(No Model.) 2 Sheets—Sheet 1.

W. HAINSWORTH.

BESSEMER PLANT.

No. 272,683. Patented Feb. 20, 1883.

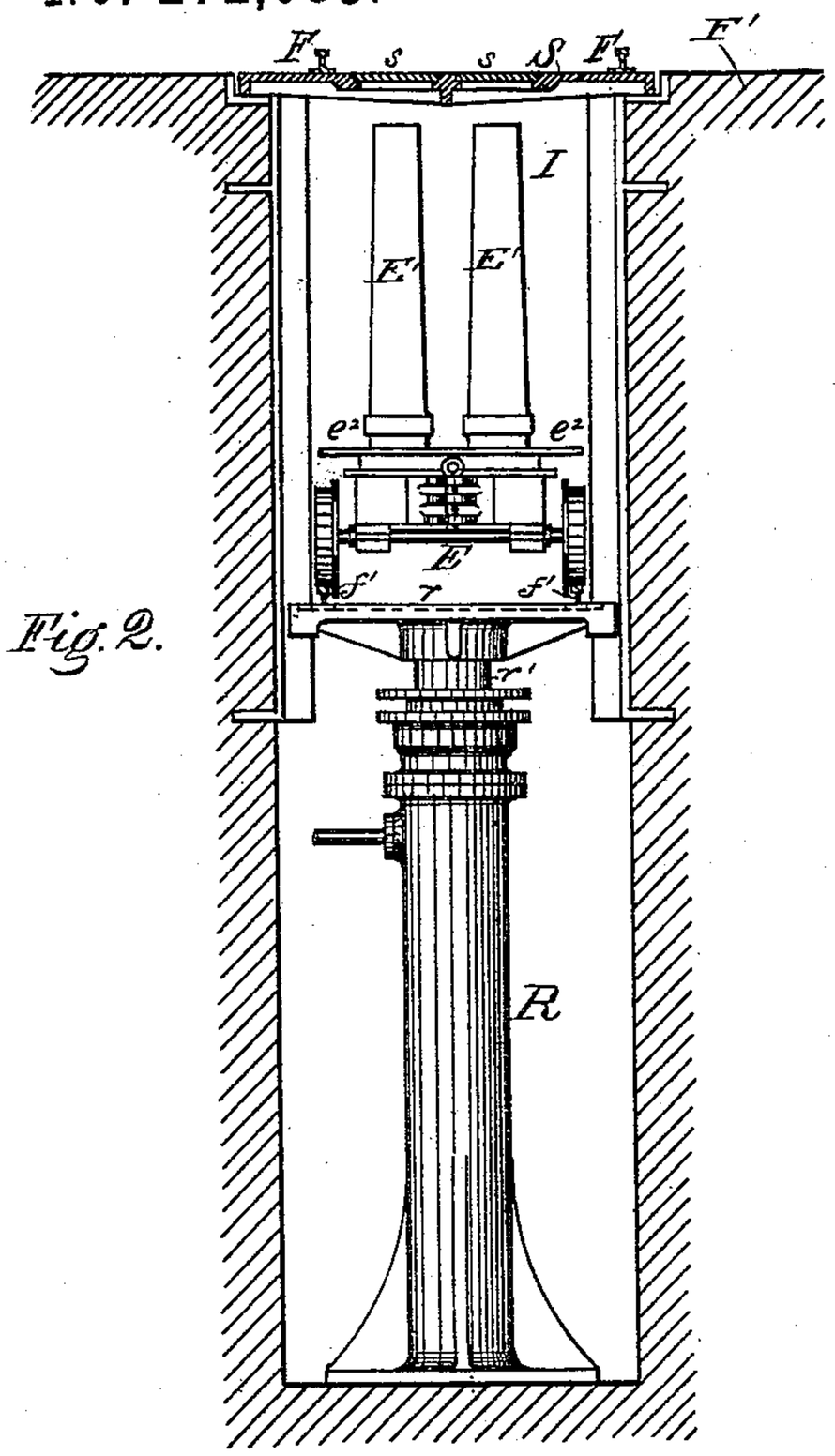

Fig. 2.

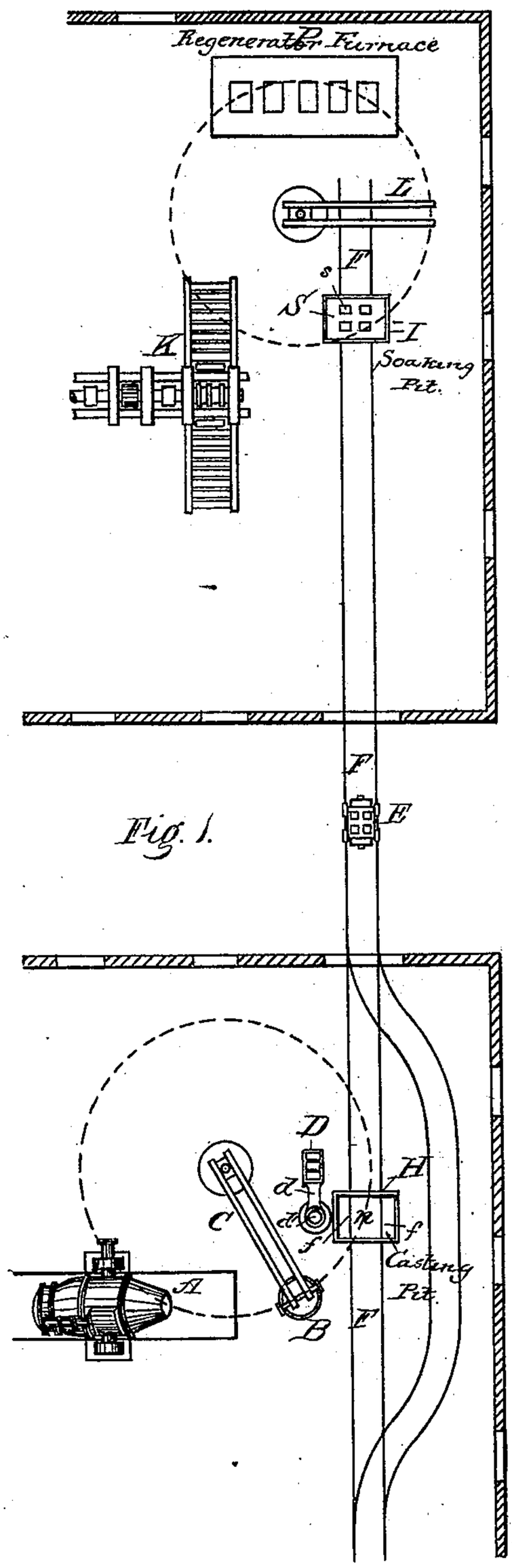

Fig. 1.

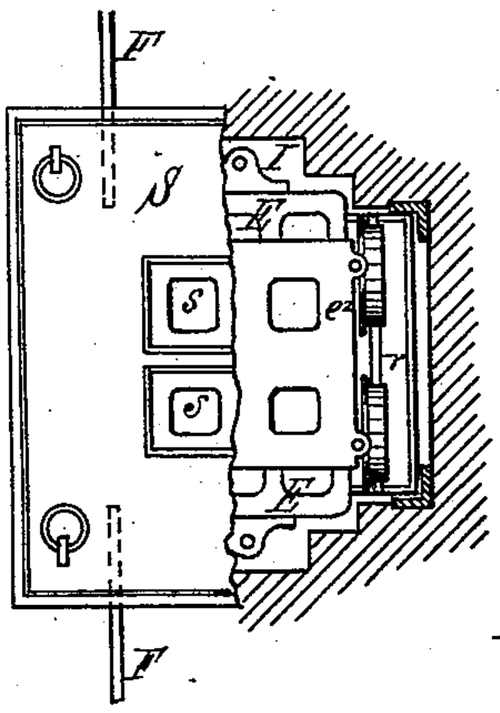

Fig. 3.

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(No Model.)

2 Sheets—Sheet 2.

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Fig. 4.

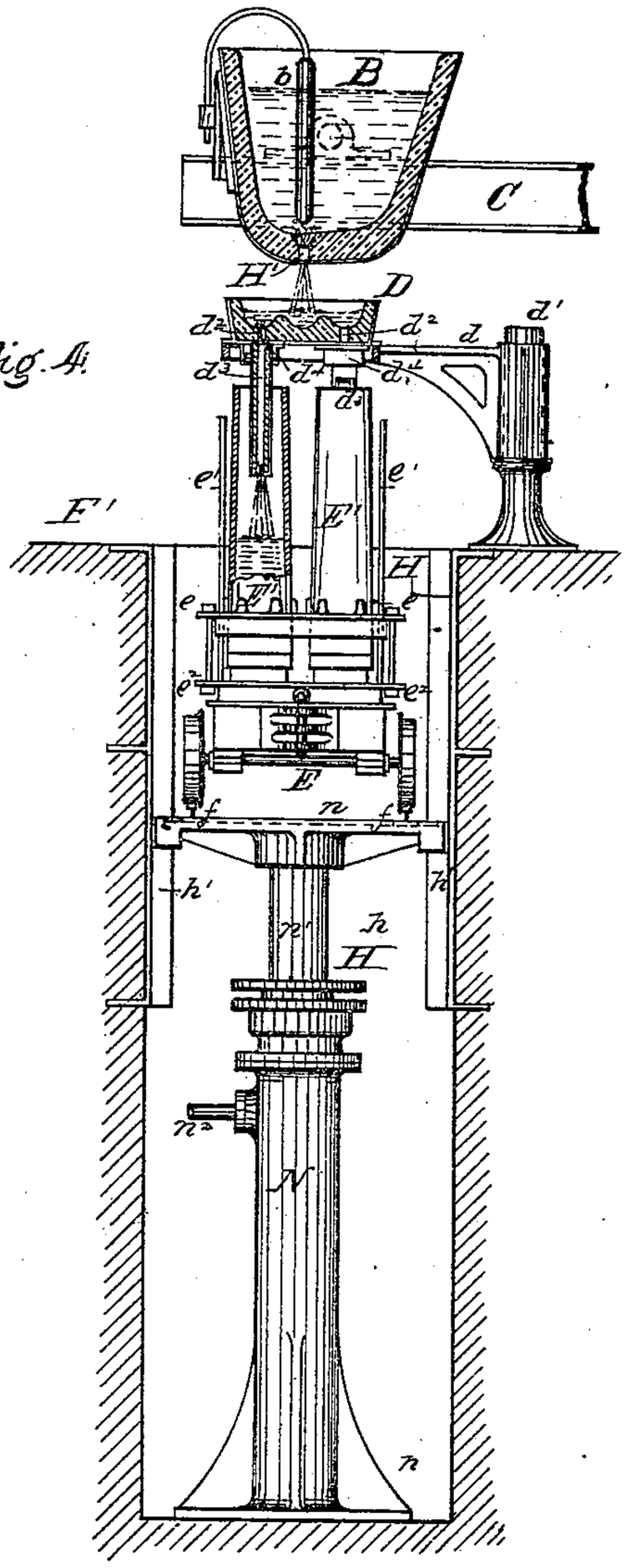


Fig. 5.

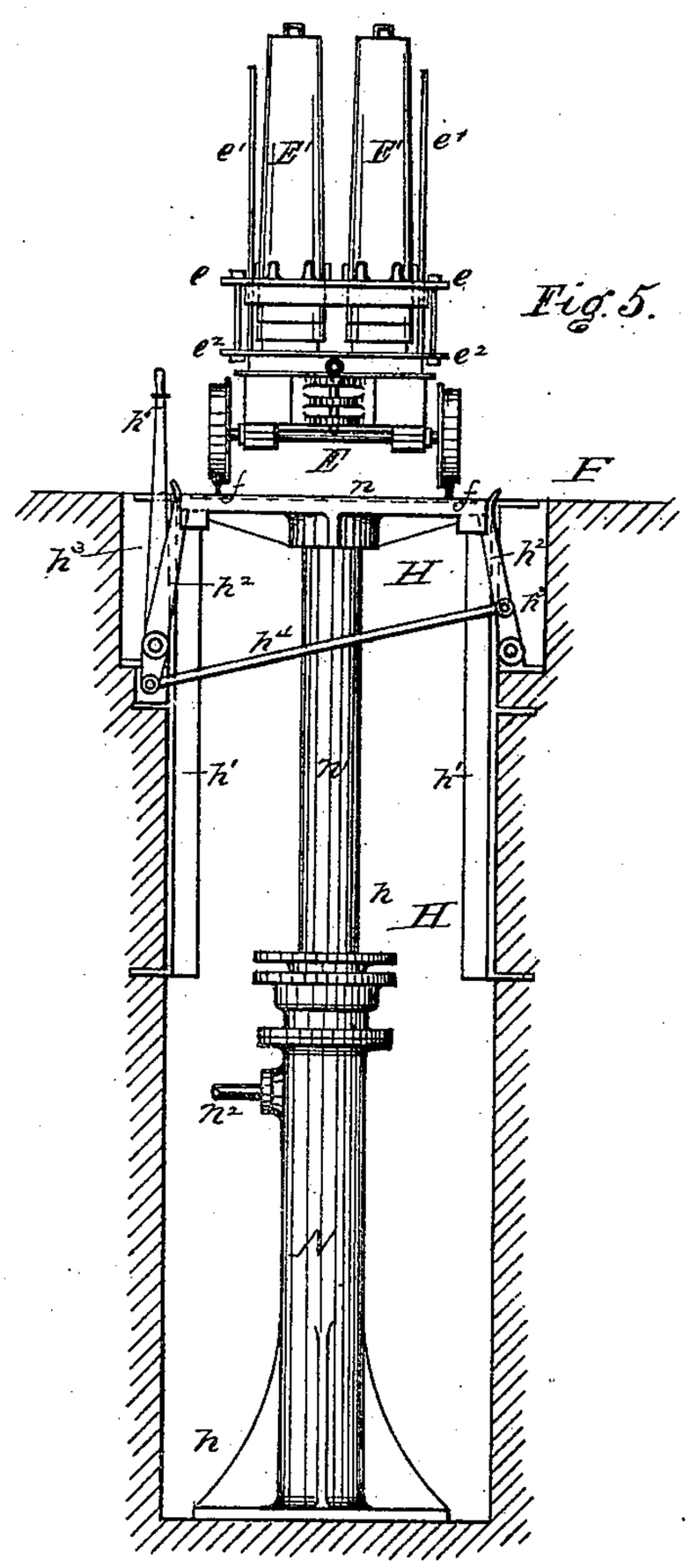
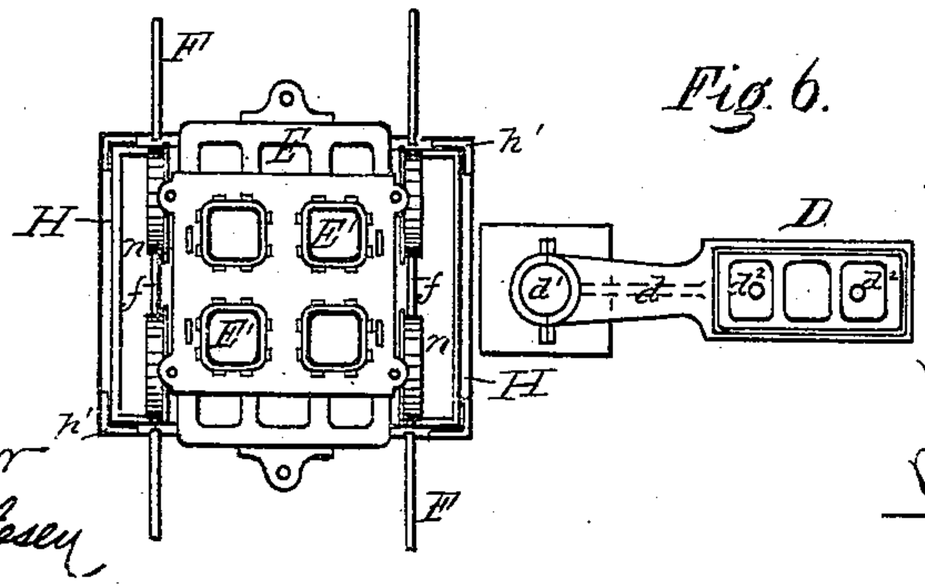


Fig. 6.



Witnesses.
C. L. Parker
R. H. Whittlesey

Inventor. William Hainsworth.
By Attorney. George H. Christy

UNITED STATES PATENT OFFICE.

WILLIAM HAINSWORTH, OF PITTSBURG, PENNSYLVANIA.

BESSEMER PLANT.

SPECIFICATION forming part of Letters Patent No. 272,683, dated February 20, 1883.

Application filed January 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HAINSWORTH, of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Bessemer Plants; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1, Sheet 1, is a plan view of a Bessemer plant illustrative of my invention. Fig. 2 is a vertical sectional view, to a scale larger than Fig. 1, of a heating-pit employed in my improved plant; and Fig. 3 is a plan view, partly in section, of such pit. Figs. 4 and 5, Sheet 2, are vertical sectional views, partly in elevation, of a casting-pit and operating mechanism employed therein, forming a part of my improved plant; and Fig. 6 is a top plan view of the mechanism shown in Figs. 4 and 5.

In the manufacture and reduction of blooms of Bessemer steel the labor required and the time expended in casting the ingots and reheating the same for rolling form comparatively large items of expense; also, the presence of workmen in close proximity to the fluid metal or heated ingots exposes them to danger more or less, and as a rule the danger is increased as the number of workmen are increased. It is therefore desirable, both for commercial and prudential reasons, that such a construction and combination of the parts of a plant be employed as will permit of the least number of workmen and consume a comparatively small amount of time in effecting the several steps of manufacture, in order to utilize as far as possible the heat of the ingot, when cast, in preparing it for subsequent reduction by rolling in the blooming-mill.

The purpose of my present invention is to secure these advantages to a greater degree than heretofore by the use of an improved plant for carrying out the several steps of manufacture.

In general terms my invention consists in certain combinations of a converter, a ladle and runner-box for pouring metal into the molds, a car-track, a casting-pit formed beneath and as a section of such track, and having power mechanism for raising and lowering the track-section within the pit, a car adapted to run on the track and carry the molds and ingots, a heating-pit formed under and as a section of the track, with power mechanism for raising and lowering the track-section within the pit, means for raising the ingot separately or collectively from the heating-pit, and a blooming-mill in proximity to the heating-pit, such parts of the plant being constructed and combined as hereinafter more fully described and claimed.

In the drawings, Fig. 1, I have illustrated the general arrangement of my improved plant, comprising a converter, A, a ladle, B, a crane, C, for carrying the ladle to and from the converter, a runner-box, D, for conducting the metal from the ladle to any desired one of several molds, a car, E, for carrying the molds E′, a track, F, and a casting-pit, H, under and forming a section of the track, the same being located within the arc of crane C or runner-box D, or preferably in the arc of both, a heating-pit, I, also formed under and as a section of the track, a blooming-mill, K, for reducing the ingots to blooms, and a crane, L, for transferring the ingots from pit I to the blooming-mill. Of these several parts of the plant, the converter A, crane C, ladle B, crane L, and blooming-mill K may be of the usual or any desired construction adapted to the purposes for which they are ordinarily employed in Bessemer plants.

The car-track F is run from the converter to the blooming department, and at some point therein in convenient proximity to the converter, and by preference in the rotary arc of crane C, is constructed a casting-pit, H, as follows: A shaft or hole, *h*, of suitable depth and area in cross-section, is sunk under the track at the desired point, and is walled in with masonry to afford protection from water and other injuries. On the bottom of this shaft is secured a hydraulic ram, N, carrying a platen, *n*, on the upper end of its piston *n′*. The depth of the shaft is determined with reference to the length of the ram and the desired extent or range of lift from the surface downward. The platen is guided in this movement by angle-irons *h′*, set in the corners or in other convenient positions on the side walls of the pit.

Water or other suitable fluid medium under pressure is supplied to the ram-cylinder by pipe n^2. This ram, both in construction and operation, may be substantially like those in common use for kindred purposes in the arts, and therefore need not be described in detail.

In order to lock and support the platen n in position level, or approximately so, with the floor F′, levers h^2 are pivoted at or near their lower ends in side recesses, h^3, which levers are connected by cross-rod h^4, and are moved at their upper ends in opposite directions by hand-lever h^5, whereby such upper ends may be set under the edges of the platen to support the same, as illustrated in Fig. 5, or may be moved outward free from the platen, so as to permit of its descent.

On the upper face of the platen n are secured rail-sections f, adapted in their position and arrangement to register with and form a section of the car-track F.

The car E may be of the usual or any suitable construction adapted to carry one or more ingot-molds, E′, preferably a nest of four molds, which are connected at their bases with a frame-work, e, and lifting rods or stirrups e', by which the molds may be placed upon the car, or may be raised from the car-bed e^2, leaving the molds standing thereon. Suitable means for stripping the ingots in this manner are in common use in the art, and therefore need not be described in detail.

In casting, the car, with its molds, is run upon the track-section f and the platen n is lowered, sinking the car and molds together into the pit sufficiently to permit the bracket d, carrying the runner-box D, to be turned or rotated on its center post, d', into position directly over the molds. This box D is provided with bottom openings or sprue-holes, d^2, corresponding in relative arrangement with the positions of the molds.

In order to prevent metal from spattering against the sides of the molds as it is run in, baked clay or clay-lined tubes d^3 are secured to the under face of the runner-box by a case or sheath, as at d^4, with their tubular passages in line with the holes d^2. When the runner-box has been turned into position the car and molds are raised by the ram, thereby passing the tubes d^3 into molds any desired distance, preferably near to the bottom. As the molds are filled with metal they are lowered in the pit, thereby withdrawing the tubes.

If clay tubes are used, or tubes of other material which will not be destroyed by or be injurious to the metal, they may be allowed to enter the metal in the molds, and thereby insure, even to a greater degree, the filling of the molds without spattering their sides. This feature of advantage in casting Bessemer ingots is greatly facilitated by making the molds vertically movable while being filled, whereby the tubes d^3 may be inserted and withdrawn at pleasure without moving the runner-box or ladle. This ladle B may be of the usual construction, operated by the crane C in the usual way, both in filling at the converter-mouth and in emptying into the runner-box, the usual stopper, b, being provided for closing the tapping-hole H′ in the bottom. The crane C is by preference located, with reference to carrying the ladle, directly over the casting-pit H; but if for any cause this cannot be done, the metal may run from the ladle to the runner-box through a suitable spout. It will also come within my invention to run the metal directly from the ladle into the molds without the use of the runner-box, the molds and their carrying-car being lowered into a pit beneath the track for this purpose, as before described.

The molds being filled, as above described, the ladle and runner-box are turned aside, and the car is raised to the surface by the ram, and then may be run off on the track F to the blooming department, or to other desired points.

In the line of track, at convenient distance from the blooming-mill K, and within the arc of crane L, a pit, I, is sunk, which is walled with masonry and lined with fire-brick or other suitable refractory material, with reference to preserving a comparatively high degree of temperature within the chamber thus made. In the bottom of this chamber is secured a ram, R, similar in construction and operation to the ram N in pit H, such ram R having a platen, r, mounted on piston r', which platen carries the track-section f', adapted to receive the car from the main track F when the platen is raised, and to lower the car, with its load of ingots, into the pit as the platen is lowered. The bed e^2 of the car corresponds, by preference, in form and area of surface approximately to the cross-section of the chamber I, into which it is lowered, so that when lowered such car-bed forms practically a close bottom for that part of the chamber in which the ingots are contained, and thereby protects the track, truck, platen, and ram from injury by heat. Previous to lowering the ingots and ingot-car into this chamber or pit the molds E′ are stripped off by the provisions for this purpose before described, and when lowered the chamber is closed by a cover, S, having therein lids or small openings and covers s, through which the ingots may be raised, one by one, as required, without opening the whole chamber. The cover S and its smaller lids s may be made of metal, or preferably of metal frames filled with fire-brick. The purpose of this chamber is to maintain or raise the ingots at or to the required degree of heat. This may be done by closing the chamber with the ingots inclosed, and in case the ingots themselves contain sufficient heat in their interiors it will pass to or reheat the surface of the ingots, being prevented from escaping by the surrounding walls, the chamber thus performing substantially the function of a soaking-pit.

In case the ingots do not contain sufficient heat for the purpose stated, the chamber may be heated to the required degree before lowering the car therein by introducing heated

gases in any convenient way. In practice I contemplate the use of this pit or chamber more especially for the purpose of receiving comparatively hot ingots and for keeping them at the requisite temperature until desired for blooming. If additional heat is desired, I prefer to employ a regenerator-furnace of any suitable construction for such purpose, which is located in the arc of crane L, as at P, and therefore in convenient proximity to both the pit I and blooming-mill K. As the ingots are required for blooming they may be removed, one by one, by the crane L, through the separate small openings *s* until all or any desired number have been removed, when the car, with such ingots as may remain, may be raised altogether, the whole cover S being removed, the car be run off on track F, and another loaded car be run over and lowered into the chamber, as before described. The crane L being located with the pit I and blooming-mill K in its rotary arc, ingots may be transferred directly from one to the other with little loss of time or heat.

In carrying out the several operations herein described, especially those of casting and heating preliminary to rolling, the duties of the workmen will be light, and the immediate presence of but few will be required around the casting and heating pits. Consequently they will to a great degree be removed from danger and relieved from severe labor and exposure to excessive heat; but comparatively few workmen will be required at any part of the operation, and the successive steps can be carried out rapidly and in quick succession, thereby rendering it possible and practicable to utilize a large percentage of the heat of the ingot as first cast in preparing it for reduction in the blooming-mill. These are important considerations in the economical manufacture of Bessemer steel, and by the improved plant herein described I provide for securing these advantages to a much greater degree than heretofore.

I claim herein as my invention—

1. A Bessemer plant having in combination a converter, a ladle, a crane, an ingot-car and track, a casting-pit located in and beneath the track, and lifting mechanism for moving a section of the track, with the car and its load, up and down within such pit, substantially as and for the purposes set forth.

2. In a Bessemer plant, the combination of a converter, a ladle, a car-track, a car for carrying ingot-molds, a pit beneath the track, and a ram within the pit carrying a section of the track, substantially as described, whereby the car and molds thereon may be lowered to receive the metal from the converter through the ladle and be raised to be run off on the track.

3. A Bessemer plant having in combination a converter, A, a ladle, B, a crane, C, for carrying the ladle, track F, car E, carrying molds E′, a pit, H, under the track in the rotary arc of the crane, and a ram, N, in such pit, carrying a section of the track, substantially as and for the purposes set forth.

4. The combination of runner-box D, having tubular projections d^3, extending downward from its discharge-holes, molds E′, and mechanism, substantially as described, for raising and lowering the molds with reference to the runner-box, whereby the tubes are inserted and withdrawn into and from the molds to prevent spattering the mold-walls.

5. A Bessemer plant having in combination a converter, a ladle and ladle-crane, a runner-box, a track and car adapted to carry ingot-molds, a pit beneath the track and in the rotary arc of the ladle-crane and runner-box, a ram, N, in such pit, carrying a section of the track, and adapted to raise and lower the car, with its load, substantially as and for the purposes set forth.

6. A Bessemer plant having in combination a converter, a blooming-mill, a car-track extending from the converter to the blooming departments, a car adapted to carry ingot-molds and ingots on the track, a casting-pit located beneath the track, near the converter, with a ram therein carrying a section of the track, a heating-pit located beneath the track, near the blooming-mill, with a ram therein carrying a section of the track, such rams being adapted to lower the ingot-car, with its load, into and raise it from the respective pits, and cranes for transferring the metal from the converter to the car and from the car to the blooming-mill, substantially as described.

7. In a Bessemer plant, the combination of a blooming-mill, a car-track leading to the blooming-mill from the converting department, a car adapted to carry ingots thereon, a heating-chamber located near the blooming-mill and beneath the track, a ram in such chamber carrying a section of the track, and adapted to lower the car into and raise it out of the chamber, and a removable cover to close the chamber when the track-section is lowered, substantially as set forth.

8. In a Bessemer plant, the combination of blooming-mill K, track F, ingot-car E, a heating-chamber, I, located near the blooming-mill and beneath the track, ram R, carrying platen *r*, with a section of the track thereon, and crane L, substantially as and for the purposes set forth.

9. In combination with a car-track, a heating-chamber located beneath the track, a ram in such chamber, carrying a platen with a section of the track secured thereon, an ingot-car having a bed adapted in form and size to fill approximately a cross-section of the chamber and form a bottom to the chamber when lowered within it, and a removable cover for closing the chamber above when the platen and car are lowered, substantially as set forth.

10. In a Bessemer plant, the combination of blooming-mill K, crane L, track F, ingot-car E, heating-pit I, located beneath the track in the arc of the crane, and mechanism, substantially as described, for lowering and raising a

section of track, with the car, into and out of the heating-pit.

11. In a Bessemer plant, the combination of a crane, a blooming-mill, a car-track, an ingot-car, a heating-pit beneath the track, having a lifting mechanism for lowering and raising a section of the track, with the car and its load, into and out of the pit, and an ingot heating furnace, such blooming-mill, pit, and furnace being located at different points in the rotary arc of the crane, substantially as set forth.

In testimony whereof I have hereunto set my hand.

WILLIAM HAINSWORTH.

Witnesses:
R. H. WHITTLESEY,
C. L. PARKER.