Nov. 14, 1950 F. E. COPPOCK 2,529,488

DIPPING MACHINE

Filed Feb. 27, 1948

Fig.1

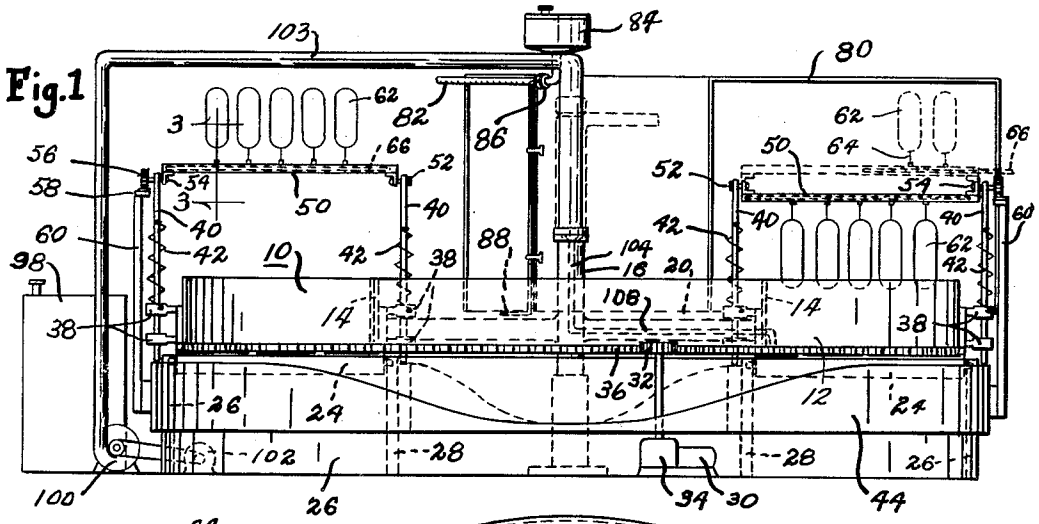


Fig.3

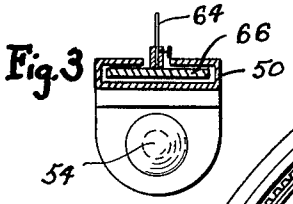


Fig.2

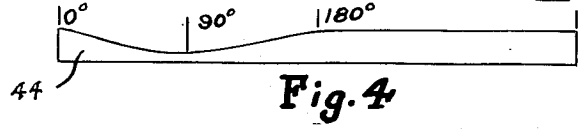


Fig.4

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DIPPING MACHINE

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14 Claims. (Cl. 91—46)

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This invention relates to a method and apparatus for dipping articles in a coating solution.

It is an object of this invention to provide a dipping machine suitable for use in coating articles with materials such as cellulose acetate.

There are a number of problems present in dipping articles in cellulose acetate solutions and the like which are not present when dipping articles in some other types of solutions. Since the cellulose acetate solution is very volatile, it is hard to control the viscosity of the solution. Furthermore, there is a tendency for the surface of the solution to thicken or harden and to entrain any bubbles which might form during the dipping operation. Due to the many critical factors involved, it has been difficult to coat articles with a cellulose acetate solution on a mass production basis without having an abnormally large percentage of dipped articles rejected upon inspection.

It is an object of this invention to provide a simple machine which insures uniformity of coating and which depends, to a minimum degree, upon the skill of the operator.

One of the problems encountered when dipping articles in a cellulose acetate solution by ordinary dipping methods is that the movement of the articles through the cellulose acetate solution causes uneven coating of the article. This is due to the fact that as the articles move through the solution, a large amount of cellulose acetate collects behind the articles and only a thin coating remains on the front side of the articles. Furthermore, a considerable amount of power is required to move the articles through the solution. It is an object of my invention to overcome the above problems by moving the article and the solution together at a uniform rate of speed.

Another object of this invention is to provide an improved arrangement for maintaining the viscosity of the solution substantially uniform. More particularly it is an object of this invention to add a solvent to the solution so as to replace the vaporized solvent and to add the solvent in such a manner that it facilitates release of any air bubbles which may be formed in the dipping solution.

Another object of this invention is to provide a method and apparatus which requires a minimum amount of solution and which makes it possible to dip articles in solutions of various colors with a minimum of inconvenience.

Still another object of this invention is to provide an improved arrangement for supporting

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and rotating the tank containing the dipping solution.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

In the drawing:

Figure 1 of the drawing is an elevational view showing a preferred embodiment of my invention;

Figure 2 is a plan view of the apparatus shown in Figure 1;

Figure 3 is a fragmentary sectional view showing the arrangement used in supporting the articles to be dipped; and

Figure 4 is a developed view of a typical cam used in controlling the dipping operation.

For purpose of illustrating my invention, I have shown a rotatable circular dipping tank having attached thereto and rotatable therewith suitable supports on which the articles to be dipped are mounted so that the articles to be dipped are merely raised and lowered into the solution and move with the solution. Whereas certain features of my invention are equally applicable to an arrangement in which the dipping tank and article supports are moved along together on a straight line conveyor, a number of advantages are gained by using the arrangement shown as will be explained more fully hereinafter.

Referring now to the drawing wherein I have shown a preferred embodiment of my invention, reference numeral 10 designates a rotatable circular tank having an outer wall 12 and an inner wall 14. Reference numeral 16 designates a centrally disposed axle which is journalled in a stationary bearing 18 and which is connected to the inner wall 14 of the tank 10 by means of a plurality of spoke-like members 20. A plurality of stationary conveyor type rollers 24 are arranged to rotatably support the tank proper. The rollers 24 are journalled in stationary outer and inner frame members 26 and 28 respectively.

In order to impart rotation to the tank 10, I have provided an electric motor 30 which drives a small gear 32 through a gear reduction mechanism 34 arranged as shown in Figures 1 and 2. The small gear 32 engages gear teeth 36 carried adjacent the bottom edge of the outer wall 12 of the circular tank 10. These teeth extend all the way around the tank 10 whereby continuous operation of the motor 30 causes continuous rotation of the tank.

Suitable article supports 50 are provided

which move along with the tank 10 so that the articles to be dipped are not required to move through the solution during the period of time when the articles are immersed. Guide bearing elements 38 attached to the inner and outer side walls of the tank as shown in Figure 1 of the drawing serve to guide the vertically reciprocating cam elements 40 to which the article supports are attached. The cam elements 40 are biased downwardly by means of springs 42 having their lower ends attached to the guide elements 38 and having their upper ends attached to the element 40. The lower ends of the cam elements 40 are arranged in engagement with the stationary cam rings 44 and 45 respectively which extend throughout the full 360 degrees through which the tank rotates and which are attached to the outer and inner frame members 26 and 28 respectively. In Figure 4 of the drawing, I have shown a development which is typical of each of the cams 44 and 45. While I do not wish to be limited to the particular cam shape shown, this shape has been found to be well suited for use in dipping articles in cellulose acetate. By properly correlating the rate of rotation of the tank and the shape of the cams 44 and 45, it would be possible to provide more than the one dipping cycle per revolution of the tank. The number of dipping cycles provided per revolution of the tank will also depend partly upon the size of the tank and the size and shape of the articles to be dipped.

A channel shaped article support 50 is rotatably supported adjacent the upper end of each set of reciprocating cam elements 40. The channels are pivotally supported by shafts 52 and 54 arranged as shown. Each shaft 54 is provided with a gear 56 which is used for rotating the channel and the articles carried thereby. In the arrangement shown, I have provided a first stationary rack element 58 supported adjacent the upper end of the stationary post 60 so that when the gear 56 moves into registry with the rack 58, the article supporting channel 50 will be rotated half a revolution. It will be noted that rotation of the article support 50 serves to swing the articles 62 to be coated from a position in which the articles to be coated project upwardly from the channel 50 into a position in which the articles project downwardly from the channels 50. The articles 62 are fastened to mounting pins 64 which in turn are fastened to a slide bar 66 which is slidable endwise into and out of a channel 50 whereby it is possible to mount a number of articles on each of the removable bars 66 and to slide the assembly into the channel 50 at one station and to remove the assembly from the supports at the same station after the articles have been properly dipped.

The arrangement of the rack 58 is such that the articles to be dipped are rotated 180° about the horizontal axis so as to move into the down position while the vertically movable cams 40 are still in the up position. Just after the articles to be dipped swing down, the supporting cams 40 move downwardly so as to lower the articles into the dipping solution. The tank will then rotate through approximately thirty degrees before the cam 44 lifts the articles out of the solution.

Soon after the articles have been lifted out of the solution, the gear 56 engages a stationary rack portion 58 which serves to rotate the gear 56 and the article supporting channel 50 through 180 degrees so that the dipped articles will then project upwardly as shown at the left in Figure 1 of the drawing. The dipped articles remain in the up position while the tank 10 and the article supports travel through the next 180 degrees after which the article supporting bars 66 are removed and new bars are inserted containing uncoated articles to be dipped. With this arrangement, a single operator may be used for removing the dipped articles and for inserting a new set of articles to be dipped.

A hood 80 has been provided for partially inclosing the tank as it rotates through a distance corresponding to approximately 100 degrees. The purpose of this hood is to prevent too rapid drying of the coated articles. The hood keeps the vapors from escaping too rapidly from the zone directly under the hood with the result that the coating dries at the most efficient rate to prevent the formation of bubbles.

Unless some means is provided for diluting the dipping solution so as to make up for the losses resulting from vaporization of the solution, the dipping solution becomes too thick and in order to prevent this taking place, I have provided means for adding a predetermined quantity of solvent or thinner to the coating material in the tank. This means, comprises a spray or drip pipe 82 which is arranged directly above the tank 10 at a point close to the entrance to the hood 80 as shown in Figure 2 of the drawing. It has been found that the addition of solvent in this manner facilitates the release of air bubbles from the surface of the coating material. Furthermore, by adding solvent (which in itself is highly volatile) at this particular point, the atmosphere under the hood will contain the desired amount of beneficial vapors to facilitate the retardation of the initial drying rate of the coated articles.

In order to control the flow of solvent from the main supply tank 84 into the solvent drip pipe 82, there is provided a valve 86 which may be manually operated but which is preferably automatically opened and closed so as to prevent any of the solvent from dripping out at the instant when the coated articles are passing thereunder. In the arrangement shown, the valve 86 is normally biased to the open position and is provided with an operator 88 which is adapted to be engaged by the cam members 40 so as to close the valve at that particular time when dipped articles pass under the drip pipe 82.

In addition to the loss of solvent from the main supply of liquid, there will be a normal consumption of coating material by the articles dipped into the coating solution and in order to replenish the supply of dipping solution, there is provided a storage tank 98 from which additional dipping solution may be pumped into the tank 10 by means of a pump 100 driven by any suitable means such as the electric motor 102. The one side of the pump is directly connected to the storage tank 98 and the other side of the pump is connected to the pipe 103 leading to and communicating with the central passage 104 provided in the centrally disposed axle 16. The passage 104 communicates with a radially extending passage 106 provided in one of the spokes 20 so as to convey the solvent directly into the tank 10. By reversing the direction of rotation of the pump 100, it is possible to use the pump 100 for returning the solution to the storage tank when for any reason it may be desirable to empty or replace the solution in the tank 10.

There may be times when it becomes desirable

to coat some articles one color and to coat other articles a different color and to perform both coating operations simultaneously with the same equipment. In order to make this possible, there may be provided one or more removable tank sections such as the section **110** which may be used for holding a solution of a different color than that contained in the main tank **10**. By virtue of the article supporting and dipping arrangement disclosed herein, it is obvious that those articles inserted in the article supports above the tank **110** will be coated with a material of the color contained in the tank **110**. It is also obvious that the solvent dipping mechanism described hereinabove will be effective in maintaining the proper viscosity within the tank **110**.

Another arrangement for segregating a portion of the solution in the tank **10** from the remainder of the solution in the tank **10** has been shown in Figure 2 of the drawing wherein the reference numeral **112** designates removable tank partitions which may be installed and removed at will in order to segregate the solutions of different color in the tank **10**. The number of partitions **112** and the location of the partitions **112** may be varied without departing from the spirit of my invention. Conventional gasket means (not shown) are provided so as to prevent the passage of solution from the one side of the partition to the other side thereof. By virtue of the above described arrangement, it is obvious that a single revolving tank arrangement may be used for simultaneously coating articles of different colors and that all of the articles to be coated will remain in the dipping solution of the desired color the same length of time irrespective of the size of the tank beneath each article supporting rack. Likewise, the correct amount of solvent will be added to each body of coating material irrespective of the size of the tank. Likewise the length of time required for each coated article to pass beneath the hood **80** is always the same.

Another advantage of the above described arrangement is that it is possible to conserve on fluid at such times when it is desired to coat only a few articles at a time since it is not necessary to fill the entire tank with a coating solution just to dip a few articles.

In carrying out the coating operation, it is preferable to maintain the ambient air temperature and the relative humidity of the air substantially constant. As an alternative to maintaining the temperature and humidity of the air substantially constant, the composition of the coating solution may be varied either manually or automatically such as by varying the amount of solvent added at **82** so as to compensate for changes in the atmospheric conditions.

The coated articles removed from the channel bars **50** are placed on suitable racks (not shown) which may be used in transferring the coated articles into a curing room or the like. In certain types of installations it may be desirable to increase the size of the equipment shown herein so as to make room for an additional curing chamber through which the coated articles would pass.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of

carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. A dipping machine comprising a horizontally disposed circular tank adapted to contain a quantity of coating medium into which articles to be coated are dipped, means for revolving said tank about its central vertical axis, article supporting means carried by said tank, and means for lowering and raising said article supporting means in response to movement of said tank, said article supporting means comprising a support extending over a portion of said tank and means for rotating said support about a horizontal axis.

2. A dipping machine comprising a circular tank adapted to contain a quantity of coating medium into which articles to be coated are dipped, means for revolving said tank about its vertical axis, article supporting means movable in unison with said tank, and means for raising and lowering said article supporting means in response to movement of said tank, said article carrying means comprising a support extending over a portion of said tank and mounted for rotation about its horizontal axis, and means operable to rotate said support at fixed points along the path of travel of said support.

3. A dipping machine comprising a circular tank adapted to contain a quantity of coating medium into which articles to be coated are dipped, means for revolving said tank about its central axis, article supporting means carried by said tank, means for lowering and raising said article supporting means, a hood surrounding a portion of said circular tank whereby articles carried by said article supporting means pass through said hood, and means for adding solvent to the surface of said dipping solution in said tank, said last named means being located adjacent the inlet side of said hood.

4. A dipping machine comprising a tank adapted to contain a quantity of coating medium into which articles to be coated are dipped, means for moving said tank, article carrying means movable along with said tank, means for lowering and raising said article carrying means, a hood through which said tank and article carrying means pass whereby articles carried by said article carrying means pass through said hood along with the tank, and means located adjacent the path of movement of said tank adjacent the inlet to said hood for spraying solvent onto the surface of the dipping solution in said tank.

5. In combination, a central support, a circular tank surrounding said support and adapted to contain a coating medium, means for rotatably mounting said central support, means for attaching said circular tank to said support, a plurality of rollers radially arranged relative to said support and disposed directly beneath said circular tank for supporting said tank, means for rotatably mounting said rollers, circular cam ring means surrounding said last named means, cam followers slidably supported by said tank and cooperating with said cam ring means, article supports carried by said cam followers and extending out over said tank, and means for rotating said tank.

6. In combination, a rotatable support, a circular tank attached to and surrounding said support, a plurality of rollers radially arranged relative to said support and disposed directly beneath said circular tank for supporting said tank, means for rotatably mounting said rollers, a circular cam ring attached to and surrounding said

last named means, cam followers slidably supported by said tank and cooperating with said cam ring so as to be moved upwardly by said cam ring, article supports carried by said cam followers and extending above the tank, spring means for biasing said cam followers downwardly, and means for rotating said tank, said last named means comprising a series of gear teeth mounted along the outer periphery of said tank and a motor operated pinion arranged to engage said teeth.

7. A dipping machine comprising a receptacle, means for supporting said receptacle for movement along a given path, article supporting means extending across at least a portion of said receptacle, cam means supported by said receptacle for supporting said article supporting means, means for raising and lowering said cam means and said article supporting means carried by said cam means, and means for rotating said article supports about a horizontal axis so as to invert the articles carried by said supporting means.

8. A dipping machine comprising a receptacle, means for supporting said receptacle for movement along a given path, article supporting means extending across at least a portion of said receptacle, and cam means supported by said receptacle so as to move therewith for supporting said article supporting means, means for raising and lowering said cam means and the article supporting means carried by said cam means relative to said receptacle, and means for rotating said article supporting means about its horizontal axis, said last named means including mechanism stationed at spaced points along said path of travel of said receptacle for rotating said supporting means.

9. A dipping machine comprising a receptacle, means for supporting said receptacle for movement along a given path, article supporting means extending across at least a portion of said receptacle, cam means carried by said receptacle for supporting said article supporting means, means for raising and lowering said cam means relative to said receptacle, and means for rotating said article supporting means about the horizontal axis, said last named means including mechanism stationed at spaced points along said path of travel, each of said article supporting means comprising a member having formed therein a slotted channel and a bar slidable into and out of said channel and having secured thereto article engaging means adapted to project through the slot in said channel.

10. A dipping machine comprising a receptacle, means for moving said receptacle through a given cycle past an operator's station, means carried by said receptacle for supporting articles to be dipped into said receptacle, said last named means comprising an article supporting bar and a member having formed therein a channel for slidably supporting said bar, means for rotatably supporting said member, and means for preventing removal of said bar when said member is rotated into a position in which the articles to be dipped project down from said supporting bar.

11. A dipping machine comprising a dipping solution receptacle, means for moving said receptacle through a given cycle past an operator's station, means carried by said receptacle for removably supporting articles to be dipped into said solution, said means for supporting articles comprising a channel member and an article supporting bar slidable endwise into said channel member, and means for rotatably supporting said channel member including means for preventing removal of said bar when said member is rotated into a position in which the articles to be dipped project down from said supporting bar, said means for rotating said article supporting means comprising a gear secured to said channel member and a rack located adjacent the path of movement of said receptacle and in the path of said gear whereby the rack operatively engages said gear so as to cause rotation of said channel member.

12. In combination, a central support having a fluid passage therein, a circular tank surrounding said support and adapted to contain a coating medium, means for rotatably mounting said central support, means for attaching said circular tank to said support including a member having a fluid passage extending from said first named fluid passage to said tank, means for rotating said tank, a storage tank adapted to contain a dipping medium, and means for pumping dipping medium from said storage tank through said fluid passages and into said tank.

13. In combination, a central support having a fluid passage therein, a circular tank surrounding said support and adapted to contain a coating medium, means for rotatably mounting said central support, means for attaching said circular tank to said support including a member having a fluid passage extending from said first named fluid passage to said tank, means for rotating said tank, a storage tank adapted to contain a dipping medium, means for pumping dipping medium from said storage tank through said fluid passages and into said tank, a solvent supply tank adapted to contain a solvent solution, and means including a stationary spray pipe to said circular tank.

14. In combination, a central support having a fluid passage therein, a circular tank surrounding said support and adapted to contain a coating medium, means for rotatably mounting said central support, means for attaching said circular tank to said support including a member having a fluid passage extending from said first named fluid passage to said tank, means for rotating said tank, a storage tank adapted to contain a dipping medium, means for pumping dipping medium from said storage tank through said fluid passages and into said tank, a solvent supply tank adapted to contain a solvent solution, means including a stationary spray pipe for supplying solvent to said circular tank, and means operated in response to movement of said circular tank for controlling the flow of solvent through said spray pipe.

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