(No Model.)

B. ATHA.

INGOT MOLD.

No. 330,281. Patented Nov. 10, 1885.

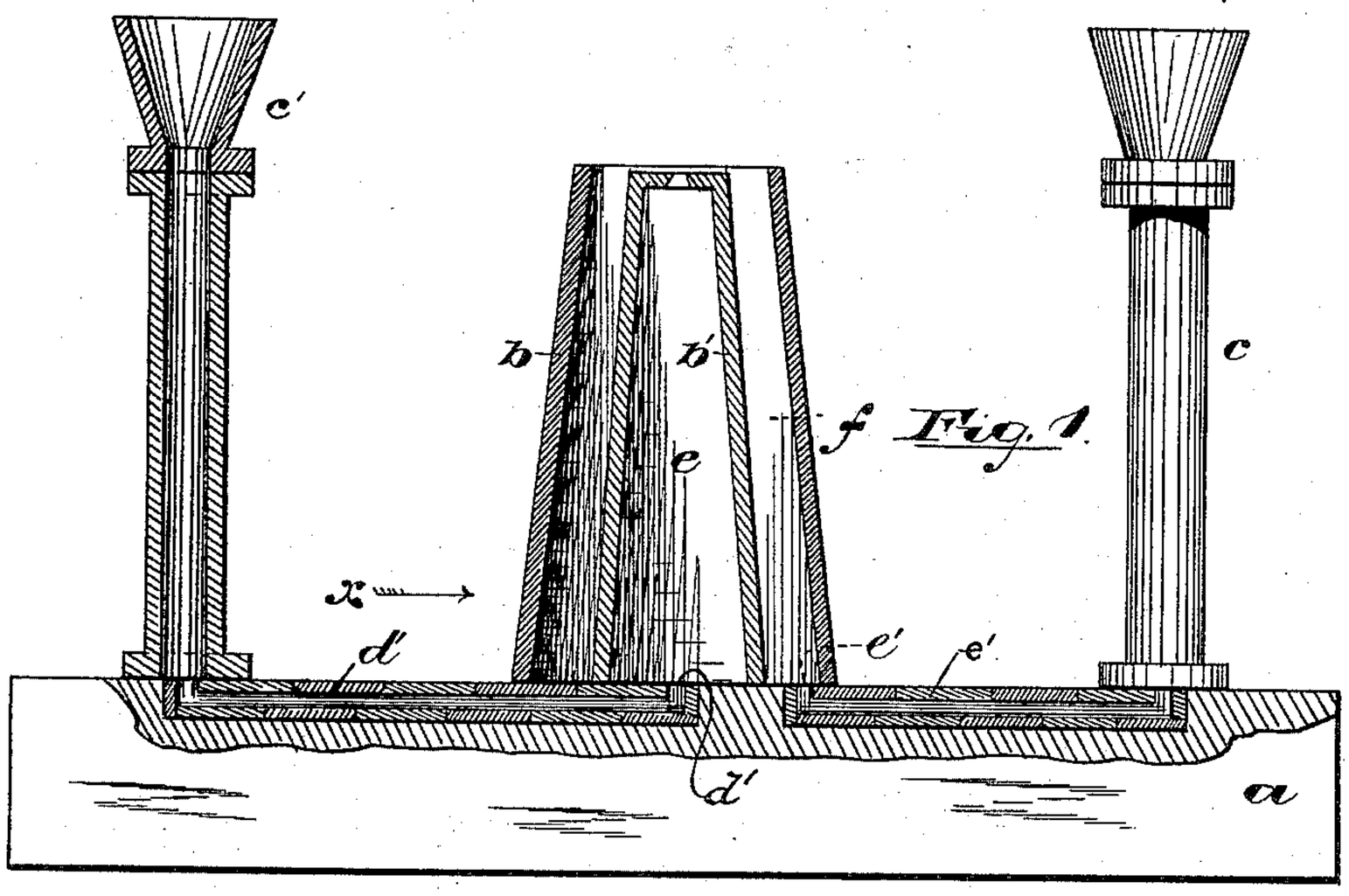

Fig. 1.

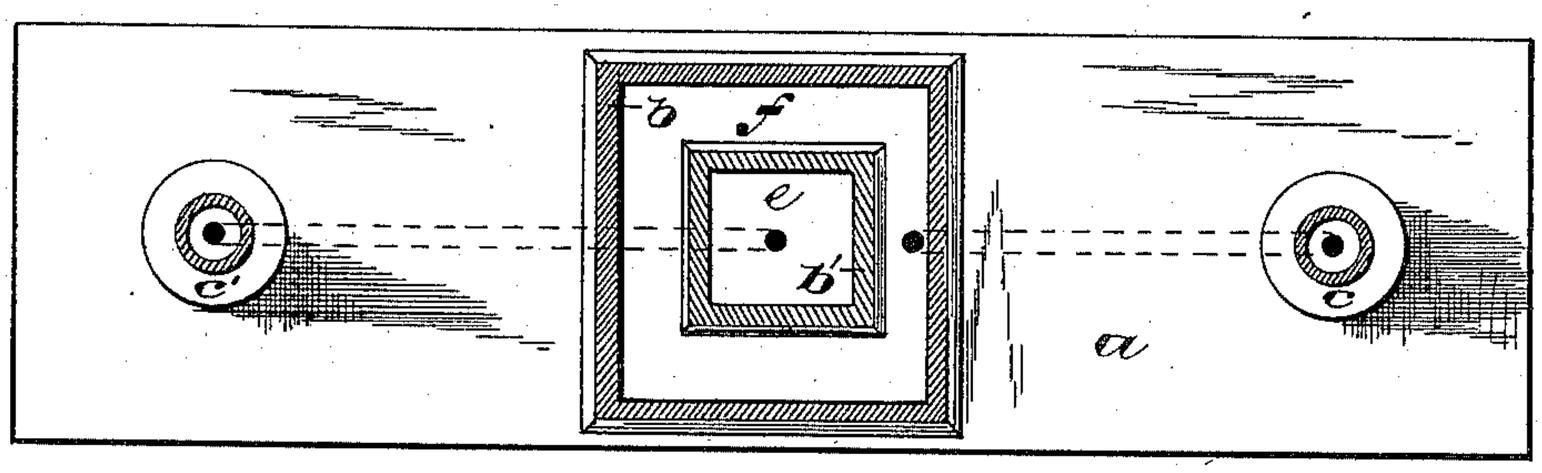

Fig. 2.

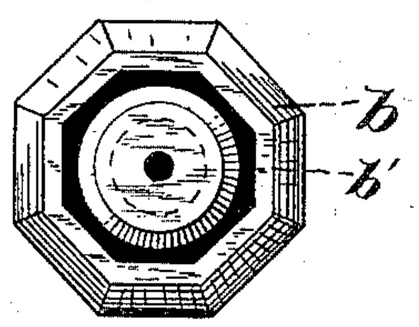

Fig. 3.

Attest:

Frdk. F. Campbell

B. L. McGrilly.

Inventor:

Benjamin Atha,

by Drasen & Co.,

Attys.

UNITED STATES PATENT OFFICE.

BENJAMIN ATHA, OF NEWARK, NEW JERSEY.

INGOT-MOLD.

SPECIFICATION forming part of Letters Patent No. 330,281, dated November 10, 1885.

Application filed May 5, 1885. Serial No. 164,443. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN ATHA, 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 Ingot-Molds; 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 mold ingots composed of differing metals or qualities of metal from which to manufacture guns, gun-tubes, armor-plates for ships and fortifications, and other articles, which layers will be more evenly and perfectly united or welded together than those in ingots manufactured by the means and processes now in vogue.

A further object is to facilitate the process of casting, whereby the cost of producing the ingots is reduced.

The invention consists in the means for casting ingots, substantially as will be hereinafter set forth, and embodied in the clauses of the claims.

Referring to the accompanying drawings, in which like letters indicate corresponding parts in each of the figures, Figure 1 is a side elevation of my improved mold for casting ingots, portions thereof being in section to show more clearly the interior construction thereof. Fig. 2 is a sectional view taken through line *x*, Fig. 1; and Fig. 3 is a plan showing forms of molds preferred in manufacturing gun-ingots.

Several methods of forming heavy ingots have been devised and employed with more or less success, the process most commonly practiced being to heat a plate or plates to redness, then to arrange them in or in connection with a suitable mold, and finally to cast the molten metal around or against them. This method secures a cohesion of layers of considerable strength; but when the plates made from such ingots are tested they are always found to possess imperfections in the weld. In other cases compound ingots of iron and steel have been formed for other purposes by casting with a mold having one or more movable plates or slabs therein. The slab being in position in said mold, one layer or body of metal is cast and allowed to set, when the said slab is removed, leaving a space in the mold, into which a second layer of metal of a differing quality is cast, forming the compound ingot. Inasmuch as the slabs used in this process are liable to warp when subjected to the extreme heat and weight of the molten metal, and thus allow the said metal to escape between the edges of the slabs and the sides of the mold, and, hardening, to cement the said slab fast to the mold, so that it cannot be readily withdrawn before the mass of cooling metal becomes unfit for perfect welding, this device or process cannot be successfully employed in casting ingots of a size adapted for the purposes for which the ingots formed by my improved device are intended; but, even should the slabs work freely in the mold referred to, the process of withdrawing the several side slabs, when such are used, successively form a core just cast and set, would consume so much time as to allow the air a sufficient contact with the core-surface on the portion of the sides thereof to form a coating or film of oxide which would seriously interfere with a proper cohesion of the different layers. To overcome these difficulties and others of practical importance, and to secure an ingot of differing layers in which one casting surrounds another and in which the cohesion of adjacent layers is perfect, the said layers being joined under the best conditions of heat and without any intervening oxides, I construct my improved mold as follows:

In the drawings, *a* indicates a bed or base, made preferably of cast metal, in which are formed independent channels or ducts *d d'*, through which the molten metal may run from certain separate funnels or receptacles *c c'* for the poured metal to upright molds *b b'*, said ducts being preferably provided with linings of fire-brick in any suitable manner. The molds for forming the compound steel ingots are removable from said base or bed and have inclined sides, as shown in Fig. 1, whereby they may be readily drawn from the newly-cast metal before the latter becomes too cool to secure subsequently a perfect welding of

layers. Said molds are arranged in a concentric series or nest, as shown in the several figures, *e'* being an upright center mold having therein a core-chamber, *e*, communicating with the funnel *c'* through the duct *d'*. Outside of and around said core or center mold is arranged, preferably before casting the core, a mold, *b*, which forms a chamber, *f*, with the core-mold or the core itself. Said chamber *f* has communication through the duct *e'* with another funnel, *c*.

The opening at the top of the outer mold is ordinarily as large or larger than the base of the inner mold, to allow the said inner mold to be drawn therethrough. I prefer, furthermore, to have a greater degree of inclination in the side walls of the outer mold than is in those of the inner mold, as illustrated in Fig. 1, so that the layers of the ingot will each be proportionably thicker at the same end of the said ingot. When the ingot is subsequently forged to bring it to a prismatic shape, the several layers will be proportionately compressed and lie parallel, being then of approximately equal thickness throughout their length. In casting with this mold or set of molds, the core metal, which is preferably of a harder grade of steel than that of the outer layer, is poured through the furnace *c'*, filling the chamber *e*. When the metal is sufficiently set or hardened to hold its own weight, the center mold is drawn off from the core by suitable means, and at the same time, or as soon thereafter as possible, steel of a differing grade of hardness is poured through the funnel *c* and rises quickly and evenly around the core. As this said core still retains a very high degree of heat, and as no or extremely little opportunity is given for the oxygen of the air to come in contact with and coat the surface of the core with a film of oxide, a complete and perfectly-cohering weld or union of layers is formed. Thus cast, the layers of the ingot, when the latter is subjected to the forging process, cannot be separated and the ingot rendered worthless for the purposes proposed.

The center mold may, under some circumstances, be drawn off before the outer mold is placed in position to form the chamber around the core; but inasmuch as there would under that process be considerable lost time, and as the outer mold protects the surface of the core while the core-mold is being drawn off, I prefer the arrangement of molds first described.

The molds may, in plan, be of any shape; but for making ingots for guns or gun-tubes I form the center mold round, as in Fig. 3, and larger than the desired barrel or bore in the gun. By means of this mold I form a gun-ingot with a hard-steel core and an outer layer of soft and elastic metal, the core being round, so that when bored out a barrel-lining of hard steel is formed of uniform thickness and power of resistance throughout its periphery.

In forming ingots of concentric layers of hard and soft metal for armor-plates for vessels, fortifications, &c., I prefer to make the molds oblong, and for this purpose I may have suitable molds adapted to form two or more oblong cast cores included or surrounded by one inclosing cast jacket.

Although the devices shown in the drawings are especially adapted for bottom casting, it is evident that they may be employed in top casting without making any material changes in their construction. In using them in the latter process, however, I would prefer to fill the runners with clay in any ordinary manner, so that the metal cannot be wasted by escaping into the funnels. In said process of top casting I may enlarge the opening in the top of the center mold to allow the metal to be poured in more freely.

It will be evident that the features embodied in clauses three and seven of the claim are applicable alike to molds arranged on beds with ducts for bottom casting, and also to molds used by pouring the metal into their tops, or in any way known as "top casting."

I do not claim herein, broadly, the combination of an inner and outer mold and a base, the inner mold being capable of withdrawal from the ingot cast within it, whereby an ingot may be cast, one mold may be withdrawn from it, and another casting may be made between the first casting and the other mold, this being the subject-matter of another application filed May 5, 1885, Serial No. 164,443.

The claims for the processes herein described are reserved for an independent application numbered serially 152,462.

What I claim is—

1. A series of separable inner and outer molds for casting compound ingots, having independent chambers therein, in combination with a bed having ducts leading to said chambers, substantially as and for the purposes set forth.

2. In combination with a bed, *a*, having independent ducts, the inner and outer molds removable from the bed and separable from one another, and the funnels or receptacles for the poured metal, substantially as and for the purposes set forth.

3. In combination with a bed, a mold having walls of one degree of inclination, and a larger mold with a wall of a differing degree of inclination, said molds being removable from the bed and from one another, substantially as and for the purposes set forth.

4. In combination, a bed, *a*, having independent ducts therein, inner and outer molds arranged thereon, separable from one another and from the bed, and having separated chambers and independent funnels, said parts being arranged and combined substantially as set forth.

5. In combination with a bed having independent ducts, removable molds *b b'*, one of which is seated over the mouth or exit of one

of said ducts and the other of which molds is seated over the mouth or exit of one of said ducts, and the other of which is larger than the first, to form a chamber with the ingot cast in the first said mold, the other of said ducts leading into said chamber, substantially as set forth.

6. In combination, a bottom, base, or bed, *a*, having ducts *d d'* and funnels *c c'*, and removable inner and outer molds, substantially as and for the purposes set forth.

7. In combination with a suitable bed or base, inner and outer molds, the inner of which is provided with tapering sides and is of one integral piece from the base upward, and free from joints, to prevent said mold from warping and the liquid from passing into said joints, whereby said inner mold may be quickly withdrawn from the core-casting and a second casting or layer be cast against the first under the best conditions, as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 2d day of May, 1885.

BENJAMIN ATHA.

Witnesses:

OLIVER DRAKE,

FREDK. F. CAMPBELL.