

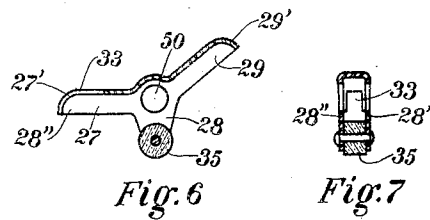
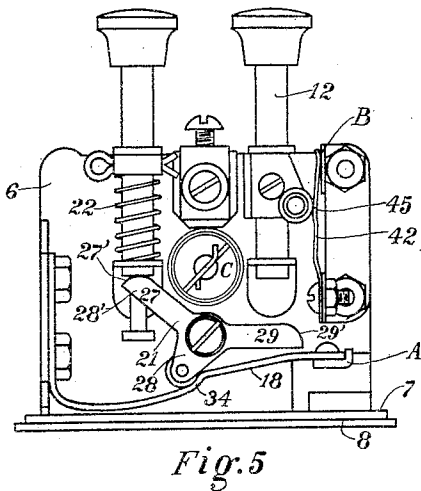
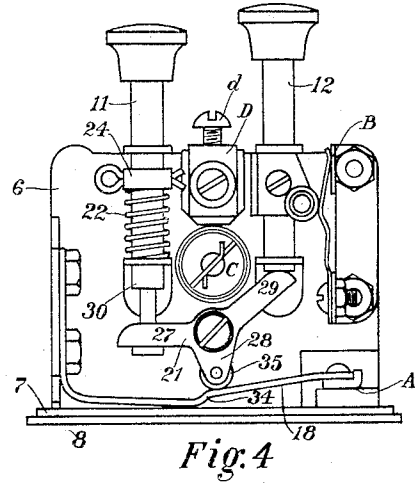
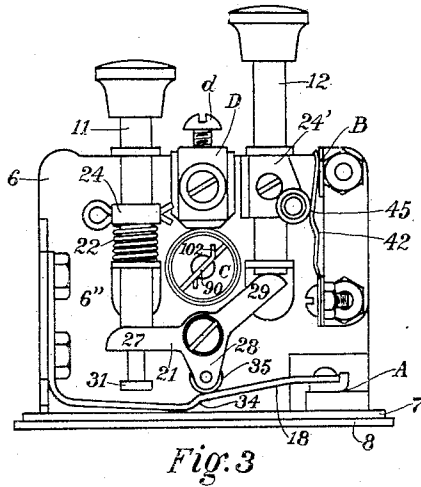
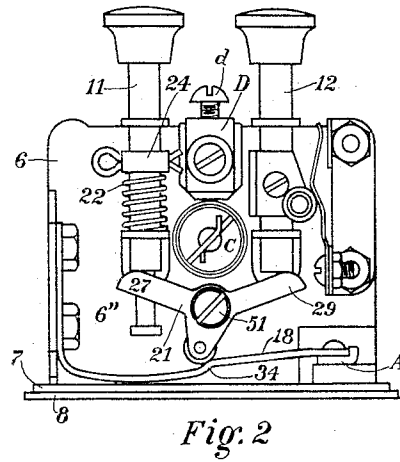
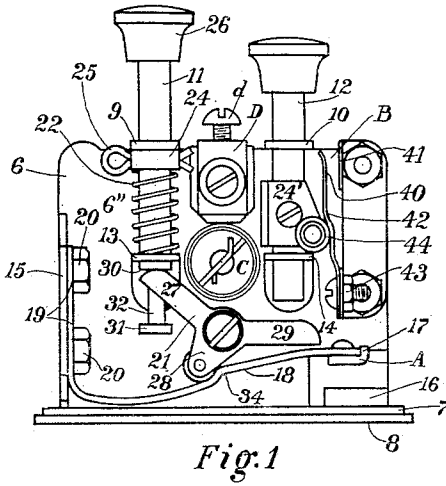
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F. O. HARTMAN.
CIRCUIT CONTROLLING MECHANISM.
APPLICATION FILED AUG. 19, 1918.

1,424,402.

Patented Aug. 1, 1922.

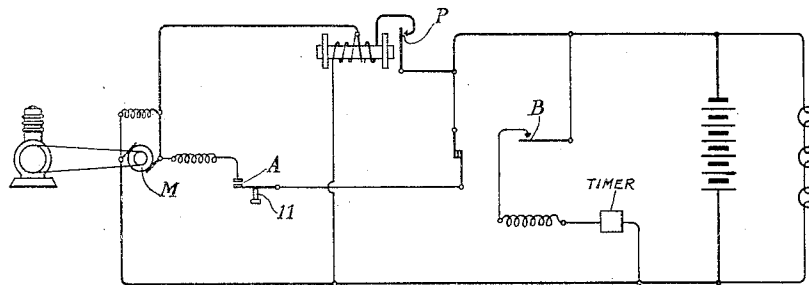
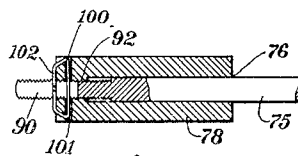
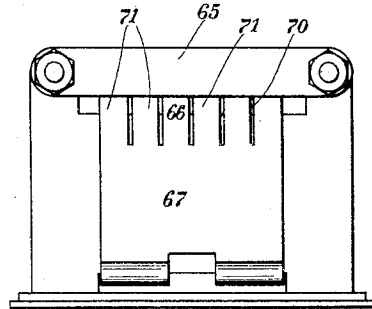
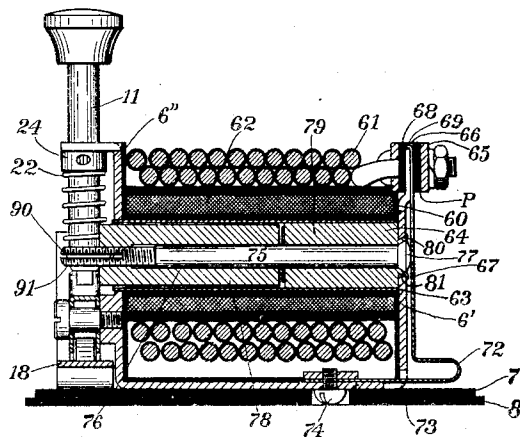
2 SHEETS—SHEET 1.



FRANK O. HARTMAN
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BY *40. Richey*
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

FRANK O. HARTMAN, OF MANSFIELD, OHIO, ASSIGNOR TO THE HARTMAN ELECTRICAL MANUFACTURING COMPANY, OF MANSFIELD, OHIO, A CORPORATION OF OHIO.

CIRCUIT-CONTROLLING MECHANISM.

1,424,402.

Specification of Letters Patent.

Patented Aug. 1, 1922.

Application filed August 19, 1918. Serial No. 250,502.

To all whom it may concern:

Be it known that I, FRANK O. HARTMAN, a citizen of the United States, and a resident of Mansfield, in the county of Richland and State of Ohio, have invented certain new and useful Improvements in Circuit-Controlling Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to circuit controlling mechanism, and has for its general object the improvement of such mechanisms.

One of the objects of my invention is the provision of circuit controlling means or switch-opening and closing means, which is capable of being moved to closed switch position, after which action it is incapable, for moderate movements thereof, of affecting the switch or the relation of the contacts thereof to each other, but which at the same time is capable of causing the opening of the switch for substantial, predetermined movements of said means.

Moreover, I provide circuit controlling mechanisms such that the single element may control both of the switches. This control element may be in the form of a plunger or any other suitable form.

I also provide improved means for insuring a quick break of the circuit or opening of the switch, and such apparatus in which it is impossible in the ordinary operation thereof to open the switch in any way other than suddenly. Moreover, I provide means in combination for performing both these functions.

I also aim to produce an improved electromagnetic switch capable of closing, with accuracy and dispatch, contacts in a circuit over which relatively heavy currents pass.

I also aim to produce circuit controlling mechanism in which a plurality of switches are employed in connection with a plurality of controlling devices controlling said switches independently, or one through the other to accomplish the results hereinafter mentioned.

These and other objects of my invention and the invention itself will be understood from the following description of an embodiment of the invention.

Fig. 1 is a front end elevation of an embodiment of my invention showing the apparatus in normal position.

Fig. 2 is a view similar to Fig. 1, showing the main plunger part way depressed.

Fig. 3 is a view similar to Fig. 1, showing the main plunger depressed to way-down position.

Fig. 4 is a view similar to Fig. 1, showing the main plunger returned to part-way up position.

Fig. 5 is a view similar to Fig. 1, showing the main plunger returned to normal position.

Figs. 6 and 7 are details of the bell crank lever used in this embodiment.

Fig. 8 is a longitudinal sectional view.

Fig. 9 is a rear end elevation.

Fig. 10 is a section of a detail taken at right angles to Fig. 8.

Fig. 11 is a diagrammatic view of a circuit to illustrate one use of my invention.

Referring now to the drawings and to the embodiment of the invention illustrated therein, and first to Figs. 1 to 5 and 8, at 6 is shown generally a frame or base plate, upon which the switches and plungers are mounted. In the embodiment shown this frame plate consists of a bottom part and end parts 6' and 6''. The frame may be mounted on the bases 7 and 8 to which it is connected. Means 9 and 10 are formed, preferably from the material of the plate and integral therewith, for guides for the plungers 11 and 12. At 13 and 14 are shown other guides for the plungers. These may, likewise, be integral with the frame.

The ears 9 and 10, 13 and 14 are provided with openings, in which the plungers slide. A contact supporting member is shown at 15 and in the embodiment shown, is integral with the plate 6, being turned up at right angles thereto upon one end of the same. A switch is shown at A, which here will be called the main switch, and consists of the contacts 16 and 17, the contact 16 in the embodiment shown being stationary and the contact 17 being mounted upon a spring 18, which is fastened at 19 to the ear 15 of the plate 6 by some suitable means, such as screws 20.

The spring 18 normally tends to maintain the switch open, as illustrated in Figs. 1 and 5, and to reopen the switch when closed as

soon as pressure is relieved therefrom. Means are provided for closing the switch, here consisting of a manual device 11 and an intermediate device 21. One form of manual device which is suitable for the closing of the switch A, is a plunger 11, which is slidable in the ears 9 and 13, and which is returned to normal when released by a spring 22, which always endeavors to force the plunger to the position illustrated in Figs. 1 and 5, where a shoulder 24 on the plunger engages the lip 9. In the embodiment shown, the shoulder 24 consists of a collar fastened on the plunger by any suitable means, such as a key 25. The plunger may be equipped with a push button 26, which is engaged by the hand when the plunger is depressed.

The means which transmit the motion of the plunger to the spring 18 and causes the closing of the switch may well consist of a bell crank lever 21, provided with three arms 27, 28 and 29. Means is provided on the plunger for rocking the bell crank lever to cause the closing of the switch, which here consists of a shoulder 30. Means is also provided on the plunger for rocking the bell crank lever to cause the opening of the switch, and here consists of a catch 31 formed upon an extension 32 of the plunger.

The bell crank lever is provided with a slot 33, illustrated in Figs. 6 and 7, in which the stem operates. Means are provided for maintaining the bell crank lever in the position to which it is rocked, and in which it is illustrated in Figs. 3 and 4, until the catch 31 moves the bell crank lever from this position. Such means consists, in the embodiment shown, of such arrangement of the lever 21 and the spring 18 that the arm 28 of the lever 21 is on or beyond the dead center line, with respect to spring 18, when in the position shown in Figs. 3 and 4.

A second switch is shown at B, consisting of a pair of contacts 40 and 41, one of which may be stationary and the other of which preferably is mounted upon, or is a part of, a spring 42 connected at one end by suitable means 43 to the frame. The switch B is adapted to be controlled both by the main plunger 11 and by a second or auxiliary plunger 12, which is adapted to slide in the guides 10 and 14. The plunger 12 is equipped with a roller 44 for engaging the spring 42, and causing the same to close the switch B. Means is provided, and here consists of a shoulder 45, upon the spring 42, for maintaining the plunger 12 in the position shown in Fig. 3, to which it has been moved by the operation of the main plunger 11, after said main plunger has been returned to normal position, as illustrated in Fig. 5.

At C is shown the end of the core of the magnet, illustrated more particularly in

Figs. 8 and 10 of the drawing. At D is shown means including a screw *d* through which a cover is connected to the apparatus illustrated.

Referring now to Figs. 6 and 7, it will be seen that the bell crank lever is formed out of a punching, and that each of the arms 27 and 29 is provided with a camming surface, illustrated at 27' and 29', respectively. These surfaces engage shoulders upon the plungers, facilitating the operation of the plungers and switches through the lever. The lever is provided with an opening 50 through which it is pivoted to the frame by suitable means, such as a screw 51. The arm 28 is forked, thus consisting of two parts 28' and 28'', between which the roller 35 is mounted.

The operation of the device is as follows: The plunger 11 is depressed by engaging the push button 26 with some suitable means, as the hand. During the first part of the movement, the spring 22 is depressed and the bell crank lever is rocked, the roller 35 mounting upon the ridge 34 and depressing the spring 18 until the switch A is closed. The results of this operation are indicated in Fig. 2, where the plunger 11 is in intermediate descending position. The end of the arm 29 has engaged the bottom of the plunger 12 and is ready to cause the elevation of the same.

During the next part of the operation, the results of which are represented in Fig. 3, the plunger 11 is forced to way-down position, the bell crank lever causing the elevation of the plunger 12 to the position indicated in Fig. 3, where the switch B is closed. The lever 21 is rocked until the roller 35 is in such position that the force of the spring is in a line which passes through the axis upon which the lever rocks, or has passed this direction. In other words, the lever is on or beyond the dead center line. When the parts in the embodiment shown are so arranged, the lever 21 cannot rock farther in a counter-clockwise direction on account of the plunger 12, whose lower end now engages the arm 29 of lever 21, and which plunger is in its farthest upward position. A shoulder 24' on the plunger 12 has engaged the lip 10 and limited the upward movement of the plunger. The lever 21 cannot (when in the position illustrated in Fig. 3) be rocked to the left or clockwise, on account of the action of the spring 18, previously described, until it has been pulled back past the dead center by catch 31 on the plunger 11.

Both of the switches A and B are now closed, and remain closed as long as the plunger 11 is held down. When it is desired that the switch A shall be opened, the plunger 11 is released, and impelled by the spring 22, rises to the position of

the parts indicated in Fig. 4. During this movement no change takes place with respect to the switches A and B. However, when the plunger 11 reaches the intermediate ascending position indicated in Fig. 4, the catch 31 engages the arm 27 of the bell crank lever with sufficient force to cause the lever 21 to rock to the left sufficiently to pull roller over the dead center, when the spring 18 will rise quickly, moving the bell crank lever to the position illustrated in Fig. 5 with arm 27 of the lever 21 against shoulder 30 of the plunger 11, and causing the sudden opening of the switch A. With this arrangement a sudden opening of the switch is assured, since it cannot be opened in any other manner than as described, thereby reducing to a minimum the danger of arcing, and especially of prolonged arcing and the effects thereof.

If, when the parts are positioned as in Fig. 3, the pressure upon the plunger vacillates, or for any other reason the plunger is allowed to fluctuate through moderate ranges of movement, the switch will be unaffected thereby, since the switch contacts and the lever 21 will remain as shown in Fig. 3, even though the plunger 11 is moved up and down through a range represented by the distance between the catch 31 and the lower face of arm 27 of lever 21. Of course, this distance may be varied and predetermined to suit particular conditions of use. Though of general utility, devices so operating are of especial use where operated by women, children, and inexperienced persons, as devices requiring uniform pressure by the operator may vacillate, thereby opening and closing the switch. Under such circumstances, switches carrying relatively heavy current will arc and cause injury to the switch contacts. By my invention I avoid such effects, for, in the embodiment shown, the plunger 11 may be moved back and forth between its positions illustrated in Figs. 3 and 4, without in any way affecting the relation of the contacts 16 and 17 with respect to each other.

In Fig. 5 the apparatus is illustrated in final position, the switch A being opened by the spring 18 when the bell crank lever was moved to the left, and the switch B remaining closed since the plunger 12 is retained in elevated position by the shoulder 45 upon the spring 42. When it is desired to open the switch B, the plunger 12 is depressed independently of plunger 11 to the position indicated in Fig.

1. Assuming, for example, that the circuit controlling apparatus illustrated in Figs. 1 to 5 is used in the circuit illustrated in Fig. 11, and that the switch A is in the circuit of the starting motor and the switch B in the ignition circuit of the engine,—if the parts are as illus-

trated in Fig. 1, and it is desired to start the engine, the depression of the plunger 11 not only closes the switch of the motor M, but also closes the switch B in the ignition circuit. After the motor has started the engine, the plunger 11 is released and the switch in the circuit of the motor suddenly opened in the manner described, but the ignition circuit of the engine remained closed at B until it is desired to stop the engine, which may be effected by depressing the plunger 12. This makes it unnecessary for the operator to perform two operations, as is common practice now, so far as I am aware. Of course, the action of the switch 12 may be reversed, being open when the plunger 12 is elevated and closed when depressed, without departing from the spirit of my invention. The desired action of this switch may depend upon the character of the source of power for ignition.

Referring now to Figs. 8, 9 and 10, at 60 is shown an electromagnetic winding which, in the embodiment shown, consists of two windings 61 and 62, which are formed about a sleeve 63 within which is the magnet core 64. The magnet is mounted in the frame 6 and an electromagnetic switch is shown at P and consists of the contacts 65 and 66. The contact 65 is preferably stationary and in the embodiment shown, consists of a bar extending across the end of the structure. The contact 66 is movable and mounted upon, or is a part of, a spring plate 67, which is tensioned to cause it normally to rest against insulation material 68, and apart from the contact 65, thereby maintaining the switch P open. The contact 66, as here shown, consists of a plurality of contact fingers formed by a number of slits 70 being cut in the spring plate 67, thereby forming a plurality of tongues 71, the end of each of which is turned over, as illustrated at 69. The spring plate 67 is double-backed in the embodiment shown, as illustrated at 72, to give the same the proper resiliency and the portion 73 thereof extending at right angles to the main portion is fastened to the frame under the magnet in any suitable manner, as by screws 74.

Means are provided for causing the closing of the switch P, here consisting of a plunger 75, which projects through a bore 76 in the core of the electromagnet. This plunger is provided with a head 77, which engages the spring plate 67 and when the magnet is energized causes the closing of the same.

The core consists of two parts 78 and 79, which are adjustable with respect to each other. The part 79 is fastened in the frame plate 6' in any suitable manner, such as by lips 80 on the part 79, and which are turned outward to engage the sides of an opening 81 in the end plate 6'. The portion 78 of

the core, however, is movable, and means are provided for adjusting one of the core parts with respect to the other. In the embodiment shown, the end of the plunger 75 is slotted, as shown at 90 and threaded exteriorly, as shown at 91. A portion 78 of the core is provided with threads on the interior thereof to co-operate with the threads 91, so that when the plunger is rotated, the portion 78 of the core will travel along the same.

Means are provided for locking the portion 78 of the core with respect to the plunger after suitable adjustment, here consisting of a key 100 which extends through the slot 90, and through a transverse opening 101 in the core part 78. In the embodiment shown the ends of the key are folded over, as shown at 102, into the slot 90. When it is desired to modify the effect of the electromagnet upon the switch, or to change the force exercised by the magnet to operate the switch, the key 100 is removed and the plunger 75 is rotated in any suitable manner, such as by a screw driver inserted into the end of the slot 90, and the core portion 78 is caused to travel along the plunger 75 until the desired adjustment is secured.

When current is sent through either coil of the magnet, the plunger which is attached to core part 78, will move to the right, as shown in Fig. 8, and engage the plate 67 and cause the contact 66 to engage the contact 65 and thereby close the switch.

The operation of the electromagnetic switch P is as follows: When the engine has been started and sufficient speed developed to cause the voltage of the motor M, acting as a generator, to rise, sufficient current passes through the shunt coil 61 to move the plunger and close the switch. This causes current to pass from the generator through the series winding 62 of the switch P, through the switch contacts, to the storage battery, lights, etc., and then back to the other terminal of the generator. The magnetism produced by the series winding 62 aids that of the shunt coil 61, and the switch is maintained in closed position by strong pressure. However, should the speed of the engine drop to a point where the voltage of the generator would be below that of the battery, a reverse current would flow from the battery to the generator, which would reverse the polarity of the field produced by the series coil. The two coils would, therefore, be acting in opposition and the magnetism would be reduced to such a value that the spring of the switch would automatically open the contacts, thus preventing the discharge of battery current into the generator through the switch P.

I have illustrated this particular embodiment of my invention and the details thereof for the purpose of describing my inven-

tion. It will be apparent that my invention is not limited to such embodiment and such details, but that many departures may be made therefrom without departing from the spirit of the invention.

I claim.

1. In combination, a pair of switches, contact springs therefor, switch operating buttons, a camming element adapted to be advanced against a resilient contact spring of one of said switches to cause it to engage a second contact thereof, means to cause a closure of the contacts of the other switch, one of said buttons adapted when depressed to advance said element, and to operate said other switch contact closing means, whereby both switches are adapted to close their contacts by the depressing of one of said buttons, said resilient contact spring being so formed as to accelerate the rate of return movement of said camming element while the contact operated by it is being broken, beyond the rate of return movement of the depressed button when released, said other said switch contacts being adapted to remain in contact closing position after the said depressed button is restored to normal position.

2. In combination, a pair of switches, contact springs therefor, a pair of switch operating buttons, a camming element adapted to be advanced against a resilient contact spring of one of said switches to cause it to engage a second contact thereof, means to cause a closure of the contacts of the other switch, one of said buttons adapted when depressed to advance said element, and to operate said other switch contact closing means, whereby both switches are adapted to close their contacts by the depressing of one of said buttons, said resilient contact spring being so formed as to accelerate the return movement of said camming element when said camming element is released from switch contact closing position, to move it at a greater rate while the contacts operated by it are being broken, than the rate of return movement of the depressed button when released, said other said switch contacts being adapted to remain in contact closing position after the said depressed button is restored to normal position, said other button being subsequently manually operable to restore said other switch contacts to opened contact position.

3. A switching mechanism comprising a frame, a pair of switches on the frame, contact springs therefor, a pair of reciprocable switch-operating rods journaled thereon, said rods being parallel and close to each other, push buttons on the upper ends of the said rods, a switch-operating cam, said cam being adapted to be advanced against an inclined portion of a contact spring of one of the said switches, to deflect the said spring

to cause it to engage a second contact of the said switch when one of the said rods is advanced by depressing the push button on its upper end, said cam being thereby
5 advanced to switch closing position wherein it engages a less inclined portion of the said spring, a restoring spring to restore the said depressed rod to normal position when the pressure on the button
10 is relieved, means, operative when the said rod is advanced, to cause the closure of the contacts of the second switch, said second switch contacts being adapted to remain closed when the said rod is re-
15 stored to normal position, said last named contacts being adapted to be restored by reciprocating the other rod by manipulating the button thereon, said contact spring being adapted to accelerate the return move-
20 ment of the said cam to normal position, after an initial impulse given the said cam by the returning first rod, beyond the rate of return of the first rod.

4. In combination, a switch mechanism
25 comprising a plunger, a pair of normally open contacts therefor, a spring carrying one of said contacts, camming means interposed between the said spring and the
30 said plunger, a shoulder on the plunger adapted to engage the said camming means upon a forward movement of the plunger, said camming means thereupon engaging an inclined portion of said spring to cam the said
35 spring carrying contact against the other contact, said camming means being thereby moved to a contact closing position where it engages a less inclined portion of the said spring, such position being substantially a
40 dead center camming position, a second shoulder on the plunger and spaced therefrom adapted to engage the said camming means after a certain return movement of the plunger, whereby said camming means
45 is given an initial impulse to cause it to move from said dead center position to a position on said inclined spring portion, said spring thereafter accelerating the return movement of the said camming means to cause it to move at a speed rate greater than
50 the speed rate of return of the said plunger to cause a quick breaking of the contacts, a second switch for the said mechanism, and

plunger operated means to cause said second switch to operate its contact when the said
55 plunger is advanced to switch contact closing position, and separate manually operated restoring means for the said second switch contact.

5. In combination a switch mechanism comprising a reciprocable plunger, a contact operating spring, a pair of contacts
60 adapted to be moved upon a forward movement of the said spring, an intermediate element adapted to transmit motion from the said plunger to the said spring, said
65 intermediate element being adapted to cam said spring against the spring power thereof when the plunger is advanced until said contacts are closed, said intermediate element then occupying a sub-
70 stantially "dead center" position wherein the spring is inoperative to restore it, a lost motion connection between the said plunger and said intermediate element whereby said
75 plunger is adapted to give said intermediate element an initial restoring impulse only after said plunger has been moved towards normal position a predetermined amount, whereby said intermediate element is moved
80 to a position where its motion is accelerated by the power of the said spring to cause it to turn towards normal position at a rate in excess of the rate of movement of the restoring
85 plunger, said contacts being adapted to be broken during such accelerated rate of movement, a second switch for the said mechanism, contacts therefor and means to operate the said second switch contacts when the said
90 plunger is advanced to first switch contact closing position, and separate restoring means for the said second switch contacts.

6. In combination, a first switch, a second switch, common means for operating both
95 said switches, separate restoring means for each of said switches, one of the said restoring means being under the control of said common switch operating means, and means associated with said last named switch restoring means adapted to accelerate the rate at which its associated switch is re-
100 stored.

In witness whereof, I have hereunto signed my name this 5th day of August, 1918.

FRANK O. HARTMAN.