

Jan. 7, 1947.

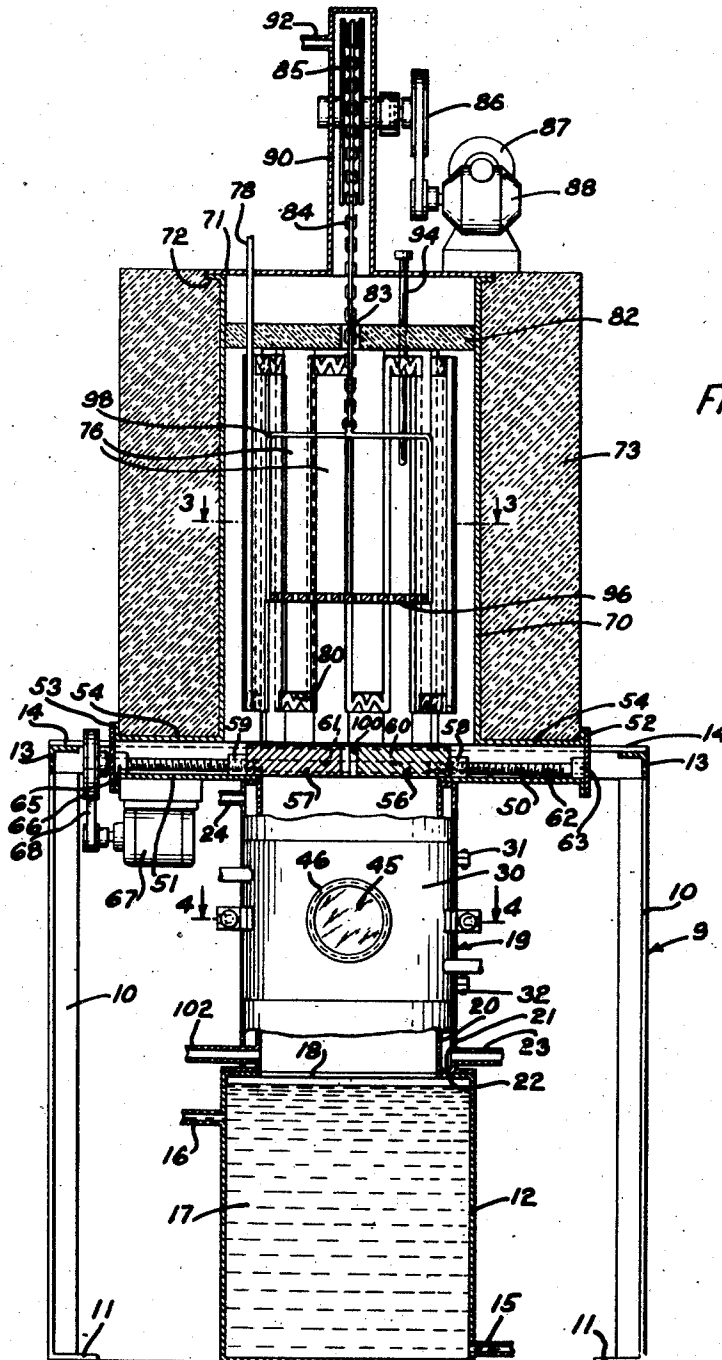
G. J. MAXSON

2,413,987

HEAT TREATING APPARATUS

Filed Jan. 10, 1942

2 Sheets-Sheet 2



INVENTOR
G. J. MAXSON
BY *Harry L. Swift*
ATTORNEY

UNITED STATES PATENT OFFICE

2,413,987

HEAT-TREATING APPARATUS

Gordon J. Maxson, Western Springs, Ill., assignor
to Western Electric Company, Incorporated,
New York, N. Y., a corporation of New York

Application January 10, 1942, Serial No. 426,369

18 Claims. (Cl. 266—4)

1

This invention relates to a heat treating apparatus and more particularly to an apparatus in which parts may be brazed, hardened and annealed in a prepared atmosphere.

It is an object of the present invention to provide a relatively simple heat treating apparatus in which parts may be brazed or heat treated and quenched either in a quenching bath or a prepared atmosphere quenching area.

In accordance with one embodiment of the invention, a heat treating furnace is provided wherein the heating area is sealed from the outside atmosphere and supplied with a prepared atmosphere and has positioned directly beneath it a cooled chamber, also sealed from the outside atmosphere and in communication with the furnace, so that gas supplied to the furnace will pass through the cooled area. The cooled portion of the apparatus extends down to a liquid quench which is positioned in the bottom portion of the cooling chamber whereby parts may be lowered directly from the furnace in which they are heated, through the cooled chamber, to the quenching bath without leaving the controlled atmosphere.

In the specific embodiment of the invention disclosed herein, a water jacketed cooling chamber is in communication with the heating chamber and a prepared atmosphere, preferably nitrogen, is forced into the upper portion of the heating chamber down through the cooling chamber and back to a source of supply or a circulating mechanism, which will continuously circulate the prepared atmosphere through the furnace. The area in which parts may be cooled is provided with a door which effectively seals this area and which may be removed to permit parts to be loaded on to a lifting platform movable from the heating chamber to the quenching bath directly beneath the chamber, whereby parts may be supported in the heating chamber, the cooling chamber, and/or the quenching bath.

A better understanding of the invention may be had by reference to the accompanying drawings, wherein

Fig. 1 is a plan view of the heat treating apparatus constituting one embodiment of the invention;

Fig. 2 is a vertical sectional view taken substantially on the line 2—2 of Fig. 1 in the direction of the arrows, showing the details of construction of the article supporting platform and its elevating mechanism and the relative location of the heating chamber, cooling chamber and quenching bath;

2

Fig. 3 is a horizontal sectional view taken along the line 3—3 of Fig. 2 in the direction of the arrows showing the arrangement of heating units within the heating chamber, and

Fig. 4 is a horizontal sectional view taken along the line 4—4 of Fig. 2 in the direction of the arrows showing the relative position of the cooling chamber and charging door, whereby parts may be placed in the apparatus.

Referring to the drawings, wherein like reference characters designate the same parts throughout the several views, particular reference being had to Figs. 1 and 2, wherein a framework 9, comprised of a plurality of angle members, supports the furnace. Vertically extending angle members 10—10, extending upwardly from suitable base members 11—11, are disposed about a quench tank 12 and carry, at their upper ends, horizontally extending angle members 13—13, on which there are supported a pair of transverse plates 14—14, which structure makes up the supporting framework for the upper portions of the apparatus. The quench tank 12, which is cylindrical in shape, is provided with an inlet pipe 15 and an outlet pipe 16, whereby a supply of quenching material 17 may be circulated and supplied to the quench tank 12. Secured to the upper end of the quench tank 12 is an annular member 18, which forms an inwardly extending flange for the quench tank and on which the circular walls of a cooling chamber 19 may be supported.

The cooling chamber 19 comprises inner and outer walls 20 and 21, which define the limits of a water jacket or compartment 22, in which a cooling fluid may be circulated. The compartment 22 may be supplied with a cooling fluid through an inlet pipe 23 and an outlet pipe 24 is provided for directing the cooling fluid back to a circulating system of any suitable type (not shown).

The cooling chamber 19 is provided with a door 30 hinged to the main portion of the chamber 19 by means of hinges 31 and 32. This door 30 is hollow and may be connected to the same cooling system as the chamber 22 by inlet and outlet ports 33 and 34, suitable flexible connections (not shown) being provided for connecting the inlet and outlet ports 23 and 24 and 33 and 34 to the coolant circulating system. In order to effect an air tight seal between the door 30 and the remainder of the cooling chamber 19, lock bolts 35 and 36 are pivoted at 37 and 38 in flange members 39 and 40, respectively, fixed to the main part of the cooling chamber.

3

Threaded on the forward end of the lock bolts 35 and 36 are hand wheels 41 and 42, respectively, which may be run down on the threads of the bolts 35 and 36 to engage slotted flange members 43 and 44, respectively, thus to tightly clamp the door of the cooling chamber to the main portion thereof. Positioned in the center of the door 30 is a window 45, set into a collar 46 extending through the door 30, whereby parts in the furnace may be inspected without opening the door.

The upper end of the cooling chamber 19 is suitably connected, as by welding, to plates 50 and 51, which are bent downwardly at their outer ends to form a flange against which end members 52 and 53 are fixed. The plates 50 and 51 and end members 52 and 53 cooperate with an annular casing member 54 to provide a door receiving compartment into which doors 56 and 57 of heat insulating material may be moved. The doors 56 and 57 are provided at their rear ends with threaded members 58 and 59 and have apertures 60 and 61 formed therein in alignment with the threaded members 58 and 59 for receiving oppositely threaded portions of a door actuating screw 62. The screw 62 is journaled in a bearing member 63, at the right side of the apparatus (Fig. 2), which bearing member is mounted on the plate 52 and at the left side of the apparatus (Fig. 2), the screw member 62 is journaled in a bearing 65. The screw 62 has mounted on its left end a driving sheave 66, which is adapted to be driven by a motor 67 through a belt 68 to open or close the doors 56 and 57.

The casing member 54 has mounted on it a tubular shell 70, the upper end of which is closed by means of a plate 71 resting on a flange 72 formed integrally with the tubular member 70. Surrounding the member 70 and resting upon the casing member 54 is a tubular body of insulating material 73, and within the tubular member 70 there are placed a series of refractory members 76, which cooperate to form a cylindrical heating chamber and which are cut away along their inner edges, as shown at 77, to receive a heating element 78, which is bent to form an irregularly shaped coil extending all the way around the inside of the chamber defined by the refractory members 76. At their upper ends, the refractory members 76 are cut away so that several folds of the heating element may be formed adjacent the upper end of the heating chamber. Similarly, alternate ones of the members 76 are cut away, as shown at 80, to receive several folds of the heating element 78. In this manner, the upper and lower areas of the furnace heating chamber which are not heavily insulated will have a larger amount of heating element therein than the central area thereof so that an even temperature may be maintained in the heating chamber defined by the refractory member 76.

The upper end of the refractories 76 have a circular cap member 82 positioned thereon to prevent any substantial amount of heat from escaping from the heating chamber. The cap member 82 has a central aperture 83 formed therein to permit the passage therethrough of a platform supporting chain 84, the upper end of which passes around a sheave 85 adapted to be driven through a belt and pulley connection 86 by a motor 87, transmitting power through speed reducer 88. The shaft on which the sheave 85 is mounted is positioned in a housing 90, sealed to the plate 71 and the shaft is properly bushed to

4

prevent the escape of gas from the housing 91. The housing 91 is provided with an inlet port 92, whereby a gas, preferably nitrogen, may be supplied to the furnace to maintain a controlled atmosphere therein. Extending through the plate 71 and cap member 82 is a thermocouple 94 for controlling the temperature of the heat treating chamber defined by the refractory members 76. Articles to be heat treated in the apparatus may be positioned therein through the door 30 and may be placed upon a perforated platform 96 having a bail structure 98 connected thereto and to the platform elevating chain 84. Any gas admitted to the housing 90 will pass therethrough, through the aperture 83, through an aperture 100 formed by cooperating walls of notches cut in the inner ends of the doors 56 and 57 and thence down into the cooling chamber 19, from which the gas may pass through an outlet 102 to a suitable circulating system for preparing a desirable gaseous atmosphere for use in heat treating parts in the furnace.

In the operation of the apparatus, the doors 56 and 57 may be retracted into the compartment formed by the members 52 and 53 and the casing member 54 by supplying current to the motor 67 for rotating the screw 62 in the proper direction. After the doors 56 and 57 have been opened, the platform 96 may be lowered to position just below the door 30 and the door may be removed by manipulating the hand wheels 41 and 42 and the lock bolts 35 and 36 to permit the parts to be heat treated to be placed on the platform, whereupon the platform may be elevated to the position shown in Fig. 2, the door 30 closed and clamped in place on the cooling chamber 19 and the apparatus started in operation by supplying current to the heating element 78 and controlling the heat generated by these elements through the thermocouple 92. When the apparatus is started in operation, a prepared gas may be supplied to the apparatus through the inlet port 92. This gas may be circulated through the apparatus, passing first through the aperture 83 into the chamber, defined by the refractories 76, thence to the aperture 100 and to the air quenching area or chamber 19 and out through the outlet port 102. Suitable systems for generating a gas constituting a desired controlled atmosphere are disclosed in the co-pending applications of G. J. Maxson, Serial No. 426,367, filed January 10, 1942, and A. W. Laird and G. J. Maxson, Serial No. 426,368, filed January 10, 1942. The gas prepared in systems such as these may be circulated through the apparatus repeatedly, the quenching bath 17 serving as a seal for the lower end of the apparatus and the upper end of the apparatus being closed to the outside atmosphere by the tubular shell 70 and housing 90.

If it is desired to quench the treated articles or parts in a bath, the bath 17, which may be continuously circulated through the inlet and outlet ports 13 and 18, provides a suitable quench to which parts may be directed by the platform 96 under actuation by the motor 88 and if it is desired to quench the articles in the controlled atmosphere, this may be done in the chamber 19, which is supplied with a coolant circulated there-through through the ports 23, 24, 33 and 34, it simply being necessary to close the doors 56 and 57 after parts have been passed into the cooling chamber 19 or quench bath 17, whereby the heat of the furnace will be substantially cut off from the cooling bath or chamber while the controlled atmosphere may be circulated through the sys-

tem. Thus, articles to be heat treated may be either quenched in a controlled atmosphere or in a quenching bath without coming in contact with the outside atmosphere and the controlled atmosphere may be conserved, making it possible to use treating atmospheres which heretofore were too expensive for commercial use. With the furnace described hereinbefore, the door 30 may be opened without contaminating gas in the heating chamber due to the fact that the gas in the upper or heating chamber is heated and lighter than the air. This process is further aided by feeding the prepared atmosphere in at the top of the furnace, eliminating the necessity of purging the heating chamber each time the door is opened to load the work on the platform 96.

What is claimed is:

1. An apparatus for treating articles comprising a heat treating chamber, a gas quenching chamber in communication with the heat treating chamber, a door in said gas quenching chamber, a liquid quenching chamber in communication with the gas quenching chamber and sealed to the bottom of said gas quenching chamber, and means for receiving parts passed through said door for supporting the parts selectively in any of said chambers.

2. An apparatus for treating articles comprising a heat treating chamber, a gas quenching chamber in communication with the heat treating chamber, a door in said gas quenching chamber, a liquid quenching chamber in communication with the gas quenching chamber and sealed to the bottom of said gas quenching chamber, means for receiving parts passed through said door for supporting the parts selectively in any of said chambers, and means operable to move said supporting means into any of the chambers.

3. An apparatus for treating articles comprising a heat treating chamber, a gas quenching chamber in communication with the heat treating chamber, a door in said gas quenching chamber, a liquid quenching chamber in communication with the gas quenching chamber and sealed to the bottom of said gas quenching chamber, means for receiving parts passed through said door for supporting the parts selectively in any of said chambers, and doors interposable between the heating chamber and gas quenching chamber for preventing any substantial amount of heat from passing from the heating chamber to the gas quenching chamber during the quenching of parts.

4. An apparatus for treating articles comprising a heat treating chamber, a gas quenching chamber in communication with the heat treating chamber, a door in said gas quenching chamber, a liquid quenching chamber in communication with the gas quenching chamber and sealed to the bottom of said gas quenching chamber, means for receiving parts passed through said door for supporting the parts selectively in any of said chambers, doors interposable between the heating chamber and gas quenching chamber for preventing any substantial amount of heat from passing from the heating chamber to the gas quenching chamber during the quenching of parts, and compartments sealed from the outside atmosphere and in communication with the chambers of the apparatus for receiving said doors when the doors are opened to permit passage of the article support from the heating chamber to the quenching chamber.

5. An apparatus for treating articles comprising a heat treating chamber, a gas quenching

chamber in communication with the heat treating chamber, a door in said gas quenching chamber, a liquid quenching chamber in communication with the gas quenching chamber and sealed to the bottom of said gas quenching chamber, means for receiving parts passed through said door for supporting the parts selectively in any of said chambers, doors interposable between the heating chamber and gas quenching chamber for preventing any substantial amount of heat from passing from the heating chamber to the gas quenching chamber during the quenching of parts, compartments sealed from the outside atmosphere and in communication with the chambers of the apparatus for receiving said doors when the doors are opened to permit passage of the article support from the heating chamber to the quenching chamber, and means for actuating said doors.

6. An apparatus for treating articles comprising a heat treating chamber, a gas quenching chamber in communication with the heat treating chamber, a door in said gas quenching chamber, a liquid quenching chamber in communication with the gas quenching chamber and sealed to the bottom of said gas quenching chamber, means for receiving parts passed through said door for supporting the parts selectively in any of said chambers, doors interposable between the heating chamber and gas quenching chamber for preventing any substantial amount of heat from passing from the heating chamber to the gas quenching chamber during the quenching of parts, compartments sealed from the outside atmosphere and in communication with the chambers of the apparatus for receiving said doors when the doors are opened to permit passage of the article support from the heating chamber to the quenching chamber, and a passage formed by cooperating portions of said doors to permit passage of gas from the heating chamber to the gas quenching chamber.

7. An apparatus for treating articles comprising a heat treating chamber, a gas quenching chamber in communication with the heat treating chamber, a door in said gas quenching chamber, a liquid quenching chamber in communication with the gas quenching chamber and sealed to the bottom of said gas quenching chamber, means for receiving parts passed through said door for supporting the parts selectively in any of said chambers, means operable to move said supporting means into any of the chambers, and a housing in communication with the heating chamber for enclosing a portion of the support actuating means.

8. An apparatus for heat treating articles in a nitrogen atmosphere comprising a vertically disposed heating chamber having an inlet port at its upper end, a gas quenching chamber sealed to and disposed directly beneath the heating chamber, a quench tank sealed to and disposed directly beneath the gas quenching chamber, a loading door in said gas quenching chamber, and a gas outlet port in said gas quenching chamber.

9. An apparatus for heat treating articles in a nitrogen atmosphere comprising a vertically disposed heating chamber having an inlet port at its upper end, a gas quenching chamber sealed to and disposed directly beneath the heating chamber, a quench tank sealed to and disposed directly beneath the gas quenching chamber, a loading door in said gas quenching chamber, and a gas outlet port adjacent the seal between the gas quenching chamber and quench tank to with-

draw the gas from the bottom of the gas quenching chamber.

10. An apparatus for heat treating articles in a nitrogen atmosphere comprising a vertically disposed heating chamber having an inlet port at its upper end, a gas quenching chamber sealed to and disposed directly beneath the heating chamber, a loading door in said gas quenching chamber, and a gas outlet port in said gas quenching chamber.

11. A treating apparatus comprising in vertical alignment, a bottom loading furnace, a charging chamber having closure means for the admission of work to be treated, and a quenching bath, and means for transferring work from said charging chamber into the furnace and after heat treatment, into said quenching bath.

12. A heat treating apparatus comprising a bottom loading furnace, a charging chamber positioned beneath said furnace, a quenching bath positioned beneath said charging chamber, said furnace, chamber and bath being in vertical alignment, and transfer means for moving articles from the furnace through the charging chamber to the quenching bath.

13. A heat treating apparatus comprising a bottom loading furnace, a charging chamber positioned beneath said furnace, a quenching bath positioned beneath said charging chamber, and transfer means selectively operable to position articles in the furnace, chamber or bath.

14. A heat treating apparatus comprising a bottom loading furnace, a charging chamber positioned beneath said furnace, a closure means in said charging chamber for the admission of work to be treated, a quenching bath positioned beneath said charging chamber, and means for transferring work selectively from the charging chamber to the furnace and from the furnace to the bath.

15. A heat treating apparatus comprising a bottom loading furnace, a charging chamber positioned beneath said furnace, a charging door in said charging chamber for the admission of work to be treated, a quenching bath positioned be-

neath said charging chamber, and means for transferring work selectively from the charging chamber to the furnace and from the furnace to the bath, said furnace, charging chamber and bath being in direct communication and sealed relation one to another.

16. A heat treating apparatus comprising a bottom loading furnace, a charging chamber positioned in direct vertical alignment beneath the furnace, a quenching bath positioned in direct vertical alignment with the charging chamber, said furnace chamber and bath being in sealed communication one with the other, transfer means for transferring articles to be treated from one to another chamber and bath, and means for introducing treating gas into the furnace and directing it through the furnace to the charging chamber.

17. A heat treating apparatus comprising a bottom loading furnace, a charging chamber positioned in direct vertical alignment beneath the furnace, a quenching bath positioned in direct vertical alignment beneath the charging chamber, said furnace chamber and bath being in sealed communication one with the other, transfer means for transferring articles to be treated from one to another of the chamber, furnace and bath, means for introducing treating gas to the upper end of said furnace, and an outlet adjacent the bottom of the charging chamber, whereby gas may be forced through the furnace and charging chamber to purge the charging chamber of air admitted during the loading of the furnace.

18. An apparatus for treating articles comprising a heat treating chamber, a charging chamber in communication with the heat treating chamber, a door in said charging chamber, a liquid quenching chamber in communication with the charging chamber and sealed to the bottom of the charging chamber, and means for receiving parts passed through the door for supporting articles selectively in any of the chambers.

GORDON J. MAXSON.