(No Model.) 4 Sheets—Sheet 1.

W. E. MAY.

APPARATUS FOR USE IN CASTING AND WORKING METALS.

No. 481,799. Patented Aug. 30, 1892.

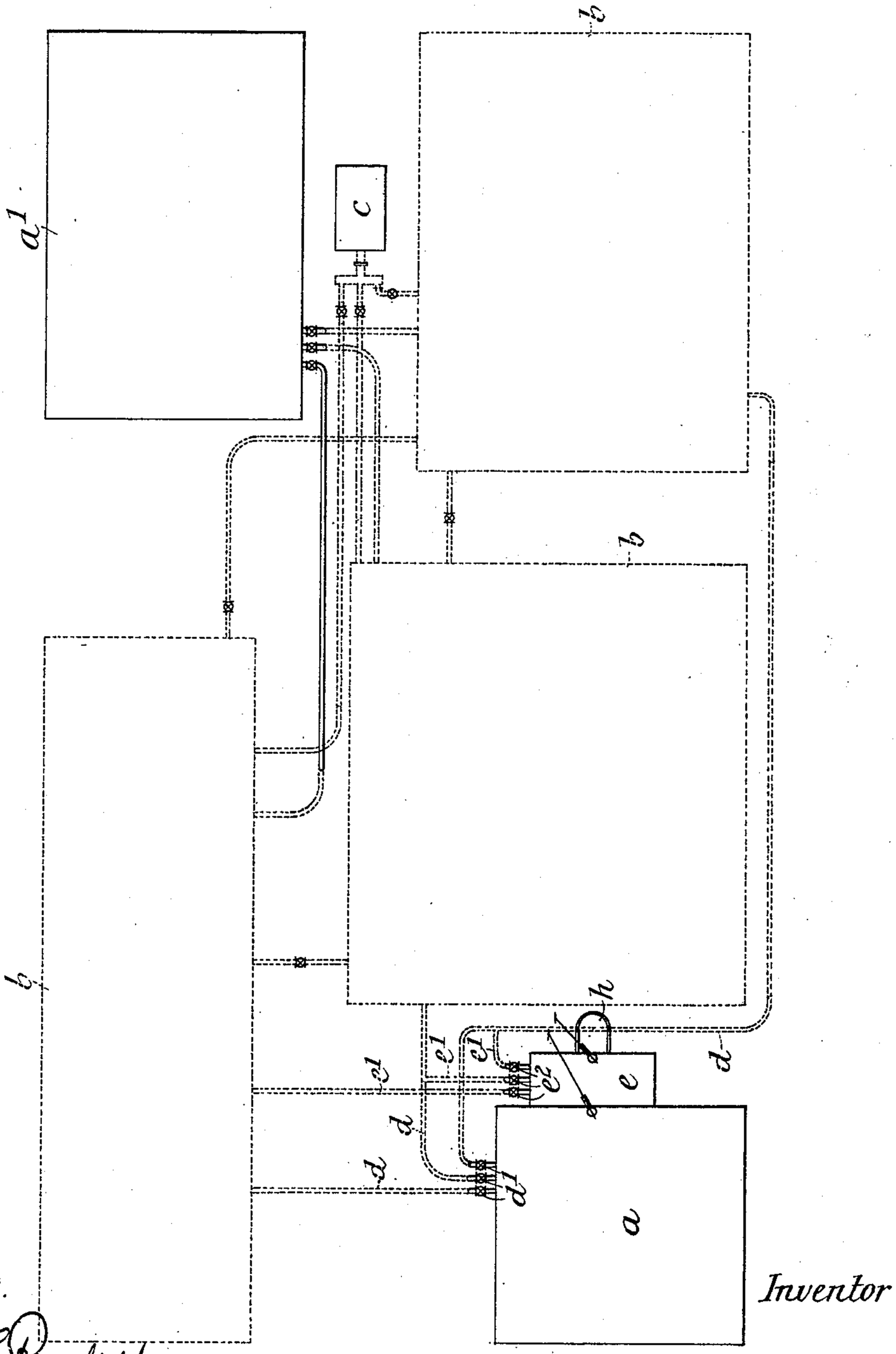

Fig 1.

Witnesses.

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(No Model.) 4 Sheets—Sheet 2.

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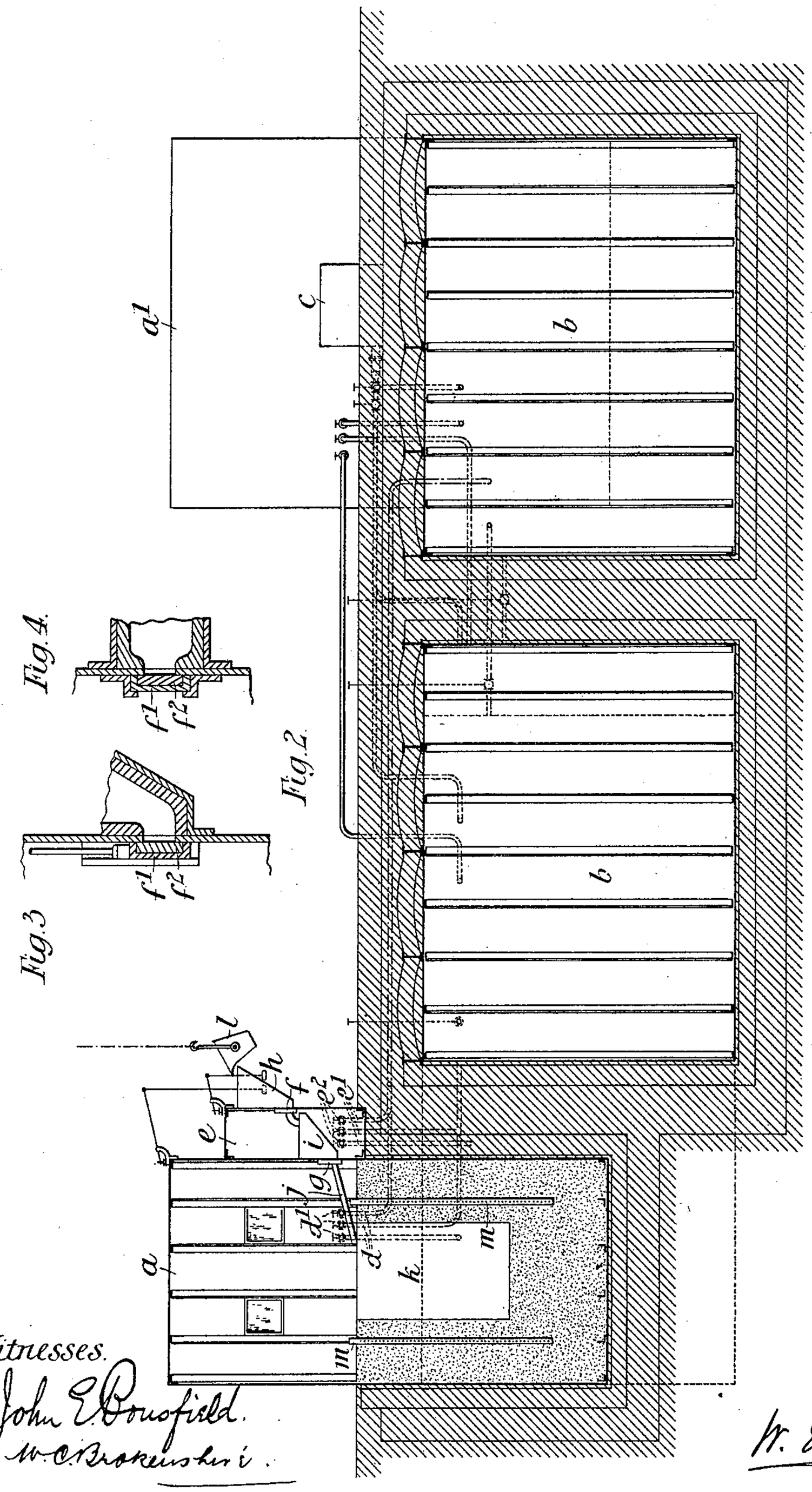

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Fig. 5.

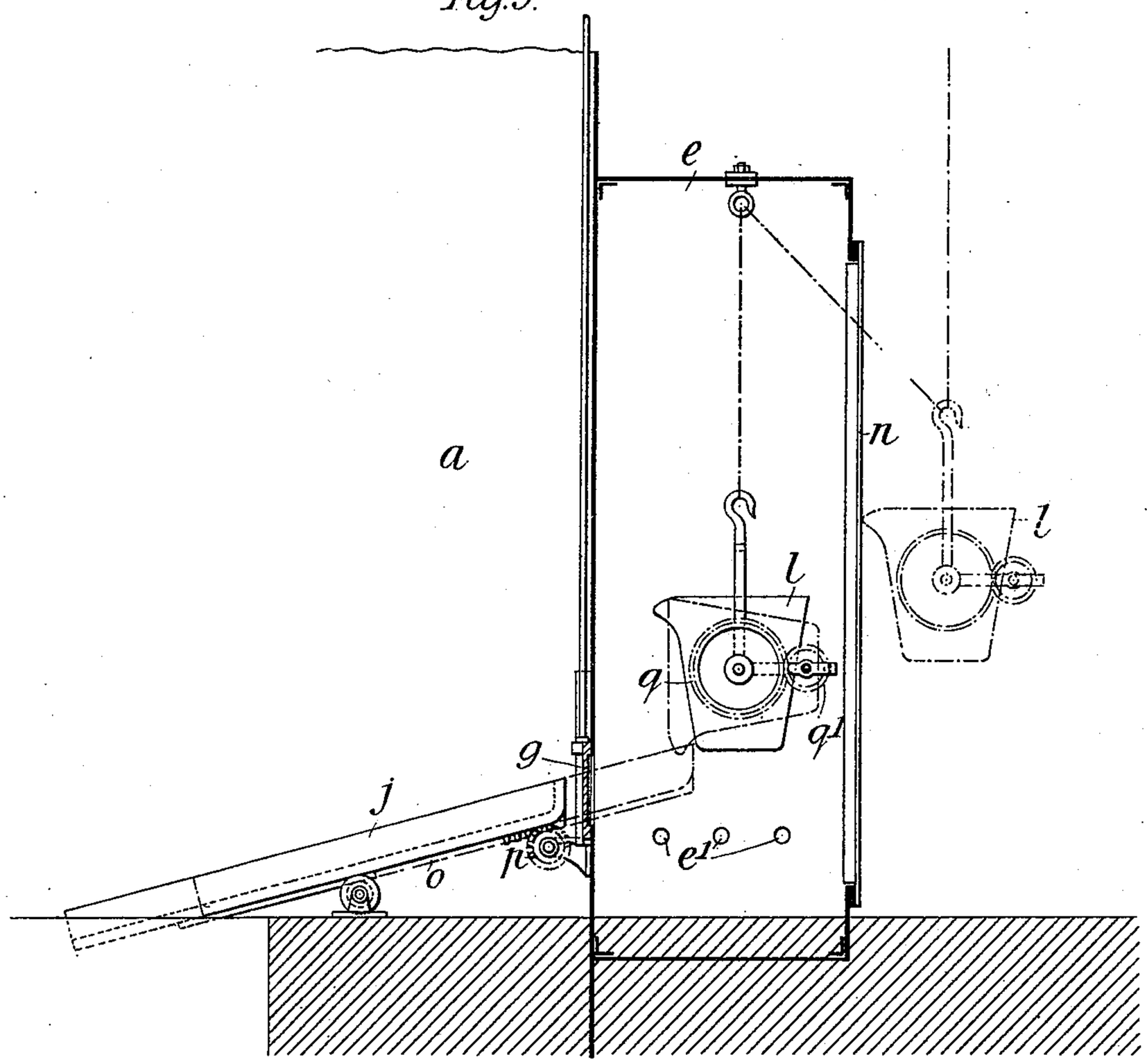
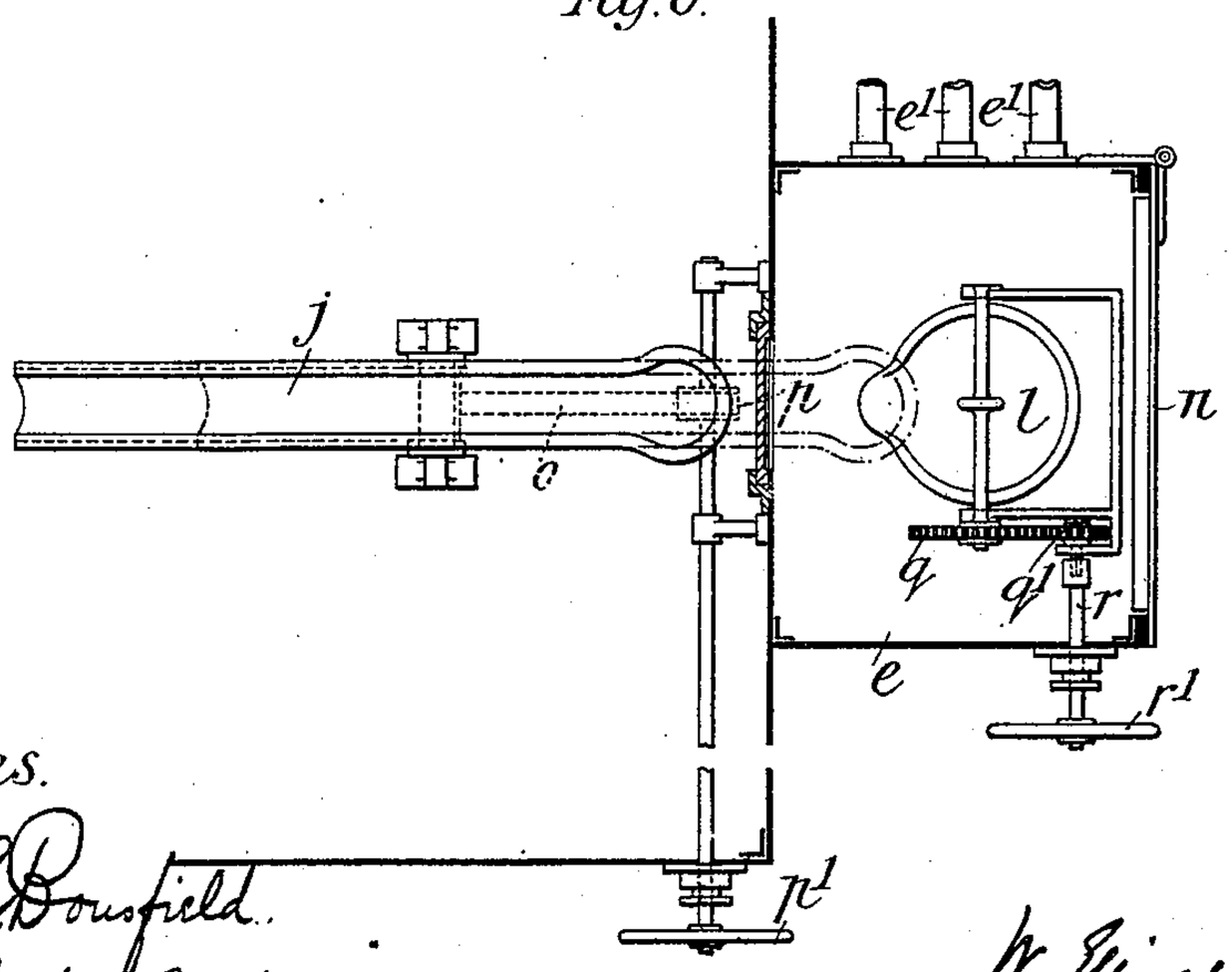


Fig. 6.



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(No Model.) 4 Sheets—Sheet 4.

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APPARATUS FOR USE IN CASTING AND WORKING METALS.

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Fig. 8.

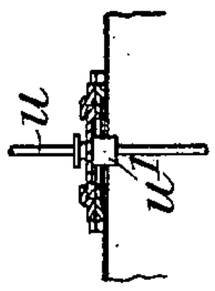

Fig. 7.

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UNITED STATES PATENT OFFICE.

WILLIAM ELLIS MAY, OF LONDON, ENGLAND.

APPARATUS FOR USE IN CASTING AND WORKING METALS.

SPECIFICATION forming part of Letters Patent No. 481,799, dated August 30, 1892.

Application filed May 12, 1891. Serial No. 392,481. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM ELLIS MAY, a subject of the Queen of Great Britain, residing at London, England, have invented new and useful Improvements Relating to Apparatus for Use in Casting and Working Metals, of which the following is a specification.

My invention relates to the casting and working of metals, and has for its object to prevent air or other gases from being confined or imprisoned in such metals.

According to my invention casting, forging, rolling, coiling, and other operations are performed in as perfect a vacuum as possible, and for this purpose I provide a chamber (hereinafter referred to as the "working" chamber) which can be hermetically closed and from which the air can be exhausted.

In order to permit the air to be quickly exhausted from the working chamber, I advantageously provide a series of store vacuum-chambers from which the air can be exhausted when required and previous to the commencement of work in any desirable manner and which are in connection with the working chamber, valves being provided for controlling the communication between such store vacuum-chambers and the working chamber.

In order to pour molten metal into the working chamber, I provide an intermediate chamber on the walls of the said working chamber and construct the same with suitable valves.

To enable forging, rolling, coiling, and other operations to be accomplished, the rod of the steam or other hammer and the rods for manipulating the material are passed through stuffing-boxes in the walls of the working chamber.

To enable my invention to be fully understood, I will describe how it can be carried into practice by reference to the accompanying drawings, in which—

Figures 1 and 2 are respectively a plan and a vertical section of apparatus suitable for use in casting metals in a vacuum according to my invention. Figs. 3 and 4 are respectively a vertical section and a horizontal section of a detail of the same. Figs. 5 and 6 are respectively a vertical section and a horizontal section of a modified arrangement of a portion of the said apparatus. Fig. 7 is a vertical section of apparatus suitable for use in forging metals in a vacuum according to my invention, and Fig. 8 is a section of a detail of the same.

Similar reference-letters indicate similar or corresponding parts throughout the drawings.

a is the working chamber, and *b b* are the store vacuum-chambers, which are separately connected to the chamber *a* and from which the air has been exhausted by a suitable exhauster or air-pump at *c*, the said chambers *b b* being preferably placed below the surface of the ground, as shown most clearly in Fig. 2.

d d are pipes for establishing communication between the store vacuum-chambers *b b* and the chamber *a*, and *d' d'* are the valves for controlling such communication. The chamber *a* is provided with doors (not shown) adapted to be hermetically sealed and with glass windows, which are advantageously made double, with a space between, and with a valve in the frame of the inner pane, adapted to close instantaneously if the outer pane is broken.

The operation is carried out in the following manner—that is to say: The working chamber *a* is hermetically closed, and then, say, one of the chambers *b b* (from which the air has been previously exhausted by the pump at *c* or by other suitable means) is placed in communication with the said working chamber by opening its valve *d'*, thereby allowing the air in the said working chamber to expand into the store vacuum-chamber, whereby its density is reduced. The valve *d'* is now shut and communication is established between the chamber *a* and the other chambers *b* in succession, so that a close approximation to a vacuum is very rapidly obtained in the said chamber *a*, and work can at once be carried on therein.

e is the intermediate chamber arranged on one wall of the working chamber *a* and used when casting, the said intermediate chamber

being connected by pipes e' e' to the pipes d d and the chambers b b, the passage through the said pipes e' e' being controlled by valves e^2 e^2. As shown in Figs. 1 and 2, the intermediate chamber e is provided with valves f g, one of which serves to permit the molten metal to flow from a hopper h into a hopper i, while the other serves to allow the metal to flow from the hopper i into the chamber a. Each of the said valves, one of which is shown drawn to an enlarged scale in Figs. 3 and 4, is advantageously formed with a metal frame f', in which is held a fire-clay face f^2 for contact with the molten metal.

j is a shoot for conducting the molten metal from the hopper i to a mold k in the chamber a. In this arrangement the valve d' is partially opened to allow the air to gradually escape into one of the store vacuum-chambers. When the metal is ready for working, the valve is closed and another valve d' is opened. This is then closed and the third valve d' is opened, or as may be required. The molten metal is then poured into the hopper h^2 from the ordinary ladle. The valve f is then opened and the metal passes into the hopper i. The valve f is then closed and communication is established between the intermediate chamber e and the chambers b b by the valves e^2 e^2 in a similar manner to that hereinbefore described in connection with the chamber a, so as to exhaust the air from the said chamber e, and consequently from the metal in the hopper i. In some cases I exhaust the air from the chamber e previous to opening the valve f. When the metal is in the hopper i, the valve g is opened to allow the metal to run into the mold. The valves e^2 are all closed previous to opening the valve g, and the valves e^2, like the valves d', are never opened two at the same time.

To allow of the escape of the air contained in the sand around the mold k without injury to the latter, I advantageously arrange in the sand perforated pipes m m.

I sometimes provide for introducing the ladle or shank containing the molten metal directly into the chamber e, as illustrated in Figs. 5 and 6, so that I can pour the molten metal directly into the chute j. In this case I dispense with the hoppers h and i and the valve f and provide an opening in the chamber e, sealed by a door n, through which opening the ladle l can pass into the chamber and be suspended therein, as shown.

The chute j, as shown, is provided with a toothed rack o underneath to enable it to be moved by a pinion p, operated by a hand-wheel p', outside the chamber a, to place it beneath the ladle l to receive the molten metal, the opening of the valve g being formed large enough to allow of the passage of the said chute.

To enable the ladle to be tipped to pour the metal into the chute, I advantageously provide it with a gear-wheel q, with which gears a pinion q'. The spindle of the pinion q' is formed with a square end, so that it can engage with a correspondingly-shaped opening in a key r, provided with a hand-wheel r', the said key working through a stuffing-box, so as to enable it to be moved into engagement with and turn the said spindle when the ladle is in the chamber e.

In Fig. 7 the chamber a is shown in conjunction with a hammer—such as a steam-hammer s—for forging, and in this case the rod s' of the hammer is arranged to work through a stuffing-box s^2 on the said chamber. t is the usual bar for turning the forging when under the hammer, the said bar being passed through a stuffing-box t' and advantageously connected by bolts and nuts to a flange upon a bar welded to the metal to be forged. u is a rod which serves to support the weight of the turning-bar t and the forging in a well-known manner, the said rod passing through a stuffing-box u' in the top of the chamber a. The stuffing-boxes t' and u' are each advantageously formed in two parts, arranged to slide in directions at right angles to one another to provide for the necessary movement for enabling the forging to be properly handled. Fig. 8 represents a section (at right angles to the section shown in Fig. 7) of the stuffing-box u' and its connected sliding portions.

In the manufacture of a coil the metal to be coiled is passed through a trough or chute, the outer end of which is provided with an air-tight door, while the inner end is open to the chamber a, in which the coiling-machinery is arranged.

Although I have described only a single working chamber in connection with the store vacuum-chambers, it is to be understood that two or more of such chambers may be arranged in conjunction with one set of store vacuum-chambers.

In Fig. 1, a' indicates a second working chamber.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination of a working chamber provided with an opening to admit molten metal, means for hermetically sealing the opening, a series of vacuum-chambers having independent valved connections with the working chamber, and means for separately removing the air from each vacuum-chamber.

2. The combination of a working chamber, a series of vacuum-chambers having independent valved connections with the working chamber, and means for separately removing the air from each vacuum-chamber, an auxiliary chamber having a receiving-opening, an opening in the working chamber, and doors for hermetically closing said openings, as set forth.

3. The combination of a working chamber, a vacuum-chamber having a valved connection with the working chamber, and means for removing the air from the vacuum-chamber, an auxiliary chamber having a receiving-opening, an opening into the working chamber, and doors for hermetically closing said openings, and means for conveying molten metal into and through the auxiliary chamber into the working chamber, all substantially as set forth.

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