W. F. M. McCARTY.

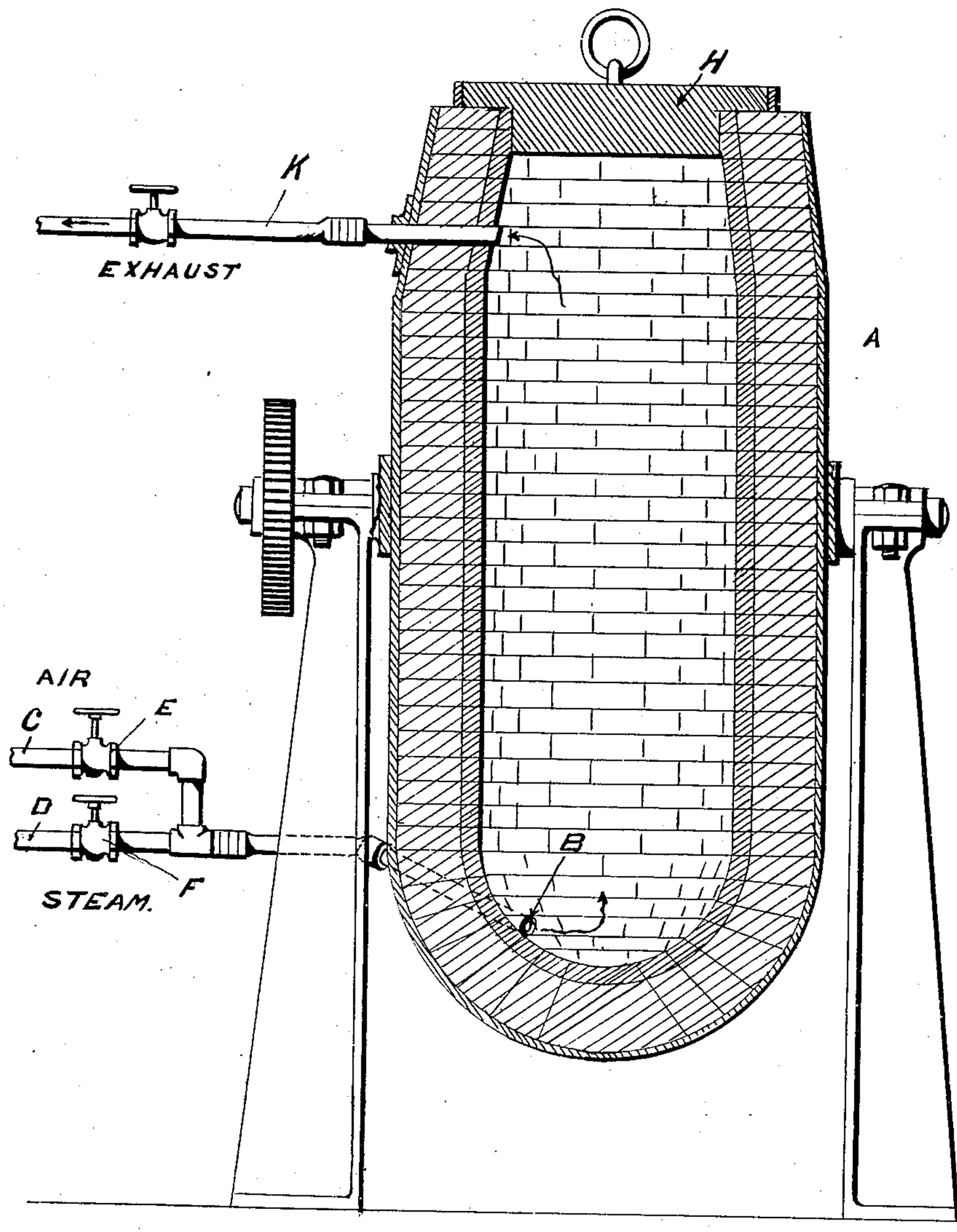
METHOD OF PRODUCING INGOTS FREE FROM BLOW HOLES.

APPLICATION FILED JULY 12, 1907.

898,770. Patented Sept. 15, 1908.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

Chas. T. Davies.

Myron G. Cleary

INVENTOR

William F. M. McCarty

By C. L. Parker

Attorney

W. F. M. McCARTY.

METHOD OF PRODUCING INGOTS FREE FROM BLOW HOLES.

APPLICATION FILED JULY 12, 1907.

898,770. Patented Sept. 15, 1908.

2 SHEETS—SHEET 2.

FIG. 2.

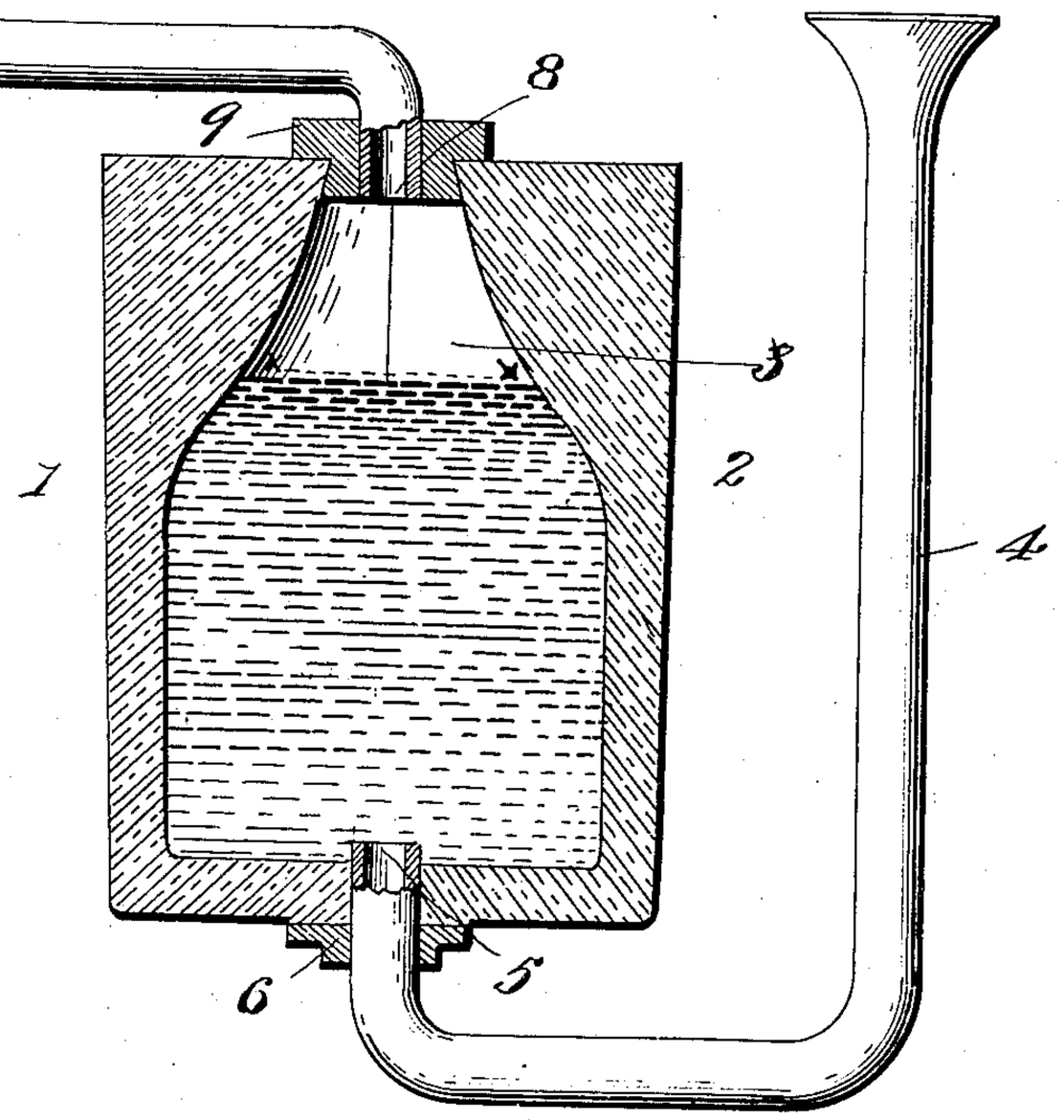
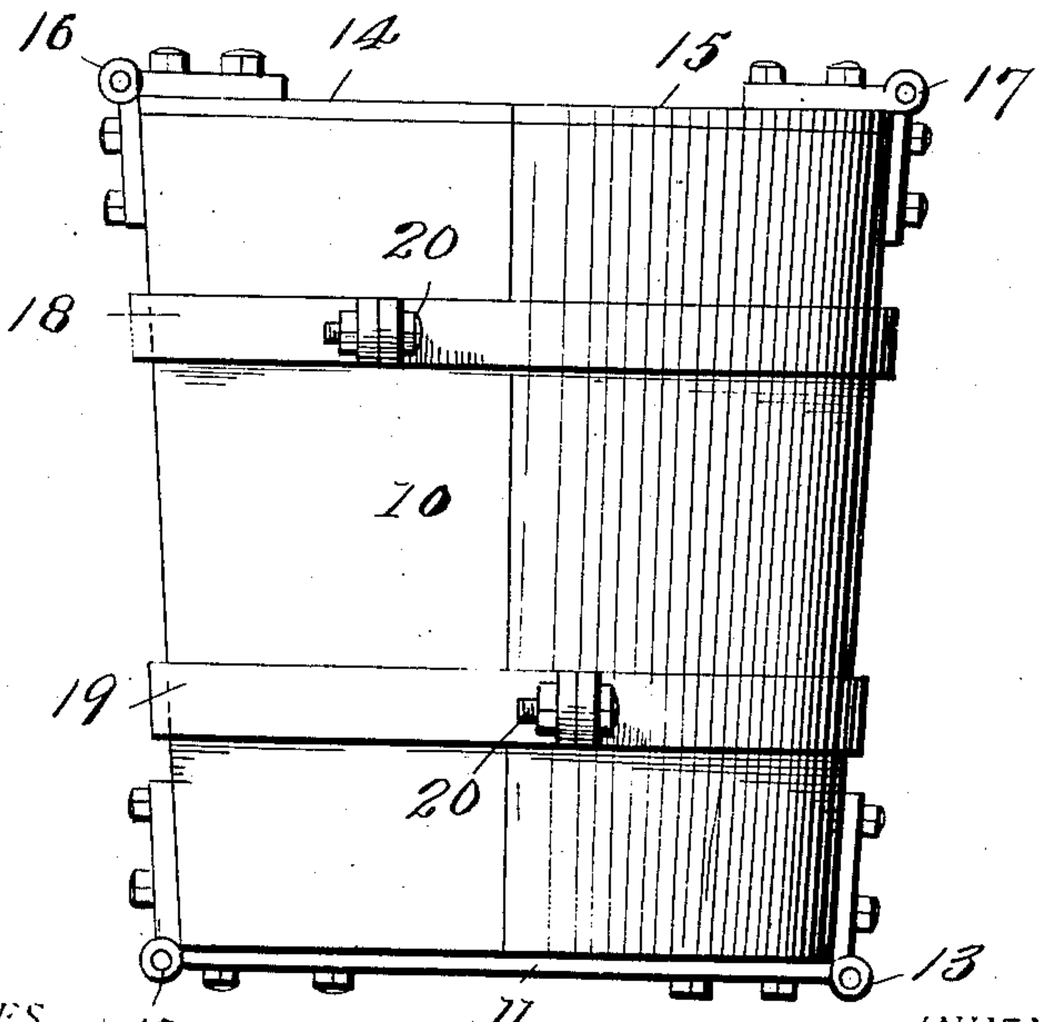


FIG. 3.



WITNESSES

Chas. T. Davies.

Myron G. Chean

INVENTOR

William F. M. McCarty

by C. L. Parker Attorney

UNITED STATES PATENT OFFICE.

WILLIAM F. MASON McCARTY, OF PLEASANTVILLE, NEW YORK, ASSIGNOR OF ONE-FOURTH TO GEORGE O. EATON, ONE-FOURTH TO THOMAS M. ACKEN, AND ONE-THIRTIETH TO ALEXANDER J. GUTTMAN, OF NEW YORK, N. Y.

METHOD OF PRODUCING INGOTS FREE FROM BLOW-HOLES.

No. 898,770. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed July 12, 1907. Serial No. 383,488.

To all whom it may concern:

Be it known that I, WILLIAM F. MASON McCARTY, a citizen of the United States, residing at Pleasantville, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Methods of Producing Ingots Free from Blow-Holes, of which the following is a specification.

This invention relates to an improved process of treating and molding molten metal to produce therefrom ingots which are homogeneous, of a distinctly fibrous or lamellar structure; neither granular nor crystalline, and wholly free from blowholes, fissures, flaws and seams.

It is customary in the manufacture of steel to first run the molten metal into a converter, and then blow atmospheric air into the mass until the carbon contained therein has been eliminated to the extent desired. This passing of air through the molten metal incidentally, but necessarily, results in the occlusion of certain gases in the metal. These gases are for the most part carbon dioxid, nitrogen, resulting from the air blown into the metal, hydrogen sulfid resulting from the burning of the fuel used in smelting the iron, and cyanogen resulting from the reaction of the nitrogen of the air with the carbon in the metal. These gases are present in varying quantities in the metal when it is ready to be poured, and their presence in the metal results in the production of blowholes, granulation and other imperfections in the resulting product. The presence of the gases also chemically affects the resulting metal, particularly in the case of cyanogen, which renders it friable and "short".

Under the practice which has heretofore obtained in the art, it has only been possible to eliminate the occluded gases, with the consequent lack of homogeneity and the presence of blowholes, flaws, and the like, by long continued manipulation of the cast metal, either by rolling or forging it under heavy steam hammers while hot. It is known in the art that the occluded gases cannot be wholly eliminated by such manipulation, and that the finished product is necessarily of an uncertain quality by reason of unevenness of texture and the presence of weak spots which inspection cannot disclose.

As a result of long continued experiment, I have developed a process by which occluded gases in molten metal may be wholly removed, in a simple and economical manner, without the necessity of prolonged forging or rolling, and with the result that the molten metal so treated may be cast into ingots or blooms, followed with but a single rolling or forging. I have found that plates, rails, beams, and other finished products produced from metal, which has been treated according to my process, are not only homogeneous in structure, but have a distinct fibrous or lamellar structure, neither granular nor crystalline.

In the accompanying drawing Figure 1 is a sectional view of a converter in which my process may be advantageously carried out. Fig. 2 is a vertical section of a form of mold which is well adapted for use in connection with my process, and Fig. 3 is a view in side elevation of a supporting frame for the said mold.

In the practice of my process I take steel which has been subjected to treatment with atmospheric air in a Bessemer converter until the carbon has been sufficiently eliminated. Instead of then pouring the metal into the ingot molds as is the present practice, I introduce superheated steam into the metal through the twyers for a period of from ten to thirty minutes. I employ the superheated steam under high tension, and in small quantities, introducing it in intermittent jets or impulses. The steam, upon coming in contact with the molten metal, becomes decomposed into its elements, and as the steam is injected in intermittent impulses, the decomposition results in a series of explosions in the mass of the metal, the oxygen and hydrogen combining with the occluded gases, eliminating them from the metal. When the blow of superheated steam has been of sufficient duration, which will be determined by practice on the metal under treatment, I close the twyers and the upper opening of the converter, and subject the molten metal to the action of a vacuum by withdrawing air from the converter, at or near the upper portion thereof, by means of a powerful exhaust pump. The action of the vacuum results in the removal of the remaining occluded gases which I have found to be rendered easily removable by the treatment with superheated steam.

I have found that it is possible to remove a

considerable portion of the occluded gases from molten metal by the action of superheated steam alone, and by the action of a vacuum alone, but my experiments have demonstrated that by first treating the metal with superheated steam, as hereinbefore described, and then, preferably at once, subjecting the metal to the action of a vacuum, I am able to obtain results in the elimination of occluded gases which are greatly in excess of the sum or aggregation of the results of each of the operations conducted separately. It thus appears that the action of the superheated steam not only serves to eliminate a considerable portion of the occluded gases, but by chemical combination or otherwise, to render said gases capable of ready and complete removal by the action of a vacuum. After the metal has been subjected to the action of a vacuum for a period of from ten to thirty minutes according to the character of the metal under treatment, to be determined by practice, I withdraw the metal from the converter and pour the same into ingot molds which are subject to the action of a vacuum. The metal is introduced into the molds through the bottom thereof by means of an inverted siphon or goose-neck, the top of the mold being in communication with a suitable exhaust pump.

The converter shown by way of example in Fig. 1 of the drawing is well adapted for use in carrying out my process. In the figure, A represents the converter which may be of the usual Bessemer converter construction. Twyer B is provided at the lower end of the body of the converter and by means of this, the molten metal may be supplied at will with air from pipe C or superheated steam from pipe D. Valves E and F are supplied to control the passage of air and steam.

A cover H is provided which forms a substantially air tight joint with the top of the converter A. A vacuum is produced in the body of the converter by means of an exhaust pump (not shown) connected with exhaust pipe K.

The mold proper comprises two semi-cylindrical sections 1 and 2 of suitable material, adapted to fit together, and be hermetically sealed at their points of contact. The mold is provided with the metal-receiving opening or reservoir 3 in which the ingot is formed. An inverted siphon or goose-neck 4, preferably of terra cotta or like suitable material, is connected with an opening 5 in the base of the mold. A flange 6 carried by the siphon 4 fits closely against the base of the mold and serves to prevent leakage. A pipe 7 connected with a suitable exhaust pump, not shown, leads to the upper opening 8 of the mold and serves to withdraw air therefrom.

A flange 9 carried by the pipe 7 fits tightly against the top of the mold and serves to prevent the entrance of air through the opening 8.

After the mold has been set up, a supporting frame or casing 10 is secured around it. This frame or casing comprises a base 11 having two hollow semi-cylindrical sides pivoted thereto by hinges 12 and 13. Hinged top or cover portions 14 and 15 are secured to the sides by hinges 16 and 17. Adjustable bands 18 and 19 surround the frame or casing 10 when in position about the mold, and these bands are adapted to force the two parts of the mold tightly together by means of adjusting screws 20 and 21.

In using the mold, the molten metal is introduced through the siphon 4 under the action of a vacuum until the metal reaches the level X—X. The vacuum is maintained until the metal is set or hardened. I have found in the practice of my process that I am able to eliminate all of the occluded gases from the metal and to maintain the metal free from the presence of such occluded gases until the final ingot is produced. I have also found that ingots produced in accordance with my process are entirely homogeneous and possessed of a distinctly fibrous or lamellar structure, and to be free from fissures, flaws, blowholes or other weak spots.

Having thus described my invention, I claim:

1. A process of treating metal to remove occluded or otherwise held gases therefrom which consists in subjecting said metal, while in the same molten state, to the action of superheated steam and to the action of a vacuum.

2. A process of treating metal to remove occluded or otherwise held gases therefrom which consists in subjecting said metal, while in the same molten state, to the action of superheated steam in intermittent jets or impulses and to the action of a vacuum.

3. A process of treating metal to remove occluded or otherwise held gases therefrom which consists in first passing superheated steam through said metal, while in a molten state, and then subjecting said metal, while in the same molten state, to the action of a vacuum.

4. A process of treating metal to remove occluded or otherwise held gases therefrom which consists in passing superheated steam in intermittent jets or impulses through the metal, while in a molten state, and then subjecting said metal, while in the same molten state, to the action of a vacuum.

5. The hereindescribed method of producing ingots free from blowholes which consists in eliminating occluded or otherwise held gases from molten metal by treating the metal, while in the same molten state, with superheated steam and vacuum, withdrawing said metal into a mold by and under the

action of a vacuum, and permitting said metal to set or harden under diminished atmospheric pressure.

6. The hereindescribed method of producing ingots free from blowholes which consists in blowing superheated steam in intermittent jets or impulses through molten metal, then subjecting said metal, while in the same molten state, to the action of a vacuum, then withdrawing said metal into a mold under the action of a vacuum, and permitting said metal to set or harden under diminished atmospheric pressure.

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

WILLIAM F. MASON McCARTY.

Witnesses:
AIDA F. McCARTY,
ANNA R. WILCOX.