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POTENTIOMETER

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Fig. 2

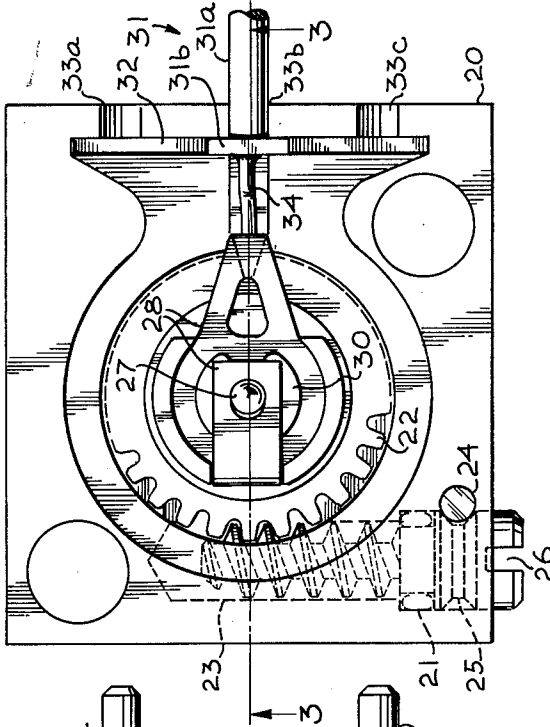
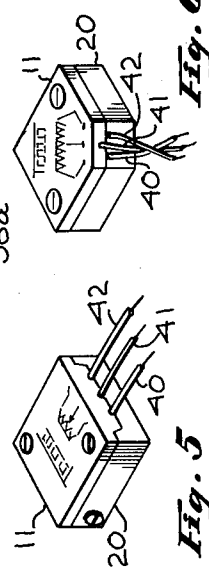
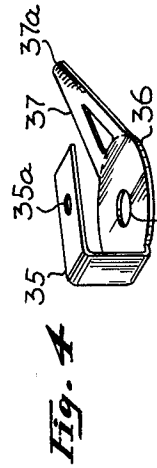
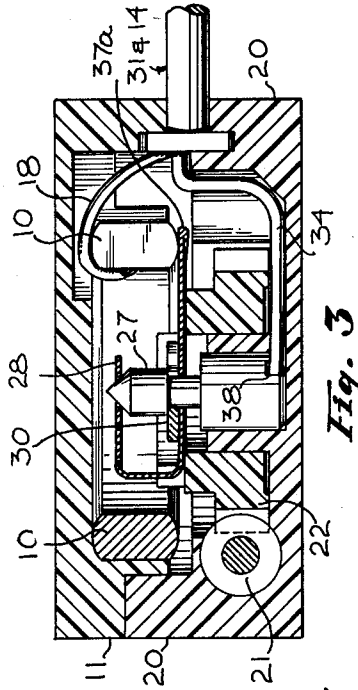
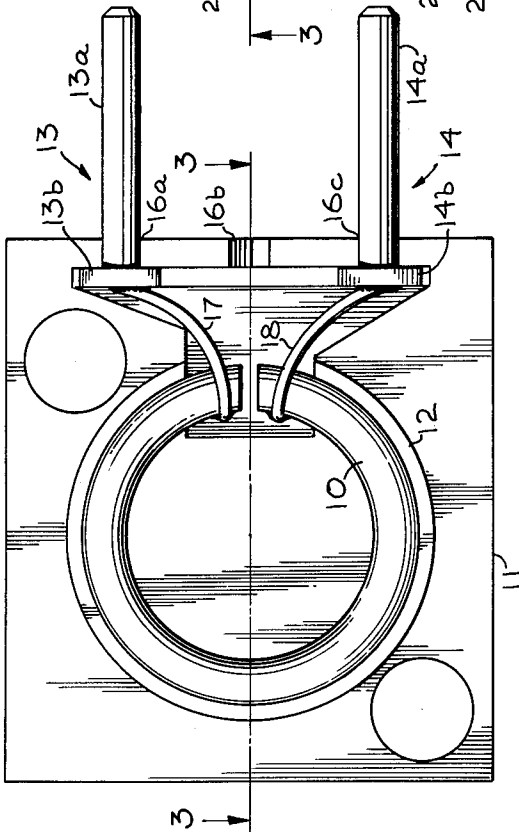


Fig. 1



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POTENTIOMETER

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The present invention relates in general to the field of electrical resistors and more particularly relates to a new and novel potentiometer apparatus.

A potentiometer is basically a variable voltage divider device or, stated differently, it is a resistor which has a variable contact arm so that any portion of the potential applied between its ends may be selected. An almost infinite variety of applications exist for potentiometer devices in the electronics field such as, for example, radio, instrumentation, controls, etc. In radio, for example, potentiometer devices are oftentimes used to intercouple succeeding stages or for volume-control purposes. Again by way of example, in the instrumentation art a potentiometer will oftentimes be used as one of the arms in a bridge circuit of a meter.

One of the big problems encountered today in connection with potentiometers is that of miniaturization. A major effort has been and is still being exerted to substantially reduce the size and complexity of electronic components to meet present and future needs. In keeping with this effort and because of the large number of uses to which it can be put, there is a present need for miniaturized potentiometer. The present invention fulfills this need in that it provides a potentiometer containing fewer parts than prior devices of this type, with the result that the potentiometer to be described herein may be more compact, as well as more mechanically and electrically reliable, than the earlier devices.

It is, therefore, an object of the present invention to provide a potentiometer containing relatively fewer parts.

It is another object of the present invention to provide a potentiometer that is relatively more reliable, both mechanically and electrically. The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawing in which an embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for the purpose of illustration and description only and is not intended as a definition of the limits of the invention.

FIG. 1 is a top view of the resistance element as it is mounted in the potentiometer casing;

FIG. 2 is a top view of the remaining elements as they are mounted in the bottom part of the potentiometer casing;

FIG. 3 is a side-view in cross section of the entire potentiometer assembly;

FIG. 4 is a perspective view of a novel wiper element in the potentiometer of the present invention; and

FIGS. 5 and 6 show in perspective the external construction of the potentiometer and, in particular, respectively illustrate two arrangements for mounting and holding the leads in place.

Considering now the drawings, reference is made in particular to FIG. 1 wherein is shown a wire-wound toroidal-shaped potentiometer resistance element 10 fixedly mounted on the upper part 11 of the potentiometer casing, a suitably shaped recess being provided in member 11 for the resistance element. The wall forming a boundary for the recess is designated 12. The FIG. 1 section of the potentiometer also includes a pair of

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T-shaped connecting pins generally designated 13 and 14, the pins being relatively rigid structurally and being mounted in position on casing member 11. In a sense, connecting pins 13 and 14 resemble ordinary nails in that each connecting pin includes a prong-like element and a head mounted on one end thereof and at right angles thereto. The prong-like element and head for connecting pin 13 are respectively designated 13a and 13b whereas the prong-like element and head for connecting pin 14 are respectively designated 14a and 14b. Casing member 11 also includes a plurality of semicircular openings 16a, 16b, and 16c, in which elements 13a and 14a respectively lie. Thus, connecting pins 13 and 14 are held in position by casing member 11 with elements 13a and 14a protruding therefrom. A pair of wire leads 17 and 18 respectively interconnect the ends of resistance element 10 with connecting pins 13 and 14, lead 17 being connected at one end to head 13b and, therefore, to element 13a, while lead 18 is connected at one end thereof to head 14b and, therefore, to element 14a. Hence, connecting-pin elements 13a and 14a are electrically connected through their associated heads and wire leads to ends of resistance element 10.

Reference is now made to FIG. 2 wherein is illustrated the potentiometer arrangement in the bottom portion 20 of the potentiometer casing. As shown therein, the arrangement includes a worm screw 21 whose threads mesh with the teeth of a gear 22, the worm screw being inserted in a tunnel 23 bored into casing 20 at one side thereof. The dimensions of tunnel 23 are such that the worm screw can be easily turned, the latter being prevented from moving out of the tunnel by means of a keeper pin 24 which extends into a groove 25 circumferentially machined in the body portion of the screw. The unthreaded end of worm screw 21 protrudes from the potentiometer casing and is slotted, that is, contains a keyway 26, so that the worm screw can be turned with the aid of a screwdriver or other device. Gear 22 is mounted on a hollow cylindrically-shaped boss 20a which is centrally located in an upright position on the potentiometer's bottom casing, a pivot 27 being mounted in a vertical position in the hollow of the boss. Immediately above gear 22 and resting on both the gear and pivot 27 is a wiper mechanism 28, the wiper mechanism being held firmly in contact with the gear and pivot by means of a retaining ring 30. As will be shown later in connection with FIG. 3, the retaining ring itself is fastened down by a portion of pivot 27. The arrangement in FIG. 2 also includes a connecting pin generally designated 31, this connecting pin also having two parts to it, namely, a prong element 31a and a head 31b. The head is fitted into a slit 32 formed in the casing and the prong element rests in the center one of three semicircular openings in the casing designated 33a, 33b, and 33c. Needless to say, openings 33a, 33b, and 33c are respectively in registration with openings 16a, 16b, and 16c in FIG. 1 so that when the arrangement of FIG. 1 is inverted and placed as a lid over the arrangement of FIG. 2, these six semicircular openings will be superimposed to form three circular openings in the casing through which the connecting pins will extend, the three circular openings thusly formed together with slit 32 firmly holding the connecting pins in position. Although it is more clearly presented in FIG. 3, a wire lead 34 electrically interconnects head 31b of connecting pin 31 with the base of pivot 27.

Having thus described the two basic units of the potentiometer as they are shown in FIGS. 1 and 2, it would be well at this point to proceed to a description of these two units as they are combined to form a complete potentiometer assembly, as shown in FIG. 3. However, it is deemed worthwhile to present beforehand a more de-

tailed description of wiper mechanism 28 and for this purpose reference is now made to FIG. 4 wherein the wiper mechanism is shown. The wiper mechanism basically includes three elements, namely an L-shaped element 35, an annular shaped disc-like element 36 and a V-shaped element 37. Element 35 has a long side and a short side bent at a right angle to the long side to form an L shape, the long side having an elongated hole 35a therethrough for reasons that will be more fully explained below. Element 36 is integral with and extends from the short side of element 35 and at right angles to it so that element 36 is substantially parallel to the long side of element 35. Element 36 also has a circular hole 36a therethrough located beneath elongated hole 35a so that the two above said holes have the same center line. As for V-shaped element 37, this element is integral with and extends from element 36 upwardly and away from the long side of element 35 so that its plane forms an acute angle with the plane of element 36. Finally, the apex of element 37 is shaped concave downward for reasons that will also be described later.

Reference is now made to FIG. 3 wherein the complete assembly is illustrated. As shown therein, pivot 27 has four major sections, three of them being cylindrical in shape, one above the other, and the fourth section being conical in shape and uppermost on the pivot. More specifically, a bottommost section has the widest cross-sectional diameter, the intermediate cylindrical section has the narrowest cross-sectional diameter, and the third and uppermost cylindrical section has a cross-sectional diameter that is intermediate the previous two. Integral with and extending upwards from the third cylindrical section is the conical-shaped section. Pivot 27 is firmly held in position both by casing 20 and boss 20a, the pivot being cemented to the casing at its base whereat may also be found a keyway 38 into which one end of wire lead 34 is inserted for interconnecting the pivot with pin 31. Gear 22 is mounted on boss 20a and rests on and is supported by the boss. Immediately above gear 22 is mounted wiping mechanism 28, annular-shaped element 36 of the wiper mechanism resting directly on the gear and the long side of L-shaped element 35 resting directly on the conical-shaped section of the pivot. Thus, since element 36 fits around the intermediate cylindrical section of pivot 27, the reason for circular hole 36a is now self-evident. Likewise, the reason for hole 35a in element 35 is now also obvious in that the apex of the conical-shaped section of pivot 27 extends upwards through hole 35a which is purposely elongated to provide a sufficient tolerance so that element 35 will fully rest on this pivot section, thereby achieving good mechanical and electrical contact between the parts. Inserted between element 36 of the wiping mechanism and the third cylindrical-shaped section of pivot 27 is retaining ring 30 which, as its name implies, is used to maintain the wiping mechanism firmly in position on the pivot. With respect to the wiping mechanism, it should be noted that when the potentiometer is completely assembled as is shown in FIG. 3, V-shaped element 37 is pushed downward by resistance element 10 until element 37 lies in the same plane as element 36. As a result, a spring action is produced which has the effect of forcing the apex portion 37a of the wiping mechanism up and against resistance element 10, thereby obtaining good electrical contact between the wiper mechanism and the resistance element.

In operation, the turning of worm screw 21 causes gear 22 to rotate about pivot 27. In turn, wiper mechanism 28, which is firmly locked to gear 22 by retaining ring 30, also rotates about the pivot, apex portion 37a thereby sliding along resistance element 10. In this way, any portion of the over-all voltage applied to the ends of the resistance element through connecting pins 13 and 14 may be tapped, the voltage thusly tapped being applied to connecting pin 31.

Slight modifications of the potentiometer described above are shown in FIGS. 5 and 6. More specifically, as modified, relatively rigid pins 13, 14, and 31 are replaced by highly flexible wire leads 40, 41 and 42. However, in order to prevent these wire leads from being torn loose, as is often the case among potentiometer devices in the prior art, the orifices formed by casing members 11 and 20 and through which the wire leads enter the casing to connect with the potentiometer assembly are of slightly smaller diameter than the leads themselves. As a result, casing members 11 and 20 press against the wire leads and thereby help to firmly keep them in place. In this way, too, therefore, the potentiometer of the present invention is more mechanically reliable.

Having thus described the invention, what is claimed as new is:

1. A potentiometer, the internal structure of said potentiometer comprising: a circular resistance member non-rotatably fixed in position; a shaft-like pivot member immovably mounted along the axis of said resistance element; a wiper mechanism mounted on said pivot member and rotatable thereabout, said wiper mechanism being in direct electrical contact with said resistance and pivot members; input means for applying a potential difference between the ends of said resistance member; output means electrically connected to said pivot member for developing an output potential corresponding to the point of contact between said wiper mechanism and said resistance member; and means for rotating said wiper mechanism to selectively obtain different points of contact between said mechanism and said resistance element.

2. A potentiometer, the internal structure of said potentiometer comprising: a circular resistance member non-rotatably fixed in position; a shaft-like pivot member immovably mounted along the axis of said resistance element; a gear mounted for rotation around said pivot member; a wiper mechanism rotatably mounted on said pivot member and mechanically coupled to said gear, said wiper mechanism being in direct electrical contact with said resistance and pivot members; a worm screw for rotating said gear in order to rotate said wiper mechanism, said wiper mechanism thereby being brought into contact with different points on said resistance member; input means for applying a potential difference between the ends of said resistance member; and output means electrically connected to said pivot member for developing an output potential corresponding to the point of contact between said wiper mechanism and said resistance element.

3. In a potentiometer, apparatus comprising: a hollow structure for housing the potentiometer; a circular resistance element rigidly mounted in the hollow of said structure on one surface thereof; a shaft-like pivot member rigidly mounted in the hollow of said structure on the surface facing said one surface and along the axis of said resistance element, said pivot member including first, second and third cylindrical sections and a conical section one above the other in the order named, said first and second sections respectively having the largest and smallest cross-sectional diameters and said third section having a cross-sectional diameter that is intermediate said other two; a J-shaped wiper mechanism respectively having a pair of co-lined openings through the opposite sides thereof, said pivot member extending through said openings in such a manner that the short side of said wiper mechanism rests on the conical section of said pivot member and is in electrical contact therewith and the long side of said mechanism rings the second section of said pivot member, whereby said mechanism is rotatable about said pivot member, the free end of the long side of said wiper mechanism being in electrical contact with said resistance element; first means for holding said wiper mechanism on said pivot member and in electrical contact with said resistance element; and second means for rotating said wiper mechanism.

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4. The potentiometer apparatus defined in claim 3 wherein said second means includes a gear rotatably mounted in the hollow of said structure on the surface facing said one surface, said pivot member projecting axially through the center thereof; a worm screw for rotating said gear, said screw being mounted on said structure and through a wall thereof to couple with said gear; and a retaining ring for fastening said wiper mechanism to said gear, whereby the rotation of said gear causes said wiper mechanism to rotate.

5. The apparatus defined in claim 3, said apparatus further including first and second connecting pins electrically connected to the ends of said resistance element, said first and second connecting pins extending through a wall of said structure and rigidly held in position thereby; and a third connecting pin electrically connected to said pivot member at the base thereof, said third connecting pin extending through a wall of said structure and rigidly held in position thereby.

6. The potentiometer apparatus defined in claim 4, said apparatus further including first and second connecting pins electrically connected to the ends of said resistance element, said first and second connecting pins extending through a wall of said structure and rigidly held in position thereby; and a third connecting pin electrically connected to said pivot member at the base thereof, said third connecting pin extending through a wall of said structure and rigidly held in position thereby.

7. A potentiometer, the internal structure of said potentiometer comprising: a rigidly mounted circular resistance element; a shaft-like pivot member rigidly mounted perpendicular to and along the axis of said resistance element, said pivot member including first, second and third cylindrical sections and a conical section one above the other in the order named, said first and second sections respectively having the largest and smallest cross-sectional diameters and said third section having a cross-sectional diameter that is intermediate said other two; a wiper mechanism having an L-shaped section, an annular section integral with and extending from the small side of said L-shaped section parallel to the long side thereof, and a V-shaped section integral with and nor-

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mally extending at an angle from said annular section in a direction away from said long side, the apex of said V-shaped section being shaped concavely and opening in a direction away from said resistance element, said wiper mechanism respectively having a pair of co-lined openings through said L-shaped and annular sections, said wiper mechanism being mounted on said pivot member in such a manner than said pivot member extends through said openings with the long side of said L-shaped section resting on the conical section of said pivot member and said annular section ringing the second section thereof, whereby said mechanism is rotatable about and in electrical contact with said pivot member, the apex of said V-shaped section being pressed against said resistance element which pushes said V-shaped section out of its normal position for good electrical contact therewith; input means for applying a potential difference between the ends of said resistance element; output means electrically connected to said pivot member for developing an output potential corresponding to the point of contact between said wiper mechanism and said resistance element between the ends thereof; and means for rotating said wiper mechanism to selectively obtain different points of contact between said mechanism and said resistance element.

8. The potentiometer structure defined in claim 7 wherein said pivot member has a slot at the base thereof, said output means being inserted in said slot for electrical connection with said pivot member.

9. The potentiometer structure defined in claim 7 wherein said means includes a gear mounted so as to encircle said pivot member and rotatable thereabout; a worm screw for rotating said gear; and a retaining ring for fixedly coupling the annular section of said wiper mechanism to said gear.

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