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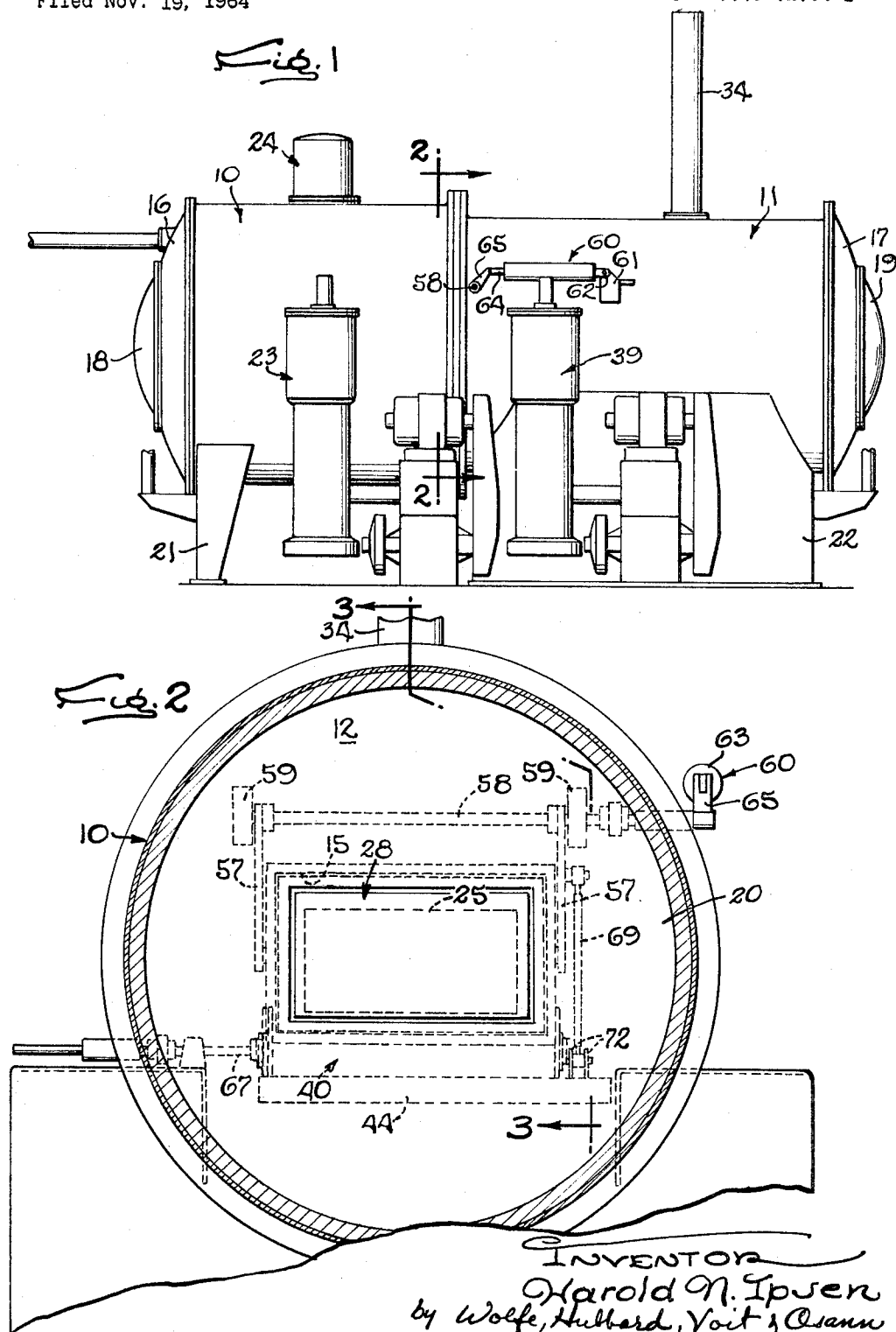
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3,266,644

CONDITIONING APPARATUS WITH TILTABLE RECEIVING PLATFORM

Filed Nov. 19, 1964

3 Sheets-Sheet 1



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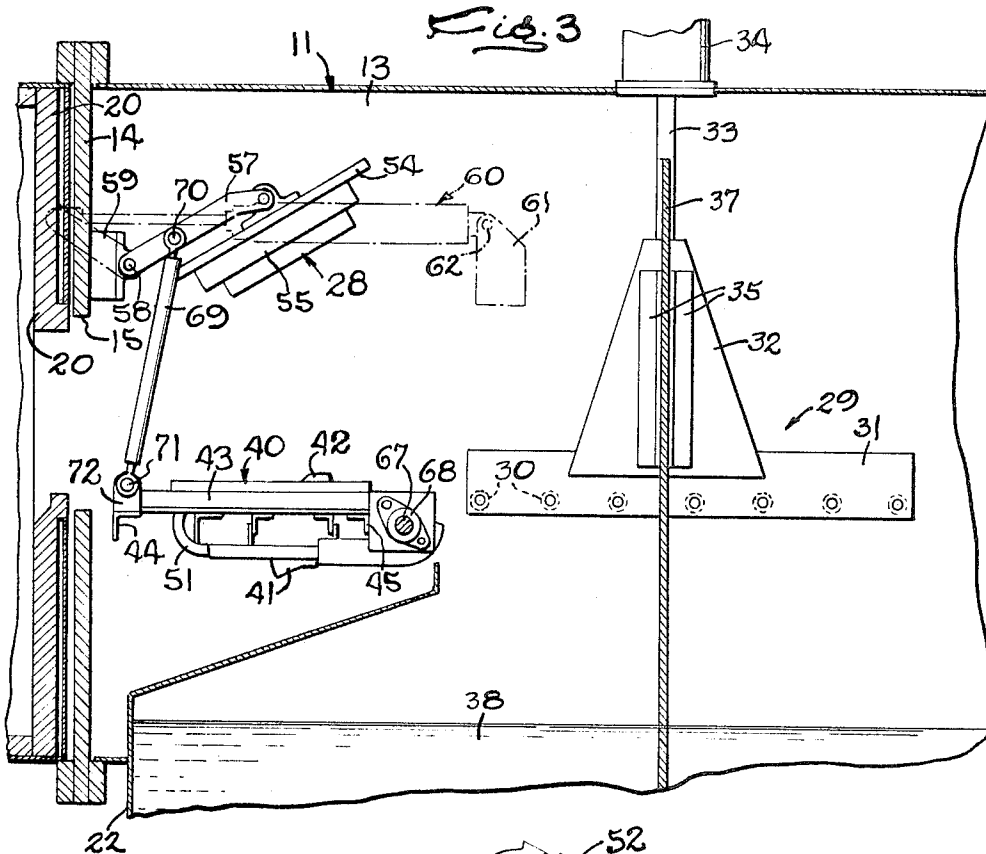
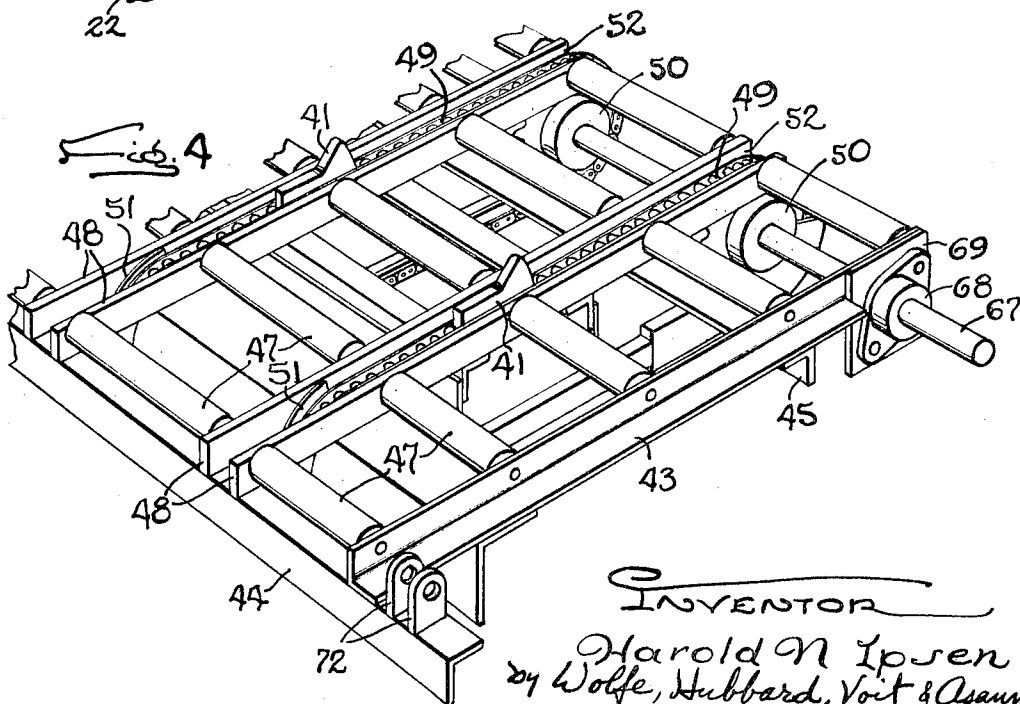
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3 Sheets-Sheet 2



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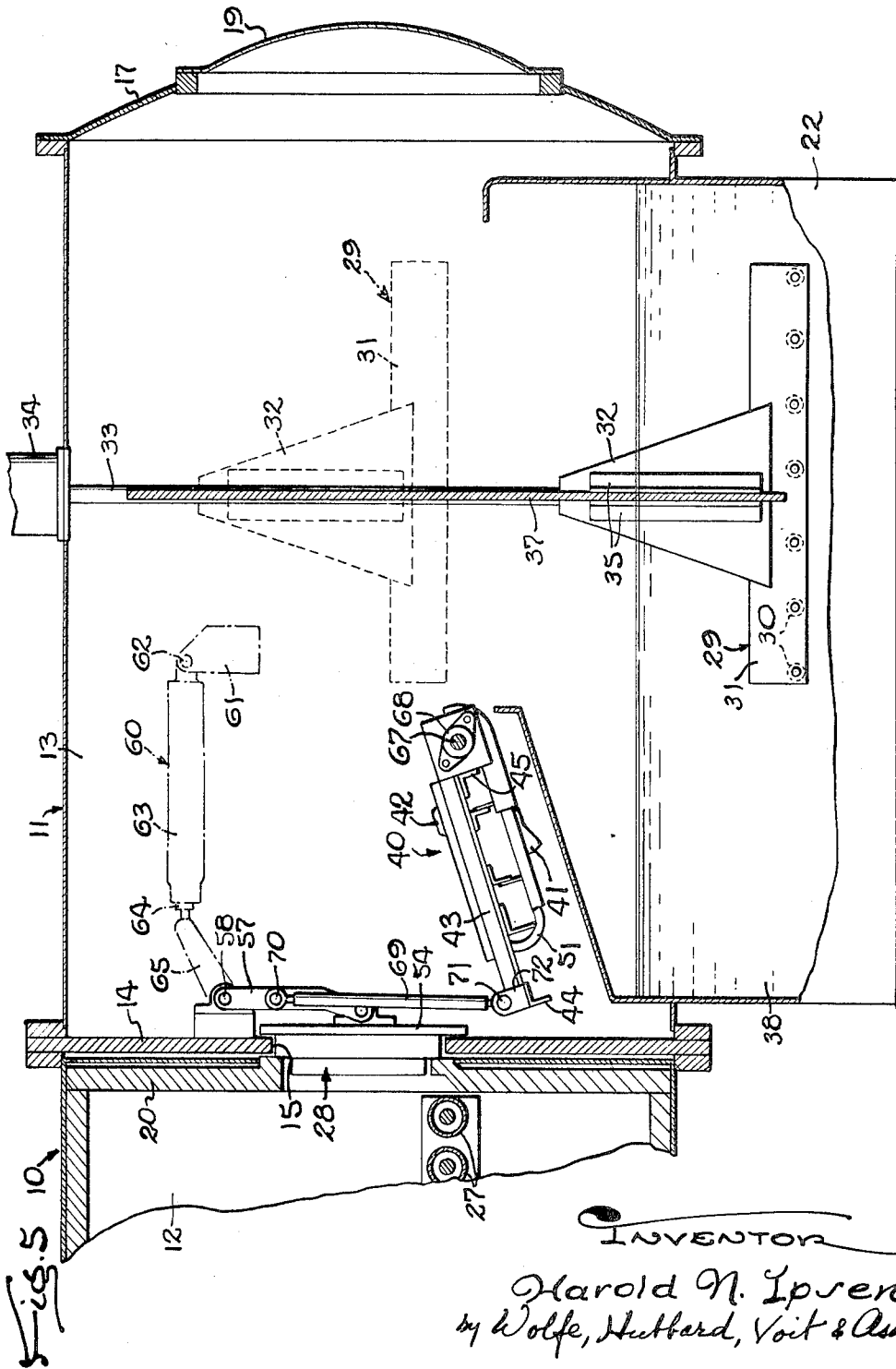
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3 Sheets-Sheet 3



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3,266,644 CONDITIONING APPARATUS WITH TILTABLE RECEIVING PLATFORM

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6 Claims. (Cl. 214—18)

This invention relates to conditioning apparatus in which a work load is heated in a protective atmosphere in an enclosed chamber and then is moved through a door controlled transfer opening into a second chamber for an additional step in the conditioning treatment. More particularly, the invention relates to an automatic transfer system for sealing the transfer opening between the two chambers during conditioning operations and automatically transferring work loads from one chamber into the other between the two conditioning steps.

In such an apparatus, a first conveyor is provided for advancing work loads through the first treating chamber and partially through the transfer opening when the latter is open, and partially onto a receiving platform mounted in the second chamber closely adjacent the transfer opening. Associated with the receiving platform is a second conveyor for picking up the projecting end of the work load and pulling the latter through the opening so that the transfer door may be closed.

The primary object of the present invention is to provide, in an apparatus of the above general character, a new and improved automatic transfer system for tightly sealing the transfer opening during the respective treating steps, opening the transfer door when it is desired, and then closing the door to effect a vacuum-tight seal between the chambers during the next step in the treatment, all of this being accomplished without opening either chamber to the outside atmosphere.

A more specific object is to position the receiving platform closely adjacent the transfer opening when the door is open to receive work loads through the opening as a continuation of the furnace hearth, and to shift the platform into an out-of-the-way position automatically as an incident to movement of the transfer door toward its closed position thereby making possible the vacuum-tight closure of the transfer door.

The invention also resides in the mechanism for moving the receiving platform automatically as an incident to opening and closing movement of the transfer door.

Other objects and advantages of the invention will become apparent from the following detailed description, taken in connection with the accompanying drawings in which

FIGURE 1 is a fragmentary side elevational view of a conditioning apparatus embodying the novel features of the present invention.

FIG. 2 is an enlarged fragmentary cross-sectional view taken substantially along the line 2—2 of FIG. 1.

FIG. 3 is a fragmentary cross-sectional view taken substantially along the line 3—3 of FIG. 2.

FIG. 4 is an enlarged fragmentary perspective view of parts of the receiving platform.

FIG. 5 is a view similar to FIG. 3 with some of the parts in moved positions.

As shown in the drawings for purposes of illustration, the invention is embodied in a heat-treating apparatus comprising generally two hollow pressure-tight vessels 10 and 11 disposed in end-to-end relation and defining a heating or furnace chamber 12 in the left end portion of the apparatus as viewed in FIG. 1 and a quench chamber 13 in the right end portion, the two conditioning chambers or zones being separated by an upright divid-

ing wall 14 formed with a rectangular transfer opening 15 (see FIG. 2) near its center.

Herein, the two vessels are cylindrical in shape and the remote ends of the vessels are closed by outwardly dished covers 16 and 17 formed with access openings that are closed during operation by two doors 18 and 19. The doors preferably are hinged on the covers for swinging about vertical axes between open and closed positions. As shown in FIGS. 3 and 5, the inner or right-hand end of the heating chamber 12 is defined by an insulated wall 20 lying against the dividing wall 14 and having a central opening aligned with and forming a continuation of the transfer opening 15 in the dividing wall. At its left or front end, the apparatus is supported on two legs 21 depending from the outer end of the vessel 10, and the right end of the apparatus is supported on top of a quench tank 22 disposed beneath the vessel and opening upwardly into the interior of the latter.

The furnace vessel 10 is equipped as a conventional heat-treating furnace with the usual radiant heating elements (not shown), insulated walls, a vacuum pumping apparatus shown generally at 23 in FIG. 1, and a fan 24 mounted in the top of the vessel for circulated atmosphere cooling when this is desired as a part of the treating cycle. Work loads are supported in this vessel in baskets or trays 25 which are placed on a hearth herein formed by a series of side-by-side horizontal rollers 27 extending across the heating chamber somewhat above the level of the lower side of the transfer opening 15 and forming a conveyor for work loads in the furnace.

In order to move the leading end portion of a tray 25 of heated workpieces through the transfer opening 15 when the heating portion of the conditioning cycle is completed, a selectively operable power actuator (not shown) is provided for rotating the rollers 27 clockwise as viewed in FIG. 5 after the transfer door 28 has been opened. As the rollers rotate, the tray is advanced into and partially through the transfer opening, stopping after the trailing end of the tray clears the last roller of the series. In this position, the leading end portion of the tray projects through the transfer opening and partially into the quench chamber 13.

As shown in FIG. 3, the quench tank 22 opens upwardly into the chamber 13 beneath an elevator platform 29 which, in its raised position, is level with the tops of the hearth rollers 27. In this instance, the bottom of the elevator platform is formed by a second series of horizontal rollers 30 extending between and journaled on two side plates 31 disposed in laterally spaced vertical planes and carried on upright supporting plates 32 depending from the lower end of a piston rod 33 extending upwardly through the top wall of the vessel 11. A cylinder 34 mounted on top of the vessel above the elevator platform reciprocates the piston rod endwise up and down and thus raises and lowers the elevator platform.

To stabilize the platform 29 in its horizontal position, two spaced angle bars 35 are secured to the outer side of each supporting plate 32 in vertical positions to ride along the opposite sides of a vertical guide plate 37 stationarily mounted in the vessel 11. With this arrangement, the elevator platform is movable downwardly from the raised position shown in FIG. 3 through the open top of the quench tank 22 to a lowered position shown in full in FIG. 5 in which the work load is submerged in the body of oil 38 in the tank for circulation of the oil through the load. Then the elevator platform is returned to its raised position for removal of the load through the rear door 19.

A second evacuating apparatus 39 (FIG. 1), which may be identical to the furnace evacuating apparatus 23, is provided for evacuating the vessel 11 independently

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of the furnace vessel 10. With this arrangement, the quench vessel may be opened and unloaded during the heating portion of the treatment cycle while the transfer door 28 is closed, and then re-evacuated preparatory to transfer of a work load into the quench chamber. After the transfer door is closed, the furnace vessel may be opened, reloaded, closed and then re-evacuated preparatory to another heating operation.

Between the transfer opening 15 and the elevator platform 29 is a receiving platform 40 with one end closely adjacent the transfer opening to form a continuation of the hearth and thus receive and support the leading end portion of each work tray after it is moved into and partially through the transfer opening. To move the trays on toward the elevator platform for quenching, the receiving platform is equipped with a conveyor having abutments 41 and 42 thereon engageable with the forward portion of each tray to pull the tray to the right out of the transfer opening and then shift the tray onwardly into the desired position on the elevator platform. A conveyor of this type is disclosed in Patent No. 2,842,349 to which reference is made for details of construction and operation not included herein.

In this instance, the receiving platform 40 is formed by a rectangular framework shown most clearly in FIG. 4 and including a pair of parallel side bars 43 disposed in a common horizontal plane and joined together at the front and rear ends by cross bars 44 and 45 of angle-shaped cross-section. On the platform, the trays rest on rollers 47 (FIG. 4) journaled between the side bars and intermediate bars 48 parallel to the side bars, the tops of these rollers normally being level with the rollers 27 and 30. Herein, there are three rows of five rollers each on the platform.

The conveyor is completed by two endless chains 49 disposed in laterally spaced vertical planes on opposite sides of the center row of rollers 47 and trained around two sprocket wheels 50 at one end of the platform 40 and around two arcuate guides 51 at the other end. The upper runs of these chains lie in and extend along two guideways 52 formed between adjacent intermediate bars 48 below the tops of the rollers. The two abutments 41 and 42 are lugs fast on each chain to project upwardly therefrom on the upper run of the chain and extend above the tops of the rollers for engagement with a tray. The leading abutment 41 on each chain enters an opening (not shown) in the underside of the tray, as described in the aforesaid patent, to pull the tray completely onto the receiving platform, and the trailing abutment 42 then engages the trailing portion of the tray to push the latter off the receiving platform and onto the elevator platform 29. After the tray is clear of the transfer opening 15, the door 28 is closed. Of course, the operation of the door, the feed rollers 27, and the conveyor chains 49 may be controlled either manually or by an automatic cycle control for the proper sequence of operations. Such controls are well known to those skilled in the art and, therefore, are not described herein.

In accordance with the present invention, the transfer door 28, when closed, is in vacuum-tight sealing engagement with the dividing wall 14 completely around the transfer opening 15 and is hinged on the wall for swinging upwardly and away from the opening into an open position above the receiving platform 40. To permit the door to swing downwardly from its open position, past the receiving platform and into the closed and sealed position, the receiving platform is mounted for downward movement of the end adjacent the transfer opening from its normal position closely adjacent the transfer opening to a lowered position out of the path of closing movement of the door. Moreover, the platform is connected to the door for up and down movement as an incident to opening and closing of the door.

In this instance, the transfer door 28 is formed by a rectangular plate 54 somewhat larger than the transfer opening 15 so that the side edge portions of the plate

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overhang the dividing wall 14 on all sides of the opening as shown in FIG. 5. Mounted on the side of the door facing toward the heating chamber 12 is an insulated backing 55 which minimizes heat transfer through the dividing wall. This backing fits into the transfer opening and abuts against the insulated wall 20. Suitable seals (not shown) are provided between the door and the sides of the opening for vacuum-tight closing.

The door hinge is formed by a pair of arms 57 (see FIG. 2) each connected at one end to the door plate 54 and fast at its other end on a horizontal hinge pin 58 extending between and journaled in two lugs 59 on the dividing wall 14 above the transfer opening 15. Thus, back and forth turning of the hinge pin swings the door between its open and closed positions.

Herein, the transfer door 28 is opened and closed by a reciprocating pneumatic actuator 60 mounted on the outside of the quench vessel 11 on an exterior bracket 61 pivotally connected at 62 to the head end of the cylinder 63 as shown in phantom in FIGS. 3 and 5. The piston rod 64 is pivoted at its outer end on the free end of a radial crank arm 65 fast on the outwardly projecting end portion of the hinge pin 58 outside the vessel. Thus, back and forth endwise movement of the piston rod oscillates both the crank arm and the hinge pin back and forth about the axis of the pin through a preselected arc to swing the door open and closed. The length of the stroke of this actuator and the angular position of the crank are selected to swing the door between the two positions shown in FIGS. 3 and 5 during each stroke of the piston rod.

In this instance, the receiving platform 40 is hinged the end remote from the transfer opening 15 on a shaft 67 extending horizontally into the quench vessel 11 and carrying the sprocket wheels 50 for driving the conveyor chains 49. The shaft extends through bearings 68 mounted on plates 69 forming the right-hand ends of the side bars 43 and thus pivotally mounts the receiving platform in the quench chamber 13 for up and down movement of the end of the platform adjacent the dividing wall 14. One end of the sprocket shaft 67 projects outwardly through the left side of the vessel as shown in FIG. 2 for connection to a selectively operable operator (not shown) for driving the conveyor.

To raise and lower the free end portion of the receiving platform 40 at the appropriate times, that is, during opening and closing movement of the transfer door 28, the free end of the platform is connected to one of the hinge arms 57 and, thus, to the door, by an elongated link 69 which is pivoted at one end on a pin 70 on the hinge arm and at the other end on a pin 71 mounted between two lugs 72 projecting upwardly from the angle bar 44 forming the free end of the receiving platform. It will be seen in FIGS. 2 and 4 that the link is offset to one side of both the transfer opening and the door and therefore is out of the path of work loads moving through the opening.

With the transfer door 28 and the receiving platform 40 connected by a link 69 at points spaced from the respective hinges, rotation of the hinge pin 58 clockwise as viewed in FIG. 3 not only swings the door downwardly from the open position but also, simultaneously, lowers the free end of the platform out of the path of the door to permit the latter to close and seal the transfer opening 15. Similarly, as the door is opened by counter-clockwise rotation of the hinge pin, the connecting link pulls the receiving platform back up to the horizontal position to receive the work load through the transfer opening. Thus, the platform swings up and down automatically as an incident to the opening and closing movement of the transfer door and is positioned as desired in accordance with the position of the transfer door.

In operation of the conditioning apparatus, the first batch of workpieces to be treated is loaded into the heat-treating furnace through the door 18 and the door is closed to seal the heating chamber 12. The selected heating cycle

is started manually and preferably continued under the control of an automatic controller (not shown) which programs the pre-heat and high heat temperatures, the degree of vacuum, the partial pressures of inert gas, such as nitrogen or argon, if any are used, and the operation of the circulating fan 24. At the same time, the quench chamber 13 is evacuated by the pumping apparatus 39. After the work load has been heated in the chamber 12, the reciprocating actuator 60 opens the transfer door 28 preparatory to the transfer of the work load into the quench chamber. As the piston rod 64 moves to the left, as viewed in FIG. 5, the door swings open and simultaneously raises the free end portion of the platform 40 to bring the latter into its horizontal positions to receive the work load. Then the hearth rollers 27 are rotated in a direction to slide the work load into the transfer opening and bring the leading end of the load onto the platform for engagement by the abutments 41 on the chains 49. As soon as the work load is on the platform, the conveyor operator is actuated to rotate the shaft 67 clockwise as viewed in FIG. 5, bringing the abutments 41 into engagement with the forward portion of the work tray and then advancing the latter toward the elevator platform 29. Then the second set of abutments 42 engages the rear portion of the work tray and pushes the tray off the receiving platform and onto the elevator platform.

After the work load has been moved onto the elevator platform 29, the transfer door 28 may be closed simply by reversing the actuator 60 to turn the hinge pin 58 clockwise. Then the furnace chamber 12 may be opened to receive a new batch of workpieces without opening the quench chamber 13. The load on the elevator platform 29 is lowered into the oil 38 for quenching, which is completed during the heating of the next batch of workpieces. Then the elevator platform is raised for removal of the workpieces through the rear door 19. After the latter is closed, the quench chamber is re-evacuated preparatory to the transfer of the next batch of workpieces into the quench chamber upon completion of the heating portion of the cycle.

I claim as my invention:

1. In a conditioning apparatus, the combination of, means defining a conditioning chamber having an upright wall with an opening therein for the passage of workpieces through the wall, a door overlying said opening on one side of said wall to close and seal the latter, a first hinge above said door pivotally mounting the latter on said wall for swinging upwardly and away from the opening into an open position and back downwardly to the closed position, said hinge including a hinge pin journaled on said wall above said opening and an arm fast on said pin and extending radially therefrom along said door and connected at its free end to the door, a platform disposed beneath the open position of said door for supporting a workpiece in alinement with said opening, one end of said platform being closely adjacent the lower side of said opening, a second hinge pivotally supporting the end of said platform remote from said wall for swinging of said one end downwardly to a level well below the lower side of said opening and out of the path followed by said door during closing of the latter, and an elongated link pivotally connected to said one end and to said door at points spaced from the respective hinges thereby to raise and lower said platform as an incident to opening and closing of said door, said link being offset laterally from the path followed by workpieces through said door.

2. The combination defined in claim 1 further including a selectively operable power actuator connected to said hinge pin to turn the latter back and forth through a pre-selected arc about its axis thereby to open and close said door while simultaneously raising and lowering said platform.

3. In a conditioning apparatus, the combination of, means defining first and second conditioning chambers dis-

posed in end-to-end relation with an upright dividing wall between said chambers and having an opening therein for the passage of workpieces through the wall, a door disposed within said second chamber overlying said opening and overhanging said wall around the opening to close and seal the latter, a first hinge above said door pivotally mounting the latter for swinging upwardly away from said wall within said second chamber into an open position and back toward the wall into the closed position, a platform disposed in said second chamber beneath the open position of said door in position to support a workpiece in alinement with said opening, one end of said platform being closely adjacent said wall and the lower side of said opening to receive workpieces through the opening, a second hinge pivotally supporting said platform in said second chamber at the end of the platform remote from said opening for swinging of said one end downwardly to a level well below the lower side of said opening and out of the path followed by said door during closing of the latter, and a link pivotally connected to said one end and to said door at points spaced from the respective hinges to raise and lower said platform automatically as an incident to opening and closing of said door.

4. In a conditioning apparatus, the combination of, means defining a conditioning chamber having an upright end wall with an opening therein for the passage of workpieces through the wall, a door overlying said opening on one side of said wall and overhanging the wall around the opening to close and seal the latter, a first hinge above said door pivotally mounting the latter on said wall for swinging upwardly and away from the opening into an open position and back downwardly to the closed position, a platform disposed beneath the open position of said door for supporting a workpiece in alinement with said opening, one end of said platform being closely adjacent the lower side of said opening, a second hinge pivotally supporting the end of said platform remote from said wall for swinging of said one end downwardly to a level well below said lower side of said opening and out of the path followed by said door during closing of the latter, and a link connecting said platform and said door to raise and lower said platform automatically as an incident to opening and closing of said door.

5. The combination defined in claim 4 in which said link is pivotally connected at one end to the free end portion of said platform and at its other end to said door at a point spaced from said first hinge.

6. In a conditioning apparatus, the combination of, means defining a conditioning chamber having an upright end wall with an opening in one end for the passage of workpieces through said wall, a door overlying said opening and closing the latter, means hinging said door adjacent the top of said opening for swinging of the door upwardly and away from the opening into an open position and back downwardly toward the opening to the closed position, a horizontal platform positioned at a predetermined level adjacent the level of the lower side of said opening in said chamber with one end of said platform closely adjacent the opening to receive workpieces passing therethrough, means mounting said platform in said chamber for movement of said one end downwardly from said predetermined level to a level well below said lower side and out of the path of said door during closing of the latter and then back to said predetermined level, and means for raising and lowering said one end automatically as an incident to opening and closing of said door.

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GERALD M. FORLENZA, *Primary Examiner*.

R. G. SHERIDAN, *Assistant Examiner*.