Dec. 26, 1939. L. WINTER 2,184,967

OIL BURNING APPARATUS

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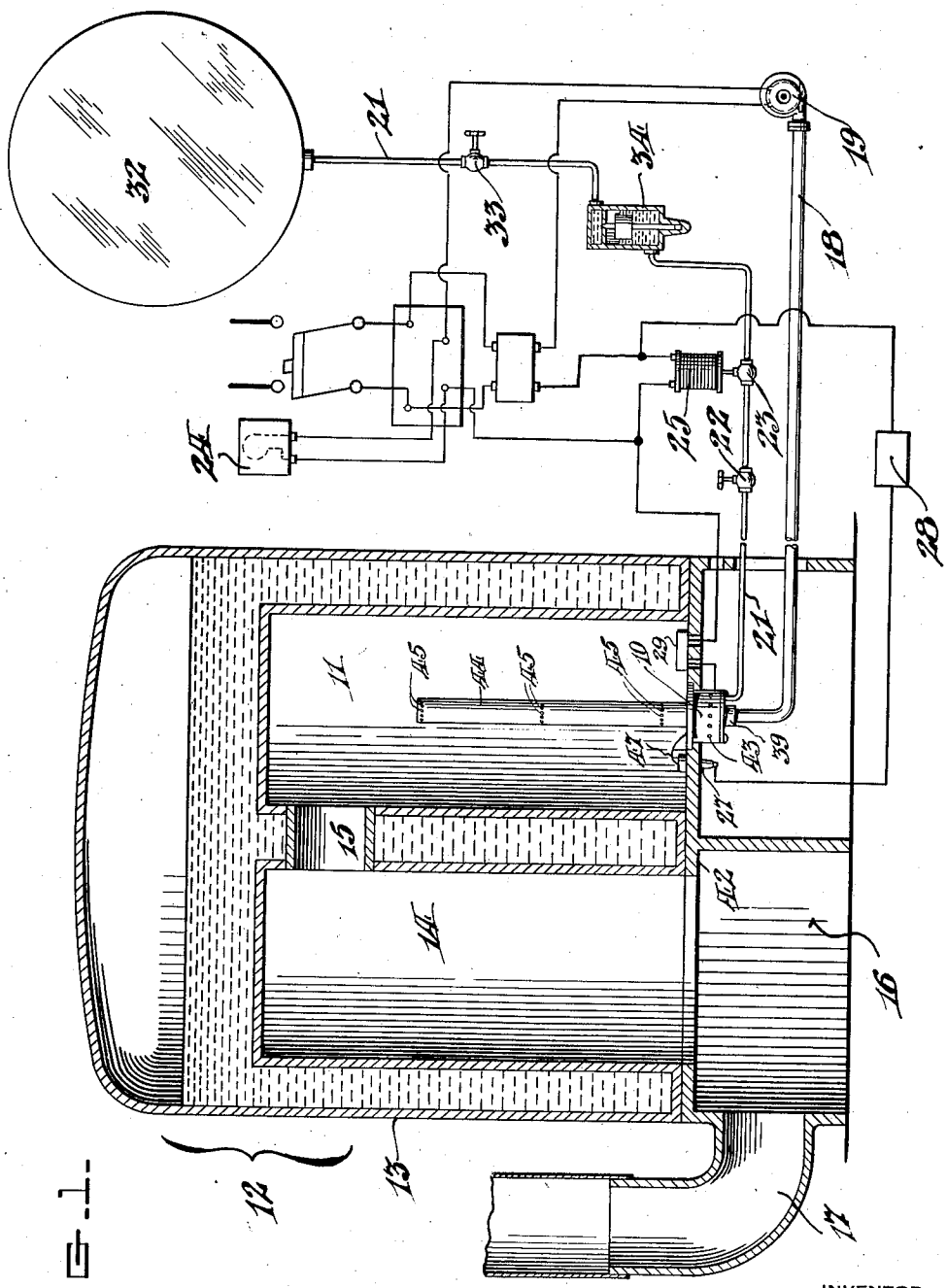


FIG. 1.

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FIG. 2.

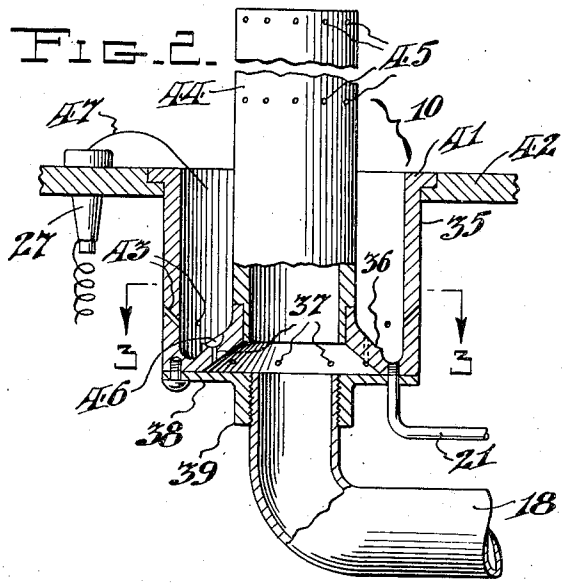


FIG. 3.

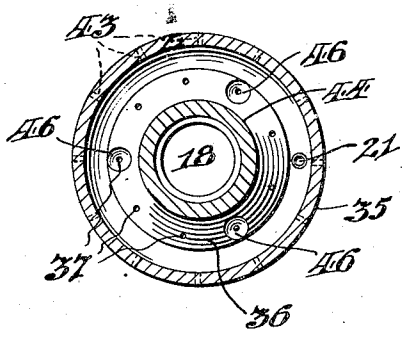


FIG. 5.

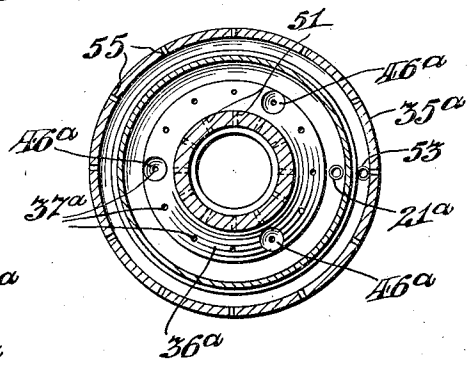


FIG. 4.

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OIL BURNING APPARATUS

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11 Claims. (Cl. 158—92)

This invention relates particularly to oil firing of heating apparatus for homes and other buildings with an oil burner having features of generating the combustible mixture and flame distribution as herein described.

One object of my invention is to provide a novel oil burning unit of this type which embodies certain new features of construction and operation resulting in a higher degree of simplicity, efficiency and economy than the units heretofore available for this purpose.

Another object is to provide a novel oil burner for such units.

Another object is to provide such an oil burner which generates a combustible mixture by simultaneous vaporization and atomization, or spraying action, of the liquid fuel.

A further object is to provide such a burner with a novel oil pot arrangement capable of combining the vaporized fuel with the sprayed or atomized fuel within the pot to effect a combustible mixture.

A still further object is to provide such an oil burner with an air distributing arrangement which will produce smokeless blue flames in the combustion chamber and consume the generated mixture by effecting smokeless burning of the fuel, in one or more stages of combustion.

Another object is to provide such a burner with an air distributing arrangement which is capable of continuing combustion of the generated medium in the upper region of the combustion chamber.

Another object is to provide such a burner with a novel annular pilot flame arrangement which functions to maintain the burner in preheated condition and to facilitate ignition.

An additional object is to provide such a burner with a novel combination spark and pilot flame ignition arrangement.

Another object is to provide such a burner with a jump spark ignition arrangement which will not become fouled with soot.

Another object is the provision of such a burner in which ignition of the generated medium is effected without resorting to high pressure feeding of the oil or air.

Another object is to provide a burner of this type having an oil pot arrangement capable of producing an oil spray effecting a balanced flame.

A further object is to provide an oil burning unit having some or all of the foregoing features and which has a gravity oil feed arrangement and a low pressure air feed system.

With these and other objects in view, which will become apparent from the following detailed description of various practical and illustrative embodiments of my invention shown in the accompanying drawings, the invention comprises the novel elements, features of construction and arrangement of parts in cooperative relationship in an oil burning unit and an oil burner as hereinafter set forth in the claims.

In the accompanying drawings:

Figure 1 is a schematic view, partly in vertical section, of one form of my novel oil burning apparatus;

Fig. 2 is a detail cross-sectional view of my novel oil burner shown in Fig. 1;

Fig. 3 is a horizontal sectional view of the oil burner shown in Fig. 2, taken substantially as indicated by the arrows 3—3 on said Fig. 2;

Fig. 4 is a view similar to Fig. 2, but of a modified form of construction, certain of the elements shown in Fig. 1 being included in order to illustrate their cooperative relationship; and

Fig. 5 is a horizontal sectional view taken substantially as indicated by the arrows 5—5 on Fig. 4.

Referring to the drawings, in which similar reference characters designate similar parts, it will be noted from Fig. 1 that my novel oil burning apparatus comprises an oil burner 10, suitably mounted in the lower end of a combustion chamber 11, of a furnace, or heater 12, of any standard type.

For illustrative purposes, the combustion chamber is shown as being cylindrical, and the heater 12 is shown as comprising a water boiler 13 which surrounds the combustion chamber 11, a down draft heat chamber 14, and a horizontal duct 15 which connects the upper ends of the chambers 11 and 14. Although not shown, it will be understood that the heater 12 is also provided with the usual and well known appurtenances and fixtures so that it may perform its intended function and be connected to a heating system in customary manner.

The lower end of the chamber 14 communicates with a heater base compartment 16 from which extends an outlet pipe 17 for directing the spent gases from the chamber 14 to a chimney.

Leading to the oil burner 10, is an air conduit 18 through which air under pressure is conducted to the burner 10, from a motor driven fan, or blower 19.

Also entering the bottom of the oil burner 10, is a fuel oil feed line or pipe 21, having connected therein, between the burner 10 and an oil reservoir or tank 32, a standard flow regu-

lating valve 22, a magnetically operated valve 23, an emergency valve 33 and a float valve 34.

The valve 23 is operated by a standard electromagnetic unit 25, connected in an automatic electric control system of the type constituting usual equipment of modern oil burning units. In the present instance, this control system includes a thermostatic temperature control switch 24, a burner ignition spark element 27, a spark coil 28, and a thermostatic spark control switch 29, all of which devices are well known and are therefore only diagrammatically indicated in Fig. 1.

Referring now more particularly to Figs. 2 and 3, which are detail views of one form of my novel oil burner shown in Fig. 1, it will be noted that the burner 10 comprises an oil pot having a cylindrical casing 35, which is open at its top and has a conically shaped bottom 36, provided with a series of vertical apertures 37, which extend entirely through the conically shaped bottom thereby to permit the air from the conduit 18 to flow into the interior of the cylindrical oil pot or burner 10. A base plate 38, suitably connected to the casing 35, forms a closure member at the bottom of the burner 10. The plate 38 is provided with a centrally located flange 39 in which the conduit 18 is secured. The oil feed line 21, extends through an aperture in the base plate 38 and is secured in the conically shaped bottom part 36 of the burner 10 in such manner that the oil will flow into the annular trough formed between the conical bottom part 36 and the inner wall of the casing 35.

The upper part of the casing 35 is flanged as at 41 and is seated in an annular groove in the base plate 42 of the heater 12. The casing 35, near its bottom, is also provided with an annular series of apertures 43, which are downwardly inclined toward the inside and function as air inlets for directing the air surrounding the burner, under atmospheric pressure, into the interior of the oil pot or burner 10.

An air stack, or cylinder 44 is centrally mounted in the base part 36 and extends upwardly beyond the oil pot into the combustion chamber 11 of the heater 12. The stack 44 is closed at its upper end and is open at its lower end to permit the air from the conduit 18 to flow upwardly therethrough. One or more annular series of upwardly inclined air outlet apertures 45 are provided in the stack 44, arranged to effect a predetermined amount of air to flow into the combustible mixture or medium surrounding the stack, so as to bring about combustion of the fuel in one or more stages.

Three of the vertical apertures 37, in the base part 36, are equally spaced about the center of the burner and are provided at their upper ends with cup-shaped enlargements 46, for the purpose of permitting the oil from the line 21, to flow therein, as the oil rises in the mentioned annular trough. The rate of flow of the oil is adjusted so that it does not reach the upper ends of the remaining apertures 37, due to their location at a higher elevation in the conical floor of the pot. This arrangement effects an initial vertical spray action or atomization of the oil as induced by the air under pressure from the conduit 18, at the point where the cup-shaped enlargements 46 are located, and this results in a balanced flame during combustion.

The sparking element 27 is provided with a conductor 47, which extends into the upper end of the burner 10 and is so arranged that a spark will jump from this conductor either to the casing 35, or the stack 44.

The oil burner unit shown in Figs. 1, 2 and 3, operates as follows:

When the temperature at the control switch 24 reaches the point at which it functions to operate the electrical system, the valve 23 opens and oil flows into the trough in the floor of the pot 35, through line 21, at the rate of flow to which control valve 22 is adjusted. A uniform pressure exists in this oil line due to the level maintained in float chamber 34.

At the same time that the oil begins to flow, the blower 19 is caused to operate and air under pressure is delivered to the interior of the oil pot. Simultaneously with the flow of air and oil, the ignition spark leaps from the conductor 47.

As the oil rises in the aforementioned trough it finds its way into the three cups 46. From these cups it is blown into a vertical spray by reason of the air pressure existing in the centrally located conically shaped air chamber at the bottom of the burner. The air flows through the apertures 37 having the cup-shaped enlargements at their upper ends, as well as all the others. The air from the other apertures 37 serves to help break up the oil spray and blow the same out of the pot. These latter apertures function as vertical air jets which create a suction action within the oil pot, which in turn causes air at atmospheric pressure to enter the pot through apertures 43.

The oil spray is ignited by the jump spark leaping from the conductor 47, which projects into the sprayed oil.

As the flame increases, the oil spray is converted, or changed, into vapor, thus creating a rich combustible mixture. The flame in the pot about this time becomes extinguished and combustion is thereafter supported by the air issuing from the air stack 44. The air jets from this stack then form individual jets of blue flame resembling Bunsen flames, which reach to the side wall of the combustion chamber 11.

The suction action of the vertical air jets issuing from the apertures 37, causes air to enter or be drawn through apertures 43 and this air fills the slight vacuum space created. When the pot becomes sufficiently hot, vapor or gas rises from the oil in the trough which in turn mixes with the air entering through apertures 43 and unites with the oil spray blown upwardly out of the pot. Thus vaporization and atomization of the oil takes place simultaneously within the oil pot.

The heat in the lower end of chamber 11 acts upon the thermostatic spark control switch 29 and opens the jump spark circuit so that sparking of the element 27 ceases. In practice, the blue flames in the combustion chamber 11 leave no carbon deposit on the combustion chamber wall or floor, so that combustion of the gas is complete and maximum heat is created. Due to this, the sparking element 47 does not foul with soot. As a limited amount of oxygen is present in each air jet, only part of the gas is consumed during each stage of combustion. However, complete consumption of the gas occurs by the time the last, or uppermost, air jets 45 of the stack 44, effect combustion with the generated mixture.

The rate of flow of the oil into the pot is regulated so that combustion of the generated gas is completed with the uppermost or last series of air jets issuing from said stack 44.

I have found in practise that with this arrangement the gas or generated mixture, is entirely

consumed and that the greatest amount of heat accumulates in the upper end of the combustion chamber. By directing these hot gases through the conduit **15** and downwardly through chamber **14**, or through fire tubes, efficient extraction of the heat is obtained.

When the temperature in the room or other place where the switch **24** is located, reaches the point at which it functions to open the electrical system, the automatic control valve **23** is closed and stops the flow of the oil into the pot so that the flame promptly extinguishes. Of course, the blower **19** also ceases to function.

As already pointed out, the burner **10**, when in operation, effects both atomization and vaporization of the fuel oil. I have found that this, in conjunction with the air or oxygen feed arrangement of the burner, as disclosed, results not only in smokeless and complete combustion of the fuel, but in producing a blue flame which leaves no carbon deposit at any point in the combustion chamber and a maximum amount of heat is, therefore, generated by this burner unit.

It is also to be noted that the air feed arrangement of the burner creates a gaseous mixture with the atomized and vaporized oil fuel medium such that a balanced flame condition exists in the combustion chamber at all times.

Burner **10** may be embodied in another form of burner, such for example, as illustrated in Figs. 4 and 5 of the drawings, wherein the parts which are substantially similar to the parts of the burner **10**, are designated by corresponding reference numerals, having the exponent *a* added thereto.

In this modified form of my burner invention, I have added a novel pilot flame arrangement which functions to preheat the burner, and effects ignition of the fuel at the time that the burner is turned on.

From Fig. 4, it will be seen that the construction of this modified form of burner, comprises an oil pot substantially the same as before. However, that in this arrangement, the air for overcoming the vacuum created by the vertical air jets is introduced into the oil pot through an annular series of apertures **51** in the air stack **44***a*, and that the oil pot is centrally located within, and spaced from, the casing **35***a* by a partition or wall **35***b*, thus providing an annular oil channel **52** which surrounds the oil pot.

A branch oil line **53**, leads from the oil line **21***a*, to the bottom of the channel **52**, and liquid oil is constantly maintained in this channel at the point shown in Fig. 4, by properly positioning the float valve **34***a*, as clearly illustrated in the said figure. The oil in the channel **52** serves to provide a slow burning annular flame in this instance, which burns continuously when the main, or central oil burner is on or off. When the main burner unit is automatically shut down, as previously described in connection with the first form of my invention, the flow of oil to the channel **52** continues as controlled by the liquid level valve **34***a*, and the oil in this channel continues to burn so that the annular flame produced functions as a pilot burner, which additionally keeps the centrally located oil pot in preheated condition for instantaneous ignition of the fuel generated therein when the electro-magnetically controlled valve **23***a* is turned on in conjunction with the flow of air in conduit **18***a*, as previously explained.

One or more annular series of apertures **55** in the casing **35***a* provide the proper amount of air flow to the pilot flame, and assist in inducing smokeless combustion of the generated oil mixture or medium.

If desired, a second emergency valve **33***a* may be located in this burner unit arrangement, as shown, in order to provide a means for simultaneously cutting off the flow of fuel oil through the oil lines **21***a* and **53**.

The burner unit of Figs. 4 and 5 functions in principle the same as the unit of Figs. 1, 2 and 3, in that the fuel oil is converted into an atomized and vaporized fuel medium properly mixed with air or oxygen to produce a highly combustible gas, resulting in a smokeless blue flame burning of the combustible mixture produced.

It will be understood that the pilot flame arrangement of the burner of Figs. 4 and 5, in conjunction with the spark element **27***a*, provides a dual ignition system. Also, that this arrangement not only keeps the centrally located main burner or oil pot in preheated condition at all times, so as to effect instantaneous functioning of this burner when automatically turned on, but additionally insures that ignition of the fuel generated in the main burner will take place in the event that the annular pilot flame in the channel **52** is accidentally extinguished.

Of course, my novel burner unit, and burner, as shown and described, can be changed and modified in various ways, without departing from the invention herein disclosed, and hereinafter claimed.

I claim:

1. An oil burner of the character described comprising a pot having an annular oil trough at its bottom and an annular series of air feeding apertures in the wall thereof above said trough; means to supply oil to said trough; and an air duct centrally positioned in said pot and arranged to direct primary currents of air under pressure through an annular series of vertical apertures whose upper ends terminate below the liquid level of the oil trough, and to direct secondary currents of air under pressure through an annular series of apertures in the duct at a point above said first series and in a direction so that the secondary currents of air intersect the combustible mixture created by the oil and primary currents of air.

2. An oil burner of the character described comprising a pot having an annular oil trough at its bottom and an annular series of air feeding apertures in the wall thereof above the trough; means to supply oil to the trough; and an air duct centrally positioned in said pot and arranged to direct air under pressure through an annular series of vertical apertures whose upper ends terminate below the liquid level of the oil trough and one or more of which apertures are enlarged at their upper ends, and to direct air under pressure through one or more annular series of apertures in the duct at a point above said first series.

3. An oil burner of the character described comprising a pot having two annular oil troughs, and an annular series of air feeding apertures in the wall thereof above the troughs; an air duct centrally located in said pot and arranged to direct air under pressure through an annular series of vertical apertures whose upper ends terminate below the liquid level of one of said oil troughs, and to direct air under pressure through one or more annular series of apertures in the duct at a point above said vertical apertures.

4. An oil burner of the character described

comprising a pot having two annular oil troughs at different elevations in said pot and an annular series of air feeding apertures in the wall thereof above the troughs; an annular partition separating said troughs; individual means for supplying oil to the respective troughs; an air duct centrally located in said pot and arranged to direct air under pressure through an annular series of vertical apertures whose upper ends terminate below the liquid level of one of said oil troughs, and to direct air under pressure through one or more annular series of apertures in the duct at a point above said vertical apertures.

5. An oil burner of the character described comprising a pot having an annular oil trough at its bottom and an annular series of air feeding apertures in the wall thereof above the trough; means to supply oil to the trough; an air duct centrally located in said pot and arranged to direct air under pressure through an annular series of vertical apertures whose upper ends terminate below the liquid level of the oil trough, and to direct air under pressure through a plurality of annular series of apertures in the duct at different elevations above the top of the pot.

6. In an oil burning apparatus of the character described, the combination of a vertically positioned pot having an annular oil trough, oil feeding means arranged to maintain oil at a predetermined level in said trough, means arranged to convert oil from said trough into an upwardly flowing annular stream of oil spray, air directing means arranged in a circle along the path of travel of said stream of oil spray, and means for continuously feeding air under pressure into said stream of oil spray through said air directing means.

7. In an oil burning apparatus of the character described, the combination of a vertically positioned pot having an annular oil trough, oil feeding means arranged to maintain oil at a predetermined level in said trough, means arranged to convert oil from said trough into an upwardly flowing annular stream of oil spray, air directing means arranged in a circle along the path of travel of said annular stream of oil spray, for directing air into the latter substantially radially and outwardly from the inner perimeter thereof, and means for feeding air under pressure through said air directing means.

8. In an oil burning apparatus of the character described, the combination of a vertically positioned cylindrical pot having an annular oil trough at its bottom, oil feeding means arranged to maintain oil at a predetermined level in said trough, a circular series of apertures extending vertically through the bottom wall of said pot and arranged so that their upper ends are below said oil level, means for feeding air under pressure through said apertures to thereby convert oil from said trough into an upwardly flowing stream of oil spray, and means for continuously feeding air under pressure into said oil spray in an angular direction relative to the latter.

9. In an oil burning apparatus of the character described, the combination of a vertically positioned cylindrical pot having an annular oil trough at its bottom, oil feeding means arranged to maintain oil at a predetermined level in said trough, a circular series of apertures extending vertically through the bottom wall of said pot having cup-shaped enlargements at their upper ends into which the oil from the trough flows when the oil in said trough reaches said predetermined level, a second series of apertures extending vertically through the bottom wall of said pot and having their upper ends arranged above said cup-shaped enlargements, means for feeding air under pressure through said two series of apertures to thereby convert oil from the trough into an upwardly flowing stream of oil spray, and means for continuously feeding air under pressure into said oil spray in an angular direction relative to the latter.

10. In an oil burning apparatus of the character described, the combination of a vertically positioned cylindrical pot having an annular oil trough, oil feeding means arranged to maintain oil at a predetermined level in said trough, an annular series of apertures extending vertically through the bottom wall of said pot and arranged so that their upper ends are below said oil level, means for feeding air under pressure through said apertures to thereby convert oil from said trough into an upwardly flowing stream of oil spray, an annular series of apertures in the side wall of said pot above said oil level arranged to effect feeding of air at atmospheric pressure into said pot, a cylindrical conduit closed at the top and open at the bottom connected at its lower end with the pot in such manner as to be centrally positioned in the latter and arranged to extend a substantial distance above the same, a multiplicity of series of circularly arranged apertures extending through the wall of said conduit at different levels above said pot, and means connected with the lower open end of said conduit and the apertures in the bottom wall of the pot for feeding air under pressure through the same.

11. In an oil burning apparatus of the character described, the combination of a vertically positioned pot having an annular oil trough, oil feeding means arranged to maintain oil at a predetermined level in said trough, means arranged to convert oil from said trough into an upwardly flowing stream of oil spray, a cylindrical conduit closed at the top and open at its bottom connected at its lower end with the pot in such manner as to be centrally positioned in the latter and arranged to extend a substantial distance above the same, one or more series of circularly arranged apertures extending through the wall of said conduit above the pot, and means for feeding air under pressure through said conduit and the apertures in its wall.

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