No. 890,235.

PATENTED JUNE 9, 1908.

J. T. JONES.

METHOD OF FORMING INGOTS.

APPLICATION FILED MAR. 10, 1908.

Fig. 2.

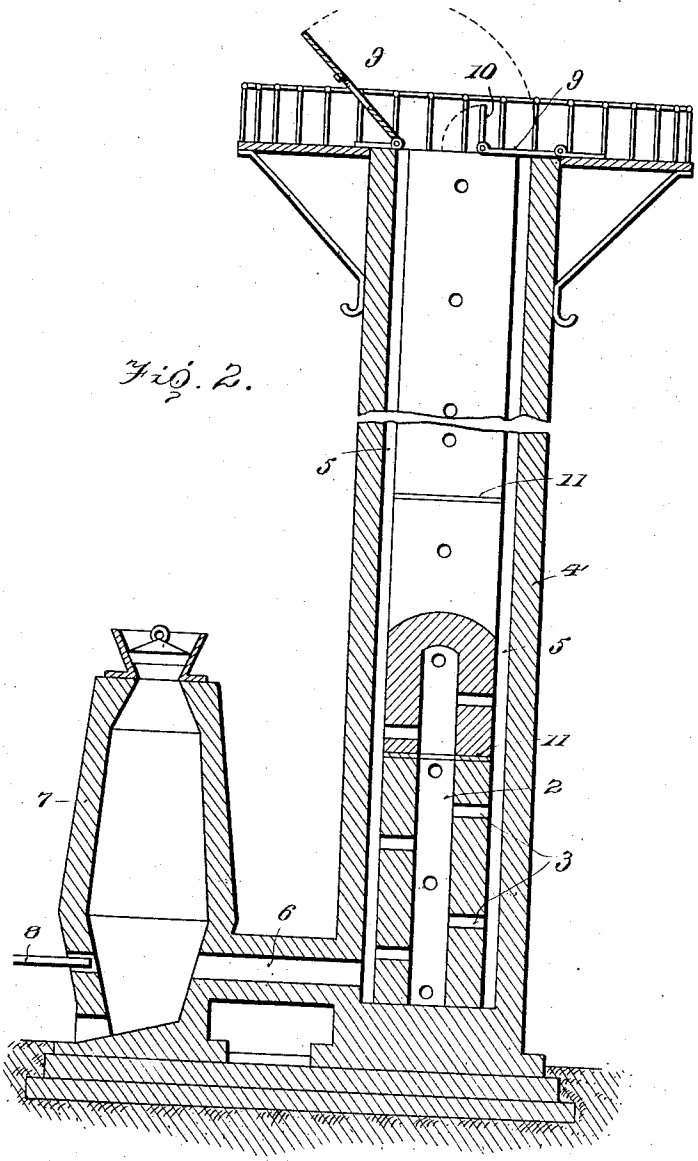
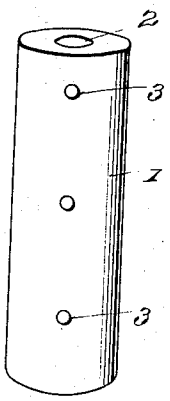


Fig. 1.



Witnesses

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METHOD OF FORMING INGOTS.

No. 890,235. Specification of Letters Patent. Patented June 9, 1908.

Application filed March 10, 1908. Serial No. 420,273.

To all whom it may concern:

Be it known that I, JOHN T. JONES, citizen of the United States, residing at Iron Mountain, in the county of Dickinson and State of Michigan, have invented certain new and useful Improvements in Methods of Forming Ingots, of which the following is a specification.

My invention relates to an improved method of forming ingots, either wrought iron or steel, preferably of large dimensions, say ten to twenty tons in weight which may be employed for the production of large articles of manufacture, such, for example, as armor plates, rails, I-beams, etc., or melted down for other forms of product.

In carrying out my invention I mold a sufficiently large mass of iron ore into a, preferably, cylindrical block with which is incorporated a binder, the block being formed with passages through it, and subject the block, after it has become sufficiently hardened, and while confined against access thereto of oxygen, to the reducing action of hot reducing gases.

In the accompanying drawing I show, in Figure 1, a block or cylinder of the ore as I prefer to form it; and in Fig. 2, a furnace structure, of one improved form in which the operation of reducing the metallic oxid constituents of the ore may be carried on to produce the completed ingots.

In carrying out my invention I take a sufficiently large mass of the crude ore and mix therewith a suitable cementitious material, which, for example, may be hydraulic cement or quicklime, and mold the mass; under hydraulic or other great pressure, into a preferably cylindrical block 1. The block or cylinder 1 has a central passage through it, 2, from which extend passages 3 to the outer surface of the cylinder. A block of a diameter of three feet would be formed with a central passage 2, say one foot in diameter, the laterally extending passages 3 being much smaller. When molded to shape the blocks or cylinders are caused to harden and become perfectly dry.

For the further operation or completion of the ingot I provide a stack 4 of suitable height and of a diameter capable of receiving the blocks stacked end to end one upon the other as indicated in the sectional elevational view shown in Fig. 2 of the drawing. The internal diameter of the stack 4 should be somewhat in excess of the external diameter of the blocks 1 to leave an annular passage 5 between them. Communicating with the lower part of the interior of the stack is a passage 6 leading from a furnace 7. The furnace 7 may be of any desired form for the production of reducing gas in the desired volume and at the desired temperature. The furnace is fitted with one or more twyers 8 at which pressure is introduced to promote combustion in the furnace 7 and expel the generated reducing gases through the passage 6 and stack 4. At the top of the stack 4 is a hinged outer valve 9 capable of manipulation for opening and closing the annular space 5, which intervenes between the inserted blocks 1 and wall of the stack 4. Another valve carries a hinged portion 10 capable of closing over the top of the opening 2 through the column of blocks. Thus the outlet for the draft from the furnace through the stack may be controlled to an extent sufficient to direct it more or less uniformly through the passages 2 and 5.

In practice, the reducing gases are delivered into the stack 4 at a temperature sufficient to deoxidize the iron constituent of the ore and render it sufficiently plastic to agglomerate as metal. The hot gases work from the passage 2 outward into the blocks and from the passage 5 inward into the blocks to effect deoxidation of the metallic oxids, and the operation should be sufficiently prolonged to cause thorough reduction of all the metallic oxid constituents of the blocks. It is to be understood that the binder should be of such composition that it will not disintegrate under the temperature necessary to reduce iron oxids to metal, yet will fuse at a temperature lower than that necessary to melt metallic iron. As the metallic oxids are reduced to metal the metal particles agglomerate into a more or less honey-comb structure to which the slag making constituents adhere.

In the accompanying drawing, I have shown no means for withdrawing the blocks, when reduced, from the lower part of the furnace, though such means are contemplated. To permit the blocks to be readily separated and lifted out of the furnace, when reduced, disks 11 of silicious or other refractory material may be placed between the blocks,

the disks corresponding in diameter with the diameter of the blocks and having central openings corresponding with the passage 2.

When the operation is completed, the metallic oxid constituents of the blocks are practically all reduced to metal, though sufficient metallic oxids may remain to aid in fluxing the other slag making ingredients in the after treatment of the ingots. When the ingots, as I have termed them, are withdrawn from the furnace they may, for example, be placed in a heating furnace and there subjected to a welding temperature which will free the slag making ingredients, and permit the latter, for the most part, to be eliminated by the common methods of squeezing and rolling.

What I claim as new and desire to secure by Letters Patent is—

1. The method of forming an ingot which consists in molding a sufficiently large mass of ore, with which is incorporated a cementitious binder, into a block, drying and hardening the block and then subjecting the block to the reducing action of hot reducing gas, to deoxidize the metallic oxids without first disintegrating the slag making constituents of the ore, and cause the reduced metal constituent to agglomerate within the block.

2. The method of forming an ingot which consists in molding a sufficiently large mass of ore, with which is incorporated a cementitious binder, into a block formed with a gas passage through it, drying and hardening the block and then subjecting the block to the reducing action of a hot reducing gas, to deoxidize the metallic oxids without first disintegrating the slag making constituents of the ore, and cause the reduced metal constituent to agglomerate within the block.

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

JOHN T. JONES.

Witnesses:
J. W. DYRENFORTH,
FRANCIS M. PHELPS.