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COMBINATION OIL AND GAS BURNER

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2 SHEETS—SHEET 2

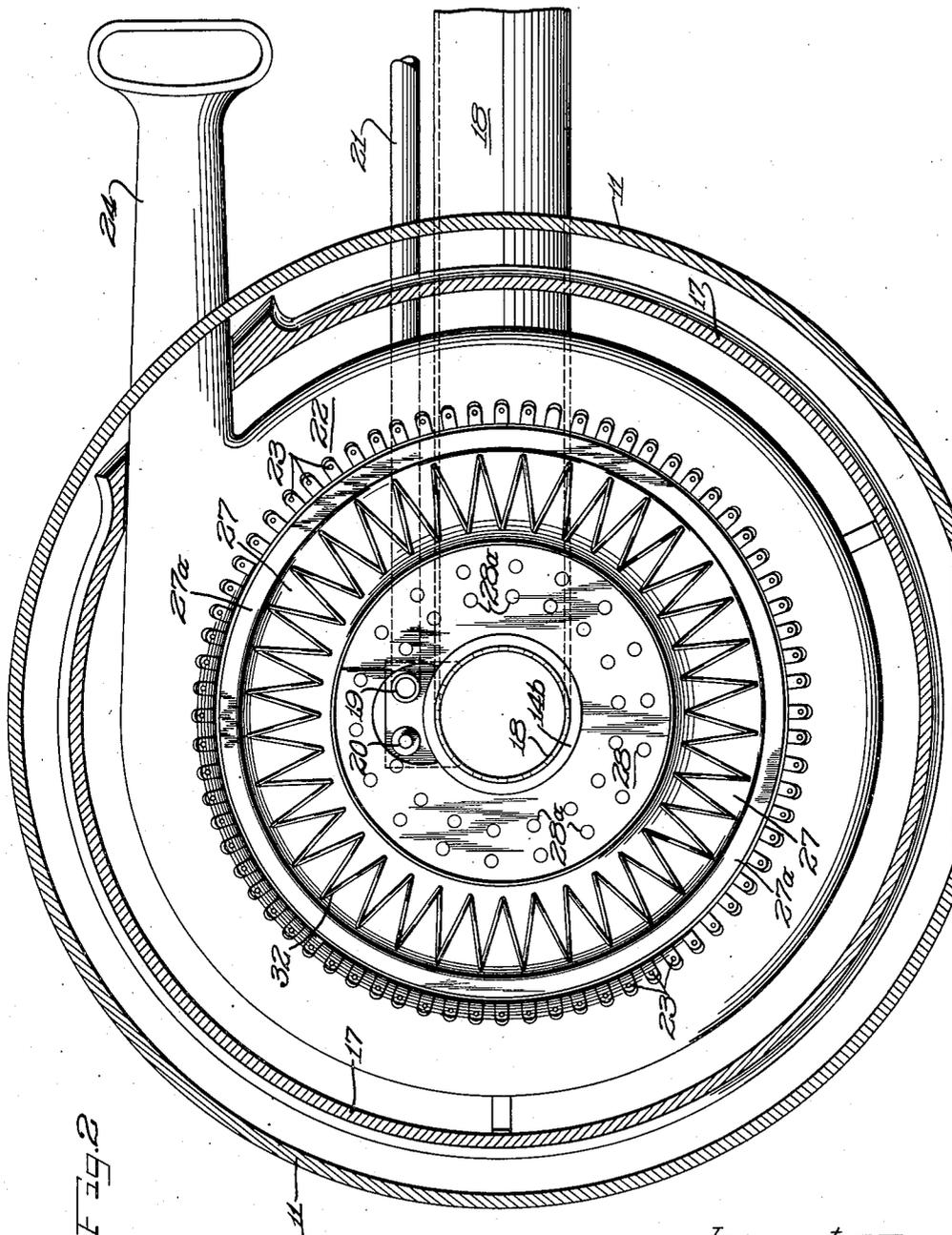


FIG. 2

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COMBINATION OIL AND GAS BURNER

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6 Claims. (Cl. 158—11)

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This invention relates generally to heating units and more particularly relates to an improved combination gas and oil burner which finds a desirable application in the conditioning of air to be furnished to occupied spaces.

Burner units for heating purposes have been developed which may be alternately operated on gas or a vaporizable fuel such as oil or a combination of both in accordance with the requirement of the particular heating system or in accordance with the availability of the respective type of fuel. In any event, burner units adapted for the utilization of a vaporizable fuel such as oil are frequently provided with a structure which effects the conditioning of fuel oil for proper combustion by vaporizing the fuel in a high temperature zone produced by a gas burner.

An object of this invention is to provide a vaporizer burner unit with a thermally conductive booster arranged to contact the fuel to be vaporized and extending therefrom so as to transfer heat by conduction from a high temperature zone into the fuel to increase the efficiency of vaporization.

Another object of this invention is to provide a method of operating a vaporizer burner whereby heat may be introduced into a fuel to be vaporized from a high temperature zone by means of a thermally conductive booster.

A further object of this invention is to provide a burner unit structure whereby oil vapor arising from a pool of fuel may be pre-heated or superheated for more efficient combustion.

Another object of this invention is to provide a novel and improved method of operating a vaporizer burner unit by arranging a segmented booster in the bottom of a fuel carrying vaporizer pan, whereby movement of the segments relative to the pan in response to temperature variations will break up residual solids precipitated in the pan by combustion.

According to the general features of this invention, a booster for a vaporizer burner unit may be provided which preferably takes the form of a coil of heat resisting wire capable of transferring heat by conduction arranged in a circular form and adapted to rest loosely in the bottom of a burner vaporizer pan so as to conform to the bottom contour thereof. The coil is so constructed as to have its upper sections extend into a high temperature zone produced by jets of flame emanating from a vaporizer burner. Since each spiral coil of the booster is adjacent to the inner bottom contour of the vaporizer pan, the bottom of each coil section will dip into the fuel to be

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vaporized, thereby providing a multiplicity of conductors to transfer heat from the high temperature zone directly into the fuel medium for greatly increased rate of vaporization thereof.

5 Vapors rising from the liquid fuel in the vaporizer pan will then pass through and around the upper sections of the booster thereby becoming preheated sufficiently to greatly improve the combustion of these vapors with a clear and smokeless flame.

10 Furthermore, the arrangement of the booster coil provides a plurality of heated surfaces which assist in the combustion of the gases burned for vaporizing purposes in accordance with the principles of surface combustion.

15 It is believed that the methods practiced and claimed as a part of this invention will be best understood from the explanation of the apparatus provided for practicing same.

20 Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings, in which:

25 Figure 1 is a vertical cross-sectional view of a combination oil and gas burner unit embodying the principles of my invention; and

Figure 2 is a cross-sectional view taken on line II—II of Figure 1.

30 As shown on the drawings:

35 While the principles of the present invention are obviously applicable to any type of heating unit employing a structure to vaporize and burn a volatile fuel, such as oil or the like, I have chosen to describe the application of my invention to a combination oil and gas burner unit which has found wide application in the heating and ventilating trade.

40 The exemplary construction shown on the drawing is particularly adaptable for installation in connection with a furnace having a combustion chamber 10 supported in a relatively elevated position on a hollow cylindrical casing 11. The combination oil and gas burner unit 12 embodying the principles of my invention may then be conveniently mounted within the confines of the casing 11 and is generally cylindrical with respect to the vertical axis of a fire box aperture 13 provided in the bottom of the combustion chamber 10 of the furnace.

45 The combination burner unit 12 embodies a base casting 14 having an annular base portion 14a which supports a generally cylindrical shell 16 and a housing 17.

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The base casting 14 is provided with an up-standing cylindrical hub 14b defining a central bore for positioning a gas nozzle or conduit 18.

The nozzle or conduit 18, at its bottom portion, forms a horizontal leg which extends radially outward of the casing 11.

Although not a specific part of the present invention, it will be understood that a suitable structure may be provided in communication with the nozzle or conduit 18 such as a motor driven blower adapted to direct a stream of combustion supporting air through the nozzle or conduit 18.

It will further be understood that the nozzle or conduit 18 may be employed to conduct a combustible mixture of gas and air to supply a main burner gas flame when the combination burner unit 12 is operated on a gas cycle. Such combustible mixture of gas and air may be produced by a conventional inspirator nozzle which projects into the lower housing. Such structure is not disclosed herein, however, and further information regarding the details of construction of a combination gas and oil burner unit of this type is contained in my co-pending application entitled "Combination Gas and Oil Burner and Control Therefor," Serial No. 47,319, filed September 1, 1948, now Patent 2,547,611, April 3, 1951.

As may be seen in dotted lines on Figure 1 and in Figure 2, a conventional pilot flame unit 19 may be provided adjacent the nozzle or conduit 18 having a pilot flame thermal switch unit 20 and operable in a conventional manner to maintain a pair of switch contacts closed so long as the pilot flame is burning and to open such contacts in the event of failure of the pilot flame produced by the pilot flame unit 26. Fuel gas may be supplied to the pilot flame unit through a conduit 21 connected to a fuel source at any desired point.

Referring further to Figures 1 and 2, an annular gas burner element 22 of generally hollow, torus-like configuration is shown mounted on the top of the shell 16 and in surrounding relationship to the hub 14b of the base casting 14.

The burner element 22 is provided with a hollow bore 22a and a plurality of gas burner jets 23 which are arranged to define two axially spaced sets of jets which extend around the inner periphery of the burner element 22 and are respectively directed angularly upwardly and downwardly and toward the axis of the base casting 14.

Gas fuel is supplied to the burner element 22 through a conduit 24 which may be supplied with a combustible mixture of gas and air, for example, at a point remote from the combination burner unit 12. Hereinafter, the burner element 22 will be referred to as the vaporizer burner 22.

As may be most clearly seen on Figure 1, the vaporizer burner 22 is provided with a radially inwardly extending ledge 22b extending around the inner circumference. A ring 26 of suitable heat insulating material rests upon the ledge 22b and, in turn, is utilized to support an annular vaporizing pan or tray 27, which has an outturned edge 27a engaging the ring 26.

The vaporizing tray 27 may be of any desired configuration and preferably is provided with a depressed bottom portion so as to permit a substantial quantity of fuel oil to be collected in the tray without spilling.

Inasmuch as the tray 27 is supported intermediate the two rings of flames produced by the vaporizer burner 22, in operation, the tray will be rapidly heated to a high temperature. The in-

sulating ring 26 sealingly mounts the tray 27 without substantial transfer of heat from the hot vaporizer tray to the relatively cool vaporizer burner 22.

To further amplify the heating effect of the gas jets of the vaporizer burner 22, a radiant is provided below the vaporizer pan 27. Although the radiant could conceivably take alternative structural forms, the embodiment shown in the drawing includes a ring of refractory material 28 which is mounted in axially spaced relationship below the vaporizer tray 27 and is conveniently supported upon the top surface of the base casting 14 concentric with the hub 14b. To further facilitate the heating of the vaporizing tray 27, the surface of the refractory material 28 may be provided with a plurality of spaced refractory points 28a.

By way of illustrative example, it may be noted that the radiant could also be provided in the form of a lower coil (not shown) made of thermally conductive heat resistant metal which could be located on the upper surface of the base casting 14 in spaced relation to the vaporizer tray 27 so as to present a surface to be heated by the downwardly projecting jets of flame emanating from the ports 23 for radiant heating of the vaporizer tray 27.

The combination burner unit 12 is further provided with a mixing nozzle 29 which is of such a configuration as to describe a Venturi throat in registry with the fire box opening 13. The mixing nozzle 29 is preferably an annulus of refractory material suitably adapted to be supported in the upper portion of the housing 17 in spaced relation to the nozzle or conduit 18 and to the vaporizer tray 27 so as to serve as an upper radiant and further defining the high temperature zone proximate the pan or tray 27.

The mixing nozzle 29 is provided with an aperture or passage 29a having one leg thereof directly overlying the vaporizing tray 27 and positioning a conventional drip mechanism 30 which may be employed to supply a limited flow of fuel such as oil or the like to the vaporizer tray 27 when it is desired to burn a volatile fuel in the combined burner unit 12.

To protect the drip nozzle mechanism 30 from the high temperatures developed within the burner unit 12 and to effect the feeding of the fuel to the vaporizing tray 27 without carbonization, the mechanism 30 and the supply pipe leading thereto are preferably encased within a sheet metal conduit 31 which extends radially outwardly through the casing 11 and which is open to the atmosphere so as to permit a flow of cooling air to be continuously inducted through such conduit. Therefore, the conduit 31 not only provides additional air for combustion of the gas and oil within the burner unit 12, but also effectively maintains the drip nozzle mechanism 30 at a sufficiently low temperature to preclude carbonization of the fuel fed therethrough.

According to this invention, a booster 32 is provided which preferably takes the form of a coil consisting of a helix of stainless or other heat resisting wire capable of transferring heat by means of conduction. It may be noted that material to be used in the composition of a booster 32 may be any conductor of heat which is resistant to deterioration at high temperatures including such metals as are normally used under similar conditions, for example, alloys such as stainless steels and rustless irons, nichrome steel, which is a ferrous alloy containing about 60%

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nickel, 24% iron, 16% chromium and 0.1% carbon, and inconel, which is a non-magnetic alloy containing approximately 80% nickel, 13% chromium and 6.5% iron.

The booster 32 in the form of a helix of wire or rod is arranged in a circular form so that it may rest loosely within the vaporizer pan 27 and conform along its bottom section roughly with the inner bottom contour of the vaporizer pan 27.

The booster 32 is preferably arranged so as to have its upper section extend into the high temperature zone proximate to the vaporizer tray 27. As herein embodied, it will be seen that the upper sections of the booster 32 are quickly heated to a high temperature by the flame jets emanating from the upper row of ports 23 of the vaporizer burner 22. Since each coil of the helix rests on, or is adjacent to, the inner bottom contour of the vaporizer pan, the bottom of each coil section will dip into any pool of fuel or oil collected at the bottom of the vaporizer tray 27.

In this manner, there is provided a multiplicity of conductors, each section being heated at the top by the burning gas and the heat being transferred through the conductors into the oil itself by the thermally conductive booster 32, thereby increasing the efficiency of vaporization. Heat which would otherwise pass quickly above the oil and out through the Venturi throat of the mixing nozzle 29 is thereby transferred through the conductor into the oil itself permitting a more efficient vaporization of fuel and requiring less fuel consumption in the vaporizer burner 22.

One of the features resulting from the employment of the booster 32 lies in the fact that the vapors rising from the pool of fuel collected at the bottom of the vaporizer tray 27 pass through and around the upper sections of the booster 32, thereby becoming pre-heated sufficiently to greatly improve the combustion of these vapors.

The helical coil shape of the booster 32, as shown, is desirable in that no substantial restriction is presented in and above the vaporizer tray 27 to the flow of burning gases emanating from the upper row of ports 23 of the vaporizer burner 22. As a practical matter, the presence of the heated surfaces presented by the upper sections of the booster 32 actually assists in the combustion of the gases burned for vaporizing purposes in accordance with the principles of surface combustion.

The booster 32 develops an additional function which makes it uniquely suitable for adaptation to a burner unit of the type which burns a vaporized fuel such as oil or the like. In the burning of certain fuel oils by means of a vaporizing type burner there are certain solids precipitated out of the burning liquid which are comparatively difficult to burn and which, if not disposed of, interfere with the efficient operation of the burner unit.

It will be readily understood that in normal automatic operation of a unit 12, the booster 32 will be alternately heated and cooled thereby causing a slight movement of the individual segments of the coil relative to the bottom of the vaporizer tray 27 within which the booster 32 is resting. The relative movement of the segments effectively breaks up any residual solids resulting from the combustion of the fuel and prevents such coagulated masses from interfering with the normal operation of the burner unit.

It will be understood, that if the booster 32 is employed in a single oil burner unit, alternate heating and cooling of the booster 32 could be

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accomplished by temporarily securing operation of the burner unit.

From the foregoing description, it is apparent that whenever fuel oil is supplied to the vaporizer tray 27 and the vaporizer burner 22 is operated to produce a high temperature zone in the locale of the vaporizer tray 27, the fuel oil in the tray will be rapidly vaporized. Air supplied through the central opening in the annular vaporizer tray 27 as well as through the passages above and below the vaporizer tray 27 and above the mixing nozzle 29 adequately supports combustion of the vaporized fuel. The temperature of the vaporizing zone is maintained sufficiently high to insure the rapid vaporization of fuel oil supplied thereto and, while some "cracking" of fuel oil occurs, and resulting combustibles are completely consumed, due to the high temperature in the vaporization zone and the presence of adequate combustion supporting air.

It may be noted that the induced air flow produced around the upper and lower faces of the vaporizer tray 27, as well as the induced air flow through the conduit 31, will operate to sweep ash or non-combustibles deposited in the locale of the tray 27 into the air stream thereby assuring cleanliness of the vaporizer tray 27.

It will be apparent that the housing 17 may be constructed in such a manner as to position the mixing nozzle 29 in its optimum axial position relative to the remaining elements of the burner unit 12 so as to insure a thorough mixing action of fuel oil vapors and combustion supporting air in the throat portion of the mixing nozzle 29. Thus, the burning of the combustible mixture is initiated before such mixture passes out of the end of the mixing nozzle 29 and into the combustion chamber 10. A target or flame spreader 33 may be mounted within the chamber 10 in such a manner as to lie in registry with the throat of the mixing nozzle 29 and the fire box opening 13. The target or flame spreader 33 operates in a conventional manner to diffuse the flame entering the fire box throughout the chamber 10.

It will be apparent to those skilled in the art that I have described a structure for a combination oil and gas burner unit which affords novel and improved methods of operating a vaporizer type burner unit.

It will be further apparent that I have described a novel and improved burner unit which effects improved combustion of a vaporized fuel.

It is contemplated that various modifications may be suggested to those versed in the art which will not mark a departure from the essential spirit of my invention. It is to be understood, therefore, that I do not wish to be specifically limited to the preferred embodiment herein shown and described by way of illustrative example only.

I claim as my invention:

1. A heating unit comprising an annular gas burner, an annular tray disposed within and adjacent said burner so as to be heated thereby, a booster element arranged in said tray and having a portion extending out of said tray and arranged to be heated by said gas burner, means for supplying a vaporizable fuel to said tray, means for guiding an air stream through the central opening in said tray, and a Venturi nozzle disposed in alignment with the central opening of said tray, whereby said fuel may be vaporized by the heat surrounding said tray and by the heat conducted into said fuel by said booster to produce a combustible mixture of said fuel in

the air stream at the locale of the throat of said Venturi nozzle.

2. In a vaporizing type oil burner, an annular radiant, a mixing nozzle, means for supporting said radiant and said mixing nozzle in aligned axially spaced relationship, an annular gas burner disposed between said radiant and said mixing nozzle and arranged to produce a high temperature zone therebetween, a vaporizing pan suspended in said zone, a thermally conductive booster in said pan to conduct additional heat from said zone into fuel supplied to said pan, means for supplying a limited flow of fuel oil to said pan, whereby the fuel oil is continuously vaporized, and means to supply a flow of combustion supporting air in the locale of said high temperature zone to burn the vapor emanating from said pan.

3. In a vaporizing type oil burner, an annular radiant, a mixing nozzle, means for supporting said radiant and said mixing nozzle in aligned axially spaced relationship, an annular gas burner disposed between said radiant and said mixing nozzle and arranged to produce a high temperature zone therebetween, a vaporizing pan suspended in said zone, a thermally conductive booster in said pan to conduct additional heat from said zone into fuel supplied to said pan, means for supplying a limited flow of fuel oil to said pan for vaporization, and means to supply a flow of combustion supporting air in the locale of said high temperature zone to burn the vapor emanating from said pan, said booster comprising a coil consisting of a helix of heat resistant metal.

4. In a vaporizing type oil burner, an annular radiant, a mixing nozzle, means for supporting said radiant and said mixing nozzle in aligned axially spaced relationship, an annular gas burner disposed between said radiant and said mixing nozzle and arranged to produce a high temperature zone therebetween, a vaporizing pan suspended in said zone, a thermally conductive booster in said pan to conduct heat from said zone into fuel supplied to said pan, means for supplying a limited flow of fuel oil to said pan for vaporization, and means to supply a flow of combustion supporting air in the locale of said high temperature zone to burn the vapor emanating from said pan, said booster comprising a segmented element movable relatively to the bottom of said pan in response to temperature variations in said zone whereby residual solids precipitated in said pan may be broken up.

5. In a vaporizing type oil burner, a vaporizing pan, means for supplying a vaporizable fuel to said pan, a gas burner disposed adjacent said pan, said burner having a first series of flame jets disposed relatively above said pan and a second series of flame jets disposed relatively beneath said pan, a radiant spaced below said pan in the path of said second series of flame jets and a booster coil of a thermal conductive material carried in said pan and extending therefrom to have its upper portions in the path of said first series of flame jets, whereby said pan is disposed in a zone maintained at a sufficiently high temperature to vaporize said fuel in said pan and additional heat from said zone is conducted into said fuel by said booster.

6. A heating unit comprising an annular gas burner, an annular oil vaporizer tray disposed within and adjacent said burner so as to be heated thereby for the vaporization of oil in said tray, means to supply oil to said tray, a booster element arranged in said tray and having a portion extending out of said tray and arranged to be heated by said gas burner to conduct additional heat into the oil in said tray, and means for guiding a combustion supporting air stream through the central opening in said tray to burn the oil vapors arising from said tray.

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