

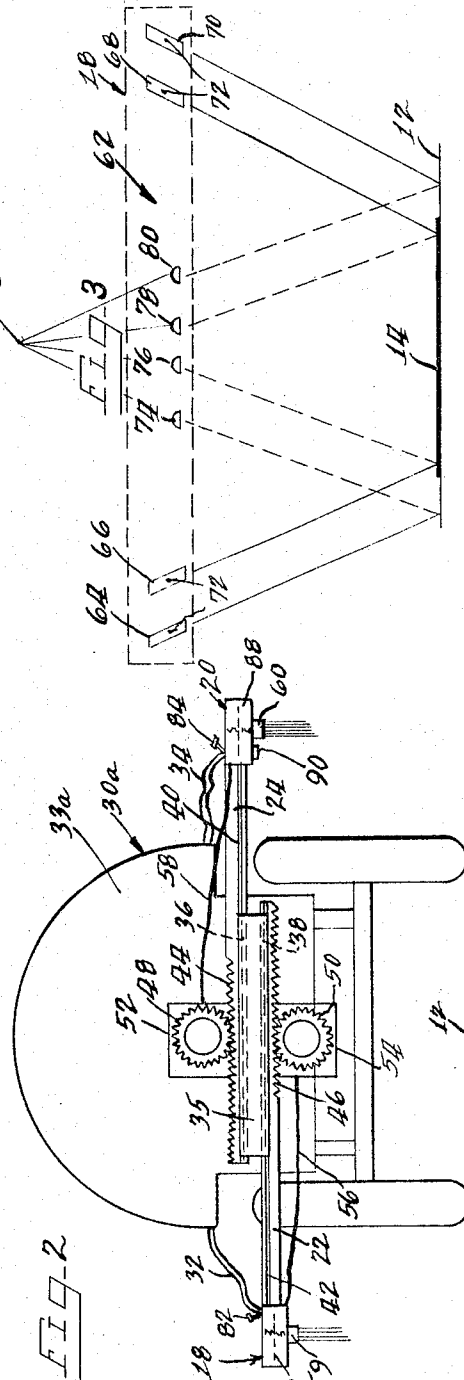
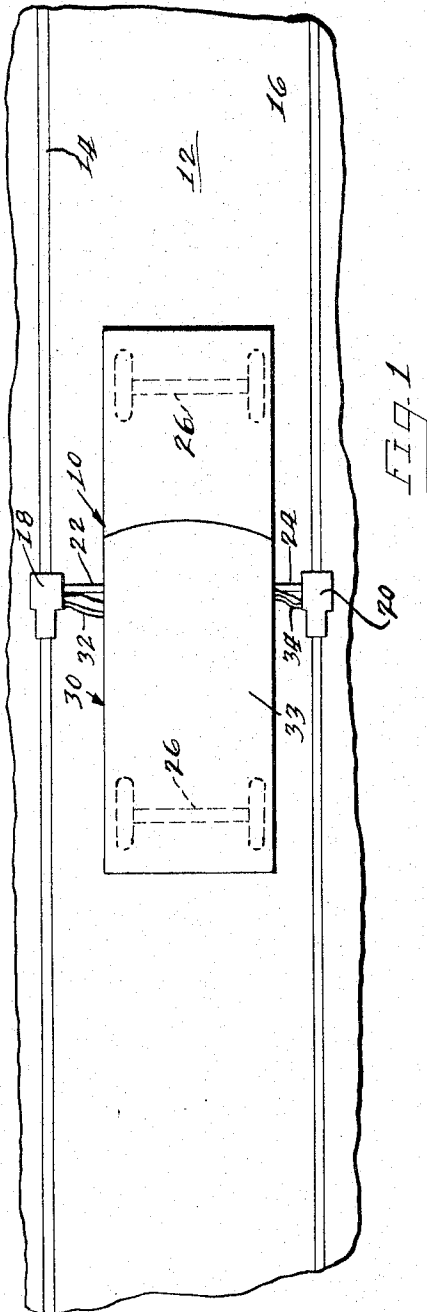
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HIGH SPEED AUTOMATED PAINTING DEVICE

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HIGH SPEED AUTOMATED PAINTING DEVICE

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1 Claim. (Cl. 118-4)

This invention relates to a self-adjusting system for applying paint or like materials to traffic control and guide lines on roadbeds, to highway guard rails, and the like, and more particularly to a high-speed automated painting device which obviates the need for painstaking manual control of paint application in the uses indicated as well as in other uses.

As is well known, the painting of center lines and other lines along highways, and the painting of guard rails and the like has been an exceptionally tedious procedure, requiring the expenditure of large amounts of money as well as being subject to human error in the determination of whether the newly applied coat of paint precisely followed the existing line. The present invention eliminates these difficulties and permits a high-speed application of paint, or other materials along the center lines, shoulder lines and other traffic control lines along the highway. Thus the system of invention applies paint automatically to center lines, and the like, and also permits painting of all lines required along the highway, whether at the edges, yellow no passing lines, intermittent center lines, or individual lane lines as required. The invention may also be used for sandblasting as well as spraying guard rails and other objects, or for other automated operations in addition to painting. In a suitable embodiment, a paint applicator, which may be of a spray, wheel or brush applicator type, is mounted on a head in combination with a scanner system which includes one or more signal transmitting and signal receiving means. Preferably, two or more transmitting elements are utilized in proximately spaced calibrated relationship to transmit an angularly deflected signal to correspondingly spaced receiver elements in the head. The head is mounted on a support which may be a rack, a worm gear or other adjustable means in supported relation to a tank truck or paint carrying vehicle so that when a signal indicates that deviation of the head from registration with an existing paint line or the like has occurred, automatic shifting of the head back into registration with the line will be produced. Where complementary pairs of transmitter and receptor elements are provided, a signal from the outermost transmitter and receptor pair may indicate a deviation from a line while an inner proximately located transmitter and receptor pair may indicate that the head is still substantially in alignment with the existing line. Thus feed-back or servomotor means operating the worm gear means will effect a slight adjustment to realign the head. Also, four sets of transmitter and receptor pairs may be used, two sets for each side of an existing white line or the like, so that if the line varies in width, the adjustment afforded will still maintain the applicator effectively centered over the line.

Accordingly, it is an object of the present invention to provide a high-speed, automated painting device which eliminates the laborious hand controlled painting operation for highways or the like heretofore required.

Another object of the invention is to provide a device and method as described which precisely applies paint or other flowable material along an existing line or surface despite variations or discontinuities in the line or surface.

Another object of the invention is to provide an apparatus as described which may be utilized in sand-blasting or in painting guide rails or the like on highways.

Another object of the invention is to provide a device as described which may be utilized in a wide range of

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painting applications or similar procedures in addition to those described.

Other objects and advantages of the invention will become apparent as the description proceeds in accordance with the drawings in which:

FIGURE 1 is a top plan view of a high-speed automated painting apparatus according to the present invention;

FIGURE 2 is an enlarged, rear elevational view generally of the structure shown in FIGURE 1; and

FIGURE 3 is a schematic representation of a scanning system utilized in a painting head as shown in FIGURES 1 and 2.

Referring now to the drawings, a high-speed automated painting apparatus is shown according to the present invention and designated by general reference numeral 10. The unit 10 is shown in operative relationship to a highway or the like 12 having existing traffic control lines 14 and 16 which are to be repainted by the apparatus 10. For this purpose, the apparatus 10 includes applicator and scanning heads 18 and 20 supported on laterally adjustable support bars 22 and 24 which may be mounted in a suitable guide and support structure intermediate the front and rear axles 26 and 28 of a tank truck 30 for carrying the paint or other material to be dispensed. The paint or other flowable material is supplied to the heads 18 and 20 by flexible conduits or hoses 32 and 34 in communication with the tank 33 of the truck 30, as controlled by suitable valve means.

A mounting and control system according to the invention is shown specifically in FIGURE 2, the applicator structure being mounted on the back of a truck 30a to dispense paint from a tank 33a in order that the system of the invention may be more readily envisioned. It will be appreciated, however, that mounting the applicators 18 and 20 intermediate of the axles 26 and 28 affords a desirable stability for the structure inasmuch as vertical movement will be minimized at such a location. Thus the support bars 22 and 24 may be guided in a horizontal bracket 35 defining axial recesses 36 and 38 receiving axial guide bosses or splines 40 and 42 in the respective bars 24 and 22. The bracket 35 may be secured to a truck frame or otherwise mounted in stable relationship to the vehicle, and it will, of course, be appreciated that other relationships in this respect may be encompassed within the scope of the invention.

In the order to control the lateral movement of the heads 18 and 20, the support bars 24 and 22 may each define longitudinally extending rack structures 44 and 46, in meshing relationship with pinion means 48 and 50 controlled by motor means 52 and 54 which in turn are controlled through the individual heads 20 and 18 respectively as by electrical conduits 58 and 56 which are effective to transmit signals from scanner means in the heads 18 and 20 as herein further described. Thus, the pinion means 48 and 50 will be rotated in one or another angular direction in accordance with the signals transmitted from the scanner means. Although the units 18 and 20 are shown as being relatively substantially elevated with respect to the surface 12, it will be appreciated that this relationship may be varied, and, in fact, it may be desirable to dispose the units 18 and 20 in proximate relation to the surface 12 or the like. Further in accordance with the invention, the units 18 and 20 are provided with applicators or sprayer heads 59 and 60 individually communicating with the hoses 32 and 34 and formed with orifices or the like (not shown) which direct the sprayed material vertically downwardly for a precisely defined line forming action to correspond with the initial or existing lines 14 and 16. It will, of course, be appreciated that wheel spray-

ing means or brush means may also be utilized in accordance with the invention.

It will further be appreciated that but a single head, similar to the heads 18 and 20, may be utilized in conjunction with motor means as described, and that the motor means may actuate heads such as the heads 18 and 20 by intermediate means other than the rack and pinion means described, such as pneumatic or hydraulic control means, drum and cable means or the like.

In accordance with the invention, each of the heads 18 and 20 includes signal transmission and receptor means as generally indicated at 62 in FIGURE 3 illustrated diagrammatically in combination with the head 18. The signal transmitting and receptor means 62 may have a construction such as is well understood by those skilled in the automated processing arts, and preferably includes a pair of proximately laterally spaced transmitter elements 64 and 66 and a corresponding pair of proximately laterally spaced transmitter elements 68 and 70 at a laterally opposite end of the head from the units 64 and 66. Desirably also, the units 64 and 66 and 68 and 70 are adjustably angled inwardly by screw means 72 or the like at an angle depending upon the height of the units 18 and 20 with respect to the surface 12 and upon the width of the existing line to be painted. Thus, the pairs 64 and 66 and 68 and 70 are spaced apart a distance which may be slightly greater than the width of the existing line 14 in the example shown. It will, of course, be appreciated that variations in the particular construction of the device will be encompassed within the scope of the invention in this respect.

Also in accordance with the invention, complementary pairs of receptor units 74, 76 and 78, 80 are mounted in the unit 18 intermediate the transmitter elements, with the pairs 74 and 76 preferably being spaced correspondingly to the elements 64 and 66 and the units 78 and 80 being correspondingly spaced to the elements 68 and 70. It will thus be seen that to each transmitter element there corresponds a receptor unit or element with two sets of transmitter and receptor elements being provided for each side of the line.

The inner transmitter elements 66 and 68 are preferably constructed to direct a light beam or the like onto the existing line such as the line 14, and the outer elements 64 and 70 are constructed to direct a preferably parallel light beam or the like outside of the line when the device is accurately centered. The spacing between the incidence of the beams from the elements 64 and 70 with the surface 12 and the outer edges of the line such as line 14 is relatively small so that when the unit such as the unit 18 directing paint onto the existing line 14 is inadvertently carried laterally to one side or another for a slight extent, one of the other elements 64 or 70 transmits a signal to the corresponding receptor 74 or 80 indicating that a deviation from precise registration of the unit 18 with the line has occurred. Likewise, such inadvertent movement of the head relative to the existing line will cause one of the transmitting units 66 and 68 to transmit a signal to the corresponding receptor 76 and 78 indicating that the head is no longer centered properly, by a reflected light intensity which is different than that from the existing line 14. In other words, the receptors 74 and 80 will be calibrated to remain inoperative when a reflected beam is transmitted thereto corresponding to the surface adjacent the existing white line, and to actuate a servomotor such as the motor 54 in one direction or another as required when the reflected intensity corresponds to the intensity or color generally provided from the existing line. The receptors 76 and 78, on the other hand, are calibrated to remain inoperative during the period that the intensity or color of the reflected light corresponds to the effect produced by the existing white line, and to become operative to energize a servomotor such as the motor

54 when receiving a signal corresponding to the intensity from the surface 12.

The receptors may be either light-intensity or color responsive in accordance with the understanding of those skilled in the art, and may be constructed to meet the particular conditions produced by yellow traffic lines, white traffic lines, or colors along guard rails and the like.

In the latter connection, it will be appreciated that the heads may be disposed vertically to spray adjacent guard rails, with the reciprocal movement of the carrying elements such as the elements 22 and 24 being vertical to maintain registration with the spraying heads and the guard rails.

It will be appreciated that other transmitter-receptor relationships may be provided than those in the particular construction shown, as for example a single pair of transmitter-receptor sets may be used such as one of the sets 64-74, 66-76. However, the provision for two such sets for each head 18 and 20 accommodates variations in the width of an existing line in a desirable manner. Also, but a single transmitter and receptor set may be utilized, with a beam of relatively wide incidence, and with the receptor responsive to an intensity indicating substantial deviation from the existing line of the head such as the head 18.

The receptors 74-80 open and close appropriate electrical contacts in the motors 52 and 54, by way of the lines 56, 58 to afford a feed-back actuation of the gears 48 and 50 which will maintain the heads, and scanner units therein, over the existing painted line.

The spraying means or the like 59 and 60 are coordinated with the scanning structures described and valve means 82-84 may be utilized in conjunction with the conduits 22 and 24, as actuated by solenoid elements (not shown) controlled by the receptors 74-80, to terminate flow through the heads when the heads are substantially out of register with the existing line. Also, for painting intermittent lines, a plurality of scanners may be utilized in spaced relation along the longitudinal axis of vehicle an existing line so as to detect a greater lateral variance if the driver varies from the course. Again, the valves 82 and 84 may also be connected with speed indicating means to transmit a greater or lesser amount of paint to the surface to be painted in accordance with the speed of the vehicle 30 or 30a.

Likewise, additional scanning units spaced longitudinally from the control scanning units described may be provided to determine if an appropriate amount of paint is being applied to the surface, and to effect adjustment in the volume of paint being applied. To this end, the spraying mechanism may incorporate as many spraying heads or the like as required to cover painted areas at high speeds.

It may also be noted that although the location of the support bars 22 and 24 midway between the axles of the propelling vehicle and in parallel thereto, will maintain a substantially level ride, if the elevation of the spraying heads is varied substantially due to high-speed conditions or other variables, the heads may be mounted on gyroscopes 86 and 88 wherein the wheels are disposed parallel to the surface of the road, the gyroscopes being spring mounted and the spray heads 59 and 60 being secured to trunnions or support elements therefor to maintain the desired elevation in spite of road dips or pitching of the propelling vehicle. Variations in this relationship may also be encompassed within the scope of the invention.

Where intermittent line spraying is required, in accordance with particular traffic patterns, and where multiple sprayers are utilized in accordance with the intended speed of the vehicle, each of the spray heads will in general require a scanner unit as described, permanently directed at the center of the line. The individual scanning unit for each of the spray heads will then turn the spray on and off as required and in the manner indicated. In

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this form, each spray-scanner unit effectively paints one line; and it will also be appreciated that a single truck can paint all of the lines, including edge lines, yellow no-passing lines and intermittent center lines. Also, individual lane lines may be thus painted if such occur and spray and support bars may be added to the vehicle 30 as required. Where instant drying paint is applied, such as may be utilized in conjunction with the invention by means of an ether solvent for the paint, the highway may be sealed off temporarily, since the completion of the job will be effected with great rapidity.

Thus only a short time is required for painting a highway to provide traffic lines as described, since one truck can paint all of the lines, including edge lines, yellow no-passing lines and intermittent center lines. Also, individual lane lines may be thus painted if such occur and spray and support bars may be added to the vehicle 30 as required. Where instant drying paint is applied, such as may be utilized in conjunction with the invention by means of an ether solvent for the paint, the highway may be sealed off temporarily, since the completion of the job will be effected with great rapidity.

Further in accordance with the invention, the nature of the lines sensed by the scanner units may be used in controlling the vehicle so that color sections or intermittent lines, or, for example, multiple lines may change the vehicle speed and control the applicators as well as the vehicle. For this purpose, the paint may be impregnated with magnetic particles to transmit information to a scanner unit, which may include a magnetic receiver, generally indicated by reference numeral 90 with respect to the unit 20. Thus, it will be appreciated that an automatic vehicle control and guidance system is encompassed within the scope of the invention. Further, the receiver 90 preferably includes radar means to detect the presence of obstacles, human or otherwise, in either direction of movement of the vehicle.

Although the scanner means of the invention have been described specifically in terms of optical sensing functions, the invention also encompasses any scanning means for determining the registrations of the applicator means with an existing surface or the like to be treated, which scanning means may include radar, sonar, or other electromagnetic wave systems, or otherwise.

Although the invention has been described with respect to painting of existing lines and guard rails, it may also be utilized for sandblasting and for spraying guide rails on highways, and may incorporate an automatic safety shut-off to prevent painting where the vehicle has strayed too far from the course or where lines are improperly positioned initially. Thus the device has application in a wide range of systems of the type indicated.

Although I have herein set forth and described my invention with respect to certain specific principles and details thereof, it will be understood by those skilled in the art that these may be varied without departing from the

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spirit and scope of the invention as set forth in the hereunto appended claim.

I claim as my invention:

Apparatus for applying materials to highway traffic control lines, guard rails, and the like, comprising a vehicle carrying a supply of material to be applied, applicator means for applying the material, means supporting the applicator means for movement relative to the vehicle, servomotor means for moving the applicator means relative to the vehicle, and scanner means controlling the servomotor means to maintain the applicator means in a desired relation to traffic control lines, guard rails, or the like including a pair of proximately spaced light transmitting elements and a pair of proximately spaced light receiving elements, each of said light transmitting elements being arranged to direct light from a surface to one of the light receiving elements and one of the light receiving elements being responsive to reflected light intensity corresponding to a surface to be treated to actuate the servomotor means and the other of the light transmitting elements being responsive to light intensity different from the intensity of light reflected from the surface to be treated to actuate the servomotor means, a second pair of light transmitting elements in proximately spaced relation and a second pair of light receiving elements in proximately spaced relation adjacent the first mentioned pair of light receiving elements, said pairs of light transmitting elements being relatively widely spaced to direct light beams convergingly so that the inner light beams from the inner light transmitting elements of said pairs of light transmitting elements will contact the surface to be treated and the outer light beams of said outer light transmitting elements of said pairs of light transmitting elements will contact a surface adjacent the surface to be treated when the applicator means is properly centered relative to the surface to be treated.

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