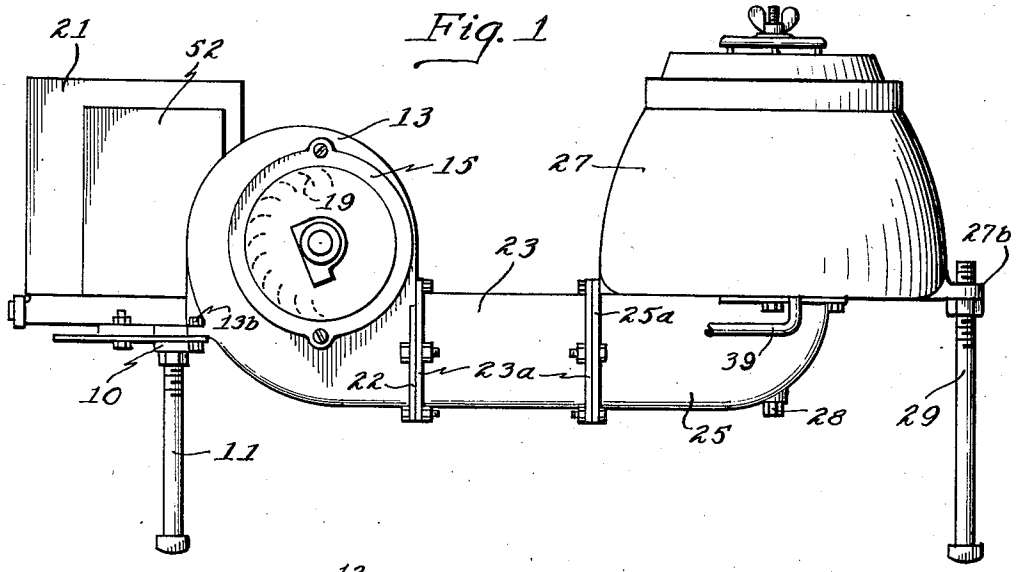
Nov. 26, 1940. J. C. REYNOLDS 2,222,854

FUEL OIL BURNER

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Fig. 1



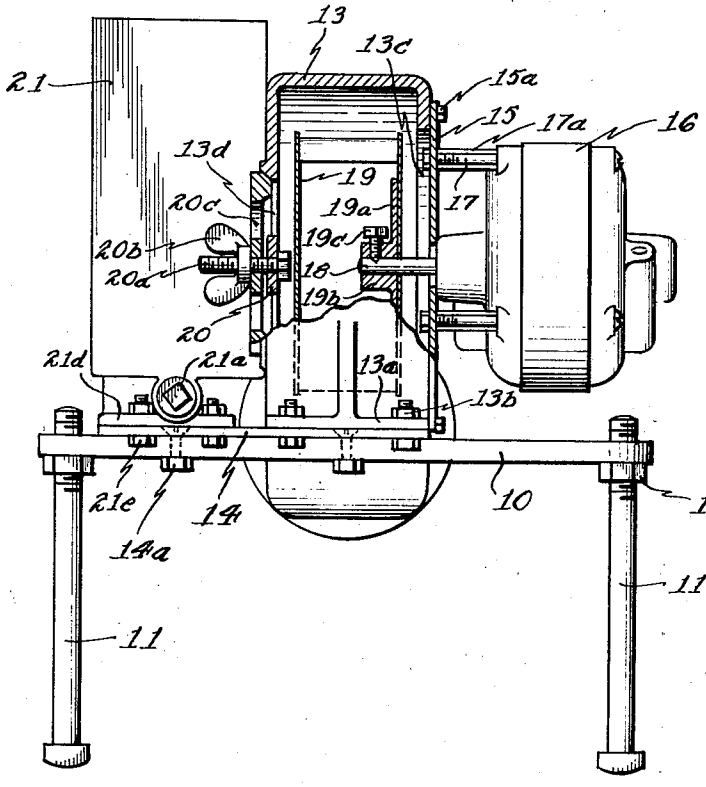


Fig. 2

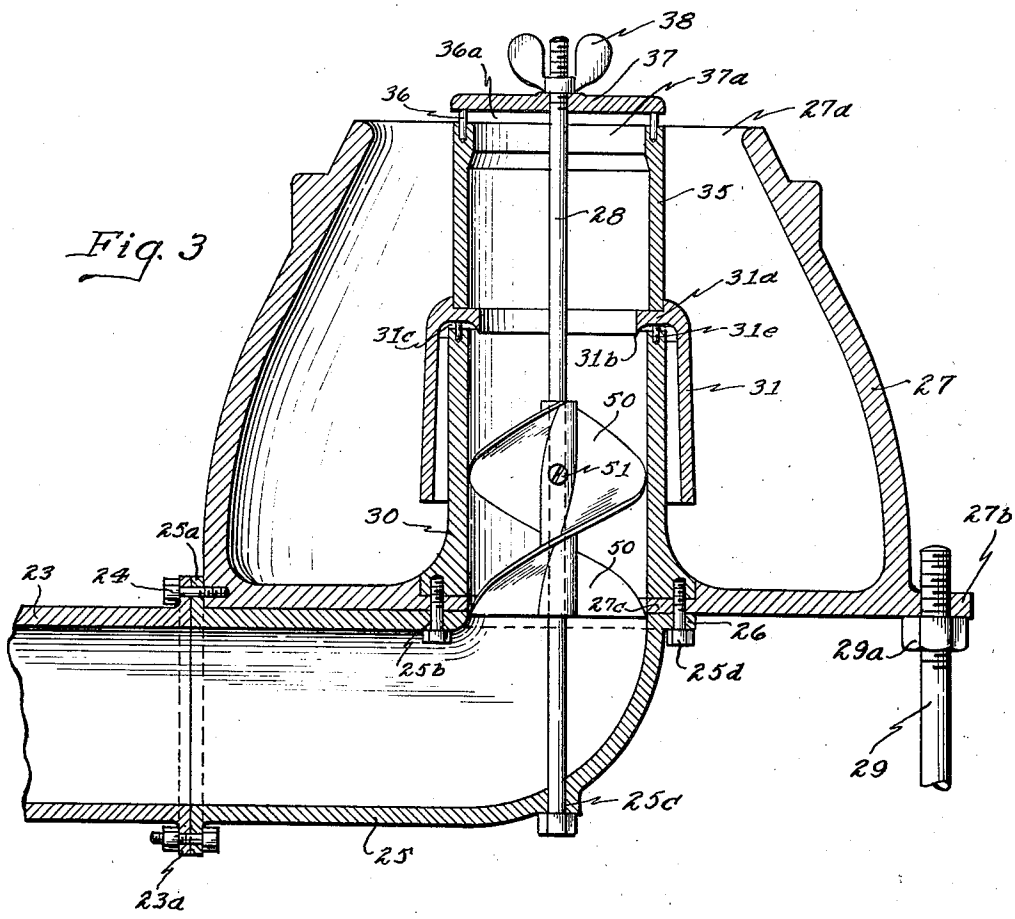
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FUEL OIL BURNER

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Fig. 3



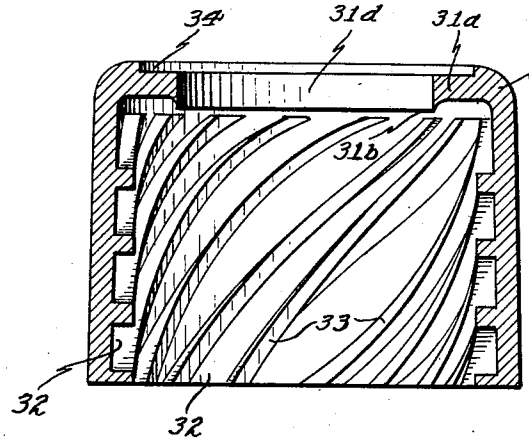


Fig. 4

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UNITED STATES PATENT OFFICE

2,222,854

FUEL OIL BURNER

James Carroll Reynolds, Mattoon, Ill.

Application July 7, 1938, Serial No. 217,937

9 Claims. (Cl. 158—91)

This invention is directed to a novel oil burner adapted for liquid vaporizable fuel such as fuel oil, and other petroleum by-product fuels.

My invention is also directed to a novel burner fire pot construction in which the air is rotated and passed out in spiral and circular paths; and in which air draft under which the ignition elements operate said elements will maintain a state of decarbonization.

Other novel provisions of my invention are pointed out in the following objects, specification and description.

It is an important object of my invention to provide a novel construction of a burner bowl assembly which causes both the primary air and secondary air to be inletted and passed through the area of greatest heat and therein pre-heated before it is used, by contact with center air housing which is maintained at a high temperature by the actual flame.

Further novel objects of my invention are:

(*a*) To provide a novel burner bowl and draft tube assembly in which the introduced air is first directed into spiral paths upwardly, whereafter a portion of said air is turned back and downwardly through spirally downwardly extending passageways to be outletted upon the inside surfaces of the bottom and side surfaces of the burner bowl.

(*b*) To provide a novel bowl and air pre-heater construction in which the remaining portion of the air is passed out from within the pre-heating chamber within the bowl through an annular laterally opening passage at the top of the bowl to cause desirable spreading of the flames emitting from the bowl, and also means for adjusting the size of said annular air outlet opening.

(*c*) To provide a novel construction within the burner bowl which will introduce the primary air into the bottom of the burner bowl to cause such draft of air to maintain the interior of the bowl substantially free from carbonization.

(*d*) To provide a method of ignition which kindles a slow fire, this in combination with novel structural features permitting a slow fire.

(*e*) To provide an oil burner apparatus having control means for blower motor operation only during burning operation on high flame.

Other and further important objects of the invention will be apparent from the following description and claims.

This invention (in one illustrative or preferred form), is illustrated in the following description, specification and drawings.

On the drawings:

Fig. 1 is a side elevation of my complete burner assembly omitting, however, any parts of a furnace into which the fire pot portion is mounted when installed.

Fig. 2 is an end elevational view (looking at the left of Fig. 1) showing the relative positions of the blower, motor and oil control valve.

Fig. 3 is an enlarged cross sectional view of the burner bowl and air pre-heating and separating units.

Fig. 4 is an enlarged cross sectional view of the air diverting and rotating unit within the burner bowl.

Referring to the drawings, reference numeral **10** designates a steel supporting bar forming a support on which the blower, oil control valve and adjacent parts are rested. Said bar is held at the desired height by steel lug bolts **11** which have their upper ends threaded in correspondingly threaded apertures in bar **10** and have also threaded thereon lock nuts **12** for securing the said bolts rigidly and against rotation. A flat steel supporting plate **14** is secured on bar **10** by suitable bolts **14***a*, as shown in Fig. 2, said supporting plate **14** forming a base on which the blower, fuel control level valve and connected parts are mounted.

A spiral metal fan housing **13** having flanges **13***a* is secured to base plate **14** by suitable bolts **13***b*, as shown in Figs. 1 and 2. Said fan housing has relatively large side openings **13***c* and **13***d* in the opposite parallel walls. Metal cover plate **15** is removably mounted on fan housing **13** over opening **13***c* by means of bolts **15***a*. A conventional electric motor **16** is securely mounted to said plate **15** by means of a plurality of metal connecting sleeves **17**, preferably four in number, and which have one end of each thereof secured in the motor housing. The opposite ends of said sleeves **17** abut the plate **15** and are removably secured by means of bolts **17***a*.

The armature shaft **18** of motor **16** projects into fan housing **13**, as shown in Fig. 2 and a blower type rotary fan **19** is mounted removably thereon by means of a mounting plate **19***a* having an apertured and threaded integral mounting plate **19***b* in which a set screw **19***c* is threaded and which is adapted to engage the motor shaft **18**. Securely mounted horizontally across the opposite air inlet opening **13***d* of fan housing **13** is a metal apertured cross bar **20** through which a bolt **20***a* extends. An annular apertured air intake adjustor plate **20***c* is mounted on bolt **20***a* and held in desired position by thumb screw **20***b*.

Said adjustor plate has relatively large openings therein which are so positioned that rotation of the plate varies the size of said openings to control the volume of air inflow.

As shown in Figs. 1 and 2, numeral 21 designates a metal oil valve housing having a removable drain and cleanout plug 21*a*. Said oil valve housing has an integral apertured flange 21*d* by which said housing is secured to base plate 14 by means of bolt 21*e*. Inlet port 21*c* is connected to a suitable fuel supply tank (not shown).

The open end of the spiral fan housing terminates in an integral flange 22 of substantially square cross-section, said flange having a plurality of spaced apart apertures to provide for mounting of a metal draft tube section 23, preferably of substantially square cross section. Draft tube section 23 has integral apertured end flanges 23*a* at each end, one of which is securely bolted against flange 22 by means of bolts 24.

A second metal draft tube section 25 of equal cross section and shown in cross section in Fig. 3, has its integral end flange 25*a* bolted to end flange 23*a* to form a tight seal. The other end of tube section 25 is curved so that the opening lies in a plane perpendicular to the longitudinal axis of the tube section. An integral apertured flange 26 on end of tube section 25 provides means whereby said tube section is bolted by bolts 25*d* to the bottom 27*a* of burner bowl 27. Certain of the bolts 25*d* pass through suitable apertures 25*b* formed in the end portion of tube section 25 and diametrically opposite to flange 26. The bent portion of tube section 25 has an aperture 25*c* therein for the mounting of the lower end of a bolt 28 which is secured therein by a suitable nut, as shown in Fig. 3.

As illustrated in Fig. 3, numeral 27 designates the cup-shaped metal fire pot or burner bowl which is preferably cast in one piece and whose annular side wall converges gradually inwardly to form a reduced upper opening defined by annular periphery 27*a*. Burner bowl 27 has an apertured threaded flange 27*b* formed integral with the bottom thereof in which is threaded a supporting leg bolt 29 which is secured in desired position by lock nut 29*a*.

Burner bowl 27 has a central bottom opening thereof of a size equal to and in registry with the upper opening of draft tube section 25, which bottom opening being defined by an annular flange 27*c* which is part of the bowl bottom. Said flange 27*c* forms an annular shoulder with the bottom, as shown in Fig. 3, thereby providing an annular seat for the lower enlarged end of a central cylindrical air housing member 30. The upper periphery of air housing member 30 has a plurality of spaced apart relatively short pins 31*e* which act as spacers to hold up air rotator member 31, thereby forming an annular air outlet space. Size of said space may be adjusted as desired by changing the length of pins 31*e*.

The bolts 25*d* also thread into threaded apertures formed in the lower end of the air housing member 30, as clearly shown in Fig. 3, to securely hold said air housing member in desired position.

Air rotator member 31 is an inverted cylindrical cup-like metal unit having integral inwardly extending annular flange 31*a* terminating in a relatively sharp annular edge 31*b*. The interior surface of the air rotator member 31 merges into a rounded annular surface 31*c* forming the lower wall of the flange. The size of the flange 31*a* is such that its annular sharp edge 31*b* extends a short distance within the center air housing casting 30, as clearly shown in cross section in Fig. 3. Said air rotator member 31 seats upon and is supported by a plurality of relatively short spaced apart lugs 31*e* which support said member in the position desired and illustrated in the drawings, and so that a part of the upwardly traveling air current would be deflected by the downwardly extending portion of the flange 31*a* to be directed through annular opening 31*d* and into the spaced apart spiral channels in grooves 32 formed on the interior portion of said air rotator member 31, as clearly shown in cross section in Fig. 4. The size of annular opening 31*d* may be increased or decreased by shortening or lengthening the lugs 31*e*. Referring to Fig. 4, it will be noted that the spiral channels 32 are defined by spaced apart spiral and substantially parallel inwardly extending integral vanes or flanges 33 which terminate substantially at the upper and lower edges of said air rotator member, as indicated in Fig. 4.

As shown in Figs. 3 and 4, the upper end of air rotator member 31 is so formed that an annular right-angled groove 34 is formed in the upper surface thereof concentric with the relatively large opening 31*d* in the top thereof, said annular groove providing a seat for the lower end of upper cylindrical member 35. Said cylindrical member 35 is preferably thicker at its upper end to provide a slightly narrower or more restricted opening. A plurality of metal pins 36, preferably four in number, are removably seated in spaced apart apertures formed in the upper edge of the cylindrical member 35, these supporting pins 36 being adapted to support a deflecting baffle plate 37 which is removably and adjustably mounted over the upper opening of cylindrical member 35, the periphery thereof being supported by the pins 36. To change the size of the annular opening 36*a* between the upper edge of cylindrical member 35 and baffle plate 37, it is only necessary to remove said baffle plate and insert pins of the desired length to support baffle plate 37 at the desired height. The baffle plate 37 is removably secured in the desired position by means of a relatively long bolt 28 which is threaded at its upper end and which upper end passes through a central aperture in baffle 37, said upper end having threaded therein a thumb screw 38. Said bolt 28 passes downwardly through the center of the chambers formed by cylindrical member 35 and air housing member 30 and its lower end passes through a suitable aperture formed in an integral boss in the draft tube section 25.

It is to be noted that the annular opening designated by numeral 36*a* is in substantially the same plane as the upper annular edge of the burner bowl 27, this being for the purpose of causing the air forced through opening 36 to contact, and mix with, the upwardly rising vaporized oil from the lower chambers of the burner bowl 27.

A pair of spiral metal vanes 50 are secured to the bolt 28 by suitable screws 51 within the chamber formed by cylindrical air housing 30. It is to be noted that as the forced air enters the bottom opening of the burner bowl or fire pot 27, it is immediately caused to rotate diagonally and spirally by the spiral baffles 50. Due to the inward projection of the annular flange 31*b* of air rotator 31, a portion of said air is deflected and caused to circulate through the opening 31*c* between the flange 31*a* and the upper edge of air

cylinder 30 to thence enter the various spiral channels between the inwardly extending vanes 33 of the air rotator member 31. This causes the air to continue in rotation in a spiral and diagonal direction in which direction it continues to travel as it strikes the bottom of the burner bowl or the fuel oil body therein, and it still continues to rotate in such spiral and longitudinal direction as it travels along the inside walls of the burner bowl 27 to cause a continuous sweeping action of the said side walls which prevents undesirable carbonization and carbon accumulation on the interior walls of said burner bowl.

The major portion of the air which is not deflected by the air rotator member travels upwardly through the air cylinder 35 and against baffle plate 37 which directs it in a radial direction to mix it with the upwardly rising mixture of vaporized oil and air from within the burner bowl. This results in a complete and efficient combustion about the rim of the burner bowl and causing a radially and upwardly extending flame.

An important feature and accomplishment of the aforedescribed construction is that the portion of the introduced air which passes through the air housing 30 and thence downwardly through the passage between the air-housing 30 and the air rotator member is substantially preheated by contact with the air housing member 30 and air rotator 31 and such air is therefore substantially heated before contacting the surface of the oil body in the bottom of the burner bowl. In similar manner, the air which is expelled through the annular opening 36*a* between the periphery of baffle plate 37 and the upper end of air cylinder 35 is likewise pre-heated to a substantial degree before it mixes with the mixture of vaporized oil and air from within the burner bowl.

Referring to Figs. 1 and 2, it is to be noted that metal oil supply conduits 39 and 39*a* communicatively connecting the outlet of the valve casing 21 with the inlets 40 formed in the bottom of the burner bowl at points substantially diametrically opposite to each other.

Attention is called to the fact that an oil level control valve is mounted within the metal enclosing casing 21, said valve being operable by the body of oil in said casing and adapted to maintain the same at an operating depth up to 3/8 of an inch. The oil from the bottom of said case runs by gravity through a conduit pipe 39, the end of which is communicatively fitted by means of a suitably threaded fitting in the two inlet ports 40 formed in the bottom of the burner bowl 27.

As the respective flames about the ignition coils continue to increase, a continuously increasing area and quantity of the body of oil is raised to its flash point, causing the flame to gradually spread over the entire surface of the oil body. As the aforesaid spirally moving air circulates and travels over the surface of the oil, the mixed air and vaporized oil is caused to move upwardly to the annular opening of the burner bowl defined by the rim 27*a* of the bowl 27. As the mixed air and oil reaches this opening, the rapidly expelled air which is forced through annular opening 37*a* in radial directions contacts the mixed air and oil from the bottom of the burner bowl, the consequent mixture igniting to cause a radially directed cup-shaped frame and complete combustion.

This operation continues until the respective circuits are closed to stop the motor, and consequently the inflow of air, and to actuate the relay switch which causes a closing of the fuel feed valve.

When the thermostat is at a predetermined setting, the same will close the switch and drop the oil level valve by means of its relay action, which same relay action breaks the two other circuits through suitable mercoid switches as attached to a relay bar, thus shutting off current to the motor and to the ignition circuits.

A warp finger switch (not shown) is normally in closed position during the relatively short period, namely one and a half or two minutes, during which it closes the circuit to energize the ignition cells. In the said period said warp switch is, by its own "warping" action, by utilization of a bi-metal element, caused to open and permit the ignition elements to cool and be off.

When the burner is turned off and the heating element in the warp finger is allowed to cool, the switch automatically closes and is then in readiness to heat the ignition elements when the burner is again turned on.

Simultaneous with the closing of said circuit by the operation of said warp finger switch, the relay switch is actuated to close the mercoid switches to connect the electric motor and circuit to start operation of the fan and to cause opening of the oil control valve 21*f* in the oil valve housing 21 to permit flow of oil into the burner bowl in the manner hereinbefore described.

I am aware that various changes may be made in the embodiment of the invention herein specifically described without departing from or sacrificing any of the advantages of the invention or any features thereof, and nothing herein shall be construed as limitations upon the invention, its concept or structural embodiment as to the whole or any part thereof except as defined in the appended claims.

I claim as my invention:

1. In a liquid fuel oil burner having a power driven blower, a blower housing, a fuel casing and fuel valve therein; a metal burner bowl having a reduced upper opening and a central air inlet opening; air conducting draft tubes connecting said blower housing and said burner bowl inlet; oil supply conduits connecting said fuel oil valve housing and the bottom of said burner bowl; means for conducting a portion of the forced air rising to the upper rim of said burner bowl comprising a lower air housing member and an upper air cylinder in alignment with each other and having their adjacent ends spaced apart, an air diverting and rotating member having an integral inwardly extending flange extending into the space between the adjacent ends of said air housing member and said upper air cylinder whereby a portion of the upwardly forced air will be deflected by said flange and directed radially and downwardly, the main portion of said air rotating member overhanging said lower air housing member; a plurality of spiral vanes on the interior surface of said air rotating member whereby the air diverted by said flange will be directed in spiral paths against the bottom and sides of said burner bowl, and a baffle plate mounted over the outlet of said upper air cylinder to cause the air passing therethrough to be directed radially to be mixed with the oil vapor and air mixture from within the burner bowl.

2. In a liquid fuel oil burner of the vaporizing type, a power driven blower; a blower housing; a fuel casing and fuel valve therein; a metal burner bowl having a reduced upper opening and a central air inlet opening; air conducting draft tubes

connecting said blower housing and said burner bowl inlet; oil supply conduits connecting said fuel oil valve housing and the bottom of said burner bowl; means for conducting a portion of the forced air rising to the upper rim of said burner bowl comprising a lower air housing member and an upper air cylinder in alignment with each other and having their adjacent ends spaced apart; an air diverting and rotating member having an integral inwardly extending flange extending into the space between the adjacent ends of said air housing member and said upper air cylinder whereby a portion of the upwardly forced air will be deflected by said flange and directed radially and downwardly, the main portion of said air rotating member over-hanging said lower air housing member; a plurality of spiral vanes on the interior surface of said air rotating member whereby the air diverted by said flange will be directed in spiral paths against the bottom and sides of said burner bowl.

3. In a liquid fuel oil burner having a power driven blower, a blower housing; a fuel valve casing and fuel valve therein; a metal burner bowl having a reduced upper opening and a central air inlet opening; air conducting draft tubes connecting said blower housing and said burner bowl inlet; oil supply conduits connecting said fuel oil valve housing and the bottom of said burner bowl; means for conducting a portion of the forced air rising to the upper rim of said burner bowl comprising a lower air housing member and an upper air cylinder in alignment with each other and having their adjacent ends spaced apart; a plurality of spiral baffles mounted in said lower air housing member; an air diverting and rotating member having an integral inwardly extending flange extending into the space between the adjacent ends of said air housing member and said upper air cylinder whereby a portion of the upwardly forced air will be deflected by said flange and directed radially and downwardly, the main portion of said air rotating member over-hanging said lower air housing member; a plurality of spiral vanes on the interior surface of said air rotating member whereby the air diverted by said flange will be directed in spiral paths against the bottom and sides of said burner bowl, and a baffle plate mounted over the outlet of said upper air cylinder to cause the air passing therethrough to be directed radially to be mixed with the oil vapor and air mixture from within the burner bowl.

4. A fire pot for oil burning apparatus of the vaporizing type comprising a circular metal bowl having a reduced upper opening and having a central air inlet opening in its bottom, and having oil supply inlet ports in its bottom; a cylindrical air housing member mounted in said bowl over said air inlet opening; spiral vanes mounted in said air housing member; a cylindrical air rotator member over-hanging said air housing member and upper integral inwardly extending flange, said flange being mounted above the upper edge of said air housing member, the remainder of said air rotator member over-hanging said air housing member; spacing elements for supporting said air rotating member to provide a restricted annular opening through which the portion of the upwardly traveling air will be diverted through said annular opening and downwardly against the bottom of the burner bowl; an upper air conductive member mounted upon said air rotator member and in alignment with said air housing member for conducting the remainder of said air upwardly, and an adjustable baffle plate removably mounted over the upper air cylinder member and providing an annular air outlet whereby the air passing therethrough will be directed radially to be mixed with the oil vapor and air circulating upwardly from within the burner bowl.

5. A fire pot for an oil burner of the vaporizing type comprising a substantially round burner bowl having a gradually inwardly-converging wall terminating in a reduced upper opening and a central bottom opening forming a forced air inlet port; oil supply inlets in the bottom of said burner bowl; an air housing member mounted in said burner bowl concentrically with said inlet air opening; spiral baffles mounted in said air housing member; a cylindrical air rotator member having an inwardly extending flange at one end and depending exteriorly of said air housing member, said flange being mounted above the upper end of said air housing member and providing a restricted opening between said flange and said upper edge of said air housing member; supporting elements for holding said air rotator member spaced from said air housing member; a plurality of spiral inwardly extending vanes on the interior of said air rotator member whereby a portion of the upwardly traveling air passing through said opening between said air housing member and air rotator member will be directed and expelled in downward spiral paths along the bottom and sides of the burner bowl; an air conducting cylinder mounted above said air rotator member and in alignment with said air housing member, and a baffle plate adjustably mounted at the upper end of said air conducting cylinder whereby the upwardly traveling air is expelled radially and outwardly to be mixed with the rising oil vapor and air mixture from within the burner bowl.

6. A fire pot for an oil burner of the vaporizing type comprising a substantially round burner bowl having a gradually inwardly-converging wall terminating in a reduced upper opening and a central bottom opening forming a forced air inlet port; oil supply inlets in the bottom of said burner bowl, the bottom of said burner bowl having shallow wells formed therein to provide for mounting of electric ignition elements; an air housing member mounted in said burner bowl concentrically with said inlet air opening; spiral baffles mounted in said air housing member; a cylindrical air rotator member having an inwardly extending flange at one end and depending exteriorly of said air housing member; supporting elements for holding said air rotator member spaced from said air housing member; a plurality of spiral inwardly extending vanes on the interior of said air rotator member whereby a portion of the upwardly traveling air passing through said opening between said air housing member and air rotator member will be directed and expelled in downward spiral paths along the bottom and sides of the burner bowl; an air conducting cylinder mounted above said air rotator member and in alignment with said air housing member, and a baffle plate adjustably mounted at the upper end of said air conducting cylinder whereby the upwardly traveling air is expelled radially and outwardly to be mixed with the rising oil vapor and air mixture from within the burner bowl.

7. In a fire pot structure for an oil burner of the vaporizing type, an annular metal burner

bowl having an inwardly converging annular wall terminating in a reduced opening, and having a relatively large central inlet and oil supply inlets formed in its bottom spaced from said central opening; a pair of metal cylindrical members mounted one above the other, the lower thereof being mounted over said central air inlet opening, and the upper thereof being spaced from the upper end of the lower cylindrical member; an air diverting and rotating cylindrical member of a circumference greater than said cylindrical air housing members and having an integral inwardly extending flange; spiral veins on the interior surface of said air rotator member, said annular flange extending into the space between said upper and lower air housing members and being spaced from the upper edge of the lower of said air housing members to provide a restricted annular opening whereby a portion of the upwardly forced air will be diverted by said annular flange through said annular space in a spiral downwardly to the bottom of the burner bowl, and adjustable baffle means for directing the air expelled at the upper end of said upper cylinder members in a radial direction.

8. In a fire pot structure for a fuel oil burner, a burner bowl having a substantially flat bottom and an air inlet opening in said bottom, and having inwardly converging walls terminating in a reduced upper opening, and having fuel inlet ports in said bottom; a substantially cylindrical air housing member mounted over said central air inlet opening and terminating substantially below the upper rim of said burner bowl; spiral air circulating vanes in said air housing member; an upper air cylinder mounted above said air housing member and spaced therefrom to form an annular wide air outlet opening; a cylindrical air rotator member exterior of said cylindrical housing member and having a portion thereof extending through said annular opening and projecting into the normal path of upwardly traveling air to cause a portion of the upwardly traveling air to be deflected and diverted into the space between said air housing member and said air rotator member; and a plurality of spiral vanes on the interior of said air rotator member for causing the diverted air to circulate in spiral direction against the bottom and side walls of said burner; and means for adjusting the annular side opening between the upper edge of said air housing member and the inwardly projecting portion of said air rotator member.

9. In a liquid fuel oil burner of the vaporizing and driven blower type, a burner bowl having a cylindrical air housing member in the burner bowl; a substantially cup shaped air rotator member mounted on and about said air housing member and adapted to divert a part of said upwardly moving air downwardly along the exterior of said air housing member; an air cylinder mounted above said air housing member and said air rotator member; and an adjustable baffle at the top of said air cylinder, said baffle being adapted to direct the air moving upwardly through said air cylinder toward the periphery of said burner bowl.

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