March 10, 1942. R. S. MOORE 2,275,980

BURNER

Filed Feb. 8, 1939

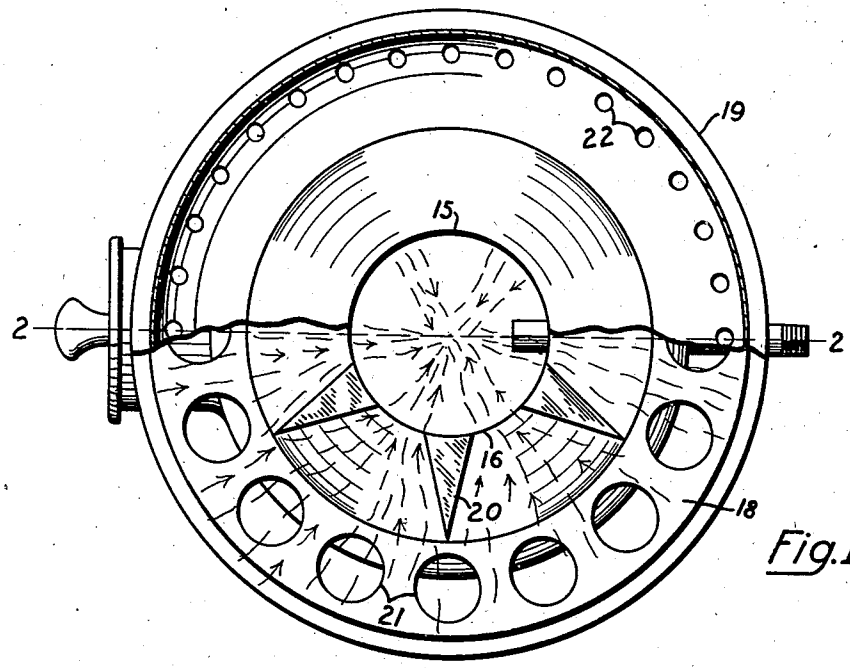


Fig.1

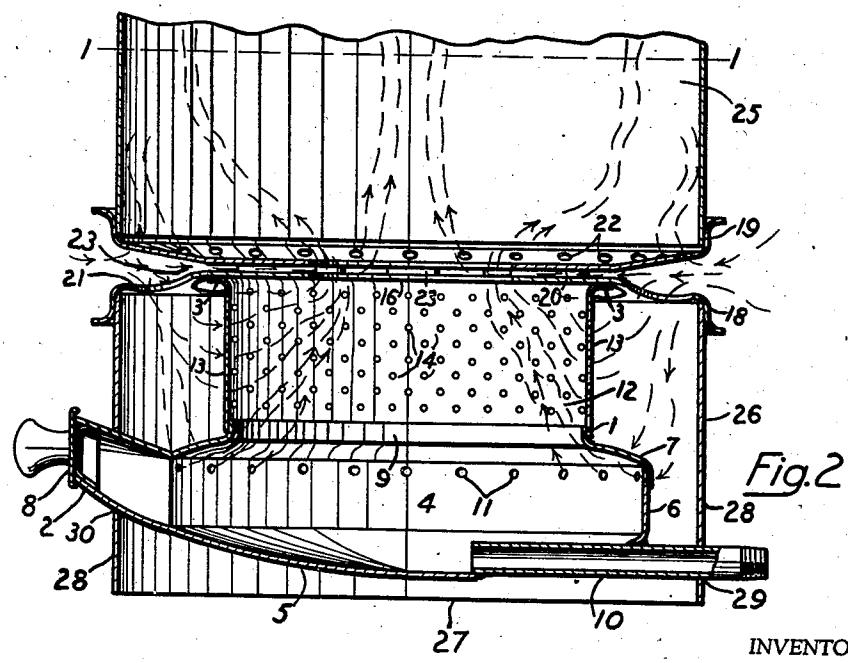


Fig.2

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BURNER

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Application February 8, 1939, Serial No. 255,191

10 Claims. (Cl. 158—91)

This application relates to an improved oil burner and is a continuation in part of my copending application No. 141,309, filed May 7, 1937. In the said application I disclosed a three stage oil burner consisting of a vaporizing chamber, a pre-heating chamber in which primary air was supplied to the vapors arising from the vaporizing chamber and a means to supply a secondary supply of air to the vapors as they passed from the mixing and pre-heating chamber. In the present invention I utilize all three of these features, but in addition I provide deflecting plates in the last mentioned means so that the supply of secondary air will be admitted to the vaporizing gases in the form of a series of jets. The air is injected in the form of jets into the flame stream with such force that it creates a mixing and a high degree of turbulence within the flame itself and also produces, instead of a single cone, a fire of multiple flames; the air not only surrounding the flame, but being injected into the flame itself. The center of the flame structure can be best described as a cone of air surrounded by cones of flames which radiate, forming the air cone as a common center and these cones or branches of flame are surrounded by air so that the flame instead of being a solid mass of flame having a cold center becomes a thin, brilliant flame with air inside and outside thereof. Such a flame produces extremely high temperatures and has a high radiating efficiency.

Another object of the invention is the means to prevent hard carbon forming in the vaporizing chamber. I have provided means to maintain at all times a pool of oil in the vaporizing chamber regardless of whether the flame is burning at extremely low or extremely high fires. As there is a pool of oil continually in the vaporizing chamber, the centralized vapor remains in contact with this pool of oil and this is a distinct advantage as no cracking of the oil takes place as long as its saturated vapor is in contact therewith. It is, therefore, apparent that no hard carbon will be formed for the cracking which produces the hard carbon is eliminated.

Another object of the invention is to provide means to eliminate the noise of flame vibration.

Another distinct advantage of the invention is that I pass the air over and through the metal forming the structure tending to cool the metal and preventing it from reaching a high degree of heat, which prevents the metal from burning up and gives a long life and trouble-free operation, without replacement of parts. Furthermore, the air in cooling the metal is pre-heated before entering the flame stream thereby providing better and faster combustion.

Another object of the invention is that by my improved construction I am enabled to greatly increase the burning range. Heretofore oil burners have had a burning range of only about 1 to 4, that is, if they can burn one pound of oil at low fire, the maximum oil which they can burn is approximately four pounds in a given period of time. I find it possible with my improved burner to burn four ounces of oil per hour at low fire and four pounds of oil per hour at high fire so that with my improved construction I have extended the range from 1 to 4 up to 1 to 16. This increased burning range, particularly in the low fire ranges, makes it possible to control the fire with thermostatic controls which are highly desirable from the standpoint of comfort and convenience, and which have heretofore been impractical in most oil burners because the consumption of oil at their lowest burning range was so great that the thermostatic controls were generally rendered useless.

Other objects and advantages of the invention will appear in the detailed specification and claims which follow.

In the drawing:

Fig. 1 is a plan view on the line 1—1 of Fig. 2 looking downwardly and having a portion thereof broken away so as to disclose the structure of the plate at the top of the pre-heating and mixing chamber and,

Fig. 2 is a cross-sectional elevational view on the line 2—2 of Fig. 1.

In the drawing, similar reference characters indicate corresponding parts in the several views.

The vaporizing chamber 4 consists of a bottom wall 5, side walls 6 and a top wall 7, the top wall 7 being secured to the side walls 6 and being provided with an upstanding circular flange 1 forming a circular burner opening 9. The vaporizing chamber is provided with a door 8. When the door 8 is removed, a lighter can be inserted into the liquid fuel which is introduced into the vaporizing chamber through the pipe 10 which leads to a source of oil supply such as a reservoir. The vaporizing chamber 4 is housed in the lower portion of a housing 26 consisting of a bottom 27, side walls 28 and an upper cover plate 18. The side walls 28 are provided with an opening 29 through which the pipe 10 extends and with an opening 30 through which the spout 2 extends and which leads to the door 8. The vaporizing chamber 4 is also provided with a series of apertures or holes 11 near the upper portion of the

side walls 6 and through these holes a limited amount of air from the housing 26 passes into the vaporizing chamber 4 where it mixes with the vapors arising from the pool of oil on the bottom wall 5. The amount of air that is admitted through these openings, however, is insufficient to support combustion normally as will hereinafter be described.

A second and distinct part of my burner is a mixing and pre-heating chamber 12 which in the present embodiment of the invention consists of a perforated cylinder 13 with a large number of openings 14 for the passage of air from the housing 26 into the mixing and pre-heating chamber 12. The lower end of the cylinder 13 is secured to the circular flange 1 by any conventional means, such as welding, and this cylinder 13 is of substantially the same size as the burner opening 9 in the upper part of the vaporizing chamber. The upper portion of the cylinder 13 is flared outwardly forming a flange 3 and on this flange and on the upper end of the housing 26 rests the cover plate 18. The cover plate 18 is provided with an opening 16 in the center thereof through which the hot burning gases from the mixing and pre-heating chamber 12 pass upwardly. The chamber 12 might be better described as the initial combustion chamber.

A combustion chamber 25 is mounted above the housing 26 and above all of the structure heretofore described in detail. It is provided with a bottom wall 19 which is spaced a distance above the cover plate 18 providing an opening or passageway 23 through which air from the atmosphere is drawn. The bottom wall 19 is provided with a circular opening 15 which is the same size or substantially the same size as the opening 16, as is clearly shown in Fig. 1. Baffles 20 are interposed between the cover plate 18 and the bottom wall 19. These baffles are preferably triangular in shape, as shown in Fig. 1, except that the base thereof would form an arc of a circle instead of a straight line. It will be noted that the V-shaped portion of each triangular baffle points outwardly so that the incoming air between two baffles is forced together and the distances between two adjacent baffles constantly decreases as the air progresses inwardly.

The cover plate 18 is provided with a series of holes 21 leading from the outside atmosphere to the housing 26, these holes being in that portion of the cover plate 18 between the side walls 28 and the perforated cylinder 13. The bottom wall 19 of the combustion chamber 25 is provided with a series of holes 22 near the outer margins thereof and adjacent the side walls of the combustion chamber so that air is drawn into the combustion chamber close to the side walls thereof.

It will be noted that there are four distinct parts consisting of the following:

First, the vaporizing chamber 4 in which oil is admitted through the pipe 10 forming a pool on the bottom thereof and a limited supply of air passes into the vaporizing chamber 4 through the apertures 11. Initially the door 8 is removed and a lighted taper is inserted into the vaporizing chamber 4 to ignite the oil therein. After the oil starts burning in the vaporizing chamber 4, the door 8 is replaced, thereby shutting off the air which would pass through the doorway. There is now an insufficient amount of air in the vaporizing chamber 4 to support combustion and the flame arises into the mixing and preheating chamber 12.

Second, the initial combustion chamber 12 receives the gases arising from the vaporizing chamber 4 and air is introduced through the openings 14 so as to make a combustible mixture. After the lighting process, there is no burning, that is, no flame in the vaporizing chamber 4 and the flame does not appear, that is, the vapors are not ignited until they are passing through the chamber 12 where they are mixed with a sufficient supply of air 14 to support combustion although it may not be complete combustion.

Third, the burning vapors now pass through the opening 16 in the cover plate 18 and through the opening 15 in the bottom wall 19 and while making this transition, the baffles 20 have deflected and compressed together a supply of air from the passageway 23 and injects this air into the burning flame in a series of jets thereby creating a high degree of turbulence and producing not one flame, but many flames. The air coming in between the baffles rushes in with enough force to completely penetrate the flame and meets in the center of the openings 15 and 16. This unique method of bringing secondary air into a highly pre-heated gas promotes efficient mixing and fast flame propagation. Furthermore, it will be noted that the incoming air is pre-heated before meeting and mixing with the burning vapors. This pre-heating and high degree of turbulence and thorough mixing of both air and oil vapors produces a flame of high velocity and intense heat. Each of these jets of air must enter between the baffles creating its own turbulence in the flame and creates individual cones, each with a hollow center having its own peak of flame. The number of these multiple flames will depend on the number of air deflectors or baffles.

Fourth, the combustion chamber 25 is where the final combustion is completed. It will be noted, however, that the openings 22 allow a current of air to pass upwardly adjacent the side walls of the combustion chamber 25 and thereby eliminate much of the noise of flame vibration. These holes 22 could be eliminated, however, without interfering with the action of the burner itself. It is simply an additional improvement over the burner action per se.

It is well known that in producing radiant heat there must be some body to produce the radiation. A burner such as I have described produces a highly radiant type flame, because the carbon particles in the oil vapor are heated to a high degree and produces a distinctly white, hot, radiant flame.

It will be noted that the travel of the air currents is such as to pre-heat the air before it enters the combustible vapors and the pre-heating of this air tends to cool the metal parts contacted by the inrushing air and therefore prevents the metal from burning out as quickly as it otherwise would.

It will be noted that the fuel is vaporized in the vaporizing chamber 4 from whence it passes upwardly into the initial combustion chamber 12, which is of a smaller cross-sectional area. The vapors are ignited in the chamber 12 and then pass upwardly through the central holes 15 and 16 in the plates 18 and 19, which holes are much smaller in cross-sectional area than either the chamber 12 or the chamber 25, into which chamber 25 they expand after passing through said holes in the plates thereby giving a Venturi effect. Furthermore, the supply of air is introduced inwardly from the atmosphere

through the passageway between the plates so that the final supply of air is introduced into the restricted portion of the flame as it passes through the holes 15 and 16. Attention, in particular, is called to the fact that this passageway between the plates is directly open to the outside atmosphere thereby allowing such a large quantity of air to pass inwardly into the flame as to further constrict the cross-sectional area of the flame as the final air is introduced into the flame. This large final supply of air is furthermore subdivided by the wide baffles 20 so that an eddy effect or turbulence is given to the flame, thereby greatly increasing the effectiveness of the mixture of the air with the burning vapors.

I realize that many changes may be made in the specific form of the invention shown by way of illustration therein and I, therefore, desire to claim the same broadly, except as I may limit myself in the appended claims.

Having now described my invention I claim:

1. A burner including a vaporizing chamber into which liquid fuel is fed, said chamber being provided with perforations through which a limited amount of air, insufficient to support combustion under normal operating conditions, is introduced into the chamber, an initial combustion chamber above and communicating with the vaporizing chamber, said initial combustion chamber being in the form of a perforated cylinder of materially smaller diameter than that of the vaporizing chamber, a final combustion chamber larger than and above and communicating with the initial combustion chamber and spaced apart plates between the initial and final combustion chambers, the said plates having central apertures of smaller cross-sectional area than that of the initial combustion chamber and through which apertures the burning vapors pass from the initial combustion chamber into the final combustion chamber, the spaces between said plates opening directly into the outside atmosphere and through which a large amount of air may sweep inwardly into the flame.

2. A burner including a vaporizing chamber, a final combustion chamber, an initial combustion chamber interposed between and communicating with the vaporizing chamber and the final combustion chamber, the said initial combustion chamber being of materially smaller cross-sectional area than that of the vaporizing chamber, means whereby a small amount of air, insufficient to support combustion, is introduced into the vaporizing chamber, means whereby additional air is introduced into the initial combustion chamber and spaced apart plates between the initial and final combustion chambers, the said plates having central apertures of smaller cross-sectional area than that of the initial combustion chamber and through which apertures the burning vapors pass from the initial combustion chamber into the final combustion chamber, the spaces between said plates opening directly into the outside atmosphere and through which a large amount of air may sweep inwardly into the flame.

3. A burner including a vaporizing chamber, a final combustion chamber, an initial combustion chamber interposed between and communicating with the vaporizing chamber and the final combustion chamber, the initial combustion chamber being of materially smaller cross-sectional area than that of the vaporizing chamber, means whereby a small amount of air, insufficient to support combustion, is introduced into the vaporizing chamber, means whereby additional air is introduced into the initial combustion chamber and means opening directly into the outside atmosphere whereby a plurality of jets of air are introduced into the gases passing from the initial combustion chamber into the final combustion chamber, said last named means including a plurality of wide baffles.

4. A burner including a vaporizing chamber, a final combustion chamber, an initial combustion chamber interposed between and communicating with the vaporizing chamber and the final combustion chamber, said initial combustion chamber being of materially smaller cross-sectional area than that of the vaporizing chamber, means whereby a small amount of air, insufficient to support combustion, is introduced into the vaporizing chamber, means whereby additional air is introduced into the initial combustion chamber and means whereby a final supply of air is introduced into the flame after it passes the initial combustion chamber and before it reaches the final combustion chamber, said means consisting of spaced apart plates forming a passageway opening directly into the outside atmosphere and through which air is drawn from the atmosphere into the flame.

5. A burner including a vaporizing chamber, a final combustion chamber, an initial combustion chamber interposed between and communicating with the vaporizing chamber and the final combustion chamber, said initial combustion chamber being of materially smaller cross-sectional area than that of the vaporizing chamber, means whereby a small amount of air, insufficient to support combustion, is introduced into the vaporizing chamber, the initial and final combustion chambers being spaced a small distance apart, and means whereby a plurality of jets of air are introduced into the gases passing through the space separating the initial combustion chamber from the final combustion chamber, said means consisting of spaced apart plates forming a passageway opening directly into the outside atmosphere and through which air is drawn from the atmosphere into the flame and wide baffles between said plates to divide the incoming air into jets to create turbulence in the flame.

6. In a burner, a vaporizing chamber for oil, an initial combustion chamber into which the vaporized fuel from the vaporizing chamber passes, said initial combustion chamber being of materially smaller cross-sectional area than that of the vaporizing chamber, a final combustion chamber above and communicating with the initial combustion chamber, spaced apart plates between the initial combustion chamber and the final combustion chamber forming a passageway therebetween opening directly from the outside atmosphere into the burning fuel passing from the initial combustion chamber into the final combustion chamber, and baffles extending to said passageway whereby the air passing into the vaporized fuel through said passageway is divided into separate jets.

7. In a burner, a vaporizing chamber and a final combustion chamber, an initial combustion chamber between and communicating with the vaporizing chamber and the final combustion chamber and of materially smaller cross-sectional area than that of either the vaporizing chamber or the final combustion chamber, spaced apart plates between the initial and final combustion chambers, said plates being provided

with central holes through which the flame passes from the initial combustion chamber into the final combustion chamber, the space between said plates serving as an air passageway leading directly from the outside atmosphere into the flame as the flame passes upwardly through said holes in said plates.

8. In a burner, a vaporizing chamber and a final combustion chamber, an initial combustion chamber between and communicating with the vaporizing chamber and the final combustion chamber and of materially smaller cross-sectional area than that of either the vaporizing chamber or the final combustion chamber, spaced apart plates between the initial and final combustion chambers, said plates being provided with central holes through which the flame passes from the initial combustion chamber into the final combustion chamber, the space between said plates serving as an air passageway leading directly from the outside atmosphere into the flame as the flame passes upwardly through said holes in said plates, said holes in said plates being of materially smaller cross-sectional area than the cross-sectional area of the initial combustion chamber.

9. In a burner, a vaporizing chamber and a final combustion chamber, an initial combustion chamber between and communicating with the vaporizing chamber and the final combustion chamber and of materially smaller cross-sectional area than that of either the vaporizing chamber or the final combustion chamber, spaced apart plates between the initial and final combustion chambers, said plates being provided with central holes through which the flame passes from the initial combustion chamber into the final combustion chamber, the space between said plates serving as an air passageway leading directly from the outside atmosphere into the flame as the flame passes upwardly through said holes in said plates, said holes in said plates being of materially smaller cross-sectional area than the cross-sectional area of the initial combustion chamber, the outer parts of the plates diverging away from each other so as to form an inwardly tapering entrance for the incoming air.

10. In a burner, a vaporizing chamber and a final combustion chamber, an initial combustion chamber between and communicating with the vaporizing chamber and the final combustion chamber and of materially smaller cross-sectional area than that of either the vaporizing chamber or the final combustion chamber, spaced apart plates between the initial and final combustion chambers, said plates being provided with central holes through which the flame passes from the initial combustion chamber into the final combustion chamber, the space between said plates serving as an air passageway leading directly from the outside atmosphere into the flame as the flame passes upwardly through said holes in said plates, and wide baffles extending between the plates and extending to the holes in said plates so that the air sweeping between the wide baffles and into the flame will create a turbulence therein.

RICHARD S. MOORE.