Aug. 30, 1927. 1,640,728

L. L. SCOTT

DOMESTIC OIL BURNER

Filed Aug. 24, 1925

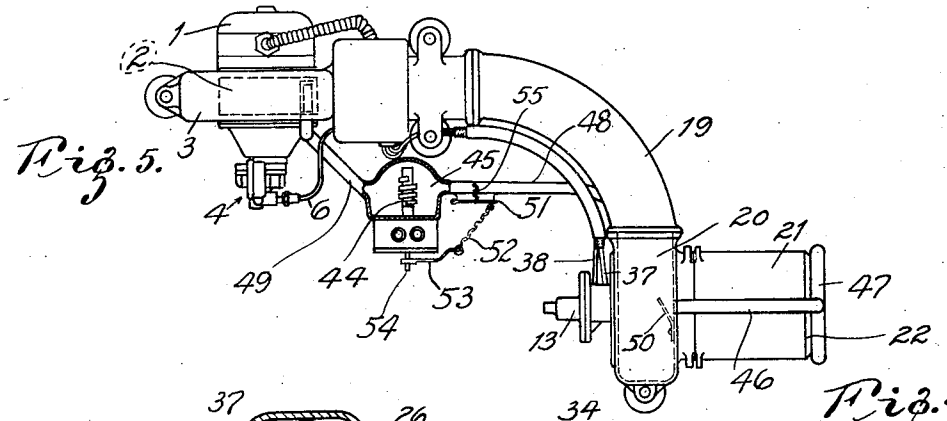


Fig. 5.

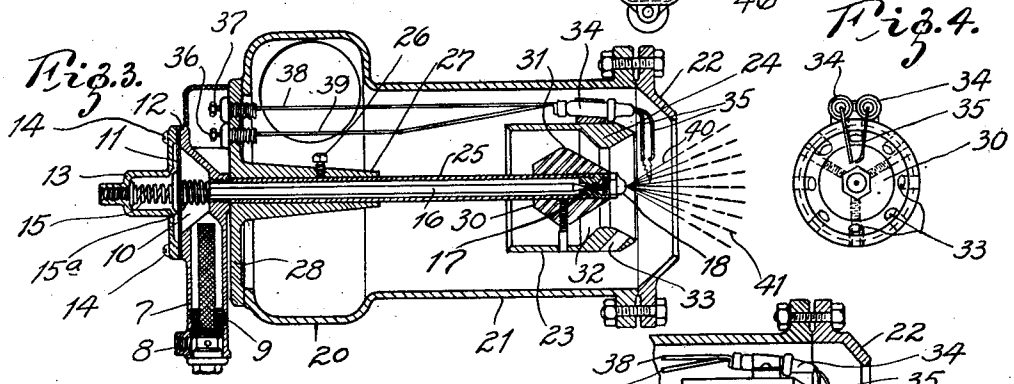


Fig. 3.

Fig. 4.

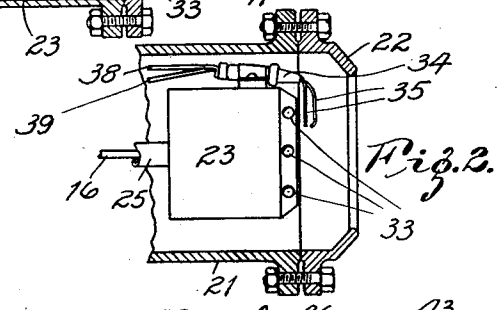


Fig. 2.

Fig. 1.

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UNITED STATES PATENT OFFICE.

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DOMESTIC OIL BURNER.

Application filed August 24, 1925. Serial No. 51,979.

This invention relates to certain new and useful improvements in domestic oil burners of the type adapted for burning heavy oils.

One of the objects of the invention is to provide means for projecting a flame of oil and air into a furnace in such manner that the flame will only burn, or exist as such, outside of the mechanism by which it is produced.

Another object is to provide means for preventing the flow of fuel from the nozzle after the burner has been shut off, due to radiant heat from the fire-box or combustion chamber, which causes the oil to expand and flow out of the nozzle with certain undesirable results.

Another object is to provide a novel means of electrically igniting the oil spray involving locating the spark terminals outside of the zone of said spray and causing a current of air to blow or extend the spark discharge into the spray.

Another object is to provide a hollow casting that directs the air and fuel into the furnace, with a removable tip or end, so that different sizes of these tips may be used in accordance with varying volumetric discharges of oil.

Another object is to rotate the air which mixes with the oil spray, and to provide a converging course for said air directed into the spray.

A final object is to provide a novel means of heating for an electric safety device.

In the accompanying drawing:—

Figure 1 is a view partly in side elevation and partly in section of a domestic oil burner constructed according to my invention;

Figure 2 is an enlarged sectional view of the tip end of the air director;

Figure 3 is a sectional view also on an enlarged scale of the ignition, fuel spray, and air-rotating devices;

Figure 4 is an end view of the cylindrical casting surrounding the spray nozzle and of the igniting device mounted thereon; and

Figure 5 is a top plan view of the oil burner.

Referring now to the drawing, the numeral 1 indicates an electric motor which operates a blower wheel 2, located in a blower case 3. The motor 1 also operates a fuel pump 4 which has a suction pipe 5 leading from a fuel tank (not shown). The numeral 6 (Figures 1 and 5) indicates the discharge line from the fuel pump, which is connected to a hollow casting 7 (Figure 3) and communicates with the interior thereof through an inlet opening 8. The fuel passes through a screen 9 located in said casting and into a chamber 10 on one side of a diaphragm 11 mounted in said chamber. The chamber 10 is conveniently formed in an upper extension 12 of the casting 7, and the diaphragm 11 is secured between said casting and the edge portion of a cap 13 secured to the wall of said chamber by means of screws 14. Mounted within the cap 13 is a coil spring 15 bearing upon the diaphragm 11. Secured centrally of said diaphragm is one end of a needle valve 16, the opposite end of which, indicated at 17, seats directly in the inlet of a spray nozzle 18. The numeral 19 indicates a curved pipe which connects the blower case 3 with a circular air receiving chamber 20 into which the air is projected from said pipe in a tangential direction, whereby the air receiver will cause the air to be given a rotary motion.

Connected to one side of the air receiver 20 is a cylindrical extension or casting 21 for directing the air passing into the same from the air receiver 20, and removably secured on the outer end of the air director 21 is a removable conical tip 22 which is located in advance of the nozzle 18 and operates to converge the air into the fuel spray from said nozzle. The fuel pump 4 is adapted to create a pressure on the fuel of anywhere from forty to eighty pounds, and the fuel or oil passes through the spray nozzle 18, which is of conventional construction, and is sprayed into a very fine fog-like mist. Mounted within the air director 21 near the outer end thereof is a hollow cylindrical casting 23, the outer end of which is thickened circumferentially to provide an annular inwardly-tapered projecting portion 24. The spray nozzle 18 is secured in the outer end of a tube 25, the inner end of which is screwed into the casting extension 12 to communicate with the chamber 10 (Figure 3), and has secured thereon, by means of a screw 26, a hollow boss 27 projecting inwardly from a plate 28 forming the rear end of the air receiving chamber 20, and by means of which said chamber and the air

director 21 are supported on the burner structure, the structure, as a whole, being supported by legs or standards 29, as shown in Figure 1. Mounted on the outer end of the fuel tube 25 is a head 30, which is centrally enlarged as indicated at 31, providing a restricted annular passage 32 between it and the tapered portion 24 of the casting 23, which passage converges inwardly to direct air toward the spray nozzle. Air from the air receiver 20 passes through the interior of the air director 21, some of said air passing through the space between the wall of the air director and the casting 23, and a portion of the air passing between the inner wall of the casting 23 and the outer surface of the head 30.

It will be noted that the air passing through the casting 23 is increased in velocity at the central portion 31 of the head 30, due to the enlargement at this point of the head, and is then converged into the spray by the tapered portion 32 of casting 23. The casting 23 is provided near its outer end in the enlarged portion 24 with a series of outwardly directed openings 33, which are directed toward the zone of spray issuing from the nozzle 18. It will be seen that a small portion of the air passing between the inner wall of the air director 21 and the outer wall of the casting 23 will go through the openings 33, which I have shown by Figure 4 to be eight in number, and will be directed thereby into the spray. The means and method of igniting the sprayed fuel will now be described.

The ignition is caused by an electric spark, which is produced from any source of electricity, (not shown). The spark plugs consist of two porcelain tubes 34 mounted on the casting 23 and having long projecting terminals 35, which, as shown by Figure 3, are located outside of the zone of the spray which will be projected from the nozzle 18, which spray is indicated by the light lines extending from the spray nozzle. According to my method of procedure, the arc or spark discharge between these terminals is extended or blown outwardly into the path of the fuel spray, and this result is effected by the air from the blower passing through the air director 21 and being forced inwardly around the spark terminals by the conical tip 22. The arc thus blown into the path of the spray will ignite the same, but will prevent any burning from occuring around the terminals, and, in fact, will prevent any of the fuel spray itself from coming in contact with the terminals. This provides a simple and highly effective means for preventing fouling of the spark terminals.

The two line wires 36, 37 from the source of electricity connect to the electrodes 38 and 39 of the spark plugs, which electrodes are both insulated. I have found that by insulating both electrodes, I can prevent radio interference, where the oil burner is operated in a home that is using a radio. In cases where I have used only a single insulated terminal and ground the other side to the metal of the machine, when the oil burner is running and the electric spark is on, it will completely put a radio receiving set out of commission.

Referring to Figure 3, it will be seen that I have indicated the fuel spray issuing from the nozzle in light lines, indicated by the numeral 40, and also beyond the light lines by heavy lines, indicated by the numeral 41. The line of meeting between the light lines 40 and heavy lines 41 indicates where the flame actually starts to burn. This suspended ignition, so to speak, of the flame of the spray is due to the high velocity of air caused by the converging walls of the conical tip 22. It is a very important feature of the invention in that, in conjunction with the projection of the arc discharge away from the spark terminals, previously described, it insures against any combustion occurring in the vicinity of the terminals, and thus tends to prevent them from becoming fouled.

The air director 21 may be projected into any type of furnace, one such type being conventionally illustrated in Figure 1, and the wall thereof indicated by the numeral 42, and in which the fire is burned in a refractory chamber 43.

With the construction of oil burning apparatus above described, I am enabled to produce and maintain a fire that is substantially noiseless, due to the low flame velocity in the large chamber 43, and to the further fact that no burning of the flame takes place in any restricted passages or in any part of the apparatus. By reason of this fact, I am able to avoid the use of expensive casting material, such as nichrome, which has heretofore been very generally used in oil burning apparatus, and can use ordinary cast iron which, of course, is vastly cheaper.

All domestic oil burners are required to have a safety device which will shut off the burner in a very short period of time in the event that the fuel fails to ignite when the burner is turned on. For this purpose, I prefer to use the form of safety device, the principle of which is broadly shown in my Patent No. 1,320,936, dated November 4th, 1919. I show here a portion of this safety device which corresponds to the thermostat 55 of my patent aforesaid. In my pending application, Serial No. 6,909, filed February 4th, 1925, "Combustion system and safety device therefor", I show a thermostatic element 59 and the electrical system connected therewith, providing an automatic safety control device of the general nature of that herein shown. The thermostat in the present

case is indicated by the numeral 44 (Figure 5) and is located in a chamber 45, which chamber is adapted to receive hot air in the following manner:

The numeral 46 (Figures 1 and 5) indicates a pipe which is connected to and communicates with the air receiver 20 at one end, and at its other, with a pipe 47, which surrounds the opening of the tip 22, and is in close proximity to the flame from the burning oil. Leading from the pipe 47 is a pipe 48 which connects to and communicates with the chamber 45. A pipe 49 leads from the opposite side of the chamber 45 from that entered by the pipe 48, and thence passes into the suction side of the air blower wheel 2. The plate 50 (Figure 5) is a deflector plate which serves to direct air from the air receiver 20 into the pipe 46.

In operation, air passing into the air receiver 20 will be blown through the pipe 46 into the pipe 47, where it will be quickly heated, and will thence pass through the pipe 48 into the chamber 45. This air will also be sucked through the pipe 49 by the blower 2, and this heated air is again delivered to the air receiver 20. Heated air entering the chamber 45 will affect the thermostat 44, and close certain circuits so as to permit the feed of fuel and combustion to continue. Should ignition not occur, however, cold air will be forced into the chamber 45, causing the thermostat 44 to be operated in the reverse manner to that described to break such circuits, or prevent them from being established, and thus prevent the further feed of fuel to the burner, and, in fact, causing the apparatus to stop. The numeral 51 indicates a door controlling an opening which leads from the outside air into the pipe 48. The numeral 52 indicates a connecting chain, one end of which is attached to the door and the other end to the end of a lever 53, secured to a shaft 54, which shaft is adapted to turn in unison with the movement of the thermostatic element 44. The door 51 is normally held closed by a light spring 55. The purpose of opening the door 51 is, at a predetermined temperature, to permit cool air to be drawn over the thermostatic element 44 so as to maintain a fairly even temperature on said thermostatic element. The thermostatic element 44 will act a few seconds after the burner has started, and after the burner has run for fifteen minutes, the intensity of the heat on this element would greatly increase, if the door 51 were not provided for regulating the temperature thereon.

In the general operation of the device, the fuel being fed to the spray nozzle through the tube 25 and said spray ignited by blowing the arc discharge between the terminals 35 into the zone of the spray by means of air forced through the tube 19 into the air receiving chamber 20 and the air director 21, as previously described, the burning will continue until the device is automatically shut off in any of the well known ways common to this character of burner. When the device is in operation, the parts of the apparatus near or impinged upon by the flame necessarily become very highly heated. In burner constructions prior to the present invention, it frequently occurs that after the burner has been shut off, the radiant heat from the fire-box or combustion chamber will cause the oil in the pipe leading to the fuel nozzle to expand and dribble out of the nozzle down into the interior parts of the castings, where it catches on fire, and soon causes a lot of soot, and in some constructions, causes a stoppage in some of the operating members. Such undesirable results are prevented by the construction above described, by the provision of the needle valve 16 controlling the inlet to the fuel nozzle. This valve operates to normally close the inlet to the fuel nozzle, by reason of the pressure on diaphragm 11 of the spring 15. The fuel entering through the opening 8 of casting 7 and passing through the screen into said casting and into the chamber 10 will exert pressure upon the diaphragm 11 and cause it to move outward or toward the left in Figure 3 against the resistance of spring 15, permitting the fuel to pass from the tube 25 into the nozzle and be sprayed. Owing to the relatively high pressure on the fuel (from forty to eighty pounds) and the relatively small amount passing through the nozzle, the pressure on the diaphragm once established will remain uniform, so that the fuel nozzle will operate in a uniform manner to spray the fuel. As soon, however, as the supply of fuel is shut off, which, in practice, is effected automatically by a thermostatic control, when the temperature of the room to be heated has reached a predetermined degree, the pressure on the diaphragm 11 will be removed, and the spring 15 will at once move the needle valve 16 to its seat, and thus prevent the possibility of oil passing out of the fuel nozzle until said valve is again moved by pressure of the fuel, as previously described.

In the drawing, a counter spring 15^a is shown on the opposite side of the diaphragm to that of the spring 15, whereby the spring pressure on the diaphragm can be nicely adjusted to permit of the proper action of the needle valve.

The air entering the air receiver 20 from the pipe 19 is given a rotary movement within said receiver, owing to the tangential position of the pipe 19 relative to said receiver, and this rotary motion will, of course, continue as the air passes through the air director 21 to the outlet opening in the tip 22, this tip causing the whirling air to be converged in the direction of the spray, the

result being that the velocity of the air causes the extension of the spark, as previously described, and the whirling of the air produces a thorough mixture thereof with the spray. It will be apparent that as the air rotates in the relatively confined space between the casting 23 and the inner wall of the air director, a certain proportion of this air will pass through the outwardly directed openings 33 in the casting and will be directed by said openings into the path of the spray issuing from the spray nozzle, thus further insuring an intimate mixture of the air with the spray. The air of the greatest velocity, however, is that passing through the casting 23, and it is this branch of the air current more particularly which, by its velocity, causes actual combustion of the sprayed fuel to occur at a point quite remote from both the nozzle and the spark terminals of the igniting device.

The provision of removable tips 22 for the discharge end of the air director enables me to use different sizes of tips, and to locate the openings therein at different distances from the spray nozzle, according to the rate or volumetric discharge of the fuel therefrom. For example, in a burner put into an eight-room house, the volumetric discharge of fuel through the spray nozzle will be approximately two and one-half gallons per hour, as compared with a fuel discharge of, say, four gallons per hour with the same burner in a sixteen-room house. In the latter case, the mouth or opening of the tip 22 would be located at a greater distance from the spark plug, as shown by Figure 2, and its outlet would be proportionately larger.

Finally, I wish to call attention to the importance of the provision of the apertures 33 in the hollow casting 23 surrounding the spark plug. These apertures are so positioned as to direct the air passing in them into the spray issuing from the spray nozzle. I have found that without these apertures, a slight vaporous condition is caused by the fuel spray, which tends to form tar deposits on the terminals of the electrodes. It has been found that with the use of these apertures, very low grade oils can be burned, such oil can be ignited with an electric arc, and complete combustion can be secured, the flame being white in character, odorless and smokeless, and with a construction of apparatus as shown on the drawings, testing out on an Orsat machine, twelve per cent of carbon dioxide, no carbon monoxide, and about five per cent of oxygen.

I have illustrated in the drawing the embodiment of my invention which, according to my present knowledge, is best adapted for carrying out the purposes of the invention set forth. However, as to the exact form, construction and arrangement and position of parts, it will be apparent to those skilled in the art that various modifications and changes could be made without departing from the spirit of my invention.

I claim:

A burner for an oil burning device of the class described comprising an air directing duct, a fuel spray nozzle mounted centrally within the same near one end thereof and provided with a head having a portion of enlarged diameter, and a hollow cylindrical casting mounted concentrically within and in spaced relation to said air directing duct and surrounding said head, said casting having at its end adjacent the spray nozzle an annular inwardly-extending projection having its inner wall tapered to provide, with said head, a converging outlet for air directed toward the zone of the spray issuing from said spray nozzle, said casting also being provided at the end having said inwardly-extended projection with circumferential apertures directed toward the zone of said spray.

In testimony whereof, I have hereunto set my hand.

LEWIS L. SCOTT.