Aug. 10, 1965 W. D. HULBERT 3,200,359

VARIABLE RESISTOR

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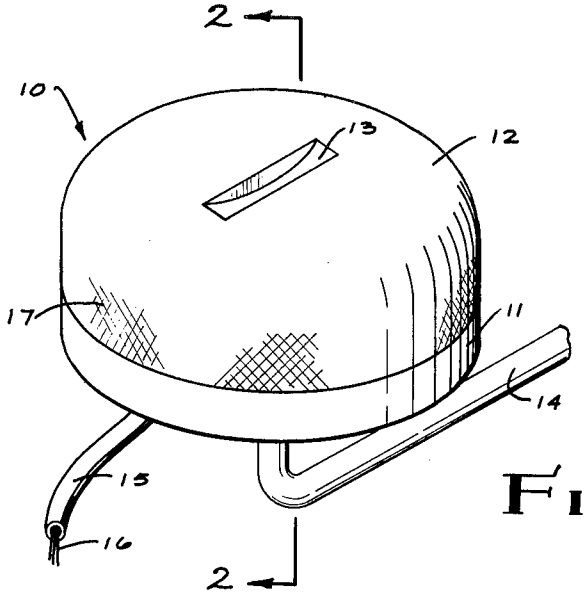


FIG. 1

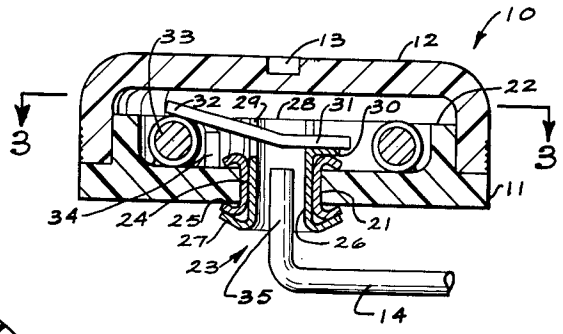


FIG. 2

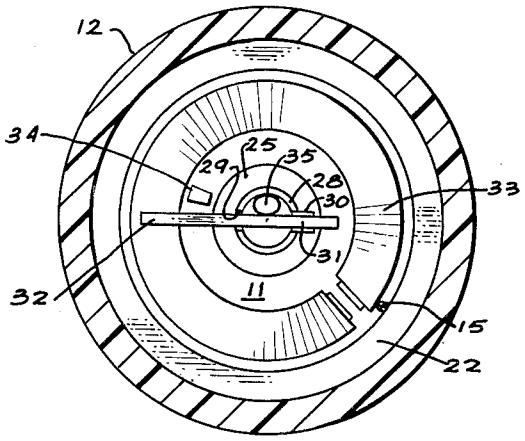


FIG. 3

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VARIABLE RESISTOR

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This invention relates generally to resistors and more particularly to miniature variable resistors which may be directly connected into a circuit with no other means of support.

It is many times desirable to insert a precise amount of resistance in an electrical circuit. This may be accomplished either by using a fixed precision resistor or a variable resistor that is adjusted to provide the desired resistance. The cost of such resistors in most instances is quite significant and in some cases is prohibitive. The fixed precision resistors require special manufacturing techniques to obtain the desired resistance values within the required tolerances. All known prior art trimmer or variable resistors capable of replacing fixed precision resistors require special housing and mounting facilities and are usually more expensive than the fixed resistor would be.

Accordingly it is an object of the present invention to provide a miniature variable resistor which may be utilized by being connected directly into an electrical circuit in the place of fixed precision resistors and which is exceedingly inexpensive to manufacture, is rugged, and requires no mounting accommodations.

Additional objects and advantages of the present invention will become apparent from a consideration of the following description taken in conjunction with the accompanying drawing which is presented by way of example only and is not intended as a limitation upon the scope of the present invention as defined in the appended claims and in which:

FIG. 1 is a perspective view of a variable resistor in accordance with the present invention;

FIG. 2 is a cross sectional view of the variable resistor in accordance with the present invention taken about the lines 2—2 of FIG. 1; and

FIG. 3 is a cross sectional view of a variable resistor in accordance with the present invention taken about the lines 3—3 of FIG. 2.

A variable resistor in accordance with the present invention includes a base member which is electrically non-conductive and which has an axially located opening therethrough with a resistance element mounted thereupon. Extending through the opening is an electrically conductive means which is relatively rotatable with respect to the base. Wiper means is affixed to the electrically conductive means and contacts the resistance element to provide wiping electrical contact therewith.

Referring now to the drawing and more particularly to FIG. 1 thereof, there is illustrated generally at 10 a variable resistor in accordance with the present invention. The variable resistor includes a housing which consists of a base member 11 and a cap 12 having an outer roughened surface 17. Provided within the upper portion of the cap 12 is a recess 13 which may be utilized to receive a screwdriver blade for purposes of adjustment. Extending from the lower portion of the base 11 is a relatively rigid electrical lead 14 and a flexible electrical lead 15 which preferably comprises a plurality of strands 16 of wire having an insulating sheath thereabout.

In use the relatively rigid electrical lead 14 is soldered or otherwise affixed in place at the desired point in the electrical circuit and functions as one electrical connection to the resistor and as the only mounting support for

the variable resistor 10. The flexible lead 15 is soldered or affixed at the desired point. Thereafter the resistor is adjusted by utilization of the screwdriver slot 13 or alternatively the outer vertical surface 17 of the cap 12 may be knurled or otherwise roughened as illustrated to provide a manually graspable area for purposes of varying the resistance imparted to the electrical circuit by the variable resistor 10.

By referring more particularly to FIGS. 2 and 3 of the drawing the internal construction and configuration of the variable resistor will become more readily apparent. As is therein illustrated the base member 11 defines an opening 21 therethrough. The opening 21 is located substantially at the center of the base 11. The base member 11 also defines an upstanding circular ridge 22 which provides a seat for the cap 12 and a locating means for a resistance element 33 which may be cemented or otherwise held in place. As is illustrated the base member 11 and the cap 12 is preferably constructed of an electrically non-conductive material such as a phenolic or similar type resin and may be molded or stamped from sheet material. Extending completely through the opening 21 provided in the base member 11 is an electrically conductive member generally designated at 23. The relatively rigid electrical lead 14 forms a part of the electrically conductive member 23. Also forming part of the electrically conductive member 23 is an electrically conductive hollow member such as an eyelet or hollow rivet-like member 24. The end portions of the rivet-like member 24 are deformed, such that the ends 25 thereof embed themselves within the upper and lower surfaces of the base member 11 thus rigidly affixing the rivet-like member 24 in place.

The rivet-like member 24 provides a bearing surface for the hollow electrically conductive member such as the eyelet or rivet-like member 26 which is inserted within the hollow rivet-like member 24. The lower portion of the rivet-like member 26 is deformed to provide a radially outwardly extending flange member 27 which prevents upward axial movement of the rivet-like member 26. The opposite end 28 of the rivet-like member 26 has a slot 29 formed therein. At least one portion 30 of the material which is removed to form the slot is bent outwardly to form an outwardly protruding tab 30 affixed to the rivet-like member 26. The tab 30 prevents downward axial movement of the rivet-like member 26. The outer diameter of the rivet-like member 26 and the inner diameter of the rivet-like member 24 are selected such that the member 26 is rotatably disposed within and is surrounded by the member 24. In this manner the member 24 functions as a bearing for the member 26 which functions as a rotor as will be more fully explained below.

One end 31 of a wiper arm 32 is rigidly affixed as by spotwelding to the tab 30. As illustrated the end 31 of the wiper arm 32 is affixed at a position which is below a plane formed by the upper surface of the resistance element 33 such that tension is applied to the wiper arm 32 to thereby cause it to make constant electrical contact with the upper surface of the resistance element 33.

An upwardly extending stop member 34 is also provided on the upper furface of the base 11. The member 34 is positioned with respect to the terminal ends of the resistance element 33, as is more clearly seen in FIG. 3, in such a manner that the end portion 31 of the wiper arm 32 contacts the stop member 34 at each terminal end of the resistance element. As is illustrated in FIG. 2 the stop member 34 must be slightly below the plane formed by the upper surface of the resistance element 33 so the wiper arm 32 passes over it but at the same time the end 31 thereof will contact it at the desired point.

In operation the relatively rigid lead is soldered or otherwise affixed at the desired point within the circuit. The flexible lead **15** which, as is illustrated in FIG. 3, is welded to one terminal end of the resistance element **33**, is also affixed at its opposite end at the desired point in the circuit. Thereafter the entire housing of the variable resistor is rotated by the utilization of a screwdriver placed within the screwdriver slot **13** or by manually grasping the exterior portion of the housing and turning it. This causes the entire base to turn about the rotor formed from the rivet-like member **26** thus causing the wiper arm **32** to move along the upper surface of the resistance element **33**. The movement is continued until the desired resistance has been placed within the circuit in accordance with the desired application thereof.

Although only one embodiment of a variable resistor in accordance with the present invention has been disclosed herein it should be expressly understood that various modifications may be made without departing from the scope or spirit of the present invention as defined in the appended claims.

What is claimed is:

1. A variable resistor comprising: an electrically nonconductive base member defining an opening therethrough at substantially the center thereof; a resistance element mounted upon on side of said base member; electrically conductive means extending through said opening in supporting engagement with said base member and including a relatively rigid electrical lead affixed rigidly thereto, said lead being the only mounting support for said resistor, said base and said electrically conductive means being relatively rotatable; a flexible electrical lead connected to said resistance element and adapted to permit said relative rotation; and elecrically conductive wiper means rigidly electrically connected to and affixed to said electrically condutive means and disposed on said one side of said base member for wiping contact with said resistance element during said relative rotational movement.

2. A variable resistor as defined in claim **1** in which said electrically conductive means includes a hollow rivet-like member having an end extending from each side of said base member, said rigid electrical lead being received within and rigidly affixed to said hollow member, each of said ends having at least a portion thereof deformed to restrain said hollow member from axial movement.

3. A variable resistor as defined in claim **1** which includes a hollow rivet-like member having ends extending from each surface of said base, said ends each being deformed by outwardly flaring the same to grip a surface of said base thereby to rigidly fix said hollow member in place, said hollow member surrounding said electrically conductive means and providing a bearing surface therefor.

4. A variable resistor comprising: an electrically nonconductive base member defining an opening therethrough at substantially the center thereof; a resistance element mounted upon on side of said base member; a first electrically conductive hollow member extending through said opening and rigidly secured in place upon said base member; a second electrically conductive hollow member extending through said first member and being relatively

rotatable with respect thereto, a radially outwardly extending flange at one end portion of said second member in contact with said first member to prevent axial movement thereof in one direction, the other end portion of said second member defining a slot therein; electrically conductive wiper means disposed on said one side of said base member within said slot and electrically connected to and rigidly affixed to said second member and contacting said resistance element for wiping contact therewith during said relative rotational movement and a relatively rigid solid electrical lead affixed to said second hollow member and a flexible electrical lead affixed to one end of said resistance element and adapted to permit said relative rotation, said solid electrical lead being the only mounting support for said variable resistor.

5. A variable resistor as defined in claim **4** which further includes stop means extending upwardly from said base member and in which one end of said wiper means contacts the upper surface of said resistance element and the other end thereof is affixed to said second member at a point below a plane formed by the upper surface of said resistance element and extends outwardly from said second member thereby to contact said stop member while said one end passes over said stop member.

6. A variable resistor comprising: an electrically nonconductive base member defining an opening therethrough at substanially the center thereof; a resistance element mounted upon one side of said base member; a first electrically conductive hollow member extending through said opening and rigidly secured in place; a second electrically conductive hollow member extending through said first member and being relatively rotatable with respect thereto, a radially outwardly extending flange at one end portion of said second member in contact with said first member to prevent axial movement thereof in one direction, the other end portion of said second member defining a slot therein; and electrically conductive wiper means disposed on said one side of said base member within said slot and electrically connected to and rigidly affixed to said second member and contacting said resistance element for wiping contact therewith during said relative rotational movement; a relatively rigid solid electrical lead affixed to said second hollow member and a flexible electrical lead affixed to one of said resistance element and adapted to permit said relative rotation, said solid electrical lead being the only mounting support for said variable resistor; and a cap member sealed to said base member covering said resistance element and said wiper means, said cap member having a roughened outer surface thereby providing a manually graspable area for rotating said base member.

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