

No. 608,264.

Patented Aug. 2, 1898.

E. NORTON.
HEATING FURNACE.

(Application filed Sept. 30, 1897.)

(No Model.)

2 Sheets—Sheet 1.

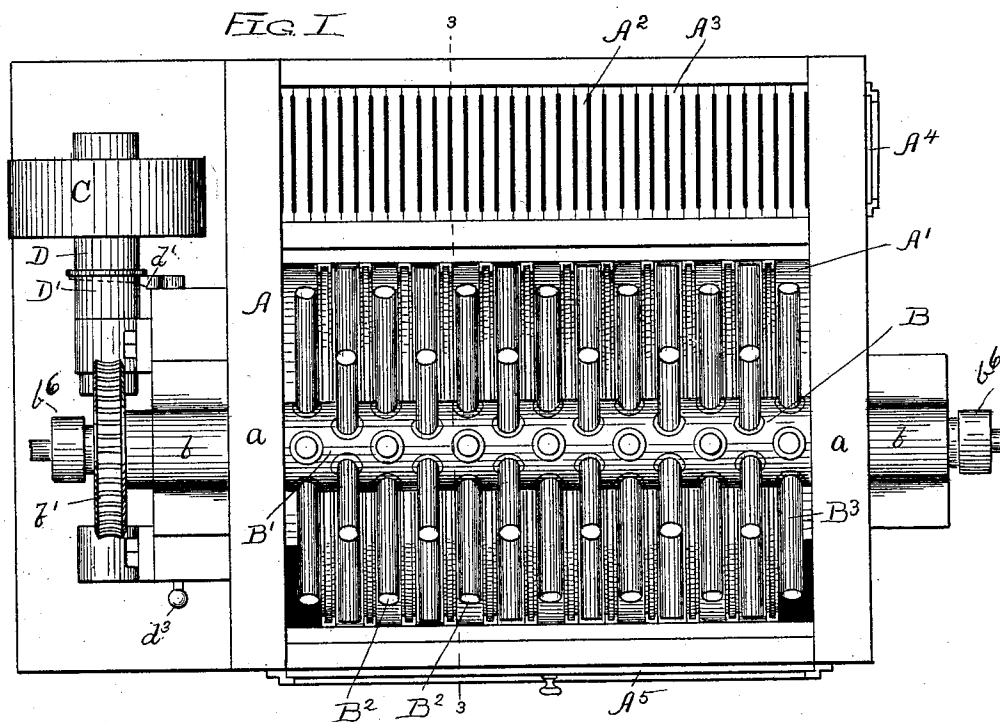
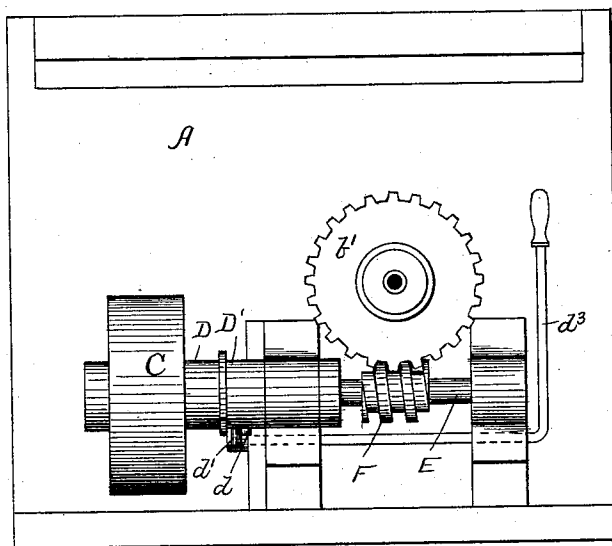


FIG. 2



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E. NORTON.
HEATING FURNACE.

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2 Sheets—Sheet 2.

FIG. 3.

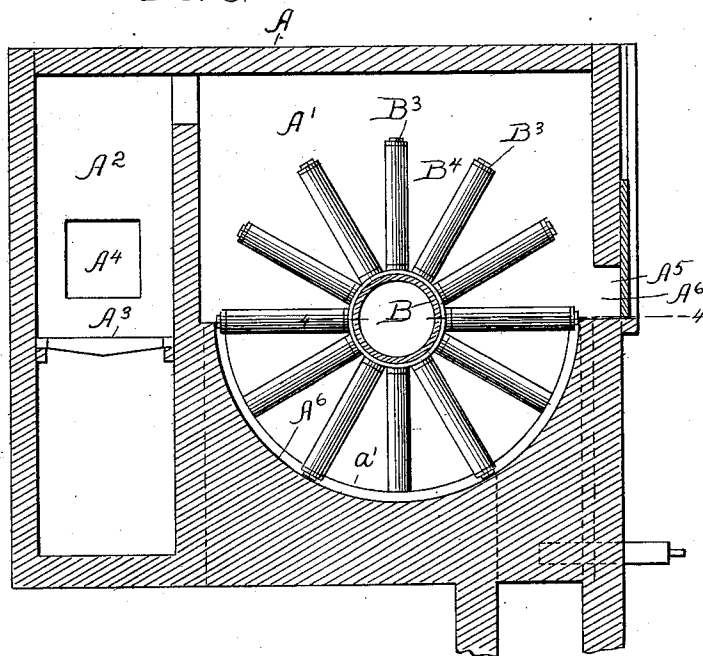


FIG. 4.

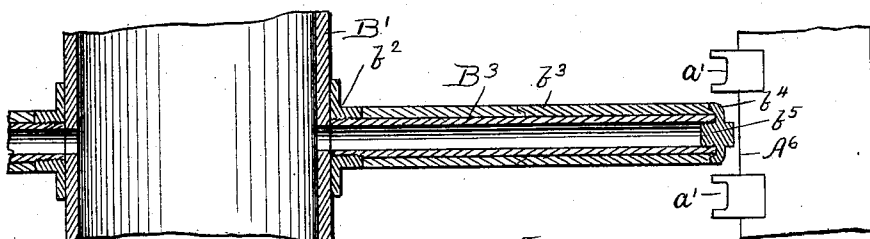


FIG. 5.

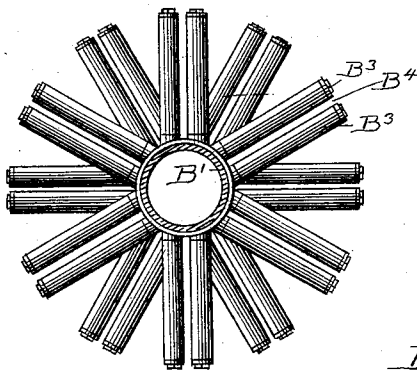


Fig. 6.

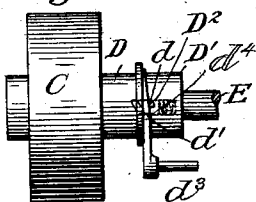
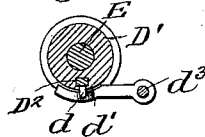


Fig. 7.



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UNITED STATES PATENT OFFICE.

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HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 608,264, dated August 2, 1898.

Application filed September 30, 1897. Serial No. 653,607. (No model.)

To all whom it may concern:

Be it known that I, EDWIN NORTON, a citizen of the United States, residing in Maywood, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Heating-Furnaces, of which the following is a specification.

My invention relates to improvements in furnaces for heating sheets and bars of steel or other metal preparatory to rolling the same into thin sheets for tin-plate or other purposes.

The object of my invention is to provide a furnace of an efficient, simple, and durable construction by means of which such sheets or bars may be cheaply, rapidly, and uniformly heated, so that when delivered from the furnace to the rolling-mill certainty and uniformity of action may be secured and danger of breaking the rolls or injuring the mill prevented.

My invention consists in the means I employ to accomplish this result—that is to say, it consists, essentially, in the combination, with the heating-chamber of the furnace, of a rotary rack comprising a central shaft and a series of radial arms projecting therefrom and upon which the sheets to be heated are placed in the radial spaces or receptacles between the different sets or rows of radial arms and by which the sheets or bars are carried successively to different positions in the furnace as the rack is turned to bring each successive set of arms into position opposite the furnace-door for removing the heated sheets or bars and putting in fresh ones. The bottom of the furnace is semicylindrical and supports the sheets or bars in the lower half of the rack in position between the radial arms as the rack revolves. The rotation of the rack in the furnace-chamber keeps the sheets or bars in a series of separated radial planes or positions with open spaces between, thus securing efficient and economical heating action, and as the rack rotates each radial set of arms brings its load of sheets or bars successively into all the different positions, thus giving a uniform heating action upon each and every batch or charge of sheets or bars put in one after another as each set of radial arms is brought

opposite to the door of the furnace. The radial sheet or bar holder or rack is preferably rotated by a power-driven shaft or pulley, which is momentarily clutched at intervals to a shaft geared to the shaft of the rack, so as to give the necessary step-by-step movement to the rack, the clutch automatically disengaging as soon as the movement is completed.

In the accompanying drawings, forming a part of this specification, and in which similar letters of reference indicate like parts throughout the views, Figure 1 is a plan view of a sheet or softening furnace embodying my invention, the top or cover portion of the furnace being removed. Fig. 2 is an end elevation. Fig. 3 is a vertical section on the line 3 3 of Fig. 1. Fig. 4 is an enlarged detail transverse sectional view of the rotary rack or sheet-holder; and Fig. 5 is an end view showing the modified form of rack employed when the furnace is used for heating bars which are thicker, but much smaller in width and length, than the sheets. Fig. 6 is a detail view of the clutch, and Fig. 7 is a section on line 7 7 of Fig. 6.

In the drawings, A represents the furnace, the same being of any suitable or well-known construction of sheet or softening furnace or bar-furnace.

A' is the heating-chamber of the furnace; A², its fire-chamber; A³, the grate; A⁴, the door through which fuel is put into the fire-chamber above the grate, and A⁵ the door or opening through which the sheets or bars are put in and taken out of the heating-chamber of the furnace.

B is a rotary rack or holder for receiving and holding the sheets or bars in the heating-chamber of the furnace and moving or conveying them successively into different positions therein, so that they may be economically and properly and uniformly heated or softened with regularity and certainty, and by which the heated sheets or bars are finally returned into position opposite the heating-chamber door, so that they may be conveniently removed from the furnace. This rotary rack or holder for the sheets or bars consists, preferably, of a shaft B', provided with a series of sets or rows B² of radial arms B³,

forming a series of radial spaces or receptacles B^1 for the sheets or bars between the several rows or sets of radial arms, the arms separating the sheets or bars in one receptacle from those in another, thus leaving free open radial spaces between the several receptacles and the sheets or bars therein to enable the flame and heat to efficiently and properly act. The shaft B' extends through the two end walls $a a$ of the furnace and is journaled in suitable bearings b outside the furnace, and it is given a step-by-step rotary movement to bring each successive set or row B^2 of radial arms B^3 in turn in line with the feed door or opening A^5 by means of a power-driven shaft or pulley C , which is adapted to be connected by a clutch $D D'$ with a shaft E , which is provided with a worm F , that meshes with a worm-gear b' on the shaft B' . The member D' of the clutch, which is carried by the shaft E , is provided with a slide D^2 , actuated by a spring d' , and which engages the notch d^2 of the member D , said slide D^2 being provided with a pin or projection d , which is engaged by a cam or shoe d' , which is connected to the clutch-operating lever or rock-shaft d^3 . One revolution of the worm-shaft E turns the rack B the radial space or distance between the successive sets or rows of radial arms B^3 on the rack, and as the clutch mechanism permits the shaft E to make but one turn each time the clutch-lever is operated each set or row of arms B^3 is thus successively brought into position opposite the door A^5 , so the heated sheets or bars may be removed therefrom and fresh ones put in place thereon. Each and every load or charge of sheets or bars successively put into the furnace thus undergoes the same precise operation and receives the same precise treatment or heating action and are therefore each and all heated with great uniformity and regularity, thus removing all danger of breaking the rolls or doing other injury to the rolling-mill in the rolling operation, which heretofore has been a great difficulty in tin-plate-rolling mills.

The mechanism above described and shown in the drawings is that which I prefer to use for giving the necessary step-by-step movement to the rotary rack or holder B ; but my invention is not limited to any particular mechanism for performing this function or operation.

The heating-chamber A' of the furnace is provided with a curved bottom A^6 , preferably composed of curved or semicircular iron ribs a' , set at intervals and filled in between with fire-brick or refractory material a^2 . This curved bottom or its ribs a' serve to hold the sheets or bars in the lower half of the rotary rack in position between the radial arms as the rack revolves.

The shaft B' and its radial arms B^3 may, if desired, be made hollow, so that air or water may circulate through the shaft and into the arms to increase their durability or protect them from the heat. If it is desired to have

water circulate through the shaft, its ends will be connected by stuffing-boxes b^6 with water supply and outlet pipes. The radial arms B^3 are preferably secured to the shaft by screw-threaded flanged bosses b^2 , and the arms are also preferably surrounded by protecting tubes or coverings b^5 , of refractory or non-heat-conducting material, held in place by flanges b^4 on the caps or plugs b^5 , fixed on the ends of the arm B^3 .

Where my furnace is used for a sheet or softening furnace, the length of the rack or holder B should be somewhat greater than that of the sheets or packs of sheets to be heated or softened and the length of the radial arms somewhat greater than the width of the sheets, and when my furnace is used as a bar-furnace the rack or holder may preferably be of substantially the same dimensions; but in this case I prefer to provide the rack or holder with double rows or sets of radial arms set parallel to each other, as illustrated in Fig. 5, so that two or more of the narrow bars may be placed edgewise against each other in each radial space or receptacle B^1 and also two or more end to end lengthwise in each radial space or receptacle. The double rows of radial arms will thus serve to hold all the bars properly in place edge to edge on top of each other as the rack or holder revolves. This same double-row arrangement of the radial arms may also be used when the furnace is employed for heating or softening the sheets; but owing to the larger size of the sheets it is not necessary with the sheets.

A sliding door A^6 closes the feed-opening A^5 , through which the sheets or bars are put in or taken out.

By my invention I am not only enabled to produce the important result of heating the sheets or bars with regularity and certainty to a uniform heat, but it also results in a great saving of fuel, as the heating action is more effectually applied and distributed, and it also effects a very great saving in labor, as it entirely dispenses with the necessity of moving the bars or sheets about in the furnace by hand, as heretofore has been the practice.

I claim—

1. In a sheet or bar heating furnace, the combination with the heating-chamber of a rotary rack having a horizontal shaft and rotating vertically in said chamber and provided with a series of rigid radial receptacles for receiving and holding the sheets or bars and conveying them in a complete circuit about the axis of said rotary rack and thus causing them to receive the heating action of the furnace in different radial planes and first with one side and edge uppermost and then with the other side and edge uppermost, and means for keeping the sheets or bars in position in said radial receptacles while being conveyed through the lower half-circle of their orbit, substantially as specified.

2. In a sheet or bar heating furnace, the combination with the heating-chamber of the

furnace provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary rack or holder in said chamber for receiving and holding the sheets or bars and conveying them in a complete circuit about the axis of said rotary rack from said door back again to the same and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one of their edges uppermost and part of the time with their opposite edges uppermost, and comprising a horizontal shaft provided with a series of sets or rows of radial arms projecting therefrom and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

3. In a sheet or bar heating furnace, the combination with the heating-chamber of the furnace, of a rotary rack or holder in said chamber for receiving and holding the sheets or bars, and comprising a shaft provided with a series of sets or rows of radial arms projecting therefrom, said heating-chamber having a curved bottom to hold or keep the sheets or bars in position between the sets or rows of radial arms, substantially as specified.

4. In a sheet or bar heating furnace, the combination with the heating-chamber of the furnace provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary rack or holder in said chamber for receiving and holding the sheets or bars and conveying them in a complete circuit about the axis of said rotary rack from said door back again to the same and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one of their edges uppermost and part of the time with their opposite edges uppermost, and comprising a horizontal shaft provided with a series of sets or rows of radial arms projecting therefrom, and mechanism for imparting a step-by-step rotary movement to said shaft and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

5. In a sheet or bar heating furnace, the combination with the heating-chamber of the furnace provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary rack or holder in said chamber for receiving and holding the sheets or bars and conveying them in a complete circuit about the axis of said rotary rack from said door back again to the same and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one of their edges uppermost and part of the time with their opposite edges uppermost, and comprising a horizontal shaft provided with a series of sets or rows of radial arms projecting therefrom, and mechanism for imparting a step-by-step

movement to said shaft, said mechanism comprising a worm-gear, worm and a clutch provided with devices for automatically disengaging its members and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

6. In a sheet or bar heating furnace, the combination with the heating-chamber of the furnace, of a rotary rack or holder in said chamber for receiving and holding the sheets or bars, and comprising a shaft provided with a series of sets or rows of radial arms projecting therefrom, said heating-chamber having a curved bottom to hold or keep the sheets or bars in position between the sets or rows of radial arms, and mechanism for imparting a step-by-step rotary movement to said shaft, substantially as specified.

7. In a sheet or bar heating furnace, the combination with the heating-chamber of the furnace provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary rack or holder in said chamber for receiving and holding the sheets or bars and conveying them in a complete circuit about the axis of said rotary rack from said door back again to the same and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one of their edges uppermost and part of the time with their opposite edges uppermost, and comprising a horizontal shaft provided with a series of sets or rows of radial arms projecting therefrom, said shaft and radial arms being hollow and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

8. In a sheet or bar heating furnace, the combination with the heating-chamber of the furnace provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary rack or holder in said chamber for receiving and holding the sheets or bars and conveying them in a complete circuit about the axis of said rotary rack from said door back again to the same and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one of their edges uppermost and part of the time with their opposite edges uppermost, and comprising a horizontal shaft provided with a series of sets or rows of radial arms projecting therefrom, said radial arms having covering-tubes of refractory or non-heat-conducting material and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

9. The combination with the heating-chamber of a furnace provided with a door-opening through which sheets or bars may be removed from or delivered into said chamber,

of a rotary sheet or bar holder or rack mounted in said chamber and provided with a series of radial receptacles for sheets or bars and conveying them in a complete circuit about the axis of said rotary rack from said door back again to the same and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one of their edges uppermost and part of the time with their opposite edges uppermost and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

10. The combination with the heating-chamber of a furnace provided with a door-opening through which sheets or bars may be removed from or delivered into said chamber, of a rotary sheet or bar holder or rack mounted in said chamber and rotating in a vertical plane on a horizontal shaft and provided with a series of radial receptacles for sheets or bars and conveying them in a complete circuit about the axis of said rotary rack from said door back again to the same and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one of their edges uppermost and part of the time with their opposite edges uppermost, and mechanism for turning said rotary rack or holder to bring each of said radial receptacles opposite said door or opening, to permit the heated sheets or bars to be removed from the rack or holder and fresh ones put in and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

11. The combination with a furnace heating-chamber provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary rack or holder mounted therein and comprising a horizontal shaft and a series of double sets or rows of radial arms, for receiving holding and conveying sheets or bars in a complete circuit about the axis of said rotary rack and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one edge uppermost and part of the time with the opposite edge uppermost and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

12. The combination with a furnace heating-chamber, of a rotary rack or holder mounted therein and comprising a shaft and a series of double sets or rows of radial arms, said chamber having curved ribs in its bottom to hold or keep the sheets or bars in position between the sets or rows of radial arms, substantially as specified.

13. The combination with a furnace heating-chamber provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary rack or holder mounted therein, and comprising a hollow horizontal shaft, and a series of hollow radial arms projecting therefrom in a series of rows arranged in different radial planes for receiving holding and conveying sheets or bars in a complete circuit about the axis of said rotary rack and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one edge uppermost and part of the time with the opposite edge uppermost, and said shaft being provided with stuffing-boxes to connect the same with water-supply pipes and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

14. The combination with a furnace heating-chamber provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary rack or holder mounted therein, and comprising a hollow horizontal shaft, and a series of hollow radial arms projecting therefrom in a series of rows arranged in different radial planes for receiving holding and conveying sheets or bars in a complete circuit about the axis of said rotary rack and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one edge uppermost and part of the time with the opposite edge uppermost, and said shaft being provided with stuffing-boxes to connect the same with water-supply pipes, and tubes or coverings of refractory material surrounding said radial arms and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

15. The combination with a furnace heating-chamber provided with a door at one side for putting the sheets or bars in and taking them out, of a rotary bed for holding the sheets and conveying them in a complete circuit about the axis of said rotary rack from said door back again to the same and thus cause them to receive the heating action of the furnace in different radial planes and part of the time with one of their edges uppermost and part of the time with their opposite edges uppermost, having a hollow horizontal shaft connected with a water-supply pipe and means for keeping the sheets or bars in position in said rotary rack while being conveyed through the lower half of their circular orbit, substantially as specified.

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Witnesses:

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