Nov. 22, 1949 W. C. ANDREWS ET AL 2,488,519

AUTOMATIC SPRAYING MACHINE

Filed Nov. 20, 1945 2 Sheets-Sheet 1

Fig. 1.

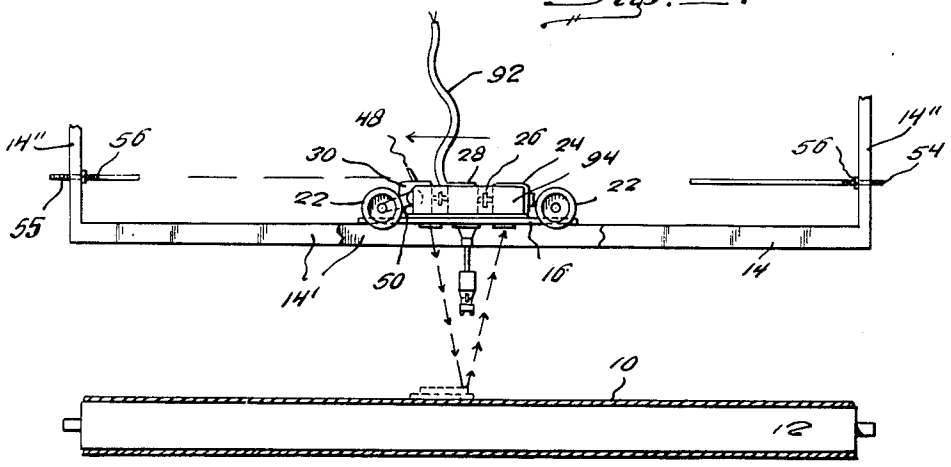
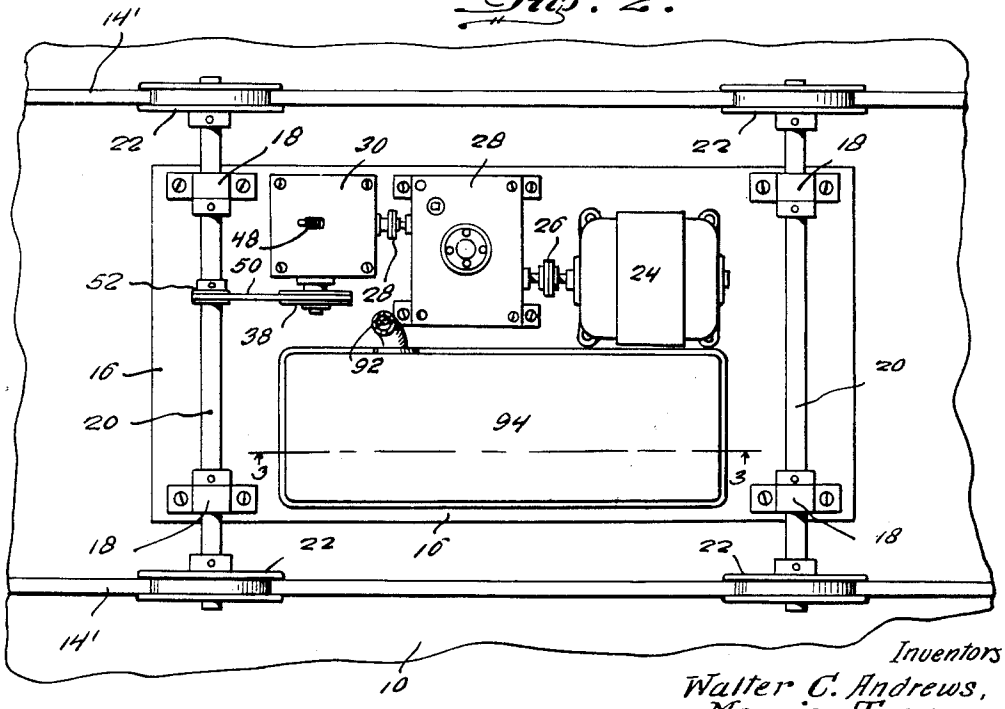



Fig. 2.




Inventors
Walter C. Andrews,
Morris Tyre,

By McMorrow, Berman & Davidson
Attorneys

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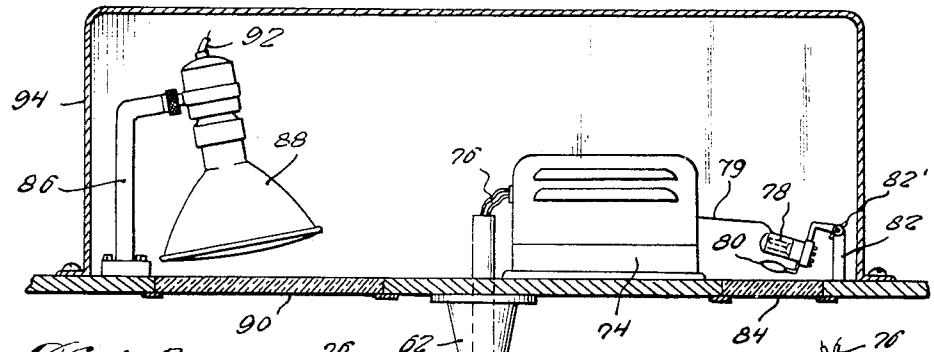



Fig. 3.

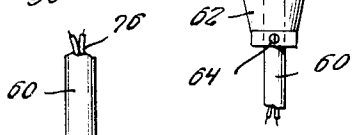






Fig. 4.

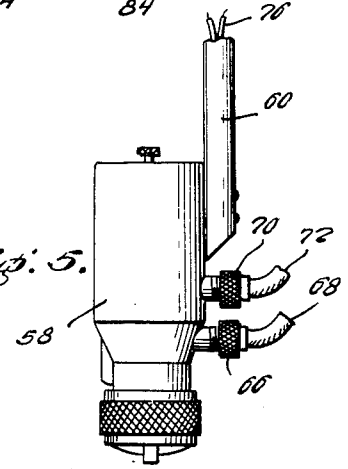
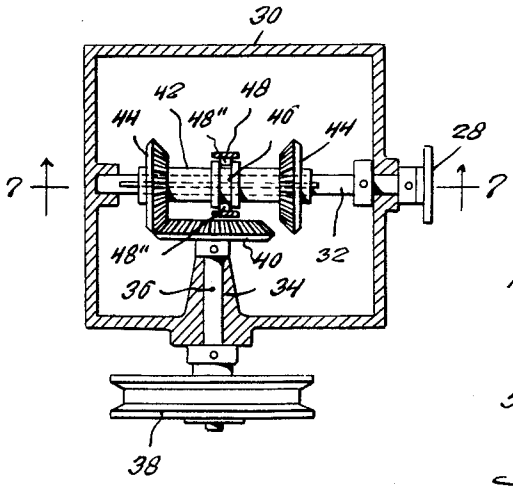



Fig. 5.

Fig. 6.



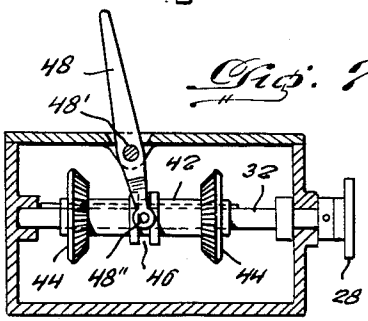




Fig. 7.

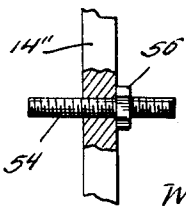



Fig. 8.

Inventors
Walter C. Andrews,
Morris Tyre,

By McMorrow, Berman & Davidson

Attorneys

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## AUTOMATIC SPRAYING MACHINE

Walter C. Andrews, Covina, and Morris Tyre, Los Angeles, Calif.

Application November 20, 1945, Serial No. 629,740

4 Claims. (Cl. 91—45)

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This invention appertains to an improvement in automatic spraying machines, and has for an object to provide one of a comparatively simple, inexpensive, and efficient design and construction, to spray paint or the like onto an object, especially a flat surface, which is movable by an endless conveyor or the like relatively to the spray head or nozzle of the machine; the spray head or nozzle, itself, being movable relatively to the object and the conveyor, in order to completely coat the exposed surface, or surfaces, of the object automatically, without need for any manual control or operation, other than that required to start and stop the machine.

Another object of the invention has to do with the provision of a spray machine of this kind, wherein an electrically operated spray gun is mounted on a motor driven dolly, which is, in turn, mounted on a trackway for reverse directional movements thereon relatively to and transversely of the aforesaid conveyor, a reverse gearing being interposed between the motor and the drive connection with the dolly to change the direction of travel of the latter along the trackway, the reverse gearing being automatically operable when the dolly reaches its opposite limits of travel.

A further object of the invention lies in the provision of a spray apparatus as hereinbefore characterized, wherein an electric eye and a light source are cooperatively mounted on the dolly to have a common focal point to scan the surface, or surfaces, to be coated, during the relative travel of the dolly and the aforesaid conveyor, and thereby control the operation of the spray gun; the electric eye acting to close a circuit on the spray gun following the movement of the object into focus and to open the circuit when the latter moves out of focus, thus assuring of full coverage of the exposed area of the object and, at the same time, preventing waste of the coating material, or paint.

With these and other objects and advantages of equal importance in view, the invention resides in the certain new and useful combination, construction, and arrangement of parts and circuits, as will be hereinafter more fully described, set forth in the appended claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a front elevation, partly in section, of a practical embodiment of the spray apparatus or machine, in accordance with our invention;

Figure 2 is an enlarged, fragmentary, top plan view;

Figure 3 is an enlarged, fragmentary, vertical, longitudinal section, taken through the line 3—3 on Figure 2, looking in the direction of the arrows;

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Figure 4 is a front elevation of the electrically operated spray gun, per se;

Figure 5 is an elevational side view of the spray gun, taken at right angles to the elevational view of Figure 4;

Figure 6 is an enlarged, horizontal section, taken through the housing of the reverse gearing interposed between the motor and the drive connection with the dolly;

Figure 7 is a vertical, longitudinal section, taken through the line 7—7 on Figure 6, looking in the direction of the arrows; and,

Figure 8 is an enlarged, fragmentary, elevational view, partly in section, of an end of the trackway, showing one of the adjustable abutments or pins for actuating the control lever of the reverse gearing.

Referring to the drawings, wherein like characters of reference denote corresponding parts in the several views, the invention, as it is exemplified therein, is generally comprised in a horizontally travelling work conveyor; a trackway mounted transversely of and above the conveyor; a carriage or dolly supported for reverse directional movements on the trackway; a power drive mechanism mounted on the carriage or dolly for its operation; an electrically operated spray gun mounted on the carriage or dolly; means, also mounted on the carriage or dolly, for automatically controlling the operation of the spray gun; and other means, mounted in part on the carriage or dolly and in part by the framework of the trackway, for automatically controlling the directional movements of the carriage or dolly along the trackway.

The work conveyor is preferably in the form of an endless belt 10, mounted on rollers 12 (one only being shown in Figure 1), to convey objects, e. g., sheet materials, to be coated, i. e., painted, beneath the trackway 14; the latter is of extremely simple construction and, as shown in Figures 1 and 2, is comprised of horizontally disposed, parallel rails 14', suitably supported in properly spaced relation above the conveyor 10; one of the rails at least is provided with vertically extending end portions 14'', substantially as shown.

The carriage or dolly is embodied in a substantially rectangular platform 16, having journals 18 adjacent the opposite ends of its upper side to support axles 20, upon which grooved wheels 22 are keyed for rolling engagement with the rails 14' of the trackway 14. Secured on the platform

16 is an electric motor 24 which is coupled, at 26, to a reduction gearing 28 that, in turn, is coupled, at 28, to a reversing gearing 30. As best shown in Figures 6 and 7, the reversing gearing is housed within a casing having a shaft 32 journalled in its end walls, with one end of the shaft extending outwardly for coupling to the power take-off shaft of the reduction gearing 28. Opening through the inner side wall of the reversing gearing casing, is a bearing 34 to support a power take-off shaft 36, disposed at right angles to the shaft 32, which shaft 36 carries a pulley 38 on its outer end and a bevel gear 40 on its inner end. Splined on the shaft 32 is a sleeve 42, having a pair of opposed bevel gears 44 mounted on its ends. Formed centrally on the sleeve 42 is a channel 46 to receive the forked inner end of an actuating lever 48, the outer end of which projects from the top wall of the casing 30 for its operation to shift the sleeve 42 in opposite directions on the shaft 32 to move the bevel gears 44 alternately into and out of mesh with the fixed bevel gear 40. The pulley 38 is connected by an endless belt 50 to a pulley 52, keyed on one of the axles 20, thus applying the power of the motor 24 to the carriage or dolly for its reversed directional movements along the trackway 14, at a proper speed as determined by the gearing and pulley ratio. The lever 48 is pivoted, as at 48', in ears formed at the opposite longer sides of a slot in the top wall of the gear casing 30, and carries lugs 48'' on the inner sides of the arms of its inner forked end in engagement with the channel 46, on the sleeve 42, substantially as is shown in Figures 6 and 7.

For the purpose of reversing the direction of travel of the carriage or dolly, abutments 54 and 55 in the form of adjustable pins are provided and are mounted in the vertical members 14'', of the trackway 14, in the path of movement of the lever 48, so as to strike the outer end of the latter at the end of each movement of the carriage or dolly in opposite directions on the trackway; the lever, when struck, acting to shift the sleeve 42 and the bevel gears 44 relatively to the gear 40, causing the latter to rotate the take-off shaft 36 and the pulley 38, together with the pulley 52 and the axle 20 on which it is mounted, alternately in opposite directions, with the result that the carriage or dolly is positively driven likewise and at a uniform speed. The abutment pins 54 and 55 are screw threaded through the parts 14'' and each carries a nut 56 to secure them in adjusted positions, substantially as shown in Figures 1 and 8.

A conventional form of electromagnetically operated spray head or gun 58 is carried on the lower end of a length of metal tube 60, depending through an opening, formed in the platform 16, and a substantially conical support 62, is secured on the under side of the latter; a set screw 64 is carried by the support to permit of vertical adjustment of the tube in setting the spray head or gun 58, at a selected spraying distance relatively to the work, supported on the conveyor 10. As best shown in Figures 4 and 5, the spray head or gun 58 is provided with a liquid inlet connection 66 for the coating material or paint and a second inlet connection 70 for a fluid pressure supply, the connections 66 and 70 being adapted for attachment to lengths of flexible hose 68 and 72, respectively, lead to sources of supply.

Mounted on the platform 16, adjacent the upper end of the supporting tube 60 for the spray head or gun 58, is an amplifier 74, having proper electrical connections 76, from its power output side, leading to the operating solenoid 77 of the spray head or gun, and other proper electrical connections 79 leading to a photo-electric cell 78, also mounted on the platform and at one side of the amplifier and, consequently, at one side of the spray head or gun. The photo-electric cell 78 is carried by a bracket 82 and is adjustable thereon by means of a thumb-screw 82' to vary its angular relation with respect to a focal point on the work, which point is located in line with the vertical axis of the spray head or gun 58. Supported from the bracket 82, immediately below the photo-electric cell 78, is a light beam concentrating lens 80, which, together with the cell 78 is positioned above a glass panel 84, mounted in an opening in the platform 16. Rising from the platform 16, at the opposite side of the amplifier 74 and beyond the upper end of the supporting tube 60, is a bracket 86 to support an electric lamp 88 above a second glass panel 90, mounted in an opening in the platform; the lamp being set at an angle that its beam is directed onto the aforesaid focal point of the photo-electric cell 78. The lamp 88 is provided with electrical connections 92, leading to a suitable source of current, which may be the same source from which the motor 24 is supplied.

In operation, with the conveyor 10 provided with a suitable electric drive (not shown), the work is positioned thereon with reference to the spray head or gun 58, in a manner that the spraying operation will be initiated at the leading edge or side of the work, so that, in the relative movement of the conveyor and the carriage or dolly, the entire exposed side and top surfaces of the object or sheet will be uniformly coated. As the work moves with the conveyor 10, the carriage or dolly moves crosswise thereof in reversed directions and continues so to do until the object or sheet is completely coated. With the starting motions of the conveyor 10 and the carriage or dolly, light from the lamp 88 is reflected from the point of its impact on the work to the cell 78 and the current generated by the latter passes to the amplifier 74 and, thence, to the solenoid control 77 of the spray head or gun 58, placing the latter in desired operative condition, and, thereafter, the spraying operation is entirely automatic, until the work is completely coated. With the completion of the spraying operation, the work passes from the focal point of the cell 78 and the lamp 88 and the reflection of the light beam from the latter ceases, rendering the cell 78 inoperative to supply further current to the amplifier 74 and, consequently, to the solenoid 77, which de-energizes and cuts off the supply of the coating material and the fluid pressure from the spray head or gun. The electric motor 24 is preferably of a variable speed type, or it will be operatively connected to the carriage or dolly through a variable speed drive system (not shown), in order that the rate in speed of the carriage or dolly may be readily adjusted to conform to the speed of the conveyor 10. In this manner, a greater flexibility in control of the thickness of the coating of the spray material on the object or sheet will be obtained. The amplifier-photo-electric cell system here employed is designed to have the sensitivity of the cell 78 to be greater when the spray head or gun 58 is not in operation and to decrease in sensitivity as soon as the latter is brought into play, in order that the head or gun will come into operation immediately upon its arrival over the leading edge or surface of the

object or work and will cutoff likewise promptly upon the passing of the latter out of the focal point of the cell **78** and the lamp **88** thereon. In this way, all wastage of the coating material is avoided, without leaving any of the edges of the object or sheet uncoated. In the movements of the carriage or dolly along the trackway **14**, when the limits thereof are reached in each direction, the gear shift lever **48** is engaged by the abutments or stop pins **54** and **55** and is moved to proper positions to alternately move the bevel gears **44** into and out of engagement with the bevel gear **40**. An explosion-proof casing **94** is provided to enclose the amplifier **74**, the photoelectric cell **78**, and the electric lamp **88**, and it may be extended to completely enclose the upper side of the platform **16**, if desired, to afford protection to the drive mechanism. A cable **92** leads from the casing **94** for connection with a suitable source of electric current supply (not shown) to provide the necessary energy to the motor **24** and the lamp **88**.

While in the foregoing we have described our invention in its preferred embodiment, it is to be understood that the words which we have used are words of description rather than of limitation, and that changes within the purview of the appended claims may be made, without departing from the true scope and spirit of our invention in its broader aspects.

What we claim is:

1. In an automatic machine for spraying work supported on a continuously moving conveyor, a trackway extending transversely across and spaced above the conveyor, a carriage mounted on said trackway for movement therealong and crosswise of the work as the work is moved beneath said carriage, a spray nozzle depending from said carriage for directing spray onto the flatwork beneath said carriage, supply means supplying spray fluid under pressure to said nozzle, and drive means for moving said carriage along said trackway in opposite directions whereby contiguous transversely extending areas of said flatwork are sprayed as said conveyor moves the work along beneath said carriage, said drive means comprising a motor means, means on said carriage operatively engaging said trackway and motor means, reversing mechanism operatively connecting said motor means with said trackway engaging means, and trip means at opposite ends of said trackway operatively engageable by a portion on said reversing mechanism for reversing the operation of said trackway engaging means as said carriage reaches one end of said trackway whereby said carriage is driven toward the opposite end of said trackway.

2. In an automatic machine for spraying work supported on a continuously moving conveyor, a trackway extending transversely across and spaced above the conveyor, a carriage mounted on said trackway for movement therealong and crosswise of the work as the work is moved beneath said carriage, a spray nozzle depending from said carriage for directing spray onto the flatwork beneath said carriage, supply means supplying spray fluid under pressure to said nozzle, and drive means for moving said carriage along said trackway in opposite directions whereby contiguous transversely extending areas of said flatwork are sprayed as said conveyor moves the work along beneath said carriage, said drive means comprising a motor means, means on said carriage operatively engaging said trackway and motor means, reversing mechanism operatively connecting said



motor means with said trackway engaging means, and trip means at opposite ends of said trackway operatively engageable by a portion on said reversing mechanism for reversing the operation of said trackway engaging means as said carriage reaches one end of said trackway whereby said carriage is driven toward the opposite end of said trackway, said drive means further comprising photo-electric starting and stopping means operatively connected with said motor means, said photo-electric control means comprising a light source and a photo-electric cell longitudinally aligned with and spaced from each other in the direction of movement of said conveyor and focused on a common spot, whereby light from said source is reflected by the work to said photoelectric cell and said motor means is started as the work is moved into the effective zone of said spray nozzle and whereby said motor means is stopped when light from said source is no longer reflected by the work to said photo-electric cell as the work is moved beyond the effective zone of the spray nozzle.

3. In an automatic machine for spraying work supported on a continuously moving conveyor, a trackway extending transversely across and spaced above the conveyor, a carriage mounted on said trackway for movement therealong and crosswise of the work as the work is moved beneath said carriage, a spray nozzle depending from said carriage for directly spray onto the flatwork beneath said carriage, supply means supplying spray fluid under pressure to said nozzle, and drive means for moving said carriage along said trackway in opposite directions whereby contiguous transversely extending areas of said flatwork are sprayed as said conveyor moves the work along beneath said carriage, said drive means comprising a motor means, means on said carriage operatively engaging said trackway and motor means, reversing mechanism operatively connecting said motor means with said trackway engaging means, and trip means at opposite ends of said trackway operatively engageable by a portion on said reversing mechanism for reversing the operation of said trackway engaging means as said carriage reaches one end of said trackway whereby said carriage is driven toward the opposite end of said trackway, said drive means further comprising photo-electric starting and stopping means operatively connected with said motor means, said photo-electric control means comprising a light source and a photo-electric cell longitudinally aligned with and spaced from each other in the direction of movement of said conveyor and focused on a common spot, whereby light from said source is reflected by the work to said photoelectric cell and said motor means is started as the work is moved into the effective zone of said spray nozzle and whereby said motor means is stopped when light from said source is no longer reflected by the work to said photoelectric cell as the work is moved beyond the effective zone of the spray nozzle, and control means operatively connected between said photoelectric starting and stopping means and said supply means whereby supply of spray fluid under pressure to said nozzle is started and stopped in concert with the starting and stopping of said motor means.

4. In an automatic machine for spraying work supported on a continuously moving conveyor, a trackway extending transversely across and spaced above the conveyor, a carriage mounted

on said trackway for movement therealong and crosswise of the work as the work is moved beneath said carriage, a spray nozzle depending from said carriage for directing spray onto the flatwork beneath said carriage, supply means supplying spray fluid under pressure to said nozzle, and drive means for moving said carriage along said trackway in opposite directions whereby contiguous transversely extending areas of said flatwork are sprayed as said conveyor moves the work along beneath said carriage, said drive means comprising a motor means, means on said carriage operatively engaging said trackway and motor means, reversing mechanism operatively connecting said motor means with said trackway engaging means, and trip means at opposite ends of said trackway operatively engageable by a portion on said reversing mechanism for reversing the operation of said trackway engaging means as said carriage reaches one end of said trackway whereby said carriage is driven toward the opposite end of said trackway, said drive means further comprising photo-electric starting and stopping means operatively connected with said motor means, said photo-electric control means comprising a light source and a photo-electric cell longitudinally aligned with and spaced from each other in the direction of movement of said conveyor and focused on a common spot, whereby



light from said source is reflected by the work to said photo-electric cell and said motor means is started as the work is moved into the effective zone of said spray nozzle and whereby said motor means is stopped when light from said source is no longer reflected by the work to said photo-electric cell as the work is moved beyond the effective zone of the spray nozzle, said drive means including said motor means, said reversing mechanism, and said photo-electric starting and stopping means being mounted on said carriage.

WALTER C. ANDREWS.
MORRIS TYRE.

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