Sept. 9, 1958 E. F. MEKELBURG 2,851,545

TIME DELAY SWITCH

Filed Nov. 24, 1952 3 Sheets-Sheet 1

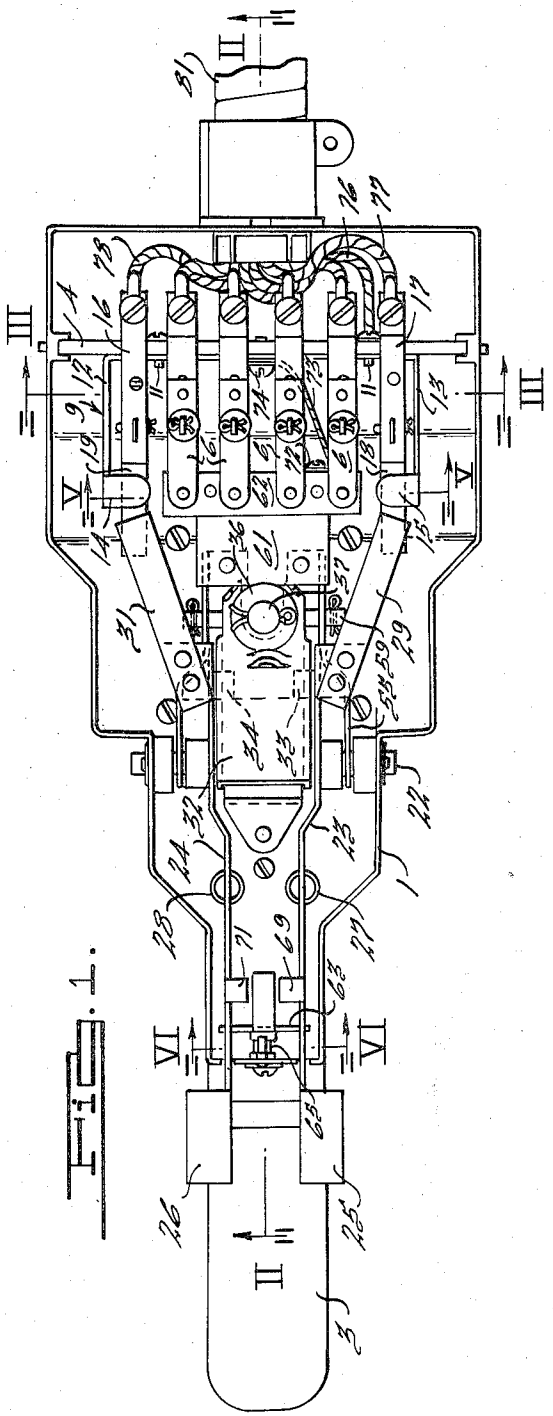


Fig. 1.

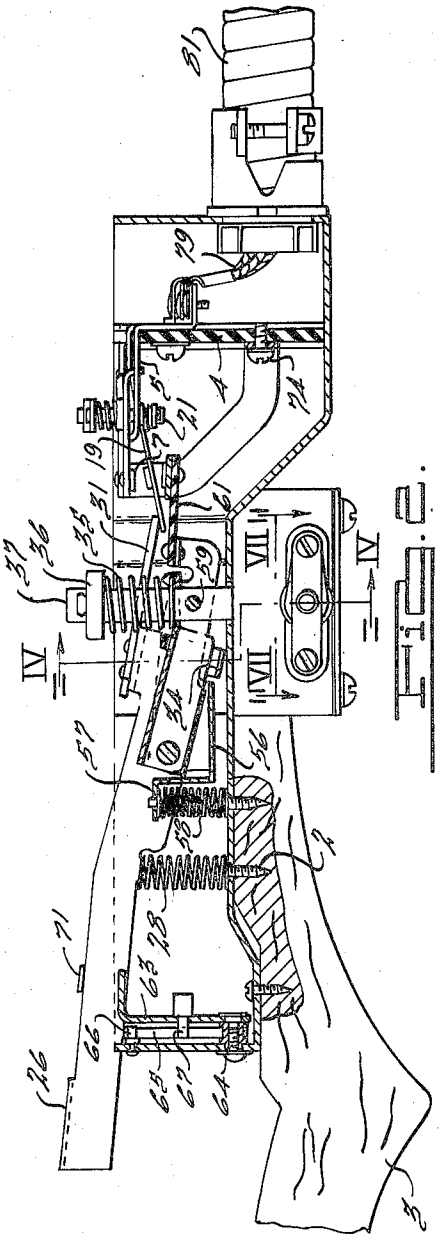


Fig. 2.

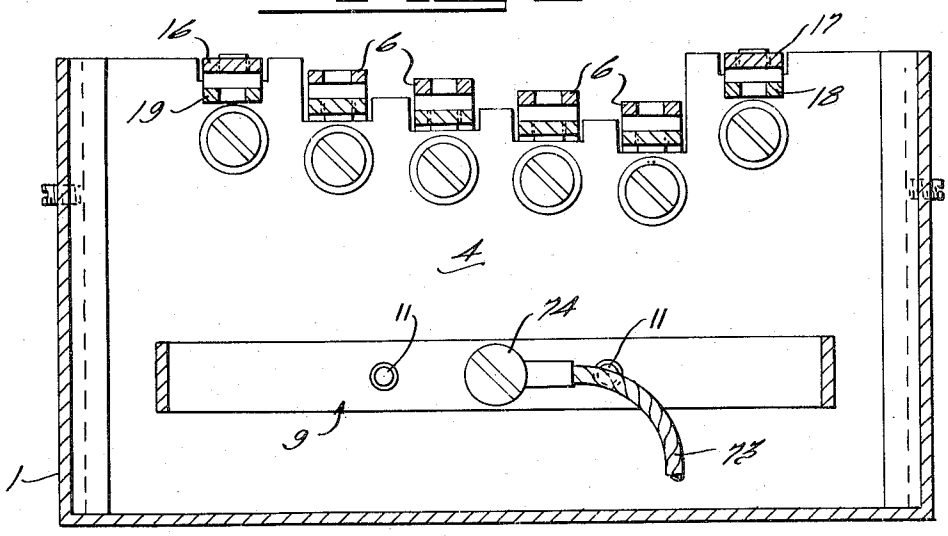
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Fig. 3.



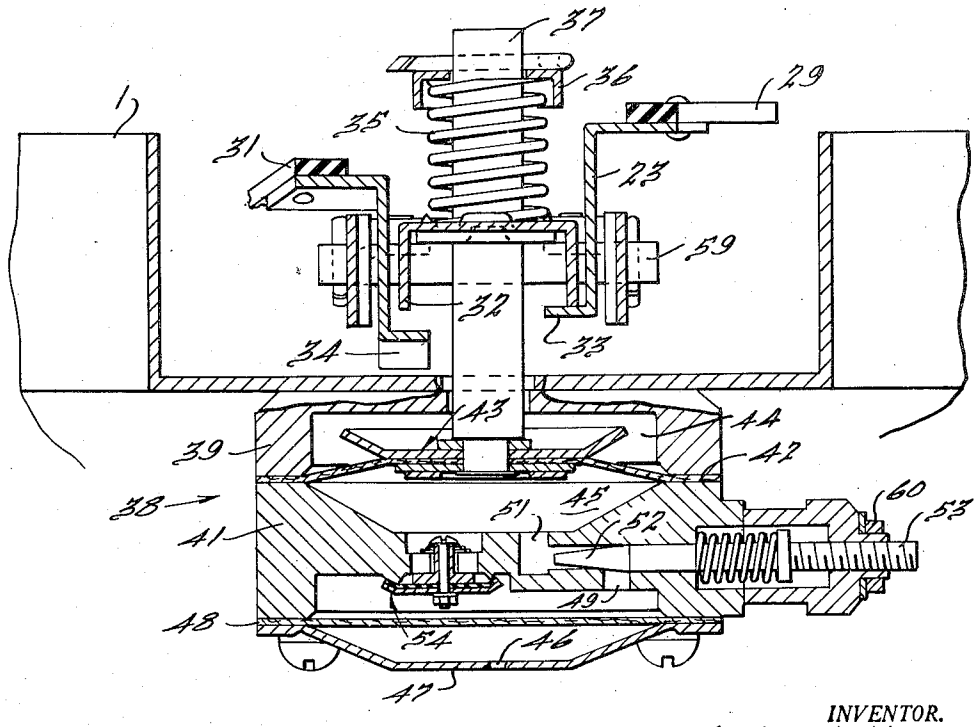


Fig. 4.

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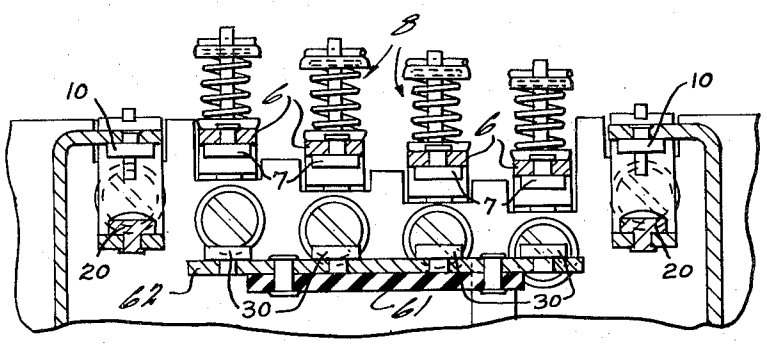


Fig. 5.

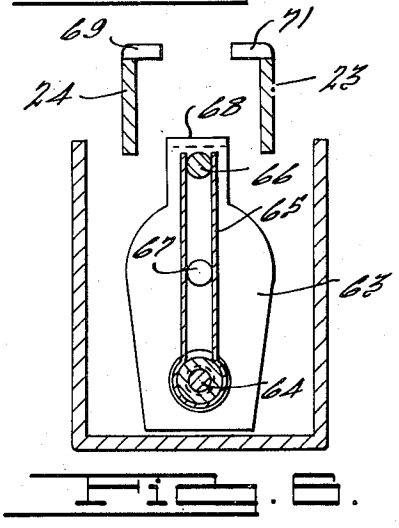


Fig. 6.

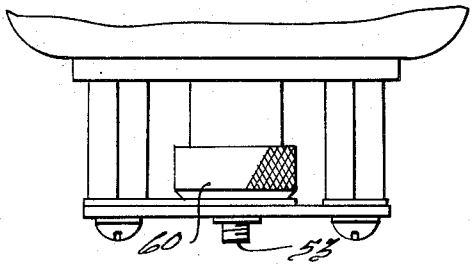


Fig. 7.

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TIME DELAY SWITCH

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8 Claims. (Cl. 200—5)

This invention relates, in general, to devices for controlling electric translating devices. More specifically, the invention relates to a switch having contacts for controlling the direction selecting circuit associated with an electric motor, and further having time delay means controlling other contacts associated with the accelerating circuit of the electric motor.

Another object of the invention is the provision of an improved electric switch for starting and controllably accelerating an electric motor, the device incorporating a timing mechanism operating in response to the flow of air through an adjustably restricted orifice.

Another object of the invention is the provision of a device in accordance with the preceding object in which manual operable means are provided which operate the direction controlling circuit of the associated device, and which simultaneously initiates operation of the timing mechanism.

Another object of the invention is the provision of the device in accordance with the preceding object in which the amount of operation of the timing mechanism is directly controlled by the movement of the manual means.

Another object of the invention is to provide a switch having a pair of common contacts for connection to a suitable source of electric energy, manual means being provided for operating these contacts, and further switching means being provided having common movable contacts electrically connected to the aforementioned common contacts.

Another object of the invention is the provision of the device in accordance with the preceding objects in which means are provided for preventing simultaneous operation of both of the manual operable contacts.

Other objects and features of the invention will be readily apparent to those skilled in the art from the specification and appended drawings illustrating certain preferred embodiments in which:

Figure 1 is a plan view of the device of the present invention with the cover removed.

Figure 2 is a sectional view along the plane of line II—II of Figure 1.

Figure 3 is an enlarged sectional view along the plane of line III—III of Figure 1.

Figure 4 is a sectional view along the plane of line IV—IV of Figure 2 showing the timing mechanism and its associated structure in operating position.

Figure 5 is an enlarged sectional view on the plane of line V—V of Figure 1.

Figure 6 is an enlarged sectional view on the plane of line VI—VI of Figure 1.

Figure 7 is an enlarged sectional view on the plane of line VII—VII of Figure 2.

The device of the present invention includes metallic base 1 mounted by suitable means such as the screws 2 to a handle 3 shaped to facilitate manual holding. A cover for the base 1, which is not shown in the drawings,

may be provided and attached to the base 1 by suitable means.

Disposed transversely of the base 1 is an insulating block 4 upon which are mounted a plurality of generally Z-shaped conducting members 5. The members 5 are mounted upon the block 4 in such manner that they are spaced both laterally and vertically from each other. Upon each of the members 5 there is pivotally attached a contact finger 6 each of which carries an electrical contact 7. As may be seen from Figure 5, the contact fingers 6 are biased toward the associated members 5 by suitable, conventional spring means 8.

Also connected to the block 4 at the interior wall thereof is a generally U-shaped member 9 which is mounted to the block 4 by suitable means such as the screw 11. The member 9 has spaced arms 12 and 13 at the extremities of which are ears 14 and 15 respectively. Each of the ears 14 and 15 carries an electrical contact 10, as shown in Figure 5.

Also mounted upon the block 4 are generally Z-shaped members 16 and 17, similar to members 5. Hingedly mounted to the under side (from the view of Figure 1) of the members 16 and 17 are contact fingers 18 and 19, each of which carries an electrical contact 20 disposed to cooperate with the electrical contacts 10 upon the ears 14 and 15. Suitable spring means 21, similar to spring means 8, are provided to bias the fingers 18 and 19 toward the members 17 and 16 respectively.

Extending transversely across, and mounted through suitable apertures in, the base 1 is a pin 22 upon which are rotatably mounted a pair of manual operating means comprising levers 23 and 24. Levers 23 and 24 are provided at their exterior ends with suitable flanges 25 and 26 respectively whereby the operator may effect rotation of the levers. Springs 27 and 28 are provided which bias the operating levers 23 and 24 respectively toward the position illustrated in Figure 2. The interior extremities of levers 23 and 24 carry insulating arms 29 and 31 respectively. Insulating arm 29 engages contact finger 18 and normally prevents its moving under the bias of the spring means 21. Simultaneously, insulating arm 31 normally engages contact finger 19 and prevents its movement toward the member 16 under the influence of the associated spring means 21, as illustrated in Figure 2.

Also rotatably mounted upon the pin 22 is a spring retainer plate 32. Provided on the operating levers 23 and 24 are lugs 33 and 34 respectively which, upon the operation of the operating levers, engage the underside of the spring retainer plate 32 to move it in a counter-clockwise direction about the pin 22. Abutting against the spring retainer plate 32 is one end of a spring 35, the other end of which engages a retainer 36 which is biased by the spring 35 against a cotter pin which extends through a suitable hole in a pin 37.

As may be seen from Figure 4, the opposite end of the pin 37 extends through the base 1 and into one chamber of a timing mechanism, indicated generally by the numeral 38. This timing mechanism, which is mounted to the under surface of the base 1, comprises a pair of segments 39 and 41 separated by a diaphragm 42. As seen in Figure 4, the central portion of the diaphragm 42 is mounted to the pin 37 by suitable fastening means indicated generally at 43. The diaphragm 42 divides a central chamber formed of the two segments 39 and 41 into two compartments 44 and 45. Movement of the diaphragm 42 from the unoperated to the operated position, which is indicated in Figure 4, is accomplished at a rate determined by the rate of the flow of air, by the atmosphere through a hole 46 in a cover plate 47 mounted to the segment 41, through a suitable filter 48, an aperture 49, and a variable retractable passage 51. The effective

area of the passage 51 is determined by the depressed end 52 of an adjusting screw 53 having suitable threads and being positionable to vary the position of the end 52 relative to the passage 51. A valve indicated generally by the numeral 54 is provided which permits movement of the diaphragm 42 from the position illustrated in Figure 4 to the unoperated position; that is to say, to the position in which the chamber 45 is the minimum substantially instantaneously.

Also provided upon the pin 22 is a bracket 55 having a pair of arms which are positioned upon the pin 22, the arms being joined together at their under surface by a plate 56. A flange 57 is provided on the plate 56 and a spring 58 is interposed between the flange 57 and the base 1 to bias the bracket 55 toward the position illustrated in Figure 2. The inwardly projecting portions of the arms of bracket 55 are connected together by a pin 59 which extends through the pin 37. These inward portions of the arms of bracket 55 are also provided with flanges which mount an accelerating plate 61 to which is fastened a conducting plate 62 having electrical contacts 30 thereon disposed to cooperate with the electrical contacts 7 upon the fingers 6.

A mechanical interlock is provided for operation with the operating levers 23 and 24 which comprises a plate 63 of sufficient breadth, as may be seen from Figure 6, as to be contacted by either operating lever upon its depression. The plate 63 is pivoted upon a screw 64 extending through the base 1, the screw 64 also carrying a U-shaped centering spring 65, the arms of which are biased to close upon a stud 66 protruding from the inner surface of the base 1 and also a post 67 rigid with the plate 63 to center it. A flanged end 68 of the plate 63 and normal to the plane thereof is disposed between inwardly projecting ears 69 and 71 on the operating levers 24 and 23 respectively.

As may be seen from Figure 1, a terminal 72 is provided upon the conducting plate 62 and a flexible electrical conductor 73 is connected from the terminal 72 to a suitable terminal 74 upon the member 9. A flexible lead 76 is connected to the member 9 at a mounting screw 11. Similar flexible leads 77 and 78 are connected to the members 17 and 16 respectively, and other flexible connectors 79 are connected to the members 5. These flexible connectors project through the base 1 and extend through a flexible tubing 81.

Operation of the device will now be described:

The flexible connector 76 is connected to a suitable source of electrical energy. Flexible connectors 77 and 78 are connected to the direction selecting circuits of the controlled motor, one of these connectors being connected to the "forward" circuit while the other is connected to the "reverse" circuit. Flexible connectors 79 are connected to the circuits for controlling the amount of resistance in circuit with the electrical motor to determine thereby its rotational speed.

Depression of the flange 25 of the operating member 23 will effect its rotation in a generally counter-clockwise direction from the view of Figure 2, whereby the insulating arm 29 will be raised. The contact finger 18 will thereby close its contact 20 upon the contact 10 on ear 15 so that the flexible lead 77 will be electrically connected to the source of energy. As the operating lever rotates, the lug 33 thereof will engage the under surface of the spring retainer plate 32 to effect its rotation in a counterclockwise direction about the pin 22. As plate 32 is raised, spring 35 is compressed and operates against retainer 36, and consequently biases the pin 37 outwardly. The rate at which pin 37 moves is determined, as previously described, by the setting of the pin 53 of the timing mechanism. As the pin 37 moves upwardly at its controlled rate, the arms of bracket 55, connected to the pin 37 by means of the pin 59, will be raised therewith whereby the conducting plate 62 will move steadily upwardly. As plate 62 moves upwardly, it will successively engage its contacts 30 with contacts 7 on the contact fingers 6, as will readily be seen from a consideration of Figure 5. As each of these fingers 6 is successively engaged, that finger is electrically connected to the source of electrical energy, and the flexible lead connected with that finger 6 carries current to the associated portion of the acceleration circuit to cut out some of the resistance in circuit with the controlled motor. When the plate 62 has reached its maximum movement, all of the fingers 6 are engaged thereby, and all of the accelerating resistance is disconnected from the controlled motor.

Upon release of the lever 23, the spring 27 rotates it in a clockwise direction whereby the insulating bar 29 engages the finger 18 to break the connection between finger 18 and ear 15. Simultaneously, lug 33 releases the plate 32 and spring 58 rotates the bracket 55 to the position illustrated in Figure 2. As previously indicated, the pin 37 will return rapidly to its retracted position. Upon release of the lever 23, the spring 65 returns the plate 63 to the position illustrated in Figure 6 whereby either of the levers may then again be depressed. When lever 24 is rotated, plate 63 again prevents operation of the other lever, while insulating arm 31 permits engagement of the contacts 20 and 10 of finger 19 and ear 14, whereby the direction selecting circuit associated with the flexible connector 78 is energized and the accelerating circuits associated with the electrical motor are energized in the manner previously described.

It should be noted that the operator may at any time change the timing characteristic of the device by rotation of the knurled nub 60, thereby changing the position of pin 53 relative to the passage 51. Furthermore, the operator can also effect engagement between the contact plate 62 and the associated contact finger 6 at as slow a rate as he desires, inasmuch as the force applied to the pin 37 to move it outwardly is directly controlled by the amount of movement applied by the lugs 33 and 34 to the spring retaining plate 32. This also permits him to stop the movement of contact plate 62 in any intermediate position.

It will therefore be seen that the device of the present invention provides for controlling both the "forward" and "reverse" circuits of an electric motor and simultaneously provides for controlling the acceleration of the motor. The rate of acceleration may at any time be varied and the operator may, by controlling the amount of pressure applied to the operating lever, accelerate the control motor as slowly as he sees fit. Furthermore, means are provided which positively prevent operation of both the "forward" and "reverse" circuits simultaneously.

While a certain preferred embodiment of the invention has been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In a switching device of the character described, the combination comprising; a first and a second manually operable means, a first switch mechanically connected with and operable by the first manually operable means, a second switch mechanically connected with and operable by the second manually operable means, interlock means operative to prevent simultaneous operation of both said first and second switches, a plurality of third switches, and an adjustable timing means operably connected with the third switches and with the first and second manually operable means and rendered operative by either of the first and second manually operable means upon operation of either of the first and second switches to actuate the third switches at predetermined time intervals after either of the first and second switches is operated.

2. In a switching device of the character described, the combination comprising; a first and a second manually operable means, a first switch mechanically connected with and operable by the first manually operable means,

a second switch mechanically connected with and operable by the second manually operable means, interlock means operative to prevent simultaneous operation of both said first and second switches, a plurality of third switches, and an adjustable timing means operably connected with both the third switches and with said first and second manually operable means and arranged for sequentially actuating the third switches at predetermined time intervals after either of the first and second switches is operated by the manually operable means.

3. In a switching device of the character described, the combination comprising; a first and a second manually operable means, a first switch mechanically connected with and operable by the first manually operable means, a second switch mechanically connected with and operable by the second manually operable means, interlock means operative to prevent simultaneous operation of both said first and second switches, a plurality of third switches, means mounting said third switches in mutual lateral and vertical displacement, and an adjustable timing means operably connected with said first and second operable means and rendered operative upon operation of either of the first and second switches to move vertically to engage and operate the third switches successively at predetermined time intervals after either of the first and second switches is actuated by the manually operable means.

4. In a switching device of the character described, the combination comprising; a first and a second manually operable means, a first switch mechanically connected with and operable by the first manually operable means, a second switch mechanically connected with and operable by the second manually operable means, interlock means operative to prevent simultaneous operation of both said first and second switches, a plurality of third switches, each of said third switches comprising a relatively fixed and a relatively movable contact engageable with each other, means mounting the fixed contacts in mutual lateral and vertical displacement, means mounting the movable contacts in a common plane, and an adjustable timing means operably connected with said first and second operable means and rendered operative upon operation of either of the first and second switches to move vertically and force said movable contacts into engagement with said stationary contacts, respectively, successively at predetermined time intervals.

5. In a switch device of the character described, the combination comprising; a first and a second manually operable means, a first switch mechanically connected with and operable by the first manually operable means, a second switch mechanically connected with and operable by the second manually operable means, interlock means for preventing simultaneous operation of both said first and second switches, a plurality of third switches, an adjustable timing means operably connected with the third switches, spring means arranged to normally bias

the timing means to an inoperative position, and means connecting the timing means with the first and second manually operated means for controlling movement of the timing means, when the manual means are moved for selectively operating the first and second switches, thereby to cause said third switches to operate at a predetermined time interval after the operation of the first or second switches.

6. In a switch the combination comprising; a first and a second manually operable means, a first switch mechanically connected with and operable by said first manual means, a second switch mechanically connected with and operable by said second manual means, interlock means for preventing simultaneous operation of both said first and second switches, a plurality of third switches, each of said third switches including a relatively fixed and a relatively movable contact, means mounting said relatively fixed contacts in mutual lateral and vertical displacement, means mounting said relatively movable contacts in a common plane and in electrical connection with each other, timing means including a member movable vertically at a controlled rate from an unoperated to an operated position, spring means normally biasing said member toward unoperated position, means connecting said manual means with the timing means for permitting said movement of said member after said manual means has operated either said first or second switch, means connected with said movable member and operative during said movement of said member to move said movable contacts into engagement with said stationary contacts, respectively, at predetermined times after operation of either of said first or second switches, and means for connecting said first, second and third switches to exterior electrical circuits whereby said third switches operate to change the condition of the electrical circuits associated therewith at timed intervals subsequent to the operation of either said first or second switches and consequent changes in the condition of the electrical circuits associated therewith.

7. The device of claim 1 in which said first and second switches each comprises a fixed contact and a movable contact, and in which said fixed contacts of said first and second switches are electrically common.

8. The device of claim 1 in which said first and second switches each comprises a fixed contact and a movable contact, and in which said fixed contacts of said first and second switches are electrically common, and further in which said third switches each comprises a relatively fixed and a relatively movable contact with the movable contacts of said third switches being electrically common.

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