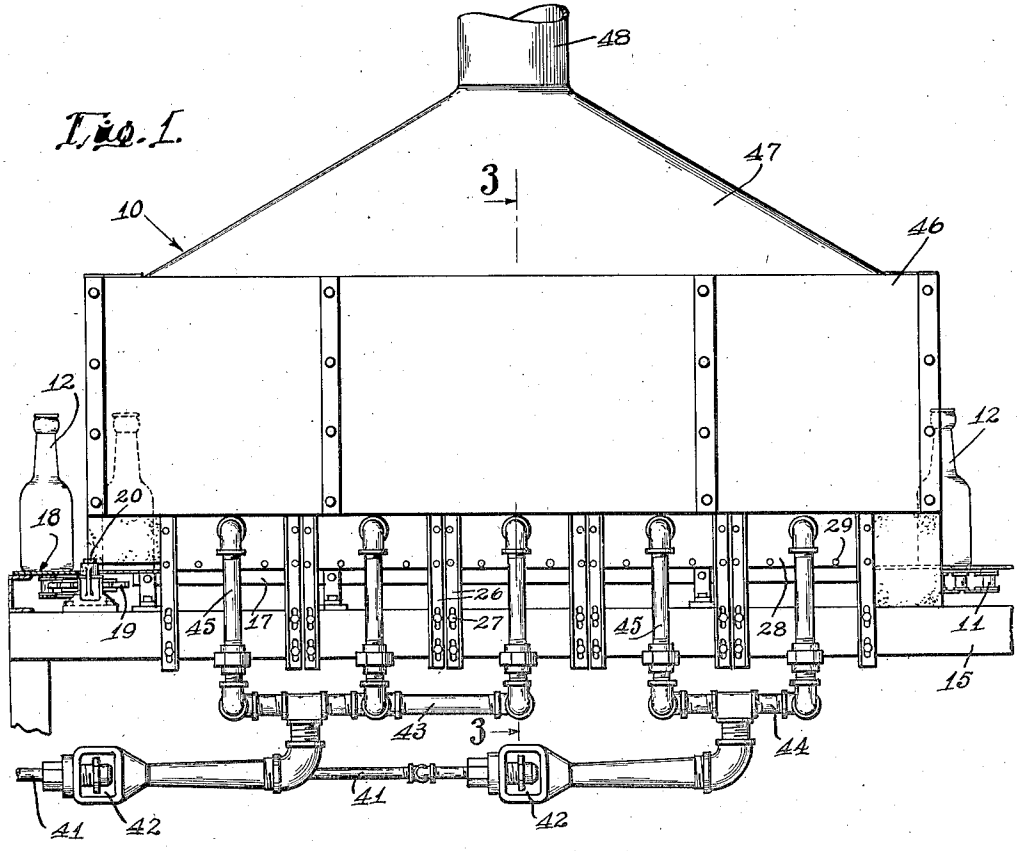
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DRIER

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Fig. 1.



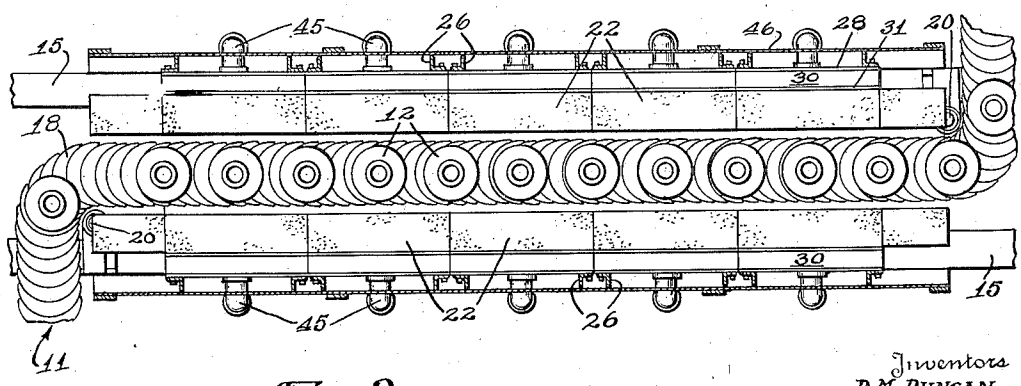


Fig. 2.

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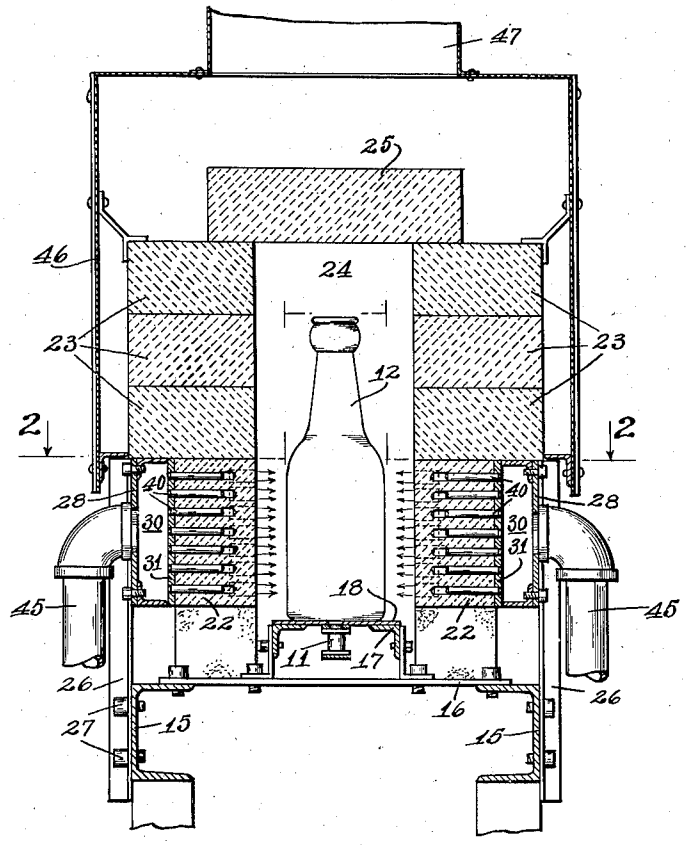
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DRIER

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Fig. 3.



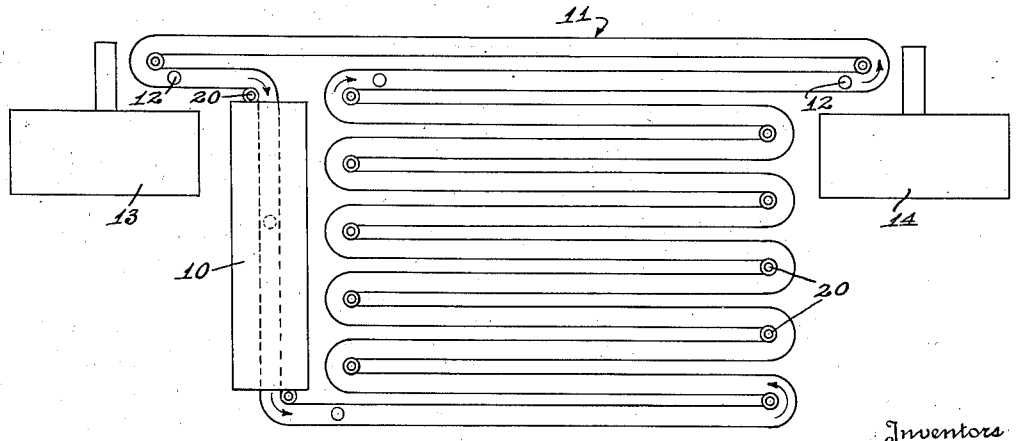


Fig. 4.

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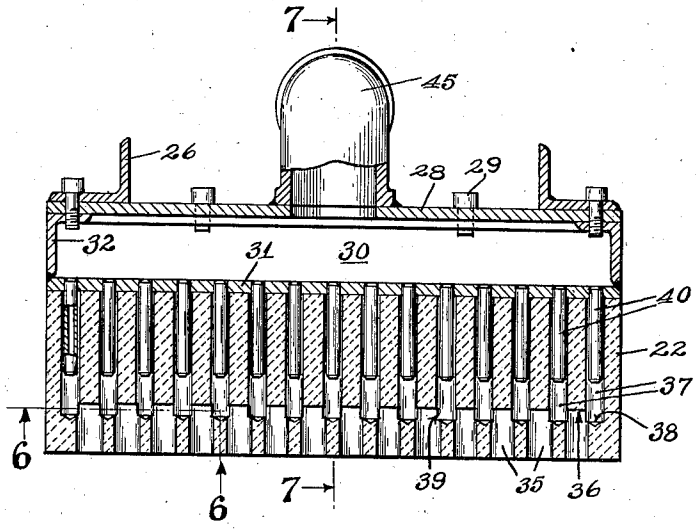


Fig. 5.

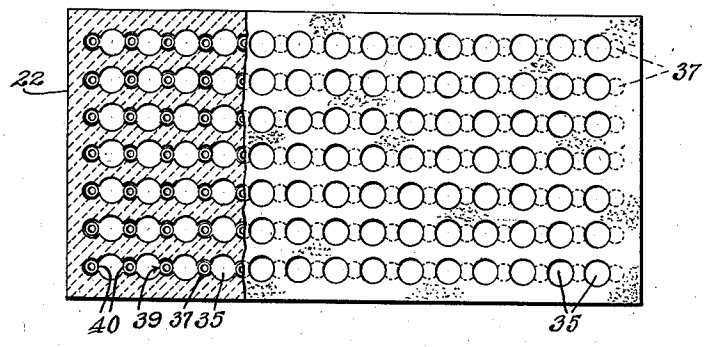


Fig. 6.

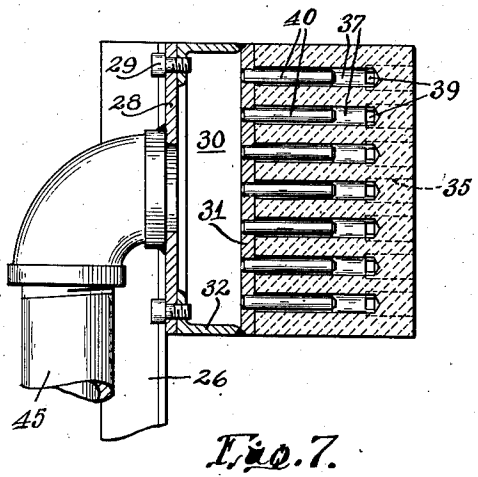


Fig. 7.

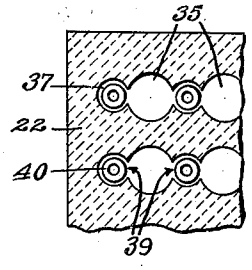


Fig. 8.

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UNITED STATES PATENT OFFICE

2,393,521

DRIER

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Application June 8, 1943, Serial No. 490,020

6 Claims. (Cl. 263—8)

Our invention relates to heating and drying apparatus. In the form herein illustrated, the invention is particularly adapted for use in connection with processes of decorating glassware or the like, by the application of coloring or decorating material. In decorating glassware it is common practice to apply two or more colors in succession to the articles by separate operations. After one color is applied, the article must be heated and the decorating material thereby dried or hardened before a succeeding color is applied. It is also necessary after each such operation, to cool the ware before a succeeding decoration.

An object of our invention is to provide an efficient apparatus for heating the glassware after the application of a decorating material, to set and harden such material, and means for cooling the article preparatory to the application of a succeeding color or material.

Other objects of the invention will appear hereinafter.

Referring to the accompanying drawings:

Fig. 1 is a side elevation of a heating and drying unit.

Fig. 2 is a sectional plan of the same at the line 2—2 on Fig. 3.

Fig. 3 is a cross-sectional elevation at the line 3—3 on Fig. 1.

Fig. 4 is a diagrammatic plan view of the apparatus.

Fig. 5 is a sectional plan view showing a heater block and burners.

Fig. 6 is an elevation of the same, with a portion thereof in section at the line 6—6 on Fig. 5.

Fig. 7 is a section at the line 7—7 on Fig. 5.

Fig. 8 is a fragmentary sectional view on a larger scale, of a portion of the heater block shown in Fig. 6.

As shown diagrammatically in Fig. 4, the apparatus comprises a heating and drying unit 10, and an endless conveyor 11 by which articles 12 are carried through the heating unit 10 for heating the articles and thereby drying and hardening coloring material which has been applied as by means of a decorating machine 13. After passing through the heating and drying unit 10, the articles are carried by the conveyor in a zigzag or circuitous path to a second decorating station to receive a second color application by a decorating unit 14. The necessary cooling of the articles between succeeding decorations takes place during their travel with the conveyor between the drying unit 10 and the second decorating station.

The conveyor 11 is mounted on a framework including channel bars 15 (Figs. 1 and 3), cross bars 16 mounted thereon, and parallel-spaced angle bars 17 providing a runway for the conveyor 11. The conveyor comprises an endless chain having pivoted thereto a series of plates 18 which provides a substantially flat supporting surface for the articles 12, herein shown as bottles. The plates 18 are supported on the angle bars 17 during their travel through the heating tunnel. The conveyor chain is trained over a series of sprocket wheels 19 (Figs. 1 and 4) on shafts 20, the conveyor being guided thereby in a zigzag path and comprising a multiplicity of leads or strands, each extending from one shaft to the next. The conveyor is thus made of sufficient length to permit the necessary degree of cooling of the bottles during their passage from one decorating unit to the next. The conveyor is driven continuously as by means of an electric motor (not shown).

The heating and drying unit 10 comprises burner blocks 22 in each of which is mounted a multiplicity of burners. These blocks are arranged in rows and spaced as shown in Figs. 2 and 3 to provide a passageway for the articles 12. Blocks 23 surmount the blocks 22 and together therewith, provide a heating tunnel 24 through which the articles are carried. Cap blocks 25 provide a roof for the tunnel. The blocks 22, 23, and 25 are made of heat insulating, refractory material.

The heating unit is supported on the framework 15 by means of vertical angle bars 26 (Figs. 1 and 3). These bars are attached to the framework by bolts 27 which extend through elongated slots in the bars. The bars 26 are attached to plates 28 by bolts 29 (Fig. 5), which plates form the outer walls of distributing chambers 30. The inner walls of said chambers comprise plates 31 which are secured to and form a facing for the outer surfaces of the blocks 22. The end walls of the chambers as shown, are in the form of angle bars 32 secured by welding to the plate 31 and bolted to the plate 28.

Each burner block 22 is provided with a multiplicity of circular openings 35 arranged in horizontal and vertical rows, with the openings extending from the inner face of the block to an intermediate position, the inner end walls 36 of said openings being arranged in the same vertical plane. A second series of openings 37, circular in cross section, extends from the opposite face of the block to an intermediate position. The openings 37 are arranged in stag-

gered relation to the openings 36. The ends 38 of the openings 37 extend beyond the ends 36 of the openings 35. The distance between adjacent openings 35 is less than the diameter of the openings 37, so that the block is cut through at the overlapping portions of the openings 35 and 37, thus providing passageways 39 (Figs. 7 and 8) between the openings, so that the openings 35 and 37 together provide channels extending entirely through the burner blocks.

The plate 31, has mounted thereon a series of burner pipes or tubes 40 secured in said plate and arranged to project into the openings 37. The pipes 40 are of somewhat smaller diameter than the openings 37 and also shorter than said openings. Fuel gas is supplied through pipes 41 (Fig. 1) to mixing chambers or inspirators 42. The mixture of gas and air is conducted to manifold pipes 43, 44 from which branch pipes 45 lead to the distributor chambers 30. Combustion of the mixed gases takes place within the openings 35. The heat is of sufficient intensity to heat the walls of said openings to incandescence. The bottles 12 or other articles, passing through the tunnel 24 are thus subjected to radiant heat, the heat rays, as indicated by the arrows in Fig. 3, being radiated from the refractory walls of the burner blocks 22.

A sheet metal casing 46 is provided to enclose the walls of the tunnel and arranged to receive the gases of combustion which are conveyed therefrom through a hood 47 to a stack 48.

Operation.—The operator transfers the bottles 12 from the decorating unit 13, when the color or decorating material has been applied, and places them on the conveyor 11 (Fig. 4) adjacent the intake end of the heating tunnel. The articles as they pass through the tunnel are heated to the desired high temperature, thereby drying and hardening the applied decorating material. The articles after they emerge from the tunnel are carried by the conveyor in a zigzag or circuitous path which is of sufficient length to permit the articles to be cooled to the required temperature, which may be in the neighborhood of 90° F., more or less, by the time they reach the second decorating unit 14.

Modifications may be resorted to within the spirit and scope of our invention.

We claim:

1. A heating apparatus comprising a horizontal open-ended tunnel, a traveling conveyor extending along the tunnel in position to convey articles through the tunnel, said tunnel comprising a row of burner blocks extending along one side thereof and having inner vertical faces forming a portion of the inner wall surface of the tunnel, said burner blocks being formed with a multiplicity of closely spaced channels extending through the blocks in a direction transverse to the said faces, said channels being symmetrically arranged and of predetermined size and shape, and means for supplying fuel gases to said channels.

2. A heating apparatus comprising a horizontal open-ended tunnel, a traveling conveyor extending along the tunnel in position to convey articles through the tunnel, said tunnel comprising a row of burner blocks extending along one side thereof and having inner vertical faces forming a portion of the inner wall surface of the tunnel, said burner blocks being formed with a multiplicity of closely spaced channels extending through the blocks in a direction transverse to the said faces, said channels being symmetrically arranged and of predetermined size and shape, a distributing chamber positioned to overlie the outer faces of the burner blocks and open to said channels, and means for supplying a mixture of fuel and combustion supporting gases to the distributing chamber.

3. A heating apparatus comprising a horizontal open-ended tunnel, a traveling conveyor extending along the tunnel in position to convey articles through the tunnel, said tunnel comprising a row of burner blocks extending along one side thereof and having inner vertical faces forming a portion of the inner wall surface of the tunnel, said burner blocks being formed with a multiplicity of closely spaced channels extending through the blocks in a direction transverse to the said faces, said channels being symmetrically arranged and of predetermined size and shape, a distributing chamber positioned to overlie the outer faces of the burner blocks and open to said channels, means for supplying a mixture of fuel and combustion supporting gases to the distributing chamber, and burner tubes individual to the said channels and extending from said distributing chamber into said channels and terminating at intermediate points between the inner and outer faces of the burner blocks.

4. A heating and drying apparatus comprising a horizontal open-ended tunnel, horizontally-spaced burner blocks forming the lower portion of the side walls of the tunnel, said burner blocks having vertical inner faces forming the lower portion of the side wall surfaces of the tunnel, superposed refractory blocks forming the upper side wall portions of the tunnel, cap blocks positioned to form the roof of the tunnel, said burner blocks being formed with a multiplicity of symmetrically arranged closely spaced channels of predetermined size and shape extending horizontally through the burner blocks and opening through said vertical faces into the tunnel, means for conveying fuel gases and combustion supporting gases into said channels, and means for causing combustion of said gases within said blocks intermediate the said inner and outer faces thereof.

5. A heating and drying apparatus comprising a horizontal open-ended tunnel, horizontally-spaced burner blocks forming the lower portion of the side walls of the tunnel, said burner blocks having vertical inner faces forming the lower portion of the side wall surfaces of the tunnel, superposed refractory blocks forming the upper side wall portions of the tunnel, cap blocks positioned to form the roof of the tunnel, said burner blocks being formed with a multiplicity of symmetrically arranged closely spaced channels of predetermined size and shape extending horizontally through the burner blocks and opening through said vertical faces into the tunnel, distributing chambers mounted at the outer wall faces of the burner blocks, burner tubes extending from said chambers into said channels, and means for supplying fuel and combustion supporting gases to said chambers and burner tubes.

6. A heating apparatus comprising an open-ended tunnel, a traveling conveyor extending along the tunnel in position to convey articles through the tunnel, said tunnel comprising horizontally-spaced side walls, a said side wall being formed with a set of openings comprising a multiplicity of openings extending inwardly from the outer surface thereof and terminating at points intermediate the outer and inner wall surfaces, said openings being of predetermined size and positioned at regular intervals over the wall sur-

face, said wall being formed with a second set of openings extending from the inner surface of the wall outwardly parallel with said first mentioned openings and in staggered relation thereto with the inner ends of the two sets of openings overlapping, and the openings of the two sets merging to provide continuous passageways through the tunnel wall, burner tubes extending from the outer surface of the wall into the openings of said outer set, and means for supplying a mixture of fuel and combustion supporting gases to said tubes.

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