

Oct. 24, 1939.

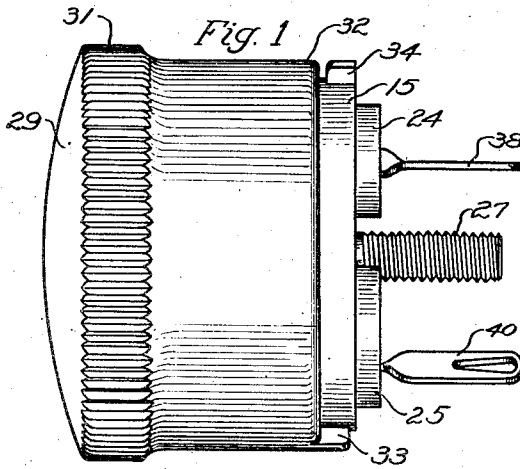
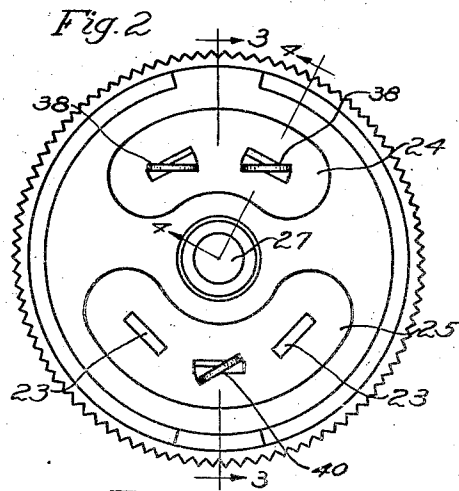
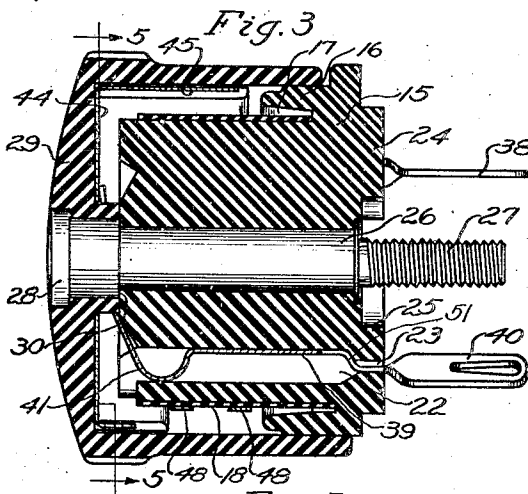
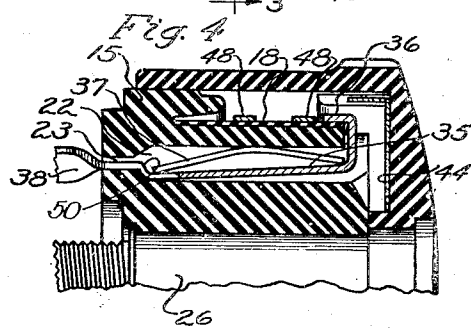
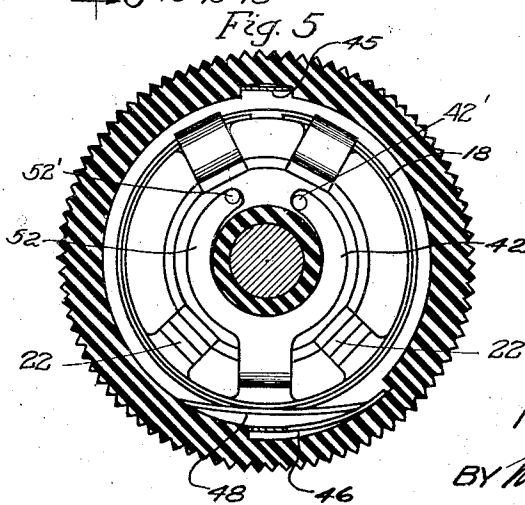
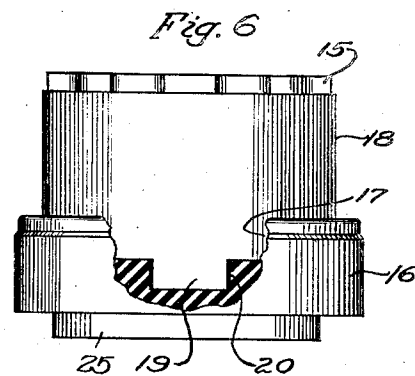
N. C. SCHELLENGER

2,177,285

VARIABLE RESISTANCE DEVICE

Filed March 8, 1937

2 Sheets-Sheet 1



INVENTOR.

NEWTON C. SCHELLENGER.

BY *William Husley, Byron & Knight*
ATT'YS.

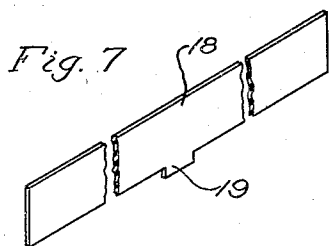
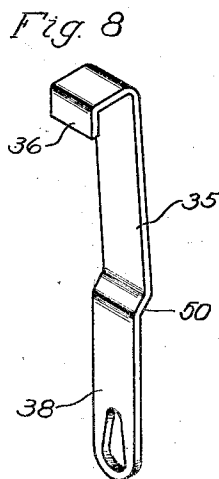
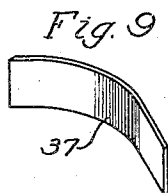
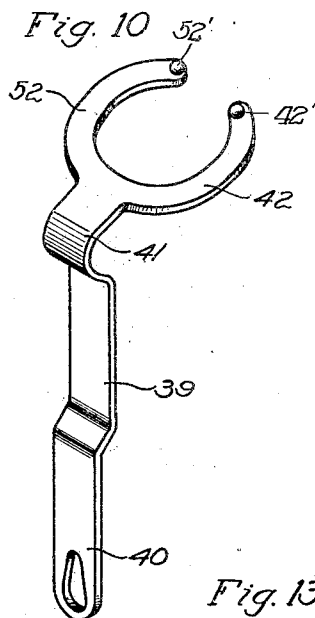
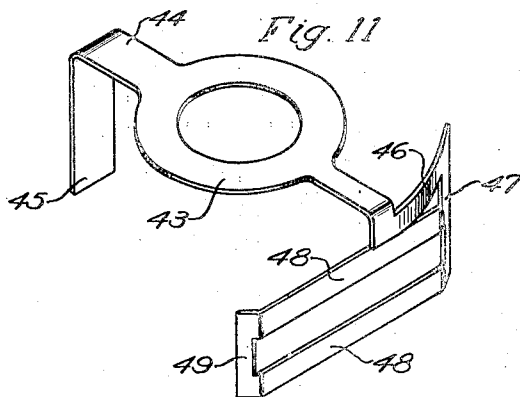
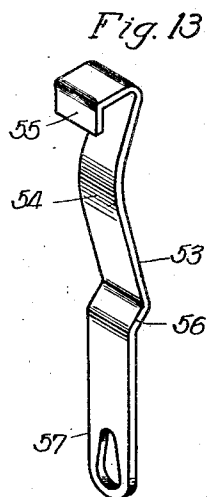
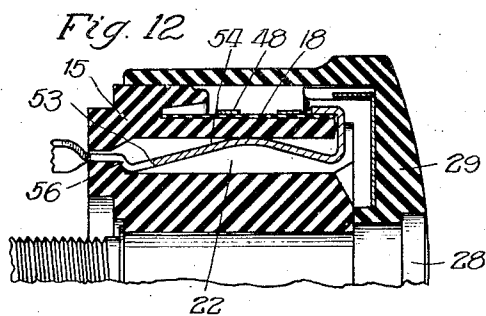
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N. C. SCHELLENGER
VARIABLE RESISTANCE DEVICE

2,177,285

Filed March 8, 1937

2 Sheets-Sheet 2



INVENTOR.

NEWTON C. SCHELLENGER.
BY *Wilkinson, Huxley, Ryerson & Knight*
ATT'YS.

UNITED STATES PATENT OFFICE

2,177,285

VARIABLE RESISTANCE DEVICE

Newton C. Schellenger, Elkhart, Ind., assignor to
Chicago Telephone Supply Company, Elkhart,
Ind., a corporation of Indiana

Application March 8, 1937, Serial No. 129,553

14 Claims. (Cl. 201—55)

This invention relates to a new and improved variable resistance and more particularly to a compact type of device especially adapted for use in connection with radio apparatus or the like.

The present trend with many types of radio receivers and of radio test apparatus is toward reduction in size of the assembly and consequently there is a demand for variable resistances which will occupy a minimum of space upon the chassis or in the set housing. This trend is especially present in automobile radio receivers. It is customary with automobile receivers to locate a control head at a distance from the set proper and to connect the head to the set by means of flexible shafts. The usual construction involves two such shafts, one of which controls the tuning condenser and the other of which controls the volume control of the set, which control is in the form of a variable resistance. The control heads are small in size and it has not been considered practical to install the variable resistance in the head. It is customary to provide a pilot light in the head connected to the radio set by a shielded cable and with a compact variable resistance mounted on the head this cable can carry the necessary conductors with a saving in the expense of one of the flexible shafts, and of the space taken in the set by the variable resistance.

Many types of automobile receivers are also provided with a tone control in the form of a variable resistance. These devices in some cases are mounted in the set to be operated by a knob on the set itself and in other cases are mounted on the control head.

According to the present invention I provide a variable resistance entirely contained within a knob of the size usually used for operating such variable resistances. The only projections from the knob are a securing screw or shaft and the necessary terminals for electrical connection to the variable resistance.

It is an object of the present invention to provide a new and improved variable resistance.

It is a further object to provide a device of this character which is compact in size and adapted to have its working parts enclosed within an operating member or knob.

It is also an object to provide a device comprising a resistance element having a convex contact surface and a contactor normally flat and flexed by engagement with the convex surface.

It is another object to provide a device having

fixed terminals yieldingly urged into contact with the resistance element.

It is an additional object to provide a device in which the several terminals are secured in position in the device by means of deformation of the terminals and without the use of rivets or other separate securing devices.

It is a further object to provide a contact construction in which the contactor and collector ring are integral.

It is also an object to provide a contactor construction in which the contactor engages a convex surface by means of a concave surface of greater radius of curvature and in which the contactor is positively driven in either direction from points below the line of tangency drawn through the line of engagement between the contact and resistance.

It is another object to provide a contact of the character described having a plurality of spaced, separately flexed contact elements.

It is an additional object to provide a variable resistance construction in which a resistance strip is located and positioned by integrally formed means on the base and resistance strip.

It is a further object to provide a construction in which the base is provided with openings into which end, intermediate, and movable contact terminals may be selectively fitted as desired.

It is also an object to provide a variable resistance device in which the operating knob houses the parts and directly drives the movable contact.

It is another object to provide such a construction in which the housing knob has a central bearing on a shaft and a second bearing of its skirt against the periphery of the base, with contacting stops formed in the housing and base.

It is an additional object to provide a device which is compact and comprises few parts designed for commercial production and assembly.

Other and further objects will appear as the description proceeds.

I have shown a preferred embodiment of my invention in the accompanying drawings in which—

Figure 1 is an elevation of one form of construction of the device;

Figure 2 is a view of Figure 1 as seen from the right;

Figure 3 is a section taken on line 3—3 of Figure 2;

Figure 4 is a fragmentary section taken on line 4—4 of Figure 2;

Figure 5 is a section taken on line 5—5 of Figure 3;

Figure 6 is an elevation, partly broken away, of the base with the resistance element assembled thereon;

Figure 7 is a perspective, partly broken away, of the resistance element;

Figure 8 is a perspective view of an end terminal member;

Figure 9 is a perspective view of the terminal spring;

Figure 10 is a perspective view of the terminal making sliding contact with the movable contact member;

Figure 11 is a perspective view of the new movable contact member;

Figure 12 is a fragmentary section, similar to Figure 4, showing a modified form of end or intermediate terminal; and

Figure 13 is a perspective view of the terminal of Figure 12.

In the drawings, the base member 15 which is formed of insulation, is provided with a bottom flange 16 which has formed therein a groove 17 which serves to receive the resistance element 18. The base member 15 may be formed of any suitable insulation material, such, for example, as Bakelite, and may be made by a molding process. The resistance element, as shown in Figure 7, is preferably a flexible strip of fibre or other similar insulating material, which carries a resistance film sprayed or otherwise suitably applied to the outer cylindrical surface thereof. The resistance element 18 is provided on its lower edge with a lug or extension 19 which, as shown in Figure 6, fits into a corresponding recess 20 in the base of the groove 17 in the base member 15.

The base member 15 is further provided with a plurality of openings 22 extending therethrough, these openings being shown in Figures 3 and 4. These openings 22 have reduced portions 23 extending through the lower or bottom portion of the base member. As shown in Figure 2, the base member is provided with five such openings in two spaced groups of two and three respectively. These groups are located in arcuate extended portions 24 and 25 on the bottom of the base member. These extended portions may be fitted in corresponding openings in a mounting plate or set chassis to locate the base member thereon and to serve as insulation between the chassis or plate and the terminals which extend through two or more of the openings.

The axis of the base member 15 is provided with a cylindrical opening which receives the mounting stud or bolt 26. This bolt 26 has a threaded inner end 27 which will pass through the mounting plate or chassis and receive a nut to secure the device in place. The bolt 26 also has an enlarged head 28 which fits in the cup-shaped rotatable housing member 29 to retain it in position upon the base member 15. The bolt 26 is further provided with a shoulder 30 engaging the upper or outer face of the member 15 so as to properly position the housing 29 for rotation without binding.

The housing 29 is provided with a knurled edge 31, as best shown in Figure 1, so as to facilitate its manipulation and rotation. As also shown in Figure 1, the depending skirt 32 of the housing 29 is provided with a lug 33 adapted to engage the lug 34 formed on the base member 15 for the purpose of limiting rotation of the housing in either direction.

The end terminals 35 are fitted in the openings 22 and have reversely bent portions 36 which engage the upper edge of the resistance strip 18 adjacent its ends. One of these terminals is shown in perspective in Figure 8, and its location and engagement is shown in Figure 4. The spring 37 which is fitted in the opening 22 with the terminal urges the terminal toward the axis of the base member 15 and thus serves to press the reversely bent portion 36 of the terminal firmly against the upper edge of the resistance element 18. Consequently there will be adequate pressure and the proper electrical contact between the terminal and the resistance strip throughout the life of the device, since this connection will not be modified by changes in temperature or humidity. It is to be noted that the portion 36 engages only the upper edge of the resistance strip so that the main portion of the strip is available for contact by the rotatable contact member throughout the full arc covered by the strip.

The terminals 35 are each provided with an offset portion 50 which, as shown in Figures 3 and 4, seats against the bottom of the larger portion of the opening 22 adjacent the reduced portion 23 of the opening. This seating positively limits the downward movement of the contact, which is preferably made of such length that there is a slight clearance between the terminal member and the upper edge of the base wall against which the resistance strip seats. This prevents any flexing of the radially extending portion of the terminal such as might adversely affect uniform contact with the resistance strip.

It will be understood that similar terminals may be inserted in the additional openings 22, shown in Figure 5, to provide intermediate taps if desired. Since the terminals engage the resistance strips only adjacent the edge, the same type of terminal may be used at the ends or at any intermediate point.

After the terminals have been put in place, the connection end 38 of each terminal is twisted through a substantial arc so as to firmly retain the terminal in place with the offset portion 50 against the base member and to prevent the terminal being drawn or forced back into the body of the device.

The terminal which makes sliding connection with the movable contact is shown in detail in Figure 10, and also is shown in Figures 3 and 5. This member has a body portion 39 which fits in one of the openings 22 and has a connection portion 40 passing through the reduced opening 23 and twisted to hold the terminal in place with the shoulder 51 seated against the base member at the bottom of the opening 22. Above the body portion 39 is formed a reversely bent portion 41 adapted to seat against the opposite side of the opening 22 from the body portion and thus firmly locate the terminal in the base member 15. Extending from the upper end of the reversely bent portion 41 are the arcuate arms 42 and 52. The arms 42 and 52 are provided with the upwardly rounded sliding contact portions 42' and 52' respectively, which engage the under side of the central circular portion 43 of the rotatable contact element 44. These two contact portions 42' and 52' are preferably located at slightly different distances from the axis of rotation of the member 44 and consequently engage different circular paths on that element. This serves to minimize wear and each contact forms a path to suit its own contour so that a highly efficient

sliding contact is had throughout a long life and continued use of the device. The rotatable contact element 44 is fitted in suitable recesses formed in the base and skirts of the rotatable housing 29.

The member 44 has a depending locating portion 45 at one side and at the opposite side is provided with a circumferentially extending arm 46 terminating in the downwardly extending portion 47. From the portion 47 extend the spaced contact portions 48, the opposite ends of which are joined by the portion 49. These contact portions 48 engage the surface of the resistance strip 18, as clearly shown in Figures 3, 4 and 5 of the drawings. It will be noted that these members 48 are normally flat and are caused to have a slightly concave form in operation, due to the radial pressure exerted upon them by the resistance strip 18. It is therefore possible to manufacture the devices with very uniform contact pressure since the pressure is not dependent upon any permanent deformation of the spring material forming the contact. It will also be apparent from Figure 5 that the thrust which moves the contact members 48 is exerted in a plane below the plane of tangency at the point of contact between the members 48 and the resistance strip 18. This is important as the thrust exerted in this direction does not cause any tendency for the contacts to bite into the resistance strip. It will be apparent that the contacts 48 are moved in one direction by a thrust from the rotatable housing 29 against the member 47 and are moved in the opposite direction by a thrust from the housing 29 against the member 49. Consequently, in either direction the contacts are positively pushed.

The member 43 is unitary so that there is only a single sliding contact connection between the point of engagement with the resistance element and the solder lug end of the member 40. The contact bars 48 are spaced apart a considerable distance and are connected only at their ends. Thus they are substantially independent of each other in their contact action which assures an efficient contact with the resistance element even though parts be not accurately aligned or assembled or the resistance element be rough.

The fact that the contact surfaces of the resistance engaging bars 48 are not deformed or broken during production of the member is important in assuring a smooth and efficient contact for long life. If a metal strip of this character be deformed, as for example in forming it upon a curve, as is necessary in making many types of contactors, the metal is broken. This may not be apparent to the eye but is shown by the microscope. Such a broken surface gradually abrades and wears the resistance element causing a change in the resistance value during the life of the unit. The smooth, unbroken surfaces of the contacts of the present invention glide over the resistance surface without appreciable abrasion of the surface in many thousands of operations of the device.

A modified form of terminal contact member 53 is shown in Figure 13 and is shown in assembled position. This member 53 is similar to the member 35 except for the fact that it is formed of resilient metal and has an intermediate outwardly bent portion to serve the same function as the separate spring member 37 of the form of construction shown in Figure 4. It is provided with the downturned resistance engaging portion 55, the seating offset portion 56 and the

solder lug end portion 57. The terminal of Figures 12 and 13 must be made of spring stock while the terminal of Figures 4 and 8 need not be made of spring stock since the resilient gripping action is provided by the separate spring 37.

The raised portions 24 and 25 on the bottom of the base member 15 serve the function of providing better insulation between the terminals and also serve, when seated in similar openings in a chassis or other support, to prevent rotation of the base and insulate the terminals from the support.

My improved variable resistance is composed of but few parts and the assembly is extremely simple since no separate eyelets or rivets are used. This also insures permanently efficient connections, as eyelets and rivets tend to gradually work loose, especially when used upon bases formed of synthetic resins which shrink more or less as they age.

While I have shown certain preferred forms of construction, it is to be understood that they are capable of further change and modification to meet varying conditions and requirements and I contemplate such other variations and modifications as come within the spirit and scope of the appended claims.

I claim:

1. In a variable resistance device, a base having a cylindrical outer face, axially extending slots in said base, a resistance element located against the outer face of the base, terminals extending through the slots in the base and having reversely bent portions engaging the outer face of the resistance element, and resilient means within the slots urging said terminal portions against the resistance element.

2. In a variable resistance device, a base, a cylindrical resistance element carried by the base, a cup-shaped housing enclosing the resistance element and rotatably mounted on the base, a movable contact carried by the inner face of the skirt of the housing and having an intermediate portion in engagement with the outer face of the resistance element, said contact having its ends positively driven by the housing.

3. In a variable resistance device, a base, a cylindrical resistance element carried by the base, a cup-shaped housing enclosing the resistance element and rotatably mounted on the base, a movable contact carried by the inner face of the skirt of the housing in engagement with the outer face of the resistance element, said contact having its ends positively driven by the housing, and having an intermediate portion spaced from the housing and flexed by engagement with the resistance element to provide a concave surface in contact with the convex surface of the resistance element.

4. In a variable resistance device, a base, a resistance element carried by the base, said resistance element having an outer cylindrical contact surface, a cup-shaped rotatable housing enclosing said resistance, a movable contact carried by the inner surface of the cup-shaped housing, said contact comprising a ring carried in the base of the cup and an integral contact portion extending against the lateral wall of the cup tangentially of the resistance element, the wall having a recess formed therein to receive the contact portion and to positively drive the contact portion upon rotation of the housing in either direction, and a connecting member carried by the base and engaging the ring.

5. In a variable resistance device, a base, a

- resistance element carried by the base, said resistance element having an outer cylindrical contact surface, a cup-shaped rotatable housing enclosing said resistance, a movable contact carried by the inner surface of the cup-shaped housing, said contact comprising a ring carried in the base of the cup, a locating arm extending from one side of the ring and an integral contact portion extending from the opposite side of the ring, the lateral wall of the cup having recesses therein to receive the locating arm and contact portion, and a connecting member carried by the base and engaging the ring.
6. In a variable resistance device, a base member having a lateral wall, a resistance element adjacent the lateral wall, the base member having an opening extending through said member adjacent the lateral wall, a terminal in said opening, one end of the terminal extending beyond the upper wall of the base and reversely bent to engage the outer face of the resistance element, and resilient means in the opening urging the terminal in such direction as to force the reversely bent portion resiliently against the resistance element.
7. A variable resistance device comprising a base, a cylindrical resistance member carried by the base, a rotatable member having a portion movable about the outer face of the resistance member, and a movable contact extending tangentially of the resistance member and carried by said portion of the rotatable member in engagement with the outer face of the resistance element, said contact comprising a flat strip of metal of substantial size having both ends positively engaged by the rotatable member whereby the contact is positively pushed in each direction of rotation.
8. A variable resistance device comprising a base, a cylindrical resistance member carried by the base, a rotatable member having a portion movable about the outer face of the resistance member, and a movable contact carried by said portion of the rotatable member in engagement with the outer face of the resistance element, said contact being positively driven by the rotatable member in both directions, said contact having a normally flat intermediate resistance engaging portion, said intermediate portion being outwardly flexed by engagement with the resistance element to provide a concave surface in contact with the convex surface of the resistance element.
9. A variable resistance device comprising a base, a cylindrical resistance member carried by the base, a rotatable member having a portion movable about the outer face of the resistance member, and a movable contact carried by said portion of the rotatable member in engagement with the outer face of the resistance element, said contact being positively driven by the rotatable member in both directions, said contact having a normally flat intermediate resistance engaging portion, said intermediate portion being outwardly flexed by engagement with the resistance element to provide a concave surface in contact with the convex surface of the resistance element, the positive drive of the contact element being from points closer to the axis of rotation of the rotatable member than a line drawn tangent to the resistance element at the point of contact.
10. A variable resistance device comprising a base, a cylindrical resistance member mounted on the base, a rotatable member adjacent the outer face of the cylindrical resistance member, and a movable contact member carried against the outer face of the resistance element by said rotatable

member, said contact member comprising a plurality of spaced, normally flat portions flexed by engagement with the resistance element, said plurality of portions being integrally joined at their ends and being pushed in either direction by the rotatable member.

11. In a volume control device: a base; a control member mounted over the base, variable resistance means carried by the base and control member and actuated by movement of one with respect to the other; means engageable with the base and a support with which the base is associated for securing the base to the support; terminals projecting from the base adjacent to said securing means and connectible with instrumentalities at the opposite side of said support; and raised portions on the base adjacent to said support, said raised portions being unlike and having areas substantially less than that of the base, and extending between and around the terminals; said raised portions being adapted to coact with openings in the support to hold the terminals spaced from the edges of the openings, and coacting with said securing means to locate the device relative to the support and prevent its rotation with respect to the support.

12. In a circuit control device, a base, the base having an opening therethrough, said opening having a narrow flat portion adjacent one face of the base and an inner shoulder formed in the base adjacent said narrow portion, a terminal member extending through the opening, a bent portion of the terminal engaging the inner shoulder, and the terminal member being twisted adjacent the opposite face of the base to retain the terminal in place.

13. In a variable resistance device, a base, a cylindrical resistance element carried by the base, a cup-shaped housing enclosing the resistance element and rotatably mounted on the base, said housing having spaced shoulders on its inner face, a movable contact comprising a flat strip of metal of substantial size carried by the inner face of the skirt of the housing with its ends engaging the shoulders on the housing, and an intermediate portion of the contact in engagement with the outer cylindrical face of the resistance element, said contact being normally flat and being flexed by engagement with the convex surface of the resistance element.

14. A variable resistance device comprising: a base of insulating material having a cavity therein; a resistance element embracing a portion of the external surface of the base; a contact in said cavity with its inner end having a portion engaging the outer surface of said resistance element and with its outer end projecting from the base through a restricted opening leading from the cavity to the adjacent end of the base; the junction between the inner end of said opening and the cavity defining a shoulder within the base; means on said contact engaging said shoulder to limit movement of the contact with respect to the base in one direction; a shoulder on the end of the contact projecting from the base and engageable with the base for limiting motion between the contact and the base in the opposite direction, said last named shoulder being formed by twisting the end of the contact outwardly of said restricted opening out of alignment with the general plane of the contact; and spring means between the contact and one wall of the cavity for yieldingly maintaining the inner end of the contact engaged with the resistance element.

NEWTON C. SCHELLENGER.