No. 674,341. Patented May 14, 1901.

A. J. LUSTIG.

APPARATUS FOR CASTING INGOTS.

(Application filed July 16, 1900.)

(No Model.) 2 Sheets—Sheet 1.

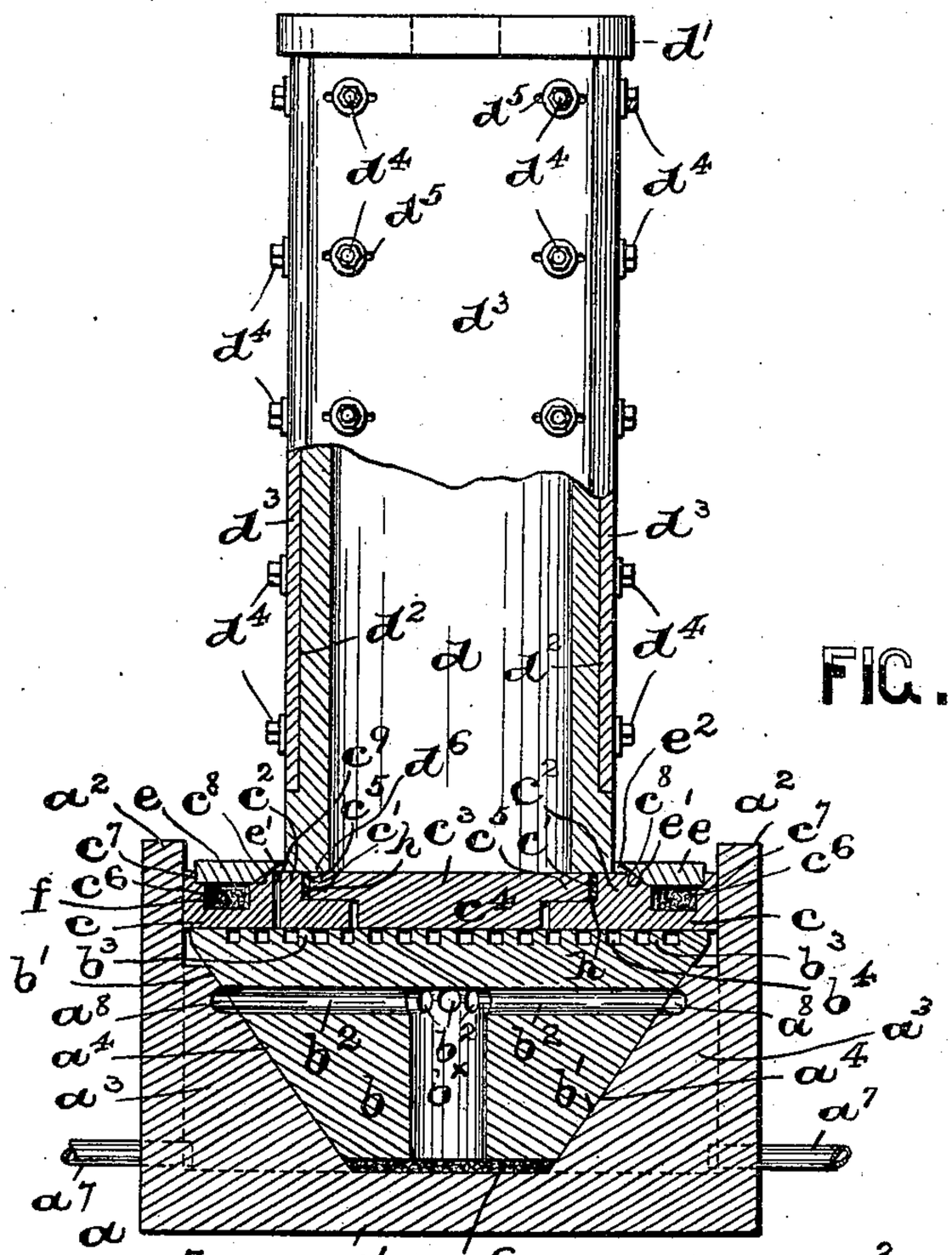

FIG. 1

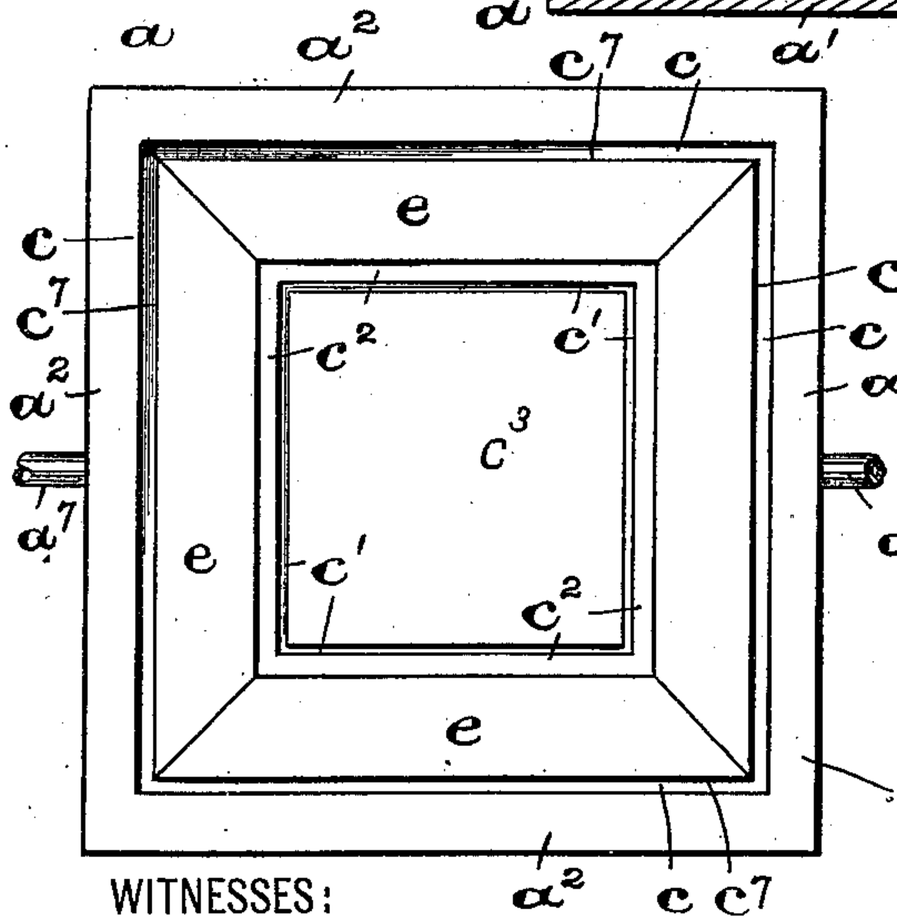

FIG. 2

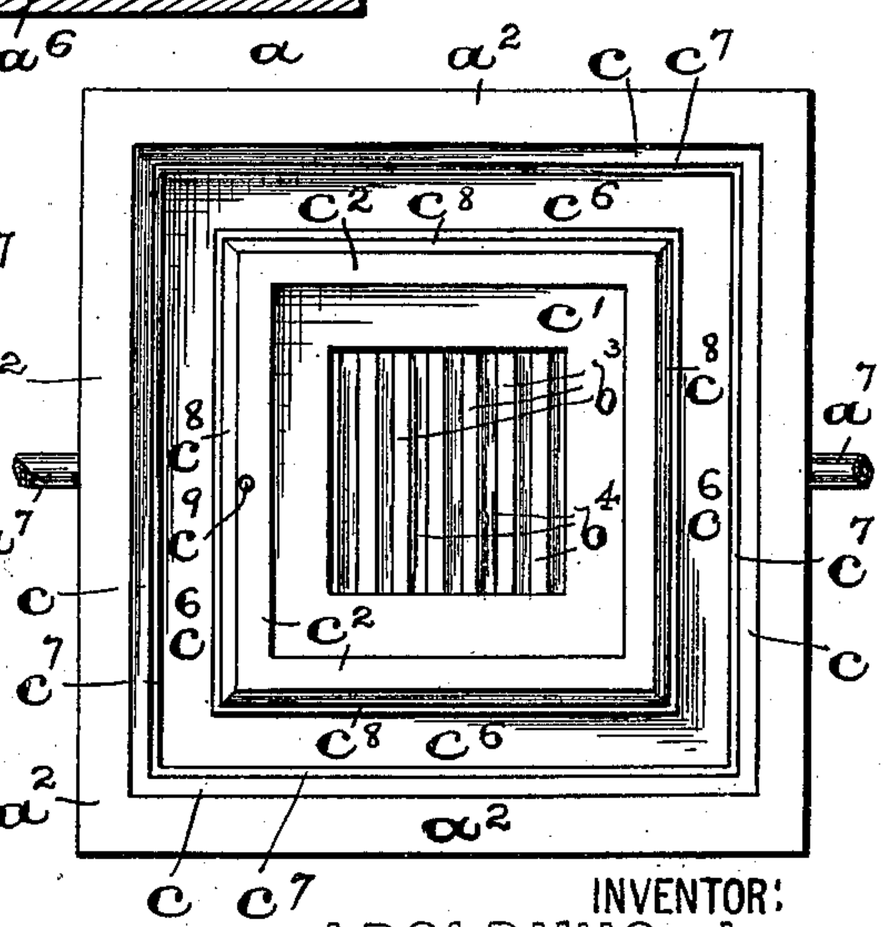

FIG. 3

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FIG. 4

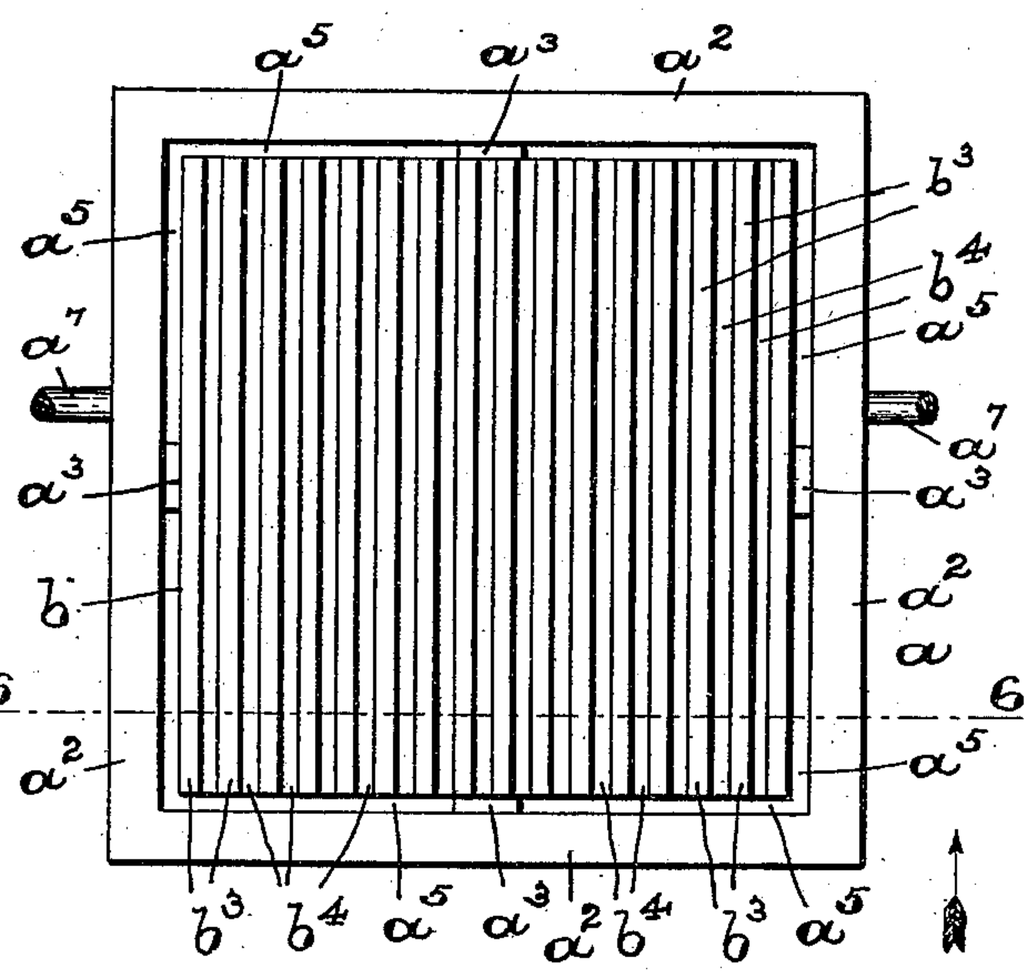


FIG. 5

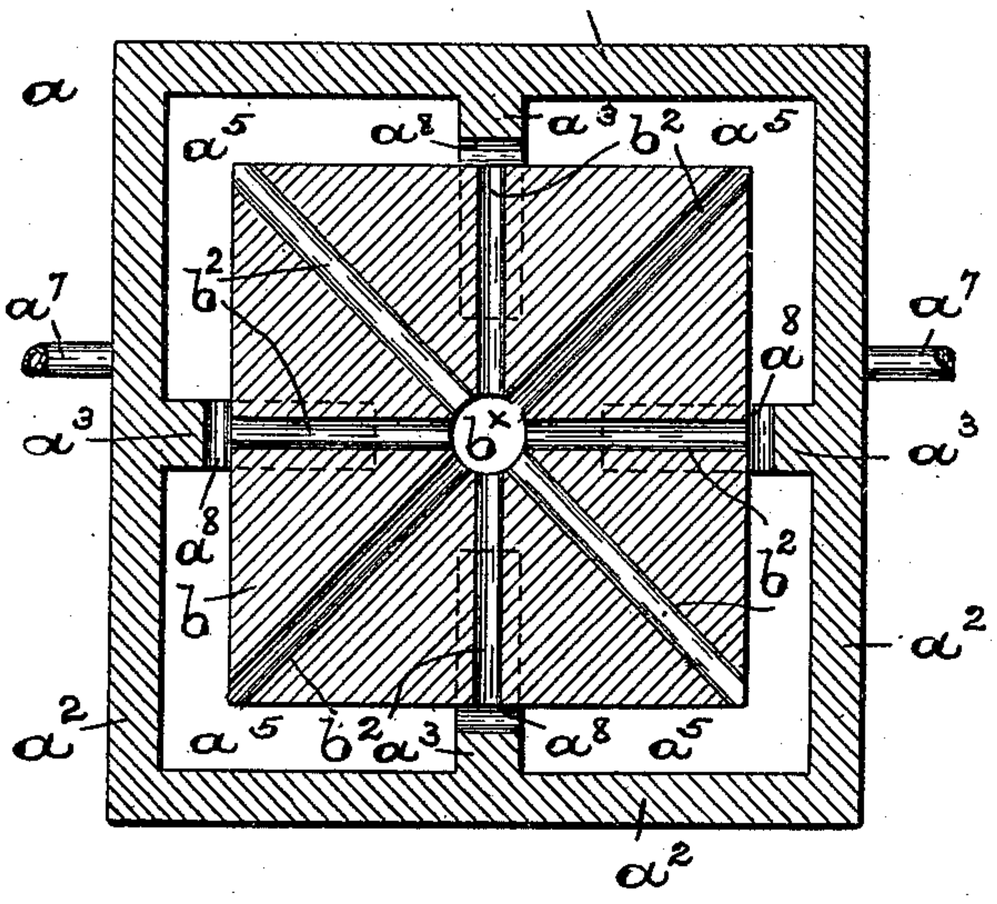
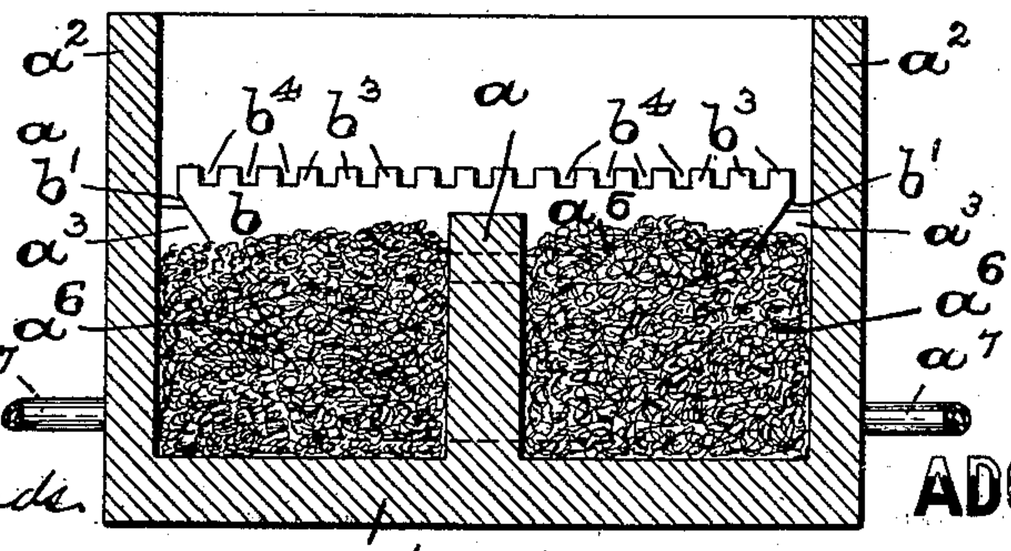


FIG. 6



WITNESSES:

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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.

APPARATUS FOR CASTING INGOTS.

SPECIFICATION forming part of Letters Patent No. 674,341, dated May 14, 1901.

Application filed July 16, 1900. Serial No. 23,713. (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 Apparatus 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.

My present invention is in the nature of improvements in supports for molds for the casting of steel ingots, and relates more particularly to improvements in mold-supports of the nature and character set forth in my previous application for Letters Patent, filed November 28, 1899, Serial No. 738,581.

The invention has for its principal objects to secure a more perfect exclusion of atmospheric oxygen from the molten steel in the operation of casting steel ingots, to prevent decarbonization and oxidation, as well as produce desulfurization, and to secure many other advantages and beneficial results, all of which will be hereinafter more fully set forth.

This invention therefore consists in the novel construction of mold-support and the various arrangements and combinations of the parts thereof, all of which will be fully set forth in detail in the following specification and then finally embodied in the clauses of the claim which are appended thereto.

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

Figure 1 is a central vertical section of a mold-support and parts connected therewith embodying the principles of my present invention, with an ingot-mold in position thereon, said mold being represented partly in vertical section and partly in elevation. Fig. 2 is a top or plan view of the several parts of the mold-support, the mold being omitted; and Fig. 3 is a similar view of the mold-support, but with certain cover-plates and a centrally-disposed block or plate in the plate on which the mold is supported removed. Fig. 4 is a plan view of the base or foundation and the mold-support, with the several parts arranged above the support in the manner indicated in Figs. 1 and 3 omitted. Fig. 5 is a horizontal section of the said base or foundation and the mold-support, and Fig. 6 is a vertical cross-section taken on line 6 6 in said Fig. 4.

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

In the said drawings, a indicates the base or foundation, which consists, essentially, of the base-plate a' and the upwardly-extending and surrounding sides a^2, which form a box-like or chambered base or foundation. Extending from the inner surfaces of the sides a^2, preferably formed integral with the 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 to form a support for a mold-support b and at the same time serving the purpose of properly and centrally placing said mold-support in said box-like or chambered base or foundation. These several parts of said base or foundation and of the mold-support b are preferably made in the manner of the mold-support described in my said previous application for Letters Patent, Serial No. 738,581. The said support b is made of cast-iron or other similar porous metal and is preferably made in the manner of an inverted truncated pyramid of four sides, its downwardly-tapering sides b' resting upon the said ribs a^3, whereby surrounding open surfaces a^5 are formed, which are filled with a loose material a^6, of pumice-stone, asbestos, or other material of a like character and which is a non-conductor of heat. Leading into one or more of the said sides a^2 or other suitable portion of the box-like or chambered foundation a are suitable gas-conveying pipes or ducts a^7. The said mold-support b is provided with a central duct or chamber $b^\times$ and the radially-arranged ducts or passage-ways b^2, leading therefrom

to the sides of the support b, as shown in Figs. 1 and 5. To permit a 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 provide 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 the said ribs. The mold-support b is also provided in its upper surfaces with raised portions b^3 and channels b^4 in the manner and for the purposes described in my said previous application for Letters Patent, Serial No. 738,581. Resting directly upon the upper surface of the support b is a metal supporting-plate c, which is preferably made rectangular in outline to conform with the cross shape of the mold d to be supported thereon. The said supporting-plate c is also provided with a correspondingly-shaped depression or recess c', formed by the main body portion of the frame c, and a surrounding shoulder c^2. Resting directly in said depression or recess c' is a central block or plate c^3, made of cast-iron or other porous material, the enlarged central portion c^4 of which extends down into the central opening of the frame c, and the surrounding edges c^5 of the block c^3 being surrounded by the shoulder c^2 of the frame c and the parts being arranged in such a manner to permit of proper expansion and contraction, as will be clearly evident from an inspection of Fig. 1.

The mold d has its lower surrounding surface d^6 placed directly over the joint formed by the shoulder c^2 of the supporting-plate c and the surrounding edges c^5 of the central block or plate c^3, substantially as illustrated in Fig. 1 of the drawings, and the central block or plate c^3 thus serves as a bottom to the mold for receiving the stream of molten metal poured into the mold through the usual pouring-opening in the mold-cover d'.

The supporting-plate c, as will be seen from the several figures of the drawings, is also formed with open channels c^6 for the reception of carbonaceous materials, such as tallow, asphaltum, or a compound of asphaltum with mineral oils, or, in fact, any other carbonaceous matter. As shown, these channels are surrounded by the recessed parts c^7 and the chamfered edge surfaces c^8. Resting upon the recessed parts c^7 and said surfaces c^8 are suitable covers e, which are of sufficient thickness that they will project above the upper surface of the frame c, and a chamfered portion or surface e' of each cover e will rest upon the chamfered surface portion c^8 and extend beyond the same to points near the outer and lower surfaces of the mold d, and thereby practically form a chamber e^2, surrounding the lower edge of said mold, substantially as illustrated. The said supporting-plate c is also provided with a suitably-disposed duct c^9 for the escape of any oversupply of gas in the foundation a and for the ignition of the gas or gases escaping at the start of the casting operation to enable the operator to determine the quantity and proper supply of the gas in the foundation a.

The mold d may be of any well-known construction and is preferably recessed in its several sides, as at d^2, being provided in said recesses with 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 to allow for the expansion and contraction of the plates when the mold becomes heated or cooled. When these several parts have been placed in position, as described and as shown in Fig. 1 of the drawings, and when it is desired to cast an ingot, hydrocarbon gas or hydrogen gas is admitted through the pipe or pipes a^7 into the loose material a^6, contained in the open spaces a^5 of the box-like or chambered foundation a, the gas or gases thus filling these spaces a^5 and then passing into the central duct or chamber $b^\times$ and into the radiating ducts b^2 in the mold-support b, permeating the pores thereof and expelling all atmospheric air from the box-like or chambered foundation a and the support b and other parts connected therewith. At the same time some of the gas will pass upward from the spaces a^5 to the grooves b^4 in the support b, where such gas is collected, the gas subsequently passing through the porous-metal block c^3, substantially as and in the manner hereinafter set forth. Molten metal is now poured into the top of the mold d through the opening in the mold-cover d' in the usual manner. The heat from the cast metal is soon transmitted to the central block c^3 and the surrounding supporting-plate c, as well as the upper channeled surface of the support b. In order to test the supply of the gas, a light is applied to the mouth of the duct c^9. This supply of gas can also be lighted before any metal is poured into the mold, as will be clearly evident. A stronger supply of hydrocarbon gas or hydrogen gas is then turned into the foundation a, which soon becomes volatilized by the excessive heat from the molten metal in the mold, said volatile hydrocarbon passing through the joints between the upper surrounding edge and upper surface of the support b and the plate c thereon and the hydrocarbon gas then passing through the joints between said plate c and the block c^3 and through the porous metal of which the block c^3 is made into the bottom of the mold and through the column of cast metal therein. At the same time the carbonaceous material f in the channels c^6 begins to melt and becomes volatilized, the gas passing into the surrounding chamber e^2, which is now closed at the edges of the plates e, which surround the mold, by the expansion of the mold. The gas then forces its way beneath the joint formed by the lower surface of the mold and

the surfaces of the supporting-plate *c* and the block c^3 into the mold, thereby preventing any influx of the atmospheric oxygen through the surrounding crevices, as will be clearly understood. Thus it will be clearly seen that the cast metal within the mold is prevented from being decarbonized, and any oxid that may have formed during the process of pouring is fully deoxidized. All oxygen is driven off with the superfluous gas. Furthermore, desulfurization takes place, and the metal is held in proper condition free from oxids and sulfur, which tend to reduce the value of the metal and are the causes of producing imperfect ingots. I also reduce, by means of the herein-described construction and arrangements of the parts, the generation of carbonaceous gas in the second stage of cooling, when the outer parts of the ingot are hardened and the center parts of the ingot are still liquid or semifluid, and a perfect and homogeneous ingot will result, in which the piping of the ingot is almost, if not entirely, overcome.

In order that the molten metal when it is first poured into the mold and before expansion of the parts may not flow into and fill up the surrounding space or crevice formed by the depression *c'* and the surrounding edge of the block c^4, the said crevice is preferably filled with cardboard *h*, as indicated in Fig. 1 of the drawings. This arrangement of the cardboard permits of the center block c^4 being properly centered and provides for the surrounding space through which the volatile gas shall pass. When the molten metal is poured into the mold, this cardboard becomes immediately charred, and the joint or crevice, due to the expansion of the parts, would close up tightly were it not for the carbon which is produced by the charred cardboard and which is compressed in place to still permit the passage of the volatile gas from the mold-support through said crevice and into the bottom of the mold.

Having thus described my invention, what I claim is—

1. The combination, with an ingot-mold, of a mold-support, consisting, essentially, of a chambered base-plate or foundation, means for conducting a reducing-gas into said base or foundation, a supporting means within said chambered base-plate or foundation, a supporting-plate on said supporting means, and a block or plate in said supporting-plate, of a material which will retain the gas in said base-plate or foundation while the mold is still cold, but permit it to pass into the mold and the metal therein when heated by the molten metal in the mold, 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-plate or foundation, means for conducting a reducing-gas into said base or foundation, a supporting means within said chambered base-plate or foundation, a supporting-plate on said supporting means, a surrounding shoulder and recessed portion in said supporting-plate, and a block or plate resting in said recessed portion and a part thereof extending down into the central opening of the supporting-plate, of a material which will retain the gas in said base-plate or foundation while the mold is still cold, but permit it to pass into the mold and the metal therein 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-plate or foundation, means for conducting a reducing-gas into said base or foundation, a supporting means within said chambered base-plate or foundation, a supporting-plate on said supporting means, and a block or plate in said supporting-plate, of a material which will retain the gas in said base-plate or foundation while the mold is still cold, but permit it to pass into the mold and the metal therein when heated by the molten metal in the mold, a channel or channels in said supporting-plate, adapted to contain a carbonaceous material, and means for closing said channel or channels, 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-plate or foundation, means for conducting a reducing-gas into said base or foundation, a supporting means within said chambered base-plate or foundation, a supporting-plate on said supporting means, and a block or plate in said supporting-plate, of a material which will retain the gas in said base-plate or foundation while the mold is still cold, but permit it to pass into the mold and the metal therein when heated by the molten metal in the mold, a channel or channels in said supporting-plate, adapted to contain a carbonaceous material, and means for closing said channel or channels, consisting, of plates *e* having chamfered portions extending in close proximity to the outer surfaces of the mold, and forming a chamber, 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-plate or foundation, means for conducting a reducing-gas into said base or foundation, a supporting means within said chambered base-plate or foundation, a supporting-plate on said supporting means, a surrounding shoulder and recessed portion in said supporting-plate, and a block or plate resting in said recessed portion and a part thereof extending down into the central opening of the supporting-plate, of a material which will retain the gas in said base-plate or foundation while the mold is still cold, but permit it to pass into the mold and the metal therein when heated by the molten metal in the mold, a channel or channels in said supporting-plate, adapted to contain a carbonaceous material, and means for closing said chan-

nel or channels, 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-plate or foundation, means for conducting a reducing-gas into said base or foundation, a supporting means within said chambered base-plate or foundation, a supporting-plate on said supporting means, a surrounding shoulder and recessed portion in said supporting-plate, and a block or plate resting in said recessed portion and a part thereof extending down into the central opening of the supporting-plate, of a material which will retain the gas in said base-plate or foundation while the mold is still cold, but permit it to pass into the mold and the metal therein when heated by the molten metal in the mold, a channel or channels in said supporting-plate, adapted to contain a carbonaceous material, and means for closing said channel or channels, consisting, of plates *e* having chamfered portions extending in close proximity to the outer surfaces, of the mold, 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-plate or foundation, means for conducting a reducing-gas into said base or foundation, and means in said base-plate or foundation of a material which will retain the gas in said base-plate or foundation while the mold is still cold, but permit the gas to pass into the mold and the metal therein when heated by the molten metal in the mold, and a supporting-plate provided with a channel or channels, adapted to contain a carbonaceous material, and means for closing said channel or channels, 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-plate or foundation, means for conducting a reducing-gas into said base or foundation, and means in said base-plate or foundation of a material which will retain the gas in said base-plate or foundation while the mold is still cold, but permit the gas to pass into the mold and the metal therein when heated by the molten metal in the mold, and a supporting-plate provided with a channel or channels, adapted to contain a carbonaceous material, and means for closing said channel or channels, consisting, of plates *e* having chamfered portions extending in close proximity to the outer surfaces of the mold, substantially as and for the purposes set forth.

9. The combination, with an ingot-mold, of a supporting means on which said mold is placed, provided with a channel or channels, adapted to contain a carbonaceous material, and means for closing said channel or channels, consisting, of plates *e* having chamfered portions extending in close proximity to the outer surfaces of the mold, substantially as and for the purposes set forth.

10. The combination, with an ingot-mold, of a chambered base-plate or foundation, *a*, having internal ribs, a support *b* on said ribs, and a supporting-plate *c* on said support and a central block or plate in the open portion of said supporting-plate, said mold resting on said supporting-plate and central block or plate, and means for conducting a gas into said base-plate, and means connected with said support *b* and the supporting-plate and central block for conducting the gas into the mold, substantially as and for the purposes set forth.

11. The combination, with an ingot-mold, of a chambered base-plate or foundation, *a*, having internal ribs, a support *b* on said ribs, and a supporting-plate *c* on said support and a central block or plate in the open portion of said supporting-plate, said mold resting on said supporting-plate and central block or plate, and means for conducting a gas into said base-plate, and means connected with said support *b* and the supporting-plate and central block for conducting the gas into the mold, a channel or channels in said supporting-plate, adapted to contain a carbonaceous material, and means for closing said channel or channels, substantially as and for the purposes set forth.

12. The combination, with an ingot-mold, of a chambered base-plate or foundation, *a*, having internal ribs, a support *b* on said ribs, and a supporting-plate *c* on said support and a central block or plate in the open portion of said supporting-plate, said mold resting on said supporting-plate and central block or plate, and means for conducting a gas into said base-plate, and means connected with said support *b* and the supporting-plate and central block for conducting the gas into the mold, a channel or channels in said supporting-plate, adapted to contain a carbonaceous material, and means for closing said channel or channels, consisting, of plates *e* having chamfered portions extending in close proximity to the outer surfaces of the mold, substantially as and for the purposes set forth.

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

14. A support for an ingot-mold, comprising a base or foundation, having a cavity, and a supporting means therein, arranged and constructed to close said base at the top, but pro-

viding a surrounding space in said base or foundation for a reducing-gas, a loose material, which is a non-conductor of heat in said space, means for conducting the gas into said space and beneath said supporting means, a supporting-plate on said supporting means, and a central block or plate in the central opening of said supporting-plate, and means connected with said supporting means, and the said supporting-plate and central block for conducting the gas into the mold, a channel or channels in said supporting-plate adapted to contain a carbonaceous material, and means for closing said channel or channels, substantially as and for the purposes set forth.

15. A support for an ingot-mold, comprising a base or foundation, having a cavity, and a supporting means therein, arranged and constructed to close said base at the top, but providing a surrounding space in said base or foundation for a reducing-gas, a loose material, which is a non-conductor of heat in said space, means for conducting the gas into said space and beneath said supporting means, a supporting-plate on said supporting means, and a central block or plate in the central opening of said supporting-plate, and means connected with said supporting means, and the said supporting-plate and central block for conducting the gas into the mold, a channel or channels in said supporting-plate adapted to contain a carbonaceous material, and means for closing said channel or channels, consisting, of plates *e* having chamfered portions extending in close proximity to a mold arranged on said frame-piece, and forming a chamber, 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 13th day of July, 1900.

ADOLPHUS J. LUSTIG.

Witnesses:

FREDK. C. FRAENTZEL,

GEO. D. RICHARDS.