(No Model.) 3 Sheets—Sheet 1.

W. R. HINSDALE.

INGOT FORMING APPARATUS.

No. 402,325. Patented Apr. 30, 1889.

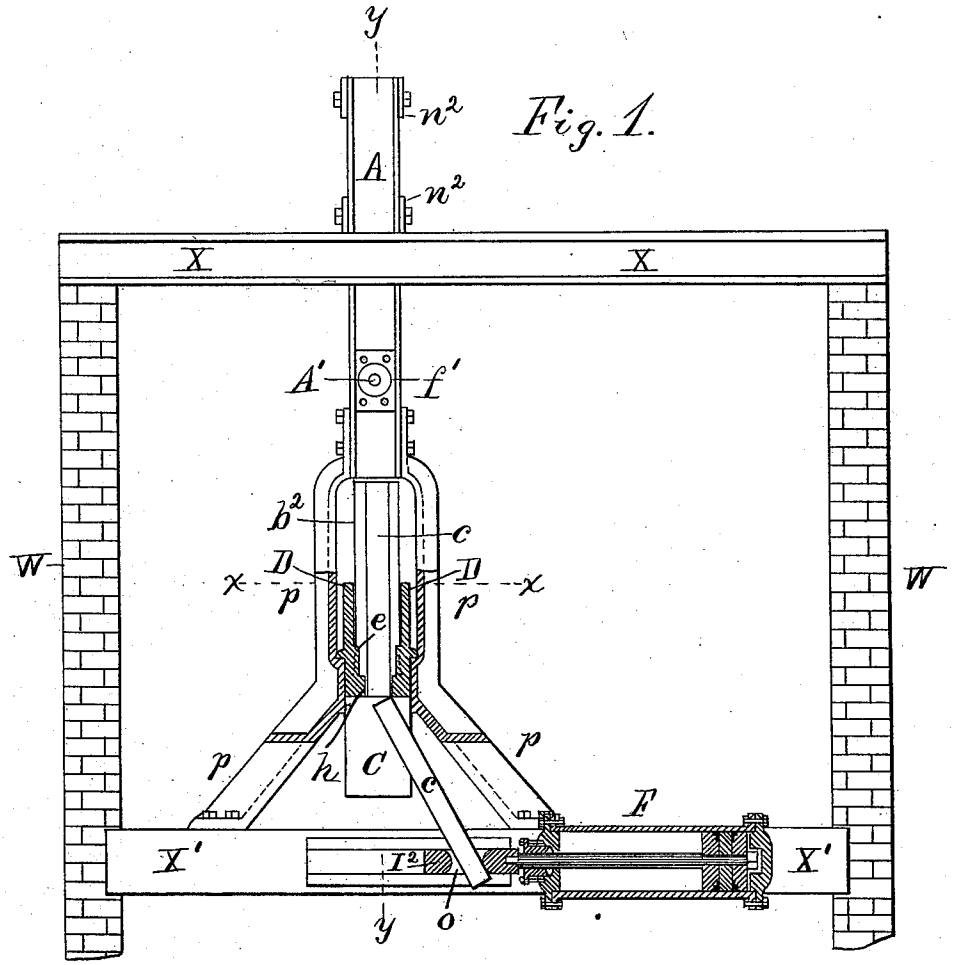


Fig. 1.

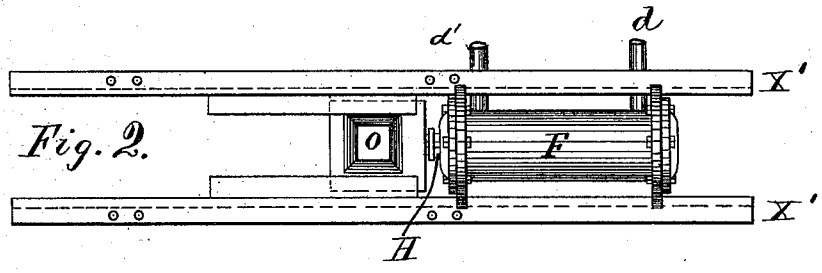


Fig. 2.

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N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

W. R. HINSDALE.

INGOT FORMING APPARATUS.

No. 402,325. Patented Apr. 30, 1889.

Fig. 3

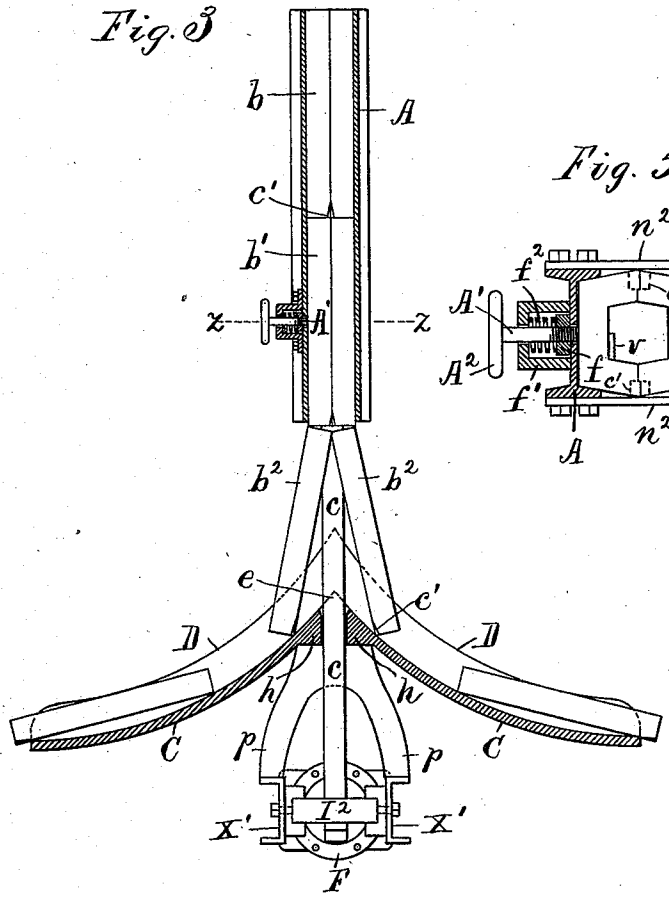


Fig. 5.

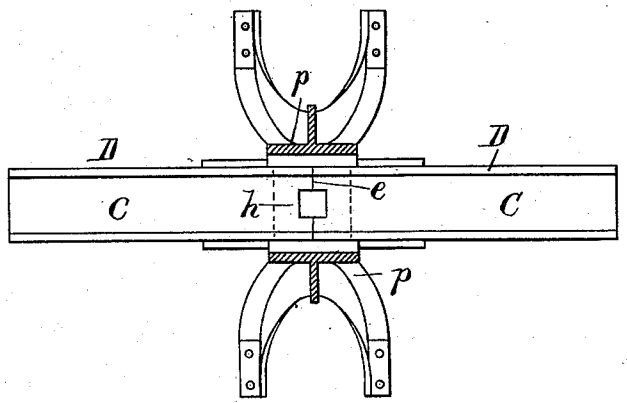


Fig. 4.

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(No Model.) 3 Sheets—Sheet 3.

W. R. HINSDALE.

INGOT FORMING APPARATUS.

No. 402,325. Patented Apr. 30, 1889.

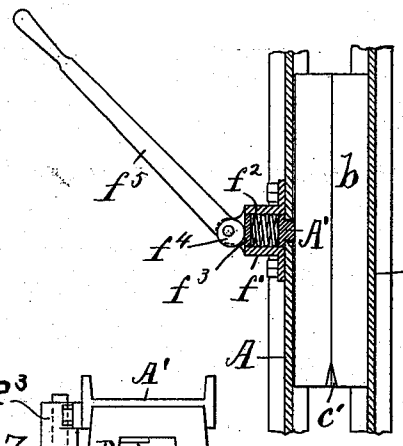


Fig. 6.

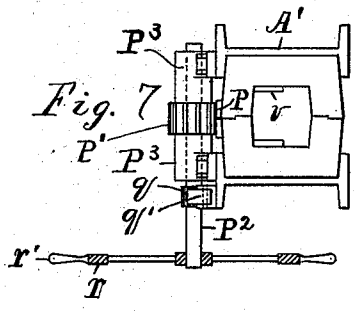


Fig. 7.

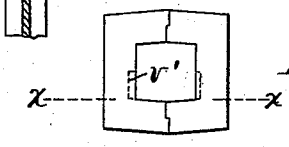


Fig. 9.

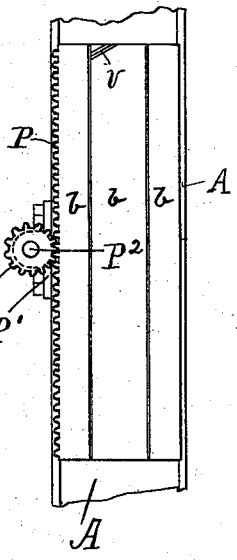


Fig. 8.

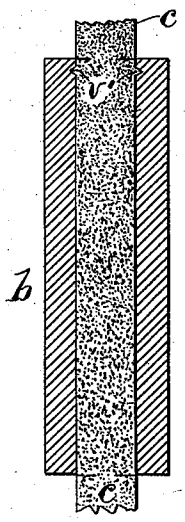


Fig. 10.

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UNITED STATES PATENT OFFICE.

WILLIAM R. HINSDALE, OF HOBOKEN, NEW JERSEY.

INGOT-FORMING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 402,325, dated April 30, 1889.

Application filed June 8, 1888. Serial No. 276,493. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM R. HINSDALE, a citizen of the United States, residing at Hoboken, Hudson county, New Jersey, have invented certain new and useful Improvements in Ingot-Forming Apparatus, 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 form an ingot-bar in a series of movable mold-sections and to sever a portion from the bar to form an ingot, while the remainder of the bar is retained in a heated condition within a portion of the mold-sections.

The invention consists in a special construction of the ways and holders required for lowering the mold-sections with their contents, and in mechanism for automatically stripping the mold parts from the ingot-bar to prepare the same for severing into ingots and in other details, hereinafter set forth.

My invention is designed as an improved means of carrying out the inventions covered by Letters Patent No. 365,902, issued July 5, 1887, and Patent No. 382,427, issued May 8, 1888. Patent No. 365,902 is for an "apparatus for forming a cast-steel or metal ingot, consisting in a holder adapted to retain a series of mold-sections in line with one another and means for moving the sections downward within the holder," and requires for its performance mechanism adapted to force the mold-sections downward against the resistance of the holder. Patent No. 382,427 is for "the combination, with a frame-work having stripping-spaces and a severing-chamber, of a series of mold-sections and holders adapted to be withdrawn from said sections, to allow such sections to gravitate, and means for severing the ingot, said parts being arranged and combined substantially as set forth." In Patent No. 365,902 means is also employed for moving the mold-section and its contents laterally to rupture the ingot-bar and sever therefrom, while in Patent No. 382,427 the mold-sections are stripped from the ingot-bar and the bared portion of the bar is sustained in a suitable bearing, while a portion is broken therefrom to form an ingot.

My present invention embodies, like Patent No. 365,902, "a holder adapted to retain a series of mold-sections in line with one another," and, like Patent No. 382,427, it provides for stripping the ingot-bar and sustaining the same in a suitable bearing while the bared portion of the bar is severed therefrom.

In Patent No. 382,427 the same means is shown for severing the ingot-bar that is claimed in my prior patent, No. 362,381, dated May 3, 1887; but my present invention may be operated with any suitable means for severing the ingot-bar.

The holder shown connected with the ways in Patent No. 382,427 for sustaining the ingot-molds consists, merely, in set-screws, which press the molds against one of such ways, and the downward movement of the molds is arrested by a perforated floor, upon which such mold rests during the stripping operation. To lower the mold successively when filled with fluid metal, such set-screws are turned backward and the mold is permitted to drop with its contents until arrested by a perforated stop or floor. It is obvious that in such construction the operation of the machine is entirely arrested until manual force is applied to strip the ingot-bar to prepare the same for severing and to permit the lowering of the succeeding molds with their charges of heated metal. Such stripping of the mold is, however, performed under a great disadvantage, since the mold-section which requires removal from the ingot-bar is held by the entire superposed weight of the upper molds tightly between the parallel surfaces of the perforated floor and the mold above it, and that the removal of such mold-section could only be effected by pulling it off in a line parallel with such surfaces. Such removal is far from easy, as the ends of the molds are never smooth or parallel, and the mold and its contents are exceedingly hot and can only be touched with tongs or similar long-handled implements. The mold parts are also fitted tightly together, to prevent the leakage of the metal when fluid, and the mold can therefore only be removed from the bar by prying the heavily-weighted halves apart and pulling them away with tongs, the tipping of either mold part from a vertical position only jamming it more tightly between the perforated floor and the base of the mold above it.

My object is to avoid the delay and diffi-

culty of thus removing the mold-sections, which I am enabled to effect by applying a yielding holder to the ways, and thus lowering the mold-sections gradually, instead of letting them drop with their contents into contact with the perforated floor, as in Patent No. 382,427, which is liable to splash the fluid metal from the top of the last-filled mold upon the interior of the ways, and thus obstruct the subsequent operation of the machine. I also improve the construction by providing in a suitable stripping-space below the ways a mechanical agency for removing the mold-sections as they descend, and I thus make the entire operation automatic and greatly facilitate the process of casting the ingot-bar and severing it into sections.

By automatically stripping the mold parts from the bar I avoid all the delay of wrenching the mold away from the bar while loaded with the weight of all the molds above it and their heated contents.

The apparatus for sustaining the mold-sections within the ways is shown in two forms in the annexed drawings, and the means for severing the ingot-bar is substantially the same as that shown in Figs. 3 and 5 of my patent, No. 362,381, dated May 3, 1887, such severing apparatus operating by bending the ingot-bar below an apertured ingot-bearing, through which the ingot is projected when stripped of its incasing-mold. The apparatus may, however, be used with the severing means described in my patent applications, Serial Nos. 266,460 and 269,219, or with any other suitable means for separating the ingot when stripped from the bar.

In the drawings, Figure 1 is a side elevation of the entire mechanism, partly in section where latched. Fig. 2 is a plan of the device for bending the ingot-bar to sever the same. Fig. 3 is a vertical transverse section on line *y y* in Fig. 1, the ingot-bar and molds in elevation. Fig. 4 is a plan in section on line *x x* in Fig. 1, the parts shown in Fig. 2 being omitted. Fig. 5 is a section of the ways with a contained mold-section and a spring-holder on line *z z* in Fig. 2. Fig. 6 is a vertical section, similar to that shown in Fig. 3, of a portion of the ways with a contained mold-section, but showing an alternative means for compressing the spring of the holder. Fig. 7 is a plan of a mold-section longitudinally divided, with a rib to indent the head of the ingot; and Fig. 8 is an inside view of one-half of such mold-section. Fig. 9 is a plan of a mold-section longitudinally divided, with a groove to form a rib upon the ingot; and Fig. 10 is a longitudinal section on line *x' x'* in Fig. 10.

I have shown herein two constructions for the holder that sustains the molds in the ways, Figs. 1 and 3 showing the ways provided with spring-holders, regulated by a screw, which press the mold bodily toward one side of the ways, while Fig. 6 shows another construction in which a separate spring-holder is actuated by a cam.

The term "ways" is used herein for the ribbed parts of the construction, which form a vertical channel or guideway in which the molds are sustained and held in line in their progress through the machine.

In Fig. 1 the ways consist in two wrought-iron channel-bars held with the edges of their ribs toward one another by means of tie-pieces n^2, extended between the bars and bolted to the ribs at their edges. The spring-holder consists in a movable piece pressed toward the mold by a spring and provided with means for varying the pressure of the spring during the passage of the mold through the ways. With such holders the molds are moved downward when filled by the mere action of gravity, the pressure of the spring-holder being diminished after the filling of each mold to permit its gradual descent.

The frame of the apparatus may consist of any suitable means for sustaining the ways over a stripping and severing space, and is shown in Fig. 1 formed partly of transverse beams X X' and partly of castings, and partly of the ways extended between such beams.

The beams X, near the top of the apparatus, rest upon the top of walls W at a level with the floor upon which the operator stands to pour the metal into the molds, and the beams X', which support the lower end of the apparatus, are extended between the walls, preferably above a pit, to permit the discharge of the ingots downward from the machine.

An ingot-bar, *c*, is shown in the apparatus inclosed in a series of separate and similar mold-sections, *b b' b²*, the latter one being stripped from the bar to prepare it for severing into ingots.

Fig. 3 shows the separation of the mold-bars b^2 from the ingot-bar *c*.

Upon the beams X' is mounted a hydraulic cylinder, F, its piston-rod H being connected with a head, I^2, having an aperture, *o*, to receive the lower end of the ingot-bar. Standards *p* are extended from the beams X' to the lower ends of the cylinders I, ways A, and two inclined troughs, C, are sustained upon such standards and joined together in the path of the ingot-bar as it is projected from below the ways and provided with flanges D to guide the divided parts of the mold-sections when stripped from the bar *c*. The mold-sections are beveled or sloped at their junction (upon their lower ends) to form a tapering notch, *c'*, to admit a separator, by which the mold-sections may be divided to strip them from the bar. Wedges *e* are provided inside the flanges D at the middle line of the ingot-bar to enter the notches *c'* and separate the mold parts, as desired. When thus separated, the mold parts slide downward in the troughs C between the flanges D, as shown in Fig. 3, and would be removed by any suitable means.

At the junction of the troughs is formed an

aperture, *h*, adapted to form a bearing for the ingot-bar, to determine the point of rupture in the breaking operation, as is shown by the bending and severing of an ingot from the bar in Fig. 1, in which figure the head I^2 is shown drawn out of line with the center of the ways and the ingot ruptured from the bar.

An open space, S, is left between the ingot-bearing *h* and the bottom of the ways A, to form a stripping-space, in which the mold parts may be separated from the ingot-bar and discharged laterally, while the ingot-bar is extended through the bearing. The space below the bearing serves as a severing-chamber, in which any kind of severing apparatus may operate to separate the series of ingots from the bar when protruded through the ingot-bearing.

The halves of the mold first used would be provided each with a bottom, so that the first mold-section would retain the fluid metal poured therein. As the molds are filled and lowered, the wedge *e* penetrates a notch, *c'*, between the opposite parts of each mold and automatically separates and directs them into the troughs C, as shown in Fig. 3. The stripped ingot-bar passes through the bearing *h* into the aperture *o* in the head I^2, which would be adjusted in line with the bearing at such time. The water being admitted to the cylinder F by one of the pipes *d d'*, the head I^2 is reciprocated and the ingot broken from the bar, as shown in Fig. 1.

In Figs. 1 and 5 the holder A' is a movable friction-piece formed as a screw, provided with a hand-wheel, A^2, and extended through a nut, *f*, held in a socket, *f'*, which is secured upon one of the ways A, over an aperture, through which the spring holder or screw operates upon the mold. The nut is movable in the socket and is pressed toward the ways by a spring, f^2, which is held behind the nut by a suitable cover on the socket. The nut being constantly pressed toward the mold-sections within the ways by the spring, the turning of the screw in the nut presses the point of the screw against the mold-section with a spring-pressure, which may be varied in any desired degree. With this construction the mold-sections would each be sustained at the proper height in the ways A during the filling operation, and then by retracting the screw the spring-pressure would be diminished during the lowering of each section with its contents to the proper point.

In Fig. 3 a spring-holder like that represented in Fig. 5 is shown applied to only one point in the ways adjacent to the mold *b'*, and it is obvious that in such position the spring-holder would sustain all the mold-sections within the ways at and above such point.

The holder A' (shown in Fig. 6) consists in a plug held in the socket *f'*, with the spring f^2 pressed upon its outer end by a cam, f^4. A plate, f^3, is interposed between the eccentric face of the cam and the plate, and a lever, f^5, is provided to turn the cam and thus vary the spring-pressure upon the plug, as desired. The hand-lever would naturally assume the same position when relaxing the spring-pressure to lower each filled mold-section, and its position thus furnishes a convenient gage or index to guide the operator in lowering the molds at the desired rates.

The mode of using the spring-holder shown in Fig. 6 is the same as that already described in connection with Fig. 5, the extent to which the molds are lowered being regulated by observation, with the construction shown.

In Fig. 1 the bottom of the walls W is broken off for want of room; but it is evident that a pit could be constructed below the severing apparatus to receive the ingots when broken from the bar, if required.

In place of the spring-holder adapted to exert a variable pressure upon the mold-sections in their passage through the mold, the movement of the molds may be regulated by providing teeth upon their sides and rotating a pinion in contact with the same. Such teeth are shown at P in Figs. 7 and 8, the pinion at P', pinion-shaft at P^2, and its bearings, bolted upon the ways A, at P^3. A ratchet-wheel, Q, is shown upon the shaft, and a pawl, Q', pivoted upon one of the ways to sustain the molds while being filled, and a wheel, *r*, with spokes *r'*, is provided to turn the pinion when required.

The use of a pinion and teeth upon the molds for regulating their descent in the ways is not claimed herein, as I have made it the subject of a separate application, Serial No. 303,146, filed March 13, 1889, with title "Ingot-Casting Machine."

The process of forming ingots with any of the above-described holders is continued as long as desired by adding empty mold-sections and filling them successively with successive charges of fluid metal. While the metal is being poured into the upper mold-sections, that in the lower mold-sections becomes partially cooled, and when the parts of the mold are separated by the contact of the wedge or separator *e* with the notch *c'* such cooled portion of the ingot-bar becomes stripped and exposed to the air, which cools it still more rapidly. Such stripped portion of the ingot-bar then passes through the ingot-bearing *h*, and by previously setting the aperture *o* in the head I^2 in line with the ingot-bar the lower end of the bar passes into such aperture, and is broken from the bar by reciprocating the head I^2 while one of the empty mold-sections at the top of the series is being filled with fluid metal. The cooled portion of the ingot-bar would thus be severed at one end, while the remainder of the bar would be retained in a heated condition within certain of the mold-sections, and a portion of the metal would still be in a fluid condition at the upper end of the bar. The operation of applying the mold-sections and filling them with fluid metal would be so timed that the

metal within the mold-sections would be sufficiently cooled when it reached the stripping-space to retain its solid form when the mold parts were stripped therefrom, and such stripping of the ingot-bar would permit the cooling to progress thereafter more rapidly, so that the ingot, when projected into the severing-chamber, would be adapted to separate from the bar in the desired manner.

It will be obvious that the particular form of holder is not essential to my invention, but that the essential part of my improvement is the combination, with the ways, the ingot-molds, and means for severing the ingot-bar, of a spring-holder operated with a varied pressure upon each mold-section in its passage through the ways, so as to retain it while filling and then lower it gradually to be stripped and severed.

I hereby disclaim Patent No. 382,427, dated May 8, 1888. My invention differs therefrom in having a spring-holder for maintaining a frictional grip upon the mold-sections in the ways, and in having such holder operated with a varied pressure upon each mold-section in its passage through the ways to lower the mold-section gradually when filled. I also disclaim United States Patent No. 365,902, dated July 5, 1887, in which movable mold-sections are used and a spring-holder exerting a constant uninterrupted pressure upon the molds. My invention differs from that of the said patent, in having a spring-holder operated with varied pressure upon each mold in its passage through the machine, in shifting the molds within the ways exclusively by gravity, in combining a stripping-space with the lower end of the holder, in removing the mold-sections from the ingot-bar within such space, and in applying the severing devices directly to the bar. The said patent shows no stripping-space within the organism, nor any means or provision for removing the mold-sections from the bar, nor any means for taking hold of the ingot-bar or applying any severing devices thereto. In the said patent the adjacent ends of the mold-sections are used as shearing devices to rupture the bar by a transverse movement, while the sections in my invention are removed from the bar and perform no function in the severing operation. Neither is there in the said machine any means whatever of lowering the molds in the ways by the force of gravity; but hydraulic mechanism or equivalent power is required, which is entirely dispensed with in my present invention. I do, however, claim in the present application a special means of retaining the mold-sections upon a given part of the ingot-bar until stripped therefrom, and such device is shown in Figs. 7 to 10, inclusive, and consists in a tongue, *v*, formed upon the mold or ingot-bar to prevent any longitudinal movement of the mold upon the bar.

Figs. 7 to 9, inclusive, show the mold without the bar; but Fig. 10 shows the mold with a portion of the ingot-bar extended through the same. In Figs. 7 and 8 the tongue *v* is shown formed upon the mold close to one end of the same, and arranged at an angle with the bar, to facilitate the separation of a small sample from the corner of the ingot when the latter is detached from the bar. Such sample is frequently taken to determine the quality of the bar; but for the purposes of my present invention the tongue may be cast upon the ingot-bar by forming a groove, *v'*, in the side of the mold, as shown in Figs. 9 and 10. In either construction the tongue serves to hold the mold-section from longitudinal movement upon the ingot-bar until it is intentionally detached, as by the separator *e*. The function of such tongue is merely to lock the mold and bar together temporarily, and any projection formed upon one or the other in the manner described would effect such purpose.

It is immaterial to my invention what form of stripping mechanism be employed to detach the mold parts from the ingot bar; but it is obvious that a separator like the wedge *e*, which operates automatically, is the most simple and effective construction.

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

1. In an ingot-forming apparatus, the combination, with a frame having ways to guide the mold-sections, of a series of ingot-mold sections movable in such ways, a spring-holder to retain the mold-sections within the ways, means for operating it to effect a varied pressure upon each mold-section in its passage through the ways, to permit the mold-sections to fall after filling, and means below such ways, applied directly to the ingot-bar, for severing the lower portion of the ingot, substantially as herein set forth.

2. In an ingot-forming apparatus, the combination, with a frame having ways to guide the mold-sections, of a series of ingot-mold sections movable in such ways, a spring-holder to retain the mold-sections within the ways, means for operating it to effect a varied pressure upon each mold-section in its passage through the ways, to permit the mold-sections to fall after filling, a stripping-space, a severing-chamber, and an apertured ingot-bearing for the ingot-bar below such ways, and means for severing the ingot, substantially as herein set forth.

3. In an ingot-forming apparatus, the combination, with a frame having suitable ways, of a series of mold-sections movable in such ways and adapted to be stripped from the ingot-bar, a stripping-space below such ways, a separator to detach the mold-sections from the bar, and means for severing the stripped portion of the bar, substantially as set forth.

4. In an ingot-forming apparatus, the combination, with a frame having suitable ways, of a series of mold-sections movable in such ways and adapted to be stripped from the ingot-bar, a stripping-space below such ways, a

separator to detach the mold-sections from the bar, and guides for receiving the mold-sections from the separator, and means for severing the stripped portion of the bar, substantially as set forth.

5. In an ingot-forming apparatus, the combination, with a frame having suitable ways, of a series of mold-sections movable in such ways and adapted to be stripped from the ingot-bar, a stripping-space below such ways, an apertured bearing below such stripping-space, a separator mounted upon such apertured bearing to detach the mold-sections from the bar, and guides for receiving the mold-sections from the separator, and means for severing the stripped portion of the bar, substantially as set forth.

6. In an ingot-forming apparatus, the combination, with a frame having suitable ways, of a series of mold-sections movable in such ways and adapted to be stripped from the ingot-bar, a stripping-space below such ways, inclined troughs C for the mold-sections, united in the path of the ingot-bar, an aperture through the troughs at their junction to form an ingot-bearing, the wedges *e*, for separating the ingot-sections and diverting them into the troughs, and means for severing the stripped portion of the bar, substantially as set forth.

7. In an ingot-forming apparatus, the combination, with a frame having suitable ways, of a series of ingot-mold sections movable in such ways, a holder applied to the ways to sustain the mold-sections therein, a spring applied to the holder, means for increasing the tension of the spring, means for stripping the mold-sections from the ingot-bar, and means for severing the ingot, substantially as set forth.

8. In an ingot-forming apparatus, the combination, with a frame having suitable ways, of a series of ingot-mold sections movable in such ways, a holder applied to the ways to sustain the mold-sections therein, a spring pressed upon the holder, and a cam to vary the pressure of the spring, means for stripping the mold-sections from the ingot-bar, and means for severing the ingot, substantially as set forth.

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

WILLIAM R. HINSDALE.

Witnesses:
THOS. S. CRANE,
HENRY J. MILLER.