May 1, 1945. J. W. MILLER ET AL 2,374,693

COMBUSTION APPARATUS

Filed March 6, 1941 2 Sheets-Sheet 1

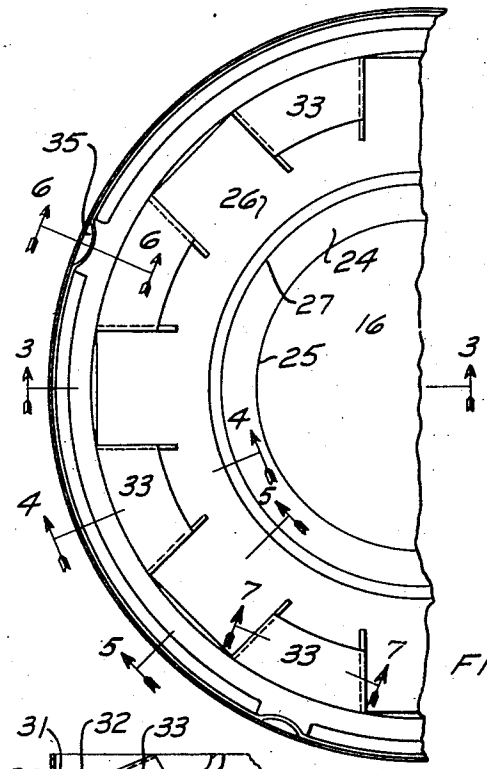


FIG. 2

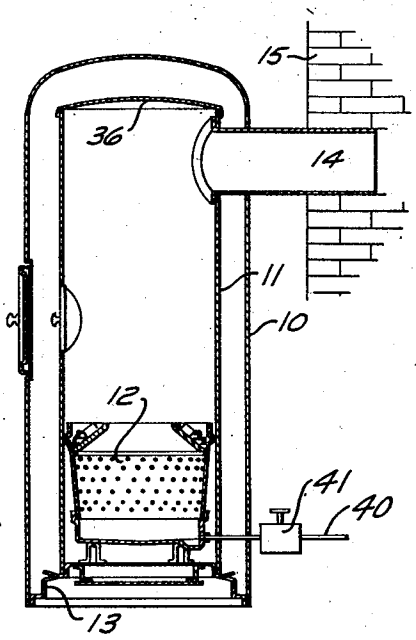


FIG. 1

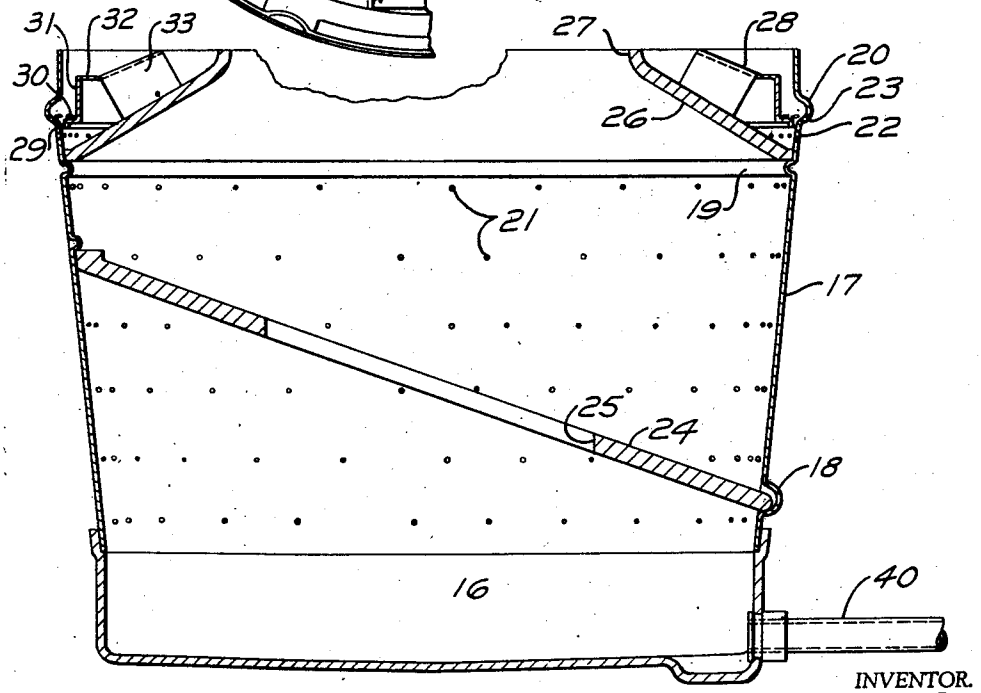


FIG. 3

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COMBUSTION APPARATUS

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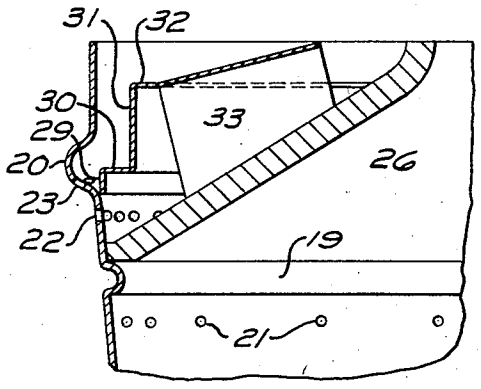


FIG. 4

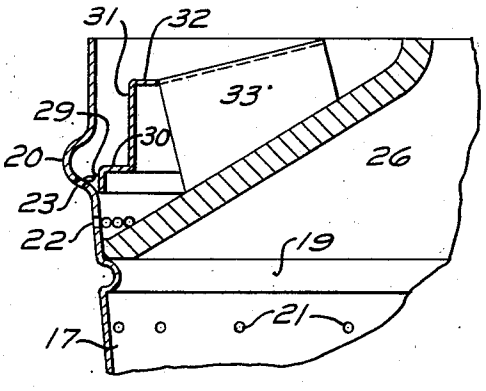


FIG. 5

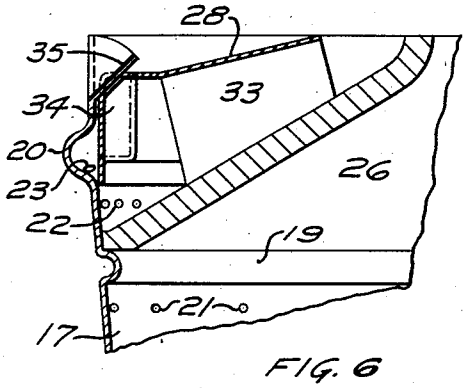


FIG. 6

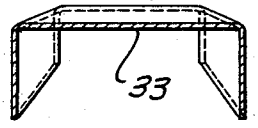


FIG. 7

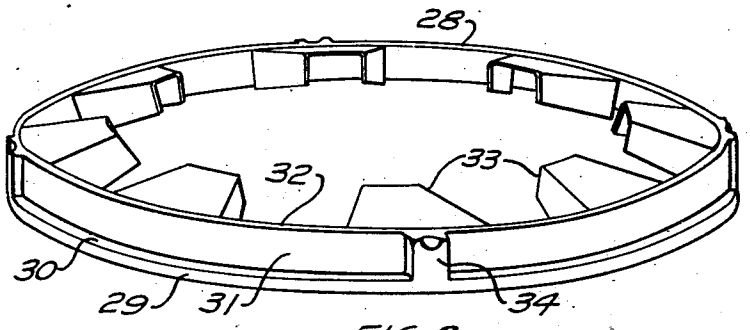


FIG. 8

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2,374,693

COMBUSTION APPARATUS

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Application March 6, 1941, Serial No. 381,942

8 Claims. (Cl. 158—91)

This invention relates to combustion apparatus and more particularly to heaters employing vaporizing pot type burners as a source of heat.

The principal object of this invention is to improve the performance of combustion apparatus of this type during the so-called high fire stages of operation.

This object is attained primarily by a novel construction and arrangement of the parts of the apparatus adjacent the upper extremity of the burner. More specifically, this object is attained by providing a centrally apertured top wall for the burner, admitting an accurately metered volume of air to the apparatus above the top wall through a plurality of air inlet openings, positioning a baffle ring above the top wall, and arranging the top wall, the air inlet openings and the baffle ring whereby all of the air admitted to the apparatus above the top wall impinges against either the top wall or the baffle ring and is thereby positively directed into three radially spaced concentric zones between the central opening in the top wall and the side wall of the combustion chamber.

By accurately metering all of the air admitted to the apparatus above the top wall, uniformly efficient operation is attained. Heretofore there has been no real appreciation of the necessity for metering and controlling the distribution of all of the air admitted to the apparatus above the top wall. In many of the prior art devices the burner is assembled in the combustion chamber in such a manner as to permit a leakage of air into the combustion chamber between the burner and the combustion chamber wall. Thus, regardless of the fact that the air admitted to the apparatus above the top wall through the air inlet openings provided for that purpose was accurately metered, the total air admitted to the apparatus, including that which leaked between the burner and the combustion chamber, was not accurately metered or distributed. The present invention overcomes this disadvantage of the prior art.

By positively directing the air admitted to the apparatus above the top wall into three spaced concentric zones, the flame during high fire operation is distributed throughout the radial extent of the combustion chamber so as to obtain the most efficient transfer of heat to the medium to be heated. As mentioned above, this positive direction of air is accomplished by impinging the air against either the top wall or the baffle ring. In this manner, there is accomplished not only an efficient distribution of the air but also a desirable reduction in the velocity of the air, whereby the flame during high fire operation is lazy and quiet rather than vigorous and noisy.

Other objects, more or less incidental to the primary object stated above, will appear from the following description when read in connection with the accompanying drawings, wherein—

Figure 1 is a vertical cross-sectional view of a circulating type space heater embodying the invention;

Figure 2 is a fragmentary top plan view of the burner employed in the heater of Figure 1;

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

Figure 4 is a fragmentary cross-sectional view taken on substantially the line 4—4 of Figure 2;

Figure 5 is a fragmentary cross-sectional view taken on substantially the line 5—5 of Figure 2;

Figure 6 is a fragmentary cross-sectional view taken on substantially the line 6—6 of Figure 2;

Figure 7 is a fragmentary cross-sectional view taken on substantially the line 7—7 of Figure 2; and

Figure 8 is a perspective view of the anti-explosion baffle used in the burner.

The invention is embodied in a space heater of the circulating type. In general the heater comprises an outer casing 10 and a heat chamber shell 11 located inside the outer casing and spaced from the walls thereof. In the lower portion of the heat chamber shell is a burner 12 of the vaporizing pot type. The burner is supported on a bottom wall 13 which is supported by the casing 10. Part of the heat chamber 11 above the burner forms the combustion chamber of the heater. It communicates with a chimney 15 by means of a flue outlet 14.

The burner 12 has a bottom wall 16. A sheet metal side wall 17 is joined to the upper edge of the bottom wall 16 in sealed engagement therewith. The side wall 17 has an indentation 18 slightly above the upper edge of the bottom wall 16 for a purpose which will appear presently. Near the top of the side wall is an annular inwardly extending bead 19. Above the bead 19 and spaced therefrom is an outwardly extending annular bead 20.

The burner side wall is provided with a plurality of air inlet openings to admit air to the burner. In the apparatus here shown, there are six horizontal rows of spaced apart primary air inlet openings 21, the rows being substantially equidistantly spaced between the bottom wall 16 of the burner and the bead 19. Slightly above the bead 19 is a horizontal row of sec-

ondary air inlet openings 22. The axes of the openings 22 preferably are horizontal, as shown in Figures 2, 4 and 5. A second row of secondary air inlet openings 23 is formed in the lower portion of the bead 20 and inclined upwardly and inwardly through the burner side wall.

The burner side wall 17 is preferably formed from a plurality of flat blanks of metal in the manner disclosed in the Valjean Patent No. 2,186,156, sheared to the proper shape and coiled into the substantially frusto-conical shape shown in the drawings. The upright edges are welded together. Preferably the air inlet openings, both primary and secondary, are formed in the flat blanks. The beads 19 and 20 are formed by rolling after the side wall is coiled and welded into frusto-conical shape. The burner side wall is then expanded slightly in suitable dies whereby to bring it to proper size and roundness. All burners of a given size are thus made uniform in diameter.

Within the burner 12 is a partition 24 having a large central opening 25 therein. A portion of the partition 24 is received in the indentation 18 whereby to support it in position in the burner. The partition is inclined upwardly from the indentation and across the burner. The lower edge of the partition 24 is spaced just above the lowermost row of primary air inlet openings 21. The upper edge of the partition is at approximately the level of the next to the uppermost row of primary air inlet openings 21.

A top wall 26 is mounted in the burner upon the inwardly extending bead 19. The top wall 26 is a substantially frusto-conical upwardly converging annulus. It has a large central opening 27 located directly above the opening 25 in the partition 24. The upper edge of the top wall 26 is located at approximately the level of the top of the burner side wall, and in any event, above the upper row of secondary air inlet openings 23. The lower edge of the top wall 26 is located below the lower row of secondary air inlet openings 22.

An anti-explosion baffle 28 is positioned within the burner upon the top wall 26. The anti-explosion baffle 28 is shown best in Figures 4 to 8. It comprises an annular rim consisting of a vertical peripheral flange 29, a horizontal annulus 30 extending inwardly therefrom, a vertical wall 31 projecting upwardly from the annulus 30, and another horizontal annulus 32 at the top edge of the wall 31. Projecting inwardly from the annulus 32 is a plurality of angularly spaced downwardly opening channels 33. The inner ends of the channels terminate a short distance from the opening 27 in the top wall 26. The side flanges of the channels are cut away at an angle so as to rest upon the top wall 26. The webs of the channels are inclined upwardly and inwardly at an angle between that of the top wall and the horizontal. The channels 33 together with the top wall form a plurality of ducts for conveying air toward the opening 27.

The anti-explosion baffle 28 is positioned within the burner so that the lower edge of the peripheral flange 29 is just below the row of secondary air inlet openings 23 and above the row of openings 22. The flange 27 is positioned closely adjacent to the side wall 17 of the burner.

At a plurality of points around its rim the baffle is pressed outwardly as shown at 34 in Figure 6. The rim of the burner side wall 17 is then bent inwardly as at 35 to hold the baffle and the top wall in assembled relationship with the burner.

The heat chamber 11 previously mentioned comprises a one piece side wall and a top wall 36 welded in air-tight engagement with the side wall. The heat chamber shell 11 and the burner 12 are so formed and sized that the bead 20 tightly fits the heat chamber shell when the burner is inserted into the heat chamber shell. Thus, any leakage between them will be negligible.

In general, the operation of the present burner is similar to that described in Valjean Patent No. 2,186,156 granted January 9, 1940, the only difference being in the so-called high fire stages of operation, i. e., when some or all of the air untilized for combustion is supplied by the secondary air inlet openings 22 and 23. Reference may be had to the said Patent No. 2,186,156 for description of the general operation of burners of the present type.

It is during the high fire stage of operation that the construction and arrangement of the top wall 26, the anti-explosion baffle 28 and the air inlet openings 22 and 23 produce the novel effect heretofore described. The air admitted through air inlet openings 22 impinges against the upper surface of top wall 26 and is directed by the anti-explosion baffle 28 into the apparatus in an inward and upward direction, a part of the air admitted through these openings being carried to a point near the central opening 27 in the top wall by the channels 33, and the remainder being admitted into the apparatus in the areas between the channels. That is to say, the air admitted through the openings 22 is divided into two portions, one portion entering the apparatus in an annular zone near the opening 27, and the other being admitted to the apparatus in an annular zone concentric with and spaced radially outwardly from the first mentioned zone. That part of the air entering through openings 22 and carried inward by the channels 33 to the zone near opening 27 in the top wall 26 mixes with the rich vapors emerging from the opening 27, forming combustible mixture in that zone even though the vapors as a whole are too rich to burn. Thus a localized flame near the ends of the channels is maintained at all times and explosions are effectively prevented. This gives the "anti-explosion baffle" 28 its name.

The air admitted to the apparatus through the openings 23 impinges against the vertical wall 31 of the anti-explosion baffle 28 whereby it is directed upwardly into the apparatus in an annular zone adjacent the side wall of the combustion chamber. That is to say, the air admitted through the air inlet openings 23 enters the apparatus in an annular zone concentric with and spaced radially outwardly from the two zones into which the air admitted through openings 22 is directed.

From the foregoing description it will be apparent that the air supplied to the apparatus above the top wall 26 is positively directed so as to localize combustion in the region between the side wall of the combustion chamber and the central opening 27 in the top wall 26. It will be readily understood that by thus locating the combustion adjacent the side wall of the combustion chamber, a most efficient transfer of heat to the medium to be heated is effected.

As previously mentioned, the positive direction of the secondary air into the three annular zones is accomplished by reason of the impingement of

that air against the top wall 26 or the anti-explosion baffle 28. By such impingement the velocity of the air is reduced so that it rises slowly and gently into the combustion apparatus and thereby produces a lazy, quiet flame. The advantage of such a flame, in addition to its quietness, is that greater opportunity is afforded for transfer of heat to the medium to be heated, so that baffles or the like are not needed in or adjacent the chimney outlet to prevent the loss of heat up the chimney.

The inclined top wall 26 increases the volume of the burner and tends to cause a more even upward flow of vapors rising from the burner. This has a tendency to reduce eddy currents within the burner itself. Furthermore, the upward inclination of the top wall prevents the downward flow of air and gases, and thereby minimizes eddy currents which might otherwise drop down into the burner and upset the operation thereof.

From the foregoing it will be seen that this invention makes provision for accurately metering and positively directing the secondary air into three radially spaced zones, a part going to meet the vapors issuing from the burner, another part flowing up along the side wall of the combustion chamber, and the rest being conveyed into a zone intermediate the first two. The number and size of secondary air inlet openings can be worked out for each different size of burner to provide maximum efficiency. The flow of air and vapors is smoothed out by inclining the top wall, and eddy currents are thereby substantially reduced.

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

We claim:

1. Combustion apparatus comprising a combustion chamber having a side wall, a pot type burner having a side wall, said burner being arranged below and in open communication with the combustion chamber, a centrally apertured top wall mounted on the burner, baffle means positioned above the top wall of the burner and having an annular portion arranged in spaced relation to the side wall of the combustion chamber, one of said side walls being provided with a plurality of air inlet openings arranged about the circumference thereof adjacent the upper extremity of the burner to admit air into the apparatus above the burner top wall, the axes of certain of said air inlet openings intersecting said top wall at an angle thereto whereby the air entering through said certain openings impinges on said top wall, and the axes of certain others of said air inlet openings intersecting the annular portion of said baffle means at an angle thereto whereby the air entering said last mentioned openings impinges on the annular portion of said baffle.

2. Combustion apparatus as defined in claim 1 wherein said air inlet openings are arranged in two vertically spaced horizontal rows, the axes of the openings in one row intersecting the top wall and the axes of the openings in the other row intersecting the annular portion of the baffle means.

3. Combustion apparatus as defined in claim 1 wherein said air inlet openings are arranged in two vertically spaced horizontal rows, the openings in one row being positioned above the outer periphery of the annular portion of the baffle means, the openings in the other row being positioned below the outer periphery of the annular portion of the baffle means.

4. Combustion apparatus comprising a combustion chamber having a side wall, a pot type burner having a side wall, said burner being arranged below and in open communication with the combustion chamber, a centrally apertured top wall mounted on the burner, baffle means positioned above the top wall of the burner including an annular portion arranged in spaced relation to the side wall of the combustion chamber, one of said side walls being provided with a plurality of air inlet openings arranged about the circumference thereof adjacent the upper extremity of the burner to admit air into the apparatus above the burner top wall, the axes of certain of said air inlet openings intersecting said top wall at an angle thereto whereby the air entering through said certain openings impinges on said top wall, and the axes of certain others of said air inlet openings intersecting the annular portion of said baffle at an angle thereby whereby the air entering through said last mentioned openings impinges on the annular portion of said baffle, and additional baffle means for directing the air admitted through certain others of said air inlet openings toward the central opening in the top wall.

5. Combustion apparatus as defined in claim 4 wherein said air inlet openings are arranged in two vertically spaced horizontal rows with one row located above and the other row located below the lower extremity of the annular portion of said baffle means.

6. Combustion apparatus comprising a combustion chamber having a side wall, a pot type burner having a side wall, said burner being arranged below and in open communication with the combustion chamber, a centrally apertured top wall for the burner, and a baffle above said top wall, one of said side walls having a plurality of air inlet openings therein arranged about the circumference thereof, the axes of certain of said air inlet openings intersecting said top wall at an angle thereto, and the axes of the remainder of said air inlet openings intersecting said baffle at an angle thereto, said baffle being constructed and arranged to direct a portion of the air impinging against the top wall toward the central aperture in the latter.

7. Combustion apparatus comprising a combustion chamber having a side wall, a pot type burner having a side wall, said burner being arranged below and in open communication with the combustion chamber, a centrally apertured top wall mounted on the burner, baffle means positioned above the top wall of the burner, one of said side walls being provided with a plurality of air inlet openings arranged about the circumference thereof adjacent the upper extremity of the burner to admit air into the apparatus above the burner top wall, the axes of certain of said air inlet openings intersecting said baffle means at an angle thereto whereby the air entering said certain air inlet openings impinges on said baffle means, the axes of the remainder of said air inlet openings intersecting said top wall at an angle thereto whereby the air entering through said last mentioned openings impinges on said top wall, said baffle means including portions spaced from the last mentioned side wall and cooperating therewith to direct the air which impinges on said baffle means into an annular outer zone, said baffle means including other portions cooperating with said top wall to

direct a part of the air impinging on the top wall into an annular inner zone adjacent the aperture in the top wall, said baffle means having still other portions directing part of the air impinging on the top wall into an annular intermediate zone.

8. Combustion apparatus comprising a combustion chamber, a pot type burner having a side wall, said burner being arranged below and in open communication with the combustion chamber, a centrally apertured top wall for the burner, said top wall having a circumferentially continuous portion, and a baffle above the top wall, said burner side wall having two vertically spaced rows of air inlet openings therein spaced about the circumference thereof above the top wall, the axes of the openings in the lower row being directed toward said top wall, a substantial portion of the axial projection of each of the openings in said lower row intersecting said circumferentially continuous portion of said top wall at an angle thereto, said baffle being constructed and arranged to direct a portion of the air impinging against the top wall toward the central aperture in the top wall.

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