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[54] **PAINTING OF INTERRUPTED LINES ON ROAD SURFACES**

[75] Inventors: **Francis A. Moon**, Palos Verdes; **Robert G. Halliday**, Malibu, both of Calif.

[73] Assignee: **Unimasco, Inc.**, Gardena, Calif.

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[52] **U.S. Cl.** **239/150**

[51] **Int. Cl.** **B05b 1/28**

[58] **Field of Search** 239/150, 155, 156, 157

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Primary Examiner—Lloyd L. King

Attorney, Agent, or Firm—William P. Green

[57] **ABSTRACT**

Apparatus for painting an interrupted line on a road surface, including a digitizer for producing a series of pulses in accordance with movement of a motor vehicle along the road surface, and control means operable by the digitizer to actuate a paint spraying gun carried by the vehicle between spraying and nonspraying conditions in accordance with the number of pulses produced by the digitizer. Preferably, pulses can be added to or subtracted from the pulses produced by the digitizer at will in a manner advancing or retarding the time at which the paint sprayer is actuated between its two conditions.

22 Claims, 4 Drawing Figures

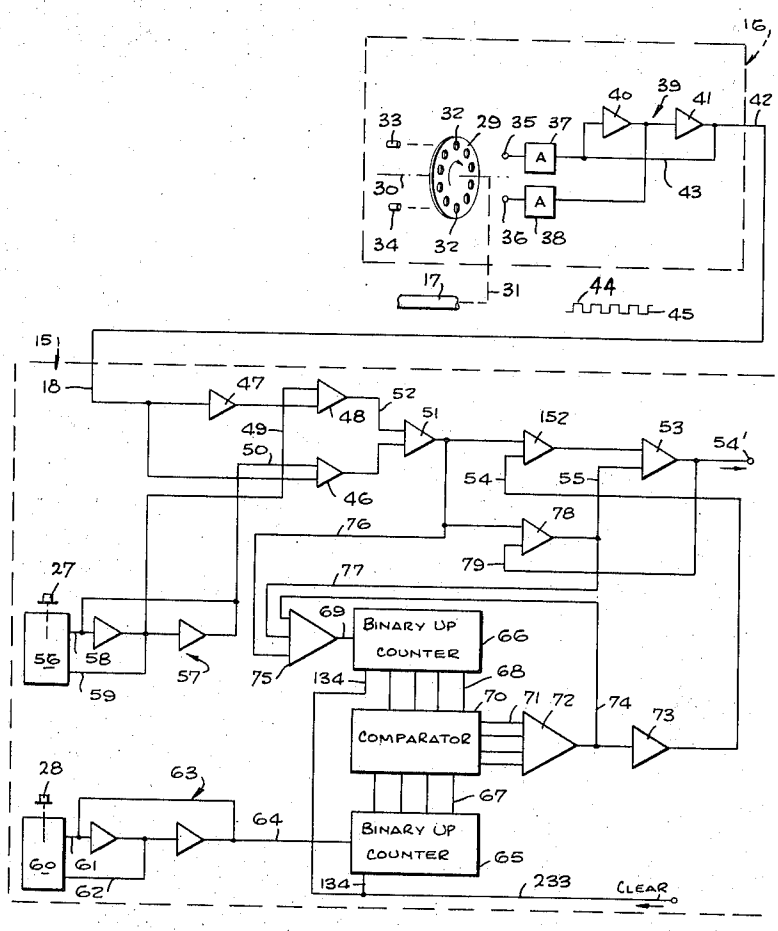


Fig. 1

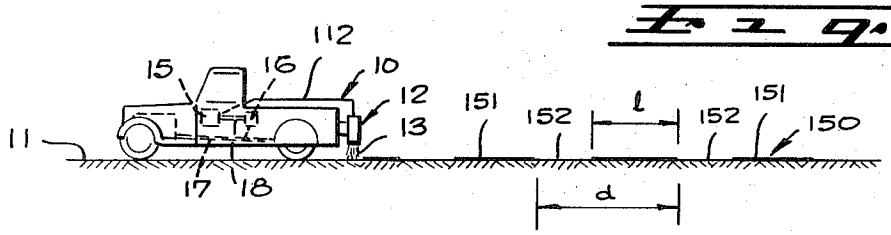


Fig. 2

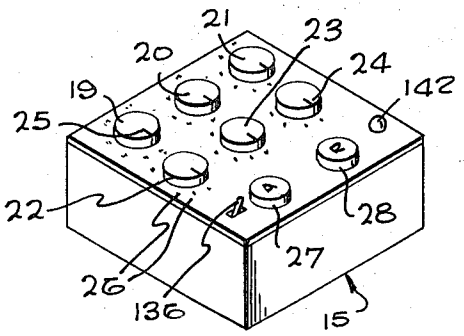
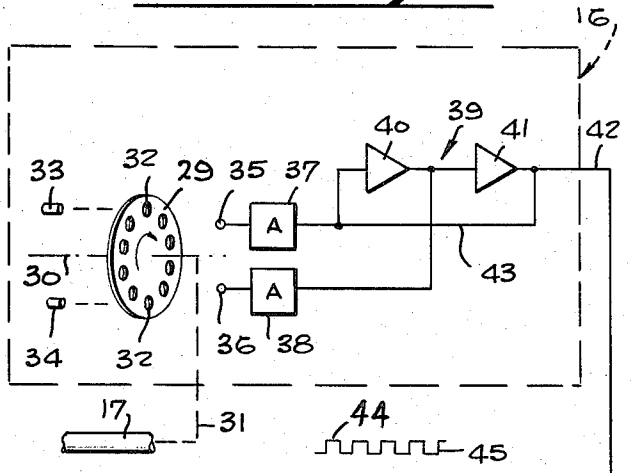


Fig. 3



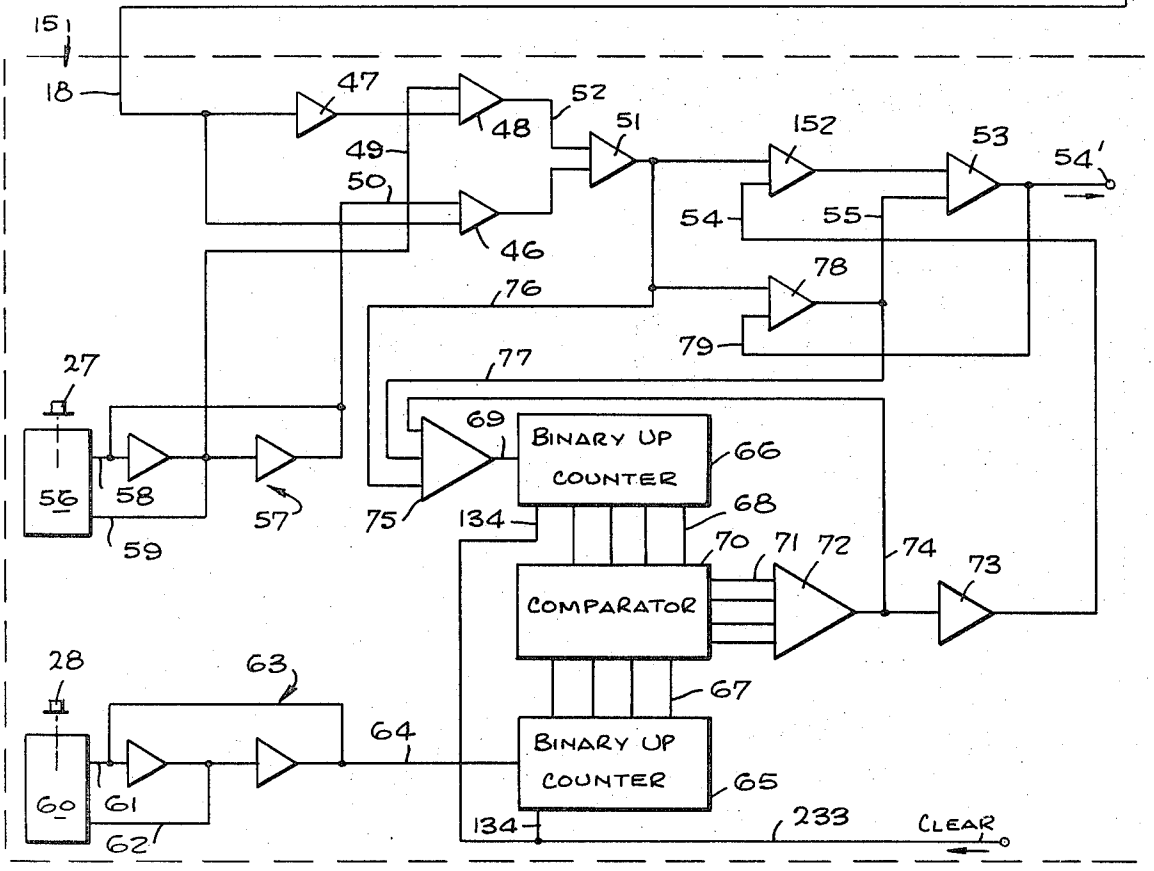
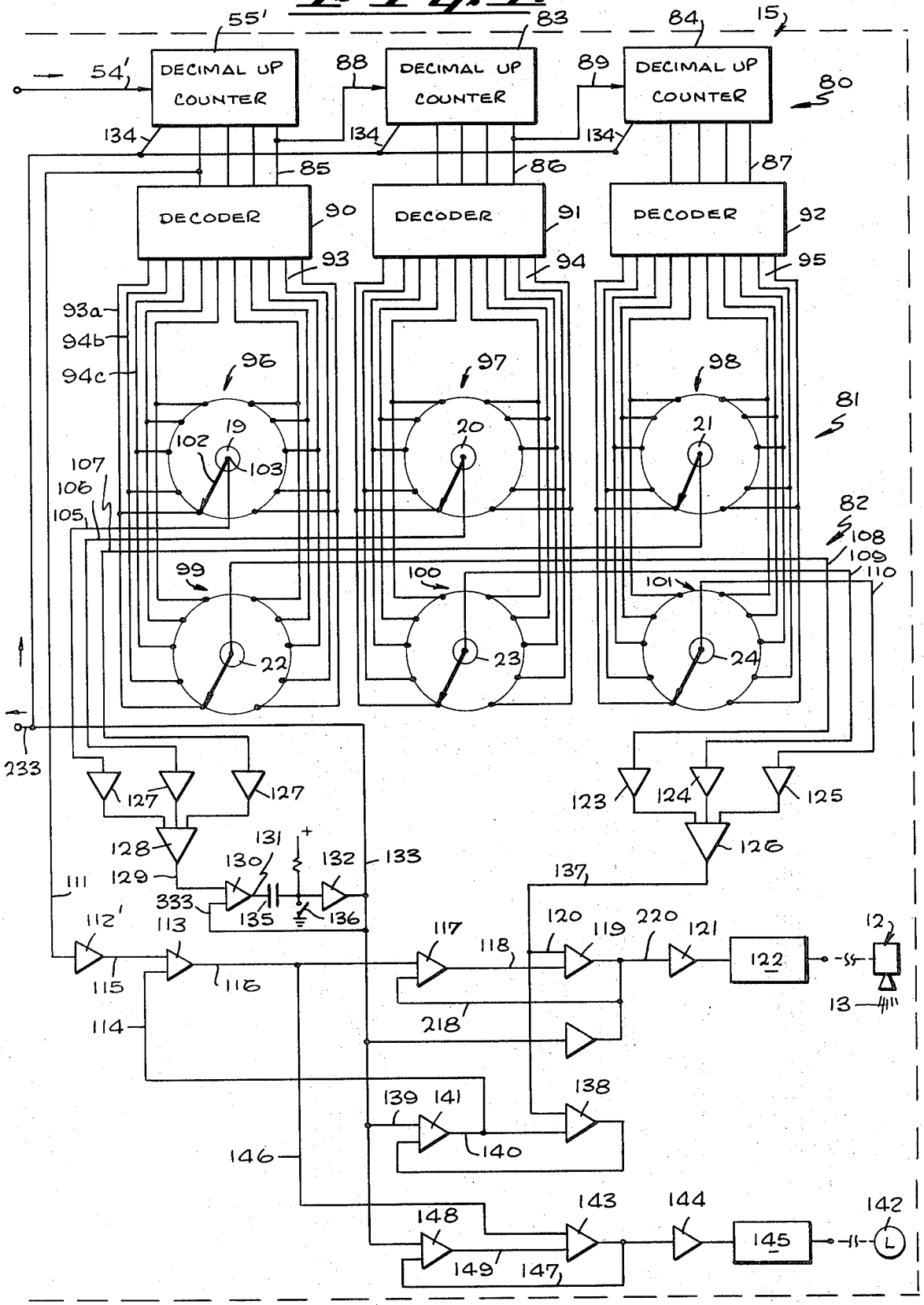


Fig. 4


55'
83
84
15
54'
DECIMAL UP COUNTER
88
89
80
134
85
86
87
DECODER
90
91
92
93
94
95
93a
94b
94c
96
97
98
81
19
20
21
102
103
107
106
105
82
108
109
110
99
100
101
22
23
24
233
127
123
124
125
126
128
131
130
132
133
129
111
333
135
136
112'
113
115
116
114
117
118
120
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220
121
122
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218
137
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148
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147
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PAINTING OF INTERRUPTED LINES ON ROAD SURFACES

BACKGROUND OF THE INVENTION

This invention relates to improved apparatus for painting stripes on road surfaces.

Road striping equipment has been devised in the past which includes a paint spraying gun carried by a motor vehicle and adapted to paint a stripe on a road surface as a vehicle moves therealong. The spraying equipment may include bead dispensing apparatus for depositing reflective beads on the paint in a manner rendering the stripe highly reflective and therefore very readily visible. Where an interrupted or broken line is desired, the spray gun may be intermittently turned on and off, to first paint for a short distance, then skip an area, then paint for another short distance, etc. Mechanical timers have been employed for thus turning the spray gun on and off, but these have been less reliable than would be desired in actual operation, have been relatively expensive to produce and maintain, and have not allowed for easy adjustment of the length of painted area and the length of 'skip' under varying painting conditions.

SUMMARY OF THE INVENTION

The present invention provides a new type of spray gun control which can inherently be more precise than prior equipment in measuring and automatically controlling the length of painted area and the length of 'skip' area in a broken line. Of great importance is the manner in which the present apparatus can be adapted to allow for an almost limitless variety of paint and skip area patterns, with easy and very rapid conversion of the apparatus to those different patterns by an extremely simple type of control actuable by the operator.

These results are achieved by employment of apparatus which includes means for producing a series of pulses at a rate corresponding to the rate of advancement of the vehicle over a road surface, and control means responsive to those pulses to actuate the paint sprayer between on and off conditions in accordance with the number of pulses produced. That is, the sprayer may first be turned on for a predetermined number of pulses, then turned off for another predetermined number of pulses, then be turned back on again for the first mentioned number of pulses, etc., to form the desired interrupted line. Suitable counter means may be employed for counting the pulses, in conjunction with variably settable selector switches or the like which can determine the pulse count at which the sprayer is shifted from one condition to another.

In many instances, it may be necessary or desirable, while the apparatus is in use and as the motor vehicle is being driven along a road surface, to advance or retard very slightly in a controlled manner the precise points at which the painting gun is turned on or off. This may be desirable, for example, in order to bring the spray pattern being laid down into exact correspondence with the pattern of a broken line already on the road surface. To achieve this result, the present apparatus may include means for adding extra pulses to the series of pulses as desired, or subtracting a predetermined number of pulses, to achieve proper advancement or delay of the spray gun actuation. Manually controlled switches accessible to the operator may supply these extra pulses, or effect subtraction of the pulses, while the apparatus is in operation.

BRIEF DESCRIPTION OF THE DRAWING

The above and other features and objects of the invention will be better understood from the following detailed description of the typical embodiment illustrated in the accompanying drawings, in which:

FIG. **1** is a somewhat schematic or diagrammatic side view of a truck carrying paint spraying apparatus embodying the invention;

FIG. **2** is a perspective representation of the control box of the FIG. **1** spraying apparatus;

FIG. **3** is a schematic representation of the digitizer of the device, and a portion of the control circuitry; and

FIG. **4** is a schematic representation of the remainder of the control circuitry within the main control box of the device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. **1**, I have represented at **10** a truck or other motor vehicle which is to be driven on the surface **11** of a road or street, and which carries at the back of the truck a conventional road striping paint sprayer **12** adapted to emit a downward spray **13** of paint onto surface **11**, to form a painted stripe of predetermined width on the road as the vehicle advances. Spray gun **12** may be of the type in which minute glass beads are dropped onto the upper surface of the painted stripe to adhere thereto and render the paint highly reflective. The spray gun is typically controlled electrically, by on-off signals received through an electrical conductor **112** leading rearwardly to the spray gun from a control box **15** located in the driver's compartment of the truck, at a location accessible for actuation and control by the driver or a passenger. Alternatively, the control box **15** may of course be located at any other point on the vehicle. A digitizer **16** is also carried by the vehicle and is driven by the main drive shaft **17** of the truck, or by any other portion of the drive train, and produces a series of electrical pulses in a line **18** leading to control box **15** at a rate corresponding to and therefore representing the rate of advancement of the truck.

The internal circuitry of the digitizer **16** is represented schematically in FIG. **3**. All of the remainder of the circuitry illustrated in FIG. **3** and in FIG. **4** may be contained within the control box **15**. This circuitry may all be solid state electronic circuitry, occupying a very small space while allowing for the below discussed very effective type of control of the spray gun **12**. Externally, the control box **15** may have a number of manually actuated control elements, including a first set of three rotary knobs **19, 20** and **21** adapted to be turned to different settings representing a predetermined pulse count at which an overall cycle of operation of the apparatus is to terminate. Similarly a second series of three rotary knobs **22, 23,** and **24** may be turned to settings representing a predetermined pulse count at which a painting portion of the cycle is to end. Each of these knobs **19, 20, 21, 22, 23,** and **24** may have an index marking **25** coacting with a circular series of decimal numbers **26,** reading in each case from zero through **9.**

The manual controls on box **15** may also include two manually depressible push buttons **27** and **28,** or other

manually actuated elements, for controlling the addition of extra pulses to, or the subtraction of pulses from, the pulse stream produced by digitizer **16.**

The preferred type of digitizer illustrated in FIG. **3** includes a rotary disc **29** which is mounted to turn about an axis **30,** and is driven about the axis at a rate corresponding to and proportional to the rate of advancement of truck **10** along the road surface **11.** That is, for each foot of advancement of the truck along the road surface, disc **29** turns through a predetermined number of revolutions about its axis **30.** This proportional rotation of the disc may be effected by means of a direct mechanical connection **31** which turns the disc in exact correspondence to the rate of rotation of drive shaft **17** extending from the truck engine to its rear wheels.

Disc **29** by its rotation controls the passage of light from two electric lamps **33** and **34** to a pair of photoelectric cells **35** and **36** respectively. For this purpose, the disc may be opaque to the light from lamps **33** and **34,** except at the locations of a series of circularly spaced apertures **32** which successively move into and out of the light paths between lamps **33** and **34** and the photoelectric cells. Preferably, the lamps, photoelectric cells, and openings are so positioned relative to one another that, as the disc turns, first one of the apertures **32** will pass light from the lamp **33** to photoelectric cell **35** for a short instant, following which that light will be blocked off while light is for a short instant passed from the second lamp **34** to the second photoelectric cell **36,** following which a next successive aperture passes light to cell **35,** with another aperture subsequently passing light to cell **36,** to thereby alternately energize the two cells in rapid succession. Outputs of the cells are fed through amplifiers **37** and **38** to a bistable flip-flop circuit **39,** including two inverter gates **40** and **41** interconnected in the antibounce type circuit shown in FIG. **3.** When the signal from the amplifier **37** is 'high,' the high input to gate **40** causes a low output from that gate, which in turn produces a high output from the entire flip-flop circuit in line **42.** When the output from amplifier **37** subsequently goes 'low,' and the output from amplifier **38** then goes high, the resulting high input to gate **41** causes a low output in line **42** and in the feed-back line **43** to the input side of gate **40.** Thus, each energization of photo-electric cell **35** commences a pulse **44** in line **42,** while each energization of photo-electric cell **36** ends the pulse, to produce the square wave pulse pattern represented at **45** in FIG. **3.**

At this stage, it may be noted that throughout the entire logical circuit illustrated in FIGS. **3** and **4,** all of the various gates shown in the circuit (represented as triangles) are of a type in which, regardless of whether the particular gate has only one input or more than one input, all inputs to the gate must be in their low condition in order to produce a 'high' in the output line from the gate. Unless all inputs are low, the output from the gate is itself low.

The series of pulses **44** in line **42** are fed to one of the inputs of a two input gate **46,** and are fed through an inverter **47** to one of the inputs of another two input gate **48.** The second input **49** of gate **48** is normally high, except when pushbutton **27** is depressed; while the second input **50** of gate **46** is normally low. Thus, gate **48** is normally turned off and gate **46** is normally turned on, so that the series of pulses from line **42** can pass through gate **46** and a next successive gate **51,** whose second input **52** is normally low. From the output gate **51,** the series of pulses passes successively through two additional gates **152** and **53,** which are turned on because of the presence of low signals in their second inputs **54** and **55.** The output from the final gate **53** of FIG. **3** is delivered through line **54'** to a decimal up counter **55'** in FIG. **4,** which will be discussed in greater detail at a later point.

To now return to FIG. **3,** when the operator presses pushbutton **27** on the control box, this actuates a switch within the control box diagrammatically represented at **56.** Switch **56** controls a bistable flip-flop circuit **57** which is substantially the same as the previously discussed antibounce bistable circuit **39** of the digitizer, and which acts upon depression of pushbutton **27** to change line **49** from high to low, and to change line **50** from low to high, with return of those lines to their initial condition upon release of the pushbutton. Switch **56** in its normal condition maintains a high in input line **58** to the bistable circuit, and a low in the second line **59** to the bistable circuit, with the switch reversing these conditions, and therefore the output signals from the bistable circuit, upon depression of the pushbutton.

When the pushbutton **27** is depressed, the resultant high signal in line **50** of FIG. **3** turns gate **46** off, while the corresponding low signal in line **49** turns gate **48** on, so that the pulse stream **45** from the digitizer passes through gate **48** instead of gate **46** while the pushbutton is pressed. When the pushbutton is released, the gates return to their original condition, in which the pulse stream passes through gate **46** and not through gate **48,** but the overall effect of the switch from one gate to the other and back is to add one pulse to the pulse stream delivered to counter **55'** through line **54'.** Thus, each time that pushbutton **27** is pressed and released, a single pulse is added to the series of pulses from the digitizer.

The second pushbutton **28** acts in reverse to subtract a single pulse from the pulse stream in line **54'** upon each depression and release of the pushbutton. For this purpose, the pushbutton **28** actuates a switch **60** corresponding to switch **56** of pushbutton **27,** which switch **60** normally maintains a high in line **61** and a low in line **62** leading to bistable flip-flop circuit **63** corresponding to the previously discussed circuits **39** and **57.** The output from this bistable circuit passes through a line **64** to the input of one of two binary up counters **65** and **66,** which are identical and produce output signals in their output lines **67** and **68** representing in binary the number of pulses received on their respective input lines **64** and **69.** These two binary counts are fed into a comparator **70,** which compares the outputs of the two counters **65** and **66,** and produces low signals on all four of the output lines **71** from the comparator if and only if the counts in the two counters **65** and **66** are identical. If the outputs from the two counters are different from one another, one or more of the output lines **71** from the comparator will have a high signal, thus turning off the four input gate **72.**

In normal operation, the two counters **65** and **66** will in fact have identical counts, and the resultant all low signals on comparator output lines **71** will maintain the output of gate **72** high, to thereby act through inverter gate **73** to maintain the previously discussed line **54** normally low. Also, the high output from gate **72** is fed

back through line 74 to one of the inputs to a three input gate 75, to thus turn that gate off and prevent the admission of any input pulses to counter 66.

If the operator now depresses and then releases pushbutton 28, this acts through bistable flip-flop 63 to change the output in line 64 from high to low and back to high, thus introducing one pulse into counter 65, with the result that the comparator 70 will now sense the fact that counters 65 and 66 have different pulse counts, to produce a high in at least one of the lines at 71, and a low in line 74 and a high in line 54. The high in line 54 turns off gate 52, to stop the delivery of signals through that gate to line 54'. The low signal in line 74 turns gate 75 on, and the pulse which has been blocked against passage through gate 52 is now diverted through line 76 and gate 75 into counter 66. The third input 77 to gate 75 is maintained low at this time by a gate 78, which receives at its input side a high signal through a line 79 from the output side of gate 53, thus maintaining gate 78 off and its output low to assure passage of the pulse or pulses through gate 75. If pushbutton 28 is depressed and released only once, the passage of the single pulse through gate 75 to counter 66 will return counter 66 to a condition identical with that of counter 65, so that all of the lines 71 from comparator 70 will again go low and the entire circuitry will return to its originally discussed condition for passing the pulses in stream 45 through gates 52 and 53 to line 54' and counter 55'. Thus, the overall effect is to subtract one pulse from stream 45 from the digitizer for every depression and release of pushbutton 28.

With reference now particularly to FIG. 4, the circuitry there shown includes pulse counting means, generally designated by the number 80, adapted to count the pulses in line 54' up to a predetermined maximum, and connected to two series 81 and 82 of selector switches whose settings determine the counts at which the apparatus automatically terminates a counting cycle, and automatically terminates a painting interval, respectively. It will of course be understood that the counting means and selector switches can be adapted to count and respond to total numbers of pulses up to any desired maximum, but in the particular circuitry typically illustrated in the drawings it is assumed that the counting means and selector switches can handle any numbers up to a maximum of three digits, that is, up to 999. For this reason, the counting means 80 in the particular form of the invention illustrated includes three counters to handle the three digits respectively, a first of the counters being the one previously referred to as number 55', and the other two counters being designated by the numbers 83 and 84 in FIG. 4. Each of these counters is preferably a decimal up counter, whose output is in the form of binary coded decimal on four output lines 85, 86, or 87. Thus, counter 55' counts pulses successively from zero to nine, and then repeats the count, and on each tenth count produces an output in line 88 to the input side of the second counter 83, which similarly counts from zero to 9 as the second digit of the overall number, producing its binary output in lines 86, and on each tenth count producing a pulse in line 89 to the input side of the third counter 84. Counter 55' thus represents the units digit in the overall number, while counters 83 and 84 represent the tens and hundreds digits respectively. The binary coded decimal outputs from these three counters are delivered to three decoders 90, 91, and 92, each of which has ten output lines 93, 94, or 95 which are energized successively in a repeating pattern by signals representing the numbers zero through nine respectively. Stated differently, for example, when decoder 90 is in its zero state, an initial one of the output lines 93 (separately designated as line 93a) is energized. On receipt of a first pulse on line 54', line 93a is de-energized and the next successive output line 94b is energized, while on the next pulse only line 94c is energized, etc., until each line has been energized in turn, at which time the cycle repeats upon receipt of the next or tenth pulse.

The series 81 of selector switches for determining the overall cycle length includes three selector switches 96, 97, and 98, connected to the three decoders 90, 91, and 92 respectively; and similarly the series 82 of selector switches includes three separate switches 90, 100, and 101. As will be apparent from FIG. 4, each of these six switches 96 through 101 is a rotary selector switch having a rotary contact 102 adapted to turn about an axis 103 to engage selectively any of 10 different stationary contacts 104 connected respectively to the 10 output lines 93, 94, or 95 of the associated decoder 90, 91, or 92. The rotary contacts 102 of the three switches 96, 97, and 98 are actuable by the three knobs 19, 20, and 21 of FIG. 2, while the three rotary contacts of switches 99, 100, and 101 are actuable by the three knobs 22, 23, and 24 respectively. The numbers 26 of FIG. 2 indicate settings of the rotary contacts of the associated switches.

When the rotary contact 102 of any particular one of the switches is set to a particular position, this rotary contact completes a circuit from a particular one of the output lines from the associated decoder 90, 91, or 92 to one of three lines 105, 106, or 107 carrying cycle length signals, or one of three lines 108, 109, or 110 carrying paint interval termination signals. Thus, when and only when the pulse count represented by the outputs from decoders 90, 91, and 92 reaches a particular three digit count corresponding to the settings of the three selector switches 96, 97, and 98, simultaneous output signals will be present on all three of the lines 105, 106, and 107. At all other times, at least one of these lines does not carry an output signal. In the same manner, simultaneous output signals occur on lines 108, 109, and 110 only when the count attained by decoders 90, 91, and 92 corresponds exactly to the count to which the three switches 99, 100, and 101 have been set.

During each individual counting cycle for the three counters 55', 83, and 84, the spray gun 12 is preferably turned on at a very low count, but for best results not at the 'zero' count. Desirably, the spray gun turns on automatically at the 'one' count, and for this purpose a line 111 (FIG. 4) is connected to the particular one of the BCD output lines 85 from counter 55' which is energized on the first pulse count of the counter. This signal in line 111 is inverted by a gate 112', and then inverted again by a gate 113 having a second input 114 which is normally low to normally maintain the gate 113 in on condition. Thus, a high signal at the input side of gate 112, representing a one count, produces a low in line 115, and an instantaneous high in line 116 which is normally low. This high in line 116 turns off a gate 117, whose second input 218 is normally low, to produce a low in output line 118 which is fed into a two input gate 119. This low signal in line 118 coacts with a low on a second input 120 to gate 119, to produce a

high in line **220** leading to a gate **121,** whose output is thus changed to low. This low signal causes actuation of a power switch **122** to an on condition, and that power switch when on energizes paint gun **12** to commence the spraying operation.

The mentioned high signal on line **220** is fed back through line **218** to the input side of gate **117,** to thereby maintain that gate in its off position, and maintain the signal in line **118** low, thus functioning as a holding circuit to continue operation of the spray gun after initial commencement of the spray gun operation and until the selector switches **99, 100,** and **101** turn the spray gun off as will be discussed hereinbelow.

When the pulse count in counters **55; 83,** and **84** and their related decoder reaches the value to which selector switches **99, 100,** and **101** have been set, the resultant simultaneous output signals on lines **108, 109,** and **110** cause simultaneous energization of three inverter gates **123, 124,** and **125,** which thus deliver three simultaneous inputs to gate **126,** whose normally low output is thereby made high. This high signal is delivered through line **120** to gate **119,** to turn that gate off and return line **220** to its normally low condition, resulting in actuation of switch **122** to its off condition for turning off the spray gun **12.** Thus, the gun automatically turns off when the count represented by selector switches **99, 100,** and **101** is attained. The low signal in line **220** is fed back through line **218** to the input side of gate **117,** to break the holding effect on that gate.

After the paint gun has thus been turned off, the counters **55′, 83,** and **84** continue to count pulses upon further advancement of the truck along the street surface, to form a gap or unpainted area in the broken line being formed. When the count reaches the value to which selector switches **96, 97,** and **98** have been set, the three resultant simultaneous output signals on lines **105, 106,** and **107** act to automatically clear the counters and commence another counting cycle. More particularly, these three signals simultaneously actuate three gates **127** to conditions in which their outputs are all low, to thereby actuate a gate **128** to a condition in which its normally low output **129** goes high. This turns off a gate **130,** both of whose inputs are normally low, so that the normally high output **131** from that gate goes low to cause the normally low output from a next successive gate **132** to go high. This instantaneous high signal in line **133** functions as a 'clear' signal, which is delivered by line **133** and a connected line **233** to the reset inputs **134** of all five counters **65, 66, 55′, 83,** and **84,** to return all of these counters simultaneously to a zero count condition for commencement of the next successive cycle. The next pulse received on line **54′** then actuates counter **55′** to its one count condition, to again act through line **111** and the connected circuitry to turn the spray gun on and commence the next painted portion of the broken line being formed.

The high reset signal in line **133** is also fed through a line **333** to one of the inputs of gate **130,** to hold gate **132** in its high state for a short period of time when the high state of gate **128** is removed by the reset signal in line **133.** This action assures that all other units actuated by line **133** will have the opportunity to reset on the change of state. A capacitor **135** connected between gates **130** and **132** functions to determine the length of pulse produced at the output of gate **132.** A manual clearing or resetting of the counters can be effected prior to commencement of a cycle of operation by connecting the input side of gate **132** to ground through a switch **136,** to change the input to gate **132** from high to low, and thus change the signal in line **133** from its normal low to high, thus clearing the counters.

Returning now to the instant when the count set into switches **99, 100,** and **101** is attained, and the gun is thereby automatically turned off as previously discussed, the instantaneous high signal produced at that instant in line **137** from gate **126** acts to turn off a gate **138,** so that its normally high output goes low, to thereby coact with a low signal on line **139** from the clear line **133** to produce a high in output line **140** from a gate **141.** This high is returned to the input **114** of gate **113,** to thus prevent actuation of gate **113** to a condition for turning the spray gun on during the remainder of the count, and until termination of the counting cycle by attainment of the count set into switches **96, 97,** and **98.** When that count is attained, the high clear signal in line **133** is delivered to the input **139** of gate **141,** to turn that gate off, and return the lines **140** and **114** to their normal low condition, so that the signal received from counter **55′** through line **111** and gate **112′** at the one count can again turn the spray gun back on.

A signal light **142** (FIGS. **2** and **4**) indicates when energized that the counters are in their clear or zero count conditions. When the counters are clear, both of the inputs to a gate **143** (FIG. **4**) are low, so that its output which is delivered to a second gate **144** is high, and the output from that gate is low, actuating a power switch **145** to its on condition in which light **142** on control box **15** is illuminated. When the discussed first pulse is received from line **54′** by counter **55′,** and the one count output is produced in line **111** from counter **55′,** this acts through gates **112′** and **113** to produce a high in line **116,** as previously discussed, and this high in line **116** is delivered through line **146** to gate **143,** to turn that gate off, and convert its output to a low condition, thus turning the signal light **142** off. This low at the output side of gate **143** is returned by a line **147** to one of the inputs of a gate **148,** to coact with the low then present on clear line **133** in turning gate **148** on, and producing a high in output **149** for holding gate **143** in its off condition until an instantaneous clear signal in line **133** ultimately turns gate **148** off to coact with a low then attained in line **116** in returning gate **143** to its high output condition in which the signal light is on. Consequently, the signal light is turned on whenever the counters are in their zero count or clear condition, and remains on until counter **55** reaches its one count condition.

To summarize very briefly the overall operation of the disclosed apparatus, assume that it is desired to paint a broken line **150** on the road surface **11** of FIG. **1,** with the truck **10** traveling at a predetermined uniform rate of speed. The operator may initially actuate switch **136** on control box **15** instantaneously to a closed condition, and then open the switch, so that an instantaneous high signal is produced on line **133** to assure that all counters are in a zero count condition. The operator of course has prior knowledge as to the exact number of pulses which are produced by digitizer **16** per inch or foot of travel of the vehicle, and therefore can calculate, or derive from an appropriate chart, the exact number of pulses or counts which will be required to paint a line of a particular length *l* on the

pavement. This count is therefore set into the three switches **99, 100,** and **101.** Similarly, a count representing a predetermined desired combined length *d* for one of the painted regions **151** and the intermediate 'skip' or unpainted region **152** is set into the cycle control switches **96, 97,** and **98.**

With the switches thus set to produce a desired paint pattern, the operator may drive the truck along the road surface **11,** and as the vehicle moves along that surface, digitizer **16** produces pulses in proportion to the distance traveled. These pulses are counted by the counters **55', 83,** and **84;** and the first pulse, as previously discussed, turns the spray gun **12** on, to thereby commence the painting of one of the intervals **151** of FIG. **1** almost simultaneously with the commencement of movement of the vehicle. The spray gun remains on until the count set into switches **99, 100,** and **101** is achieved, at which time three simultaneous pulses in the output lines **108, 109,** and **110** from these switches act together to turn the spray gun off. The count continues until the reading on counters **55', 83,** and **84** reaches the count set into switches **96, 97,** and **98,** at which time simultaneous output pulses from these switches cause production of an instantaneous clear signal in line **133,** to return all of the counters to zero, for commencement of another cycle, with the spray gun again being turned on by the first pulse or count of that second cycle, etc. In this way, a repeating pattern of painted areas and unpainted areas is produced on the road surface.

If the painted areas being produced do not occur at precisely the desired locations on the road surfaces, as for instance, if they do not coincide exactly with previously painted regions still present on the surface, the operator may advance or retard the actuations of the spray gun by either adding pulses to the series of pulses in line **54'** or subtracting pulses therefrom. Depression of pushbutton **27** acts through its connected circuitry to add one pulse for each actuation of the pushbutton, while the second pushbutton **28** subtracts a pulse upon each operation. The positioning of the paint on the road surface can thus be adjusted very precisely and controllably until exact correspondence with a previously laid down line is attained.

While a certain specific embodiment of the present invention has been disclosed as typical, the invention is of course not limited to this particular form, but rather is applicable broadly to all such variations as fall within the scope of the appended claims.

We claim:

1. Road striping apparatus comprising means to be mounted on a vehicle and responsive to movement of said vehicle to produce a series of pulses; means for applying paint to a road as said vehicle moves therealong and adapted to be actuated intermittently between painting and nonpainting conditions to form a broken line on the road; and control means responsive to said pulses for actuating said paint applying means from one of said conditions to the other in accordance with the number of pulses produced by said first mentioned means, said first mentioned means including light source means, a rotary structure turning in response to movement of said vehicle and having opaque and light passing portions which alternately block and pass light from said source means upon rotation of said structure, and light responsive means positioned beyond said rotary structure and controlling the formation of said series of pulses in accordance with the intermittent passage and nonpassage of light by said rotary structure as it turns.

2. Road striping apparatus comprising means to be mounted on a vehicle and responsive to movement of said vehicle to produce a series of pulses; means for applying paint to a road as said vehicle moves therealong and adapted to be actuated intermittently between painting and nonpainting conditions to form a broken line on the road; and control means responsive to said pulses for actuating said paint applying means from one of said conditions to the other in accordance with the number of pulses produced by said first mentioned means, said first mentioned means including light source means for emitting light along two different paths, rotary means having opaque and light passing portions movable across said paths as said rotary means turn, two light responsive units positioned in said two paths respectively beyond said rotary means, and circuitry controlled by said light responsive units for producing said series of pulses and acting to commence a pulse under the control of one of said light responsive units and to terminate the pulse under the control of the other of said light responsive units.

3. Road striping apparatus comprising means to be mounted on a vehicle and responsive to movement of said vehicle to produce a series of pulses; means for applying paint to a road as said vehicle moves therealong and adapted to be actuated intermittently between painting and nonpainting conditions to form a broken line on the road; and control means responsive to said pulses for actuating said paint applying means from one of said conditions to the other in accordance with the number of pulses produced by said first mentioned means, said first mentioned means including light source means for emitting light along two different paths, rotary means having opaque and light passing portions movable across said paths as said rotary means turn, two light responsive units positioned in said two paths respectively beyond said rotary means, and circuitry including a bistable flip-flop actuable to a first stable condition by one of said light responsive units and to a second stable condition by the second light responsive unit and acting in one of said conditions to commence one of said pulses and in the second condition to terminate said pulse.

4. Road striping apparatus comprising means to be mounted on a vehicle and responsive to movement of said vehicle to produce a series of pulses; means for applying paint to a road as said vehicle moves therealong and adapted to be actuated intermittently between painting and nonpainting conditions to form a broken line on the road; control means responsive to said pulses for actuating said paint applying means from one of said conditions to the other in accordance with the number of pulses produced by said first mentioned means, first manually actuated switch means, circuitry for adding extra pulses to said series of pulses from said first mentioned means in response to actuation of said first switch means, second switch means, and circuitry for subtracting pulses from said series of pulses in response to actuation of said second switch means, said control means including counter means for counting the number of pulses in said series of pulses as altered by actuation of said first and second switch means, fist manually settable selector switch means determining the count on said counter means at which said paint ap-

plying means are actuated to one of said conditions thereof, and second manually settable selector switch means controlling actuation of said paint applying means to its other condition.

5. Road striping apparatus as recited in claim **4,** in which said first selector switch means turn said paint applying means off upon attainment of a predetermined count, and said second selector switch means clear the count from said counter means upon attainment of a second predetermined count, there being circuitry for commencing the application of paint by said paint applying means upon attainment of a predetermined low count on said counter means greater than zero.

6. Road striping apparatus as recited in claim **5,** in which said pulse adding means include a flip-flop actuable by said first switch means to add a pulse to said series of pulses upon each operation of the first switch means, said pulse subtracting means including two additional counters, a comparator circuit responsive to a difference in count in said two additional counters to divert pulse produced by said first mentioned means from said counter means to one of said additional counters until said additional counters are in identical settings, and circuitry for adding a count to the other of said additional counters upon actuation of said second switch means.

7. Road striping apparatus comprising means to be mounted on a vehicle and responsive to movement of said vehicle to produce a series of pulses proportional in number to the distance traveled by the vehicle; means for applying paint to a road as said vehicle moves therealong and adapted to be actuated intermittently between painting and nonpainting conditions to form a broken line on the road; counter means for counting said series of pulses and actuable sequentially by said pulses to a series of predetermined different conditions representing different pulse counts; and circuitry for actuating said paint applying means from one of said conditions to the other in accordance with the attainment of a predetermined count on said counter means.

8. Road striping apparatus as recited in claim **7,** in which said first mentioned means include a rotary structure which is driven rotatively in correspondence with movement of said vehicle, and means responsive to said rotation of said structure to produce said series of pulses.

9. Road striping apparatus as recited in claim **7,** in which said counter means have a series of output lines energizable selectively to represent the pulse count, said circuitry being responsive to a particular pattern of energization of said output lines to actuate said paint applying means from one of said conditions thereof to the other.

10. Road striping apparatus as recited in claim **7,** in which said counter means have a series of output lines energizable differently to represent the count; said circuitry including selector switch means actuable to different settings in which said selector switch means are connected to said output lines in different patterns to set the apparatus for response to the attainment of different counts in said counter means, and means connected to said output lines of the counter means through said selector switch means and operable to actuate said paint applying means from one of said conditions thereof to the other upon attainment of a predetermined count represented by the setting of said selector switch means.

11. Road striping apparatus as recited in claim **7,** in which said counter means have a series of output lines energizable differently to represent the count; said circuitry including first selector switch means actuable to different settings in which said selector switch means are connected to said output lines in different patterns to set the apparatus for response to the attainment of different counts in said counter means, means connected to said output lines of the counter means through said selector switch means and operable to actuate said paint applying means from one of said conditions thereof to the other upon attainment of a predetermined count represented by the setting of said selector switch means, second selector switch means actuable to different settings in which said second selector switch means are connected to said output lines from said counter means in different patterns, and means connected to said output lines through said second selector switch means and operable to control reverse actuation of said paint applying means from said other condition back to said one condition at a time dependent upon the setting of said second selector switch means.

12. Road striping apparatus as recited in claim **7,** in which said circuitry is operable to actuate said paint applying means to said painting and nonpainting conditions alternately and in accordance with the number of pulses produced by said first mentioned means to form said broken line on the road.

13. Road striping apparatus as recited in claim **7,** in which said counter means have a series of output lines energizable in different patterns to represent a count, said circuitry including means responsive to signals on said output lines to alternately commence and halt operation of said paint applying means in response to different numbers of said pulses respectively.

14. Road striping apparatus as recited in claim **7,** including means for injecting added pulses into said series of pulses beyond the number produced by said first mentioned means as a result of movement of the vehicle, to thereby advance the point at which said paint applying means are actuated between said conditions thereof.

15. Road striping apparatus as recited in claim **7,** including means for reducing the number of pulses in said series of pulses to a number less than that normally produced by said first mentioned means for a predetermined distance of travel of the vehicle, to thereby delay the point at which said paint applying means are actuated between said two conditions thereof.

16. Road striping apparatus as recited in claim **7,** including manually controlled means for producing additional pulses beyond those produced by said first mentioned means, and circuitry for adding said additional pulses to said series of pulses produced by said first mentioned means in a relation advancing the point at which said paint applying means are actuated between said two conditions thereof.

17. Road striping apparatus as recited in claim **7,** including a manually actuated switch, circuitry for producing an extra pulse upon each manual actuation of said switch, and circuitry for adding said extra pulse into said series of pulses from said first mentioned means in a relation shifting the point at which said paint

applying means are actuated between said two conditions thereof.

18. Road striping apparatus as recited in claim **7**, including first manually actuated switch means, circuitry for adding extra pulses to said series of pulses from the first mentioned means in response to actuation of said first switch means, second switch means, and circuitry for subtractung pulses from said series of pulses from the first mentioned means in response to actuation of said second switch means.

19. Road striping apparatus as recited in claim **7**, including two additional pulse counters, a comparator circuit for comparing the output of said additional counters and operable to divert pulses produced by said first mentioned means from said counter means to a first of said additional counters when said additional counters are not in identical settings, and manually controlled means for delivering additional pulses to the second of said additional counters to actuate it to a different setting than said first additional counter and thereby require diversion of pulses from said counter means until said two additional counters are again at identical settings.

20. Road striping apparatus comprising means to be mounted on a vehicle and responsive to movement of said vehicle to produce a series of pulses proportional in number to the distance travelled by the vehicle; means for applying paint to a road as said vehicle moves therealong and adapted to be actuated intermittently between painting and nonpainting conditions to form a broken line on the road; counter means for counting said series of pulses and actuable sequentially by said pulses to a series of predetermined different conditions representing different pulse counts; control means settable to any of a plurality of different conditions corresponding to different pulse counts; and circuitry operable to compare the conditions of said counter means and said control means, and respond to the attainment of a predetermined count in said counter means corresponding to the setting of said control means, in a relation causing actuation of said paint applying means from one of said conditions thereof to the other at times varying in accordance with the setting of said control means.

21. Road striping apparatus as recited in claim **20**, including second control means settable independently of said first mentioned control means to any of a plurality of different conditions corresponding to different pulse counts; and circuitry operable to compare the conditions of said counter means and said second control means, and respond to the attainment of a predetermined count in said counter means corresponding to the setting of said second control means, in a relation causing actuation of said paint applying means from said other condition thereof back to said one condition at times varying in accordance with the setting of said second control means.

22. Road striping apparatus as recited in claim **21**, in which said first mentioned control means and said second control means are two separate selector switch structures separately settable manually to conditions representing different pulse counts.

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