

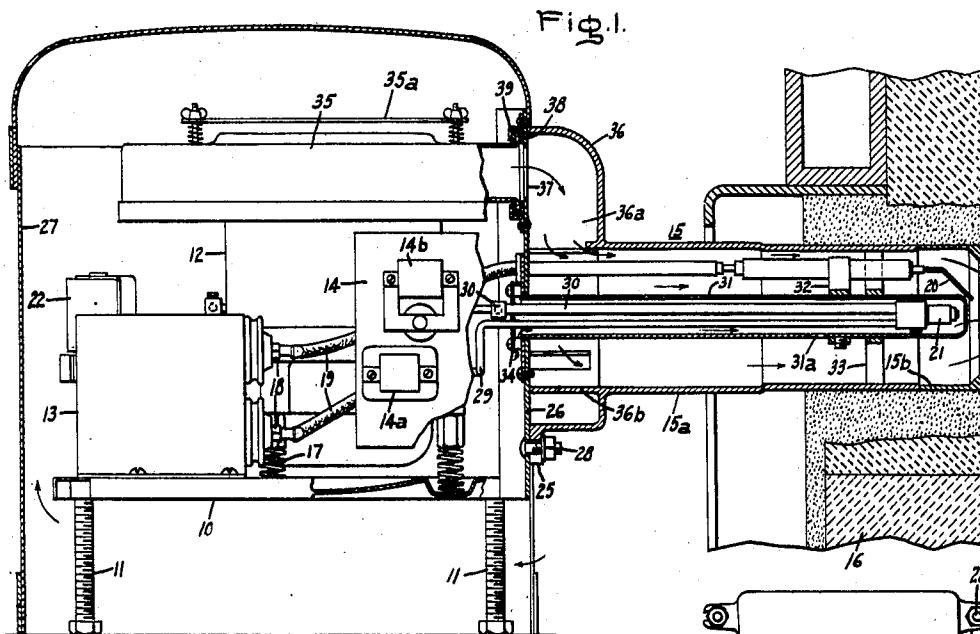
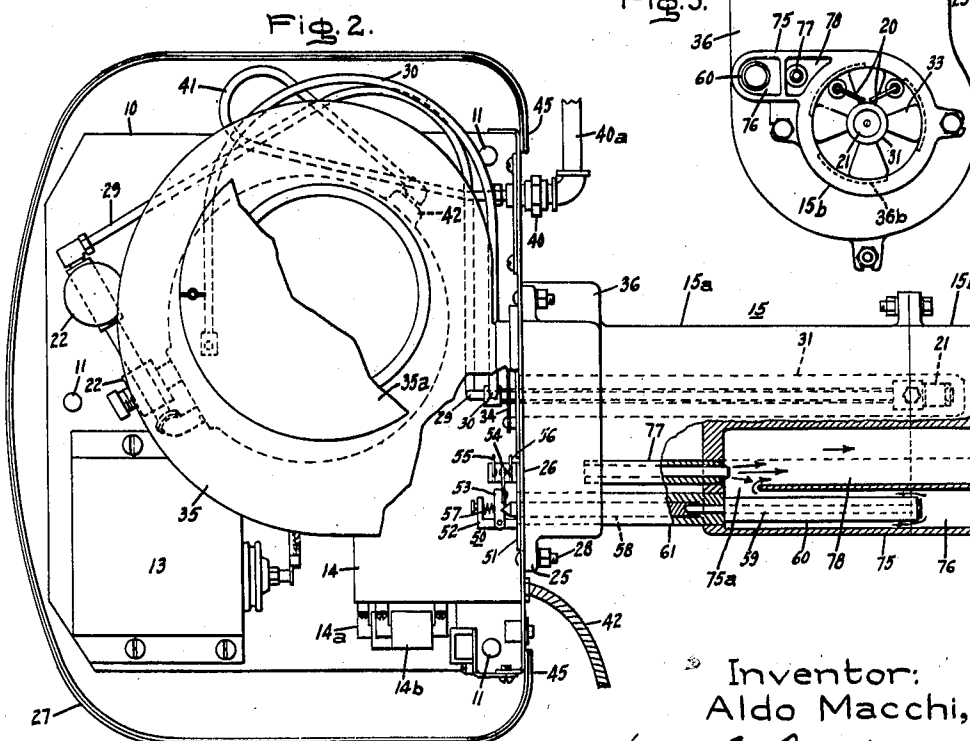
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OIL BURNER CONTROL

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OIL BURNER CONTROL

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4 Claims. (Cl. 158—28)

The present invention relates to oil burners and the principal object is to provide an improved automatic combustion responsive control, particularly adapted for an electrically operated oil burner unit of the conversion type, so as to enable the unit to be readily applied to various types of furnaces or boilers.

This application is a division of my application Serial No. 320,557, filed February 24, 1940, which issued as Patent 2,311,404 on February 16, 1943.

A specific object is to provide an improved burner nozzle and combustion responsive control construction whereby the burner nozzle and automatic control parts can be built into a unit and interconnected in cooperating relation thereby insuring that these parts of the unit work properly together and facilitating the proper installation, and servicing of the unit irrespective of the type of furnace or boiler to which the unit is applied.

A more specific object is to provide an improved oil burner construction having the nozzle and flame detector control parts, which must project into the furnace, removably connected in proper operating relation with the other parts. This improved structure enables the burner nozzle height to be readily varied to conform with the height of the furnace door opening and also enables the control parts to be readily accessible for inspection, repairs, removal or replacement, without disturbing the burner nozzle tube after it is once sealed in its proper position in the refractory walls of the furnace combustion chamber.

Another object of the invention is to provide an improved offset air injection construction adjacent the end of the conversion burner combustion air discharge nozzle extending into the combustion chamber, whereby a quick and reliable response of the automatic flame detector control is obtained without subjecting the temperature responsive parts to excessive or destructive temperatures.

Other objects will appear in the following description of the accompanying drawing illustrating preferred embodiments of the invention and in which Fig. 1 is a side view partially in section of an automatic electrically operated conversion oil burner unit provided with the improvements of the present invention; Fig. 2 is a top view partially in section of the oil burner unit shown in Fig. 1; and Fig. 3 is an end view of the burner nozzle showing the improved laterally offset injector housing for the improved flame detector control part adjacent the end of the nozzle.

As shown in Fig. 1, the conversion oil burner unit comprises a base 10 with the adjustable legs 11 upon which base are mounted all of the principal operating and control parts of the conversion oil burner unit including the electric motor driven air blower and air and oil pumping mechanism 12, the high voltage electric ignition transformer 13, the automatic starting, stopping and sequence timing control mechanism 14 as well as the complete burner air and oil discharge nozzle assemblage 15 including the main combustion air discharge nozzle 15a which is adapted to be sealed into the refractory wall 16 of a boiler furnace or other type of furnace to which the conversion oil burner unit is applied and the oil atomizing nozzle 21 and other parts which are mounted inside of the main nozzle 15a. The three supporting legs 11 are threaded into the base 10 so as to be independently adjustable, thereby permitting the entire burner nozzle assemblage 15 to be raised or lowered to the proper height from the floor upon which the unit is mounted to conform with the furnace combustion chamber and also permitting leveling of the unit at the desired height. The base 10 preferably is of pressed metal formed into the shape of an oil or drip pan, as shown in the drawing.

The motor driven mechanism 12 constitutes the electric motor driven oil and air pressure supply means for the burner nozzle assemblage 15 and preferably is of the improved type described and claimed in the Lum Patent 2,032,291, granted February 25, 1936, although any other suitable type of combustion air blower and atomizing air and oil pumping means may be provided for supplying the burner nozzle 15 with oil and combustion air. The motor driven mechanism 12 preferably is resiliently mounted upon the base 10 by means of suitable springs 17 so as to avoid transmission of noise and vibration to the base.

The electric ignition transformer 13 is shown of the conventional type with its high voltage terminals 18 connected through suitable conductors 19 to produce an arc between the two spaced apart ignition electrodes 20 which are located inside the combustion air nozzle 15a and above and closely adjacent to the end of the oil atomizing nozzle 21 so as to ignite the atomized oil stream discharged therefrom into the combustion air stream discharged from nozzle 15a. The oil atomizing nozzle 21 preferably is of the improved construction illustrated and described in my Patent 2,249,482, granted July 15, 1941.

The proper energization of the ignition transformer 13, the electromagnetically operated oil

flow control valve 22, and also the electric motor driven air and oil pumping mechanism 12 from a suitable source of electric power are under the control of a suitable oil burner timing sequencing control switch mechanism 14 which may be of any desired type although preferably it is of the type which is described and claimed in the Eaton Patent No. 2,134,550 granted October 28, 1938. The various control details are well known in the art and are not deemed essential to proper understanding of the present invention and hence are not shown other than the transformer 14a for energizing the usual low voltage room thermostat control circuits and the control motor 14b for operating suitable sequencing cam switch mechanism for coordinating the energization of the proper burner control circuits at proper times, in conjunction with the flame detector switch mechanism 50 which is described in more detail hereinafter.

As shown in Figs. 1, 2 and 3, the burner combustion air supply nozzle 15a preferably is moulded of cast iron and provided with suitable mounting lugs 25 so that it may be detachably mounted upon the upright wall 26 which is suitably secured thereto as by spot welding and extends upwardly from the right-hand end of the base 10. The removable jacket or enclosing casing 27 for the unit cooperates with the upright wall 26 to enclose all of the operating parts of the oil burner unit except the nozzle assemblage 15 on the outside of the wall. The upright wall 26 is provided with suitable openings for receiving the bolts 28 which detachably mount the main combustion air nozzle 15a within which all the other nozzle parts are mounted.

The upright wall 26 has suitable openings formed therein through which extend the oil supply pipe 29 and the air supply pipe 30 which interconnect the inner oil of atomizing nozzle 21 with the air compressor and oil pump of the motor driven mechanism 12. As shown, these oil and air supply pipes 29 and 30 extend through the nozzle tube 31 which is mounted along the axis of the main combustion air nozzle 15a and adjacent the end of which the oil atomizing nozzle 21 is mounted. The nozzle tube 31 also carries the supporting bracket 32 in which the ignition electrodes 20 are mounted in proper spaced relation with the atomizing nozzle 21 to effect ignition of the atomized oil stream discharged therefrom. A suitable combustion air whirler or spinner 33 is mounted upon the nozzle tube 31 with the ends of the blades thereof extending into sliding engagement with the interior of the combustion air nozzle 15a adjacent the discharge end thereof. Thus the spinner 33 serves to maintain the nozzle tube 31 centrally at the axis of nozzle 15a.

The oil and air supply pipes 29 and 30 are suitably secured to a removable mounting plate 34 which is removably mounted in spaced apart relation with the removable mounting plate 34a to which tube 31 is secured so as to permit a flow of air through the nozzle tube 31 from inside the enclosing jacket 27 due to natural draft and thus provide a cooling action for the atomizing nozzle 21 after shut down of the burner unit. Also, cooling during the running periods of the burner unit is obtained by allowing some fan air to enter the tube 31 through the hole 31a which is located in tube 31 so that the air flow resistance (Fig. 1) offered by the air spinner 33 will cause some combustion air to enter tube 31 through hole 31a.

The upright wall 26 also is provided with another suitable opening adjacent the top thereof for transmitting air under pressure from the motor driven blower 35 to the inside of the enlarged offset scroll portion 36 of the combustion air nozzle 15. The pressure of the air supplied from blower 35 is regulated by means of a suitable adjustable damper 35a located adjacent the blower inlet. As shown in Figs. 1 and 3, the enlarged offset scroll portion 36 of the air nozzle 15 forms in conjunction with the upright wall 26 a flow directing chamber 36a for directing the combustion air flow downwardly and imparting a slight rotating motion thereto upon the entrance of the air under pressure to the nozzle 15. This enlarged offset scroll portion 36 of the air nozzle 15 distributes the combustion air coming from the blower 35 through chamber 36a so that it flows in equal amounts between the three equilaterally spaced fixed baffles 36b thereby improving the stability of the flame. The converging air discharge tip 15b of the combustion air nozzle 15 preferably is made removable so that the tip 15b may be replaced whenever required as, for example, in case an extension of the air and oil nozzles should become necessary for properly installing the conversion oil burner unit in a large size warm air furnace. The enlarged offset scroll portion 36 of the air nozzle 15a serves to intercept much of the direct radiant heat from the furnace combustion chamber and transmit such heat to the air flowing into the air nozzle 15a thereby improving the combustion efficiency and at the same time preventing overheating of the operating part of the burner unit located behind the wall 26 within the enclosing jacket or casing 27 closely adjacent the combustion chamber.

The air flow connection from the scroll housing of the blower 35 into the combustion air inlet opening 37 formed in the upright wall 26 preferably is made flexible and resilient by means of a suitable felt bushing 38 which is enclosed within the bushing mounting casing 39 which in turn is removably mounted upon the upright wall 26 in any suitable manner. The flexible felt bushing 38 prevents transmission of mechanical vibration from the electric motor driven blower compressor mechanism 12 to the wall 26 and also serves to prevent leakage of the air under pressure in its passage from the blower housing 35 into the flow directing chamber 36a.

The upright wall 26 also is provided with a suitable opening for mounting the detachable coupling 40 of the oil supply pipe 40a. Coupling 40 is connected through the flexible looped pipe 41 with the intake port 42 of the oil pump embodied in the electric motor driven oil and air mechanism 12.

With the improved conversion oil burner unit construction as above described it will be observed that all of the main operating parts of the burner are readily detachable from the cast iron air nozzle 15a after it is once sealed in proper operating condition in the furnace combustion chamber as illustrated in Fig. 1. By loosening the mounting bolts 28 and disconnecting the oil supply pipe 40a and the electric power supply and control cable 42, the entire unit including the base 10, upright wall 26 and all the parts mounted thereon, and also including the nozzle 21, the inner nozzle tube 31, and electrodes 20 may be moved as a unit to the left and thereby detached entirely from the com-

bustion air nozzle 15. This facilitates ready inspection, replacement or repair of all of the operating parts of the burner unit. Furthermore, by merely lifting the enclosing jacket 27 which rests upon its bottom edge upon the floor entirely independently of the main supporting base 10, all of the main essential operating parts of the burner and control mechanism are made readily available for repair, adjustment or replacement.

As shown in Fig. 2, the opposing upright edges 45 of the removable enclosing jacket 27 extend in overlapping sliding relation with the opposite side edges of upright wall 26. Thus when the base 10 is adjusted to its maximum height so as to bring the upper edge of wall 26 into overlapping sliding engagement with jacket 27, as shown in Fig. 1, then all combustion air is drawn into the blower air intake opening 35a inside of the enclosing jacket 27 after passing between the opposing upright edges 45 of the jacket 27 and under the base 10 from the right-hand side of the enclosing jacket closely adjacent the furnace combustion chamber as indicated by the arrows in Fig. 1. In case the base 10 should be lowered so as to decrease the area of the air inlet opening extending between the opposing upright edges 45 of the enclosing jacket 27 below the base 10, then an equivalent area of air inlet opening is obtained above the top of the wall 26. Hence, the necessary air inlet area into the jacket 27 is obtained irrespective of the height at which the base 10 is mounted. In any case, the air inlet opening into jacket 27 is directly adjacent the furnace combustion chamber so as to draw therein any heated air, fumes or products of combustion that may be released from the furnace. This location of the air inlet opening into jacket 27 also serves to suppress the transmission of noise from the inside of the enclosing casing 27 to the surrounding atmosphere since any noise vibrations which may pass through the air inlet opening are intercepted by the furnace.

The improved burner unit construction described above provides for maximum freedom in the construction, size and location of the various essential elements of the burner air and oil supply and ignition mechanism mounted upon the base 10 without interference with the other cooperating elements. Each main essential element may be separately manufactured in a standard form or size and mounted independently of the others but in proper spaced and cooperating relation therewith. This permits separately improving and mounting of the several elements and facilitates the final interconnection thereof in proper cooperating relation in the improved conversion oil burner unit. Any one of the various essential elements may be improved in structure with a minimum of interference with the other elements.

In the preferred form of the invention illustrated in the drawing, the automatic burner control mechanism 14 is shown mounted directly upon the upright supporting wall 26 with the flame responsive switch mechanism 50 preferably constructed as an integral part of the main automatic control 14 and arranged to be responsive to combustion conditions immediately adjacent the end of the burner nozzle. It will be understood, however, that the flame responsive switch mechanism may be made a separate element from the main automatic sequencing control switch mechanism 14 if desired.

In the form shown in Fig. 2 the flame responsive switch mechanism comprises a base plate 51 to which is attached the supporting bracket 52 carrying the pivoted switching arm 53 having the contact 54 carried at the end thereof between the two cooperating contacts 55 and 56. The pivoted switch arm 53 is biased by spring 57 to engage contact 54 with the contact 56 by means of the spring 57. The pivoted switch arm 53 is operated against the bias of spring 57 by the sliding pin 58 which is connected through the agency of the quartz rod 59 which is relatively non-expansible upon temperature changes with the temperature responsive expansive tube 60. The temperature responsive expansive tube 60 preferably is formed of nichrome or other suitable high temperature expansible material and is mounted at the end of the supporting tube 61 which in turn is supported from the base plate 51.

The burner combustion air nozzle 15 is provided with a special offset injector housing 75 extending from one side thereof adjacent the discharge end of the nozzle into the combustion chamber of the furnace. This special offset injector housing 75 is formed with a substantially U-shaped internal passageway 75a with both ends of the U-shaped passage opening directly into the furnace combustion chamber as indicated more clearly in Figs. 2 and 3. In one leg 76 of this internal U-shaped passageway 75a, the temperature responsive expansible element 60 of the flame detector is located. A small auxiliary air jet nozzle 77 is connected with the laterally offset scroll portion 36 of the combustion air supply nozzle 15 so as to admit a jet of air under pressure from the scroll portion 36 into the other leg 78 of the U-shaped passage 75a. Thus the jet of air under pressure issuing from the nozzle 77 into the passage 78 sets up an injector action which produces a circulation of the products of combustion from the combustion chamber through the U-shaped passage itself and back again to the furnace combustion chamber, as indicated by the arrows in Fig. 2. In this way a flow of the products of combustion from the furnace combustion chamber are drawn by the injector action set up by the auxiliary air nozzle 77 over the temperature responsive tube element 60 of the flame detector. Thus the element 60 although located entirely outside the furnace combustion chamber is made directly responsive to the temperature conditions produced by combustion in the furnace whenever the blower 35 is operating to supply air under pressure to the injector nozzle 77.

Whenever the oil burner unit is started into operation by means of the suitable automatic control mechanism 14 which ordinarily is under the control of a room thermostat or other automatic condition responsive control, oil and air will be supplied under pressure from the motor driven oil and air supply mechanism 12 to the burner atomizing nozzle 21. At the same time combustion air under lower pressure will be supplied from the blower 35 to the inlet 37 of the combustion air nozzle 15. This flow of combustion air passes along and cools the outside of the nozzle tube 31 within which the oil atomizing nozzle 21 is mounted. Also, a further cooling air flow is drawn through the inside of the nozzle tube 31 directly over the oil atomizing nozzle 21. This cooling air flow through the inside of the nozzle tube 31 is jointly dependent upon the injector action produced by the blower air flow at the tip of nozzle 15 and also upon the natural

draft produced by the furnace. Hence the cooling air flow through the inside of nozzle tube 31 will continue independently of the operation of blower 35 and prevent overheating of nozzle 21 when the burner unit is shut down.

When the atomized oil stream issuing from the nozzle 21 is ignited from the electric arc established between the electrodes 20, combustion normally will be established within the furnace combustion chamber. The arcing electrodes 20 are energized from the high voltage terminals of the ignition transformer 13, the primary of which is suitably energized during the proper interval by the operation of the sequencing timing control mechanism 14.

Due to the injector action produced by the auxiliary air nozzle 77, some products of combustion will be drawn from the furnace combustion chamber over the temperature responsive expansible tube 60 thereby producing a movement of the flame responsive switch arm 53 to indicate the presence of combustion in the combustion chamber. In case combustion should thereafter fail, the tube 60 will cool thereby reversing the operation of the switch arm 53 to indicate the absence of combustion. It will be understood that the flame detector switch 50 is connected to cooperate with the burner control mechanism 14 so as to shut down the motor driven oil and air supply means in case of combustion failure in the manner which is well known in the art. Likewise the flame detector switch 50 will cooperate with the control mechanism 14 to prevent continued operation of the motor driven compressor mechanism 12 in case combustion is not established within a limited time interval after the burner unit is started into operation. This prevents accumulation of unburned oil in the combustion chamber which might result in puffs, explosions or other dangerous conditions.

With the improved conversion burner unit construction described above, the flame detector 50 and control mechanism 14 form an integral part of the unit and hence materially simplify the installation problem. All of the various cooperating parts may be properly mounted, interconnected in the proper cooperating relation and tested together. Thus all that is necessary for installation is to seal the burner air nozzle 15 in the furnace combustion chamber and provide the necessary oil and electric power supply and control connections to the unit.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An oil burner having, in combination, a combustion air discharge nozzle having air pressure supply means and jointly operable means including an oil atomizing nozzle and an ignition means for producing combustion adjacent the discharge end of said nozzle, an injector housing disposed adjacent the discharge end of said nozzle and having an injector air jet means connected with said air pressure supply means for inducing a flow of the products of

combustion through said injector housing, and control means including a temperature responsive element mounted in said injector housing in the path of the induced flow of said products of combustion for controlling the operation of both of said jointly operable means.

2. In an oil burner, in combination, a burner combustion air discharge nozzle having an oil atomizing nozzle and an ignition means mounted therein adjacent the discharge end thereof, motor driven supply means for supplying oil and combustion air under pressure through said nozzles to establish combustion, a U-shaped injector casing having the open ends thereof disposed adjacent the discharge end of said combustion air nozzle and provided with an injector air jet means connected with said motor driven combustion air supply means to discharge air under pressure through one leg of said U-shaped injector casing and thereby induce a flow of the products of combustion into the other leg of said U-shaped injector casing, and control means including a switch having a temperature responsive operating element mounted in said other leg of said U-shaped injector casing in the path of the induced flow of said products of combustion for controlling the operation of said motor driven supply means.

3. An oil burner having, in combination, combustion producing means including a nozzle for discharging a combustible mixture of oil and air, said nozzle having an integral injector housing laterally offset from the discharge end thereof and provided with a U-shaped passage having the open ends thereof disposed adjacent the discharge end of said nozzle, air jet means for discharging air under pressure through one leg of said passage toward the open end thereof to induce a return flow of the products of combustion into the other leg of said passage, and control means including a temperature responsive element mounted in said injector housing in the path of the induced flow of said products of combustion for controlling the operation of said combustion producing means.

4. An oil burner having, in combination, combustion producing means including a horizontally projecting cylindrical combustion air discharge nozzle tube provided with an internal axially disposed oil atomizing nozzle and an externally offset U-shaped injector casing at the discharge end thereof and with an enlarged air inlet casing at the other end thereof having an auxiliary air jet nozzle extending therefrom for discharging air from said air inlet casing into one leg of said U-shaped injector casing to induce a return flow of the products of combustion into the other leg of said casing, and means including a combustion responsive element disposed in said other leg of said injector casing in the path of the induced flow of said products of combustion for controlling the operation of said combustion producing means.

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