

Jan. 6, 1948.

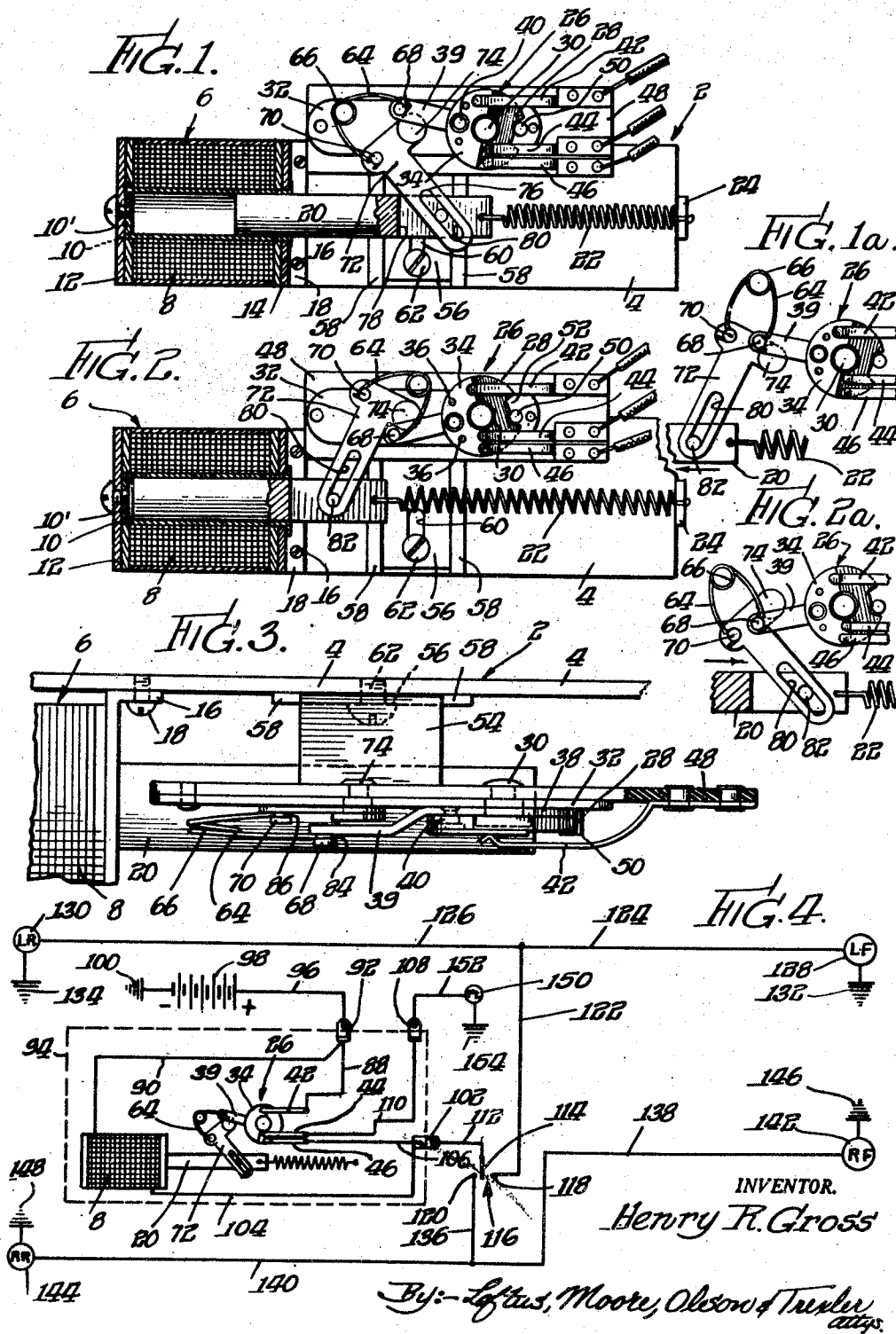
H. R. GROSS

2,434,070

FLASHER

Filed April 8, 1943

3 Sheets-Sheet 1



Jan. 6, 1948.

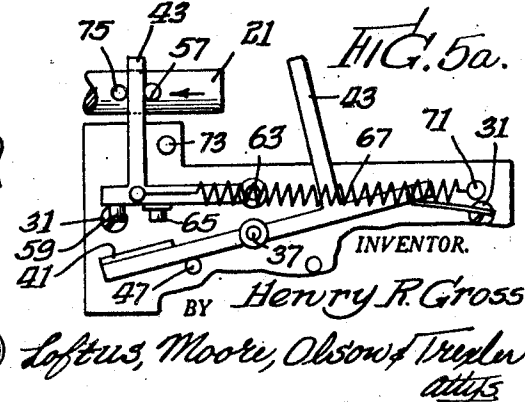
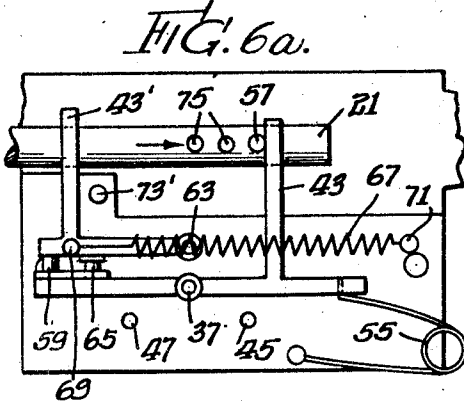
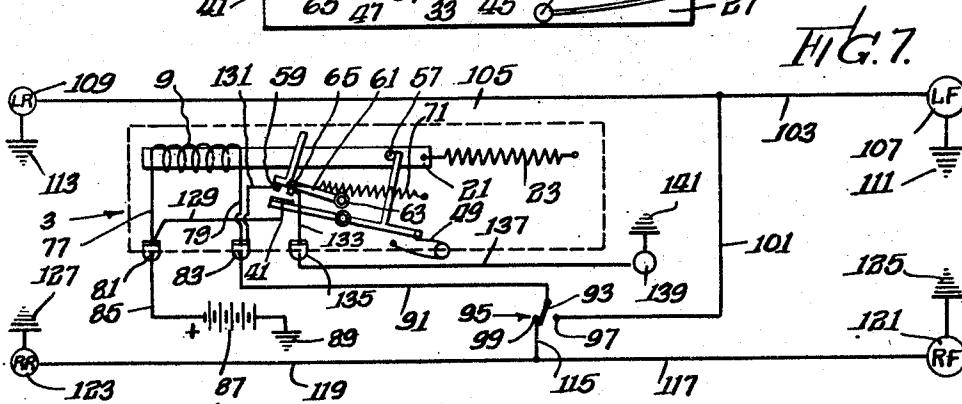
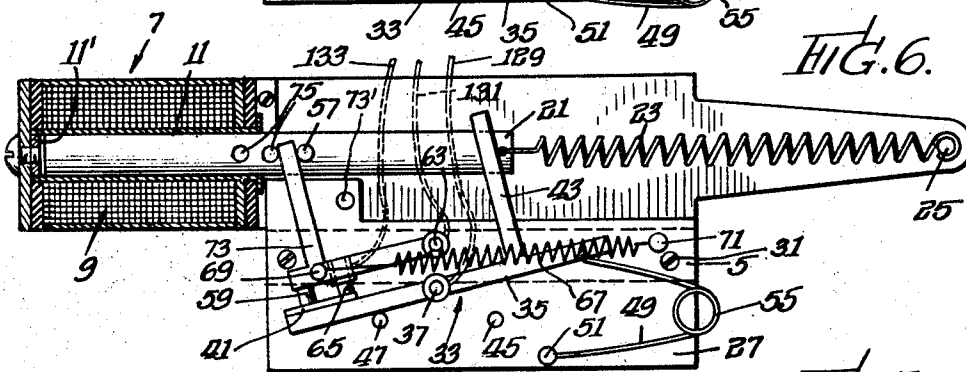
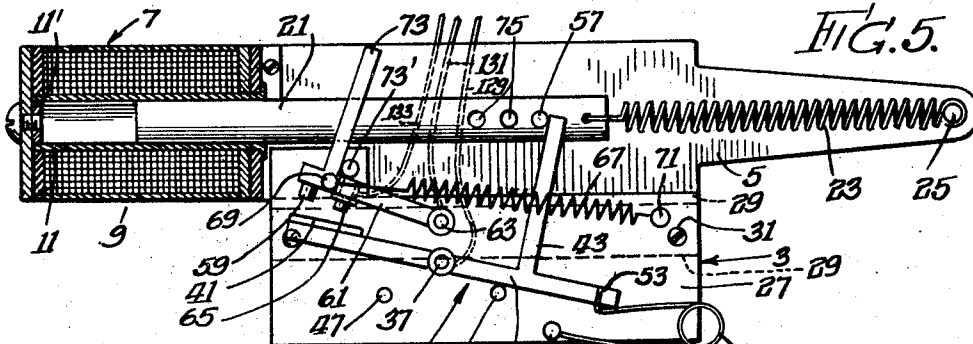
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2,434,070

FLASHER

Filed April 8, 1943

3 Sheets-Sheet 2



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Jan. 6, 1948.

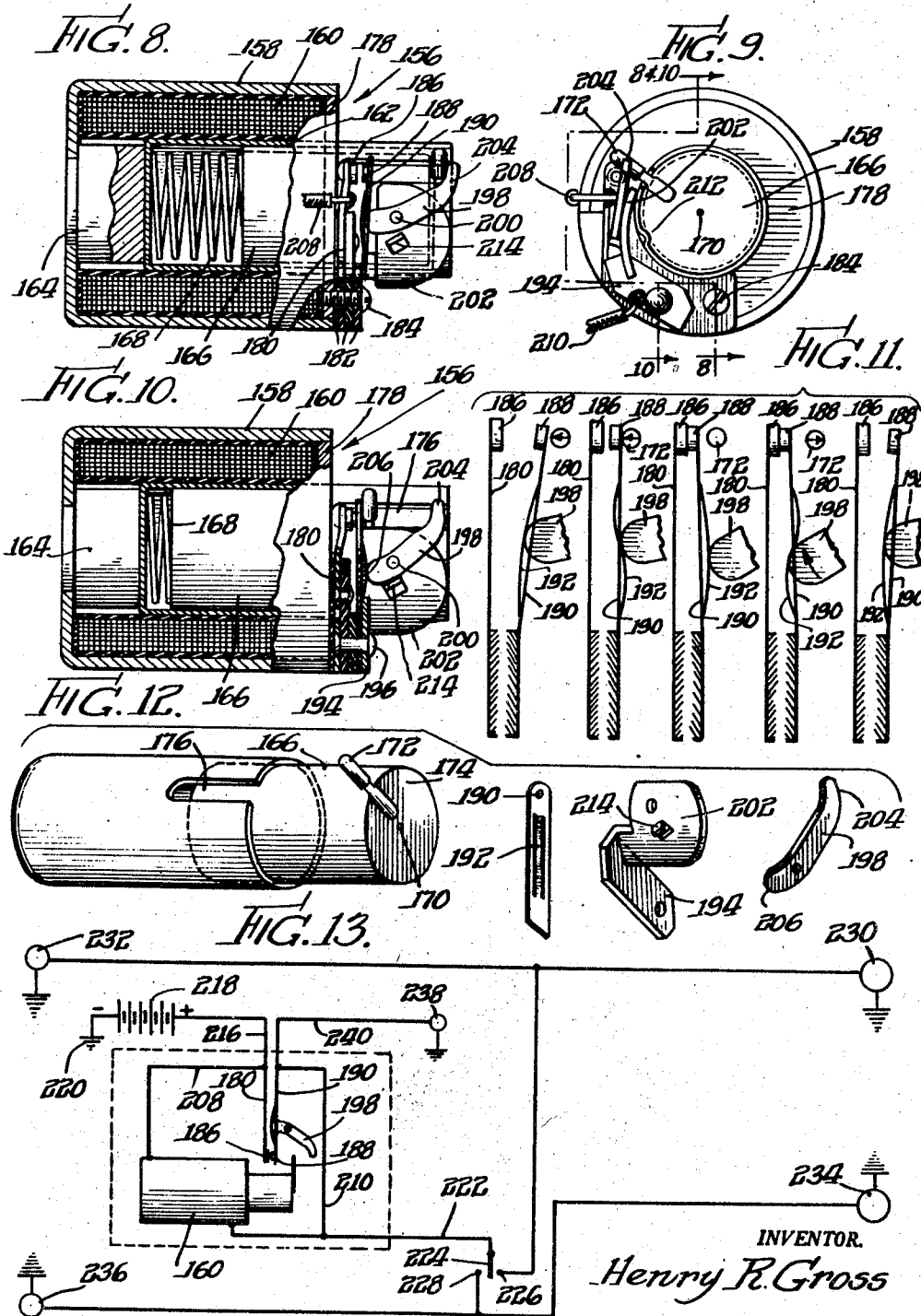
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2,434,070

FLASHER

Filed April 8, 1943

3 Sheets-Sheet 3



By: Loftus, Moore, Olson & Threlow attys.

UNITED STATES PATENT OFFICE

2,434,070

FLASHER

Henry R. Gross, Chicago, Ill.

Application April 8, 1943, Serial No. 482,252

10 Claims. (Cl. 172—126)

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This invention relates to improvements in flashers, and more particularly to electromagnetically operated cyclic switches.

An object of the invention is to provide a flasher and electric circuit, in which said flasher is adapted to be inserted to alter periodically the current supplied to a light source or other signal device associated therewith, so that it may be caused to flash or flicker.

Prior flashers have not been entirely satisfactory because relatively fragile; sensitive to variations in temperature or other atmospheric conditions; difficult to manufacture; of relatively high loss or breakage in manufacture; uncertain in operation; inconstant in periodicity of operation; slow in starting; and relatively high in cost. It is, accordingly, an important object of the invention to provide a flasher device of the character described which is rugged; not affected by variations in temperature or other atmospheric conditions; simple to manufacture; capable of manufacture with minimum loss and breakage; certain in operation; constant in periodicity of operation; quick starting under all conditions; and of relatively low cost.

Prior electromechanical, periodic or flasher switches have not proved entirely satisfactory because they tend to stick between the instant that the circuit of the electric actuator is changed and the mechanical operator or linkage passes through the fixed midposition. It is accordingly a further object of the invention to provide an electromechanical flasher or periodic switch, wherein the switch contacts remain out of engagement during substantially the complete movement of the electric actuator in one direction, at which time they are moved into engagement and yet are not moved out of engagement until the electric actuator has substantially completed its movement in the opposite direction.

My invention contemplates an electromechanical flasher or switch in which relatively movable contacts may be caused to separate as the electric actuator approaches its limited movement in one direction but will not be returned into engagement until the electric actuator approaches the limit of its movement in the opposite direction.

It is a further object of the invention to provide an electromechanical switch operating flasher device, wherein the contact operating

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mechanism passes through spaced midpositions or dead centers as it moves successively in opposite directions, so that the circuit of the actuator may remain unchanged during the complete, or substantially complete, movement of the electric actuator in both directions.

A further object of the invention is to provide a flasher device of the above stated character, wherein the periodicity of flashing may be accurately and readily determined or adjusted in the manufacture and use thereof.

Other and further objects and advantages of the invention will be apparent from the following description when taken in connection with the accompanying drawings, wherein—

Figure 1 is a view in plan of a flasher embodying the invention, the housing thereof being removed;

Figures 1a, 2, and 2a are views similar to Figure 1, but showing the parts in different positions of operation;

Figure 3 is an enlarged, fragmentary view in side elevation of the flasher shown in Figure 1;

Figure 4 is a schematic diagram of a circuit incorporating the flasher shown in Figures 1 and 3;

Figure 5 is a view in plan of another form of flasher embodying the invention, the housing thereof being removed;

Figures 5a, 6, and 6a are views similar to Figure 5 but showing the parts in different positions of operation;

Figure 7 is a schematic diagram of the circuit incorporating the flasher shown in Figures 5 and 6;

Figure 8 is a view partly in section of another form of flasher embodying the invention;

Figure 9 is an end view of the flasher shown in Figure 8;

Figure 10 is a view similar to Figure 8 but showing the parts in a different position of operation;

Figure 11 is a view diagramming the operations of the flasher of Figure 8;

Figure 12 is an exploded view in perspective of certain parts of the flasher in Figures 8 and 11; and

Figure 13 is a schematic diagram of the circuit incorporating the flasher shown in Figures 8 through 12.

Heretofore various types of periodic electric

switches or flashers have been developed, but those, generally speaking, have been unsatisfactory because of their fragility and/or speed of action. Usually those devices which are rugged are, in the case of thermoresponsive flashers, too slow in action, and, in other cases, too rapid in action. Various suggestions have been made to increase the speed of action of the thermoresponsive flashers and decrease the speed of action of the other types of flashers. However, in the case of thermoresponsive flashers, those which operate sufficiently rapidly are fragile and particularly sensitive to variations in temperature or other atmospheric conditions which cause a decrease or change in their speed of action, and, in some cases, changes in temperature or atmospheric conditions completely render the thermoresponsive flasher inoperative. A marked decrease in the rapidity of action of a flasher with changes in temperature or other weather conditions, creates great danger where the device is used to operate the turn signals of an automobile, for it often happens that, due to such decrease in the speed of action of the flasher, no turn signal is given before the turn is made or begun. Thus, for example, thermoresponsive wires of sufficiently small diameter, i. e., seven ten-thousandths of an inch, which are sufficiently rapid in action under the most favorable conditions, are unsatisfactorily fragile and highly sensitive to changes in ambient temperature or other atmospheric conditions and become, under any but the most favorable conditions, dangerously slow in action.

Various suggestions have been made to decrease the speed of action of the other more rugged types of flashers by means of various mechanical operators or linkages, but which have not proved satisfactory because they tend to stick by changing the circuit to the electric actuator before the mechanical operator or linkage passes through its midposition or dead center in one direction or the other.

This invention contemplates the production of a flasher rugged in all its parts, insensitive to changes in atmosphere or other atmospheric conditions, adapted to function quickly and with constant periodicity, and without sticking.

As shown in Figures 1 to 3 of the drawings, the flasher 2 comprises a base 4 which may in some instances constitute the mounting bracket, or may be secured to a suitable mounting bracket of insulating material in other instances. A cover or housing (not shown) may be secured in any convenient manner to the base 4 or the insulating mounting bracket therefor.

The base 4 may comprise a length of strap iron provided at one end with a solenoid 6. The solenoid 6 may comprise the usual coil 8 wound or mounted upon a sleeve 10 of diamagnetic or non-magnetic material such, for example, as brass closed at one end, as by a magnetic metal cap 10' soldered thereto. The sleeve is mounted on spaced magnetic plates 12 and 14, of which the plate 12 may be formed integral with the strap 4, and the plate 14 secured to the strap as by screws 16, or the like, fastening the flange 18 to the strap 14. The sleeve 10 also forms a hollow guide for the movable core or plunger 20 of the solenoid.

The plunger 20 is, of course, of magnetic material and is moved in one direction, or to the left in the drawings, by the coil 8 when the same is energized, and in the opposite direction, when the coil is deenergized, by a spring 22 suitably

fastened at one end to the plunger, and at the other end to a lug 24 upstanding from the base 4.

A switch 26 preferably comprises a disc 28 of insulating material pivoted as by pin or rivet 30 to a metal strap 32. The disc 28 has secured to, or inlaid in, its upper surface a generally semi-circular contact segment 34. As shown in Figure 3, this contact segment comprises a thin copper plate secured to the disc 28 by rivets 36 (Figure 2). A crank disc 38, on which is formed a crank arm 39, is secured to the disc 28 by a rivet 40. Spring contacts or wiper blades 42, 44, and 46 are secured at their enlarged outer ends to an insulating plate 48 secured to the strap by means including the rivet 30.

The blade 42 is of such length as always to engage the segment 34, while the blades 44 and 46 are of such lengths as to engage the segment 34 when the switch is in the position shown in Figure 2, but to engage the surface of the insulating disc when the switch is in the position shown in Figure 1. The movement of the disc 28 is limited as by a pin 50 upstanding from the plate 32 and received in aligned, peripheral notches 52 of the discs 28 and 38.

The mounting strap 32 may be formed integrally with a generally Z-shaped bracket 54 having an intumed base flange 56 slidably received between guide strips 58 secured in any suitable manner to the base 4. The flange 56 is provided with a slot 60 to receive a screw 62 threaded into the base 4, the slot 60 permitting, upon the release of the screw 62, the adjustment of the bracket 54 and the switch 26 carried thereby toward and from the plunger 20. A suitable spring 64, preferably of generally U-shape and having one or more convolutions 66, is secured at one end to a pin 68 carried at the outer end of the crank arm 39, and at the other end to a pin 70 of a lever or bellcrank 72 pivotally secured to the strap 32 as by rivet 74. The long arm 76 of the bellcrank is received in a diametrical slot 78 in the plunger 20, and is provided with an elongated slot 80 receiving a pin or key 82 extending perpendicularly to the slot 78.

The pivot 74 for the bellcrank 72 is so positioned in relation to the pivot pin 30 of the crank disc 38 that the pin 70, as the bellcrank swings, approaches the pin 68, thereby compressing the spring 64 until the pin 70, the pin 68, and the pivot pin 30 are in alignment, as shown in Figure 1a, after which the spring 64, in expanding, rotates the crank disc 38 and moves the disc 28 of the switch from the position shown in Figure 1 to the position shown in Figure 2. It should be noted that the ends of the spring 64 are received in annular grooves 84 and 86 in the pins 68 and 70, so that the ends of the spring are movable angularly about these pins.

As exemplified in Figure 4, the flasher 2 may be connected in a circuit for flashing the turn signals of an automobile. Thus, the wiper blade 42 of the switch 26 and one end of the coil 8 may be connected internally of the flasher as by wires 88 and 90 to a common terminal 92, which may project out of the housing represented by the dash line 94. The terminal 92 may be connected by a wire 96 to the positive side of a battery 98, or other source of electrical energy, which battery or source is grounded on the negative side as at 100. The other end of the coil 8 and the wiper blade 46 of the switch 26 may be connected internally of the flasher housing to a common terminal 102 by wires 104 and 106. The wiper blade

44 may be connected internally of the flasher housing to a terminal 108 by wire 110.

The terminal 102 may be connected by a wire 112 to the movable blade 114 of a turn signal control switch 116, having fixed contacts 118 and 120. The contact 118 may be connected by the common wire 122 and wires 124 and 126 in parallel to the front and rear left turn signal lights 128 and 130, respectively. As is the usual custom, the battery 98 being grounded as at 100, the signal lights 128 and 130 may also be grounded as at 132 and 134, respectively. The contact 120 is similarly connected by a common wire 136 and wires 138 and 140 in parallel to the front and rear right turn signal lights 142 and 144, respectively, which are also grounded as at 146 and 148, respectively.

The terminal 108 may, for the purpose of controlling an auxiliary load or signal, such as a pilot lamp 150, be connected to the load or lamp as by wire 152.

The operation of the device is as follows: Upon manual movement of the turn signal control switch blade 114 into engagement with one or the other of the fixed contacts of this switch, for example, the contact 118, the circuit will be completed from the source or battery 98 through wire 96, to terminal 92, wire 90, solenoid coil 8, wire 104, terminal 102, wire 112, switch blade 114, contact 118, and wires 122, 124 and 126 to the front and rear left turn signal lights 128 and 130. The solenoid coil 8 is of such relatively high resistance that the current flowing through this circuit to the signal lights is insufficient to energize the same fully or to the point of full incandescence or illumination. At the same time, the ampere turns of the solenoid coil are sufficient to create a magnetic field for attracting or drawing in the plunger 20 against the action of the spring 22. As the plunger 20 moves inwardly, the bellcrank or lever 72 is thereby swung in a clockwise direction from the position shown in Figure 1 through the position illustrated in Figure 1a, and to the position shown in Figure 2. When the pin 70 passes dead center position with relation to the pin 68, i. e., when the former passes the position of alignment with the pins 30 and 68 (Figure 1a), the spring 64, in expanding, rotates the switch 26 in a counter-clockwise direction, but the contact segment 34 of the switch does not connect the several wiper blades until the disc 32 has swung through a predetermined angle.

When the contact segment 34 connects the wiper blade 42 to the wiper blade 46, the solenoid 8 is shunted out of the circuit to the turn signal lights, to which a circuit is then completed from the battery 98, through wire 96, terminal 92, wire 88, blade 42, segment 34, blade 46, wire 106, terminal 102, wire 112, switch blade 114, contact 118, and wires 122, 124, and 126 to the front and rear left turn signal lights 128 and 130. At the same time the circuit is completed, the pilot lamp 150 is connected to the battery 98, through the wire 96, terminal 92, wire 88, blade 42, segment 34, blade 44, wire 110, terminal 108, and wire 152—the signal lamp 150 being, of course, grounded as at 154.

The shunt established around the solenoid coil 8 by the wire 88, the blade 42, the segment 34, the blade 46, and the wire 106 effects the deenergization of the coil and the spring 22 pulls the plunger outwardly and rotates the bellcrank in a counterclockwise direction. When the pin 70 of the bellcrank moves past dead center position with the pin 68, as shown in Figure 2a, the spring 64 expands and moves the crank arm 39 in a

clockwise direction to the position shown in Figure 1. It should be noted that this last mentioned dead center position, as shown in Figure 2a, is different from the dead center position shown in Figure 1a. The angular difference between these two dead center positions is determined by the angular swing of the crank arm 39 required to move the switch disc 28 between its two limit positions shown in Figures 1 and 2. When the switch disc 28 has been moved to the full-line position shown in Figure 1, the wiper blades 44 and 46 are disconnected from the wiper blade 42, and the shunt circuit around the solenoid coil is thereby broken; the coil is reenergized and the current through the signal leads, which are in series with the coil, is thereby reduced to cause the lights to flicker or flash.

It will be observed that the mechanical linkage comprising the bellcrank or lever 72 and the crank 38—39 does not pass through a dead center position in either direction until the actuator has substantially completed its movement in either direction, and that the circuit to the actuator is not changed until the linkage has passed through dead center position in either direction; and further, that the dead center position of the linkage, as the actuator moves in one direction, is different from the dead center position of the linkage as the actuator moves in the other direction. Hence, there is no opportunity for the switch to be moved to change the circuit to the actuator as the linkage approaches as fixed dead center position. Consequently there will be no tendency to stick, and the circuit to the actuator will remain unchanged until the switch has been shifted to one or the other of its control positions.

Adjustment of the flasher intervals, in manufacture and use, may be accomplished by loosening the screw 62 and sliding the bracket 54 inwardly or outwardly relative to the plunger 20. Thus, if the bracket 54 is adjusted outwardly to increase the distance from the vertical plane through the axis of the plunger 20 and the pin 82 to the pin 74 as measured along a line perpendicular to such plane, the flashing interval will be increased because it will require a greater movement of the plunger 20 to effect the fixed angular motion of the bellcrank, whereas, if this distance is decreased, the flashing interval will also be decreased because then a lesser motion of the plunger 20 will effect movement of the bellcrank through its fixed angular distance. The flasher would ordinarily be adjusted when used to flash turn signal lights to flash at the rate of approximately sixty times per minute, but it may, as above pointed out, be adjusted to flash at other rates for the same or other uses.

As shown in Figures 5 to 7, the flasher 3 comprises a base 5 similar to the base 4 of the form of the invention shown in Figures 1 to 4, and on this base there is mounted a solenoid 7 similar to the solenoid 6 and similarly mounted. The solenoid 7 comprises a coil 9 wound or mounted on a sleeve 11 of nonmagnetic or diamagnetic material, such as brass closed at one end, as by magnetic metal cap 11'. The sleeve forms a guide for a plunger 21 of magnetic material. The plunger 21 is operated in one direction by the coil 9 and in the opposite direction by a spring 23 similar to the spring 22 of the first form, and similarly fastened to the plunger and to a lug 25 upstanding from the base 5.

An auxiliary supporting block 27 of insulating material may be secured in any convenient manner to the base 5 so as to be positioned approxi-

mately at the elevation of the plunger 21; thus, for example, the base 5 may be formed with an integral flange upstanding from one edge and provided with an outwardly turned edge 29 to which the block 7 may be secured as by screws or bolts 31. The block 27 supports a combined switch and switch-operating linkage 33. This comprises a lever 35 pivoted intermediately its ends to the block 27 as by pin or rivet 37.

The lever 35 is made of electrically conducting material and on one side of the pivot carries a contact strip 41, and on the other side of the pivot is formed an arm or crank 43 extending perpendicularly from the lever 35. Movement of the lever 35 is limited by stops 45 and 47, which may consist of pins suitably secured to the block 27. The pin 47 limits the movement of the lever in a counter-clockwise direction, while the pin 45 limits the movement in a clockwise direction. The lever is urged in a counter-clockwise direction by a spring 49 fixed at one end to a pin 51 and bearing at its other end against the free end of the lever 35. The lever is provided with a small aperture 53 receiving the free end of the spring 49. The spring 49 is preferably formed with one or more central convolutions 55 increasing the resilience of the spring. The lever 35 is operated by the plunger 21 which, for that purpose, is provided with a pin 57 to engage the arm 43 which projects over the plunger 21.

The switch contact 41 carried by the lever 35 cooperates with a switch contact 59 secured in electrically conducting relation to a metal lever 61 pivoted at its opposite end as by pin or rivet 63 to the block 27. The switch contact 41 also cooperates with a second contact 65 mounted on but insulated from the lever 61. The lever 61 is moved in one direction or the other by a spring 67 secured to a pin 69 carried by the lever and to a fixed pin 71 carried by the block 27. The pins 69 and 71 are so positioned in relation to the pivot pin 63 that the spring will be moved from one to the other side of the pivot as the lever swings, and consequently, when it passes from one side to the other side of the pivot pin, it causes movement of the lever to its extreme position.

The lever 61 is formed with an integral arm 73 projecting perpendicularly therefrom and over the plunger 21 to engage and be operated by the pin 57. A stop 73' limits the clockwise movement of lever 61. The plunger may be provided with openings 75 to receive auxiliary pins similar to the pin 57, by means of which the stroke of the plunger required to operate the levers may be adjusted to adjust the flashing interval. Alternatively, the pin 57 may have a head portion extending a substantial distance axially of the plunger and receive a set screw in either end surface, that may be adjusted inwardly or outwardly of the enlarged head to adjust the flasher interval in the same manner.

As shown in Figure 7, the flasher may be used to operate the turn signal lights of an automobile. Thus, as shown in this figure, the opposite ends of the coil may be connected internally of the flasher 3 by wires 77 and 79 to terminals 81 and 83, respectively. The terminal 81 may be connected by wire 85 to the positive side of a battery 87, or other source of electric energy, the negative side of which is grounded as at 89.

The terminal 83 may be connected by wire 91 to the movable blade 93 of a turn signal control switch 95, having also fixed contacts 97 and 99. The contact 97 may be connected by wire 101 and wires 103 and 105 in parallel to the left front and

rear signal lights 107 and 109 grounded as at 111 and 113. The contact 99 may be connected by the wire 115, and wires 117 and 119 in parallel to the right front and rear signal lights 121 and 123 grounded as at 125 and 127. The contact 41 may be connected internally of the flasher as by wire 129 to the terminal 81, while the contact 59 is connected as by wire 131 to the terminal 83. The contact 65 may be connected by wire 133 to the terminal 135 that is adapted to be connected as by wire 137 to an auxiliary load or pilot signal light 139 grounded as at 141.

The operation of this device is as follows: Upon movement of the blade 93 of the turn signal control switch into engagement with one of its contacts 97 or 99, as, for example, contact 97, a circuit will be completed from the battery 87 through wire 85, terminal 81, wire 77, solenoid coil 9, wire 79, terminal 83, wire 91, blade 93, contact 97, and wires 101, 103, and 105 to the signal lights 107 and 109. The solenoid coil 9, similarly to the solenoid coil 8 of the first form, is of relatively high resistance, so that the current flowing through this circuit is insufficient to energize the lights fully or to full incandescence. Therefore, the lights are unlit or only partially lit.

The solenoid coil being energized, attracts its armature 21 and moves it from the position shown in Figure 5 to the position shown in Figure 6. As the pin 57 moves to the left in the drawings from the position shown in Figure 5, the lever 35 is rotated in a counter-clockwise direction by the spring 49 until it engages the stop 47 as shown in Figure 5a. When the pin 57 engages the arm 73 of the lever 61, it causes the lever to swing in a counter-clockwise direction until the pin 69 passes dead center with relation to pins 63 and 71 as shown in Figure 5a, and thereafter the spring, having thus been moved from above the pin 63 as indicated in Figure 5 to a position below the pin as indicated in Figure 6, causes the lever to snap to its limit of motion in the counter-clockwise direction, in which position the contacts 59 and 65 engage the common contact 41. When this occurs, a direct connection is established between the terminals 81 and 83 in shunt to the coil 9. Hence, the coil is de-energized and current flows direct'y to the signal lights from the battery, and also to the pilot lamp 139 in parallel to the main turn signal lights 107 and 109. The solenoid coil being deenergized, the plunger immediately begins to move to the right under the action of the spring 23. The lever 61 remains in the position shown in Figure 6, in which it is held by the spring 67, until the pin 57 engages the arm 43 of the lever 35 and causes the latter to swing in a clockwise direction. As the lever 35 swings in a clockwise direction, it causes the lever 61 also to move in a clockwise direction, but the contacts 41, 59 and 65 remain in engagement during such movement of these levers and until the pin 69 passes dead center position with relation to the pins 63 and 71 as shown in Figure 6a. The spring 67 then moves above the pivot 63 as indicated in the drawings and snaps the lever 61 to its extreme position, in which its motion is limited as by the pin 73' secured to the block 27. When the switch blade 93 is moved to engage the fixed contact 99 similar actions occur to cause flashing or flickering of the right turn signal lights 121 and 123—the pilot lamp 139 also flashing at the same time.

As shown in Figures 5 and 6, electrical connection between the wires 129 and 131 is preferably established by extending the wires beneath the

block 27 and soldering, or otherwise securing them to the lower ends of the pivot pins 37 and 63, respectively. Electrical connection between the wire 133 and the contact 65 is preferably established through a lead which is sufficiently flexible to accommodate the movement of the contact. It will be evident that the circuit to the solenoid or electric actuator remains unchanged during substantially the complete movement of the plunger 21; that the switch contacts remain in engagement during substantially the entire movement of the lever 35 by the pin 57; and that the lever 61 will be moved positively beyond the position in which the pin 69 is on dead center in relation to the pins 63 and 71 before the contacts 59 and 65 will be moved into engagement with the contact 41. Consequently there will be no tendency for the flasher to stick for the circuit to the actuator will not be changed until the linkage has passed definitely beyond dead center position, and the spring 67 has snapped the contacts out of or into engagement.

It should also be noted that since the levers 35 and 61 swing about spaced pivots, the contact 41 will exert a wiping action on the contacts 59 and 65, thereby maintaining these contacts in good working order over a long period.

Either form of the invention will in operation indicate the condition of the lamps in the several circuits. Thus, if one lamp of either set of turn signal lights burns out, the resistance in the circuit to that set of lights is increased, and this decreases the current flow through the solenoid coil. The plunger, therefore, moves at a much reduced rate. This is evidenced by the slower flashing of the pilot light, which thus provides an indication to the operator that one of the lamps in that set of turn signal lights has burned out. If both lamps of one set of signal lights burn out, then no current will flow through the solenoid coil, and hence the switch 26 will remain in the position shown in Figure 1 and the switch 33 in the position shown in Figure 5. Hence the pilot light will remain dark to thus indicate to the operator that both signal lights of that set are burned out.

If a partial short circuit occurs in either set of signal lights, the current flowing through the solenoid will be increased, thus causing operation of the flasher at an increased speed, which will be evidenced by the more rapid flashing of the pilot light, thus apprising the operator of this fact. It may occur, that due to a partial short circuit, the rate of flashing exceeds the persistence of vision and the pilot light may then appear to remain constantly illuminated, thus to indicate a partial short circuit of some substantial magnitude. If a total short circuit occurs in either set, then a fuse or other circuit breaker, which, in accordance with conventional practice, may be inserted in the lead from the positive side of the battery to the flasher, will break the signal circuit and prevent damage to the elements thereof.

As shown in Figures 8 through 13, the flasher 150 comprises a cylindrical housing 158 of magnetic material, in which is mounted a solenoid coil 160 surrounding a stationary cylinder 162 of brass or like material. One end of the housing 158 is apertured to receive a magnetic plug 164 which abuts the closed end of the cylinder 162. A hollow plunger 166 is slidably mounted in the cylinder 162 and a coil spring 168 inserted in the plunger engages the bottom of the cylinder 162 so as to move the plunger outwardly when the solenoid coil is deenergized. The outer, closed

end of the plunger 166 is provided with one or more air passages or openings 170, by means of which the rate of movement of the plunger is predetermined. The operating pin 172 is secured to the closed end of the cap 174 of the plunger and is received in a guide slot 176 in the portion of the cylinder 162 extending beyond the ring 178 of iron or other magnetic material, fitted in the open end of the housing 158 and encompassing the cylinder 162.

A contact carrier or blade 180 is mounted on, and insulated from, the ring 178 by suitable insulating spacers 182 and appropriate fastening means, such as screw 184. The blade 180 carries a stationary contact 186 which cooperates with a movable contact 188 fixed to an operating member 190. The operating member 190 comprises a thin, resilient conducting metal strip slotted and shaped to form an elongated portion 192 sprung out of the plane of the spring so that, upon application of pressure to such deformed portion, the strip is caused to snap from a position in which such deformed portion is bowed from one side of the strip to a position in which such portion is bowed from the other side of the strip. It will be evident further, that this toggle-like spring strap will spring from one position to the other in response to the application of pressure to the unsupported end of the strap.

As shown in Figures 8 and 10, this operating member or snapping spring strap carries the contact 188, and is secured to a terminal plate 194 fastened as by rivet 196 to the insulating spacers 182.

A lever 198 pivoted as by pin 200 to a bracket 202 may be secured to, or formed integrally with, the terminal 194. The lever 198 is formed with a curved end 204, which extends over the slot 176 in the cylinder 162 adjacent the outer end of the slot so as to be engaged by the pin 172. The other end of the lever is rounded to provide a cam surface 206 engageable with the bowed portion 192 of the snapping spring strap 190. The lever is so mounted in relation to the strap that, upon movement in a clockwise direction, as seen in Figures 8, 10, and 11, it depresses the bowed portion 192 toward the plane of the strap, and so causes it to snap from contact closing position to contact opening position.

Supply leads 208 and 210 are connected, respectively, to the switch blade 180 and the terminal plate 194. It will be evident, upon energization of the solenoid coil 160, that the hollow plunger 166, which is of magnetic material, will be pulled inwardly of the cylinder 162 and, in so moving, compress the spring 168. On inward movement of this plunger and as it approaches its innermost position, the pin 172 engages the free end of the snap spring strap 190 and moves the body of the strap toward the now inwardly bowed portion 192 until the bowed portion snaps from one side to the other of the strap and thereby snaps the strap carried contact 188 into engagement with the stationary contact 186. On engagement of these contacts the solenoid coil is shunted, as will later be described, and the solenoid coil being thus deenergized, the spring 168 expands and moves the plunger outwardly of the cylinder 162 until, as the plunger approaches the limit of its outward movement, it engages the hook end 204 and swings the lever in a clockwise direction, so that the cam surface 206 of the lever presses inwardly upon the bowed portion 192, so that that portion passing the plane of the strap tends to automati-

cally become bowed in the opposite direction and thus snaps the contact 188 away from the stationary contact 186.

The outward movement of the plunger may be limited by a lug or protuberance 212 formed from the outer edge of the cylinder 162 and the counterclockwise movement of the lever 198 is limited as by a similarly formed lug 214 struck from the bracket 202. Thus, it will be seen that, when the contacts are in open position, the pin 172 engages the strap and moves the same past dead center with respect to the bowed portion 192, while this bowed portion extends inwardly of the strap, as shown in Figures 8 and 11, and that the contacts are moved from closed to open position by moving the bowed portion past dead center position with respect to the strap, as in the second diagram of Figure 11. The strap then snaps into its innermost contact closing position. It should be noted that this dead center position of the members past which the strap must be moved to effect closing of the switch, is different from the dead center position, as in the fourth diagram of Figure 1-, and past which the portion 192 must be moved to restore the contacts to open position. Hence, the contacts can never be stuck in either open or closed position, for the plane portion of the strap is snapped to a position changing the circuit only after the plane portion of the strap and the bowed portion of the strap have already been moved beyond one of the dead center positions.

As shown in Figure 13, the flasher when used to operate the turn signal lights of an automobile, may have its lead 208 connected as by wire 216 to the positive side of a battery or other source 218 grounded as at 220. The lead 210 of the flasher may be connected as by wire 222 to the switch blade 224 of a single pole, double-throw switch having contacts 226 and 228 connected, respectively, to the left turn signal lights 230 and 232 and the right turn signal lights 234 and 236 in the manner previously described with reference to Figures 4 and 7. It will be evident that, upon closing of the contacts 186 and 188, the solenoid coil 160 will be deenergized and the signal lights supplied directly from the battery.

Since the contacts 186 and 188 are open whenever the solenoid coil is deenergized, a grounded pilot light 238 may be connected as by wire 240 to the strap 190 so that, whenever the contacts 186 and 188 are in engagement to thereby supply the signal lights with enough current to illuminate the same, a sufficient current will be supplied to the pilot light 238. It will be evident, of course, that this pilot light will be illuminated whenever either the left or right set of the turn signals are operating. It will be clear also, in respect to the flasher shown in Figures 8 through 13, as with the flashers in Figures 1 through 7, that the increase of current flow through the solenoid, due to the burning out of one of the signal lights, will cause the flasher to operate at a slower rate, which will be revealed by the pilot signal, and that, if both lights of a set burn out, no current will flow through the solenoid coil when the same is connected to that set of lights so that in that case the pilot signal will remain deenergized, thus indicating that the set of lights has burned out.

It is thought that the invention and numerous of its attendant advantages will be understood from the foregoing illustrative description, and it is obvious that numerous changes may be made in the form, construction, and arrangement of the

several parts without departing from the spirit or scope of the invention or sacrificing any of its attendant advantages, the form herein described being a preferred embodiment for the purpose of illustrating the invention.

What I claim is:

1. A flasher switch unit comprising, an electric actuator, a pair of flasher switch contacts for controlling the energization and deenergization of said actuator and a load circuit, and a switch operator, said operator having a plurality of dead center positions past which it is moved by said actuator, and means for making and breaking the switch contacts only upon movement of the operator past one of said dead center positions whereby to maintain the circuit to the actuator unchanged during the movement of the actuator.

2. A flasher switch unit comprising, a solenoid, a plunger operated in one direction by said solenoid when the solenoid is energized, and means for operating the plunger in the opposite direction when the solenoid is deenergized, a flasher control switch, said switch being in circuit with said solenoid and comprising switch members relatively movable between circuit making and breaking positions to control the energization of said solenoid and a load circuit, said switch members being constructed to maintain the circuit unchanged during a predetermined relative shifting of said members, means for operating said switch members and including a mechanical linkage having a lost motion connection to said plunger to initiate relative movement of said switch members as the plunger approaches a limit of movement in either direction, and means for thereafter continuing the relative movement of said switch members to a limiting position changing the circuit of said solenoid.

3. A flasher switch unit comprising, a solenoid, a plunger movable in one direction by said solenoid when the latter is energized, means for moving the plunger in an opposite direction when the solenoid is deenergized, a pair of terminals, flasher switch means adapted periodically to connect and disconnect said terminals, said switch means comprising switch members controlling the alternate energization and deenergization of said solenoid, and a member operating said switch members and having an initial movement in which the relation of said switch members are maintained and a final movement changing the relation of said switch members to thereby change the circuit of said solenoid, means providing a lost motion connection between said plunger and said operator for initiating movement of said operator as the plunger approaches its limit of movement in one direction or the other, and means for continuing the movement of said operator once the same has been initiated.

4. In a flasher, a solenoid, a plunger moved by said solenoid in one direction upon energization of the solenoid, means for moving the plunger in the opposite direction upon deenergization of the solenoid, a switch having a pair of contacts connected to opposite ends of the solenoid to shunt the solenoid from the circuit when said contacts are in engagement, load terminals connected to said contacts, means connecting said switch to said plunger for initiating movement of said switch as the plunger approaches a limit of movement in either direction, said switch being constructed to maintain the relation of said contacts unchanged during initial movement of said switch, and means for automatically continuing the movement of said switch to change the rela-

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tion between said contacts thereby to control the energization and deenergization of said solenoid.

5. A flasher switch unit comprising, a solenoid, a plunger operated in one direction by said solenoid when the latter is energized, means for moving said plunger in the opposite direction when the solenoid is deenergized, a pair of terminals, said solenoid being connected to said terminals, a switch comprising a shiftable contact blade connected to one end of the solenoid, a fixed contact blade connected to the other end of the solenoid whereby to establish a shunt circuit across the solenoid when the contact blades are in engagement, a lever for shifting said shiftable contact blade, a second lever having a lost motion connection to said plunger, and a spring interconnecting said two levers at points adapted to move past dead center with relation to the pivot of the first lever as the second lever is moved by the plunger whereby energy is stored in the spring during the movement of the second lever to dead center position and utilized to shift the first lever as the dead center position is passed, the movable switch blade being constructed to have a predetermined movement relative to the fixed blade before changing the engaging or disengaging relation of the blades whereby sticking of the levers about dead center is precluded.

6. A flasher switch unit comprising, a solenoid, a plunger operated in one direction by said solenoid when the latter is energized, means for moving said plunger in the opposite direction when the solenoid is deenergized, a pair of terminals, said solenoid being connected to said terminals, a switch comprising a shiftable contact blade connected to one end of the solenoid, a fixed contact blade connected to the other end of the solenoid whereby to establish a shunt circuit across the solenoid when the contact blades are in engagement, a lever for shifting said shiftable contact blade, a second lever having a lost motion connection to said plunger, a spring interconnecting said two levers at points adapted to move past dead center with relation to the pivot of the first lever as the second lever is moved by the plunger whereby energy is stored in the spring during the movement of the second lever to dead center position and utilized to shift the first lever as the dead center position is passed, the movable switch blade being constructed to have a predetermined movement relative to the fixed blade before changing the engaging or disengaging relation of the blades whereby sticking of the levers about dead center is precluded, and adjustable means for determining the extent of lost motion in the connection between said second lever and said plunger for adjustably determining the periodicity of operation of the flasher.

7. A flasher switch unit comprising, a solenoid, a plunger moved by the solenoid in one direction when the latter is energized, means for moving the plunger in an opposite direction when the solenoid is deenergized, a pair of terminals, said solenoid being connected to said terminals, a first lever, a second lever, a switch comprising a contact carried by the first lever and a cooperating contact carried by the second lever, means for normally maintaining the first lever in a predetermined position, a spring controlled toggle connection to the second lever for moving the second lever to one or the other of its extreme positions when the second lever has been moved a predetermined distance, the contact carried by the second lever being out of engagement with

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the contact carried by the first lever when the second lever is in one of its extreme positions and in engagement with the contact carried by the first lever when the second lever is in its other extreme position, means operated by the plunger for moving said first lever against the action of said maintaining means to initiate movement of the second lever while maintaining said contacts in engagement, said spring controlled toggle moving the second lever relative to the first to move the contacts out of engagement when the levers have completed their predetermined movement, and means operated by the plunger for initiating movement of said second lever in the opposite direction, said spring controlled toggle thereafter moving said second lever to its initial position in which the contacts are in engagement.

8. In a flasher, a solenoid, a plunger moved by the solenoid in one direction when the solenoid is energized, means for moving the plunger in an opposite direction when the solenoid is deenergized, a spring strap, said strap having a bowed portion deflectable relative to the remaining portion of the strap and adapted when compressed toward the remaining portion of the strap to snap the latter from one position to another and to be snapped by said strap from one position to another upon deflection of the remaining portion of the strap toward the bowed portion, a pair of cooperating switch contacts adapted to be engaged and disengaged by the snapping of the spring strap as the bowed portion and the remaining portion of the strap are alternately deflected, and means operatively connected to the plunger for alternately deflecting the bowed portion of the strap and the remaining portion of the strap as the plunger approaches its limit of movement first in one direction and then in the other.

9. In a flasher, a solenoid, a non-magnetic cylindrical core, a hollow magnetic plunger mounted in said cylinder and movable inwardly thereof upon energization of the solenoid, spring means in said plunger and said cylinder for moving the plunger outwardly of the cylinder upon deenergization of the cylinder, said cylinder having a longitudinally extending slot therein, an operating pin carried by said plunger and movable along said slot, a stationary switch contact, a toggle spring strap carrying a switch contact for cooperation with said stationary contact, said operating pin being adapted to engage a portion of said strap for snapping the contact carried thereby into engagement with the stationary contact as the plunger approaches its limit of movement in one direction, and lever means engaging another portion of the strap and positioned for operation by the pin to snap the contact carried by the strap out of engagement with the stationary contact as the plunger approaches its limit of movement in the opposite direction, said contacts being connected to said solenoid to determine the energization and deenergization thereof.

10. In a flasher, a solenoid, a plunger moved by said solenoid in one direction upon energization of the solenoid, means for moving the plunger in the opposite direction upon deenergization of the solenoid, a pair of switch contacts connected to the opposite ends of the solenoid and to load terminals to shunt the solenoid from the circuit when said contacts are in engagement and to change the voltage between the terminals as the contacts are opened and closed,

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switch operating means operated by the plunger, said switch operating means including spring means maintaining the relative positions of the contacts during movement of the plunger, and means for rendering said spring means effective to change the relative positions of the contacts as the plunger reaches its limits of movement whereby to maintain the circuit to the solenoid unchanged during movement of the plunger in either direction.

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