Aug. 31, 1948. J. W. MILLER ET AL 2,448,148

PILOT STRUCTURE FOR POT TYPE BURNERS

Filed Sept. 24, 1942 2 Sheets-Sheet 1

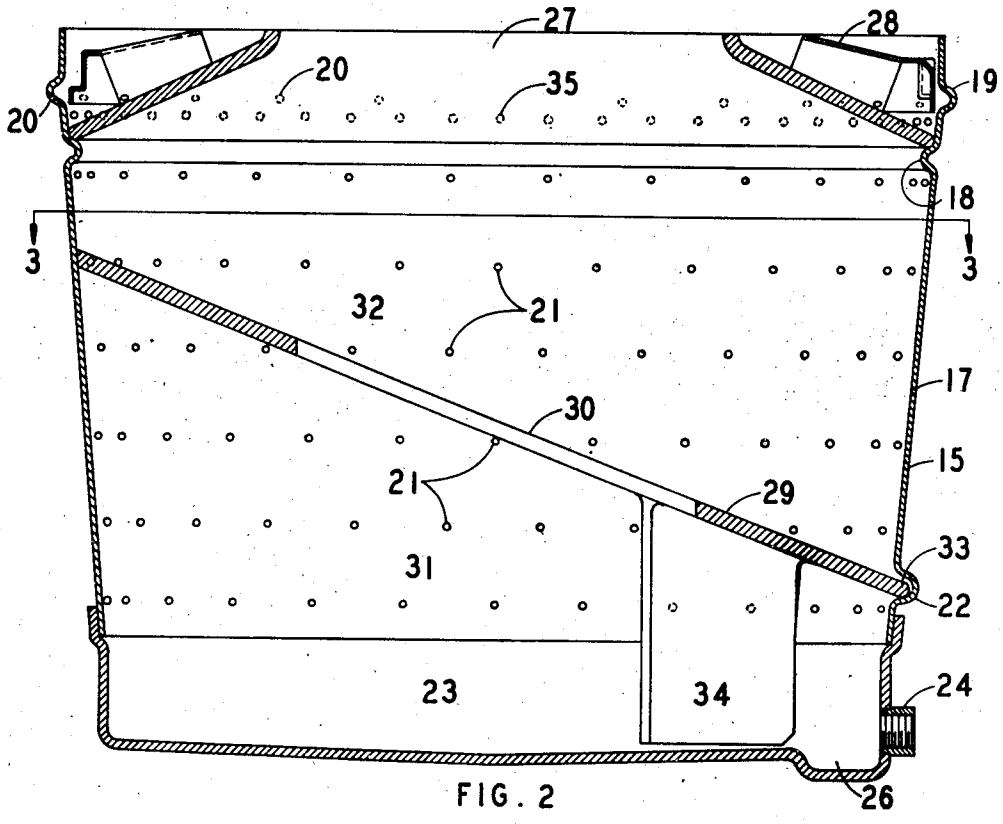



FIG. 2

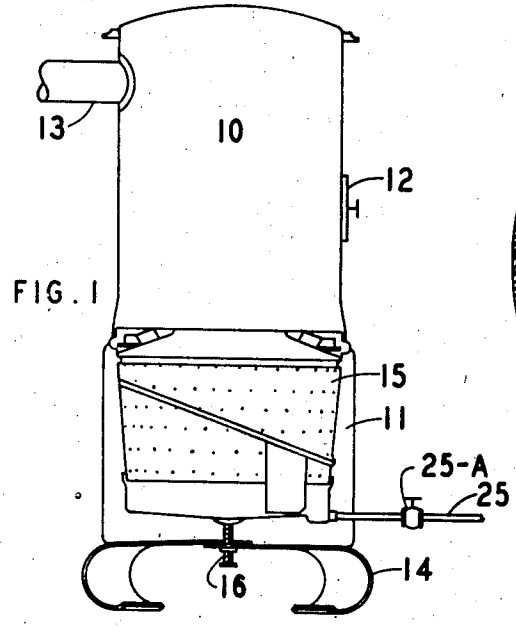



FIG. 1

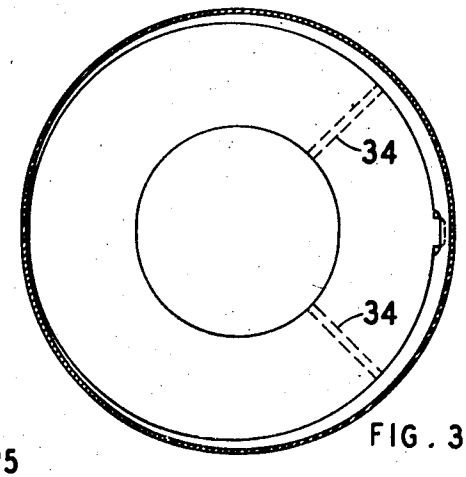



FIG. 3

INVENTOR.
JOHN W. MILLER
AND
WALDO G. SMITH

BY Carroll R. Taber

Aug. 31, 1948. J. W. MILLER ET AL 2,448,148

PILOT STRUCTURE FOR POT TYPE BURNERS

Filed Sept. 24, 1942 2 Sheets-Sheet 2

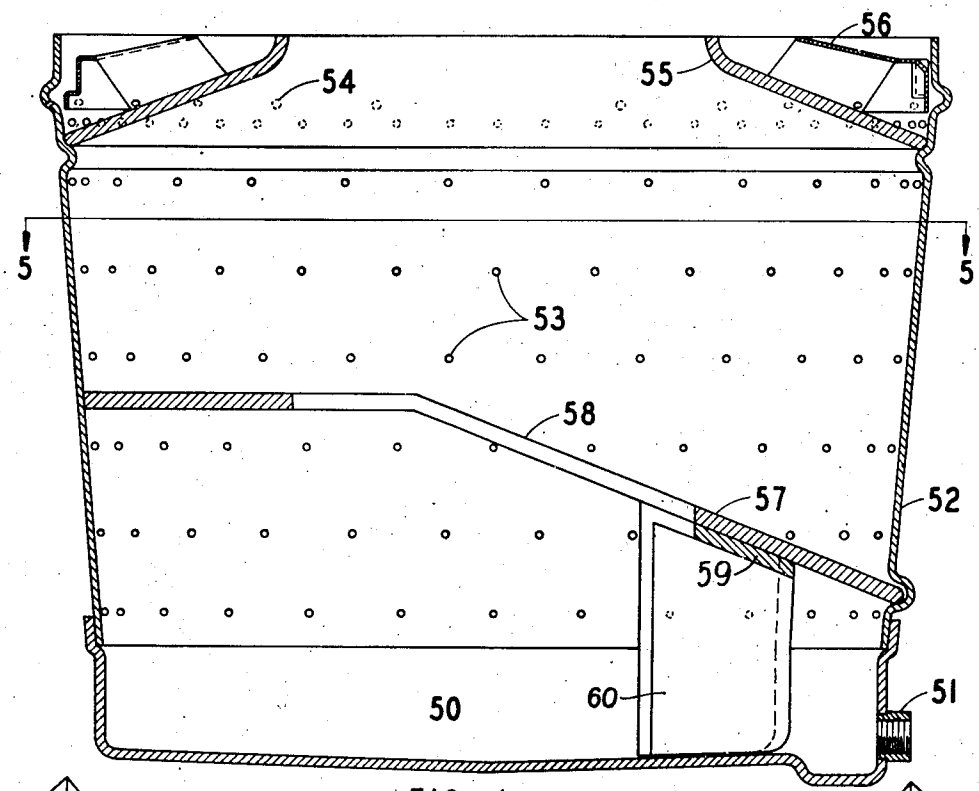



FIG. 4

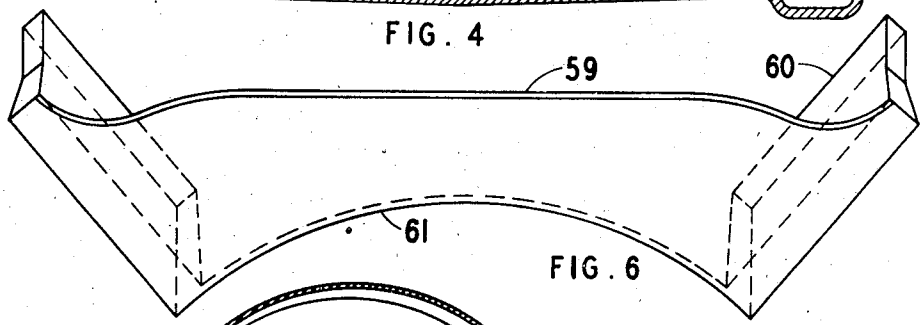



FIG. 6

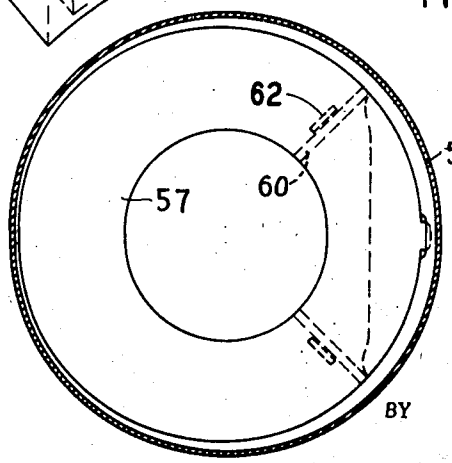



FIG. 5

INVENTOR.
JOHN W. MILLER
AND
WALDO G. SMITH
BY
Carroll P. Baker

Patented Aug. 31, 1948 2,448,148

# UNITED STATES PATENT OFFICE

2,448,148

## PILOT STRUCTURE FOR POT TYPE BURNERS

John W. Miller and Waldo G. Smith, Lansing, Mich., assignors to Motor Wheel Corporation, Lansing, Mich., a corporation of Michigan

Application September 24, 1942, Serial No. 459,500

21 Claims. (Cl. 158—91)

1

This invention relates to burners of the vaporizing pot type and constitutes an improvement in such burners.

This application is a continuation in part of our prior co-pending application Serial No. 410,498, filed September 12, 1941, now abandoned.

Burners of the vaporizing pot type are those burners which comprise a pot having a plurality of uniformly spaced apart air inlet openings in the side walls and in which the heat output can be varied according to the demand on the heating system merely by varying the rate at which the fuel is supplied to the burner.

The principal problem met with in burners of the vaporizing pot type lies in producing a clean and stable fire at all stages of operation, that is, low fire, high fire or various intermediate stages. To produce such a clean and stable fire the burner must be designed so that eddy currents are substantially eliminated at all of the stages of operation of the burner without interfering with its operation at the higher stages.

This problem has been overcome at the intermediate and high fire stages by the employment of a centrally apertured baffle or partition, preferably inclined, within the burner, located wholly between the uppermost and lowermost primary air inlet openings. This partition divides the burner into a lower vaporizing chamber and an upper vaporizing chamber.

The employment of a partition does not permit a very low turndown of the fuel supply to what is called pilot fire because eddy currents do form below the partition and either cause a smoky sooty flame or at times completely extinguish the flame. The present invention eliminates this condition, permitting a very low turn down of the fuel supply with a resulting clean and stable fire without in any way interfering with the normal operation of the burner at the higher stages of operation.

This result is accomplished by partially enclosing a portion of the burner adjacent the fuel inlet and below the partition. The enclosure is formed by the burner side wall, the bottom wall, a pair of upright non-intersecting baffles positioned on opposite sides of the fuel inlet opening and certain of the air inlet openings, and an upper baffle which, in the cases where a partition is employed, is that partition. For best results the volume of the portion of the burner included in the enclosure should be about 3% to 5% of the total volume of the burner, and in any event, less than 10% of the volume of the burner. Also, the ratio between the total area of the air inlet openings directly communicating with the enclosure and the total area of all of the air inlet openings to the burner should be slightly greater than the ratio between the volume of the enclosure and the total volume of the burner. In other words, slightly more air per unit of volume should be admitted directly to the enclosure than to the burner.

2

With such an arrangement, the formation and circulation of eddy currents in the zone around the inlet openings are thus effectively prevented and the fire burns evenly and cleanly at the fuel flow of 25% to 40% less than that required to maintain a clean and stable fire without the invention. A substantial saving in fuel when little or no heat is desired is thus effected.

Referring now to the drawings:

Figure 1 is a cross-sectional view of a heater embodying the invention;

Figure 2 is a cross-sectional view on an enlarged scale of the burner shown in Figure 1;

Figure 3 is a cross-sectional view taken on substantially the line 3—3 of Figure 2;

Figure 4 is a cross-sectional view of a burner embodying a slightly modified form of the invention;

Figure 5 is a cross-sectional view taken on substantially the line 5—5 of Figure 4; and

Figure 6 is a plan view of the baffle which forms a part of the enclosure about the fuel inlet opening.

The invention is shown in Figures 1 to 3 as embodied in a radiant heater comprising a casing having a combustion chamber 10 and an air jacket 11. The combustion chamber is provided with an access door 12 and has a flue outlet 13. The casing is supported on legs 14. The lower end of the casing is open to admit air to the air jacket 11.

A burner 15 is mounted in the air jacket 11. The side wall of the burner is held in place within the air jacket and tightly against the casing by means of a screw 16 threaded through the legs 14.

The burner 15 comprises a sheet metal side wall 17 in substantially cylindrical form. Adjacent the upper edge of the side wall are two beads, an inwardly extending bead 18, and above it an outwardly projecting bead 19. A horizontal row of uniformly spaced apart secondary air inlet openings 20 is formed in the bead 19 so that the openings 20 are inclined upwardly and inwardly. Between the bead 18 and the lower edge of the side wall 17 are six substantially evenly spaced horizontal rows of substantially uniformly spaced

apart primary air inlet openings 21. In one side of the side wall, just above the lowermost row of primary air inlet openings 21, is a concavity 22, the purpose of which will appear presently.

A cup shaped bottom wall portion 23 is welded to the bottom edge of the side wall 17. The bottom wall is slightly concave. A fuel inlet opening 24 is provided at the side of the cup shaped bottom wall and is located directly below the concavity 22.

A fuel supply pipe 25 (see Figure 1) having a metering valve 25a therein is threaded into the opening 24. Directly below the opening 24 is a well 26 to retain fuel at periods of extreme low or pilot fire.

A centrally apertured top wall 27 rests upon the bead 18. An anti-explosion baffle 28 is seated upon the top wall 27 to direct a portion of the secondary air entering the air inlet openings 35 toward the aperture in the top wall.

Lying wholly between the lowermost and the uppermost rows of primary air inlet openings 21 is a partition 29 which divides the burner into a lower chamber 31 and an upper chamber 32. The partition has a large central opening 30 to permit air, vapors and products of combustion to pass from the lower chamber to the upper chamber. The partition preferably is inclined as shown. Its lower edge is provided with a projection 33 which fits into the concavity 22 to position the partition in the burner, and is thereby located just above the lowermost row of air inlet openings. The upper edge of the partition rests against the side wall at about the level of the fifth row of openings.

Below the partition and extending downwardly toward the bottom wall are two upright baffles 34. The baffles 34 are imperforate. Preferably they are integral with the partition. The baffles 34 are located on opposite sides of the fuel inlet opening 24 and are spaced apart sufficiently to include some primary air inlet openings 21 between them. The outer and bottom edges of the baffles 34 are juxtaposed to the side wall 17 and bottom wall 23 of the burner. Together with the partition 29, side wall 17, and bottom wall 23 they provide a partial enclosure for the portion of the burner adjacent the fuel inlet. The enclosure is open at its radially inner vertical side. Preferably the baffles 34 are arranged radially of the burner to eliminate any possibility of air entering the adjacent openings 21 impinging on them and causing a smoky flame.

Preferably the baffles 34 are arranged at an angle to each other of approximately 80 to 85 degrees. With the partition 29 inclined as shown, the volume of the enclosure formed by the partition, the baffles 34 and the side and bottom walls of the burner will be about 3% to 5% of the total volume of the burner.

Only certain holes of the lowermost row of air inlet openings will directly communicate with the enclosure. If the baffles 34 are arranged as indicated above, there will be six of these openings and their area should be approximately 5% to 6% of the total area of the air inlet openings in the burner side wall. Thus, it will be seen that the percentage of the area of the air inlet openings communicating directly with the enclosure is slightly greater than the percentage of the volume of the enclosure itself. This will assure adequate air for combustion at pilot fire.

In operating the burner, the metering valve is opened sufficiently to permit fuel to flow into the burner where it collects in the bottom of the



burner. The fuel is ignited in any suitable way such as by inserting a lighted taper through the access door 12. For a short time combustion will occur directly on the surface of the pool of fuel until sufficient heat is generated to vaporize a portion of the fuel. These vapors mix with the air entering the air inlet openings 21 from the air jacket 11 and the flame will move away from the surface of the pool of fuel in the bottom of the burner.

The rate of combustion can be varied by adjusting the metering valve to regulate the flow of fuel. In doing that the zone in which combustion is initiated can be varied. Thus, combustion may, in a general way, be initiated within the enclosure (low fire), outside of the enclosure but within the lower chamber 31 (low intermediate fire), within the upper chamber 32 (high intermediate fire), or at the opening in the top wall 27 (high fire). The latter is the upper limit of combustion initiation.

While for the sake of convenience in description the burner has been divided into the four zones just mentioned, it will be understood that there is no sharp line of demarcation between these zones. The combustion can be more closely regulated than that. It will also be understood that at low fire, combustion is not necessarily restricted to that part of the burner immediately on or over the well 26. The fire may spread out more into the enclosure about the fuel inlet opening.

As previously stated, the present invention has to do with improving the operation of the burner at low fire. In the devices of the prior art when operating at a low fire such, for example, as an oil flow of 300 c. c. per hour or less in a typical burner, the flame moves from one part of the burner to another and is extremely unstable. As the flow of oil is decreased from approximately 300 c. c. per hour the combustion reaches a critical point where when the fire moves from one part of the burner to another it may become extinguished. Moreover, throughout this low fire range of operation, because of the instability of the flame, there is an improper mixing of air with the oil vapors so that a smoky flame is produced.

Figures 4 to 6 disclose a somewhat modified form of the invention. The burner itself is substantially the same as that previously disclosed. It comprises a bottom wall 50 having a fuel inlet opening 51 formed in the side thereof adjacent the bottom. A tubular side wall 52 is welded to the upper edge of the bottom wall 50. The side wall is provided with six horizontal rows of air inlet openings 53.

Near the upper edge of the burner side wall are two rows of secondary air inlet openings 54, the same as in the previously described burner.

A top wall 55 and an anti-explosion baffle 56 identical with those previously described are mounted in the burner adjacent the secondary air inlet openings and above the uppermost primary air inlet openings.

A centrally apertured partition 57 is mounted in the burner. The partition is an annulus having an aperture 58 at its center. It will be noted that the portion of the partition located above the fuel inlet opening 51 is inclined upwardly in exactly the same manner as the partition 29, but the upper part of the partition is arranged horizontally intermediate the third and fourth row of air inlet openings from the bottom. The partition 57 is the same as that disclosed in the co-pending application of John W. Miller and Raymond E. Fell, Serial No. 407,850, filed

August 22, 1941, and issued November 9, 1943, as Patent Number 2,334,117. This partition operates somewhat better than the wholly inclined partition of Figures 1 to 3. In and of itself it is not a part of this invention.

Instead of making the upright baffles integral with the partition, as in the case of Figures 1 to 3, a separate baffle construction is employed in the device of Figures 4 to 6. This baffle is shown in its entirety in Figure 6. It is a one piece inverted channel shaped construction having a web 59 inclined upwardly at the same inclination as that of the inclined part of partition 57, and a pair of vertical legs or flanges 60. These legs are arranged so that their lower edges rest upon the bottom of the burner and one pair of upright edges engage the side wall of the burner as shown in Figures 4 and 5. One edge 61 of the web is arcuate and coincides with a portion of the edge of the aperture 58 in partition 57. The baffle is held in place by a pair of lugs 62 extending downwardly from the under side of the partition 57. The lugs 62 are integral with the partition or may be welded or otherwise attached thereto.

The legs of the channel are arranged radially of the burner and at an angle to each other of approximateley 80 to 85 degrees, as in the case of the baffles 34. Thus, the percentage of the volume of the enclosure formed by the bottom wall and side wall of the burner and the upright legs 60 is approximately 3% to 5% of the total volume of the burner, exactly as in the case of the previously described modification.

The operation of the device shown in Figures 4 to 6 is identical to that shown in Figures 1 to 3.

At the low fire stage of operation of the burner described above the baffles of the present invention effectively prevent the circulation of eddy currents in the zone around the fuel inlet opening and thereby permit combustion to occur at low fire without the formation of soot. At the same time the baffle construction prevents extinguishment of the flame when at very low fire by preventing drafts due to such eddy currents. On the other hand, the baffle construction does not prevent spreading out of the fuel across the bottom of the burner at greater rates of fuel flow and does not in any way interfere with the effective vaporization of the fuel or the mixing therewith of the air for combustion. From a practical standpoint at any stage of the operation of the burner above pilot fire the baffle construction is virtually non-existent. In fact, at low fire the small portion of the burner within the enclosure acts as a tiny vaporizing pot type burner with a resultant clean and stable fire therein, and yet becomes an integral portion of the much larger burner when the burner is operating at the higher stages of combustion.

The structure is exceedingly simple and economical to manufacture and install. Furthermore, the modification shown in Figures 4 to 6 can be installed in existing burners having partitions or in burners having no partition at all, with a consequent increase in efficiency thereof.

The scope of the invention is indicated in the appended claims.

We claim:

1. A burner of the vaporizing pot type wherein combustion can be localized in different parts thereof by regulating the fuel supplied thereto, said burner comprising a bottom wall, a tubular side wall connected thereto having a plurality of spaced apart air inlet openings therein and a fuel inlet opening in the burner adjacent one side thereof, means cooperating with said bottom and side walls for partially enclosing a portion of the interior of the burner adjacent said fuel inlet opening, said means comprising a pair of spaced apart non-intersecting upright baffles positioned on opposite sides of said fuel inlet opening and certain of said air inlet openings and a third baffle engaging the upper ends of said pair of baffles and lying wholly between the uppermost and lowermost air inlet openings, all of said baffles extending transversely of the burner, one upright edge of each baffle of said pair being juxtaposed to the burner side wall and the other upright edge being spaced a substantial distance from the burner side wall.



2. A burner as defined in claim 1 wherein said third baffle is a centrally apertured annulus having its peripheral edge in substantially continuous engagement with the burner side wall.

3. A burner as defined in claim 1 wherein said pair of baffles engages the bottom wall of the burner.

4. A burner as defined in claim 1 wherein said third baffle is a centrally apertured annulus and said pair of baffles engage the bottom wall of said burner.

5. A burner as defined in claim 1 wherein said third baffle is a centrally apertured annulus and said pair of baffles extend radially of the burner from the side wall to the edge of the aperture in the annulus.

6. A burner as defined in claim 1 wherein said pair of baffles are arranged radially of the burner.

7. A burner as defined in claim 1 wherein said pair of baffles are imperforate.

8. In a burner of the vaporizing pot type wherein combustion can be localized in different parts thereof by regulating the fuel supplied thereto, said burner comprising a bottom wall, a tubular side wall having a plurality of spaced apart air inlet openings therein and a fuel inlet opening in the burner adjacent one side thereof, a centrally apertured partition extending across the burner and located wholly between the lowermost and uppermost air inlet openings, and a pair of spaced apart non-intersecting upright baffles on opposite sides of said fuel inlet and certain of said air inlet openings, said baffles extending from said side walls toward the aperture in the partition, said baffles being positioned between said partition and the bottom wall of the burner and cooperating with said bottom wall, side wall and partition to partially enclose a portion of the burner adjacent the fuel inlet opening, said enclosure being open at its radially inner and adjacent the aperture in the partition.

9. A burner as defined in claim 8 wherein said baffles extend radially of the burner.

10. A burner as defined in claim 8 wherein said baffles are integral with said partition.

11. A burner as defined in claim 8 wherein the baffles engage the partition, the bottom wall and the burner side wall.

12. A burner as defined in claim 8 wherein said baffles converge from the fuel inlet opening toward the center of the burner.

13. In a burner of the vaporizing pot type comprising a bottom wall, a tubular side wall having a plurality of spaced apart air inlet openings therein and a fuel inlet opening in the burner adjacent one side thereof, and baffle means cooperating with the bottom wall and side wall of the burner to partially enclose a portion of the

latter adjacent the fuel inlet opening, said baffle means comprising an inverted channel member having the legs thereof located on opposite sides of the fuel inlet opening and certain of said air inlet openings and the web of said channel member positioned above the fuel inlet opening and wholly between the uppermost and lowermost air inlet openings, one end of said channel member being juxtaposed to the burner side wall and the other end of said channel member being located adjacent the center of the burner.

14. In a burner of the vaporizing pot type comprising a bottom wall, a tubular side wall having a plurality of spaced apart air inlet openings therein and a fuel inlet opening in the burner adjacent one side thereof, a certainly apertured partition extending across the burner above said fuel inlet opening and located wholly between the uppermost and lowermost air inlet openings, and baffle means cooperating with the bottom wall and side wall of the burner to partially enclose a portion of the latter adjacent the fuel inlet opening, said baffle means comprising an inverted channel member positioned beneath said partition, one end of said channel member being juxtaposed to the burner side wall with the legs of said channel positioned on opposite sides of said fuel inlet opening and certain of said air inlet openings and the other end of said channel member being positioned adjacent the opening in the partition, the web of the channel member engaging the under side of the partition and above said fuel inlet opening, and a pair of lugs integral with the partition engaging the channel member to hold the same in position relative to the burner.

15. As an article of manufacture, a low fire pilot for use in combination with an oil burning vaporizing pot type burner of the type comprising a chamber having a bottom wall, generally upright side walls perforated to admit air to support combustion and an oil admission opening for delivering oil onto the bottom wall of the chamber; said pilot comprising structure including a top wall and downwardly extending side walls forming an inverted channel open at opposite ends, said side walls of the pilot structure being adapted to rest upon the bottom wall of the pot and in a position to cover the oil delivered, for pilot purpose, to the bottom wall of the pot, said structure being positioned so that one open end of the channel registers with certain of the perforations in the side walls of the pot and the upright ends of the side walls of last mentioned end of structure are juxtaposed with the upright side walls of the pot, certain of the walls of the pilot structure converging toward one another from the last mentioned end of the pilot structure toward the other open end thereof.

16. In combination, an open topped burner pot having a circumferential wall provided with a plurality of primary air inlet apertures located at various levels in the wall, means for delivering secondary air to the mixture of primary air and vaporized fuel moving upwardly through the pot and a pilot housing surrounding the area of admission of the fuel to the pot and defining a space in communication with a plurality of the lower primary air inlet apertures of the pot, said housing including generally upright inwardly converging side walls defining a flame outlet at their convergence, and extending inwardly from the pot wall, and means for delivering liquid fuel to the pot at a point enclosed by said pilot housing.



17. In combination, an open topped burner pot having a circumferential wall provided with a plurality of primary air inlet apertures located at various levels in the wall, means for delivering secondary air to the mixture of primary air and vaporized fuel moving upwardly through the pot and a pilot housing surrounding the area of admission of the fuel to the pot and defining a space in communication with a plurality of the lower primary air inlet apertures of the pot, said housing including generally upright inwardly converging side walls defining a flame outlet at their convergence, and extending inwardly from the circumferential pot wall, and cover means for said housing, said cover means located below the level of the highest of the primary air inlet apertures and below the level of admission of secondary air to the mixture, and means for delivering liquid fuel to the pot at a point enclosed by said pilot housing.

18. In combination, an open topped burner pot having a circumferential wall provided with a plurality of primary air inlet apertures located at various levels in the wall, means for delivering secondary air to the mixture of primary air and vaporized fuel moving upwardly through the pot and a pilot housing surrounding the area of admission of the fuel to the pot and defining a space in communication with a plurality of the lower primary air inlet apertures of the pot, said housing having generally upright, converging side walls and a top wall, the top wall being located below the level of the highest of the primary air inlet apertures and below the level of admission of secondary air to the mixture, the inner edges of said side and top walls defining a flame aperture in communication with the interior of the pot, and means for delivering liquid fuel to the pot at a point enclosed by said pilot housing.

19. A liquid fuel burner comprising, in combination, a combustion pot having generally upright side walls and a connecting bottom wall, said side walls having upper and lower perforations, said pot being open at the top; means forming a substantially horizontally extending fuel vaporizing chamber disposed within the pot adjacent the bottom wall thereof, said chamber having an air inlet end, said air inlet end being disposed adjacent one side wall of the pot and communicating with certain of said lower perforations, said chamber having a fuel mixture outlet confronting a side wall of the pot opposite said first mentioned side wall; means for supplying liquid fuel to the chamber; and gas and air baffle means intermediate the top and the bottom wall of the pot and extending inwardly from said confronting side wall toward said first mentioned means and located between said upper and lower perforations.

20. In combination, an open topped burner pot having a circumferential wall provided with a plurality of primary air inlet apertures located at various levels in the wall, means for delivering secondary air to the mixture of primary air and vaporized fuel formed in the pot and a pilot housing surrounding the area of admission of the fuel to the pot and defining a space in communication with a plurality of the lower primary air inlet apertures of the pot, said housing including upwardly extending side walls and a top wall and having, adjacent the inner ends of said side and top walls, a flame outlet of substantially smaller area than the area of the pot wall which is in register with the interior of the pilot housing, the highest part of said pilot housing being located

below the level of the highest of said primary air inlet apertures, and means for delivering liquid fuel to the pot at a point enclosed by said pilot housing.

21. In combination, an open topped burner pot having a circumferential wall provided with a plurality of primary air inlet apertures located at various levels in the wall, means for delivering secondary air to the mixture of primary air and vaporized fuel formed in the pot, and a pilot housing surrounding the area of admission of the fuel to the pot and defining a space in communication with a plurality of the lower primary air inlet apertures of the pot, said housing including generally upright side walls and having a flame outlet at the inner ends of said side walls, said side walls extending inwardly from the pot wall, and means for delivering liquid fuel to the pot at a point enclosed by said pilot housing.

JOHN W. MILLER.
WALDO G. SMITH.




REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,004,040 | Laizure | Sept. 26, 1911 |
| 1,984,573 | Frame | Dec. 18, 1934 |
| 2,116,278 | Morin, Jr., et al. | May 3, 1938 |
| 2,162,844 | Jenson | June 20, 1939 |
| 2,179,142 | Breese | Nov. 7, 1939 |
| 2,181,407 | Miller | Nov. 28, 1939 |
| 2,207,843 | Wilkes et al. | July 16, 1940 |
| 2,295,799 | Focke et al. | Sept. 15, 1942 |
| 2,316,227 | Donley | Apr. 13, 1943 |

FOREIGN PATENTS

| Number | Country | Date |
|---|---|---|
| 47,013 | France | Aug. 31, 1936 |