

[54] **WINDOW LIFT CONTROL SYSTEMS**

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[22] Filed: Dec. 16, 1970

[21] Appl. No.: 98,706

[30] **Foreign Application Priority Data**

Dec. 30, 1969 Great Britain.....63,230/69

[52] U.S. Cl. 318/266, 318/286, 318/466

[51] Int. Cl. H02p 1/22

[58] Field of Search.....318/265-267, 295,
318/286, 297, 466, 467, 282-284, 480;
307/10; 200/DIG. 1, 61.42, 61.43, 61.44

[56]

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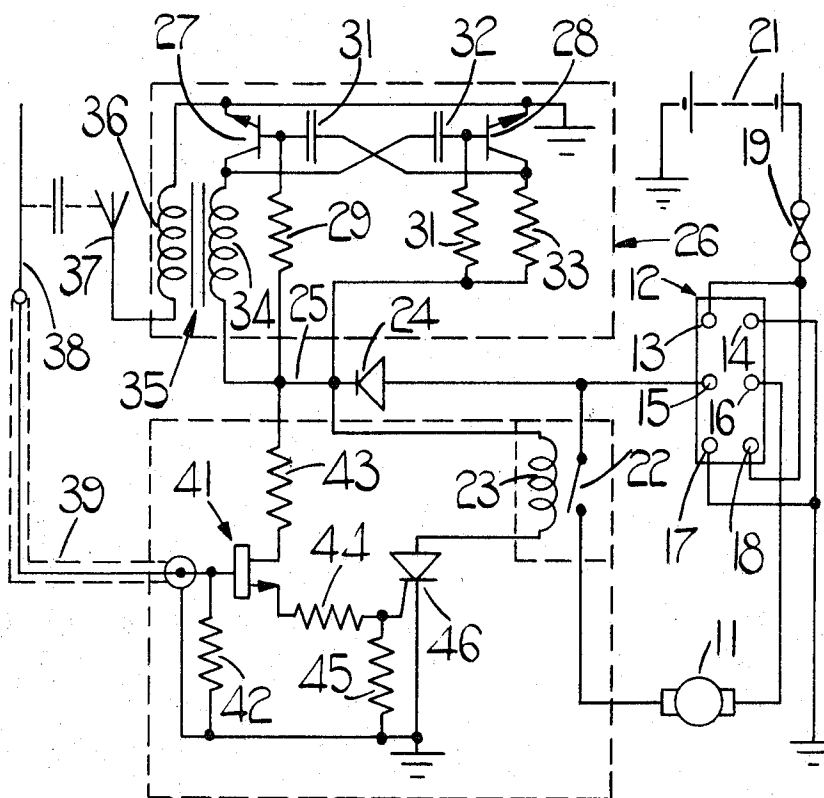
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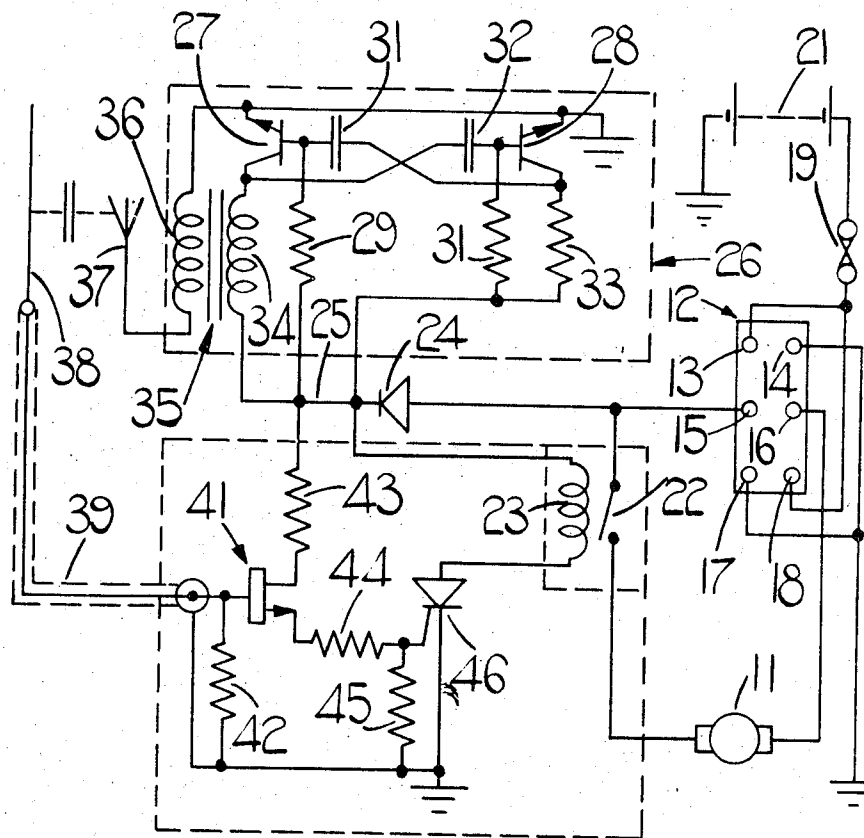
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ABSTRACT

A window lift control system has a motor for lifting and lowering the window and a reversing switch for operating motor to raise or lower the window. There is also a control circuit which when energized prevents the window from being raised, and means is provided for energizing the control circuit whenever the window is touched while it is being raised.

5 Claims, 1 Drawing Figure





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WINDOW LIFT CONTROL SYSTEMS

This invention relates to window lift control systems for use in road vehicles.

A system according to the invention comprises a motor for lifting and lowering the window, a pair of supply terminals for connection to a d.c. source, a reversing switch movable from an off position to first and second operative positions in which the motor is operated to raise and lower the window respectively, a control circuit which when energized prevents raising of the window, and means for energizing the control circuit when the window is touched provided the reversing switch is in the first operative position.

The control circuit, when energized, may stop the motor or reverse the motor to lower the window.

Preferably, the control circuit has a pair of input terminals, one of which is connected to one of the supply terminals, and the other of which is connected to the other supply terminal by way of the reversing switch when the reversing switch is in said first position. The input terminals of the control circuit may provide power to an inverter which provides power to an induction loop inside the vehicle when the window is being raised, the arrangement being such that if the edge of the window, which edge is metallized, is touched, power is fed to a device which acts to stop or reverse the motor. Depending on the design of the inverter, a diode may be inserted between the reversing switch and said other input terminal to prevent short-circuiting of the supply when the window is raised. The device can be a field effect transistor which on receiving an input provides a gate signal to a thyristor, which energizes a relay to stop or reverse the motor.

The accompanying drawing is a circuit diagram illustrating one example of the invention.

Referring to the drawing, there is provided a permanent magnet motor 11 for lifting and lowering the window, the motor being controlled by a switch 12 having three pairs of terminals 13, 14; 15, 16; 17, 18. The terminals 13, 18 are connected through a fuse 19 to the positive terminal of a vehicle battery 21, the negative terminal of which is earthed, and the terminals 14, 17 are earthed. In the off position of the switch, none of the terminals are interconnected, but in the up position of the switch, the terminal 13 is connected to the terminal 15, and the terminal 14 is connected to the terminal 16. The terminal 15 is connected to one side of the motor 11 through a normally closed relay contact 22 operable by a relay winding 23, while the contact 16 is connected to the other side of the motor 11. Thus, when the switch 12 is moved to its up position, the positive battery terminal is connected by way of the terminals 13, 15 and the contact 22 to one side of the motor 11, the other side of which is connected to earth by way of the terminals 16, 14. When the down position of the switch 12 is selected, terminals 15 and 16 are connected respectively to the terminals 17 and 18, and now the positive battery terminal is connected by way of the fuse 19 and the terminals 18, 16 to said other side of the motor 11, and said one side of the motor 11 is connected through the contact 22 and the terminals 15, 17 to earth.

The terminal 15 is further connected through a diode 24 to a supply line 25, and connected between the line 25 and earth is an inverter 26 of conventional form including a pair of n-p-n transistors 27, 28 having their

emitters connected to earth, and their bases connected through resistors 29, 31 respectively to the line 25. The base of the transistor 27 is connected to the collector of the transistor 28 through a capacitor 31, and the base of the transistor 28 is connected to the collector of the transistor 27 through a capacitor 32. The collector of the transistor 28 is connected to the line 25 through a resistor 33, while the collector of the transistor 27 is connected to the line 25 through the primary winding 34 of a transformer 35 having a secondary winding 36. The inverter 26 operates in known manner to provide an output to the winding 36 whenever the line 25 is energized, and it will be seen that the line 25 is only energized when the terminal 15 is coupled to the terminal 13, that is to say when the up position of the switch 12 is selected.

One end of the winding 36 is earthed, and its other end is connected to an aerial 37 situated inside the vehicle. The aerial is in the form of a loop, and the upper edge of the window being controlled by the motor 11 is metallized, so that when the inverter is operating, and the metallized edge of the window is touched, there will be a capacitance present between the aerial 37 and the metallized edge 38 of the window, so that power is fed from the aerial 37 to the edge 38. The edge 38 is connected through a screened cable 39 having its outer screen earthed to the gate of an n-channel field effect transistor 41, the gate of which is earthed through a resistor 42, the drain of which is connected through a resistor 43 to the line 25, and the source of which is connected through a pair of resistors 44, 45 to earth, the junction of the resistors 44, 45 being connected to the gate of the thyristor 46 having its cathode earthed and its anode connected through the winding 23 to the line 25.

In normal operation of the control system, the edge 38 will not be touched, and although power will be provided to the inverter 26 when the window is being raised, the contact 22 will play no part in the operation of the circuit, and the motor will be operated as previously described.

If the edge 38 is touched while the window is being raised, then power is fed from the inverter to the transistor 41, which turns on to provide gate current for the thyristor 46, which in turn turns on to energize the winding 23, open the contact 22 and stopping the motor 11. The thyristor 46 remains on, even when the edge is no longer being touched, until its anode-cathode current is broken by moving the switch 12 from the up position to the off position. The motor can then be operated again.

If the edge 38 is touched while the window is being lowered, nothing happens because the inverter and control circuit are not energized.

In a modification, the contact 22 is replaced by a double pole change-over relay operated by the winding 23, which can be in the cathode circuit of the thyristor 46. The operation is substantially the same, except of course that when the winding 23 is energized, the motor is actually reversed.

There have been various proposals in the past for providing some form of limit switch for reversing a motor or stopping a motor in an electrically operated window system, in order to prevent the risk of injury to passengers in the vehicle. The known arrangements all

require some pressure to be exerted on the upper edge of the window, and so although serious injury is prevented, it is still possible for the passengers to be slightly injured. The present arrangement has the great advantage that if the edge of the window is touched at all, the window stops or reverses without any pressure being applied to the passenger.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A window lift control system for use in a road vehicle, comprising a motor for lifting and lowering the window, said window having an upper edge which is metallized, a pair of supply terminals for connection to a d.c. source, a reversing switch movable from an off position to first and second operative positions in which the motor is operated to raise and lower the window respectively, a control circuit which when energized prevents raising of the window, said control circuit having a pair of input terminals, one of which is connected to one of the supply terminals, and the other of which is connected to the other supply terminal by way of said reversing switch when the reversing switch is in said

first position, the input terminals of said control circuit providing power to an inverter, which in turn provides power to an induction loop inside the vehicle, power being fed from said induction loop to said control circuit to prevent raising of the window if said metallized edge is touched while the reversing switch is in said first operative position.

2. A system as claimed 1 in which said control circuit includes a field effect transistor which on receiving an input as a result of said metallized edge being touched provides a gate signal to a thyristor which energizes a relay.

3. A system as claimed in claim 1 in which said other input terminal is connected to the reversing switch through diodes

4. A system as claimed in claim 1 in which the control circuit, when energized stops the motor.

5. A system as claimed in claim 1 in which the control circuit, when energized, reverses the motor to lower the window.

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