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OIL BURNING FURNACE

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My invention relates to oil burning furnaces, and more particularly to oil distributing apparatus for such furnaces, especially that type including a rotating atomizer.

One of the objects of my invention is to provide an oil-distributing head serving as an atomizer and whereby all possibility of the oil becoming ignited within the head is eliminated, said head having its exit or distributor openings so arranged that they cannot become clogged or carbonized due to the fact that the oil is released from the head as it reaches the exterior thereof, in contra-distinction to old methods under which the oil is dammed back or trapped against the wall of the exit openings.

Another object of my invention is to provide an atomizing or distributing head, whereby oil is projected therefrom in two different planes, and with which head are associated igniting elements; the oil projected from said head in one of said planes being limited in quantity and traveling in direct contact, at certain points under the control of the head of said head, with said igniting elements, and the oil projected in the other plane being intimately commingled with air and in part coming directly in contact with the igniting devices and in part first striking the hearth of a furnace and being ricocheted into the sparking or flame area of the igniting elements.

Another object of my invention is to provide an oil burning furnace having a rotatable oil-distributing head provided with exit or distributor openings so arranged that the oil leaves said openings in a higher plane than the air escaping outwardly through said openings with the oil, and wherein the major portion of the oil and air, in commingled form, comes in contact with the hearth short of the burning area, and under ricocheted action again commingles with other portions of the oil in atomized form, or a mixture of oil and air, at or within the burning or flame area.

A further object of my invention is the production of an oil burner wherein provision is made for a preliminary distribution of the oil to assure a quicker ignition by direct projection of the oil, mixed with air, into the area of the spark or flame of the igniting element or elements.

Other objects of my invention are to provide new and novel means for supporting the oil-distributing head and the hearth, and improved means of introducing air to the distributing head, the air being regulated by suitable means readily accessible from the exterior of the furnace.

A further object of my invention is to provide a simple and efficient device for distributing oil to the oil distributing head, and to so commingle air with the oil that assurance is had of a perfect mixture of oil and air, capable of maintaining a flame above the hearth in an endless manner within the shell of the furnace so as to thoroughly heat the surrounding space and the dome above the hearth.

With the above and other objects in view to appear hereinafter, the invention consists in the novel features of construction and in the arrangement and combination of parts to be hereinafter described and more particularly pointed out in the subjoined claims.

In the drawings:

Fig. 1 is a central vertical section through the lower portion of a furnace equipped with my improved oil distributing apparatus, including my new and novel hearth construction; the section being taken tangentially through the wall of the fuel-distributing head at diametrically opposite points and axially of two exit or fuel-distributing openings therein.

Fig. 2 is a horizontal section taken on line 2—2, Fig. 1, parts of the furnace being broken away.

Fig. 3 is a horizontal section taken on line 3—3, Fig. 1, parts of the furnace being broken away.

Fig. 4 is an enlarged vertical section taken through the oil-distributing head and the central portion of the support whereby both the oil-distributing head and the hearth are supported within the furnace; the section being taken tangentially through the wall of the fuel-distributing head at diametrically opposite points and axially of two exit or fuel-distributing openings therein.

Fig. 5 is an enlarged horizontal section taken on line 5—5, Fig. 4.

Fig. 6 is an enlarged vertical section through the hearth of the furnace adjacent the shell or casing thereof.

Fig. 7 is a vertical section taken on line 7—7, Fig. 6.

Fig. 8 is a vertical section through a portion of the oil-distributing head taken on line 8—8, Fig. 5.

Fig. 9 is a perspective view of one of the curb elements mounted on the marginal portion of the hearth.

Reference being had to the drawings in detail, 10 designates the shell of a furnace, which may in some instances serve as the outer shell and
in others as the inner shell, depending on the nature, or construction of the furnace. Disposed centrally within this shell is a support 11, which rests upon the floor or other foundation of the furnace and sustains the hearth 12. This support is formed of a body portion 13 and suitable supporting legs 14; the body portion comprising a comparatively flat member 15 and a cylindrical member 16. The flat member 15 is of substantially triangular formation in preferred form, and has the depexed edges of the bosses 17 at its three angles through which the upper ends of the supporting legs 14 are passed.

In order to position the body portion 13 of the support the desired distance from the floor or foundation of the furnace, each of the legs 14 has a nut 18 adjustable thereto, against which the lower ends of the legs or bosses 17 bear, and at the upper ends of these legs nuts 19 are applied which secure the flat members 15 in adjusted position. Extending inwardly from the legs or bosses 17 are webs 20 which serve to strengthen the flat member 15 of the body portion.

An opening 21 is formed centrally in the flat member 15, and this member is provided with an upstanding flange 22 around said opening, which is encircled by the lower end of the cylindrical member 16. Member 16 therefore receives support from the flat member and is retained in position thereon by said upstanding flange.

23 designates an electric motor which is provided with an outstandig flange 24 at its upper end, by means of which it is fastened to the flat member 15 of the body portion of the support; suitable bolts 25 being passed through the said flat member and said flange for this purpose.

This motor has a portion fitting into the central opening 21 of the support and it is provided with an axial boss 26 extending into said opening and into the lower portion of the cylindrical member 16; an annular oil trough 27 being thus provided in the bottom of the cylindrical member 16, which latter serves as an air chamber, as will appear hereinafter.

The support 11, and more particularly the body portion 13 thereof, sustains the hearth 12, and for this purpose the cylindrical member 16 of the support has angular carriers 28 secured thereto which are in the form of L-shaped straps or hangers fastened to the cylindrical member 16 by bolts 29 adjustable within vertical slots 30 within said cylindrical member so that, if desired, the thickness of the hearth may be varied, yet the upper surface thereof maintained level with the upper edge of the cylindrical member 16; or, the hearth may be elevated or lowered with relation to the length of said cylindrical member so that the upper surface of the hearth is above or beneath the upper edge of said cylindrical member, as may be desired.

The supporting legs 14 are entered at their lower ends in sockets 31, having enlarged lower portions provided with down wardly-facing depressions in which cork or other cushioning or insulating material 32 is placed.

Formed in the peripheral wall of the cylindrical member or air chamber 16 is an air inlet opening 33 having a central hub 34 from which radiate arms 35 whose outer ends are connected to the wall of said inlet opening. The hub 34 is therefore axially supported within the air inlet opening and the spaces between the arms admit air to the cylindrical member or air chamber.

For the purpose of regulating the quantity of air admitted through said air inlet opening, a flat or disk valve 36 is held in any desired spaced relation to the surrounding wall of said opening by means of a screw stem 37 to the hub 34, and for the purpose of adjusting this valve so as to increase or diminish the supply of air delivered to the air chamber 16, it is provided with a hand or finger hold 38 in the form of a web extending outwardly therefore from.

The attachment of the motor 23 to the flat member 15 of the support results in the closing of the air chamber 16 at its lower end and, if desired, a gasket may be interposed between the flange 24 of said motor and said flat member to render the air chamber air and liquid-tight at this point.

The shaft 39 of the electric motor extends axially through the air chamber 16, and keyed or otherwise secured in any approved manner to the upper extremity of this shaft is an oil atomizing or distributing head 40, which is of frustroconical formation and tapers downwardly, the lower portion thereof extending into the upper portion of the air chamber. The tapering wall 41 of this head is externally enlarged at its upper end to provide a downwardly-facing shoulder 42 slightly spaced from the upper edge of the wall of the air chamber 16, and between this downwardly-facing shoulder and said upper edge, an asbestos or other suitable filler 43 is arranged.

Said filler may, if desired, extend over the inner marginal portion of the hearth proper, especially when the upper surface of the hearth is flush with the upper edge of the cylindrical wall of the air chamber, which is the preferred arrangement, except when vertical adjustment of the hearth is otherwise demanded. The said filler serves to prevent the free escape of air outwardly between the upper end of the wall of the air chamber and the atomizing or distributing head.

The upper portion of the atomizing or distributing head overhangs the upper edge of the wall of the air chamber 16 in all instances, and as the upper portion of this wall may be considered as forming part of the hearth, it may be said that the upper portion of the atomizing or distributing head overhangs the hearth and that the hearth has centrally arranged therein an opening or passage, the wall of which is the upper portion of the cylindrical wall of the air chamber 16.

The atomizing or distributing head is hollow and the bottom wall thereof is provided with a comparatively large opening 44 and with an upstanding flange 45 around said opening so as to form an annular internal oil trough 46 at the bottom of said head. The top wall 47 of this head is flat and provided with a depending hub 48, and connecting this hub with the downwardly tapering circular wall 41 are fan blades 49, which serve to draw air into the head and direct the same outwardly to its peripheral wall.

The upper wall of the head may be provided with a circular depression 50, the surrounding wall of which is dovetailed, as at 51, and in this depression refractory cement or other suitable refractory material 52 may be arranged, it being retained in place by the dovetailed walls of said depression.

Keyed or otherwise secured to the motor shaft 39 is a primary distributor 53 disposed in the opening 44 in the bottom of the atomizing or distributing head 40. As illustrated, this primary distributor extends above and beneath said opening. While such location is not important, it is essential that the upper portion of this primary
distributor terminates within the atomizing or distributing head, regardless of whether or not it is provided with a funnel-like casing or body beneath said opening. This primary distributor is in the form of a funnel-like casting fastened to the motor shaft by means of a key 54, or otherwise, and it comprises a solid hub portion 55 and an upwardly flaring wall 56.

The oil is delivered to said primary distributor by spray nozzles 31, the oil being delivered therethrough under gravity, and the upper end of this supply pipe terminates above or within said funnel. As shown in the drawings, this supply pipe is passed through the atomizing or distributing head 40 which is secured to the motor shaft and consequently the fuel supply pipe 57 is directed upwardly through the opening 44 in the bottom of said head, it being a matter of no importance as to how this fuel pipe is brought to said opening since, in some instances, it may be found desirable to pass the same through the cylindrical wall of the air chamber 16 instead of through the outstanding flange 24 of the motor. The initial oil-feed openings 59 are disposed in line with the spark or flame areas of igniting devices 60, which are provided in the annular trough 21 in the bottom of the air chamber 16 and its lower end terminates a suitable distance beneath the outstanding securing flange 24 of said motor so that a receptacle can be suspended therefrom or, if desired, placed underneath the same to receive the oil drippings accumulating in said trough, as will be hereinafter explained.

While I have illustrated the shell of the furnace as cylindrical in formation, it may be of any other formation. Included in the hearth construction is a curb 65 providing two vertical endless curb faces 66, 68, respectively, and two horizontal ledges 68, 69, respectively, said endless curb faces being disposed in two different vertical planes, and the lower of these ledges being preferably in a plane beneath that in which the initial oil feed openings 59 in the atomizing or distributing head 40 are disposed, and also preferably in a plane beneath the sparking area of the igniting or sparking devices 60. Said curb is disposed between said igniting or sparking devices and the shell of the furnace, said sparking or igniting devices being in close relation to the inner curb face 66. The outer curb surface 67 is provided with vertical grooves 70 which extend upwardly from the lower horizontal ledge 69 and are gradually reduced in depth from their lower ends to their upper; the bottom walls 71 of said grooves being parallel and in close relation to the inner curb face 66. Grooves 72 are also formed in the ledge 69 and extend inwardly from the plane of the outer curb surface 68 toward the inner curb surface 69, said grooves being gradually reduced in depth inwardly. This curb 65 is constructed of units 73 of refractory material, which may be exact counterparts and constructed as shown in Fig. 9; said units being arranged both horizontally and vertically and having their meeting faces at corresponding angles so they may be used interchangeably to form the outer curb surface and upper ledge or the inner curb surface and lower ledge. The joints between the units may not, in some cases, be in perfect alignment, but this depends on the size and form of the furnace.

From the foregoing, it will be apparent that the fuel oil is delivered by suitable means through the supply pipe 57, and is directed into the primary distributor 53 secured to the motor shaft. When current is supplied to the motor, the shaft thereof is rotated, and with it the funnel-shaped primary distributor 53 and the atomizing or distributing head 40. Under centrifugal force, the oil delivered into the funnel-shaped primary distributor moves upwardly along
the upwardly-flaring wall of said distributor and is projected from the upper edge thereof evenly against the interior surface of the peripheral wall of least resistance, and consequently travels upwardly along and through the distributor grooves 53, and thence outwardly through the comparatively small initial feed openings 59, the oil under centrifugal force being projected from said feed openings directly into the sparking area of the igniting devices 65 and against the outer curb surface 67. To assure this horizontal distribution of the oil as it escapes from the initial feed openings 59, the atomizing or distributing head 74 is provided with a bead directly above the plane of said feed openings so that the oil is projected outwardly in contact with the horizontal lower face of said head, which assures an approximately straight-line course of travel for the oil distributed. Due to the admission of air into the air chamber and from the latter through the opening 44 into the atomizing or distributing head, the necessary quantity of air is mixed with the oil escaping through the initial feed openings so that a sufficient quantity of air is commingled with the oil to sustain combustion. Ignition of this mixture takes place immediately at the curb 65 in the region of the igniting devices, and as these devices are at a distance, the oil in atomized form is delivered against the outer curb surface 67 and onto the lower horizontal ledge 65 along the regions between the igniting devices. This oil trickles down said outer curb surface and accumulates in the grooves 70 therein, and it also accumulates in the grooves 72 formed in the lower ledge 65. The oil thus accumulated becomes ignited due to the fact that the flame adjacent the igniting devices carries along the curb from one igniting device to the other. Meanwhile, oil will have been projected through the exit or distributing openings 58, this oil being projected therefrom with the necessary quantity of air escaping through the lower portions of said openings so as to form a sustaining wall of air underneath the oil distributed from said openings, an initial commingling of air and oil taking place in the openings and in the course of the two ingredients outwardly therefrom. Due to the downward inclination of the exit or distributing openings 58, the air and oil is directed toward the hearth in a circular region between the atomizing or distributing head and the curb, and by said hearth is ricocheted in an upward direction toward the igniting devices and the flame already created by distribution of oil projected through the initial oil feed openings 59, the contact of the oil and air with the hearth causing a combustion of both, and in its upward and outward course under ricocheting action being further and more intimately commingled, especially with any oil and air that may be projected through the comparatively small initial oil feed openings 59. It is clearly here the key that a certain quantity of oil and air will escape through the exit and distributing openings 58 in a substantially horizontal plane, but the major portion of both oil and air will be directed downwardly against the hearth in the manner stated, and when ricocheted will intimately commingle with any oil and air which has managed to traverse a horizontal course in its escape from the openings 55, thus causing a complete and intimate distribution of the oil, air, and any combustible mixture and an extremely hot flame, completely along the shell of the furnace.

The electrical circuits depended upon to cause sparking of the electric sparking devices and operation of the motor are, as usual, controlled by a thermostat or stack-stack, and consequently both the motor and the electrical sparking devices cease to operate when the desired degree of heat has been attained. When the temperature lowers within the building or other area to be heated, the thermostat, or stack-stack, as the case may be, reaches a predetermined cooling point, and an electrical circuit is consequently closed to cause the sparking devices to function, and also the motor to again operate. Controls for this purpose are common and sometimes are in the form of a thermostat or stack-stack control located in the smokestack of the furnace, or a furnace-control or limit-switch placed on the furnace. Any common means for automatically regulating the heat may therefore be employed, as this forms no part of my invention.

In addition to automatic controls for the igniting device or the igniting device, it is common to employ an electrically-operated valve in connection with the fuel-supply pipe so that flow of oil is shut off when a predetermined high temperature is attained and automatically opened upon reaching a predetermined low temperature, the variations between high temperatures and low temperatures varying, according to design. These control elements operate in unison with the control devices of the motor and sparking devices so that upon starting of the motor and functioning of the sparking devices, oil will be supplied to the atomizing or distributing head. The oil in atomized form supported by the proper quantity of air will become ignited by the electrical sparking devices, or other approved fuel igniting means, and an endless or circular region of fire or flame created over the hearth inwardly from the shell 10 of the furnace, due to the fact that the flame will spread from one igniting device to the other, or when a single igniting device is employed, the flame will travel in a circular or endwise manner in the direction in which the distributing or atomizing head is rotated until a complete endless flame is provided which plays against the shell of the boiler and is directed upwardly toward the dome.

In the event that the controls function properly but the electrical igniting devices fail to spark or are, or any other igniting device employed fails to function, the atomized oil will lodge in the series of grooves formed in the curb and when these are filled will overflow onto the hearth, the space above which may be termed the fire box, until the stack-stack or other control shuts off, such control being normally arranged so that it will make a complete cycle and automatically shut off or "close down", even though no additional heat is generated by failure of the oil to ignite. Under such conditions a considerable portion of oil will have been accumulated on the hearth between the curb and the atomizing or distributing head, and would be liable to cause a dangerous explosion. To avoid this, the filler ring 43 arranged between the overhanging portion of the atomizing or distributing head and the inner marginal portion of the hearth is formed of material that will allow the oil to seep underneath the same and enter the air chamber 16, where it
accumulates at the bottom thereof within the annular oil trough 27, from which it escapes through the drip pipe 54. Any oil adhering to the wall of the atomizing or distributing head will, upon stopping of the motor, travel downwardly along the wall of said head and accumulate in the annular trough 46; such oil being utilized when the motor is brought into operation.

It will be apparent from the drawings that the shell of the boiler may be provided with an ash spit opening 75, and door 76, respectively, air being supplied through this opening to the space beneath the hearth so that it can be easily drawn into the air opening controlled by the valve 35, it simply being necessary to rotate the valve clockwise for diminishing the supply of air, and counterclockwise for increasing the same.

While the fan blades 49 function to draw air into the air chamber and also to direct the air outwardly toward the distributing openings 58, assisting in furnishing the necessary amount of air to the escaping oil to assure a proper combustible mixture, I particularly desire to stress the fact that the tangential arrangement of the fuel exit or distributing openings 58 and the initial feed openings 59 eliminates the possibility of said openings becoming clogged or carbonized, since the direction of rotation of said head is such that the circular wall of said head is moving in a direction away from the oil and air mixture projected through said openings. The leading or forward portions of the walls of said openings are freed of oil under the rotary action of the head, assisted by centrifugal force, in contradistinction to the usual action of the oil, which is dammed back or obstructed in its outward movement when such openings are drilled or otherwise formed radially in the head. This assures a free escape of the mixture of oil and air from the head under rotation of said head, while maintaining the desired trajectory for the mixture with a wide diffusion of oil and air and with full trajectory.

It is, of course, understood that the refractory facing or layer applied to the upper side of the atomizing or distributing head may be dispensed with, but the use of such facing will maintain the shaft of the motor in a cool condition.

Having thus described my invention, what I claim is:

1. An oil burner, comprising a hollow rotatable atomizing head having an upwardly-flaring wall provided internally with an annular groove, exit openings spaced apart in a plane above said groove, distributor grooves connecting said annular groove with said exit openings, means to supply liquid fuel to said annular groove and exit openings, and means to rotate said atomizing head.

2. In an oil burning apparatus, the combination with a motor having a shaft extending vertically therefrom, of a hollow atomizing head secured to the upper end of said shaft and having a downwardly-tapering peripheral wall, a top wall and a bottom wall provided with an opening through which said shaft extends, said peripheral wall having oil exit openings, a funnel-shaped distributor secured to said shaft and having its wide upper end opening into the interior of said atomizing head, and an oil feed pipe extending upwardly through the opening in said bottom wall and having a goose neck at its upper end adapted to deliver oil into said funnel-shaped distributor.

3. An oil burner, comprising a rotatable atomizing head, means to supply liquid fuel to said atomizing head, said atomizing head having means for distributing an initial quantity of oil therefrom and means for distributing a larger quantity of oil in a different plane than the oil initially distributed therefrom, and means to rotate said atomizing head.

4. An oil burner, comprising a hollow rotatable atomizing head, means to supply liquid fuel to said atomizing head, said atomizing head having means to distribute and project an initial quantity of oil outwardly therefrom in a substantially horizontal plane and means for distributing and projecting a larger quantity of oil in a plane different from that of the initial distribution of oil, and means to rotate said head.

5. An oil burner comprising a hollow rotatable atomizing head having an upwardly-flaring wall provided with exit openings spaced apart and with fluid intercepting means and distributing means extending along said upwardly flaring wall connecting said intercepting means with said exit openings, means to supply liquid fuel to said fluid intercepting means, said distributing means and said exit openings, and means to rotate said head.

6. In an oil burner, the combination with a motor having a shaft extending vertically therefrom, of a hollow atomizing head secured to the upper end of said shaft and having a peripheral wall provided with oil exit openings, a funnel-shaped distributor secured to said shaft and having its wide upper end opening into the interior of said atomizing head, and means adapted to deliver oil into said funnel-shaped distributor.

7. An oil burning apparatus, comprising a hollow rotatable atomizing head having a flaring peripheral wall provided internally with an annular groove, exit openings spaced apart around said wall and spaced from said annular groove and distributor grooves connecting said annular groove with said exit openings, means to supply liquid fuel to said atomizing head, and means to rotate said atomizing head.

8. An oil burning apparatus, comprising a hollow rotatable atomizing head having an upwardly flaring peripheral wall provided with exit openings spaced around said wall and with an internal annular groove having grooved connection with said exit openings, means to supply fuel to said internal annular groove, and means to rotate said atomizing head.

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