

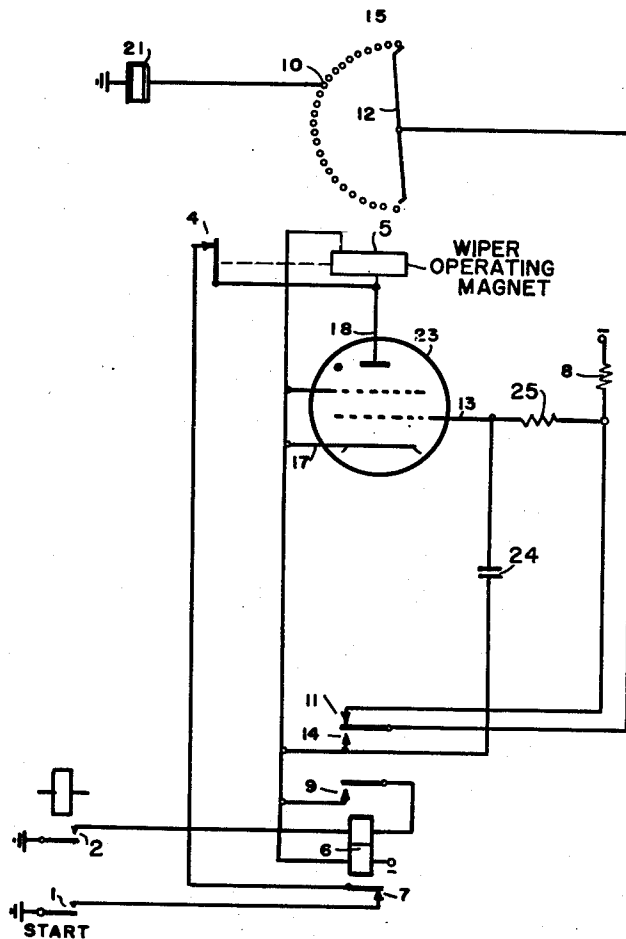
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FAST STOPPING CIRCUIT FOR HIGH-SPEED SWITCHES

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FAST STOPPING CIRCUIT FOR HIGH-SPEED SWITCHES

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This invention relates in general to an improved circuit for electronically controlling a high speed stepping switch of the type generally used in telephone systems.

One of the objects of this invention is to provide a novel control circuit for such a stepping switch which will be simple and inexpensive to manufacture.

Another object of this invention is to simplify and reduce the equipment generally needed in switch control circuits to thereby eliminate much of the need for supervision and adjustments while in service.

Another object of this invention is to provide a control circuit for a rotary switch which will use a minimum of power.

One of the features of this invention is a circuit extremely sensitive to potential encountered by a rotary switch.

Another of the features of this invention is the circuit designed to provide reliable fast stopping for high speed rotary switches. The particular embodiment of the invention disclosed in this application shows a rotary switch used in searching for an idle bank contact in a telephone system. The circuits for initiating operation of the rotary switch being old and well known need not be discussed herein.

The stepping operation of the switch is performed in any well known manner by the rotary switch magnet. The rotary switch magnet is arranged in series with a low impedance winding of a double wound relay which winding does not cause operation of the relay until the gas filled thyatron tube operates to shunt the rotary switch magnet. The tube operates when the switch wiper encounters ground potential to thereby reduce the negative bias of the grid of the tube. This in turn allows the low impedance winding of the relay to operate the relay to thus close a circuit for its other winding. This latter winding then operates the relay to open the stepping circuit of the rotary switch magnet, the grid circuit to the switch wiper and the plate circuit of the tube to thus halt the further operation of the tube, rotary switch magnet and wiper. Although the preferred embodiment of the invention is herein disclosed and discussed it is to be understood that this invention is not limited to this embodiment but may easily be adapted to other uses either in its present form or by slight alterations.

The single figure of the drawing shows a preferred form of the applicant's invention.

While I have chosen to illustrate my inven-

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tion in connection with a rotary stepping switch which may be of the type shown in Patent No. 2,522,715, issued September 19, 1950, to Graybill and Sengebusch, it will be understood that the circuit may be as well adapted for use with any high speed stepping switch of the type having both vertical and rotary motion or those having horizontal movement, it being only necessary to adapt the electronic circuit shown to the particular stepping magnet and wiper of the switch.

Having thus generally described the function of the invention the detailed operation will now be disclosed.

After starting contact 1 is closed in any well known manner (such as by a line relay in a telephone subscriber's circuit) a circuit is completed as follows: ground, starting contact 1, contacts 7, self-interrupter springs 4, rotary switch magnet 5, lower winding of relay 6 to negative battery. Anode 18 of tube 23 is connected to positive ground potential at this time through contacts 1 and 7 and springs 4 while cathode 17 is connected to negative potential through the lower winding of relay 6. Tube 23 does not operate however as grid 13 is biased negative with respect to cathode 17 by negative battery through resistors 8 and 25 and also through condenser 24 and the lower winding of relay 6. Relay 6 does not operate at this time but rotary switch magnet 5 does operate to step the wiper 12 in a self-interrupted manner as is well known in the art. As the rotary switch wiper 12 rotates, it will be assumed that the first contact encountered in the bank contacts 15 is impressed with negative potential indicating a busy circuit in the associated equipment. Self-interrupted springs 4 which had opened before wiper 12 encountered the first contact are again closed and the aforementioned circuit is again completed for operating rotary switch magnet 5 to step wiper 12 to its next contact. Grid 13 connected to negative potential through resistors 25 and 8 and also through condenser 24 and the lower winding of relay 6 is maintained sufficiently negatively biased with respect to cathode 17 to prevent operation of the tube 23 at this time. The rotary switch magnet 5 will continue to operate as described, to step the wiper 12. As long as the switch wiper 12 in stepping over the contacts of bank contacts 15 encounters negative potential, grid 13 is maintained sufficiently biased to prevent tube 23 from becoming conductive.

However when rotary switch wiper 12 encounters ground potential on the idle bank contact

10 through relay 21, a circuit is completed over the bank contacts 10, wiper 12, contacts 11 and resistor 3 and a drop in negative potential occurs across resistor 8 to make grid 13 more positive with respect to cathode 17, therefore the gas in tube 23 ionizes and the tube 23 instantaneously conducts current. Condenser 24 prevents transient potentials encountered as the wiper sweeps over the bank contacts from influencing the bias on grid 13 sufficiently to render the tube conductive before the wiper reaches the marked contact 10. In this condition there is a constant potential difference of low value between plate 18 and cathode 17 of the tube and also across rotary switch magnet 5 to thereby virtually short circuit rotary switch magnet 5 so that the latter stops at that step.

The short circuit of magnet 5 also causes an increased current flow in the lower winding of relay 6 and causes it to operate to close contact 9. A circuit is then completed to energize the upper winding of relay 6 as follows: ground contacts 2, upper winding of relay 6, contact 9, lower winding of relay 6 to negative battery. The upper winding of relay 6 when energized is additive and holds contacts 9, opens contacts 7 and 11 and closes contacts 14. On opening contact 7 the circuit to the rotary switch magnet 5 and tube 23 are immediately broken to thereby prevent their further operation and the tube deionizes. Contact 11 on opening restores the original bias potential for the grid 13. Contact 14 closes a circuit to operate relay 21 of the next piece of equipment from battery through the lower winding of relay 6, contacts 14, wiper 12 and contact 10 to ground potential through relay 21 and also places a low negative guarding potential on bank contact 10 to prevent other switches from stopping at that point. The tube being deionized is prepared for reuse on release of the upper winding of relay 6 which may be accomplished in any well known manner.

Therefore having disclosed my invention what I claim is:

1. In a stepping switch, a switch wiper having bank contacts accessible thereto, a source of potential connected to one of said contacts for placing a potential on said contact, an electromagnet for stepping said wiper, means for causing operation of said electromagnet for stepping said wiper over said contacts, an electronic valve connected in shunt with said electromagnet, and means for first rendering said valve non-conductive while said electromagnet operates to step said wiper and rendering said valve conductive to short circuit said electromagnet and thereby render said electromagnet inoperative to step said wiper when said wiper encounters said potential on said one contact.

2. In a stepping switch, a switch wiper having bank contacts accessible thereto, a source of potential connected to one of said contacts for placing a potential on said contact, an electromagnet for stepping said wiper, means for causing the operation of said electromagnet for stepping said wiper over said contacts, an electronic valve connected in shunt with said electromagnet, means for rendering said electronic valve conductive when said wiper reaches said contact having said potential thereon to short circuit and thereby render said electromagnet inoperative to step said wiper, and means operated by said conductive valve to render said valve non-conductive, said means also preventing further operation of said electromagnet and stepping of

wiper by said electromagnet when said valve is rendered non-conductive.

3. In a stepping switch, a switch wiper having bank contacts accessible thereto, a source of potential connected to one of said contacts for placing a potential thereon, an electromagnet for stepping said switch wiper, means for causing operation of said electromagnet for stepping said wiper over said contacts, an electron tube having a plate, grid and cathode circuits, said plate circuit connected to one side of said electromagnet and said grid and cathode circuits connected to the other side of said electromagnet, means rendering said tube non-conductive until said wiper reaches said contact having said potential thereon, means then rendering said tube conductive to thereby short circuit said electromagnet for halting its operation, and means rendered effective by said conductive tube to render said tube non-conductive and also prevent further operation of said electromagnet for stepping said wiper.

4. In a stepping switch, a switch wiper having bank contacts accessible thereto, a source of potential connected to one of said contacts for placing a potential thereon, an electromagnetic stepping means, means for causing operation of said stepping means for stepping said switch wiper over said contacts, a thyatron tube having plate, grid and cathode circuits, said plate circuit connected to one side of said electromagnet and said cathode circuit to the other side of said electromagnet, said grid circuit connected to said wiper and arranged to render said tube conductive when said wiper encounters said one contact having said potential thereon to thereby halt said electromagnetic stepping means, and means operated by said conductive tube for preventing further operation of said tube, stepping means and wiper.

5. In a stepping switch having a wiper, bank contacts accessible thereto and an electromagnet to step said wiper, means for causing the operation of said electromagnet for stepping said wiper over said contacts, means for placing a potential on one contact of said bank contacts, a thyatron tube having plate, grid and cathode circuits, said plate circuit connected to one side of said electromagnet, said grid and cathode circuits connected to the other side of said electromagnet, a relay commonly connected to said other side of said electromagnet and said cathode circuit, and means for rendering said tube conductive when said wiper encounters said one contact having said potential thereon, said conductive tube short circuiting said electromagnet to thereby prevent said electromagnet from stepping said wiper, said relay operated when said tube is conductive to prevent further operation of said tube, electromagnet and wiper.

6. In a switch having a wiper, bank contacts accessible thereto and an electromagnet for stepping said wiper, a potential on one of said contacts, means for causing operation of said electromagnet for stepping said wiper over said contacts, a thyatron tube having plate, grid and cathode circuits, said plate circuit connected to one side of said electromagnet, said cathode and grid circuits and other side of said electromagnet being connected to each other, a source of potential for biasing said grid, a relay winding commonly connected on one side to said cathode and other side of said electromagnet, a source of potential connected to the other side of said relay winding, said relay wind-

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ing thereby aiding in biasing said grid sufficiently to prevent said tube from conducting current, a circuit completed when said wiper encounters said potential on said one contact for removing said grid bias, said tube instantaneously conducting current when said grid bias is removed to thereby short circuit and render said electromagnet inoperative to step said wiper, said relay winding energized by said conductive tube, and means operated by said energized relay winding for rendering said tube non-conductive and for preventing further operation of said electromagnet to step said wiper, said means also connecting said source of potential to said contact for preventing another wiper from being halted on said contact.

7. In a device as claimed in claim 6 in which said wiper is connected to said grid to thereby complete a circuit for causing removal of said bias when said wiper encounters said contact having a potential thereon.

8. In a stepping switch having a wiper, bank contacts accessible thereto, a potential on one of said contacts, an electromagnet for stepping said wiper, a source of potential for causing the operation of said electromagnet for stepping said

wiper over said contacts, a thyratron tube having a plate, grid and cathode circuits, said plate circuit connected to one side of said electromagnet, said cathode and grid circuits connected to the other side of said electromagnet, a relay winding commonly connected on one side to said cathode and other side of said electromagnet, said source of potential connected to the other side of said relay winding, a resistor connected on one side to said grid and on the other side to said source of potential, said wiper connected to said grid and said one side of said resistor so as to complete a circuit for enabling said tube to become conductive when said wiper encounters said potential on said contact, to short circuit said electromagnet and cause energization of said relay winding, and means operated by said energized relay winding for returning said tube to its normal non-conductive condition and preventing further operation of said electromagnet to step said wiper, said means also connecting said source of potential to said contact for preventing other wipers from halting at said contact.

No references cited.