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[54] **COMBINATION VARIABLE RESISTANCE AND ELECTRICAL SWITCH CONTROL**

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[22] Filed: **Jan. 6, 1971**

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Related U.S. Application Data

[62] Division of Ser. No. 761,602, Sept. 23, 1968, Pat. No. 3,567,876.

[52] **U.S. Cl.** **338/172**, 338/198, 338/200

[51] **Int. Cl.** **H01c 5/08**

[58] **Field of Search** 338/118, 135, 160, 338/162, 172, 174, 198, 200

[56] **References Cited**

UNITED STATES PATENTS

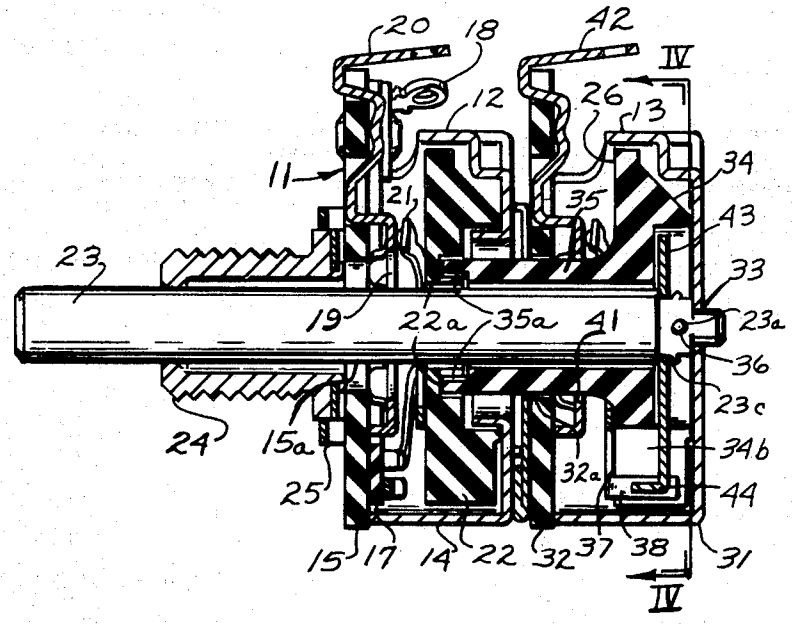
2,844,676	7/1958	Barden et al.	338/172 X
2,836,686	5/1958	Barden et al.	338/172 X
2,855,490	10/1958	Arisman et al.	338/172
3,349,358	10/1967	Cassedy	338/172

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Assistant Examiner—Stanley J. Witkowski
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[57] **ABSTRACT**

An electrical control has a variable resistance control combined with a normally open switch. Any manual adjustment made to the variable resistance control causes the switch contacts to be closed before actual adjustment of the variable resistance control begins and, after the force causing manual adjustment of the control is removed, the switch contacts are opened without disturbing the resistance setting of the control.

9 Claims, 9 Drawing Figures



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2 Sheets-Sheet 1

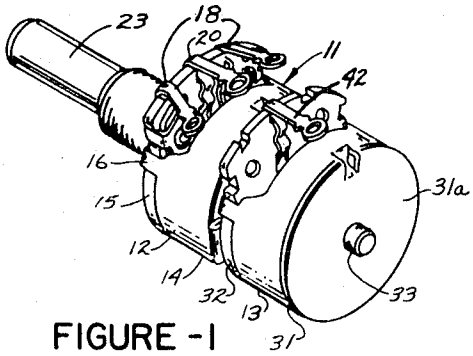


FIGURE - 1

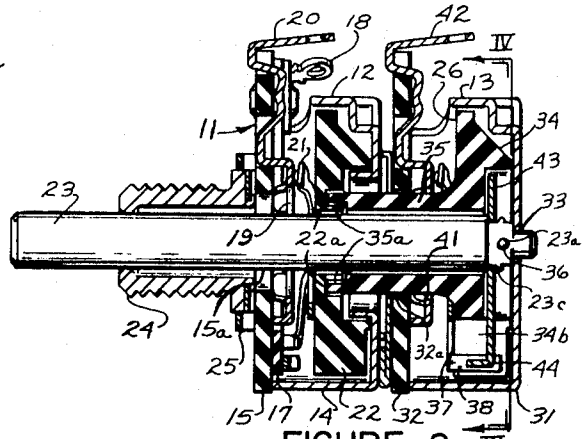


FIGURE - 2

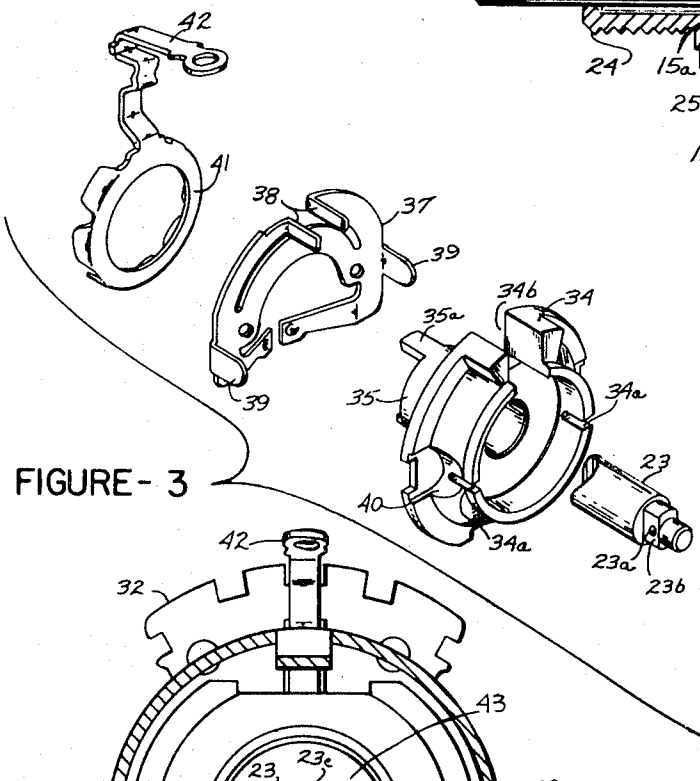


FIGURE - 3

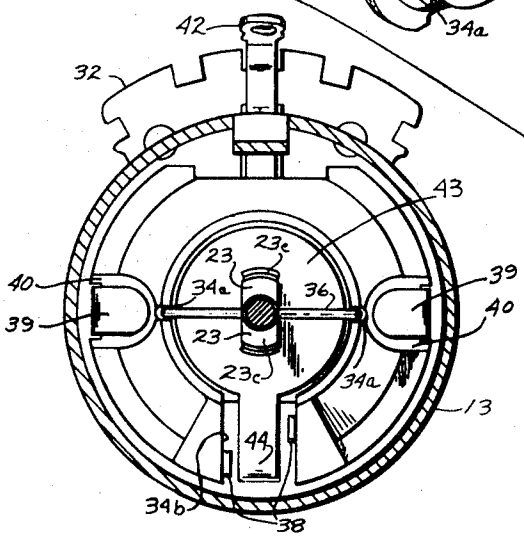


FIGURE - 4

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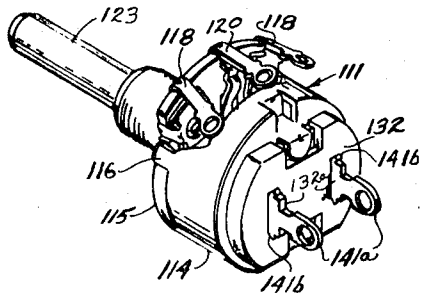


FIGURE-5

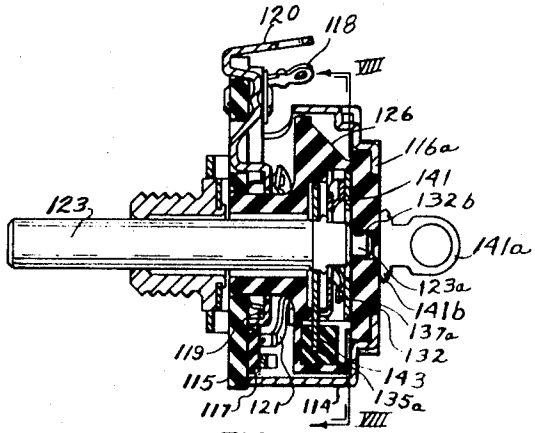


FIGURE-6

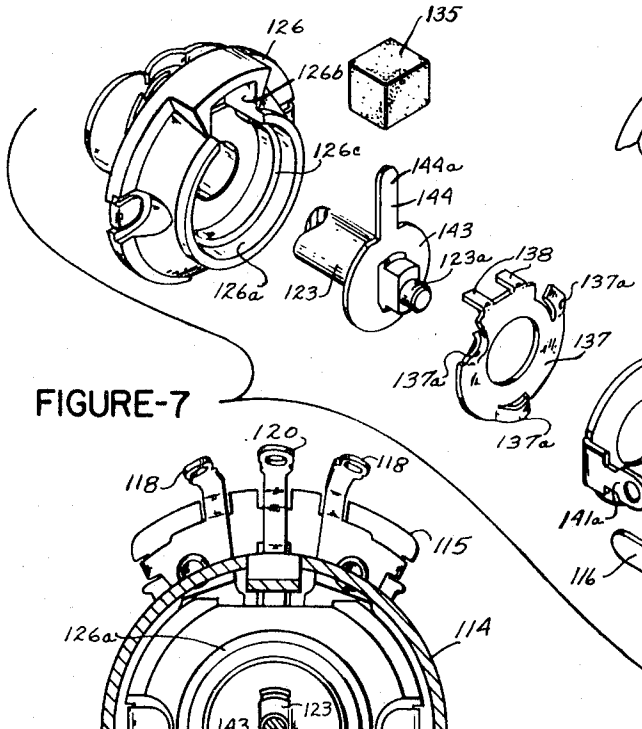


FIGURE-7

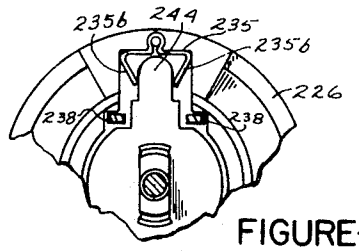


FIGURE-9

FIGURE-8

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COMBINATION VARIABLE RESISTANCE AND ELECTRICAL SWITCH CONTROL

This is a division of application Ser. No. 761,602 filed Sept. 23, 1968, now U.S. Pat. No. 3,567,876. The present invention relates to combination electrical controls, and, more particularly, to a combination variable resistance and electrical switch control.

Variable resistance controls are used in different types of electrical equipment, e.g., radio and television receiving sets for controlling various functions such as volume. When a variable resistance control is mounted in a remotely controlled television set for controlling the volume, it is preferable that manual adjustment override and render inoperable the remote control circuitry. Remote control circuits preferably are rendered inoperable, e.g., by disconnecting or grounding out the control circuit signal, before manual adjustment of the variable resistance control is made. Although the remote control circuitry can be rendered inoperable by separate manual switching means, it would be desirable to combine such switching means with the variable resistance control. Preferably actuation of the switching means is performed before any adjustment is made to the variable resistance control and, after the adjustment has been made, the switching means should open the contacts without disturbing the resistance setting of the control.

Accordingly, it is an object of the present invention to provide a new and improved combination electrical control having the various desirable features as set forth above. Another object of the present invention is to provide a combination electrical control with an improved switch for rendering inoperable a circuit as soon as manual adjustment of the control is started and before any change to the resistance of the control is made. An additional object of the present invention is to provide a new and improved combination electrical control having a normally open switch closing with initial movement of the control actuating means and, after the switch is closed, further movement of the control actuating means alters the resistance of the control. A further object of the present invention is to provide a new and improved electrical switch whereby a force causing movement of the switch actuating means initially stresses a spring centering means storing energy therein and then closes a pair of switch contacts, the energy stored in the spring centering means opening the switch contacts when the force causing movement of the switch acuating means is removed. Still another object of the present invention is to provide a combination variable resistance and electrical switch control whereby initial movement of the control actuating means in either direction closes a pair of switch contacts and further movement of the control actuating means alters the resistance of the control and, upon removing the force causing movement of the control actuating means, the switch contacts open without disturbing the resistance setting of the variable resistance control. Further objects and advantages of the present invention will become apparent as the following description proceeds, and the features of novelty characterizing the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly, the present invention is concerned with a combination electrical control comprising a variable resistance control and a switch operable with a control

actuating means. A driver supported in the housing frictionally engages one of the surfaces thereof and a contactor carried by the driver wipably engages a collector for electrically connecting the resistance element into an electric circuit. A switch actuator constrained to rotate with the control actuating means, e.g., a shaft, is provided with an actuator arm. A pair of switch contacts carried by the driver is disposed on opposite sides of the actuator arm. Spring centering means resiliently connects the driver to the control actuating means. By applying a force to the control actuating means and moving the acutator arm, the actuating means stresses the spring centering means until the actuator arm engages one of the switch contacts carried by the driver making an electrical connection therebetween. Further movement of the control actuating means in the same direction causes movement of the driver altering the resistance of the variable resistance control. Energy stored in the spring centering means during movement of the control actuating means before the switch contacts are closed is insufficient to overcome the friction between the driver and the housing. Movement of the driver does not, therefore, occur until the actuator arm engages one of the switch contacts. When the force is removed from the actuating means, the energy stored in the spring centering means is sufficient to cause movement of the actuator arm in the opposite direction opening the electrical connection between the actuating arm and the contact without disturbing the resistance setting of the variable resistance control.

For a better understanding of the present invention reference may be had to the accompanying drawings wherein the same reference numerals have been applied to like parts and wherein:

FIG. 1 is an isometric view of a combination variable resistance and electrical switch control built in accord with the present invention;

FIG. 2 is a sectional view of the control shown in FIG. 1;

FIG. 3 is an exploded view of the electrical switch of the control shown in FIG. 1;

FIG. 4 is a sectional view taken along line IV—IV of FIG. 2 assuming that FIG. 2 is shown in full;

FIG. 5 is an isometric view of another embodiment of a combination variable resistance and electrical switch control;

FIG. 6 is a sectional view of the control shown in FIG. 5;

FIG. 7 is an exploded view of the electrical switch shown in FIG. 5;

FIG. 8 is a sectional view taken along line VIII—VIII of FIG. 6 assuming that FIG. 6 is shown in full;

and FIG. 9 is a fragmentary sectional view similar to that shown in FIG. 8 of the drawings of an additional embodiment of the invention.

Referring now to FIGS. 1–3 of the drawings, there is illustrated a combination electrical control generally indicated at 11 comprising a variable resistance control 12 having an electrical switch 13 secured thereto.

Considering first the variable resistance control 12, it comprises a cup-shaped housing 14 having a base 15 of suitable electrically nonconductive material closing the open end of the housing. The base 15 is fixedly secured to the housing 14 with a plurality of ears 16 folded over the outer surface of the base 15. Means defining an arcuate resistance path 17, e.g., a carbon film

resistance element, is suitably bonded or mechanically secured to the inner surface of the base **15** and the ends of the resistance element are connected to a pair of terminals **18.** When a not-shown wirewound resistance element is employed instead of a carbon film resistance element, it is insulatedly disposed in the housing **14** in a manner well known in the art. A collector ring **19** mounted on the base **15** in spaced relationship to the resistance path **17** is provided with a center terminal **20** and a wiper **21** electrically connects the resistance path **17** to the collector **19.**

A resistance driver section **22** is constrained to move with a control actuating means **23** after the actuating means **23** is displaced a predetermined distance. In the present emobdiment, the control is of the rotatable type; therefore, the control actuating means **23** is a rotatable member such as a shaft. The control also can be of the rectilinear type, i.e., having an actuating means movable in a straight line. In the present invention, the shaft **23** extending through an opening **15***a* provided in the base **15** is rotatably mounted in the housing **14** concentric to the arcuate resistance path **17** and rotatably supports the resistance driver section. The wiper **21** is secured to the driver section **22** and, therefore, constrained to rotate therewith for wiping contact with the resistance path **17** and the collector **19.** The control **11** can be mounted to a not-shown mounting panel with the shaft **23** extending through an opening provided in the panel by securing a fastener such as a nut to a threaded bushing **24** rotatably supporting the shaft. The threaded bushing **24** is fixedly secured to a ground plate **25** butting against the outer surface of the base **15** and secured to the housing **14** by means of the folded ears **16.** As will become apparent from the following description of the switch **13,** one of the contacts of the switch is electrically connected to the shaft composed of electrically conductive material and, since the shaft is rotatably supported in the bushing **24** which is grounded to the mounting panel, an electrical connection can readily be made to one side of the switch by grounding one side of the circuit.

Considering now the electrical switch **13,** it comprises a switch housing **31** (see FIG. 2) fixedly secured to the variable resistance housing **14** by means well known in the art. An electrically nonconducting supporting member **32** closes the open end of the switch housing and an opening **33** provided in the rear wall **31***a* of the switch housing **31** rotatably supports the end of the shaft **23** extending into the switch housing **31.** A switch driver section **34** rotatably supported on the portion of the shaft **23** disposed in the switch housing **31** is provided with a connecting hub **35** passing through an opening **32a** in the supporting member **32.** For interlocking and constraining the switch driver section **34** to rotate with the resistance driver section **22,** a pair of diametrically opposed lugs **35***a* projecting from the hub **35** are received in slots **22***a* provided in the driver section **22.** Hereinafter, when the resistance driver section and the switch driver section **34** are considered as a unit, they will be referred to as a driver **26.**

As illustrated in the preferred form of the invention, spring centering means such as a short section of spring wire **36** is received in an opening **23***a* provided in the shaft **23.** The ends of the spring centering means **36** are contained in slots **34***a* provided in the switch driver section **34** for resiliently connecting the driver section **34** to the shaft. A switch contactor **37** provided with a pair of spaced contact fingers **38** is fixedly secured to the switch driver section **34** with a pair of ears **39** folded over the peripheral edge of the switch driver section and secured in suitable notches **40.** The contactor **37** wipably engages a switch collector **41** secured to the supporting member **32** for electrically connecting the contactor **37** to a switch terminal **42** integral with the collector **41.** A switch actuator **43** provided with a noncircular opening **43***a* is mounted on the portion **23***b* of the shaft having a noncircular cross section for constraining the shaft **23** to rotate with the actuator **43.** Staked portions **23***c* (see FIGS. 2 and 4) of the shaft fixedly secure the actuator **43** to the shaft. An actuator arm **44** extending radially outwardly from the switch actuator **43** is centered between the pair of spaced contact fingers **38** by the spring centering means **36** (see FIG. 4). The pair of contact fingers **38** extend rearwardly from the switch contactor **37** into a radial slot **34***b* provided in the switch driver section **34.** To prevent deflection of the fingers **38** with respect to the switch driver section **34** when engaged by the actuator arm **44,** the fingers **38** abutt against opposite walls of the slot **34b** as best shown in FIG. **4.**

In accord with the present invention, initial rotation of the shaft **23** in either direction closes the switch contacts before rotation of the driver **26** begins. Initial rotation of the shaft is defined as angular rotation of the shaft through a predetermined angle from either a normally opened or closed switch position when the actuator arm is centered between the contact fingers **38** to a closed or opened switch position. It is, therefore, essential that the spring centering means **36** can be flexed by the shaft sufficiently to permit displacement of the switch actuator **43** causing contact to be made between the actuator arm **44** and one of the contact fingers **38** before any displacement of the driver **26** occurs. If the spring centering means is too stiff, the torque applied for rotating the shaft will not flex the spring sufficiently to cause rotation of the driver **26** before the actuator arm **44** makes contact with one of the contact fingers. After the switch actuator **43** rotates through a predetermined angle and the actuator arm **44** is in electrical contact with one of the contact fingers, any additional or continued torque applied to the shaft is transmitted directly by the shaft through the actuator arm to the driver **26** causing movement of the wiper **21** and altering the resistance of the variable resistance control. When the torque is removed from the shaft, the energy stored in the spring centering means **36** is sufficient to overcome the friction between the shaft and the housing and cause movement of the actuator arm **44** in the opposite direction opening the electrical connection between the actuator arm **44** and one of the contact fingers **38** without disturbing the resistance setting of the control. Since the control is electrically connected to a mounting panel, a remotely controlled electrical circuit connected to the switch is rendered inoperable as soon as any torque is applied in either direction to the shaft **23** for manually altering the resistance of the variable resistance control. After proper adjustment has been made to the variable resistance control and the torque has been removed from the shaft, the actuator arm **44** rotates in the opposite direction and permits the remote control to operate.

In another embodiment of the present invention as shown in FIGS. **5–8** of the drawings, a variable resistance and electrical switch control **111** having a single

driver **126** are combined in one housing. The control **111** comprises a housing **114** having apertured end walls. A base **115** identical to the base **15** closes one of the end walls of the housing **114** and is fixedly secured to the housing with a plurality of ears **116** folded over the outer surface of the base **115.** Means defining an arcuate resistance path **117,** e.g., a resistance element, is bonded or mechanically secured to the base **115** and the ends of the resistance path are connected to a pair of terminals **118.** A collector ring **119** is fixedly secured to the base **115** and a wiper **121** electrically connects the resistance element **117** to a center terminal **120** integral with the collector **119.**

An electrically nonconductive supporting member **132** closes the aperture in the other end wall of the housing and a switch collector **141** has a pair of terminals **141*a*** received in a pair of slots **132*a*** and staked to the supporting member **132** at **141*b*** (see FIGS. **5** and **6**). A pair of ears **116*a*** formed from the rear portion of the housing secures the supporting member **132** to the housing. The driver **126** is provided with a circular cavity **126*a*** and a switch actuator **143** secured to the shaft **123** and constrained to rotate therewith is disposed in the cavity. A rectangular cavity **126*b*** (see FIGS. **7** and **8**) communicating with the circular cavity **126*a*** retains a spring centering means **135** and in this embodiment is a body of resilient material, i.e., an elastomer. A slot **135*a*** provided in the body **135** receives the end portion **144*a*** of the actuator arm **144.** A switch contactor **137** provided with a pair of spaced contact fingers **138** disposed on opposite sides of the actuator arm **144** also is disposed in the cavity **126** *a* and maintained in spaced relationship from the switch actuator **143** by means of an annular ridge **136*c*** supporting the peripheral edge of the contactor **137.** The contact fingers **138** abutt against wall portions **126*d*** provided in the cavity **126*a*.** A plurality of paddles **137*a*** integral with the contactor **137** wipably engage the collector **141** electrically connecting the contact fingers **138** to the terminals **141*a*** for any setting of the control **111.** The supporting member **132** is provided with a bearing **132*b*** (see FIG. **6**) rotatably supporting the end **123*a*** of the shaft **123.** Circular openings provided in the collector **141** and in the contactor **137** electrically space the contactor and the collector from the shaft.

Any initial torque applied to the shaft **123** for adjusting the variable resistance control causes initial rotation of the actuator **143** thrrough an arc causing contact to be made between the actuator arm **144** and one of the contact fingers **138** for closing a circuit or eliminating a signal in the circuit by grounding before the driver is displaced and further torque alters the resistance of the variable resistance control. The initial torque applied to the shaft stores energy in the spring centering means **135** and such energy is sufficient to cause movement of the actuator arm **143** in the opposite direction for opening the electrical connection between the actuator arm **144** and one of the contacts **138** when the torque is removed from the shaft. The spring centering means **135** resiliently connects the driver **126** to the control actuating means or shaft **123** and positions the actuating arm **144** between the contact fingers maintaining the switch in a normally open position when no torque is applied to the shaft.

In still another embodiment of the present invention as shown in FIG. **9** of the drawings, spring centering means **235** such as a steel hairpin spring having symmetrical legs **235*b***, is carried by a driver **226** and employed for centering an actuator arm **244** between a pair of contact fingers **238.** Initial rotation of the actuator arm **244** in either direction deflects one of the legs **235*b*** of the hairpin spring causing an electrical connection to be made between the actuator arm **244** and one of the contact fingers **238.** The energy stored in one of the legs **235*b*** of the hairpin spring **235** centers the actuator arm **244** between the pair of contact fingers **238** when the torque causing rotation of the actuator arm **244** is removed.

While there has been illustrated and described what is at present believed to be a preferred embodiment of the present invention and several modifications thereof, it will be appreciated that numerous changes and modifications are likely to occur to those skilled in the art and it is intended in the appended claims to cover all those changes and modifications which fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In an electrical control, the combination of a housing, an electrically nonconductive base member closing one end of the housing, means defining a resistance path and a collector carried by the base, an electrically nonconductive supporting member closing the other end of the housing, a driver disposed in the housing between the base member and the supporting member, wiper means engaging the resistance path and the collector and constrained to rotate with the driver for altering the resistance setting of the control, a shaft rotatably journaled in the housing projecting through one of the members, a contactor carried by the driver and provided with a contact, the contactor and contact being constrained to rotate with the driver, means for electrically connecting the contactor to one side of an electrical circuit, an actuator connected to the shaft and provided with a contact portion movable in an interference path with the contact, and a spring centering means providing a resilient connection between the driver and the shaft whereby upon applying torque to the shaft initial rotation of the shaft causes flexing of the spring centering means and movement of the contact portion of the actuator relative to the contact and further displacement of the shaft in the same direction causes rotation of the driver and upon removing the torque applied to the shaft the energy stored in the spring centering means cuases displacement of the shaft in the opposite direction and movement of the actuator relative to the contact without disturbing the resistance setting of the control.

2. The control of claim **1,** wherein the spring centering means comprises a spring wire having its center portion constrained to rotate with the shaft and its end portions connected to the driver for resiliently connecting the driver to the shaft.

3. The control of claim **1,** wherein the means for electrically connecting the contactor comprises a collector having a terminal carried by the supporting member, and the contactor slidably engages the collector.

4. The control of claim **2,** wherein the means for electrically connecting the contactor comprises a collector having a terminal carried by the supporting member, and the contactor slidably engages the collector.

5. The control of claim **1,** wherein the shaft is of electrically conductive material and electrically connects

the actuator to the other side of the electrical circuit.

6. The control of claim **2**, wherein the shaft is of electrically conductive material and electrically connects the actuator to the other side of the electrical circuit.

7. In an electrical control, the combination of a resistance means and driver means, wiper means engaging the resistance means and constrained to rotate with the driver for altering the resistance setting of the control and a switch comprising a contactor constrained to move with the driver means, a nonresilient actuator movable in an interference path with the contactor and engageable therewith, and resilient means providing a resilient interconnection between the actuator and the driver means and establishing a neutral position of the actuator relative to the contactor and providing a lost motion connection between the actuator and the driver means, said actuator being displaceable from the neutral position with an initial movement in a first direction relative to the contactor against the bias of the resilient means, such initial movement causing a stressing of the resilient means, displacement of the actuator in said first direction after such initial movement effecting a corresponding movement of the driver means without additional stress of the resilient means, the stressed resilient means providing a means for moving the actuator relative to the driver means in a direction opposite to said first direction and for returning the actuator to the neutral position relative to the contactor.

8. In an electrical control, the combination of a resistance means and driver means, wiper means engaging the resistance means and constrained to rotate with the driver for altering the resistance setting of the control and a switch comprising a first contact and a second contact engageable with the first contact, an actuator movable in an interference path with the second contact for making engagement of the first contact with the second contact, and resilient means for providing a resilient connection between the actuator and the driver means and establishing a neutral position of the actuator relative to the second contact and maintaining a lost motion connection between the actuator and the driver means, said actuator being displaceable from the neutral position by a force producing an initial movement in a first direction relative to the driver means against the bias of the resilient means, such initial movement causing a deflection of the actuator in said first direction after such initial movement effecting a corresponding movement of the driver means, the resilient means providing a means for moving the actuator relative to the driver means in a direction opposite to said first direction and for returning the actuator to the neutral position relative to the driver means after said force has been removed from said actuator.

9. The control of claim **8**, wherein the second contact is constrained to move with the driver means for altering the resistance setting of the control.

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