

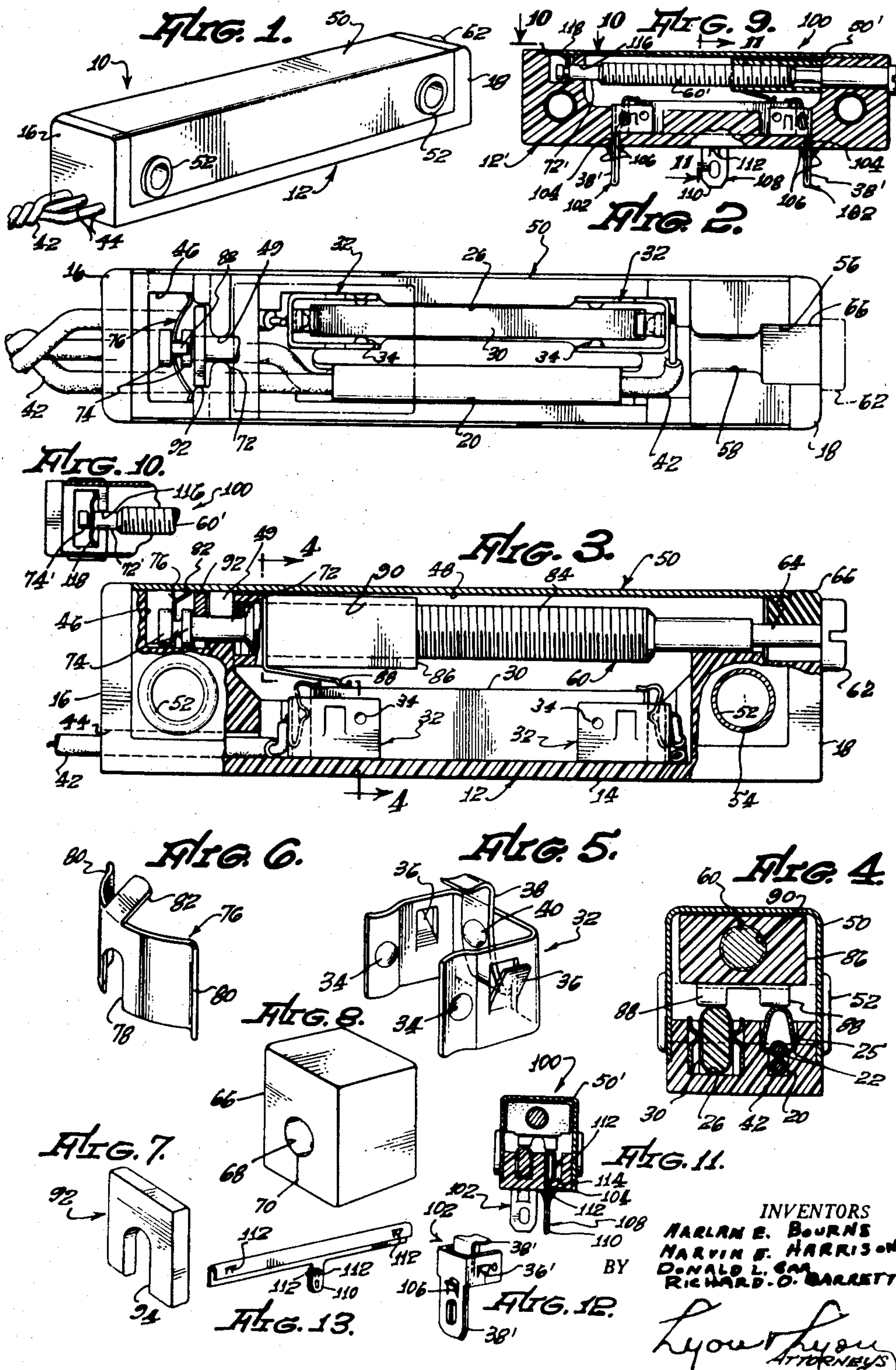
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VARIABLE RESISTOR CONSTRUCTION

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1

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VARIABLE RESISTOR CONSTRUCTION

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8 Claims. (Cl. 338—183)

This invention relates to the construction of new and improved variable resistors, and, more particularly, improved potentiometers. This application is a division of our co-pending application, Serial No. 582,422, filed May 3, 1956, now Patent No. 2,886,881 for Variable Resistor Construction.

A number of different types of lead screw actuated potentiometers have been developed in the past. One particular type of unit of this category which has enjoyed wide commercial acceptance is formed so as to include a base member having an elongated center portion and upstanding ends. A metal cover is secured about this base portion in this particular unit so as to define an internal cavity between the two ends and on one side of the elongated center portion. A shaft is held by these two ends so as to project through this cavity adjacent to an electrical resistance element and an electrical return or shorting member. With this construction contact means are mounted upon a movable member carried by the shaft so as to engage the resistance element and electrical return.

In lowering the cost of potentiometers of the category specifically indicated in the preceding while simultaneously improving the mechanical performance of these units a number of distinct problems have been encountered. One of these problems concerns the mounting of a resistance element in a groove in a quick, cheap, effective manner. One object of this invention is to teach the construction of clip members capable of being cheaply manufactured and capable of being easily and conveniently used so as to securely mount an electrical resistance element or other equivalent member within a groove while simultaneously establishing electrical contact with such an element.

Another object of this invention is to provide a cheap, effective structure or construction for mounting and holding a shaft in potentiometers of the category specifically indicated in the preceding discussion. This latter objective is exceedingly important inasmuch as the shaft in units of the category described must be securely held against end play, and yet must be mounted in such a manner as to prevent damage as through too great adjustment of a shaft.

Further objects of this invention as well as many specific advantages of it will be more fully apparent from the remainder of this description including the appended claims and the accompanying drawings in which:

Fig. 1 is an isometric view of a potentiometer of this invention;

Fig. 2 is top view of a potentiometer shown in Fig. 1 with the cover of this potentiometer removed;

Fig. 3 is a cross sectional view taken at line 3—3 of Fig. 2;

Fig. 4 is a sectional view of a complete potentiometer of this invention taken at line 4—4 of Fig. 3;

Fig. 5 is an isometric view of a retaining clip employed with the potentiometer illustrated in the preceding figures;

2

Fig. 6 is a isometric view of a spring retainer used with this potentiometer;

Fig. 7 is an isometric view of a spacer for use with this potentiometer;

Fig. 8 is an isometric view of a rubber bushing employed in this unit;

Fig. 9 is a cross sectional view similar to Fig. 3 of a modified potentiometer of this invention;

Fig. 10 is a partial view similar to Fig. 2 of the modified potentiometer shown in Fig. 9;

Fig. 11 is a cross sectional view taken at line 11—11 of Fig. 9;

Fig. 12 is an isometric view of modified clip used in the potentiometer shown in Fig. 9; and

Fig. 13 is an isometric view of a modified electrical return used with this potentiometer.

In all figures of the drawing like numerals are used to designate like parts wherever convenient for purposes of illustration and explanation. It is to be understood that this invention is not to be considered as being limited to potentiometers having the precise proportional sizes and shapes shown inasmuch as the basic principles of this invention can be readily applied to a number of other different units with a minimum of difficulty.

It may be indicated by way of a summary which will help understanding of this invention that it is primarily concerned with potentiometers which include: a base member formed of a non-conductive material so as to include an elongated center portion and upstanding ends; a metal cover secured about this base member between the two ends thereof so as to define an elongated internal cavity on one side of the elongated center portion; means for holding a shaft formed in the upstanding ends adjacent to the cover; retainer means located in said means for holding a shaft in an operative position; a shaft held by said retainer means so as to project through the cavity and out of one end of the potentiometer; a movable member mounted upon this shaft within the cavity; an electrical resistance element located generally upon the center portion of the base member; clip means holding the electrical resistance element in this position and establishing electrical communication with the ends of this resistance element; an electrical return located upon the center portion of the base member adjacent to the electrical resistance element; terminal means leading from the clip means and the electrical return to the outside of the potentiometer so as to connect these elements into an electrical circuit; and contact means mounted upon the movable member so as to establish electrical communication between the resistance element and the electrical return.

The precise nature of the invention is best explained directly by reference to the drawings. Here there is shown a potentiometer 10 having a base member 12 formed of a nonconductive material such as a phenolic or other resin so as to include an elongated center portion 14 to the ends of which there are attached upstanding ends 16 and 18.

Within the center portion 14 there is located a first groove 20 having internal shoulders 22 which are designed to support the ends of an elongated electrical return 24 of conductive metal having a generally U-shape. This return 24 may be conveniently snapped into position. Ratchet like extensions 25 on the sides of it engage the walls of the groove 20 so as to prevent dislodgment of this return. Also within the center portion 14 parallel to the groove 20 there is located a second groove 26 of larger internal dimension; the ends of these two grooves 20 and 24 are connected together by short passages 28.

Within the groove 26 there is located a conventional wire wound resistance element 30 or equivalent, the ends

of which are held by spring clips 32, the construction of which is best seen in Fig. 5 of the drawings. The clips 32 are located, as shown, with enlarged ends of the groove 26 so as to be incapable of lateral movement within these grooves. Each of these clips is formed of a conductive, resilient metal in a general U-shape so as to have semi-cylindrical projections 34 on the ends thereof facing one another. The ends of these clips adjacent to the projections 34 are also curved slightly so as to bend towards one another. Upon the sides of the two clips there project outwardly small ratchet like extensions 36, and from the bottom of the center portion of these clips there project towards the ends of the clips 32 resilient tongues 38 having bent over ends and which are provided with projections 40 similar to the projections 34. These clips are designed in such a manner that the resistance element 30 may be disposed with respect to them and firmly held in position within the groove 26 and with a minimum of difficulty. The projections 34 are designed to engage the sides of the resistance elements 30 establishing electrical communication or contact therewith and resiliently holding the resistance element in a manner in which it cannot be damaged by vibration. The extensions 36 act as ratchets against the sides of the groove 26 when the clips 32 are in position preventing accidental dislodgement of the resistance element 30. The tongues 38 bear against the ends and the top of the resistance element 30 so as to resiliently hold this resistance element in a fixed position in which it cannot slide lengthwise within the groove 26. Electrical wires 42 enter into the potentiometer 10 through openings 44 in the end 16. One of these wires is connected directly to the electrical return 24, and the other two wires are connected to the clips 32 as indicated in the drawing. The groove 20 forms a very convenient passage for holding the wires 42 in position where they cannot interfere with the operation of the complete potentiometer.

Within the top of the end 16 there is formed a generally rectangular cavity 46 which is in connection by means of a groove 49 with an enlarged, elongated cavity 48 formed within the potentiometer 10 when a cover 50 of metal is disposed over the ends 16 and 18 and part of the center portion 14. This cover is conveniently held in this location by means of metal rivets 52 passing through holes 54 in the ends 16 and 18. Within the other end 18 there is formed a generally rectangular opening 56 adjacent to the outside of the potentiometer 10 from which there leads a groove 58 leading to the cavity 48.

A metal shaft 60 is held so as to project between the ends 16 and 18 so that a head 62 on the shaft is located against the exterior of the potentiometer 10. Immediately back of this head the shaft 60 is provided with a reduced diameter portion 64, the exterior of which is smooth. This portion 64 is adapted to be held by a resilient block 66 of rubber or equivalent material, the construction of which is best seen in Fig. 8 of the drawings. Here it is shown that this block has a center cylindrical passage 68 designed to hold the portion 64 and a cut 70 which is designed so that the block 66 may be deformed in order to introduce the portion 64 into the location specified. The block is so dimensioned that it fits tightly around the shaft 60, forming an effective seal against dirt or the like entering the potentiometer 10.

The other end of the shaft 60 is provided with another portion 72, having a smooth exterior, of reduced diameter which is designed to go through the slot 49 so as to extend into the cavity 46. Within this cavity this portion 72 is provided with two projecting cylindrical flanges 74 which are spaced from one another. These flanges are designed so that a small spring retainer 76 of conductive metal having the shape shown in Fig. 6 of the drawings may be conveniently located with a generally U-shaped opening 78 in the center portion of this retainer positioned over the portion 72 between the flanges 74. Thus, with this construction, portions of the retainer are engaged by

the two flanges 74 so that the ends 80 of this retainer bear against the wall of the cavity 46 pulling or urging the shaft 60 towards the end 16 of the potentiometer 10. In order for this function to be satisfactorily achieved, the center portion of this retainer 76 is bowed in much the shape of a common leaf spring. A tab 82 attached to the retainer 76 projects from the center portion thereof so as to bear against the cover 50, maintaining the retainer 76 and the shaft 60 in the proper position. The tab 82 also serves to place the shaft 60 in electrical communication with the cover 50 so as to provide a "ground" connection for this shaft.

Upon a threaded portion 84 of the shaft 60 there is located a non-conductive movable member 86 which carries resilient spring contacts 88, formed of the same piece of metal, designed to engage the resistance element 30 and the electrical return 24. Because a threaded cylindrical opening 90 within this movable member 86, engaged by the threaded portion 84 of the shaft 60, must pass over the flanges 74 in assembling the potentiometer 10, a bearing spacer 92 is located against the flange 74 closest to the end 18 of the potentiometer and against the wall adjacent the groove 49 so as to provide a bearing surface which prevents movement of the shaft 60 toward the end 18 if the shaft 60 is turned so as to force the movable member 86 against the end 16. This bearing spacer 92 is provided with a generally U-shaped opening 94 as indicated in Fig. 7 of the drawings so as to fit over the portion 72 of the shaft 60, and is so dimensioned as to be held in place by the cover 50.

With the preferred embodiment of the invention the movable member 86 and the spring contacts 88 are so dimensioned that the end of the contact 88 engaging the resistance element 30 so as to be in electrical communication with it is capable of being moved beyond the projections 34 on the clips 32 at either end of the potentiometer 10 as indicated by the positions of these elements in Fig. 2. This is important since the projections 34 serve as end terminals for the resistance element 30; it has the result that adjustment can be made over the entire effective length of this resistance element, and to a greater extent, that is, beyond the terminals if desired. Being able to provide such adjustment has been considered a problem in the past.

In Figs. 9, 10, and 11 there is illustrated a modified potentiometer 100 of this invention which is substantially the same as the potentiometer 10 except for several differences in the construction of certain parts. One of these differences is that the wires 42 are not employed and that clips 102 (Fig. 12) similar to the clips 32 are utilized in place of certain of these wires. All of the parts of the clips 102 which are the same as corresponding parts of the clips 32 are designated by the primes of the numbers previously employed. With the clips 102 the tongues 38' are each formed of a single strip of metal which extends through an opening 104 in the base 12 and which is doubled back on itself so as to extend back through this opening where it terminates in a structure as previously described. Small ratchet-like protruding extensions 106 formed on each of these metal strips engage the exterior of the base 12' to securely hold each of the clips in position. Further, in the potentiometer 100 an electrical return 108 (Fig. 13) differing from the return 24 is employed. This return is preferably formed out of a single sheet of metal so as to include a tongue 110 of a single strip of metal bent back along itself having ratchet-like protruding extensions 112 formed thereon so that this return can be conveniently snapped into place within a smooth walled groove 114 with the tongue extending through an opening 104 and with the extensions 112 engaging the exterior of the base 12'. Similar extension 112 on the sides of an elongated U-shaped top to the return engage the walls of the groove locking the return 108 securely in place. The structure of the potentiometer 100 so far described

5

is very advantageous since it eliminates the necessity of soldering wires to various members and making provision for these wires. Also it is easier to hold the base 12' in this modified device than it is to hold the base 12 in the potentiometer 10. The tongues 38' and 110 can be shaped as desired so as to be capable of being fitted into sockets, or so as to be capable of being secured to wires, etc. The assembly of the potentiometer 100 is also comparatively simple since the clips 102 and the return 108 can be merely snapped into a permanent position.

In the potentiometer 100 the groove 49 may be replaced by a hole 116 through which the portion 72' of the shaft 60' projects. One of the flanges 74 is omitted with this construction so that a single bowed resilient metal plate or retainer 118 having an opening formed therein similar to the opening 78 can be used to hold the shaft 60' in position. The cover 50' holds this plate 118 in position. Thus, this part of the construction of the potentiometer 100 is simpler than the equivalent part of the construction of the potentiometer 10.

Those skilled in the art to which this invention pertains will realize that the constructions defined herein incorporate a number of minor changes over pre-existing potentiometers of similar category. While these changes are minor, they are nevertheless of major importance from a commercial standpoint inasmuch as they contribute to the construction of potentiometers which are efficient, easy to assemble and which can be constructed at a comparatively low cost. These persons will further realize that many of the individual features of this invention have separate utility apart from the complete invention as a whole, although these features are best employed in conjunction with one another. For this reason, certain of these features are separately claimed. It will also be realized that the retainer structure of the potentiometer 100 can be used with the potentiometer 10, and vice versa; the clip and return structure shown can also be interchanged. Because minor changes may be made in the structure shown without departing from the essential nature of this invention, the invention itself is to be considered as being limited only by the appended claims.

We claim:

1. A variable resistor which includes: a base member having an elongated center portion formed of a non-conductive material with a groove formed therein; a cover positioned upon said base over said groove in said elongated center portion so as to define an internal cavity; an elongated resistance element positioned within said groove; spring clip means engaging each end of said resistance element and the walls of said groove positioned within grooves at each end of said resistance element, said spring clips means holding said resistance element in place and establishing electrical termination for said resistance element; a shaft positioned within said internal cavity; contact means carried by said shaft so as to engage said resistance element, said contact means being movable along said resistance element; and means affording electrical connections from the outside of said variable resistor attached to said spring clip means.

2. A variable resistor as defined in claim 1 wherein said spring clip means each is formed of a conductive, resilient metal in a general U-shape so as to have projections formed on the ends thereof facing one another and ratchet like extensions projecting outwardly from the sides thereof, and wherein said projections engage said resistance elements so as to terminate said resistance elements between the ends thereof and wherein said extensions engage the walls of said groove so as to hold said clip means in position.

3. A spring clip formed of a conductive resilient metal having a generally U-shape, said clip including projec-

6

tions on the ends thereof facing one another, ratchet like extensions projecting outwardly from the sides thereof, and a tongue extending from the center thereof generally between the sides of said clip toward the ends thereof.

4. A variable resistor which includes: a base member having an elongated center portion formed of non-conductive material with a groove formed therein; a cover positioned upon said base over said groove in said elongated center portion so as to define an internal cavity; means defining openings in said base member leading from the ends of said groove to the exterior of said variable resistor; an elongated resistance element positioned within said groove; spring clip means engaging each end of said resistance element and the walls of said groove positioned within said groove at each end of said resistance element, said spring clip means holding said resistance element in place and establishing electrical termination for said resistance element, said spring clip means each including a terminal portion extending through said openings to the exterior of said variable resistors; a shaft positioned within said terminal cavity; and contact means carried by said shaft so as to engage said resistance element, said contact means being movable along said resistance element.

5. A variable resistor as defined in claim 4 including ratchet like protruding extensions formed on each of said terminal portions, said extensions engaging the exterior of said base member so as to firmly hold said clip means in position.

6. In a variable resistor having a housing, a leadscrew journaled on said housing, a resistance element mounted on said housing parallel to said leadscrew, a slider operatively engaged by said leadscrew and movable thereby lengthwise of the leadscrew, said slider having contact means wiping on said resistance element, a retainer mounted on said housing transverse to said leadscrew, said retainer comprising a bowed clip of spring metal having a U-shaped notch formed in one of the transverse edges thereof adjacent the midpoint of the clip, the ends of said clip bearing against said housing, and annular shoulder means on said leadscrew engaging said clip around the margin of said U-shaped notch, said clip resiliently urging said leadscrew in one direction so as to take up endwise clearance between said leadscrew and said housing.

7. The invention as defined in claim 6, wherein said leadscrew is provided with a circumferential groove adjacent one end thereof, and said U-shaped notch of said retainer clip is engaged in said circumferential groove.

8. A variable resistor comprising an elongated housing having a lengthwise extending cavity formed therein, a leadscrew journaled in said housing and extending through said cavity, a resistance element mounted within said cavity parallel to said leadscrew, a slider operatively engaged by said leadscrew and having a contact wiping on said resistance element, a second cavity in said housing adjacent one end thereof and separated from said first-named cavity by a partition, said partition having hole provided therein through which one end of said leadscrew projects, said projecting one end of said leadscrew having a circumferential groove formed therein within said second cavity, and a spring clip retainer seated within said second cavity, said retainer having a U-shaped notch engaging said circumferential groove, and the ends of said retainer bearing against said partition, whereby said spring clip retainer resiliently urges said leadscrew in one direction.

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UNITED STATES PATENTS

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UNITED STATES PATENT OFFICE
CERTIFICATION OF CORRECTION

Patent No. 2,953,763

September 20, 1960

Marlan E. Bourns et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 47, for "position" read -- positioned --.

Signed and sealed this 15th day of August 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents