

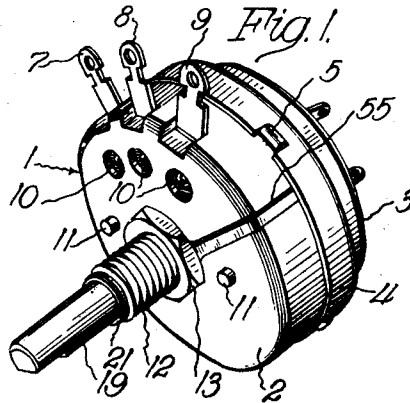
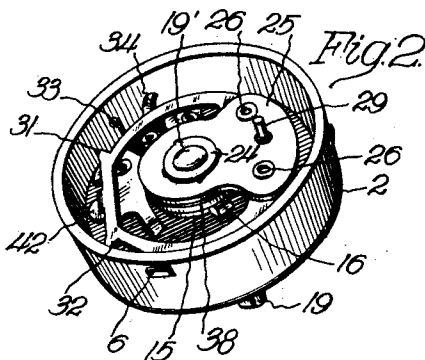
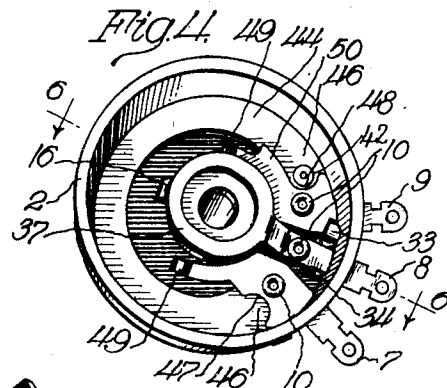
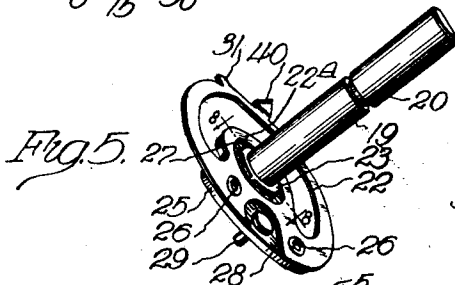
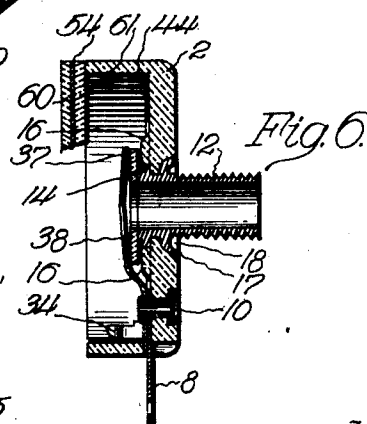
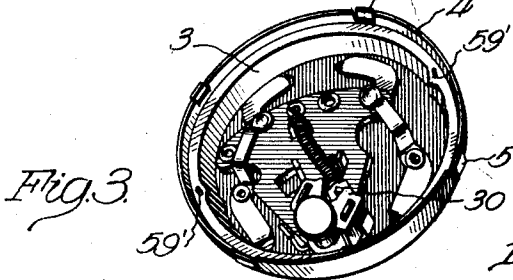
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N. C. SCHELLENGER

1,996,175

RHEOSTAT

Original Filed Dec. 7, 1931 2 Sheets-Sheet 1



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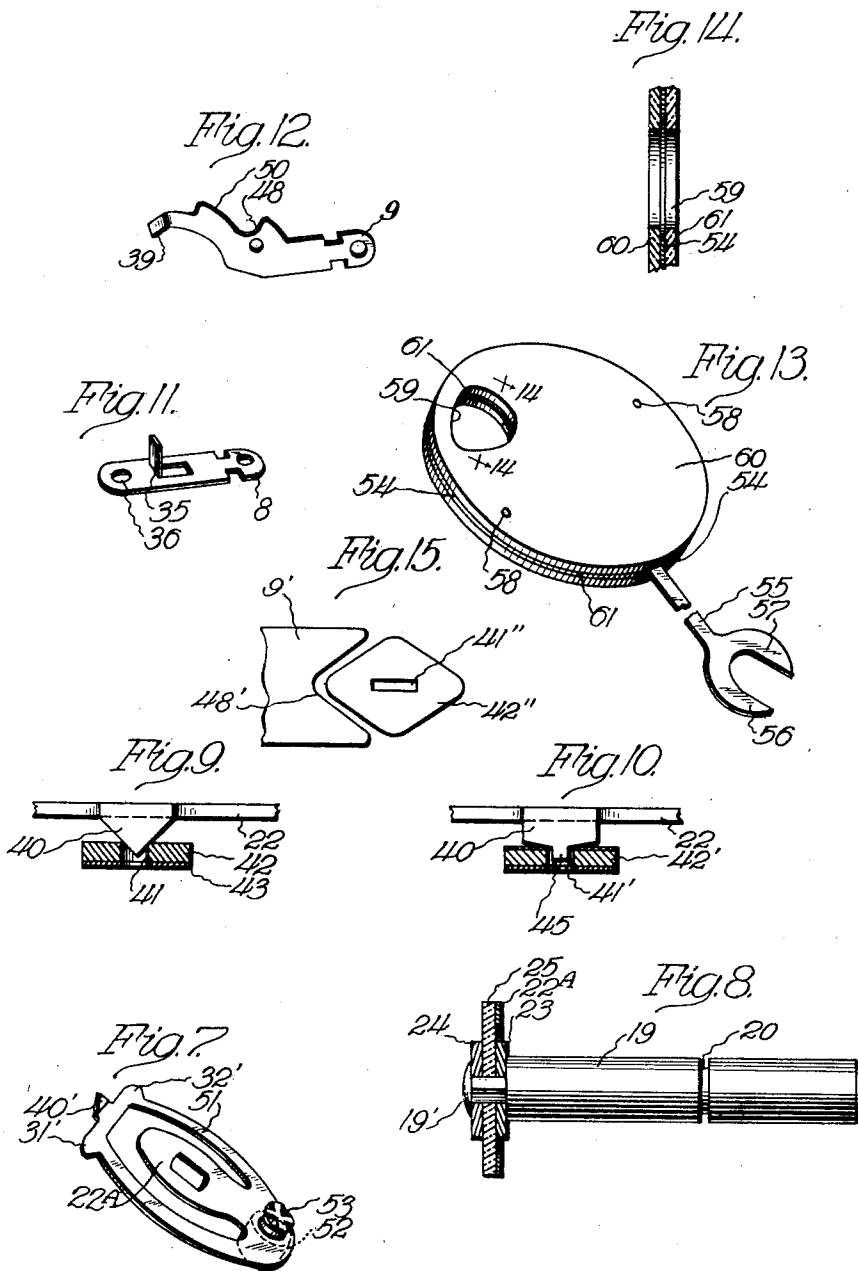
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UNITED STATES PATENT OFFICE

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RHEOSTAT

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Original application December 7, 1931, Serial No.
579,552. Patent No. 1,920,217, dated August 1,
1933. Divided and this application June 12,
1933, Serial No. 675,377

21 Claims. (Cl. 201—55)

This invention relates to control devices and particularly to a combined variable resistance device and power switch for use in sound reproduction apparatus; such as, radio receiving sets, public address systems, and the like.

This invention is a division of my application filed December 7, 1931, Serial No. 579,552, patented August 1, 1933, Patent No. 1,920,217.

Where a variable resistance device is employed in a sound reproduction system, and is disposed in close proximity to a switch or other current carrying devices, any variation in the current flowing in the switch or other device will be coupled with the variable resistance circuit. If the variation is of audible frequency it will be reproduced as an undesirable noise in the sound reproducer.

An example of this undesirable result is the hum produced in the sound reproducer when a power switch adjacent a variable resistance device, associated in circuit therewith, is carrying sixty cycle alternating current, such as is commonly employed as a source of power supply.

The present invention contemplates eliminating disturbances of the above character by shielding the variable resistance device, when used in combination with a power switch, so as to eliminate all electromagnetic and electrostatic disturbances arising from variations in the current flowing in the switch. This shielding is accomplished in the variable resistance device and switch, by an electrically conductive shield or barrier, which is in most cases provided with a grounding connection.

The present invention further contemplates the use in some cases of insulative material in such a manner as to completely isolate all of the current carrying parts of the switch from the shielding and the variable resistance device as well as from external objects.

It is, therefore, an object of the present invention to provide a combined variable resistance device and power switch unit wherein the variable resistance device is electrostatically and electromagnetically shielded from the switch.

It is another object of my invention to provide a combined variable resistance device and power switch unit wherein the switch is electrically isolated from said variable resistance device.

In the drawings:—

Figure 1 is a perspective view of a unit volume control and switch;

Figure 2 is a perspective view of the rheostat or volume control;

Figure 3 is a perspective view of the switch, with the metal attaching ring which secures the switch housing in operating relation to the rheostat housing;

Figure 4 is a perspective view of the rheostat or volume control with the control shaft and contactor arm removed;

Figure 5 is a perspective view of the control shaft and contactor arm showing the arm insulated from the shaft, and also showing the operating pin for the switch member insulated from the arm;

Figure 6 is a sectional view taken substantially on the line 6—6 of Figure 4, illustrating in detail the manner in which the terminal members are secured within the housing;

Figure 7 is a perspective view of a modified form of the spring pressed rheostat arm;

Figure 8 is a sectional view taken substantially on the line 8—8 of Figure 5, and illustrating in detail the mounting of the contact arm with respect to the control shaft;

Figure 9 is a fragmentary elevational view partly in section, showing the details of the contacting arrangement;

Figure 10 is a view similar to Figure 9, but showing a slightly modified form of contacting arrangement;

Figure 11 is a perspective view of the terminal member which connects the movable contactor to an external circuit;

Figure 12 is a perspective view of the terminal for the resistance element, showing the diverging horn extending from the recess in which the contacting shoe is adapted to nest;

Figure 13 is a perspective view of the metallic shielding member adapted to be inserted between the rheostat housing and the switch housing to provide a static shield therebetween, with its associated grounding connection;

Figure 14 is a section taken substantially on the line 14—14 of Figure 13, showing in detail the aperture through which the cam member of the switch is adapted to project for engagement by the operating pin carried by the contactor arm; and

Figure 15 is a plan view of a modified form of shoe and cooperating terminal member.

Referring now in detail to the drawings, the combined variable resistance device and switch unit is indicated generally by the reference numeral 1. This unit comprises the shell or housing 2, which contains the variable resistance device or rheostat member, and the housing 3, which contains the switch for controlling the

power circuit to which the unit is connected. These two housings are held in co-operating relationship by means of a metallic ring member 4, this ring being provided with a plurality of ears
 5 such as 5, which co-operate with raised lugs 6 formed on the periphery of the housing 2 to prevent the ring 4 from rotating with respect to the housing when the ears carried by the ring 4 are engaged over the lugs 6 on the shell.

10 The molded shell or housing 2 is formed with three rectangular apertures through which the terminal members 7, 8, and 9 project. These terminal members are provided with lugs at their outer ends which are adapted to engage the con-
 15 ductors (not shown) leading to an external circuit. The terminal member 8 is adapted to connect the movable contactor to an external circuit, as will be brought out more fully herein-
 20 after whereas the terminal members 7 and 9 serve to connect external conductors (not shown) to the opposite ends of the resistance element. It will be noted that the rivets 10 for supporting the
 25 terminals 7, 8, 9, as is shown clearly in Figures 1 and 6, are set in counter bored holes in the outer surface of the base of the housing, so that they
 30 will be insulated from the panel upon which the control is mounted. These rivets may be in the form of eyelets which are simply inserted through co-operating apertures in the base and the ter-
 35 minal members and have their edges peened over to secure them in position.

The end wall 104 of the housing 2 is provided with two outwardly projecting molded buttons or studs 11 which co-operate with suitable holes
 35 formed in the mounting panel. These studs 11 serve to prevent rotation of the variable resistance unit 1 on its mounting panel. It is neces-
 40 sary to provide some such means for preventing this rotation as the unit 1 is subjected to the additional torque required to snap the switch upon
 45 opening or closing of the circuit. If the unit 1 were mounted so that it might be rotatable with respect to its panel (not shown), the terminals of the switch, which may be connected directly to
 50 the power supply, might become grounded and result in serious damage both to the unit and to the associated apparatus.

A mounting thimble 12, having its exterior portion threaded to receive a mounting nut 13, is
 50 secured in the base of the housing 2. The inwardly projecting portion of the thimble 12 has a flange 14 engaging the inner surface of the
 55 end wall of the housing 2, and is provided with notches which receive raised portions 16 formed on the inner face of the end wall 104 of the hous-
 60 ing 2. Preferably, the inner end of the flange 14 has a slightly smaller surface area than the remainder of the flange, and provides a bearing surface at the end of the thimble.

60 The notches in the flange 14 preferably are made by a single punch press operation, and the flange is secured in engagement with the notches. The thimble also has the outwardly flanged portion 17, which is adapted to seat in a recessed por-
 65 tion 18 of the housing 2 and which forms a bearing surface engaging the panel when the locking nut is threaded inwardly upon the thimble to secure the control in position upon the panel.
 70 Thus, the thimble is secured against both axial and angular displacement in the housing 2.

A control shaft 19, which is provided with a flattened end portion adapted to receive a suitable control knob or dial member, is inserted
 75 through the mounting thimble 12, and is provided with an annular groove 20, which receives

a C-shaped washer or split ring member 21 for securing the shaft in position with respect to the thimble 12. The inwardly projecting end of the shaft 19 is provided with a reduced portion,
 5 which extends through the spring pressed contactor arm 22. Suitable washers 23 and 24, having inwardly projecting radial tongue portions, are interposed on the adjacent sides on the in-
 10 sulation strip 25, which carries the contactor arm 22. The tongue portions are adapted to bite into the surface of the insulation strip to secure it rigidly in position. This insulating member 25
 15 may be formed from a flat piece of suitable insulating material, and serves to effectively insulate the contactor arm 22 from the control
 20 shaft 19. The inner end of the control shaft 19 is spun over, as at 19', to secure the insulating member 25 between the washers 23 and 24 in strong frictional engagement therewith. As
 25 shown in detail in Figure 8, the reduced portion of the shaft 19 is of substantially rectangular form, and serves to engage a similar rectangular slot formed in the insulating member 25, so that the insulating member will be secured in rotat-
 30 ing engagement therewith.

The contactor arm 22 is secured to the insulating member 25 by means of suitable eyelets or rivets 26, and is provided with a cut-out
 35 portion 27, which is of a diameter substantially larger than the diameter of the washer 23, as shown in Figure 5, to space the contactor arm 22 from the washer 23 in insulating relation
 40 thereto, and to provide the equivalent of an open ring contacting surface or brush 22A (see Figs. 5, 7 and 8). As the brush 22A and the contact-
 45 ing member oscillate relative to one another a sliding or rotary electrical contact is required. Thus, the function of the brush 22A obviously is to electrically connect the contact on the resist-
 50 ance element, through the arm 22, together with the annular contacting member 37 and the mid-terminal 8. The contactor arm 22 is also pro-
 55 vided with a cut-out portion 28, cut into its periphery, which is adapted to provide clearance around an operating pin 29, carried by the insulating member 25. This operating pin 29 is
 60 rigidly secured in insulated relation with respect to the arm 22, and projects through the insulating member 25 to transiently engage the cam member 30 of the switch, shown in Figure 3 as
 65 the shaft is rotated.

The contactor arm 22 is in the form of an annular ring member, which has the extending
 70 ear members 31 and 32, adapted to engage suitable stop members for limiting the rotation of the arm. These extending ear members 31 and
 75 32 contact against corresponding stop members 33 and 34, which are integral with the terminal member 8. The terminal member 8 has the two projecting tongue members 33 and 34, which are
 80 formed by a simple stamping operation, and which extend up into the interior of the housing 2 for the purpose of engaging the ears 31 and 32 of the contactor arm 22.

In Figure 11, I show a modified form of terminal member, which is provided with a struck
 85 up tongue portion 35, which acts as a stop for each of the ears 31 and 32. The terminal member 8 is provided with an aperture 36, which registers with an aperture formed in the tongue
 90 of the contacting member 37. The contacting member 37 contacts against the lower surface 22A of the contact arm 22, and as more clearly shown in Figures 4 and 6, this contactor member
 95 37 is provided with a looped enlarged end por-

tion which fits over an insulating washer 38 carried on the surface 14 of the thimble 12. Both the washer 38 and the contactor member 37 are provided with central openings for receiving the control shaft 19, the aperture formed in the contacting member 37 being of a larger diameter than the washer 14, so that the contacting member 37 will be spaced from the control shaft and thus insulated therefrom. The eyelet 10 serves to rivet the contactor 37 to the terminal member 8 and secures the two in rigid co-operating relationship.

It is therefore apparent that the control shaft 19 is effectively insulated from the contacting arm 22 and its brush 22A, and that the terminal member 8 is directly connected by means of the contacting member 37 and the brush 22A, with the arm 22, but is also effectively insulated from the control shaft. The operating pin 29, for operating the snap switch illustrated in Figure 3, is insulated from the contactor arm 22, and also from the shaft 19.

The contacting arm 22 is also provided with a downwardly turned tongue member 40, which is shown clearly in Figure 9, and has engagement in a suitable aperture or chamber 41 formed in the contacting shoe or disc 42. The contacting shoe 42 is preferably circular in form, and is provided with a lower surface 43 composed of a neutral metal, for engagement with the surface of the resistance element 44. The connection between the tongue member and the aperture 41 provides a universal movement between the shoe 42 and the contacting arm 22, and also between the bottom surface 43 of the shoe and the resistance element 44. This insures a high degree of uniformity in the contact area between the shoe and the resistance element, and also assures of a substantially constant unit pressure between the contacting members. Although making a full wiping contact upon the surface of the carbonaceous resistance element, the shoe is adapted, because of its universal movement, to effect no detrimental changes in either the electrical or physical characteristics of the resistance element.

In Figure 10, I have shown a slightly modified form of universal connection, wherein the depending tongue member 40 is provided with a second reduced stud portion 45, which is adapted to seat in an aperture 41' of the contacting shoe 42'. In this modification there is a slight lost motion connection between the tongue 45 and the shoe 42'.

The resistance element upon which the shoe is adapted to have wiping contact, preferably comprises a carbonaceous strip of generally annular shape, which is provided with enlarged end portions adapted to lie under the terminal members 7 and 9. By providing the enlarged end portions under the terminal, a considerable pressure may be exerted by the rivets or eyelets used in mounting the terminals, without exceeding the allowable unit pressure of the resistance strip. This affords a much better contact with the resistance strip, and also prevents damage to the strip in the mounting of the terminal.

While the strip 44 may be cemented to the flat face of the housing 2, I preferably coat the back of the resistance element with a suitable material to neutralize the strains set up by the carbonaceous resistance film and thus prevent curling of the element. This material may comprise any type of coating, such as varnish, lacquer, or the like, which will have the desired amount of

shrinkage upon setting to offset the curling effect of the paper caused by the coating of the conducting paint on the opposite side thereof. This makes it possible to mount the resistance element merely by means of the end terminals, without resorting to the use of a cement or glue for securing it to the housing.

The enlarged ends 46 of the resistance element are adapted to fit under the inner portion of the terminal members 7 and 9. These terminal members 7 and 9 have recessed portions 47 and 48, which are adapted to form a nest in which the shoe or contact disc 42 is adapted to seat when the volume control is in its minimum and maximum positions.

In Figure 15, I show a contacting shoe 42'' of substantially diamond form, with a rectangular perforation 41'' formed therein for maintaining the shoe in aligned position. The terminal member 9' is provided with a recess 48' which conforms to the configuration of the contacting shoe.

The inner end of the terminal member 9 is provided with a downwardly turned tongue portion 39, which seats in suitable recesses 49 formed in the bottom of the housing 2. These recesses 49 are directly above the projecting buttons or studs 11, which serve to secure the control in rigid position with respect to the panel.

As shown in detail in Figure 12, the resistance terminal is integral with the extending terminal 9, and the entire terminal portion is inserted from the interior of the housing, with the projecting lug portion 9 extending through the rectangular opening formed in the housing 2. These terminal members have supports along a plurality of surfaces, so that they will be rigidly held in position by means of a single eyelet or rivet 10. As clearly shown in Figure 4, the terminal element 9 has support on the two sides of the rectangular opening to which the connecting portion of the terminal extends, and has support along the inner periphery of the wall of the housing 2. Further, the inwardly extending portion 39 of the terminal member is supported in the recess 49 formed in the base of the housing 2, and therefore the terminal member is securely held in position, merely by its contact with the surrounding supporting surfaces. The eyelet 10 serves to secure the terminal 9, together with the enlarged end 46 of the resistance element, in tight contacting relation.

In Fig. 7, is shown a modified form of arm adapted for use when it is not necessary to insulate the arm from the control shaft. In devices of the type herein disclosed, it is sometimes desirable to have the central terminal directly connected to the inner shaft end of the mounting bushing, and in such cases the arm is changed so as to eliminate the necessity of the bakelite support 25, shown in Fig. 2. The shaft is then secured directly to the arm, as by means of washers corresponding to the washers 23 and 24, which frictionally engage the contactor arm. In using an arm of this type, a fibre pin 52 may be used in place of the metallic pin 29 for the purpose of operating the switch.

This type of contactor arm, indicated by the numeral 51, is similar to the contactor arm 22, and has the extending ears 31' and 32' which correspond to the ears 31 and 32 as shown in Figure 2. The arm is also provided with a depending tongue 40' adapted to engage the contact shoe for moving the shoe over the surface of the resistance element. The pin used for operating the switch arm is composed of fibre or

other suitable insulating material, and has a portion 53 of reduced diameter which fits snugly into an extruded hole in the contactor arm. By extruding the hole into which the pin fits, a much greater supporting surface is provided, and a fillet is also provided under the shoulder of the pin which will, as shown, greatly strengthen the pin in its operating position. Preferably the pin 52 is thoroughly dehydrated before being assembled in the contacting arm, so that if any moisture is absorbed, the pin will merely become more securely engaged in the arm.

In a combined volume control or variable resistance device and switch of the type disclosed in this invention, the switch, which might in some cases carry an alternating current of audible frequency, is disposed in relatively close proximity to the volume control or variable resistance device, and there may be an appreciable feed-back or coupling between the switch and the volume control or variable resistance device, which in many cases will be so connected in the circuit of the radio set that such a coupling may be objectionable. In order to prevent such a coupling, I preferably employ a metallic plate, which serves as an electro-magnetic and electrostatic shield between the switch and volume control. This metallic plate is shown in detail in Figures 13 and 14, and is indicated by the reference numeral 54. It is composed of a flat sheet of suitable metal and is of a thickness on the order of ten one-thousandths (0.010") of an inch. It is provided with a narrow ribbon portion 55 extending from the periphery thereof, which is adapted to be bent along the outer periphery of the housing 2, as shown in Figure 1, and is provided at its end with a bifurcated or forked end portion which fits around the mounting thimble 12. This forked end portion is composed of the two arms 56 and 57, which fit around the thimble 12 and are adapted to form a substantial contact due to the large surface bearing against the panel when the unit is mounted. If desired, a looped end portion may be provided in place of the forked end. This contact is effectively increased by means of the pressure exerted when the mounting nut is drawn up tight to secure the control in position.

The plate 54 and the insulating members 60 and 61 are provided with a pair of diametrically opposed apertures 58 formed near the periphery thereof, which are adapted to fit over the projecting pins 59 extending from integral projections carried by the peripheral wall of the housing 3. This serves to locate the shielding plate in position with respect to the switch so that the aperture 59 formed therein will fit over the cam portion 30 of the switch.

As shown more clearly in Figure 14, the aperture 59 is shaped to conform to the general outline of the cam member 30, and is of a size large enough to accommodate movement of the cam member from on to off position. The metallic member 54 is provided with an aperture slightly larger than the required aperture 59, and two insulating disc members 60 and 61 are positioned on opposite sides of the metallic plate member 54 for effective insulation between the switch and the volume control. These members 60 and 61 may be formed of a flat piece of fibre or other suitable insulating material, and the apertures 59 cut therein are smaller than that formed in the metallic plate 54. This will provide insulation about the cam member 30 of the switch

which projects through this opening and will thereby insulate the shielding plate from the cam member. The insulating discs 60 and 61 may be secured to the plate member 54 in any suitable manner, such as by gluing or cementing, or they may be riveted by means of suitable eyelets.

By the provision of this metallic shielding means, it is possible to dispose the volume control and switch in close proximity to each other without in any way influencing the individual characteristics of each part of the unit. This shield, as well as the mounting thimble and control shaft, when constructed as shown, is effectively grounded to the grounded metal panel upon which the control unit is mounted in the normal use of the device. I also have provided means for effectively insulating the contactor arm 22 from the control shaft, so that there will be no possibility of grounding of this contactor unit. By the configuration of the contacting arm, it is also possible to provide a metallic operating pin for the switch which is effectively insulated from the arm. Effective insulation is also provided between the contacting member 37 and the thimble for preventing any current leakage through these parts.

The molded shell for a housing 2 has a plurality of apertures 100 formed in the shell during the molding operation and each of the terminals 7, 8 and 9 is adapted to project through their associated apertures designated 100. As the apertures are similar, but one aperture need be described.

The aperture 100 is defined by a wall 102, Figs. 1 and 6, substantially parallel to the plane X—X of an end wall 104 but solely within the cylindrical wall and also a plurality of other walls 106, 108 and 110. Projecting to the left from the wall 102, as viewed in Fig. 1, and also projecting in the same direction as the axis of the operating shaft projects, are the walls 106 and 108. Another wall 110 is a distance removed from the circumference of the end wall 104 approximately equal to that of the thickness of the cylindrical wall and of a width approximately equal to the width of the terminal, thus a suitable opening through which the terminal may be bent through an angle 90°, from that position as shown in Figure 1, is provided. It is to be noted that the complete part of the housing to the right of the line X—X, Fig. 6, is to be included in the term end wall 104, and the part to the left of the line X—X is the cylindrical wall. In addition, the walls define a limiting aperture and positioning means for the terminal. If the terminals should be bent downwardly through an angle of 90°, from that position as shown in Figure 1, it will be seen that the terminals do not extend outside the circumference of the shell or housing 2.

The molding of the above noted apertures may be readily done in a simple two piece mold without any complications arising.

Other objects and advantages of my invention are contemplated, and I do not intend to be limited to the particular embodiment shown and described, but only insofar as defined by the scope and spirit of the appended claims.

I claim:—

1. In combination, a variable resistance device, a switch, a housing for said variable resistance device and said switch, driving means disposed in said housing for connecting said switch to said variable resistance device, and a conductive electric shield interposed between said va-

riable resistance device and switch and having an opening therein accommodating said driving means.

2. In combination, a variable resistance device having an eccentrically driven switch actuating element, a switch having an element transiently engaged by said switch actuating element to constitute switch actuating means operatively connecting said variable resistance device and said switch, a conductive electric shield interposed between said variable resistance device and said switch and having an eccentrically disposed opening therein through which opening said transiently engageable means extends, and housing means substantially enclosing said variable resistance device, said switch and said switch actuating means.

3. In combination, a housing, a variable resistance device and a switch in said housing, means operatively connecting said variable resistance device and said switch whereby they are jointly operable by said means, a conductive electric shield interposed between said switch and said variable resistance device and having an opening therethrough to accommodate said connecting means, a ground connection for said shield, and an insulating barrier between said switch and said shield, said shield and said barrier being imperforate where they overlie the current-carrying elements of said switch.

4. A combined variable resistance device and switch comprising a housing, a variable resistance device disposed in said housing, a conductive grounding member having at least a portion disposed exteriorly of said housing, a switch in said housing, a single actuator for effecting operation of said variable resistance device and switch, a conductive electric shield interposed between said variable resistance device and said switch, and an electrical connection between said shield and said conductive grounding member.

5. A control device comprising a housing, an electrically conductive partition defining with said housing a plurality of chambers, a switch in one of said chambers, a variable resistance device in another of said chambers, a control shaft for said switch and variable resistor extending into said housing and terminating in said second-named chamber, and means extending through said partition for operatively connecting said switch to said variable resistance device, whereby both may be actuated by said shaft.

6. A control device comprising a housing including a plurality of sections, a variable resistance device disposed in one of said sections, a switch disposed in another of said sections, a grounded electric shield interposed between said variable resistance device and said switch, means securing said housing sections together and clamping said shield between said sections, and an actuator positioned in one of said sections for operating said variable resistance device and switch.

7. A control device comprising a plurality of substantially cylindrical housing members, a circular electric shield having an eccentrically disposed perforation therein, means securing said housing members and said shield together to constitute a housing having a plurality of chambers, means for securing said shield against angular displacement in said housing, a variable resistance device in one of said chambers, a switch in another of said chambers, means extending through said perforation for operatively connecting said switch to said variable resistance

device, and a unitary control for operating said last named means.

8. A control device comprising a housing, a variable resistance device in said housing and including a resistance element, a contactor engageable with said resistance element, and movable actuator means for varying the point of engagement of said contactor on said resistance element, a switch in said housing, a conductive electric barrier interposed between the current carrying portions of said switch and the conductive portions of said variable resistance device and means extending through said barrier for operatively connecting said switch to the actuator means of said variable resistance device.

9. In combination, a housing, a variable resistance device in one portion of said housing, a switch in another portion of said housing, a conductive electric shield disposed between said variable resistance device and said switch, said shield comprising a grounded conductive plate and an insulating plate overlying said grounded conductive plate, and actuator means for operatively connecting said switch to said variable resistance device.

10. A control device comprising a housing having an opening therein, a variable resistance device disposed in said housing, a conductive electric shield substantially closing the opening in said housing, a second housing having an opening therein, a switch disposed in said second housing, means securing said housings and shield together with said shield substantially closing the opening in said switch housing, an insulating plate disposed between said shield and said switch and in intimate contact with said shield, and means for operatively connecting said variable resistance device and said switch whereby they may be operated by a single control.

11. In combination, a housing having a conductive wall portion formed with a perforation, a variable resistance device in said housing, a second housing secured to said first housing and having an opening substantially closed by said conductive wall portion, a switch in said second housing, means securing said housings together, an insulating barrier interposed between said conductive wall portion and said switch and having a perforation registering with the perforation in said conductive wall portion, the perforation in said barrier being smaller than the perforation in said conductive wall portion, whereby the barrier overlies the marginal portion of the perforation in said conductive wall portion, means extending through said perforations for operatively connecting said switch and said variable resistance device, and a unitary control for effecting operation of said last named means.

12. In combination, a switch, a housing for said switch, a variable resistance device, a housing for said variable resistance device and having a substantially planar conductive wall portion extending between said switch and said variable resistance and overlying said switch, said planar portion having a perforation therethrough, means extending through said perforation for operatively connecting said variable resistance device and said switch, and a unitary control for effecting operation of said last named means.

13. In combination, a variable resistance device, a switch, means securing said variable resistance device and said switch together, a conductive electric shield interposed between said switch and said variable resistance device, an insulating barrier overlying said switch, said bar-

rier and said shield having registering openings, and means operatively connecting said variable resistance device and said switch and including a member extending through said registering openings, whereby said variable resistance device and said switch are controlled by a single actuator.

14. In combination, a variable resistance device, a switch, means securing said variable resistance device and said switch together, a substantially planar electric shield interposed between said variable resistance device and said switch, a flat insulating barrier extending between said switch and said shield and substantially parallel to said shield, and means extending through said shield and said barrier for operatively connecting said switch and said variable resistance device, whereby said variable resistance device and said switch are both controlled by a single actuator.

15. In combination, a variable resistance device, a switch, housing means for said variable resistance device and said switch and including an electrically conductive wall portion interposed between said variable resistance device and said switch and overlying the current carrying element of said switch, actuating means operatively connecting said switch and said variable resistance device, said actuating means extending through said conductive wall portion and lying wholly within said housing means, and a unitary controller cooperating with said actuating means to effect actuation of said variable resistance device and said switch simultaneously.

16. In combination, a variable resistance device comprising an arcuately movable contact member, a switch, a member carried by the contact member and adapted to transiently engage the switch to operate the same, an electrostatic shield interposed between the switch and resistance device, and an eccentric opening in said shield through which the member and switch transiently engage.

17. In combination, a variable resistance device comprising an arcuately movable contact member, a switch, a member carried by the contact member and adapted to transiently engage the switch to operate the same, an electrostatic shield interposed between the switch and resistance device, an eccentric opening in said shield through which the member and switch transiently engage, and insulating means supporting the switch with its current carrying portions located laterally of the opening.

18. In combination, a variable resistance device comprising a resistance element, an arcuately movable contact member, an electrically conductive shaft for said contact member, a switch, a switch operating element supported from the shaft and movable with the contact member for transient engagement with the switch to actuate the switch, a conductive metal plate interposed between the switch and the resistance element forming an electrostatic

shield therebetween, an eccentric opening in said plate to permit the transient engagement between the switch and operating element, and an electrical connection between the plate and the shaft.

19. In combination, a variable resistance device comprising a resistance element, an arcuately movable contact member, an electrically conductive shaft for said contact member, a switch, a switch operating element supported from the shaft and movable with the contact member for transient engagement with the switch to actuate the switch, a conductive metal plate interposed between the switch and the resistance element forming an electrostatic shield therebetween, an eccentric opening in said plate to permit the transient engagement between the switch and operating element, an electrical connection between the plate and the shaft, and insulating means supporting the switch with its current carrying portions located laterally of the opening.

20. In combination, a variable resistance device comprising an arcuate resistance element, an arcuately movable contact member engaging the resistance element, a shaft for said contact member, an electrically conductive support for said shaft, said switch having an actuating cam insulated from the current carrying portions of the switch, a switch operating element supported from the shaft and movable with the contact member for transient engagement with the switch actuating cam member, a conductive metal plate interposed between the current carrying portions of the switch and the resistance element forming an electrostatic shield therebetween, an eccentric opening in said plate to permit transient engagement between the switch and operating element, and an electrical connection between the plate and the shaft support.

21. In combination, a two chamber housing, a variable resistance device in one chamber, a switch in the second chamber, the variable resistance device comprising an arcuate resistance element, an arcuately movable contact member engaging the resistance element, a shaft for said contact member, an electrically conductive support for said shaft, the switch comprising an actuating cam and a current carrying portion insulated from the cam, the shaft for the contact member of the resistance device having a switch operating element supported from said shaft and movable with the contact member for transient engagement with the switch actuating cam member, a conductive metal plate interposed between the current carrying portions of the switch and the resistance element forming an electrostatic shield therebetween, an eccentric opening in said plate to permit the transient engagement between the switch and operating element, and an electrical connection between the plate and the shaft support.

NEWTON C. SCHELLENGER.