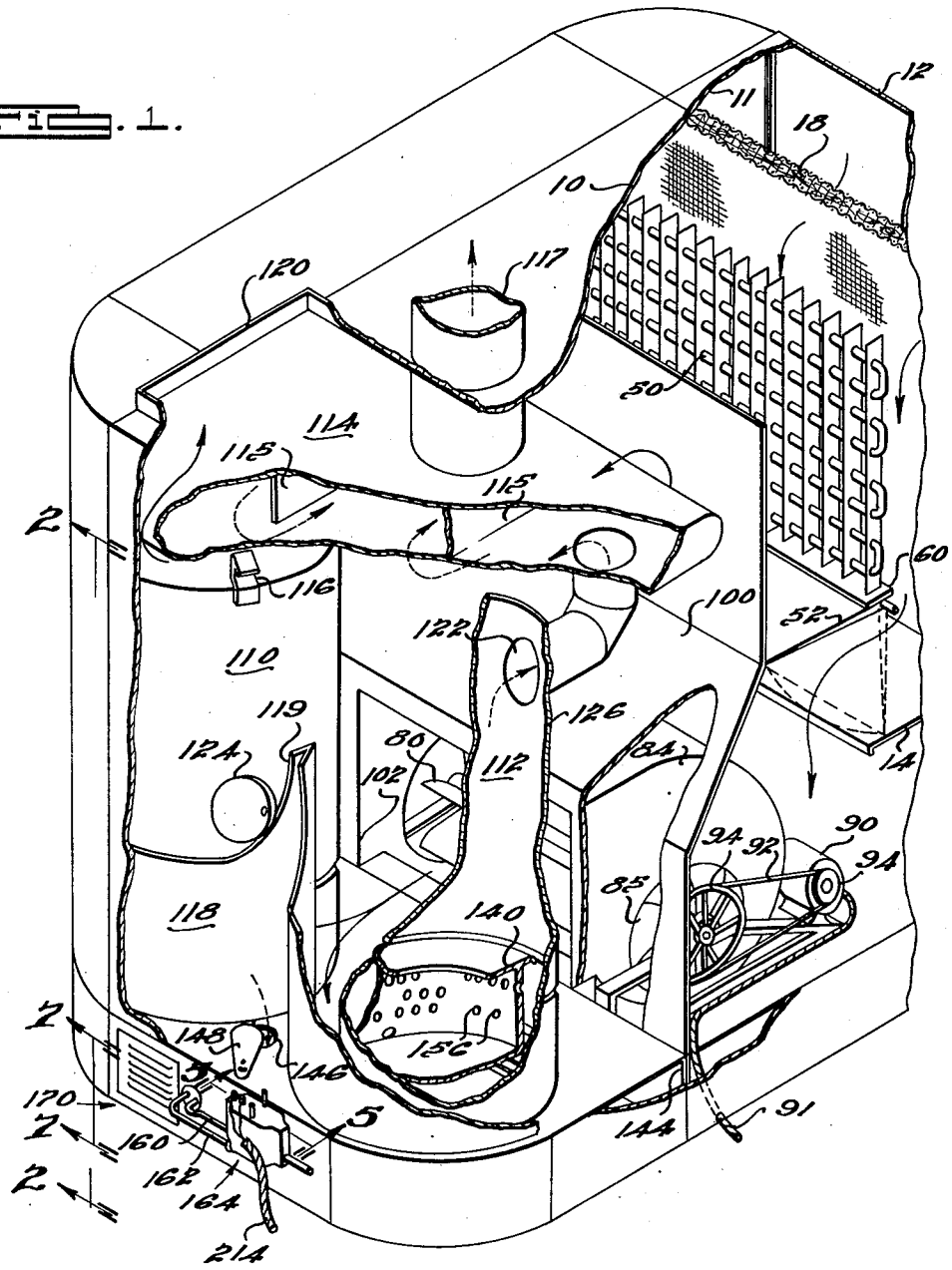
March 12, 1940. M. L. MUELLER 2,193,735

WARM AIR FURNACE

Filed April 18, 1938 3 Sheets-Sheet 1

Fig. 1.



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WARM AIR FURNACE.

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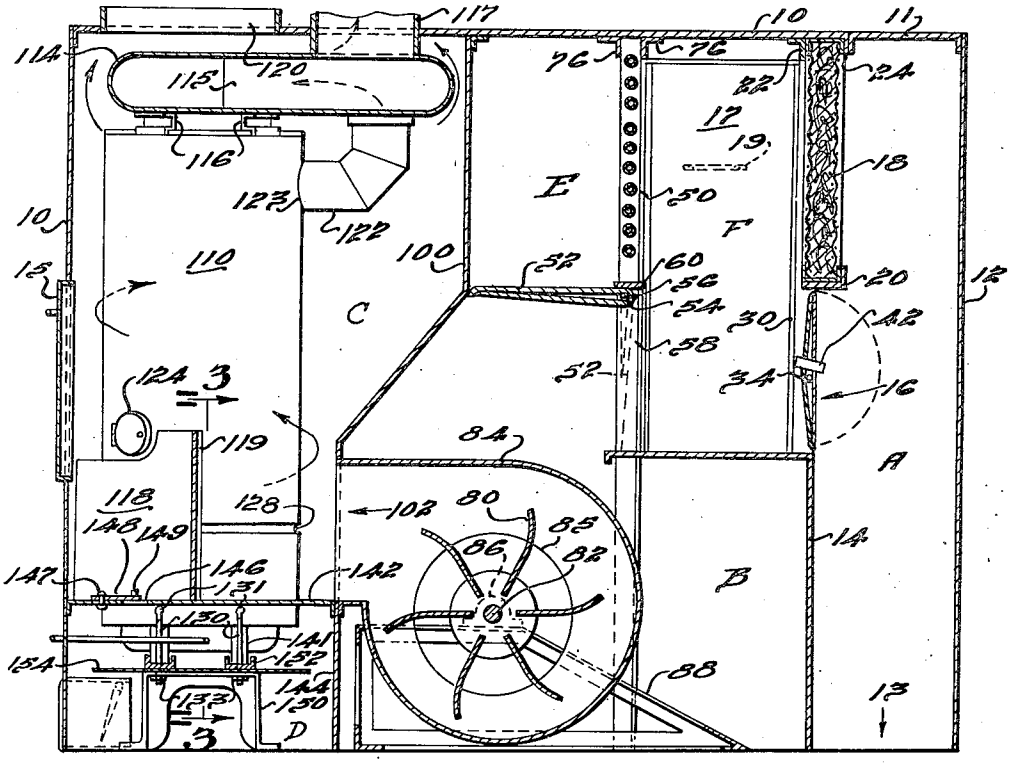


FIG. 2.

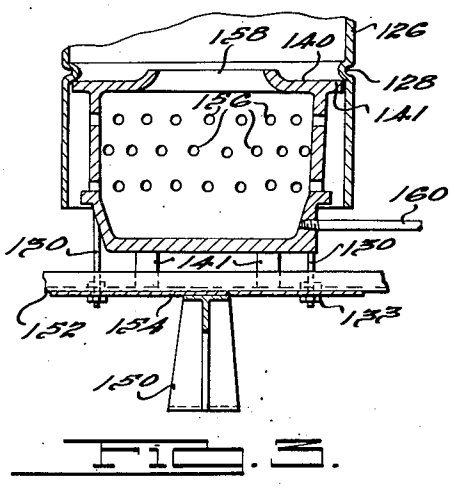


FIG. 3.

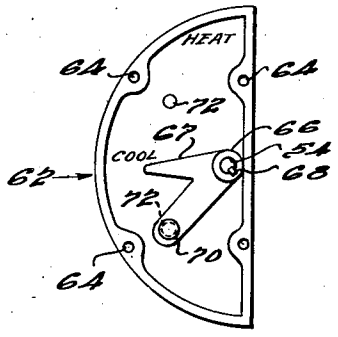


FIG. 4.

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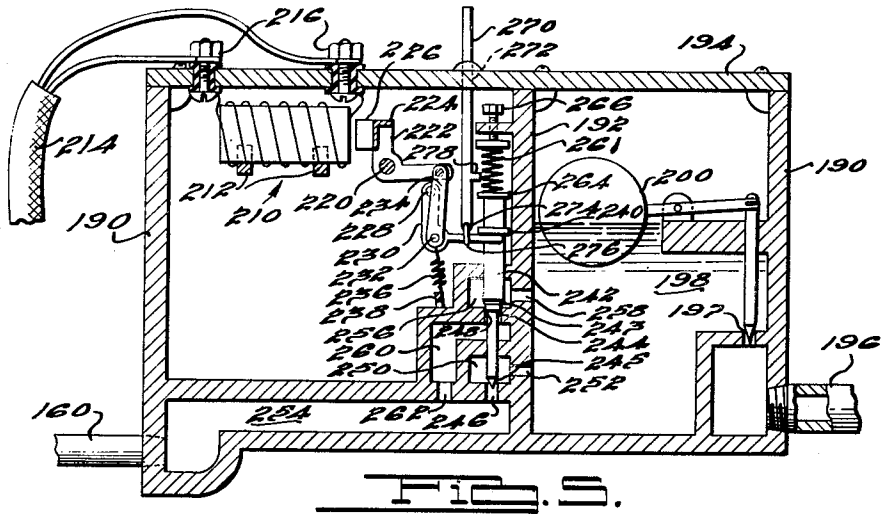


FIG. 5.

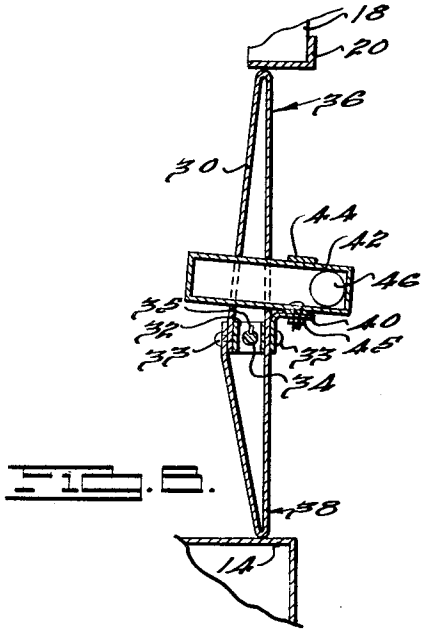


FIG. 6.

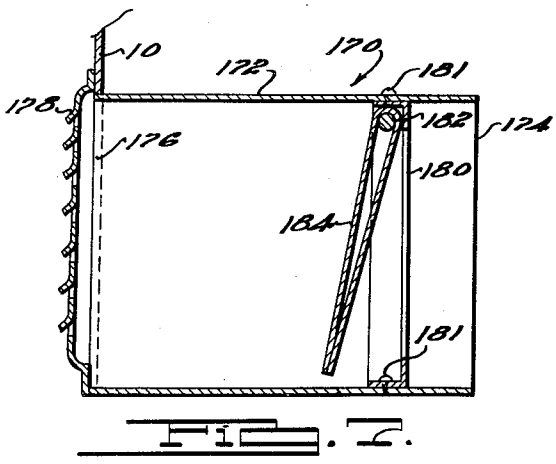


FIG. 7.

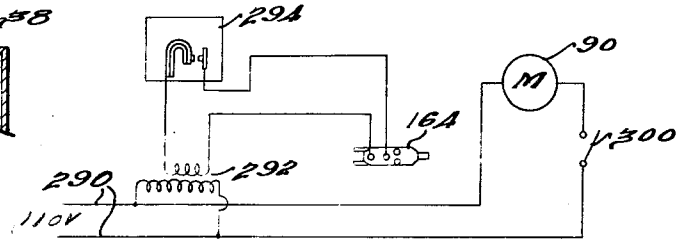


FIG. 8.

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UNITED STATES PATENT OFFICE

2,193,735

WARM AIR FURNACE

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Application April 18, 1938, Serial No. 202,670

5 Claims. (Cl. 126—110)

This invention relates to warm air domestic furnaces and more particularly to domestic furnaces which use oil for fuel and have fans or blowers for circulating air through the house.

One object of the invention is to provide a furnace in one unit which will be readily convertible between two ranges of heat output. With this object in view my furnace can be operated efficiently in different sized houses or in the same house during different seasons without changing the structure of the furnace.

Another object of the invention is to superimpose an automatic heat controlling feature upon the manual regulation mentioned above. In this manner my furnace is adapted to be manually adjusted for low or high heat output and to be further automatically controlled for a minimum or maximum output within each operating range.

Another object of the invention is to provide a furnace unit which may be readily adapted to form a house cooling or ventilating unit in the summer time.

Another object of the invention is to provide a furnace unit which will filter the air each time it is circulated through the house.

Other objects of my invention will be apparent from a consideration of the following specification and drawings of which there are three (3) sheets and in which:

Fig. 1 represents a broken away isometric view of the furnace;

Fig. 2 represents a section taken along the line 2—2 of Fig. 1 and looking in the direction of the arrows;

Fig. 3 represents a vertical section through one of the stoves and oil burners shown in Figs. 1 and 2;

Fig. 4 represents the control handle and panel for selecting the heating or cooling position of the damper which controls the flow of air through the furnace;

Fig. 5 is a vertical section through the valve shown in Fig. 1 and taken along the line 5—5 looking in the direction of the arrows;

Fig. 6 is a vertical section through the relief damper and balance weight shown in Fig. 2;

Fig. 7 is a vertical section taken along the line 7—7 of Fig. 1; and

Fig. 8 is a circuit diagram of the electrical connections for operating the unit.

The furnace unit is contained within a shell or casing generally indicated at 10 which is made up of metal sheets or plates bolted or welded together in any suitable fashion. The casing is divided into several compartments as indicated in Fig. 2 where A represents the cold air intake compartment, B represents the blower compartment, C represents the heating compartment, D represents the draft chamber, E represents the cooling compartment and F represents the filter compartment. A door 15 in the front panel provides access to the heating compartment C. A door 17 with a handle 19 on each side of the casing 10 provides access to the space between a filter 18 and a cooling coil 50 and provides for their service or removal therethrough.

Air is drawn from the intake compartment A through the filter compartment F by the blower B and is delivered into the heating compartment C from where it is forced out into the heating system of the house.

The intake compartment comprises the back portion of the furnace and I provide for various panels of the casing to be removed to form intake passages. The top panel 11 may be removed if it is convenient to have the air intake supplied to the top of the furnace. As an alternative supply passage, either part or all of the back panel 12 may be removed or the air intake duct may be connected to the bottom of the furnace at the opening indicated at 13.

The intake compartment is further formed by the vertical portion of panel 14, the relief damper 16 and the filter 18.

The filter 18 may be of any desired construction which will remove dust and impurities from the air as required by the individual users. I provide for it to be supported upon a cross piece or angle iron 20 and secured at the top by an angle iron 22 and a depending flange 24, a part of the outer casing.

The relief damper 16 extends completely across the furnace and is more clearly indicated in Fig. 6 and its construction and operation is as follows: The damper comprises a sheet of metal 30 bent or shaped around a horizontal center member 32 and fastened thereto by bolts 33. The center member 32 has holes in each end through which is run the shaft 34. The shaft 34 extends through and is carried by the side panels of the furnace. The damper 16 is prevented from rotating on shaft 34 by keys 35. It will be noted that the damper is unbalanced in that the upper side 36 is longer than the lower side 38.

Directly in back of the shaft 34 I provide a clip or lug 40 which may be bolted through the damper to the center member 32 or may be welded directly to the damper. To the clip 40 I fasten

a hollow cylinder 42 by means of a strap iron 44 and bolts 45. Within this cylinder 42 I place a heavy metal ball 46. The cylinder 42 is inclined downward toward the rear in such a manner that the ball 46 will normally be at the rear end of the cylinder.

From the above construction it is apparent that if the damper is rotated in a counterclockwise direction the ball 46 will roll forward in the cylinder 42 and so unbalance the damper that it will not return to its vertical position without the application of outside force. I provide handles on each end of the shaft 34, outside the furnace, which indicate the position of the damper and by which the damper may be set. Since the upper arm of the damper is larger in area than the lower arm, the force of air due to the suction of the blower exerted against the upper arm will be greater than that against the lower arm. If the filter 18 is clean it will offer little resistance to the air drawn through it by the blower and the weight of the ball 46 at the rear end of the cylinder 42 will be sufficient to counterbalance the uneven force of the air on the damper 16, however, if the filter becomes clogged there will be an increased pressure on the damper until it is unbalanced and is rotated counterclockwise in which case the ball 46 will roll as explained before and will keep the damper in its new position. The weight of the ball 46 at the forward or lower end of cylinder 42 will keep the cylinder in an upright or vertical position and will maintain the damper in a horizontal or open position thus allowing air to be by-passed around the filter 18.

After the air has entered the filter chamber F it may pass directly to the blower chamber B or may be directed through the cooling coil 50 according to the position of the control damper 52.

The control damper 52 extends completely across the furnace and is composed of a metal plate pressed or fastened around a shaft 54 and fastened to said shaft by pins or keys 56. The shaft 54 extends through and is journaled in the upright angle irons 58 on each side of the furnace.

The outside ends of the shaft 54 extend through an indicator plate 62 which is shown in Fig. 4. This plate is bolted to the casing through the holes 64. A handle 66 is keyed to each end of the shaft 54 by a key 68. The handle 66 carries a pointer 67 and a bolt or set screw 70 which may be screwed in to engage holes 72 in the indicator plate 62 to lock the handle and the control damper in either the heating or cooling position.

The cooling coil 50 may be either a brine coil or evaporator coil of any suitable refrigerating system. It may be supported at its top side by such means as angle irons 76 and at the bottom on a cross member 60 which is supported on the upright angle irons 58 just above the damper 52.

When the control damper 52 is in a vertical position it will be closely spaced from the cross member 60 and will nearly touch the horizontal portion of plate 14 at the bottom. Since it extends from side to side in the furnace the only passage open for the flow of air is through the cooling coil 50 and the cooling compartment E. When the damper is raised to a horizontal position it remains in contact with the cross member 60 and the sides of the furnace and its lower end abuts against the partition plate 100 thus closing off the cooling compartment E and allowing air to flow directly from the filter compartment F to the blower compartment B through the opening vacated by rotating the damper.

The blower for the furnace may be of any desired construction with sufficient capacity. In my embodiment of the invention I have provided a fan 80 on a shaft 82 within a metal shell or hood 84. The shaft 82 is journaled at each end in bearings 86 which are supported on framework 88. Air is drawn in through holes 85 in each side of the hood.

The framework 88 is made up of angle irons and also forms a mount for the electric motor 90 which drives the fan 80 through the belt 92 and pulleys 94. Power is supplied to the motor through cable 91.

The heating compartment is separated from the cooling and blower compartments by the metal plate 100 which extends completely across the furnace from side to side. The blast from the blower is delivered into the heating compartment through the opening 102.

The heating compartment contains two stoves 110 and 112 which support a radiator 114 by means of clips 116. Air from the blower is directed between the two stoves and is there split into two currents by the baffle 118. The air is thus blown in a spiral path around each stove upward and around the radiator 114 from where it is exhausted through the opening 120 into the heating system of the house.

Each of the stoves is composed of a sheet metal cylinder open at the bottom and with a connection 123 at the top for a flue 122. Each stove has a circular opening closed by a door 124 through which the fire pot may be inspected and the fire lighted. A raised portion 119 of the baffle protects the operator from the direct blast of the blower when so doing.

Near the lower end of each stove is an impressed ring 128 which supports the stove and forms a seal with the flange 141 of the fire pot 140. The stoves are fastened down to the fire pots by means of rods 130 which have hooks slipped through slots 131 in the stoves and are then passed through holes in the supporting channels 152 and drawn down by nuts 133.

The draft chamber D is separated from the heating chamber C by a plate 142 and from the blower compartment by a plate 144. Air is admitted to the draft chamber through a port or hole 146 in the plate 142. This hole may be covered wholly or in part by the damper 148 which is adjustable to regulate the amount of air to be admitted. Damper 148 is fastened to plate 142 by a pin 147 and may be moved in a plane just over hole 146 by means of handle 149.

The draft chamber contains a supporting framework composed of metal legs 150 and supporting channel irons 152. These supporting channel irons form supports for the legs 141 of the fire pots 140 and the stoves 110 and 112 as mentioned before. I also provide a plate 154 below each stove for catching dust or oil from the burners.

The operation of the burners is as follows: Oil is supplied to the bottom of the burners by pipes 160 and 162 from the valve 164. Air enters through the port 146 and is drawn in through the holes 156 where it is burned with the oil and the burned gases are forced upward through the hole 158 in the top of the burner. From there the gases rise in the stoves and are forced out through the flue 122 into the radiator 114. The radiator 114 is formed of sheet metal and contains baffles 115 around which the

gases must pass before passing out through the stack 117. The dotted arrows indicate the path of the products of combustion.

The draft chamber also contains an exhaust chamber and damper generally indicated at 170. This chamber is indicated as Fig. 7 in which 172 represents a rectangular metal sleeve open at one end 174 and extending through a hole in the front wall of the casing 10 at 176. The hole 176 may be covered by an ornamental grill such as 178. Near the rear end of the sleeve a rectangular frame formed of metal angles is formed as indicated at 180. This may be fastened inside the sleeve by welding or by means of screws 181 as shown. The frame 180 carries the shaft 182 in holes provided at the top of its side members. Around the shaft 182 is formed a sheet metal damper 184 which is free to rotate with or to rock on the shaft 182.

When the damper 148 is properly adjusted a quantity of air will be forced into the draft chamber which is more than sufficient to completely burn all of the oil supplied to the burners. This air will be at a higher pressure than the atmosphere surrounding the furnace as it is desirable to maintain the pressure in the draft chamber at a predetermined pressure to maintain a specific stack pressure or draft. To accomplish this result the damper 184 may be weighted so that it will swing forward under the pressure of the air in the draft chamber to a position that will allow the proper amount of air to escape through the grill 178. In this manner if the pressure in the draft chamber rises too high the damper 184 will swing further forward and allow more air to escape. The damper acts as an automatic variable resistance building up the pressure behind it in the draft chamber to a point determined by the angle of the damper.

Fig. 5 represents a section through the valve supplying oil to the two stoves and the controls for operating the valve. While the valve is not claimed as part of my invention, it is described to explain the manner in which my furnace operates.

The valve is composed of a metal case 190 with an intermediate dividing wall 192. It may be supplied with a removable cover plate 194 through which access may be had to the mechanism of the valve.

196 indicates a pipe by which oil is supplied to the valve. The oil is allowed to flow into the valve proper through a needle valve 197 which is controlled by a float 200 in such a manner as to maintain a predetermined level of oil in the valve.

210 indicates a solenoid or relay supported at the center of the valve by cross members 212. This is arranged to be energized by current from the control mechanism, which will be described later, through the cable 214 and contacts 216.

A fixed shaft 220 extends completely across the valve and carries toward each side a crank member 222. The tops of these crank members 222 are connected by an L-shaped cross piece 224 and are adapted to rotate around the shaft 220. The cross piece 224 carries at its center a piece of metal 226 which will be attracted to the solenoid 210 when the solenoid is energized. This will operate to rotate the cranks 222 in a counterclockwise direction.

Projecting inwardly from the sides of the valve are two short shafts 228 each of which carries another crank member 230. Each crank 230 has a central pivot 232 which is connected to the crank 222 by link 234. The cranks 222 are urged downward by springs 236 which are fastened to the cranks 230 near the pivots 232 and to a ring formed on the valve casing at 238. When the solenoid is energized the cranks 222 will rotate in a counterclockwise direction and links 234 will operate to rotate the cranks 230 also in a counterclockwise direction. The free ends of the cranks 230 engage shoulders 240 on two needle valves 242 and the counterclockwise rotation of the cranks 230 operates to raise each needle 242.

Each needle 242 has three shoulders 243, 244 and 245. The shoulder 245 is designed to close the opening 246 and the shoulder 244 is designed to close the opening 248. Shoulder 243 is designed to engage the surface through which opening 248 is formed and acts to limit the downward movement of the needle 242.

Each needle 242 operates in a series of chambers and passages as follows: 250 is an annular space which is open to the supply chamber 198 through port 252 and to a delivery chamber 254 through the port 246. 256 is another annular chamber which is open to the supply chamber 198 through port 258 and to the connecting chamber 260 through the port 248. Connecting chamber 260 is open to the delivery chamber 254 through the port 262. The delivery chamber 254 of each of the above series is connected by a pipe to one of the fire pots 140.

When the needle is in its completely raised position oil may flow from the chamber 198 through the port 252, chamber 250, port 146 into the delivery chamber 254, and may also flow through the port 258, chamber 256, port 248, chamber 260, port 262 into the delivery chamber 254. If the needle is partially lowered the shoulder 244 will close the port 248 shutting off the supply of oil through that port but will not close the port 246. Thus the supply of oil to each furnace may be regulated between two amounts determined by the sizes of the ports 246 and 248.

The needle 242 is normally held in position by means of a spring 261 which bears on the upper surface 264 of the needle 242 in such a position as to close port 248 but not port 246. The needle setting may be adjusted by turning the thumbscrew 266.

When the crank 230 is rotated in a counterclockwise direction through the action of the solenoid 210, as described before, the needle will be raised against the compression of spring 261 by the action of the crank 230 against the shoulder 240. This operates to open both of the supply ports and delivers the larger amount of oil to the delivery chamber 254 as explained before.

The plunger 270 passes through a friction connection 272 in the cover plate 194 and extends downward until it is in contact at its lower end 274 with the crank 230. The plunger 270 is slidably fastened to the crank 230 by a stirrup or ring 276. The plunger 270 also carries a projection or shoulder 278 which is adapted to engage the top of the needle 264 after the plunger has been depressed some distance.

When the plunger 270 is depressed it will first rotate the crank 230 in a clockwise direction until the fixed pivot 228 is on the right hand side of the link 234. From this position any upward movement of the link 234 will tend to give the crank 230 a clockwise rotation rather than a counterclockwise rotation and will not affect the position of the needle 242.

After the crank 230 has been pushed to its

inoperative position, further depression of the plunger 270 will engage the top of the needle 242 and will depress it to close both ports 248 and 246. The friction connection 272 will hold the plunger 270 down until it is pulled upward by some outside force. When it is pulled up the stirrup 276 will pull the crank 230 back to its original operative position.

From the above it is apparent that each of the cranks 222 may be given a counterclockwise rotation by action of the solenoid 210 with or without affecting the position of the needles 242 according to the position of the cranks 230 as determined by the position of the plungers 270. In this manner both needles may be left in control of the solenoid or either or both may be taken out of its control and closed.

Considering now the operation of the furnace as a whole: If both plungers 270 are left up the valve will supply a set minimum or maximum amount of oil to each furnace thus giving two ranges of heat output say 100,000 or 20,000 B. t. u. per hour. However, either one of the furnaces may be shut off completely by depressing one of the plungers 270 and the valve will then function to supply oil to only one of the furnaces thus giving two smaller amounts of heat, 10,000 or 50,000 B. t. u. per hour, according to the action of the solenoid.

Fig. 8 indicates one way in which the furnace may be controlled. A 110 volt electricity supply is provided on the line 290. Some current is taken from the line by the step-down transformer 292. A thermostat 294 will be placed in the space or room to be heated. When the thermostat 294 is closed, there will be a complete circuit through the thermostat 294, transformer 292, and the valve 164. The valve then operates to control the furnace as described above.

The motor 90, for operating the blower, may or may not be connected for regulation by the thermostat 294 and I have shown it to be manually controlled by the switch 300.

It is to be understood that I intend this specification to be descriptive only and not limiting on my invention.

I claim:

1. In a furnace of the type described, a casing defining an air heating chamber, two stoves supported in said heating chamber, means to direct a blast of air transversely between said stoves, a baffle to split said air blast into two spiral paths, and means shielded from said air blast by said baffle for supplying air for combustion in said stoves.

2. In a furnace of the type described, a casing defining an air heating chamber, two upright cylindrical stoves supported in said heating chamber, means to direct a blast of air transversely between said stoves, and a baffle extending halfway around the front of each stove, said baffles being joined in the center and operable to direct the air blast in two spiral paths upward and around each stove.

3. In a furnace having a casing defining a heating compartment containing two cylindrical stoves and a radiator common to both stoves, means for directing a blast of air transversely between said stoves, means for causing said air to spiral upwardly around each stove and around said radiator, means for joining the aforementioned currents of air for delivering them to a house heating system.

4. In a furnace of the type described, a casing defining a heating chamber, two upright cylindrical stoves supported in said chamber, a rectangular radiator above said stoves, said radiator being connected to receive the burning gases from said stoves, means for directing a blast of air transversely between said stoves, and means to divide said air blast into two spiral paths upward around each stove and said radiator.

5. In a furnace containing a heating compartment, two stoves within said compartment, a single door in said compartment wall giving access to both stoves, means for directing a blast of air between said stoves, a baffle between said stoves for guiding the direct blast of air away from said door and around each of said stoves.

MORITZ L. MUELLER.