

Aug. 8, 1933.

F. E. HERR

1,921,922

OIL BURNER

Filed Aug. 9, 1928

3 Sheets-Sheet 1

Fig. 1.

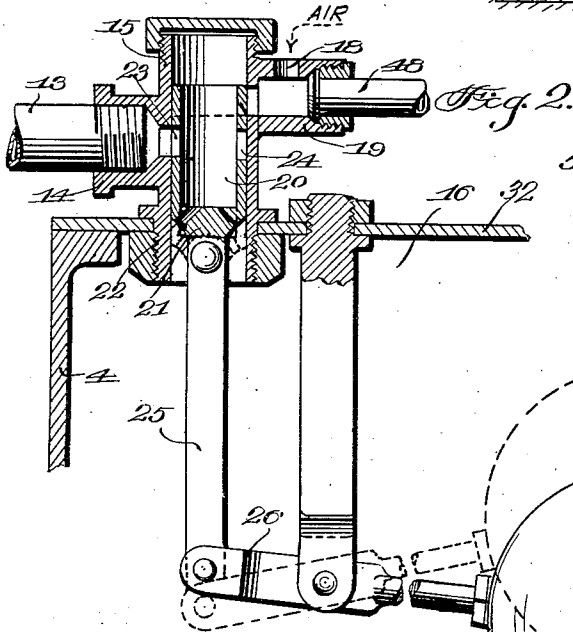
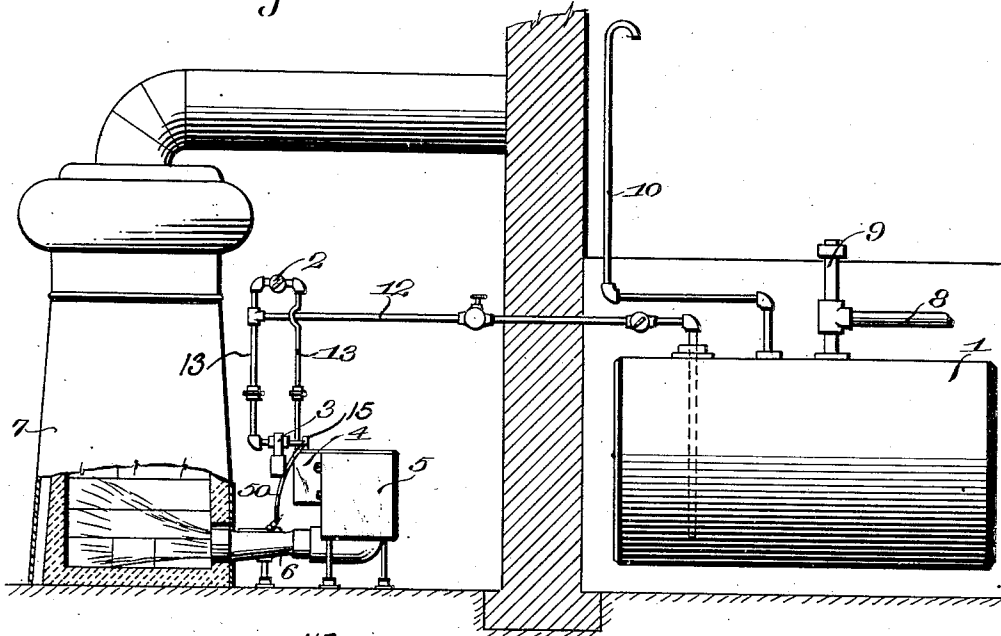
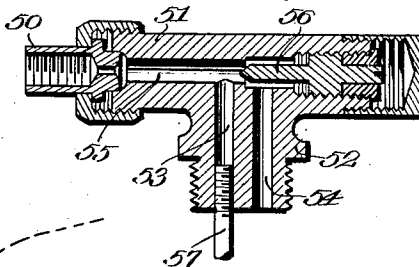


Fig. 3.



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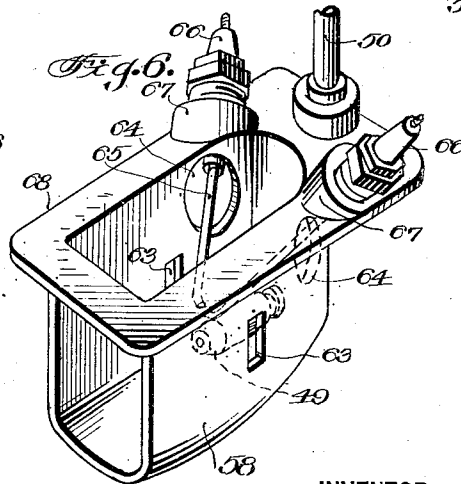
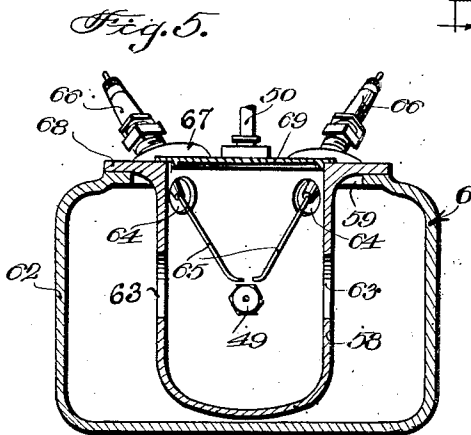
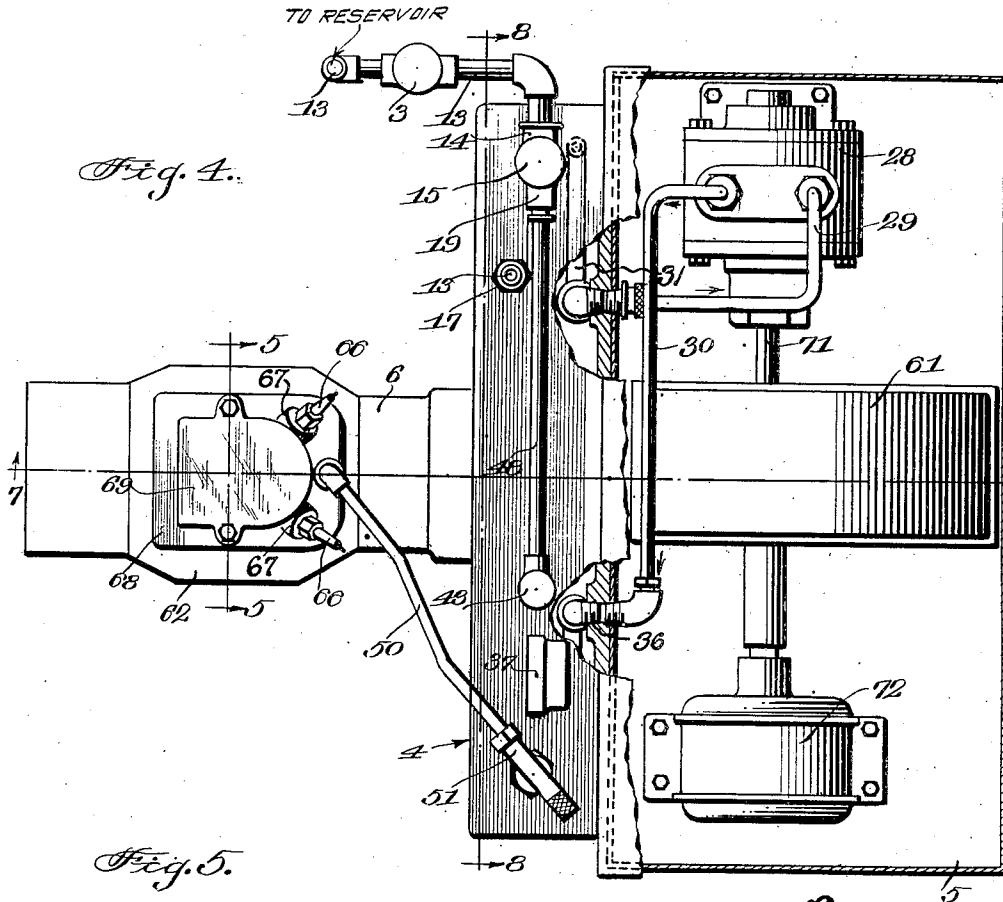
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OIL BURNER

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3 Sheets-Sheet 2



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OIL BURNER

Filed Aug. 9, 1928

3 Sheets-Sheet 3

Fig. 7.

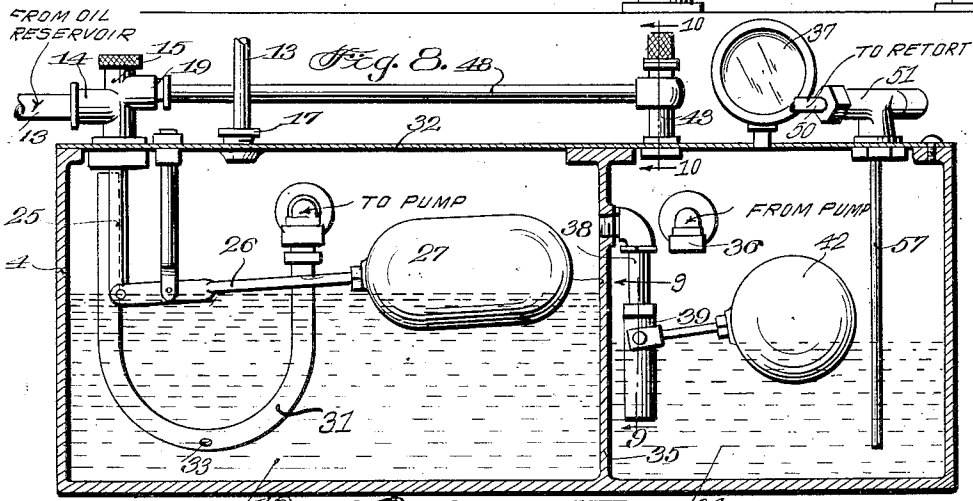
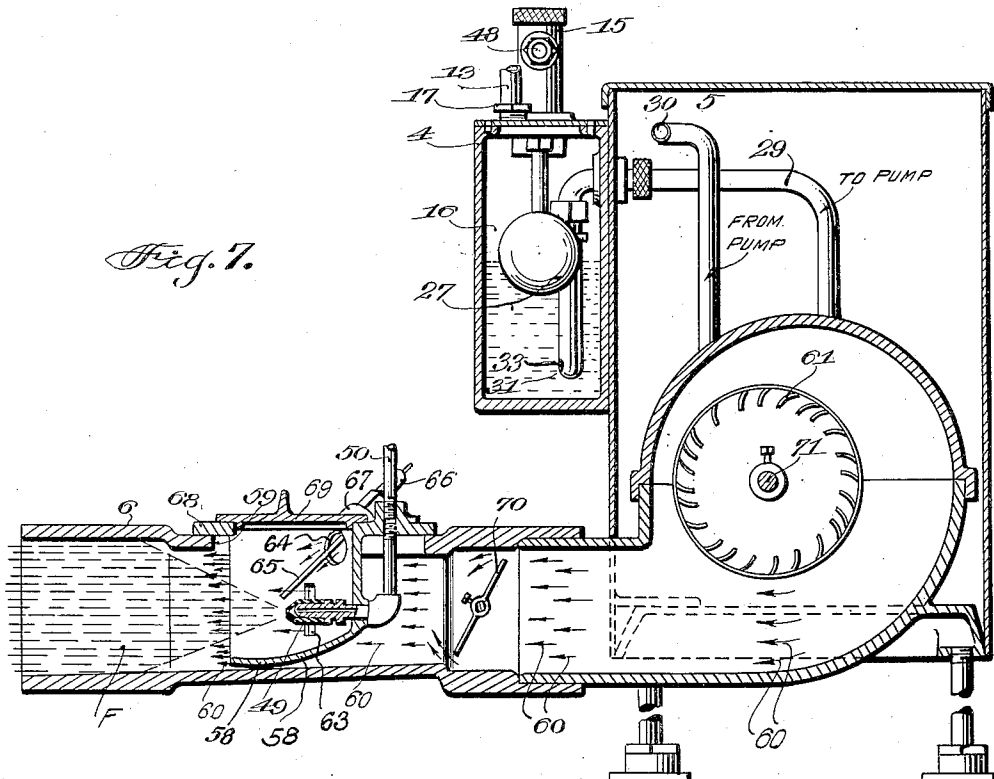


Fig. 9.

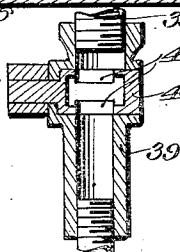
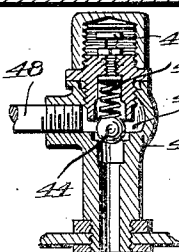


Fig. 10.



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1,921,922

OIL BURNER

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Application August 9, 1928. Serial No. 298,568

4 Claims. (Cl. 158—36.1)

This invention relates to improvements in oil burners, and it consists of the constructions, combinations and arrangements herein described and claimed.

An object of the invention is to provide what is herein known as a control tank which has components that operate either singly or cooperate with each other for the ultimate purpose of delivering a combustible fluid to the burner housing, the working of said components being such that the proportions of air and oil in said fluid will always be constant.

Another object of the invention is to embody a particular construction in the air and oil suction valve which is one of the components of the aforesaid control tank, the outstanding function of this valve being to supply the pumping or primary chamber of said tank with correct amounts of air and oil to meet the requirements of the burner.

A further object of the invention is to provide a single valve casing which is the common charging means for the fluid tank in that pipes from oil and air sources lead to it, said casing containing a single actuator which is in itself capable of controlling the admission of the two elements (oil and air), the position of the actuator being governed by an oil level-controlled float in the tank.

A further object of the invention is to fire the combustible fluid in the burner housing outside of the furnace, thus to throw into the furnace flames only, these being confined to the fire brick-lined ash chamber in which their intensity will be magnified and from which heat will radiate to the heating surfaces or flues of the furnace.

A further object of the invention is a general simplification in the structure of an oil burner, which object is supported by the use of large and simply constructed conduits the main attribute of which is the avoidance of clogging should the oil contain sediment.

Other objects and advantages appear in the following specification, reference being had to the accompanying drawings in which

Figure 1 is a diagram illustrating a typical installation of the improved oil burner, portions being shown in section,

Figure 2 is a detail section of the air and oil suction valve which is one of the principal components of the control tank,

Figure 3 is a detail section of a mixing valve used in connection with the control tank,

Figure 4 is a plan view of the burner unit, portions being shown in section,

Figure 5 is a cross section of the burner housing, taken on the line 5—5 of Figure 4,

Figure 6 is a perspective view of the removable atomization and firing chamber,

Figure 7 is a longitudinal section of the burner and fan taken on the line 7—7 of Figure 4,

Figure 8 is a longitudinal section of the control tank taken on the line 8—8 of Figure 4,

Figure 9 is a section of the oil relief valve taken on the line 9—9 of Figure 8,

Figure 10 is a section of the air relief valve taken on the line 10—10 of Figure 8,

The fundamental purpose of the improved oil burner is to produce a clean and intensely hot flame which is thrown into the furnace at a point relatively low in the latter so that only the ash pit needs to be lined with fire brick, it being from the hot center produced by the high temperature flame that the heat will radiate to the heating surfaces or flues of the furnace. By cleanliness of the flame is meant the lack of unignited fuel which, if present, would either settle on the bottom of the furnace or collect on the sides as well as on the heating surfaces to the detriment of the operation, the means by which the desirable result is attained residing primarily in that element known as the burner housing. As will presently be brought out, the structure of the burner housing is such that the incoming combustible fluid is subjected to considerable heat so that it will readily lend itself to atomization and ignition in the chamber provided for the purpose.

It would be but an incomplete arrangement were the automatic control of the air and oil not provided for properly. The formation of the combustible fluid, which is herein considered as air and oil but which may comprise other ingredients, is left to the element known as the control tank, the components of which not only keep the tank supplied with air and oil but also regulate the quantities of air and oil in such a manner that the combustible fluid will comprise approximately four parts of air and one part of oil. This ratio is not exclusive because, by making adjustments at the control tank, the proportions can be varied.

Reference is made to the drawings. In Figure 1 the main parts of the apparatus comprise an oil storage tank 1, siphon breaker 2, oil strainer 3, control tank 4, motor compartment 5, burner housing 6 and furnace 7. The oil storage tank may obviously be of any capacity. It has a filling pipe 8 and a cleaning and test pipe 9 as well as a conventional vent pipe 10. A feed pipe 12 leads from a point approximately four inches of

the bottom of the tank to a point of connection in the inlet piping 13. This piping is composed of sections so connected that it presents a substantial vertical oblong when viewed as in Figure 1.

One end of the piping connects with the oil nipple 14 of the air and oil suction valve 15 (Figs. 2, 4 and 8). The other end of the piping communicates with the primary or pumping chamber 16 of the control tank 4 through a bushing 17 (Figs. 4 and 8). The particular form of the inlet piping 13 in Figure 1 will be used only where the supply tank 1 is placed at a level higher than the burner unit. In such installations a siphon breaker must be employed, and the general arrangement of the piping 13 is designed to accommodate the siphon breaker.

The siphon breaker 2 comprises nothing more than a swinging check valve. It is placed at the highest point in the system. It is located directly above the feed pipe 12. When a suction occurs in the primary or pumping chamber 16 by means which is presently described, the swinging check valve will gravitate to the closed position. Oil will be drawn from the tank 1 through the feed pipe 12. When the oil has reached a sufficient level in the pumping chamber 16, air will be admitted by means of the valve 15. This air immediately rushes into one side of the piping 13 and opens the swinging check valve 2, so that air is admitted to the feed pipe 12 and breaks the vacuum between the oil storage tank 1 and the chamber 16.

The feed pipe 12 is connected with the oil nipple 14 of the suction valve 15 which has an air port 18 (Fig. 2) located in the air nipple 19. The casing of this valve is the common terminal of oil and air sources represented by the pipe 13 and port 18 (Fig. 2), and the passage of these elements is controlled by a single actuator which is capable of performing the necessary functions of admitting oil and air at proper times.

Oil is pumped into the primary or pumping chamber 16 in the following manner:—A sleeve 20 (Fig. 2), constituting the foregoing single actuator, is slidable in the hollow body of the suction valve 15. The sleeve is open at the top and has a closure 21 at the bottom, but the closure has passages 22 through which oil or air is conducted to the chamber 16. The sleeve has oil and air ports 23 and 24 registrable either with the oil nipple 14 or the air nipple 19. Upon registration of the oil port and nipple the air nipple 19 will be closed off, and upon registration of the air port and nipple the oil nipple 14 will be closed off. Registration of the air port 24 and nipple 19 does not occur in the ordinary operation of the burner, but only in instances when the float 27 either sinks to the bottom of the primary chamber or the suction valve 15 refuses to work.

A link 25 connects the sleeve 20 with the stem 26 of the float 27. The float will be buoyed by the oil in the primary chamber 16. When the level of the oil recedes below a point which may conveniently be regarded as normal, the float 27 will assume the inclined position in Figure 2 whereupon the oil port 23 will stand open and the air port 24 will be closed. Situated in the motor compartment 5 is a pump 28 (Fig. 4). This pump has intake and discharge pipes 29 and 30. The intake pipe has connection with an air and oil manifold 31 within the primary or pumping chamber (Fig. 8).

This manifold is in the form of a U. One leg

is slightly longer than the other, and the long leg terminates rather close to the top 32 of the tank 4, well above the oil level. The submerged part of the manifold has an oil hole 33.

It is assumed that the pump 28 is in continuous operation, and upon the occurrence of the condition wherein the oil in the chamber 16 has receded from its normal level and the nipple 19 to have closed as a result, the partial vacuum created in the chamber 16 by the exhaustion of the air will serve to draw oil from the storage tank 1 by way of the oil port 23. The so-called pumping operation will continue until the oil level is restored, and the oil port 23 is closed by the lifting of the float 27.

There will now be communication of the primary chamber 16 with the outside atmosphere through the air nipple 19. Continued operation of the pump 28 causes the continued drawing in of air and oil at the inlet and hole 33 respectively of the manifold 31. The areas of the air inlet of the manifold and of the oil hole 33 are approximately four to one, so that four parts of air and one part of oil will be delivered by the pump in the form of an emulsive mixture. This mixture is delivered from the pump by way of the discharge pipe 30 (Fig. 4) to a secondary or air and oil control chamber 34 (Fig. 8). This chamber is defined by a partition 35 in the tank 4. The point of connection of the discharge pipe 30 is indicated at 36.

A constant level of oil is maintained in the secondary or air and oil chamber 34, as well as a constant pressure thereupon, in the following manner:—Inasmuch as the mixture discharged from the pipe 30 into the secondary chamber 34 has the force of the pump behind it a pressure will be built up in the secondary chamber. The air in the primary chamber 16 will be at atmospheric pressure, but the air in the secondary chamber 34 will be slightly above, say five pounds. The pressure will be registered on a gauge 37.

The effect of the air cushion will be to force oil from the secondary chamber through a pipe 38 which extends from an opening in the partition 35 to a point within the secondary chamber where it is equipped with an oil relief valve 39 (Fig. 9). The valve element 40 has ports 41 which are registrable with the passage of the valve body when the connected float 42 rises sufficiently high. Under this circumstance the air cushion above the oil will force the oil up the pipe 38 and into the primary chamber 16. The built up pressure in the chamber 34 is slightly higher than that existing in the chamber 16, and thus when the valve 39 opens, the oil delivered into the chamber 16.

Regulation of the built up pressure in the secondary chamber 34 is had by means of an air relief valve 43 (Figs. 8 and 10). This valve has a ball 44 which tends to be seated in a chamber 45 by a spring 46. The spring can be adjusted by a threaded pin 47. The adjustments can be made so that pressures from one to five pounds (less or more, if desired) will be permitted to build up in the secondary chamber 34 before the ball 44 will unseat and permit the excess pressure to escape.

By preference the escape of the excess pressure will be into a guard pipe 48, connected between the chamber 45 of the valve 43 and the air nipple 19 of the suction valve 15. The escaping air will discharge either into the valve 15 or become dissipated at the air port 18. The purpose of the guard pipe 48 is to avoid any

dripping of oil on top of the tank 4, it being evident that the escaping air might carry with it minute particles or oil that would collect in the chamber 45 of the valve 43 and drip. Any oil thus blown out would collect in the guard pipe 48 and ultimately run back into the primary chamber 16.

Mixing of air and oil for the purposes of the retort 8 is accomplished in the following manner:

Air and oil are taken from the secondary chamber 34 and are delivered to an adjustable atomizer nozzle 49 in the retort by way of a spray pipe 50 (Figs. 1, 4 and 7). One end of this pipe is connected with a mixing valve 51 (Fig. 3). The plug portion 52 of this valve is screwed into the top 32 of the tank 4 at a point of communication with the secondary chamber 34. The plug has oil and air passages 53 and 54 which communicate with a mixing passage 55. The volume of air discharged into the mixing passage is regulated by an adjustable valve stem 56. The oil passage 53 has a feed pipe 57 which extends to a point close to the bottom of the chamber 34.

The air pressure above the oil in the chamber 34 forces the oil up through the pipe 57 into the passage 53 and thence into the passage 55. This oil is still partially aerated. It comprises an emulsive mixture as previously stated. The action of the air under pressure from the passage 54 will be to reduce the emulsive mixture to a spray, and this spray will be further broken up when it reaches the nozzle 49. The type of mixing valve 51 shown is not necessarily adhered to. Some other mixing valve might be substituted. Although this is true, the particular form of mixing valve 51 embodies an important feature to recommend its use. Its construction is such that oil is prevented from siphoning into the burner housing 6 upon shutting down of the apparatus. The air passage 54 is always open, and it is here that the siphon will be broken when the burner ceases operation. Thus oil is delivered to the nozzle 49 only while the burner is in operation and the oil is needed.

Upon shutting down the burner any residual oil will simply run into the secondary chamber 34. Air will be admitted at the passage 54 and any tendency toward the siphoning of the oil will be instantly prevented. No control or shut-off valve of any kind is thus necessary between the secondary chamber and the retort. This is an important feature.

The manner in which the oil spray is ultimately atomized in the burner housing 6, further mixed with air and fired is as follows:—A firing chamber 58 is inserted through an opening 59 in the housing of the burner housing 6 so as to occupy a position directly in the path of a stream of air, designated by arrows 60, from a fan 61. There is ample space at the sides of the firing chamber for the passage there around of the stream of air, the burner housing being enlarged at 62 (Figs. 4 and 5) for the purpose. The firing chamber has a pair of side slots 63 in proximity with the nozzle 49. It has holes 64 higher up, these admitting the electrodes 65 of a pair of spark plugs 66 that are screwed into bosses 67 on a flange 68 of the firing chamber by which the latter is secured upon the housing.

Air from the stream 60 enters at the openings 63, 64 to immediately commingle with the atomized oil. The entrance of air at the four points 63 and 64 (Fig. 6) is important. By immediately combining with the atomized oil there is formed fluid which becomes perfectly combustible when

it unites with an additional volume of air around the chamber 58. There will be no accumulation of any kind on the electrodes 65, and these, as a consequence will be kept clean. By admitting a plurality of streams of air into the firing chamber the ignited fluid will be directed into the two cross currents of air coming around each side of the firing chamber 58.

The resulting flame, denoted by F in Figure 7, will fill that portion of the burner housing 6 immediately beyond the firing chamber 58. This portion is outside of the combustion chamber of the furnace 7 (Fig. 1). But inasmuch as the end of the burner housing sits flush with the inside of the fire brick lining, there will be no chance of any diminution in the heat, for the flame will be thrown directly into the combustion chamber in the region ordinarily known as the ash pit, whence there will be a radiation of heat to other parts of the furnace.

In its passage through the retort the air designated by the arrows 60 in Fig. 7 becomes highly heated by the burning atomized oil. The pre-heated air is in better condition to assist the vaporization of the previously atomized oil. After the operation of the burner is well established, heat will naturally travel backwardly in the burner housing 6 and pre-heat the incoming air stream. That portion of the spray pipe 50 occurring within the retort will be subjected to considerable heat so that the oil spray contained thereby will be partially gasified before it is discharged at the nozzle 49.

A cover 69 closes the opening of the firing chamber 58. The firing chamber is removable from the burner housing but for the ordinary purpose of inspection of the interior the cover 69 can be removed. A standard stove pipe damper 70 is adjustable to regulate the air stream from the fan 61. The shaft 71 of the fan is common to the fan and pump 28, and is driven by an electric motor 72 in the motor compartment 5.

The operation

is readily understood. The feed pipe 12 (Fig. 1) establishes communication between the oil storage tank 1 and the air and oil suction valve 15 whether the storage tank be above or below the level of the burner unit. In the first instance a siphon breaker 2 must be used. In the second instance the valve 15 will operate as its own siphon breaker. The siphon breaker 2 is nothing more than a swinging check valve which gravitates to a closed position when there is a suction in the feed pipe 12 as when the oil port 23 (Fig. 2) is in communication with the nipple 14, and is forced open by the pressure of atmospheric air as when communication between the nipple 19 and valve 15 is established after a pumping operation has ceased.

Assume the pump 28 to be operating continuously. As a matter of fact it will not operate continuously because the motor 72 will, in practice, be subject to a suitable thermostatic control as well as a switch. The motor may be stopped entirely by means of the switch, and temporarily by means of the thermostatic control. These parts are all of common knowledge and consequently are not illustrated in the drawings. So, reverting to the original proposition, the pump 28 is considered as being in continuous operation.

When the level of oil in the primary chamber 16 (Fig. 8) is such that the float 27 is supported in the substantially horizontal position (full lines Fig. 8, dotted lines Fig. 2) the sleeve 20 will be in a

position of opening of the air nipple 19 and closure of the oil nipple 14. There is thus free communication of the atmosphere with the primary chamber 16, and the space above the oil will be filled with atmospheric air.

As the pump 28 operates it will draw some of this air in at the upper inlet of the manifold 31, and will draw oil into the manifold at the hole 33. This produces a mixture of air and oil. There will be more air than oil because the air orifice is larger than the oil hole. The mixture will be well broken up by the action of the pump 28, prior to the discharge thereof into the secondary chamber 34 by way of the discharge pipe 30, because the pump will be operated at approximately 1750 R. P. M.

As the oil in the primary chamber 16 is used up the float 27 will drop so that it will presently assume the full line position in Figure 2. The air nipple 19 will be closed by the sleeve 20, and the oil port 23 brought into registration with the oil nipple 14. Continued operation of the pump 28 will soon exhaust the air in the primary chamber 16 to a point where the partial vacuum will draw on the oil in the feed pipe 12 and lift a supply from the storage tank 1. As the oil supply is replenished in the primary chamber 16 the float 27 will re-assume its first position, closing off the oil supply and establishing a re-connection with the atmosphere.

The pressure of air and oil discharged from the pipe 30 (Fig. 4) into the secondary chamber 34 is above that in the primary chamber 16. The emulsive mixture is separated as it enters the secondary chamber, but as the superior air pressure in the secondary chamber forces the mixture through the mixing valve 51 in Figs. 3, 4 and 8 it is again converted into a fine spray which thoroughly commingles with the various air streams in and around the firing chamber 58 in Figure 7. These air streams are produced by the fan 61. The main stream flows around the sides of the firing chamber, the burner housing 6 being enlarged at 62 for the purpose. But some of the air also enters the firing chamber at the openings 63 and 64, forming independent streams which guide the flaming, atomized and gasified combustible fluid into the two air currents emerging at the sides of the firing chamber.

The function of the suction valve 15 is important for by means of it the admission of both oil and air is controlled. Only one oil pump is necessary, and it serves both to replenish the oil supply from the storage tank 1 and to supply the burner with a mixture of oil and air. The valve 15 can be relied upon to prevent the flooding of the pumping chamber 16. Should the float 27 become damaged and sink to the bottom of the primary chamber, or for any reason refuse to operate, the valve 15 would automatically close off the supply of oil, and at the same time would bring the air port 24 into registration with the nipple 19 so that air would be freely admitted to the pumping chamber 16 and break the vacuum in the supply line between the pumping chamber and the supply tank 1.

Actual use has developed the fact that better ignition and burning of the oil is accomplished by producing a mixture of oil and air. The breaking up of the oil first occurs in the manifold 31. The pump 28 produces a further breaking up of the oil, and after the mixture leaves the mixing valve 51 it can be relied upon to be in the state of a spray. Inasmuch as a portion of the spray pipe 50 (Fig. 7) is situated within the burn-

er housing 6, the spray is partially gasified before it emerges at the nozzle 49.

By igniting the mixture within the burner housing and outside of the furnace 7 there is no possibility whatever of damaging the effectiveness of the flame by undesired drafts of cold air which would occur were the mixture thrown into the combustion chamber of the furnace and ignited there. The latter practice sets up uncontrollable drafts in the combustion chamber, carrying the flaming oil above the area of the grate center with certain deleterious effects which need not be enlarged upon here. It is sufficient to say that the arrangement of the burner housing 6 permits no cold air to enter the combustion chamber of the furnace, nor allows uncontrolled air currents to retard the complete combustion of any unburnt gases or carry them off through the flues of the furnace before they have become sufficiently heated for complete combustion.

By firing the oil spray within the firing chamber 58 of the burner housing the parts become sufficiently hot to insure the instant gasification of the mixture as it leaves the nozzle. In its passage through the burner housing the air from the fan 61 is heated by the burning mixture to a temperature of over 1400° F. and enters the combustion chamber of the furnace in the form of a flame. Complete combustion is materially aided by pre-heating the air before it commingles with the spray from the nozzle.

It is to be noted that in various parts of the oil burner the openings are sufficiently large to prevent any clogging by dirt or other sediment in the oil. For instance, there are no exceptionally small openings in the suction valve 15. The manner in which the oil relief valve 39 functions to maintain a constant oil level in the secondary chamber 34 has been fully explained. The valve 39 and float 42 function to keep the level of oil normal, while the valve 43 is adjusted for a relief of air when the pressure exceeds a desired set amount.

While the construction and arrangement of the improved oil burner is that of a generally preferred form, obviously modifications and changes may be made without departing from the spirit of the invention or the scope of the claims.

I claim:—

1. In an oil burner, a valve structure having air and oil openings in communication with air and oil sources, a sleeve in said structure having an oil port, a tank with which the valve has connection, a pump also in connection with the tank to draw on its fluid contents, and a float resting on the oil and connected with the sleeve for sliding the sleeve either for the admission of oil or air as the oil level fluctuates within determined limits.

2. In an oil burner, a valve structure having air and oil nipples in communication with air and oil sources, a sleeve in said structure having an oil port, being open at one end and provided with passages at the opposite closed end, a tank with which the valve is connected, a pump also connected with the tank to draw on its fluid contents, and a float resting on the oil and connected with the sleeve to slide the sleeve in either of the two directions as the oil level fluctuates within determined limits, to either register the oil port with the oil nipple and close the air nipple, or move the open end of the sleeve below the air nipple for the entrance of air and close off the oil nipple.

3. In an oil burner, a tank having a single chamber, a pump in communication with the

tank so that it will perform a suction on the fluid contents of the tank, a single valve casing connected with the tank and comprising a common tank-charging means communicable with an oil storage tank and with the outside air, a single actuator in said casing functioning as a double valve being sequentially movable into any of various positions respectively to admit atmospheric air or oil from the storage tank or both, to be drawn out of the tank as a mixture by the pump, and float-controlled means in said tank having a connection with said actuator for causing said sequential movement by virtue of oil level-fluctuations.

4. In a control tank having an air and oil chamber, a cover for the chamber, and means at which air and oil are delivered to the chamber comprising a valve casing carried by the cover having air and oil ports in communication with the interior of the casing, a valve member operable in the casing comprising a sleeve having air and oil inlets sequentially registrable with the respective ports and having a common outlet for both air and oil, float means in connection with the sleeve for governing its position by the rise and fall of oil in the chamber, and means by which the float means is suspended from the cover.

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