July 19, 1949. M. D. HUSTON 2,476,871

POT TYPE BURNER WITH COVERED PILOT

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Fig. 1

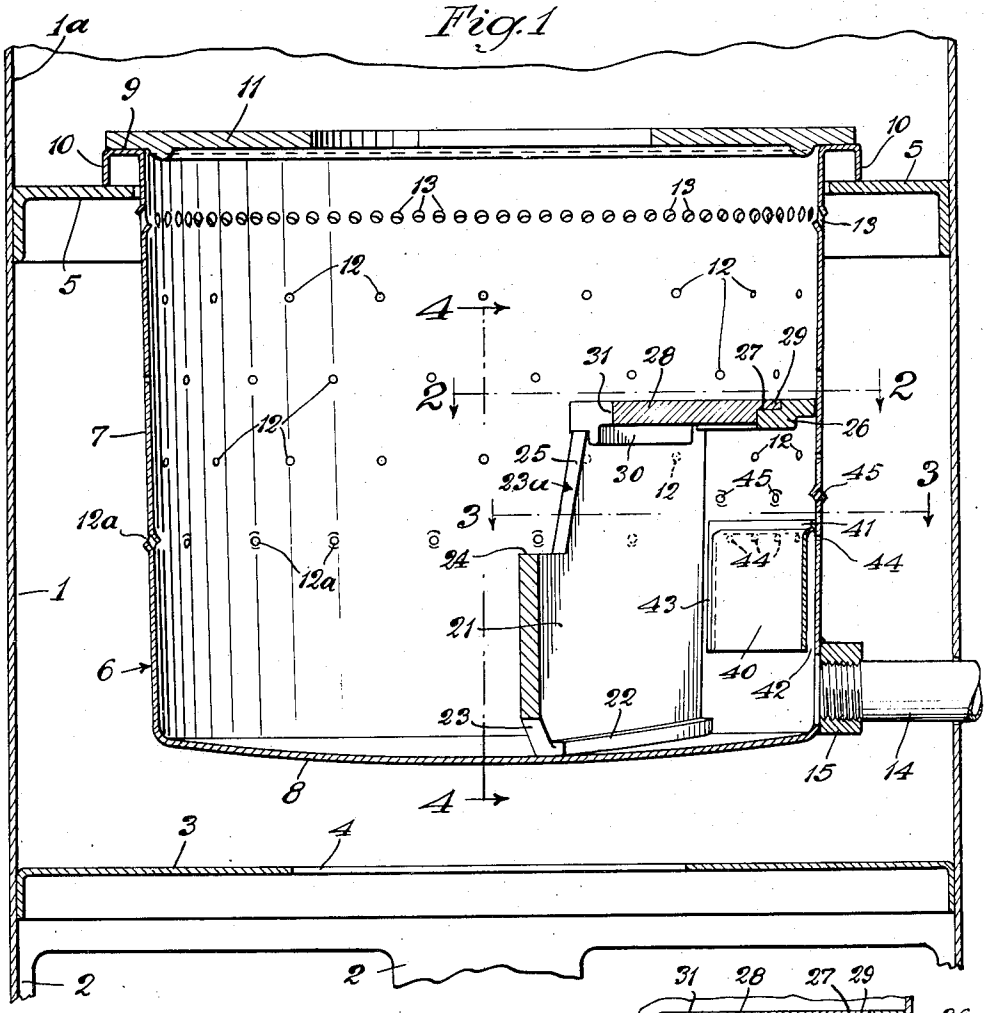


Fig. 5

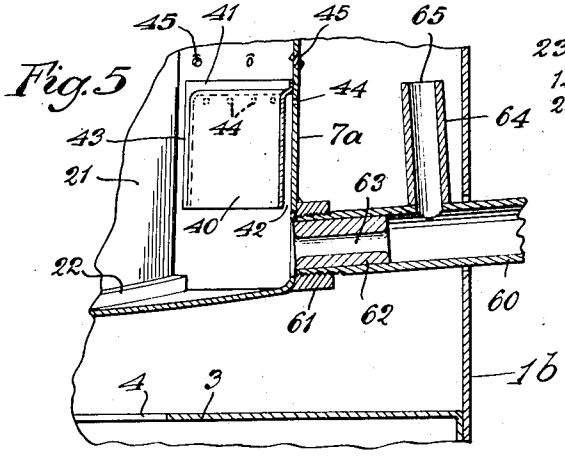
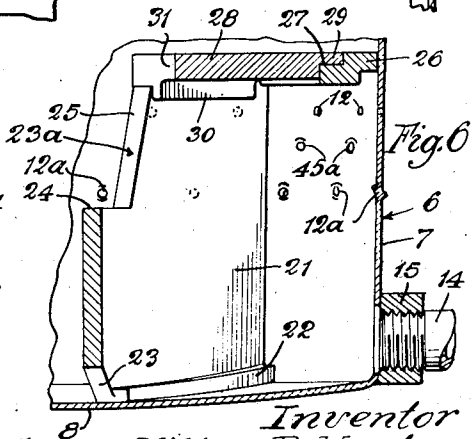


Fig. 6



Inventor
Milton D. Huston
by Parker & Carter
Attorneys

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Fig. 2

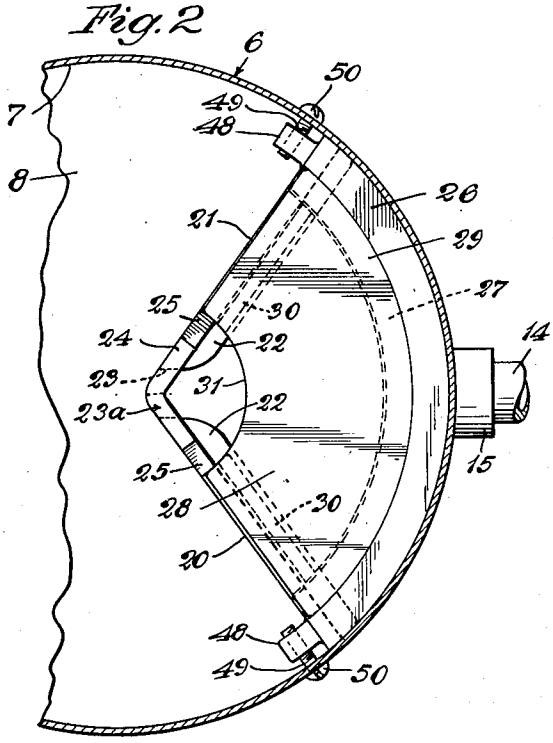


Fig. 3

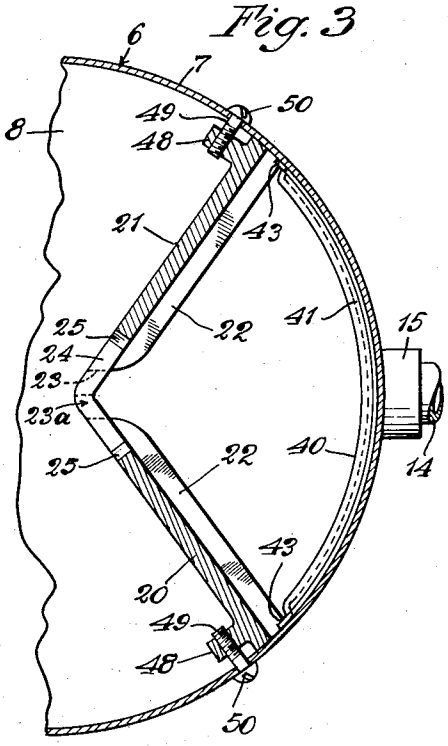
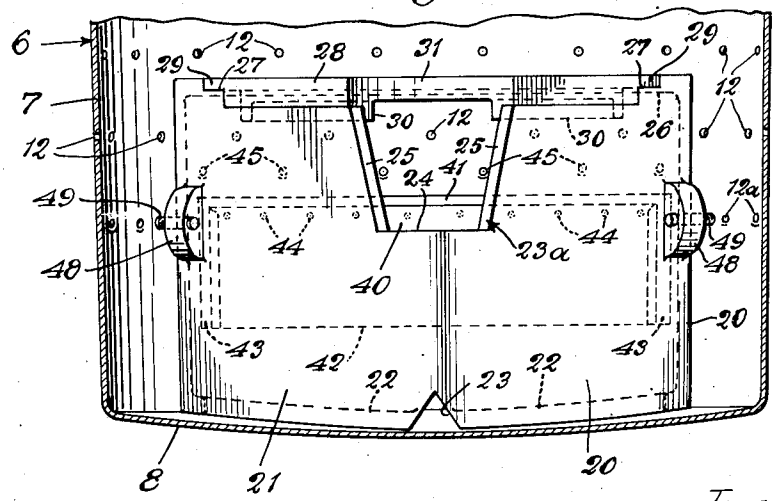


Fig. 4



Inventor
Milton D. Huston
by Parker & Carter
Attorneys.

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POT TYPE BURNER WITH COVERED PILOT

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Fig. 7

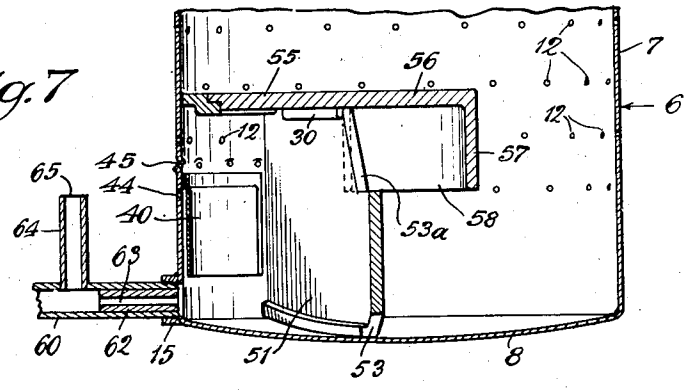


Fig. 8

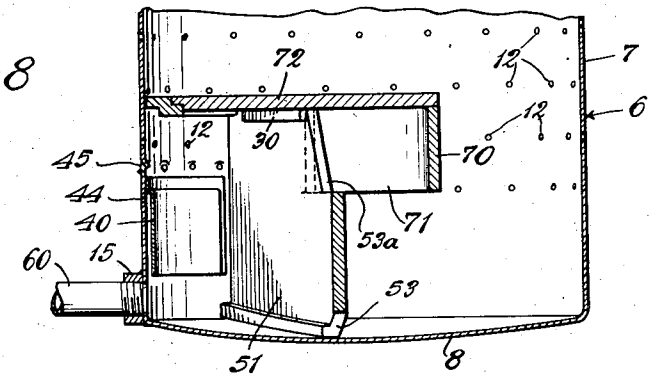
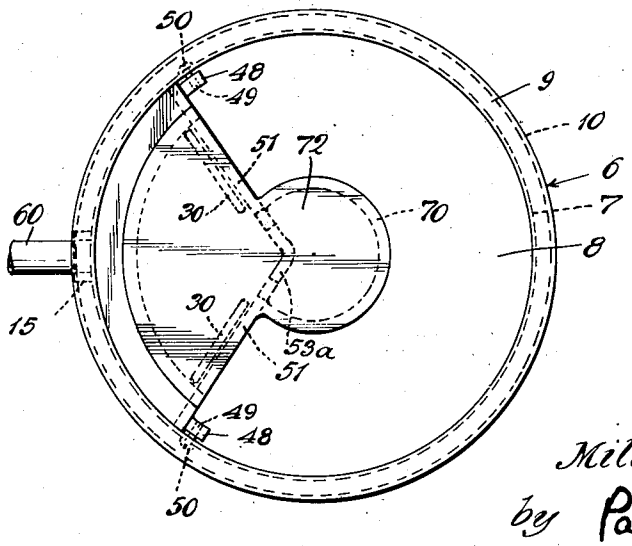


Fig. 9



Inventor
Milton D. Huston
by Parker & Carter
Attorneys.

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UNITED STATES PATENT OFFICE

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POT TYPE BURNER WITH COVERED PILOT

Milton D. Huston, Santa Fe, N. Mex., assignor, by mesne assignments, to Breese Burners, Inc., Sante Fe, N. Mex., a corporation of Delaware

Application July 11, 1945, Serial No. 604,449

11 Claims. (Cl. 158—91)

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The invention relates to an improvement in liquid fuel burners and has for one purpose to provide improved pilot means for such a burner.

Another purpose is to provide improved pilot means for hydroxylating pot type burners.

Another purpose is to provide an improved pilot housing with improved access means to the interior of the housing.

Another purpose is to provide an improved flame propagator for use with such a pilot housing.

Another purpose is to provide improved means for securing the pilot housing to the pot.

Other purposes will appear from time to time in the course of the specification.

The invention is illustrated more or less diagrammatically in the accompanying drawings wherein:

Figure 1 is a vertical axial section through a pot in which the invention is employed;

Figure 2 is a section on the line 2—2 of Fig. 1;

Figure 3 is a section on the line 3—3 of Fig. 1;

Figure 4 is a section on the line 4—4 of Fig. 1;

Figure 5 is a partial vertical section of a variant form of the device;

Figure 6 is a partial section similar to Fig. 1 of a variant form;

Figure 7 is a vertical section through a variant form of the device;

Figure 8 is a vertical section through a variant form of the device; and

Figure 9 is a plan view of the structure shown in Fig. 8.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings 1 generally indicates an outer housing or drum having any suitable supporting leg portions 2, the space within the drum is partially enclosed by the transverse lower partition 3 having an axial aperture 4. 5 is an angle ring extending inwardly from the wall of the drum 1. The upper portion of the drum 1, as at 1a, forms a combustion chamber located above the angle ring 5. 6 generally indicates a burner pot having a circumferential side wall 7 and a concave bottom 8. It is also provided with a top outwardly extending flange 9 having a downwardly turned portion 10 which rests upon the angle 5. The top of the pot is partially closed by the centrally apertured flame ring 11. The

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side wall 7 of the pot has a plurality of primary air inlet apertures 12 spaced circumferentially thereabout and located at various distances from the ends of the pot. The lowest row of primary air inlets 12a may be downwardly inclined. Any suitable means for supplying secondary air may be employed but I illustrate a top row of secondary air inlets 13 which are both more closely spaced and larger than the primary air inlets 12, and which are upwardly and inwardly inclined toward the central aperture of the flame ring 11. 14 is any suitable liquid fuel pipe which may be threaded into the nut 15 secured to the exterior of the side wall 7 of the pot. Liquid fuel from any suitable source may be delivered along the pipe 14 to the pot bottom adjacent the wall 7. Any suitable means, not herein shown, may be employed for varying or controlling the rate of flow of liquid fuel to the pot. I may for example employ the conventional and well known float valve assembly. It is important, however, that some means be provided for manually or automatically varying the rate of flow of liquid fuel between minimum or pilot flow and maximum or full combustion flow. If desired any suitable fan means for varying or controlling the rate of flow of air to the space about the pot may be employed. I may for example mount any suitable fan, not herein shown, in the aperture 4 of the partition 3.

The burner pot shown in the present application is of the hydroxylating type in which a preliminary or primary mixture of vaporized fuel and primary air has added to it an additional or secondary air supply. When the burner is burning at full volume, with the liquid fuel flowing to the pot at a maximum rate of flow, the liquid fuel flows from the duct 14 across the pot bottom 8 and is vaporized by the heat of combustion taking place above. As the vaporized fuel rises it receives primary air from the apertures 12 and 12a. The result is a primary mixture of vaporized fuel and air. This primary mixture flows toward the open end of the pot. When it receives its secondary air supply through the secondary inlets 13 it forms a completely combustible mixture, and combustion takes place at or above the level of the secondary air inlets and the flame ring. In practice a substantial

flame extends upwardly into the space within the housing 1*a*.

In burners of this type a low "turn down" is desirable. In effect, a pilot fire must be maintained, without resulting in carbon deposit in the burner or causing a blocking of the liquid fuel duct.

I find it desirable to surround the area of entry of the liquid fuel to the interior of the burner pot with a pilot housing or chamber. I illustrate for example the chamber having inwardly converging side walls 20 and 21. These side walls may be of any suitable material but I find it desirable to employ a metal casting of substantial thickness. I illustrate also bottom flanges 22 which directly engage the bottom of the pot. The mass of metal thus provided serves as a heat storage means and as a means for providing efficient heat transfer to the pot bottom. In the particular form of the device herein shown the walls 20 and 21 converge or join at their inner edges. However a bottom central outlet 23 is provided, through which unvaporized liquid fuel may flow, when the burner is at high fire and through which a pilot flame may pass, when the burner is at low fire. The walls 20 and 21 are also cut back to provide a top aperture 23*a* formed by horizontal bottom edges 24 and rearwardly inclined side edges 25.

The outer top edges of the walls 20 and 21 are shown as connected by an arcuate brace 26 having a top inner recess 27 to receive the inner edge of a removable cover plate 28. The cover plate 28 is shown as having an inner edge portion 29 seated in the recess 27 and also having lower aligning flanges 30 which may abut against the inner faces of the upper edges of the walls 20 and 21. The cover plate terminates at its inner edge in an arcuate wall 31 which with the edges 24 and 25 defines the upper aperture 23*a* through which the interior of the pilot housing and the interior of the rest of the pot are in communication.

In the form of Figure 1 a flame propagator below described is positioned within this space surrounded by the pilot housing. In the form of Figure 6 the propagator is omitted, but the housing is shown as identical with that of Figure 1 and the same descriptive numbers are employed.

With reference to the form of Figure 1, I illustrate a flame propagator in the form of a deflector 40 which is secured at its upper edge, as at 41 to the opposed inner face of the pot wall 7. The member 40 is generally uniformly inwardly spaced from the pot wall. The space between the two members is open, as at 42, along the lower edge of the member 40. However the ends of the member 40 are secured to the pot wall as at 43. Air may be downwardly deflected by the member 40 toward the bottom of the pot. This air is preferably low velocity air which is "bled" downwardly along the lower portion of the pot wall. Air may be admitted by a plurality of relatively small relatively closely spaced apertures 44 which are shown in Figure 1 as at the level of the lowest row of primary air inlets 12*a*. It will be understood, however, that the size, shape, number and spacing of these apertures may be varied to suit the particular conditions involved. If desired I may also employ extra apertures within the interior of the pilot housing. I illustrate for example an intermediate row of downwardly tilted apertures 45 which may for convenience be located just above the upper edge of the propagator 40. In the arrangement of apertures shown in Figure 1 it will be understood that there is a greater concentration of air inlets in the area of the pot wall which registers with the interior of the pilot housing than there is in any corresponding area of the pot wall which is out of register with the interior of the pilot housing. Thus an extra air supply, or an extra concentration of air, is provided.

In order to secure the pilot housing in place any suitable means may be employed. I may for example employ ears 48 outwardly extending from the inner parts of the walls 20 and 21. These ears are threaded to receive the inner ends of screws 49, the heads of which, 50, are exterior to the pot. Thus the pilot housing may be drawn into snug connection with and contact with the inner face of the pot wall and bottom, but may be loosened or removed by loosening the screws 49. It will be understood also that any suitable gasketing or cementing may be employed, in order to provide a tight joint. Since a very thin layer of cement may be used the cement is not actually illustrated in the drawings. It will be understood that under normal circumstances furnace cement of some kind will be employed, but that it may not always be essential.

With reference to the form of Figure 6 the propagator 40 is omitted and the lower row of apertures 12*a* is continued about that part of the pot which is in register with the pilot housing. However, the extra apertures 45*a* are preferably employed, or some extra aperturing is used, in order to maintain an adequate supply of air in the pilot housing.

With reference to the form of Figure 5, I illustrate a variation in the form of liquid fuel inlet or duct. Otherwise the structure is the same as that illustrated in the form of Figure 1. A liquid fuel duct or tube 60 is threaded as its end into the nut 61 secured to the outer surface of the pot 7*a*. A reducer 62, with the central aperture 63, is located in the inner end of the duct 60. Preferably the duct 60 is inclined from the horizontal at an angle of from three to five degrees. The result is a puddling or accumulation of oil back of the reducer 62. A supply of air is admitted to the interior of the duct 60 above this puddle of oil, for example by the air inlet duct 64 with its open top 65, the duct being located in the space between the exterior of the pot 7*a*, and the inner face of the outer housing 1*b*.

Referring to the form of Figs. 7 and following I illustrate a deflector adapted to turn the tip of the upper flame down toward the floor to heat the floor or bottom of the pot. The deflector also serves to discharge products of combustion in close proximity to the lower aperture of the pilot structure. In case the draft flows in at the lower pilot aperture it will draw in products of combustion rather than air. If air were drawn into the pilot housing, it would interrupt or destroy the process of hydroxylation within the pilot area. When carbon dioxide is pulled into the bottom opening of the pilot housing, it not merely does not destroy the process of hydroxylation, but tends to assist it.

With reference first to Fig. 7, the pilot housing will be understood to be substantially the same as shown in Fig. 1 and the arrangement of pot apertures is the same and need not be described. The converging walls 51 of the pilot housing define a lower pilot aperture 53 and an upper pilot aperture 53*a*. The cover 55 is provided with a forwardly extending portion 56 which may have

a circular contour. Downwardly extending from the circular portion is a generally cylindrical wall 57 defining a bottom aperture 58. Thus a flame path is open through the aperture 53a downwardly through the space surrounded by the walls 56 and 57 and downwardly and outwardly through the aperture 58.

With reference to Fig. 8 the deflector is cast as part of the bottom pilot as shown at 70 and defines a bottom aperture 71. A unitary top member 72 in provided which closes both the top of the quadrant or pilot housing itself and the top of the space surrounded by the circumferential cylindrical wall 70.

It will be realized that, whereas, I have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing.

The use and operation of this invention are as follows:

When the rate of flow of fuel through the duct 14 is at a predetermined minimum or pilot stage a relatively small supply of liquid fuel is delivered to the bottom 8 of the pot, in the space surrounded by the pilot housing. The inlets 12 and 45 admit an ample supply of air to the interior of the pilot housing. The relatively small flow of liquid fuel is vaporized in the pilot housing. The vaporized liquid fuel is mixed with the air delivered through the apertures 12 and 45 to form a primary mixture. This mixture flows outwardly through the two apertures in the pilot housing wall. The air delivered to the interior of the pot outside of the pilot housing provides a secondary air supply and the final or completed mixture burns at one or both of the two apertures. This flame is effective to heat the walls 20 and 21 and the adjacent part of the pot bottom. In the event that combustion takes place chiefly at the upper aperture the relatively thick gauge metal conducts the heat down to the pot bottom. Thus the pot bottom is kept hot, and is ready to effect the vaporization of the liquid fuel when a larger supply of fuel is admitted, to increase the rate of combustion of the burner. As the rate of combustion is increased by increasing the rate of fuel supply, unvaporized liquid fuel will flow through the aperture 23 to the outer part of the pot bottom 8. The area of vaporization is increased and the volume of liquid fuel vaporized is increased. This vaporized fuel flows upwardly in the pot and receives primary air from all of the apertures 12 and 12a, when the pot is at the high fire stage. This primary mixture then receives its secondary air through the secondary air inlets 13 and full combustion takes place at or above the level of the flame ring 11.

When the flame propagator 40 is employed the necessary heat is produced with very slight additional air and the capacity of the pilot burner is kept down. For instance to obtain the necessary heat with the structure as shown in Figure 6 the minimum capacity for the pilot in a seven inch burner pot was, in a particular test, two cubic centimeters of fuel per minute. With the structure as shown in Figures 1 to 4, with the propagator 40 employed, the minimum capacity was dropped to 1.25 cubic centimeters per minute. A further advantage of the use of the flame propagator is that any tendency of the pilot to snuff out when turned down very low is prevented. In the form of Figure 5 some air is admitted to the liquid fuel before it reaches the pot at all. In the particular form shown the air which flows downwardly through the duct 64 passes across the surface of the puddle of oil behind the reducer sleeve 62 and flows, with the liquid fuel, through the bore 63. In view of this additional air supply the total cross sectional area of the inlet apertures to the interior of the pilot housing may be reduced.

Regardless of whether the propagator 40 is employed or not it will be understood that the deflector structure of Figs. 7 and following may be employed in order to deflect flame or the products of combustion downwardly toward the bottom pilot aperture 23 or 53. As a matter of convenience the deflector structure may be formed unitarily with the lid as at 55, 56 and 57 of Fig. 7, or it may be formed unitarily with the converging housing walls as at 60 in Figs. 8 and 9, with the top closure 72 preferably removably applied.

Whereas I have illustrated the propagator 40 as closed at the top and sides and open at the bottom it will be understood any suitable means for supporting the propagator in position may be employed.

I claim:

1. 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, having a closed top, located below the highest of the primary air inlets, 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 defining a flame outlet and extending inwardly from the pot wall, means for delivering liquid fuel to the pot at a point enclosed by said pilot housing, and flame propagating means within the pilot housing including an arcuate solid sleeve secured to the inner face of the pot wall and defining with the opposed portion of the pot wall a space which is open to the interior of the pot at the bottom thereof along one edge of the sleeve, the pot wall being apertured to admit air to the space between the pot wall and the sleeve.

2. 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, having a closed top, located below the highest of the primary air inlets, 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 defining a flame outlet extending inwardly from the pot wall, means for delivering liquid fuel to the pot at a point enclosed by said pilot housing, and an air deflector located within the pilot housing and defining, with an opposed portion of the pot wall, a closed space open only at the bottom to the interior of the pot, the pot wall being apertured to admit air to the interior of said space, said air deflector being adapted to direct air downwardly toward the pot bottom.

3. 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 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 defining a flame outlet extending inwardly from the pot wall, means for delivering liquid fuel to the pot at a point enclosed by said pilot housing, an air deflector located within the pilot housing and defining, with an opposed portion of the pot wall, an open space, the pot wall being apertured to admit air to the interior of said space, said air deflector being adapted to direct air downwardly toward the pot bottom, the deflector terminating above the bottom of the pot and extending about and overlying the area of admission of the fuel to the pot.

4. 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, a pilot housing 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, said side walls extending inwardly from the pot wall and converging inwardly and partially defining an upper and a lower flame outlet, and a cover for said pilot housing, the inner edge of said cover assisting in defining the upper flame outlet, said cover being removably supported in relation to said side walls.

5. 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, a pilot housing defining a space in communication with a plurality of the lower primary air inlet apertures of the pot, said housing including generally upright side partition walls partially defining a flame outlet and extending inwardly from the pot wall, and means for delivering liquid fuel to the pot at a point enclosed by said pilot housing, said pot and partition walls being of metal, the metal of the partition walls being substantially thicker than the wall of the pot, said partition walls being adapted to serve as heat storage elements, said side partition walls having laterally extending bottom flanges adapted to increase the area of engagement between the lower edges of said side partition walls and the bottom of the pot.

6. 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, a pilot housing 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 partially defining a flame outlet and extending inwardly from the pot wall, means for delivering liquid fuel to the pot at a point enclosed by said pilot housing, an arcuate connecting piece joining the upper edges of the walls of said pilot housing, said connecting piece having an outer edge conforming closely to the opposed inner face of the pot wall, and a removable cover plate having portions resting upon said arcuate connecting piece and the upper edges of said side wall.

7. In a liquid fuel burner and pilot housing therefor, a burner pot having a circumferential side wall, a closed end wall and an open end, said side wall having a plurality of primary air inlet apertures located therein at various distances from the ends of the pot, means located adjacent the open end of the pot for delivering secondary air to the primary mixture, a liquid fuel supply duct adapted to deliver a supply of liquid fuel therethrough to the interior of the pot adjacent the intersection of the closed end at the side wall, a pilot housing in said pot, surrounding the point of admission of liquid fuel to the interior of the pot, said housing including generally upright side walls and a removable top wall, said housing having a lower flame aperture adjacent the bottom of the pot and an upper flame aperture adjacent said removable top wall.

8. In a liquid fuel burner and pilot housing therefor, a burner pot having a circumferential side wall, a closed end wall and an open end, said side wall having a plurality of primary air inlet apertures located therein at various distances from the ends of the pot, means located adjacent the open end of the pot for delivering secondary air to the primary mixture, a liquid fuel supply duct adapted to deliver a supply of liquid fuel therethrough to the interior of the pot adjacent the intersection of the closed end at the side wall, a pilot housing in said pot, surrounding the point of admission of liquid fuel to the interior of the pot, said housing including generally upright side walls and a removable top wall, said housing having a lower flame aperture adjacent the bottom of the pot and an upper flame aperture adjacent said removable top wall, and deflector means for directing products of combustion from said upper flame aperture downwardly toward said lower flame aperture.

9. In a liquid fuel burner and pilot housing therefor, a burner pot having a circumferential side wall, a closed end wall and an open end, said side wall having a plurality of primary air inlet apertures located therein at various distances from the ends of the pot, means located adjacent the open end of the pot for delivering secondary air to the primary mixture, a liquid fuel supply duct adapted to deliver a supply of liquid fuel therethrough to the interior of the pot adjacent the intersection of the closed end at the side wall, a pilot housing in said pot, surrounding the point of admission of liquid fuel to the interior of the pot, said housing including generally upright side walls and a removable top wall, said housing having a lower flame aperture adjacent the bottom of the pot and an upper flame aperture adjacent said removable top wall, and deflector means for directing products of combustion from said upper flame aperture downwardly toward said lower flame aperture, at an area within the pot and exterior to said pilot housing.

10. For use in a hydroxylating pot type burner having a circumferential side wall, a bottom wall, and a liquid fuel inlet duct adapted to discharge liquid fuel into the pot adjacent the intersection of the bottom wall and the side wall, a pilot housing adapted to surround the area within the pot in direct communication with said duct, said pilot housing including side and top walls partially

defining a lower flame opening adjacent the bottom of the pot and an upper flame opening spaced from the bottom of the pot, and means for directing the flame and products of combustion flowing outwardly through said upper opening to a point adjacent but exterior to said lower opening.

11. For use in a hydroxylating pot type burner having a circumferential side wall, a bottom wall, and a liquid fuel inlet duct adapted to discharge liquid fuel into the pot adjacent the intersection of the bottom wall and the side wall, a pilot housing adapted to surround the area within the pot in direct communication with said duct, said pilot housing including side and top walls partially defining a lower flame opening adjacent the bottom of the pot and an upper flame opening spaced from the bottom of the pot, and means for directing the flame and products of combustion flowing outwardly through said upper opening to a point adjacent but exterior to said lower opening, said means including a deflector in general alignment with the top of and having a flange extending downwardly in front of the upper opening.

MILTON D. HUSTON.

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