Nov. 2, 1948. C. S. GREER, JR 2,452,924

POT BURNER HAVING SEGMENTAL AIR DIRECTING MEANS

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Fig. 1

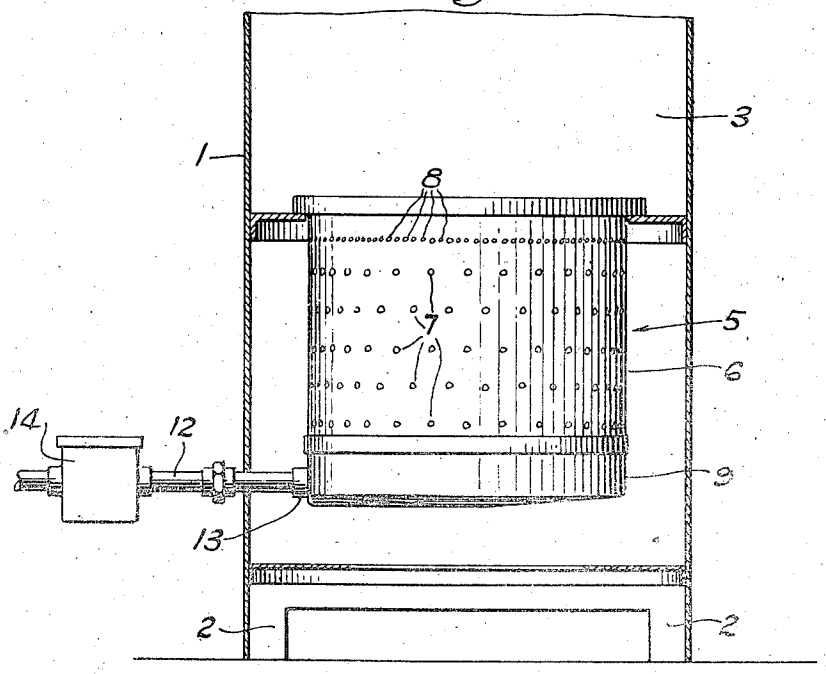
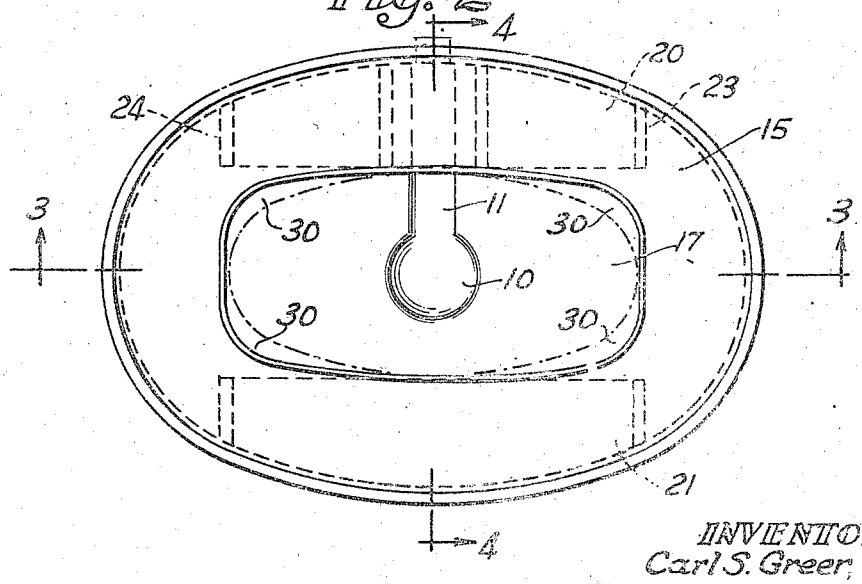


Fig. 2



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Fig. 3

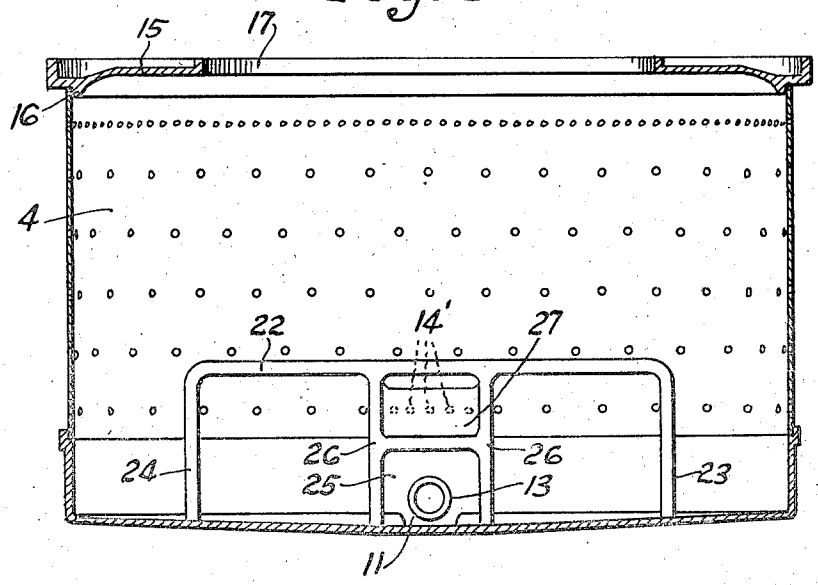
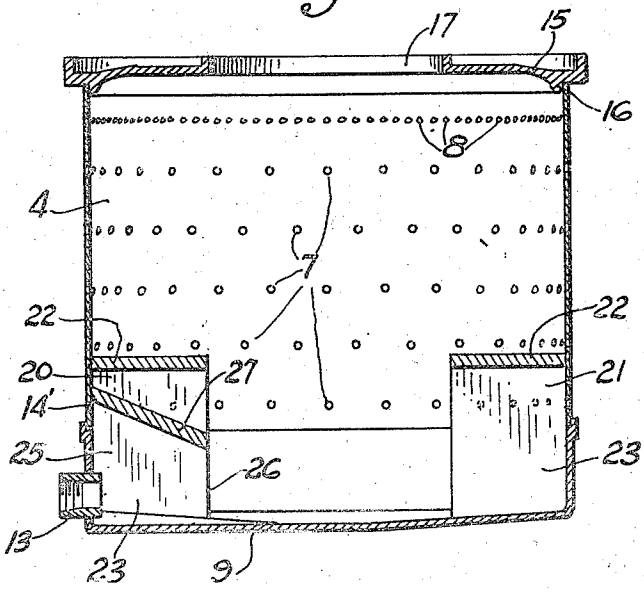


Fig. 4



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POT BURNER HAVING SEGMENTAL AIR DIRECTING MEANS

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Application July 5, 1947, Serial No. 759,193

8 Claims. (Cl. 158—91)

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This invention relates to a new and improved vaporizing type burner for liquid fuel and has for an object the provision of an improved construction capable of safe and economical operation over a wide range.

An object of the invention is to provide a simple and efficient form of vaporizing pot adapted to burn economically at low, intermediate and high fire stages.

A further object of the invention is to provide in conjunction with a vaporizing pot having primary and secondary air inlet openings in the walls thereof, novel accumulator elements preferably arranged on opposite sides of the pot to direct the air supplied by certain of said inlet openings to the space between the elements whereby to mix with the vaporized fuel rising from the bottom of the pot and to provide thereby a combustible mixture capable of burning at an intermediate flame adjacent these elements without formation of soot or other products of combustion, and, with an increased supply of fuel, to burn at higher levels with the same efficient action, additional air from the inlet openings at higher levels in the side of the pot further mixing with said combustible mixture to assure this efficient burning at higher flame levels.

A still further object of the invention is to provide in a burner of this type a novel pilot structure in the form of a vaporizing chamber in one of said accumulator elements, the pilot burning at pilot stage when intermediate and high flames are not desirable whereby to conserve on fuel consumption without requiring as in most burners of the prior art the burning of a predetermined quantity of fuel, equivalent to the herein intermediate stage, to prevent soot or carbon formation.

Other objects and advantages of the invention will be apparent from the following detail description when taken in connection with the accompanying drawings in which:

Figure 1 is a cross sectional view of an oil burner embodying the present invention.

Fig. 2 is a top view in elevation of the vaporizing pot;

Fig. 3 is a cross sectional view taken on line 3—3 of Fig. 2 looking in the direction of the arrows; and

Fig. 4 is a similar view but taken on line 4—4 of Fig. 2 looking in the direction of the arrows.

The heater illustrated in the drawings is what is commonly called a space heater. It will be understood, however, that this heater may be of any other type and that the invention may be

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incorporated in central heating units, furnaces generally, stoves, etc. As illustrated, the heater comprises a housing 1, a supporting frame 2, a combustion chamber 3 and a burner chamber 4. The burner chamber 4 is disposed in pot 5 supported in any suitable way in housing 1, this depending upon the design of the housing and the type of heater in which this pot 5 is used.

The shape of pot 5 will also depend upon the shape and type of the heater. It is illustrated as elliptical or oval and has side wall 6 provided with uniformly spaced groups of air inlet openings. These groups of air inlet openings are disposed at different levels, the primary air inlet openings 7 being located in rows below the secondary air inlet openings 8. If the side wall 6 is sheet metal, these air inlet openings may be formed therein before the wall is formed, but, irrespective of how the wall is formed, they may be of substantially uniform size and spacing. The bottom 9 of pot 5 may be a cast metal or sheet metal pan with a well 10 substantially centrally provided and a trough 11 leading thereto from one side of the pot. As illustrated, oil line 12 will connect at 13 to supply oil at a controlled rate to trough 11 by a suitable metering device 14.

The upper wall of pot 5 rests on side wall 6 and is in the form of an apertured flame plate 15 with an annular depending flange 16 holding the same in position. It is provided with an opening 17, which, in this instance, is illustrated somewhat elongated with portions cut away at the ends on opposite sides of the longitudinal axis, the purpose of which is to provide a smooth uniform flow upwards and thereby to prevent eddy currents of the combustible mixture within the burner chamber 4 and so as to eliminate pocketing of the combustible mixtures in zones below this upper wall 5. This constitutes the subject matter of copending application Serial No. 759,194, filed July 5, 1947, and is claimed therein.

Two accumulator segments or elements 20 and 21 are provided in burner chamber 4 and are arranged to embrace a number of primary air inlet openings 7, and, while only those of the lower row are illustrated as included, it will be understood that openings of other rows might also be included. Accumulator elements 20 and 21 are specifically shown as substantially U-shaped, each with a top wall 22 and with side walls 23 and 24, and are seated preferably upon bottom 9 in opposing relation against the side wall 6 of pot 5. The inside edges of these top and side walls of the accumulator elements may be cut

somewhat arcuate to conform to the shape of side wall 6 of the pot.

One of the accumulator elements, say element 20, is provided with an area enclosed on three sides to form a vaporizing or pilot chamber 25. This chamber 25 may have its side walls 26 perpendicular to the bottom 9 and be integrally connected to top wall 22 of accumulator element 20. A top wall 27 may span side walls 26 in integral relation and slope somewhat downwardly so that the lower inner edge will be below the lower row of the primary air openings 7 and the upper edge will be above these openings whereby the latter will communicate with this vaporizing chamber 25 and supply air thereto. It will be noted in Fig. 3 that additional openings 14' have been furnished in the lower row of openings 7 to communicate with vaporizing chamber 25 so that the necessary volume of air to assure a proper mixture at low or pilot flame with minimum fuel consumption at this stage without formation of smoke or carbon will be obtained.

The supply of liquid fuel to the burner chamber 4 may be controlled by suitable adjustment of the metering device 14. The liquid fuel entering at 13 will vaporize and form a combustible mixture and burn at low or pilot flame at and slightly to the rear of the forward edge of top wall 27 of vaporizing chamber 25. At this stage of operation, a minimum consumption of oil takes place, and, in actual operation, it is found that the arrangement of the parts provides for a consumption as low as 1 cc. of oil per minute without smoke or carbon being produced. The flame may continue to burn at a low pilot stage indefinitely with a clear smokeless appearance and the mixture will be adequate to effect complete combustion. By increasing the supply of liquid fuel, the pilot flame will increase until the flame either is held at intermediate stage, which is within the zone defined by the space between accumulator elements 20 and 21 and in the vicinity of their top walls 22, or is permitted to rise in burner chamber 4 until it burns at and above opening 17 in flame plate 15 where combustion is then completed in combustion chamber 3 at high fire stage.

Accumulator elements 20 and 21 serve to direct the air entering the lower primary air inlet openings 7 embraced by these elements to the space therebetween to mix with the vaporized oil rising from well 10. The combustible mixture at intermediate fire will burn in this space slightly above or at the level of top walls 22 and consume at this stage, say between 6 and 8 cc. of liquid fuel per minute, without the flame smoking or producing carbon. Accumulator elements 20 and 21 will direct a smooth uniform flow of air forwardly and prevent undesirable eddy currents. As the fuel supply increases, the level of the flame will increase so that the air supplied by the upper primary air inlets 7 will mix with the vaporized fuel to provide a completely combustible mixture. With the flame at opening 17 and burning in combustion chamber 3, the secondary air inlets 8 will supply additional air to the mixture and assure complete combustion, the flame at this high stage consuming between 35 and 45 cc. of liquid fuel per minute.

It is not necessary to go directly from pilot flame to intermediate stage. Merely increasing the supply of liquid fuel slightly will increase the pilot flame during mild weather when little heat is desirable. The burner may operate economically at minimum flame to generate the heat necessary for the room without being compelled to generate excessive heat by the use of a larger flame and thus cause unnecessary waste. The ease of controlling minimum flame and of controlling oil consumption from this exceptionally low pilot to an intermediate stage without requiring the intermediate stage as a starting flame to avoid smoke and carbon, are obviously the result of the arrangement of the parts including the accumulator elements 20 and 21 and the vaporizing chamber 25 forming a part of the accumulator element 20.

The pilot flame burns in a most advantageous location with respect to the area of intermediate fire. The pilot flame may be increased from low stage by varying degrees until the intermediate flame stage is reached without the flame smoking or without producing carbon or soot. During this period of an increasing pilot flame, the accumulator elements supply enough air to effect complete combustion of the mixture produced and hold the generation of vapor to the vicinity of well 10. In this manner, control at lower flame stages may be had to prevent fluttering and a consequent incomplete burning that would otherwise produce smoke and carbon.

The pot 5 and its accumulator elements, together with the simple form of vaporizing chamber 25 disclosed, may obviously be incorporated in any burner whether in a space heater, stove or furnace. These parts may be proportioned to provide a burner of a desirable capacity that will burn liquid fuel economically and with minimum fuel consumption.

As previously stated, the shape of pot 5 is preferably elliptical or oval and side wall 6 is curved at all points. This will make pot 5 thinner from back to front which I find is advantageous in the construction of heaters of this type because the space to be occupied by them with respect to the distance or projection from the wall will be less, and these heaters may be used therefore in many places where limited space has otherwise restricted their use. With side wall 6 curved at all points and elliptical, the primary air inlet openings 7 will feed jets of primary air in converging streams toward the center of pot 5. The contour of flame opening 17 in flame plate 15 is different from the contour cross-sectionally of pot 5. Instead of making flame opening 17 an ellipse charted along the same axes as the ellipse of pot 5, the portions on opposite sides of the longitudinal axis of opening 17 are cut away, this being indicated at 30, so that the opening 17 becomes somewhat larger at the ends. It is found that cutting away the corners of opening 17 at 30 relieves congestion of the mixture or air streams at these ends in burner chamber 4 and provides for uniform flow upwardly, thereby eliminating eddy currents within the pot.

It is also found that accumulator elements 20 and 21 disposed in opposed relation on opposite sides of the major or longitudinal axes of both the pot 5 and the flame opening 17 in cover 15 became particularly useful in the general arrangement of the parts described. These accumulator elements have a straight front edge which will have the space therebetween somewhat of the same general shape as the flame opening 17 so that there will be a tendency of the mixture or rising vapors mixing with the streams of primary air, in burner chamber 4 to assume a body of corresponding formation and thus produce a flame having a contour of substantial flame surface for heat radiation. Not only will there be maximum

heat liberation but the flame will burn clean and will not smoke or cause soot.

Without further elaboration, the foregoing will so fully explain the gist of my invention that others may, by applying current knowledge, readily adapt the same for use under varying conditions of service, without eliminating certain features, which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to me by the following claims.

I claim:

1. A liquid fuel burner comprising, in combination, an elongated fire pot having a bottom wall and a side wall, a flame plate at the top of said pot having an elongated flame opening therein, a plurality of air inlet openings disposed circumferentially about said side wall, fuel supply means for delivering a regulatable quantity of fuel to the bottom of said pot, and spaced segments disposed one on each side of the major axis of said pot substantially against said side wall and adjacent said bottom wall, said segments extending inwardly toward said major axis of said pot and defining an upper and laterally confined area, said segments being open at their inner portions and their front edge being substantially parallel with the major axis of the pot and spaced from the opposing segment whereby the air directed by each segment into the space between said segments opposes the air directed into said space by the opposite segment to establish a mixing and a combustion zone at said space beginning at said bottom wall at low fire and extending to said flame opening at high fire.

2. A liquid fuel burner comprising, in combination, an elongated fire pot having a bottom wall and a side wall, a flame plate at the top of said pot having an elongated flame opening therein, a plurality of air inlet openings disposed circumferentially about said side wall, fuel supply means for delivering a regulatable quantity of fuel to the bottom of said pot, spaced segments disposed one on each side of the major axis of said pot substantially against said side wall and adjacent said bottom wall, said segments extending inwardly toward said major axis of the pot and defining an upper and laterally confined area, said segments being open at their inner portions and their front edge being substantially parallel with the major axis of the pot and spaced from the opposing segment whereby the air directed by each segment into the space between the segments opposes the air directed by the opposite segment to establish a mixing and a combustion zone at said space beginning at said bottom wall at low fire and extending to said flame opening at high fire, and means defining a vaporizing chamber adjacent said bottom wall forming a part of one of said segments.

3. A liquid fuel burner comprising, in combination, an elongated fire pot having a bottom wall and a side wall, a flame plate at the top of said pot having an elongated flame opening therein, a plurality of air inlet openings disposed circumferentially about said side wall, fuel supply means for delivering a regulatable quantity of fuel to the bottom of said pot, and spaced segments disposed one on each side of the major axis of said pot, each segment having a top wall extending substantially horizontally above the bottom air inlet openings and substantially vertical end walls closing off at the ends of said segments the area covered by said top wall, said segments being open at their inner portions and their front edges being substantially parallel to the major axis of said pot, said open inner portions being spaced from and opposed to each other, the space between the opposing portions of said segments continuing beyond their said end walls substantially the entire distance of the major axis of said pot.

4. A liquid fuel burner comprising, in combination, an open topped elongated burner pot having a bottom, a side wall and a flame plate at the top of said side wall, fuel supply means for delivering a regulatable quantity of fuel to said bottom, a series of air inlet openings disposed circumferentially about said side wall to supply air for mixture with the vaporized fuel within said pot, a plurality of segments seated upon said bottom opposite to one another in spaced relations and against said side wall, said segments extending inwardly toward the major axis of the pot and defining an upper and laterally confined area, said segments being open at their inner portions and their front edge being substantially parallel with the major axis of the pot and spaced from the opposing segment, and means defining a low fire vaporizing chamber within one of said segments.

5. A liquid fuel burner comprising, in combination, an elongated combustion pot having a bottom wall, a side wall and a flame plate at the top of said side wall, a plurality of spaced air inlet openings disposed circumferentially about said side wall, inverted substantially U-shaped segments positioned on opposite sides of said pot adjacent portions of said side wall, said segments extending inwardly toward the major axis of the pot and defining an upper and laterally defined area, said segments being open at their inner portions and their front edge being substantially parallel with the major axis of the pot and spaced from the opposing segment whereby the air directed by each segment into the space therebetween opposes the air supplied by the other segment and mixes with vaporized fuel at the bottom of the pot, and means to deliver a regulatable quantity of fuel to said pot bottom to provide a low flame burning at said pot bottom on low fuel feed and a high flame burning at said flame plate on high fuel feed.

6. In a liquid fuel burner comprising, in combination, an elongated combustion pot having a bottom wall, a side wall and a flame plate at the top of said side wall having a flame opening therein, a plurality of spaced air inlet openings disposed circumferentially about said side wall, two inverted substantially U-shaped segments positioned on opposite sides of said pot adjacent said side wall with their front edges substantially parallel to the major axis of the pot and spaced from each other to form an unobstructed combustion area therebetween continuing from said bottom wall to said flame plate, said combustion area being substantially equal in width to the width of said flame opening as defined by the minor axis of said pot and of a length substantially equal to the major axis of the pot, each segment extending inwardly toward the major axis of the pot and defining an upper and laterally confined area whereby the air directed by each segment into said combustion area opposes the air directed thereto by the other segment and mixes with vaporized fuel at the bottom of said pot beginning with minimum low flame at said pot bottom on low fuel feed and continuing to high flame at said flame plate on high fuel feed,

and means to supply a regulatable quantity of fuel to said pot bottom.

7. A liquid fuel burner comprising, in combination, an open topped elongated burner pot having a bottom, a side wall and a flame plate at the top of said side wall, fuel supply means for delivering a regulatable quantity of fuel to said bottom, a series of air inlet openings disposed circumferentially about said side wall to supply air for mixture with the vaporized fuel within said pot, inverted U-shaped segments seated upon said bottom opposite to one another in spaced relation and against said side wall, said segments extending inwardly toward the major axis of the pot and defining an upper and laterally confined area, said segments being open at their inner portions and their front edge being substantially parallel with the major axis of the pot and spaced from the opposing element, each segment extending about a number of air inlet openings for directing air entering the same into the space between the segments and to there join the air supplied by the other segment, and means defining a low fire vaporizing chamber seated upon said bottom and disposed as a part of one of said segments.

8. A liquid fuel burner comprising, in combination, an elongated combustion pot having a bottom wall, a side wall and a flame plate at the top of said side wall, a plurality of spaced air inlet openings disposed circumferentially about said side wall, segments disposed adjacent said bottom wall and extending upwardly therefrom along a portion of said side wall on opposite sides of said pot and about the air inlet openings disposed in said portions, said segments extending inwardly toward the major axis of the pot and defining an upper and laterally confined area, said segments being open at their inner portions and their front edge being substantially parallel with the major axis of the pot and spaced from the opposing segment, said segments directing into the space therebetween to mix with vaporized fuel at the bottom of said pot opposing streams of air supplied by said air inlet openings about which said segments extend, and means to deliver a regulatable quantity of fuel to said pot bottom to provide a low flame burning at said pot bottom on low fuel feed and a high flame burning at said flame plate on high fuel feed.

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