

May 15, 1962

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3,034,475

CONTOUR SPRAY MACHINE

Filed Aug. 25, 1958

4 Sheets-Sheet 1

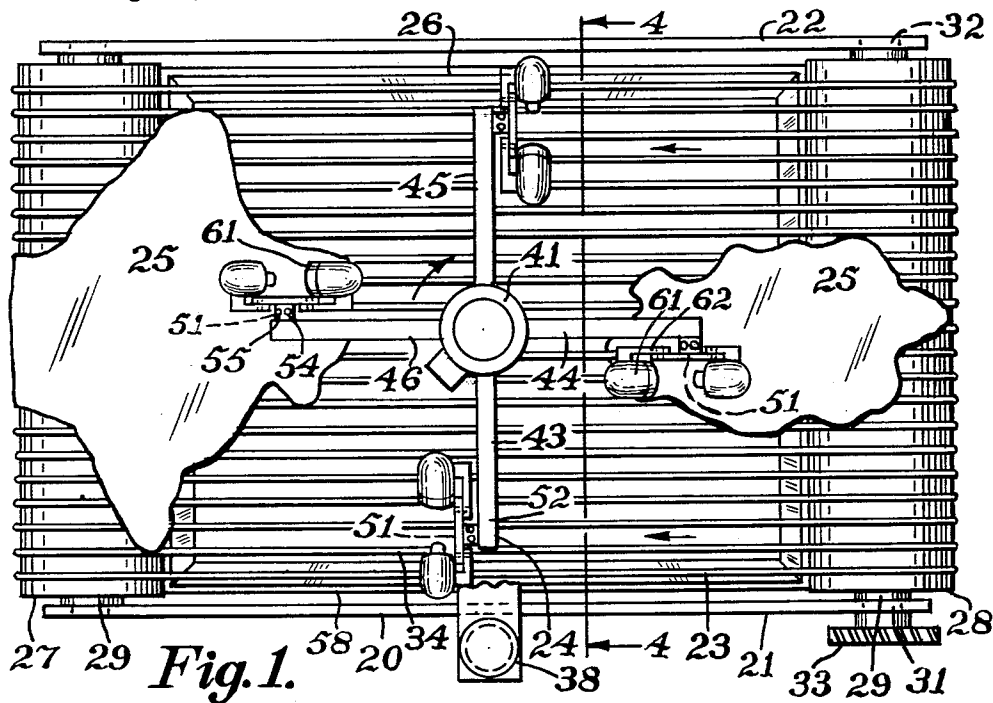


Fig. 1.

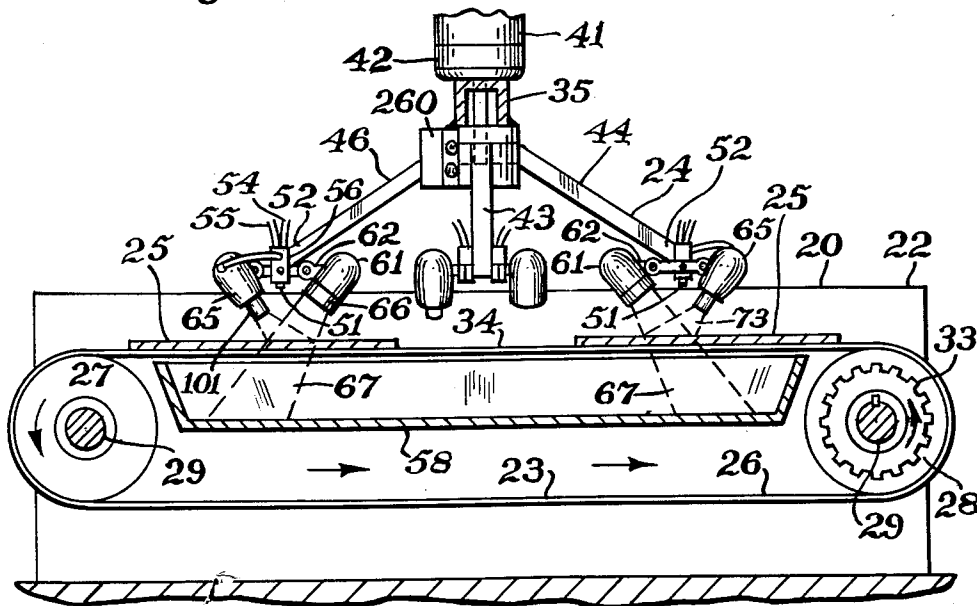


Fig. 2.

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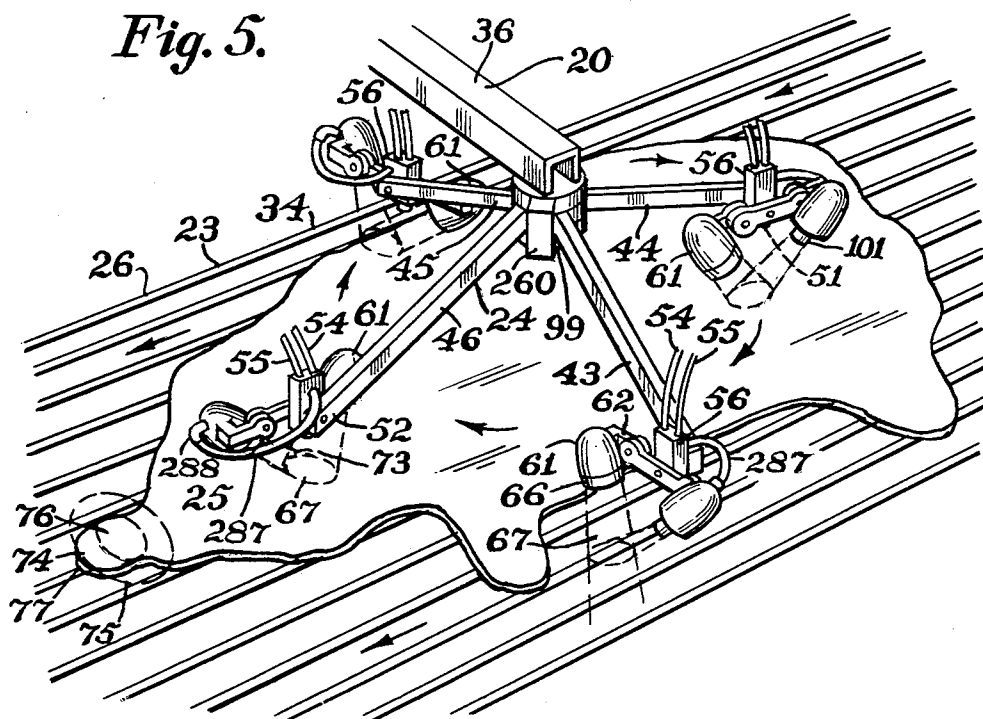
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Fig. 5.



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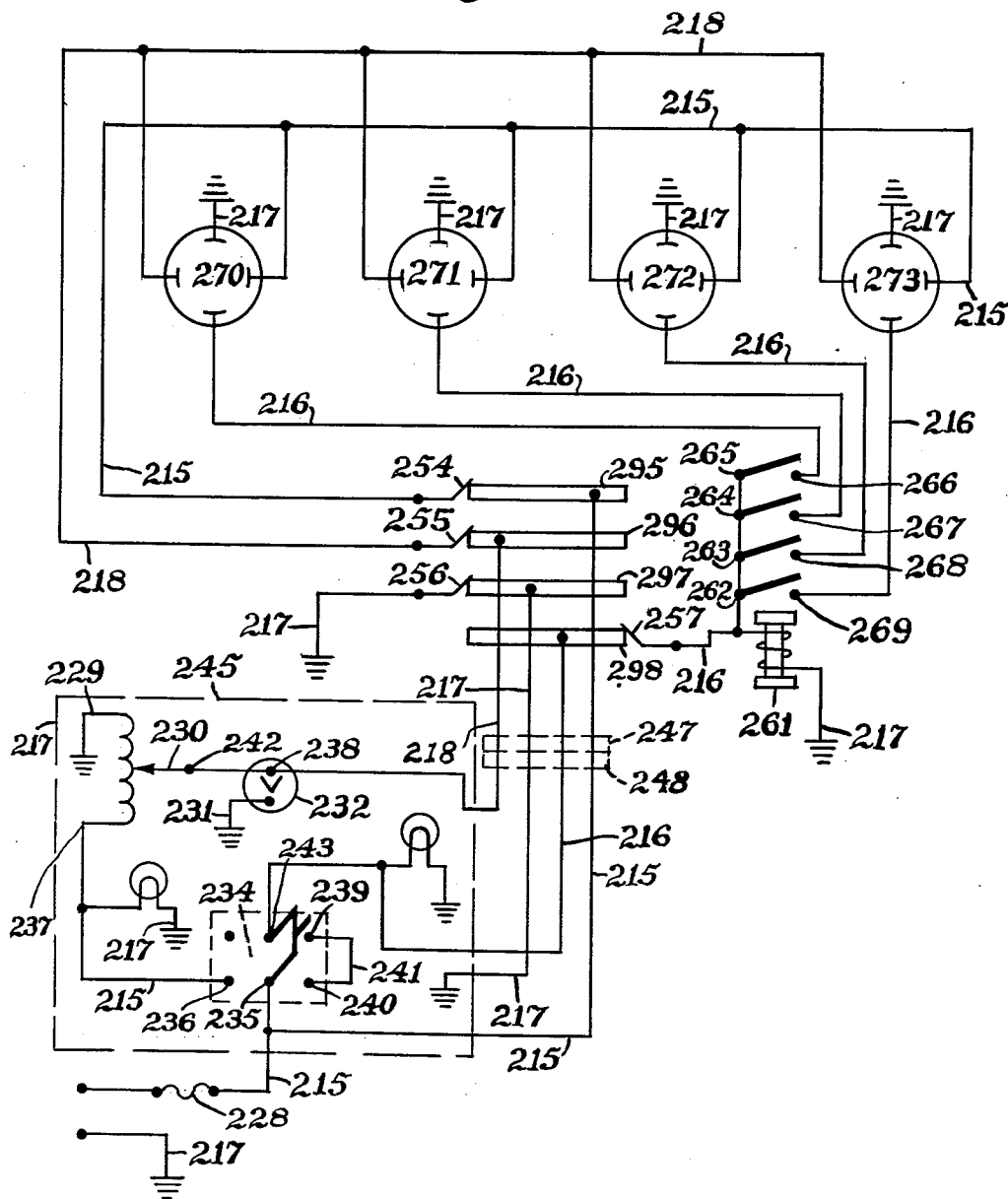
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Fig. 6.



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Filed Aug. 25, 1958, Ser. No. 756,918

8 Claims. (Cl. 118-2)

This invention relates to controlled, or contour spraying of flat sheets of non-symmetrical outline.

The invention is particularly applicable in the coating of large flat hides in the tanning industry. It has been customary in this, and many other arts, to advance articles to be treated individually and successively along a path and to treat such articles, for example by spray coating, at a treatment station along the path. In the tanning industry the flat, ungainly hides are usually advanced flatwise on a horizontal endless conveyor under reciprocating or rotating spray heads. Sometimes, however, the hides are pasted to large plates which are advanced in pendant position through a spray station as is U.S. Patent 1,966,093 to Griffin of July 10, 1934.

There has been considerable wastage of the spray liquid when coating non-symmetrical articles such as hides, because the sprays have been continuous even though the tail, leg or head portion of a hide is of less width than the body portion. Spray liquid has fallen on the pendant plates or on the horizontal conveyor on each side of the narrow portions of the hide to no effect and to cause considerable gumming up of the entire mechanism.

It has heretofore been proposed to mount a light sensitive device and a light source on opposite sides of pendant plates or above and below a horizontal conveyor to control the valves of the spray guns. However, one or the other such unit is usually in the path of the spray and becomes gradually clouded by the spray mist. It has also been proposed as in U.S. Patent 2,754,795 to Ensle of July 17, 1956 to actuate the spray guns by a pattern of detectors which sense the irregular outline of the hide and actuate the spray guns accordingly. As far as I am aware, no one has heretofore successfully controlled spray guns, rotating at high speed, in accordance with the irregular outline of flat sheets or hides passing thereby on a conveyor.

The principal object of this invention is to provide a simple, low cost, control apparatus responsive to the irregular outline, or contour, of flat articles advancing on a conveyor to activate and deactivate a moving spray gun so that only the article is coated and not the entire conveyor.

Another object of the invention is to provide photo electric control apparatus for a moving spray head which travels with, but leads, a spray head to sense predetermined minimum areas of the work to be sprayed and those areas not to be sprayed.

A further object of the invention is to provide photo electric control apparatus for a plurality of rotating spray guns wherein the entire apparatus is on the same side of the work as the spray guns and rotatable therewith for scanning work areas and intermittently actuating each spray gun when travelling over such areas.

Still another object of the invention is to provide photo electric control apparatus wherein the light source is a light, with a divergent non-focussed, beam, adapted to illuminate a predetermined minimum area of the work and the light sensitive device is a cadmium sulphide transistor adapted to respond to reflected light only from such a predetermined minimum area for activating a spray gun or other treatment device.

A still further object of the invention is to provide

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an improved spraying machine and method wherein the work is advanced on an open mesh, non reflective conveyor, wherein a flood light and a light sensitive device continuously scan the non reflective conveyor in a prescribed path and wherein the spray guns are actuated only when a predetermined area of the work on the conveyor intercepts the flood of light and reflects the same back to the light sensitive device in a predetermined intensity.

Other objects and advantages of the invention will be apparent from the claims, the description of the drawings and from the drawings in which:

FIG. 1 is a plan view, partly broken away of a rotating spray machine with the contour spray control of this invention installed thereon.

FIG. 2 is a side elevation on line 2-2 of FIG. 1.

FIG. 3 is an enlarged view of the light sensitive control device of the invention also illustrating the electrical circuit thereof.

FIG. 4 is an end view on line 4-4 of FIG. 1.

FIG. 5 is a diagrammatic, perspective view showing the operation of the machine and method of the invention, and

FIG. 6 is an electrical diagram of the preferred circuit for energizing the circuit shown in FIG. 3.

As shown in the drawings, 20 is a rotary spray machine having side frame pieces 21 and 22, an endless conveyor 23 and rotary spray means 24 in juxtaposition to the path of the conveyor and arranged to spray coat articles such as 25 carried thereby on the conveyor.

In this invention the endless conveyor 23 is of open mesh material in order that a light beam directed thereon will pass through without being reflected thereby. A preferred form of non-reflective conveyor comprises the plurality of spaced apart, parallel nylon strands such as 26 supported on rolls such as 27 and 28. The shaft 29 of each roll 27 or 28 is journaled as at 31 and 32 in side frame pieces 21 and 22 and at least one conveyor roll is driven in the direction of the arrows by a gear or sprocket 33 powered by any convenient means such as a motor, not shown. The articles 25 illustrated are non-symmetrical, flat, ungainly animal hides which are fed manually or automatically in flatwise position onto the upper stretch 34 of conveyor 23 and are advanced in a horizontal directed path while supported at laterally spaced intervals by the nylon strands 26.

The rotary spray means 24 is centered above the upper stretch 34 of conveyor 23 and rotatably supported at 35 from one side of the machine by the lateral arm 36, lateral brace 37 and the vertical post 38. A suitable electric motor 41 and gear reducer 42 are mounted above the arm 36 at 35 for rotating the four downwardly and outwardly inclined spray gun arms 43, 44, 45 and 46 at a predetermined speed such as 30 r.p.m. which speed may, however, be varied by suitable rheostat means 47 well known in the art and actuated by a switch 48 from a source of electric current 49. Each spray gun arm such as 43, includes a spray gun such as 51 at the lower terminal end 52 of the arm.

Each spray gun 51 is supplied with coating liquid by a supply pipe 54, with atomizing fluid pressure, such as air, by supply pipe 55 and is actuated and deactivated by a normally closed valve 56 and supply pipe (not shown) all through suitable glands well known in the art, for example, in the De Vilbiss type spray gun. Heretofore, valve 56 has been opened by fluid pressure such as air from an air supply pipe in accordance with suitable cam means not shown or control thereof has been entirely manual.

As thus far described, the machine is well known. It will be apparent that when valve 56 is open, articles 25 advanced under rotary spray means 24 will be subjected to successive, completely annular paths of liquid coating or spray from the rotating guns 51 as the articles continuously advance unidirectionally thereunder. It will also be apparent that the head, flank and tail portions of the non-symmetrical hides will intercept only part of the spray, with the remainder, on the outer margins of the conveyor, passing through into the drip pan 58 after coating the nylon strands 26 of the conveyor.

The method and apparatus of this invention for avoiding such wastage of coating liquid, gumming up of the conveyor and the excessive mist caused by non-contour spraying includes a light beam and a light sensitive device both on the same side of the conveyor and arranged to control the spray gun valves in accordance with the scanning of a predetermined minimum area of the articles to be coated.

As shown, a source of light in the form of an outdoor type lamp 60, preferably of about 150 watts, is mounted in a suitable housing 61, the latter being conveniently supported by an arm 62, adjustably connected at 63 to a bracket 64 also carrying the housing 65 of the light sensitive device. An elongated hood or shield 66 encircles the beam 67 from lamp 60 to prevent clouding of the lamp by spray mist and to better guide the beam 67.

The light sensitive device housing 65 includes a light sensitive device which is preferably in the form of a cadmium sulphide transistor 70 at the base of an elongated tube 71, the housing 65 being supported on an arm 69 and adjustable by the connection 72, to various angles relative to the bracket 64 and housing 61. Tube 71 forms an elongated hood to shield the transistor 70 from the spray mist and to encircle the beam 73 reflected thereinto from the work, or articles, 25. The light beam 67 is not focussed as a spot light to a focal point and the beam does not converge. Instead, light beam 67 is in the shape of a diverging cone whereby it brightly illuminates, or floods, a circle or oval, zone of predetermined area, such as a circle of about six inches in diameter, on the upper face of the work and illuminates a circle of greater diameter on the drip pan 58 when the beam passes through the meshes of the conveyor unintercepted by articles 25. The hoods 66 and 71 converge toward each other in order that light sensitive device 70 will be actuated by the beam 73 reflected from the articles 25, but device 70 responds only to the intensity of light reflected from the above mentioned minimum predetermined area and does not respond to lesser amounts or to the reflection of a spot light or similar bright focal point. A portion of an article one or two inches in width therefore does not reflect sufficient light to transistor 70 to actuate the same, but a portion six or seven inches wide, or more, causes the transistor 70 to activate the spray guns 51. It will be obvious that the predetermined minimum area specified above is suitable for animal hides but could be increased or decreased to other zone dimensions if desired.

As best shown in FIG. 5, a tapered head or tail portion 74 of a hide 25 does not reflect enough light to the transistor 70 until an area such as shown in dotted lines at 75, entirely within the outline of the hide 25, is illuminated by lamp 60. The spray which is cone shaped, and deposits a circle of spray such as at 76, then coats the portion 74 rather than starting to spray the instant the leading edge 77 of article 25 intercepts the light beam 67.

A housing 65 and a housing 61 are mounted angularly in advance of each spray gun 51 in order to scan the open mesh non-reflective conveyor 23 to determine the presence or absence of the predetermined minimum area of the work. A lead of about one foot has been found advantageous to enable the spray pattern such as 76 to strike the area such as 75 being scanned by the light sensitive device 70 and illuminated by the beam 67.

It should be noted that the length of the tube or hood 71 is critical to the successful operation of the invention. If it is too long, insufficient intensity of light reaches the light sensitive device and if too short, the light sensitive device reacts too often. A tube of about six inches in length and two inches in diameter has been found to give satisfactory results in the particular relationship of parts depicted herein. A telescopic hood 101 and set screw 102 is provided for achieving the exact reaction to reflected light desired. I may use a truncated conical shield, in place of the cylindrical hood 66 in order to better maintain the dead air space therewithin which keeps the spray mist away from the lamp 60 during rotation of the spray guns 51.

The electrical diagram of FIG. 6 shows the power circuit of the device leading from the control box 245, through commutator means 85 to the four female connectors 270, 271, 272 and 273, into which the male connectors, such as 274 (FIG. 3) of each control unit circuit are inserted.

As shown in FIG. 3 each lamp 60 is illuminated by a circuit including the lamp, conductor 218, a switch 289, conductors 217, a male connector such as 274 fitting in one of the female connectors 270, 271, 272 or 273 (FIG. 6) and a conductor 278. The light intensity of the lamps 60 is controlled by means of an auto transformer 230, the transformer 230 being located in the control box 245 convenient for actuation by the operator.

The control box 245 includes a centre-off toggle switch 234 D.P.D.T. which placed in one position completes the control unit circuit. In the other position it by-passes the control unit and opens the solenoid valves 56 for testing the spray guns, washing them of foreign material or clearing the guns of different colored mixtures and finish.

The control unit circuit includes the cadmium sulphide cells 70 of each spray gun arm and the cells sense the proper amount of light during their rotation with the spray gun arms. Each cell 70 successively senses the intensity of light reflected thereto and, when sufficient, closes the circuit in the two pole relay coil 201 of its control circuit. The energized coil 201 then attracts armature 202 away from contact 203 and against contact 204. This in turn completes a circuit including armature 202, conductor 215, male connector 274, ground conductor 217, relay coil 205, conductor 282 and contact 204 to thereby energize the coil of four pole double throw relay 205.

Energization of the relay 205 draws the armatures 206 and 207 away from contacts 208 and 210 and into engagement with contacts 209 and 211. When armature 205 disengages with contact 210 and engages contact 211 it closes a circuit including male connector 274, conductor 215, armature 206, contact 211, pilot light 290, conductor 291, the coil 89 of valve 56 and ground conductor 217. The energization of coil 89 causes the spray gun valve 56 to be actuated and causes spray to be emitted by the spray gun 51 controlled by the above specified control circuit. Simultaneously, the change of position of armature 207 from contact 208 to contact 209 opens a holding circuit 283 and interposes a potentiometer 213 in series with coil 201 and conductor 215. This enables the holding flux in armature 202 to be varied by potentiometer 213 which makes it very easy for armature 202 to return to engagement with contact 203 whenever the light intensity decreases a very small amount.

Any lag or delay in deactuation by the cell 70 is thus overcome and the spray from gun 51 ceases as soon as light intensity in the reflected beam 73 becomes even slightly reduced. It will be understood that most of the above control and holding circuit is contained in the housings 65 on each spray gun arm 43.

As shown in the electric diagram of FIG. 6 the power source is a 115 volt A.C. line leading to control box 245

to which the ground conductor 217 is grounded. The ground conductor 217 goes to terminal 229 of auto transformer 230, then to terminal 231 of A.C. voltmeter 232, then to the annular bronze disc 297 of the commutator 253.

Conductor 215 goes to fuse 228, thence to the centre terminal 235 of four pole double throw switch 234. From terminal 236 of switch 234, conductor 215 goes to terminal 237 of auto transformer 230. Conductor 215 also leads to the annular bronze ring 295 of commutator 253. Conductor 216 goes from terminal 243 of switch 234 to the annular bronze disc 298 of commutator 253. Terminals 239 and 240 of switch 234 are connected together by conductor 241. Conductor 218 goes from terminal 242 to transformer 230 to terminal 238 of A.C. voltmeter 232 and thence to the annular bronze disc 296 of commutator 253.

A male connector 247 and a female connector 248 of the four prong type, as shown in dotted lines, may be provided for disconnection purposes. The conductors 215, 216, 217 and 218 are preferably enclosed within the tubular arm, or boom, 96 of commutator means 85, the laterally extending arm 96 being supported on the post 38 by a suitable bracket 97 and carrying centralized, stationary discs such as 295 at the other end thereof. A casing, or commutator housing, 99 rotates with the spray gun arms 43 for transferring current thereto, the casing 99 including four resilient brushes 254, 255, 256 and 257.

The switch toggle of switch 234 and the control knob of transformer 230 protrude through control box 245 for easy access by the operator and the components designated by numerals 228 to 244 are contained within the box 245.

A junction box 260 is provided on the rotatable spray gun arms and includes four female four prong connectors 270, 271, 272 and 273 into which the four male connectors such as 274 of the control units may be inserted.

Conductor 216 goes from brush 257 to one side of the coil of a four pole relay 261, then to armatures 262, 263, 264 and 265 and the other side of the coil is connected to ground conductor 217. When manual circuit is closed by the operator at switch 234, the relay 261 attracts armatures 262, 263, 264 and 265 against contacts 266, 267, 268 and 269. The contacts 266, 267, 268 and 269 are each connected by the four sub conductors 216 to one of the terminals of each female connector 270, 271, 272 and 273. The remaining terminals of the connectors 270, 271, 272 and 273 are connected by the conductors 215, 217 and 218 to their respective annular commutator rings 295, 296 and 297.

In operation, the operator places the switch 234 in the manual position to wash or test the spray guns 51. After this is accomplished, the switch 234 is placed in the automatic position and light intensity of lamps 60 is adjusted by transformer 230 to the desired voltmeter reading for the particular color to be sprayed. If desired, the control knob of transformer 230 can be turned to the high stop pin for an incoming voltage check. The A.C. voltmeter 232 is for a rapid voltage check and serves as a reference indicator for different colors only.

I claim:

1. A machine for coating material of irregular shape, said machine comprising an open mesh, non reflective conveyor for supporting and advancing said material along a path; rotating support means mounted at a spaced distance from said path, said support means including at least one spray gun describing a circular path and adapted to coat the material on said conveyor; a normally closed spray valve on each said spray gun and valve control means mounted on said rotating support means angularly in advance of each said spray gun, each said valve control means including a light source directing a divergent beam through said open mesh conveyor, and adapted to illuminate a predetermined, minimum, critical area of the material on said conveyor, a light sensitive device

energized by light reflection from the material on said conveyor which intercepts said divergent light beam, a tubular hood of predetermined length on said light sensitive device for controlling the intensity of said reflected light and electric means, actuated by energization of said light sensitive device, for opening the valve of each said spray gun in accordance with a predetermined intensity of reflected light.

2. A combination as specified in claim 1 wherein said electric means comprises a main circuit including a source of electric energy, a spring closed solenoid adapted to open said spray gun valve when energized and a photo relay actuated by said light sensitive device, and holding circuit means, including a potentiometer for maintaining the actuation of said spray gun under the control of said potentiometer.

3. A combination as specified in claim 1 wherein said light source includes a tubular shield in advance thereof which encircles a substantial dead air space for shielding said light source from spray mist during rotation of said spray guns.

4. A combination as specified in claim 1 wherein said tubular hood is telescopable and includes means for adjusting the overall length thereof for controlling the intensity of reflected light reaching the said device.

5. Apparatus for spraying flat sheets of non-symmetrical outline supported on a continuously moving, open mesh non-reflective conveyor, said apparatus comprising a plurality of rotating spray guns mounted above the path of said conveyor for spraying downwardly on each individual and successive sheet carried thereunder; an electrically actuated spray valve on each said spray gun for activating and deactivating the spray therefrom, and photo electric valve control means mounted to rotate with, but at a spaced angular distance in advance of each said spray gun, each said valve control means including a light sensitive device with a tubular hood of predetermined length and a light source with a divergent beam, both on the same side of said conveyor, said light sensitive device being responsive to a predetermined intensity of light reflected from a predetermined area within the outline of each said sheet to energize and de-energize the valve of said spray gun.

6. A machine for coating flat work of irregular outline, said machine comprising a non reflective open mesh conveyor for supporting and advancing said flat work along a horizontal path, a plurality of angularly spaced spray guns continuously rotating above said horizontal path, each adapted to spray successive annular zones of said conveyor, a plurality of photo electric spray control means, each operably connected to, one of said spray guns and rotatable therewith and tubular hood means, of predetermined length, mounted on said photo electric spray control means for controlling the activation of each spray gun individually and successively in accordance with the intensity of light reflected from predetermined minimum areas within the outline of work occupying the annular zone of said conveyor to be sprayed by said gun.

7. A machine as specified in claim 6 wherein said photo electric spray control means includes a cadmium sulphide cell for sensing the intensity of light reflected from said work, a main spray gun circuit for electrically actuating each gun in response to a predetermined light intensity sensed by said cell and a holding circuit, including a potentiometer, for maintaining the actuation of said spray gun under the control of said potentiometer.

8. A machine for coating material of irregular shape, said machine comprising light pervious conveyor means; a plurality of spray guns rotating above said conveyor means for coating material carried thereon; light source means mounted in advance of each said spray gun for illuminating a relatively broad area of said material to a predetermined minimum intensity; light sensitive means mounted in advance of each said spray gun, including an

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elongated tubular hood of predetermined length directed toward said illuminated area of said material, for sensing light reflected only at said predetermined minimum intensity from said material and electric, spray gun control means including said light sensitive device for actuating each spray gun individually and successively when a predetermined minimum area within the outline of said material is scanned by said light source.

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