No. 121,422. Patented Nov. 28, 1871.

JONATHAN M. ROBERTS - IMPT IN

-FURNACES FOR MAKING STEEL & MALLEABLE CAST IRON-

Fig. I.

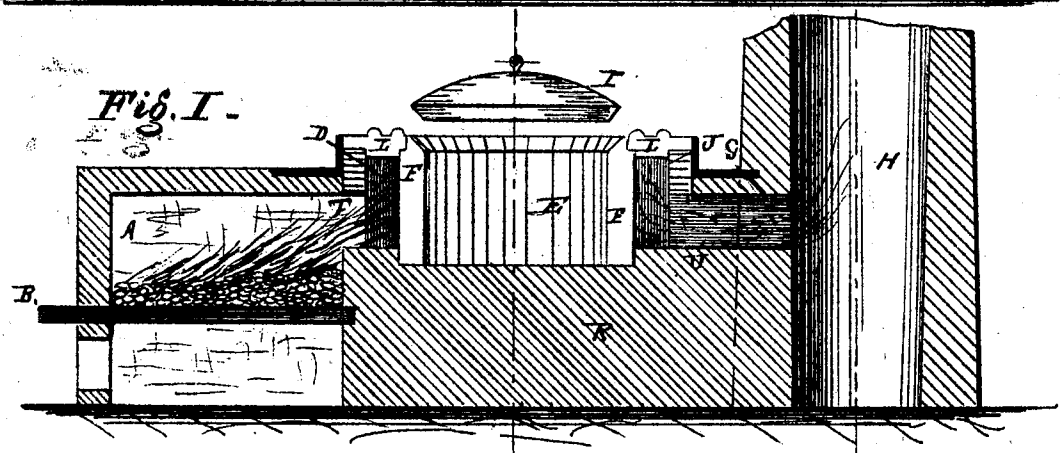


Fig. II.

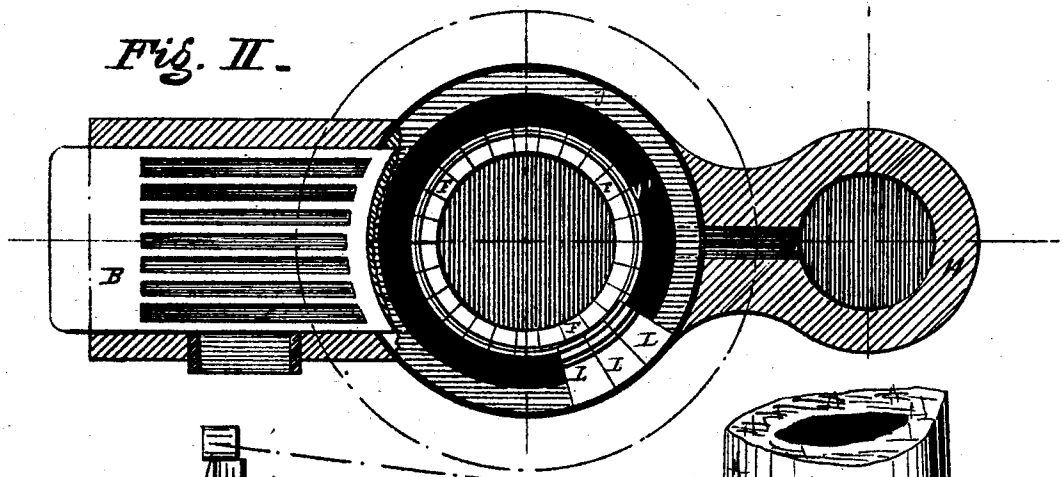
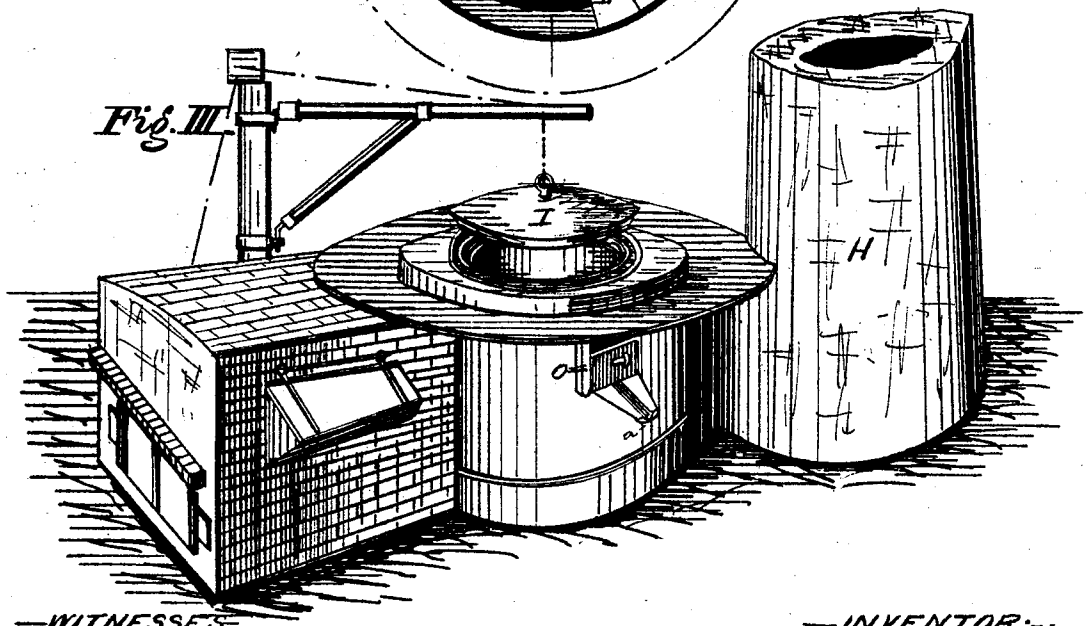


Fig. III.



WITNESSES

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IMPROVEMENT IN FURNACES FOR THE MANUFACTURE OF IRON AND STEEL.

Specification forming part of Letters Patent No. 121,422, dated November 28, 1871.

To all whom it may concern:

Be it known that I, JONATHAN M. ROBERTS, of the city of Burlington, county of Burlington and State of New Jersey, have invented an Improvement in Furnaces for Manufacturing Malleable Cast-Iron and Cast-Steel; and I do hereby declare the following description and accompanying drawing are sufficient to enable any person skilled in the art or science to which it most nearly appertains to make and use my said invention or improvement without further invention or experiment.

My invention relates to the construction of furnaces used for making malleable cast-iron and cast-steel. The object of my invention is to provide the necessary mechanical devices for effecting economically the purification of crude cast-iron and its direct conversion into malleable cast-iron or steel, as may be desired.

The time that is necessary to accomplish this is so great that no furnace heretofore used will admit of the iron remaining in the furnace sufficiently long to complete the purification and conversion of the iron.

In my improved furnace the process may be protracted at the pleasure of the operator without any material loss or deterioration of the product.

For a more particular description of my invention reference is had to the accompanying drawing and letters marked thereon, forming a part of this specification.

Similar letters of reference in each of the figures indicate like parts.

Figure 1 is a vertical sectional view of my invention on a line running through the middle of the furnace from the front to the back of it. Fig. 2 is a view of the top of the furnace with a part of the roof and cover removed. Fig. 3 is a perspective view of the furnace as seen when completed, showing tap-hole, platform for workmen, appliance for removing cover, and the relative position of the fire-chamber, body of the furnace, furnace-neck, and stack.

On a platform or hearth, R, at such an elevation relatively to the grate B of the fire-chamber A as will admit of the most effective action of the heat, I construct a working chamber or crucible, E, of sufficient capacity to work at one heat anywhere from five hundred pounds to ten thousand pounds of crude metal. I prefer to build this chamber E circular, as it is then better adapted to the binding of the furnace and the utilization of the heat. This working chamber E I construct of suitably-formed staves or sectional slabs F F, which must be composed of the most durable fire-proof materials, and must be made long enough to extend at least four inches below the floor of the surrounding heating-passage or chamber D and up through the roof L. The staves F F must be from five to eight inches thick, and when placed together and the intervening joints between them are perfectly luted with good fire-proof cement they will form a durable and tight wall for the working chamber E. The staves F F should also be formed with a rectangular recess on the outer side at the top to receive and support the roof-tile L L; they should also be beveled or chamfered on the inner side at the top, as shown in Fig. 1, so as to give ready access to the working tools when the cover is slightly raised. The wall F F is firmly supported, and bound at top and bottom by the roof-tiles L L and the floor of the surrounding heating-chamber D. Near the bottom of the crucible and opposite the tap-hole door O in the side of the furnace I provide two or more tapping-holes, one above the other, for drawing off the fused scoria as it is formed, and the metal also when the operation is completed. The height of the working chamber E may be varied, but must be sufficient to present an adequate exterior surface to the action of the fire to produce the required temperature within the working chamber—say from fifteen to thirty-six inches high. A movable cover, I, is provided of a shape corresponding with the top or mouth of the chamber E. This cover may be made in one or more pieces, but must be made of good fire-proof materials and be bound firmly with an iron clamp, and be provided with loops, rings, or hooks for attaching the apparatus used in handling it. When this lid I is lowered on the chamber E it should exclude the air, and when slightly raised should form an opening around the edge of it for the convenient introduction of the working tools to all parts of the bottom of the working chamber E. This may readily be done by beveling or chamfering the under part of the edge of the lid to correspond with the chamfered mouth of the working chamber. Around

the working chamber E and at from ten to eighteen inches from the exterior of it I construct the wall of the furnace J of good fire-bricks. The exterior of this wall must correspond with the exterior of the platform or hearth R so as to facilitate the binding of the furnace, which may be readily done by placing upright plates around the body of the furnace and supporting them with strong iron hoops placed above and below the fire-chamber A. From the top of the outer wall of the furnace J heavy fire-tiles are laid across the top of the fire-chamber D and rest in the rectangular recess in the top of the crucible wall F F. These tiles must be formed especially for the purpose, and should be thick enough to resist the heat without sinking down, and to prevent as much as possible the radiation of heat, to the annoyance of the workmen. At the front of the heating-chamber D an opening, T, is left corresponding with the width of the fire-chamber, and high enough to admit of free access of the heat to the wall of the crucible or working chamber and around it. At the back of the heating-chamber D and directly opposite the front opening T another opening, U, is left in the furnace-wall extending the whole height of the heating-chamber D, but which is narrowed sufficiently to partially obstruct the heat current in its passage to the stack. A fire-brick neck or flue, G, corresponding in dimensions with the opening T, leads to the stack H, and connects the heating-chamber with the flue of the latter.

Both the fire-chamber A and the throat or neck G must be securely fastened to the body of the furnace and bound in the ordinary manner.

The furnace must be provided with blowing apparatus and the usual dampers to enable the workmen to regulate the heat. The heat may be produced by the ordinary furnace fires or by gas-furnaces, as may be preferred.

The method of using my improved furnace is as follows: I construct the bottom or working bed in the chamber E of any durable fire-proof compound, such as is used for lining the Bessemer converters or similar purposes. This working bed must be formed so as to receive within it the whole mass of fused materials that will at any time constitute the charge or heat which is intended to be operated upon at one time, and should be made to extend high enough to prevent the molten materials from touching the walls of the working chamber. It must be formed so that the melted metal and slag can all be drawn off through the tap-holes. The furnace is now ready for firing, and this should be done very gradually until every part of the furnace is completely dried and freed from all moisture. The lid or cover D should be kept down or closed until the crucible becomes heated sufficiently to melt cast-iron readily within it. When heated to this point the lid must be raised sufficiently to introduce the crude cast-iron that is to be treated. This may be done by charging broken pig-iron directly into the furnace, or, which is better, either draw it melted from a cupola-furnace conveniently placed for that purpose, or directly from the blast-furnace when it can be conveniently done. When the charge of iron is in the furnace or working chamber and completely fused the work of purification may be commenced.

If the crude iron is poor in carbon and fuses but imperfectly, it may be made to do so freely by adding speigeleisen, Franklinite iron, or any other more highly carbonized iron in sufficient quantities. When the fusion is completed the purification of the iron may be effected by means of any of the oxidizing substances which are used for that purpose, which are to be introduced and intermingled with the molten metal.

Oxide of iron, oxide of manganese, oxide of titanium, wolfram, furnace and hammer slag, and many other substances which supply oxygen largely, may be used to the best advantage in this furnace for oxidizing the impurities of the crude iron and removing them from it.

In addition to the use of the above oxidizing agents atmospheric air may be blown into and through the molten metal by means of a hollow rabble of suitable shape.

While introducing the materials and working the charge the lid D must be slightly raised, in order to do so, but at all other times should be kept lowered or closed.

If the impurities of the iron are very considerable and the supply of carbon in the metal insufficient to produce the required heat in the working chamber E, pulverized carbon, as pure as can be obtained, may be introduced from time to time.

As all action of the air upon the metal in the chamber E is under the control of the workmen the iron may be kept in the furnace without waste or injury as long as may be found necessary for its thorough purification.

If too much carbon be removed from the iron when the work of purification is complete it can readily be introduced by using the necessary quantity of speigeleisen or manganiferous iron. Having attained the condition of purification and carbonization desired, the lid of the crucible must be tightly closed, and the heat of the furnace kept up to the melting point of steel or malleable cast-iron for any length of time that may be required to allow of the complete intermingling of every part of the metal and until it has acquired a uniform and homogeneous condition throughout. When this condition is attained the metal is drawn out through the tapping-hole and cast into ingots for rolling or forging.

This furnace is every way adapted for the successful working of any of the many purifying and carbonizing methods heretofore used, as it embodies the advantages presented by the various furnaces heretofore used, while it avoids their defects.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The crucible E, constructed, as described, of

the slabs F F, held at the bottom by the hearth R and at the top by the tiles L L, as described.

2. The centrally-arranged and circularly-formed crucible E entirely surrounded by the heating-chamber D, as described.

3. The combination of the fire-chamber A, heating-chamber D, and crucible E.

4. The furnace described, provided with fire-chamber A, heating-chamber D with tile L, crucible E with cover I, contracted throat U, and stack H, all combined and arranged as described.

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Witnesses:
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