March 12, 1935. A. HORMEL 1,994,220

METAL SHEET DRYING OVEN

Filed Jan. 3, 1934 2 Sheets-Sheet 1

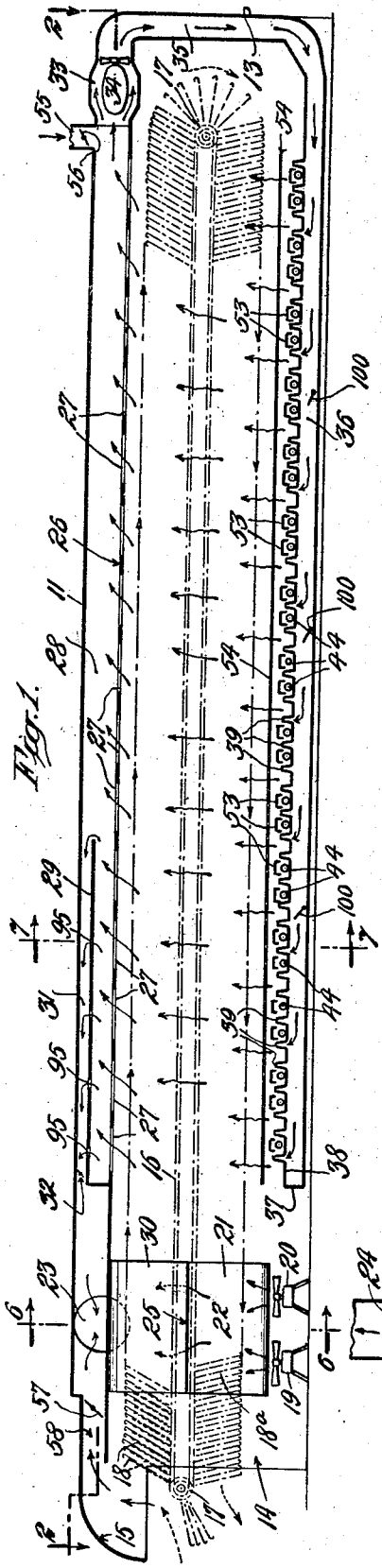


Fig. 1.

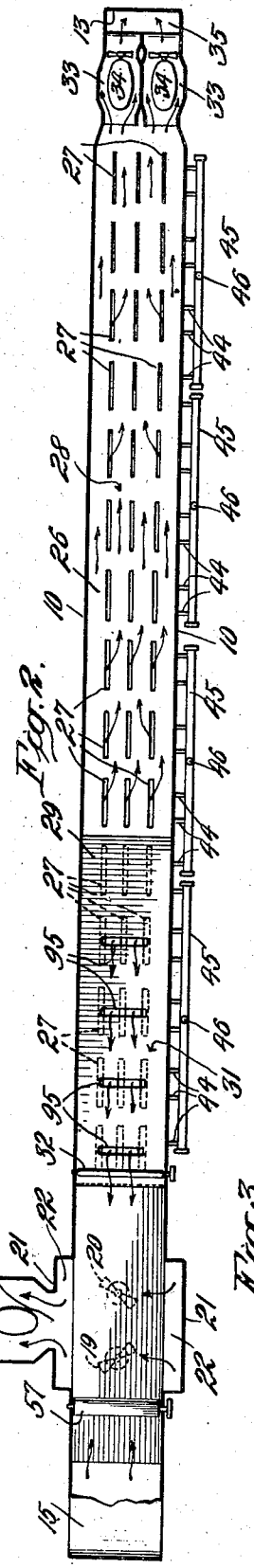


Fig. 2.

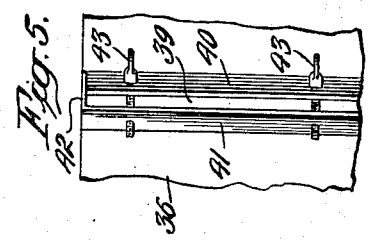


Fig. 5.

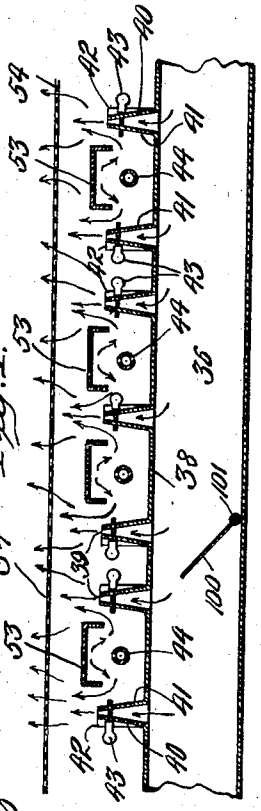


Fig. 4.

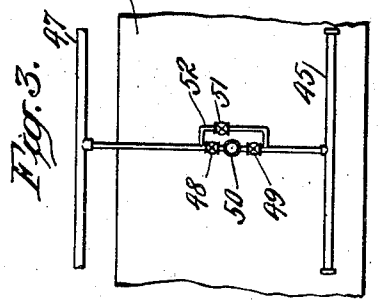


Fig. 3.

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Filed Jan. 3, 1934 2 Sheets-Sheet 2

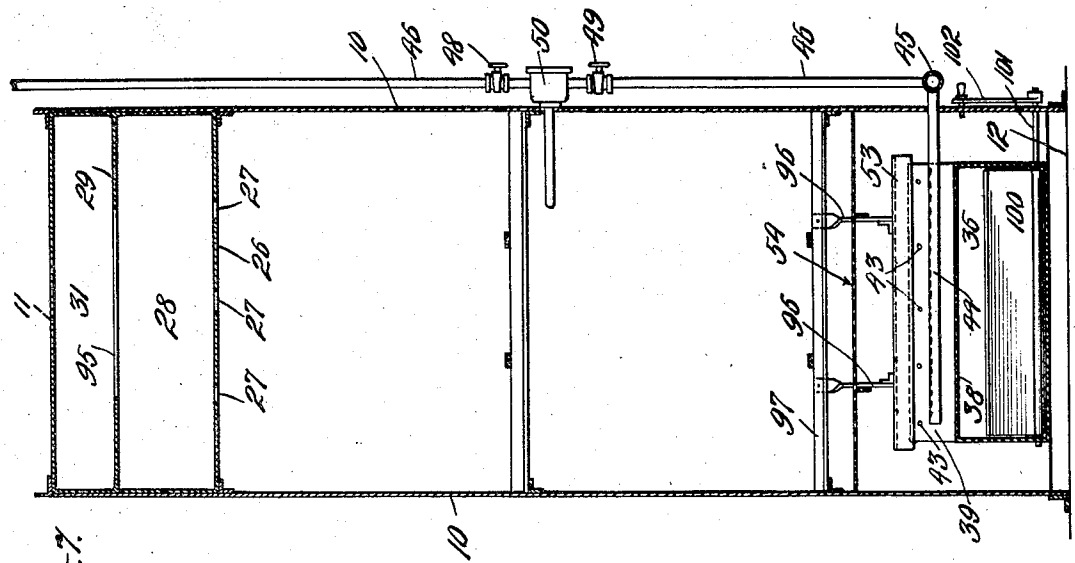


Fig. 1.

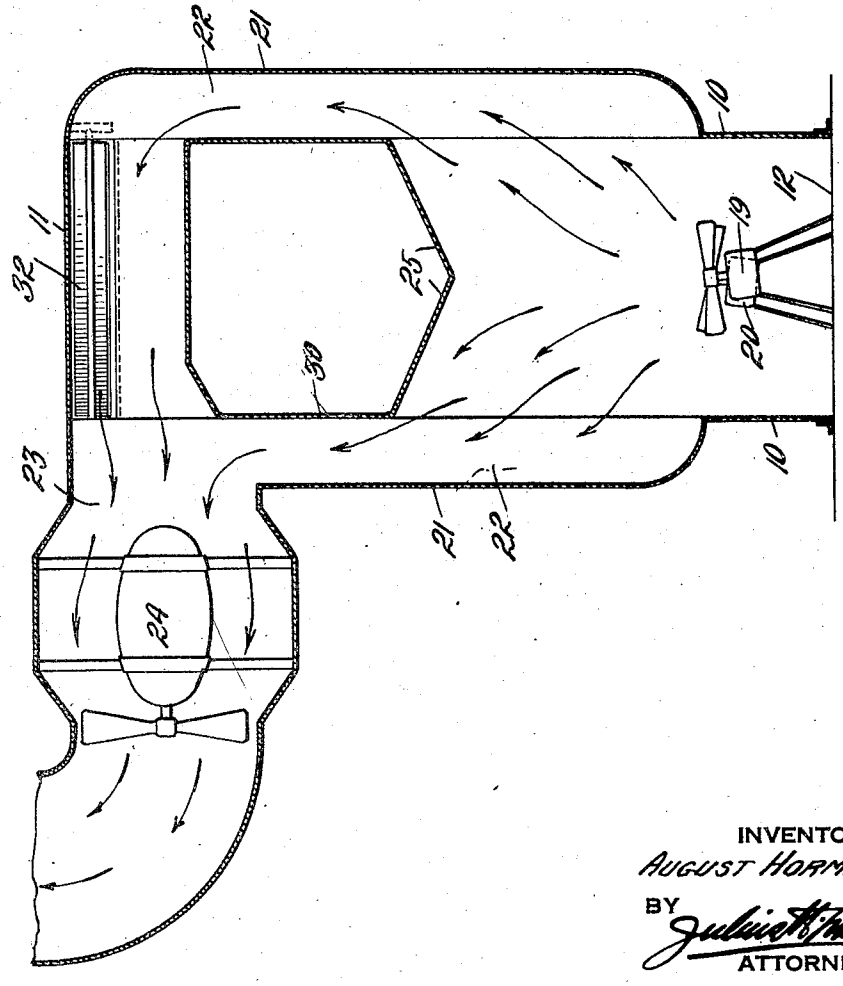


Fig. 6.

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METAL SHEET DRYING OVEN

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5 Claims. (Cl. 34—12)

This invention relates to an apparatus for drying freshly varnished or lacquered sheet metal plates, such as are used for the production of can bodies and other like bodies. The object of the invention is to provide a heating chamber or oven through which the plates, supported on a suitable conveyor, are carried, while an improved heating means located in the chamber distributes heated air uniformly within the chamber to effect rapid drying of the varnish or lacquer which has been applied to the surfaces of the plates.

A further object of the invention is to provide means for releasing the fumes of the varnish or lacquer from within the chamber as the plates enter and are carried for some distance within the chamber. A still further object of the invention is to provide a heating means so arranged and regulated that positive uniformity of heat for the entire length of the chamber is assured.

More particularly, the invention contemplates a lengthy chamber in which a conveyor carrying a number of the varnished or lacquered plates moves. Near the bottom of the chamber, a plurality of burners, surmounted by deflector plates heat the air which rises through a diffusing screen and passes upwardly through the chamber to pass through slots in an auxiliary top in the chamber to enter a passage formed between said auxiliary top and the top proper of the chamber. The air is then drawn through said passage by suction fans and forced thereby through a passage which carries it back to a point below the burners where it is forced upwardly through regulatable openings adjacent the burners, to be reheated and forced into circulation through the chamber in the manner just described. Other features of the invention will be set forth hereafter.

In the accompanying drawings, in which an embodiment of the invention is shown, Fig. 1 is a vertical section shown diagrammatically, of the improved drying oven; Fig. 2 is a sectional view on the line 2—2 of Fig. 1, looking in the direction of the arrows; Fig. 3 is a side view of a part of the oven, showing the valves for controlling the supply of gas used for heating; Fig. 4 is a longitudinal sectional view through a portion of the lower part of the oven, showing the heating means and the means for regulating the supply of air to the chamber; Fig. 5 is a view of one of the air valves located adjacent to the burners; Fig. 6 is a sectional view on the line 6—6 of Fig. 1, looking in the direction of the arrows; and Fig. 7 is a sectional view on the line 7—7 of Fig. 1, looking in the direction of the arrows.

The drying chamber or oven consists of an elongated enclosure preferably made of sheet metal and lined with any suitable heat-insulating material. It is provided with side walls 10 and a top 11, the floor 12 or other support upon which the chamber rests, constituting the bottom of the same. At one end the chamber is closed by the wall 13. At the other end of the chamber an entrance opening 14 is located, said opening being surmounted by a hood 15 which constitutes a downward extension of the top 11 of the chamber.

Located within the chamber and movable therethrough is a conveyor 16 which may consist of one or more endless chains travelling in the direction of the arrows in Fig. 1, over sprockets 17. These chains are provided with means for supporting the varnished or lacquered metal plates 18 on edge, such means usually consisting of wire holders secured to and projecting from the chains, and arranged to hold the plates during the travel of the conveyor. The plates are carried along on the top stretch of the chain conveyor toward the end 13 of the chamber until the conveyor passes over the sprocket adjacent that end and the plates are then carried on the lower stretch of the chains toward the front opening 14 of the chamber from where they emerge in a dried condition.

Adjacent to the front end or entrance 14 near the top of the chamber is provided a tubular open-ended enclosure 30 which acts as a shield for such plates as have just been placed on the conveyor and are entering the chamber, so that a blast of air directed upwardly by fans 19 and 20, located on the floor of the chamber will not impinge against these plates. The blast of air from the fans 19 and 20 is utilized for the purpose of applying a cooling treatment to those plates, indicated at 18*a*, which have already been carried through the chamber and are about to emerge therefrom. This cooling treatment, consisting of the air blast directed by the fans 19 and 20 is performed in a widened portion of the chamber defined by the walls 21 which form passages 22 through which the blast of air passes as indicated by the arrows in Fig. 6 to enter the passage 23 into which it is drawn by the fan 24 and from which it is forced by the action of the fan. The angularly disposed bottom surfaces 25 of the enclosure 30 act to deflect the air blast directed by the fans 19 and 20 into the passages 22.

Located co-extensively with the top plate 11 of the chamber and spaced at a distance below the same, is a supplemental top plate 26 which is provided for the greater part of its length with a plurality of slots 27. These slots communicate with the interior of the chamber and also with the passage 28 formed between the top plate 11 and the supplemental top plate 26.

Adjacent to the entrance end of the chamber and in the passage 28, is located a baffle plate 29 having transversely arranged slots 95, said baffle plate cooperating with the top plate 11 to form a relatively narrow passage 31 in which a flap valve 32 is mounted. Toward its rear end, the passage 28 is enlarged as shown at 33, and located within this enlarged portion of the passage, are fans 34 which draw air from the passage 28 and direct it downwardly through a vertical passage 35 located at the closed end of the chamber. The vertical passage 35 has its lower end connected to a lower, longitudinally extending passage 36 which extends along the bottom of the casing. The end of the passage 36, toward the entrance end of the chamber is closed, as indicated at 37.

Located within the passage 36 are several spaced baffle plates 100 which act to impede a too rapid flow of air through the passage. Each plate 100 is secured on a pivotal shaft 101 (Fig. 7) which has its end projecting outside of the chamber. A handle 102 is secured on the end of the shaft 101 and is adapted to be manually moved to rock the shaft and thus position the baffle plates at any desired inclination within the passage 36.

Provided in the top plate 38 of the air passage 36 are number of air openings 39 which are regulatable in size by means of the angular plates 40 and 41 constituting valves. The plates 41 have their ends 42 bent laterally to overlap the ends of the plates 40. Said plates 40 and 41 may be brought toward, or separated from one another by means of the adjusting screws 43 so that the openings 39 between the plates 40 and 41 are regulatable in size.

Located between the numerous sets of the plates 40 and 41 are heating members consisting of gas burner pipes 44, perforated in their upper faces to form jets from which gas emanating from the perforations can be ignited. These various burners 44 extend inwardly from manifold pipes 45. Each manifold pipe 45 is connected to a group of burner pipes 44 so that a number of the manifold pipes 45 are employed. Each manifold pipe 45 is connected to a supply pipe 46 which connects to a gas main 47. Each of the supply pipes 46 is provided with shut-off valves 48 and 49 between which is located a thermostatic control device 50 arranged to shut off or decrease the gas supply to the particular manifold to which pipe 46 is connected. The thermostatic control 50 for each of the pipes 46 is governed by the temperature in the particular part of the chamber where it is located. With the arrangement just described, the temperature throughout the lengthy heating chamber may be constantly maintained uniform since each section of the chamber defined by a separate manifold pipe 45 is independently controlled by its own thermostatic control. It is, therefore, possible for the first section of the chamber, at the left of Fig. 2, for example, to be constantly maintained at the same temperature as the extreme end section, located at the right of Figs. 1 and 2. Should the use of the thermostatic control in any of the sections of the chamber be found undesirable at any time, the valves 48 and 49 may be closed and a valve 51 located in a bypass 52 in the pipe 46 is opened which permits the gas flow to pass around the thermostatic control, and enter the manifold 45.

A deflector plate 53 supported by the brackets 96 from cross-bars 97 is located over each of the burner pipes 44, these plates 53 deflecting the heated air in the manner shown by the arrows in Fig. 4. The heated air rises and passes through a perforated plate or screen 54 mounted over the burners and deflector plates 53. The screen 54 diffuses or breaks up the air flow which then passes upwardly through the heating chamber impinging against the varnished or lacquered plates carried on the conveyor and acting to dry the same. The heated air upon rising toward the top of the chamber, passes upwardly through the slots 27 in the supplemental top plate 26 and enters into the passage 28, as shown in Fig. 1, where it is drawn by the fans 34 toward the end of the chamber and forced downwardly through the passage 35 into the lower longitudinal passage 36 and up through the air openings 39 to be reheated by the burners 44 to again pass upward through the chamber, as just described. Adjacent to the fans 34 in the top plate 11 is provided an air opening 55 in which is located a valve 56 permitting the entry of a supply of fresh air to the fans 34 in regulatable quantity.

Briefly, the operation of the device is as follows:

The varnished or lacquered plates 18 are placed on the conveyor at the entrance opening 14 thereof and are moved through the chamber on the upper stretch of the chain conveyor 16. The fumes from the freshly applied varnish or lacquer pass upwardly under the hood 15 into the contracted portion 56 of the passage 28 and are drawn into the exhaust passage 23 by the fan or blower 24. A valve 57 is located in the passage 58 to control the size of the passage.

As the plates are moved on the conveyor toward the right in Fig. 1, they are carried through the tubular enclosure 30 and finally pass out of the same. Any additional fumes emanating from the varnish can pass upwardly through the slots 27 in the supplemental top plate 26 and pass through the transverse slots 95 in the baffle plate 29 to enter the narrow passage 31 to be drawn into the exhaust passage 23 by the action of the blower 24. When the plates pass beyond the inner end of the baffle plate 29, the fumes emanating therefrom are negligible and the plates continue their movement toward the inner end of the chamber, receiving a constant flow of hot air from the burners 44 over which they pass while being moved by the conveyor. When the plates reach the inner end of the chamber where the chain conveyor passes over the inner sprockets, the plates then depend from the lower stretch of the chain and are carried toward the left in Fig. 1 on their movement to the opening 14. When they reach a point below the enclosure 30, they receive a cooling treatment in the form of a blast of air directed from the fans 19 and 20 which completes their drying and cooling, and on reaching the opening 14 in the chamber, they are removed from the conveyor in a dried condition.

What I claim is:

1. An apparatus of the character described comprising, an elongated heating chamber having an entrance opening at one of its ends and closed at its other end, a conveyor movable therein, heating means arranged along the bottom of the chamber, a continuous air passage located

below the heating means and extending along the back end and along the top of the chamber, said passage having apertures in its top portion communicating with the interior of the chamber, the passage having valve-regulated openings in its bottom portion adjacent to the heating means, means for forcing air from the top portion of the passage down through the end portion to reach the bottom portion of said passage, an air-diffusing plate located above the heating means, means for directing an air blast against the bottom portion of the conveyor and means for shielding the top portion of the conveyor from said air blast.

2. An apparatus of the character described comprising, an elongated heating chamber having an entrance opening at one of its ends and closed at its other end, a conveyor movable therein, heating means comprising a plurality of spaced burners arranged along the bottom of the chamber, a continuous air passage located below the heating means and extending along the back end and along the top of the chamber, said passage having apertures in its top portion communicating with the interior of the chamber, the passage having valve-regulated openings in its bottom portion adjacent to the heating means, means for forcing air from the top portion of the passage through the end portion and down to the bottom portion of said passage, a fresh-air supply for the top portion of the passage and means for regulating said supply, an air-diffusing plate located above the heating means, means located near the entrance opening for directing an air blast against the bottom portion of the conveyor and means for shielding the top portion of the conveyor from said air blast.

3. An apparatus of the character described comprising, a heating chamber, a conveyor movable therethrough heating means arranged along the bottom of the chamber, said heating means comprising spaced burner pipes with overlying plates to be heated thereby, a lower air passage located below the heating means, said passage being provided with vents located between the plates, means for regulating the size of said vents, an upper air passage, a connecting passage between the upper and lower passage, and a blower operative to force air from the upper passage to the lower passage and through the vents formed therein.

4. An apparatus of the class described comprising, an elongated heating chamber having an entrance opening at one of its ends and closed at its other end, a conveyor movable therethrough, heating means arranged along the bottom of the chamber and consisting of spaced burner pipes with overlying plates to be heated thereby, a continuous air passage located below the heating means and extending along the back end of the chamber and along the top of the same, the upper portion of said passage being provided with vents in the form of transverse slots, means for contracting said slots to regulate the width of the same, means for forcing air from the top portion of the passage down through the end portion to reach the bottom portion thereof, and means adjacent the entrance opening of the chamber for directing an air blast against those plates on the conveyor which have been carried through the chamber and are on their way to the entrance opening.

5. An apparatus of the character described comprising, a chamber, a conveyor movable therethrough, means for heating and means for circulating air within the chamber, the chamber having an opening at one of its ends through which articles are placed on and removed from the conveyor, means located within the chamber and below the conveyor for directing an air blast upwardly against those articles which are located on the lower run of the conveyor and which are being moved toward the opening in the chamber, a tubular, open-ended enclosure located above the air-blast directing means and enclosing the upper run of the conveyor, to shield from the air blast articles which are being moved toward the interior of the chamber by the conveyor, and air passages extending upwardly on opposite sides of the enclosure to carry the air blast past the same and out of the chamber.

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