Nov. 21, 1944. O. C. SCHAUBLE 2,363,266

OIL HEATER

Filed May 30, 1942

Fig. 1.

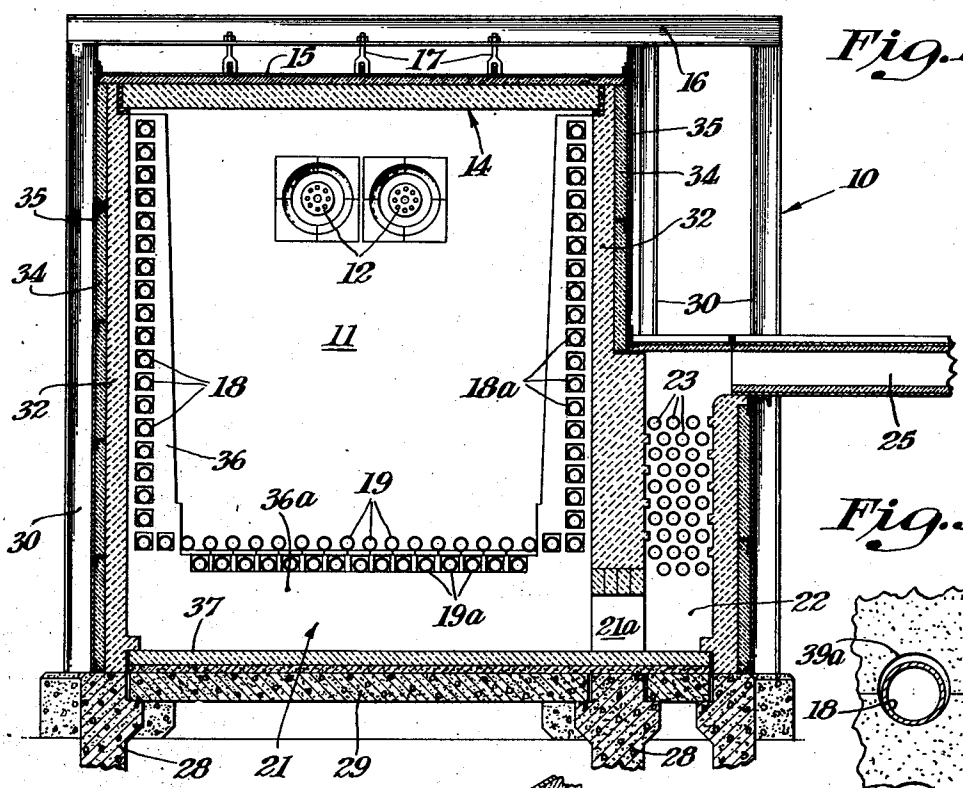


Fig. 3.

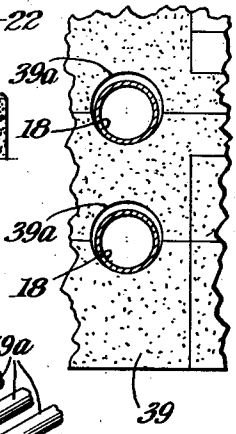


Fig. 2.

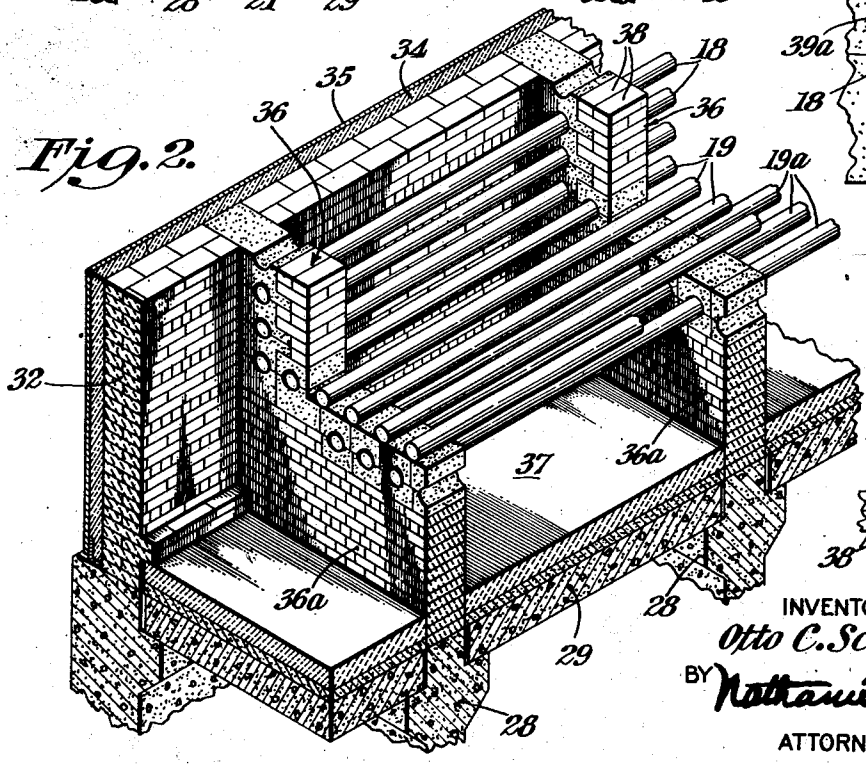
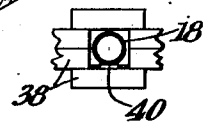


Fig. 4.



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2,363,266

OIL HEATER

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Application May 30, 1942, Serial No. 445,128

2 Claims. (Cl. 196—116)

This invention relates to a heater and is particularly useful for furnaces in which hydrocarbon oils are subjected to pyrolysis. It is more particularly a variation and improvement on the construction shown in the patent to Reed, et al., No. 2,147,609, patented February 14, 1939, particularly with respect to the use of fewer metallic parts.

With oil furnaces of this type, it has become common to have a heat input of the order of 30,000,000 B. t. u. per hour, and a furnace of this type will customarily have tubes which are of the order of 20 to 40 feet in length supported around the walls of a chamber which will be of the order of 20 feet square cross section, the tubes being of the order of 2½" to 5" in diameter. The weight of the tubes is thus very substantial; with the temperature in the combustion zone varying from 3,000° F. at the burner to a gas outlet temperature of around 1,400° F. from the radiant section, it has been found necessary to use tube supports of a high quality, heat-resistant alloy. In general, it is considered necessary at this time to use alloy steel castings containing approximately 25% chromium and 12% nickel for temperature service above 1,400° F. The weight of the tube support castings is in the order of 10 to 12 pounds per tube supported, and the total weight of castings as well as the cost is thus very substantial.

It is not only desirable to eliminate the expense of these castings, but, at the present time, due to war emergency, it has become increasingly difficult to obtain the chromium and the nickel, and efforts have been made to find a substitute which will be substantially as effective and which will use less metal of the high quality type. However, with average temperatures from 1,400° F. to 2,100° F., it is substantially impossible without heat-resisting alloys to reduce the amount of metal.

It is the principal object of this invention to provide built-up ceramic pilasters of standard or special shapes for the support of the radiant-heated elements in the combustion chamber of a furnace, such pilasters being adapted to freely receive the heat-receiving elements so that removal and replacement are readily accomplished.

Another object of the invention is to provide an improved arrangement of the radiant and convection sections of an oil heater in which a greater proportion of the load of the tubes is carried directly by the foundation so that a smaller amount of alloy metal is used and so that the overhead structural supports may be materially reduced in size.

A still further object of the invention is to provide an improved arrangement of an oil heater in which a plenum chamber is mounted below the radiant section with an intermediate row of radiant tubes extending across the gas exit from the radiant section, such radiant tubes and plenum chamber aiding to distribute the flow of gases uniformly across the gas exit.

Further objects and advantages of my invention will appear from the following description of a preferred form of embodiment thereof taken in connection with the attached drawing, in which:

Fig. 1 is a substantially central vertical cross section through the improved form of heater;

Fig. 2 is a perspective view of a detail of the lower part of the furnace;

Fig. 3 is a detail cross section of the tube support, and

Fig. 4 is a detail cross section showing a modified form of tube support.

In accordance with my present invention, one preferred arrangement of furnace for the radiant heating of oil tubes is shown in the attached drawing, it being understood that the principles disclosed may be applied to different forms of construction and that the chambers of the furnace may be made in pairs or otherwise, depending upon the number of units and the nature of operations to be carried out. The simple form of furnace 10 shown consists primarily of a radiant section 11, in which fuel is burned by burners 12, which may be located either in an end wall or both end walls or in the roof 14. The roof consists primarily of a ceramic arch suitably supported by metal backing plates 15 with intermediate insulation, such plates 15 being carried by the ceiling beams, 16 through suitable hangars 17. It is, of course, to be understood that the roof is usually made in a plurality of sections and necessary expansion joints will be provided.

The radiant section 11 is provided with side wall tubes 18, which are of a desired size and through which oil is passed in a desired flow path. Customarily, the side wall banks 18 and 18a will be connected in series with the oil introduced at suitable points for the desired heating effect. In addition, the radiant section is provided with at least one row of tubes 19 extending substantially across the gas exit opening from the radiant section. If desired, a second row 19a may also be used, and in such case they will

serve as diffusion baffles to aid in prevention of channeling of the discharge gases, as hereinafter pointed out.

The products of combustion pass across these tubes into the plenum chamber 21 and thence through arches 21*a* to the convection section 22, which is provided with a bank of tubes 23 for preheating of oil or for the generation of steam or for other lower temperature operation so that the products of combustion ultimately discharge at 25 to the stack at a minimum temperature consistent with good engineering practice.

A furnace of this type is customarily supported on concrete foundations or piers 28, between which extend floor beams 29. The structural steel beams 30 extending above the piers 28 carry the ceramic side walls 32 and the insulating medium 34 and the supporting plates 35 as well as the roof 14 and upper beams 16. Suitable panel wall constructions are more particularly shown in the patents to Reed, et al., Nos. 2,144,597 and 2,144,598, patented January 17, 1939, or in my Patent No. 2,222,576, patented November 19, 1940.

The principal purpose of the panel wall construction, besides economically closing the furnace, is to reduce the heat transfer through the walls of the furnace and to use the minimum of wall thickness and the minimum of weight of refractory for this objective.

In accordance with my present invention, and as a specific feature thereof, I support the tubes 18 in the radiant section entirely by ceramic means, as distinguished from the typical alloy castings heretofore used. As will appear from Fig. 2, transverse and vertical piers or pilasters 36 are built across the floor 37 and up the side walls 32, and such piers are preferably of standard refractory 38, the brick in one example being approximately 2½'' high by 9'' long by 4½'' wide. It is possible to build the desired size of pier with such ceramic units and with special shapes 39. These latter may have openings 39*a*, in which the tubes 18 and 19 may be supported, or spaces may be left between the standard shapes 38, as shown in Fig. 4. No other support for the tubes is required. If desired, however, the openings may be provided with flat plates 40 to facilitate movement during expansion of the tubes. These may be of a high chrome, high nickel alloy, but the amount of metal is relatively small.

Preferably, the vertical portions of the piers 36 may be tapered toward the top. It will be apparent that the load is least at the top and the minimum of material is necessary for the desired support. Preferably, the piers 36 also extend as vertical abutments 36*a* transversely across the bottom of the radiant section and, as shown in Fig. 2, these piers are spaced at suitable intervals, as, for example, six feet apart.

The ceramic piers or pilasters, together with the transverse supports for the horizontal bank of tubes, provides an entirely substantial support with no appreciable amount of metal. The openings can be arranged to permit the insertion of the tubes from the ends of the furnace, and, as the load is carried directly to the foundations, there is no appreciable variation in shape or location under heat.

The combustion of the fuel within the radiant section is not materially impeded by the transverse projections of these piers, for the flow of gas is downward and at a relatively low velocity and through the channels of the plenum chamber 21 to the confined convection section 22.

Suitable refractory for the radiant section can be first-quality or super-duty refractory clay brick or special shapes. They are built in pilaster formation to form the supports for the tubes at the intermediate points.

With the lower temperature in the convection section, it is possible to use customary cast iron or low chrome tube supports, and in view of the restricted cross section, the metal supports would be preferred, but such material is not suitable for use in the combustion zone as there is no known substitute for the high chrome, high nickel, heat-resisting alloy to withstand the radiant chamber temperatures.

I have also found an unexpected advantage in this arrangement of furnace, in which the horizontal bank of tubes is placed across the gas exit opening at the bottom of the chamber. It is not only not necessary to shield these tubes, but it is possible to obtain a highly desirable baffling arrangement, which tends to prevent channeling of the gases from the radiant zone. This improves the blanketing effect of the gases on the side wall tubes and reduces the convection effect, which might otherwise be objectionable.

As previously pointed out, a second row of tubes 18*a* below the first row and spaced therebetween can be used with advantage, not only from the standpoint of additional heat input, but also to further reduce channeling effects and to reduce the intertube area so that the aggregate flow area is less than the aggregate intertube area of the portions of the tubes in the first row. It will, of course, be appreciated that suitable tile, as shown in Zimmerman patent, No. 2,147,610, could be used in lieu of the second row of tubes or in addition to them.

While I have shown a preferred form of embodiment of my invention, I am aware that modifications may be made thereto; I, therefore, desire a broad interruption of my invention within the scope and spirit of the description herein and of the claims appended hereinafter.

I claim:

1. An oil heater including a housing defining a radiant heating chamber and a plenum chamber beneath said heating chamber, and with a gas exit from the bottom of the heating chamber to the plenum chamber, said housing having opposite vertical inner side walls, vertical banks of horizontally arranged oil-heating tubes at said side walls and with the tubes of said banks vertically spaced over the areas of the respective side walls, a horizontal bank of horizontally arranged oil-heating tubes transversely spaced in a series between the lower ends of said vertical banks and extending across said gas exit, burner means for fuel combustion within said heating chamber to heat the tubes of said vertical and horizontal banks by radiant heat, vertical ceramic pilasters on said side walls and integrated therewith respectively and located intermediate the ends of said tube banks and in opposition to each other across the interior of the housing and providing support for the tubes of said vertical banks, and a ceramic bridge within the plenum chamber and extending between the lower end portions of the opposed pilasters and continuous therewith and affording intermediate under support for the tubes of said horizontal bank, the opposed pilasters and bridge together forming a U-shaped structure supported at its opposite sides by said

side walls and at its base by the bottom of the housing.

2. In a fluid heater including a housing defining a radiant heating chamber and a plenum chamber beneath said heating chamber, and with a gas exit from the heating chamber to said plenum chamber, the housing having opposite vertical inner side walls, and burner means for fuel combustion within said chamber; vertical banks of horizontally arranged fluid-heating tubes at said side walls and with the tubes of said banks vertically spaced over the areas of the respective side walls, a horizontal bank of horizontally arranged fluid-heating tubes transversely spaced in a series between the lower ends of said vertical banks and extending across said gas exit, vertical ceramic pilasters on said side walls and integrated therewith respectively and located intermediate the ends of said tube banks and in opposition to each other across the interior of the housing and providing support for the tubes of said vertical banks, and a ceramic bridge extending between the lower end portions of the opposed pilasters and continuous therewith and affording intermediate under support for the tubes of said horizontal bank, the opposed pilasters and bridge together forming a U-shaped structure supported at its opposite sides by said side walls and at its base by the bottom of the housing.

OTTO C. SCHAUBLE.