July 12, 1966 C. S. McCLELLAN 3,260,823

SINGLE IMPULSE LATCHING RELAY

Filed June 29, 1964

Fig. 1

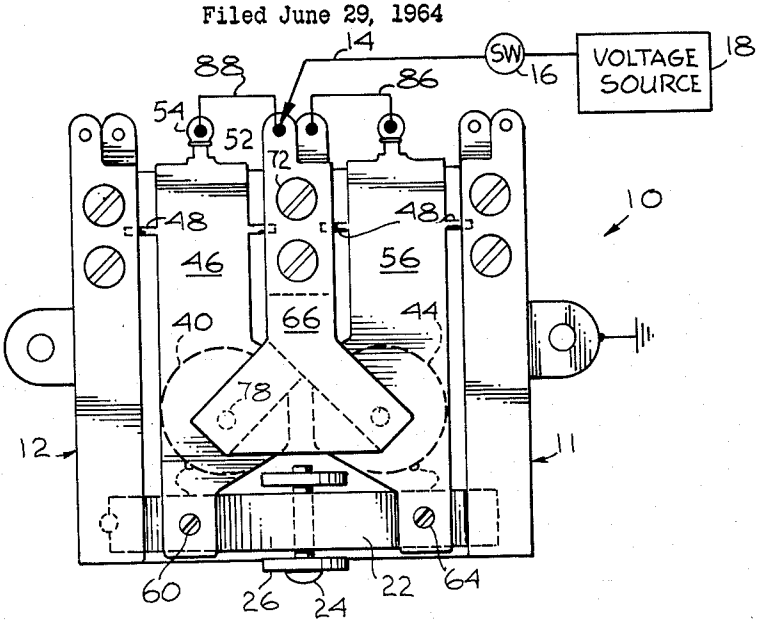
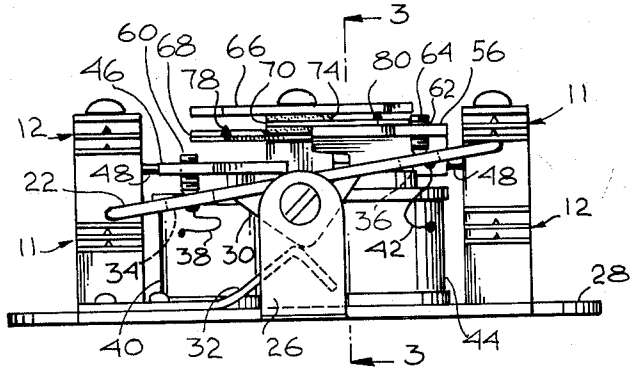


Fig. 2



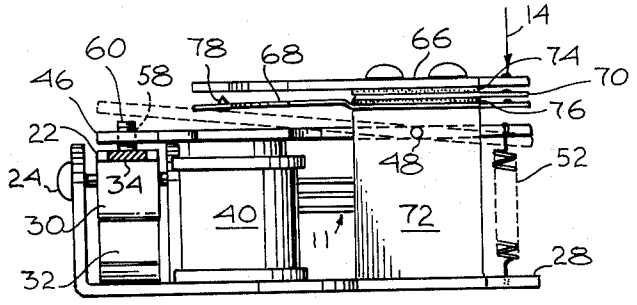


Fig. 3

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SINGLE IMPULSE LATCHING RELAY

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This invention relates generally to improvements in relays of the single impulse latching type.

Single impulse latching type relays are intended to switch in response to the application of an electrical pulse and then hold or latch in that condition until the application of a subsequent pulse. Although many relays of this type are known in the prior art, they all appear to possess certain undesirable characteristics. For example, many prior art relays are sensitive to pulse duration and in the event the applied pulse is too long, are likely to oscillate. In applications where pulse duration cannot be precisely controlled, as for example where the relay is responsive to the closure of a manually controlled switch, such oscillation is usually intolerable. Another characteristic typical of relays of this type is that they require a sustaining voltage to latch them in a selected position. The provision of a sustaining voltage can represent a significant burden in certain types of equipment, such as battery powered devices.

In view of the above, it is an object of the present invention to provide an improved relay which is insensitive to variations in the duration of pulses applied thereto.

It is a further object of the present invention to provide a latching relay which does not require a sustaining voltage.

It is a still further object of the present invention to provide a relay which has a reliable and consistent response and is relatively inexpensive to provide and maintain.

The relay, in accordance with the present invention, utilizes a movable arm capable of assuming first and second positions. Detent means are provided for retaining the arm in either of the assumed positions. When the arm is in one position, a first switch in series with a first relay coil is closed and when it is in the other position, a second switch in series with a second relay coil is closed. Each of the first and second switches is connected in series with a different normally closed switch to thus always establish a path to one of the coils. When a voltage is applied to the established path, the arm will be moved to a different position and the established path will be maintained for as long as the voltage continues to be applied. In addition, the normally closed switch in the open path will be opened and held open for as long as the voltage is applied to the established path.

In the disclosed preferred embodiment of the invention, a rocker arm is employed in conjunction with a pair of first and second armatures positioned adjacent thereto. When the first relay coil is energized, the first armature will be moved to force the rocker arm to a first position and when the second relay coil is energized, the second armature will be moved to force the rocker arm to a second position. When the rocker arm is in the first position, it establishes a connection between the second armature and the second relay coil and similarly, when the rocker arm is in the second position, a connection is established between the first armature and the first relay coil. Each of the armatures is connected to a common source of selectively applied pulses through a different normally closed switch. When the first armature is moved in response to the energization of the first relay coil, it opens the normally closed switch in series with the second armature and similarly when the second armature is moved in response to the energization of the second relay coil, it opens the normally closed switch in series with the first armature. In this manner, an established path between the pulse source and a relay coil is maintained for the duration of the pulse while the establishment of the other path is prevented during this period.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawings, in which:

FIGURE 1 is a plan view of a preferred embodiment of the invention;

FIGURE 2 is a front view of a preferred embodiment of the invention; and

FIGURE 3 is a vertical sectional view taken substantially along the plane 3—3 of FIGURE 2.

Attention is now called to the drawings which illustrate the relay **10** in accordance with the invention for alternately closing contacts in first and second banks **11** and **12** in response to voltage pulses applied to a common input line **14**. Input line **14** is derived from a switch **16** connected to the output of a voltage source **18**. Switch **16** can, for example, be of the manually operated type in which event the duration of pulses applied to the line **14** are difficult to precisely control. The relay **10** constitutes means for alternately closing the contacts of banks **11** and **12** in response to each pulse applied to input line **14** regardless of the duration of the pulse.

The relay **10** includes a rocker arm **22** supported for pivotal movement on pin **24**. Pin **24** is mounted on a plate **26** extending vertically from a base plate **28**. The arm **22** is provided with a depending substantially V-shaped portion **30** which cooperates with an inverted V-shaped spring **32** secured to the base plate **28**. The spring **32** acts as a detent means to cause the rocker arm **22** to be retained in either the position illustrated in FIGURE 2, i.e. with its left end down and its right end up, or in an oppositely oriented position with its right end down and its left end up. The rocker arm extends between the banks of contacts so that when it is retained in its first position as illustrated in FIGURE 2, the contacts of bank **11** are closed. When the rocker arm **22** is retained in its second position, the contacts of bank **12** will be closed. Inasmuch as both ends of arm **22** can be utilized to close contacts, the banks **11** and **12** can be separated into two sections as illustraed in FIGURE 2. It should of course be realized that the number of contacts which can be included in the banks **11** and **12** is substantially unlimited.

The rocker arm **22** is formed of an electrically insulating material but however, has first and second conductive portions **34** and **36**. A short wire **38** connects conductive portion **34** to the input terminal of a first relay coil **40** whose output terminal is grounded through the base plate **28**. The second conductive portion **36** is similarly connected through a short conductive lead **42** to the input terminal of a second relay coil **44** whose output terminal is also electrically grounded.

An armature **46** is mounted immediately above the relay coil **40**. The armature **46** comprises a plate of a material, such as iron, which is attracted by a magnetic field. The armature has a pair of pins **48** extending therefrom which pins are supported for rotational movement to thus allow the armature **46** to pivot about a line extending therebetween. A spring **52** is connected between the base plate **28** and the rear end **54** of the armature **46** consequently normally pivoting the armature **46** upwardly as represented by the dotted line position in FIGURE 3. An armature **56** is similarly supported above the second relay coil **44**.

The armature 46 has an internally threaded aperture 58 adapted to adjustably receive a screw contact 60. The aperture 58 is aligned with the first conductive portion 34 of the rocker arm 22. The armature 56 similarly has an internally threaded aperture 62 receiving screw contact 64 in alignment with the second conductive portion 36 of the rocker arm 22.

The common input line 14 is electrically connected to an upper conductive wafer 66 which is stacked in alignment with but insulated from a first leaf spring 68 and a second leaf spring 70. More particularly, the conductive wafer 66 and leaf springs 68 and 70 are stacked on posts 72. An insulator 74 insulates wafer 66 from leaf spring 70 while insulator 76 insulates leaf springs 68 and 70 from one another. The leaf springs 68 and 70 respectively carry contacts 78 and 80 which are adapted to contact conductive wafer 66. However, the leaf springs are inherently biased downwardly so that a gap would normally be defined between wafer 66 and contacts 78 and 80. Portions of the armatures 46 and 56 are aligned with the leaf springs 68 and 70 and when the armatures are in their normal upwardly urged position, as represented by the dotted lines in FIGURE 3, they force the respective leaf springs upwardly to engage the contacts 78 and 80 with the conductive wafer. On the other hand, when the armatures 46 and 56 are pulled downwardly, the leaf springs are free to disengage the contacts 78 and 80 from the conductive wafer 66.

Although the leaf springs are not in electrical contact with the armatures used to push them upwardly, they are however connected through leads 86 and 88 to the opposite armatures. Thus, leaf spring 68 is connected through lead 86 to armature 56 and leaf spring 70 is connected through lead 88 to armature 46.

In the operation of the relay 10, the armatures 46 and 56 will normally be pivoted upwardly away from the associated relay coils by the springs 52. The rocker arm 22 can be in either one of its two possible detented positions thus closing the contacts of either bank 11 or bank 12. Assuming that the rocker arm is in its second position, that is, with its right end down and its left end up, contact 60 will be electrically engaged with conductive portion 34 of the rocker arm. Likewise, wafer 66 will be connected through leaf spring contact 78 and lead 86 to the armature 56. Similarly, the conductive wafer 66 will be connected through leaf spring contact 80 and lead 88 to the armature 46.

Thus, a complete circuit will be established only through the coil 40. The circuit through the coil 44 will of course be open inasmuch as the contact 64 and conductive portion 36 of the rocker arm 22 will not be in electrical contact. When the switch 16 is then closed to apply a voltage pulse to the wafer 66, the coil 40 will be energized to pull the armature 46 down to thus pivot the rocker arm 22 to the position illustrated in FIGURE 3. As long as the switch 16 is closed, the relay coil 40 will remain energized and thus the armature 46 will remain down as illustrated in FIGURE 2. Inasmuch as contact 58 will remain electrically connected to conductive portion 34 of the rocker arm 22, the path through the relay coil 40 will continue to exist. Even though contact 64 and the conductive portion 36 of the rocker arm 22 will move into electrical contact with each other, the path through the relay coil 44 will not be established inasmuch as the leaf spring contact 78 moves out of electrical contact with the wafer 66 when the armature 46 is pulled down. When the switch 16 is open, the spring 52 will pull the armature 46 to its normal up position leaving the rocker arm 22 in the position illustrated.

From the foregoing, it should be appreciated that a relay has been provided herein which switches only once in response to the application of a pulse thereto regardless of the duration of the pulse. Inasmuch as the established path through the relay coil is maintained for the duration of the applied pulse and since the path through the non-

energized coil is prevented from being established until the energized relay coil is de-energized, the relay is prevented from oscillating. Use of the detent means comprising the spring 32 to cooperate with the V-shaped portion 30 to latch the rocker arm 22 in position, avoids the need of providing a sustaining voltage for latching. Thus, the relay requires the expenditure of a very small amount of power therefore making it extremely suitable for use in battery powered devices.

What is claimed is:

1. A relay comprising:
first and second normally closed switches each having an input terminal and an output terminal;
first and second armatures;
a first relay coil for moving said first armature in response to the energization thereof;
a second relay coil for moving said second armature in response to the energization thereof;
an arm mounted for movement between first and second positions;
means for moving said arm to said first position in response to said first armature moving and to said second position in response to said second armature moving;
means electrically connecting said first armature to said first relay coil when said arm is in said second position;
means electrically connecting said second armature to said second relay coil when said arm is in said first position;
means respectively connecting said first and second normally closed switch output terminals to said second and first armatures;
means responsive to the energization of said first and second relay coils for respectively opening said first and second normally closed switches; and
means selectively connecting a voltage source to said normally closed switch input terminals.

2. The relay of claim 1 including detent means for holding said arm in either said first or second position.

3. In combination:
a voltage source;
first and second relay coils; and
first and second circuit paths respectively connecting said source to said first and second relay coils;
said first circuit path including first and second serially connected switches;
said second circuit path including third and fourth serially connected switches;
said first and third switches being normally closed;
means closing either said second or fourth switches to respectively energize either said first or second relay coil;
means for closing said fourth switch and opening said third switch in response to said first relay coil being energized; and
means for closing said second switch and opening said first switch in response to said second relay coil being energized.

4. The combination of claim 3 wherein said second and fourth switches each includes first and second contacts;
said second and fourth switch first contacts respectively comprising first and second armatures respectively movable in response to the energization of said first and second relay coils;
an arm movable to a first position in response to the energization of said first relay coil and to a second position in response to the energization of said second relay coil;
said arm carrying said second and fourth switch second contacts.

5. Apparatus for alternately closing first and second banks of contacts in response to the provision of an input pulse, said apparatus including:
first and second relay coils;
first and second armatures adapted to move in response

to the respective energization of said first and second relay coils;

a rocker arm;

means mounting said rocker arm adjacent said armatures whereby movement of said first armature will force said rocker arm to a first position to close said first bank of contacts and movement of said second armature will force said rocker arm to a second position to close said second bank of contacts;

a first conductive portion on said rocker arm engaging said first armature when said rocker arm is in said second position;

a second conductive portion on said rocker arm engaging said second armature when said rocker arm is in said first position; and

means respectively connecting said first and second conductive portions to said first and second relay coils.

6. The apparatus of claim **5** including first and second normally closed switches for respectively coupling said input pulse to said first and second armatures;

means for opening said first normally closed switches for respectively coupling said input pulse to said first and second armatures;

means for opening said first normally closed switch in response to the movement of said second armature; and

means for opening said second normally closed switch in response to said movement of said first armature.

7. The apparatus of claim **6** wherein said first and second normally closed switches include a conductive wafer and first and second leaf springs having contacts spaced from said wafer; and

spring means for urging said armatures against said leaf springs to thereby electrically engage said first and second leaf spring contacts with said wafer.

8. The apparatus of claim **5** including detent means for holding said rocker arm in either said first or second position.

9. The apparatus of claim **5** wherein said rocker arm includes a protruding V-shaped portion; and

spring means adapted to bear against said V-shaped portion for holding said rocker arm in either said first or second position.

No references cited.

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