

No. 729,540.

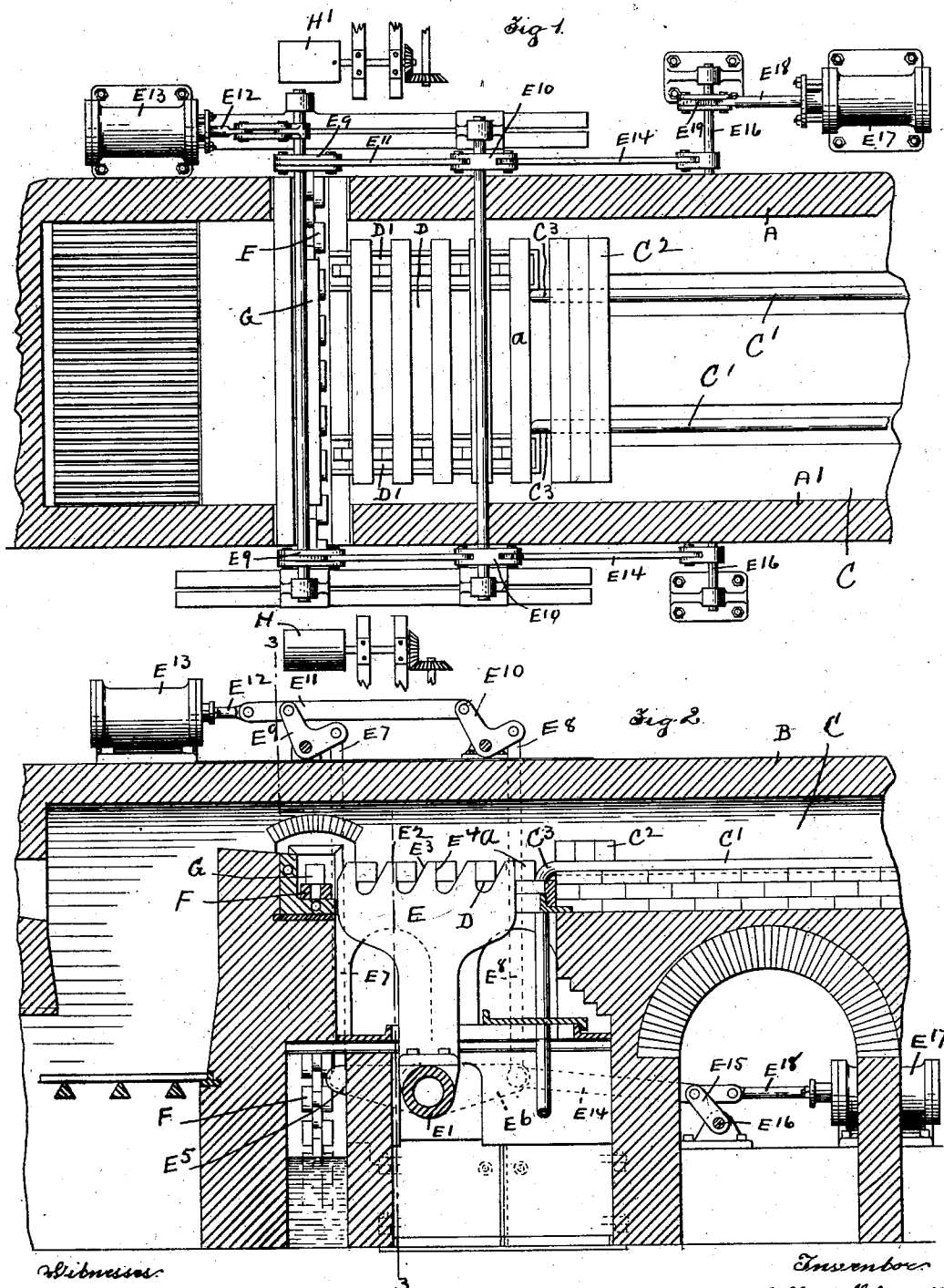
PATENTED JUNE 2, 1903.

E. H. CARROLL.
FURNACE.

APPLICATION FILED NOV. 25, 1901.

NO MODEL.

2 SHEETS—SHEET 1.



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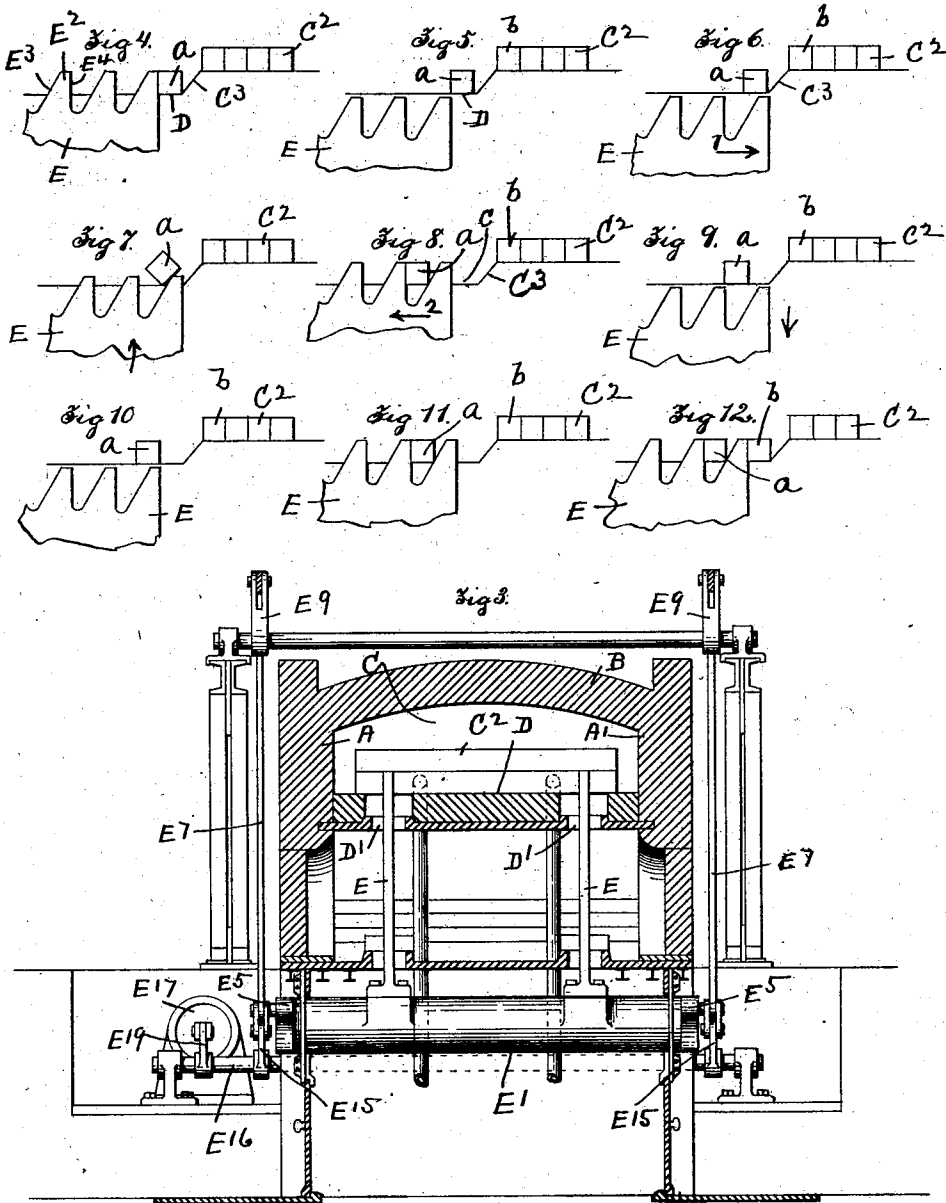
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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FURNACE.

SPECIFICATION forming part of Letters Patent No. 729,540, dated June 2, 1903.

Application filed November 25, 1901. Serial No. 83,670. (No model.)

To all whom it may concern:

Be it known that I, ELBERT H. CARROLL, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Furnaces, of which the following is a specification, accompanied by drawings forming part of the same, in which—

Figure 1 represents a plan view of a furnace embodying my invention and represented in sectional view by the removal of the roof portion in order to disclose the heating-chamber and the mechanism embodying my present invention. Fig. 2 is a central vertical longitudinal sectional view of that part of the furnace represented in Fig. 1. Fig. 3 is a transverse sectional view on line 3-3, Fig. 2; and Figs. 4 to 12, inclusive, are diagrammatic views illustrating the different positions of the billet lifting and turning mechanism and also illustrating its action upon the billets at different periods of its movement.

Similar reference-letters refer to similar parts in the different views.

My present invention relates to a furnace for heating billets; and it has for its object to provide means for the uniform heating of the different sides of the billet and for the better diffusion of heat through the mass of the billet, and I accomplish this result by providing means for successively turning each billet as it approaches the delivery-opening of the furnace in order to present the different sides of the billet to the action of heated gases and for maintaining open spaces between the billets as they approach the delivery-opening; and my invention consists in providing the furnace at its delivery end with means for separating the advance billet from a series of billets as they are pushed by a step-by-step motion through the heating-chamber of the furnace, successively turning the separated billet in order to present its different sides to the action of heat and moving the separated billet intermittently to the delivery end of the furnace, at the same time maintaining an open space between it and the next succeeding billet to permit the circulation around the billet of heated gases. In the following specification and accompanying drawings I have fully described a mechanism for this purpose and embodying my invention, the novel features having been set forth in the annexed claims.

Referring to the accompanying drawings, A A' denote the side walls, and B the roof, of a billet-heating furnace having a heating-chamber C, provided with a longitudinal track C', upon which a series of billets C² are fed from the receiving end to the delivery end of the heating-chamber by means of a reciprocating pushing mechanism in common use in furnaces of this class and not shown in the drawings, as its construction and operation will be well understood by all conversant with billet-heating furnaces. Near the delivery end of the heating-chamber the longitudinal track C' is bent downward, as at C³, and as the billets pass over the downwardly-turned section C³ of the track they fall upon a hearth or supporting-surface D. As the advancing billet in the series C² falls upon the supporting-surface D it occupies the position of the billet *a*, Figs. 2 and 4. The hearth D is provided with openings D' for a pair of vertical reciprocating lifting-plates E, supported at their lower ends by a transverse oscillating beam E' and provided at their upper ends with teeth E². The teeth E² are spaced to receive a billet between them, and the forward sides E³ of each of the teeth are inclined, while the rear sides E⁴ are vertical. The rocking bar E' is provided with arms E⁵ E⁶, connected by links E⁷ E⁸ with bell-cranks E⁹ E¹⁰. The bell-cranks E⁹ E¹⁰ are connected by a link E¹¹ with a reciprocating piston-rod E¹² of a steam or hydraulic cylinder E¹³, by which a rocking motion is imparted to the bell-cranks E⁹ E¹⁰, and a rising-and-falling movement to the lifting-plates E, by which the ends of the teeth E² are carried from a position above the hearth D, as shown in Fig. 4, to a position below the hearth D, as shown in Fig. 5, and vice versa. The arms E⁶ at the opposite ends of the rocking bar E' are connected by links E¹⁴ with arms E¹⁵, attached to a rocking shaft E¹⁶, which extends transversely across the furnace and is actuated by a hydraulic or steam cylinder E¹⁷, having its piston-rod E¹⁸ operatively connected with a radial arm E¹⁹ on the rocking shaft E¹⁶. The oscillating motion of the shaft E¹⁶ imparts a backward-and-forward movement in a horizontal

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zontal plane to the lifting-plates E. By means of the connected actuating mechanism as described the following motions are imparted to the lifting-plates E, as illustrated in the diagrammatical views, Figs. 4 to 12, inclusive: In the normal position of the lifting-plates E the teeth E^2 are raised above the supporting-hearth D and at a sufficient distance from the inclined section C^3 of the track to allow a billet to rest upon the hearth D in the position of the billet *a*, Fig. 4, and against the vertical side of the first tooth upon the lifting-plates E. At the first movement of the lifting-plates E they are carried vertically downward into the position shown in Fig. 5, with the ends of the teeth E^2 a short distance below the surface of the supporting-hearth D. The second movement imparted to the lifting-plates E moves them forward in the direction of the arrow 1, Fig. 6, in order to bring the first tooth beneath the edge of the billet *a*. The third movement raises the lifting-plates E, causing billet *a* to be turned over one-quarter turn, as shown in Fig. 7, the complete elevation of the lifting-plates E carrying them into the position shown in Fig. 8, with the billet *a* between the first two teeth of the lifting-plates and moved along a short distance from the inclined section C^3 of the track. The fourth movement depresses the lifting-plates into the position shown in Fig. 9. The fifth movement of the lifting-plates carries them back in the direction of the arrow 2 into a position with the first tooth beneath the edge of the billet *a*. The sixth movement carries the lifting-plates upward, turning the billet *a* one-quarter turn and holding it between the first and second teeth of the lifting-plates, as shown in Fig. 11, and leaving a space *c* between the vertical side of the first tooth and the inclined section C^3 of the track. A reciprocating motion is then given to the pushing mechanism in the usual and well-known manner, by which the whole series of billets are moved along and the advancing billet *b* pushed over into the space between the inclined section of the track and the upright side of the first tooth of the lifting-plates E. The successive movements of the lifting-plates E, as above described, are then repeated, and the operation is continued until all the spaces between the teeth E^2 of the lifting-plates are filled with billets, as shown in Figs. 1 and 2. At this point each successive cycle of movements will deliver a billet upon an endless conveyer-chain F, moving transversely across the furnace and driven by a suitable driving mechanism. (Not shown.) The lower section or loop of the chain F passes through a reservoir F' of water, by which the chain is cooled. The side walls of the furnace are provided with openings G G', through which the billet is delivered by an endwise movement from the conveyer-chain F upon conveyer-rolls H upon one side of the furnace, or by reversing the movement of the chain

upon conveyer-rolls H' upon the opposite side of the furnace.

The operation of my mechanism for turning and advancing the billets at the delivery end of the furnace is as follows: A series of billets C^2 is formed on the track C' in the usual manner, the admission of each succeeding billet causing the series to be advanced the thickness of a billet until the billets reach the inclined section C^3 of the track, when the advancing billet falls upon the hearth D and is stopped in proper position on the hearth by the vertical side of the first tooth E^2 of the lifting-plates E, as represented in diagrammatical view in Fig. 4. The lifting-plates are then lowered into the position shown in Fig. 5. They are next moved forward in the direction of the arrow 1 into the position shown in Fig. 6. From the position shown in Fig. 6 the lifting-plates E are raised into the position shown in Fig. 8, the vertical motion of the lifting-plates turning the billet *a* one-quarter turn, as illustrated in Fig. 7. The lifting-plates are then lowered into the position shown in Fig. 9 and are next moved back in the direction of the arrow 2 into the position shown in Fig. 10. The lifting-plates E are again raised into the position shown in Fig. 11 with the billet *a* inclosed in the first space between the teeth of the lifting-plates and with the lifting-plates in position to receive the next billet *b* in the series which is pushed upon the hearth D. The billets *a* and *b* then occupy the position shown in Fig. 12, with the lifting-plates in the raised position, the same as shown in Figs. 4 and 12, when the cycle of movements of the lifting-plates E is then repeated, moving the billets *a* and *b* along the space of one tooth and making room for the next succeeding billet of the series C^3 , and so on until all the spaces between the teeth of the lifting-plates are filled with billets, which are held apart by the teeth E^2 of the lifting-plates E, as shown in Fig. 2. Each cycle of movements of the lifting-plates will then cause the advancing billet to be delivered upon the conveyer-chain F, and a fresh billet will be received upon the hearth D against the teeth of the lifting-plates. In my improved apparatus each of the lifting-plates E is provided with five teeth E^2 , thereby causing the billets to be successively turned one-quarter turn by the vertical movement of each of the teeth E^2 and finally be delivered upon the rotating conveyer-chain F and delivered through one of the openings in the side walls of the furnace either upon the conveyer-roll H or H', according to the direction in which the conveyer-chain F is moving.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a billet-heating furnace the combination with a heating-chamber having a floor or hearth provided with an opening, of a billet-turning mechanism arranged to move vertically through said opening and engage the

billet as it rests upon said floor or hearth, substantially as described.

2. In a billet-heating furnace the combination with a heating-chamber and a longitudinal track for billets, of a hearth at a slightly-lower level than said track, said track having openings for a billet-turning mechanism, and a billet-turning mechanism operating through said openings, whereby each of the billets is turned as it passes over said hearth, substantially as described.

3. In a billet-heating furnace provided with openings in the floor or hearth of the heating-chamber, of a vertically-reciprocating turning mechanism operating through said opening to turn a billet on said floor or hearth, substantially as described.

4. The combination with the heating-chamber of a billet-heating furnace having an opening in the bottom of said chamber for the introduction of a billet-turning mechanism, of a billet-turning mechanism comprising a vertically-reciprocating plate having teeth by which the billets are engaged and turned, substantially as described.

5. In a billet-heating furnace the billet-turning mechanism consisting of a vertically-reciprocating plate arranged to strike the under side of a billet, and by a lifting movement turn the billet, substantially as described.

6. In a furnace for heating billets the billet-turning mechanism consisting of a vertically-reciprocating plate operating through an opening in the floor of the heating-chamber, said reciprocating plate having a series of teeth projecting above the floor of the furnace on the upward movement of said plate, whereby the billets are lifted by the ends of said teeth and turned, substantially as described.

7. In a furnace for heating billets, the combination with a heating-chamber having a billet-supporting surface provided with a downward step over which the billets are pushed in their movement through the heating-chamber, a toothed reciprocating plate, means for raising said plate to carry its teeth above the billet-supporting surface to form a

stop for a billet as it falls over said step, means for depressing said plate to carry its teeth below the billet-supporting surface, means for moving said plate beneath the billet, and means for raising the plate to strike the under side of the billet and turn the same, substantially as described.

8. In a billet-heating furnace provided with an opening in the billet-supporting surface for a billet-turning mechanism, a billet-turning mechanism consisting of a toothed plate capable of a rising and a falling movement and of a forward-and-backward movement transversely to a billet on the billet-supporting surface, and means for moving said toothed plate, substantially as described.

9. The combination with the heating-chamber of a billet-heating furnace of a vertically-reciprocating billet-turning plate provided with a series of wedge-shaped teeth, whereby each billet is advanced along the billet-supporting surface by the upward movement of said plate, substantially as described.

10. In a billet-heating furnace, the combination with the heating-chamber, of a billet-supporting surface, a reciprocating toothed plate having wedge-shaped teeth and located beneath said billet-supporting surface, means for imparting to said plate rising-and-falling and forward-and-backward movements, whereby said teeth are made to turn and advance the billets, substantially as described.

11. In a billet-heating furnace the combination with a billet-supporting surface upon which the billets are moved from the admission to the delivery end of the furnace, of a conveyer by which the billets are moved transversely to the furnace and in alinement with a delivery-opening, a vertically-reciprocating mechanism by which the billets are successively moved from said billet-supporting surface upon said conveyer, and means for actuating said reciprocating mechanism, substantially as described.

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Witnesses:

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