May 29, 1934. F. T. COPE 1,960,808

METHOD AND APPARATUS FOR HEAT TREATING

Filed June 24, 1932 2 Sheets-Sheet 1

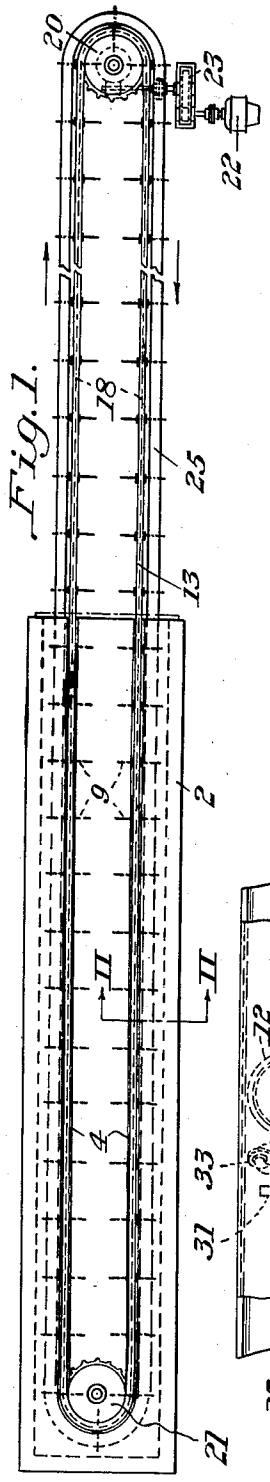


Fig. 1.

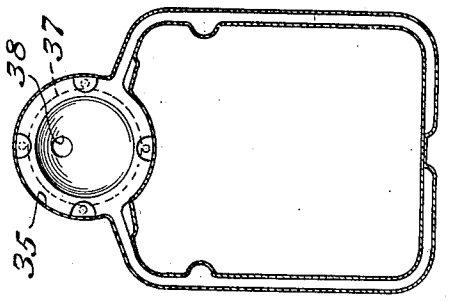


Fig. 5.

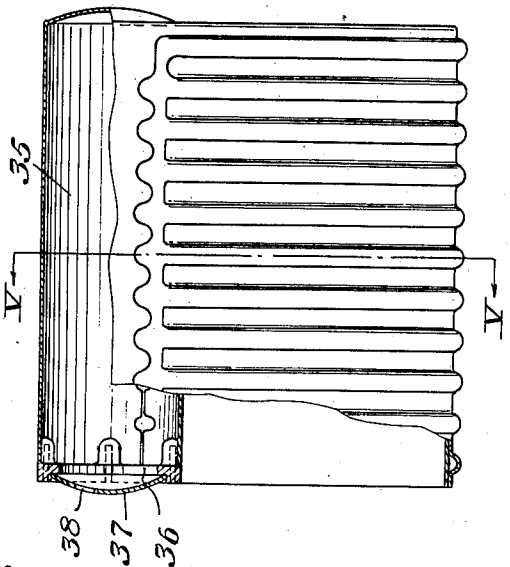


Fig. 4.

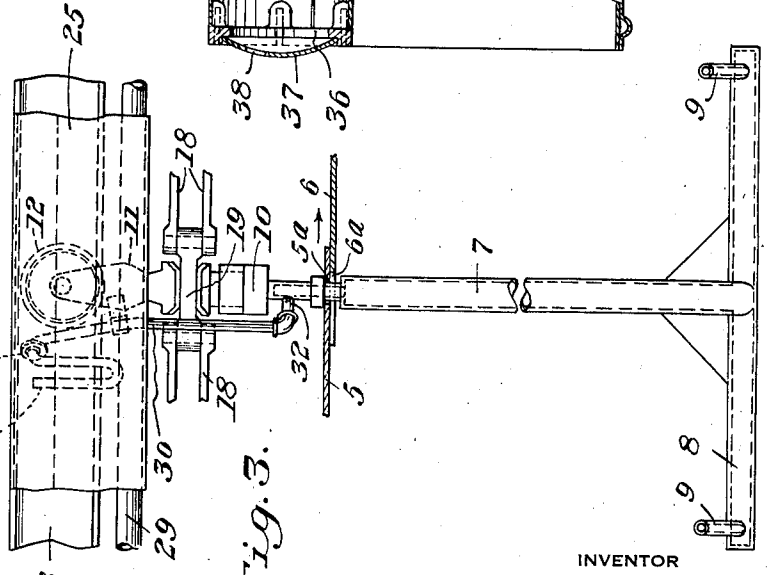


Fig. 3.

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METHOD AND APPARATUS FOR HEAT TREATING

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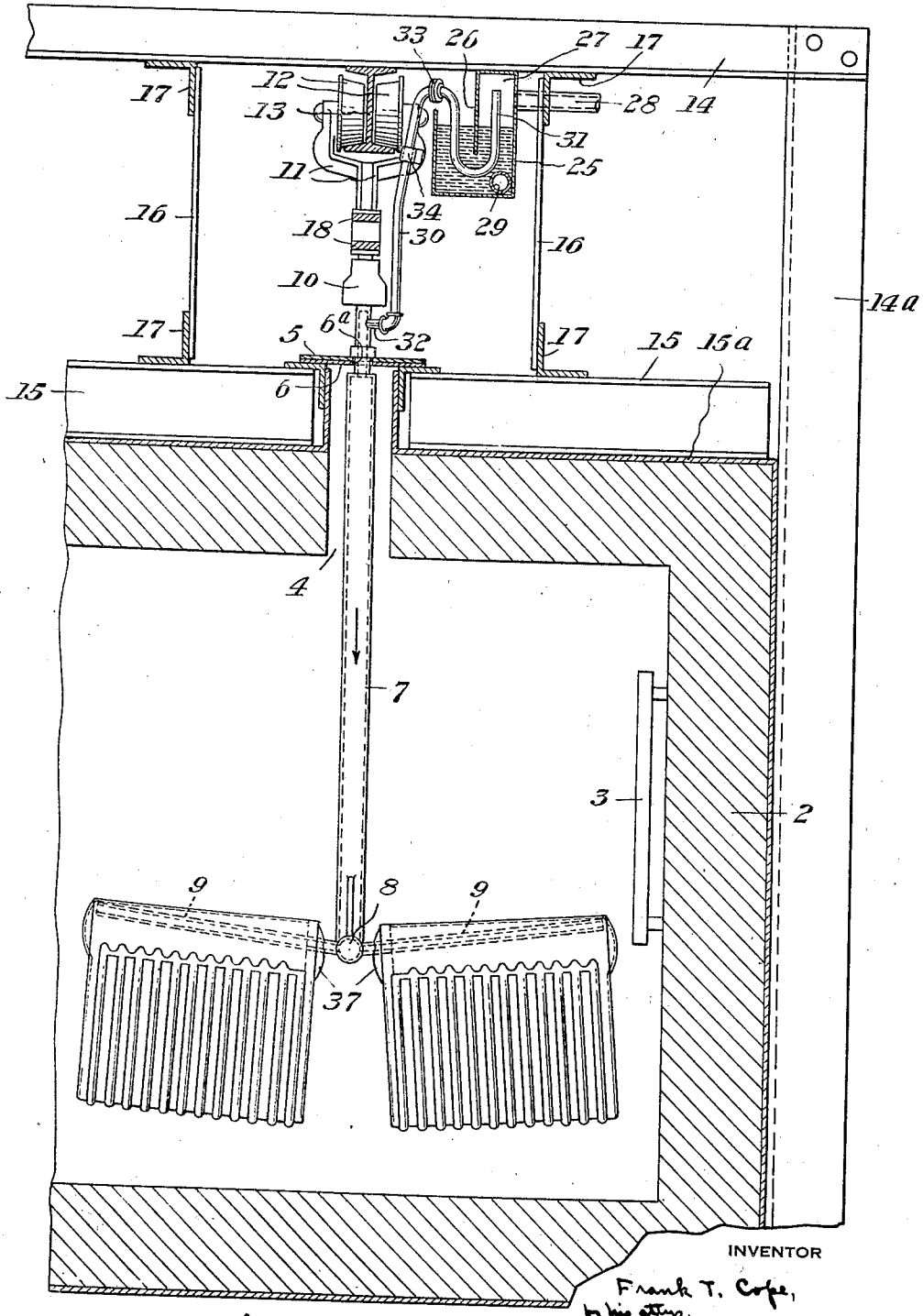


Fig. 2.

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UNITED STATES PATENT OFFICE

1,960,808

METHOD AND APPARATUS FOR HEAT TREATING

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Application June 24, 1932, Serial No. 619,087

20 Claims. (Cl. 148—16)

This invention relates generally to a method and apparatus for heat treating, and more particularly to a method and apparatus for heat treating hollow articles in such manner that the interior of the articles is protected from oxidation and scaling. This is accomplished by supplying a protective gas to the interior of the articles from a point outside of the furnace and maintaining the supply of protective gas separate from the furnace atmosphere until after the protective gas has been supplied to the interior of the articles. The invention is applied particularly herein to the heat treatment of refrigerator evaporators during the baking step of the enameling process. The invention, however, is applicable to the heat treatment of all hollow articles wherever it is desired to protect the interior of the articles from oxidation.

In the accompanying drawings, which illustrate the present preferred embodiment of my invention,

Figure 1 is a diagrammatic plan view of the whole apparatus showing the furnace and means for conveying the articles therethrough;

Figure 2 is a vertical section through a portion of the furnace taken in a plane corresponding to the line II—II of Figure 1, the sectional view being on an enlarged scale;

Figure 3 is an elevation taken in a plane at right angles to Figure 2, the furnace being omitted for clearness, and showing the article support, conveying mechanism, and the seal for the protective gas;

Figure 4 is a view partly in side elevation and partly in section of a refrigerator evaporator which may be heat treated according to the present invention, and

Figure 5 is a sectional view taken on the line V—V of Figure 4.

Refrigerator evaporators which have been selected for purposes of illustration as one type of hollow article which may be heat treated in accordance with the present invention, are enameled and then passed through a heat treating furnace to bake the enamel thereon. The evaporators are shown in Figures 4 and 5. The upper portion of the evaporator is hollow and is open at one end to the atmosphere. Where these evaporators are heated in a furnace in order to bake the enamel on the outside thereof, the interior of the evaporator is oxidized unless some protective gas is supplied to the furnace. The scale resulting from oxidation sometimes prevents the proper passage of the cooling fluid through the evaporator. The interior of the evaporator which is not enameled is prevented from oxidation according to the present invention by supplying a protective gas such as hydrogen to the interior thereof during the baking of the enamel.

Referring more particularly to the accompanying drawings, there is shown a furnace 2 having electric resistance heating elements 3 mounted on its walls. The furnace is of the slot-in-the-roof type, the slot being partially closed by plates 5 and 6 which overlap each other and slide along the slot as the articles move through the furnace, as hereinafter described. Each of the plates has a hole 5a in its leading end and a slot 6a in its trailing end for the purpose of allowing for slight changes in spacing between hangers which takes place when going around curves. Extending through the slot 6 is a hollow support tube 7 having at its lower end a hollow cross arm 8. The cross arm 8 extends longitudinally of the furnace and to each end of the cross arm are connected two hollow supporting arms or pipes 9 which act as supports for the evaporators during their passage through the furnace. The number of supporting arms may be increased or decreased according to the type of article which is being heat treated. The supporting arms slope upwardly and outwardly in order to insure that the evaporators will not slip off, and the arms are of sufficient length to extend well into the evaporators in order to thoroughly purge the evaporators of any air which they may contain, as hereinafter described.

The support tube is connected at its upper end which is outside of the furnace by a coupling 10 to the hanger arms 11 of a trolley having rollers 12 rotatably mounted on the arms. The rollers run on an I-beam 13 secured to angle cross members 14 supported at their ends by buckstays 14a attached to the side plates of the furnace. The cross members 14 also hold stiffeners 15 for the roof plate 15a, the stiffeners being connected to the cross members by plates 16 and angles 17. The trolley or hanger 11 is moved so as to convey the support tube 7 and the articles being treated through the furnace by means of a chain 18, the lower ends of the hanger arms 11 being connected to a link 19 of the chain, as indicated in Figures 2 and 3. The chain passes around a sprocket wheel 20 located outside of the furnace, as shown in Figure 1, and around a sprocket wheel 21 located in the furnace. The sprocket wheel 20 is rotated from a motor 22 through gearing 23.

In order to supply protective gas to the interior of the articles while they are being heated and conveyed through the furnace, a liquid sealing trough 25 is secured to the angles 14. This trough is adapted to contain water or oil and is formed with a flange 26 extending below the liquid level so as to form a chamber 27 for receiving protective gas from a pipe 28. The sealing liquid may be cooled by a pipe 29 in the trough. A bent con-

duit, indicated generally by the reference numeral 30, has one end 31 extending into the chamber 27, the other end 32 being connected to the support tube 7, a suitable coupling 33 being used to make the connection, and the conduit being connected by a bracket 34 to one of the hanger arms 11. As the sprocket wheels 21 and 22 are rotated by the motor, the chain 18 which is connected to the trolley, moves the trolley, the support tube 7 and the evaporators through the furnace. During their passage through the furnace, the interior of the evaporators is supplied with protective gas which flows from the chamber 27 of the sealing trough through the conduit 30 into the support tube 7, the cross arm 8, and the support arms 9 and expels any air originally present in the hollow upper chamber 35 of the evaporator.

In carrying out the method, the ends 36 of the evaporators are partially closed by sealing discs 37, each of which has an opening 38 therein for receiving the support arms 9. The chain moves in the direction indicated by the arrows in Figure 1. The evaporators are placed on the support arms while the arms are outside of the furnace and as the chain moves, they are carried first toward the left-hand end of the furnace, passing around the sprocket wheel 21 and then toward the right-hand end of the furnace, and after they have cooled down sufficiently, are removed from the support arms.

It will be seen that the protective gas is supplied directly from the outside of the furnace through the hollow support tube 7, cross arm 8 and support arms 9 to the interior of the chamber 35 in the evaporator without the protective gas mingling with the furnace atmosphere. The supports for the evaporators serve themselves as conduits for leading the protective gas to the interior of the evaporators. Where it is attempted to heat treat articles in a furnace and supply protective gas to the interior of the furnace, it is necessary that the furnace be sealed from the outside air. This is not necessary in carrying out the present method, since even though the atmosphere within the furnace may be oxidizing, it does not cause oxidation of the interior of the evaporators because the evaporators are being continuously supplied with protective gas by means which has been described. The arms 9 extend well into the interior of the chamber 35 so that any air will be forced out and its place will be taken by the protective gas supplied from the sealing chamber 27 before the evaporators has reached a temperature sufficient to cause oxidation thereof. The use of the sealing discs 37 greatly reduces the amount of gas which it is necessary to supply to the evaporators in order to keep the interior purged of air.

In an enameling furnace, the furnace atmosphere must be oxidizing in character in order to mature the enamel properly. This fact renders the usual bright annealing furnace filled with a protective atmosphere, unsatisfactory for enameling. By the present invention, however, the interior of the article may be protected from oxidation by the use of protective gas and yet the furnace atmosphere enveloping the article may be of an oxidizing character suitable for enameling. If the articles being heat treated are of such shape that they may be conveyed through the furnace while inverted, it may not be found necessary to use the sealing discs 38 so long as a protective gas which is lighter than air is employed. In such cases, the gas will displace the air in the article due to its lighter weight and the sealing disc may be dispensed with. It is preferred, however, to use the sealing discs in all cases in order to decrease the rate of diffusion of the protective gas and air. Oil, water or other suitable liquid may be used as the sealing liquid in the trough 25, it being preferred, however, if water is used, to cover the surface with a layer of oil in order to prevent the protective gas from absorbing an undesirable amount of water in the sealing trough. The invention is applicable irrespective of the particular kind of protective gas used, gases such as hydrogen, cracked ammonia, nitrogen, natural gas, and mixtures of natural gas with steam or air being suitable according to the particular type of heat treatment which is involved.

I have illustrated and described the present preferred embodiment of my invention. It is to be understood, however, that the invention may be otherwise embodied or practiced within the scope of the following claims.

I claim:

1. Apparatus for heat treating hollow articles, comprising a furnace, means for conveying articles through the furnace, means for supplying protective gas to the interior of the articles while the articles are in the furnace and when they are cooling outside of the furnace, and means for sealing the supply means so as to prevent escape of gas to the furnace atmosphere before the gas is admitted to the interior of the article.

2. Apparatus for heat treating hollow articles, comprising a furnace having a slot, an article support extending through the slot, means for moving the article support through the furnace, means for supplying protective gas from outside of the furnace to the interior of articles carried by said article support, and means for sealing the supply means so as to prevent escape of gas to the furnace atmosphere before the gas is admitted to the interior of the article.

3. Apparatus for heat treating hollow articles, comprising a furnace having a slot in the roof, an article support extending through the slot and supported from a trolley, means for moving the article support through the furnace, means for supplying protective gas from outside of the furnace to the interior of articles carried by said article support, and means for sealing the supply means so as to prevent escape of gas to the furnace atmosphere before the gas is admitted to the interior of the article.

4. Apparatus for heat treating hollow articles, comprising a furnace having a slot in the roof, an article support extending through the slot and supported from a trolley, a conveyor chain connected to the support for moving it through the furnace, means for supplying protective gas from outside of the furnace to the interior of articles carried by said article support, and means for sealing the supply means so as to prevent escape of gas to the furnace atmosphere before the gas is admitted to the interior of the article.

5. Apparatus for heat treating hollow articles, comprising a furnace having a slot in the roof, an article support extending through the slot, means outside of the furnace connected to the support for moving the article through the furnace, a protective gas liquid seal, and means for supplying protective gas from the seal to the interior of the article.

6. Apparatus for heat treating hollow articles, comprising a furnace having a slot in the roof, a hollow article support extending through the slot and supported from a trolley, means outside

of the furnace connected to the support for moving the article through the furnace, a protective gas liquid seal, and a conduit leading from the seal to the hollow support.

7. Apparatus for heat treating hollow articles, comprising a furnace having a slot in the roof, a support tube extending through the slot and supported from a trolley, means outside of the furnace for moving the support tube through the furnace, a liquid seal outside of the furnace for the protective gas, a conduit connecting the seal and support tube, and a support arm communicating with the support tube and adapted to support a hollow article thereon and supply protective gas to the interior thereof.

8. Apparatus for heat treating hollow articles, comprising a furnace having a slot in the roof, a support tube extending through the slot and supported from a trolley, means outside of the furnace for moving the support tube through the furnace, a liquid seal outside of the furnace for the protective gas, a conduit connecting the seal and support tube, and a support arm communicating with the support tube and adapted to support a hollow article thereon and supply protective gas to the interior thereof, said support arm being inclined upwardly.

9. Apparatus for heat treating hollow articles, comprising a furnace having a slot in the roof, a support tube extending through the slot and supported from a trolley, means outside of the furnace for moving the support tube through the furnace, a liquid seal outside of the furnace for the protective gas, a conduit connecting the seal and support tube, a hollow cross arm connected to the support tube, and a hollow support arm connected to the cross arm and adapted to support a hollow article thereon and supply protective gas to the interior thereof.

10. The combination with a furnace having a slot, an article support extending through the slot, and means for moving the support through the furnace, of means for supplying protective gas to the interior of the article, said means comprising a liquid seal outside of the furnace adapted to be supplied with protective gas, and a conduit movable relative to said seal and in communication therewith and with the interior of the article.

11. The combination with a furnace having a slot, a hollow article support extending through the slot, and means for moving the support, of means for supplying protective gas to the interior of the articles, said means comprising a liquid seal outside of the furnace adapted to be supplied with protective gas, and a conduit movable relative to said seal and in communication therewith and with said hollow article support.

12. The combination with a furnace having a slot, a hollow article support extending through the slot, and means for moving the support, of means for supplying protective gas to the interior of the articles, said means comprising a liquid sealing trough adapted to be supplied with protective gas, and a conduit having one end connected to said hollow article support and the other end in the sealing trough above the liquid.

13. The method of protecting the interior of hollow articles during heat treatment, which comprises conveying an article through a furnace, supplying a protective gas from outside of the furnace to the interior of the article, maintaining the supply of protective gas separate from the furnace atmosphere until after the protective gas has been supplied to the article, removing the article from the furnace, and maintaining the supply of gas to the interior of the article while cooling outside of the furnace.

14. The method of protecting the interior of hollow articles during heat treatment, which comprises conveying an article through a furnace, supplying a protective gas directly from the outside of the furnace to the interior of the article, removing the article from the furnace, and maintaining the supply of gas to the interior of the article while cooling outside of the furnace.

15. The method of protecting the interior of hollow articles during heat treatment, which comprises conveying an article through a furnace while supported on a hollow support, supplying protective gas to the interior of the article through said support, removing the article from the furnace, and maintaining the supply of gas to the interior of the article while cooling outside of the furnace.

16. The method of protecting the interior of hollow articles during heat treatment, which comprises conveying an article through a furnace while supported on a hollow support, supplying protective gas from outside of the furnace through said support to the interior of the article, sealing the protective gas from the furnace atmosphere before the gas is admitted to the interior of the article, removing the article from the furnace, and maintaining the supply of gas to the interior of the article while cooling outside of the furnace.

17. The method of protecting the interior of hollow articles during heat treatment, which comprises supplying protective gas to the interior of the article while heating the outside thereof in an oxidizing atmosphere, removing the article from the furnace, and maintaining the supply of gas to the interior of the article while cooling outside of the furnace.

18. The method of protecting the interior of hollow articles during heat treatment, which comprises supplying protective gas from outside of the furnace to the interior of the article, maintaining the supply of protective gas separate from the furnace atmosphere until after the protective gas has been supplied to the article, removing the article from the furnace, and maintaining the supply of gas to the interior of the article while cooling outside of the furnace.

19. The method of protecting the interior of hollow articles during heat treatment in a furnace, which comprises supplying protective gas to the interior of the article, heating it, removing it from the furnace, and maintaining a supply of protective gas to the interior of the article while it is outside of the furnace and at a temperature sufficient to oxidize it.

20. The method of protecting the interior of hollow articles from oxidation during heating, which comprises supplying protective gas to the interior of the article, thereafter placing the article in a furnace, heating the article, removing it from the furnace, and maintaining a continuous supply of gas to the interior of the article while it is outside of the furnace and at a temperature sufficient to produce oxidation.

FRANK T. COPE.