United States Patent [19]

Ordway et al.

[11] **3,908,592**

[45] **Sept. 30, 1975**

[54] **APPARATUS FOR SPRAYING MATERIAL WITH TWO FLUIDS**

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[73] Assignee: **Circle Machine Co., Inc.**, Seabrook, N.H.

[22] Filed: **Dec. 9, 1974**

[21] Appl. No.: **530,677**

Related U.S. Application Data

[63] Continuation of Ser. No. 422,209, Dec. 6, 1973, abandoned.

[52] **U.S. Cl.** **118/313;** 118/323; 118/324; 239/66; 239/67; 239/97; 239/99; 239/225

[51] **Int. Cl.²**..... **B05B 3/02;** B05B 9/00; B05C 5/00

[58] **Field of Search**..... 239/67, 66, 97–99, 239/225, 243, 398, 443, 444; 118/8, 313, 321, 324, 323; 137/624.18; 134/178–181; 68/205 R

[56] **References Cited**

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3,077,422	2/1963	Slatkin	118/314 X
3,301,488	1/1967	Norris	239/225 X
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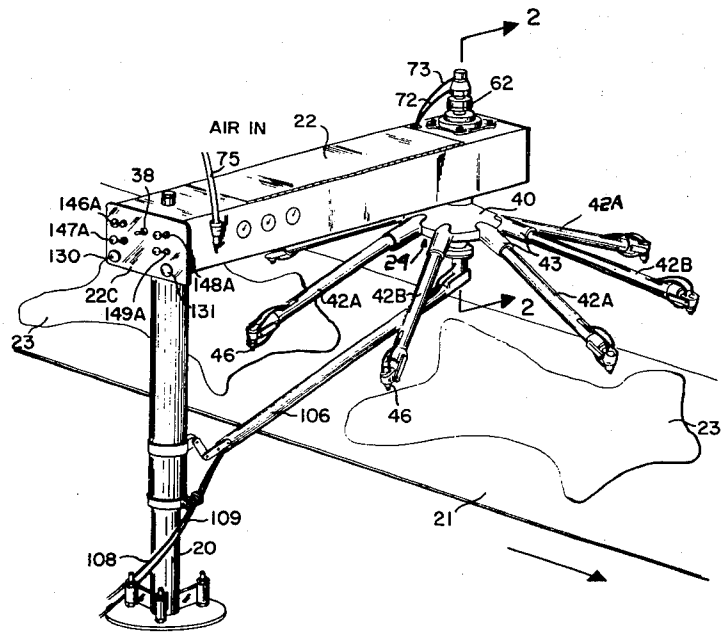
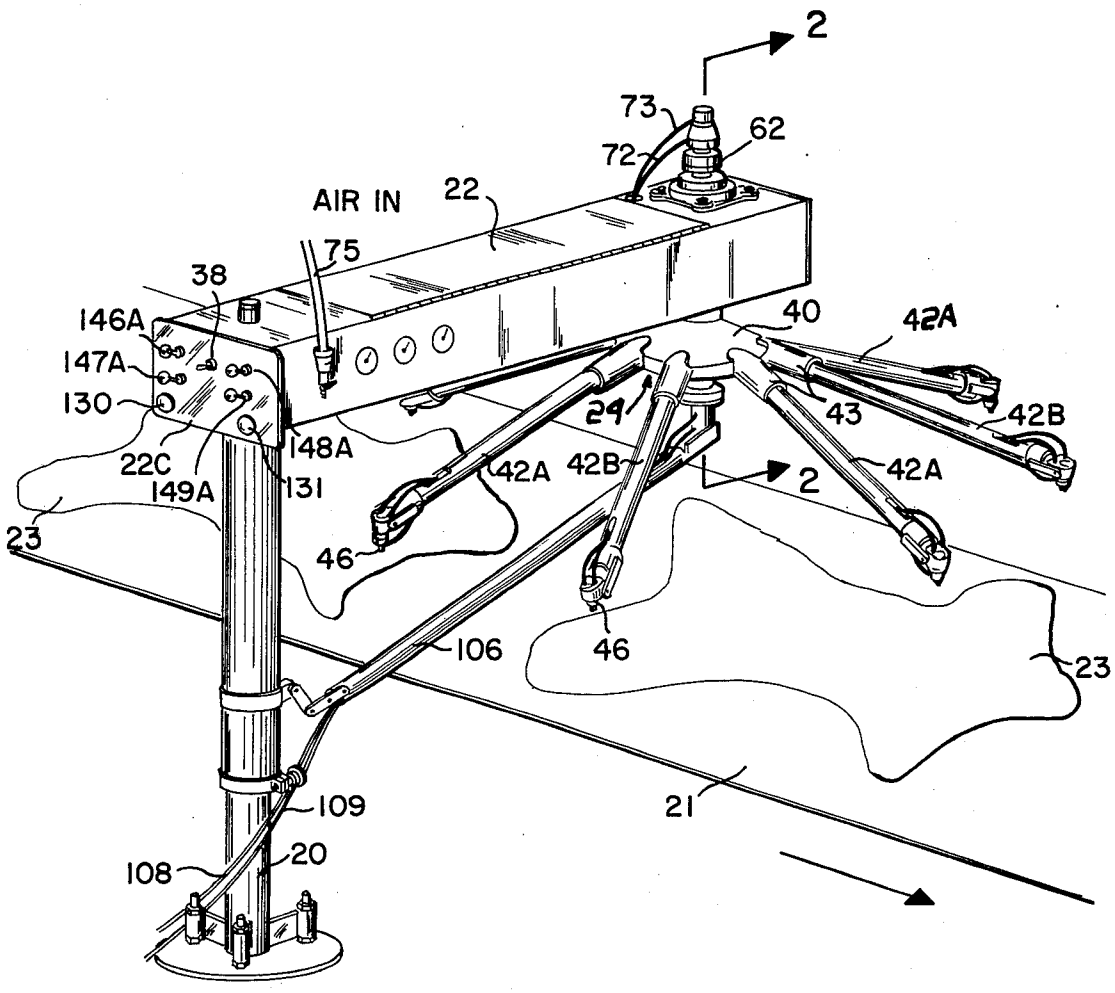
Primary Examiner—Robert S. Ward, Jr.

[57] **ABSTRACT**

Apparatus and method for creating a finish with sprays of two fluents on flat surfaced material being conveyed has a rotatable unit provided with a plurality of radially and circumferentially spaced spray heads having normally closed valves. One fluid is delivered to certain ones of the spray heads and another fluid is delivered to alternate spray heads. Means are provided to open the spray heads when in predetermined positions for a brief period on each rotation of the unit then to spray a zone that partially overlaps and is subsequently partially overlapped by a zone to which a different fluid has been or will be delivered. Means are provided to enable either or both fluids to be sprayed on the material in either the downstream or upstream direction relative to the position of the apparatus with respect to the conveyor or simultaneously in both directions.

17 Claims, 14 Drawing Figures




2
73
72
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AIR IN
22
75
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146A
147A
130
22C
149A
148A
131
40
42A
43
42B
29
42A
42B
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42A
23
46
46
106
23
109
21
108
20

FIG. 1

FIG. 2

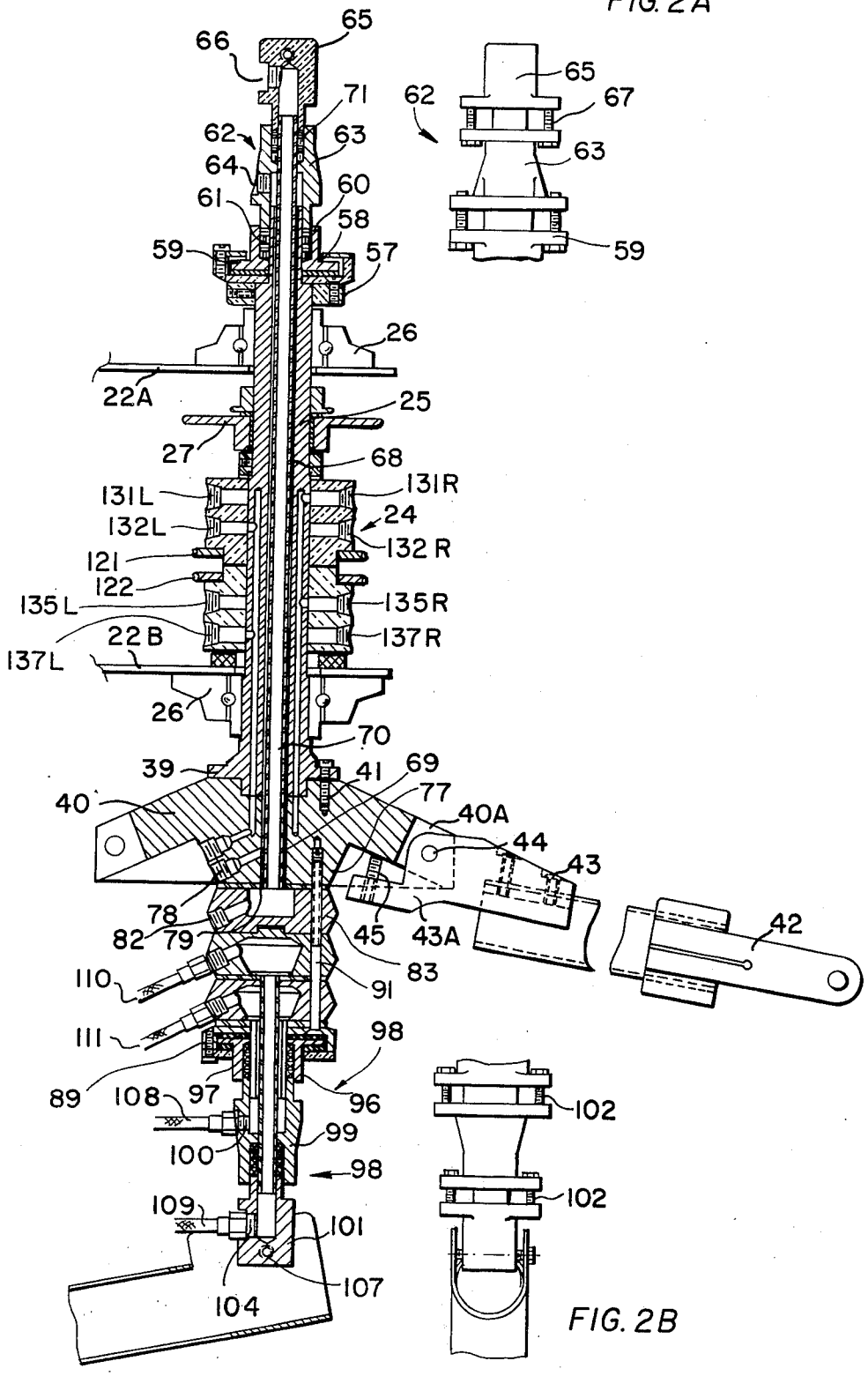
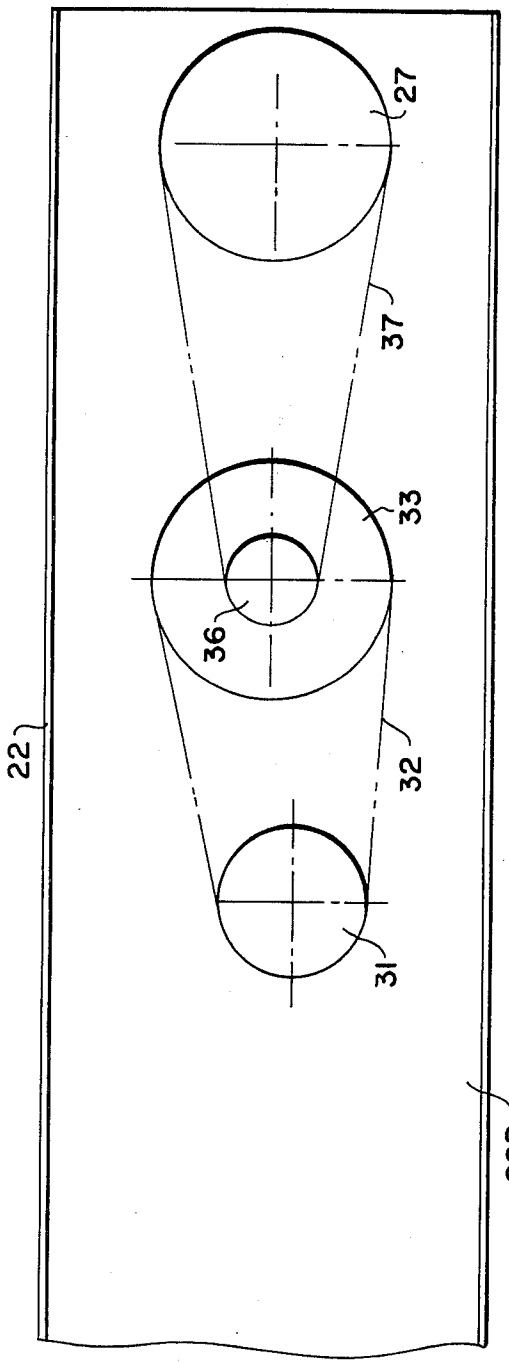


FIG. 2A

FIG. 2B


22
27
37
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36
32
31
22B

FIG. 3

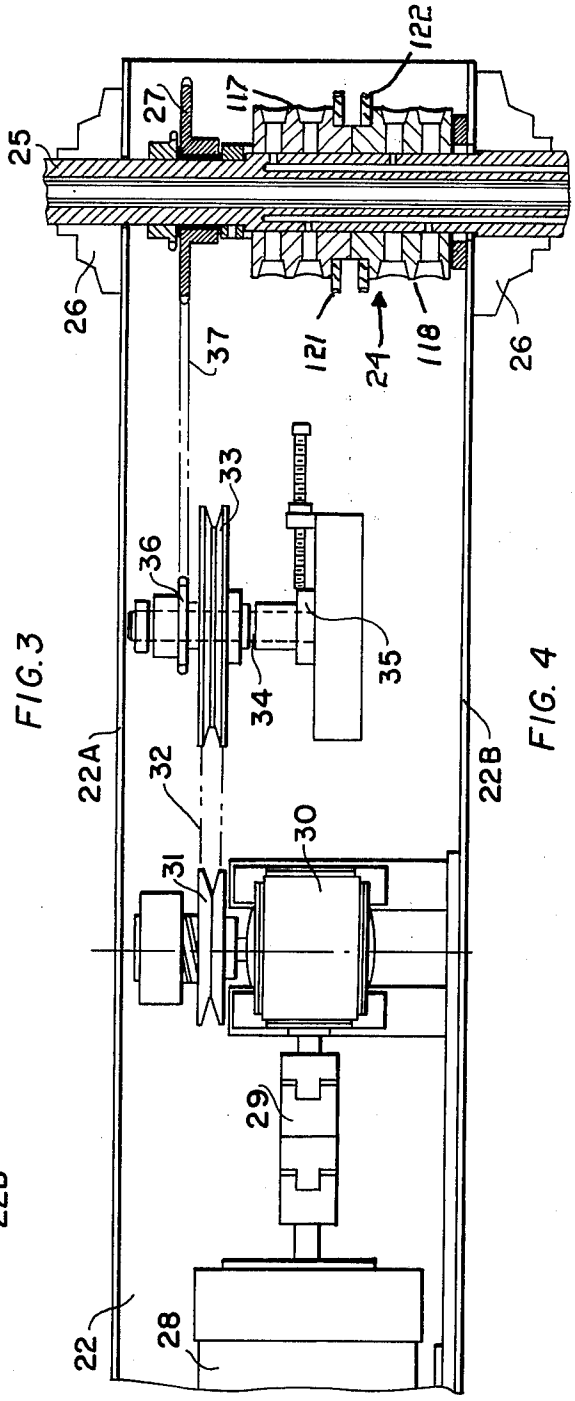
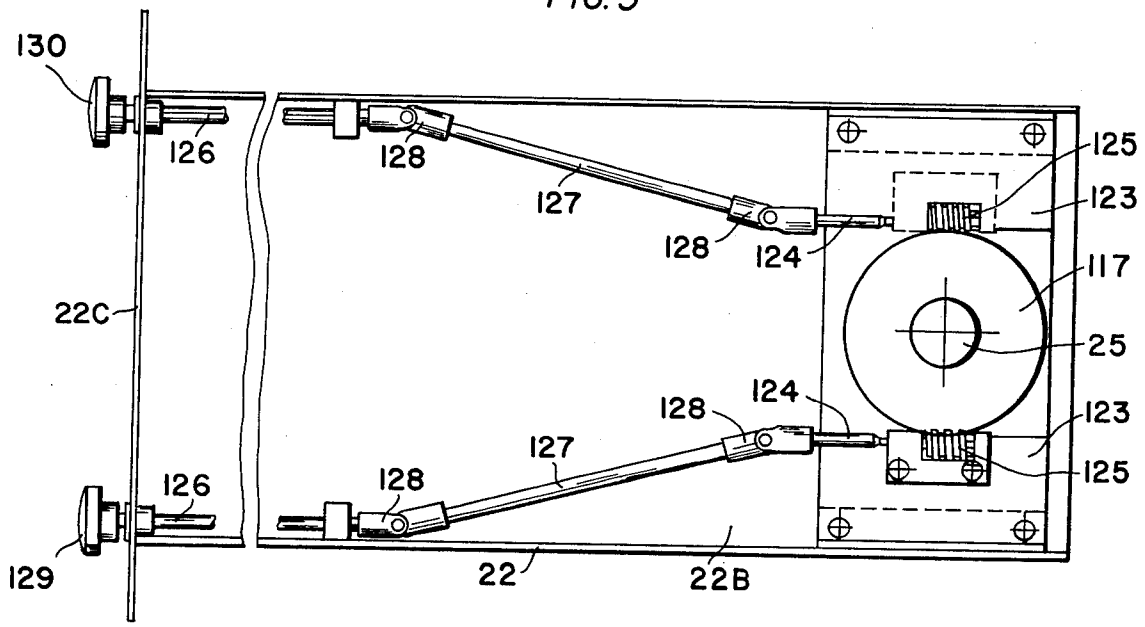

122
117
27
25
26
37
121
24
118
26
33
36
35
34
22A
22B
32
30
31
29
22
28

FIG. 4

FIG. 5


130
126
128
127
128
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117
22C
25
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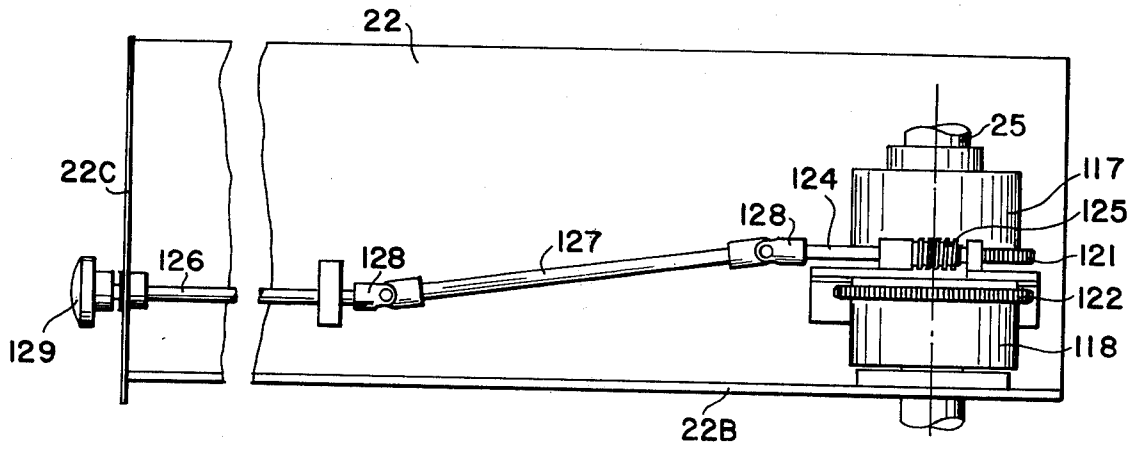
22
22B

FIG. 6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22B

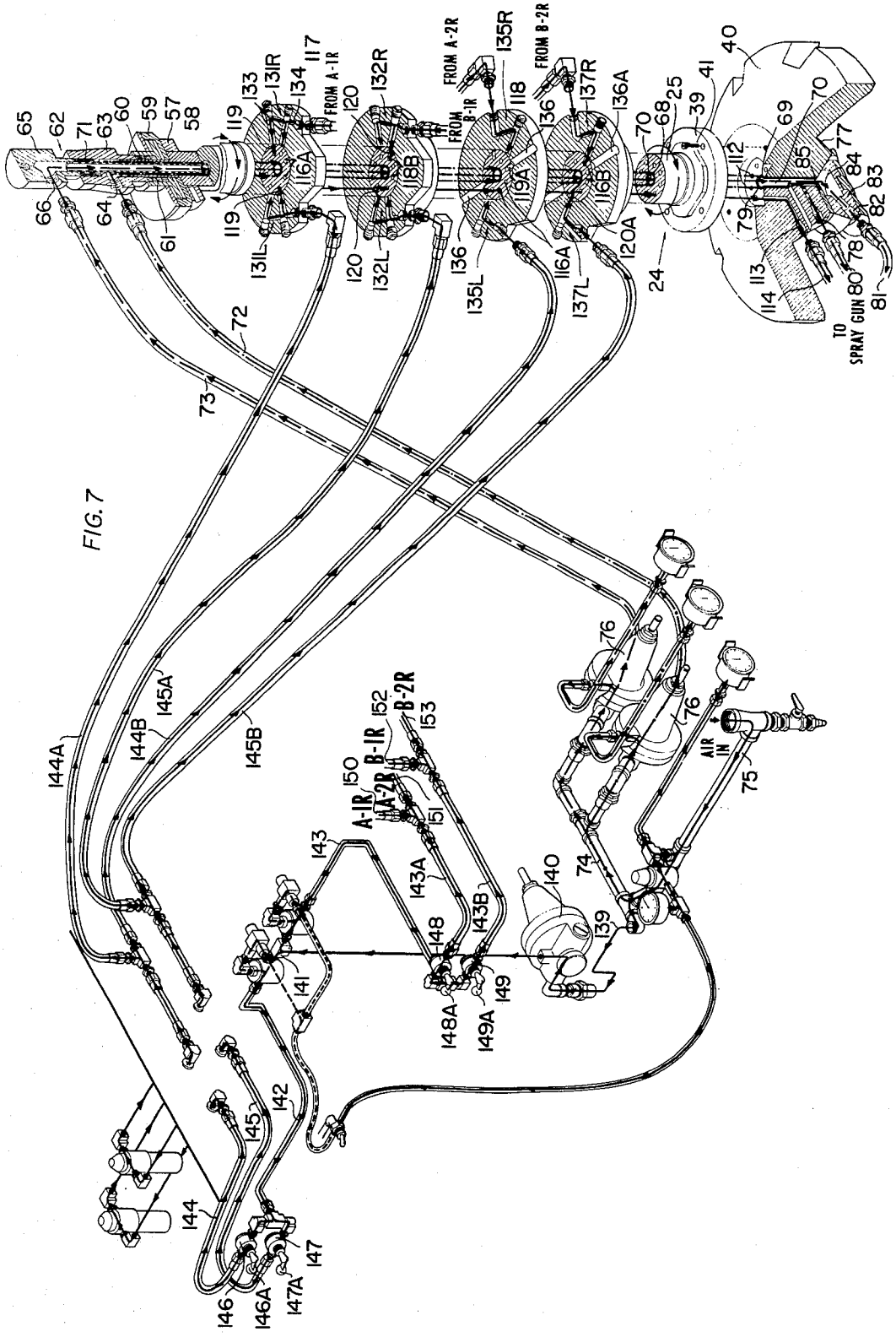

FROM A-2R
FROM B-1R
FROM B-2R
FROM A-1R
TO SPRAY GUN
AIR IN
A-1R
A-2R
B-1R
B-2R

FIG. 7

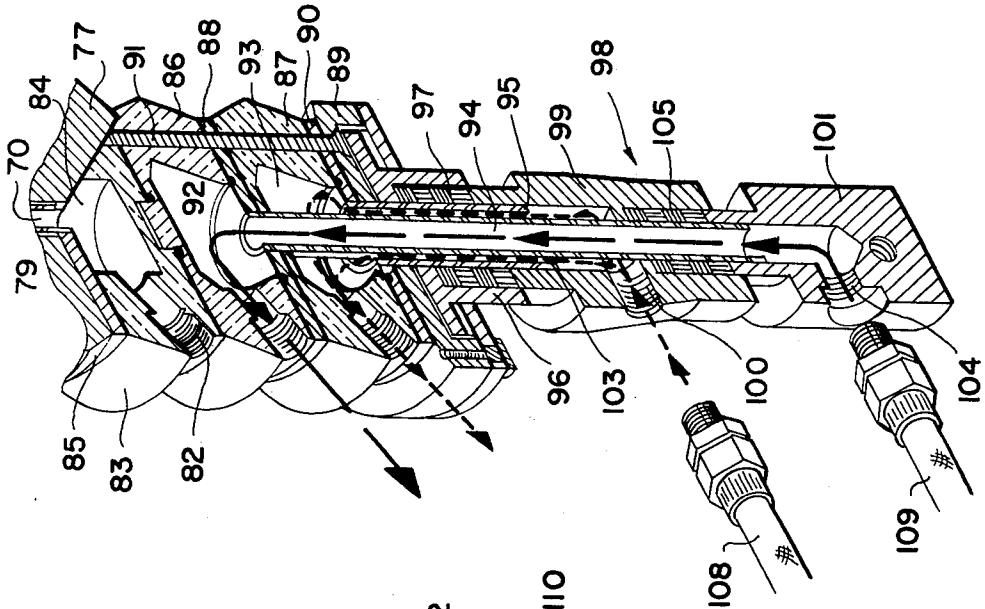


FIG. 8

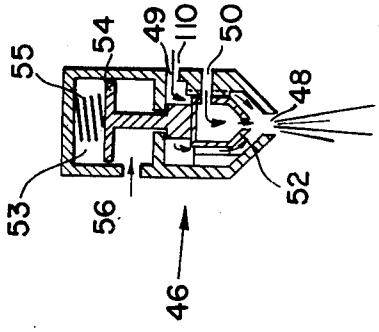


FIG. 10

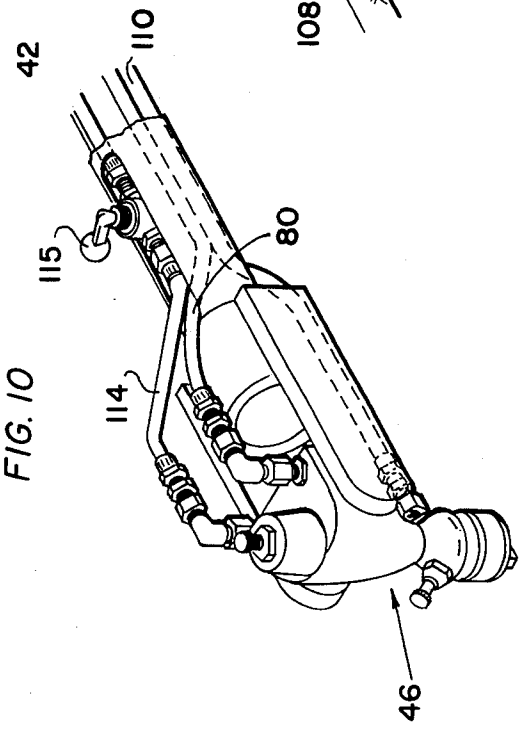
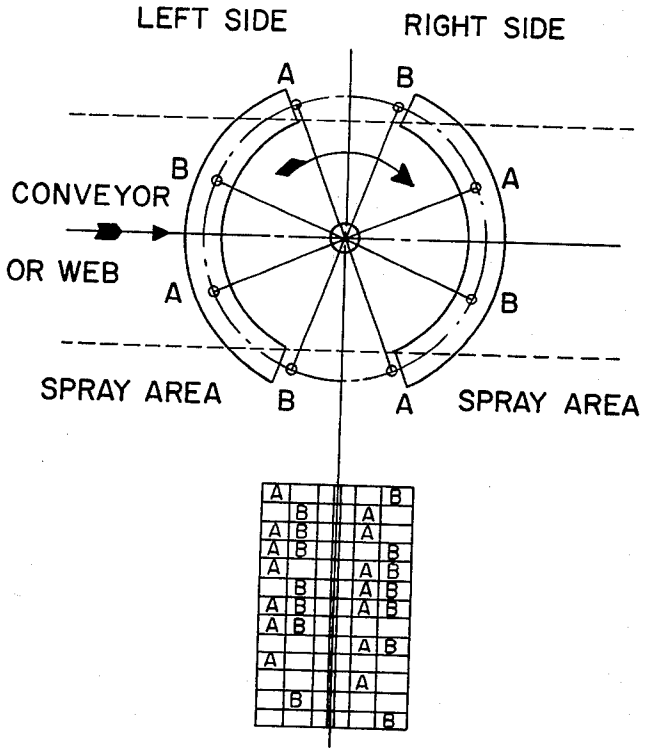


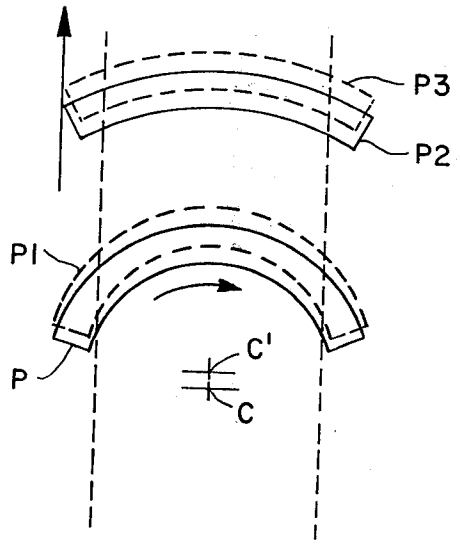
FIG. 9

FIG. 11



COLOR SYSTEMS A & B
POSSIBLE COMBINATIONS

FIG. 12



APPARATUS FOR SPRAYING MATERIAL WITH TWO FLUIDS

This is a Continuation of application Ser. No. 422,209, filed Dec. 6, 1973 and now abandoned.

BACKGROUND REFERENCES

U.S. Letters Pat. No. 2,335,116
U.S. Letters Pat. No. 3,055,596
U.S. Letters Pat. No. 3,412,939
U.S. Letters Pat. No. 3,426,973

BACKGROUND OF THE INVENTION

A common requirement is that such materials as hides and plastic sheeting be colored or otherwise treated and apparatus for efficiently and economically spraying such flat-surfaced materials with a single fluid while being conveyed is disclosed in U.S. Letters Pat. No. 3,426,973.

There is also a demand that such materials be provided with finishes that result from the application to their surface of two fluids of which the application of liquids of different colors is but one example. Air brushes are used to apply one layer or coat on a previously dry coat and apparatus has been proposed for applying two different coloring liquids to different portions of a surface or simultaneously to the same portion in a single application. These are not adapted to meet requirements where the surface areas to be treated are substantial and a high production rate is wanted with the required finish consisting of predetermined successive applications of both fluids to the same area to provide a unitary finish.

THE PRESENT INVENTION

The general objective of the invention is to provide a method and apparatus for use in spraying flat surfaced materials with a plurality of fluids while being conveyed to provide a finish thereon.

This objective, in terms of apparatus, is attained with a rotatable unit suspended over the conveyor with its axis normal thereto and provided with a drive. The unit has a plurality of spray heads uniformly spaced from the axis of the unit and from each other. The spray heads are arranged in series, one for each fluid and with the spray heads of the series alternating. The spray heads are of a type having their spray outlets under the control of a normally closed valve. Means are provided to deliver the appropriate fluid to each spray head together with air under air pressure adequate to discharge the fluid as a spray and means are provided to enable each normally closed valve to be opened when the spray head which it controls is in at least one predetermined position then to deliver spray transversely of the material. The unit is rotated in relation to the conveyor speed so that successive sprays overlap to an extent.

A particular objective of the invention is to enable the operator to have a wide range of control of the fluid, an objective attained by enabling the operator to use the fluids of the independent systems together or separately in both upstream and downstream directions with respect to the conveyor travel or in either one of such directions thereby enabling various methods to be practiced with one or two fluids of the same or different types and with different conveyor speeds that provide the desired finish.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, a preferred embodiment of the invention is shown and -

FIG. **1** is a perspective view of the apparatus positioned beside a conveyor;

FIG. **2** is a section taken vertically approximately along the indicated line **2—2** of FIG. **1**;

FIG. **2A** is a fragmentary view showing in elevation the assembly of the stationary parts used in connecting the air conduits to the rotatable unit;

FIG. **2B** is a like view of the assembly of the stationary parts used in connecting the fluid conduits to the rotatable unit;

FIG. **3** is a somewhat schematic side view of the drive for the rotatable spray unit;

FIG. **4** is a fragmentary view taken lengthwise of the housing to show the drive, with the air conduits and the means for adjusting the width of the spray path omitted to simplify the drawing;

FIG. **5** is a plan view of the interior of the housing showing the means for adjusting the width of the spray path, with the air conduits and the drive for the rotatable unit omitted to simplify the drawing;

FIG. **6** is a side view of one of the adjusting means shown in FIG. **5**;

FIG. **7** is a perspective and partly sectioned view of the rotatable unit and the upper fixed unit showing the atomizing and the control air conduits and controls;

FIG. **8** is a partly sectioned side view of the lower end of the rotatable unit and the lower fixed unit;

FIG. **9** is a perspective view of one of the spray heads;

FIG. **10** is a schematic view thereof;

FIG. **11** is a schematic view showing the spray path and the relationship of the control conduits by which the spray heads are operated to deliver a fluid along a substantially arcuate path against material being conveyed and illustrating the ranges of choices available to the operator as to the spray treatments of the material; and

FIG. **12** is another view illustrating schematically the relationship between successive spray paths.

THE PREFERRED EMBODIMENT OF THE INVENTION

In FIG. **1**, the apparatus is shown as comprising a vertically adjustable stand **20** at one side of a conveyor **21** and having a housing **22** fixed on its upper end and extending transversely over the conveyors **21** on which any flat-surfaced material **23**, hides or a plastic sheet, for two examples, are conveyed to be treated. A rotatable spray unit, generally indicated at **24** is supported by the housing **22** a predetermined distance above the conveyor **21** with its axis normal relative thereto, the conveyor traveling in the direction indicated by the arrow in FIG. **1**. For convenience, the housing **22** may be regarded as dividing the conveyor **21** into right or downstream and left or upstream sides, as viewed from the stand side thereof.

The unit **24**, see FIGS. **2** and **7**, includes an upper portion having a shaft **25** extending vertically through the housing **22** and rotatably supported by bearings **26** on the upper and lower housing walls **22A** and **22B**, respectively. Within the housing **22**, the shaft **25** is provided with a sprocket **27**. The bottom housing wall **22B** also supports a motor **28** connected by a universal joint **29** to a gear box **30** with a Reeves pulley **31** fast on its

driven shaft and connected by a belt 32 to a pulley 33 whose shaft 34 is supported by a mount 35 adjustably connected to the housing wall 22B for movement lengthwise thereof. The shaft 34 is also provided with a sprocket 36 connected to the sprocket 27 by a chain 37. The circuit of the motor 28 includes a switch 38 exposed on the end wall or panel 22C of the housing 22.

The shaft 25 has a flange 39 at its lower end to which the flange 40 of the lower section of the unit 25 is secured by screws 41. Tubular arms 42, eight in number and equally spaced about the periphery, are radially supported by the flange 40. Each arm 42 has a holder 43 entrant of a slot 40A in the periphery of the flange 40 pivotally connected thereto as at 44. Each holder 43, see FIG. 2, has a shoulder 43A underlying the flange 40 and provided with a set screw 45 enabling the angle of the arms relative to the axis of the unit 24 to be adjusted to raise or lower their outer ends relative to the conveyor 21.

The arms 42 are provided with spray heads, generally indicated at 46, in the disclosed embodiment, one spray head for each arm and mounted on its outer end. The spray heads 46 may be either of a type providing for the external or the internal mixing of the air and the fluid. Spray heads such as Model AGB No. 50 made by the Devilbis Company are well adapted for use and a spray head 46 in which the air and fluid are mixed externally is shown schematically in FIG. 9. In FIG. 9, the spray head 46 has a chamber 47 provided with a spray nozzle or outlet port 48 which is in practice detachable and inlet ports 49 and 50. A valve 51 has a stem 52 extending into a chamber 53 and there provided with a head 54 backed by a spring 55 yieldably holding the valve 51 in its closed position. The valve 51 is moved into its open position when control air under pressure is delivered into the chamber 53 through a port 56. The port 49 opens directly into the chamber 47 and discharge through the port 48 is blocked when the valve 51 is in its closed position. The valve 51 has a chamber 51A and an outlet port 51B and the port 50 is in communication with the chamber 51A only when the valve 51 is in its open position.

As the described embodiment of the invention is for use in applying two different fluids to sheet material carried by the conveyor 21, the arms 42 consist of two series with the arms of one series distinguished in FIG. 1 by the suffix addition A and alternating with the arms of the other series distinguished by the suffix addition B.

The shaft 25 extends through the upper wall 22A of the housing 22 and has a collar 57 attached thereto resting on the inner race of the upper bearing 26 and above the collar 57 the shaft 25 is of reduced diameter providing a shoulder 58 in support of a holder 59 attached to the collar 57. The holder 59 receives the cup 60 for the annular seal 61 between the upper end of the shaft 25 and the upper unit or assembly generally indicated at 62. The unit 62 consists of a sleeve 63 having a port 64 above the upper end of the shaft 25 and a cap 65 having a port 66 and connected to the sleeve 63 by screws 67, see FIG. 2A.

The shaft 25 has an axial bore 68 extending from end-to-end thereof and in communication with an axial bore 69 extending through the flange 40. A tube 70 of a lesser diameter than the bores 68 and 69 extends therethrough with its upper end extending beyond the upper end of the shaft 25 and through the sleeve 63 and into the cap 64 through seals 71. The ports 64 and 66 have air conduits 72 and 73, respectively, connected thereto which hold the unit 62 in position and against turning. The conduits 72 and 73 extend lengthwise of the housing 22 and are connected to a branch 74 of a conduit 75 from a suitable source of air under pressure and each includes a pressure regulator 76 also located within the housing 22.

The flange 50 includes a hub 77 on its undersurface having radial ports 78, one for each of the arms 42A with one shown in FIGS. 2 and 7 and opening into the annular conduit 79 between the walls of the axial bores 68 and 69 and the tube 70 with each port 78 connected by a conduit 80 extending through that arm 42A to the inlet port 49 of the appropriate one of the spray heads 46 thereby enabling atomizing air to be delivered to that spray head when its valve 51 is opened with the means for so doing subsequently detailed. Only one of the four equally spaced ports 78 is shown in the drawings.

Atomizing air is delivered to the inlet ports 49 of the spray heads 46 of the series of arms 42B which heads are similarly connected by conduits 81 extending through the arms 42B to radial ports 82, best seen in FIG. 8, in a member 83 having an axial chamber 84 open to the tube and clamped, with a plate 85 between it and the hub 77 of the flange 40 with the plate 85 holding the lower end of the tube 70 in position and closing the lower end of the conduit 79.

In FIGS. 2 and 8, only one of the four equally spaced ports 82 is shown and, for convenience, in FIG. 2 without showing that each such port is arcuately spaced from the adjacent ports 78. Members 86, 87, an interposed plate 88, a holder 89 and a plate 90 between it and the member 87 together with the member 83 and plate 85 are secured to the hub 77 by screws 91.

The members 86 and 87, separated by the circular plate 88, have chambers 92 and 93, respectively. An axial tube 94 opens into the chamber 92 and is supported at its upper end by the plate 88 and extends downwardly through a tube 95 of substantially greater diameter which opens into the chamber 93 and is supported by the plate 90.

The holder 89 carries a depending cup 96 for the annular seal 97 between the lower end of the tube and a unit generally indicated at 98. The unit 98 consists of a sleeve 99 having a laterally opening port 100 and an end cap 101 connected thereto by screws 102, see FIG. 2B. The sleeve port 100 is placed in communication with the chamber 93 by the annular conduit 103 defined by the space between the tubes 94 and 95. The end cap 101 has a laterally opening port 104 and is placed in communication with the chamber 93 by the annular conduit 103 defined by the space between the tubes 94 and 95. The end cap 101 has a laterally opening port 104 and is placed in communication with the chamber 92 through the tube 94 between which and the sleeve 99 there is an annular seal 105. The seals 97 and 105 permit the spray unit 24 to rotate with the unit held against turning by the tubular arm 106 to which the cap 101 is connected by a pin 107 and which is attached to the post 20, see FIGS. 1 and 2.

A conduit 108 connects the port 100 to a pump controlled source of one liquid, not shown, and a conduit 109 connects the port 104 to the source of another liquid which source is also not shown. The conduits 108 and 109 extend through the arm 106. The member 86

has a series of four ports 86A, one for the spray head 46 of each arm 42A and opening into the chamber 92. The member 87 also has a similar series of four ports 87B, one for the spray head 46 of each arm 42B. Only one of each of the ports 86A and 87B is shown in the drawings. Each port 86A is connected to the port 50 of the appropriate spray head 46 of an arm 42A by a conduit 110 and each port 87B is connected to the port 50 of the appropriate spray head 46 of an arm 42B by a conduit 111, the conduits 110 and 111 extending through the arms.

With the means by which the different fluids and the atomizing air are delivered to the spray heads 46 having been described, the means by which their valves are operated will now be detailed.

The flange 40 has, as may be seen in FIG. 7, a circular series of bores 112, one for each arm 42 of both series and each bore 112 has an outwardly opening port 113 with a conduit 114 connecting it to the port 56 of the spray head 46 of the appropriate one of the arms. In practice, each conduit 114 is provided with a valve 115 to enable the associated spray head 46 to be placed out of service, see FIG. 10.

The shaft 25 has a like series of bores extending upwardly from its lower end, the bores 116A of one series alternating with those of the other series 116B and so located that when the flanges 39 and 40 are interconnected each of the bores 116A, 116B is in communication with that one of the bores 112 that will enable it to be in communication with an arm of the appropriate series, the bores 116A with the spray heads 46 of the arms 42A and the bores 116B with the spray heads 46 of the arms 42B.

The bores 116A and 116B extend upwardly with their closed ends within the housing 22 and at this point, reference is made to FIG. 11 wherein the arrangement of the two series of bores is shown and reference is again made to the fact that the housing 22 establishes right and left sides of the apparatus relative to the conveyor 21.

Within the housing 22, there are upper and lower rings 117 and 118, respectively, through which the shaft 25 extends and which is rotatable with reference thereto, the rings being held by adjustable means, later to be detailed. As may be seen in FIG. 7, the bores 116A extend into the zone encircled by the ring 117 and each has a radially disposed port 119 within the ring 117 and the diametrically opposed bores 116B have radially disposed ports 120 below the ports 119 but also within the ring 117.

The bores 116A have laterally opening ports 119A encircled by the ring 118 and the bores 116B have ports 120A below the ports 119A but within the ring 118.

The rings 117 and 118 have worm gears 121 and 122, see FIGS. 5 and 6, respectively, and the housing 22 has mounts 123 therein, each rotatably supporting a shaft 124 with each shaft 124 having a worm 125. Each worm 125 meshes with appropriate ones of the gears 121, 122. Shafts 126 are rotatably supported by the panel 22C, one adjacent each side edge thereof and an intermediate shaft 127 is connected to appropriate ones of the shafts 124 and 126 by universal joints 128. Knobs are fastened on the outer ends of the shafts 126, the knob by which the ring 117 may be turned being indicated at 129 and that for adjusting the ring 118 being indicated at 130.

The ring 117 has a pair of diametrically opposed ports generally indicated at 131L and 131R located above another diametrically opposed pair of ports 132L and 132R, the suffix additions L and R indicating left and right sides of the apparatus with reference to the conveyor 21. Each port of the ring 117 consists of a pair of radial and closely spaced bores 133 opening through the inner surface of the ring and a bore 134 interconnecting them and opening through the outer wall thereof.

The ring 118 has an upper pair of ports 135L and 135R opening its inner and outer walls and a pair of transversely aligned radial relief ports 136 and a similar radially aligned lower pair of ports 137L and 137R and relief ports 138.

A conduit 139 connected within the housing 22 to the air supply conduit 75 includes an adjustable pressure regulator 140 and a junction 141 between a left hand control conduit 142 and a right hand control conduit 143. The control conduit 142 includes branches 144 and 145 having valves 146 and 147, respectively, with their operating handles 146A and 147A exposed on the left side of the panel 22C. The branch conduit 144 has branches 144A and 144B with the branch 144A connected to the port 131L of the ring 117 while the branch 144B is connected to the ring port 135L so that with the valve 246 open, control air is delivered to two bores 116A thereby to open the valves 51 of the spray heads 46 of diametrically opposed arms 42A until the shaft 25 turns to connect the ports 119A with the relief ports 136 with the resulting sprays limited to one fluid and that delivered to the left or upstream side of the apparatus. The branch conduit 145 has branches 145A and 145B with the branch 145A in communication with the port 132L of the ring 117 and the branch 145B in communication with the port 137L of the ring 118 so that with the valve 147 open control air is delivered via the ring port to the bores 116A within the ring 117 to open the valves 51 of the spray heads 46 of the arms 42A until the ports 119A are in communication with the relief ports 136, the spray being of the other fluid and also confined to the left or upstream side of the apparatus.

It will thus be apparent that the operator can effect by the valves 146 and 147 the delivery of either or both fluids onto the conveyed material on the left hand side of the apparatus.

In a similar manner the operator is able to effect the delivery of either or both fluids to the conveyed material at the right hand side of the apparatus. To that end, the conduit 143 has branches 143A and 143B provided, respectively, with valves 148 and 149 having their operating handles 148A and 149A exposed on the right hand side of the panel 22C. The branch line 143A has branch conduits 150 and 151 and the branch 143B has branch conduits 152 and 153. The branch conduits 150 and 151 are connected, respectively, to the port 131R of the ring 117 and the port 135R of the ring 118. The branch conduits 152 and 153 are connected, respectively, to the ports 132R and 137R so that the operator can effect the delivery of either or both fluids to the right or downstream side of the apparatus.

From the foregoing, it will be apparent that the operator is able to deliver either or both fluids to either one or both sides of the housing and also to narrow or widen the spray path as required by the width of the material or the portion thereof that is to be treated. It

will be observed that each control conduit is connected to the air source several times before its ring-encircled port is connected to a relief port **136** or **138** thus making it unnecessary to employ seals between the shaft **25** and the rings **117** and **118.**

It will also be noted from FIG. **7** that a conduit **154** having a valve **155** is connected to the air supply conduit **75** and has branches **156** and **157** that may be used if the fluid pumping source is air operated.

In use, the operator adjusts either one or both of the rings **117, 118** by turning either one or both knobs **130,** 131 in the appropriate direction to provide a spray path of desired width and location for imparting a predetermined finish to the material being conveyed with such adjustments varying the arcuate extent to which the spray head **46** of each arm will remain in operation. As will be apparent from FIG. **11,** either fluid may be delivered by itself or alternatively with the other fluid in either the upstream or downstream direction of conveyor travel or in both such directions. While the fluids may be wholly dissimilar, powdery material carried by an air stream and a binder therefor, for example, they are usually liquids and commonly of different colored liquids.

The spray heads **46** are typically about nine inches from the surface of the material and their distance may be varied by adjusting the screws **45** to raise or lower the outer ends of the arms **42.** While each spray head **46** travels along a circular path and, when opened, remains open through a predetermined minor arc, spray delivered therefrom follows a path from side-to-side of the material that is similar but somewhat distorted because the material is traveling at a predetermined rate. See FIG. **12.** For many applications it is preferred that the overlap be in the neighborhood of fifty percent between successive sprays and that a spray of both fluids be delivered twice to the same area and this common requirement makes it desirable that there should be as little variation as possible between the overlapping sprayed areas at either end and the middle portion thereof.

Best results are obtained when the radius of the arc through which the spray heads **46** travel when in use is as much greater than the width of the material being sprayed as the available space beside the conveyor permits. The longer the arm **42** in relation to the width of the material, the more nearly does each sprayed area approach a straight path and the more uniform the overlap. As conveyors are typically six to eight feet wide, the diameter of the circle through which the spray heads travel is typically at least twice the width of the conveyor but usually not much greater as in practice, the full width of a conveyor is seldom covered by the material and the space available for the apparatus is often too limited to warrant the use of longer arms.

Reference is made to FIG. **12** where a spray path P is arcuate with respect to the center C with the next spray path P1 arcuate with respect to the center C^1 with the distance between the centers C and C^1 representing the travel of the conveyor. No attempt is made to show the distortion of the spary paths due to the conveyor travel but it will be noted that the overlap between the paths P and P1 is not uniform. With an increased arm length and utilizing the centers C and C^1 to provide spray paths P2 and P3, it will be apparent that the overlap is much more uniform.

The nozzles of the spray heads **46** enable the sprays being delivered to have a desired cross sectional shape and area. For most applications, the sprays do not mix in the air and while the radial extent of each spray may be varied within a substantial range, eight to twenty inches, for example, for most purposes it is usually about twelve inches in extent. Such variations in the cross sectional shape and area of the spray as delivered to the material may be changing the nozzles, if they are not adjustable, by raising or lowering the outer ends of the arms **42,** or by both procedures.

With the spray path adjusted and with the pumping means for either or both fluids in operation and an available source of air under suitable pressure, the selected valve or valves whose handles are exposed on the panel **12C** are opened and the switch **38** is closed to start the motor **28.**

It will be apparent that if the sheet material is to be coated without a gap, the rate of travel of the conveyor **21** and the rate at which the unit **24** turns are necessarily related.

While a rate of conveyor travel in the neighborhood of forty feet per minute is relatively common and the relation of the conveyor speed to the rate of rotation of the units **24** is usually in the neighborhood of 2:1, the conveyor speeds present difficulties when the rate of travel is much greater. It is apparent that the higher the rate of conveyor travel, the greater the volume of the fluids required, per unit of time, to effect the desired coating. There are obviously limits as to the maximum rate of rotation of the unit **24** that can be tolerated without waste of fluids and attendant problems.

It will be assumed that the rate of conveyor travel is such that the unit **24** may be rotated at a rate within the desired range and a finish consisting of one layer of each fluid can be established with the spray heads discharging only on the one side of the housing. When the conveyor speed is substantially higher, the machine may be operated with the spray heads also discharging on the other side of the housing to compensate for the higher conveyor speed although downward adjustments of the R.P.M. of the unit **24** might also be in order.

As to the nature of the finish, first consider one requiring that it be of a mottled type. In that case two different coloring fluids are used and the resulting finish is characterized by a somewhat irregular pattern having colored areas of greater or lesser intensity than can be varied in several ways as by varying the spray of the heads **46** of one series relative to the others by adjusting their nozzles or their vertical position, and by utilizing only one of the two fluids on one side of the housing, or by combinations of such procedures.

While the use of coloring fluids provides excellent examples of the adaptability of machines in accordance with the invention, the fluids may be of other types and used for other purposes. For example, a protective rather than an ornamental finish may be applied and one fluid may carry particles of small size that can be effectively delivered to the spray heads and discharged by air as a spray on the upstream side of the conveyor and the other fluid, a finishing coat discharged on the downstream side of the housing. Another example involves the use of two fluids that coact so quickly that they could not be premixed.

We claim:

1. Apparatus for spraying two different fluids on material as it is carried at a predetermined rate by a conveyor, said apparatus comprising above said conveyor, two series of spray heads, means supporting said spray heads above said conveyor and operable to effect their movement across said conveyor first in one direction and then the other the spray heads of one series alternating with those of the other series, each spray head having a spray port and a valve normally closing that port, means to deliver one fluid to the heads of one series and to discharge that fluid as a spray when the valves of those heads are opened, means to deliver the other fluid to the heads of the other series to discharge that fluid as a spray when the valves of those heads are open, means operable to open the valve of each head when it is in at least one predetermined position relative to the conveyor in each direction and while it travels a predetermined distance across the conveyor from that position and including controls to enable the fluids to be delivered to the spray heads of either or both series in either direction or in but one of said directions.

2. The apparatus of claim 1 in which the supporting means includes a rotatable unit including an axial shaft, structure supporting said shaft with its axis centrally of and vertically with respect to the conveyor, and the fluid delivery and discharge means includes concentric passages in one end portion of the shaft, one passage for each fluid, conduits effecting communication between each of said passages and the spray heads of the appropriate one of the two series and a separate supply conduit for each of the fluids, means connecting each fluid supply conduit to the appropriate passage and enabling the shaft to rotate relative thereto, and means to deliver atomizing air to the spray heads of both series.

3. The apparatus of claim 2 in which the delivery means for the atomizing air includes second concentric passages in the other end portion of said shaft, one passage for each series of spray heads, conduits effecting communication between each of said second passages and the spray heads of the appropriate one of the two series thereof, a separate air conduit for each second passage, means connecting each air conduit to the appropriate one of said second passages and enabling the shaft to rotate relative thereto, and each air conduit is connectable to a source of air under pressure and includes an adjustable pressure regulator.

4. The apparatus of claim 1 in which there are at least four spray heads, the supporting means includes a rotatable unit including an axial shaft, structure supporting said shaft with its axis centrally of and vertically with respect to the conveyor, and the fluid delivery and discharge means includes a circular series of at least four bores in said shaft spaced from the axis thereof and extending lengthwise thereof, one bore for each spray head of both series, a conduit placing each of said bores in communication with the appropriate spray head, each bore having a laterally opening inlet port, the inlet ports arranged as two pairs of diametrically opposed ports, one port for the upstream side of the supporting means and the other for the downstream side thereof, the two pairs of inlet ports spaced vertically from each other, and means encircling said ports and enabling said shaft to rotate relative thereto, said encircling means having a pair of diametrically opposed delivery ports for each pair of inlet ports that register therewith as the shaft turns, and delivery conduits, one for each delivery port and in communication therewith and connectable to a source of air under pressure, each delivery port including a valve, said encircling means having relief means with which each of the inlet ports is in communication after the shaft has turned a predetermined number of degrees.

5. The apparatus of claim 4 in which there are eight spray heads and the shaft has a second circular series of bores spaced from the axis of the shaft and from the bores of the first series and extending lengthwise of the shaft, one bore of the second series for each of the other four spray heads, a conduit placing each bore of the second series in communication with the appropriate spray head, the bores of said second series having inlet ports arranged and disposed in the same manner as those of the first series, and the encircling means includes two rings, one below the other, one encircling the ports of the first series and one encircling the ports of the second series, the ring for the second series having delivery ports arranged and disposed in the same manner as those for the first series, and delivery conduits, one for each delivery port of the second series and in communication therewith and with the appropriate one of the conduits for the first series of bores to be controlled by the valve thereof.

6. The apparatus of claim 5 in which each inlet port of the first series includes a pair of radial bores arcuately spaced from each other and opening with respect of the shaft, and an intersecting bore opening outwardly through the encircling means.

7. The apparatus of claim 5 in which the relief means includes relief ports in the ring for the second series of bores, the relief ports being arranged as two pairs of diametrically opposed ports vertically spaced from each other and in the plane of the appropriate pair of inlet ports encircled by said ring and angularly spaced therefrom, and each bore of the first series has a second port in the plane of the relief ports for the corresponding inlet ports of the second series of bores.

8. The apparatus of claim 7 and means connected to each ring and operable to turn them relative to the shaft and to each other.

9. The apparatus of claim 1 in which the supporting means includes a rotatable unit including an axial shaft, structure supporting said shaft with its axis centrally of and vertically with respect to the conveyor, and the fluid delivery and discharge means includes concentric axial passages in the lower end portion of the shaft, one passage for each fluid, conduits effecting communication between each of said passages and each spray head of the appropriate one of the two series of spray heads and a separate supply conduit for each of the fluids, means connecting each fluid supply conduit to the appropriate passage and enabling the shaft to rotate relative thereto, and means to deliver atomizing air to the spray heads of both series.

10. The apparatus of claim 9 in which the valve of each spray head is normally closed and is opened by air pressure, and the valve opening means includes a concentric series of bores extending downwardly in said upper shaft end, one bore for each spray head and conduits effecting communication between each bore and the appropriate one of said valves.

11. The apparatus of claim 9 in which the supporting means includes a series of arms, one arm for each spray head of both series, each spray head connected to the outer end of the appropriate arm, the shaft includes a flange intermediate its rods to which the inner ends of

the arms are connected and the flange includes a hub on its undersurface and the lower shaft end is an assembly axially connected thereto, and including vertically spaced chambers, means separate said chambers from each other, one chamber for each fluid passage and having ports to which the fluid conduits of the appropriate series of arms is connected, and one chamber in communication with the inner one of the atomizing air passages and having ports to which the atomizing air conduits of one series of spray heads are connected and the hub has ports in communication with the outer atomizing air passage to which the atomizing air conduits of the other series of spray heads are connected.

12. The apparatus of claim **1** in which the means to deliver fluid to the spray heads and to discharge it as a spray includes separate fluid delivery means and separate delivery means for fluid-atomizing air for each series of spray heads, each fluid delivery means and each air delivery means including supply conduits and conduits effecting communication between the appropriate supply conduits and the appropriate spray heads and said air delivery means includes an adjustable pressure regulator in control of each supply conduit.

13. Apparatus for spraying two different fluids on material as it is carried at a predetermined rate by a conveyor, said apparatus including two series of spray heads, rotatable means supporting said spray heads above said conveyor and operable to effect their movement along a circular path the axis of which is centrally of and vertical with respect to the conveyor, the spray heads of one series alternating with those of the other series, each spray head having a spray port and a valve normally closing that port, means to deliver one fluid to the heads of one series and to discharge that fluid as a spray when the valves of those heads are opened, means to deliver the other fluid to the heads of the other series to discharge that fluid as a spray when the valves of those heads are open, means operable to open the valve of each head while it travels through a predetermined arc over the conveyor, the rate of rotation of the unit relative to the rate of the conveyor travel being such that the major portion of the path of the spray provided on the operation of each spray head is overlapped by the spray of the next operated spray head.

14. The apparatus of claim **13** in which the spray heads provide a spray that is of substantial radial extent but is relatively narrow.

15. The apparatus of claim **14,** and means to control the number of spray heads that are in service and the radial extent of each spray is such that an overlap occurs with the minimum number of spray heads in service.

16. The apparatus of claim **13** in which there are eight spray heads, four for each series, and the rotatable supporting means, with a conveyor travel in the order of forty feet per minute, rotates at a rate within the approximate range of from 15 to 25 R.P.M.

17. Apparatus for spraying two different fluids on material as it is carried at a predetermined rate by a conveyor, said apparatus comprising above said conveyor, two series of spray heads, means supporting said spray heads above said conveyor and operable to effect their movement across said conveyor first in one direction and then the other the spray heads of one series alternating with those of the other series, each spray head having a spray port and a valve normally closing that port, means to deliver one fluid to the heads of one series, means to deliver to said heads air under pressure operable to discharge that fluid as a spray when the valves of those heads are opened, and a pressure regulator common to all of said air delivery means of said one series, means to deliver the other fluid to the heads of the other series, means to deliver to said last named heads air under pressure operable to discharge that fluid as a spray when the valves of those heads are open, and a pressure regulator common to all of said last named air delivery means, means operable to open the valve of each head when it is in at least one predetermined position relative to the conveyor in each direction and while it travels a predetermined distance across the conveyor from that position.

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