Aug. 27, 1968 G. SOULAKIS 3,399,369

POTENTIOMETER HAVING HOUSING FORMED OF ELECTRICALLY NON-CONDUCTIVE MATERIAL INCLUDING INTEGRAL HINGE SECTION AND METHOD OF MAKING THE SAME

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Fig. 1

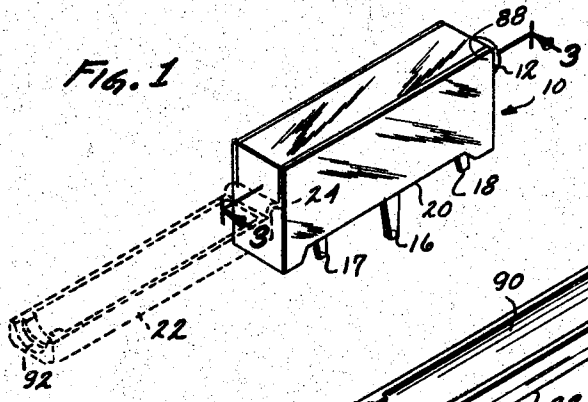


Fig. 2

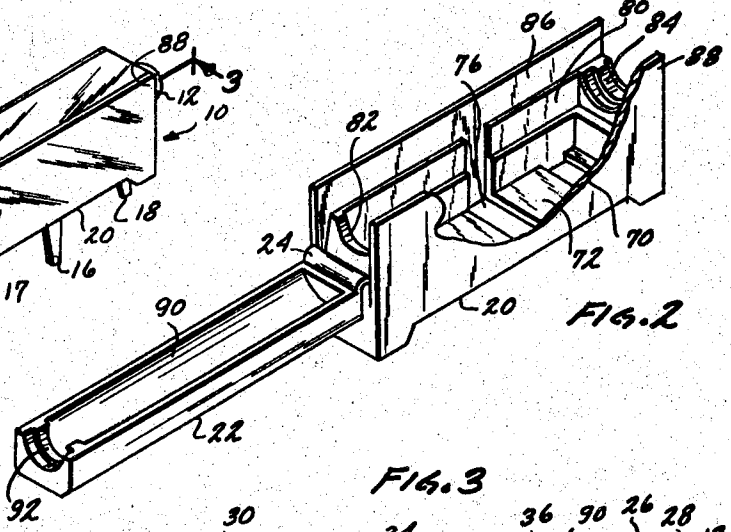


Fig. 3

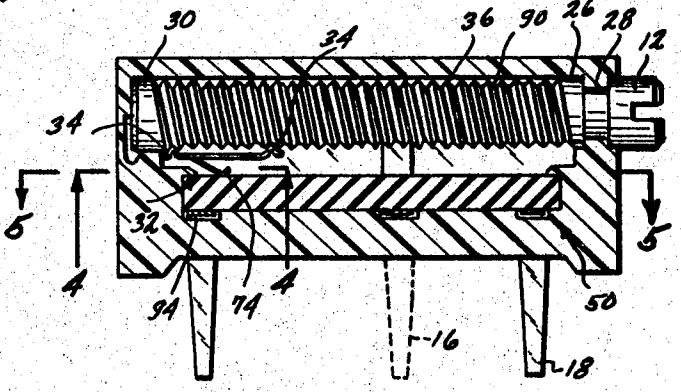


Fig. 6

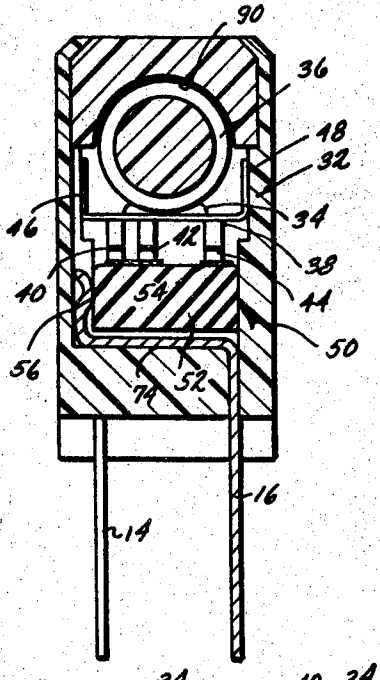


Fig. 5

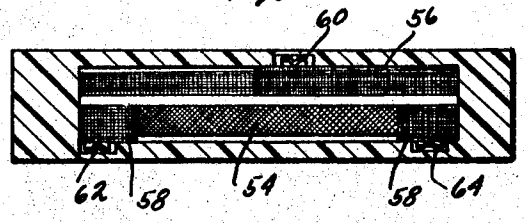
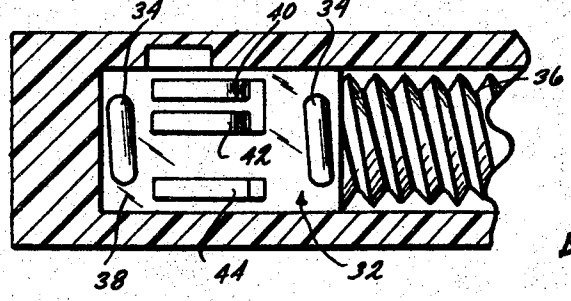


Fig. 4



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POTENTIOMETER HAVING HOUSING FORMED OF ELECTRICALLY NON-CONDUCTIVE MATERIAL INCLUDING INTEGRAL HINGE SECTION AND METHOD OF MAKING THE SAME

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6 Claims. (Cl. 338—180)

ABSTRACT OF THE DISCLOSURE

Disclosed is a potentiometer having a resistance element, electrical contact, and lead screw for moving the contact along the resistance element all disposed within the cavity formed by an integral housing including a base member having side and end walls with a top hinged to one of the walls, the hinged top being held in place by heat forming opposed walls of the base.

This invention relates generally to variable resistors and more particularly to a potentiometer incorporating a unitary housing and which may cooperatively contain a lead screw for traversing a contact means over a resistance element.

As a result of widespread developments in automatic control apparatus and other complex electrical systems, considerable demand exists for potentiometers to provide a variable voltage ratio. One common basic form of potentiometer employs a resistance element adapted to be connected across a source of electrical potential so that each point along a contact path on the resistance element provides a different voltage. Various wiper arrangements have been proposed in the past to contact the resistance element at different points under control of a rotary shaft or other drive means. Of course, the mechanism for positioning the wiper must be supported for movement and such support is frequently attached and referenced to the housing of the potentiometer.

Over the years substantial progress has been made in reducing the cost and improving the structure of potentiometers. However, in general, the mechanism for supporting and driving the sliding contact has remained somewhat expensive to produce and assemble. In this regard, prior forms of lead screw potentiometers have usually required a delicate assembly operation in which the lead screw is carefully fitted or otherwise set within, the housing for relative motion and in proper alignment then the housing is fastened or adhesively sealed closed. Therefore, a need exists for an improved potentiometer structure, wherein delicate assembly operations may be somewhat avoided and which potentiometer may be economically manufactured.

Accordingly, it is an object of the present invention to provide an improved variable resistance element.

It is another object of the present invention to provide a lead screw actuated trimmer potentiometer wherein a sliding contact is variously positioned by a lead screw which is rotatably supported in a housing that is of unitary construction and requires neither adhesives nor separate fasteners.

It is another object of the present invention to provide a lead screw actuated trimmer potentiometer including a unitary housing which may be formed as an integral casting and which provides bearing surfaces for the lead screw and facilitates simplified assembly of the potentiometer structure.

Another object of the present invention is to provide an improved lead screw potentiometer wherein a resistance element may be variously engaged by a contact structure which is driven by a lead screw or similar mechanism that is supported for revolution, within a unitary housing, which housing includes two integral parts joined along parallel edges by an integral hinge section and which housing further incorporates integral fastening means for locked engagement with the lead screw mechanism whereby to hold the potentiometer in closed operating configuration.

Other and more specific objects and advantages of the present invention both as to its method of operation and to its organization 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 claims appended hereto and in which:

FIGURE 1 is a perspective view illustrating an assembled lead screw actuated potentiometer embodying a housing in accordance with the present invention, the top of which housing is also indicated in an open configuration in phantom;

FIGURE 2 is a perspective view illustrating the unitary housing of a potentiometer constructed in accordance with the present invention;

FIGURE 3 is a vertical sectional view taken along line 3—3 of FIGURE 1;

FIGURE 4 is a horizontal sectional view taken along line 4—4 of FIGURE 3;

FIGURE 5 is a horizontal sectional view taken along line 5—5 of FIGURE 3; and

FIGURE 6 is a vertical sectional view taken somewhat centrally through the structure of FIGURE 1.

A variable resistor or potentiometer constructed in accordance with the present invention may have a variety of geometric configurations, and may employ several different types of adjusting mechanisms; however, for purposes of clarity of illustration and ease of description, the present invention is described with respect to a lead screw actuated sliding contact potentiometer. The housing of the illustrative potentiometer is of generally parallelepiped configuration and is formed of an upper section which is affixed by an integral hinge to a lower portion so as to fold into a closed position engaging the lead screw of the potentiometer so as to snap lock the structure in a closed assembled configuration in which the screw is rotatably supported.

Referring now to the drawing and more particularly to FIGURE 1 thereof, an illustrative potentiometer of the lead screw actuated type is shown to include a housing **10** containing a lead screw, the slotted adjustment head **12** of which extends out one end of the housing **10**. Also extending from the housing **10** are downward contact terminals **14**, **16** and **18** passing from the bottom. The terminals **14** and **18** provide connections to the ends of a resistance element while the terminal **16** provides a connection to a sliding contact which is variously positioned by the lead screw head **12**.

The detailed structure of the housing **10** is considered below; however, it is to be noted that as shown in FIGURE 2, the housing includes a body **20** connected to a cover **22** by a hinge **24**, all of which are one integral unit of a single substantially-homogeneous material having yieldably deformable characteristics. Specifically, for example, the material may comprise various plastics as injection-molded styrene. Furthermore in this regard, the housing **10** is formed to receive the internal mechanism in a rotatably supporting relationship, to accomplish the dual functions of preserving the unit closed and providing a reference for rotary motion.

Considering the internal mechanism of the illustrative embodiment in greater detail, reference will now be made

to FIGURES 3, 4, 5 and 6 which are various sectional views taken through the structure of FIGURE 1. As shown in FIGURE 3, the lead screw head **12** is integral with a lead screw **26**, the two elements being joined by a shaft **28** of reduced diameter which matingly receives annular extensions or ridges defined in the housing **10** to provide bearing support as well as locked closure.

The lead screw **26** is journalled into the housing **10** and terminates in a journal section **30** (remote the head **12**) which is also matingly received within the housing **10** for rotary motion. Thus, the entire lead screw structure is supported effectively for rotary motion to variously position an electrical contact element **32** having shaft-engagement ridges **34** extending upwardly to be received by the threaded section **36** of the lead screw. The contact element **32** includes a substantially flat plate **38** (FIGURES 4 and 6) from which the contact fingers **40**, **42** and **44** are stamped, and which further includes perpendicular upwardly extending sides **46** and **48** to slidingly contact the interior sides of the housing **10**.

The contact fingers **40**, **42** and **44** are in flexed engagement with a resistance element **50** (FIGURE 3) comprising a substrate body **52** (FIGURE 6) having a resistive element surface **54** and a collector surface **56** deposited thereon. The resistive element surface **54** is terminated by end sections **58** (FIGURE 5) of low resistance conductive medium. The substrate body **52** may comprise a block of ceramic material while the resistive element surface **50** may comprise variously formed resistive strips, for example a bonded metal composition finally deposited on the substrate element. The collector surface **56** and the end surfaces **58** may comprise a highly conductive metal composition deposited upon the substrate element.

The lead screw threaded section **36** (FIGURE 6) drives the contact element **32** to place the contact finger **44** at various positions on the resistive surface **54**. Electrical contact is then established from the contact finger **44** through the contact element **50** to the parallel fingers **40** and **42** then through the conductive surface **56** (FIGURE 5) to a lug **60** of the terminal **16** (FIGURE 6). Similar lugs **62** and **64** (FIGURE 5) electrically engage the end sections **58** for providing electrical contact to accomplish application of a potential along the surface **54**. Thus, as the lead screw head **12** is turned, the threaded section **36** of the lead screw **26** is revolved to linearly displace the contact element **32** (FIGURE 3) providing a selected contact position of the contact finger **44** on the resistive surface **54** (FIGURE 5). As described, connection from the surface **54** to the collector surface **56** is provided by the bridging contact element **32** (FIGURE 4). From the collector surface **56**, connection to the terminal **16** is provided through the terminal lug **60** (FIGURE 5). It is therefore apparent, that as the lead screw is variously adjusted, the contact element **32** is variously positioned to accomplish the conventional variable resistor or potentiometer function.

Returning now to a consideration of the housing **10** in greater detail the body **20** (FIGURE 2) along with the cover **22** and the hinge **24** may be molded or otherwise formed as a single unit with the hinge disposed along generally parallel adjacent surfaces of the housing body and cover. The interior of the body **20** includes a number of mounting recesses and shoulders for matingly engaging the internal mechanism. Specifically, a traverse central slot **76** is formed substantially at the center of the body **20**, which slot extends across the bottom **72** and perpendicularly in the rear sidewall. The slot **76** recives the collector terminal **16** (FIGURE 6). Specifically the lugs **56** and the traverse section **74** are mated in the slot **76**. Similar slots **70** are provided at each end of the housing across the bottom and opposite wall, to receive the terminals **62** and **64**.

Inside the housing **10** (FIGURE 2) immediately above the slots **70** and **76**, is a substantially rectangular space for holding the resistance element **50**. Above that space the body **20** enlarges to provide guide surfaces **80** on either side of the body for slidably receiving the side extensions **46** and **48** (FIGURE 6) of the contact element **32**. At the ends of the surfaces **80** (FIGURE 2) semi-annular extensions **82** and **84** are formed to provide journal surfaces. That is, the extension **82** provides a bearing surface into which the journal **30** (FIGURE 3) of the lead screw is fitted while the extension **84** is lockingly received in the lead screw by engagement with the recess shaft **28**.

Above the extensions **82** and **84**, the body **20** again enlarges as defined by sidewalls **86** and **88** between which the cover **22** is matably received. Considering the cover **22**, an elongate semi-cylindrical trough **90** extends from the hinge **24** substantially the full length of the cover **22**, to receive the lead screw in journalled relationship so as to support the lead screw for rotary motion. The trough **90** is terminated at a semi-annular ridge **92** which is lockingly received in the lead screw at the shaft **28** in opposed relationship with the semiannular extension **84**.

In the manufacture of the complete unit, as indicated above, the housing **10** may be molded or otherwise formed as a unitary body. The internal components may be variously formed individually employing techniques of the prior art. Specifically, the lugs **14**, **16** and **18** may be stamped of metal or otherwise formed, along with the wiper element **32** which may be formed of berylium copper. The resistance elements **50** carrying the resistive surface and the collector surface may be formed in accordance with well-known techniques of ceramics and deposited metal surfaces. The lead screw may be molded of nylon and glass filled for extensive use with little wear.

In assembling the structure, the contact terminals **14**, **16** and **18** are simply dropped into position within the housing **10** and a portion of the housing is heat formed to hold the pins in place. Thereafter, the resistive element **50** is placed in position and locked therein as by heat-formed locking mechanisms such as tabs **94** (FIGURE 3) as well known in the prior art. Thereafter the contact element **32** is placed in position between the sides of the housing **10** in sliding engagement with the surfaces **80**. The lead screw **26** is then set within the housing and the shaft **28** of the lead screw element is snapped into fastening engagement with the semi-annular extension **84** to seat the lead screw **26** within the body **20**. The cover **22** is next folded over the internal mechanism and the annular ridge **92** is snapped into fastening mating engagement with the shaft **28**. Finally, the upper edges **95**, **96** of the side walls of the housing body are heat formed as shown in FIGURE 3 to effect final closure of the housing and to firmly hold the cover **22** in position for supporting the lead screw over its entire length. Thus, the assembly is completed without the use of any adhesives, auxiliary fasteners or closures to provide an effectively enclosed mechanism with simple operating characteristics capable of prolonged periods of maintenance free use.

An important feature of the present invention resides in the simplicity of assembly which may be accomplished with considerable economy and yet produce an effective variable resistor or potentiometer. There has thus been disclosed an exemplary potentiometer which is simple and inexpensive to manufacture and assemble and which is rugged in construction. Although the structure has been disclosed and described in some detail, such as is not intended as a limitation upon the scope of the present invention as defined in the appended claims:

What is claimed is:

1. A variable resistor comprising:

(A) a resistance element;

(B) at least one electrical contact;

(C) means for traversing said electrical contact over said resistance element; and

(D) a unitary integral housing of electrically non-conductive yieldably deformable material, including:

(1) a first section having a pair of parallel side

wall portions and a pair of parallel end wall portions,

(2) a second section, matable with said first section to define a space for said resistance element, said electrical contact and said means for traversing,

(3) said housing further including a hinge section connecting said first section and said second section along generally parallel adjacent surfaces, said hinge forming a continuous surface of one of said wall portions and further forming a planar surface when said first and second sections are mated.

2. A variable resistor according to claim **1** in which said first section of said housing is the top thereof and defines a trough like depression extending along substantially the entire length thereof and said traversing means is a lead screw journalled in said housing and supported along the length of the threaded portion thereof by said trough like depression.

3. A variable resistor according to claim **2** wherein said means for traversing includes an electrically non-conductive threaded lead screw of molded plastic material extending substantially perpendicular to said parallel surfaces of said first and second housing sections to which said hinge is connected.

4. A variable resistor according to claim **2** wherein said lead screw further includes first fastening means and said first and second sections of said housing include second and third fastening means for engagement with said first fastening means to lock said housing closed.

5. A variable resistor according to claim **2** wherein said housing comprises injection molded plastic material and wherein the upper edges of said second section are heat formed to engage said first section for closing said housing.

6. A variable resistor according to claim **4** wherein said lead screw includes journal means adjacent each end thereof and wherein said housing defines bearing means adjacent each end thereof for matingly receiving said journal means, said journal means at one end of said lead screw including said first fastening means and said bearing means at one end of said housing including said second and third fastening means.

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