March 3, 1942. D. J. HOWARD 2,275,149

OIL BURNER

Filed April 19, 1939

Fig. 1.

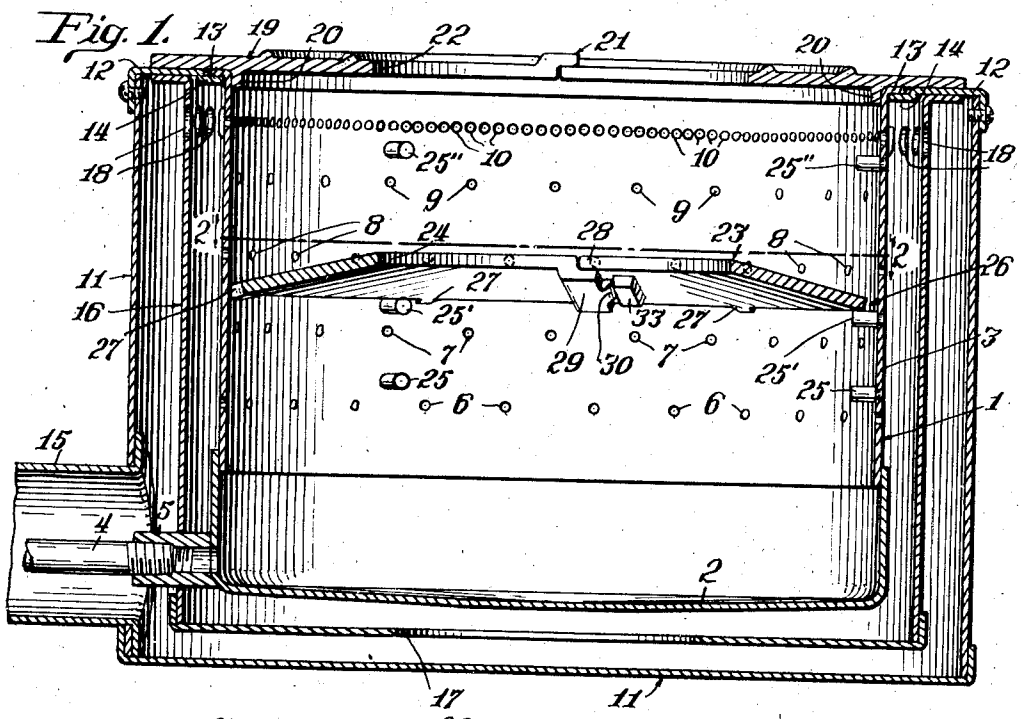


Fig. 2.

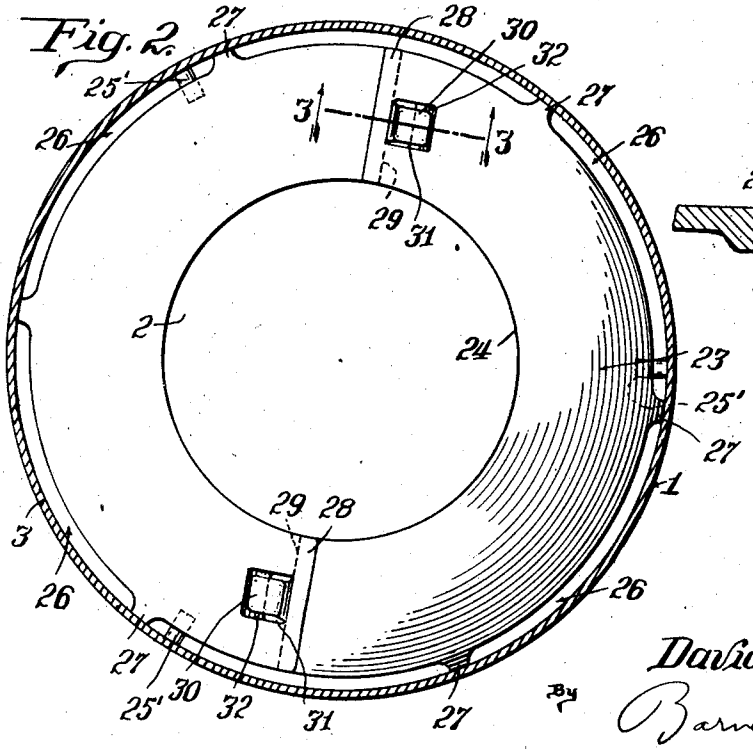
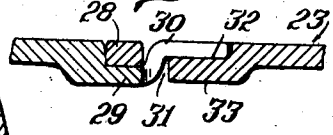


Fig. 3.



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OIL BURNER

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14 Claims. (Cl. 158—91)

This invention relates to certain new and useful improvements in a burner for liquid fuel, such as oil, and more particularly to improvements in the pilot-ring used within a burner of the open pot type.

One well known type of oil burner comprises a pot member having an open top and a closed bottom, and provided with a plurality of spaced openings in the upright cylindrical wall through which combustion air is admitted. Oil is admitted into the lower portion of the pot and when vaporized and mixed with air burns through the large central opening in an annular member which partially closes the top of the pot. An annular partition or pilot-ring is mounted at an intermediate height within the pot, and when the supply of oil and air is reduced a smaller pilot flame will burn adjacent this ring and through the large central opening therein, the pilot-ring functioning much the same as the annular top member functions when the supply of oil and air is increased to sustain the maximum fire. Prior to the present invention this pilot-ring has had a sufficiently large outside diameter to fit snugly within the pot against the cylindrical side wall thereof so that all flow of gases or oil between the portions of the pot above and below the pilot-ring must pass through the large central opening in the ring. According to the present invention the outer diameter of the pilot-ring is decreased sufficiently to leave a passage of substantial width between the ring and the side wall of the pot, and means are provided for centering the ring so that the annular space or passage between the ring and pot will be of substantially uniform width throughout the circumference. This annular passage permits a flow of gases directly adjacent the side wall of the pot and materially improves the functioning of the burner as will be set forth in detail hereinafter.

The principal object of this invention is to provide an improved burner for liquid fuel as briefly described hereinabove and disclosed in detail in the specifications which follow.

Another object is to provide an improved form of pilot-ring for oil-burners of the pot type.

Another object is to provide improved means for centering a pilot-ring within the burner pot.

Another object is to provide an improved sectional pilot-ring.

Other objects and advantages of this invention will be more apparent from the following detailed description of one approved form of apparatus constructed and operating according to the principles of this invention.

In the accompanying drawing:

Fig. 1 is a central vertical section through the burner assembly.

Fig. 2 is a partial horizontal section, taken substantially on the line 2—2 of Fig. 1.

Fig. 3 is a detail section taken substantially on the line 3—3 of Fig. 2.

The main inner housing or pot 1 is open at the top and comprises a closed bottom portion 2 which is preferably slightly dished or concave, and an upright cylindrical side wall 3. The oil or other liquid fuel is supplied through a pipe 4 connected into the inlet nipple 5 near the bottom 2 of the pot. The rate at which the fuel flows in through pipe 4 is suitably controlled to feed oil at a predetermined rate onto the upper surface of the bottom 2 of the pot, thus determining the size of the flame.

The required air for mixing and combustion purposes is supplied through a plurality of holes formed in the side wall 3 of the pot 1. In the example here shown these holes are arranged in several circumferential rows indicated at 6, 7, 8, 9 and 10 at different successive heights. Preferably the holes will be staggered with relation to the holes in adjacent rows, that is a hole in row 7 will be above the space between two holes in row 6. Also the holes are more numerous and inclined upwardly and inwardly in the upper row 10 which is located adjacent the upper open end of the pot.

The bottom and sides of the pot 1 are completely enclosed in an outer housing 11 which is partially closed at the top by an annular wall 12. An outturned flange 13 at the top of side wall 3 of the pot rests on the inner flange 14 of top wall 12 thus suspending the pot 1 within the housing 11. Air under controlled pressure may be forced into housing 11 through the air-tube 15 leading from a suitable blower or fan. In order to most advantageously distribute the air supply in housing 11 to the several inlet openings 6 to 10 inclusive in the burner pot 1 an intermediate shell 16 is preferably positioned between the pot 1 and the outer housing 11. This shell 16 is provided with a large central opening 17 in its bottom so that a considerable portion of the air flow will pass through this opening 17 and across the bottom 2 of the pot before reaching the inlet openings 6 to 9. This flow of air serves to prevent over-heating and burning out of the pot bottom 2, and also serves to pre-

heat the air before this air reaches the combustion zone. Preferably a circumferential series of openings 18 is provided in the upper side wall portion of shell 16 through which air may pass directly to the upper row of pot openings 10. As far as the present invention is concerned it is not essential that the air be supplied to the several rows of inlet openings 6 to 10 in the preferred manner hereinabove described by way of example. The burner may operate by natural draft, the air being drawn into the pot through the several openings by suction from above the upper open end of the pot.

The top of the pot 1 is partially closed by the fire-ring 19 in the form of an annular metal plate resting on the top wall 12 and provided intermediate its inner and outer edges with a downwardly extending circular flange 20 engaging within the side wall 3 of the pot so as to properly center the fire-ring. For convenience in manufacturing and assembling this ring 19 may be made in two similar semi-circular sections which overlap at the meeting ends as indicated at 21.

When this burner is operating normally at "high fire," that is so as to provide the maximum heat, oil introduced onto the bottom 2 of the pot will be vaporized by heat from above and mixed with primary air flowing in through the lower rows of openings 6, 7, 8 and 9 and then burned by combining with the secondary or combustion air flowing in through the upper row of openings 10. The flames will extend from adjacent these openings 10 through the large central opening or burner throat 22 in the fire-ring 19 and thence upwardly into the combustion space above the burner. At this time practically all of the flame is above the pot 1 which serves as a vaporizing chamber and as a mixing chamber for the fuel and air before combustion actually takes place.

It has been found useful, in order to facilitate starting the fire and controlling the fire at lower stages to use a pilot-ring or auxiliary fire-ring within the pot as indicated generally at 23. This ring is usually in the form of an annular metal partition fitting closely within the pot at its outer edge and provided with a large central opening 24 comparable with the similar opening 22 in the upper fire-ring 19. This pilot-ring 23 is supported on a circumferential series of studs or pegs 25 projecting inwardly from the side wall 3 of the pot, thus substantially dividing the pot chamber into upper and lower compartments. The ring 23 may be used at selected positions within the pot by supporting the ring on alternative series of pegs 25' or 25''. Usually a suitable positioning for the ring will be at a height substantially midway the top and bottom of the pot as indicated in the drawing.

The fire is started by igniting the shallow pool of oil introduced through pipe 4 onto the pot bottom 2. The oil will burn here for a short time until sufficient heat is created to vaporize a portion of the oil after which these oil gases will carry up the flame so that it will burn from the air inlets such as 6 and 7 below the pilot-ring 23 and project upwardly through the central opening 24 in this ring. At this time the oil in the lower portion of the pot is being vaporized by heat from the flame above and from the heated ring 23 and the oil vapors are first mixed with a portion of the air entering through openings 6 and 7, and then burned under and at the central opening in the pilot-ring. At this time the pilot-ring functions much the same as the upper fire-ring 19 does when the high fire is burning. This fire burning in and directly below the ring 23 is the low or pilot fire which is maintained continuously after the desired temperature has been reached in the space being heated. When more heat is required, the supply of oil and air is increased and the flame then leaves the pilot-ring 23 and burns (for an intermediate fire) in the space between the rings 19 and 23 and extending upwardly through the opening in fire-ring 19, and eventually (for a high fire as already described) burning almost entirely outside and above the pot.

The operation of this type of burner as thus briefly described has been greatly improved by the new type of pilot-ring which forms the particular subject matter of this invention and which will now be described. This improved ring 23, instead of fitting closely at its outer edge against the wall 3 of the burner-pot as was the practice prior to this invention, has an outer diameter substantially less than the inner diameter of pot 1 so that an open annular passage 26, or more accurately a continuous circumferential series of arcuate openings 26, remains between the outer periphery of the pilot-ring and the wall of the burner chamber. This passage permits a free flow of gases along the inner wall of the burner-pot between the portions of the mixing and combustion chamber above and below the pilot-ring. In order to insure the proper centering of the pilot-ring within the pot, the ring is provided with a circumferential series of outwardly projecting lugs or fingers 27 which engage the inner wall of the pot so that the annular passage 26 will be of uniform width at all sides of the ring. These lugs 27 are small and only sufficient in number to insure the centering of the ring so that the passage 26 will be practically continuous around the entire circumference of the ring.

This new form of spaced pilot-ring improves the operation of the burner in many respects. When the former type of pilot-ring fitting tightly against the pot at its outer edge is used, there is a tendency for the fire to "snuff out" during the initial stages before the burner is very hot and before the pilot-flame has been well established at and directly beneath the central opening 24 in the pilot-ring. Apparently the tight pilot-ring holds down some of the rich gases formed by vaporization of the oil and these gases, in the absence of sufficient combustion air, blanket the flame so that the fire goes out. Since the air inlet holes beneath the pilot-ring are rather widely spaced apart a certain amount of the vaporized oil will not be mixed with the air from these holes. Some of this unburned gas will be held down by the pilot-ring and will tend to blanket and "snuff out" the flame, while some will come up through the center opening 24 in the ring. These gases rising through the center opening 24 will have partial combustion with air entering from the holes above the pilot-ring but this flame burns almost entirely at the center of the burner chamber and because combustion is not complete the flame is dirty and a considerable deposit of soot will be left on the side wall of the burner between the pilot-ring 23 and upper fire-ring 19. Probably this is partly on account of an undue cooling of the side-wall, and the air introduced above, as from holes 8, and flowing over the top of the pilot-ring has a cooling

effect on the ring itself and thereby slows up the vaporization of the oil in the lower portion of the burner chamber.

With the new improved pilot-ring herein disclosed portions of the unburned gases float up in the spaces between the air jets from the openings beneath the ring and through the outer annular passage 26 between the ring and side wall 3 and come in direct contact with the air coming in through the staggered openings above the ring. This mixture of air and gases will ignite and burn above the pilot-ring and at varying distances from wall 3 since the velocity of the incoming air streams will vary from time to time due to inconstant draft. The flames seem to dance across the upper surface of the pilot-ring, at times burning almost adjacent the side wall openings and at other times nearer the center of the ring.

As a result there is more complete combustion in the burner and a much cleaner flame, especially between the pilot-ring and upper fire-ring when operating at intermediate fire. A stronger and steadier pilot-flame is maintained and there is no tendency during the starting period for the rich vaporized gases to build up unduly within the lower portion of the chamber and snuff out the flame. There is less tendency for soot to be deposited on the inner walls of the burner chamber, and the flames burning adjacent the side-wall above the pilot-ring would tend to burn away any carbon deposits which might form and thus keep the pot comparatively clean. Also the flames burning directly above the pilot-ring keep the ring at a higher temperature, the heat projected downwardly from this ring helping to vaporize the oil.

Even after "high" fire is established and the actual combustion occurs mostly outside the burner chamber (that is the flames originate directly below the upper ring 19 and project upwardly from and through the central opening 22 in this ring) the vaporized oil and primary air within the burner chamber is more efficiently mixed because of the additional flow of gases through the annular space 26 between the pilot-ring and side-wall 3 of the pot.

In order to facilitate installation and removal of the pilot-ring 23, this ring is preferably made in two or more similar arcuate sections. In the preferred form here shown, the ring is divided into two similar half sections. The end portion 28 of one section overlies and rests upon the depressed portion 29 at the end of the other section, and a tongue 30 extending first upwardly and then outwardly from the depressed portion 29 is inserted upwardly through a passage 31 and then received in a pocket 32 formed above the depressed portion 33 of the first mentioned section. The two ring sections are identical, each having a tongue 30 at one end and a tongue-receiving pocket 32 at the other end. The sections are joined in an obvious manner by first tipping the meeting ends of the sections upwardly so that each tongue 30 can be inserted through a passage 31, after which the sections are swung down to normal position and the parts are engaged as clearly shown in Figs. 2 and 3. The two ring sections are now mutually supporting and function as a solid unitary ring. This multi-part type of ring can be assembled after the parts have been separately inserted into the burner.

I claim:

1. In a burner for liquid fuel, a pot member having an open top, a substantially cylindrical side wall and a closed bottom, the side wall being provided with a plurality of air inlet openings distributed in spaced apart relation throughout the circumferential area of the side wall between the top and bottom thereof, means for introducing air through these openings, means for introducing liquid fuel into the lower portion of the pot, a fire-ring forming an annular top member for partially closing the top of the pot, a pilot fire-ring forming an annular partition member having a large central aperture, and means for supporting said partition member within the pot at an intermediate height, said partition having an outer diameter substantially less than the inner diameter of the pot so that an annular gas passage of substantial width will remain between the outer edge of the partition and the side wall of the pot, and means for centering the partition so that the passage will be of uniform width throughout the circumference of the pot.

2. In a burner for liquid fuel, a pot member having an open top, a substantially cylindrical side wall and a closed bottom, the side wall being provided with a plurality of air inlet openings distributed in spaced apart relation throughout the circumferential area of the side wall between the top and bottom thereof, means for introducing air through these openings, means for introducing liquid fuel into the lower portion of the pot, a fire-ring forming an annular top member for partially closing the top of the pot, a pilot fire-ring forming an annular partition member having a large central aperture, and means for supporting said partition member within the pot at an intermediate height, said partition being formed to provide a substantially continuous annular gas passage of uniform width between the outer portion of the partition and the adjacent wall of the pot.

3. In a burner for liquid fuel, a pot member having an open top, a substantially cylindrical side wall and a closed bottom, the side wall being provided with a plurality of air inlet openings distributed in spaced apart relation throughout the circumferential area of the side wall between the top and bottom thereof, means for introducing air through these openings, means for introducing liquid fuel into the lower portion of the pot, a fire-ring forming an annular top member for partially closing the top of the pot, a pilot fire-ring forming an annular partition member having a large central aperture, and means for supporting said partition member within the pot at an intermediate height, said partition being apertured adjacent its outer edge to provide a substantially continuous annular gas passage adjacent the pot wall.

4. In a burner for liquid fuel, a pot member having an open top, a substantially cylindrical side wall and a closed bottom, the side wall being provided with a plurality of air inlet openings distributed in spaced apart relation throughout the circumferential area of the side wall between the top and bottom thereof, means for introducing air through these openings, means for introducing liquid fuel into the lower portion of the pot, a fire-ring forming an annular top member for partially closing the top of the pot, a pilot fire-ring forming an annular partition member having a large central aperture, and means for supporting said partition member within the pot at an intermediate height, said partition having an outer diameter substantially less than the inner diameter of the pot so that an annular gas passage of substantial width will remain between the outer edge of the partition and the side wall

of the pot, and means for centering the partition so that the passage will be of uniform width throughout the circumference of the pot comprising a plurality of lugs projecting from the partition and engaging the side wall of the pot.

5. In a burner for liquid fuel, a pot member having an open top, a substantially cylindrical side wall and a closed bottom, the side wall being provided with a plurality of air inlet openings distributed in spaced apart relation throughout the circumferential area of the side wall between the top and bottom thereof, means for introducing air through these openings, means for introducing liquid fuel into the lower portion of the pot, a fire-ring forming an annular top member for partially closing the top of the pot, a pilot fire-ring forming an annular partition member having a large central aperture, and means for supporting said partition member within the pot at an intermediate height, said partition having an outer diameter substantially less than the inner diameter of the pot so that an annular gas passage of substantial width will remain between the outer edge of the partition and the side wall of the pot, and means for centering the partition so that the passage will be of uniform width throughout the circumference of the pot comprising a plurality of lugs of equal length projecting radially from the partition at equally spaced intervals and engaging the side wall of the pot.

6. In a burner for liquid fuel, a pot member having an open top, a substantially cylindrical side wall and a closed bottom, the side wall being provided with a plurality of air inlet openings distributed in spaced apart relation throughout the circumferential area of the side wall between the top and bottom thereof, means for introducing air through these openings, means for introducing liquid fuel into the lower portion of the pot, a fire-ring forming an annular top member for partially closing the top of the pot, a pilot fire-ring forming an annular partition member having a large central aperture, and means for supporting said partition member within the pot at an intermediate height, said partition having an outer diameter substantially less than the inner diameter of the pot so that an annular gas passage of substantial width will remain between the outer edge of the partition and the side wall of the pot, and means for centering the partition so that the passage will be of uniform width throughout the circumference of the pot comprising a plurality of lugs of equal length projecting radially from the partition at equally spaced intervals and engaging the side wall of the pot, said partition being formed of detachably connected arcuate sections to facilitate installation in and removal from the pot.

7. In a burner for liquid fuel, a pot member having an open top, a substantially cylindrical side wall and a closed bottom, the side wall being provided with a plurality of air inlet openings distributed in spaced apart relation throughout the circumferential area of the side wall between the top and bottom thereof, means for introducing air through these openings, means for introducing liquid fuel into the lower portion of the pot, a fire-ring forming an annular top member for partially closing the top of the pot, a pilot fire-ring forming an annular partition member fitting transversely within the pot and having a large central aperture, and means for supporting said partition within the pot at an intermediate height, said partition being apertured uniformly throughout its outer circumferential portion to permit a flow of gases between the partition and pot wall.

8. An auxiliary fire-ring for use in the pilot flame of a liquid fuel burner of the pot type, said ring comprising an annular plate designed to be supported in a position extending transversely within an intermediate portion of the pot with its large central aperture left open for the free passage therethrough of gases from the lower portion of the pot to the space above the ring, said ring also being apertured uniformly throughout its outer circumferential portion to permit a more restricted flow of gases between the ring and pot wall.

9. An auxiliary fire-ring for use in the pilot flame of a liquid fuel burner of the pot type, said ring comprising an annular plate designed to be supported in a position extending transversely within an intermediate portion of the pot with its large central aperture left open for the free passage therethrough of gases from the lower portion of the pot to the space above the ring, said ring having an outer diameter substantially less than the inner diameter of the pot, and means for centering the ring within the pot so as to provide an additional gas passage of uniform width between the ring and pot wall.

10. An auxiliary fire-ring for use in the pilot flame of a liquid fuel burner of the pot type, said ring comprising an annular plate designed to be supported in a position extending transversely within the intermediate portion of the pot with its large central aperture left open for the free passage therethrough of gases from the lower portion of the pot to the space above the ring and having a series of centering lugs of equal length projecting outwardly from the outer edge of the plate at spaced apart intervals and adapted to engage the inner surface of the pot wall and thus provide a circumferential series of arcuate gas passages of similar width, between the lugs, and between the outer edge of the ring and the inner surface of the pot wall.

11. An auxiliary fire-ring for use in the pilot flame of a liquid fuel burner of the pot type, said ring designed to be supported in a position extending transversely within an intermediate portion of the pot with its large central aperture left open for the free passage therethrough of gases from the lower portion of the pot to the space above the ring, said ring having an outer diameter substantially less than the inner diameter of the pot, and means for centering the ring within the pot so as to provide an additional gas passage of uniform width between the ring and pot wall.

12. An auxiliary fire-ring for use in the pilot flame of a liquid fuel burner of the pot type, said ring designed to be supported in a position extending transversely within the intermediate portion of the pot with its large central aperture left open for the free passage therethrough of gases from the lower portion of the pot to the space above the ring and having a series of centering lugs of equal length projecting outwardly from the outer edge of the plate at spaced apart intervals and adapted to engage the inner surface of the pot wall and thus provide a circumferential series of arcuate gas passages of similar width, between the lugs, and between the outer edge of the ring and the inner surface of the pot wall.

13. In a burner of the character described, a

casing defining an oil vaporizing and air mixing chamber having perforated side walls and a burner throat in a top wall, and means substantially dividing said chamber into upper and lower compartments and affording vapor passage to said throat at the center of said chamber and along the edge of said chamber along the side walls.

14. In a liquid hydrocarbon burner, a pot having a plurality of air inlets in its wall located at various levels therein, said burner having a bottom portion, means for delivering a controlled volume of fuel to said bottom portion, a pilot baffle located intermediate the top and the bottom of the pot, and means for supporting it, the outer edge of said baffle being spaced inwardly from the inner face of the pot, said baffle having a central opening.

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