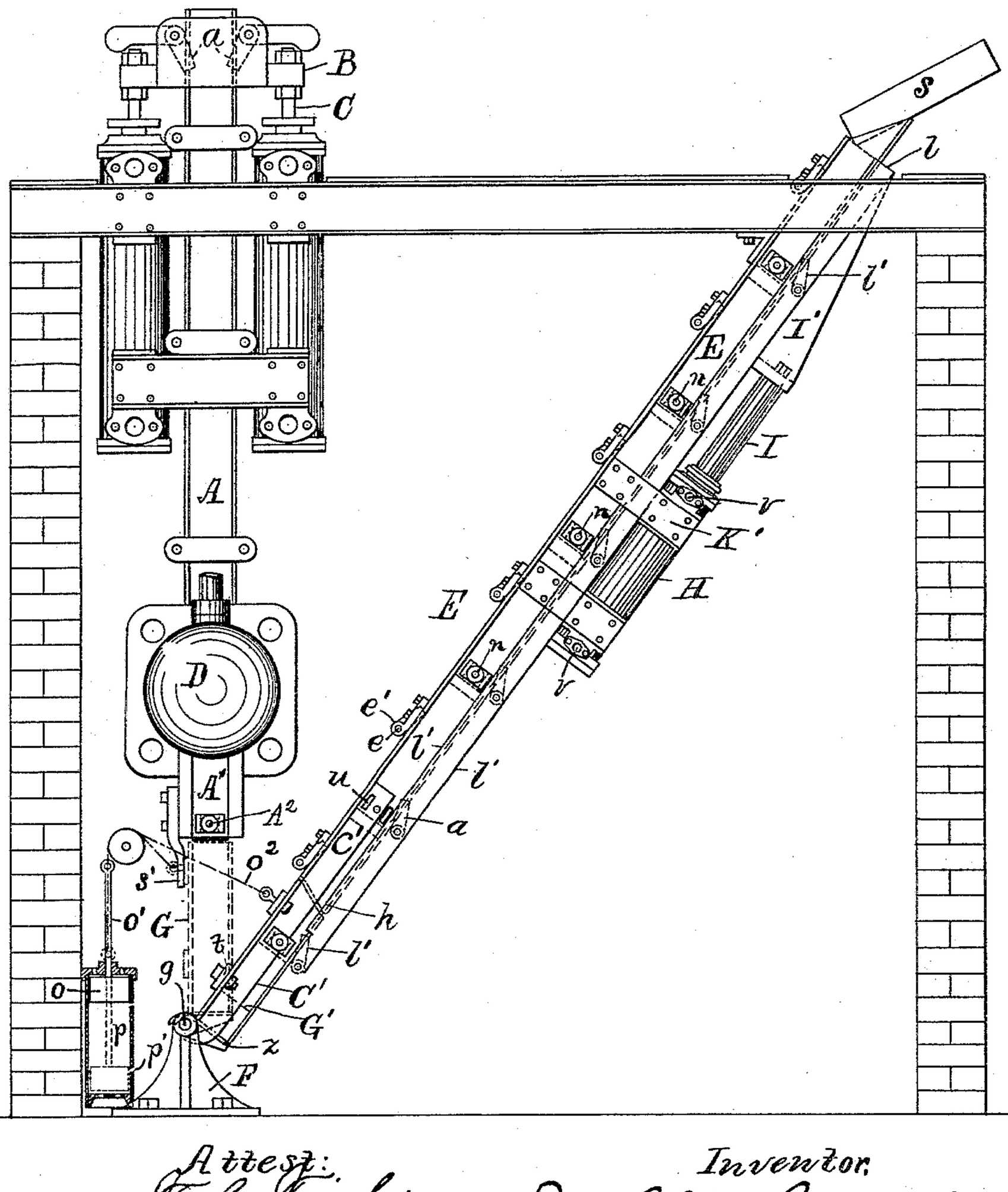
(No Model.) 2 Sheets—Sheet 1.

J. B. D'A. BOULTON.

ELEVATOR FOR INGOT CASTING MACHINES.

No. 384,345. Patented June 12, 1888.

Fig. 1.



Attest:
F. C. Fischer.
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Cross & Miller, attys.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 9.

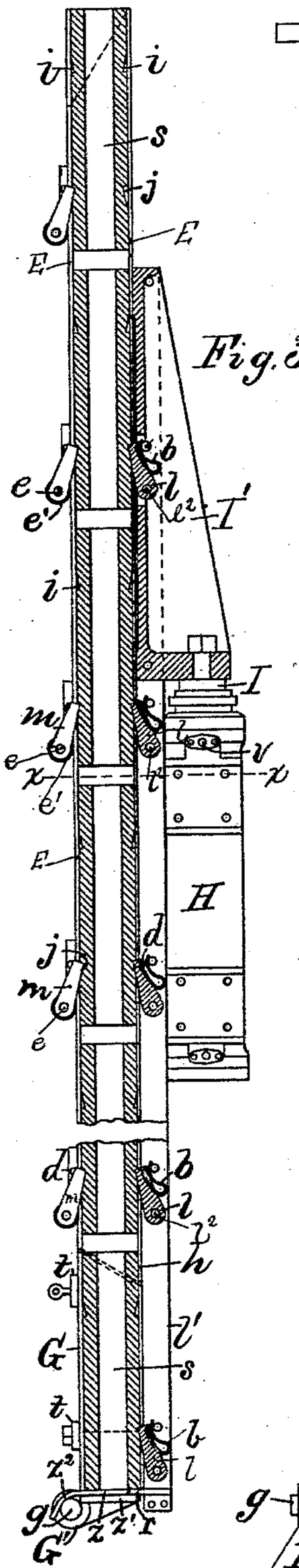

Fig. 3.

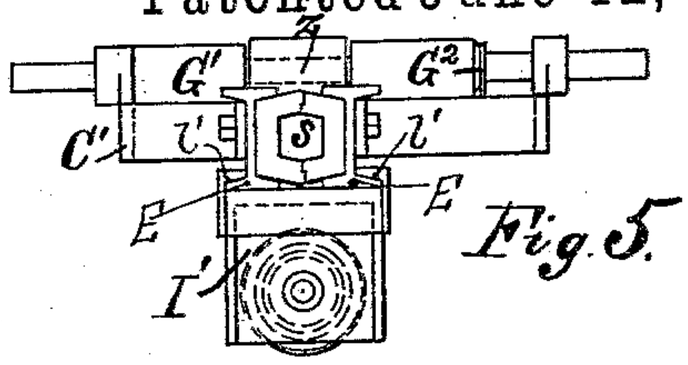

Fig. 5.

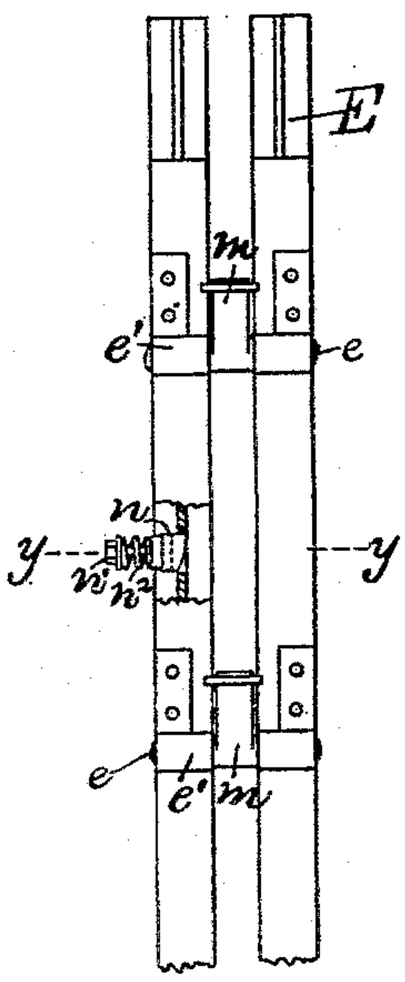

Fig. 2.

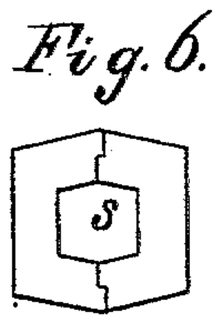

Fig. 6.

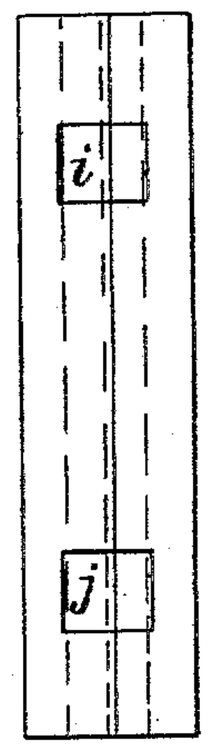

Fig. 7.

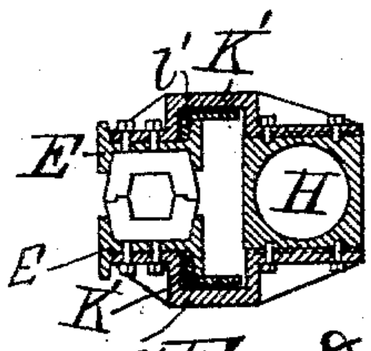

Fig. 8.

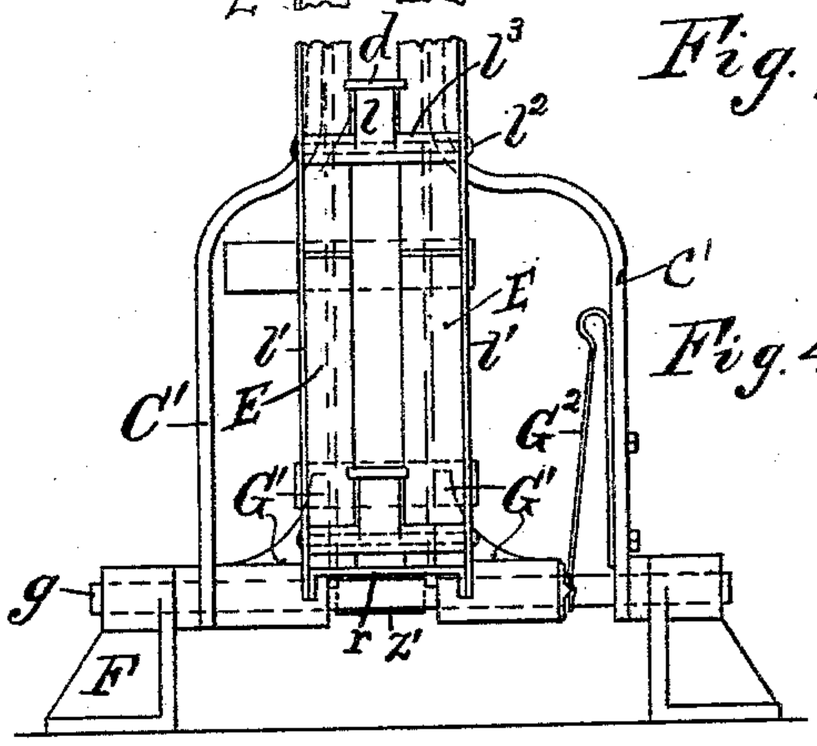

Fig. 4.

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UNITED STATES PATENT OFFICE.

JAMES B. D'ARCY BOULTON, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO THE SOLID INGOT COMPANY, OF NEW JERSEY.

ELEVATOR FOR INGOT-CASTING MACHINES.

SPECIFICATION forming part of Letters Patent No. 384,345, dated June 12, 1888.

Application filed March 23, 1888. Serial No. 268,218. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. D'ARCY BOULTON, a subject of the Queen of Great Britain, residing at Jersey City, Hudson county, New Jersey, have invented certain new and useful Improvements in Elevators for Ingot-Casting Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to furnish a convenient means of elevating ingots and ingot-molds in cases where they are produced at the bottom of a pit or in other situations where they require elevation to a higher level for the subsequent use of the molds or further treatment of the ingots.

The invention is applicable to many situations, but is illustrated herein in connection with the apparatus patented July 5, 1887, as No. 365,902. In such apparatus or casting-machine a series of ingots is formed in a series of separate mold-sections, which are discharged at intervals from the bottom of the apparatus, and the elevator is shown herein adjusted to the bottom of such apparatus to receive the mold-sections successively and to elevate them to a level with the top of the apparatus, where the ingots may be removed from the sections for further treatment, and the molds may be in readiness for further use at the upper end of the casting-machine.

This invention consists in the combination, with a vertical casting-machine adapted for receiving a series of movable mold-sections, of means for sustaining the mold-sections in the machine, means for discharging them from the lower part of the machine, a guiding-trough having one end arranged below such casting-machine to receive the mold-sections from the same, and means for elevating the mold-sections in the guiding-trough. By this construction the separate sections of mold or ingot may be supplied intermittently at the bottom of the trough, and the pawls operate to move them forward within the trough, while the detents hold them in their advanced position until again shifted by the actuating-pawls. The pawls would preferably be advanced a little more than the length of one section at each actuation; and the invention consists, partly, in the means for connecting the pawls together in a "ladder" or frame and for reciprocating such frame the desired distance, and in the means for transferring the sections of mold or ingot automatically from the casting-machine to the elevator.

The invention is shown herein applied to the elevation of the mold-sections with their partially-cooled contents; but it will be seen that the apparatus is equally adapted to operate upon the naked ingots, as the actuating-pawls and detents would operate the same upon the lower ends of the ingots as upon the lower end or side of an ingot-mold.

In the annexed drawings, Figure 1 is a side elevation of a casting-machine provided with the elevator, one edge of the latter being shown in the view with a hydraulic cylinder attached to the trough to actuate the reciprocating pawls. Fig. 2 is a side view of the upper side of the trough near its upper end. Fig. 3 is a central longitudinal section of the trough and its attachments, (the hydraulic cylinder not being shown in section.) Fig. 4 is a view of the under side of the elevator, and Fig. 5 is a plan or end view of the elevator-trough and its attached cylinder. Figs. 2 to 5, inclusive, are upon a larger scale than Fig. 1, and the views are broken off at Figs. 2, 3, and 4 for want of room to display the entire proportions. Figs. 6 and 7 are respectively an end view and side view of one of the ingot-molds, such as are shown in the other figures, upon a larger scale. Fig. 8 is a section on line *x x* in Fig. 3, and Fig. 9 a section on line *y y* in Fig. 2.

In Fig. 1, A is the holder of the casting-machine, supplied intermittently at the top with mold-sections like those shown in Fig. 7, such sections being moved downward when successively filled by pawls *a*, attached to a reciprocating head, B, actuated by hydraulic piston-rods C. A hydraulic cylinder, D, is shown in end view directly under the holder A, and has a piston provided with a pocket, A′, to receive the ingot-sections when moved downward by means of the pawls *a*. Such piston serves to rupture the successive ingots from one another at the joint of the mold-sections, as claimed in the said Patent No. 365,902. The mold-section is sustained within the pocket after being severed from the one above it by the spring-presser A^2 at the lower end of the said pocket,

and such mold-section is discharged from the bottom of the casting apparatus by being forced downward by the mold-section above it.

The trough of the elevator consists in two I-beams, E, of wrought-iron, of suitable dimensions to form, when placed side by side, a channel to receive the ingot-molds, as shown in Fig. 5. The I-beams are held at a suitable distance apart by tie-bolts *e*, fixed in ears *e'*, which are secured upon the edges of the beams, and the lower ends of the beams are secured upon a stand, F, with one edge of the trough or internal channel coincident with one edge of the molds as discharged from the holder A. The stand F is furnished with a pivot, *g*, upon which is hinged a carrier, G, arranged when vertical in line with the holder A and formed to receive the mold or ingot sections *s* therefrom. The pivot is arranged at one edge of the carrier, so that the weight of the latter tends to turn it around the pivot and throw it into line with the trough of the elevator, and it is only prevented from thus turning by a counterbalance-weight, *o*, attached to a rod, *o'*, and connected with the carrier by a cord or chain, o^2. The sides of the carrier consist of two short pieces of I-beam pivoted upon the stand F by castings G', and the lower end of the trough is provided with two arms, C', fitted also to the pivot *g*, the lower ends of the beams E being cut on a bevel between the arms to admit the carrier.

The carrier G is beveled at its upper end, as are the lower ends of the beams E, and the section *s*, when shifted from below the casting-machine to the carrier, is thus permitted to project from the mouth of the carrier and to strike the bottom of the trough at the point *h*. A foot-plate, *z*, is fitted upon ribs *z'* upon the castings G' to form a bottom for the carrier, the end of the plate being curved about the pivot *g* at z^2 to protect the pivot from concussion or injury from the sections. The weight *o* is fitted to move as a piston loosely within a closed cylinder, *p*, and apertures *p'* are formed in the cylinder near its top and bottom to permit the free escape of the contained air as the weight moves to and fro. The air in the extreme ends of the cylinder is confined to cushion the weight at such points, and thus prevent the weight and carrier from striking violently at the opposite ends of its movement.

To prevent the weight *o* from moving too slowly when near the end of the cylinder, I prefer to provide the ends of the cylinder with holes, as shown in the drawings, to regulate the passage of the air; but in no case would the area of such holes be great enough to allow the free passage of the air, thereby avoiding the attainment of the object of the cylinder.

The movement of the carrier is limited when elevated by a stop, *s'*, upon the holder A, and when lowered into line with the elevator-trough by its contact with the flanges forming the bottom of the trough.

Notches *i* are shown formed in the sides of the molds near their upper ends to operate with the pawls *a* in the casting-machine, and notches *j* are shown in the sides of the molds near their opposite ends to operate with the pawls and detents upon the elevator. The carrier, being supported by a pivot at one side and balanced by the weight *o*, is held beneath the casting-machine nearly in a state of equilibrium, and the weight of the mold or ingot section when dropped into the same immediately overbalances the weight *o* and operates to turn the carrier around the pivot until arrested by contact with the trough, thus laying the section *s* within the latter in readiness for elevation.

The means for pushing the sections upward within the elevator-trough consists in the pawls *l*, pivoted between two side bars, *l'*, which are reciprocated in contact with the under side of the elevator-beams by a hydraulic cylinder, H, and piston I. The bars constitute a pawl-frame, and the pawls are pressed toward the trough by springs *b*. The bars *l'* are made of angle-iron, hooked each, as shown in Fig. 8, under one edge of the flange upon the beams E, the pawls being formed with hubs l^3, fitted between the bars and pinned thereto by rivets l^2.

The cylinder H is secured to the beams E by cast brackets K', and the piston I is provided with a head-piece, I', which is fitted between the two bars *l'* and riveted thereto. One of the pawls *l* is pivoted in the head-piece I', and the series of pawls is secured to the bars *l'* at regular distances corresponding to the stroke of the piston I, which is made a little greater than the length of the mold-sections to compensate for irregularity and lost motion of the bars.

A series of mold-sections with their contained ingots is shown in section in Fig. 3, one of the pawls *l* being engaged with the notch *j* in each of said sections, and the piston I being retracted, so that the pawls are at the lower end of their stroke in readiness to advance all the sections in the trough.

In Fig. 1 the piston is shown at half-stroke and the flanges upon the upper sides of the beams E are shown beveled off near the top of the elevator to permit the section when pushed nearly to the top of the trough to tip over and fall out of the trough. Upon the upper side of the beams E detents *m* are shown, constructed to fit in the notches *j* opposite those in which the pawls engage, the detents being arranged to enter such notches when the piston is at full stroke and each mold-section elevated one step.

In operating upon ingots in which no notches similar to those shown at *i* and *j* could be provided, the pawls and detents would be arranged to engage the lower ends of the sections, and a tongue, *r*, (shown in Fig. 3,) secured to the lower ends of the bars *l'*, would be used to push the first section from the carrier in place of the lowest pawl shown in the drawings. The

carrier being constructed of I-beams similar to those of which the trough is formed, the bars l' are adapted to hook over the flanges upon the same when the carrier is in line with the trough, and the carrier is thus held firmly in line therewith while the section is pushed upward by the action of the pawl or tongue.

In the casting-machine shown in Fig. 1 the rupturing of the successive ingot-sections is effected by a lateral movement of the ingot-mold, which is not illustrated in the drawings, as it is fully shown in the said Patent No. 365,902; but provision is made in the construction of the carrier G to permit the carrier to move sidewise without injury, should such lateral movement of the ingot-mold be accidentally effected while the mold is partly within the holder A and partly within the carrier. To permit such lateral movement of the carrier, the castings G′ are fitted loosely upon the pivot g, and are held in their normal position by a spring, G^2, which is adapted to yield should the carrier be moved laterally, and to push the carrier back into line with the holder A and the elevator-trough when such lateral movement is completed. The two pieces of channel-beam of which the carrier is composed are tied together by cross-bars t, to one of which the cord o^2 is attached.

The mold-sections are commonly formed in halves, as shown in Figs. 6 and 7, and to prevent the lateral separation of such longitudinal parts when in the elevator-trough pressers n are located at intervals upon one of the beams E, and are shown in detail in Figs. 2 and 9.

The presser consists in a piece, n, having tongues fitted through slots (shown in Fig. 9) in the side of the beam E, and is pressed inwardly by spring n^2, fitted to a stud, n', inserted through a hole in the middle of the casting n and tapped into the beam between the slots u.

Should the mold-sections be accidentally separated and a little thin film of metal become jammed between their two halves, the dimensions of the section would be increased, so that it might jam within the trough, and the use of the pressers prevents any such separation of the parts and holds the halves of the sections firmly together until they are discharged from the top of the elevator.

Pipes v are shown applied to the cylinder H, and the operator would control the movements of the piston I by supplying the fluid to the opposite ends of the cylinder, as required, and the entire mechanism then operates as follows:

The pawls and bars l' are moved to the upper end of their stroke by means of the piston I, and the carrier, being emptied, is held in line with the holder of the casting-machine, as shown in Fig. 1, until a mold or ingot section is dropped therein. The weight of such section then overbalances the counter-weight o, and the carrier is tipped over into line with the elevator-trough, and the section is laid in a line therewith. The piston I is then retracted, moving the bars l' downward, the flanges upon their lower ends engaging with the flanges upon the carrier, and thus holding the same firmly in line with the beams E. The pawl or tongue r then engages the section in the carrier, and, the piston being extended, the bars l' are advanced and the ingot shifted out of the carrier and engaged with the first detent. The surplus weight being thus removed from the carrier, it is automatically elevated by the counter-weight o into line with the holder A in readiness to receive another mold or ingot section. Such section being deposited in the carrier, it automatically tips into line with the elevator-trough, and the movements of the piston are again repeated, its second downward and upward stroke serving to elevate the first section another step and to elevate the second section out of the carrier into the position of the first.

The movements of the piston I are controlled by the operator, and its actuations are effected after each section is deposited in the carrier and the carrier moved in the line with the elevator-trough.

The elevator-trough is shown in an inclined position, so as to receive the sections directly through the bottom of the casting-machine and to deliver them upon a level with its top, and at sufficient distance therefrom to be out of the way of the operators around the top of the casting-machine, who supply the ingot-molds and fill them with fluid steel.

The elevator in its constructive features would evidently operate the same if placed in any other position, and I do not therefore limit myself to the particular arrangement shown in the drawings.

It is obvious that the trough may be made of other materials and its forms materially modified without affecting its function, which is merely to guide the sections in their upward movement and to hold them in contact with the pawls and detents. With the inclined position for the trough the sections obviously rest upon its lower side, and if the pawls which propel them within the trough were applied to their upper sides the pressure of the pawls would be added to the weight of the sections and induce an excessive friction. By applying the pawls upon the under side of the sections they are partially elevated from the bottom of the trough during their advance movement, and the friction is greatly reduced.

Both the pawls l and the detents m are provided with transverse cross-bars d at their free ends, which project slightly beyond their edges. Such cross-bars are made of such length that they will not pass between the I-beams when there is no ingot or mold to prevent the movement of the pawl or detent within the trough, and they thus serve to check the movement of the pawls and detents when not exercising their functions.

The application of a pivoted carrier to the lower end of the trough below the casting-machine is immaterial to my invention, since

the end of the trough may be so arranged as to receive the mold-sections directly as they leave the casting-machine. It is also immaterial what means is used to move the mold-sections in the trough, as the essential feature of my invention is the combination, with an ingot-casting machine, of a trough leading from the bottom of the machine and means applied thereto for moving the mold-sections.

It is evident that in the construction shown herein only one pawl and one detent at the lower end of the trough are essential to move the mold-sections, since the lower mold-section tends to push the others above it upward when actuated itself by the pawl, and to sustain them when held by the detent.

Having thus set forth my invention, what I claim herein is—

1. The combination, with a vertical casting-machine adapted for receiving a series of movable mold-sections, of means for sustaining the mold-sections in the machine, means for discharging them from the lower part of the machine, a guiding-trough arranged below such casting-machine to receive the mold-sections from the same, and means for elevating the mold-sections in the guiding-trough, substantially as herein set forth.

2. In an elevator for ingot sections or molds, the combination, with a guiding-trough, of a reciprocating frame carrying a series of pawls applied to one side of the trough, a series of detents fixed upon the trough, and a series of pressers corresponding in succession with the detents, as and for the purpose set forth.

3. In an elevator for ingot sections or molds, the combination, with a guiding-trough, of a reciprocating frame carrying a series of pawls applied to one side of the trough, a series of detents fixed upon the trough, and a pivoted carrier adapted to move to and from the trough, as and for the purpose set forth.

4. In an elevator for ingot sections or molds, the combination, with a guiding-trough, of a reciprocating frame carrying a series of pawls applied to one side of the trough, arms extended from the base of the trough, and a pivoted carrier adapted to move to and from the trough between the said arms, as and for the purpose set forth.

5. In an elevator for ingot sections or molds, the combination, with a guiding-trough, of a reciprocating frame carrying a series of pawls applied to one side of the trough, arms extended from the base of the trough and sustained by a pivotal bar, and a carrier pivoted at one side upon such bar and movable to and from the trough between the arms, as and for the purpose set forth.

6. In an elevator for ingot sections or molds, the combination, with a guiding-trough, of a reciprocating frame carrying a series of pawls applied to one side of the trough, arms extended from the base of the trough and sustained by a pivotal bar, and a carrier pivoted at one side upon such bar, the carrier being movable to and from the trough between the arms and laterally upon the pivotal bar, as and for the purpose set forth.

7. In an elevator for ingot sections or molds, the combination, with a guiding-trough, of a reciprocating frame carrying a series of pawls applied to one side of the trough, arms extended from the base of the trough and sustained by a pivotal bar, a carrier pivoted at one side upon such bar and movable to and from the trough and laterally upon the pivotal bar, and a spring to hold the carrier laterally upon the bar in line with the trough, substantially as set forth.

8. In an elevator for ingot sections or molds, the combination, with a guiding-trough sustained at an angle with its base adjacent to an ingot-casting machine, of a reciprocating frame carrying a series of pawls applied to one side of the trough, a pivoted carrier movable to and from the bottom of the casting-machine and the bottom of the trough, and a counterweight to hold the carrier in line with the casting-machine when empty, as and for the purpose set forth.

9. In an elevator for ingot sections or molds, the combination, with a guiding-trough sustained at an angle with its base adjacent to an ingot-casting machine, of a reciprocating frame carrying a series of pawls applied to one side of the trough, a pivoted carrier movable to and from the bottom of the casting-machine and the bottom of the trough, and a counterweight, combined with a dash-pot or air-cushion to hold the carrier in line with the casting-machine when empty, as and for the purpose set forth.

10. In an elevator for ingot sections or molds, the combination, with a guiding-trough and reciprocating pawls for elevating the mold, of notches in the side of the mold to engage with the pawls, as and for the purpose set forth.

11. The combination, with a casting-machine having means for sustaining the mold, pawls and means for operating them to move the molds downward, and a guiding-trough below such casting-machine provided with reciprocating pawls for moving the mold, of mold-sections having one set of notches for the application of the pawls in the casting-machine and a separate set of notches for the application of the pawls in the elevator-trough, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JAMES B. D'ARCY BOULTON.

Witnesses:

L. LEE,

THOS. S. CRANE.