Aug. 13, 1929. H. L. CHARLES 1,724,340

SMELTING FURNACE

Filed Nov. 27, 1926 2 Sheets-Sheet 1

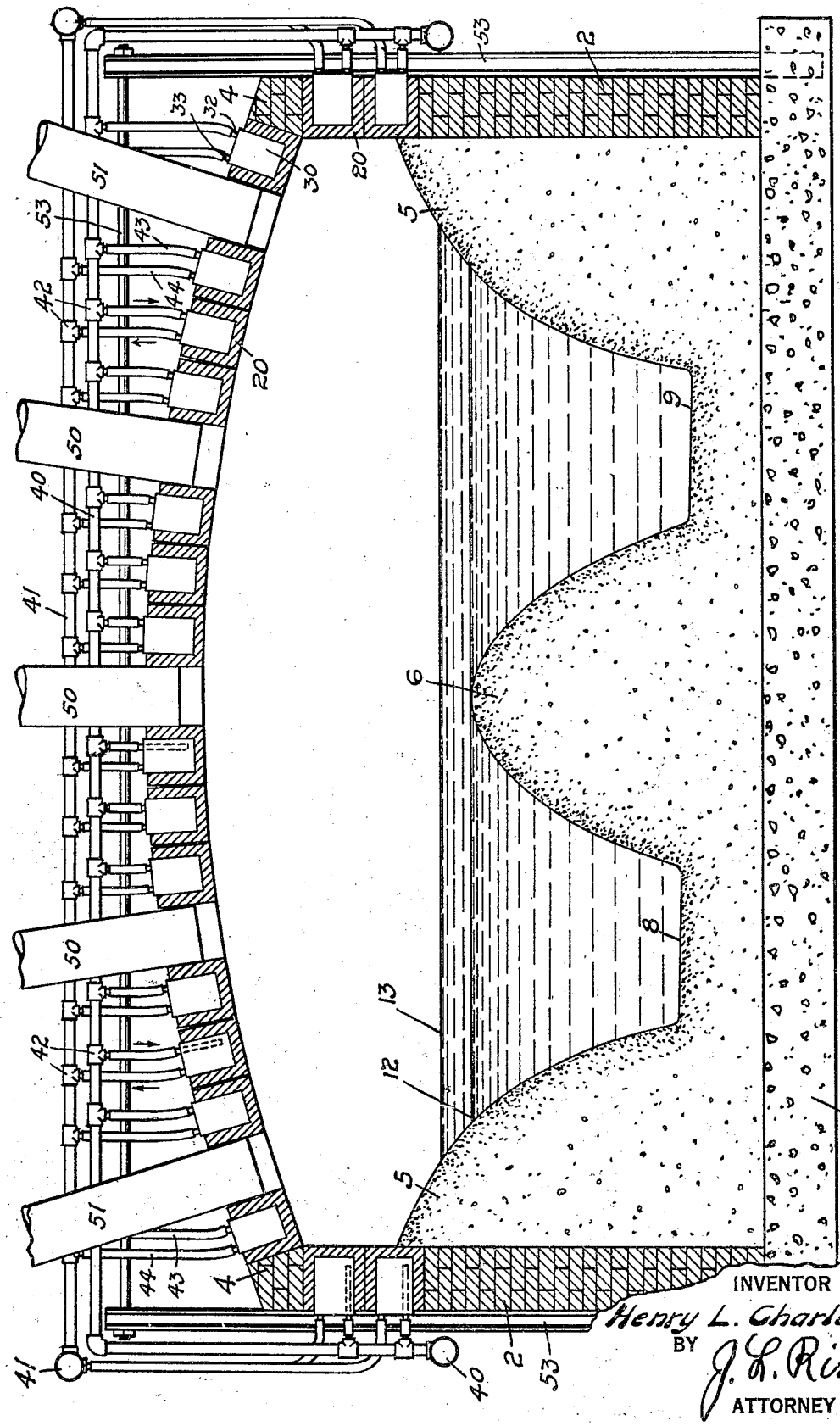


Fig. 1.

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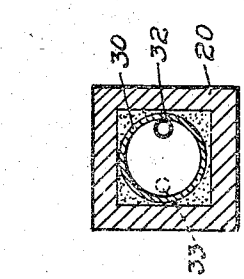


Fig. 5.

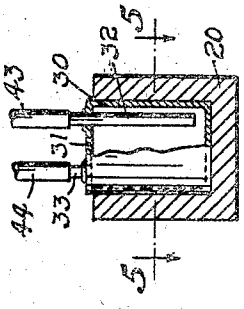


Fig. 4.

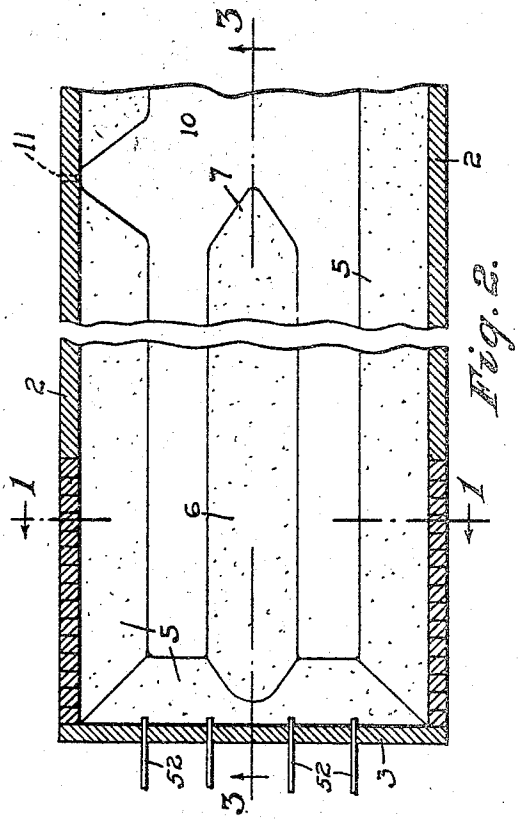


Fig. 2.

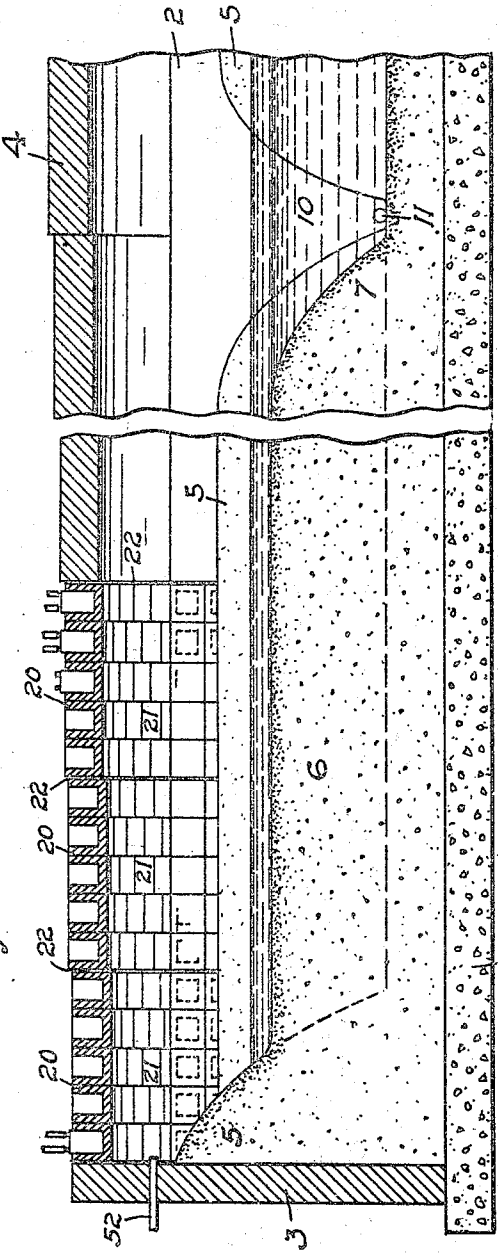


Fig. 3.

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UNITED STATES PATENT OFFICE.

HENRY L. CHARLES, OF KENT, WASHINGTON.

SMELTING FURNACE.

Original application filed December 29, 1925, Serial No. 78,155. Divided and this application filed November 27, 1926. Serial No. 151,264.

My invention has particular reference to improvements in smelting furnaces of the reverberatory type, and its objects, generally stated, are, to provide a series of water-cooled bricks, the utilization of which affords an arch of lighter construction and thinner furnace walls; and, to afford a furnace approximately one-third smaller in size, having the smelting capacity of a reverberatory furnace of usual dimensions adapted to a large output.

In the accompanying drawings—

Figure 1 is a cross section of the furnace drawn on the line 1—1, of Fig. 2;

Fig. 2, a plan view of the same, broken away, the firing end being indicated, but the flue end omitted;

Fig. 3, a longitudinal section through the line 3—3, of Fig. 2;

Fig. 4, a vertical section of one of the hollow cooling bricks, with its cooling chamber inserted; and,

Fig. 5, a cross section of the same drawn on the line 5—5, of Fig. 4.

The base of the furnace 1, constructed of concrete in the usual manner, supports vertically extending and parallel side walls 2, a wall 3, representing the firing end, a flue end, which is of ordinary construction and hence not shown, and an arched roof generally designated as 4.

The hearth shown is the subject of my application for Letters Patent of the United States, Serial No. 78,155, filed December 29th, 1925, of which this is a divisional application, and while the means herein shown and described are particularly useful in connection with such a hearth structure, it will be obvious to those skilled in the art that said means can be as well applied to a furnace having a horizontally disposed hearth, or a hearth of other form.

The hearth, of silicious material, comprises an integral banked section 5, contiguous with each side and end of the furnace, and having its upper terminal near the arch. A mound portion 6, dividing the smelting zone of the hearth into two parts, extends longitudinally of the furnace for about two-thirds of its length, and it is provided at its free end with a pointed terminal 7. 8 and 9 denote channel-like sections disposed between the mound and the banked sections which are adapted to cooperate with said terminal in facilitating the flow of the metal into the metal bath 10 and out through the tap hole 11. The matte and slag lines of the metal bath are denoted by 12 and 13 respectively, showing a deep path, brought close to the arch.

In the ordinary furnace of this class, averaging about 125 feet in length, the width of the side walls ranges from 2½ to 3 feet, with an arch from 18 to 24 inches in thickness. While I do not desire to be limited to specific dimensions, under the construction heretofore and presently to be described, it is practical to reduce the thickness of each wall and of the arch to 1 foot, and reduce the length of the furnace to approximately 75 feet, without a decrease of output.

Adjacent the firing end of the furnace—where the greatest heat is generated—I provide an arch formation of hollow bricks, said bricks being denoted as 20. In the present embodiment of the invention, this formation consists, as shown in Fig. 3, of three sets of said bricks, said sets being designated as 21, as each are of identical construction. Each set constitutes the enclosing roof structure at this portion of the furnace, and, after the first one, is disposed in ascending and stepped relation to an adjacent set, and they are provided with expansion joints 22, as are common in arch construction. In view, however, of the cooling means to be described and which effect a reduction in expansion, these joints may be about one-third as thick as those commonly required. The balance of the arch may be constructed of brick, and in any suitable manner, said stepped relation of the different sections being maintained throughout, as indicated in Fig. 3, to allow for expansion of the gases produced by the smelting operation, and to limit the erosive effect of the gases on the arch.

The side walls and ends of the furnace may be of light and ordinary brick construction, by reason of the protection afforded by the banked sections 5. The upper ends of the side walls, however, directly exposed to the heat in the zone covered by said sets just described, are also built up of the said hollow bricks, as shown in Fig. 1, the same being disposed in the same vertical planes occupied by the similar bricks in the arch. Should the furnace be one in which a hearth of different form is utilized and which would afford but little, if any, protection to the

side walls, it would be desirable, as is evident, to extend this hollow brick construction farther downwardly in said walls.

Each of the hollow brick is adapted to carry a cylindrical container 30, preferably of metal, provided with a top 31. Through one side of the top, a pipe 32 is secured with a watertight connection, its lower terminal extending close to the bottom of the container, and its upper terminal projecting a short distance above the top. On the other side of the top, a nipple 33 also affords communication with the container.

A cold water main 40 and a hot water header pipe 41 are operatively mounted on the furnace for each transversely extending row of brick in the arch and the adjacent brick in the side walls which carry each a container just described, and the same are connected up with the containers through the T's 42 and the rubber tubes 43 and 44, thereby establishing a circulation of water through said containers. As is obvious, if deemed desirable, but one cold water main and one hot water header may be provided for each two rows of the cooling brick, and the adjacent cooling brick disposed in the side walls.

The openings to accommodate the centrally located hoppers 50 and the side hoppers 51, where located in connection with the cooling means, are provided by eliminating a hollow brick for each, as indicated in Fig. 1, otherwise the hoppers, arranged in the relative positions shown and in the required numbers, present the usual construction. The means for firing the furnace 52, and the buckstaves and connections, generally designated as 53, are also of ordinary construction, and perform their common functions.

The cooling means referred to permit a relatively light construction in the walls and roof, thereby reducing the size of the furnace without reducing its capacity, and at the same time adding to its life by limiting the corrosive effect of the smelting operations. As it will be noted, the closed end of each of said hollow brick as laid provides an inner peripheral section of the furnace and the open end provides an outside section of the furnace, hence if the same should become defective, through erosion or otherwise, it can be readily replaced as it is accessible exteriorly of the furnace. Said means, as is evident, may be installed in other sections of the furnace more remote from the firing end than are shown in the present embodiment, and other changes in and modifications of the construction described may be made without departing from the spirit of my invention or sacrificing its advantages.

I claim:

1. In a reverberatory smelting furnace having vertically extending side and end walls and a roof, cooling means located adjacent the firing end, comprising a plurality of hollow brick laid in the roof and in the walls contiguous to the roof, each brick being open at one end and closed at the other, the closed ends providing inner peripheral portions of the furnace and the open ends extending exteriorly thereof, a metallic container mounted within each brick, a cold water main, a hot water header pipe, and means for operatively connecting said main and pipe with each container.

2. In a smelting furnace, an arch construction comprising a set of hollow brick laid transversely of the arch, each brick being open at one end and closed at the other, the closed ends providing inner peripheral portions of the furnace and the open ends extending exteriorly thereof, a plurality of sets of similar construction located in ascending and stepped relation with the first set, relatively thin expansion joints disposed between the sets, a metallic container mounted within each brick, a cold water main, a hot water header pipe, and means for operatively connecting said main and pipe with each container to provide for a circulation of water through the container.

3. In a reverberatory smelting furnace, a brick construction for sections of the furnace subjected to the corrosive effect of smelting operations, comprising a plurality of hollow brick, each brick being open at one end and closed at the other, the closed ends providing inner peripheral portions of the furnace and the open ends extending exteriorly thereof, a metallic container mounted within each brick, a cold water main, a hot water header pipe, and flexible connections for each container with the cold water main and the hot water pipe for establishing a circulation of water through the container.

4. In a smelting furnace having a cooling system, including a cold water main and a hot water header pipe, a plurality of hollow cooling brick, a metallic container detachably mounted in each of said brick, and connections for each container with the main and pipe for establishing a circulation of water through the container.

HENRY L. CHARLES.