Sept. 2, 1958

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2,850,608

ADJUSTABLE ELECTRICAL RESISTORS

Filed Nov. 7, 1955

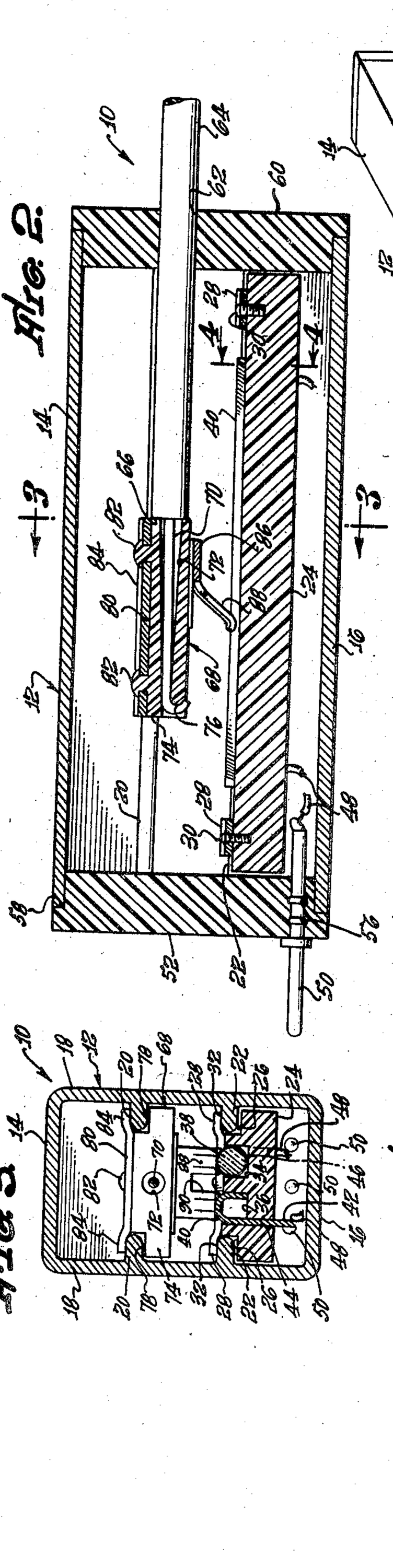

Fig. 2

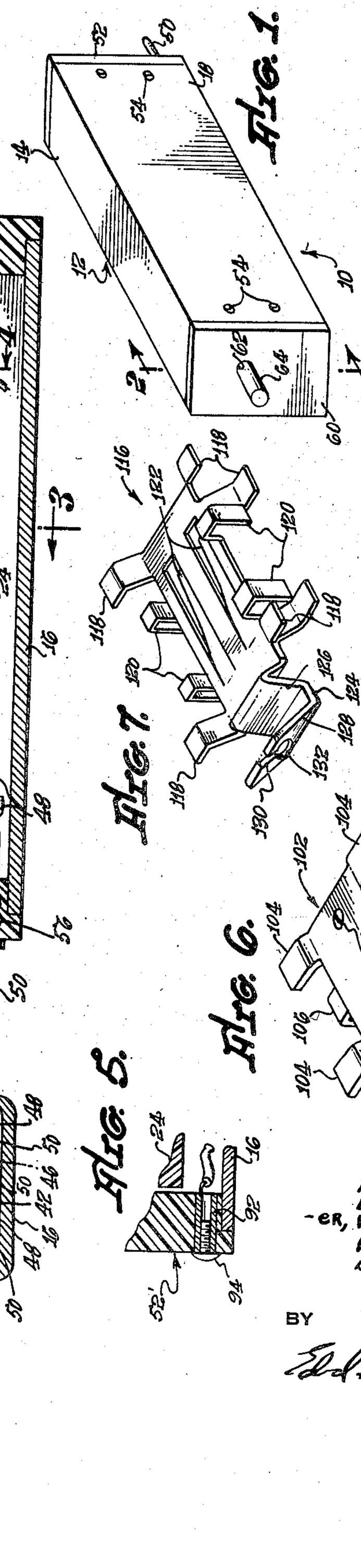

Fig. 1

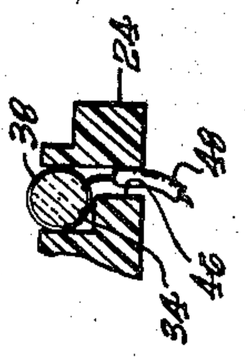

Fig. 4

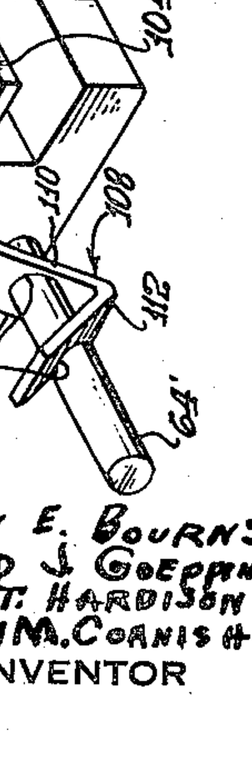

Fig. 8.



Fig. 3



Fig. 5.



Fig. 6.

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2,850,608

Patented Sept. 2, 1958



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# ADJUSTABLE ELECTRICAL RESISTORS

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Application November 7, 1955, Serial No. 545,464

7 Claims. (Cl. 201—62)

This invention relates to new and improved adjustable electrical resistors, and, in particular, to a species of adjustable electrical resistors commonly termed potentiometers.

There is considerable competition amongst manufacturers of potentiometers and like electrical instruments at the present time. A broad aim of this invention is to provide new potentiometers which will serve to give the manufacturers of these new units a competitive advantage over the other instruments presently being manufactured.

A potentiometer, in order to benefit a manufacturer in the present competitive market, must possess a number of distinct advantages over known units. The new potentiometers herein described may be distinguished from known units in a number of different ways, all of which are believed to relate to the commercial utility of these new units.

The new adjustable electrical resistors herein described employ comparatively light weight housings having reinforcing ribs formed on the interior thereof so as to prevent collapse of the walls of the housings. With this type of structure the individual housings utilized may be manufactured out of metals such as aluminum, stainless steel or out of various plastics such as, for example, a high molecular weight nylon composition by extrusion techniques. These housings, once manufactured, may be cut to any desired length by a manufacturer so as to eliminate the necessity of keeping on hand a number of separate different housings of different sizes for different sized units.

Another major advantage of the new units of this invention lies in the fact that a number of different types of end closures may be kept in stock, and these end closures may be used with any size of potentiometer manufactured in accordance with this invention with a standard housing cut from an extrusion. These end closures with the invention may, if desired, be stocked so as to be formed with any type male or female connections, screw type terminals, solder lugs, or the like.

Also end type closures used with the invention can be manufactured so as to provide for virtually any desired type of shaft actuation desired. Thus, rigidly secured shafts can be used with the units herein described by appropriate formation of end closures with the center openings serving as bearings. Also, end closures capable of being used with any of a number of different size units can be developed utilizing screw actuation, flexible shaft type actuation, or the like.

The above discussion will indicate to those skilled in the art certain broad objectives of the invention. It is to be emphasized, however, that the invention is not limited to units having these broad objectives, inasmuch as various different details of construction, as will hereinafter be set forth, are considered to be of independent significance. These details, as well as other objects and advantages of the invention, will be more fully explained by the remainder of this specification including the appended claims, and by the accompanying drawings, in which:



Fig. 1 is an isometric view of a potentiometer manufactured in accordance with this disclosure;

Fig. 2 is a cross sectional view taken at line 2—2 of Fig. 1;

Fig. 3 is a cross-sectional view taken at line 3—3 of Fig. 2;

Fig. 4 is a detailed cross sectional view taken at line 4—4 of Fig. 2;

Fig. 5 is a detailed cross sectional view similar to part of Fig. 2, showing the use of screw type terminals;

Fig. 6 is an isometric view of a modified slider which may be employed with the invention;

Fig. 7 is an isometric view of a second modified slider which can be employed with the invention; and

Fig. 8 is a side view of the slider illustrated in Fig. 7 showing the manner in which this slider is employed.

In all figures of the drawings, like numerals are used to designate like parts whenever convenient for purposes of illustration and explanation. It is to be understood that the invention is not limited to units having the precise shape and dimensions shown in the drawings, inasmuch as considerable modification is possible without departing from the essential nature of this invention as explained in this specification.

The appended claims effectively summarize the novel features of this invention which are considered important. For purposes of explaining the invention, it is possible to briefly state that it is concerned with adjustable electrical resistors, each of which comprises: an elongated housing of rectangular cross section, said housing including parallel top and bottom walls, and parallel side walls; a pair of upper reinforcing ribs located in a plane parallel to said top wall, each of said upper ribs being located on the interior of one of said side walls, said upper ribs being spaced from said top wall and serving to reinforce said side walls; a pair of lower reinforcing ribs located in a plane parallel to said bottom walls, each of said lower ribs being located on the interior of one of said side walls, said lower ribs being spaced from said bottom wall and said upper ribs, and serving to reinforce said side walls; a support member located within said housing so as to extend from adjacent one end thereof to adjacent the other end thereof, said support member being supported by said lower ribs, and being spaced from said bottom; a resistance element carried by said support member so as to have a surface exposed on the side of said support member adjacent to said top; a slider carried by said upper ribs, said slider including resilient contact means projecting therefrom so as to engage said exposed surface of said resistance element so as to establish electrical communication therewith; a closure located within one end of said housing; means projecting through said closure operatively connected to said slider whereby said slider may be moved within said housing causing said resilient contact means to engage different parts of said exposed surface of said resistance element; a closure positioned within the other end of said housing; electrical terminal means attached to said second closure; electrical wires connecting the ends of said resistance element and said terminal means, said electrical wires extending through the space between said bottom and said support member.

Unfortunately, a summary of this category is not considered to be sufficiently explanatory in nature to fully appraise even those skilled in the art to which this invention pertains of the precise nature of the invention. In Figs. 1, 2 and 3 of the drawings there is shown a potentiometer 10 having a housing 12 including top and bottom walls 14 and 16 respectively, and side walls 18. It will be realized from consideration of Fig. 3 that this

housing is of essentially rectangular cross sectional shape, and is formed with comparatively thin wall sections. On the side walls **18** adjacent to the top **14** there are formed upper reinforcing ribs **20** which project into the interior of the housing **12**. These ribs are located in a plane parallel to the top **14**, and are spaced therefrom. A pair of lower reinforcing ribs **22** similar to the upper ribs are also provided on the side walls **18** adjacent to the bottom **16**. These lower ribs are in a plane parallel to the bottom **16**, and are spaced from both the bottom wall **16** and the upper ribs **20**. The housing **12** is preferably formed so as to have two axes of bilateral symmetry located at right angles to one another. Thus, with this construction, the ribs **20** and **22** are spaced from one another along the side walls **18** so as to provide effective reinforcement to these side walls.

Upon the lower ribs **22** there is held a support member **24** extending from adjacent to one end of the housing **12** to adjacent to the other end of this housing so that elongated notches **26** in it fit against the ribs **22**. This support member **24** is held in this position by means of resilient metal retaining clips **28** which are secured to the ends of the support **24** by means of screws **30**. These clips, as is best seen in Fig. 3 of the drawings, are shaped so as to have curved ends **32** which engage the lower ribs **22** tending to center the support member **24** between the side walls **18**.

Within the side of the support member **24** adjacent to the top **14** there are provided two elongated grooves **34** and **36**. The groove **34** is adapted so as to carry a conventional wound resistance element **38** so that a surface of this element is exposed. The other groove **36** is provided with an electrical return **40** consisting of an elongated sheet of metal bent in the shape of a U. This electrical return includes a projecting end or tongue **42** which extends through an opening **44** in the support member **24** so as to, in effect, lie within the space between the support member **24** and the bottom wall **16**. Through other openings **46** wires **48** are attached to the ends of the resistance element **38** as by solder or like means so that these ends may be connected to prong type male plugs **50** mounted upon the end closure **52**. A wire **48** is also used to connect the end **42** to one of the plugs **50**. This closure **52** is held within an end of the housing **12** by means of screws **54**. These plugs **50** may be formed so as to include serrations **56** facing the exterior of the housing **12** so that they may be merely driven within the end closure **52** during manufacture so as to be securely mounted. The end closure **52** is preferably formed of any convenient non-conductive material such as, for example, a filled phenolic resin or the like so as to include a peripheral groove **58** enabling the closure **52** to be positioned partially within the housing **12** so that it may not be readily dislodged. The position of the screws **54** is quite important with the invention inasmuch as these screws extend through the ribs **20** and **22**. The walls of the housing **12** are preferably so thin so as not to provide a sufficient thickness for the screws **54** to engage. However, the ribs **20** and **22** are sufficiently thick so as to provide sufficient contact area to enable the screws **54** to be securely mounted or carried by the housing **12**.

Within the end of the housing **12** remote from the closure **52** there is located another end closure **60** which is essentially the same as the closure **52** except that no plugs are provided in this closure **60**, and instead an opening **62** is provided therein so as to serve as a bearing support for a shaft **64** which is used to adjust the potentiometer **10**. An end **66** of the shaft **64** fits closely against a slider **68** which is carried upon the upper ribs **20** as will be explained. This end **66** of the shaft **64** is secured to a small wire **70** which projects through a generally conical opening **72** in a non-conductive block **74** of a phenolic resin or the like forming a part of the slider **68**. The end of the wire **70** remote from the shaft **64** is bent over into a hook shape within a notch **76** in the block **74**.



This construction of the slider is considered to be particularly advantageous inasmuch as when the shaft **64** is moved towards the end closure **52** this shaft hits against the block **74** pushing the slider **68**. This eliminates the problem of the wire linkage used from being ever used under compression where buckling of the wire is likely. When the shaft **64** is moved towards the end closure **60** the wire is under tension and it will be realized that there is substantially no danger of buckling under these conditions. The shape of the conical opening **76** and the wire **70** permits a good deal of misalignment of the slider **68** and the shaft **64** without interfering with the operation of the potentiometer **10**.

The block **74** is provided with edge notches **78** which engage the upper ribs **20** in much the same manner in which the notches **26** engage the lower ribs **22**. This block **74** is held in position against the ribs **20** by means of a top plate **80** secured to the upper surface of the block **74** by means of what, in effect, are the equivalent to rivets **82** formed by melting over projections of the thermoplastic such as nylon material forming the block **74**. This top plate **80** is provided with sides **84** of approximately the same basic configuration as the ends **32** previously described, and is preferably formed out of a resilient metal.

Attached to the surface of the block **74** adjacent to the support member **24** is a resilient contact member **86** which may be formed out of a single sheet of resilient metal; this contact member may be secured to the block **74** in any desired manner. One preferred means for accomplishing this purpose is to metalize part of the surface of the block **74** and then to solder the contact member **86** directly to this metalized surface.

With the preferred construction of the invention, the contact member **86** includes three resilient fingers **88** of different length engaging the resistance element **38**. This contact member also preferably includes three resilient fingers **90** engaging the electrical return **40**. As will be apparent from the close examination of Fig. 3 of the drawings, the center finger of each of these sets is shorter than the outer fingers of each of these sets of fingers so that the fingers effectively engage different areas or paths on the resistance element **38** and the electrical return **40** as the slider **68** is moved. The feature of using a plurality of fingers in this manner is quite desirable as it tends to lower the "noise" obtained during the use of the potentiometer **10**, and also in that the various fingers located in the manner shown serve to engage different parts of the resistance element **38** and their electrical return **40** in such a manner as to tend to prevent any twisting which might occur through maloperation of the slider **68**.

In Fig. 5 of the drawings there is shown a portion of a modified end closure **52'** of the invention employing instead of the plug connections **50** previously described a small metal sleeve **92** provided with a tapped interior surface so that a screw **94** may be secured to it in order to connect the potentiometer **10** into a circuit. Wires **48'** as previously described, are with this modification soldered directly to the sleeve **92**. It will be understood by those skilled in the art that other types of end connections can be substituted with end closures such as a closure **52** in the same manner in which the construction shown in Fig. 5 was created.

In Fig. 6 of the drawings a modified slider **96** of the invention is shown which consists of a block **98** such as the block **74** previously described having secured to the top thereof by means of screws **100** a top plate **102** similar to the top plate **80** previously indicated. This top plate differs from the top plate **80**, however, in that on it four projecting ends **104** such as the ends **32** are provided to engage the upper ribs **20**. In addition, side projecting ends **106** are provided so as to resiliently engage the opposed ends of the upper ribs **20** providing

spring tension against these upper ribs. This latter feature is considered desirable inasmuch as it tends to prevent misalignment or binding of the slider **96** during movement thereof. Also, it is considered desirable because it provides a uniform amount of friction opposing the motion of the slider **96**. The top plate **80** acting in conjunction with the block **74** also provides a certain measure of this friction but the friction in this case is not as carefully controlled as in the construction shown in Fig. 6 of the drawings.

This construction in Fig. 6 is also advantageous inasmuch as a shaft **64'** may be attached directly to a strip **108** projecting from the top plate **102**. This strip is bent so as to include two segments **110** and **112** located at an angle to one another so that as the two segments **110** and **112** are bent toward one another the shaft **64'** may be inserted through generally oval shaped openings **114** formed therein. When the segments are released after having been so bent, the strip **108** will tend to straighten out effectively engaging the shaft **64'** and holding the end of this shaft. Because of the inherent flexibility of the strip **108** a slight amount of misalignment of the shaft **64'** is permissible when the slider **96** is utilized. A contact member such as the contact member **86** may be secured directly to the block **74** as previously indicated.

In Fig. 7 of the drawings a second modified slider **116** of the instant invention is shown which is preferably formed out of a single sheet of sheet metal such as, for example, spring steel, so as to include projecting tongues or ends **118** which are designed so that when this modified slider is used, these tongues **118** engage with the upper and lower surfaces of the ribs **20** effectively holding this slider to these ribs. In order to center the slider **116** when it is used in this manner, stabilizing tongues **120** are preferably formed so as to project therefrom so as to present surfaces remote from the central part of the slider **116** which are designed to bear directly against the ends of the ribs **20**.

Formed within the center portion of the slider **116** are projecting resilient contact arms **122** which are designed to engage the electrical return and resistance element **38** previously described. From one end of the slider **116** there projects a strip **124** having a first wall **126** located at an angle to the main or center portion of the slider **116** and a second wall **128** located at an angle to this first wall. Within wall **128** there is formed a relatively narrow passage **130** leading to an enlarged circular opening **132**. This arrangement is provided so that the slider **116** may be used with a shaft **64''** having secured to the end thereof a smaller shaft **134** leading to an end ball **136**. Thus, with this construction, the shaft **134** may be inserted through the passage **130** and the ball **136** will be held between the walls **126** and **128** much in the manner of a common ball and socket joint. This type of joint is quite desirable in that it prevents misalignment.

It is preferable with this modification of the invention to coat all of the slider **116** except for the contact arms **122** with a non-conductive plastic as by dipping the slider in a hot melt of polyethylene or the like or in an organosol type of suspension containing a vinyl resin. A plastic coating of this category when applied to all except the contact arms **122** effectively insulates slider **116** so as to prevent any danger of shorting. If desired, this expedient can be dispensed with and small blocks of a non-conductive resin secured to the ends **118** and the stabilizing tongues **120** so as to effectively insulate the slider **116** from the housing **12**. Similar insulation means can be applied to the strip **124** if the shaft **64** is made out of a conductive material. Such means, of course, can be dispensed with if the shaft **64** is formed of a non-conductive material. Such means, of course, can be dispensed with if the shaft **64** is formed of a non-conductive material.



Those skilled in the art to which this invention pertains will realize a large number of other modifications can be made in the inventive concept present in this specification without departing from the essential nature of this inventive concept. As an example of such modification in a number of different types of enclosures besides those shown can be employed, including enclosures embodying dust shields or other structures.

We claim:

1. An adjustable electrical resistor which comprises: an elongated housing of rectangular cross section, said housing including parallel top and bottom walls, and parallel side walls; a pair of upper reinforcing ribs located in a plane parallel to said top wall, each of said upper ribs being located on the interior of one of said side walls, said upper ribs being spaced from said top wall and serving to reinforce said side walls; a pair of lower reinforcing ribs located in a plane parallel to said bottom wall, each of said lower ribs being located on the interior of one of said side walls, said lower ribs being spaced from said bottom wall and said upper ribs, and serving to reinforce said side walls; a support member located within said housing so as to extend from adjacent one end thereof to adjacent the other end thereof, said support member being supported by said lower ribs, and being spaced from said bottom; a resistance element carried by said support member so as to have a surface exposed on the side of said support member adjacent to said top; a slider carried by said upper ribs, said slider including resilient contact means projecting therefrom so as to engage said exposed surface of said resistance element so as to establish electrical communication therewith; a closure located within one end of said housing; means projecting through said closure operatively connected to said slider whereby said slider may be moved within said housing causing said resilient contact means to engage different parts of said exposed surface of said resistance element; a second closure positioned within the other end of said housing; electrical terminal means attached to said second closure; and electrical wires connecting the ends of said resistance element and said terminal means, said electrical wires extending through the space between said bottom and said support member.

2. A resistor as defined in claim 1 wherein said means projecting from said closure comprises: a shaft having an end to which there is secured a projecting wire; and wherein said slider includes a block of a non-conductive resin having a conical opening formed therein facing said shaft and wherein said end of said shaft is positioned adjacent to said block with said wire projecting into and through said conical opening so as to be secured to said block at the end of said opening remote from said shaft, and wherein said end of said shaft is positioned adjacent to said block so as to hit against said block when said shaft is moved toward said block.

3. A resistor as defined in claim 1 wherein: said means projecting through said closure comprises a shaft having an end and wherein said slider comprises a single sheet of sheet metal having a center portion, said sheet being formed so as to include tongues adapted to engage the upper and lower surfaces of said upper ribs and tongues having surfaces designed to bear directly against the ends of said ribs and means adapted to hold the end of said shaft, said means holding the end of said shaft.

4. A resistor as defined in claim 3 wherein: said means adapted to hold the end of said shaft comprises: a strip having a first wall located at an angle to the center portion of said slider and a second wall located at an angle to said first wall, said second wall including means defining a narrow passage leading to means defining circular opening, and wherein a small shaft having a ball end is secured to said end of said shaft and said shaft is held by said means with said ball end being posi-

tioned between said walls and said small shaft projecting through said opening.

5. A variable resistor comprising an elongated housing having a cavity formed therein, the inner surfaces of said housing have two spaced pairs of longitudinally extending parallel ribs formed thereon, a support member contained within said cavity and supported on one of said pairs of ribs, a resistance element mounted on the side of said support member adjacent said other pair of ribs, a contact member slidably supported on said other pair of ribs and wiping on said resistance element, means projecting through a wall of said housing for shifting said contact member along the length of said resistance element, and terminal means connected to said resistance element and electrically connected to said contact member.

6. A variable resistor comprising a housing, a resistance element mounted on said housing, a contact member slidably supported for movement parallel to said resistance element and wiping thereon, said contact member including a main body portion, means at one end of said contact member defining a pair of opposed walls spaced apart along the direction of travel of said contact member, the outer of said walls being notched and having an enlarged opening at the bottom of the notch, and a push rod extending through one end of said housing and operatively connected to said contact member, said



push rod having a slender shaft portion passing through said notch in said outer wall of said contact member, and a ball at the end of said slender shaft portion confined between said opposed walls, said ball and said opposed end walls forming a ball and socket joint between said push rod and said contact member so as to accommodate misalignment between them.

7. A variable resistor as defined in claim 5, wherein said contact member includes means at one end thereof defining a socket, and a push rod projecting through one end of said housing, said push rod having a ball formed on the end thereof, said ball being confined within said socket to form a flexible joint between said push rod and said contact member, so as to acccommodate misalignment between them.


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