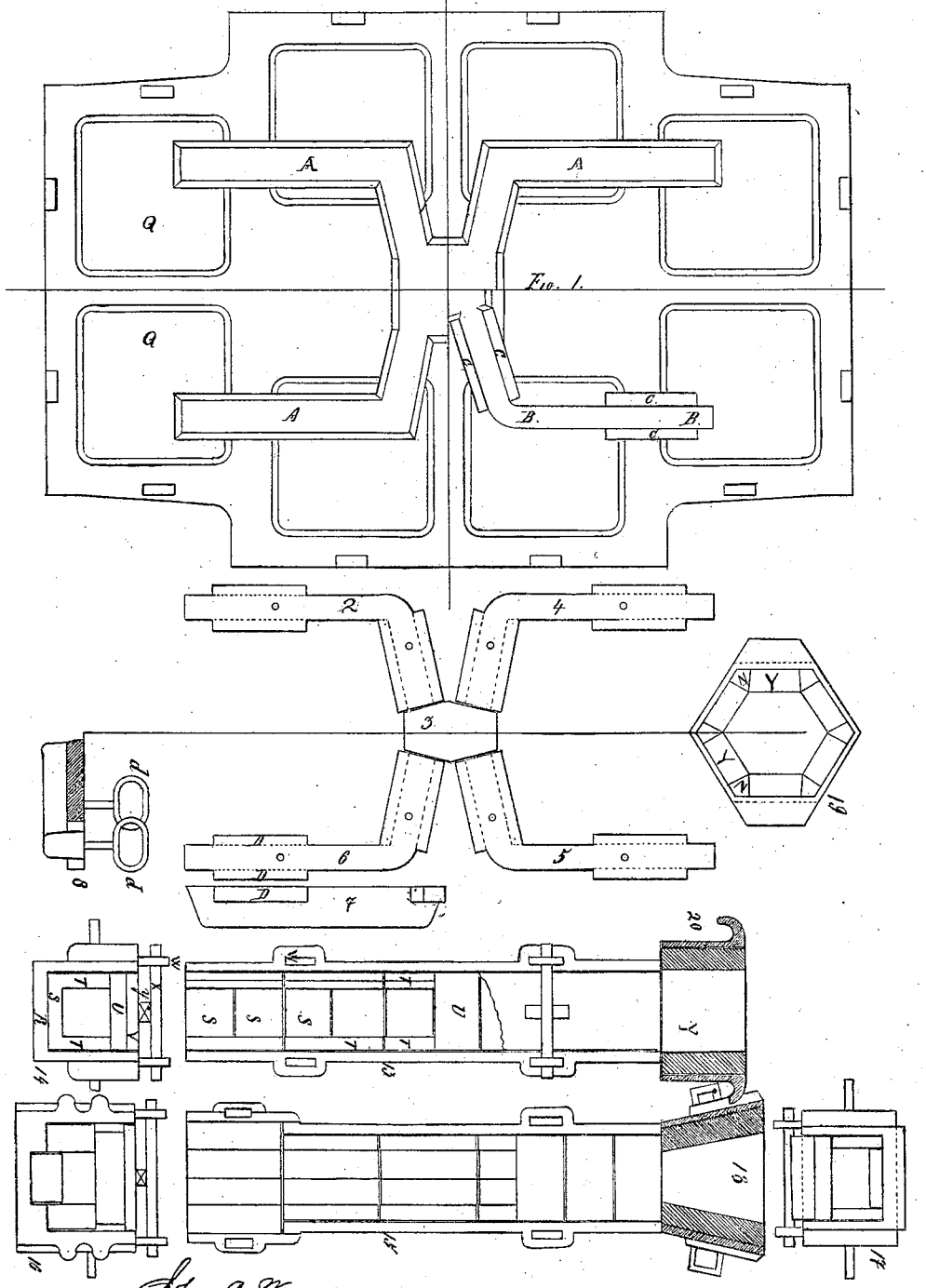
2 Sheets--Sheet 1.

A. L. HOLLEY.

Improvement in Apparatus for Casting Ingots of Iron and Steel.

No. 133,030 Patented Nov. 12, 1872.



Witnesses.
John C. Hyman
Louis Haas.

Inventor
A. L. Holley

2 Sheets--Sheet 2.

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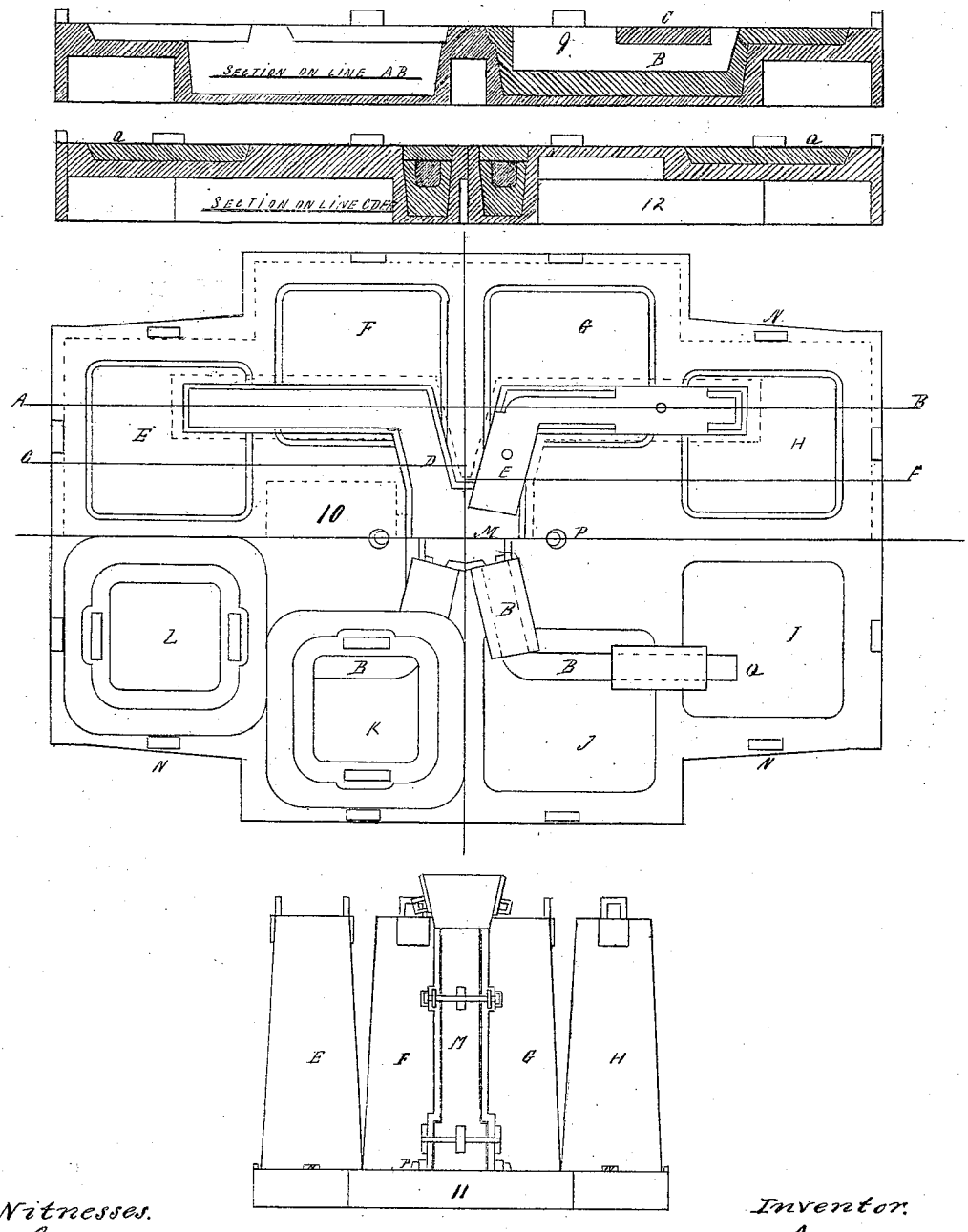

Witnesses.

John C. Wyman

Louis Haas

Inventor.

A. L. Holley

UNITED STATES PATENT OFFICE.

ALEXANDER L. HOLLEY, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN APPARATUS FOR CASTING INGOTS OF IRON AND STEEL.

Specification forming part of Letters Patent No. **133,030**, dated November 12, 1872.

To all whom it may concern:

Be it known that I, ALEXANDER L. HOLLEY, of the city of Brooklyn, county of Kings and State of New York, have invented certain new and useful Improvements in Apparatus for Casting Ingots and Castings of Iron and Steel; and that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing.

Iron and steel ingots and castings have sometimes heretofore been cast by arranging the molds on a "distributing-bottom," consisting of an iron flask lined with loam, and provided with passages through which the iron or steel poured into the top of one mold would be conducted to the bottoms of the other molds and would rise in them all, thus filling them all at one operation. This operation is called bottom casting, and to this my invention refers. The said iron flasks have usually heretofore been lined with loam or molded by inserting a pattern on a follow-board into the top of the flask, ramming the loam against the pattern from the bottom of the flask, placing a bottom plate over the loam thus rammed, withdrawing the follow-board and pattern, and covering, at proper points, the passages thus molded by the pattern with cores. Fire-bricks are sometimes used for these cores. This operation will be readily understood by molders. I find it more convenient and economical in practice to make the flask solid—that is to say, without the removable bottom plate, and to mold it from the top by pressing the patterns into plastic loam or suitable molding material placed in the flask. This first part of my invention is illustrated by Figs. 1 to 11, inclusive.

Figure 1 is a top view of a cast-iron flask, intended to receive eight ingot-molds and a center or sprue mold. The flask may be arranged for a larger or a smaller number of molds, if required; or it may be arranged to receive molds either of iron or of refractory material, molded in flasks, for making other castings than ingots—such as tire-blocks, anvil-dies, gearing, frogs, &c. The flask consists of a plate, suitably strengthened by ribs, in which are formed the depressions A A, which I prefer to make about four and one-half inches wide, to fit an ordinary fire-brick, and about five inches deep. I fill these depressions with plastic molding material—by preference, equal parts of ground fire-brick, ground fire-clay, and loam mixed with water—of such consistency that it will retain its shape after a pattern pressed into it is withdrawn. I then press the pattern, shown in plan by Figs. 2, 4, 6, 5, and 3, into the depressions A A. I prefer to make these patterns of iron. They should be so smooth that they will pull out easily, and they should be oiled before being pressed in so that the molding material will not stick to them. They may be pressed in by any suitable means, such as a heavy weight placed upon them, or a screw-press, or a hydraulic press, and in such cases the patterns may be made in one piece. In many cases, however, it is more convenient to make the pattern in several pieces, each so small that a workman standing on them or striking them with a bar can drive them down. I then remove with a trowel from the surface of the flask the molding material that has been pressed out of the depressions A A by the entrance of the patterns, and I withdraw the patterns by means of the eyebolts *a*, Fig. 8. To facilitate their withdrawal I sometimes prefer to run the point of a trowel down between the molding material and the patterns at several points, so as to loosen the patterns and to admit air beneath them. When the patterns are withdrawn there will be left in the depressions A A the molded runner B, Fig. 1, and also the places C which have been molded by the core-prints D, Figs. 6 and 7. I then place a core, by preference a "split" fire-brick, in the places C. These cores are arranged to cover the runner B at the points where the runner passes between the bottoms of two ingot-molds. The flask molded with the cores in their places is shown by Fig. 10, and two of the ingot-molds, L K, are shown set on the flask.

Fig. 9 is a section of the molded flask on the line A B, Fig. 10; and Fig. 12 is a section on the line C D E F, Fig. 10. I then dry the flask thoroughly, by preference, by baking it in a core-oven. Any cracks that may occur in the molded lining may be stopped by painting a thick clay-wash over them, by preference, while the flask is warm.

It will be observed that the molding mate-

rial forms a complete lining to the parts of the flask in which the stream of steel runs from mold to mold.

I set ingot-molds on the flask at E, F, G, H, I, J, K, L, and M, Fig. 10. The flask and a part of these molds are shown in elevation at Fig. 11. All these molds may be the ordinary cast-iron ingot-molds; but I prefer to make the center or receiving mold M, Fig. 11, of iron lined with loam or brick or other refractory material, because it has to conduct the liquid iron or steel to fill all the other molds, and is in this way much heated, and if made of unprotected iron it is rapidly destroyed. I form the lugs N N P, Figs. 10 and 11, on the flask to guide the molds to their places.

The advantages of using a "solid" flask, by which I mean a flask with a fixed bottom instead of a bottom plate, which can be removed for the purpose of ramming up the flask, are the following: First, the flask can be made without lugs, pins, and other such projections on the bottom as will become fixed in the iron or steel that runs out upon and under the flask in case a mold bursts or a ladle-stopper burns off, or the metal is spilled from any cause; second, there is no opening in a solid flask through which explosive gases can pass under the flask; third, the solid flask more securely holds the refractory lining in place, and in case of the failure of the lining at any point the solid iron flask will generally hold the liquid metal; whereas if a movable bottom plate is not closely and tightly secured to a flask, the lining is more likely to be defective, and the liquid metal will sometimes run through the lining and through the opening between the bottom plate and the flask.

My improvement further consists in making pockets Q, Figs. 10 and 12, by preference, about one and one-half inch deep, in the surface of the flask, where the ingots stand, and in ramming or pressing into these depressions the above described or any suitable molding material, and then leveling off its surface even with the top surface of the flask. These pockets are so situated that, while the ingot-molds will stand on the iron flask, the ingots cast in them will stand on the material molded into the pockets. The object of this is to prevent the cracking of the flask by the heat of the ingots.

When the molds are placed on the flask the iron or steel is poured into the center mold M, whence it runs through the molded runners B B, Fig. 10, into the bottoms of the surrounding molds, in the manner usual in "bottom casting."

My improvement further consists in the construction and arrangement of molds lined with refractory material, and hence specially adapted to receive the iron or steel and conduct it to the other molds.

Iron molds and sprues have heretofore been lined by plastering or painting refractory material upon their interiors; but these methods are not always convenient or well adapted to very hot iron or steel. Ramming up molds of refractory material in a flask by means of a pattern is sometimes too inconvenient and expensive. I make a lined mold by placing bricks of suitable material into an iron case fitted to receive them. I hold the bricks in place by means of a cover fastened down tightly upon them, and I stop the openings between and around the bricks by means of clay, kaolin, or other suitable refractory material. This part of my invention is further explained by Figs. 13, 14, 15, 16, and 17.

Fig. 13 is a side view, and Fig. 14 an end view, of an iron case, R, of suitable size to receive the ordinary split fire-bricks S T U, which are laid into it in such manner, as shown, as to form a continuous brick tube throughout the length of the case. Upon the bricks U the cover V is wedged down by means of the lugs W, the bar X, and the wedge Y, or in any other suitable manner. It will be seen that the cover thus holds all the bricks in their places, and that the case and the cover, together with the bricks, form a mold completely lined with refractory material.

In order to stop the spaces between the bricks I dip the bricks into a paste of kaolin and water, as is usual in laying fire-bricks, and I also, if necessary, press a paste of fire-clay or other suitable refractory mortar into the larger spaces with a trowel. I prefer, also, to dip the case and lining bodily into a bath of kaolin or fire-clay made fluid or semi-fluid with water, so that all the spaces around and between the bricks shall be thoroughly stopped. I then dry the mold thus formed in an oven, or in any convenient manner, after which it is ready for use. After a sprue or other casting is made in the mold I remove the cover V and such of the bricks as it may be necessary to remove in order to get out the casting. The case may then be relined as before described. The same bricks may in most cases be used several times. I prefer, however, to place new bricks at the bottom where there is most heat and pressure.

Another arrangement of bricks to form a small mold is shown by Figs. 15, 16, and 17, which are, respectively, a side view, a bottom view, and a top view of an iron case with a brick lining. The case is enlarged at the bottom to receive one course of whole fire-bricks, and the rest is lined with split brick. The bricks are laid and are held in place by a cover, substantially in the manner above described. I sometimes use common building-bricks instead of fire-bricks, but prefer fire-bricks for the bottom course, as they are less likely to give way from the heat of the fluid iron or steel poured into the mold.

In case a larger mold is required than can be conveniently built up from bricks of the usual sizes, and in case I require castings of cylindrical or other form, I make the bricks of the proper sizes and shapes to form such cast-

ings. In case the mold thus formed is too small at the top to receive the stream of iron or steel which is to be poured into it, I set a suitable mouth-piece upon it. For this purpose a conical iron box lined with loam or other refractory material rammed into it around a pattern, or plastered upon its interior surfaces, is shown by Fig. 18. I prefer, however, an iron box of suitable size to receive a lining of common building-brick set on end, as shown in plan by Fig. 19 and in section by Fig. 20. The bricks Y are set in the box, and the spaces Z are filled with loam.

I am aware that crucibles, tuyeres, and other objects have heretofore been partially formed by means of patterns pressed into plastic clay, and I do not claim forming molds by impressing patterns into plastic material. I am also aware that Letters Patent were granted to F. J. Slade, dated March 29, 1870, in which certain corners of a flask for bottom casting are protected; and I am also aware that Letters Patent were granted to Z. S. Durfee, dated September 27, 1870, in which reference is made to the possibility of lining iron flasks for bottom casting with refractory material; and I therefore lay no claim to the devices described in these inventions; but

What I do claim as new, and desire to secure by Letters Patent, is—

1. The apparatus for casting ingots and other castings, consisting of suitable molds, in combination with a solid flask containing suitable runners, which lead from one mold to another, and which are lined throughout with refractory material, molded by means of impressed patterns, in the manner and for the purpose described.

2. A mold lined with bricks or any suitable refractory material in removable blocks, substantially as described.

3. A mold formed of an iron shell lined with bricks or removable blocks, in combination with a cover capable of being pressed upon the bricks or blocks to hold them in their places, substantially as described.

4. The combination, with a flask for casting bottom-cast ingots or castings, of a sprue-mold for receiving the iron or steel, lined with removable bricks or blocks of refractory material, substantially as described.

A. L. HOLLEY.

Witnesses:
ADOLPH SCHMIDT,
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