The invention relates to an improvement in pot type oil burner apparatus, the primary object of the invention being to provide a pot type burner having reduced tendency to accumulate non-combustible material.

Pot type oil burners are not as apt to be rendered ineffective by becoming clogged with fuel residue and impurities therein as are nozzle type oil burners, but usually the pot type burners are apt to become inefficient due to accumulations of non-combustible material in the burner pot.

Other more specific objects of the invention will become apparent from the following description of the illustrative form shown in the drawings wherein:

Fig. 1 is a side elevation of the burner pot and control cabinet assembly, partly broken away;

Fig. 2 is an electrical control diagram for use therewith;

Figs. 3 and 4 are plan and central vertical sectional views respectively of the burner, Fig. 3 being partly in section as indicated on Fig. 4; and

Fig. 5 is a fragmentary sectional view showing a modification in an air distributor portion of the burner assembly.

The burner or burner pot assembly, as shown in Figs. 1, 3 or 4, comprises a main hollow metal body casting 2 having a bowl-like bottom portion 3 of generally hemispherical form and an integral annular air receiving and distributing portion 4 including a nearly vertical rim 5 integrally connected to the bowl-like bottom portion 3 by an approximately horizontal ledge or web 6. Supporting legs 7 and 8 (cf. Figs. 1 and 4) adapted to rest on the floor F of any furnace or fire chamber may be connected to the web 6 at boss portions 9 thereof as by screw threads.

An electric-motor-operated blower, indicated generally at 10 in Fig. 1 and located in the control cabinet 11 which is suitably attached and sealed to the front entrance or doorway D of the furnace (parts of the furnace being indicated diagrammatically), receives air through an opening 12 of the blower casting and delivers it through a pipe 14 to the burner pot assembly. The air delivered by the blower 10 enters an annular plenum chamber 15 within the rim 5 of the burner pot casting 2. The chamber is formed or defined by the inner surface of rim 5, lower surface of a burner ring or plate 16 (overhanging the bowl of the burner pot) and the outer peripheral surface of an annular air distributor member 11 of sheet metal. Member 17 extends from the underside of the burner plate or ring 16 to the ledge 6 and rests on the ledge. The ledge 6 has an annular rib 18 at its inner limit which locates the distributor ring concentrically of the burner bowl and rim 5 thereof to form the plenum chamber 15.

The joint between the burner ring 16 and rim 5 of the burner casting is preferably sealed as by a rope-like asbestos strip 19a which may be forced into a gap of wedge shaped cross section made by a chamfer on the outer periphery of the ring 16.

Air delivered from the pipe 14 enters the plenum chamber 15 tangentially as shown in Fig. 3 through a tubular inlet portion 19 of the burner body casting 2 and thereby tends to circulate unidirectionally in the plenum chamber due to the manner of inlet and its centrifugal force. The circulating air in the plenum chamber is admitted at circumferentially spaced regions of the chamber to the annular space below the ring 16 through a series of openings 20 in the ring 17, being aided (in the construction according to Figs. 3 and 4) by baffles 21 bent out from the metal of the ring 17 as clearly shown in Fig. 3 into air-current-intercepting relationship to the interior of the plenum chamber 15.

Since considerable pressure is necessarily built up in the chamber 15, due to the nature of the walls which define it including the relatively restricted area of the openings 20, the air content of the chamber tends to remain in a cyclonic condition as it enters the burner ring. The bent-out form of baffles 21 distributes the introduced air while encouraging such cyclonic action below the ring or plate 16. An alternative construction of the ring 17 is shown in Fig. 5, wherein the metal portions 21' lanced from the ring to form the openings 20 are directed inwardly of the ring at acute angles to the associated wall portions of the ring.

In the case of the bent-out baffles 21 of Figs. 3 and 4, the baffles may extend outwardly uniform distances around the ring 17 (not illustrated) or, as shown, may be bent outwardly at progressively increasing distances from the region of the inlet 18 nearly back to said region, so that the various baffles tend to intercept proportional shares of the annular body of air for uniform distribution thereof to the burner pot. Such incremental interception is not ordinarily necessary because of the pressure built up in the plenum chamber over the pressure in the burner pot. If desired the ring 17 may be interlocked as at 17a with the body 2 as at a notch 17a to insure proper placement of the ring in case the baffles are differently disposed at different portions of the ring, as in Fig. 3. Either illustrated arrangement of the
lanced-out portions (2 or 2') of the ring 17 tends to maintain cyclonic action of the air admitted inwardly through the ring.

Fuel is admitted to the burner pot through a feed tube 25 which enters a bottom cavity 26 of the bowl portion 3. The lower end of a foraminous or porous low-flame-supporting wick or tip 27 occupies the cavity 26 and absorbs introduced fuel therefrom for supporting an initial or low-flame such as indicated at A. The amplitude of such flame is determined by the limited rate of admission of fuel to the cavity 26 through the tube 25.

The tip 27 is a rigid porous body preferably of incombustible ceramic material of the nature of fire clay and it may be molded or cut therefrom as desired. The flame may be lighted by a suitable taper, match or electric spark depending upon the elaborateness of the controls.

The illustrated control arrangement, to be described later, operates initially to admit only sufficient fuel to the cavity 26 to support a pilot flame A which may burn for an indefinite period at very low fuel cost, keeping the furnace above the dew point incidentally, until main flame heating is required. Such main flame, B, Fig. 4, is propagated simply by admission of fuel through the tube 25 at a greater rate for the required duration under conventional thermostatic control, the pilot flame A being maintained continuously whenever the main flame is not present. Thus only two feeding rates for fuel are necessary; once combustion or furnace operation is commenced.

The main flame (B, Fig. 4) is fed by absorption of the greater rate fuel feeding of the burner through a wick disc 30 which is preferably a circular flexible piece of sheet asbestos centrally perforated (without removal of material) and fitted over the tip 27 as at 31 in intimate contact therewith. The disc absorbs fuel from its underside which is in direct contact with the bottom of the pot hence with the cavity 26 and the absorbed fuel becomes gasified solely over the top side of the disc. No burning occurs at the outer edge of the disc although exposed. A heat retaining and air directing metal ring 32 having a central opening 33 concentric with the wick tip 27 lies over the wick disc 30 in spaced relation thereto, being supported by the pot portion 3 of the burner through the intermediary of the margin of the asbestos disc 30. The weight of the metal ring assists in holding the relatively flexible disc 30 in shape, i.e., generally conforming to the bottom of the pot.

The control cabinet 11, Fig. 1, has a readily removable top and front cover section 35 which enables access to the controls including an air gate 36 pivoted to the blower casing 10 as at 37 across the air inlet opening 12 to variably restrict it as will be described.

The principal parts of the fuel control, as schematically illustrated in Fig. 2, are obtainable at the present time as a complete unit, the casing for which is indicated at 40 in Fig. 1. A float chamber 42, Fig. 2, of the unit has the usual valving, not shown, for incoming fuel through a line 29. A safety latch, indicated by handle 43 and trip 44 is usually provided to close off the fuel line by the float valve until such time as the furnace is to be used. The fuel from the float chamber flows to a metering valve 45 shown as a plunger with a restricted cross passage 46 and main or high fuel service cross passage 47, the plunger being slidable in a suitable body, not shown, having inlet and outlet ports in registration with the restricted passage 46 in the illustrated lowered position of the plunger and with the high fuel passage 47 in a raised position (not shown) the plunger being biased downward by a suitable spring 48 against a bimetallic actuator 50 at a shoulder 49 on the plunger. The actuator normally holds the valve plunger in the low fuel position in which shown.

Closing of a main or service line switch 51 (usually located separate from the furnace control cabinet) connects the usual service line current to the primary winding 53 of a step-down transformer 54, thereby charging the secondary winding 55 connected to a room thermostat 56, as clearly shown. A thermostatic limit switch 57 is usually provided in the bonnet of the furnace in series with the room thermostat. Otherwise a jumper is used as at 58.

Assuming the pilot flame A is already burning at the ceramic tip 27, Fig. 4, and that the thermostat 56 is calling for heat, the low voltage in the secondary line portion 58 now heats a resistance element therein, hence the bimetallic actuator 59, releasing the metering valve plunger upwardly against a suitable stop such as a high-fuel-limiting adjustment screw 61. A corresponding initial rotation of the eccentric screw 62 is represented as limiting the downward valve-creating movement of the actuator arm.

As the operating arm of the actuator 50 raises to enable the high fuel adjustment of the metering valve (thereby admitting enough fuel to the feed tube 25 to charge the large wick disc 30), said arm closes a switch 65 in a main service line loop connection 66 which includes the motor 10', causing high speed operation of the blower.

While the flame in the burner pot 3 is relatively low, still burning at the ceramic tip 27, a correspondingly low rate of air supply should be admitted to the burner chamber through the pipe 14, distributor chamber 15, etc. Such regulation of air volume at low heat is the principal improvement hereof in the otherwise standard cleaning and installation intended to be illustrated by Fig. 2.

For the purpose just indicated I connect a variable resistance unit 70 between one side of the service feed line and the motor 10', as through a service line branch 71 leading to a portion of the loop 68. The unit 70, or at least its adjusting knob or lever, is located outside the cabinet 11 as on one of its end walls so that the resistance is adjustable with the cover 35 in place. The selector arm 72 of the resistance unit can thus adjust the motor speed from very low to its full or nearly full speed at which it operates when the switch 65 is closed and independently of all parts of the control system exclusive of the master switch 51.

During the full or nearly full line voltage operation of the blower motor 10' at the start of high flame burner operation the volume of air admitted to the burner pot is controlled by adjusting the air gate 35. After the air and the fuel have been properly mated for high flame operation and that operation has been discontinued the proper amount of air for the pilot flame is obtained by adjusting the speed of the motor by means of the control 70.

It is evident from Figs. 3 and 4 that heat radiated by the pilot flame A maintains the pot 3, ring 32 and annular top plate or ring 16 fairly hot; and, as soon as high fuel is admitted by the valve 45, soaking the asbestos wick 30, that flame
will commence to be propagated over the latter. The flame grows vertically at first in a rapidly whirling cone or pencil as air from the distributor openings 20 circulates in the pot in a descending cyclonic stream pouring toward the center as deflected by the ring 32 into supporting contact with the flame and rising therewith around the vertical central axis of the pot. The oncoming air maintains the annular top plate or ring 16, the pot walls and ring 32 relatively cool or normally below the glow point. At the same time the air is preheated by contact with the metal walls for efficient combustion. As the high flame attains the diameter as indicated at B below the plate or ring 16 the top of it spreads out into a whirl over the curved annular plate or ring 16 and continues at even height until the room thermostat is satisfied and returns the system to pilot-flame operation as already described.

Because the flame B burns cleanly and only off the main face of the wick disc 30 (not at the edges as usual with oil wicks) the wick does not become charred. The heat is sufficient to burn out all impurities hence the wick does not become clogged by oil residue.

The same thing may be said for the pilot wick tip 21. Being of ceramic material it is efficient in absorbing oil; does not become coated with carbon no matter how long the pilot flame is kept burning because it is unaffected by the intense heat of the main or high flame.

The burner is entirely safe in operation without requiring manual attention once put into service as described. As long as the pilot flame is maintained there can be no unburned gases generated at the burner. Should the pilot flame become accidentally extinguished from any cause the motor 16 will continue to operate at low speed thus purging the furnace of any unburned gases and cooling down the metal surfaces and any residual carbon to below incandescence.

I claim:
1. In a pot type oil burner, a metal body of bowl form having a bottom cavity extending below its lower surface, a rigid porous wick lying in the cavity and extending above said lower surface, a flexible porous wick of disc-like form surrounding the rigid wick and in contact therewith, means for supplying air to support combustion at both wicks downwardly and inwardly within the body and means for supplying fuel to the cavity for absorption by both wicks.

2. In a pot type oil burner apparatus, a metal body of bowl form, flame supporting means including a fuel-absorptive wick at the bottom portion of the body concentric therewith and fuel supply means therefor, means forming an annular air receiving and conducting chamber above the flame supporting means concentric therewith, the chamber having an inner wall with a series of openings and air-directing vanes associated therewith and extending therefrom in directions tending to maintain air passing from the chamber into the body in a cyclonic condition, and annular means overhanging the body concentric therewith and having a continuous downwardly directed surface arranged to deflect such cyclonically moving air downwardly toward the wick for supporting combustion thereover.

3. The burner apparatus according to claim 2 including means for charging the annular chamber with air in unidirectionally whirling condition and wherein the vanes extend outwardly from said inner wall generally unidirectionally and circumferentially at acute angles to associated portions of the wall for intercepting portions of the body of air circulating in the chamber.

4. The burner apparatus according to claim 2 wherein the vanes extend inwardly of said wall at acute angles to associated portions thereof and generally unidirectionally and circumferentially about the interior of said wall.

5. The burner apparatus according to claim 2 including means for charging the annular chamber with air in a unidirectionally whirling condition and the vanes extend outwardly at different distances from said wall incrementally therefrom into intercepting relationship to such whirling air.

6. The burner apparatus according to claim 2 wherein the inner wall of the annular chamber is a sheet metal ring having the vanes lanced therefrom whereby they are readily adjustable to vary the effective area of the openings.

7. A pot type burner comprising a metal body of bowl form having a central bottom entrance means for fuel and a wick in the form of a disc absorbatively associated therewith in contact with the bottom wall portion and exposed at its top face for supporting a flame thereover, said wick having a central upwardly protuberant pilot-flame-supporting portion, a metal ring overlying the wick and extending inwardly thereover within the body near the bottom thereof, and means to introduce air into the body so that it flows over the top of the ring toward the open portion thereof whereby flame tends to be propagated at the main upper face of the wick rather than at its marginal edges.

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