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CURTAIN COATING APPARATUS

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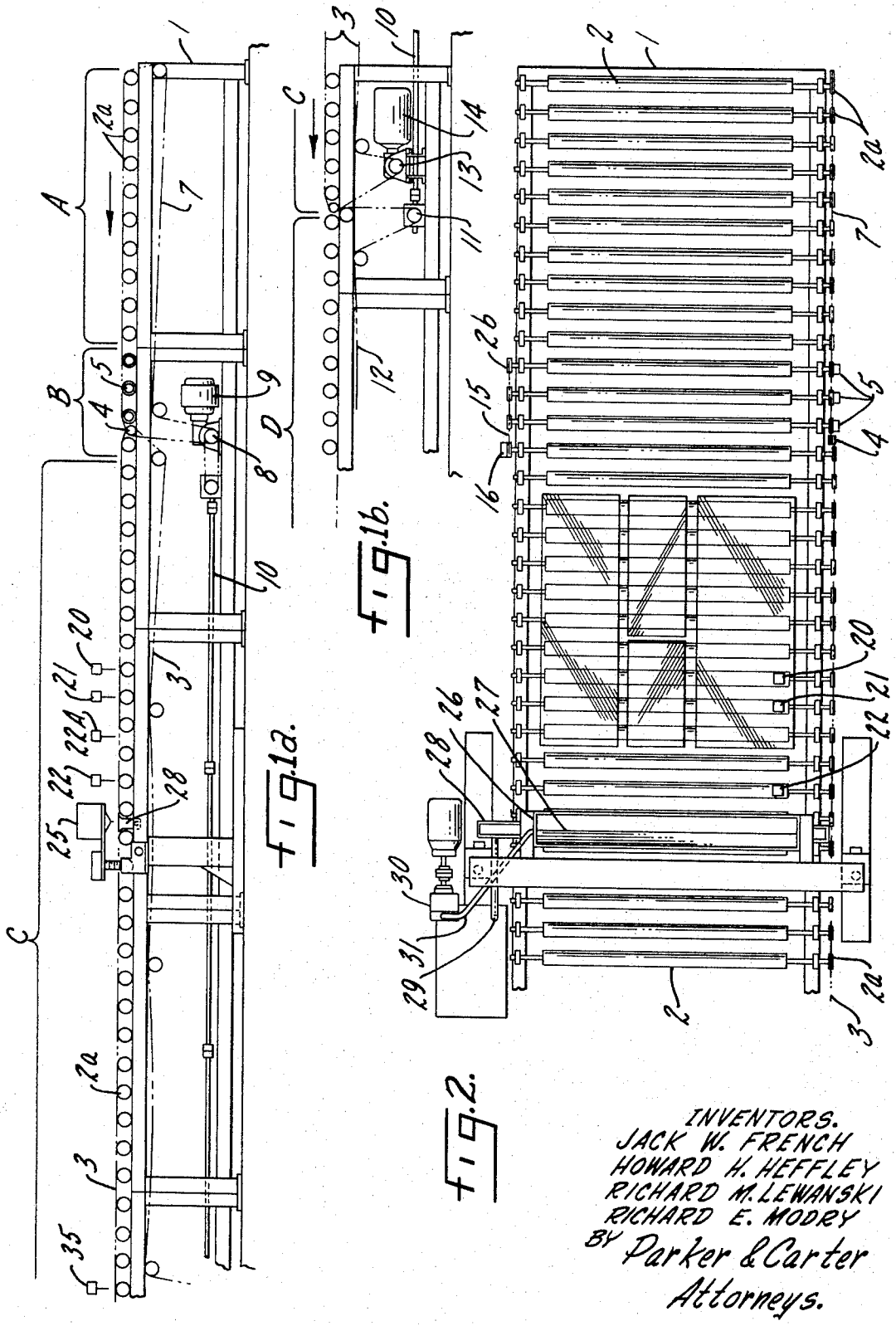


FIG. 1a.

FIG. 1b.

FIG. 2.

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CURTAIN COATING APPARATUS

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ABSTRACT OF THE DISCLOSURE

An apparatus for coating glass panels including a conveyor having portions or groups of rollers movable at variable speeds to enable glass panels to be received at a slow speed, conveyed through a curtain coater at a high speed, and discharged at a low conveying speed.

This invention relates to an apparatus for coating and has particular relation to the coating of mirrors and the like.

Conventionally, mirrors have been manufactured by conveying the same through a series of stations, e.g. a piece or panel of glass may move through a polish station, a wash station, a trimming station, a silvering station, in which the silver is placed on one side of the glass, a second wash station, a galvanic station in which a metallic material such as copper, for example, may be placed over the silver, a third wash station, a preheat station, a painting station and an oven station. Glass panels are conventionally moved through all of said stations at a uniform speed of the order of four to seven feet per minute. At the painting station paint has been conventionally sprayed from a plurality of spray nozzles to provide a protective paint layer intended to prevent oxidation of the galvanic layer and consequent destruction of the mirror effect produced by the silver layer. Since a first paint layer may be uneven, a second paint layer has been conventionally employed. Occasionally a phenomenon occurs which has come to be called "chance holiday," wherein low points in the second paint layer overlie low points in the first layer resulting in eventual breaks in the total paint layer, due for example to salt air, and resulting in the oxidation of the galvanic layer and separation of the silver layer. The employment of paint spray nozzles produces a film or cloud of paint which may flow about and settle upon conveyor surfaces and upon the leading edge and underside or glass face of the mirror piece. Moreover, in order to insure full coverage, the amount of paint sprayed from such nozzles is such that substantial paint overuse and loss or wastage occurs. Accordingly, it is one purpose of the invention to provide a coating means and method for mirrors and the like which shall be effective to overcome all of the shortcomings of the present spray nozzle means and method.

Another purpose is to provide a conveyor system including means for varying the speed of materials conveyed thereon.

Another purpose is to provide a coating method productive of a minimum loss of coating material.

Another purpose is to provide an apparatus for rapid coating.

Another purpose is to provide a means and method productive of an even, level and unbroken coat.

Another purpose is to produce maximum economy by recirculation of unused coating material, by application of a uniform coating layer and by minimizing of paint loss.

Another purpose is to provide a coating apparatus effective to insure complete coverage of a mirror galvanic

layer with a single coat of paint of minimum thickness.

Another purpose is to provide a coating apparatus effective to produce an increased volume production of coated items.

Another purpose is to provide a coating apparatus requiring a minimum of cleaning and maintenance.

Another purpose is to provide a conveyor assembly including means permitting simultaneous, adjacent transfer of items of varying sizes.

Another purpose is to provide a conveyor and painting station assembly permissive of random loading of items to be painted.

Another purpose is to provide a conveyor having segments movable at varying speeds without contact between items conveyed thereon.

Other purposes will appear from time to time during the course of the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawings wherein:

FIGURES 1*a* and 1*b* are side views; and

FIGURE 2 is a top plan view.

Referring now to the drawings, the numeral **1** generally designates a suitable frame or support. Forming a conveyor bed and rotatably mounted throughout the length of the frame **1**, and extending laterally across the upper surface thereof, is a plurality of parallel rolls or rollers **2**. The rollers **2** are closely spaced to insure level support of the smaller glass panels intended to be conveyed. It will, of course, be understood that the conveyor bed formed of rollers **2** could be formed of belts, cable or other conveyor means without departing from the nature and scope of the invention. The conveyor bed formed of rollers **2** is divided into conveyor segments represented by the brackets in FIGURES 1*a* and 1*b*. Conveyor segment A, for example, is illustrated as including the ten rollers **2** at the right-hand portion of FIGURE 1*a*. The ensuing group B is composed of four rollers **2**. The next group C is composed of thirty-one rollers **2** and the final group D is composed of a suitable number of rollers **2**. It will be realized that the number of rollers **2** within each of the groups A through D may be varied without departing from the nature and scope of the invention herein.

Each of the rollers **2** has a sprocket **2***a* carried on an end stub shaft along one longitudinal edge of the frame **1**. The rollers of group A and three of the four rollers of group B have their sprockets **2***a* engaged with endlesss chain **7** which in turn engages a driving sprocket **8** driven by motor means **9**. A driving shaft **10** is also driven by motor means **9** and extends along frame **1** beneath roller groups B and C. A second driven sprocket **11** is driven by the shaft **10** and engages a second endless chain **12** which in turn engages the sprockets **2***a* on the rollers of group D. The sprockets **2***a* of the rollers in group C and one of the rollers of group B are engaged by endless chain **3** which is also engaged by a drive sprocket **13**. The drive sprocket **13** is driven by a second motor means **14**, the motor means **9** and **14** being conveniently supported on frame **1** beneath the rollers **2**.

The rollers of group B carry the sprockets **2***b* extending beyond the opposite longitudinal edge of the frame **1** from that beyond which the sprockets **2***a* extend. The sprockets **2***b* engage a fourth endless chain **15** which is in turn in engagement with a timed clutch member **16**.

It will be observed that endless chains **3** and **7** both engage parallel, independent idler sprockets as indicated at **4**. The last or downstream roller of group B, considered in the line of travel along the conveyor or from right to left as the parts are shown, is driven by chain **3** and the sprocket at its opposite end engages chain **15** and clutch actuator **16**. The remaining rollers of group B are driven by chain **7** and have their opposite end sprock-

ets engaging chain **15**. As may be best seen in FIGURE 2, clutch elements **5** are associated with said remaining rollers of group B.

Thus the rollers of group B, shown as four in number, may be engaged with chain **15**, for simultaneous driving with the rollers of group C through the mediacy of chain **3**. Alternately, chain **15** may be rendered ineffective by de-energizing clutch **16**, leaving the one downstream roller of group B to be driven by chain **3** with the rollers of group C and the remaining rollers of group B to be driven by chain **7** with the rollers of group A.

Overlying the rollers of group C in longitudinally spaced relation along the conveyor surface formed by the rollers **2** are control switch members **20**, **21** and **22**. The switch members **20**, **21**, **22** and **22***a* may be mechanically-operated microswitches, proximity type switches, air pressure switches or, as preferred, "electric eye" beams.

Beyond the switch **22** in the direction of conveying, a curtain-coater assembly **25** overlies and extends laterally across the conveyor surface formed by the rollers **2** between the first and last roller **2** of group C. The curtain-coater station **25** includes an elongated hopper **26** having a thin, elongated, straight slot or opening **27** at its bottom above the roller group C. Between two of the rollers **2** in group C and immediately beneath the slot or opening **27** is a drain trough **28**. While the coater station is here described as relating to paint, it will be realized that other coating materials may be employed. The conduit **29** conveys the coating material, such as paint, from the trough **28** to a pump **30** for recirculation through conduit **31** and return to hopper **26**. As is well known in the art, paint, for example, falls in a thin "curtain" or sheet, having a thickness of the order of .005 to .030 inch, from the opening **27** across the conveyor bed and into the drain trough **28**. The rate or speed at which the paint is moving as it contacts the glass is relatively slow in comparison with the speed of movement of the glass and a resultant thinning of the curtain or sheet occurs, producing the desired coat of a thickness of one or two mils.

The curtain of coating material may be formed by gravity, the material falling from a slot **27**, flowing over a weir or forced through a slot by pressure, gravity flow from the slot **27**, as shown, being preferred.

Beyond the curtain-coater structure **25** a fourth control switch **35** overlies the conveyor bed adjacent the distal end of roller group C.

Suitable electrical circuitry (not shown) connects the switches **20**, **21**, **22**, **22***a* and **35** with motor means **14**. Within said circuitry an appropriate selector switch provides for incorporation of one of the switches **20**, **21**, **22**, **22***a* in the circuit. Similarly, said circuitry provides for actuation of clutch **16** as described hereinbelow. It will be realized that a clutching structure comprised of one or more clutches, such as that shown at **16**, may be employed and may be engaged or disengaged in sequence, in groups, or all simultaneously by timing devices or similar means in relation to the length of the panel or group of panels being treated, without departing from the nature and scope of the invention.

The use and operation of the invention are as follows:

Items to which a coat of paint or similar material is to be supplied at coating station **25** are arranged on the conveyor in juxtaposition and, when desired, in batches or groups. A representative arrangement of glass panels, for example, is shown in FIGURE 2. It will be realized that the individual panels of such grouping may be of various planar shapes and that the same are arranged within a predetermined spatial outline or imaginative frame, such for example as would extend from the active switch **20**, **21**, **22** or **22***a* rearwardly to a point lying, for example, adjacent the rearmost roller of group B. The width of such spatial frame is, of course, governed by the width of the conveyor formed of rollers **2**.

Glass panels to be made into mirrors, for example, may range from approximately eighteen inches to as much as ten feet in length or more and from approximately a foot to the full width of the conveyor bed. To minimize waste area, it is desirable to avoid open areas or spaces between glass panels placed on the conveyor. If such panels were of a uniform large size they could be simply loaded sequentially on the conveyor, but it has been conventional and desirable to employ random loading of panels of varying shapes and sizes while attempting to minimize spaces therebetween. The present invention, while productive of the advantages described, also enables continuation of the random loading and close spacing of varying panels necessary for efficient use of present facilities and procedures.

It will be realized also that such panel groupings may reach the rollers of group A from a prior conveyor system along which such panels may have received differing treatment. For example, in a mirror-producing operation such prior conveyor system could include stations at which the glass panels are loaded, polished, washed, trimmed, silvered, washed, coated with galvanic copper, washed and preheated. Similarly, the rollers of group D may lead to additional treating stations in which such panels are subjected to flashing, baking, coddling and cleaning operations.

The structure of the present invention is directed toward the painting or coating operations occurring as intermediate steps in a process of the type described and result in the application of a smooth, even and complete coating of paint with a virtually nonexistent loss or wastage of paint or coating material.

The panels to be painted arrive upon the upstream conveyor portion, shown herein as the rollers of group A, and are driven or moved along at a given speed of the order, for example, of four to seven feet per minute. All of the conveyor portions or segments, shown herein as the rollers of groups A, B, C and D, are at this point all being rotated to provide a predetermined, uniform, relatively slow speed. The panels thus move forward and approach the switches **20**, **21**, **22**, **22***a*. Dependent upon the length of the spatial frame occupied by such panels, one of said switches has been previously selected and energized. It will, of course, be understood that such spatial frame may be occupied by one glass panel. In any event, the leading edge of the panel or panels occupying such spatial frame moves beneath the energized switch **20**, **21**, **22**, **22***a*, whereupon said switch is activated to energize motor means **14** and a suitable clutch or clutches, such as that shown for example at **16**. When that happens the intermediate conveyor segment formed of the rollers of group C is driven at much more rapid predetermined speed of the order, for example, of sixty to one hundred fifty feet per minute through the mediacy of chain **3**. The downstream roller of group B is also driven at said increased speed by chain **3** and the remaining rollers of group B are driven at said increased speed through the mediacy of clutch **16** and chain **15**; the clutches **5** overrun to disengage the opposite end sprockets of said remaining rollers of group B so as to permit continued movement of chain **7** at its normal slower speed. As the rearmost panel or panels pass over the rollers in section B, said rollers may be disengaged in sequence or all simultaneously or in groups, depending upon the length of the spatial frame occupied by the panel or group of panels undergoing treatment.

With the rollers of groups C and B thus moving at such rapid speed, the glass panels are moved beneath the slot **27** at coating station **25** at a rapid speed so correlated that the thin curtain of coating material falling from the slot **27** as to insure application of the desired smooth, even and complete coat to the glass panels within the spatial frame described. The speed-up of the rollers of group B is effective to insure against any dragging or frictional resistance of the rollers of group B against

the rearmost portions of glass panels within said spatial frame.

As the glass panels move beneath switch **35** the latter is actuated to again disengage motor means **14** and to provide for reinstatement of a uniform roller speed throughout groups A, B, C and D. The glass panels move onto the downstream conveyor segment formed of the rollers of group D which are at all times rotated at the speed of the rollers of group A, the shaft **10** and endless chains **7** and **12** insuring said continuous equality of rotational speed produced by means **9**.

The panels of each group are thus moved along the entry group A at a predetermined, relatively slow speed. When the panels are safely aboard the rollers of group C and, when desired, in part on the rollers of group B, the said rollers of groups C and B virtually immediately rotate at a greatly increased speed and the panels are moved rapidly through the wall or curtain of falling paint or material at station **25**. The panels are then returned to their original speed upon reaching switch **35** near group D. Hence the panels of each panel group are precluded against contact with those panel groups preceding and succeeding them.

It will be realized that motor means **14** may be activated at varying speeds and that the speed of the accelerating conveyor section may thus easily be varied to vary the thickness of the coating being applied as the panels move through the curtain of coating material produced at **25**. Motor means **14** may, for example, conveniently take the form of a direct current motor associated with a potentiometer for easy and rapid change of speed. Alternate speed varying means, such as variable drives, pulleys, sprockets or the like, may, of course, be employed without departing from the nature and scope of the invention.

The switches **20**, **21**, **22**, **22***a* and **35** may take a variety of forms, as above indicated, and the circuitry referred to may be any conventional circuitry as is well known.

Whereas there has been shown and described an operative form of the invention, it should be understood that this showing and description are to be taken in an illustrative or diagrammatic sense only. For example, while the foregoing description exemplifies the invention in relation to the application of a coating of paint, coating materials other than paint may be applied without departing from the nature and scope of the invention. Similarly, the number of sensors, shown herein as switches **20**–**22***a* may vary and a single sensor controlling multiple clutches for variance of conveyor section speeds could be employed. Such sensor, sensors, or suitable timing devices could be positioned for actuation with respect to either end of the panel or panel group moving along the conveyor. There are many modifications in and to the invention which will be apparent to those skilled in the art and which will fall within the scope and spirit of the invention.

What is claimed is:

1. An apparatus for use in coating a succession of glass panels including, in combination,

means forming a generally horizontal conveyor course and including, successively, a first, second, third, and fourth group of generally parallel rollers,

first driving means adapted to drive said first and fourth groups of rollers at a generally uniform slow speed.

second driving means adapted to selectively drive said third group of rollers at said uniform slow speed and at a generally uniform high conveying speed,

clutch means adapted to selectively connect said second group of rollers for rotation with said first group of rollers and to connect said second group of rollers for rotation with said third group of rollers,

means adapted to produce a curtain of coating material laterally across a portion of said conveyor course defined by said third group of rollers, and

switch means positioned along the portion of said conveyor course defined by said third group of rollers for actuation by glass panels moving therealong, said switch means adapted to control said clutch means and said second drive means so that all glass panels are moved through said curtain coating means at said high conveying speed and delivered to said fourth group of rollers at said low conveying speed.

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