Sept. 28, 1937. D. H. HILL 2,094,069

YELLOW FLAME OIL BURNER

Filed June 14, 1935

Fig. 1

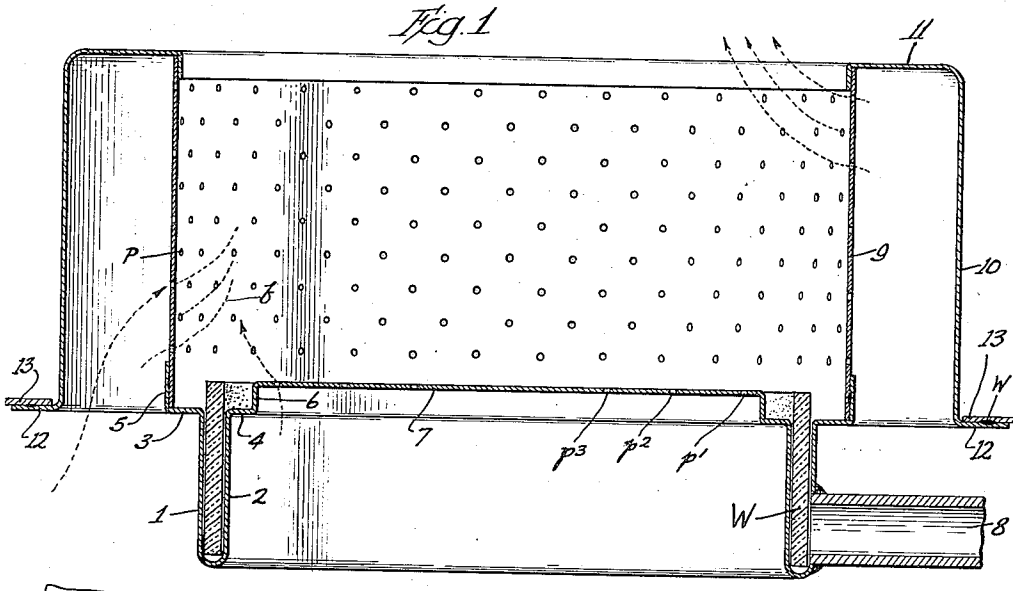


Fig. 2

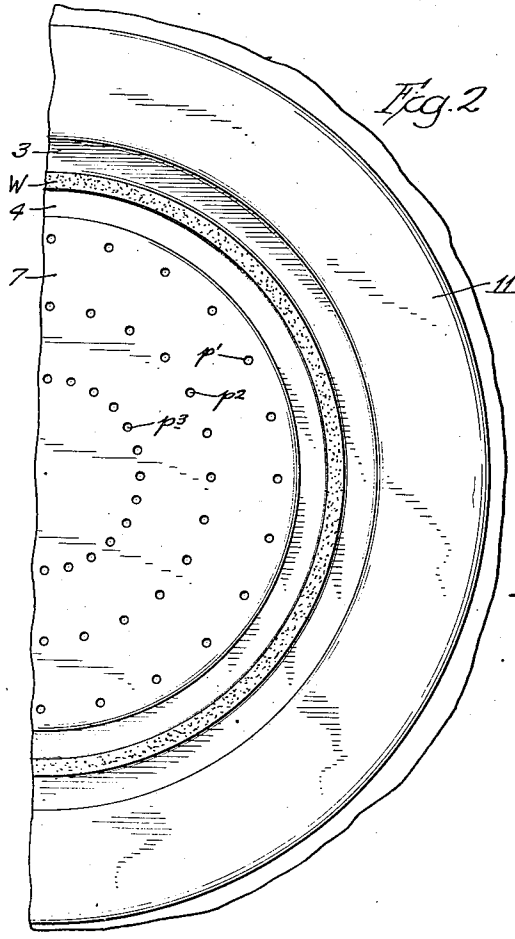
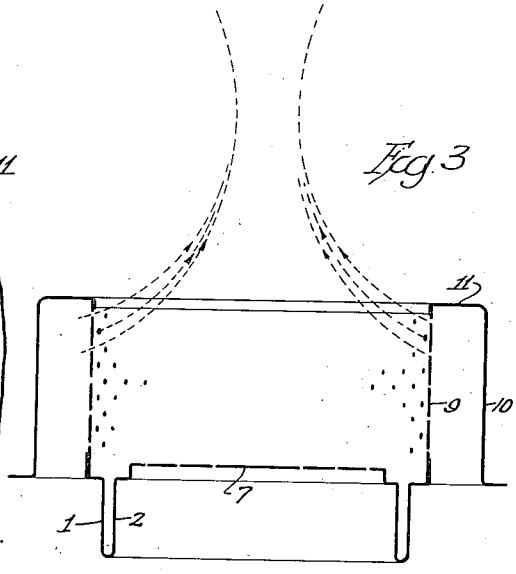


Fig. 3



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Patented Sept. 28, 1937 2,094,069

UNITED STATES PATENT OFFICE

2,094,069

YELLOW FLAME OIL BURNER

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Application June 14, 1935, Serial No. 27,714

5 Claims. (Cl. 158—94)

My invention relates to oil burners of the so-called "pot type", in which the flame is produced within the interior of a substantially pot-shaped part of the burner. In general, the objects of my invention are those of providing a simple, inexpensive and highly efficient burner of this class which, when used with a stack draft will produce a clear yellow flame even with a low rate of oil consumption; which can instantly be lit by merely dropping a lighted match into it, and which will avoid numerous objections heretofore encountered with pot type oil burners.

More particularly, my invention aims to provide a pot type burner having the following cooperating features for producing the also recited advantageous effects:

(1) The use of a sparsely perforated pot bottom and the upward feeding of the oil by a wick from a trough surrounding the perforated bottom portion, instead of having the oil flow and spread upon the burner bottom to form a layer of oil which cannot be lighted with a mere match.

(2) Disposing the upper end of the wick near air-admitting perforations in the burner bottom, and also near the lowermost row of air-ports in the riser wall of the burner pot, thereby enabling the combustion to be started by merely dropping a lighted match on the wick.

(3) Supplying the air for the air ports in the port wall from an air chamber surrounding this wall, into which chamber air is drawn upwardly; thereby enabling the lowermost air ports in this pot wall to supply sufficient air, when oil is fed at a low rate to the wick, to maintain small flames near the lower portion of the pot wall, and also pre-heating the air when the burner is operating at a higher rate of oil consumption.

(4) Proportioning the height of the said pot wall to its diameter so that with air ports disposed in horizontal rows at varying wall heights and of uniform diameters, the combustion will be efficient regardless of the upward and downward shifting of the resulting flame in response to variations in the rate of oil supply and in the draft of the stack connected to the heater in which the burner is used.

(5) Providing auxiliary air ports in the burner bottom, in addition to those disposed near the wick, for assisting in keeping the oil vapor (which rises from the wick) near the perforated riser wall of the pot and for increasing the draft up the burner when the oil is fed at a high rate.

Illustrative of my invention,

Fig. 1 is a full sized central and vertical section through an oil burner of adequate capacity for consuming 8 gallons in 24 hours when used in a heater drum connected to a draft-producing stack, including a portion of a heater-drum bottom to which the burner is fastened, with dotted lines indicating the axes of the initially separate flames produced when the oil supply is throttled to its operative minimum.

Fig. 2 is a fragmentary plan view of the same burner.

Fig. 3 is a reduced central and vertical section, with dotted lines indicating the flame produced with substantially the maximum rate of oil supply.

In the illustrated three-piece construction of my burner, the lower part comprises an upright annular oil trough having concentric tubular sides 1 and 2 of equal height extending upwards for a height many times the width of the annular space between these sides, and having a widened mouth portion of relatively short height in proportion to the said trough sides. This widened mouth portion comprises an outer annular flange 3 extending radially outward from the upper end of the outer trough side 1, an inner annular flange 4 extending radially inward from the upper end of the inner trough side 2, and two short tubular portions 5 and 6 rising respectively from free edges of the said two flanges.

Spanning the upper end of the inner tubular portion 6 of the trough mouth, and desirably forming a part of the same sheet metal stamping with the oil trough and its wide-mouthed upward extension, is a horizontal burner bottom 7. Seated in the annular oil trough, to the lower portion of which oil is normally supplied through an oil pipe 8 is an annular wick W, preferably of a non-combustible material such as woven asbestos, which desirably presents its upper edge approximately at the same level as the top of the burner bottom 7.

Telescoped at its lower end into the outer tubular portion 5 of the said lower part of my burner and desirably welded to this portion, is a perforated tube 9 which forms the riser wall of my pot type burner, which tube desirably has a height approximating the radius of its bore. This tube is freely surrounded by an imperforate riser tube 10 which is spaced from and maintained coaxial with the tube 9 by an imperforate annular flange 11 extending radially inward from the upper end of the riser tube 10, the said flange having its inner portion welded to the upper portion of the perforated tube 9 which constitutes the riser wall of the burner pot.

The lower end of the imperforate outer tube

10 desirably has an outwardly extending horizontal flange 12 adapted to be welded (as at W) to a heater drum bottom 13 which has a perforation through which the said outer tube 10 extends upwardly. Thus arranged, the said outer tube 10 together with the top flange 11 respectively constitute the riser wall and the top of an air chamber surrounding the perforated pot wall 9, within which the major part of the air supply for the burner is warmed before passing through the perforations P in that pot wall into the interior of the pot.

For efficient operation, the perforations P in the pot wall 9 desirably are distributed uniformly circumferentially of the said wall and also are distributed over a height reaching, from near the top of that wall, down to a level somewhat higher than the pot bottom 7. In practice, these perforations may all be uniformly spaced, as here shown, since the outer tubular portion 5 of the lower sheet metal part of my burner can cover an unduly low row of such perforations, thus permitting the perforated pot wall 9 to be cut from a strip of standard perforated sheet metal. However, this strip or blank is desirably cut so that the perforations in consecutively superposed rows will be relatively staggered, as in Fig. 1.

To co-operate with the said wall perforations and to facilitate the lighting of the burner, I provide the burner bottom 7 with auxiliary perforations, the total area of which preferably is less than half of the total area of the perforations in the said burner wall. These bottom perforations preferably include an outer circular row of air ports p^1 relatively close to the periphery of the bottom 7, and therefore near to the oil vapor which is evaporated from the wick W, and additional rows of air ports spaced farther from the wick, such as the rows of ports p^2 and p^3.

When oil is first supplied to the oil trough through the oil pipe 8, some of this oil is drawn up into the upper portion of the wick by capillary action. The burner then can speedily be lit by merely dropping a lighted match on or near the exposed portion of the wick, since the needed air will readily enter through the lower row of perforations P in the pot wall and also through the outer row of air ports p^1 in the pot bottom. The flame then speedily travels around the wick and the resulting warming of the oil vapor soon causes separate small flames to be formed along flame axis lines (such as f in Fig. 1) corresponding somewhat to the direction of the air jets entering through the lower rows of perforations in the pot wall.

The heat of these flames then gradually increases the rate at which the oil is drawn up into the wick and vaporized from the upper portion of the wick. This heat also gradually warms the entire heater drum so as to increase the draft in the usual stack leading from the (not illustrated) upper portion of the heater drum, so as to increase the rate of air supply correspondingly.

Then, when the metal of the burner also becomes sufficiently hot so that the oil in the oil trough is considerably warmed, the burning rate as well as the draft increase, and the petty flames (which first form as separate petty flames) merge with one another into an annular flame which gradually shifts its starting point, from that shown for a portion of this flame in Fig. 1, to the maximum elevation shown in Fig. 3.

During this flame production, the air entering through the outer row of air ports p^1 in the burner bottom issues upwardly, thereby keeping the rising oil vapor sufficiently near to the air-admitting perforations P in the pot wall 9 to insure a fairly good combustion efficiency even when the flame is receiving its air supply from wall perforations below the mid-height of the said pot wall.

Then, when the temperature of the burner and the stack draft have both risen so that the flame receives most of the needed air from the higher wall perforations, this air is drawn from the upper or hottest part of the annular air-warming chamber between the tubular walls 9 and 10, so that its temperature increases the efficiency of the combustion. Consequently, I have found my here illustrated burner to show a combustion efficiency of from 90 to 94 percent with fairly cheap grades of oil, when the burner is operated at approximately its maximum capacity. Since the draft is most intense along the flow lines of the flame-precipitating air jets, the amount of air then drawn through the lower wall perforations and through the air ports in the burner bottom is relatively small, so that the loss of heat up the stack is small.

Moreover, when the rate of oil supply is reduced, so that the burner temperature is lowered and the stack draft is decreased, the starting points of the flame gradually shift downward, and the reduction of the temperature of the oil trough causes the rate of oil vaporization to diminish also. With the here disclosed burner construction, this throttling of the oil supply can be continued until the flames are confined to petty ones for which air is supplied only by lowermost rows of perforations in the pot wall 9; and even with the reduced draft the flow of air through the outer row of air ports p^1 in the burner bottom will then keep the oil vapor sufficiently close to the said pot wall to maintain the flame. Consequently, I have found that the oil consumption can be cut down to approximately one-sixteenth of the maximum for which my burner is constructed, without having the flame become smoky or extinguish.

I have also found that with suitably proportioned sizes of the air-admitting ports, my burner will give a clear yellow flame at all rates of oil consumption. If the oil should be supplied at an excessive rate when the burner is first lighted, the widened mouth extension of the oil trough will afford a chamber for storing a reasonable excess of this oil until it is vaporized.

In practice, my burner will show most of its advantages even if the burner bottom has only the radially outer row of air ports p^1. Indeed, many of its advantages would still be obtained if this burner bottom is imperforate, but the flame would not be as clear, and an overflowing of oil upon this burner bottom would then cause the objectionable inadequate combustion of this oil and the still more objectionable smouldering and depositing of carbon which I avoid by the perforations in my burner bottom.

Other changes might also be made while still permitting my burner to present some of its important advantages, as for example in the proportioning of some of its parts, provided that my burner is used with a stack draft. However, I preferably make my perforated pot wall only about half as high as its diameter. With such a wall, the high temperature of the flame, when the burner is operating at or near its maximum capacity (as indicated in Fig. 3) causes the air to be drawn mainly through the upper rows of per-

forations in the pot wall, and the warming of this air while moving upward within the shield tube 10 probably contributes materially to the temperature of the flame so as to account (at least in part) for the high combustion efficiency.

Moreover, while my burner is allied in some respects to pot type burners with imperforate bottoms, and in other respects to blue flame burners in which the oil vapor rises between two perforated tubes, I have found my burner to have approximately four times the oil-consuming capacity (in proportion to its diameter) of either of the just mentioned older types, and have found this to be true even in comparison with a pot type burner constructed with greatly enlarged air ports in the upper portion of its pot wall.

Incidentally, it will be noted that my entire burner is exceedingly simple and inexpensive in construction, that is can easily be fastened to and supported by a heater drum bottom; that it affords ready access to the wick in case this needs to be replaced; and that all of the air-admitting ports can easily be cleaned, either by brushing the interior of the pot or by merely blowing air into it.

While I have shown the body of my burner as of a three-piece sheet metal construction, the three parts are fastened to and substantially sealed to one another. Consequently, I have a substantially unitary body comprising these parts: an outer annular portion of an inverted channel section in which the inner wall 9 has air ports P distributed over its greater portion; an annular oil trough opening into the bore of the said inner wall 9 and preferably having a widened upper portion of relatively small height in proportion to the part of the trough below this widened mouth portion; and a substantially horizontal (or at least not upwardly concaved) disk-like bottom part 7 spanning the inner edge of the mouth of the trough and provided, at least adjacent to its periphery, with air ports p^1.

In practice, I preferably make the spacing between the two concentric cylindrical-tubular walls 9 and 10 of the outer (inverted channel part) less than half of the height of these walls, so as to reduce the volume of air between these walls, thereby insuring an adequate heating of this air for producing a highly efficient flame when the burner is in operation.

Moreover, the character of the flame remains the same at all burning rates; and the desirably provided widening of the trough mouth allows the circular bottom portion of the burner to be at a level near that of the lowermost perforations in the pot wall and accommodates an overflow of oil without having the oil spread on the said bottom portion.

I claim as my invention:

1. An oil burner for use with a stack draft, comprising a circular and substantially horizontal bottom portion; an annular oil trough having the upper end of its inner wall sealed to and depending from the periphery of the said bottom portion, the said trough having a widened upper portion; a non-combustible annular wick disposed within the trough and extending substantially the entire length of the trough, the wick having its upper edge approximately at the level of the said bottom portion; an upright cylindrical-tubular pot wall sealed at its lower end to the upper end of the outer wall of said trough, the said pot wall being provided with perforations distributed both circumferentially and vertically from a level somewhat higher than the said bottom plate to a level near the upper edge of the said pot wall; an imperforate annular flange sealed at its inner edge to the upper end of the said pot wall, and an outer imperforate tubular wall member depending from the outer edge of the said flange, the outer wall member extending downwardly beyond the level of the lowermost perforations in the said upright perforated pot wall; and means for feeding oil into the lower portion of the said trough.

2. A yellow flame oil burner comprising an inverted annular trough-shaped member of considerably greater height than the radial spacing of the two riser walls of the trough formation, the inner wall of which is provided with perforations distributed throughout the length of that wall and over the major portion of the height of that wall; an annular oil trough of considerably greater depth than width having a widened mouth portion, and having the upper end of its outer wall sealed to the lower end of the inner wall of the aforesaid member; a disk-like horizontal burner bottom spanning and sealed to the upper end of the inner wall of the said trough; means for feeding oil into the oil trough; and a noncombustible wick disposed in the said trough and extending substantially the entire length of the trough, the said wick reaching from approximately the bottom of the trough to approximately the level of the said burner bottom; the burner bottom being provided with air-admitting perforations, the total area of which is less than half the total area of the perforations in the inner wall of the first named member, the perforations in the said member and in the burner bottom comprising the sole means for admitting air to the burner.

3. An oil burner as per claim 1, including an annular and generally horizontal supporting flange sealed to and extending radially outward from the lower end of the said annular pot wall member.

4. An oil burner as per claim 1, in which the said bottom portion is provided near its outer edge with a circular row of perforations cooperating with the lowermost of the perforations in the said pot wall for supplying all the air for combustion of the oil when the oil is fed at a low rate to the said trough.

5. A yellow flame oil burner as per claim 3, in which the depth of the widened mouth portion of the trough is less than half the total depth of the trough, and in which the said widening is at both sides of the upper portion of the wick, whereby the spacing of the walls of the said mouth portion of the trough from the upper part of the wick permits oil vapor to evaporate freely from both sides of the said upper part of the wick.

DEWEY H. HILL.