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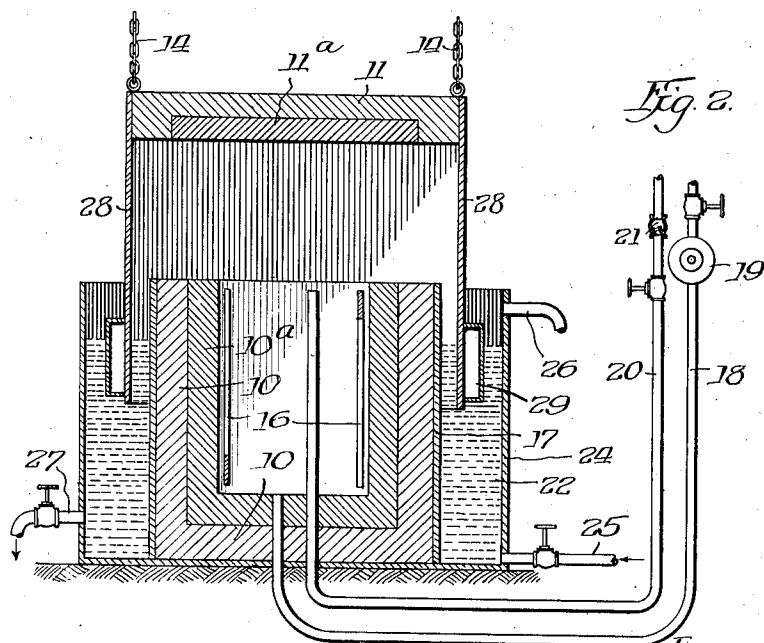
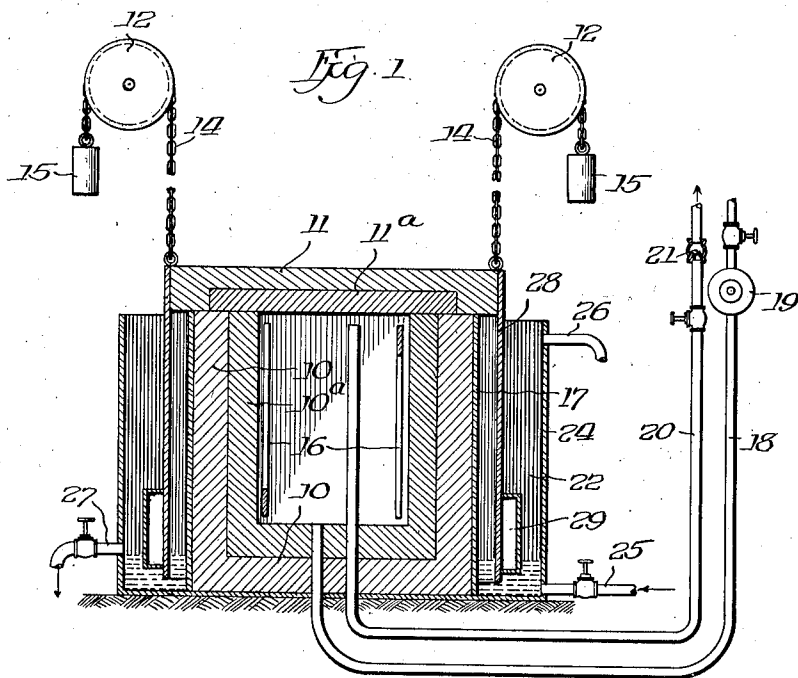
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J. SCHONBRUNN ET AL

HEAT TREATMENT APPARATUS

Filed Sept. 8, 1927

2 Sheets-Sheet 1



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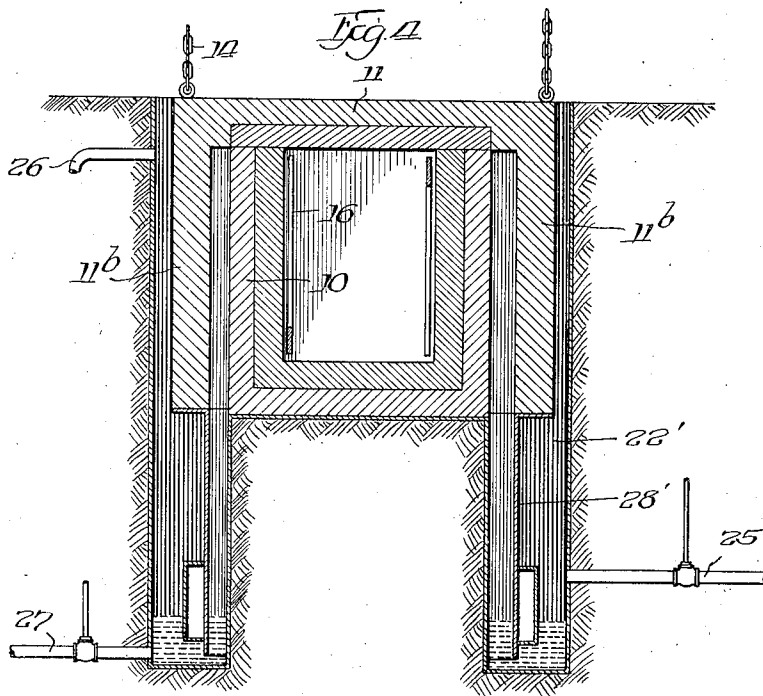
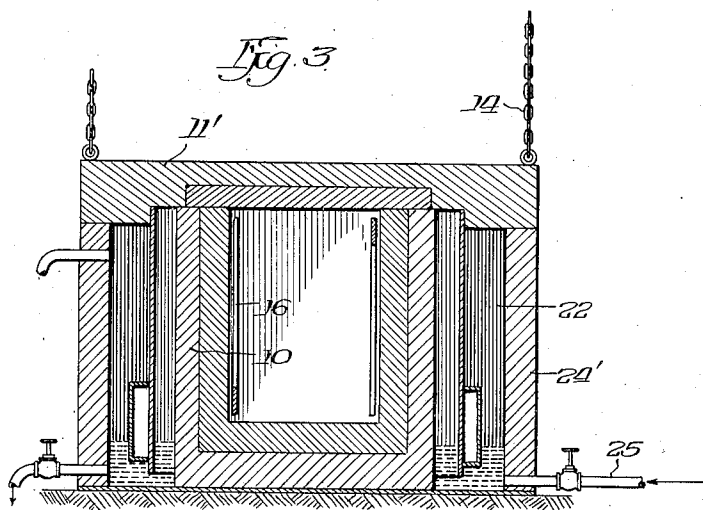
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HEAT TREATMENT APPARATUS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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HEAT TREATMENT APPARATUS.

Application filed September 8, 1927, Serial No. 218,158, and in Germany September 10, 1926.

This invention relates to heat treatment apparatus, particularly furnaces such as may be employed for annealing or other heat treatments of various materials.

5 The general object is the provision of a furnace apparatus which is adapted to increase production by virtue of provision of means for expediting the cooling of a charge while it is still within the furnace and protected
10 from undesirable effects of atmosphere, dust, contamination, or the like.

Another object is the provision of an apparatus which is adapted to expedite and regulate cooling of a charge in the furnace
15 without involving excessive loss of heat in subsequent heating of a succeeding charge.

A further object is the provision of apparatus having the characteristics specified which may be easily and rapidly operated to
20 accommodate charging and discharging and which expedites cooling and heating of charges.

Other and further objects will be pointed out or indicated hereinafter, or will appear
25 to one skilled in the art upon an understanding of the invention or its employment in practice.

In the drawing forming a part of this specification we illustrate three structural embodiments of the invention but it is to be understood that these are presented for purpose of illustration only and are not to be
30 accorded any interpretation calculated to limit the claims short of the true and most comprehensive scope of the invention in the art.

In said drawings,

Fig. 1 is a sectional elevation, shown diagrammatically, of one form of apparatus
40 embodying the invention, the furnace being in the closed condition, as for heating of a charge;

Fig. 2 is a similar diagrammatic sectional elevation representing the furnace in condition for cooling of a charge therein;

Fig. 3 is a similar sectional elevation of a second embodiment of the invention, the furnace being shown in the condition when closed
45 for heating of a charge; and

50 Fig. 4 is a sectional elevation of a third embodiment of the invention with the furnace closed for the heating of a charge.

Certain heat treatment processes require that the cooling down of the charge should

take place within the furnace itself. For
55 example, if certain metallic articles are required to be bright (unoxidized) after the heat treatment, care must be taken to exclude all air from them during the heating and cooling periods. To keep down the heat
60 loss during the heating period, the furnace walls must be made of material having a low heat conducting capacity, and while expediting heating of a charge, this has the effect of rendering the cooling period disproportionately long, far longer than is necessary for the requisite cooling down of the charge
65 alone. The productive capacity of such a furnace is greatly limited by these circumstances, and owing to the extended time required for the treatment of a charge, cannot be worked economically. On the other hand, if no special measures are taken to insulate the furnace, a much greater expenditure of energy for heating will be required, as the
70 heat losses will be great, and the economy under such conditions will be low.

According to the present invention, the furnace may be well insulated, and the heating costs kept within an economical range, while
80 at the same time rapid cooling of the charge may be effected, with complete exclusion of air during heating and cooling.

The nature of the invention will be ascertained from the examples illustrated in the accompanying drawings. Figs. 1 and 2 represent one construction of apparatus in which the furnace is of pit form having the walls and bottom 10 with heat insulating lining 10^a, and the removable cover 11 with
85 lining 11^a. Of course, the walls and cover may be made throughout of material having the necessary heat insulating qualities. The cover is provided with an elevating mechanism including the sheaves 12 over which run
90 suspension members 14 which carry the cover, the weight of the latter being almost completely counterbalanced by the weights 15, so that it may be raised with the application of but little power. The sheaves may
95 be actuated in suitable fashion to raise the cover to the charging position. Suitable heating means, such as the electrical heating elements 16, are provided for heating the furnace chamber interiorly, and the furnace
100 may be rendered gas tight by enclosing its walls and bottom with a metal shell 17. A pipe 18 is provided through which an inert

gas may be supplied to the furnace under control of a suitable pressure regulating device 19, and a pipe 20 affords means for the return or withdrawal of the inert gas from the furnace chamber, said pipe being provided with a non-return valve 21. In the embodiment illustrated, the furnace is surrounded by a chamber 22 formed by enclosing the furnace within a tank 24, said chamber being adapted to hold liquid, such as water, which may be introduced through a pipe 25, to fill the chamber to the overflow 26. A suitable valve control 27 is arranged to permit discharge of the liquid from the chamber 22. The movable cover carries a bell 28 which has relatively thin walls made of material having good heat conductivity and adapted to move in telescopic relationship with the walls of the furnace, completely encompassing the same, said bell adapted to travel in the chamber 22, and carrying at its lower end a float 29, arranged to permit the lower margin of the bell 28 to dip below the surface of the liquid in the chamber 22 to an extent sufficient to form an effective air seal. The float has sufficient buoyancy to support the difference in weight between the cover and bell on the one hand and the counterweights 15 on the other hand, so that the cover and bell may be elevated by liquid introduced into the sealing chamber 22.

In operation, the cover, together with the bell, is elevated to a sufficient extent to permit the charge to be introduced into the furnace chamber and the cover is lowered to the position illustrated in Fig. 1, the sealing chamber 22 being nearly empty of liquid to permit this. The furnace chamber is filled with the inert gas, ingress of air being prevented by the seal afforded by the liquid in which the lower end of the bell is submerged. The heat is then applied and the charge brought to the requisite temperature. Then, for the cooling down of the charge, liquid is introduced through the pipe 25 into the sealing chamber 22, resulting in the elevation of the cover and the bell to a position such as illustrated in Fig. 2, wherein the gas enclosed within the furnace chamber and the bell, which now forms substantially an extension of the furnace chamber, is exposed to the cooling effect of the bell, the walls of which are relatively thin and of good heat conducting material and are cooled exteriorly. Thus the charge may be cooled much more rapidly than would be possible by the normal progress of radiation through the poorly conducting walls of the furnace. At the same time, ingress of air is prevented, so that the charge may be cooled to the proper degree without exposure to oxidation or dust or other contaminating influences outside the furnace. When the charge is sufficiently cooled, the confined inert gas may be withdrawn through pipe 20, and the cover and bell then elevated

to the position permitting discharge and recharging of the furnace. When again closed, the furnace and the new charge may be heated quickly to the desired temperature without undue loss of heat through the furnace walls. Thus, it will be observed, the output of the furnace may be greatly increased due to the shortening of the heating and cooling down periods.

In the embodiment illustrated in Fig. 3, the movable cover 11' is adapted to close the sealing chamber 22 as well as the furnace chamber, thus contributing to the heat insulation of the furnace during the heating period, the encompassing walls 24' in this instance being made also of material of low heat conductivity. The other parts shown in this embodiment are as described in reference to the form shown in Figs. 1 and 2, and operate in similar fashion. By the provisions illustrated in this embodiment, the furnace chamber walls may be less massive than normally required, and the time necessary for cooling thereby still further reduced. The cooling may be expedited by using the sealing liquid also as a cooling medium, by passing it continuously into and out of the sealing chamber during the cooling period.

A third embodiment is illustrated in Fig. 4, wherein the furnace chamber walls are comparatively thin, to facilitate the escape of heat during the cooling period, the insulating effect during the heating period being contributed by the downward extensions 11^b of the cover, which extensions encompass the furnace chamber walls when the cover is in the closed position. The bell 28' is formed as an extension from the lower end of this cover skirt and has thin walls of good heat conductivity. Thus, for the cooling operation the cover must be raised to twice the elevation required in the foregoing embodiments, to expose the bell outside the sealing chamber 22', which latter must be approximately twice the depth of the furnace in order to accommodate the bell when it is in the lowered position. The accessories for the embodiments illustrated in Figs. 3 and 4 may be the same as in Figs. 1 and 2, and the operation is substantially the same.

What we claim is:

1. Heat treatment apparatus comprising the combination of a furnace chamber, means for heating the same interiorly, a movable closure for the chamber, and a heat-conductive extension carried by the closure and movable therewith to maintain the chamber closed to atmosphere when the cover is removed therefrom.

2. Heat treatment apparatus comprising the combination of a heat-insulated furnace chamber, means for heating the same interiorly, a heat-insulating movable closure for the chamber, and a heat-conducting closure portion movable into exposure to the atmos-

phers inside and outside the furnace chamber to facilitate transfer of heat between them.

3. Heat treatment apparatus comprising the combination of a heat-insulated furnace chamber, and a closure for same comprising a heat-insulating portion and a heat conducting portion, said closure being movable to a position wherein the chamber is closed by the heat-insulating portion and to another position wherein the confined atmosphere is exposed to the heat-conducting portion.

4. In heat treatment apparatus, the combination of a heat-insulated furnace chamber, means for heating the chamber interiorly, a movable closure for the chamber, a heat-conducting shell movable with said closure in telescopic relationship with the chamber, and means for providing a seal between the shell and chamber for prevention of ingress of external atmosphere into the latter.

5. In heat treatment apparatus, the combination of a heat-insulated chamber, a heat insulated closure therefor, an extension member in telescopic relationship to the chamber and movable with the closure, said extension member being of heat-transmitting material, and means for maintaining a seal between the extension member and the chamber incident to its movement, to prevent ingress of air into the chamber.

6. In heat treatment apparatus, the combination of a heat-insulated chamber, means for heating the same interiorly, a movable closure for the chamber, a heat-transmitting member movable with the closure to form an extension of the chamber, and means cooperative with the heat-transmitting member to prevent ingress of air into the chamber.

7. In heat treatment apparatus, the combination of a heat-insulated chamber, means for heating the same interiorly, a heat-transmitting member adapted to form an extension of the chamber, a movable closure for cooperation with the chamber and heat-transmitting member, and means for moving the closure to expose the heat-transmitting member to the internal atmosphere of the chamber.

8. In heat treatment apparatus, the combination of a heat-insulated chamber, a heat-transmitting bell adapted to form an extension of the furnace chamber, a closure for closing both the chamber and bell to prevent ingress of air into the chamber, and means for supporting the heat-transmitting member at a selected position with respect to the chamber.

9. Heat treatment apparatus as specified in claim 8, wherein a liquid is utilized to form a seal between the bell and furnace chamber.

10. Heat treatment apparatus as specified in claim 8, wherein a liquid is employed to form a seal between the bell and the furnace

chamber and to support the former in a selected position with respect to the latter.

11. Heat treatment apparatus as specified in claim 8, wherein a liquid is utilized to form a seal between the bell and the furnace chamber, the bell being buoyantly supported by the liquid and the height of the latter determining the position of the bell.

12. Heat treatment apparatus as specified in claim 6, together with means for introducing an inert atmosphere into the chamber.

13. Heat treatment apparatus as specified in claim 8, together with means for introducing an inert gas into the chamber.

14. Heat treatment apparatus as specified in claim 8, wherein the closure and bell are movable vertically, together with means for counterbalancing the weight of the closure and bell, and a float for supporting them buoyantly on the sealing liquid.

15. In heat treatment apparatus, a heat-insulated chamber, a tank enclosing said chamber in spaced relation thereto, a heat-insulated closure member for said chamber, and a heat-transmitting member secured to said closure member to provide for varying the capacity of said chamber to permit regulation of the rate of cooling thereof.

16. In apparatus of the character described, means providing a heating chamber, and means movable to different positions and operable when in one of said positions to provide a fluid seal for said chamber and operable when in another position to provide a cooling chamber for said heating chamber while maintaining such seal.

17. In heat treatment apparatus, a chamber, a tank disposed about and spaced from said chamber, a closure member provided with an extension disposed intermediate said chamber and said tank, and means cooperating with said extension to provide therewith a fluid-seal for said chamber.

18. In apparatus of the character described, means providing a heating chamber, a closure member for said chamber, and means forming part of said closure member and operable when the latter is in position partially removed from said chamber to provide a fluid-cooling chamber for said heating chamber.

19. In heat treatment apparatus, an insulated chamber, a tank enclosing said chamber and spaced therefrom, liquid disposed between said chamber and said tank, an insulated closure member for said chamber, and a heat-conducting portion depending from said closure member into the liquid in such wise as to provide a fluid trap for said chamber, and means operable to provide a support for said closure member and said heat-conducting portion and including float means forming part of said heat-conducting portion and being responsive to level conditions of said liquid.

20. In heat treatment apparatus, an insulated chamber, a tank enclosing and spaced from said chamber, the space between said chamber and said tank being adapted to contain a liquid, an insulated closure member for said chamber, and a heat-conducting portion depending from said closure member into the liquid, said heat-conducting portion having an annular air chamber formed in the lower portion thereof to buoyantly support said heat-conducting portion. 10

In testimony whereof we have hereunto subscribed our names this 23 day of August A. D. 1927, at Zurich, Switzerland.

JAKOB SCHONBRUNN.
GOTTLIEB KELLER.