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C. E. MORAN

2,194,208

FLUID FUEL BURNER

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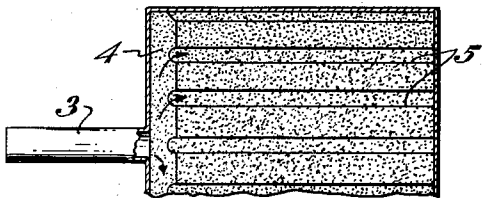
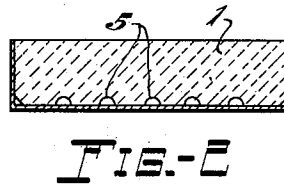
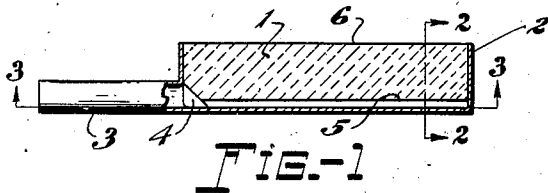


FIG. -3

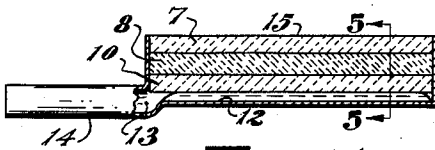


FIG. -4

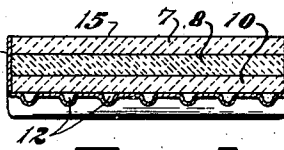


FIG. -5

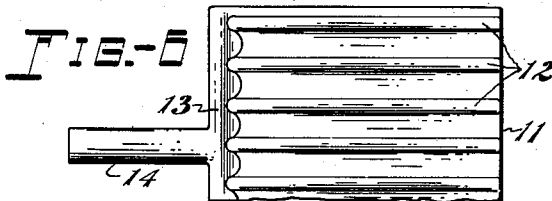


FIG. -6

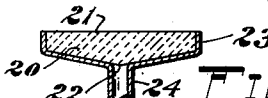


FIG. -7

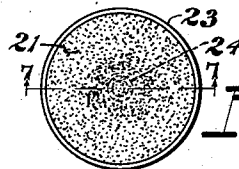


FIG. -8

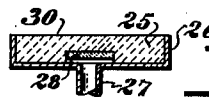


FIG. -9

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FLUID FUEL BURNER

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5 Claims. (Cl. 158—99)

This invention relates to fluid fuel burners and in particular to burners of the type which employ a burner head in the form of a porous refractory diaphragm.

5 The broad idea of constructing a burner head in the form of a porous refractory diaphragm is old in the art of gas burning apparatus. F. C. Krause Patent 21,076 issued August 3, 1858 and W. Bone et al. Patent 1,223,248 issued April 17, 1917 illustrate burner heads of this general type.

10 In burners of the type illustrated in the Krause and Bone et al. patents, in order to have proper combustion, it is necessary to supply air and gas in proper proportions to the rear side of the diaphragm so that the burner would not need to depend upon a secondary supply of air to complete the combustion of the fuel used.

15 The later inventors in this field recognized that the supplying of a combustible or explosive mixture of fuel might lead to a hazardous condition in case of backfiring into the mixing chamber of the burner and many of the later patents in this field were directed to ways and means for overcoming this hazardous condition.

20 For example: In Patent 1,225,381 issued to U. Wedge, May 8, 1917, a series of cooling coils were provided in the diaphragm to prevent the inlet side of the diaphragm from becoming overheated and thus igniting the explosive mixture of fuel at the inlet side of the burner.

25 In Patent 1,313,196 issued to C. E. Lucke on August 12, 1919, it was also attempted to solve the same problem by providing means to cool the combustible mixture before admitting the same to a loose bed of refractory particles.

30 In Patent 1,677,156 issued to S. P. Vaughn, July 18, 1928, a burner is shown in which the porous refractory diaphragm of the burner is provided with a fine mesh screen at its rear face to prevent backfiring of the burner, and in Patent 1,830,826 issued to F. J. Cox, November 10, 1931, the diaphragm of the burner head is provided with portions of different porosity for accomplishing the same result.

35 In all of the patents cited, the burners disclosed therein are arranged so as to carry at all times a considerable volume of explosive mixture at the rear side of the burner. If the volume of this space is materially reduced in the constructions shown, it is difficult, if not impossible, to obtain uniform heating over the entire area of the operating face of the burner without producing flames above the diaphragm.

40 In burners of any substantial size, there is a tendency for the diaphragm to produce a flame in

the locality opposite to the discharge end of the inlet feed pipe and with the arrangements shown in the first cited two prior art patents, the closer the mouth of the feed pipe approaches to the diaphragm, the greater becomes this tendency.

5 In the present invention, a relatively simple arrangement is provided to obviate the danger of backfiring of the burner and to insure at the same time uniform operation over the entire area of the exposed face of the diaphragm.

10 These highly desirable results are accomplished by reducing the volume of free space behind the diaphragm to a minimum and by providing a plurality of small passageways in communication with a large portion of the rear face of the diaphragm so that gas is supplied uniformly throughout the area of the diaphragm without substantially reducing its velocity.

15 By reason of this arrangement, there is never present a very large amount of combustible mixture at the rear side of the diaphragm and the fuel that is present at the rear side of the diaphragm has sufficient velocity so as to prevent rearward propagation of a flame or ignition of such fuel.

20 One of the objects of this invention relates to the provision of a porous refractory diaphragm which is adapted to safely provide for uniform combustion over the entire area of the operating face of the burner.

25 Another object of the invention relates to the provision of a burner head of the type defined in which the danger of explosion of the combustible mixture which is supplied to the burner is greatly reduced if not entirely obviated.

30 A further object of the invention relates to the provision of a fluid fuel burner employing a burner head in the form of a porous refractory diaphragm of sectional construction and in which the operating face of the diaphragm may be renewed without renewing the entire diaphragm.

35 A further object of the invention relates to the provision of a burner of the type defined employing a burner head in the form of a porous refractory diaphragm which is configured and arranged so as to provide for substantially uniform flow of fuel throughout the entire area of the operating face of the diaphragm, while at the same time maintaining at a relatively low temperature, the face of the diaphragm opposite to the operating side thereof.

40 These and other objects of the invention will become more apparent and better understood after consideration has been given to the following detailed description of the invention taken 55

in connection with the drawing which shows, merely by way of illustration, structure adapted for carrying out the objects of the invention.

In the drawing, Figure 1 is a central sectional view of a gas burner illustrative of one form of the invention; Figure 2 is a sectional view taken on line 2—2, Figure 1; Figure 3 is a plan view of the underside of the burner shown in Figure 1, with the bottom of the burner casing removed to more clearly illustrate the details of the burner diaphragm; Figure 4 is a central sectional view of a modified form of gas burner; Figure 5 is a sectional view taken on line 5—5, Figure 4; Figure 6 is a plan view of the underside of the burner shown in Figures 4 and 5; Figure 7 is a sectional view taken on line 7—7, Figure 8, of another modified form of burner; Figure 8 is a plan view of the burner which is shown in section in Figure 7; and Figure 9 is a central sectional view of yet another modification of the invention.

The burner illustrated in Figure 1 comprises a diaphragm in the form of a porous refractory block 1 which is received within a hollow casing 2, formed from sheet metal or any other suitable material. A conduit 3 communicates with the interior of the bottom portion of the casing structure, as shown in Figures 1 and 3. One of the corner edges of the diaphragm is cut away to define a passageway 4 which is normally in communication with the conduit 3.

A series of grooves or channels 5, which are formed on one face of the diaphragm, communicate with the passageway 4 and with the conduit 3. A combustible mixture of fluid fuel is supplied to the passageways 4 and 5 by way of the conduit 3 and in this manner, the fuel is supplied to the operating face 6 of the diaphragm at a substantially uniform pressure throughout the entire area of the diaphragm so that upon its ignition, the entire exposed face 6 of the diaphragm will be raised to a substantially uniform degree of incandescence after the burner has been in operation a short time.

By arranging the burner in the manner described, it is possible to maintain the quantity of combustible mixture behind the operating face of the burner at a minimum, thus reducing the possibilities of a dangerous explosion occurring in the combustible mixture before it burns at the operating face of the burner.

The provision of a relatively large number of small passageways, such as the passageways 4 and 5, also insures the maintenance of relatively high velocities for the combustible mixture which is supplied to the burner and this tends to obviate the dangers of an explosion taking place because the rate of gas flow may be maintained in this manner at a higher rate than the rate of flame propagation in a direction counter to the flow of the combustible mixture.

In the modification of the invention illustrated in Figures 4 to 6, the burner comprises a plurality of relatively thin porous refractory slabs 7, 8 and 10, which are carried in a casing structure 11 having a bottom wall with a series of grooves or channels 12 which communicate with a channel 13 which is formed in one edge of the casing structure.

A conduit 14 communicates with the channel 13 and in this manner operates to supply a combustible mixture of fluid fuel to the channels 12. The slabs 7, 8 and 10 of the diaphragm may be of the same or of different porosity. It has been found that a sectional diaphragm of the type

shown promotes uniformity of combustion at the operating face 15 of the burner and this construction is also advantageous in that the slab 7 is the only one which ordinarily is subjected to any wear or deterioration and the same may be replaced with less expense than would be incurred if a single block of the combined thickness of the three diaphragms were replaced.

In the forms of the invention illustrated in Figures 1 to 6, it is, of course, understood that the number of passageways between the diaphragm and its casing may be varied from the number shown and as their number is increased the cross-sectional area of each passageway would, of course, be decreased so that for a relatively high number of passageways the arrangement would approach the situation where the rear side of the diaphragm would be separated slightly from the contiguous face of the casing so as to define a single restricted passageway coextensive with the entire area of the rear face of the diaphragm and thus define a minimum of free space between the diaphragm and its casing.

In the form of the invention illustrated in Figures 7 and 8, a circular porous refractory diaphragm 20 is employed. The operating face 21 of this burner is relatively flat and the face 22 opposite thereto, is of conical configuration. The diaphragm is carried by a casing structure 23 of similar shape to the diaphragm and a conduit 24 communicates with the central conical portion thereof.

When a combustible mixture of fluid fuel is supplied by way of the conduit 24, the relatively thicker central portion of the diaphragm impedes the flow of fuel through the diaphragm in a direction parallel to the axis of the conduit and thus serves to distribute the fluid fuel uniformly throughout the area of the operating face 21 of the burner.

Figure 8 illustrates another modification of the invention in which the burner is provided with an annular porous refractory diaphragm 25 carried by a casing structure 26 of annular configuration. A conduit 27 communicates with the interior of the casing structure centrally thereof. The diaphragm 25 is provided with a porous disk 28 inserted above the outlet of the conduit 27 and this disk is spaced a slight distance above the bottom wall of the casing structure 26 to facilitate the uniform distribution of the fluid fuel over its area.

The porosity of the disk 28 is slightly greater than the porosity of the diaphragm 25 and because of this, it operates to equalize the fuel pressure throughout the diaphragm, and in this manner, insures uniform heating throughout the entire area of the operating face 30 of the diaphragm.

The use of the insert 28, which is less porous than the rest of the diaphragm, illustrates another modification of the invention in which the indicated portion 28 at the underside of the diaphragm is treated with a material to reduce its porosity, as for example, sodium silicate or any other suitable material which will not be affected by the heat and gases to which it is exposed.

The treated central portion of the diaphragm serves to provide for uniform gas distribution throughout the entire area of the diaphragm in the same manner as it is accomplished through the use of the disk 28.

The burners described herein are also adapted to use fuels other than gas. For example, atomized or vaporized liquid fuels and air may be used in place of the suggested gas and air mixtures.

5 The foregoing description and the accompanying drawing to which it relates, describes what might be termed the preferred modes of practicing the invention. It is to be clearly understood, 10 however, that the invention includes each and every novel feature or combination of novel features herein disclosed, subject only to the restrictions of the prior art, and that the invention may assume other forms and it is not to be limited to 15 the particular and specific structure shown and described herein.

Having thus described my invention what I claim is:

1. A fuel burner comprising a porous refractory diaphragm having a front operating face, a casing structure for enclosing the rear face at least of said diaphragm, said casing structure and said diaphragm having a portion of their opposed faces substantially in contact with each other, conduit means in communication with the interior of said casing structure for supplying a combustible mixture of fluid fuel thereto, a plurality of interconnected passageways communicating with said conduit means and located substantially parallel to the enclosed face of said diaphragm, the sides of said passageways being defined in part at least by said diaphragm so that

a relatively large area of the porous diaphragm is directly exposed to the gaseous fuel in the passageways and the fuel filters through the pores of the diaphragm and is thus substantially uniformly distributed over the entire area of the operating face of the diaphragm and produces a substantially uniform heating effect thereat when the burner is operated.

2. A burner as set forth in claim 1 characterized by the fact that the stated passageways are defined in part at least by the face of the casing structure opposite the rear face of the diaphragm.

3. A burner as set forth in claim 1 characterized by the fact that the stated passageways are formed by and between the opposed faces of the diaphragm and the casing structure.

4. A burner as set forth in claim 1 characterized by the fact that the stated passageways are located between the opposed faces of the diaphragm and casing structure and are defined in part, at least by channels formed in the rear face of the diaphragm.

5. A burner as set forth in claim 1 characterized by the fact that the rear face of the stated diaphragm is substantially in contact with the adjacent face of said casing structure and the stated passageways are located between the aforesaid faces of the diaphragm and casing structure and are defined by channels formed in the face of the casing structure which is in contact with the rear wall of the diaphragm.

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