March 22, 1966 J. H. BROWN 3,242,003

METHOD AND APPARATUS FOR INTERRUPTING LIQUID COATING

Filed Oct. 31, 1962 2 Sheets-Sheet 1

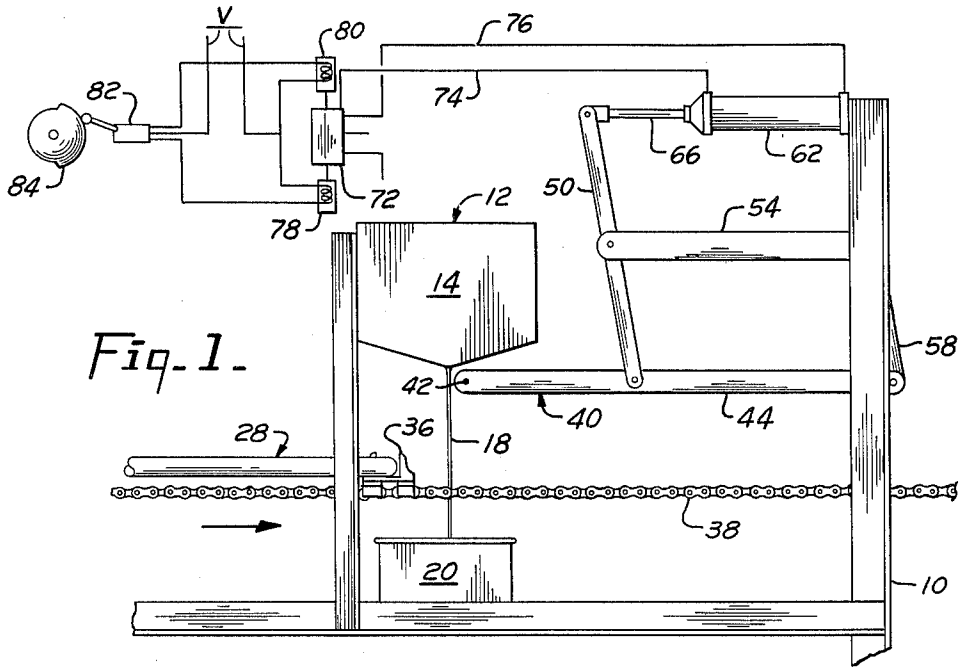

Fig. 1.

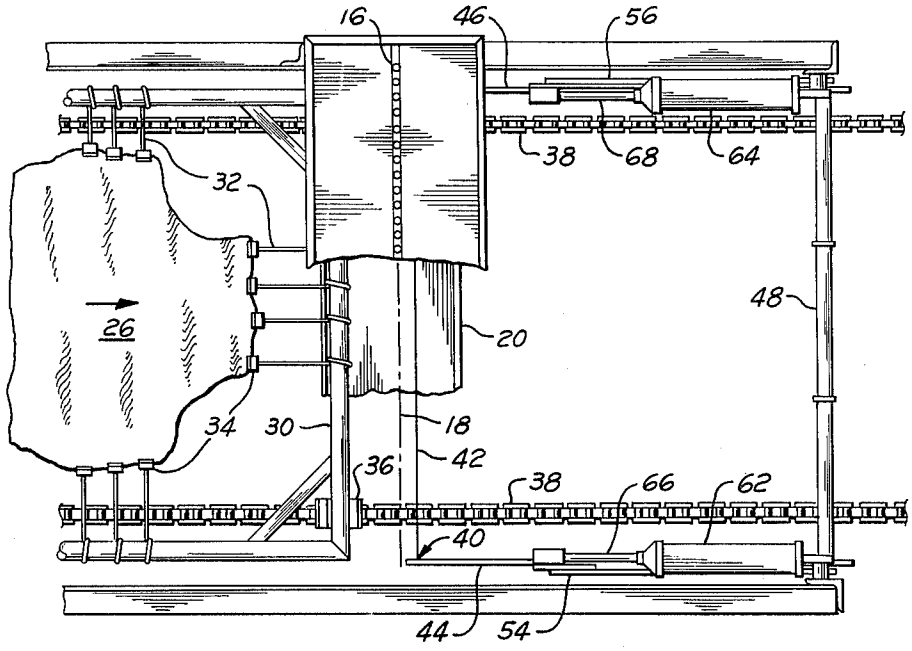

Fig. 2.

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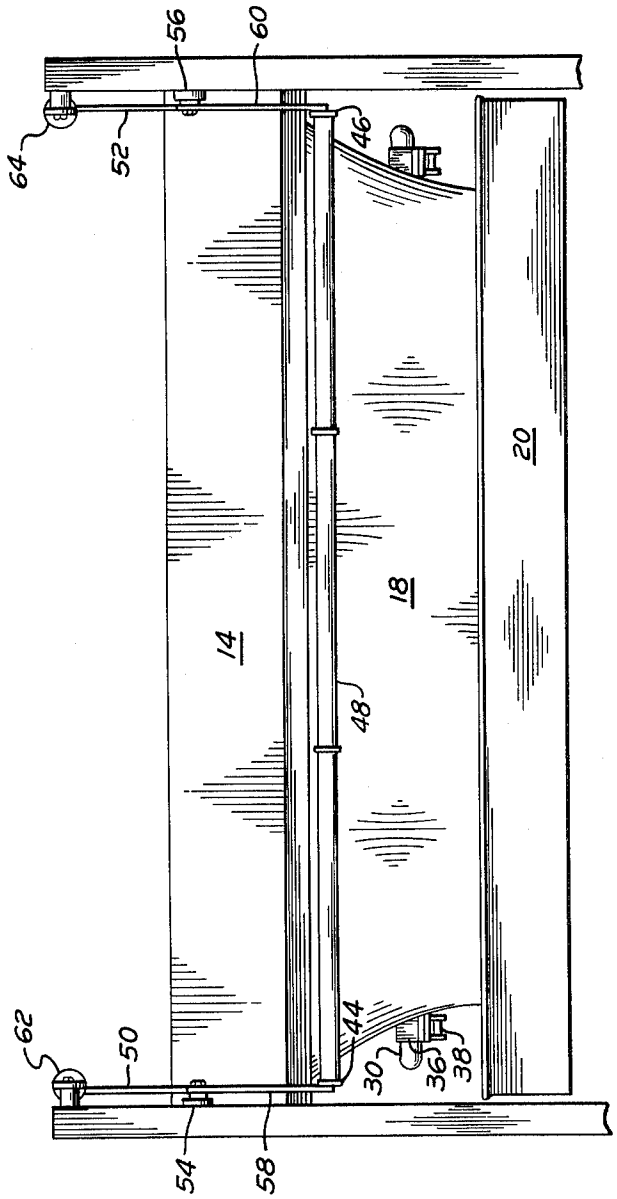

Fig. 3.

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METHOD AND APPARATUS FOR INTERRUPTING LIQUID COATING

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5 Claims. (Cl. 117—105.3)

The present invention deals generally with improvements in method and apparatus for coating articles by pouring liquid material thereon. More specifically, this invention deals with an improved method and apparatus for interrupting the descent of liquid from a liquid pouring device.

A well-known method and means for applying a coating of liquid material uniformly to the surface of an article involves the pouring of a thin curtain of such liquid across the path along which the article is passed. Various liquid finishing materials, such as dyes, lacquers, varnish, and the like, may be applied to sheet-like items in this manner. Usually, the liquid material is poured in a curtain disposed generally transversely of the direction of motion of the article to be coated. The liquid descends by gravity from a weir or orifice type reservoir across the path of the article, and the excess is recovered in a pan or sump and usually recirculated to the reservoir. In most instances, the curtain is poured continuously as successive articles are passed therethrough. Excess liquid falling between articles is recovered in the pan and there is little loss. However, where such articles are automatically fed through the curtain of liquid, a system of conveyors, detouring around the pan is utilized and the article must span, unsupported, a narrow space extending to either side of the curtain of liquid. Such apparatus is shown in the Glaus Patents Nos. 2,935,424 and 2,963,002.

Such systems present no difficulty where the articles to be coated are rigid. However, where flexible material such as leather, textiles, and other sheet-like material is to be coated by pouring, some special means must be provided to enable the material to bridge the gap across the liquid pan. Otherwise, the weight of the material, or the weight of the liquid falling thereon, may cause it to fall into the pan.

In the past where such flexible articles have been supported on a conveyor device while passing through the curtain of liquid several problems have resulted. Portions of the device exposed between successive articles have been coated by the liquid material and have required extensive cleaning. Furthermore, the liquid falling on the conveyor device has been lost; and often such material is transferred to the underside of successive articles in an undesirable manner.

Accordingly, it is an object of the present invention to provide an improved method and apparatus for briefly interrupting a descending curtain of liquid material at desired times.

A further object of the present invention is to provide an improved method and apparatus for coating particles by pouring liquid thereon wherein the curtain of liquid may be briefly interrupted while an exposed portion of a conveyor device passes underneath.

Basically, this invention contemplates the substantially continuous pouring of a curtain of liquid material through which articles are to be passed and, as a conveying means passes therebeneath, exposed between successive articles, briefly interrupting the curtain of liquid by concurrently passing a filament through the length thereof.

An apparatus devised for carrying out this method comprises, in combination with a pouring means and an article conveying means, a single filament member held parallel to the curtain of liquid at a level between the pouring and conveying means, and means connected to the filament to reciprocate it through the curtain of liquid.

Additional objects and advantages of the present invention will become apparent upon reading the following specification in conjunction with the drawings wherein:

FIGURE 1 is a side elevation of the apparatus of this invention with a device for carrying an article to be coated partially shown;

FIGURE 2 is a plan view of the apparatus of FIGURE 1 with parts broken away;

FIGURE 3 is a front elevation of the apparatus of FIGURE 1.

In practicing the present invention, an article to be coated is placed upon a conveyor member which is constrained to travel in a given path. A liquid material, to be applied to the article, is continuously poured in a descending curtain disposed generally transversely of the path at a location to intercept the article. As the leading edge of the conveyor member approaches the curtain of liquid the latter is interrupted briefly to form a horizontal space in the curtain through which the leading edge of the conveyor member may pass without being coated.

The curtain of liquid may be best interrupted along a line close to its origin or source of liquid material. This is done by passing a single filament, such as piano wire held horizontal and parallel to the curtain of liquid quickly through the entire length of the liquid curtain.

It will be obvious that the falling curtain of liquid accelerates downwardly under the force of gravity, and the velocity of a given increment thereof increases with the distance from its origin. However, since the rate of flow of the liquid past any given level will be constant, it will be seen that the cross sectional dimensions of the curtain of liquid will be reduced as it falls. This may be seen in FIGURE 3 which shows how the curtain tends to draw in along its length to a shorter dimension. The width of the curtain will similarly decrease.

However, as the velocity of the liquid increases, the effect of passing a filament through it will be lessened and, instead of being parted, the curtain of liquid, at some level, will merely be diverted to one side of the filament. Accordingly, the filament must be passed through the curtain of liquid at a level sufficiently close to its source to cause partition.

It has been found that by thus passing a single filament through the curtain of liquid, the latter is parted along a horizontal line and a substantial horizontal space, free of liquid, is provided. It is believed that this takes place because the filament is sufficient to momentarily halt the liquid above it while the liquid therebeneath continues to accelerate while falling under the influence of gravitational forces. The liquid above the filament is briefly halted and thereafter recommences gravitational acceleration from a velocity of zero at the level intercepted by the filament. However, the liquid below the wire has already achieved some velocity and continues to accelerate to even faster speeds, thereby increasing the distance between it and the portion of liquid above the wire. The dimension of the space is affected by the size of filament and the characteristics of the flowing liquid. Also, for a given filament the space will decrease with increases in rate of flow of the liquid.

An apparatus devised for carrying out this method is shown in FIGURES 1 through 3 wherein the various elements of apparatus are mounted upon a superstructure, generally **10**. A liquid coating applicator, or pouring device, generally **12**, comprising a reservoir **14**, having a sloped bottom with an orifice opening **16**, at the lowest point therein, produces a substantially planar liquid curtain **18** which is received in a pan **20**, spaced therebeneath. The liquid received in the pan **20** may be recirculated to the reservoir **14** by suitable apparatus, not shown.

An article to be coated by the liquid such as a side of leather **26** is supported upon a carrying member, generally **28**. In the illustrated embodiment the carrying member comprises a frame **30**, having a multitude of lacings **32** by which the leather is tautly stretched within the frame. Each lacing **32** has a toggle fastener **34** at one end, secured to the leather, and is adjustably secured to the frame **30**. The carrier frame **30** is removably supported by a plurality of dogs **36** attached to a pair of parallel spaced endless chains **38** trained beneath the reservoir **14**.

At one side of the liquid reservoir **14**, supported across the path of the carrier frame **30**, upon a pair of uprights, is a liquid curtain interrupting means generally **40**. The interrupter means comprises a filament **42**, such as piano wire, tightly stretched between forward ends of a pair of parallel arms **44**, **46**. A tension rod **48** is connected between the rear ends of arms **44**, **46**. The arms **44**, **46** are held substantially perpendicular beyond the limits of the liquid curtain **18**, and the filament **42** is held horizontal and parallel to the curtain. Arms **44**, **46** are parts of four-bar linkages and are pivotally connected to a pair of levers **50**, **52** respectively, which are rotatably mounted on cantilever members **54**, **56** extending from the superstructure uprights. A pair of connector links **58**, **60** are pivotally connected to the ends of arms **44**, **46** and the cantilever members **54**, **56**. Thus, the arms **44**, **46** will always be held parallel and horizontal while they are free to be swung perpendicular to the liquid curtain **18**.

Actuating means preferably comprising a pair of pneumatic cylinders, **62**, **64** are connected to the upper ends of levers **50**, **52** by respective piston rods **66**, **68**. The pneumatic cylinders in turn are secured to the upper ends of the superstructure uprights. Actuation of the pneumatic cylinders to move the piston rods in either direction will result in reciprocation of the arms **44**, **46** in the direction of the liquid curtain, passing the filament **42** through the latter.

A four-way valve, **72** (shown only in FIGURE 1) is connected by manifold **74** to the forward ends of cylinders **62**, **64**, and by manifold **76** to the rear ends thereof. The four-way valve **72** is actuated by a pair of solenoids **78**, **80** to connect either manifold to a source of air under pressure (not shown) and the remaining manifold to atmosphere. The solenoids **78**, **80** are connected across a source of electric power and a two-way switch **82**, which is operable to energize the solenoids alternately so as to cause the four-way valve to connect first one manifold and then the other to the source of air under pressure.

The two-way switch **82** is actuated in accordance with the position of the carrying member generally **28** so as to pass the filament **42**, through the liquid curtain **18** just prior to the time at which the exposed portion of the carrying member would intercept the curtain. The switch **82** may obviously be actuated by various suitable means such as the illustrated cam **84** which may be driven either directly from the carrying member power source, or by a time drive (neither shown). The cam **84** is set to throw the switch **82** in accordance with the position of the dogs **36** on the endless chains **38**. Also, it will be obvious that the switch **82** could be replaced by suitable trip switches positioned in the path of the carrying member, or by photoelectric cell devices.

In operation, as the leading edge of the carrier frame **30** approaches the curtain of liquid **18**, the four-way valve **72** is actuated to deliver air under pressure through manifolds **74** to the forward end of cylinders **62** and **64**. The piston rods **66**, **68** are moved to the right (as shown in FIGURES 1 and 2) to swing levers **50**, **52** clockwise and move the arms **44**, **46** to the left. The filament **42** will be passed through the liquid curtain **18**, causing it to be briefly interrupted and parted as the carrier frame **30** passes by. The liquid curtain **18** will almost immediately re-establish and fall continuously upon the leather **26**.

As the rear portion of the frame **30** approaches the liquid curtain **18**, the solenoid actuated valve **72** is reversed to deliver air under pressure through manifolds **76** to the rear end of cylinders **62**, **64**, reversing the previously described movements, and moving the filament **42** again through the liquid curtain from left to right. The curtain will again be briefly interrupted and parted as exposed following edge of the carrier frame passes through.

The carrier frames **30** may be mechanically or manually placed upon the endless chains **38** to the left of the coating apparatus and similarly removed after passing therebeneath. Frames are then stacked or otherwise handled while the coated leather dries.

The operations will be continuously repeated as subsequent carrier frames transport articles through the liquid curtain **18**. Also, it will be obvious that a single carrying member may be reciprocated between positions to either side of the coating apparatus and the device will perform equally well. Also, it will be obvious that a single actuating means could be used in place of the pair of pneumatic cylinders illustrated.

An apparatus for coating leather with solvent type patent leather finish has been constructed and operated in accordance with the foregoing description. In that apparatus a reservoir containing a 6 to 8 inch head of liquid capable of delivering a curtain 50 to 109 inches long (according to the width of leather) at the rate of 10 to 20 g.p.m. is spaced with the orifice 6 inches above the path of a carrier frame. The filament member is located to pass through the curtain 1 inch below the orifice. In this instance the filament was No. 20 piano wire. The filament is actuated by a cam mechanism to intercept the liquid curtain just prior to the leading edge and trailing edge of the frame reaching the curtain. A 4 to 5 inch space is produced in the curtain allowing a 1½ inch diameter frame to pass through uncoated at a speed of 3.75 ft./sec. With this apparatus it is possible to coat approximately 400 hides of leather per hour (constituting approximately 16,000 sq. ft.), allowing one pass per hide through the liquid curtain. Frames with hides are stacked, after coating, while the coating is dried and cured; and subsequently again passed through the coating apparatus one or more additional times until the desired finish is built up. No irregularity or unevenness in the applied coating has been observed.

Obviously, many other modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and, therefore, only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. An improved method for coating flexible articles by pouring a curtain of liquid material thereon, said method comprising: placing each article on a frame member having an exposed leading edge; moving the frame and article on a given path; continuously pouring a curtain of liquid material across said path; and reciprocating a single filament through said curtain of liquid in timed relation to the movement of said frame and said article and at a level above said frame selected to briefly interrupt said curtain as said exposed leading edge of said frame passes therebeneath, said filament being held horizontal and parallel to said curtain of liquid.

2. An improved apparatus for coating a surface of an item with a liquid material, said apparatus comprising, in combination: conveyor means for supporting and carrying the item to be coated in a given path; pouring means disposed above the path of said conveyor means for delivering a curtain of liquid material through which the item will pass; moveable filament means to briefly interrupt the curtain of liquid material, said filament means being positioned between said conveyor means and said pouring means; and actuating means connected to reciprocate said moveable filament means

through said curtain of liquid in timed relation to said conveyor means.

3. An improved apparatus for coating the surface of an item with a liquid material, said apparatus comprising, in combination: a reciprocable conveyor frame for supporting the item to be coated, said conveyor frame moving in a given path and having an exposed leading edge disposed transversely to said path; pouring means positioned above the path of said conveyor frame for continuously delivering a curtain of liquid material substantially transverse to said path through which the item will be passed; a filament tautly held parallel to said curtain of liquid material between said coating means and said path; and actuating means connected to reciprocate said filament through said curtain of said liquid material proximate to said coating means to briefly interrupt said curtain just prior to the exposed leading edge of said conveyor frame reaching said curtain, whereby said leading edge will pass beneath said pouring means free of said liquid material.

4. In combination with apparatus for pouring a continuously descending, substantially planar, curtain of liquid material upon articles to be coated therebeneath, an improvement for interrupting said curtain of liquid, said improvement comprising: a single filament held parallel to the plane of said curtain of liquid; and reciprocating means supporting said filament to move it perpendicular to said plane and through said curtain of liquid.

5. In combination with apparatus for pouring a continuously descending, substantially planar, curtain of liquid material upon articles to be coated therebeneath, an improvement for interrupting said curtain of liquid, said improvement comprising: a pair of spaced parallel arms positioned perpendicular to said curtain of liquid; a length of wire stretched between ends of said arms, said wire being parallel to, and at a level closely below, the origin of said curtain; and means to reciprocate said arms toward said curtain to pass said length of wire concurrently through the length of said curtain whereby said liquid material will be interrupted through its length.

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