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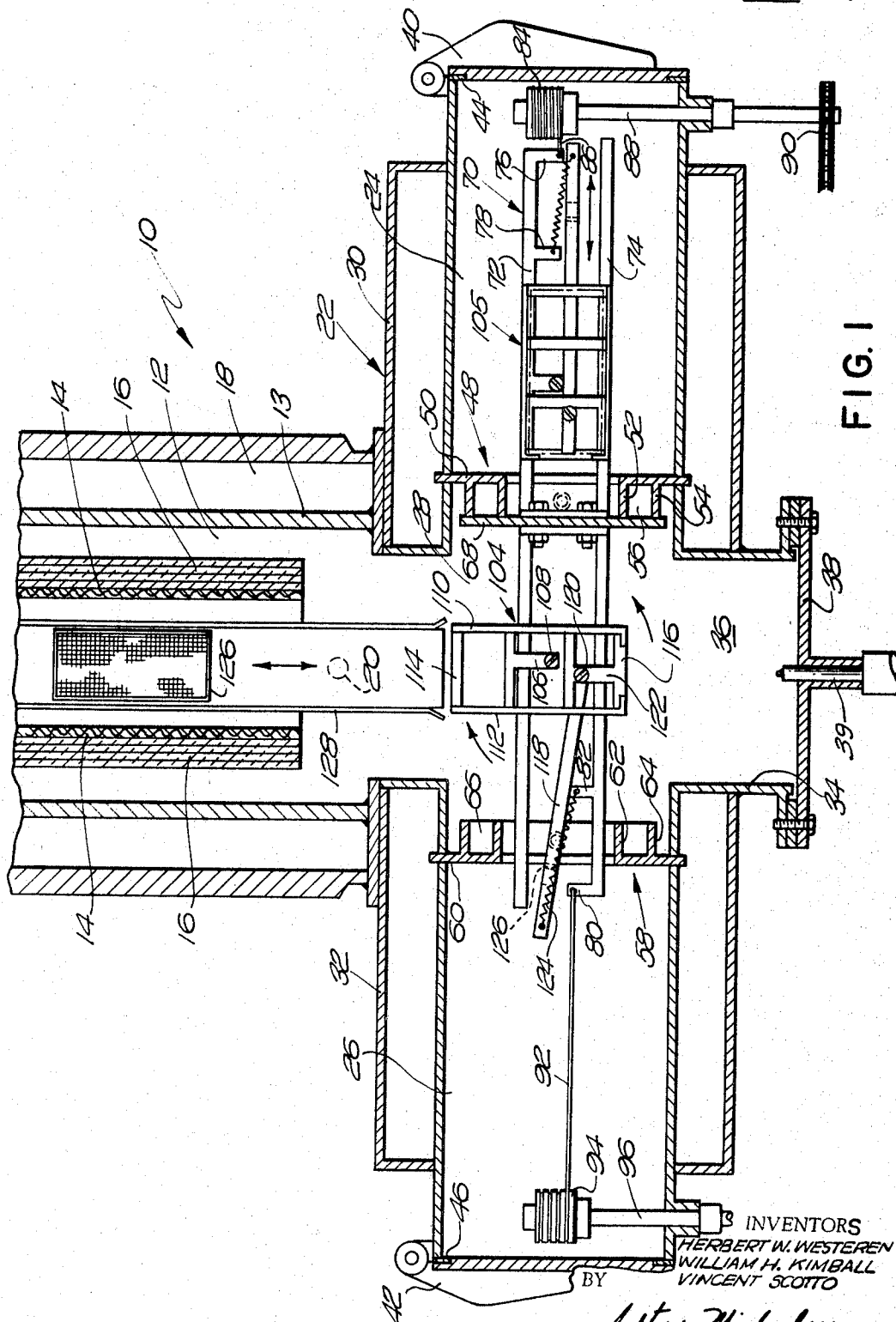
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3,431,346

ELECTRIC FURNACE WITH CONTINUOUSLY SEALED HEATING CHAMBER

Filed Feb. 6, 1967

Sheet 1 of 3



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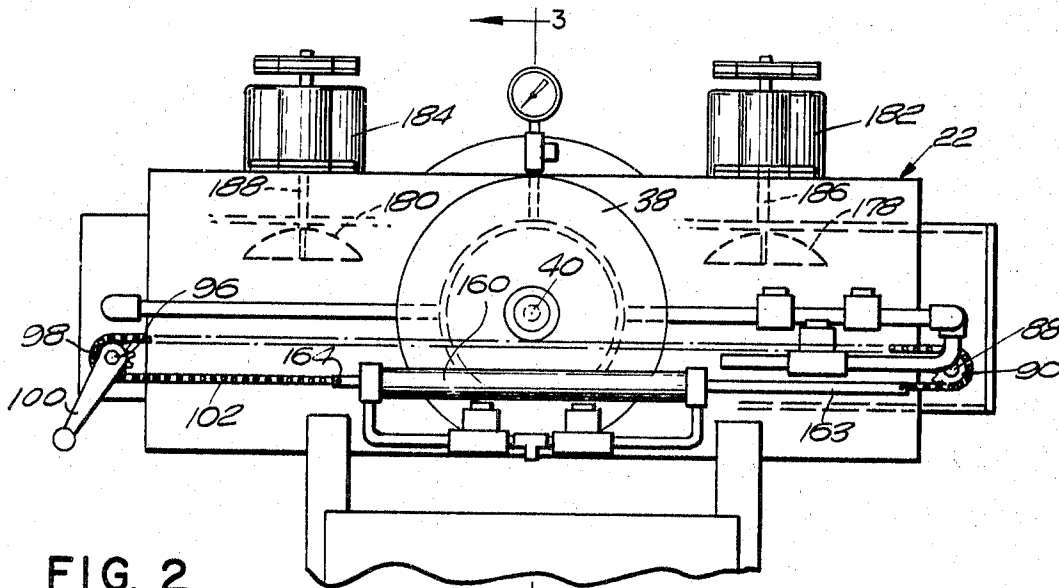


FIG. 2

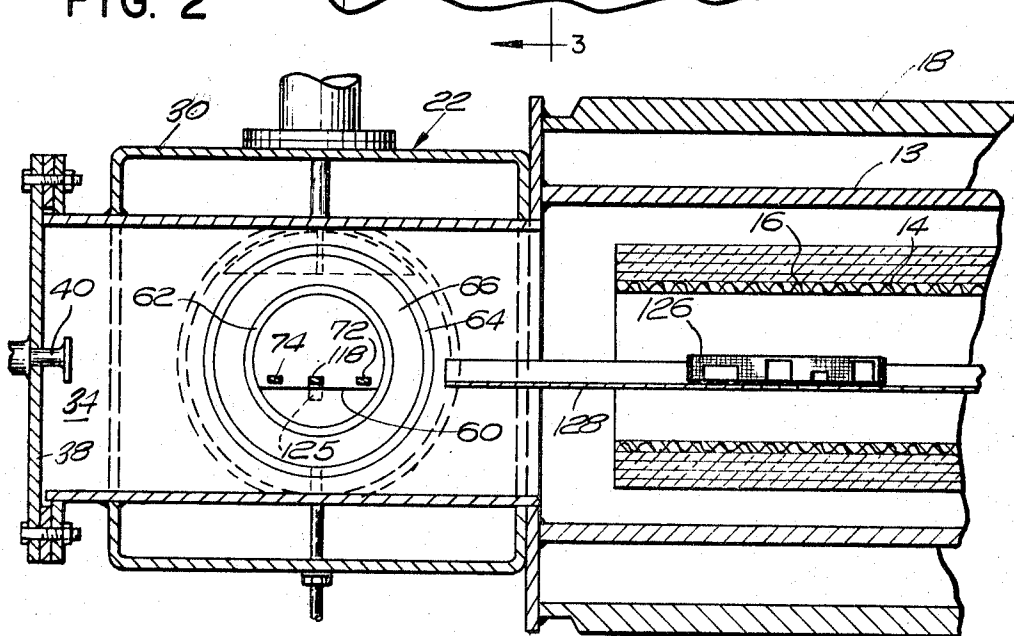
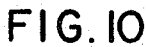


FIG. 3

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ELECTRIC FURNACE WITH CONTINUOUSLY SEALED HEATING CHAMBER

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ABSTRACT OF THE DISCLOSURE

An electrically operated furnace that includes a heating chamber in which the operating conditions are continuously maintained and in which an inert atmosphere is present so as to maintain a low concentration of impurities at a partial pressure in the heating chamber that have an oxidizing influence wherein a work load being heat treated in the heating chamber is not deleteriously affected by the impurities. A work load is moved into and out of the heating chamber by way of a vestibule area that enables the heating chamber to be continuously operated at the same temperature and pressure and which insures relative purity of the atmosphere within the heating chamber even with the periodic transfer of a work load thereto and therefrom.

Background of the invention

One of the problems associated with vacuum furnaces, to which field the present invention relates, has been the time required to cool or back fill the heating chamber of the furnace and the work load therein after the heat treating cycle was completed.

When the work load was to be removed from the prior known vacuum furnace after the heat treating cycle, the heating chamber was backfilled with a gaseous medium, such as nitrogen, so as to speed up the cooling cycle and to bring the pressure within the furnace to atmosphere for the removal of the work load therefrom. The objectionable feature of this technique was that the entire heating chamber together with the work load had to be quenched which resulted in the complete shutdown of the furnace after which the work load was removed therefrom. Because the conventional batch-type vacuum furnace heating chamber was continually heated and quenched, relatively high maintenance costs resulted, particularly because the heating elements and the radiation shields within the furnace along with the work load in the heating chamber were subjected to drastic heating and quenching temperatures. Because frequent quenching through backfilling with a gas was necessary in the prior known conventional batch-type vacuum furnace, a relatively large power load which necessitated larger baffles, radiation shields and hearth was required. Further, the prior known batch-type furnace required a relatively large floor space to accommodate it because of the frequent quenching of the heating chamber. It has been the custom because of the type of equipment embodied in the prior known vacuum furnace to employ skilled labor. The skilled labor for such furnaces helped reduce the maintenance costs thereof but the overall operational costs of the furnace were materially increased.

Summary of the invention

The furnace of the present invention includes a heating chamber in which an inert atmosphere is continuously maintained substantially at the same pressure and temperature and preferably at a pressure less than atmospheric. The presence of the inert atmosphere within the

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heating chamber insures that impurities which are maintained in the heating chamber at a partial pressure are in such insignificant quantities as to not affect the surface of the work being heat treated in the heating chamber. In order to retain the pressure and temperature of the atmosphere within the heating chamber, and by so doing maintain the impurities at a minimum, the heating chamber is adapted to be located in communication with a vestibule area that is intermittently sealed from the heating chamber. In the specific form of the invention, opposed vestibule areas communicate with the heating chamber through an intermediate or transfer zone. By employing opposed vestibule areas a work load may be transported after a heating cycle to one of the vestibule areas for cooling without changing the operating conditions within the heating chamber.

In order to accomplish the purpose of introducing a work load into the furnace while simultaneously removing a heat treated work load therefrom, a unique transfer and sealing mechanism is incorporated therein which simultaneously transfers a work load to or from the heating chamber while sealing one of the vestibule areas from the heating chamber. Thus, while a work load is being heat treated in the heating chamber, the previously heated work load that had been moved to a vestibule area may be cooled therein for a predetermined cycle and thereafter removed from the furnace while the furnace is simultaneously heat treating a new work load within the heating chamber. The alternate sealing of the vestibule areas from the heating chamber is achieved principally because of a unique metallic seal that communicates with a vacuum system, the vacuum system being separate and apart from the vacuum system with which the heating chamber communicates. Because of the metallic seal a vestibule area may be conveniently backfilled with a gaseous medium such as nitrogen which cooperates with a cooling fan to cool a work load in the vestibule area. The metallic seal further enables the vestibule area in which the work load is cooled to be brought to atmospheric pressure for removal of the work load and without affecting the vacuum and temperature in the heating chamber.

Accordingly, it is an object of the present invention to provide a vacuum furnace that simultaneously heat treats a work load in the heating chamber thereof while cooling a work load that had been removed from the heating chamber, the removal of a heat treated work load from the heating chamber and introduction of a new work load therein, being accomplished without backfilling, quenching or shutting down the operation of the heating chamber.

Another object of the invention is to provide a vacuum furnace in which the initial power requirements and maintenance costs are low, that utilizes relatively little floor space, and that avoids thermal shock of the furnace heating chamber that is normally experienced in backfill quenching and complete chamber reheating.

Still another object is to provide a furnace wherein the heating chamber therein is continuously operated without quenching or backfilling, a vacuum metal-to-metal seal being employed for sealing work load entry and cooling chambers from the heating chamber so as to enable the temperature and vacuum to be continuously maintained in the heating chamber.

Other objects, features and advantages of the invention will become apparent as the description thereof proceeds when considered in connection with the accompanying illustrative drawings.

Description of the drawings

FIG. 1 is a horizontal sectional view of the vacuum furnace embodied in the present invention;

FIG. 2 is a front elevational view of the vacuum furnace shown in FIG. 1 and illustrating the control for the transfer and sealing mechanism;

FIG. 3 is a sectional view taken along lines 3—3 in FIG. 2;

FIG. 4 is a diagrammatic illustration of the furnace showing the vacuum systems therefor and for the sealing mechanism;

FIG. 5 is a diagrammatic illustration of the control for operating the transfer and sealing mechanism; and

FIGS. 6 through 11 show a sequential operation of the furnace illustrating the manner in which a work load is introduced into the heating chamber of the furnace and removed therefrom while another work load is simultaneously inserted into the furnace for transfer to the heating chamber.

Description of the invention

Referring now to the drawings and particularly to FIG. 1, the furnace construction embodied in the present invention is generally illustrated at 10 and includes a T-shaped housing defined by a head portion generally indicated at 22 and a leg portion indicated at 13. Although not shown, the housing is mounted on a suitable support structure. Formed in the leg portion 13 of the T-shaped housing is a chamber 12 that defines the heating chamber of the furnace 10. Located within the heating chamber 12 are a plurality of heating elements 14 that are of the graphite type such as is illustrated and described in Patent #3,257,492. Surrounding the graphite heating elements 14 for maintaining the heat within a selected area are insulating layers 16, while a cooling jacket 18 in which a cooling fluid is circulated envelops the heating chamber 12. Formed in the cooling jacket 14 and communicating with a vacuum pump through suitable piping is an opening 20, the vacuum pump being operated, as will be described, to maintain the heating chamber at the required vacuum.

In this connection when the heating chamber is evacuated to a sufficient vacuum as 100 microns, an appropriate valve is closed to seal the heating chamber 12. An inert atmosphere such as nitrogen is then introduced into the heating chamber to bring the vacuum to an operating range of approximately 5 inches Hg. The nitrogen atmosphere which is maintained in the heating chamber at a partial pressure effectively reduces the impurity level therein and enables the heat treating operation, to be described, to be carried out in a non-oxidizing atmosphere so as to not deleteriously affect the work load being heat treated. It is understood, that the oxidizing impurities in the heating chamber are also maintained at a partial pressure therein, the heat treating operation thus being accomplished in an atmosphere where there is a low concentration of materials that have an oxidizing influence.

The head portion 22 of the housing is formed in a generally cylindrical configuration and includes opposed vestibule areas indicated at 24 and 26 that are disposed in aligned and coaxial relation with respect to each other. The vestibule areas 24 and 26 are spaced apart by an intermediate or transfer zone 28 that communicates with the heating chamber 12, the transfer zone 28 being employed as an intermediate area for transfer of a work load into and out of the heating chamber 12. Surrounding the vestibule areas 24 and 26 are water jackets 30 and 32 that provide for cooling of the housing in the conventional manner. Also joined to the head portion 22 of the housing and located centrally thereof is a cylindrical section 34 that communicates with the transfer zone 28 and that defines a central port 36 that is sealed by a door 38. A control rod 39 projects through a sealed opening in the door 38 and is provided for manually moving a work load to and from the heating chamber 12 by an operator, as will be described.

As will be further described hereinafter, the vestibule areas 24 and 26 are alternately employed as a loading station for receiving a work load to be heat treated and as

a cooling station that receives a heat treated work load subsequent to the heat treating cycle. In order to insert or remove a work load from either the vestibule area 24 or 26, the head portion 22 is provided with pivotally mounted doors 40 and 42 that are located at the extreme ends of the vestibule areas 24 and 26, respectively. The doors 40 and 42 include annular seals 44 and 46, respectively, that are adapted to engage the extreme ends of the head portion 22 that define the vestibule areas 24 and 26; and as will also be further described, the doors 40 and 42 are adapted to be opened automatically when the pressure within the vestibule areas 24 and 26 is at atmospheric.

Fixed in the vestibule area 24 and adjacent to the transfer zone 28 is a sealing assembly generally indicated at 48 that includes a plate 50 to which is joined an inner annular wall 52. The inner annular wall 52 defines an opening or port that provides communication between the vestibule area 24 and the transfer zone 28 and through which a work load is adapted to be moved. Also joined to the plate 50 and spaced from the annular wall 52 is an outer annular wall 54, the walls 52 and 54 defining an annular chamber 56 therebetween that communicates with a vacuum pump. Located in the vestibule area 26 adjacent to the transfer zone 28 and spaced from the sealing assembly 48 is a sealing assembly generally indicated at 58 that is substantially similar to the sealing assembly 48 as just described. In this connection, a plate 60 is fixed to the housing that defines the vestibule area 26, and joined to the plate 60 are an inner annular wall 62 and an outer annular wall 64 between which a chamber 66 is defined that also communicates with a vacuum pump. It is also seen that the inner annular wall 62 defines an access port that provides for communication between the vestibule area 26 and the transfer zone 28.

In the operation of the furnace, it is required that the vestibule areas 24 and 26 be alternately sealed from the transfer zone 28 and the heating chamber 12, and, for this purpose, a sealing plate 68 that is secured to a transfer assembly generally indicated at 70 is provided and is adapted to be brought into sealing engagement with either the annular walls 52, 54 or 62, 64. As will be described in connection with FIG. 4, the chambers 56 and 66 are adapted to be evacuated by a vacuum pump that is separate from the vacuum pump that evacuates the heating chamber 12, the vacuum produced in the sealing chambers 56 and 66 being somewhat greater than that produced in the heating chamber 12. It is seen that the purpose of the sealing chambers 56 and 66 is to insure that the heating chamber 12 is protected from the vestibule area that is sealed therefrom when a work load is to be removed from that vestibule area or inserted therein and when that vestibule area is at atmospheric pressure.

In order to move work loads to and from the heating chamber 12 by way of the vestibule areas 24 and 26 the transfer assembly is provided and is interconnected to the sealing plate 68 so as to simultaneously seal a vestibule area when transferring a new work load into the heating chamber. Referring again to FIG. 1 and with reference to FIG. 3, the transfer assembly 70 is shown including parallel rods 72 and 74 to which the plate 68 is fixed for movement therewith. The elongated rod 72 is formed with an end portion 76 from which a projection 78 is spaced. Formed on the opposite end of the elongated rod 74 is an end portion 80 from which a projection 82 is spaced. The end portion 76 that is joined to the elongated rod 72 is interconnected to a reel 84 through an operating wire 86, the reel 84 being mounted on a shaft 88 that extends outwardly of the vestibule area 24 and that has a sprocket gear 90 secured to the end thereof. An operating wire 92 is secured to the end portion 80 of the elongated rod 74 and is wound on a reel 94 that is mounted on a shaft 96. The shaft 96 extends outwardly of the vestibule area 26 and has a sprocket gear 98 (FIG. 2) fixed to the outer end thereof. A handle 100 is mounted on the outermost

end of the shaft 96 and is provided for manual rotation of the shaft 96, and, as seen in FIG. 2, a chain 102 is received on the sprocket gears 90 and 98 and transfers movement of the shaft 96 to the shaft 88 upon rotating movement of the handle 100. It is seen that the elongated parallel rods 72 and 74 together with the plate 68 are shiftable in an axial direction with respect to the vestibule areas 24 and 26 upon rotation of the handle 100.

In order to transfer a work load to and from the heating chamber 12, a carrier generally indicated at 104 is provided and is interconnected to the elongated rod 72 through a shortened bar 106 having a pivotal connection 108. The carrier, which includes side rails 110 and 112, and end rails 114 and 116, is pivotally interconnected to a rod 118 through a pivot connection 120, a bar 122 joined to the end bar 116 also being interconnected to the pivot connection 120. The outermost end of the rod 118, as shown in FIG. 1, is connected to the projection 82 through a tension spring 124. A finger 125 is formed on the underside of the rod 118 (see FIG. 3) and is adapted to engage the fixed plate 60 upon movement of the transfer assembly 70 to the right as seen in FIG. 1. A second carrier 105 is shown located in the vestibule area 24 in FIG. 1, and the construction of this carrier is identical to carrier 104 previously described. As will be apparent hereinafter, the carriers 104 and 105 are moved alternately from their respective vestibule areas to the transfer zone 28 while the furnace is in operation and are employed for moving work loads into and out of the heating chamber 12 without the requirement of backfilling and quenching the heating chamber after each heat treating cycle.

Referring again to FIG. 1, a work basket 126 in which a work load is located is shown positioned in the heating zone between the heating elements 14 of the heating chamber 12 and located on a track 128. The track 128 extends from the transfer zone 28 to the heating chamber 12 and when the carrier 104 which carries the work basket 126 thereon is moved into the transfer zone 28 and rotated to the position illustrated in FIG. 1, the basket 126 is then in position for movement onto the track 128 and into the heating area between the heating elements 14. As will be described, the transfer rod 40 is manually controlled for moving the basket 126 from the carrier 104 onto the track 128 to the heating position and is also employed for retracting the basket 126 from the heating chamber for placement on the carrier 104 after the heating cycle is completed.

It is seen that when a basket 126 is placed on a carrier located in a vestibule area and the handle 100 is rotated, the transfer assembly 70 will then move the carrier from its vestibule area into the transfer zone 28. As the carrier moves into the transfer zone 28, the finger 125 strikes either the fixed plate 50 or 60 (depending upon the direction of movement), causing the rod 118 to be prevented from further forward movement. The parallel elongated rods 72 and 74 which are slidably moved on the plates 50 and 60 continue to carry the carrier forwardly, but since the carrier is pivoted to the rod at 120, the carrier will be caused to pivot from an axial position with respect to the vestibule areas to a position transverse with respect thereto as shown in FIG. 1. The rotating movement of the carrier causes the spring 124 to be tensioned so as to positively locate the carrier in the transverse position. With the carrier located as illustrated in FIG. 1, the basket 126 mounted thereon may then be moved onto the track 128 for transfer to the heating chamber 12 and into the heating area between the heating elements 14. As further illustrated in FIG. 1, when the carrier 104 moves from the vestibule area 26 to the transfer zone 28, the plate 68 is moved with the transfer assembly 70 into engagement with the sealing assembly 48, thereby sealing the vestibule area 24 from the transfer zone 28, the heating chamber 12 and the vestibule area 26. During the time that the vestibule area 24 is

sealed it may be employed for cooling a heated work load or for placing a new work load to be heat treated therein. As will be further described, when the pressure within either of the vestibule areas is increased to atmospheric, the door associated therewith is automatically opened.

It is understood that after the basket 126 is returned to either the carrier 104 or 105 located in the transfer zone 28, and the handle 100 is rotated, the carrier will rotate under the action of the spring 124 to the position that is axial with respect to the vestibule areas. Continued rotation of the handle 100 will retract the carrier with the basket 126 thereon through either the vestibule plate 50 or 60 and then into the appropriate vestibule area. During this movement, the sealing plate 68 is moved from a sealing position with respect to one sealing assembly to the sealing position with respect to the other sealing assembly.

Referring now to FIG. 4, a diagrammatic illustration of the furnace 10 is shown wherein the piping for the vacuum systems is particularly illustrated. One of the features of the present invention is maintaining a vacuum in the heating chamber 12 while alternately bringing the vestibule areas 24 and 26 to atmosphere. As previously described, the heating chamber 12 communicates with a vacuum pump through the port 20 and as shown in FIG. 4, both the vestibule areas 24 and 26 communicate with the same vacuum pump through the lines 130, 132, and 134. Solenoid operated valves 136 and 138 are interposed in the lines 130 and 132, respectively, and are adapted to control the evacuation of the chambers 24 and 26 as required. Since the sealing assemblies 48 and 58 are evacuated to a lower pressure than the heating chamber 12, a separate vacuum pump is provided therefor, and, as further illustrated in FIG. 4, lines 140 and 142 are connected to the secondary vacuum pump through a line 144. It is understood that the vacuum in the sealing assemblies 48 and 58 is somewhat greater than that maintained within the heating chamber 12, wherein any leakage through either the sealing assembly 48 or 58 when the plate 68 is in engagement therewith will always be from the heating chamber thereto thereby protecting the heating chamber 12 when either the vestibule area 24 or 26 is brought to atmosphere. Solenoid operated valves are also employed in the lines 140 and 142 for controlling the evacuation of the sealing assemblies 48 and 58.

As previously mentioned, it is necessary to quench the work load in an atmosphere after the heat treatment thereof, and for this purpose a gaseous medium, such as nitrogen, is introduced into the vestibule area to which the heat treated work load has been moved. In order to introduce the nitrogen into the vestibule areas 24 and 26, a nitrogen supply is indicated in FIG. 4 and communicates with the vestibule areas 24 and 26 through a line 146 and lines 148 and 150. An intermediate line 152 also communicates with the nitrogen supply and directs the nitrogen to a manifold 154 which in turn directs the nitrogen into another portion of the vestibule areas 24 and 26 through lines 156 and 158. Appropriate solenoid operated valves are interposed in all of the lines in the backfill system as indicated in FIG. 4 for controlling the supply of nitrogen to the vestibule areas.

As previously described, the sealing plate 68 that is interconnected to the transfer assembly 70 and is moved therewith is adapted to be placed in sealing engagement with either the sealing assembly 48 or 58, depending upon whether the carrier 104 or 105 is moved into the transfer zone 28. In order to positively locate the sealing plate 68 in the sealing position thereof, the sprocket chain 102 that is utilized for moving the transfer assembly 70 is supplemented by an air cylinder 160, the piston rods 163 and 164 of which are interconnected to the sprocket chain 102. As shown in FIG. 5, an air supply directs air under pressure into the cylinder 160 through the lines 166 and 168. Switches 170 and 172 are responsive to movement of the air cylinder piston rods 163 and 164

for operating solenoid valves 174 and 176 which direct the air under pressure into the appropriate side of the cylinder 160. Thus, the piston rods 163 and 164 will be shifted, which will, in effect, move the sealing plate 68 into a positive sealing position on either the sealing assembly 48 or 58.

After the work load has been removed from the heating chamber 12 following the heating cycle and transferred to a vestibule area, a cooling cycle then ensues, following which the work load is quenched by backfilling the vestibule area with nitrogen. In order to cool the vestibule areas 24 and 26, cooling fans 178 and 180 are provided and are driven by separate motors 182 and 184, respectively. As shown in FIG. 2, the cooling fans 178 and 180 project into the vestibule areas 24 and 26, respectively, and are interconnected to their respective motors through shafts 186 and 188, the motors 182 and 184 being mounted on the housing sections that define the vestibule areas 24 and 26, respectively. As will be further described, the motors 182 and 184 are automatically controlled to begin the cooling cycle after a work load has been removed to the appropriate vestibule area.

Operation

The operation of the furnace will now be described, and reference is made to FIGS. 6 through 11. In FIG. 6, the transfer mechanism 70 is positioned such that the sealing plate 68 is located in engagement with the sealing assembly 58, thereby sealing the vestibule area 26 from the transfer zone 28 and the heating chamber 12. In this position of the sealing plate 68 the vestibule area 24 is located in communication with the transfer zone 28 and the heating chamber 12, and the vacuum in the vestibule area 24 is essentially the same as that in the heating chamber 12. With the sealing plate 68 located as shown in FIG. 6, and with the vestibule area 26 at atmosphere, the left door 42 is automatically in the open position, which permits a basket 126 with a work load therein to be placed on the carrier 104 that is located within the vestibule area 26. The door 42 is then closed, which then closes a switch 174 (FIG. 4) that starts a timing cam motor (not shown). The timing cam operates the solenoid valve 138 to cause the vestibule area 26 to be placed in communication with the vacuum pump for the chambers. After the vestibule area 26 is evacuated to approximately 100 microns or better, it is then backfilled with nitrogen to approximately 5 inches mercury and equalizing valves (not shown) are then operated to equalize the pressure in the main heat chamber 12 and the vestibule area 26. With the pressure in the vestibule area 26 reading approximately five inches of mercury vacuum, the transfer mechanism 70 is manually operated by rotating the handle 100, and the carrier 104 is then moved to the transfer zone 28 and rotated at right angles therein. The work rod 39 which is manually controlled by an operator is shifted to move the work basket 126 from the carrier 104 onto the track 128 and into the heating chamber 12 as shown in FIG. 7. Simultaneously with the movement of the transfer mechanism 70 to the position illustrated in FIG. 7, the plate 68 is shifted to the right hand position for engagement with the sealing assembly 48, thereby sealing the vestibule area 24 from communication with the heating chamber 12. In this position of the plate 68, the seal is protected by the evacuation of the chamber 56 of the sealing assembly 48 through the line 140. After the heating cycle for the work load in the heating chamber 12 has been completed as determined by the material being heat treated, the work basket 126 is manually withdrawn to the carrier 104 for return to the vestibule area 26 (FIG. 8). During the heating cycle, the vestibule area 24 is returned to atmosphere by backfilling with nitrogen through line 148 and the line 156. When the vestibule area 24 returns to atmosphere, the door 40 automatically opens. A basket 126a with a work load therein is then placed within the vestibule area 24 on the carrier 105 lo-

cated therein and is ready for transfer to the heating chamber 12 (FIG. 7).

With the vestibule area 24 sealed, and the new work load located therein, the vestibule area is then placed in communication with the vacuum pump and reduced in pressure to approximately 100 microns. The vestibule area is then backfilled with nitrogen to approximately 5 inches mercury which is essentially the same pressure that exists in the heating chamber 12. At this time, the pressure is equalized in the vestibule area 24 and the heating chamber 12, and the operating handle 100 is again rotated to move the heat treated work load from the transfer zone into the vestibule area 26. Simultaneously, the basket 126a with the work load to be heat treated that is located in the vestibule area 24 is moved to the transfer zone for transfer to the heat treating chamber 12, and the sealing plate 68 is moved from engagement with the sealing assembly 48 to engagement with the sealing assembly 58 (FIG. 9). The cooling motor within the vestibule area 26 is automatically operated, and the timing motor controls the cooling cycle to cool the heat treated work load located in the vestibule area 26 for a predetermined period of time. The timing motor then opens the backfill supply valve to the vestibule area 26 to provide for entry of nitrogen therein to backfill the vestibule area 26. The vestibule area 26 is then brought to atmospheric pressure and the door 42 is automatically opened. The procedure is then repeated wherein a basket 126b with a new work load is placed in the vestibule area 26 while the work load in the basket 126a in the heating chamber 12 is going through the heating cycle (FIG. 10). Once the work load in the basket 126a has completed the heating cycle, it is moved back to the transfer zone 28 onto its carrier 105 by the operator and returned to the vestibule area 24 (FIG. 11) which simultaneously moves the basket 126b with a new work load from the vestibule area 26 to the transfer zone 28. Thereafter the basket 126b is moved into the heating chamber 12. With the vestibule area 24 now sealed by the plate 68, the work load therein is cooled and quenched by the introduction of nitrogen therein and thereafter the vestibule area 24 is brought to atmosphere for removal of the heat treated work load therefrom.

While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described.

What is claimed is:

1. In a furnace construction for heat treating metallic articles, a heating chamber into which said articles are transferred for the heat treatment thereof, opposed vestibule areas located in spaced relation adjacent to said heating chamber and being disposed for communication therewith, said vestibule areas being coaxially aligned with respect to their longitudinal axes, the longitudinal axis of said heating chamber being generally perpendicular to the longitudinal axes of said vestibule areas and projecting generally intermediate therebetween, each of said vestibule areas defining a loading and cooling station in which the articles are placed for transfer to said heating chamber and to which the articles are transferred for cooling after the heat treating operation in said heating chamber, a sealing member that is coaxial with said vestibule areas and that is movable therebetween, and means for sequentially moving said sealing member to alternately seal one vestibule area from said heating chamber during the cooling and loading operations and to locate the other vestibule area in communication with said heating chamber when said articles are to be transferred thereto for the heat treatment thereof.

2. In a furnace construction as set forth in claim 1, means for evacuating said heating chamber and the vestibule area in communication therewith during the heat

treating operation, each of said vestibule areas having a sealing assembly against which the sealing member is alternately moved, and means for evacuating the sealing assemblies of said vestibule areas and maintaining a pressure therein that is lower than in said heating chamber, thereby effectively sealing the vestibule areas from the heat treating chamber as each vestibule area is sealed off therefrom during the cooling and loading operations.

3. In a furnace construction as set forth in claim 2, said moving means including means for carrying said articles and for transferring them to and from said vestibule areas, said carrying and transferring means being movable in an axial direction through a vestibule area and then being movable to a position that is transverse to said first direction of movement, wherein the carrying and transferring means is located such that the articles carried thereon are positioned for movement to said heat treatment chamber for heat treatment therein.

4. In a furnace construction as set forth in claim 3, a transfer chamber located between said vestibule areas and forwardly of the throat of the heating chamber, said sealing member being movable within the transfer chamber to locate either of the vestibule areas in communication with said heating chamber and to seal the other vestibule area therefrom.

5. In a furnace construction as set forth in claim 4, said carrying and transferring means including a carrier on which a basket is mounted, the articles to be heat treated being located within said basket said carrier being pivotally mounted and being responsive to movement thereof into said transfer chamber for pivoting from a position that is coaxial with respect to said vestibule areas to a position transverse thereto and coaxial with respect to said heating chamber, said carrier thereafter being movable axially with respect to said heating chamber from said transfer chamber for location within said heating chamber.

6. In a furnace construction as set forth in claim 5, resilient means interconnected to said carrying and transfer means and cooperating therewith to cause said carrier to be pivoted under tension to the transverse position, wherein the carrier is returned by the action of said resilient means to the position that is coaxial with said vestibule areas when the moving means is actuated to move the sealing member from a sealing position with respect to one vestibule area to a sealing position with respect to the other vestibule area.

7. In a furnace construction as set forth in claim 1, means responsive to movement of the articles from the heating chamber to a vestibule area for cooling said articles therein.

8. In a furnace construction as set forth in claim 7, means for introducing a gaseous medium into the vestibule area to which the articles are moved after the heat treatment thereof and following a predetermined cooling cycle, said gaseous medium being introduced in the vestibule area to bring the pressure therein to approximately atmospheric so that the articles may be removed therefrom.

9. In a furnace construction for heat treating a work load therein, a heating chamber in which the work load is heat treated, opposed vestibule areas located adjacent to said heating chamber and being spaced from each other in generally aligned relation, means for sealing each

of said vestibule areas from atmosphere means for selectively evacuating each of said vestibule areas to a pressure less than atmosphere, means for moving a work load from one vestibule area after reducing the pressure therein to a position intermediate said vestibule areas, wherein said work load is transferred to said heating chamber for a predetermined heating cycle, means responsive to the moving of said work load intermediate said vestibule areas for sealing the other vestibule area from said one vestibule area and said heating chamber, said moving means transferring the work load to said one vestibule area after the heating cycle and simultaneously moving the sealing means to a position for sealing said one vestibule area from said heating chamber while locating the other vestibule area in communication therewith, and means for cooling the heat treated work load that has been moved to said one vestibule area after the heating cycle.

10. In a furnace construction for heat treating metallic articles, a heating chamber into which said articles are transferred for the heat treatment thereof, said heating chamber being maintained at a substantially constant temperature and vacuum and having a non-oxidizing atmosphere located therein under partial pressure that maintains oxidizing impurities in said heating chamber at a low level of concentration, at least one vestibule area located adjacent to said heating chamber and normally in communication therewith and defining a loading and cooling station in which the articles are placed for transfer to said heating chamber, a sealing member for sealing off communication between said vestibule area and heating chamber and means for moving said sealing member to and from the sealing position thereof, at least one other vestibule area located adjacent to said heating chamber and disposed in aligned, coaxial relation with respect to said first-named vestibule area, the axes of said vestibule areas being located generally transverse with respect to the axes of said heating chamber, wherein the longitudinal axis of said heating chamber as projected extends substantially intermediate the vestibule areas, means for transferring a work load of said articles in a first direction from one of said vestibule areas to a zone intermediate said vestibule areas, said work load being thereafter transferred to said heating chamber in a second direction that is transverse to said first direction, and means for sealing the other of said vestibule areas during movement of the work load from the one vestibule area to the intermediate zone and then to said heating chamber, said sealing means being responsive to movement of the work load to the intermediate zone for sealing said other vestibule area.

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