Dec. 27, 1938. C. J. WESTIN 2,141,630

MACHINE FOR COATING TUBES INTERNALLY

Filed April 3, 1936 6 Sheets-Sheet 1

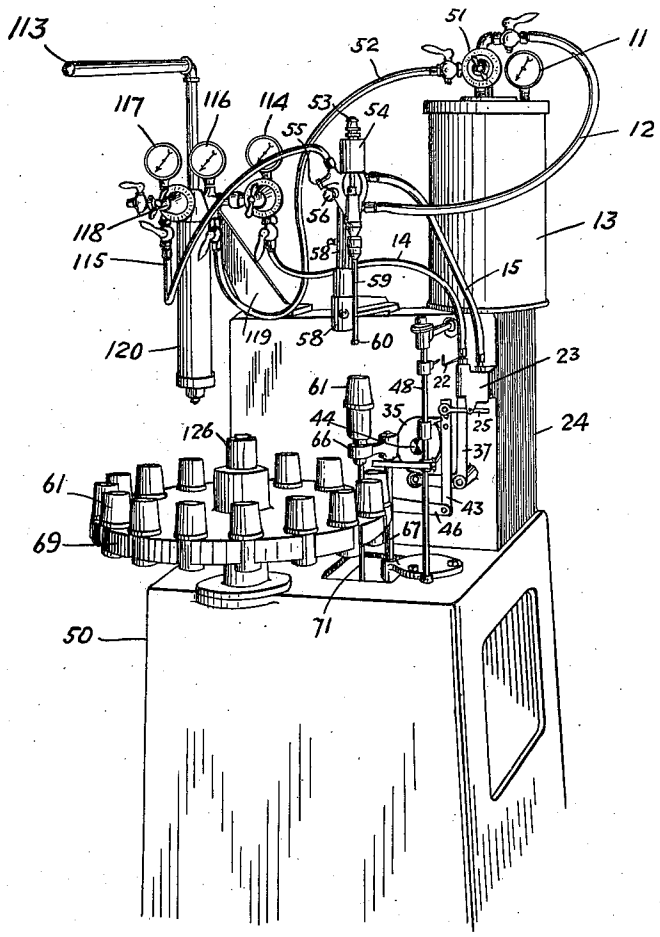


FIG. 1.

INVENTOR

WITNESS:

Robt. P. Kitchel.

Charles J. Westin

BY

Augustus B. Stoughton

ATTORNEY.

Dec. 27, 1938. C. J. WESTIN 2,141,630

MACHINE FOR COATING TUBES INTERNALLY

Filed April 3, 1936 6 Sheets-Sheet 2

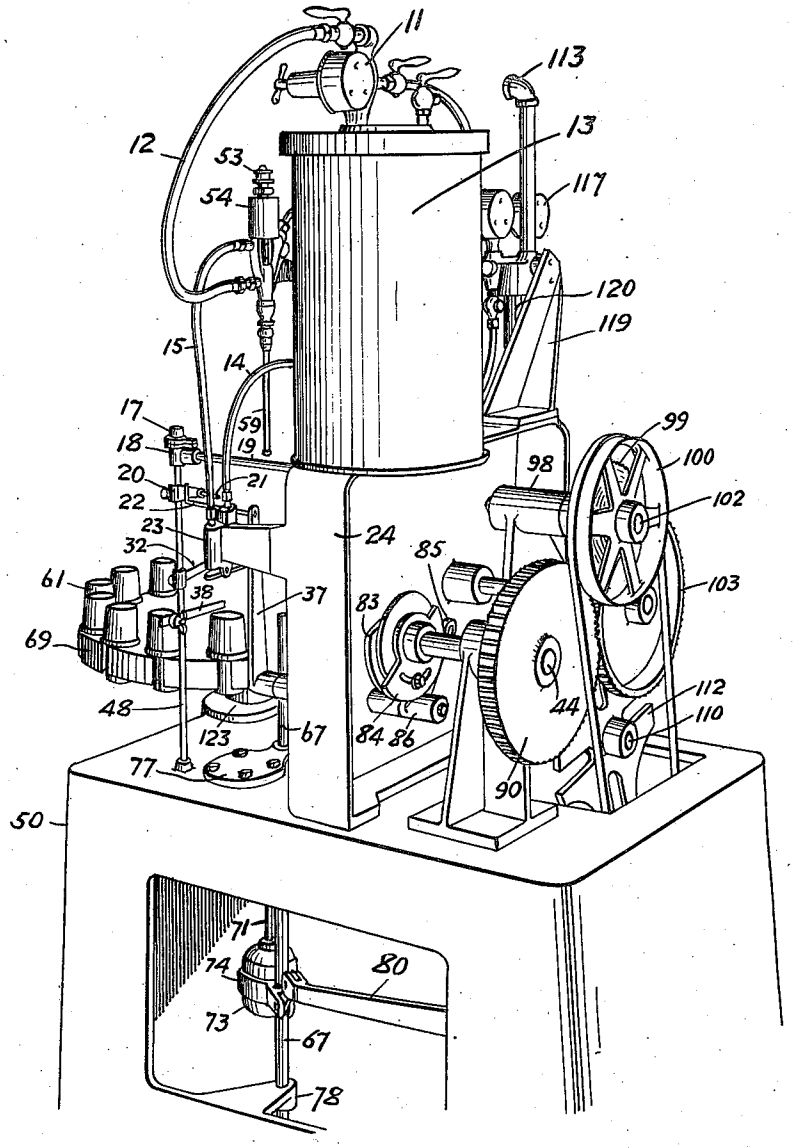


FIG. 2.

INVENTOR

Charles J. Westin

BY

Augustus B. Stoughton

ATTORNEY.

WITNESS:

Robt. R. Kitchel.

Dec. 27, 1938. C. J. WESTIN 2,141,630

MACHINE FOR COATING TUBES INTERNALLY

Filed April 3, 1936 6 Sheets-Sheet 3

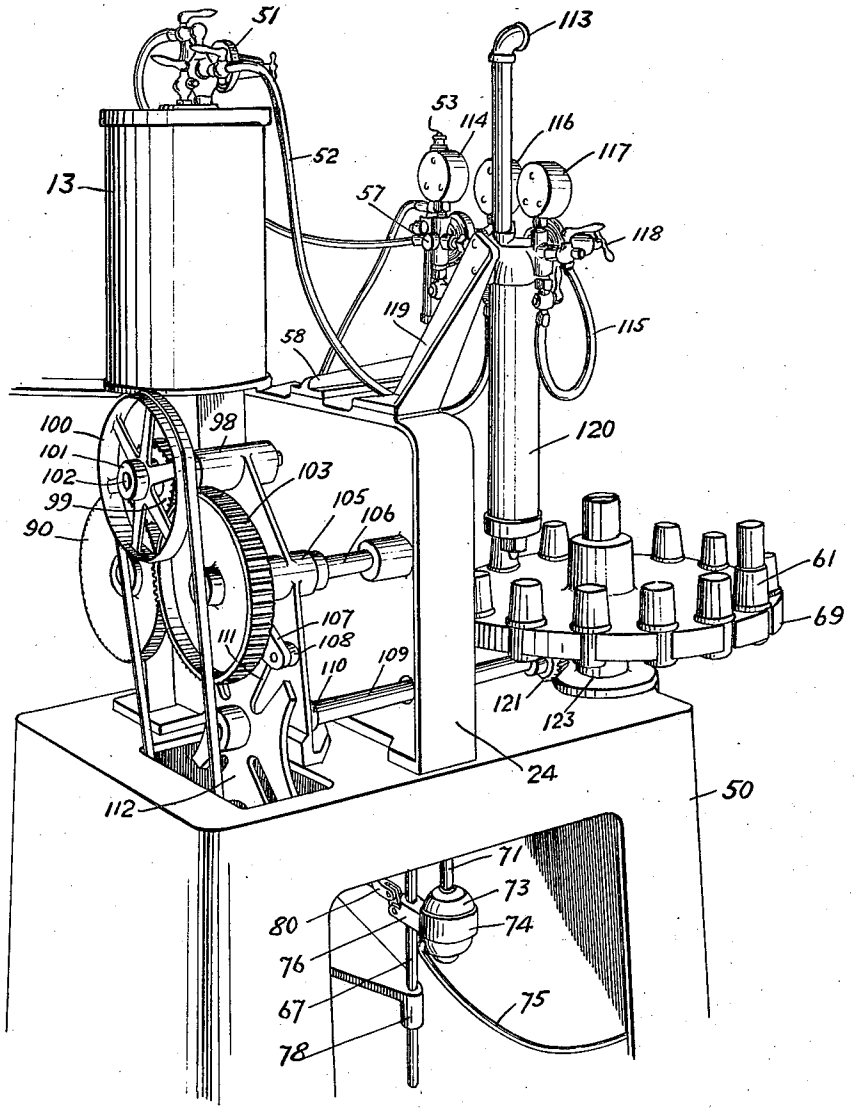


FIG. 3.

WITNESS:

Robt. P. Stitchel.

INVENTOR

Charles J. Westin

BY

Augustus B. Stoughton

ATTORNEY.

Dec. 27, 1938. C. J. WESTIN 2,141,630

MACHINE FOR COATING TUBES INTERNALLY

Filed April 3, 1936 6 Sheets-Sheet 4

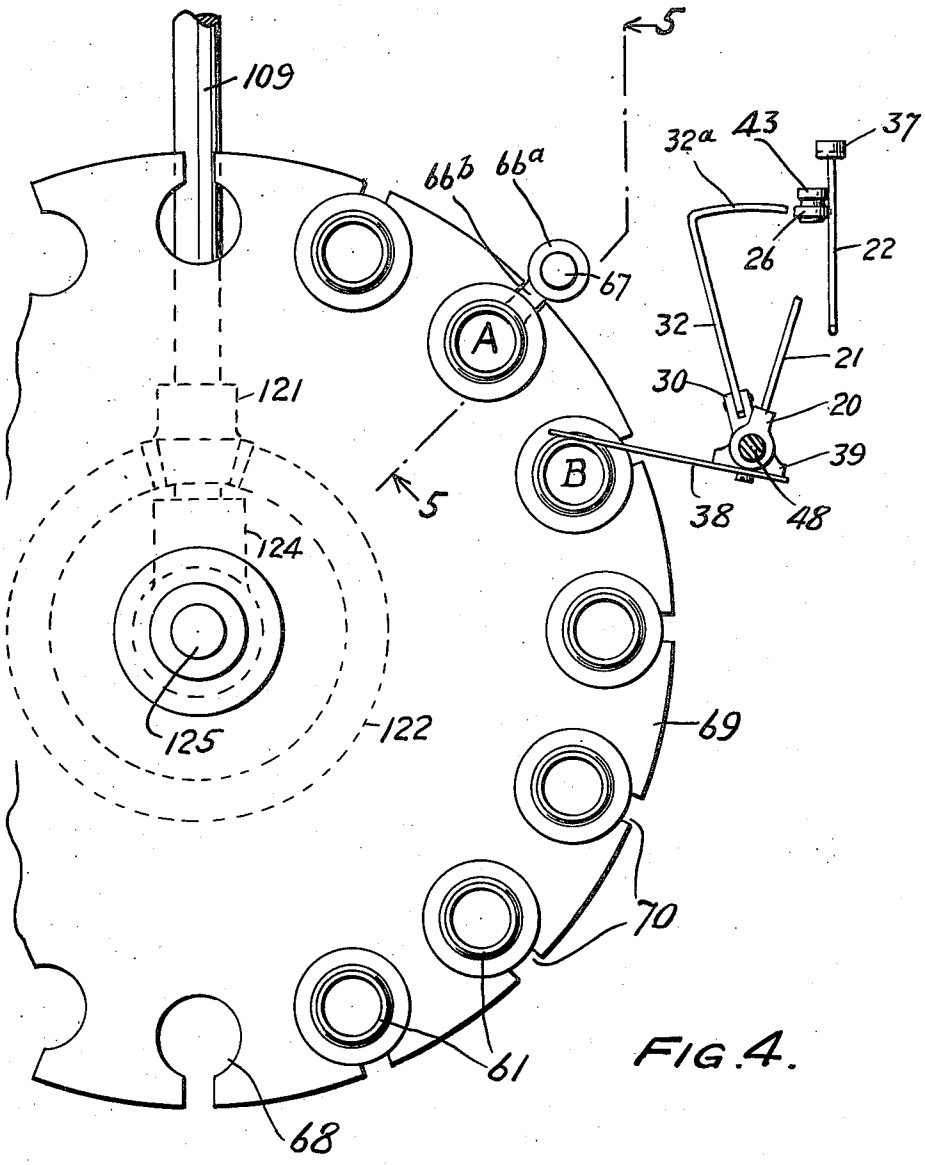


FIG. 4.

INVENTOR

Charles J. Westin

BY

Augustus B. Stoughton

ATTORNEY.

WITNESS:

Dec. 27, 1938. C. J. WESTIN 2,141,630

MACHINE FOR COATING TUBES INTERNALLY

Filed April 3, 1936 6 Sheets-Sheet 5

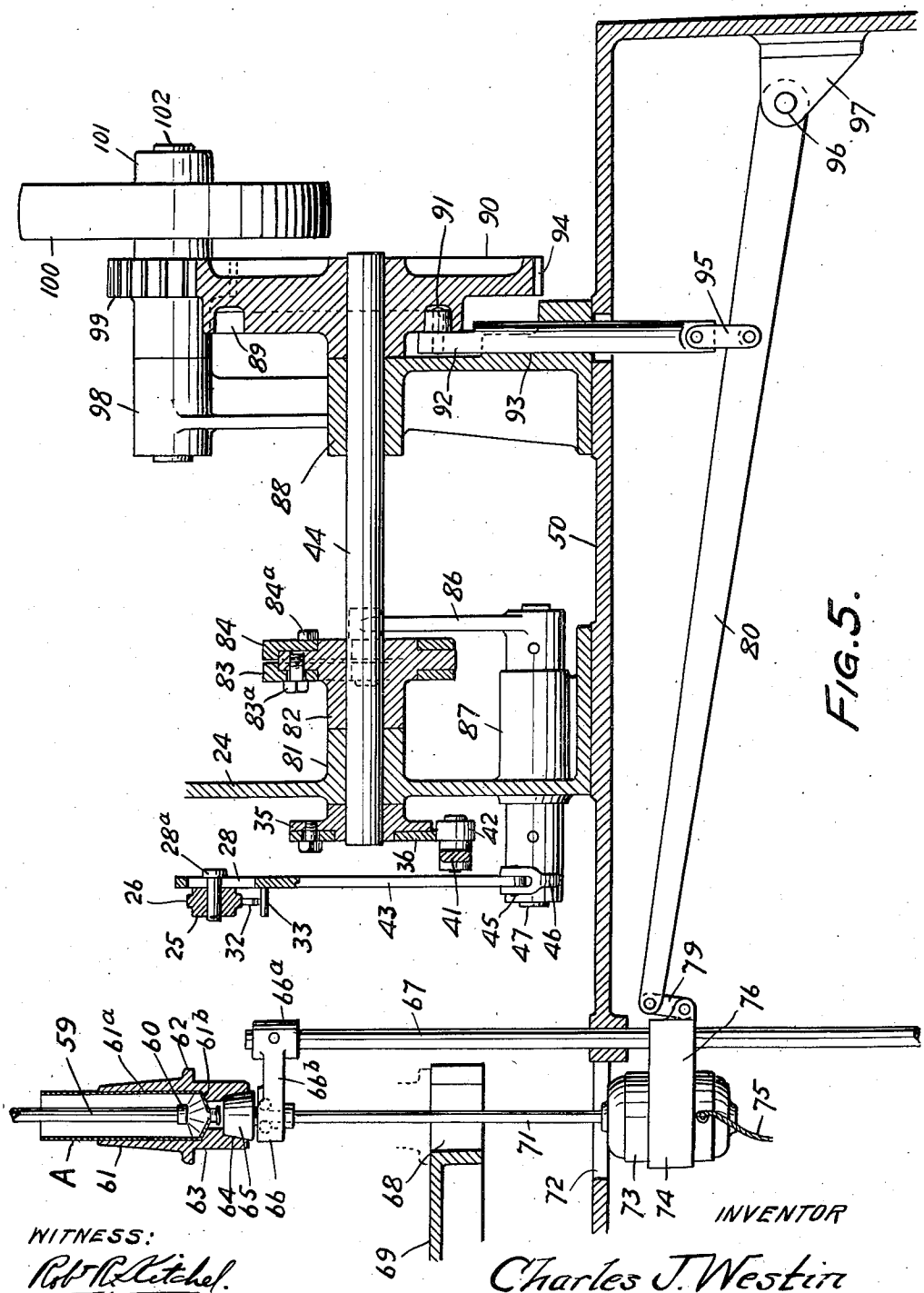


FIG. 5.

WITNESS:
Robt R. Ketchel.

INVENTOR
Charles J. Westin
BY
Augustus B. Stoughton
ATTORNEY.

Dec. 27, 1938. C. J. WESTIN 2,141,630

MACHINE FOR COATING TUBES INTERNALLY

Filed April 3, 1936 6 Sheets-Sheet 6

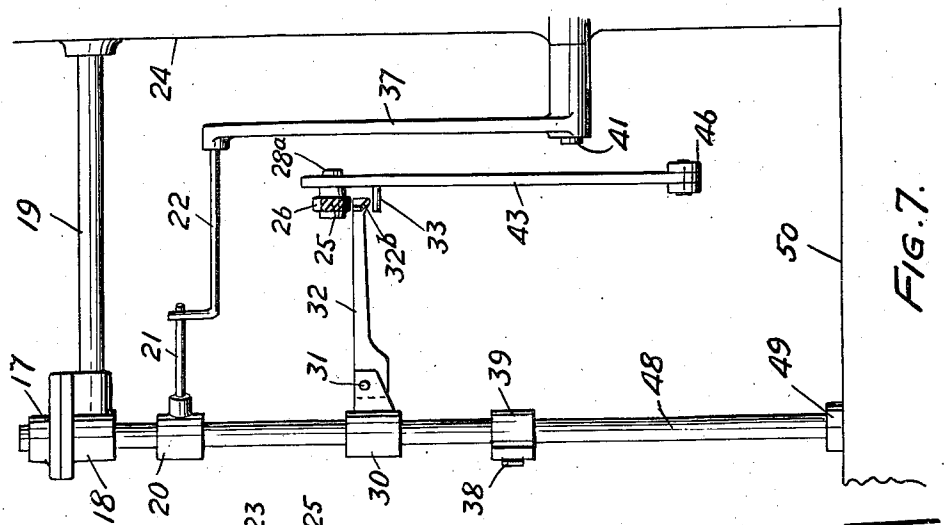


FIG. 7.

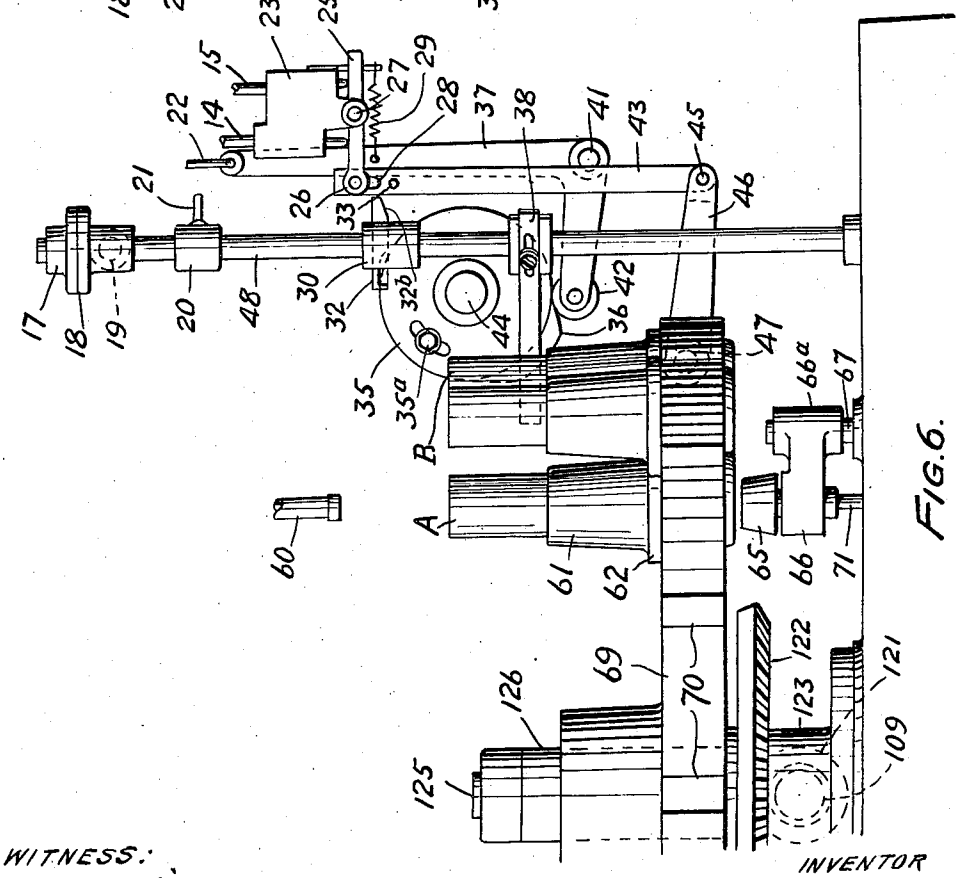


FIG. 6.

WITNESS:

Robt. R. Mitchell.

INVENTOR

Charles J. Westin

BY

Augustus B. Stoughton

ATTORNEY.

Patented Dec. 27, 1938 2,141,630

UNITED STATES PATENT OFFICE

2,141,630

MACHINE FOR COATING TUBES INTERNALLY

Charles J. Westin, Philadelphia, Pa., assignor to F. J. Stokes Machine Company, Philadelphia, Pa., a corporation of Pennsylvania

Application April 3, 1936, Serial No. 72,493

11 Claims. (Cl. 91—45)

This invention relates to coating machines and more particularly to methods of and means for coating hollow bodies, like collapsible tubes, internally through the use of a spray-gun.

One object of my invention is to provide a dependable method for applying a protective coating of uniform density and perfect coverage to the inside walls of hollow bodies.

Another object is to provide automatic means for coating hollow bodies internally so as to facilitate their manufacture and at the same time insure uniform results.

It is also an object of my invention to provide a machine embodying such desirable features as:

Adequate holders (cups) for the tubes;
Suitable conveyor for the holders;
Means for the spray-nozzle to enter the tube;
Means for rotating the tube;
Means for controlling spray-operation by the tube: such as a "no tube-no spray device";
Means for regulating density or thickness of coat;
Means for controlling duration of spraying with relation to size or length of tube; and
Other features which will be evident from the drawings and description to follow.

While my invention may be employed to advantage in connection with hollow bodies of various characters, sizes and materials, the disclosure of the new methods made in the specification and the preferred embodiment of the mechanical means used in the illustrations are directed particularly to the efficient handling and treatment of collapsible tubes.

Collapsible tubes are used extensively as dispensing containers for a large variety of products, such as tooth-paste, shaving creams, medicinal ointments, food preparations, etc. Some such products have ingredients which will attack the material from which the tube is made and destroy the tube-walls, or a chemical reaction may take place and ruin the product. Difficulties of this kind are prevented by providing a coating of suitable protective material on the inside walls of the tube. A variety of coating materials are in use, such as certain kinds of varnish, lacquer, petroleum jelly, etc., but a kind of coating must be selected which will remain unaffected by the ingredients of the product contained in the tube. It is evident from the above that the protective coating must cover the surfaces completely throughout. Any bare spots, no matter how small, would defeat the purpose.

Many methods have been proposed and used to a small extent in the past—for example: spraying a stationary tube by hand; filling the tube with the protective coating material and then emptying or draining it out; applying the protective coating by means of a brush or brushes. But such methods are inadequate, unreliable and too laborious for efficient, commercial practice.

Through the practice of my method, any hollow body of fairly regular outline may be provided with a uniform protective coating from end to end and radially all around the inside walls. The application of the coating may be so regulated that there will be no bare or uncoated surfaces nor any waste of coating material by spraying outside of the article being coated. On the other hand, the machine may be so adjusted and regulated that the coating is applied only to some one desired portion of the internal walls.

My method consists in starting the spray-jet at one end of a tube which is rotating at a comparatively high rate of speed, continuing the spray at constant density as the jet is traveling at an approximately constant speed along the central axes of the rotating tube, and stopping the spray-jet when the desired wall area has been covered.

The spray-jet may be of the side-type, which directs a fan- or cone-shaped spray against only a small arc of the circumference of the tube, but I prefer to use a central jet of very blunt cone-shape so as to cover simultaneously the complete circumference. If such a jet could be depended on to produce a coating of perfectly uniform density all around, it would not be necessary to rotate the tube. I have found, however, that, even with the best guns available, the cone-shaped jet at times will have some inactive sectors and thus leave some uncoated spots. It is therefore desirable to rotate the tube so that all points on the circumference on the level of the spray-jet are presented to the action of the spray.

The speed of rotation of the tube depends on the rate at which the spray-nozzle travels with relation to the surface being coated. In production machines this rate of relative travel is considerable and the speed of rotation may therefore be as high as a thousand or more R. P. M. in order to insure perfect coverage.

The high speed of rotation also appears to have a beneficial action on the bonding of the coat to the surface. The resulting centrifugal force evidently has a tendency to drive the atomized coating material into the pores of the surface, thus producing a stronger bonding.

In the drawings:

Fig. 1 represents a front elevation of my machine.

Fig. 2 is a side elevation showing particularly the parts associated with the "no tube-no spray device".

Fig. 3 is a side elevation.

Fig. 4 is a plan view, showing the dial and the drive mechanism as well as features of the "no tube-no spray device".

Fig. 5 is a section taken on line 5—5 of Fig. 4, showing the tube-lifting and rotating means, spray-gun and spray control parts.

Figs. 6 and 7 show the "no tube-no spray device" in greater detail.

Referring to the drawings:

In Figs. 1, 2 and 3 is seen a base 50 with a dial 69 rotatably mounted on bracket 123, and in back of dial 69 a frame 24 supporting the tank 13, the spray-gun 54 and parts associated with the spray control.

Any type of conveyor, for example a chain or belt, may be used to carry the tube-cups 61 in spaced relation from station-to-station. For the purpose of illustration, I have chosen a disk, here referred to as dial 69, which carries the tube-cups 61 in sockets 68 by an intermittent or step-by-step motion. The dial 69 may be fastened to the hub 126 (Fig. 6) of bevel gear 122 which rotates on shaft 125 fastened in bracket 123. A pinion 121 (Fig. 3) fastened on shaft 109, which has its bearings at 110 and 124, meshes with bevel gear 122. A Geneva-star 112 is also fastened to shaft 109 and imparts the usual intermittent motion to the shaft through the action of the Geneva drive-gear 103 and its drive-arm 107 which carries the roller 108 for engagement with one of the slots 111 upon each revolution of the gear 103.

Collapsible tubes are manufactured in a large variety of diameters and lengths and the holders or, as they will be referred to here, the tube-cups 61 are therefore made so as to be quickly interchangeable for any size. The tube-cup may consist of a body 61 with a collar 62 suitably shaped to rest on top of the dial 69, and below the collar is a base 63 loosely fitting into sockets 68 of dial 69. The body is hollowed out to form a deep recess with long supporting walls 61*a* for supporting the tube A and a suitable shoulder 61*b* for the tube A to rest on. Long side walls 61*a* are desirable because, at the high speed of rotation, the tube has a tendency to wabble on account of the necessary diametral clearance, which causes an objectionable mark in the tube wall at the top of the cup body unless the tube is properly supported longitudinally. The base 63 is provided with a taper socket 64 to fit onto the tapered spinning head 65. The angle of taper on these mating parts is of considerable importance, as it is relied on to hold the cup steady on the spinning head, and the fit must be snug enough to provide traction so that the cup will quickly pick up the high rotary speed of the spinning head as soon as lifted from a position of rest on the dial. The fit between the tapers, however, must not be too snug as then the cup will stick on the spinning head and cause damage as it is re-seated on the dial. I have found that a taper of between 1° and 3° on the side is preferable. If the taper exceeds 6° on the side, some means has to be provided to keep the cup from riding up on the spinning head at the high speed of rotation and falling off.

The spinning head 65 is mounted on a spindle 71 attached to and rotated by a motor 73 which receives current through cable 75. The spindle 71 is journaled in bearing 66 which is supported by arm 66*b* and attached to the vertically sliding shaft 67 by means of bracket 66*a*. Arm 66*b* is of such dimensions that, when lifting the cup 61, it can pass through the slots 70 provided for that purpose in the rim of dial 69. Motor 73 is also attached to the sliding shaft 67 through bracket 76 to which it is clamped by strap 74. Shaft 67 reciprocates up-and-down in bearings 77 and 78, receiving synchronized motion through link 79 and lever 80, which is fulcrumed at 96 in bracket 97 and operated from cam 90 through the co-operation of cam-follower 91 with cam-groove 89. The cam-follower 91 is fastened to plunger 92 for which a bearing is provided at 93, the lower end of plunger 92 being connected through link 95 to lever 80. Cam 90 is fastened to cam-shaft 44 and drives this shaft, receiving its motion through the gear teeth 94 meshing with the gear 103, which in turn is driven by pinion 99 fastened to pulley 100. As the spinning head 65 and associated parts are lifted by shaft 67, it engages the cup 61, lifts it off the dial 69 and starts it rotating, continuing to lift and rotate the cup for sufficient distance to bring the nozzle well down into the tube. It would be understood that, instead of lifting the tube A onto the nozzle, the reverse might be just as readily accomplished; that is, the nozzle lowered into the tube.

Any automatic spray-gun, for example the type described in Patents Nos. 1,070,428 and 1,321,014, may be used to atomize and spray the protective coating material. A spray-gun 54 is shown mounted directly in the path and central with a tube-cup 61 by means of clamp 56 on stem 58*a* which is fastened to bracket 58 supported on frame 24. Gun 54 is provided with a special extension nozzle 59 so that spray-jet 60 can be inserted in tube A to any desired point.

Coating material is placed in pressure tank 13, which is supported on frame 24 and connected by means of a hose 12 to the gun 54. Compressed air from any suitable source is connected into the machine through pipe line 113 and received for purification by air filter 120, which is supported by bracket 119 on frame 24. On the transformer are mounted the pressure regulators 57 and 118 as well as pressure-indicating gauges 114, 116 and 117. Gauge 116 shows the pressure of the incoming compressed air, which may be of 50 to 100 pounds pressure. The air for atomizing the coating material passes through the regulator 118 where it is reduced to a suitable pressure, usually between 35 and 50 pounds, depending on the consistency of the coating material. This pressure is indicated on gauge 117 and the connection to the gun is made by means of hose 115. Purified but unregulated air is connected through hose 52 and regulator 51 to pressure tank 13. The pressure in the tank is adjusted by means of regulator 51 and indicated by gauge 11.

The spray-gun 54 here shown is, as mentioned above, of the automatic type and operated by compressed air. The air for operating the gun is taken through regulator 57 and hose 14 into control valve 23. This valve 23 is of such construction that, by manipulating the lever 25, the air is either connected through hose 15 to the gun or the supply of air is shut off and hose 15 connected through a port to atmosphere for instantly relieving the pressure in the hose and gun.

With lever 25 (Fig. 6) in normal position,

the supply of compressed air is shut off but if head 26 of lever 25 is lifted the supply is connected and continues to act on the gun as long as the head 26 is elevated. The length of duration of the action on the gun must be adjusted to suit the length of the tube being coated. For this purpose the cams 83 and 84 (Fig. 2) are provided and adjustably mounted by means of screws 83a and 84a, respectively, on hub 82 (Fig. 5) which is fastened on cam shaft 44. This cam shaft 44, of course, makes one revolution for each step made by the dial 69. Cams 83 and 84 act on cam-follower 85 which is fastened on lever 86. The motion imparted to lever 86 is transmitted through shaft 47, journaled in bearing 87, to the lever 46 and linkage 43. It will be noticed that link 43, although connected to head 26 of lever 25 by means of a pin 28a (Fig. 7), is free to move in the lifting direction on account of the slot 28. For every revolution of cam shaft 44 and every time a cup 61 is lifted, the link 43 is also lifted in order to operate the gun. To operate the gun, however, link 43 must be coupled to lever 25 and this coupling is controlled by the tube to be coated. Occasionally a tube A will be omitted from a cup 61 and when this happens, if the gun was operated, the machine would be covered with coating material, resulting in waste of material and cleaning expense, but this is prevented through the use of the coupling or "no tube-no spray device".

It will be noticed that a bar or finger 38, Figs. 4 and 6, extends into the path of tube B as the dial 69 indexes, carrying tube B to the station shown for tube A. The tube wall contacts finger 38 and swings it out of the way, thereby turning the revoluble shaft 48 to which finger 38 is fastened by means of clamp 39. Shaft 84 is journaled in bearings 18 and 49. Bearing 18 is supported by rod 19 from frame 24. A collar 17 is fastened to shaft 48 and rests on bearing 18, supporting the shaft. A coupler 32, best seen in Figs. 4, 6 and 7, is fastened to shaft 48 in such a way that normally it remains at rest in a horizontal position but free to swing vertically on fulcrum 31 of clamp 30, while at the same time it is free to oscillate with shaft 48 in a horizontal plane except when locked between head 26 of lever 25 and pin 33 on link 43. Coupler 32 is provided with a key extension 32a having a partly tapered lower edge 32b. When a tube contacts finger 38 and thereby swings shaft 48 with all depending parts, the coupler-key 32a enters between head 26 and pin 33, which is ready to lift head 26 through the action of link 43 and to operate control valve 23, which in turn operates the spray-gun 54. Thus the tube to be coated couples the cam-actuated linkage to the valve operating and controlling the coating of that same tube.

In order to obtain a fair production, the tubes are moved quite fast from station-to-station and the contact between tube and finger is so sudden as to swing the shaft 48 at sufficient speed, causing it and its parts to rebound. Unless the rebound is prevented, the finger 38 strikes back and dents the tube, which is not permissible. The taper portion 32b on key 32a serves to overcome the tendency of shaft 48 to rebound by producing sufficient friction between the bottom edge of 32a and pin 33 to gradually slow down and stop the swinging movement. This friction is created by clamping coupler 32 onto shaft 48 at such a level that the key 32a must be slightly raised by the taper 32b as it swings in over pin 33. It should be noticed that the upper edge of key 32a does not touch head 26 when this motion takes place.

After the coating is completed, the linkage returns to the starting point, releasing the key 32a. The finger 38 is then returned into the path of the next tube by the action of the cam 35—36 on cam-follower 42 which causes the lever 37, fulcrumed at 41, to swing its arm 22 into contact with finger 21, clamped to shaft 48 by hub 20, and thus turn shaft 48 to its original position with finger 38 in the path of the tube.

As described above, means are provided from cams 83—84 for the control of the duration of the spraying operation in relation to the length of the tube as well as the vertical travel of the tube. The thickness of the coating is controlled through the combined action of the pressure maintained in tank 13 and the extent of opening of the nozzle valve in gun 54. As described above, the pressure in tank 13 is controlled through the regulator 51 and this pressure must be such as to maintain a constant and ample supply of coating material under suitable pressure at the nozzle valve. The pressure, of course, will vary considerably depending on the consistency of the coating. Usually the pressure has to be adjusted between 30 and 45 pounds. The amount the nozzle valve opens is adjusted by means of screw 53 at the end of gun 54. This adjustment, of course, also is influenced by the consistency of the material.

The operation of the machine may be briefly stated as follows: A tube is placed in the proper size tube-cup. The dial carries the tube step-by-step through the machine. In passing the "no tube-no spray" index finger, the tube couples the cam-actuated linkage to open the control valve operating the spray-gun-nozzle-valve as the tube is rotated and lifted around the nozzle, receiving its coating usually while being lowered away. The control valve closes, stopping the spray. The tube-cup is re-seated on the dial and carried on from station-to-station until removed by the operator.

It is apparent from the above description that the spray-gun-nozzle-valve may be operated by the control-valve so as to produce a double coat. In this case the spray-jet would be started the moment the top edge of the tube is on a level with the nozzle 60 and kept in continuous operation while the nozzle is entering as well as while it is withdrawing. The adjustment necessary to produce the double coat would be taken care of by sufficiently extending the length of cams 83 and 84 so that they would keep the nozzle valve open from the time the nozzle enters the tube until it returns to that same position in leaving the tube.

It should also be understood that the spray-jet may be controlled so as to only coat a portion of the interior walls. In filling and closing collapsible tubes, there usually remains an empty space between the product and the closure and within this space, of course, a certain amount of air is trapped. It has been found that, with certain products, this air causes a chemical reaction which results in a sufficiently severe attack on the tube wall to eat holes in the wall at the point where the product and air meet. I have found that in some such cases applying a coating for a sufficient distance into the tube to cover the wall at the junction of the product and air would prevent the attack and the eating away of the wall. By means of the simple adjustments of cams 83 and 84, such a protection can readily be provided without the necessity of going to the

expense of covering the complete interior of the tube.

I do not intend to be limited save as the scope of the prior art and of the attached claims may require.

I claim:

1. A tube-coating machine comprising, first means for conveying a plurality of tubes to be coated, a spray-gun having a nozzle adapted to provide a spray of coating material, second means operable to transfer a tube from one location on said first means to a position surrounding said nozzle and to return said tube to said one location on said first means, third means for rotating said tube when said tube is detached from said first means, and fourth means operable simultaneously with said second means for providing a spray from said nozzle.

2. A tube-coating machine comprising, first means for conveying a plurality of tubes, a spray-gun having a nozzle adapted to provide a spray of coating material, a shaft mounted for movement relative to said first means so as to remove a tube from said first means and to convey said tube to a position surrounding said nozzle and to return said tube to said first means, second means for rotating said shaft and thereby rotating said tube relative to said nozzle, and third means operable simultaneously with said shaft for providing a spray from said nozzle.

3. A tube-coating machine comprising, first means for conveying a plurality of tubes, a spray-gun having a nozzle adapted to provide a spray of coating material, a shaft mounted for movement relative to said first means so as to remove a tube from said first means and to convey said tube to a position surrounding said nozzle and to return said tube to said first means, a tapered head provided on said shaft, a plurality of tube-holders interfitting with said first means and detachably supported thereby and each having a cavity therein adapted to receive said tapered head, second means for rotating said shaft and the tube-holder and the tube carried thereby relative to said nozzle, and third means operable simultaneously with said shaft for causing a spray from said nozzle.

4. A tube-coating machine comprising, a Geneva-gear arranged so as to be intermittently operated, first means for conveying a plurality of tubes and connected so as to be driven by said Geneva-gear, a spray-gun having a nozzle adapted to provide a spray of coating material, second means movable relative to said first means so as to transfer a tube from said first means to a position surrounding said nozzle and to return said tube to said first means, third means carried by said second means and arranged to rotate said tube relative to said nozzle when said tube is removed from said first means, a cam arranged to operate said second means, fourth means operable to provide a spray from said nozzle, a second cam co-operating with said fourth means, a cam-shaft carrying said cams, and means for driving said cam-shaft and said cams and said Geneva-gear.

5. A tube-coating machine comprising, first means for conveying a plurality of tubes, a spray-gun having a nozzle adapted to provide a spray of coating material, second means operable to transfer a tube from said first means to a position surrounding said nozzle and to return said tube to said first means, third means carried by said second means and operable to rotate said tube relative to said nozzle when said tube is detached from said first means, a control valve controlling the operation of the spray from said spray-gun, fourth means operable synchronously with said second means, and fifth means operable by said tube on said first means and arranged to connect said fourth means so as to operate said control valve.

6. A tube-coating machine comprising, first means for conveying a plurality of tubes, a spray-gun having a nozzle adapted to provide a spray of coating material, second means operable to transfer a tube from said first means to a position surrounding said nozzle and to return said tube to said first means, third means carried by said second means and operable to rotate said tube relative to said nozzle when said tube is detached from said first means, a control valve controlling the operation of the spray from said spray-gun, fourth means operable synchronously with said second means, fifth means operable by said tube on said first means and arranged to connect said fourth means so as to operate said control valve, and sixth means for returning said fifth means into a position to be engaged by the tubes on said first means.

7. A tube-coating machine comprising, first means for conveying a plurality of tubes, a spray-gun having a nozzle adapted to provide a spray of coating material, second means operable to transfer a tube from said first means to a position surrounding said nozzle and to return said tube to said first means, third means carried by said second means and operable to rotate said tube relative to said nozzle when said tube is detached from said first means, a control valve controlling the operation of the spray from said spray-gun, fourth means operable synchronously with said second means, a first lever mounted for horizontal oscillation and for vertical oscillation, and a second lever arranged in the path of travel of said tubes on said first means and operable to move said first lever between said fourth means and said control valve so as to cause said fourth means to operate said control valve to cause a spray from said nozzle.

8. A tube-coating machine comprising, first means for conveying a plurality of tubes, a spray-gun having a nozzle adapted to provide a spray of coating material, second means operable to transfer a tube from said first means to a position surrounding said nozzle and to return said tube to said first means, third means carried by said second means and operable to rotate said tube relative to said nozzle when said tube is detached from said first means, a control valve controlling the operation of the spray from said spray-gun, fourth means operable synchronously with said second means, a first lever mounted for horizontal oscillation and for vertical oscillation, a second lever arranged in the path of travel of said tubes on said first means and operable to move said first lever betwen said fourth means and said control valve so as to cause said fourth means to operate said control valve to cause a spray from said nozzle, a third lever connected to said first and to said second levers, and fifth means operable to stress said third lever so as to move said first lever into position to be engaged by the tubes on said first means.

9. A tube-coating machine comprising, a dial having a plurality of openings therein and arranged for rotation, a Geneva-gear mounted for intermittent movement and connected to operate said dial, a plurality of tube-cups arranged to be supported in said openings in said dial and each

having a tapering cavity therein, a first shaft mounted for reciprocating movement relative to said dial, a second shaft mounted for rotation on said first shaft and movable with said first shaft, a motor mounted on said first shaft and connected to said second shaft so as to rotate it, a tapering head on said second shaft adapted to enter the tapering cavities in said tube-cups, a spray-gun having a nozzle adapted to provide a spray of coating material, a first cam, linkage between said first cam and said first shaft whereby said first shaft lifts said second shaft and the tube-cup and the tube carried thereby from said dial into a position surrounding said nozzle and returns said tube-cup to said dial, a supply of compressed air for said spray-gun, an air filter connected between said supply and said spray-gun to purify said compressed air, a first pressure regulator connected between said air filter and said spray-gun to provide and to regulate a supply of atomizing air to said spray-gun, a second pressure regulator connected between said air filter and said spray-gun, a control valve connected between said second pressure regulator and said spray-gun and controlling the supply of air for providing the spray from said nozzle, a second cam, a first lever mounted so as to be engaged by each of the tubes on said dial in succession, a second lever mounted for horizontal oscillation and for vertical oscillation and operable to be moved by said first lever into a position between said second cam and said control valve so as to cause said second cam to actuate said control valve and to thereby cause a spray from said nozzle, a third cam, a third lever connected to said first lever and to said second lever and operable by said third cam to restore said first lever into position to be engaged by the tubes on said dial, a cam-shaft bearing said first cam and said second cam and said third cam, and gearing for connecting said shaft so as to be driven simultaneously with said Geneva-gear.

10. In a tube-coating machine, the combination of, means for conveying a plurality of collapsible tubes with their longitudinal axes vertical, a spray-gun mounted above a portion of the path of travel of said tubes in axial alignment therewith, said spray-gun having a nozzle adapted to provide a spray of coating material having a uniform horizontal cross-section, and means for providing relative movement between one of said tubes and said nozzle, whereby said tube surrounds said nozzle during the spraying operation.

11. In a tube-coating machine, the combination of, means for conveying with an intermittent motion a plurality of opened top collapsible tubes with their longitudinal axes vertical and with their opened tops uppermost, a spray gun mounted above a portion of the path of travel of said tubes in axial alignment therewith, said spray gun having a nozzle adapted to provide a spray of coating material having a uniform horizontal cross-section, and means for providing relative movement between one of said tubes and said nozzle whereby said tubes surround said nozzle during the spraying operation.

CHARLES J. WESTIN.