

Dec. 4, 1951

H. L. COYNE ET AL
VARIABLE RESISTANCE DEVICE

2,577,108

Filed April 11, 1946

4 Sheets-Sheet 1

FIG. 1

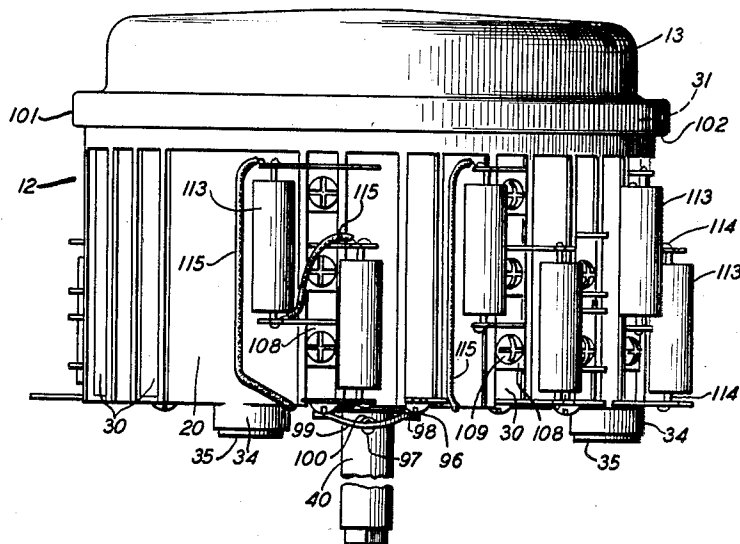
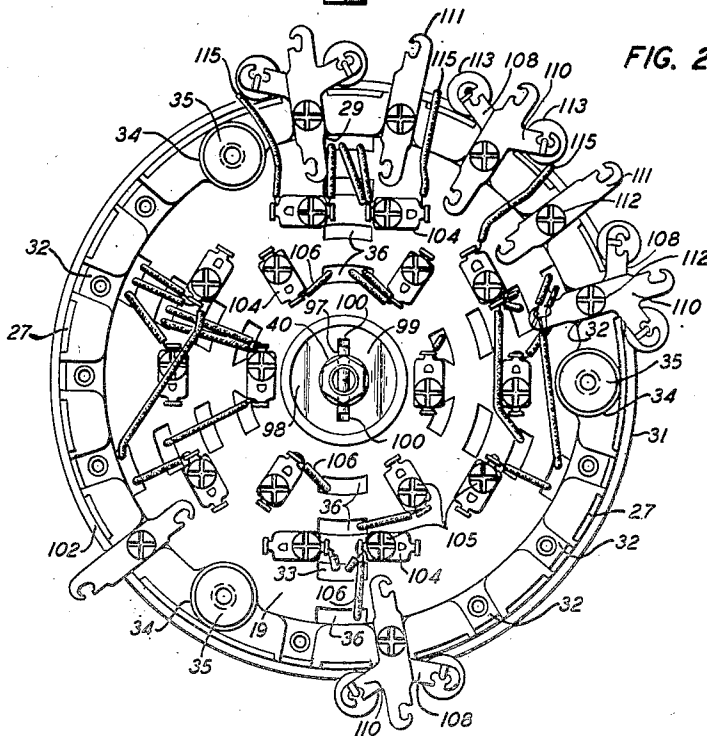


FIG. 2



H. L. COYNE
F. D. FESSLER
L. N. HAMPTON
O. S. A. MESCH
W. N. THOMPSON
INVENTORS:
BY *J. Mac Donald*
ATTORNEY

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4 Sheets-Sheet 2

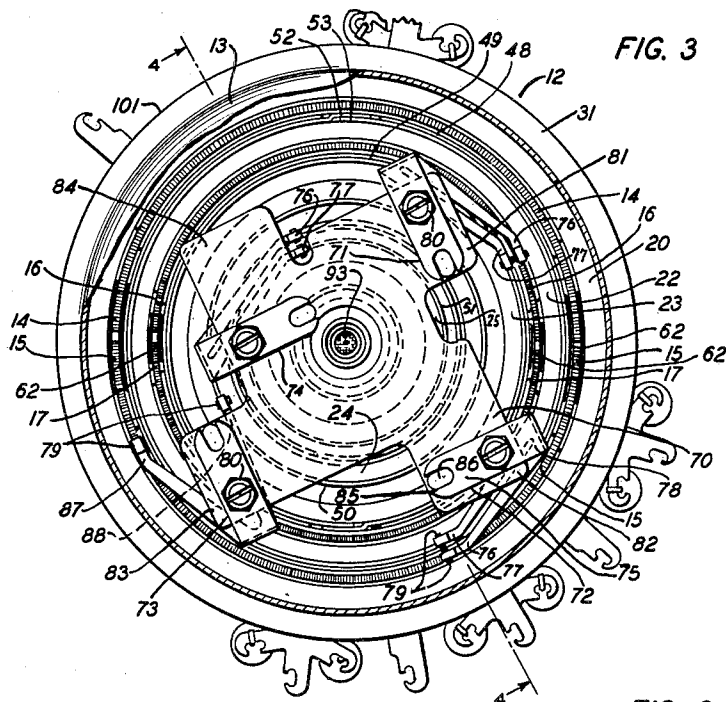


FIG. 3

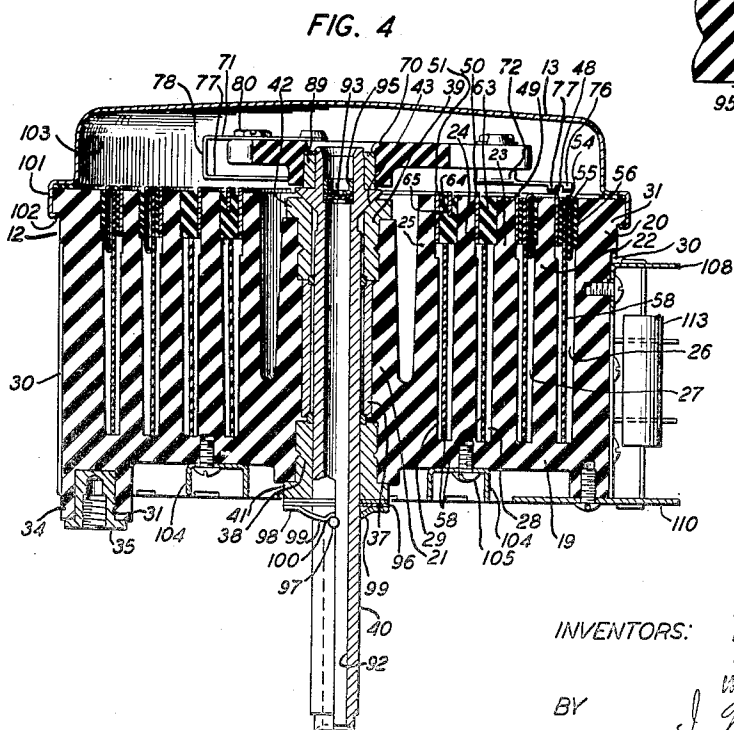
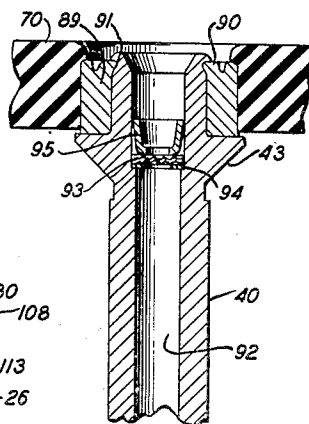


FIG. 4



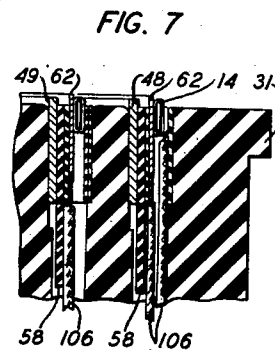
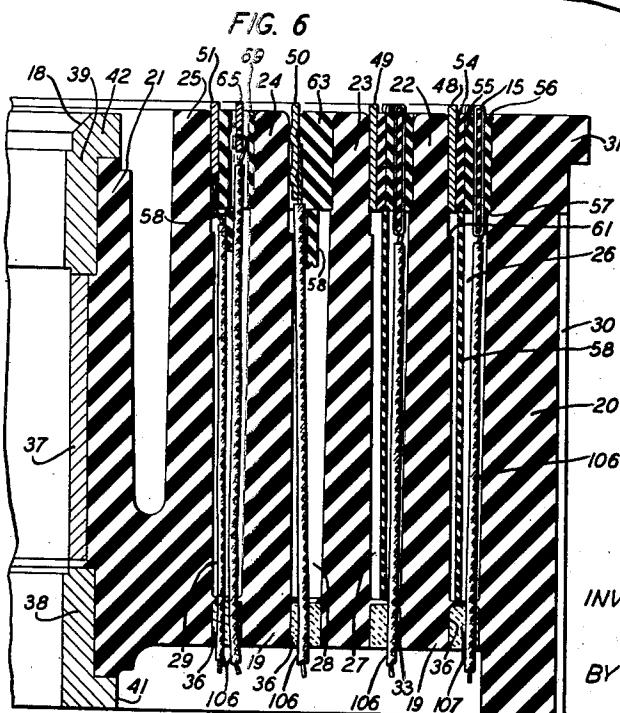
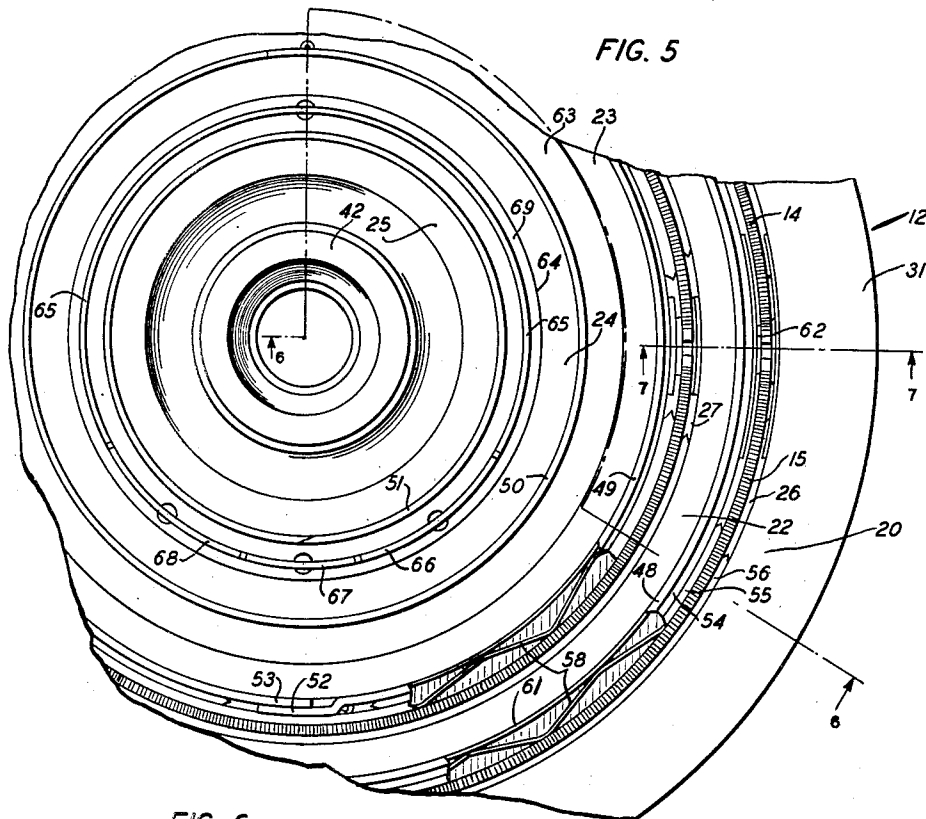
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INVENTORS:

BY

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O. S. A. MESCH
W. N. THOMPSON

J. MacDonald
ATTORNEY

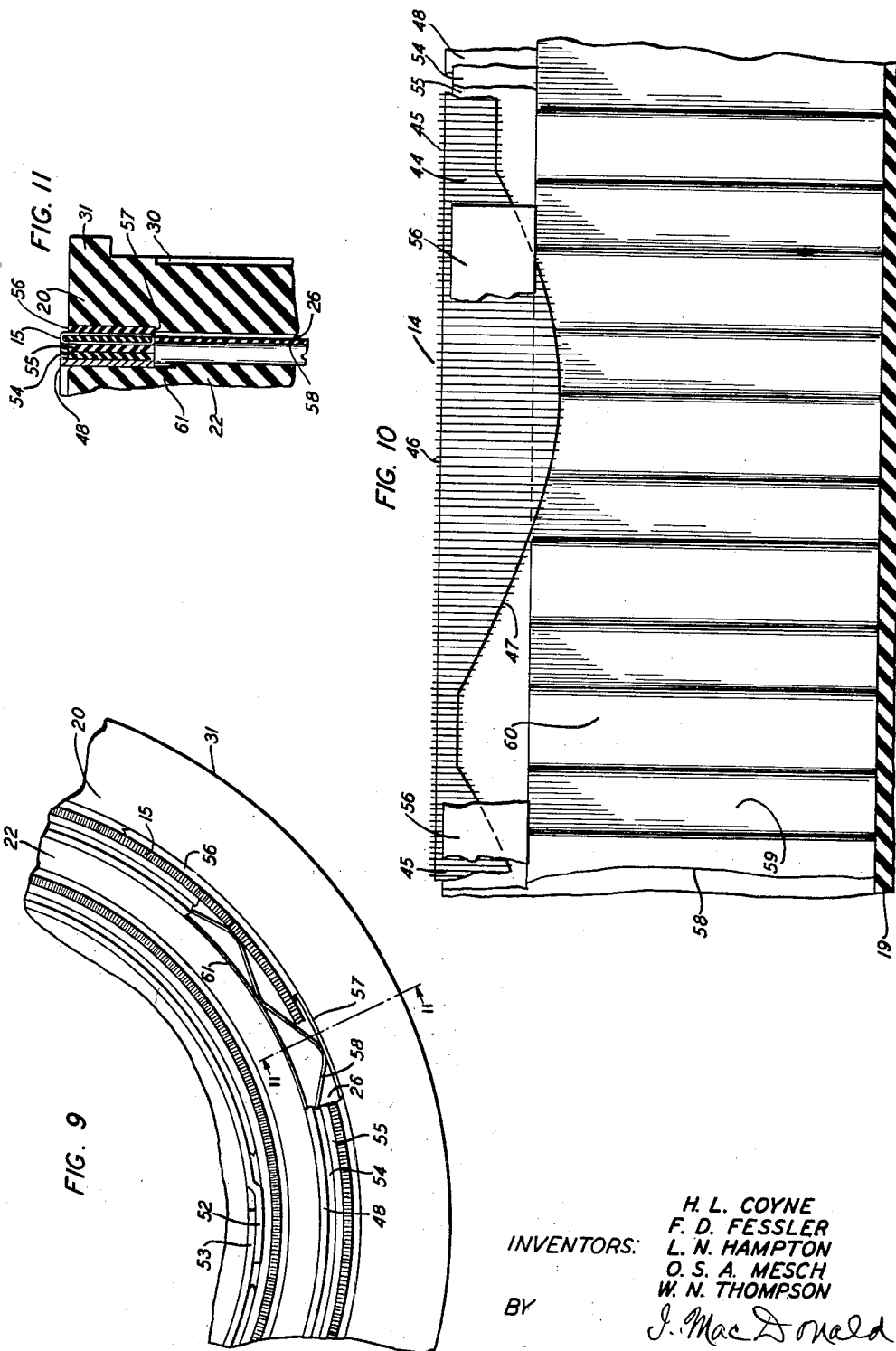
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O. S. A. MESCH
W. N. THOMPSON
INVENTORS:
BY *J. Mac Donald*
ATTORNEY

UNITED STATES PATENT OFFICE

2,577,108

VARIABLE RESISTANCE DEVICE

Howard L. Coyne, Rockville Centre, Frank D. Fessler, Lynbrook, Leon N. Hampton, New York, and Orwar S. A. Mesch, St. Albans, N. Y., and Walter N. Thompson, Mont Vernon, N. H., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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14 Claims. (Cl. 201—55)

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This invention relates to control devices and more particularly to variable electrical resistance control devices operable as rheostats or potentiometers.

An object of the invention is to provide a relatively light weight and compact precision potentiometer suitable for use in electrical apparatus carried in airplanes or other vehicles and subjected in service to comparatively wide range changes in temperature or other atmospheric conditions.

A feature of the invention resides in a casing structure cooperatively formed by a body and a cover and serving as a housing for resistance elements, collector conductors and wiper contacts in the device.

Another feature resides in the relative arrangement of the resistance elements and collector conductors in the body.

Another feature resides in means provided for supporting the resistance elements, the collector conductors and insulating bands in the body.

Another feature resides in a stem type support for the wiper contacts and in which breather means are provided.

Another feature resides in spring means provided to maintain the stem type support seated in bearing means supported in the body.

Another feature resides in terminals mounted on the body and providing supports for resistance devices mounted exteriorly of the body.

In the drawings:

Fig. 1 is a side elevational view of a potentiometer embodying the invention;

Fig. 2 is an under surface view of the potentiometer shown in Fig. 1;

Fig. 3 is a top view of the potentiometer with portions of the cover removed;

Fig. 4 is a side view, partly in section, of the potentiometer and taken on the line 4—4 in Fig. 3;

Fig. 5 is an enlarged top view of part of the body with the resistance elements and certain other parts mounted in the body;

Fig. 6 is an enlarged side view, partly in section, of part of the body and parts mounted therein and taken on the line 6—6 in Fig. 5;

Fig. 7 is an enlarged view, in cross-section, of a portion of the body and parts mounted therein and taken on the line 7—7 in Fig. 5;

Fig. 8 is an enlarged side view, in section, of an upper portion of the stem type support and parts mounted thereon.

Fig. 9 is an enlarged top view of a portion of the body with parts mounted therein and with

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certain parts broken away to disclose a part normally hidden;

Fig. 10 is an enlarged side view of a portion of the body and portions of parts mounted in the body and taken on the line 10—10 in Fig. 9; and

Fig. 11 is an enlarged view in section of a portion of body and parts mounted therein and taken on the line 11—11 in Fig. 9.

In some cases potentiometers are required for use in electrical computers in which very precise electrical potentials must be obtained when a wiper contact in the potentiometer reaches predetermined points on a resistance element provided in the potentiometer. It is often found necessary or advantageous in producing electrical apparatus for the particular requirement to, in effect, electrically pad up a potentiometer nearly meeting a particular requirement in order that the required electrical potentials will be obtained when the potentiometer is suitably operated. The resistance pads sometimes employed to electrically pad up a potentiometer are resistance devices of fixed and selected values located remote from the potentiometer and electrically connected by means of conductor wires to the electrical resistance element or elements in the potentiometers.

Potentiometers devised for use in electrical computers are often of considerable size and weight and contain complicated and elaborate arrangements and structures of collector rings and contacts engaging the collector rings and means forming electrical connections between the resistance elements and the collector rings. Such potentiometers are frequently found to be unsuitable for use in airplanes and other vehicles because the potentiometers are relatively large and heavy and the fact that large protective casing would be required to protect some of the parts.

In the present invention the resistance elements and collector conductors and certain other parts are mounted directly in the body of the potentiometer and electrical resistance devices used as resistance pads for the resistance elements are supported on terminals mounted on the body. The body and a cover mounted on the body cooperatively form a protective closure for certain delicate parts of the potentiometer and means are provided to let the protective closure breathe under changes in temperature.

The potentiometer embodying the present invention as shown in Figs. 1, 3 and 4 comprises a body 12 and a cover 13 which cooperate to form a casing for resistance elements 14, 15, 16 and

17 and certain other parts associated therewith, the construction and arrangements of which will be later explained.

The body 12 is cup-like in form and as shown in Fig. 4 has a base wall 19, an outer wall 20, a tubular central boss 21 and spaced concentric walls 22, 23, 24 and 25 extending upwardly from the base wall 19, the upwardly extending walls in the body 12 cooperating to define annular spaces 26, 27, 28 and 29 in the body 12. The annular spaces 26, 27, 28 and 29 terminate at one end in the base wall 19 and extend upwardly therefrom to the top of the body 12. The outer surface of the outer wall 20 is fluted to provide longitudinal recesses 30, shown in Fig. 1 and the outer wall 20 is provided with an outwardly extending flange 31. The outer wall 20 is extended below the base wall 19 and the lower end of the outer wall 20 is formed to provide spaced notches 32 and countersunk holes 33. Recessed embossings 34 are provided at spaced points on the lower end of the outer wall 20 to accommodate internally threaded inserts 35 adapted to receive mounting screws, not shown, but employed in mounting the potentiometer on a support, not shown. The lower surface of the base wall 19, as shown in Figs. 2 and 6, is provided with indentations 36 at spaced points in register with the annular spaces 26, 27, 28 and 29 to facilitate the forming of apertures in the base wall 19. A sleeve 37 and bearings 38 and 39 are mounted in the boss 21 to receive a tubular stem 40 which extends through the body 12 and to points above and below the body 12. The bearings 38 and 39 are provided with end flanges 41 and 42, respectively to engage portions of the body 12, the end flange 42 on the bearing 39 extending over and against the upper end of the boss 21. The upper end of the bearing 39 is formed to provide a seat 43 for a conical bearing portion 43 formed on the upper portion of the tubular stem 40. The body 12 may be readily made by molding suitable material into the form required and the sleeve 37 and bearings 38 and 39 may be molded into the body 12 when the body 12 is being formed. The material of the body 12 is a matter of choice but is shown in the drawings as being insulating material since the use of such material in the body reduces the number of insulating parts that would otherwise be required. The tubular stem 40 and the body 12 are made and assembled so that they are relatively rotatable.

The body 12 serves as a support for resistance elements such as the resistance elements 14, 15, 16 and 17 which are typical of resistance elements employed in potentiometers of the type shown to illustrate the invention. Each resistance element 14 to 17, inclusive comprises a card-like support of predetermined form and a resistance wire wound in a plurality of turns on the card-like support. The card-like support has preferably at least one long edge portion all parts of which are in the same plane. In some cases another long edge portion of the card-like support is curved in form and so that the card-like support varies in width at different points taken along the card-like support. A typical resistance element employed in the potentiometer is shown in the upper portion of Fig. 10 in which the resistance element is identified as the resistance element 14 but which may be any one of the resistance elements supported in the body 12.

The resistance element 14 shown in Fig. 10 comprises a card-like support 44 and a resistance

wire 45 which is wound in a plurality of turns on the card-like support 44. The upper edge 46 of the card-like support 44 is straight and the lower edge 47 is curved, the card-like support 44 being of a predetermined size and pattern found necessary in the resistance element required.

The annular spaces 26, 27, 28, and 29 in the body 12 provide spaces in which the resistance elements and certain other parts of the potentiometer may be located. Each resistance element is set edgewise in the body 12 and so that the turns of resistance where on the long straight edge 46 of the resistance element may be frictionally engaged by a wiper contact in the potentiometer. The annular spaces 26, 27, 28 and 29 in the body 12 also provide spaces in which collector conductors 48, 49, 50 and 51 may be located, the collector conductors serving in the nature of collector rings for the resistance elements. In most cases a resistance element and a collector conductor serving as a collector ring for the resistance element are located in the same annular space. In some cases, however, a collector conductor for a resistance element located in one annular space is located in an annular space different from the one in which the resistance element is located. The collector conductors 48 to 51, inclusive are bands of conducting material set edgewise in the annular spaces provided in the body 12 and are arranged for engagement by wiper contacts in the potentiometer. Certain parts to be engaged by the wiper contacts and other than the resistance elements and certain insulating strips are also positioned in the annular spaces in the body 12. The annular spaces in the body 12 also provide spaces in which portions of lead-out conductors for parts of the potentiometer may be located.

As shown in Figs. 3 and 5, the resistance elements 14 and 15 are arranged and supported in the annular space 26 defined by the outer wall 20, the concentric wall 22 and the base wall 19, the resistance elements 14 and 15 being arranged in substantially end relation and so that they cooperatively and substantially encircle the concentric wall 22. In parallel spaced relation with the resistance elements 14 and 15 and also set edgewise in the space 26 is a collector conductor 48 which completely encircles the concentric wall 22. The collector conductor may be a complete ring of conducting material or as shown in the drawings may be a band of conducting material with one end portion 52 disposed in overlapping relation with the opposite end portion 53. Strips 54, 55 and 56 of insulating material are disposed edgewise in the annular space 26, the strips 54 and 55 being located between the collector conductor 48 and the resistance elements 14 and 15 and the strip 56 being located between the resistance elements 14 and 15 and the inner surface of the outer wall 20. The strips 54, 55 and 56 of insulating material, the collector conductor 48 and at least some portion of the resistance elements 14 and 15 are not very wide and do not extend far down in the annular space 26. The strips 54, 55 and 56 of insulating material, the collector conductor 48 and the resistance elements 14 and 15 must however be supported so that the upper edges of the resistance elements 14 and 15 and the upper edge of the collector conductor 48 will be slightly above the top of the concentric walls in the body 12 and the upper edges of the strips 54, 55 and 56 of insulating material. The lower edge of the strip 56 as shown in Fig. 6 rests on a shoulder 57

formed in the inner surface of the outer wall 20

to hold the strip 56 elevated in the annular space 26.

A corrugated strip 58 of sufficient length to encircle the wall 22 and of sufficient width to extend from the upper surface of the base wall 19 to the lower edge of the collector conductor 48 and the lower edges of the strips 54 and 55 is disposed in the annular space 26 to serve as a support for the collector conductor 48, the strips 54 and 55 of insulating material and some portions of the resistance elements 14 and 15.

The corrugated strip 58, as shown in Figs. 5 and 10, is made so that its corrugations 59 and 60, extending on opposite sides of a median line, run transversely of the length of the strip. The corrugations are made large enough to extend substantially across the space 26 and provide supports for the lower edge of the collector conductor 48, the lower edges of the insulating strips 54 and 55 and some portions of the lower edges of the resistance elements 14 and 15. At such points where the resistance elements 14 and 15 may be so wide that portions extend below the upper edge of the corrugated strip 58 the corrugations 59 and 60 are displaced to accommodate the low extending portions of the resistance elements 14 and 15. It will be seen as shown in Figs. 5 and 9 that the corrugated strip 58 takes a zig-zag course through the annular space 26 and that as shown in Figs. 9 and 10 some portions of the corrugated strip 58 extend under the insulating strip 56 and into engagement with the inner surface of the outer wall 20, some portions extend under portions of the lower edges of the resistance elements 14 and 15, some portions extend under the lower edges of the insulating strips 55 and 54 and some portions extend under the lower edge of the collector conductor 48 and into engagement with the outer surface of the concentric wall 22. In some cases some portions of the corrugated strip 58 extend over a shoulder 61 formed on the outer surface of the concentric wall 22 and located some distance below the lower edge of the collector conductor 48.

When the resistance elements 14 and 15, the strips 54, 55 and 56 of insulating material and the collector conductor 48 are properly located they substantially fill the upper portion of the annular space 26. After the parts directly above mentioned are in required position a suitable insulating cement is applied to hold the parts together and cooperate with the parts in filling the upper portion of the annular space 26.

It will be seen that the upper edge of the collector conductor 48 and the upper edges of the resistance elements 14 and 15 associated with the collector conductor 48 form in effect an annular two-rail track upon which wiper contact members, to be later described, may run. One rail comprising the collector conductor 48 is continuous since ends of the strip from which the collector conductor 48 is formed are arranged in overlapping relation. At such points where ends of the resistance elements are in register or in abutting relation bridging strips 62 are provided to form in effect a track piece to be engaged by the wiper contact during the travel of the wiper contact over the area in which ends of the resistance element or elements are in register. Each bridging strip 62 is a piece of suitable flat material set edgewise in the annular space 26 and overlapping the end portions of the resistance element or elements disposed in register. The bridging strip 62 in some cases is made of conducting material and in other cases of insulating

material. In all cases, however, the upper edge of the bridging strip 62 extends upwardly at least to the level of the upper edges of the resistance element ends in register and serves to prevent the wiper contact from dropping below the level of the upper edges of the resistance elements when the wiper contact is passing over the area in which there is no upper edge of a resistance element to support the wiper contact.

Supported in the annular space 27 as shown in Figs. 3, 4 and 5 are resistance elements 16 and 17 which follow in general the structure of the resistance element 14 shown in Fig. 10 and already described. Supported also in the annular space 27 and in parallel spaced relation with the resistance elements 16 and 17 is a collector conductor 49 which follows in general the structure of the collector conductor 48. Bridging strips 62 and a corrugated strip 58 and insulating strips are also supported in the annular space 27 where required, the arrangement of the parts being substantially like the arrangement of the resistance elements, collector conductors and other parts in the annular space 26.

Supported in the upper portion of the annular space 28 is the collector conductor 50 which follows in general the structure of the collector conductor 48, an insulating ring 63 being located adjacent the collector conductor 50 to press the collector conductor 50 against the outer surface of the concentric wall 24.

Supported in the upper portion of the annular space 29 and as shown in Figs. 5 and 6 is the collector conductor 51 and a switch ring 64 comprising fixed contacts 65, 66, 67 and 68 and an insulating support 69, the collector conductor 51 following in general the structure of the collector conductor 48 and the fixed contacts 65, 66, 67 and 68 being strips of conducting material set edgewise in the insulating support 69 in end to end spaced relation and forming a broken conducting ring with upper edge portions extending above the plane of the upper portion of the concentric wall 25. Corrugated strips 58 may be provided under the parts supported in the upper portions of the annular spaces 28 and 29 to hold the parts elevated in the annular spaces.

Carried by the stem 40 and secured to an apertured insulating plate 70, shown in Fig. 3, are bifurcated wiper contacts 71, 72, 73 and 74. The wiper contacts 71, 72 and 74 are alike in structure and each comprises a body portion 75 terminating at one end in tines 76 and 77. Near the point of termination of the body portion 75 in the tines 76 and 77 the body portion is bent downwardly and backwardly to provide a return bend portion 78 to make the tines 76 and 77 extend angularly and backwardly below the body portion 75. A contact piece 79 is attached to and supported on the free end of each tine 76 and 77, one of the contact pieces 79 being arranged to ride on and frictionally engage an edge of one of the electrical current carrying parts supported in one of the annular spaces in the body 12 and the other contact piece 79 being arranged to in like manner engage another of the electrical current carrying parts supported in the same annular space in the body 120. For example, the contact piece 79 on the tine 76 in the wiper contact 72 is arranged to ride on and frictionally engage the resistance element 15 and the contact piece 79 on the tine 77 is arranged to ride on and frictionally engage the collector conductor 48 arranged in parallel spaced relation with the resistance element 15. The body portion 75 of each wiper con-

tact is apertured to receive a mounting screw 80 by means of which the body portion 75 is secured to the apertured insulating plate 70 which is provided with arm portions 81, 82, 83 and 84 on which the respective wiper contacts 71, 72, 73 and 74 are carried. To prevent each wiper contact 71, 72, 73 and 74 from pivoting on its mounting screw 80 one end of the body portion 75 is provided with a notch 85 engaging a projection 86 on the apertured insulating plate 70.

The wiper contact 71 is arranged to serve the resistance elements 16 and 17 and the collector conductor 49, the contact piece 79 on the tine 76 of the wiper contact 71 being arranged to ride on and frictionally engage the resistance elements 16 and 17 and the contact piece 79 on the tine 77 being in engagement with the collector conductor 49 located in the annular space 27 in the body 12.

The wiper contact 73 is constructed along the general lines of the other wiper contacts 71, 72 and 74 but has its tines 87 and 88 more widely spaced than the tines 76 and 77 in the other wiper contacts and serves the resistance elements 14 and 15 in the annular space 26 and the collector conductor 50 on the annular space 28. The contact piece 79 on the tine 87 engages the resistance elements 14 and 15 and the contact piece 79 on the tine 88 engages the collector conductor 50.

The wiper contact 74 serves the switch ring 64 and the collector conductor 51 supported in the annular space 29, the contact piece 79 on the tine 76 being in engagement with the switch ring 64 and the contact piece 79 on the tine 77 being in engagement with the collector conductor 51.

The apertured insulating plate 70 is securely mounted on a bushing 89 which as shown in Figs. 4 and 8 is supported on the upper portion of the stem 40 and secured thereto by staking at the points 93 and 91. When the stem 40 is rotated the wiper contacts are moved to travel along the resistance elements and other current carrying parts supported in the annular spaces in the body 12.

Supported in the bore 92 of the stem 40 and located in the upper portion of the stem 40 is a dust screen 93 comprising one or more perforated discs 94, a washer 95 and an apertured retainer plug 96, the washer 95 and the perforated discs 94 being pressed toward an internal shoulder 97 formed in the bore 92 of the stem 40 and the apertured retainer plug 96 being forced into the bore 92 and against the perforated discs 94 and spread against the walls of the bore 92 to hold the perforated discs 94 and the washer 95 in place in the stem 40. The dust screen 93 is provided to screen dust particles from air passing through the bore 92 of the stem 40. The perforated discs 94 may be discs of screen wire or other material suitable for stopping relatively large dust particles from passing entirely through the bore 92 of the stem 40.

To hold the stem 40 against undue rising in the body 12 and to maintain the conical bearing 43 seated in the corresponding seat 18 formed in the bearing 39 a pile-up 96 of washers is mounted on the stem 40 and a retainer pin 97 is secured in the stem 40. The lowermost washer 98 in the pile-up 96 is made of spring material and has a downwardly bowed and centrally apertured portion 99. Recesses 100 are provided in the lower surface of the downwardly bowed portion 99 to receive projecting ends of the retainer pin 97 which serves to prevent the washer 98 from dropping downwardly of the stem 40. The washer 98

and the stem 40 are assembled so that spring pressure is developed in the washer 98 to urge the pile-up 96 toward the body 12 and to urge the stem 40 downwardly in the body 12 to maintain the conical bearing 70 in required seating engagement with the seat 18 formed in the bearing 39.

The cover 13 is bowl-like in form and is mounted in inverted position on the top of the body 12 and forms a protective cover for the upper portion of the body 12 and the parts supported in the body 12. A rim portion 101 of the cover 13 fits over the flange 31 on the body 12 and the lower end 102 of the rim portion 101 is extended under and pressed upwardly against the lower surface of the flange 31 to hold the cover 13 securely mounted on the body 12. As shown in Fig. 4, the cover 13 in cooperation with the upper portion of the body 12 forms an air space 103 in the upper portion of the potentiometer. When the potentiometer is subjected to changes in temperature air may enter or leave the space 103 by way of the bore 92 and the dust screen 93 in the stem 40. The potentiometer may therefore breathe to make the air pressure in the potentiometer equal to the air pressure exterior of the potentiometer.

Mounted on the lower portion of the body 12 and located exterior of the body 12 are terminals 104 which are located near some of the recesses 36 formed in the lower surface of the base wall 19, the terminals 104 being secured in place by mounting screw 105. The terminals 104 provide outside terminals for lead wires 106 extending from the resistance elements and certain other electrical current carrying parts located in the body 12. Some of the lead wires 106, for instance, extend from the resistance elements 14 and 15 and others extend from the collector conductors such as the collector conductors 48 and 49. Other lead wires 106 may extend from the fixed contacts in the switch ring 64. The lead wires 106 as shown in Fig. 6 extend downwardly in the annular spaces provided in the body 12 and through apertures made in the body 12 in register with the recesses 36 and from thence to the required terminals 104. After the lead wires 106 have been extended through the apertures made in the base wall 19 and through the recesses 36 the recesses 36 are filled with a suitable cement 107 to seal the apertures made in the base wall 19 to accommodate the lead wires 106.

Mounted on the outer surface of the outer wall 20 of the body 12, as shown in Fig. 1, and disposed in the recesses 30 in the fluted portion of the body 12 are bracket-type terminals 108 which are mounted in spaced relation on the body 12 by means of screws 109 or other suitable mounting means. Mounted on the lower end of the body 12 and set into the notches 32 are branched terminals 110 and straight terminals 111 certain end portions of which extend in parallel spaced relation with the lower surface of the base wall 19 and other end portions of which extend outward of the outer side wall 20. Screws 112 or other suitable mounting means are employed to mount the terminals 110 and 111 on the body 12.

The branched terminals 110 and straight terminals 111 and the bracket type terminals 108 provide supports and terminal means for fixed resistance devices 113, the terminals 114 of which are electrically connected as required to the bracket type terminals 108 and the branched terminals 110 or the straight terminals 111. The resistance devices 113 are employed either singly

or in various combinations as required to serve as additional resistances or resistance pads for the resistance elements supported within the body 12. To bring the resistance devices 113 into circuit connection with resistance elements or other current carrying means housed in the body 12 conductor wires 115 are led exterior of the body 12 and connected to the required terminals 105, bracket type terminals 108, branch terminals 110 or straight terminals 111.

By suitably wire connecting the current carrying parts supported in the body 12 to the terminals supported on the body 12 and by rotating the stem 40 so that the wiper contacts of the potentiometer are moved along the current carrying parts supported in the body 12 and including the fixed contacts in the switch ring 64 electrical potentials of different values and within the range of the potentiometer may be obtained when the potentiometer is electrically energized.

What is claimed is:

1. A variable electrical resistance device comprising a body, a resistance element and a collector conductor for the resistance element supported in parallel spaced relation in said body, a stem rotatably supported in the body and a wiper contact carried by said stem and operable along and in contact with said resistance element and said collector conductor.

2. A variable electrical resistance device comprising a body, walls in said body defining a spaced relation in the body, a resistance element and a collector conductor mounted in parallel spaced relation in the space defined by said walls, means supporting said resistance element and said collector conductor, stem means rotatably supported in said body and a wiper contact carried by said stem means and operable along and in frictional engagement with said resistance element and said collector conductor.

3. A potentiometer device comprising a body, spaced concentric walls in said body defining annular spaces in said body, resistance elements and collector conductors supported in parallel spaced relation in the annular spaces in said body, a stem rotatably supported in said body and bifurcated wiper contacts carried by said stem and having tines engaging said resistance elements and said collector conductors and operable upon rotation of said stem to form electrical connections between various portions of said resistance elements and said collector conductors.

4. An electrical device comprising a body, walls in said body defining a space in the body, electrical current carrying members supported in spaced relation in the upper portion of the space defined by said walls and a corrugated strip located in the space defined by said walls and operating to hold said current carrying members elevated in the space defined by said walls.

5. An electrical device comprising a body, a base wall and spaced walls cooperating to define a space in said body, electrical current carrying members supported in spaced relation in the upper portion of the space defined by said walls and a corrugated strip disposed in the space defined by said walls and extending from said base wall to said current carrying members and operating to support said current carrying members in elevated position in said body.

6. An electrical device comprising a body, walls in said body defining a space in the body, conductor and insulating members disposed in elevated position in the space defined by said walls

and a corrugated strip disposed in the space defined by said walls and having its corrugations extending under portions of said conductor and insulating members and operating to hold said conductor and insulating members elevated in said body.

7. An electrical device comprising a body, spaced upright walls and a base wall cooperating to define a space in said body, conductor and insulating members disposed in edgewise relation in said body and occupying an upper portion of the space defined by said walls, a corrugated strip disposed in the space defined by said walls and having its corrugations extending upwardly from said base wall and said corrugated strip extending in zig-zag form between said spaced upright walls and under portions of said conductor and insulating members and serving to support said conductor and insulating members in elevated position in the space in said body.

8. An electrical control device comprising a body, walls in said body defining a space in the body, electrical current carrying members arranged in parallel spaced relation and supported in the space defined by said walls, a cover supported on said body and cooperating with said body to define an upper space in the device, tubular stem means rotatably supported in said body and extending from without said body and through said body to the upper space in the device, said stem means providing an air passageway into said body, a wiper contact carried by said stem means and in frictional engagement with said current carrying means and dust-screen means supported in said tubular stem means.

9. A variable electrical resistance device comprising a body, walls in said body defining a space in the body, a resistance element and a collector conductor supported in parallel spaced relation in the space defined by said walls and forming parallel current carrying tracks, stem means rotatably supported in said body and extending within and outwardly of the body, said stem means having a longitudinal bore extending the full length of said stem means, a wiper contact carried by said stem means and operable along and in frictional engagement with said resistance element and said collector conductor and operable to electrically connect various portions of said resistance elements to said collector conductor, a cover secured to said body and defining in cooperation with said body an air space in the electrical resistance device and in which said wiper contact operates and a dust-screen means secured in the bore in said stem means, said dust-screen means and the bore in said stem means providing an air passage to permit air to enter and leave the space cooperatively defined by said body and said cover.

10. A control device comprising a body, a stem rotatably supported in said body, a bearing portion on said stem, a seated bearing in said body to receive said bearing portion, spring washer means supported on said stem and means projecting from said stem and pressing against said spring washer means to develop spring pressure in said spring washer means, said spring washer means operating on said stem to maintain said bearing portion in seated engagement with said seated bearing.

11. A control device comprising a body, a stem rotatably supported in said body and extending through said body, a bearing portion formed on said stem, a bearing seat located in said body

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and constructed to receive the bearing portion on said stem, a washer supported on said stem exterior of said body, a bowed spring portion on said washer, a pin supported in said stem and engaging the bowed spring portion on said washer and a recess formed in said bowed spring portion of said washer to receive said pin and said washer operating to longitudinally urge said stem in a direction to keep said bearing portion in seated engagement with said bearing seat.

12. A potentiometer device comprising a body, a resistance element supported in said body, a bracket type terminal and a branched terminal supported on said body in spaced relation, a resistance device electrically connected to and supported on said bracket type terminal and said branched terminal and means electrically connecting said resistance element to said resistance device by way of the terminals supported on said body.

13. A potentiometer device comprising a body, spaced walls in said body defining spaces in said body, resistance elements and collector conductors supported in spaced relation in the spaces in said body, means to support said resistance elements and said collector conductors, wiper contacts electrically connecting said resistance elements and said collector conductors, supporting means for said wiper contacts, terminals supported on and exterior of said body, a set of resistance devices supported by and electrically connected to said terminals and employable as

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resistance pads for the resistance elements supported in said body and lead wires extending from said resistance elements and electrically connected to said resistance elements and said terminals.

14. A potentiometer device comprising a body, resistance elements and a collector conductor therefor supported in parallel spaced relation in said body, a set of fixed contacts and a collector conductor therefor supported in spaced relation in said body, means supporting said resistance elements said fixed contacts and said collector conductors in said body, a stem rotatably supported in said body, a bifurcated wiper contact carried by said stem and operable as an electrical connecting means between said resistance elements and the collector conductor therefor, a second bifurcated wiper contact carried by said stem and operable as an electrical connecting means between said fixed contacts and the collector conductor therefor, terminals supported on said body and lead wires extending from said resistance elements, said fixed contacts and said collector conductors to said terminals.

HOWARD L. COYNE.
FRANK D. FESSLER.
LEON N. HAMPTON.
ORWAR S. A. MESCH.
WALTER N. THOMPSON.

No references cited.