June 5, 1928. 1,672,397

L. T. THURBER

OIL BURNER

Filed Feb. 25, 1926 3 Sheets-Sheet 1

Fig. 1.

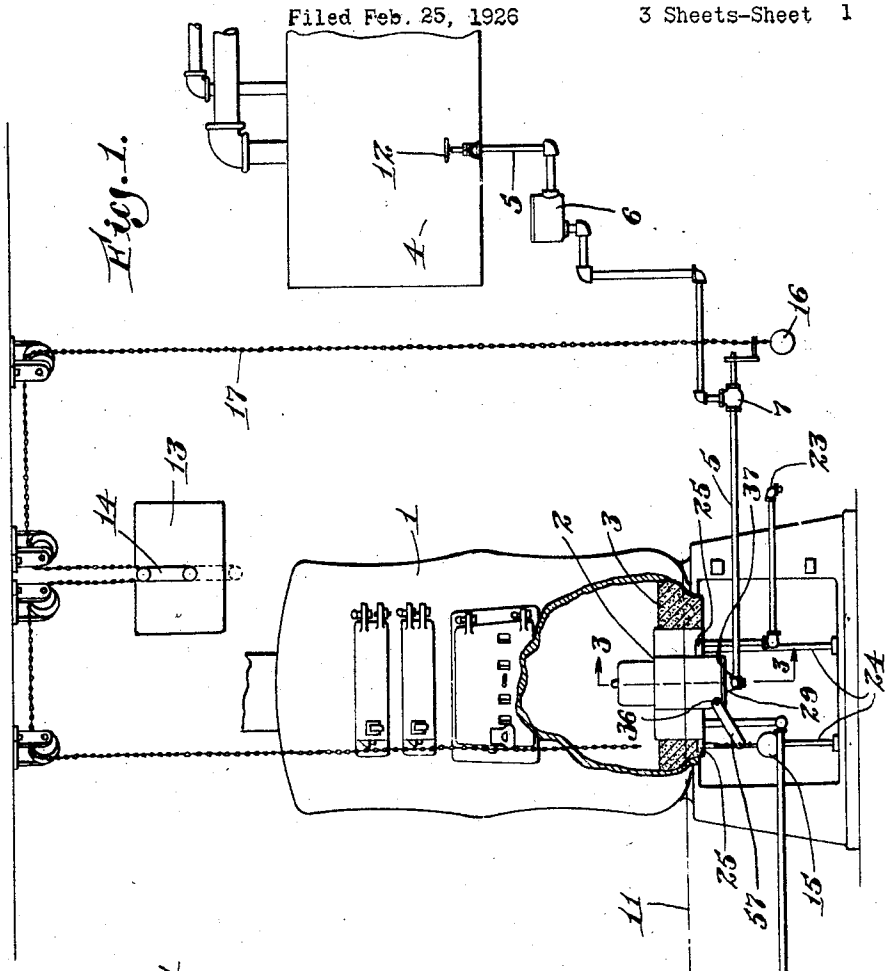
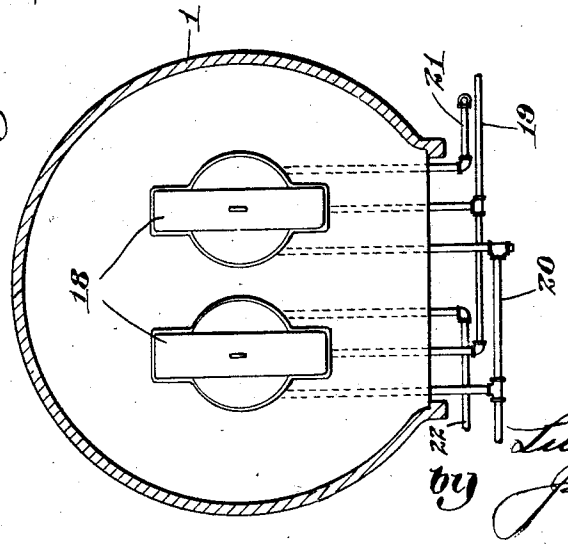


Fig. 2.



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Fig. 4.

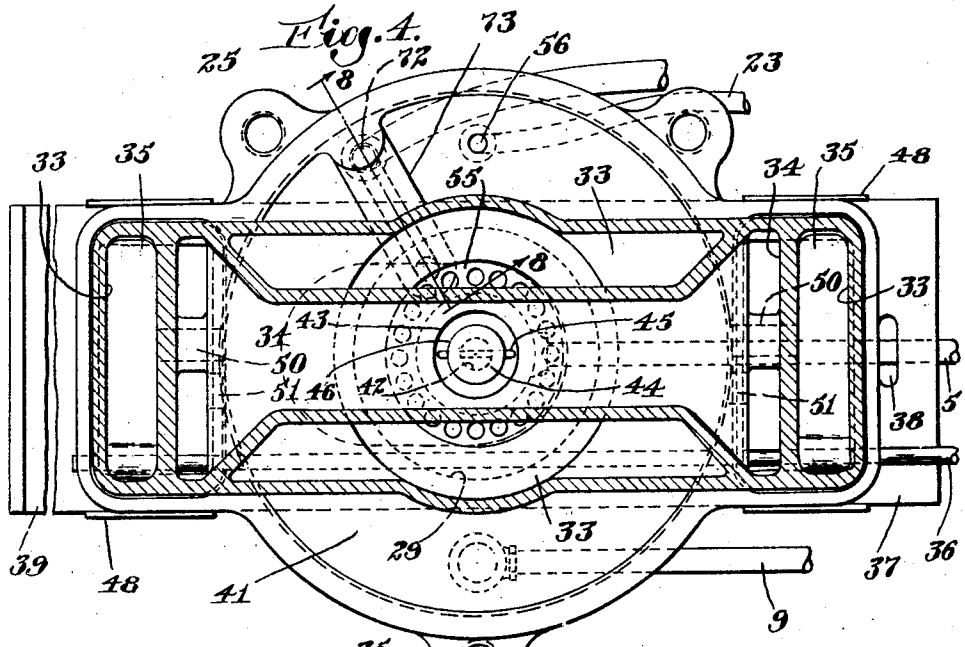
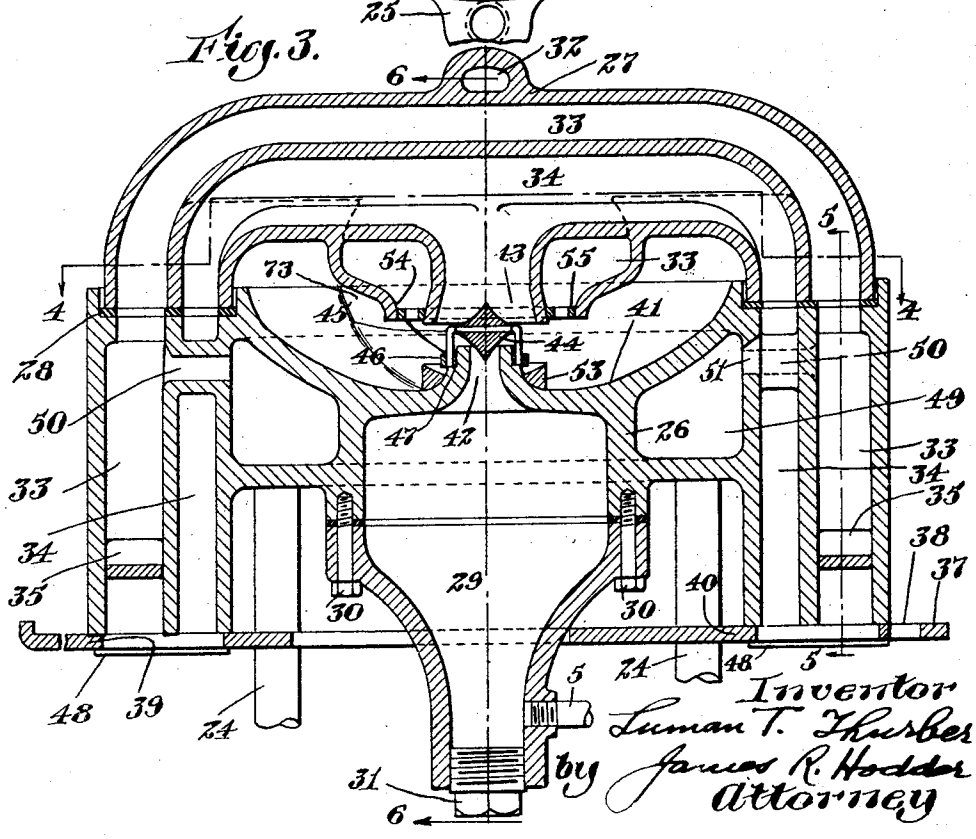


Fig. 3.



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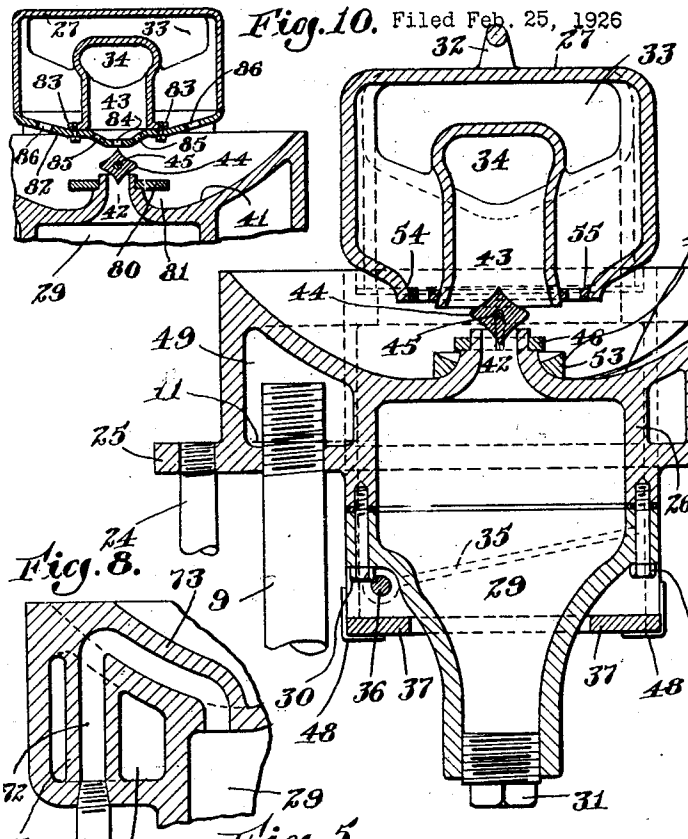
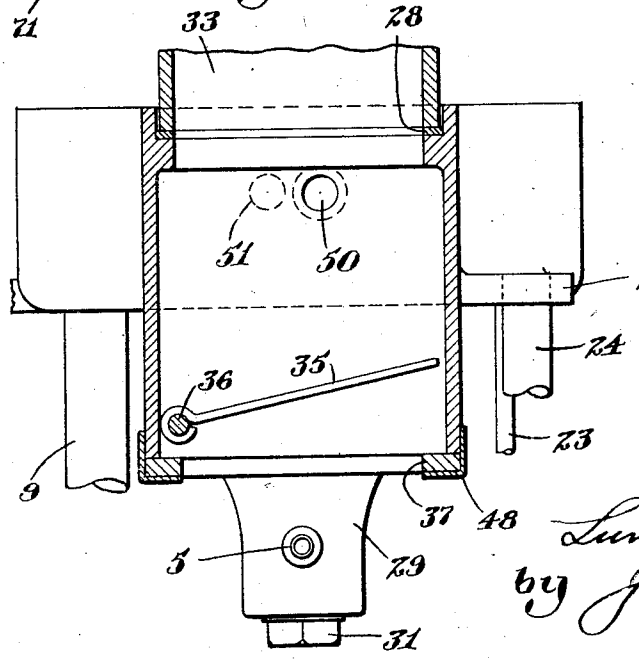


Fig. 10.

Fig. 6.

Fig. 8.

Fig. 5.



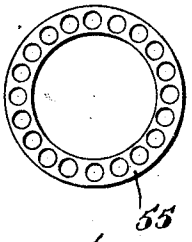
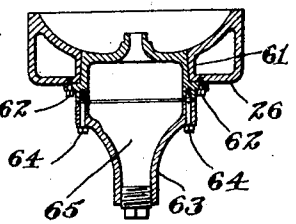


Fig. 7.

Fig. 9.



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Patented June 5, 1928. 1,672,397

UNITED STATES PATENT OFFICE.

LUMAN T. THURBER, OF BROOKLINE, MASSACHUSETTS.

OIL BURNER.

Application filed February 25, 1926. Serial No. 90,633.

My present invention relates to oil burners, and more particularly to automatic oil burners of the gravity feed or flow type.

I am aware that there are many oil heaters now on the market, but most of these are more or less complicated in structure, expensive to manufacture and to operate, and have other disadvantages.

An important feature of my present invention, therefore, is to devise an oil burner which is relatively economical to manufacture, cheaper to install, and easier to operate.

To this end I have devised my present novel oil burner, which has many new features. Among these are means to produce a more uniform mixture of the oil vapor or oil gas, and the air; means to preheat the oil gas before admixture with the air; means to preheat and temper or moisten the air before admixture; and means to present further moistened preheated air in a manner to complete combustion and increase the efficiency of my burner. I also provide novel deflecting means for the oil gas as it comes from its nozzle, to cause a more positive admixture with the moistened air, and also to insure more perfect combustion.

I also so construct my novel burner that it may be readily dismounted for inspection, cleaning, replacements, and the like. A further feature of my present invention is the provision of air control dampers preferably contained directly within the burner unit and automatically operated, together with means controlled from the same automatic source to control the flow of oil.

My novel burner, so constructed and arranged, gives a more uniform admixture of the oil gas and air; prevents overheating of the firebowl, thus preventing "cracking" or "coking" of the oil under the bowl, and substantially eliminates the formation of carbon in the burner.

In carrying out my present invention I utilize an oil burner having an oil vaporizing chamber or reservoir, a water receiving or vaporizing chamber, a fire bowl, a spreader tip at the outlet or nozzle from the oil vaporizing chamber, and a double air manifold. I also provide means whereby the air in each manifold may be mixed with the water, forming a moistened vapor to subsequently mix with the oil gas and form a more uniformly combustible mixture. The purpose of having two air manifolds is very important, in that the moistened air from one manifold admixes with the oil gas for a preliminary combustion, and the air from the second manifold enters the fire bowl at a point further removed from the point of preliminary combustion, and being admitted to the fire bowl through a plurality of nozzles, forms a series of impinging jets of moistened air, which admixes with the already burning mixture, and gives a more perfect combustion, resulting in an elimination of waste oil, a reduction in oil consumed, and a complete combustion of the oil gas before carbonizing has an opportunity to set in, by providing additional oxygen to break up and consume all the products of combustion. Or I may have the air enter the combustion area from the outer manifold outlet in a single annular jet, if desired, which will produce substantially the same effect as the series of impinging jets.

Furthermore, an additional advantage of the double manifold is that when it is desired to lower the fire, the automatic dampers will control or shut off the air in the outer air manifold, thus reducing the volume of moistened air introduced into the combustion area, but still retaining the same velocity of the air introduced from the inner manifold outlet. This constant velocity, with reduced volume, and reduced flow of oil gas, will eliminate the difficulties of smoking, or a "sulky" fire, and produce an even, smooth combustion, at decreased volume of moistened air and oil gas.

A further and important feature of my present invention consists in the provision of means whereby steam may be introduced directly into the oil vaporizing chamber, thus aiding and assisting in the ejection of the oil gas through the burner nozzle, and tending to keep the space between the burner nozzle and the deflecting or spreader tip, free from carbon or sediment.

I may utilize, if desired, a plurality of my novel burners in a single heating apparatus, thus giving greater heating capacity in a simple manner.

For the automatic regulation of my burners, I may utilize a standard heat regulator, or thermostatic controls, or any other desired form of automatic control. These heat regulators are set to operate at pre-

determined temperatures, to increase or decrease the heating capacity of the burner unit. I may also provide a manually controlled damper to shut off all of the air manifolds, to decrease the heat created by the burner.

Further features of the invention, novel combinations of parts, details and advantages, will be hereinafter more fully pointed out and claimed.

Referring to the drawings, illustrating a preferred embodiment of my present invention,

Fig. 1 is a diagrammatic lay-out of my complete system;

Fig. 2 is a detail illustrating the utilization of two burners in place of a single burner;

Fig. 3 is a sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a cross-sectional view on the line 4—4 of Fig. 3;

Fig. 5 is a sectional view on the line 5—5 of Fig. 3;

Fig. 6 is a sectional view on the line 6—6 of Fig. 3; and

Fig. 7 is a detail of the perforated ring;

Fig. 8 is a detail sectional view on the line 8—8 of Fig. 4; and

Fig. 9 is a sectional view, on a reduced scale, of a modification of attaching the oil vaporizing chamber;

Fig. 10 being a cross-sectional detail, also on reduced scale, of a modification of the air manifold outlets.

As shown in the drawings, I have installed my novel burner in a usual furnace or heater 1, the burner, illustrated generally at 2, being set in packing 3. The supply tank 4 has an oil pipe line 5 leading to a float chamber 6, thence to a valve 7 and thence to the burner. A water supply tank 8 has a water pipe 9 leading to the water chamber in the burner. This water tank 8 is preferably of the usual type, having a float 10 to maintain the water in the tank at a predetermined level. This level is illustrated at 11. A shut-off valve 12 is provided at the oil tank. A conventional automatic heat regulator is illustrated at 13, the arm 14 being in raised position permitting the weights 15 and 16, attached to the ends of the chain 17, to operate, respectively, an air damper and the flow of oil through the valve 7. When the arm 14 assumes the position illustrated in dotted lines in Fig. 1, the chain 17 will be lifted and the damper closed and the oil flow cut down.

Fig. 2 illustrates a furnace 1 with two burners 18 therein, both burners being supplied from a single oil tank and a single water tank by the pipes 19 and 20 respectively, and having overflow pipes 21 and 22. In the arrangement illustrated in Fig. 1 I have provided an overflow pipe 23. The heater in Fig. 1 rests on supports 24 secured to the heater in any suitable manner, as at lugs 25.

Fig. 3 illustrates my novel burner in cross-sectional detail, wherein I preferably form the lower or base portion 26 of the burner, comprising the fire bowl and adjacent parts, as a unit, preferably casting or molding the same. I also prefer to cast or mold the upper portion 27 as a single unit, resting this unit 27 on the base portion 26 on gaskets 28, 28. To the base portion 26 I also attach the lower part of the oil vaporizing chamber 29, secured thereto by bolts 30. A plug 31 is provided in the bottom of this fuel reservoir, for cleaning or draining purposes. In Fig. 9 I have illustrated another method of attaching the oil vaporizing chamber to the base 26, wherein the upper portion 60 of the oil vaporizing chamber is secured to the web 61 of the base 26 by bolts or the like 62. The lower portion 63 is then secured to the portion 60 by bolts 64, or the entire vaporizing chamber 65 may be formed as a single unit, secured only to the web 61 by the bolts 62. This will facilitate removal of the same for inspection, cleaning, replacement, etc. On the top of the portion 27 is an eye or hook-loop 32, by means of which the top 27 may be raised from the base 26 and the entire apparatus is thus open for inspection, cleaning or replacements.

I provide the burner as assembled in Fig. 3 with two air manifolds 33 and 34. The outer air manifold 33 is controlled by the dampers 35, both operated by a single automatically controlled damper rod 36, as clearly shown in Fig. 4. For controlling the flow of air through both the manifolds when the burner is not working, I provide a hand operated damper or draft regulator 37, having a hole or recess 38 to receive a poker or instrument for operating the same. This damper is so constructed and arranged that manipulation of same to the right, Fig. 3, would cause the web 39 to close the bottom of the air manifolds 33 and 34, simultaneously moving the web 40 to the right to close the opposite entrances to the air manifolds 33 and 34. This damper 37 is slidably held in brackets 48, secured to the base portion 26.

Above the oil vaporizing chamber 29 I provide a fire bowl 41 having an orifice 42 leading thereto. The walls of the inner air manifold 33 are so constructed that they form an orifice or outlet 43, leading downwardly over the burner orifice 42. To act as a spreader for the oil gas coming from the oil vaporizing chamber or reservoir 29 and a deflector for the air coming from the manifold 34, I utilize a burner tip 44 mounted on a wire or holder 45, which wire is in turn secured to a base ring 46 resting on the shoulder 47. The tip 44 is made of any smooth surface material to withstand high

temperature, and is preferably of non-heat-conducting material. Because of the smooth concaved surfaces of the tip, both top and bottom, and the unrestricted passage of the oil gas and air, the mixture is made more perfect and the tendency for the carbon to collect at the burner opening is lessened.

To further increase the efficiency of my oil burner and render the more complete combustion of the fuel, I provide a vaporizing chamber 49 extending entirely around the oil vaporizing reservoir 29 and under the fire bowl 41. The water supply pipe 9, as shown in Fig. 6, leads to this vaporizing chamber 49, the level of the water coming approximately to the top of the pipe, or near the top of the pipe in the chamber, said level being adjustable to give the required amount of steam. Passages 50 extend from the air manifold 33 to the chamber 49, and passages 51 from the air manifold 34 to the chamber 49, thus permitting a free vaporizing of the water and admixture of the vapor with the air, which moistened and heated air will continue in circulation around and through the air manifolds 33 and 34.

Combustion being started in any desirable way, and the burner becoming heated, the oil or fuel in the reservoir 29, will vaporize, and the oil gas will rise through the orifice 42, be deflected by the tip 44 and enter the fire bowl 41 in a flaring jet. Simultaneously admixing therewith, for combustion, will be the moistened and heated air from the inner air manifold 34, entering through the orifice 43 and being deflected by the tip 44 to meet the oil gas also in a flaring jet. This concave deflector tip 44 may be varied, to change the juncture of the oil gas and moistened air in the combustion area. This heated oil gas and heated moistened air cause excellent combustion due to the perfect admixture caused by the arrangement above described. An auxiliary deflector ring 53 is also provided to further increase the efficiency of the burner. To complete the combustion and increase the efficiency of my burner, the air manifold 33 terminates over the fire bowl in an orifice 54, in which orifice is preferably fitted a perforated ring 55, through the perforations of which the preheated and moistened air will be forced in a series of impinging jets into the already burning mixture, which further admixture will still further break up the particles of fuel gas and consume all the products of combustion, or I may form the orifice 54 with a narrow annular jet.

It will thus be seen that I have devised a novel oil burner, and one that is extremely efficient in action, producing as it does, a perfect combustion of the fuel, thus reducing the waste heretofore experienced in unburned fuel, formation of carbon, and the like, and because of the complete combustion and more intensive flame, is capable of greater heat-giving properties.

In Fig. 6 I have shown my oil burner in cross-section on the line 6—6 of Fig. 3, illustrating the general form of the upper portion 27 in this position, as well as the general form of the base 26. Also in this figure I have illustrated an overflow outlet 56 leading from the fire bowl to the overflow pipe 23, which overflow outlet will take care of any excessive filling or flooding of the fire bowl 41 by excess oil.

In Fig. 8 I have illustrated my novel method of applying steam to the oil vaporizing chamber 29. A cylindrical hollow web 70 is provided in the vaporizing chamber 49, to which is attached the water pipe 71. This pipe 71 may lead from the same source of supply as the pipe 9, if desired. Steam will then be formed in the passage 72 and will pass upwardly to a point above the overflow opening 56 and thence through a web 73 downwardly into the oil vaporizing chamber 29, where it will increase the vaporizing of the oil and assist in keeping the burner orifice 42 and the space around the burner tip 44 free of sediment or carbon.

Referring now back to Fig. 1, illustrating a general assembly lay-out of my burner system, controlled by a standard heat regulator or the like, and assuming the burner to be in operation, the working of my novel device is as follows:

The burner being open and full combustion taking place, the weights 15 and 16 are as shown at their bottom limit. When the temperature in the building or house being heated, has risen to a desired predetermined degree, the arm 14 is automatically moved to the position shown in dotted lines, thus raising the chain 17 and the weights 15 and 16, the weight 15 in rising operating the link 57 and acting on the shaft 36 to close the dampers 35 in the air manifold 33, thus cutting down the volume, but not the velocity, of the air supplied to the mixture. Simultaneously the weight 16 in rising, acts on the valve 7 to decrease the flow of oil from the tank 4, thus reducing the fire to the desired degree. When the temperature in the building has dropped to a predetermined degree, the arm 14 will then be moved upwardly, lowering the chain by the weights 15 and 16, and opening the dampers 35 and valve 7, permitting full combustion to again take place. Should it be desired to stop the combustion, the damper 37 is closed, thus entirely shutting off the air manifolds 33 and 34 and stopping the combustion in the fire bowl 41, as the oil would be shut off simultaneously therewith.

It will also be appreciated that by having the vaporizing chamber 49 extending entirely around and under the fire bowl 41,

together with the air manifolds, containing moistened air, also adjacent the fire bowl and its component parts, that excessive heating of the parts below and under the fire-bowl 41 will be prevented, and thus still further prevent the forming of carbon, or "cracking" or "coking" of the oil, and render my novel burner more positive and efficient in its action.

I believe that my burner, containing as it does the novel features above set forth, is new, and I claim the same herein broadly.

In Fig. 10 I have illustrated a modification of the air outlets from the manifolds 33 and 34. In this figure the air manifolds 33 and 34 are illustrated as raised higher above the fire bowl than in the form illustrated in Fig. 6 for example. I have also formed the base ring 80, which supports the deflector tip 44, as of sufficient area to extend out over a portion of the fire bowl, to act as a further deflector. This leaves a "dead air space" 81 under the ring 80 and prevents excessive heating of the fire bowl 41 at this point. To provide for more efficient admixture of the moistened air and the fuel gas I apply a cap 82 which is bolted or otherwise secured to flanges 83 on the walls of the manifold 34. This cap has a central depending opening 84 through which a portion of the air from the manifold 34 will strike the deflector tip 44 and be deflected in a flaring jet outwardly to the fire bowl. A series of jets 85 surround the central opening 84, and direct the moistened air from the manifold 34 into the mixture in a series of impinging jets, thus affording means to break up the particles of combustion for more efficient burning. It will be noted that the jets 85 are inclined outwardly, slightly, to direct the jets of moistened air into the fire bowl at a point further removed from the center, thus preventing excessive heating of the fire bowl at its center.

The cap 82, in the outlet from the manifold 33, also has a series of jets or apertures 86, also inclined away from the center of the fire bowl, which will force the moistened air from the air manifold 33 into the burning mixture at a point still further removed from the center of the bowl, and still further breaking up the particles of combustion and resulting in a complete combustion and more efficient heating. I also believe that this form of my invention is new and wish to claim the same herein.

While I have necessarily described my invention somewhat in detail, it will be appreciated that I am not limited thereto, but may vary the size, shape and arrangement of parts within reasonably wide limits without departing from the spirit of the invention.

My invention is further described and defined in the form of claims as follows:

1. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom of the bowl, means to introduce steam into the fuel vaporizing reservoir, a steam generating chamber arranged beneath the bowl, an air manifold surmounting the bowl and having its mouth directed downwardly thereinto to distribute the draft around the burner nozzle, and a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air, said burner tip comprising a member of non-heat-conducting material mounted on a base ring outside of said burner nozzle.

2. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom of the bowl, a passage through which steam may be introduced into the fuel vaporizing reservoir, a steam manifold, a steam generating chamber arranged beneath the bowl and connected to said steam manifold, an air manifold surmounting the bowl and having its mouth directed downwardly thereinto to distribute the draft around the burner nozzle, and a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air, said burner tip comprising a member of non-heat-conducting material mounted on a base ring outside of said burner nozzle.

3. A liquid fuel burner comprising in a unitary structure, a fire bowl having a burner nozzle at its center, a fuel vaporizing reservoir arranged beneath the bowl in communication with the nozzle, air ducts leading upwardly at the sides of the bowl, an air manifold connected with said ducts and provided with a downwardly extending opening arranged above the burner nozzle, a second air manifold connected with said ducts and provided with a downwardly extending opening outside the periphery of the first air opening, and a steam generating chamber arranged beneath the bowl and communicating with the air ducts to provide for the passage of steam thereinto to moisten the air passing to the flame.

4. A liquid fuel burner comprising in a unitary structure, a fire bowl having a burner nozzle at its center, a fuel vaporizing reservoir arranged beneath the bowl in communication with the nozzle, air ducts leading upwardly at the sides of the bowl, an air manifold connected with said ducts and provided with a downwardly extending opening arranged above the burner nozzle, and a second air manifold connected with said ducts and provided with a downwardly extending opening outside the periphery of the first air opening, a ring in said second opening having a plurality of perforations

therein, and a steam generating chamber arranged beneath the bowl and communicating with the air ducts to provide for the passage of steam thereinto to moisten the air passing to the flame.

5. A liquid fuel burner comprising in a unitary structure, a fire bowl having a burner nozzle at its center, a fuel vaporizing reservoir arranged beneath the bowl in communication with the nozzle, air ducts leading upwardly at the sides of the bowl, an air manifold connected with said ducts and provided with a downwardly extending opening arranged above the burner nozzle, and a second air manifold connected with said ducts and provided with a downwardly extending opening outside the periphery of the first air opening, a ring in said second opening having a plurality of perforations therein, and a steam generating chamber arranged beneath the bowl and communicating with the air ducts to provide for the passage of steam thereinto to moisten the air passing to the flame, and dampers positioned within the air ducts and automatically operated to close the same.

6. A liquid fuel burner comprising in a unitary structure, a fire bowl having a burner nozzle at its center, a fuel vaporizing reservoir arranged beneath the bowl in communication with the nozzle, air ducts leading upwardly at the sides of the bowl, an air manifold connected with said ducts and provided with a downwardly extending opening arranged above the burner nozzle, and a second air manifold connected with said ducts and provided with a downwardly extending opening outside the periphery of the first air opening, a ring in said second opening having a plurality of perforations therein, and a steam generating chamber arranged beneath the fire bowl and communicating with the air ducts to provide for the passage of steam thereinto to moisten the air passing to the flame, the perforated ring in said second opening forcing the moistened air or steam in a series of impinging jets into the already burning mixture, dampers positioned within the air ducts and automatically operated to control the same, and a manually controlled damper to close all the air ducts.

7. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom wall of the bowl, a steam generating chamber arranged beneath the bowl, air ducts leading upwardly at the sides of the bowl, a plurality of air manifolds surmounting the bowl and having their mouths directed downwardly thereinto to distribute the draft around the burner nozzle, and a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air from one of said manifolds.

8. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom wall of the bowl, a steam generating chamber arranged beneath the bowl, air ducts leading upwardly at the sides of the bowl, a plurality of air manifolds surmounting the bowl and having their mouths directed downwardly thereinto to distribute the draft around the burner nozzle, a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air from one of said manifolds, dampers positioned within certain of the air ducts and automatically operated to control the same, and a damper, manually controlled, to control the flow of air through all the air ducts.

9. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom wall of the bowl, a steam generating chamber arranged beneath the bowl, air ducts leading upwardly at the sides of the bowl, a plurality of air manifolds surmounting the bowl and having their mouths directed downwardly thereinto to distribute the draft around the burner nozzle, a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air from one of said manifolds, dampers positioned within certain of the air ducts and means to automatically control the operation of said dampers, and simultaneously control the flow of fuel into said fuel vaporizing reservoir, and a manually controlled damper to control the flow of air through all the air ducts.

10. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom wall of the bowl, means to introduce steam into said fuel vaporizing reservoir, a steam generating chamber arranged beneath the bowl, air ducts leading upwardly at the sides of the bowl, a plurality of air manifolds surmounting the bowl and having their mouths directed downwardly thereinto to distribute the draft around the burner nozzle, a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air from one of said manifolds, dampers positioned within certain of the air ducts and means to automatically control the operation of said dampers and simultaneously control the flow of fuel into said fuel vaporizing reservoir, and a manually controlled damper to control the flow of air through all the air ducts.

11. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom of the bowl, a steam generating chamber arranged beneath the bowl, an air manifold surmounting the bowl and having its mouth directed downwardly thereinto to distribute the draft around the burner nozzle, and a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air, said burner tip comprising a member of non-heat-conducting material, a base ring outside of said burner nozzle and on which said tip is mounted, said base ring acting as an additional deflector and spreader.

12. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom of the bowl, a steam generating chamber arranged beneath the bowl, an air manifold surmounting the bowl and having its mouth directed downwardly thereinto to distribute the draft around the burner nozzle, and a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air, said burner tip comprising a member of non-heat-conducting material, a base ring outside of said burner nozzle and on which said tip is mounted, said base ring acting as an additional deflector and spreader and forming a dead air space thereunder.

13. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom wall of the bowl, a steam generating chamber arranged beneath the bowl and communicating with air ducts leading upwardly at the sides of the bowl, a plurality of air manifolds surmounting the bowl and having their mouths directed downwardly thereinto to distribute the draft around the burner nozzle, and a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air from one of said manifolds, and means to permit removal of the air manifolds from adjacent the bowl.

14. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a fuel vaporizing reservoir extending beneath the bottom wall of the bowl, a steam generating chamber arranged beneath the bowl, air ducts leading upwardly at the sides of the bowl, a plurality of air manifolds surmounting the bowl and having their outlets directed downwardly thereinto, and means to distribute the draft around the fire bowl, and a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air from one of said manifolds.

15. A liquid fuel burner comprising a unitary structure having a fire bowl with a burner nozzle therein, a removable fuel vaporizing reservoir extending beneath the bottom of the bowl, means to introduce steam into the fuel vaporizing reservoir, a steam generating chamber arranged beneath the bowl, an air manifold surmounting the bowl and having its mouth directed downwardly thereinto to distribute the draft around the burner nozzle, and a burner tip positioned over said burner nozzle to act as a spreader for the fuel gas and a deflector for the air, said burner tip comprising a member of non-heat-conducting material, a base ring outside of said burner nozzle and on which said tip is mounted.

In testimony whereof, I have signed my name to this specification.

LUMAN T. THURBER.