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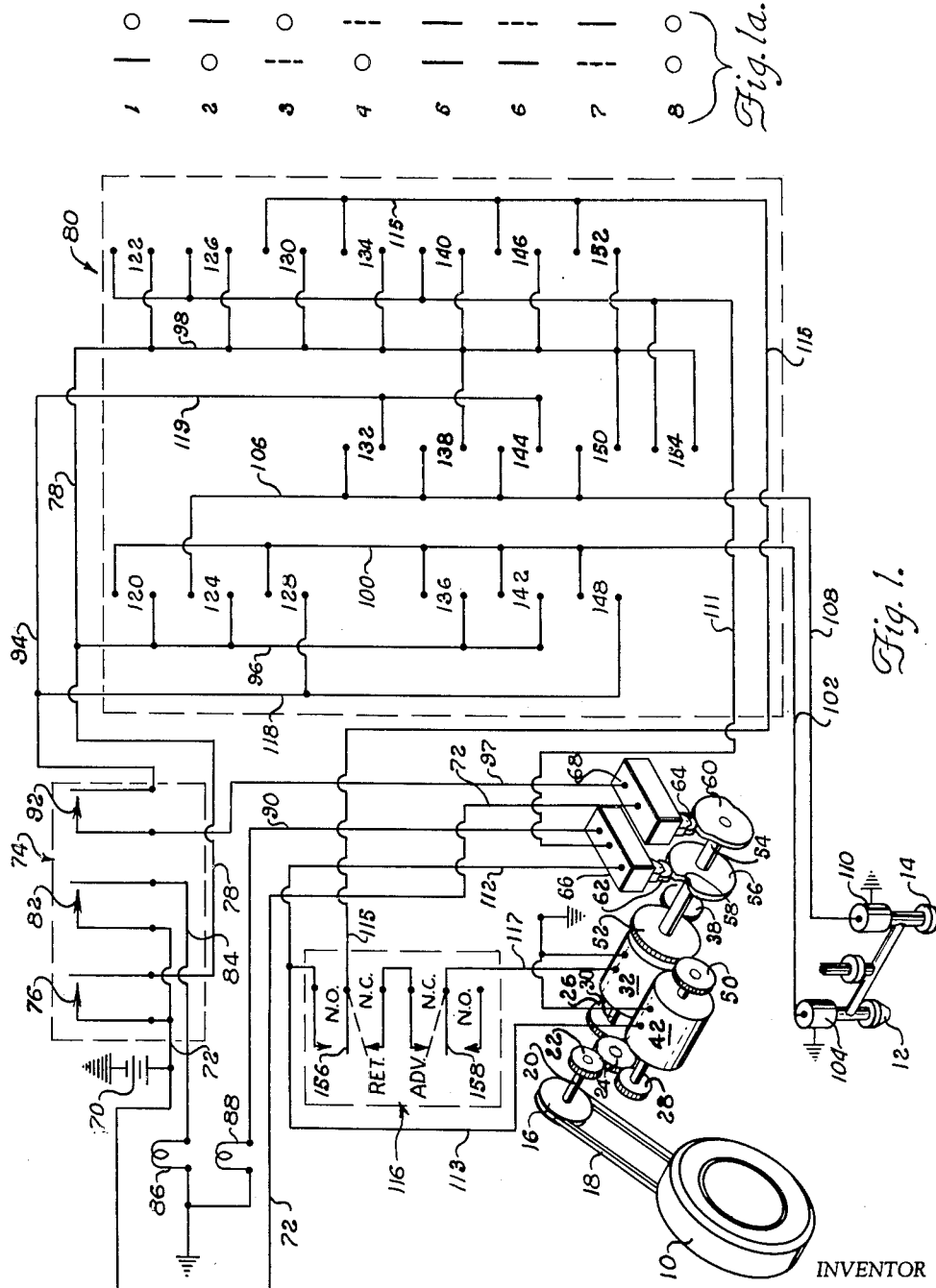
W. R. SHAFFER

2,988,285

ROAD STRIPING MACHINE

Filed July 27, 1959

2 Sheets-Sheet 1



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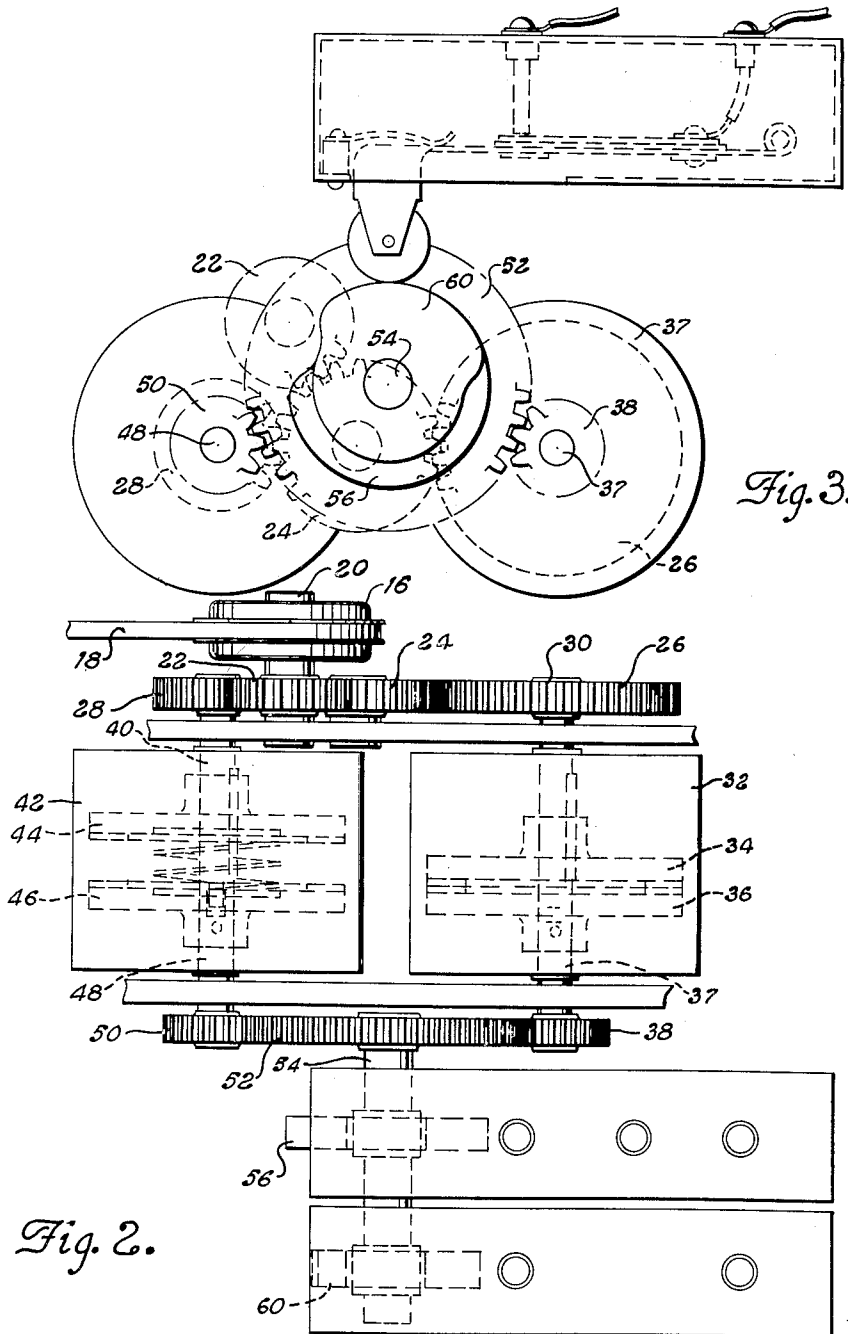


Fig. 2.

Fig. 3.

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ROAD STRIPING MACHINE

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14 Claims. (Cl. 239-106)

The present invention relates to highway line spraying apparatus. More particularly the present invention relates to highway line spraying apparatus having an electrical control for various line patterns, and includes means for automatically returning an intermittent line generating device to an initial position.

It has long been the practice to place markings or indicating lines along the center of a highway, or between the lanes of a multi-lane highway. In order to rapidly and economically apply the desired line pattern, it is necessary that equipment be provided that is capable of laying down or spraying a number of different line patterns. Prior to the instant invention, this equipment usually comprised a vehicle having a plurality of spray guns directed towards the roadway, together with the necessary paint supply containers, air compressors, and controls. The equipment known in the prior art, although generally comprising the noted parts, did not provide for economical, remote control of the sprayed pattern. Thus, some of the known prior art road marking equipment relied upon complicated mechanical connections and linkages to control the spray pattern. Other apparatus known heretofore did utilize an electrical system but this was of limited scope and adaptability.

It is therefore a general object of the present invention to provide a highway line spraying apparatus in which electrical circuits are utilized in order to obtain an easily operated remote control of the spray patterns, together with certain improvements that will answer all of the needs and requirements of modern highway line spraying. These needs and requirements will become apparent as the specification proceeds.

A more specific object of the present invention is to provide a highway line spraying apparatus in which multiple spray guns are remotely controlled by an easily manipulated, electrically operated system.

Another object of the present invention is to provide a highway line spraying apparatus which may be remotely and electrically controlled to spray various selected line patterns.

Still another object of the present invention is to provide a highway line spraying apparatus which includes means for automatic recycling of the intermittent line generating device after the completion of the spraying of an intermittent line.

Still another object of the present invention is to provide means for automatically retarding or advancing the striping pattern depending upon the desired requirements.

Still another object is to provide means for selectively controlling the operation of a pair of solenoid operated paint spraying guns for applying a continuous line, an intermittent line, or a combination of both.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a circuit diagram of the electrical system embodied in the present invention, the ground wheel for controlling the operation of the line striping paint generating guns being shown mechanically interconnected to the electromagnetic clutches that transfer the drive from the ground wheel to switch operating cams.

FIG. 1a is a diagrammatic illustration of the various line patterns produced by the present invention and their

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relation to the circuit controlling switches illustrated in FIG. 1.

FIG. 2 is a plan view of the driving gears, electromagnetic clutches and switches which control the operation of the electrical circuit embodied in the present invention; and

FIG. 3 is an elevational view of the apparatus shown in FIG. 2.

Referring now to the drawings and particularly FIG. 1, a ground wheel 10 is illustrated therein and it is understood that the ground wheel 10 is to be rotatably mounted on a vehicle for applying markings to a highway or road. The ground wheel 10 may be one of the drive wheels for the vehicle or may be separately mounted thereon. The vehicle on which the ground wheel 10 is rotatably mounted may be of any conventional style now in use for applying road striping, and accordingly may be of the self-propelled or trailer type used for this purpose. The road striping vehicle normally carries thereon containers for the paint binder and glass reflecting spheres, a compressor, an internal combustion engine, paint guns and sphere dispensers. The paint guns are diametrically illustrated in FIG. 1 at 12 and 14 and it is understood that they will communicate in the usual fashion with the air compressor and paint binder container through suitable conduits.

The line striping apparatus embodied herein is adapted to apply a continuous or interrupted line and since the two paint guns 12, 14 are utilized, variations of the interrupted and continuous line are adapted to be applied, these variations being illustrated in FIG. 1a.

In order to control the operation of the paint guns 12, 14 an electrical circuit shown in FIG. 1 is employed, the electrical circuit being adapted to automatically control the paint guns to effect the desired striping operations.

Since the striping operation is dependent on the travel of the striping vehicle, a direct drive is provided from the ground wheel 10 to the paint gun control means. The direct drive includes a drive pulley 16 that is driven by the ground wheel 10 through a belt 18, the shaft of the ground wheel 10 also including a pulley (not shown) that operatively engages the belt 18. As shown in FIGS. 2 and 3, the drive pulley 16 is mounted for rotation on a stub shaft 20 which also has a gear 22 mounted on the other end thereof. Operatively engaging the gear 22 is an idler gear 24, the idler gear 24 in turn engaging a relatively large gear 26 and a relatively small gear 28. The ratio of the gear 26 to 28 is 2:1 and accordingly the gear 28 is driven twice as fast as the gear 26. The gear 26 is mounted on an input shaft 30 that extends into the housing of an electromagnetic clutch 32 and is secured to an axially movable clutch disc 34, the clutch disc 34 and its mating disc 36 being shown in FIG. 2 in dotted lines in the closed or engaging position thereof. An output shaft 37 operatively engages the disc 36 and has a gear 38 secured to the outer end thereof. The gear 28 is similarly mounted on an input shaft 40 that extends into the housing of an electromagnetic clutch 42. Secured to the input shaft 40 is an axially movable clutch disc 44 that is shown in the unengaged position with respect to its mating disc 46. An output shaft 48 operatively engages the disc 46 and has a gear 50 secured to the outer end thereof. Although the electrical connections to the electromagnetic clutches 32 and 42 are not shown in FIGS. 2 and 3, it is understood that the clutches are conventional in design and are adapted to effect a driving connection through shafts 30, 37 and 40, 48 upon energization thereof.

Operatively engaging the gears 38 and 50 is a gear 52 that is mounted for rotation on a cam shaft 54. Thus it is seen that the clutches 32 and 42 define parallel drives for the cam shaft 54, and the cam shaft 54 will be ro-

tatably driven by the ground wheel 10 through either clutch 32 or 42 depending upon which clutch is energized.

Secured to the cam shaft 54 intermediate the ends thereof is a reset cam 56 that is formed with a recess 58 in the periphery thereof. Mounted on the outer end of the cam shaft 54 for rotation therewith is a skip cam 60 that is defined by two parallel engaging plates, the parallel plates determining the percentage of operating surface of the cam and the manner in which it may be varied. The skip cam 60 may also be rotated relative to the cam shaft 54 so that the high and low portions of the cam contour may be positioned relative to the reset cam 56. It is seen that the plates of the skip cam 60 may be positioned in any desired manner and that the beginning of the skip line cycle defined by the cam contour may be located relative to the recess 58 formed in the reset cam to enable the skip line cycle to always begin at the same relative position. Engaging the cams 56 and 60 and responsive to the rotation thereof are followers 62 and 64, respectively, which are formed as part of a reset switch 66 and a cam switch 68, respectively. The operation of switches 66, 68 will be described in more detail hereinafter with respect to their relation in the electrical circuit employed for controlling the operation of the paint guns 12 and 14.

Referring now to FIG. 1, the electrical circuit for controlling the operation of the paint guns 12, 14 is illustrated and includes a power source, such as a battery 70, that may be the battery of the vehicle on which the stripping equipment is mounted. The battery 70 is connected to ground and also to a conductor 72 that is connected with a main switch indicated at 74 of the three pole single throw type.

One set of contacts 76 of the switch 74 connects the conductor 72 with the conductor 78 that in turn is connected with a multi-station switch indicated at 80, the conductor 78 forming a part of the power feed for the circuit. The conductor 72 is also connected to one side of the cam switch 68 as will be described in more detail hereinafter. A second pair of contacts 82 connects the conductor 72 with a conductor 84 that is connected to ground through an indicating light 86. The light 86 is conveniently mounted on the same panel as the multi-station switch 80 and serves to indicate when voltage has been applied to the switch 80 and is available to operate the unit.

A second indicating light 88 is connected in series with the reset switch 66 through a conductor 90. The light 88 serves to indicate a complete circuit through the reset switch 66 and thus indicates when the skipline unit is ready to operate, as will be described hereinafter. A third pair of contacts 92 connects the cam switch 68 to a conductor 94, the conductor 94 forming a part of the circuit for supplying skip power during the skip cycle as will be described hereinafter.

The multi-station switch 80 has eight separate operators, and each of these operators controls either two or three sets of contacts as will be apparent hereinafter. The conductor 78 is connected with conductors 96 and 98 of the switch 80. A conductor 100 in the switch 80 is connected with a conductor 102 which in turn is operatively connected to a valve operating solenoid 104 mounted on the spray gun 12. As shown in FIG. 1, the solenoid 104 is connected to ground and controls the operation of the left spray gun 12, the conductors 100, 102 thus constituting a left spray gun operating circuit. A conductor 106 is also included in the switch 80 and is connected to a conductor 108. The conductor 108 is operatively connected to a valve operating solenoid 110 mounted on the spray gun 14, the solenoid 110 connected to ground and controlling the operation of the right spray gun 14.

Formed as part of the circuit in switch 80 is a conductor 111 that is adapted to be operatively connected to

the conductor 98 by selected operators. When only a solid line is to be applied or the unit is to be located in the off position (pattern No. 8) the conductor 111 completes the circuit to the reset switch 66, conductors 112 and 113 and clutch 42. When only a skip line is to be applied, a conductor 115 in the switch 80 is adapted to be connected to the conductor 98 through selected operators and is thus connected to the clutch 32 through a double pole double throw switch 116 and a conductor 117.

The circuit for controlling the skip marking operations includes conductors 118 and 119 connected to the conductor 94. As described hereinabove, the power for the skip marking operation is supplied by the battery 70 through conductor 72, skip switch 68, conductor 97, contacts 92 and conductor 94. The conductors 100 and 106 are adapted to be operatively connected to the conductors 118 and 119 for predetermined marking operations, as will be described, and thus supply the power for the marking operation to the spray gun solenoids 104, 110. As will be more clearly described, the cams 56 and 60 are adapted to actuate the switches 66 and 68 which break or complete a circuit for carrying out a predetermined marking operation.

Referring again to the multi-station power switch 80, switches 120 and 122 are connected for movement together and are moved by a common operator or key. It is seen that closing of the switch 120 will connect conductor 96 with conductor 100 and that closing of the switch 122 will connect conductor 98 with conductor 111. In a similar manner, switches 124 and 126 are connected for movement together as are switches 128 and 130 and switches 132 and 134. As shown in patterns Nos. 1-4 in FIG. 1a, the aforesaid switches are utilized for the marking of a single pattern wherein only one spray gun is utilized. In patterns indicated at Nos. 5-7 in FIG. 1a, a double marking is applied and thus it is necessary to control both spray guns. For this purpose an additional switch in the control circuit is necessary and as illustrated in FIG. 1, switches 136, 138 and 140 are connected for movement together as are switches 142, 144 and 146 and switches 148, 150 and 152. Switch 154 in the multi-station switch 80 is utilized when it is desired to discontinue the marking operation as shown by pattern No. 8.

The circuit illustrated in FIG. 1 also provides for retarding or advancing the line pattern during the intermittent or skip line applying operation. For this purpose the double pole double throw switch 113 is provided. As illustrated, the switch 113 includes contacts 156 and 158 which are normally closed as indicated and thus completes the circuit to the skip clutch 32. In the advance position and in order to lengthen the skip lines, or spaces, the electrical circuit to conductor 117 and skip clutch 32 is broken and the rotation of the skip cam 60 stopped. This lengthens either the line or space, depending upon the position of the follower 64 with respect to the cam 60 and in effect advances the line in the direction of the vehicle. In the retard position, the circuit through the skip clutch 32 is interrupted and a new circuit is established through the conductor 113 and the retard clutch 42. Since the clutch 42 is rotated at twice the speed of the clutch 32, the speed of the skip cam is increased and this in effect retards the line position.

Operation

The input gears 26 and 28 are continuously rotated by the ground wheel 10 and, depending upon the line pattern requirements, either clutch 32 or 42 is energized by means of the electrical circuit.

The power for the circuit is supplied by actuating the switch 74 which closes contacts 76, 82 and 92. Assuming that a solid or continuous line is to be applied by the left spray gun 12, as indicated by pattern No. 1 in FIG. 1a, the operator depresses the button for switches 120,

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122. Power from the battery 70 is then supplied to the solenoid 104 through conductor 78, conductor 96, switch 120 and conductor 100. Power is also supplied from conductor 78 through switch 122, conductor 111, and reset switch 66. However, since the follower 62 is normally disposed in the recess 58, the circuit through the switch 66 is interrupted. If the follower 62 is not in the recess 58, the clutch 42 will be energized through conductors 112 and 113 to rotate shaft 54. However, as soon as the follower reaches the recess 58 the circuit will be interrupted in the switch 66 and the clutch 42 will be deenergized, the circuit to the light 88 then being complete to turn the light 88 on.

If a solid or continuous line is to be applied by the right spray gun 14, as indicated by pattern No. 2, switches 124, 126 are closed and power is then supplied to conductor 106 and the solenoid 110 through the conductors 78 and 96. The circuit through switch 126 and conductor 111 is open, as described above, in connection with pattern No. 1.

Assuming now that a double solid or continuous line is to be applied, as indicated by pattern No. 5 in FIG. 1a, the switches 136, 138 and 140 are simultaneously closed by a single operator and power is supplied to both of the spray gun solenoids 104 and 110 through switches 136 and 138 respectively, and conductors 96, 102 and 98, 108 respectively. The circuit through switch 140 and conductor 111 is open, as described above in connection with pattern No. 1.

If an interrupted or skip line is to be applied by the left gun, for example as illustrated by pattern No. 3 in FIG. 1a, switches 128 and 130 are closed. Power to the solenoid 104 is then supplied through conductor 72, skip switch 68, conductor 97, contact 92, conductor 94 and conductor 118, switch 128, conductor 100 and conductor 102. In order to drive the cam 60 to cause the switch 68 to intermittently break the circuit to the solenoid 104 and thus apply the skip line, the skip clutch 32 must be energized. Power to the clutch 32 is supplied through conductor 78, conductor 98, switch 130, conductor 115, normally closed contacts 156 and 158 of switch 116, and conductor 117. The clutch 32 is thus energized to cause the shaft 54 and cam 60 to be rotated, thereby interrupting the circuit through the switch 68 as determined by the contour of the cam 60. If it is desired to cause the right spray gun 14 to apply an interrupted or skip line, as indicated by pattern No. 4, the switches 132 and 134 are closed and the solenoid 110 is periodically energized by power supplied through the skip switch 68, contacts 92, conductors 94, 119, switch 132 and conductors 106, 108. The operation of the skip switch 68 is controlled by continuous rotation of the cam 60 as described above.

On occasion it is necessary to apply a solid line and a continuous line simultaneously, such as shown by pattern No. 6 in FIG. 1a. In this instance, switches 142, 144 and 146 are closed by the single operator. Since the left gun 12 is to apply the continuous line, continuous and uninterrupted power is supplied to the solenoid 104 through conductors 78 and 96, switch 142 and conductors 100 and 102. The skip power to solenoid 110 is supplied through conductor 72, switch 68, conductor 97, contacts 92, conductors 94 and 119, switch 144 and conductors 106 and 108. As described above in connection with patterns Nos. 3 and 4, the skip switch 68 is alternately opened and closed by rotation of the cam 60 that is driven by skip clutch 32, that in turn receives power through switch 146, conductor 115, switch 116 and conductor 117. If the opposite line pattern is to be applied, as indicated at pattern No. 7 in FIG. 1a, the switches 148, 150 and 152 are closed by their single actuator and the power to solenoids 104 and 110 is supplied as described above. Switch 152 closes the circuit to the skip clutch 32 for driving the cam 60.

During all operations when a solid line is being applied,

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such as indicated at patterns Nos. 1, 2 and 5, the reset clutch 42 is momentarily actuated to set the cam 60 at the point where the skip cycle begins. For example, in pattern No. 1, the left spray gun 12 is operated by energization of the solenoid 104. The circuit through switch 122, switch 66, conductors 112 and 113 energizes clutch 42 to quickly rotate the shaft 54. As soon as the follower 62 falls into the recess 58, the circuit through the reset switch 66 is broken thereby breaking the circuit through the reset clutch 42. At this point, the cam 60 is positioned so that it will begin the skip cycle whenever the skip clutch 32 is energized, for example when applying pattern No. 3.

As explained above, the skip line or space may be advanced or retarded during the application of a skip pattern by closing contacts 156 or 158 of switch 116 as indicated in FIG. 1.

It is also understood that three spray guns may be employed in the system using the identical circuit with the addition of circuit connections within switch 80 and line connections to the third spray gun solenoid. Air lines and paint lines will also be added and connected to the third spray gun to complete the unit.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. In a road striping machine, a plurality of spray guns, solenoid means for controlling the operation of said spray guns, an electrical circuit electrically connected to said solenoid means for controlling the operation thereof, said electrical circuit including a power supply, a multi-station switch connected to said power supply, a skip circuit including a skip switch responsive to movement of said machine and operable to cause said spray guns to spray an interrupted line through a predetermined skip cycle, a reset circuit including a reset switch for automatically resetting the skip cycle, said multi-station switch including a plurality of sets of contacts that are electrically connected to said spray guns and said skip and reset circuits, each set of contacts defining a predetermined striping pattern and controlling the operation of said electrical means to control the application of said pattern by said spray guns.

2. In a road striping machine, a ground wheel rotatably mounted on said machine, a plurality of spray guns mounted on said machine, an electrical circuit responsive to movement of said ground wheel for controlling the operation of said spray guns, electromagnetic clutch means electrically connected to said electrical circuit and adapted to be operatively connected to said ground wheel, cam means connected to said clutch means and responsive to the operation thereof, said electrical circuit including a power supply, a multi-station switch, a skip circuit and a reset circuit, said skip circuit including a switch responsive to movement of said cam means for intermittently controlling the operation of said guns, said reset circuit responsive to movement of said cam means for automatically resetting the cycle of said skip circuit, and said multi-station switch including a plurality of sets of contacts that are actuated to control the operation of said clutches for establishing or breaking driving connection through said ground wheel to said cam means, thereby controlling the operation of said spray gun.

3. In a road striping machine, a ground wheel, a skip clutch and a reset clutch having their input shafts operatively connected to said ground wheel, a skip cam and a reset cam connected to a drive shaft, said drive shaft being operatively connected in parallel relation with the output shafts of said reset and skip clutches, a skip switch having a follower operatively engaging said skip cam, a

reset switch having a follower operatively engaging said reset cam, an electrical circuit electrically connected to said skip and reset switches and said skip and reset clutches, a pair of spray guns mounted on said machine, each of said spray guns including a valve controlling solenoid for controlling the flow of striping material through said valve, said solenoids being responsive to operation of the reset and skip cams and reset and skip clutches to apply a predetermined striping pattern.

4. In a road striping machine as set forth in claim 3, said electrical circuit including a multi-station switch having a plurality of sets of contacts, each set of contacts controlling the electrical circuit for causing said spray guns to apply a predetermined pattern.

5. In a road striping machine, as set forth in claim 3, switch means for controlling the operation of said reset clutch and said skip clutch for causing said spraying pattern to be advanced or retarded depending upon the marking requirements.

6. In a road striping machine, as set forth in claim 3, said reset cam having a recess formed in the periphery for receiving the follower of said reset switch, the location of said recess being interrelated with the contour of said skip cam, so that when said reset switch follower is disposed in said recess, the skip cam is located at the beginning of the skip cycle.

7. In a road striping machine, a plurality of spray guns having valve operating solenoids, means responsive to movement of said striping machine for controlling the operation of said spray guns, said controlling means including driving means, electromagnetic clutch means adapted to be coupled to said driving means, and cam means including reset cam means operatively connected to said clutch means, an electrical circuit operatively connected to said clutch means and said solenoids, and switch means in said electrical circuit for selectively supplying power to said clutch means to couple said driving means to said cam means, whereby the said solenoids are selectively controlled to cause said spray guns to apply a predetermined pattern.

8. In a road striping machine as set forth in claim 7, said electrical circuit including a skip circuit responsive to rotation of said cam means for intermittently controlling the operation of said spray guns.

9. In a road striping machine as set forth in claim 8, a second switch electrically connected to said skip circuit and adapted to be actuated to cause the marking applied by said spray guns to be advanced or retarded depending upon the marking requirements.

10. In apparatus for marking a surface, right and left spray guns, right and left spray gun operating circuits, each including the solenoid of a solenoid operated spray gun control valve, a multi-station selector switch having said operating circuits connected therewith, a source of energy connected to said selector switch, circuit interrupter means comprising a cam shaft having a skip cam and reset cam thereon, a drive for said cam shaft including an electromagnetic skip clutch and an electromagnetic reset clutch operatively connected to a ground-engaging wheel and to said cam shaft, a skip cam circuit including a skip cam switch operated by said skip cam and connected to said source of energy and also to said selector switch, a reset cam circuit including a reset cam switch operated by said reset cam and connected to said selector switch and to said reset clutch, and an advance-retard circuit including a switch connected to said reset clutch and skip clutch and supplying power to either of said clutches for increasing or decreasing the skip or interrupted line during the application of a skip line.

11. In apparatus as set forth in claim 10, said selector switch including contacts for connecting said skip cam circuit with either or both of said spray gun operating circuits.

12. In apparatus as set forth in claim 10, said reset cam having a recess formed therein, said reset switch including a follower engaging said reset cam and adapted to be received by said recess, whereby the reset circuit is interrupted to stop the rotation of said cam shaft, said skip cam thereby being positioned at the beginning of the skip cycle.

13. In apparatus as set forth in claim 10, said reset and skip clutches being connected in parallel with respect to said ground wheel and cam shaft, whereby energization of either clutch effects a drive from said ground wheel to said cam shaft.

14. In apparatus as set forth in claim 13, said reset clutch being driven by a gear train having a 2:1 ratio with respect to the drive for said skip clutch, whereby said reset clutch rotates said cam shaft twice as fast as said skip clutch.

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Disclaimer

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