Oct. 3, 1933. A. MARSDEN 1,928,839

APPARATUS FOR BURNING LIQUID FUEL

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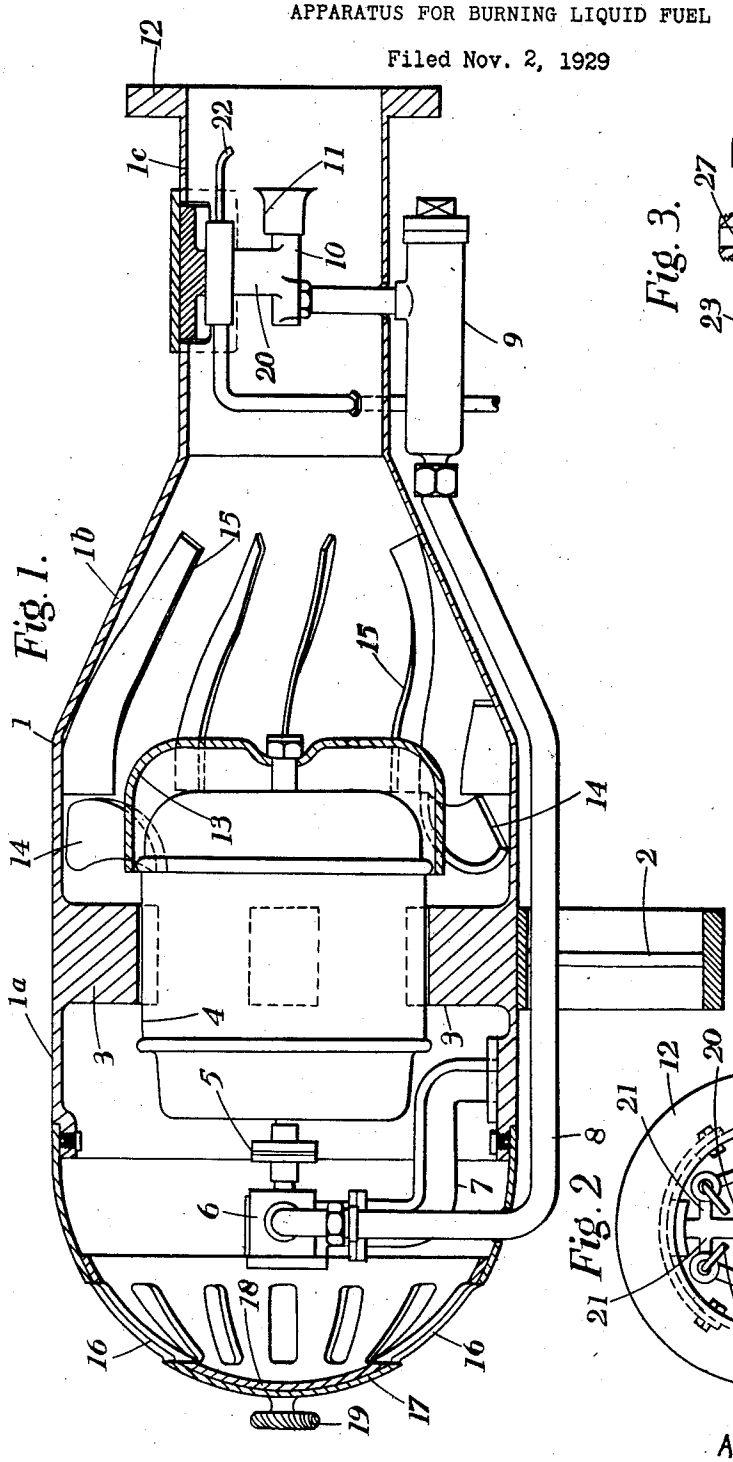


Fig. 1.

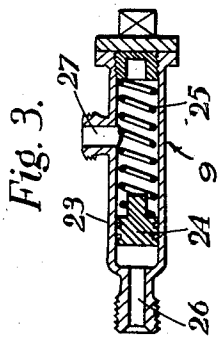


Fig. 3.

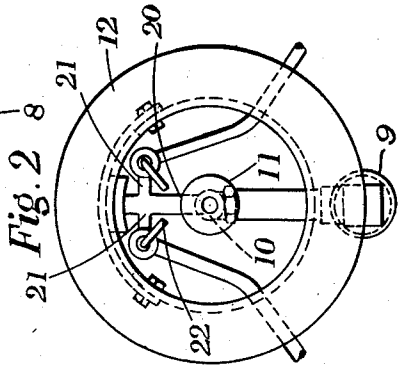


Fig. 2

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Fig. 4.

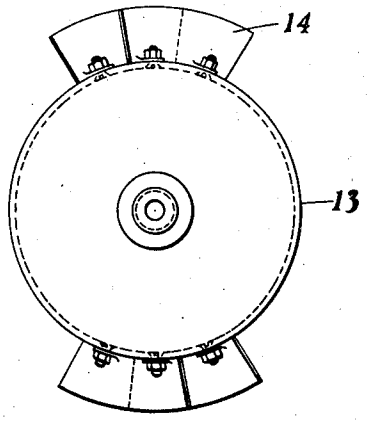


Fig. 5.

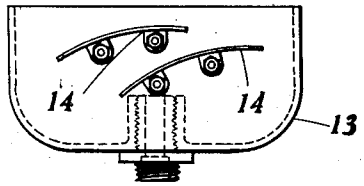


Fig. 7.

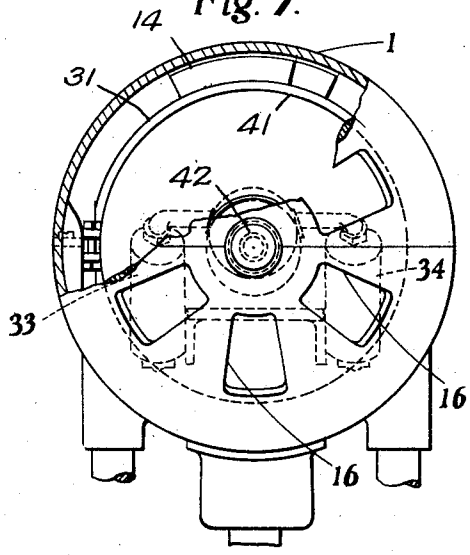


Fig. 10.

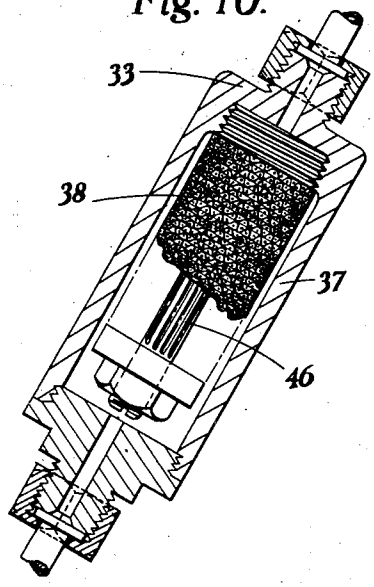
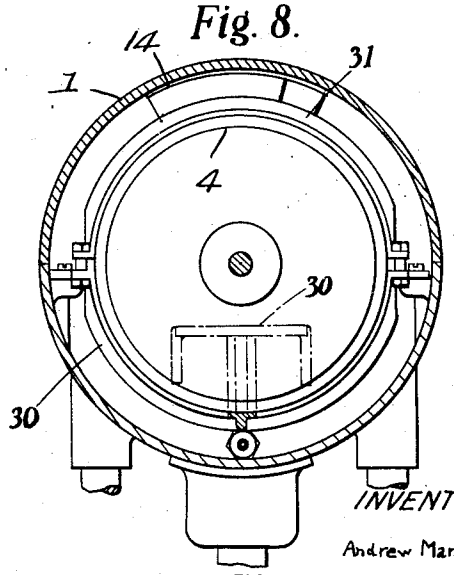


Fig. 8.



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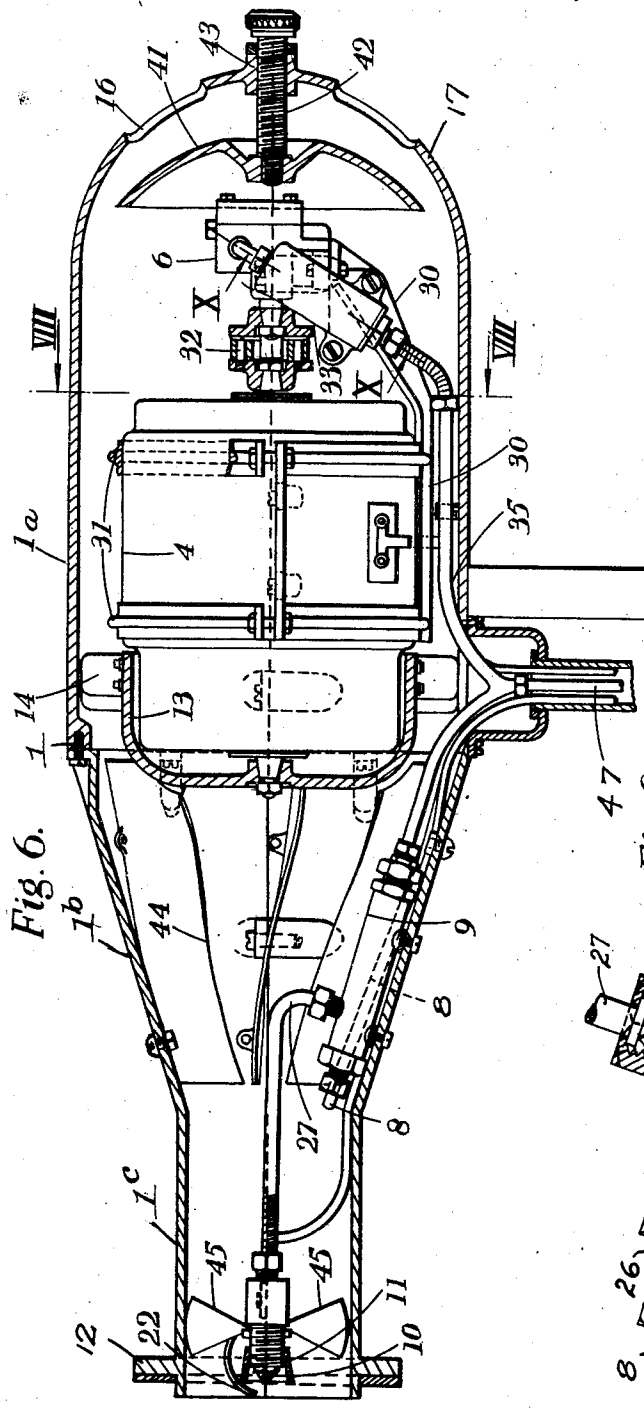


Fig. 6.

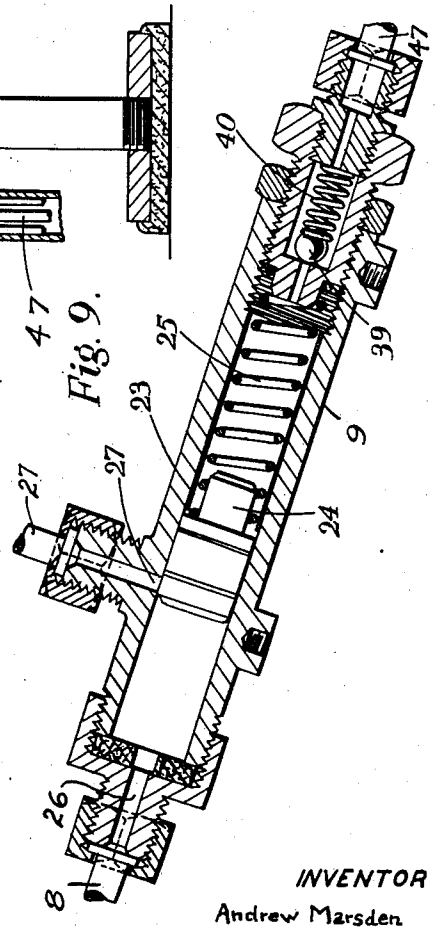


Fig. 9.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR BURNING LIQUID FUEL

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Application November 2, 1929, Serial No. 404,368, and in Great Britain April 25, 1929

6 Claims. (Cl. 158—76)

This invention relates to apparatus for burning liquid fuel and in particular it is concerned with apparatus in which oil is forced to a burner by a pump, the secondary air for combustion is supplied to the burner by a fan or the like and means such as an electric motor are provided for driving the fan and are mounted within the same casing as the fan. Hitherto in such apparatus fans of the centrifugal type have been employed so that the air has been forced radially outwards before flowing to the burner and streamline flow of the air within the casing has been impossible. Further the use of such fans has involved the provision either of two casings or of a single casing having projecting portions to accommodate the air directed radially outwards and thus of ungainly appearance. One main object of the present invention is to provide a simple construction of apparatus in which stream-line flow of the air shall take place, and another main object is to mount the burner, a fuel pump, a fan and a motor driving the pump and fan within a single casing or shell of neat appearance so as to constitute a unit which can be placed in position or removed with ease. Further the invention particularly aims at providing a unit suitable for use with central heating boilers, domestic boilers, bakers' ovens and the like, where a plant is required which shall be automatic in operation and entirely self-contained.

With this object in view the main feature of the present invention consists in providing a unit comprising a casing formed with a tapering portion leading to a cylindrical portion, a burner mounted within the cylindrical portion and a fan so constructed as to move air axially and substantially without radial displacement and arranged so that it can drive air into the tapering portion of the casing to the burner. By making the burner stationary and mounting the fan and a motor connected to drive the fan about substantially the same horizontal axis as the burner, a particularly neat construction may be obtained.

A further particular feature of the present invention consists in mounting the burner, the fan and the motor within a single casing which in shape comprises essentially three portions only, that is two substantially cylindrical portions of different diameters connected together by a conical portion, the larger cylindrical portion having a flat, hemispherical, conical or like end formed with ports for the admission of secondary air of combustion, the motor and fan being mounted within the larger cylindrical portion and the burner being mounted within the smaller cylindrical portion. The casing thus presents a particularly neat, smooth and simple external appearance, and furthermore is of such a shape that it can readily be placed in position in front of most existing furnaces.

Very conveniently a pump for supplying the fuel to the burner can be mounted about the same horizontal axis at the motor and can be connected to be driven by it.

The fan is preferably mounted on the driving shaft of the motor between the latter and the burner and is in the form of a rotary bell having vanes spaced around its periphery in such a way as to draw air around the motor and drive it forward to the burner in stream-like flow. By making the fan as a bell partially fitting over the motor, the heat reflected backwards through the unit is kept off the motor. The air which is admitted to the casing may be controlled by a hemispherical member mounted symmetrically about the same horizontal axis on which the other devices are mounted and placed within the back end of the burner which may be hemispherical in shape and provided with ports for the admission of the secondary air. Particularly conveniently, this hemispherical member may be made adjustable along the axis of the unit, being spaced away from the hemispherical end of the casing to a greater or less extent. The result of this arrangement is that the air is directed in stream-line flow through the casing around the motor to the fan, and all objectionable humming noises and so forth, due to the air being made to traverse an irregular course, are avoided.

In order that the invention may be clearly understood and readily carried into effect, two forms of apparatus constructed in accordance therewith will now be described by way of example with reference to the accompanying drawings, in which

Figure 1 is a longitudinal section through the apparatus;

Figure 2 is an end view of the apparatus shown in Figure 1;

Figure 3 is a central section through the drain pump shown in Figure 1;

Figure 4 is an end view and Figure 5 a plan of the fan shown in Figure 1.

Figure 6 is a longitudinal section through a modified form of apparatus;

Figure 7 is an end view of the apparatus shown in Figure 6 with part of the casing broken away;

Figure 8 is a cross-section on the line VIII—VIII of Figure 6;

Figure 9 is a central section to an enlarged scale through the drain pump shown in Figure 6, and

Figure 10 is a section to an enlarged scale through the oil strainer on the line X—X in Figure 6.

Referring first to Figures 1 to 5, the apparatus comprises a casing or shell 1 having the shape specified above, that is a cylindrical portion 1*a* and a conical portion 1*b* tapering to a smaller cylindrical portion 1*c*. The casing 1 is mounted on a metal bracket or cradle 2. Within the cylindrical portion 1*a* of the casing 1, there are projecting bosses 3 forming a mounting for an electric motor 4 which is so placed that its shaft rotates about the central longitudinal axis of the casing 1. The motor 4 is connected by a flexible coupling 5 to an oil pump 6 which is supported by a bracket 7. The suction side of this pump is connected by a pipe passing through the bottom of the casing 1 to an oil well, while the delivery side of the pump is connected to a pipe 8 which leads through an automatic drain pump 9 to the underside of a burner 10 and which thus assists to support the burner 10.

The burner 10 is of the type in which oil is atomized by a ripping action while it passes through a nozzle, this latter being surrounded by a cone 11 which shrouds it from the action of cold air passing around it. The front of the part 1*c* of the casing is formed with a flange 12 by means of which the unit may be attached to a boiler or furnace door.

A metal bell 13 is mounted to surround the forward end of the motor 4 and is connected to the motor shaft. Two pairs of fan blades 14 are mounted upon the outside of the bell 13 and are so shaped that the bell and vanes constitute a true axial fan which forces air axially forwards without displacing it radially. This air is guided by a number of inclined vanes 15 mounted on the inside of the part 1*b* of the casing. The air is admitted through a number of ports 16 formed in the hemispherical end 17 of the casing 1, these ports being controlled by a rotatable shutter 18, also formed with ports and movable by means of a knob 19.

The burner 10 is mounted upon a bracket 20 depending within the part 1*c* of the casing 1. The bracket 20 is provided with cross arms 21 which carry electrodes 22 projecting just in front of the shroud 11. When the motor is started sparks are simultaneously produced across these electrodes 22 so as to ignite the oil issuing from the burner 10.

When the apparatus is stopped it is highly desirable to be able to drain oil away from the burner so as to prevent the latter choking or clogging. Accordingly the drain pump 9, already mentioned, is provided and comprises a hollow cylinder 23 containing a piston 24 slidable against the action of a spring 25. The cylinder 24 is formed with a fuel inlet 26, connected to the pipe 8, and an outlet 27 leading to the burner 10. The oil is delivered by the pump 6 into the cylinder 23 and the spring 25 is such that the oil pressure serves to move the piston 24 far enough to uncover the opening 27. When the motor 4 is stopped and the pressure of the oil is consequently released, the spring 25 forces the piston 24 backwards and thus creates a partial vacuum in the cylinder 23 which results in the oil being drawn backwards through the opening 27 so that dripping at the burner 10 and consequent choking due to the action of heat is avoided.

In the construction shown in Figures 6 to 10 several further valuable features are incorporated. In this case the casing 1 is divided horizontally into two halves and the motor 4 and pump 6 are mounted in a stirrup 30 fixed in the bottom half of the casing 1, the stirrup 30 embracing the lower half of the motor 4 and having a rearward extension supporting the pump. The motor 4 is held in the stirrup 30 by means of semi-circular strips 31 which are bolted to the stirrup and may be separated from it by means of rubber or like packings.

The motor 4 is connected as before to the pump 6 through a flexible coupling 32 and carries on its shaft an axial fan 13, 14. Strainers 33 and 34 are arranged, one on each side of the pump, which is arranged to draw in oil from a tank or sump through the pipe 35 and strainer 33 and force it through the strainer 34 and pipe 8 to the drain pump 9. Each strainer 33 or 34 comprises a hollow cylindrical body member 37 (see Figure 10) within which is a large number of layers of wire gauze 38 so tightly pressed together around a grooved or fluted spindle 46 that the oil can only percolate slowly through the edges of the gauze to the flutes of the spindle which lead to the pump 6 or to the burner. The provision of this type of strainer enables the pump 6 to be directly connected to the motor 4 without the intervention of reducing gearing, and thus to be driven at the same speed as the motor. Of course, if the same type of pump is employed in the apparatus shown in Figures 1 to 3, the strainers 33 and 34 employed there should be similar to that shown in Figure 10. It will be seen that the strainers 33 and 34 and drain pump 9 are all mounted within the casing 1, thus giving the whole apparatus a particularly neat external appearance.

The drain pump 9 shown in detail in Figure 9 is slightly modified from that shown in Figure 3. As before a piston 24 is arranged to slide against a spring 25 but the part of the cylinder 23 in which the spring lies is connected by a non-return valve with a fuel delivery pipe 47 leading from the oil tank to which the pump suction pipe 35 is also connected. The non-return valve comprises a ball 39 pressed by a spring 40, and as a result of this arrangement when the apparatus is started up again after being stopped, the oil drawn back into the cylinder 23 is forced by the piston 24 past the ball 39 into the pipe 47 and is thus again drawn up by the pump 6 through the pipe 35.

The control of the secondary air for combustion entering the casing 1 is effected by means of a part-spherical hood 41 mounted upon a screw-threaded spindle 42 which passes through a screw-threaded boss 43 in the hemispherical end 17 of the casing 1. Ports 16 are formed as before in this end 17, and by screwing the hood 41 longitudinally into the casing to a greater or less extent, the amount of air entering can be controlled. This construction has the very great advantage that the air is directed by the hood 41 in smooth stream-line flow along the inner edge of the casing 1 to the blades 14 of the fan. The air is directed by guide vanes 44 shaped as helices of very large pitch, and has a suitable whirling motion imparted to it by means of vanes 45 mounted around the burner and which are curved to a much greater extent than the vanes 44.

The apparatus shown in Figures 6 to 10 comprises all the necessary parts, that is, the oil

strainers, the pump, the fan, the driving motor, the burner, and the air control, within a single casing of neat appearance, with the result that the unit can easily be placed in position. Further, by merely removing the top of the casing any repairs or adjustments can easily be made, but at the same time none of the working parts are ordinarily visible.

The invention is not, of course, limited to the precise constructions shown by way of example, and it will be clear that many modifications may be made. As one small modification the vanes 14 of the fan may be spaced in other ways to that shown, but particularly good results are obtained by spacing them in small groups some distance apart as shown in Figures 4 and 5.

I claim:—

1. In an apparatus for burning liquid fuel, in combination, a casing in shape comprising essentially three portions only, said portions consisting of two substantially cylindrical portions of different diameter connected together by a conical portion, said larger cylindrical portion having a substantially hemispherical end wall formed with air inlets, a hemispherical member spaced away from said hemispherical end wall and capable of movement along the longitudinal axis of said casing, said member being so positioned and shaped as to direct the air passing through said inlets in substantially stream-line flow along the inside of said casing, a burner mounted within said smaller cylindrical portion, an air fan mounted within said larger portion and arranged to move air axially and substantially without radial displacement into said tapering portion, and a motor connected to drive said fan and also mounted within said larger cylindrical portion.

2. In an apparatus for burning liquid fuel, in combination, a casing in shape comprising essentially three co-axial portions only, said portions consisting of two substantially cylindrical portions of different diameter connected together by a conical portion, a burner mounted in said smaller cylindrical portion, a fan mounted within said larger cylindrical portion, a motor operatively connected to said fan and also mounted within said larger cylindrical portion, said motor, said fan and said larger cylindrical portion being substantially co-axial, and an air deflector on the side of said motor and said fan remote from said burner, said fan having blades extending radially from points on a circle of diameter substantially equal to the diameter of said motor to points on a circle of diameter nearly equal to the internal diameter of said larger cylindrical portion, said blades being so shaped and positioned that they can move a substantially cylindrical column of air past said motor to said conical portion without themselves causing any substantial radial displacement of the air and said baffle being operative to deflect air into said cylindrical column of air, and guide vanes fixed within said conical portion and operative to reduce rotation of air in said tapering portion of said casing.

3. In an air-oil burner organization, in combination, a casing having an open mouth and a tapering portion leading to said mouth, a liquid fuel burner disposed close to said mouth, a fan mounted within said casing, a motor for driving said fan disposed within said casing adjacent said fan and on the side thereof remote from said burner, said fan comprising an imperforate bell-shaped disc of radius greater than that of the exterior of said motor and at least equal to that of said mouth, said bell-shaped disc projecting over said motor and carrying spaced around it vanes adapted to drive air forwards substantially axially.

4. In an air-oil burner organization, in combination, a casing having an open mouth and a tapering portion leading to said mouth, a liquid fuel burner disposed close to said mouth, a fan mounted within said casing, a motor for driving said fan disposed within said casing adjacent said fan and on the side thereof remote from said burner, said fan comprising a central imperforate shield for preventing slip back of air past said fan and for protecting said motor from heat, and said fan also comprising blades spaced round said shield and adapted to drive air axially, without themselves causing substantial radial displacement of the air, towards said burner.

5. In an air-oil burner organization, in combination, a casing having an open mouth and a tapering portion leading to said mouth, a liquid fuel burner disposed close to said mouth, a motor mounted within said casing, air manipulating and directing means located between said motor and said burner and comprising fan blades connected to be driven by said motor and a shield, said fan blades being arranged to deliver air axially, without themselves causing substantial radial displacement of the air, towards said mouth, and said shield being adapted to prevent slip back of air past said fan blades and to protect said motor from heat.

6. In an air-oil burner organization, in combination, a casing having an open mouth and a tapering portion leading to said mouth, a liquid fuel burner disposed close to said mouth, a motor mounted within said casing and a fan arranged to be driven by said motor and located between said motor and said burner, said fan comprising a central imperforate circular member and blades of small radial depth fixed round the periphery of said circular member, said blades being set at a small angle to a plane at right angles to the axis of the fan so as to move air axially towards said burner, and said circular member being of sufficient area to protect said motor from heat.

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