

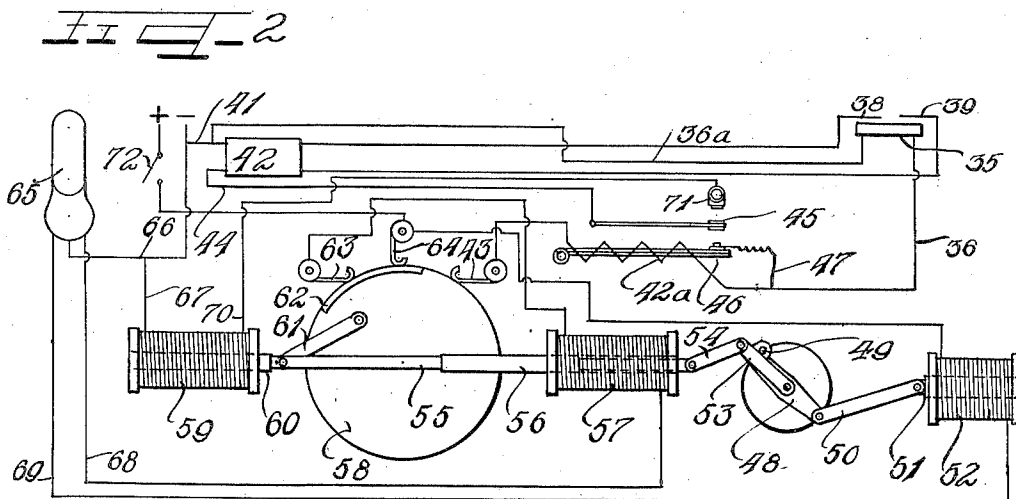
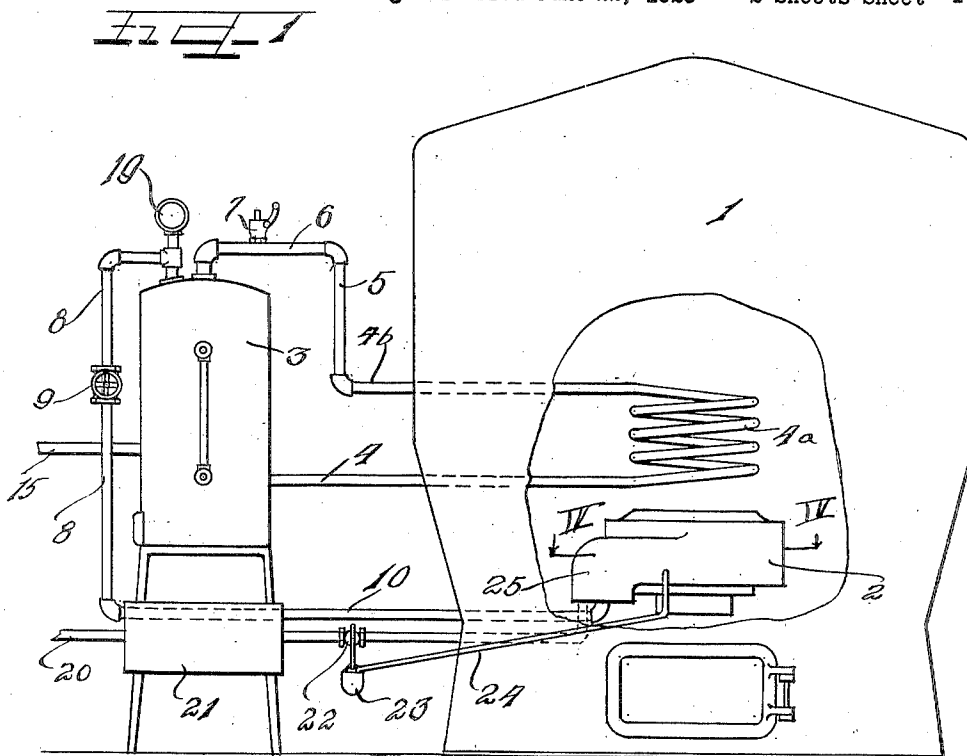
Aug. 7, 1928.

1,679,900

F. HIGGINS ET AL

OIL BURNING SYSTEM

Original Filed June 22, 1925 2 Sheets-Sheet 1



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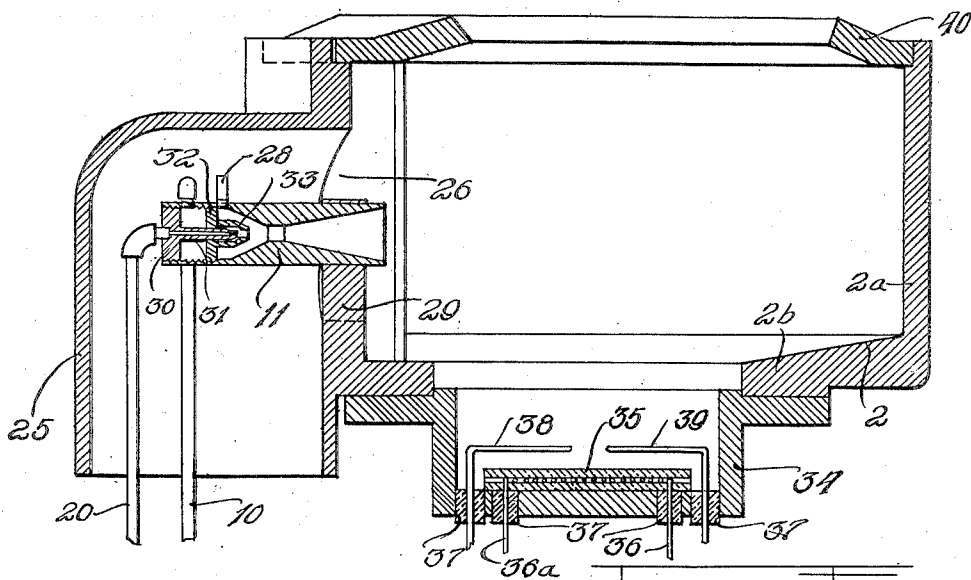
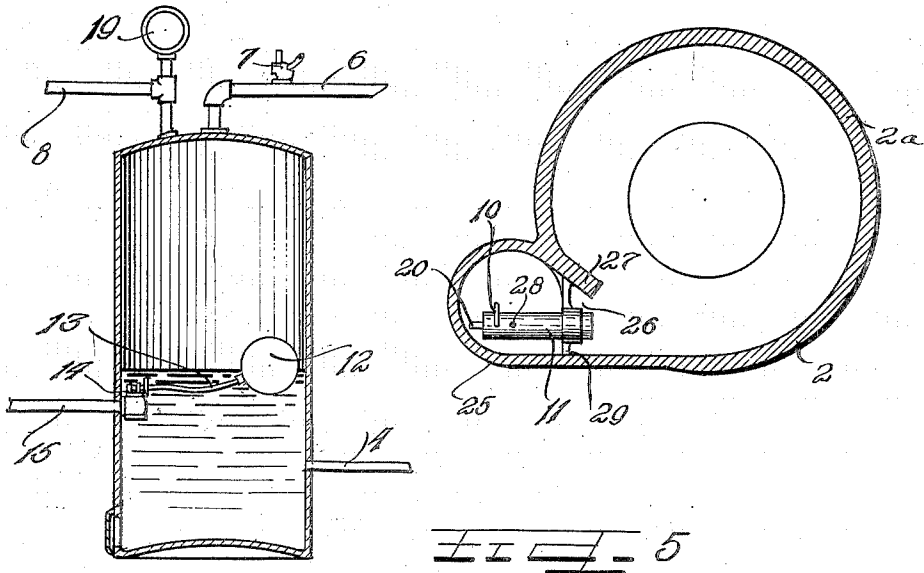
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UNITED STATES PATENT OFFICE.

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OIL-BURNING SYSTEM.

Original application filed June 22, 1925, Serial No. 38,942. Divided and this application filed February 7, 1927. Serial No. 166,415.

This invention relates to an oil burning system adapted for use in connection with furnaces, steam and hot water heating plants, and the like.

The principal objections to certain oil burners in use exist in the formation of carbon usually due to incomplete or improper combustion and the noise arising therefrom which make them objectionable in dwellings and the like.

It is an object of this invention to overcome these objections in the provision of an oil burning system in which the fuel is mixed with dry or superheated steam at low pressure, together with air, which produces a bluish or almost colorless flame of intense heat.

It is a further object of this invention to provide a novel system of control for the burner including a sparking mechanism for producing initial combustion.

This application is a division of our pending application Serial No. 38,942, filed June 22, 1925.

With these and other objects in view, which will become more apparent in the following description and disclosures, this invention comprises the novel structure and combinations hereinafter described and more particularly pointed out and defined in the appended claim.

In the accompanying drawings which illustrate a preferred form of this invention and in which similar reference numerals refer to similar features in the different views: Figure 1 is an elevational view of the oil burning apparatus installed in connection with a furnace.

Figure 2 is a plan view showing diagrammatically the control system.

Figure 3 is an enlarged sectional view through the water tank.

Figure 4 is an enlarged sectional view upon the line IV—IV of Figure 1.

Figure 5 is an enlarged vertical sectional view through the fire pot.

As illustrative of this invention, there is shown a furnace 1 in which the fire pot 2 of the system is positioned. A water tank 3 is positioned adjacent the furnace. From the tank 3, a pipe 4 extends into the furnace and directly above the fire pot in the form of a coil 4^a which returns through a branch 4^b and the pipe sections 5 and 6, to a safety valve 7 which communicates with the top of

the tank. A pipe 8 provided with a control valve 9 extends from the top of the tank and connects with a pipe 10 that communicates with the top of the fire nozzle 11 (Figure 5).

The water in the tank 3 is maintained at a level which should be a suitable distance below the top of the coil 4^a in order that the steam may be preheated in the upper part of the coil 4^a before it reaches the burner. In the present instance the level of the water is shown to be substantially a turn and a half of the coil 4^a below the top of such coil, leaving substantially a coil and a half in which the steam may be preheated before it reaches the burner. This water level is maintained by means of a float 12 which is secured upon a flexible rod 13 which controls a valve 14 in the water supply pipe 15. On account of the flexibility of the float rod, it may be adjusted to vary the water level within the tank. A low pressure gauge 19 is connected to the top of the tank for indicating the pressure of the steam.

The oil supply pipe 20 for the system extends through a regulating box 21, the mechanism in which will be later described. From the regulating box, the oil supply extends through the wall of the furnace and into the front end of the fire nozzle 11 as shown in Figure 5. Adjacent the regulating box, there is a trip valve 22 in the pipe 20, which is operated by the usual trip bucket 23 from which a pipe 24 extends. The pipe 24 extends into the lower part of the fire pot. As such a trip bucket and its functions are old and well-known it need not be more specifically described.

The fire pot 2 which is best shown in Figures 4 and 5 consists of a substantially cylindrical body portion 2^a with a downwardly directed hood 25 which is offset with respect to the body portion, but integral therewith. The wall of the body portion is not continuous; there is a gap 26 that establishes communication between the hood and body portion. The hood is so formed in connection with the body portion that the outer wall of the gap lies in substantially the same plane as the inner surface of the adjacent wall of the fire pot. The inner side of the gap 26 is formed by the juncture wall 27 of the hood and body portion. This juncture wall slopes inwardly and serves to deflect the flames with respect to the gap 26. This gap serves as a thoroughfare for air which may

enter the fuel nozzle through an inlet 28. The nozzle 11 is supported in the wall 29 that connects the deflector portion 27 with the wall of the hood below the gap 26. According to this construction, the fuel mixture passing through the nozzle 11 will be tangentially directed against the wall of the body portion and be given a swirling motion; after substantially one revolution the same will strike the deflector 27 and be deflected inwardly of the gap 26 so as not to interfere with the operation of the nozzle.

The nozzle consists of a hollow Venturi tube. A nut 30 is threaded in the outer end of the tube, the oil pipe 20 being secured in said nut. This nut has an extended tube 31 which communicates with the oil pipe 20. This tube extends into a second nut 32 threaded in the nozzle 11 in spaced relation with the nut 30 to provide a steam chamber therebetween. The nut 32 is provided with a forwardly projecting nozzle 33. It will be noted that the passage in the nozzle 11 is cylindrical at the rear; it then becomes conical to provide a restricted portion which merges into a flaring portion to give a Venturi effect to the mixture.

It will be noted that the tube 31 in the nut 30 fits loosely in the nut 32. Consequently the steam entering the pipe 10 will pass into the nozzle of the nut 32 and mix with the oil and as the steam has been superheated and is dry, there will be no hindrance to combustion. The air inlet 28 communicates with the conical portion of the passage in the nozzle and forward of the nut 32. Consequently, the air will become mixed with the oil after the steam strikes the oil.

In referring to Figure 5, it will be noted that the body portion 2^a of the fire pot has a downwardly sloping annular flange 2^b which forms part of the bottom thereof. The remainder of the bottom is formed by a basin 34 or the like attached to the flange 2^b. An electrical heating unit 35 is attached to the bottom of the basin 34. A pair of conductors 36 and 36^a which pass through insulated blocks 37, in the bottom of the basin, convey the current with respect to the heating unit.

The fuel mixture will initially drop into the basin 34 and be heated into vapor which will be ignited by an electrical spark produced by the spaced conductors 38 and 39 above the heating unit. These spaced conductors, which may be termed the spark wires, extend through suitable insulated blocks 37 in the base of the basin to the electrical control which will be later described. An apertured cover 40 having an upwardly flaring portion around the aperture therein rests upon the top of the fire pot and produces a Venturi effect with respect to the emitted flames.

Referring now to the control mechanism

which is housed in the box 21 and which is shown in Figure 2, it will be seen that the conductor 36^a of the heating unit connects with a wire 41 leading from a high tension coil 42 to a source of power, and that the other wire 36 of the heating unit connects with a resistance coil 42^a which in turn connects with a stationary switch contact 43.

The spark wire 38 is connected to the high tension coil 42, while the spark wire 39 also leads to the high tension coil 42. The circuit through the coil 42 is however, completed through a conductor 44 that is connected with a flexible switch element 45 which is adapted to be contacted by a thermostatically operated switch element 46 adapted to be heated by the coil 42^a and which is connected by a conductor 47 to the wire 36.

The oil supply pipe in the box 21 has an automatically controlled valve which is connected to an arm 48 intermediate the ends thereof; one end of this arm has a projecting pin 49 while the other end is connected to one end of a link 50. The other end of the link 50 is pivotally connected to a core 51 of a valve closing solenoid 52.

Mounted loosely upon the axis of the arm 48, there is a second arm 53 which is pivotally connected by a link 54 with a rod 55 embodying a core 56 of a valve opening and switch closing solenoid 57. The rod 55 extends contiguous to and past a rotary switch 58 into a switch opening solenoid 59; the rod being provided with a suitable core for such solenoid. The rod 55 is also pivotally connected by a link 61 to the rotary switch 58.

The rotary switch comprises an insulated disk having an arcuate conductive portion 62 upon its periphery adapted to form electrical connections between the stationary contact members 63, 64 and 43 as will later more fully appear.

After the system has been started, it may be automatically regulated by a thermostat 65 in the dwelling room. The deflecting portion of this thermostat is connected to the source of power through a conductor 66 which is connected by a conductor 67 with the switch opening solenoid 59. The low temperature side of the thermostat is connected by a wire 68 with the valve opening solenoid 57 and the high temperature side of the thermostat is connected by a conductor 69 with the valve closing solenoid 52.

After the system has been put into operation, it is desirable to rotate the switch to off position. In order to accomplish this the switch opening solenoid must be energized. For this purpose, a conductor 70 leads from the solenoid 59 to a stationary contact 71 above the yielding switch member 45. Obviously, after the thermostatic bar 46 has been brought into engagement with the

yielding switch member 45, it will continue to move as its temperature increases until it strikes the contact 71 for completing the circuit through the solenoid 59 which will actuate the bar 55 for rotating the switch to off position as shown in Figure 2. In order to start the system, a suitable switch 72 may be inserted in the main line of the circuit.

10 The operation is as follows:

In the position shown in Figure 2, the switch 58 is in off position and the automatic valve in the oil supply pipe is closed. Now if the switch 72 is closed, the circuit 15 through the solenoid 57 will be completed through the low temperature side of the thermostat 65. The solenoid 57 will attract the core 56 and shift the rod 55 to the right, thereby closing the switch 58. Simultaneously, the arm 53 will engage the pin 49 20 and swing the arm 48 to the right for opening the oil valve, the oil then flowing into the fire pot.

As soon as the switch 58 is rotated to 25 closed position, it will put the contact 43 in circuit and establish the circuit through the heating unit 35 for heating and vaporizing the oil. By the time the oil is vaporized, the thermostatic bar 46 will be sufficiently 30 heated by the resistance coil 42^a to flex upwardly and contact with the switch element 45 for completing the circuit through the high tension coil 42, to which the spark wires connect; consequently the sparks produced across the gap of the spark wires 38 35 and 39 will ignite the vapors and start the burner. A short interval after the thermostatic bar 46 has contacted the switch element 45, it will sufficiently flex through additional temperature to force the said bar 40 46 against the contact 71 for completing the circuit through the solenoid 59 which will become energized and draw the rod 55 back to the position shown in Figure 1 and rotate the switch 58 to open position for disconnecting the contact 43 and breaking the circuit through the heating unit 35 and the spark wires. When the rod 55 is drawn 45 to the left, the arm 53 will swing away from the pin 49, leaving the valve open. However, as long as the bar 45 remains in contact with contact post 71 there will be a short circuit through the solenoid 59. In open position, the solenoid 57 will be in circuit and the switch may be actuated back and forth as before explained, after the bar 50 46 has cooled sufficiently to break the connection with the post 71, provided the temperature in the room has not sufficiently risen to break the contact at the low temperature side with the solenoid 57. However, 55 60

no harm will be done, since the valve in the pipe line will remain open as the pin 49 on the valve arm 48 is beyond the range of movement of the arm 53. As soon as the 65 thermostat 65 is sufficiently heated, the connection through the low temperature side to the solenoid will, of course, be broken.

Under normal operating the parts will be in the position shown in Figure 2. Now, if 70 the room gets too hot and establishes a connection on the high temperature side of the thermostat 65 with the solenoid 52, the same will be energized for drawing the core 51 inwardly and swinging the arm 48 for closing the valve in the oil supply pipe. This 75 movement will bring the pin 49 in close proximity to the arm 53, so that when the room cools off and establishes the contact through the solenoid 57, for actuating the bar 55 to the right, the arm 53 will engage 80 the pin 49 and open the oil valve, when the operation may be repeated as before explained. It will of course be understood that during the operation of the apparatus 85 herein described, suitable fuel is fed to the burner, and after sufficient heat has been generated, the water in the lower turns of the coil 4^a will give off steam which will be superheated in the upper turns of said coil 90 so that dry and superheated steam will be mixed with the fuel.

We are aware that many changes may be made, and numerous details of construction may be varied through a wide range without 95 departing from the principles of this invention, and we therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

We claim as our invention: 100

In an oil burning system, a furnace having a fire pot therein, a fuel nozzle in the fire pot, a coil positioned over the fire pot, a tank having an upper steam storage space and a lower water storage space connected 105 by pipes to the top and bottom of the coil respectively, water flow controlling means adapted to maintain the level of the water in the coil below the top thereof to ensure a steam generating and superheating space in 110 the upper portion of the coil, the lower end of the coil being connected to the tank in the upper part of its water space to maintain a supply of relatively hot water to the coil, steam conduit means extending from the 115 tank to the nozzle, and means for feeding fuel to said nozzle for commingling with the steam.

In witness whereof, we have hereunto subscribed our names.

FRANK HIGGINS.
ARTHUR E. NORDSTROM.