Feb. 2, 1937. C. J. HATHORN 2,069,440

FRICTION CLUTCH RHEOSTAT

Filed July 23, 1935 4 Sheets-Sheet 1

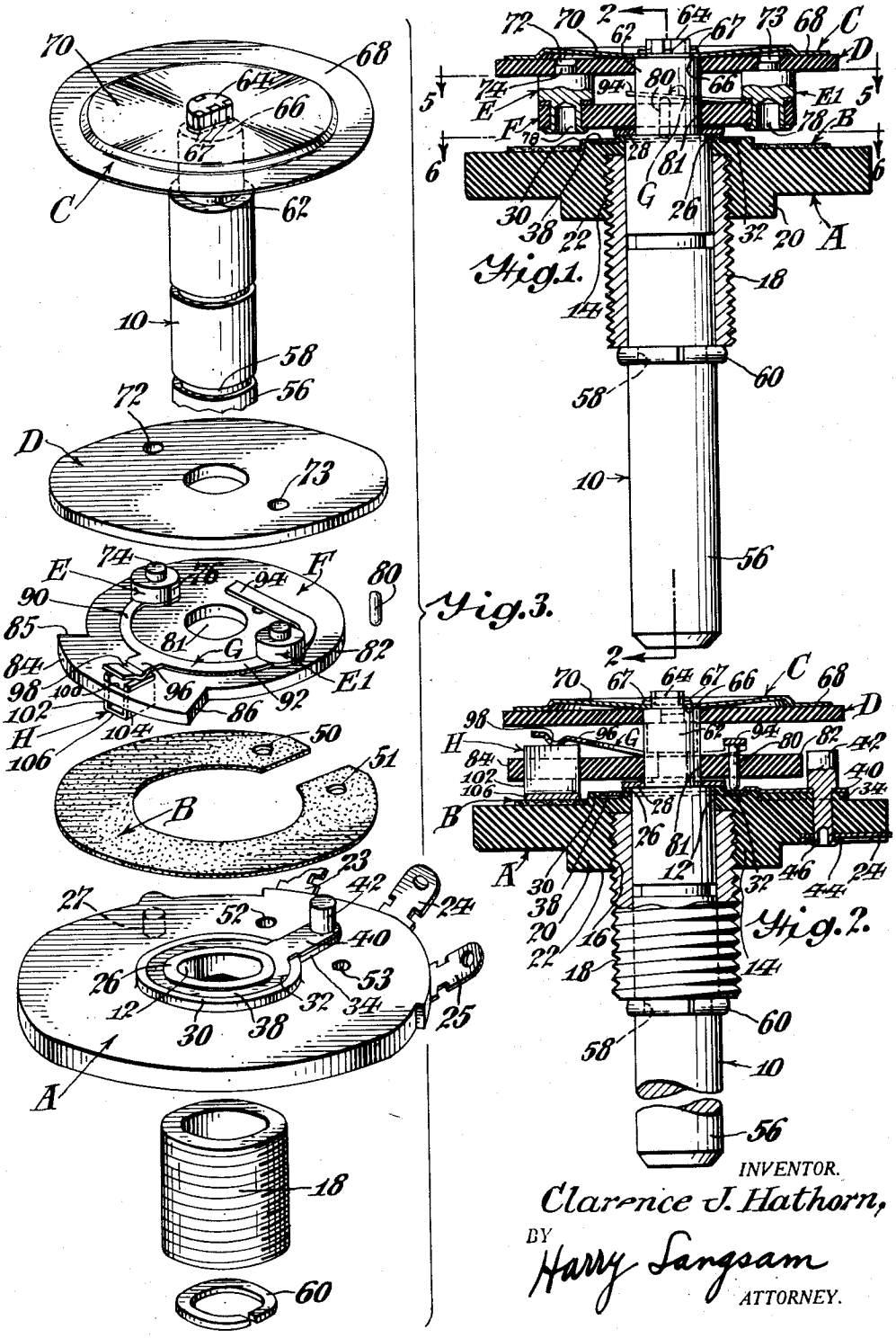


Fig. 1.

Fig. 3.

Fig. 2.

INVENTOR.

Clarence J. Hathorn,

BY

Harry Langsam

ATTORNEY.

Feb. 2, 1937. C. J. HATHORN 2,069,440

FRICTION CLUTCH RHEOSTAT

Filed July 23, 1935 4 Sheets-Sheet 2

Fig. 4.

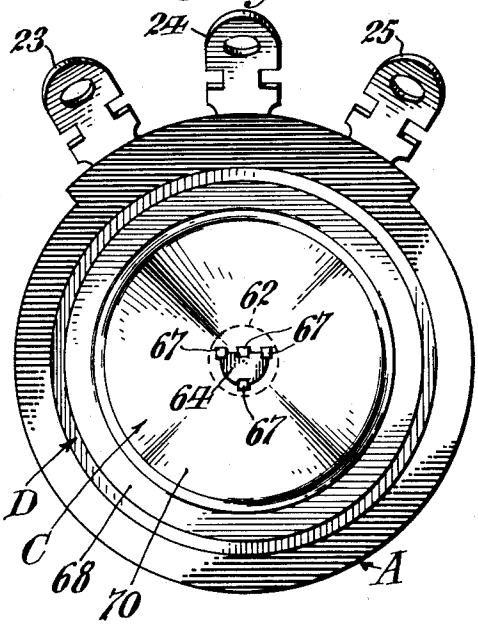


Fig. 5.

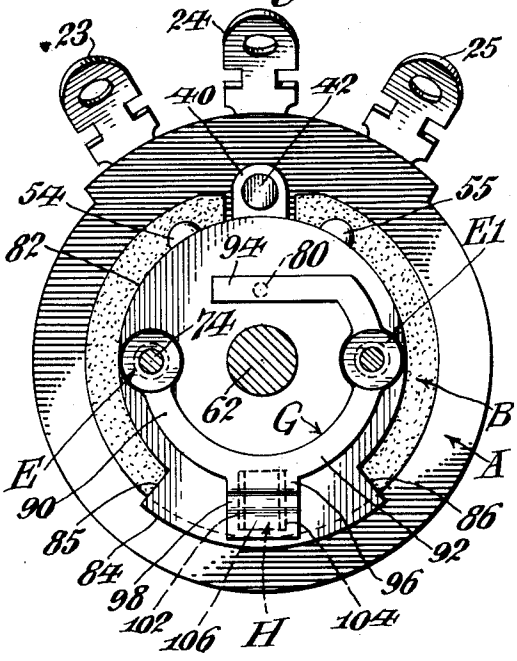
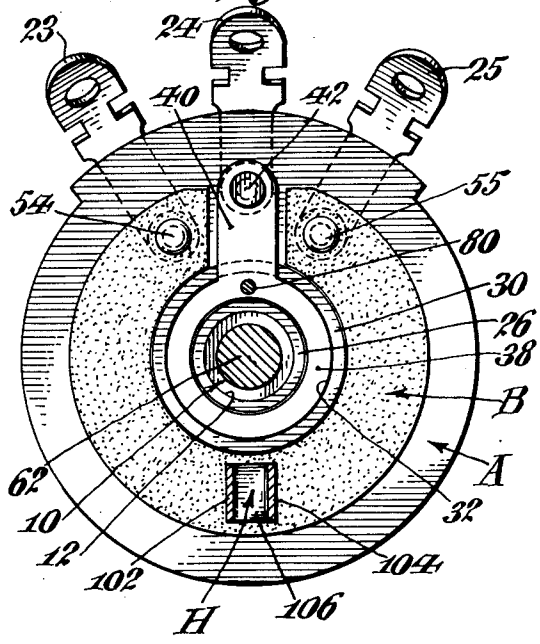


Fig. 6.



INVENTOR.
Clarence J. Hathorn,
BY
Harry Langsam
ATTORNEY.

Feb. 2, 1937. C. J. HATHORN 2,069,440

FRICTION CLUTCH RHEOSTAT

Filed July 23, 1935 4 Sheets-Sheet 3

Fig. 7.

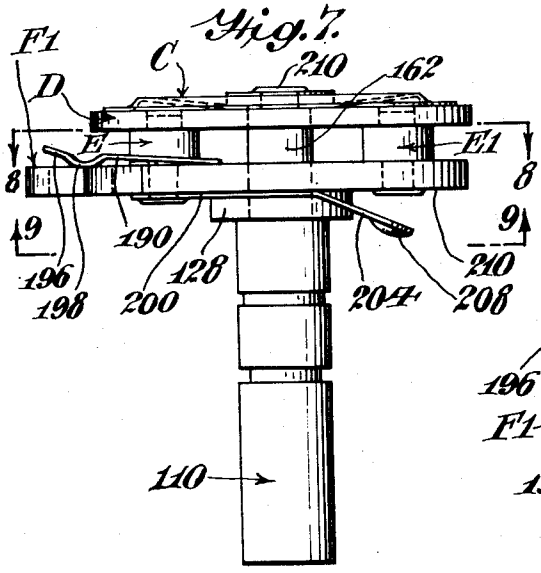


Fig. 8.

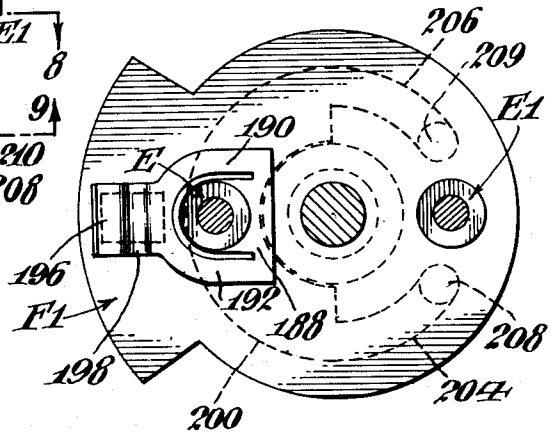
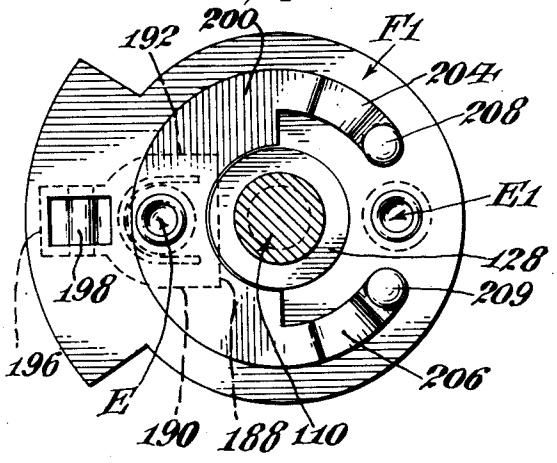


Fig. 9.



INVENTOR.

Clarence J. Hathorn,

BY

Harry Langsam

ATTORNEY.

Feb. 2, 1937. C. J. HATHORN 2,069,440

FRICTION CLUTCH RHEOSTAT

Filed July 23, 1935 4 Sheets-Sheet 4

Fig. 10.

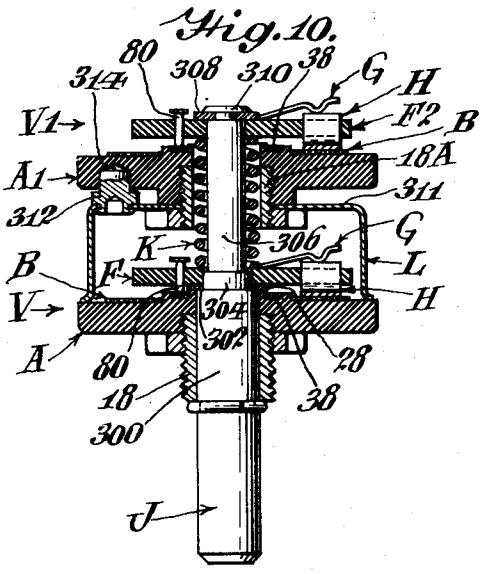


Fig. 11.

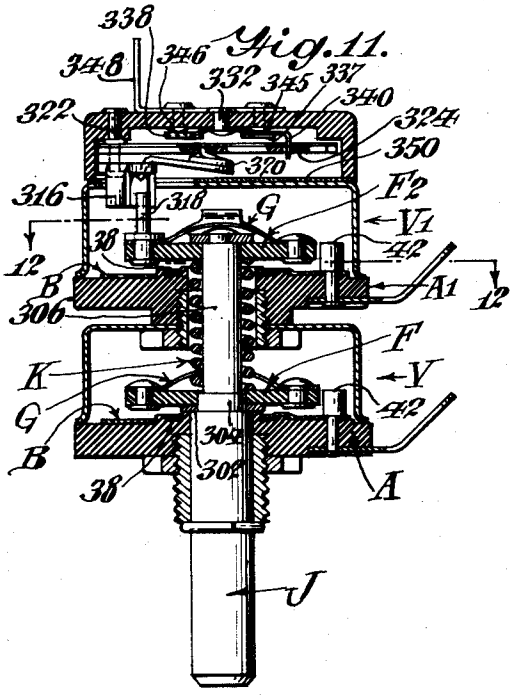


Fig. 12.

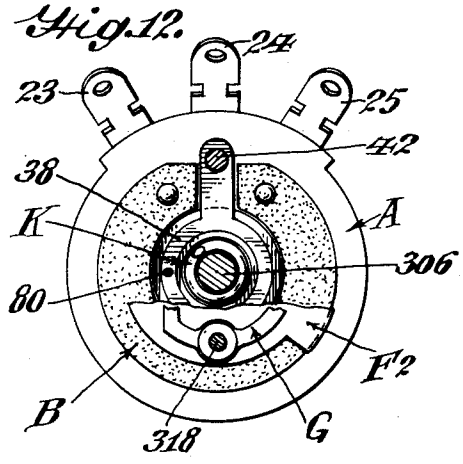


Fig. 13.

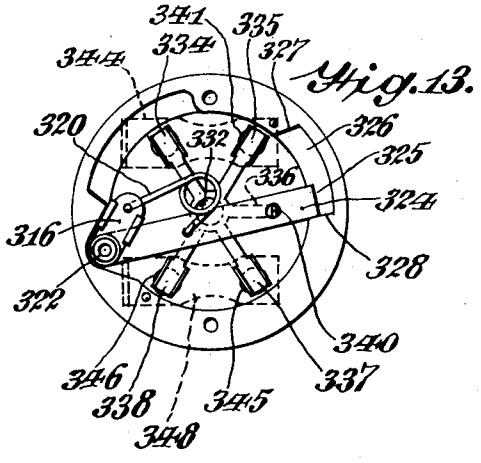
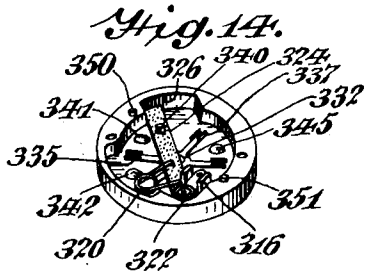


Fig. 14.



INVENTOR.
Clarence J. Hathorn,
BY
Harry Langsam
ATTORNEY.

Patented Feb. 2, 1937 2,069,440

UNITED STATES PATENT OFFICE

2,069,440

FRICTION CLUTCH RHEOSTAT

Clarence J. Hathorn, St. Marys, Pa., assignor to The Stackpole Carbon Company, St. Marys, Pa., a corporation of Pennsylvania

Application July 23, 1935, Serial No. 32,717

9 Claims. (Cl. 201—55)

My invention relates to an adjustable resistance device and relates more particularly to a device for controlling the intensity of sound or the tone of sound in radio receiving circuits or public addressing systems.

Heretofore, it has been customary to employ a volume control for an automobile radio system which is actuated from a flexible shaft, the latter having one end connected to a knob on the control head which may be mounted either upon the dash board or upon the steering column, and the other end connected to the control shaft of the volume control. The snap switch in certain cases has been mounted and controlled independently of the volume control. Therefore, in automobile radio sets employing a separately controlled switch and a separately controlled volume control, difficulty of properly synchronizing the switch and the volume control has been experienced.

Since a flexible shaft of considerable length generally must be employed to operate the volume control, the flexible shaft, of sufficient strength to withstand the maximum turning torque applied to the knob, is quite expensive. To reduce the strength of the flexible shaft, which generally comprises multiple layers of closely coiled wires, and still use the old type of volume control would result in kinking or distorting the flexible shaft when an excessive turning torque would be applied.

In rheostats or volume controls which are key controlled and where the shaft is limited in rotation, an excessive turning force occasionally will twist or break the key.

It is, therefore, an object of my invention to construct a volume control or adjustable resistance device which has a rotatable control shaft suitably connected to a resistance element contact member so that the contact member may be varied within limits of less than 360° but wherein the control shaft may be continuously rotated 360° or more in either a clockwise or a counterclockwise direction.

It is another object of my invention to construct a friction clutch volume control or adjustable resistance device which may be actuated in the customary manner, i. e. by a clockwise or counterclockwise turning moment.

Another object of my invention is to employ a volume control which may be readily synchronized with a separately mounted and separately controlled snap-switch.

Another object of my invention is to construct a volume control which may be actuated by a light and inexpensive type of flexible cable without resulting in the flexible cable kinking or being permanently distorted.

Another object of my invention is to construct a clutch between the rotatable control shaft and the pressure member which is efficient in operation.

Another object of my invention is to construct a contact member for the resistance element which is positive in action and which burnishes or slides frictionally in engagement with the resistance element.

Another object of my invention is to construct a movable contact shoe or current collector which will adjust itself to any irregularities appearing upon the surface of the resistance element which will not cause undue abrasion between the contact shoe and the resistance element.

Another object of my invention is to construct an inexpensive efficient rotary current collector between the pressure arm and the stationary current collector for the derived circuit terminal.

A still further object of my invention is to construct an inexpensive combined spacer and turning coupling between the volume control and the friction disc.

Another object of my invention is to construct tandem arranged volume control units actuated from a single control shaft having an interposed friction clutch.

Another object of my invention is to construct two tandem arranged volume control units actuated from a single control shaft and having a single spring for applying pressure to each of the two volume controls.

Another object of my invention is to construct a snap switch operably actuated by a rotatable control shaft wherein a friction clutch is interposed between the snap switch mechanism and the control shaft.

Another object of my invention is to construct a combined adjustable resistance device and switch unit, both of which are actuated by a single control wherein a clutch is interposed between the control and the resistance device and switch mechanisms.

Other objects of my invention are to construct an improved device of the character described which is readily and economically produced, that is sturdy in construction, and which has a maximum degree of efficiency in operation.

With the above and related objects in view, my invention consists in the details of construction and combination of parts, as will be more fully understood from the following description when

read in conjunction with the accompanying drawings, in which:

Fig. 1 is a fragmentary sectional side elevational view of an adjustable resistance device or volume control embodying my invention.

Fig. 2 is another fragmentary sectional view of the volume control embodying my invention taken along the line 2—2 of Fig. 1.

Fig. 3 is an exploded view of the volume control illustrated in assembled form in Figs. 1 and 2.

Fig. 4 is a top plan view of the volume control illustrated in Figs. 1 and 2.

Fig. 5 is a view taken along the line 5—5 of Fig. 1 with the friction clutch removed.

Fig. 6 is a view taken along the line 6—6 of Fig. 1.

Fig. 7 is a modification of the volume control head and friction clutch showing only the control shaft, the friction clutch, the pressure arm on the control head, and the rotary brush.

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 7 illustrating a modification of the pressure arm.

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 7 illustrating a modification of the sliding contact member for the derived circuit.

Fig. 10 is a fragmentary side elevational view of a midget type of dual volume control with a helical spring-type of friction clutch.

Fig. 11 is a fragmentary sectional view of a midget type of dual volume control, arranged in tandem, with spring-type of friction clutch and switch, all controlled from a single shaft.

Fig. 12 is a sectional view taken on the line 12—12 of Fig. 11.

Fig. 13 is a plan view of the snap switch.

Fig. 14 is a perspective view of the snap switch in its open circuit position.

Referring now in detail to the drawings, I show a friction clutch mounted upon a volume control or adjustable resistance device, the unit comprising a molded base, generally designated as A, of insulating material, such as material known under the trade-mark "Bakelite". The base is substantially a disc-like member having a central aperture through which a control shaft 10 extends. Defining the central aperture is a cylindrical bore 12 of a diameter slightly in excess of the diameter of the shaft 10, and an internally threaded bore 14 for receiving the external threads 16 of one end of a shaft bushing 18. The bushing 18 holds the entire volume control on a mounting panel (not shown) by means of a lock-nut—this is the well-known single hole volume control mounting.

A boss 20 is formed integrally with the outside flat surface of the base A so that the annular flat surface 22 of the boss abuts against a mounting panel (not shown) to space the volume control from the mounting panel. This arrangement precludes the electrical terminals 23, 24, 25, which are mounted in grooves on the minor peripheral surface 22 of the base, from being short circuited when the unit is mounted upon a metal panel. A stud 27 is integrally formed with the base and is adapted to fit into a complementary opening on the mounting panel to prevent rotary movement of the rheostat with respect to the mounting panel, which might result in the breaking or short circuiting of the lead wires connected to the terminals. Upon the inner surface of the base is a small circular boss 26 whose outermost surface is engaged by a washer 28 to limit the movement of the shaft in one direction (as hereinafter will be more fully described), which direction is downwardly as Fig. 3 is viewed.

Another circular boss 30, on the base A, whose uppermost surface is slightly lower than the upper surface of the concentric boss 26, as Figs. 1 and 2 are viewed, has an annular groove 32 upon its upper surface. A radially extending raised portion 34 has an end joining a portion of the outermost curved surface of the boss 30 and the other end of the radially extending raised portion terminates near the curved peripheral surface of the base A. The groove 32 serves as a resting-place for a washer or ring-like electrical conducting member 38 whereby the washer 38 will not be laterally displaced, and the raised portion 34 serves to support the tab 40 of the washer. A stop member 42, which is comprised of a stud of electrical conducting material, has one end 46 passing through the tab 40, through the base A, through one end of the middle terminal 24, and through a small copper washer 44 in order to retain the tab and the terminal both mechanically and electrically together on the base A when its end 46 is expanded. The end 46 of the stop member, also, holds the stop member 42 in position.

Upon the upper surface 48 of the base A is mounted a flat ring-like carbonaceous type of resistance element, generally designated as B. The inner diameter of the resistance element abuts against the curved bounding surface of the raised boss 30 to prevent lateral displacement or shifting of the resistance element when the contact shoe is moved. Openings 50, 51 through each end of the resistance element B are aligned with openings 52, 53, respectively, in the base. A flat head holding rivet 54 passes through the aligned openings 50, 52 in the resistance element and the base, respectively, through one end of the electrical conducting terminal 23 and, also, through a washer, so that when the outside end of the rivet is expanded, one end of the resistance element, the base, the terminal 23 and the washer are secured together. Thus, the resistance element and the terminal 23 are electrically connected together by the rivet. Another rivet 55, connected in a manner similar to the rivet 54, holds the other end of the resistance element in electrical contact with the terminal 25.

The control shaft 10 is journaled in the bore of the bushing 18 as well as the central bore 12 of the base A, and at one end it is adapted to have a knob (not shown) attached thereto, or it may have a central slot for the reception of the flexible cable (not shown) or a key (not shown).

Intermediate the ends of the shaft 10 is a circumferential groove 58 for the reception of a split or C-washer 60, the latter prevents the shaft 10 from moving inwardly by engaging an end of the bushing. Thus, the shaft is prevented from moving in one longitudinal direction by the C-washer 60 which engages one end of the bushing 18 and is prevented from moving in the opposite longitudinal direction by the washer 28 and other means, hereinafter described, which engages the boss 26 of the base.

The other end 62 of the shaft 10 is of a diameter that is smaller than the diameter of the major portion of the shaft, and upon the outermost portion of the shaft is a substantially semi-circular segment 64 which serves as a key for a metal friction clutch or disc spring member, generally designated as C. The metal spring clutch member C has a complementary semi-circular opening to interfit with the segment 64, and the metal

adjacent the central opening of the spring clutch member rests upon a shoulder 66 of the shaft 10. By compressing various portions of the segment 64, as at 67, Figs. 1 to 4, to engage the friction disc spring member C, the latter member is securely fastened to the shaft and revolves in unison therewith. The spring clutch member C has a peripheral flange 68 offset slightly from the central portion 70.

When the flange 68 is mounted to bear against a fibre friction disc member, generally designated as D, the latter being positioned to extend at right angles to the longitudinal axis of the shaft, the flange likewise extends at right angles to the longitudinal axis of the shaft and presses against the friction disc D. The disc D has a central aperture which loosely interfits with the shaft end 62. Thus, the friction disc D is not directly attached to the shaft.

The friction clutch member defined by the friction disc spring C and the friction disc D serves to couple the shaft 10 to the volume control head F, the latter being hereinafter described in considerable detail.

A combined disc spacer and coupling, generally designated as E, has a wide main body portion 76 of metal or of insulating material, and an upper end 74 of a smaller diameter than the body 76, see Fig. 3. The curved surfaces of the body portion 76 and the end portion 74 are joined by an annular flat surface which engages the lower surface of the friction disc adjacent the opening 72, when the opening 72 and the end 74 are fitted together. A hollow cylindrical metal rivet 78, of a diameter less than the diameter of the body 78 of the spacer and coupling E and having its bounding surface about the coupling's longitudinal axis is joined to and projects from the lower end of the spacer and coupling body portion 76.

The rivet member 78 passes through an opening in the volume control head or disc-like member F, comprised of insulating material, and the rivet member 78 also passes through an opening at one end 90 of the pressure arm, generally designated as G, and after the rivet's outside end is swedged over or expanded, the spacer is firmly held in position.

The disc-like member or volume control head F carries the contact shoe pressure arm G, it also moves a resistance element contact member or shoe, generally designated as H, and moves a sliding electrical contact 80 for leading the current from the contact member H to the washer 38, the latter in turn being connected to the terminal 24.

The control head F has a central aperture 81 which loosely interfits with the reduced end 62 of the shaft 10; and the control head has a major arcuate edge 82 which extends for approximately 266° and a minor peripheral extending edge 84 subtending the angle of (360° minus 266°) 94° the minor peripheral edge protrudes radially outwardly so that its bounding edges 85, 86 may abut against the stop 42 to limit the movement of the control head.

A second combined spacer and coupling member, generally designated as E1, is constructed similarly to the member E and is symmetrically positioned upon the control head F to retain the other arm 92 of the pressure member. The arm 92 does not terminate under the spacer member E1 but is continued so that its end 94 is freely extended. Thus, the freely extended arm 94 is fulcrumed at a single position thereby permitting a limited degree of resiliency. This resiliency is employed to press the electrical contact pin 80 into enagement with the electrical conducting washer 38.

The pressure arms 90 and 92 merge into a contact shoe engaging member 96. The shoe engaging member has a trough formed on its upper surface so that its lower surface has a downwardly extending tongue 98 convex about its transverse axis and straight along its longitudinal axis.

Within a rectangular recess 100 of the volume control head is positioned the U-shaped contact shoe H. More specifically, the U-shaped deformable contact shoe has substantially parallel legs 102 and 104 joined by a bight-like portion 106 that engages the resistance element B. The uppermost surface of each leg is pressed by the tongue 98 so that a good electrical contact is made by the bight-like portion 106 upon the resistance element, and the bight-like portion wipes the resistance element as it moves thereupon, thus removing any corrosive substance that may form, and always establishing a good electrical contact. The legs 102, 104 of the contact shoe H may diverge slightly so that when they are inserted into the recess 100, each leg abuts against an edge of the recess whereby there will be no lost motion between the volume control head and the contact shoe, nevertheless the contact shoe may adjust itself upon the resistance element. The bight-like portion 106 that engages the resistance element may have its engaging surface either flat or arcuately formed, the latter reduces the contact area and so increases the effective length of the resistance element.

A recapituation of the operation of the illustrated device embodying my invention is as follows:

With the various elements comprising the friction clutch rheostat connected as illustrated in Figs. 1 and 2, movement of the control shaft 10 either in a clockwise or counterclockwise direction rotates the friction disc spring C in a clockwise or counterclockwise direction. Now assuming that the edge 86 of the control head abuts against the stop 42 and the shaft 10 is rotated in a counterclockwise direction as the device in Fig. 5 is viewed. Since the control head remains stationary as the friction disc spring revolves, the friction disc D is prevented from moving as it is keyed to the volume control head F by means of the combined spacer and couplings E, E1. It is to be observed that the friction disc spring may be revolved a multiple number of revolutions without injuring the mechanism of the rheostat.

Now assume that the direction as above mentioned is reversed and the edge 86 moves from the stop member 42. As the shaft is revolved clockwise, the frictional force between the friction disc spring C and the friction disc D moves the volume control head. The control head F carries with it the contact member H which slidably engages the resistance element B, and since each end of the resistance element is suitably connected to terminals 23, 25, the voltage will be varied due to the R I drop between the contact member and each terminal as the contact member changes its position with respect to either of the terminals. In order to secure the appropriate derived circuit, it is necessary to carry the current from the contact shoe H to the terminal 24 of the derived circuit. The current is taken from the contact shoe by means of the tongue 98 of the pressure arm G engaging the contact shoe, the current continuing to pass through the arm 92 to the end 94 which engages the electrical conducting pin 80. As the control head revolves the pin is in

continuous electrical engagement with the washer 38, the washer in turn being connected to the tab 40 which is electrically connected to the terminal 24. As the volume control head F continues to be revolved, the ledge 85 engages the stop 42, thus limiting the arcuate movement of the contact shoe in one direction. Further movement of the control shaft in the same direction merely results in frictional engagement between the friction disc spring C and friction disc D, but there is relative movement between the disc spring C and the disc D. Upon a reversal of the direction of the movement of the control shaft 10, the friction disc spring C and the friction disc D move in unison.

Although I have described and illustrated one embodiment of my invention I illustrate another embodiment of my invention in Figs. 7, 8, and 9 wherein a contact shoe pressure member as well as a rotary electrical contact member is shown.

In the modifications illustrated in Figs. 7, 8 and 9, a shaft 110 has a reduced circular end 162 integrally formed therewith. Projecting from the upper end of the reduced end is another reduced section which projects through the friction disc spring C. Upon the upper surface of the friction disc spring C is a washer which firmly bears the disc spring C against the shoulder formed at the end of the reduced member 162 after the end of the shaft is swedged over to securely lock the spring disc D to the shaft 110 so that the friction disc spring C will not turn with respect to the shaft. The outer flat surface of the friction disc D bears against the flange of the disc spring C and is loosely mounted about the reduced member 162. Combined spacers and couplings E, E1 space and connect the friction disc D to the volume control head, generally designated as F1. The control head F1 is constructed similarly to the control head F (Fig. 3) except the contact shoe opening the control shaft opening, and the combined spacers and couplings E, E1 are located on the same diameter.

The control head rests upon a fibre washer 128, the latter in turn abuts against the shoulder formed at the junction of the shaft 110 and its reduced portion 162.

The metallic contact shoe pressure member comprises a base member 188 from which two converging arms 190 and 192 merge into a member 196 for engaging the contact shoe (not shown in Figs. 7, 8, and 9). The arms 190, 192 are formed integrally with the base member 188 by cutting away a U-shaped area from adjacent the interior portion of the base. The bottom of the U of the U-shaped cut away area is closer to the member 196, which actually engages the contact shoe, than the ends of the U.

A depending tongue 198 of arcuate cross-sectional area and constructed similar to the tongue 98, Figs. 2 and 3, also is formed in the shoe engaging member 196. The base 188 of the pressure arm has an opening therein which interfits with the rivet portion of the spacer E. The rivet of the spacer E also passes through an opening in a metallic rotatable brush 200 and when the end of the rivet is expanded, then the rotary brush 200 is securely held to the control head F1. The brush 200 has two downwardly inclined prongs 204, 206 integrally formed therewith and the prongs are sprung away from the lowermost surface 210 of the control head so that the prongs resiliently engage the stationary washer 38. Each of the prongs 204, 206 have their respective ends 208, 209 bowl-shaped or semi-hemispherical so that they frictionally slide in engagement with the stationary washer 38 without ripping or unduly scraping the member on which it rubs.

In Fig. 10, I disclose two volume controls V, V1 arranged in tandem wherein each resistance element contact member only can be moved less than 360° and wherein the single control shaft may be rotated clockwise or counterclockwise 360° or more. Referring now more specifically to Fig. 10 wherein similar designations refer to parts hereinbefore described, a control shaft, generally designated as J, has a circular main body portion 300 of a diameter to fit within the bore of the base A and the bore of the bushing 18. From one end of the main body portion 300 extends a flat shoulder 302 which joins a reduced diameter portion 304 of the shaft J. This reduced diameter portion 304 serves as the center for the first volume control head F which is above the base A. Upon the shoulder 302 rests a washer 28. The shoulder 302 lies in the same plane as the uppermost surface of the base so that one face of the washer 28 just abuts or clears the uppermost surface of the base A. From the reduced portion 304 of the shaft J is still another reduced circular portion 306. This reduced portion of the shaft 306 is of considerable length and extends a distance substantially equal to the distance between the two volume control heads F, F2.

The reduced portion 304 of the shaft loosely interfits with the central opening in the volume control head F and the turning torque for moving the control head is supplied from the control shaft to the control F by a friction clutch, as shall hereinafter be described.

The reduced portion 306 of the shaft loosely interfits with the opening in the volume control head F2, the latter being constructed similarly to the control head F. The turning torque for the control head F2 is indirectly supplied to the control head by the friction clutch, as shall be hereinafter described. The volume control heads F, F2 are rotatable in parallel planes about the same axis.

Encircling the reduced portion 306 of the shaft is a helical expansion spring, generally designated as K. The spring presses against each of the parallel volume control heads F, F2 tending to separate them in a direction along the longitudinal axis of the shaft. However, the lower volume control head F is limited in movement in a downward direction by abutting against the washer 28, the latter in turn being limited by engaging the shoulder 302; and the upper volume control head F is limited in movement in an upward direction, as Fig. 10 is viewed, by abutting against a washer 308 which is fastened to the shaft J by having the uppermost end 310 of the shaft swedged over. Hence, the shoulder 302 and the expanded end 310 not only serve as stop members but also serve to provide the positive force to the frictional coupling which has as its slip members the volume control heads F and F2. The volume control instrumentalities are mounted in operable position upon the base A which is substantially enclosed by a metallic casing, generally designated as L. The metallic casing has suitable holding lugs or ears and may be constructed similarly to the casing as described in my copending application, Serial No. 701,802 filed December 11, 1933.

Upon the flat surface 311 of the cover L is a central opening to accommodate the holding bushing for the base, generally designated as A1.

The base A1 is constructed similarly to the base A except that its central bore as well as the aligned bore in the bushing 18A has a larger diameter than the aligned bores in the base A. A nut for the bushing 18A holds the volume control unit V1 on the casing L. The continuous bore in the base A1 permits free expansion of the helical spring H. A small opening is also formed adjacent the periphery of the flat portion of the cover so that a rivet portion of a lug 312 may be inserted therein. The lug 312 has the rivet integrally formed therewith so that after the rivet is inserted in its complementary opening in the cover L and after having its end expanded the lug 312 firmly grasps the cover. An opening or recess 314 in the base A1 receives the other end of the lug so that when the lug 312 and the recess 314 interfit they prevent rotary movement of the base A1 with respect to the cover L since the latter in turn is prevented from rotating with respect to the base A by suitable stop members.

The casing L being constructed of metal serves as an electromagnetic shield since the stray lines of the magnetic force will be dissipated as heat within the metallic casing J, and if the casing J is grounded or connected to a place in the electrical circuit where the electrical potential is zero, then the cover also serves as an electrostatic shield.

The operation of my invention as disclosed in Fig. 10 is as follows:

The volume control head is limited in movement by the stop member 42 of Fig. 5 having either edge 85 or the edge 86 abutting therewith. This limits the distance of movement of the control head between the major portion of the circle between the edges 85 and 86 which in this case is approximately 266°.

Assume that the edge 86 of the control head abuts against the stop 42 and the shaft J is rotated in a counterclockwise direction as the device is viewed when it is in a position similar to that illustrated in Fig. 5. Both volume control heads F, F2 remain stationary as the shaft is revolved in a counterclockwise direction, since each volume control head abuts its cooperative stop member.

Now assume that the direction of the shaft is turned in a clockwise direction. As the shaft G is revolved, sufficient friction exists between the washer 308, the upper control head F, the spring K, and the lower control head F to move both volume control heads F, F2 over and in engagement with their respective resistance elements. The device operates for the remainder of its cycle of operation similar to the device illustrated in Figs. 1 to 9.

Referring now to Fig. 11, I show dual tandem-arranged volume controls having a helical-spring-type of friction clutch, arranged together with a snap switch, all of the volume-controls as well as the snap switch are controlled from the same control shaft. The structure of each of the dual controls is similar to that described in conjunction with Fig. 10, but upon the upper metallic housing a snap switch is mounted. The snap switch has a forked trigger actuator 316 operatively connected thereto. A lug 318 is suitably fastened upon the upper volume control head F1 to transiently engage one arm of the forked trigger 316. The amount of friction produced by the spring K must be greater than the opposing resistance produced by the snap switch spring 320 in order to operatively move the volume control head. By employing a spring K of sufficient strength so that the frictional coupling force between the control member and the volume control head is large, there will be substantially no phase difference in the two volume control heads, using the word "phase" in the sense that the volume control heads F, F2 do not move identically with respect to the same starting point. Thus, the volume control head F will move in synchronism with the control head F2 even though there is a greater opposing frictional force opposing the movement of the volume control head F2 than the frictional force opposing the movement of the volume control head F.

The switch mechanism is mounted within a chamber of an insulator base, the base preferably being comprised of a molded phenolic condensation product. A pivot 322 is located adjacent the peripheral edge of the chamber and about the pivot is loosely mounted the fork trigger actuator 316 and one end of a rectangular strip 324. The strip 324 has its other end 325 located within a recess 326 on the base. The side edges 327 and 328 of the recess 326 limit the rotary movement of the strip 324. The torsional spring 320 for rapidly moving the strip from one extreme position to the other extreme position has one leg suitably connected to the strip and its other leg suitably connected to the outermost free end of the trigger.

Upon the flat wall of the switch housing and centrally located therein is a pivot 332 which carries a bridging element having five arms 334, 335, 336, 337, and 338 radially extending from its center. The arm 336 has its free end bent at right angles so that the tip interfits with an opening in the strip 324. The ends of the arms 334, 335, 337, and 338 are adapted to wipe into engagement with rivets, which are connected to the outside terminals. Rivets 341, 342 are connected to the outside terminal 344 and rivets 345 and 346 are connected to the outside terminal 348. Thus, as the strip 324 is oscillated from one extreme position to the other extreme position, it moves the lever arm 336, because of the interfitting tip 340 and the recess, about the pivot 332. Therefore, in consequence of the movement of the arm 336, the contact members will wipe into or out of engagement with the contact members.

Movement of the trigger does not actuate the bridging members until the medial axis of the closed end of the spring passes slightly beyond dead center. The trigger compresses the spring arms of the torsional spring together, and the energy stored in the spring after the dead center position of the spring is passed rapidly turns the strip as well as the bridging member, the latter either closing the electrical circuit when the terminals are bridged or breaking the circuit when the bridging member is moved away from the terminals.

Interposed between the switch and the metallic flat base of the casing is a disc of insulation 350 which has an opening aligned with the opening in the flat metallic base for the accommodation of the trigger. This insulation is to eliminate any short circuit from occurring between the rheostat casing and the switch mechanism elements.

A sheet of insulation is also disposed upon the movable strip.

Upon the rim of the switch housing extend studs 350, 351, see Fig. 14, which facilitate lo-

cating the switch in a predetermined position upon the rheostat housing.

The adjustable resistance device illustrated in Figs. 1 and 2 is of the potentiometer type comprising a constant resistance main circuit and a derived circuit of variable resistance. However, the unit may readily be employed as a variable resistance by using only two terminals instead of three terminals.

The friction clutch type of rheostat or the combined friction clutch rheostat and switch unit may be suitably adapted for the home-type of radio where the rheostat or the rheostat and switch unit may be mounted upon the chassis, which carries the signal receiving circuits and apparatus, while the control knob is mounted at an angle with respect to the rheostat shaft and where a flexible shaft suitably connects the rheostat and the control knob; the latter being mounted upon the radio cabinet.

Although this invention has been described in considerable detail, such description is intended as illustrative rather than limiting as the invention may be variously embodied.

My invention, therefore, is not restricted except as far as it is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:—

1. An adjustable resistance device comprising a base of insulating material, a flat resistance element mounted upon said base, a central circular boss on said base having a diameter of substantially the same diameter as the inner diameter of the flat resistance element, a groove upon the upper surface of said boss, a washer of electrical conducting material within said groove, a control shaft having a friction disc spring securely mounted upon one end thereof, a friction disc loosely mounted upon said control shaft and engaged by said friction disc spring, a volume control head parallel to said friction disc and loosely mounted upon said control shaft and having a contact shoe opening therein, a plurality of spacer members between said friction disc and said volume control head, said spacer members securely mounted to said volume control head and connected to said friction disc whereby rotatable movement of the friction disc rotates the volume control head, a pressure arm connected to said volume control head, a resistance element contact shoe interfitting with said contact shoe opening and engaging said resistance element and being pressed against the resistance element by the said pressure arm, said contact shoe being rotatable upon rotation of said volume control head, and means to limit the movement of said contact shoe, said control shaft being unlimited in clockwise or counterclockwise movement.

2. A volume control comprising a resistance element, a contact shoe for selectively engaging the resistance element along its length, a plurality of terminals, one of said terminals connected to one end of said resistance element and another terminal connected to the other end of the resistance element thereby establishing a constant resistance main circuit between the said end terminals, an electrical brush member, a pressure member engaging said contact shoe and electrically connected to said brush member, said brush member being adapted to rotate in unison with said pressure member and having a resiliently mounted concave prong, a stationary annular washer of electrical conducting material engaged by said movable concave prong, one of said terminals electrically connected to said stationary washer thereby forming one side of the derived circuit, a control shaft, and a friction clutch interposed between said shaft and said contact shoe.

3. A volume control comprising a resistance element, a contact shoe for selectively engaging the resistance element along its length, a plurality of terminals, one of said terminals connected to one end of said resistance element and another terminal connected to the other end of the resistance element thereby establishing a constant resistance main circuit between the said end terminals, an electrical brush member, a pressure member engaging said contact shoe and electrically connected to said brush member, said brush member being adapted to rotate in unison with said pressure member and having a resiliently mounted concave prong, a stationary annular washer of electrically conducting material engaged by said movable concave prong, one of said terminals electrically connected to said stationary washer thereby forming one side of the derived circuit, a control shaft, a friction clutch interposed between said shaft and said contact shoe, and means to limit the movement of said contact shoe, said control shaft being connected to said friction clutch whereby said shaft may be continuously moved in either direction.

4. In combination, two rheostats arranged in tandem, and a snap-switch having a forked trigger, a single control shaft for controlling the two rheostats and the snap switch, each of said rheostats including a resistance element, a rotor member, and a contact shoe movably connected to said rotor, each of said rotors freely rotatable about said control shaft, a helical spring interposed between said rotor members and imposing a force upon said rotor members, means engaged by said rotors and movable by said control shaft whereby the frictional force between the said means and said rotors will move said rotors, and a stud on one of said rotors and cooperable with said forked trigger of said switch whereby the switch may be actuated to open or closed circuit position at a predetermined definite transient movement of said stud.

5. A variable resistance device comprising a resistance element, a U-shaped deformable contact member for engaging said resistance element, a pressure member having a depressed tongue which tongue is in engagement with an upper portion of each leg of said U-shaped member, an insulation member carrying said pressure member and having an opening to complementarily receive the contact member, the legs of said U-shaped member extending above the upper surface of said insulation member, and said insulation member being adapted to push against each leg of said contact member whereby the contact member may selectively engage the resistance element between its ends.

6. In combination, two rheostats arranged in tandem, each of said rheostats including a resistance element, a rotor, and a contact shoe movably connected to said rotor, a single control shaft for adjusting the contact shoe of each rheostat, each of said rotors freely rotatable about said control shaft, frictional stop members rotatable with said shaft, and a helical spring interposed between and engaging said rotors and imposing a force upon said rotors, the frictional force between each rotor and said frictional stop member being sufficient to exert a turning torque on said rotor upon the turning of the control at

predetermined portions of arcuate movement of said control.

7. A rheostat comprising a base of insulating material, a flat arcuate-shaped resistance element mounted upon said base, an annular boss formed on said base whereby the inner surface of said arcuate-shaped resistance element is adapted to abut against the curved surface of said boss, means to hold the terminal ends of said resistance element firmly to said base, a U-shaped deformable contact member for selectively engaging said resistance element along its length, a pressure arm having a depressed tongue which tongue is in engagement with an upper portion of each leg of said U-shaped member, an insulation member carrying said pressure arm and having an opening to complementarily receive the U-shaped contact member, the legs of said U-shaped member extending above the upper surface of said insulation member, said insulation member being adapted to push against each leg of said contact member whereby the contact member may selectively engage the resistance element, a groove on the upper surface of said boss, a ring-like member of electrical conducting material interfitting with said grooves whereby the ring-like member will not be laterally displaced, and means for electrically connecting said U-shaped member to said ring-like member.

8. In combination; two rheostats arranged in tandem; each of said rheostats including a resistance element, a rotor, and a resistance element contact shoe movably connected to said rotor; a single control shaft for adjusting the contact shoe of each rheostat; each of said rotors freely rotatable about said control shaft; frictional coupling members rotatable with said control shaft and engaged by said rotors; and a helical spring interposed between and engaging said rotors and pressing said rotors against said coupling members rotatable with said control shaft whereby the force created by the spring upon the rotors and their cooperative coupling members will be sufficient to exert a turning torque on said rotors upon the turning of the control shaft.

9. A variable resistance device comprising a resistance element, a U-shaped deformable contact member for engaging said resistance element, a pressure member, an insulation member carrying said pressure member and having an opening to complementarily receive the U-shaped member, the legs of said U-shaped member extending above the upper surface of said insulation member, an upper portion of each leg of said U-shaped member engaged by a portion of said pressure member, and said insulation member being adapted to push against each leg of said contact member whereby the contact member may selectively engage the resistance element between its ends.

CLARENCE J. HATHORN.