June 20, 1950 M. J. LARSEN 2,511,923

VOLUME CONTROL DEVICE

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Fig. 1.

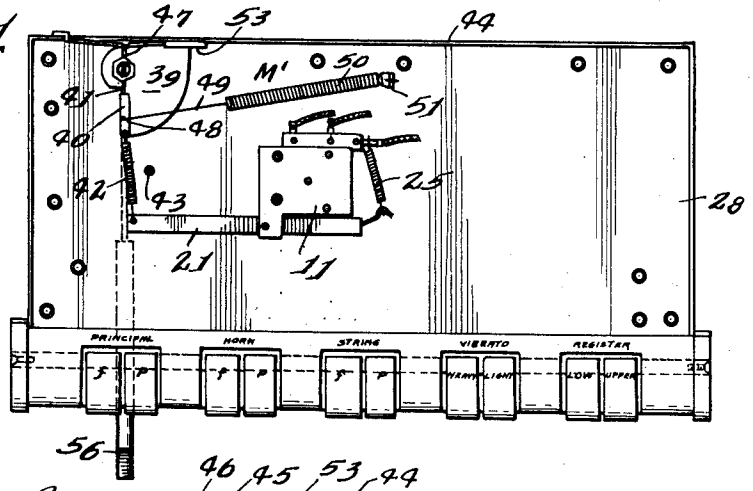



Fig. 2.

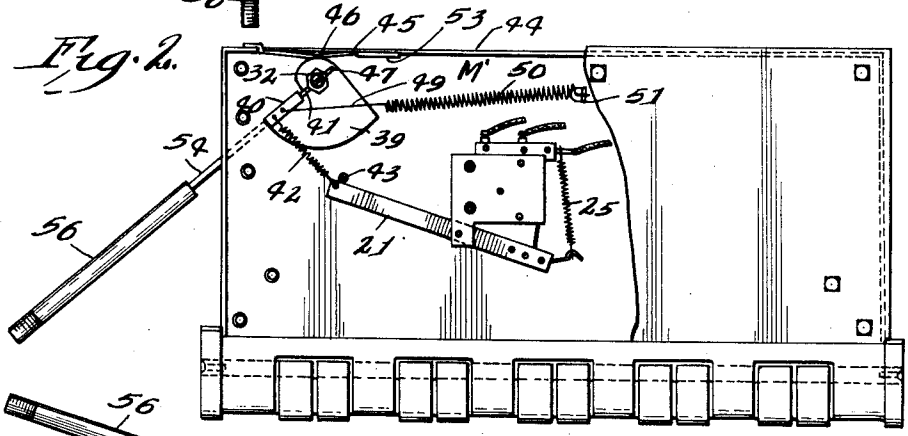
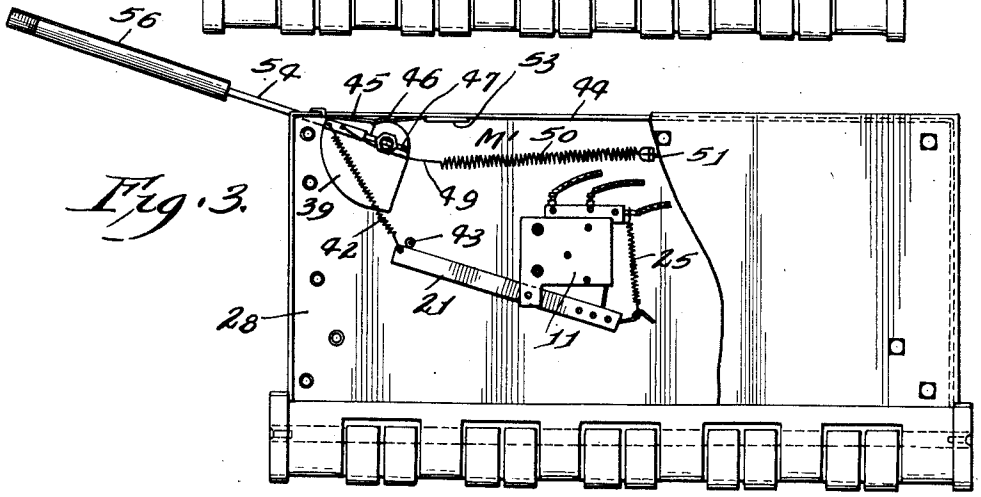



Fig. 3.



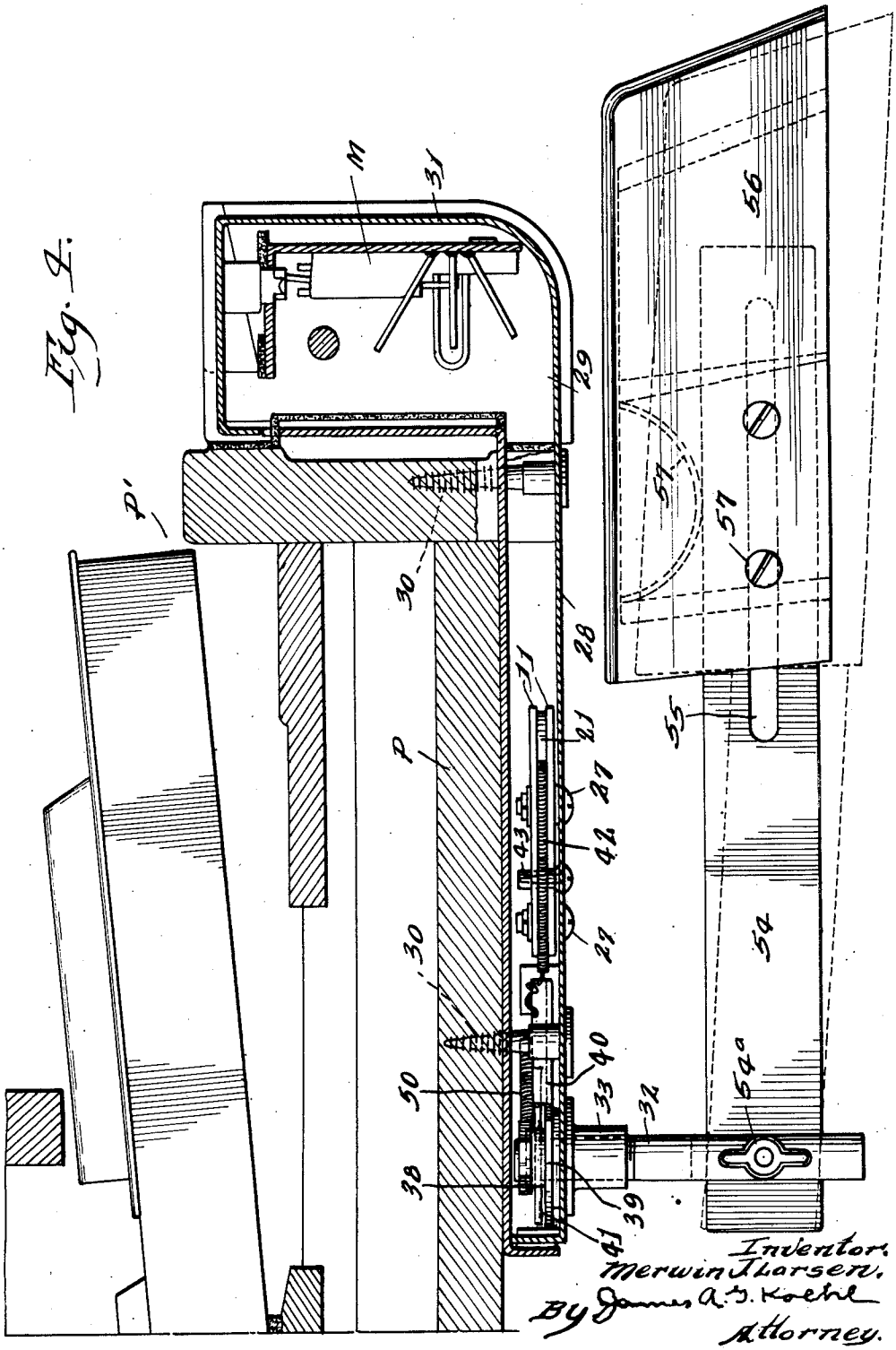

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Fig. 4.




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Fig. 5.

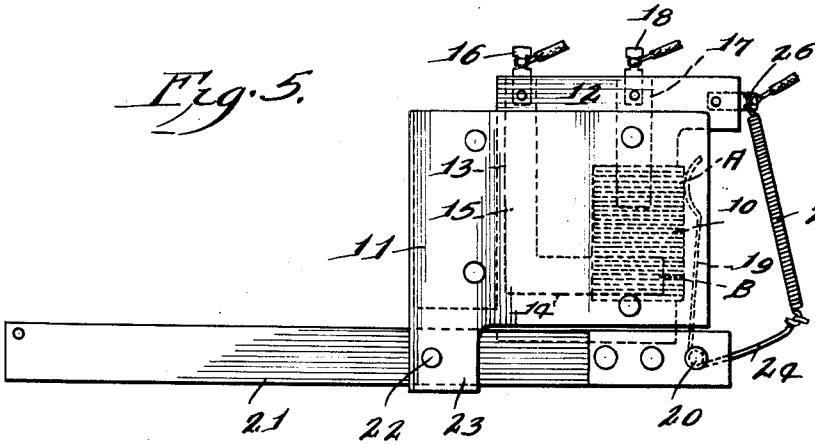



Fig. 6.

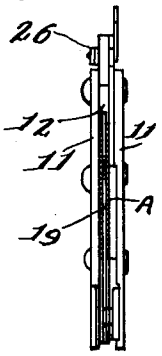



Fig. 8.

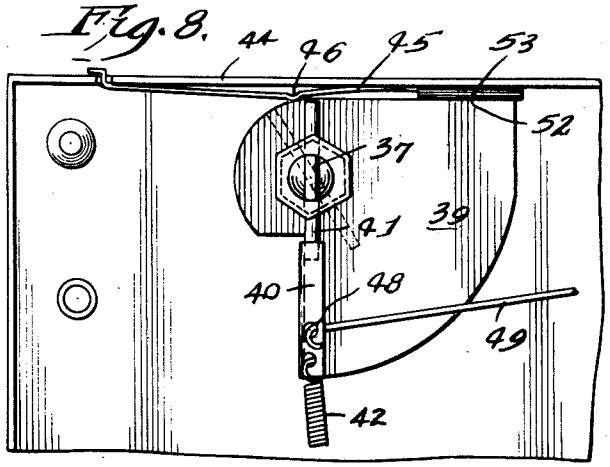



Fig. 9.

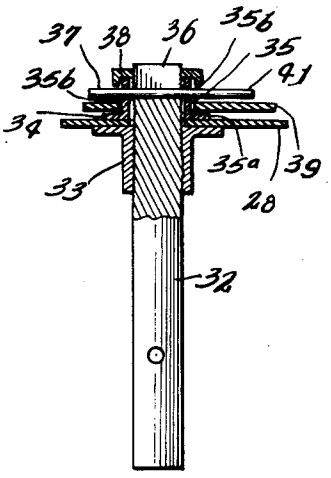
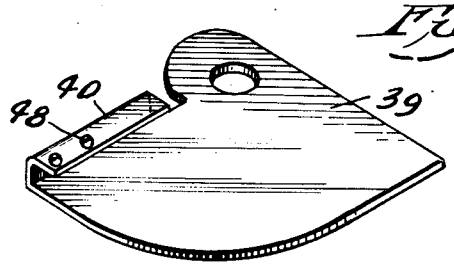



Fig. 7.




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Patented June 20, 1950

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# UNITED STATES PATENT OFFICE

2,511,923

## VOLUME CONTROL DEVICE

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Application October 22, 1949, Serial No. 122,938

12 Claims. (Cl. 201—48)

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This invention relates to volume control devices and more particularly devices adapted for use with musical instruments employing an electroacoustic device for the translation of waveforms of audio tone signals into audible sounds for musical expression. A musical instrument of this general character is disclosed in U. S. Letters Patent No. 2,250,065, dated July 22, 1941. In said patent, audio tone signals are generated by vacuum tube oscillators. The signals are impressed on the input circuit of an audio amplifier having a volume control device in circuit therewith for selectively controlling the volume of sound produced by a loud speaker in the output circuit of said amplifier. Also in said patent, the outputs from said vacuum tubes are selectively impressed on the input circuit of said amplifier in response to depression of the playing-keys of the keyboard of a piano or other keyboard musical instrument.

Certain essential objects of the invention are:

(1) The provision of a volume control device which is applicable to a piano and is actuable by the knee of the player;

(2) The provision of a knee actuated volume control device, the various coactive mechanisms of which are formed, designed, constructed and adapted to prevent accidental injury or damage thereto in the event of actuation of a movable control member past an intended position, as when moving the knee further than required for maximum volume of the translating device.

(3) The provision of a volume control device in which the movable contactor of a variable resistance is selectively movable between a first extreme or full "on" position, and a second extreme or full "off" position, which member when moved in a direction to effect the second extreme position of the contactor can continue its motion in the same direction while the contactor remains at said second extreme position without disabling or disrupting any individual part of the device.

(4) The provision of a volume control device, the knee actuated movable member of which is automatically returned to a neutral or starting position upon releasing pressure of the knee therefrom and for insuring concurrent return of th contactor to a first extreme position at which the volume level of sound is zero.

(5) The provision of a volume control device, the movable knee actuated member of which is capable of adjustment for proper association thereof with the knee of the player.

Other objects and advantages will appear from

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the following description and upon reference to the accompanying drawings, in which:

Figure 1 is a view in top plan of the device showing the parts in an "off" condition, in which the movable contactor of the variable resistance is at its first extreme position;

Figure 2 is a view similar to Figure 1 showing the parts in an "on" condition, in which the movable contactor is at its second extreme position;

Figure 3 is a view similar to Figure 2 showing the parts in an "on" condition, in which the movable contactor of the variable resistance is at its second extreme position and is retained at said position even though the knee actuated member has been moved past an intended position of adjustment.

Figure 4 is a vertical section through a piano showing the device attached thereto, the parts being shown on an enlarged scale;

Figure 5 is a plan view of the variable resistance;

Figure 6 is an edge view of the variable resistance;

Figure 7 is a plan view of a portion of the device showing in detail the motion transferring element;

Figure 8 is a perspective view of the motion transferring element, and

Figure 9 is a vertical section on an enlarged scale of the rotary shaft and is coactive.

In carrying the invention into practice, use is preferably, but not necessarily made of a variable resistance comprising a relatively flat horizontally disposed coil 10 of resistance wire which is set in a Bakelite spacer 12, the latter secured between thin pieces of sheet Bakelite 11—11. Secured to the spacer 12 is an L-shaped member 13 of thin sheet conductive material such as phosphor bronze, which is securely clamped between the Bakelite pieces 11—11 and arranged with its short leg 14 in flat, firm engagement with one side of the coil at one end thereof. The long leg 15 of the conductive member 13 terminates in a clip or connector 16 disposed for attachment thereto of a ground wire, not shown. Similarly clamped between said pieces 11—11 is a thin strip of conductive material 17 which bears flatwise against the coil 10 at the opposite end thereof and has a clip or connector 18 for attachment thereto of a signal transmitting lead, not shown. At 19 is a contactor of phosphor bronze which is mounted between said pieces 11—11 for free yielding engagement with one edge of the resistance coil, the movement of the contactor

being from a first extreme or "off" position A to a second extreme or "on" position B. Said contactor has an intermediate portion which passes over and part way around a rivet 20 secured to one end of a lever arm 21, which arm has pivotal motion about a rivet 22 secured between lugs 23 on said strips 11—11. The wire then extends into a short angular tail piece 24 to which one end of a coil retractile spring 25 is attached, the opposite end of said coil being connected to a signal output terminal 26.

To this point in the description, there has been disclosed and described a variable resistance in which rectilinear motion is imparted to a laterally resilient contactor in response to rocking motion in one direction of a pivoted lever arm, such that the contactor will move by even increments between points A and B, thereby varying the resistance in an electrical circuit in accordance with any selected position of said contactor. The resistance of the wire coil may be of any predetermined value and the parts arranged so that when contactor 19 is at position A the current flow will be from terminal 18, through the resistance coil and to ground via member 13. As the contactor leaves position A and moves toward position B, the resistance is gradually lowered and the current flow is from terminal 18, through portions of the resistance coil and to terminal 26 via spring 25. Assuming now that the variable resistance is connected in an electrical network having means for transmitting signal voltage to an audio amplifier via said resistance, activation of a sound translating device in the output of the amplifier can be controlled as desired as the contactor is moved any selected distance away from the zero or neutral position A. At this point, it is noted that the retractile spring 25 functions both as a current conductor and as resilient means which tends normally to rock the lever arm in a direction to place the resistance engaging portion of contactor at the zero position A.

Upon reference to Figure 4 of the drawings, it is noted that the variable resistance, including resistance coil 10, contactor 19 and lever arm 21 are secured at 27 to the horizontally disposed plate 28 of a metallic housing 29 secured by screw or equivalent fastenings 30 to the underside of the bed plank P of a piano P'. The mechanism M in the forward portion 31 of the housing is a conventional illustration of a timbre controlling system adapted to be connected in circuit with my volume control device for selectively sounding tones of selected timbre. As my invention is essentially a volume control device for controlling the amplitude of tone signals regardless of the particular system employed for producing said signals, any further descripiton of said mechanism M is not deemed necessary.

It suffices to say that in order that the contactor 19 is normally urged to said position A and can be moved to any intermediate position between points A and B, a knee actuated mechanism M' is employed, as shown in detail at Figure 9, the same comprising a vertical threaded shaft 32 which passes through a bearing 33 on the underside of plate 28 of the housing and through a bushing 34 inside the housing. Said bushing is formed with a base flange 35*a* and a sleeve 35, the latter having alined openings 35*b* which register with a bifurcated portion 36 of said shaft. Passing through the bifurcation 36 and the alined openings 35*b* is a metal collector pin 37. Secured to the bifurcated end of the shaft is a retaining nut 38 and free to turn on the shaft is a metallic sector plate 39 having one of its side edges upset to form a rectilinear channel portion 40. From the above, it follows that the bushing 35 is fixed to turn with the shaft 32 so that when the shaft is turned in a clockwise direction, extension 41 of the pin will engage in said channel portion 40 for transmission of rotational motion in the same direction to said sector plate 39.

Said plate 39 has connected thereto one end of a coil spring 42, the opposite end of which is connected to the outer end of lever arm 21. When contactor 19 arrives at point B, its motion is definitely stopped and the contactor thereby retained at this position even in the event of continued motion of the shaft 32 in a clockwise direction. To accomplish this, the lever engages a stop pin 43 on housing plate 28 and the coil spring 42 stretches while the lever arm remains at said stop, sector plate 39 continuing its clockwise motion. The spring 42, therefore, serves no other purpose than that of resilient compensating means enabling possible continued rotational motion in a clockwise direction of the shaft after the contactor has arrived at its second extreme position of adjustment.

The back flange 44 of housing plate 28 has attached thereto one end of a leaf spring 45 which is upset to provide a laterally yieldable stop lug 46. This lug lies in the path of extension 47 of pin 37. Movement of shaft 32 in a clockwise direction is limited by contact of a portion of plate 39 with the back flange 44, as shown at Figure 3.

The channel portion 40 of plate 39 connects at 48 with the long stretch 49 of a coil retractile spring 50, the opposite end of which is attached to the housing plate 28, as at 51, the spring serving normally to urge the plate to rotate counterclockwise to the position shown at Figure 1 where the extension 47 of pin 37 rests against lug 46. By this order of arrangement and construction of parts, contactor 19 returns to point A on the resistance coil and edge portion 52 of plate 39 rests against a buffer or cushion 53 at one end of leaf spring 45. Pivoted for vertical tilting adjustment to shaft 32 is a flat leaf spring 54, the outer end of which is formed with a longitudinally disposed slot 55. Slidable on the spring 54 is a hollow knee engageable member 56. Guide fastenings 57 extend through said member 56 and through said slot 55, and, as shown, a spring 57 within said member bears against one edge of the spring. In this manner, the spring may be tilted vertically to any selected angular position and the member 56 adjusted longitudinally upon the spring and held in any position of longitudinal and vertical adjustment. Angular adjustment of the spring can be effected by a winged nut connection 54*a* at the pivotal point of said spring with said shaft 32.

The long, normally straight stretch 49 of spring 50 lies in a plane parallel to plate 28 of the housing and is disposed in such relation to the sleeve 35 of bushing 34 that when the shaft 32 is turned clockwise and the actuating member 56 is in the angular position shown at Figure 3, said lead engages said sleeve at a tangent thereto and flexes to the form shown at said figure, at which time plate 39 comes against the back flange 44 and further rotational motion of the shaft is stopped in said clockwise direction. Also, when the parts are in these positions, spring 42 is stretched so that resilient compensating

means is provided when lever **21** is moved to a position of engagement with stop **43**.

There is such coordination between the various mechanisms of the device that when pressure of the knee is released from member **56**, plate **39** returns to a starting or normal position under the influence of spring **50** and concurrently contactor **19** is returned to position A on the resistance coil **10** under the influence of spring **25**. Also, when the parts have been restored to said positions, the actuating member **56** lies in a position substantially at right angles to the longitudinal center line of the housing where it is disposed to accommodate the knee of a player seated at the keyboard of a piano. If, in the return movement of member **56** to a neutral or zero position, it tends to continue counter-clockwise motion by inertia, the extension **41** of pin **37** releases itself from the channel portion of rotatable plate **39**. The full limit of counter-clockwise motion of member **56** is determined by contact of extension **41** with the back flange of the housing, as will be readily understood.

A volume control device characterized by the aforementioned coactive elements is positively acting and is applicable to most any keyboard musical instrument of the class wherein the amplitude of tone signals is desired to be controlled by the knee of the player for desired musical expression. I stress those features of the device for automatically moving the coactive mechanisms and elements to their normal or starting position upon release of knee pressure from the actuating member **56**. A further desirable feature of the invention finds expression in its general simplicity and the fact that the various mechanisms are coordinated in a manner enabling the actuating member to rotate substantially throughout 360 degrees without the possibility of disruption of any individual element. This is important as a safeguarding measure against careless or mischievous use of the device. I stress also the feature which consists in connecting said member **56** with the flat leaf spring **54**, the latter capable of flexure to compensate for any extreme or unnecessary force that may be applied to said member **56**. To this is added the feature enabling the member **56** to be disposed at any desired effective elevation that may be most convenient to the player.

What I claim as my invention is:

1. A volume control device comprising a variable resistance including a resistive element and a contactor movable thereover between a first extreme position and a second extreme position, means tending to urge said contactor to said first extreme position, and an actuating mechanism for moving said contactor against the tendency of said urging means and towards said second extreme position, and including a manually actuable member mounted for pivotal motion about an axis at right angles to the plane of said resistive element, and means connected therewith for urging same to a position where the contactor is at its first extreme position in response to said first named urging means.

2. A volume control device according to claim 1, wherein motion of the manually actuable member is clockwise during movement of the contactor from said first extreme position and counter-clockwise during return movement of the contactor to said first position, and wherein said member is connected to said contactor for continued clockwise motion of the member after the contactor is at said second extreme position.



3. A volume control device comprising a variable resistance, including a resistance, a contactor movable over said resistance, means tending to urge said contactor to one position on said resistance, and means yieldingly connected to said contactor for moving same from said one position to any selected position on said resistance and against the tendency of said urging means, said second named means comprising a manually actuable member mounted for rotational motion and including coactive resilient means for moving said member to a position enabling the contactor to return to said one position following motion thereof from said position upon release of manual force from said member.

4. In a volume control device, a bearing, a shaft journaled to rotate in said bearing, a bushing through which one end of the shaft extends, a pin passing through the bushing and the shaft, a plate through which a portion of the shaft passes and about the axis of which shaft it can turn independently of the bushing, means on the plate engageable with the pin to cause the plate to rotate with the shaft in response to movement of the shaft in a clockwise direction and to disengage therefrom in response to counter clockwise motion of the shaft, and a variable resistance connected to said plate for actuation thereof in response to the aforementioned motions of said shaft.

5. A volume control device according to claim 4, wherein the connection between the plate and the variable resistance includes a retractile spring capable of being stretched during motion in a clockwise direction of said shaft.

6. A volume control device according to claim 4, wherein the connection betwen the plate and the variable resistance includes a retractile spring capable of being stretched during motion in a clockwise direction of said shaft, and wherein spring means are provided tending always to move the plate and the shaft in a counter clockwise direction.

7. A volume control device comprising a circuit controlling mechanism, including a contactor movable from an "off" to an "on" position and vice versa, an actuating shaft mounted for motion respectively in clockwise and counter clockwise directions, and a system of interconnected springs coactive with said shaft and said contactor for urging the shaft in a counter-clockwise direction and moving the contactor to a position establishing an "off" condition of said circuit controlling mechanism and for enabling selective clockwise motion of the shaft and movement of the contactor to a position establishing an "on" condition of said circuit controlling mechanism and for allowing motion of the shaft to be continued in a clockwise direction when the contactor is in said last named position.

8. A volume control device comprising a circuit controlling mechanism, and a knee responsive actuating mechanism for said controlling mechanism and including a shaft mounted for rotational motion, a leaf spring connected at one end to said shaft for vertical angular adjustment, and a knee engaging member adjustable longitudinally on said spring forwardly of its point of connection with said shaft, and means incorporated between said spring and said member for holding the latter in any selected position of longitudinal adjustment.

9. A volume control device comprising a movable circuit controlling member actuable selectively for "on" and "off" conditioning of said

device, and an actuator for said member, said actuator and said member mounted for rotational motion about respective parallel axes, said actuator including an element capable respectively of clockwise and counterclockwise motion and means for yieldingly urging same in a counterclockwise direction, and an element capable of clockwise and counterclockwise motion and means for imparting clockwise motion to the first named element.

10. A volume control device comprising a variable resistance including means providing a longitudinal resistive surface and a contactor coactive therewith, a pivotally mounted lever supporting said contactor for movement on said surface from one end to the other end thereof, means coactive with the lever for yieldingly urging same in a direction to establish effective engagement of the contactor with said surface at one end thereof, and a system of resilient devices for actuating the lever with resultant motion of the contactor on said surface to vary the resistance by even increments.

11. A volume control device according to claim 10 wherein means are provided for stopping motion of said lever in one direction and wherein said system of coactive resilient actuating devices includes a spring enabling possible prolonged operation of said actuating system after motion of the lever in the direction aforementioned has been stopped.



12. A volume control device according to claim 10 wherein means are provided for stopping motion of said lever in one direction and wherein said system of coactive resilient actuating devices includes a spring enabling possible prolonged operation of said actuating system after motion of the lever in the direction aforementioned has been stopped, and a spring tending always to establish a neutral condition of said switch.

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