ROTARY FLAME SPREADER ANNULAR RETORT OIL BURNER

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The invention has for an object to effect improvements in oil burners adapted to general use, and especially suitable for use where a rotary mechanical flame spreader is required. It is valuable in conjunction with fire boxes having water passages in the walls thereof, though it may be used elsewhere as well.

Another important object of the invention is to coordinate a rotary mechanical flame spreader and fuel vaporizing retort in a novel relation whereby the rotary impeller becomes a part of the burner, and not merely a flame spreader, contributing to the efficiency of combustion by functioning in a new way.

It is an aim to eliminate the need for a casing around the impeller, and to make it possible to utilize a simple construction of impeller directly in the flame without liability of burning of the impeller (even if not of special alloy) or of excessive heating of parts.

An important object of the invention is to induce an especially efficient vaporization action in the device, and produce novel mixing and flame-form effects contributing greatly to the efficiency of heat generation and of heat transfer. Another object of great value is to enable the attainment of the advantages of the mechanical flame spreader and forced draft while utilizing the simplest form of burner construction, and to do this in a way whereby a very inexpensive gravity-feed fuel supply liquid retort burner construction may be employed.

Additional objects, advantages and features of the invention reside in the construction, arrangement and combination of parts involved in the embodiment of the invention, as will be understood from the following description and accompanying drawings, wherein Figure 1 is a longitudinal section of the complete burner and operating device. Figure 2 is a top view of the impeller. Figure 3 is a vertical section on the line 3-3 of Figure 2. Figure 4 is a horizontal section through the impeller midway of the blades, on the line 4-4 of Figure 3. Figure 5 is a plan of one arm of the blank for the impeller.

There is illustrated a burner comprising a base plate 10, which may be variously formed to suit requirements of different furnaces, and in the present instance is formed with a motor footing 11 at the outer end adapted to sit upon a floor and a burner footing 12 to sit in an ash pit, the footings 11 and 12 being connected by a raised intermediate section 13 adapted to extend clear over the ash pit sill.

In the burner foot there is set a standard 14 the upper end of which is set in a socket 15 integrally formed on the lower side of an annular cast, trough-like open retort burner body or bowl 16 (although more in shape like a saucer) having a deep narrow annular channel 17 or slot at the inner side concentric with the bowl, which receives fuel oil or the like from a fuel supply pipe 18 engaged by a threaded joint in the bottom of the bowl, a suitable fuel inlet opening 19 being formed through the bowl to permit the fuel to enter the trough. The inner wall of the slot forms the boundary of the opening 19, and is extended to the same height as the lip of the bowl. Fuel may be supplied through the pipe 18 from any suitable source, the present instance involving what may be a gravity supply 20 and regulating valve 21 in the pipe 18, and an automatic valve 22 incorporated at a suitable location, which may be thermostatically controlled in any usual way.

The burner body is also fitted with a drain pipe 23 leading from an outlet or drain opening 24 in the burner at a higher level than the fuel inlet opening 19, this opening 24 and the drain pipe being the same height as the inlet opening and fuel supply pipe. The outer end of the drain pipe leads downward to an automatic safety cut-off including an operating bucket 25, so that when the latter is filled by oil draining from the burner, the bucket with its content operates the cut-off, as is well understood in the art. The pipe 23 has a loop or dip 24' therein, whereby oil may stand therein in sufficient quantity to form a trap to prevent air from entering through the pipe. The cut-off may include both the valve 22 and a switch 22' in the circuit to a motor 26, the valve, switch and circuits not being illustrated in detail, since they are familiar in the art. The automatic cut-off devices and the operating bucket 25 are all mounted longitudinally outward of the motor on the foot 11 of the motor. On the standard 14 an extension 27 is formed having a horizontal step or ledge 28 on which there is formed a bearing 29 supporting the outer end of the motor shaft 30 which is of considerable length in order that the motor may be without the ash pit while the shaft drives the flame spreader in the furnace.

On the extension 27 there is also a bearing 31 in which there is set a vertical impeller shaft 32. The annular burner 16 has a very large central opening or air port 33 therethrough formed by the inner wall of the channel 17, and across the open-
ing there is an arm 34 integral with the burner, in which arm a bearing is formed concentric with the burner, supporting the impeller shaft 32. A worm member 35 is mounted on the motor shaft 20 engaged with and driving a worm gear 38 on the impeller shaft, so that the latter may be driven at proper speeds by the motor 26.

On the upper extremity of the shaft 32 there is fixed an impeller 37 having a series of blades 38 movable on the shaft as a center over the annular bowl 16. The body of the impeller is located well above the burner 16, but the blades thereof are projected downwardly and have lower edges located closely adjacent the plane of the top edges of the bowl. The inner edges of the vanes are spaced radially beyond the outer side of the channel 17, leaving a space between the vanes and inner wall of the channel through which air may pass freely downward into the bowl. This impeller is stamped integrally from sheet material, though it may have a hub piece 36 fixed therewith, if desired.

The blank of the impeller as stamped in the flat appears as a disc 40 with a series of radial strips or arms at the ends of which are lateral extensions comprising approximately rectangular blade plates 38 projecting all in the same direction. These plates may appear substantially like flags full spread from their staffs. The arm portions and disc form a spider, and the arms are broadened sufficiently so that one half, 42, may be turned downward at right angles to the other half 43, forming a stiffening flange, the blade forming a continuation of this flanged flange half and being turned at the same time and to the same degree so that it is at right angles to the plane of the spider. The part 43 or arm proper may stop short of the extreme outer peripheral edge 44 of the blade 38, and the part of the blade outwardly of this extremity is curved reversely with respect to the direction of rotation of the impeller. This curvature is greater at the upper part than at the lower part, whereby air drawn and impelled outward across the burner 16 and up the sweep over the trough, and a comparatively high vacuum condition is produced over the trough, and particularly over the channel 17, whereby vaporization of fuel at lower temperatures than usual is accomplished.

The plate disc portion of the spider may be stiffened or reinforced as desired and secured to the upper end of the shaft 32 in any approved manner. In the present instance a thicker plate or hub piece 39 is secured thereto receiving the shaft, which is pinned therein.

In use, the parts being assembled as described, the hand valve 21 is opened, a piece of oil-saturated waste is laid in the channel 17 and ignited, and after a short period sufficient to heat the burner body 16, the switch to the electrical circuit is closed and the automatic fuel valve opened, the bucket device 25 being set in burner-operating position. Fuel reaching the burner now will be vaporized and the vapor ignited by propagation of the flame after admixture with air from the port 33. The rapid movement of the impeller causes a rapid horizontal radial movement of air across the channel 17 and also draws away from the trough the vapor forming, so rapidly that a partial vacuum is formed throughout the channel, enhancing the vaporization of the fuel, as will be understood due to lowering of atmospheric pressure therein. Furthermore, the vanes passing along the channel, and if desired, projecting downwardly thereinto short of the drain level, create whirls and gyrations of the air and vapor which contribute to effective mixture thereof and efficient combustion. At the same time the flame is caused to spread horizontally across the floor 50 of the combustion chamber or fire-box of the furnace on which the device is installed. In addition, the rapid inflow of the air supply cools the bearing at 34 and the impeller. The air moving upward rapidly as it enters through the burner port 33 has momentum, which when the blades 38 of the impeller thrust it outwardly contributes to the production of the vacuum effect over the channel 17, and as the air sweeps outwardly it is in contact with the spider 40—41 and upper parts of the blades 38. This is a reason for the inversion of the impeller. The lower one-third parts of the blades are found to operate in the flame propagating toward the axis of the bowl (although, due to outward movement of air with great rapidity, the flame may not reach entirely across the bowl), and the air passing over this flame is heated before admixture with the vaporized fuel so that a highly inflammable mixture is produced.

The installation of the burner is accomplished by setting up the feet 12 on the floor of the ash pit of a furnace or air chamber having a corresponding boss, and a floor 50 of refractory material is formed on a level with the burner and meeting snugly therewith below the outwardly sloping side 16 of the bowl, this floor being airtight and being extended flush to the sides of the fire-box or combustion chamber. This floor may be made of fire-clay or made up of refractory material of suitable thickness. It becomes highly heated under operation of the burner, so that the flame shaft may be manifest therefrom upon the surfaces of the fire-box or combustion chamber, and it also serves to heat air entering the ash pit or air chamber.

The effect of this heating of air is to enable the heated air to pass directly to the port 33 through the burner, and thence outward across the channel 17 across the floor 50.

In the outer end portion of the drain pipe 23, a portion of steel wool 23', mineral wool or other fibrous material may be introduced, if desired, to prevent ingress of vermin and also to retard enthanol of air if no oil is in the trap 24 of the pipe. The saucer-like outer side 16 of the bowl forms a broad friend zone formed by the channel 17 so that fuel oil may spread over the lower part beyond the channel 17 in a very shallow pool or film, enabling its ready vaporization.

An auxiliary safety drain device 51 is provided, consisting of a Y fitting 52 connected in the fuel feed pipe 18, from which a stand pipe 53 is extended upward to a return fitting 54 having a vent opening 55 in its upper side. A drain pipe 56 leads from the return fitting to a point over the bucket 25, so that in case the pipe 24' becomes clogged, the oil will flow through the fitting 54 and drain pipe 56. The vent 57 prevents siphon action of the drain 51. The drain pipe 23 and drain opening 24 may be omitted if desired, simplifying the connections.

I claim:

1. In a burner of the character described, a combustion chamber having a floor, a burner bowl fitted snugly therein comprising an upper saucer-shaped part above said floor, and an inner integral deep narrow concentric annular channel portion set in and fitted in the floor, the bowl having a coaxial main air inlet opening there-through, the inner wall of said channel forming...
the opening and being extended above the bottom of said saucer-shaped part, a rotary shaft concentric with the bowl and extending through said opening and above the said inner wall, an impeller fixed on the upper end of the shaft including a spider portion spaced above the said inner wall to afford clearance for passage of air laterally thereunder and across the bowl, said impeller including vanes extending downwardly from said spider to adjacent the top of said wall and bowl and spaced radially beyond the said channel, whereby a space without bounding wall is formed within the impeller over and around the air inlet.

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