Sept. 15, 1931. T. E. MURRAY ET AL 1,823,117

FURNACE

Filed Nov. 3, 1925

Fig. 1.

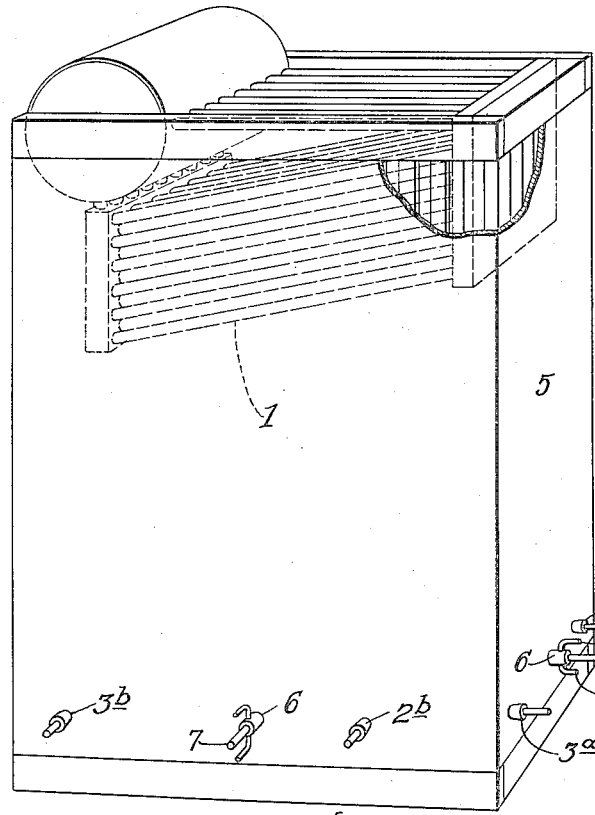


Fig. 2.

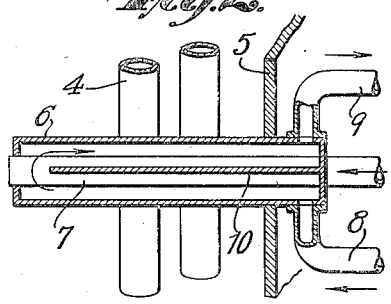
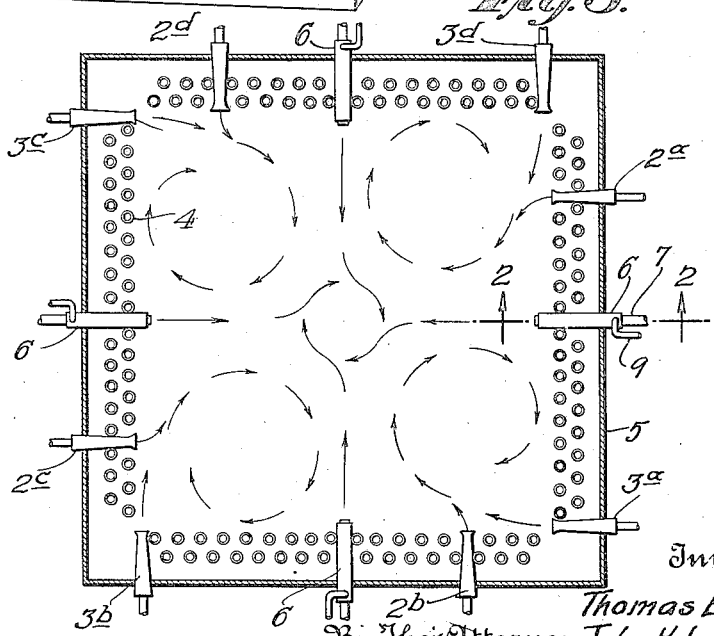


Fig. 3.



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UNITED STATES PATENT OFFICE

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FURNACE

Application filed November 3, 1925. Serial No. 66,616.

Our invention aims to provide certain improvements in furnaces burning pulverized coal, oil, gas or other jet fuel whereby a desirable distribution of the burning gases can be secured and other advantages obtained. The accompanying drawings illustrate an embodiment of the invention.

Fig. 1 is a perspective view of a boiler furnace to which the invention is applied.

Fig. 2 is an enlarged sectional view of one of the nozzles.

Fig. 3 is a horizontal sectional view of a furnace.

In Fig. 1, we have illustrated in dotted lines at 1 a set of conventional boiler tubes supported above the combustion chamber of the furnace, to which fuel is supplied through burner nozzles 2^a and 3^a on one side, similar nozzles 2^b and 3^b on the adjacent side and others similarly arranged on the remaining sides. The drawings show what we believe to be the best arrangement. But the invention may be utilized with various other arrangements, locations and groupings of nozzles.

The invention may be applied to ordinary furnaces with walls of refractory brick or to furnaces with various other types of wall. It is particularly useful in connection with furnaces the walls of which are composed of or lined with water tubes, this being a construction which is fully described in several pending applications of Thomas E. Murray and which is illustrated in Fig. 3. According to this figure the walls are composed of vertical water tubes 4 in parallel rows surrounded by an outer shell 5.

Each jet of gas directed along a side wall is deflected at an intermediate point along the width of such wall by a second jet in a transverse direction. As shown in Fig. 3, for example, the jet from the nozzle 3^a traveling across the face of the wall at the lower side of the figure is deflected by the jet from the nozzle 2^b located about one-fourth of the width of the wall beyond the end of the nozzle 3^a. The same arrangement is repeated at each corner, the jet from 3^b being deflected by that from 2^c, the jet from 3^c by that from 2^d and the jet from 3^d by that from 2^a. The resulting distribution of the gases is indicated roughly by the arrows. The horizontal space is occupied and practically filled by four whirling and, of course, ascending columns of burning gases. Thus the heat is carried into the corners which in a rectangular furnace are comparatively difficult of access and in a furnace of moderate size practically the entire space is well heated. It is as if the combustion chamber were divided into four cells in each of which the volume of gases is separately controllable, and this without the necessity of any walls between the cells. The several whirling columns may be made larger or smaller by shifting the position of the nozzles 2^a—2^d with respect to the nozzles 3^a—3^d and by altering the velocity of the jets. Where the whirling columns are small compared with the area of the combustion chamber, additional jets may be introduced near the middle of the walls to supply burning gases beyond the effective zones of the whirls in the four corners. Generally the larger the furnace, the greater the number of jets. While the nozzles 3^a—^{d} are shown parallel to the respective side walls and the nozzles 2^a—^{d} at right angles thereto, the former may be turned more toward the center of the furnace and the latter also turned more or less obliquely.

In Fig. 3 there are illustrated also additional jets introduced near the middle of the walls and extending well beyond the tubes and into a zone where the temperature is very high. In such zones and in fact wherever very high temperature conditions are to be met, it is advisable to use water cooled nozzles as indicated in Fig. 2. Here an outer tube 6 passes through the shell 5 and the tubes 4 of the wall. The tube 7 of the nozzle, carrying a mixture of air and fuel, passes through the closed ends of the outer tube 6. At points outside the boiler wall tubes 8 and 9 connect with the outer tube 6 so as to deliver water and to discharge water or steam therefrom. A diaphragm 10 located at either side of the pipe 7 causes the water to circulate from the outer to the inner end of the tube 6 and thence back to the outer end. Va-

rious other arrangements may be adopted for cooling jackets around the nozzles.

The provision of a cooling jacket for fuel nozzles is not claimed in the present application.

The directing of a second jet of fuel transversely against the first has certain important advantages independently of the production of whirling columns of burning fuel. The jet from the nozzle 3^a, for example, strikes that from the nozzle 2^b near the end of the latter and deflects it and retards its movement forward. The result is to cause a more thorough mixing of the fuel with air at the point where the fuel emerges from the nozzle 2^b and thus to accelerate combustion at this initial point of the jet.

In the ordinary arrangement of nozzles, the fuel is projected to a considerable distance from the nozzle at such a high velocity that there is little or no combustion for a substantial distance. The transverse jet (from the nozzle 3^a, for example,) causes a deflection, mixing and extra heating of the fuel (from the nozzle 2^b), so as to reduce the distance which the fuel travels before it is efficiently ignited.

The result of such a combination of nozzles, therefore, is to secure a quicker complete ignition and a more complete combustion of the fuel in the combustion chamber.

Various modifications of the embodiments disclosed may be made by those skilled in the art without departing from the invention as defined in the following claims.

What we claim is:

1. A furnace fired with jet fuel having a nozzle arranged to direct a jet substantially along a wall of the combustion chamber and a second nozzle arranged to direct a second jet transversely against the first, the said arrangement being repeated at intervals around the furnace so as to produce in the combustion chamber a plurality of whirling columns of burning fuel.

2. A rectangular furnace fired with jet fuel having in each corner of the combustion chamber a nozzle arranged to direct a jet substantially along a wall of said chamber and a second nozzle arranged to direct a second jet transversely against the first so as to provide separate whirling columns of burning fuel in the several corners of the furnace.

3. A furnace the sides of the combustion chamber of which comprise walls of water tubes, said furnace being fired with jet fuel and having a nozzle arranged to direct a jet substantially along a wall of the combustion chamber and a second nozzle arranged to direct a second jet transversely against the first, the said arrangement being repeated at intervals around the furnace so as to produce in the combustion chamber a plurality of whirling columns of burning fuel.

4. A furnace structure as defined in claim 1 in which additional nozzles are arranged to project fuel into the spaces between the whirling columns.

5. A boiler furnace fired with jet fuel having a nozzle arranged to direct a jet of fuel into the combustion chamber, a second nozzle arranged to direct a second jet of fuel transversely against the first near the end of the first nozzle so as to deflect the first jet and accelerate the mixing of the fuel with air and its ignition at a point close to its origin, the walls of the combustion chamber in the immediate vicinity of the two jets being composed of steam generating water tubes.

6. A boiler furnace fired with jet fuel having adjacent walls extending in different directions and having a nozzle passing through one wall and arranged to direct a jet of fuel along the second wall, and a second nozzle passing through the second wall and arranged to direct a jet of fuel transversely against the first jet near the end of the first nozzle so as to deflect the first jet and accelerate the mixing of the fuel with air and its ignition at a point close to its origin, both walls being composed of steam generating water tubes.

In witness whereof, we have hereunto signed our names.

THOMAS E. MURRAY.
JOHN H. LAWRENCE.