May 8, 1945. B. F. CASTLE ET AL 2,375,347

OIL BURNER

Filed April 28, 1941 2 Sheets-Sheet 1

Fig. 1

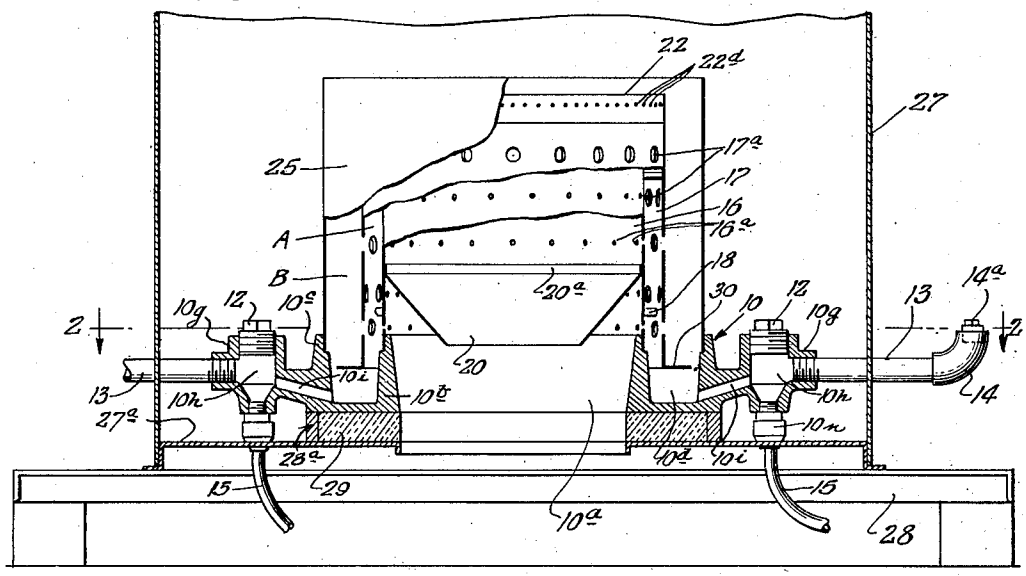
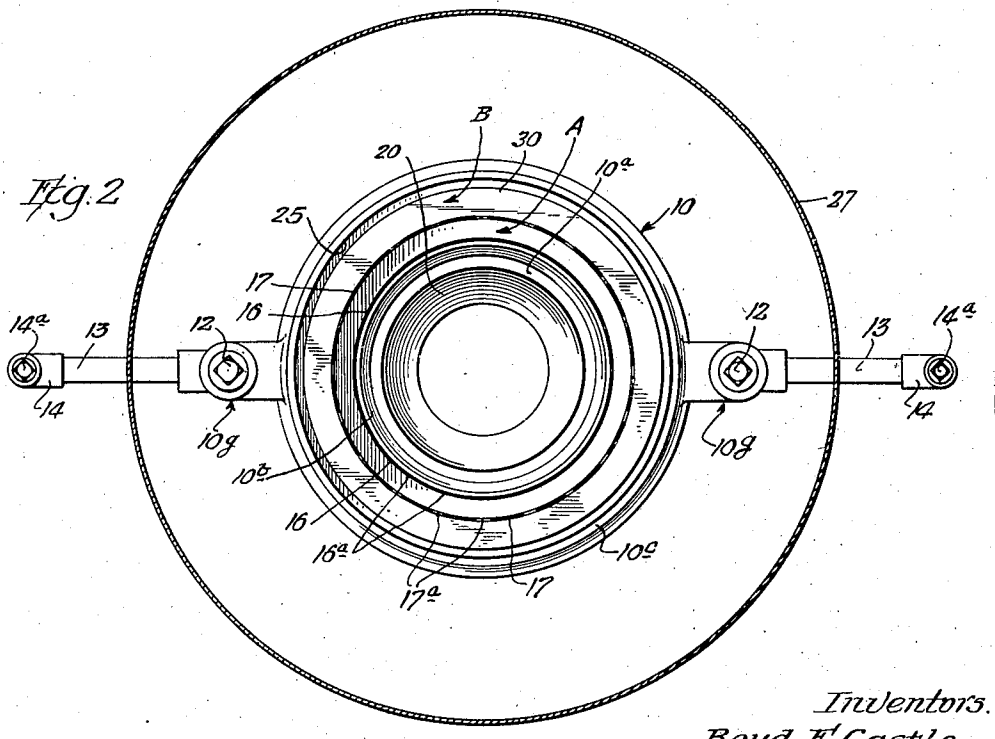


Fig. 2



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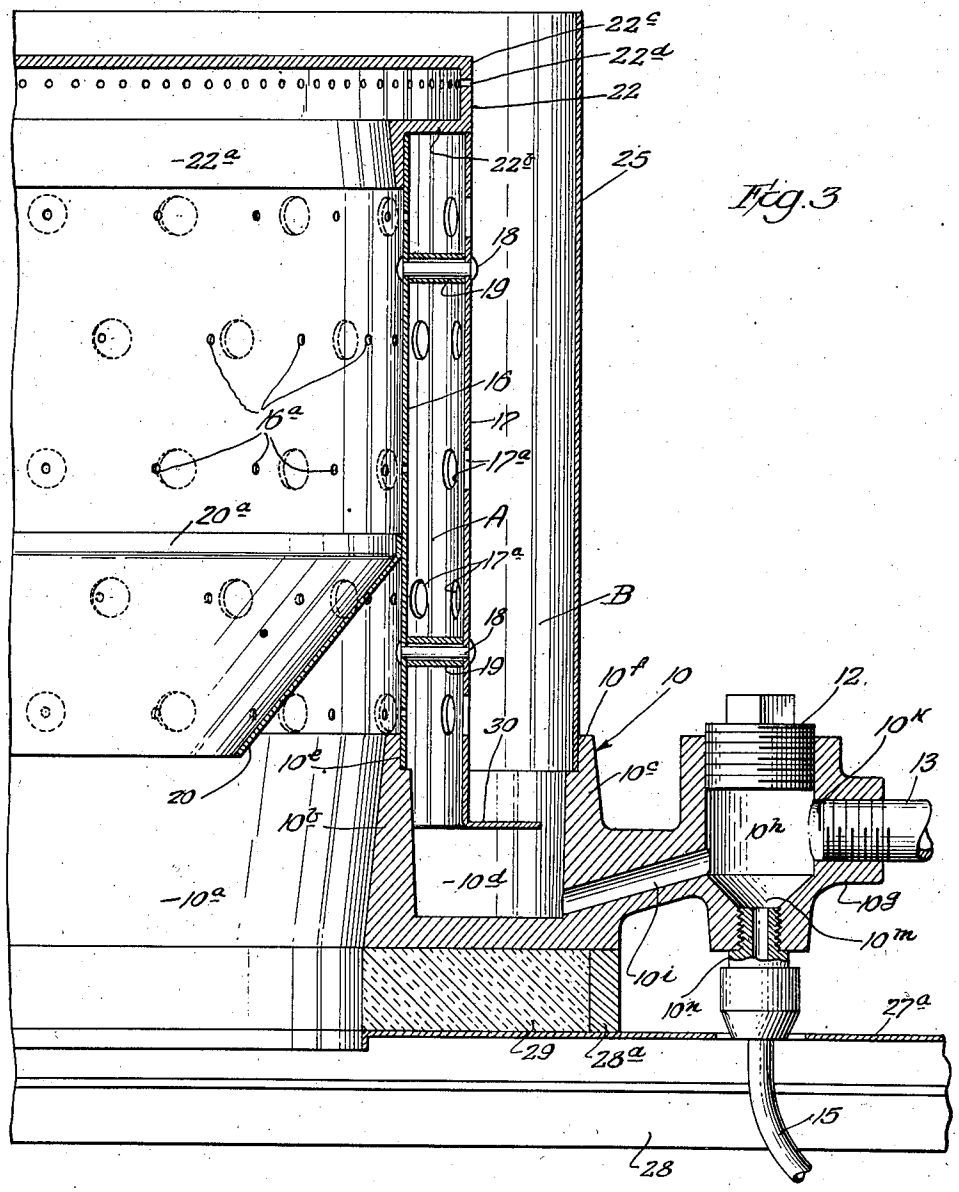


Fig. 3

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2,375,347

OIL BURNER

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Application April 28, 1941, Serial No. 390,670

2 Claims. (Cl. 158—91)

This invention relates to improvements in oil burners and has an object to provide a device of that character in which the oil will be efficiently vaporized and gasified and in which the gasified oil will thereafter flow into a mixing chamber comprising a spaced sleeve and shell, each being perforated and the perforations in each being in substantial alignment and arranged to provide an aspirating or injecting effect whereby jets of air will be delivered into the mixing chamber, will admix with the gasified fuel and thereafter jets of mixed air and fuel gas will be delivered into a combustion chamber for combustion.

Another object is to provide a device of the character described in which the fuel will be vaporized and gasified without introduction or substantial introduction of air during such gasification.

Other objects are to provide new and improved structure including fuel delivery means which may be utilized as an auxiliary pilot if so desired and means to introduce additional air in the nature of secondary air as a scavenging or salvaging medium effective particularly at "high fire" to insure complete combustion of all of the gasified fuel.

These and other objects will be set forth and made clear in the following specification.

In the accompanying drawings we have illustrated one embodiment of our invention. In such drawings,

Fig. 1 is a front elevation partially in section.

Fig. 2 is a sectional plan view of the same on line 2—2 of Fig. 1.

Fig. 3 is a vertical section through a portion of the device drawn to an enlarged scale.

Like numerals refer to like elements throughout the drawings, in which 10 designates generally a fuel receiving base, illustrated as a casting, having a central air inlet 10*a* and spaced circular flanges 10*b*, 10*c* forming an annular channel 10*d* open at the top. The upper edge of the flange 10*b* is recessed at 10*e* and the upper ridge of the outer flange 10*c* is similarly recessed at 10*f* as illustrated in Fig. 3, for example.

Projecting outwardly from the base 10 at each side is a boss generally indicated by numeral 10*g* having a central chamber 10*h* from which leads the duct 10*i* to the channel 10*d*. Chamber 10*h* is open at the top and threaded to receive a plug or closure 12. There is also an inlet aperture 10*k*, internally threaded to receive the threaded end of a tube 13 which projects outwardly of the burner casing and is provided with an up-turned elbow 14 normally closed by the plug 14*a* as illustrated in Fig. 1.

Each boss 10*g* is also provided with an inlet opening 10*m* in the bottom thereof threaded to receive the nipple 10*n* connected to the fuel supply pipe 15 which communicates with a source of oil or similar fuel and which may be associated with any suitable level-metering and regulating mechanism, operating automatically or otherwise to control the supply of fuel as may be desired.

While we have illustrated only one boss 10*g* with chamber 10*h*, it will be recognized that a plurality of such members may be provided if so desired.

Surrounding the air inlet 10*a* and seated in the recess 10*e* is the sleeve 16 provided with apertures 16*a* and extending upwardly from the flange 10*b*.

Surrounding and spaced from the sleeve 16 is the perforated shell 17 having apertures 17*a* therethrough. The shell may be located and maintained in fixed spaced relation to the sleeve 16 by any suitable means but we have illustrated for convenience rivets 18 extending through the sleeve and shell and co-acting with spacer sleeves 19 between the sleeve 16 and shell 17 as illustrated in Fig. 3.

It will be noted that the apertures 16*a* are each located in alignment with a corresponding aperture 17*a*, the former being relatively small and the latter relatively large, for reasons hereinafter set forth. Secured in any suitable manner to the interior of the sleeve 16 is the ring 20 which for convenience we term an air ring, the same being open at the top and bottom and in the form illustrated inclined upwardly and outwardly from the lower aperture to the point where it is attached to the sleeve 16 as by the flange 20*a*, it being desirable to prevent leakage of air between the ring 20 and the sleeve 16. Mounted upon the top of the sleeve 16 and shell 17 is a hollow cap 22 closed at the top and provided with a downwardly extending flange 22*a* and a horizontal flange 22*b*, the latter serving to close the top of the chamber between sleeve 16 and shell 17, as illustrated in Fig. 3.

The vertical wall 22*c* of the cap 22 is provided with a row of peripheral air holes 22*d* directed outwardly as illustrated for a purpose hereinafter specified.

Seated in the recess 10*f* of the flange 10*c* and extending upwardly therefrom in spaced relation to the shell 17 is the outer casing 25 open at the top as illustrated. While we have illustrated the top of this casing as extended slightly above the top of the cap 22 it should be understood that

it may be located below or approximately at the same level or otherwise as may be desired to permit unrestrained outward flow of air through the perforations or holes 22*d* or to baffle such flow for control of the flame at "high fire."

The entire device heretofore described may be and preferably is enclosed in a suitable housing generally indicated by numeral 27 (see Fig. 1) extending upwardly from any suitable base 28 constructed to permit free flow of air through the air inlet 10*a*. As illustrated, we have provided a supporting ring 28*a* upon which the base 10 is supported at its outer periphery and have also provided insulating material 29 between the bottom of the base 10 and the bottom 27*a* of the housing 27. It will be understood that housing 27 functions as a heating drum and is provided with any suitable flue outlet for gases of combustion in well-known manner.

Projecting outwardly from the shell 17 at or near the bottom thereof is the ring or flange 30. The purpose of the ring 30 is to separate the gas chamber from the combustion chamber and at the same time to build up a pressure in the bottom of the pot during vaporization and gasification so that the gas is uniformly distributed to all parts of the screen.

It will be noted that the chamber A formed by and between the sleeve 16 and shell 17, which we term a mixing chamber, while closed at the top as disclosed above is open at the bottom for communication with the gasification or vaporizing chamber 10*d* in the base 10.

In the operation of our device, as we understand it, at the start, fuel is admitted through the supply pipe 15 to the chamber 10*h* from which it will flow through the duct 10*i* into the gas chamber 10*d* where it may be ignited initially in any suitable manner. As soon as the heat of this initial fire is sufficient, the oil will vaporize in chamber 10*h* and gas will be generated in such quantity as to be capable of flow from the gas chamber 10*d* into the chamber A. To expedite the initial heating we may remove the plug 14*a* and permit air to flow through tube 13 for initial combustion with the oil, but as soon as normal operation is attained such plug is replaced and it will be noted that no air, at least in substantial amount, is admissible to the gas chamber 10*d*. It is our belief from observation that during normal operation sufficient heat is transmitted to the chamber 10*h* to effect a vaporization of the fuel, such vapor flowing through the ducts 10*i* into the gas chamber 10*d* where a complete gasification takes place. In other words, the vaporized fuel is gasified in the chamber 10*d*.

While it is obvious that this device may be utilized for either forced draft or natural draft, in the form illustrated we are relying upon natural draft, the effect of which is to draw air from outside the heater through the inlet 10*a* from which a portion of it is diverted and flows through the lower two rows of apertures 16*a* in the sleeve 16, the remainder flowing upwardly into the interior of the sleeve 16 and out through the upper rows of apertures 16*a* which are preferably arranged in horizontal rows, the apertures of each row being staggered with respect to those immediately above and below.

The air flowing through the apertures 16*a* will attain sufficient velocity to form jets which will be projected on through the corresponding apertures 17*a* in the shell 17. This results in an aspirating or induction effect which draws the fuel gas upwardly into the chamber A, the aspirating air mixing with such gas and carrying the combustible gas mixture into the combustion chamber B between the outer casing 25 and the shell 17. This inductive effect of these air jets is probably supplemented by the expansion of the fuel gas, the outlet for which is normally into the chamber A. The ring or baffle 30 serves to prevent or at least obstruct direct flow of gas from the chamber 10*d* into the chamber B, and to build up a pressure on the gas during operation.

If the supply of fuel be properly regulated at a minimum the jets of combustible gas will be confined to the lowermost row or rows of apertures 17*a* and blue jets of flame will project therefrom into the chamber B indicating substantially perfect combustion. This is frequently termed "low fire" utilized as a pilot fire or flame burning during such periods as there is no demand for substantial heating. The air ring 20, as we term it, tends to insure delivery of sufficient air to the lowermost rows of apertures 16*a* below the ring at any stage of operation.

When more heat is desired the supply of fuel is increased either automatically or manually in well-known manner and, with consequent increase of gas generation, more jets of combustible mixture will result with proportionally greater combustion. In other words, jets of flame will result opposite or in line with apertures 17*a* above the ring 20 in addition to those directed from the lower row or rows of apertures 17*a*. With maximum fuel delivery in sufficient amount for production of a "high fire" these burning jets will be located the entire height of the shell 17, or at least to and in line with the uppermost row of apertures 17*a* and any unburned gas arising thereabove either by passage from beneath the ring 30 due to the increased gas generation or because of non-combustion of a portion or portions of the jets from apertures 17*a* will be scavenged or salvaged by the air flowing outwardly from the holes 22*d*, which it will be noted, deliver only air unmixed with gas which is in the nature of so-called "secondary air." These air holes 22*d* being outwardly directed may be partially obstructed or baffled by the upper end of the casing 25 in the form illustrated with the result that the final flame at the top of the burner will be more compact than if the casing terminated near, at, or below the level of the holes 22*d*, in which case more of a saucer-shaped top flame will result.

Not only do we obtain a clean substantially perfect combustion within the casing 25 from the jets of combustible gas emanating from the apertures 17*a*, but we obtain substantial heating effect from the bottom of the casing 25 upwardly in proportion to the character of the fire in contradistinction to present-day apparatus which at "high fire" locates all of the flame at the top of or above the burner unit, leaving a substantial area therebelow which is heated to much lesser or negligible degree with a lesser external heating effect near the floor of a room or the like than is attained with our burner.

Thus it will be seen that our burner is distinctive in its operation of delivering and burning jets of combustible gas mixture through the lowermost row or rows of perforations, regardless of the degree of fuel supply and gas generation, differing materially in that respect from prior devices.

As the generation of gas increases, the visible

combustion or flames is raised higher and higher above the bottom of the burner unit because the air for combustion is introduced with the gas and is sufficient in such a case to support active combustion at the lower levels.

Should it be desired, the chamber **10***h* may be utilized as an individual pilot by removing the plug **12** and the plug **14***a* and reducing the fuel supply to a point where insufficient fuel is supplied to **10***h* to exceed the rate of combustion therein and to overflow into the duct **10***i*. In utilizing this auxiliary pilot, of course it will be understood that the pilot is initially ignited in any suitable manner and it is better when it is desired to initiate operation of the burner proper for heat delivery by increasing the fuel supply, to replace the plug **12**. The increased fuel then operates to charge the gas chamber **10***d* and is vaporized as described above.

It is to be understood that in describing the ring **20** as an "air ring," the chamber **10***d* as a "gas chamber," the chamber A as a "mixing chamber," the chamber **10***h* as a "vaporizing" or a "pre-vaporizing chamber," and the chamber B as a "combustion chamber," we have arbitrarily resorted to those terms and do not wish needlessly to be limited by such specific appellations.

While it will be obvious that our burner may be built in different sizes and with different dimensions, for the guidance of the men skilled in the art we point out that in a specific embodiment of our invention the casing is substantially 10 inches in diameter and with the top thereof approximately 8½ inches from the bottom of the base **10**; the sleeve **16** is 7 inches in diameter; the shell **17** is 8 inches in diameter; there are five horizontal rows of holes in the sleeve and in the shell, the holes in the sleeve being number 38 drill size, i. e. approximately .0101 inch in diameter; the holes in the shell **17** are approximately $\frac{11}{32}$ of an inch in diameter; there are 100 holes of number 38 drill size, i. e., .0101 inch in diameter in the cap **22**; the outer diameter of the base **10** is approximately 10¾ inches and the inner diameter thereof approximately 6 inches at its base.

While we have described and illustrated one embodiment of our invention we do not wish to be restricted to that specific embodiment except as the appended claims construed with proper recognition of the prior art may demand such limitation.

We claim:

1. In a device of the class described, a base member having a fuel receiving chamber, means to supply liquid fuel thereto, said base member being provided with an air inlet, an apertured sleeve mounted upon and projecting upwardly from said base member and in communication with said inlet, an apertured shell surrounding and spaced from said sleeve, the apertures in said sleeve and shell being arranged in alignment and constructed to cooperate to produce an aspirating effect upon flow of air through the apertures in said sleeve, the space between said sleeve and shell being in communication with the fuel receiving chamber of said base member whereby gas may flow from the latter into the former, said shell being provided with a flange overlying said fuel receiving chamber and located below the apertures in said shell to form a gasification chamber, a casing surrounding and spaced from said sleeve and shell and a closure member mounted upon said sleeve and shell to close the space therebetween at the upper end thereof, said closure member being provided with apertures in communication with said air inlet and arranged to discharge air into gases flowing upwardly around said shell.

2. In a device of the class described, a base member having a fuel receiving chamber, means to supply liquid fuel thereto, said base member being provided with an air inlet, an apertured sleeve mounted upon and projecting upwardly from said base member and in communication with said inlet, an apertured shell surrounding and spaced from said sleeve, the apertures in said sleeve and shell being arranged in alignment and constructed to cooperate to produce an aspirating effect upon flow of air through the apertures in said sleeve, the space between said sleeve and shell being in communication with the fuel receiving chamber of said base member whereby gas may flow from the latter into the former, said shell being provided with a flange overlying said fuel receiving chamber and located below the apertures in said shell to form a gasification chamber, a casing surrounding and spaced from said sleeve and shell and forming a combustion chamber therewith and a cap mounted upon said sleeve and shell to close the space therebetween at the top, said cap being chambered and in communication with said air inlet, said cap also being apertured for passage of air from said inlet into said combustion chamber.

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