

April 20, 1954

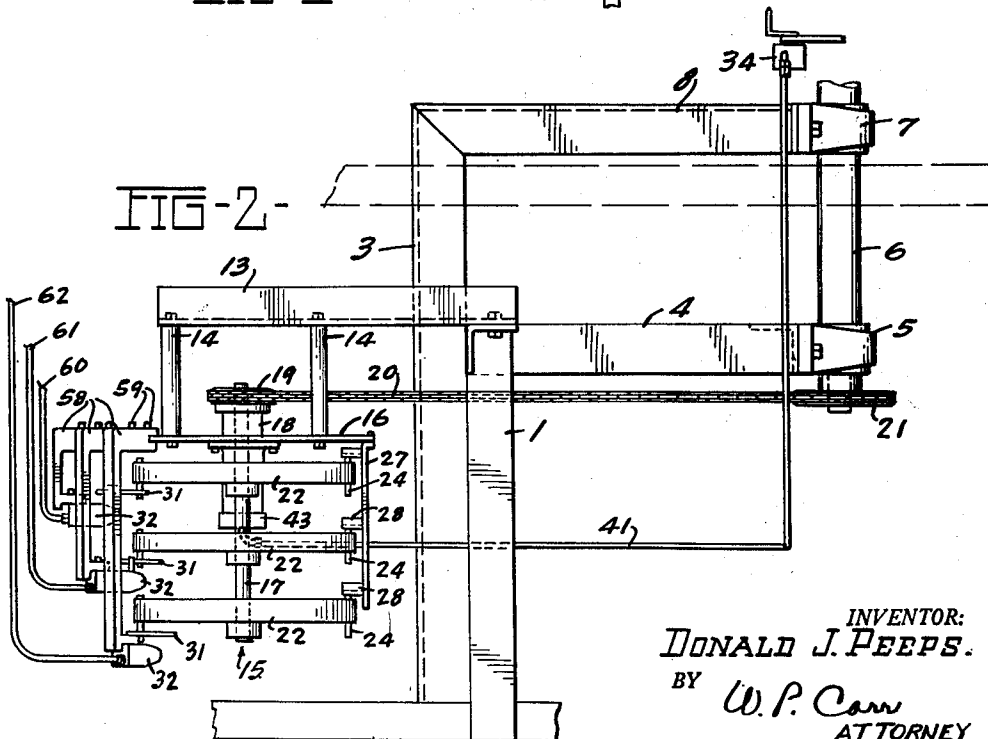
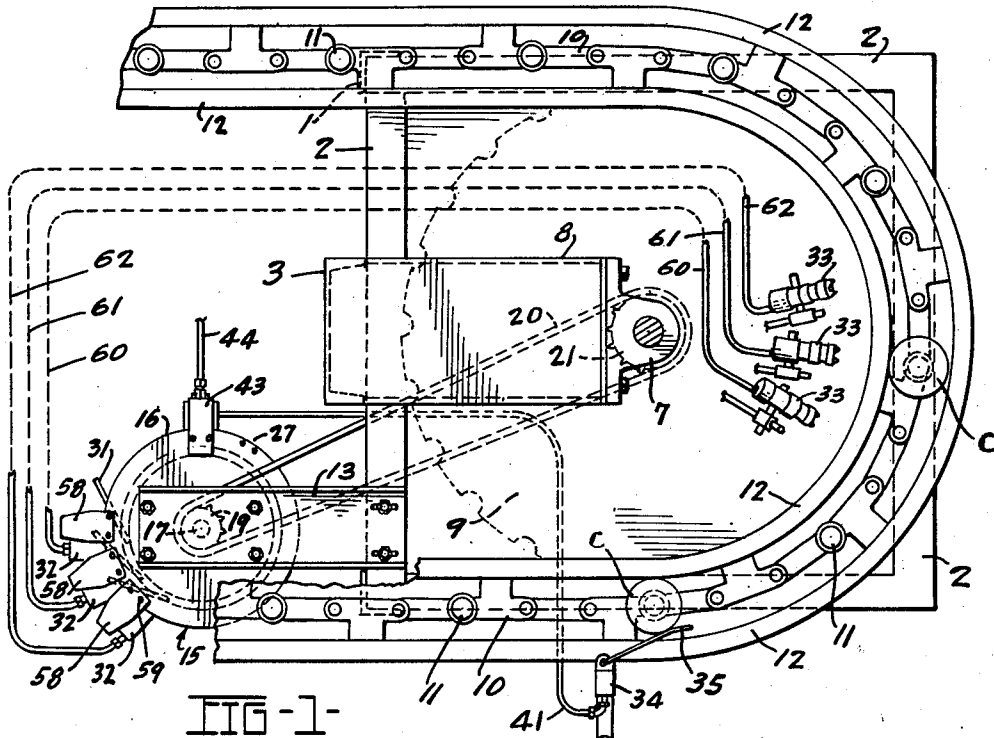
D. J. PEEPS

2,675,778

SPRAY COATING APPARATUS

Filed June 5, 1952

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

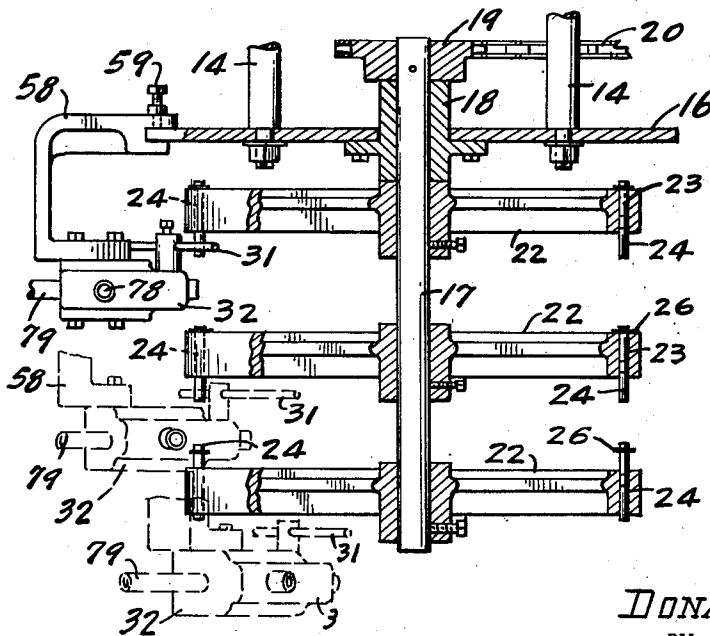
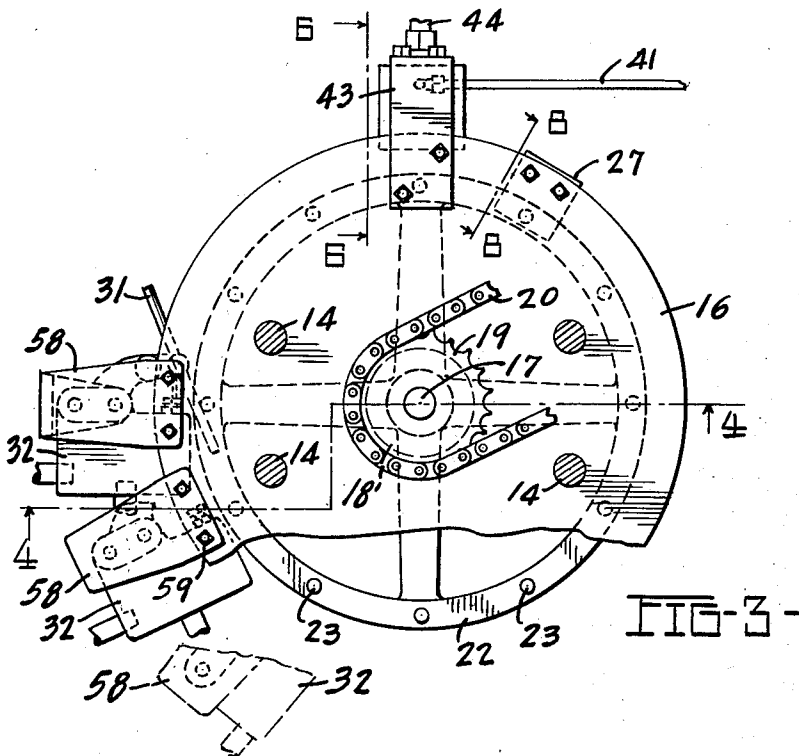


FIG-4 -

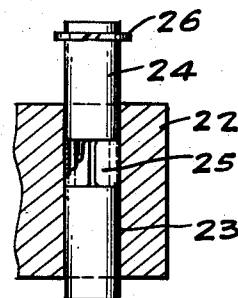


FIG-5 -

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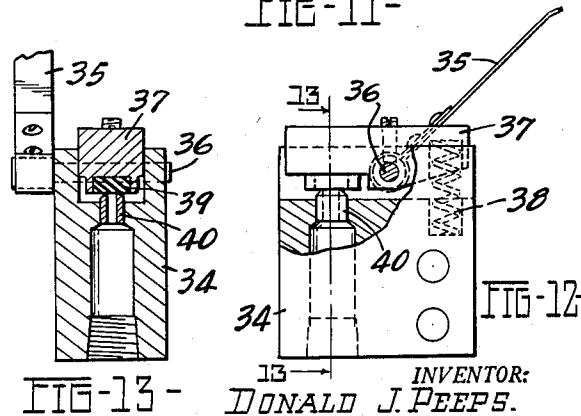
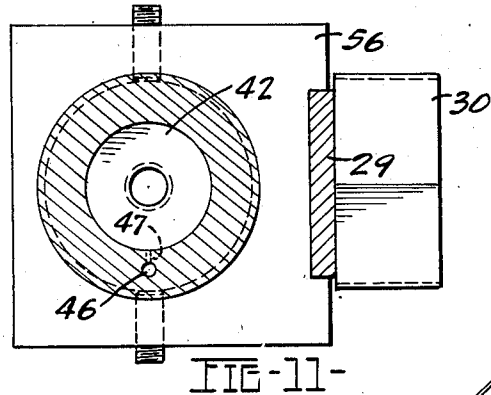
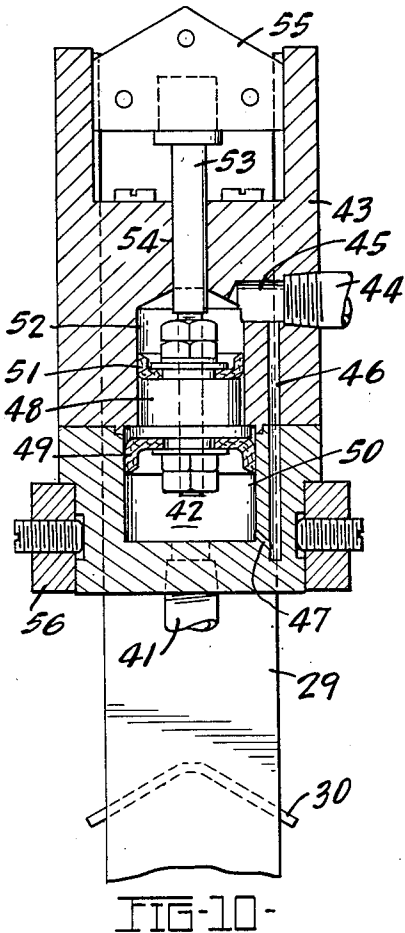
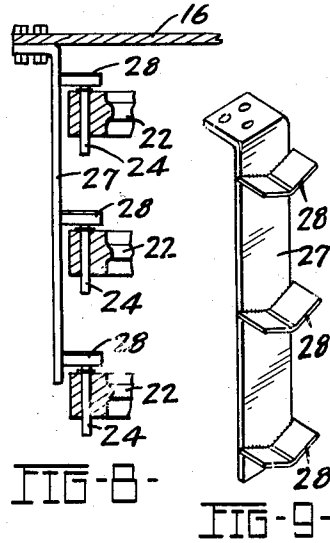
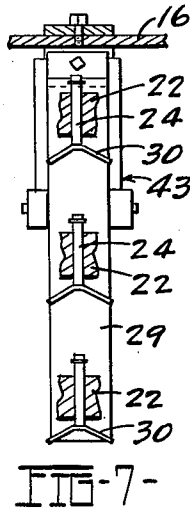
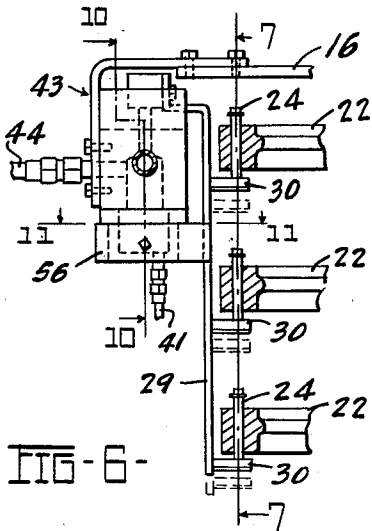
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SPRAY COATING APPARATUS.

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SPRAY COATING APPARATUS

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4 Sheets-Sheet 4

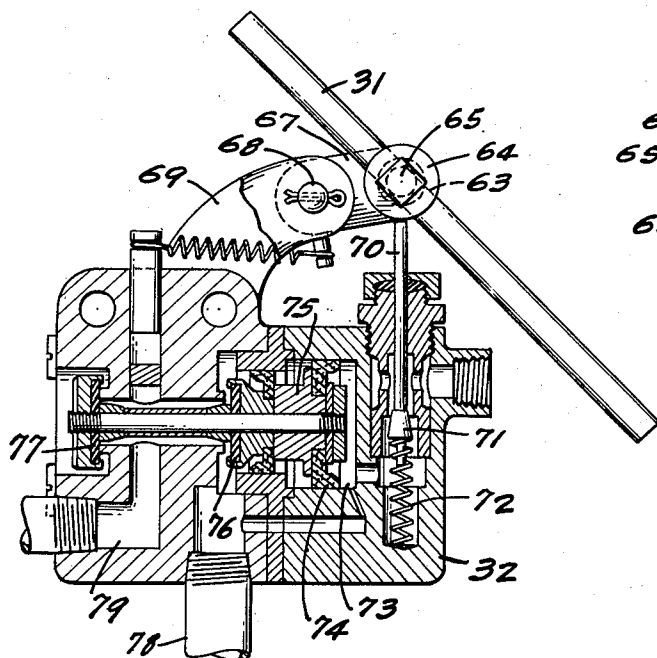


FIG-14-

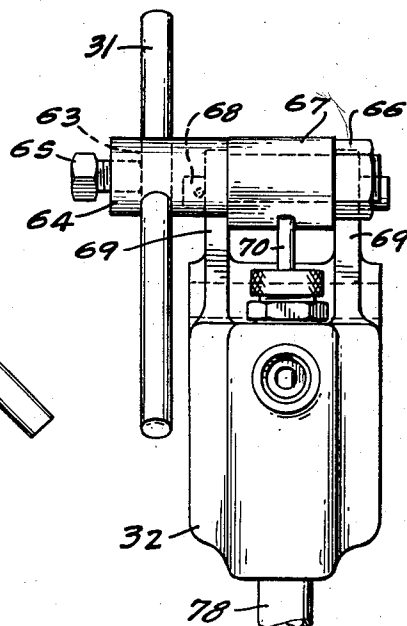


FIG-15-

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UNITED STATES PATENT OFFICE

2,675,778

SPRAY COATING APPARATUS

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Application June 5, 1952, Serial No. 291,841

6 Claims. (Cl. 118—2)

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This invention relates to apparatus for successively actuating spray guns and is particularly adapted to automatic spray coating machines in which articles to be coated are individually mounted upon uniformly spaced supports of a conveyor and carried through a spray coating station where a plurality of spray guns are located. It relates to such a machine in which the spray guns are mounted to discharge coating upon articles at selected points of travel with the conveyor and in which is incorporated a detecting device which records the presence or absence of an article upon each support of the conveyor.

The invention provides adjustable mechanism responsive to a detecting device to actuate the spray guns to apply coating material at spaced or overlapping intervals upon articles carried through the spray coating station.

In prior spray coating machines such as that disclosed in U. S. Patent 2,383,023 issued August 21, 1945, to R. E. Sykes et al. detecting means have been used to control mechanism to successively actuate spray guns. However these earlier devices were so designed that adjustment of the spray sequence was limited and it was difficult to overlap the operation of two or more spray guns. They also had the limitation of not being usable with articles of small size. This was due to the fact that the movement of the detecting device caused by interception of an article was transmitted mechanically. If the article was too light in weight it would likely be dislodged by the force necessary to move the detecting device.

In this invention the movement of the detecting device requires only a light force as the movement is transmitted pneumatically instead of mechanically. While a single detecting mechanism is provided with this invention a separate group or series of actuating elements for each of the spray guns involved is responsive to the detecting mechanism. These elements are incorporated in a revolving turret structure having vertically spaced wheels. In each wheel is an annular series of slidably held vertical pins constituting the actuating elements for one gun.

Stationary cams extending inwardly over the edges of the wheels from a stationary supporting bracket intercept the pins and thrust them downwardly to their actuating positions. An air valve controlling the operation of one of the spray guns is mounted adjacent the periphery of each wheel with a valve opening arm in the path of the pins of the wheel when they are in their actuating position. Between the location of the stationary cams and the air valves, adjacent the

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wheel peripheries, is a vertically movable member with cam surfaces normally in position to thrust the pins upwardly into non-actuating position. Pneumatic means associated with the member is energized by the detecting device when an article is on a conveyor support to move the cam surfaces of the member downwardly out of the path of the pins leaving the pins in actuating position.

An object of this invention is the provision of means which are easily adjustable within a wide range of correlated action for controlling the operation of a plurality of spray guns.

A further object is the provision of pneumatic communicating means between a detecting device and gun actuating elements which permits a wider choice of location for the structure housing the elements.

Another object of the invention is the provision of a detecting device which is actuated with slight force permitting it to be used with articles of small size.

Other objects and advantages may be perceived from the following description with reference given to the drawings in which:

Figure 1 is a plan view of a spray coating machine embodying my invention;

Figure 2 is a front elevation somewhat enlarged of the left hand portion of the machine of Figure 1 with the bracket 27 about 60° out of place for better disclosure.

Figure 3 is an enlarged plan view of the revolving turret structure with associated air valves;

Figure 4 is a vertical section of the portion of the machine shown in Figure 3 taken on the line 4—4 thereof;

Figure 5 is an enlarged elevation of one of the actuating pins mounted in the wheels of the turret structure;

Figure 6 is an elevation partly in section of the pneumatically operated pin moving device and border portions of the wheels;

Figure 7 is a vertical section taken on the line 7—7 of Figure 6;

Figure 8 is an elevation of the pin resetting cams on bracket 27 and associated parts;

Figure 9 is a perspective view of the bracket 27 to which the resetting cams are fastened;

Figure 10 is an enlarged vertical section of the pneumatic member of the device of Figure 6 taken on the line 10—10 of said figure;

Figure 11 is an enlarged horizontal section of the device of Figure 6 taken on the line 11—11 thereof;

Figure 12 is an elevation partly in section of

the detecting device and the vent valve incorporated therein;

Figure 13 is a vertical section on the line 13—13 of Figure 12;

Figure 14 is a horizontal section of one of the air valves associated with the turret structure; and

Figure 15 is an end view thereof.

Referring to the drawings in more detail the spray coating machine illustrated has a supporting frame formed of posts 1 and cross beams 2. Within the frame, mounted on an upright 3, is a cantilever beam 4 with a vertical bearing 5 at its free end. Journaled for rotation within the bearing is a shaft 6 the upper end of which turns within a bearing in pillow block 7 fixed to the outer end of overhanging plate 8.

Fixed to the shaft 6 just below the pillow block 7 is a large sprocket 9 (Figure 1). This is engaged and driven by chain conveyor 10. Equally spaced article supporting spindles 11 are carried by the conveyor and project upwardly between conveyor guide plates 12.

Extending from the side of the frame is a broad channel 13 from which is suspended by rods 14 a turret assembly 15. This has a stationary upper plate 16 to which the rods are secured.

A rotatable vertical shaft 17 passes through a bearing 18 at the center of plate 16 and is suspended in place by the sprocket 19 pinned to the upper end of the shaft. The shaft 17 is rotated by a chain 20 between sprocket 19 and sprocket 21 mounted on the lower end of shaft 6. The sprocket sizes provide a speed ratio of two to three between shafts 6 and 17.

Fastened by set screws to shaft 17 for turning therewith are three vertically spaced wheels 22. The wheels 22 are turned with shaft 17 in a counterclock-wise direction as viewed in Figures 1 and 3. In the rim of the wheels 22 are vertical bores 23 within which are slidably fitted pins 24. These are held frictionally in place within the bores by the outward thrust of springs 25 bent around a shallow groove near the center of the pins. The pins are prevented from dropping out of the bores by snap rings 26 at their upper ends (see Figure 5). Normally the pins in each wheel are vertically in line with pins of the other wheels and there ordinarily would be the same number of pins in each wheel.

On a bracket 27 fixed to and depending from stationary plate 16 are V-shaped cam elements 28. These extend over the rims of wheels 22 in the path of the upper ends of pins 24. Upon meeting these cam elements, the pins are thrust downwardly if they are not already in their lower positions (see Figures 2, 8 and 9).

Counterclock-wise around the turret assembly 15 from the location of the bracket 27, preferably a short distance therefrom, is a vertically movable strap 29 supporting inverted V-shaped cams 30. These cams normally extend beneath the rims of wheels 22 in line to thrust the pins back upwardly to the positions held prior to the action of cam elements 28 (Figures 6 and 7).

If the pins 24 are left in their downward positions their lower ends in traveling beyond the movable strap 29 strike arms 31 and therethrough open valves 32. These valves control the flow of actuating air to the spray guns 33 mounted in the spray station within the curved portion of the path of the chain conveyor 10. The spray guns are thus actuated when the strap 29 and associated cams 30 are moved downwardly out of pin-intercepting position through action of

the detecting device 34. The spray guns 33 are directed to coat successively the lower, middle and upper portions of an upright cylindrical article C. These are placed on the supporting spindles at a loading station in advance of the disclosed portion of the conveyor. Due to various causes some spindles may not be loaded.

The detecting device 34 has a finger 35 normally extending above and close to the center line of the conveyor chain and is adapted to meet and be turned away from the center line by an article on a supporting spindle 11. When thus thrust aside a pivot pin 36 to which the inner end of the finger is fixed is turned clockwise as viewed in Figures 1 and 12. This tilts a narrow block 37, fastened to the pivot pin against spring 38 and raises a sealing plug 39 carried by the block from sealing contact with air venting nipple 40.

The air bled therethrough to the atmosphere reaches the nipple 40 through tubing 41 from the lower end of a cylindrical air chamber 42 within a pneumatic controller 43 for the strap 27 and its associated cams (Figures 6 and 10). Compressed air is delivered to the air chamber 42 through tubing 44 from any suitable source. This air freely enters the upper end of the chamber through passage 45 and reaches the lower end of the chamber through bore 46 and metering passage 47.

A double faced piston assembly 48 includes a downwardly facing plunger leather 49 fitting within the lower enlarged portion 50 of the chamber and an upwardly facing plunger leather 51 lodged within the upper portion 52 of reduced diameter. A rod 53 connected to the piston assembly 48 extends upwardly through a bore 54 and has fixed to its outer end a block 55. To the block is bolted the flanged upper end of strap 29.

With compressed air of equal pressure against both plunger leathers 49 and 51 the piston assembly 48 is held in its uppermost position because of the larger area of plunger leather 49. Through its connection with the piston assembly through piston rod 53 and block 55 the strap is thus held in its upper position with its cams in line to displace the pins 24 upwardly out of actuating position.

When the finger 35 of the detecting device is thrust aside by an article on a conveyor spindle 11, the venting nipple 40 is unsealed and air is exhausted from beneath plunger leather 49 in the chamber 42 faster than it is delivered by the restricted metering passage 47. The resulting reduction of pressure against plunger leather 49 causes the piston assembly 48 to be driven downward by the continued pressure upon the smaller plunger leather 51. This moves the cams 30 downwardly out of the path of the actuating pins associated with the particular supporting spindle and the pins consequently remain in position to open the air valves 32 to actuate the spray guns when the spindle carrying the article reaches the spray station. Around the lower end of the pneumatic controller 43 is a collar 56 held in place by set screws. A vertical groove 57, in the side of the collar, guides and steadies the strap 29 in its vertical movement, as shown in Figure 11.

The valves 32 are bolted to individual brackets 58 which are hung from selected points on the edge of plate 16 by lock bolts 59. The brackets are of such length that each holds a valve 32 adjacent a separate wheel 22. By adjusting the peripheral positions of the brackets the sequen-

tial operation of the valves and the spray guns they control may be varied to coincide with different locations of an article traveling with the conveyor. Actuating air is delivered to the spray guns 33 from the valves through air lines 60, 61 and 62.

In order that the spray gun operation be synchronized with the action of the detecting device, the travel of a particular spindle, from the location of the detecting device, to where an article on the spindle is coated by a spray gun, must take the same time as a particular pin in a wheel 22 in moving from the area of action of the pin shifting controller 43 to the location of the air valve 32 actuating the spray gun.

The circumferential distance from the location of the detecting device to the station of the last spray gun is generally less than 180°. In view of this the rotating speed of the wheels is usually arranged to be higher than that of the large sprocket 9. In this manner a greater relative portion of the periphery of the wheels may be utilized for the placement of the valves.

For example, by selection of the proper sizes of sprockets 19 and 21, the rotational speed of the wheels 22 may be set fifty per cent higher than that of the large sprocket 9. With this arrangement a spindle 11 travels in an arc of 60° with sprocket 9, while a pin 24 on a wheel 22 travels through an arc of 90°. Applying these figures to Figure 1—assume that the distance from the point where the detecting device 34 acts in respect to a spindle to the point where the lower spray gun 33 discharges a coating upon an article is 60°. The peripheral distance from the pneumatic controller 43, which responds to the detecting device in acting upon a pin 24, to the location of the air valve 32 controlling the spray gun discharge should then be 90°. Assuming the distance from the detecting device to the second spray gun station is 80° then the location of the air valve 32 for that gun should be 120° from the pneumatic controller 43.

With the speed ratio above, in order that the spray guns do not operate between spindles and do function properly in regard to a loaded spindle the number of pins within an arc of 60° should be the same as or a multiple of the number of spindles within an arc of 90° of the large sprocket 9.

Accordingly should the spindles be spaced 40° apart as illustrated in Figure 1, the pins should be spaced 60° apart (or under the multiple basis, 30° or 15°). In the embodiment of Figure 3 there are twelve pins in each wheel. These are therefore 30° apart. Every other one would be an idler in the particular set-up illustrated, always being displaced to a non-operative position, as at the time they are ready to be acted upon by the pneumatic controller 43 there would be no spindle adjacent the detecting device and hence no article to activate the controller. A wheel with the twelve pins, therefore, may be used with the disclosed arrangement or with a conveyor with the number of spindles doubled or 20° apart. In which instance all of the pins would be utilized.

Details of the structure of a valve 32 may be seen in Figures 14 and 15. The valve arm 31 is inserted through a cross bore 63 on rod 64 and held therein by a set screw 65. The portion of the arm subject to contact by a pin 24 may be lengthened or shortened according to how far it is inserted through the cross bore 63 and the duration of the valve opening accordingly varied. The timing of the valve action may also be modified

by angular adjustment of rod 64 by loosening nut 66 which holds the rod on rocker 67 which in turn is pivotally mounted on pin 68. The latter spans two arms of bracket 69.

Upon depression of the rocker 67 resulting from the contact of a pin 24 with rod 31 the rocker pivots against valve stem 70 and opens valve 71 in opposition to spring 72. This exhausts compressed air from chamber 73 and the face of plunger leather 74. The piston and valve assembly 75 consequently moves to the right as viewed in Figure 14 opening main valve 76 and bringing atmospheric vent valve 77 to its seat. Compressed air from a supply source is thus permitted to flow through entering connection 78 past main valve 76 and from outlet 79 to one of the air lines 60, 61 or 62 for spray gun actuation.

When the rod 31 is released and valve 71 is returned to its seat, air pressure is reestablished in chamber 73 against plunger leather 74. This moves the piston and valve assembly 75 to the left closing valve 76 and opening atmospheric vent valve 77. The actuating air in the line to the spray gun is thus drained back past valve 77 and the spray gun operation is terminated. Because of the limited capacity of chamber 73 the valve action is rapid. A valve of this general structure is preferred because a pin has only the light resistance of spring 72 to overcome as compared to the heavy spring of an ordinary air valve.

In the operation of the machine in its present embodiment, it will be understood that articles C are placed on the spindles 11 at some point of the conveyor travel before the conveyor reaches the detecting device 34. When each article passes the finger 35 at the beginning of its movement around the large sprocket 9, it thrusts the finger outwardly and opens venting nipple 40, as the sealing block 37 pivots away from the nipple 40 with the finger movement. If there is no article on a spindle the finger 35 is undisturbed and venting nipple 40 remains closed.

When the venting nipple 40 is uncovered by the presence of an article C on a spindle, compressed air below plunger leather 49 in chamber 42 of the controller 43 is exhausted to the atmosphere through tubing 41. This immediately effects the downward movement of piston assembly 48 because of the air pressure on the upper face of plunger leather 51. Can strap 29 moves downward in association with piston assembly 48 because of its connection thereto through head block 55 on the end of piston rod 53. Accordingly the cams 30 projecting from the strap 29 are brought downwardly out of the path of the tier of pins 24 on wheels 22 synchronized in movement with the particular spindle under detection. The three pins then are left in their downward valve contacting position in which they have been placed by the stationary cam elements on bracket 27.

As the spindle travels toward the spray station the three pins approach the position of the spray gun air valves 32. The spindle carrying the article first reaches the position where the article is coated by the lowest spray gun 33, about a 60° turn from the detecting device. Coincidentally the pin 24 on the uppermost wheel 22 reaches the first of the peripherally placed valves 32. This valve is approximately 90° from the controller 43. The pin opens the valve through motivating contact with the valve arm 31. Compressed air immediately flows to the lowest spray gun through

air line 60 actuating the spray discharge for the short instant the valve is held open.

The spindle carrying the article continues to a point to receive the discharge of coating from the middle spray gun which is roughly an 80° turn from the detecting device 34. Simultaneously the associated pin 24 on the middle wheel 22 has covered an arc of approximately 120° and opens valve 32 to actuate the middle spray gun. The last pin of the tier of three subsequently opens the lowermost valve 32 to actuate the third spray gun 33 through air line 62.

The three pins continue around the turret 15 in their constant vertical alignment. They are left in their operative position by the stationary cams on bracket 27 and reach controller 43 in timed association with another spindle under action of the detecting device. If there is no article on this particular spindle, cams 30 remain in position to move the pins upwardly out of valve opening position.

With a separate wheel 22 and its series of pins 24 for each spray gun the timing of the spray discharge of each gun is entirely independent of that of any other gun. For instance the spray guns 33 may be more widely separated and their operation further spaced by positioning the valves farther apart around the turret 15. Conversely the spray guns may be directed toward the same article at the same time with their spraying action simultaneous or overlapping to any degree. This coaction is secured by placing the valves closely in line vertically and adjusting the positions of the valve arms 31 so that they are contacted wholly or partly for the same interval by pins on the three wheels 22.

It should be apparent from the preceding description that this invention provides a particularly broad range of adjustment of the operation of a plurality of spray guns permitting practically any degree of coaction desired.

In addition, the pneumatic transmission of the findings of the detecting device enables it to be used with articles of small size and also permits the spray gun actuating elements to be placed at a more favorable location since there is only an air line connection instead of a mechanical association between the detector and the actuators.

While this invention has been described in a preferred embodiment, it should be understood that modifications may be made therein without departing from the spirit or scope of the appended claims.

The invention claimed is:

1. A spray coating apparatus including a conveyor having a plurality of equally spaced article supports, a spraying station in which a plurality of spray guns are positioned to coat surfaces of articles on said supports, a device adjacent the conveyor in advance of the spray station detecting by contact the presence of an article on each support, an air valve associated with each spray gun for supplying actuating air thereto, a separate series of opening elements for each valve, said elements individually having operative and non-operative positions, mechanism driving each series of elements in a circuit synchronized with the travel of the conveyor, pneumatically operated means responsive to a pneumatic signal from the detecting device establishing an element of each series in operative valve-opening position when an article is detected on a support, and a tubular member of selective length and positioning transmitting the pneumatic signal,

the positioning of the air valves and the separate series of opening elements for each valve being sufficiently independent to permit the spray guns to be actuated contemporaneously to any desired degree.

2. In a spray coating apparatus as set forth in claim 1, a revolving turret in which the opening elements of each series are mounted peripherally in vertically spaced relation from the elements of the other series, and the valves are located adjacent the periphery of the turret in preselected alterable positions vertically and peripherally spaced from each other.

3. A spray coating apparatus including a conveyor having a plurality of equally spaced article supports, a spraying station in which a plurality of spray guns are positioned to coat surfaces of articles on said supports, an air valve controlling the flow of actuating air to each spray gun, a rotatably mounted turret, driving mechanism rotating the turret in synchronism with the conveyor movement, a separate series of valve actuating pins for each valve positioned peripherally of the turret and traveling past each of said valves, said pins being vertically slidable to upper and lower positions and when in their upper positions passing past the respective valves without contact and when in their lower positions in line to contact and open said valves, a detecting device associated with the conveyor in advance of the spray station and constructed to detect by contact the presence of an article support, a vertically movable camming element adjacent the periphery of the turret in advance of the position of the air valves and normally situated to intercept and slide the pins to their upper position, pneumatic means responsive to the detecting device to move the camming element downwardly out of its intercepting position, and a tubular member carrying a pneumatic signal from the detecting device to the pneumatic means, the length and positioning of said member being subject to selection according to the location desired for the turret.

4. A spray coating apparatus according to claim 3 in which the pneumatic means includes a double-faced air piston connected to the camming element, means delivering compressed air to both ends of the air piston to apply pressure upon both faces thereof and a venting valve at the detecting device end of the tubular member opened by movement of the detecting device to vent the air pressure from one end of the piston permitting the air pressure at the other end to move the piston.

5. A spray coating apparatus including a conveyor, equally spaced article supports on the conveyor, a spray gun positioned to coat surfaces of articles on said supports, an air valve operatively associated with the spray gun, a delayed action pneumatically governed means opening said air valve, adjustable means determining the final starting and stopping points and the duration of the opening period of the air valve, an article detecting device, a pivot on which the device is mounted for horizontal swinging movement, an article contacting finger on the device extending from one side of the pivot, an air venting valve carried by the device on the other side of the pivot, a stationary ported valve seat for the air venting valve, a spring acting upon the device inclining it to a position with the contacting finger adjacently above the article supports and the air venting valve against its seat, and pneumatic communication between the ported air valve seat

and the pneumatically governed means whereby the latter reacts to the flow of air from the ported seat when an article contacts the finger and there-through swings the device on its pivot and the air venting valve away from the ported seat, the pneumatic communication including a tubular member of a length and positioning subject to selection permitting a choice of location for the air valve and for the delayed action pneumatically governed means at a desirable spacing from the spray gun.

6. A spray coating apparatus including a conveyor, a plurality of equally spaced article supports on the conveyor, a spraying station, a plurality of spray guns positioned in the spray station to coat surfaces of articles on said supports, an air valve controlling the flow of actuating air to each spray gun, a rotatably mounted turret, driving mechanism rotating the turret in synchronism with the conveyor movement, a plurality of vertically spaced wheels in said turret, a series of valve actuating pins positioned peripherally of each wheel and travelling past a spray gun air valve, said pins being verti-

cally slidable into and out of valve contacting position, a vertically extending and vertically slidable bar stationed adjacent the wheel peripheries, a plurality of vertically spaced cam flanges on the bar, a first position of said bar in which the cam flanges intercept said pins and move them vertically, a second position of said bar in which the cam flanges do not intercept said pins, a detecting device associated with the conveyor in advance of the spray station and constructed to detect by contacting movement the presence or absence of an article on each support, and means responsive to the findings of the detecting device establishing said bar in its first or its second position.

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