Jan. 23, 1951

H. M. REEVES ET AL
VAPORIZING-TYPE OIL BURNER
WITH BAFFLE MEANS THEREFOR

2,538,911

Filed June 7, 1947

2 Sheets-Sheet 1

Fig. 1

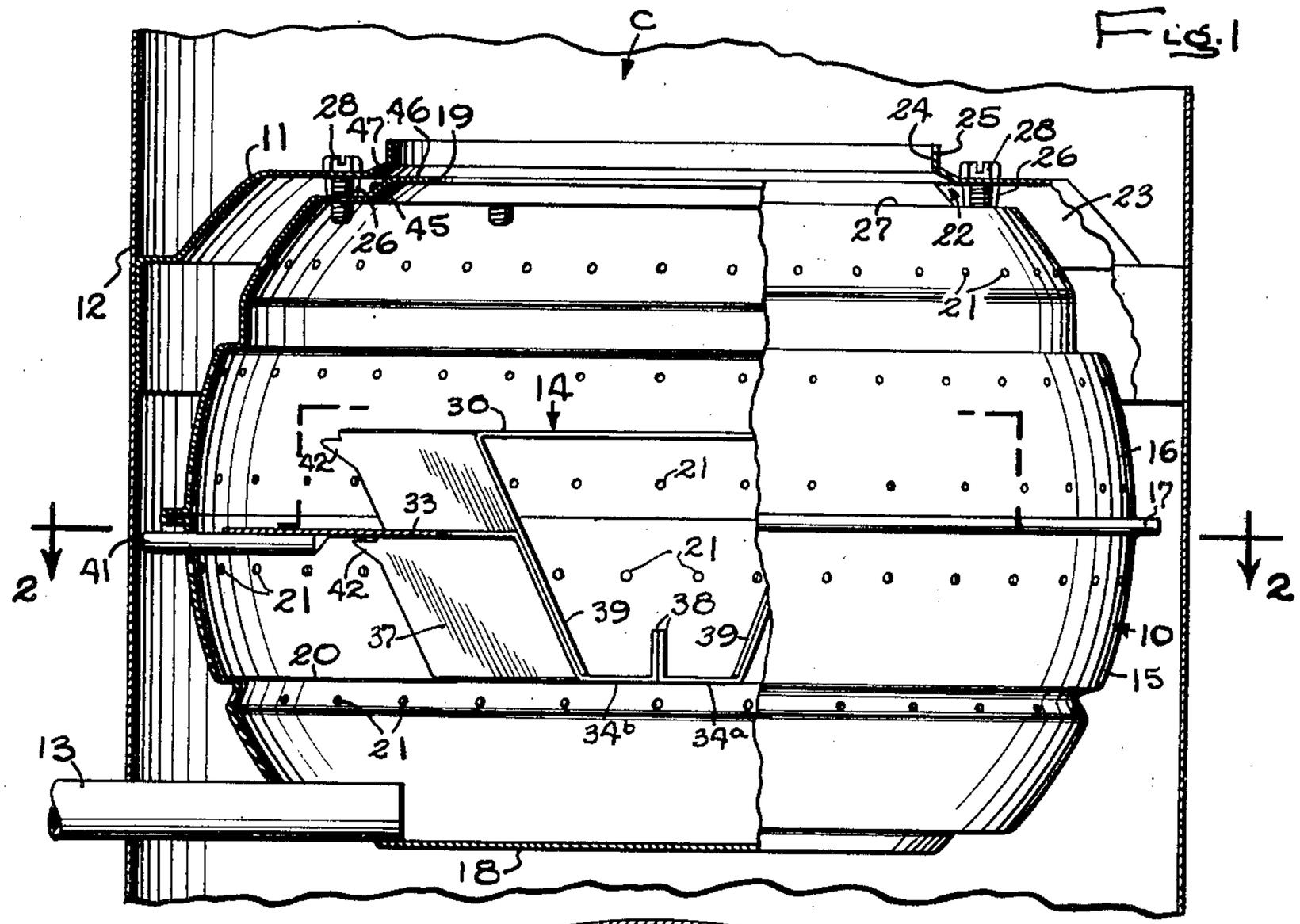

Fig. 2

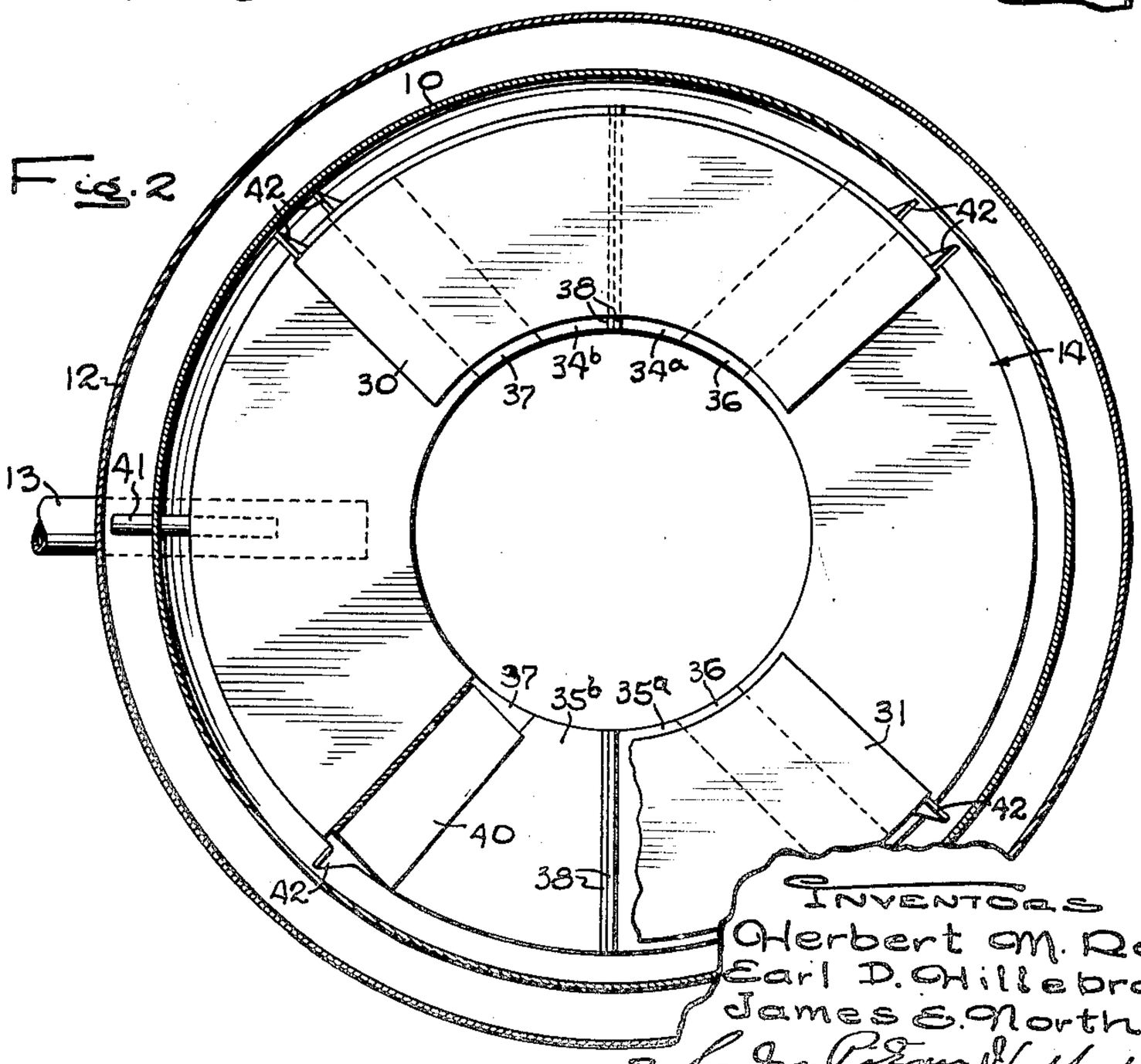

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Fig. 3

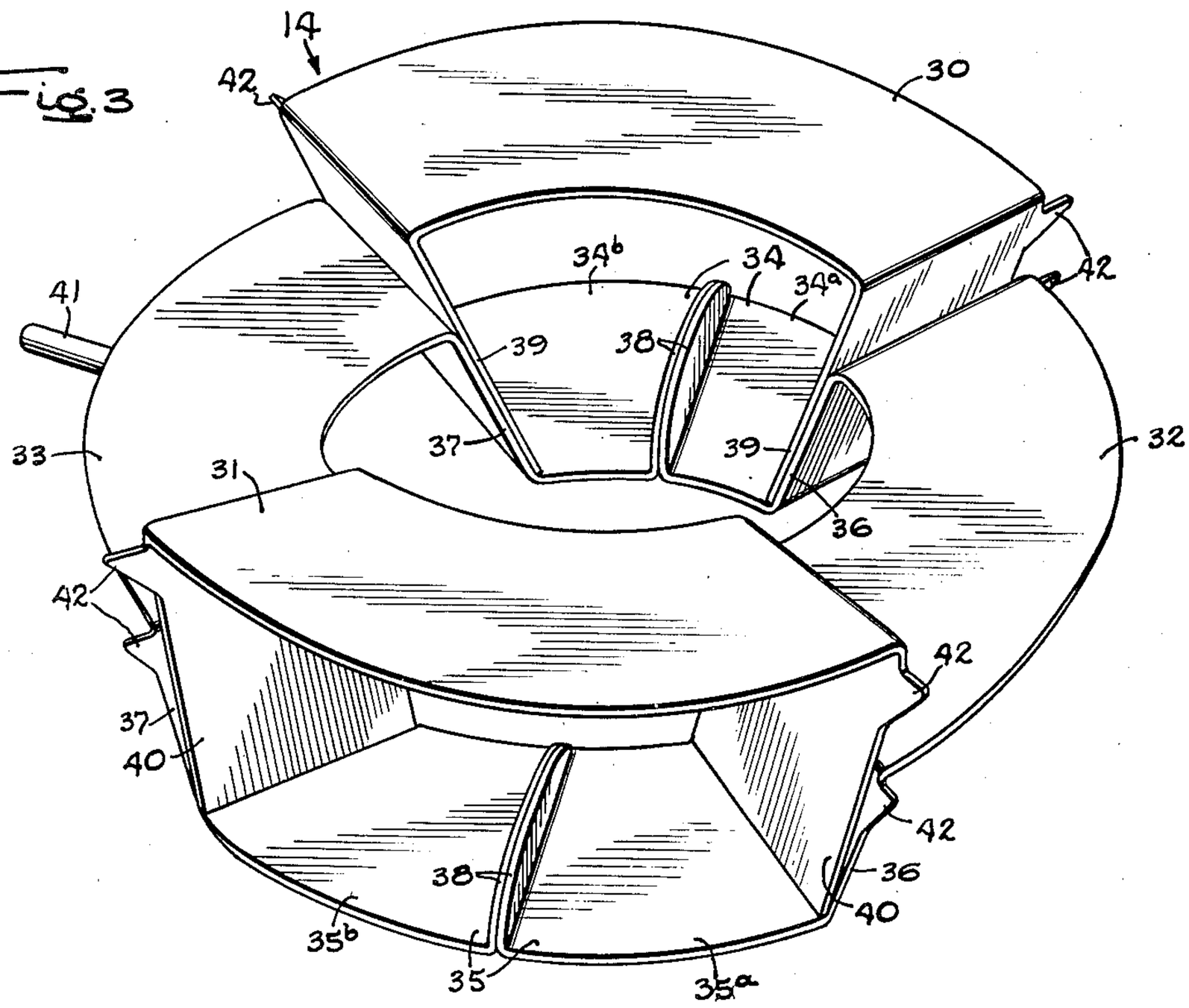


Fig. 4

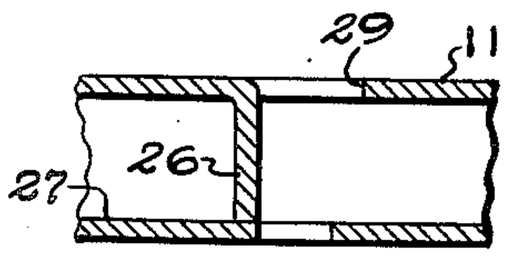


Fig. 5

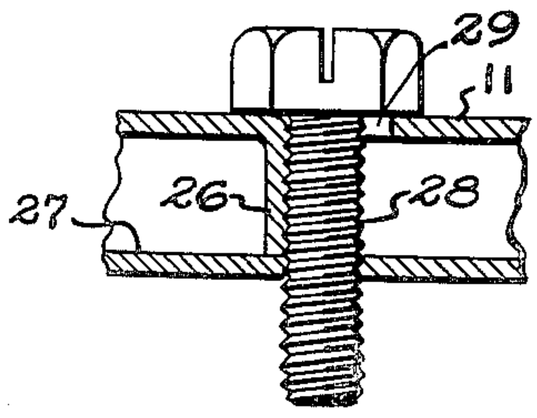
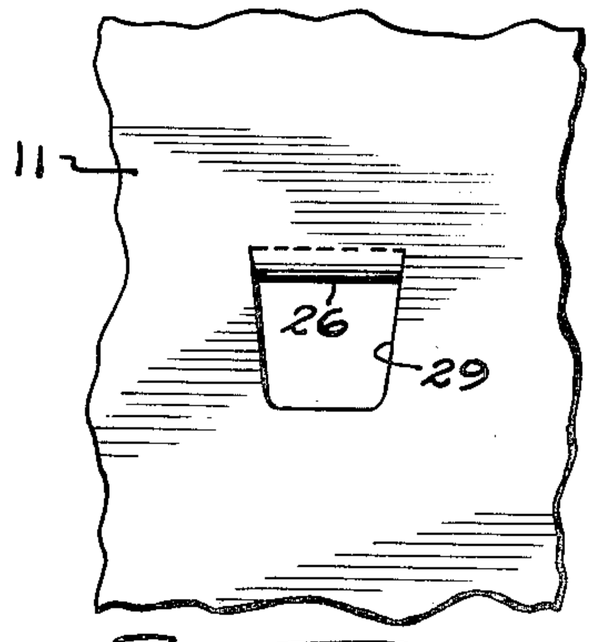


Fig. 6



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VAPORIZING-TYPE OIL BURNER WITH BAFFLE MEANS THEREFOR

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5 Claims. (Cl. 158—91)

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The invention relates to improvements in liquid fuel burners and more particularly to burners of the so-called pot type adapted to burn fuel oil.

It has been found that a large percentage of the troubles encountered in the operation of oil burners of the above general character, and particularly the troubles which are sufficiently serious to require the attention of a serviceman, are caused by insufficient draft. Most burners now in use or on the market require a draft of from .05 to .06 inch of water for operation, and some burners produced in the past have been found to operate satisfactorily only when a draft of at least .08 inch of water is maintained. Pot type oil burners are frequently bought and installed by people who have neither the equipment nor the knowledge necessary to determine the intensity of the available draft. In any case it is usually impractical to make changes in the flue or chimney to increase the draft if it is found to be inadequate. As a result, many pot type burners are operated at very low efficiency, thereby wasting fuel and correspondingly increasing heating costs.

With the above in view, the primary object of the invention is to provide an improved pot type oil burner which is capable of operating efficiently with a draft of substantially lower intensity than that heretofore required by burners of the same general type.

A more specific object is to provide a pot type oil burner adapted to operate cleanly and efficiently with a draft of only .03 inch of water.

Another object is to provide novel means for supporting the burner pot while affording an effectual inlet for the secondary air supply, and for stabilizing the operation of the burner when lighted in a flooded condition.

It is also an object of the invention to provide a pot type oil burner having a novel baffle structure which, in cooperation with the burner pot, effects a thorough and adequate mixing of the air and oil vapors to insure a clean flame when operated on either high or low fire levels, and which permits the burner to be operated at a low fire level without allowing the flame to drop to the bottom of the burner pot or to produce a deposit of carbon or soot in the burner pot or heating chamber.

Other objects and advantages of the invention will become apparent from the following detailed description of the preferred embodiment illustrated in the accompanying drawings, in which:

Figure 1 is a vertical sectional view of a fuel oil burner embodying the features of the invention.

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Fig. 2 is a transverse sectional view of the burner taken in a horizontal plane substantially on the line 2—2 of Fig. 1.

Fig. 3 is a perspective view of the baffle structure forming part of the burner.

Figs. 4 and 5 are fragmentary sectional views showing the manner in which the burner pot is spaced from and secured to the member by which it is supported.

Fig. 6 is a fragmentary plan view of the portion of the supporting member shown in Fig. 4.

While the invention is susceptible of various modifications and alternative constructions, we have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that we do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring to the drawings, the fuel oil burner selected to illustrate the invention comprises a fuel receptacle or oil pot 10 adapted to be supported below an apertured partitioning member 11 herein shown as a sheet metal panel, which with a casing 12 defines the combustion chamber C of a stove or furnace. In the exemplary embodiment, the pot 10 is supported by the partitioning member 11 and in depending relation thereto. Fuel oil is supplied to the burner pot 10 through an inlet tube or pipe 13 opening into the bottom of the pot and under control of suitable valve means (not shown).

The burner pot 10 is preferably constructed in the form of a sphere flattened at the poles similar to that shown in Patent No. 2,422,209 to H. M. Reeves and L. F. Vixler, which has been found to possess the desirable characteristics of providing efficient operation on widely varying fire levels and of reducing flame pulsations to a minimum. The functioning of the burner is further improved by providing within the pot 10 a baffle structure 14 of novel and advantageous construction which, in cooperation with suitably proportioned and positioned air inlet openings, insures proper mixing of the fuel vapors and primary air and the delivery of the mixture to the combustion zone of the burner for efficient operation at a low draft level.

In the exemplary burner the oil pot 10 is constructed in two sections, including a lower section 15 and an upper section 16, each comprising a sheet metal stamping in the form of a segment of a sphere. These sections are joined together in the medial plane of the oil pot by an

interlocking seam 17. As will be seen by reference to Fig. 1 of the drawings, the lower burner section 15 is formed with a flat bottom 18 suitably dimensioned so as to spread the liquid fuel over an area calculated to produce a clean stable flame at the low fire level. The upper pot section 16 is provided with an outlet opening 19 for the fuel and air mixture generated in the pot 10. An inwardly pressed bead 20 in the side wall of the bottom section 15 forms an annular ledge or shoulder around the interior of the pot for supporting the baffle structure 14. Each pot section is also formed with a plurality of vertically spaced rows of holes 21, such holes constituting inlet openings or ports for admitting primary air to the pot 10.

Secondary air is supplied to the burner through a continuous annular port 22 encircling the opening 19 in the pot 10. The port 22 in this instance constitutes the outlet of a secondary air passage 23 formed by the top section 16 of the burner pot and the partitioning member 11. The partitioning member is formed with an opening 24 slightly larger than the opening 19 and registering with it to form the mouth of the burner which provides communication between the pot and the combustion chamber C of the stove thereby causing expansion of the gas and air mixture at the point of introduction of secondary air. An upstanding flange 25 of substantial height surrounding the opening 24 prevents blowing or lifting of the flame from the burner mouth and eliminates the need for the usual flame ring.

In order to maintain the width of the port 22 uniform around the entire burner mouth, the pot 10 is secured to the supporting member and spaced therefrom in a novel manner. For this purpose a plurality of depending lugs 26 (Figs. 4–6) of uniform length are struck out from the partitioning member around the opening 24 and arranged for cooperation with a flattened wall portion 27 formed around the top of the pot. Securing elements 28, such as self tapping screws inserted through the openings 29 left by the lugs and screwed through registering holes in the pot, serve to draw the pot wall 27 into engagement with the lugs and thus accurately space the pot from the supporting member.

In accordance with the invention, the draft requirements of the burner are reduced substantially, as compared with burners heretofore available, by constructing and coordinating the various elements of the burner so as to offer a minimum of resistance to the flow of air and oil vapors from the pot 10 into the combustion chamber C. This involves a number of structural features each of which contributes to the attainment of the desired result. Thus the mouth of the burner as defined by the outlet opening 19 in the top section 16 of the burner port and the opening 24 in the partitioning member 11 is made relatively large, preferably with a diameter of at least sixty per cent. of the diameter of the spherical portion of the pot. Further, the secondary air inlet port 22 is so positioned and the mouth of the burner is constructed so as to eliminate the necessity for a flame ring, thus leaving the burner mouth completely unobstructed for the free flow of gaseous products therefrom. The proportioning and positioning of the primary air ports 21 is also highly important. With respect to the latter openings, it has been found that best results are obtained by providing relatively small openings, but in substantially larger numbers than is conventionally done, and by locating the

openings in rows extending around the burner pot and spaced apart for efficient cooperation with the baffle structure 14 in mixing the air and oil vapors and directing the flow of the mixture to the burner mouth.

The baffle structure 14 (as shown in Fig. 3) comprises a plurality of baffle elements or plates, each in the form of a segment of an annulus adapted to be assembled in vertically and horizontally staggered relation around the side walls of the burner pot 10. In the exemplary burner the baffle structure is arranged to provide diametrically opposed baffle plates at three different levels, including two upper baffle plates 30 and 31, two intermediate baffle plates 32 and 33, and two lower baffle plates 34 and 35.

To facilitate assembly of the baffle structure in the burner pot, the lower baffle plates are constructed in two sections 34^a, 34^b, 35^a and 35^b and a section of each of the lower plates is formed integrally with an adjacent intermediate baffle plate. Thus the sections 34^a and 35^a are joined to the intermediate baffle plate 32 by legs 36 depending from opposite ends thereof, the plate, the legs and the sections being formed as a unit, preferably from sheet metal. Sections 34^b and 35^b are similarly formed as a unit with intermediate baffle plate 33 and are joined thereto by upright portions herein shown as depending legs 37. Upturned flanges 38 on the abutting edges of the lower baffle plate sections assist in maintaining them in proper assembled relation in the burner pot.

The upper baffle plates 30 and 31 are held in assembled relationship with the companion baffle plates and suitably spaced therefrom by inclined legs 39 and 40 depending from opposite ends thereof and adapted to rest on the lower baffle plates 34 and 35. Preferably these legs are disposed in planes generally radial with respect to the burner pot and inclined downwardly and inwardly for interfitting relation with the legs 36 and 37 of the other baffle units which are similarly inclined. Due to the inclination of the legs of the baffle units, the upper baffle units are interlocked with the lower units and securely held against inward displacement when the baffle structure is assembled in the burner pot. A locating pin 41 rigidly secured to one of the intermediate baffle plates, in this instance the plate 33, is adapted to project radially through an aperture in the side wall of the burner pot to insure accurate positioning of the baffle structure in the pot. As herein shown, the locating aperture for the pin 41 is located directly above and in line with the pipe 13.

When assembled in the burner pot with the flanges 38 of the end sections in abutting relation, the baffle members 32—35 form a continuous annular wall disposed coaxially of the pot and having alternate portions located in vertically offset planes. The upper baffle members 30, 31 are received in segmental pockets formed by the upright portions or legs 36, 37 and the lower baffle members 34 and 35 and thus securely retained in place. The assembled baffle structure 14 is supported by the lower baffle plates 34 and 35 resting on the shoulder formed by the bead 20 in the pot wall. The intermediate and upper baffle plates preferably have their outer edges formed on radii somewhat shorter than the radius of the pot 10 so as to provide passages between the baffle plates and the pot walls. Lugs 42 projecting upwardly from the legs 36, 37, 39 and 40 engage the

pot walls to hold the baffle plates in spaced relation thereto.

In the preferred form of the burner, the primary air ports are arranged in five circumferential rows so located with respect to the baffle plates that through intermixing of fuel vapors and primary air is insured. As shown in Fig. 1, the three lower rows of ports are located respectively below the three levels of the baffle structure 14. The two remaining rows of ports are located in the upper section 16 of the oil pot between the top level of the baffle structure and the outlet opening 19 of the pot. To promote vaporization of the liquid fuel, the ports 21 of the lower row are formed in the pressed in portion of the pot wall constituting the bead 20. This portion of the wall is inclined at an angle such that the air entering through such openings is directed inwardly and downwardly against the pool of oil at the bottom of the pot. All of the other primary air ports are directed toward the center of the pot. Accordingly, as the fuel vapor rises from the bottom of the pot, it is pierced by the numerous jets entering through the primary air ports which together with the baffle structure 14 effect a thorough mixture of the air and vapor. It will be understood that sufficient ports are provided to admit air in the correct proportion for efficient combustion. Due to the generally spherical shape of the pot 10, the air and vapor mixture is allowed to expand in the the lower portion of the pot and then only slightly compressed in the upper portion of the pot before it is discharged through the outlet opening 19 for mixture with the secondary air.

As indicated heretofore, secondary air is supplied through the passage 23 and circular port 22 adjacent the outlet opening 19 in the top of the pot 10. In order to insure intimate mixing of the secondary air and fuel vapor and primary air mixture without unduly increasing the resistance offered to the flow of the mixture, the passage 23 is tapered slightly toward the port 22 and positioned so that the secondary air stream is directed somewhat upwardly and across the mouth of the burner. To this end, the wall portion of the burner pot adjacent the opening 19 is shaped to provide an upwardly sloping surface 45 inclined at an angle of approximately 40° to the horizontal and terminating in a flat lip or flange 46 projecting slightly beyond the port 22. The wall portion of the supporting member overlying the inclined area of the pot wall is also shaped to provide a sloping surface 47 inclined in this instance at an angle of approximately 20° to the horizontal. The inclined surfaces thus produce a gradual restriction of the passage 23 adjacent its outlet port 22 and act to direct the stream of secondary air against the rising fuel and air mixture from the burner pot in a manner which insures complete and efficient combustion without formation of carbon or soot.

In the operation of the burner, liquid fuel such as oil is delivered to the pot 10 by way of the pipe 13 and spreads out in a shallow pool on the bottom 18 of the pot. Primary air entering through the lower row of openings 21 assists in vaporizing the fuel and as the vapors rise they are intermixed with air entering through the other openings in the pot wall. This mixture of course passes over the baffle plates of the baffle structure 14 and along the walls of the pot and is discharged through the burner mouth into the combustion chamber C of the stove in which the burner is installed. Due to the large size of the burner mouth and the absence of any restrictions therein, relatively little resistance is offered to the flow of the fuel mixture which receives its supply of secondary air through the port 22 immediately below the burner mouth. The flame is therefore held close to the burner mouth and its stability is enhanced by the relatively wide flange 25 encircling the mouth. It has been found that this construction eliminates any need for the usual fire ring so that the burner mouth may be left entirely unobstructed. Thus, through the cooperation of the various features described above the resistance to the flow of the fuel and air mixture is reduced to a minimum so that the burner is enabled to operate efficiently with a draft of low intensity. Efficient use of fuel and low heating costs are thus insured in the case of burners installed by inexpert persons or in heating systems having inadequate draft for conventional burners.

The improved burner is simple in construction, foolproof in operation and capable of being produced at relatively low cost. The use of a generally spherical burner pot in combination with the novel baffle structure provides the advantages of efficient performance without pulsation or flickering of the flame at all feeding rates between the highest and lowest for which the burner is designed. The baffle is constructed from a plurality of interfitting units each of a size capable of being inserted through the mouth of the pot and adapted for easy assembly therein. Moreover the baffle structure may be readily removed from the pot for cleaning when required.

We claim as our invention:

1. In a liquid fuel burner, in combination, a sheet metal burner pot of generally spherical contour having an outlet opening at the top, a sheet metal panel for supporting said pot in a stove casing, said panel having an opening adapted to register with the outlet opening of the pot, a plurality of depending lugs struck out from said panel and engageable with the wall of the pot to hold the pot in predetermined spaced relation to the panel, fastening elements extending through the openings formed by striking out said lugs and connecting said pot and said panel so as to maintain the pot wall in tight engagement with said lugs, said panel and said pot forming a secondary air inlet passage terminating in a continuous port encircling the outlet opening of the pot.

2. In a liquid fuel burner, in combination, a sheet metal burner pot of generally spherical contour having an outlet opening at the top, a sheet metal panel for supporting said pot in a casing, said panel having an opening adapted to register with the outlet opening of the pot, a plurality of depending lugs struck out from said panel and engageable with the wall of the pot to hold the pot in predetermined spaced relation to the panel, and a plurality of fastening screws extending through the openings in the panel formed by striking out said lugs and threading into the top wall of the pot so as to draw the wall into engagement with the lugs.

3. A baffile structure for liquid fuel burner pots comprising a pair of sheet metal members each having a segmental central section, segmental end sections offset downwardly from the plane of the central section and upright portions connecting the end sections with opposite ends of the central section, said members when assembled within the pot with the ends of said end sections in abutting relation forming a continu-

ous annular wall disposed coaxially of the pot and having alternate portions located in vertically offset planes, the end sections of the two members and the upright portions connecting them with the respective central sections defining upwardly opening segmental pockets, and a second pair of baffle members each comprising a segmental section with depending legs at opposite ends adapted to fit into one of said segmental pockets and to rest on the end sections of the first-mentioned members.

4. A baffle structure for liquid fuel burner pots comprising a pair of sheet metal members each having a segmental central section and segmental end sections connected with the central section by depending legs, said members when assembled with the ends of said end sections in abutting relation forming a baffle ring with the portions formed by said central sections disposed in one plane and the portions formed by said end sections disposed in another plane parallel to and located below said one plane, the end sections of the two members and the legs connecting them with the respective central sections defining upwardly opening pockets with substantially flat bottom walls and with side walls diverging generally upwardly and outwardly, and a second pair of sheet metal members each comprising a segmental section with depending legs at opposite ends adapted to fit into one of said pockets and to rest on the end sections of the first-mentioned members, said legs being disposed so as to lie substantially flush against opposite walls of the pocket whereby the second baffle member is retained in fixed relation to the other baffle members.

5. A sheet metal baffle structure for spherical burner pots comprising, in combination, a pair of

complemental baffle units each including a complete baffle plate and sections of two adjacent baffle plates, each of said baffle plates being in the form of a segment of an annulus, relatively thin flat legs connecting opposite ends of said first-mentioned baffle plate with the adjacent ends of the respective plate sections, said legs being disposed edgewise in planes directed generally radially with respect to the pot, and a second pair of baffle units each including a baffle plate in the form of a segment of an annulus and having relatively thin flat depending legs at opposite ends adapted to rest on the baffle plate sections of the other units, said legs being disposed edgewise in said radially directed planes and cooperating with the legs of the other baffle units to maintain said second baffle units in assembled relation therewith.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,183,812	Horns	Dec. 19, 1939
2,258,679	Hayter	Oct. 14, 1941
2,260,839	Miller et al.	Oct. 28, 1941
2,311,570	Pyle	Feb. 16, 1943
2,326,221	Hill	Aug. 10, 1943
2,337,088	Donley	Dec. 21, 1943
2,358,012	Kahn	Sept. 12, 1944
2,393,231	Breese	Jan. 22, 1946
2,422,209	Reeves et al.	June 17, 1947