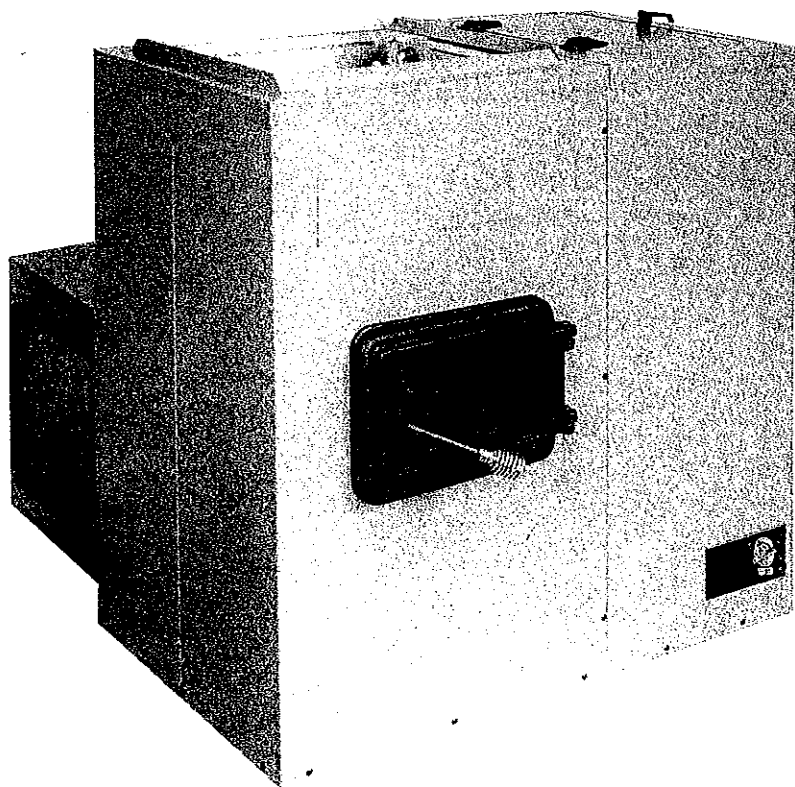


Combustioneer®

Mk IV

STOKER FIRED FURNACE



OWNER'S MANUAL and PARTS LIST

SAVE THIS MANUAL FOR FUTURE USE

WARNING
ALL SERVICE AND/OR REPAIR OF WILL-BURT HEATING EQUIPMENT MUST BE PERFORMED BY LICENSED, CERTIFIED HEATING/VENTILATION/AND AIR CONDITIONING (HVAC) CONTRACTORS AND/OR LICENSED ELECTRICAL SERVICE TECHNICIANS IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS. FAILURE TO COMPLY WITH THIS WARNING MAY RESULT IN PROPERTY DAMAGE, SERIOUS INJURY, OR DEATH.



ORRVILLE, OHIO 44667

21655

STARTUP AND OPERATING THE MK IV

The Mk IV Furnace is designed and tested to produce an output of 75,000 BTU's per hour using coal of 11,500 BTU's per pound. The two-speed drive is therefore designed to feed approximately 10 pounds of coal per hour when the drive belt is in the large diameter groove of the motor sheave and the small diameter groove of the transmission sheave. When the belt is in the other groove the feed rate is approximately 8.7 pounds per hour. If your coal has a heating value over 11,500 BTU per pound, the 8.7 pound feed rate should suffice.

Recommended Coal Specifications:

Moisture Content	1 - 10%
Ash content	3 - 8%
Ash Fusion Temperature	2100 degrees F - 2450 degrees F
Type (Washed)	Bituminous
Minimum BTU/pound	12,000
Coke Button	Less than 4
Size	1" x 1/4"

START UP:

SAFETY NOTE: The Mark IV Furnace requires special break-in procedures to cure the paint. Initial firing of the furnace should be moderate to allow for proper curing. Be sure to ventilate the house during this first firing. Windows should be opened to allow any irritating fumes from the curing paint and/or smoke from evaporating oils to escape.

SAFETY NOTE: Keep children away from furnace while in operation. DO NOT touch firedoor, smoke pipes, or other possibly hot surfaces.

SAFETY NOTE: When the power switch on the front of the Mark IV Furnace is turned "OFF", the circulating fan will continue to operate to cool the heater until the fan control shuts it off.

Notice the inlet damper on the combustion blower housing. Rotating the damper "in" and "out" will determine how much underfire air you are putting into the fuel bed. Set almost closed for start up by rotating the damper in.

Place kindling over some crumpled paper on top of coal in burner and ignite. DO NOT use flammable liquids of any kind to ignite coal. Allow to burn until coal starts burning. Now switch stoker on at power switch. Make sure thermostat is set high enough for stoker to continue to operate.

Allow fuel bed to build for about 15-20 minutes, checking periodically to be sure fire is burning. At this point it is time to make some adjustments to the barometric damper in the smoke pipe (Figure 1) and also the combustion blower inlet damper. Gradually open the inlet damper until fire brightens to a yellow flame. Note: When making adjustments and checking flame, DO NOT leave firedoor open for extended periods of time. This takes away heat from fire which will result in poor burning.

During this same time period you will need to adjust the barometric damper. If the unit is installed by a heating contractor he can check draft through the firedoor air inlet damper with a draft gauge. The barometric damper should be adjusted to show a neg. .03 to .05 minimum overfire draft reading in the firebox with the stoker operating. If a gauge is not available, take a small piece of paper 3" x 7" and place over the open air inlet in the firedoor and adjust weight on barometric damper so that paper will just barely hold onto the door. This automatically adjusts to changes in draft caused by wind on the chimney or by fire cooling down.

Allow to burn another 15 to 20 minutes and recheck the underfire air and overfire draft as described previously. All coals have different burning characteristics and it could be necessary to make additional adjustments. You want to have a bright yellow flame with proper draft. A dark lazy flame indicates too little air. A hard burning white flame with excess sparks indicates too much air. It should not be necessary to open the inlet damper completely. At this point the heater should continue to operate without any additional adjustments. An improved feature of the Mk IV Furnace is the heat reflector located in the combustion chamber centered over the retort. It is designed to reflect heat back on the fuel bed for improved burning of the coal.

Removing clinkers will probably be required 1 or 2 times per day depending on the weather and the ash content of the coal. Turn heater "OFF" 15-20 minutes before cleaning the fire. Use hook to feel for clinkers between burner and side of firebox, then remove clinkers with tongs provided. DO NOT stir fuel bed directly over burner. Soft ash should be left to clinker and removed later. If ash starts to interfere with air distributions, remove some of the ash. After cleaning the fire, and while the heater is still "OFF", fill the hopper with fresh coal. This will prevent smoke from drifting out of the pressurized hopper. Note: When the power switch on the front of the Mark IV Furnace is turned "OFF", the circulating fan will continue to operate to cool the heater until the fan control shuts it off.

During the start-up while the stoker is feeding coal the warm air blower will come on and may cycle several times. The on/off combination fan and limit switch is located on the rear of the cabinet. (See Page 17, Part #13555). The control has been pre-set at the factory.

Because each installation is different, the settings of this control can be tailored to the job. Generally speaking, the "ON" setting of the fan should allow the blower to start, remain on and deliver 100 degrees F air to the registers in the area to be heated. The factory set-points for the fan control are to have the fan on at 140 degrees and off at 110 degrees. The blower will continue to run after the stoker is shut down. If cool air is discharged through the registers, move the "OFF" blower setting in higher increments until a proper setting is obtained. It may be necessary to re-adjust these settings after the furnace has been working for several weeks, the final tuning being done when the furnace is under a heavy load. The high limit has been set at 200 degrees F. This is a safety control, and when the set temperature is exceeded, it will not allow the stoker feed to operate. This setting can be increased to 200 degrees F if necessary.

CARE AND MAINTENANCE

Every effort has been made to provide you with a troublefree, efficient furnace; however, it is up to the owner to maintain and operate this heating unit properly.

Over the years, we have found that about 75% of all service calls are made because the owner did not fully understand the proper operation of the furnace.

Every member of the household who is involved with the furnace should be thoroughly familiar with these instructions.

Itemized in the next section are some of the things that you as the owner can do to prolong the life of your furnace and reduce service calls.

COAL:

There is no substitute for good coal. Good coal will have a higher heating value, less ash, fewer foreign objects, and burn cleanly all producing more heat with fewer problems than a cheaper, but poorer grade of coal.

Under no circumstances use coal over 1" in top size and under ¼" in bottom size. The coal should be free of dust with the right amount of oil treatment. Too much OIL will cause the fire to smoke. Too much DUST will cause the fire to go out (You should use the same coal every time you change coal, or you may have to change the adjustments on your heater). DO NOT FILL HOPPER WITH WET OR FROZEN COAL. DO NOT BURN REFUSE OR GARBAGE IN YOUR MK IV FURNACE.

LUBRICATION:

The transmission uses SAE 90 weight oil, which should be replaced after the first heating season. Fill only to the bottom of the pipe plug located on the front of the transmission. After the first oil change, only an occasional check of the oil level should be necessary.

Each of the motors may require 2 to 3 drops of SAE 20 oil each season. Do not over-oil any motor. There are no other parts requiring lubrication on the Mk IV.

CLINKER OR ASH REMOVAL:

Clinkers should be removed at least once a day, EVERY DAY. The fire should never be allowed to get above the bottom of the firebox door, it may (1) warp the heat chamber, (2) warp the baffle plate on the inside of door, or (3) it may cause the blower to run continuously. In extremely cold weather, the clinkers should be REMOVED AS NEEDED. This may be two or three times in one day, depending on the ash content of the coal and the firing rate.

ADJUSTMENT:

There are only two adjustments that you can make. The first adjustment controls the coal feed rate as explained earlier.

The second adjustment involves two separate steps, i.e., controlling the draft and controlling the combustion air. An increase in the draft (lower pressure if a gauge is used) will be offset by an increase in the volume of air supplied by the combustion air blower. The reverse is also true; therefore, the barometric damper, if adjusted will require a corresponding change in the combustion air supply. This is not a major problem, because once these settings are found for a clean burning fire, they will not require further adjustment if there are no changes in the feed rate or coal.

THERMOSTAT:

The thermostat should be located on an inside wall of a room where the greatest comfort zone is required. This is normally the living room. Do not locate a thermostat near a lamp, register or other source of heat.

When using coal as fuel it is not a good idea to set the thermostat to a very low temperature at night as this forces the stoker to operate at a lower efficiency which offsets any potential fuel savings. This should not preclude setting the temperature lower for extended periods such as an entire weekend or a 5 degree set back for night comfort. To return to your normal temperature, set the thermostat to its regular setting. If it is set much higher, it will cause an overheated condition. The furnace will not heat faster with the control set higher.

The thermostat is operated by a switch which makes and breaks the electrical connection to the stoker and turns it off and on. At times a blue arc may be seen as the thermostat breaks this electrical connection. This is normal and should not cause any alarm.

BLOWER - WARM AIR:

The warm air blower operation is controlled by the fan portion of the combination fan and limit switch, not by the thermostat. When the thermostat calls for heat the stoker will start and produce heat. This heat causes the fan switch to close and start the blower at a predetermined temperature setting.

The warm air blower pulls air from the living spaces through the cold air return ducts, forces the air through the furnace cabinet and over the heating surfaces. Then, the warm air is forced under pressure to the living spaces. The blower will normally run after the stoker is off until the built-up heat of the heat exchanger is dissipated.

It is important to remember that the air flow created by the blower serves a dual purpose, i.e. the air is heated and the air cools the heat exchanger.

The air filter should be replaced as required, the belt drive inspected for wear each season and the blower bearings lubricated with 2 to 3 drops of SAE 20 oil.

NOISE:

Some noise is to be expected with all moving machinery. The general noises are motor hum, air (wind) noise and those sounds associated with the coal feed system. Most noise is caused by vibration of metal on metal and can usually be found by pressing in on the sides of furnace at various points you think the noise may be coming from. Also check your fire cleaning tool or other objects to be sure they are not vibrating against some part of the heater.

Many abnormal noises are an indication of some type of malfunction and can be traced to the source by careful listening at various places while observing the operation of the furnace. Some sounds will be amplified by the warm and cold air ducts and can be adjusted by locating the offending section of duct and applying additional bracing or hangers.

FIRE GOES OUT - CAUSED BY:

(1) Not having a good bed of coals in the furnace at all times. This usually happens after the fire has been cleaned out "TOO CLEAN". Always maintain a good bed of live coals in the firebox. This is especially true on warm days when the furnace is not running often. DO NOT DISTURB THE CENTER OF THE FIRE, CLEAN ONLY OUTSIDE OF THE TUYERES.

(2) Not feeding any coal or not enough coal. This is usually caused by large pieces of coal or permitting paper, pasteboard, or wood, to get into the coal hopper. Fine coal or wet coal will bridge over the coal screw (use poker to break bridge). This prevents the coal from getting down onto the "screw" to be carried into the firebox, and the fire goes out. Use oil treaded coal NOTE: never fill hopper with snow covered or wet coal; it will rust out your furnace. The shear pin may need replacing (See Replacing Shear Pin).

(3) Failure of time clock (timer relay). This clock runs the stoker a set number of minutes out of every 15 or 30 minutes. This maintains the fire, especially on warm days. If you think the clock is not running, turn the thermostat down as low as it will go, WAIT AT LEAST 45 minutes. Sometime during this period, the clock should turn the stoker on for a period ranging from one to five minutes. This running period takes place regardless of the thermostat. If adjustment is required, See Page 14.

TEMPERATURE GOES ABOVE THERMOSTAT SETTING:

This is a common occurrence during the spring and fall months when the outside temperature has a wide variation placing unusual demands on the furnace. Do not attempt to compensate for weather changes by adjusting the thermostat up or down. In extreme cases, removing some of the excess coal in the firebox may be necessary (clean fire).

The thermostat should be set at a comfortable temperature and left there (70 - 75 degrees F). If the thermostat is set back at night, it should be reset in the morning to its normal setting. A higher setting will not create heat faster.

STOKER RUNS CONTINUOUSLY:

The term "stoker" refers to the coal feeding system, i.e., motor, transmission, coal screw and combustion air blower, all located beneath the coal hopper.

The signal to operate the stoker comes from either of two devices, i.e., the thermostat or the refueling timer. These devices are electro-mechanical controls and may have failed or the wiring may be defective.

If the cause is not apparent, turn the power switch off and call a qualified serviceman. To maintain heat while waiting, it is permissible to run the unit for short periods, not exceeding 15 minutes.

STOKER WON'T RUN:

In cases where there is a complete shut down of the entire unit, a check must be made to be sure power is available at the unit. Normally this is easily checked by turning the power switch on and observing the power indicator light. (Occasionally an indicator light may burn out). If the house fuse supplying the unit appears good, try another device such as a lamp in the same receptacle. If power is available, but the transmission motor does not run when the thermostat calls for heat, call your serviceman.

If the motor operates, but the transmission does not feed any coal, the coal may have bridged over in the hopper, in which case the bridge must be broken and coal allowed to reach the screw.

You may have broken a shear pin. If the small diameter shaft (with cross hole) projecting from the face of the transmission is not turning, but the larger diameter shaft does turn, you have a broken shear pin.

TO REPLACE SHEAR PIN:

Turn power off. Remove the rubber "O" ring that retains the shear pin. Use a large screw driver shank through the cross hole in the small shaft to "rock" the shaft and attempt to dislodge the foreign matter that caused the problem. Turn the small shaft with the screw driver until the two dots on the ends of the shafts are in line and push the broken shear pin pieces out. Install a new shear pin and replace the "O" ring.

The shear pins provided are of a special material selected to drive a normal transmission load, but protect the motor and transmission from temporary overloads; the use of other materials for shear pins such as nails and screws can cause extensive damage to the drive unit and will void the warranty on these parts.

In extreme cases, it may be necessary to remove the drive unit and coal screw to dislodge whatever caused the overload. There are (2) 5/16 cap screws on the far side of the transmission to the hopper. Using 1/2" box or socket wrench, remove these two screws and pull the entire drive unit towards you. It is not necessary to disconnect any other parts or wiring. Use a large wrench on the exposed end of the coal screw and turn it counterclockwise to back it out of the housing. Remove the foreign matter and reassemble.

SMOKE IN HOPPER:

During some combustion and draft conditions, smoke may feed back from the retort into the hopper. If the hopper lid is sealed it is usually not a problem as some air under pressure from the combustion air blower forces the smoke back into the combustion zone. During the stoker off periods, this pressurized air is not available, but a properly adjusted barometric draft control will then create a negative pressure in the combustion zone and draw the smoke out. The rubber gasket used to seal the hopper lid must be maintained in good condition and the lid latch properly adjusted to maintain an airtight seal.

SMOKE BACK THROUGH FIRE DOOR:

This is a normal occurrence when a fire is first being started and will clear up as soon as the flue pipe and chimney warm up and establish a proper draft. If it occurs during normal heating cycles, all the draft producing elements should be checked for blockages, leaks and the barometric damper for proper operation. Do not connect the flue pipe of this furnace to a chimney that has any other device discharging into it. A separate flue and chimney is required.

GENERAL:

Keep your furnace clean and dry for long, trouble-free service. A little periodic cleaning will remove dust and moisture that can cause major repairs in the future. A potential source of trouble is easy to locate if it is not covered with several years of accumulated dirt.

ELECTRICAL:

Your furnace has been pre-wired using several types of plugs and sockets so that the proper connections cannot be interchanged, but still allow servicing.

WARNING: DISCONNECT POWER BEFORE WORKING ON ANY ELECTRICAL EQUIPMENT.

Only 115 VAC, 60 Hz power can be used on the Mk IV Furnace, and a properly installed 15 AMP circuit should supply the furnace.

Most of the interconnecting wiring is enclosed. All wiring external to the control box is connected to the control box by means of a plug and terminal strip for the thermostat. All components can be replaced by a qualified electrician — it should not be necessary to replace the entire box. A copy of the wiring diagram is placed inside the cover of the control box and is duplicated in this manual.

Should it be necessary to replace the control box, first unplug the furnace, disconnect the thermostat wires, remove the (4) sheet metal screws holding the box to the front panel, and then slide the control box out while removing the plug.

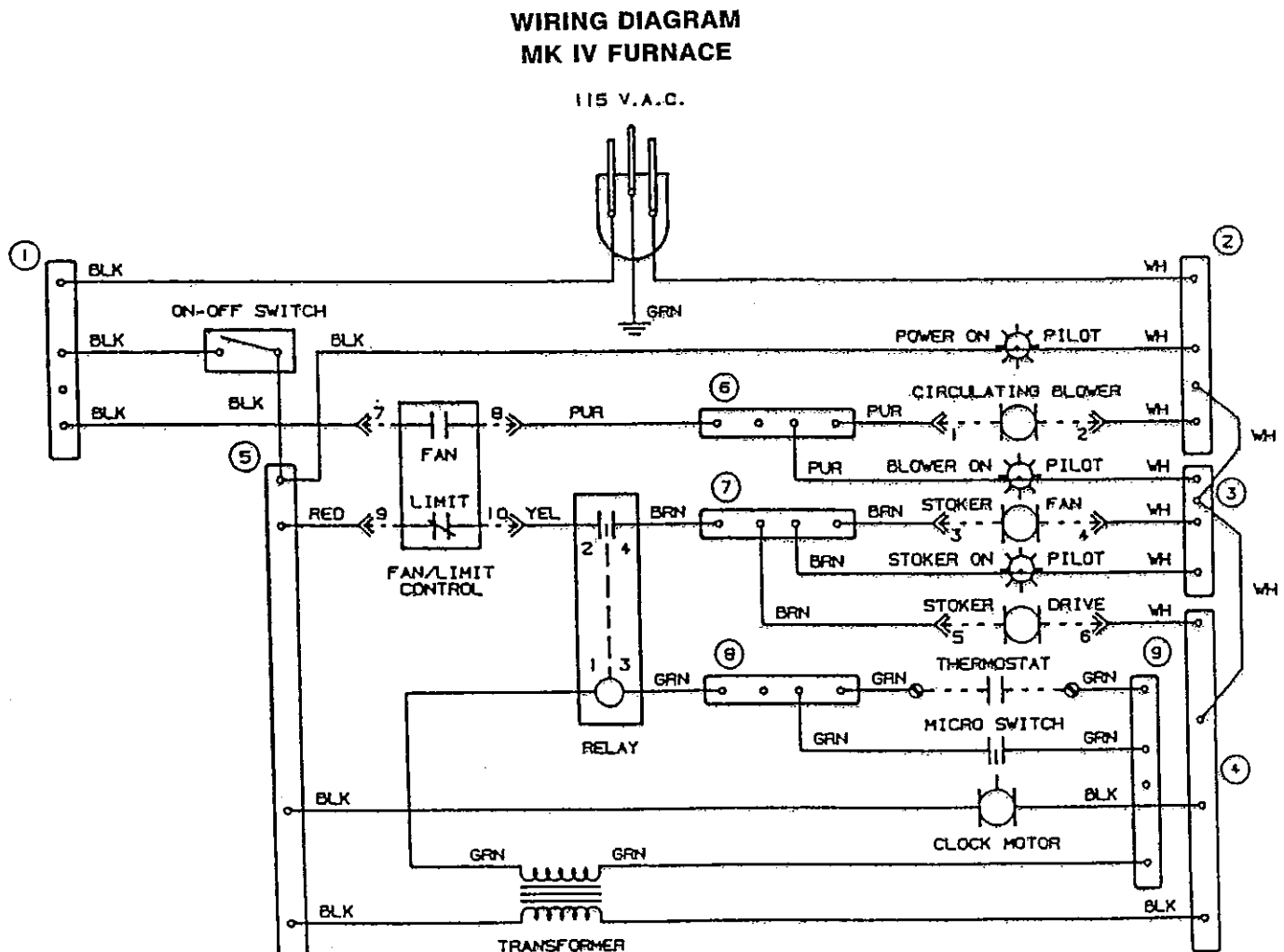


FIG. 9

ADJUSTMENT INSTRUCTIONS FOR STOKER TIME CLOCK

The Stoker Time Clock is located within the control box. To gain access to the control box, the cabinet service door must be removed.

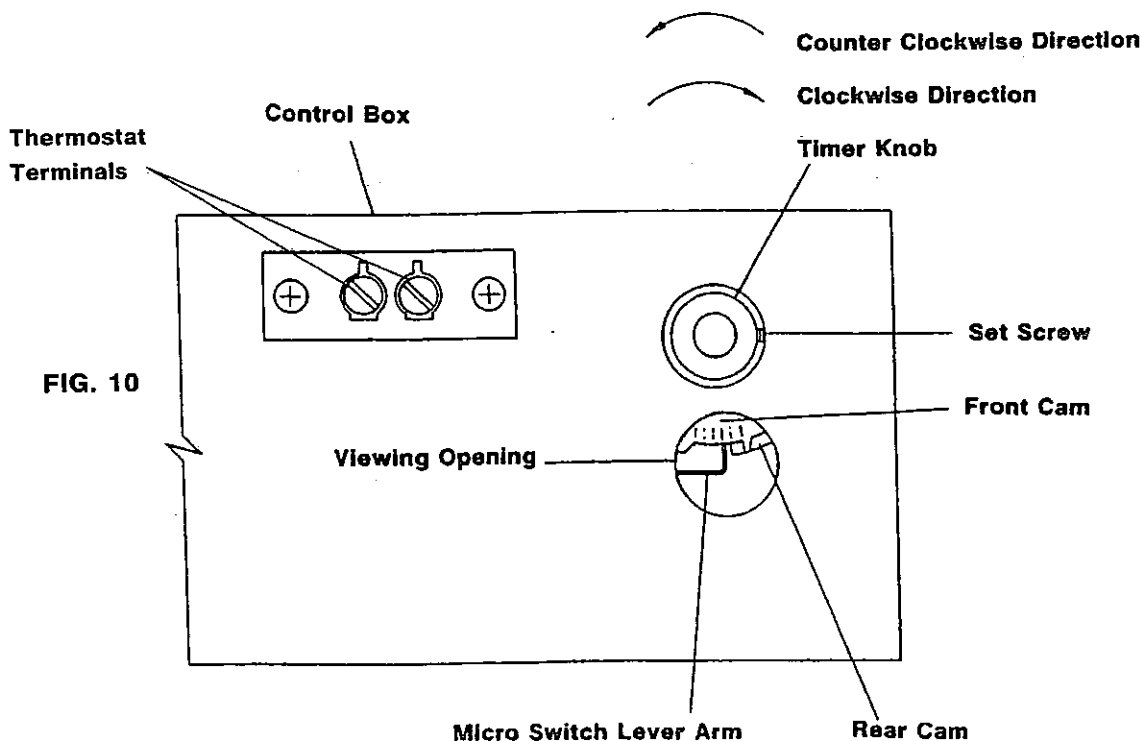
The purpose of the timer operation is to add coal and air to the fuel bed periodically, in order to keep the fire **alive** and ready for the next call for heat from the thermostat. The timer has been preset at the factory to operate the stoker for approximately three minutes every half hour. This factory setting will be satisfactory under most circumstances. If, however, the fire either a) becomes too heavy or b) goes out, you may wish to change the time cycle. To do so, refer to Fig. 10 and proceed as follows:

1. Turn the heater power switch **OFF**.
2. While observing the cams and micro switch lever arm through the viewing opening, turn the timer knob counter clockwise until the lever arm just lifts into the slot in the cams.
3. To reduce the operating time, loosen the set screw on the timer knob (with the Allen wrench provided in the parts bag) and turn the timer knob counter clockwise to the desired setting (Note: Minimum operating time is one minute. Each increment on the front cam equals one minute, and the time of operation is the gap formed between the edges of the two cams). Retighten set screw.
4. To increase the operating time, loosen the set screw and turn the timer knob clockwise to the desired setting (Note: Maximum operating time is five minutes). Retighten set screw.

For certain types of difficult to burn coal, it may be desirable to have the timer operate the stoker every fifteen minutes. To change from the thirty minute to the fifteen minute time cycle, proceed as follows:

1. Turn the heater power switch **OFF**.
2. Turn the timer knob counter clockwise until the lever arm just lifts into the slot in the cams.
3. Loosen the set screw and turn the timer knob clockwise until the full five minute setting is reached. Retighten set screw.
4. Now turn the timer knob counter clockwise until the lever arm just begins to push out of the slot.
5. Loosen set screw again and turn timer knob counter clockwise until another slot appears.
6. Set operating time as desired. (Note: Minimum one minute every fifteen minutes - maximum four minutes every fifteen minutes). Retighten screw.

Remember to turn heater power switch **ON** after Time Clock adjustments are complete.



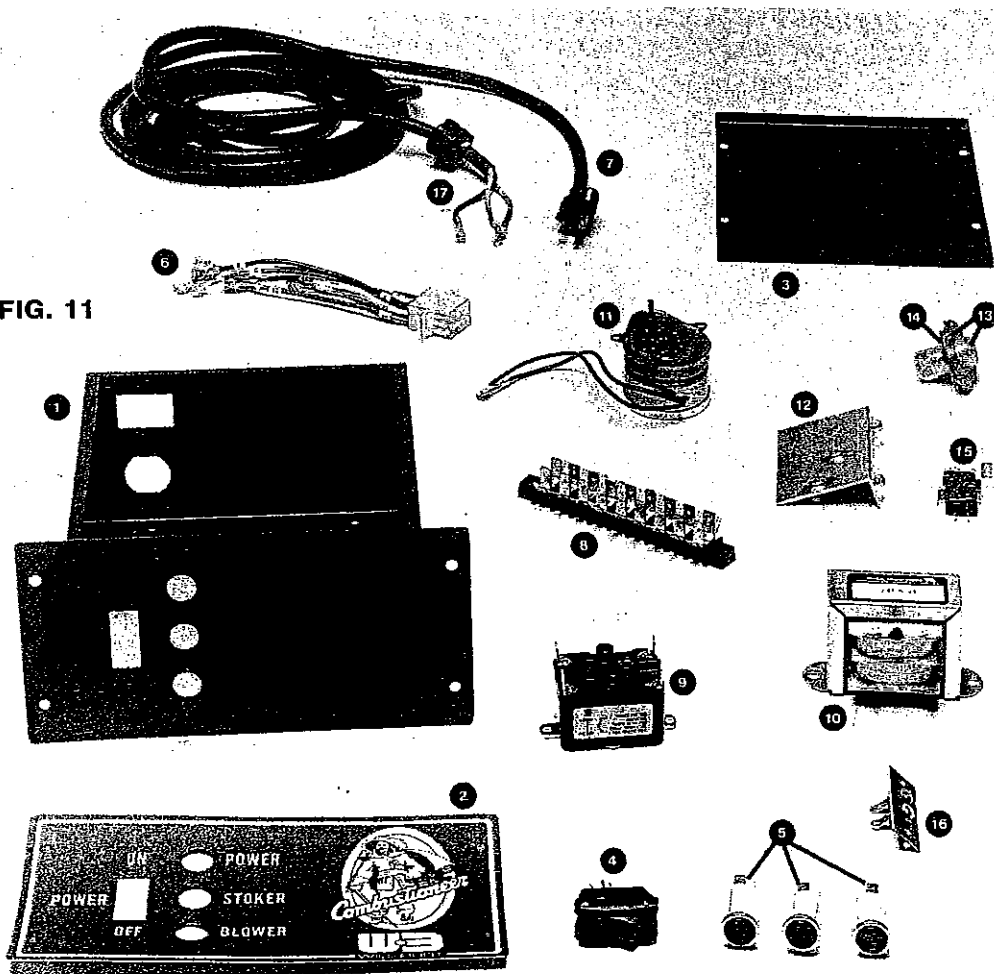
22050 CONTROL BOX COMPLETE

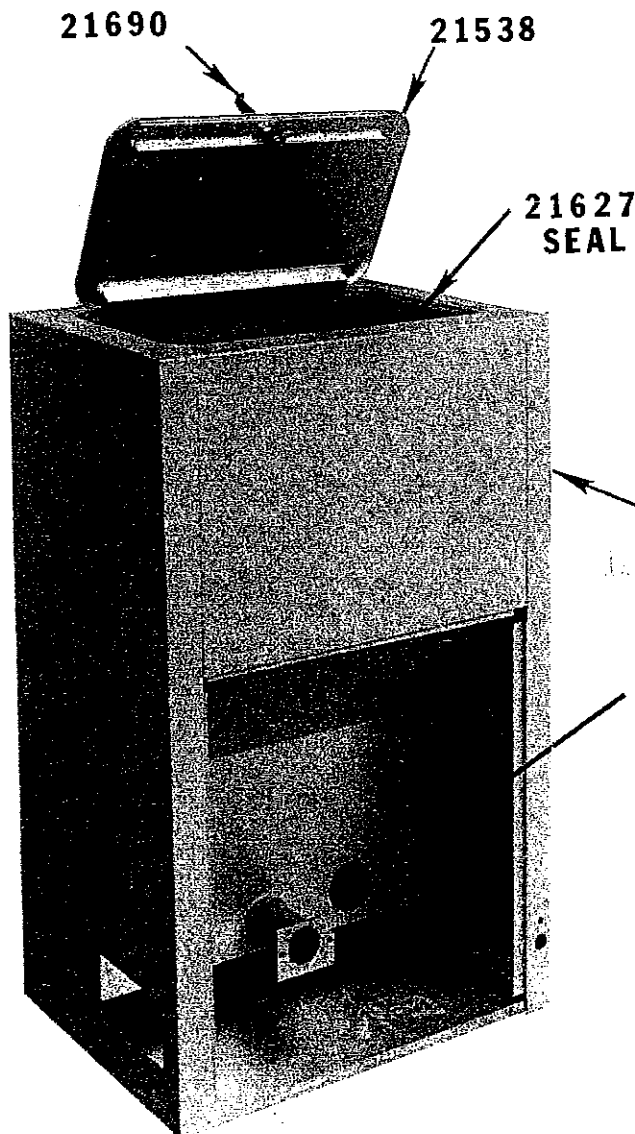
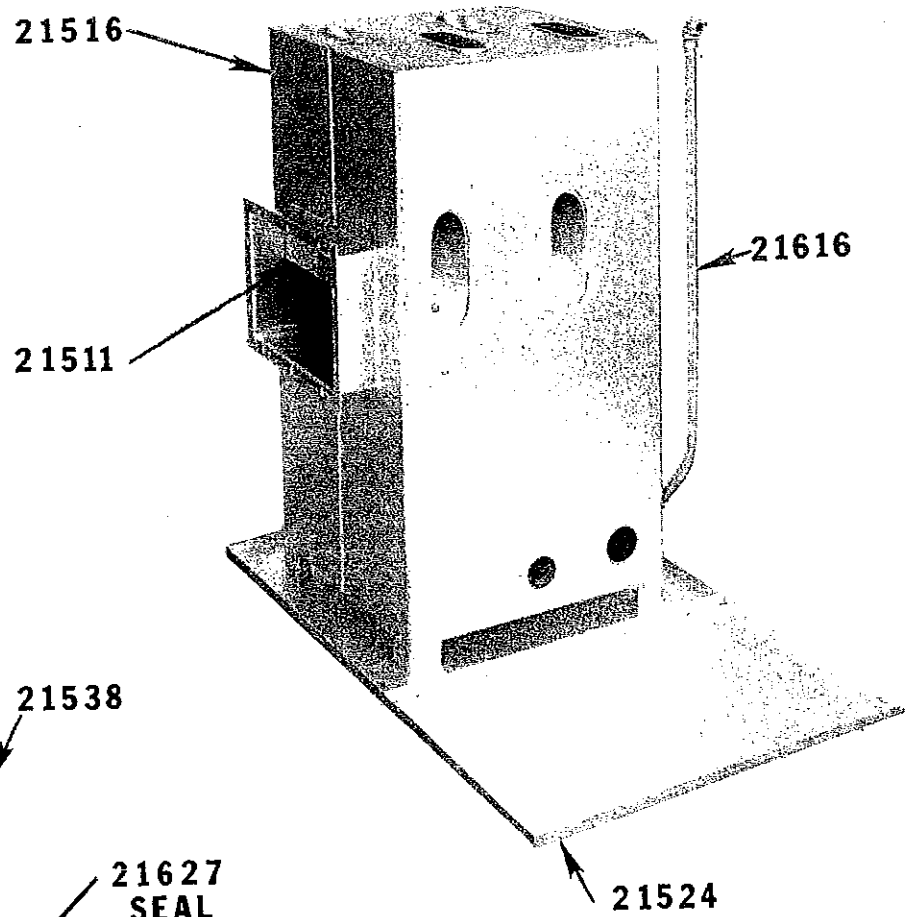
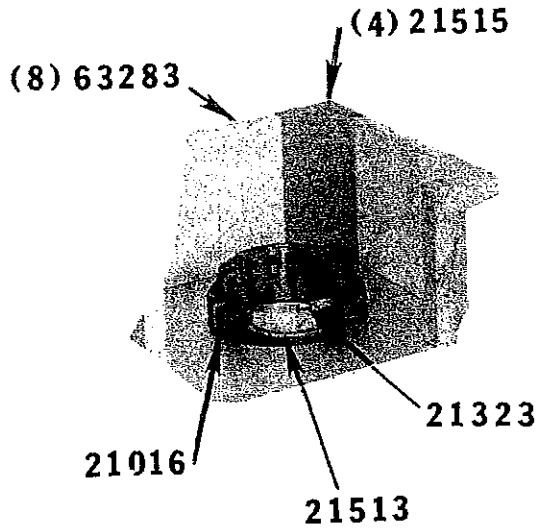
PARTS LIST

Refer to FIG. 11

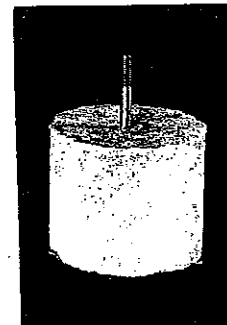
Ref. No.	Code No.	Req'd.	Description
1	22051	1	Control Box
2	22068	1	Label
3	22069	1	Cover
4	22055	1	On-Off Power Switch
5	22056	3	Pilot Light
6	22060	1	Wire Harness
7	21698	1	Power Chord
8	22057	1	Terminal Strip
9	34175	1	Relay
10	21603	1	Transformer
11	21646	1	Stoker Timer
			Clock Motor
12	21572	1	Motor Bracket
13	21601	1	Cam Front
14	21598	1	Cam Rear
15	34176	1	Micro Switch
16	22061	1	Thermostat Connection
17	42378	1	Strain Relief

FIG. 11



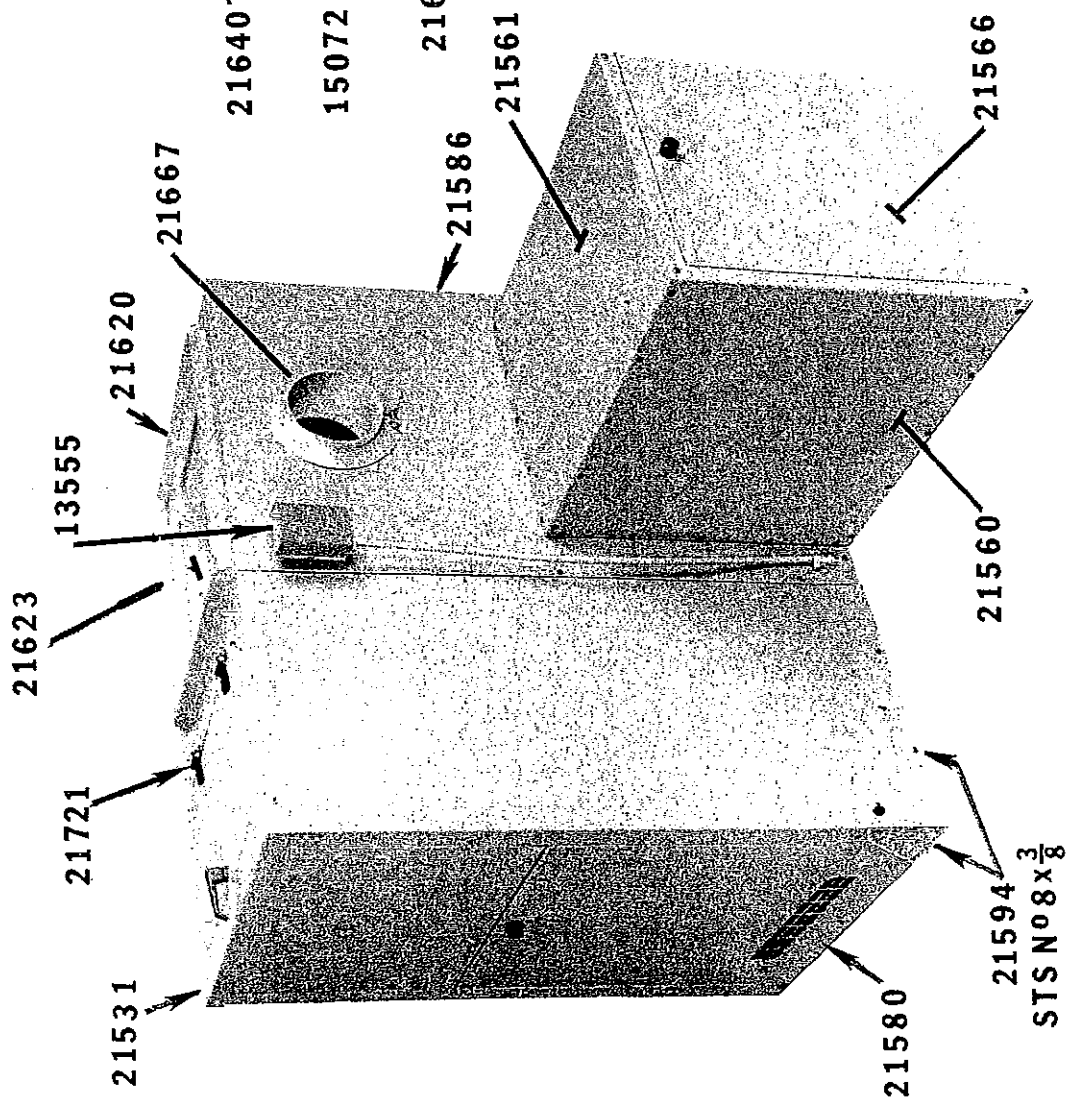
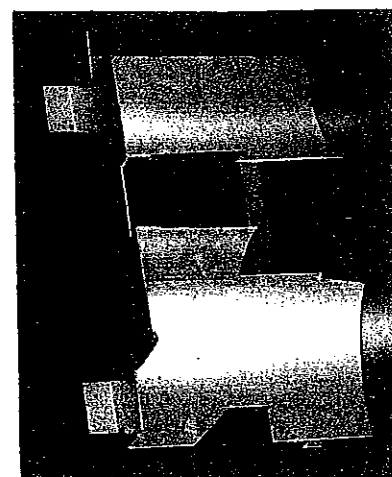
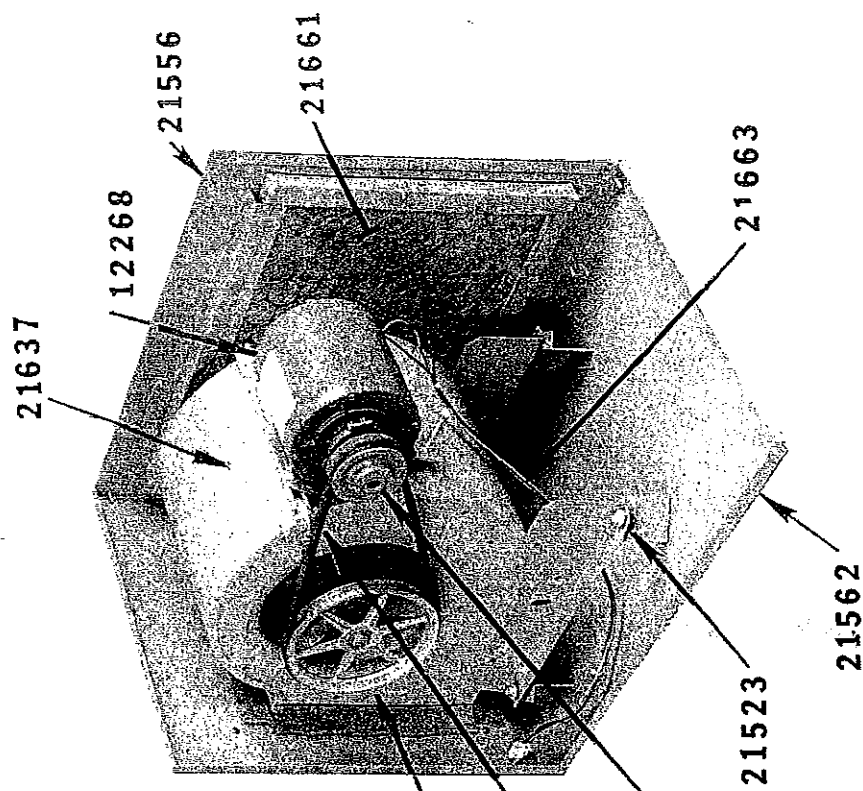


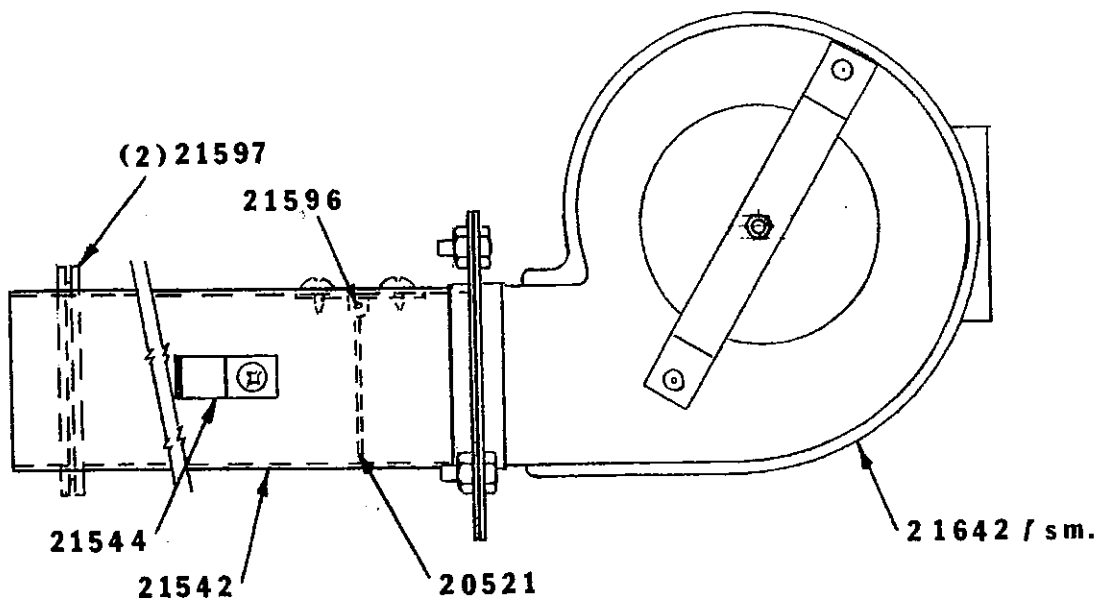
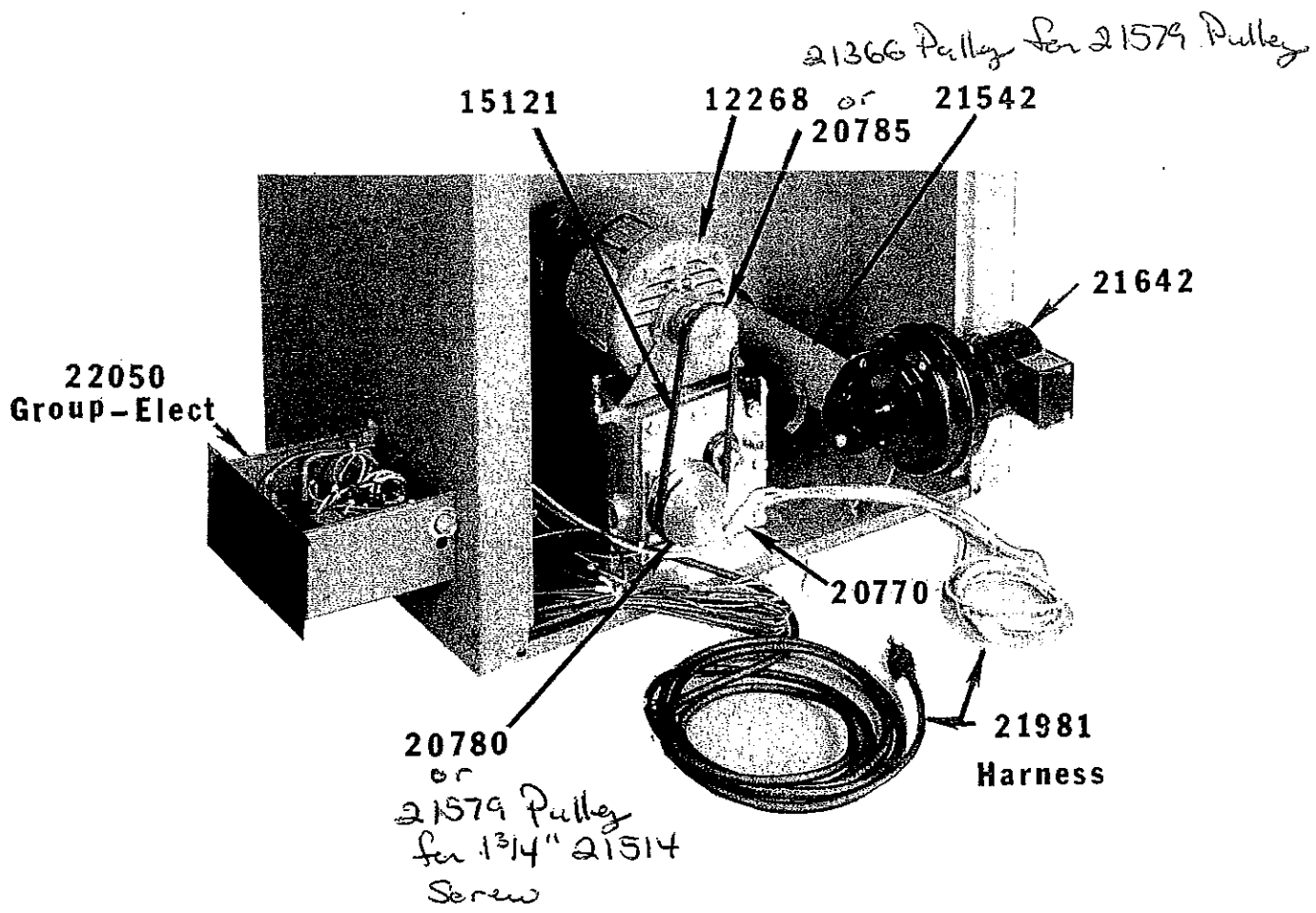
(2)
21597



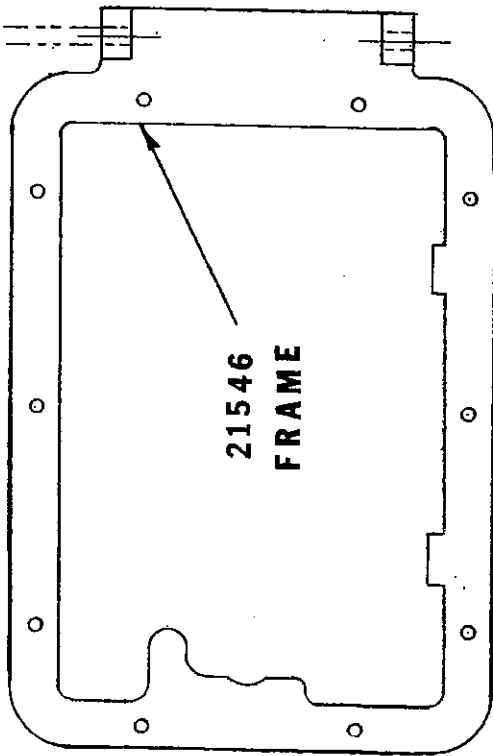
21741-1 3/4 std, long
21514



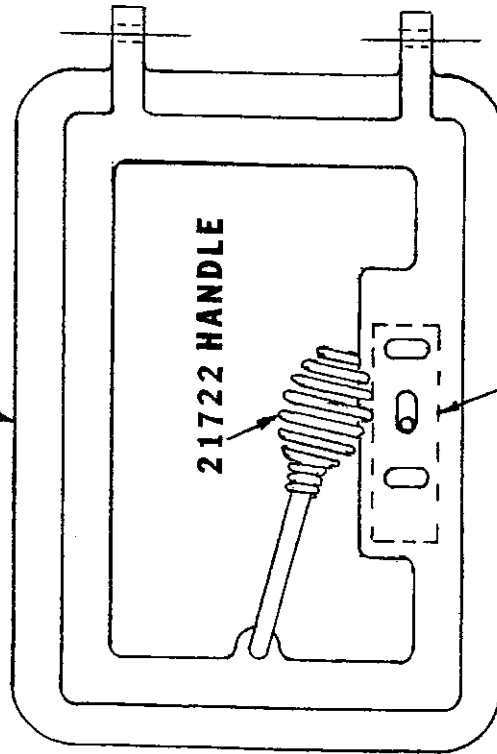




(2) 21592
RIVET



21547 DOOR



TO ADJUST DOOR SEAL CLOSER THAN SHOWN

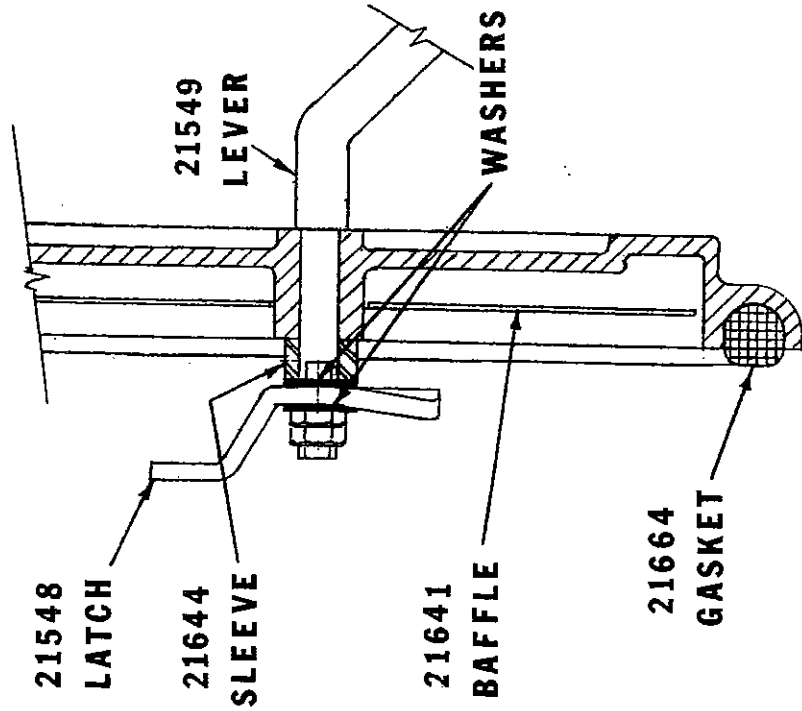
Remove nuts, washers and latch.

Assemble with latch against sleeve, then

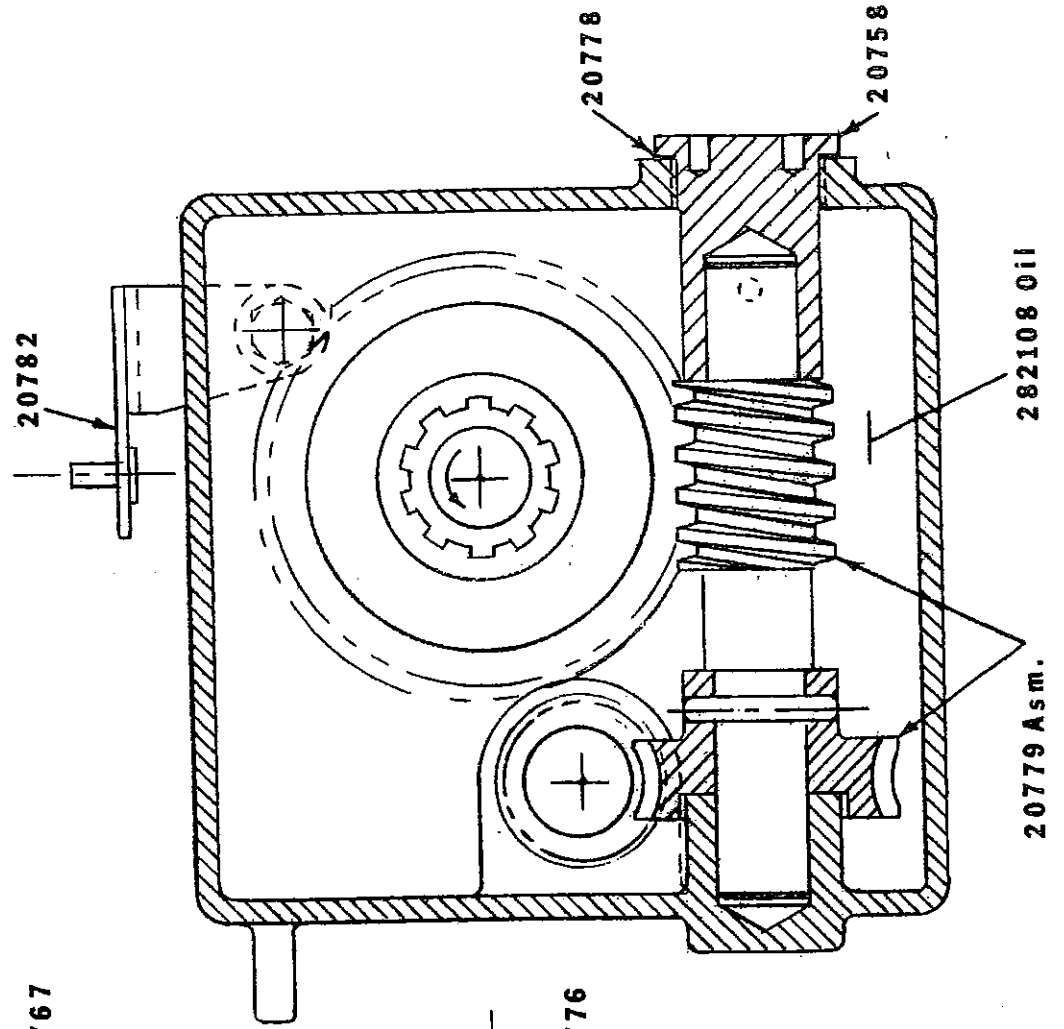
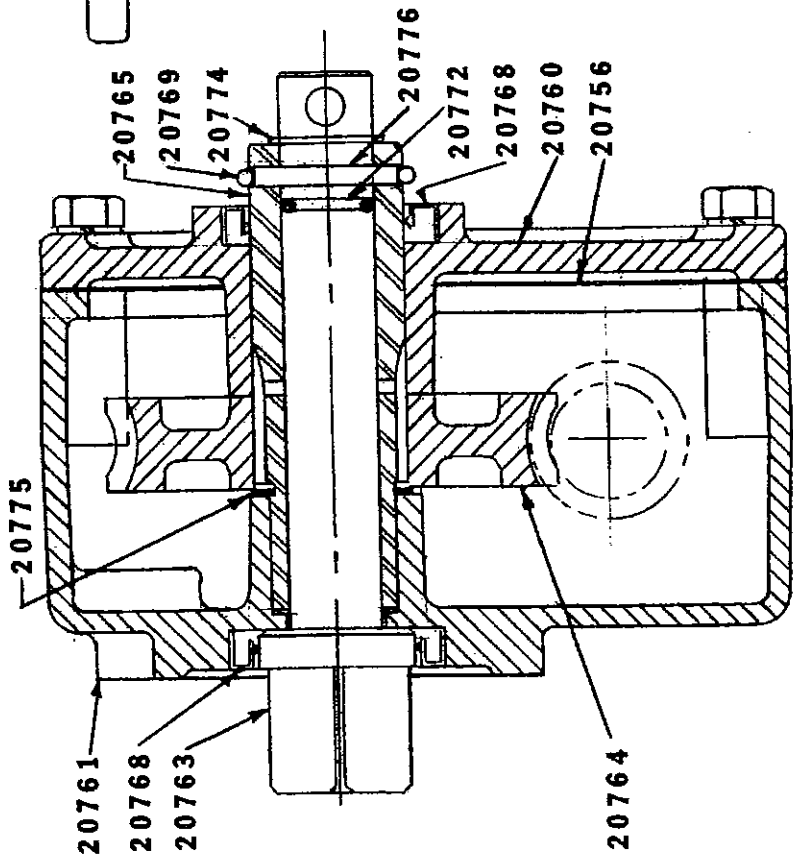
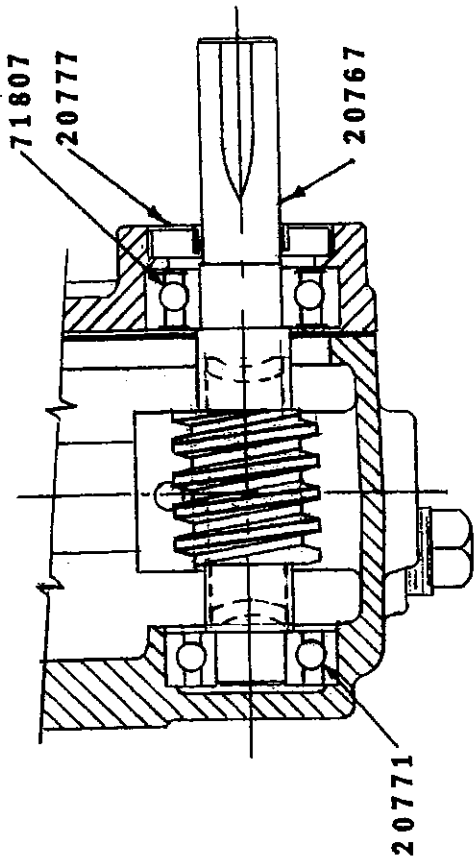
two washers and one nut.

Adjust nut for proper clearance and

lock with other nut.



20770 ASM. TRANSMISSION COMPLETE



PARTS LIST

Always provide complete serial number when ordering parts.

PAGE 16

Part No.	Name	Qty.
21016	Tuyere	12
21323	Tuyere Band	1
21511	Curtain	1
21513	Retort	1
21514	Coal Screw	1
21515	Tile - Corner	4
21516	Comb. Chamber	1
21524	Base	1
21531	Hopper Assembly	1
21538	Hopper Door	1
21597	Grommet	2
21616	Tube	1
21627	Seal	1
21690	Handle	1
21715	Cast Tile	1
63283	Firebrick	8

PAGE 18

Part No.	Name	Qty.
12268	Motor	1
15121	"V" Belt	1
20521	Damper	1
21542	Air Tube	1
21544	Strap	1
21596	Pivot	1
21597	Grommet	2
21981	Harness	1
22050	Group - Elect.	1
21642	Blower	1
20770	Transmission	1
20780	Sheave	1
20785	Sheave	1

PAGE 19

PAGE 17

Part No.	Name	Qty.
12268	Motor	1
13555	Switch-Fan/Limit	1
15072	"V" Belt	1
21523	Grommet	4
21531	Hopper Assembly	1
21556	Filter Rack	1
21560	Panel	1
21561	Top	1
21562	Base	1
21566	Door	1
21580	Service Door	1
21586	Panel - Rear	1
21594	STS N.° 8 x 3/8	44
21620	Top	1
21623	Panel - Front	1
21637	Blower	1
21639	Sheave	1
21640	Sheave	1
21661	Filter	1
21663	Wire - Blower	1
21667	Collar	1
21708	Rear Air Baffle	1
21721	Hinge	2

Part No.	Name	Qty.
21722	Handle	1
21546	Frame	1
21547	Door	1
21548	Latch	1
21549	Lever	1
21592	Rivet	2
21632	Damper	1
21641	Baffle	1
21644	Sleeve	1
21664	Gasket	1

PAGE 20

Part No.	Name	Qty.
71807	Bearing	1
20756	Gasket	1
20758	Bearing	1
20760	Cover	1
20761	Case	1
20763	Shaft	1
20764	Worm Wheel	1
20765	Sleeve	1
20767	Shaft	1
20768	Seal	2
20769	"O" Ring	1
20771	Bearing	1
20772	"O" Ring	1
20774	Snap Ring	1
20775	Snap Ring	1
20776	Shear Pin	1
20777	Seal	1
20778	Gasket	1
20779	Worm Assembly	1
20782	Bracket - Motor	1
282108	Oil	1 qt.

WARNING

ALL SERVICE AND/OR REPAIR OF WILL-BURT HEATING EQUIPMENT MUST BE PERFORMED BY LICENSED, CERTIFIED HEATING/VENTILATION/AND AIR CONDITIONING (HVAC) CONTRACTORS AND/OR LICENSED ELECTRICAL SERVICE TECHNICIANS IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS. FAILURE TO COMPLY WITH THIS WARNING MAY RESULT IN PROPERTY DAMAGE, SERIOUS INJURY, OR DEATH.