(No Model.) 3 Sheets—Sheet 1.

J. ILLINGWORTH.

APPARATUS FOR CASTING INGOTS.

No. 414,841. Patented Nov. 12, 1889.

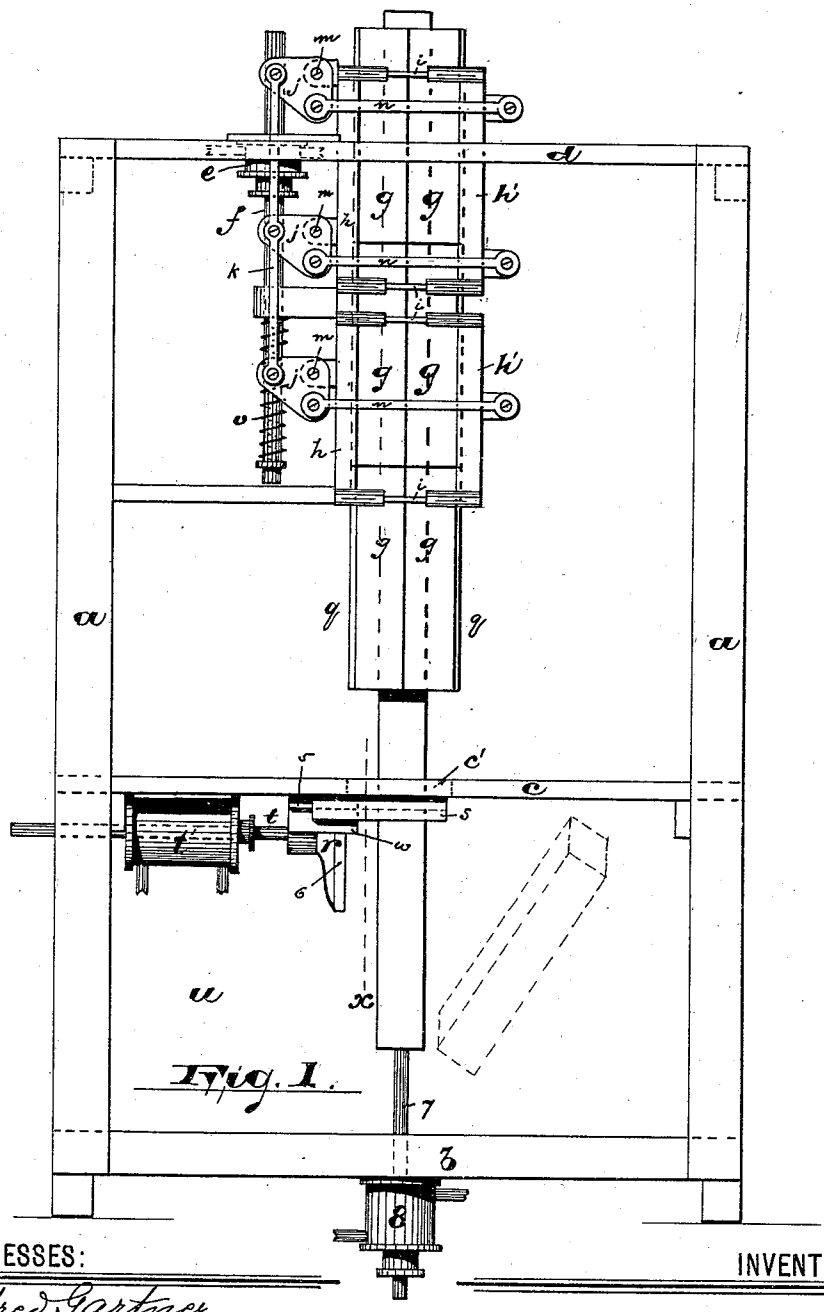


Fig. 1.

WITNESSES:

Alfred Gartner
E. L. Sherman

INVENTOR:

John Illingworth,

BY Dyer & Co ATTY'S.

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

(No Model.) 3 Sheets—Sheet 2.

J. ILLINGWORTH.

APPARATUS FOR CASTING INGOTS.

No. 414,841. Patented Nov. 12, 1889.

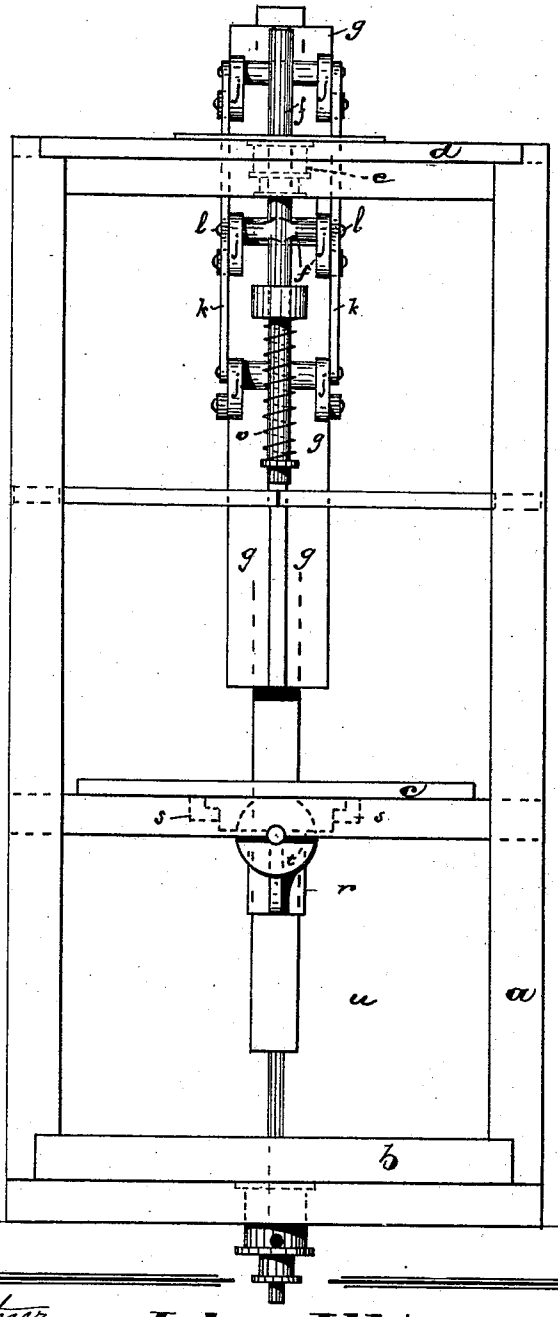


Fig. 2.

WITNESSES:

Albert Leitner
E. L. Sherman

INVENTOR:

John Illingworth,

BY Drake & Co ATTY'S.

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

(No Model.) 3 Sheets—Sheet 3.

J. ILLINGWORTH.

APPARATUS FOR CASTING INGOTS.

No. 414,841. Patented Nov. 12, 1889.

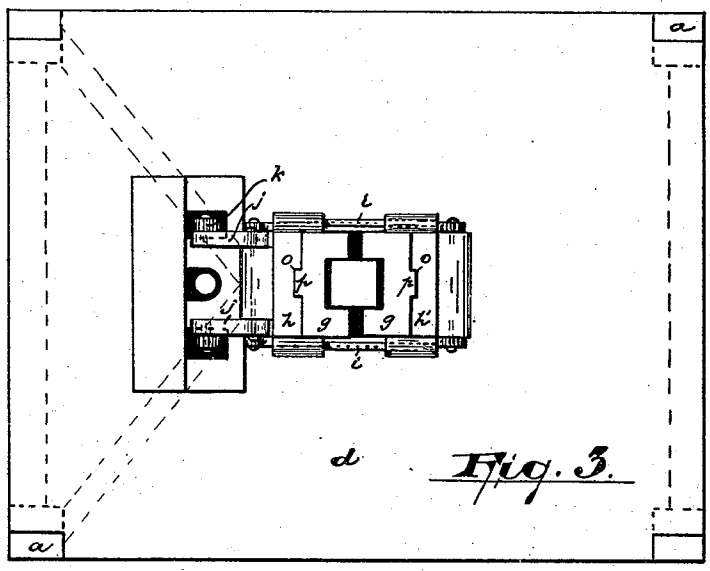


Fig. 3.

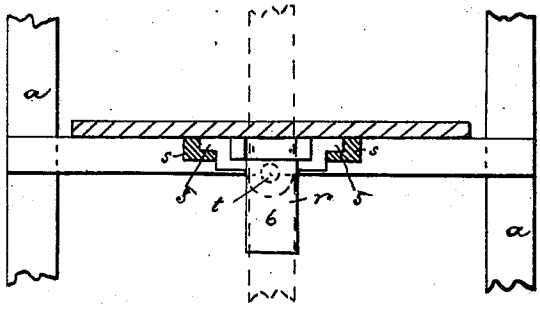


Fig. 4.

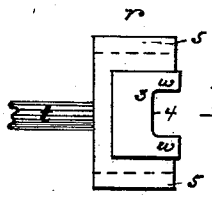


Fig. 5.

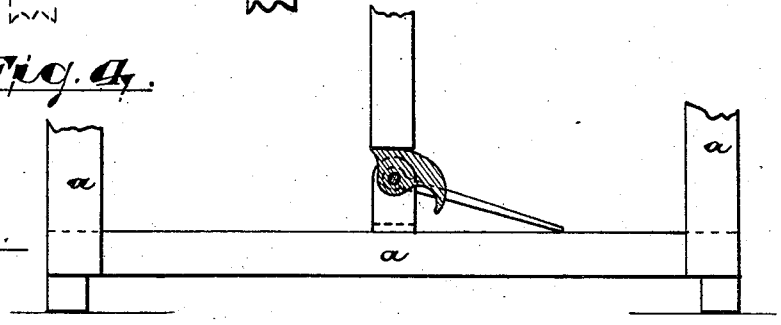


Fig. 6.

WITNESSES:

Alfred Gartner
E. L. Sherman

INVENTOR:—

John Illingworth.

BY Drake & Co. ATTY'S.

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

UNITED STATES PATENT OFFICE.

JOHN ILLINGWORTH, OF NEWARK, NEW JERSEY.

APPARATUS FOR CASTING INGOTS.

SPECIFICATION forming part of Letters Patent No. 414,841, dated November 12, 1889.

Application filed July 17, 1889. Serial No. 317,816. (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 Apparatus for Casting Ingots; 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.

This invention relates to certain improvements in that class of mechanisms for manufacturing steel ingots illustrated by me heretofore in prior applications. (See applications Serial Nos. 240,875, 241,163, 245,992, and 258,239.)

The objects of the present improvements are to reduce still further the cost of manufacturing the ingots, to reduce the number of hands required in manufacturing the same, to facilitate the process of forming the ingot, and to secure a more perfect product.

The invention consists in the arrangements and combinations of parts, substantially as will be hereinafter set forth, and finally embodied in the clauses of the claim.

Referring to the accompanying drawings, in which like letters indicate corresponding parts in each of the several figures, Figure 1, Sheet 1, is a side elevation of the improved device. Fig. 2, Sheet 2, is a front elevation of the same. Fig. 3, Sheet 3, is a plan showing the mold-sections in an unclamped relation to the ingot. Fig. 4 is a detail section taken on line *x*, Fig. 1. Fig. 5 is a plan of the head of a severing-piston; and Fig. 6 is a view of a modified construction, showing a hand device for elevating the ingot in the die preliminary to severing the said ingot.

In said drawings, *a* is a frame or structure in which the ingot-forming mechanisms are arranged, the said structure being provided with three floors or platforms *b c d*, of which *b* is a ground floor or lowest floor, on or at which the severing mechanisms may be operated and the severed ingot removed from the machine; *c*, a middle floor or platform, at which the mold-sections may be stripped from the lowered ingot prior to severing the same into parts, and *d* a top floor or platform, on which the workmen may stand in adjusting the molds prior to casting and in carrying on the operation of casting the liquid metal therein. At a suitable point in said frame, preferably at the top floor, is arranged a hydraulic cylinder *e* and piston *f*, and to this piston *f* are secured means for clamping the mold-sections *g g* and holding them together, so as to receive the molten metal, the said mold-section being held stationary, so as to enable additional sections to be superposed thereon and be filled with metal.

By operating the clamps by water-power, instead of a series of screws, in the manner heretofore described by me in one of the prior cases referred to the molds and ingots may be lowered and loosened with greater ease and facility by a single workman. Furthermore, by the use of a hydraulic piston the several parts of the clamping mechanisms may be operated simultaneously and together by the single workman, as they cannot when two or more hand-screws are employed, as heretofore.

The clamp of the most advantageous construction of any of which I am at present aware is illustrated in the drawings, the illustration of modifications being deemed unnecessary. This consists of parallel jaws *h h′ h′*, one of which is preferably a fixture arranged in or to the frame or structure *a* and adapted to guide the mold-sections as they slide vertically when released, and the others *h′ h′* being connected with the piston, so that when the latter is operated under the influence of the water the said jaws *h′ h′* will move to or from said mold-sections into or out of holding relation to the said sections. At the sides of the fixture *h* are arranged guide-rods *i i*, which project toward the movable jaws *h′*, and on which the said movable jaws slide horizontally, while still holding a parallel relation to the ingot, as will be understood. To the said fixture *h* are secured bell-cranks *j j j*, which are connected with one another by rods *k k*, so as to move simultaneously and together. Said rods lie adjacent to and parallel with the piston, and are connected to said piston by a bolt *l*, and thus

move with said piston. The piston *f* has formed thereon integral therewith right-angled arms *f'*, which extend to the crank-plates *j*, holding said plates at a proper distance apart. Through said arms or into said arms the bolt *l*, for connecting the rods *k*, extends. A movement of the piston *f* affects a corresponding movement of the rods *k k*, causing the bell-cranks *j* to move on their pivots *m m*. This movement is transmitted through connecting-rods *n n* to the movable clamping-jaws *h*, forcing them to move horizontally on the guide-rods *i i* to or from holding relation to the mold-sections, as will be clearly understood upon reference to Figs. 1 and 2. A return movement is secured by means of a spring. The clamping-jaws are preferably grooved vertically, as indicated at *o o*, Fig. 3, to receive longitudinal tongues *p p* on the mold-sections. Thus the said sections are held in proper relation to the clamping-jaws while moving therebetween under the influence of gravity or otherwise. The lower ends of the jaws *h h'* terminate at points considerably above the flooring *c*, providing a space *q* through which the mold-sections may be drawn in stripping them from the ingot.

In the floor *c*, in line with the ingot-chamber in the mold, is a hole of about the size of the ingot. This is preferably formed in a die-plate *e*, of steel, which is adjusted in said floor with sufficient firmness to resist lateral pressure exerted in severing the ingot. Beneath said floor is arranged a severing-head *r*, which slides horizontally in suitable ways *s s*, Figs. 1 and 4, under the influence of a hydraulic piston *t*, and co-operating with the die in severing the ends of the ingot projecting down into the chamber *u*.

By the use of a severing-head independent of the molds themselves the wear on the molds produced in the shearing operation is removed or avoided, and as the head *r* is made of much harder metal than that from which the ordinary molds are formed the durability of the machine is much increased. The use of a head such as is embraced in this case possesses other advantages over the devices heretofore employed. For example, by its use I avoid the inconvenience of having the mold-sections fall away after severing with the severed ingot, and, again, the specially-prepared shearing-head, acting in conjunction with a die-plate, serves to produce a much more perfect ingot end, all as will be evident.

The severing-head is shown in detail in Fig. 5, in which *w w* are arms which project into engagement with the sides of the ingot to prevent the same from spreading. 3 is a bearing which rests up against the under side of the die. 4 is a bearing which co-operates with the said die to shear the ingot into parts. 5 5 are bearings which enter the ways *s s* to hold the severing-head into position close against the die, so as to secure a shearing action, and 6 is an arm which extends downward parallel with the ingot to secure a broad bearing thereon, so that the soft metal will not be forced out of the desired shape in the act of severing. The piston *t* is operated by a hydraulic cylinder *t'*, arranged beneath the flooring *c* or in any other suitable position.

At the flooring *b* is arranged an elevating-piston 7, operated by a hydraulic cylinder 8. This serves to raise the ingot into suitable relation to the die-plate prior to severing said ingot into parts when the joint formed where two castings unite is brought below the die plate or bearing. Thus prior to severing the ingot which has dropped too low may be readily raised to the desired point of breaking or severing. In lieu of the hydraulic piston a hand machine or device of a suitable construction to be operated by hand—such, for example, as that shown in Fig. 6—may be employed, although for convenience the hydraulic device is preferred.

While the piston or its equivalent serves as an elevator, it also forms the part of a movable stop for the ingot, by which the length of the smaller ingots, after breaking, may be graduated or made of any desired size, as will be understood.

In operating the device a pair of mold-sections, forming a complete mold, are secured between the clamps, at the upper part thereof, the lower end of the mold being suitably plugged or closed to enable the said mold to retain the metal. The said mold is then filled with metal in any usual way. The piston *f* is then worked and the clamps relaxed slightly, so that the molds and ingot therein slowly gravitate sufficiently to allow a second pair of sections to be arranged at the upper end of the first, the metal first cast in the meantime remaining quiet and cooling. When the second mold is down to the desired position, the clamps are again forced into holding contact and a second casting of metal superimposed onto the first, the molten metal entering into the "pipe" or recess formed or which otherwise would be formed by the contraction of the cooling first casting, as heretofore described in the prior cases referred to. The objectionable pipe is thus avoided and the ingot rendered perfectly sound or devoid of flaws at the center. The clamps are then again released and the molds again allowed to gravitate to receive a third mold, and afterward a third casting is in like manner cast. When the third mold has been filled and lowered, the first molds are brought to the opening *q*, and, the metal being sufficiently hard, said molds are removed from the ingot and the latter, after another lowering, passes through the die, and then may be severed by the head *r*, forming an ingot of a size suited to the demands of the market. The operation may be continued until all the metal of a "heat" is exhausted or worked into ingots.

I am aware that in my prior patent, No. 382,427, I have described a device for break-

ing the ingot into smaller ingots, the said device being operated by means of a hydraulic cylinder and piston, and I do not claim the same herein. In the present device the ingot is sheared into merchantable ingots, the die-plate c' serving as one member of the shears, and the severing-head r, which engages the lower side of the die-plate, acting as the other member. The result of this construction is that the ingot is smoothly cut and that the ingots are made with great facility.

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

1. The improved ingot-machine combining therein a series of sectional molds, clamps for holding the mold-sections together and the molds from gravitating, a hydraulic piston, and intermediate devices for connecting the clamps and hydraulic piston, the said intermediate devices being operated by said piston to actuate the clamps, substantially as set forth.

2. In combination with a series of sectional molds, fixed and movable clamps, a piston, cranks J, and connecting-rods, all arranged and adapted to be operated substantially as and for the purpose set forth.

3. The combination, with a frame or structure having a die arranged therein and means for lowering the ingot through said die, of a hydraulic cylinder and piston, and head having arms w w and 6, said head being arranged on said piston and adapted to engage the ingot and shear a portion from the ingot, substantially as and for the purpose set forth.

4. In combination with a frame or structure a and molds g g, a clamping-jaw fixed to said structure, a movable jaw, connecting-rod n, bell-cranks j, connecting-rod k, and piston f, and hydraulic cylinder e, all said parts being arranged and operating substantially as and for the purpose set forth.

5. In combination with a frame or structure a and sectional molds g g, a jaw h, having guide-rods, a jaw h', movable on said rods, and means for clamping and separating said jaws, substantially as and for the purpose set forth.

6. In combination with a frame or structure a and sectional molds g g, jaws h h', separable from one another, and a series of bell-cranks connected with said jaws and with one another, and a piston for moving said cranks, substantially as and for the purposes set forth.

7. In combination with a series of molds, means for severing the ingot into sections, an elevator for raising the ingot, and means for operating the said elevator, substantially as and for the purposes set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 11th day of July, 1889.

JOHN ILLINGWORTH.

Witnesses:

OLIVER DRAKE,

CHARLES H. PELL.