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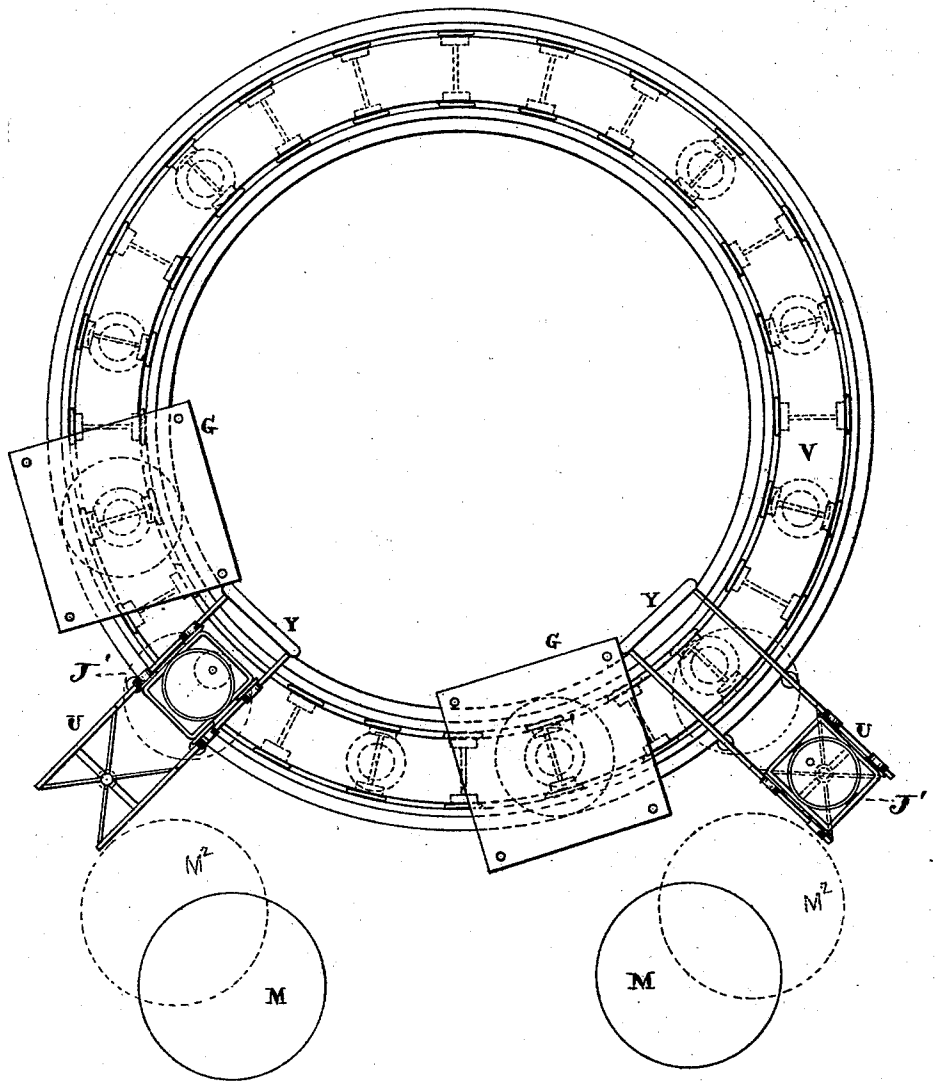
G. WEBB.

Apparatus for Forming Molten Metal into Ingot, &c.

No. 223,563. Patented Jan. 13, 1880.

FIG. 1



— WITNESSES —

W. Colborne Brookes

Charles C. Stetson

— INVENTOR —

George Webb

by his Attorney

Thomas D. Stetson

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G. WEBB.

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FIG. 2.

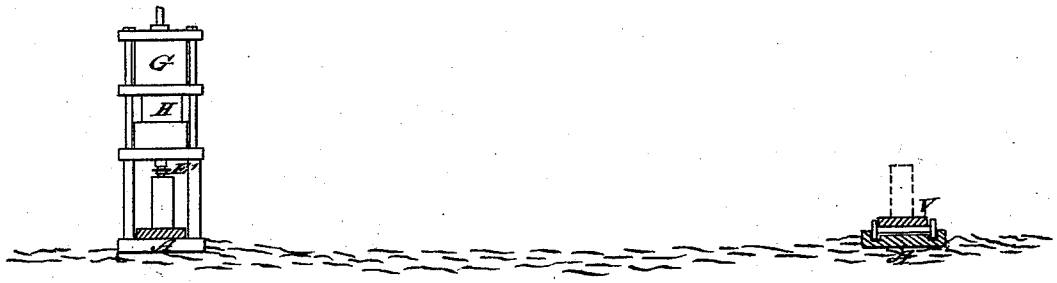
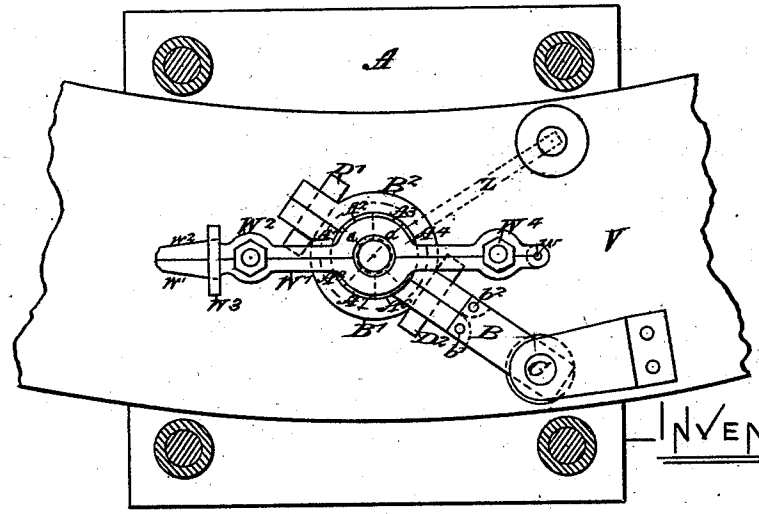


FIG. 6.



INVENTOR:—

George Webb,
by his Attorney E. B. Stetson,

WITNESSES:—

W. Colborne Brookes

E. B. Bolton

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G. WEBB.

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FIG. 4.

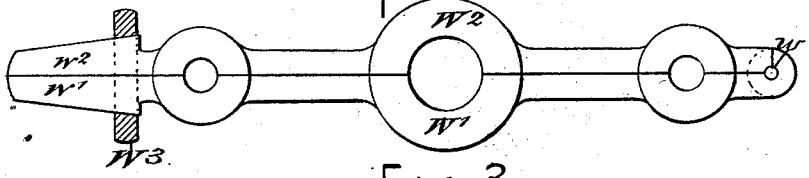
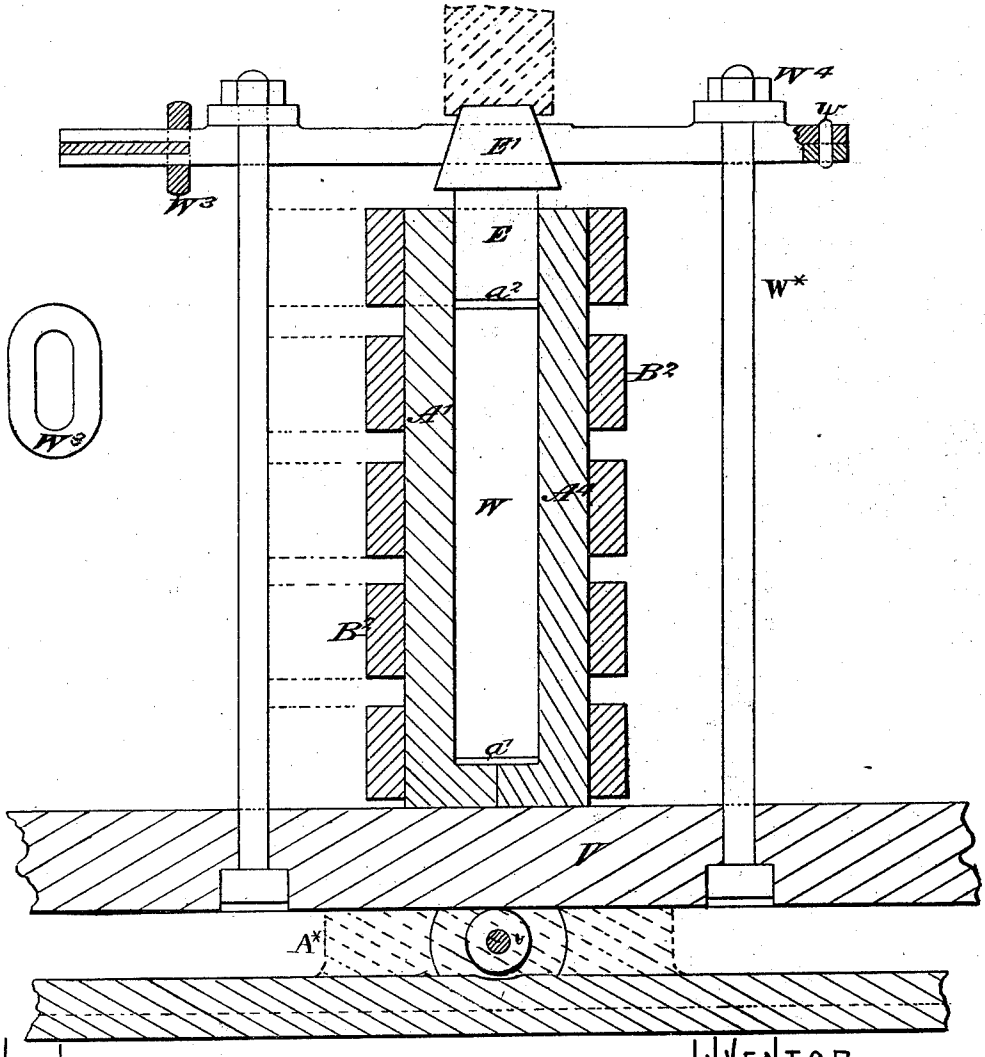


FIG. 3.



WITNESSES:—
W. Colborne Brookes
Charles C. Stetson

INVENTOR—
George Webb,
by his attorney T. S. Stetson.

5 Sheets—Sheet 4.

G. WEBB.

Apparatus for Forming Molten Metal into Ingot, &c.

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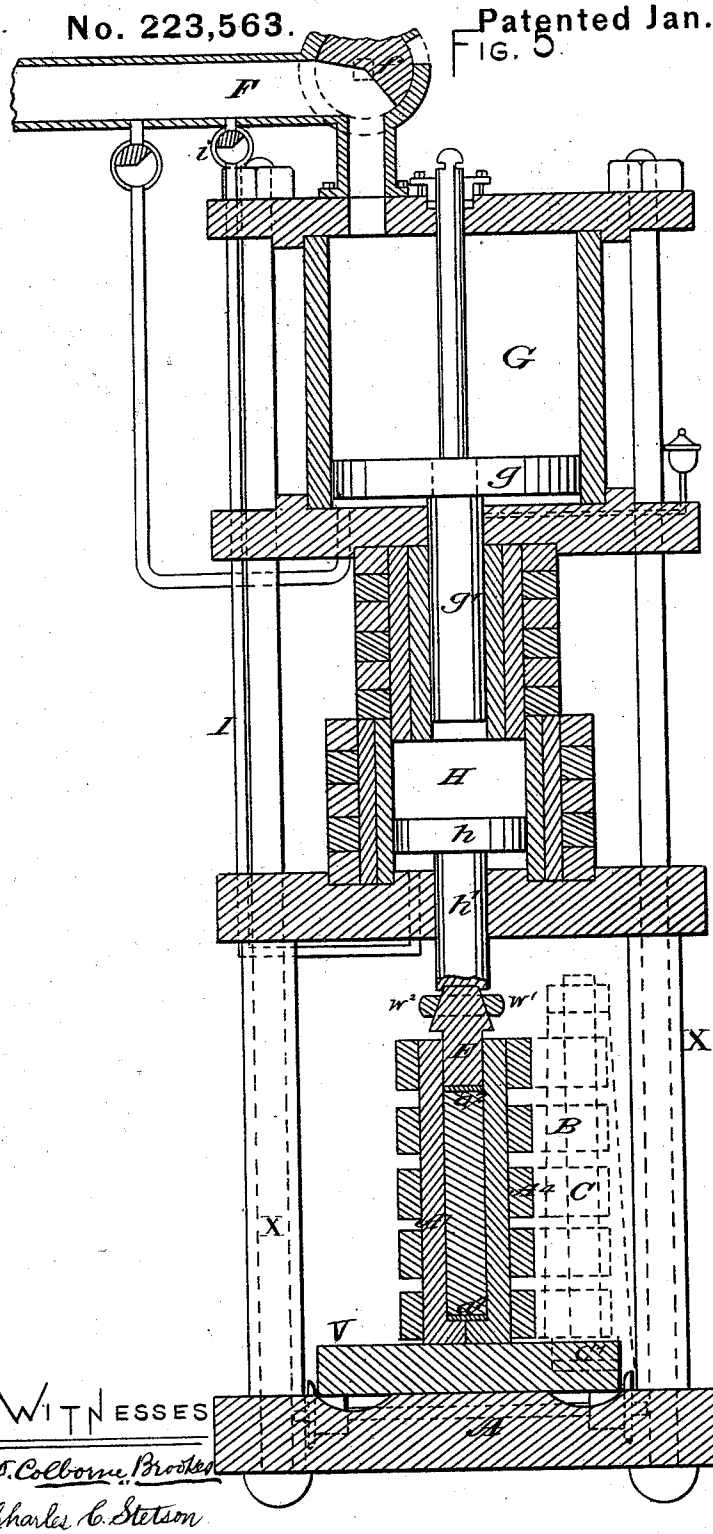
FIG. 5.



WITNESSES

W. Colborne Brooks

Charles C. Stetson

INVENTOR:

George Webb,

by his attorney

C. C. Stetson.

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G. WEBB.

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Fig: 7.

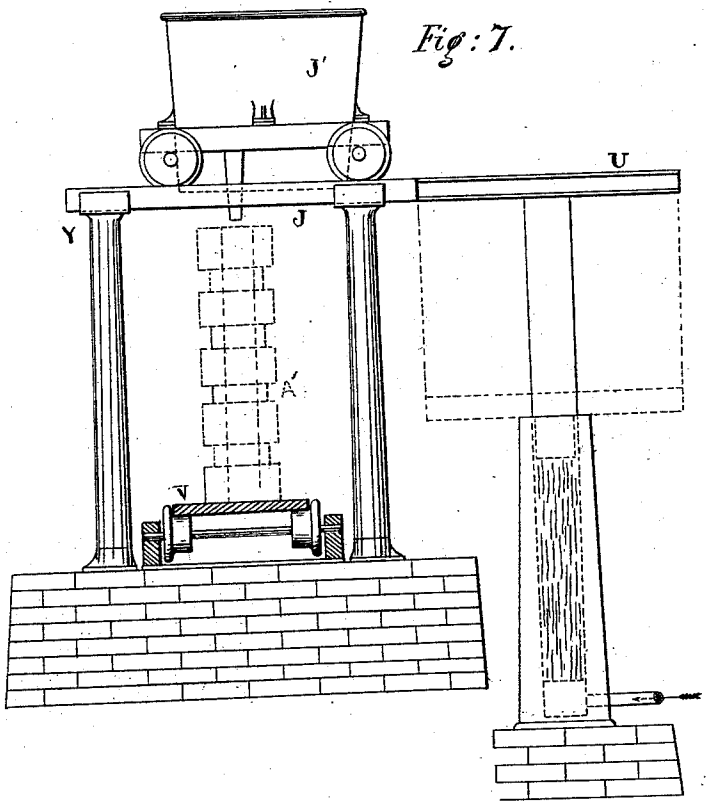
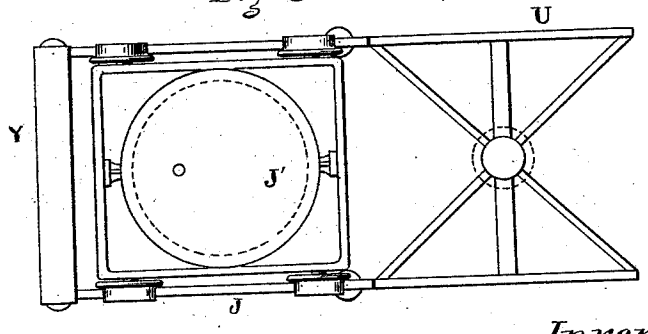


Fig: 8.



Witnesses

W. Colborne Brookes

Charles C. Stetson

Inventor

George Webb,

by his attorney

Thomas D. Stetson.

UNITED STATES PATENT OFFICE.

GEORGE WEBB, OF JOHNSTOWN, PENNSYLVANIA.

APPARATUS FOR FORMING MOLTEN METAL INTO INGOTS, &c.

SPECIFICATION forming part of Letters Patent No. 223,563, dated January 13, 1880.

Application filed July 29, 1879.

To all whom it may concern:

Be it known that I, GEORGE WEBB, of Johnstown, Cambria county, in the State of Pennsylvania, have invented certain new and useful Improvements relating to Apparatus for Forming Molten Metal into Ingots or other Castings, of which the following is a specification.

I subject the melted steel to strong compression, which is rapidly applied and maintained until the metal has set. I have devised a system for conveniently and effectively operating on quantities made in the large way in modern practice.

My invention is intended to overcome the difficulties and to adapt the work to successful and economical manufacture on a large scale, with repetitions rapidly conducted and continued indefinitely.

I employ gas-discharging sectional ingot-molds, which are or may be used repeatedly without any preparation beyond a thin wash. The molds are rapidly filled with liquid metal. They are in long narrow sections, strongly united. Provision exists for the escape of gases from all the joints. A great pressure is applied and maintained on the limpid metal immediately after it is poured, and all the movements may be effected easily at the right periods. Large charges may be disposed of with rapidity, and the charges may succeed each other indefinitely.

I employ hydraulic pressure in a form of mechanism very powerfully working, and adapted for treating a single ingot at a time by one press and repeating the operation rapidly and indefinitely. By employing suitable molds I can produce various simple or complex forms. I will describe it as the simplest form, a plain ingot.

I use a circular track, with cars or equivalent carrying devices mounted thereon, with one or two presses to exert the required compressive force on the melted metal immediately after it is received from the ladle. Means are provided for holding down firmly upon the melted metal after the force of the press is removed, and this pressure is maintained as the ingot-molds and their carrying means are successively moved around the circle until the ingots have had time to become certainly solid on their entire exteriors. Then the confining means are released, and the molds are opened and the ingots removed. The same or another set of sections is rejoined and placed on the car or carrying means, and a large series are successfully filled, compressed, held, removed, opened, emptied, and restored to a condition for refilling in proper succession.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a plan view of the general arrangement of the parts on a small scale. Fig. 2 is a cross-section through the center of Fig. 1. Fig. 3 is a vertical section through one of the ingot-molds and its immediate connections in position on the platform, which latter is made in an annular or ring form, and traversed around, carrying the ingot-molds and their connections upon it. The dotted lines show it in the press. Fig. 4 is a plan view of certain levers employed. Fig. 5 is a section of the press, taken vertically through the center. It is shown in the act of inducing pressure on the contents of an ingot-mold which has been previously clamped in proper supports carried on the ring, and has, by the step-by-step revolution of the ring, been presented in the press. Fig. 6 is a horizontal section, showing some of the same parts. Fig. 7 is a vertical section across the ring or annular platform. The ingot-mold is shown only in dotted lines. This section is in the plane of one of the bridges carrying the ladle for filling the several ingot-molds. This figure shows, also, the lift for raising and lowering the ladle. Fig. 8 is a plan view of these parts.

Similar letters of reference indicate like parts in all the figures

In Fig. 1 the circles M M represent the positions of Bessemer converters turning on trunnions adapted to pour into the ladles J′, held in cars on the lifts U, so as to be raised and lowered, as required. When the ladle is filled it is raised to the level of the bridge Y, and is then moved horizontally by the traversing of its car on the short track provided. The ladle J′ on the right is on the lift in the position for being supplied with melted metal

from the converter M. The ladle J′ on the left is on the bridge in the position to fill the several ingot-molds as they are successively presented. These parts are shown clearly in Figs. 7 and 8.

The dotted circles M^2 in Fig. 1 show the position which may be occupied by the metal-supply when they are open hearths or nests of crucibles to discharge directly into ladles in the same filling positions. With such the lifts need not be used, or, if present, they may be held fixed at the level of the bridges Y.

V is my annular revolving platform, carrying a series of appliances for receiving and supporting ingot-molds. These are so arranged in a circular series equally spaced that when the ring V stops after each partial rotation it presents one of the ingot-molds to be filled and another to be pressed. Much depends on the strength and the facility and rapidity of working of the molds and press.

A′ A′ &c., are the sections of an ingot-mold, of cast-iron, adapted, when applied together, to present a smooth and cylindrical exterior and a smooth cavity of uniform rectangular section on the interior, which cavity receives the melted steel and forms the ingot. The surfaces of the ingot-mold A′ A′ which abut together are marked *a*. They are accurately fitted together, but instead of being absolutely smooth are left with fine scores running across their surfaces, such as result from filing with a coarse file.

The sections A′ A′, &c., are held together by clamps B′ B^2, which are provided in sufficient numbers, and with peculiar locking pieces or gibs D′ D^2, and embrace the ingot-mold at short distances apart along its length.

On sufficiently raising the mast C and the connected clamps and ingot-molds and their contents, the whole may be swung around clear of the bed and moved back into the central position under the press to receive the compressive strain.

The peculiarities of the ingot-molds and their immediate attachments are made the subject of a separate application for Letters Patent.

The construction of my press affords a peculiarly powerful and persistent compressing force.

I employ a press which is compound, using, in effect, two hydraulic presses, one of which receives the steam, water, or other fluid from a boiler, accumulator, or other source, and, by the motion of its plunger, induces a greater pressure in another mass of fluid, which acts in a second cylinder to apply a still greater pressure on the plunger of the second press. This latter acts on the steel in the ingot.

The peculiarities of my compound hydraulic press are made the subject-matter of a separate application for Letters Patent.

U is an ordinary hydraulic lift, carrying a suitably-braced platform with rails for the car J′ bearing the ladle. This presents the ladle to the converter or other source of metal-supply M, and holds it at the desired level to receive the melted metal. Then, by rising or sinking, it delivers it on a level with the rigid bridge Y, which supports the ladle in the required position to fill the several ingot-molds A as they are successively presented under it by the step-by-step motion of the carrying-ring or annular platform V.

The annular ring or revolving platform V is moved intermittently by hand or by any suitable means, (not shown,) and presents the several ingot-molds A′ successively, first, to a ladle, J′, to be filled, and then to a press, G, to have its fluid contents strongly compressed.

I have represented two ladles, J′, and two sources of metal-supply, M; but it will only happen in rare contingencies that both sets will be in the same stage of advancement, so as to pour at the same time.

The ring V is mainly supported on anti-friction rollers *v*, held in fixed bearings; but immediately under each press G the ring V rests directly on a fixed support, which constitutes the base of the press. This support is slightly indicated by dotted lines in Fig. 3. I desire to inflict a greater pressure than can be borne by rollers.

Fig. 3 shows the ingot-mold supported in two positions. The strong lines show it in the act of passing over one of the supporting-rollers. These rollers do not traverse with the ring, but are mounted in fixed bearings, as shown in Fig. 7. The dotted lines in Fig. 3 show the condition when the ingot-mold stands briefly under the press and its contents are subjected to a severe compression.

Under each press is a stout fixed abutment, A*, which supports the ring V at that point. The force of the press has but to spring the ring down a very little to cause it to be firmly supported on A*.

When the pressure has been maintained for a sufficient time the steam or other fluid under pressure is shut off from the cylinder and the fluid above the piston *g* is allowed to escape. Then both the pistons *g h* and their connections are raised, and the ingot-mold, with its contents, may be moved away from the press.

It will now be seen that I provide means for filling a series of cold ingot-molds with melted steel in quick succession, and for presenting each rapidly to my press and subjecting it to strong compression, which I term "live-pressure," for a period which may be very brief; and I also provide for holding the metal thus compressed for a considerable time afterward under what I term "dead-pressure," by the aid of appliances adjusted during the brief period while the live-pressure is on.

The set E is formed with a large conical top, E′, projecting above the top of the ingot-mold sections A′ A^2. I provide two stout levers, W′ W^2, hinged together at the point *w*, and formed with corresponding tapering ends *w′* w^2, adapted to be held together by a link, W^3, driven on.

The conical top E′ of the set E is received

in a properly-formed recess between these levers, the taper of the ends allowing the link W^3 to be instantly driven to a tight bearing, whether the set E E′ is a little higher or lower. If the quantity of melted steel be a little in excess, the set will stand higher and the levers W' W^2 will stand a little open; but in any case they will take a strong hold instantly. These levers W' W^2 embrace fixed posts W*, one or both of which has a stout nut, W^4, threaded thereon. So soon as the levers are secured together by the link W^3 the nut W^4 may be turned down strongly by hand, or by suitable connection to a steam-engine or other source of power. (Not shown.) This strongly holds down the ends of the levers W' W^2. It takes up all the slack and spring of the parts, and, remaining on after the mold is moved away from the press, retains the strain which the press has enforced. There will always be some elasticity in the levers W' W^2. This becomes available afterward in following up any shrinkage of the ingot after it is removed from the mold. I keep the dead-pressure thus on the ingot a considerable time after its removal from the press, preferably until the step-by-step motion of the platform V has carried it half or more of the way around the circle.

To remove the solidified ingot the link W^3 is knocked off and the levers W' W^2 separated; then the locking-pieces D' D^2 are removed, the clamps B' B^2 thrown open, and the sectional mold A' A^2 and its contents will be seized by properly-shaped tongs. (Not shown.) Z represents a mast or upright shaft for a swinging way for this purpose. The sectional mold A' A^2 and its contents are thus brought to and deposited on a car on a track. (Not shown.)

After release from the clamps B' B^2 the sections of the mold are held together by slight bands, (not represented,) which bands are afterward to be removed when the car and its load have been hauled away a convenient distance. The fresh mold may be held together by similar small bands and brought in by the same route and appliances, and thus delivered to the clamps B' B^2.

I prefer, for steel rails, to make the ingots about seven inches square and of a length from four to six feet—sufficient to serve for only one rail, with a minimum wastage at the ends.

I claim as my invention—

1. The ring-platform V, rollers *v*, and abutments A*, in combination with the series of molds A' and one or more presses, G, mounted on posts or ties X, spanning the ring V, all as herein specified.

2. The levers W' and W^2, link or clip W^3, and nut W^4, in combination with the set E, having a taper head, E′, and with the molds A' A^2, adapted to serve, in connection with a press, G, in the treatment of melted steel in changing from a fluid to a solid, as herein specified.

3. The bridge or bridges Y and lift U, in combination with each other and with the ladle J′, adapted to traverse each, and with the ring-platform V, carrying molds A', and with one or more sources of metal-supply, M, and one or more presses, G, all arranged for joint operation, as herein specified.

In testimony whereof I have hereunto set my hand this 7th day of July, 1879, in the presence of two subscribing witnesses.

GEO. WEBB.

Witnesses:
A. MONTGOMERY,
J. EARL OGLE.