

Dec. 18, 1945.

W. R. PRICE

2,391,071

HEATING APPARATUS

Filed Oct. 23, 1943

2 Sheets-Sheet 1

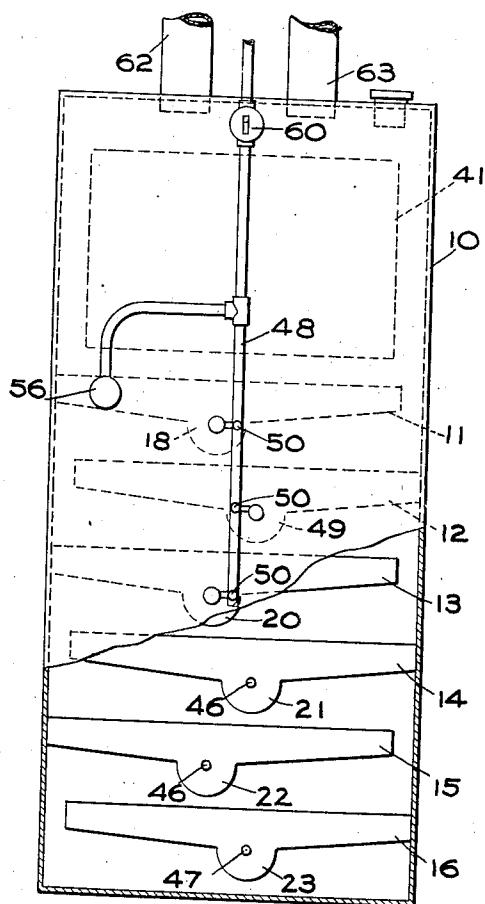


FIG. 1.

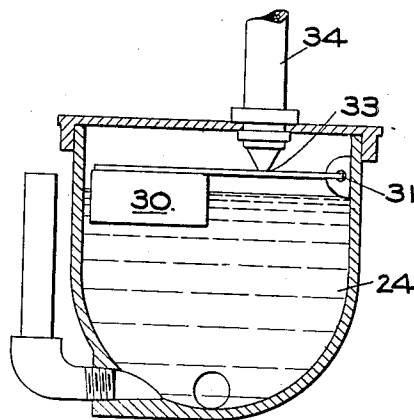


FIG. 4.

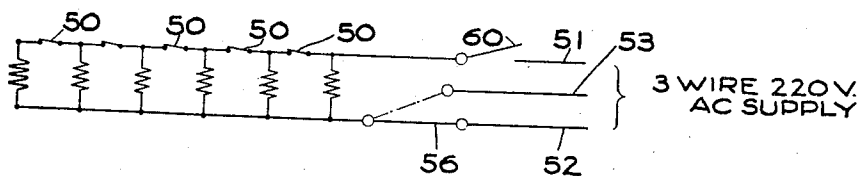


FIG. 5.

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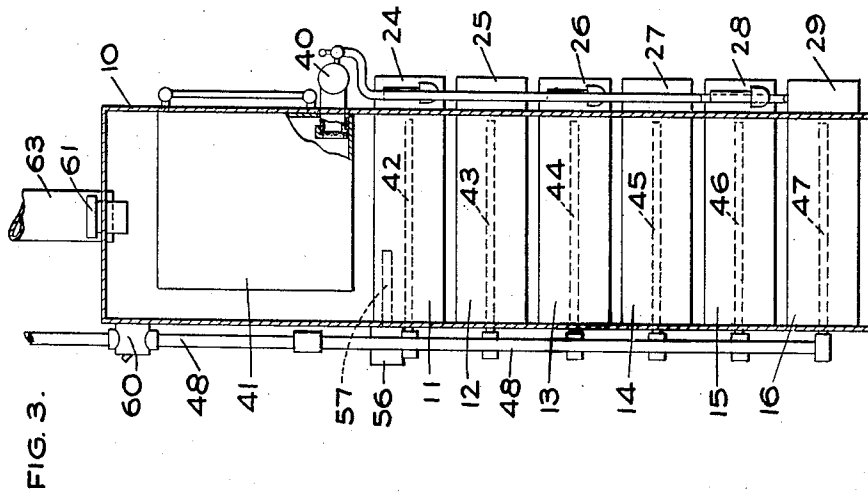
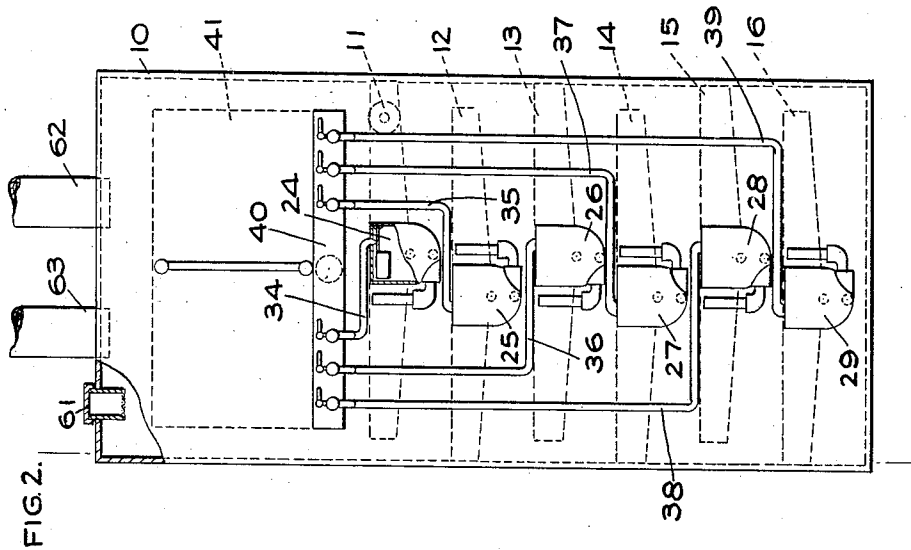
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HEATING APPARATUS

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6 Claims. (Cl. 219—38)

This invention relates to electric furnaces and particularly to an electric vapor generator for use in domestic space heating and in other instances where the requirements and conditions are similar.

According to the present invention means are provided which are especially adapted to the production of relatively great volumes of water vapor or saturated steam at little or no pressure. The objects of the present invention are achieved with apparatus which makes it possible to produce such relatively great volumes without the necessity of maintaining large volumes of water in heated or partly heated condition. As an example, the generator set forth herein as an embodiment of the principles of my invention comprises six generating units capable of producing a relatively large volume of water vapor or saturated steam and yet the entire six units contain a normal total volume of only about one cubic foot of water.

The design and construction and the proposed system of operation are all such as to avoid the usual considerations of pressure and strength which complicate devices of this general nature and render them expensive to construct and operate and sometimes also dangerous in use. Further, operating temperatures are such that no particularly refractory materials need be employed in the construction of the water reservoirs or pans or in the furnace casing itself or the conduits leading therefrom.

The manner in which the several units of the device of the present invention are arranged physically with respect to each other makes operation of the device extremely flexible since the several units may be serially cut out of operation without affecting the efficiency of the units remaining in operation, despite the fact that operation of the several units is interdependent, insofar as units in operation are concerned.

In addition to the means provided for using any desired number of units, the system is so arranged that an initial applied voltage in excess of the normal operating voltage is provided to insure quick starting without excess operating temperatures. To this end an initial 220 volt potential may be automatically cut back to 110 volts when satisfactory operating temperature is reached, with the result that the operating wattage is only one-fourth that obtaining during the starting period. The system of the present example utilizes a 220 volt three wire A. C. source and automatically cuts back to the neu-

tral wire for 110 volt operation after the "warming-up" period.

An example of one specific manner in which the present invention may be practiced is shown in the accompanying drawings and is described in detail hereinafter. It is to be understood, however, that various mechanical and electrical modifications may be introduced without departing from the spirit or scope of the invention, as defined in the appended claims.

In the drawings:

Fig. 1 is an elevational view looking at what may be considered the front of the furnace or pressure generator, with parts of the casing broken away for added clearness;

Fig. 2 is a rear elevational view;

Fig. 3 is a side elevational view with the outer casing in cross section to show the interior arrangement;

Fig. 4 is a detailed cross sectional view of one of the water level control devices; and

Fig. 5 is a wiring diagram showing the manner in which the several units are electrically connected.

Throughout the several figures of the drawings like characters of reference denote like parts and the numeral 10 designates a generally rectangular casing for housing the several elements of the generator illustrated by way of example. The casing contains a series of superposed pans designated 11 through 16 and it will be noted that alternate pans have their opposite side edges in abutment with one or the other of the side walls of the casing 10, the opposite side edge of each pan being spaced from the other side wall, see Figs. 1 and 2. Reference to Fig. 3 shows that each of the pans 11 through 16 extends from front to rear of the casing, so that a tortuous fluid passage beginning at the bottom and extending laterally across each pan, thence upwardly, is provided.

All of the pans 11 through 16 have central depressed sump portions numbered, respectively, 18 through 23, and these sump portions extend rearwardly through the casing 10 to form float chambers numbered 24 through 29, respectively. The float chamber 24 is shown in detailed cross section in Fig. 4 and comprises a float 30 pivoted at 31 and adapted, when the water level is at a predetermined maximum as indicated in Fig. 4, to close a valve post 33 formed at the end of a water supply conduit 34. Each of the float chambers 24 through 29 have supply conduits designated 34 through 39, respectively, leading from a manifold 40 which is connected with a

condensing vessel and reserve water tank 41 disposed in the casing 10 conveniently above the pans 11 through 16. It is thus seen that whenever the level of liquid in one of the float chambers falls, its related float valve will open to restore the level by gravity feed of water from the condensing vessel and reserve tank 41.

Disposed in the several pans 11 through 16 are electrical resistance heating elements 42 through 47, respectively, which project from a common support 48 which may be in the form of a rigid conduit for containing suitable wiring for the heating elements. As indicated in the wiring diagram, Fig. 5, the several units are connected in parallel and may be cut off serially, beginning with the bottom element 47, by opening any of the several manual switches 50, which may be located along the support 48 for ready access. It will be noted that the opening of any switch 50 cuts out all of the heating elements therebelow and this insures that when a part only of the units are active the active units will be the top one, the second one from the top, and so on for as many units as are active.

As has previously been indicated, it is desired that higher voltage be used during the warming-up period, to hasten the same, and to this end I preferably employ a three wire 220 volt A. C. supply. In Fig. 5, 51 and 52 designate the opposed conductors of such a current supply and 53 designates the so-called neutral wire. A thermostatic switch 56 is shown schematically in full line in Fig. 5 in position to apply the full 220 volt potential to the several heating elements 42 through 47. When the switch moves to the dot-and-dash line position, which occurs automatically when the water reaches a predetermined temperature, the applied voltage is reduced to 110 volts and the power consumption and heat production are reduced to one-fourth of the original value.

The heat sensitive means for controlling switch 56 may be of any conventional form and is shown as comprising merely a cylinder 57 projecting into the uppermost pan 11. The interior construction of the cylinder 57 is conventional and forms no part of the present invention. Devices of this class, including the thermostatic switch 56, are commercially available.

A manual main control switch is shown at 60 in the wiring diagram, Fig. 5, and in the front elevation, Fig. 1. A filler cap 61 is shown associated with the top of the casing 10 and the numerals 62 and 63 designate a pair of conduits which may be utilized as vapor output and condensate return conduits, respectively. If desired, forced vapor circulation may be provided by means of external circulating means without affecting the principles of operation of the vapor generator itself.

From the foregoing it will be seen that a multiple-effect vapor generator is provided whose capacity is selectively adjustable and whose operation from the starting period to normal running is automatically effected. It will further appear that the apparatus of the present invention is highly efficient and safe in use. Other advantages will appear to those skilled in the art.

I claim:

1. A low pressure vapor generator comprising a casing, a plurality of relatively shallow superposed water pans supported therein in vertically spaced relation, alternate pans being in abutment with one wall of said casing and spaced from the opposite wall, the intervening pans being spaced from said one wall and in abutment with said

opposite wall, said pans extending substantially across said casing whereby to define a zig-zag fluid path extending horizontally over each of the several pans in series, electrical heating means associated with each of said pans for heating water therein to generate vapor, and a vapor discharge conduit leading from the upper portion of said casing.

2. A low pressure vapor generator comprising a casing, a plurality of relatively shallow superposed water pans supported therein in vertically spaced relation, alternate pans being in abutment with one wall of said casing and spaced from the opposite wall, the intervening pans being spaced from said one wall and in abutment with said opposite wall, said pans extending substantially across said casing whereby to define a zig-zag fluid path extending horizontally over each of the several pans in series, electrical heating means associated with each of said pans for heating water therein to generate vapor, a vapor discharge conduit and a condensate return conduit at the upper portion of said casing, a receptacle between said pans and the upper end of said casing for receiving condensate, and float controlled conduit means to each of said pans from said receptacle to automatically maintain predetermined liquid level in each of said pans by gravity flow from said receptacle.

3. A low pressure vapor generator comprising a casing, a plurality of relatively shallow superposed water pans supported therein in vertically spaced relation, alternate pans being in abutment with one wall of said casing and spaced from the opposite wall, the intervening pans being spaced from said one wall and in abutment with said opposite wall, said pans extending substantially across said casing whereby to define a zig-zag fluid path extending horizontally over each of the several pans in series, electrical heating means associated with each of said pans for heating water therein to generate vapor, a vapor discharge conduit leading from the upper portion of said casing, and water supply means comprising a reservoir externally of said casing adjacent each of said pans, a water supply conduit and float controlled valve means in each of said reservoirs for controlling the water level therein, the several reservoirs being so disposed with respect to their associated water pans that the common water of each pan and reservoir automatically establishes and maintains proper water levels in the several pans.

4. A low pressure vapor generator comprising a casing having a series of spaced superposed open water pans arranged therein in alternately staggered relation to provide a zig-zag fluid path extending horizontally over the several pans in series, a vapor discharge conduit and a condensate return conduit at the upper part of said casing, a receptacle between said series of pans and the upper end of said casing for receiving condensate, and float controlled conduit means to each of said pans from said receptacle to automatically maintain predetermined liquid level in each of said pans by gravity flow from said receptacle, and electrical heating elements immersed in the several water pans.

5. A low pressure vapor generator comprising a series of spaced superposed water pans each having an electrical heating element therein, a power supply circuit having the several heating elements connected thereacross in parallel, switch means in said power supply circuit between each of the several heating elements, said

supply circuit connecting first with the heating element of the uppermost pan, then with the next below, and so on, whereby opening of any of said switches de-energizes all heating elements in circuit below said switch.

6. A low pressure vapor generator comprising a series of spaced superposed water pans each having an electrical heating element therein, a three wire alternating current supply circuit and means connecting the several heating elements thereacross in parallel, a switch and thermally responsive means in the uppermost pan for controlling said switch, said switch being disposed in said supply circuit and movable automatically

under the action of the thermally responsive means to switch from full connection of the supply circuit to connection with the neutral conductor thereof to reduce power consumption to one fourth when the water in the uppermost pan reaches a predetermined temperature, and manual switch means in said power supply circuit between each of the several parallel-connected heating elements, said supply circuit connecting first with the heating element of the top pan, then with the next below, and so on, whereby opening of any of said manual switches de-energizes all heating elements in circuit below said switch.

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