March 19, 1946. W. G. NOACK 2,396,875

FIRING ARCH FOR FURNACES

Filed Nov. 1, 1943

Fig. 1.

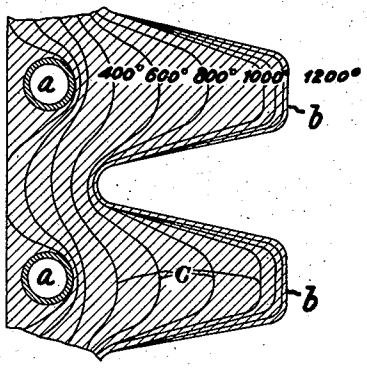
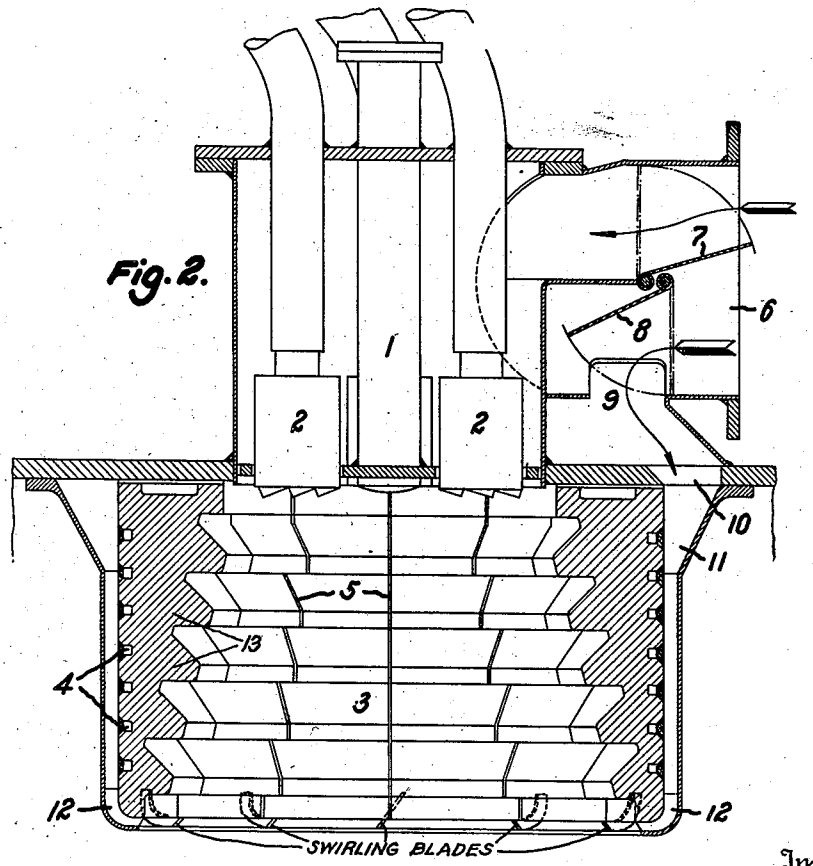


Fig. 2.



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Patented Mar. 19, 1946

2,396,875

UNITED STATES PATENT OFFICE

2,396,875

FIRING ARCH FOR FURNACES

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Application November 1, 1943, Serial No. 508,607
In Switzerland November 19, 1942

5 Claims. (Cl. 110—28)

In order to ensure that in furnaces the fuel bed becomes rapidly heated up and that combustion is certain to occur, and furthermore to enable the ignited fuel to develop heat rapidly, the fuel bed is protected against radiation losses by covering it with a so-called firing arch. This firing arch is always made of fire-proof bricks which not only have a heat insulating effect but due to their mass also serve to store the heat. In ordinary furnaces, particularly with fire grates, the mass of the firing arch is relatively large compared with the heat produced by the amount of fuel lying opposite to the firing arch. The heat storage capacity of the firing arch thus tends to maintain the temperature, that is to prevent the flame from extinguishing, despite the low conductivity of its brick material. With highly loaded combustion chambers, such as are usual in pressure fired furnaces, this is, however, not the case. With such furnaces it may happen that the amount of cold fuel mixture is so large that if there is a momentary reduction in the heat generation the surface of the firing arch cools more rapidly than it is possible for heat to flow from the interior of the heated brick firing arch. The result is that the firing arch becomes even cooler and the flame extinguishes entirely.

It is therefore proposed to construct the firing arch of metal, preferably iron, which for the same cubic capacity has more than twice the heat storage capacity and about a fifty times greater heat conductivity than fire brick. These metallic bodies must, however, be so cooled that they fulfill their function as heat storers without their structural strength being affected.

The present invention thus concerns a firing arch for furnaces, particularly pressure fired furnaces, which consists of metallic elements which on the side furthest away from the firing are cooled by a cooling medium such as water, steam, air or the like. According to the invention the form and cooling of these metallic bodies is so arranged that a temperature drop can occur inside of same, which on the side nearest to the firing approaches the melting point of the metallic body and on the side furthest away from the firing approaches the temperature of the cooling medium. The invention is illustrated in the accompanying drawing in which:

Fig. 1 is a diagrammatic illustration of the temperature distribution in a firing arch and;

Fig. 2 is a vertical section through the combustion chamber of a pressure fired furnace.

Fig. 1 of the accompanying drawing shows the temperature distribution in such a firing arch. The ends *b* which are furthest away from the cooling medium *a* reach a temperature which is nearly equal to the flame temperature, indicated as being 1200° whilst those parts which are nearest to the cooling medium remain cool and thus ensure that the structure retains its strength. The lines C marked 400°, 600°, 800° and 1000° mark regions within the firing arch at these temperatures. In practice it has been found that a condition of stability is soon reached, because the inner ends burn or melt away, if necessary, until equilibrium has established itself between the heat supplied and the heat carried away. The cooling medium channels *a* are, as shown in the drawing, either cast with the arch or subsequently produced by machining. The surface of the arch facing the fire can be a smooth conical surface, but it is also an advantage to make it ribbed as shown in Fig. 2 so that small flames can form in the hollows between the ribs, these flames helping considerably to stabilize the main flame.

Fig. 2 shows a firing arch constructed according to the invention for a highly loaded pressure-fired furnace. The combustion chamber in question may for instance belong to a Velox steam generator, gas turbine or some heating device employed in the chemical and metallurgical industries. It is assumed that coal dust is used as fuel. With pressure firing generally very high combustion air velocities are employed, so that the diameter of the burner assembly becomes comparatively small. The firing arch, which is shaped like a hollow cylinder or cone located concentrically to the burner, has therefore correspondingly small dimensions. In Fig. 2 of the drawing 1 indicates the burner support, 2 the individual burners and 3 the firing arch. For cooling purposes feed water or circulating water is used which is forced through the grooves 4. The arch surface facing the flame is in the constructional example under consideration provided with ribs 13 which facilitate the removal of the slag and also the formation of small subsidiary flames. The cylinder is subdivided by means of the joints 5 so that the individual hot parts can expand by varying amounts.

It is not necessary that all the combustion air should be immediately mixed with the fuel. To initiate combustion the primary air used for the transportation of the coal dust is generally adequate. The secondary air is then to advantage entirely or partially supplied to the combustion chamber beyond the firing arch. For this purpose the supply 6 of secondary air is divided into two parts each of which is provided with a valve

7 and 8 respectively, whereby the amount of air to be added in front of or beyond the firing arch can be adjusted. The air which is supplied to the combustion chamber beyond the firing arch passes through openings 9 and 10 into the annular space 11 and from there over swirling blades 12 into the combustion chamber.

The firing arch can be made of ordinary steel, but it is preferable to use a non-scaling material such as molybdenum cast iron.

Since the heating of the firing arch depends on the loading of the combustion chamber the cooling can be regulated so as to maintain the flame. The cooling channels can for instance be arranged in several parallel-flow banks. By disconnecting one or more of these banks of channels the amount of heat which is carried away can be reduced and the temperature in the arch correspondingly increased.

In plants where there is no cooling water available, air is used for cooling purposes. Where superheaters are separately fired, saturated steam is used as the cooling medium.

I claim:

1. Firing arch for pressure fired furnaces operating with powdered fuel consisting of a metal wall enclosing a combustion chamber, means at one end thereof for the introduction of fuel and air, the inner surface of said wall comprising alternate ridges and valleys extending substantially transversely of the direction of flow of gases through the arch, and spaced apart conduits for cooling fluid in heat transfer relation to said wall adjacent the outer surface thereof, said cooling conduits being positioned opposite said ridges.

2. Firing arch as defined in claim 1 in which the ridges and valleys extend around the wall in planes perpendicular to the axis of the cylinder.

3. Firing arch as defined in claim 1 in which the surface of each ridge adjacent the means for supplying fuel slopes inwardly and away from said means.

4. Firing arch as defined in claim 1 in which the surface of each ridge adjacent the means for supplying fuel slopes inwardly and away from said means and the surface of each ridge remote from said means lies substantially in a plane perpendicular to the axis of the cylinder.

5. Firing arch as defined in claim 1 in which the outer surface of the wall is enclosed by a second wall spaced apart therefrom, and means for passing air through said space and delivering it into the gases issuing from the space within said wall.

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