Jan. 13, 1931. W. ISAACS ET AL 1,788,796

PAIR FURNACE

Filed Oct. 11, 1928

Fig. 1.

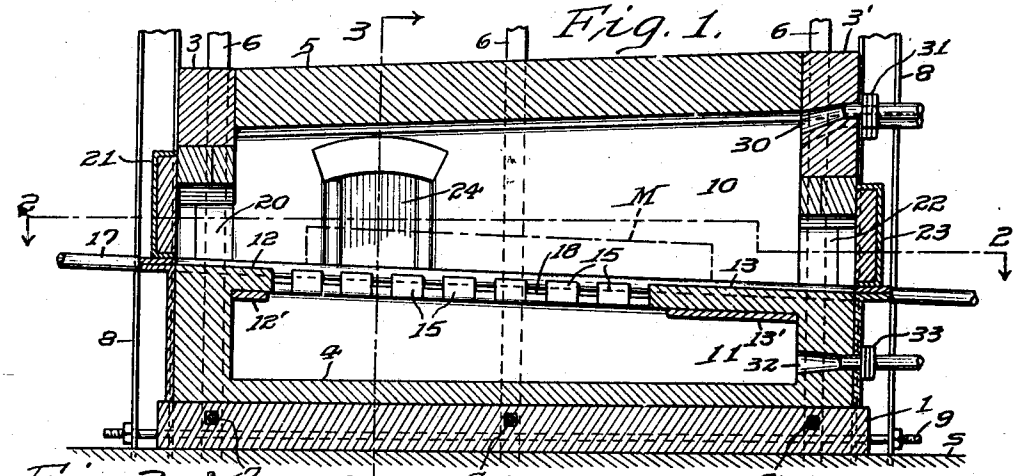


Fig. 2.

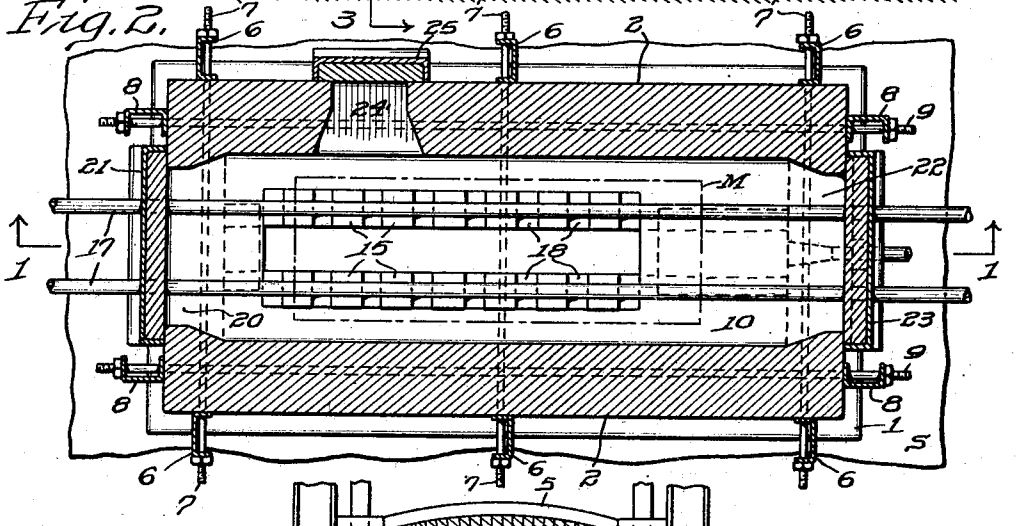
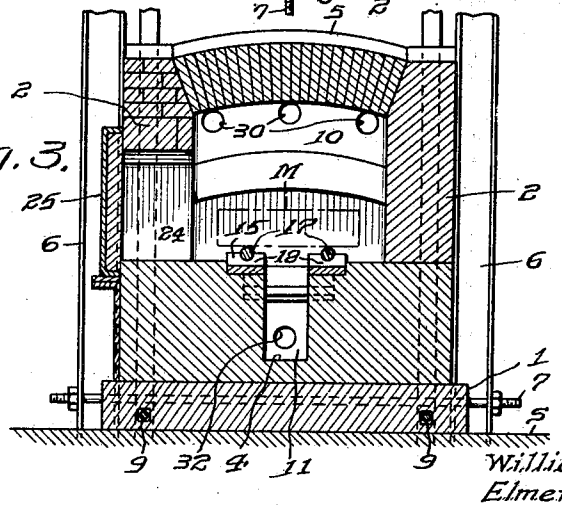


Fig. 3.



WITNESS

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UNITED STATES PATENT OFFICE

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PAIR FURNACE

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Our invention relates to furnaces more especially intended for heating that class of material known in steel mill practice as "pairs", preparatory to subjection of the material to subsequent treatment in a rolling mill, a principal object of our invention being to provide a furnace of novel construction whereby more uniform heating of the material can be secured than in the types of furnaces heretofore employed with the result that the percentage of rejections due to improper heating is reduced, the subsequent rolling operations facilitated and the liability of roll breakage decreased.

Other advantages resulting from the use of a furnace constructed in accordance with our invention reside in improved workability of the heated material in the subsequent operations to which it may be subjected and material reduction in the amount of scale produced on the material while being heated, and frequently entire elimination of the production of any scale at all, because of the absence of drafts within the furnace.

Our improved furnace is also advantageous because of the exactitude of heat control which can be effected through suitable regulation of the burners, because of the reduction in fuel consumption through elimination of stack draft and because of decrease in cost of initial installation through avoidance of the cost of the usual stack.

Moreover, in the operation of the furnace any suitable fuel gas may be employed and conveniently regulated in any desirable way so as to produce the exact heating effects required.

Our invention further includes other objects, advantages and novel features of construction and arrangement hereinafter more particularly referred to or which will be apparent from the following description of a furnace constructed in accordance with one embodiment of our invention and illustrated in the accompanying drawing in which Fig. 1 is a vertical section through the furnace on line 1—1 in Fig. 2; Fig. 2 is a horizontal section through the furnace on line 2—2 in Fig. 1 and Fig. 3 a transverse vertical section through the furnace on line 3—3 in said figure, the direction in which the several sections are taken being indicated by the arrows upon the section lines and the same symbols being utilized to designate the same parts in the several figures.

As shown, the furnace comprises a base 1 of concrete disposed on a supporting surface S and in turn serving to support the brick walls of the furnace. These comprise longitudinally extending, transversely spaced side walls 2—2 and transversely extending, longitudinally spaced end walls 3, 3′ connecting the adjacent ends of the side walls. The furnace may also be provided with a bottom 4 below the side walls and with a roof 5 extending between the side and end walls and desirably slightly transversely arched. The side walls of the furnace are supported by suitable buckstays 6 tied together by rods 7 and the end walls similarly supported by end buckstays 8 tied together by rods 9 while the roof 5 is preferably upwardly inclined from the front end wall 3 to the rear end wall 3′ as best shown in Fig. 1.

The furnace is divided into upper and lower heat chambers generally designated as 10 and 11 respectively; the upper chamber preferably extends for the full distance between the inner adjacent faces of the side walls while the lower heat chamber 11 is of considerably less width and disposed symmetrically with respect to the longitudinal center line of the furnace; it may thus be considered as in the nature of a longitudinally extending slot in the relatively thick furnace bottom 4 as best shown in Fig. 3. Near the front end of the furnace the lower chamber is bridged over by a relatively short bridge wall 12 extending inwardly from the front end wall 3 while in like manner at its rear end, the lower chamber is similarly bridged but preferably by a somewhat longer bridge wall 13 extended inwardly from the rear end wall 3′, plates of steel respectively designated as 12′, 13′ being desirably disposed beneath the bridge walls to afford them suitable support. Thus, between the inner adjacent end of the bridge walls the upper and lower heat chambers are in free communication with each other and adjacent this inter-

val or opening on each side of the lower chamber and extending for a short distance into the upper chamber are disposed a plurality of longitudinally spaced skid blocks 15 conveniently seated in longitudinal recesses in the corners formed at the intersections of the floor of the upper chamber and side walls of the lower, these blocks being desirably grooved out on their upper faces so that each longitudinally aligned series of blocks will serve as supports for one of the superjacent, preferably cylindrical skids 17 which extend entirely through the furnace and project for any suitable distance from its opposite ends, these skids serving to support the material, generally designated as M, during its passage through the furnace. The bridge walls 12 and 13 may also be suitably grooved for the reception of the skids which are preferably downwardly inclined from the front end toward the rear end of the furnace to facilitate the passage of the material therethrough and are thus oppositely inclined to the roof 5. It will thus be apparent that between each adjacent pair of skid blocks an opening 18 is provided through which free circulation of gases can take place between the upper and lower chambers or vice versa beneath the skids while, additionally, as the upper end of the lower chamber is open between the adjacent ends of the bridge walls, the heat from said chamber can directly impinge on the under surface of the material supported on the superjacent skids.

The front wall 3 of the furnace is provided with a door opening 20 closed by a removable door 21 and the rear end wall similarly provided with a door opening 22 closed by a removable door 23 so that by opening the door 21 material can be pushed into the furnace through the adjacent door opening and along the inclined skids and, after it is heated, may be removed with equal facility through the door opening in the rear wall when door 23 is open. Another door opening 24 closed by an auxiliary door 25 may be provided in one of the side walls to permit convenient access to the interior of the furnace for cleaning or repairs.

Gases for heating the furnace are introduced into the upper chamber from a plurality of ports 30 connected with burners 31 and arranged in the end wall 3′ just below the roof 5, and to the lower chamber through a port 32 near the base of the end wall 3′ and connected with a burner 33. Desirably a plurality of the upper burners may be utilized, three being indicated in the drawing, so as to effectively distribute the heat throughout the realtively wide upper chamber although but a single burner is ordinarily sufficient for heating the lower chamber because of its relatively restricted capacity. The burners may be of any suitable type adapted to handle the particular kind of gas which is to be burned and their specific construction therefore forms no part of the present invention, but of course suitable means are provided for regulating the flow of air and gases through the burners and consequent volume of heat delivered thereby, so that a substantially exact control of the heating effect in both the upper and lower heat chambers may be obtained.

The manner of operating a furnace constructed substantially as described will be apparent from the foregoing without extended explanation as it will be obvious that the material to be heated is simply pushed into the furnace through the front door and along the skids until it either rests between the adjacent inner ends of the bridge walls or overlaps one or both of them for a short distance. The doors are now closed and the heating gases projected into both chambers of the furnace with the result that the material is subjected to substantially uniform heating throughout as the gases are free to circulate around it in substantially all directions. The material having been heated to the desired degree the gases may be shut off and the material then removed from the furnace through the rear door by pushing it along the skids with a bar inserted through the front door or in any other convenient way and then subjected to further treatment such as rolling or the like. Because of the absence of drafts through the furnace but little or no scale is formed on the material during the heating operation so that the inimical effect of scale formation in subsequent work on the material is avoided while, as stated, because of the uniformity with which the material is heated, the subsequent rolling or other operations are facilitated and the breaking of the rolls or other damage to the rolling mills which frequently occurs during the passage therethrough of non-uniformly heated material is avoided.

Furnaces constructed in accordance with our invention are less expensive to install than the ordinary types of furnace for heating similar materials because of the elimination of the cost of the usual stack, are of relatively long life and readily lend themselves to minor repairs when necessary so that our invention, apart from its other advantages, provides a furnace of commercially practical form well adapted for use and maintenance under conditions to which furnaces for heating this class of material are ordinarily subjected. In practice our improved pair furnaces may be, and in fact usually are, associated with one or more "sheet furnaces" of suitable form as will be readily understood by those familiar with the art.

While we have herein illustrated and described with considerable particularity one form of pair furnace embodying the principles of our invention, we do not thereby de-

sire or intend to limit or confine ourselves thereto, as changes and modifications may be made in minor particulars and/or structural details without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described our invention, we claim and desire to protect by Letters Patent of the United States:

1. A furnace of the class described, comprising transversely spaced longitudinally extending side walls, longitudinally spaced transversely extending end walls and a roof extending between said walls and inclined toward the front end of the furnace and provided with an operatively closed upper heat chamber extending between the side and end walls and beneath the roof and with a similarly closed lower heat chamber disposed beneath and of less width than the upper chamber and communicating therewith for a portion of its length, means for directing a gaseous heating medium into the upper chamber through one wall thereof adjacent the roof, means for directing a similar medium into the lower chamber through said wall, spaced skids adapted to support material to be heated extending longitudinally through the furnace and disposed in the upper chamber on opposite sides of the lower chamber, means for suporting the skids comprising a plurality of longitudinally spaced blocks disposed beneath the central portions of the skids and forming between them a plurality of passages for the free circulation of gases from one chamber to the other adjacent said central portions of the skids, and means adjacent the end walls of the furnace for preventing such circulation.

2. A furnace of the class described, comprising transversely spaced longitudinally extending side walls, longitudinally spaced transversely extending end walls and a roof extending between said walls and inclined toward the front end of the furnace, said furnace having an upper heat chamber extending between the side and end walls and beneath the roof and with a lower heat chamber disposed beneath and of less width than the upper chamber and communicating therewith for a portion of its length, means for directing a gaseous heating medium into the upper chamber through one wall thereof adjacent the roof, means for directing a similar medium into the lower chamber through said wall, spaced skids adapted to support material to be heated extending longitudinally through the furnace and disposed in the upper chamber on opposite sides of the lower chamber, means for supporting the skids comprising a plurality of longitudinally spaced blocks disposed adjacent the juncture of the two chambers and a bridge wall separating the upper and lower chambers adjacent each end wall of the furnace.

3. A furnace of the class described, having longitudinally extending transversely spaced side walls, longitudinally spaced transversely extending front and rear walls and a roof extending between all of said walls, and comprising an upper heat chamber and a lower heat chamber of less width than the upper chamber and centrally disposed therebelow, bridge walls extending between the upper and lower chambers adjacent the front and rear walls of the furnace but longitudinally spaced apart at their inner extremities to afford communication between said chambers, means for directing a gaseous heating medium into the upper chamber through a wall of the furnace, means for directing a similar medium into the lower chamber through said wall, longitudinally disposed skids extending through the furnace and downwardly inclined from the front to the rear wall thereof and arranged on opposite sides of the lower chamber and within the upper chamber, and a series of longitudinally spaced blocks adapted to support said skids between said bridge walls whereby a plurality of openings are provided between the blocks to facilitate the circulation of the gases between the chambers and about the material to be heated when resting on the skids.

In witness whereof we have hereunto set our hands this 9th day of October, 1928.

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ELMER E. McVEY.