(No Model.) 3 Sheets—Sheet 1.

C. M. RYDER.

CASTING ATTACHMENT FOR OPEN HEARTH STEEL MELTING FURNACES.

No. 277,850. Patented May 15, 1883.

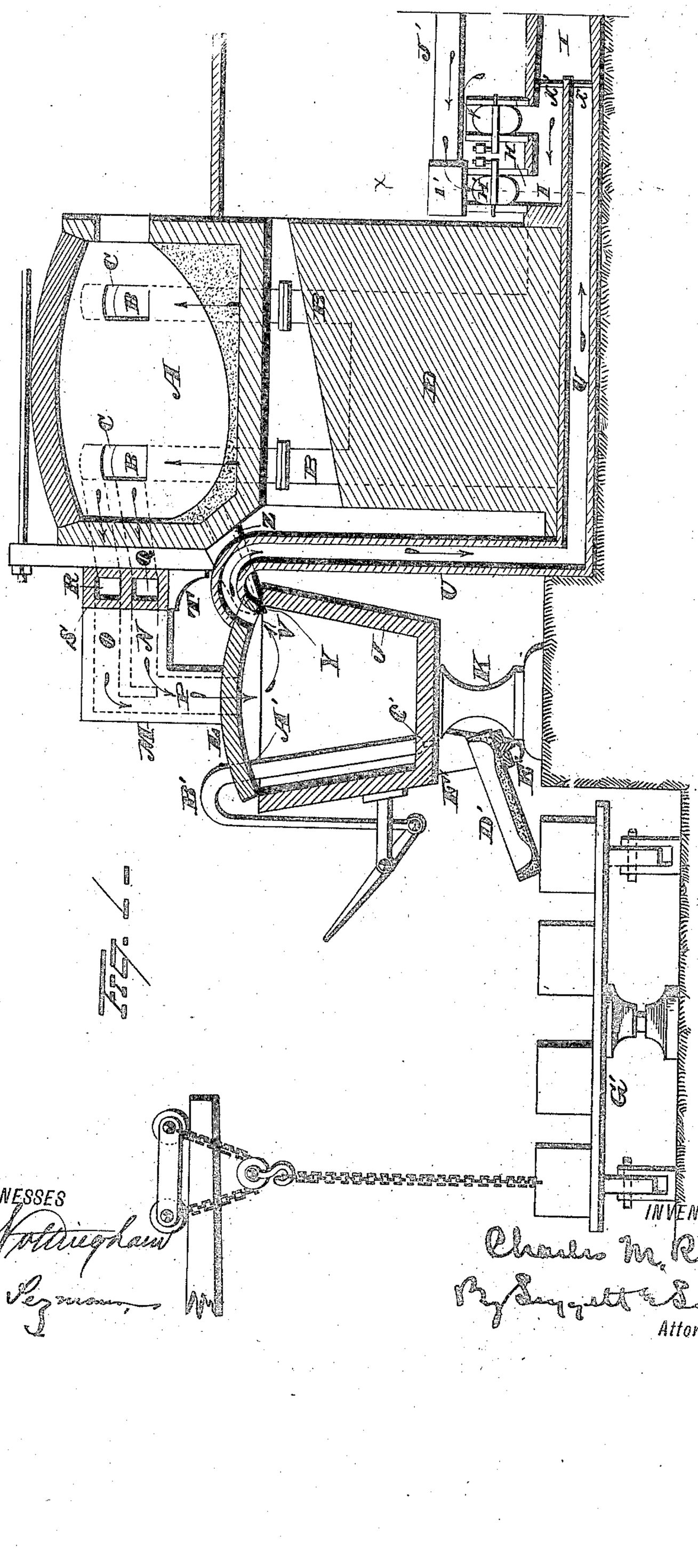

Fig. 1.

WITNESSES

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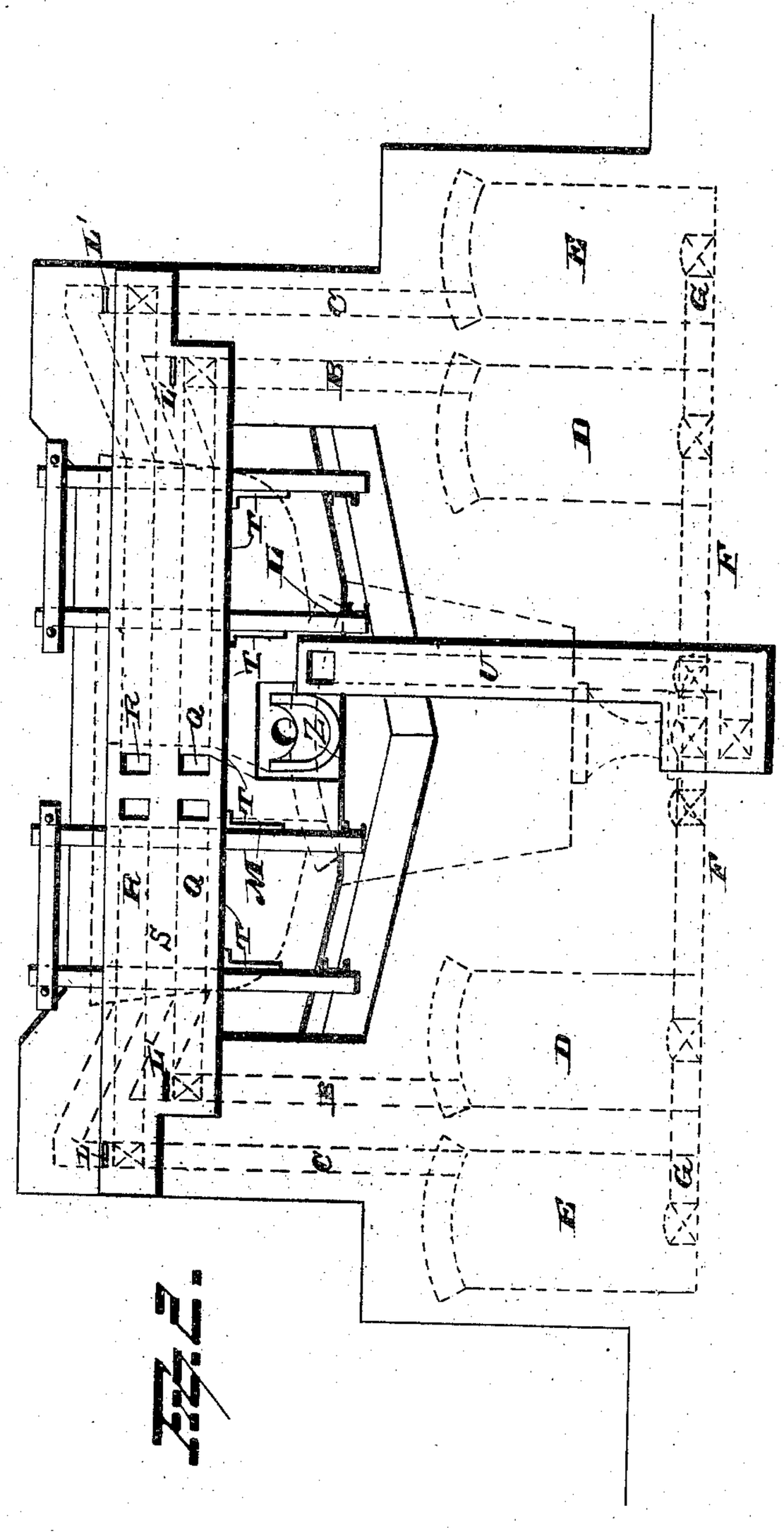

Fig. 2.

WITNESSES

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C. M. RYDER.

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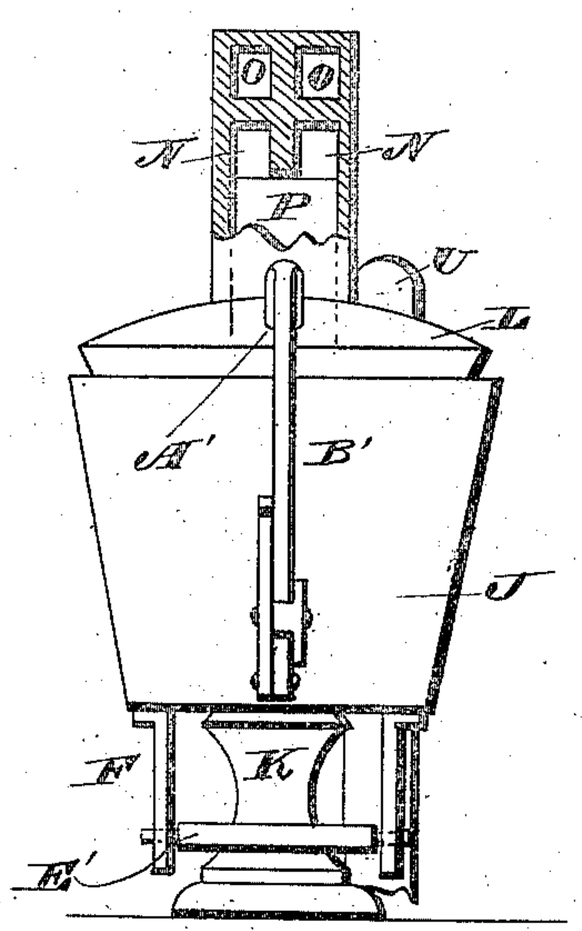
FIG. 3.



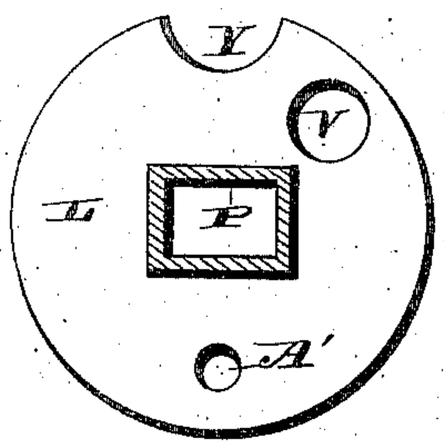


FIG. 4.

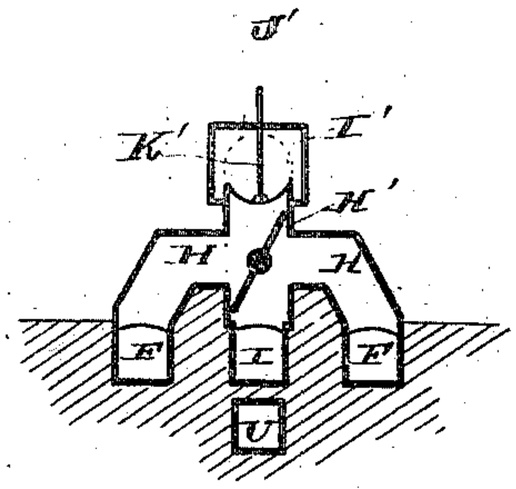


FIG. 5.

WITNESSES

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UNITED STATES PATENT OFFICE.

CHARLES M. RYDER, OF CHESTER, PENNSYLVANIA.

CASTING ATTACHMENT FOR OPEN-HEARTH STEEL-MELTING FURNACES.

SPECIFICATION forming part of Letters Patent No. 277,850, dated May 15, 1883.

Application filed December 7, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES M. RYDER, of Chester, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Open-Hearth Steel-Melting Furnaces; 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.

Heretofore all operations of casting have been seriously embarrassed by the rapid cooling of the metal after it is tapped into the ladle. For this reason large castings occupying considerable time in pouring lack homogeneity of crystallization, while the operation of casting a number of small pieces from a common ~~mass of metal~~ involves the expenditure of so much time that a portion of the metal cools before it can be poured. The above is especially true of all operations of casting structural steel, which cools rapidly and acquires a spongy texture, being in this respect similar to wrought-iron.

The object of my invention is to overcome the difficulties above referred to by providing means for sustaining the heat of the metal, after it has been tapped into the ladle, at any desired temperature and for any desired time. A further object of the invention is to provide effectual and convenient means for heating the ladle before the metal of the bath is tapped into it.

With these objects in view my invention consists in the combination, with a ladle, of flues for conveying gas and air blasts thereinto, and a flue for the escape of the waste products of combustion therefrom.

My invention further consists in the combination, with an open-hearth steel-melting or regenerative furnace and a ladle, of flues connecting the gas and air flues of the furnace with the ladle, and means for deflecting a portion or the whole of the gas and air blasts of the furnace to the ladle, and for regulating the draft through the same.

My invention further consists in certain details of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in vertical transverse section of a furnace and ladle embodying my invention. Fig. 2 is a view in elevation of the pit side thereof, the ladle being represented in broken lines. Fig. 3 is a view in front elevation of the ladle, the structure surmounting it being shown in section. Fig. 4 is a plan view of the ladle-cover, the surmounting structure being broken away; and Fig. 5 is a view in transverse section through line *x y* of Fig. 1.

A is the melting-chamber of an open-hearth steel-melting or regenerative furnace. Two gas-flues, B, and two air-flues, C, terminate in each end of the melting-chamber aforesaid, the air-flues being respectively located above the gas-flues, according to the arrangement now generally adopted in this class of furnaces. The flues thus arranged to introduce gas and air blasts into opposite ends of the melting-chamber respectively terminate in suitable regenerative chambers, D and E, a pair of the same being located at each end of the furnace. The chambers D of the said pairs are respectively provided with flues F, which intersect each other and the chimney-flue I through a chamber, H, leading into the same, gas under pressure being introduced into the said chamber H from the box I′ of the gas-conduit J′. A regulator, K′, located in the box I′ aforesaid, determines the quantity of gas admitted to the furnace in any given time. The oscillation of the gas-blast from one side of the furnace to the other is controlled by the reversing-valve H′, located in the chamber H, and arranged to deflect the blast through the flue of either of the chambers D. The above-described arrangement for reversing the gas-blasts is shown in Fig. 5 of the drawings. The chambers E of the said pairs of regenerative chambers are respectively provided with flues G, which intersect each other and the chimney-flue I through a chamber leading into the same, and provided with an aperture for the admission of air, and with a reversing-valve, the arrangement of the several parts being substantially the same as described and shown in Fig. 5, and not having for this reason a special figure devoted to their illustration. The ladle J, which is mounted upon a column or standard, K, during the operation of casting, is furnished with a removable cover, L, lined with refractory material and surmounted by a structure, M, embodying two gas-flues, N, the same number of

air-flues O, and a flue, P, in which all of the said flues terminate, and which communicates with the ladle. The outer ends of the said flues N and O are arranged to coincide, respectively, with the terminals of the auxiliary flues Q and R, embodied in the refractory structure S, supported by a bracket, T, projecting from the pit side of the furnace. These auxiliary flues intersect the gas and air flues B and C at points without their intersection with the melting-chamber A. A flue, U, terminating in the escape or chimney flue I, and communicating with the ladle through an orifice, V, formed in the cover L thereof, is designed to convey the waste products of combustion from the ladle when the gas and air blasts are deflected thereinto, as will be hereinafter described. A damper, X, located in the flue I and arranged to control the draft through the flue U, is employed in connection with a damper, X′, also located in the flue I, in the deflection of the gas and air blasts through the ladle, this being effected by opening the damper X and partially closing the damper X′. The metal of the bath is introduced into the ladle through an aperture, Y, formed in its cover and registering with the spout Z of the furnace. The cover of the ladle is also provided with an aperture, A′, for the introduction of the stopper B′, the lower end of which fits in an orifice, C′, formed in the bottom of the ladle. The stopper is manipulated to open or close the orifice C′ by means of a system of levers, arranged as shown in the drawings or in any equivalent manner. The metal is conveyed from the ladle to the molds by means of a spout, D′, pivoted to a short bar, E′, journaled in lugs F′, depending from the ladle. By mounting the spout in this manner it is rendered laterally and vertically adjustable, enabling it to be handled to the best advantage in filling the molds. When a number of small pieces are being cast a turn-table, G′, will facilitate the operation by reducing the necessary handling of the molds.

Having detailed the construction of my improvement, I will now proceed to describe its operation.

The charge in the melting-chamber of the furnace is first subjected to the action of the gas and air blasts, which are reversed through the furnace and regenerative chambers in the usual manner. When the tests declare that the metal has been reduced to the desired condition for casting, the damper X is opened and the damper X′ partially closed, with the effect of creating a strong draft through the flue U, the ladle L, the flues P, N, and O of the structure M, and the auxiliary flues Q and R, which, as before described, respectively intersect the gas and air flues B and C of the furnace, and as the draft thus created is stronger than the normal draft of the furnace, which is through the gas and air flues of the regenerative chambers being heated, a great portion or all of the gas and air blasts will be deflected through the auxiliary flues and into the ladle. When the same has been sufficiently heated the furnace is tapped and the metal drawn into it and sustained at the desired temperature for any desired time by the combustion therein of the gas and air blasts, which are still continued through it, being regulated in quantity by the regulators, which control the proportions in which the blasts are commingled in the furnace. As in the operation of the furnace the gas and air blasts are reversed through the ladle and the regenerative-chambers by manipulating the reversing-valves in the usual manner for reversing the blasts through the furnace. In virtue of this arrangement the whole mass of metal in the ladle may be maintained at a uniform temperature throughout the entire operation of casting, whereby homogeneity of crystallization is attained in large pieces which require considerable time in pouring, and whereby the fabrication of small articles of structural steel is placed on a practical footing, inasmuch as the temperature of a large charge of metal can be sustained until it is entirely poured. On the other hand, without provision for sustaining the temperature of the metal after its withdrawal into the ladle, it has been impossible to insure homogeneity of crystallization in large castings and to cast any considerable number of small pieces from a single charge of metal.

It is thus apparent that the improvements herein described mark an important advance in the art of casting structural steel, and that they may be embodied in any of the approved forms of open-hearth steel-melting or regenerative furnaces P. The deflection of the gas and air blasts into the ladle prior to tapping the furnace affords a rapid, convenient, and economical method of preparing it for the reception of the metal, being much superior to any of the old methods for accomplishing the same result.

Instead of relying alone on the draft obtained through the flues leading from the ladle to the chimney for the deflection of the gas and air blasts through the ladle, the said blasts may be entirely excluded from the melting-chamber of the furnace, for the time being, by means of dampers L, located in the furnace-flues at points above those at which they are intersected by the auxiliary flues leading to the ladle.

It is designed to maintain the metal in the ladle below its boiling temperature, inasmuch as when ebullition and the evolution of gas takes place the character of the metal changes. Should this occur, however, small quantities of spiegeleisen or other material, as may be required, can be successively introduced into the ladle through its cover and test ingots cast until the mass of metal is restored to its original condition. So, too, if it is required to produce several castings varying slightly in character from a common mass of metal, the requisite changes therein may be effected either by allowing the same to boil or by the addition of raw material, according to the quality of metal which it is desired to produce.

The ladle may be adapted to have additional material introduced into it and tests taken by means of an orifice formed in the cover, or it may be revolved on its support to bring the aperture registering with the spout of the furnace in convenient position to be utilized for the purpose.

The escape-flue of the ladle may be arranged to lead to an independent chimney, and, if found desirable, gas and air derived from other sources and conveyed to the ladle through other flues may be employed instead of the gas and air blasts of the furnace. The utilization of the furnace-blasts in the manner shown is, however, probably the most simple and economical which can be adopted.

In view of the alterations involved in the modifications and adaptations suggested of the other changes which may be incurred in applying the improvement to different styles of furnaces, and also of the changes which must often be made to meet the requirements resulting from the oscillation of the ordinary practical conditions, I would have it understood that I do not limit myself to the construction and arrangement of parts herein shown and described, but hold myself at liberty to make such changes and alterations as fairly fall within the spirit and scope of my invention.

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

1. The combination, with the ladle of a furnace, of flues for conveying gas and air blasts thereinto, and a flue for the escape of the waste products of combustion therefrom, substantially as set forth.

2. The combination, with the ladle of a furnace, of flues for conveying gas and air blasts thereinto, and a flue for the escape of the waste products of combustion therefrom, and means for controlling the draft through the ladle and for regulating the blasts deflected into it, substantially as set forth.

3. The combination, with an open-hearth steel-melting or regenerative furnace and a ladle, of flues connecting the gas and air flues of the furnace with the ladle, and means for deflecting the whole or a portion of the gas and air blasts of the furnace to the ladle, and for regulating the draft through the same, substantially as set forth.

4. The combination, with an open-hearth steel-melting or regenerative furnace and a ladle, of auxiliary flues embodied in the furnace and intersecting its gas and air flues, flues supported by the ladle and coinciding with the said auxiliary flues, and means for deflecting the whole or a portion of the blast of the furnace through the ladle, and for controlling the draft of the same, substantially as set forth.

5. The combination, with an open-hearth steel-melting or regenerative furnace provided with auxiliary flues intersecting its gas and air flues, of a ladle and a removable cover therefor, said cover being provided with flues coinciding with the said auxiliary flues and with an aperture registering with the spout of the furnace, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES M. RYDER.

Witnesses:
GEO. D. SEYMOUR,
F. O. MCCLEARY.