Jan. 18, 1949. F. KONICEK ET AL 2,459,228

ARTICLE ASSEMBLING APPARATUS

Filed Sept. 15, 1943

3 Sheets-Sheet 1

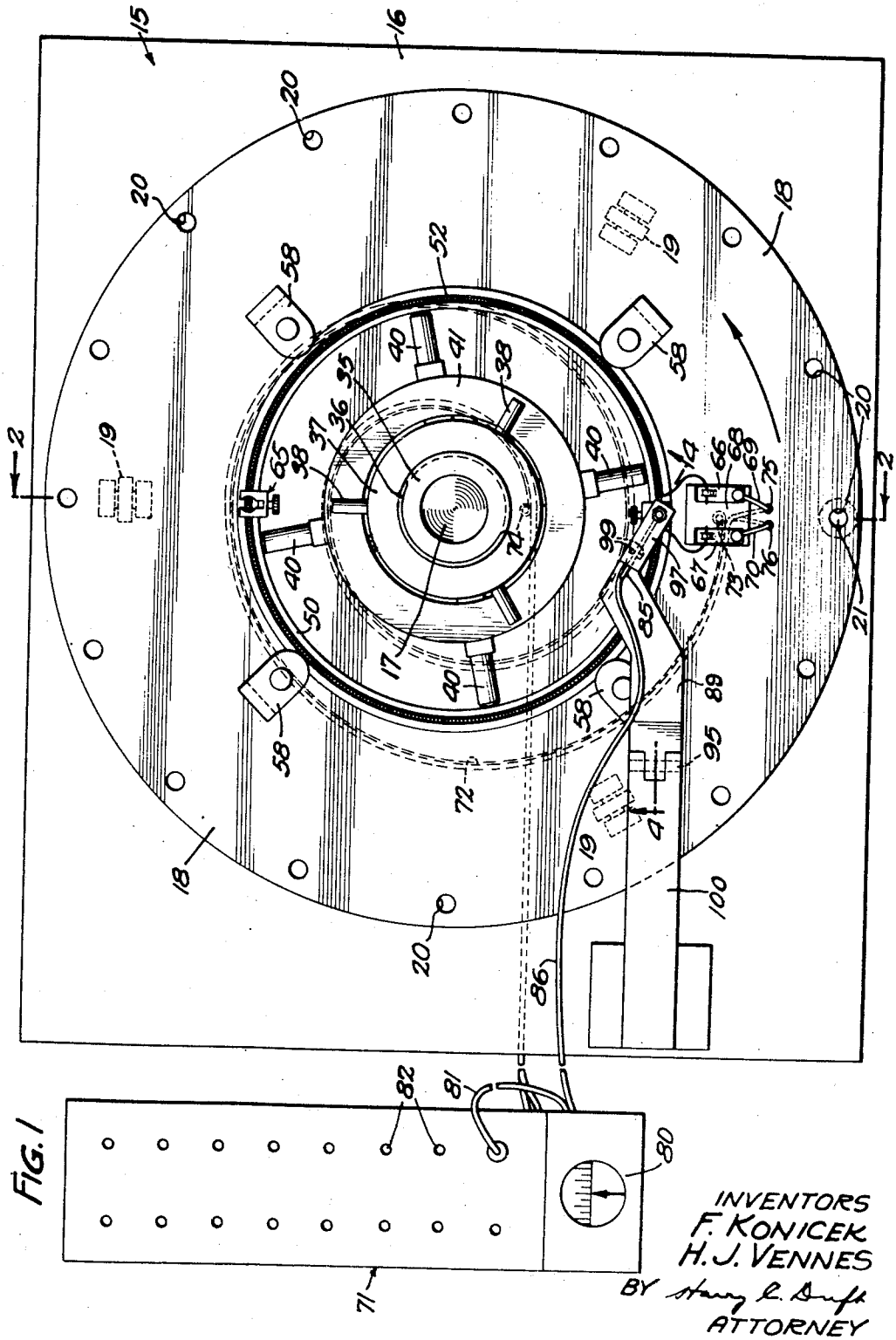


FIG. 1

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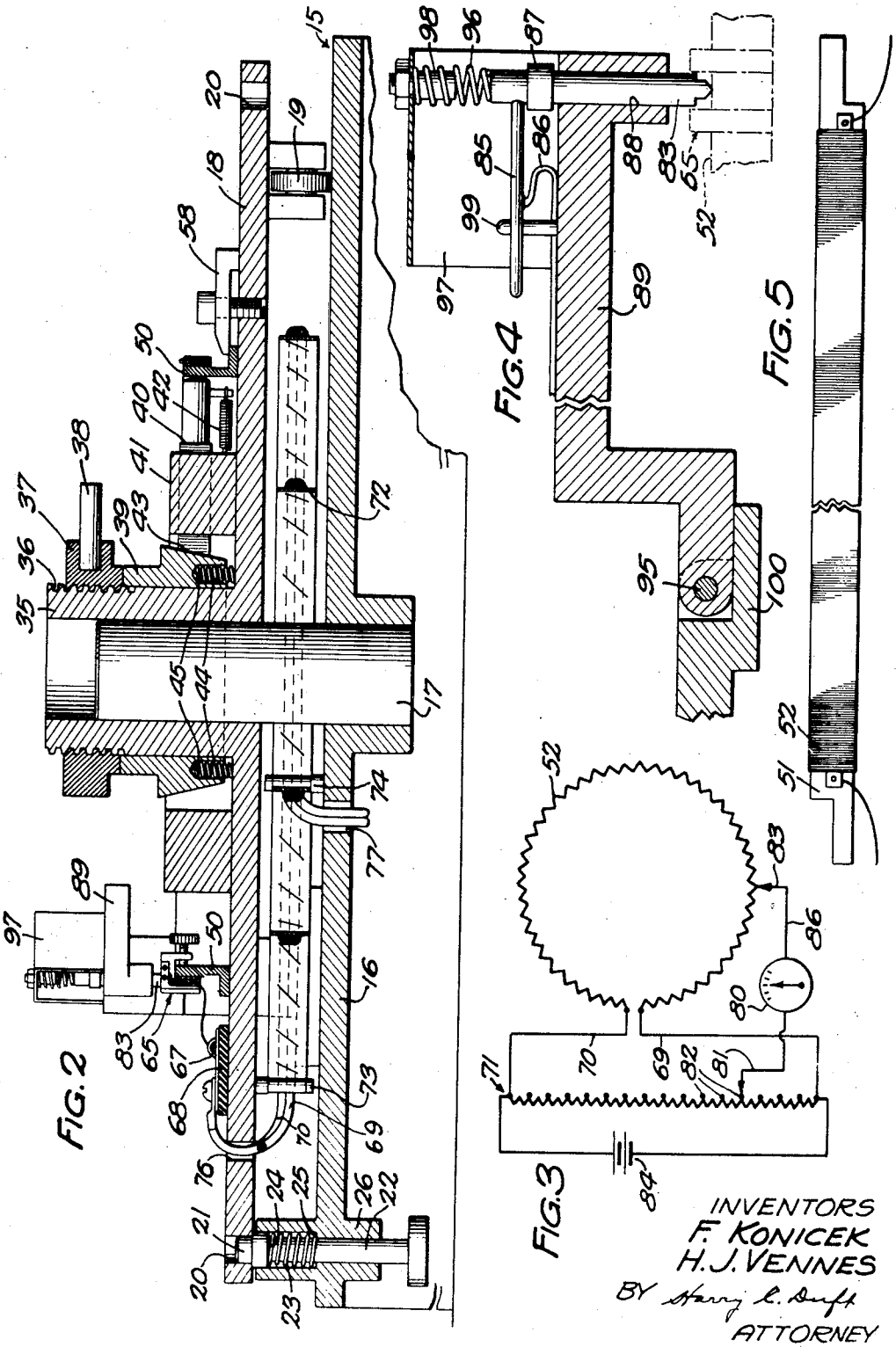


FIG. 2

FIG. 4

FIG. 5

FIG. 3

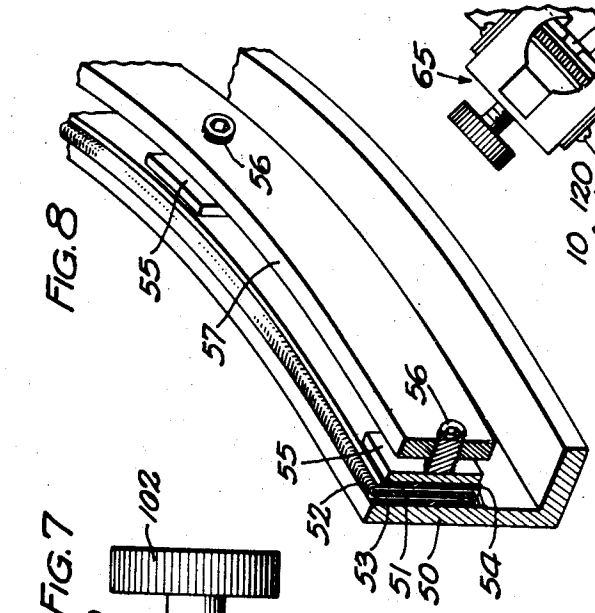
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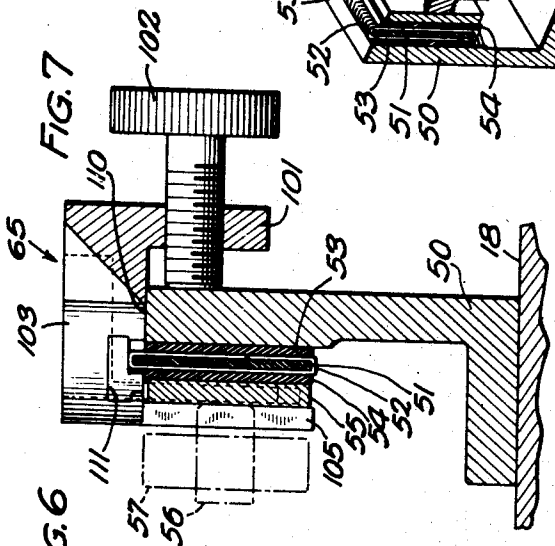
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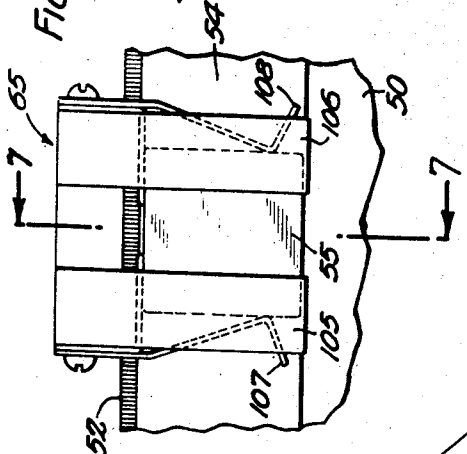
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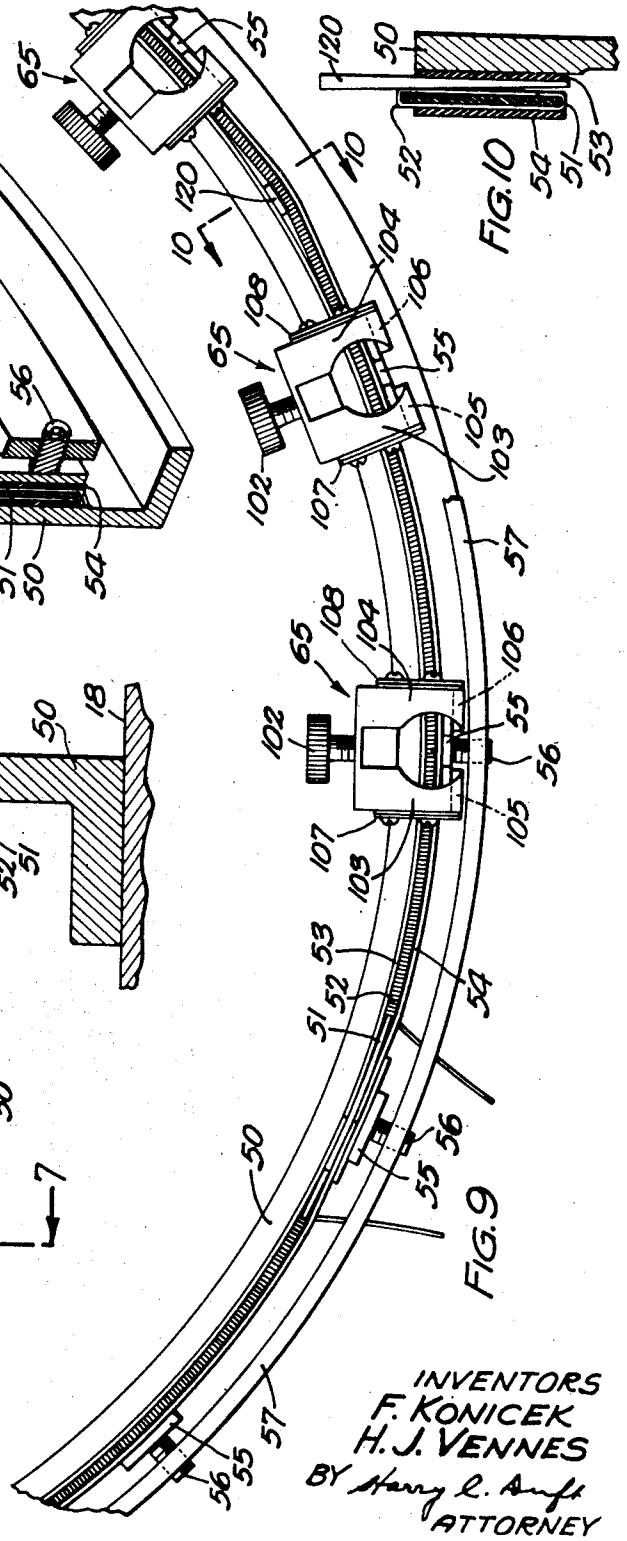
Filed Sept. 15, 1943

3 Sheets-Sheet 3









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Patented Jan. 18, 1949

2,459,228

UNITED STATES PATENT OFFICE

2,459,228

ARTICLE ASSEMBLING APPARATUS

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Application September 15, 1943, Serial No. 502,410

6 Claims. (Cl. 175—183)

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This invention relates to an article assembling apparatus and more particularly to apparatus for simultaneously adjusting and assembling resistance elements.

It is an object of the present invention to provide a simple mechanism for quickly assembling an article in a manner such that the article will have a desired characteristic.

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 element 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 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;

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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 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, 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 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 the apparatus comprising the present invention as shown most clearly in Figs. 8 and 9 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 spacers 55, which are, in turn, held in place by a predetermined number of equally spaced set screws 56 threaded into a ring 57 extending around the outer surface of the upright flange of the base member 50. The set screws 56—56 are provided on the ring 57 at points in registry with the locating apertures 20—20 provided in the disc 18. 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 has thus been properly located on the disc 18, the potentiometer card 51, with the winding of resistance wire 52 thereon, is 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 clamps 65—65 are positioned around the annular base 50 at equally spaced points in registry with the locating apertures 20—20 provided in the disc 18 and, consequently, are in registry with the set screws 56—56 carried by the ring 57. 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 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 in the top plate 16, in the base 15, and thence to the measuring device 71. The provision of the spiral spring 72 between the disc 18 and the base 16 makes the disc 18 rotatable in a counterclockwise direction for one complete revolution against the action of the spring, as indicated by the arrow thereon, and provides a fixed starting position for the disc 18, as shown in Fig. 1. In addition, the spring 72 serves to urge the disc to its fixed starting position whenever the locating pin 21 is withdrawn from one of the locating apertures 20 provided in the disc..

The measuring device 71 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. The leads 69 and 70 are connected to the end taps of the resistance box and a source of potential 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 member 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 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 spacer 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 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 the operation of the apparatus, the annular base 50 is positioned on the disc 18, coaxially aligned with the axis of rotation thereof by operation of the cam 39 and pins 40—40 and clamped in this position by clamps 58—58. The potentiometer card 51, having windings of resistance wire 52 on it, is clamped lightly against the upright flange of the base member 50 so that the first turn of the winding 52 engages the contact finger 83 of the arm 89 by means of the clamps 65. The beginning and end turns of the winding 52 are connected to the clips 67 and 68, respectively, which are electrically connected by leads 69 and 70 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 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 on the disc 18 and after the proper adjustments have been made in the length of resistance wire including between the various clamps, the ring 57 may be placed in position surrounding the base member 50 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. An article assembling apparatus comprising rotatable means for supporting an annular element of the article for rotation, means provided on the rotatable means for aligning the annular element coaxially with the axis of rotation of the supporting means including an annular cam, a plurality of locating pins actuated by said cam for engaging the inner surface of the annular element and spacing it equi-distant from the center of the supporting means at all points of contact, removable clamping means for attaching a resistance element around the annular element at a plurality of equally spaced points, means for positioning the rotatable supporting means in predetermined rotative positions in registry with the clamped points of the resistance element, and pivotally mounted contacting means engageable with the resistance element at each clamped point thereof when the rotatable means is in one of its rotative positions.

2. An article assembling apparatus comprising rotatable means for supporting an annular element of an article to be assembled, removable clamping means for attaching a resistance element around the annular element at a plurality of equally spaced points, means for positioning the rotatable supporting means in predetermined rotative positions in registry with the clamped point of the resistance element, a pivotally mounted contractor engageable with the resistance element at each clamped point thereof when the rotatable means is in one of its rotative positions, said clamping means comprising a plurality of individual clamps each having a single leg in which a thumbscrew is threaded to engage the annular element and a pair of opposed legs for holding a spacer element of the article against the resistance element, and spring fingers on the clamps for holding the spacer element adjacent to the opposed legs during the assembling operation of the resistance element on the annular element.

3. In an article assembling apparatus including a resistance ratio measuring circuit, the improvement which comprises a base, a rotatable disc mounted on the base, means for securing the disc in any one of a given number of equally spaced positions with respect to said base, means carried by the disc for centering and securing thereon an annular support on which an insulated potentiometer card is to be positioned, means for clamping the potentiometer card around the support at points in registry with the rotative positions of the discs, means for connecting the ends of a potentiometer card positioned upon the annular support to the resistance ratio measuring circuit, an arm pivotally mounted upon the base and carrying a contact member for engaging the edge of the potentiometer card at each of the clamped points thereof, and means for connecting the contact member in the resistance ratio measuring circuit.

4. In an article assembling apparatus including a resistance ratio measuring circuit, the improvement which comprises rotatable means for supporting an annular element of an article to be assembled, means for centering the annular element on the rotatable supporting means, removable clamping means for attaching a resistance element around the annular element at a plurality of equally spaced points, means for positioning the rotatable supporting means in predetermined rotative positions in registry with the clamped points of the resistance element, pivotally mounted contacting means engageable with the resistance element at each clamped point thereof when the rotatable means is positioned in one of its rotative-positions, and means for connecting the resistance element and the contacting means in the resistance ratio measuring circuit.

5. In a fixture for assembling potentiometer cards on annular supports including a resistance ratio measuring circuit, the improvement which comprises a base, a disc rotatably mounted on the base and having a fixed starting point, means for securing the disc in any one of a given number of equally spaced rotative positions with respect to its starting position, means carried by the disc for centering and securing thereon an annular support on which a potentiometer card may be positioned, means for clamping the potentiometer card around the annular support at points in registry with the rotative positions of the disc,

means for connecting the ends of a potentiometer card positioned upon the annular support to the resistance ratio measuring circuit, an arm pivotally mounted upon the base and carrying a contact finger for engaging the edge of the potentiometer card at each clamped point thereof when the disc is in one of its rotative positions, a spring for supporting said contact member and operable to urge the contact member to engage the potentiometer card, and means for connecting the contact member in the resistance ratio measuring circuit.

6. An apparatus for assembling a composite resistance unit including an annular support, a resistance element and a ring for clamping the resistance element to the support, which comprises a base, a rotatable disc mounted on the base, means for selectively securing the disc in any one of a given number of equally spaced rotative positions with respect to the base, means carried by the disc for centering and securing an annular support of the article thereon, and temporary clamping means for clamping the resistance element around the annular support at

points in registry with the rotative positions of the disc so that the resistance element may be permanently secured to the annular support by the clamping ring after which the temporary clamping means may be removed from the annular support.

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Certificate of Correction

Patent No. 2,459,228. January 18, 1949.

FRANK KONICEK ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 12, claim 2, for the word "contractor" read *contactor*;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of September, A. D. 1949.

[SEAL]

JOE E. DANIELS,
Assistant Commissioner of Patents.