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SUBMINIATURE POTENTIOMETER
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Fig. 2

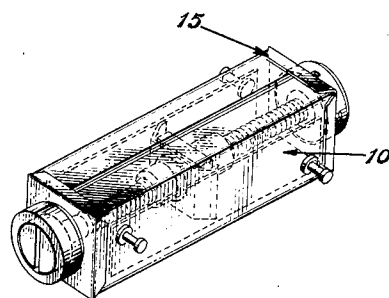
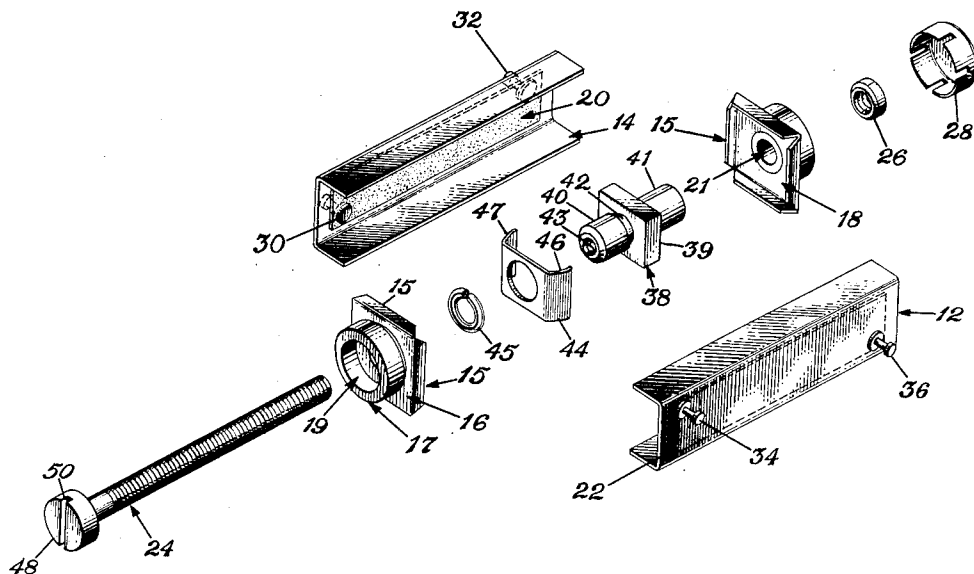


Fig. 1

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SUBMINIATURE POTENTIOMETER

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This invention relates to electrical components with electrical properties or characteristics variable in nature, and is particularly concerned with potentiometers but its principles may be applied to rheostats, variable inductances, variable transformers and the like.

Of the miniature potentiometers now available, the range of resistance is relatively small to the overall length of the potentiometer. I cite a successful miniature potentiometer now commercially available whose length of travel is but $\frac{7}{8}$ of an inch, although its housing is $1\frac{1}{4}$ inches long. There also exists a need for a potentiometer with absolute minimum frontal area (i. e., end surfaces) as required by subminiature electronic circuits. Potentiometers in accordance with this invention may be constructed so as to take up relatively little space and yet give fine adjustment. The absence of external moving and auxiliary parts facilitates insulation and installation in close proximity to other components. This invention has a frontal area one half the size of the smallest potentiometer known to be commercially available and has possibilities, through product design analysis, of resulting in a design of an even smaller frontal area. The subminiature potentiometer of this invention thus is particularly adapted for incorporation in compact electronic equipment and is constructed of a pair of enclosed portions bearing integral conductor and resistance elements, a pair of end plates and a jackscrew between the end plates carrying a wiper element which contacts the conductor and resistance elements.

It is the principal object of this invention to provide a potentiometer of extremely small size, even miniature in form, but maintaining maximum accuracy and ability to render superior service without being affected by conditions of severe shock, acceleration, vibration and extreme temperature conditions.

Another object of this invention is to provide a potentiometer which offers long-life, simple and easy adjustment, and the capability of being enclosed in order to exclude dust, moisture and other injurious media.

A further object of this invention is to provide a potentiometer of the character which is very simple to construct and yet is extremely close and compact in its design with the ability of effective and efficient operation while maintaining the ability to handle the loads to which it may be subjected under various extreme conditions.

A still further object of this invention is to

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provide a potentiometer of small size which allows for easy adjustment of either voltage or resistance without sacrificing accuracy in the precision balancing of electronic circuits.

Yet another object of this invention is to provide a new and useful composition element type resistor potentiometer whose basis for miniaturization exists in the reduction of the area of the resistor element as the frontal area is reduced.

Other objects and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate an embodiment of the invention.

In the drawings:

Figure 1 is an isometric view showing the exterior lines of the potentiometer with interior parts shown in phantom lines; and

Figure 2 is an exploded view in isometric projection showing the individual parts of the invention.

With reference to the drawing, the potentiometer of this invention is in the form of a rectangular parallelepiped housing 10, the main parts of which are a pair of channel-shaped housing members 12 and 14, together with two end caps 16 and 18. The channel members 12 and 14 may be of fiber glass, plastic or other dielectric material having good insulating qualities. The members 12 and 14 are mated so that when their edges are placed in contiguous relationship they form an open-end box-like structure. The end caps 16 and 18 are identical and have flanges 15 along each edge which fit over the ends of channel members 12 and 14 in the assembled condition. A boss 17 extending from the surface of each end cap is recessed as at 19 and centrally bored to provide orifice 21 through the boss and end cap.

A composition resistance element 20 is applied to the inner major surface of one of the housing members as shown on member 14 in Fig. 2. While the resistance composition can be made available in tape form which can be adhesively applied to the member 14, it has been found effective to brush or spray the composition on the surface of element 14 through a silk screen in a manner common to application of paints through screen. The composition used for the resistance element is made up of carbon black and a phenolic resin binder together with sufficient solvent or thinner to bring the compound to a painting or spraying consistency. It will be understood that changes in resistance value can be readily obtained by changing the ratio of the carbon to binder material and the formula is accordingly prepared for the particular resist-

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 ance value desired. Such composition resistor elements provide a high degree of sensitivity and are little affected by temperature changes. Two terminals 30 and 32, in contact with the ends of composition element 20, project through the housing 14 to which they are firmly affixed as by riveting, and provide exterior terminal contacts.

A conductor element 22 is mounted on the inner major surface of dielectric channel member 12. The conductor 22 is made of a highly-sensitive non-corrosive material, such as silver, gold, platinum, phosphor bronze or copper. Two terminals 34 and 36 having contact with conductor element 22 project through channel member 12 to which they are firmly affixed as by riveting to provide exterior terminal contacts. Terminals 34 and 36 also serve to hold conductor element 22 in place on the inner surface of channel member 12.

The end caps 16 and 18 are so constructed as to effectively position the two channel members 12 and 14 which make up the container 10. A screw 24 threaded over its entire shank length is axially mounted in housing 10, passing through the apertures 21 in end caps 16 and 18. The head of screw 24 rests in recess 19 of boss 17 of one end cap while the other end of screw 24 extends through aperture 21 and into recess 19 of the other end cap where it is held in place by setting a collar 26 on the screw and burring the threads so as to join both the screw 24 and the collar 26 together, thus holding the housing elements in position within the confines of the flanges 15 on end caps 16 and 18. The collar 26 is protected from outside interference by means of a dust cap 28 which has a friction fit over boss 17.

A carrier or traveler 38, preferably constructed of a melanin fibre, is provided, having a main body portion 39 and cylindrical bosses 40 and 41 extending on either side of main body portion. The height dimension of the main body portion 39 is such as to provide a sliding fit with the internal surfaces of the flanges of channel members 12 and 14, thus preventing the carrier 38 from turning within the housing, while the width of carrier 38 is less than the distance between the conductor 22 and the resistance element 20. Carrier 38 is drilled and continuously threaded through boss 40, main body 39 and boss 41. A wiper element 44 composed of material having high conductance qualities such as phosphor bronze is mounted on boss 40 and positioned thereon by a lock ring 45 fitting in groove 42 of boss 40. The wiper 44 has arcuately bent side flanges 46 and 47 which present a sliding arcuate surface to the resistance element 20 and conductor 22. The side flanges also serve to hold wiper 44 in position relative to the main body portion 39 of carrier 38. It will be understood that carrier 38 is threaded onto screw 24 prior to the assembly of the screw to the housing elements 12, 14 and end caps 16, 18 as explained in the preceding paragraph. The bosses 40 and 41 of carrier 38 act as stop members when they abut end cap 16 or 18, thus limiting the movement of carrier 38 within the contacts 30, 34 near one end of the housing and contacts 32, 36 at the other end of the housing.

The head 48 of the adjusting screw 24 is slotted as at 50 to permit adjustment by means of a screwdriver.

The adjustment of the potentiometer is brought about by rotating the head 48 of the adjusting screw 24 relative to the adjustment desired. When head 48 is rotated, the jackscrew effect of

screw 24 moves carrier 38 and wiper 44 along the length of the adjusting screw 24, wiper 44 being in contact with both the composition resistor 20 and the conductor plate 22. The desired resistance setting may thus be obtained on test bench adjustment before the potentiometer is put into use in an electrical circuit.

It will be understood that the two contacts 34 and 36 to the conductor 22 are provided for multiple circuit connections, if desired.

While only one embodiment of the invention has been shown in the accompanying drawings, it will be evident that various modifications are possible in the arrangement and construction of these electrical components without departing from the scope of the invention.

Now having described and explained the nature of this invention I claim:

1. An adjustable potentiometer for miniaturized equipment comprising: two mating channel-shaped members forming a parallelepiped housing, end caps adapted to fit over the ends of said channels, an axially mounted screw extending through said end caps having an adjusting head extending externally of said housing and a collar fixedly mated to the end of said screw opposite said head, a traveler adjustably mounted on said screw within said housing, a composition resistance element mounted on an interior wall of one of said channel members, a conductor plate mounted on an interior wall of said channel member opposite said resistance element, a wiper element mounted on said traveler having electrical contact with said composition resistance element and said conductor plate, and terminals having individual contact with said resistance element and said conductor plate and extending externally of said housing.

2. A variable potentiometer comprising a parallelepiped shaped housing, a composition resistance element composed of a carbon compound painted on an internal wall of said housing, a conductor plate mounted on the internal surface of the opposite wall of said housing, terminal elements contacting each of said resistance element and said conductor plate and extending externally of said housing, a traveler mounted within said housing having a means of adjustment outside of said housing, and a wiper carried by said traveler and having sliding contact with said composition element and with said conductor.

3. A miniature variable potentiometer comprising, a pair of mating dielectric channel members forming a housing, a pair of flanged end caps fitting over the ends of said mating channel members, a screwjack axially mounted in said housing through said end caps to hold said channel members and said end caps in assembled position and having an external adjustment means, a traveler mounted on said screwjack having a sliding fit with two walls of said housing, a carbon composition resistance element applied to one internal wall of said housing, a conductor element mounted on an internal wall of said housing in opposed relationship to said resistance element, wiper means fixedly mounted on said traveler and contacting said resistance element and said conductor element, and terminals in contact with said resistance element and said conductor element and extending exteriorly of said housing.

4. A miniature variable potentiometer comprising, a pair of mating dielectric channel members forming a housing, a pair of flanged end

caps fitting over the end of said mating channel members, a screwjack axially mounted in said housing through said end caps to hold said channel members and said end caps in assembled position and having an external adjustment means, a traveler mounted on said screwjack having a sliding fit with two walls of said housing, a carbon composition resistance element applied to one internal wall of said housing, a conductor element mounted on an internal wall of said housing in opposed relationship to said resistance element, wiper means fixedly mounted on said traveler and contacting said resistance element and said conductor element, terminals in contact severally with said resistance element and said conductor element and extending through said housing to form external terminal points, and axial protrusions on either side of said traveler to limit the end travel of said traveler by abutment against said end caps.

5. A miniature variable potentiometer comprising, a pair of mating dielectric channel members forming a housing, a pair of flanged end caps fitting over the end of said mating channel members, a screwjack axially mounted in said housing through said end caps to hold said channel members and said end caps in assembled position and having an external adjustment means, a traveler mounted on said screwjack having a sliding fit with two walls of said housing, a carbon composition of lamp black, resin and toluene in combination to form a painted resistance element which is applied to one internal wall of said housing, a conductor element mounted on an internal wall of said housing in opposed relationship to said resistance element, wiper means fixedly mounted on said traveler and contacting said resistance element and said conductor element, terminals in contact severally with said resistance element and said conductor element and extending through said housing to form external terminal points, and axial protrusions on either side of said traveler to limit the end travel of said traveler by abutment against said end caps.

6. A variable miniature potentiometer comprising; a housing constructed of a pair of mating dielectric channel shaped members, one of which includes a composition resistance element painted on an interior surface thereof and the other of which contains a silver strip conductor mounted on an interior surface thereof, terminal contacts inserted through said channel members contacting said resistance element and said conductor to provide contact points exteriorly of said housing, a pair of end caps adapted to cover the ends of said channel members, a wiper adapted to contact said resistance element and said conductor, and means external of said housing for adjusting the position of said wiper within said housing to vary the resistance value.

7. The method of making a variable miniature potentiometer comprising the following steps: first, painting an interior surface of a channel shaped member with a resistance composition composed of carbon black, resin and toluene, second, mounting a silver conductor plate to the interior surface of a second mating channel shaped member, next, installing terminal contacts through each of said channel shaped members in contact with said resistance composition and said conductor element, interpositioning a traveler and wiper element to a screwjack and assembling said screwjack assembly through said end caps, and assembling said end caps to said mating channel members to form a housing whereby said screwjack is positioned axially within said housing in a position where said wiper contacts both said resistance composition and said conductor element.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,371,049	Oler	Mar. 8, 1921
2,178,241	Rubinstein	Oct. 31, 1939
2,229,072	Green	Jan. 21, 1941