(No Model.) 3 Sheets—Sheet 1.

J. ILLINGWORTH.

INGOT MOLD.

No. 473,579. Patented Apr. 26, 1892.

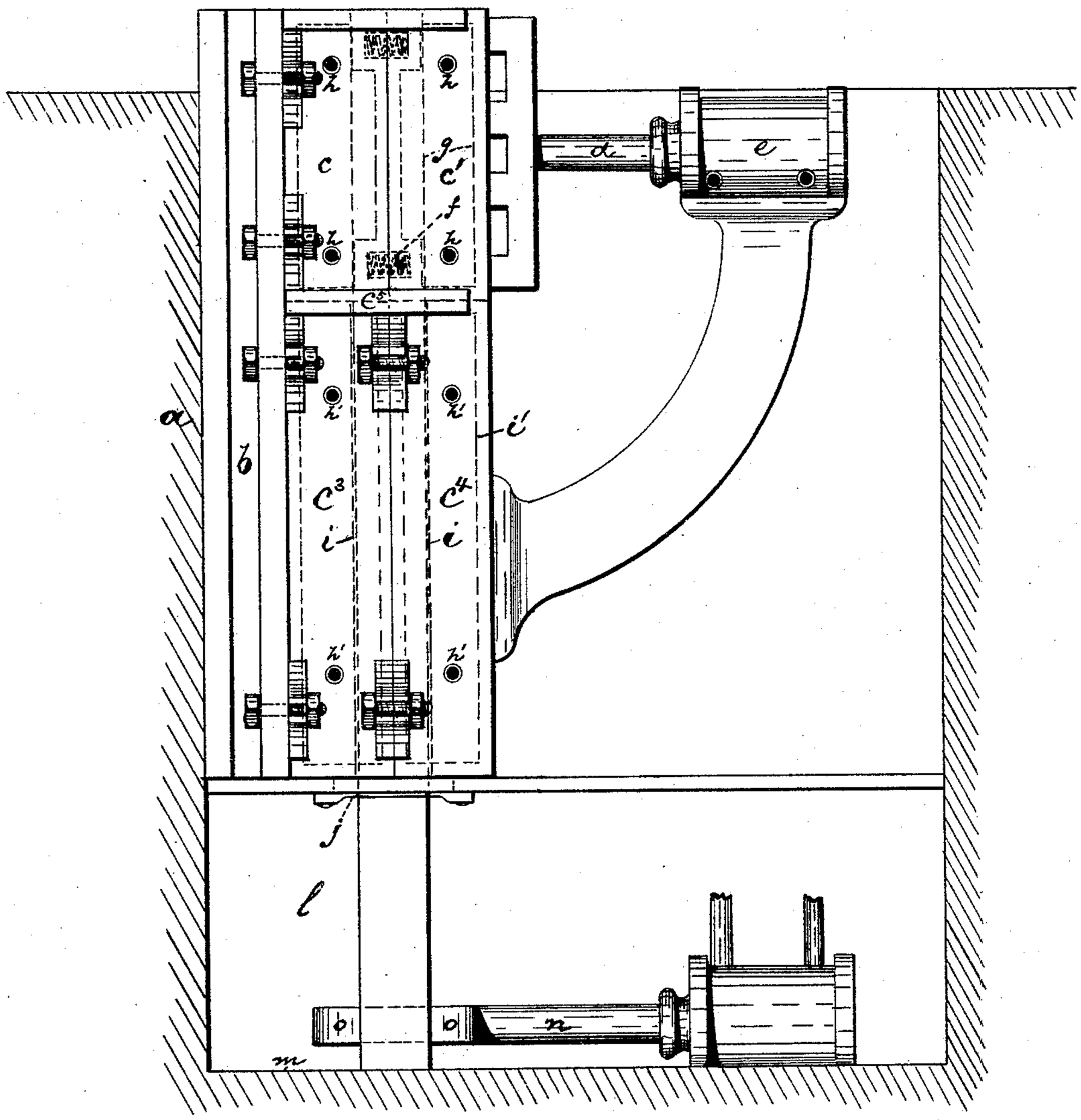

Fig. 1.

Witnesses

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(No Model.) 3 Sheets—Sheet 2.

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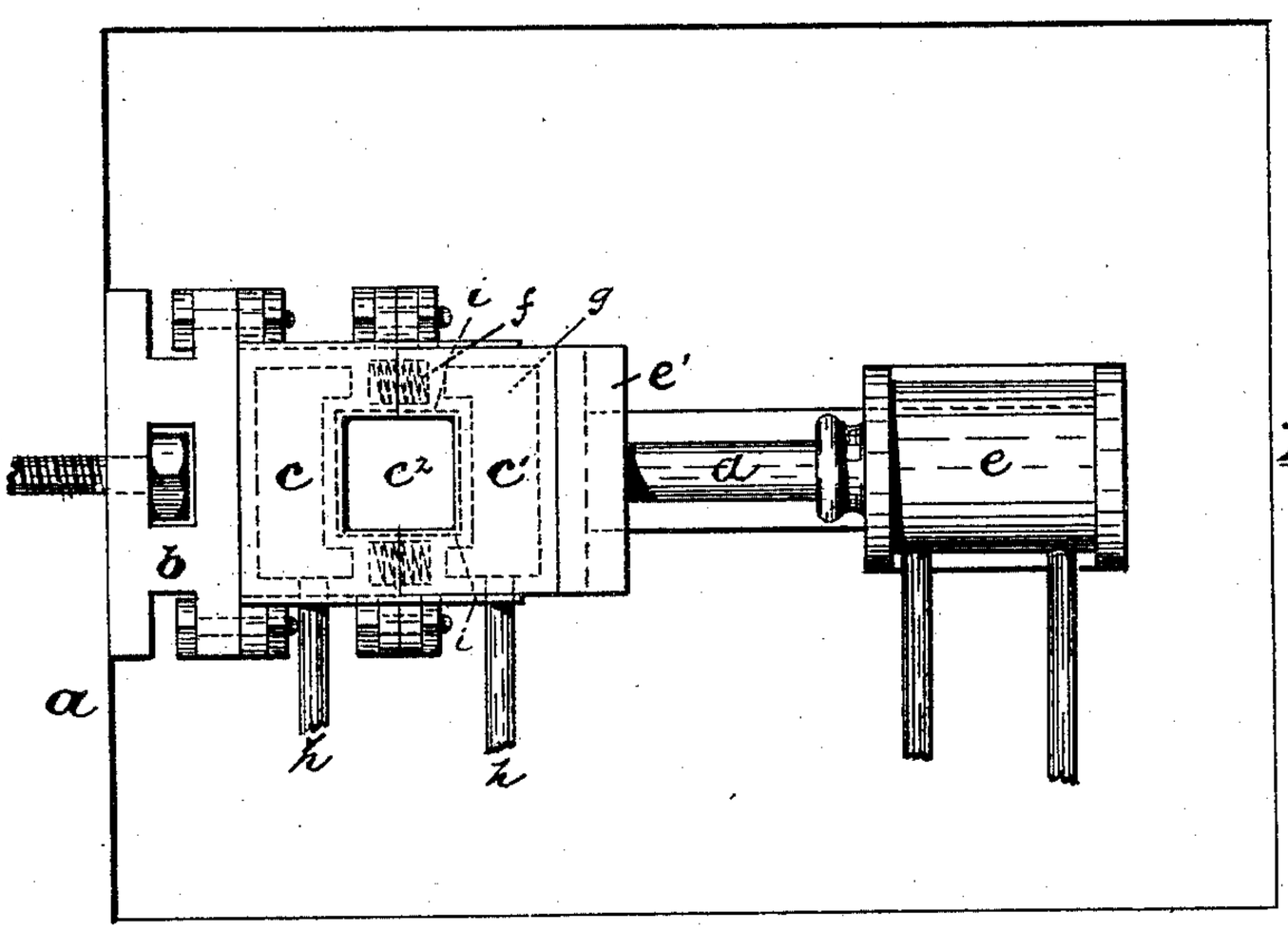

Fig. 2.

Fig. 5.

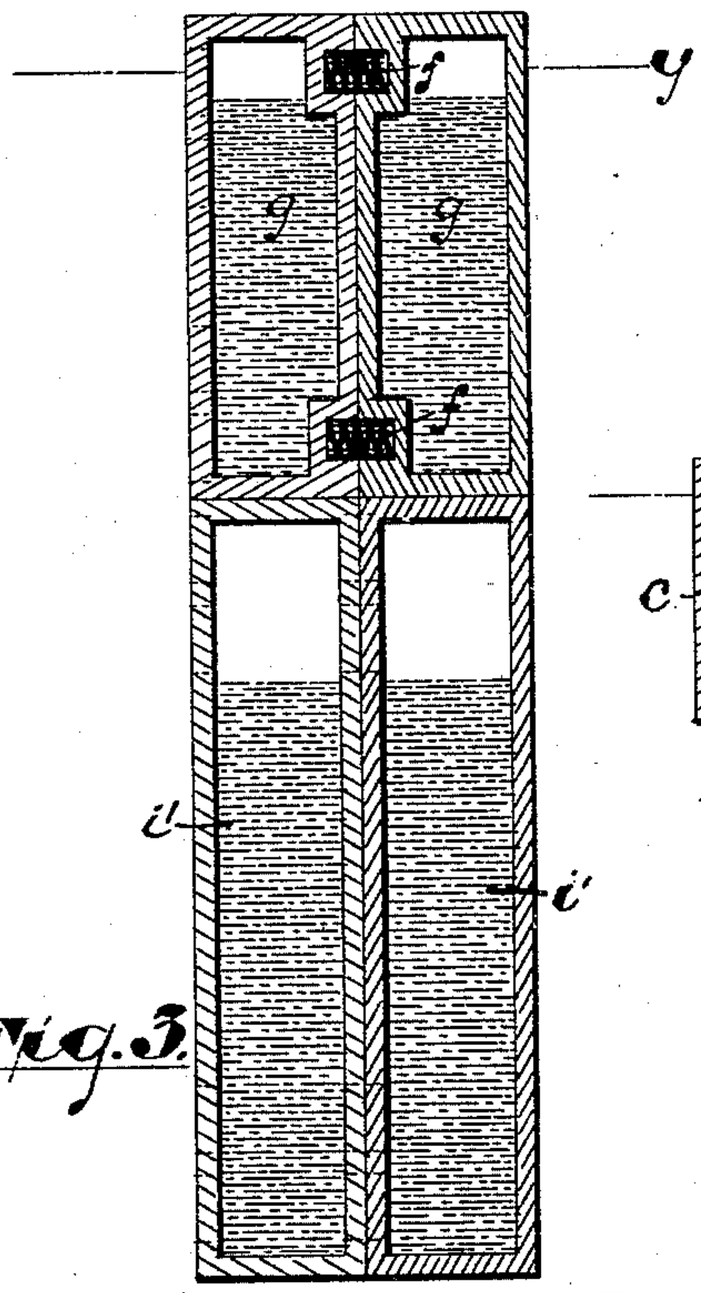

Fig. 3.

Fig. 4.

Witnesses

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(No Model.) 3 Sheets—Sheet 3.

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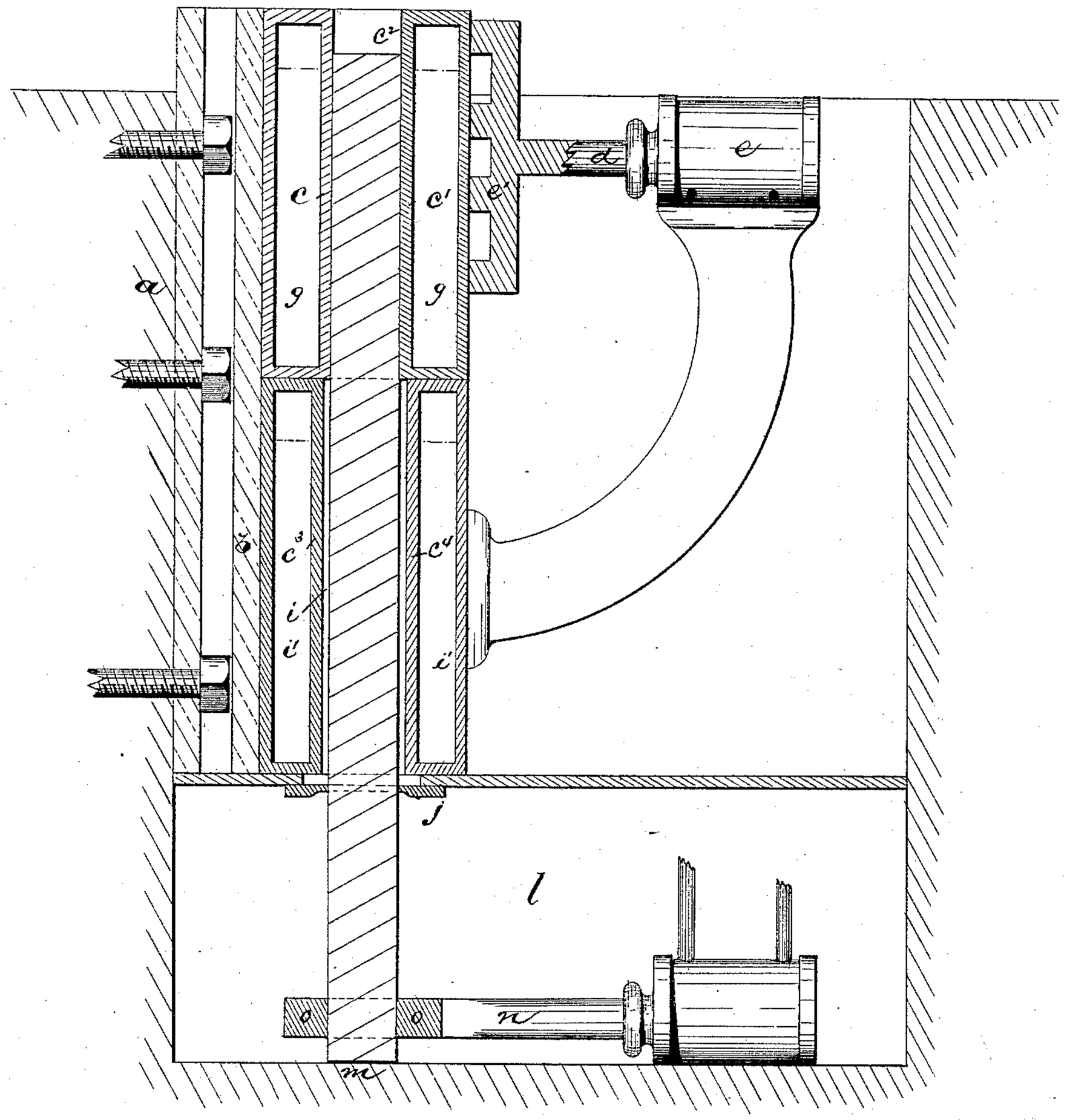

Fig. 6.

Witnesses

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UNITED STATES PATENT OFFICE.

JOHN ILLINGWORTH, OF NEWARK, NEW JERSEY.

INGOT-MOLD.

SPECIFICATION forming part of Letters Patent No. 473,579, dated April 26, 1892.

Application filed July 15, 1890. Serial No. 358,858. (No model.)

To all whom it may concern:

Be it known that I, JOHN ILLINGWORTH, 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 Molds and the Casting of Ingots Therein; 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.

The object of this invention is to facilitate the operation of casting metal ingots, to avoid the formation of cold-shuts or faults in the ingot at which the same is rendered imperfect and weak, to prevent the surface of the ingot from becoming unduly oxidized and flaking while cooling, to protect the men attending the machine from the heat radiating from the ingot when the latter is first allowed to gravitate from the mold, and to obtain other advantages and results in the operation of casting and in the ingot, some of which will be hereinafter indicated.

The invention consists in the improved ingot-forming machine and in the arrangements and combinations of parts of said machine, substantially as will be hereinafter set forth, and finally embodied in the clauses of the claim.

Referring to the accompanying drawings, in which like letters indicate corresponding parts in each of the several views, Figure 1 is a side elevation of the improved machine. Fig. 2 is a plan of the same; and Figs. 3 and 4 are sectional views taken through lines *x* and *y*, respectively. Fig. 5 illustrates a series of dummy ingots used in the beginning of the process. Fig. 6 is a vertical transverse section taken centrally through the ingot-forming chamber and the cooling-chamber beneath the same.

In said drawings, *a* indicates a suitable foundation or groundwork or wall of masonwork, and *b* a vertical bed-plate permanently bolted or otherwise fixed thereto, so as to provide a substantial and otherwise suitable support for the mold and parts co-operating therewith.

To the upper part of the bed-plate *b* a section *c* of the mold is secured by bolts or other means adapted to allow the said section to be readily removed when worn or otherwise imperfect and be replaced by a new or more perfect one. The co-operating section *c'*, which, with the section *c*, comprises the complete mold or matrix, is arranged vertically parallel with said section *c*, and is movable horizontally to and from the same. The movement of the movable section toward and into co-operative engagement with the fixed section is secured by means of a hydraulic piston *d*, and cylinder *e*, operated in any ordinary manner, the said piston being provided with a vertical bearing-plate *e'*, which presses against the side of the mold-section *c'*, as shown in Fig. 1, and forces it into close relation with the fixed section, whereby the mold-chamber is rendered capable of retaining the liquid metal. The movement from the fixed section, whereby the walls of the mold-chamber release their close hold on the ingot and allow the latter to drop or gravitate by the mere weight of the ingot, is obtained by means of springs *f*, interposed between said sections, as shown in Fig. 4, and held in proper relation with said sections by means of sockets or recesses formed in the edges of the mold-sections. The mold-chamber c^2, formed by the sections, is open at the top and bottom to allow of the filling of the mold and the subsequent lowering or gravitation of the ingot. Water-chambers *g g* are formed in the mold-sections, and thus the liquid metal is quickly solidified. Suitable inlet and outlet pipes *h* for supplying cold water and carrying away the warm water are provided in any manner desirable.

Below the mold, vertically in line with the mold-chamber, is arranged a cooling-chamber *i*, which is considerably longer than the mold and is larger than the mold-chamber in its horizontal dimensions, as shown in Fig. 1, so that the ingot in gravitating will not be retarded because of resistance by friction, but will have a free and open passage downward.

The metallic casing forming the cooling-chamber *i* is preferably in sections for convenience in opening the chamber, and is bolted or otherwise secured to the bed-plate *b*, and is provided with a water-chamber *i'*

outside of the ingot-cooling chamber, by means of which a body of cold water may be made to surround the ingot-cooling chamber and the latter be thus kept cool. Thus the ingot may be rapidly cooled in its passage downward without coming to any material extent into contact with the oxygen of the air and scaling on account of oxidation, and, furthermore, the chamber or working space around the cooling-chamber is kept cool, so that there will be no inconvenience experienced by the workmen in attending to the machine.

The top of the cooling-chamber provides a guideway or bearing c^6, on which the horizontally or laterally movable mold-section c' slides when releasing the ingot hardened in the mold.

Just below the cooling-chamber is arranged a die or fulcrum j, through which the ingot passes as it moves toward the ground. This serves as a suitable bearing for holding the upper part of the ingot firm and steady during the severing operation. The breaking of the ingot, which is the preferred method of severing, although other methods may be employed, is accomplished in the severing chamber or space l, and at the bottom of this is a stop or flooring m, against which the descending ingot falls when the movable mold-section releases its hold on the hardened metal. A reciprocating hydraulic piston n, having fingers o for holding the ingot, may be employed as the breaker.

The distance from the bottom of the mold to the top of the flooring is about equal to three times the depth of the mold-chamber, so that two ingot portions may remain in the cooling-chamber and a third extend into the severing-chamber, where it may be removed from those above. The distance from the die to the stop is about equal to the depth of the mold-chamber, and thus when the ingot portion is broken off at the die, the mold released from the ingot, and the latter allowed to drop to the flooring or stop, the top of the ingot will lie at the bottom of the mold-chamber, filling the same or serving as a bottom thereof, so that the mold may be again filled with liquid metal.

In operating the ingot-forming machine thus described and in carrying out the process of casting and forming ingots depending on said machine the bottom of the mold is first closed by a dummy ingot, which may be in two or three parts or sections corresponding in length to the ingot portions to be made. When in three parts, the dummy extends from the bottom of the mold to the flooring. The dummy being in position, the liquid metal is poured into the mold, filling the same, and then allowed to cool and harden sufficiently to sustain its own weight or remain in proper form when released from the mold. Sufficient time for hardening being allowed, the hydraulic piston is moved back and the springs are allowed to operate to open the mold or force the movable section from the fixed section. At the same time, or just prior to this operation, the lowest dummy ingot is disconnected from the one next above, so that when the mold is open and it releases its hold on the ingot it or the next dummy falls to the stop or floor, the parts still retaining their upright positions, so that the lowered first casting fills the lower opening in the mold. The movable mold-section is immediately closed after lowering and a second casting is made, and when sufficiently hard a second dummy is removed, the mold opened, and the ingots are again lowered. A third repetition of the above operations brings the first casting, which has remained in the cooling-chamber a sufficient time to be comparatively cool, below the fulcrum or die, and now the hydraulic severing-machine is brought into operation to remove the first casting from the ingot. This may be by simply breaking or by shearing or by any other of the means commonly employed for separating one portion of metal from another. The first casting being removed from the ingot and another casting being made at the top, the mold is again opened, the ingots lowered, and the processes repeated until all the metal of a "heat" is consumed or worked up into ingots. Having to operate but the single mold-section to release the ingot and then close the mold, but little power is needed and the operation is done with great facility, and thus I am enabled to easily make repeated castings without waiting for the ingot to cool sufficiently to produce faults or cold-shuts; but, on the other hand, a perfect integral connection is made at the union, so that the ingot is one continuous whole. Therefore should the ingot be broken at a point other than at the said union the ingot having the union will not be in the least imperfect on that account, the cold-shut being entirely dispensed with. When the ingot gravitates from the vertical mold, it enters the inclosing cooling-chamber, which is enlarged to allow a free entrance, yet is small enough to exclude any considerable amount of atmospheric air or oxygen, and thus the surface of the ingot is prevented from scaling, and at the same time the workmen are protected from the heat radiating from the ingot. The walls of the cooling-chamber being away from the ingot, as heretofore described, there is no interference with the free gravitation of the ingot from the mold, and thus all drawing-down mechanisms are dispensed with, thus reducing the cost of the machine, dispensing with operations which consume valuable time and require the employment of additional labor, and avoiding the use of mechanisms which occupy space where space is valuable. The mold and cooling-chamber being vertically stationary, there is no handling of heavy iron sections or adjusting of the same by hand, as in certain other processes, whereby time and labor are expended.

Having thus described the invention, what I claim as new is—

1. The improved ingot-mold herein described, combining with an elevated mold-section immovably secured to a suitable fixture a mold-section movable to and from the same, the said sections being open top and bottom, and means connected with the movable section for operating the same, a cooling-chamber stationed beneath the chamber formed by the mold-sections, and means for supplying the said cooling-chamber with an abnormal cooling medium, substantially as set forth.

2. In an ingot-forming machine, the combination, with separable mold-sections open top and bottom and means for separating the same, of a cooling-chamber independent of the mold and arranged beneath the same in line with the mold-chamber to receive the ingot therefrom, means for supplying the cooling-chamber with a cooling medium, and severing mechanisms arranged beneath the cooling-chamber for severing the ingot into sections, substantially as set forth.

3. In an ingot-forming machine, the combination, with mold-sections, one of which is separable from the other and which together form a mold-chamber open top and bottom, of a cooling-chamber, also open top and bottom, means for supplying the same with a cooling medium other than normal atmospheric air, and severing mechanisms disposed beneath said cooling-chamber, all said parts being arranged and adapted to operate substantially as and for the purposes set forth.

4. In an ingot-forming machine substantially as described, a sectional mold open top and bottom and permanently held in an elevated position, means for separating the sections horizontally, a cooling-chamber in line with said mold beneath the same, means for supplying the cooling medium, and severing means arranged beneath the said cooling-chamber, substantially as set forth.

5. In an ingot-forming machine, the combination, with a bottomless mold, of a cooling-chamber beneath said mold and open top and bottom to allow the ingot to pass therethrough and also larger horizontally in its interior dimensions than the mold-chamber to allow a free gravitation therethrough, and means for supplying the cooling medium, substantially as set forth.

6. The improved ingot-forming machine herein described, combining separable water-chambered mold-sections open top and bottom and having interposed springs, a hydraulic piston and cylinder for forcing said sections together, a cooling-chamber beneath said sections, a die beneath said cooling-chamber, and a piston for forcing the ingot against said die and breaking or severing the same, substantially as set forth.

7. The combination, with the bed-plate *b*, of a mold open top and bottom and in sections *c c'*, one of which is secured to said bed-plate and the other is horizontally movable to open the mold and allow the gravitation of the ingot therefrom, sections c^3 c^4, fixed beneath the mold and having a mold-chamber therein a little larger in its horizontal dimensions than the mold-chamber to allow a free gravitation of the ingot, means for supplying the mold with a cooling medium, and means for severing the ingot beneath said sections c^3 c^4, substantially as set forth.

8. The combination, with the vertical bed-plate *b*, of mold-sections *c c'*, open top and bottom and one of which is fixed to said bed-plate and the other is movable therefrom, a hydraulic piston for operating the movable section, water-jacket sections fixed beneath said mold-sections and forming a chamber *i*, larger than the mold-section, and means for severing the ingot after gravitation from the mold through the cooling-chamber, substantially as set forth.

9. In combination with the bed-plate, mold-sections *c c'*, inclosing a vertical mold-chamber, one of which sections is horizontally movable, a chamber beneath said mold in line therewith, the sections c^3 c^4 of which chamber provide a guideway for the movable section, and means for supplying a cooling medium, and means beneath the cooling-chamber for severing the ingot, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 10th day of July, 1890.

JOHN ILLINGWORTH.

Witnesses:
CHARLES H. PELL,
OSCAR A. MICHEL.