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J. H. JACKSON

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OIL BURNING APPARATUS

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FIG. 1.

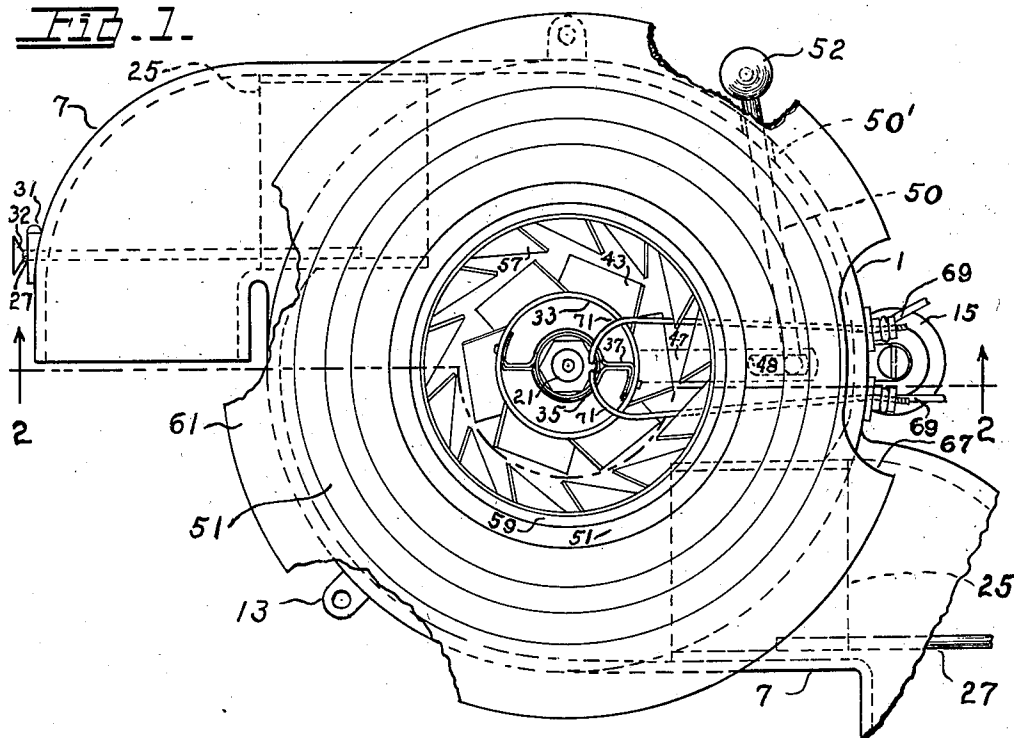


FIG. 2.

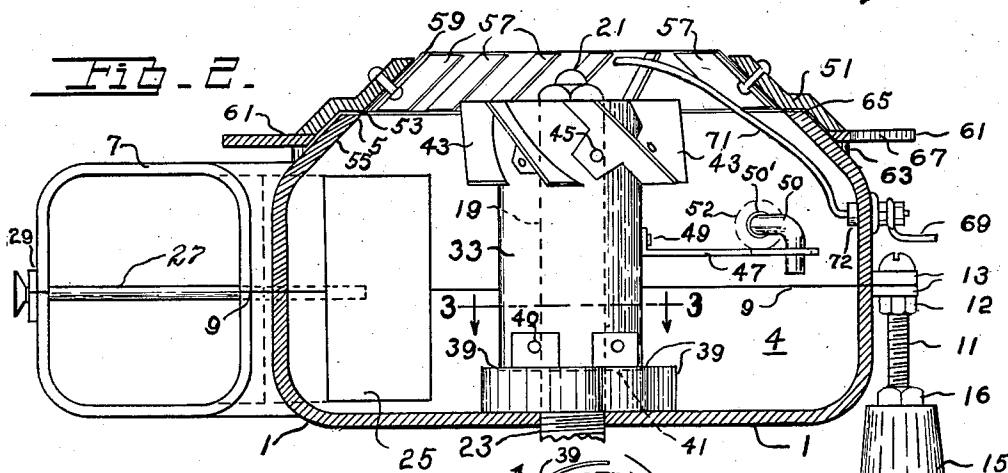
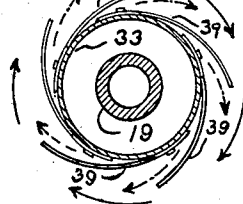


FIG. 3.



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OIL BURNING APPARATUS

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11 Claims. (Cl. 158—28)

My invention pertains to oil burning apparatus of the blower or gun type in which fuel oil is atomized through a nozzle and mixed with a stream of air for combustion, and is an improvement on my oil burner disclosed in my copending patent application Serial No. 115,974 filed December 15, 1936, and issued on November 28, 1939, as Patent No. 2,181,186.

Oil burner apparatus of the blower or gun type, while economical and simple to install, has previously had the difficulty that it was either noisy or, if the rate of air flow was regulated to decrease the objectionable noise the combustion was not satisfactory and an unburned mist of oil was created that was very objectionable.

It is accordingly an object of my invention to provide improved oil burning apparatus of the gun or blower type which so produces and supplies the combustible mixture of air and finely divided oil that by the complete mixing of all the air with all the oil it burns in suspension in a flame which is silent, dependable, efficient, steady and self-sustained.

It is also an object of my invention to provide such an oil burning apparatus of the vertical type in which a down-draft, or secondary air suction tube is provided around the oil spray nozzle having means associated therewith for utilizing the kinetic energy of the air swirling in the chamber for drawing air down through the down-draft tube from adjacent the spraying end of the nozzle, and having vanes provided between the upper end of the tube and the top opening of the chamber suitably inclined for guiding the swirling air smoothly from the chamber inside conical shaped walls.

It is a further object of my invention to provide in combination with such oil burner apparatus adjustable sleeves or other suitable turbulence regulators in the air delivery ends of the air inlet conduits to introduce the inlet air into the chamber with a minimum of turbulence to swirl smoothly around the chamber in co-operative relation with the down-draft tube and associated air guiding means.

It is another object of my invention to provide a down-draft or air suction tube for oil burners having centering means therein so that the tube may be conveniently installed in the air mixing chamber in coaxial and spaced relation on the oil supply stem of spray nozzles of vertical or horizontal type oil burners, vanes spreading and opening from the lower ends of the tube in a suitable direction for utilizing the kinetic energy of the swirling air in the chamber of the oil

burner for drawing air through the tube from adjacent the spraying end of the nozzle, and having inclined air guiding vanes projecting outwardly from the upper or outer end of the tube for smoothly guiding the swirling air in the chamber to the conical shaped inside walls as it rises from the chamber of the oil burner in which the down-draft tube has been installed.

Another object of my invention is to provide an improved blast ring in various sizes for convenient installation on the upper openings of the air mixing chambers of oil burners comprising a cast metal ring of generally frusto-conical conformation of a suitable shape and size around the larger or lower portion for fitting over the upturned or outer end of the air discharge opening of the air chamber of vertical or horizontal gun type oil burners, the smaller or upper portion of the ring being of a suitable size for restricting and defining the blast opening of the chamber on which the ring is installed, a set of inclined sheet metal vanes being secured to a conical ring of sheet metal fitted into the inside of the smaller portion of the blast ring, and the thin sheet metal vanes being suitably shaped and inclined to smoothly guide swirling air with a minimum of turbulence as it is projected from the air chamber of the oil burner.

Further objects and advantages are within the scope of my invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements, per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification in conjunction with the drawing disclosing specific embodiments of my invention, in which:

Fig. 1 is a plan view, partially broken away, and with internal elements dotted, showing a vertical type oil burner arranged in accordance with my invention;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; and

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2, showing the lower portion of the down-draft secondary or suction tube and having arrows applied to demonstrate the operation thereof.

Referring more particularly to the drawing it will be seen that I have disclosed my improved oil burning apparatus in combination in a vertical oil burner of the blower or gun type having an outer casing 1 of circular cross-sectional conformation for enclosing an air mixing cham-

ber 4 closed at the bottom and having an air discharge opening 5 in the upper wall thereof. Air supply conduits 7 connect into the casing for supplying combustion air into the air mixing chamber 4, and the casing and air supply conduits may be made as interfitting castings adapted to be clamped snugly together along a joint line 9 by any suitable bolts or screws 11 passing through apertured lugs 13 disposed in adjacent cooperative pairs on said casings. Each bolt 11 is provided with a nut 12 by which the lugs 13 are clamped together and the lower end of the bolt threadably enters any suitable pedestal support 15 where it is to be installed. A nut 16 on the bolt locks against the upper end of the support 15 to secure the oil burner casing 1 at a properly adjusted level above the floor 15'. The air supply conduits 7 are adapted to be connected with any suitable blower (not shown) or other source of air under suitable pressure, which may be either near or remote from the casing, and which may be automatically controlled to supply the air when heat is required, in any well known manner usual with oil burners, as will be readily understood.

The air supply conduits 7 open through the side walls of the casing 1 in such a manner as to deliver air therein with a swirling circular movement which is more effectively accomplished by having these conduits open through the side walls of the casing in a substantially tangential direction and at diametrically opposed positions.

In accordance with the usual practice in oil burners of this type, an oil supply stem 19 is mounted in the center of the bottom of the air mixing chamber from which it rises vertically, coinciding with the axis of the air mixing chamber 4, for supporting and supplying oil under pressure to an oil spray nozzle 21 for projecting a spray of finely divided oil particles through the top or air discharge opening 5 of the casing. In accordance with my invention, the various available oil spray nozzles may be used for projecting either a plain conical spray or a whirling spray, and in cooperation therewith my oil burning apparatus may be adjusted and arranged to provide the optimum conditions for efficient combustion. The base of the oil nozzle stem 19 may pass through a central aperture in the bottom of the air chamber 4 in a usual manner and be suitably threaded for attachment firmly therein to secure the spray nozzle 21 accurately in a central position in the chamber. A pipe 23 leads from the oil stem for connection with any oil supply source (not shown) to supply oil of properly regulated quantity and pressure in the usual manner.

As the air is delivered from the air supply conduits 7 to diametrically opposed positions in the air mixing chamber, the tangential projection of the air thereinto causes it to swirl around the centrally disposed oil nozzle stem 19 with a swirling circular movement, and it is very important that this movement of the air be as smooth and free from turbulence as possible. I have found that the smooth delivery and flow of air into the mixing chamber may be greatly improved by suitable air controlling means or turbulence eliminators such as sleeves 25 which are slidably inserted into the throats of the air supply conduits 7 where these open and deliver air into the chamber. An adjusting rod 27 is attached at one end, as by welding, to each sleeve 25 and projects outwardly therefrom through a suitable apertured bushing 29 in the side wall of the air con-

duit 7 to provide for convenient external regulation as by sliding the sleeves back and forth while the oil burner is in operation. To secure each sleeve in any adjusted position, a set screw 31 is provided in the side of the apertured bushing 29 for clamping the rod 27 in any set position. A knob 32 is on the outer end of the adjusting rod 27 to facilitate adjustment.

By adjusting either turbulence regulating sleeve 25 toward the air chamber sufficiently, it is possible to close it to eliminate blasting by air projected in from the other conduit, which would set up eddies and turbulence in the air stream. By the proper adjustment of both sleeves 25 the apparatus is regulated to receive a proper supply of air and to silently and thoroughly commingle it with the oil spray for efficient combustion, as also disclosed and claimed in my copending patent application previously mentioned, and issued as Patent Number 2,181,186.

In accordance with my present invention I provide a down-draft or suction air tube 33 which is of a suitable size to be placed down over the oil spray nozzle and the oil supply stem in a spaced relation thereon. As the down-draft tube is substantially larger in diameter than the oil supply stem 19, a pair of centering rings 35 are centrally secured therein, one near the bottom and one near the top end of the tube, as by radially extending brackets 37 which are attached to the side walls of the down-draft tube, as by rivets or welding. The centering rings 35 are made of a suitable diameter to fit snugly down over the oil spray nozzle and its oil supply stem, so that the suction tube 33 may be conveniently mounted in a coaxial spaced relation on the oil nozzle and stem by merely pushing it down thereon. A lower set of curved vanes 39 is provided each having one end attached to the lower end of the tube, as by rivets 40, as may be seen in Figs. 2 and 3. The lower vanes 39 project below the bottom of the tube 33 for holding the lower end 41 of the tube spaced above the bottom of the air chamber to provide an air flow passage thereunder.

Said lower circular shaped vanes 39 open and spread away from the lower end of the air suction tube 33 in a substantially spiral fashion and in a direction corresponding to the circular swirling motion of the air introduced into the air mixture chamber, as shown by the arrows in Fig. 3. By arranging the lower set of vanes on the tube in this manner, the kinetic energy of the air whirling around the chamber is utilized to create a suction, drawing air down from the upper end adjacent the nozzle and discharging it from the lower end of the tube out between the spiral vanes into the chamber. This operation serves the very useful purpose of eliminating or correcting the air eddies and turbulence in the vicinity of the nozzle so that a steady flame will be properly suspended above the nozzle and quiet efficient combustion will be obtained.

The air drawn down the tube is discharged from the bottom of the tube between the spiral vanes 39 into the air mixing chamber, where it is redirected by the moving air for free movement up and around the inside surface of the outer walls of the chamber.

A second or upper set of vanes 43 is also provided on the upper end of the tube to smoothly direct and guide the air stream moving up out of the air chamber around the oil spray nozzle. The vanes of the upper set are attached to the outside of the tube, as by rivets 45, and project

therefrom suitably inclined so that the entire set of vanes smoothly guide the swirling air stream, as it moves up into the air opening 5, with a minimum of stirring and turbulence. A lever 47 attached to one side of the air suction tube 33, as by a rivet 49, has a slot 48 pivotally receiving an end of a rod 50 extending out through a hole 50' in the side of the casing 1 for convenience in adjusting by a circular motion the angular position of the tube and associated vanes in the air mixing chamber. A knob 52 on the outer end of the rod 50 facilitates adjustment.

To provide a minimum of obstruction, stirring and turbulence in the flowing air stream, the air suction tube 33 with its associated centering ring and vanes are preferably made of thin sheet metal, such as a suitable gauge galvanized sheet iron for example. Various numbers of air guiding vanes may be utilized. Although as shown in the drawing five vanes 39 are in the lower set, and six vanes 43 are in the upper set inclined at about forty-five degrees to a horizontal plane, it is to be understood that such details may be varied to most effectively utilize the principles of my invention in various different installations. Mainly it is important that the number of vanes provided in each set be sufficient to guide the flowing air stream smoothly without stirring, and not so many as to form a substantial obstruction to the air.

Mounted on top of the oil burner casing around the top opening is a blast ring 51 which is selected of a suitable size for defining a blast opening of a proper size for the air chamber in accordance with the heat load demand to be satisfied by the oil burner in any particular installation. Also by selecting from different sized blast rings, one of suitable size, an oil burner casing of a given size can be very conveniently adapted for efficient combustion to satisfy the different heat load requirements of different locations, installations and buildings. The blast ring 51 may be a relatively heavy casting of a generally frusto-conical shape and, in the preferred form, my improved blast ring casting consists of two frusto-conical sections of different sizes joined integrally together in off set relation, as shown in Fig. 2, forming a down turned shoulder 53 adapted to engage or to be aligned with the upper edge of the inclined casing walls 55 around the top opening 5, and so that the inside of the larger portion fits down over the outside of the conically inclined walls of the casing around the top opening.

Inside of the upper or smaller portion of the blast ring I provide a set of thin vanes 57 suitably inclined and positioned to guide the air blast smoothly around the inclined side walls as it is projected upwardly from the air mixing chamber without stirring the air stream and causing eddies and turbulence. For this purpose the vanes 57 are preferably made thin, as of sheet metal, and are attached, in any suitable manner, as by rivets, to the inside surface of a sheet metal ring 59 of a frusto-conical shape suitable for fitting into the smaller upper portion of the air blast ring. The sheet metal ring 59 is then secured in the small upper portion of the blast ring 51 as by rivets.

When installed, the lower edge of the blast ring 51 sits upon the upper surface of a flat annular collar or hearth support plate 61 which is supported in a level position upon several stub or lug projections 63 on the outside surface of the tapered upper walls of the casing. Any suit-

able plastic material, such as fire clay for example, is applied between the abutting portions of the blast ring 51, the hearth collar and the casing 1 where it dries and sets to provide a snug well sealed connection so that the blast of air and oil spray is all discharged through the blast opening.

On one side of the hearth collar 61 an open portion 67 is provided in the outer edge to facilitate extending the insulated high tension electrical connections 69 which connect the two insulated igniting electrodes 71 which extend together into the chamber in slightly spaced relation adjacent the upper end of the oil spray nozzle. The connections 69 from the ignition electrodes extend for connection with any suitable source of high tension electricity (not shown) for supplying an igniting spark to ignite the oil air blast for starting the operation of the oil burner, in any well known manner usual with oil burners, and as referred to in my co-pending patent application, passing through insulating bushings 72 in the casing wall.

As shown, the air is introduced tangentially into the air mixing chamber from the air supply conduits 7 in such a direction as to cause a swirling rotation of the air in a clock-wise direction when viewed from above. In such an installation, the vanes on both ends of the air suction tube 33 and in the blast ring and my anti-turbulence sleeves 25 are all set in a proper direction for smooth air flow in accordance with the direction of rotation of the air whirling in the chamber. Also for effective commingling of the oil with the air, I prefer to use an oil nozzle throwing an oil spray which whirls in the reverse direction or counter-clockwise. This is the usual direction of rotation of the air in oil burners of this type, but it is to be understood that the principles of my invention may also be advantageously applied in any oil burner casing in which the air whirls in a reverse or counter-clockwise direction by merely reversing the positions of my sleeves and vanes which would then all continue to cooperate in a similar manner.

In operation, after the oil burner apparatus has been installed and assembled in the manner described, the movable sleeves 25 are adjusted in the ends of the air inlet conduits 7 until the required volume of combustion air is introduced in the air mixing chamber to swirl smoothly around the oil spray nozzle and stem 19 with a minimum of turbulence and eddies. This is conveniently accomplished by observing the burner in operation, as the beneficial effects of a proper setting of the turbulence eliminating sleeves are very noticeable. Also with the burner in operation the down-draft or suction air tube 33 is moved to various angular positions in the chamber by means of the lever 47 extending therefrom. The aim is to get the greatest quantity of air possible rotating or swirling smoothly around the inside surface of the casing without setting up a turbulence in the center which will interfere with the flame and the proper suspension thereof. The down-draft or air suction tube when properly adjusted draws air down from the vicinity of the oil spray nozzle and eliminates the turbulence at the upper end which usually interferes with the flame and prevents efficient and quiet and safe combustion. The air drawn down the tube by the whirling air in the chamber 4, passes out of the lower end into the air mixing chamber, as indicated by dotted arrows in Fig. 3, where it is redirected by the incoming air pass-

ing up around the outer walls of the chamber and free air flow is provided.

The oil burning apparatus is in this manner very conveniently adjusted for efficient combustion, and when properly adjusted the proper combustible mixture of air and finely divided oil is produced by mixing all the air with all the oil and it burns silently in a clean hot flame which is properly suspended in the combustion chamber of the furnace and which more efficiently burns the oil fuel to produce more heat from a given quantity of fuel oil. Furthermore, a heavier and cheaper grade of fuel oil may be successfully burned in my improved oil burning apparatus and such oil has more heat units, measure for measure, than the more expensive and lighter fuel oils which it was previously considered necessary to burn. My improved oil burner features and the principles thereof, although shown in combination in a vertical type oil burner, have also been advantageously utilized in horizontal types of oil burner apparatus, to which these improved features are equally adaptable.

It is to be understood that within the scope of my invention modifications and different arrangements may be made other than herein disclosed, and the present disclosure is illustrative merely, the invention comprehending variations thereof.

I claim:

1. In an oil burner the combination of, a casing forming a chamber having an air discharge opening in one side, an oil nozzle mounted in a substantially central position in said chamber for projecting a swirling oil spray from said opening, an air suction tube disposed in spaced relation around said nozzle for conducting air from adjacent the spraying end of the nozzle, air inlet conduits projecting through the side walls into the chamber at diametrically opposed positions and suitably directed substantially tangentially for projecting the introduced air into the chamber, vanes connected to and spreading spirally from said air suction tube for conducting air through the tube from adjacent the spraying end of said nozzle, and a set of inclined vanes disposed adjacent the air discharge opening of the casing.

2. The combination in an oil burner comprising, a casing enclosing a chamber and having an air discharge opening, a whirling spray projecting oil nozzle, said nozzle being mounted in a substantially central position in said chamber for projecting a whirling oil spray through said opening, air inlet conduits opening in a substantially tangential direction through the side walls of said chamber for delivering air into said chamber so that the air will circulate with a circular whirling movement around said nozzle, an air suction tube disposed substantially coaxial with and spaced from said nozzle, vanes connected to and spreading from said tube to utilize the energy of the whirling air in the chamber for drawing air through said tube from adjacent the spraying end of the nozzle, and a set of vanes suitably positioned and inclined for smoothly guiding the swirling air as it is projected from the chamber through said air discharge opening with a rotary movement.

3. In a vertical type oil burner the combination of, a casing forming a chamber having a top opening, an oil nozzle mounted substantially vertically and centrally in said chamber for projecting an oil spray through said top opening,

air inlet conduit means leading substantially tangentially into said chamber for imparting a circular swirling motion to the air after entering the chamber, a tubular member disposed in a coaxial spaced relation around said nozzle with the lower end spaced above the bottom of the chamber to provide a passage for down-flowing air, a plurality of vanes each attached at one end to the lower end of said tubular member, said vanes spreading in a generally spiral fashion from the lower end of the tubular member in a direction corresponding to the swirling motion of the air for utilizing the kinetic energy of the air to create a down-draft in the tubular member, and a second set of vanes attached around the outside of the upper end of the tubular member so that each vane is inclined with reference to the axis of the tubular member and suitably positioned in a proper direction to smoothly guide the swirling air to the inside surface of the walls of the chamber as it passes upwardly through the top opening of the chamber.

4. An oil burner apparatus comprising the combination of, a casing forming a chamber having an air discharge opening in one side, an oil nozzle mounted in a substantially central position in said chamber for projecting an oil spray from said opening, an air suction tube disposed in spaced relation around said nozzle for conducting air from adjacent the spraying end of the nozzle, air inlet conduits projecting through the side walls of the chamber in a suitable tangential direction for conducting air into the chamber so that the air will circulate therein with a circular swirling movement, adjustable turbulence regulating means disposed in the air delivery portions of the air inlet conduits for imparting a smooth whirling movement to the introduced air with a minimum of turbulence, vanes connected to and projecting in a generally spiral arrangement from said tube in a direction for utilizing the energy of the moving air to conduct air through the tube from adjacent the spraying end of said nozzle, and a set of vanes disposed in the air discharge opening of the casing with the vanes disposed in suitably inclined positions for smoothly guiding the swirling air therethrough as it is projected outwardly from the chamber with a rotary movement.

5. The combination with an oil burner comprising, a casing enclosing a chamber and having an air discharge opening, an oil nozzle, said nozzle being mounted in a substantially central position in said chamber for projecting a whirling oil spray through said opening, air inlet conduits opening through the side walls of said chamber in a substantially tangential direction of an air suction tube disposed substantially coaxial with and spaced from said nozzle, vanes connected to and spreading substantially in a spiral arrangement from the lower end of the air suction tube, a set of vanes projecting outwardly from the other end of said tube and suitably inclined in a proper direction for smoothly guiding the swirling air outward as it flows from the chamber around the tube with a rotary movement, means for adjusting the air suction tube in said chamber by turning it by a circular motion to various angular positions, a blast ring disposed on said air discharge opening for defining the blast opening of said chamber, and air guiding vanes supported on said blast ring projecting inwardly in suitably inclined positions for smoothly guiding the swirling air moving toward the air opening from the inside walls of the chamber and co-

operating with the set of vanes on the upper end of the air-suction tube for smoothly guiding the whirling air stream as it is projected from the chamber through the blast opening.

6. In a vertical oil burner the combination of, a casing forming a chamber having a top opening, an oil nozzle mounted substantially vertically and centrally in said chamber for projecting an oil spray through the top opening of the chamber, air inlet conduits leading substantially tangentially into said chamber at diametrically opposed positions for delivering air to circulate with a circular swirling motion after entering the chamber, adjustable turbulence regulating means movably disposed in the air delivery portion of each of said air inlet conduits opening through the walls of the chamber to cooperate therewith for imparting a smooth even whirling movement to the introduced air with a minimum of turbulence, a tubular air suction member disposed in a spaced and substantially coaxial relation around said nozzle with the lower end spaced above the bottom of the chamber to provide a passage for down-flowing air, a plurality of vanes each attached at one end to the lower end of said tubular member, said vanes spreading in a generally spiral fashion from the lower end of the tubular member in a direction corresponding to the swirling motion of the air for utilizing the kinetic energy of the air to create a down-draft in the tubular member, an upper set of vanes attached to the outside of the upper end of the tubular member at circumferentially spaced positions and suitably inclined to a horizontal plane for smoothly guiding the swirling air as it passes upwardly from the chamber, a blast ring on the top opening of said chamber, and vanes on the inside of said blast ring suitably positioned for cooperating with the upper set of vanes on the upper end of the tubular member to smoothly guide the swirling air blast projected from the chamber.

7. A vertical type oil burner comprising the combination defined in claim No. 6 and including adjusting means extending from said tubular member externally from said chamber for turning the tubular member with the associated vanes with a circular motion to various angular positions in said chamber.

8. A vertical type oil burner comprising the combination defined in claim No. 3 and including an adjusting member extending from said tubular member to a point external to said casing for turning said tubular member and the associated sets of vanes with a circular motion to various angular positions in said chamber.

9. A flame spreader and silencer adapted to be installed for redirecting the air in oil burners provided with an oil spray nozzle comprising, an air-suction tube of a suitable size for fitting over the usual oil spray nozzle and stem in the air mixing chamber of any such oil burner in a coaxial spaced relation, centering means in said

air-suction tube for supporting said tube in a coaxial spaced relation on any oil supply stem on which it may be installed, vanes connected to and extending from the lower end of said tube and suitably disposed to be positioned for cooperating with swirling air in an oil burner air mixing chamber in which the tube may be installed to create a suction to conduct air through the tube from adjacent the spray end of an oil spray nozzle on which it is installed, and a set of vanes attached on the upper end of said tube and projecting outwardly therefrom in suitably inclined positions for smoothly guiding a swirling stream of air passing outwardly from an air-mixing chamber in which the air-suction tube is installed.

10. A flame spreader and silencer adapted to be installed for redirecting the air in oil burners provided with an oil spray nozzle comprising, an air-suction tube of a suitable size for fitting over the usual oil spray nozzle and stem in the air-mixing chamber of any such oil burner in a coaxial spaced relation, centering means in said tube for supporting the tube in a coaxial spaced relation on such an oil supply stem on which it may be installed, a set of spiral vanes attached around the lower end of the tube, said spiral vanes extending below and spreading and opening out from said tube in a substantially spiral manner in a suitable direction to utilize the kinetic energy of the swirling air in an air-mixing chamber of an oil burner in which the tube may be installed for drawing air through the tube from adjacent the oil spraying nozzle at the upper end of the stem on which the tube is installed, and a set of air guiding vanes attached around the upper end of said tube and extending therefrom in suitably inclined positions for smoothly guiding a swirling stream of air to the inside of a conical shaped wall of an air-mixing chamber as it passes around and beyond the upper end of the air-suction tube.

11. In oil burner apparatus the combination of, a casing forming a chamber having an air discharge opening, an oil spray projecting nozzle, said nozzle being mounted in said chamber for projecting an oil spray from said opening, an air-suction tube disposed adjacent said nozzle for conducting air into the chamber from adjacent the spraying end of the nozzle, air inlet conduits connecting through the side walls of the chamber substantially tangentially for delivering air into the chamber so that the air will circulate therein with a circular swirling movement, a plurality of vanes each secured at one end to the lower portion of the air suction tube and the other end of each vane extending in a generally spiral direction from the air-suction tube in a direction suitable for utilizing the energy of the swirling air to conduct air through the tube from adjacent the spraying end of said nozzle.

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