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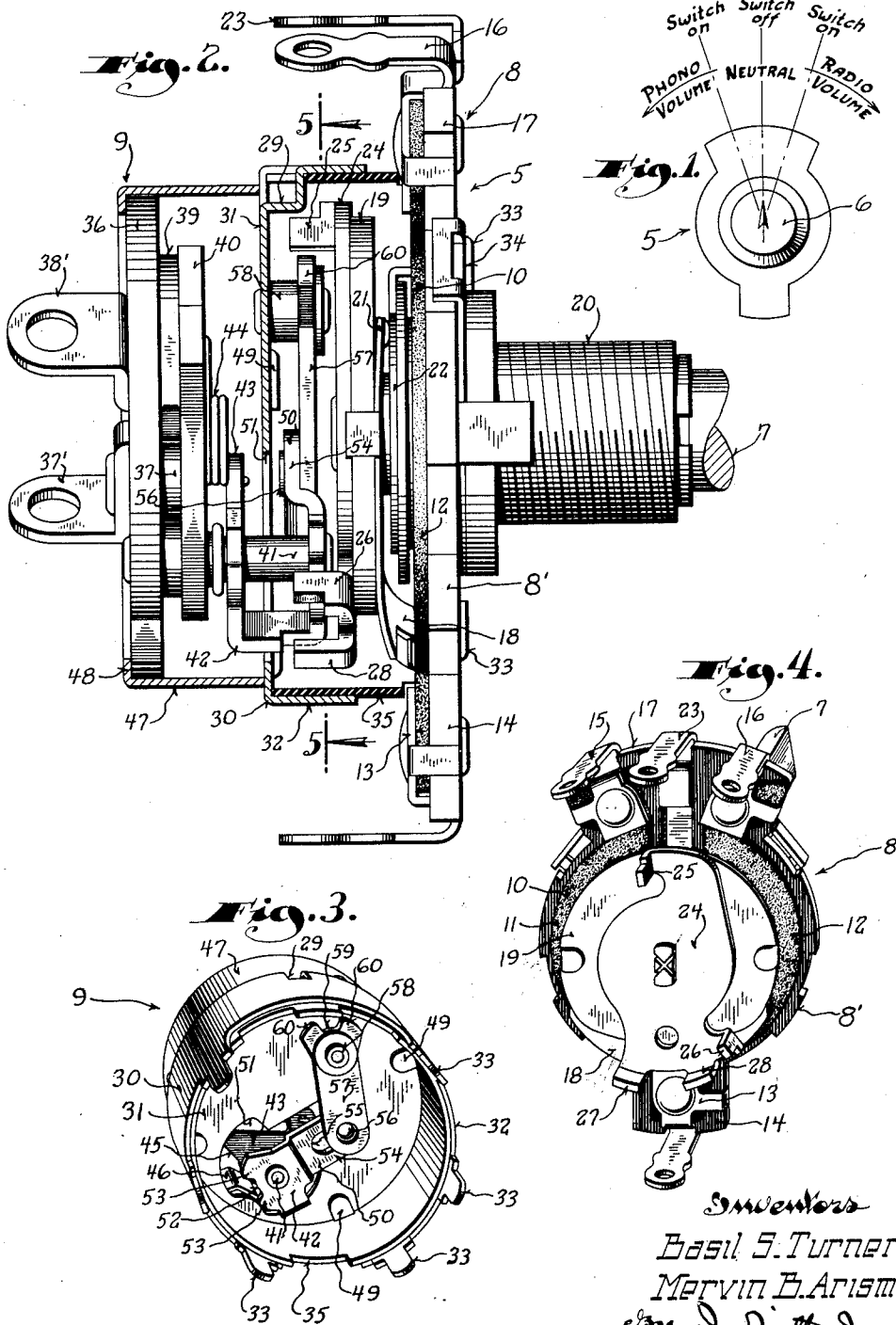
B. S. TURNER ET AL

2,320,837

COMBINATION RHEOSTAT AND SWITCH

Filed Jan. 31, 1941

2 Sheets-Sheet 1



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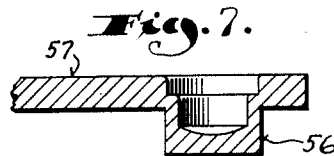
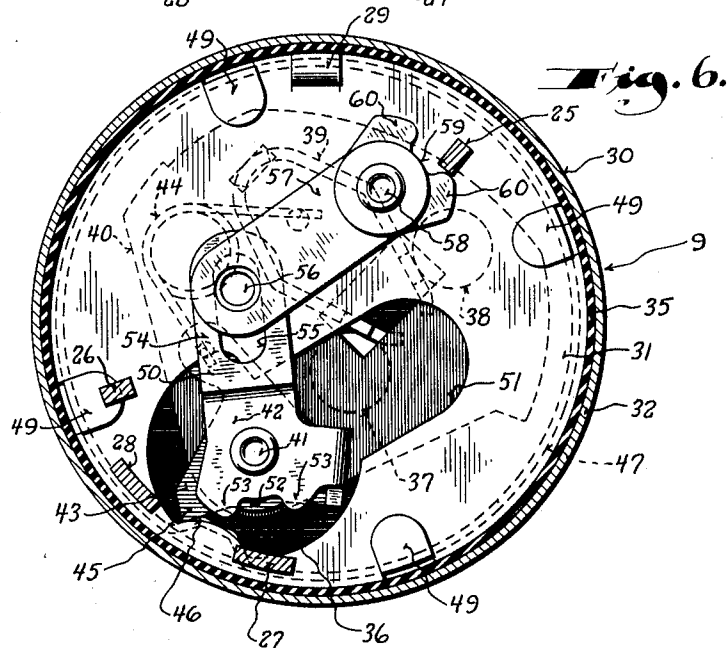
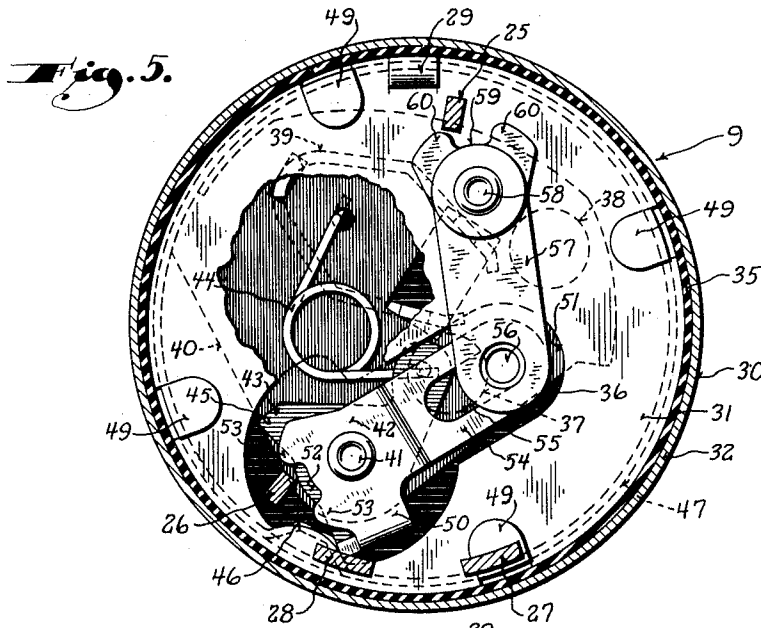
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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COMBINATION RHEOSTAT AND SWITCH

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13 Claims. (Cl. 201—55)

This invention relates to combined rheostat and switch units of the type used in radio receivers as a combination volume control and power switch.

Volume controls have been combined with switches before, but heretofore there has never been a unitary control incorporating two rheostats selectively and individually operable by rotation of a single control shaft in opposite directions from a central neutral position in conjunction with a single switch arranged to be actuated in the same manner concomitantly with adjustment of either rheostat. Such a control unit would enable independent control of the volume of a radio and a phonograph in a radio-phonograph combination and actuation of the power switch from a single knob rotatable in one direction for radio volume control and in the opposite direction for the phonograph volume control.

The provision of a control embodying these features in one unitary structure is the primary object of this invention.

More specifically this invention contemplates the provision of a combined volume control and power switch unit so designed that rotation of a single control knob in one direction from a neutral "off" position closes the power switch and commences the rheostat function for the volume control of the radio, while rotation of the same knob in the opposite direction from the neutral "off" position, likewise closes the same power switch but commences the rheostat function controlling the volume of the phonograph output.

It is to be understood, however, that while the invention is directed primarily to a combined rheostat and switch especially adapted to radio-phonograph combinations, it is by no means limited to this use, being admirably suited for use in any situation where separate rheostat functions are to be combined with the same switch function in each instance.

In addition to the broad general objectives stated, this invention has as a specific object the provision of a combination control of the type described which is exceptionally compact, and being a single unitary structure, is considerably less expensive than the two separate units heretofore necessary.

Another object of this invention is to provide a dual control unit of the character described which entails a minimum number of changes in design and manufacturing practice presently in vogue in the production of combination volume control-power switch units.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention, constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a diagrammatic view illustrating the functions of the combination control of this invention;

Figure 2 is a view partly in side elevation and partly in longitudinal section through a control constructed in accordance with this invention;

Figure 3 is a perspective view of the switch portion of the control illustrating particularly the means for actuating the switch;

Figure 4 is a perspective view of the rheostat portion of the control illustrating the same from the inside to show particularly the drivers which cooperate with the toggle of the switch mechanism;

Figure 5 is a cross sectional view taken through Figure 2 on the plane of the line 5—5, said view showing the switch open and the switch drivers in their neutral position;

Figure 6 is a view similar to Figure 5 but showing the switch closed in response to rotation of the control shaft in a clockwise direction as viewed from the front of the complete unit; and

Figure 7 is a detail sectional view through part of the switch actuating mechanism.

Referring now more particularly to the accompanying drawings in which like numerals indicate like parts, the numeral 5 designates generally the combined control unit of this invention which, as is customary, is operable by a control knob 6 fixed to a rotatable actuating shaft 7.

As pointed out hereinbefore the purpose of the control of this invention is to combine a single switch with two rheostats in such a manner that the switch is turned on and off as each of the two rheostats is adjusted, and specifically to combine radio volume control and phonograph

volume control with power switch operation in a single unit.

Figure 1 illustrates graphically the manner in which rotation of the control knob 6 in one direction from a neutral switch "off" or open position closes the switch and regulates radio volume while rotation of the knob in the opposite direction from the neutral position closes the switch and regulates phonograph volume.

It is desired to repeat, however, that the invention is not limited to a combination radio-phonograph control but is equally susceptible to use in any instance where a single switch is to turn on and off during adjustment of each of a plurality of rheostats.

The control consists of a rheostat section 8 and a switch section 9, each capable of independent assembly prior to final assembly.

The rheostat section 8 consists of a base 8' of insulating material upon which a resistance element 10 is mounted. This resistance element is of the conventional flat circular band type except that it consists of two sections 11 and 12.

While these two sections are physically one continuous unit, their respective resistance gradients are arranged end to end to progress in the same direction from the mid point defined by their meeting ends. Obviously, this progression may be either up or down.

A terminal 13 mounted on an extension 14 of the insulated base connects with the midpoint of the resistance element to provide a common terminal for the two sections. Other terminals 15 and 16 mounted on a substantially diametrically opposite extension 17 of the base connect with the opposite ends of the sections 11 and 12, respectively, to provide a second terminal for each section.

The resistance surfaces of the elements 11 and 12 lie substantially in a common plane so that a single contactor 18 may be selectively traversed across either element. This contactor may be of any desired construction but in the present instance consists of two spring fingers carried by an insulated disc 19 drivably fixed to the actuating shaft 7.

The actuating shaft 7 is journaled in a metal bushing 20 fixed to the outer face of the base, and is suitably held against inward axial movement which the spring tension of the contactor tends to produce.

The contactor also has sliding contact as at 21 with a collector ring 22 mounted on the inner surface of the base inside the resistance element and insulated from the bushing 20. A terminal 23 extended from the collector ring is brought out to the base extension 17 to be located between the two terminals 15 and 16.

Hence, it will be seen that the rheostat unit provides in effect two complete rheostats suitable for radio and phonograph volume control with practically no change in design or construction from the present units now employed in controls of this type. One of the resistance element sections obviously provides the rheostat for the control of radio volume, while the other serves in a similar capacity for the control of phonograph volume.

The rotation of the actuating shaft besides selectively carrying the contactor across either resistance element section, also opens and closes the switch and as the switch must be closed during initial movement of the contactor from its neutral position in either of two opposite directions, a special switch driver is provided. This special driver consists of a metal plate 24 fixed to the

inner end of the shaft and overlying the insulated contactor carrier.

At substantially diametrically opposite points, the plate 24 has outwardly projecting lugs 25 and 26. These lugs have their opposite flat surfaces lying on substantially radial lines for a purpose to be hereinafter described.

The plate 24 also has two stop lugs 27 and 28 projecting outwardly therefrom. These lugs have their flat surfaces tangent to an arc concentric to the axis of the shaft and disposed radially outward of the lugs 25 and 26.

The lugs 27 and 28 are positioned to collide with the opposite sides of a stationary stop lug 29 struck in from the metal rheostat housing 30 to define the limits of rotation of the actuating shaft. The metal rheostat housing is in the conventional cup-shaped form having a flat end wall 31 and a cylindrical side wall 32.

The side wall has tongues 33 projecting therefrom which in assembly are clinched over the edges of the base 8' to hold the cover to the base. Two of these tongues pass through apertures in the arms of a grounding plate 34 which is confined between the base 8' and the flange by which the bushing 20 is secured in place. Hence, the cover becomes grounded to the bushing.

The stop lug 29, as clearly shown in Figure 2, is formed by indenting the inner edge of the cover at the juncture of its end and side walls, and is so positioned as to be substantially aligned with the center terminal 23. Consequently, in the neutral position of the control the stop lugs 27 and 28 are substantially diametrically opposite the stop lug 29 to thus allow maximum rotation in both directions.

As is customary, the side wall of the rheostat housing is cut out to accommodate the terminals and its inner surface is lined with suitable insulation 35.

The switch unit hereinbefore designated generally by the numeral 9, is mounted on the rheostat cover. In fact it is completely assembled with the rheostat cover before the cover is secured to the rheostat base.

In its major aspects the switch unit is the same as that heretofore used in rheostat switch combinations. Consequently, it includes a base 36 of insulating material upon which contacts 37 and 38 are mounted to be electrically bridged by a contactor 39.

The contacts 37 and 38 are located on the inner surface of the base and have terminals 37' and 38', respectively, mounted on the outside surface of the base.

The contactor 39 is actuated to and from bridging position by a contactor arm 40 of insulating material pivoted on a stud 41 fixed to the base 36. A switch actuating unit 42 referred to in the art as a cam is also pivoted on the stud 41.

The cam has a U-shaped formation with both arms pivoted on the stud and with its inner arm 43 overlying the contactor arm.

A torsion spring 44 is connected between the end of this inner arm 43 and the contactor arm to snap the switch from one position to the other as the cam is swung from one position of rest to the other, the limits of motion of the cam being defined by cooperating stops 45 and 46 on the cam and the adjacent side wall of the cylindrical metal switch housing 47.

The switch housing 47 is substantially in the form of a cylindrical shell having the base 36 secured in one end thereof by means of an

inturned flange 48 and indentations in the side wall of the shell overlying the base and holding it against the flange 48.

The open end of the switch housing which is slightly smaller in diameter than the rheostat housing, in assembly of the parts is closed by the flat end wall 31 of the rheostat housing, the two housings being secured together by tongues 49 extending from the edge of the switch housing to pass through apertures in the end wall 31 where they are struck over as clearly shown in Figure 3.

To the extent thus far described, the switch mechanism follows conventional design, but to enable closing of the switch during initial rotation of the actuator from its neutral position in both directions, a novel cam mechanism is employed.

The cam as stated, is substantially U-shaped. Its outer arm 50 occupies a plane lying within the rheostat housing when the parts are assembled as clearly shown in Figure 2, and to enable assembly of the parts the end wall 31 of the rheostat housing has an opening 51 of a size to accommodate the total area of the arm 50.

That portion of the arm 50 adjacent to the stud 41 upon which the cam is mounted has an indentation or recess 52 in its edge facing the side wall of the switch housing to provide spaced abutments or horns 53 so located that one of them is in the path of the lug 26 as it moves with the actuator shaft and contactor through approximately one-half of their permitted rotation.

In the neutral position of the parts when the switch is closed and the contactor stands at the midpoint of the resistance element, the lug 26 occupies a position partially within the indentation or recess 52 as shown in Figure 5. Hence, if the actuator is turned in one direction the lug 26 moves farther into the indentation or recess to engage one of the horns 53 and snap the switch to its closed position. It is to be observed that such engagement is between a flat side of the lug 26 and one of the horns 53. This insures smooth action.

In the embodiment illustrated, it requires counterclockwise rotation of the shaft as viewed from the front of the unit to bring the lug 26 into cooperative relation with the cam for closure of the switch. Clockwise rotation of the shaft merely carries the lug 26 away from the indentation or recess.

The outer arm 50 of the cam also has an extension 54 disposed on a slightly lower plane and provided with an elongated opening or slot 55.

Engaging in the opening or slot 55 is a driving lug 56 carried by the outer end of a lever 57 pivoted as at 58 to the inner surface of the rheostat housing end wall 31.

The opposite end of the lever 57 projects beyond the pivot 58 toward the side wall of the housing where it has an indentation or recess 59 similar to the recess 52 and likewise providing horns 60. In the neutral position of the parts these horns 60 occupy positions at opposite sides of the driving lug 25 as shown in Figure 5. Consequently, clockwise rotation of the shaft carries the driving lug 25 into engagement with one of the horns 60 to swing the lever 57 about its pivot 58 in a clockwise direction. Such motion, by virtue of the toggle-like driving connection between the lever 57 and the

cam, swings the cam across dead center in a counterclockwise direction and closes the switch.

Counterclockwise rotation of the shaft from the neutral position merely carries the driving lug 25 away from the horns 60.

Thus it will be seen that a novel toggle mechanism for actuating the switch is provided. This toggle mechanism, which, for recapitulation, comprises the connected cam and lever 42 and 57, respectively, with their driven abutments, and the spring 44 connected between the cam and the switch arm, enables rotation of the shaft in either direction from its switch-off neutral position to effect snap closure of the switch while returning the shaft to its "switch-off" neutral position from either direction opens the switch with a snap action. A corollary of this is that as the shaft is rotated towards and across the "switch-off" neutral position, the switch is actuated first in one direction and then the other, as the shaft approaches "switch-off" neutral the switch is opened and as the shaft crosses neutral and moves beyond, the switch is closed.

Inasmuch as the rheostat housing is grounded, the end wall 31 provides a shielding barrier between the switch and rheostat mechanisms and although the opening 51 is relatively large, transfer of disturbing radiations from the switch to the rheostat mechanism through the opening 51 is precluded by virtue of the grounded metal plate 24 which overlies the opening 51 and because the cam mechanism is grounded to the end wall 31. There is, therefore, an effective shielding barrier interposed between the switch and rheostat mechanisms even though the opening 51 is relatively large.

The driving lug 56 which is carried by the lever 57 may be a separate unit riveted thereto, but it is preferable to emboss the same as shown in Figure 7, adequate length being obtained for the lug through a double or successive forming operation.

Operation

Although the operation of the control unit is undoubtedly clear from the preceding description a brief summary will be given.

In the neutral position of the control the switch is open so that neither radio nor phonograph are operative. In this position the rheostat contactor is at the midpoint of the resistance element adjacent to the common terminal 13.

As the control knob is turned in a clockwise direction, the initial motion carries the driving lug 25 into cooperative relationship with the lever 57 of the toggle mechanism to snap the cam to its closed position. Continued clockwise rotation traverses the contactor across the resistance element 12 controlling the volume for the radio.

When the knob is restored to its neutral position, the driver 25 again cooperating with the lever 57, returns the switch to its open position.

An opposite or counter-clockwise rotation of the knob from neutral position carries the driver 26 into cooperative relation with the horns of the cam per se to snap the switch closed. Continued counterclockwise rotation traverses the contactor across the resistance element 11 for control of phonograph volume and retrograde rotation of the shaft toward neutral position, again through the action of the driving lug 26 and the cam, snaps the switch to open position.

The limits of clockwise rotation are defined by engagement of the lug 28 with the lug 29, while the limits of counterclockwise rotation are de-

fined by the engagement of the lug 27 with the stop lug 29.

From the foregoing description, taken in connection with the accompanying drawings, it will be readily apparent that this invention provides an exceedingly simple unitary control having selectively and individually operable rheostats in combination with a single throw power switch arranged to be actuated in the same direction concomitantly with adjustment of either rheostat, and that by virtue of its adherence to the design accepted in the radio industry, is admirably suited for use in radio-phonograph combinations.

What we claim as our invention is:

1. In a combined volume control and power switch for radio-phonograph combinations: a rheostat mechanism including a resistance element section for radio volume control; a resistance element section for phonograph volume control, and contactor means selectively movable across said resistance element sections from a neutral position with respect to said sections; a single actuator for the volume control and power switch movable in one direction from a "switch-off" neutral position for effecting traversal of the contactor means across one resistance element section and movable in the opposite direction from said "switch-off" neutral position for effecting traversal of the contactor means across the other resistance element section; a snap switch for controlling the power supply of the radio and phonograph; pivoted toggle mechanism for snapping the switch to its closed and open positions; and toggle tripping means drivingly connected with the actuator and operable to trip the toggle mechanism to close the switch during initial movement of the actuator in either direction from its "switch-off" neutral position so that closure of the power switch precedes traversal of the contactor means across either resistance element section.

2. A control instrumentality for radio-phonograph combinations comprising: a single snap type power switch for turning the radio-phonograph combination "on"; toggle mechanism for snapping the switch to its open and closed positions; two resistance element sections, one for radio volume control and the other for phonograph volume control; contactor means selectively movable across said resistance element sections from a neutral position with respect to said sections; a single actuator for the control instrumentality drivingly connected with the contactor means and movable in either direction from a "switch-off" position at which the contactor means is in its neutral position for selectively effecting traversal of either resistance element section by the contactor means; and means driven by the actuator into engagement with the toggle mechanism during the initial movement of the actuator from said "switch-off" neutral position for tripping the toggle mechanism to close the power switch as traversal of either resistance element section begins and for tripping the toggle mechanism to open the power switch as the contactor means is returned to its neutral position.

3. A combination electrical switch and control instrumentality comprising: a manually operable actuator movable in either of two opposite directions from a "switch-off" neutral position; a snap switch; toggle mechanism connected with the snap switch for snapping the same open and closed; toggle tripping means operable by

the actuator and transiently engageable with the toggle mechanism to trip the same and cause closure of the switch upon movement of the actuator in one direction from said "switch-off" neutral position; another toggle tripping means operable by the actuator and transiently engageable with the toggle mechanism to trip the same and likewise cause closure of the switch upon movement of the actuator in the opposite direction from said "switch-off" neutral position; two electrically separate adjustable controls; and means drivingly connected with the actuator and operable by movement of the actuator beyond its switch-closing motion in either direction from the "switch-off" neutral position for selectively effecting adjustment of one or the other of said controls depending upon which direction the actuator is moved from its "switch-off" neutral position so that closure of the switch always precedes initial adjustment of both of said controls.

4. In a combined rheostat and snap switch: rheostat mechanism including movable contactor means, and electrically separate resistance element sections arranged to be successively traversed by said contactor means to effect two different resistance controlling functions, the contactor means being in a neutral position when at the adjacent terminals of the resistance element sections; an actuator drivingly connected with the contactor means for moving the same in opposite directions from said neutral position to selectively cause the contactor means to traverse one or the other of said resistance element sections; a snap switch; toggle mechanism connected with the snap switch for snapping the same to its closed and open positions, said toggle mechanism having a part provided with spaced abutments against which toggle tripping pressure may be applied; a toggle tripping lug carried by the actuator and transiently engageable with said spaced abutments to trip the toggle and snap the switch to closed position as traversal of one of the resistance element sections is begun by movement of the contactor means away from its neutral position, and to trip the toggle and snap the switch open as the contactor means is returned to its neutral position; a lever constituting part of the toggle mechanism and having spaced abutments against which toggle tripping pressure may be applied; and a second toggle tripping lug carried by the actuator and transiently engageable with the lever carried spaced abutments to trip the toggle and snap the switch closed upon initial traversal of the other resistance element section by the contactor means by motion thereof away from its neutral position and to trip the toggle and snap the switch open upon restoration of the contactor means to its neutral position.

5. In a combined rheostat and snap switch: rheostat mechanism including two resistance element sections, and a movable contactor rotatable about a fixed axis in opposite directions from a neutral position with respect to said sections and between defined limits to selectively adjust the effective resistance of said sections; a snap switch; toggle means for snapping the switch to open and closed positions; an actuator drivingly connected with the contactor for imparting rotation thereto; and switch actuating means driven by the actuator and transiently engageable with the toggle means for snapping the switch successively in opposite directions as the contactor is rotated in one direction between said defined limits.

6. In a combined rheostat and switch: two resistance element sections; contactor means for selectively traversing said resistance element sections by motion in opposite directions from a neutral position with respect to the sections; an actuator connected with said contactor means and movable in opposite directions for effecting traversal of the contactor means selectively across the resistance element sections from said neutral position; a snap switch controlled by the actuator and open in the neutral position of the contactor means, closure of the switch being required to render either resistance element section effective to perform its function; toggle mechanism for snapping the switch to its open and closed positions, said toggle mechanism being movable in one direction to close the switch and in the other direction to open the switch; and means driven by the actuator and engageable with portions of the toggle mechanism lying in the path thereof during the initial part of the actuator motion in either direction to carry said contactor means away from its neutral position for moving the toggle mechanism in the direction necessary to snap the switch closed so that the switch is snapped closed substantially concomitantly with initial traversal of either of the resistance element sections by the contactor means to render the selected resistance element section effective to perform its function.

7. In a snap switch of the character described: a contact carrier movable to and from a switch closed position; pivoted toggle mechanism having its spring connected to the carrier so that the toggle spring snaps the carrier to switch closed position upon collapse of the toggle mechanism; a driver movable in opposite directions from a "switch-off" neutral position; spaced driving abutments movable with the driver; and spaced driven abutments carried by the toggle mechanism and positioned for transient engagement by said driving abutments to receive toggle tripping pressure therefrom, said driven abutments being so positioned with relation to the driving abutments that one set of cooperating driving and driven abutments is transiently engaged to trip the toggle mechanism and thereby effect snapping of the carrier to switch closed position during initial motion of the driver in either direction from its "switch-off" neutral position.

8. A combined dual-function rheostat and snap switch comprising: rheostat mechanism including contactor means rotatable about a fixed axis in opposite directions from a neutral position to effect different resistance controlling functions; an actuator for said contactor means for rotating the same in opposite directions from said neutral position; a snap switch; switch actuating means driven by the actuator so as to be rotatable with the contactor and located substantially at diametrically opposite sides of said fixed axis; and toggle mechanism operable by said switch actuating means for snapping the switch closed during initial rotation of the contactor from said neutral position in either direction to effect one of said resistance controlling functions.

9. A combined dual-function rheostat and snap switch comprising: rheostat mechanism including contactor means rotatable about a fixed axis in opposite directions from a neutral position to effect different resistance controlling functions; an actuator for said contactor means for rotating the same in opposite directions from said

neutral position; stop means limiting rotation of the actuator and contactor means to slightly less than one-half turn in each direction from said neutral position; a snap switch; toggle mechanism for snapping the switch to its open and closed positions; and means on the actuator for actuating the toggle mechanism by initial rotation of the actuator and contactor means from said neutral position including driving lugs connected with the actuator to rotate therewith and engageable with the toggle mechanism to trip the same, said driving lugs being located at substantially diametrically opposite sides of said fixed axis so that one of the driving lugs moves in a switch actuating direction for each direction of rotation of the actuator and contactor means from said neutral position to effect one of said resistance controlling functions.

10. In a combined rheostat and snap switch: rheostat mechanism including contactor means constrained to rotation about a fixed axis; an actuator for rotating the contactor means; snap switch mechanism including a pivoted actuating cam; a pivoted lever; a driving connection between the lever and the switch actuating cam so that the cam may be driven for switch actuation by driving means engaging it or the lever; driving lugs carried by the actuator so as to be moved with the contactor means upon operation of the rheostat mechanism, said driving lugs being arranged at opposite sides of said fixed axis; and driven abutments on the cam and the lever engageable by said driving lugs upon operation of the rheostat mechanism for transmitting switch actuating motion to the cam.

11. In a combined rheostat and snap switch: rheostat mechanism including two resistance element sections and contactor means therefor rotatable in opposite directions from a neutral position with respect to said sections; an actuator for rotating the contactor means; a housing for the rheostat mechanism having an end wall substantially parallel with the plane of motion of the contactor means; snap switch mechanism mounted on the exterior of said end wall including a pivoted driving cam for snapping the switch to its open and closed positions; said pivoted driving cam having a portion extending through an opening in said end wall into the rheostat housing; a cam actuating lever pivoted to said end wall inside the rheostat housing and having a pivotal driving connection with the pivoted cam; a first set of cooperating driven and driving abutments on the pivoted cam and the actuator respectively engageable to actuate the switch to one position during initial motion of the contactor means in one direction from said neutral position to effect one resistance controlling function, and engageable to actuate the switch to the opposite position during motion of the contactor means back to said neutral position; and a second set of cooperating driven and driving abutments on the lever and the actuator respectively engageable to actuate the switch to said first designated position during initial movement of the contactor means in the opposite direction from said neutral position to effect a second resistance controlling function, and engageable to actuate the switch to said opposite position during motion of the contactor means back to said neutral position.

12. In a combined snap switch and rheostat: rheostat mechanism including two electrically separate resistance element sections, and a mov-

able contactor for selectively traversing said sections; an actuator for selectively moving the contactor across either resistance element section; a housing for the rheostat mechanism having an end wall provided with an opening; snap switch mechanism mounted on the exterior of the end wall and including a cam having a part projecting through the opening, said cam being adapted to snap the switch mechanism to its open and closed positions; a lever pivoted to the end wall inside the rheostat housing; a readily separable driving connection between the lever and the cam part which projects through the opening whereby said connection may be established upon mounting of the switch mechanism on the rheostat housing end wall; cooperating transiently engageable driving means on the cam and the actuator for snapping the switch to one position during initial actuator produced motion of the contactor across one of said resistance element sections; and cooperating transiently engageable driving means on the lever and the actuator for snapping the switch to said position during initial actuator produced motion of

the contactor across the other of said resistance element sections.

13. A combined power switch and dual volume control instrument for radio-phonograph combinations in which electrically separate resistance element sections for the control of volume in the radio and phonograph are arranged to be selectively traversed by contactor means driven in opposite directions from a neutral position with respect to the resistance element sections by a single actuator for the control instrument, characterized by the provision of a snap type power switch for controlling the supply of power to either the radio or the phonograph and mechanism driven by the actuator for snapping the power switch closed substantially simultaneously with motion of the actuator in either direction out of a "switch-off" neutral position corresponding to the neutral position of the contactor means to initiate control of the volume in either the radio or the phonograph.

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