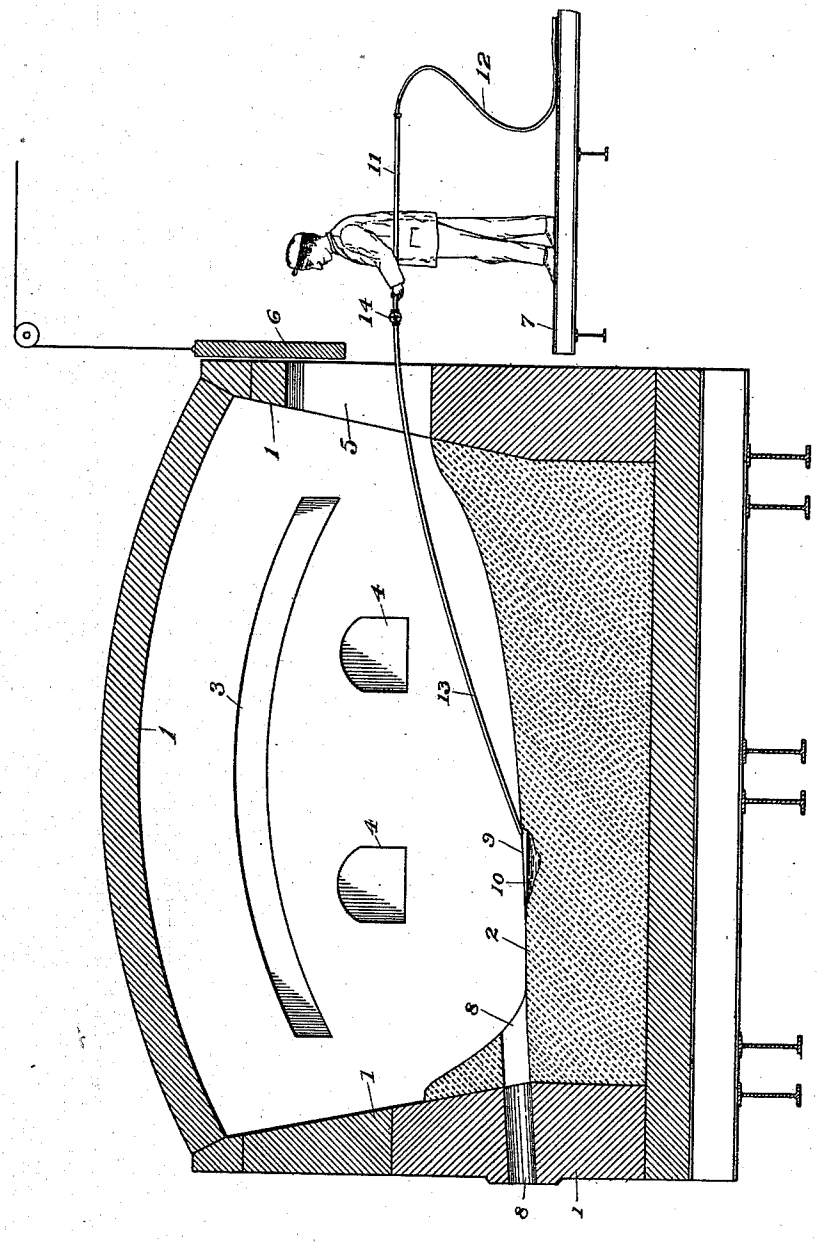
No. 714,565. Patented Nov. 25, 1902.

J. DUNFORD.

FURNACE BOTTOM AND PROCESS OF MAKING AND REPAIRING SAME.

(Application filed Aug. 16, 1902.)

(No Model.)



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FURNACE-BOTTOM AND PROCESS OF MAKING AND REPAIRING SAME.

SPECIFICATION forming part of Letters Patent No. 714,565, dated November 25, 1902.

Application filed August 16, 1902. Serial No. 119,877. (No model.)

To all whom it may concern:

Be it known that I, JOHN DUNFORD, a citizen of the United States, residing at Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Furnace-Bottoms and Processes of Making and Repairing Same; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Although my process may be applied to reverberatory heating-furnaces, pit-furnaces, open-hearth steel-melting furnaces, &c., I will for the sake of simplicity confine my description and illustration to open-hearth steel-melting furnaces, as the other applications will be obvious to those familiar with the art, and while steam or various gases under pressure may be used in conducting that part of my process relating to cleaning out cavities in the furnace-bottom I will confine my description to the use of compressed air for this purpose.

Incidental to the process of manufacturing steel in an open-hearth furnace it frequently happens that the bottom of the furnace is scorified or cut locally, with the result that after tapping the melt therefrom one or more cavities or depressions may be found in the hearth of the furnace. Such cavities or depressions are sometimes of considerable size, and the molten metal or slag held therein should be cleaned out before the necessary repairs previous to the next heat can be made. If the slag or metal is not all removed or drained from such cavities, it is difficult or impossible to secure proper or sufficient cohesion between the refractory material used to repair and fill said cavities and the adjacent portions of the bottom. As a consequence such patches or repairs are raised up or eroded during the following heat, with resulting additional injury to the hearth or furnace-bottom. The process of making the furnace-bottom in the first instance and of cleaning and repairing same afterward is ordinarily known in the art as "making bottom."

Heretofore it has been customary to use rabbles for dashing or cleaning the hot metal and slag out of the depression, and the labor incidental to this procedure is very arduous and expensive. The rabbles are very heavy and cumbersome appliances. A large number of them is required for each operation, and after having been used once each rabble must be dressed by a blacksmith, thus increasing the cost of this operation very largely. The worst defect connected with the use of rabbles is the impossibility of effectively and completely drying and draining the cavities referred to, with the result, as hereinbefore stated, that it may be necessary to repair the bottom very frequently.

My invention remedies all the above-mentioned disadvantages, and a better furnace bottom or hearth results from my improved process of making and repairing same.

In practicing my invention I employ a pressure-pipe carrying compressed air, provided with the necessary valves and connections attached thereto. If after tapping a furnace it is found that there is one or more pools of molten slag or metal in the bottom of said furnace, I introduce the air-pipe into the furnace through the charging-door and place the end of said pipe within or near the hot metal or slag. The air is then turned on, and said slag or metal is ejected much more thoroughly and in a very small fraction of the time required by the ordinary method, outlined hereinbefore.

As can be readily understood, my process is extremely simple and very cheap. Moreover, it is highly efficient, because I can completely drain every cavity or depression of the hot metal or slag contained therein, with the result that the new refractory material placed in said cavities or depressions will adhere to the adjoining portions of the bottom or hearth, which are composed of similar material. Hence the repairs thus made are more permanent and the bottom more homogeneous.

With imperfect cleaning or drainage of the cavities resultant from the old method the refractory repairs are not in direct contact with and sintered to the old bottom, but are separated therefrom by portion of the metal or slag, with the result that said patches or repairs rise with succeeding heats and are de-

stroyed, thus forming the cavity anew, all of which is prevented by my improved process, which thoroughly cleans the cavities.

Another advantage resulting from my improved process is that little cooling of the furnace need occur, as the gas used for heating the same can be kept turned on without interfering with my operation, with the satisfactory result that the furnace is kept hot, and I may proceed with the next heat without delay. This is not practicable when rabbles are used, for it is then necessary to turn off the gas to enable the workmen to see clearly what they are doing and to protect them from the heat, and as the operation takes a long time the furnace is in consequence greatly cooled, thus causing additional delay due to the time required for heating again to the working temperature.

As my process is conducted very quickly and completely, it constitutes a valuable improvement in repairing and making furnace-bottoms. A further and very important advantage of my process is that one man alone can very easily perform the operation of cleaning the furnace-bottom, while if rabbles are used a number of men are required to handle each rabble, thus incurring a considerable expense in labor, which is entirely eliminated by my process.

Having thus given a general description of my invention and its advantages, I will now, in order to make the matter more clear, refer to the annexed drawing, showing a vertical cross-sectional elevation of an open-hearth furnace which forms part of this specification.

1 represents the furnace walls and roof, generally built of refractory bricks.

2 is the bottom or hearth, made of loose refractory material, set or sintered by raising the temperature until the material hardens into a solid mass.

3 is the air-port; 4, the gas-ports.

5 is the charging-opening. 6 is a door for closing said opening, and 7 is the charging-floor or standing.

8 is the tapping-hole, which is placed at the lowest point of the bottom and is closed by refractory material during the melt.

9 is intended to show a cavity or depression such as is sometimes cut in the bottom or hearth of furnaces by the action of the slag or the molten metal and which, for convenience of illustration, is shown situated opposite the tapping-hole, but may be above or on either side thereof. No matter in which portion of the hearth these cavities occur, they can be reached by merely introducing a sufficient length of pipe or by bending the same.

10 represents the pool of molten slag or metal that collects in such cavities and which should be completely removed or drained out before a good repair can be made. In the illustration a man is indicated as holding a high-pressure pipe 11, which is connected at one end to a flexible connection or hose 12, which latter is attached to a compressed-air main. (Not shown.)

13 is a piece of ordinary gas-pipe secured to the pressure-pipe 11 by means of the intermediate valve 14, which regulates the amount of air admitted. The destruction of the pipe 13 may be prevented in part by using a thick wash of lime, in which it is dipped from time to time.

An additional advantage of my process when the gas is left on the furnace is that in the act of blowing the slag or molten metal out of a cavity heat is generated by the action of the compressed air on the hot gas present in the furnace-chamber after the manner of a blowpipe, and the metal or slag is rendered fluid thereby.

In addition to using my process for cleaning out and repairing the larger cavities in the hearth of a furnace, I also use the same during the making of the original bottom, the refractory material for which, in ordinary practice, is deposited in comparatively thin layers, each of which is baked or sintered to the preceding one, this being continued until the bottom is of the required thickness and form. During the process of making the original bottom in this manner soot, ashes, brick-spalls, and other foreign matter may accumulate on the surface of a layer, which will prevent to a certain extent the proper cohesion thereto of the succeeding layer, and to obviate this difficulty I clean the surface by use of my air-jet preparatory to the deposition of another layer, thus permitting the succeeding deposits to come into direct contact with the similar material of prior layers, and thereby become sintered to them, thus forming a solid and practically homogeneous mass without the intervention of foreign matter. This process, therefore, makes a more solid bottom and one which will wear and last much longer than one containing admixtures of foreign material, as can be readily understood.

Having thus given a general description of my invention, what I claim, and desire to secure by Letters Patent, is—

1. The process of cleaning and repairing furnace-bottoms, which consists in the ejection of slag or metal from cavities therein, by the action of fluid under pressure, then depositing refractory material in said cavities and baking or sintering the same.

2. A step in the process of repairing furnace-bottoms, which consists in the ejection of slag or metal from cavities therein by the action of air under pressure issuing from a pipe, the open end of which is inserted in, or directed to said cavities.

3. The process of cleaning furnace-bottoms, which consists in maintaining a flow of gas in the furnace; heating the slag or metal con-

tained in cavities in said bottom and ejecting the same from said cavities, by the action of air under pressure applied thereto.

4. An improved furnace-bottom, the refractory patches or repairs of which are in direct contact with and sintered to the surfaces of previous cavities after said cavities have been freed of slag or metal by the action of an air-blast impinging thereon.

5. An improved furnace-bottom, the various refractory layers of which are in direct contact with and baked or sintered to the surfaces of the previous layers, after said previous layers have been cleaned and freed from foreign material by the action of an air-blast.

In testimony whereof I hereto affix my signature in the presence of two witnesses.

JOHN DUNFORD.

Witnesses:
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