

Feb. 8, 1955

D. G. LANTZ
APPARATUS FOR COATING AN APERTURED
ARTICLE WITH A GEL LACQUER

2,701,544

Filed June 3, 1949

5 Sheets-Sheet 2

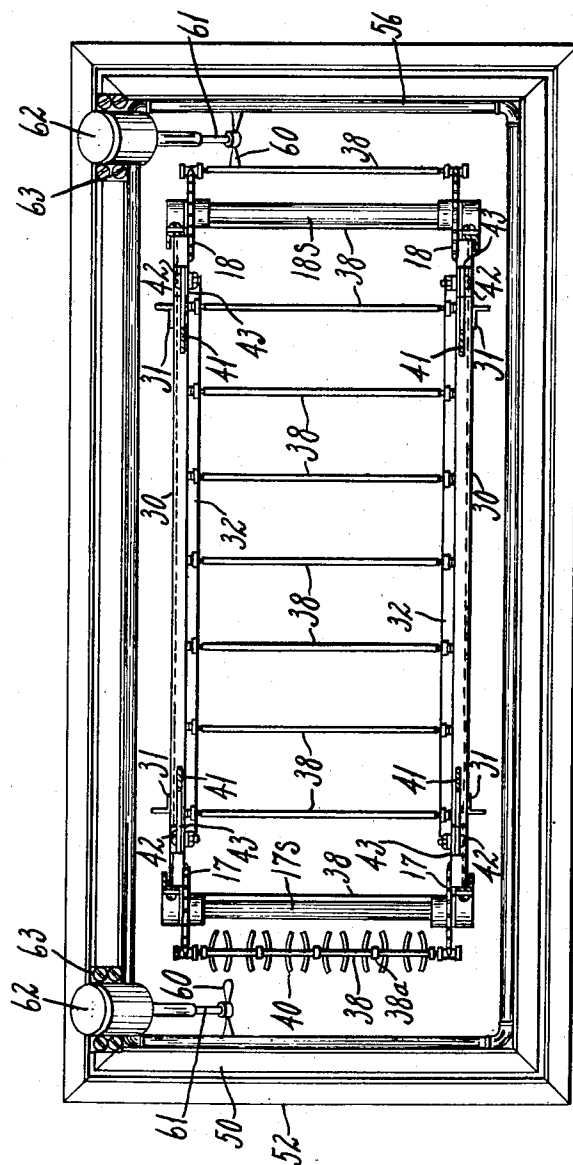


Fig. 2

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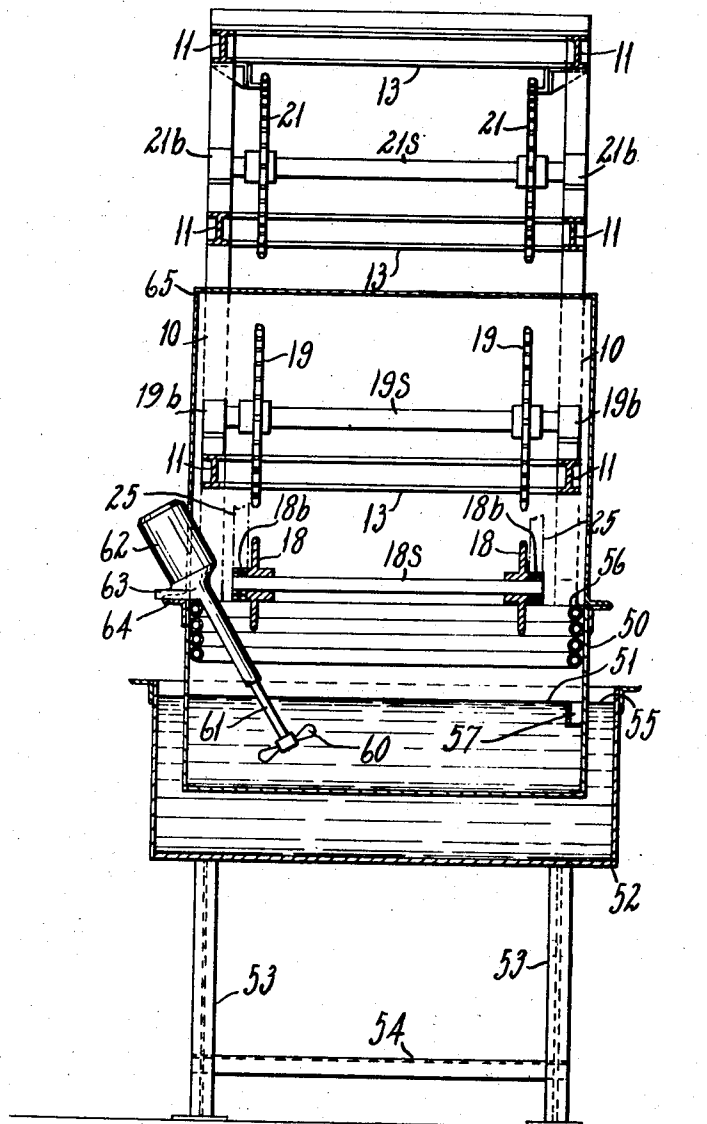


Fig. 3

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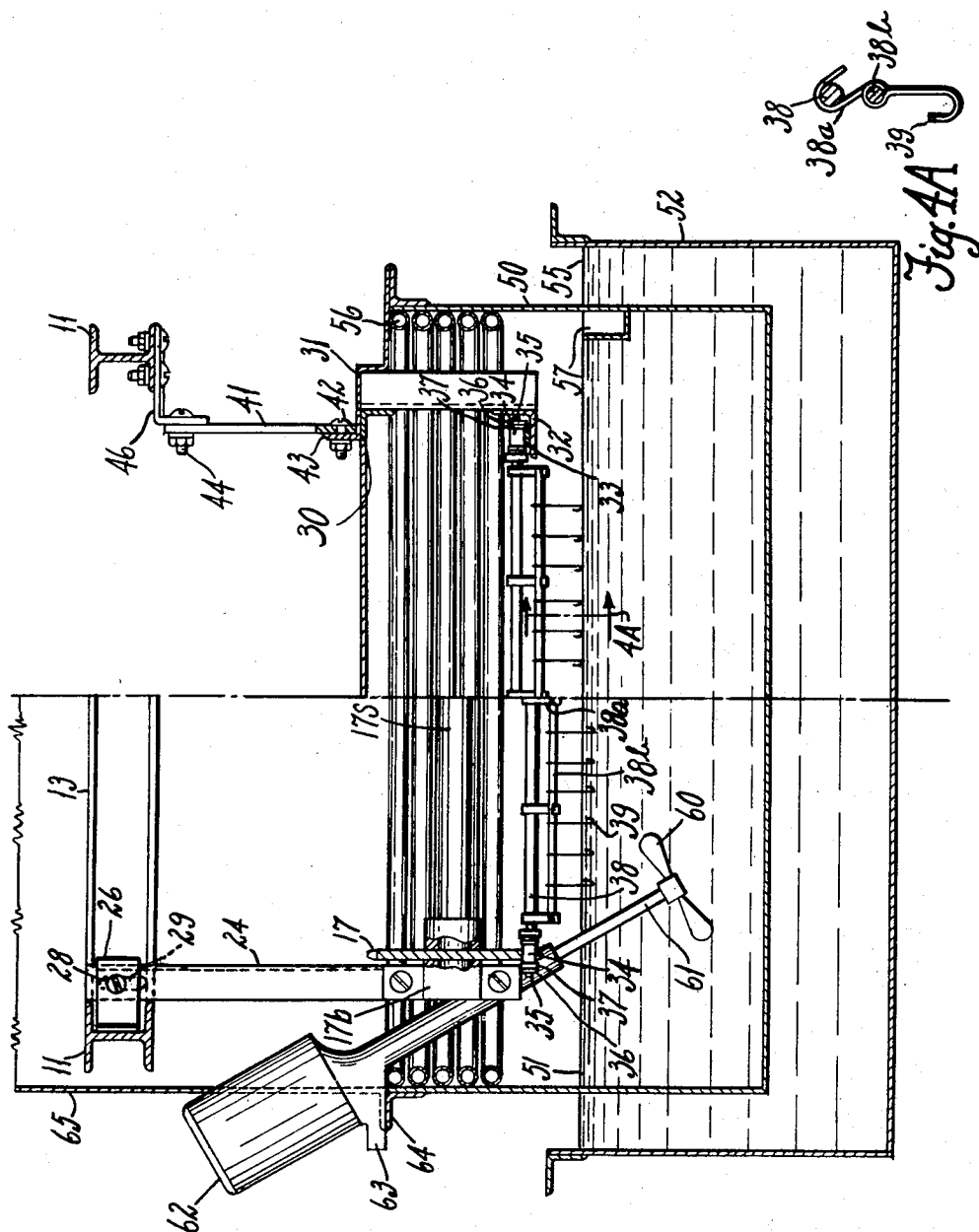


Fig. 4

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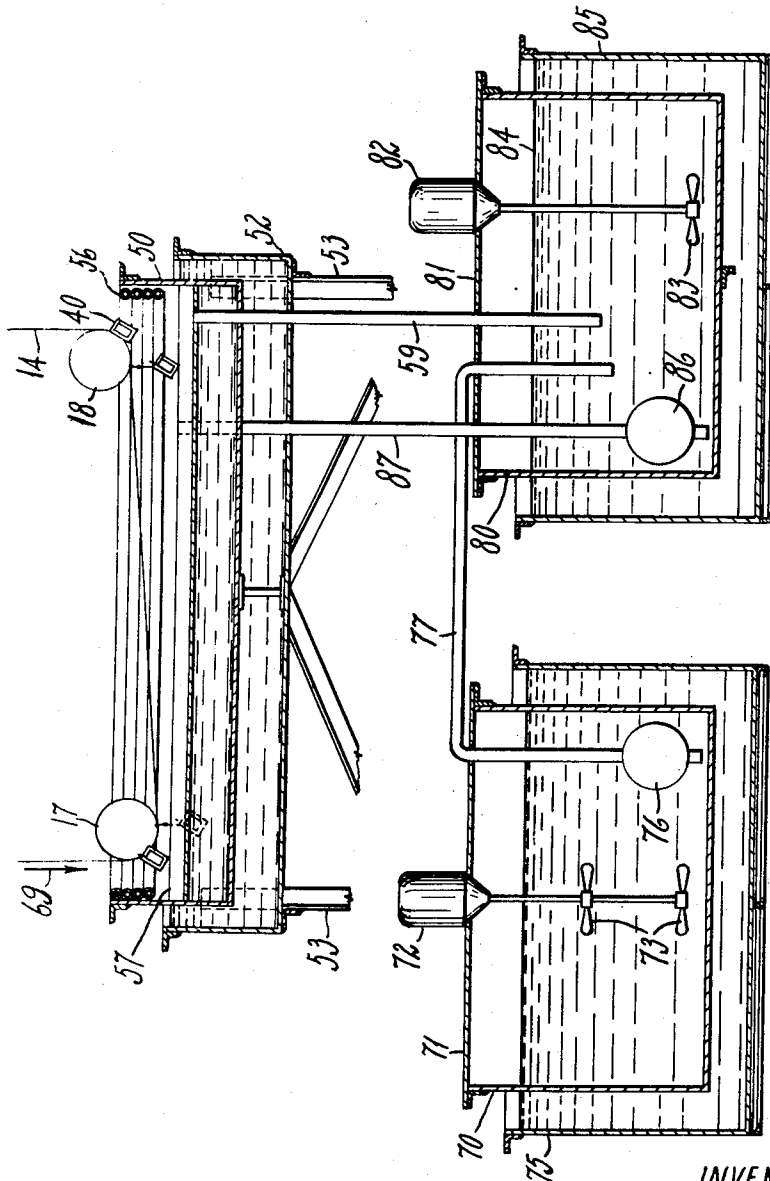


Fig. 5

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2,701,544

APPARATUS FOR COATING AN APERTURED ARTICLE WITH A GEL LACQUER

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Application June 3, 1949, Serial No. 96,980

1 Claim. (Cl. 118—64)

This invention relates to the art of coating objects with gel lacquer and more particularly metal objects having holes through them. One difficulty which is encountered in the application of gel lacquer by the dipping process is that the lacquer forms a web across the hole as the object is withdrawn from the lacquer bath.

An object of the invention is to prevent the formation of the web of gel across the hole. In the disclosed embodiment of the invention, this object is accomplished by providing for retention of a layer of warm vapor of lacquer solvent above the surface of the lacquer bath. As the objects are withdrawn from the bath, the warm vapor breaks the surface tension of the lacquer and thus prevents formation of a web of lacquer across the hole through the object. This layer of lacquer vapor which arises from the bath formed by volatilization of the lacquer thinner in the bath is caused to hover over the surface of the lacquer bath by a covering layer of cooler air.

A further object of the invention is to provide apparatus for conveying objects through the bath and to provide for a cool air zone above the vapor layer.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a longitudinal, sectional view of the apparatus.

Fig. 2 is a sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view on the line 3—3 of Fig. 1.

Fig. 4 is a sectional view on a larger scale than Fig. 3, the left half of Fig. 4 being a sectional view on the line 4L—4L of Fig. 1 and the right half being a sectional view on the line 4R—4R of Fig. 1.

Fig. 4A is a sectional view on the line 4A—4A of Fig. 4.

Fig. 5 is a diagram showing connections between the mixing tank, the reservoir tank and the dip tank.

The frame work of the apparatus comprises four vertical I-beams 10 forming corner posts (Fig. 1) and supported by horizontal I-beams 11 (Fig. 3). On each side of the apparatus two I-beams 11 are joined by I-beam struts 12 (Fig. 1). Horizontal I-beams 13 connect the I-beams 11 intermediate the corner posts 10. Parallel conveyor chains 14 pass around sprockets 15, 16, 17, 18, 19, 20, 21 and 22 attached, respectively, to shafts 15s, 16s, 17s, 18s, 19s, 20s, 21s, and 22s supported by bearings 15b, 16b, 17b, 18b, 19b, 20b, 21b, and 22b which are supported as shown in Fig. 1. The bearings 15b are supported by a bracket which is guided for vertical movement by bars 15c and are urged downwardly by springs 23 retained by rods 23a in order to take up slack in the chains 14. The bearings 17b and 18b are supported by angles 24 and 25, respectively, which are adjustable vertically relative to brackets 26 and 27, respectively, which are supported by the lower I-beams 11. For purposes of adjustment, each of the angles 24, 25 is adjustably secured to its supporting bracket 26 or 27 by a screw 28 passing through a round hole in the bracket and through a slot 29 in the angle (Fig. 4). The angles 24 and 25 are connected by horizontal angles 30 (Figs. 1 and 4) which are connected by short vertical angles 31 with inclined angles 32 which, as shown in Fig. 4, support tracks 33 along which the rollers 34 of the conveyor chains can roll. These rollers are journaled on pins 35 which connect the chain lengths 36 and 37. The chains are arranged on the sprockets so that the pins

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35 on one side will be in alignment with the pins 35 on the other side of the conveyor. At equal intervals aligned pins 35 are connected by rods 38 upon which detachable hooks 38a (Fig. 4A) carrying bars 38b are supported. Each bar 38b supports a plurality of hooks 39 upon which the objects to be coated, such as electrical coils 40, are suspended. The structure supporting sprockets 17 and 18 and the conveyor tracks 33 are braced by bars 41 (Fig. 1) connected by screws 42 with brackets 43 attached to angles 30. The upper end of each bar 41 receives a screw 44 passing through a slot 45 in a bracket 46 attached to a lower I-beam 11. Each of the screws 28 (Fig. 4) and each of the screws 44 (Fig. 1) receives a nut which is tightened when the sprockets 17, 18 and the tracks 33 have been properly located.

Referring to Fig. 3, the dip tank 50 containing the bath of gel lacquer whose level is indicated at 51 is supported by and within a tank 52 supported above the floor by a frame-work comprising legs 53 and cross braces 54. Tank 52 contains heated oil (whose level is indicated at 55) for the purpose of maintaining the lacquer bath at the proper temperature. While the structure supporting sprockets 17 and 18 and rails 30 is located above the position shown in Fig. 1, tanks 50 and 52 are moved in under the lower I-beams 11. The walls of the tank 50 support a coil of pipe 56 through which cold water is circulated in order to maintain a blanket of cold air within the tank 50 above a warmer layer of lacquer thinner vapor above the level 51 which is maintained by an overflow weir 57 connected, as shown later, with a reservoir. The height of this vapor layer is somewhat variable but may be indicated approximately by the dot-dash line 58 in Fig. 1. By circulating heated oil in the tank 52, the temperature of the gel bath in tank 50 is maintained at the proper temperature, for example, 215° F. Initially, the lacquer bath has the amount of thinner required for a certain viscosity. As the bath is heated to a temperature slightly above the boiling point of the thinner, some of the thinner escapes from the vapor layer to the surrounding atmosphere due to the motion of the objects 40 toward the right and up in Fig. 1. By means disclosed in my copending application, Serial No. 96,979, filed June 3, 1949, now U. S. Patent No. 2,587,174, a thinner is added automatically when the viscosity of the bath tends to become too high. In order that the thinner will mix with the bath when added, two agitating propellers 60 are provided. As shown in Fig. 3, each propeller is attached to an inclined shaft 61 driven by an electric motor 62 supported by a bracket 63 attached to an angle 64, which braces the side of the tank 50.

The air above the tank 50 is confined in space beneath hoods 65 and a plate 66 as shown in Fig. 1 so that it will not be disturbed by exterior air currents for a purpose to be described. The left hood 65 provides an opening at 67 adjacent the loading station and the right hood provides an opening 68 adjacent the unloading station. At the loading station, the objects, such as coils 40, are placed upon the hooks 39 carried by the detachable bars 38b. These objects pass with the conveyor which moves in the direction of the arrow 69 and pass relatively quickly into and relatively gradually out of the gel bath as shown in Fig. 1. The coils 40 are lifted out of the bath and passed through the lacquer thinner vapor zone where the heated vapor breaks the surface tension of the gel and thereby prevents a formation of a web across the hole through the objects. The coated objects are conveyed to the opening 68 where they are removed.

For the successful operation of the apparatus, it is necessary that the air surrounding it be maintained as quiet as possible. Therefore, the hoods 65 and plate 66 are provided. Since there is no movement of air above the coils 56 in tank 50, the zone of cold air within the space surrounded by the coils 56 remains undisturbed. This cold air tends to gravitate downwardly against the layer of warmer lacquer thinner vapor which, by exerting upward pressure, supports the layer of cooler air a substantial distance above the level 51 of the lacquer bath. Therefore, the cold air zone sets as a blanket confining the thinner vapor to a layer having approximately the

thickness represented by the distance between the bath level 51 and the line 58 (Fig. 1).

Referring to Fig. 5, there is a mixing tank 70 closed by a cover 71 which supports an electric motor 72 driving agitator propellers 73. Tank 70 is supported by and within a tank 75 in which heated oil is circulated for the purpose of heating the ingredients mixed in the tank 70. Tank 70 encloses a pump 76 by which the mixed ingredients are pumped from the tank 70 to a pipe 77 which discharges into a reservoir 80 having a cover 81 which supports an electric motor 82 which drives an agitator or stirring propeller 83. The level of the prepared gel lacquer is indicated at 84. Tank 80 is supported by and within a tank 85 through which heated oil is circulated by maintaining the proper temperature of the lacquer in tank 80. Tank 80 encloses a pump 86 which withdraws lacquer from tank 80 and forces it through a pipe 87 into the tank 50. When the lacquer has reached the level 51 (Fig. 3) it flows over the weir 57 and returns to the tank 80 through a pipe 59.

The materials for the lacquer bath are mixed together in the tank 70 for the coating of electrical coils. The following ingredients have been found satisfactory:

Solvent	-----gals.	200
Ethocel	-----lbs.	300
Paraplex	-----lbs.	130
Agerite Resin D	-----lbs.	4.5
Dye	-----lbs.	.25

The solvent may be a mixture of 88% Solvesso #2 and 12% Troluol. Solvesso #2 is a hydrogenated naphtha made by Standard Oil Company. Troluol is a petroleum fraction somewhat lighter than mineral spirits and made by Anderson-Pritchard.

Ethocel is ethyl-cellulose made by Dow Chemical Company.

Paraplex is a modified castor oil which acts as a plasticizer.

Agerite Resin D is an added ingredient to prevent change of properties with time, or in other words, a stabilizer.

The solvent is first placed in the tank 70, the agitators 73 are caused to rotate and the temperature control for this tank is set to maintain a temperature of 215° F. When the solvent has reached this temperature, the ethocel is slowly added. After the ethocel is completely in solution, other ingredients are added. The agitators continue to operate for a time sufficient to insure that all of the ingredients are in solution. The agitators 73 are stopped and pump 76 is caused to operate to pump the mixture into the reservoir tank 80. After the mixing tank 70 is empty, the required amount of solvent may be placed in this tank for the next batch of material. The material in the tank 80 is agitated and kept at required temperature. The pump 86 operates continuously to supply lacquer to the dip tank to the required level determined by the weir 57 and the overflow returns to the reservoir and is recirculated. For the effective control of viscosity of the lacquer, the temperature in the dip tank should be maintained within at least 3° of 215° F. It is necessary that the two agitators 60 in the dip tank 50, the reservoir pump 86 and the reservoir agitator 83 be kept running constantly regardless of use of the apparatus to coat the objects 40. The pumps which circulate oil through the tanks 52, 75 and 85 are kept running. The circulated oil is filtered in order to give better heat control. The viscosity control disclosed in my co-pending application referred to automatically adds solvent when viscosity rises above a certain value which is predetermined in order that the amount of lacquer coating, which the coils 40 receive, is not too heavy or too light. As shown in Fig. 2, the coils 40 to be coated are arranged in pairs on the hooks supported by the bars 38b. Each pair of coils is adapted for assembly with the poles of a two pole generator, for example. The coil leads and terminals of the coil should not be allowed to hang below the lowest point of the hooks which support the coils.

When the coils arrive at the unloading station, the bars 38b supporting the coated coils are removed from the conveyor and are placed on a rack supported by a truck. When the truck is filled, it is moved into an oven for baking the lacquered coating. When the lacquer is prepared according to the specifications stated herein, the coils are baked for one and one-half hours at 160° F.

after which time the oven temperature is raised automatically to 250° F. Baking continues for two hours longer and the truck is removed from the oven. The coils are allowed to cool before they are removed from the truck.

Samples of coated coils are taken at regular intervals and are weighed immediately to determine the weight of the coating. If this weight does not meet the requirements, the viscosity controller referred to is adjusted.

The coils 40 enter the gel bath at room temperature. Each coil therefore absorbs heat from the lacquer which surrounds it and causes the surrounding lacquer to drop in temperature so that a gel layer is formed on the coil as it passes through the bath. The time during which the coil is in contact with the bath should be long enough to effect the required reduction of lacquer temperature adjacent the coil, but should not be so long that the coil becomes appreciably heated by the lacquer. In this way the sagging of the coating or "tearing" or formation of tear-drops of lacquer on the coating is minimized. In the dipping operation, anything that prolongs the time of gelling, such as wrong solvents or too high operating temperature or preheating the coil, increases the sagging and "tearing" tendency. Therefore the following items should be taken into account: the temperature of the bath, the temperature of the coil before dipping, the quantity of solvent, the time of immersion of the coil, and the speed of withdrawal of the coil from the bath. It is necessary that all dewebbing must be done immediately upon removal of the coil from the bath. By causing the coil to travel through the warm layer of lacquer solvent vapor, surface tension of the lacquer is broken before it has a chance to set. Therefore the formation of a web of lacquer across the opening of the coil is prevented.

The lacquer coating will cease to be tacky in a few minutes after the dipped coil is withdrawn from the lacquer bath. The solvent should be expelled gradually from the coating to prevent the running down or thinning down of the coating; but, if removed too gradually, there is an overall shrinkage of the coating. At room temperature, removal of the solvent could be completed within 24 hours. Removal of the solvent can be effected in a shorter time by baking at the temperatures and for the times stated. Too high baking temperatures should be avoided in order to avoid breaks in the gel coating and running off or sagging.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

Apparatus for coating an apertured article with a gel lacquer wherein the lacquer web across the aperture is eliminated, comprising in combination; an elongated horizontal tank adapted to contain lacquer in a solvent, a constant temperature bath surrounding the lower portion of the tank, for heating the lacquer in the tank and for maintaining a substantially constant temperature above the volatilization point of the lacquer solvent, cooling means adjacent the upper portion of the tank and spaced from the liquid level of said lacquer whereby a vapor zone is maintained above the lacquer, said cooling means preventing loss of vapor from the tank, a conveyor for conveying the article through the tank, said conveyor passing in a plane perpendicular to the lacquer level as it enters the tank whereby the article is plunged directly into the lacquer immediately as it enters the tank, and emerging from the lacquer at a relatively acute angle with respect to the level thereof whereby the article is conveyed out of the lacquer and is slowly passed through the vapor zone immediately thereafter substantially throughout the length of the tank, said conveyor emerging from the tank in a plane perpendicular to the level of the lacquer whereby the article is quickly conveyed through the cooling means, and a hood for covering the tank, said hood having entrance and exit apertures for the conveyor and the article being conveyed thereby.

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