

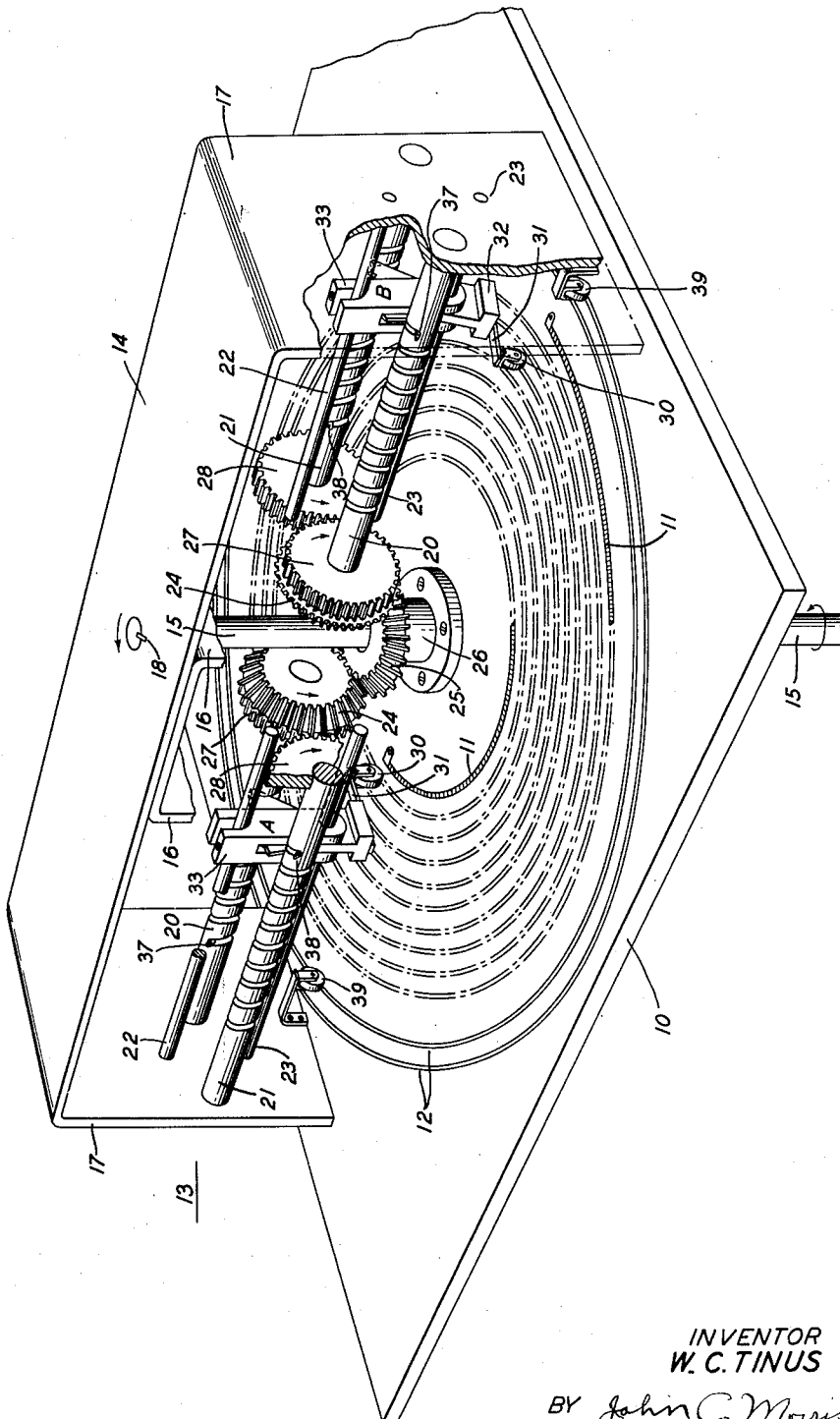
April 13, 1954

W. C. TINUS
POTENTIOMETER

2,675,451

Filed Oct. 20, 1952

4 Sheets-Sheet 1



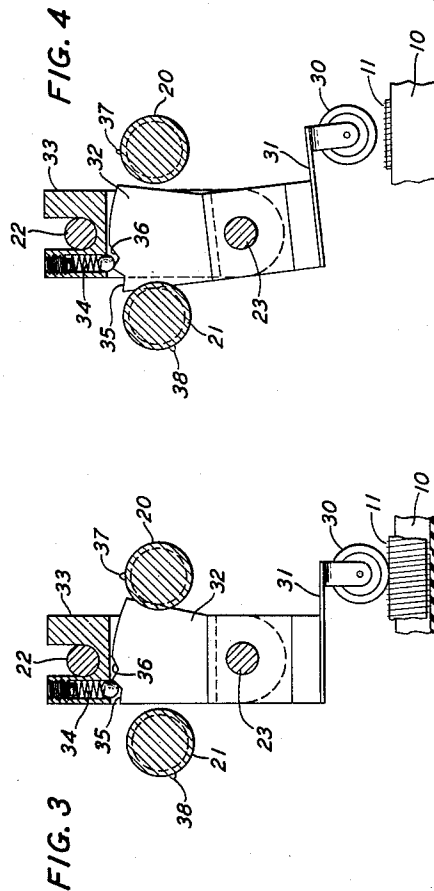
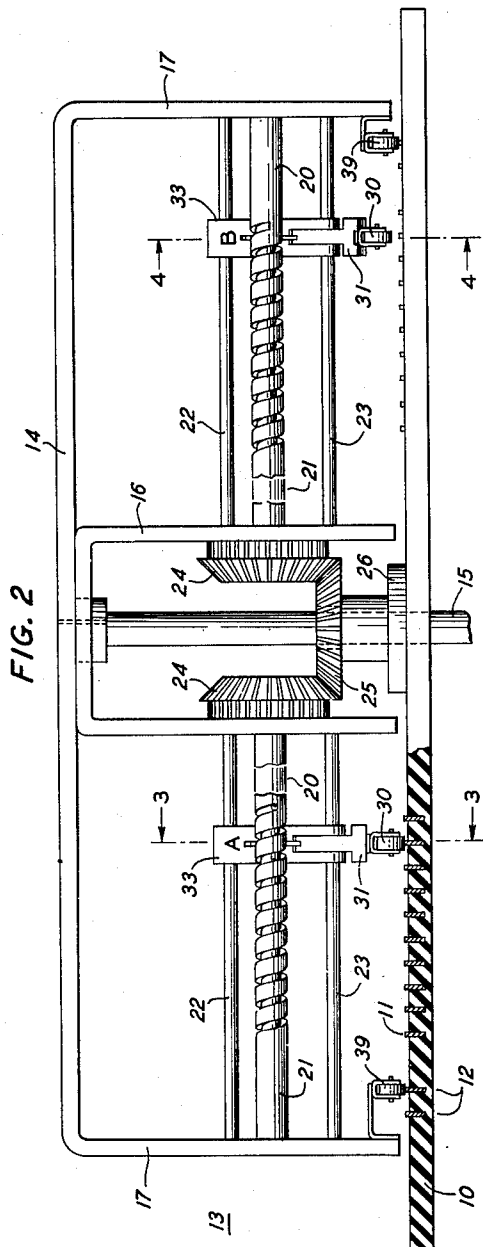
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4 Sheets-Sheet 2



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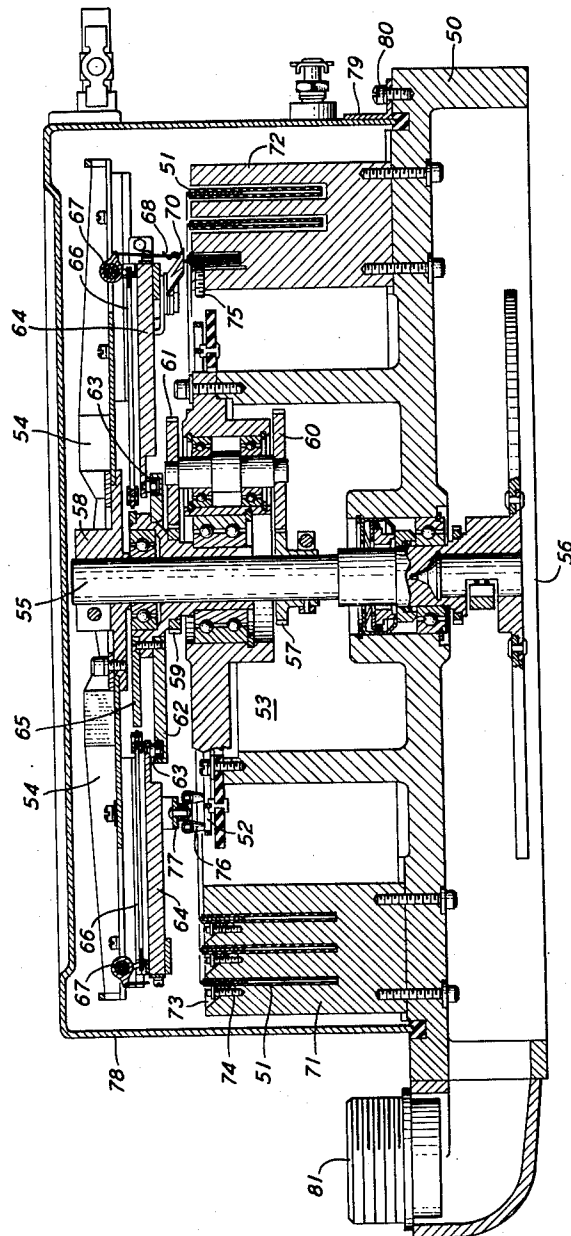
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FIG. 5



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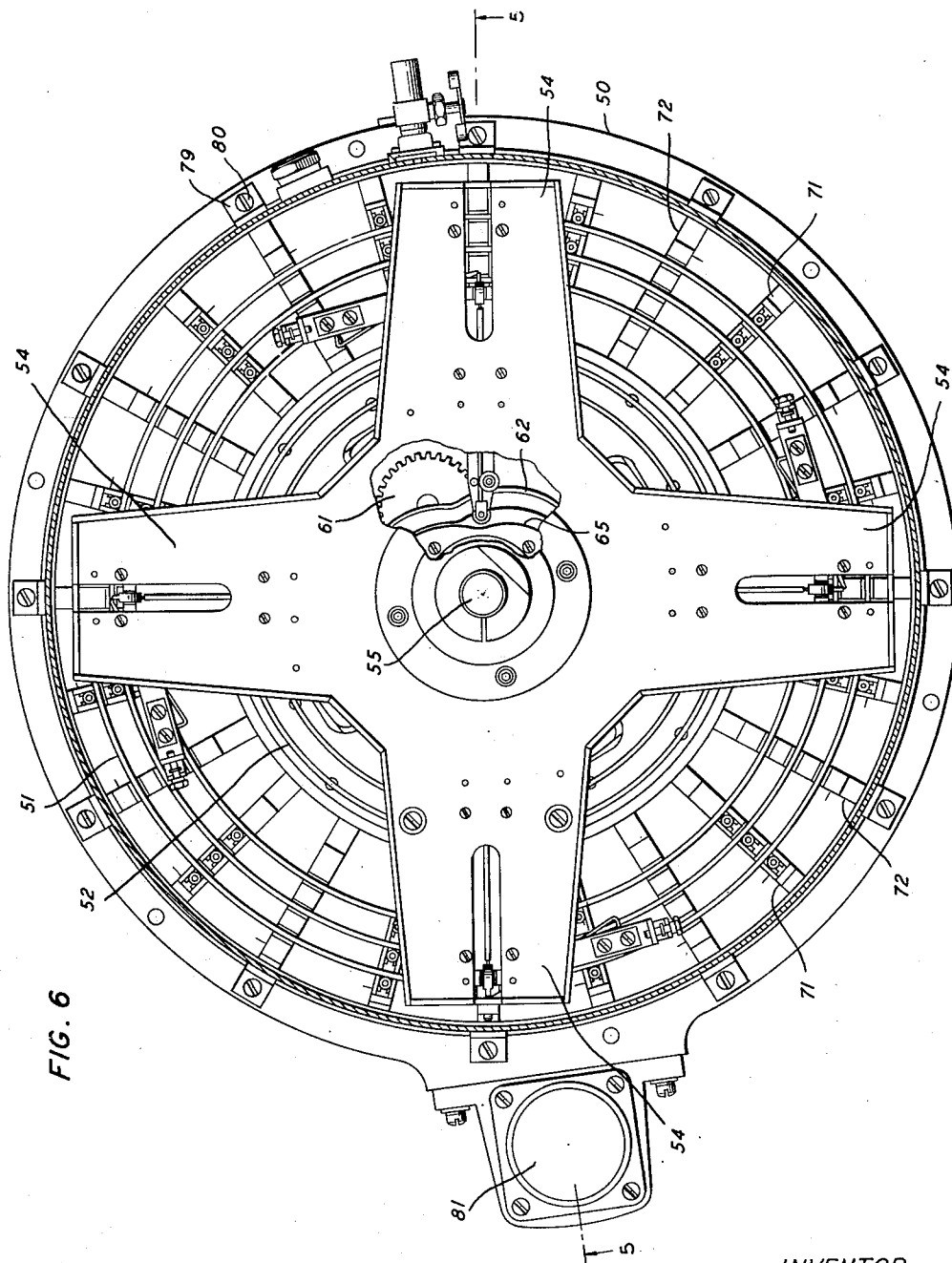


FIG. 6

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UNITED STATES PATENT OFFICE

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POTENTIOMETER

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Application October 20, 1952, Serial No. 315,756

10 Claims. (Cl. 201—48)

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This invention relates to variable resistors of the potentiometer type and, more particularly, to mechanisms for operating continuous rotation, spiral potentiometers.

In order to obtain the desired accuracy in potentiometers used for calculating, computing and like systems, a relatively long card or resistance strip arranged in circular configuration may be used. In the interest of compactness, such a card is often arranged in a spiral pattern with a brush or contactor mounted on a rotatable arm and arranged to follow the spiral. Many uses of such devices require that the rotation be continuous in either direction.

An object of this invention is to improve spiral potentiometers so that a continuously repeating function may be handled expeditiously and accurately.

Another object is to make possible the attaining of proper resistance values at all positions of a continuous rotation spiral potentiometer.

A feature of this invention resides in positioning means for applying one or the other of two suitably mounted contactors or brushes to the resistance spiral at all times so that the active contactor is always electrically in the proper position.

Another feature of this invention lies in alternately operable means for activating the correct contactor and deactivating the other contactor at particular angular positions of contact arm rotation.

A further feature of this invention involves a mechanical train including gears and having alternately operative aspects for positioning a contactor during the electrically active part of its cycle and for returning it to an initial position during the inactive part of said cycle.

Other and further objects and features of this invention will appear more fully and clearly from the following description of illustrative embodiments thereof, taken in connection with the appended drawing in which:

Fig. 1 is a perspective view with parts broken away of one embodiment of the invention;

Fig. 2 is a view partially in section of the embodiment of Fig. 1;

Fig. 3 is a section taken on line 3—3 of Fig. 2;

Fig. 4 is a section taken on line 4—4 of Fig. 2;

Fig. 5 is a view in vertical section of another embodiment of the invention, the section being taken on line 5—5 of Fig. 6; and

Fig. 6 is a top view of the embodiment of Fig. 5 with the cover removed.

The embodiment illustrated in Figs. 1 to 4, inclusive, comprises a base plate or member 10 of

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insulation which supports a spiral resistor 11, slip rings 12 and a rotatable brush or contact carrier and control means, generally designated as 13.

The contact controlling means comprises a member 14 secured to axle 15 for rotation therewith, by the key 18 or like means. The axle 15 may be driven by suitable means not included in this invention. The member 14 includes oppositely extending radial arms having depending portions 16 and 17 between pairs of which are secured shaft and guide elements of the contact controlling means.

The contact controlling means includes spiral cams comprising spirally grooved main shafts 20 extending radially from the axle, and spirally grooved auxiliary shafts 21, respectively, parallel to shafts 20 and in a horizontal plane therewith. These shafts are journaled in the depending portions 16—17 of the member 14. Guide rods 22 and 23 are also mounted between the portions 16 and 17, and lie in parallel relation in a vertical plane between the spirally grooved shafts.

The shafts 20 are provided at their inner ends with bevel gears 24 each of which meshes with a stationary bevel gear 25, which is coaxial with the axle 15 and is secured to the base plate 10 by means of a flanged collar 26. Spur gears 27 mounted on shafts 20 adjacent to the bevel gears 24 mesh with spur gears 28 on the corresponding ends of shafts 21.

For convenience of description, the contact holder or brush holder at the left in Figs. 1 and 2 will be designated as A and that on the right as B. Since the various parts of the contact holder assemblies are the same, they are given the same reference characters in each assembly. The contactors or brushes 30, which in the illustrated embodiment are rollers, but may be of other suitable form, are mounted on spring arms 31 secured to followers 32 pivoted in slots provided in the riders 33. The riders 33 are supported and guided by the rods 22 and 23 so that the brush holders A and B move radially with respect to the axis of the rotation system.

The ball and spring detent means 34 on the riders 33 cooperate with notches 35 and 36 in the followers 32. As may be seen in Fig. 3, the detent 34 when in notch 35 holds the pivoted follower 32 in the groove of the shaft 20 with the brush 30 in contact with the resistor 11. In Fig. 4 the detent is shown in notch 36 to hold the follower 32 in the groove of the shaft 21 with the brush 30 raised out of contact with the resistor 11.

The shafts 20 are each provided at the outer extremity of their grooves with a pin 37 and the shafts 21 at the inner extremity of their grooves with a pin 38.

The brushes 30 are connected to an external terminal (not shown) by way of the brushes 39 which travel on slip rings 12. Since the brushes 30 operate alternately and each performs the same function circuitwise, they are connected to the same external terminal. The interconnection between the brushes 30 and 39 may be through the supports and frame or auxiliary connections (not shown) may be used.

When the axle 15 is rotated in the direction shown by the arrow on top of the member 14 (Fig. 1), this member and the elements mounted thereon are rotated. Bevel gears 24 travel around fixed bevel gear 25 and rotate counterclockwise as viewed from the position of axle 15. Since the follower 32 of contact holder A is in the groove of shaft 20, as shown in Figs. 1 and 3 (for reasons to be explained), this holder moves outwardly. The gear ratios and groove pitches are designed so that the brush 30 will follow the spiral of the resistor 11. The brush 30 of contact holder A is in contact with the resistor during this movement. At this time the contact holder B has its follower 32 in the groove of shaft 21 with the brush 30 raised and is moved or translated spirally inwardly, but makes no contact with the resistor 11.

When the follower 32 of the contact holder A reaches the outer end of the groove in its shaft 20, the pin 37 strikes the follower and moves it from the position shown in Fig. 3 to that shown in Fig. 4. At the same time the contact holder B reaches the inner limit of its travel and pin 38 of its shaft 21 moves its follower 32 from the position of Fig. 4 to that of Fig. 3. At the time that the just described transitions take place, the brush of contact holder A is at the outer end of the spiral resistor 11 and that of the contact holder B at the inner end of said spiral. The roles of the holders A and B are here reversed for the second half of the cycle, the brush of B becoming electrically active due to contact with the resistor and that of A becoming electrically inactive due to separation from the resistor and the direction of radial translation being reversed.

The embodiment of the invention shown in Figs. 5 and 6 accomplishes results similar to those obtained in the previously described embodiment with somewhat different, but generally equivalent means. In this device, there are two pairs of brush or contact arms 90 degrees apart; however, the diametrically opposite brushes cooperate with the spiral resistor in the same manner as those of the previously described device.

Referring to Figs. 5 and 6, the base plate or member 50 supports a spiral resistor 51, slip rings 52, and a rotatable brush or contactor controlling means generally designated as 53.

The brush or contactor supporting arms 54 are secured to a shaft 55 by way of a hub member 58. The shaft 55 is mounted for rotation in the base 50 and is driven by suitable means (not shown) through the member 56. A gear 57 secured to the shaft 55 drives the gear 59 through a gear train including gears 60 and 61. The gear 59 is secured to a cam assembly rotatably mounted on the shaft 55. The gear ratios are such as to rotate the cam assembly relative to the contactor supporting arms 54.

The cam 62 of the cam assembly is grooved

to guide the followers 63 of the brush holders 64, slidably mounted on the supporting arms 54, for radial movement with respect to the rotating system. The contour of the cam 62 is correlated with the gear train ratios to cause the brushes to follow the spiral of the resistor 51.

The cam 65 of the cam assembly operates through connecting rods 66, bell cranks 67, and cords 68 to raise or lower the brushes 70. One brush is raised and the opposite brush simultaneously lowered when the ends of the resistor spiral 51 are simultaneously reached by each.

The resistor 51, shown in the usual card form, is supported in spiral configuration by means of alternately located yokes 71 and 72. The yokes 71 are provided with wedge and screw means 73 and 74, respectively, for locking the resistor card in place. The yokes 72, except for those located at the end of the resistor card, serve as means for aiding in properly orienting the card during assembly. Those yokes, which are at the ends of the resistor spiral, such as the ones shown at right in Fig. 5, serve to clamp the card ends by means of screws 75. A more complete description of the means for mounting the resistor card may be found in the application of John E. Ross, Serial No. 314,700, filed October 14, 1952. External contact is made through the slip rings 52 by means of brushes 76 on supports 77 which are carried on brush arms 54.

The assembly may be enclosed with a cover 78 resting on the base 54 and secured in place by brackets and screws 79 and 80, respectively.

What is claimed is:

1. A potentiometer comprising a spirally arranged resistance element, contactors, and a rotatable contactor carrier on a rotatable axle; contactor control means including angularly located, radially movable contact holders, means cooperating with the holders for radially moving said holders during axle rotation to maintain the contactors in register with the resistance element, means for activating one contactor and simultaneously deactivating another contactor at a predetermined stage of the contact carrier rotation; and means mechanically interconnecting the axle and the contactor control means.

2. A potentiometer comprising a spirally arranged resistor element, a rotatable contactor carrier having diametrically located members, a contactor associated with each member, contactor control means including a contact holder connected to each member, means cooperating with each holder connected to each member, means cooperating with each holder to move said holders respectively in radially opposite directions to maintain the contactors in register with the resistor element spiral, and means for activating one contactor and simultaneously deactivating the opposite contactor at a predetermined stage of carrier rotation; and means mechanically interconnecting the contactor control means and the contactor carrier.

3. A potentiometer comprising a spiral resistance element, a rotatable brush carrier mounted on a rotatable axle and having oppositely extending radial arms, a brush associated with each arm; brush control means including a brush holder mounted on each arm, means cooperating with each holder to move said holders respectively in radially opposite directions to maintain the brushes in register with the resistor element spiral, and means for raising one brush and for lowering the other at a predetermined stage of

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brush carrier rotation; and gear means connecting the control means to the rotatable axle.

4. A potentiometer comprising a spirally arranged resistor on a base, an axle mounted on said base, contactors, and a contactor control means secured to and rotatable with said axle, said contactor control means including oppositely extending radial arms having depending portions, spirally grooved shafts mounted on said depending portions and including oppositely directed, radial main shafts and auxiliary shafts parallel thereto in a horizontal plane, a bevel gear on the inner end of each main shaft meshing with a fixed bevel gear secured to the base and coaxial with the axle, mating spur gears on the main and the auxiliary shafts for rotating the auxiliary shafts in opposite directions to the rotation of the main shafts, guide rods secured to the depending portions and lying in a plane perpendicular to that of the main and auxiliary shafts, contactor holders on the guide rods for substantially radial travel parallel to and between the main and the auxiliary shafts, each of said contactor holders including a rider mounted on the guide rods, a follower pivoted on the rider, and a spring mounted contactor on the follower; each follower having spaced portions for following respectively in the spiral groove of the associated main or auxiliary shaft, pins at the outer and inner ends respectively of the spiral grooves on the main and the auxiliary shafts for positioning the follower in the groove of the other shaft, and detent means for maintaining the follower in either position, each follower maintaining its associated contactor in contact with the resistor when following the groove of the main shaft, and out of contact with the resistor when following the groove of the auxiliary shaft.

5. Means for causing radially, oppositely located, rotatable contactors to follow a spiral resistor with one contactor in contact with the spiral and the opposite contactor out of contact therewith, comprising a base for mounting the resistor, an axle on said base; contactor control means secured to said axle and including oppositely directed radial arms, oppositely radially directed, spirally grooved, main shafts and parallel, spirally grooved, auxiliary shafts secured to said arms, means mounting contactor holders for substantially radial travel between and parallel with said shafts, said contactor holders including pivoted followers tiltable to mesh alternatively with a groove of a main or an auxiliary shaft, and means on the shafts for altering the tilt at the inner and outer extremity of holder travel, the contactors being mounted for tilting with the followers so as to be alternatively in and out of contact with the resistor.

6. A continuously operable, spiral potentiometer comprising a base, a spiral resistor on the base, a rotatable axle on the base, contactor and

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contactor controlling means on the axle for rotation therewith, said means including diametrically extending arms, a contactor associated with each arm, means for moving each contactor along its arm during rotation thereof for following the resistor spiral, the means for moving including spirally grooved main and auxiliary shafts, gearing means for oppositely rotating said shafts, means for alternatively connecting each contactor for substantially radial translation by one of said shafts, means on each shaft for shifting the connecting means to the alternate shaft at the end of each translation, and means, associated with the connecting means, for electrically activating a connector during its translation by the main shaft and electrically deactivating said contactor during its translation by the auxiliary shaft.

7. A continuously operable spiral potentiometer, as in claim 6, in which the gearing means comprises a bevel gear on each main shaft, each meshing with a stationary bevel gear coaxial with the axle and spur gears interconnecting the main and the auxiliary shafts.

8. A continuously operable spiral potentiometer comprising a base, a spiral resistor on the base, a rotatable axle on the base, alternatively active contactor means, means rotatable with the axle for guiding each contactor means along the resistor spiral and for alternatively placing one contactor means in engagement with the resistor and the other contactor means out of engagement therewith.

9. A continuously operable spiral potentiometer, as in claim 8, in which the contactor guiding means for each contactor means comprises oppositely rotating, spirally grooved, parallel shafts, one of which is located radially with respect to the axle, a contact carrier mounted for translation between and parallel to said shafts, said carrier including a follower for alternate engagement with the groove of one of said shafts, a contactor support connected to said follower for lowering the contactor into engagement with the resistor when the follower is engaging the groove of one shaft and for raising said contactor from the resistor when engaging the groove of the other shaft.

10. A potentiometer comprising a base, a spiral resistor and a rotatable axle mounted on the base; alternately operable, diametrically opposite, rotatable contactors; and means connecting the contactors to said axle; said connecting means including gear and cam means for translating opposite contactors simultaneously in opposite radial directions, and including means for maintaining one contactor in contact with the resistor and the opposite contactor out of contact therewith.

No references cited.