

No. 801,977.

PATENTED OCT. 17, 1905.

W. L. FORSTER.
FURNACE.

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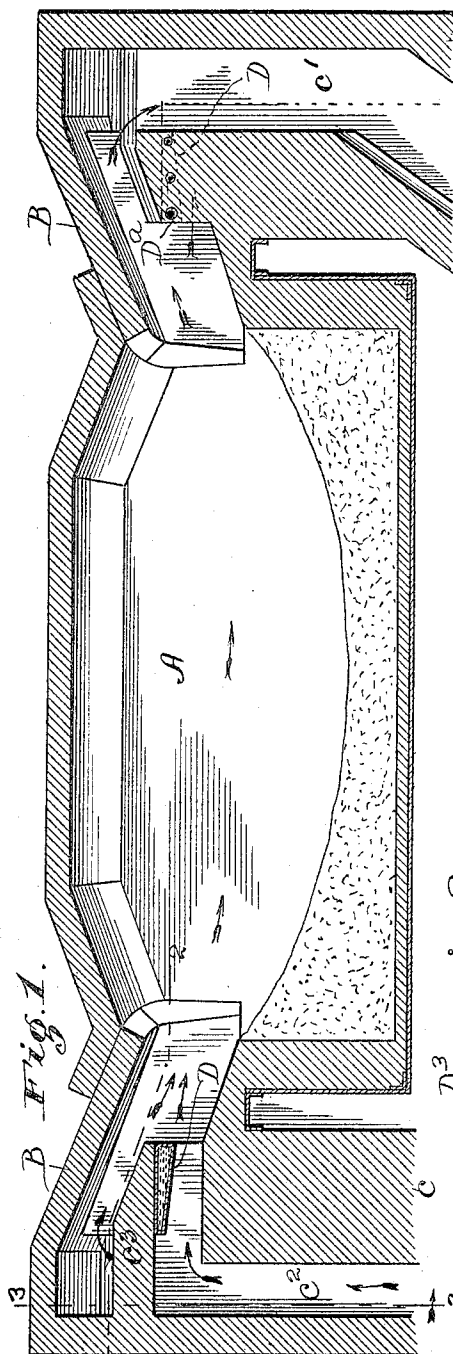


Fig. 1.

Witnesses:
Chas. O. Sturwey
Russell W. M.

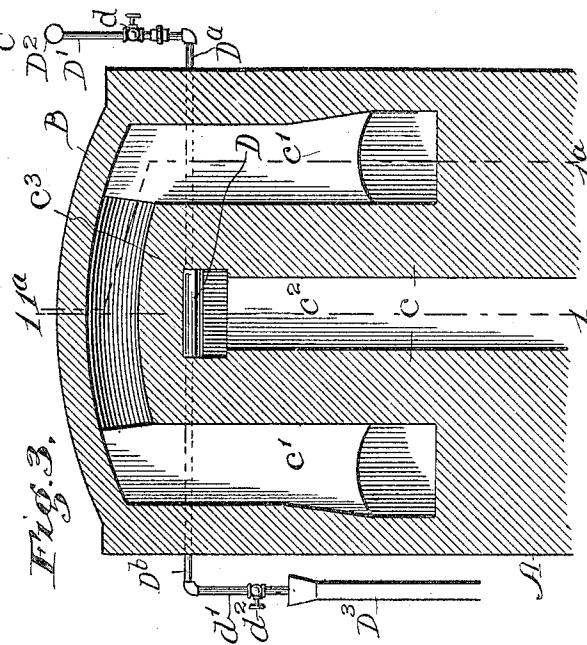


Fig. 3.

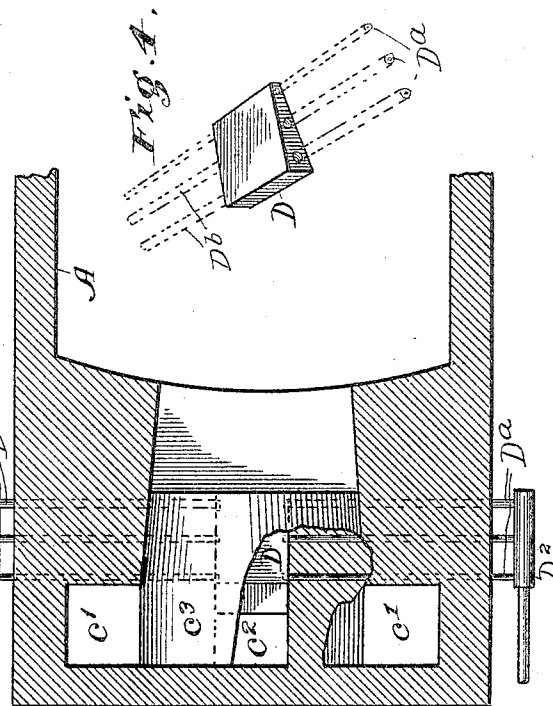


Fig. 4.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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FURNACE.

No. 801,977.

Specification of Letters Patent.

Patented Oct. 17, 1905.

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To all whom it may concern:

Be it known that I, WILLIAM L. FORSTER, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to certain new and useful improvements in furnaces; and its object is to produce a device of this class which shall have certain advantages which will appear more fully and at large in the course of this specification.

To this end my invention consists in certain novel features of construction, which are clearly illustrated in the accompanying drawings and described in the specification.

In the aforesaid drawings, Figure 1 is a longitudinal section through an open-hearth furnace embodying my construction, the section at the left-hand end of Fig. 1 being in the line 1 1 of Fig. 3 and the section at the right-hand end thereof being in the line 1^a 1^a of Fig. 3. Fig. 2 is a section in the line 2 2 of Fig. 1, and Fig. 3 is a section in the line 3 3 of Fig. 1 looking in the direction of the arrow.

The furnace herein illustrated is of the type known as "open hearth," and it is for this type of furnace that my invention is particularly designed; but it could be used with the so-called "heating-furnace," the object of which is to heat iron and steel ingots preparatory to forging rather than to produce steel, as is done with the furnace herein illustrated. In both these types of furnace the two ends are substantially duplicates, each having an air-inlet and a gas-inlet, and in practice the air and gas are let in at one end for a certain period of time, burning in the body of the furnace and passing out through the air and gas inlets at the other end of the furnace, the burning and burned vapor being passed through suitable valves to chambers commonly called "regenerators," which they heat to a high temperature before passing up the stack. After the furnace has been used for a certain period with the vapor passing in one direction the gas and air are shut off at one end and admitted at the other, passing through the regenerators and being intensely heated before being introduced into the furnace. It is owing to the fact that these regenerators are heated by the exhaust-vapor and are

cooled down by the incoming vapor that it is necessary to reverse the action of the furnace from time to time, the reversals taking place in ordinary operations at intervals of about fifteen minutes. It will be seen that the ports of the furnace serve alternately the purpose of inlet-ports for the unburned gas and air and for the burned and burning vapor in an intensely-heated condition.

In describing the construction of this furnace one end only will be particularly described, it being understood that the two ends are constructed substantially alike.

Referring now to the drawings, A is the body of the furnace, in which is placed a quantity of the material to be acted upon, in the case of an ordinary open-hearth furnace this material being iron and suitable carbon-furnishing material for the production of steel.

B indicates an arch which opens into one end of the furnace, this arch being inclined downwardly, so that vapor passing down it will be deflected into the lower part of the furnace. At the rear end of this arch is a rear wall C. In front of this wall are two longitudinally-extending walls *c*, Fig. 3, which divide the space immediately inside the rear wall into three flues *c'* *c'* *c''*, the flues *c'* being at the two sides of the flue *c''*. The two walls *c* are surmounted at their top by an inner arch *c''*, which covers the top of the center flue *c''*. This arch lies within the outer arch B and has its upper surface substantially parallel therewith. It will also be seen that the two side flues *c'* *c'* communicate with the space above this arch, so that vapor passing up the side flues will pass out under the arch B above the inner arch *c''*, while vapor passing up the center flue will pass underneath this arch, and the two streams of vapor will mix immediately beyond the forward edge of this inner arch. Immediately below the forward edge of the inner arch *c''* is situated a hollow wedge-shaped metallic shield D, adapted to receive and hold a body of water. This shield, it will be noted, has its upper surface in continuous contact with the flat lower surface of the inner arch *c''*, said upper surface of the shield being adapted to form a support for the arch, as will be hereinafter set forth. A plurality of pipes D^a run through the walls of the furnace and enter one side of this shield, the opposite ends of the pipes D^a being connected by suitable pipes D', having valves *d*,

with a supply-pipe D^2 . Similar pipes D^b lead from the opposite side of the shield D and are connected to outlet-pipes d' , having valves d^2 . Below the ends of these outlet-pipes is a suitable trough or basin D^3 , connected to a suitable sewer pipe or the like. It is to be noted that the larger end of the wedge-shaped shield is situated at the point of the arch, so that the bottom surface of this shield has a slanting surface sloping toward the center of the furnace.

In operating my improved furnace the gas passes up through the center flue c^2 and out under the inner arch c^3 , and the air passes up the side flues and out above the arch. Both gas and air are very highly heated from passing through the regenerators, as above described, and owing to the intense heat of the furnace and their own heated condition they mix and ignite spontaneously immediately after passing the outer edge of the inner arch c^3 , and in their burning condition they pass down through the space under the outer arch B into the lower part of the furnace-body. The vapor then passes out under the corresponding arch at the other end of the furnace, impinges against the edge of the inner arch at that end of the furnace, and is divided into two parts, one of which passes out through the air-flue and the other through the gas-flue at the other end of the furnace. It will be seen, then, that the entire mass of heated vapor immediately after passing through the furnace strikes against the edge of the inner arch, and this point is therefore the most vulnerable of the entire furnace. Furthermore, it is absolutely essential to the proper action of the furnace that the edge of this arch be maintained at exactly the right position, for the reason that if it is allowed to melt off the gas and air will mix too far up the space under the arch B and will be improperly ignited. Owing to the agitation of the vapor arising from improper ignition, the directing force of the blast will to a large extent be lost, and the vapor instead of being directed down into the bottom of the furnace will rise and strike the top of the furnace just outside the end of the arch B and owing to its intense heat will attack

the furnace at that point, causing it to rapidly go to pieces. To protect this particularly vulnerable point of the furnace, cold water is flowed continuously through the shield immediately under its most exposed edge. The shield cools the vapor immediately in contact with the arch to a certain extent, and it also serves as a shelf which supports any loosened portions of the arch. The peculiar advantage which arises from this wedge-shaped shield lies in the fact that the water within the shield tends to flow by gravity into the end of the shield nearest the center of the furnace. Thus steam is prevented from accumulating in that end of the shield which is most exposed to the heat and forcing away the water from this exposed part. With a shield having a flat lower surface some difficulty might arise through the accumulation of steam at the hot end of the pipe, and this peculiar construction is adapted to prevent this accumulation.

I realize that considerable variation is possible in the details of this construction without departing from the spirit of the invention, and I therefore do not intend to limit myself to the specific form herein shown and described.

I claim as new and desire to secure by Letters Patent—

In a device of the class described, the combination with the body of a furnace and an outer arch at each end of the same, of an inner arch within each of said outer arches, and out of contact therewith, passages for conducting gas to one side of said inner arch and air to the opposite side thereof, a hollow water-shield below said inner arch having a flat lower surface inclined downward toward the exposed face of the arch, and means for conducting water to and from said shield.

In witness whereof I have signed the above application for Letters Patent, at Chicago, in the county of Cook and State of Illinois, this 3d day of February, A. D. 1904.

WILLIAM L. FORSTER.

Witnesses:

LOUISA S. FRENCH,
SAMUEL A. FRENCH.