J. J. LICHTER.

HEAT TREATING APPARATUS.

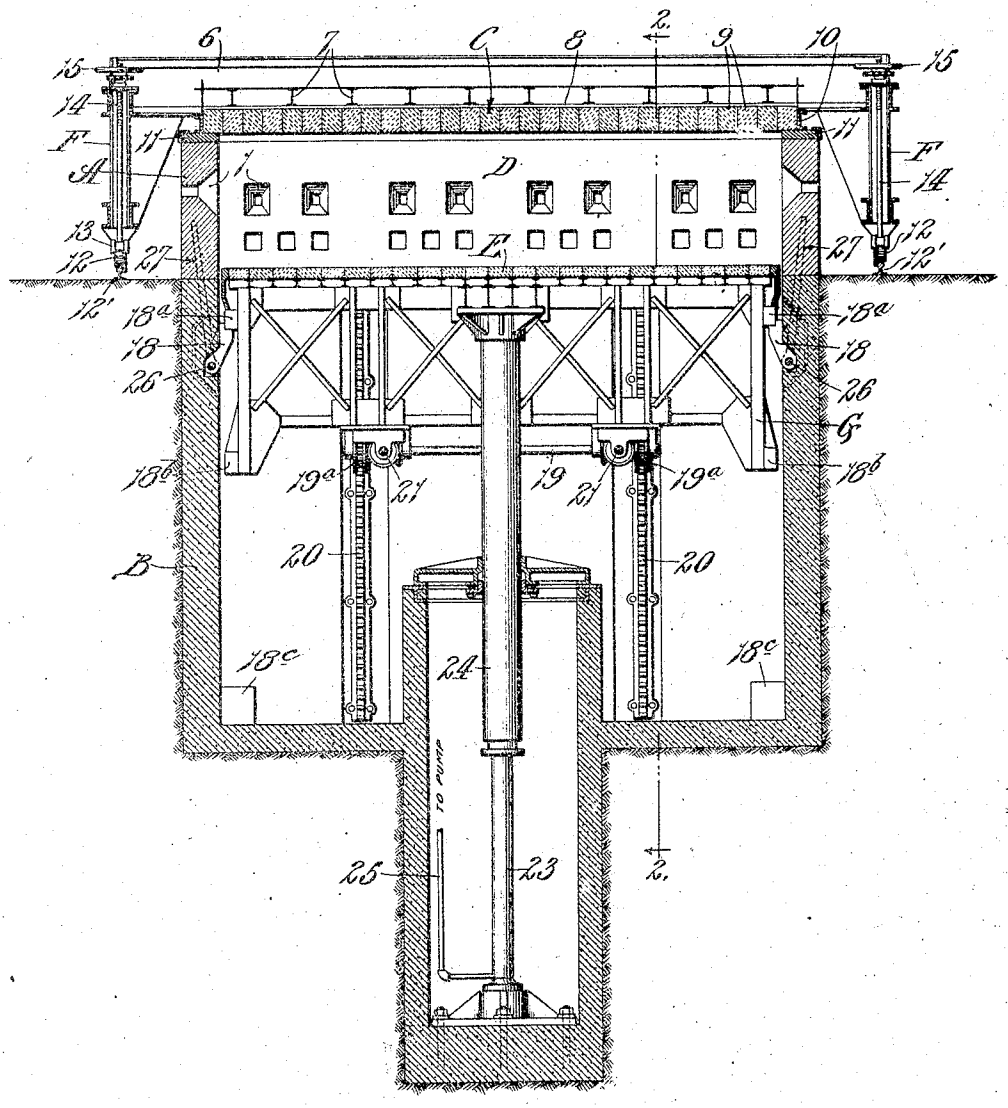
APPLICATION FILED SEPT. 13, 1915.

1,173,590.

Patented Feb. 29, 1916.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

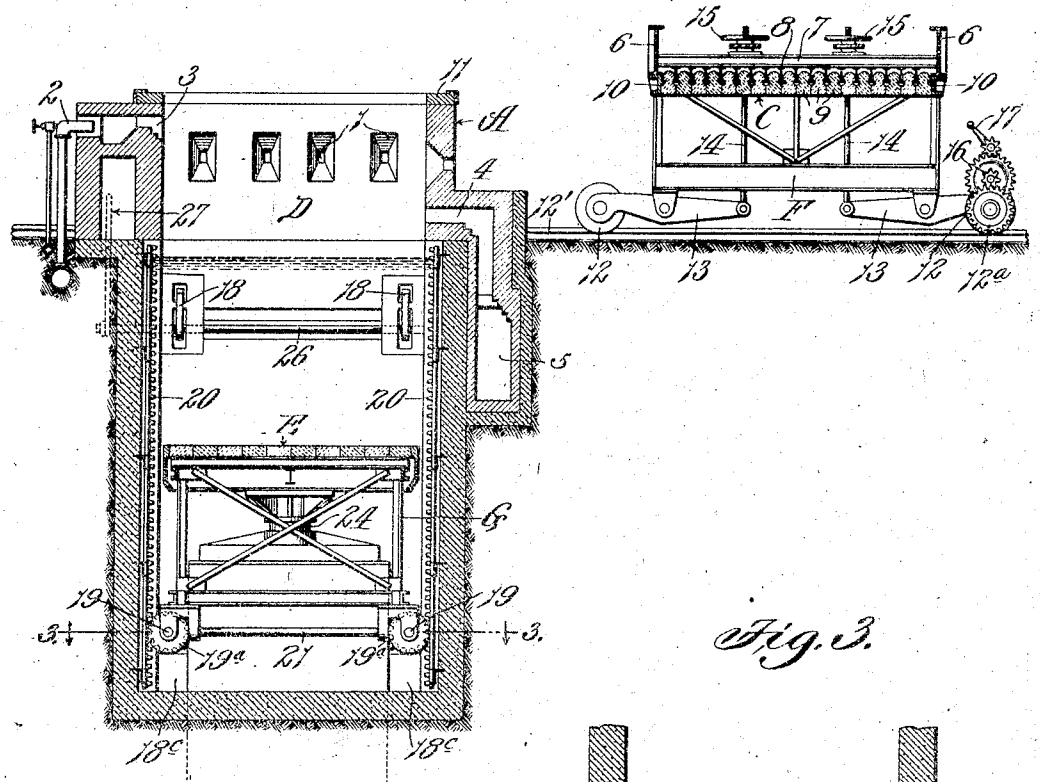
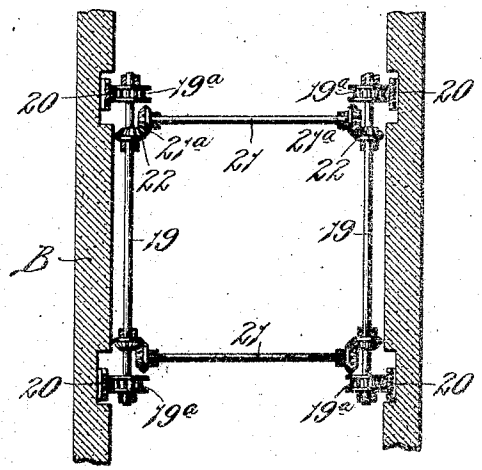


Fig. 3.



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UNITED STATES PATENT OFFICE.

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HEAT-TREATING APPARATUS.

1,173,590. Specification of Letters Patent. Patented Feb. 29, 1916.

Application filed September 13, 1915. Serial No. 50,485.

To all whom it may concern:

Be it known that I, JOHN J. LICHTER, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Heat-Treating Apparatus, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to heat treating apparatus, and is an improvement on the heat treating apparatus described in my prior U. S. Patent No. 1,112,074, dated September 29, 1914.

One object of my present invention is to provide a heat treating apparatus in which the entire quenching bath is located directly beneath the furnace chamber and is completely cut off from the atmosphere when the material being treated is being heated and quenched, thereby eliminating the possibility of the material being exposed to the atmosphere, and thus cooling off or oxidizing while it is being conveyed from the furnace chamber to the quenching bath, and also overcoming the necessity of sealing the joints between the side walls of the furnace chamber and the movable member that supports the material.

Another object is to provide a heat treating apparatus that comprises a furnace which is provided with a removable top or roof and a vertically movable floor that is adapted to be moved upwardly through the furnace chamber into a position to receive the material being treated, and thereafter lowered into a dipping tank that is arranged under the furnace, the top of the furnace being constructed in such a manner that it can be removed easily when the material is being introduced into the furnace or removed therefrom, and thereafter replaced in operative position on the vertical walls of the furnace. And still another object is to provide a heat treating apparatus in which the vertically movable element that supports the material while it is being heated and quenched is so constructed that there is no possibility of said element binding or not moving freely in case the material is not loaded on same evenly.

Other objects and desirable features of my invention will be hereinafter pointed out.

Figure 1 of the drawings is a vertical longitudinal sectional view of an apparatus constructed in accordance with my invention. Fig. 2 is a vertical transverse sectional view taken on the line 2—2 of Fig. 1; and Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 2.

Referring to the drawings which illustrate the preferred form of my invention, A designates a furnace of substantially oblong shape in outline that is arranged directly over a dipping tank B which contains a quenching bath in which the material being treated is dipped, after said material has been heated to a predetermined temperature in the furnace A.

The furnace A and dipping tank B may be of any preferred construction, but I prefer to build the vertical walls of the furnace A upon the vertical walls of the dipping tank B, so that said tank will act as a foundation for the furnace and will be of the same shape or outline as the furnace. The side and end walls of the furnace A are provided with sight openings 1 and any suitable means may be employed for heating said furnace.

In the apparatus herein shown burners 2 are arranged at one side of the furnace in alinement with inlet ports 3 in one of the vertical side walls of the furnace, the opposite side wall being provided with waste flues 4 that lead to a horizontally-disposed flue 5 which communicates with a stack (not shown).

The top or roof C of the furnace A is flat, as shown in Figs. 1 and 2, and the waste flues 4 extend throughout the entire length of the furnace so that the heat will be distributed uniformly and evenly throughout the entire length and width of the furnace chamber D.

The bottom or floor E of the furnace A is formed of refractory material and it is so arranged that it can be raised and lowered into and out of the quenching bath and also moved upwardly through the furnace chamber D.

The top or roof C of the furnace is removable, so that the material being treated can be introduced into the furnace and removed therefrom, thereby overcoming the necessity of forming doors in the vertical walls of the furnace.

The roof C can be constructed in various

ways, but I prefer to mount said roof on a movable supporting structure that travels on tracks, so as to enable the roof to be moved easily into and out of operative position. In the form of my invention herein illustrated the movable supporting structure that carries the roof C is composed of two end frames F arranged outside of the end walls of the furnace A and connected together by girders 6 that extend longitudinally of the furnace. Cross members 7 that are connected to the girders 6 carry longitudinally-disposed members 8, preferably I-beams, which support tiles 9 that form the roof or top C of the furnace chamber. Said tile top or roof is surrounded by a rectangular shaped frame 10, preferably built up of channel irons, and connected to the longitudinal girder 6, as shown in Figs. 1 and 2. When the roof C is in operative position, as shown in Fig. 1, said rectangular shaped frame 10 rests upon metal top plates 11 on the vertical walls of the furnace A. The end frames F are provided with wheels 12 that travel on tracks 12′ and means are provided for raising and lowering said end frames so that the top C will clear the vertical walls of the furnace A when said top is being moved into and out of operative position. The vertical movement of the end frames F can be effected in various ways, but I prefer to construct said end frames in the manner shown in Fig. 2, wherein it will be seen that the wheels 12 are journaled in the outer ends of levers 13 whose inner ends are pivotally connected to operating rods 14 which can be moved upwardly and downwardly by means of operating wheels 15 that have internally screw-threaded bores through which externally screw-threaded portions on the rods 14 pass. By turning the wheels 15 in one direction the inner ends of the levers 13 will be moved upwardly, thereby raising the end frames F, owing to the fact that said end frames are carried by said levers, and by rotating said wheels 15 in the opposite direction, said end frames will be lowered, it, of course, being understood that the end frames are raised preparatory to moving the roof C into inoperative position, as illustrated in Fig. 2. If desired, one of the wheels 12 can be provided with a gear 12^a, as shown in Fig. 2, that meshes with a pinion 16 that forms part of a manually-operable driving mechanism that comprises a crank 17, thereby enabling the roof C to be moved laterally away from the furnace A by a single workman, after said roof has been raised sufficiently to clear the vertical walls of the furnace.

The floor or bottom E of the furnace A is carried by an elevator or vertically-movable supporting structure G, which may be of any preferred type, the one herein shown being built up of commercially rolled members, such, for example, as angle irons, channels and I-beams, and being of sufficient height so that it will rest upon supporting devices 18, hereinafter described, when the floor E is at its upper limit of movement, namely, flush, or approximately flush, with the upper edges of the vertical walls of the furnace A. The structure G is equipped with two horizontally-disposed shafts 19, shown in Fig. 3, that are provided with pinions 19^a which mesh with vertically-disposed racks 20 mounted on the side walls of the dipping tank B, and said shafts 19 are connected with one another by means of two cross shafts 21 that are provided with beveled pinions 21^a that mesh with beveled pinions 22 on the shafts 19. By guiding the structure G in this manner I eliminate the possibility of said structure binding or not moving freely, in case the material being treated is not loaded on the floor E evenly, owing to the fact that the shafts 19 are geared together and are provided with pinions that mesh with vertically-disposed rack bars on the side walls of the dipping tank. In other words, the structure G that carries the floor E of the furnace is provided with four pinions that mesh with four vertically-disposed rack bars, said pinions being geared together in such a manner that all of the pinions will move in unison, and thus hold the floor E level, irrespective of whether the load on one end of the floor is greater than the load on the other end.

Various means may be employed for raising and lowering the floor E, but I prefer to use a hydraulic means consisting of a stationary piston 23 that projects into a movable cylinder 24 that projects downwardly from the structure G, as shown in Fig. 1, the motive fluid being supplied to the cylinder 24 by means of a pipe 25 that communicates with a duct in the stationary piston 23.

When the material is being heated the floor E of the furnace is arranged in the position shown in Fig. 1, said floor being held securely in this position by means of the supporting devices 18, previously referred to, which coöperate with abutments 18^a on the structure G that carries said floor. After the material on the floor has been heated to a predetermined temperature the supporting devices 18 are moved into an inoperative position and the structure G is then moved downwardly into the position shown in Fig. 2, so that the material on the floor E will be immersed in the quenching bath in the dipping tank B, the structure G being provided at its lower end with abutments 18^b which rest upon stops 18^c on the bottom of the dipping tank, when the floor E is in its lowermost position. After the material has been quenched, the top C of the furnace is raised slightly by manipulat-

ing the hand wheels 15 and then moved laterally into its inoperative position, shown in Fig. 2. Thereafter, the motive fluid is admitted to the cylinder 24, so as to move the structure G and floor E upwardly into such a position that the material can be unloaded from the floor and fresh material placed thereon, the floor E being held securely in its elevated position by means of the supporting devices 18 which then cooperate with the abutments 18^b at the lower end of the structure G. After the fresh material has been placed on the floor E, the structure G that carries said floor is moved downwardly into the position shown in Fig. 1, and the top C of the furnace is thereafter moved back to its operative position. In the apparatus herein shown the supporting devices 18 that hold the floor E of the furnace in position while the material is being heated and while the material is being removed from the furnace and introduced into the furnace consist of arms on rock shafts 26 journaled in the end walls of the dipping tank B and provided with operating handles 27, shown in broken lines in Fig. 1, but, of course, it will be understood that various other means could be employed for sustaining the weight of that element of the apparatus which supports the material being treated. Furthermore, while I prefer to use a hydraulic means for raising and lowering said element, I wish it to be understood that my invention is not limited to an apparatus of the exact construction herein shown, as it is immaterial, so far as my broad idea is concerned, what means is employed for raising and lowering the member that supports the material being treated.

In an apparatus of the construction above described the entire quenching bath is located directly beneath the furnace chamber and forms a liquid seal for the furnace chamber. Consequently, there is no possibility of the material cooling off or oxidizing when it is being conveyed from the furnace chamber to the quenching bath, owing to the fact that the material passes directly from the furnace chamber into the quenching bath without being exposed to the atmosphere and without coming in contact with air which is at a lower temperature than the air in the furnace chamber and the air at the surface of the quenching bath. The treated material can be removed quickly from the furnace and fresh material can be introduced into the furnace quickly, owing to the fact that the vertical walls of the furnace are not provided with doors which have to be sealed, and the removable top of the furnace is of sufficient weight to make sealing unnecessary; and still another advantage of such an apparatus is that there is no liability of the elevator or vertically-movable structure G that carries the floor of the furnace binding or not moving freely, in case the material is not loaded with uniform distribution of weight on the floor E.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is:

1. A heat-treating apparatus, comprising a heating furnace provided with a removable top, a movable floor or bottom for the chamber of the furnace that supports the material being treated and which is adapted to be moved upwardly through the furnace chamber into position to be loaded and unloaded when the top of the furnace is removed, and a dipping tank completely cut off from the atmosphere when the furnace is in operation and containing a quenching bath which acts as a liquid seal for the furnace chamber.

2. A heat treating apparatus comprising a dipping tank that is adapted to contain a quenching bath, a heating furnace whose vertical walls form continuations of the vertical walls of said dipping tank, a removable roof or top for said furnace, and means for supporting the material that is to be treated, said means being adapted to be immersed in the quenching bath in said tank.

3. A heat treating apparatus comprising a heating furnace, a dipping tank arranged under said furnace for holding a quenching bath that is completely cut off from the atmosphere when the furnace is in operation, a removable top or roof for said furnace, a traveling structure that carries said roof, a floor for said furnace that holds the material being treated, and means for lowering and raising said floor so as to immerse the material thereon in the quenching bath and thereafter move the floor upwardly through the chamber of the furnace into such a position that the material on said floor can be taken out of the furnace through the opening that the top or roof closes.

4. A heat treating apparatus comprising a heating furnace, a dipping tank arranged under said furnace for holding a quenching bath, a flat roof for said furnace, a traveling structure that carries said roof, means for raising and lowering said roof so that it will clear the vertical walls of the furnace when the roof is being moved into and out of operative position, and a vertically movable floor for said furnace that holds the material being treated, said floor being adapted to be moved downwardly into the quenching bath and thereafter upwardly through the furnace chamber into such a position that the material on the floor can be removed therefrom through the opening at the upper end of the furnace chamber that the roof closes when said roof is in operative position.

5. A heat treating apparatus comprising

a heating furnace provided with a removable flat roof, a dipping tank arranged under said furnace and adapted to contain a quenching bath, waste flues at one side of the furnace that extend throughout the entire length of same, means arranged at the opposite side of the furnace for causing fire gases to pass transversely across the furnace chamber, and a vertically movable structure in said dipping tank that carries a refractory floor for said furnace chamber.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this tenth day of September 1915.

JOHN J. LICHTER.

Witnesses:
WELLS L. CHURCH,
GEORGE BAKEWELL.