(No Model.)

2 Sheets—Sheet 1.

W. F. DURFEE & T. EGLESTON.

APPARATUS FOR CASTING COPPER.

No. 287,646. Patented Oct. 30, 1883.

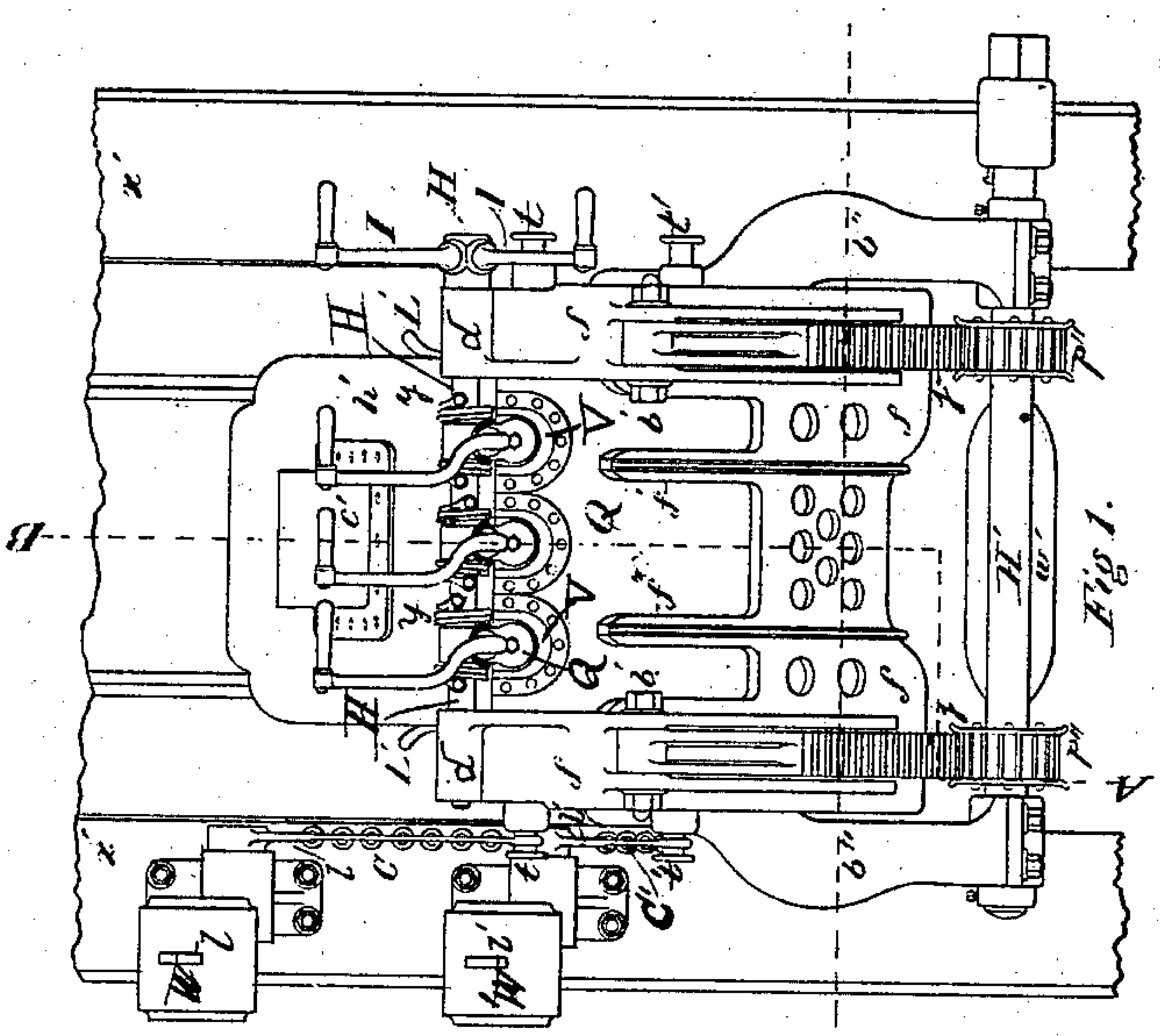

Fig 1. Front Elevation.

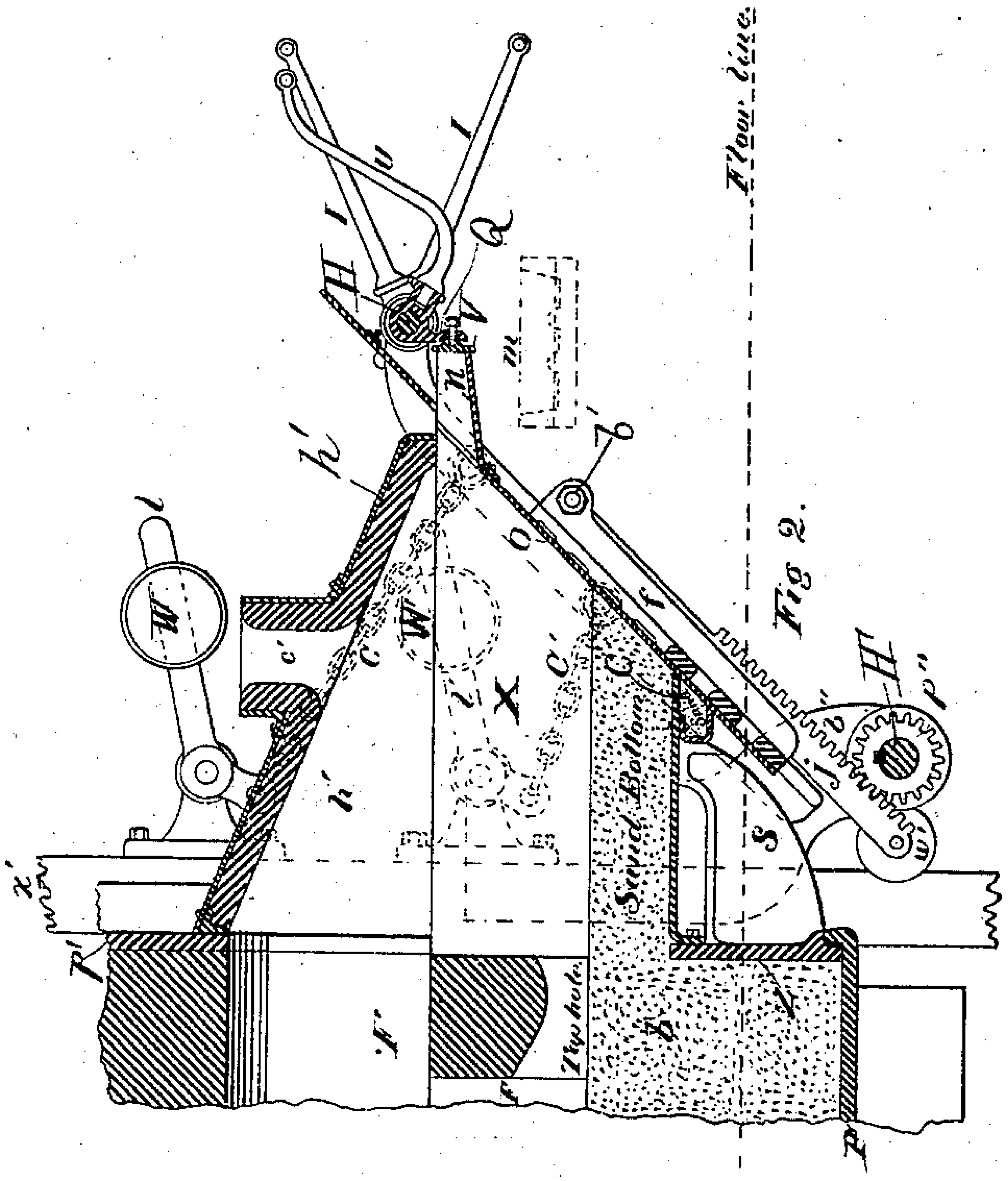

Fig 2. Section on line A.B.

Witnesses;

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(No Model.) 2 Sheets—Sheet 2.

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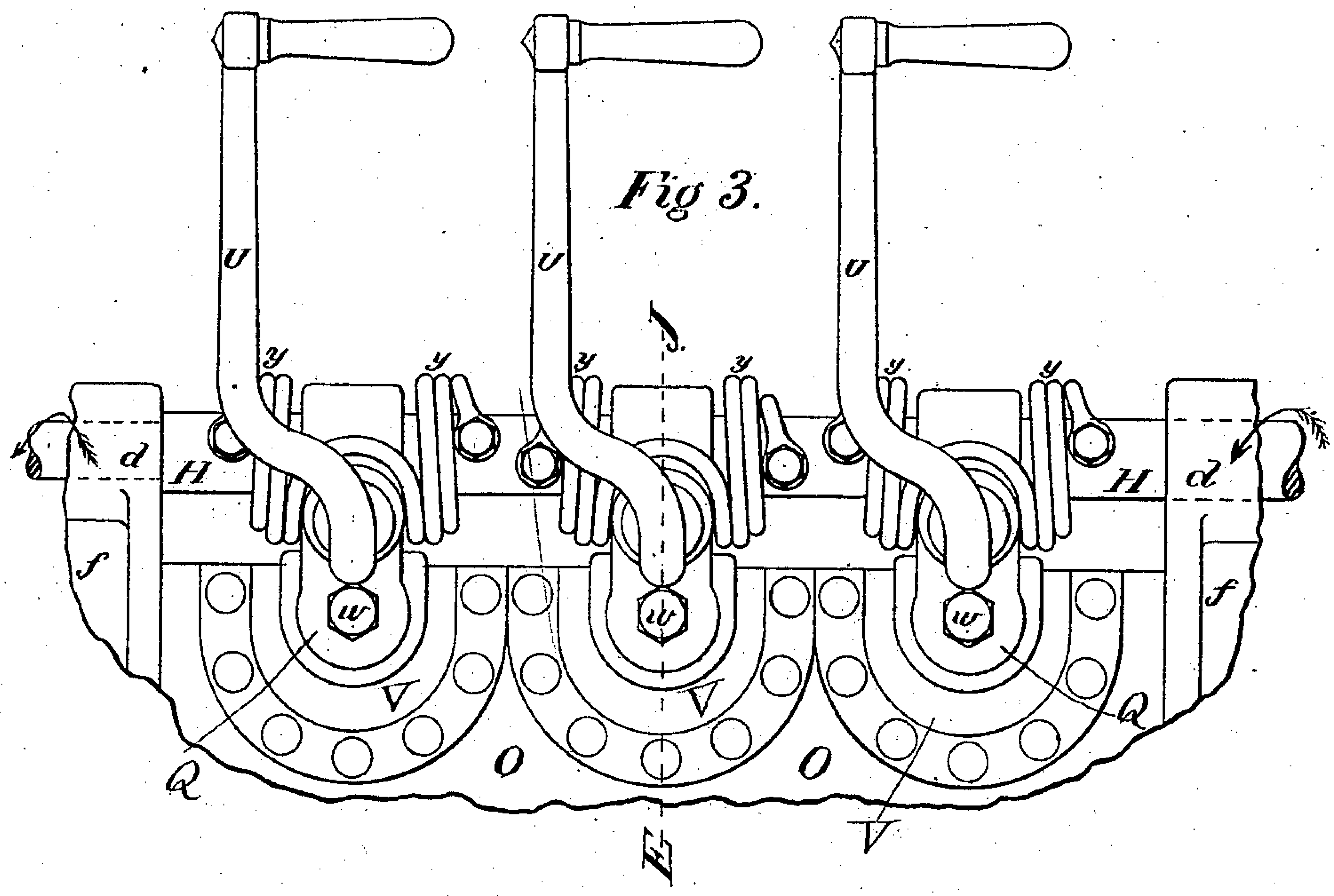

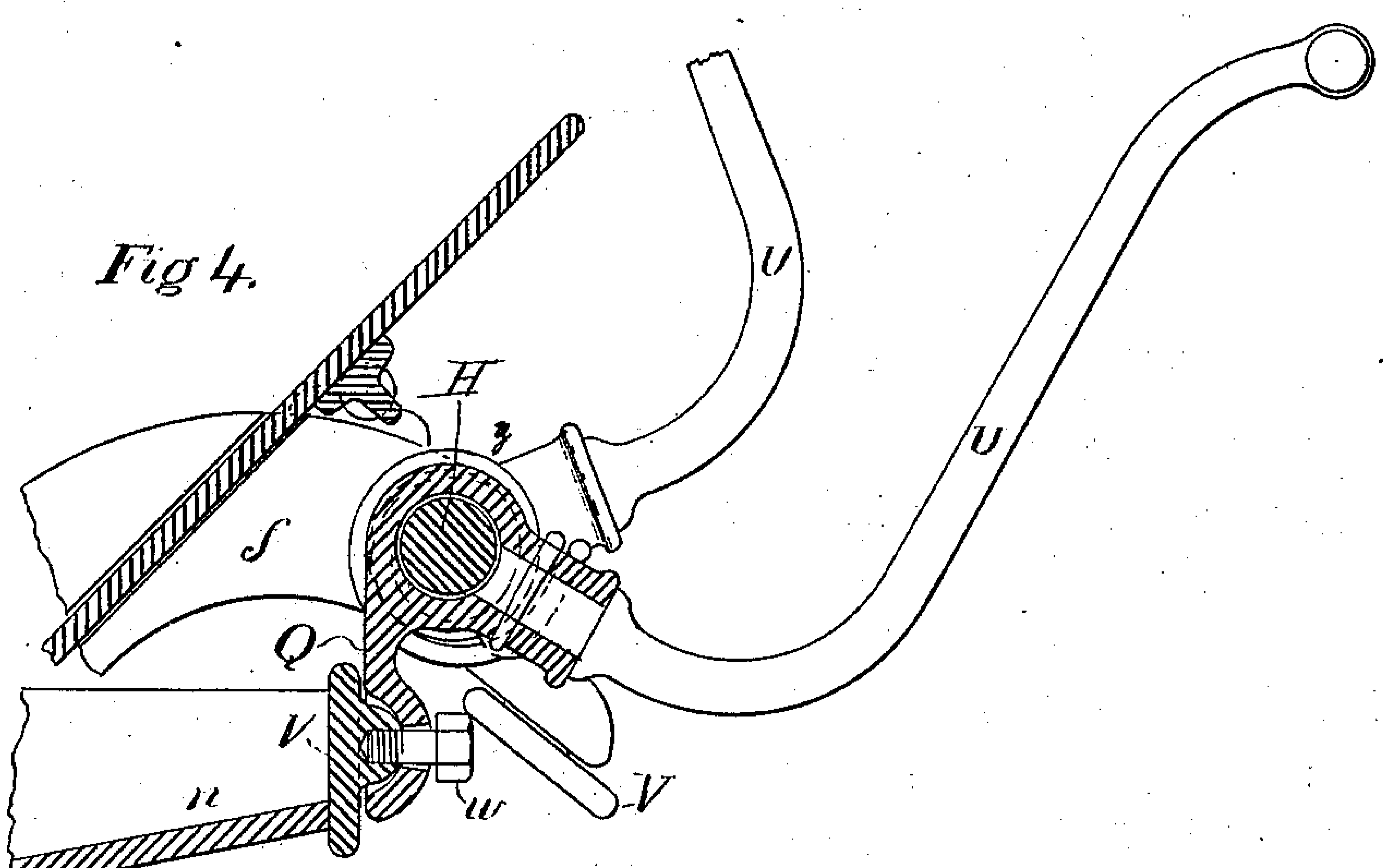

Section on line E. J.

Witnesses;

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UNITED STATES PATENT OFFICE.

WILLIAM F. DURFEE, OF BRIDGEPORT, CONNECTICUT, AND THOMAS EGLESTON, OF NEW YORK, N. Y.

APPARATUS FOR CASTING COPPER.

SPECIFICATION forming part of Letters Patent No. 287,646, dated October 30, 1883.

Application filed January 13, 1883. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM F. DURFEE, of Bridgeport, in the county of Fairfield and State of Connecticut, and THOMAS EGLESTON, of the city, county, and State of New York, citizens of the United States, have jointly invented new and useful Apparatus and Machinery for Casting Copper and other Metals, of which the following is a specification.

Our invention relates to a reverberatory furnace for use in casting copper; and it consists in the construction and arrangement of parts, as hereinafter more fully described.

Figure 1 is a front elevation of that part of our improved casting apparatus which is attached to the side of the reverberatory furnace in which the copper or other metal is refined or melted. Fig. 2 is a vertical cross-section of Fig. 1, (taken on line A B,) and shows a part, F, of the reverberatory furnace, having a sand bottom, *b*, iron bottom plates, P, binders *x'*, furnace-plates *p'*, and that part of our improved casting apparatus which is attached to the furnace extending to the right of the outside of the same. Fig. 3 is an enlarged view of that portion of our improved casting apparatus which regulates the flow of the metal from the receiving-chamber X, Fig. 2, to the ingot-molds *m m m*. Fig. 4 is a cross-section of Fig. 3 on line E J.

Similar letters refer to like parts in the several figures.

In order to render the construction and purposes of our invention more clear, we will describe it as applied to the casting of ingots of refined copper. The crude or pig copper is melted and undergoes the process of refining in the chamber F, Fig. 2, of a reverberatory furnace, and ordinarily the casting operation consists in bailing out the refined metal by means of wrought-iron ladles more or less hemispherical in shape, which are protected from the corrosive action of the fluid metal by a thin wash of fire-clay. The fluid metal is carried in the ladles aforesaid to the ingot-molds and the metal is carefully and quietly poured therein. The ingot-molds are, in the ordinary arrangement, located above the water in a tank, which water is constantly supplied at one end of the tank as it flows away at the other, thus keeping its temperature and level practically uniform. The ingot-molds aforesaid are hung in a hinged frame in such a manner that when the ingot is sufficiently solid to admit of it they can be inverted, in which position the ingot-mold is nearly covered with water, thus suddenly cooling the ingot, which then drops out of its mold into the water of the tank, from which it is taken by tongs and placed in a wheelbarrow for removal.

Now, our improvement in casting, as distinguished from the ordinary method just described, is as follows: The copper is melted and refined in a furnace of practically the same internal construction as that used for the ordinary method; but instead of bailing the metal out of the furnace with hand-ladles, which is a tedious and laborious process, exposing the fluid metal for a considerable time to injury from oxidation, we proceed as follows, to wit: As soon as the copper is refined the "tap-hole," Fig. 2, is opened and so much of the metal in the furnace as will is allowed to flow through the tap-hole into the receiving-chamber X, where it finally comes to rest, with its surface free from slag, on a level with that of the metal in the body of the furnace. This receiving-chamber X is made of wrought-iron, and is firmly secured to the outside plates, Z, of the body of the furnace and supported by the brackets S S. The iron body of the receiving-chamber X is protected from the action of the fluid metal by a layer of sand or loam upon its bottom and by fire-clay or brick upon its sides; but its right-hand-inclined end (see Fig. 2) is closed by a sliding plate, O, of wrought-iron, which is protected on its inside from the action of the metal by a thin layer or wash of clay, quite similar to that heretofore described as applied to the ladles used in the ordinary method of casting.

The inclined plate O aforesaid is held firmly against the edges of the bottom and side plates of the receiving-chamber X by the chains C C', (see Figs. 1 and 2,) attached to the studs *t t'* on the cast-iron frame *f*, (which supports and moves with the inclined plate O,) and to the short arms of the levers $l\ l'$, having suitable counter-weights, W W', on their longer ends. (These weights, levers, and chains are placed on each side of the receiving-chamber X; but for the sake of clearness they are omitted on the right-hand side of the drawing, Fig. 1.) The contact-joint made by the plate O with the bottom and sides of the receiving-chamber X is made tight as regards any leak of fluid metal by dry sand filling the groove *c*, Fig. 2, which extends across the bottom and up each of the sides (following the inclination of the plate O) of the receiving-chamber X. The wrought-iron plate O is provided along its upper edge with three projecting tapering nozzles or spouts, *n n n*, (see Figs. 3 and 4,) also of wrought-iron, secured to it by rivets. These nozzles are protected on their inside from the action of the fluid metal by a wash of clay in the same way as the plate to which they are attached, and their outer ends are planed, so that they lie in the same plane. It is through these nozzles that the fluid metal runs into the ingot-molds *m*, and for the purpose of regulating its flow or stopping it altogether the outer extremity of each of the nozzles is provided with a valve, V, which has a plane surface opposed to the end of the nozzle and a hemispherical projection on its reverse side. This valve is loosely sustained by a screw-bolt, *w*, in the cup-shaped lower extremity of the arms Q, (see Figs. 3 and 4,) said arms being mounted on and actuated by the shaft H (which is supported in bearings *d d* of the frame *f*) through the medium of the springs *y y y*, which encircle the shaft H, and are fastened to it and to the upper side of the lever-sockets of the arms Q, which sockets carry hand-levers U U U, Figs. 3 and 4. These hand-levers enable us to give each of the arms Q a partial motion of rotation about but independent of the shaft H aforesaid, thus permitting any one of the valves V to be opened or closed independent of the others, (see Fig. 4, in which the valve V beyond the plane of section is shown open,) and at the same time allows all of the valves V to be actuated simultaneously by means of the hand-levers I I, secured to the right-hand end of the shaft H, Figs. 3 and 4, and also admits of any one or all of the valves V yielding slightly to any obstruction that comes between the valve and the end of the nozzles. The plate O is loosely attached to its supporting and carrying frame *f* in such way that it is free to expand in all directions (as its temperature rises) without constraint, and whenever its supporting and carrying frame *f* is moved up or down the plate Q accompanies the movement. The upward and downward movement of the carrying-frame *f* and its plate O is intended to regulate the rapidity of the flow of melted metal through the nozzles *n n n* when the valves V are opened. Thus it will readily be seen that if the nozzles *n n n* are so placed relative to the surface of the fluid metal in the receiving-chamber X that they are filled with metal the outflow will be rapid when the valves V are opened; but if the plate O is only raised to such a height that the nozzles *n n n* are but half filled with metal the outflow on opening the valves V will be slower than if they were full. Thus by regulating the height of the nozzles *n n n* by moving the plate O, to which they are attached, all of the metal can be drawn from the furnace at such rate as is desired.

The carrying-frame *f* has attached to it the racks *j j* by the bolts $b'\ b'$ passing through their upper extremities, (see Figs. 1 and 2,) and their lower ends are coupled together and held in gear with the pinions $p''\ p''$ by means of the long cylindrical weight-bar w', which arrangement allows the carrying-frame *f* to have a certain freedom of movement relative to the racks *j j*, the better to allow the plate O to adapt itself to any slight variation of form of the end of the receiving-chamber X, against which it bears and slides. The pinions $p''\ p''$ are attached to the shaft H', which is supported by and turns in the lower ends of the brackets $b''\ b''$, which are secured at their upper ends to the sides of the receiving-chamber X. By rotating the shaft H', the carrying-frame *f*, with the plate O, its nozzles *n n n*, valves V, and levers U U U and I I are raised or lowered together, as desired.

The receiving-chamber X and the metal therein are protected from the action of the air by a removable hood or cap, h', made of wrought-iron lined with a layer of fire-clay or loam. This hood has a short chimney, c', on its top, and during the operation of casting the draft of the reverberatory furnace is so regulated and the amount of air supplied to it so adjusted that there will be within it what is known as a "reducing" or "neutral" atmosphere, which will have free access through an opening in the side of the furnace above the top-hole to the interior of the hood h', and thus prevent the oxidation of the metal in the furnace and receiving-chamber X, any outward pressure of the reducing atmosphere finding free vent through the short chimney c' aforesaid.

The hood h' can be readily removed as occasion requires by a crane or other mechanism, lifting it by the handles L' L', Fig. 1, attached to its sides for that purpose.

As soon as the refined metal has (after the opening of the tap-hole, as before described) filled the receiving-chamber X, Fig. 2, the arm of the hydraulic crane is turned by an attendant, by means of a suitable hand-lever, so as to bring the ingot-molds, that are on the top of suitable supporting-wheels, under the nozzles *n n n* of the plate O, and the attendant then adjusts the height of the crane by causing water under pressure to flow into or out of the crane-cylinder, according as he wishes to raise or lower the crane, the position of which being properly determined, he will then adjust the nozzles *n n n* to a proper relation with the surface of the metal in the receiving-chamber by means of power acting through the pinions p'' and racks j, before described, all of which adjustments being made, a second attendant opens the three valves V V V, Figs. 3 and 4, by means of the levers I I, which act upon them through the shaft H and springs y y, &c., and the metal in the receiving-chamber will at once commence to flow through the nozzles n n n into the ingot-molds m m m beneath them, and when these molds are filled the second attendant will close the valves V V V by means of the levers I I aforesaid; but in case any of the molds m m m beneath the nozzles n n n have not received the proper amount of metal, when the remaining molds are filled, the attendant closes the valve or valves, which stops the flow of metal to the filled mold or molds, and holds the other valve or valves open (by means of the levers U U U, the elasticity of the springs y y, &c., permitting of the movement of the valves in the way described) until all the molds m m m in the group below the nozzles n n n have received the proper supply of metal. This group of molds is then removed or moved along by appropriate means, and the contents thereof deposited in a suitable receptacle, another group of molds being substituted and filled, as before, and so on until all the metal in the furnace has been cast into ingots. The operations just described are repeated as the groups of molds are filled, and as they are moved along and caused to descend the supporting-plates on which they rest are maintained in a horizontal position by appropriate mechanism, thus giving the fluid metal time to solidify on its outside before the molds containing it are immersed in a cooling-tank, which completes the solidification of the ingots.

It will be evident to any one acquainted with the ordinary method of casting ingots of refined copper that by our improvements we effect a large saving of time and manual labor, and that owing to the rapidity of the operation, as compared with ordinary practice, the copper will be of better quality.

It will be understood that we do not herein claim the cooling-tank or the mold-carrying plates and connecting mechanism, such being reserved for a future application.

Having thus described our improvements and the method of their operation, what we claim, and desire to secure by Letters Patent of the United States, is—

1. The combination, with a reverberatory furnace for melting and refining metals, of a receiving-chamber, X, provided with a sliding plate, O, having at its upper end nozzles n n, substantially as and for the purpose described.

2. The fluid-metal-tight joint between the sliding plate O and inclined end of the receiving-chamber X, consisting of dry sand contained in a groove extending along the bottom and up the side of said receiving-chamber, and following the inclination of said plate, substantially as described.

3. The sliding plate O, provided with nozzles n n, and supported loosely in a carrying-frame, f, whereby it is enabled to expand or contract as its temperature varies without binding or in any way interfering with its movements when in use, substantially as described.

4. The combination, with the receiving-chamber X and frame f f, of the sliding plate O, held against the inclined end and sand-groove of said receiving-chamber by the gravity of the weights W W, acting through the levers l l' and chains C C', substantially as described.

5. The combination, with the plate O, having nozzles n n, of the valves V V, shaft H, arms Q Q, springs y y, and levers I I and U U, substantially as described.

6. The racks j j, secured at their upper ends to the carrying-frame f f by pins, and provided with a coupling at their lower ends, the two racks being acted upon by the pinions p'' p'' on the shaft H', all combined and operating substantially as described.

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THOMAS EGLESTON.

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