Dec. 7, 1965 V. R. TROGLIONE ET AL 3,222,043

FURNACE TRANSFER MECHANISM

Filed April 17, 1964

Fig. 1.

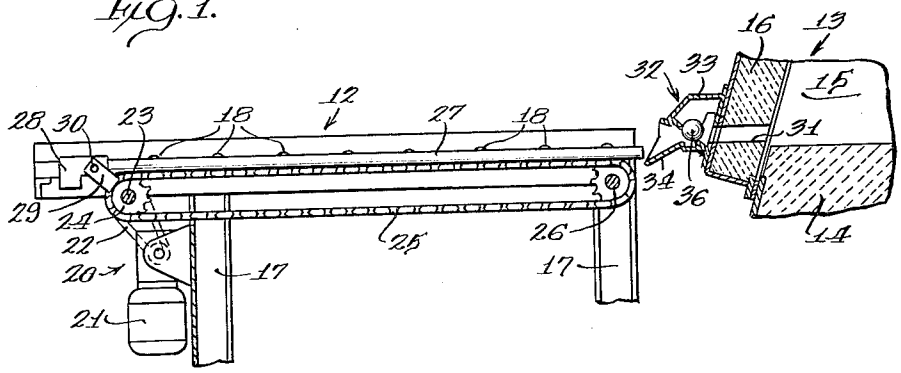


Fig. 2.

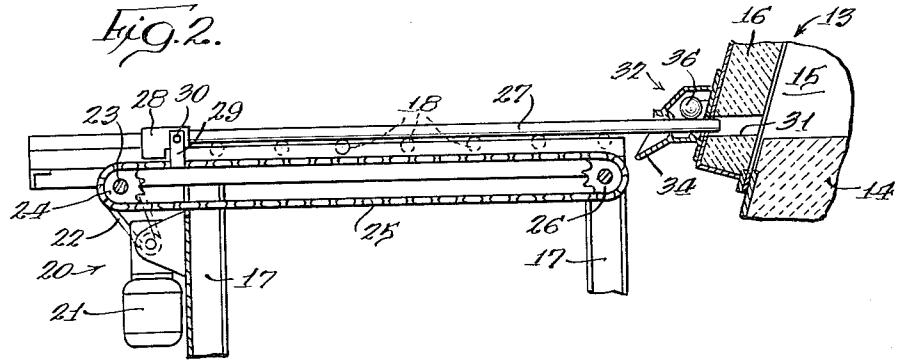


Fig. 4.

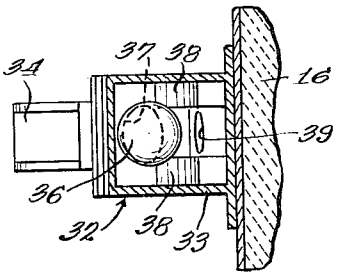
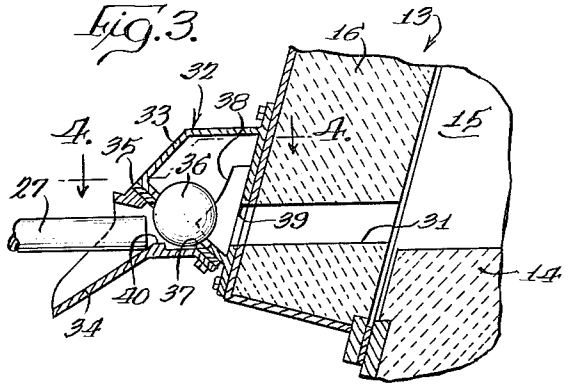


Fig. 3.



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FURNACE TRANSFER MECHANISM

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5 Claims. (Cl. 263—6)

The present invention relates to heat treating apparatus and more particularly to apparatus for transferring material within a sealed heat treating furnace.

The invention is concerned with the type of furnace in which a gas or atmosphere is maintained within the furnace during the heat treating cycle. At the end of the heat treating cycle and prior to exposing the work to the air outside of the furnace, the work is quenched. It is desirable that the parts or work be maintained in the furnace atmosphere until they have been quenched, cooling the parts to a low temperature at which oxidation is not likely to occur. The furnaces of this type are provided with a quench tank within a quench chamber which is sealed and in communication with the high temperature portion of the furnace containing the atmosphere gas. The apparatus of the instant invention provides a means for transferring parts from the high temperature portion of the furnace into the quench chamber and quench tank while maintaining the furnace enclosure sealed.

The high temperatures associated with the furnace complicate the problem of providing a transfer mechanism within the furnace which will move the work from one portion of the interior thereof to another. Any complex conveyors or mechanisms positioned within the heat treating enclosure and subjected to the high temperatures therein would malfunction and cease to operate in a relatively short time. In Acker et al. U.S. Patent No. 2,965,369, there is disclosed a transfer mechanism for heat treating apparatus in which reciprocating pusher members are employed to move work to be heat treated into the furnace and from the interior of the furnace into the quenching chamber. In this prior apparatus, the portion of the transfer mechanism which advances the work from the heat treating enclosure to the quench chamber extended through an opening in the wall of the furnace enclosure. This portion of the transfer mechanism, which is termed a pusher element, reciprocates forwardly and backwardly to move the work through the furnace.

One of the problems associated with the above-cited Acker et al. patent was the necessity for an opening in the furnace enclosure through which the reciprocating pusher element exended. The presence of the pusher element extending through the wall of the furnace at all times prevented the complete sealing of the furnace enclosure. Other attempts at overcoming this problem have involved the use of a multiple position door which would serve to expose an opening through which the pusher element could extend upon actuation of suitable controls. It would be desirable, however, to provide a simple work transfer element which would be positioned exterior of the furnace enclosure and be easily inserted therein without the necessity of removing closure means from an entrance opening.

It is an object of the present invention to provide a simple effective transfer mechanism for a sealed furnace enclosure.

It is a further object of the present invention to provide a work transfer mechanism for a heat treating furnace which is completely external of the furnace enclosure and may be inserted into the sealed enclosure without the necessity for separate actuating means for removing a closure for an entrance opening.

It is an additional object of the present invention to provide a work transfer mechanism utilizing a pusher element which, upon insertion through the wall of the furnace, automatically displaces a closure means for the opening through which the pusher element is inserted.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

FIG. 1 is a side elevational view of the improved transfer mechanism of the present invention with a portion of the furnace shown in section;

FIG. 2 is a side elevational view similar to FIG. 1 with the pusher element of the transfer mechanism shown in the partially advanced position;

FIG. 3 is an enlarged sectional view of the portion of the furnace door through which the pusher element extends with the pusher element shown in its position immediately prior to dislodging the seal for the entrance opening; and

FIG. 4 is a top plan view partially in section taken on line 4—4 of FIG. 3.

The present invention is concerned with a work transfer mechanism for use in controlled atmosphere type heat treatment apparatus. The transfer mechanism includes a longitudinally movable member which is adapted for insertion into the furnace enclosure to move parts contained therein from the furnace enclosure into the quench chamber which is in communication with the furnace enclosure while maintaining the atmosphere within the enclosure during the transfer of the work to the quench chamber. The entrance door of the furnace is provided with an opening through which the transfer mechanism extends. This opening is sealed by means of a ball mechanism which is automatically displaced by the forward movement of the transfer mechanism. This provides a means whereby the opening through which the transfer rod extends is maintained sealed until the rod itself is inserted therein, at which time the sealing means is automatically displaced and the transfer rod itself seals the opening through which it extends.

Referring now to the drawings, there is illustrated a work supporting table or conveyor designated generally by reference numeral **12**. The conveyor **12** is positioned immediately adjacent a heat treating furnace **13**, only a fragment of which is shown in the drawings since the details thereof form no part of the instant invention. It should be understood that the furnace **13** is similar to the type shown in the U.S. Patent No. 2,965,369 to Acker et al. having a high temperature heat treating chamber which is sealed and connected to a quench chamber including a quench tank. The opening between the high temperature furnace enclosure and the quench chamber is toward the back of the furnace whereby work may be transferred from the furnace to the quench chamber by merely pushing the parts through from the front out of the back of the furnace.

The furnace **13** includes a hearth or floor **14** which defines the bottom of a furnace enclosure **15**. The front of the furnace is closed by a door **16** which is slidable upwardly to provide access to the enclosure **15**. The furnace **13** as well as the slidable door **16** are fabricated of conventional castable refractories and provided with a sheet metal enclosing structure.

The conveyor **12** includes a frame **17** which supports a plurality of spaced rollers **18** which are adapted to receive work baskets to be moved horizontally into the furnace

13. While it should be understood that automatic means may be provided to advance the work baskets along the rollers 18 of conveyor 12, in the particular embodiment disclosed, it is intended that the work baskets be pushed manually across the rollers 18 into the enclosure 15 when the door 16 is moved to its elevated nonobstructing position.

In order to move the work baskets after they have been positioned within the enclosure 15, there is provided a work transfer mechanism generally designated by reference numeral 20. This mechanism is supported by the frame 17 and includes a motor and gear reducer unit 21 which is drivingly interconnected by means of a chain 22 to a horizontally disposed shaft 23. The shaft 23 is also supported for rotation on the frame 17 and carries on its outer ends sprockets 24 which are drivingly engaged with two continuous roller chains 25. Additional sprockets 26 are provided to support the continuous roller chains 25 at the end of frame 17 toward the furnace 13.

For insertion into the furnace enclosure 15 to move work baskets therethrough, there are provided two pusher elements or rods 27 which in their rest or retracted positions as shown in FIG. 1 lie along the upper surface of the roller chains 25. Each rod 27 is elongated and cylindrical in shape but provided at its rearmost end with an L-shaped flattened portion 28. The flattened portion 28 of each rod 27 is interconnected with one of the roller chains 25 by means of two spaced, flat, link members 29 which are pivotally secured by pins 30 to the pusher rods 27. Each of the pusher rods 27 is connected to one of the chains 25 by two of the links 29 which are positioned on either side of the flattened portion 28 having their lower ends riveted or welded to the roller chain with their outer ends receiving the pin 30. The links 29 are designed to space the pusher rods 27 above the upper surfaces of the rollers 18 and the hearth 14 so that upon forward movement as shown in FIG. 2, the pusher rods 27 will lie in the plane of the work baskets and above the plane of the supporting surface such as hearth 14.

To permit the forward end of each of the pusher rods 27 to enter the furnace 13, the door 16 is provided with an aperture or opening 31 which is slightly larger than the diameter of the pusher rod and is aligned with the axis to be assumed by the pusher rod for engagement with the work baskets. To seal each opening 31 against the escape of the atmosphere gas from the furnace, a ball seal 32 is secured to the outer face of the door 16. The ball seal includes a housing member 33 and a funnel portion 34. The funnel portion 34 is bolted to the housing 33 with a replaceable steel seat 35 positioned therebetween. A steel ball 36 is received within the housing 33. The seat 35 is a flat steel member provided with a round opening 37 in the center thereof, which opening is slightly less than the diameter of the ball 36 so that the ball may seat within the opening as best shown in FIG. 3. To guide the ball 36 in its movement within the housing 33, there is provided a pair of spaced ramps 38 which curve upwardly substantially along the face of the door 16 as is best shown in FIGS. 3 and 4.

To best understand the function of the ball seal 32 during the operation of the work transfer mechanism 20, the positions of the pusher rods 27 and the ball 36 must be considered in their various relative positions during the operation of the mechanism. At the beginning of each cycle, each pusher rod 27 begins moving inwardly or to the right as viewed in FIG. 1. As the left end is moved upwardly by the links 29, the leading end engages the funnel portion 34 and moves upwardly into an opening 40 in the funnel portion and into alignment with the door opening 31 as is best shown in FIG. 3. As the pusher rod 27 moves inwardly, the ball 36 is displaced upwardly on the curved spaced ramps 38 until it arrives at a position in which the pusher rod 27 may pass beneath it and moves into the door opening 31. Aligned with the opening 40 and the door opening 31 is a round opening 39 in the inner face of the housing 33 which closely receives the pusher rod 27. Thus, as soon as the ball 36 is displaced out of sealing engagement as shown in FIG. 2, the rod 27 is already obstructing the opening 40 in the funnel portion 34 and then moves into obstructing relationship with the housing opening 39 and the door opening 31 to prevent the escape of any furnace gas or atmosphere or the entrance of any outside air. Thus, when the pusher rod 27 moves from the position shown in FIG. 3 to the position shown in FIG. 4, it has displaced the sealing ball 36 and simultaneously sealed opening into the furnace by virtue of its filling the opening 40 in the funnel portion 34 and the opening 39 in the seal housing 33 as well as the opening 31 in the door 16. The pusher rods then move inwardly across the hearth 14 into engagement with the work baskets. As the pusher rods continue to be advanced, the work baskets are moved from the heat treatment portion of the furnace into the quench chamber.

Upon completion of the transfer of the work baskets into the quench chamber, the pusher rods 27 are withdrawn, moving them to the left as viewed in FIG. 2. Upon the withdrawal of the rods through the ball seal 32, the balls 36 roll downwardly on the spaced ramps 38 into sealing engagement with the seats 35 simultaneously with the withdrawal of the ends of the pusher rods 27 through the openings 40 in the funnel portions 34. Thus both on insertion and removal of the pusher rods 27, the ball seals 32 are effective in preventing the entrance of outside air into the enclosure 15 or the leakage of atmosphere gases out of the enclosure 15. The disclosure arrangement of the pusher rods 27 and the ball seals 32 provide a simple and expedient means of transferring parts through a furnace enclosure while maintaining the enclosure completely sealed and utilizing a mechanism which is located completely outside of the heated area of the furnace.

While there has been shown and described a particular embodiment of the invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention, and that it is intended by the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. Heat treating apparatus comprising a furnace enclosure having an entrance through which work to be heat treated may be inserted, a movable door for said entrance, work transfer mechanism including a longitudinally movable rod, said door being formed with an opening through which said rod may extend, means for reciprocating the rod through said opening to transfer work within said enclosure, sealing means for said opening including a ball seated by gravity in a seat member, said ball and seat member sealing said opening into said enclosure, means guiding said rod into engagement with said ball whereby said ball is displaced out of sealed engagement with said seat member permitting said rod to enter said enclosure.

2. Heat treating apparatus comprising a furnace enclosure having an entrance through which parts to be heat treated are inserted, a door of refractory material mounted for slidable movement between an open position and a closed position over said entrance, a work transfer mechanism including at least one longitudinally movable rod, means for reciprocating the rod through an aperture in said door into said furnace enclosures, sealing means carried by said door and covering said aperture to prevent the escape of gas from said enclosure, said sealing means including a housing with a ball positioned therein for sealing engagement with a downwardly facing opening in said housing, said opening being aligned with said aperture, means guiding said rod into engagement with said ball whereby said ball is displaced out of sealing

engagement with said housing as said rod is inserted into said opening and said aperture into said enclosure.

3. Heat treating apparatus as set forth in claim 2 wherein said housing is provided with a pair of spaced ramps for guiding said ball as it is displaced upwardly and inwardly by said rod, said rod sealing said housing and extending between said ramps upon insertion into said enclosure.

4. Heat treating apparatus comprising a furnace having an entrance opening, a door slidable between an open position in which parts may be inserted through said opening into said furnace enclosure and a closed position in which said door seals said entrance opening, a furnace hearth defining the bottom of said furnace enclosure and being horizontally aligned with the lower edge of said entrance opening, a horizontal parts conveyor positioned outside of said entrance opening to facilitate the movement of parts into said furnace enclosure, a work transfer mechanism including a pair of push rods extending horizontally below the level of said conveyor, means for moving said push rods vertically and then longitudinally through apertures provided in said door into said furnace enclosure, said apertures being positioned above the level of said hearth, sealing means for each said aperture including a ball seated by gravity in a seat member, each said ball and seat member sealing one of said apertures in said door, and means guiding said push rods into engagement with said balls whereby said balls are displaced out of sealed engagement with said seat members permitting said rods to enter said enclosure above the level of said hearth.

5. Heat treating apparatus comprising a furnace having an entrance opening, a door slidable between an open position in which parts may be inserted through said opening into said furnace enclosure and a closed position in which said door seals said entrance opening, a furnace hearth defining the bottom of said furnace enclosure and being horizontally aligned with the lower edge of said entrance opening, a horizontal parts conveyor positioned outside of said entrance opening to facilitate the movement of parts into said furnace enclosure, a work transfer mechanism including a pair of push rods extending horizontally below the level of said conveyor, means for moving said push rods vertically and then longitudinally through apertures provided in said door into said furnace enclosure, said apertures being positioned above the level of said hearth, sealing means for each said aperture including a ball seated by gravity in a seat member, said ball and seat member sealing one of said apertures in said door, and each said sealing means including guide means for moving the forward end of one of said push rods vertically into alignment with one of said apertures.

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JOHN J. CAMBY, *Examiner.*