March 4, 1941. F. E. HERR 2,233,529

COMBUSTION TUBE

Filed Jan. 25, 1939

Fig. 1.

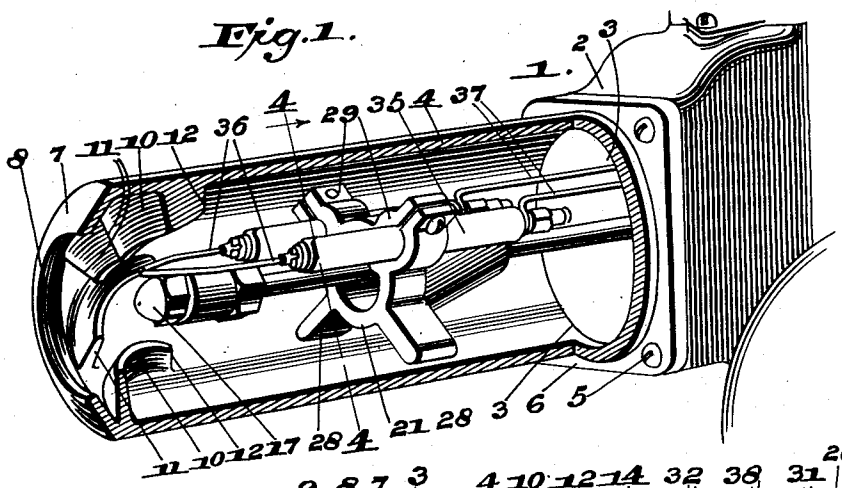


Fig. 2.

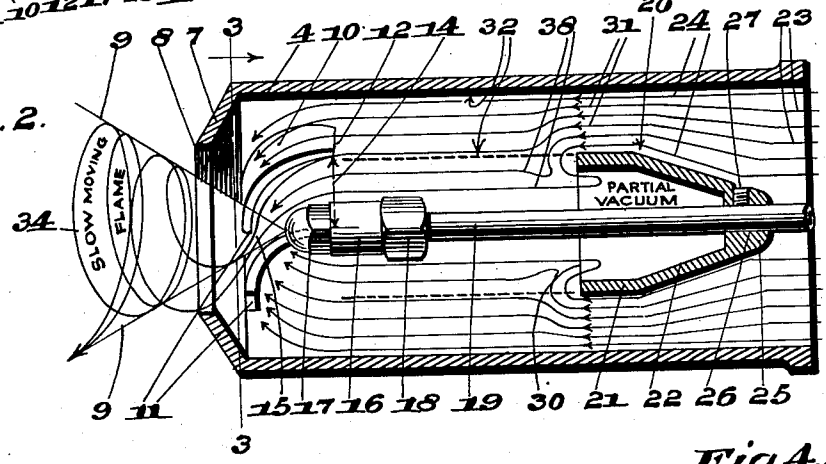


Fig. 3.

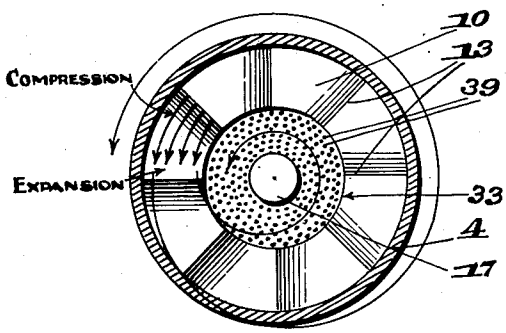
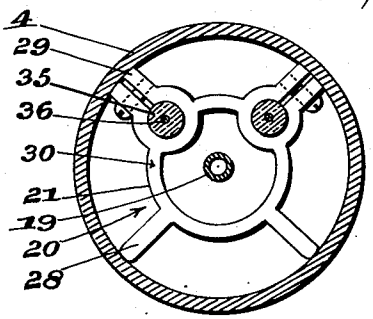


Fig. 4.



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COMBUSTION TUBE

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2 Claims. (Cl. 158—73)

This invention relates to improvements in domestic and similar oil burners, and one of its foremost principles is the handling of the fuel oil in such a manner that a maximum heating effect is obtainable. It is common knowledge, achieved largely by actual personal experience on the part of users of oil burners, that the flame projected into the fire pot of the furnace usually has considerable force behind it. This is often accompanied by a roaring sound which is evidence of the pressure with which the flame is driven from the orifice of the burner.

After careful consideration it is readily concluded that the same force which drives the flame into the fire pit at a fairly high velocity can also be responsible for a considerable loss of heat due to the speed with which the flame is projected. In other words, it is readily seen that if the flame can be slowed down or held back in some effective way the liberation of the heat units at the bottom or beginning of the water jacket would be far more effective in heating the water than when said liberation is delayed until later in the progress of the flame into the furnace, as in the majority of known installations.

Thus, as has already been suggested, the main purpose of the invention is to slow down the flame, the specific objects being briefly expressed as follows:

First, to provide a combustion tube for oil burners having as one of its chief characteristics provisions for producing a non-pulsating slow-moving flame.

Second, to provide a combustion tube for oil burners having means embodied therein especially constructed to produce a slow-moving flame, thereby permitting the fuel consumption to be reduced to a very low hour-rate and at the same time to derive the maximum amount of heat therefrom.

Third, to provide a combustion tube wherein the tip of the oil nozzle is situated directly within the confines of a cluster of annularly located vanes which are continuously curved from their forward to their rearward ends, the particular function of which is to divert the cylindrical layer of air into a course substantially at right angles to its passage through the tube and directly across the tip of the nozzle, thereby to establish a whirl.

Fourth, to provide a combustion tube wherein the totally curved vanes convert the fast forward-moving air current into a slow-moving whirl wherein the speed of the foregoing current is dissipated in the characteristic swirling or spiral motion.

Fifth, to provide a support with the threefold purpose of mounting the oil feed pipe, centering the oil nozzle and diffusing the air current, a particular effect of the diffusing function of the support being to produce a swiftly moving cylinder of air with a slightly slowed core.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawing, in which:

Figure 1 is a perspective view of a portion of an oil burner, the combustion tube being shown in section to reveal the internal construction.

Figure 2 is a diagram of the combustion tube, particularly illustrating the cyclonic action which is responsible for slowing the flame.

Figure 3 is a diagrammatic cross section taken on the line 3—3 of Fig. 2, illustrating the relationship of the swiftly moving air cylinder to the slightly slowed air core.

Figure 4 is a cross section taken on the line 4—4 of Fig. 1.

In carrying out the invention provision is made of an oil burner generally designated 1, this burner being of the type commonly used for domestic heating. This statement, however, is not to be construed as a limitation upon the invention because the identical principles announced below are applicable to burners of much larger types, for example such as employed in office buildings, factories and the like.

The oil burner includes the case 2 which has an air outlet 3. The blower which produces the air current is not shown but it will be understood that such a blower is provided and that it drives a current of air at a considerable velocity through the outlet 3 and into the attached combustion tube 4. The latter is secured to the casing 2 in any desired way, for example by means of screws 5 which are driven into the casing through holes in a flange 6 at the base of the tube.

At its free end the combustion tube 4 has a frusto-conical terminal 7. The wall represented by this terminal is located on a sharp pitch with respect to the combustion tube. Said terminal has a flame opening 8, and it is through this opening that the flame, conveniently represented by the diverging lines 9, is projected into the form of a cyclonic whirl. The manner in which this is accomplished is fundamental to the invention, the structural details of the latter being described as follows:

Immediately adjacent to the flame opening 8 there is an annular series of vanes 10 (Fig. 3).

These vanes do not ordinarily overlap, that is to say, the trailing edge 11 of any given vane is in line with the axial position of the leading edge 12 of an adjacent vane (Fig. 2) so that when viewing the series of vanes from the front (Fig. 3) the radial dividing lines 13 there designated can be regarded as representing both the leading and trailing edges of any selected pair of vanes.

The particular purpose of this unusual structural arrangement is to provide the widest possible mouth 14 between a given pair of vanes and at the same time to provide a constricted neck 15. An outstanding characteristic of the vanes is the particular curvature of each. In other words, each vane has a curved contour which is continuous from the leading to the trailing edge, there being no straight component in its formation whatsoever.

This vane formation insures an easy turning of the air current with the least possible friction. The vanes are shaped on an approximately quarter turn, as can be seen in Fig. 2, the result being that the air current which they control is diverted from its longitudinal movement along the internal wall of the combustion tube 4 into a course substantially at right angles to its passage. An oil nozzle 16 is so located within the tube 4 that its tip 17 is situated directly within the confines of the annular series of vanes 10. The nozzle is coupled at 18 to the oil feed pipe 19. This pipe goes through a support generally designated 20.

Said support comprises a metal casting which has a ring portion 21. A hood 22 tapers rearwardly from the ring portion. Said hood is in flaring relationship to the incoming air current 23, but at the same time said flare has a compressive effect on the air current, as denoted by the bends in the arrows representing the air current. The hub 25 constitutes the smallest portion of the hood 22. This has a bore 26 in which the feed pipe 19 is tightly fitted, the attachment being completed by a set screw 27. The support 20 is of spider formation (Fig. 4). To this end it has a radial pair of ribs 28 and a radial pair of clamps 29. These elements are generally situated 90° apart so that when the support 20 is slid along the pipe 19 into the tube 4, it will so station the pipe that the nozzle tip 17, especially the oil orifice thereof, will be axially centered in the combustion tube.

It is clear from the showing in Fig. 2, that the support 20 will contain slightly rarified air. As already stated, the fitting at 26 is tight. The end of the support opposite to the hub 25 is open, in other words, the rim 30 of the ring portion 21 constitutes the opening to the hollow inside of the support. The latter is thus subject to a partial vacuum which is set up by the swift passage at 31 of the compressed air around the ring portion past the rim 30.

The effect of the ring portion 21 of the support 20, is to segregate a cylinder or stratum of air so called for convenience, and designated 32. This stratum of air is situated contiguously to the interior of the combustion tube 4. Its depth is equal to the distance of the perimeter of the ring portion 21 from the interior of the combustion tube. Said depth is also coextensive with the height of the curved vanes 10. In other words, the inner edges 33 of the vanes (Fig. 3) are on a line with the perimeter of the ring portion 21.

Said cylinder of air 32 is thus projected directly across the perimeter of the ring portion 21 into the series of vanes 10 where it is turned almost directly at right angles from its course across the tip 17 of the nozzle. The sharply pitched terminal wall 7 now plays an important part in repressing the swiftly moving air current, so guiding it that it commences to swirl. In other words, the erstwhile longitudinally moving air current is converted into a cyclonic body 34.

However, this cyclonic body or whirl does not consist solely of air. It would be more correct to state that said body comprises a swirling flame because by the time that the cyclonic effect is evident the oil vapor will have been ignited. For the latter purpose the previously mentioned clamps 29 serve to secure the insulators 35 of a pair of electrodes 36. Now these electrodes provide the sparking points for a high tension current, the latter being supplied by way of wires 37 from some suitable source.

Reverting to the cylinder of air 32, it will be obvious from Fig. 2 that as this air passes the rim 30 there will be some diversion from its longitudinally moving direction as denoted by the bent arrows 38. This diversion is produced by the partial vacuum inside of the support 20. Some of the air will tend to enter the hollow support, but being under considerable pressure will progress forwardly despite the partial vacuum.

The result of this action is a diffusion of the cylindrical air current 32, so that the air stream will travel on straight lines contiguously to the feed pipe 19 as well as next to the interior wall of the tube 4. That volume of air diverted at 38 resolves itself into a core 39 represented by the dots in Fig. 3. Inasmuch as the air in this core is first partially drawn into the hollow support 20, it follows that said core will be slightly slowed as regards the speed of the cylindrical stream 32. This slowed core is a direct contribution toward the sudden bending of the cylindrical air stream by the curved vanes 10.

By carefully following the action of the combustion tube on the air current emanating from the outlet 3, it will be found that the velocity of said current is first increased to some extent by the constricted passage around the ring portion 21, whence it passes on in cylindrical formation at 32 until it encounters the curved vanes 10 where a sharp bend in its course occurs.

These vanes are the first obstacles to the air current. Their purpose is to direct the air across the orifice of the nozzle tip. The inherent speed is not materially checked but instead of the air being projected forwardly out of the flame opening 8, it is converted into a cyclone by the combined action of the vanes and of the frusto-conical terminal wall 7.

The rate of swirling can be high, but the rate of linear progress of the ultimate flame will be slow. The effect of the obvious retardation is to insure a full liberation of all of the heat units in the fire pit of the furnace whence the water in the jackets will be heated from the bottom.

I claim:

1. In combination with a combustion tube, a composite air diffuser and mounting device for the dual purpose of supporting the oil pipe and electrodes of an oil burner, said device comprising a hollow body having a hub to receive said pipe, diametrically positioned pairs of ribs and clamps extending from the body in substantial cross form and at radially equal distances to loosely touch the bore of said body, thus to axially centralize said body and pipe solely by the bracing function of said ribs and clamps, and a

pair of electrodes fixed in positions in said clamps.

2. In combination with a combustion tube, a composite air diffuser and mounting device for the dual purpose of supporting the oil pipe and electrodes of an oil burner, said device comprising a hollow body consisting of an imperforate ring portion merging into a hollow imperforate hood which tapers toward a hub terminal having a bore to receive said pipe, diametrically positioned pairs of ribs and clamps in cross form, being integral with said ring portion and extending radially therefrom at equal distances to loosely touch the bore of said body and thus to axially centralize said body and pipe solely by the bracing function of said ribs and clamps, and a pair of electrodes affixed in and by said clamps.

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