checkvalves, into solid-state hunks of metal.

COMPOUNDS MUST HAVE, high detergency, be highly concentrated, have excellent lubricity, serve as a lubricant for check valves, water pump and other working parts; include rust inhibitors and corrosion preventatives; i.e. they must be a water treatment and conditioning system as well as a soap. They must be powerful enough so that you can dilute them for economy and still get very excellent cleaning.

QUESTION: CAN I USE A STRONG CAUSTIC STEAM CLEANING LIQUID COMPOUND IN MY HIGH PRESSURE WASHER OR IN MY COMBINATION STEAM CLEANER-PRESSURE WASHER? ? ?

ANSWER: YES, YOU MAY USE CAUSTIC STEAM CLEANING COMPOUNDS IN YOUR PRESSURE WASHER OR IN YOUR COMBINATION MACHINE; provided you spray only on heavy grease dirt on rouch machinery (where there are no fine paint finishes that could be dulled).

SAFEST PROCEDURE IS TO USE AN ALL PURPOSE LIQUID CLEANING CONCENTRATE LIKE OUR "LIQUID AP". LIQUID AP CAN BE USED IN ANY STEAM CLEANER, ANY PRESSURE WASHER OR ANY COMBINATION CLEANING MACHINE ON ANY FINE CAR FINISH OR ON THE ROUGHEST MACHINERY. IT DOES IT ALL. There are other good all-purpose materials made by others, that you can buy. As above about 2/3 of all the products offered are good. Beware of those that clog up coils, plug up machines, or are not perfectly dissolved and therefore abrasive. Beware also of those that corrode the inside working parts of cleaning machines. Safest procedure is to buy chemicals from the firms that make the machines; for you can be sure they are compatible.

FINALLY, CONSIDER CONCENTRATION. IT IS MORE ECONOMICAL TO PAY TWICE AS MUCH FOR A GOOD CONCENTRATE THAT CAN BE DILUTED 40 to 1, THAN TO PAY ONLY HALF AS MUCH FOR A WEAKER LIQUID THAT MUST BE USED FULL STRENGTH OR CAN BE DILUTED ONLY 3 - 5 to 1. Simple arithmetic!

GENERAL INSTRUCTIONS: Any wand type of cleaning machine is basically a combination of three units, a) a good coil; b) a punp; c) a burner for heating, either gas or oil.

If a steam cleaner, the more water fed into the coil, the less the steam it makes. The less water fed into the coil the hotter the steam. If steam is too wet, it may not be hot enough for good cleaning unless (as with our machines) it is especially designed for very wet high pressure steam. If steam is too dry it will not clean well. Steam is a gas. As such it propels the droplets of water and acts as a heat transfer agent.

Should, for any reason, such as the water supply being accidentally turned off while the burner is firing, or through faulty check valve operation, or worn pump, or leaky connections on the suction plumbing, or for any other reason, insufficient water gets to the coil, steam will be too dry. Other reasons would be a loose V-belt, or defective motor, etc. DRY STEAM makes excessive noise, does little or no cleaning, and burns out your hose, steam gauge and relief valve. If anything seems abnormal, turn off machine and check it. Make a gallonage test. If possible make such gallonage test at full operating pressure.

28. GALLONAGE TEST: A measured amount of solution flowing through the coil, heated by a measured amount of heat coming from an oil or gas burner, makes for good cleaning. Except for clogged coil, worn pump, or best slippage, your machine should pump the same number of gallons per minute as it did when brand new. Make GALLONAGE TEST whenever you need to check out your machine. Run cold water from cleaning gun into a 1 gallon container and time it with a watch having a sweep-second hand. Each minute contains 60 seconds. Each hour contains 60 minutes. Each hour therefore contains 3600 seconds. Having timed with your watch, the number of seconds required to fill a one-gallon container, divide 3600 by the number of seconds you have timed. This gives you the pumping rate per hour in gallons. If pumping rate is less than 3/4ths what it was originally, repair or replace the pump. If the amount of water being pumped each minute is nearly what it should be, pumping system and pump drive are OK. THIS GALLONAGE TEST IS MOST MEANINGFUL IF TAKEN UNDER RESISTANCE i.e. make this flow test with the maching running cold at its full operating pressure. If amount of water pumped is substantially less, check condition of motor, drive, V-belt, water pump; check valves; check all hose connections on suction line to water pump; also check detergent tank. If this detergent tank is empty, make sure detergent valve is closed, to prevent air being sucked into water pump fluid. Insufficient gallonage may be due to limed up coil or obstructions anywhere in the system from the pump outlet through the coil, through the cleaning hose, and through the cleaning gun. Isolate the cause by a process of elimination. Check motor speed for proper RPM. Check line voltage to the motor. Too light an extension cord may starve the motor for voltage and current. Your cleaner MUST pump a specific quantity of liquid every minute it runs.

29. GALLONAGE TEST UNDER RESISTANCE: Since good cleaning with a wand depends on a good balance between enough pumping rate, enough burner performance, and properly sized coil, the first thing we need to know is HOW THE PUMP IS WORKING.

a) Did you run corrosive acids through the pump and partially destroy its efficiency?
b) Are the falves or valve springs weak, pitted, corroded, grooved, broken or chipped?
c) Are the pistons or seals and their cylinders pumping correctly, or are they scored, grooved, worn and leaky?
d) Are the connecting rods, bearings, piston rods, eccentrics, and bearings still tight? If not in good shape, you may be losing part of the pumping stroke.

A GALLONAGE TEST UNDER RESISTANCE is the quickest way to get a report on all these conditions. This means you put some kind of valve on the end of the hose or gun and turn on the machine pumping cold water. Throttle the valve carefully till the pressure guage reads the same pressure the machine is supposed to work at normally. BE CAREFUL NOT TO EXCEED THE RATED PRESSURE BUILT INTO THE MACHINE.
Now while the machine is pumping cold water against this normal rated working pressure, take a gallonage test.

EXAMPLE: You fill a one-gallon container with water (while machine is bucking pressure), in 15 seconds.

$$\frac{\text{3600 seconds per hour}}{\text{15 seconds, test reading}} = \text{240 gallons per hour, or } 4 \text{ gallons per minute.}$$

Let us suppose the pump is supposed to pump 6 gallons per minute and your test shows it is actually pumping only 4 gpm. Pump efficiency has dropped 1/3. Time to repair or replace pump. Any pump should be repaired several times, before it needs replacement.
We repeat; the test should be made while the pump is bucking pressure.
In this example, either you or we would disassemble the pump, examine check valves, pistons, seals, and cylinders; replace worn parts, and then test-bench run the pump to check performance. When repaired, the performance should again be up to 6 GPM at full rated pressure.

30. WATER SUPPLY PRESSURE: If incoming water pressure exceeds 75 psi, reduce pressure machine by installing a reducing valve -- buy one from your local plumbing supply store, or from us. If when ordering your cleaning machine you tell us about unusually high or unusually low incoming water pressure, we can usually do something about it here before we ship your machine.
THE FLOAT VALVE IN YOUR MACHINE'S WATER TANK IS NOT INTENDED AS A POSITIVE SHUT-OFF VALVE. IT IS ONLY A WATER CONTROL VALVE, AND MAY DRIP A LITTLE. WHEN FINISHED CLEANING, TURN OFF WATER AT THE BUILDING VALVE.

GENERAL COMMENTS: *YOU MUST PUMP THE RIGHT AMOUNT OF WATER, AT THE MACHINE'S RATED PRESSURE!*
IF PUMP MOTOR PULLEY IS WORN, BELT MAY SLIP.
BELT MUST NOT BOTTOM IN MOTOR PULLEY, (replace pulley & belt to cure this)
BELT DRIVES DUE TO WEDGING ACTION ON PULLEY SIDES.
PUMP MUST MAKE FULL RPM'S. CHECK WITH TACHOMETER.
GET ALL YOUR DATA PUT TOGETHER AND TELEPHONE US IF YOU'RE STUCK (no collect calls please). We can trouble-shoot you by phone, if you give us model and serial number of machine and tell us clearly what the trouble is.

31. PAINT DISCOLORATION: OUR PAINT IS SPECIAL FOR THIS APPLICATION. IT IS FORMULATED FOR QUICK DRYING, HIGH GLOSS, AND LONG LIFE. In the beginning, till it cures from heat, it will turn brown each time you use the machine. On cooling it turns yellow again. After a time it will darken permanently showing it has cured and heat bonded to metal, for protection against corrosion. This is normal. It is a very good paint for this purpose.

REVIEW: STEAM CLEANING MACHINES (STEAM CYCLES)

WHAT TO DO IF:

1. IF STEAM CLEANER OVERHEATS, (AND STEAM PRESSURE TOO HIGH) (OR TOO DRY) check these;
   a) Insufficient water pumped for amount of fire (heat input).
   b) Suction leaks in plumbing, valves, fittings, etc. Snug up packing nut on detergent valve, and replace core in air tank valve.
   c) Empty Soap Tank, admitting air to pump when soap valve is left open. On Kleanline machines, has detergent hose line been left open to air so it draws air into pump instead of water. Remember the pump should receive a full charge of liquid on each pump stroke. Part liquid and part air cause many troubles.
   d) Worn pump, working at partial capacity.
   e) Dirt under check valves preventing tight opening and closing.
   f) Aeration, air bubbles entering water tank (water splashing near bottom suction hose.
   g) Wrong pulley sizes resulting in insufficient water (make gallonage test).
   h) Burner set too high, too much fuel pressure, fuel nozzle(s) too large, etc.
   i) Slipping or worn V-belt drive, causing reduced pumping rate.

2. IF STEAM CLEANER DOES NOT BUILD UP PRESSURE, check these;
   a) Firing rate too low, worn out fuel pump, undersized fuel nozzle.
   b) Burner requires adjustment (see burner sections 19-24 and also supplement included).
   c) Excessive soot on coil (use our SOOT CHASER) (use one container per tankful).
   d) Excessive lime build-up inside coil acting as a heat insulator (see section #32).
   e) Excessive pumping rate, too much liquid entering coil.

3. IF MACHINE HAS VISIBLE SMOKE FROM CHIMNEY STACK, (burning dirty-smoke) check these;
   a) Fuel nozzles worn or oversize (replace with new fuel nozzles once a year).
   b) Fuel pump pressure too high (set fuel pump pressure with gauge, 80 psi to 130 psi OK).
   c) Insufficient air, burner shutters closed too much; open them. If still more air is needed, remover another snap-ring from flame retention disc (ask us).
   d) Flames impinges (raw fuel hitting cold coil surfaces; burner misaligned). Slide combustion assembly forward or back in slot on side of burner housing. If burner is sitting cocked on machine, shim it with flat washers; so fireball aims straight down the centerline of the coil.

4. IF MACHINE BURNS CLEAN BUT CHIMNEY ODOR OFFENDS: (producing nitric oxide fumes)
   Reduce air input to combustion chamber - BUT DO NOT LET MACHINE SMOKE.
   REMEMBER: tolerate no visible smoke. Get adjustment right, then use SOOT CHASER.
   THERE IS ONLY ONE BEST ADJUSTMENT OF THE AIR-FUEL RATIO, WHERE THERE IS NO SMOKE OFFENSIVE ODOR THAT RESULTS FROM EXCESS AIR.

5. IF BURNER DOES NOT LIGHT (oil burners)
   a) Make sure there is fuel in fuel tank. Sometimes water or detergent is accidentally put in fuel tank.
   b) Use some dry-gas in fuel tank. When finished using machine, refill fuel tank to keep out condensate. Do not dump water out of water pail, fill with fuel and pour into fuel tank; for it will surely put a little water into the fuel. This will quickly rust and stop the fuel pump, reduce fuel pressure, and burner quits.
   c) Check transformer for spark (arc it with a screwdriver).
   d) Check for plugged fuel nozzle(s); plugged fuel filter, and/or plugged screen inside of fuel pump. Keep them all clean.
   e) Check electrode gap; check for cracked porcelains, replace burner switch, check for faulty or frayed wiring in burner compartment, check flexible coupling for wear.
   f) Did you bump burner motor end-plate hard, bending it and misaligning the bearing?

REV. 8-5-77

THE PUMP ON MY MACHINE -- WHEN IS IT WORN OUT -- WHEN SHALL I REPAIR IT ???

ANSWERS: *Our high pressure pumps have EITHER CUPS OR SEALS. EACH CYLINDER HAS TWO CHECK VALVES, ONE INLET AND ONE OUTLET VALVE.*

REDUCED VOLUME AND PRESSURE result from two main sources;

a) WEAR of piston and cylinder assemblies, or wear of valves, valve seats, or both.
b) Dirt or foreign particles under check valves, weak valve springs, etc.

TO CHECK PUMP, MAKE TWO GALLONAGE TESTS: #1 is FREE FLOW TEST; #2 is FULL PRESSURE TEST.

#1: FREE FLOW TEST: Remove gun from hose, start pump, then clock the number of seconds it takes to fill a one-gallon pail, with no resistance or back pressure (no gauge pressure).

#2: FULL PRESSURE TEST: Connect pressure (resistance) tester, shown on reverse side, to hose; Pump cold water and turn tester up to whatever gauge pressure reading your machine was built for. Now, fill a one-gallon pail again and count the number of seconds. If your machine is rated at 4 gpm it should fill the pail in 15 seconds; if 3 gpm, pail should fill in 20 seconds, etc. If it is a 500 psi machine, full pressure test should be at 500 psi, etc. If an 800 psi machine, your pressure test should be at 800 psi.

Any pressure-test readings showing pumping rate less than what the machine was built for shows wear on pump; or belt slippage, low voltage, or any of many other reasons; see MANUAL. *If check valves are loaded with dirt and only partially working, you may get 3 gpm or 2 gpm or even 1 gpm out of a 4 gpm pump. Find out WHY. Then make repairs. Since the firing rate of your power washer is constant, your machine may overheat; may even make steam.*

TO DETERMINE THE GALLONS PER HOUR, divide 3600 (seconds per hour), by the number of seconds you clock in your gallonage test. *EXAMPLE:* $\frac{3600 \text{ seconds}}{15 \text{ seconds}} = 240 \text{ GPH} = 4 \text{ gpm}$

for a 4 gpm pump . . .

Any resistance device consisting of a high pressure relief valve and a high pressure gauge to create back-pressure equal to the rating designed into the machine originally will give the desired readings. The idea is to make the pump "buck" the rated pressure, and still pump the correct amount of water - at that high pressure. You then know the valves are opening and closing correctly; full opening, and tight closing. If test #1 gives the right gallonage, and test #2 is way under; the valves need repairing or replacing. The piston assemblies may be leaking (blowby).

If test #2 shows a slightly reduced pumping rate, but not bad enough to warrant a pump rebuilding job yet, use the next smaller sized spray nozzle. That will increase your gauge pressure. Pressure is a function of resistance (the smaller the spray tip hole, the higher the pressure). Do not overload pump by using too small a nozzle. Do not exceed machine's rated pressure.

If your pump runs at motor speed and you used it hard for 6 months to 1 1/2 years you probably need a cup kit to renew its efficiency. If your high speed pump (Hypro) is used only occasionally, you can get by for 2-4 years before installing a cup kit. If your pump is a slow-speed type or with an oil-filled crankcase, you can use it hard for 2-4 years before needing cups, cup kits, piston assemblies, crank parts, valves, etc.

If you use unfiltered pond water with grit and abrasives in it, or it is very hard, you will face frequent pump rebuilding. If you disassemble your pump, examine all check valves. Look for dirt, rust, scoring, grooving or pitting. If not perfect, replace them. Same applies to cylinder sleeves, piston assemblies, etc. If cylinders show scoring or scratches, use very fine emery cloth to clean them.

CONCLUSION: YOUR PUMP SHOULD PUT OUT RATED GALLONAGE, BOTH UNDER FREE FLOW: AND UNDER FULL PRESSURE TEST. If your gallonage output is insufficient, make repairs.

MEL SEARS & COMPANY, INC.
Holland Patent, NY 13354

March 1, 1975

ABOUT YOUR PRESSURE GAUGE

PRESSURE GAUGES SHOULD GIVE STEADY PRESSURE READINGS.

IF A PRESSURE GAUGE VIBRATES AND QUIVERS WITH EACH STROKE OF THE PUMP, IT WILL NOT LAST LONG. EARLY FAILURE IS A CERTAINTY.

VARIOUS GAUGE DAMPING DEVICES HAVE BEEN AROUND FOR A LONG TIME AND DO A NECESSARY JOB. I.E. THEY STEADY THE GAUGE NEEDLE SO IT DOES NOT DANCE AROUND.

ONE GOOD TYPE, DESPITE ITS HIGH COST IS THE GLYCERN FILLED GAUGE. GLYCERIN IS SO SLUGGISH THROUGH THE TINY ORIFICE IN THE GAUGE THAT IT EFFECTIVELY DAMPENS NEEDLE VIBRATION. SUCH GAUGES ARE GOOD, ALSO EXPENSIVE. WE SELL THEM. WE DO STOCK THEM.

ANOTHER POPULAR "STEADY-READING" GAUGE IS THE DIAPHRAGM DAMPER TYPE. THIS TOO IS EXPENSIVE FOR IT INCLUDES A DIAPHRAGM MECHANISM THAT REMOVES MOST OF THE VIBRATION INHERENT IN PISTON PUMPS. WE CAN FURNISH THEM ON SPECIAL ORDER (ALLOW SIX WEEKS LEAD TIME).

OUR RESTRICTOR GAUGE, AS DEVELOPED BY MEL SEARS & CO., INC. WORKS AS WELL AS ANY OF THE OTHER "STEADY-READING" GAUGES; IT IS SO SIMPLE IT IS HARD TO BELIEVE, AND IT IS NOT EXPENSIVE.

IF YOU ORDER A GAUGE FOR ANY MACHINE DEVELOPING 500 PSI to 1000 PSI, WE WILL SHIP YOU A STANDARD 1500 PSI PRESSURE GAUGE WHICH, ITSELF, HAS A BRASS RESTRICTOR BUILT INTO IT. TO THIS GAUGE WE ADD OUR OWN TCA CAVITY TYPE RESTRICTOR. THIS IS A BRASS BODY MACHINED SO IT IS AN EFFECTIVE RESTRICTOR BY ITSELF. HOWEVER, EVEN WITH THESE TWO RESTRICTORS WORKING TOGETHER, YOU STILL GET GAUGE PULSATION THAT MUST BE CONTROLLED. THE CONTROL MEDIUM, BELIEVE IT OR NOT, IS ORDINARY PAPER TOWELLING.

AT THE FACTORY, WE USE SPECIAL PAPER TOWELS WHICH HAVE GOOD BODY. WE TEAR UP SMALL PIECES OF THIS PAPER TOWEL MATERIAL AND STUFF THEM HARD INTO THE CAVITY IN THE TCA RESTRICTOR. WHEN JUST THE RIGHT AMOUNT OF THIS PAPER TOWELLING HAS BEEN STUFFED INTO THE TCA THE NEEDLE OF THE GAUGE WILL SLOWLY COME UP TO FULL PRESSURE. WHEN YOU TURN OFF THE MACHINE, THE NEEDLE GOES BACK DOWN TO ZERO GAUGE READING, WITH NO VIBRATION WHATEVER.

STUFF THE TCA TIGHTLY, THEN REPLACE THE GAUGE AND TURN ON THE MACHINE. IF YOU STILL HAVE VIBRATION, REMOVE GAUGE AND STUFF MORE PAPER IN CAVITY. TEST AGAIN FOR VIBRATION. CONTINUE DOING THIS SEVERAL TIMES, TILL NO NEEDLE VIBRATION EXISTS; AND NEEDLE RISES SMOOTHLY AND EVENLY. IF YOU PACK TOO MUCH PAPER INTO CAVITY IN TCA, THE GAUGE NEEDLE WILL NOT MOVE AT ALL. SIMPLY REMOVE A LITTLE OF YOUR PAPER.

WITH 5 or 10 MINUTES OF PATIENT EFFORT YOU WILL PACK JUST ENOUGH PAPER INTO GAUGE SO THE NEEDLE GOES UP AND DOWN WITH NO PULSATION, AND YOUR GAUGE WILL LAST A LONG TIME. UNLESS THE WATER IS UNUSUALLY DIRTY AND LOADED WITH SILT, THE PAPER TECHNIQUE IS GOOD INDEFINITELY WITHOUT FURTHER ATTENTION. IF THE GAUGE STOPS READING, REMOVE A LITTLE PAPER (rarely ever necessary).

SUMMARY: IF YOU ORDER A GAUGE FOR A HIGH PRESSURE MACHINE, WE WILL SHIP A GAUGE AND A TCA RESTRICTOR (WITHOUT THE PAPER IN SAME). ALSO INCLUDED IN THE SHIPMENT WILL BE ENOUGH OF THIS SPECIAL PAPER TOWELLING, TO TAKE CARE OF THIS ASSEMBLY.

IF YOU DO NOT WISH US TO SHIP THE TCA RESTRICTOR WITH THE GAUGE, PLEASE SO SPECIFY AT TIME OF ORDERING.

IF YOU HAVE ANY QUESTIONS; CONTACT FACTORY

MEL SEARS AND COMPANY
Holland Patent, N.Y. 13354

YOUR COIL + + + + how to take care of it

de-liming your coil :::: acid treatment

YOUR COIL IS A LONG PIPE,

from 110 ft. long on up to 450 ft. long in larger machines. Each 21 feet there is a fusion joint, so perfectly made by men of long years of welding experience that a) it is stronger than the parent tube alloy itself; b) the inner wall has no rib or protrusions to catch dirt or lime build-up; and c) the joint is the longest lasting portion of your coil. Tests repeatedly prove 100% weld metal penetration.

If you allow the coil to freeze it will crack. If you overheat it, even red hot, you will not hurt it. If you run acids through it, you will, in time, eat pin holes in it. Liquid chlorine in excessive amounts, and certain other chemicals sometimes found in inferior detergents, run through it, will over the years, produce pin holes. If you mount your machine on a utility trailer without springs, then drive at 80 mph, you may tear it apart. One did!

IF YOU RUN VERY HARD WATER THROUGH IT, WATER CONTAINING A HIGH PERCENTAGE OF CALCIUM CHLORIDE (lime) you will restrict flow; either in part, or in full.
IF YOUR WATER IS SOFT, or you use a water softening machine, you should get 10-20 years of useful life from your coil; with no liming problems and no need for acid deliming, anytime.
IF YOUR WATER IS average soft-hard, about a PH7, you should delime (acid treatment) about once each six months.
IF YOUR WATER IS very hard, about a PH10--PH13, watch coil output flow very closely; for each time you run your machine you are depositing more lime on coil insides. As the inside diameter of the coil gets smaller and smaller due to lime buildup, the pump has to work much harder to push the liquid through to the cleaning hose and gun.

By the time your coil is 3/4 plugged up, the motor is working so hard, either your V-belt drive will begin slipping or you will pop circuit breakers or blow out fuses (or both). In this condition, tho your pump and motor are working harder than they should, and with much strain on your pulleys and belt drive, the cleaning performance will be poor. If on steam, you will have poor heating for the lime will insulate against heat transfer; if on POWER WASH you will have low spray pressure due to reduced volume reaching gun nozzle. By having two pressure gauges, one on coil inlet and another on coil outlet, and reading the difference in pressures, you can tell when it is time to acid clean to remove lime. Our coils are designed for an approximate 15 psi pressure drop (from coil inlet to coil outlet). If your readings differ by, let us say, 50 psi, do acid clean coil.

IF YOU WAIT TILL ALL FLOW STOPS (100% plugged up), before deliming, chances are you have WAITED TOO LONG; it is too late to save THAT coil. Buy a new coil.

HOW SHOULD DELIMING (cleaning coils with ACID be done ?
Years ago, with simpler pumps, you could pour one or two gallons of our COIL CLEANING ACID into the water tank, put the gun into same tank, turn on machine (COLD) and let it run for a couple of hours; then drain and rinse out. That was YESTERYEAR when things were simpler. Do that today with more expensive, much higher pressure pumps and you will cause pump damage. One user we know, with very hard water, dumped one gallon of coil cleaning acid into his expensive machine every sixty days, to keep coil clean. Result: all the dirt that came off the coil inner surfaces recirculated around and through his pump; *in a two year period he replaced five pumps, value $367.50 per pump.* The dirt that is removed from the coil insides must not recirculate and act as GRINDING COMPOUND running through the pump. Moreover, the acid causes the pump insides to deteriorate!

"CORRECT METHOD TO DELIME" BUY OR RENT ONE OF OUR COIL DELIMING MACHINES (ask our representative or telephone us) (no collect calls, please), and connect it to the coil inlet and coil outlet. This will pump and circulate acid ONLY THRU THE COIL. Pump the acid BACKWARD ONLY, to the normal flow. Our filter screen will trap all the dirt and solids. If you cannot rent or buy a coil deliming machine, take your cleaner to your local repairer who has one, and let him do it for you. *REMEMBER: CIRCULATE ACID IN REVERSE ONLY THRU YOUR COIL!*

MEL SEARS & COMPANY, INC.
Holland Patent, NY 13354
Ph: 315-865-8101

12/1/77

SIMPLIFIED ---- CONDENSED ---- INSTRUCTIONS

If your cleaning machine does not work perfectly, check these things . . . . . .

1. MAKE A GALLONAGE TEST: There are 60 seconds per minute and 60 minutes per hour - 3600 seconds per hour. TIME THE NUMBER OF SECONDS REQUIRED TO FILL A 1 - gallon CONTAINER WITH COLD WATER PUMPED THRU THE MACHINE AND DIVIDE 3600 BY THAT NUMBER OF SECONDS. This gives the GPH (gallons per hour) pumped by machine. If a steam cleaner, you should be able to pump more than 2/3 the original pumping rate of machine when new; if a pressure washer or combination machine, rate must be 90% of new machine pumping rate, or more. If less, rebuild pump, check bypass circuits, pressure regulators, unloaders, etc., replace worn cleaning nozzles.

2. FOR STEAM CLEANERS: With cold water being pumped, place thumb on gun tip and press hard. If pump will pump 35-40 PSI and water pushes thumb away, check valves are probably O.K. If you can prevent water from coming out of gun, and gauge pressure does not build up, one or more check valves are not working. Clean, inspect; replace as needed.

3. HOW TO TEST PERFORMANCE OF HIGH PRESSURE PUMPS: Connect a resistance tester (of any kind) to the cleaning hose. Even a valve, carefully throttled to create a back pressure equal to the pump rating will do. Adjust so that pressure gauge reads whatever pressure the machine is built for. At this pressure, make a GALLONAGE TEST, as in paragraph one above, count the number of seconds to fill a one gallon pail. Divide 3600 by that number. This is the GPH (gallons per hour) being produced by the pump. If it is less than 80% of what the machine was built for, rebuild or replace pump.

4. WHEN SOAP TANK IS EMPTY, CLOSE SOAP VALVE to keep pump from drawing in air at each stroke. If pump sucks in some air and some water or solution with each stroke, it may overheat machine due to insufficient water entering coil. If a pressure washer, it will cause erratic pressure at gun spray tip.

5. TO AVOID DILUTION AND MIXING OF WATER IN WATER TANK & SOAP TANK: shut off soap valve after you finish using soap on your cleaning job. Shut off water supply at building each time you finish cleaning. The float valve is not really a shut off valve. It is a water level control valve only.

6. AVOID: slipping V-belt drive; avoid running pumps and motors without lubrication; avoid starving pump for water by using good quality garden hose; avoid starving electricals for current by using a #12-3 extension cord or heavier; avoid plugging machine into outlets with undersized fusing or circuit breakers (use 30 amp); avoid all suction leaks of air into pump from empty soap tank or loose suction line fittings; avoid use of diesel fuel (DO use kerosene or household fuel oil).

7. If a pressure washer or combination, developing 500 PSI or more, replace brass cleaning nozzles three or four times a year. As pump becomes older and begins to wear, reduce nozzle size slightly in order to increase cleaning pressure. Stainless nozzles last 3-4 times longer than brass nozzles.

8. All coils accumulate lime on the inside coil surfaces; also dirt, sediment and foreign matter. If coil is not too far gone, CHEMSEARS product #1655-C Crystalline Coil Cleaner is the easiest coil cleaning material to use. Mix a 2# jar in a pail of water, then pour into water tank in machine and let it pump thru for a half hour to two hours as necessary. Place a cloth bag filter on the end of the cleaning gun to filter out the dirt and then let the pumped solution get back into the water tank for recirculation. Occasionally turn

on the burner for a short time to keep the solution luke warm. Do not overheat. When coil is clean, flush thoroughly.

If coil is badly plugged, best way to delime is to pump our coil cleaning acid (dilute acids thru it in REVERSE. Pumping acid thru coil in direction of normal flow, if coil is badly plugged, tends to completely plug coil so that it has to be discarded. Pumping acid thru coil in opposite direction of normal flow will usually clean out the dirt and lime. Use an external bronze pump, connect it to coil outlet and let acid flow backwards thru coil for one or two hours to clean thoroughly OR remove coil from your machine and ship to us for acid deliming. If your coil is badly plugged up and you need to reverse clean it as above use CHEMSEARS Liquid 980-6X1 Liquid Coil Cleaner or any similar competitive product of equal quality. This is a much stronger treatment and must be done with extreme caution as acid, carelessly handled can be dangerous.

If further information is needed, please telephone factory or contact our representative who will gladly furnish information.

9. If a Hypro pump apply one shot of lithium grease (to fitting) every 30 running hours. If a crankcase type pump, change oil every three months. Check monthly - add if necessary. Mercury, Cat, Giant and Myers take #40 non detergent oil; Phantom requires #90 gear oil.

MEL SEARS & COMPANY INC.

HOLLAND PATENT, NY 13354

865-8101

BULLETIN ON THE SUBJECT OF FLOAT VALVES

The purpose of a float valve is to maintain a constant level within a tank. The valve has a hole in it called an orifice and a rubber or composition washer to act as the seat. Occasionally it is a teflon washer. Very rarely is it a metal to metal seat. Most of the time it is a composition seal pressing against a brass seat. When testing the machine before shipment we put the correct float valve on them for average city water pressures which are from 50 to 75 psi. We frequently drill the orifice opening oversize to make sure that within this city water pressure range we develop enough flow through the valve.

If there is low water pressure like 20 or 30 psi, the float valve will cause trouble because the flow will be insufficient for that size orific For such lower water pressures the orifice needs to be substantially larger. At the time of shipment of the machine we can furnish a larger orifice to compensate for the lower water pressures. On the other hand if the pressure is very high, like for example 100 psi, then the orifice opening is too large. It will not seat properly. In these situations, when user has finished cleaning, the float valve will not cut-off the water supply completely and the machine may over-flow. The problem is matching the orifice size in the float valve to the approximate water pressure.

In the Providence, Rhode Island area, for example, water pressures are much higher than average. Result, complaints that float valves leak. One chap replaced three float valves, each time replacing with the same, thinking the float valve was defective. This was not the case. It was simply excessive water pressure which had to be reduced by installing a water pressure regulator.

Where water pressure is higher than usual, we furnish a valve with a smaller orifice, if we know in advance. Once the machine is in the users' hands, if he will install a water pressure regulator at the garden hose connection and set it to deliver water at about 60 pounds pressure, that should end that problem.

In one unusual case a coal strip mine operation had to truck water to the top of a mountain and pump it into a tank about ten feet above the machine. There was no water pressure to push the water through the float valve. Instead of a standard 3/4" float valve we furnished a two inch valve which physically was 7 times larger and weighed approximately 10 times more. It worked beautifully. The orifice was many times larger. Therefore the lower the water pressure the larger the orifice needs to be. The higher the water pressure the smaller the orifice needs to be.

In the field the cure is to install a relatively inexpensive water pressure regulator to regulate the high water pressure and cut it down.

Finally; the float valve should be used only during cleaning. When cleaning is finished, turn off the water at the building supply valve.

MEL SEARS & CO., INC.

Holland Patent, NY 13354

315-865-8101

9-29-77

WHAT DOES ONE DO WHEN A STEAM CLEANER RUNS TOO HOT?

1. Check the V-belt tension. Our V-belt drives have automatic tensioning to maintain V-belt tension. As the belt stretches the spring automatically takes up this slack.

2. Make sure V-belt and pulleys are not so worn that belt is "bottoming" ingroove of drive pulley. If belt is bottoming, replace belt and maybe replace motor pulley. Slippage means less water pumped into coil, and overheating results.

3. If air is getting into pump, pumping efficiency is lessened; less water gets to coil and machine runs too hot. When soap tank is empty turn soap valve closed; else air will enter pump with each stroke of piston. Also snug up packing nut under TEE handle on soap valve. If it has worked loose, air may seep into pump with each piston stroke.

4. The air valve which is used to blow out machine in winter time, will occasionally have a defective core (same as on your car tires). If defective, it will let air be drawn into pump with every stroke. Check and replace.

5. Any suction leak in plumbing will allow air to enter pump instead of a full charge of water or solution. Correct all suction leaks, tighten worm clamps on suction plumbing.

6. Fuel pump pressure set too high, producing too large a flame inside of coil. On the fuel pump there is one acorn nut. Remove this ACORN nut, and turn the screw counter-clockwise. Each turn will drop steam pressure 20-30 psi. If machine still runs too hot, try a smaller fuel nozzle. Make sure it is an 80° nozzle, solid cone nozzle.

7. Solution pump may be worn out. If a Craftmaster type pump with a large packing nut, snug up the nut till pump stops dripping. If all adjustment has been used, REPACK THE PUMP. Standard quality packing is graphited asbestos high temperature packing. Premium quality is TEFLON packing. It costs more, and does a superior sealing job. If a packless pump like Hypro or Delavan, it may be worn out, with valves not sealing, and so less water is entering the coil. MAKE A GALLONAGE TEST. Learn what gallonage the pump was rated at when new. IT MUST produce at least 2/3 of its new rating; or needs repairs.

8. Make a thumb test. With cold water being pumped, hold thumb on end of gun. If machine can build up more than 35 PSI and pushes thumb away, valves are OK; if thumb can prevent water from coming out, replace valves.

9. Never waste time with a cheap "drug store" garden hose that kinks and starves pump for water. Use a high quality hose with a minimum 5/8" ID or 3/4" ID. Check for plugged or clogged suction lines to pump.

10. Inside of water tank is a pipe cap with seven or more little holes in it. See if those holes are partially plugged.

11. Use kerosene for fuel, Household fuel oil is hotter; and diesel oil which should never be used, runs very much hotter and smokier. Diesel oil might run the machine into overheat, Always feed cold water into machine. NEVER feed hot water into your machine.

12. Insufficient air from burner might cause overheating and smoky combustion. Adjust air shutter on burner for clean burning, using more air, for cleaner combustion and cooler running.

(Over please)

MODEL EH, EHA, MH

BURNER ADJUSTMENT

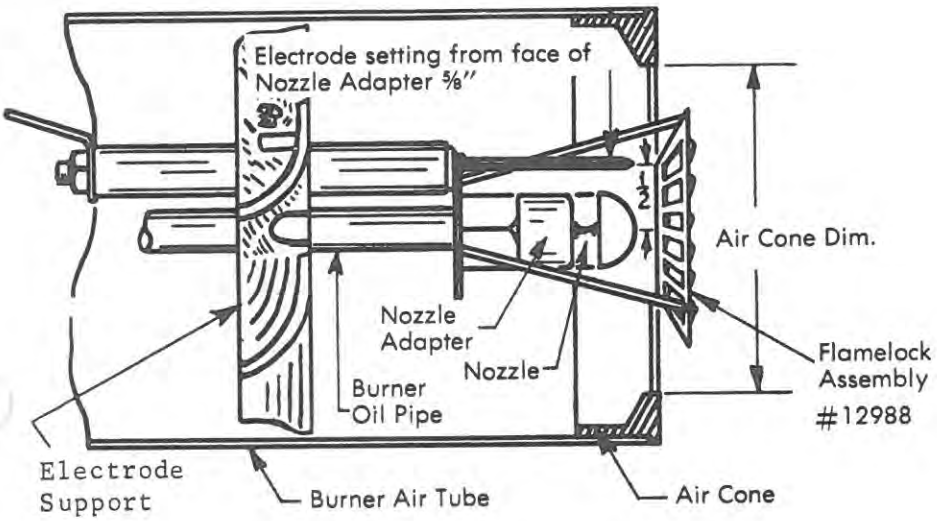
Removing gun assembly. Disconnect the oil line at the fan housing and remove the lock nut on the oil pipe fitting. Remove the transformer hold-down screw in the upper right-hand corner and swing the transformer on the hinge. Gun assembly can now be removed through this opening.

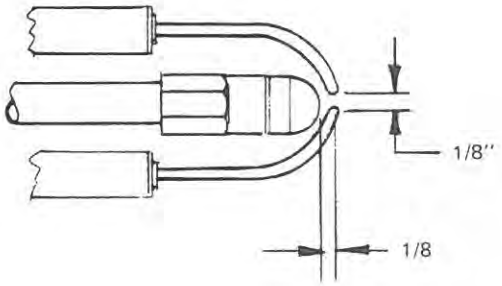
BURNER NOZZLE

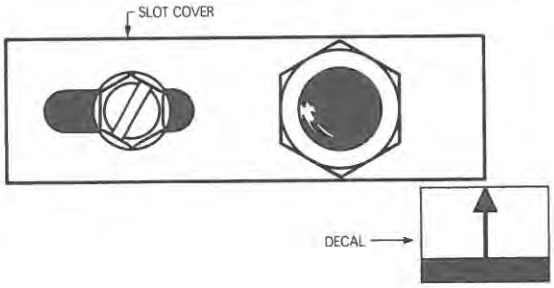
Check to see that the nozzle conforms to the installation requirement. Install the nozzle in the nozzle adapter with a nozzle wrench.

Nozzle Adapter: This burner is equipped with a dribble-proof nozzle adapter which will accomplish intended results only when installed with the stamped word "TOP" in the correct position.

Spacing of Electrodes: The electrodes should be spaced 1/8 inch apart. They should extend 1/8 inch beyond the end of the nozzle and 1/2 inch above the center of the nozzle as shown in drawing below.







NOTE: Gun Assembly is pre-set at factory. End of slot cover is set with arrow on decal as shown.

On reinstalling gun assembly, slot cover to be set as shown.

Gun Assembly Adjustment: The gun assembly can be adjusted in the slot in side of fan housing by loosening the screw holding the slot cover in position and the oil pipe fitting lock nut. The approximate flamelock location for conversion burners should be flush with the face of the air cone for the MH burner and ¼ inch ahead for the EH and EHA burners. See enclosed chart for special setting to be used on packaged heating units.

Air Adjustment: The air intake is located on the left side of the blower housing and consists of two interlocking bands. To adjust, loosen the screw in outer band and position the band by rotating to the desired opening. Sufficient air should be introduced into the fire until a Number 1 or trace of smoke is obtained. Retighten the screw after adjustment to assure a permanent adjustment.

(Check with smoke tester).

FUEL UNIT: See separate instruction sheet packed with burner.

EH
EHA
MH

MODEL ER, ERA

BURNER ADJUSTMENT

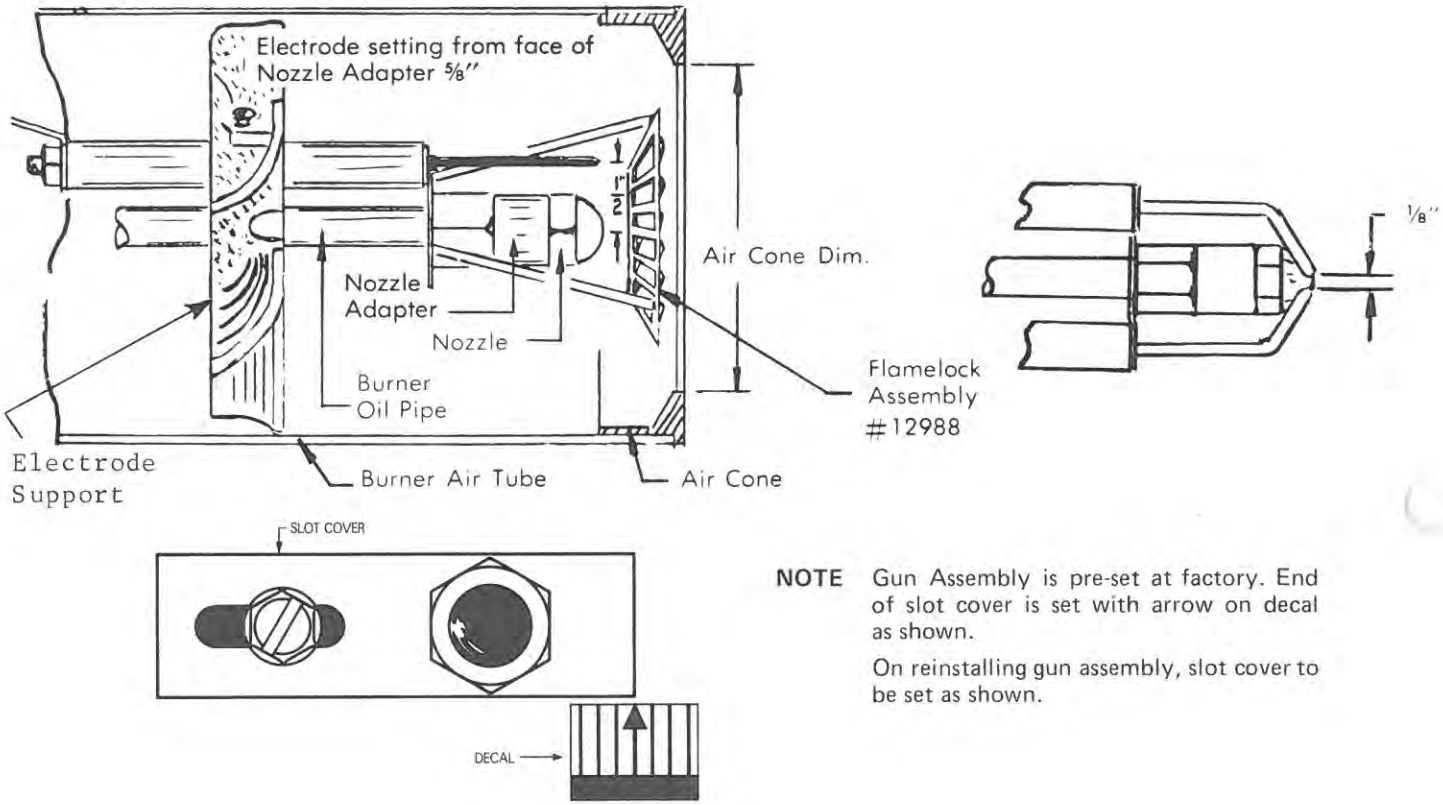
Removing Gun Assembly. Disconnect the oil line at the fan housing and remove lock nut on copper tube fitting. Remove transformer hold-down screw in upper right-hand corner and swing transformer to left on hinge. Gun Assembly can now be removed through this opening.

BURNER NOZZLE

Check nozzle size as to conformance to installation requirements. Install nozzle by screwing into hexagon adapter.

Nozzle Adapter: This burner is equipped with a dribble-proof nozzle adapter which will accomplish intended results only when installed with the stamped word "TOP" in the correct position.

Spacing of Electrodes: The electrodes should be spaced 1/8 inch apart. They should extend 1/8 inch beyond the end and 1/2 inch above the center of the nozzle tip as shown in drawing below.



NOTE Gun Assembly is pre-set at factory. End of slot cover is set with arrow on decal as shown.

On reinstalling gun assembly, slot cover to be set as shown.

Gun Assembly Adjustment: The gun assembly can be adjusted in the slot in side of fan housing by loosening screw holding slot cover in position. Flamelock should ordinarily be located 1/8 inch behind the front face of the air cone for conversion burners. See enclosed chart for special setting to be used on packaged heating units.

Air Adjustment: The air intake is located on the left side of the blower housing and consists of two interlocking bands. To adjust, loosen screw in outer band and position band by rotating to the desired opening. Retighten screw after adjustment to assure permanent adjustment.

Sufficient air should be introduced into the fire until a Number 1 or trace of smoke is obtained. (Check with smoke tester). The screws should then be locked in position.

FUEL UNIT: See separate instruction sheet packed with burner.

DIRECTIONS FOR THE OPERATION AND CARE OF

OIL BURNER

Read Instructions Carefully and Hang This Card Near Burner for Future Reference

(A) TO START BURNER:

1. Check for oil in the storage tank.
2. Fuses in the main switch must be good.
3. Have oil burner switch open.
4. Set room thermostat about 10 degrees higher than room temperature to make sure the thermostat contacts are made. Limit control must be set high enough to make contact also.
5. Oil valve at the tank should be open and the check valve in return line properly installed so oil can return to tank.
6. Be sure nozzle of proper size for heater is in the adapter and tightly screwed down, and that the electrodes are properly spaced (See Manual). With heating plant door open, close the burner switch; and if wiring is properly done and all controls properly installed and adjusted, the burner should start. If not, check primary relay first to be sure it is properly set; and if burner does not start, recheck wiring and all controls thoroughly.
7. If burner is installed with a single oil line, the fuel unit will have to be purged of the entrapped air in the oil lines and fuel unit before the oil will flow to the nozzle (See fuel unit instruction sheet for this operation). If a return line is used, purging will not be necessary, although this will speed the starting of the burner if done. If this is done, the pump should pick up its oil in less than a minute (which is the setting for the lockout switch in the primary control). If ignition does not take place during this time, check the nozzle and electrodes.

STARTING BURNER AFTER IGNITION FAILURE.

1. Do not attempt to restart burner when excess oil has accumulated, when heating unit is full of vapors, or when the combustion chamber is very hot.
2. Press reset button on primary control and burner should start. Do not attempt this more than twice. If burner fails to operate call serviceman.

(B) FUEL OIL SPECIFICATIONS:

1. This burner is approved for oil not heavier than No. 2 The commercial standards for this oil are: Flash 110° minimum or legal; Maximum 230°F; Pour point 20°F; Water and sediment not more than 0.1%; Distillation temperature 600°F minimum and 675°F maximum at 90% of recovery. Viscosity at 100°F Saybolt Universal of 40 seconds maximum.

DO NOT USE GASOLINE, CRANKCASE OIL, OR ANY OIL CONTAINING GASOLINE.

(C) LUBRICATION:

1. The two oil cups on the oil burner motor should be lubricated every three months with a few drops of good grade light motor oil, No. 10 or 20 S.A.E.

(D) AT THE END OF THE HEATING SEASON:

1. Shut off electric current to burner at oil burner switch.
2. If oil strainer has not been cleaned recently, it should be removed and cleaned (consult instructions card furnished with fuel unit).
3. Oil storage tank should be kept filled to prevent water vapor from collecting. It is suggested the valve in the suction line be closed and oil burner switch opened. Oil storage tank should be cleaned every 2 or 3 years to remove any sediment or water that has collected in the tank. Your Fuel Oil Dealer has the equipment to do this.

(E) AT THE START OF THE HEATING SEASON:

1. It is advisable to have the Dealer inspect and service your burner for the coming heating season.
2. Heating plant, smoke pipe and chimney should be cleaned and checked for repairs.
3. Lubricate burner as directed under "C" above.
4. It is advisable to have the entire electrical system inspected before putting the burner into operation after it has been standing idle for the summer months. This should include primary relay, limit control, thermostat (clean dust from contact points), and check the electrodes for carbon and cracks in insulators, and corrosion on all terminals of the electrodes and transformer.

(F) EMERGENCY STOPS:

1. CUT OFF ALL CURRENT TO THE BURNER BY MOVING LEVER ON THE OIL BURNER ELECTRIC SWITCH TO THE "OFF" POSITION.

CAUTION

1. Check the gauge in oil storage tank periodically. Keep tank filled.
2. Don't attempt to burn garbage or refuse in your heating unit.
3. Don't fill storage tank while burner is operating.
4. Don't start burner if there is oil or vapor in the heating unit.
5. Don't attempt to burn crankcase drainings or crude oil.
6. DON'T TAMPER WITH BURNER OR CONTROLS – CALL YOUR SERVICEMAN.

DEALER

Day Phone .....

Night Phone.....

Burner Serial No .....

Date installed .....

BE SURE TO GIVE US SERIAL NUMBER OF BURNER WHEN ORDERING REPAIR PARTS

INSTALLATION SUNDSTRAND INFORMATION

FOR A-7000 SINGLE STAGE AND B-8000 TWO STAGE FUEL UNITS

MODELS A1 & B1 FOR 1725 RPM, BLACK LABEL

MODELS A2 & B2 FOR 3450 RPM, WHITE LABEL

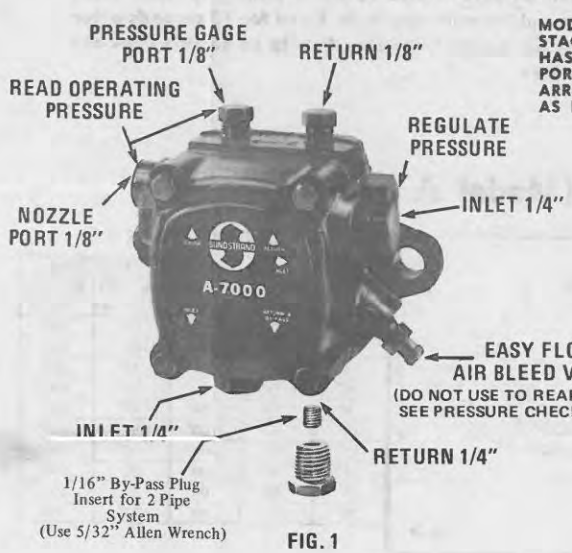


FIG. 1

MODEL B TWO STAGE FUEL UNIT HAS SAME PORTING ARRANGEMENT AS MODEL A

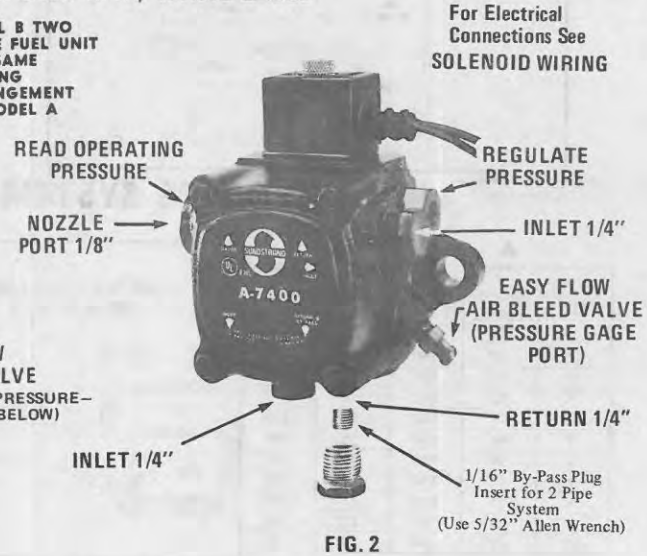


FIG. 2

ONE-PIPE SYSTEM

Connect inlet line to pump inlet. Start burner. Arrange primary burner control for continuous operation during purging. Open easy flow bleed valve 1 turn CCW. Bleed unit until all air bubbles disappear – HURRIED BLEEDING WILL IMPAIR EFFICIENT OPERATION OF UNIT. Tighten easy flow bleed valve securely. (Fig. 4)

TWO-PIPE SYSTEM

Remove 1/16" by pass plug from plastic bag attached to unit. Remove 1/4" plug from return port. Insert by pass plug (See Figure 1 or 2). Attach return and inlet lines.

Start burner—Air bleeding is automatic. Opening Easy Flow Air Bleed Valve will allow a faster bleed if desired.

Return line must run to within 3" of the bottom of the tank (See Figure 5). Failure to do this may introduce air into the system and could result in loss of prime.

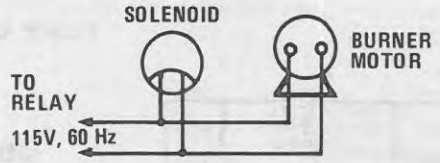


FIG. 3

SOLENOID WIRING

DISCONNECT POWER SUPPLY BEFORE WIRING TO PREVENT ELECTRICAL SHOCK OR EQUIPMENT DAMAGE. Lead wires on these devices are long enough to reach the junction box on most burner installations. Wire solenoid in parallel with burner motor (See Fig. 3). All electrical work should be done according to local and national codes. (Solenoid 115V, 0.1A, 60 Hz)

ALL SYSTEMS

IMPORTANT INFORMATION

Long or oversized inlet lines may require the pump to operate dry during initial bleeding period. In such cases, the priming may be assisted by injecting fuel oil into the pump gearset.

Under lift conditions, oil lines and fittings must be air tight. To assure this, "Pipe Dope" may be applied to both the used and unused inlet and both return fittings.

MOUNTING POSITION

Model "A" Single Stage Fuel Unit may be mounted in any position.

Model "B" Two Stage Fuel Unit may be mounted in any position except upside down (1/8" ports pointed down).

VACUUM CHECK

A Vacuum Gage may be installed in either of the 1/4" inlet ports or in the 1/8" return port (on single pipe installations), whichever is most convenient. The Model "A" pump should be used where the vacuum does not exceed 6" hg. single pipe and 10" hg. two pipe. The Model "B" should be used where vacuum does not exceed 15" hg.

PRESSURE CHECK

If a pressure check is made use GAGE PORT OR NOZZLE PORT. DO NOT USE EASY FLOW BLEED VALVE PORT FOR THE 7000 SERIES.

The Easy Flow Bleed Valve Port contains pressure higher than operating pressure. Setting pump pressure with gage in the Easy Flow Bleed Valve Port results in WRONG operating pressure. The 7400 is an exception (See Fig. 2).

CUTOFF PRESSURE

Average cutoff pressure for A and B fuel units is 80 psig. To check cutoff pressure, install pressure gage in nozzle port. Run burner for short period of time. Shut burner off. Gage shows cutoff pressure.

CAUTION

Pressurized or gravity feed installations must not exceed 10 P.S.I. on inlet line or return line at the pump. A pressure greater than 10 P.S.I. may cause damage to the shaft seal.

ONE-PIPE SYSTEM (Model A)

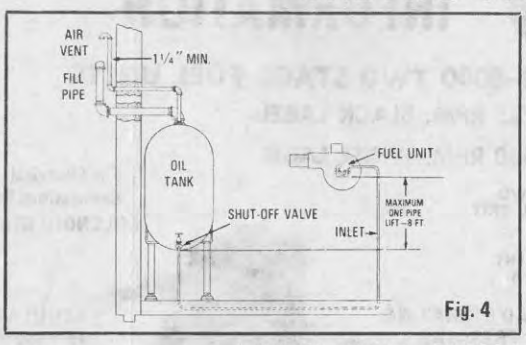


Fig. 4

The SUNDSTRAND MODEL "A"-70 FUEL UNIT may be installed ONE-PIPE with Gravity Feed or Lift.

The maximum allowable lift is 8 ft. – See Figure 4.

IMPORTANT: One-pipe installations must be absolutely air tight or leaks or loss of prime may result. Bleed line and fuel unit completely. **Bleed for 15 seconds after last air is seen from easy flow to be certain lines are air free.**

TWO-PIPE SYSTEM (Model A and B)

A SINGLE STAGE

Lift "L" Fig 5	1725 RPM		3450 RPM	
	⅜" OD Tubing	½" OD Tubing	⅜" OD Tubing	½" OD Tubing
0′	65′	100′	53′	100′
1′	60′	100′	49′	100′
2′	54′	100′	45′	100′
3′	50′	100′	41′	100′
4′	45′	100′	37′	100′
5′	40′	100′	33′	100′
6′	35′	100′	29′	100′
7′	30′	100′	25′	99′
8′	25′	100′	21′	83′
9′	20′	83′	17′	68′
10′	16′	64′	13′	52′

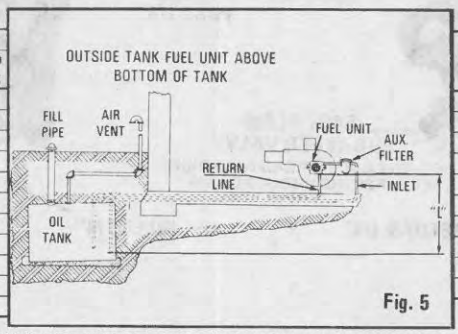


Fig. 5

B TWO STAGE

Lift "L" Fig 5	1725 RPM		3450 RPM	
	⅜" OD Tubing	½" OD Tubing	⅜" OD Tubing	½" OD Tubing
0′	100′	100′	68′	100′
2′	92′	100′	63′	100′
4′	85′	100′	58′	100′
6′	78′	100′	53′	100′
8′	70′	100′	48′	100′
10′	63′	100′	42′	100′
12′	56′	100′	37′	100′
14′	48′	100′	32′	100′
16′	40′	100′	27′	100′
18′	33′	100′	22′	88′

ALWAYS TERMINATE RETURN LINE AS SHOWN IN FIG. 5
LINE LENGTHS INCLUDE BOTH VERTICAL & HORIZONTAL LENGTHS

PUMP USAGE IDENTIFICATION

A

MODEL	MAX NOZZLE CAPACITY (GPH) AT 100 PSI	RPM
A1V-7000	3	1725
A2V-7000	3	3450
A1V-7100	3	1725
A2V-7100	3	3450
A2V-7400	3	3450
A1Y-7900	7	1725
A2Y-7900	7	3450

IDENTIFICATION EXAMPLE

B

MODEL	MAX NOZZLE CAPACITY (GPH) AT 100 PSI	RPM
B1V-8200	3	1725
B2V-8200	3	3450
B1Y-8900	7	1725
B2Y-8900	7	3450

STRAINER TYPE	UL Strainer Rating (GPH)*	
	#2 Fuel Oil	#1 Fuel Oil
V	3	6
Y	7	18

*Max. Firing Rate Not to Exceed Max. Nozzle Capacity or Strainer Rating Whichever is Less. A Greater Firing Rate Requires a Suitable External Strainer.

ALL INSTALLATIONS SHOULD BE MADE IN ACCORDANCE WITH LOCAL AND NATIONAL CODES

SUNDSTRAND HYDRAULICS — ROCKFORD, ILLINOIS
UNIT OF SUNDSTRAND COPORATION
SEPTEMBER 1978
FORM NO. 440100

DESCRIPTION OF FUEL OIL SYSTEM

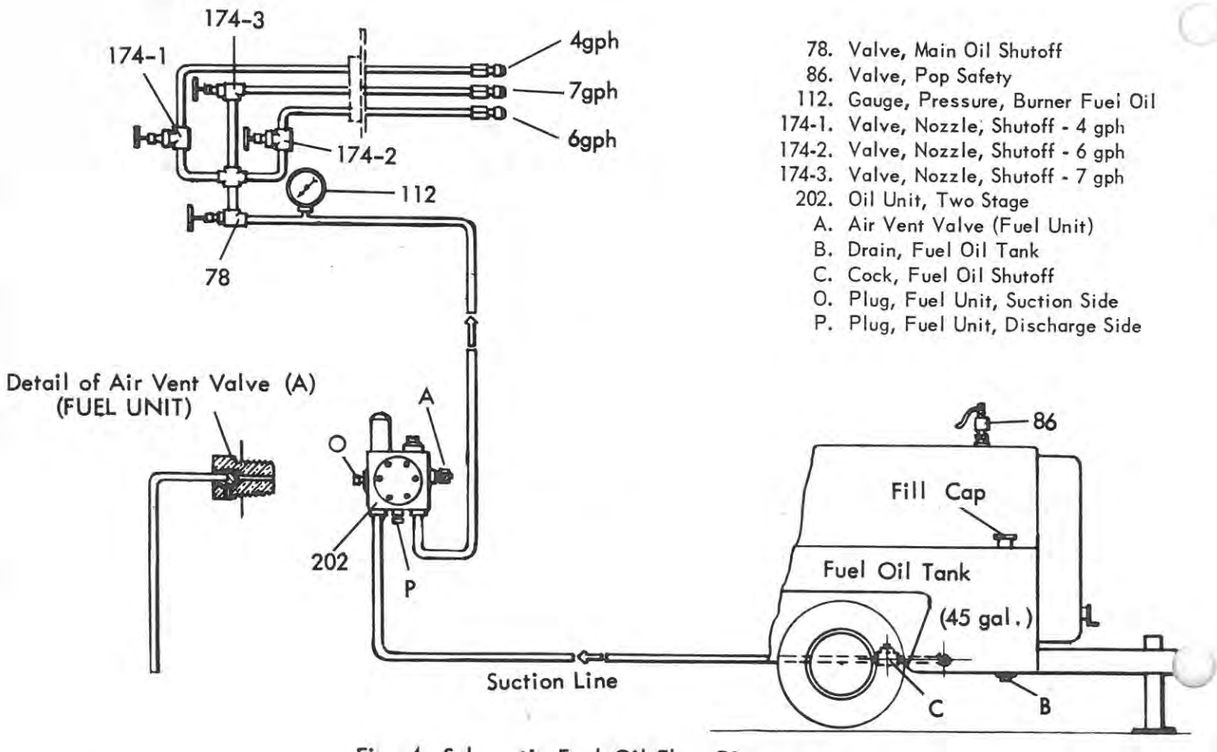
During normal operation the belt driven Fuel Unit (202) takes oil from the fuel oil tank, and delivers it to the nozzle assembly at the pressure indicated on the Burner Fuel Oil Gauge (112).

Principle parts of the system are, the tank, the fuel oil unit and the burner assembly. The tank holds 45 gallons of fuel oil. It is fitted with a vented fill cap and a drain cock; and is built into the fender of the unit.

Since the two stage fuel oil unit is connected for one pipe operation and runs whenever the engine does, its pump is equipped with an internal by pass to pump oil not used by burner back into the suction line. As pump capacity is greater than burner capacity there is always some oil by passed.

This fuel unit pumps in two stages; in the first stage oil is transferred from the tank to the unit and in the second stage the pressure is raised to that required for atomization. The fuel unit also contains a strainer assembly in the suction side and a pressure regulator and nozzle cut off valve in the discharge side. An air vent valve is furnished in the discharge chamber of pump to bleed air from suction line if necessary. (See (A) in Figure 4). The pump discharge pressure is controlled by the built in pressure regulating valve. Port (P) and Port (O) are plugged. Port (O) can be used for connecting a vacuum gauge for test purposes.

The oil burner assembly is a three nozzle pressure atomizing burner with a shut off valve (78) and individual nozzle shut off valves for adjusting firing rate. The normal operating oil pressure is 100-110 psi, as indicated on Gauge (112).

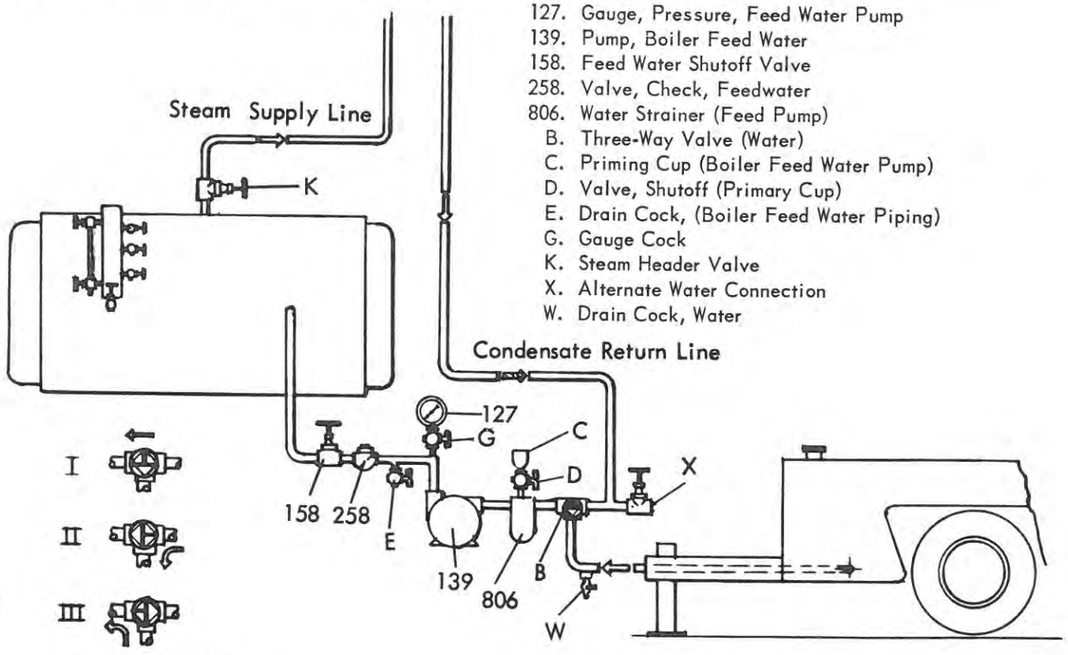


78. Valve, Main Oil Shutoff
86. Valve, Pop Safety
112. Gauge, Pressure, Burner Fuel Oil
174-1. Valve, Nozzle, Shutoff - 4 gph
174-2. Valve, Nozzle, Shutoff - 6 gph
174-3. Valve, Nozzle, Shutoff - 7 gph
202. Oil Unit, Two Stage
A. Air Vent Valve (Fuel Unit)
B. Drain, Fuel Oil Tank
C. Cock, Fuel Oil Shutoff
O. Plug, Fuel Unit, Suction Side
P. Plug, Fuel Unit, Discharge Side

Fig. 4. Schematic Fuel Oil Flow Diagram

DESCRIPTION OF STEAM AND BOILER WATER SYSTEM

The Boiler Feed Water Pump (139) withdraws water from the source and delivers it at the pressure indicated by Gauge (127) into the boiler when Feed Water Shut-off Valve (158) is open. The pump is driven continuously by belt drive from the gasoline engine.



127. Gauge, Pressure, Feed Water Pump
139. Pump, Boiler Feed Water
158. Feed Water Shutoff Valve
258. Valve, Check, Feedwater
806. Water Strainer (Feed Pump)
B. Three-Way Valve (Water)
C. Priming Cup (Boiler Feed Water Pump)
D. Valve, Shutoff (Primary Cup)
E. Drain Cock, (Boiler Feed Water Piping)
G. Gauge Cock
K. Steam Header Valve
X. Alternate Water Connection
W. Drain Cock, Water

Positions of Valve B

Fig. 5. Schematic Flow Diagram - Steam and Boiler Water

INITIAL FILLING OF BOILER WITH WATER - **Fill fender tank with water, turn Three-Way Valve (B) to position #III, and open Drain Cock (E) until a stream of water is visible and then close. Now open Feed Water Shut-off Valve (158). The Priming Cup (C) is not used as tank water level is above pump center line. Start engine and continue pumping water into boiler until proper level is observed in gauge glass. Another method is to connect water source at Alternate Water Connection (X), turn Valve (B) to position #I and open Pet Cock (E) until water is discharged. If source is above center line of pump or pressurized no priming of pump is necessary. However, a valve must be installed in the condensate return line to prevent the flow of water in this line and the admission of air to pump suction.**

SUCTION TYPE WATER FEED - **When necessary to lift water from a source below center line of pump, priming is necessary. To prime open Cock (E) and Valve (D) and pour water into Cup (C) until water appears at (E). Close Cock (E) and Valve (D) and start engine. It is important that suction line to water source be tight and free of air leaks.**

NORMAL OPERATION - During normal operation steam generated by boiler flows through Header Valve (K) and supply line to load where it is condensed and the resulting hot water is returned through condensate line. During this operation Valve (B) must be turned to position I so that condensate can be pumped into boiler. When boiler water line falls below normal operating level through loss of water in external heating system make-up water must be added to the system by turning Valve (B) to position III to shut off condensate system and draw water from the fender tank. As soon as operating water level is re-established, Valve (B) is again turned to position I to allow for normal return of condensate. Tank may be filled from a pressurized water system by connecting to (X) and turning Valve (B) to position II. IMPORTANT: Water tank Fill Cap must be removed to provide venting or tank will be damaged.

CAUTION!! Make sure that condensate does not contain oil or other foreign matter which will damage boiler. If contaminated, condensate must be discharged to waste. If portable steamer is subject to freezing temperatures it must be drained by opening all drain cocks.

OPERATING INSTRUCTIONS

OPERATION

1. Open vent cap at exhaust gas outlet.
2. Close main oil shutoff valve (78) and nozzle shutoff valves 174-1, 2, & 3. Open shutoff cock in fuel oil suction line near tank outlet under trailer frame.
3. Open valve on gasoline filter assembly at gasoline tank outlet.
4. Refer to engine instruction book and start engine with hand crank. Engine will operate at factory governor setting of approximately 2550 R.P.M. This engine speed will drive air fan at approximately 3650 R.P.M.
5. Operate engine until thoroughly warmed. During this period fuel oil will flow to fuel unit (202) which will establish operating oil pressure of 100-110 P.S.I. indicated on oil pressure gauge (112). If pressure is not established pump is air bound. Relieve air by loosening air vent valve in pressure section of fuel unit. Use 1/4" Allen wrench (1/8" across flats) and open valve until a clear stream of fuel oil is visible at vent fitting. Close vent valve.
6. Check water level in boiler. With engine running at reduced speed close air damper (120) tightly. Soak lighter torch in fuel oil, ignite and insert through lighter hole (T). Open main oil shutoff valve (78) and nozzle shutoff valve (174-1). Burner now ignites at minimum firing rate. Remove lighter torch and raise engine speed to normal. Open air damper (120) just enough to clear vent pipe of smoke.
7. Operate burner at this minimum rate until vapor is visible at top trycock.
8. Increase burner firing rate by opening valves 174-2 and 174-3. Open one valve at a time and readjust air damper (120) with each valve opening to clear vent.
9. With normal operation established and boiler thoroughly warmed tighten all head bolts and handhole gaskets.

OPERATING INSTRUCTIONS

Refer to identification photographs, schematic flow diagrams and engine instruction manual.

PREPARATION FOR OPERATION

In preparing the steamer for operation these points must be given attention:

1. Tires must be inflated to 44 lb air pressure. The heater unit is designed for towing speeds of 20 mph with boiler drained.

2. Level heater through adjustment of front support leg.

3. Fill the boiler, tanks and accessories with liquids as follows. Close valves as required;

   Boiler - clean water - approximate capacity to normal water line 168 gallons 1415 pounds.

On initial fill with cold water, fill to lower trycock which will give 1" of water in gauge glass. This water will expand when heated to normal operating water line which is 2-1/2" in gauge glass.

Water Supply Tank - (in right fender) - clean water - approximate capacity 45 gallons.

Fuel Oil Tank - (in left fender - front) - No. 3 Commercial Standard Fuel Oil or lighter - approximate capacity 45 gallons.

Gasoline Tank - (in left fender - rear) - regular grade gasoline - approximate capacity 8 gallons.

Engine Crankcase - SAE-20 for 32° F and above - approximate capacity 2-1/2 quarts. Fill to top of filler cap opening.

4. Make the necessary steam hose or piping connections to the heating or process load.

BURNER MAINTENANCE INSTRUCTIONS

To remove the burner drawer assembly the following steps should be taken:

1. REMOVE BELT GUARD (Refer to Figure 6)

   (a) Loosen top and left hand bolt holding top of belt guard to air damper. Because of close clearance a box wrench will facilitate loosening.

   (b) Remove the two capscrews holding lower part of belt guard to base.

   (c) The entire belt guard can now be twisted to the left and removed as a unit.

2. REMOVE BURNER DRAWER (Refer to Figure 7)

   (a) Loosen 1/2" flare nut just to the right and below the burner oil pressure gauge (Item 112 Figure 2).

   (b) Loosen and remove the six nuts and lockwashers which hold burner drawer assembly to front head.

   (c) Lift up slightly on burner drawer to clear water pump drive belt and withdraw entire burner drawer.

3. ADJUSTMENT OF BURNER NOZZLE POSITION (Refer to Fig. 8 and 9)

   (a) The nozzles must be mounted in the burner drawer in definite relationship to air diffuser. (Figure 9 shows the diffuser in in place in the boiler furnace) In assembly at the factory the initial setting before fire testing is as indicated in Figure 9 i.e., the distance from the tip of the nozzle to the burner drawer plate is 12-3/4". To adjust, loosen the three set screws (A Fig. 8) and slide the nozzles to the desired position. Lock in that position by tightening the three set screws.

4. DIFFUSER ADJUSTMENT (Refer to Figure9)

   (a) The diffuser is held in place in the firetube by means of three Allen head setscrews with locking nuts. In the event of replacement or cleaning of the diffuser it must be relocated in a definite position.

   (b) To remove the diffuser, loosen the three locknuts and use an Allen wrench to loosen the three setscrews. The entire diffuser assembly can then be withdrawn.

   (c) In reassembly position the diffuser by measuring from the front of the burner tube to the center of the diffuser. This distance must be 7-1/2" as indicated in Figure 9.

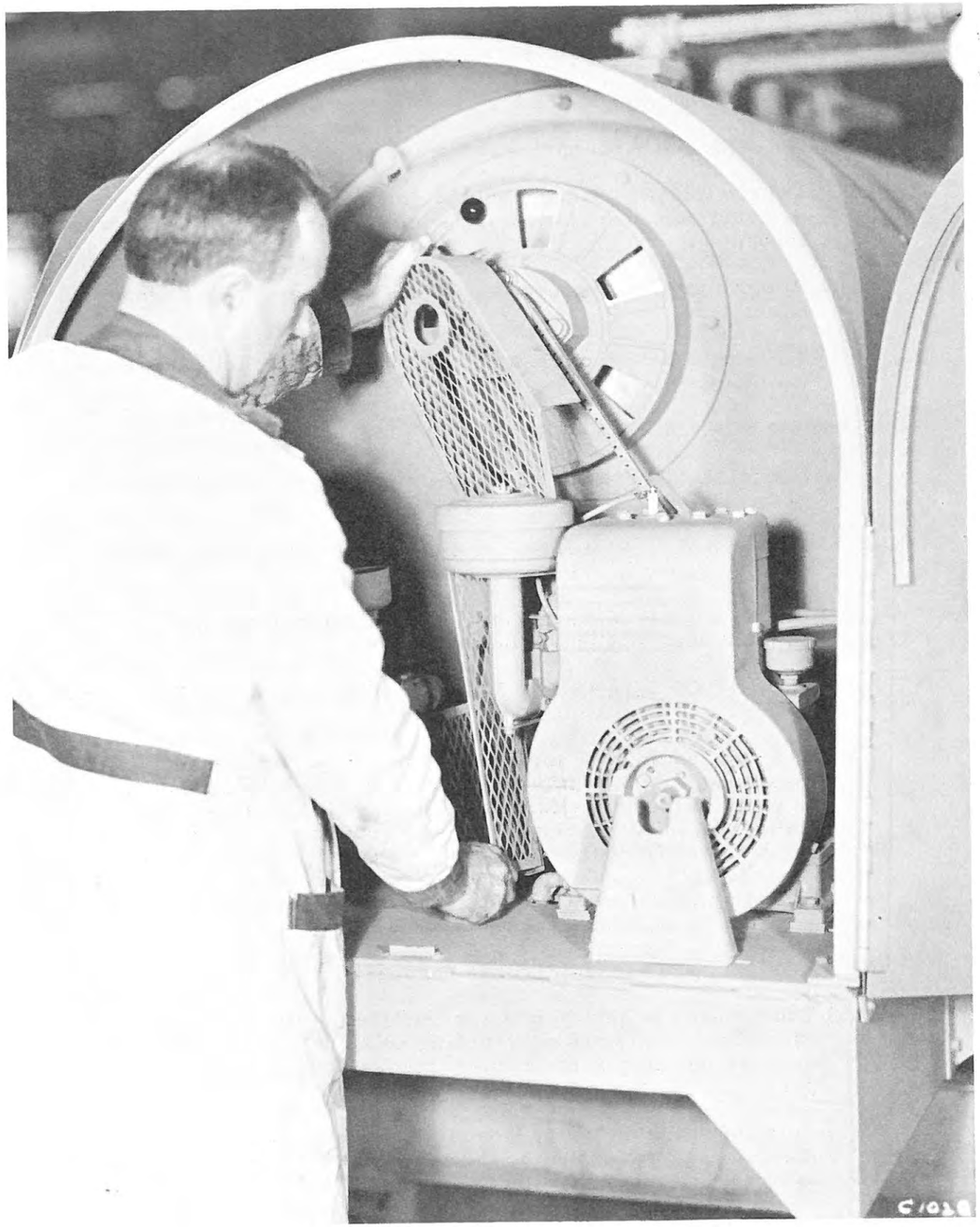


Fig. 6 – Removal of Belt Guard

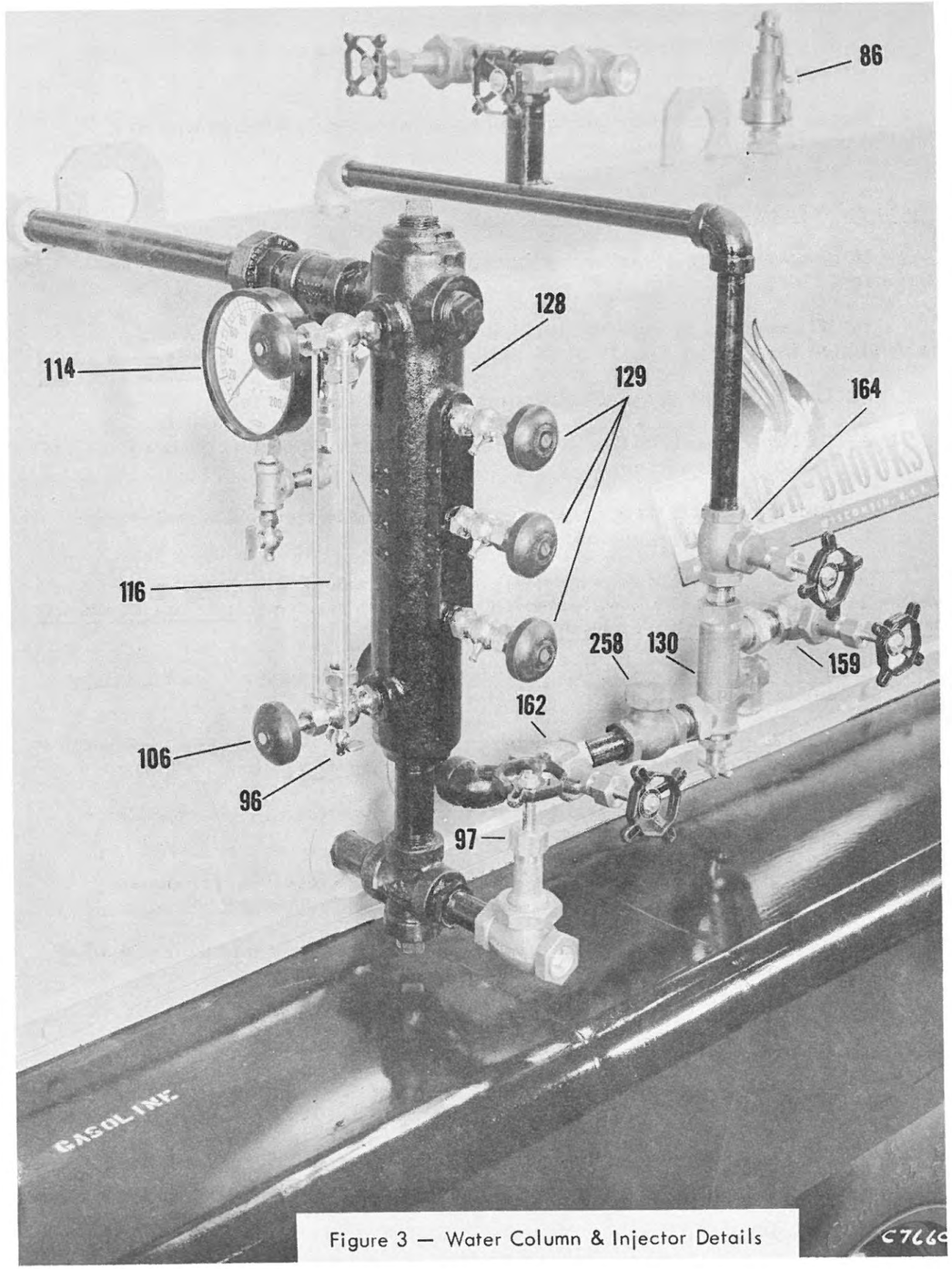


Figure 3 — Water Column & Injector Details

86. Valve, Pop Safety
96. Valve, Blowdown, Glass Gauge
97. Valve, Blowdown, Water Column
106. Cock, Gauge Glass Shut-off
114. Gauge, Pressure, Steam
116. Gauge, Water Level
128. Column, Water
129. Try-Cocks
130. Injector
159. Valve, Injector Water Supply
162. Valve, Discharge Injector
164. Valve, Injector, Steam Supply
258. Valve, Check, Injector

Figure 3 – Water Column and Injector Details

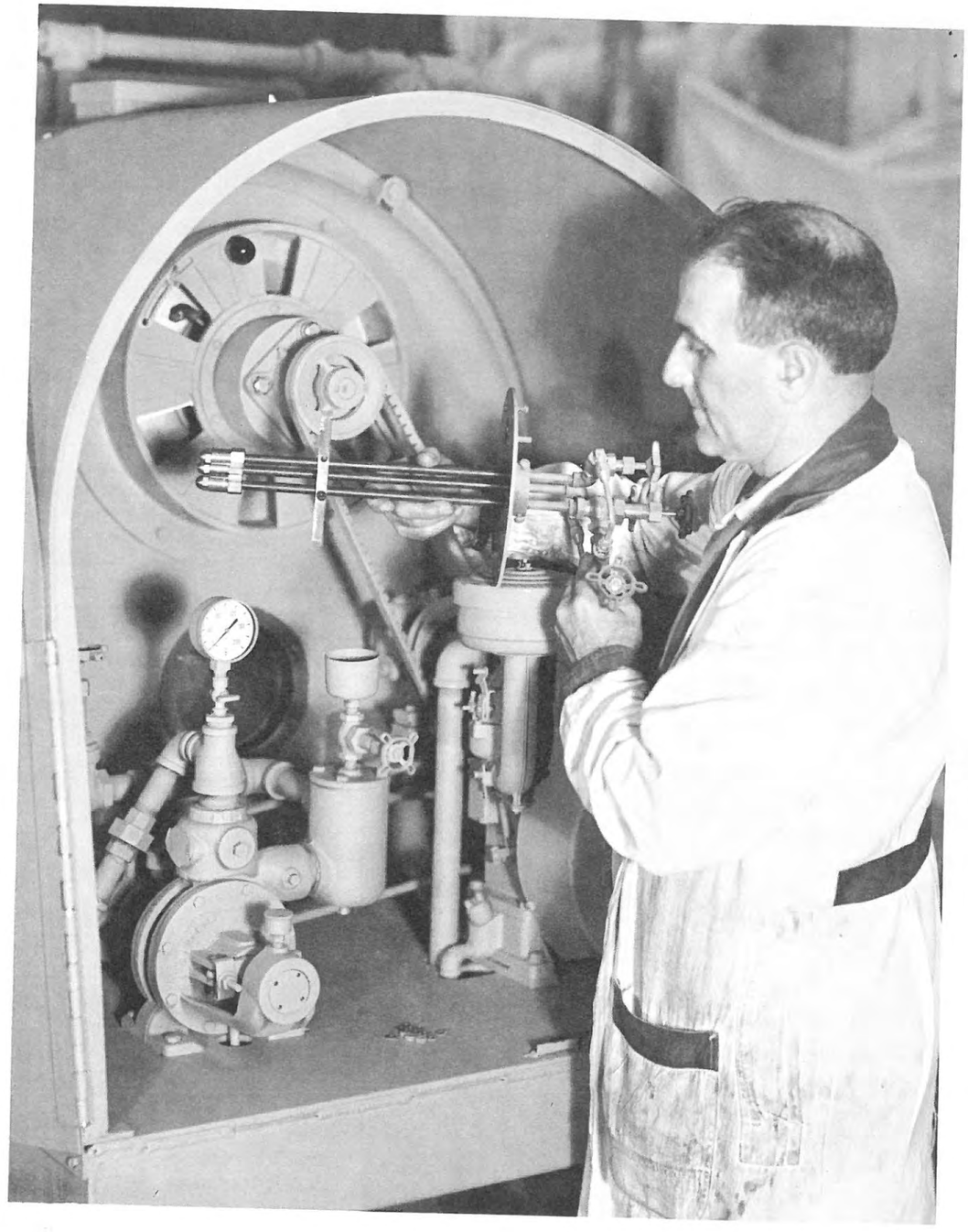


Fig. 7 – Removal of Burner Drawer

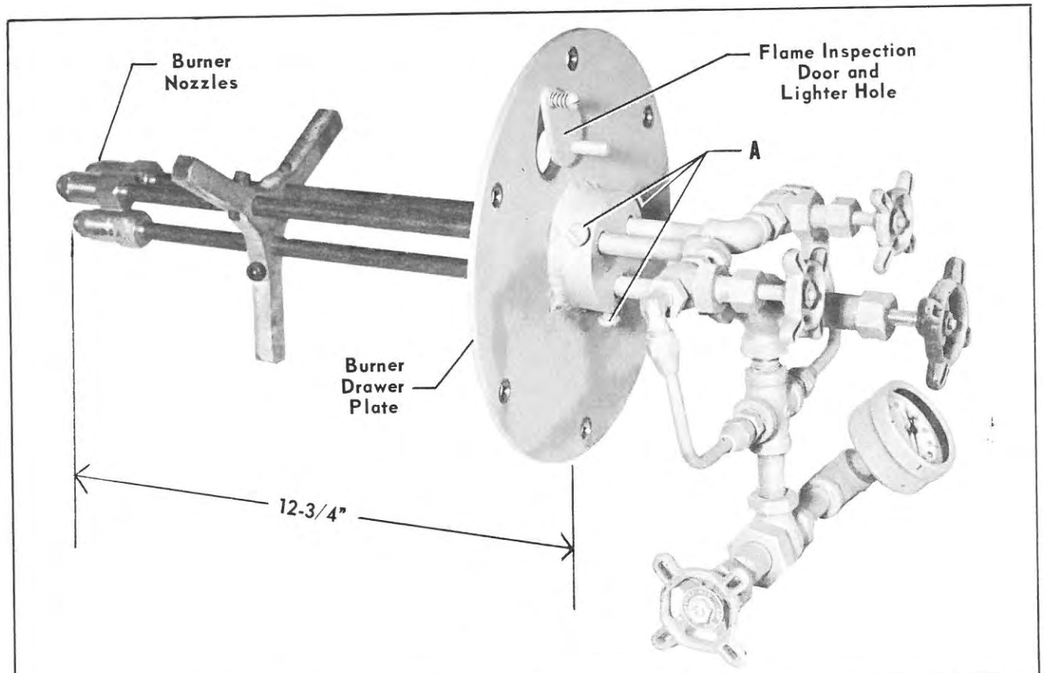


Fig. 8 – Burner Drawer Assembly

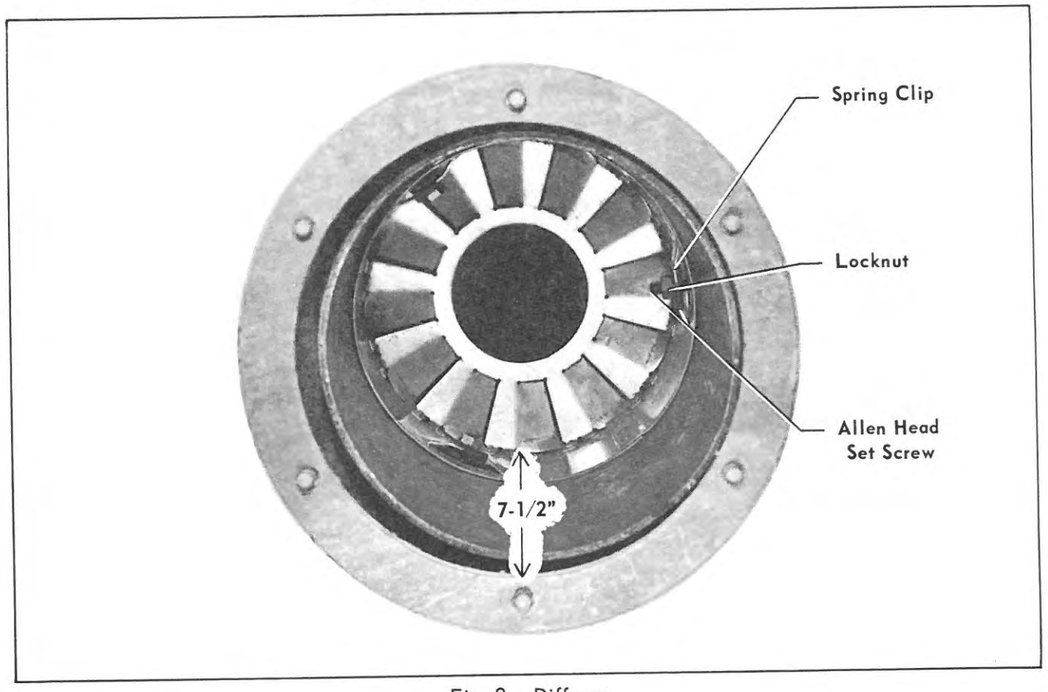


Fig. 9 – Diffuser

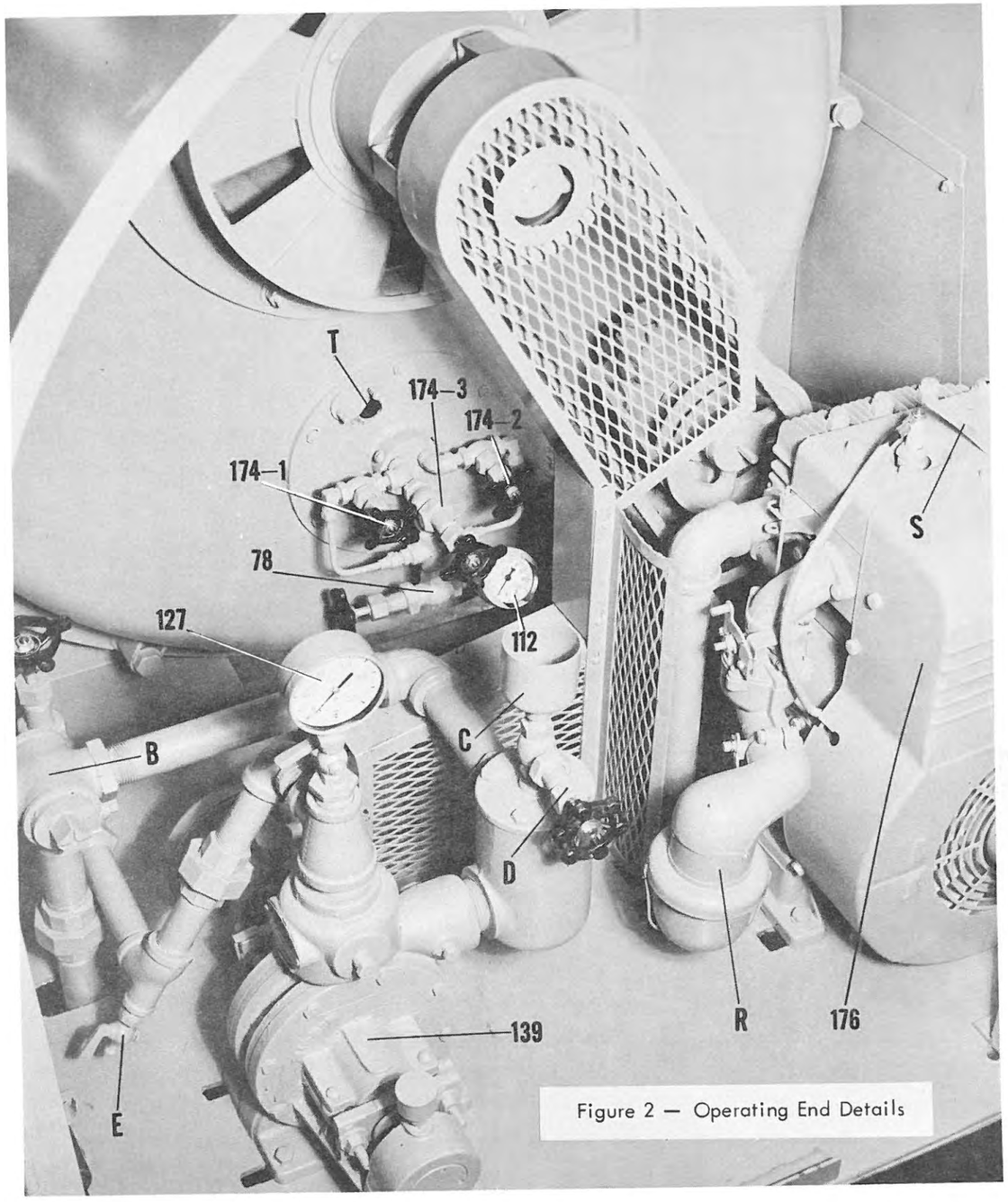


Figure 2 — Operating End Details

B. Three-Way Valve (Water)
C. Priming Cup (Boiler Feed Water Pump)
D. Valve, Shut-off (Priming Cup)
E. Drain Cock (Boiler Feed Water Piping)
R. Engine Air Cleaner
S. Engine Stop Switch
T. Lighter Hole

78. Valve, Main Oil Shut-off
112. Gauge, Pressure, Burner Fuel Oil
127. Gauge, Pressure, Feed Water Pump
139. Boiler Feed Water Pump
174-1. Nozzle Shut-off Valve
174-2. Nozzle Shut-off Valve
174-3. Nozzle Shut-off Valve
176. Gasoline Engine

Figure 2 – Operating End Details

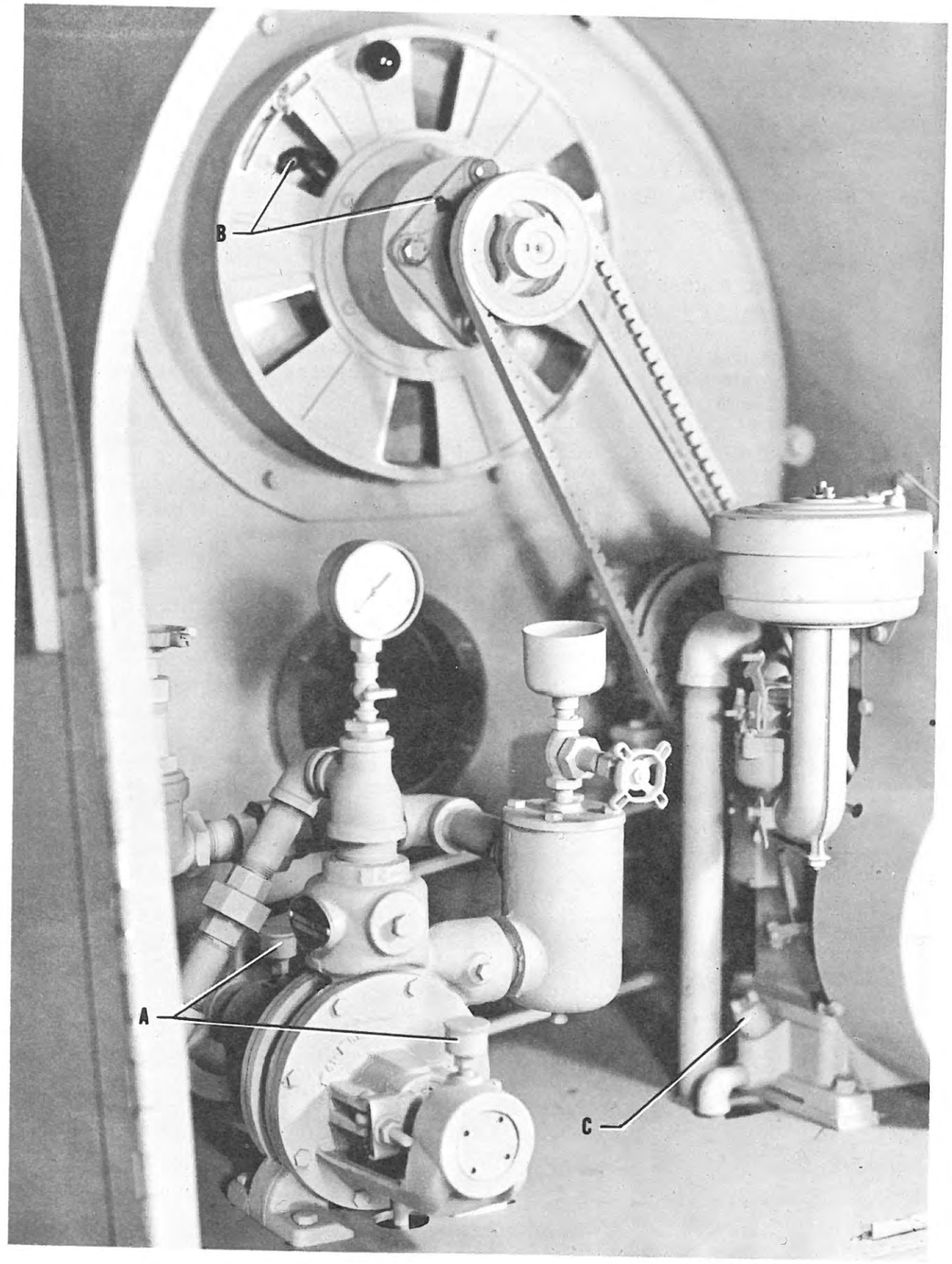


Fig. 10 – Lubrication Points

HOSE COUPLINGS

The hose coupling is illustrated in Fig. 11. Couplings do not require maintenance of any kind except to keep threads clean so that they can be easily closed and tightened. The locking nut is equipped with lugs as illustrated so that a hammer can be used to tighten.

LUBRICATION

(Refer to Figure 10)

(a) Main Fan Shaft - Lubricate with approximately 1/2 ounce of soda soap ball bearing grease once per month. Apply Zerk fittings "B". It is advisable to disassemble the bearings aproximately once a year and remove old grease and replace with fresh.

(b) Water Pump Bearings - The water pump is equipped with two grease cups (See A, Fig. 10.) Approximately every 20 hours of operation the cup should be turned clockwise about 1/4 turn. When empty refill with a soft lime base grease similar to Standard Oil Company Superla No. 18 or equal.

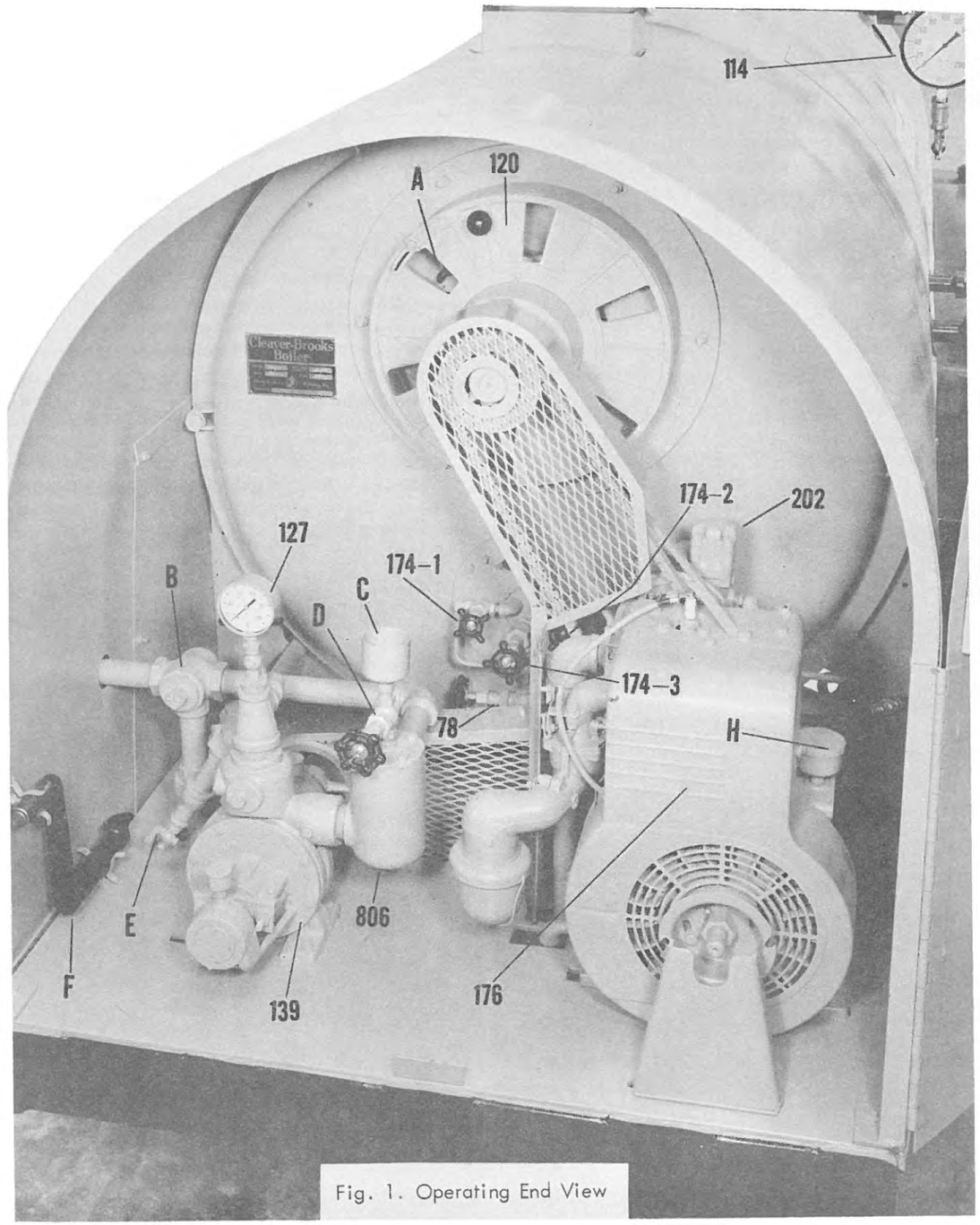


Fig. 1. Operating End View

A. Lubricating Fitting (Main Fan Shaft)
B. Three Way Valve (Water)
C. Priming Cup (Boiler Feed Water Pump)
D. Valve, Shut-off (Priming Cup)
E. Drain Cock (Boiler Feed Water Piping)
F. Engine Hand Crank
H. Engine Crankcase Breather

78. Valve, Main Oil Shut-off
114. Gauge, Pressure, Steam
120. Damper, Secondary Air
127. Gauge, Pressure, Feed Water Pump
139. Pump, Boiler Feed Water
174-1. Nozzle Shut-off Valve
174-2. Nozzle Shut-off Valve
174-3. Nozzle Shut-off Valve
176. Gasoline Engine
202. Fuel Oil Unit
806. Water Strainer (Feed Pump)

Figure 1 – Operating End View

OPERATING INSTRUCTIONS

OPERATING ADJUSTMENTS & CARE

1. Maintaining constant steam pressure.

The burner is a three nozzle unit equipped with a 4.0 gallon, 6.0 gallon and 7.0 gallon nozzle. Each of the three nozzle lines can be opened or closed with a nozzle shutoff valve. By the selection of one or more nozzles the oil burning rate can be adjusted to closely match the steam demand or load on the boiler.

Each time the oil burning rate is changed the air adjustment, damper (120) must be reset to just clear smoke at the vent pipe. Light smoke indicates too much air. Dark smoke indicates a lack of air. Do not open air damper beyond the point where the stack clears as this practice passes excess air through the boiler and wastes fuel with a reduction of steam output.

If fuel oil pressure adjustment is required unscrew slotted plug in pressure section of fuel unit and insert a 1/4" Allen setscrew wrench (1/8" across flats) and adjust for required pressure.

The boiler is a high pressure firetube type and requires the same thorough care as all firetube boilers. The water used must be clean and free of scale producing impurities or water treatment and more frequent waterside cleaning and inspection will be required. The pressure atomizing burner and the combustion air supply furnished is more than adequate for the designed output of the unit. If the air adjustment is neglected and the burner permitted to smoke an abnormal deposit of soot on the heating surfaces will be experienced. The gas velocities through the tubes is high and will keep the heating surfaces clean if the burner is operated at proper air and fuel adjustments. If an abnormal deposit of soot is allowed to accumulate on the heating surfaces it will be necessary to remove the rear head and wire brush the tubes to remove this deposit.

Adhere to boiler blowdown instructions as proper blowdown will reduce the concentration of solids in the boiler water and greatly reduce its scale forming ability.

This list of operating notes will aid the operator in quickly checking operating conditions.

DO

1. **Carefully and frequently observe water gauge glass and steam pressure gauge during all periods of operation.**
2. **Inflate tires to proper pressure and operate unit in level position.**
3. **Maintain the normal operating water level of 2-1/2" in the gauge glass at all times.**
4. **Determine the quality and cleanliness of return condensate from heating load before it is fed into system.**
5. **Adjust burner to closely match steam load. The continuous blowing of the safety valve will cut valve life and waste water and fuel.**
6. **Keep adequate supplies of water, fuel oil, gasoline and lubricating compounds available at operating site.**
7. **Blow down boiler shell and drain gauge glass during every 4 hours of operation.**
8. **Close vent cap during periods when unit is not in operation.**
9. **Fire boiler at minimum firing rate on cold start until unit is warm and vapor is visible at upper trycock.**

GENERAL DESCRIPTION

The portable steamer is a compact trailer, boiler and burner assembly designed and equipped for mobile use. The boiler is constructed in accordance with the A.S.M.E. Power Boiler Code. The boiler receives insurance inspection prior to shipment and an inspection certificate is furnished purchaser.

BOILER

The boiler is a four pass horizontal firetube arranged for updraft gas travel. The maximum steam working pressure is 150# sq. in. gauge. The steam producing capacity is 50 Boiler horsepower or 1725# steam per hour. The exposed section of the boiler shell is insulated with 2" fibre glass insulation which is protected by 16 gauge sheet metal lagging.

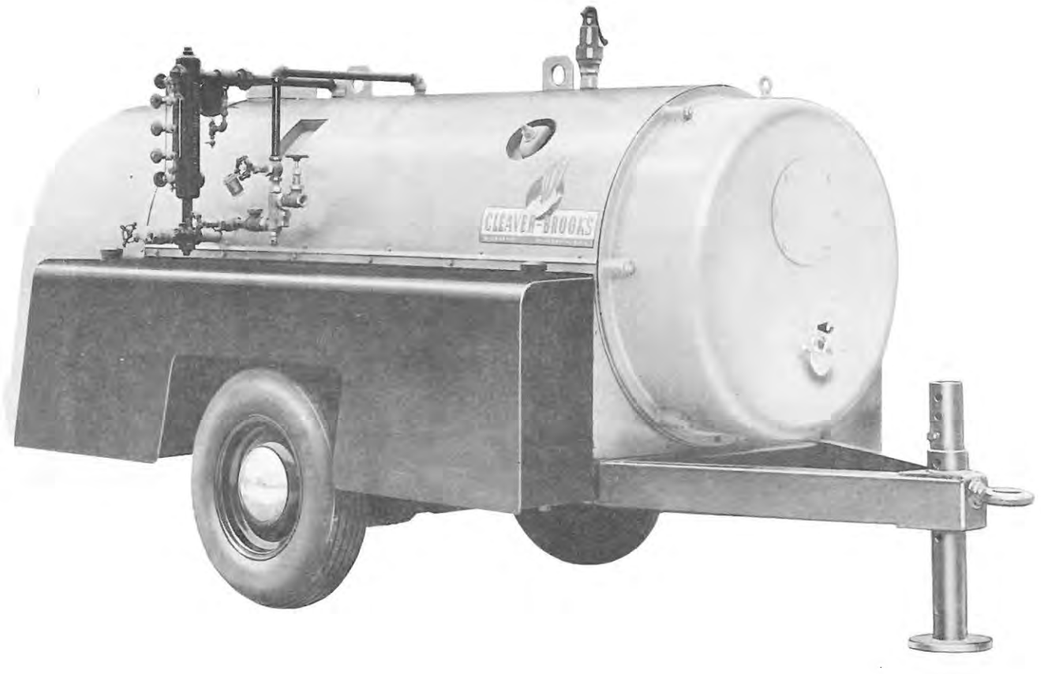
BURNER

The burner is a 3 nozzle pressure atomizing type with individual nozzle control. The fuel oil required is Commercial Standard #3 or lighter grades. The maximum burning rate is 17 GPH @ 100# atomizing pressure. Combustion air is supplied by a built in centrifugal blower. The burner is driven by a Briggs & Stratton four cycle Model 23A Engine. The engine is a single cylinder L-Head, air-cooled unit with 3" bore and 3-1/4" stroke. The engine rating is 7.2 HP @ 2500 RPM.

TRAILER

The trailer upon which is mounted the boiler, water, fuel oil and gasoline tanks and burner equipment is fitted with a towing hitch and a leveling leg for leveling boiler during operation. The two wheeled trailer has 7:50 x 16, 8 ply grooved implement type tires for inflation to 44 pounds. The trailer is designed for a speed of 20 miles per hour.

In describing equipment and referring to its location in the general assembly, the front of the unit has been taken as the towing hitch end.



TYPICAL PSM-50 UNIT

DON'T

1. Don't ignite burner unless water in gauge glass is within normal operating range.
2. Don't tow trailer at excessive speeds as this will seriously shorten tire life.
3. Don't dip lighter torch into fuel oil tank. Withdraw a small amount of oil and use open container for saturating lighter torch.
4. Don't open oil valves at burner unless the lighter torch flame is visible at lighter hole.
5. Don't feed contaminated condensate or makeup water into boiler water system. Discharge it to waste.
6. Don't pump liquids into tanks at high flow rates as the fill opening is the only venting source.
7. Don't neglect the operating and maintenance requirements of your equipment. The unit requires operating and maintenance attention to keep it in dependable condition and ready to start and finish your important jobs without interruption.

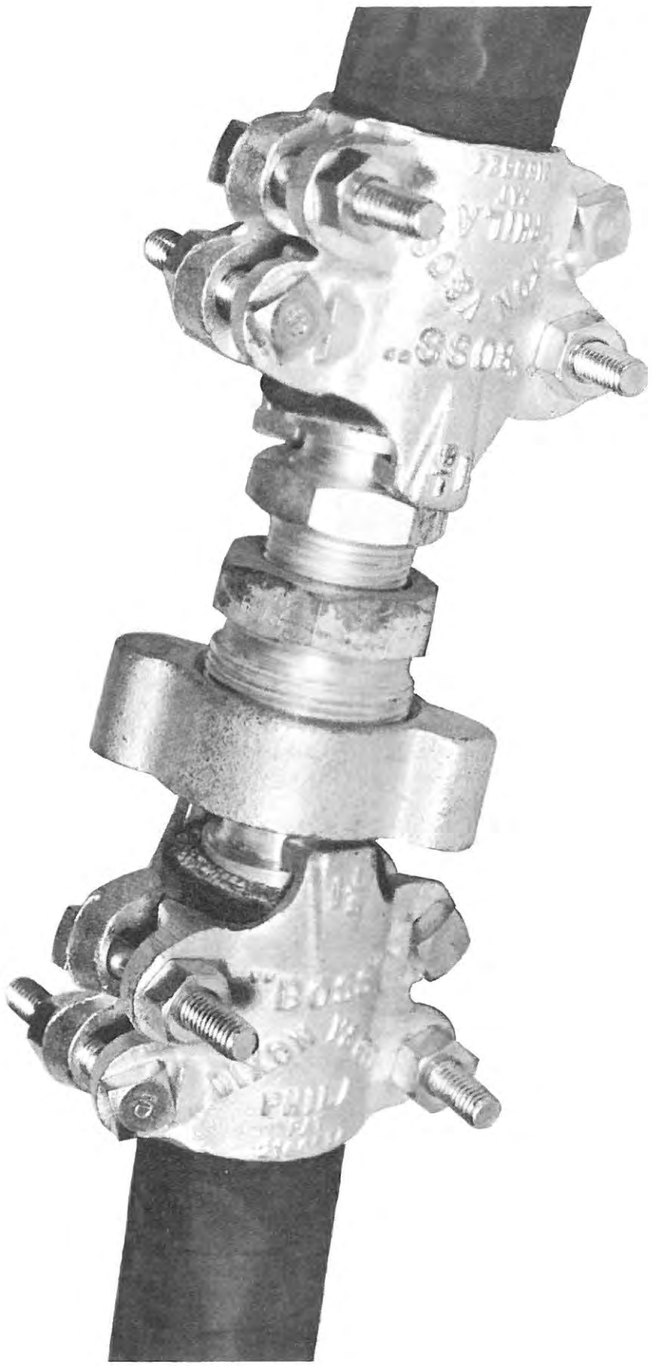


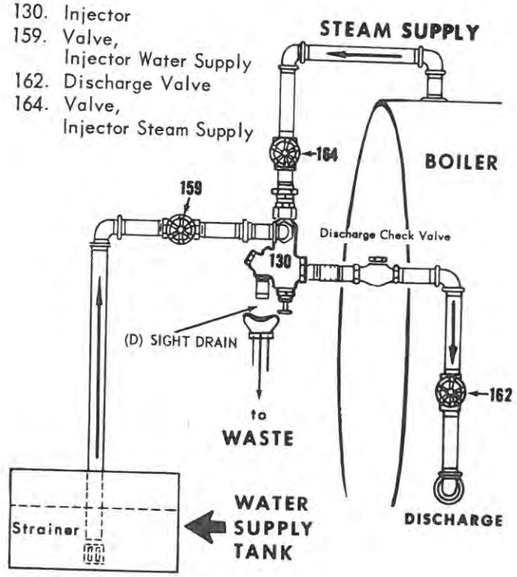
Fig. 11 – Hose Coupling

INDEX

GENERAL DESCRIPTION

An injector is used for forcing feedwater into a boiler operating under pressure. To accomplish this it takes steam from the boiler, transforms its energy in such a manner that part of the energy is impacted to the feedwater forcing it into the boiler. The remainder of the energy is returned to the feedwater in the form of heat to raise its temperature. All this the injector accomplishes without the use of any moving parts.

130. Injector
159. Valve, Injector Water Supply
162. Discharge Valve
164. Valve, Injector Steam Supply

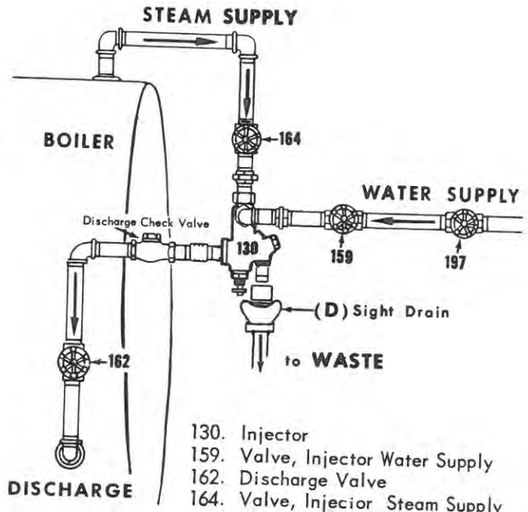


A-24

Application 1

precautionary measure to protect system from any back flow from boiler.

Note: Since the pressurized water system of Application II furnishes a water rate greater than the injector capacities, an additional Throttling Valve (197) is installed as shown; and this valve is permanently adjusted to cut the water supply rate to the injector system. The Throttling Valve (197) provides the additional pressure reduction to bring the water supply rate within the limits of the injector capacity.



130. Injector
159. Valve, Injector Water Supply
162. Discharge Valve
164. Valve, Injecior Steam Supply
197. Valve, Throttling

A-25

Application 2

OPERATION

Starting – To put injector in service, open first the Discharge Injector Valve (162), next the Water Supply Valve (159); and finally the Steam Supply Valve (164). Automatically water now enters boiler; but to establish correct rate of feed adjust Water Supply Valve (159) as required.

If water is discharging at Sight Drain (D) during normal operation of injector throttle Water Supply Valve (159) until discharge at Drain (D) stops.

Stopping Injector Action – To discontinue water input to boiler, close first Steam Supply Valve (164), then the Water Supply Valve (159), and finally Discharge Valve (162); this is in the reverse order to the starting procedure. The Discharge Valve (162) is closed as a

Performance – Unsatisfactory performance of the injector will be experienced if any of the following conditions exist:

a) Leaky suction system: If there are pipe leaks so that air is drawn in at joints or at water supply valve stems the injector will not operate smoothly; and water will be discharged erractically at Drain (D).

b) Dirt in injector tubes.

c) Water supply or discharge lines choked.

Capacities – Effective capacity is reduced if injector is required to handle water at higher than normal temperature (75° F). An injector looses its ability to condense steam at higher boiler temperatures and pressures.

C9-43-1

THEORY OF OPERATION
(Refer to Type I Injector)

When Steam Supply Valve (164) is opened, steam passes through Steam Jet (C), over Ring Valve (F), Suction Jet (E) out to overflow drain.

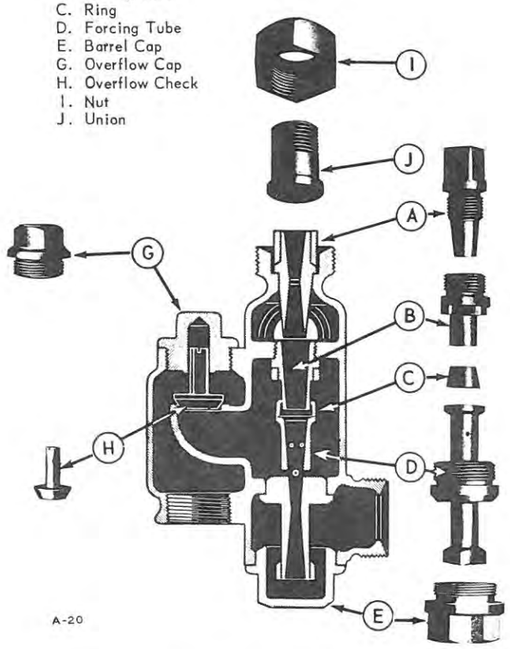
The high velocity steam entrains air in Suction Chamber (D) and creates a vacuum so that feedwater is drawn in at W from supply line when Water Supply Valve (159) is opened.

The steam gradually condenses as the mixture advances through the injector; and Ring Valve (F) rises to close. The kinetic energy of the steam is now sufficient to build up a pressure greater than the boiler pressure so that water is forced to flow through discharge check valve into the boiler. When flow into boiler is established the Over Flow Valve (M) closes automatically and prevents entrance air which would disrupt operation of injector.

Maintenance – To clean injector, unscrew bottom plug; and the removable jet which rests upon it will follow the plug out. Turn on steam pressure (not less than 40 psi) and dirt will be blown out. Examine all passages and drill holes and see that no dirt or scale has lodged in them. Replace jet and screw into place tightly. Be careful not to bruise jets; and use no wrenches on body of injector.

If jets are incrusted with scale ("limed") acid clean with a dilute solution of muratic acid. Manufacturer recommends that solution consist of one part acid to seven parts of water. After parts are clean neutralize acid with a solution of soda in water and rinse thoroughly with water before reassembling.

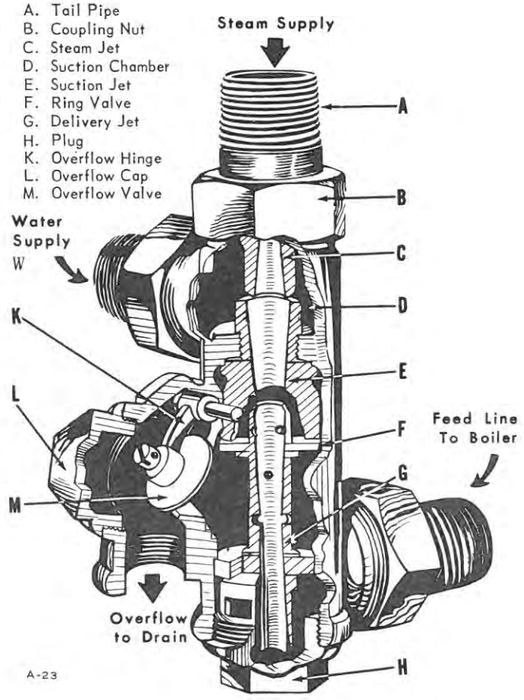
A. Steam Jet
B. Lifting Tube
C. Ring
D. Forcing Tube
E. Barrel Cap
G. Overflow Cap
H. Overflow Check
I. Nut
J. Union



A-20

TYPE 2 – INJECTOR
Sectional View and Parts

A. Tail Pipe
B. Coupling Nut
C. Steam Jet
D. Suction Chamber
E. Suction Jet
F. Ring Valve
G. Delivery Jet
H. Plug
K. Overflow Hinge
L. Overflow Cap
M. Overflow Valve



A-23

TYPE 1 – INJECTOR
Sectional View and Parts

OPERATING INSTRUCTIONS

for

MODEL PSM-50
PORTABLE STEAMER

and

MODEL PS-50
SKID-MOUNTED STEAMER

Cleaver Brooks®

MILWAUKEE, WIS. 53201

MANUAL PART NO. 750-58

Jan 1971

C11-3580 REV. 5/67

Printed in U.S.A.

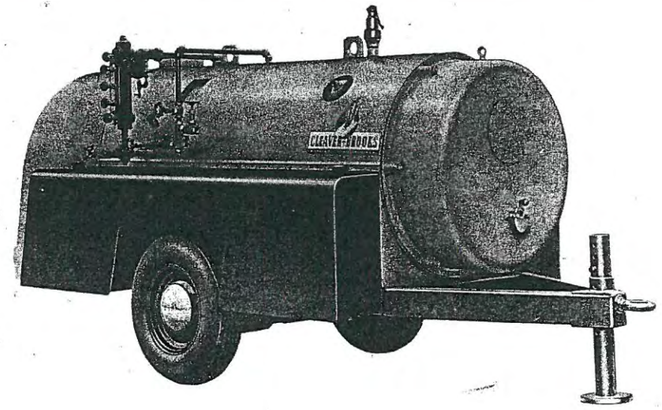
ILLUSTRATED PARTS LIST

for

MODEL PSM-50
PORTABLE STEAMER

and

MODEL PS-50
SKID-MOUNTED STEAMER



Cleaver-Brooks

DIVISION OF AQUA-CHEM, INC.
Milwaukee, Wisconsin 53201
Service and Parts Coast to Coast
Boilers and Accessories for the Complete Boiler Room

PARTS BOOK NO. 750-508

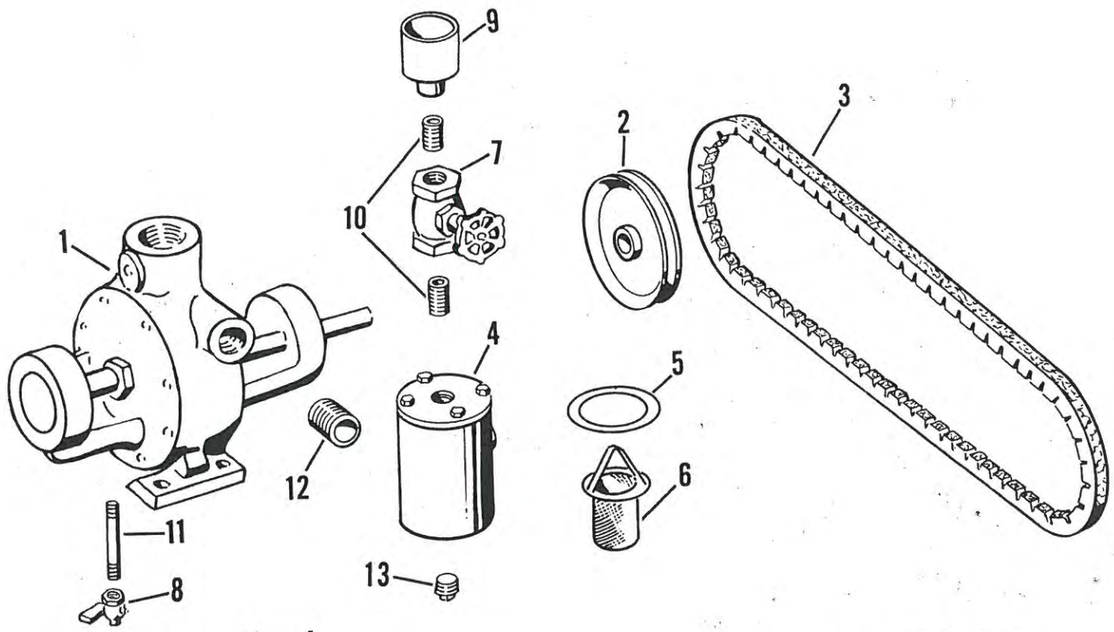


Figure 1

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	901-346	1	Pump, Water, Aurora E-41 CD
2	921-398	1	Sheave, 1A Groove, 5.2 PD .787" Bore
3	809-185	1	V-Belt, V-Steel A-60
4	923-48	1	Strainer, Feed Water Pump, Aurora
5	853-314	1	Gasket, Water Pump Strainer
6	923-52	1	Basket, Water Pump Strainer, Aurora
7	941-55	1	Valve Globe, 1/4"
8	825-54	1	Cock, Pet 1/8"

REPLACEMENT PARTS
Listed for Identification
Please Order Locally as Mill Supplies

9	123-16	1	Cup, Priming
10	857-33	1	Nipple, Black Std, 1/4" Close
11	857-119	1	Nipple, Black Std, 1/8" x 2"
12	857-184	1	Nipple, Black Std, 1-1/4" Close
13	858-2	1	Plug, Brass 1/8"

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

Figure 1. – WATER PUMP and STRAINER

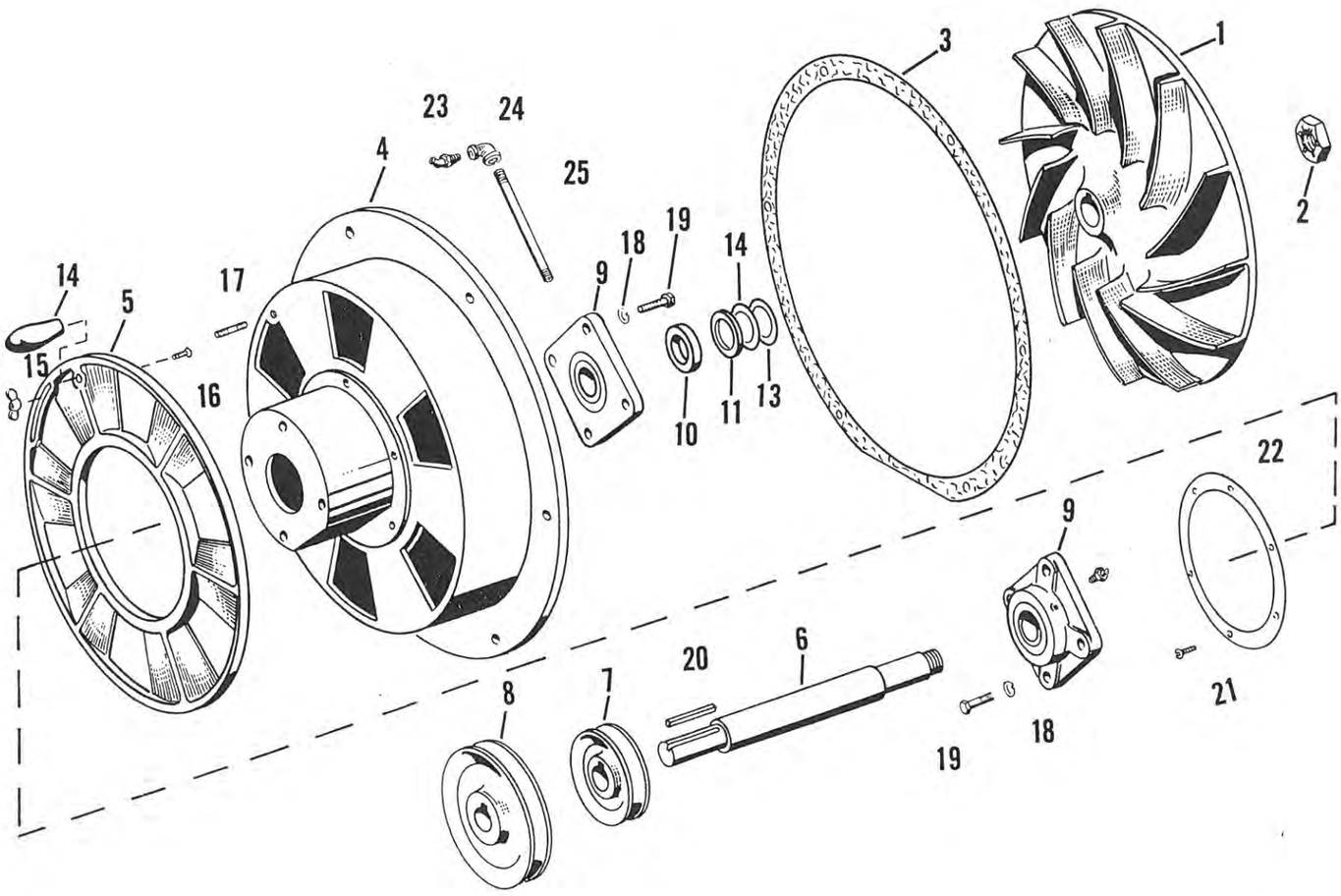


Figure 2. – BLOWER ASSEMBLY

Figure 2. – BLOWER ASSEMBLY

Figure 2

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	192-47	1	Impeller, PS 50
2	51-176	1	Nut, Lock, Impeller
3	32-678	1	Gasket, Bearing, Support
4	40-168	1	Housing, Air Inlet and Bearing Support
5	108-40	1	Damper, PS 50
6	74-29	1	Shaft, Impeller
7	921-399	1	Sheave, 1A Groove, 2.4 PD, 1" Bore
8	921-305	1	Sheave, 1A Groove, 4.4 PD, 1" Bore
9	807-66	2	Bearing, Flanged, 1-3/8" Shaft (SKF FY 106)
10	77-65	1	Spacer, Impeller
11	91-46	1	Washer, Spacing, Impeller
12	91-47	1	Washer, Spacing, Impeller
13	91-53	1	Washer, Spacing, Impeller
14	865-18	1	Handle, Plastic

REPLACEMENT PARTS Listed for Identification

Please Order Locally as Mill Supplies

Ref. No.	Part No.	No. Req'd.	Description
15	869-87	1	Nut, Wing 1/4"-20
16	868-684	1	Capscrew, Flat Hd, 3/8"-16 NC x 3/4" Lg
17	841-632	1	Stud, Machine 1/4-20 NC x 1-1/2" T 3/4" N 3/4"
18	952-94	8	Lockwasher, 1/2"
19	868-93	8	Capscrews, Hex Hd, 1/2"-13 NC x 1-1/4"
20	841-410	1	Key, 1/4" x 1/4" x 2"
21	868-406	6	Capscrews, Hex Hd, 1/4"-20 NC, 3/8"
22	66-29	1	Ring, Damper
23	857-121	1	Nipple, 1/8" x 3" Std Black
24	859-77	1	Elbow, 1/8"-90° Std. Black
25	844-13	2	Alemite Fitting

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

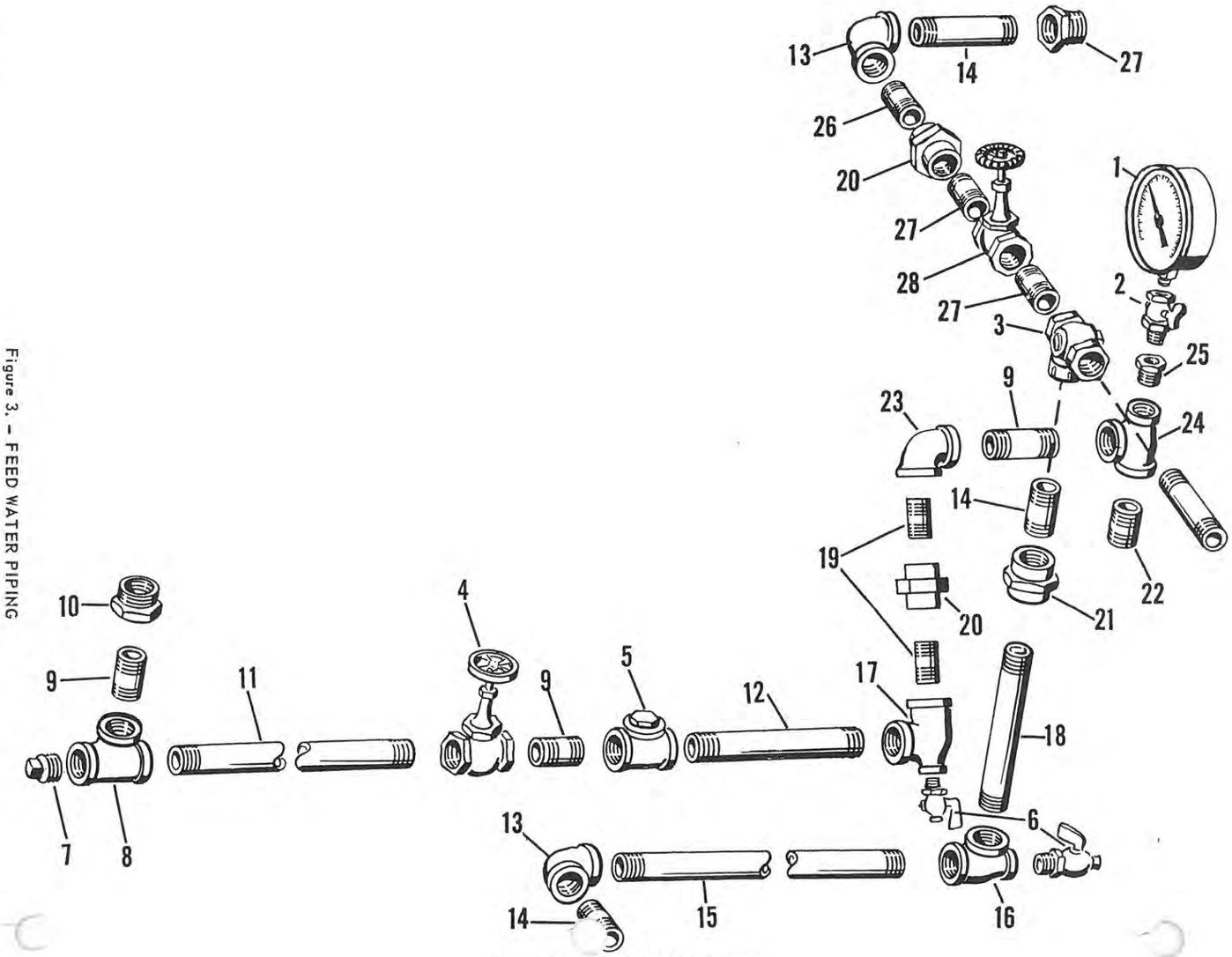


Figure 3. – FEED WATER PIPING

Figure 3. – FEED WATER PIPING

Figure 3

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	850-117	1	Gauge, Pressure 2-1/2"., 0-200 lbs
2	825-31	1	Cock, Union Gauge 1/4"
3	825-85	1	Cock, Three Way, 1"
4	941-134	1	Valve, Globe 200 lb, 3/4"
5	940-142	1	Valve, Check, Horizontal Swing, 3/4"
6	825-68	2	Cock, Pet 3/8"
28	941-94	1	Valve, Gate, 1"

REPLACEMENT PARTS Listed for Identification Please Order Locally as Mill Supplies

Ref. No.	Part No.	No. Req'd.	Description
7	858-92	1	Plug, Black, 3/4"
8	859-35	1	Tee, XH Black, 3/4"
9	857-282	3	Nipple, XH Black, 3/4" Close
10	847-426	1	Bushing, Black, 1" x 3/4"
11	900-22	1	Pipe, Black, Std, 3/4" x 39-3/4" (Approx.)
12	857-173	1	Nipple, Black Std, 3/4" x 5-1/2"
13	859-82	2	Elbow, Black Std, 90°, 1"
14	857-179	4	Nipple, Black Std, 1" x 4"
15	900-76	1	Pipe, Black Std, 1" x 46" (Approx.)
16	847-340	1	Tee, Black, 1" x 3/8" x 1"
17	847-264	1	Tee, Black Std, 3/4" x 3/8" x 3/4"
18	857-180	1	Nipple, Black Std. 1" x 4-1/2"
19	857-168	2	Nipple, Black Std, 3/4" x 3"
20	858-166	1	Union, Black 1"
21	858-165	1	Union, Black Std, 3/4"
22	857-184	1	Nipple, Black Std, 1-1/4" Close
23	859-81	1	Elbow, Black, Std 90°, 3/4"
24	847-284	1	Tee, Black Std, 1-1/4" x 3/4" x 3/4"
25	847-422	1	Bushing, Hex Black, 3/4" x 1/4"
26	857-8	1	Nipple, Black, Std, 1" x 3"
27	857-10	2	Nipple, Black, Std, 1" x 2"

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

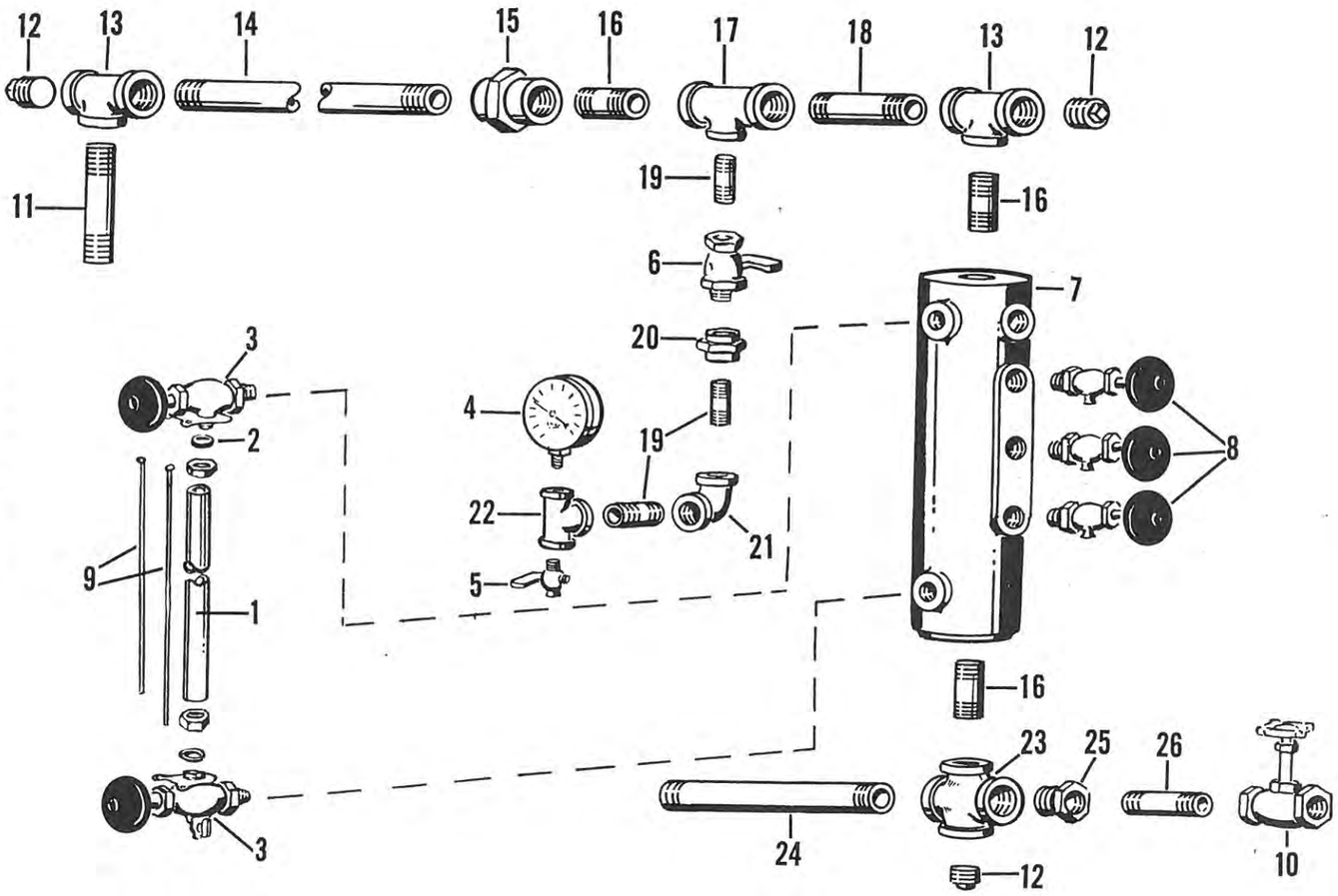


Figure 4. – WATER COLUMN

Figure 4. – WATER COLUMN

Figure 4

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	851-56	1	Glass, Gauge, 5/8" x 10-1/4"
2	853-115	2	Gaskets, Gauge Glass, Rubber, 5/8"
3	825-93	1	Set, Water Gauge, Consolidated, 1/2" (Includes upper and lower valve)
4	850-114	1	Gauge, Pressure, 4-1/2" 0-200 lb
5	825-64	1	Cock, Pet 1/4"
6	825-31	1	Cock, Union Gauge, 1/4"
7	100-13	1	Column, Water
8	825-92	3	Trycock, Water Column, 1/2"
9	912-34	2	Rod, Gauge Glass, 3/16" x 13" lg
10	941-142	1	Valve, Globe, 3/4"

REPLACEMENT PARTS
Listed for Identification
Please Order Locally as Mill Supplies

Ref. No.	Part No.	No. Req'd.	Description
11	857-303	1	Nipple XH Black, 1" x 5-1/2" lg
12	858-93	3	Plug, Black, Solid, 1"
13	859-36	2	Tee, XH Black 1"
14	900-85	1	Pipe, XH Black, 1" x 15-1/8" (Approx.)
15	858-176	1	Union, XH Black, 1"
16	857-296	3	Nipple, XH Black, 1" x 2" lg
17	847-320	1	Tee, XH Black, 1" x 1" x 1/4"
18	857-297	1	Nipple, XH Black, 1" x 2-1/2" lg
19	857-448	3	Nipple, Brass, 1/4" x 1-1/2"
20	858-193	1	Union, XH Brass, 1/4"
21	859-199	1	Elbow, XH Brass 90° x 1/4"
22	859-54	1	Tee, XH Brass, 1/4"
23	859-274	1	Cross, XH Black, 1"
24	857-180	1	Nipple, Black, Std, 1" x 4-1/2"
25	847-469	1	Bushing, Hex, Steel, 1" x 3/4"
26	857-167	1	Nipple, Black, 3/4" x 2-1/2" lg

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

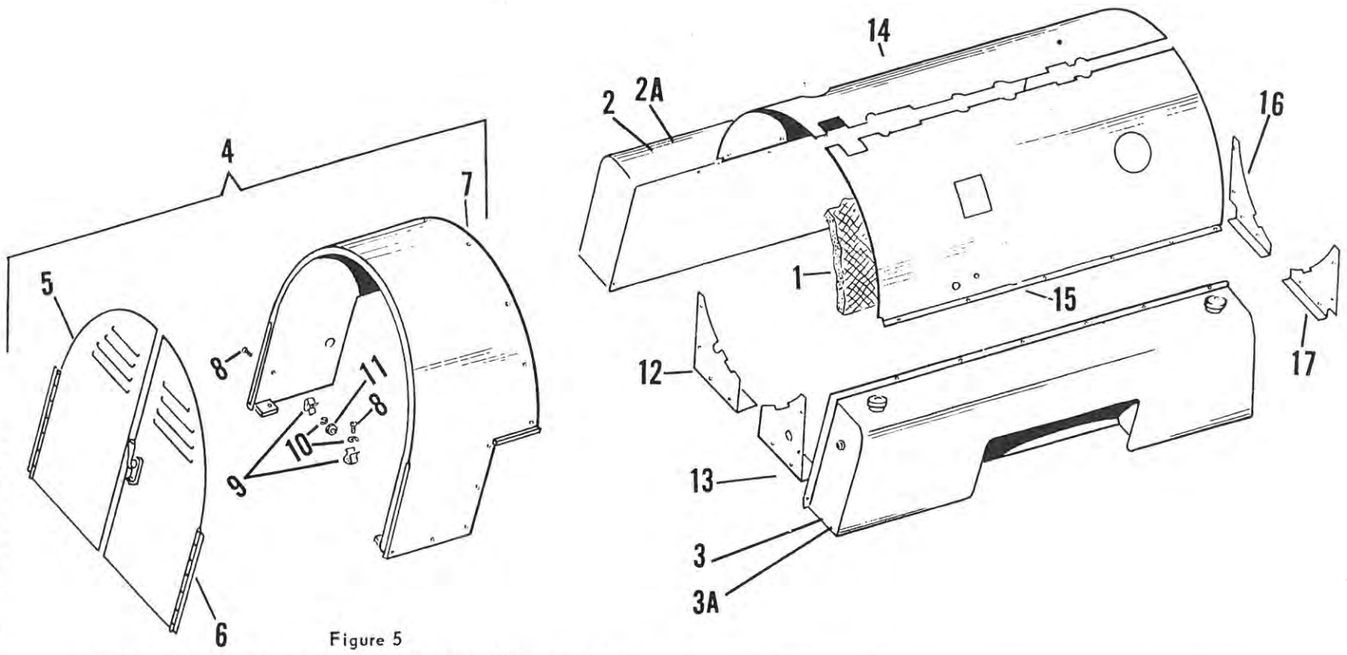


Figure 5

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	872-159	36 sq ft	Insulation
2	195-174	1	Tank, Water PSM-50
2A	195-176	1	Tank, Water PS-50
3	195-175	1	Tank, Gasoline & Fuel Oil, PSM-50
3A	195-177	1	Tank, Gasoline & Fuel Oil, PS-50
4	414-42	1	Canopy, Rear Deck
5	25-16	1	Door, Left, Canopy
6	25-15	1	Door, Right, Canopy
7	26-2	1	Canopy
8	860-7	2	Screw, Machine Rd Hd, 1/4"-20 x 1/2"
9	828-22	2	Clip, Crank Holding
10	952-92	2	Lockwasher, Std Steel 1/4"
11	869-21	1	Nut, Hex Steel 1/4"-20 NC
12	107-129	1	Lagging, Lower Left, Burner End
13	107-130	1	Lagging, Lower Right, Burner End
14	107-126	1	Lagging, Left Side
15	107-125	1	Lagging, Right Side
16	107-127	1	Lagging, Lower Rear, Left Hand
17	107-128	1	Lagging, Lower Rear, Right Hand

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE EL and UNIT NUMBER

Figure 5. – TANKS, LAGGING and CANOPY

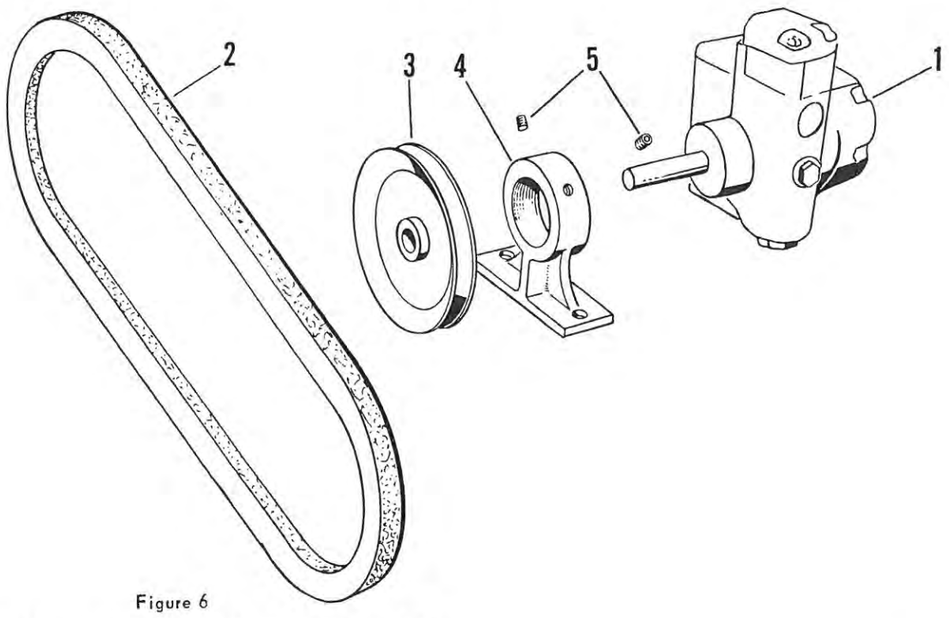


Figure 6

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	901-438	1	Pump, Webster IR213D-AM
			(Parts for pump - not shown)
1A	923-89	1	Strainer Basket, for 901-347 Pump
1B	853-168	1	Gasket, Strainer, for 901-347 Pump
1C	853-169	1	Gasket, Strainer Cover, for 901-347 Pump
2	809-142	1	V-Belt, 4L430
3	921-470	1	Sheave, 1A Groove 4.8" PD, 7/16" Bore
4	8-210	1	Bracket, Mounting, Oil Pump
5	860-39	2	Setscrew, 1/4"-20 x 3/8"

NOTE: 4T-8000 Pumps (901-347) Furnished On Previous Models No Longer Available.

TO REPLACE, ORDER:

Part No.	No. Req'd	Description
901-438	1	Pump, Webster IR 213D-AM
921-470	1	Sheave, 4.8 PD, 1A, 7/16" Bore
847-542	1	Elbow, Reducing, 1/4" x 1/8"
857-118	1	Nipple, 1/8" x 1-1/2"
845-177	3	Union, Flared, 3/8" ODC x 1/4"
507-599	1	Tubing, Ass'y, Pump to Burner

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

Figure 6. – FUEL OIL PUMP and DRIVE

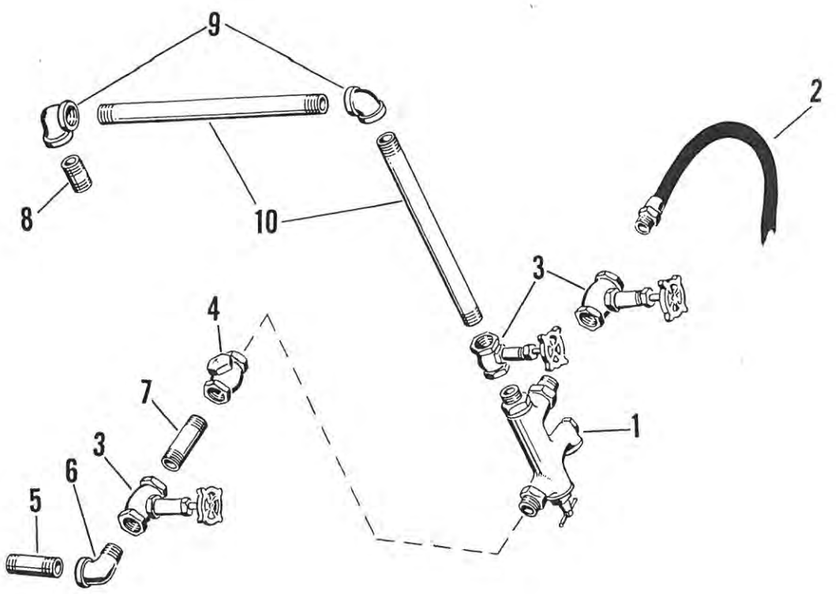


Figure 7. – INJECTOR

Figure 7

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	934-95	1	Injector, 3/4" Penberthy No.BB-330
2	861-186	1	Hose, Suction, Injector
3	941-142	3	Valve, Globe 3/4", 200 lb
4	940-136	1	Valve, Check Horizontal Lift 3/4"

REPLACEMENT PARTS
Listed for Identification
Please Order Locally as Mill Supplies

Ref. No.	Part No.	No. Req'd.	Description
5	857-289	1	Nipple, XH Black, 3/4" x 4"
6	859-107	1	Elbow, Street Black, Std, 90° 3/4"
7	857-291	1	Nipple, XH Black 3/4" x 5"
8	857-287	1	Nipple, XH Black 3/4" x 3"
9	859-126	2	Elbow, XH Black 90°, 3/4"
10	900-84	2	Pipe, XH Black, 3/4" (Length Varies)

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

Figure 7. – INJECTOR

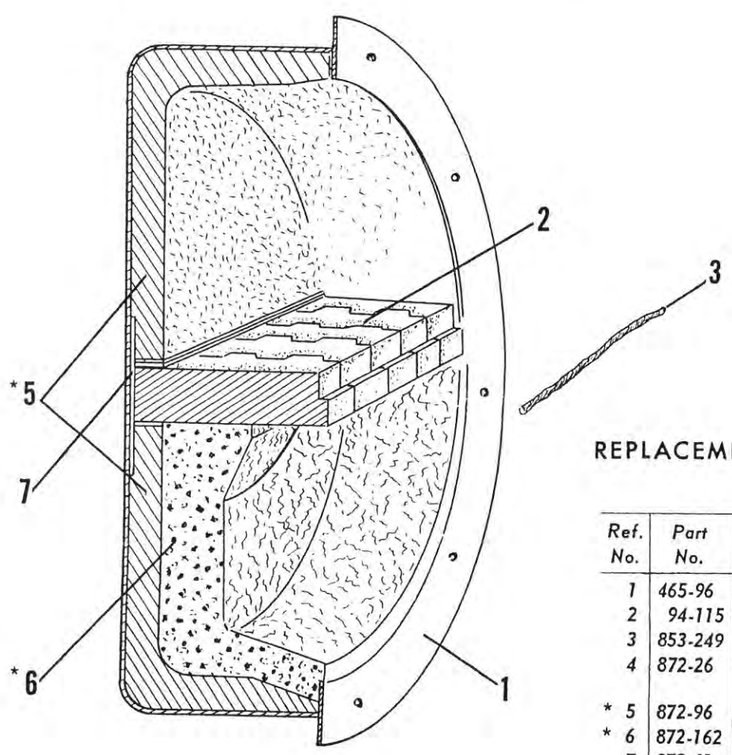


Figure 8. – REAR HEAD ASSEMBLY

Figure 8

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	465-96	1	Rear Head, with Refractory, PS 50
2	94-115	8	Tile, Rear Baffle
3	853-249	35"	Gasket, Asbestos Rope, 5/8"
4	872-26	5 lb	Cement, Asbestos (For Resealing Door) (Not Shown)
* 5	872-96	200 lb	Cement, Bafflecrete
* 6	872-162	100 lb	Cement, V-Block Mix
7	872-61	6 sq ft	Board, Asbestos, 1/4 in. Thick
8	872-47	1	Cement, Firefrax, (For Baffle Tile) (40 lb Drum) (Not Shown)

* Material only - in loose form.

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

Figure 8. – REAR HEAD ASSEMBLY

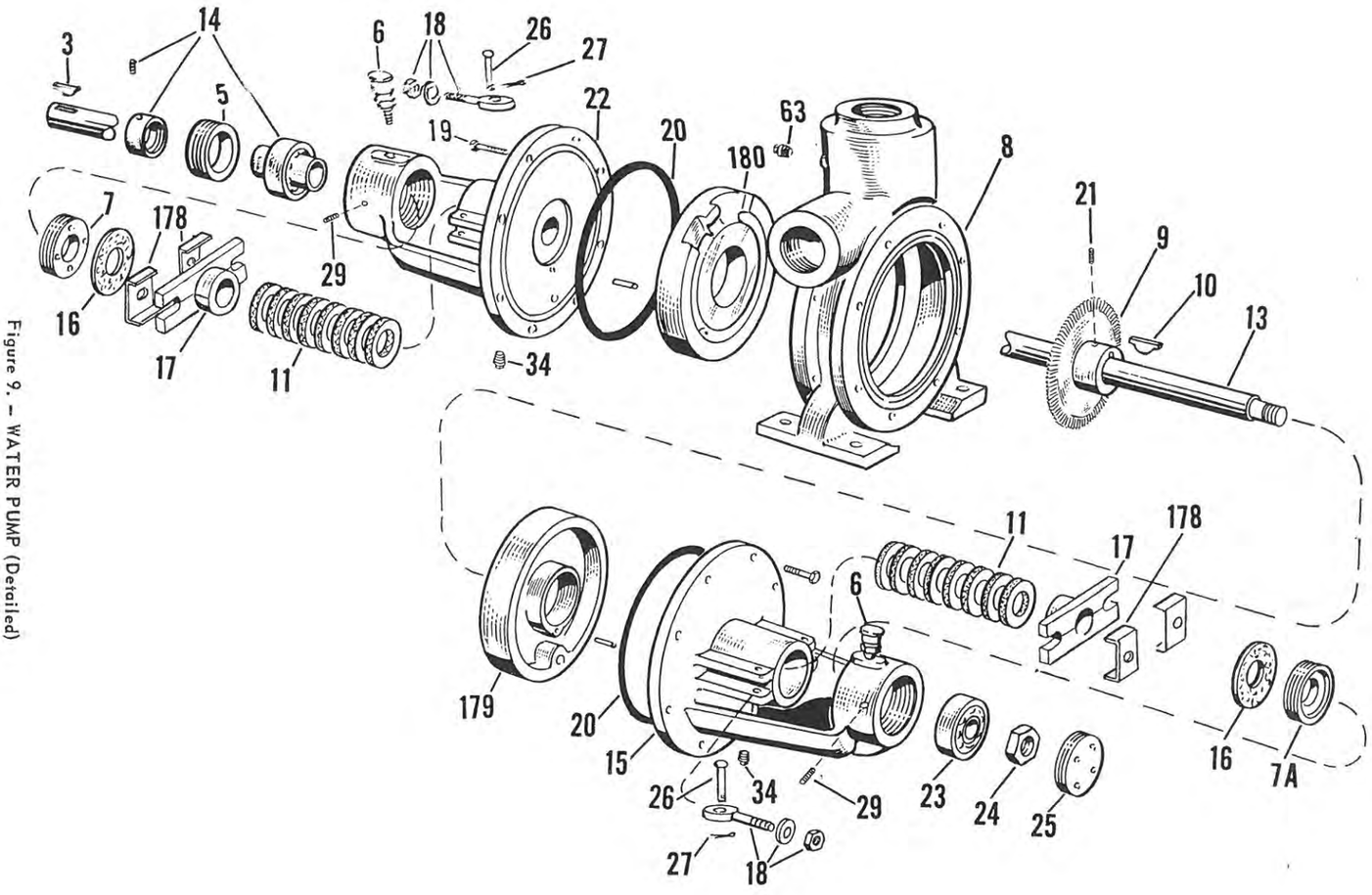


Figure 9. – WATER PUMP (Detailed)

Figure 9
REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
3	841-580	1	Key, Coupling, No. 11-10-A104
5	841-641	1	Nut, Adjusting, No. 5-8D
6	844-21	2	Fitting, Grease, No. 1/8" OD
7	841-640	1	Nut, Adjusting, No. 5-7D
7A	841-451	1	Nut, Adjusting, No. 5-7
8	902-77	1	Shell, No. 4-1
9	871-101	1	Impeller, No. E40-4
10	841-530	1	Key, Impeller, No. 11-10-M104
11	52-5	1	Packing, No. 1 (set of 16) (1/4" x 3 5/8")
13	932-141	1	Shaft, No. 5-6A
14	807-177	1	Bearing, Ball, No. SM1012K2
15	821-173	1	Cover, (Blind End), No. 41-3R
16	929-34	2	Slinger, Water, No. 11-10-B103
17	852-49	2	Gland, No. 5-5C
18	841-455	4	Eyebolt Ass'y. Includes Nut and Washer, No. 5-10
19	868-641	16	Capscrew, 1/4 NC x 3/4", No. 11-10 F104
20	853-144	2	Gasket, No. 4-12
21	841-463	1	Setscrew, 1/4 NF x 1/4 S.S., No. 11-10-G 104
22	821-172	1	Cover, (Drive End), No. 41-2R
23	807-174	1	Bearing, Ball, No. 303
24	841-454	1	Jam Nut, 5/8 NF
25	841-453	1	Nut, Adjusting, No. 5-9
26	903-108	4	Clevis Pin, (1/4 x 1 1/4), No. 100-10-B28
27	841-534	4	Cotter Pin, 1/16 x 3/4, No. 100-10-D 28
29	841-463	4	Setscrew, 1/4 NF x 1/4 SS, No. 11-10-G104
34	902-70	3	Plug, Drain, 1/8", No. 11-10-K104
63	858-89	1	Plug, 1/4",
178	928-76	4	Gland Clamp, No. 100-10-1
179	914-153	1	Channel Ring, (Fits Cover 821-173), No. E4-3R
180	914-154	1	Channel Ring, (Fits Cover 821-172), No. E4-2R

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

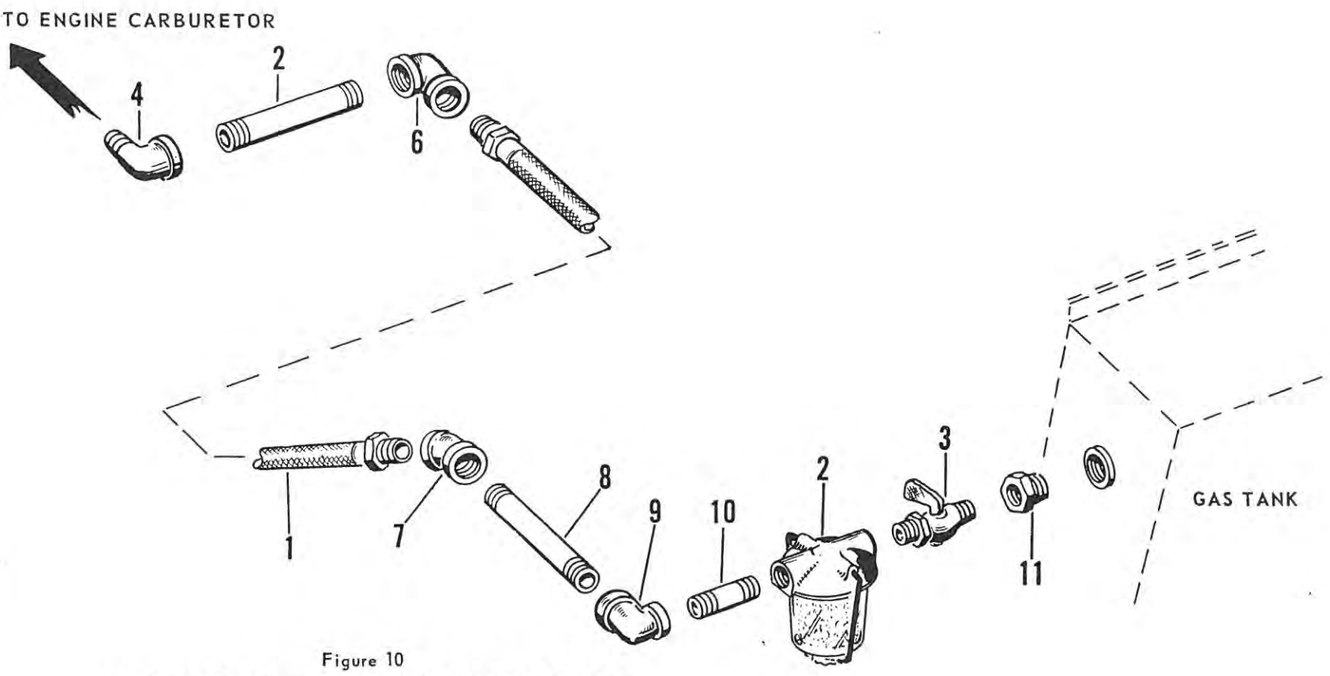


Figure 10

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	861-222	1	Hose, Flexible, Gas Line
2	923-86	1	Strainer, Fuel, Imperial
3	825-102	1	Cock, Shut Off, Gas Strainer
Replacement parts (listed for identitication please order locally as mill supplies)			
4	859-104	1	Elbow, Street, Black, 1/4"
5	857-133	1	Nipple, Black, 1/4" x 3-1/2"
6	859-78	1	Elbow, Black, 1/4"
7	859-92	1	Elbow, Black, 1/4", 45°
8	857-132	1	Nipple, Black, 1/4" x 3"
9	847-542	1	Elbow, Reducing, Black, 90°, 1/4" x 1/8"
10	857-116	1	Nipple, Black, 1/8" x Close
11	847-415	1	Bushing, 1/4" x 1/8"

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIV[illegible]ODEL and UNIT NUMBER

Figure 10. – GASOLINE LINE

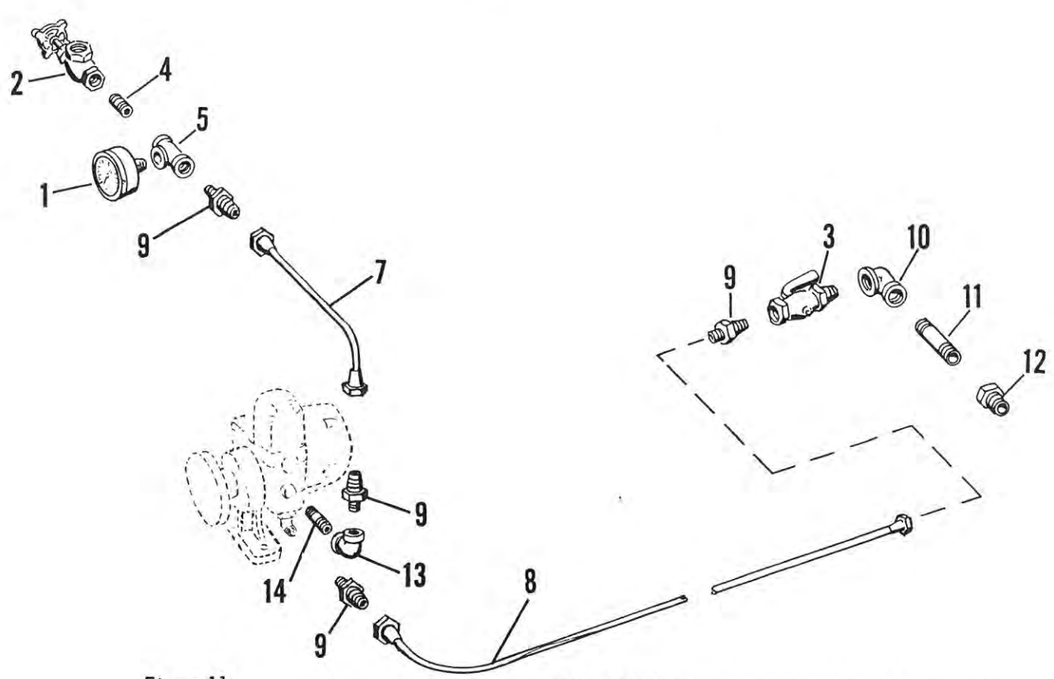


Figure 11

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	850-82	1	Gauge, Pressure 2", 0-200 lb
2	941-217	1	Valve, Angle Globe, 1/4"
3	825-62	1	Cock, Gauge 1/4"

When ordering parts, you MUST include PARTS NUMBER,
DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

REPLACEMENT PARTS Listed for Identification Please Order Locally as Mill Supplies

Ref. No.	Part No.	No. Req'd.	Description
4	857-128	1	Nipple, Black Std. 1/4" x 1-1/4"
5	859-22	1	Tee, Black Std, 1/4" x 1/4" x 1/4"
7	507-599	1	Tubing, Assembly, Pump to Burner w/Nuts
8	507-567	1	Tubing, Fuel Line, Tank to Pump w/Nuts
9	845-177	4	Union, Flared, 3/8" ODC x 1/4" SPT
10	859-78	1	Elbow, Black Std. 90°, 1/4"
11	857-129	1	Nipple, Black Std. 1/4" x 1-1/2"
12	847-424	1	Bushing, Hex, Black 1" x 1/4"
13	847-542	1	Elbow, Reducing, 1/4" x 1/8"
14	857-118	1	Nipple, 1/8" x 1-1/2"

Figure 11. – BURNER FUEL SYSTEM PIPING

Figure 12. – BASE FRAME and RUNNING GEAR

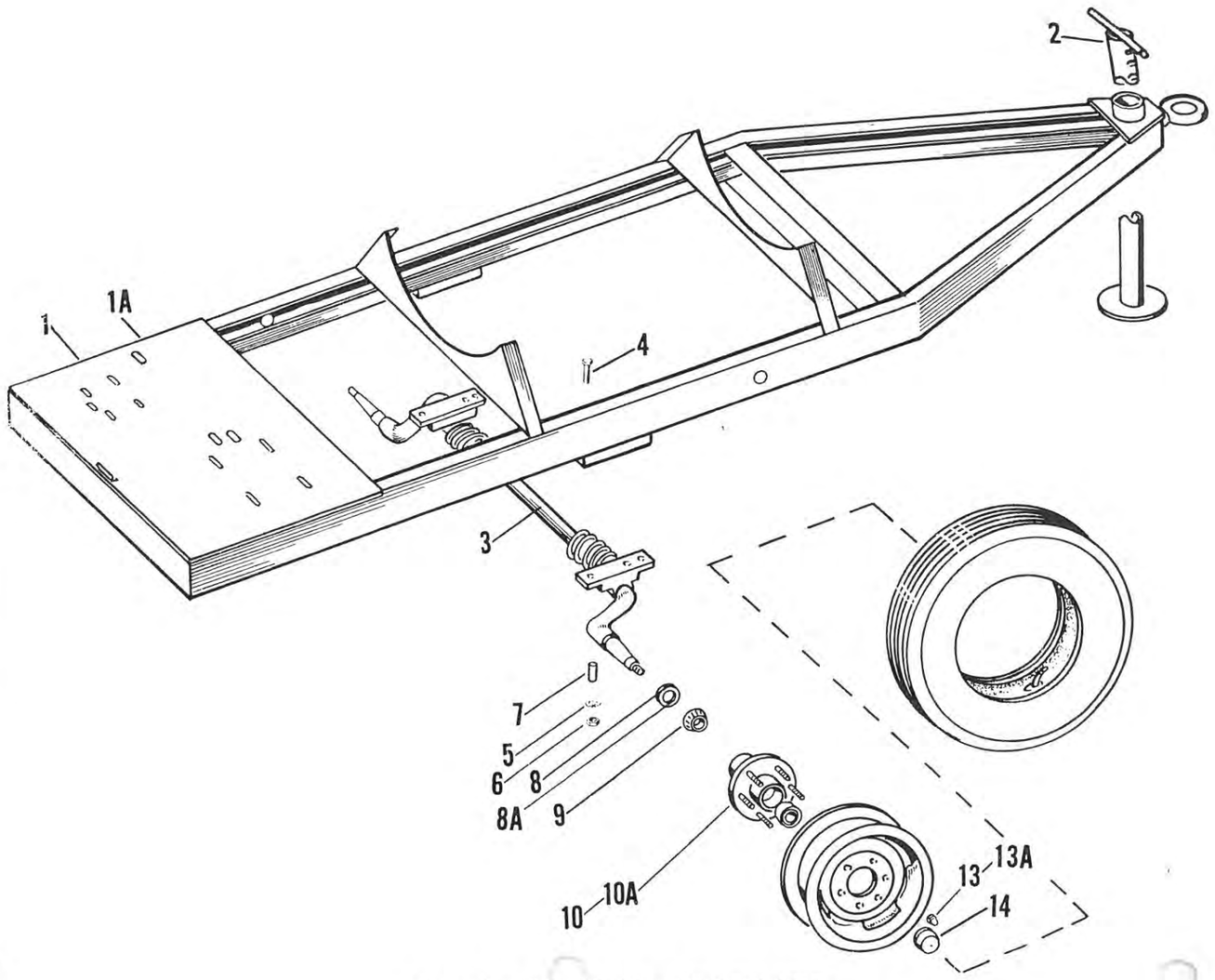


Figure 12. – BASE FRAME and RUNNING GEAR

Figure 12

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	446-96	1	Frame, Base, PSM-50
1A	446-99	1A	Frame, Base, PS-50
2	101-46	1	Leg, Front Support
			Following components used on 3000 lb axle which is standard equipment on most units. Verify size axle by determining if tire size is 7.50-16
3	801-6	1	Axle, 3000 lb
4	868-478	4	Capscrew, 5/8"-11 x 3-3/4"
5	869-17	4	Nut, Hex. 5/8"-11
6	952-84	4	Lockwasher, 5/8"
7	939-279	2	Tubing, Sleeve
8	925-120	2	Seal, Grease, Inner
9	807-311	2	Bearing, Inner, No. 2788
10	864-30	2	Hub, w/bearing cups and 6 studs RH & LH
11	807-312	2	Bearing, Outer, No. 1779
12	951-68	2	Wheel, 6 Hole, 16 x 5.50 (7.50) No. 31753
13	841-353	12	Nut, RH & LH
14	820-74	2	Cap, Hub
			Following components used on 6000 lb axle which is special or optional. Verify size axle by determining if tire size is 7.50-20
3	801-18	1	Axle, 6000 lb
4		4	Capscrew, 3/4" - 10 x 3/4"
5	869-18	4	Nut, Hex. 3/4" - 10
6	952-95	4	Lockwasher, 3/4"
8	913-24	2	Felt, Bearing Seal
8A	913-23	2	Retainer, Bearing
9	807-206	2	Bearing, Roller No. 3578 Timken
10	864-24	1	Hub, Wheel, R.H. w/bearing, cups and 6 studs
10A	864-25	1	Hub, Wheel, L.H. w/bearing, cups
11	807-203	2	Bearing, Roller, No. 2689 Timken
12	951-48	2	Wheel, 6 Hole, 20 x 6.00 w/locking ring
13	841-417	6	Nut, Wheel, RH
13A	841-418	6	Nut, Wheel, LH
14	13-19	2	Cap, Hub

NOTE: Tire and tubes not available from CBCO.
Refer to local implement or tire dealer.

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

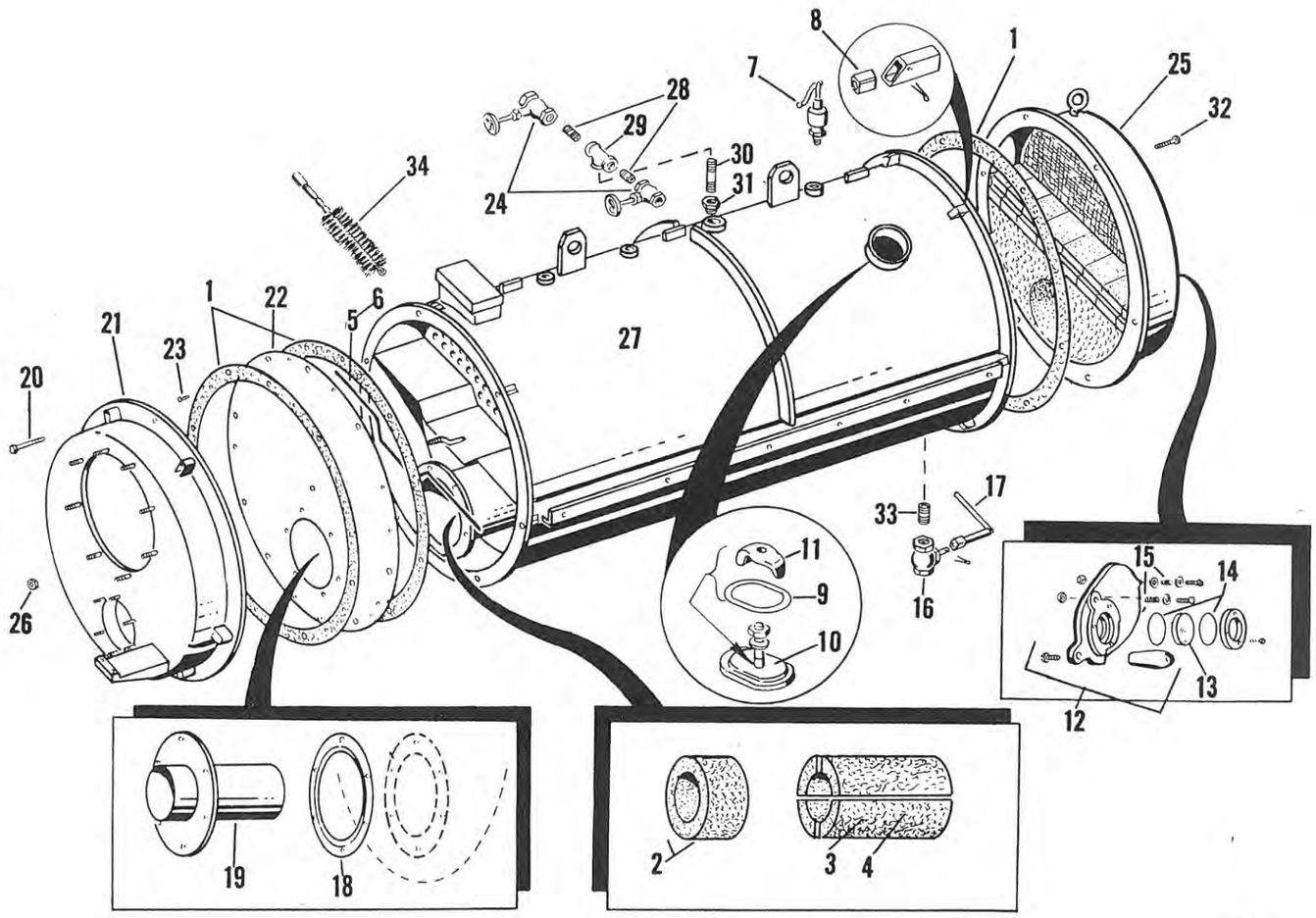


Figure 13. – BOILER ASSEMBLY

Figure 1. BOILER ASSEMBLY

Figure 13

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	32-442	3	Gasket, Front & Rear Head
2	94-128	1	Refractory, Dry Oven Ring
3	94-127	4	Refractory, Dry Oven
4	872-47	1	Cement, Firefrax, 40 lb Drum
5	853-394	1	Gasket, Tadpole, 2" x 38" long
6	841-551	10	Rivet, Split, 1/4" x 7/8"
7	940-390	1	Valve, Pop, 1", 150 lb Kunkle No. 82
8	51-160	12	Nut, Square, Head Bolt
9	853-177	4	Gasket, Handhole 2-3/4" x 3-1/2" Spirotallic
10	821-46	4	Cover, Handhole 2-3/4" x 3-1/2", Curved to 48" Includes Nut and Washer
11	953-12	4	Yoke, Handhole
12	550-24	1	Observation Window Assembly
13	851-26	1	Glass Sight Pyrex, 1-3/4"
14	853-213	2	Gasket, Sighthole, Glass
15	82-67	1	Spring, Observation Window
			Above 4 items furnished on early model units only.

Ref. No.	Part No.	No. Req'd.	Description
16	825-65	1	Cock, 1" Blowdown
17	37-3	1	Handle, Blowdown
18	32-443	2	Gasket, Dry Oven
19	40-177	1	Housing, Burner
20	868-479	6	Capscrew, Hex, Hd 5/8" x 4-1/4"
21	132-170	1	Head, Front
22	465-97	1	Plate, Head Front, Insulated
23	841-494	12	Rivet, Split, 3/16" x 3/4"
24	941-39	2	Valve, Globe 1"
25	465-96	1	Head, Rear Insulated
	Replacement parts (listed for identification)		
26	869-37	7	Nut, Brass, 3/8"
27	524-382	1	Shell, Boiler, PS 50
28	857-10	2	Nipple, Black Std, 1" x 2"
29	847-282	1	Tee, Black Std, 1" x 1" x 1-1/2"
30	857-203	1	Nipple, Black Std, 1-1/2" x 6"
31	847-443	1	Bushing, Black, 2" x 1-1/2"
32	868-477	6	Capscrew, Hex Hd, 5/8" x 3-1/4"
33	857-177	1	Nipple, Black Std, 1" x 2-1/2"
34	814-8	1	Brush, Flue, 1-7/8"

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

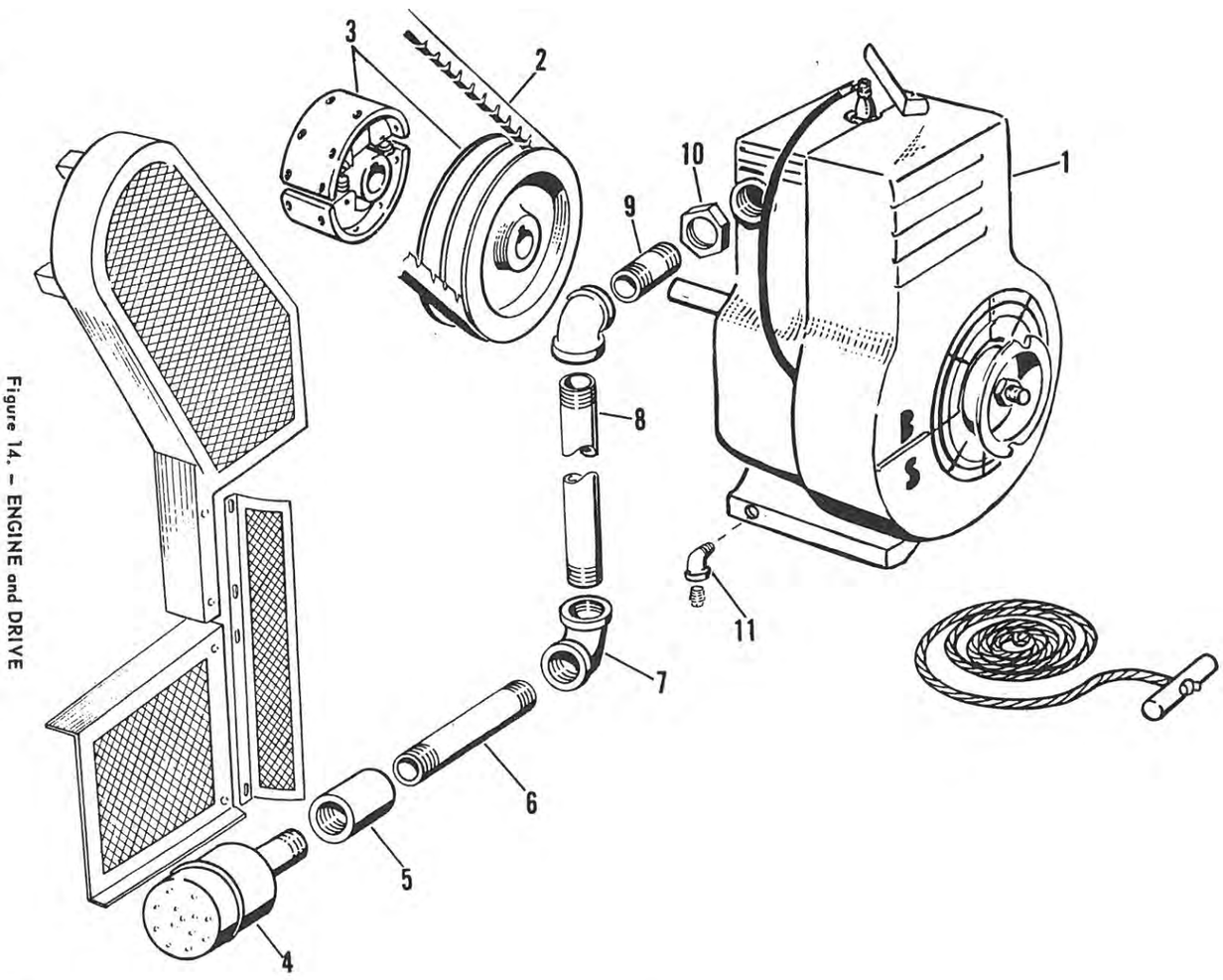


Figure 14. – ENGINE and DRIVE

Figure 14. – ENGINE and DRIVE

Figure 14

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	834-21	1	Engine, Gasoline, B & S No. 23 (Refer to Engine Manual for Detailed Parts Breakdown. When ordering parts identify with B & S Parts Numbers)
2	809-121	1	V-Belt, V-Steel B-62
3	831-28	1	Clutch & Pulley Assembly
4	835-97	1	Muffler, B & S No. 290933

REPLACEMENT PARTS
Listed for Identification
Please Order Locally as Mill Supplies

Ref. No.	Part No.	No. Req'd.	Description
5	858-23	1	Coupling, Steel 1"
6	857-181	1	Nipple, Black, Std. 1" x 5"
7	859-82	2	Elbow, Black, Std. 90°, 1"
8	900-76	1	Pipe, Black, Std. 1" x 15-1/4"
9	857-177	1	Nipple, Black, Std. 1" x 2-1/2"
10	848-98	1	Locknut, Conduit, 1"
11	859-105	1	Elbow, Street 3/8", 90° St. Black

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

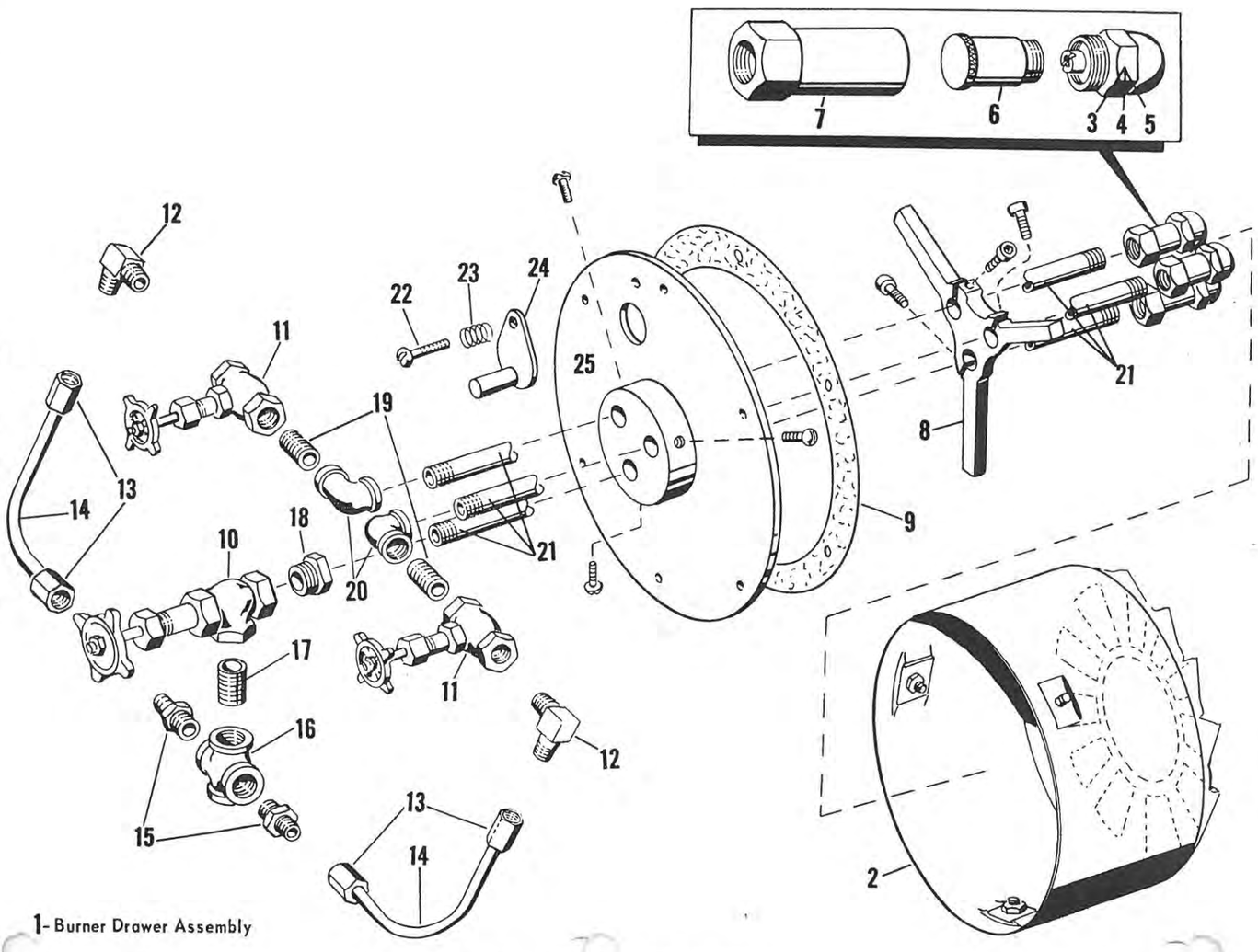


Figure 15. – BURNER DRAWER

Figure 15. – BURNER DRAWER

Figure 15

REPLACEMENT and MAINTENANCE PARTS

Ref. No.	Part No.	No. Req'd.	Description
1	429-193	1	Burner Drawer Assembly, PS 50
2	275-75	1	Diffuser, PS50
3	899-20	1	Nozzle, Burner 4.0 GPH, 30° Monarch
4	899-80	1	Nozzle, Burner 6.0 GPH, 30° Monarch
5	899-59	1	Nozzle, Burner 7.0 GPH, 30° Monarch
6	899-14	3	Strainer, Nozzle
7	899-11	3	Nozzle, Body 1/8"
8	456-30	1	Spider, Burner Assembly
9	32-677	1	Gasket, Burner Plate
10	941-217	1	Valve, Angle Globe, 1/4"
11	941-105	2	Valve, Globe 1/8"

REPLACEMENT PARTS Listed for Identification Please Order Locally as Mill Supplies

Ref. No.	Part No.	No. Req'd.	Description
12	845-42	2	Elbow, Flared, Connector, 1/4" ODC x 1/8" SPT x 90°
13	845-8	4	Nut, Flared, Connector Brass, 1/4" OD
14	939-25	2	Tubing, Copper, 1/4" OD x 4-1/2"
15	845-7	2	Union, Flared Connector, 1/4" ODC-1/4" SPT x STR
16	859-299	1	Cross Galv 1/4"
17	857-565	1	Nipple, 1/4" Close
18	847-77	1	Bushing, Hex 1/4" x 1/8"
19	857-42	2	Nipple, Galv, 1/8" Close
20	859-219	2	Elbow, Galv, 90°, 1/8"
21	900-72	3	Pipe, Black, 1/8" x 12-1/2" long
22	860-121	1	Screw, Mach. Rd Hd, Steel 10-32 x 1" long
23	82-10	1	Spring, Lighter Hole Cover
24	19-27	1	Cover, Lighter Hole
25	59-301	1	Plate, Burner

When ordering parts, you MUST include PARTS NUMBER, DESCRIPTION, and QUANTITY REQUIRED
ALWAYS GIVE MODEL and UNIT NUMBER

MISCELLANEOUS — Not Illustrated

Part No.	Description
873-23	Torch, Burner Ignitor
861-184	Hose, Steam, Rubber, 1" x 15"
861-185	Hose, Steam, Rubber, 1" x 25"

CUSTOMER COPY

FICES:
CHESTER ST.-P.O. Box 504
D, NEW HAMPSHIRE 03302-0504
-4000

KEEP THIS INVOICE - We do not itemize again.

INTEREST AT 1½% PER MONTH (18% PER ANNUM) WILL BE CHARGED TO ACCOUNTS PAST DUE. THE PURCHASER AGREES TO PAY ALL COSTS OF COLLECTION INCLUDING REASONABLE ATTORNEY FEES. ALL RETURNS MUST BE ACCOMPANIED BY THIS INVOICE AND MAY BE SUBJECT TO A HANDLING CHARGE.

MOST MANUFACTURERS PROVIDE WARRANTIES ON THEIR PRODUCTS. WARRANTIES ARE LIMITED TO THOSE MADE DIRECTLY BY MANUFACTURERS.

AIN ST - CONCORD
) 225-4100
'ARTS..PARTS PLUS

SHIP TO
GENERAL SERVICES
PO# & SIGN. ON INV.!
BLK. PO

1
CD-1 OF
00000 3/14 1

O. NO.	SALES NO.	CNTR. NO.	SHIP VIA	TERMS
RAL	$ 26	6		SNL-CHARGE

PED	BKO	LIST PRICE	NET	NET CORE	EXT. AMOUNT
1	0	13.080	5.445		5.45
			P.O.	64350	

PO#:GENERAL SERVICES

TAL CORE	TAXABLE AMT.	SALES TAX		SUB TOTAL
0.00	0.00	0.00	0.00	5.45
SEAN R BERTH	LIST TOTAL ▶	13.08	PAY THIS AMOUNT ▶	5.45

fredericksealinc.

461 STRAW ROAD
MANCHESTER, N.H. 03102
TEL: 603-668-0900

**PAGE 01 OF 01 **

TRANSACTION NO. 117148

CITY OF CONCORD
PUBLIC WORKS DEPARTMENT
311 NORTH STATE STREET
CONCORD NH 03301

CUSTOMER NO.	TERRITORY	DATE ENTERED	CUSTOMER ORDER NUMBER	CASH	CHG.	COD	TAKEN BY	PICKED BY	SHIP
95514	NHNO	8/14/08	79-16161		X		BOS/CUS		UPS

ITEM NO.	REORDER NUMBER	ORDER QTY.	SHIP QTY.	U/M	
1	926H27-35E50	10	10	EA	STYLE 926 GATOR GRIP GASKET 2-3/4" X 3-1/2" X 1/2" E
	FREDERICKSEAL INC. 461 STRAW ROAD MANCHESTER, N.H. 03102 603-668-0900				
2	REORDER NUMBER	ORDER QTY.	SHIP QTY.	U/M	
	FREDERICKSEAL INC. 461 STRAW ROAD MANCHESTER, N.H. 03102 603-668-0900				
3	REORDER NUMBER	ORDER QTY.	SHIP QTY.	U/M	
	FREDERICKSEAL INC. 461 STRAW ROAD MANCHESTER, N.H. 03102 603-668-0900				
4	REORDER NUMBER	ORDER QTY.	SHIP QTY.	U/M	
	FREDERICKSEAL INC. 461 STRAW ROAD MANCHESTER, N.H. 03102 603-668-0900				
5	REORDER NUMBER	ORDER QTY.	SHIP QTY.	U/M	
	FREDERICKSEAL INC. 461 STRAW ROAD MANCHESTER, N.H. 03102 603-668-0900				
6	REORDER NUMBER	ORDER QTY.	SHIP QTY.	U/M	
	FREDERICKSEAL INC. 461 STRAW ROAD MANCHESTER, N.H. 03102 603-668-0900				
7	REORDER NUMBER	ORDER QTY.	SHIP QTY.	U/M	
	FREDERICKSEAL INC. 461 STRAW ROAD MANCHESTER, N.H. 03102 603-668-0900				

Brent
1/22/08
2:49
$3.46 ℮

CUSTOMER ORDER NO. 79-16161

SHIP TO
CITY OF CONCORD
PUBLIC WORKS DEPARTMENT
311 NORTH STATE STREET
CONCORD NH 03301

FREDERICKSEAL INC.
461 STRAW ROAD
MANCHESTER, N.H. 03102
TEL: 603-668-0900

117148 TRANSACTION NO.

CUSTOMER ORDER NO. 79-16161

SHIP TO
CITY OF CONCORD
PUBLIC WORKS DEPARTMENT
311 NORTH STATE STREET
CONCORD NH 03301

FREDERICKSEAL INC.
461 STRAW ROAD
MANCHESTER, N.H. 03102
TEL: 603-668-0900

117148 TRANSACTI

Hansen-Fox CO. INC.

WPQ18

September 22, 1998

City of Concord
General Services Department
311 No. State Street
Concord, NH 03301

Attn: Kevin Bartlett
Re: Boiler Repair

We are pleased to offer our proposal to perform repairs to your portable steam boiler. Our price includes cutting out one bad tube, installing new tube, rolling into tube sheet, and back welding tube. Boiler to be drained and opened by City. Our price includes R-1 form for code welding and authorized inspector to perform insurance inspection. Materials are available 1 week from date of order.

Boiler Repair	$1,770.00
R-1 Form	$ 75.00
R Stamp Fee	$ 250.00
Insurance Inspection Fee	$ 500.00
Total	$2,595.00

If you have any questions please call Albert LaPierre or myself.

Terms: Net 10 days. Interest at 1-1/2% per month will be charged on all invoices 30 days past due. Work will not commence until signed copy is returned to us.

HANSEN-FOX CO., INC.

Alan E. Gray
Vice President
Date: 9-22-98
AEG:wk

City of Concord

_____

Date: _____

MECHANICAL CONTRACTORS
Plumbing • Heating • Air Conditioning
Mailing Address: P.O. Box 1048, Concord, New Hampshire 03302-1048
Garvins Falls Road • Bow, NH 03304
(603) 224-9951 FAX (603) 228-1677

x

Hansen-Fox CO. INC.
MECHANICAL CONTRACTORS
POST OFFICE BOX 1048 • CONCORD, N.H. 03302-1048
TEL: (603)224-9951 • FAX: (603)228-1677

INVOICE NO. 5109

BILL TO
CONCORD PURCHASING DEPARTMENT
41 GREEN STREET
CONCORD, NH 03301

SITE
GENERAL SERVICES ADMIN. DEPT.
311 NO. STATE STREET
CONCORD, NH

INVOICE DATE	INVOICE NO.	CUSTOMER NO.	PAYMENT TERMS	CONTRACT NO.
03/10/1999	5109	13056	-----NET 10 DAYS----	

TICKET #	QTY	UNIT MEAS	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
W/O # - 990304006			P.O. # - 99-9630		
			3/8 FURNISHED (1) 50 FT. 1" H.P. STEAM HOSE W/1" LOCKING LUG END. ONE END WITH HOSE BARB, AS REQUESTED.(PO#79-13431)		
99-9630			AS QUOTED:		465.0

32550 VNO _____ PONO
$465.00 Amt. _____ Acct./No
$_____ Amt. _____ Acct./No
$_____ Amt. _____ Acct./No
I hereby certify this claim against the City has been incurred and verified in accordance with reasonable procedures and payment is hereby warranted.

_____
Date

RECEIVED
MAR 25 1999
GENERAL SERVICES

RECEIVED
MAR 17 1999
GENERAL SERVICES

INTEREST AT 1-1/2% PER MONTH WILL BE CHARGED ON ALL INVOICES 30 DAYS PAST DUE.

GROSS	TAX	NET AMOUNT
465.00	.00	465.0

Hansen-Fox CO/INC.
MECHANICAL CONTRACTORS
POST OFFICE BOX 1048 • CONCORD, N.H. 03302-1048
TEL: (603)224-9951 • FAX: (603)228-1677

INVOICE NO. 5223

PAGE NO. 1

BILL TO
CONCORD PURCHASING DEPARTMENT
41 GREEN STREET
CONCORD, NH 03301

SITE
GENERAL SERVICES ADMIN. DEPT.
311 NO. STATE STREET
CONCORD, NH

INVOICE DATE	INVOICE NO.	CUSTOMER NO.	PAYMENT TERMS	CONTRACT NO.
04/08/1999	5223	13056	-----NET 10 DAYS----	

TICKET #	QTY	UNIT MEAS	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
W/O # - 990309004			P.O. # - 99-9653		
	4/6		FURNISHED WIRE CHAFE GUARD FOR H.P. STEAM HOSE. PO# 79-13435		
'99-9630			MATERIAL WIRE CHAFE GUARD FOR H.P. STEAM HOSE	.00 196.00	

RECEIVED
APR 14 1999
GENERAL SERVICES

32550 V/NO 13435 PO/NO
$196.00 Amt. _____ Acct/No
$_____ Amt. _____ Acct/No
$_____ Amt. _____ Acct/No
I hereby [illegible] has been incurred [illegible] reasonable prosecution [illegible] delay will ensue.

_____
Date

INTEREST AT 1-1/2% PER MONTH WILL BE CHARGED ON ALL INVOICES 30 DAYS PAST DUE.

GROSS	TAX	NET AMOUNT
196.00	.00	196.00


123
103


123
103