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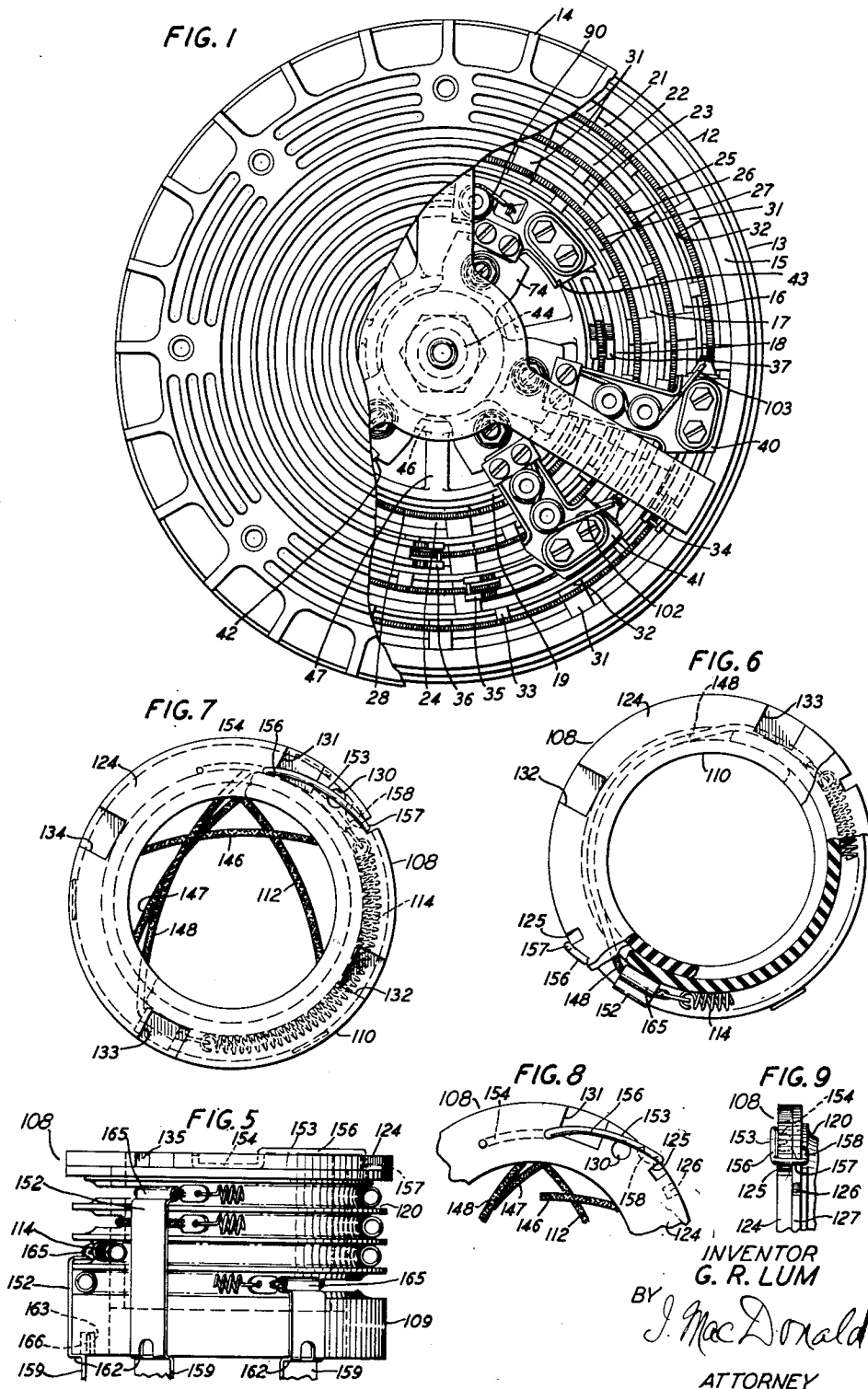
G. R. LUM

2,581,266

ELECTRICAL BRUSH CONTACT DEVICE

Filed June 25, 1946

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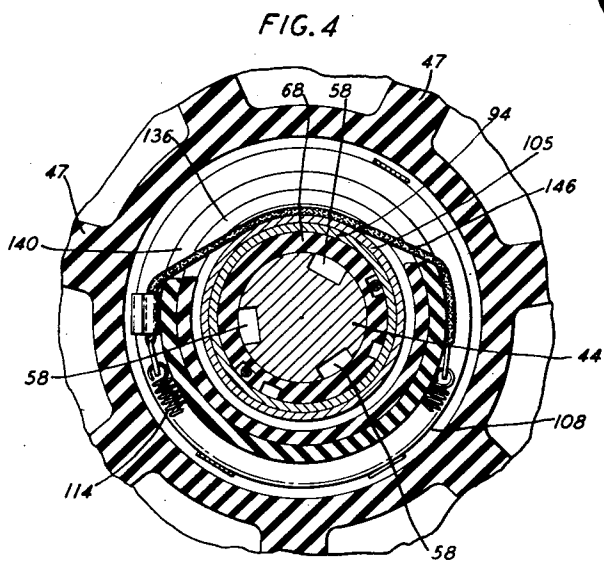
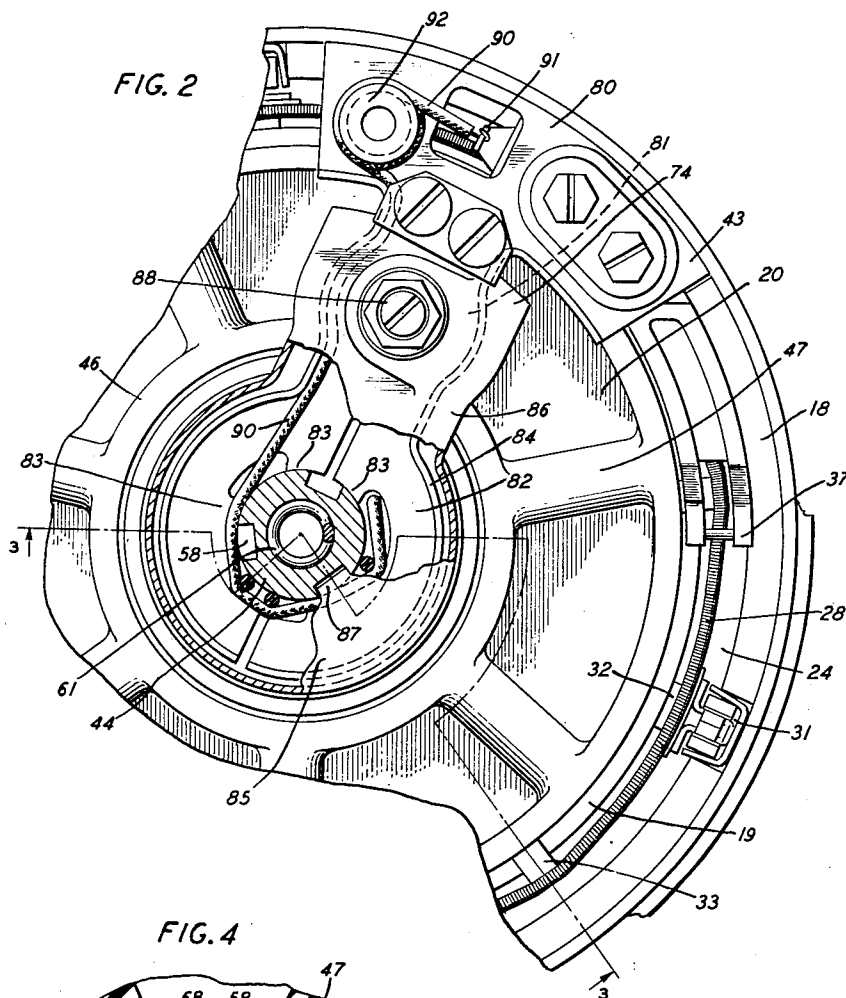
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4 Sheets-Sheet 2



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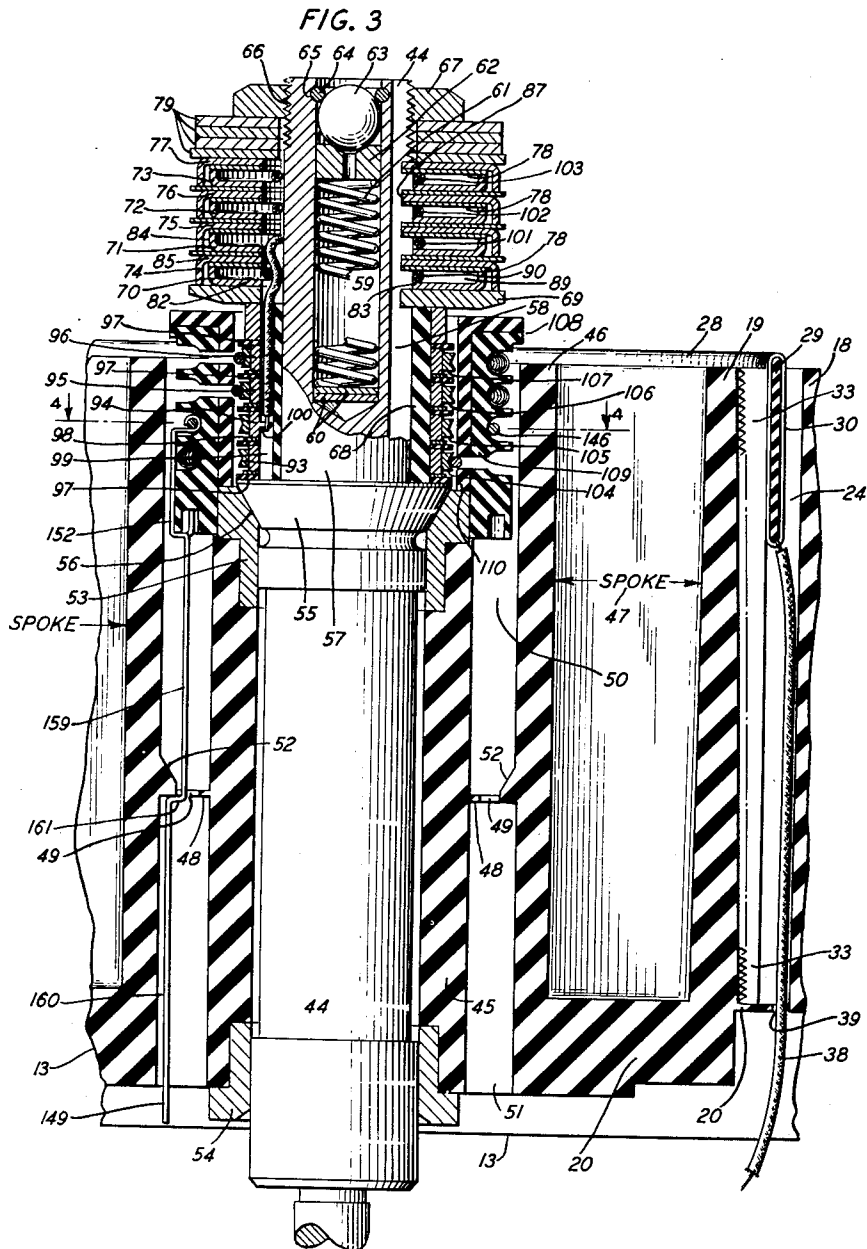
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ELECTRICAL BRUSH CONTACT DEVICE

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4 Sheets-Sheet 3



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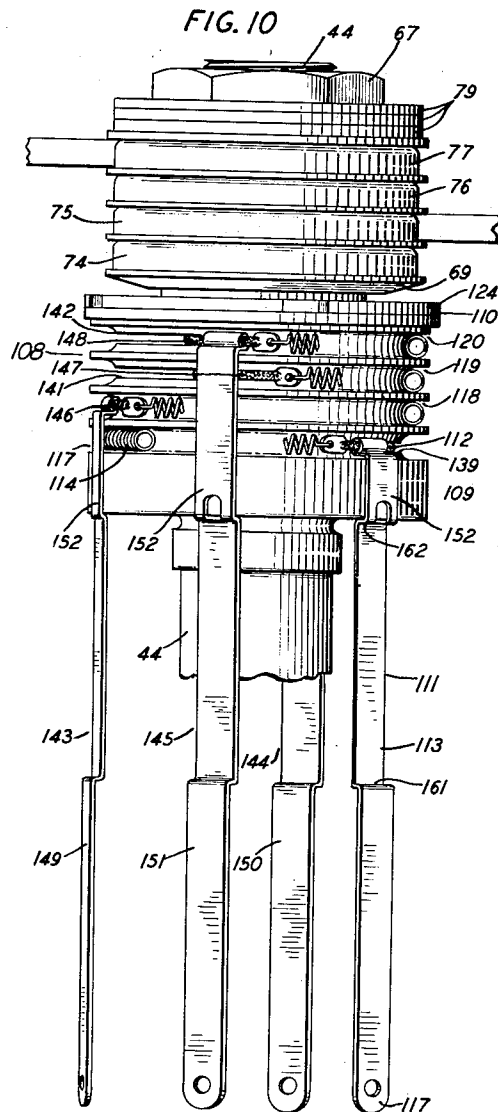
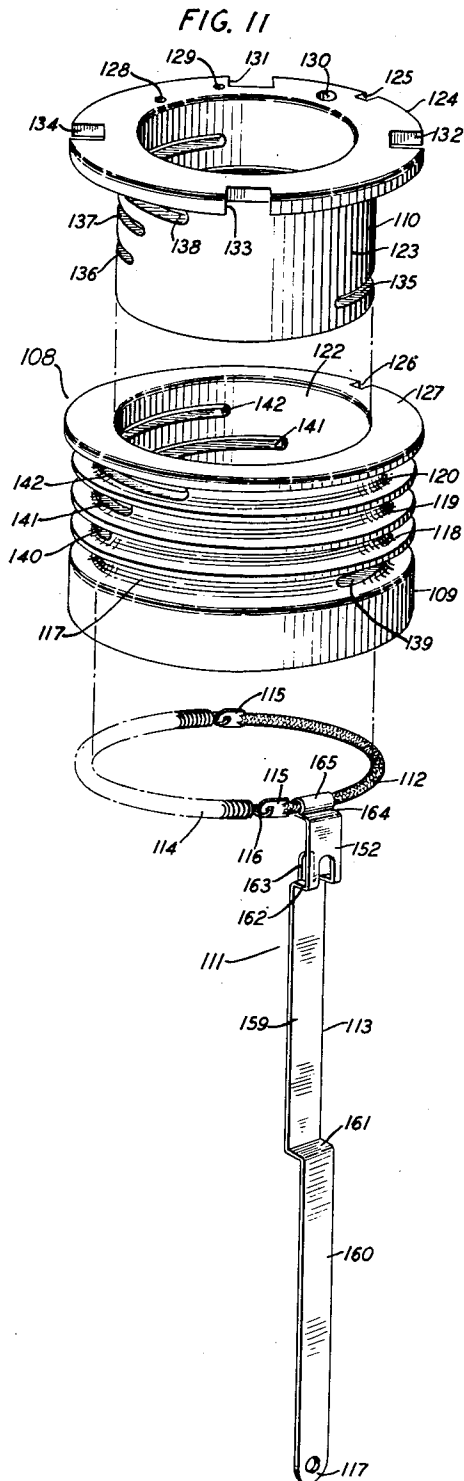
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ELECTRICAL BRUSH CONTACT DEVICE

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,581,266

ELECTRICAL BRUSH CONTACT DEVICE

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12 Claims. (Cl. 173—324)

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This invention relates to electrical connecting means and more particularly to electrical connecting means forming electrical connections between relatively movable parts.

An object of the invention is to provide improved electrical connecting means for relatively movable parts of an electrical device.

A feature of the invention resides in a shaft receiving element which provides a support for terminals and frictional contact means.

Another feature resides in contact means supported on the shaft receiving element.

Other features reside in the structures and arrangements of parts in the electrical connecting means.

The invention provides an improved electrical connecting means suitable for use in electrical potentiometers in which wiper contacts are required to be electrically connected to terminals.

In the drawings:

Fig. 1 is a plan view of an electrical potentiometer in which the invention is embodied, a cover member on the potentiometer being partly broken away to disclose parts normally covered by the cover member;

Fig. 2 is an enlarged view, partly in section, of a portion of the potentiometer shown in Fig. 1;

Fig. 3 is an enlarged view, in section, of a portion of the potentiometer shown in Fig. 1 and taken on the line 3—3 in Fig. 2;

Fig. 4 is a view, in section, taken on the line 4—4 in Fig. 3;

Fig. 5 is an enlarged view, in elevation, of the shaft receiving element with terminals and contact means supported thereon;

Fig. 6 is a top view, partly in section, of the shaft receiving element shown in Fig. 5;

Fig. 7 is a view, corresponding, in general, to Fig. 6 but with certain parts of the device relatively moved from the positions shown in Fig. 6;

Fig. 8 is a top plan view of a portion of Fig. 7 but with some of the parts slightly moved;

Fig. 9 is an edge view of the portion shown in Fig. 8;

Fig. 10 is an enlarged view, in elevation, of the shaft receiving element mounted on a portion of the shaft and shows a pile-up of portions of arms and arm supports mounted on the upper portion of the shaft; and

Fig. 11 is an exploded view of the shaft receiving element and shows one of the contact means and a terminal therefor.

The electrical connecting means of this invention is useful in various electrical devices, in which conducting members carried on a stem

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or shaft are required to be in frictional engagement with other conducting members of the electrical device while the shaft is rotated or when there is relative rotation of certain other parts of the electrical device and the shaft. Electrical potentiometers are often required in which wiper contacts are arranged to frictionally sweep over concentrically arranged resistance elements and transmit potentials to terminals or other conductors in the potentiometer. With the understanding that it is not a limitation of the invention the present invention is shown in the drawings as being embodied in a potentiometer. The potentiometer may be constructed along the general lines of a potentiometer shown and described in a patent application identified as L. N. Hampton-O. S. A. Mesch-C. V. Obst, Serial No. 661,246, filed April 11, 1946, now Patent No. 2,578,353 issued December 11, 1951.

The potentiometer 12 as shown in Fig. 1 comprises a cup-type body 13 and a removable cover 14. The body 13 is constructed to provide spaced annular walls 15, 16, 17, 18 and 19 extending upwardly from a base wall 20 shown in Figs. 2 and 3. The spaced annular walls 15, 16, 17, 18 and 19 and the base wall 20 cooperatively define annular spaces 21, 22, 23 and 24 in which resistance elements 25, 26, 27 and 28 are respectively set, the resistance elements 25, 26, 27 and 28 comprising in each case as shown in Fig. 3 a card-like support 29 with a resistance wire 30 wound thereon. The resistance elements 25, 26, 27 and 28 are mounted edgewise in the body 13 and are held in place at spaced points by means of wedge devices 31 which are located in the annular spaces 21, 22, 23 and 24. The wedge devices 31 form no part of the present invention but their function is to urge spaced points of the resistance elements toward the associated annular walls in the body 13 and maintain the resistance elements in the required annular spaces in the body 13. Spacers 32 are provided between the inner face of each resistance element 25, 26, 27 and 28 and the annular wall toward which the resistance element is urged by the wedge device 31 and at some points wedge sticks 33 are located between the inner face of the resistance element and the associated annular wall in the body 13.

The resistance elements 25, 26, 27 and 28 are arranged so that upper edges of the resistance elements will be frictionally engaged by wiper contacts 34, 35, 36 and 37, respectively. Lead-out wires 38 are connected to the resistance elements 25, 26, 27 and 28 and are extended through apertures 39 formed in the base wall 20, the lead-

out wires 38 serving as outside leads for the resistance elements in the potentiometer 12.

The wiper contacts 34, 35, 36 and 37 are insulatively supported on arms 40, 41, 42 and 43, respectively which are mounted on a shaft 44 supported and arranged in the body 13 so that the shaft 44 and the body 13 are relatively rotatable. A tubular hub portion 45 is provided in the central portion of the body 13 to accommodate the shaft 44, the tubular hub portion 45 being located inwardly of an annular wall 46 which is located inwardly of the annular wall 19. The walls 19 and 46 extend upwardly from the base wall 20 and are further connected by spokes 47 shown in Figs. 1 and 2. The wall 46 and the hub portion 45 are connected by a horizontal wall 48 in which spaced apertures 49 are formed. The wall 46, the hub portion 45 and the horizontal wall 48 cooperatively define spaces 50 and 51 which are in communication through the spaced apertures 49. The upper surface of the horizontal wall 48 is bevelled where it meets the annular wall 46 to provide a slope 52 extending downwardly from the wall 46 to the apertures 49.

Supported in the upper end of the hub portion 45 is a flanged bearing 53 and supported in the lower end of the hub portion 45 is a flanged bearing 54, the bearings 53 and 54 being constructed to accommodate the shaft 44 and serve as bearing members therefor. The shaft 44 is provided with a conical bearing portion 55 which is in frictional bearing engagement with the flanged bearing 53, the flanged bearing 53 having formed therein a seat 56 to accommodate the conical bearing portion 55 on the shaft 44. The upper portion 57 of the shaft 44 is smaller in diameter than other portions of the shaft and is formed to provide, at spaced points, longitudinally extending slots 58. A well 59 is formed in the upper portion 57 of the shaft 44 to accommodate plates 60, a spring 61, a plunger 62 and a ball 63. The plates 60, the spring 61, the plunger 62 and the ball 63 are placed in the well 59 in the order mentioned and so that the spring 61 will tend to urge the plunger 62 and the ball 63 toward the top of the well 59. A retainer ring 64 is set into groove 65 to prevent the ball 63 from rising entirely out of the well 59. The ball 63 and the plunger 62 may be pressed downwardly in the well 59 against the action of the spring 61. The upper end of the shaft 44 is screw threaded at 66 to receive a nut 67 which serves as a retainer means for a stack of parts mounted on the upper portion 57 of the shaft 44. The stack of parts mentioned comprise an insulating tube 68, a washer 69, portions 70, 71, 72 and 73 of arms 43, 42, 41 and 40, respectively, arm holders 74, 75, 76 and 77 and washers 78 and 79. The arms 40, 41, 42 and 43 as above mentioned provide supports for the wiper contacts 34, 35, 36 and 37 respectively and except for length are alike in structure. The arm holders 74, 75, 76 and 77 are alike in structure and an understanding of the structures of the arms 40, 41, 42 and 43 and the arm holders 74, 75, 76 and 77 may be had by consideration of the structures of the arm 43 and arm holder 74 shown in Fig. 2.

The arm 43 shown in Fig. 2 comprises a plate portion 80, an arm portion 81 which is channel shaped in cross-section and a body portion 82. The body portion 82 as shown in Fig. 2 is apertured to receive the shaft 44 and is made like an incomplete ring so that it may be sprung open

to accommodate the shaft 44 and is provided with inwardly extending spaced projections 83 to frictionally engage the shaft 44. An upwardly extending flange 84 is provided on the outer edge portions of the arm portion 81 and the body portion 82. The arm holder 74 has a flanged body portion 85 and a flanged arm portion 86, the body portion 85 being constructed to fit over the body portion 82 and the arm portion 86 being constructed to fit over the arm portion 81 above described. The body portion 85 is provided with inwardly extending lugs 87 to engage in the slots 58 formed in the shaft 44. The arm 43 is releasably secured to its arm holder 74 by a bolt or other suitable fastening means 88. The body portions of the arm 43 and the arm holder 74 cooperatively define a space 89, shown in Fig. 3, to accommodate portions of a lead wire 90 which is extended from a heel portion 91 of the wiper contact 37 and to a conducting ring 93 which will be subsequently described. The lead wire 90 is an insulated lead wire and a portion of it is snubbed around a post 92 mounted on the arm 43. One end of the conductor of the lead wire 90 is electrically connected to the wiper contact 37 and the other end is electrically connected to the conducting ring 93. For each wiper contact there is an arm and an arm holder constructed along the lines of the arm 43 and the arm holder 74, respectively. Conducting rings 94, 95 and 96 are provided as conducting rings for the respective wiper contacts 36, 35 and 34.

The conducting rings 93, 94, 95 and 96 are dimensioned to accommodate the insulating sleeve 68 and are arranged in stack formation on the insulating sleeve 68 together with washers 97 and 98 which are alternated with the conducting rings and serve to hold the conducting rings 93, 94, 95 and 96 in spaced relation. The washers 97 are made of insulating material and form insulating barriers between the conducting rings. Passageways 99 are formed in the insulating sleeve 68 to accommodate portions of the lead wires extending from the wiper contacts to the conducting rings, each conducting ring 93, 94, 95 and 96 having a lug 100 formed on its inner surface and extending into a passageway 99 to meet and be electrically connected to the conductor of the lead wire.

The wiper contact 37 is electrically connected to the conducting ring 93 by means of the lead wire 90 which extends through the space 89 and through one of the passageways 99 to a lug 100 on the conducting ring 93. The wiper contact 36 is electrically connected to the conducting ring 94 by means of the lead wire 101 which extends between the arm 71 and the arm holder 75 and through a passageway 99 to a lug 100 on the conducting ring 94 as shown in Fig. 3. The wiper contacts 35 and 34 are electrically connected to the respective conducting rings 95 and 96 by means of the respective lead wires 102 and 103 which like the lead wires 90 and 101 extend through passageways 99 to the required conducting rings.

Peripherally grooved contact rings 104, 105, 106 and 107 are attached to and supported on the outer surfaces of the conducting rings 93, 94, 95 and 96, respectively. When the shaft 44 is rotated in the body 13 the wiper contacts 34, 35, 36 and 37 are moved along the respective resistance elements 25, 26, 27 and 28 and frictionally engage turns of the resistance wires on the resistance elements. The conducting rings 93,

94, 95 and 96 and the peripherally grooved contact rings 104, 105, 106 and 107 are rotated when the shaft 44 is rotated. Electrical potentials obtained in the operation of the potentiometer are conducted from the resistance elements 25, 26, 27 and 28 to the contact rings 107, 106, 105 and 104 respectively by way of the respective conducting rings 96, 95, 94 and 93.

The electrical connecting means of the present invention provides a means for taking off electrical potentials coming to the peripherally grooved contact rings 104, 105, 106 and 107. The electrical connecting means is identified in the drawings by a general number 108 and is shown in whole and in part in Figs. 3, 4, 5, 6, 7, 8, 9, 10 and 11.

The electrical connecting means 108 as shown in Figs. 10 and 11 comprises two parts 109 and 110 of insulating material and an assembly 111 of conducting parts and spring means. The assembly 111 comprises a flexible conductor 112, a terminal 113 and a spring 114. The flexible conductor 112 and the spring 114 are connected at their ends to cooperatively form an expansible and contractile hoop which may be expanded to receive the insulating part 109. The flexible conductor 112 may be any flexible conductor found suitable for the purpose but is shown in the drawings as a braided wire having eye tips 115 secured to its ends. The spring 114 may be any expansible and contractible member found suitable for the purpose but is shown in the drawings as a helical spring having hook portions 116 formed on its ends and hooked into the eye tips 115 on the flexible conductor 112. The terminal 113 is a strip of conducting material secured at one end to the flexible conductor 112 and having an end portion 117 to which a circuit wire, not shown, may be connected.

The part 109 of the electrical connecting means 108 is a supporting body for other parts of the connecting means and will hereinafter be called the body 109. The body 109 is constructed to rest on the hub portion 45 in the potentiometer body 13 and is tubular in form and has spaced annular grooves 117, 118, 119 and 120 formed in its outer cylindrical surface 121. A portion of the base of each annular groove 117 to 120, inclusive, is apertured to provide an elongated aperture extending through the inner surface 122 of the body 109. The aperture formed in each annular groove 117 to 120 is relatively long and is of sufficient width to readily allow a flexible conductor 112 of the assembly 111 to pass into the space defined by the inner surface 122 of the body 109.

The part 110 of the electrical connecting means 108 is a flanged sleeve of insulating material and will hereinafter be called the sleeve 110. The sleeve 110 is constructed for mounting in the body 109 and comprises a barrel portion 123 and a flange portion 124. The barrel portion 123 is constructed to readily enter the space defined by the body 109 and is of sufficient internal diameter to readily accommodate the contact rings 104, 105, 106 and 107. The flange portion 124 is constructed and arranged to rest on the top of the body 109 and has a notch 125 formed in its outer edge to be brought into register with a notch 126 formed in the outer edge of an upper flange 127 on the body 109. Spaced apertures 135, 136, 137 and 138 are formed in the flange portion 124 of the sleeve 110.

Elongated apertures 135, 136, 137 and 138 are formed in the barrel portion 123 of the sleeve 110 to match with the respective elongated apertures 139, 140, 141 and 142 formed in the bases of the annular grooves 117, 118, 119 and 120 in the body 109. The elongated apertures 135, 136, 137 and 138 follow the curvature of the barrel portion 123 of the sleeve 110 and the elongated apertures 139, 140, 141 and 142 follow the curvature of the body 109.

The elongated apertures 135, 136, 137, 138, 139, 140, 141 and 142 are of equal length and extend a considerable distance measured around the circumference of the parts in which they are formed. Considered in a counterclockwise direction the elongated aperture 136 is in an advanced position relative to the elongated aperture 135 and the remaining elongated apertures 137 and 138 are each in advanced positions relative to the preceding elongated apertures. Also considered in a counterclockwise direction the elongated aperture 140 in the body 109 is in an advanced position relative to the elongated aperture 139 and the remaining elongated apertures 141 and 142 are each in advanced positions relative to the preceding elongated apertures.

When the sleeve 110 is placed within the body 109 and so that the flange 124 on the sleeve 110 rests on the flange 127 of the body 109 the elongated apertures 135, 136, 137 and 138 in the sleeve 110 are in the same planes as the respective elongated apertures 139, 140, 141 and 142 in the body 109. By rotatably adjusting the sleeve 110 in the body 109 the elongated apertures 135, 136, 137 and 138 in the sleeve 110 may be brought into or out of register with the respective elongated apertures 139, 140, 141 and 142 in the body 109 as required. The notches 131, 132, 133 and 134 provide convenient gripping points for a spanner wrench, not shown, but which may be used in rotatably adjusting the sleeve 110 in the body 109.

Each annular groove 117 to 120, inclusive, in the body 109 provides a receptacle in which a flexible conductor 112 and a spring 114 of an assembly 111 may rest. The hoop cooperatively formed by the flexible conductor 112 and the spring 114 is somewhat smaller in circumference than the circumference of the base of any annular groove in the body 109 and the spring 114 must be stretched when the assembly 111 is mounted on the body 109 with the sleeve 110 in the body 109 and when the elongated apertures 135 to 138 in the sleeve 110 are not in register with the respective corresponding elongated apertures 139 to 142 in the body 109. Assuming, however, that the flexible conductor 112 and the spring 114 of the assembly 111 are in the annular groove 117 in the body 109 and the sleeve 110 is rotated to bring the elongated aperture 135 in the sleeve 110 into full register with the elongated aperture 139 in the body 109 the spring 114 will cause the flexible conductor 112 to move through the elongated apertures 139 and 135 and to such position that the flexible conductor 112 extends across the space defined by the inner surface of the barrel portion 123 of the sleeve 110. By relatively rotating the sleeve 110 and the body 109 to bring the elongated apertures 135 and 139 out of register the flexible conductor 112 may be moved out of the space since in this operation an unapertured portion of the sleeve 110 comes into register with the elongated aperture 139 in the body 109 and, in doing so, forces the flexible conductor 112 outwardly against the action of the spring 114.

In the potentiometer shown and described to explain the invention the assembly 111 serves as a conducting take-off for one of the contact rings carried by the rotatable shaft 44. The number of contact rings and the number of assemblies 111 employed will depend on the requirements of the case. The potentiometer shown and described contains four contact rings 104, 105, 106 and 107 for each of which an electrical take-off is provided involving an assembly 111. As shown in Figs. 3 and 10 the rotatable shaft 44 extends through the electrical connecting means 108, a portion of the rotatable shaft 44 extending through the sleeve 110 mounted in the body 109.

The contact rings 104, 105, 106 and 107 are in the space defined by the inner surface of the sleeve 110.

Four electrical take-off assemblies 111, 143, 144 and 145 which are alike except for the length of one portion of a terminal are mounted on the body 109. The assemblies 143, 144 and 145 have respectively flexible conductors 146, 147 and 148 which correspond to the flexible conductor 112 in the assembly 111 and also have respectively terminals 149, 150 and 151 which correspond to the terminal 113 of the assembly 111 except that there is some difference in the length of an offset portion 152 provided on each terminal. It will be seen in Fig. 10 that the springs 114 of the take-off assemblies 111, 143, 144 and 145 are in the respective annular grooves 117, 118, 119 and 120 of the body 109 and that the springs 114 are of sufficient diameter to prevent the springs 114 from passing through the elongated apertures 139, 140, 141 and 142 in the body 109 and through the respective elongated apertures 135, 136, 137 and 138 in the sleeve 110 when the elongated apertures 139, 140, 141 and 142 are in register with the respective elongated apertures 135, 136, 137 and 138. In Fig. 10 the flexible conductors 112, 146 and 148 are shown as drawn through the respective elongated apertures 135, 137 and 138 in the sleeve 110. It will also be understood that the flexible conductor 146 is drawn through the elongated apertures 140 and 136 when the parts are in the positions shown. In Fig. 7 the flexible conductors 112, 146, 147 and 148 may be seen extending across the space defined by the inner surface of the sleeve 110.

When the sleeve 110 and the body 109 are relatively rotated so that the elongated apertures in those parts are brought out of register the flexible conductors 112, 146, 147 and 148 are moved outwardly, against the action of the springs 114, by unapertured portions of the sleeve 110 until the flexible conductors no longer cross the space defined by the inner surface of the sleeve 110 and are entirely in the respective annular grooves 117, 118, 119 and 120 in the body 109. Fig. 6 shows the space defined by the inner surface of the sleeve 110 entirely clear of the flexible conductors. Under this condition the rotatable shaft 44 together with the contact rings 104, 105, 106 and 107, the conducting rings 93, 94, 95 and 96 and the insulating tube 88 may be withdrawn from or entered in the electrical connecting means 108. It will be obvious that the flexible conductors 112, 146, 147 and 148 may be brought into and out of electrical connection with the respective contact rings 104, 105, 106 and 107 as required simply by relatively rotating the sleeve 110 and the body 109 to required positions.

A releasable latch 153 is provided to hold the sleeve 110 in the body 109 and to hold the sleeve rotated relative to the body 109 to such position that the flexible conductors 112, 146, 147 and 148

extend across the space defined by the inner surface of the sleeve and in contact with the respective contact rings 104, 105, 106 and 107 when the rotatable shaft 44 and the parts carried thereby are in required operating positions in the body 13 of the potentiometer 12. The releasable latch 153 as shown in Figs. 5, 7, 8 and 9 comprises a spring wire with a staple end portion 154 extending through a groove 155 formed in the under surface of the flange 124 of the sleeve 110 and into the apertures 128 and 129 in the flange 124. A free portion 156 of the latch 153 extends in bowed form over a portion of the upper surface of the flange 124 and to the notch 125 and then extends downwardly in a portion 157 across outer edge portions of the flange 124 and the upper flange 127 on the body 109 and terminates in a backwardly extending bowed free end portion 158 arranged in bearing engagement with the under surface of the upper flange 127 on the body 109 to hold the sleeve 110 against undue rising in the body 109. The notches 125 and 126 in the sleeve 110 and the body 109 respectively are arranged so that they will be in register when the sleeve 110 is in such position relative to the body 109 that the elongated apertures 135, 136, 137 and 138 in the sleeve 110 are in register with the respective elongated apertures 139, 140, 141 and 142 in the body 109. When the notches 125 and 126 come into register the tension in the bowed portion 156 of the latch 153 causes the portion 157 to snap into the notches 125 and 126 to prevent undesired relative rotation of the sleeve 110 and the body 109. The latch 153 may be operated to release the latched parts for relative movement by applying a suitable force to the bowed portion 156 of the latch. The bowed portion 156 extends across the aperture 130 in the flange 124 to facilitate engagement of the bowed portion 156 by a suitable hand tool, not shown, but which may be any device suitable for engaging the latch 153 to move the portion 157 from the notches 125 and 126.

When the shaft 44 and the contact rings 104, 105, 106 and 107 are in required position in the electrical connecting means 108 and the sleeve 110 is positioned relative to the body 109 so that the flexible conductors 112, 146, 147 and 148 extend through the respective elongated apertures 139, 140, 141 and 142 in the body 109 and through the respective elongated apertures 135, 136, 137 and 138 in the sleeve 110, under the pull of the springs 114, the flexible conductors 112, 146, 147 and 148 are in frictional engagement with the respective contact rings 104, 105, 106 and 107 carried by the rotatable shaft 44. (Fig. 4 shows the flexible conductor 146 in frictional engagement with the contact ring 105). Under this condition the potentials coming to the wiper contacts 37, 38, 35 and 34 and conducted by way of the respective lead wires 90, 91, 92 and 93 to the respective conducting rings 93, 94, 95 and 96 and from them to the respective contact rings 104, 105, 106 and 107 are transmitted to the flexible conductors 112, 146, 147 and 148, respectively. The flexible conductors 112, 146, 147 and 148 are in electrical connection with the respective terminals 113, 149, 150 and 151 of the respective electrical take-off assemblies 111, 143, 144 and 145 and the potentials coming to the flexible conductors 112, 146, 147 and 148 are therefore transmitted to the respective terminals 113, 149, 150 and 151.

The terminals 113, 149, 150 and 151 are supported in spaced relation on the body 109. Each terminal is a relatively long strip of conducting

material formed to have a substantially straight body portion 159 terminating at its upper end in an offset portion 152 and terminating at its lower end in an offset portion 160. The offset portions 152 and 160 on each terminal are in the same plane and are offset from the plane of the body portion 159 to form shoulders 161 and 162. A tab 163 is provided on the terminal to extend in the same plane as the body portion 159 and in parallel spaced relation with the offset portion 152. The tab 163 may be formed by striking out portions of the offset portion 152 and the shoulder 162 as shown in Fig. 11. The upper end of the offset portion 152 is turned inwardly to the plane of the body portion 159 to provide a top shoulder 164 and the upper end of the terminal is formed to provide a tubular portion 165 constructed to extend around the required flexible conductor and be electrically connected to the flexible conductor. When the terminals are mounted on the body 109 the tabs 163 extend into spaced recesses 166 formed in the lower end of the body 109 as shown in Fig. 5, the offset portions 152 extend upwardly in engagement with the outer surface of the body 109 and to a required annular groove in the body 109. The shoulders 162 on the terminals extend under the lower edge of the body 109 and the top shoulders 164 extend over flanges defining the annular grooves in the body 109. The upper end of each terminal extends into a required annular groove in the body 109 and is connected to the flexible conductor in the required annular groove.

It will be seen, therefore, that upper portions of the terminals are mounted on the body 109 and that the body portions 159 and offset portions 160 of the terminals extend considerable distances below the body 109. When the body 109 with the terminals supported thereon is in required position in the potentiometer body 13 and as shown in Fig. 3 the terminals extend downwardly through the body 13 between the wall 46 and the hub 45. The body portions 159 of the terminals are long enough to extend to and through apertures 49 in the horizontal wall 48 and the shoulder 161 on the terminals are positioned to snap under and engage the lower surface of the horizontal wall 48. When the terminals are being placed in the body 13 the offset portions 160 of the terminals engage the slope 52 on the horizontal wall 48 and are slightly flexed to pass through the apertures 49. Some spring pressure is developed in the terminals in moving them into the body 13 and the spring pressure causes the shoulders 161 to snap under and engage the lower surface of the horizontal wall 48 when the shoulders 161 on the terminals pass entirely through the apertures 49. Engagement of the shoulders 161 of the terminals with the lower surface of the horizontal wall 48 in the body 13 prevents undue rising of the electrical connecting means 108 in the body 13.

What is claimed is:

1. An electrical connecting means forming an electrical connection between relatively movable parts comprising a contact, a flexible conductor extending around and engageable with said contact, a terminal electrically connected to said flexible conductor, spring means attached to said flexible conductor and operable to pull said flexible conductor into engagement with said contact, an apertured body for said flexible conductor, spring means and terminal, an apertured sleeve supported in said apertured body and extending around said contact and cooperable with

said apertured support to control the engagement of said flexible conductor with said contact.

2. An electrical connecting means forming an electrical connection between relatively movable parts comprising a contact, a tubular body having an elongated aperture formed therein, a sleeve mounted in said tubular body and extending around said contact, said sleeve having an elongated aperture formed therein corresponding to the elongated aperture formed in said tubular body, said sleeve and said tubular body being relatively rotatable to bring the elongated apertures into and out of register and a flexible conductor and a spring cooperatively forming a hoop extending around and mounted on said body, said spring being operable to pull said flexible conductor through the elongated apertures in said tubular body and sleeve and into contact with said contact when the elongated apertures are in register.

3. An electrical connecting means forming an electrical connection between relatively movable parts comprising a ring contact, a tubular body, a sleeve supported in said tubular body and rotatable therein and extending around said ring contact, said tubular body and said ring contact being relatively movable, an expansible and contractile hoop extending around and in engagement with said body, said sleeve and said body having apertures formed therein to be brought into and out of register through relative movements of said tubular body and sleeve, a portion of said hoop being operable to pass through the apertures formed in said tubular body and sleeve and into engagement with said ring contact when the apertures in said tubular body and sleeve are in register and a terminal electrically connected to said hoop and extending therefrom.

4. An electrical connecting means forming an electrical connection between relatively movable parts comprising a ring contact, a tubular body, a sleeve supported in said tubular body and rotatable therein and extending around said ring contact, said tubular body and sleeve having elongated apertures formed therein to be brought into and out of register by relative movement of said tubular body and sleeve, a flexible conductor and a spring cooperatively forming an expansible and contractile hoop supported on said tubular body, said spring being operable to pull said flexible conductor through the elongated apertures in said tubular body and sleeve and into engagement with said ring contact when the elongated apertures in said tubular body and sleeve are in register and a terminal mounted on said body and having electrical connection with said flexible conductor.

5. An electrical connecting means forming an electrical connection between relatively movable parts comprising a ring contact, a support for said ring contact, a tubular body having a groove formed therein, a sleeve supported in said tubular body and extending in spaced relation around said ring contact, said body and said ring contact being relatively rotatable, the groove in said body having an aperture formed therein and extending through the inner wall of said body, said sleeve having an aperture formed therein to be brought into register with the aperture formed in the groove in said body, an expansible and contractile conducting hoop extending around said body and disposed in the groove in said body, a portion of said hoop being operable to extend through the aperture

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formed in said body and through the aperture formed in said sleeve and into contact with said ring contact when the apertures in said body and sleeve are in register, said body and said sleeve being relatively rotatable to withdraw said hoop from engagement with said ring contact and a terminal supported on said body and having electrical connection with said hoop.

6. An electrical connecting means forming an electrical connection between relatively rotatable parts comprising a grooved ring contact, a support for said ring contact, a tubular insulating body having an annular groove formed in its outer surface and having an elongated aperture formed in the groove and extending through to the space defined by said body, a tubular sleeve rotatably supported in said body and extending in spaced relation with and surrounding said ring contact, said tubular sleeve having an elongated aperture formed therein in register with said ring contact and operable to be brought into register with the elongated aperture in said body by relative rotation of said body and sleeve, an expansible and contractile hoop mounted in the groove in said body and having a conducting portion operable to extend through the elongated apertures in said body and sleeve and into contact with said ring contact when the elongated apertures in said body and sleeve are in register and a terminal of conducting material, mounted on said body and electrically connected to the conducting portion of said hoop.

7. An electrical connecting means forming an electrical connection between relatively rotatable parts comprising a plurality of spaced ring contacts, a support for said ring contacts, a tubular insulating body having spaced annular grooves formed in its outer surface and having an elongated aperture formed in each groove and extending through to the space defined by said body, a sleeve rotatably supported in said body extending in spaced relation with and surrounding said ring contacts, said sleeve having elongated apertures formed therein to register with said ring contacts and operable to be brought into and out of register with the elongated apertures formed in said body, a contractile and expansible hoop supported in each annular groove in said body and having a conducting portion operable to extend through an elongated aperture in said body and an elongated aperture in said sleeve and into contact with a predetermined ring contact when the elongated apertures in said body and sleeve are in register, said body and sleeve being relatively rotatable to selectively bring the elongated apertures in said body into and out of register with the corresponding elongated apertures in said sleeve and terminals, individual to the expansible and contractile hoops, mounted on said body, each of said terminals being electrically connected to the conducting portion of the hoop it is required to serve.

8. An electrical connecting means forming an electrical connection between relatively rotatable parts comprising a plurality of spaced contacts, a support for said contacts, a tubular body having elongated apertures formed therein and arranged in advanced positions around said body, said contacts and said body being relatively rotatable, a sleeve rotatably supported in said body and having elongated apertures formed therein to match the elongated apertures formed in said body, said sleeve surrounding said contacts and expansible and contractile conducting hoops supported on

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said body and having portions operable to extend through the elongated apertures in said body and sleeve and into frictional engagement with said contacts when the elongated apertures in said body are in register with the elongated apertures in said sleeve, said body and said sleeve being relatively rotatable to bring the elongated apertures in said body into and out of register with the elongated apertures in said sleeve.

9. An electrical connecting means forming an electrical connection between relatively rotatable parts comprising a contact, a flexible conductor extending around and operable to be moved into and out of engagement with said contact, a relatively rotatable body and sleeve supporting said flexible conductor and extending around said contact, said body and contact being relatively rotatable, said body and sleeve having apertures formed therein to be brought into and out of register and providing openings through which a portion of said flexible conductor may pass to engage said contact when the apertures in said body and sleeve are in register, means to urge said flexible conductor through the apertures in said body and sleeve and into engagement with said contact and a releasable latch engaging said body and sleeve and operable to hold said body and sleeve in required position to allow said flexible conductor to extend into engagement with said contact.

10. An electrical connecting means forming an electrical connection between relatively rotatable parts comprising a contact, a relatively rotatable body and sleeve extending around said contact, said body and sleeve having elongated apertures formed therein to be brought into and out of register by relative rotation of said body and sleeve, a flexible conductor supported on said body and operable to move into and out of engagement with said contact through the elongated apertures in said body and sleeve, means to urge said flexible conductor through the elongated apertures in said body and sleeve and into engagement with said contact when said body and sleeve are relatively rotated to positions in which the elongated apertures in said body and sleeve are in register and a releasable spring latch engaging said body and sleeve and operable to hold said body and sleeve in required adjusted positions for engagement of said flexible conductor with said contact.

11. In an electrical control device, in combination, an electrical element, a support for said electrical element, a wiper contact to travel over and frictionally engage said electrical element, a shaft extending through said support and supporting said wiper contact, said support and said shaft being relatively rotatable, a ring contact carried by said shaft, a tubular body supported in said support, a sleeve rotatably supported in said tubular body and constructed to accommodate said shaft and ring contact, an expansible and contractile conducting hoop supported on said body and having a portion operable to extend through said body and sleeve and into contact with said ring contact, said body and said sleeve having elongated apertures formed therein in which may be brought into and out of register by relatively rotating said body and sleeve, the elongated apertures being constructed to allow passage therethrough of a portion of said conducting hoop and a terminal electrically connected to said conducting hoop and supported on said body and extending into holding engagement in said support.

12. In an electrical control device in combination a cup-type casing, spaced concentric walls extending in said casing, a connecting wall extending across the space between two of said concentric walls, said connecting wall having spaced apertures formed therein, a body supported on an end of one of said concentric walls, electrical terminals supported on said body in spaced relation, leg portions of said terminals extending through the apertures in said connecting wall and offset shoulders formed on said leg portions at points where said leg portions extend through the apertures in said connecting wall, said offset shoulders being in snapped-over

engagement with said connecting wall to hold said body in said casing.

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