

W. T. HARDISON ET AL

INDICATING VARIABLE RESISTANCE

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BY *J. Peterson*

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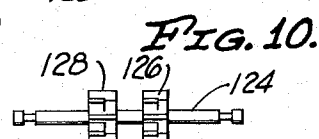
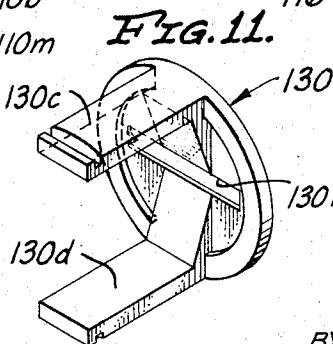
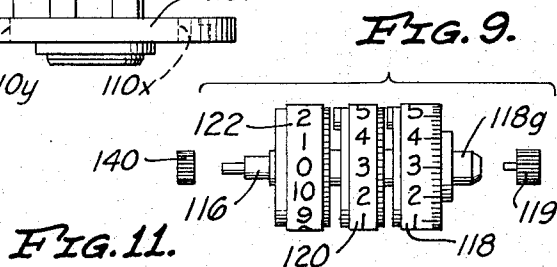
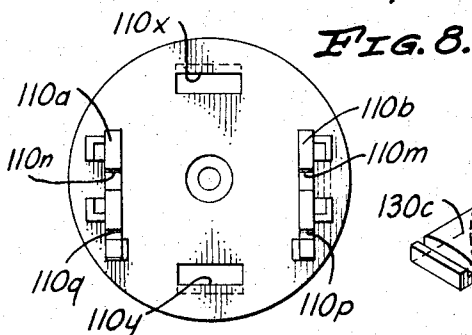
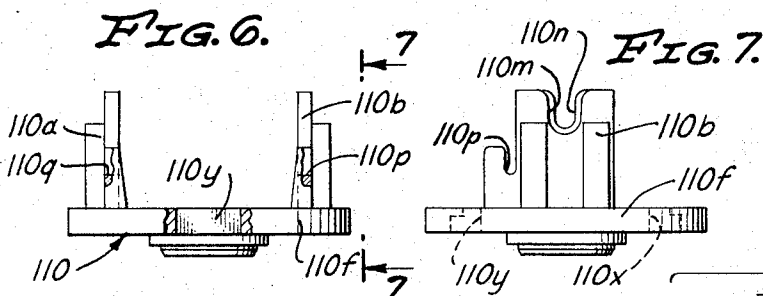
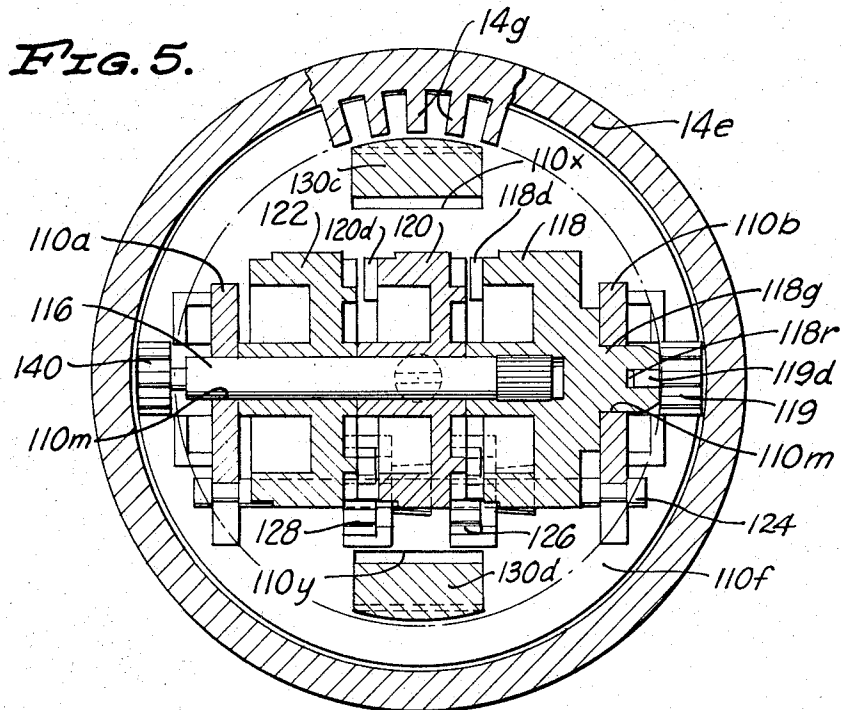
W. T. HARDISON ET AL

3,370,260

INDICATING VARIABLE RESISTANCE

Filed April 26, 1965

2 Sheets-Sheet 2



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INDICATING VARIABLE RESISTANCE

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ABSTRACT OF THE DISCLOSURE

A variable resistor of the type comprising a multiple-turn helical resistance element, a contact movable along the resistance element and slider means to carry and move the contact, the preceding element and means being housed in a manually-rotatable shell means which concurrently serves to effect movement of the slider means and contact, all of the foregoing structures being supported at the front face of a panel by rigid supporting means secured at a rear end thereof in an aperture in the panel, with terminal connections to the element and contact passing through the aperture within the supporting means, the resistor comprising at the front thereof digital turns-counting and indicating means affixed to the front of the supporting means by locking means and the turns-counting and indicating means comprising gear means driven by a gear included in the rotatable shell means, whereby with manual rotation of the shell means the movable contact is traversed around and along the helical resistance element and concurrently the gear means drives a turns-counting and indicating set of wheels providing a visible easily read digital indication of the extent of movement of the contact along the element and hence of the decimal fraction of the total resistance of the element interposed between two of the terminals of the resistor.

The invention herein disclosed pertains to variable resistors, and more particularly to variable resistors of the type in which a plural-turn helical resistance element is disposed within a rotary housing by means of which the resistor is varied. Still more particularly, the invention pertains to means whereby visual indications of the adjustment or relative positioning of the variable contact of the resistor are improved.

In U.S. Patent No. Re. 25,674, there is described a variable resistor device adapted for mounting on the front face of a panel or console, with the terminals or other insulated conductors connected to a sliding contact and respective ends of a plural-turn resistance element and with the conductors extending through a mounting aperture in the panel or console via a hollow rigid supporting structure in the form of a stud, whereby the terminals or connections are accessible at the rear of the panel or console and the variable resistor per se is located forwardly of the front or face of the panel or console. The variable resistor device disclosed in the noted patent is characterized by a clock-like dial-indicator device disposed at the front end of the resistor device and arranged to provide a visual indication of the number of complete convolutions and fractional part of a complete convolution of the resistance element traversed by the movable contact during adjustment of the resistor; all to the end that a visible indication of the value of resistance exhibited between two terminals of the device is made available, and so that the device may readily be readjusted to a previous setting or value. The present invention is directed to improvements in devices of the character of that disclosed in the noted patent.

Briefly, the present invention comprehends a variable resistor device having a plural-turn helical resistance element with a sliding contact device and means to effect relative movement of the resistance element and contact

device whereby the point of electrical contact between the element and contact device is shifted along a working extent of the resistance element as the hollow shell or housing of the resistor device is rotated, all similar to or as disclosed in the noted patent, and the resistor device having an integral indicator means at the front or forward end thereof, which indicator means is such as to provide a direct visible digital representation of the adjustment of the resistor. The indicator means furnishes or provides a visually perceptible numerical representation of the value of the adjustment either in terms of percentage of total resistance of the element that is electrically exhibited between the movable contact and one end terminal, or full-turns and fractional part of turn through which the point of contact has at the time traversed. In the case of the prior-art variable resistor, error in ascertaining the correct value of the indication was possible due to the necessity for reading two differently-positioned spaced-apart members, and further, the large number of indicia on the face of the indicator dial necessarily restricted the size of the indicia and thereby made it necessary that the observer be quite close to the resistor if an accurate reading was to be made. In the case of the present invention, the indicia made visible are restricted ordinarily to three and to an ultimate maximum of four numerals, and those are presented in close adjacency and may be instantly read as a unit; and, due to the fewer visible indicia each may be of larger size in a resistor of comparable dimensions, whereby the setting or adjustment value of the resistor may be read with facility at a greater distance.

Structurally, the presently disclosed variable resistor device is of generally cylindrical configuration, with a tubular or hollow support or stud at the rear end through which the insulated terminal conductors extend and by means of which the resistor is secured to a panel or console. The supporting structure comprising the stud provides a support on which a cylindrical shell is rotatably mounted. The stud and shell further comprise means for supporting a helical resistance element, a return electrical bus, and a contact device that is disposed in a space between the stud and the shell. The contact device includes a contact member that has point-contact with the resistance element, and the arrangement is such that rotation of the shell causes the point of engagement or contact to be shifted along the active or electrical extent of the resistance element as the shell is rotated. In the aforementioned reissue patent, a structure having such an arrangement of stud, resistance element, contact device, and rotatable shell, is described; and in the exemplary illustrative form of the present invention a very similar arrangement of like parts is employed. In the present invention, however, the rotatable structure comprising the shell is made somewhat longer and is made to carry a driving gear member that is used to drive a digital display device. The digital display device is secured to the aforementioned stud or stationary supporting device so as to remain stationary in operative attitude, but comprises a set of wheels or like moving members each bearing indicia such as numerals, and movable means for progressively actuating the indicia-bearing members, the movable means including a driven gear arranged to be driven by the driving gear member of the rotatable structure or shell. A fenestrated shield or the like is provided, whereby only appropriate ones of the indicia are made to be visible to an operator of the resistor; and a transparent crystal or cover, carried by the rotary shell, permits reading of the indicia while concurrently serving to exclude foreign matter such as dust from the working parts of the device inside the shell. Thus the device is such that rotation of the shell successively brings appropriate indicia into view in an elongate view-

ing region defined by the elongate window of the shield, as the point of contact on the resistance element moves. Proper orientation of the window is accomplished when the resistor is initially mounted in an aperture in the supporting panel or console. Details of the mounting means and method may be as disclosed in the noted re-issued patent, to which reference may be made and the disclosure of which patent is incorporated herein by reference.

The preceding brief general description of the invention makes it evident that it is a principal object of the invention to provide a plural-turn helical-element variable resistor device having a rotatable housing or shell in which the resistor and wiper or contact components are housed and by means of which adjustments are effected and the resistor device having at the front end thereof an indicating device providing a set of digital indicia disposed to facilitate reading and indicating the status of the adjustment of the resistor device.

Another object of the invention is to provide improvements in plural-turns helical-element variable resistors.

An additional object of the invention is to provide a rotatable knob-like generally cylindrical shell and appurtenant means including means adapted to be secured at the front of a panel, and which upon rotation of the shell from a base position adjusts a potentiometer contained in the shell and concurrently provides at the forward end of the shell remote from the mounting point a direct numerical representation of the extent of the adjustment.

Additional objects and advantages of the invention will hereinafter be stated or made evident in the appended claims or in the following description of a preferred exemplary physical embodiment of indicating variable resistor according to the invention as illustrated in the accompanying drawings forming a part of this specification. In the drawings:

FIGURE 1 is a view in elevation of the aforementioned preferred exemplary variable resistor, with a portion of a rotary shell broken away to reveal certain internal details, the drawing being to an arbitrary scale;

FIGURE 2 is a face view of the front end of the variable resistor depicted in FIGURE 1, showing the means for presenting an easily-read numerical or digital indication of the state of adjustment of the resistor;

FIGURE 3 is a fragmentary sectional view, to an arbitrary larger scale, of the forward portion of the variable resistor depicted in FIGURES 1 and 2, the section being taken on a plane end in a direction indicated by broken line and arrows 3—3 in FIGURE 2;

FIGURE 4 is a fragmentary sectional detail view of internal structure, taken on a plane and in a direction indicated by arrows and broken line 4—4 in FIGURE 3;

FIGURE 5 is a cross-section view of the variable resistor depicted in FIGURES 1 and 2, to an arbitrary larger scale, the section being as indicated by broken line 5—5 in FIGURE 3;

FIGURE 6 is a view in elevation of a base or support for a set of number wheels and appurtenant means, with parts broken away to reveal structural details;

FIGURE 7 is a side view of the base or support depicted in FIGURE 6;

FIGURE 8 is a top view of the base or support depicted in FIGURE 6;

FIGURE 9 is a partly-exploded representation of a number-wheel device comprising a shaft, a set of number wheels, and driving and idler gears, depicted partly in section in FIGURE 5;

FIGURE 10 is a view of a pinion shaft and pinions comprised in the structures depicted in FIGURES 3 and 5; and

FIGURE 11 is a pictorial view of a fenestrated shield comprised in the variable resistor depicted in assembled form in FIGURE 2.

In the drawings, parts are shown to arbitrary scales,

and the scales are not uniform but have been selected in the interest of economy and convenience.

Referring first to FIGURES 1 and 2, and preferably with supplementary reference also to the drawings of the aforementioned Letters Patent No. Re. 25,674, there is shown a rigid supporting structure including a hollow supporting stud 10 adapted for insertion through an aperture in a panel (indicated in phantom view at P) and adapted to be firmly affixed to such panel. The rear end portion of the supporting structure at stud 10 is threaded to receive a clamping nut N and lock-washer W, whereby the supporting structure at the rear end thereof is affixed with only a small portion thereof disposed at the rear of the panel. The stud 10 contains or supports insulated electrical terminal devices, which as shown are insulated solder hooks 16f. Two of the hook terminal devices are electrically connected to respective ends of a helical plural-turn resistance element 16, and the third hook terminal device is electrically connected to a deformed spring washer 30 (FIGURE 3) which is carried at the forward end of an insulative support device 12 that is affixed to the stud and which washer is brushed by a bare conductive ring 24a that is integral with or otherwise connected to a contact collector bus 24 that is affixed to the interior of a rotatable shell presently to be described.

The insulated support member or device 12 is of generally cylindrical configuration and is affixed to stud 10 by press fitting or by adhesive means. The stationary supporting structure comprising the stud 10 and device 12 has a front end and a middle or body portion formed to provide a longitudinal slot S (FIGURE 3) that provides a passage for insulated termination conductors leading to the rear of the panel or console, as illustrated in the patent. The supporting structure comprising device 12 provides at the rear end thereof bearing means, as indicated in FIGURE 1, for rotatably supporting the rear end of a cylindrical shell 14. The shell 14 comprises a radially-inwardly projecting flange 14a (FIGURE 3) which is rotatably supported at an annular surface 18a provided at the rear face of a stationary counter base 110 adjacent to the front end of the stationary supporting structure. The counter base is by suitable means held affixed to the stationary supporting structure; for example, by means of a clamping screw 112 the head of which fits in a stepped axial aperture in the base 110 and the threaded shank of which screw engages in the threaded bore of a stepped draw-plug 114 slidable in the complementary stepped bore of stud 10 as indicated in FIGURE 3. A reduced forward end portion of stud 10 is slotted to provide two opposed arcuate protuberances 10p (FIGURE 4) which extend forwardly into two complementary arcuate recesses 110r provided in the central portion of base 110, whereby the base is locked against rotation relative to stud 10. As is evident, the flange-like generally circular flat plate portion of counter base 110 confines flange 14a of shell 14 from forward escape and thus determines that the shell may rotate about an axis extending lengthwise therethrough and upon the bearing surfaces provided by support device 12 and surface 18a on base 110 while being confined against substantial axial movement.

Disposed in a generally annular space or chamber between the stationary supporting structure and the rotary shell, and preferably mounted as a helical device on the support device 12, is a plural-turn resistance element herein shown in exemplary form as a wire-wound helical resistance element 16. The element 16 has electrical terminal or end connections by way of insulated wires to respective ones of members 16f at the rear end of stud 10 as is illustrated in Patent No. Re. 25,674. Also confined in the annular or cylindrical space between support device 12 and the inner surface of shell 14, and herein shown supported and driven by the shell and guided for translation along a helical path by means such as helical resistance element 16, is a contact-carrying slider 26

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(FIGURE 3). The slider carries a wiper or contact member 28 which has contact with element 16 and with the aforementioned collector bus 24. The structural and electrical relationships of element 16, shell 14, slider 26 and member 28 may be like or similar to that illustrated and described in Patent Re. 25,674, to which reference may be had for details and modifications. Rotation of shell 14 on the stationary core causes slider 26 to move around the coincident axes of the shell and stud 10, and engagement of portions of the slider with the helical element or its equivalent causes the slider to move in a helical path so that contact member 28 remains in contact or engagement with element 16 and with bus conductor 24. Conductor 24 extends along the inside of shell 14.

It is desirable that the extent of the traverse of the contact member 28, that is, of the point of the contact between member 28 and the resistance element 16, from an initial or base position at one electrical terminal end of element 16, be instantly available in numerical form to an operator of the shell 14. Further it is desirable that the numerical value furnished vary proportionally to the variation in the resistance exhibited between a fixed terminal member 16f and that terminal member 16f connected to contact member 28 by way of washer 30 and bus conductor 24, irrespective of the instantaneous rotational position of shell 14. Hence to those ends there is disposed, within an extension 14e of shell 14, a numerical indicator device including the aforementioned counter base 110 and appurtenant means. Base 110 comprises a pair of upstanding forwardly extending compound or stepped pedestals 110a and 110b (FIGURES 6, 7 and 8) suitably supported by the base as by being formed integrally with the generally circular bottom portion 110f of the base. The pedestal 110b (FIGURE 7) is formed to provide an upper saddle or bearing 110m and a lower saddle or bearing 110p; and pedestal 110a is formed to provide similar bearings 110n, 110q, each of which bearings of pedestal 110a defines an axis in alignment with that defined by a respective one of the bearings of pedestal 110b.

Rotatably seated in the uppermost saddles 110m, 110n, is a structure comprising a number-wheel shaft 116 (FIGURES 5 and 9) and affixed number wheel 118. As indicated in FIGURE 5, wheel 118 is molded on or otherwise affixed to one end of shaft 116 and comprises a gudgeon 118g which is rotatably seated in bearing 110m. Wheel 118 further comprises a recessed end into the shaped recess 118r of which is fitted a complementary driving gudgeon 119d of a driving gear 119, whereby rotation of gear 119 is transmitted positively to wheel 118. Shaft 116 further supports for free rotation thereon between pedestals 110a and 110b, second and third number wheels 120 and 122 (FIGURES 5 and 9).

Supported by and preferably fixedly secured in lower saddles or bearings 110p and 110q (FIGURES 5 and 8) is a shaft 124 on which are loosely rotatable first and second double pinions 126 and 128 (FIGURE 10). Each of the pinions has half of alternate teeth removed or missing, as is common in counters such as odometers, and is arranged with the teeth of the full-set thereof in driving engagement with teeth of one of the number wheels and with the teeth of the half-set thereof disposed for engagement by a double-tooth member of one of the number wheels, as is common in counters. Thus when gear 119 (FIGURE 5) is rotated, number wheel 118 is directly rotated, and during such rotation a double-tooth member 118d thereon is brought around and engages a tooth of the half-set of teeth on pinion 126. Pinion 126, with its full set of teeth engaged with a full set of teeth on wheel 120, rotates the latter (one-tenth revolution, for example). Continued rotation of wheel 118 disengages double-tooth member 118d from pinion 126 and the pinion 126 and wheel 120 remain quiescent until member 118d again effects a step of rotation of the pinion 126 and wheel 120. That action continues, with intermittent rotation of number wheel 120 until a double-tooth member 120d thereon

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engages and drives one of the teeth of the half-set of teeth on the second pinion 128. The full-set of teeth of pinion 128 engage a full set of teeth on the third number wheel 122. The set of teeth on wheel 122 is greater in number than that of wheel 120, for a reason presently made evident. Thus rotation of gear 119 rotates wheel 118 directly to bring into a viewing position successive ones of numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 thereon; and at each complete revolution wheel 120 is stepped one number forward. Similarly, each full revolution of wheel 120 steps wheel 122 forward one step, hence the latter is stepped one revolution during ten revolutions of wheel 120. Wheel 120 is provided with ten numbers, namely, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0; and wheel 122 is provided with eleven numbers, namely, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. Since wheel 122 has eleven numbers it is provided with ten percent more teeth than is wheel 120. Hence a full rotation of wheel 122 requires eleven revolutions of wheel 120. But wheel 122 is never rotated a full revolution, being rotated only $\frac{10}{11}$ of a revolution incident to wheel 120 rotating ten complete revolutions. Thus when appropriately driven in a forward direction from one extreme the number wheels may register or indicate upwardly from 000 to 1000 at the other extreme, and vice versa. Stops formed as shown in Patent No. Re. 25,674 prevent rotation of shell 14 more than ten revolutions.

Resiliently clamped onto base 110 (FIGURE 3) is a fenestrated shield device 130 (FIGURE 11) having a generally circular plate-like forward shield 130s and rearwardly extending resilient notched legs 130c and 130d. The shield 130s is provided with a rectangular window 130w (FIGURES 2 and 3) through which an array of numbers on wheels 118, 120 and 122 may be viewed. The notched legs 130c and 130d are received with an interference fit in respective complementary apertures 110x and 110y (FIGURE 8) provided in the bottom plate-like portion of base 110, as indicated in FIGURE 3. The legs are resilient and must be sprung toward convergence to permit insertion of their ends in respective ones of the noted apertures, after which the legs resiliently spring outwardly and, as indicated in FIGURE 3, lock the shield device 130 to base 110. As indicated in FIGURE 2, shield 130s permits only a limited portion of the peripheries of the three number wheels to be seen through window 130w.

Extension 14e of shell 14 is shaped with an annular bevel at its forward outer surface, and is secured to shell 14 by suitable means, as by adhesive. The inner surface of the extension 14e is fitted with an annular step provided with a continuous set of gear teeth 14g (FIGURES 3 and 5) that are complementary to and engage the teeth of gear 119 affixed to counterwheel 118. Thus as shell 14 is rotated, gear 119 is forced to rotate, whereby the number-wheel train is operated as hereinbefore described. During operation the number wheels 120 and 122 and shaft 116 are precluded from moving out of position by the gears and shield device 130 (FIGURE 3). A transparent lens or face-plate 14f (FIGURE 3) is secured in the front end portion of shell extension 14e, whereby foreign matter is excluded from the variable resistor device. To provide balancing of forces and to aid in maintaining the pinion-shaft 116 in place, an idler pinion 140 (FIGURES 5 and 9) is rotatably mounted on the reduced end of shaft 116, the idler gear being formed and dimensioned to be complementary to the internal ring gear teeth 14g provided in shell extension 14e.

The ratio of the number of teeth 14g on the driving gear formed in shell extension 14e, to the number of teeth on driven gear 119 secured to number wheel 118, is such that the number wheel 118 is driven through ten revolutions for each revolution of the shell 14. Thus the numerals on wheels 118 and 120 are effective to indicate the hundredths and tenths, respectively, of each revolution of the shell; and the numerals on wheel 122 accordingly are

effective to indicate the number of complete revolutions or "full turns" through which the shell has been rotated from a base position or attitude. Since traverse of the contact point of contact member 28 along the resistance element from an end position coincident with an electrical end of the element is proportional to the extent of rotation of the shell device, the numerical indication provided at window 130w is in fact alternatively an indication of (a) the percentage, from 0.0% to 100.0%, of the resistance element active between the contact member and the "low" end of the resistance element (or the corresponding terminals) or (b) the number of hundredths of a full revolution of the shell from the end position. Thus a previously employed adjustment of the variable resistor device may readily and accurately be again effected, by merely rotating the shell until the previous "reading" or indication is visible through window 130w. Direct numerical indication greatly enhances the ease and accuracy of the setting or readjustment of the variable resistor. Also, the numerical indication furnishes an accurate representation of the resistance exhibited between the active terminals, providing the total resistance of the element is known.

The preceding description makes it evident that following attachment of base 110 (FIGURE 3) to flange 14a of shell 14 by means of screw 112, shaft 124 with pinions 126 and 128 may be disposed in place and number wheels 118, 120 and 122 with shaft 116 and gears 120 and 140 disposed in position as shown. Thereafter shield device 130 is disposed in position by insertion of the ends of legs thereof into the rectangular stepped apertures 110x, 110y of base 110, and shell extension 14e with face plate 14f in place, is fitted onto the flanged complementary forward end of shell 14 with a sealant-adhesive such as epoxy cement. Care is taken that during assembly the slider 26 of the resistor device is run to one end of its traverse, and that the number wheels are arranged to present the appropriate reading (000 or 1000) at the front-center area to be exposed through window 130w. Thereafter, rotation of the rotatable shell causes positive traverse of contact member 28 along the resistance element and concurrent extremely accurate operation of the number-wheel train to provide very accurate instantly-readable numerical indications of the state of adjustment of the variable resistor. The contact-carrying slider 26 is engaged and driven directly by shell 14, in a manner and by means fully disclosed in Patent No. Re. 25,674; and due to the fact that the contact-carrying slider 26 and the indicating number-wheel are both actuated directly and concurrently by the same member (shell 14) which concurrently serves to house the structure and as an actuating device, a considerable increase in accuracy of indications and a meritorious decrease in the number and complexity of necessary parts are attained by the structure. Also it is made evident that the aforementioned objects of the invention have been attained. In the light of the disclosure, changes of form and arrangement of parts within the true spirit and scope of the invention will occur to those skilled in the art. For example, if the resistance element 16 is of other than ten turns or convolutions, appropriate changes in the gearing for driving the number wheels are made, complementary with proper changes in the indicia on the wheels. Accordingly it is not desired that the invention be restricted to the particular exemplary form and arrangement shown and described other than is required by the appended claims.

We claim:

1. A variable resistor device comprising:

first means, including a rigid supporting structure arranged at a rear end thereof for attachment to a panel at an aperture in the panel, said structure having a front end and a body portion;

second means, including a rotary shell device rotatably supported on said supporting structure and enclosing said body portion and front end of said structure, said shell device including a driving gear;

third means, including a helical plural-turn resistance element enclosed within said rotary shell device and disposed between said body portion of said supporting structure and said rotary shell device, said resistance element having first and second electrical ends;

fourth means, including a contact-carrying slider device having engagement with said shell device and having a contact member arranged in electrical contact with said resistance element at a contact point, said slider device being arranged for guidance along a path adjacent to said resistance element and for traverse of the contact point of said contact member along an extent of said resistance element, incident to rotation of said shell device;

fifth means, including insulated terminal means extending rearwardly from said supporting structure, and further including respective electrical connections from said terminal means to respective electrical ends of said resistance element and to said contact member; and

sixth means, including a member secured to and forming an extension of said shell device, and including a digital counting and indicating device enclosed in said extension of said shell device and said counting and indicating means and said front end of said supporting structure comprising interengaged protuberance and recess means and fastening means securing said interengaged means together and said counting and indicating means to the front end of said supporting structure, said counting and indicating device comprising a driven gear engaged with said driving gear and further comprising a set of number wheels driven by connections to said driven gear, to register appropriate numerical indicia on said wheels in aligned reading positions, whereby said counting and indicating device provides a numerical indication of the position of said contact point relative to one electrical end of said resistance element.

2. A variable resistor according to claim 1, said shell device including a transparent face plate at the front end thereof to permit visual examination of indicia presented in viewing position at said reading positions by the number wheels of said set.

3. A variable resistor according to claim 1, said sixth means including a fenestrated shield arranged to obscure all of the numerical indicia on said number wheels except an aligned series restricted to one number on each number wheel.

4. A variable resistor device comprising:

first means, including a rigid supporting structure having front and rear ends and a body portion therebetween and arranged at said rear end to be affixed thereat in an aperture in a panel, said supporting structure having a passage therethrough at said rear end for extension of insulated conductors therethrough and through such aperture;

second means, including a rotary shell device rotatably supported upon and by said first means and enclosing said body portion of said supporting structure and forming therewith a chamber therebetween, said second means including a driving gear rotatable with said shell device;

third means, including a plural-turn helical device including a helical resistance element disposed between said supporting structure and said shell device and housed within the latter, said third means including insulated termination conductors electrically connected to respective ends of said resistance element and extending through said passage in said supporting structure;

fourth means, including a contact-carrying device and a contact member carried by said contact-carrying device, disposed in said chamber with said contact member in electrical contact with said resistance

element, and said fourth means including an electrically conductive connection to said contact member and said connection including an insulated conductor extending through said passage, said contact-carrying device being arranged by engagement with said helical device and said shell device to traverse said contact member along an extent of said element incident to rotation of said shell device whereby to vary the electrical resistance exhibited between said connection and either end of said element; and

fifth means, including an indicator device comprising a stationary device, said stationary device and said rigid supporting structure having mutually interengaged means locking said device and structure against relative rotation, and means detachably securing said stationary device to said supporting structure, and said indicator device including a set of number-wheels each having a series of numerical representations thereon and said number-wheels being rotatably supported by said stationary device, said fifth means further including driven gear means engaging said driving gear of said second means and arranged to drive said number-wheels, said gear means and said number-wheels arranged and connected to provide a numerical indication of the extent of said element traversed by said contact device from one end of said element.

5. A variable resistor device according to claim 4, in which said indicator device includes a shield having an aperture so arranged that but a single numerical representation of each of said number-wheels is exposed to view through said aperture at the front end of said variable resistor device.

6. A variable resistor device according to claim 5, in which said shell device comprises a transparent face plate at the front end thereof whereby foreign material is prevented from entering said indicator device.

7. A variable resistor device comprising:

first means, including a helical resistance element having a plurality of convolutions and disposed about a longitudinal axis;

second means, including a stationary supporting structure disposed about said axis and having means whereby the supporting structure may be secured at the rear end thereof in an aperture in a panel or console;

third means, including a generally hollow shell device supported by said supporting structure for rotation thereon about said axis, said supporting structure and said shell device providing therebetween a chamber encircling said axis and containing said resistance element;

fourth means, including a contact device and contact-carrying device disposed in said chamber with said contact device in electrical engagement with said re-

sistance element and arranged for movement relative to said shell device and to said supporting device by interengagement with one thereof incident to rotation of said shell device whereby an extent of said element is wiped by said contact device incident to rotation of said shell device;

fifth means, including conductors connected respectively to electrical ends of said element and said contact device, whereby to provide electrical access thereto; and

sixth means, including an indicator device having a stationary portion, said stationary portion and said stationary supporting structure comprising interlocking means effective to prevent relative rotation therebetween and means detachably securing said stationary portion to said stationary supporting structure, and said indicator device further including rotatable indicia-bearing wheels and driving means therefor including means engaging and positively driven by said shell device incident to rotation of the latter, said wheels being arranged to present a series of indicia along a viewing area at the front end of said variable resistor device and the driving means therefor arranged to cause said wheels to present for viewing digital representations of the extents of relative movement between said element and said contact device from one end of said element, in terms of percentage of the electrical length of said element,

whereby indications provided by said indicator device are accurate representations of the percentage of the total resistance of said element connected between said contact device and one electrical end of said element.

8. A variable resistor device according to claim 7, in which said shell means includes a transparent end plate permitting viewing of said wheels and serving to protect said indicator device from entrance of foreign matter.

9. A variable resistor device according to claim 7, in which said shell device comprises an internal ring gear and said driving means comprises a driven gear engaging said ring gear, whereby adjustment of the point of contact between said element and contact device, and operation of said indicator device are directly and concurrently performed by said shell device with attendant advantages of high accuracy of indications and economy of components.

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