

May 6, 1947.

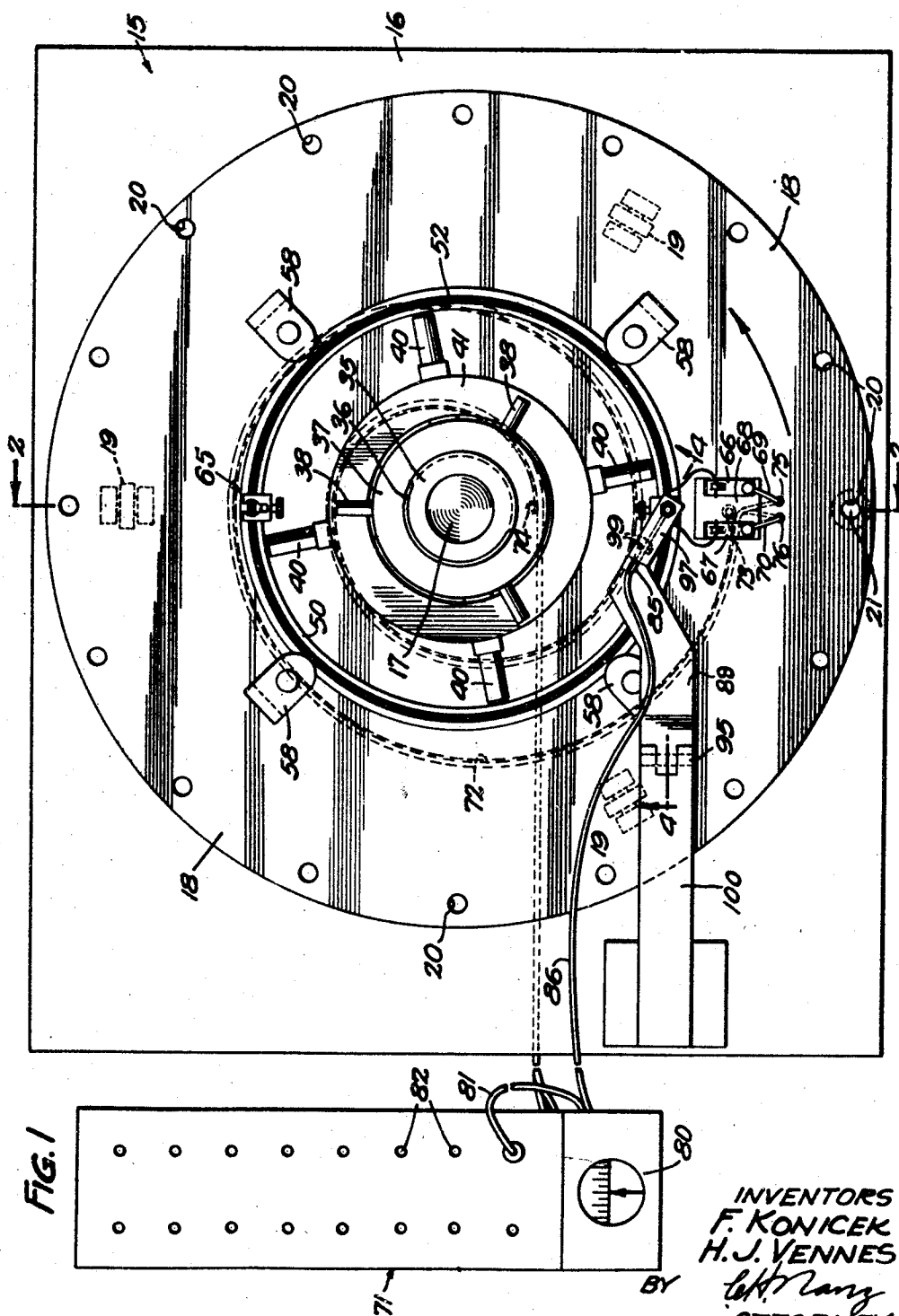
F. KONICEK ET AL

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METHOD OF MOUNTING AND ADJUSTING POTENTIOMETER ELEMENTS

Original Filed Sept. 15, 1943

3 Sheets-Sheet 1



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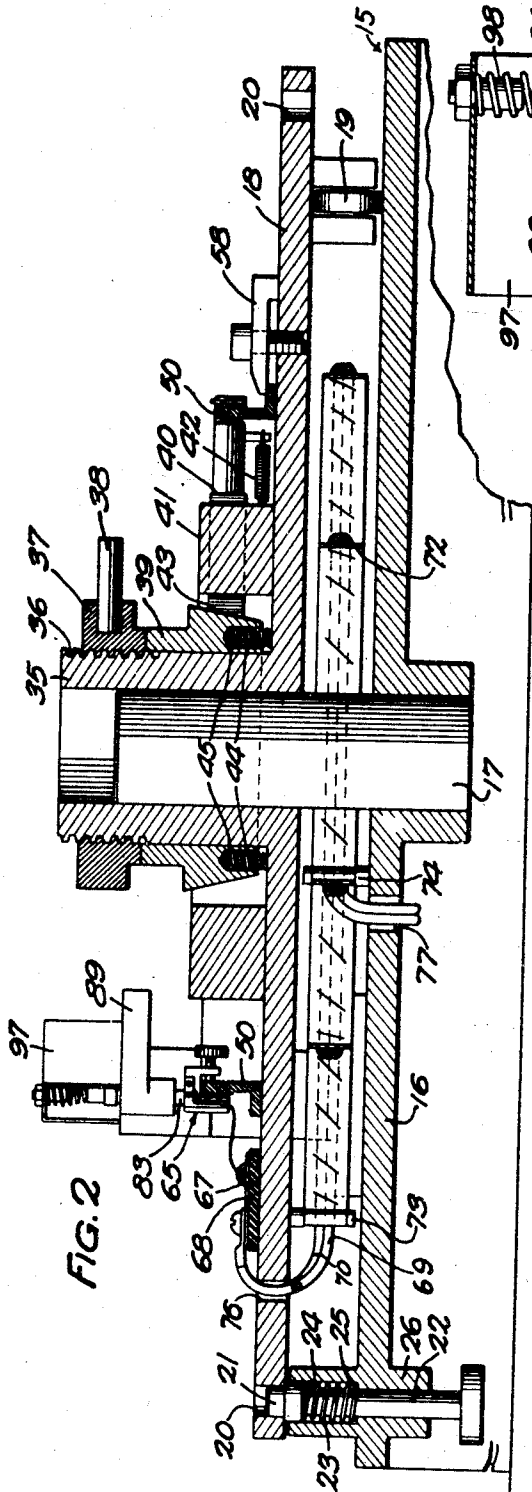


FIG. 2

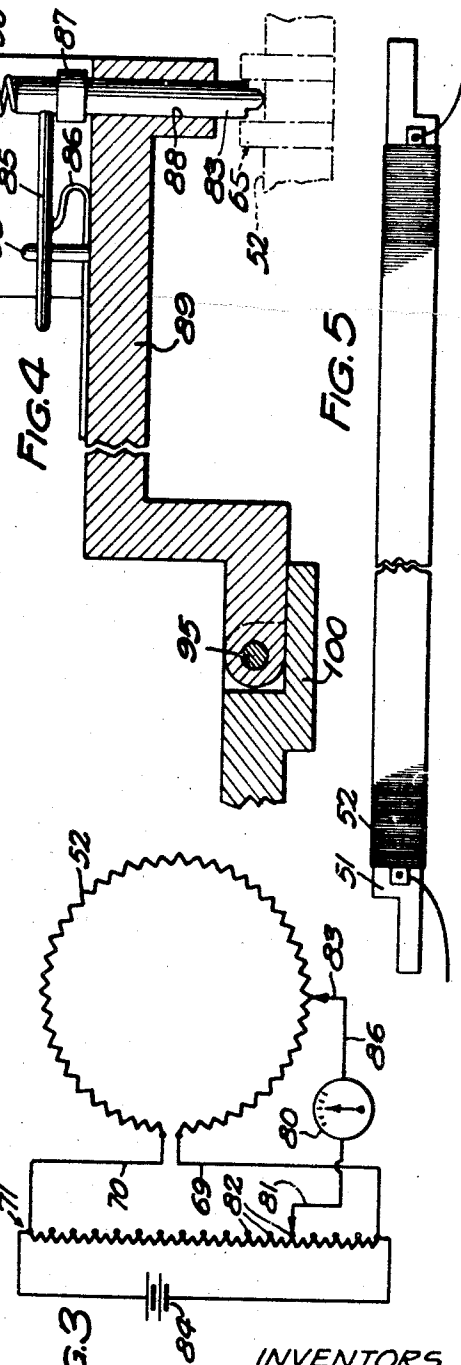


FIG. 3

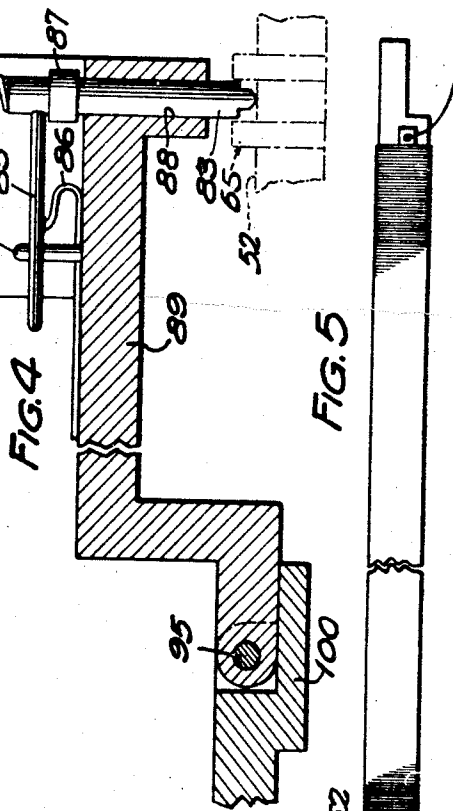


FIG. 4

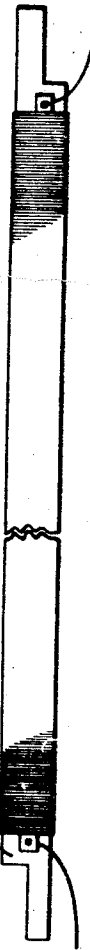


FIG. 5

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METHOD OF MOUNTING AND ADJUSTING
POTENTIOMETER ELEMENTS

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No. 502,410. Divided and this application No-
vember 4, 1944, Serial No. 561,960

8 Claims. (Cl. 29—155.5)

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This invention relates to methods of mounting and adjusting potentiometer elements.

This application is a division of copending application Serial No. 502,410, filed September 15, 1943, for "Article assembling method and apparatus."

It is an object of the present invention to provide new and improved methods of mounting and adjusting potentiometer elements.

In accordance with one embodiment of the invention, a potentiometer card, that is, a strip of insulation having a resistance element wound thereon, is assembled on a circular supporting member and tested during the assembling of the card on the supporting mechanism. A supporting member, to which a potentiometer card is to be attached, is placed on a rotatable disc or table and centered thereon so that the disc and supporting member will be rotatable about the same axis when the disc is rotated. Means are provided for stopping the disc in a predetermined number of positions and a measuring circuit, including a resistance ratio box, is provided with contacting means adapted to engage the resistance element at predetermined points about its periphery after the card has been mounted upon the supporting member, whereby the resistance element may be adjusted to have the desired resistance ratios at the said predetermined points.

A clear understanding of the invention may be had by reference to the following detailed description of a method forming one embodiment thereof, when considered in conjunction with the accompanying drawings showing said embodiment, wherein

Fig. 1 is a plan view of the apparatus showing a supporting member and resistance element positioned on the disc;

Fig. 2 is a transverse sectional view taken substantially along the line 2—2 of Fig. 1 in the direction of the arrows;

Fig. 3 is a circuit diagram of the connections to the testing circuit;

Fig. 4 is an enlarged irregular vertical sectional view taken substantially along the line 4—4 of Fig. 1 in the direction of the arrows;

Fig. 5 is a detail view of a resistance element to be assembled on its supporting member in the apparatus, part of the element being broken away to conserve space;

Fig. 6 is an enlarged fragmentary detail view of a portion of a clamping means mounted on the supporting means;

Fig. 7 is a transverse vertical sectional view taken substantially along the line 7—7 of Fig. 6 in the direction of the arrows;

Fig. 8 is a fragmentary perspective view of a portion of the article assembled in the apparatus;

Fig. 9 is a plan view of a portion of the article

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assembled in the apparatus with some of the clamps in place, and

Fig. 10 is a fragmentary sectional view taken substantially along the line 10—10 of Fig. 9 in the direction of the arrows.

In the drawings, there is shown a base member 15 (Figs. 1 and 2), which may be of any suitable construction, provided with a top plate 16, in which there is fixed a stud shaft 17. The stud shaft 17 extends upwardly above the top of the plate 16 and serves to properly position a disc 18 for rotation with respect to the plate 16. The disc 18 is provided with a plurality of rollers 19, freely rotatable with respect thereto and serving to support the disc 18 in spaced relation to the plate 16. A plurality of locating apertures 20 are equally spaced about the disc 18 for receiving a locating pin 21, which serves to locate the disc 18 in any one of sixteen positions of rotation. The pin 21 is formed on the upper end of a manually operable plunger 22, which is normally urged upwardly with respect to the plate 16 by a compression spring 23 surrounding the shank of the plunger 22 and nested between a collar 24 formed on the plunger 22 and a shoulder 25 formed in a bearing 26 in which the plunger 22 is slidable.

Formed centrally on the disc 18 (Fig. 2) is a hub portion 35, which encircles the stud shaft 17 and on which there is formed a relatively coarse thread 36 adapted to threadedly engage a collar 37 provided with actuating pins 38, whereby the collar may be rotated on the hub portion 35. Surrounding the hub portion 35 is an annular cam member 39, which engages the inner ends of the series of locating pins 40 equally spaced about the annular cam member 39. The locating pins 40 are slidably mounted in a ring 41 suitably attached to the upper surface of the disc 18 and concentric with the hub 35. Each of the pins 40 is urged toward the axis of the hub 35 by contractile springs 42 individual thereto and will thus be urged to engage a sloping cam surface 43 on the cam member 39. It is believed to be apparent from the foregoing that the pins 40 will be forced radially outwardly with respect to the hub 35 by rotating the collar 37 in a direction to move it downwardly toward the upper surface of the disc 18 and that the springs 42 will normally urge the pins 40 radially inwardly to cause them to follow the sloping cam face 43 of cam member 39 when the collar 37 is rotated in a direction to move it upwardly on the hub 35. A series of springs 44 seated in pockets 45 formed inwardly from the lower surface of the cam member 39 bear against the upper surface of the disc 18 and normally urge the cam member 39 upwardly against the collar 37.

The article to be assembled and adjusted during its assembly in a method embodying the

present invention is shown most clearly in Figs. 8 and 9 and comprises an annular base member 50 of L-shaped cross section, on which a potentiometer card 51 having a winding of resistance wire 52 wound thereon is to be positioned. The potentiometer card 51 with the resistance wire 52 wound thereon is interposed between two strips 53 and 54 of insulating material and is clamped on the upright flange of the base member 50 by spacer or clamping members 55, which are, in turn, held in place by set screws 56 threaded into a ring 57 extending around the outer surface of the upright flange of the base member 50. In assembling this potentiometer unit, the base member 50 is first positioned on the disc 18 and then positioned co-axially of the axis of rotation of the disc by manipulating the collar 37 to force the pins 40 outwardly to properly align the base member 50. Thereafter, the clamps 58 may be clamped onto the horizontal flange of the base member 50, as seen in Fig. 2, to hold the base member tightly in the position shown, where it will be concentric with the hub 35.

After the base member 50 (Fig. 1) has been properly located on the disc 18, the potentiometer card 51, with the winding of resistance wire 52 thereon, may be clamped on the base member 50 by means of a series of clamps, designated generally by the numeral 65, to be described more in detail hereinafter, and the ends of the resistance wire may be connected to spring connectors 66 and 67. The spring connectors 66 and 67 are mounted upon a block of insulation 68 (Fig. 2) and are electrically interconnected by means of leads 69 and 70 to a resistance measuring device 71 (Fig. 3). The block of insulation 68 (Fig. 1) is mounted upon the upper surface of the disc 18 and the leads 69 and 70 are mounted upon and suitably insulated from a spiral spring 72, having one end fixed to the undersurface of the disc 18 by means of a pin 73, and having the other end fixed to the top plate 16 of the base member 15 by means of a pin 74. The two leads 69 and 70 pass through suitable apertures 75 and 76 in the disc 18 and then are attached to the spiral spring 72 in any suitable manner and then extend down through an aperture 77 (Fig. 2) in the top plate 16, in the base 15, and thence to the measuring device 71.

The measuring device 71 (Fig. 3) includes a galvanometer 80, having one lead 81 therefrom connectible to taps 82 of a resistance box, and having the other end connected, as will be described hereinafter, to a contact member 83 adapted to engage the windings of resistance wire 52 wound on a potentiometer card 51 (Fig. 9). The leads 69 and 70 (Fig. 3) are connected to the end taps of the resistance box, and a source of current 84 is connected across all of the resistances in the resistance box. This arrangement constitutes a Wheatstone bridge whereby the resistance ratio of resistance wire 52 at the point where it is contacted by the contact member 83 is measured with a high degree of accuracy.

The contact member 83, as shown most clearly in Fig. 4, is electrically connected to a horizontally disposed arm 85, which is, in turn, connected, through a lead 86, to the galvanometer 80. The contact member 83 is provided with a shoulder 87 and is normally urged downwardly by a compression spring 96, being slidably mounted in a bearing aperture 88. A guard member 97 has a spring guiding post 98 fixed in it for holding the spring 96 against the contact mem-

ber 83, thereby to urge the collar 87 into engagement with a pivoted lever 89, in which the aperture 88 is formed. The arm 85 is disposed between a pair of guide pins 99-99, which are mounted in the lever 89 and serve to prevent rotation of the contact member 83 when the contact member moves in its bearing aperture. The pivoted lever 89 is mounted on a pivot pin 95, which is set into a bracket 100 suitably attached to the top plate 16 of the base member 15, and is in horizontal alignment with the normal position of the point of the contact member 83, thereby to permit free vertical movement of the contact member with respect to the pivoted lever 89 and at the same time to permit the assembly of the contact member and pivoted lever to move about pin 95 without moving laterally with respect to the resistance card.

The contact member 83 is adapted to engage the winding of resistance wire 52 at predetermined points around the periphery of the potentiometer card 51, and since it is essential that the resistance ratios of the resistance wire at the points of contact be held within very close limits, the potentiometer card 51 is clamped to the upright flange of the base member 50 at these points by means of set screws 56 (Fig. 9) and adjustments may be made between these points by including a few more turns or a few less turns of resistance wire between these points. Since the set screws 56 are to clamp the clamp or spacer elements 55 against the base member 50 at these points, the clamp 65 is cut away to permit the passage through it of the set screws 56.

The clamp 65 comprises, as shown most clearly in Figs. 6, 7 and 9, a thumb screw receiving leg 101, in which a thumb screw 102 may be threaded.

The leg 101 extends vertically and is formed integrally with horizontal portions 103 and 104 adapted to extend over the top of the resistance card 51 and to terminate in vertically disposed legs 105 and 106, respectively. The horizontal portions 103 and 104 are rounded on their adjacent surfaces to permit the passage through the clamp of the contact member 83, and they have bent leaf springs 107 and 108, respectively, attached to them for supporting the clamp element or spacer 55 during the assembling operation and until it is clamped in place by the set screws 56. The lower surfaces of the horizontal portions 103 and 104 of the clamp 65 rest on the upper surface of the base member 50, as shown at 110 (Fig. 7) and cutouts 111 are formed in these horizontally extending portions to prevent contact of the metallic clamp element with the resistance wire 52.

In practicing a method forming one embodiment of the invention, a potentiometer card 51 (Fig. 9), having windings of resistance wire 52 on it, is clamped lightly against the upright flange of the base member 50 by means of the clamps 65, and the leads 69 and 70 (Fig. 1) are electrically connected to the resistance measuring device 71, described in detail hereinbefore. After this connection has been made, the disc 18 may be rotated to the place where the locating pin 21 will enter the first locating aperture 20 clockwise from the adjacent ends of the resistance wires, the disc 18 being rotated counterclockwise in making the test. With the disc 18 in this position, the pivoted lever 89 may be lowered to bring the contact member 83 into the rounded-out adjacent portions of the horizontal portion of the clamp 65 and the ratio of resistance between the end of the resistance wire 52 and the point of

contact and the entire resistance may be read on the galvanometer. If this resistance is less than the desired amount, the clamp 65 may be loosened slightly and a wedge 120 (Fig. 10) may be forced between the potentiometer card 51 and the strip of insulation 53 to thereby draw one or more additional turns of resistance wire into position between the point of contact of the contact member and the end of the wire, thus to correct any slight difference between the desired amount of resistance and that actually included in this portion of the potentiometer card.

The just-described operation may be repeated at each of the locating apertures 20 (Fig. 1) on the disc 18 and after the proper adjustments have been made in the length of resistance wire included between the various clamps, the ring 57 may be placed in position surrounding the base member 20 and the set screws 56 may be clamped against the clamp elements or spacers all the way around the base member 50, whereupon the clamps 65 may be removed from the base member 50 and the base member 50 may be released from the clamps 58 and locating pins 40 and a new base member 50 placed in position to assemble another potentiometer unit.

What is claimed is:

1. The method of assembling potentiometer cards, which comprises fixing the ends of such a card to a support, fixing the intermediate portions of the card to said support at predetermined points between the fixed ends of the card, measuring the ratio of the resistance of a portion of the card between one of said fixed points and one end of the card to the resistance of the entire card, unfixing the card at said predetermined point at the end of said portion, flexing the card to move the portion of the card at the unfixed point to adjust the resistance ratio, and refixing the card at the unfixed point.

2. The method of assembling potentiometer cards, which comprises clamping such a card along a support at predetermined points on the support, measuring the ratio of the resistance of a portion of the card between an end thereof and one of the predetermined points to the resistance of the entire card, unclamping the card from the support at the predetermined point at which one end of said portion is located, moving the portion of the card adjacent to the last-mentioned point relative to that point to adjust said resistance ratio, and reclamping the card to the support at the last-mentioned point.

3. The method of mounting and adjusting a potentiometer element, which comprises temporarily attaching the ends of an elongated resistance element to a support, determining the ratio of resistance of a portion of the element between fixed points to the element as a whole, wedging the resistance element away from the support in the area between said fixed points to increase the length thereof between said points when the ratio is too low, and then permanently attaching the element to the support at said points.

4. The method of assembling and adjusting a potentiometer element and a support, which comprises temporarily attaching a resistance element at fixed points to a support, measuring the resistance ratio of the parts of the element between said points to the resistance element as a whole, bending the element away from the support between said points to increase the ratio of the

portion between the points to the whole, and permanently affixing the element to the support in said bent condition.

5. A method of assembling and adjusting a potentiometer element and its support, which comprises temporarily clamping a resistance element at fixed points to the support, temporarily connecting portions of the resistance element between said fixed points to a ratio measuring circuit to measure the resistance ratio of a portion between said points to the resistance element as a whole, adjusting the ratio of the portion between said points to the whole by displacing the resistance element from the support to increase the resistance ratio of the displaced portion to the whole, and permanently fixing the element to the support at said fixed points.

6. The method of mounting and adjusting a potentiometer element, which comprises clamping an annular supporting member to a support, placing an elongated resistance element around the annular supporting member, clamping the resistance element to the annular supporting member at points on the member spaced predetermined distances from each other, measuring the ratio of the resistance to the whole element of a portion of the element between an end thereof and one of said points, unclamping the element at that point if the determined ratio is not a desired ratio and flexing the portion of the element adjacent to said point to adjust the ratio, determining the adjusted ratio, repeating said procedure at the other points on the annular supporting member, placing a clamping ring around the resistance element, clamping the clamping ring to the element at said points, whereby the resistance element is clamped to the annular supporting member at said points, and unclamping the annular member from the support.

7. The method of assembling potentiometer cards, which comprises fixing the ends of such a card to a support, measuring the ratio of the resistance of a portion of the card at a predetermined point thereon to the resistance of the entire card, flexing the card at the predetermined point to obtain a given resistance ratio at said point, and fixing the card at the predetermined point in its flexed position.

8. The method of mounting and adjusting a potentiometer element, which comprises securing the ends of an elongated resistance element to a support, temporarily securing intermediate portions of the resistance element to the support at a plurality of predetermined points, determining the ratio of resistance to the whole element of a section thereof extending a fixed distance from one end, deforming said section to increase the length thereof between fixed points when the resistance ratio is too low, and then permanently securing said deformed section to the support.

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REFERENCES CITED

The following references are of record in the file of this patent:

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