July 9, 1968 L. RESNICOW 3,392,359

POTENTIOMETER ROTOR BRUSH MOUNT

Filed Oct. 21, 1966 2 Sheets-Sheet 1

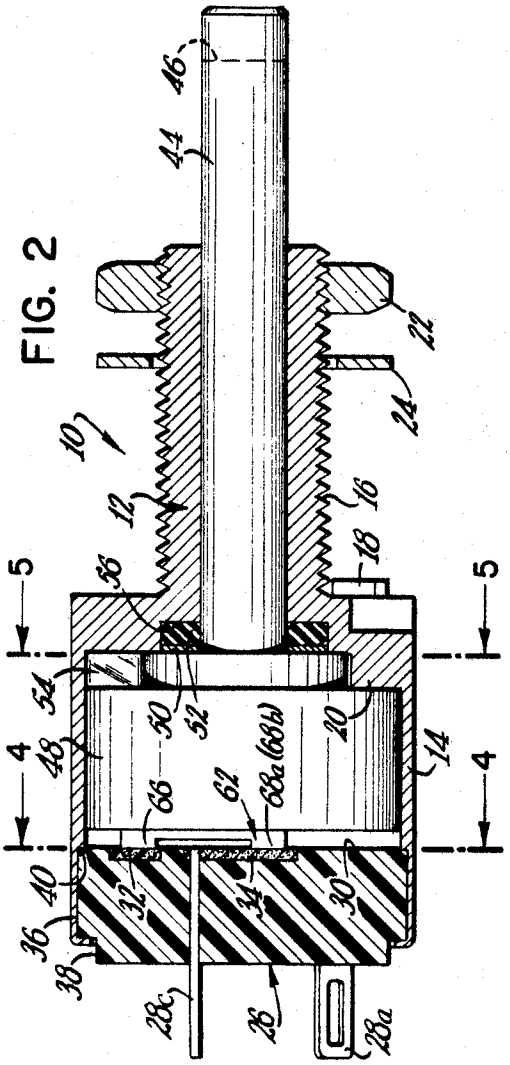

FIG. 2

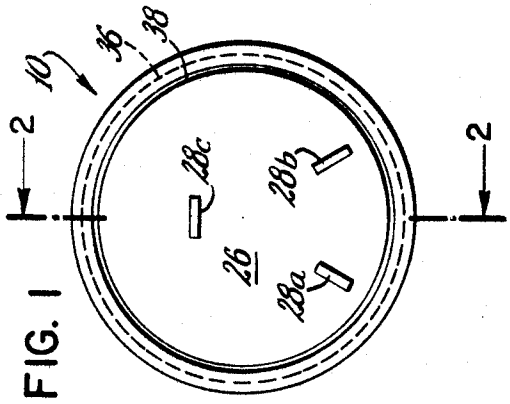

FIG. 1

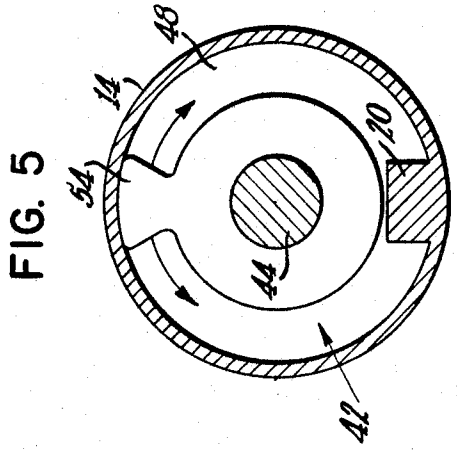

FIG. 5

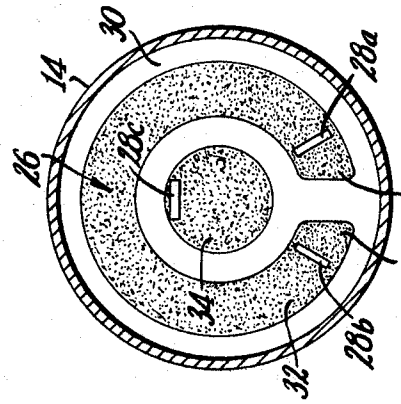

FIG. 4

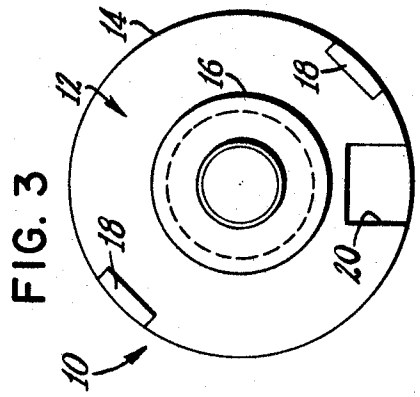

FIG. 3

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POTENTIOMETER ROTOR BRUSH MOUNT

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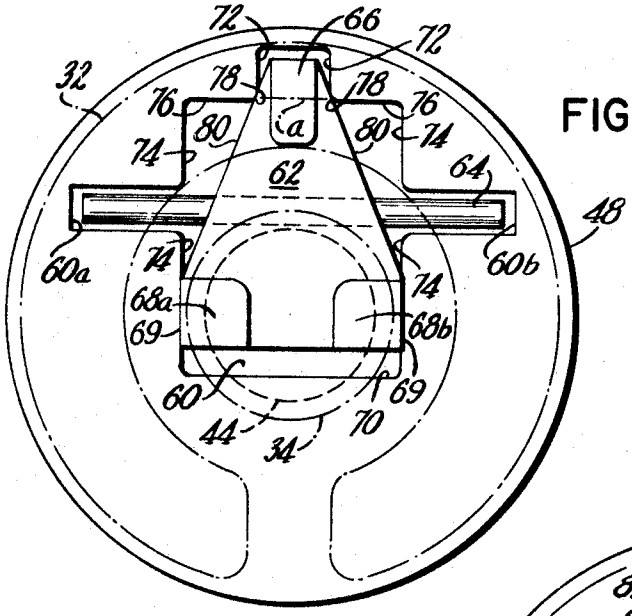

FIG. 6

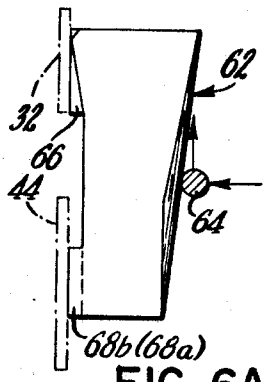

FIG. 6A

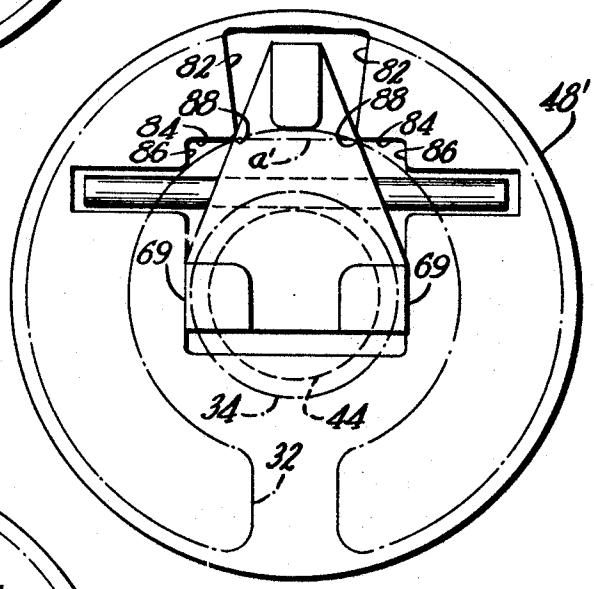

FIG. 7

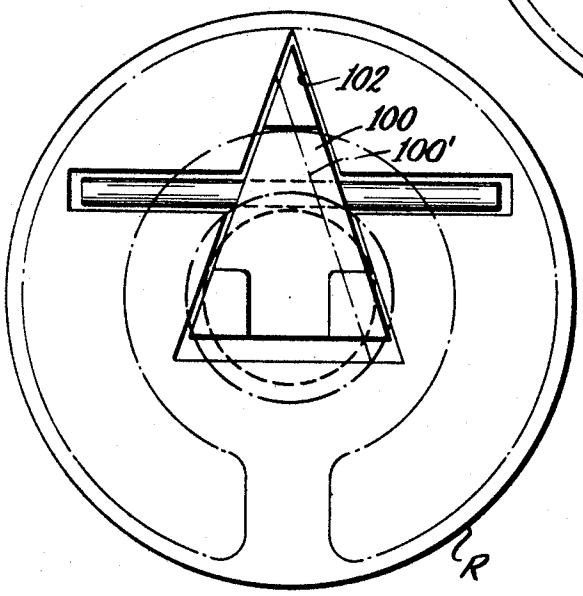

FIG. 8 (prior art)

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POTENTIOMETER ROTOR BRUSH MOUNT

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Filed Oct. 21, 1966, Ser. No. 588,584
10 Claims. (Cl. 338—174)

ABSTRACT OF THE DISCLOSURE

In a potentiometer a brush and rotor wherein a wedge-shaped brush member is provided with steps that permit point contact and wedging engagement with the walls of a recess in the rotor.

This invention relates generally to potentiometers and more particularly to improved brush mounting means in a miniature potentiometer.

A potentiometer illustrative of the general class to which the present invention is directed is described in U.S. Patent No. 2,839,642 granted to C. R. Dickinson et al. on June 17, 1958. The potentiometer is comprised of a hollow metal housing having means permitting its mounting in a panel. The outer end of the housing is sealed off by a closure member that includes a comolded, arcuate resistance track and a centrally located, conductive collector element. Terminal means, in electrical contact with the resistance track and the collector element, extend outwardly of the closure member and are arranged to be connected to the utilization circuit.

A rotor, having an external shaft, is contained within the housing and carries with it a brush member arranged to concurrently wipe both the resistance track and the collector element. It should be noted that two of the terminals are in contact with the two ends of the resistance track that is substantially circular but less than 360°. The third terminal is in electrical contact with the collector element. In the prior art devices a triangular recess is provided in the face of the rotor confronting the resistance track and the collector element so that the brush may be inserted therein together with spring biasing means.

The present invention is particularly directed to improved means for mounting the brush within the rotor. It has been found that in the prior art devices the brush member had a distinct tendency to shift position within the recess of the rotor during angular movement of the external shaft. This displacement of the brush reduced the reliability of the potentiometer because the precise position of the brush with respect to the resistance track could not be accurately and repetitively predicted.

The prior art device referred to above utilizes a triangular brush that is seated in a triangular recess in the rotor end face. Part of the difficulties encountered with the patented construction results from the extreme smallness of the elements, in combination with the necessarily large tolerances required in the fabricating of the parts by molding techniques. In addition, the oversized recess permitted excess movement of the brush in virtually every direction in a plane parallel to the rotor face. Thus, because of the size of the components, the material and the physical shape of the prior art device, a loose fit was an inherent characteristic of the mating parts.

While the present invention utilizes substantially the same size basic elements, and forms them of the same material, means are provided for more positively locking the brush member in place by a wedging action at a precise position within the rotor recess. A generally triangular brush is used but the rotor recess, instead of being triangular, is provided with stepped side walls that permit only point contact with the sides of the brush. From

the drawings and the description that follows it will be apparent that a slight radial movement of the brush is permitted in order that the parts may be easily assembled and to provide the wedging lock, but that no angular movement is allowed the brush relative to the rotor. A spring member is employed to urge the block into the wedged condition and to maintain the brush in sliding contact with the resistance track and collector element. It should be understood that the small radial movement of the brush will not affect the accuracy of the potentiometer, whereas even the slightest angular movement of the brush will adversely affect the reproducibility of the instrument.

Accordingly, it is an object of this invention to provide a more accurate potentiometer in the miniature class.

It is another object of this invention to provide means for more accurately locating the brush of a miniature potentiometer with respect to the rotor thereof.

A particular object is to provide improved locating means on the rotor of a miniature potentiometer for accurately positioning the brush thereof.

Another object is to provide locating means, for a potentiometer as described above, whereby the brush member is permitted only limited radial movement but which locating means constrains the brush from any substantial angular movement relative to the rotor thereof.

Yet another object of this invention is to provide means that lock the brush member in place at precise position desired.

It is a further object of this invention to provide the aforementioned locating accuracy for molded plastic members of a miniature potentiometer.

These and other objects, features and advantages of the invention will, in part, be pointed out with particularity and will, in part, become obvious from the following more detailed description of the invention, taken in conjunction with the accompanying drawing, which forms an integral part thereof.

In the various figures of the drawing like reference characters designate like parts.

In the drawing:

FIG. 1 is an end elevational view of a potentiometer employing the construction of this invention;

FIG. 2 is a longitudinal, sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is another end elevational view opposite to that of FIG. 1;

FIG. 4 is a transverse sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is a transverse sectional view taken along line 5—5 of FIG. 2;

FIG. 6 is an enlarged transverse view schematically illustrating the relationship of the brush and rotor;

FIG. 6A is a fragmentary sectional elevational view of the embodiment shown in FIG. 6;

FIG. 7 is a view similar to FIG. 6 illustrating an alternative configuration of the rotor recess; and

FIG. 8 is an enlarged transverse view schematically illustrating the relationship of the brush and rotor in the prior art device.

A miniature potentiometer, designated generally by the reference character **10**, is illustrated in FIGS. 1, 2 and 3. The potentiometer includes a metal housing **12** defined by a first hollow, cylindrical section **14** having an outside diameter in the order of ½ inch and a second hollow, externally threaded extension **16** integral with the cylindrical section. Locating tabs **18** that facilitate the positioning of the instrument on a panel, extend axially from the transverse interface formed by different diameter sections **14** and **16**. For reasons to be explained subsequently,

the interface is also inwardly deformed to provide a fixed stop member **20**. In the assembled condition nut **22** and washer **24** serve to retain the potentiometer on the panel.

Closure member **26** is a plastic, insulating disc-like element having a plurality of integrally molded electrically conductive terminals **28***a*, **28***b* and **28***c* extending axially from the outer surface thereof. The opposite or inner surface **30** of the closure member has concentric resistance and collector tracks **32** and **34**, respectively, comolded flush thereon (FIG. 4). Resistance track **32** is arcuate in shape, is almost a complete circle and has ends **32***a* and **32***b* which are in electrical contact with terminals **28***a* and **28***b*, respectively. Collector track **34**, which is conductive, is in electrical contact with terminal **28***c*.

Closure member **26** has a first diameter **36** that is slightly larger than a second diameter **38**. In the assembled condition, first diameter **36** is disposed in close fitting relationship with the open end of the housing and seats on a shoulder **40** therein. Initially then the wall of the housing is slightly spaced from the second diameter. When all the internal components are assembled the end of the housing wall is rolled over the interface between diameters **36** and **38** to securely retain the closure member in place.

Rotor assembly **42** is comprised of an elongated shaft **44** having a slot **46** at one end and an insulating plastic rotor **48** molded integrally on the opposite end. The rotor assembly is provided with a thin, metallic washer **50** and a resilient gasket **52** disposed about the shaft. In addition, the rotor also includes a radially extending lug **54** molded integrally with the rear face thereof. In the assembled condition the gasket is seated within a recess **56** in the housing to provide a measure of sealing for the interior of the housing while the lug **54** is in the same transverse plane as stop member **20** in order to limit the angular movement of the shaft to an arc of less than 360° (FIG. 5).

As shown in FIG. 6, the forward end face of rotor **48** is provided with a recess **60** dimensioned to receive a conductive carbon brush member **62**. The opposed ends of an elongated, leaf type spring member **64** are seated in laterally extending portions **60***a* and **60***b* of the rotor recess so that the central part of the spring will bias the brush member in a direction towards the resistance track and the collector element. The phantom outlines in FIG. 6 and FIG. 7 illustrate the relationship of the resistance track and the collector element with respect to the brush.

The relationship of the brush and the spring are shown in FIG. 6A. Spring **64** urges the brush into sliding contact with face **30** of the closure member and also urges the brush in a radial direction to provide the wedging action between the converging brush sides and the inwardly projecting corners of the rotor recess. It should be clearly understood that the radial movement is minimal and is included only to permit easy assembly. In the assembled condition the brush is accurately located and locked in place against further movement by the aforementioned wedging action.

Brush member **62** is substantially triangular and is provided with a raised contact area **66** positioned on one face thereof at the apex of the triangle. Contact area **66** is arranged to slide on the resistance track **32**. A second pair of raised contact areas **68***a* and **68***b* are formed on the same rotor face at the base end thereof and are positioned such that they slide on the collector track **34**. It will be noted that a short length of the brush member sides is parallel near the base thereof.

Referring again to FIG. 6, it will be seen that recess **60** is substantially rectangular and includes base wall **70**, a first pair of side walls **72**, and a second pair of parallel side walls **74** spaced further apart than walls **72** and interfaces **76** connecting one each of the first and second pairs of side walls. The junctures between the interfaces and the first side walls are defined by corners **78**. In the assembled condition the base wall of the triangular brush member is substantially parallel to the recess base wall while the apex of the brush member is disposed between side walls **72**. Thus the converging side walls **80** of the brush member are in tangential contact with corners **78**.

Since the maximum width of the parallel sides of the brush member is substantially the same as the dimension between the parallel side walls **74** of the rotor recess, movement of the brush perpendicular to a radial line is for all practical purposes eliminated. Radial movement of the brush can be closely controlled by accurately gauging the width of the brush at a particular point. For example, since the width dimension between the first pair of side walls and the width of the brush at a line *a* are known to be substantially the same, it will be apparent that the brush cannot move radially away from the rotor shaft and can move only a short radial distance towards the rotor shaft. As a matter of fact, the wedging action side walls **80** of the brush and opposed corners **78** of the rotor recess will serve to accurately lock the brush in place.

An alternative embodiment is fragmentarily illustrated in FIG. 7. The recess of rotor **48'** includes a first pair of side walls **82** that are divergent from each other starting from the point where they are connected to interfaces **84**. The second pair of side walls **86** are parallel to each other and are spaced apart by a dimension substantially equal to the base side of the triangular brush. The converging sides of the brush will be in tangential contact with corners **88** as in the first embodiment.

By way of contrast, the prior art device schematically shown in FIG. 8 provides a loose fit between the rotor recess and the brush. Therefore, the actual position of the brush with respect to the resistance track and the external shaft cannot be reliably predicted. Brush **100** is seated within recess **102** of the rotor R. Since these are the only components of concern in connection with this invention, the remaining elements need not be described in detail. Recess **102** is triangular and somewhat larger than the triangular brush. Thus the brush may move laterally in any direction until one of its sides touches one of the recess walls, as shown in phantom outline at **100'**. Brush **102** may also move radially until its apex abuts the corner of the recess or until its base wall touches the base wall of the triangular recess. It is obvious then that there is no positive locating means provided by the prior art and certainly, since no wedging action is provided, the brush cannot be locked in place with respect to the rotor.

The invention described hereinabove is particularly directed to the construction of a very specific combination of elements in a miniature potentiometer. By providing accurately dimensioned and located shoulders in a rotor recess the brush position remains the same at all times with respect to the resistance track regardless of angular shaft position. Since the brush is substantially triangular in shape and at least one width dimension thereof is accurately controlled, a wedging action is provided with a portion of the rotor recess so that the brush is locked in place against further movement. When so locked it is evident that the position of the brush and the external shaft relative to the resistance track can be repetitively predicated.

Having thus disclosed the best embodiment of the invention presently contemplated, it is to be understood that various changes and modifications may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a miniature potentiometer of the type characterized by a housing, an insulating housing closure member including a comolded resistance track and collector element, terminal means in electrical contact with said resistance track and said collector element, said terminal means being arranged for connection to a utilization de-

vice, a shaft rotatable within said housing and a conductive brush having two converging sides, said brush being arranged to slidably traverse said resistance track and collector element, an improved mounting for said brush comprising in combination:

(a) a rotor carried by said shaft for rotation therewith, said rotor having a recess arranged to receive said brush;

(b) locating means integral with the recess of said rotor, said locating means being in contact with the converging sides of said brush, said locating means being defined by a first pair of side walls, a second pair of side walls, a first interface connecting a wall of said first pair to a wall of said second pair and a second interface connecting the other wall of said first pair to the other wall of said second pair, each of the converging sides of said brush being in tangential abutment with a juncture of one of said interfaces and one of said first pair of side walls; and

(c) biasing means urging said brush into contact with said locating means whereby a wedging action is provided between said brush and said locating means.

2. The combination in accordance with claim 1 wherein said first pair of side walls are parallel to each other.

3. The combination in accordance with claim 1 wherein said first pair of side walls are divergent from each other starting at the juncture of said first pair of side walls and said first and second interfaces.

4. The combination in accordance with claim 2 wherein said second pair of side walls are parallel to each other and have a dimension therebetween substantially equal to the base side of said brush.

5. The combination in accordance with claim 3 wherein said second pair of side walls are parallel to each other and have a dimension therebetween substantially equal to the base side of said brush.

6. An improved miniature potentiometer comprising, in combination:

(a) a housing;

(b) a closure member for said housing;

(c) a resistance track and a collector element formed integrally with said closure member;

(d) terminal means in electrical contact with said resistance track and said collector element, said terminal means being arranged for connection to a utilization device;

(e) a shaft rotatable within said housing;

(f) a conductive brush having two converging sides, said brush being arranged to slidably traverse said resistance track and said collector element in response to the rotation of said shaft;

(g) a rotor carried by said shaft for rotation therewith, said rotor having a recess arranged to receive said brush;

(h) locating means integral with the recess of said rotor, said locating means being in contact with the sides of said brush, said locating means in said rotor being defined by a first pair of side walls, a second pair of side walls, a first interface connecting a wall of said first pair to a wall of said second pair and a second interface connecting the other wall of said first pair to the other wall of said second pair, each of the converging sides of said brush being in tangential abutment with a juncture of one of said interfaces and one of said first pair of side walls; and

(i) biasing means urging said brush into contact with said locating means whereby a wedging action is provided between said brush and said locating means.

7. The combination in accordance with claim 6 wherein said first pair of side walls are parallel to each other.

8. The combination in accordance with claim 6 wherein said first pair of side walls are divergent from each other starting at the juncture of said first pair of side walls and said first and second interfaces.

9. The combination in accordance with claim 7 wherein said second pair of side walls are parallel to each other and have a dimension therebetween substantially equal to the base side of said brush.

10. The combination in accordance with claim 8 wherein said second pair of side walls are parallel to each other and have a dimension therebetween substantially equal to the base side of said brush.

References Cited

UNITED STATES PATENTS

2,514,682	7/1950	Tellkamp	338—163
2,839,642	6/1958	Dickinson et al.	338—174 X

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H. HOHAUSER, *Assistant Examiner.*