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OIL BURNER

Filed May 28, 1937

Fig. 1.

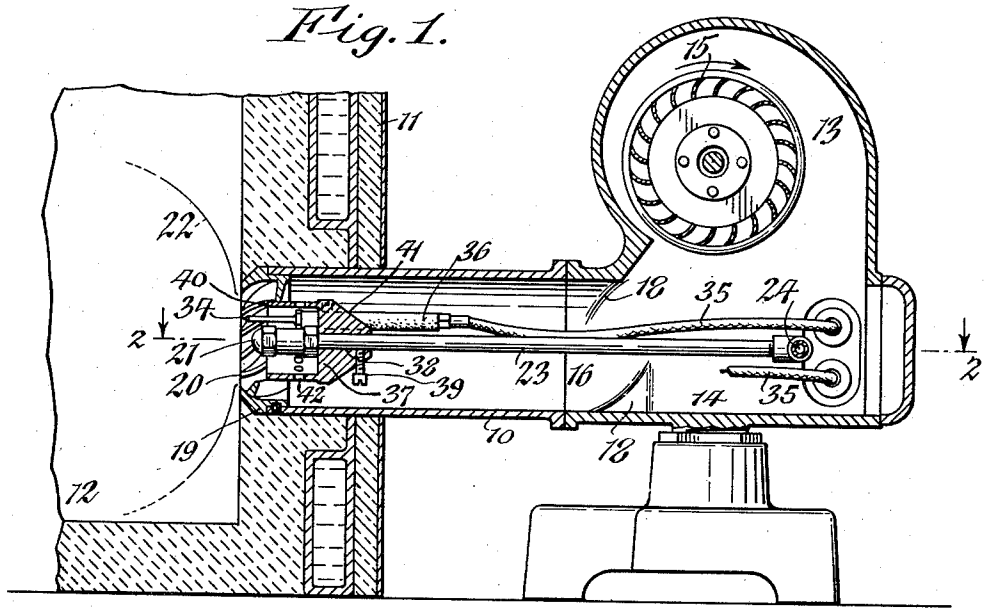


Fig. 2.

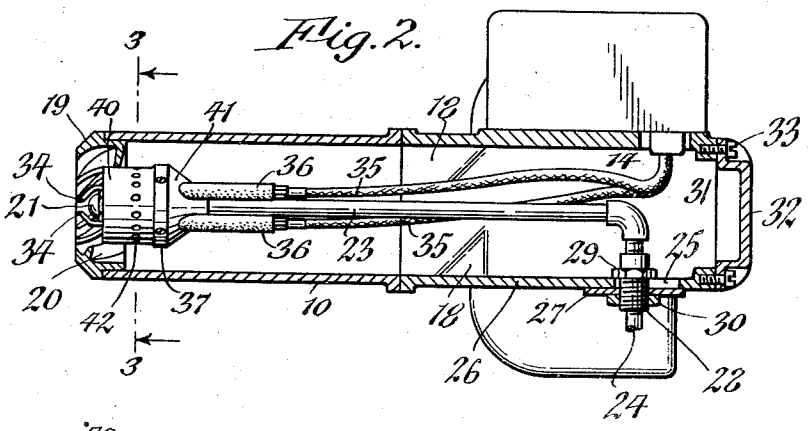
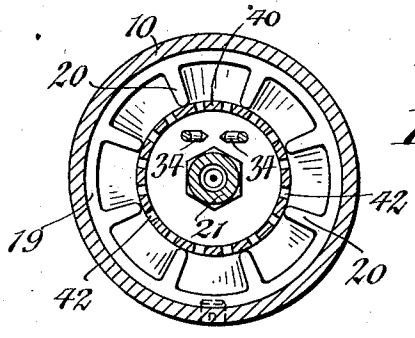


Fig. 3.



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OIL BURNER

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Application May 28, 1937, Serial No. 145,274

1 Claim. (Cl. 158—76)

This invention relates to a fuel oil burner of the pressure atomizing type which is now more generally employed for domestic heating plants but which may also be advantageously employed in other installations.

The chief aim in burners of this character is to produce a mixture of atomized fuel oil and air supplying sufficient oxygen which upon being burned as a flame will cause the greater amount of carbon in the fuel oil to be consumed and thereby develop the maximum amount of heat and the least formation of smoke.

In oil burners now in common use it is customary to supply approximately 190% to 200% excess air to the fuel oil in order to produce a flame which is clean enough to prevent undue production of smoke and deposit of carbon within the furnace or boiler. With this ratio of excess air relative to the fuel oil in the mixture the carbon dioxid content of the resultant flame would be about 5% which indicates low flame efficiency and incomplete combustion. This is generally due to inadequate means for properly and scientifically mixing the air and oil intimately, thereby causing unnecessary waste of a large amount of fuel.

It has been definitely determined that the highest flame efficiency and complete combustion requires that the air and oil must be intimately mixed, that the flame must be kept away from cooling influences and that the amount of excess air must be kept within reasonable limits.

The object of this invention is to provide means whereby a more intimate mixture of the air and fuel oil is obtained, thereby reducing the amount of excess air required for complete combustion increasing the CO_2 in the products of combustion and increasing the amount of heat produced.

This object generally is attained by causing the air to be supplied to the atomized fuel oil in the form of a spiral stream or current moving into the cone of atomized oil and by reflecting the air away from the center of this cone but deflecting the air from the bore of the air conduit into the peripheral part of this atomized fuel cone, thereby producing an equally distributed directional movement of the air relative to the fuel cone and ensuring complete mingling of the same and yielding the maximum amount of heat with the least production of smoke.

In the accompanying drawing:

Fig. 1 is a vertical longitudinal section of an oil burner embodying this improvement and showing the same applied to a boiler.

Fig. 2 is a horizontal section taken on line 2—2, Fig. 1.

Fig. 3 is a vertical cross section, on an enlarged scale, taken on the correspondingly numbered line in Fig. 2.

In the following description similar characters of reference indicate like parts in the several figures of the drawings.

Referring to Fig. 1, the numeral 10 represents an air tube preferably arranged horizontally and having its front end secured in a wall 11 of a boiler or heater and opening into a furnace or combustion chamber 12 of the same. In rear of the air tube is arranged an air blower which comprises a hollow body or casing having an upper circular part 13 and a lower tangential part 14 and a rotary propeller 15 arranged in the circular part of the body. The lower tangential part of the blower body is arranged axially in line with the air tube and has an outlet neck 16 at its front end which is connected with the rear inlet end of said air tube so that the latter and the blower body together form a conduit for the air which is drawn by the propeller from the exterior and forced through the body of the blower and the air tube into the furnace. This blower may be of any suitable construction and the propeller may also be rotated by various means, for example by an electric motor, not shown in the drawing.

As the air passes from the blower body into the air tube a preliminary spiral or helical whirling action is imparted to the same by engagement of the same with a plurality of inclined faces 18 arranged in an annular row in the bore of the outlet neck of the blower body, as shown in Figs. 1 and 2. Within its front discharge end the air tube is provided with further means for continuing the spiral or helical whirling motion of the air as it mixes with the atomized fuel oil and forms a combustible mixture therewith upon entering the combustion space of the heater or boiler preparatory to being ignited and burned therein in the form of a flame. The means for imparting this final whirling action to the air preferably consists of a mixing head having a forwardly tapering conical ring 19 secured to the front end of the air tube and provided on its inner side with an annular row of agitating vanes 20 which trend in the same direction as the preliminary whirling inclines 16.

Arranged lengthwise and centrally in the outlet end of the air tube and within the annular row of vanes in the mixing head is a nozzle 21 whereby the fuel oil is atomized and delivered in

the form of a globular mass or spray 22 into the combustion chamber or furnace of the boiler, as shown in Fig. 1. This atomizing nozzle is mounted on the front end of the front section or main body 23 of a fuel oil supply pipe which is arranged lengthwise in the central part of the air conduit formed by the air tube and the lower part of the blower casing. The rear section or branch 24 of this fuel oil supply pipe extends laterally from the rear end of the front longitudinal section through an opening 25 in the adjacent upright side wall 26 of the blower casing, as shown in Fig. 2, and receives fuel oil which may be supplied from any suitable source and subjected to pressure by a pump of any approved character.

Means are provided for adjusting the fuel oil nozzle lengthwise relative to the outlet end of the air tube and the mixing head in order to produce the most effective mixing of the oil and air and the most desirable discharge of this mixture into the furnace space or combustion chamber of the boiler or heater. This is preferably accomplished by making the opening 25 which receives the branch pipe 24 in the form of a horizontal slot so that the longitudinal pipe 23 and the parts carried thereby may be adjusted lengthwise of the air conduit. The transverse branch 24 of the fuel supply pipe is mounted on a supporting and closure plate 27 through which it passes from the interior to the exterior of the air conduit which plate engages the outer side of the wall 26 of the blower casing and covers the slot 25 said plate being of sufficient area to move with the atomizing nozzle and associated parts upon adjusting the latter and still close the slot 25 at all times. This closure and supporting plate is clamped on the blower casing and the atomizer nozzle and the fuel supply pipe are held in position by providing that part 28 of the fuel oil pipe which passes through the plate 27 with an external screw thread which is arranged in the slot 25 and with a shoulder 29 engaging the inner side of the blower casing and providing said threaded part with a screw nut 30 bearing against the outer side of this plate, as shown in Fig. 2. By loosening the nut 30 this plate and the nozzle and the fuel pipe may be adjusted lengthwise of the air conduit and the mixing head and upon tightening this screw nut these parts are held in their adjusted position.

Access to the interior of the air conduit for adjusting the fuel supply device, the oil and air mixing means associated therewith and the means for igniting the combustion mixture is made possible through a passage 31 in the rear end of the lower section of the blower casing which passage is normaliy closed by a cover or lid 32 secured to the casing over this passage by screws 33.

An electric spark is produced in front of the fuel oil nozzle for igniting the combustible mixture in the furnace chamber 12 by two electrodes or terminals 34, 34 arranged adjacent to each other in front of the nozzle and connected respectively with supply wires 35, 35 which form part of an electric circuit and pass through an adjacent wall of the blower casing. Each of these electrodes is preferably supported in its operative position by means which include a longitudinal sleeve 36 of insulating material which carries the respective electrode and is mounted by means as will hereinafter appear.

In the absence of any other provision the operation of those parts of the burner described thus far will produce a combustible spray of mixed air and atomized fuel oil in which an insufficient amount of air is mixed with the atomized fuel oil in the heart or central part of the spray and a grossly excessive amount of air must therefore be supplied to the peripheral or surface part of this spray to even secure a mixture which is combustible but will not equally distribute the air throughout the spray and produce a flame of uniform intensity. The result is that a substantial amount of unconsumed fuel oil reaches the chimney and is lost, and that fuel oil which is burned yields a low amount of carbon dioxid and less heat than it is possible to otherwise derive from the fuel oil. Means are therefore provided in accordance with this invention whereby the introduction of an excess amount of air into the spray at the periphery of its mass is avoided and a greater amount of air is mixed with the atomized fuel at the center or heart of the mass of spray so that a combustible mixture is produced in which the air and oil are mixed equally through the entire mass and a flame of uniform intensity is produced thereby avoiding waste of fuel and securing a greater yield of heat from the fuel which is burned. In its preferred form the means accomplishing these advantageous results are constructed as follows:

Within the front part of the air tube and the adjacent part of the mixing head and surrounding the fuel oil nozzle and the adjacent part of the oil supply pipe is an air distributor or director whereby the air passing forwardly through the air tube is induced to mingle with the entire mass of sprayed or atomized fuel issuing from the nozzle and thus equalize the quality of the mixture and ensure uniform and complete burning of the same. In its preferred form this distributor comprises a rear circular head 37 having a central perforation 38 which receives the fuel supply pipe and to which it is secured by a set screw 39 and a cylindrical skirt or shield 40 projecting forwardly from this head in the annular space between the nozzle and electrodes on the inner side and the inclined vanes of the mixing head on the outer side of this skirt. The rear side or face 41 of the distributor head is made in the form of a rearwardly tapering cone and between this head and the vanes the skirt of the distributor is provided with a distributing passage which may have any suitable form, for example, as shown in the drawing, the same has the form of a plurality of openings 42 arranged in an annular row on the skirt and extending from the bore to the periphery of the same.

Any suitable means may be employed for supporting the ignition electrodes or terminals but this is preferably accomplished by extending the insulating sleeves 36 through suitable openings in the head of the air distributor, as shown in Figs. 1 and 2.

As the stream of air is forced forwardly through the air tube that part of the air in the central area of the tube is deflected sidewise so as to join that part of the stream of air next to the bore of this tube and pass with the same through the annular space between the skirt of the distributor and the air tube. Upon entering this space the air is compressed and its speed is accelerated so that upon issuing from this space it strikes the inclined vanes 20 and the conical ring 19 at a higher velocity, whereby the air is whirled more rapidly and also directed inwardly at a higher speed in the form of a forwardly tapering cone into the forwardly spreading mass of atomied fuel and thus promotes mixing of the

air and oil and causes a more uniform distribution of these elements throughout the mixture.

As the stream of air issues from the annular space between the nozzle and the distributor a forward suction is produced on the space within the distributor which tends to form a vacuum therein, whereby air is drawn from the passage between the distributor and the air tube transversely inward through the openings 42 into the space within the skirt 40 and forwardly through the interior of the latter thereby causing sufficient air to be supplied to the central part of the mass of sprayed or atomized fuel oil issuing from the nozzle to aerate the same to an extent equal to the aeration of the marginal part of this mass of atomized oil.

It follows from this that no incomplete aerated oil from the central part of the atomized mass of oil escapes in a partially consumed condition and that this part of the oil is therefore not discharged through the chimney and wasted and its heating values lost, but instead all of the oil is completely and uniformly aerated so that the full heating effect is obtained therefrom.

Moreover all the carbon in the oil is consumed by this burner so that no soot is formed and the furnace maintained in a cleaner and more efficient condition.

By thus supplying air to the interior of the distributor and relieving the vacuum therein the flame of the burning mixture of air and oil is drawn to the periphery of this distributor, thereby avoiding heating of the atomizing nozzle and preventing the same from being fouled and rendered inoperative.

Furthermore this burner causes the flame to burn in complete suspension or free from the nozzle and the mixing head of the main tube so that these elements will not be worn by the flame and it also enables the flame to be maintained without continuous ignition and without the aid of a refractory target or baffle.

Owing to the oil nozzle, air mixing head and the ignition means being adjustably mounted as a unit on the side of the blower housing or casing it is possible to readily adjust the same from the rear end of the housing when required while the burner is in operation.

The advantages of this improved burner may be summarized in that it develops a greater heating efficiency than those heretofore known, it permits the use of a small combustion chamber in the boiler or furnace, combustion is accelerated and initial smoky stages of firing are eliminated, a steady balanced flame is maintained so that pulsation of the boiler or furnace is eliminated, a brilliant luminous flame of high efficiency, virtually transparent and free from smoke and odor is produced, maximum safety is attained in that the flame cannot leave the nozzle, and the burner is flexible inasmuch as the nozzle and air controlling means can be easily adjusted to suit varying conditions of draft and boiler or furnace designs.

We claim as our invention:

An oil burner comprising an air tube having a rear air inlet and a front outlet for a combustible mixture, a fuel oil spray nozzle arranged centrally in the front part of said tube, a tubular distributor surrounding the spray nozzle and separated on its inner side therefrom by an annular cylindrical space which is wholly unobstructed and also separated on its outer side from the inner side of said tube by an annular passage, said distributor being closed at its rear end and open at its front end and provided in its side with openings and having its wall of cylindrical form from the rear to the front end thereof, whereby part of the air entering said inlet of the air tube moves forwardly through this outer annular passage and produces a suction effect on the fuel spray issuing from the nozzle and another part of the air passes inwardly through the openings in said distributor to the interior thereof and thence forwardly around the nozzle and produces a concentrating effect of the air on the central part of the fuel spray so as to equalize the supply of air relative to the central and side parts of the fuel spray and cause the mixture of air and fuel to burn uniformly.

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