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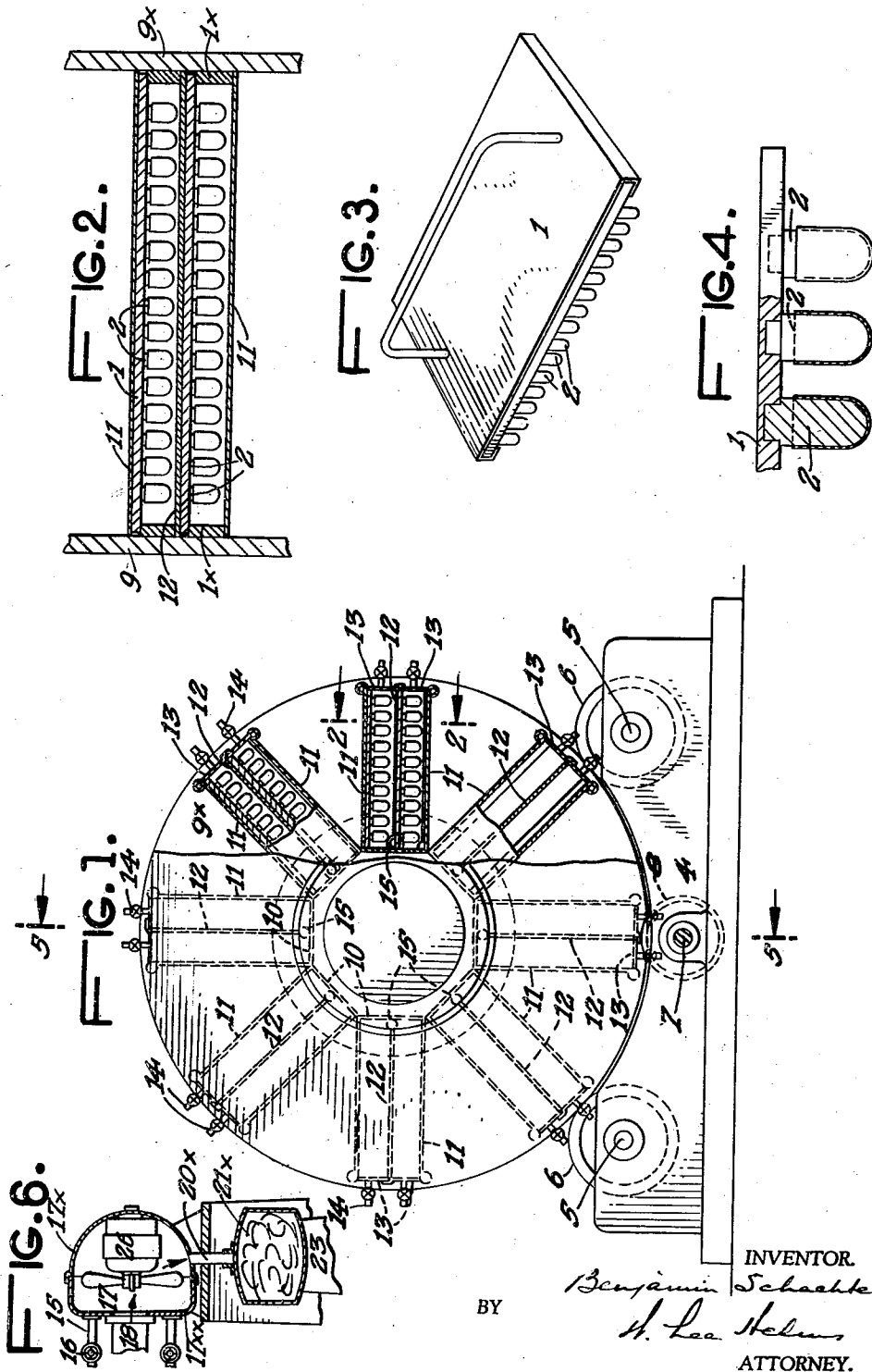
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METHOD FOR MANUFACTURING CELLULOSE DIPPED ARTICLES

Filed Aug. 5, 1938

2 Sheets-Sheet 1



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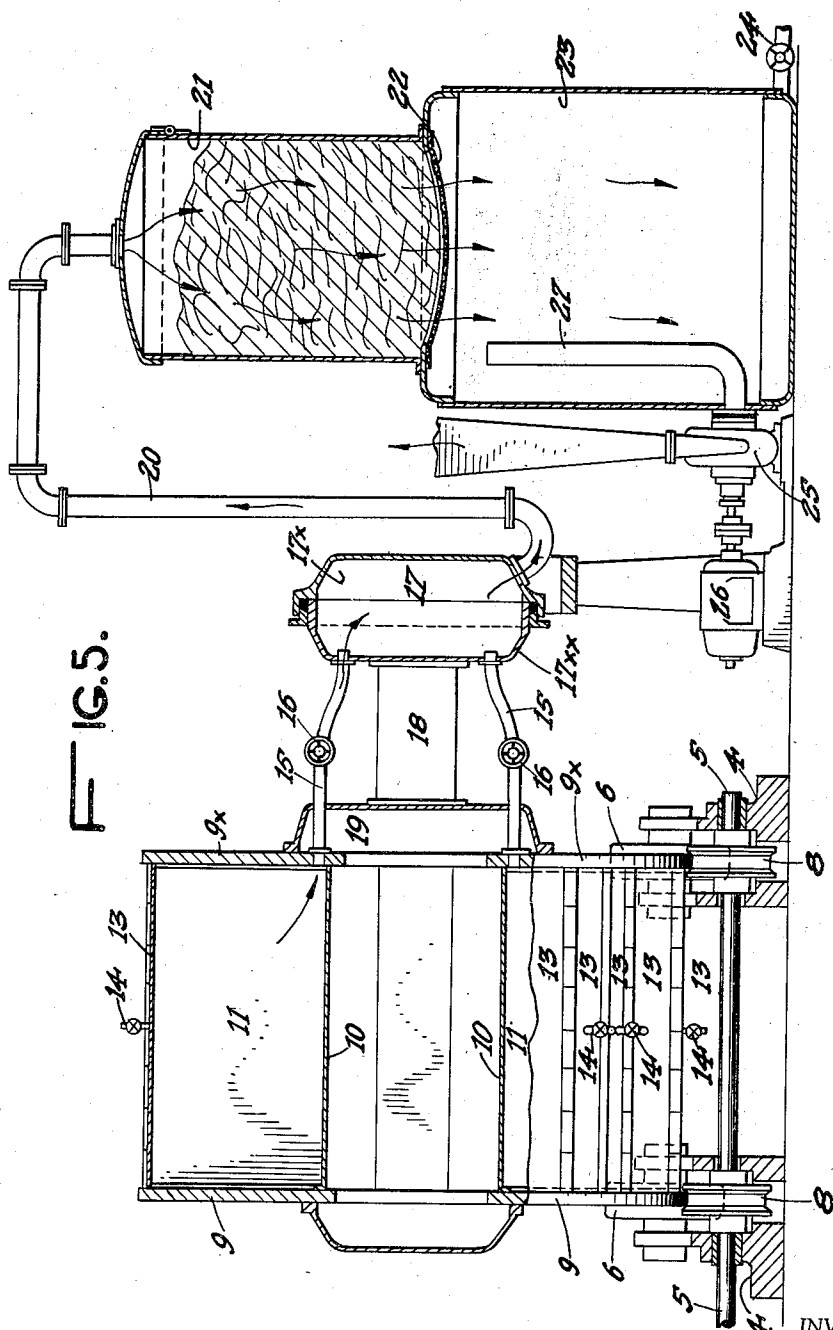
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BY

INVENTOR.
Benjamin Schachter
H. Lee Helms
ATTORNEY.

UNITED STATES PATENT OFFICE

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METHOD FOR MANUFACTURING CELLULOSE
DIPPED ARTICLES

Benjamin Schachter, New York, N. Y.

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2 Claims. (Cl. 34—21)

The manufacture of cellulose articles by dipping forms into cellulose acetate or cellulose nitrate and drying the coating thus produced upon the forms has been practiced for years, but such practice is not satisfactory from the commercial standpoint because of bubbles, irregularities and deformities in the products. I have discovered that these difficulties may be overcome by the control of solvent fumes discharged by the cellulose coating and by providing means by which such control may be commercially effected. The forms may be of any desired shape enabling final removal therefrom of the finished cellulose article such as geometrical shapes including oblongs, squares, octagon and tubes, closed at one end, and of any desired size as from $\frac{1}{4}$ " diameter to 20 inch diameter and from $\frac{1}{4}$ " in length to 20" in length. Also, the thickness of the products may be varied in accordance with one phase of my invention which relates to a method of dipping.

The drawings accompanying this specification relate to apparatus for commercially controlling the solvent fumes after dipping. In the drawings:

Figure 1 is an end elevation of the fume-controlling or "drying" apparatus, partly broken away to show therein a plurality of form-carrying boards and the chambers which receive them.

Figure 2 is a longitudinal section on the line 2—2, Figure 1.

Figure 3 is a perspective view, showing one of the form-boards, and a carrier for dipping.

Figure 4 is a fragmentary side elevation, partly in section, of one of the form-boards, showing a coating of cellulose on each of a plurality of forms.

Figure 5 is a front elevation, partly in section, showing the fume-control or drying apparatus, certain elements being in section for clearness of illustration.

Figure 6 is a view in elevation, partly in section, showing a modified form of suction assembly.

In practicing my invention I provide a plurality of form-boards 1, and, as shown in Figure 4, secure thereto forms 2 in spaced relation. These forms may be of glass, aluminum, or other smooth-surfaced material which is not affected by the acetone, diethyl phthalate or other solvent ingredients employed in making the coating solution. Boards 1 may be of any desired size, as, for example, $6\frac{1}{2}$ " x 36" with a thickness of

$\frac{5}{8}$ ". The forms may be fixed to the boards or may be removably secured thereto.

When cellulose acetate is employed the solution mixture may be as follows:

5	Cellulose acetate 5 second viscosity	pound	1
	Santolite M 17	ounces	8
	Diethyl phthalate	do	4
	Acetone C. P.	do	22
	190-proof S. D. 1, alcohol	do	10
10	Toluol	do	4
	Cellosolve acetate	do	4

The above solution held in a tank, formed preferably with sliding covers, receives the form preferably by means of a mechanical carrier which will hold the form-boards and will move them downwardly into the open top of the tank until the forms are covered by the solution. The tank may be of the constant level variety and in this dipping operation the flanges 12 may straddle the walls of the tank so as not to come into contact with the solution. The forms should be 15° F. lower in temperature than the solution. Thus if the solution is room temperature (say, 70° F.) the forms should be cooled to 55° F.

I have discovered that the thickness of the final article, i. e., the wall thickness, may be controlled by the speed at which the forms are withdrawn from the solution. For example, if a wall thickness of $\frac{1}{1000}$ " is required the form may be withdrawn from the solution at a speed of 1" in 60 seconds, and if a thicker wall is desired, the timing is proportionately increased.

After the form-boards are withdrawn from the solution, they are turned with the coated forms end up and placed into the air-tight solvent-control apparatus. The time of such control depends upon the thickness of the coating on the forms.

I will now describe the control apparatus:

Referring to the drawings, I have shown at 4 two frame members provided with bearings which receive the transverse shaft 5, each shaft carrying two flanged bearing wheels 6. The frame members support a third shaft 7 which carries a frictional drive wheel 8, having a flanged periphery. Supported by the two sets of flanged wheels 6 is a drum comprising the side disk members 9, 9', the latter being connected by an internal hub 10, the hub in the present embodiment, being octagonal in form, and each wall of the octagon forms the base wall of a plural-cavity chamber, each cavity being adapted to receive a form-board with its attached cellulose-coated forms. The end walls of the said chamber are formed

by the disks 9, 9x and the side walls of the chamber are indicated at 11. Each chamber is provided with a division wall at 12 providing two cavities and each cavity may be closed by a hinged cover plate shown at 13. Each cover plate is provided with a valve-controlled inlet pipe 14. Each of the cavities near its base communicates with an exhaust pipe, and the two cavities of a chamber may have separate exhaust pipes, although in the present embodiment I have shown a single exhaust pipe common to the two cavities of each chamber, the exhaust pipes being indicated at 15 and their control valves at 16, Figure 5. These exhaust pipes lead to a solvent-vapor-receiving chamber 17 formed by a fixed cup-like wall 17x and a rotary cup-like wall 17rx to which the exhaust pipes are immediately secured. The rotary cup-like member 17x may be fixed to a carrier tube 18 having a hub 19 fixed to drum wall 9x.

It will be seen from the above description that upon rotation of the drum the exhaust pipes will partake of such rotation, and likewise, member 17rx of the collection chamber. Communicating with the interior of the collection chamber is an exhaust conduit 20 which discharges into the top of a chamber 21 containing infusorial earth or other condensing material for the solvent vapors. Below chamber 21 is a screen 22 and below the screen is a collection tank 23 for the condensed liquid, the latter being drawn off through valve-control pipe 24. In order to effect the exhaust action, I may employ a rotary pump 25 driven by motor 26, the pump having an intake pipe 27, leading upwardly within tank 23 and out of range of the descending condensate.

It will be understood that as the forms are dipped each form is placed within the cavity of one of the chambers and the cover for the cavity is closed. If the chamber was not revolved the solvent vapors, being twice the weight of air, would move to the base of each chamber and unequal drying would result. Also, the solution on the forms would tend to run downwardly. By revolving the chamber the vapors are not only equalized, but the cellulose solution on the forms remains at uniform thickness.

The chamber-carrying drum is preferably revolved at the rate of 1 revolution per 30 seconds continuously during the process, excepting when loading or unloading. Approximately 5 minutes after the forms are placed into the chambers, the vapors will have reached an approximate saturation point. This is a characteristic of my method. In other words, I enable the formation of an enveloping body of solvent vapors for the coated forms and thereby prevent too rapid drying of the outer surface of each coating. When the outer surface dries too fast, the solvent vapors in the undersurface are entrapped or unduly retarded in their movement out of the coating. This develops pressures within the coating, thereby forming bubbles, corrugations and other deformities. When the vapors have reached an approximate saturation point, a certain proportion of the vapors is exhausted. The power of the exhausting apparatus will be regulated in proportion to the size of the control drum and its chambers, the number of forms or objects dipped, and the thickness of the coating on the dipped forms.

As an example, to make an article with a wall thickness from 6 to $\frac{19}{1000}$ " , the dipped forms are placed in the chamber cavities of the drum and the latter is rotated as aforesaid. Five minutes thereafter the valve 16 or appropriate valves are opened and the exhaust is operated for 120 sec-

onds. The exhaust is then shut off and 5 minutes thereafter the exhaust is repeated for a very short interval, say, approximately 1 second, and this is repeated every 5 minutes within the period of 25 minutes. Thereupon, a warm, dry flush of air will be drawn into the cavities by opening the valve-control pipe 14, for a few seconds, to complete drying. The articles may then be stripped from the forms. To strip the articles from the forms, they may be placed in hot water approximately 120° F., whereupon compressed air ejected through a nozzle may be applied along the sides of the forms which causes the articles to blow off instantly.

The timing is different with different thicknesses of cellulose walls. Thus when the thickness is increased to 12 to $\frac{18}{1000}$ " the solvent vapors may be exhausted for 20 seconds at each of 4 times at 5 minute intervals. Thereafter, the exhausting operation may be effected every 5 minutes for an interval of 1 second at a time and for 16 times. The valve-control pipe 14 may then be opened to enable flushing with room-temperature air for a short period. For wall thickness above $\frac{18}{1000}$ " slow exhaust timing is employed, a practical method being to start the exhaust of vapor after the coated forms have remained five minutes in their chamber cavities, the first exhaust period being 20 seconds and thereafter 1 exhaust period every 5 minutes for a time of 3 hours, followed by warm air flushing every 5 minutes for 4 or 5 times, 1 second at a time.

The timing also varies depending upon the thickness or viscosity of the solution. Some solutions may require movement of the form 1" in 60 seconds for the first half of the dipped object and 1" in 30 seconds for the balance. If the forms are redipped they are turned end up and placed in an airtight chamber and allowed to stand for a minute or so to equalize the coating on the form before the revolving action.

In Figure 6 the rotary pump is contained directly within the chamber formed by the cup-like walls 17, 17rx and the fumes are discharged through a port 20x below which is the chamber 21x similar to chamber 21 and below which is collection chamber 23.

Having described my invention, what I claim and desire to secure by Letters Patent, is as follows:

1. A method of manufacturing cellulose dipped articles, which comprises placing forms coated with cellulose solution in a closed chamber until the evolved solvent vapors accumulate about the coatings, rotating the form during the evolution of the solvent vapors, and withdrawing the vapors by a plurality of vapor-exhausting steps, in the absence of the introduction of air into the closed chamber in said plurality of vapor exhausting steps.

2. A method of manufacturing cellulose dipped articles, which comprises placing a form coated with cellulose solution in a closed chamber until the evolved solvent vapors accumulate about the coating, rotating the form during evolution of the solvent vapors, until the latter reach an approximate saturation point, then exhausting a proportion of the solvent vapors, continuing the said rotation, and withdrawing the remaining vapors by a plurality of vapor-exhausting steps spaced as to timing, in the absence of the introduction of air into the closed chamber in said plurality of vapor exhausting steps.

BENJAMIN SCHACHTER.