United States Patent

Southwell

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[45] **May 2, 1972**

[54] RESISTOR WITH AT LEAST TWO POINTS OF MANIPULATION FOR ADJUSTMENT

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[73] Assignee: **Weston Instruments, Inc.,** Newark, N.J.

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[52] **U.S. Cl.**.....**338/180,** 338/183

[51] **Int. Cl.**.....**H01c 9/02**

[58] **Field of Search**.....338/122, 176, 180, 181, 183, 338/184, 199

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[57] **ABSTRACT**

Fully encased adjustable resistors, typically rectilinear potentiometers, characterized by having at least two points of manipulation for adjustment. In a typical embodiment, a lead screw-operated rectilinear potentiometer has the head of the lead screw exposed at one end of the housing and is provided with an additional adjusting member the head of which is exposed through the top of the housing, the lead screw being provided with a helical gear portion and the additional adjusting member having a helical gear portion meshed therewith.

7 Claims, 11 Drawing Figures

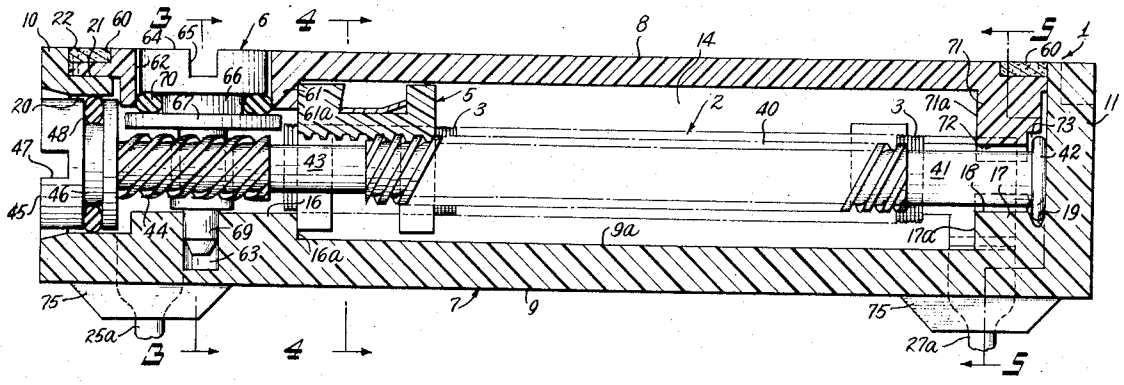

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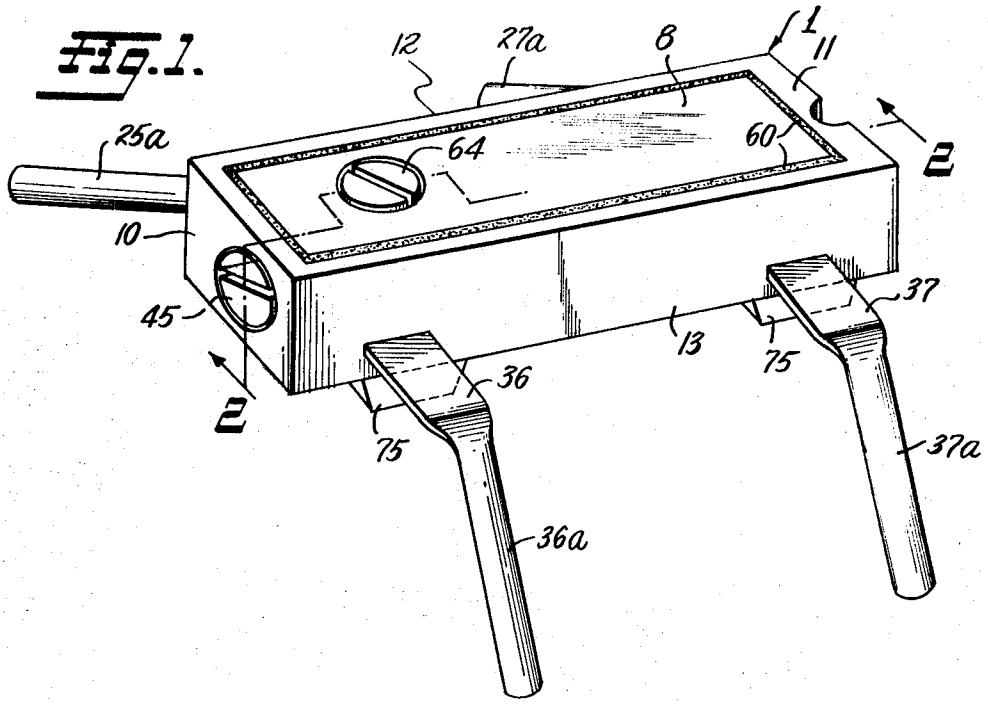
Fig. 1.



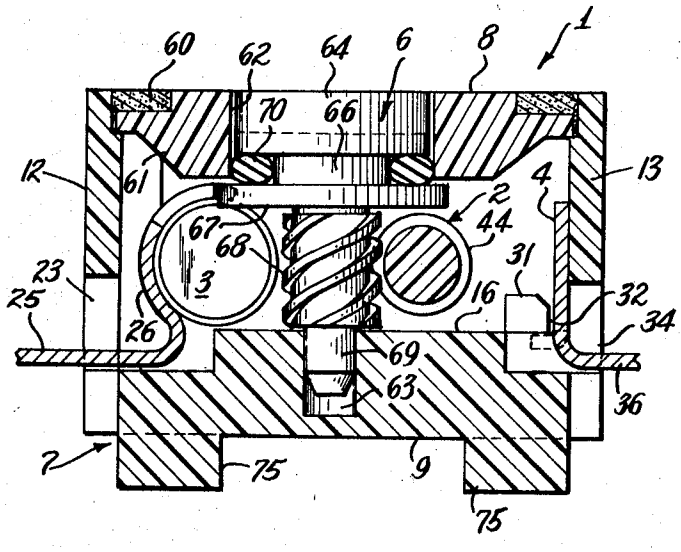


Fig. 3.

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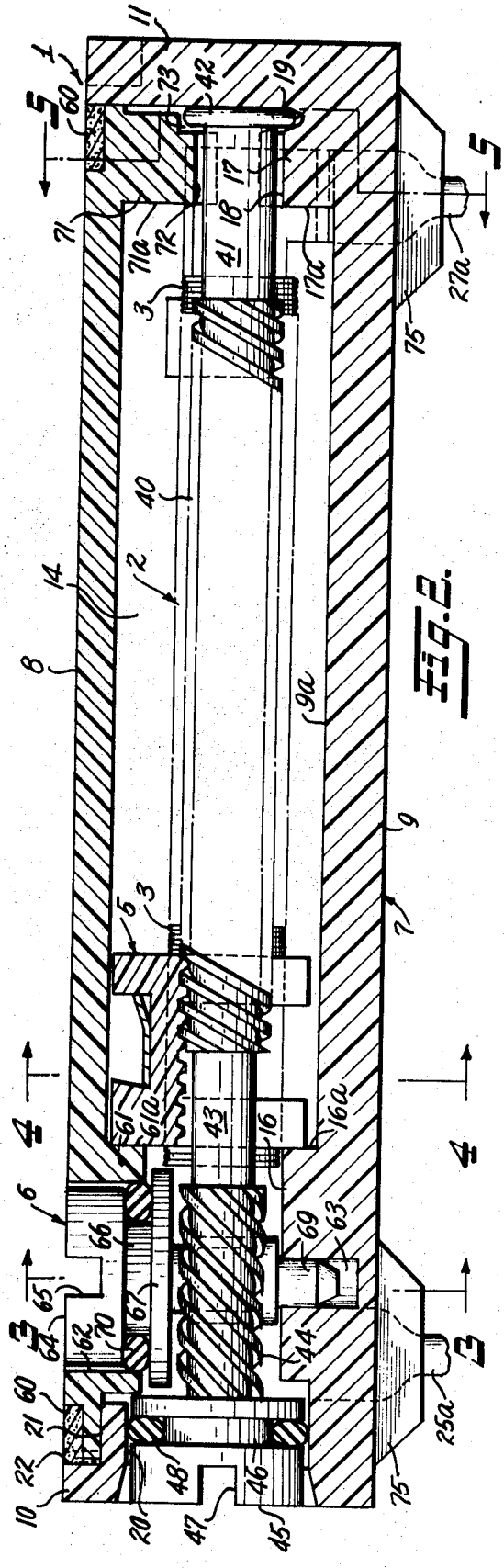

FIG. 2.

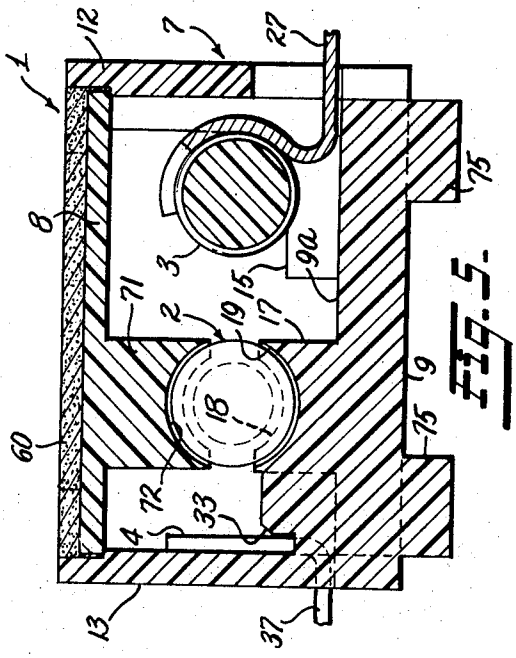

FIG. 5.

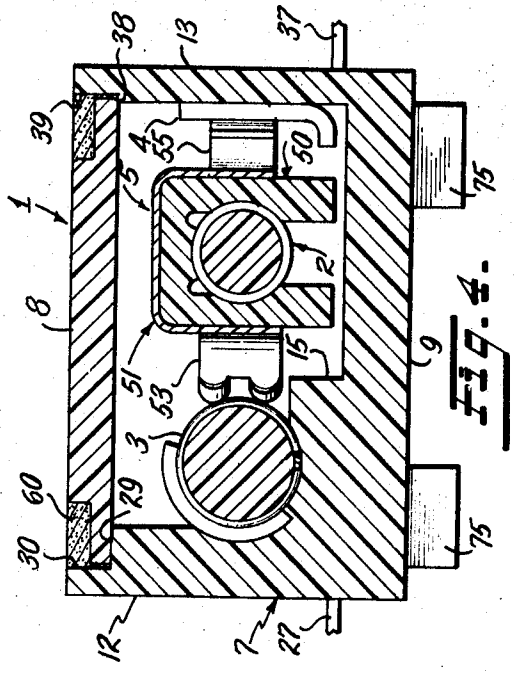

FIG. 4.

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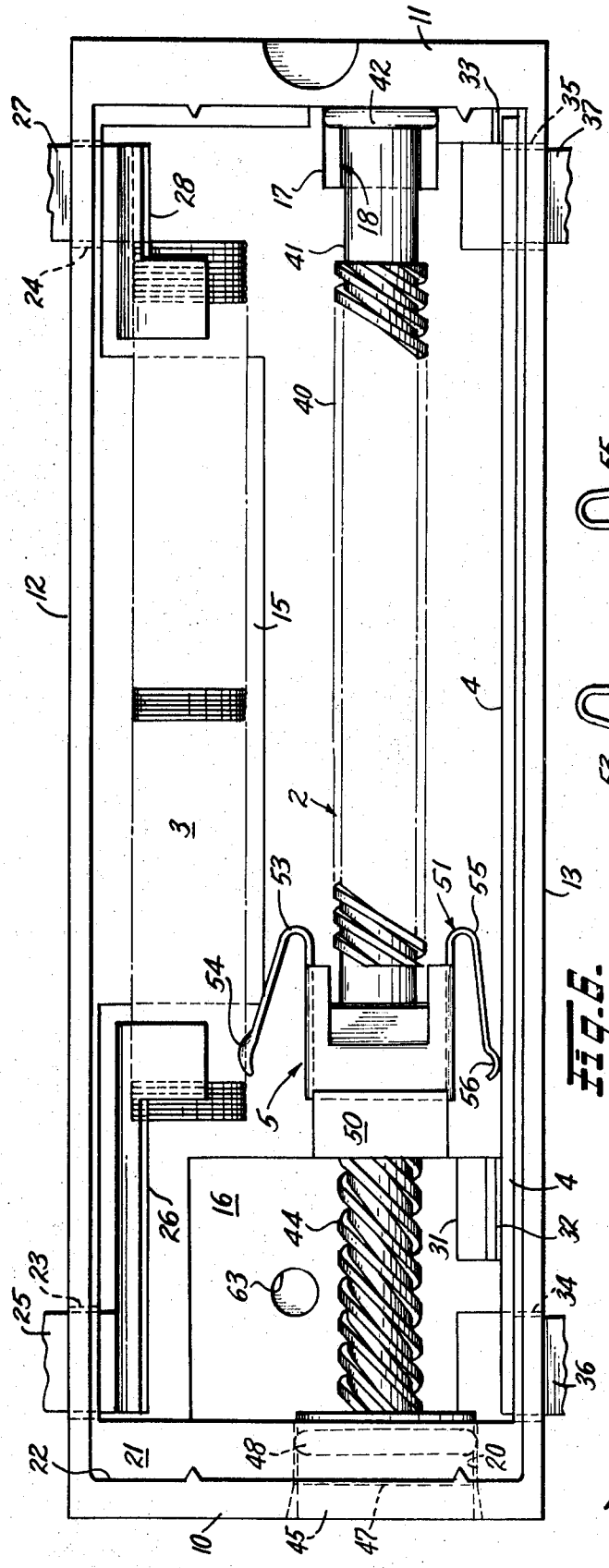

Fig. 6.

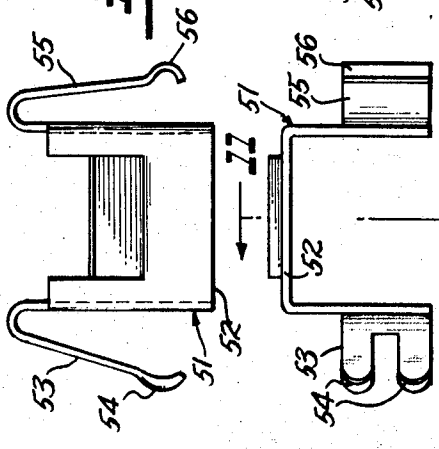

Fig. 9.

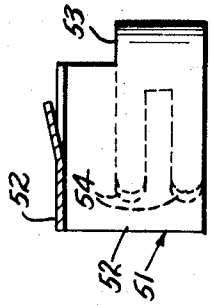

Fig. 11.

Fig. 10

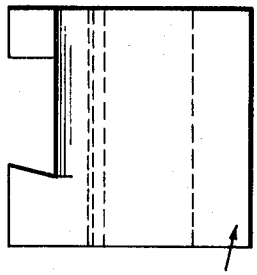

Fig. 8.

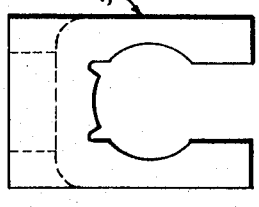

Fig. 7.

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RESISTOR WITH AT LEAST TWO POINTS OF MANIPULATION FOR ADJUSTMENT

This invention relates to adjustable resistors of the type in which a rotary drive member, typically a lead screw, moves a contact in rectilinear fashion along an elongated resistance element. The invention finds particular application to rectilinear potentiometers.

In recent years, it has become common practice to provide rectilinear potentiometers, especially in miniaturized form, which are fully encased in an elongated housing of rectilinear transverse cross section, and which include a lead screw having a head exposed at one end of the housing. In some applications, a plurality of such devices are mounted side-by-side, and the fact that the head of the lead screw, usually provided with a screw driver slot for ease of manipulation, is exposed at an end of the housing is particularly convenient. In other applications, such as certain types of circuit board mountings, the appropriate end of the device is not necessarily readily accessible for manipulation of the lead screw, and the fact that the lead screw can be operated only from an end of the device therefore constitutes a problem.

A general object of the invention is to devise an adjustable resistor of the type described which can be adjusted by manipulation of a first element, such as the head of a lead screw, exposed at one end of the resistor and also by a second element exposed at a side of the resistor.

Another object is to provide such a resistor which can be adjusted from the top as well as from one end.

A further object is to provide, in a rectilinear potentiometer of the type described, the combination of an improved housing structure, drive member and adjusting means making it possible to assemble with relative ease a potentiometer capable of being adjusted both from one end and at least from one side.

Stated generally, resistors according to a typical embodiment of the invention include an elongated housing having opposite end walls and a side wall and defining an elongated cavity; an elongated resistance element extending lengthwise of the cavity; a lead screw extending in the cavity and including a head exposed exteriorly at one of the end walls, a threaded portion, and a helical gear portion; movable contact means driven by the threaded portion of the lead screw and operatively engaged with the resistance element; and an adjusting member journalled in the housing and including a head exposed exteriorly at the side wall and a helical gear portion operatively meshed with the helical gear portion of the lead screw. Advantageously, the helical gear portion of the lead screw is located between the threaded portion and head thereof, and the adjusting member extends at right angles to the axis of the lead screw and has its head exposed through the top wall of the housing in a location adjacent the end wall at which the head of the lead screw is exposed.

In order that the manner in which the foregoing and other objects are attained according to the invention can be understood in detail, one particularly advantageous embodiment thereof will be described with reference to the accompanying drawings, which form part of the original disclosure of this application, and wherein:

FIG. 1 is a perspective view of a potentiometer constructed according to one embodiment of the invention;

FIG. 2 is a longitudinal sectional view taken generally on line 2—2, FIG. 1;

FIGS. 3–5 are transverse sectional views taken respectively on lines 3—3, 4—4 and 5—5, FIG. 2;

FIG. 6 is a plan view of the potentiometer of FIG. 1, with the cover removed;

FIGS. 7 and 8 are end and side elevational views, respectively, of a carriage member employed in the potentiometer of FIG. 1;

FIGS. 9 and 10 are top and end elevational views, respectively, of a movable contact member employed in the potentiometer of FIG. 1; and

FIG. 11 is a longitudinal sectional view taken on line 11—11, FIG. 10.

Referring now to the drawings in detail, the illustrated embodiment of the invention is a miniaturized rectilinear potentiometer comprising a housing, indicated generally at 1, a lead screw 2, an elongated resistance element 3, a return conductor 4, a movable contact unit 5, and an adjusting member 6.

Housing 1 comprises a base 7 and a cover 8. Base 7 is an integral unit molded, for example, from polymeric material having good electrical insulating characteristics. Base 7 includes a bottom wall 9 which is of elongated rectangular plan configuration, end walls 10 and 11, and side walls 12 and 13, so arranged as to define an elongated cavity 14. As best seen by comparison of FIGS. 4 and 6, bottom wall 9 is provided with a thickened portion 15 which extends for a portion of the length of the cavity along the juncture between walls 9 and 12. In effect, portion 15 constitutes a pedestal for support of resistance element 3, the resistance element being a cylindrical, wire wound element and pedestal 15 including a shallow upwardly opening groove which extends along wall 12 and in which the resistance element 3 is seated. Adjacent end wall 10, bottom wall 9 is provided with an upwardly projecting portion 16 which is of rectangular plan configuration and serves to markedly increase the thickness of bottom wall 9 in this area. Adjacent end wall 11, bottom wall 9 includes an upwardly projecting portion 17 in the nature of an upstanding pedestal which projects a short distance inwardly from end wall 11 and is of limited extent transversely of the housing, as will be seen from FIG. 6. The top of pedestal 17 presents a cylindrical groove 18 which opens upwardly and extends lengthwise of the housing. Immediately adjacent end wall 11, pedestal 17 is provided with a transverse arcuate groove 19.

End wall 10 is of substantial thickness and is provided with a cylindrical through bore 20. At the side of end wall 10 which is directed inwardly of the housing, the top edge portion of the end wall is cut away to provide a shoulder defined by surfaces 21 and 22.

Adjacent end wall 10, side wall 12 is provided with a lateral opening 23. Similarly, side wall 12 includes a lateral opening 24 adjacent end wall 11. A terminal strip 25 extends through opening 23 and is connected to one end of resistance element 3 by an integral conducting strip 26. Similarly, a terminal 27 extends through opening 24 and is connected to the other end of resistance element 3 by an integrally formed conducting strip 28. As best seen in FIGS. 2, 4 and 5, openings 23 and 24 are located immediately adjacent the upper face 9*a* of the bottom wall 9 of base 7. The upper edge of side wall 12 is cut away, at the surface directed inwardly of the housing, to provide shoulder surfaces 29 and 30, FIG. 4.

As best seen in FIGS. 3 and 6, raised portion 16 includes an upwardly extending projection 31 which is axially shorter than portion 16 and is spaced from end wall 10. Projection 31 includes a side surface 32 which faces the inner surface of side wall 13 and is spaced therefrom by a distance only slightly greater than the thickness of return conductor 4. As seen in FIG. 5, pedestal 17 is provided with an upwardly opening notch 33 immediately adjacent side wall 13, the flat bottom wall of notch 33 being aligned with the upper face of raised portion 16. Return conductor 4 is a flat metal strip disposed in flush face-to-face contact with the inner surface of side wall 13. Return conductor 4 is seated in the space between projection 31 and side wall 13, and in notch 33, as will be clear from FIGS. 3 and 5. Side wall 13 is provided with a lateral opening 34, FIG. 6, adjacent end wall 10, and with a similar lateral opening 35 adjacent end wall 11. Terminal strips 36 and 37 are formed integrally with the respective ends of return conductor 4 and are bent to project laterally therefrom, terminal strip 36 extending through opening 34 and terminal strip 37 extending through opening 35. At its upper edge, the inner portion of side wall 13 is notched to provide shoulder surfaces 38 and 39, FIG. 4.

Lead screw 2 includes an elongated threaded portion 40, a right cylindrical end portion 41, and a free tip 42 in the form of an outwardly projecting transverse annular flange. At the other end of threaded portion 40, the lead screw includes a plain right cylindrical intermediate portion 43, a helical gear

portion 44, and an enlarged cylindrical head 45 provided with an outwardly opening transverse annular groove 46 and an end slot 47 to accommodate, e.g., a screwdriver. Lead screw 2 extends lengthwise through cavity 14, the cylindrical peripheral surface of head 45 being closely embraced by the wall of bore 20, gear portion 44 extending parallel to and spaced above portion 16 of the bottom wall of the housing, threaded portion 40 extending through the space between resistance element 3, and return conductor 4, cylindrical portion 41 extending through groove 18 of pedestal 17 but being spaced from the surface presented by the groove, and flange 42 being engaged in transverse arcuate groove 19, all as seen in FIG. 2. An O-ring 48 is engaged in groove 46 to seal against the wall of bore 20.

Movable contact unit 5 includes a carriage member 50, FIGS. 7 and 8, and a contact member 51, FIGS. 9–11. Formed of resiliently deformable polymeric material, carriage member 50 is bifurcated and embraces the threaded portion of the lead screw in threaded relationship therewith. Contact member 51 is formed as an integral piece from resilient sheet metal and includes a body portion 52 of generally U-shaped configuration which embraces carriage 50, retaining the contact member on the carriage. At one end of body portion 52 of the contact member, a contact finger 53 projects lengthwise from one side of the U of body 52 and is bent upon itself to extend back beside the contact member, terminating in a free tip 54. The contact member is similarily provided, at its other side, with a contact finger 55 terminating in a free tip 56. With contact member 51 properly engaged on carriage 50, and with the carriage operatively engaging the threaded portion of lead screw 2, the spacing between contact tips 54 and 56, when the fingers 53 and 55 are in relaxed, undistorted condition, is greater than the space available between resistance element 3 and return conductor 4. Accordingly, in the assembled device, with tip 54 slidably engaging resistance element 3 and tip 56 slidably engaging return conductor 4, the two contact fingers are resiliently deformed toward the carriage, providing good contact pressure with the resistance element and return conductor, respectively. Further, it will be observed that the spring forces developed in the two contact fingers are in opposition to each other, therefore tending to hold the lead screw in a centered position, parallel with the resistance element and return conductor.

Since carriage 50 is operatively engaged with the threaded portion 40 of lead screw 2, rotation of the lead screw will cause contact unit 5 to travel lengthwise of the lead screw, with the direction of travel depending upon the direction in which the lead screw is turned.

Housing 1 is completed by the cover 8 which is of rectangular plan, matching the dimensions and configuration of the opening defined by the upper edges of end walls 10 and 11 and side walls 12 and 13. The edge portions of cover 8 are seated respectively on shoulder surfaces 21, 29, and 38. The entire peripheral portion of the cover is notched to provide a recess to receive adhesive, indicated at 60, serving to secure the cover to the base and to seal the joint between the cover and base against entry of foreign matter. Adjacent end wall 10, cover 8 is provided with a dependent boss 61 directed toward the upper surface of raised portion 16 of the bottom wall of the base. Boss 61 is provided with a right cylindrical through bore 62. Raised portion 16 of the bottom wall of the base is provided with an upwardly opening right cylindrical blind bore 63 which, in the assembled device, is coaxial with bore 62 in cover 8.

Adjusting member 6 comprises a right cylindrical head 64 having a screwdriver slot 65, a transverse annular groove 66, and an outwardly projecting annular flange 67. Additionally, member 6 includes a spiral gear portion 68, best seen in FIG. 3, and a right cylindrical tip 69. Before cover 8 is applied, head 64 of member 6 is inserted upwardly into bore 62, an O-ring 70 having first been placed in groove 66. The diameter of head 64 is only slightly smaller than the diameter of bore 62, so that the wall of the bore closely embraces the head and O-ring 70 is disposed in sealing engagement with the wall of the bore as well as the confining groove. With member 6 thus installed in cover 8, lowering of the cover into place on the supporting shoulder surfaces 21, 29 and 38 causes tip 69 to enter the blind bore 63. With lead screw 2 having been earlier installed, the helical screw portion 68 of member 6, coming to its final position seen in FIG. 3, meshes with the helical screw portion 44 of the lead screw. Helical gear portions 44 and 68 constitute a conventional right angle helical gearing capable of transferring rotational motion of member 6 into rotational motion of the lead screw.

At its end adjacent end wall 11, the cover 8 includes a dependent portion 71 having a downwardly opening semicylindrical groove, best seen in FIG. 5, which is disposed closely adjacent to plain right cylindrical portion 41 of the lead screw in the finished assembly. Portion 71 is cut away as seen at 73, FIG. 2, to accommodate the end flange 42 of the lead screw.

As best seen in FIG. 1, leads 25, 27, 36 and 37 project laterally outwardly from housing 1 to join integrally formed terminal prongs 25*a*, 27*a*, 36*a* and 37*a*, respectively, the terminals slanting downwardly and outwardly away from the housing. The relationship between the housing, leads and terminals adapts the device for handling in conventional automatic insertion equipment employed for insertion of the potentiometer into a suitable circuit board, not shown. The bottom wall 9 of the base of the housing can be provided with dependent feet 75 for engagement with the circuit board.

When the potentiometer is in its installed position, adjustment of the movable contact unit 5 can be accomplished by turning lead screw 2, either by manipulating head 45 of the lead screw, from the appropriate end of the device, or by manipulating head 64 of member 6, with such manipulation being accomplished from above the installed potentiometer.

Referring to FIG. 2, it will be seen that, in the assembled device, straight edges 16*a*, of raised portion 16, and 61*a*, of dependent portion 61, lie in a common transverse plane so as to constitute an end stop to limit movement of the movable contact unit 5. Similarly, pedestal 17 presents a face 17*a* and dependent portion 71 presents a face 71*a*, both of these faces lying in a common transverse plane and constituting stop means at the other end of the device to limit travel of the movable contact unit.

What is claimed is:

1. In an adjustable resistor, the combination of an elongated housing defining an elongated cavity and having opposite end walls and a side wall; a lead screw journalled in said housing and including an elongated threaded portion extending longitudinally within said cavity, a head exposed to the exterior of said housing at one of said end walls, and a helical gear portion located at one end of said threaded portion; an adjusting member journalled in said housing for rotation about an axis at right angles to the axis of rotation of said lead screw and including a head exposed to the exterior of said housing at said side wall, and a helical gear portion operatively meshed with said helical gear portion of said lead screw; an elongated resistance element disposed in said cavity and extending longitudinally thereof; movable contact means driven by said threaded portion of said lead screw and slidably engaging said resistance element; terminal means; and means electrically connecting said terminal means to said resistance element and said movable contact means, said lead screw being rotatable, to move said movable contact means relative to said resistance element, by rotation of said adjusting member as well as by direct manipulation of said lead screw by the exposed head of said lead screw.

2. The combination defined in claim 1 and wherein said helical gear portion of said lead screw is located between said threaded portion and said head of said lead screw.

3. The combination defined in claim 1 and wherein said adjusting member is located adjacent an end of said housing.

4. The combination defined in claim 3 and wherein said adjusting member is located adjacent the end of said housing at which the head of said lead screw is exposed.

5. The combination defined in claim 1 and wherein said housing is of rectangular transverse cross section and includes a base wall and two opposite side walls, said side wall at which the head of said adjusting member is exposed constituting the top of said housing, said terminal means including terminal members emerging from said two opposite side walls.

6. The combination defined in claim 1 and wherein said housing comprises a first integral member including a base wall of elongated rectangular plan configuration, and opposite elongated side walls each extending along and projecting upwardly from a different side of said base wall, said end walls extending across and projecting upwardly from the respective ends of said base wall, said one end wall being provided with an aperture accommodating the head of said lead screw, said base wall including a pedestal adjacent the other of said end walls, said pedestal being within said cavity and including an upwardly opening transverse groove immediately adjacent said other end wall; and a cover member secured to said first integral member and closing the opening defined by the upper edges of said elongated side walls and said end walls; and said lead screw includes a transverse annular flange at the end thereof opposite the head of said lead screw, said flange being seated in said transverse groove of said pedestal.

7. The combination defined in claim 6 and further comprising an elongated return conductor disposed in said cavity and extending along one of said elongated side walls, said resistance element extending along the other of said elongated side walls, and said threaded portion of said lead screw being disposed between said resistance element and said return conductor and extending parallel thereto, said movable contact means including a carriage engaged with said lead screw and two resilient contact fingers carried by said carriage and opposed across said lead screw and slidably engaged respectively with said return conductor and said lead screw, said contact fingers being resiliently distorted toward each other and thereby resiliently restraining said lead screw against lateral movement which would tend to displace said flange relative to said groove.

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