Feb. 10, 1959 G. H. ELLIOTT 2,873,338

POTENTIOMETER

Filed July 2, 1956

FIG. 1.

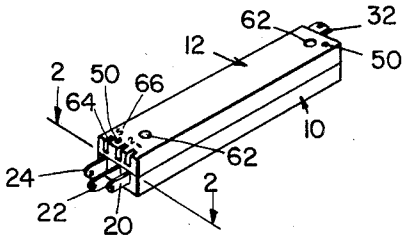


FIG. 3

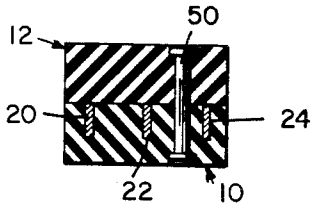


FIG. 2.

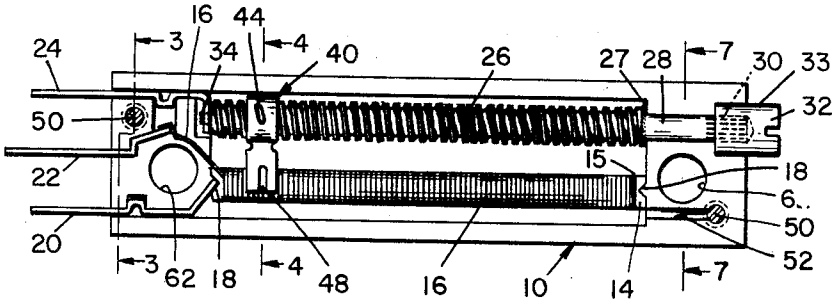


FIG. 4.

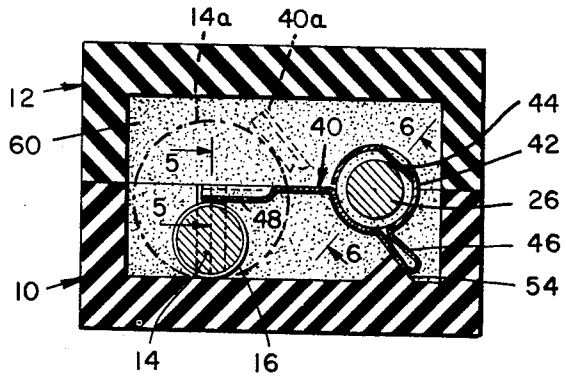


FIG. 5.

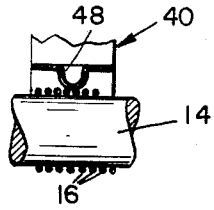


FIG. 7.

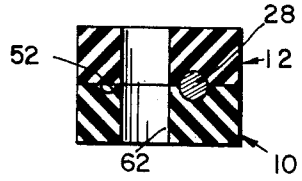
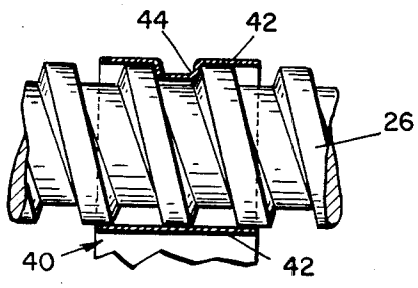


FIG. 6.



INVENTOR

GEORGE H. ELLIOTT

BY

ATTORNEY

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POTENTIOMETER

George H. Elliott, Burbank, Calif., assignor to Dale Electronics Corporation, Burbank, Calif., a corporation of California

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6 Claims. (Cl. 201—62)

This invention relates to an improved potentiometer or variable resistor, and has for one of its principal objects, the provision of a device of the class described wherein the contact member is shifted from a point exterior of the containing case, and wherein shifting provides a highly accurate adjustment.

One of the important objects of this invention is to provide a potentiometer which is extremely light in weight, very compact, composed of a minimum number of parts, and simple of construction and assembly.

Another important object resides in the provision of a resistor which will be highly resistant to changes in temperature and humidity.

Yet another object is to provide, in the device a current carrying contact element which is so constructed with relation to its support that lost motion and consequent vibrations and inaccuracies are practically completely eliminated.

Another and still further important obejct resides in the relationship of the wiper arm to the winding contact wherein back-lash and other mechanical discrepancies are eliminated, particularly when the motion of travel of the wiper arm is reversed from one direction to the other.

A still further object resides in a construction of the device wherein electrical noise, which is usually caused by discontinuity between the winding and the wiper arm and which may result from minute particles of dirt or corrosion, is eliminated.

Other and further important objects of the invention will be apparent from the disclosures in the accompanying drawings and following specification.

The invention, in a preferred form, is illustrated in the drawings and hereinafter more fully described.

In the drawings:

Figure 1 is a perspective view of the improved potentiometer of this invention.

Figure 2 is an enlarged section taken on the plane of the line 2—2 of Figure 1.

Figure 3 is a vertical section taken on the broken line 3—3 of Figure 2.

Figure 4 is a still further enlarged section on the line 4—4 of Figure 2, looking in the direction indicated by the arrows.

Figure 5 is a detail section on the line 5—5 of Figure 4, looking in the direction indicated.

Figure 6 is a further enlarged section on the line 6—6 of Figure 4.

Figure 7 is a section on the line 7—7 of Figure 2.

As shown in the drawings:

The reference numeral 10 indicates generally the bottom portion of the case which contains the elements of the potentiometer of this invention. A top portion 12 completes the container and each section is provided with a longitudinal cavity as best shown in Figure 4.

These elements 10 and 12 are preferably composed of a molded plastic or the like, which has desirable insulating and other resistant properties.

Positioned in the lower portion 10 is a resistance element which comprises a metal bar 14, wound with wire 16, insulated therefrom. The bar 14 is notched at each end as shown at 18, for better and more accurate positioning in the case, and also to prevent undesirable rotation, and additionally for a proper juxtaposition at one end thereof, with a current carrying terminal 20.

The wire 16 is soldered or otherwise permanently affixed to the outer end of the bar 14 for a proper current carrying connection as indicated at 15.

Another terminal 22 is fitted into the case 10 in a slot designed therefor, and this is connected to the wire 16 of the resistance element, as best shown in Figure 2.

A third terminal 24 is also fitted into the corresponding end of the case 10, and likewise in a slot designed to receive the same and firmly hold it in position against twisting or pulling out.

All of the terminals are preferably of beryllium copper and may be heat treated and plated with gold or some other precious metal. The terminals will not be affected or shifted by normal soldering and wire leads can be furnished if desired.

Mounted for operating contact with the terminal 24 is a threaded screw or bar 26 which is designed for rotation in the case, and has one end 28 fitted into a groove in the case for that purpose. The outer end of the portion 28 is serrated or knurled as at 30, for the reception of a slotted screw head 32, which is preferably of insulating material, and which has a portion thereof in a cylindrical recess formed in the two halves of the case.

The other end of the screw threaded bar 26 has an integral cylindrical extension 34 which fits into a circular opening in the inner end of the terminal 24 for suitable rotatable and current carrying cooperation therewith.

A crimped washer 27 surrounds the shaft 28, behind the screw threaded portion in order to maintain the same in proper position at all times, and the slotted screw head 32 is preferably encased in a metal cylinder 33 in order to keep the same from breaking or chipping.

A wiper arm 40 is mounted on the screw threaded bar 26, and this is a unitary element having a circular portion 42 adapted to practically surround the bar 26. This circular portion is indented as at 44 (Figure 6), so as to accurately fit into the recess between the threads of the bar 26. A tail piece 46 is provided for maintaining a secure contact and proper fitting between the parts, and the outer end of the wiper arm 40 is dished as shown at 48 in Figures 4 and 5, whereby suitable contact will always be provided with the adjacent portions of the resistance wire 16 on the bar 14.

The looped portion 46 of the wiper arm 40 rides against and along an integral ledge 54, formed in the bottom of the case 10, whereby desirable positioning and proper contact between all the elements is positively provided.

Aligned openings are provided in the elements 10 and 12 for the reception of fastening rivets or the like 50, and a groove 52 (Figure 2) leads from one of the rivet openings to the interior cavity of the case portion 10. Before the rivet 50 is fitted into this opening for final assembly, a quantity of some suitable filler material, as a silicone grease 60, is injected into the interior of the assembled case. This evacuates all of the air and moisture from the unit and the second rivet is then installed to completely seal the device. This grease not only prevents ingress of air and moisture under extreme conditions of pressure and temperature, but also eliminates the possibility of explosions when soldering, and further acts as a vibration damping agent for the wiper to winding contact. It has been found that this filled will not interfere with the action of the wiper as the same is very

thin and when it is moved it merely slices through the grease, displacing a very small volume thereof at any time.

Openings **62** are provided in the case for the reception of suitable screws or other fastening elements, and the terminals can be made more readily identifiable by adjacent slots **64**, cut into the leading edge of the upper portion **12** of the case, and these slots can be identified by numbers or by colors, as best indicated at **66** in Figure 1.

A wiring diagram can also be imprinted, embossed or otherwise indicated on the case.

It will be evident that herein is provided a potentiometer which includes many variable, novel features, such as absence of vibration, proper linearity, a wide range of adjustment so far as resolution or resistance is concerned, practically complete elimination of back-lash, low starting and running torque and elimination of electrical noise. The unit itself is of minimum dimensions, and the material has a high heat resistance, is non-nutrient, and has good dielectric characteristics. The lead screw to the terminal construction provides for zero end shake, which is important if vibrations occur along the screw axis.

The wiper arm **40** is especially designed, is of beryllium copper, and completely heat treated to eliminate fatigue in wiper pressure. It is so designed as to be self-compensating when vibration is applied at a 90 degree angle. The ratchet type action provided by the indentation **44** prevents damage even though the screw is turned beyond the limit of movement of the wiper arm. The wiper arm is preferably platinum plated. As indicated by the dotted lines **14***a* and **40***a* in Figure 4, the resistance bar may be made of considerably larger diameter, and the wiper arm can be correspondingly shaped so as to provide a greater available length of resistance wire and consequently a finer adjustment.

The wiper arm lead screw, the winding mandrel, and the wiper arm, are all composed of the same metal, whereby they will all have the same coefficient of expansion, thereby eliminating undesirable changes in resistance value due to temperature variations. The winding is baked and cooled at least three times, providing a distinct advantage by relieving stresses resulting in a more stable end product, and all the parts are passed through an ultrasonic cleaner to eliminate any foreign matter.

Special resistance values, or lower resistance tolerances, can be readily obtained with the devices of this invention, and the units themselves can be readily identified for proper installation in any desired equipment.

I am aware that many changes may be made and numerous details of construction varied throughout a wide range without departing from the principles of this invention, and I, therefore, do not propose limiting the patent granted hereon otherwise than as necessitated by the prior art.

I claim as my invention:

1. A potentiometer comprising a two-part hollow case, a resistance bar having a winding thereon fixed in the case, a screw threaded bar rotatably mounted in the case in parallel relationship with the resistance bar, a wiper arm on the screw threaded bar adapted for movement therealong when the bar is turned, said wiper arm including an extension adapted to contact and travel along the resistance bar, the wiper arm including a cylindrical portion adapted to surround the screw threaded bar, and having an integral loop for maintaining spring pressure and for positioning the arm on the bar, and a longitudinal ledge in one part of the case for sliding contact of the integral loop of the wiper arm therewith.

2. A device as described in claim 1, wherein the wiper arm extension is indented for positive current carrying contact with the wire winding on the resistance bar.

3. A device as described in claim 1, wherein the case is provided with aligned openings therein for the reception of fastening rivets, and wherein a groove leads from one of said openings into the interior of the case.

4. A device as described in claim 3, wherein said groove provides a passageway for injection of a filler.

5. A device as described in claim 4, wherein said filler comprises an air and moisture excluding material.

6. A device as described in claim 1, wherein current carrying terminals are fitted into slots in the case and project therefrom, and wherein additional slots are formed in one portion of the case, said additional slots including identifying and marking insignia.

References Cited in the file of this patent

UNITED STATES PATENTS

857,138	Wobber	June 18, 1907
1,853,798	Brownell	Apr. 12, 1932
2,687,463	Riley	Aug. 24, 1954
2,751,475	Gottschall	June 19, 1956

FOREIGN PATENTS

668,186	Great Britain	Mar. 12, 1952