

April 23, 1940.

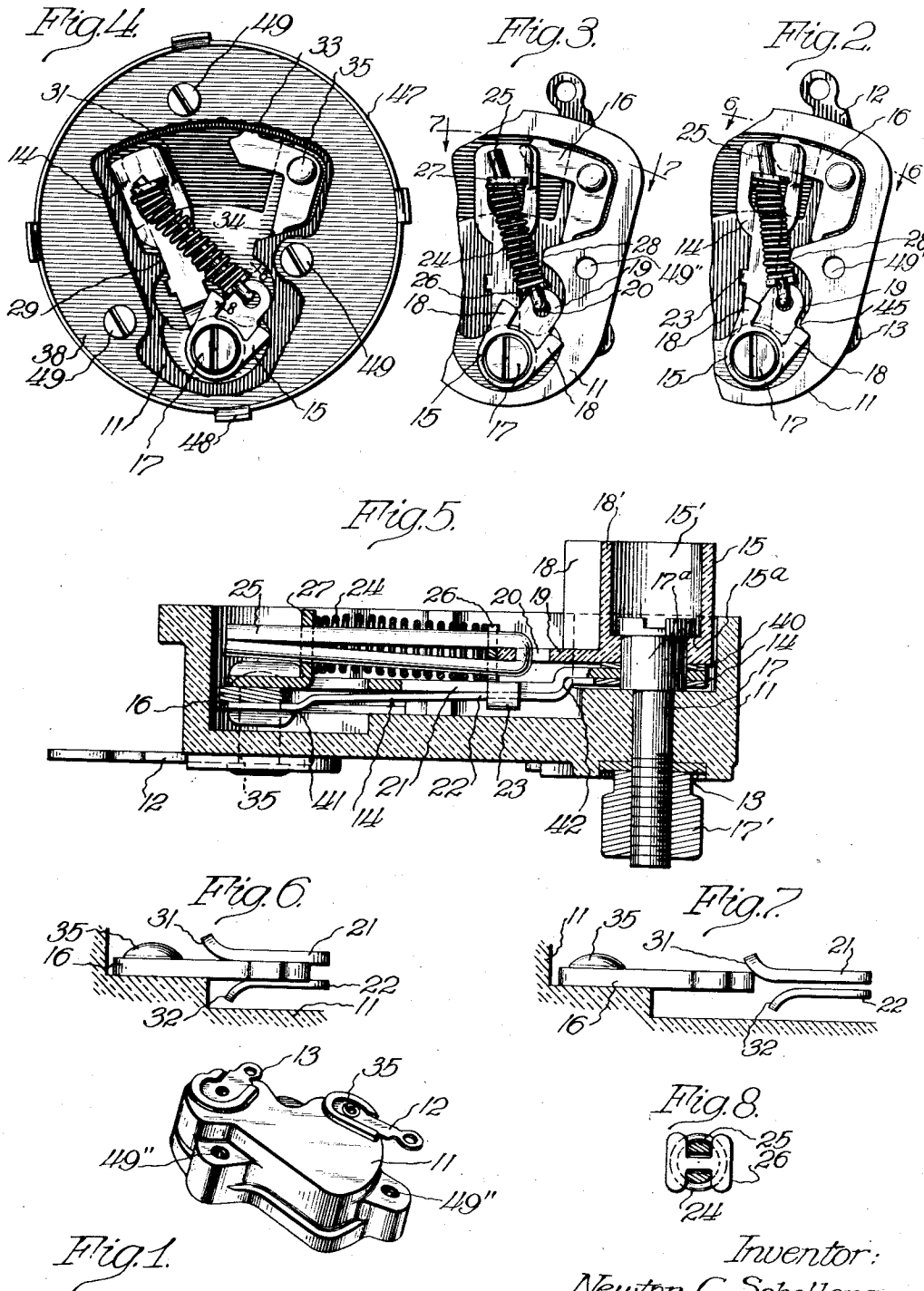
N. C. SCHELLENGER

2,198,277

CIRCUIT CONTROLLER

Filed March 30, 1932

3 Sheets-Sheet 1



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April 23, 1940.

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2,198,277

CIRCUIT CONTROLLER

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3 Sheets-Sheet 2

Fig. 9.

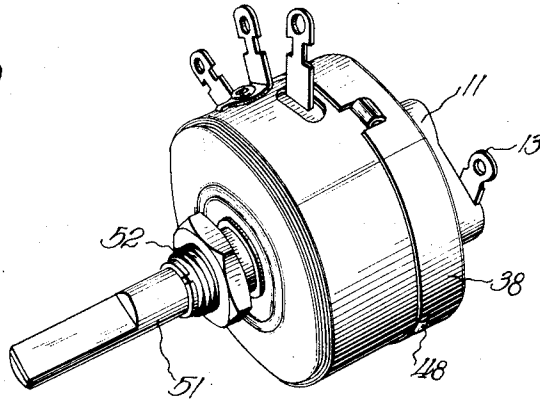


Fig. 10.

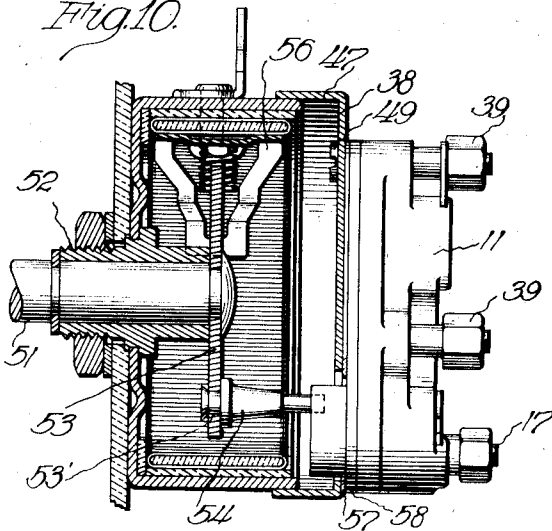
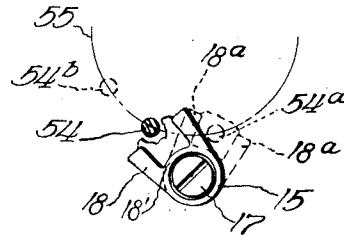


Fig. 11

Fig. 12.

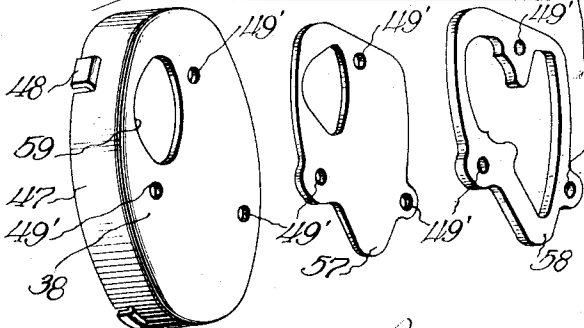
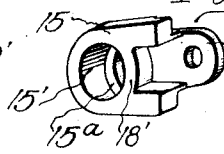


Fig. 13.



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CIRCUIT CONTROLLER

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3 Sheets-Sheet 3

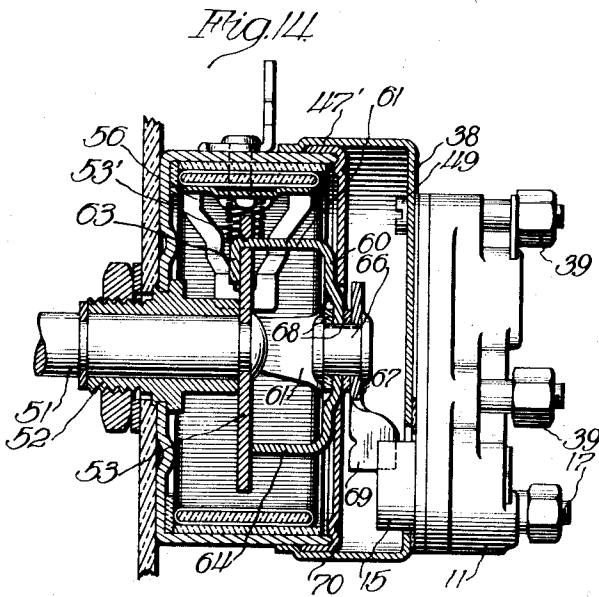
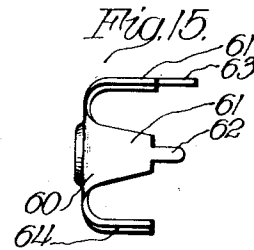
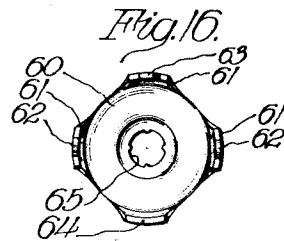
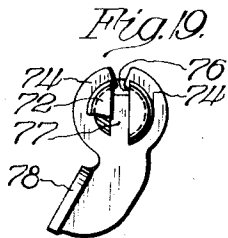
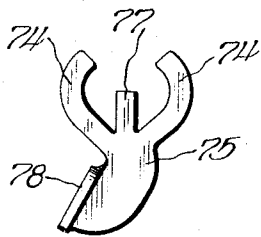
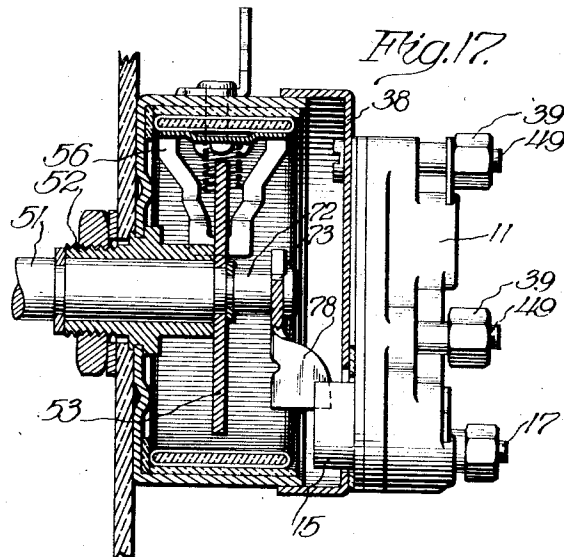


Fig. 18.



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UNITED STATES PATENT OFFICE

2,198,277

CIRCUIT CONTROLLER

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Application March 30, 1932, Serial No. 602,006

27 Claims. (Cl. 201—55)

This invention relates to circuit controllers, and more particularly is directed to circuit controllers comprising a snap actuated switch mounted in conjunction with a volume control, the assembly forming an enclosed and compact unit.

The invention, is in part a continuation of my copending application, Serial No. 518,281, filed February 25, 1931, now Patent No. 2,019,997 and in its present embodiment is directed particularly to the actuating means for engaging a novel type of snap switch.

One of the primary objects of the present invention is to provide a snap switch which is compact in construction and reliable in operation, and which may be manufactured at low cost.

Snap switches heretofore known in the art have employed structures of considerable mechanical complexity, including usually, an insulating casing, a frame structure for carrying the moving parts, an operating or actuating member, a spring, a contactor yoke or carrier, an insulating mounting on the yoke for the contactor, and the contactor itself.

In the preferred embodiment of my invention, all moving parts are mounted directly in the insulating casing to eliminate the separate frame structure and the contactor has been directly incorporated into the mechanical structure of the switch to eliminate the yoke and the insulating mounting. Since the switch actuating mechanism is insulated from the live parts of the switch, the need for electrical clearances are avoided within the switch itself and a compact construction is therefore possible. The necessary insulation between the switch and its mounting is provided by the casing, and, if desired, supplementary spacing and insulating gaskets.

The contactor is preferably made of two dissimilar metal strips, one of which provides the necessary strength and rigidity, and the other of which is resilient to effectively engage a stationary contact. One of these strips is designed to be the main current carrying part of the contactor and the other is arranged to provide an arcing tip to protect the current carrying part from destructive effects of the arc during the breaking of the circuit.

Spring supports as known to the prior art have in general employed a pitman having a shoulder near its pivoted end to take the thrust of the spring or have used a pivoted thrust plate in cooperation with a complex actuating member.

The present construction uses a rod bent to a U-shape and looped through the actuating member in combination with a blanked out thrust plate, providing a construction that is completely reliable in operation but simpler and cheaper than any heretofore known.

A simple kick-off, to manually force the starting of the contactor is also incorporated in the design of the switch.

A further object of the present invention is to provide a switch adapted to be mounted on a rheostat or similar volume control device to form a compact structure and to function therewith in an improved manner.

Heretofore, it has been known to mount a switch adjacent a rheostat so that a common operating member such as the rheostat knob may actuate both instruments, but such devices have been largely makeshifts.

In the present invention the switch and rheostat are combined into a single compact structure with the rotating contactor arm of the rheostat serving as a switch operating means. This permits the use of a very short operating lever on the switch in cooperation with a relatively long arm on the rheostat so that a slight rotation of the rheostat shaft is sufficient to operate the switch.

A further feature of the present invention resides in providing the actuating member for the switch of non-conducting material, such as Bakelite, so that there will be no possibility of A. C. hum being picked up by the rheostat from a "live" cam or of grounding the switch parts through the rheostat.

In connection with this feature, I also provide an electrostatic shield between the live switch parts carrying 110 volts alternating current, and the volume control parts which are housed in the rheostat shell and are connected to the sensitive parts of a radio receiving circuit or the like. It is to be understood that by the provision of an insulated cam in conjunction with the shield, the shielding effect desired is obtained, but such a shielding effect would be nullified by the use of a cam member of conducting material. This shield, which is preferably a thin metallic plate, is interposed between the rheostat and the switch for preventing any A. C. hum from being picked up by the volume control from the live switch parts. It is grounded in a suitable manner, such as by contact with the metallic covered housing of the rheostat, so that when the unit is assembled upon the panel there will be an effective grounding connection

between the shield and the grounded metal panel.

In order to acquaint those skilled in the art with the teachings and practice of my invention, I shall now describe a specific embodiment of the same, reference being had to the accompanying drawings which form a part of this specification.

Figure 1 is an external perspective view of a switch embodying my invention;

Figures 2, 3 and 4 are internal views of the switch and illustrate the mechanism in various operative positions;

Figure 4, in addition, discloses the electrostatic shield for mounting the switch on a rheostat or other volume control device, the shield being broken away to show the switch parts in open circuit position;

Figure 5 is a cross sectional view taken through the mechanism in dead center position and illustrating the same in detail;

Figure 6 is a cross section on the line 6—6 of Figure 2 illustrating the manner of engagement between the contact members;

Figure 7 is a cross section on the line 7—7 of Figure 3 illustrating one of the features of the operation of my device;

Figure 8 is a cross sectional view of the pitman assembly on the line 8—8 of Figure 4;

Figure 9 is a perspective view of a combined switch and volume control unit constructed in accordance with the teachings of my invention;

Figure 10 is a partial sectional view of the unit showing the manner in which the rheostat operates the switch;

Figure 11 diagrammatically illustrates the manner of engagement between the cooperating parts of the switch and rheostat;

Figure 12 is a perspective exploded view showing in detail the electrostatic shield and the insulating gaskets;

Figure 13 is a perspective view of the cam or actuating member of the switch;

Figure 14 is a sectional view of the switch and rheostat, showing a modified manner of engaging the switch cam;

Figure 15 is a side elevational view of the rider for the rheostat plate, which carries the switch engaging lever;

Figure 16 is a front elevation of the same;

Figure 17 is a second modified form of switch engaging lever;

Figure 18 is a detail of the lever shown in Figure 17, before it is secured to the rotating rheostat shaft; and

Figure 19 shows the lever of Figure 18 mounted in operative position.

The particular switch herein described and illustrated is of a type which finds considerable use in radio receiving sets. It is adapted to be mounted on the back of a rheostat, potentiometer or similar volume control device by means of rivets, eyelets or screws. The switch in the preferred embodiment, is actuated by a suitable pin mounted on the rotating contactor arm of the volume control unit.

The body or casing 11 is made of molded insulating material. A phenol condensation product is particularly suitable. The engaging mechanism of the switch consists of a contactor member 14 and an actuating member 15, both of which are pivoted about the stud or bolt 17. The contactor member which is designated generally by the numeral 14 consists of two metal strips 21 and 22, which are secured in assembled relation by means of the ears 23 on the strip 21, which are

bent around and clamped over the edge of the strip 22.

The bolt 17 extends through the housing and is secured therein by means of a nut 17' threaded over its projecting end. A spring and pitman assembly connects them in operative relation. The contactor 14 is arranged to make and break electrical connection with the stationary contact member 16 which is connected to the terminal 12 through the rivet 35. The contactor 14 is connected through its pivot 17 to the terminal or lug 13. The pin 54 of the rheostat engages the integral extending ears 18 of the actuating member 15 to operate the switch.

This actuating member 15 may be formed of moulded insulating material, or of fiber, and is provided with a central recess 15' for receiving the head of the pivot bolt 17. A suitable internally flanged seat 15a surrounds the enlarged portion 17a of the bolt 17, and forms a seat for the head of the bolt. The contactor member 14 pivots about this enlarged portion 17a, and is spaced from the cam 15 by a washer 40.

The cam member 15 has a laterally extending tongue portion 19 provided with an aperture 20 for receiving the spring actuated pitman.

The details of the switch blade mechanism are clearly shown in the cross sectional view of Figure 5. The strip 21 is, from a mechanical point of view, the main or body portion of the contactor 14. It gives the necessary mechanical strength and rigidity to the contactor, and is provided with a perforated ear 27, disposed substantially normal thereto, and adapted to engage the spring and pitman of the mechanism. Preferably the ear 27 is formed by striking up a portion of the strip 21, although it may be otherwise constructed within the teachings of my invention. The strip 22 is resilient and is intended to supply the necessary contact pressure and to carry the major portion of the current. It is offset at 41 away from the strip 21, so that the stationary contact 16 may be received and gripped between the two strips 21 and 22. The contact pressure is produced by the flexing of the strip 22.

The contactor might easily be made using only the strip 21 in which case contact pressure would be supplied by the actuating spring 24. Such an arrangement preferably requires a wider spacing between the actuating member 15 and the contactor 14 where they are pivoted on the bolt 17, which imposes a turning effect on the bolt about a transverse axis, although it is apparent that this spacing does not necessarily have to be provided in order to accommodate such a contactor.

I prefer, however, to use a two-piece contactor so that the parts of the switch may be arranged to avoid imposing any undue strain on the bolt 17. I have accordingly arranged the members 14 and 15 on the pivot 17 with a very small spacing between them such as provided by the thin washer 40. It has been found that a wider spacing may result in a cramping action, and also an increased amount of friction. The contactor 14 is offset at 42 to permit this close spacing and at the same time to provide the needed clearance between the strip 22 and the spring 24. In the switch as shown, the spring 24 exerts a slight downward pressure on the strip 21 sufficient to keep it normally depressed below the top surface of the contact 16 as will be described later.

Another novel feature of the two-piece contactor construction is illustrated in Figures 6 and 7. The lateral edges 31 and 32 of the con-

tact portion of the strips 21 and 22 are flared out away from each other so as to guide the stationary contact member 16 into engagement between them. As previously stated, the strip 22 is intended to carry the major portion of the current. It must therefore at all times make a clean, low resistance contact with the member 16 and accordingly the edge 31 is made to over-reach the edge 32 to protect the strip 22 from arcs. Thus, when the switch opens, as shown in Figure 7, the edge 31 will maintain contact with the member 16 longer than does the edge 32, and therefore, any arc that may form in breaking the circuit will be drawn between the member 16 and the member 21. Thus, the member 22 is protected from arc ravages so that its contact surface will be kept clean and bright by the normal wiping action incident to the opening and closing of the switch.

If the edge 31 is to function satisfactorily as an arcing tip its surface must be kept free of the insulating oxide that usually forms on metallic surfaces under the influence of an electric arc. Unless the edge 31 makes satisfactory electrical contact with the member 16, the circuit will be broken when the edge 32 leaves the member 16 and the arc will draw there. It will be noted from Figure 7 that the inflexible strip 21 is normally depressed by the spring 24 in a manner already described, so that its lower surface is below the top surface of the member 16 with which it engages when the switch is closed. This causes a wiping action to take place between the curved edge 31 and the corner of the contact 16 to remove any insulating oxide that may be formed.

As has been previously pointed out, current is carried by the pivotal connection between the contactor 14 and the post 17. It is important, therefore, that this connection have a low electrical resistance and ordinarily some special provision would be required to insure such a condition. But in the device herein described and illustrated, it has been found that no such special provision is needed since the spring 24 causes the eye of the contactor to bear against the pivot 17 at all times with a force sufficient to keep the resistance of the connection down to a satisfactorily low value.

While I prefer to use the resilient member 22 to carry the current and the body member 21 to take the arc, these functions might be changed within the teachings of my invention. Phosphor-bronze is an excellent spring material and since copper and bronze make a good continuous duty contact combination, I prefer to make the resilient strip 22 of phosphor-bronze and the stationary contact member 16 of copper, and to therefore use the bronze strip 22 as the current carrying portion of the contactor. The body member 21 is preferably made of brass.

The pitman construction is clearly shown in Figures 5 and 8. A U-shaped link 25 is looped through the hole 26 of the actuating member 15 so as to be pivoted therein, and is inserted in the perforated ear 27 of the contactor to be slidably engaged thereby. This link may be made of any form of rod or wire, but I prefer to use half-round cotter-key stock, since it is cheap and readily obtainable on the open market and because it is admirably adapted to fit compactly into my device. An H-shaped thrust plate 26 fits between the reaches of the U-shaped pitman and engages the edge of the actuating member 15. A compression spring 24 encircles the pitman 25

and bears against the ear 27 of the contactor and against the thrust plate 26. In operation the thrust plate 26 slides against the actuating member 15 and furnishes a bearing thereon for the spring 24, as may be seen by reference to Figures 2 and 3.

Prior constructions have often used a spring without a guide member, and considerable trouble has been experienced with such unsupported springs buckling and popping out of place. Prior constructions have also used a pitman spring guide in which the pitman had a shoulder near its pivoted end to receive the thrust of the spring. It will be noted that in my construction the pitman 25 does not receive any of the thrust but rather the total thrust of the spring is carried by the H-shaped plate 26 which rides on the edge of the actuating member 15. This cheap and dependable construction directly results from using the U-shaped pitman 25, and provides a symmetrical structure which directs the spring squarely against the edge of the actuating member and positively prevents any accidental disassembling of the switch, such as would occur in other types of construction should the spring buckle and jump out of place. It will be noted that the pitman construction is rugged and dependable and requires only the very simplest of manufacturing operations. The link member 25 is manufactured by simply cutting off the stock and bending it to shape, and the thrust plate 26 is a simple metal punching.

In operation (Figures 2, 3 and 4) the actuating member is moved towards a dead center position against the force of the spring and on passing that position the spring snaps the contactor to its other extreme position of travel. Such switches are subject to more or less sticking of the contact and the force exerted by the spring against the contactor frequently is not sufficient to move it from its rest position. My switch is therefore provided with a kick-off for exerting considerable force in addition to that of the spring so as to start the contactor from rest. Figure 2 illustrates the switch in such position that the actuating member has just been moved to the right, past the dead center position, and the contactor 14 is about to move away from the contact member 16. As may be seen from this figure, the pitman assembly engages the projection 28 of the molded casing against which it rocks, so that as the actuating member 15 moves farther to the right the pitman rod 25 acts as a lever to force the contactor 14 towards the left. Figure 3 shows the contactor 14 moving away from the contact 16 under action of the spring 24. It will be noted that in this position the kick-off is no longer operative so that the actual opening of the contacts is accomplished not by the kick-off but by the force of the spring alone. This prevents a slow manual opening of the contacts and insures a quick clean break at all times.

The actuating member 15 is limited in its motion by a stop 45 provided in the casing, the location of which determines the amount of movement of the contactor that may be obtained by the kick-off action. That is, the contactor 14 may be moved by the rocking action of the pitman against the abutment 28 until the member 15 engages the stop 45. Usually the contactor moves under the force of the spring before this maximum kick-off movement is obtained and in doing so releases the pitman from the abutment 28. The cam 15 then moves against its stop 45 where it is supported against the turning force of

the spring 24. This stop also supports the recoil of the spring 24 so that it may exert a force to move the contactor 14.

Figure 4 shows the switch in the open position. The switch is closed in a manner similar to the opening operation just described. The actuating member 15 is turned to the left to cause the contactor 14 to snap to the right. The switch will not usually stick in the open position but the kick-off abutment 29 has been provided so that the operation of the switch will be rendered positive in this direction also.

The stationary contact 16 is provided with two projections 33 and 34 (Figure 4) which cooperate with the rivet 35 to definitely locate the member 16 and to rigidly secure it to the molded casing 11. This prevents any turning of the contact member 16 on the rivet and insures that the electrical connection between the terminal 12 and the contact member will be permanently tight.

Figures 4, 9 and 10 illustrate the manner of mounting the switch upon a cover plate 38 of a rheostat. The rheostat includes a shaft 51 turning in a bushing 52 and carrying at its end a revolving arm 53, to which is secured a contact member 56 of the rheostat and a pin 54 which engages the ears 18 of the actuating member 15 of the switch. The arm 53 comprises a thin metal plate, similar to the plate 16 of my aforesaid copending application, and is provided with oppositely extending ears having slots or notches formed therein, and with an apertured tongue extending normal thereto, for a purpose to be described hereinafter. In the preferred embodiment, shown in Figure 10, the pin 54 is mounted in the apertured tongue 53' of the plate 53.

Referring in more detail to Figure 4, this figure discloses the manner of securing the switch to the cover plate 38 which engages the rear portion of the rheostat or volume control unit. This cover plate 38 is in the form of a cup-shaped member and is provided with the outwardly extending flange portion 47. This flange portion 47 preferably has a plurality of ears 48 struck off from the periphery thereof, these ears being adapted to engage suitable corresponding lugs formed in the periphery of the metallic housing of the rheostat unit. This permits the cover plate to be accurately positioned with respect to the rheostat housing so that the switch will be in correct operating position with respect to the switch pin 54 carried by the rotating arm 53. The switch housing 11 is secured to the cover plate 38 by means of a plurality of bolts 49 extending through suitable apertures formed in the plate, these apertures being indicated in Figure 12 by the numeral 49', and apertures 49'' in the switch housing. Interposed between the rear surface of the cover plate 38 and the switch housing 11 are a pair of gasket members 57 and 58, corresponding in configuration to the outline of the switch housing 11.

It is to be noted that the gasket member 58 has its inner portion cut out in substantial conformity with the recessed portion of the housing 11, and is of considerably greater thickness than the gasket member 57. Both of these gasket members are provided with corresponding apertures 49' adapted to be aligned with the apertures 49' carried by the cover plate 38 so that they will be positively secured by the bolts 49 passing therethrough. The gasket member 57 has an opening formed therein which corresponds generally to the opening 59 formed in the cover plate

38, but is of slightly smaller area. This opening is provided for the purpose of accommodating movement of the cam member 15, and fits thereabout. The slightly smaller area of the opening in the gasket 57, while preventing any portion of the insulating cam member 15 from contacting with the metallic cover plate 38, is provided for mechanical reasons, such as inaccuracies in stamping, and the like.

It is to be noted in connection with this construction that the head of the bolt 17 is disposed within the housing 11, and that no metallic portion of the switch parts extends beyond the upper surface of this housing, as viewed in Figure 5. This insures that there will be no metallic part of the switch mechanism, that might possibly be carrying electrical current, extending past the gasket members 57 and 58. The cover plate 38 therefore acts as an electrostatic shield for preventing any A. C. hum from being picked up by the volume control portion of the unit from the switch parts. Also, this positively precludes any possibility of grounding of the switch through the volume control unit. The cover plate is securely fastened to the housing 11 by the bolts 49, and cooperating nuts 39, and the ears 48 serve to secure the switch in non-rotating engagement with the rheostat.

While I have shown, in the preferred form of my invention, the operating cam 15 as being composed of an insulating material, it is to be understood that this might comprise a metallic cam member, in which case the operating pin 54 carried by the rheostat would be composed of an insulating material such as fiber or the like. However, with the construction as shown, I secure the desired result of disposing all parts of the switch mechanism within the recess formed in the housing 11, and therefore I am able to electrostatically shield these parts from the volume control portion of the unit.

Figure 11 illustrates the manner of engagement between the operating pin 54 of the rheostat and the actuating lever 15 of the switch. The pin 54 swings with the arm 53 and travels in a circular path as indicated by the arc 55, and strikes against the ear 18 to actuate the lever. When the switch is in the off position the pin 54 occupies the position 54a illustrated by dotted lines, and the ears 18 of the actuating lever are in the position 18a which is also shown in dotted lines. On being moved to the left, the pin 54 turns the actuating member to the position as shown by the full lines and thereby operates the switch, and then disengages the same. The rheostat may then be adjusted to some operating position such as 54b leaving the switch in the on position. The switch is turned off by returning the pin 54 to the position 54a.

In employing a single control knob to operate both a rheostat and a switch in a manner such as is herein disclosed, it is desirable that a very slight rotation of the knob should suffice to operate the switch. This has been obtained in the present device by means of a novel construction of the actuating lever 15.

It will be noted, referring to Figure 11, that the ears 18 of the cam define an opening for receiving the pin 54. This opening is disposed above the pivot 17 of the cam, and is insulated therefrom by the partition 18' extending about the opening 15'. This insulates the bolt 17 from the operating pin 54, although they are in proximity to each other. As a result, the member 15 has a very short effective lever arm in com-

parison with that of the arm 53 which carries pin 54; and the switch may be operated by a slight rotation of the shaft 51. It is, of course, apparent that this result may be varied in degree by moving the shaft 17 with respect to the path 55 of the pin 54, within the teachings of my invention.

The spacing between the ears 18 is made considerably greater than the diameter of the pin 54 so as to provide lost motion between these engaging parts. This lost motion contributes to the successful operation of the switch in that it permits the actuating member 15 to advance ahead of the pin 54 as soon as the contactor begins to move from its rest position. Referring to Figures 2 and 3, it will be noted that as soon as the contactor 14 moves under the action of the spring 24, the spring is freed from the kick-off abutment 28, and the force of the spring 24 acts on the lever 15 so as to push it over against the stop 45. The lost motion between the actuating member 15 and the pin 54 thus permits the lever 15 to move ahead of the pin as above described, and to thereby turn the spring to a more advantageous angle with respect to the contactor 14. Since this movement of the actuating member 15 occurs when the spring is at very nearly dead center position, it provides a considerable aid to the operation of the switch.

In Figure 14 I have disclosed a modified arrangement for actuating the cam member. In this modification, the arm or plate 53 of the rheostat, which carries the contacting shoe or member 56 for contact with the rheostat, is adapted to be engaged by the spider member indicated in its entirety by the numeral 60.

As shown in more detail in Figures 15 and 16, the spider 60 includes the extending wings 61, which terminate at their ends in suitable tongues 62, and is also provided with the extending portion 63, which extends through the aperture 53' of the plate 53 and is bent over, as shown in Figure 14, for the purpose of securing the spider to the plate. The tongues 62 engage in the oppositely disposed notches formed in the plate member. This arrangement is shown in more detail in my copending application. The spider also has the flat extending portion 64 which seats upon the face of the plate 53. The center of the spider 60 is provided with an aperture 65 which is so formed as to engage a stud member 66, which member also carries the switch engaging lever 67.

The lever 67 is insulated from the spider 60 by means of the insulating washers 68, and the stud may be made of non-conducting material, and has its ends bent over to secure the switch lever and the spider in non-rotative engagement. The operating lever 67 terminates in a flattened portion 69, which is in a plane parallel to the axis of the shaft 51 of the rheostat, and which is adapted to engage in the slot formed by the ears 18 of the cam member 15. The operation of the mechanism is the same as that disclosed in connection with the operating pin 54 shown in Figure 10. A cup-shaped plate member 70 is secured to the frame of the rheostat, and is securely held in position by means of extending flange portion 47' of the electrostatic shield 38. This flange portion clamps over the plate 70 and holds it in position. This plate member 70 serves to hold the spider 60 in position upon the arm 53 of the rheostat, and thus holds the parts in cooperative relationship.

Referring now to Figure 17, I have disclosed

therein the rheostat shown in Figures 10 and 14, but provided with a modified type of operating arm. In this embodiment, the rheostat shaft 51 is provided with an extended portion 72, which is provided with a suitable annular groove 73 adapted to receive the two extending wing members 74 of the switch lever 75. The shaft 72 is also provided with a central aperture or a groove 76 adapted to receive the extending tongue portion 77 of the lever 75. This serves to lock the member 75 in secure non-rotating engagement with respect to the shaft 72, the wing members 74 being pressed in from the position shown in Figure 18 until they seat within the groove 73, as shown in Figure 19, and form a collar thereabout.

The lower depending portion of the member 75 is provided with the struck up tongue 78, which is adapted to enter the slot formed by the ears 18 of the cam member 15, for the purpose of operating or actuating the same. The operation of this modification is the same as described in connection with Figure 10, the electrostatic shield 38 being provided for the purpose of preventing any A. C. hum being picked up by the rheostat from the live switch parts contained in the switch housing 11.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art that I have provided a snap switch which, by virtue of its novel compact shallow construction brought about by having all of its movable elements move in parallel planes, allows the switch to be mounted flat against the back of a rheostat or volume control to effect an especially compact structure and facilitate actuation of the switch from the rotatable elements of the volume control which turn on an axis normal to the planes of motion of the movable switch parts.

It will also be apparent that the snap switch is so shielded with respect to the rheostat that there will be very slight possibility of electrostatic effects being picked up by the rheostat from the live switch parts.

There are numerous modifications and changes that may be made in the circuit controller of my invention without departing from the scope thereof. I do not intend to be limited to the exact details shown and described, but only insofar as defined by the scope and spirit of the appended claims.

I claim:

1. In a combined switch and volume control unit, a recessed switch housing, switching mechanism disposed within said housing, a volume control housing, volume control mechanism disposed within said volume control housing, a metallic electric shielding plate serving as a cover for said switch housing and extending across but spaced from live metallic parts of said switching mechanism, means for securing the switch housing to said shielding plate so that the switch housing is carried by the plate, and means carried by said plate for non-rotatively securing the same and consequently said switch housing to said volume control housing.

2. In combination, a cup-shaped shell member having a peripheral wall and an end wall, a resistor mounted within the shell member, an actuating shaft journaled in the end wall, an actuator arm on the shaft having a floating shoe for engaging the resistor, a stop member for engagement by the actuator arm when the shoe member engages substantially the end of the

resistor, a closure for the shell member, a shaft section journaled in the closure substantially in alignment with the actuating shaft, the actuator arm having a series of coupling sockets, a spider mounted on the shaft section within the shell member and having projections engaging the sockets, a switch supported from the shell member and overlying the closure, said switch having an actuating member, and an arm on the shaft section outside the closure having a lost motion driving connection with the switch actuating member, said lost motion driving connection permitting operation of the switch only when the actuator arm is adjacent to the stop.

3. In combination, a cylindrical metallic cup-shaped shell, a shaft extending through the end wall thereof, a resistor of substantially cylindrical form mounted in the shell substantially concentric with the shaft, a contact member driven by the shaft for engaging the resistor, a flanged electric shield secured to the shell, a switch carried by said shield, and a Geneva-like connection between the shaft and the switch for operating the switch during a part of the angular motion of the shaft, said motion occurring when the contact member is adjacent to the end of the resistor, the resistor comprising a wire wound strip, and a terminal cooperating with the winding of the strip and short circuiting turns of the winding included within the angular motion of the shaft required to operate the switch.

4. The combination with an electrical resistance varying device having a member rotatable to opposite extreme positions, of a projecting element mounted eccentrically upon said member, a metallic cover member for said resistance varying device, said cover member having an opening formed therein, a recessed molded insulating base member adapted to overlie said opening and rigidly secured to said cover member, and a snap switch mechanism carried within said base member and enclosed thereby, said switch mechanism including an actuating element with which said projecting element has transient driving engagement in different positions of said rotatable member whereby operation of said switch mechanism is effected.

5. The combination with an electrical resistance varying device having a member arcuately movable throughout a relatively wide range, of an eccentrically mounted projecting element upon said member, a recessed molded insulating base, a snap switch mechanism carried within said base, a metal cover member for said resistance varying device to which said insulating base is secured at a plurality of spaced points on the former, said cover member having an opening formed therein to provide clearance for said switch mechanism, said projecting element having a transient lost motion connection with said switch mechanism to provide for actuation of the latter to open- and/or closed-circuit position during movement of said movable member in reverse directions, respectively, through a relatively small portion of its range.

6. In a combined variable resistance and snap switch device, a casing, variable resistance mechanism in said casing, a rotatable shaft extending into said casing, contactor elements for said variable resistance mechanism secured to said shaft for rotation therewith, a switch base of insulating material overlying said casing, snap switch mechanism on the inner face of said switch base so as to face the variable resistance mechanism, a fixed metallic electrostatic shielding member

lying in a plane between the variable resistance mechanism and the snap switch mechanism and overlying at least a part of the switch mechanism, switch actuating mechanism rotatable by the shaft and transiently engageable with said snap switch mechanism to trip the same at a predetermined point of shaft rotation, and a metallic member engaging said variable resistance casing, the shielding member and the snap switch base to maintain these parts in operative relationship and to provide means for grounding the shielding member.

7. In a combined variable resistance unit and snap switch, a cup-shaped housing for said variable resistance unit, a rotatable shaft extending into said housing, contactor mechanism secured to said shaft for varying resistance, a switch housing, switch mechanism including an operating cam disposed within said switch housing, a grounded metallic wall interposed between the switch mechanism and the variable resistance unit, said wall having an opening therein substantially concentric with the axis of the rotatable shaft, switch actuating means rotatable with the shaft and transiently engageable with the switch operating cam at predetermined points of shaft rotation, said switch actuating means being supported upon one face of the interposed metallic wall adjacent to the periphery of said opening.

8. In a combined volume control and snap switch mechanism adapted to be operated by a single shaft, a casing, volume control mechanism in said casing, a shaft journaled in the casing, contactor mechanism for the volume control secured to the shaft to be rotatable therewith, a metal end wall for said volume control casing, a snap switch overlying part of said metal end wall in fixed position relative thereto, a cam extending from said snap switch in the direction of said volume control, and a switch actuating member engageable with said cam and supported in part by one face of said end wall, said switch actuating member being rotatably driven by the shaft so as to transiently engage the switch operating cam at predetermined points of shaft rotation.

9. In a combined snap switch and variable resistance unit adapted to be operated by a single rotatable shaft, variable resistance mechanism including rotatable contactor elements, a rotatable shaft for driving said contactor elements, a grounded metallic cover for said variable resistance mechanism, a switch base overlying at least part of said cover and being in fixed position relative thereto, a snap switch mechanism on the inner face of the switch base facing the cover but spaced therefrom, a switch operating cam extending from said switch mechanism in the direction of said variable resistance mechanism, and a switch actuating member constrained to rotation in a plane between the cover and said switch base and supported at least in part by the cover, said switch actuating member being rotatably driven from the shaft, and said switch actuating member having a part transiently engageable with the switch operating cam at predetermined points of shaft rotation.

10. In a combined snap switch and variable resistance unit, a variable resistance housing, variable resistance mechanism in said housing including elements rotatable about an axis fixed with respect to the housing, a transverse electric shielding member extending across one end of the variable resistance housing and having an

opening coaxial with said fixed axis, a switch base of insulating material, means connecting said switch base with the variable resistance housing and holding the same firmly in position over the opening in said transverse shielding member, snap switch mechanism on the inner face of said base and facing said shielding member so that said shielding member electrostatically shields the switch mechanism from the variable resistance mechanism, and a transiently engageable switch actuating connection between the rotatable elements of the variable resistance mechanism and said switch mechanism including a grounded metal part substantially closing said hole in the transverse shielding member.

11. In a combined variable resistance unit and snap switch, a cup-shaped housing for said variable resistance unit, a rotatable shaft extending into said housing, contactor mechanism secured to said shaft for varying resistance, a transverse grounded metallic wall extending across one end of the variable resistance housing, said transverse wall having an opening therein substantially concentric with the axis of the rotatable shaft, a snap switch firmly attached to the variable resistance housing and overlying said opening, said snap switch having an operating cam, and switch actuating means adjacent to the outer face of the transverse metallic wall and drivingly connected with the shaft through the centrally located opening in said wall, said switch actuating means being transiently engageable with said operating cam.

12. In a combined variable resistance unit and snap switch, a cup-shaped housing for said variable resistance unit, a rotatable shaft extending into said housing, contactor mechanism secured to said shaft for varying resistance, a transverse grounded metallic wall extending across one end of the variable resistance housing, said transverse wall having an opening therein substantially concentric with the axis of the rotatable shaft, a snap switch firmly attached to the variable resistance housing and overlying said opening, said snap switch having an operating cam, switch actuating means supported upon one face of the transverse metallic wall and drivingly connected with the shaft through the centrally located opening in said wall, said switch actuating means being transiently engageable with said operating cam, and the operating cam being located wholly to one side of the opening in the transverse wall to overlie said wall.

13. In a combined snap switch and variable resistance unit, a variable resistance housing, variable resistance mechanism in said housing including manually rotatable elements, a metal electrostatic shield located at one end of the variable resistance housing, said shield having an opening coaxial with the axis of rotation of said manually rotatable elements, a switch base of insulating material, means connecting said switch base with the variable resistance housing and holding the same firmly in position over the opening in said shield, snap switch mechanism mounted on the inner face of said base facing said shield to be electrostatically shielded thereby from the variable resistance mechanism, and a transiently engageable switch actuating connection between the manually rotatable elements and said switch mechanism including a grounded metal part rotating with said manually rotatable elements and positioned adjacent to the opening in said shield so that said part coacts with said shield in shielding the switch mechanism from the variable resistance mechanism.

14. In a combined variable resistance unit and snap switch, a cup-shaped housing for said variable resistance unit, a rotatable shaft extending into said housing, contactor mechanism secured to said shaft for varying resistance, a switch housing, switch mechanism including an operating cam disposed within said switch housing, a grounded metallic shielding wall interposed between the switch mechanism and the variable resistance unit, said wall having an opening therein substantially concentric with the axis of the rotatable shaft, switch actuating means rotatable with the shaft and transiently engageable with the switch operating cam at predetermined points of shaft rotation, a grounded metallic portion of said switch actuating means being positioned adjacent to the centrally located opening in the grounded metallic wall and coacting with said wall in shielding the variable resistance unit from the switch mechanism.

15. In a combined variable resistance and snap switch unit comprising, variable resistance mechanism including, a rotatable element and snap switch mechanism including, an actuating cam, a metal shielding wall between said mechanisms having a hole through which said switch actuating cam is accessible to the variable resistance mechanism, means actuated by the rotatable element of the variable resistance mechanism and transiently engageable with the switch actuating cam, and supplementary shielding means interposed between said shielding wall and the variable resistance mechanism to intercept radiations emanating from the snap switch mechanism and passing through said hole.

16. In a combined variable resistance and snap switch unit comprising, snap switch mechanism and variable resistance mechanism, the latter including a rotatable element, a driving connection between said rotatable element and the snap switch mechanism, a metallic electrostatic shielding wall between said mechanisms having a hole through which said driving connection passes, and a second metallic electrostatic shielding wall between said mechanisms having a hole through which said driving connection passes, said holes in the shielding walls being offset with relation to each other so that the latter shielding wall supplements the first mentioned shielding wall by intercepting radiations emanating from the switch mechanism which pass through the hole in said first mentioned shielding wall.

17. In a combined variable resistance and snap switch unit comprising, variable resistance mechanism including, a rotatable element and snap switch mechanism, a metal shielding wall between said mechanisms having a hole coaxial with the rotatable element of the variable resistance mechanism, a switch driving member between said wall and the snap switch mechanism drivingly connected with the rotatable element through said hole, a second metal shielding wall between the first named wall and the snap switch mechanism having a hole eccentric to the axis of the unit, and a switch actuating member connected with the snap switch mechanism and transiently engageable by the switch driving member through said eccentrically located hole.

18. In a combined variable resistance and snap switch unit comprising, variable resistance mechanism including, a rotatable element and snap switch mechanism including, an oscillatable switch actuating member, a metal pivot for the switch actuating member, said pivot being con-

nected with the live parts of the switch mechanism, means driven from the rotatable element of the variable resistance mechanism and transiently engageable with said switch actuating member, a metal shielding wall interposed between said mechanisms and having a hole accommodating the switch actuating member and its live pivot, and supplementary shielding means interposed between said shielding wall and the variable resistance mechanism to intercept radiations emanating from said live pivot and passing through said hole.

19. In a combined variable resistance and snap switch unit comprising, snap switch mechanism and variable resistance mechanism, the latter including, a rotatable element, a driving connection between said rotatable element and the snap switch mechanism, a grounded electrostatic shield between said mechanisms having a hole through which said driving connection passes, and a supplementary grounded electrostatic shield adjacent to said hole to intercept radiations emanating from the switch mechanism and prevent their passage through the hole to the variable resistance mechanism.

20. In a combined variable resistance and snap switch unit comprising, snap switch mechanism and variable resistance mechanism, the latter including, a rotatable element, a driving connection between said rotatable element and the snap switch mechanism, an electric shield between said mechanisms having a hole through which said driving connection passes, and a grounded metallic member so located with respect to said hole as to provide a supplementary electrostatic shield intercepting radiations emanating from the switch mechanism and prevent their passage through the hole to the variable resistance mechanism.

21. In a combination rheostat and switch unit, a rheostat base, a rotatable grounded actuating shaft centrally journaled in the base, a resistor carried by the base, contactor means engaging the resistor and driven by the shaft, a grounded metallic cover member for the rheostat, said cover member having a planar end wall provided with a relatively small central opening therethrough, a switch overlying said relatively small central opening in the cover end wall, said switch having an operating member, a grounded shaft extension member in alignment with the shaft and connected therewith to be rotatable thereby, said shaft extension member extending through the relatively small central opening in the cover end wall, and switch actuating means connected with and driven by the shaft extension member, said switch actuating means being engageable with the switch operating member for operating the switch.

22. In a combined shielded rheostat and switch unit, a metallic rheostat base, rheostat mechanism carried by the base and comprising a resistance and a contactor engageable with the resistance, a cup-shaped metal cover member having a planar shielding end wall and an integral cylindrical side wall substantially normal thereto, said planar shielding wall having an opening therein, a switch base of insulating material disposed flatwise on the exterior of said planar shielding wall, fastening means located inwardly from the cylindrical side wall securing the switch base to the planar shielding wall, switch mechanism mounted on the switch base, an operating member for the switch mechanism and extending through said opening in the planar shielding wall, means

for rigidly attaching the cup-shaped metal cover member to the rheostat base with the planar shielding wall interposed between the switch mechanism and the rheostat mechanism and with said planar shielding wall overlying live parts of the switch mechanism, said means including spaced integral securing ears extending from the cylindrical side wall and engaging over portions of the rheostat base to clamp the cup-shaped cover to the rheostat base and ground the planar shielding wall to said rheostat base, manually rotatable actuating means for traversing the contactor across the resistance, and means carried by and movable with said actuating means for engaging the switch operating member to operate the switch during a predetermined sector of contactor rotation.

23. In a combined snap switch and variable resistance unit, a grounded metallic cup-shaped variable resistance housing, said housing consisting of a substantially cylindrical side wall and an integral end wall, variable resistance mechanism mounted therein, a grounded metallic cover member having an end wall substantially closing the open end of said cup-shaped housing, a switch housing mounted flatwise on said cover end wall, snap switch mechanism in said housing, the movable elements of which are confined to arcuate movement in planes substantially parallel to said cover end wall, a common operating element for the variable resistance mechanism and snap switch mechanism and having an eccentric member rotatable in a plane parallel to said end wall of the cover member and transiently engageable with the switch mechanism through an opening in the cover end wall, said cover end wall overlying live parts of the switch mechanism and cooperating with the cylindrical side wall and integral end wall of the variable resistance housing to confine the variable resistance mechanism in a grounded metallic enclosure shielding said variable resistance mechanism from interfering radiations emanating from the snap switch and from any other adjacent components of the electrical device in which the combination switch and variable resistance unit is mounted.

24. In a combined variable resistor and snap switch, a grounded metallic housing member for the variable resistance mechanism, a shallow switch housing for the snap switch mechanism having a transverse area less than the corresponding area of said housing member, a grounded metallic planar shielding wall connected with said housing member and interposed between the switch mechanism and the variable resistance mechanism, said shallow switch housing being mounted flatwise on the planar shielding wall and secured thereto at a plurality of points spaced inwardly from the periphery of said wall with said wall overlying live switch parts, a common operating element for the variable resistance mechanism and snap switch mechanism, a projecting member on said element rotatable therewith through an arcuate path in a plane parallel to said shielding wall and transiently engageable with the switch mechanism through an opening in said shielding wall, the movable elements of said switch mechanism being confined to arcuate movement in planes substantially parallel to said shielding wall.

25. In a combined shielded rheostat and switch unit, a rheostat base, rheostat mechanism carried by the base and comprising a resist-

ance and a contactor engageable with the resistance, a cup-shaped metallic cover member having a grounded planar shielding end wall and an integral cylindrical side wall substantially normal thereto, a switch base of insulating material disposed flatwise on the exterior of said planar shielding wall, fastening means located inwardly of the cylindrical side wall securing the switch base to the planar shielding wall, switch mechanism mounted on the switch base, means for holding the cup-shaped metallic cover member to the base with said planar shielding wall interposed between the switch mechanism and the rheostat mechanism and overlying live parts of the switch mechanism so as to electrically shield one from the other, an operating member for the switch mechanism, manually rotatable actuating means for traversing the contactor across the resistance, and means movable with said manually rotatable actuating means for engaging the switch operating member during a predetermined sector of contactor rotation to operate the switch.

26. A combined variable resistance and snap switch unit comprising, a grounded metallic cylindrical housing member for the variable resistance mechanism, a switch housing for the snap switch mechanism having lateral dimensions less than the diameter of said cylindrical housing member, a grounded metallic planar shielding wall connected with said housing member and interposed between the snap switch mechanism and the variable resistance mechanism and overlying live parts of the switch mechanism, said switch housing being mounted flatwise on the planar end wall and secured thereto at a plurality of points spaced inwardly from the periphery of said wall, the movable elements of said switch mechanism being confined to arcuate movement in planes substantially parallel to said wall, a common operating element for both variable resistance mechanism and snap switch mechanism, a projecting member on said element rotatable therewith through an arcuate path in a plane parallel to said shielding wall and transiently engageable with the switch

mechanism through an opening in said shielding wall, and a grounded metallic member so located with respect to said opening as to provide a supplementary electrostatic shield intercepting radiations emanating from the switch mechanism to prevent their passage through the opening to the variable resistance mechanism.

27. In a combined shielded rheostat and switch unit, a rheostat base, a metal mounting bushing connected with the base for attaching the unit to a support, said bushing being adapted to be grounded, rheostat mechanism carried by the base and comprising a resistance and a contactor engageable with the resistance, a shaft rotatable in the bushing and operable to traverse the contactor across the resistance, a cup-shaped metal cover member having a planar shielding end wall and an integral cylindrical side wall substantially normal thereto, a switch base of insulating material disposed flatwise on the exterior of said planar shielding wall, fastening means located inwardly from the cylindrical side wall securing the switch base to the planar shielding wall, switch mechanism mounted on the switch base, an operating member for the switch mechanism, means for mechanically attaching the cup-shaped metal cover member to the rheostat base with the planar shielding wall interposed between the switch mechanism and the rheostat mechanism and for electrically connecting the planar shielding wall with said bushing so that the planar shielding wall is grounded to the bushing, said means including spaced integral securing ears extending from the cylindrical side wall and engaging over portions of the rheostat base to clamp the cup-shaped cover to the rheostat base, at least one of said ears and the rheostat base having circumferentially abutting portions which prevent relative rotation between the cover member and the rheostat base, and actuating means driven by the shaft and engageable with the switch operating member for operating the switch during a predetermined sector of shaft and contactor rotation.

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