No. 682,512. Patented Sept. 10, 1901.

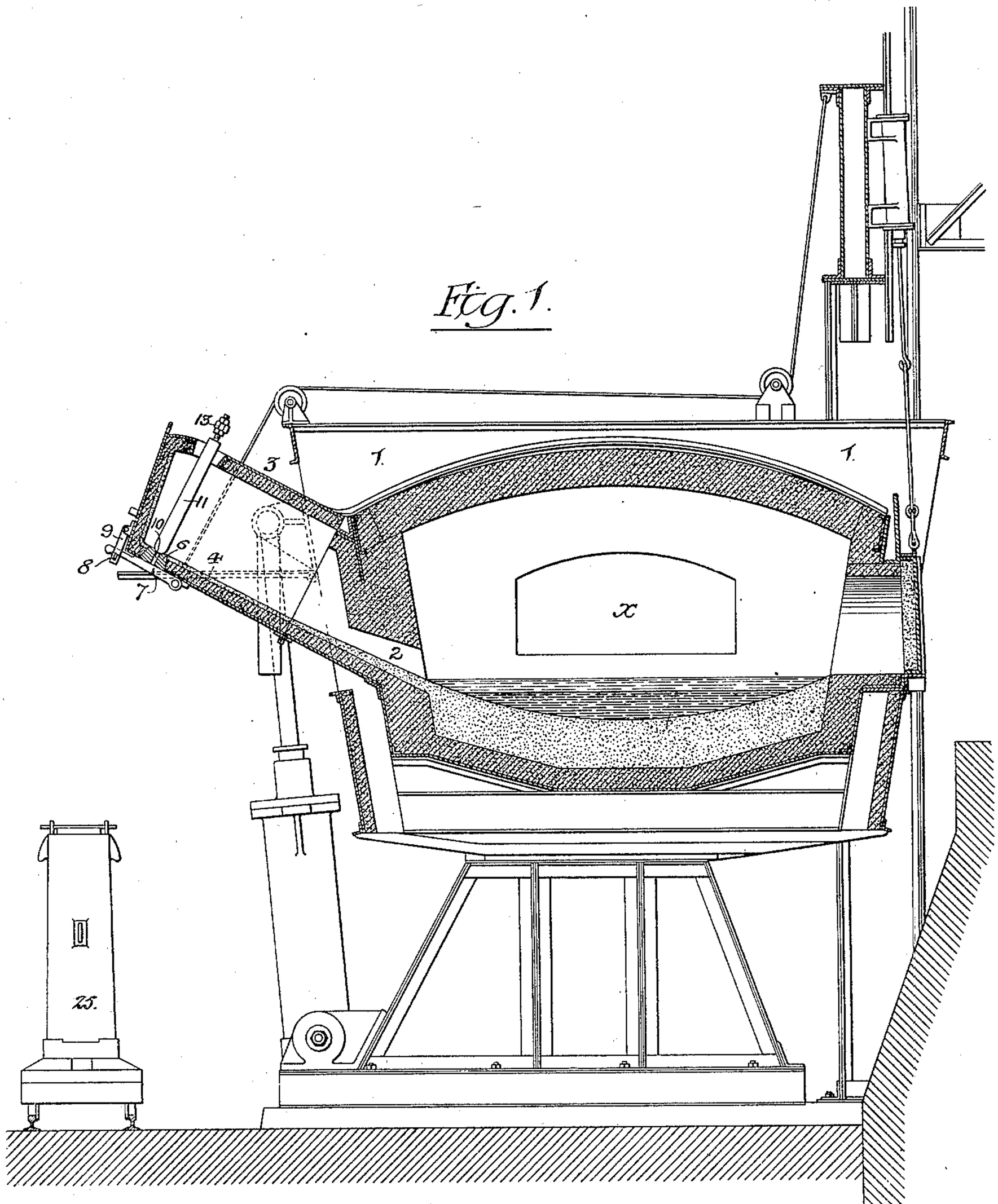
S. T. & C. H. WELLMAN.

OPEN HEARTH STEEL FURNACE.

(Application filed July 16, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses:-
Frank H. Graham.
Louis W. Whitehead.

Inventors:-
Samuel T. Wellman
Charles H. Wellman.
by their Attorneys:-
Howson & Howson

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Fig. 3.

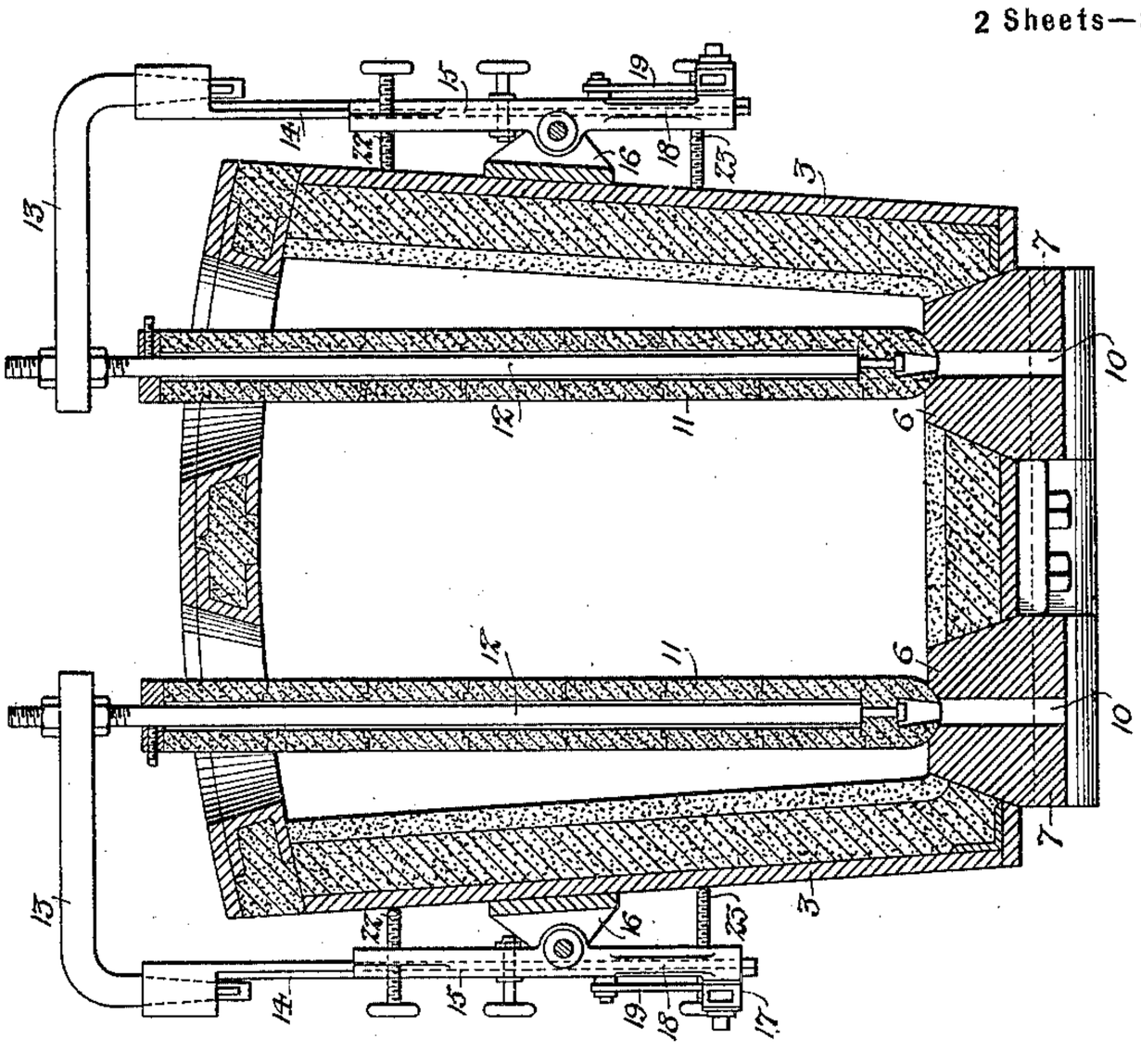
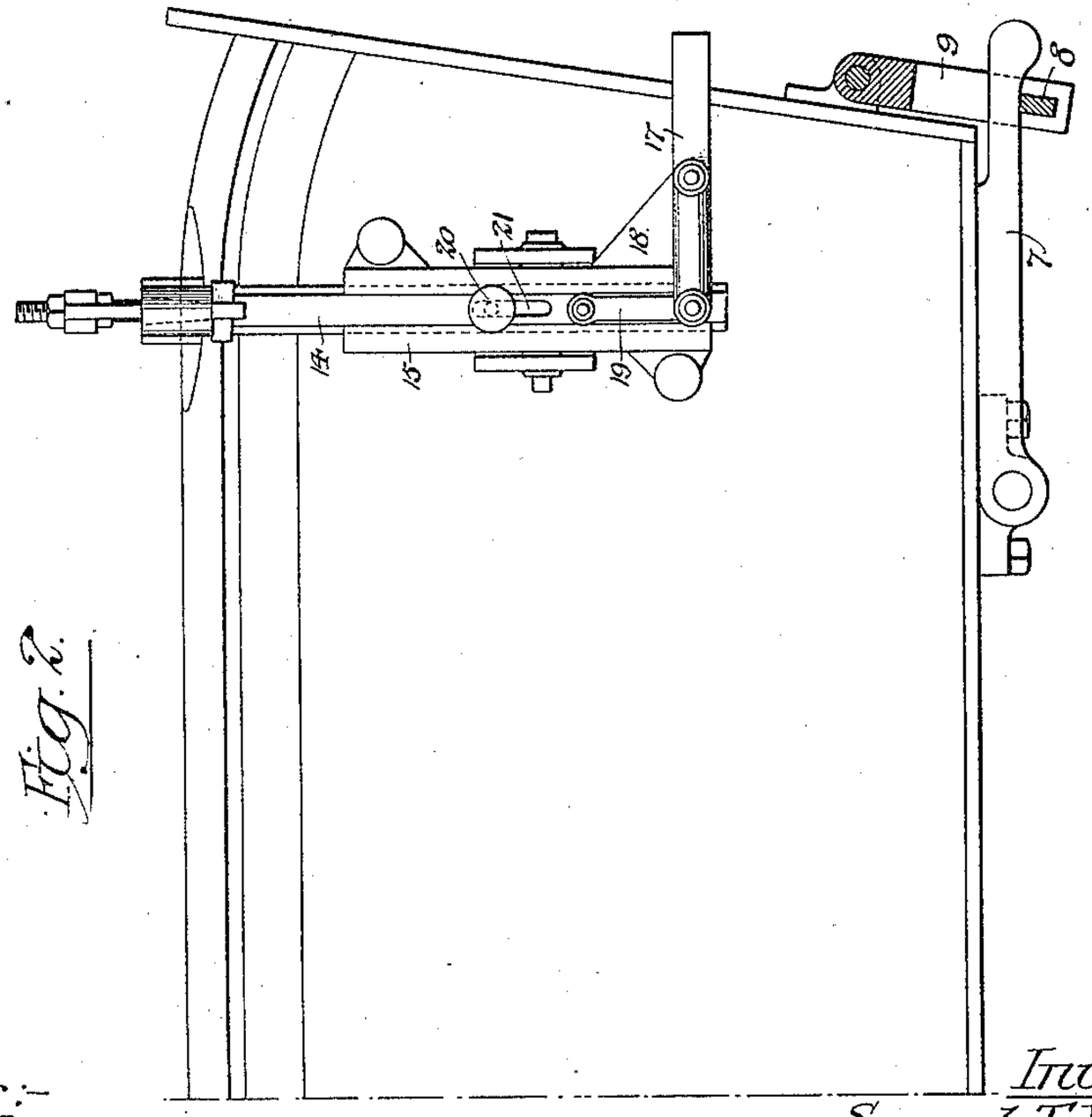


Fig. 2.



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UNITED STATES PATENT OFFICE.

SAMUEL T. WELLMAN AND CHARLES H. WELLMAN, OF CLEVELAND, OHIO, ASSIGNORS TO THE WELLMAN SEAVER ENGINEERING COMPANY, OF SAME PLACE.

OPEN-HEARTH STEEL-FURNACE.

SPECIFICATION forming part of Letters Patent No. 682,512, dated September 10, 1901.

Application filed July 16, 1900. Serial No. 23,810. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL T. WELLMAN and CHARLES H. WELLMAN, citizens of the United States, and residents of Cleveland, Ohio, have invented certain Improvements in Open-Hearth Steel-Furnaces, of which the following is a specification.

The object of our invention is to so construct an open-hearth steel-furnace as to permit of the tapping of the molten steel directly from the furnace into an ingot-mold or other receptacle and a subsequent reheating of the slag retained in the furnace, so that the latter can be poured into a slag-car and conveyed to the dump while still in molten condition, thereby saving considerable labor which is now required in the handling of the slag.

In the accompanying drawings, Figure 1 is a transverse section of an open-hearth furnace constructed in accordance with our invention. Fig. 2 is an enlarged side view of part of the furnace, and Fig. 3 is an enlarged transverse section of the same.

In Fig. 1 the structure 1 may represent any desired form of tipping or tilting furnace, provided with end ports *x* or other means for causing a flow of the heated gases through the same, the construction of the body of the furnace, the method of mounting the same, and the means employed for tipping and tilting it forming no part of our present invention.

Projecting from one side of the furnace and forming a continuation of the upwardly-inclined side pouring-spout 2 of the same is a tubular casing 3, containing a forehearth 4, which, like the pouring-spout and main bed or hearth 5 of the furnace, is lined with suitable refractory material in order to withstand the heat to which these parts are subjected, this refractory material being either of an acid or basic character, depending upon the character of the furnace to which the invention is applied. Near its outer end the forehearth 4 has formed in it in the present instance two openings, each of which is normally closed by a plug 6, carried by a pivoted frame or plate 7, hung to the under side of the forehearth-casing and retained in its normal position by means of a key 8, carried by a forked retainer 9, which embraces a projecting portion of said pivoted plate or frame 7, as shown in Figs. 1 and 2. Through each of the plugs 6 is formed a pouring-opening 10, which is normally closed by means of a stopper 11, consisting, by preference, of plugs of refractory material strung upon and longitudinally confined to a rod or stem 12, which is secured to and depends from an arm 13, projecting laterally over the structure 3 of the furnace and secured to the upper end of a vertically-movable bar 14, which is guided in a frame 15, pivotally mounted upon brackets 16 on the side of the structure 3, vertical movement of the sliding bar 14 being effected by manipulation of a lever 17, which is hung to a bracket 18 on the frame 15 and is connected to the sliding bar 14 by means of a link 19, as shown in Figs. 2 and 3, the vertical movement of the bar 14 being limited by means of a pin 20, which passes through a slot 21 in the bar, as shown in Fig. 2. Adjusting-screws 22 and 23 at the top and bottom of the frame 15 bear upon the sides of the structure 3 of the furnace and serve to maintain the guide-frame 15 in its proper vertical position.

When the furnace is in its normal position, as shown in Fig. 1—that is to say, the position assumed when the charge is being melted or treated on the bed 5 of the furnace—the pouring-spout 2 and forehearth 4 project upwardly from said bed at an angle, so that the charge upon the bed of the furnace is wholly within the main structure and under the direct action of the products of combustion therein, no part of said charge entering the pouring-spout or forehearth, owing to the fact that the bottom of the same is above the charge-receiving chamber of the furnace. The forehearth and spout, however, are kept hot by such of the products of combustion as may enter the same.

It should be observed that the passage 2 through the side wall of the furnace extends from the upper edge of what, for the want of a better term to describe it, we may define as a "basin-shaped" hearth of the furnace, which forms or constitutes the charge-receiving chamber of the furnace, and that therefore the forehearth is so disposed that its bottom is above the said charge-receiving chamber when the furnace is in its normal or working

condition. By "basin-shaped" we do not mean that the shape of the hearth shall necessarily be restricted to the exact shape shown, but we have used this term in order to define clearly the relation between the passage in the side wall of the furnace and the chamber in which the charge is placed.

When it is desired to discharge the contents of the furnace, the same is tipped or tilted until the forehearth occupies a horizontal or downwardly-inclined position. Hence the molten metal will flow into and accumulate in said forehearth and can be discharged therefrom, as desired, through the pouring-openings 10 in the plugs 6 by proper manipulation of the stoppers 11, the discharge being, if desired, directly into the ingot-molds 25, because when the discharge is effected in this way there is no likelihood of any outflow of slag with the metal into the molds, the metal always occupying the lower position on the forehearth and the flow being from the bottom of the latter. In tipping the furnace as described sufficient slag will flow into the forehearth with the metal to provide a protective covering for the latter and prevent loss of its heat, whereby the metal is kept in freely-flowing condition until it has all been run off. After the metal has been withdrawn the furnace is again restored to normal position, so that the slag will flow back onto the bed of the furnace, and the flow of the products of combustion through the furnace, which was arrested during the pouring operation, is resumed for the purpose of reheating the slag. When such reheating has been effected, the removal of the slag can be quickly accomplished by knocking out the key 8, so as to permit the plate or frame 7, carrying the plugs 6, to swing downwardly, and then again tipping the furnace in order that the slag may escape freely through the openings in the forehearth and into a slag-car or other receptacle run under said hearth to receive it, in which car the slag can, owing to the high temperature imparted to it by reheating, be conveyed while in a molten state to the slag-dump.

If desired, the forehearth structure may be detachably connected to the furnace and removed therefrom when it is desired to pour the slag from the furnace.

By this system of direct discharge the use of ladles, cranes, and similar mechanism for transporting the molten metal is rendered unnecessary, the labor involved in the handling of the slag in the ordinary way is dispensed with, and the open-hearth steel plant is materially simplified and cheapened. Owing, moreover, to the ready control of the flow of the metal and slag, the furnaces may be made much larger than is possible when the usual plan of pouring into ladles is resorted to. As the forehearth structure 3 of the furnace only receives the metal in limited quantity and for a limited time, said structure can be lighter and more lightly lined than the body of the furnace.

It will be noted that the forehearth is wholly above the level of the charge on the bed of the furnace when the latter is in its normal or working condition. Hence tipping of the furnace is essential to the flow of the molten metal or slag into the forehearth.

Having thus described our invention, we claim and desire to secure by Letters Patent—

1. The combination of a tipping or tilting open-hearth steel-furnace having a basin-shaped hearth forming the charge-receiving chamber, means for passing heating-gases therethrough, a projecting structure containing a forehearth independent of the gas-passages and having one or more stoppered discharge-openings in the bottom, and a passage extending from the upper edge of the basin-shaped hearth through the side wall of the furnace to the forehearth, whereby the bottom of the forehearth is disposed above the said charge-receiving chamber when the furnace is in its normal or working condition, substantially as specified.

2. The combination of a tipping or tilting open-hearth steel-furnace having a basin-shaped hearth forming the charge-receiving chamber, means for passing heating-gases therethrough, an upwardly-inclined passage extending from the upper edge of the said basin-shaped hearth through the side wall of the furnace, a projecting structure containing a forehearth forming an inclined continuation of said inclined passage, and having one or more stoppered discharge-openings in its bottom, said forehearth being independent of the gas-passages, whereby said forehearth is so disposed that its bottom is above the said charge-receiving chamber when the furnace is in its normal or working condition, substantially as specified.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

SAMUEL T. WELLMAN.
CHARLES H. WELLMAN.

Witnesses:
MALCOLM LOVE,
C. W. COMSTOCK.