

Feb. 12, 1946.

L. W. MILOS

2,394,629

OIL BURNER

Filed Aug. 6, 1941

2 Sheets-Sheet 1

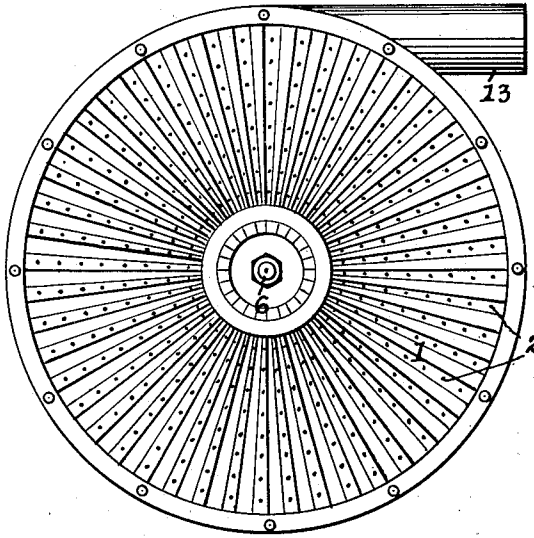


Fig. 1.

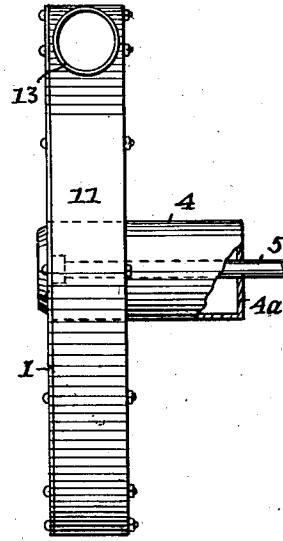


Fig. 2.

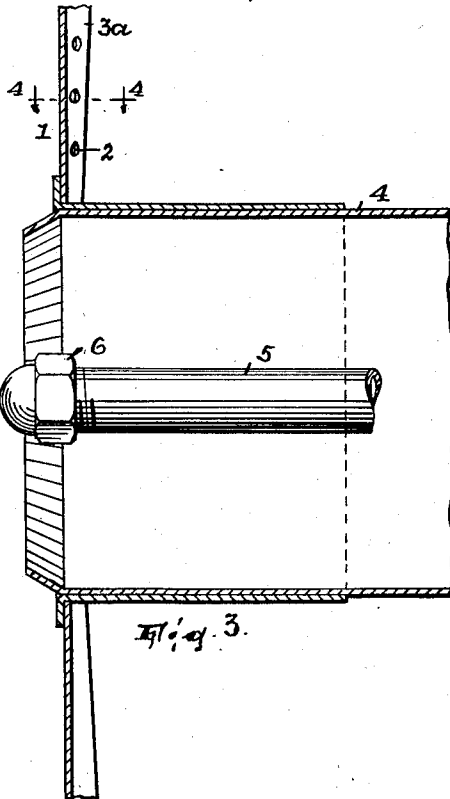


Fig. 3.



Fig. 4.

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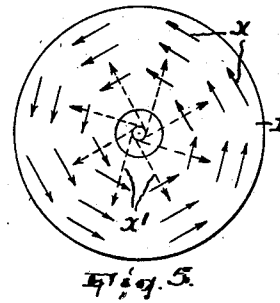
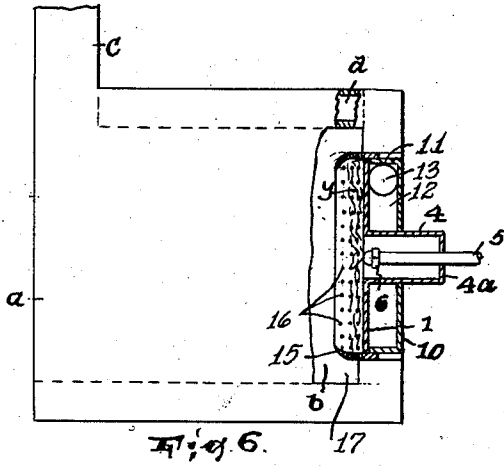
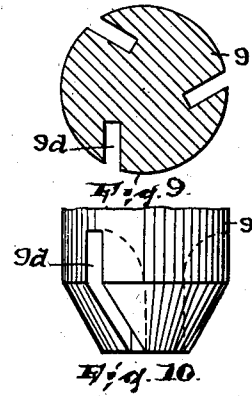
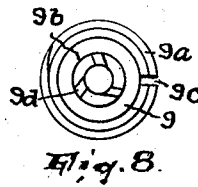
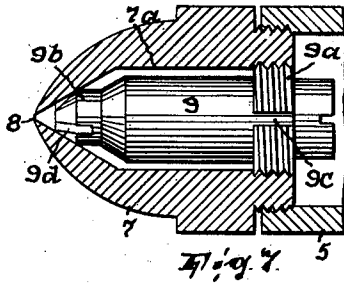
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2,394,629

OIL BURNER

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Application August 6, 1941, Serial No. 405,601

3 Claims. (Cl. 158-4)

This invention relates to combustion apparatus and particularly those using fluid fuel, as oil. Its object is to provide an apparatus of this type which may be operated with a very considerable economy of fuel. In carrying out the invention I have provided a novel device or structure, herein termed a burner, which may exist as a unit and be readily assembled with an existing furnace. In practical applications of my invention I have found that the lining of the combustion chamber of a furnace with refractory material for storing the heat may be omitted since the heated products of combustion are so directed through the combustion chamber as to undergo delayed travel in close contact with the walls of the chamber, or so as to avoid considerable quantities of them passing to the flue before their heat can be usefully availed of.

In the drawings:

Fig. 1 is a front elevation and Fig. 2 a side elevation, partly in section, of one form of the burner;

Fig. 3 is a fragmentary longitudinal section thereof, the fuel discharge means appearing in elevation;

Fig. 4 is a section on line 4-4, Fig. 3;

Fig. 5 is a front elevation of the burner, illustrating by arrows the general directions of fluid discharge;

Fig. 6 shows a furnace diagrammatically in side elevation and partly broken away and embodying the invention;

Fig. 7 shows the fuel nozzle partly in longitudinal section and partly in elevation; and

Figs. 8, 9 and 10 respectively show the nozzle plug in front elevation, transverse section and side elevation, Fig. 10 being fragmentary.

Let *a* be any furnace structure including a preferably cylindrical combustion chamber *b* having a stack or flue *c* at its discharge end for waste products of combustion and a space *d* adjacent, as here surrounding, the combustion chamber and to contain the fluid, as water, steam or air to be heated. How said space is formed, whether as here as a single space or as tubes, is of course not material. At the intake of the combustion chamber, otherwise open, there is a wall *1* obstructing fluid flow to the chamber from the atmosphere and here formed circular to conform to the cylindrical form of the chamber, in which it is fitted. This wall has numerous air passages *2* each of relatively little area and all formed to discharge air to the combustion chamber in streams biased in a common rotative direction around the axis of said intake, or here all biased anti-clockwise. In

this example this is accomplished by forming said wall with radiating flutes *3* each having two angularly related wall portions one of which at least, as *3a*, appears in cross-section in oblique relation to the plane of the wall, and all such wall portions being offset in the same rotative directions from the other wall portions *3b*, the passages *2* existing in the wall portions *3a* substantially perpendicular to the respective planes of the latter. What amounts to an axial tubular extension of said wall *1* is present at *4*, closed at its rear or atmosphere end, as at *4a*. This serves, as will appear, to support the fuel supply means. Except for the passages the intake of the combustion chamber is sealed off from the atmosphere so as to prevent flow of air into the chamber via its intake such as would interfere with the conditions to be maintained therein.

The fuel supply means, or means to pass fluid fuel through said wall, here comprises a pipe *5* supported at *4a* and a discharge nozzle *6* substantially coaxial with the intake of chamber *b* and which may be of well-known type, thus: *7* is the nozzle proper having a bore *7a* generally cylindrical but conical at its front end and having at the apex of its conical portion the nozzle outlet *8* of little diameter. *9* is a plug formed generally cylindrical and of less diameter than the cylindrical part of bore *7a* and having an enlarged threaded bushing *9a* screwed into the bore and at the end thereof adjacent said outlet a stem *9b* formed frusto-conical to fit the conical portion of said bore. By a slot *9c* in the bushing the fuel may enter the nozzle proper; and by slits *9d* formed in the conical part of the stem in tangent relation to an imaginary cylinder described about the plug axis the fuel attains the outlet. The fuel discharge, as viewed laterally, is in the form of a quite obtuse cone of finely divided particles having its apex at the outlet.

Assume air under pressure exists back of or at the atmosphere side of wall *1* and that fluid fuel, as oil, is delivered by the nozzle. The air passing through the passages *2* enters the combustion chamber in a multitude of streams as per the solid arrows *x*, viewing said wall from the front, or as in Fig. 5, so that a helical or more or less elongated vortex of air is established in said chamber. The fuel discharged by the nozzle is delivered as per the dotted arrows *x'* and so substantially radially and in paths through such multitude of streams and hence in a direction through the initial portion of the air-vortex. (Of course, viewed alterally, as in Fig. 6, both the fuel and air are directed somewhat forward and

angularly to the general plane of the wall.) Therefore, assuming, of course, that the fuel is impelled at such force as to penetrate the air vortex, a good mixing of the air and particles of fuel will be effected, such being promoted due to the vortical motion of the air. In practice, igniting being effected (however accomplished is not here material) the flame produced is found consistently to exist as a layer at *y* in Fig. 6, immediately adjacent the combustion-chamber side of said wall and covering the same throughout substantially its whole area; in short, the maximum state of combustion is confined to and substantially fills a relatively narrow zone of and within the combustion chamber immediately adjoining said wall. Apparently this is to be attributed to a condition of relatively reduced pressure adjacent the wall at its combustion-chamber side and existing around each of the passages, it being known that when a jet of liquid or gas passes through air it carries the surrounding air along with it, setting up rarefaction or an aspirating state around the jet, the aggregate aspirating action of the jets from the passages in the present case being sufficient to deflect the particles of fuel from their otherwise straight paths from said wall. Of course, to prevent the forming of carbon deposit on wall 1 the fuel is preferably not directed against said wall by nozzle 6 whose outlet 8 discharges preferably as explained, viewing such discharge laterally, and is positioned adjacent to the plane of said wall.

At any rate, the whirling of the air not only promotes good mixing of the fuel and air but has this advantage, that it continues appreciably beyond the said zone toward the flue, more or less, according to the air pressure back of wall 1, so that the hot products of combustion travel helically in close proximity to the surrounding wall of the combustion chamber so as thereby more or less directly to heat the content of space *d*. Thereby it is unnecessary to line the combustion chamber with any heat-absorbing refractory material, as in the case of the common type of oil burner where the flame, of less diameter than said chamber, is directed more or less axially through the latter and toward the flue and a refractory lining is necessary to store the heat, a considerable quantity of the heat escaping unavailed of at the flue.

Usually, of course, air under pressure is to exist at the back of wall 1, as by resort to any type of air pump fan or equivalent (not here shown). For this purpose said wall forms with another wall 10 back of it and an annular wall 11 connecting them and coaxial with wall 1 a pressure

chamber 12. The air should preferably be whirled in this chamber in the rotary direction of the air-vortex existing in the combustion chamber, wherefore the air pipe 13 for the chamber is here disposed tangentially thereto and so as to direct the air thereinto in the same direction as the direction of rotation of said vortex, or here counter-clockwise.

In some instances the combustion chamber, as 10 *b*, Fig. 6, may be of such appreciably greater cross-sectional area than the wall 1 (and it may even be also angular in cross-section) that the whirling or vortical action of the air, initiated at said wall, will fail to continue throughout an appreciable lengthwise extent of such chamber proper. Hence I have found it quite advantageous in such cases to extend into the combustion chamber from said wall a substantially annular baffle 15 substantially concentric with the fuel discharge means 5-6 and of a diameter to surround, preferably closely, all the air-passages in wall 1. The baffle is preferably perforated, as at 16, to permit air to escape through it, without which expedient it will soon be destructively influenced by the heat if it is of metal; the perforations also permit such fuel as might collect in the space 17 around the baffle and form a "gas pocket" to undergo consumption.

Having thus fully described my invention, what I claim is:

1. In combination, structure including a combustion chamber having an intake and a discharge end and having its combustion chamber of greater cross-sectional area than the intake, said structure also including a wall obstructing air flow from the atmosphere to the chamber via the intake and said wall having dispersed throughout the whole area of the intake numerous foramina forming air-passages all formed to discharge air to said chamber in a multitude of streams biased in a common rotative direction around the substantially central axis of said intake, means, substantially coaxial with said intake, to discharge fluid fuel into said chamber in directions generally radiating from said axis and through said multitude of streams, and a substantially annular baffle at the combustion-chamber side of said wall and substantially coaxial with the intake and surrounding substantially all of said passages.

2. The combination set forth in claim 1 characterized by said baffle enclosing an area approximating that of the intake.

3. The combination set forth in claim 1 characterized by said baffle being perforated.

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