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W. A. BARDEN ET AL

2,997,679

ADJUSTABLE RESISTOR

Filed Sept. 2, 1958

3 Sheets-Sheet 1

Fig. 1.

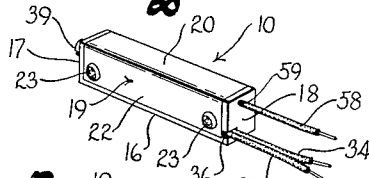


Fig. 2.

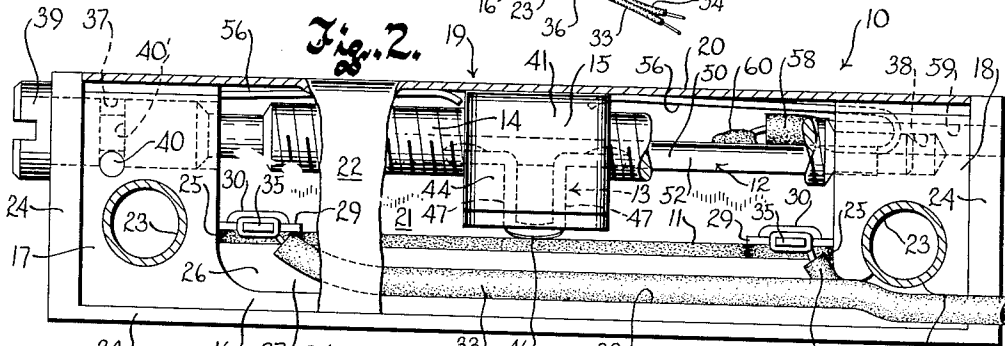


Fig. 3.

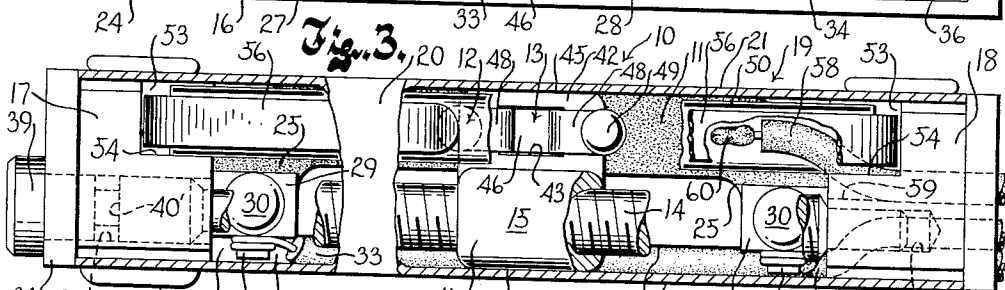


Fig. 4.

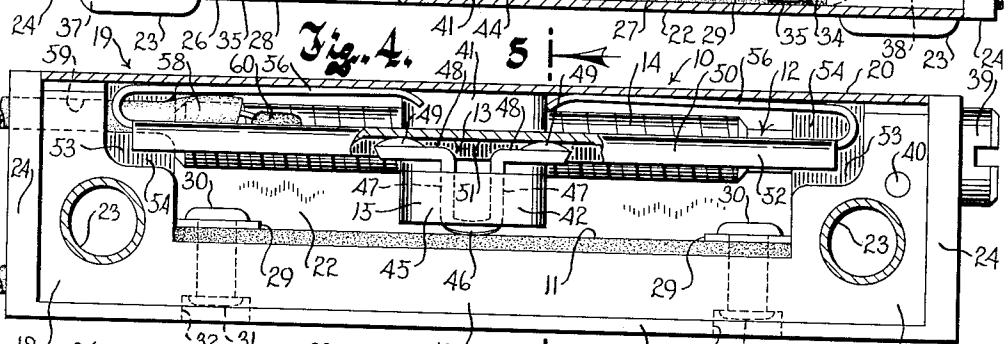
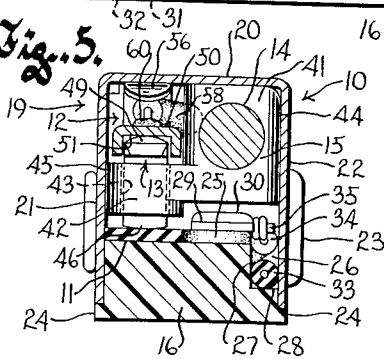


Fig. 5.



Inventors
Wayne A. Barden
Mervin B. Arisman
By *Richard Jones*
Attorney

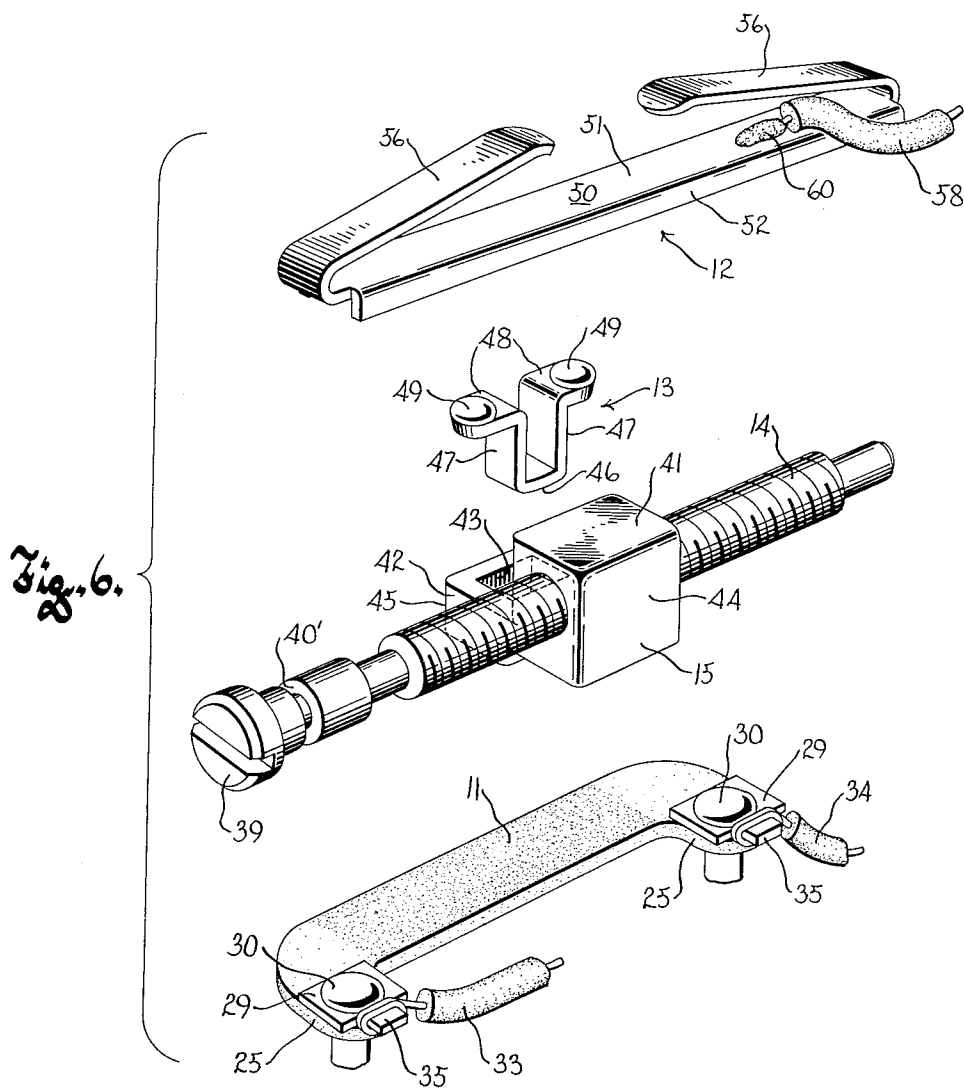
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3 Sheets-Sheet 2



Improvements
 Wayne A. Barden
 Mervin E. Arisman
 3/24 Dr. Milton Jones
 Attorney

Aug. 22, 1961

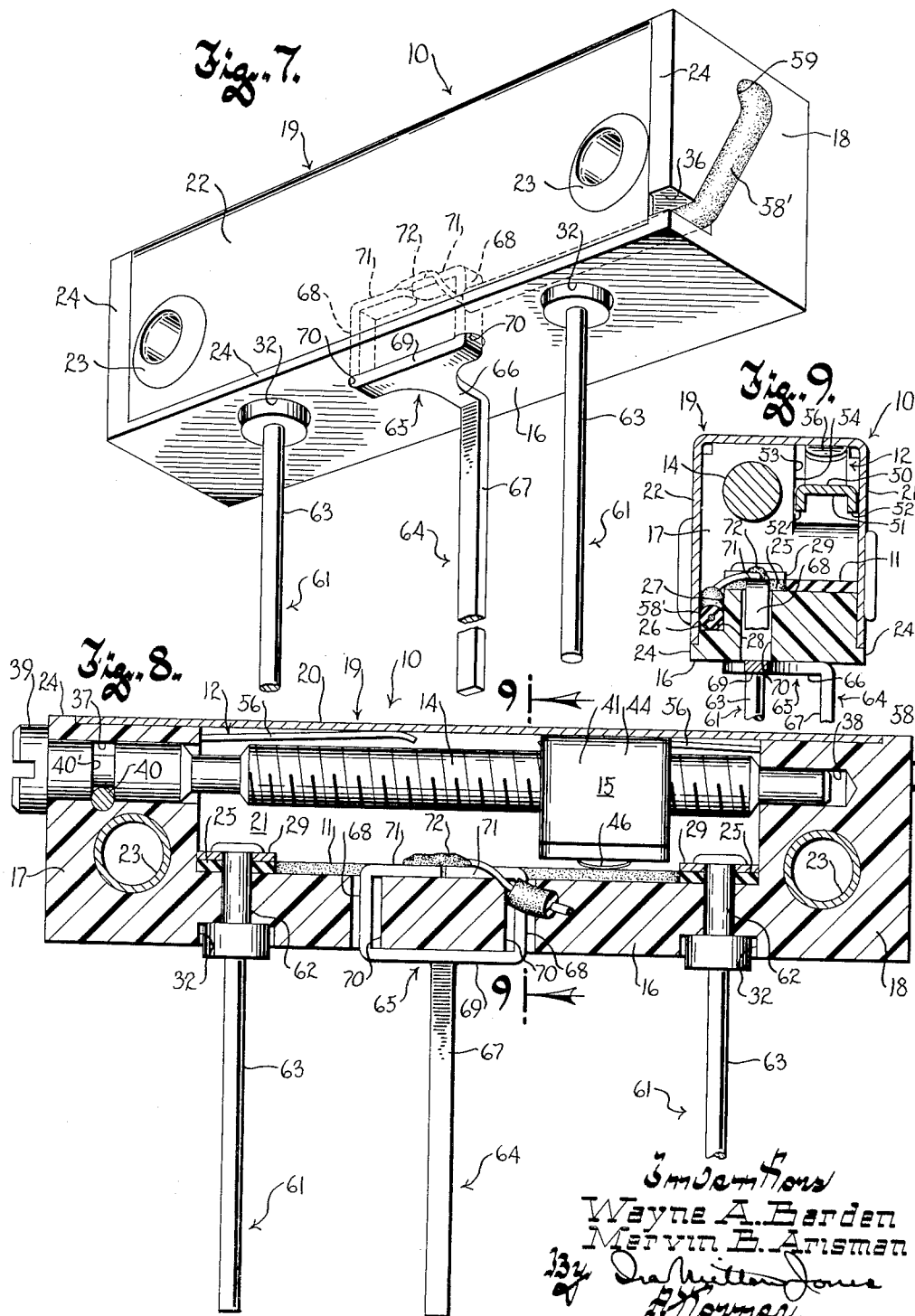
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ADJUSTABLE RESISTOR

Filed Sept. 2, 1958

3 Sheets-Sheet 3



Inventors
 Wayne A. Barden
 Marvin E. Arisman
 By *Dr. William Jones*
R. H. Horney

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2,997,679

ADJUSTABLE RESISTOR

Wayne A. Barden and Mervin B. Arisman, Elkhart, Ind., assignors, by mesne assignments, to CTS Corporation, Elkhart, Ind., a corporation of Indiana

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4 Claims. (Cl. 338—180)

This invention relates to variable resistors and refers more particularly to improvements in adjustable resistors of the type which are especially suited to achieve and maintain fine adjustments in the circuits in which they are connected. Such instruments, which are termed trimmer type potentiometers, are unlike the conventional variable resistors in that they are not intended for frequent manual adjustment.

One example of an adjustable resistor or potentiometer of the type to which this invention pertains is that shown and described in a copending application Serial No. 751,498 filed July 28, 1958, and similarly thereto it features a movable contactor which bears upon and bridges elongated parallel resistance and stationary contact members to linearly traverse said members as a consequence of rotation of an actuator screw in one direction or the other. For that purpose that contactor has a motion transmitting connection with a non-rotatable nut on the screw which traverses the screw as the same is rotated.

Also like the adjustable resistor of said copending application, the adjustable resistor of this invention is characterized by such important features as stability of resistance value under highly adverse temperature and humidity conditions, ease of manufacture despite its compactness and small overall size, and an exceptionally rugged construction.

In general, however, it is a further objective of this invention to provide an adjustable resistor or potentiometer of the character described which possesses certain important improvements over that of the aforesaid copending application. More specifically it is the purpose of this invention to provide an adjustable resistor or potentiometer of the character described which has fewer components and an improved construction and arrangement thereof to not only facilitate the manufacture and assembly of the unit at low cost, but also enable the contact pressure between the contactor, the resistance element and the stationary contact to be easily set at the desired value during final assembly of the parts.

In this respect it is a further and more specific objective of the invention to provide an adjustable resistor or potentiometer of the character described with a substantially rigid linearly movable contactor bodily confined between superimposed resistance and stationary contact members, and wherein the stationary contact is formed to have guiding engagement with the movable contactor and is also provided with integral spring arms which engage one of the walls of the housing of the unit to press the stationary contact firmly against the contactor and to accordingly urge the contactor into good engagement with the resistance element.

Still another object of this invention resides in the provision of an adjustable resistor or potentiometer of the character described wherein the movable contactor is connected with the nut on the actuator screw for bodily back and forth motion with the nut and for substantially floating up and down motion relative thereto so as to assure that the biasing force exerted on the contactor by the combined stationary contact and spring will cause engagement of the contactor with the stationary contact and the resistance element with substantially equal pressure.

A further and important object of this invention resides in the provision of an adjustable resistor or potentiometer of the character described wherein the compo-

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nent parts of the unit are so arranged that the combined stationary contact and spring member may be precisely located within the housing of the device, at the top thereof, by inter-engagement between the ends of the stationary contact member and the end walls of the housing, so as to be directly under a cover for the housing with its spring arms arranged to bear against the underside of the cover. This enables the combined stationary contact and spring member to be assembled with the unit prior to application and securement of the cover thereto, and for adjustments to be made in the spring arms integrally formed on the stationary contact in order to achieve the proper contact pressure between the movable contact, the resistance element and the stationary contact during the final stages of assembly.

Still another object of this invention resides in the provision of an improved adjustable resistor or potentiometer of the character described which is so constructed that it may be easily provided with either the conventional insulated wire leads, or alternatively, with terminal prongs of the type used for connecting the unit in a printed circuit.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate two complete examples of the physical embodiments of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is a perspective view of the adjustable resistor or potentiometer of this invention, showing the same provided with conventional insulated wire leads;

FIGURE 2 is an enlarged front elevational view of the unit, portions thereof being broken away and shown in section;

FIGURE 3 is an enlarged top view of the unit, portions thereof being broken away and shown in section;

FIGURE 4 is an enlarged rear elevational view of the unit, portions thereof being broken away and shown in section;

FIGURE 5 is a cross sectional view taken through FIGURE 4 along the plane of the line 5—5;

FIGURE 6 is a group perspective view showing the working elements of the potentiometer of this invention;

FIGURE 7 is an enlarged perspective view of an adjustable resistor or potentiometer like that shown in FIGURE 1 but provided with terminal prongs to adapt the unit for use with printed circuitry;

FIGURE 8 is a longitudinal sectional view through the adjustable resistor shown in FIGURE 7; and

FIGURE 9 is a cross sectional view taken through FIGURE 8 along the plane of the line 9—9.

Referring now more particularly to the accompanying drawings, wherein like reference characters identify like parts throughout the several views, the adjustable resistor or trimmer potentiometer of this invention is shown provided with an elongated substantially narrow box-like housing 10 enclosing the various components of the unit.

These components include a resistance element 11, a stationary contact 12 which serves as a collector, a movable contactor 13 bridgingly engaged with the resistance element and the collector or stationary contact, and an elongated actuator screw 14 having a non-rotatable nut 15 threaded thereon and connected with the contactor 13 to transmit back and forth linear motion thereto during rotation of the screw in one direction or the other.

The housing consists of an elongated substantially flat bottom wall or base 16 of insulating material, standards 17 and 18 projecting upwardly from the opposite ends of the base and preferably formed integrally therewith, and a channel shaped sheet metal cover 19 closing the top and the opposite sides of the housing. The web 20 of the cover spans and seats flatwise upon the tops of the standards to provide the top wall of the housing, while the depending flanges 21 and 22 of the cover intimately embrace the sides of the base and its standards and provide the side walls of the housing. Hollow rivets 23 passing transversely through the side walls of the housing and the standards embraced thereby serve to maintain the cover in place upon the housing.

In order to assure that the housing will have smooth and flat outside wall surfaces, the ends of the cover terminate a short distance from the extremities of the housing, and the lower edges of its side wall forming flanges 21 and 22 are likewise located a short distance above the plane of the bottom of the base 16. Narrow ribs or beads 24, formed integrally with the base and the standards, project outwardly therefrom adjacent to the ends of the cover and to the lower edges of its side flanges a distance equal to the thickness of the sheet metal from which the cover is formed. These beads or ribs have flat outer surfaces which are flush with the external surfaces of the cover. The inside surfaces of the cover are coated with a suitable insulation which may be varnish.

The resistance element 11 is in the form of an elongated straight strip, flatwise seated upon the top of the base 16, and extending the full distance between the standards 17 and 18. It has a width somewhat less than one-half that of the base, and it is secured to the base directly edgewise adjacent to one of the side walls 21 of the housing. At its opposite ends, the resistance element is formed with lateral extensions 25 that project edgewise inwardly over the base toward an elongated notch 26 in the upper corner portion of the base adjacent to the opposite side wall 22 of the housing. This notch extends the full distance between the standards at the ends of the base, and the lateral extensions 25 on the resistance element terminate in line with the outwardly facing wall 27 of the notch. The upwardly facing wall 28 of the notch 26 is parallel to the top and bottom faces of the base, and it is located at a level a substantial distance below that of the top of the base.

Flat terminal clips 29 are applied to the lateral extensions 25 of the resistance element, to rest flatwise upon the upper faces of the extensions, and to be permanently secured thereto by means of rivets 30 passing through the clips, the extensions 25 and the insulating base 16 so as to also secure the resistance element to the base. The heads 31 on the lower ends of the rivets 30 are concealed in recesses 32 in the underside of the base.

In order to facilitate securement of the bared ends of insulated wire leads 33 and 34 to the terminal clips, each of the clips is formed with a reduced tongue 35 projecting laterally from one edge thereof toward the side wall 22 of the housing, and overlying the notch 26 in the base. The length of these tongues is such that the bared ends of the conductors 33 and 34 may be twisted or wrapped at least twice around them to provide good mechanical connections therebetween prior to soldering said connections.

As seen best in FIGURE 5, the width of the notch 26 in the side of the base is substantially equal to the diameter of the insulating sheath on the terminal wires, but only one of the conductors 33 is received in the notch to extend substantially the full length thereof for electrical connection with the terminal adjacent to the standard 17. This conductor passes endwise through a notch 36 in the side of the other standard 18 to the exterior of the housing, at one end thereof. The notch 36, of course, aligns with the notch 26, but its depth is such that it is able to accommodate the other conductor 34 which is electrically connected

to the terminal adjacent to the standard 18, with those portions of the two conductors received in side by side relation in the notch 36 and held therein by the adjacent flange of the cover. Hence, both of the conductors 33 and 34 project from the same end of the housing and their close proximity at the point of emergence from the housing may identify them as the end leads for the resistance element, though the color of their insulation affords better identification.

The opposite end portions of the actuator screw are journaled in bearing holes 37 and 38 formed in the standards 17 and 18, respectively, and located to support the screw for free rotation about an axis parallel to the base 16 but adjacent to the side wall 22 of the housing. The screw, therefore, is located in one upper corner of the housing, substantially diagonally opposite the resistance element. That end of the screw which is journaled in the standard 17 projects entirely therethrough and has an enlarged head 39 formed thereon, with a cross slot in the head to facilitate turning the screw manually, as by a screw driver.

The screw is held against axial motion relative to the housing by a cross pin 40 in the standard 17, engaging in a circumferential groove 40' in that portion of the screw which is received in the bearing hole 37. The other end of the screw terminates in its bearing hole 38, the latter opening only to the interior of the housing.

The nut 15, which is threaded on the actuator screw, is formed of insulating material. It comprises a body portion 41 through which the screw passes, and a contactor carrier 42 integral therewith and extending laterally from the lower portion of the body, toward the side wall 21 of the housing, to overlie the resistance element 11 in spaced relation thereto. The height of the contactor carrier 42 is such that it is spaced a substantial distance from the top wall 20 of the housing. The nut has a motion transmitting connection with the contactor 13, and for this purpose the carrier portion 42 of the nut is provided with a rectangular hole or socket 43 extending vertically therethrough.

As seen best in FIGURES 3 and 5, the body portion 41 of the nut has a flat outwardly facing surface 44 which has intimate sliding engagement with the inner surface of the side wall 22 of the housing, and similarly, the carrier portion 42 on the nut has a flat surface 45 thereon which has intimate sliding engagement with the side wall 21 of the housing. The flatwise engagement between the oppositely facing surfaces 44 and 45 on the nut with the opposite side walls 21 and 22 of the housing, of course, prevents the nut from turning with the actuator screw so that the nut is constrained to traverse the screw whenever it is rotated in one direction or the other.

The movable contactor 13 has an upright stem portion provided by a U-shaped metal stamping. The bight 46 of the U is rounded or downwardly convex, and it bears upon the upper face of the resistance element. The opposite arms 47 of the stem project upwardly into and through the rectangular hole or socket 43 in the carrier portion of the nut and are so spaced and of such width that they more or less snugly fit the hole 43 to constrain the contactor to partake of all motion of the nut lengthwise of the actuator screw 14, while allowing the contactor to substantially float vertically in the hole, relative to the nut.

At locations a short distance above the carrier portion of the nut, the contactor arms are bent horizontally in opposite longitudinal directions to provide a pair of substantially rigid fingers 48 having rounded protuberances 49 on their extremities which project upwardly for engagement with longitudinally spaced areas of the stationary contact or collector 12.

The stationary contact or collector 12 occupies a position in the upper portion of the housing, laterally adjacent to the actuator screw 14 and in spaced superimposed relation to the resistance element 11. It has an elongated body 50 of the inverted channel shape, providing a hori-

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zontal web 51 which seats flatwise upon the protuberances 49 at the ends of the contact fingers 48, and having opposite depending flanges 52 which slidably embrace the opposite side edges of the contact fingers 48. The opposite end portions of the collector body are received in notches 53 formed in the inner corners of the standards 17 and 18 along the rear of the housing, so that the side wall 21 and the upright walls 54 of the notches opposite said side wall substantially closely but slidably engage the flanged end portions of the body 50 to accurately hold the collector parallel to the actuator screw 14 and in its proper position centered over the socket 43 in the carrier portion of the nut. Consequently, the flanges of the collector cooperate with the carrier to guide the contactor 13 for back and forth linear motion with the contactor confined between the body of the collector and the resistance element and electrically bridging the same.

It is a feature of this invention that the contact portions 46 and 49 of the movable contactor are held in pressure engagement with the resistance element and the stationary contact or collector by means of elongated spring blades 56 reacting between the collector and the top wall 20 of the housing. As shown, these spring blades may be formed as integral extensions of the ends of the collector web 51, bent back over the top of the body in spaced relation thereto, and with the free ends of the blades facing but spaced from one another. Normally the blades 56 diverge upwardly with respect to the collector body, as seen best in FIGURE 6, to project beyond the plane of the top wall 20 of the housing. This assures that the blades will be adequately tensioned by the application and securement of the cover to the standards at each end of the base.

The described construction and mounting of the stationary contact or collector 12 is highly advantageous from the standpoint of easy access to the spring blades during the final stages of assembly of the unit, prior to application and securement of the cover to the housing. At that time, it is easily possible to establish whether the contact portions 46 and 49 of the movable bridging contactor will be engaged with the resistance element and the collector with the proper contact pressure merely by depressing the outer ends of the spring blades 56 to the level of the tops of the standards 17 and 18. If any adjustments are required, the blades 56 may be readily bent either upwardly or downwardly to achieve the desired tension therein. Thereafter, of course, the cover is slipped over the base and its standards, and secured in place by the hollow rivets 23.

Like the leads 33 and 34 for the resistance element 11, the lead 58 for the stationary contact or collector 12 also projects from that end of the housing which is remote from the head 39 on the actuator screw. For that purpose, the standard 18 is provided with a hole 59 there-through parallel to the axis of the actuator screw, but located in the upper central portion of the end wall provided by the standard 18 with the inner portion of the hole opening laterally into the notch 53 in said standard. The conductor 58 projects through the hole 59 into the interior of the housing, and its inner end portion is bent laterally into the space between the adjacent spring blade 56 and the body 51 of the collector to have its bared end soldered to the top of the web portion 51 of the collector body, as at 60.

If desired, the adjustable resistor or trimmer potentiometer of this invention may be provided with prong type terminals such as shown in FIGURES 7, 8 and 9, substantially without change in the design of the unit, so as to adapt the unit for use in a circuit printed upon a panel (not shown). The two terminals 61 that connect with the ends of the resistance element 11 have rivet-like inner ends 62 which serve the same function as the rivets 30 in the previously described embodiment of the invention, namely to secure the resistance element in place upon the upper face of the insulating base 16.

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Formed integrally with the rivet-like inner ends of each of the terminals 61, however, is an elongated reduced prong 63 having a round cross section, and projecting downwardly from the base, perpendicularly thereto.

The collector terminal 64 is also secured to the base 16, at a location medially between the resistance terminals 61. It comprises a substantially T-shaped body 65 which lies flat-wise against the underside of the base with its stem 66 extending transversely of the base and having an elongated extension 67 bent downwardly from its extremity to provide a prong similar to the prongs 63 of the resistance terminals, but of rectangular cross section. The prong or extension 67, being offset laterally with respect to the prongs 63, serves to lend stability to the unit when the prongs are soldered in place in holes in a printed circuit panel.

The collector terminal is secured to the base 16 by means of tabs 68 integral with and bent upwardly from the extremities of the head 69 of the T-shaped body 65, the tabs passing through spaced holes 70 in the base and having their end portions bent over, toward one another, upon the inner face of the base, as at 71, to occupy positions alongside of but spaced from the inner edge of the resistance element 11.

The collector lead 58' in this case also has one end soldered to the web 51 of the collector in the manner previously described. The opposite end portion of the lead 58', however, is directed back through the notch 36 in the side of the adjacent standard 18 and into the interior of the housing to be received in the notch 26 in the front marginal edge of the base and to have its bared extremity soldered to the tabs 71 as at 72, at a location directly over the adjacent extremities of the tabs. The soldered joint 72 thus serves to hold the tabs and consequently the entire terminal 64, securely in place upon the base.

From the foregoing description, together with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides an adjustable resistor or trimmer type potentiometer which features fewer component parts so constructed as to render them easily accessible during the final stages of assembly to assure their proper mounting and functioning prior to securement of the cover in place on the unit.

What we claim as our invention is:

1. An adjustable resistor, comprising: a body of insulating material having an elongated bottom wall with parallel side edges, and end walls projecting upwardly from its opposite ends; means on the body providing a top wall spanning the space between said end walls, said top wall being parallel with and having substantially the same width as the bottom wall and directly overlying the bottom wall; an elongated actuator screw; means journaling the opposite end portions of the screw in said end walls to support the screw for free rotation on a fixed axis parallel to the top and bottom walls, with the screw disposed lengthwise of and between the top and bottom walls and at one side of a median plane perpendicular to and longitudinally bisecting the top and bottom walls, one end of the screw being accessible from one end of the body so that the screw may be turned at will; cooperating means on the body and the screw holding the screw assembled with the body and inhibiting axial motion of the screw relative to the body; an elongated resistance element fixed on the bottom wall and at the opposite side of said median plane; a nut threaded on the screw and having rotation inhibiting sliding engagement with said top wall so that the nut travels along the screw as the latter is turned, said nut traveling in the space at the first designated side of said median plane; a lateral extension on the nut projecting to the other side of said median plane and overlying the resistance element; a movable bridging contactor; means drivingly connecting the contactor with said lateral extension so that the contactor travels with the nut, but in the space at

said opposite side of said median plane, said contactor having oppositely facing contact portions, one of which contact portions engages the resistance element; an elongated stationary contact extending lengthwise along the underside of the top wall in the space at said opposite side of the median plane and having the other contact portion of the bridging contactor engaged therewith; and spring means confined between the top wall and said stationary contact in the space at said opposite side of the median plane to urge the stationary contact downwardly into good engagement with the resistance element.

2. The adjustable resistor of claim 1, wherein said contactor is connected to the nut so as to be constrained to partake of all motion of the nut along the screw but to be capable of vertical floating motion relative to the nut; and wherein said spring means acts through the stationary contact to place the contactor in compression between the stationary contact and the resistance element and thereby maintain said contact portion in good pressure engagement with both the resistance element and the stationary contact.

3. An adjustable resistor, comprising: means providing an elongated housing having opposite end walls joined by elongated top, bottom and side walls; an elongated actuator screw extending lengthwise of the housing, and in cross section being located in one upper corner of the housing, said screw having its end portions supported by the housing end walls for rotation on a fixed axis and being restrained against axial motion relative to the housing; a nut of insulating material threaded on said screw and slidingly engaging one of the housing walls defining said upper corner thereof to be held thereby against rotation with the screw, whereby the nut traverses the screw upon rotation of the latter; a lateral extension on the nut projecting toward the other of said side walls and spaced from the top and bottom walls; an elongated resistance element fixed on the base, extending lengthwise thereof adjacent to said other side wall of the housing so that said lateral extension on the nut travels lengthwise of and above the resistance element; a movable bridging contactor having oppositely facing contact portions, one of which engages the resistance element; means providing a motion transmitting connection between said lateral extension on the nut and the

contactor whereby the latter is propelled toward one end of the housing or the other by the nut depending upon the direction of rotation of the screw; an elongated stationary contact extending lengthwise along the interior of the housing, alongside the screw and above the resistance element and confined between the top wall of the housing and the oppositely facing contact means on the movable contactor so that the contactor provides an electrical bridge between the resistance element and the stationary contact; said lateral extension having a hole extending vertically therethrough, and the movable contactor having a vertically disposed central portion slidingly received in said hole to drivingly connect the contactor with the nut; and spring means reacting between the top wall of the housing and the stationary contact to urge the same downwardly so as to yieldingly clamp the contactor between it and the resistance element without interfering with movement of the contactor lengthwise of the housing.

4. The adjustable resistor of claim 3, wherein said stationary contact comprises an elongated strip of spring metal comprising a body portion extending from one end wall to the other, and spring blades integrally joined to the opposite ends of the body portion and overlying the opposite end portions thereof in spaced relation thereto, said spring blades engaging the top wall of the housing to urge the body of the stationary contact downwardly.

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