No. 672,447. Patented Apr. 23, 1901.

A. J. LUSTIG.

MEANS FOR CASTING INGOTS.

(Application filed Nov. 28, 1899.)

(No Model.) 3 Sheets—Sheet 1.

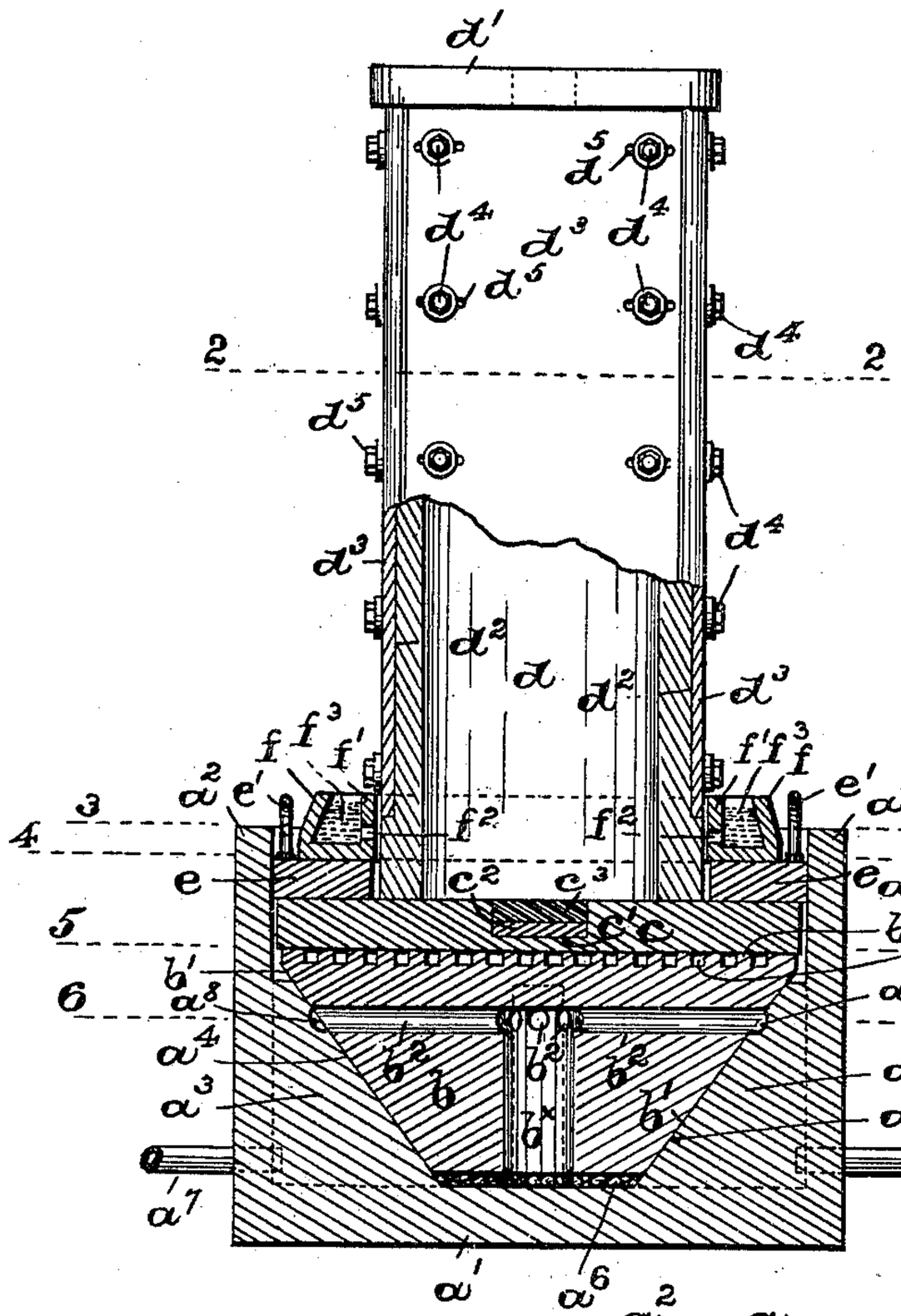

FIG. 1

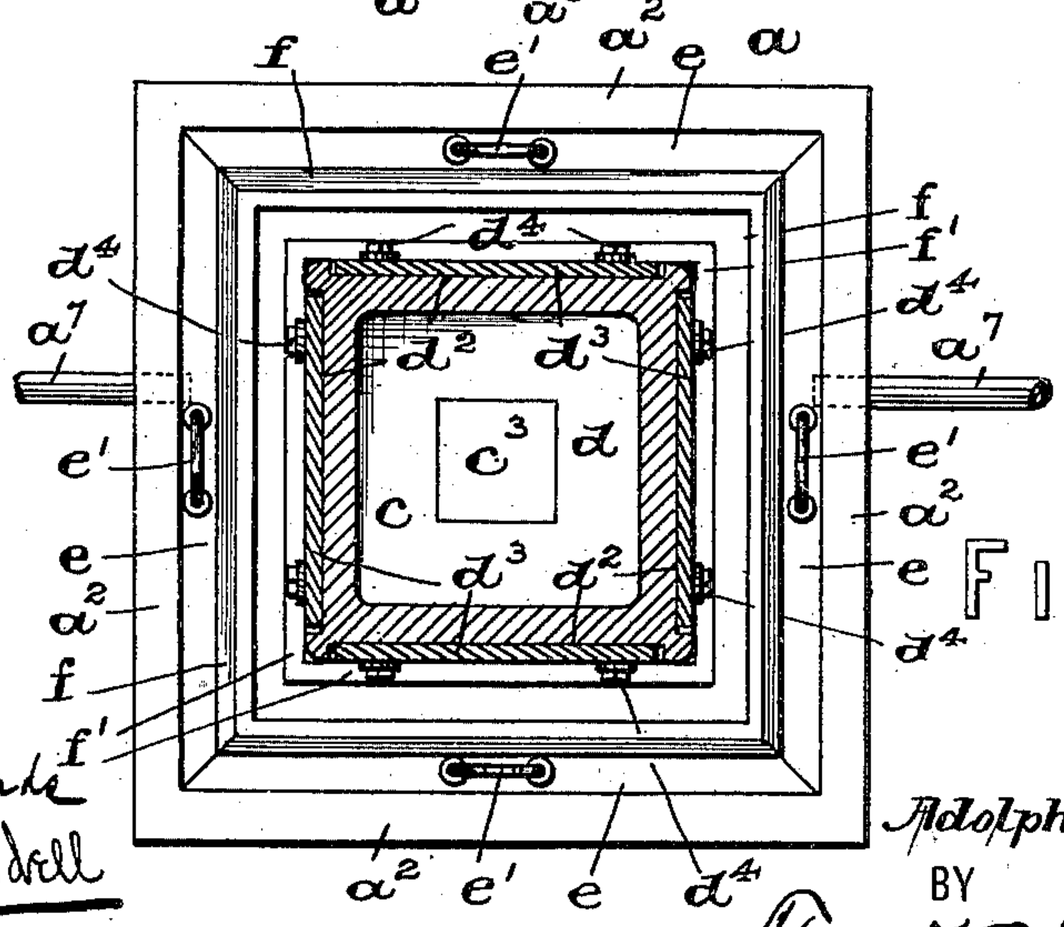

FIG. 2

WITNESSES:
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FIG. 3

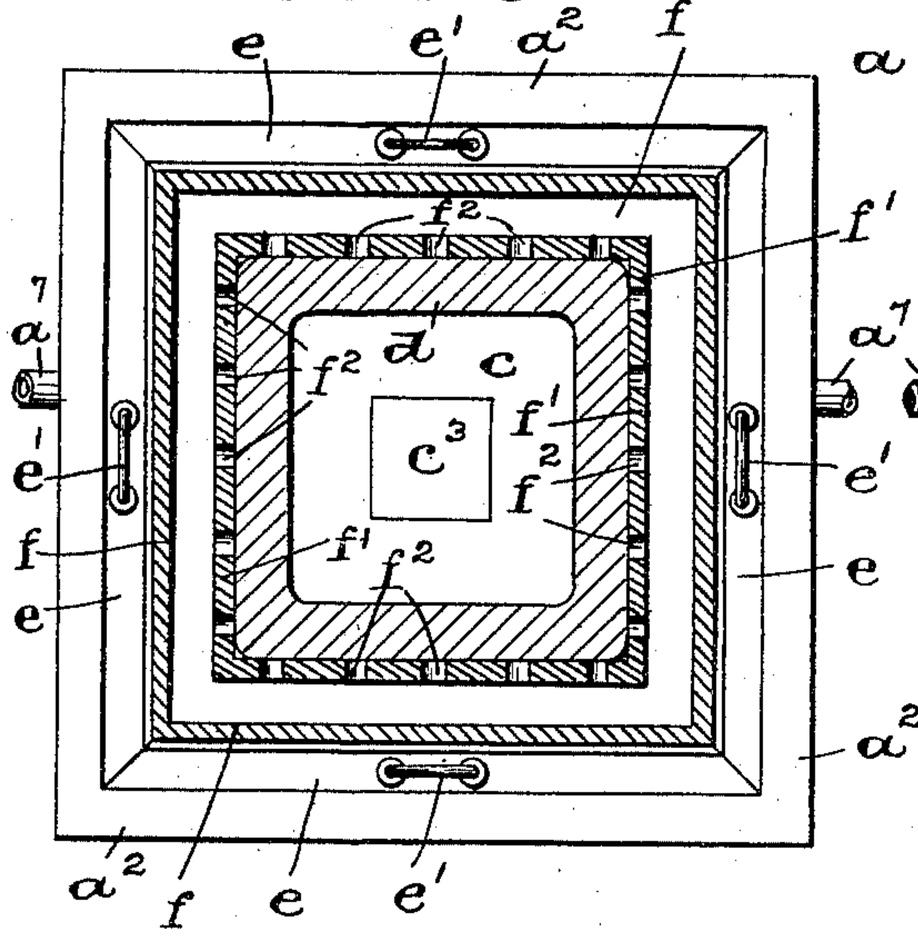

FIG. 4

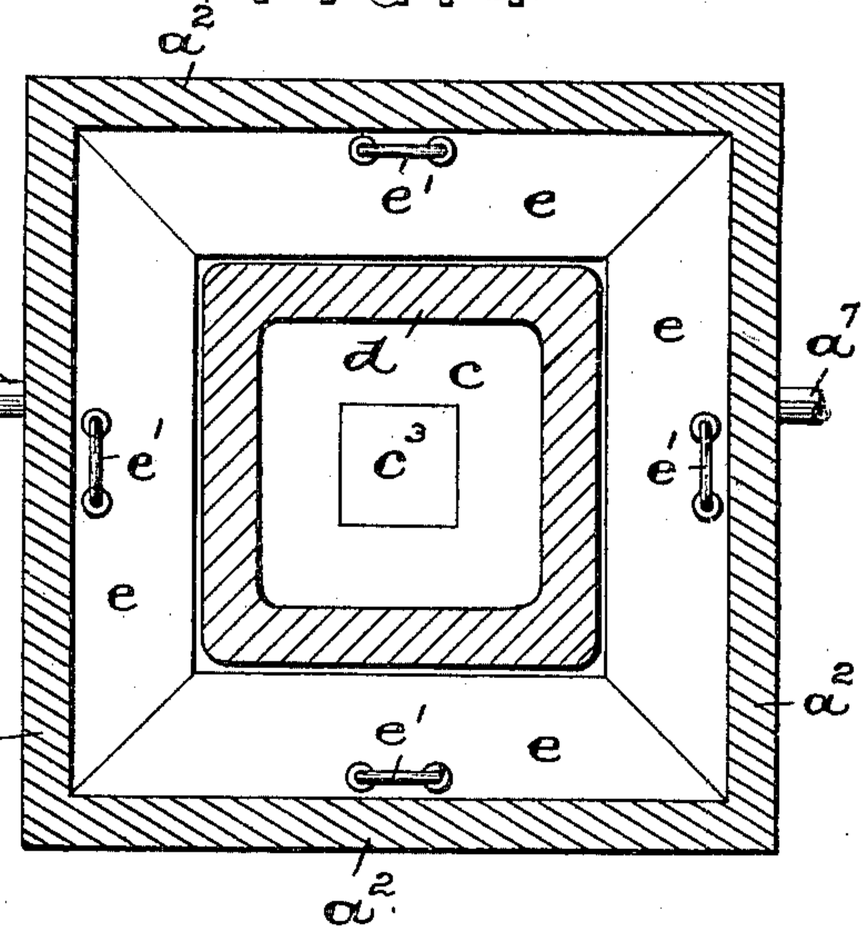

FIG. 5

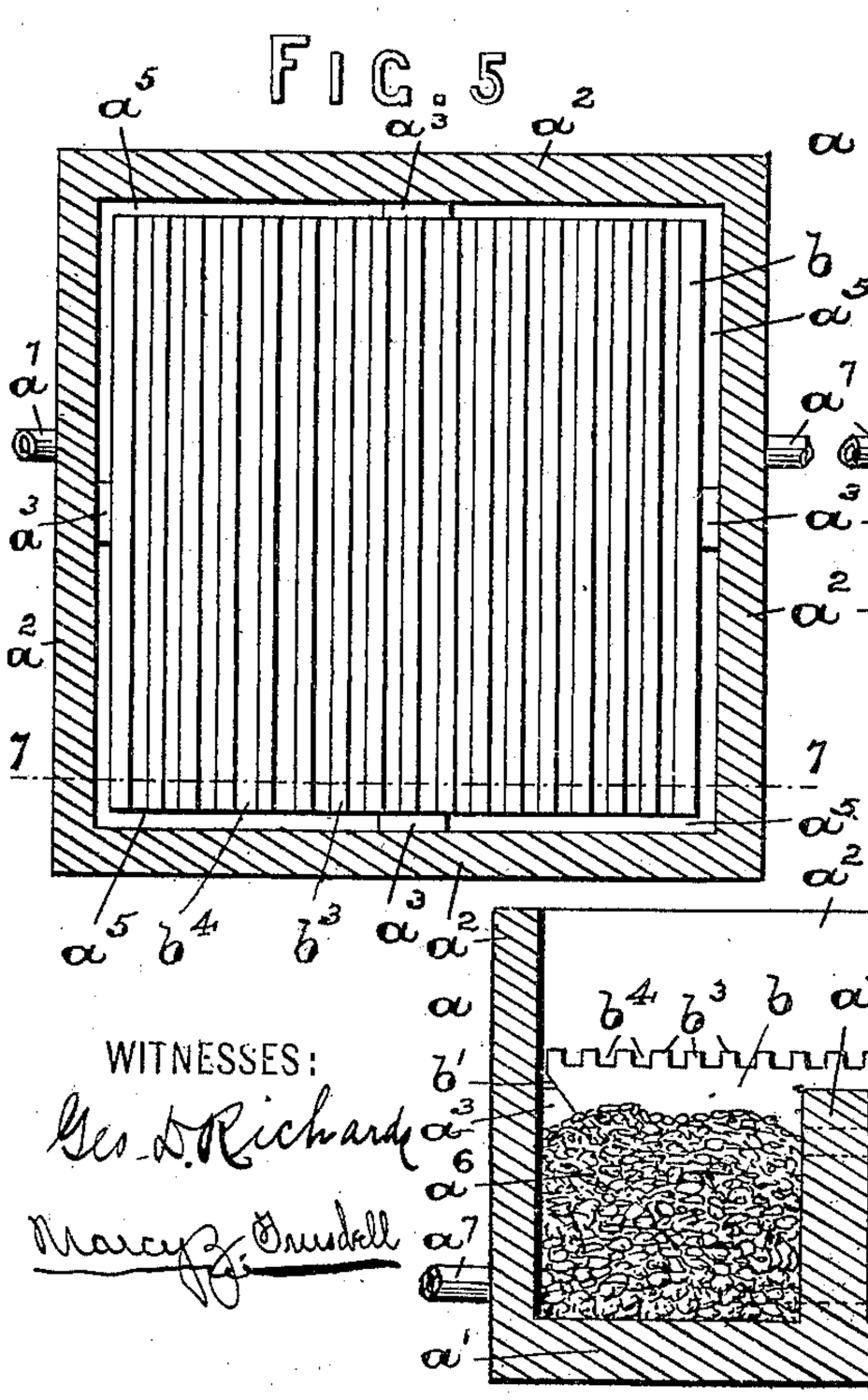

FIG. 6

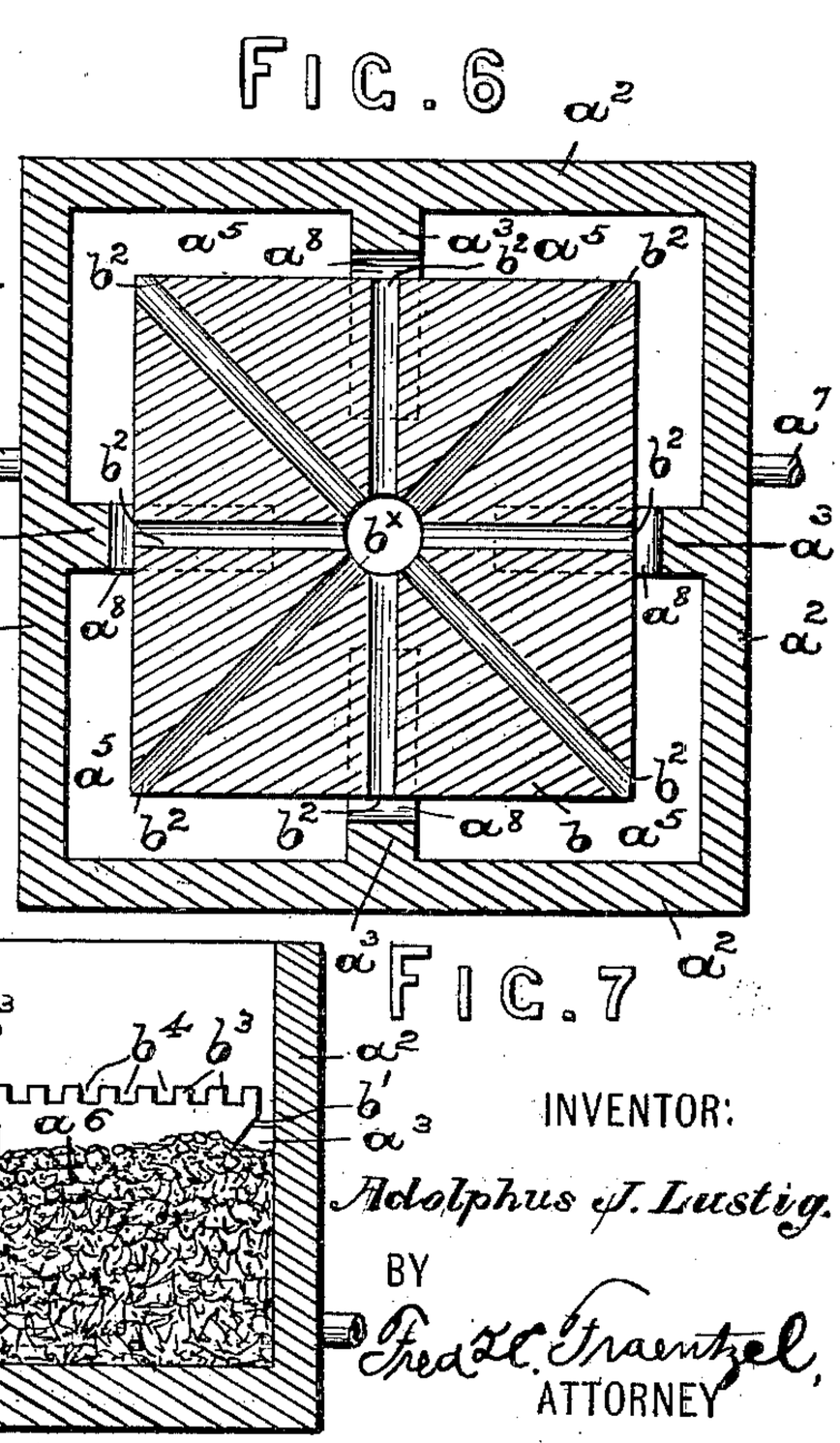

FIG. 7

WITNESSES:

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INVENTOR:

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BY

Fred'k. Krantzel,

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No. 672,447. Patented Apr. 23, 1901.

A. J. LUSTIG.

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(No Model.)

3 Sheets--Sheet 3.

FIG. 8

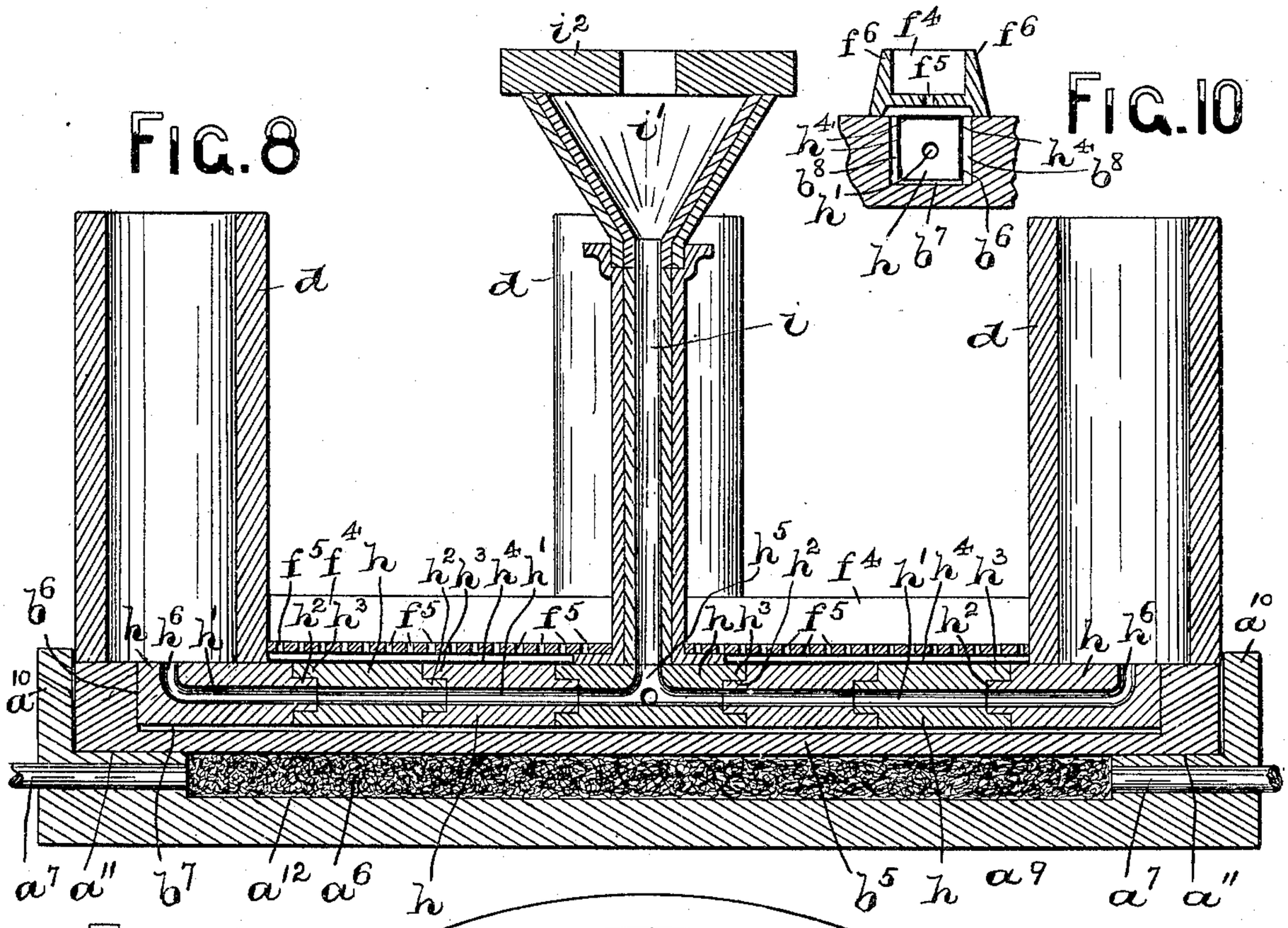
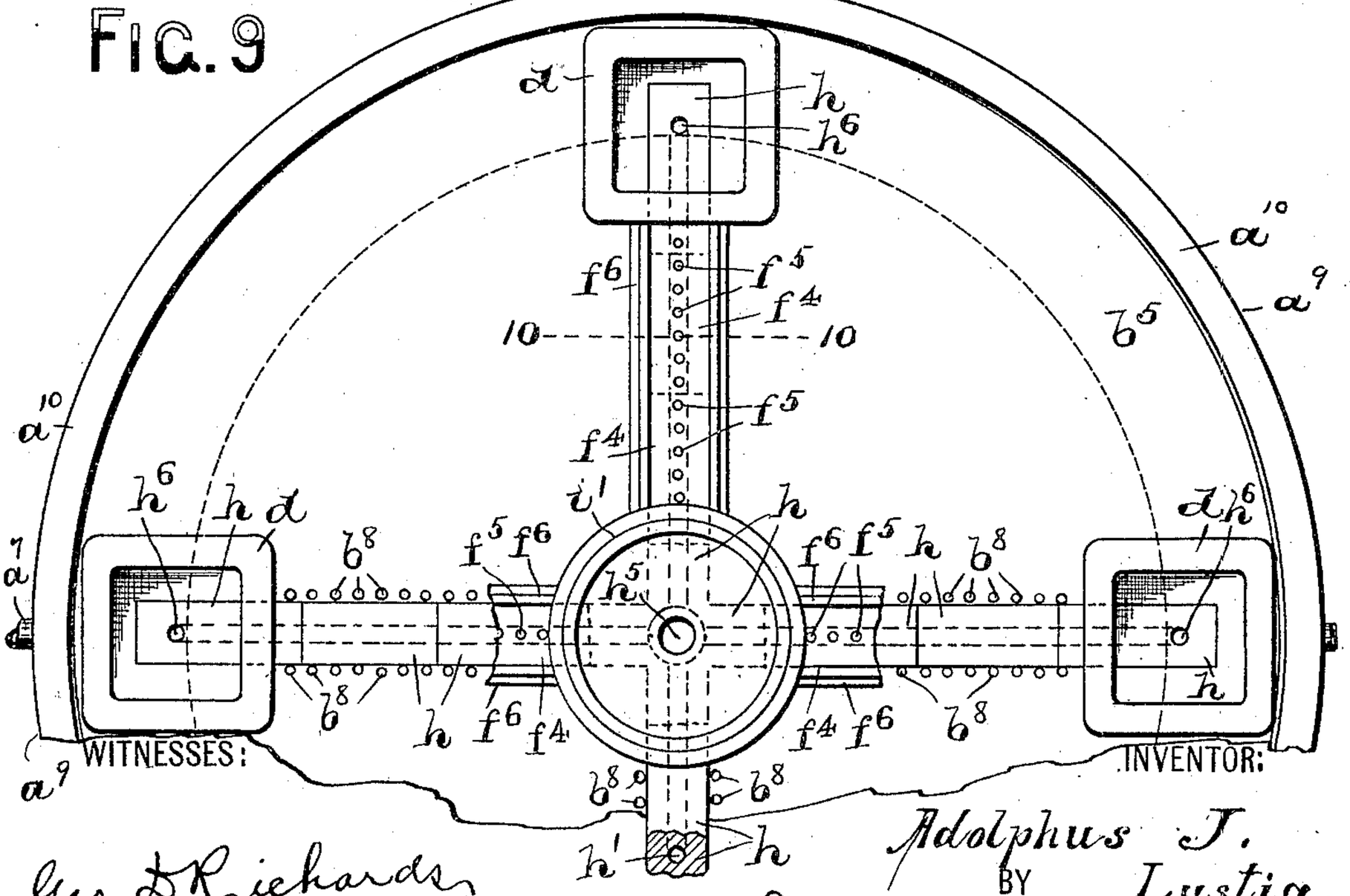


FIG. 9



UNITED STATES PATENT OFFICE.

ADOLPHUS J. LUSTIG, OF NEWARK, NEW JERSEY, ASSIGNOR OF TWO-FIFTHS TO ISAAC LEHMAN, OF SAME PLACE, AND LOUIS KAHN, OF NEW YORK, N. Y.

MEANS FOR CASTING INGOTS.

SPECIFICATION forming part of Letters Patent No. 672,447, dated April 23, 1901.

Application filed November 28, 1899. Serial No. 738,581. (No model.)

To all whom it may concern:

Be it known that I, ADOLPHUS J. LUSTIG, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Means for Casting Ingots; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in supports for molds for casting steel ingots; and the invention has for its primary objects to secure a more perfect exclusion of atmospheric oxygen from the molten steel in the operation of casting ingots, and thus prevent decarbonization and oxidation, and to secure many other advantages and results, all of which will be hereinafter more fully set forth.

My present invention therefore consists in the novel construction of mold-support and parts connected therewith, as will be hereinafter fully set forth.

My invention consists, furthermore, in the several novel arrangements and combinations of the various parts as well as the details of construction of such parts, all of which will be described more in detail in the accompanying specification and then finally embodied in the clauses of the claim, which form a part of this invention.

The invention is clearly illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical section of the mold-support and parts connected therewith with the mold in position thereon, said mold being represented partly in vertical section and partly in elevation. Fig. 2 is a horizontal section taken on line 2 2 in said Fig. 1. Figs. 3, 4, 5, and 6 are similar sections taken, respectively, on lines 3 3, 4 4, 5 5, and 6 6 in said Fig. 1; and Fig. 7 is a vertical cross-section of the mold-support, said section being taken in line 7 7 in Fig. 5. Fig. 8 is a central vertical section of a group of molds and a mold-support therefor embodying the principles of my present invention. Fig. 9 is a plan or top view of the several parts illustrated in said Fig. 8, and Fig. 10 is a detail cross-section taken on line 10 10 in said Fig. 9.

Similar letters of reference are employed in all of the said above-described views to indicate corresponding parts.

In the said drawings, in Figs. 1 to 7, inclusive, a indicates the base or foundation, the same consisting, essentially, of a base-plate a' and the upwardly-extending and surrounding sides a^2, thus forming a box-like base or foundation. Extending from the inner surfaces of the sides a^2, preferably formed integral with said sides and with the inner surface of the base-plate a', are any desirable number of inwardly-extending supporting-ribs a^3, which are formed with the inclined edges a^4, which form a support for the mold-support b, at the same time serving to properly and centrally support said mold-support in the said box-like base or foundation. The said support b is made of cast-iron or other porous metal and is preferably made in the manner of a truncated pyramid of four sides, its downwardly-tapering sides b' resting on said ribs a^3, substantially as illustrated, whereby the surrounding open spaces a^5 are formed, as clearly illustrated in Figs. 6 and 7, the said spaces being filled with a loose material a^6—such as pumice-stone, asbestos, or other material of a like character—which is a good conductor of heat. Leading into and extending through one or more of the said sides a^2 of the box-like foundation a are suitable gas-pipes or other conveying-ducts a^7 for the purposes to be hereinafter more fully set forth. The said mold-support b is provided with a central duct or chamber $b^\times$, extending upwardly from the bottom of the support to a point near the top thereof, and is also provided with any suitable number of ducts b^2, which radiate from the upper portion of said central duct or chamber $b^\times$ to the sides of the support b, as illustrated in Figs. 1 and 6. To permit of the free passage of any gas from said ducts b^2 into the open spaces a^5, where such ducts terminate directly

in front of the inclined edges of the ribs a^3, the latter are cut away to form suitable passage-ways a^8, as clearly illustrated; but of course it will be fully understood that the said ducts b^2 may be arranged in any other desirable manner so as not to terminate directly in front of said ribs. The upper surface of the said mold-support b is preferably provided with raised portions b^3 of any desirable configuration and the channels b^4 at the upper part of the support, as and for the purpose to be hereinafter fully set forth. Resting directly upon the upper surface of this support b is a cast-iron plate c, provided with a square or other suitably-shaped depression or recess c', in which are placed a plate c^2, of metal, and a plate c^3, of a refractory material, as graphite or other like material, for receiving the stream of molten metal when first poured into the mold d through a perforated plate d' on the top thereof. The said mold d rests centrally upon said plate c, being retained in its proper position upon the plate by a suitable keeper-plate e, which consists, preferably, of four pieces, as shown in the several figures of the drawings, resting upon those portions of the plate c between the outer surrounding surface of the sides of the mold and the inner surrounding surfaces of the upper portions of the sides a^2 of the box-like foundation a, and each portion of the said keeper-plate e having rings or handles, as e', for the removal of said parts of the keeper-plate when desired. Surrounding the outer and lower portion of the mold d and resting upon the keeper-plate e is an open frame f, forming a receptacle provided with perforations or holes f^2 in its sides f', which surround the lower portion of the mold, said vessel-shaped frame being for the reception of a carbonaceous material f^3, such as tallow or any other suitable material. The mold d, which may be of any well-known form and construction, is preferably recessed in its several sides, as at d^2, and has secured in said recesses suitable steel plates d^3, which are secured in position by means of bolts d^4, screwed into the mold and passing through slots d^5 in said plates d^3 to allow of the expansion and contraction of said plates as the mold d becomes heated or cooled. These several parts having been properly placed in their respective positions, as described, and as shown in Figs. 1 to 7, inclusive, hydrocarbon or hydrogen gas is slowly admitted through the pipe or pipes a^7 into the loose material a^6 surrounding the sides and the bottom of the mold-support b, as clearly indicated in the figures of the drawings, thereby completely filling the surrounding spaces a^5 between the inner walls of the base or foundation a and the sides and bottom of the mold-support b. While some of the gas immediately upon its introduction will pass around the outside of the plate c, this loss of gas is trifling, since the keeper-plate e, especially when expanded by the heat from the molten metal in the mold, will prevent any further escape of gas. The greater portion of gas will thus be collected in the spaces which surround the mold-support, from which it passes directly into the central duct or chamber and into the radiating ducts in said mold-support b, permeating the pores thereof and expelling all atmospheric air from the box-like foundation a and the mold-support b and other parts connected therewith, as will be clearly evident. At the same time some of the gas will pass from the spaces a^5 into the grooves b^4, where it is collected and from which spaces the gas passes through the porous metal plate c when the latter becomes thoroughly heated in the manner and for the purposes to be presently set forth. I now proceed to cast the molten metal into the top of the ingot-mold d through the perforation or opening in the plate d' on the top thereof in the usual manner, the plate d' preventing the atmospheric air from coming in contact with the molten metal, and hence preventing oxidation. The heat from the metal is soon transmitted to the plate c and the channeled upper portion of the support b, and I then turn on a stronger supply of hydrocarbon gas or hydrogen gas into the box-like foundation a. At the same time the carbonaceous material f^3 in the frame f begins to melt and flows through the perforations or holes f^2 in the sides f', and the hydrogen gas or hydrocarbon gas therefrom and that from the box-like foundation a is drawn or otherwise forced through the pores of the metal top of the support b, lodging in the channels b^4 and passing through the pores of the plate c into the metal in the mold d. The carbonaceous gas from the tallow in the frame f also passes through the pores in the sides of the mold and fills up the surrounding crevices, thereby preventing any influx of the atmospheric oxygen through the crevices of the surrounding keeper-plate and the plate c into the bottom of the mold d. In this manner the metal in the mold is prevented from being decarbonized, and any oxid that may have formed in the process of pouring is deoxidized and all oxygen is driven off with the superfluous gas. Thus the metal is held in a proper condition free from oxids, which tend to reduce the value of the metal and are the cause of producing imperfect ingots. By means of the above-described construction and arrangement of the several parts and by this process I reduce the generation of carbonaceous gas in the second stage of the cooling, when the outer parts of the ingot are hardened and the center parts are still liquid, and thus there will be no forming of blow-holes within the ingot, due to the introduction of a greater quantity of gas than the metal can absorb, and, furthermore, the piping of the ingot is almost, if not entirely, overcome.

In Figs. 8, 9, and 10 I have illustrated my invention as applied to a group of molds which are used with a mold-support and a stand-pipe, as i, in the process of what is commonly

termed "bottom casting." In the construction illustrated more especially in Fig. 8 I have illustrated one form of base-plate or foundation a^9, which may be circular in outline, but may be of any other suitable configuration, as will be clearly understood. This base-plate or foundation has the upwardly extending and surrounding sides a^{10} formed with an internal annular step or shoulder a^{11} and the chamber a^{12} for the reception of the loose material a^6, hereinabove mentioned. Leading into this chamber are one or more pipes or gas-conveying ducts a^7 for supplying the said chamber a^{12} with the hydrocarbon gas or hydrogen gas, as will be clearly understood. Placed upon the shoulder or step a^{11} of this base-plate or foundation a^9 is a mold-support b^5, which is provided with suitably-disposed channels b^6 for the reception of clay or tile pipes or conductors h. Each conductor is preferably made rectangular in cross-section, so as to be readily fitted into the said channels b^6, being provided with a central duct h' and each conductor h having a projection h^2 at one end and a recessed portion h^3 at the other end, whereby several conductors h can be operatively connected, so as to form a conveying-duct from the central conductor directly beneath the stand-pipe i to the end conductor h directly beneath the mold d. Each end conductor has an outlet h^6 to establish communication with the bottom of the mold d, and the central conductor h has an inlet h^5, which communicates with the interior of the stand-pipe i. The conductors h are preferably covered with a layer of carbonaceous material h^4, such as asphaltum or the like, and directly beneath the conductors h is left a space b^7, with which are in communication certain upwardly-extending ducts or holes b^8 directly contiguous to the said conductors h, which are for the purpose of carrying off any undue supply of gas, that might tend to force the conductors h from their proper positions in the channels b^6 in the mold-support b^5. Arranged directly above the said conductors h may be the receptacles f^4, provided with a base f^5, sides f^6, and perforations or holes f^7 in said base f^5, said receptacles f^4 being for the reception of a carbonaceous compound of asphaltum and tallow or other suitable material for the purpose of flowing over said conductors h and through the ducts b^8 into the space b^7, where this hydrocarbon compound volatilizes, so that the gas produced is forced through the pores of the metal into the several molds on the mold-support. When the molten metal is poured through the perforated plate or cover i^2 upon the funnel-shaped receiving portion i' of the stand-pipe i, which may be made integral with the top of said pipe i, if desired, the molten mass readily passes through the hollow conductors h and into the lower portions of the several molds d, placed upon the mold-support, the molds becoming readily filled and subjected to a treatment from the hydrocarbon gas passing through the pores of the supporting-plate b^5. In this manner any oxid that may have formed in the process of pouring is deoxidized and metal free from oxids is the result. Furthermore, the arrangement of the asphaltum layers h^4 upon the conductors h prevents any admission of the atmospheric oxygen through the pores of said conductors and into and between the crevices between any two of such conductors, thereby avoiding any deleterious effect upon the molten metal flowing through said conductors. As an extra precaution I have placed upon the funnel-shaped portion i' of the stand-pipe i a perforated cover or plate i^2, having a small opening, whereby I greatly reduce the pouring-opening, and thereby prevent the admission of the atmospheric oxygen into the stand-pipe, which might otherwise oxidize the metal. In all other respects the process of deoxidation is the same as that described in connection with the construction of the mold-support and its parts connected therewith, as illustrated and described in connection with said Figs. 1 to 7, inclusive, and therefore need not be further described.

I am fully aware that changes may be made in several arrangements and combinations of the various parts without departing from the scope of my present invention. Hence I do not limit my invention to the exact arrangements and combinations of the various parts, nor do I confine myself to the exact details of the construction of such parts.

Having thus described my invention, what I claim is—

1. The combination, with an ingot-mold, of a supporting-plate on which said mold is supported, a support on which said supporting-plate rests, and means connected with said support for conducting a gas beneath said supporting-plate, substantially as and for the purposes set forth.

2. The combination, with an ingot-mold, of a mold-support, consisting, essentially, of a chambered base, means for conducting a reducing-gas into the same, and means within said base for the support of a mold thereon, and for retaining said gas in said base while the mold is still cold, but permit it to pass through said supporting means when heated by the molten metal in the mold, substantially as and for the purposes set forth.

3. The combination with an ingot-mold, of a mold-support, consisting, essentially, of a chambered base, means for conducting a reducing-gas into the same, a means within said base for the support of a mold thereon, and for retaining said gas in said base while the mold is still cold, but permit it to pass through said supporting means when heated by the molten metal in the mold, and a receptacle, constructed to contain a carbonaceous material, upon said supporting means within said base-plate or foundation, substantially as and for the purposes set forth.

4. The combination with an ingot-mold, of

a mold-support, consisting, essentially, of a chambered base, means for conducting a reducing-gas into the same, a means within said base for the support of a mold thereon, and for retaining said gas in said base while the mold is still cold, but permit it to pass through said supporting means when heated by the molten metal in the mold, and a frame-like receptacle having perforations and constructed to contain a carbonaceous material, arranged upon said supporting means within said base-plate or foundation, substantially as and for the purposes set forth.

5. The combination with an ingot-mold, of a mold-support, consisting, essentially, of a chambered base, having internal supporting-ribs, a loose material, which is a non-conductor of heat, in said base, means for conducting a reducing-gas into the same, a mold-support on said ribs, for supporting the mold and for retaining said gas in said base while the mold is still cold, but permit it to pass through said support when heated by the molten metal in the mold, substantially as and for the purposes set forth.

6. The combination with an ingot-mold, of a mold-support consisting, essentially, of a chambered base, having internal supporting-ribs, a loose material, which is a non-conductor of heat, in said base, means for conducting a reducing-gas into the same, a mold-support on said ribs, for supporting the mold and retaining said gas in said base while the mold is still cold, but permit it to pass through said support when heated by the molten metal in the mold, and a receptacle, constructed to contain a carbonaceous material, upon said mold-support, substantially as and for the purposes set forth.

7. The combination with an ingot-mold, of a mold-support, consisting, essentially, of a chambered base, having internal supporting-ribs, a loose material, which is a non-conductor of heat, in said base, means for conducting a reducing-gas into the same, a mold-support on said ribs, supporting the mold and retaining said gas in said base while the mold is still cold, but permit it to pass through said support when heated by the molten metal in the mold, and a frame-like receptacle having perforations and constructed to contain a carbonaceous material, arranged upon said mold-support, substantially as and for the purposes set forth.

8. The combination with an ingot-mold, of a mold-support, consisting, essentially, of a chambered base, having internal supporting-ribs, a loose material, which is a non-conductor of heat, in said base, means for conducting a reducing-gas into the same, a mold-support on said ribs, having gas passages or ducts, a supporting-plate *c* thereon, having a central depression, and a plate therein made of a refractory material, all arranged for the support of an ingot-mold and for retaining the gas in said base while the mold is still cold, but permit it to pass through said supports when heated by the molten metal, substantially as and for the purposes set forth.

9. The combination with an ingot-mold, of a mold-support, consisting, essentially, of a chambered base, having internal supporting-ribs, a loose material, which is a non-conductor of heat, in said base, means for conducting a reducing-gas into the same, a mold-support on said ribs, having gas passages or ducts, a supporting-plate *c* thereon, having a central depression, and a plate therein made of a refractory material, all arranged for the support of an ingot-mold and for retaining the gas in said base while the mold is still cold, but permit it to pass through said supports when heated by the molten metal, and a receptacle, constructed to contain a carbonaceous material, upon said mold-support, substantially as and for the purposes set forth.

10. The combination with an ingot-mold, of a mold-support, consisting, essentially, of a chambered base, having internal supporting-ribs, a loose material, which is a non-conductor of heat in said base-plate or foundation, means for conducting a reducing-gas into the same, a mold-support on said ribs, having gas passages or ducts, a supporting-plate *c* thereon, having a central depression, and a plate therein made of a refractory material, all arranged for the support of an ingot-mold and for retaining the gas in said base while the mold is still cold, but permit it to pass through said supports when heated by the molten metal, and a frame-like receptacle having perforations and constructed to contain a carbonaceous material, arranged upon said mold-support, substantially as and for the purposes set forth.

11. The combination, with an ingot-mold, of a mold-support, consisting, of a chambered base, adapted to receive and retain a reducing-gas, means connected therewith for the support of the mold thereon, a centrally-arranged plate of a refractory material in said support, and means connected with said mold-support for conducting said gas into said mold-support, substantially as and for the purposes set forth.

12. The combination, with an ingot-mold, of a chambered base *a*, having internal ribs, of a support *b* on said ribs, a supporting-plate *c* on said support *b*, and a keeper plate or plates surrounding said mold, and means for conducting a gas into said base or foundation, substantially as and for the purposes set forth.

13. The combination, with an ingot-mold, of a chambered base *a*, having internal ribs, of a support *b* on said ribs, a supporting-plate *c* on said support *b*, a keeper plate or plates surrounding said mold, and a receptacle, constructed to contain a carbonaceous matter, upon said support *b*, and means for conducting a gas into said base or foundation, substantially as and for the purposes set forth.

14. The combination, with an ingot-mold, of

a chambered base *a* having internal ribs, of a support *b* on said ribs, a supporting-plate *c* on said support *b*, a keeper plate or plates surrounding said mold, and a frame-like receptacle having perforations and constructed to contain a carbonaceous material, arranged upon said support *b*, and means for conducting a gas into said base or foundation, substantially as and for the purposes set forth.

15. A support for an ingot-mold, comprising a base having a cavity and a mold-support therein, arranged and constructed to close said base at or near the top, but providing a surrounding space in said base for a reducing-gas, a loose material, which is a non-conductor of heat, in said space, and means for conducting the gas into said space and beneath the mold-support, substantially as and for the purposes set forth.

16. A support for an ingot-mold, comprising a base having a cavity, a mold-support therein, arranged and constructed to close said base at or near the top, but providing a surrounding space in said base for a reducing-gas, gas-passages in said mold-support, a loose material, which is a non-conductor of heat, in said space, and means for conducting the gas into said space and beneath the mold-support, and a keeper plate or plates thereon for retaining the mold in position, substantially as and for the purposes set forth.

17. A support for an ingot-mold, comprising a base having a cavity, a mold-support therein, arranged and constructed to close said base at or near the top, but providing a surrounding space in said base for a reducing-gas, gas-passages in said mold-support, a plate *c* having a central depression, a plate therein made of a refractory material, and a keeper plate or plates thereon for retaining the mold in position, and means connected with said mold-support for conducting said gas into said mold-support, substantially as and for the purposes set forth.

18. The combination, with an ingot-mold, of a plate on which said mold is supported, said plate having a depression, and a plate of a refractory material in said depression, a support on which said mold-supporting plate rests, and means connected with said support for conducting a gas beneath said plates, substantially as and for the purposes set forth.

19. The combination, with an ingot-mold, of a supporting-plate on which said mold is supported, and a plate of a refractory material on said supporting-plate, a mold-support on which said supporting-plate rests, and means connected with said mold-support for conducting a gas beneath said supporting-plate, substantially as and for the purposes set forth.

In testimony that I claim the invention set forth above I have hereunto set my hand this 27th day of November, 1899.

ADOLPHUS J. LUSTIG.

Witnesses:
FREDK. C. FRAENTZEL,
GEO. D. RICHARDS.