(No Model.)

J. M. HARTMAN.

IRON NOTCH FOR BLAST FURNACES.

No. 500,386. Patented June 27, 1893.

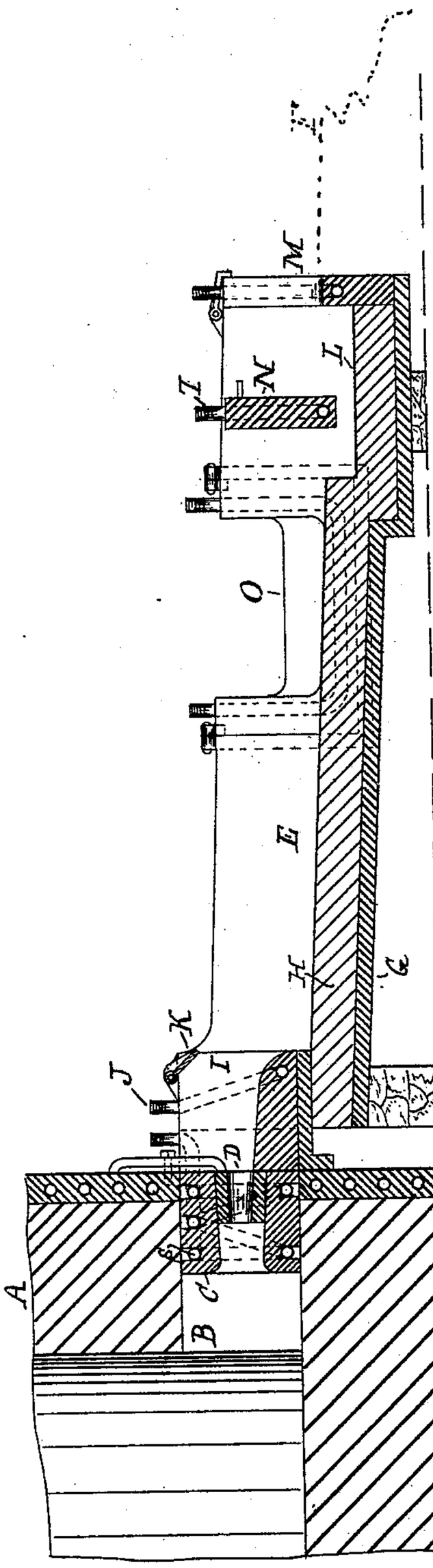

FIG. 1.

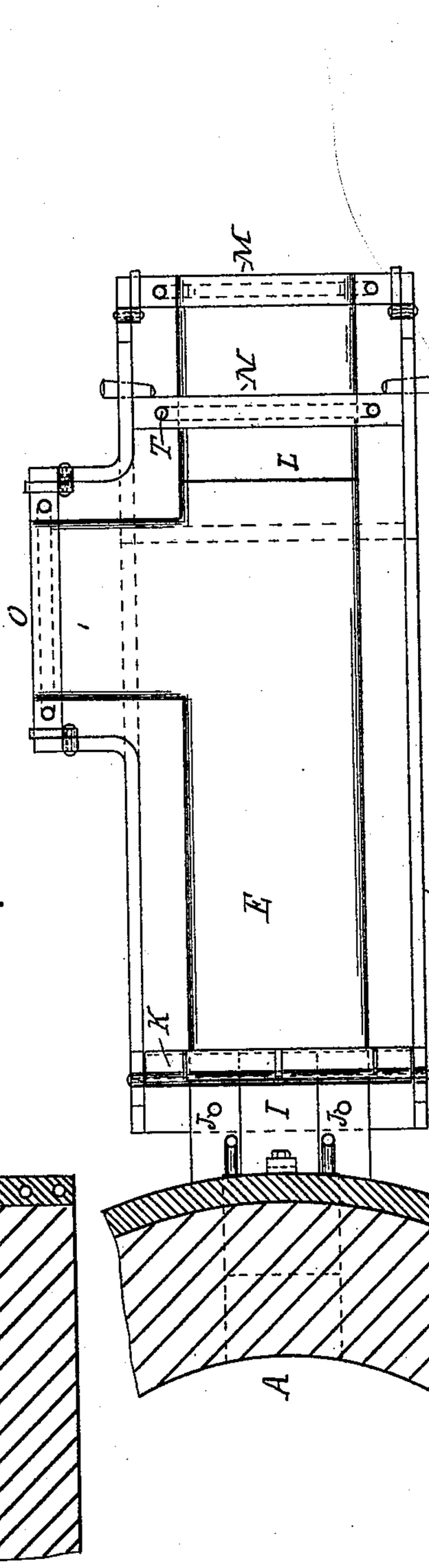

FIG. 2.

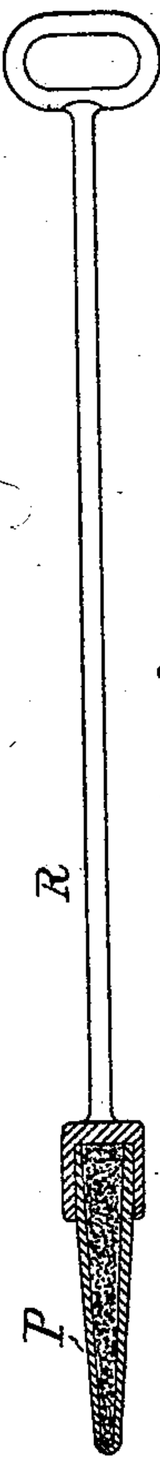

FIG. 3.

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JOHN M. HARTMAN, OF PHILADELPHIA, PENNSYLVANIA.

IRON-NOTCH FOR BLAST-FURNACES.

SPECIFICATION forming part of Letters Patent No. 500,386, dated June 27, 1893.

Application filed December 31, 1885. Serial No. 187,203. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. HARTMAN, of Philadelphia, Pennsylvania, have invented certain new and useful Improvements in the Iron-Notches of Blast-Furnaces and Appliances Used in Connection with the Same, of which the following is a specification.

The following is a specification of my said improvements, reference being had to the accompanying drawings in which Figure 1, represents a vertical section through the iron-notch of a blast furnace and the trough to be used in connection therewith, showing also a partial section through the furnace wall; Fig. 2, is a top or plan view of said trough, showing also a horizontal partial section through the blast furnace wall, and Fig. 3, is a sectional view through the plug or stopper by which the iron-notch is intended to be closed.

As heretofore constructed the iron-notch of the blast furnace, has usually consisted in an opening about eight by twelve inches, which is rammed with clay. When the furnace is to be tapped a hole is drilled or pierced through the clay to permit the escape of the iron. Among other defects, which are incident to this method, is the liability of the iron to rush through rapidly and tear out the hole so large that the iron may escape and run to waste over the ground. Furthermore in modern usage, the tapping of the furnace is frequently performed at very short intervals, as for instance, in cases where iron for the Bessemer process is taken directly from the furnace. With the old form of clay stopping a very considerable length of time is required to properly stop up the iron-notch, and hence this increase of the frequency of tapping involves a serious delay. Among other difficulties that attend the tapping of blast furnaces as now constructed, are the following: When the iron gets low in the hearth, the cinder flows out in considerable quantities along with it and requires to be skimmed off as the iron runs. To accomplish this, it is usual for the workmen to drive down an iron skimmer into the sand, aiming as near as possible to catch the cinder, but let the iron pass. To do this in the midst of the shower of sparks and the gases which issue from the notch, is a matter of danger to the workmen, and under these conditions the adjustment of the skimmer is seldom properly attained, even if possible, while any departure from the proper height for the skimmer, is liable to either dam up the iron, or hence to only partially remove the cinder. Furthermore, the temporary or make shift devices which are commonly used, are not only inconvenient in themselves, but are rapidly destroyed.

My present invention is designed to remedy these defects and supply the needed means in an organized form, which not only enhances their efficiency, but prolongs their life.

In the drawings, A, represents the furnace wall, in which at the proper level, is the opening B, for the iron-notch. The notch is formed in two parts, in an outer block C, secured in the opening B, and an inner bushing D, which constitutes the notch proper. The block C, is provided with a coil S, of circulating pipe through which cold air is caused to flow, the use of water with safety, under such circumstances, being, of course, impossible. The notch D, is made of refractory material, such as firebrick, of nearly pure silicate of alumina. This construction prevents the enlargement of the notch by the wearing of the iron, and makes the flow uniform so as to be properly controllable within the remaining devices to be described.

The trough E, which conducts the iron from the notch to the sand (represented by the dotted lines F,) is formed of a metal shell G, having a refractory lining H. It is slightly inclined as shown, and is provided with a lip or spout I, which fits closely upon the notch D, and which is preferably cooled by means of air flowing through the pipe J. Above this spout, I arrange a hinged metal lid K, of sufficient depth and width to properly protect the workmen from the sparks that fly out from the notch. The trough E, has near its extreme outer end, an offset L, at the bottom, whose purpose will be presently explained, and the gate M, at the end of the trough, has the level of its bottom substantially coincident with the level of the lowest part of the trough on the other side of the offset L. A skimmer or gate N, constructed of metal with an interior coil T, for the circulation of cold air as shown, is arranged entirely across the trough and above the bottom of the offset L, while between the skimmer N, and the fur-

nace, the trough is provided with a lateral discharging spout O, which I prefer also to cool by air circulating as in the other cases. The level of this discharging spout O, is of course above that of the iron gate M.

In Fig. 3, is shown the plug or stopper for the iron-notch, which consists of a thin shell P, of refractory material such as plumbago, filled with sand or some other friable and refractory substance to give support to the sides of the shell. To insert this plug in the notch, it is placed in a socket in the handle R, by means of which it is forced into the notch so as to stop it up.

The operation of the devices is as follows: When it is desired to tap the furnace, the sand or other friable material in the shell P, is picked out and a bar is then thrust through the end of the shell P, so as to break an opening into the interior of the furnace. So long as the shell P remains in position, it forms an inner bushing for the notch D, and aids in preserving it. As the iron flows out from the furnace, it runs down the trough E, and into the offset L, which it fills and then flows out at the gate M, into the sand. When the cinder comes with it, the skimmer N, whose lower edge is arranged somewhat below the surface of the iron stream, effectually dams the cinder and backs it up into the trough E, until it overflows at the side outlet O. The iron, however, owing to the depth of the offset L, is not backed up to any substantial extent by the skimmer N, but flows on freely beneath it and passes out at the gate M. The backing up of the iron, which occurs with the devices heretofore used, gives great trouble owing to the tendency of the iron to chill under such circumstances, a defect which is obviated by the use of my improvements.

Obviously the dimensions, and to a certain extent the position, of the parts just described, may be altered without materially affecting their combined operation, and hence, I do not desire to limit my claim to the exact construction shown. It may also be possible under some circumstances, to use oil instead of air in the circulating pipes as a means of cooling the exposed parts, so that I do not limit myself to either of these means of cooling exclusively.

I am aware that heretofore iron notches have been constructed of metal, with a water circulating coil, cast in their interior and that troughs have been similarly with water pipes cast in their bottom. Such a system however is not sufficient to prevent the notch from cutting down by the rapid flow of melted iron, under heavy pressure; and when such cutting down exposes the water coil, dangerous accidents occur. By the use of a notch, of refractory metal, combined with the block, whose interior has a cold air circulation, this tendency to cut down, is obviated, while at the same time, destructive over-heating is prevented by the air circulation, which moreover, can never become a source of danger.

I am also aware, that the use of solid plugs to close the notch is not new, but such plugs, have no advantage over the ordinary clay stopper.

By the use of a hollow plug, which, when empty, can be readily pierced, but to which the necessary body is supplied by the filling of friable material, I avoid the difficulties which attend the use of the former crude devices, and obtain further advantage that for a considerable period at each tapping, the pierced shell forms an additional shield for the notch.

I do not claim a water cooled notch or trough, nor the use of a solid plug as a stopper, nor the use of a bushing in the notch, nor do I broadly claim, the use of a trough or dam.

What I claim as my invention, and desire to secure by Letters Patent, is as follows:

1. The iron notch of a blast furnace, formed of a block of refractory material with interior annular passages for the circulation of air, in combination with a detachable bushing of refractory material placed within said block and extending inward through the outer face of the furnace, a subjacent trough leading to the sand runner, and a detachable spout also provided with air passages, said spout being arranged intermediately between the iron notch and the subjacent trough, substantially as set forth.

2. In combination with the iron-notch of a blast furnace, a stopper or plug consisting of an exterior hollow shell of hard refractory material and a filling of friable, refractory material, substantially as described.

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Witnesses:
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