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METALLURGICAL FURNACE.

APPLICATION FILED MAR. 30, 1911.

1,042,047.

Patented Oct. 22, 1912.

4 SHEETS—SHEET 1.

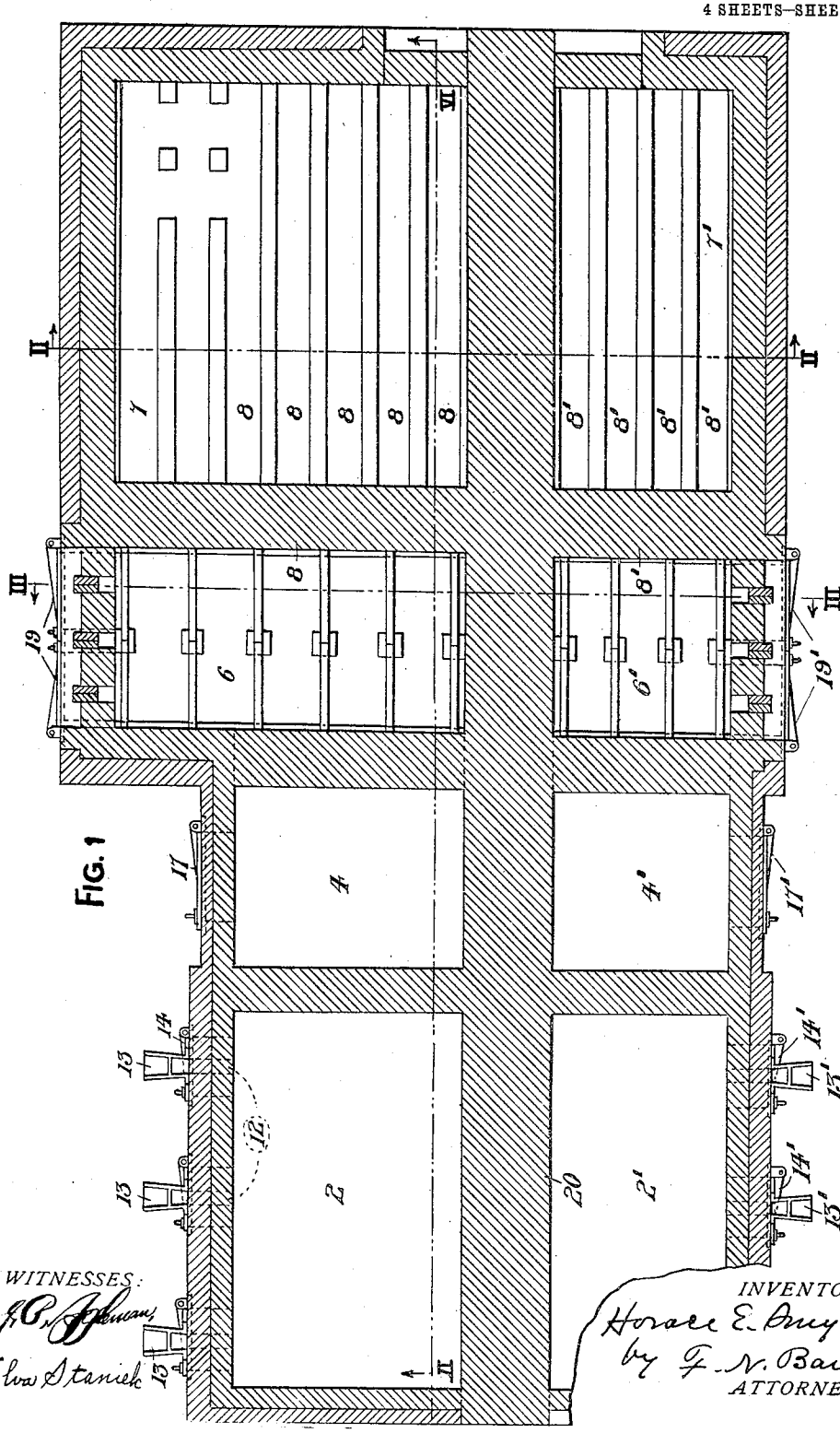

FIG. 1

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4 SHEETS—SHEET 2.

FIG. 5

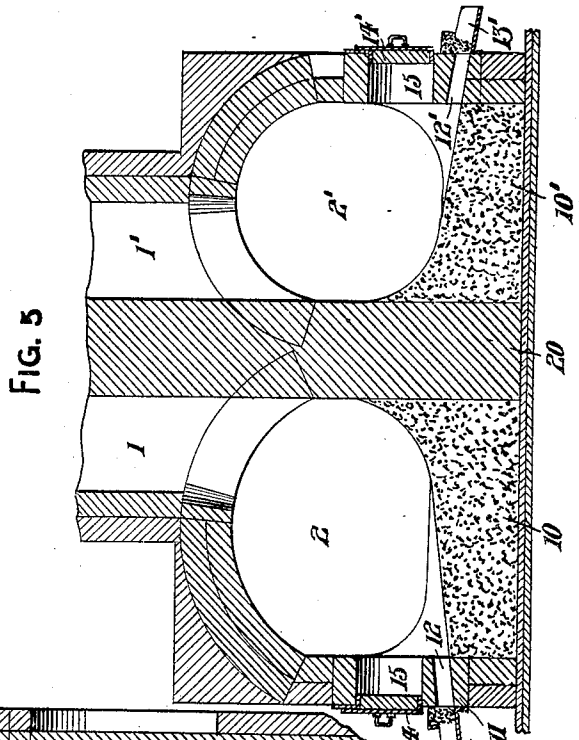
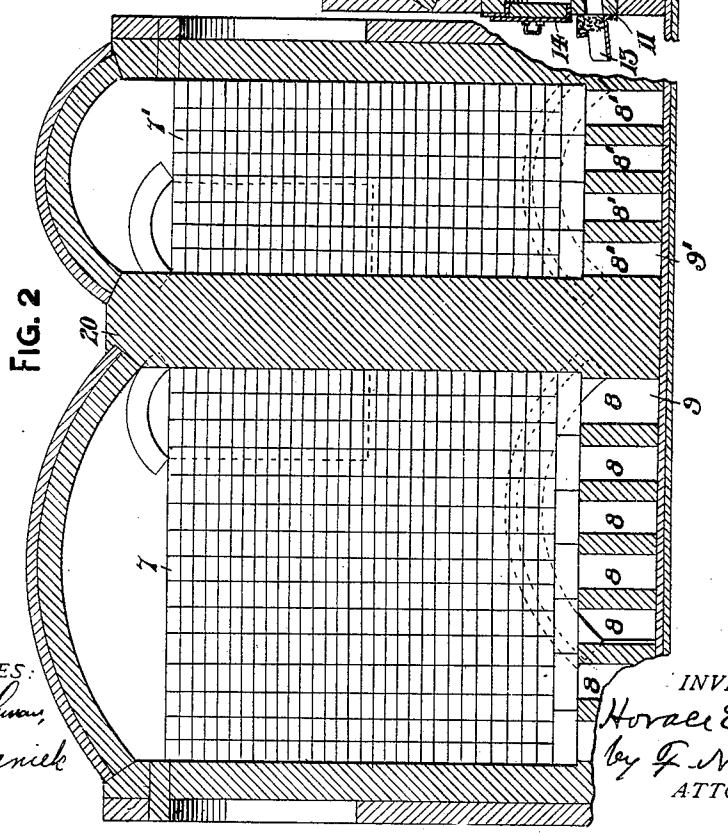


FIG. 2



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4 SHEETS—SHEET 3.

FIG. 4

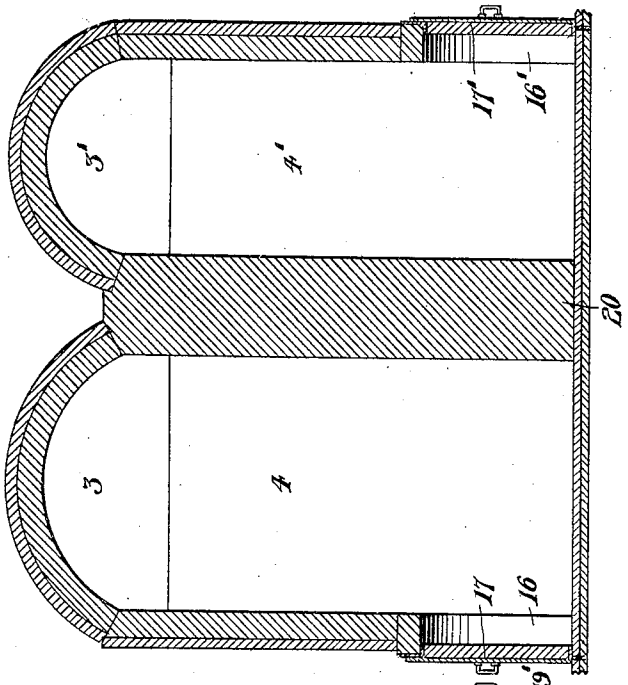
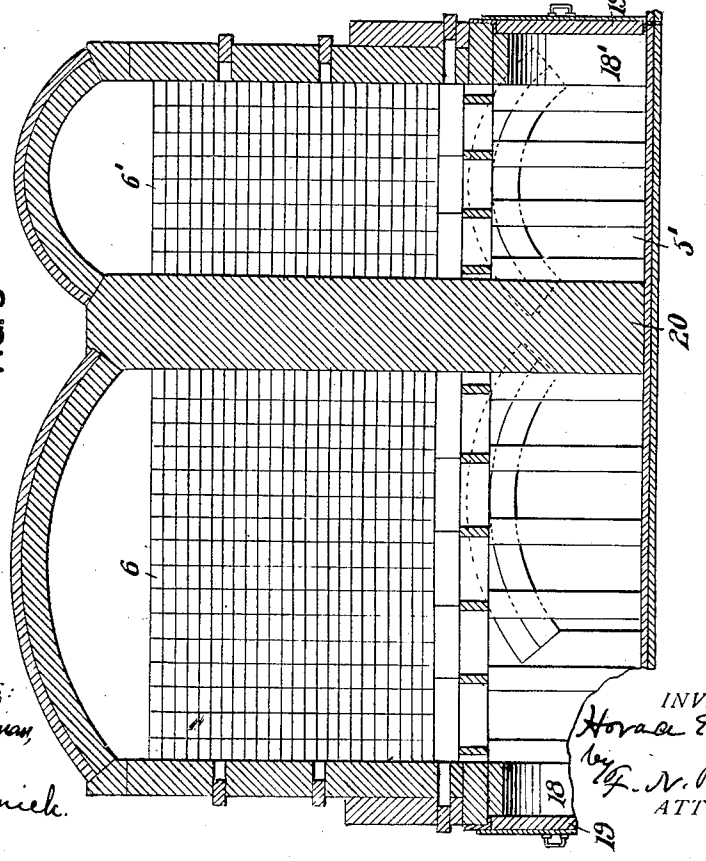


FIG. 3



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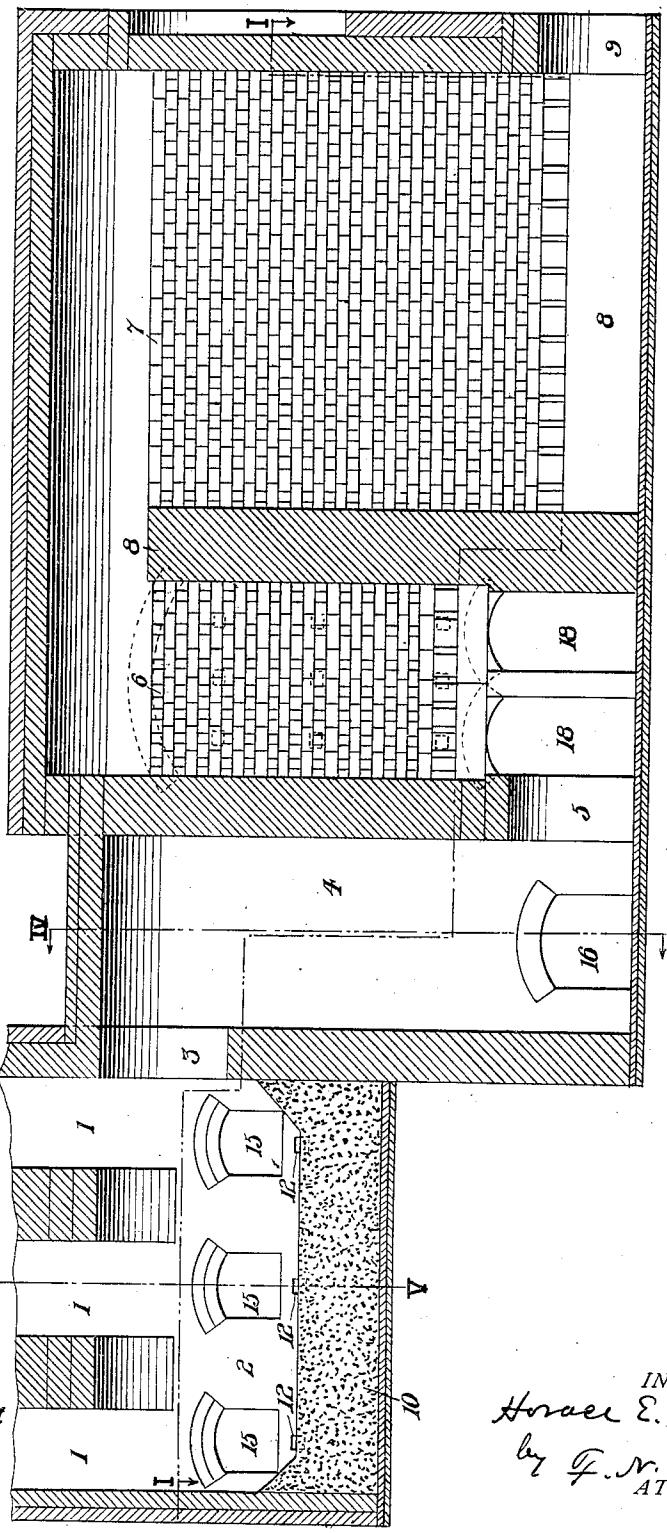
4 SHEETS—SHEET 4.

FIG. 6



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METALLURGICAL FURNACE.

1,042,047. Specification of Letters Patent. Patented Oct. 22, 1912.

Application filed March 30, 1911. Serial No. 617,963.

To all whom it may concern:

Be it known that I, HORACE E. SYMTHE, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Metallurgical Furnaces, of which the following is a specification.

My invention relates to improvements in furnaces, and has especial reference to furnaces of the regenerative type, though portions thereof are applicable to furnaces of other types.

The object of this invention is the removal of the dust, fluxes, metallic substances, and the like from the waste gases issuing from the furnace chamber prior to the down-pass of the said gases through the checkerwork of regenerative chambers. Heretofore, the waste gases laden with dust, fluxes, and the like passed by down-draft through the checkerwork causing the dust, fluxes, and the like to be deposited on the top of the checkers. The high temperature of the burned gases or waste heat fuses the said dust, fluxes, and the like, which percolate over and through the checkers and harden thereon, finally closing the checkerwork passages entirely or to such an extent as to stop or interfere with the passage of the air, gas, and waste gases through the same.

Fuller explanations of the objects of this invention will be given herein after I have described the details thereof.

Referring to the drawings which illustrate only one set of regenerators and the passages and chamber between the same and the furnace ports, the furnace chamber, stack, and reversing valves being omitted, Figure 1 is a horizontal section of Fig. 6 on the line I—I. Figs. 2 and 3 are vertical sections of Fig. 1 on the lines II—II, and III—III, respectively. Figs. 4 and 5 are vertical sections of Fig. 6 on the lines IV—IV and V—V, respectively. Fig. 6 is a section on the line VI—VI, Fig. 1.

Usually regenerative open-hearth furnaces at or over each end of the furnace chamber have heated gas and air passing through one set of hot regenerators or checkerwork chambers into one end of the furnace chamber, where they commingle and burn. The products of combustion pass out of the remaining end of the furnace chamber and through the remaining set of regenerators at or above the said end of the furnace chamber, thereby raising the checkerwork to a high temperature. After the latter checkerwork has been highly heated, the first-named checkerwork having become more or less cooled by the air and gas in their passage to the furnace chamber, the course of the air and gas, and of the waste gases are reversed by the operation of certain well known valves so that the air and gas will be heated by the checkerwork which was heated by the waste gases, and the cooled checkerwork will be heated by the waste gases.

As all the structure so far described is old and well-known I have omitted the furnace chambers and the regenerative chambers and passages at the left-hand thereof. The usual reversing valves, the stack, and the various ports and passages have also been omitted. My description will, therefore, be mainly confined to one set of regenerators and the various ports and passages between it and the furnace ports.

On the drawings, which do not exhaust the various forms which my invention may take, I represent by the numeral 1 vertical furnace ports or passages which lead from the slag pocket or chamber 2 at their lower end to the furnace chamber (not shown). One end of the slag-pocket 2 communicates by the port 3 with the upper end of the down-draft dust-collecting chamber 4 having at its lower end and in the wall opposite that in which the port 3 is located, the port 5. The port 5 opens into the bottom of the up-draft or auxiliary checkerwork chamber 6 separated from the down-draft or main checkerwork or regenerator chamber 7 by the wall 8 above whose upper end there is a free communication between the upper ends of the chambers 6 and 7. Beneath the checkerwork in the chamber 7 are the longitudinal passages 8 which lead to the stack port 9.

By reference to Figs. 5 and 6, it will be noted that the slag-pockets are very shallow as compared with the usual slag-pockets, which reach to a level as low as that represented by the bottom of the chambers 4, 6, and 7. I line the bottom of the slag-pocket with silica sand or other refractory material 10, having its surface slope toward the outer side 11, as shown on Fig. 5, so that the mol-

ten slag will run toward the outer side and through the openings 12 and thence through the spouts 13 associated with the respective openings 12. The bottom of the slag-pocket has its end portions inclined upwardly and outwardly nearly to the level of the port 3 so as to leave as little dead space as possible between ports entering the slag-pocket and the bottom of the same. This construction keeps the slag in the slag-pocket hot and in such condition that it can be removed. When the slag, which is kept by the heat in a liquid state, accumulates sufficiently in the slag-pockets, the opening 12, which is normally sealed with coke, as shown in Figs. 2 and 5, is broken away with a bar, permitting the molten slag to run out. When the slag runs out so as to open the pockets to the air, the opening 12 is again plugged with coke or similar material. The slag-pocket 2 is provided with the doors 14 which close openings 15 in the side 11, so that the doors may be opened and tools or apparatus introduced through the openings 15 to clean the pocket of the more solid or dense fluxes while the furnace is in operation. It is not necessary to stop the furnace to clean out the slag-pocket, since the slag can be drawn off from time to time through the openings 12 and the process assisted and the more solid materials removed by the aid of tools through the openings 15. Heretofore it has been the practice to make the slag-pocket very deep, as before stated, the slag being allowed to accumulate until it became necessary to shut down the furnace and remove the slag. The solid slag is very difficult to get out, it being common to tear out the sides of the pocket to get at the slag, which though exposed is exceedingly hard to remove. It will be seen that the removal of the solid slag is a very slow and expensive process, to say nothing of the loss due to the idleness of the furnace. My slag-pocket 2 is so shallow that its first cost is small and it is not necessary to destroy it to remove the slag, as the slag is always hot and in a condition to be removed as desired. The waste-furnace gases, after entering the slag-pocket, where they deposit the greater portion of their slag and heavy impurities, pass down the dust collecting-chamber 4, at the bottom of which I place the opening 16, provided with the door 17, so that access may be had to the chamber 4 for cleaning out the slag, dust, and other deposits therein and for other purposes. It is not necessary to interrupt the operation of the furnace to clean out the chamber 4. The waste gases then turn and pass through the port 5 into the comparatively open bottom portion of the chamber 6, this portion being provided with the side openings 18, having the doors 19. Except for the said lower portion and the upper portion of the chamber 6, the latter is occupied by checkerwork up through which the waste gases travel. The slag, dust, etc., contained in the waste gases come into contact with the lower courses of the brick of the checkerwork first, which check and collect substantially all the slag and dust remaining in the gases after they leave the chamber 4. As the bricks in the chamber 6 are very hot, the slag cannot harden on the bricks in the chamber 6 but drops down to the floor opposite the doors 19, which may be opened at intervals to permit the removal of the slag and other impurities. The reversal of the draft in the passage 4 also causes the slag and dust therein to be carried to the bottom of the said passage, the checkerwork in the chamber 4 acting as a filter or scrubber and preventing foreign matter from passing through the checkers or regenerators, keeping the same always free, thereby increasing the output of the furnace, effecting a saving of fuel, and prolonging the life of the furnace. When the waste gases pass over the wall 8, they are practically free from slag and dust. Heretofore the waste gases from the slag-pocket have passed horizontally and then downwardly with their burden of slag through the checkerwork of the regenerator chambers, the slag being deposited on the top of the checkerwork and in the passages between the bricks until the passages became so clogged that the furnaces had to be shut down. The slag hardens and cements the bricks together so that a very large proportion of them must be destroyed in taking down the checkerwork. In my invention, the slag and dust are nearly all removed before the waste gases reach the chamber 7, so that there are small or no deposits of slag or dust on or in the checkerwork.

So far I have described only the air passage side of the regenerator. As the gas side has the same construction as that already described it will be unnecessary to repeat the description. Accordingly, corresponding parts on the gas side will be given the same reference numerals as have been applied to the air side except that the numerals on the gas side have the prime mark in addition. The wall 20 is common to the chambers and passages of the air and gas sides of the regenerator.

I claim—

1. In a furnace structure, a slag-pocket, a chamber to receive the waste products suspended in the burned furnace gases which pass beyond the slag-pocket, and means for the removal of such suspended products while the furnace is operating normally or while the furnace is hot.

2. In a furnace structure, an auxiliary checker-chamber and a passage leading from the auxiliary checker chamber to the furnace, a main checker-chamber, communicating with each other at the top, the bottom

of the auxiliary chamber being in communication with the passage leading to the furnace chamber and the bottom of the main chamber having a port serving alternately as an outlet for the waste gases and an inlet for one of the gases to be burned, and means for the removal of the deposits below the auxiliary checker-chamber and for the cleaning of the said chamber while the furnace is operating normally or while the furnace is hot.

Signed at Pittsburgh, Pa., this 28th day of March, 1911.

HORACE E. SMYTHE.

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