(No Model.) 2 Sheets—Sheet 1.

W. HAINSWORTH.

BESSEMER PLANT.

No. 284,005. Patented Aug. 28, 1883.

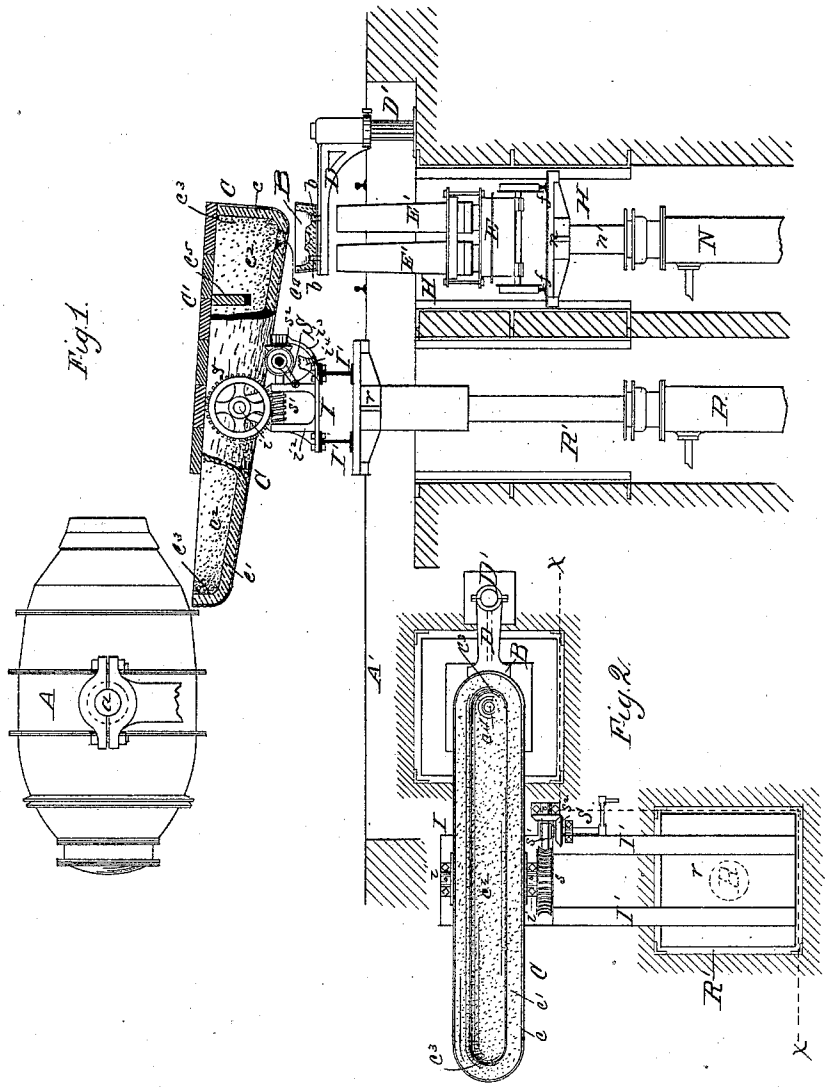


Fig. 1.

Fig. 2.

Witnesses
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Fig. 3.

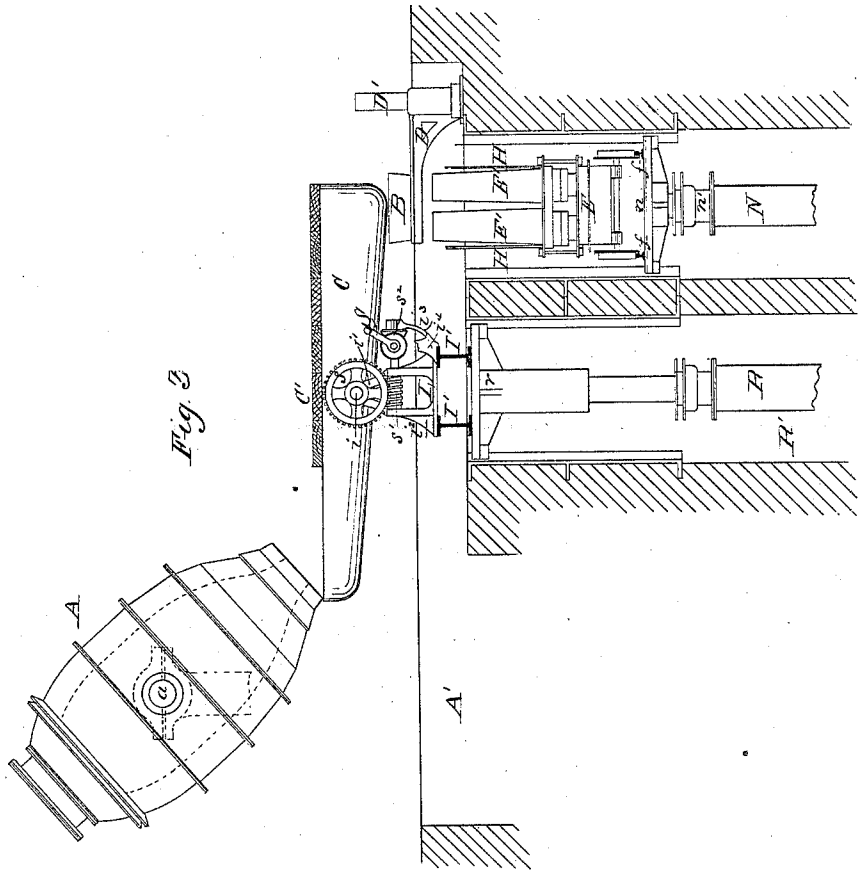
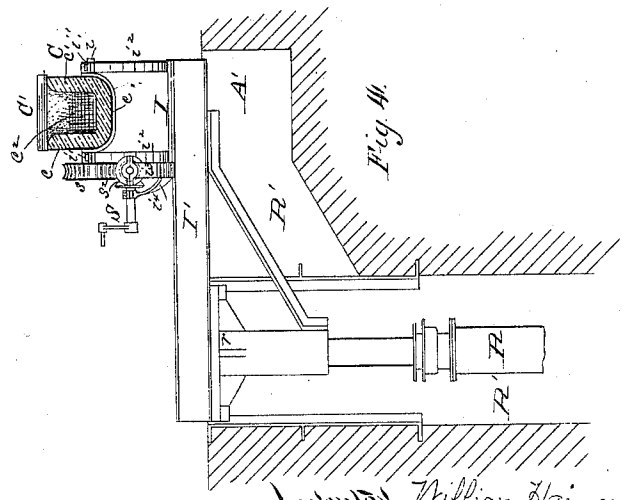


Fig. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM HAINSWORTH, OF PITTSBURG, PENNSYLVANIA.

BESSEMER PLANT.

SPECIFICATION forming part of Letters Patent No. 284,005, dated August 28, 1883.

Application filed March 12, 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 Plant; 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 is a view in sectional elevation of portions of a Bessemer plant, illustrative of my invention, the converter being in horizontal position preliminary to pouring, the section being taken in the plane of the broken line *x x*, Fig. 2. Fig. 2 is a plan view of a portion of the conductor or spout, the casting-pit, and mechanism for supporting and manipulating the same. Fig. 3, Sheet 2, is a view in elevation similar to Fig. 1, but showing the parts adjusted in position as at the completion of pouring from the converter; and Fig. 4 is a view showing a cross-section of the conductor, with the supporting-frame, ram, pit, and adjusting mechanism in elevation, the view being from the side of the casting-pit toward the converter.

My invention relates to certain improvements in a Bessemer plant; and, in general terms, it consists of certain combinations of a converter, a conductor or spout for conveying the fluid metal from the converter to the molds, a pit with mechanism for supporting, raising, lowering, and adjusting the inclination of the conductor, a casting-pit with mechanism for raising and lowering the molds therein, and a runner-box for passing the metal from the conductor to one or more of the nests of molds, as hereinafter more fully described and claimed.

In the manufacture of Bessemer steel it is customary to employ a "ladle," so called, into which the fluid metal is poured from the converter, and by which it is carried to the molds or other place of casting, the metal being discharged therefrom through a hole in the bottom, which is closed, when desired, by a stopper secured on the end of the baked-clay stem or sleeve. The use of the ladle, as usually practiced in Bessemer works, is the occasion of serious danger to the workmen, large loss of metal, heavy expense for fitting and repairs, and continual anxiety to those having responsible management of affairs. These dangers and losses are constantly arising from many causes. Stoppers break and permit the metal to escape prematurely from the ladle. Delays are encountered, during which the metal chills in the ladle, rendering it difficult to remove the stopper without exposure to great danger, and, it may be, entirely preventing the flow of metal through the discharge. Various exigencies similar to these render the uncertainties so numerous and threatening that those responsible for safety and success are ever anxious, and are never certain that the cast will be accomplished until they see the metal running from the ladle to the molds. The losses incurred in Bessemer works from these causes incident to the use of ladles are, in the aggregate, very large, probably greater than from all other steps in the manufacture combined.

The purpose of my present invention is to provide for conveying the metal in continuous uninterrupted flow from the converter to the molds without the use of a ladle, and by means which will not be attended in its use by the dangers to person and loss of metal above described.

In the drawings, A represents a converter, which may be mounted, manipulated, and operated in the manufacture of Bessemer steel in the usual or any desired manner. Converters of this class are usually more or less pear-shaped, and designed to hold the fluid charge in the swell or belly when tipped to horizontal position, as in Fig. 1. A pit, A′, is also usually provided beneath the converter, into which its ends pass when rotated on its supporting-trunnions *a*. With a plain open-mouth converter, like the one shown, the charge is poured out between the positions shown in Figs. 1 and 3, or while rotated through the lower quadrant on the casting side.

In casting I prefer to employ a pit and mechanism substantially like that shown and described in Patent No. 272,683, granted to me February 20, 1883, consisting of a pit, H, in which is seated a hydraulic ram, N, carrying

on its vertical movable plunger n' a plate, n, and section of car-track f, forming part of a track leading from the converting to the blooming departments, and adapted to receive thereon the ingot-car E, carrying any desired number of molds E′, and by movement of the plunger to lower the car and ingots into the pit for casting, as in Figs. 1 and 3, or raise them to the surface to be run off on the track.

In order to divert the metal into the molds in casting, especially when two or more molds are employed, I make use of the usual runner-box, B, mounted by swinging bracket D on post D′. The box is provided with openings b in its bottom, through which the metal is directed into the molds below. If desired, this runner-box may be mounted on or carried by the plate n, so as to move with the molds. This casting-pit is located, by preference, in the plane of rotation of the converter—say at or near the end of the converter-pit. It may be located at either side, however, and therefore I do not wish to limit my invention to any particular position. In conveying the fluid metal from the converter to the molds, I make use of a conductor or spout, C, formed of outer metallic shell, c, and refractory lining c', with a trough or channel, c^2, extending between the closed ends, c^3, a discharge-hole, c^4, being provided in the bottom at or near the lower or discharge end. In length the conductor extends from the molds to and under the converter-mouth sufficiently far to catch the metal when the converter is tipped, as in Fig. 3, to pour it all out, and its depth is increased toward the delivery end, (see Figs 1 and 3,) so as to make provision for holding a body of metal in such discharge end, which may be accumulated by pouring from the converter faster than the metal flows through the hole c^4. In practice I prefer to accumulate a body of metal in this manner in order to secure steadiness and uniformity of discharge through the hole, and more especially to arrest the slag, flux, &c., flowing on the surface of the metal, by means of a dam or bridge, c^5, crossing the conductor a little above the bottom and between the ends of its passage or channel, (see Fig. 1,) thus holding the slag, &c., back, while the heavier, pure metal flows beneath. This accumulation is not, however, designed or permitted to prevent continuous and unbroken flow of metal direct from the converter to the molds, but simply to afford sufficient depth of metal in the conductor to secure the purposes stated.

In order to prevent chilling the metal in the conductor during its passage therethrough, heavy oak planks C′ are placed across its upper edge over the metal, as in Figs. 1, 3, and 4, which will not only exclude cold air to considerable extent, but will also take fire and burn more or less on their under surfaces, thus actively assisting in maintaining the required temperature. Heavy—say 3-inch—oak plank can be used in this way for several successive pourings before becoming destroyed. A conductor may be used, however, without such cover, and without the dam c^5, as illustrated in Fig. 2; but I prefer to employ these features of improvement for the reasons above stated. Also, the conductor may be made of uniform depth through its length, such depth being by preference sufficient to hold a body of metal in the discharge end, as and for the purposes above described; but on account of economy in construction and convenience in giving the conductor inclined position, as presently described, I prefer to increase the depth toward the discharge.

In order to hold the conductor in proper position and inclination for varying positions of the converter in pouring and different elevations of the molds in casting, it is mounted and supported by a bent shaft, i, or equivalent trunnions, extending laterally from points at or near the center, which are seated in journal-bearings i', formed in brace-bars i^2, extending up from either side of metal frame or bed I. This frame is supported on beams I′, which extend laterally from the plunger r of a hydraulic ram, R, which is seated in a pit, R′, formed at the side of the converter-pit. The purpose of setting this ram R and its pit to one side of the conductor, which it carries, is to avoid danger of injury from metal which might overflow in case of accident. By the movement of the ram-plunger the conductor may be raised and lowered bodily to any desired elevation, either before, after, or during the operation of pouring metal from the converter. This movement may be given entirely independent of the movement of the converter or the molds. The inclination of the conductor may be varied or adjusted by rocking or turning the shaft or trunnions i. This is effected by means of worm-gear s s', the wheel s being secured on the shaft i, and the worm s' being journaled in bearings on the supports i^2 and on an arm, i^3, extending upward from the bed-frame I. A crank-shaft, S, is also journaled on arms i^4, extending up from the frame I, and is geared by bevel-wheels s^2 s^2 with the worm-shaft, whereby rotation of the crank-shaft by hand or by any suitable application of power will give a slow movement to the shaft i and tip the ends of the conductor up or down, as may be desired.

If desired, the adjusting mechanism of the conductor may be locked by ratchets and pawls, or other suitable device, to hold the conductor in position when set; or temporary supports may be placed under either end, to prevent tipping under the weight of metal flowing into or through it. Ordinarily the resistance afforded by the worm to force applied to it through wheel s will be so great as to permit the conductor to be held steadily and firmly by the power employed to move it by rotating the worm. This power appliance may be substantially the same in construction and operation as that ordinarily employed for rotating the converter, though less power will

be required. By such means the conductor may be manipulated and held in any desired position within its range of adjustment with precision and certainty equal to that with which converters are manipulated. When the metal is all poured from the converter, the conductor may be lowered by the ram R sufficiently to permit the converter to turn to vertical position, mouth downward; or the end of the conductor under the converter may be dropped, as indicated by dotted lines, Fig. 3, by turning the shaft *i*.

The valve-controlling mechanism for the rams R N may be located at any desired distance for safety; also the controlling mechanism for driving the worm *s'*. By such-provision the workmen will be removed from danger to a considerable degree.

By adjusting the relative heights of the conductor C and molds E' through their respective rams, any desired inclination may be given to the conductor for any pouring position of the converter, so as to insure ready and continuous flow of metal from the converter to the molds at any desired rate, fast or slow. This I consider an important and valuable feature of combination, as it affords practically complete control of the metal, not only while it is in the converter, but also during its whole course of flow from the converter to the molds. If, for any cause, delay is encountered in pouring the metal, it will be held in the converter, where it will be prevented from chilling. By this provision a prolific source of loss connected with the use of ladles is obviated; also, by dispensing with the use of stoppers and all occasion for such use, another source of great danger and loss is obviated.

With the appliances in common use for tipping the converter, the metal can be poured therefrom in a uniform stream at any desired rate of flow; and by means of the improvements herein described the metal will be conveyed directly to the molds without interruption, and practically with little more risk and danger than have heretofore been expereinced in pouring from the converter into the ladle, so that all or the greater part of the trouble, labor, loss, and expense connected with holding the metal in the ladle, manipulating the stopper, and running the metal out of the ladle will be avoided or eliminated from the process of manufacture.

I am aware that conductors or spouts have been used to convey slag and metal from a stationary furnace to a cinder-car, and also to casting-molds; also, that spouts or conductors have been used in connection with ladles proper to transfer metal from a converter to molds; but in all such cases, so far as I am aware, interrupting the flow of metal by storing the same in the ladle has been a necessary and characteristic condition of such use, thereby adding to rather than taking from the dangers incident to the use of a ladle. In no case has provision been made for uninterrupted flow of metal from the converter to the molds. Neither has any such provision as herein contained been made for controlling the flow by adjusting the relative heights of the molds and conductor, together with the degree of inclination of the latter with relation to varying positions of the converter-mouth. In securing these new and useful results various modifications may be made in the details of construction, all of which, in so far as they may be equivalents of the construction shown in performing the several functions herein described, I consider as coming within my invention.

I claim herein as my invention—

1. In a Bessemer plant, the combination of a rotary converter, a casting-pit beneath the level of the converter-mouth in its pouring position, and a conductor or spout extending from the converter-mouth to the casting-pit for carrying the fluid metal poured from the converter in uninterrupted flow to the molds in the casting-pit, substantially as set forth.

2. A Bessemer plant having, in combination, a rotary converter, a casting-pit, a conductor for carrying the metal poured from the converter to the molds in the pit in an uninterrupted flow, and power lifting mechanism for raising and lowering the conductor to accommodate the different positions of the converter in pouring, substantially as set forth.

3. A Bessemer plant having, in combination, a rotary converter, a casting-pit, a conductor extending from beneath the converter-mouth in its pouring positions to the pit, for conveying metal poured from the converter in uninterrupted flow to the molds in the pit, and tipping mechanism for adjusting the inclination of the conductor between the converter and molds to varying positions of the converter-mouth in pouring, substantially as set forth.

4. A Bessemer plant having, in combination, a rotary converter, a casting-pit, a conductor for conveying the metal from the converter in uninterrupted flow direct to the molds in the pit, lifting mechanism for raising and lowering the conductor, and tipping mechanism for adjusting the inclination of the conductor, substantially as and for the purposes set forth.

5. A Bessemer plant having, in combination, a rotary converter, a casting-pit, a conductor for carrying metal poured from the converter to the molds in the pit, such conductor having an open inlet and outlet at its ends and an uninterrupted passage between the inlet and outlet, and a lifting-ram carrying the conductor, such ram being located in a pit at one side of the vertical plane of the conductor, substantially as and for the purposes set forth.

6. In a Bessemer plant, the combination of a rotary converter and a casting-pit, a conductor, C, leading from the converter to the pit, for conveying the metal without interruption of flow from the converter to the molds in the pit, pivoted supports *i i'*, frame I, ram

R, and laterally-extending beams I′, substantially as set forth.

7. In combination with the converter and casting-pit of a Bessemer plant, the conductor C, extending from the converter to the casting-pit, pivotal bearings *i i′*, worm-gearing *s s′*, and mechanism, substantially as described, for rotating the worm, and thereby adjusting the inclination of the conductor.

8. A Bessemer plant having, in combination, a rotary converter, a casting-pit beneath the level of the converter-mouth in pouring position, a ram within the pit for raising and lowering the molds therein, a conductor for conveying the metal poured from the converter to the molds in uninterrupted flow, and a ram for raising and lowering the conductor to accommodate the different positions of the converter and molds in pouring and casting, substantially as set forth.

9. A Bessemer plant having, in combination, a rotary converter, a casting-pit, a ram for raising and lowering the molds in the pit, a conductor for conveying the metal poured from the converter to the molds in uninterrupted flow, a ram for raising and lowering the conductor, and tipping mechanism for adjusting the inclination of the conductor to accommodate it to different positions of the converter in pouring and of the molds in casting, substantially as set forth.

10. A Bessemer plant having, in combination, a rotary converter, a casting-pit, a conductor for conveying metal poured from the converter to the pit in uninterrupted flow, and a runner-box for directing the metal from the conductor into the molds in the pit, substantially as set forth.

11. A Bessemer plant having, in combination, a rotary converter, a casting-pit with one or more molds therein beneath the level of the converter-mouth in its pouring position, a conductor for conveying the metal poured from the converter to the mold or molds, and a covering of wood over the conductor-passage, substantially as and for the purposes set forth.

12. In a Bessemer plant, the combination of a rotary converter, a casting-pit, and an inclined conductor for conveying the metal poured from the converter direct to the pit, such conductor having increased depth at its delivery end, with a covering of combustible material over the deeper part of the conductor, substantially as and for the purposes set forth.

13. In a Bessemer plant, the combination of a rotary converter, a casting-pit, an inclined conductor for conveying the metal poured from the converter in continuous flow to the pit, and a bridge or dam crossing the conductor-passage between the ends and above the bottom of such passage, substantially as and for the purposes set forth.

In testimony whereof I have hereunto set my hand.

WILLIAM HAINSWORTH.

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