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E. C. STAUFFER
HOUSING FOR OIL BURNERS

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2 Sheets-Sheet 1

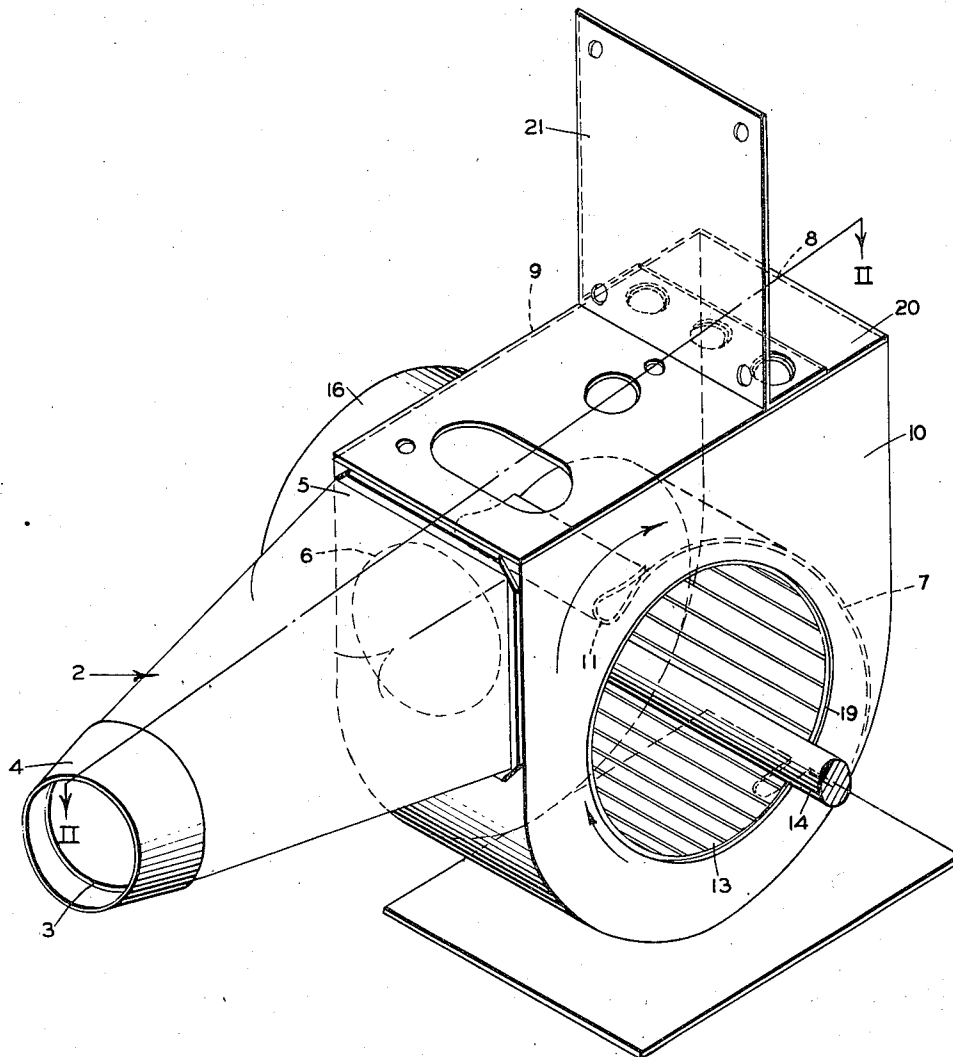


FIG. 1

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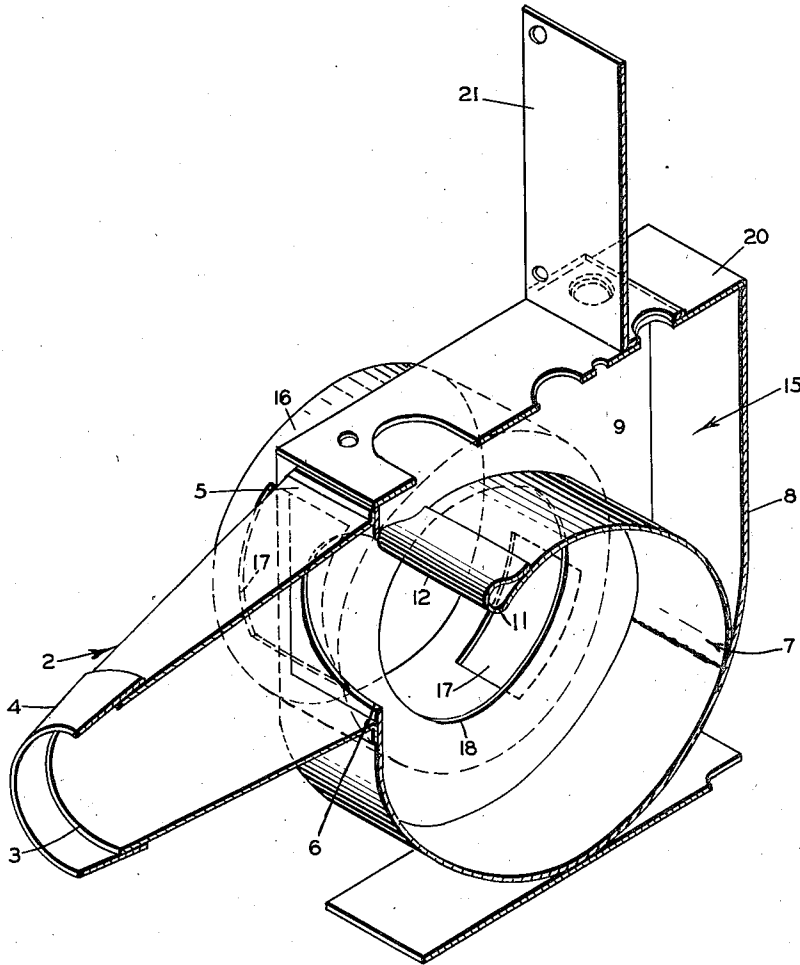


FIG. 2

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HOUSING FOR OIL BURNERS

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4 Claims. (Cl. 230-133)

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My invention relates to a housing for oil burners and more particularly, to a housing for so-called gun-type burners. The invention is concerned particularly with a housing which is so constructed and arranged that the air delivery therefrom is substantially uniform, thus obviating objectionable combustion noises and insuring better and more uniform burning of the fuel.

The principal object of my invention, therefore, is to provide a gun-type burner housing which will provide for economical and efficient fuel burning, and at the same time provide a supply of air for combustion which will be delivered at a substantially constant velocity to obviate the pulsating combustion noises which commonly occur in this type of burner and which are not only objectionable from the noise standpoint, but also result in poor firing and excessive fuel consumption.

In order that my invention may be readily understood, I shall describe the same in conjunction with the attached drawings in which:

Figure 1 is a perspective view illustrating one embodiment of my invention; and

Figure 2 is a sectional view taken along the line II-II of Figure 1.

The housing of the present invention includes a novel combination of draft tube and scroll with an air reservoir and a limiting orifice positioned between the draft tube and the air reservoir. It will be understood from the description which follows, that while each of these novel elements is included in combination with the others in the preferred embodiment of my invention which is illustrated in the drawings, certain of these novel elements may be incorporated in a blower housing alone or in combination with other of the elements and not necessarily all of them. For optimum efficiency and noiseless operation, I prefer, of course, to incorporate all of the novel elements in the combination referred to.

Referring now to the drawings, the draft tube 2 is preferably formed of sheet metal, although the same may be cast from iron or other materials, if desired. The tube 2 has an exhaust opening 3 at its forward end which is adapted to be positioned within or adjacent the fire box of a boiler or the like. Where the draft tube 2 is formed of mild steel, it is desirable to provide a stainless steel tip 4 which is positioned about the opening 3 in the draft tube and extends forwardly therefrom. If the draft tube is formed of cast iron or of stainless steel, then, of course, a stainless steel tip or tip of other heat resisting material is not necessary.

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In the embodiment illustrated, the draft tube is tapered from the exhaust end 3 to the inlet end 5 and the inlet end 5 is made square in cross section. In a typical embodiment, the opening 3 may be 3" in internal diameter and the end 5 may be 4" square. The length of the tube from the end of the tube proper to the limiting orifice 6 may be 7 1/4". While I prefer to run the draft tube from a circular cross section at the exhaust end to a square or rectangular configuration at the inlet end, I may make both ends circular in cross section or of other configuration if desired. By making the inlet end of square or rectangular configuration, I increase the cross sectional area of the tube adjacent the inlet end and this, of course, increases the air capacity of the tube without increasing its length and without increasing the width of the housing beyond the minimum shown, which is about 4 3/4".

There is a decided advantage in having the draft tube taper from a square or rectangular cross section at the inlet end to a circular cross section at the exhaust end, for by such construction, I provide an enlarged area directly forward of the limiting orifice 6 which is effective for enhancing the uniform flow of air into and through the tube, as will be more fully hereinafter described. The square surfaces disposed radially outwardly from the opening in the limiting orifice also serve to prevent any tendency for the air supplied by the fan from following a helical path down the tube to the exhaust end 3.

The scroll 7 is preferably formed of light gauge, mild steel and is welded to the main body 8 of the housing and also to the end plates 9 and 10. The scroll 7 is provided with a cutoff 11 which is formed integrally with the scroll 7 and, in the embodiment illustrated, is formed by folding the metal back into a bend 12. By this means, it is possible to avoid the creation of whistling noises which commonly occur when the cutoff is sharp. The scroll is disposed in the conventional manner to provide for an increased area in the direction of travel of the blower wheel 13 which is diagrammatically shown in Figure 1 but has been omitted in Figure 2 for clarity of illustration of other parts. The wheel is mounted upon a shaft 14 for rotation in the direction of the arrow in Figure 1. In the embodiment illustrated, the blower wheel is 5 1/4" in outside diameter and has an effective width 3 1/8". This is a Sirocco type blower wheel and is adapted to rotate at between 1725 and 1750 R. P. M.

The position of the scroll with respect to the draft tube is important in the present invention

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and constitutes a radical departure from the prior art. In prior art blowers, it has been common practice to rotate the blower wheel so that the air delivered by the fan is injected directly into the draft tube. This has been also controlled by the position of the cutoff. According to the present invention, the direction of the rotation of the fan is reversed from that normally employed and the cutoff is so positioned as to provide for the delivery of air to the air reservoir 15, as will be more fully hereinafter described.

A supply of air to the blower wheel may be controlled in the conventional manner by means of an air inlet 16, having ports 17 through which the air is inducted. A controlling band is provided for adjusting the openings 17 so that the same may be either fully opened or closed, or partially open, depending upon the quantity of air to be delivered. The end plate 9 is provided with a circular opening 18 which delivers the air from the inlet 16 and opens 17 to the blower wheel. This portion of the arrangement is conventional in gun-type burners.

The opening 19 in Figure 1 receives the housing of a motor which drives the fan wheel 13. The motor has been removed in Figure 1 in order to better illustrate the housing. It completely fills the opening 19 so that all air inlet into the blower is through the ports 17 as shown in Figure 2.

The air reservoir 15 is formed by the walls 9 and 10 of the housing and the body portion 8, and is enclosed by a top plate 20. The reservoir 15 is positioned above and to the rear of the scroll 7, as best illustrated in Figure 2. The cutoff 11 which defines the opening in the forward end of the reservoir 15, is positioned so that a line drawn horizontally through the center of the draft tube will be approximately tangent to the top of the scroll 7. The positioning of the cutoff with respect to the draft tube is not critical in the sense that a few parts an inch will materially affect the operation of the device, but its position should be such that air contained in the reservoir 15 may be fed into the draft tube 2 through the controlling orifice 6. In the embodiment illustrated, the distance from the cutoff 11 to the top plate 20 of the housing is about $2\frac{1}{8}$ " and as heretofore mentioned, the housing is about $4\frac{3}{4}$ " wide so that the entrance end of the reservoir 15 is defined by a rectangular opening about $2\frac{1}{8}$ " x $4\frac{3}{4}$ ". The reservoir 15 increases in cross sectional area as the scroll 7 curves to meet the body 8 of the housing, and the lowermost portion of the reservoir 15 in the embodiment illustrated is formed by the intersection of the scroll 7 and the body 8. This is not a critical configuration, since the reservoir 15 may be made wholly rectangular in cross section throughout, if desired, but for convenient fabrication and assembly with a minimum of metal and minimum welding, I prefer to have the reservoir 15 defined in one wall by the scroll 7, since this makes for economical fabrication.

In the embodiment illustrated, the whole of the reservoir 15 is unobstructed, but if it is necessary to carry any wires down into the chamber from controls mounted in the plate 20, a baffle may be provided across the opening between the walls 9 and 10 and welded to the scroll 7 and the walls 9 and 10, thus preventing any possibility of any wires getting caught in the fan. The baffle would, of course, be perforated to permit the free passage of air into and out of the chamber 15.

In the embodiment which I have chosen for

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illustrative purposes, the capacity of the reservoir 15 is about 87.6 cubic inches. This may be varied, of course depending on the size of the oil burner for which the housing is adapted, the cubical displacement of the fan per minute and other variable factors.

The top plate 20 may be hinged to the body 8 so as to permit ready access to the interior of the blower housing. In the housing illustrated, the top plate 20 is provided with an upright or vertical mounting plate 21 which is adapted to receive a combustion control. The plate 20 is also provided with appropriate openings for the reception and wiring of other components of the oil burner. It will be obvious that the components may be placed on the blower housing as illustrated or may be remote therefrom as desired. The mounting of the components for the control of the burner mechanism on the housing constitutes no part of the present invention. The top plate may be plain, if desired.

The opening between the reservoir 15 and the draft tube 2 is defined by the limiting orifice 6, referred to above. The orifice 6 is preferably of circular cross section and in the embodiment described above where the draft tube has an exhaust orifice 3" in diameter and an inlet 4" square, the limiting orifice 6 may be $3\frac{3}{8}$ " in diameter. The size of the opening in the limiting orifice 6 will depend upon the quantity of oil to be burned per hour and will be related to the diameter or cross sectional area of the exhaust opening in the draft tube as well as to the cross sectional area of the inlet end of the draft tube where it joins the limiting orifice. The limiting orifice will always have a lesser cross sectional area than the cross sectional area of the draft tube adjacent thereto and will always have an area greater than the cross sectional area of the exhaust end of the draft tube.

In the operation of my device, air which is introduced into the housing through the ports 17 and the opening 18, is carried by the fan 13 into the opening defined by the scroll 7. The air is cut off by the cutoff plate 11 and is fed into the reservoir 15. On completion of the filling of the reservoir 15 which occurs substantially instantaneously upon operation of the blower wheel, air is fed through the limiting orifice 6. Since the limiting orifice 6 is of lesser cross sectional area than the cross sectional area of the draft tube immediately adjacent thereto, the air expands into the draft tube and moves therealong, being compressed slightly as it moves from the inlet to the exhaust end of the draft tube. This is due, of course, to the tapering of the draft tube. While I do not wish to be limited to the following theory, it is offered as an explanation of the improved results which are achieved by the provision of the limiting orifice 6 at the inlet end of the draft tube. In operation of the blower wheel, air is delivered into the zone behind the limiting orifice 6 in a nonuniform manner and by restricting the cross sectional area of the inlet orifice to a value less than the cross sectional area of the draft tube, the total volume of air which is delivered through the limiting orifice is substantially uniformly distributed therethrough, for there is a tendency to build up a slight back pressure at the inlet orifice which is greater than the pressure which would be built up if the limiting orifice were eliminated. Thus the air delivered to the draft tube is substantially uniform in velocity at the inlet end and is compressed uniformly throughout the length of the draft

tube to the exhaust end. If the limiting orifice were not provided, it would be necessary to substantially increase the length of the draft tube in order to obtain a similar result. Regardless of the theory of the operation, however, I have found as a practical matter that by the provision of the limiting orifice in combination with the tapered draft tube, it is possible to deliver the air at a substantially uniform peripheral velocity in cubic feet per minute at the exhaust end of the tube, thus insuring the best possible combustion of the fuel and guaranteeing the least combustion noise in operation.

The reservoir 15 also has a very important effect upon the uniform supply of air to the burner mechanism. From the previous description, it will be clear that the reservoir 15 is of substantial capacity and in actual test, I have determined that a pressure can be built up in the reservoir equal to about 1½" of water. This varies depending upon conditions of operation and other variable factors, but in any event there is a substantial head pressure built up in the reservoir and this is effective for supplying air to the draft tube and delivering the same at the exhaust end thereof at a substantially uniform velocity. If there is any tendency for the blower wheel to "slip," air is bled from the reservoir directly into the draft tube, thus avoiding the setting up of any variable pressure due to the drop-in volume in the draft tube; this is common with conventional burners of the gun-type and results in excessive combustion noise.

By providing a reservoir for the air to be delivered to the draft tube, it is also possible to eliminate rarefaction and compression of air due to irregular draft pull and other causes.

In a small oil burner adapted to burn about 1¼ to 1½ gallons per hour, I have successfully delivered air at a substantially uniform velocity through the exhaust end of the draft tube; whereas, with similar, but conventional equipment, the velocity of air will in practically all instances vary about the periphery of the exhaust end of the draft tube, being generally measured as an average delivery through the tube. It is this non-uniform delivery, at the periphery where combustion occurs, which results in inefficient burning and also considerable noise due to the uneven and periodic blasting of portions of the flame. Thus my invention offers a real contribution to the art of efficient burning of fuel, coupled with quiet operation of the burner.

While I have illustrated and described a preferred embodiment of my invention, it will be understood that the same is not limited thereto but may be otherwise embodied and practiced within the scope of the following claims.

I claim:

1. In an air supply system for a gun type fluid fuel burner, a tapered draft tube having a circular exhaust opening and a substantially rectilinear inlet opening, and a constricting plate disposed in the inlet opening, said plate having an opening therein, the cross sectional area of which is greater than the cross sectional area of the exhaust opening and less than the cross sectional area of the inlet opening.

2. In an air supply system for a gun type fluid fuel burner, a tapered draft tube having a substantially circular exhaust end and a substantially rectilinear inlet end, said tube tapering from said inlet end to said exhaust end, and a substantially rectilinear plate disposed in the inlet end of said tube and having a substantially circular opening therein to provide areas for the expansion of air directed through said circular opening in the plate forwardly thereof along the direction of travel of air through said tube.

3. In an air supply system for a gun type fluid fuel burner, a draft tube having an inlet opening and an exhaust opening, said exhaust opening being substantially smaller than the inlet opening, said tube being gradually constricted from said inlet opening to said exhaust opening, and constricting means limiting the opening at said inlet end to a cross sectional area greater than the exhaust end and substantially less than the cross sectional area of the draft tube immediately forward thereof in the direction of travel of air through said tube.

4. In an air supply system for a gun type fluid fuel burner, the combination of a housing, a scroll formed therein, a draft tube extending from the housing, a reservoir formed in the housing having a portion thereof defined by said scroll, and cut-off means for said scroll serving to direct the air supplied to said scroll, said cutoff means being disposed so that a line drawn tangential thereto and substantially horizontally of the housing will intersect the draft tube about midway of the opening therein.

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