Jan. 28, 1930. F. L. HAMMER 1,745,329

BURNER NOZZLE

Filed April 21, 1927 2 Sheets-Sheet 1

Fig. 1.

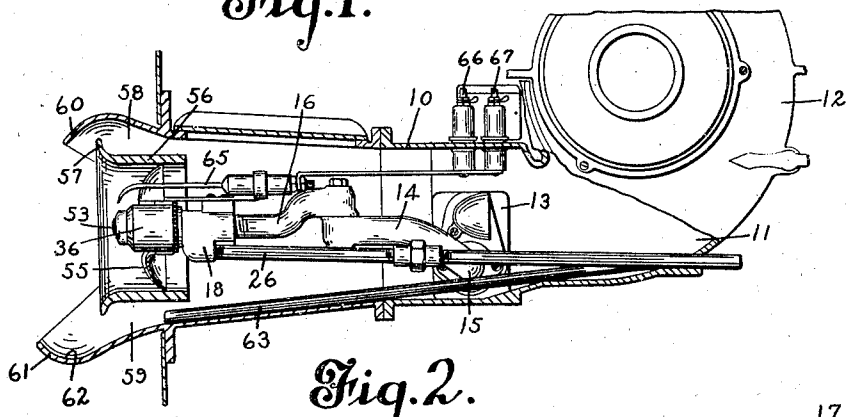


Fig. 2.

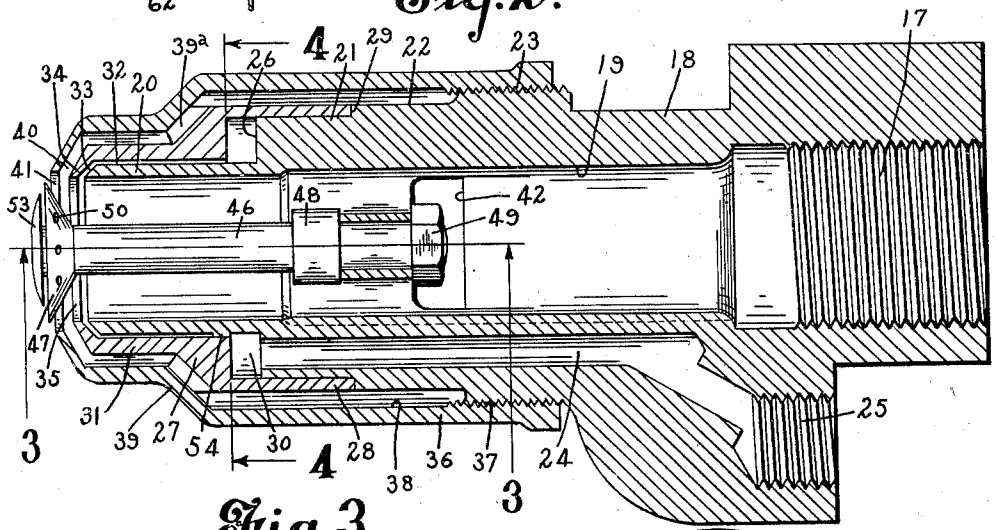


Fig. 3.

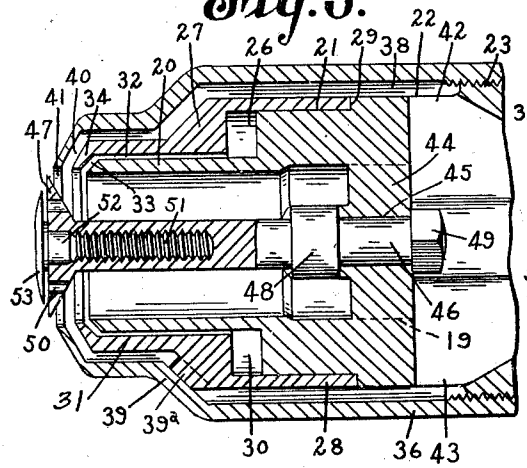
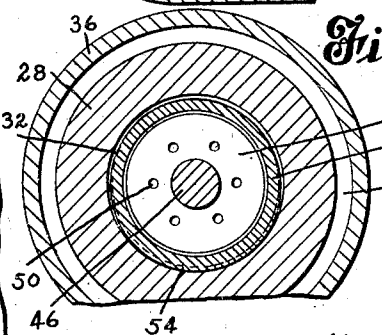


Fig. 4.



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Fig. 5.

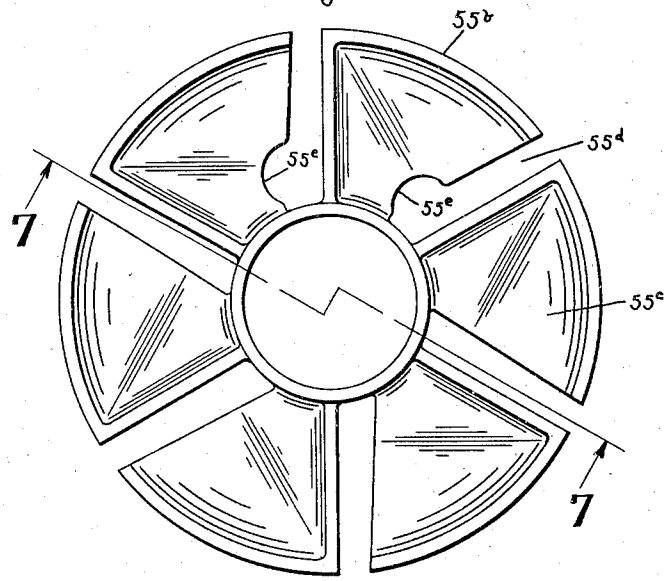


Fig. 6.

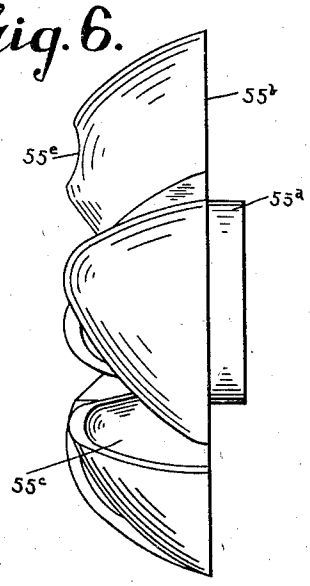
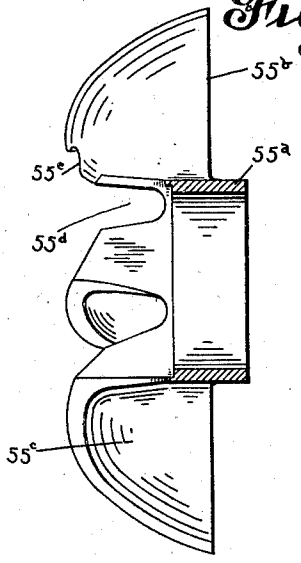


Fig. 7.



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UNITED STATES PATENT OFFICE

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BURNER NOZZLE

Application filed April 21, 1927. Serial No. 185,616.

This invention relates to oil burners, and more especially to that part of an oil burning system which may be termed the burner proper, and which comprises the means for atomizing the liquid fuel and mixing it with a quantity of air, for the purpose of obtaining substantially complete combustion of the fuel. In the preferred form of my invention which I have illustrated in the drawings, the liquid fuel or oil is first atomized by the impinging on a stream of air under a certain amount of pressure. During the atomizing process, this air is, of course, mixed with the oil and itself serves in part to support the combustion of the fuel, although as shown in the drawings, the atomized oil is thereafter mixed with a quantity of what may be termed volume air or air under a low pressure, in order to supply the necessary amount of oxygen to assure substantially complete combustion of the fuel.

One object of my invention is to provide a more efficient oil burner than has been used heretofore.

Another object of my invention is to provide a burner wherein the atomized fuel and air is discharged therefrom in a rapidly spreading jet rather than in a straight stream which might be directed against the wall of the furnace and result in uneven distribution of heat.

Another object of my invention is to provide an efficient oil burner of a type that may be used economically in household furnaces.

A still further object of my invention is the provision of an oil burner wherein the atomizing of the oil may be accomplished by a stream of air under a relatively low pressure.

To these and other ends, the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is a side elevational view of an oil burner nozzle embodying my invention, the wall of the burner housing being shown in section to expose the interior parts:

Fig. 2 is a sectional view through the atomizing nozzle;

Fig. 3 is a sectional view on line 3—3 of Fig. 2;

Fig. 4 is a transverse sectional view on line 4—4 of Fig. 2;

Fig. 5 is a rear face view of the diverter surrounding the atomizing nozzle;

Fig. 6 is a side view of the same;

Fig. 7 is a sectional view on line 7—7 of Fig. 5.

To illustrate a preferred embodiment of my invention, I have shown a burner housing 10, the interior of which is in communication with the outlet 11 of a fan 12. The fan may be of any preferred type, and it is not considered necessary to show the details thereof in this application. This fan is what may be termed the volume air fan and is designed to blow a considerable quantity of air through the interior of the housing 10 to support the combustion of the atomized oil. The interior of the housing is hollow for this purpose, and within this housing is supported the atomizing nozzle and its associated parts.

The wall of the housing 10 is provided with a recess 13 from which leads a pipe 14, designed to deliver the pressure or atomizing air to the burner. The inlet end 15 of this pipe extends in the recess 13 and through an opening in this recess for connection with the outlet of a suitable air fan or blower (not shown), designed to deliver air at the required pressure. To the forward end of the pipe 14 is detachably connected a second pipe 16, the interior of which is in communication with the interior of the pipe 14. The delivery end of the pipe 16 is threaded for engagement with the threaded socket 17 at the rear end of the atomizing nozzle 18.

This atomizing nozzle is shown in section in Fig. 2, and comprises a nozzle body having a longitudinal opening 19 extending entirely through the body and communicating at its rear end with the threaded opening 17. The nozzle body is provided adjacent its forward end with a plurality of offset or stepped portions 20, 21, 22 and 23, for a purpose hereinafter described. These portions, it will be understood, are annular in shape and extend entirely around the burner body, the part 23 being threaded in order

to secure the other parts of the nozzle thereon. Below the air passage 19, a longitudinal oil passage or bore 24 is arranged in the nozzle which, at its inlet end, communicates with a threaded socket 25 to which may be connected the oil pipe 26 leading from a source of fuel oil. At its forward end, the oil passage 24 leads through the shoulder 26 between the stepped portions 20 and 21 of the nozzle.

An inner cap 27 is designed to be slipped upon the end of the nozzle body 18, this cap having a rear skirt portion 28, adapted to fit closely upon the portion 21 of the nozzle and the rear end of which is adapted to lodge against the shoulder 29. The skirt portion 28 is somewhat longer than the part 21 of the nozzle, so as to provide in front of the shoulder 26 an annular oil chamber 30 in communication with the oil inlet passage 24. The inner diameter of the front portion 31 of the inner tip is slightly larger than the front portion 20 of the burner nozzle, so as to leave therebetween an annular oil passage 32. The front end of the burner nozzle is beveled, as shown at 33, and the adjacent inner surface 34 of the inner tip is complementally beveled so that the delivery end of the passage between these parts is directed inwardly or toward the longitudinal axis of the nozzle and of the air passage 19. At its forward end, the tip is provided with an opening 35 in line with and substantially the same size as the opening at the forward end of the air passage 19.

An outer cap member or shell 36 is designed to be telescoped over the nozzle and over the inner cap member, and at its rear end is provided with internal threads 37 to engage the threads 23 on the nozzle member. For a considerable distance forwardly of the threaded end of the outer cap, it is substantially cylindrical in shape and of such a size as to leave an annular air passage 38 between its wall and the outer wall of the burner nozzle and the skirt portion 28 of the inner cap. Forwardly of this rear cylindrical portion the wall of the outer cap or shell, is displaced inwardly, as shown at 39, to follow the shape of the inner cap, the latter being provided with two or more lugs 39^a against which the part 39 of the outer cap bears to hold the inner cap in place. It will be apparent that when the outer cap is threaded upon the nozzle, that the three parts of the burner above described, will be securely held in assembled relation and at the same time may be very readily dis-assembled if occasion requires. The outer cap is larger than the inner cap, so that the air passage 38 is continued between these two members, which are of substantially the same shape throughout their lengths, the air from the passage 38 being delivered through the annular outlet 40 in a direction toward the axis of the burner, and just forwardly of the oil delivery outlet. At its extreme forward end, an opening 41 is provided in the outer cap.

As shown in Figs. 2 and 3, openings 42 and 43 are provided between the longitudinal air passage 19 and the annular air passage 38, so that a part of the air entering the passage 17 is diverted into the annular passage 38 to be delivered through the air outlet 40 between the inner and outer caps. A web 44 extends across the passage 19, and is provided with an opening 45 to receive the stem 46 of an air tip 47, located at the mouth of the nozzle. The stem 46 is provided with an enlarged collar 48, designed to be lodged against the forward end of the web 44, and a nut 49 threaded upon the rear end of the stem is designed to draw this collar in tight engagement with the web and hold the tip in place.

As clearly shown in Figs. 2 and 3 of the drawing, the side of this tip toward the burner is of conical shape, so as to cause the air and fuel impinging thereagainst to be deflected in an outward direction away from the longitudinal axis of the burner. A number of openings 50 extend through the tip 47 in a direction longitudinally of the burner, so as to permit part of the air from the passage 19 to pass therethrough. Threaded into the stem 46 of the tip, as shown at 51, is the stem 52 of an air spreader 53, against which the air passing through the openings 50, is designed to impinge and be deflected in a direction transverse to the longitudinal axis of the nozzle. This spreader is a substantially flat disk shaped member, and is spaced forwardly of the tip 47 so that the openings 50 will not be closed. At the same time, the air passing through these openings strikes the rear face of the spreader and is deflected in a lateral direction and caused to enter the stream of atomized fuel in this direction, so as to spread out this stream laterally and prevent it from issuing from the mouth of the nozzle in a narrow axially directed stream. Also, as it is directed through the atmozied oil, so to speak, it tends to further break up and atomize the fuel.

At the rear end of the portion 20 of the burner nozzle is provided an external shoulder 54, which as shown in Fig. 2, at the lower portion of the nozzle, substantially closes the annular oil passage 32 so as to shut off communication between this passage and the oil chamber 30. As shown in Fig. 4, the shoulder 54 gradually diminishes toward the upper part of the nozzle until it merges into the wall 20, leaving the passage 32 at the upper side of the burner entirely clear. This results in forcing the oil in its passage from the chamber 30 to rise to the upper side of this chamber before it can enter freely into the passage 32, so that the last named passage

will be substantially filled with oil, and the latter will be delivered at the mouth of the nozzle about the entire periphery of the air passage 19. In view of the fact that the oil delivery tube 24 is at the lower side of the burner, if it were not for the provision of this shoulder, the upper part of the passage 32 might not receive the proper quantity of oil.

Upon the outside of the outer cap 36 is placed an air deflector or diverter 55, which is enclosed within a cylindrical sleeve 56, open at its rear end and having a flaring mouth 57. The air diverter 55 is provided with a central opening within which the outer cap is received, and surrounding this opening are a plurality of vanes of spiral shape, so as to give the air passing therethrough, volume air in this instance, a whirling movement. This air comes in contact with the atomized fuel, and due to the whirling movement given it by the diverter, and to the fact that the atomized fuel is laterally directed by the spreader 53, it becomes thoroughly mixed with the fuel, and the entire charge of mixed fuel and air issues from the flaring mouth 57 of the sleeve 56 in a whirling, spreading spray. This spray is also mixed with additional air issuing from the passages 58 and 59 between the sleeve 56 and the wall of the housing 10, which air is directed inwardly toward the mixed fuel and air coming from the sleeve 56, by the inturned lips 60 and 61 of the housing.

The lower inturned lip 61 provides a well 62 to receive from the pipe 63 any oil leakage which might occur and any oil caught by this well is consumed by the flame at the burner nozzle. The pipe 63 leads to the bed of the machine (not shown).

The operation of my device may be briefly described as follows. The oil pipe 26 is connected to a source of oil, which is preferably under no greater pressure than just a sufficient amount to deliver it at the burner tip. This pressure may be obtained by gravity from the position of the oil tank or other source of supply. This oil passes through the passage 24 and into the chamber 30, where coming into contact with the shoulder 54 it is caused to spread upwardly to fill the chamber 30, so as to pass into the upper part of the annular oil delivery passage 32, and be delivered at the mouth of this passage in an annular stream directed inwardly toward the axis of the burner. Air under a certain amount of pressure is supplied through the air tube 16, to the passage 19. With the arrangement I have provided, it is not necessary to use a high pressure for the atomizing air, a pressure of from six ounces to one pound being sufficient, and experience has shown that a pressure of six ounces produces very satisfactory results. A part of the air in the passage 19 is diverted through the openings 42 and 43 to the annular passage 38. The remainder of the air passing through the central passage 19 strikes the oil stream issuing at the mouth of the oil passage, and as this oil stream is directed inwardly across the air stream, the impact of the latter will cause the oil stream to be broken up into fine particles, so as to be prepared for thorough atomization. This combined air and oil stream then passes forwardly, where it is deflected by the tip 47 in an outward direction to pass through the opening 41. At the same time pressure air issuing from the mouth 40 of the outer air passage is delivered peripherally into and across this stream of oil and air, so as to further break up the oil particles and effect a further atomization. In the meanwhile, partially mixed oil and air issues through the openings 50 in the tip 47 to impinge against the rear surface of the spreader 53 and be deflected outwardly across the atomized oil issuing from the opening 41. This further breaks up the oil particles and completes the atomization thereof, and at the same time, serves to spread the atomized oil to prevent its being projected from the nozzle in an axially directed jet. This spreading jet of atomized fuel is then attacked by the whirling volume air passing through the diverter 55, within the sleeve 56. This volume air is delivered into the housing 10 by the fan 12, and is preferably under a very low pressure, say two to four ounces, or a pressure just sufficient to deliver the proper volume of air to support the combustion of the fuel. This whirling, spreading spray of atomized oil and air is then thrown into the furnace after being mixed with additional volume air issuing from the passages 58 and 59, when it will be in condition to be efficiently and completely burned.

Between the spiral fins of the diverter 55 are passed a pair of spark members 65, only one of which is shown, these members being electrically connected to the contacts 66 and 67, whereby a spark is obtained adjacent the mouth of the burner to ignite the fuel.

The diverter 55 is shown in more detail in Figs. 5, 6 and 7 of the drawings. This element comprises a central sleeve or collar 55^a which is adapted to fit upon and embrace the outer cap member or shell 36 of the atomizing nozzle, as shown in Fig. 1. Attached to this collar and extending forwardly therefrom are spaced vanes 55^b of spiral shape. Viewed from the rear side thereof the vanes present air cups or pockets 55^c, which receive the volume air from the fan 12 and deflect it spirally through the spaces 55^d, between the vanes in a whirling movement. Recesses 55^e may be provided in two of the vanes to allow the spark members 65 to project therethrough adjacent the front end of the atomizing nozzle. It will be apparent that the volume air passing in the sleeve 56 will be caught within the pockets 55^c and be given a whirling move-

ment as it passes through the diverter for the purpose already set forth.

Under some conditions it has been found that the jet of mixed air and oil issuing within the collar 56 has a tendency to move in an upward direction and this tendency may be counteracted by closing the passage 59 below the collar 56, so that the air issuing between this collar and the housing will be above the flame or above the issuing jet of air and oil, and will be directed thereinto in a downward direction. When the lower passage 59 is thus closed off the spray of mixed fuel and air is maintained at a lower point in the furnace, and in some instances, the operation of the burner is improved.

In the case of burners of small sizes, I have found it sometimes desirable to omit the openings 50 in the tip 47 and use this tip as a spreader for the oil and air, also, of course, omitting the provision of the spreader 53. In other words, in the case of such burners, if the tip 47 is imperforate it will act to spread the flame and the tip 53 may be omitted, thus simplifying the construction of the burner without affecting the efficiency thereof.

It is to be noted that when the oil may be atomized with air at a very low pressure, as in the present burner, and also when the volume air is furnished at a very low pressure, the charge of mixed fuel and air is thrown into the furnace with a low velocity so that it may spread out quickly in all directions and not be thrown against the back of the furnace.

While I have shown and described a preferred embodiment of my invention, it will be understood that it is not to be limited to the details shown, but is capable of modification and variation which will lie within the spirit of the invention and the scope of the appended claims.

What I claim is:

1. In a liquid fuel burner nozzle, a fuel chamber, a fuel passage leading into the chamber at the lower end thereof, an annular passage leading from said chamber, and an abutment at the entrance of said last named passage to restrict the lower portion thereof to cause the fuel in said chamber to rise toward the top thereof before being admitted to said annular passage.

2. In a liquid fuel burner, a fuel chamber, means to supply fuel thereto, an annular passage leading from the chamber, and a shoulder formed on the wall of the passage and projecting thereinto to substantially close the same at the lower side thereof, and merging into the wall of the passage toward the upper side thereof.

3. In a liquid fuel burner, an atomizing nozzle having an air passage to direct a stream of air longitudinally of the burner, a second air passage, means to direct a stream of air therefrom across the first air stream, at a point in advance of the outlet of the first passage, and means to deliver a supply of fuel between said air streams, and means to deliver a supply of air with a whirling motion about the nozzle into the atomized fuel.

4. In a liquid fuel burner, an atomizing nozzle having an air passage adapted to deliver an air stream longitudinally of the burner, a fuel passage adapted to direct a jet of fuel across the outlet of said air passage, and a second air passage beyond the fuel passage and adapted to direct a jet of air across the stream of mixed air and fuel issuing from the first two passages, and means to deliver a supply of air with a whirling motion about the nozzle into the atomized fuel.

5. In a liquid fuel burner, means providing a longitudinally disposed air passage having an open mouth, means providing a fuel passage to deliver a jet of fuel inwardly across the air stream issuing from said passage, and peripherally about the same, and a second air passage beyond the fuel passage and adapted to deliver a stream of air across the jet of air and fuel from the first two passages, and peripherally about the same, and a tip arranged forwardly of said passages against which the air and oil is directed, said tip being provided with openings through which the mixed air and fuel passes, and a spreader member to deflect the air and fuel passing through said openings in a lateral direction.

6. An oil burner, comprising a nozzle body having a longitudinal air opening therein, an annular oil passage surrounding said air passage, an annular air passage surrounding said oil passage, means affording communication between said longitudinal air passage and said annular air passage, both of said annular passages and said longitudinal passage having delivery openings adjacent the front end of the nozzle body, a tip adjacent the outlet of said openings and being itself provided with axially directed openings, and a spreader member in front of the tip to deflect in a lateral direction the oil and air passing through the tip openings.

7. An atomizing nozzle for liquid fuel burners, comprising a nozzle body having a longitudinal opening therethrough, a cap positioned telescopically on said body and spaced therefrom to provide an annular passage therebetween, a second cap supported on said body and positioned about the first cap and spaced therefrom to provide a second annular passage between the caps, and limiting members between the first and second caps to secure them in properly spaced relation, and said annular passages having outlets in communication with the longitudinal passage.

8. An atomizing nozzle, comprising a body member having a longitudinal passage there-

in, an outer cap received upon and supported by said body and spaced therefrom to leave an annular passage therebetween, an inner cap telescopically secured upon said body within said annular passage and spaced both from the wall of the body and from the outer cap to leave annular passages therebetween, and means affording communication between the longitudinal passage in the body and the annular passage between the caps.

9. An atomizing nozzle, comprising a body member having a longitudinal passage therein, an outer cap received upon and supported by said body and spaced therefrom to leave an annular passage therebetween, an inner cap telescopically secured upon said body within said annular passage and spaced both from the wall of the body and from the outer cap to leave annular passages therebetween, and means affording communication between the longitudinal passage in the body and the annular passage between the caps, and limiting members positioned on one of the caps and engaging the other thereof to hold them in properly spaced relation.

In witness whereof, I have hereunto set my hand this 19th day of April, 1927.

FORRESTER L. HAMMER.