(No Model.) 3 Sheets—Sheet 1.

J. ILLINGWORTH.

INGOT CASTING MACHINE.

No. 594,157. Patented Nov. 23, 1897.

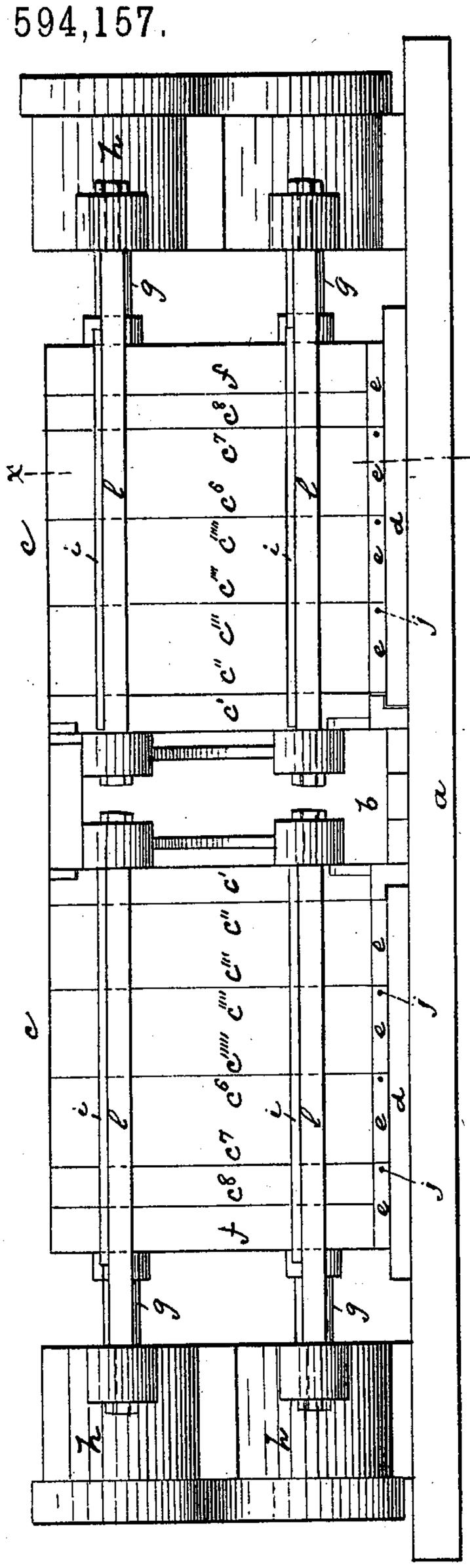

Fig. 1.

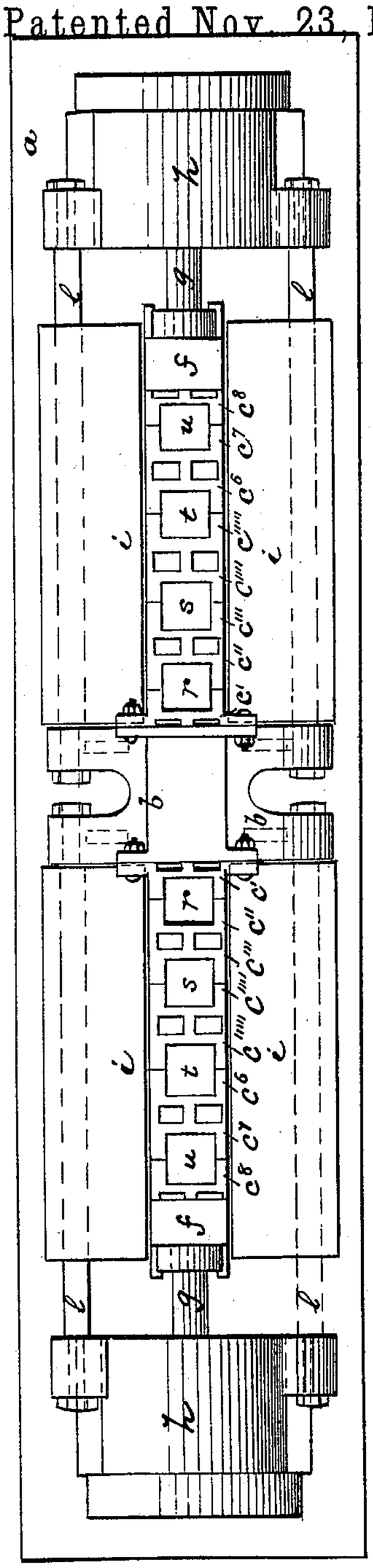

Fig. 2.

WITNESSES:

C. B. Sibley.
F. Forster

John Illingworth, INVENTOR:

BY Drake & Co.,

ATTORNEY.

(No Model.) 3 Sheets—Sheet 2.

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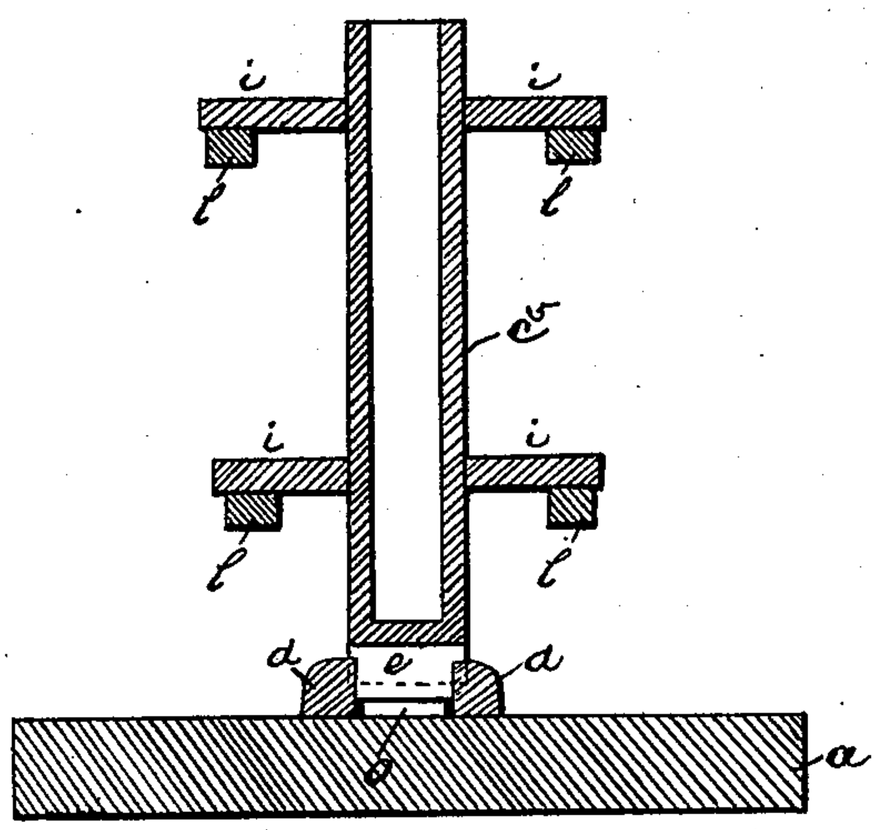

Fig. 3

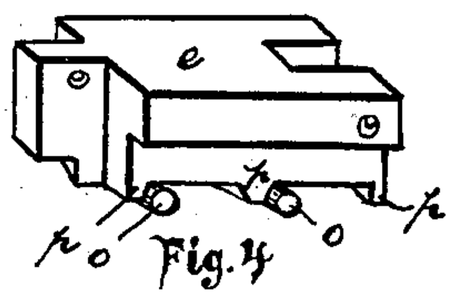

Fig. 4

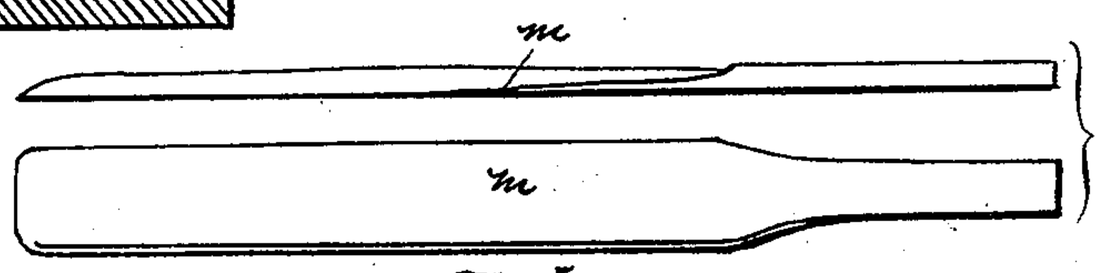

Fig. 5

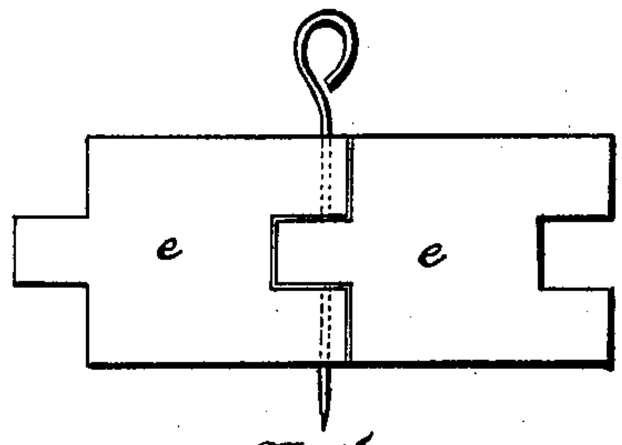

Fig. 6

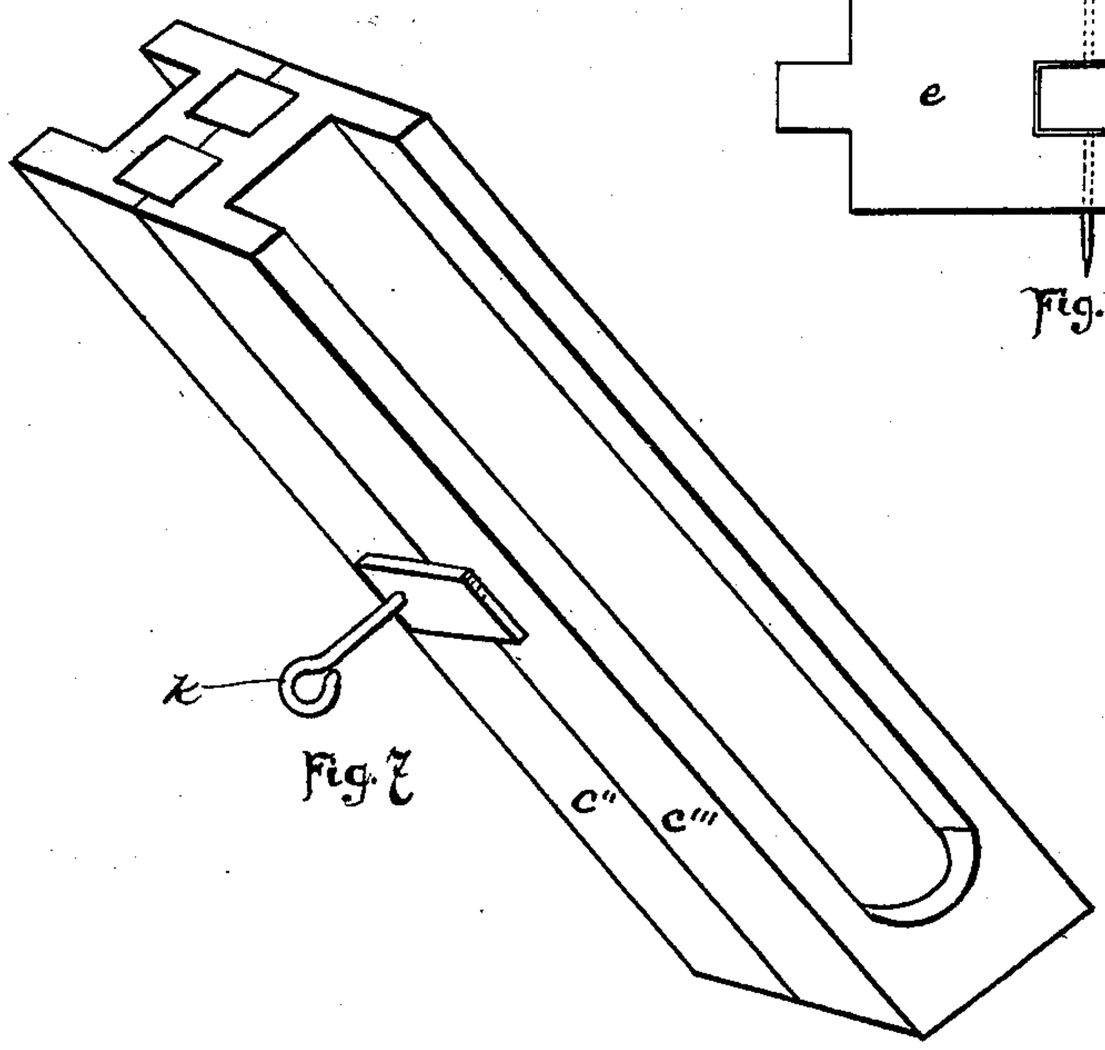

Fig. 7

WITNESSES:

C. B. Pitney.
Fr. Förster

John Illingworth, INVENTOR.

BY Drake & Co.

ATTORNEYS.

(No Model.) 3 Sheets—Sheet 3.

J. ILLINGWORTH.

INGOT CASTING MACHINE.

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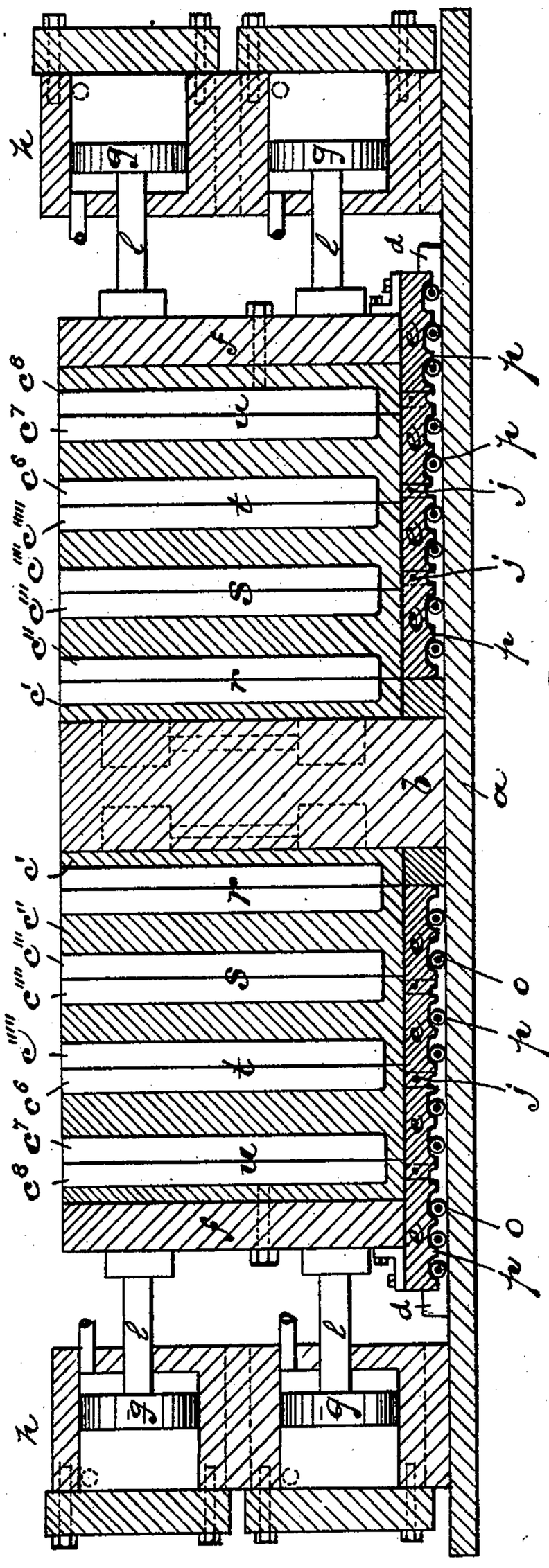

Fig. 3.

WITNESSES:

A. R. Thrasher.

C. B. Tilney.

John Illingworth, INVENTOR:

BY Drake & Co.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

JOHN ILLINGWORTH, OF NEWARK, NEW JERSEY.

INGOT-CASTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 594,157, dated November 23, 1897.

Application filed February 24, 1897. Serial No. 624,853. (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 Ingot-Casting Machines; 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 objects of this invention are to reduce the cost of casting ingots, to facilitate the operation of casting and enable said operations to be accomplished with less labor, to effectively prevent the formation of the defects known as "piping," due to the shrinkage of the metal after the outer sides of the ingot have set and hardened, and to secure other advantages and results, some of which will be referred to hereinafter in connection with the description of the working parts.

While the invention is adapted for the production of ingots of all sizes, I employ it more especially in the manufacture of ingots of a large size.

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

Referring to the accompanying drawings, in which like letters of reference indicate corresponding parts in each of the views, Figure 1 is a side elevation of the improved machine. Fig. 2 is a plan of the same. Fig. 3 is a vertical section taken on line *x x*, Fig. 1. Fig. 4 is a perspective view of a certain mold carriage or truck. Fig. 5 is a side view and plan of a certain wedge employed in connection with the ingot. Fig. 6 is a plan showing two trucks or carriages coupled, and Fig. 7 shows a back-to-back pair of mold-sections not integrally joined. Fig. 8 is a vertical section taken centrally through the series of molds and coöperating parts.

In said drawings, *a* indicates the bed-plate, upon which the several parts are supported. This is provided at a suitable central point with a heavy vertical standard *b*, at opposite sides of which are series of molds *c*, arranged in separable sections. Beneath said mold-sections and on said bed-plate are tracks or ways *d d*, on which are arranged cars or trucks *e e* of about the length and width of a pair of mold-sections placed back to back, as shown in detail in Fig. 7. Said mold-sections placed back to back may be in united pairs, as in said Fig. 7, or they may be integrally connected, as indicated in Fig. 2, the latter construction being preferred. To the central standard, at opposite ends and adjacent to said ways, are fastened mold-sections *c' c'*, their backs lying against the vertical sides of the standard and bolts being preferably used in fastening them in place. The fronts or working faces of said sections *c'* are grooved or chambered longitudinally in correspondence with the working face of the next mold-section *c''* in the series, the chambers of the two sections uniting to form the first mold-chamber of the series.

Next to the second vertical mold-sections *c''*, with their backs thereto, are third mold-sections *c'''*. These form pairs with said second mold-sections and may be integral therewith. Said pairs of mold-sections *c'' c'''* are carried by the first carriages or trucks *e* of the series, said trucks being of substantially the same size in plan as said pairs of mold-sections. Said carriages or trucks are provided at their opposite ends with coupling means, whereby the several carriages of a series may be coupled together in a train, the couplings preferred at the present time being shown in the detail plan of the said trucks, Fig. 6.

Following the pairs of mold-sections *c'' c'''* are other pairs c'''' c''''' c^6 c^7, and at the opposite ends of the series are other single sections c^8, which are fastened to vertical compression-beams *f*, to which the pistons *g g* of the hydraulic presses *h* are connected.

The pressure of the pistons *g* upon the beams *f* forces said beams against the series of mold-sections, compressing said sections against one another and against the central standard, so that the mold-chambers are closed to receive the molten metal.

The mold-sections are held in horizontal line by metal mold-guides *i i* on opposite sides of said sections, which guides press against said mold-sections to hold them in position. They allow, however, the movements back and forth of the molds on the trucks *e* under the influence of the hydraulic devices when the said trucks are coupled together. Said trucks are conveniently uncoupled from the side by withdrawing the coupling-pins *j*.

The trucks *e* work upon rollers *o*, placed between the ways *d d*, said trucks being provided with depending stop projections *p*, which prevent the displacement of said rollers with respect to the trucks.

When the back-to-back pairs of mold-sections are in separate pieces, said sections are coupled together by pins *k*. (Shown in Fig. 7.) These are of course dispensed with when the pairs are integrally connected. The metal mold-guides *i i* may serve either alone or in connection with other parts as platforms upon which the operators may work. They are preferably supported by connecting-bars *l l*, joining the central standard *b* with the hydraulic cylinders *h*, which connecting-bars thus serve a double purpose in holding said guides and in maintaining the cylinders and standards in fixed relation when pressure is brought to bear.

The molds preferably are arranged in two series independent of one another, so that said series may be worked alternately in the casting operations, as hereinafter described.

Wedges *m* are employed in compressing the ingot to close the "pipe." I prefer to provide a separate wedge for each mold-chamber.

In operating the device, the trains of carriages or trucks being coupled together and the mold-chambers being closed under the pressure of the hydraulic pistons *g*, the first mold-chambers *r*, or the ones nearest the central standards, are one after the other filled with molten metal. After the second of these is filled the first cast ingot will be about hardened sufficiently to sustain its weight, after which its mold-sections are separated by means of the hydraulic piston drawing back the train of carriages and mold-sections thereon from the mold-section fast to the standard. A wedge *m* is then forced between the ingot and the inside wall of the mold, and the hydraulic pistons are again operated to close the mold-sections *c' c''* together, so that the now viscid or comparatively soft metal of the ingot center is compressed from the outside sufficient to compensate for the shrinkage, and the pipe opening or central defect is prevented. This being accomplished, the first mold on the opposite side of the standard is in like manner opened, another wedge inserted, and the mold again closed to effect the same result. While this closing operation of the second chamber *r* is going on, one of the second mold-chambers *s* is being filled with metal and the first pair of back-to-back sections *c'' c''* is uncoupled from the train-section *c''''*, so that the chamber *r* will remain closed while the ingot therein is cooling. While this third ingot is cooling, the second chamber *s* is filled, the preliminary operations with reference to its chamber *r* being completed. The first chamber *s* is then opened, its wedge inserted, and again closed by the pressure of the hydraulic piston. These alternate operations are continued in connection with the remaining molds of the train until the chambers *t t* and *u u* are filled with metal and all are compressed.

The molds of a train may be varied in number and shape at will or as convenience requires. The carriage may be dispensed with and the molds may then slide on the ways or between the same; but I prefer the arrangement first described.

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

1. The improved ingot-machine herein described comprising a central standard, a series of separable mold-sections arranged in back-to-back pairs on opposite sides of said central standard, carriages or trucks, each supporting a back-to-back pair of said mold-sections, coupling means for the carriages, and means for compressing the ingot between said mold-sections, substantially as set forth.

2. The improved ingot-molding machine herein described comprising a series of molds each comprising two separable sections, the said series of molds being arranged upon a series of carriages, the contiguous half-sections of adjacent molds being arranged back to back on each carriage whereby when the carriages are uncoupled, the molds can be separated, wedges adapted to be inserted within the mold-chamber, after the sections thereof are separated and means for compressing the mold-sections, after the insertion of the wedges, and means for coupling the carriages, substantially as set forth.

3. The combination with a central standard, of horizontal ways *d*, for carriages, said carriages *e*, vertical mold-sections, stationed upon said carriages, the two sections of each mold being arranged on different adjacent carriages of the series, hydraulic compression devices, stationed at the ends of the series, wedges adapted to be forced into the molds after the partial consolidation of the ingot and the separation of the mold-sections, and means for coupling the carriages, substantially as set forth.

4. The combination with a series of sectional molds, of a series of carriages supporting said molds, each carriage supporting a pair of sections of adjacent molds, the said sections being back to back, and coupling means suitably disposed to hold the said sections in train, substantially as set forth.

5. The combination with a track or way and a series of carriages thereon, of compression means stationed at opposite ends of said track or way, a series of removable mold-sections

arranged on said carriages independent thereof, and means for coupling and uncoupling said carriages, substantially as set forth.

6. The combination with vertical horizontally-movable molds, arranged in sections, of a series of carriages adapted to be coupled together, each carriage having depending stop projections, *p*, adapted to limit the movements of the rolls beneath said carriages and said rolls arranged between the said stop projections, substantially as set forth.

7. The combination with a track or way and a series of separable carriages thereon, of compression means stationed at opposite ends of said track or way, a series of mold-sections, all separable from one another to permit them to be opened apart from one another and coupling means constructed and arranged to hold a part of the sections closed while others of the series are being drawn apart, substantially as set forth.

8. The combination with the standard *b*, horizontal supports for the molds, a horizontal series of horizontally-movable molds in separable sections, guides *i*, *i*, for holding said molds in alinement as they move horizontally, detachable coupling means permitting detachment of each section from the others of the series and compression means at the ends of the series, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 17th day of February, 1897.

JOHN ILLINGWORTH.

Witnesses:

CHARLES H. PELL,

C. B. PITNEY.