Aug. 31, 1937. W. B. STURGIS 2,091,658

OIL BURNER

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Fig. 1

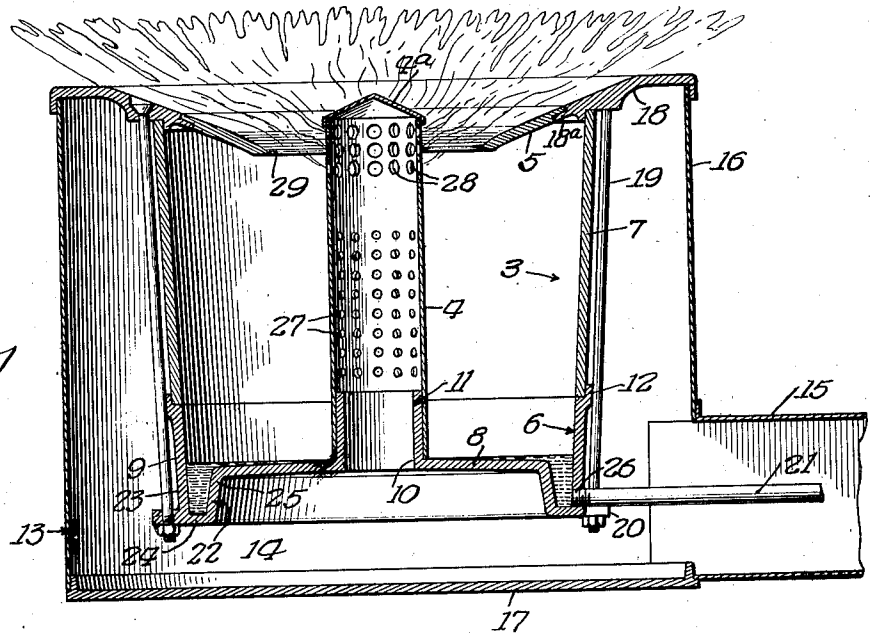
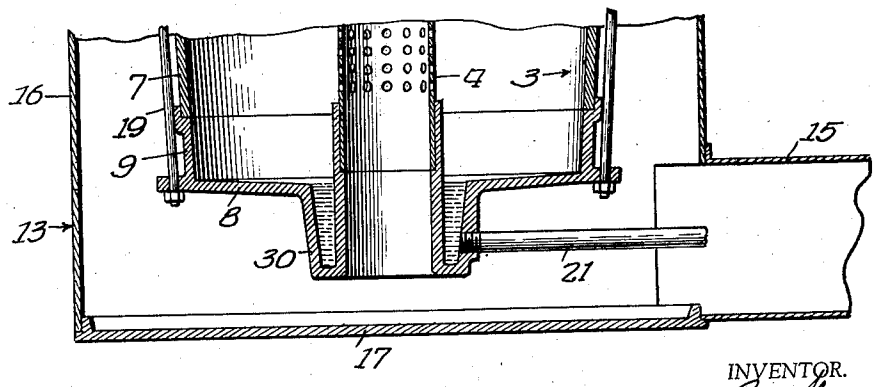


Fig. 2



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OIL BURNER

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4 Claims. (Cl. 158—92)

The present invention pertains generally to oil burners for use in connection with boilers, hot air furnaces, stoves and like heating apparatus. More particularly, the invention pertains to that type of oil burner which is known as a vaporizing burner of the "premixing" type and comprises (1) a substantially cylindrical receptacle having an open top and forming a vaporizing chamber; (2) a pipe which is connected to a source of oil and is adapted to deliver oil into the chamber; (3) a jacket which surrounds the receptacle and serves to form an air space beneath the receptacle bottom and around the side wall of the receptacle; (4) means including perforations or openings for jetting a limited quantity of air from the air space into the vaporizing chamber to effect vaporization and aeration of the oil within the chamber; and (5) means for supplying a greater quantity of air from the air space across the top of the receptacle so as to support combustion of the vaporized and aerated oil as it rises from the receptacle and passes out the open top of the latter.

Burners of this type effect vaporization of the oil by way of the heat resulting from combustion and may be divided into two classes, viz., those that operate with a "dry" bottom, and those that operate with a "wet" bottom. In the "dry" bottom burner the receptacle, during burner operation, becomes heated to such a degree that the oil vaporizes immediately upon entering the vaporizing chamber. If such a burner be operating at its normal full capacity and the flow of oil is further increased, the size of the flame increases. Inasmuch as the openings for jetting air into the vaporizing chamber are fixed as far as size and total area are concerned, a point is immediately reached when insufficient air is supplied to the oil vapor and partial combustion takes place. This is accompanied by smoke and, if carried sufficiently far, the flame chokes itself out and then relights with explosive violence, as soon as sufficient oxygen accumulates in the vaporizing chamber. A burner which acts in this manner may be defined as "unstable" because there is no means for automatically limiting the rate of vaporization. The "dry" bottom type of burner has the further disadvantage that carbon collects in the vaporizing chamber in and around the oil entrance, thereby stopping the flow of oil. Because of this, such a burner requires frequent servicing and hence is unsatisfactory in operation.

In order to obtain stability in a "wet" bottom vaporizing burner of the premixing type, it is necessary to remove from the bottom of the vaporizing chamber all excess heat delivered thereto by the combustion of the fuel over and above that amount of heat necessary to effect the proper rate of vaporization for perfect combustion at full capacity operation of the burner and thus to effect a state of equilibrium. In the event that the excess heat is not removed from the bottom of the vaporizing chamber at full capacity operation of the burner so that equilibrium is obtained, the burner will be unstable and imperfect combustion and smoke will result. Heretofore it has been customary in the manufacture of "wet" bottom burners of the premixing type to make the receptacle bottom substantially flat. Such burners are not inherently stable due to the fact that there is not sufficient radiating surface on the receptacle bottom for the air in the space under the receptacle bottom to absorb and thereby remove the excess heat from the receptacle bottom when the burner is operating at full capacity.

The primary object of this invention is to provide a "wet" bottom vaporizing burner of the premixing type which is inherently stable and therefore more efficient and safe in operation than previously designed burners of the same general character in that the bottom of the receptacle is provided with means whereby the radiating surface of the receptacle bottom is increased to a point at which the excess heat during full capacity operation of the burner is absorbed and thus removed by the air under the receptacle and a state of equilibrium results.

Another object of the invention is to provide a "premixing" type oil burner of the last mentioned character in which the means for producing inherent stability consists of an oil well which depends from, and is formed integrally with, the bottom of the receptacle.

A further object of the invention is to provide a vaporizing burner of the "premixing" type in which the pipe for maintaining a film of oil over the bottom of the receptacle is connected to the oil well and the well, by reason of its construction and depth, serves to prevent overheating of the oil at the point where it enters the receptacle with the result that cracking of the oil and the resultant clogging of the oil entrance are avoided.

A still further object of the invention is to provide a "premixing" oil burner which is generally of new and improved construction.

Other objects of the invention and the various advantages and characteristics of the present burner construction will be apparent to those

skilled in the art from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawing which accompanies and forms a part of this specification or disclosure:

Figure 1 is a vertical, longitudinal section showing in operation at full capacity an oil burner embodying the invention and having around the peripheral portion of the receptacle bottom thereof an oil well for producing inherent stability; and

Figure 2 is a similar section showing in operation at approximately fifty per cent. capacity an oil burner having a stabilizing oil well formed integrally with, and depending from, the central portion of the bottom of the receptacle.

The oil burner which is shown in Figure 1 of the drawing and constitutes one form of the invention is a "premixing" burner of the vaporizing type as contradistinguished from a "pot" type burner wherein there is but a single air supply and combustion takes place continuously within the receptacle or pot. It is adapted to be used in connection with a boiler, hot air furnace, stove or similar heating apparatus and comprises a receptacle 3, an upstanding tube 4 and a ring 5. The receptacle 3 forms an oil vaporizing and aerating chamber, is substantially cylindrical and consists of a bottom section 6 and a top section 7. The bottom section is formed of thin metal such for example as cast iron, and embodies a circular bottom 8 and a substantially cylindrical side wall 9. The bottom 8 slopes downwardly toward the marginal portion thereof and is provided with a central opening 10. A sleeve part 11 surrounds this opening and extends upwardly from, and is formed integrally with, the bottom 8. The side wall 9 is imperforate and extends upwardly and slightly outwardly and is formed integrally with the bottom 8. The top section 7 consists of a substantially cylindrical, cast iron wall which rests upon and forms a continuation of the side wall 9. This wall of the top section, together with the side wall 9, forms the side wall of the receptacle and is removably held in place by means of an annular flange 12 which is formed integrally with and projects upwardly from the top portion of the side wall of the bottom section 6.

A jacket 13 surrounds the receptacle and forms an air space 14 beneath the bottom 8 and around the side wall of the receptacle. This jacket is supplied with air by a laterally extending conduit 15 and consists of a cylindrical, sheet metal side wall 16 and a cast metal bottom plate 17. The side wall 16 extends around and is spaced from the side wall of the receptacle. The space between the side wall 16 and the side wall of the receptacle is closed at the upper end thereof by means of a ring-shaped, cast iron cross wall 18. This cross wall rests upon the top edges of the side wall 16 and the side wall which constitutes the top section 7 of the receptacle, and serves to support the ring 5. Vertically extending bolts 19 extend along the outside of the side wall of the receptacle and between the cross wall 18 and lugs 20 on the side wall 9 of the bottom section 6, and serve to clamp the top and bottom sections of the receptacle together and in conjunction with the cross wall operate to suspend the receptacle from the side wall 16 of the jacket 13. The bottom plate 17 is located in spaced relation with respect to the bottom 8 of the bottom section of the receptacle, and serves to close the bottom of the air space 14. The conduit 15 is attached to the side wall 16 of the jacket and, if desired, may be connected to a blower or fan. The ring 5, like the cross wall 18, is formed of cast iron. It rests loosely on a flange 18a around the inner edge of said cross wall and forms a restricted outlet at the top of the receptacle.

Oil is supplied to the receptacle by means of a feed pipe 21. This pipe is adapted to be connected to a source of oil supply and leads through the laterally extending conduit 15 to an annular oil well 22. The oil well is formed as an integral part of the bottom section 6 of the receptacle and consists of an outer side wall 23, a ring-like bottom 24 and an inner side wall 25. The outer side wall 23 is formed integrally with, and is in the nature of a downward continuation of, the side wall 9 of the bottom section 6. The inner side wall 25 is formed integrally with and depends from the marginal part of the bottom 8, and is joined to the outer side wall 23 by way of the bottom 24. The pipe 21 extends through the outer side wall of the well and is connected in place by means of a screw thread 26. The oil which is introduced or supplied to the receptacle by the pipe 21 flows from the pipe into the well and spreads out in a thin film over the bottom 8 of the receptacle. A valve device (not shown) is associated with the pipe 21 and serves to control the level of the oil on the bottom of the receptacle. The air passing into the space 14 from the conduit 15 flows around the exposed surfaces of the well 22 and by reason of the cooling effect, controls the temperature of the well and thereby the vaporization of the oil in the well and over the bottom 8. The depth of the well and the area of the outer surface of the well, that is, the surface of the well that is exposed to the air in the jacket 13, are such that the radiating surface of the receptacle bottom is increased to such a point that when the burner is operating at full capacity all excess heat delivered to the receptacle bottom by the combustion of the oil over and above that amount of heat necessary to effect the proper rate of vaporization for perfect combustion at full capacity operation of the burner is absorbed by the air around and under the receptacle and a state of equilibrium is effected tending to make the burner inherently stable.

By employing a well of the aforementioned character for the purpose of effecting a state of equilibrium during operation of the burner at full capacity, the burner cannot build up beyond the desired amount, and as a result imperfect combustion and smoking are eliminated. The well, in addition to rendering the burner inherently stable, by increasing the normal radiating surface of the receptacle, prevents, due to its depth and area, overheating of the oil at the point wherein it enters the receptacle, with the result that cracking of the oil and resultant clogging of the oil entrance are avoided. In the burner of Figure 1 the oil well serves materially to increase the radiating surface of the receptacle bottom. As a result of this increase in radiating surface a state of thermal-equilibrium exists when the burner is operated at full capacity by reason of the fact that the air around and under the burner absorbs all excess heat, that is, all heat over and above the amount of heat that is necessary to effect the proper rate of vaporization for perfect

combustion at full capacity operation of the burner.

The tube 4 serves to supply air from the air space 14 into the receptacle and across the receptacle top. It is positioned centrally and in an upstanding manner in the reecptacle and has the lower end thereof sleeved over the sleeve part 11 as shown in Figure 1 of the drawing. The upper end of the tube is closed by means of a cap 4a which is secured in place in any suitable manner. The tube is provided with a lower set of perforations 27 and an upper set of perforations 28. The perforations 27 are relatively small and are distributed throughout the central and lower portions of the tube. The perforations 28 are larger than the perforations 27 and are formed in the upper end of the tube so that they are located for the most part, above the inner margin of the ring 5. The perforations 27 are of less total area than the perforations 28 and introduce into the receptacle no more than 45% by volume of the total air theoretically required for the complete combustion of the oil. The air which is introduced into the receptacle via the perforations 27 is known as "primary" air and operates to aerate the oil vapor as it rises from the bottom 8 of the bottom section 6 of the receptacle. The perforations 28 operate to jet into the oil vapor rising from the receptacle, the remainder of the air theoretically required for complete combustion of the oil so as to effect combustion above the ring 5. The air emanating from the perforations 28 is known as "secondary" air and causes the flames resulting from combustion to sweep outwardly over and above the ring 5 and the cross wall 18. When the burner is operating at full capacity the air which absorbs the excess heat as the result of the increased radiating surface of the receptacle bottom flows upwardly through the tube 4 and is delivered to the oil vapor as it rises and emerges from the vaporizing chamber in the receptacle. The ring 5 slopes downwardly at the inner margin thereof and forms with the upper end of the tube, a comparatively narrow, annular passageway 29 through which the aerated oil vapor flows as it rises from the receptacle. This ring serves to prevent down draft and results in an intimate mixing of the primary air and oil vapor in the receptacle prior to contact of the oil vapor with the secondary air.

The burner is started by dropping a lighted match down through the ring 5 onto the film of oil on the bottom 8. When the film ignites, the oil heats and vaporizes. The vapor rises within the receptacle and mixes with the primary air entering the receptacle through the perforations 27. from the receptacle, the aerated oil vapor passes upwardly through the restricted passageway 29 and is brought into contact with the jets of air emanating from the perforations 28. These air jets, as previously pointed out, result in combustion during normal operation of the burner and cause the flames resulting from combustion to spread outwardly over the ring 5. When the burner is in full operation, the zone of combustion occurs opposite the perforations 28 and the flames spread outwardly and upwardly so that the heat is directed to the side walls of the combustion chamber of the heating apparatus with which the burner is associated in order to effect a highly efficient heat transference. When the burner is operating at full capacity the heat over and above that necessary to effect the proper rate of vaporization for perfect combustion at full capacity operation of the burner is absorbed, due to the increased radiating surface of the receptacle bottom, by the air which passes around the oil well 22 and flows upwardly through the tube 4. In view of this absorption of the excess heat the temperature of the receptacle bottom is maintained constant during operation of the burner at full capacity and hence the burner is inherently stable, and imperfect combustion and smoke are eliminated. In addition to rendering the burner inherently stable, the well, because of the cooling action that is produced thereby, prevents overheating of the oil and consequently there is no likelihood of the oil cracking and clogging the oil entrance as previously pointed out.

The oil burner which is shown in Figure 2 of the drawing is in the nature of a modification of that of Figure 1 in that it embodies an annular oil well 30 which is formed integrally with and depends from the central portion of the bottom wall of the receptacle. This oil well surrounds the opening in the receptacle bottom and forms a continuation of the sleeve which supports the tube. It is of greater depth than the well of the burner of Figure 1 in order that the normal radiating surface of the receptacle is increased to the proper extent to effect the desired control of the vaporization of the oil for stabilizing purposes. As shown in the drawing, the well is substantially three times as deep as it is wide. The bottom of the receptacle of the burner of Figure 2 slopes downwardly at the center thereof in order that the oil may flow properly with respect to the well 30.

The herein disclosed burners may be manufactured at a low and reasonable cost and are extremely efficient and safe in operation in that they comprehend comparatively simple means for automatically controlling the vaporization of the oil and thereby rendering them inherently stable.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

This application is a continuation in part of an application for Letters Patent of the United States filed by me May 24, 1928, Serial No. 280,241.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. A vaporizing burner of the premixing, "wet" bottom type, comprising in combination a receptacle consisting of a continuous side wall and a bottom, an air jacket surrounding the receptacle and forming an air space beneath the receptacle bottom and around the side wall, means for delivering liquid fuel over the receptacle bottom for vaporization therein, means for jetting into the receptacle less than one-half the total air theoretically required for complete combustion of the fuel in order to aerate the fuel vapor in the receptacle, means for supplying more than one-half of the total air theoretically required for the complete combustion of the fuel at the top of the receptacle to support combustion of the aerated fuel vapor, and means whereby the burner is rendered inherently stable during operation thereof at full capacity comprising a well for the fuel extending below the level of the bottom of the receptacle and of such size and character that the radiating surface of the receptacle bottom is increased to the point at which the air in the

aforesaid space operates to absorb substantially all excess heat delivered to the receptacle bottom by the combustion of the fuel over and above that amount of heat necessary to effect the proper rate of vaporization of the fuel in the receptacle for substantially perfect combustion at full capacity operation of the burner.

2. A vaporizing burner of the premixing, "wet" bottom type, comprising in combination a receptacle consisting of a continuous side wall and a bottom, an air jacket surrounding the receptacle and forming an air space beneath the receptacle bottom and around the side wall, means for delivering liquid fuel over the receptacle bottom for vaporization therein, means for jetting into the receptacle less than one-half the total air theoretically required for complete combustion of the fuel in order to aerate the fuel vapor in the receptacle, means for supplying more than one-half of the total air theoretically required for the complete combustion of the fuel at the top of the receptacle to support combustion of the aerated fuel vapor, and means whereby the burner is rendered inherently stable during operation thereof at full capacity comprising a continuous well for the fuel extending around and depending from the outer margin of the bottom and of such size and character that the radiating surface of the receptacle bottom is increased to the point at which the air in the aforesaid space operates to absorb all excess heat delivered to the receptacle bottom by the combustion of the fuel over and above that amount of heat necessary to effect the proper rate of vaporization of the fuel in the receptacle for substantially perfect combustion at full capacity operation of the burner.

3. A vaporizing burner of the premixing, "wet" bottom type, comprising in combination a receptacle consisting of a substantially cylindrical side wall and a circular bottom, an air jacket surrounding the receptacle and forming an air space beneath the receptacle bottom and around the side wall, means for delivering liquid fuel over the receptacle bottom for vaporization therein, means for jetting into the receptacle less than one-half the total air theoretically required for complete combustion of the fuel in order to aerate the fuel vapor in the receptacle, means for supplying more than one-half of the total air theoretically required for complete combustion of the fuel at the top of the receptacle to support combustion of the aerated fuel vapor, and means whereby the burner is rendered inherently stable during operation thereof at full capacity comprising an annular well for the fuel extending around and depending from the outer margin of the bottom and joined directly to the side wall and of such size and character that the radiating surface of the receptacle bottom is increased to the point at which the air in the aforesaid space operates to absorb all excess heat delivered to the receptacle bottom by the combustion of the fuel over and above that amount of heat necessary to effect the proper rate of vaporization of the fuel in the receptacle for substantially perfect combustion at full capacity operation of the burner.

4. A vaporizing burner of the premixing, "wet" bottom type, comprising in combination a receptacle consisting of a continuous side wall and a bottom, an air jacket surrounding the receptacle and forming an air space beneath the receptacle bottom and around the side wall, means for delivering liquid fuel over the bottom of the receptacle for vaporization in said receptacle, an upstanding tube in the central portion of the receptacle connected at the lower end thereof to receive air from the space by way of an opening in the center of the receptacle bottom and having openings therein for jetting into the receptacle for purposes of aeration of the fuel vapor less than one-half the total air theoretically required for the complete combustion of the fuel, means for supplying more than one-half of the total air theoretically required for complete combustion of the fuel at the top of the receptacle to support combustion of the aerated fuel vapor, and means whereby the burner is rendered inherently stable during operation thereof at full capacity comprising an annular well for the fuel joined to and depending from the central portion of the receptacle bottom and extending around and defining the aforesaid opening and of such size and character that the radiating surface of the receptacle bottom is increased to the point at which the air in the aforesaid space operates to absorb all excess heat delivered to the receptacle bottom by the combustion of the fuel over and above that amount of heat necessary to effect the proper rate of vaporization of the fuel in the receptacle for substantially perfect combustion at full capacity operation of the burner.

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