Sept. 22, 1953 H. L. COYNE ET AL 2,653,207

ADJUSTABLE POTENTIOMETER TERMINATION

Filed Dec. 15, 1950 2 Sheets-Sheet 1

FIG. 1

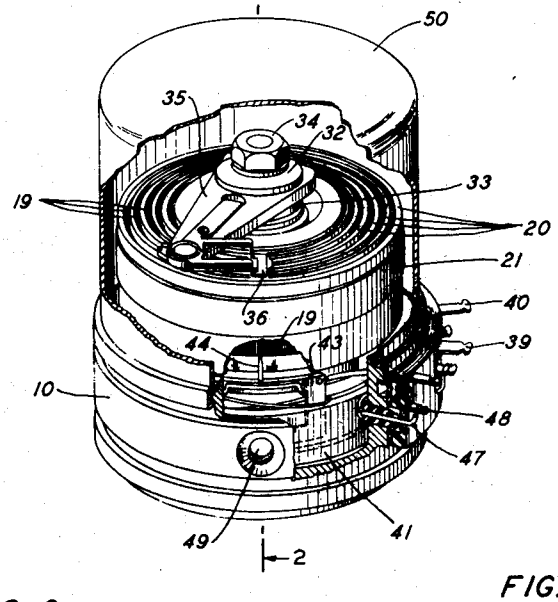


FIG. 2

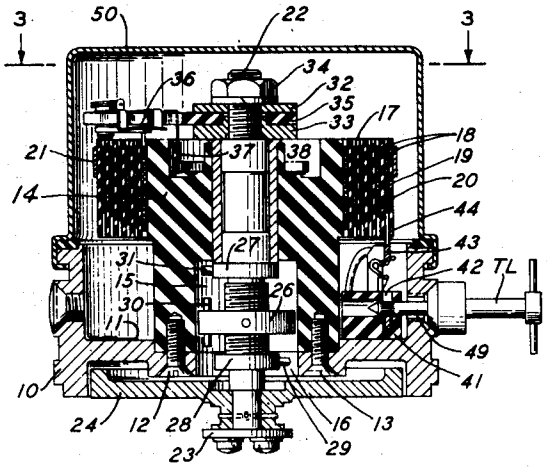


FIG. 3

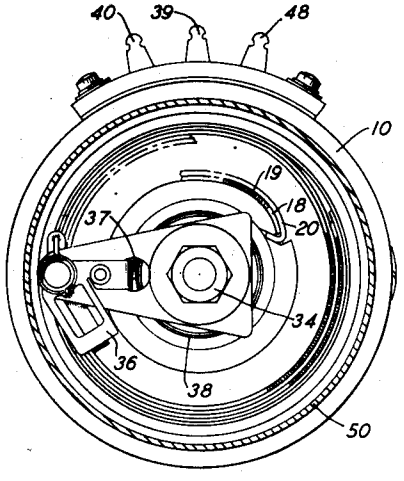
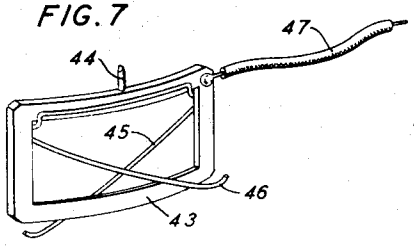


FIG. 7



INVENTORS H. L. COYNE
O. S. A. MESCH

BY

ATTORNEY

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FIG. 4

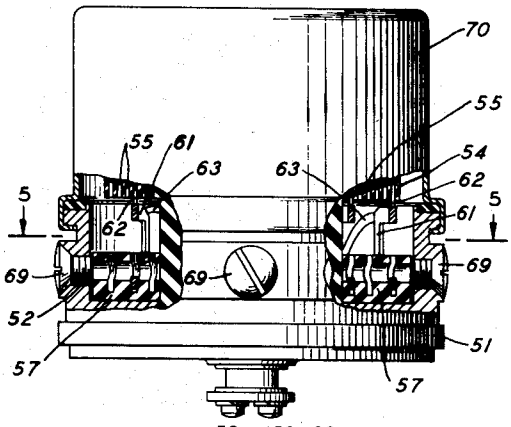


FIG. 5

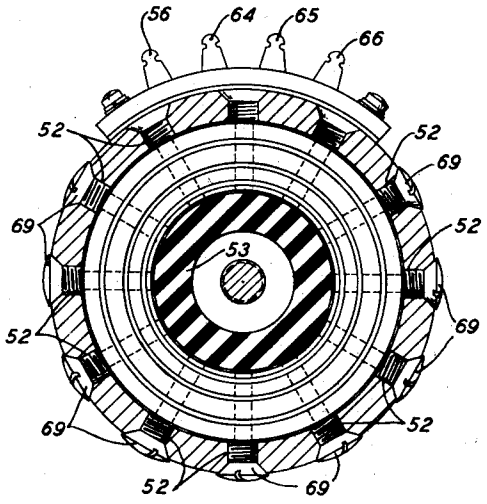


FIG. 6

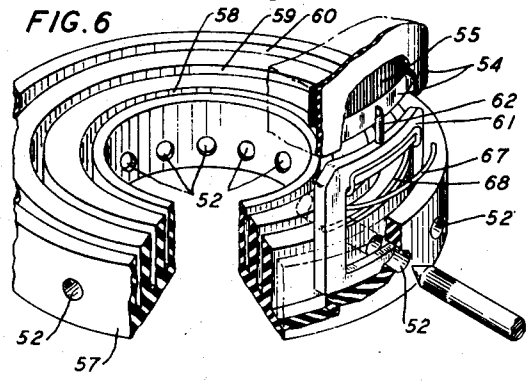


FIG. 8

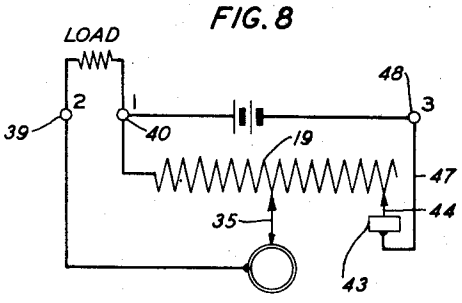


FIG. 9

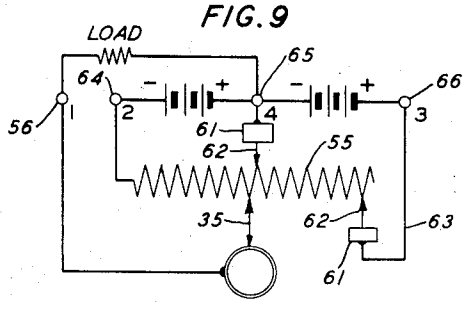
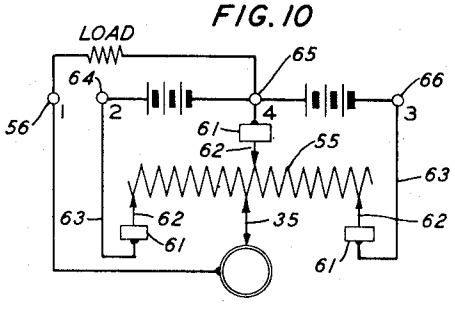


FIG. 10



INVENTORS H. L. COYNE
O. S. A. MESCH

BY

ATTORNEY

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ADJUSTABLE POTENTIOMETER TERMINATION

Howard L. Coyne, Rockville Centre, N. Y., and Orwar S. A. Mesch, Morristown, N. J., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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5 Claims. (Cl. 201—56)

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This invention relates to electrical measuring or controlling devices of the potentiometer type and, more particularly, to such devices which utilize a slide-wire unit comprising a length of resistance wire and a contact-making member or arm adapted for sliding engagement therewith.

The ideal resistance unit for a potentiometer of the self-balancing type should consist of a bare wire of resistance material so disposed that the sliding contact or arm may engage any point along its length and that the length thereof would be precise and of an exact value. However, due to the physical difficulties of obtaining suitable resistance values within the available dimensional limits, it is seldom that this ideal can be obtained without resorting to complicated mechanisms which, in themselves, tend to introduce errors that offset the precision attendant on the use of the continuous bare wires.

In potentiometers of the self-balancing type, it is usual, therefore, for the slide wire or resistance unit to be in the form of a continuous winding on a card or mandrel, with the turns of wire along one edge thereof exposed for contact with a sliding arm or contact member at successive turns. By the use of a very fine wire and a great many turns, the potential drop between successive convolutions may be made so small that a single step, that is, from one turn to the other, or a momentary short-circuit between turns is not preceptible in its effect on the apparatus in the circuit of which the potentiometer forms a part.

In resistance devices in which a resistance wire is wound in a plurality of turns on a support, it is sometimes found necessary in order to obtain predetermined precise resistance values to tap the resistance wire at precise points instead of simply connecting ends of the resistance wire to terminals and using the whole length of resistance wire as a resistance element. The point of tapping may have to be so precise that a particular turn of the resistance wire must be tapped.

It will be appreciated, therefore, in constructing potentiometers of the self-balancing type that it is highly desirable to construct the resistance unit in such a manner that a precise over-all resistance value is assured and that some means should be provided for adjusting the value or effective length of the resistance unit after it has been assembled between terminations thereon.

It is an object of the present invention to provide a potentiometer of the circular slide-wire type in which the terminals thereon may be adjusted after the potentiometer is assembled to

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obtain a precise value between the terminations.

In accordance with one preferred embodiment of my invention, I provide a circular potentiometer with variable terminations which comprises a casing, an arcuate slotted member positioned in the casing below the card of the potentiometer and having positioned therein a slidable arcuate frame having a lead-in wire secured thereto and a contact member projecting upwardly therefrom. Both the frame and the slot are of substantially the same radius of curvature as the potentiometer card and are so positioned below the card that the contact member on the frame will engage the turns of wire on the under surface of the card. Engagement between the contact member on the frame and the potentiometer wires on the card is assured by suitable spring members on the frame which bear on the slotted member and force the frame member upward so that the contact member thereon firmly engages the wires on the resistance member. Apertures are provided in the wall of the potentiometer casing, whereby a suitable tool may be inserted to engage the inner edge of the bottom portion of the frame so that either a clockwise or counter-clockwise rotation imparted to the tool will cause the frame to slide in its arcuate slot and either increase or decrease the resistance by altering the position of the termination.

In another form of the adjustable termination dveice of this invention, a circular member is provided on the interior of the potentiometer casing beneath the card and is provided with a plurality of continuous arcuate-shaped slots on its upper surface so that a plurality of contact carrying frames may be positioned therein for obtaining varying terminations on the potentiometer card at different points along its length. Suitable apertures are provided around the periphery of the potentiometer casing for the insertion of a tool therein to adjust the contact frame.

The invention will be more clearly understood from the following detailed description when read in conjunction with the accompanying drawings, of which:

Fig. 1 is a perspective view of a potentiometer illustrative of this invention, with parts broken away to expose the resistance winding and the adjustable termination in contact therewith;

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

Fig. 3 is a top plan view, partly in section, taken on line 3—3 of Fig. 2;

Fig. 4 is an elevational view, with parts broken

away, of another embodiment of the invention in which a plurality of adjustable terminations may be positioned to make contact with the winding of the resistance wire along its length;

Fig. 5 is a cross-sectional view taken on line 5—5 of Fig. 4;

Fig. 6 is a perspective view, partly in section, of the guide member for the adjustable terminations;

Fig. 7 is an enlarged perspective view of the adjustable termination contact frame;

Fig. 8 depicts a simple circuit employing the potentiometer as shown in Fig. 1 and utilizing one adjustable termination at the end of the resistor unit;

Fig. 9 shows a circuit employing the potentiometer shown in Fig. 4 and utilizes an adjustable termination at the end of the winding and one approximately at its mid-point; and

Fig. 10 illustrates a circuit utilizing the potentiometer of Fig. 4 and with adjustable terminations at each end of the resistance winding and one at the mid-point.

Referring now to the drawings and in particular to Figs. 1, 2, and 3, there is provided a circular casing or housing 10 having a recessed bottom portion 11 in which is fixedly secured, by screws 12 and 13, an insulated sleeve member 14. The sleeve member 14 is provided with a shouldered vertically extending central bore 15 which is in register with an aperture 16 in the bottom of the casing 10.

As shown in Fig. 2, the sleeve 14 extends upwardly some distance above the edge of casing 10 and has secured thereto, on its periphery, a slide-wire resistance unit 17, which comprises a spirally wound card or mandrel 18 having wound thereon in an unbroken length and in adjacent convolutions a resistant wire 19. The turns of the card 18 are separated from each other by the spiral partition or separator 20 which is continuous in length and which, as shown, extends some distance above and below the card 18 and is constructed of suitable insulating material. The resistance unit 17, which comprises the spirally wound card 18 with the resistance wire 19 wound thereon, and the insulated separator or partition 20 is clamped together to form a unitary structure by the band or clamp 21, as shown.

Rotatably mounted in the central bore 15 of the sleeve 14 and extending through the aperture 16 in the casing 10 and beyond the upper end of the sleeve 14 is the operating shaft 22. As shown in detail in Fig. 2, the shaft 22 is provided at its lower end with suitable means 23 for rotating the shaft, and a suitable cover plate 24 is also secured thereto. There is also provided suitable stop means which comprises the worm 25, the travelling washer 26, the fixed washers 27 and 28, and their associated stop pins 29, 30, and 31. These pins cooperate to limit the revolutions of the shaft as it is operated in either a clockwise or counterclockwise direction.

Fixedly secured to the shouldered portion on the upper end of the shaft 22, between the washers 32 and 33, by means of the nut 34, is a radially extending contact carrying arm 35. This arm is constructed of insulating material and has mounted on its free end a pair of contact brushes 36 and 37. Brush 36 is adapted to engage the upper surface of the resistance wire 19 on the card 18 and guided thereon by means of the partition 20, and the brush 37 frictionally engages the collector ring 38 which in turn is connected to a lead-in wire (not shown) connected to the binding post terminal 39 located on the exterior of the casing 10, as shown. This structure provides a variable electrical connection to the resistance unit 17 anywhere along the length of the card. One end of the resistance wire 19 on the card 18, which makes up the resistance unit 17, is connected to the binding post terminal 40 by a suitable lead-in wire (not shown), and the other end of the resistance unit is left unconnected.

In order to provide an accurate and precise termination for the unconnected end of the resistance unit 17, a variable or adjustable termination is provided which permits the effective length of the resistance wire 19 to be accurately adjusted within very close limits. As shown in Figs. 1 and 2, there is provided on the bottom 11 of the casing 10 an arcuate shaped member 41 which is constructed of suitable insulating material and is provided with an arcuate slot 42. The slot 42 is of substantial depth and is adapted to slidably receive the arcuate shaped frame member 43 (shown in Fig. 7), which carries a contact pin 44 on its upper edge. The frame 43 is adapted to freely slide in slot 42 and is forced upward to cause the contact pin 44 to frictionally engage the resistance wire 19 by means of the spring members 45 and 46 which bear against the top surface of the arcuate member 41 and cause the contact pin 44 on the frame 43 to be forced upwardly into contact with the resistance wire 19, as shown. A suitable lead-in wire 47 is attached to the frame 43 and in turn is connected to the binding post 48 on the exterior of the casing, as shown in Fig. 1.

In order to adjust the variable termination of this invention, a suitable tool TL is inserted in the aperture 49 adjacent the frame 43, and since the end of the tool is tapered, it will ride over the inner bottom edge of the frame and cause the contact pin 44 to be moved downward out of engagement with the resistance wire 19. The tool then may be rotated either clockwise or counterclockwise, and due to the frictional engagement of the tool with the lower inner edge of the frame, it will cause the frame 43 and the contact 44 associated therewith to be moved in the groove either in a clockwise or counter-clockwise direction, depending upon the rotation of the tool.

It will be observed that the end termination of the resistance wire may be precisely adjusted to provide the desired resistance value. After the adjustment is made, the aperture through which the tool has been inserted may be closed by any suitable means, for example, a screw. As shown in Figs. 1 and 2, a suitable cover 50 is provided to protect the instrument.

In another embodiment of the invention, as shown in Figs. 4, 5, and 6, there is provided a housing or casing 51 having a plurality of spaced apart apertures 52 on its periphery which extend through the wall thereof and communicate with the interior of the casing 51 (as shown more in detail in Fig. 5).

Like the structure illustrated in Figs. 1, 2, and 3 and described hereinabove, there is provided an insulating sleeve member 53 which is secured to the bottom of the casing 52 and extends above the edge thereof. It has mounted thereon a resistance unit 54 which comprises a structure substantially the same as that shown in and described in detail with respect to Figs. 1, 2, and 3 and is provided with an electrical connection from the rotating arm, the contacts of which are

in sliding engagement with resistance wire **55** on the resistance unit **54**, to the binding post terminal **56** located on the exterior of the casing **51**.

The embodiment of this invention, as shown in Figs. 4, 5, and 6, differs from the structure heretofore described with respect to Figs. 1, 2, and 3 in that neither end of the resistance wire **55**, which makes up the resistance unit **54**, is permanently connected to a binding post terminal. The unit is provided with adjustable terminations both at its ends and mid-way between its ends to provide precise and accurate values of resistance, as will hereinafter be described in detail.

As shown in Figs. 4, 5, and 6 and particularly in detail in Fig. 6, there is provided on the bottom of the casing **51**, surrounding the sleeve member **53** and spaced away from the resistance unit **54**, a ring member **57** of insulating material. The ring member **57** is provided with coaxial grooves or slots **58**, **59**, and **60**. As shown, each slot is of substantial depth and may have slidably positioned therein a frame member **61** having an upstanding contact **62** projecting upwardly therefrom and in frictional engagement with the bottom surface of the resistance wire **55** of the resistance unit **54**.

Each of the frame members **61** has a lead-in wire **63** connected thereto, which in turn is connected to a respective one of the binding post terminals **64**, **65**, and **66** on the outside of the casing **51**.

As heretofore described with respect to Figs. 1 and 7, the frame members **61** are provided with suitable spring members **67** and **68** which bear against the upper surface of the member **57** and force the contact pin **62** into intimate frictional engagement with the bottom of the resistance wire **55**.

The frame **61** may be positioned at any point within the confines of its respective slot or groove and may be moved clockwise or counter-clockwise by inserting a tool, as heretofore described with respect to the structure shown in Fig. 1, through any one of the apertures **52** which is in register with the respective frame, thereby providing not only a variable termination at each end of the resistance unit **54** but a variable mid-tap connection independent of the adjustable contact arm. The latter is adjustably rotated by means of the shaft connected thereto as heretofore described. Suitable closures, for example, the screws **69**, are provided for the apertures **52** when the adjustment has been completed.

As shown, a suitable casing **70** is provided to protect the interior of the device from dust and dirt.

Fig. 8 shows one application of the potentiometer shown in Figs. 1, 2, and 3 which utilizes a single variable termination and its application to a simple circuit.

Fig. 9 shows a simple circuit in which the structure shown in Figs. 4, 5, and 6 is used and in which a variable termination at one end of the resistance unit and a variable connection mid-way between the ends of the resistance unit is provided.

Fig. 10 shows a simple circuit which utilizes the structure of Figs. 4, 5, and 6 to obtain variable terminations at each end of the resistance unit and at a point mid-way between the ends thereof.

While we have shown and described preferred embodiments of the invention, it is to be understood that various changes and modifications may be made therein without departing from the spirit of the invention.

What is claimed is:

1. In an electrical resistance device comprising a card of insulating material and a resistance wire wound in a plurality of convolutions on said card, an adjustable brush in engagement with said resistance wire, a casing, means in said casing for supporting said card, a supporting member positioned in said casing in juxtaposition with respect to said card and having guide means thereon, a contact member comprising a frame and a contact, means biasing said contact against an edge of said card, for making contact with the resistance wire on said card, said frame being slidably positioned on said supporting member and confined in the plane of said card by said guide means, a lead-in wire for establishing an electrical connection, secured to said contact member, said contact member adapted to be moved along said resistance wire, to vary the termination thereof.

2. In an electrical resistance device comprising a card of insulating material and a resistance wire wound in a plurality of convolutions on said card, an adjustable brush in engagement with said resistance wire, an apertured casing, means in said casing for supporting said card, a supporting member positioned in said casing and having an aperture therein in alignment with an aperture in said casing, in juxtaposition with respect to said card and having guide means thereon, a contact member slidably positioned on said supporting member and confined by said guide means, for making contact with the resistance wire on said card, a lead-in wire for establishing an electrical connection, secured to said contact member, said contact member adapted to be moved along said resistance wire, to vary the effective length thereof.

3. In an electrical resistance device comprising a card of insulating material and a resistance wire wound in a plurality of convolutions on said card, an adjustable brush in engagement with said resistance wire, an apertured casing, means in said casing for supporting said card, a supporting member positioned in said casing below said card and having an aperture therein in alignment with an aperture in said casing, and having guide means thereon, a contact member slidably positioned on said supporting member and confined by said guide means, for making contact with the resistance wire on said card, a lead-in wire for establishing an electrical connection, secured to said contact member, said contact member adapted to be moved along said resistance wire, to vary the effective length thereof.

4. In an electrical resistance device comprising a card of insulating material and a resistance wire wound in a plurality of convolutions on said card, an adjustable brush in engagement with said resistance wire, an apertured casing, means in said casing for supporting said card, a supporting member positioned in said casing and having an aperture therein in alignment with an aperture in said casing, in juxtaposition with respect to said card and having guide means thereon, a contact member comprising a frame and a contact, means biasing said contact against an edge of said card, said contact having a knife edge adapted to forcibly engage said resistance wire, said frame being slidably positioned on said supporting member and confined in the

plane of said card by said guide means, a lead-in wire for establishing an electrical connection, secured to said contact member, said contact member adapted to be moved along said resistance wire, to vary the termination thereof.

5. In an electrical resistance device comprising a card of insulating material and a resistance wire wound in a plurality of convolutions on said card, an adjustable brush in engagement with said resistance wire, an apertured casing, means in said casing for supporting said card, a supporting member positioned in said casing and having an aperture therein in alignment with an aperture in said casing, in juxtaposition with respect to said card and having guide means thereon, a contact member comprising a frame and a contact, means biasing said contact against an edge of said card, said contact having a knife edge adapted to forcibly

engage said resistance wire, said frame being slidably positioned on said supporting member and confined in the plane of said card by said guide means and having a follower surface in alignment with said apertures adapted to be engaged by means inserted in said apertures for moving said contact member along said resistance wire, and a lead-in wire for establishing an electrical connection, secured to said contact member.

HOWARD L. COYNE.
ORWAR S. A. MESCH.

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Number	Name	Date
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