(No Model.) 4 Sheets—Sheet 1.

R. B. H. LEIGHTON.

MANUFACTURE OF CAST STEEL INGOTS.

No. 434,347. Patented Aug. 12, 1890.

Fig. 2

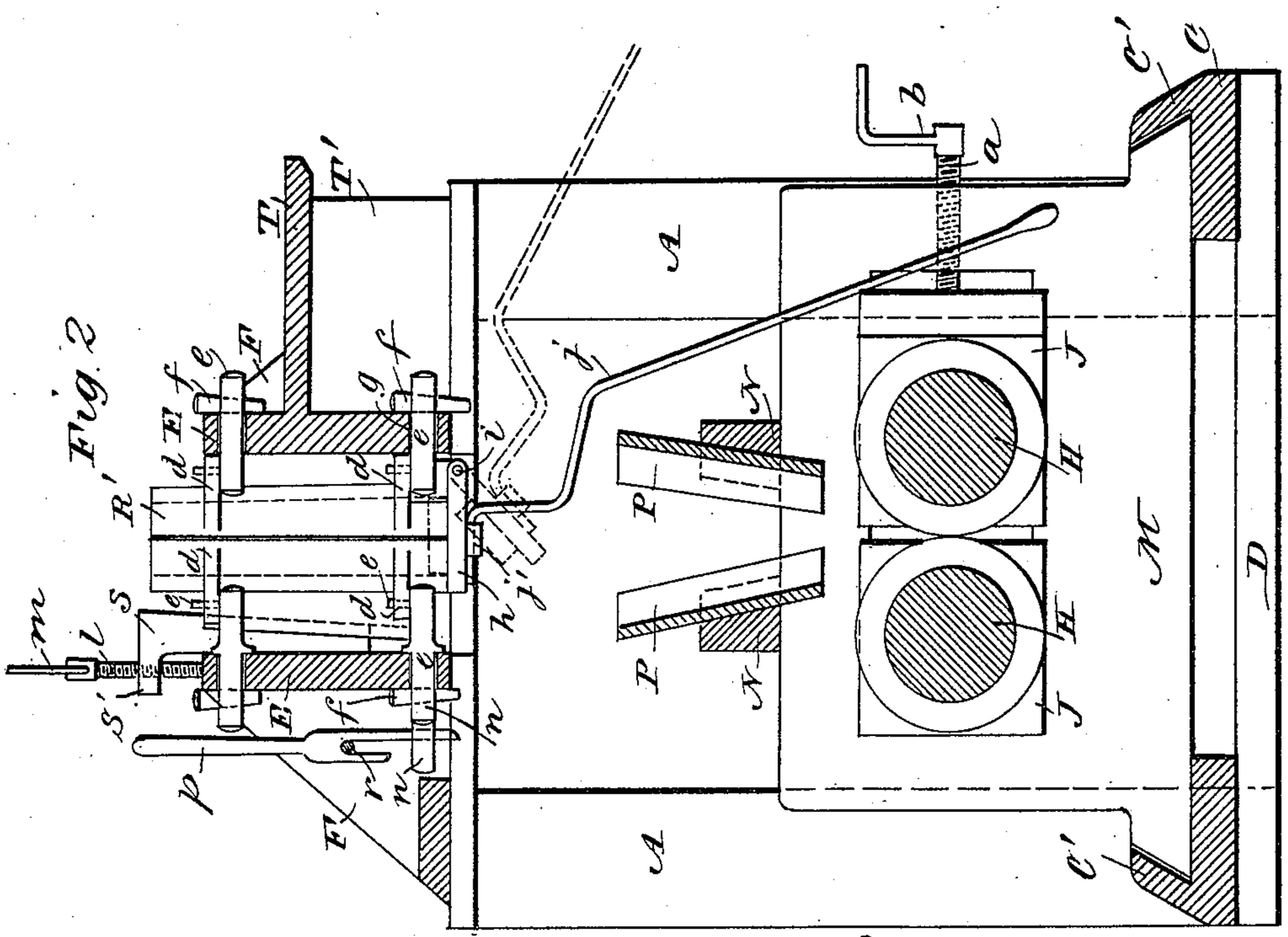
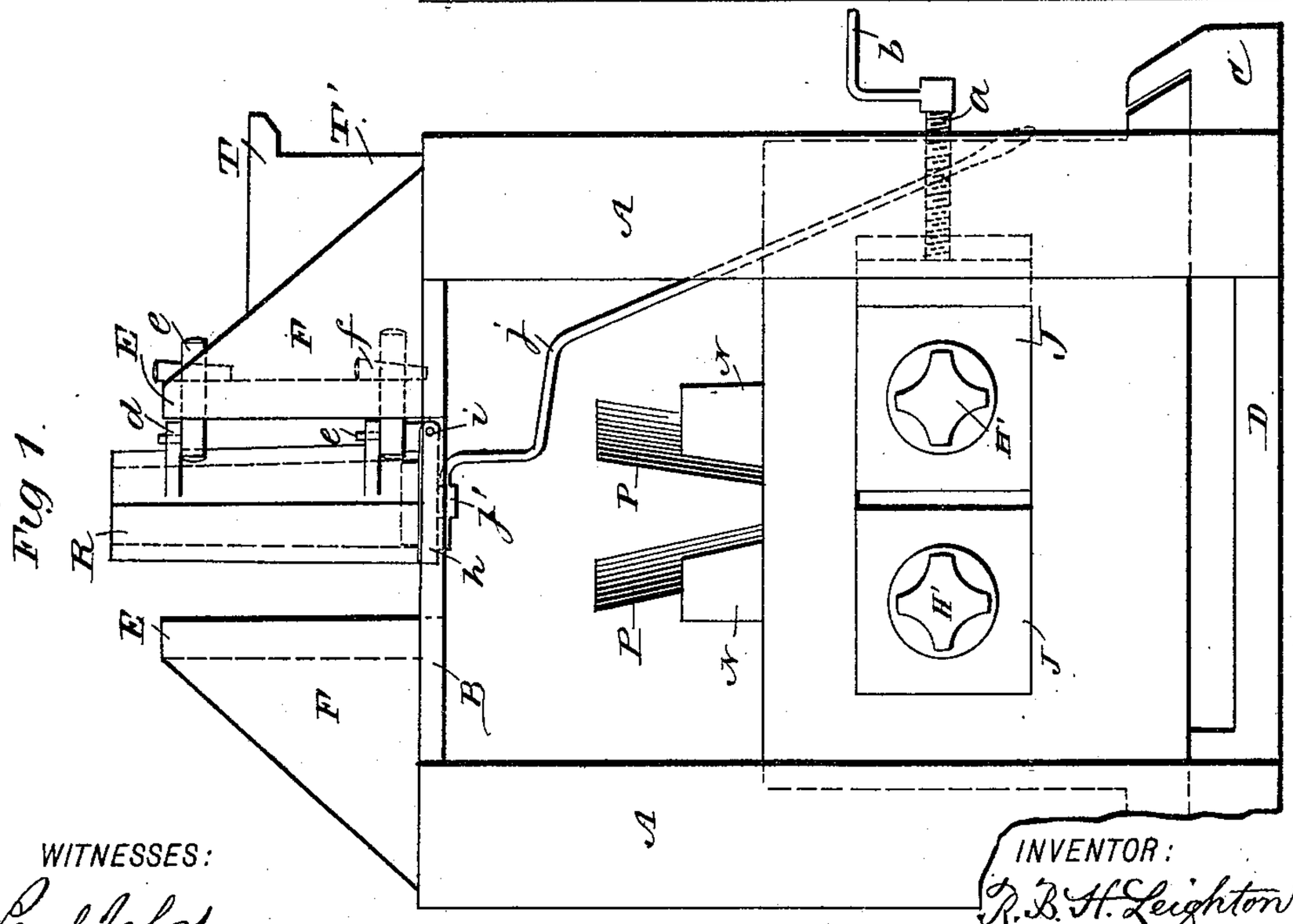


Fig 1.



WITNESSES:

Paul Johot

C. Bedgwick

INVENTOR:

R. B. H. Leighton

BY Munn & Co.

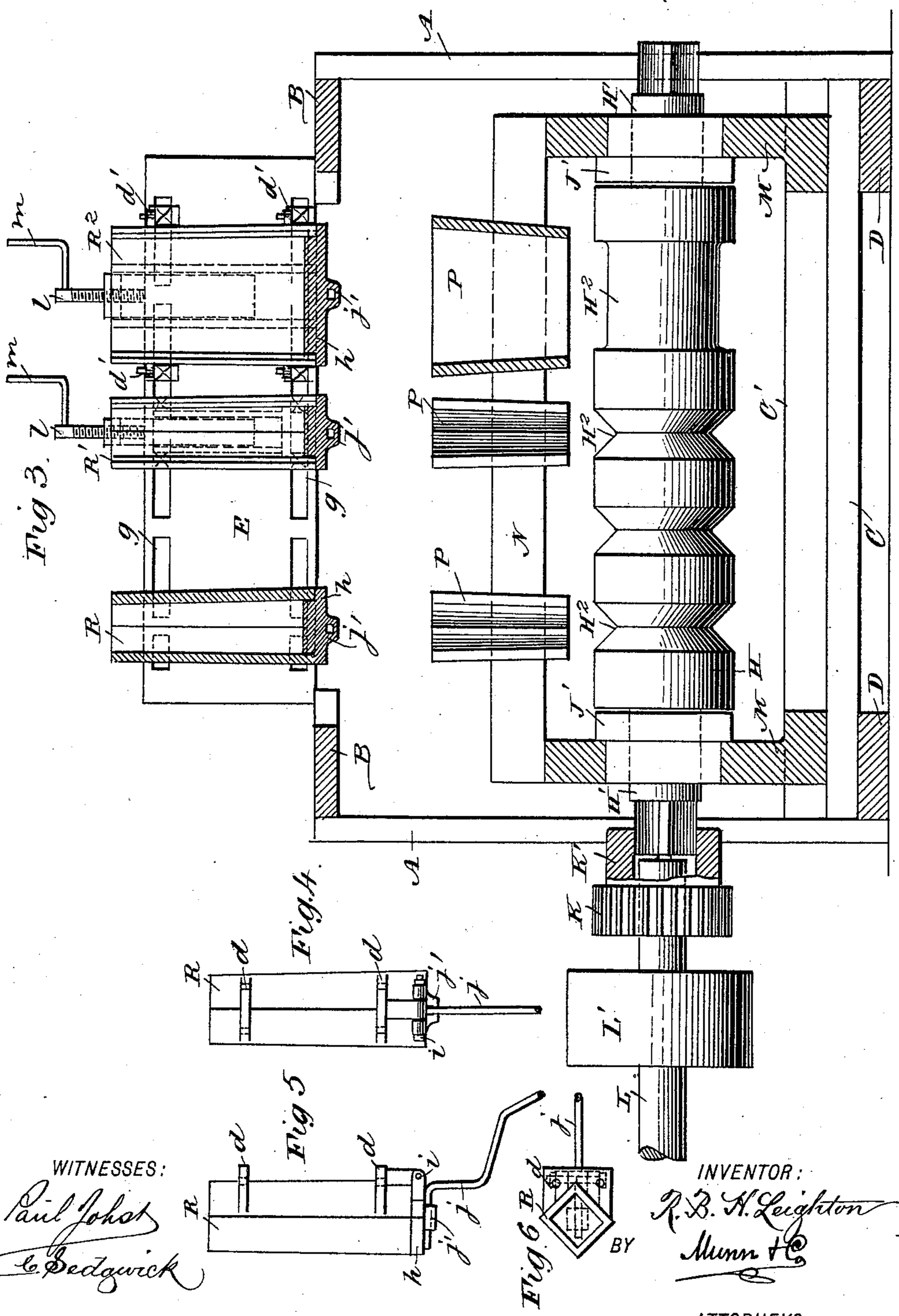
ATTORNEYS

(No Model.) 4 Sheets—Sheet 2.

R. B. H. LEIGHTON.

MANUFACTURE OF CAST STEEL INGOTS.

No. 434,347. Patented Aug. 12, 1890.



WITNESSES:

Paul Johns

C. Sedgwick

INVENTOR:

R. B. H. Leighton

BY Munn & Co

ATTORNEYS

(No Model.) 4 Sheets—Sheet 3.

R. B. H. LEIGHTON.

MANUFACTURE OF CAST STEEL INGOTS.

No. 434,347. Patented Aug. 12, 1890.

Fig 7

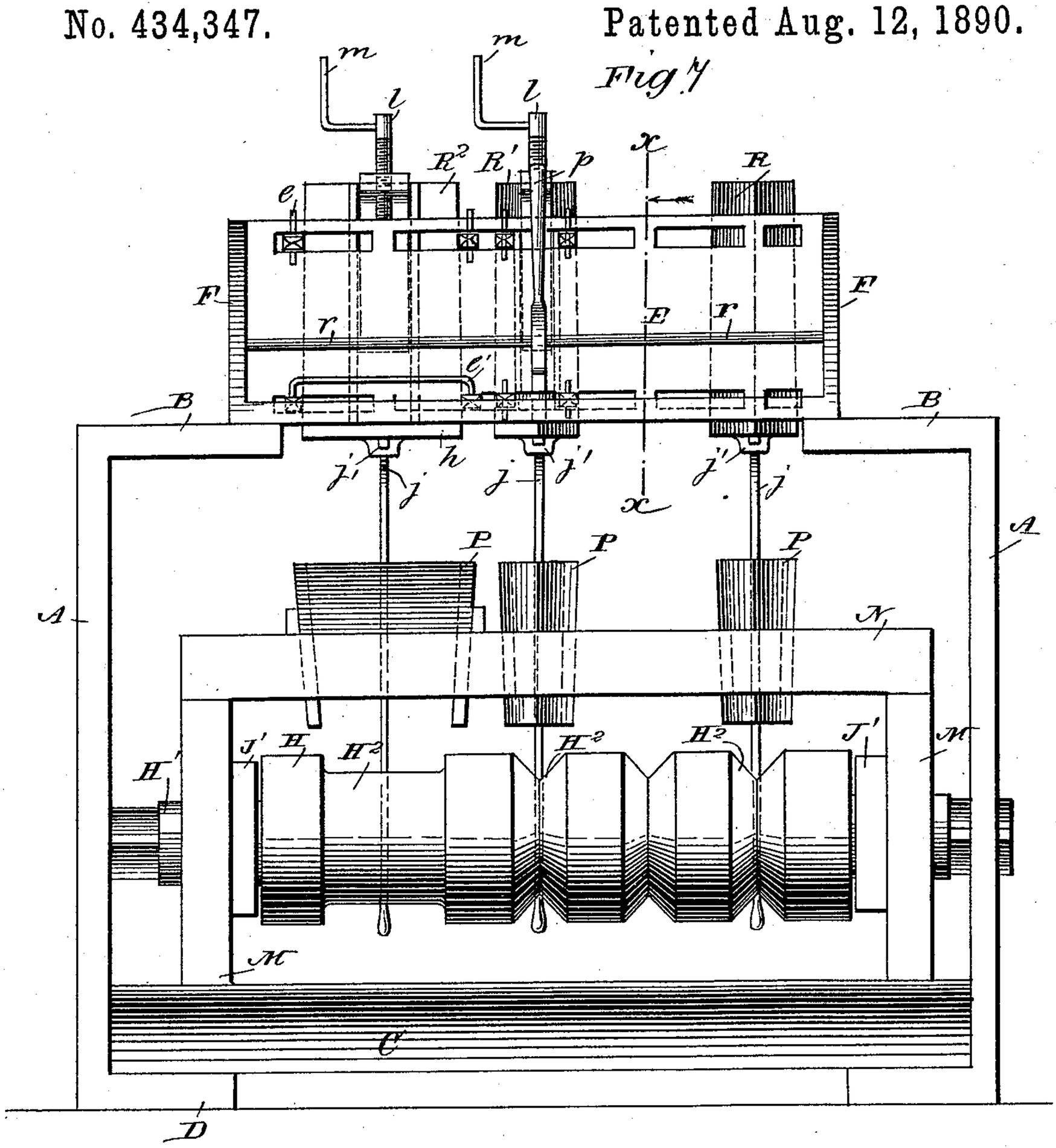
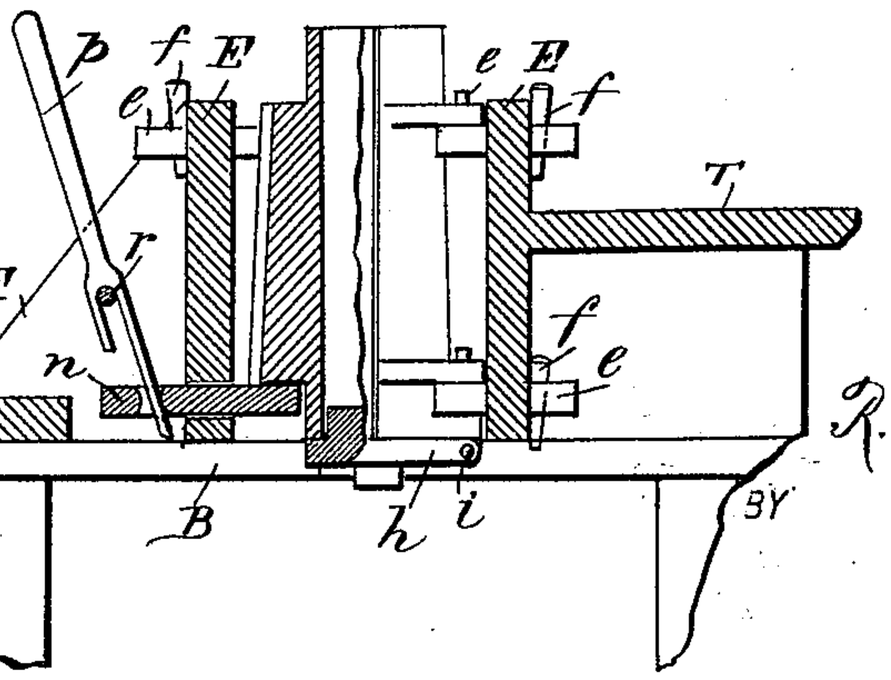


Fig. 8.



WITNESSES:
Paul Jakel
C. Sedgwick

INVENTOR:
R. B. H. Leighton
Munn & Co
ATTORNEYS

(No Model.) 4 Sheets—Sheet 4.

R. B. H. LEIGHTON.

MANUFACTURE OF CAST STEEL INGOTS.

No. 434,347. Patented Aug. 12, 1890.

Fig 9

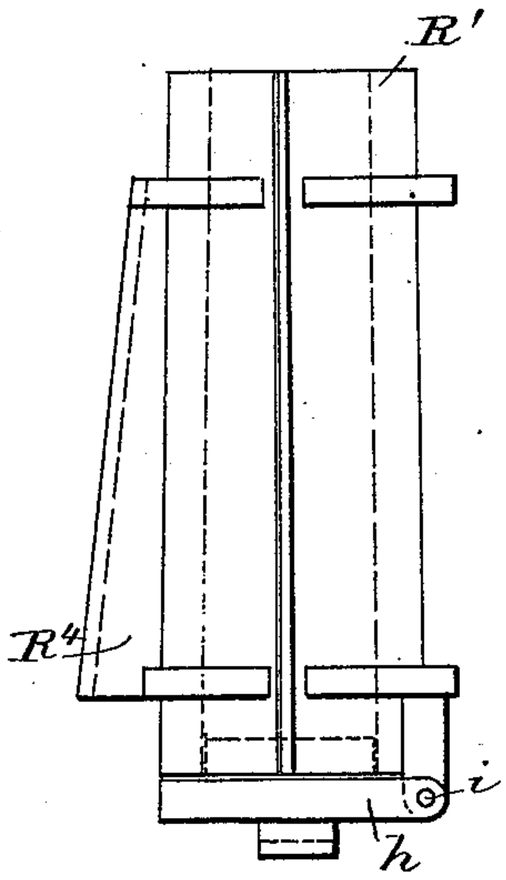


Fig 10.

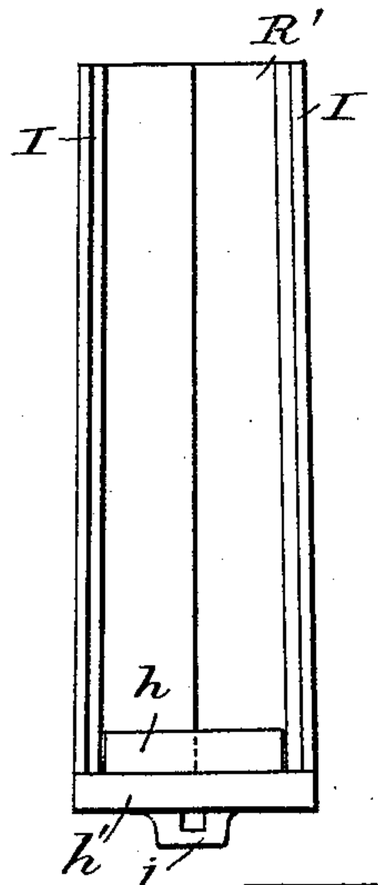


Fig 11.

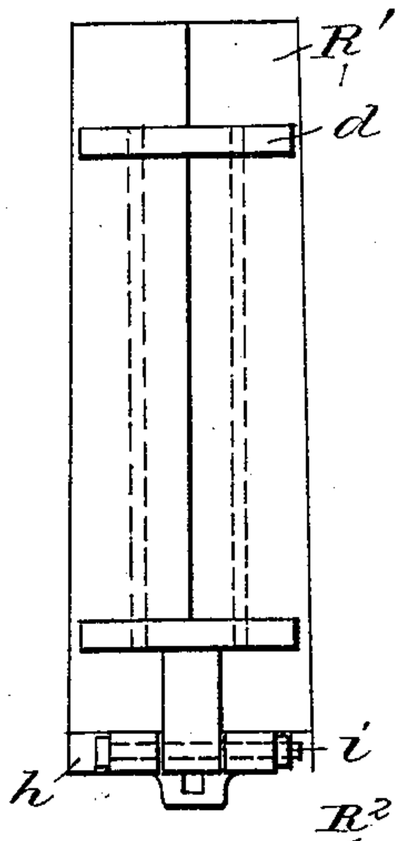
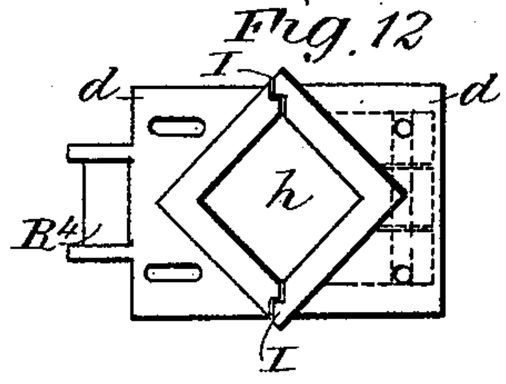


Fig. 12



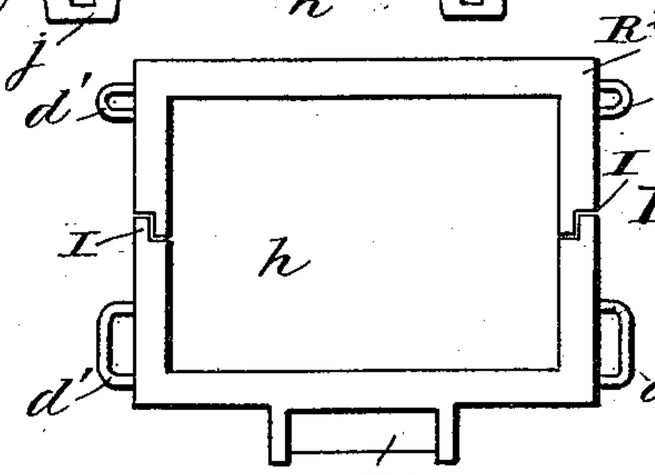
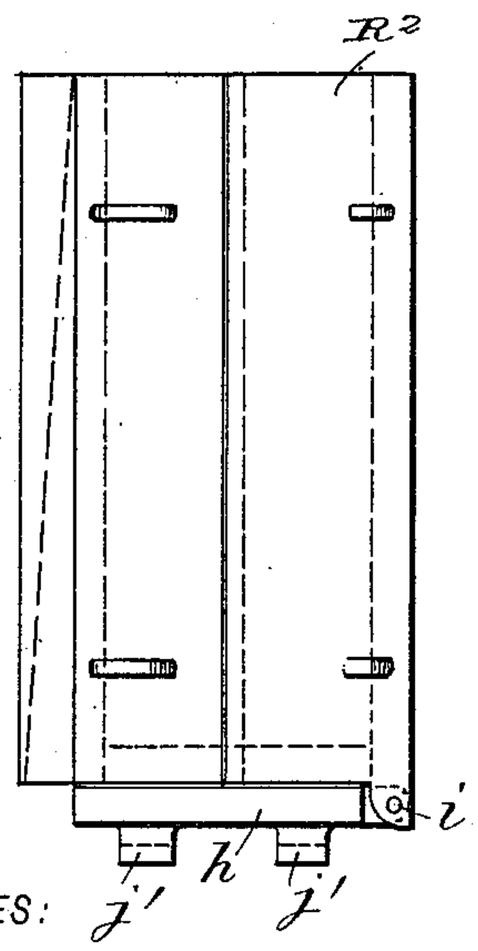


Fig. 13

Fig 14



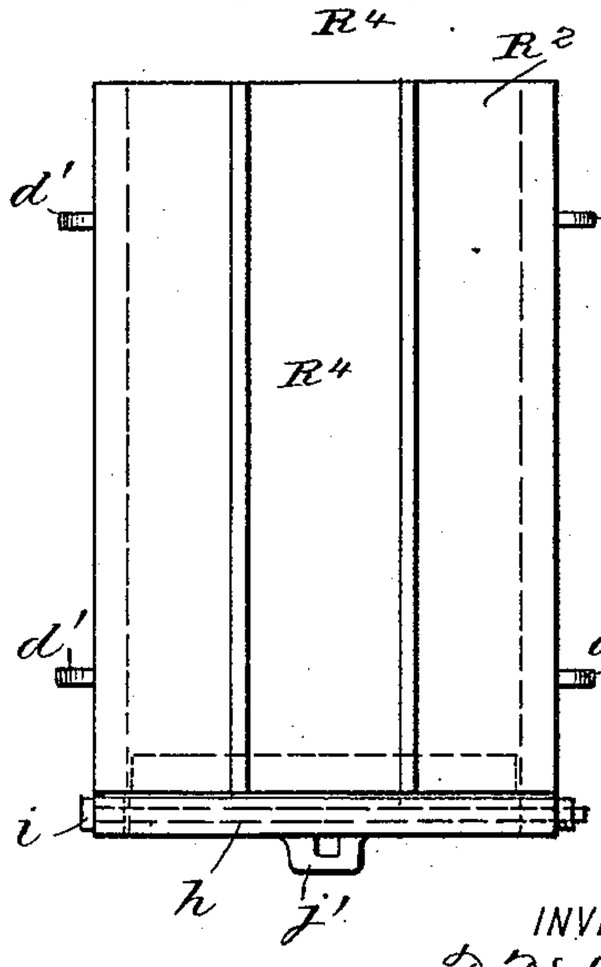


Fig. 15.

WITNESSES:

Paul Johnston

C. Sedgwick

INVENTOR:

R. B. H. Leighton

BY

Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

RICHARD B. H. LEIGHTON, OF PHILADELPHIA, PENNSYLVANIA.

MANUFACTURE OF CAST-STEEL INGOTS.

SPECIFICATION forming part of Letters Patent No. 434,347, dated August 12, 1890.

Application filed December 20, 1889. Serial No. 334,361. (No model.)

To all whom it may concern:

Be it known that I, RICHARD B. H. LEIGHTON, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented new and useful Improvements in the Manufacture of Cast-Steel Ingots, of which the following is a full, clear, and exact description.

My invention relates to improvements in an apparatus and process of manufacturing cast-steel ingots. Heretofore in the manufacture of cast-steel ingots there has been great difficulty in procuring an ingot that would be solid or free from sponginess—that is, that would not be hollow or piped. There has consequently been a great waste of material and time, as the spongy steel cannot be used for fine work, and it has been necessary to remelt and reroll said steel to make it suitable for use.

The object of my invention is to obviate this difficulty by providing means for casting and rolling ingots so that they will be free from pipe or sponginess, and to provide means whereby a solid rolled ingot or finished bar may be produced from the machine or apparatus in which it is cast and rolled.

To this end my invention consists in placing the mold-pit fitted with suitable molds in a frame above or near rotatable rollers that are grooved to fit the ingots that fall from the molds, so that the metal may be released from the molds and passed through the rollers before it becomes fully set or hardened. This construction will be hereinafter fully described, and specifically pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is an end view of the machine; Fig. 2, a vertical cross-section of the same; Fig. 3, a longitudinal section of the same; Fig. 4, a front elevation of a mold for casting an ingot to be finished upon the machine; Figs. 5 and 6, a side elevation and plan of said mold; Fig. 7, a side elevation of the machine; Fig. 8, a cross-section on the line *x x* of Fig. 7, but with some of the parts removed; Fig. 9, a side elevation of a separable mold for casting a square ingot; Fig. 10, a side elevation of the same with one half removed; Fig. 11, a front elevation of said mold; Fig. 12, a plan of the same; Fig. 13, a plan of a separable mold for casting a flat ingot; Fig. 14, a side elevation of the same, and Fig. 15 a front elevation of the same.

The upright standards A at the corners of the machine, the cross-strips B at the top, the side bars C, and the cross-sills D, upon which the machine rests, constitute the frame of the rolling-machine, which should be very heavy and substantial in accordance with the work which the machine performs.

The side pieces E and brace-pieces F constitute the frame of the mold-pit, and each end of said frame rests upon the cross-strips B, so that the mold-pit will be in line with and directly above the rollers H of the rolling-machine. The rollers H are provided with gudgeons H′, which are respectively mounted in boxes J at each end of the machine, and which project through the boxes and are each provided with an irregular section, as shown, to engage a clutch K′ of the gear-wheel K, which is attached to the shaft L, operated by a pulley L′, which is driven by a belt, so that motion will thus be transmitted to the rollers H. Power may be applied to both ends of the rollers, if necessary, and instead of being applied as shown it may be applied in any suitable manner that will produce a strong rotary motion.

The boxes J, in which the gudgeons of the rollers H turn, are mounted at each end of the rollers in a slideway of a frame M, in which they are laterally adjustable, so that the rollers H may be placed any desired distance apart, and they are also provided with flanges J′, which overlap the inner sides of the frames M and prevent the boxes J from being crowded out of the same. A box J at each end of the machine and on the same side is connected with a screw *a*, which passes through and engages a side of the frame M, and is provided at its outer end with a crank *b*, so that by turning the crank *b* and actuating the screw *a* the boxes J may be easily forced in or out, thus changing the position of the rollers H, which are hung in said boxes, as described.

The frames M extend across each end of the machine and rest upon the side bars C of

the machine, which are provided with lips C′, which press against the ends of the frames M and hold the frames in position. The frames M are connected at the top by two parallel bars N, which are spaced apart and extend from one frame to the other directly above and in line with the rollers H. The adjacent sides of these parallel bars N slant slightly toward each other, so that they are nearer together at the bottom than at the top, and are provided with guide-spouts P, which likewise slant downwardly and inwardly, one half of a spout being attached to one bar and one half to the other opposite bar. These guide-spouts should be firmly attached to the bars N directly above the grooves H^2 of the rollers H, and should approximate in shape to the shape of said roller-grooves and of the ingots that are to pass through them.

The mold-pit, which is between the two side pieces E of the mold-pit frame, is provided with molds R, R′, and R^2, which are of the same shape in cross-section as the grooves H^2 of the rollers H, and are placed directly above and in line with the grooves H^2 and guide-spouts P. The mold R′ is provided upon each side at top and bottom with perforated projecting lugs *d*, by which it is attached to the hooks *e*, which are retained in slots *g* at the top and bottom of the side pieces E by the pins *f*, and which may be slid in said slots, so that the mold may thereby be adjusted above a particular groove in the rollers and guide-spout above said groove. The mold R is provided with said perforated lug *d* at top and bottom, but only upon one side thereof, as the mold is in one piece. The mold R^2 is provided with eyes *d′* instead of the lugs *d*, and by them attached to the hooks *e*, two of said hooks being connected by a rod *e′*, so that they may be the right distance apart.

The molds are attached to the hooks *e* and sides E by simply hooking the perforation of the lugs *d* and eyes *d′* upon said hooks, so that the molds may be quickly inserted in or removed from the mold-pit. The molds are open at the top and are provided with a bottom *h*, having a flange *h′*, which fits tightly onto the bottom of the molds, thus securely closing them. The bottom *h* is hinged to the front of the mold by a pin *i*, so as to swing downwardly, and is provided with a depending handle *j*, which fits into an ear *j′* of the bottom *h*, by which it is operated, and as the handle *j* is bent outwardly it will have a tendency to swing inwardly, so that the weight of the handle will keep the bottom closed. The mold R is made in a single piece, so that an ingot cast therein will come through the rollers H in a finished condition without fins or rough edges. Ingots cast in mold R can be rolled into a finished bar of any shape without reheating, as there are no fins on the sides.

The molds R′ R^2 are made in two parts provided with overlapping flanges *h′*. The parts are attached to the side pieces E in the manner already described, and are held firmly together by a wedge S, which fits between the raised inclined portion R^4 upon the back of the molds and a side piece E, and which is raised and lowered by a screw *l*, which passes through a flange S′ of the wedge, impinges upon the top of the side piece E, and is provided at the top with a crank *m*, by which it is operated. The screw *l* fits a thread in the flange of the wedge S′, which overlaps the top of the side piece E, so that by turning the screw the wedge will be actuated.

The mold R′ is for casting a square ingot and its parts are united at two opposite corners. The mold R^2 is for casting a flat ingot and its parts are united at its two opposite narrower sides, so that in either case the fins or rough edges that will appear upon the ingots at the parts where they come in contact with the joints of the molds R′ and R^2 will come between the rollers H, and not in the groove H^2, and by this means they will not be rolled into the ingot and thereby injure the quality of the steel. The mold R is slightly larger at the bottom than at the top, and all the molds may be provided with a shaker *n*, which bears upon the lower side of the molds and extends through the lower slot *g* of the side piece E, the outer end being apertured to receive the longer member of a removable bifurcated handle *p*, which rests upon a rod *r*, extending alongside the side piece E from one flange F to the other, so that by moving the handle *p* the shaker *n* will be operated, thus rattling the molds and preventing the ingot from sticking therein.

Upon the outside of one of the side pieces E is a platform T, supported by braces T′, which rest upon the cross-strips B at each end thereof, so that the molds may be easily reached and metal poured therein.

The molds R, R′, and R^2 are placed directly above and in line with the grooves H^2 of the rollers H and the guide-spouts P. The guide-spouts should approximate in shape to the shape of the molds, and the grooves should be of the same shape; but the rollers H should be placed near enough together to compress the ingots as they pass through, so that the air in the ingot will be forced out at the top, thus leaving the same solid and free from pipe.

The apparatus is operated as follows: The molten steel is poured into the molds R, R′, and R^2, which have previously been arranged in their proper position in the mold-pit, as described above. The metal is then allowed to cool until the outside has become hardened, and then with the outside of the ingot hardened and the inside in a plastic condition the handles *j* are lifted up, thus swinging down the bottoms *h* of the molds and allowing the ingots to drop through the guide-spouts P and into the grooves H^2 of the revolving rollers H, where they will be compressed and the air forced out of them. This latter part of

the process is very important, as the ingots can be easily rolled while the inner portion is in a plastic condition, the air easily expelled, and the result is a solid ingot or bar of steel.

I do not wish to confine myself to any specific construction of this apparatus, as my invention consists, broadly, in rolling the ingot into a finished or partly finished bar while the inner portion is in a plastic condition, thus making it solid and saving the expense of reheating the ingot before rolling.

After a casting has been made a pan of rosin or other combustible may be set on fire and held under the molds, so as to smoke them without removing them from the pit. The molds are smoked, as in the usual process, so as to prevent the metal from sticking therein.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described method of rendering cast-steel ingots solid, which consists in rolling the ingot while its interior is still in a plastic condition, substantially as set forth.

2. An apparatus for producing solid steel ingots, consisting, essentially, of a mold-support, a mold and rollers mounted below or near the mold, substantially as set forth.

3. In the manufacture of cast-steel ingots, the herein-described apparatus, which consists, essentially, in a frame having a set or pair of iron or steel rollers, with grooves to fit the ingots, mounted therein, a mold-pit mounted upon said frame above and in line with the rollers, and suitable molds having swinging bottoms arranged in said mold-pit, so that the ingots may be dropped from the molds between said rollers, substantially as described.

4. In the manufacture of cast-steel ingots, the herein-described apparatus, which consists, essentially, in a frame having adjustable iron or steel rollers, with grooved faces to fit the ingots, mounted therein, guide-spouts placed above and in line with the grooves of the rollers, so as to guide the ingots into said grooves, and a mold-pit mounted upon said frame above and in line with said rollers, said mold-pit having suitable molds with swinging bottoms arranged therein above and in line with said grooves and guide-spouts, so that the ingots may be dropped from said molds through said guide-spouts and between said rollers, substantially as described.

5. The combination, with the frames M, having the rollers H and boxes J adjustably mounted therein, of the bars N, and guide-spouts P, attached to said bars, substantially as described.

6. In the manufacture of cast-steel ingots, the mold R, having its lower portion enlarged, as shown, and provided with means for attaching it to the slotted side piece E, substantially as described.

7. In the manufacture of cast-steel ingots, the combination, with the slotted side pieces E, of the molds R, having means for attaching them to said side pieces, and means, as inclined portion R^4 and wedge S, for holding said molds together between said side pieces, substantially as described.

8. The combination, with the molds R, of the hinged bottom *h*, having a flange *h'*, an ear *j'*, attached to the under side thereof, and a depending handle *j*, connecting with said ear to operate said bottom, substantially as described.

9. The combination, with the mold-pit frame and with the molds arranged therein, as shown, of the shaker *n* and handle *p* for rattling said molds, substantially as described.

RICHARD B. H. LEIGHTON.

Witnesses:
JOHN SHALLCROSS,
WM. E. DUDLEY,
CHARLES T. NORTON.